

**94 DUNE ROAD
EAST QUOGUE, TOWN OF SOUTHAMPTON
SUFFOLK COUNTY, NEW YORK**

**ENGINEERING REPORT
PROPOSED SEWAGE TREATMENT PLANT**

PREPARED FOR:

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East Quogue, New York**

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1.0 SUMMARY

In order to develop the Sunset Harbor Condominium/Townhouse Development (SHD) site, it will be necessary to construct a sewage treatment plant (STP) on the property. Construction of an on-site STP will require the approval of this Engineering Report and subsequent construction plans and specifications by the Suffolk County Department of Health Services (SCDHS).

Construction of an on-site plant will not require variances from the Suffolk County Board of Review. The proposed location of an on-site STP with a 100 percent expansion area will comply with the minimum setback distances to the existing property lines and habitable structures.

The closest STP to potentially service this facility would be CSD-24. A pump station is located approximately 19,500 feet away from the site so it is not within reasonable distances to the site to be considered to service this facility.

The preliminary cost estimate to construct an on-site STP is \$ 1,000,000 or about \$133 per gallon of capacity. This includes the cost of the on-site sewage collection system, remote pump station, remote control building, BESST sewage treatment system and effluent disposal systems, engineering, legal and contingencies.



2.0 INTRODUCTION

This report has been prepared to provide a preliminary design for the necessary construction of a new SHD facility designed to meet current SCDHS nitrogen limits for discharge to the ground water so the STP discharge will be in compliance with the effluent limitations included in the State Pollution Discharge Elimination System (SPDES) permit which would be issued for the STP discharge.

This report describes the proposed sewage disposal requirements of the new SHD Facilities to be built on the north side of Dune Road in East Quogue, Town of Southampton, Suffolk County, New York. The new residential community will consist of (25) twenty-five condominium units that vary between 1,250 and 2,500 sq. ft. in size. The site currently consists of two separate lots. The Suffolk County Tax Map Number for the lot is 900-385-1-37.3. The total gross area of the site is 405,082 square feet or 9.29 acres approximately.

Area	Suffolk County GWMZ	Area Description	Area (Acres)	Area (Square Ft.)
1	IV	Upland Area	3.38	147,233
2	IV	Wetlands Area	3.75	163,350
3	IV	Surface Water Area	2.16	94,499
Totals			9.29	405,082

Based on the current SCDHS standards for sanitary design flows, the community will generate about 7,500 GPD of sewage. The site is located in the 600 GPD/acre Suffolk County Groundwater Management Zone IV. Based on adjusted gross land area of 3.38 (acres) the site can only discharge about 2,028 GPD of untreated wastewaters into the ground (600 GPD/acre x 3.38 acres = 2,028 GPD). Therefore, to develop the site as proposed, a STP must be constructed. The new STP would be designed and constructed to meet SCDHS standards. It is intended to use the provisions for a sub-surface STP such that the reduced setbacks can be achieved.

The closest STP is the CSD-24 (Gabreski Airport) located about 18,000 feet northwest of the proposed SHD site. The SPDES permit number (NY0226971) has permitted flow of 100,000 gpd, so the facility potentially could have the capacity to accept all of the wastewater generated by the Sunset Harbor Condominium/Townhouse Development.

PWGC investigated the feasibility of a connection to this facility (CSD-24) using a new pumping station and force main to convey sewage, which may have capacity to accept all of the 7,500 GPD with little improvements and/or expansion. However, this option is cost prohibitive due the required cost to build a force main in the public right of way of Dune Road, and Montauk Highway (SR-80).

Since the off-site disposal option is not viable, it is proposed to build a new subsurface STP, at the SHD site. The proposed design would comply with the SCDHS, New York State Department of Environmental Conservation (NYSDEC) and Ten States Standards.

The proposed STP and below grade effluent disposal facilities will be constructed in the southwest corner of the community. The community STP will be provided with stand-by



power facilities. The community will have a sanitary collection system that transports raw sewage to the proposed STP facility. The influent will drain to an 8-ft. pump station/wet well.

Effluent from the pump station/wet will then be transported via force main. The pump station/wet well will provide a continuous source of flow to the STP throughout the day. A continuous flow of sewage will improve the treatment plant process by providing a continuous source of organic material for the micro-organisms to use for the synthesis of ammonia nitrogen to nitrates and a continuous source of organic carbon to cover nitrates to nitrogen gas.

Final effluent from the treatment plant will be recharged on-site with a groundwater disposal system comprised of leaching galleys.

The new STP and dedicated STP expansion area will be sited on the SHD property at a location that does provide a minimum setback distance of 75 feet from the owner's property line and from any existing or proposed habitable structure. The dedicated STP expansion area is to be contiguous with the STP area and be set aside to provide for a future 100% expansion of the STP and disposal system.

A buffer area of 50 feet will also be provided around the proposed STP and dedicated expansion area. The area is to be used exclusively for the STP appurtenances.

The location of the proposed STP is shown on Exhibit No. 2 – Site Plan with the SCDHS setback requirements.



3.0 LOCATION AND SITE CONDITIONS

The SHD Facilities will be located on the north side of Dune Road (S.R. 89) approximately 800 feet west of Dolphin Lane, in East Quogue, within the Town of Southampton, Suffolk County, New York. The specific location is shown on Exhibit No. 1 – Location Map.



Exhibit No. 1 – Location Map (Not to Scale)

The new residential community will consist of (25) twenty-five condominium units. The tax map number for the site is 900-385-1-36.1, 37.3. The total area of the site is 405,081 square feet (9.29 acres).

The site is generally flat and mostly developed. The average surface elevation is about elevation 6 feet above mean sea level (AMSL). The site is located in Zone AE (12) (the base floodplain where base flood elevations at 12ft) per FEMA flood map.

Proposed development of the site will include on-site subsurface storm water disposal systems to dispose of storm water run-off to below grade, precast-concrete, stormwater, leaching galleys.



4.0 WASTEWATER CHARACTERISTICS

The sanitary wastewater from SHD community is expected to be typical of normally found in other similar residential communities. The SCDHS generally has approved design of new treatment facilities assuming the wastewater characteristics:

5 day Biochemical Oxygen Demand	BOD ₋₅ = 272 mg/L
Total Suspended Solids	TSS = 320 mg/L
Total Nitrogen as N	TN-N = 65 mg/L
Ammonia Nitrogen as N	NH ₃ -N = 45 mg/L

While the STP has been design to achieve a nitrogen effluent concentration of 10 mg/L at the average and peak hourly flow rates, it will achieve a limit of 7 mg/L given its location and proximity to surface waters.



5.0 DESCRIPTION ON-SITE SEWAGE TREATMENT AND DISPOSAL SYSTEM

The process selected to treat the wastewaters is the Biologically Engineered Single Sludge Treatment (BESST). This process is a variation of the activated sludge process and will effectively remove BOD₅, TSS and nitrogen levels to comply with the New York State Department of Environmental Conservation (NYSDEC) State Pollution Discharge Elimination System (SPDES) Permit.

The BESST process is designed for five-day carbonaceous biochemical oxygen demand (BOD₅), ammonia nitrogen nitrification and denitrification. In this process, ammonia nitrogen is oxidized to nitrite and then to nitrate by Nitrosomonas and Nitrobacter bacteria, respectively. The nitrate is then reduced by dissimilarity nitrate reduction. In this reaction, the incoming BOD₅ serves as the carbon source or electron donor for the reduction of nitrate to elemental nitrogen. In the process, fermentation of soluble BOD₅ occurs in the anoxic zone.

The BESST process is a modified version of the Lawrence and McCarty biological process. This process introduces sewage into an anoxic section of the tank where the microorganisms will use the endogenous carbon to perform denitrification. This stream is mixed with a stream of nitrified wastewater coming from nitrified return active sludge from the sludge blanket clarifier. Submersible mechanical mixers are installed in the anoxic compartment to facilitate homogenous mixing and increase the denitrification efficiency. Mixed liquor flows in a plug flow manner to the aeration zone where fine bubble diffusers provide the oxygen required for nitrification and BOD₅ reduction.

After aeration, the mixed liquor enters the bottom of an up-flow clarifier where solid and treated effluent is separated. Mixed liquor settles to the bottom and an air lift pump conveys RAS into the anoxic tank. A weir box at the top of up-flow clarifier allows treated effluent to go to the on-site groundwater disposal system.

Sanitary wastewater from SHD community will flow by gravity to the STP via a new sewage collection system. Sewage will flow by gravity into the new exterior influent pump station. Wastewater will be pumped via one (1) of two (2) submersible explosion proof, solids handling pumps to a self-cleaning, mechanical screen. The pumps will invoke a new technology called “adaptive impellers”. This new technology will prevent all non compressible solids from becoming clogged within the pump impeller without the necessity of utilizing grinders, shredder or cutter mechanical devices. The new mechanical screen will be located above grade on a concrete pad, near the proposed BESST system. Solids removed by the screen will be discharged by gravity into the screen trash bin. The perforated openings in which the influent wastewater will cascade over will require routine maintenance to prevent excess buildup of solids. The screened wastewater will then be pumped from the influent equalization tank to the proposed influent splitter box. This box controls the forward flow rate to the BESST treatment and the return flow rate to the influent equalization tank. The splitter box automatically splits the flow equally to the influent ends of the two (2) anoxic tanks.

Refer to Exhibits No. 4 - Proposed On-Site Sewage Treatment Plant Hydraulic Profile and Exhibit No. 5 -Floor Plan of On-Site Sewage Treatment Plant for the general layout and process piping for the proposed STP.



The BEEST STP will be comprised of dual train treatment process comprised of two (2) separate aeration/clarifier tank and anoxic tank sections. A pipe and slide gate will connect the two anoxic tanks such that mixing of the RAS will occur between the two anoxic tanks thus causing both trains to have an approximate equal amount of mixed liquor suspended solids in both tanks. This will optimize operational control of the process.

The BESST STP is an easy treatment process to operate because there are no cycles within the process. This STP is a flow through process. Blowers are continuously energized to provide diffused air within the aeration and sludge holding tanks and to operate the air lift pumps to return nitrified activated sludge from the up-flow clarifier to the anoxic tanks. The STP operator will be required to manually open a sludge waste valve that will divert the RAS to the sludge holding tank.

The sludge holding tank will continue to process the RAS. Periodically the sludge holding tank blower will be de-energized such that the digested sludge will be able to settle. A supernatant return pump located within the sludge holding tank will convey top water from the sludge holding tank back to the pump station. This will significantly reduce the cost to haul sludge off-site for additional processing and disposal.

The SCDHS allows the BESST STP process to operate with three (3) blowers. One dedicated blower will be used for the aeration and the RAS air lift pumps. One blower is used exclusively for the aeration of the sludge holding tank. The third blower is used as a standby blower in the event either one of the other two blower is out of service. Periodically the aeration tank duty blower and the standby blower is alternated such that there will be equal run time on each blower. The blowers will be located within the control building and have a soundproof enclosure.

A control building will be constructed for multiple purposes. The control building will provide the required space for a laboratory and bathroom. The building will also provide additional sound attenuation for the blowers. The odor control treatment system will be located outside by the control building. The control building will also permit STP electrical equipment to be located indoors and not exposed to the elements.

A flow monitoring station will be installed upstream of the groundwater disposal system and downstream of the two (2) effluent pipes from the BESST process. A Parshall flume with a sonic meter will be used to continuously measure the flow exiting the STP. A flow meter will be setup within the control building.

Effluent from the STP will flow into a groundwater disposal system comprised of leaching pools. The leaching pools will be sized for long term disposal of effluent without the use of effluent filtration equipment.





6.0 DESCRIPTION OF ON-SITE SEWAGE COLLECTION SYSTEM

The design of the required on-site sewage collection system will depend on the design of the plumbing facilities to serve the various units of the new residential community. It has been verified that the community will consist of (25) twenty-five condominium units with a pool that is solely dedicated to the use of the community members.

The building plumbing system will have to be designed in compliance with the requirements of the SCDHS as well as the New York State Plumbing Code. The onsite sewage collection system will transport raw sewage via gravity to the proposed influent pump station from each of the residential units.

An 8" diameter DR-18 PVC gravity sewer would convey the sewage to the influent end of the pump station, entering the Influent Pump Station. Raw wastewater will then be pumped to the mechanical screen tank via force main. The onsite gravity sewer collection system will consist of twelve (12) 4-ft. diameter precast concrete manholes used at intersections, changes in direction and termination points. The total length of piping for the collection system is approximately 800 linear feet.



7.0 DESCRIPTION OF REQUIRED MONITORING WELLS

To comply with SCDHS standards, two (2), 2" diameter monitoring wells are required to be provided in the vicinity of the ground water disposal systems to permit quarterly monitoring of the effect the STP effluent has on ground water quality. The necessary new wells will consist of one (1), 2" diameter monitoring wells properly sited down gradient of the leaching pool disposal system and one (1), 2" diameter well located up gradient of the leaching pool disposal system. Review of available source of groundwater maps indicates groundwater at this site is flowing in an south – north direction.

Each new well will include the installation of a 4" diameter surface casing with lock, 2" diameter PVC schedule 40, 15 feet long, 20 slot, screened well a minimum of 10 feet into ground water. The screen shall be installed 5 feet above and 10 feet below the prevailing ground water table. New wells will be installed in compliance with the most recent requirements of the SCDHS. Wells will be monitored quarterly for required water quality parameters included in the NYSDEC SPDES permit. All well construction would be performed by a New York State licensed well driller. The proposed number and location of monitoring wells is shown on Exhibit No. 2 – Site Plan.

The installation of the monitoring wells will also include:

1. Meeting with the SCDHS to properly site the required monitoring wells based on the determined flow direction of ground water.
2. Retain the services of a licensed well driller to file for required permits.
3. Installation of monitoring wells at the location(s) approved by the SCDHS.
4. File completion logs with the NYSDEC and the SCDHS.
5. Initial bailing of wells and collection of water samples.
6. Provide well tags and casing keyed locks on all wells.
7. Locate and inspect all new monitoring wells and record the well number, the NYSDEC number, the well casing size, and height above finished grade. Verify the depth of water in each well and if samples can be properly obtained.



8.0 SETBACK DISTANCES

As required by the SCDHS standards, a 100 % expansion area immediately adjacent to the STP should be provided. This area is for the construction of a new STP. The proposed site of the STP and the location of the 100 percent expansion area will comply with the setback standards of the SCHDS, namely 75 feet from the property lines and 75 feet from habitable structures or building setback lines. The proposed construction of the STP will comply with the setback requirements for residential dwellings surrounding the project area.





9.0 ODOR CONTROL TREATMENT SYSTEM

Since the treatment system will be classified as a modified sub surface sewage treatment plant, an odor control treatment system will be installed for the process tanks and pump station. The odor control treatment system will be installed within the control building.

The proposed ventilation system will utilize mechanical ventilation equipment to collect all air discharge twelve (12) air changes per hour within the STP. The basis of design for the ventilation system is as follows:

Volume above Process Tanks (Freeboard) = 30.67 ft. x 8.0 ft. = 245.36 ft² x 1.5 ft. (freeboard) = 382 ft³
Sludge Holding Tank = 4.50 ft. x 8.0 ft. x 8.5 feet = 306 ft³
Constant Head Splitter Box Above Water 2.5' x 4' x 2' = 20 ft³

Total Volume = 708 ft³

Required cubic feet of air to be treated per hour = 708 ft³ x 12 (changes/hr.) = 8,496 ft³/hr.
Require air volume = 8,496 ft³/hr. / 60 min./hr. = 141.6 ft³/min.

The proposed odor control treatment system will be a two-stage granular activated carbon system. The system will have an air flow rate of 141.6 cfm at 7" of water column. Each tank size will be 36" in diameter by 54" in height. The fan will operate with a 110-volt, 1 phase, 1 hp motor.





10.0 BASIS OF DESIGN – ON-SITE STP

Average Daily Design Flow

Based on SCDHS Criteria:

- 25 Housing Units > 1,200-sq. ft. @ 300 gpd/unit
Average daily flow = 25 units @ 300 gallons/bed = 7,500 GPD
Pool is for use by the residents of the community only therefore, no additional flow is required.

B. Peak Daily Design Flow of the Sewage Treatment Plant

Average daily flow = 7,500 GPD

Population equivalent = 7,500 gallons / 100 gals. per capita = 75 capita

Peak Factor = $(18 + \sqrt{P}) / (4 + \sqrt{P}) = 4.28$

Peak daily flow = 4.28 x average daily flow GPD = 4.28 x 7,500 GPD

Peak daily flow = 32,200 GPD

C. Influent Wastewater Characterizes/Design Criteria

1. Influent Wastewater Characteristics

BOD₅ = 272 mg/L

Suspended Solids = 320 mg/L

TKN = 65 mg/L

Alkalinity = 150 mg/L

Maximum Wastewater Temperature 20 °C

Minimum Wastewater Temperature 10 °C (Enclosed process tanks)

Ambient Air Temperature 10 - 90 °F

Site Elevation Approximately 6 feet AMSL

2. Design 5-day Biochemical Oxygen Demand (BOD₅)

Average BOD₅ = 272 mg/L (Recommended standard)

Design Pounds BOD₅/day = 272 mg/L x 8.34 x 0.0075 MGD

Design Pounds BOD₅/day = 17.0 lbs./day

3. Design Suspended Solids

Design Suspended Solids/day = 320 mg/L (recommended standard)

Design Suspended Solids/day = 320 mg/L x 8.34 x 0.0075 MGD

Design Suspended Solids/day = 20.0 lbs./day



4. Design Total Nitrogen

Design TN = 65 mg/L (recommended standard)

Design TN - Nitrogen = 65 mg/L x 8.34 lbs./gal. x 0.0075 MGD

Design TN - Nitrogen = 4.1 lbs./day

5. Design Ammonia Nitrogen

Design NH₃ - Nitrogen = 45 mg/L (recommended standard)

Design NH₃ - Nitrogen = 45 mg/L x 8.34 lbs./gal. x 0.0075 MGD

Design NH₃TKN - Nitrogen = 2.8 lbs./day

6. Design Nitrite Nitrogen

NO₂ = Trace

7. Design Nitrate Nitrogen

Design NO₃ - Nitrogen = 2 mg/L (recommended standard)

Design Nitrate - Nitrogen = 2 mg/L x 8.34 lbs./gal. x 0.0075 MGD

Design Nitrate - Nitrogen = 0.1 day

8. Design Alkalinity (Recommended Range)

Design Alkalinity = 150 mg/L as CaCO₃

Design Alkalinity = 150 mg/L x 8.34 lbs./gal. x 0.0075 MGD

Design Alkalinity = 9.4 lbs./day

9. Design pH

Design pH = 6.8 to 7.2

Say: 6.8 to 7.2

10. Design Minimum Wastewater Temperature

Minimum Temperature = 10°C

Say: 10°C

D. Process Design

1. Influent Pump Station

A. Criteria

- (1.) The influent pump station will be used for flow equalization such that there will be a constant flow of influent sewage to provide a carbon source for equalization. The influent wet well should be designed to hold a minimum of 25 percent of the average daily design flow plus an additional 25 percent of the total volume of the sludge hold because supernatant will be sent back to the influent pump station for processing through the STP.

B. Wet Well Volume and Size Based on Average Daily Flow

25 Percent of Daily Flow: $7,500 \text{ GPD} \times 0.25 = 1,875 \text{ gallons (250.7 ft}^3\text{)}$

25 Percent of Sludge Holding Tank: $8.5 \text{ feet} \times 10 \text{ feet} \times 4.5 \text{ feet} \times 0.25 \times 7.48$
 $= 715.28 \text{ Gallons (95.6 ft}^3\text{)}$

Total Wet Well Volume = $1,875 \text{ Gal.} + 715.28 \text{ Gal.} = 2,590 \text{ Gallons (346.3 ft}^3\text{)}$

Proposed Wet Well Dimensions:

Inside Diameter:	10' - 0"
Overall Height:	14.86'
Invert In	1.50' (Typ. of 2)
Elev. High Water Level Alarm	1.25'
Elev. of Lag Pump On	0.75'
Elev. of Lead Pump Off	-3.75'
Elev. of Low Water Level Alarm	-4.25'
Elev. Of Inner Bottom of Wet Well	-5.25'
Effective Depth (Lag on – Lead Off)	4.50' ($0.75' + 3.75' = 4.50'$)
Effective Volume	353.4 ft ³ (2,644 gallons)

The proposed ventilation system will utilize mechanical ventilation equipment to collect all air discharge twelve (12) air changes per hour within the pump station.

Ventilation Calculations:

Volume of pump station	=	997.46 ft ³
Required air flow capacity	=	<u>(12 air changes/hr) x (997.46 ft³)</u>
		60 min/hr
	=	199.49 ft ³ /min

Blower Calculations:

Volume of pump station	=	7,311 Gal.
Minimum air flow required	=	1.25 cfm / 1,000 Gal.
	=	7,311 Gal. x (1.25 cfm / 1,000 Gal.)



= 9.14 cfm

Blower Discharge Pressure = Depth x (0.432 psi/ft H₂O) x H_L
 losses) = 6.45 ft x (0.432 psi/ft) + 1ft (head
 = 3.78 psi

A Space for future KMNO₄ feed system with minimum of 30-gallon drum is provided inside the Blower Room of the control building. Provide a PVC conduit from control building to wet well (buried). The installation of the KMNO₄ feed system will not be required until odors occur.

C. Influent Pump Station Pumps

Peak Factor = 4.28

Minimum Pump Size = $\frac{4.28 \times 7,500 \text{ GPD}}{1,440 \text{ minutes / day}}$

Minimum Pump Size = 22.3 GPM

Provide two (2) submersible explosion proof solids handling pumps in new influent pump station with breakaway couplings, rails and lifting chains and reversing starters. Pumps will have adaptive impeller.



D. Bouyancy Calculations

BOUYANCY CALCULATION (10' I.D. X 14.86' Concrete Manhole)	
PUMP STATION	
THE MAGNITUDE OF BOUYANCY FORCE IS EQUAL TO THE VOLUME OF THE TANK THAT IS SUBMERGED MULTIPLIED BY THE DENSITY IN WATER.	
PHYSICAL CONSTANTS	
DENSITY OF WATER =	62.4 LBS/CU. FT.
DENSITY OF CONCRETE =	150.0 LBS/CU. FT.
A- BOUYANCY FORCE ON THE MANHOLE	
TANK DIAMETER=	11.50 FT
TANK AREA=	103.8 SQ. FT.
DEPTH IN WATER=	8.82 FT
VOLUME IN WATER=	915.7 CU. FT.
F = (DENSITY OF WATER) x (VOLUME OF TANK IN WATER)	
F=	57,137.1 LBF
F(net)Fx 1.5 SAFETY FACTOR =	85,705.7 LBF
B- BALLAST FORCE (WEIGHT OF CONCRETE MANHOLE)	
DEPTH OF TANK =	14.86 FT
12" TOP SLAB =	15,101.2 LBF
8" BOT. SLAB =	10,433.5 LBF
9.5' O.D. WET WELL WALLS =	119,364.7 LBF
BALLAST =	144,899.4 LBF
C- TOTAL BALLAST	
BALLAST = 144,899.4 LBF >	BOUYANCY FORCE = 85,705.7 LBF

3. Mechanical Screen

Provide one mechanical screen with 2 mm opening within a concrete vault. Provide light weight access hatch for access to screen collection bin. Screen capacity shall be a rating greater than the pumping rate of the influent pump station.

4. Constant Head/Flow Splitter Box

Provide a new (1) 316 stainless steel Constant Head/Splitter Box at discharge from mechanical screen. Box to be provided with one (1) 8" x 8" broad crested weir box on an adjustable telescoping valve for return flow to Influent Pump Station. Fixed 30-degree V notch will be utilized to measure and control forward flow to the anoxic tanks. Compartments to be provided with plug valves to permit isolation of each

process tank. Forward flow 30-degree v-notch weir to have a design flow of 5.36 GPM or about 7,500 GPD. Return flow over weir box with 1" of head will be about 110 gallons per minute. Range of operation should be a minimum of 6" inches (3 inches above and below the bottom of the V-Notch Weir). Forward flow to the BESST Treatment System is based on Average Flow = 5.36 GPM, use 30 Degree V-notch weir.

5. Aerated Sludge Holding Tank

A. Criteria

Minimum capacity based on population equivalent of BOD₅

$$\text{Equivalent population} = \frac{17.0 \text{ (lbs. BOD}_5\text{/day)}}{0.17 \text{ (lbs./day/capita)}} = 100 \text{ equivalent population}$$

Minimum volume required = 3 (ft³/capita) x 100 people

Minimum volume required = 300 ft³ (2,244 gallons)

Nominal Length	= 4.50 ft
Nominal Width	= 8.00 ft
Nominal Height	= 8.50 ft
Nominal Volume	= 306 ft ³ (2,289 gallons)

Supernatant Return Volume

Minimum of 25% of the sludge holding tank

$$\text{Supernatant Volume} = 4.50 \text{ ft} \times 8.0 \text{ ft} \times 8.5 \text{ ft} \times 0.25 \times 7.48 \text{ gal/ft}^3 = 572 \text{ gallons}$$

E. Aerated Sludge Holding Tank Blower Capacity

Tank Volume = 306 ft³

$$\begin{aligned} \text{Minimum Air Flow Required} &= 30 \text{ Scfm} / 1,000 \text{ ft}^3 \\ &= 306 \text{ ft}^3 \times (30 \text{ Scfm} / 1,000 \text{ ft}^3) = 9.18 \text{ Scfm} \end{aligned}$$

$$\begin{aligned} \text{Blower Discharge Pressure} &= \text{Aeration Depth} \times (0.432 \text{ psi/ft H}_2\text{O}) \times H_L \\ &= 8.5 \times (0.432 \text{ psi/ft}) + 1\text{ft (head losses)} = 4.67 \text{ psi} \end{aligned}$$

6. Effluent Disposal System

A. Criteria



Design Leaching Rate without Filtration: 5.0 GPD/ft²

B. Required Disposal System Capacity

Required Sidewall Leaching Area = 7,500 GPD
5.0 GPD/ft²

Required Sidewall Leaching Area = 1,500 (ft².)

Proposed Disposal System

Provide 8.5 Feet L x 4.75 Feet W x 2.00 feet effective depth leaching galleys.

Capacity/ leaching galleys = 53 ft²/leaching galley

Required area for leaching galleys = average daily flow (GPD) / SCDHS Allowable Leaching Rate

Required area for leaching galleys = 7,500 GPD / 5 GPD/ft² = 1,500 ft²

Required number of leaching galleys = req'd area (ft²) / capacity/leaching galley

Required number of leaching galleys = 1,500 ft² / 53 ft² = 28.3 leaching galleys

Required number of leaching pools = 28.3 **Say: 29 leaching galleys**

Provide twenty-nine (29) leaching galleys to ensure symmetry for equal flow distribution the effluent disposal system. And, additional area has been provided for 100% expansion. Each leaching galley cluster will be equipped with a gate valve, so that the clusters can be rotated.

NOTE: Required disposal system capacity for future expansion will be the same size as the current design.

7. See Appendix for BESST Process Calculations

8. PWGC Aeration Calculations based on Ten States Standards

BOD₅ Removal

Pounds of BOD₅ to be removed = 17.0 Pounds Per Day

SCDHS Requirement for BOD₅ Removal = 1.8 Pounds of Oxygen per Pound of BOD₅

17.0 x 1.8 = 30.6 Pounds of Oxygen Per Day

NOD Removal

SCDHS Requirement of NOD Removal = 4.6 Pounds of Oxygen per Pound of NOD

4.1 x 4.6 = 18.9 Pounds of Oxygen Per Day

Total Oxygen Requirement = 49.5 Pounds of Oxygen Per Day

Fractional Percentage of Oxygen in Air = 23.3%

Density of Air = 0.075 lbs./ft.³





$49.5 \text{ Pounds of Oxygen Per Day} / 0.075 \text{ lbs./ft.}^3 / 0.232 = 2,845 \text{ ft.}^3/\text{day}$

Depth of Diffusers Below Water Surface = 93.6 inches = 7.8 ft.

Efficiency Rating = 1.5% per foot of submergence $7.8 \times 1.5 = 11.7\%$

$2,845 / 0.117 = 24,316 \text{ ft.}^3/\text{day}$

$24,316 \text{ ft.}^3/\text{day} / 1,440 \text{ min./day} = 16.9 \text{ CFM}$

Ten States Standards minimum for Aeration utilizing the Extended Aeration Process

= 2,050 CF Per Pound of BOD₅

$2,050 \times 17 = 34,850 \text{ CF} > 24,316 \text{ CF}$

$34,850 \text{ CF} / 1,440 = 24.2 \text{ CFM}$ (THIS IS FOR BOTH TRAINS)



9. PWGC AERATION CALCULATIONS BASED ON SCDHS REQUIREMENTS

1-1	Carbonaceous Oxygen Demand		
	$AOR_1 = A \times \frac{Q \times BOD_{IN}}{1,000,000} \times 8.34$	15.31	lbs./day/basin
	A = Lbs. of O ₂ / Lbs. BOD ₅ Removed per Day	1.80	O ₂ Lbs. / Lbs. BOD ₅
1-2	Net Nitrogen for Oxidation		
	$\Delta N = \frac{((NH3_{in} - NH3_{out}) - (BOD5_{in} - BOD5_{out}) \times Y_{obs} \times N_s) \times Q \times 8.34}{1,000,000}$	1.63	lbs./day/basin
	N _s = Sludge Nitrogen Content	0.07	
	Observed Yield Factor (Yobs)	0.65	
1-3	Nitrification Oxygen Demand		
	$AOR_2 = \Delta N \times 4.60$	7.49	Lbs./Day/Basin
	Lbs of O ₂ / Lbs. of NH ₃ Removed	4.60	O ₂ /NH ₃
1-4	Total Actual Oxygen Required		
	$AOD_T = AOD_1 + AOD_2$	22.80	Lbs./Day/Basin
1-5	Convert Actual Oxygen Required (AOR) to Standard Oxygen Required (SOR) Ratio		
	$\frac{AOR}{SOR} = \frac{\alpha \times \theta^{(T_{site}-20)} \times (\beta \times C_{sat} \times P_{site}) \times (P_{std} \times (C_{surf_T}) + (C_{surf_{20}} - D.O.))}{C_{sat_{20}}}$	0.49	
1-6	Alpha and Beta Factors	Value	Symbol
	Alpha Factor	0.650	α
	Temperature Coefficient	1.024	θ
	Water Temperature	10.000	T _{SITE}
	Beta Factor	0.950	β
	Site Atmospheric Pressure	14.700	P _{SITE}
	Standard Atmospheric Pressure	14.700	P _{STD}
	Dissolved oxygen solubility at standard conditions	9.080	C* _{sat₂₀}
	Dissolved oxygen solubility at 10 Degrees Celsius	11.280	C _{surf_T}
	Dissolved oxygen solubility at 20°C	9.080	C _{surf₂₀}
	Residual dissolved oxygen concentration	2.000	DO
1-7	Standard Oxygen Requirement		
	$SOR = \frac{AOD}{\frac{AOD}{SOR}}$	46.33	Lbs O ₂ /Day/Basin
1-8	Aeration System Standard Oxygen Transfer Rate		
	$SOTR = \frac{SOR}{TA}$	1.93	Lbs./hr
	TA = Total Aeration in hours		
1-9	Process Air Flow Required		
	$Process\ Air\ Flow = \frac{SOTR \times 10,000}{\rho_{air} \times SOTE \times O_{pw} \times 60}$	15.80	SCFM PER BASIN
	Air Density	0.075	Lbs./Day/Ft ³
	Submerged Depth of Diffuser	7.800	Feet
	Efficiency per Depth	1.500	
	Standard Oxygen Transfer Efficiency at submerged Depth	11.700	Percent
	Fraction of Oxygen in Air by Weight	23.200	Percent

11.0 SUMMARY OF PROPOSED TREATMENT UNITS

A. Influent Pump Station and Headworks Design

DESIGN CRITERIA	PROPOSED VALUES
Average Daily Influent Sanitary Flow	7,500 GPD
Equalization Volume (25% of design flow)	1,875 GPD
Aerated Sludge Holding Tank	95.6 cu. ft. (715 Gallons)
Required Wet Well Capacity (25 Percent of Daily Flow + 25 Percent of Sludge Holding Tank)	0.25 x 7,500 = 1,875 Gal. 0.25 x 2,861 = 715 Gal. Total = 2,590 Gallons
Average Influent Flow	5.21 gpm
Wet Well Diameter	10.0 ft.
Wet Well Surface Area	78.54 ft. ²
Wet Well Effective Depth	4.50 ft.
Wet Well Storage Volume	2,644 Gal. (353.4 ft. ³)
Required Wet Well Pumps	2 submersible explosion proof
Minimum Capacity	22.3 GPM
Use Homa, Explosion proof solids handling sewage pumps, 4" discharge, Model AVX446-205/2, 8T/C, Impeller size 8 1/16", 1,160 rpm, 3 Phase, 208 Volt w/ a 2.8 hp motor and VFD.	110 gpm @ 20.3' TDH. (Operating Point)

Influent Pump Station equipment will consist of the following:

- Two (2) Influent pumps, Homa, explosion proof, solids handling, sewage pumps, 4" discharge Model AVX446-205/2, 8T/C, Impeller size 8 1/16", 1,160 rpm, 3 Phase, 208 Volt, 60 hertz 2.8 hp motor with reversing starters, 4" Sch. 10 stainless steel discharge piping (velocity = 2.48 ft./sec.). Provide 316 stainless steel lift outs chains with 316 stainless steel schedule 80-guide rails. Pumps shall be complete with leak and over temperature sensors. Pump will be equipped with a VFD to run pump at 60hz.
- One (1) Pump and alarm MultiTrode level probe with low level and high level duplicate floats to control pump starters in NEMA 4X, 316 stainless steel Pump Control Panel. Panel to be installed on unistut supports next to influent wet well. Pumps to be provided with explosion proof remote disconnect switches in influent pump station room.
- One (1) 1,000 lbs. minimum capacity 316 stainless steel hoist and socket for removal of influent pumps and mixers.

B. Process Tanks

DESCRIPTION	UNITS
Total Design Flow	7,500 GPD
Number of Process Tanks	2
Bottom of Process Tanks	Elev. -0.50
Top of Process Tanks	Elev. 14.0
Freeboard	1.5'
Design High Water Level	Elev. 12.5
Process Tank Width	8.0'
Tank Length including Pre-React Zone	Refer to Manufacturer Calculations
Hydraulic Residence Time @ 7,040 GPD	Refer to Manufacturer Calculations
Aeration System	Fine Bubble
Number of Blowers	Two (2) 1 Duty and 1 Standby
Blower Horsepower	5 hp
Blower Discharge Pressure	6 PSI
Air Lift Pump	1 each basin
Mixer Horsepower	2.0 hp

Each Process Tank will be provided with the following equipment:

- One (1) 316 stainless steel submersible mixer ABS Sulzer mixer with 2.0 (hp) 3 phase, 208 volt motors, seal fail and over temperature sensors. Mixers guide pipes and supports shall be of 316 stainless steel material. One (1) spare unit to be provided as repair spare for both tank
- One (1) 1,000 lbs. minimum capacity 316 stainless steel hoists and sockets for mixer removal.
- One (1) Fine bubble aeration system consisting of air headers, supports, diffuser drops and fine bubble diffusers. All air piping and fittings and valves above the water surface to be schedule 10, 316 stainless steel. Diffusers to be mounted by manufacturer on schedule 80 PVC piping.
- Two (2) Kaeser positive displacement, sound attenuating blowers (Blower/Motor units Model BB 52C with TEFC motors 5 HP, 200 volt, 3 phase, 60 hertz, maximum capacity rated at 50 (ft³/min.) @ 6.0 (lbs./sq.in.), with integral frame/sound enclosure, inlet filter/silencer, discharge silencer, check valve, flexible connector, and pressure relief valve. One blower will be operational and the other blower will be for standby. Blowers shall automatically alternate.
- One (1) Process control panel, with PLC type controls for all STP motors. Controls to include dissolved oxygen probes, for installation in aeration tanks, D.O. analyzer and variable frequency drives for the process blowers.

C. Aerated Sludge Holding Tank Design

DESIGN CRITERIA	PROPOSED VALUES
Average Daily Flow	7,500 GPD
Required Sludge Volume	Population equivalent (3 ft ³ per capita)
Population Equivalent	0.17 (lbs. BOD ₅ per capita)
Equivalent Population	100 (people)
Minimum Required Tank volume	456 (ft ³) 3,411 gallons
Proposed Tank Height	10.0'
Proposed Freeboard	1.5'
Proposed Tank Length	4.0'
Proposed Tank Width	8.0'
Max. Water Depth	8.5'
Effective Tank Volume	232 ft ³ (1,735.4 gallons)
Minimum Air Flow Rate	30 ft ³ /min. / 1,000 ft ³
Minimum Air Flow Rate	7.0 ft ³ /min
Min. Static Pressure	3.67 PSI

Sludge Holding Tank equipment will consist of the following:

- One (1) Coarse bubble aeration system consisting of air header, supports, schedule 10, 316 stainless steel diffuser drops and coarse bubble PVC diffusers. All above water piping, fittings and valves to be 316 stainless steel.
- One (1) Kaeser positive displacement, sound attenuating blower (Model BB-52 with TEFC motors 5hp, 200 volt, 3 phase, 60 hertz, rated at 50 ft³/min. @ 6.0 lbs./sq.in.) Include integral frame/sound enclosure, inlet filter/silencer, discharge silencer, check valve, flexible connector, and pressure relief valve. A backup blower will be provided as a standby blower for the Aerated Sludge Holding Tank and the Aeration Tank Blowers.
- One (1) 316 stainless steel hoist and socket for removal of pumps.
- One (1) Provide Flygt Model 3045 Supernatant Return Pump Rating 90 GPM at 19 ft. TDH

12.0 ESTIMATED ELECTRICAL LOADS

Estimated Three Phase – 208-Volt Electrical Loads

No.	EQUIPMENT	SIZE (HP/KW)	AMPERAGE
1	Pump Station Pump No. 1	2.8 hp	9.8
2	Pump Station Pump No. 2	2.8 hp	9.8
3	Influent Mechanical Screen	1/18 hp	0.2
4	Sludge Decant Pump No. 1*	1.5 hp	5.0
5	Submersible Mixer No. 1	2.4 hp	8.6
6	Submersible Mixer No.2	2.4 hp	8.6
7	Aeration Tank Blower	5.0 hp	16.8
8	Sludge Holding Tank Blower	5.0 hp	16.8
9	Odor Control Blower	1.0 hp	4.8
10	Ventilator Controller	0.25 hp	0.7
11	Heater	3.0 kw	10.5
	Total 3-Phase Loads (All)	23.2 hp & 3.0 kw	91.6

Estimated at 0.9 Power Factor - $(91.6 \text{ A} * 0.36 * 0.9) = 29.68 \text{ kW}$ (All Systems Operational)

Note: For generator sizing sludge decant pump will not be operating when sludge blower is on.
 $91.6 \text{ A} - 5.0 \text{ A} = 86.6 \text{ Amps} = 28.1 \text{ KW}$

Estimated Single Phase – 120/240 Volt Electrical Loads

NO.	EQUIPMENT	SIZE KW	AMPERAGE
1	Interior and Exterior lighting	0.2 kW	-
2	Heater	1.5 kW	-
3	Exhaust Fans and Motor Operated Louvers	0.37	
4	Hot Water Heater	1.5 kW	-
5	Receptacles	1.6 kW	-
6	Exit and Emergency Lights	0.1 kW	-
7	General Battery Charger	1 kW	-
8	General Jack Water Heater	1.5 kW	-
9	Flow Meter and Chart Recorder	0.2 kW	-
Total Estimated 1 Phase Electrical Loads		7.97 kw	-

Generator Capacity Required = $28.1 \text{ KW} + 7.97 \text{ KW} = 36.07 \text{ KW}$

Provide 208 Volt, 3 Phase, 60 KW Generator



13.0 DESCRIPTION OF REQUIRED NORMAL AND EMERGENCY STAND-BY POWER

The STP will be serviced by a new, underground, 3 phase, four (4) wire, 208 volt, power feeder from the new community electrical service line extended to the STP. A self-standing motor control center will be provided in the proposed control building.

The treatment plant will require stand-by electrical power to provide emergency power for the various critical electrical devices to be incorporated into the treatment plant design. The generator will also handle the assisted living facility electrical loads. The generator fuel will be either diesel or natural gas.





14.0 CONCLUSIONS AND RECOMMENDATIONS

The sanitary wastewaters from the proposed DRH facility will require treatment and disposal by a STP. Construction of a BESST STP meets the required setbacks and will not require a variance. The estimated cost to construct the STP including the gravity sewer system, pump station, and disposal field is approximately \$1,000,000.





APPENDIX A

Location Plan





APPENDIX B

Overall Site Plan





APPENDIX C

Proposed On-Site Sewage Treatment Plant Diagram and Hydraulic Profile





APPENDIX D

Floor Plan of On-Site Sewage Treatment Plant





APPENDIX E

Floor Plan of STP Control Building





APPENDIX F

Equipment Manufacturer's Specifications





BESST PROCESS CALCULATIONS



PES Project #	BJB-021518-DE	Date:	2/15/18
Job Name:	Dockers		
QTY & Flow			

BESST DESIGN CALCULATIONS

1) **B_x** Actual Sludge Load [kg BOD₅ / kg VSS / d]

$$\begin{aligned}
 B_x &= B \times 1.02^{(t_{min}-20)} \\
 B_x &= 0.120 \times 1.02^{(10-20)} \\
 B_x &= 0.0984 \text{ kg BOD}_5 / \text{kg VSS} / \text{d}
 \end{aligned}$$

2) **A** Sludge Age [days]

$$\begin{aligned}
 A &= (1 / (YB_x)) \times (1 - 0.5((YB_x) / k_{ac})) + (\text{Sqrt}(1 + ((YB_x) / 2k_{ac})^2)) \\
 A &= (1 / (0.60 \times 0.0984)) \times (1 - 0.5 \times ((0.60 \times 0.0984) / 0.090)) + \\
 &\quad (\text{Sqrt}(1 + ((0.60 \times 0.0984) / (2 \times 0.090))^2)) \\
 A &= 29.1936 \text{ days}
 \end{aligned}$$

3) **k_d** Actual Rate of Decay [d⁻¹]

$$\begin{aligned}
 k_d &= k_{ac} / (1 + Ak_{ac}) \\
 k_d &= 0.090 / (1 + (29.1936)(0.090)) \\
 k_d &= 0.0248 \text{ d}^{-1}
 \end{aligned}$$

4) **X** Sludge Concentration [kg ss / m³]

$$\begin{aligned}
 X &= 1000 \times V_x / KI \\
 X &= 1000 \times 0.600 / 100 \\
 X &= 6.0000 \text{ kg ss} / \text{m}^3
 \end{aligned}$$

5) **X_v** Volatile Suspended Solids Concentration [kg VSS / m³]

$$\begin{aligned}
 X_v &= (X)(p) \\
 X_v &= 6.0000 \times 0.65 \\
 X_v &= 3.9000 \text{ kg VSS} / \text{m}^3
 \end{aligned}$$

PES Project #	BJB-021518-DE	Date:	2/15/18
Job Name:	Dockers		
QTY & Flow	0		

BESST DESIGN CALCULATIONS, Cont'd.

6) **v** Actual Hydraulic Loading [m / h]

$$\begin{aligned}
 v &= \text{Lesser of } v_l \text{ or } v_c, \text{ where } v_l = 1 \\
 v_c &= (N_x / X) \times e^{0.03(t_{min}-20)} \\
 v_c &= (6.0000 / 6.0000) (e^{0.03 * (10 - 20)}) \\
 v_c &= 0.7408 \quad \text{m / h} \\
 v &= 0.7408 \quad \text{m / h}
 \end{aligned}$$

7) **V_B** Aeration Volume [m³]

$$\begin{aligned}
 S_R &= S_T - (0.966(p)(NL)) \\
 V_B &= (Q(S_O - S_R)) / X_v B_x \\
 V_B &= ((28.3876) (0.2720 - 0.0000)) / (3.900) (0.0984) \\
 V_B &= 20.11 \quad \text{m}^3 \\
 20.11 \quad \text{m}^3 &\times 264.2 \text{ gal/m}^3 = 5314 \quad \text{gallons}
 \end{aligned}$$

8) **S_s** Clarifier Surface Area [m²]

$$\begin{aligned}
 S_s &= ((Q_Q)(Q)) / 24v \\
 S_s &= ((3) (28.388)) / (24 * 0.7408) \\
 S_s &= 4.790 \quad \text{m}^2 \\
 4.790 \quad \text{m}^2 &\times 10.76 \text{ ft}^2/\text{m}^2 = 52 \quad \text{ft}^2
 \end{aligned}$$

9) **V_s** Clarifier Volume [m³]

$$\begin{aligned}
 V_s &= S_s / SV \\
 V_s &= 4.790 \quad / \quad 0.77 \\
 V_s &= 6.221 \quad \text{m}^3 \\
 6.22 \quad \text{m}^3 &\times 264.2 \text{ gal/m}^3 = 1643 \quad \text{gallons}
 \end{aligned}$$

PES Project #	BJB-021518-DE	Date:	2/15/18
Job Name:	Dockers		
QTY & Flow	0		

BESST DESIGN CALCULATIONS, Cont'd.

10) P_x Net Mass of Volatile Suspended Solids Produced [kg VSS / d]

$$P_x = (Y / (1 + A k_d))(Q)(S_o - S_R)$$

$$P_x = (0.60 / (1 + (29.1936) (0.0248))(28.39)(0.2720 - 0.0000))$$

$$P_x = 2.687 \quad \text{kg VSS / d}$$

11) P_t Sludge Production [kg ss / d]

$$P_t = P_x / p$$

$$P_t = 2.687 \quad / \quad 0.6500$$

$$P_t = 4.133 \quad \text{kg ss / d}$$

12) V_N Nitrification Volume [m³]

$$V_N = (Q(N_o - N)) / (p_N m_U X_V)$$

$$V_N = (28.3876 (0.0650 - 0.0000)) / ((0.0639) (0.6085) (3.9000))$$

$$V_N = 12.165 \quad \text{m}^3$$

$$12.16 \quad \text{m}^3 \times 264.2 \text{ gal/m}^3 = 3214 \quad \text{gallons}$$

13) V_D Denitrification Volume [m³]

$$V_D = (QN_o Y) / (0.75 m_Z X_V)$$

$$V_D = (28.39 ((0.0650) (0.60))) / (0.75 (0.0250) (3.9000))$$

$$V_D = 15.140 \quad \text{m}^3$$

$$15.14 \quad \text{m}^3 \times 264.2 \text{ gal/m}^3 = 4000 \quad \text{gallons}$$

PES Project #	BJB-021518-DE	Date:	2/15/18
Job Name:	Dockers		
QTY & Flow	0		

BESST DESIGN CALCULATIONS, Cont'd.

14) V_A Volume of Aeration [m³]

$$\begin{aligned}
 V_A &= \text{Larger of } V_{AB} \text{ or } V_N \\
 V_{AB} &= V_B - V_D((1 + Ak_d) / (2.77(Am_Z))) \\
 V_{AB} &= 20.11 - 15.140 ((1 + (29.1936)(0.0248)) / (2.77(29.1936)(0.0250))) \\
 V_{AB} &= 7.199 \\
 V_A &= 12.165 \text{ m}^3 \\
 &12.16 \text{ m}^3 \times 264.2 \text{ gal/m}^3 = 3214 \text{ gallons}
 \end{aligned}$$

NOTE: Aeration Zone Volume will be **5625** gallons due to Suffolk County requirements
 Anoxic Zone Volume will be **4687.5** gallons due to Suffolk County requirements

15) V_T Total Volume of Reactor [m³]

$$\begin{aligned}
 V_T &= V_A + V_D + V_S \\
 V_T &= 12.165 + 15.140 + 6.221 \\
 V_T &= 33.53 \text{ m}^3 \\
 &33.53 \text{ m}^3 \times 264.2 \text{ gal/m}^3 = 8857 \text{ gallons}
 \end{aligned}$$

NOTE: Actual total volume of reactor may be greater due to oversized Aeration and Anoxic Zones

16) O_2 Oxygen Consumption [kg O₂ / d]

$$\begin{aligned}
 O_2 &= Q((S_O - S_R) / 0.55) - 1.42P_X + 4.57Q(N_O - N) \\
 O_2 &= 28.39 ((0.2720 - 0.0000) / 0.68) - 1.42(2.687) \\
 &\quad + 4.57(28.39)(0.0650 - 0.0000) \\
 O_2 &= 18.656 \text{ kg O}_2 / \text{d} \\
 &18.656 \text{ kg O}_2 / \text{d} \times 2.205 \text{ lbs./kg} = 41.14 \text{ lbs. O}_2 / \text{d}
 \end{aligned}$$

PES Project #	BJB-021518-DE	Date:	2/15/18
Job Name:	Dockers		
QTY & Flow	0		

BESST DESIGN CALCULATIONS, Cont'd.

17) **Nm** Air Consumption [Nm³ / h]

$$\mathbf{Nm} = O_2(c_S / (c_S - 2))(o_k / (0.024a))$$

$$\mathbf{Nm} = 18.656 \left(\frac{9.1580}{9.1580 - 2} \right) \left(\frac{1.3000}{0.024 \left(\frac{30}{60} \right)} \right)$$

$$\mathbf{Nm} = 43.10 \text{ Nm}^3 / \text{h}$$

$$43.10 \text{ Nm}^3 / \text{h} \times 35.31 \text{ ft}^3 / \text{Nm}^3 = 1521.75 \text{ ft}^3 / \text{h}$$

$$1521.75 \text{ ft}^3 / \text{h} \text{ divided by } 60 \text{ min/hr} = 25 \text{ ft}^3 / \text{min}$$

BESST PROGRAM AND FORMULA LISTING

The following variable and formula lists represent the program listing for the computer model used to design and size the BESST system. Not all of the formulas are listed due to copyright and patent protection. Formulas that are NOT shown are mainly sub-formulas of those listed. For formula verification see Metcalf & Eddy: Wastewater Engineering; and K.R. Imhoff: Taschenbuch der Stadtentwässerung. 28. Auflage, Oldenbourg München - Wien 1993.

INPUT VALUES

1.)	B	Sludge Load (kg BOD / kg VSS)	0.03 to 0.20
2.)	N_x	Flux Flow (kg ds / m² / h) function of temperature (use @ 20 degrees Celsius)	6.00
3.)	V_L	Limit Hydraulic Loading (m / h)	0.99 to 1.1
4.)	V_x	Sludge Volume (mL / L)	4.0 to 0.7
5.)	KI	Sludge Index (mL / g)	70 to 120
6.)	p	Volatile Suspended Solids (%)	0.62 to 0.68
7.)	Y	Maximum Yield Coefficient (kg VSS / kg BOD)	0.53 to 0.6
8.)	k_{ac}	Decay Rate (d) constant	0.09
9.)	Q	Flow Rate (m³ / d)	
10.)	Q_Q	Flow Variation	1.5 to 3
11.)	S_o	Influent BOD (kg / m³)	
12.)	S_r	Effluent BOD (kg / m³)	
13.)	N_o	Influent Ammonia (kg / m³)	
14.)	N	Effluent Ammonia (kg / m³)	typically 0.005

INPUT VALUES

15.)	N_3	Effluent Nitrates N-NO ₃ (kg / m ³)	typically	0.001 to 0.015
16.)	NL _o	Influent TSS (kg / m ³)		
17.)	NL	Effluent TSS (kg / m ³)		
18.)	min	Minimum Water Temperature (°C)		
19.)	max	Maximum Water Temperature (°C)		
20.)	a	Oxygen Transfer Coefficient (g / Nm ³)		15 to 50
21.)	SV	Ratio, Separation Surface to Separation Volume		
22.)	m _i	Specific Growth Rate of Nitrificants	constant	1.37
23.)	pH	pH		6.0 to 8.0
24.)	m _{id}	Specific Growth Rate of Denitrificants	constant	0.1 to 0.3
25.)	O _k	Peak Load of Aeration	constant	1.3

Nitrification and Denitrification

Nitrogen is removed by the nitrification and denitrification processes. Nitrification is autotrophic and all Purestream ES, LLC integrated bioreactors are designed for complete nitrification of ammonia to NO_3 (please see Metcalf & Eddy, Third Edition, Chapter 11-6).

Denitrification, however, is heterotrophic and requires a carbon source. Conventional plants' "separate sludge denitrification" requires that carbon is added, typically in the form of methanol. This adds to operating costs, and if used in excess, to increased BOD_5 content. BESST technology's "single-sludge denitrification" approach uses an endogenous carbon source to maintain denitrifiers. Influent is combined with nitrified mixed liquor in the anoxic compartment providing the carbon source needed for denitrification. Relatively high mixed liquor recycle rates are employed and sufficient denitrification retention times provided.

Total nitrogen reduction ($\mathbf{N_T}$) is a subject of not only providing sufficient anoxic volume for denitrification and keeping temperature above a certain minimum, but also a function of Recycled Activated Sludge (RAS) flow rate. The efficiency of $\mathbf{N_T}$ reduction is expressed as follows:

$$\eta = (1 - 1/(1 + n)) \times 100$$

Where n = RAS flow multiple of average flow Q .

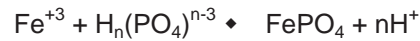
The following are typical efficiencies and RAS flow multiples used / required:

	n	η (%)
Domestic	2	66
	3	75
	4	80
Slaughterhouse Wastewater	14	93
Hog Manure	29	97

BESST technology delivers not only high efficiency reduction of organic matter, but also increased efficiency of phosphorous removal. Two processes, biological and chemical precipitation are employed with advantage

The mechanics of biological phosphorous removal, known as "Luxury Uptake", are due to exposure of activated sludge to alternating oxic and anoxic conditions. Under these conditions, the cells store more energy in the form of phosphorous than needed for their survival. If strictly oxic conditions are maintained during subsequent clarification, phosphorous will be retained by the cells and will eventually be removed with the excess sludge. Unlike most other methods of clarification, these conditions are maintained by the BESST process, and biological phosphorous reduction to less than 3 mg/L are readily achievable.

The basic reaction involved in the precipitation of phosphorous with iron is as follows:



In the case of iron, 1 mole will precipitate 1 mole of phosphate. The advantage of the process is its low chemical consumption, close to stoichiometric, and consequently, the reduction of ballast sludge production. Followed by microfiltration, reductions to 0.5 mg/L are possible.

If yet further reduction of phosphorous is required, ferric sulfate precipitation after the bioreactor followed by microfiltration must be used.

BESST Sizing and Pricing Program v7.9.2004.01

P/E Job No.	BJB-021518-DE	Date	2/15/18
Job Name	Dockers		

B	0.12 kg BOD/kg VSS d	0.12 Bx	0.098441796
Nx	6 kg SS/m2h	6 A	29.19360047
vl	1 m/h	1 kd	0.024810995
Vx	0.6 ml/l	0.6 X	6
KI	100 ml/g	100 Xv	3.9
p	0.65 MLVSS/MLSS	0.65 v	0.740818223
Y	0.6 kg-1 VSS/kg BOD	0.6 VB	20.11
kac	0.09 d-1	0.09 Ss	4.79
Flow	7,500 GPD	28.38759 Vs	6.22
Peak	3 QQ	3 Px	2.69
BODin	272 mg/l	0.272 Pt	4.13
BODout	0 mg/l	0 Vn	12.16
NH3-Nin	65 mg/l	0.065 Vd	15.14
NH3-Nout	0 mg/l	0 Va	12.16
TNout	0 mg/l	0 Vt	33.53
TSSin	320 mg/l	0.32 O2	18.66
TSSout	0 mg/l	0 Nm	43.10
T min	10 C	10 uc	100.00%
T max	20 C	20	
		30	
		0.77	
		1.37	
		7	
		0.1	
		1.3	



RAW SEWAGE PUMPS



Sunset Harbor Condominium/Townhouses Development

Equivalent Lengths of Pipe

check valve	18.5
plug valve	30
(6) 90s	75
tee	21
Pipe Length	14.7 Horizontal
Pipe Length	25.2 Vertical
Total	184.4

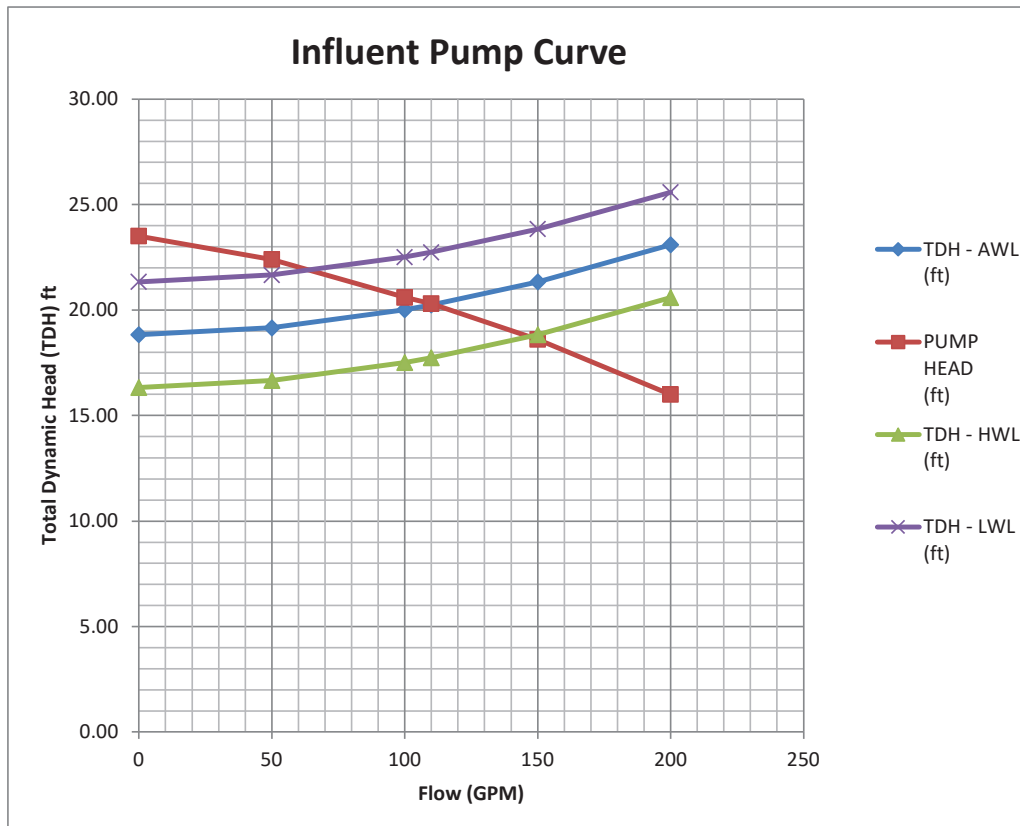
System Curve Calcs

Length of Pipe	(Feet)		184.4		
Diameter of Pipe	(in)	4" SCH. 10 S.S.	4.26		
Static Head	(Elev. In feet)		18.83	16.33	21.33
"C"	Pipe Roughness Coefficient		120		

Flow (GPM)	FRICTION HEAD (ft)	TDH - AWL (ft)	TDH - HWL (ft)	TDH - LWL (ft)	PUMP HEAD (ft)	FLOW VELOCITY (ft/s)
0	0.00	18.83	16.33	21.33	23.5	0.00
50	0.33	19.16	16.66	21.66	22.4	1.13
100	1.18	20.01	17.51	22.51	20.6	2.25
110	1.41	20.24	17.74	22.74	20.3	2.48
150	2.50	21.33	18.83	23.83	18.6	3.38
200	4.26	23.09	20.59	25.59	16	4.50

Pump: AVX446-205/2, 8T/C @ 60hz

Note: 2 mm Or-Tec Screen MB280KT has a capacity of 260 gpm



Technical Information

AVX446-205/2,8T/C



Operating data

Flow

Head

Shaft power P2 1.95 hp

Pump efficiency 28.1 %

Required pump NPSH

Pump type Single pump

No. of pumps 1

Fluid Wastewater

Pump

Pump Code AVX446-205/2,8T/C

Impeller Vortex impeller

Impeller size 8¹/₁₆"

Solid size 4 inch

Discharge port 4" ANSI

Suction port DN100

Motor

Rated voltage V

Frequency 60 Hz

Rated power P2 2.8 hp

Rated speed 1160 rpm

Number of poles 6

Efficiency 82 %

Rated current 8.2 / 4,1 A

Degree of protection IP 68

Materials

Motor housing Cast Iron ASTM A48;Cl.40B

Pump housing Cast Iron ASTM A48;Cl.40B

Impeller Cast Iron ASTM A48;Cl.40B

Motor shaft AISI 430 F Stainless Steel

Bolts AISI 304 Stainless Steel

Elastomers Nitrile Rubber

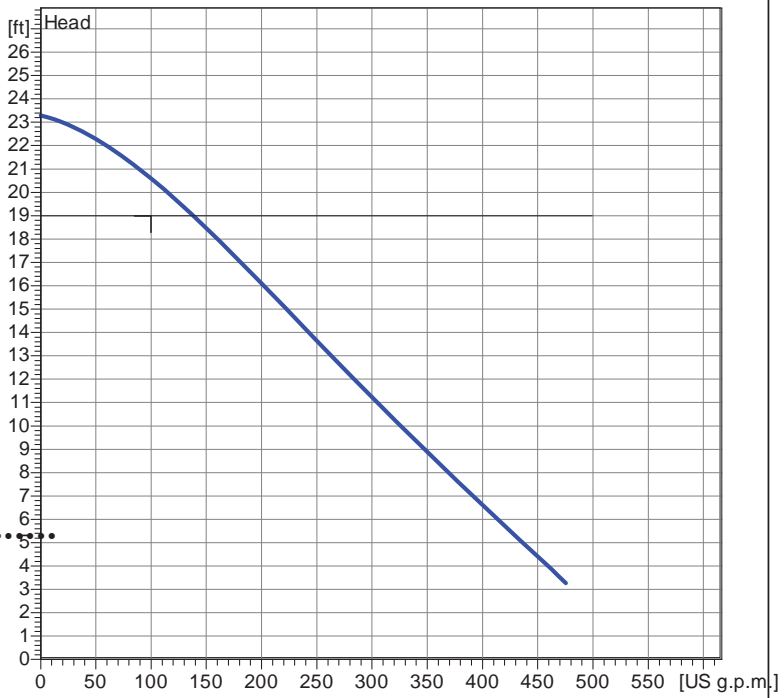
Mechanical seal on motor side SiC / SiC

Mechanical seal on medium side SiC / SiC

Lower Bearing Double row angular ball bearing

Upper Bearing Deep Groove Ball Bearing

Testnom: P2>10kW, HI Standard Grade 2B
P2<10kW, HI Standard Sect. 11.6.5.4



Wet well installation with coupling kit (T, 180...205)
Dimensions in mm [inch], letters see table

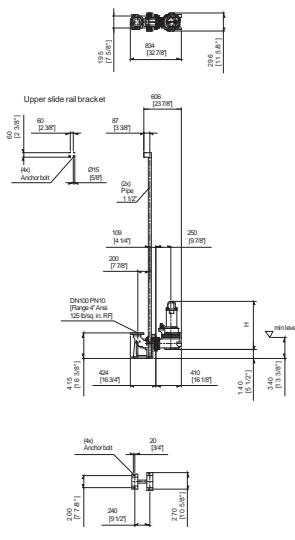


Table Dimensions (inch)

H	28 ⁹ / ₁₆
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2.0.1 - 18.08.2023 (Build 1.47)

Performance Curve

AVX446-205/2,8T/C



Impeller

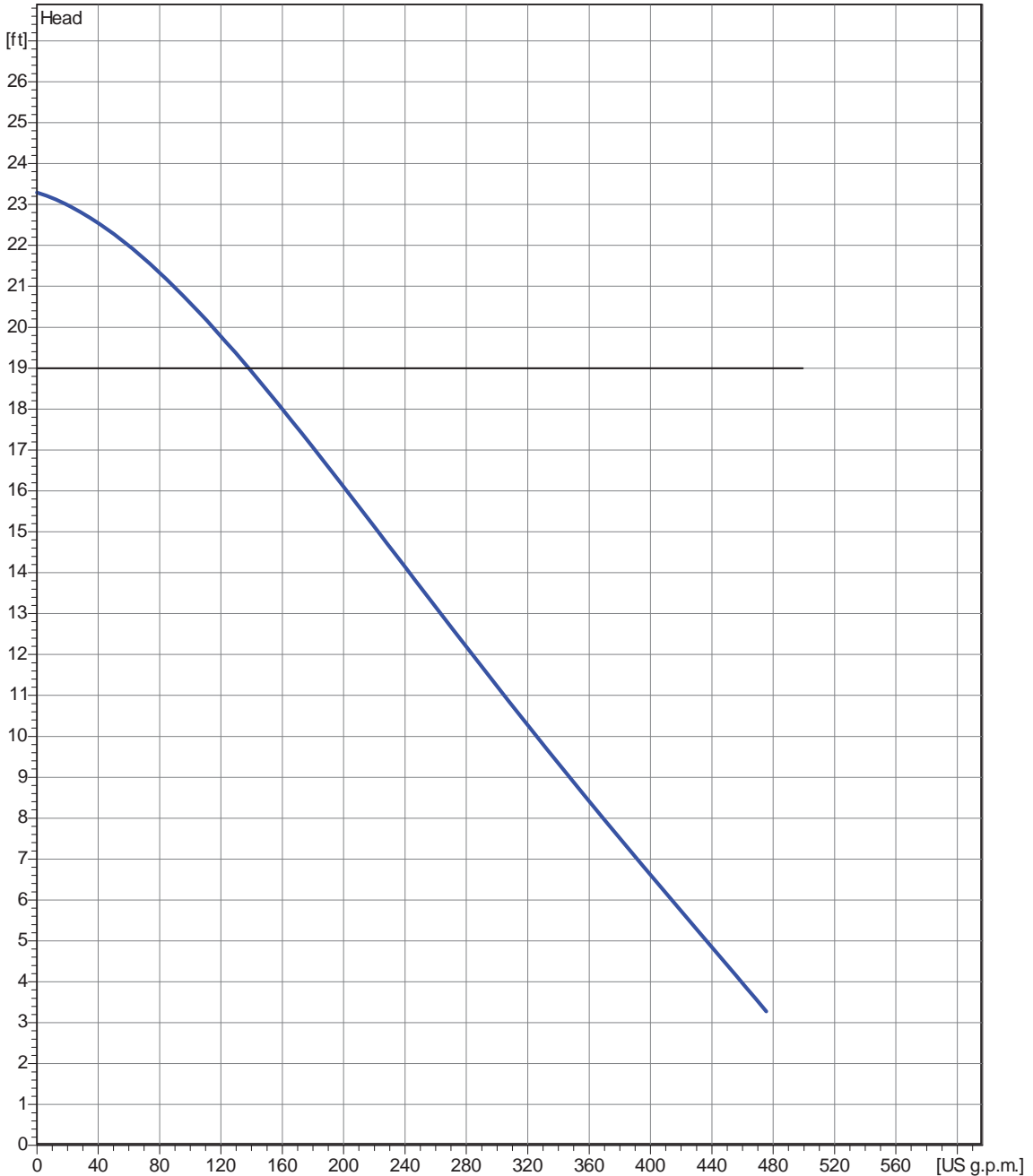
Impeller type: Vortex impeller	Solid size 4 inch	Ø:	Max. Ø: 8 1/16"	Min. Ø: 6 5/16"	Sel. Ø: 8 1/16"
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Operating data

Speed: 1160 rpm	Frequency: 60 Hz	Duty point: Q = US g.p.m. H = ft	Shaft power P2: 1.95 hp	Discharge port: 4" ANSI
---------------------------	----------------------------	--	-----------------------------------	-----------------------------------

Power data referred to:
Water, clean [100%] ; 68°F; 62.322lb/ft³; 1.0818E-5ft²/s

Testnorm: **P2>10kW, HI Standard Grade 2B**
P2<10kW, HI Standard Sect. 11.6.5.4



2.0.1 - 18.08.2023 (Build 147)

Project	Project no.:	Created by:	Page: 2	Date: 2023-10-17
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Dimensions

AVX446-205/2,8T/C

Wet well installation with coupling kit (T, 180...205)
 Dimensions in mm [inch], letters see table

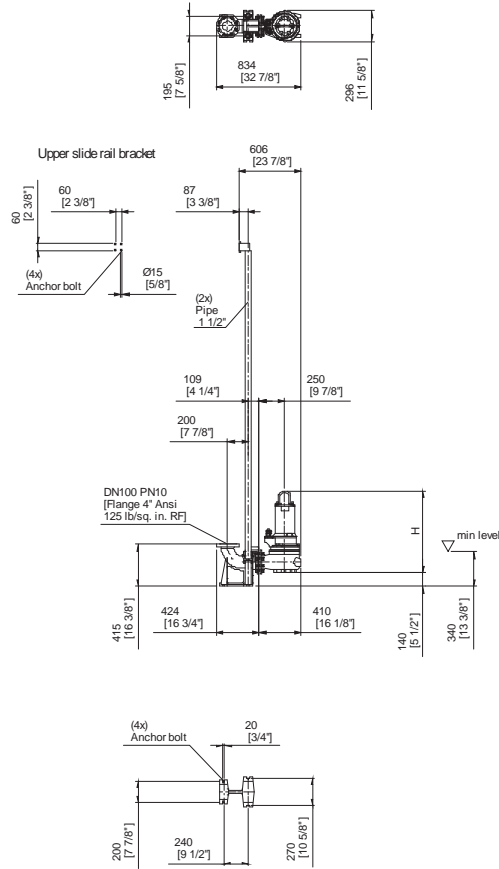


Table Dimensions (inch)

H	28 ⁹ / ₁₆
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min level = Minimum fluid level for intermittent operation (S3)

2.0.1 - 18.08.2023 (Build 147)

Technical Data

AVX446-205/2,8T/C



Operating data			
Flow	g.p.m.	Head	ft
Shaft power P2	2.0	hp	Static head
Pump efficiency	28.1	%	Required pump NPSH
Pump type	Single pump	No. of pumps	1
Fluid	Water, clean	Temperature	68 °F
Density	62.32 lb/ft³	Kin. viscosity	1.082E-5 ft²/s

Pump			
Pump Code	AVX446-205/2,8T/C	Speed	1160 rpm
Suction port	DN100	Head	Max. 23.3 ft
Discharge port	4" ANSI		Min. 3.3 ft
Impeller type	Vortex impeller	Flow	Max. 475.5 US g.p.m.
Solid size	4 inch	Pump efficiency max.	36.9 %
Impeller Ø	8.07 inch	Required rated power max. P2	2.6 hp

Motor			
Motor design	Submersible motor	Insulation class	H
Motor name	AM173.3,4T/6/3	Degree of protection	IP 68
Frequency	60 Hz	Temperature class	T3C
Rated power P2	2.8 hp	NEMA code	E
		Explosion protection	
Rated speed	1160 rpm	Efficiency at % rated power	100% 82.0 %
Rated voltage	230 / 460 V 3~		75% 83.0 %
Rated current	8.2 / 4,1 A		50% 82.0 %
Starting current, direct starting	32.0 / 16 A	cos phi at % rated power	100% 0.78
Starting current, star-delta	10 / 5 A		75% 0.72
Starting mode	Directly		50% 0.59
Power cable	10G1,5 / 14AWG-4+14AWG-4	Control cable	
Type of power cable	H07RN8-F PLUS / RHW-2	Type of control cable	
Cable length	32.8 ft	Service factor	1.15
Shaft seal	Mechanical seal on motor side	SiC / SiC	
	Mechanical seal on medium side	SiC / SiC	
Bearing	Lower Bearing	Double row angular ball bearing	
	Upper Bearing	Deep Groove Ball Bearing	
Remarks			

Materials / Weight			
Motor housing	Cast Iron ASTM A48;Cl.40B	Bolts	AISI 304 Stainless Steel
Pump housing	Cast Iron ASTM A48;Cl.40B	Elastomers	Nitrile Rubber
Impeller	Cast Iron ASTM A48;Cl.40B		
Motor shaft	AISI 430 F Stainless Steel		
Weight aggregate	231.48 lb		

Project	Project no.:	Created by:	Page: 4	Date: 2023-10-17
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2.0.1 - 18.08.2023 (Build 147)



SUPERNATANT PUMP

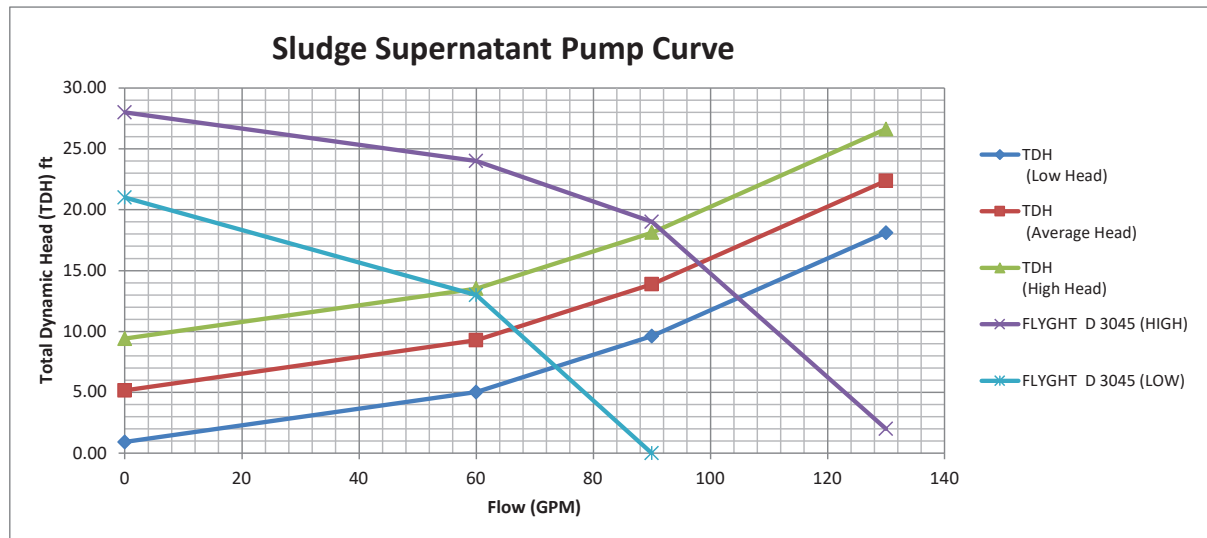


Sunset Harbor Condominium/Townhouses Development
 Sludge Holding Tank Pump Calculations

Equivalent Length of Pipe	73	ft		
Diameter of Pipe	2.245	in	Equivalent Lengths of Pipe	
Low Water Level	2.5		(2) 90s	10
High Water Level	11		Pipe Length	63
Discharge Invert	11.91		Total	73
Low Static Head	0.91			
Average Static Head	5.16	ft (Approximate Height Above LWL)		
High Head	9.41			
"C"	120	(Avg. of PVC and Stainless)		

Formula for Friction = $(10.44 \times L \times V^{1.85} / (C^{1.85} \times d^{4.8655}))$

Flow (GPM)	Friction	TDH (Low Head)	TDH (Average Head)	TDH (High Head)	FLYGHT D 3045 (HIGH)	FLYGHT D 3045 (LOW)	Velocity (ft/s)
0	0.00	0.91	5.16	9.41	28	21	0.00
60	4.12	5.03	9.28	13.53	24	13	4.87
90	8.72	9.63	13.88	18.13	19	0	7.30
130	17.22	18.13	22.38	26.63	2		10.54

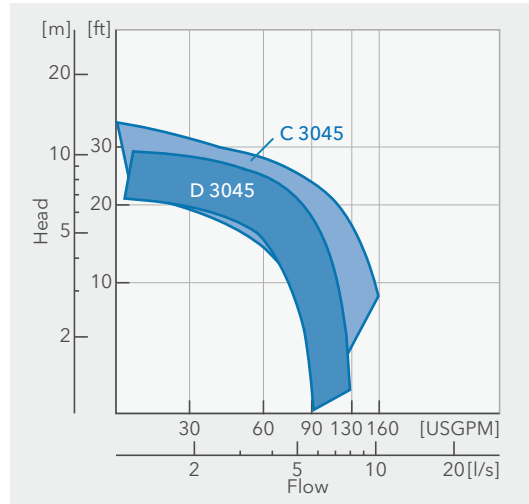


The right pump for every application

Flygt 3045



Performance



C = Channel impeller D = Vortex impeller

Product specific data*

Rating, HP (kW)	1.1–1.8 (0.8–1.3)
Discharge, in (mm)	2" (50)
Impeller material	Polyamide PA66
Installation	P, S, F, H
Weight, lbs (kg)	62 (28)
Height, in (mm)	17–19" (432–483)

Impeller options

C	Channel impeller
D	Vortex impeller

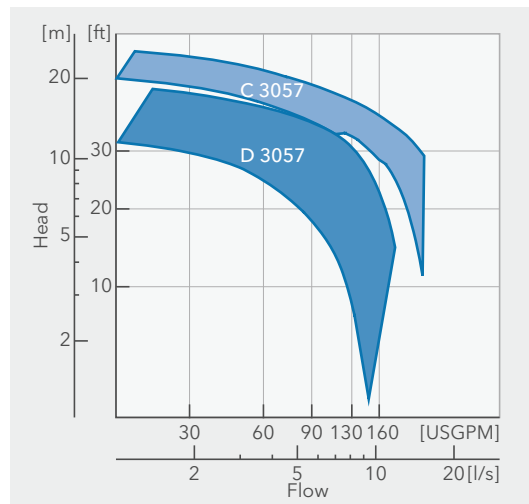
Mechanical seals

Material	Inner	Outer
Carbon/aluminum oxide	•	
Silicon carbide/silicon carbide		•

Flygt 3057



Performance



C = Channel impeller D = Vortex impeller

Product specific data*

Rating, HP (kW)	2.3–3.8 (1.7–2.8)
Discharge, in (mm)	2" (50)
Impeller material	Stainless steel/cast iron
Installation	P, S, F, H
Weight, lbs (kg)	75 (34)
Height, in (mm)	19–21" (483–533)

Impeller options

C	Channel impeller
D	Vortex impeller

Mechanical seals

Material	Inner	Outer
Carbon/aluminum oxide	•	
Aluminum oxide/corrosion resistant cemented carbide		•
Corrosion resistant cemented carbide/corrosion resistant cemented carbide	•	•



MULTITRODE PUMP LEVEL CONTROLLER



ENGINEERING REPORT – PROPOSED SEWAGE TREATMENT PLANT

P.W. GROSSER CONSULTING, INC • P.W. GROSSER CONSULTING ENGINEER & HYDROGEOLOGIST, PC
631.589.6353 • WWW.PWGROSSER.COM • PWGC.INFO@PWGROSSER.COM
BOHEMIA • MANHATTAN • SARATOGA SPRINGS • MONTICELLO • SYRACUSE • SHELTON, CT

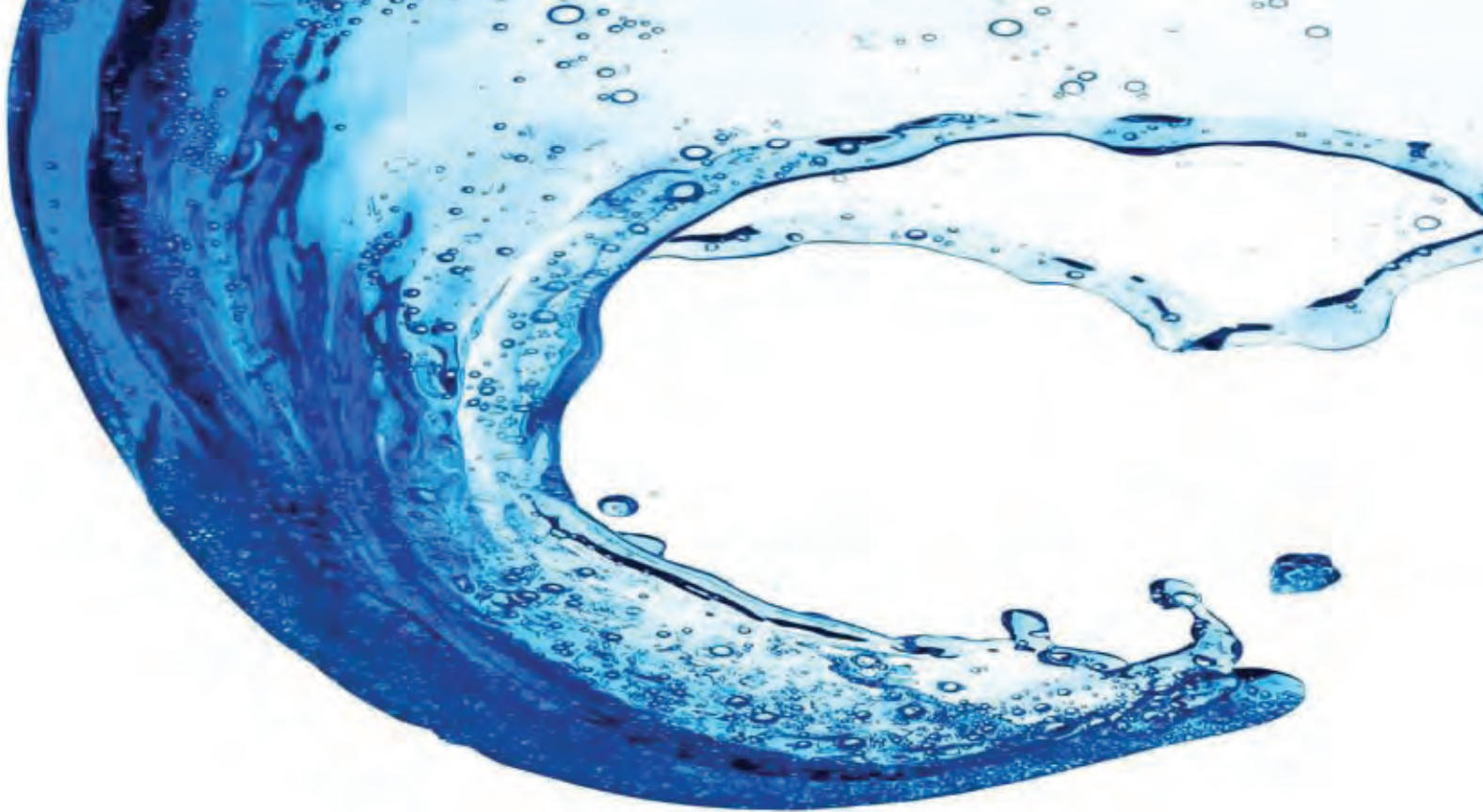


MultiSmart Pump Station Manager.

The new face of technology.



multitrode
WATER • WASTEWATER • PUMP STATION • TECHNOLOGY



What is a pump station manager?

It's the next generation of technology for water & wastewater pump stations – combining the best of PLCs, RTUs and pump controllers into a comprehensive and intuitive package.

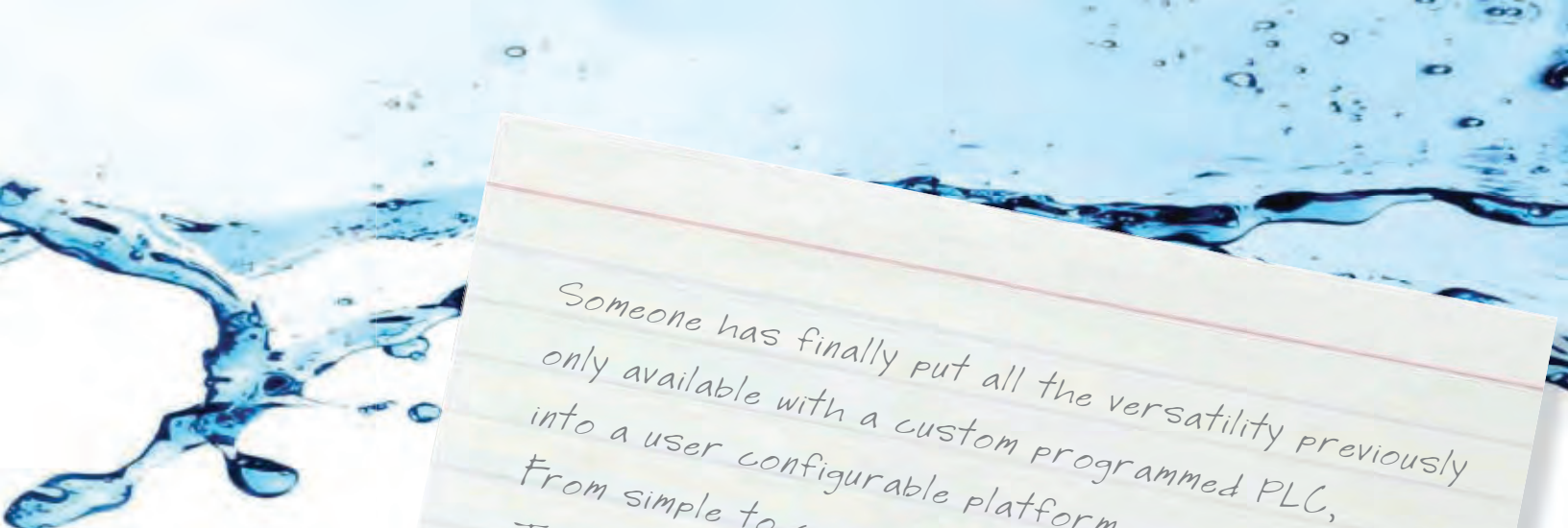
The pump station manager also integrates up to 15 control panel components, reducing control panel cost and enabling energy cost/CO₂ reduction.

Why choose MultiSmart?

MultiSmart was designed to make Utilities better managers of their assets.

Benefits include:

- Lower cost of control panel (over \$10,000 is often achievable).
- Reduces operational costs by up to 70%.
- Reduces energy costs & CO₂ footprint by up to 15%.
- Wealth of asset management data.



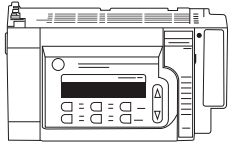
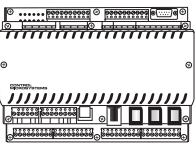
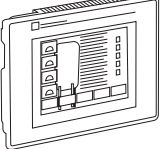
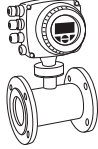
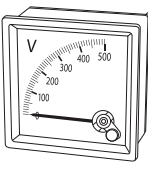
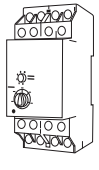
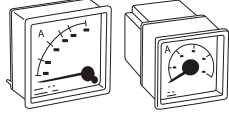
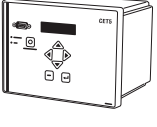
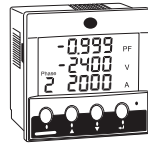

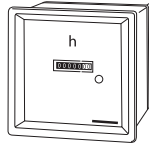
Someone has finally put all the versatility previously only available with a custom programmed PLC, into a user configurable platform. From simple to complex, this unit handles it all. The wealth of pump station operational information available to the end user is virtually limitless.

J.C. Van Harn, President, GrandTech Inc., Byron Centre, Michigan.

MultiSmart at a glance.

- “Setup wizard” for commissioning of a new station
- Save/Copy configuration using compact flash card
- Advanced pump control functionality for up to 6 pumps
- Flow without a flow meter
- Data logger for 50,000 events (10,000,000 direct to CF card)
- History page with detailed fault & event data
- 3-phase supply voltage monitoring and protection
- Flexible RTU with Modbus & DNP3 protocol for SCADA & local connectivity
- Energy, power & pump efficiency monitoring
- Expandable I/O

Why invest in PLCs, RTUs, pump controllers and \$1000s of programming...

<p>PLC</p> 	<p>RTU</p> 	<p>HMI</p> 	<p>FLOWMETER</p> 
<p>VOLTMETER</p> 	<p>PHASE FAIL RELAY</p> 	<p>CURRENT METER</p> 	<p>MOTOR PROTECTION</p> 
<p>ENERGY & POWER METER</p> 	<p>INSULATION RESISTANCE TESTER</p> 	<p>HOURS RUN METER</p> 	<p>\$10,000s of design, programming and integration.</p>

when MultiSmart does it all.





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WATER • WASTEWATER • PUMP STATION • TECHNOLOGY



MultiTrode.
For ultra-reliable
level sensing
and control.

multitrode
WATER • WASTEWATER • PUMP STATION • TECHNOLOGY

The Liquid Level Sensor you don't need to clean.

The most reliable and cost-effective level sensor for wastewater.

Lasts for over 20 years!

- Reduces maintenance costs.
- No more false readings or burnt-out pumps.
- Simple to install and guaranteed for 10 years.
- Cuts the risk of spills.

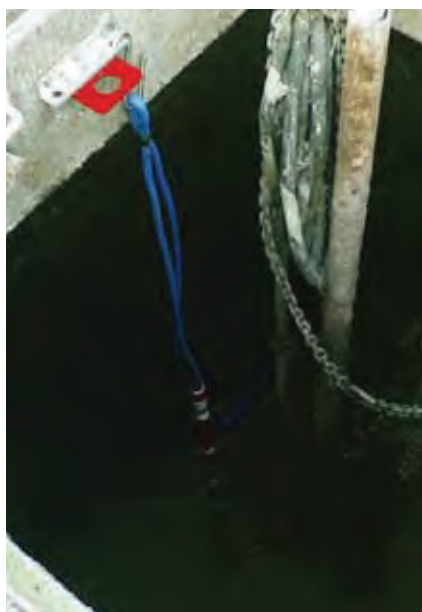
Why is it so reliable?

No electronics and no moving parts means there is nothing to fail – that's why it gets a 10-year warranty.

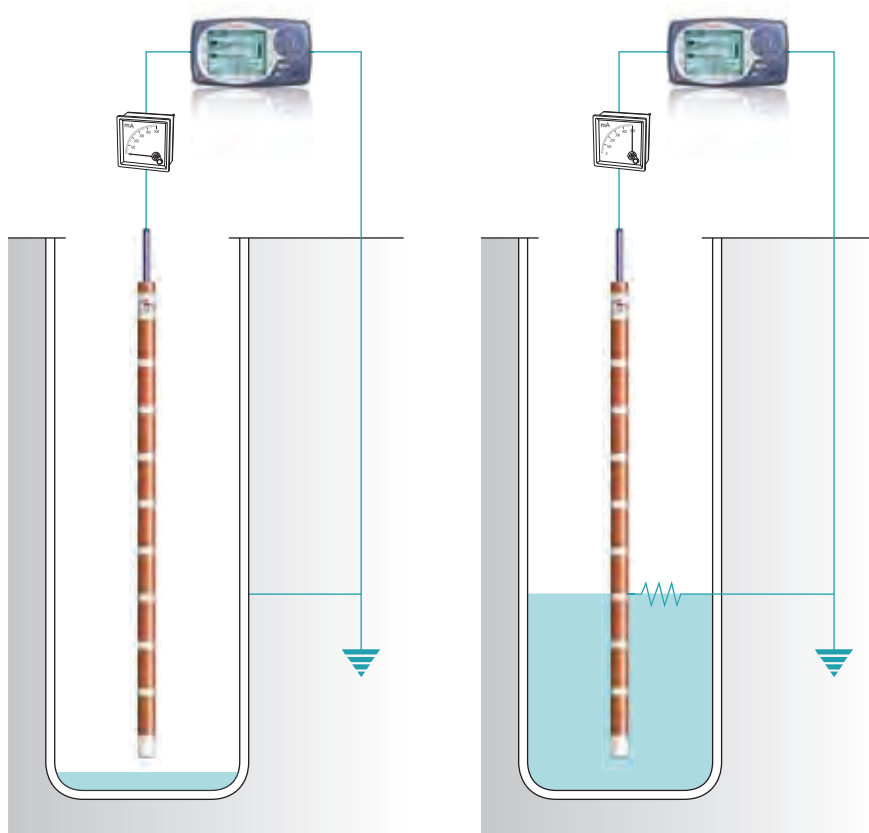
How does it work?

The Probe works by using the conductive properties of the water itself to complete a circuit with a controller. It's mounted near the inflow, allowing the turbulence to keep it clean. Even if a build-up does occur it's usually conductive (in wastewater) and so the Probe keeps right on working.

When cleaning is required, the probe is installed off a mounting bracket that includes a cleaning device.



Typical installation in the UK.



When a sensor is not covered with liquid there is no circuit to ground/earth.

Each sensor completes a separate circuit to ground/earth through the liquid.

Primary Level in Wastewater.

Connects to:



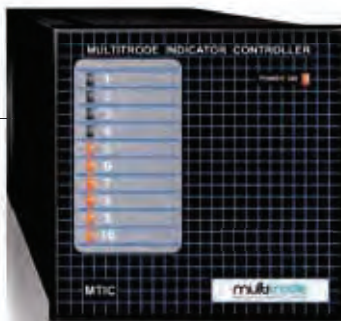
MultiSmart Pump Station Manager

Full control and monitoring with SCADA connectivity – see MultiSmart brochure for details.



MTDPC Pump Controller

Simple lead/lag control with level display, typically non-utility.



MTIC Indicator Controller

4-20mA output to connect to PLC control and 10 Digital Outputs (for each level sensor) for simple control.



MTISB Intrinsically Safe Barrier

The MTISB is used between the MultiTrobe probes and control equipment. It eliminates the risk of dangerous energy entering the potentially explosive environment where the probe is located. 5-channel (MTISB5) and 10-channel (MTISB10) barriers available.



Primary Level in Industrial Applications.

Single Pump Control.

Works well in confined spaces and with a wide variety of effluents.



MTR with
2 single sensor probes



MTRA with
3 single sensor probes



SafeSmart-TL version with
3-sensor probe

2 Pump Control.



MTIC with 10-sensor probe



MTDPC with 10-sensor probe



Two single sensor probes (e.g. from a sump pack),
with optional extender bracket.

How accurate is the Probe?

The probe gives 10% resolution, more than enough for most pump stations.

Why is it easier to install than other level devices?

All you do is hang the Probe on its own cable into your wet well, using the bracket we supply. Installation is simple – any one of your technicians could do it in an hour or so. What's more, you install the Probe relatively low down in the wet well, so compared to ball floats it allows the well to be cleaned out more thoroughly. That means less debris build-up, odors and pump clogs.

Why do we like the Probe? It's simple, safe, cuts
maintenance time and makes life so much easier!

Gray Walls, Public Works Director, Town of Troy, NC

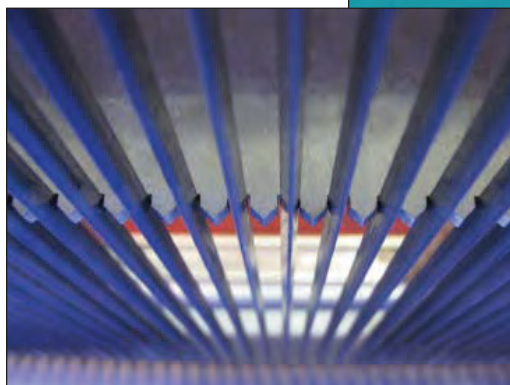


MECHANICAL SCREEN



OR-TEC MICRO BAR SCREEN

The OR-TEC Blue Whale Micro Bar Screen is a superfine mechanical bar screen suitable for the headworks of both municipal and industrial wastewater treatment plants



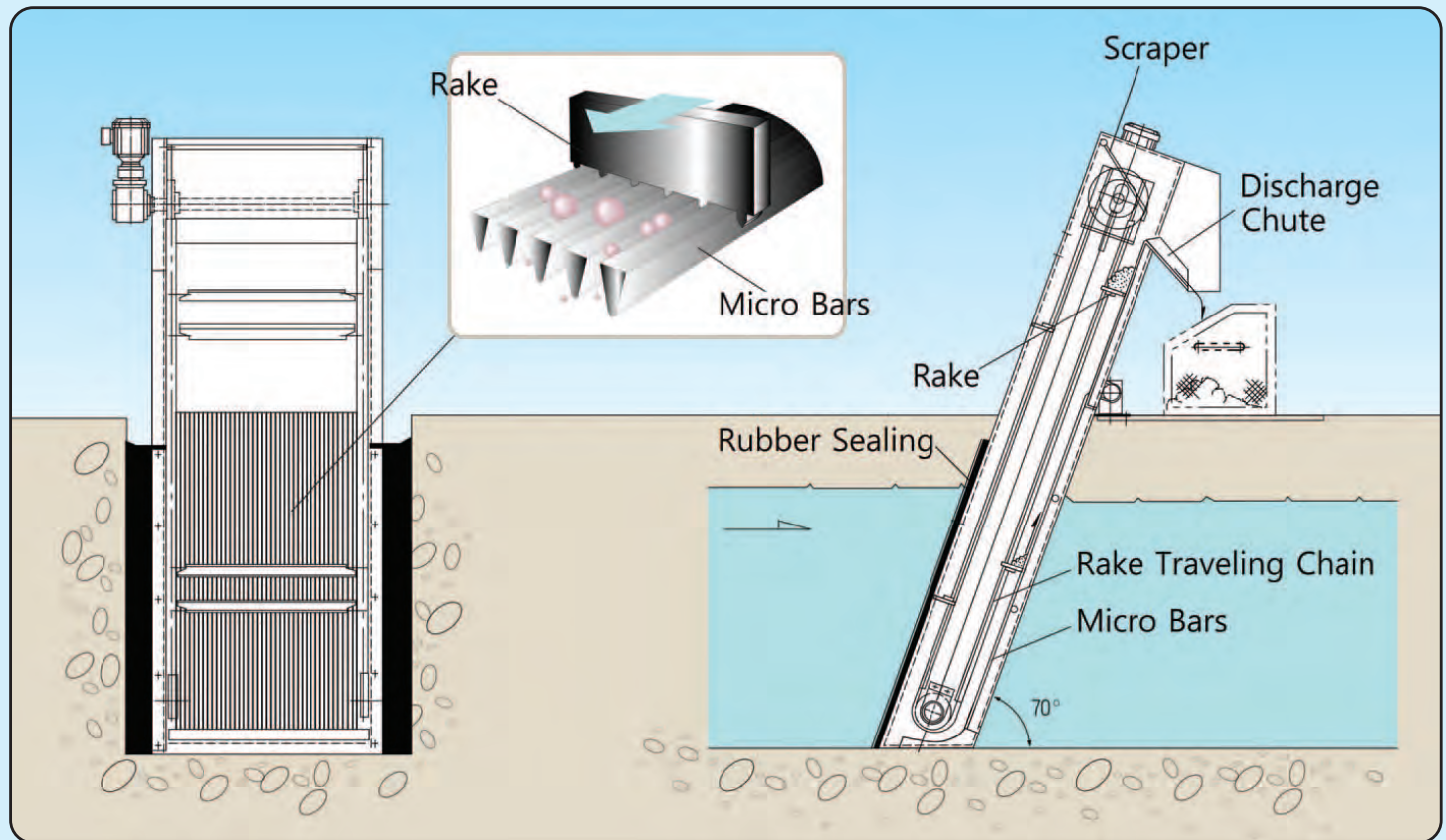
“Screen as small as 1mm, guaranteed not to blind”

14500 Industrial Ave. South
Cleveland, OH 44137
P: 216-475-5225
F: 216-475-5229
info@or-tec.com

or-tec.com



Special Features of the Micro Bar Screen



The Micro Bar Screen consists of a parallel array of wedge-sectioned bars with even spaces. It is located in the influent wastewater channel at about 70° angle. The water flows through the openings between the screen bars while the solids are captured on the upstream side of the screen bars. Captured solids are lifted up to the top of the screen by the travelling rakes whose penetrating teeth fully clean the openings between the screen bars. This screenings are discharged by a scraper mechanism.

- * Over 1,000 units of the 1~5mm opening Micro Bar Screens are installed in wastewater treatment plants protecting pumps and valves by removing stringy material and scum
- * Removing suspended solids at the headworks solves the problem of the solids settling, improving the efficiency of whole wastewater treatment plant
- * Optimal screen for protecting the 0.5~3.0mm opening pre-membrane filters
- * With 7 patents this state of the art technology is guaranteed not to blind the 1~5mm screen openings and ensures almost complete maintenance free operation for over 10 years
- * No high pressure washwater spray systems required to keep the screen openings clean (This results in huge savings in water and electrical usage)
- * No rotating brushes are required so there is no maintenance or replacement of brushes

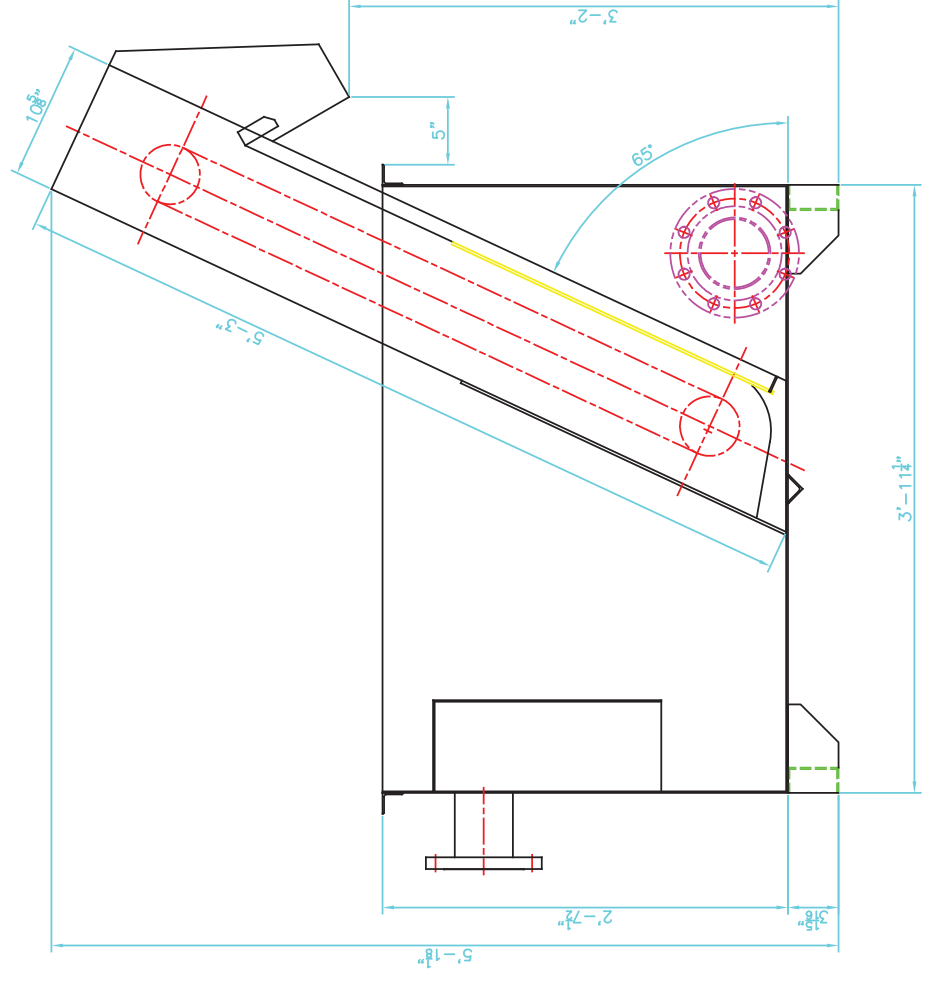
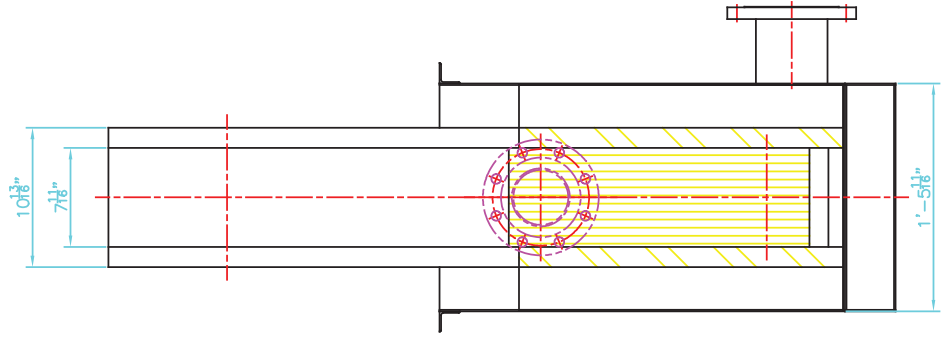
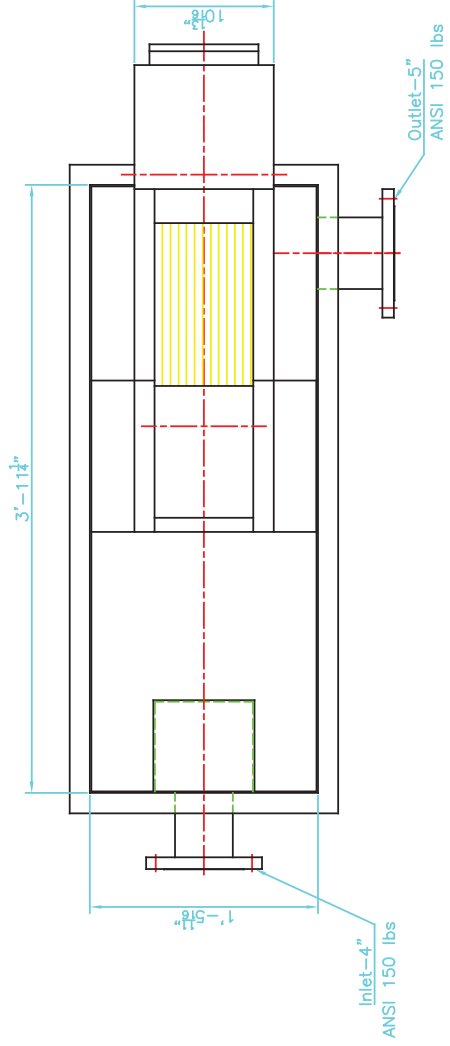
Flow Capacity of Micro Bar Screen® (m³/Hr.) (mgd)

Application	Sewage Pumping Station	Sewaget.P. Headworks I	Sewaget.P. Headworks II	Sewaget.P. Headworks III	S.T.P. Scum Screening	S.T.P. Sludge Screening	Hotel Effluent	Catering	Pulp&Paper wastewater I	Pulp&Paper Wastewater II	Textile & Dyeing	Fish Farm Effluent	Seafood Processing	Citrus Peel Liquor	Citrus Total Plant Effluent	Fruit-Vegetable Process	Dairy Wastewater	Brewing Wastewater	Beer Brewery Wastewater	Bottle Washing	Stockyard Washdown	Slaughterhouse	Paint Spray Booth Spray Water Recycling
Opening(mm)	5	2	3	5	3	3	2	2	3	5	1	1	2	1	1	1	1	1	2	2	1	1	1.5
MB-360	145 0.9	87 0.5	111 0.7	145 0.9	29 0.2	37 0.2	63 0.3	30 0.2	37 0.2	48 0.3	53 0.3	53 0.3	58 0.4	15 0.1	53 0.3	39 0.2	39 0.2	39 0.2	77 0.5	58 0.4	36 0.2	36 0.2	51 0.3
MB-460	197 1.2	118 0.7	152 1	197 1.2	39 0.2	51 0.3	85 0.5	40 0.3	51 0.3	66 0.4	73 0.5	73 0.5	79 0.5	20 0.1	73 0.5	53 0.3	53 0.3	53 0.3	105 0.7	79 0.5	49 0.3	49 0.3	70 0.4
MB-4120	394 2.5	237 1.5	303 1.9	394 2.5	79 0.5	101 0.6	171 1.1	81 0.5	101 0.6	131 0.8	146 0.9	146 0.9	158 1	40 0.3	146 0.9	105 0.7	105 0.7	105 0.7	210 1.3	158 1	97 0.6	97 0.6	140 0.9
MB-6100	493 3.1	296 1.9	379 2.4	493 3.1	99 0.6	126 0.8	214 1.4	101 0.6	126 0.8	164 1	182 1.2	182 1.2	197 1.2	51 0.3	182 1.2	131 0.8	131 0.8	131 0.8	263 1.7	197 1.2	121 0.8	121 0.8	175 1.1
MB-6150	739 4.7	444 2.8	569 3.6	739 4.7	148 0.9	190 1.2	320 2	152 1	190 1.2	246 1.6	273 1.7	273 1.7	296 1.9	76 0.5	273 1.7	197 1.2	197 1.2	197 1.2	394 2.5	296 1.9	182 1.2	182 1.2	263 1.7
MB-6200	893 5.7	536 3.4	687 4.4	893 5.7	179 1.1	229 1.5	387 2.5	183 1.2	229 1.5	298 1.9	330 2.1	330 2.1	357 2.3	92 0.6	330 2.1	238 1.5	238 1.5	238 1.5	476 3.0	357 2.3	220 1.4	220 1.4	317 2
MB-6300	1478 9.4	887 5.6	1137 7.2	1478 9.4	296 1.9	379 2.4	641 4.1	303 1.9	379 2.4	493 3.1	546 3.5	546 3.5	591 3.7	152 1	546 3.5	394 2.5	394 2.5	394 2.5	788 5.0	591 3.7	364 2.3	364 2.3	526 3.3
MB-7100	671 4.3	402 2.6	516 3.3	671 4.3	134 0.9	172 1.1	291 1.8	138 0.9	172 1.1	224 1.4	248 1.6	248 1.6	268 1.7	69 0.4	248 1.6	179 1.1	179 1.1	179 1.1	358 2.3	268 1.7	165 1	165 1	238 1.5
MB-7150	893 5.7	536 3.4	687 4.4	893 5.7	179 1.1	229 1.5	387 2.5	183 1.2	229 1.5	298 1.9	330 2.1	330 2.1	357 2.3	92 0.6	330 2.1	238 1.5	238 1.5	238 1.5	476 3	357 2.3	220 1.4	220 1.4	317 2
MB-7200	1314 8.3	788 5.0	1011 6.4	1314 8.3	263 1.7	337 2.1	569 3.6	270 1.7	337 2.1	438 2.8	485 3.1	485 3.1	526 3.3	135 0.9	485 3.1	350 2.2	350 2.2	350 2.2	701 4.4	526 3.3	323 2.1	323 2.1	467 3.0
MB-7300	1971 12.5	1183 7.5	1516 9.6	1971 12.5	394 2.5	505 3.2	854 5.4	404 2.6	505 3.2	657 4.2	728 4.6	728 4.6	788 5	202 1.3	728 4.6	526 3.3	526 3.3	526 3.3	1051 6.7	788 5.0	485 3.1	485 3.1	701 4.4
MB-9150	1232 7.8	739 4.7	948 6.0	1232 7.8	246 1.6	316 2	534 3.4	253 1.6	316 2	411 2.6	455 2.9	455 2.9	493 3.1	126 0.8	455 2.9	329 2.1	329 2.1	329 2.1	657 4.2	493 3.1	303 1.9	303 1.9	438 2.8
MB-9200	1643 10.4	986 6.2	1264 8	1643 10.4	329 2.1	421 2.7	712 4.5	337 2.1	421 2.7	548 3.5	607 3.8	607 3.8	657 4.2	168 1.1	607 3.8	438 2.8	438 2.8	438 2.8	876 5.6	657 4.2	404 2.6	404 2.6	584 3.7
MB-9300	2464 15.6	1478 9.4	1895 12	2464 15.6	493 3.1	632 4	1068 6.8	505 3.2	632 4	821 5.2	910 5.8	910 5.8	986 6.2	253 1.6	910 5.8	657 4.2	657 4.2	657 4.2	1314 8.3	986 6.2	607 3.8	607 3.8	876 5.6
MB-10150	1478 9.4	887 5.6	1137 7.2	1478 9.4	296 1.9	379 2.4	641 4.1	303 1.9	379 2.4	493 3.1	546 3.5	546 3.5	591 3.7	152 1	546 3.5	394 2.5	394 2.5	394 2.5	788 5	591 3.7	364 2.3	364 2.3	526 3.3
MB-10200	1971 12.5	1183 7.5	1516 9.6	1971 12.5	394 2.5	505 3.2	854 5.4	404 2.6	505 3.2	657 4.2	728 4.6	728 4.6	788 5.0	202 1.3	728 4.6	526 3.3	526 3.3	526 3.3	1051 6.7	788 5	485 3.1	485 3.1	701 4.4
MB-10300	2957 18.7	1774 11.2	2274 14.4	2957 18.7	591 3.7	758 4.8	1281 8.1	607 3.8	758 4.8	986 6.2	1092 6.9	1092 6.9	1183 7.5	303 1.9	1092 6.9	788 5	788 5	788 5	1577 10	1183 7.5	728 4.6	728 4.6	1051 6.7
MB-10400	3942 25	2365 15	3033 19.2	3942 25	788 5	1011 6.4	1708 10.8	809 5.1	1011 6.4	1314 8.3	1456 9.2	1456 9.2	1577 10	404 2.6	1456 9.2	1051 6.7	1051 6.7	1051 6.7	2103 13.3	1577 10	970 6.2	970 6.2	1402 8.9
MB-12150	1807 11.5	1084 6.9	1390 8.8	1807 11.5	361 2.3	463 2.9	783 5	371 2.4	463 2.9	602 3.8	667 4.2	667 4.2	723 4.6	185 1.2	667 4.2	482 3.1	482 3.1	482 3.1	964 6.1	723 4.6	445 2.8	445 2.8	642 4.1
MB-12200	2409 15.3	1446 9.2	1853 11.8	2409 15.3	482 3.1	618 3.9	1044 6.6	494 3.1	618 3.9	803 5.1	890 5.6	890 5.6	964 6.1	247 1.6	890 5.6	642 4.1	642 4.1	642 4.1	1285 8.1	964 6.1	593 3.8	593 3.8	857 5.4
MB-12300	3614 22.9	2168 13.7	2780 17.6	3614 22.9	723 4.6	927 5.9	1566 9	741 4.7	927 5.9	1205 7.6	1334 8.5	1334 8.5	1446 9.2	371 2.4	1334 8.5	964 6.1	964 6.1	964 6.1	1927 12.2	1446 9.2	890 5.6	890 5.6	1285 8.1
MB-12400	4819 30.6	2891 18.3	3707 23.5	4819 30.6	964 6.1	1236 7.8	2088 13.2	988 6.3	1236 7.8	1606 10.2	1779 11.3	1779 11.3	1927 12.2	494 3.1	1779 11.3	1285 8.1	1285 8.1	1285 8.1	2570 16.3	1927 12.2	1186 7.5	1186 7.5	1713 10.9
MB-12500	6023 38.2	3614 22.9	4633 29.4	6023 38.2	1205 7.6	1544 9.8	2610 16.5	1236 7.8	1544 9.8	2008 12.7	2224 14.1	2224 14.1	2409 15.3	618 3.9	2224 14.1	1606 10.2	1606 10.2	1606 10.2	3212 20.4	2409 15.3	1483 9.4	1483 9.4	2142 13.6
MB-15200	3066 19.4	1840 11.7	2359 15	3066 19.4	613 3.9	786 5	1329 8.4	629 4	786 5	1022 6.5	1132 7.2	1132 7.2	1227 7.8	314 2	1132 7.2	818 5.2	818 5.2	818 5.2	1635 10.4	1227 7.8	755 4.8	755 4.8	1090 6.9
MB-15300	4600 29.2	2760 17.5	3538 22.4	4600 29.2	920 5.8	1179 7.5	1993 12.6	943 6	1179 7.5	1533 9.7	1698 10.8	1698 10.8	1840 11.7	472 3	1698 10.8	1227 7.8	1227 7.8	1227 7.8	2453 15.6	1840 11.7	1132 7.2	1132 7.2	1635 10.4
MB-15400	6133 38.9	3680 23.3	4717 29.9	6133 38.9	1227 7.8	1572 10	2657 16.8	1258 8	1572 10	2044 13	2264 14.4	2264 14.4	2453 15.6	629 4	2264 14.4	1635 10.4	1635 10.4	1635 10.4	3271 20.7	2453 15.6	1510 9.6	1510 9.6	2181 13.8
MB-15500	7666 48.6	4600 29.2	5897 37.4	7666 48.6	1533 9.7	1966 13.2	3322 21.1	1572 10	1966 13.2	2555 16.2	2830 17.9	2830 17.9	3066 19.4	786 5	2830 17.9	2044 13	2044 13	2044 13	4088 25.9	3066 19.4	1887 12	1887 12	2726 17.3
MB-20250	5202 33	3121 19.8	4001 25.4	5202 33	1040 6.6	1334 8.5	2254 14.3	1067 6.8	1334 8.5	1734 11	1921 12.2	1921 12.2	2081 13.2	534 3.4	1921 12.2	1387 8.8	1387 8.8	1387 8.8	2774 17.6	2081 13.2	1280 8.1	1280 8.1	1850 11.7
MB-20300	6242 39.6	3745 23.7	4802 30.4	6242 39.6	1248 7.9	1601 10.1	2705 17.1	1280 8.1	1601 10.1	2081 13.2	2305 14.6	2305 14.6	2497 15.8	640 4.1	2305 14.6	1665 10.6	1665 10.6	1665 10.6	3329 21.1	2497 15.8	1537 9.7	1537 9.7	2219 14.1
MB-20400	8323 52.8	4994 31.7	6402 40.6	8323 52.8	1665 10.6	2134 13.5	3607 22.9	1707 10.8	2134 13.5	2774 17.6	3073 19.5	3073 19.5	3329 21.1	854 5.4	3073 19.5	2219 14.1	2219 14.1	2219 14.1	4439 28.1	3329 21.1	2049 13	2049 13	2959 18.8
MB-20500	10404 66	6242 39.6	8003 50.7	10404 66	2081 13.2	2668 16.9	4508 28.6	2134 13.5	2668 16.9	3468 22	3841 24.4	3841 24.4	4161 26.4	1067 6.8	3841 24.4	2774 17.6	2774 17.6	2774 17.6	5549 35.2	4161 26.4	2561 16.2	2561 16.2	3699 23.5
MB-25300	7885 50	4731 30	6065 38.5	7885 50	1577 10	2022 12.8	3417 21.7	1617 10.3	2022 12.8	2628 16.7	2911 18.5	2911 18.5	3154 20	809 5.1	2911 18.5	2103 13.3	2103 13.3	2103 13.3	4205 26.7	3154 20	1941 12.3	1941 12.3	2804 17.8
MB-25400	10513 66.7	6308 40	8087 51.3	10513 66.7	2103 13.3	2696 17.1	4556 28.9	2157 13.7	2696 17.1	3504 22.2	3882 24.6	3882 24.6	4205 26.7	1078 6.8	3882 24.6	2804 17.8	2804 17.8	2804 17.8	5607 35.5	4205 26.7	2588 16.4	2588 16.4	3738 23.7
MB-25500	13141 83.3	7885 50	10109 64.1	13141 83.3	2628 16.7	3370 21.4	5695 36.1	2696 17.1	3370 21.4	4380 27.8	4852 30.8	4852 30.8	5257 33.3	1348 8.5	4852 30.8	3504 22.2	3504 22.2	3504 22.2	7009 44.1	5257 33.3	3235 20.5	3235 20.5	4673 29.6
MB-25600	15770 100	9462 60	12131 76.9	15770 100	3154 20	4044 25.6	6834 43.3	3235 20.5	4044 25.6	5257 33.3	5823 36.9	5823 36.9	6308 40	1617 10.3	5823 36.9	4205 26.7	4205 26.7	4205 26.7	8411 53.3	6308 40	3882 24.6	3882 24.6	5607 35.5

* Listed peak flows for the reference only. Actual downstream liquid levels status may cause decrease in the flow capacity.

FILE NAME MB280KT

NO	REVISIONS	DATE	DRAWING	CHECKED



NO	Tank	STS 304	1	1	
1	Micro Bar Screen	STS 304	1	1	MB280
NO	DESCRIPTION	MAT'L	Q'TY	REMARKS	
DWG. NO.	BWS-MB280KT-Q01	DATE	07/30/2021	SCALE	1/1
DRAWING NAME	MB280KT				
	Micro Bar Screen				
	Or-Tec Micro Bar Screen				

DRAWING	DESIGNING	CHECKED	APPROVED



AIR LIFT PUMPS



February 15, 2018
Project: Dockers

SLUDGE AIRLIFT CALCULATIONS AND DATA

A. Maximum flow at eleven times average daily flow

$$\frac{7,500 \times 11}{1440} = 58 \text{ GPM total}$$

B. Two (2) 2-1/2" airlifts provided, each rated at 29 GPM

C. See performance curve attached for 2-1/2" airlift

At Lift (HL) = 1'
Flow = 29 GPM
Submergence (Hs) = 6.75'

At Lift (HL) = 2'
Flow = 29 GPM
Submergence (Hs) = 6.75'

$$\% \text{ Subm.} = \frac{6.75}{7.75} \times 100 = 87.1\%$$

$$\% \text{ Subm.} = \frac{6.75}{8.75} \times 100 = 77.2\%$$

Required Air = 2 CFM per airlift

Required Air = 4 CFM per airlift

At actual lift (HL) = 1.5', use 3 CFM per sludge airlift

D. Minimum flow at seven times average daily flow

$$\frac{7,500 \times 7}{1440} = 36 \text{ GPM total}$$

E. Two (2) 2-1/2" airlifts provided, each rated at 18 GPM

F. See performance curve attached for 2-1/2" airlift

At Lift (HL) = 1'
Flow = 18 GPM
Submergence (Hs) = 6.75'

At Lift (HL) = 2'
Flow = 18 GPM
Submergence (Hs) = 6.75'

$$\% \text{ Subm.} = \frac{6.75}{7.75} \times 100 = 87.1\%$$

$$\% \text{ Subm.} = \frac{6.75}{8.75} \times 100 = 77.2\%$$

Required Air = 1.75 CFM per airlift

Required Air = 2.25 CFM per airlift

At actual lift (HL) = 1.5', use 2 CFM per sludge airlift

February 15, 2018
Project: Dockers

SKIMMER AIRLIFT CALCULATIONS AND DATA

A. Maximum flow at two times average daily flow

$$\frac{7,500 \times 2}{1440} = 10 \text{ GPM total}$$

B. Two (2) 2" airlifts provided, each rated at 5 GPM

C. See performance curve attached for 2" airlift

At Lift (HL) = 1'
Flow = 5 GPM
Submergence (Hs) = 5'

$$\% \text{ Subm.} = \frac{5}{6} \times 100 = 83.3\%$$

Required Air = 1.25 CFM per airlift

At Lift (HL) = 2'
Flow = 5 GPM
Submergence (Hs) = 5'

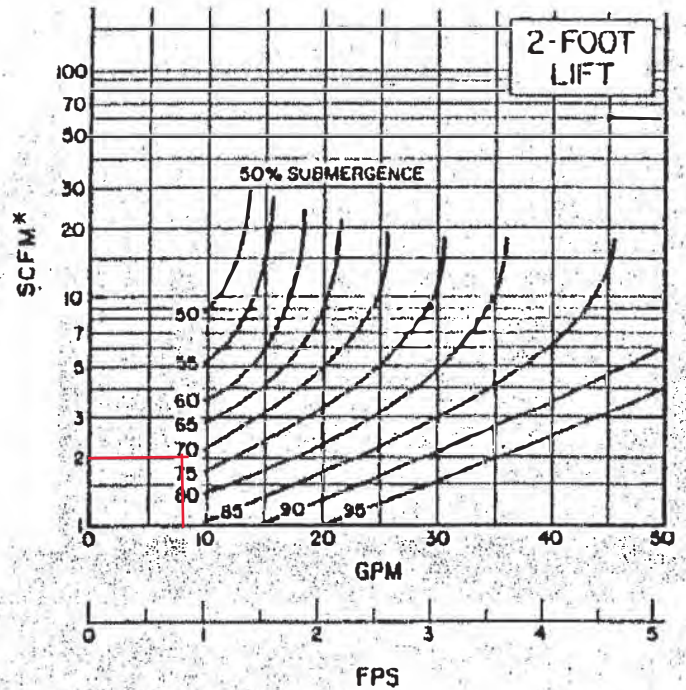
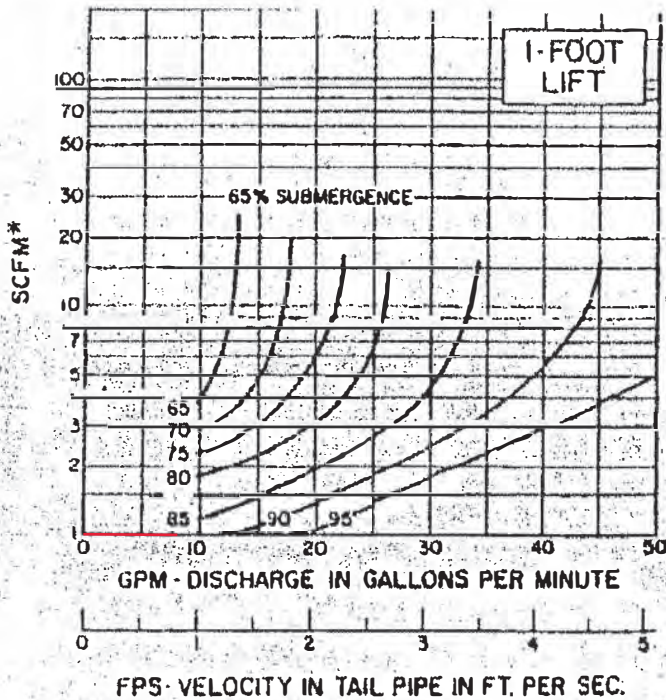
$$\% \text{ Subm.} = \frac{5}{7} \times 100 = 71.4\%$$

Required Air = 2.25 CFM

At actual lift (HL) = 1.5', use 1.75 CFM per skimmer airlift

WasteWater Treatment Systems

TYPICAL PERFORMANCE CURVES FOR A 2 - INCH AIR LIFT



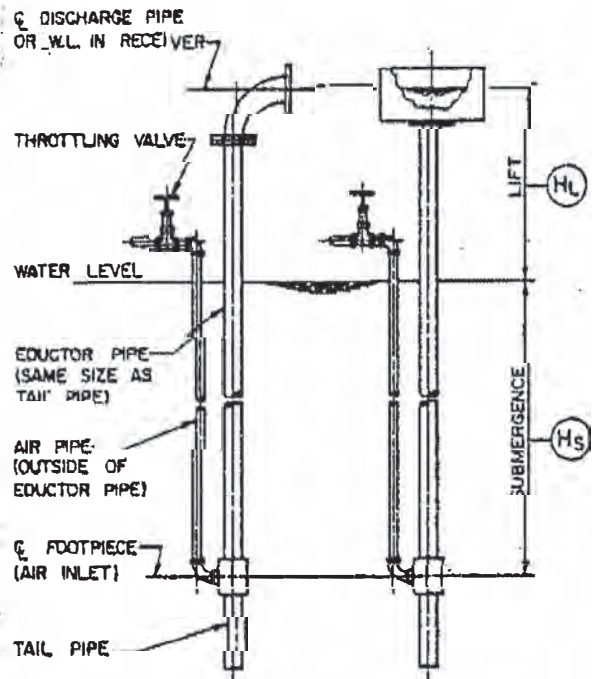
NOTES:

1. THE AIR LIFT PERFORMANCE CURVES ON THIS CHART ARE TYPICAL FOR PUMPING CLEAR WATER AND ARE INTENDED TO BE USED FOR ESTIMATING.
2. THE PER CENT SUBMERGENCE = $\frac{H_s}{H_s + H_L} \times 100$
3. IT IS SUGGESTED THAT THE CURVES NOT BE EXTENDED BEYOND THE LIMITS SHOWN BECAUSE THE APPROXIMATE MAXIMUM DISCHARGE FOR EACH CONDITION IS INDICATED
4. FOR LIFTS BETWEEN THOSE INDICATED ON THIS CHART USE A STRAIGHT ARITHMETIC PROPORTION WHEN INTERPOLATING VALUES.

EXAMPLE:

GIVEN: LIFT, $H_L = 3'$, SUBM, $H_s = 12'$
 DESIRED DISCH. = 40 GPM
 FIND: PER CENT SUBMERGENCE = $\frac{12'}{12' + 3'} \times 100 = 80\%$
 AIR REQ'D = 9 SCFM
 VELOCITY IN 2" TAIL PIPE = 4.1 FPS

* STANDARD CUBIC FEET OF AIR PER MINUTE AT 14.7 PSIA AND 70°F



TYPICAL AIR LIFTS



purestream inc.

WASTEWATER TREATMENT EQUIPMENT
 P.O. Box 68 Florence, KY 41022-0068 Phone (859) 371-9898 Fax (859) 371-3577

engineering data sheet

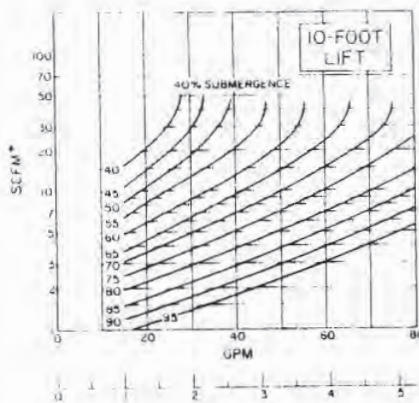
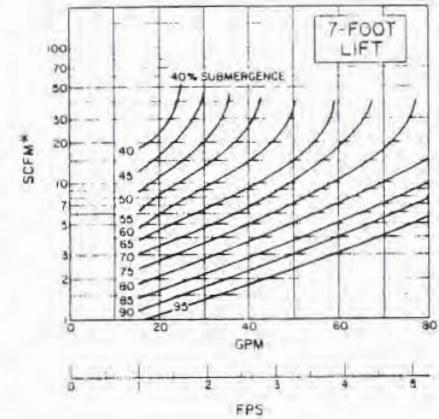
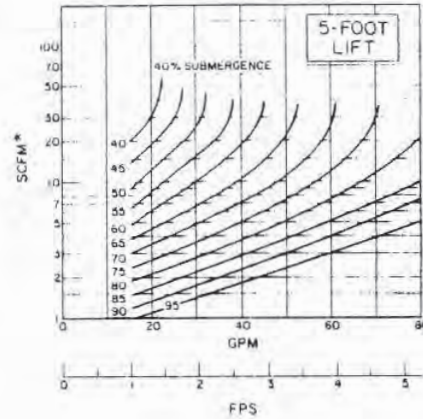
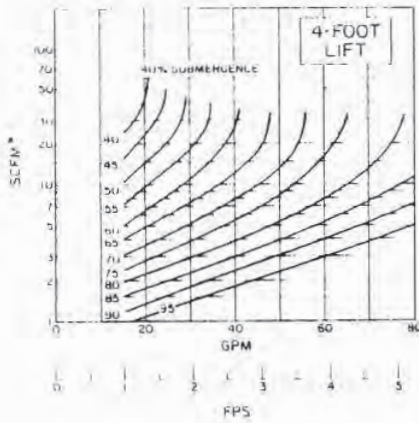
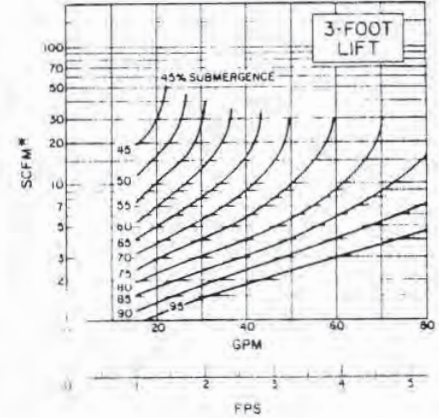
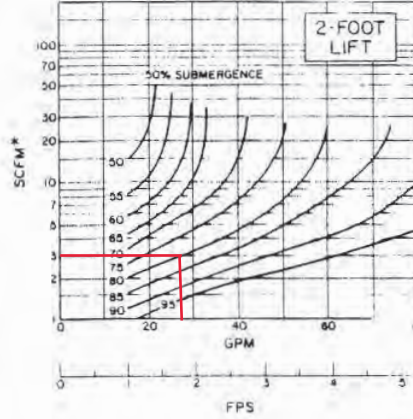
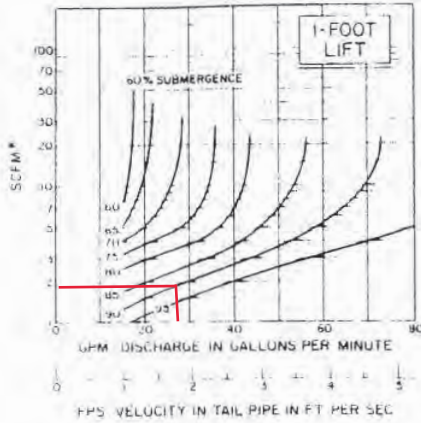
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AIR LIFT PUMP

2 1/2" SIZE

TYPICAL PERFORMANCE CURVES



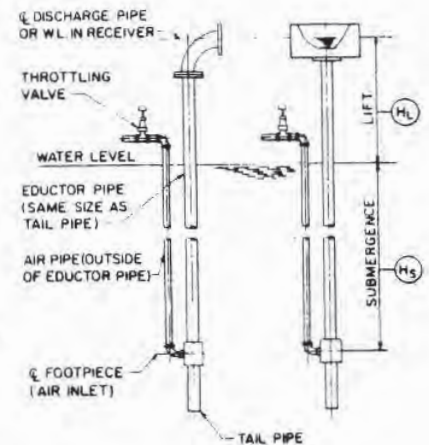
NOTES

1. THE AIR LIFT PERFORMANCE CURVES ON THIS CHART ARE TYPICAL FOR PUMPING CLEAR WATER AND ARE INTENDED TO BE USED FOR ESTIMATING.
2. THE PER CENT SUBMERGENCE = $\frac{H_s}{H_s + H_L} \times 100$
3. IT IS SUGGESTED THAT THE CURVES NOT BE EXTENDED BEYOND THE LIMITS SHOWN BECAUSE THE APPROXIMATE MAXIMUM DISCHARGE FOR EACH CONDITION IS INDICATED.
4. FOR LIFTS BETWEEN THOSE INDICATED ON THIS CHART USE A STRAIGHT ARITHMETIC PROPORTION WHEN INTERPOLATING VALUES.

EXAMPLE

GIVEN: LIFT, $H_L = 3'$; SUBM., $H_s = 12'$
 DESIRED DISCH. = 40 GPM
 FIND: PER CENT SUBMERGENCE = $\frac{12'}{12' + 3'} \times 100 = 80\%$
 AIR REQD. = 4 SCFM
 VELOCITY IN 2 1/2" TAIL PIPE = 2.6 FPS

* STANDARD CUBIC FEET OF AIR PER MINUTE AT 14.7 PSIA AND 70°F.





MIXER

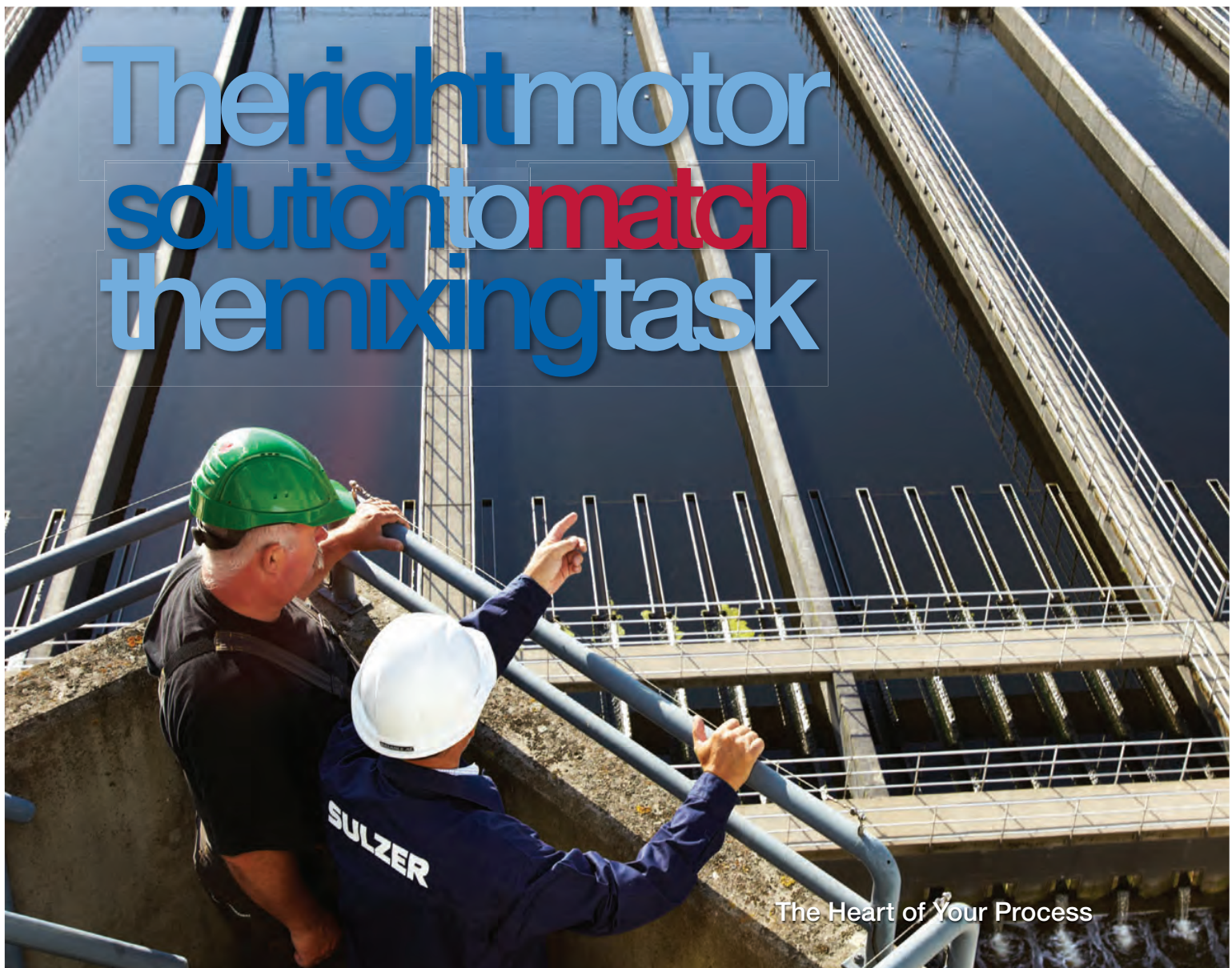


SULZER

Sulzer Pumps

ABS Submersible Mixer XRW

The right motor
solution to match
the mixing task



The Heart of Your Process

abs

The World-Class Range of Submersible Mixers

Sulzer Pumps first launched the ABS submersible mixer XRW as an innovative medium-speed mixer concept in 2010. After widespread success, it is now available as a complete mixer range with motor technologies adapted to varying applications.

The ABS submersible mixer XRW was introduced as the first submersible mixer with a permanent magnet motor. But its defining feature was not the motor itself. It was the mixer's unique balance of energy efficiency and value.

Sulzer Pumps has kept this balance in focus when expanding the ABS submersible mixer XRW into a full product range. To maintain it at various speeds, three distinct motor configurations have been used:

- **High speeds**
Shaft-mounted premium-efficiency IE3 motor
- **Medium speeds**
Premium-efficiency permanent-magnet motor (IE3-equivalent)
- **Medium-low speeds**
Premium-efficiency IE3 motor with gearbox

Choosing the right configuration for the job has substantial advantages over applying the same construction to every need.

The Most Appropriate Motor Technology

The use of multiple motor configurations gives the ABS submersible mixer XRW the best balance of equipment price, motor efficiency and long-term operating costs. No single motor technology can achieve this.

When you choose the ABS submersible mixer XRW, you therefore choose the market's best energy performance. But you also get the best lifecycle economy, from initial purchase to ongoing operation.

Minimal Energy Consumption

The use of premium-efficiency motor technologies, together with optimized and proven propeller designs, gives the ABS submersible mixer XRW the lowest energy consumption for each mixing speed. You gain a total efficiency improvement of up to 35% compared with other mixer designs, which reduces your power consumption and carbon footprint.

Cost-Effective Installation and Maintenance

The combination of compact design and considerably reduced weight allows easy mixer installation and removal. Additional maintenance advantages are offered by the medium-speed models of the ABS submersible mixer XRW (see right).

Superior Reliability

The reliability of the ABS submersible mixer XRW is just as high as its efficiency. Contributing factors include:

- Optimized mechanical seal
- Enhanced design of the solids deflection ring
- Strong new bearings with a life of 100 000 hours
- High overload capacity (medium-speed models)
- Robust gearbox with hardened helical gears (medium-low-speed models)



Medium-speed models of the ABS submersible mixer XRW come in a CR version manufactured entirely from stainless steel. All other models are available in both the CR version and an EC version, which has a mixer body of epoxy-painted cast iron.



Additional Benefits with Permanent Magnets

Medium-speed models of the ABS submersible mixer XRW offer several additional advantages. These derive from the use of permanent-magnet motors and include:

- **Greater process control**

A variable-speed drive allows process optimization and further reductions in energy consumption – beyond the savings obtained through the high-efficiency equipment design.

- **Fewer mixers for wide application**

The use of a permanent-magnet motor and a variable-speed drive allows a limited number of basic mixer sizes to cover a wide range of applications. Uptime can thus be ensured with a reduced stock of spare equipment and parts.

- **Even more cost-effective maintenance**

An ABS EffeX Exchange Program for permanent-magnet motors, together with the smaller number of basic mixer sizes, gives you cost-effective maintenance without the need for specialist equipment.

Part of the ABS EffeX Revolution

The ABS EffeX revolution is an ongoing effort from Sulzer Pumps to push the boundaries of wastewater technology, especially in the area of energy efficiency. Encompassing the whole chain from design to manufacturing, it has resulted in the most innovative and resource-conserving solutions on the market.

The revolution began in 2009 with the launch of the ABS submersible sewage pump XFP. Since then, it has expanded to comprise a complete range of world-class wastewater products. Their energy savings, reduced carbon footprint and high reliability contribute to efficient processes and satisfy the growing demands placed on the wastewater industry.

The **ABS EffeX** Revolution continues

The Most Appropriate Motor Technology

Two factors decide the configuration of the ABS submersible mixer XRW. The first is the required intensity of the mixing and flow. The second is how premium efficiency can be achieved most economically. Three motor configurations provide the best possible balance.

For High Speeds

In more intense applications with high speeds, the most economical way to premium efficiency is a squirrel-cage induction motor of IE3 standard. This configuration is direct-driven, which means the motor is mounted on the shaft without any gearbox.

For Medium Speeds

In the medium-speed range, an IE3-equivalent permanent-magnet motor provides the lowest possible energy consumption and best lifetime economy. Variable-speed control allows precise optimization of your process, as well as a reduction in spare parts, since one mixer size covers a wider range of speeds.



Sulzer Pumps has an extensive knowledge of permanent-magnet motors, derived from their development and inclusion in our range of ABS turbo-compressors HST. You can learn more about permanent-magnet motors and their advantages by folding out the adjacent page.

For Medium-Low Speeds

In applications involving medium-low speeds, a squirrel-cage induction motor of IE3 standard is used with a speed reducer. While a permanent-magnet motor would be effective here as well, a more traditional solution provides better value at these speeds.

The speed reducer is a robust single-stage helical gearbox with high efficiency and a very long operating life. Its hardened helical gears allow numerous reduction ratios, which makes the drive both compact and lightweight.

The gearbox has the same design as that of the low speed ABS flow booster XSB, which is part of the ABS EffeX range and an ideal choice for low-speed mixing.



High Speeds



Premium-efficiency IE3 squirrel-cage induction motor



XRW210
(4-pole motor)



XRW300
(6-pole motor)

Medium Speeds



Permanent-magnet motor
(IE3-equivalent)



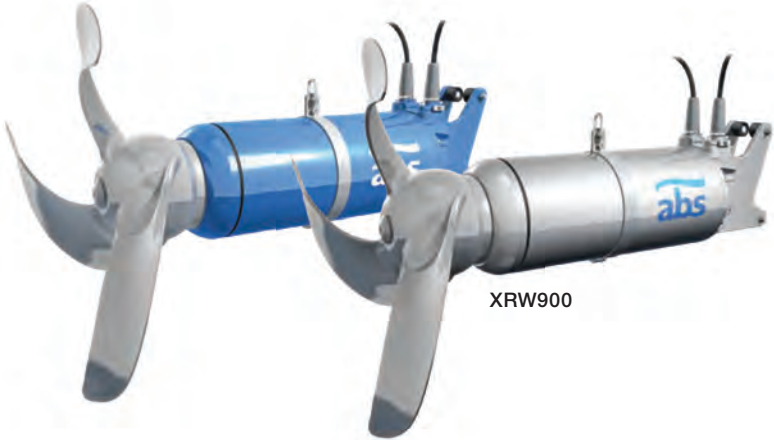
XRW400



XRW650

Medium-Low Speeds

Premium-efficiency IE3 squirrel-cage induction motor
Single-stage planetary gearbox



XRW900

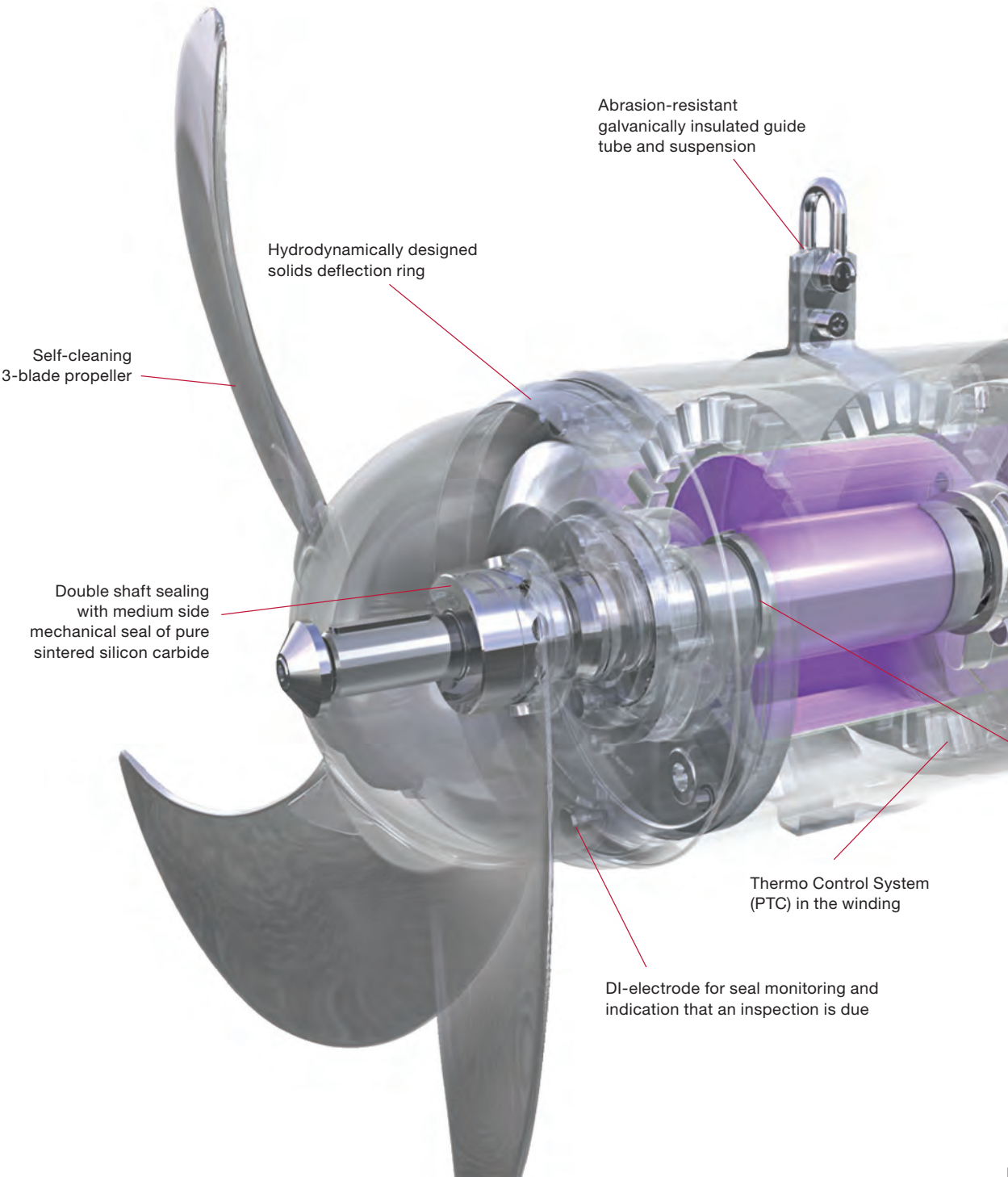
Fold out for a detailed look at the mixer construction and the advantages of permanent-magnet motors.

An Overview of Permanent-Magnet Motors

Permanent-magnet motors provide unique advantages in medium-speed models of the ABS submersible mixer XRW. Sulzer Pumps has an extensive knowledge of their use, derived from their development and inclusion in our range of ABS turbocompressors HST.

A Growing Trend
Permanent-magnet motors have been commercially available for about 20 years, but lower component prices and better technology have recently made them more attractive. For example, there has been a continuous reduction in the cost of the variable-frequency drives (VFD) used to run them.

In addition, their growth is being driven by the demand for energy savings. Permanent magnet motors require less electrical power, and they provide higher motor efficiency within a wide range of speeds.



Date: 06/14

Dwg: DS-M30-002 Rev: A

Submittal Data



Motor Specification

Motor Design	NEMA design B, squirrel cage induction
Motor Type	Fully enclosed Premium Efficiency submersible, IP68 protection rating
Motor Efficiency Standard and Rating	IEC 60034-30, IE3 rating
Motor Efficiency Test Protocol	IEC 60034-2-1
Insulation Materials	Class H, 180°C (356°F), copper windings
Motor Filling Medium	Air
Temperature Rise	Class A
Maximum Fluid Temperature	40°C (104°F) continuous
Motor Protection	Thermal Normally closed bimetallic switch in each phase, connected in series, 140°C (284°F)
	Leakage ABS Seal minder moisture detection probe in oil chamber, motor and cable connection chamber
Sensing Chamber Filling Medium	Environmentally safe, non-toxic oil
Bearing Type	Upper Pre-loaded Single row ball permanently lubricated
	Lower Single row ball permanently lubricated
Motor Starter Types	DOL, Suitable for use with Variable Frequency Drives
Maximum Starts per Hour	15, evenly spaced
Inverter Duty Rating	Motors meet NEMA MG1, part 31 requirements
Maximum Submergence	20 meters (65 feet)
Available Voltages	208, 230, 480, 600
Voltage Tolerance from Rated	+/-10%

Motor Ratings

Motor Model	Input Power (P1) (kW)	Power Output (P2) (kW/HP)	Nominal Speed (RPM)	Rated Voltage (V)	Full Load Amps (A)	Locked Rotor Amps (A)	NEMA Code Letter	NEMA Service Factor	Motor Efficiency at % Load			Power Factor at % Load		
									100	75	50	100	75	50
PA 18/4	2.11	1.80/2.41	1750	208	8.1	51.3	J	1.3	85.2	85.3	83.5	.73	.63	.50
				230	7.3	44.4								
				480	3.5	22.2								
				600	2.8	17.8								

Cable Data

Cable	Motor	Motor Voltage	Cable Qty	Cable Type	Cable Nominal Dia. +/- .5mm (.02")
Power Cable	PA 18/4	208 volt	1	SOOW 14/7	18.5mm (0.72") diameter
		230 volt			
		480 volt			
		600 volt			
Control Cable	All	All	Included in Power Cable		
Cable Length	Standard: 10m (33 ft)		Optional: 15m (49 ft), 20m (65 ft), 30m (98 ft), 40m (131 ft), 50m (164 ft)		

Date: 06/14

Dwg: DS-M30-002 Rev: A

Submittal Data



Hydraulic Data

Propeller Data without Flow Ring, 60Hz.							
Mixer Hydraulic Number	Number of Blades	Propeller Diameter in (mm)	Thrust ISO 21630 lbf (N)	Propeller Speed (RPM) ①	Mixing Capacity ② GPM (m ³ /s)	Mixing Power P _p ③ HP (kW)	Power Consumption P1③ HP (kW)
2121	2	8.27 (210)	51.0 (227)	1765	1426 (0.09)	1.53 (1.14)	1.80 (1.34)
2131	3	8.27 (210)	73.3 (326)	1750	1586 (0.10)	2.36 (1.76)	2.70 (2.01)
Propeller Data with Flow Ring, 60Hz.							
Mixer Hydraulic Number	Number of Blades	Propeller Diameter in (mm)	Thrust ISO 21630 lbf (N)	Propeller Speed (RPM)	Mixing Capacity ① GPM (m ³ /s)	Mixing Power P _p ② HP (kW)	Power Consumption P1③ HP (kW)
2141	2	8.27 (210)	---	1765	---	---	---
2151	3	8.27 (210)	---	1750	---	---	---

- ① Nominal speed at full load
- ② Flow rate in clean water at 68°F (20°C)
- ③ Power in clean water at 68°F (20°C)

Materials of Construction

Parts	EC	CR
Motor Housing	Cast Iron EN-GJL-250 (ASTM A-48, Class 35B)	Stainless Steel 1.4404 (AISI 316L SS)
Motor Shaft	Stainless Steel 1.4021 (AISI 420 SS)	Stainless Steel 1.4401 (AISI 316 SS)
Propeller	Duplex Stainless Steel 1.4460 (AISI 329 SS)	Duplex Stainless Steel 1.4460 (AISI 329 SS)
Fasteners	Stainless Steel 1.4401 (AISI 316 SS)	Stainless Steel 1.4401 (AISI 316 SS)
Lifting bracket	Stainless Steel 1.4404 (AISI 316L SS)	Stainless Steel 1.4404 (AISI 316L SS)
O-Rings and Cable Glands	Nitrile (Buna-N)	Nitrile (Buna-N)
Dual Mechanical Seal	Lower: Silicon Carbide / Silicon Carbide, Nitrile, 316 SS Upper: Silicon Carbide / Silicon Carbide, Nitrile, 316 SS	Silicon Carbide / Silicon Carbide, Nitrile, 316 SS

General Data

Motor Size	PA 18/4
Mixer Weight without Flow Ring	90.0 lbs (41.0 kg)
Mixer Weight with Flow Ring	102.0 lbs (47.0 kg)

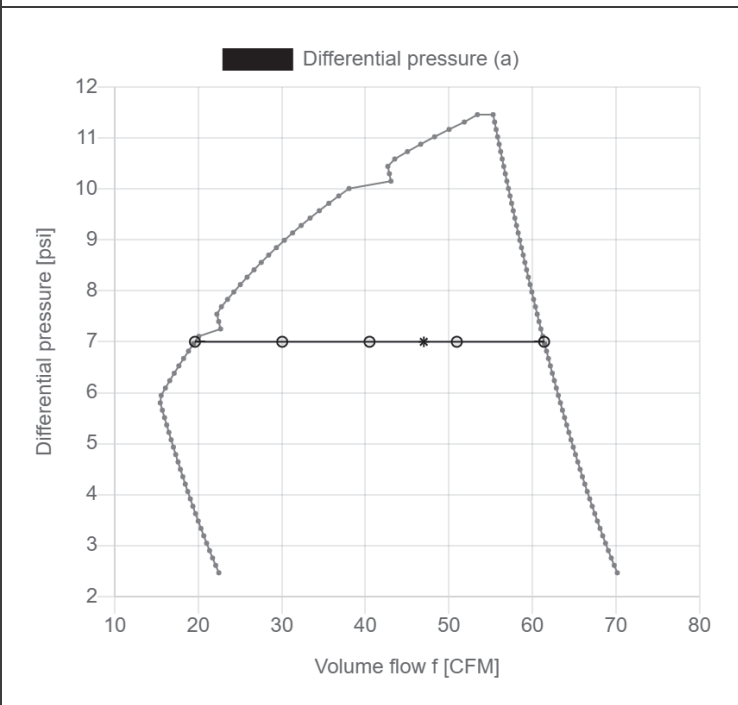
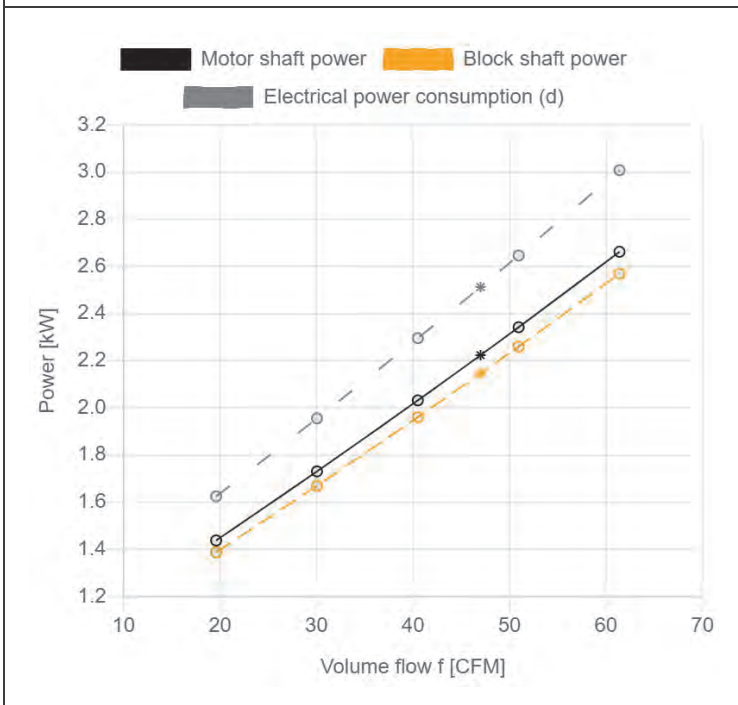
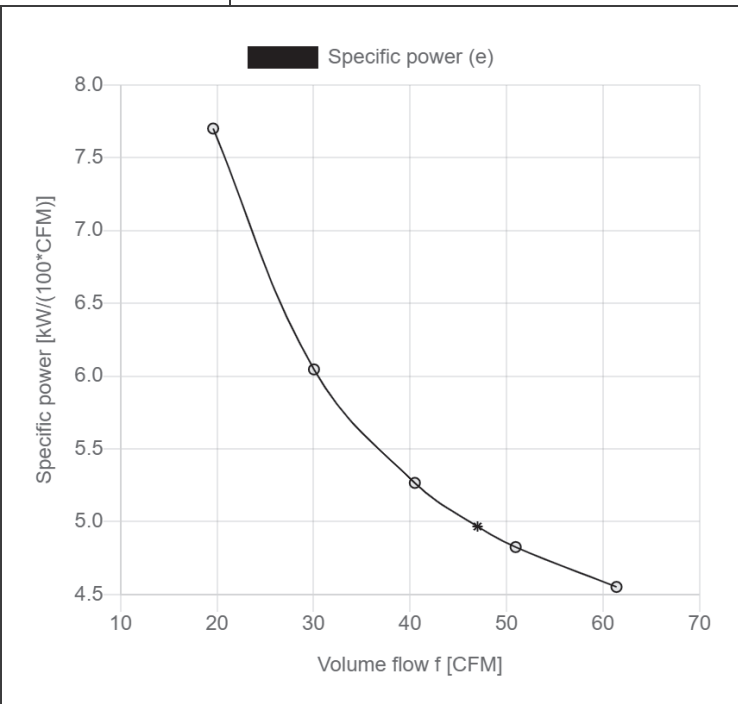
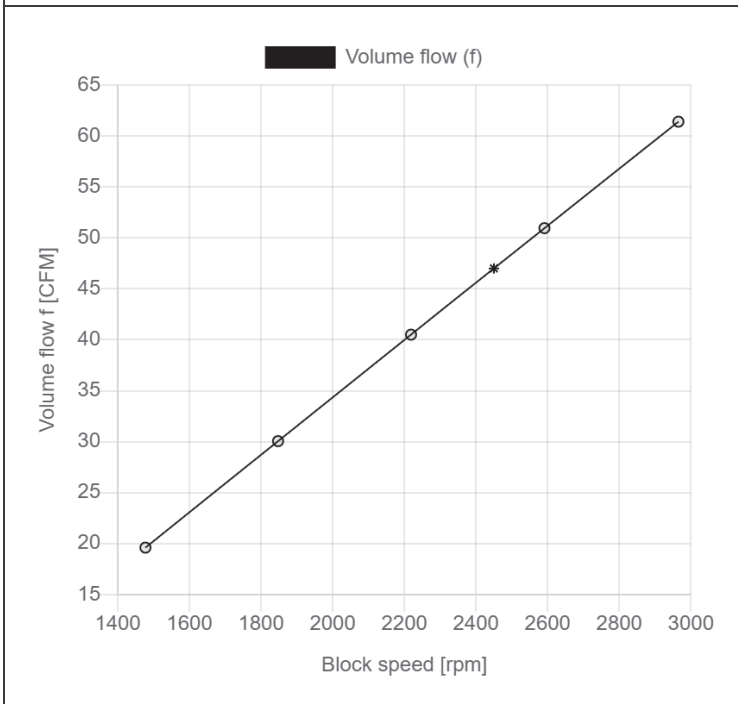


BLOWER



Data Sheet KAESER Blower (Package)		KAESER COMPRESSORS®					
Data sheet ID		b955dfb9					
Created by		Fernando Dongo / DW Martine & Associates, LLC					
Contact		fernando@dwmartineassociates.com					
Date							
Project description							
Blower		BBC 52 - 2965					
Operation mode		Pressure operation		Medium		Air	
Performance-relevant components							
<input checked="" type="checkbox"/> Filter intake air G4		<input checked="" type="checkbox"/> Non return valve			<input checked="" type="checkbox"/> Variable speed		
<input checked="" type="checkbox"/> Silencer intake air		<input checked="" type="checkbox"/> Sound enclosure					
<input checked="" type="checkbox"/> Silencer discharge air		<input checked="" type="checkbox"/> Cooling air ventilator					
Design details				Options			
Intake: <input type="radio"/> Room <input checked="" type="radio"/> Pipe				<input type="checkbox"/> Unloaded start up valve			
				<input type="checkbox"/> Temperature gauge with switch point			
				<input type="checkbox"/> Pressure switch			
				<input type="checkbox"/> Sliding ring			
Rated data machine at mains operation							
Rated speed blower [rpm]		2965					
Electrical grid [V/Ph/Hz]		208/3/60					
Rated power motor [kW/HP]		4.0 / 5.0					
Efficiency motor [%]		88.50					
Max. Lp(A) / Lw(A) [dB(A)] ^h		74 / 89					
Set pressure safety valve pSV [psi]		13.3					
Intake conditions of process air into machine							
Intake pressure p ₁ [psi]		14.7					
Intake temperature θ ₁ [°F]		90.0					
Relative humidity φ [%]		85.00					
Differential pressure Δp ^a [psi]		7.0					
Discharge pressure p ₂ [psi]		21.7					
Altitude a.s.l. [ft]		0					
Performance data under project conditions							
Volume flow		1 (V' _{min})	2 (V')	3 (V')	4 (V')	5 (V' _{max})	Design point
n	rpm	1477	1848	2219	2591	2965	2450
f _{three-phase current motor}	Hz	29.89	37.39	44.90	52.43	60.00	49.58
m' _{dry}	lbs/min	1.5	2.2	3.0	3.8	4.6	3.5
V' _S ^f	CFM	19.6	30.1	40.5	51.0	61.4	47.0
V' _b	CFM	21.1	32.3	43.6	54.8	66.1	50.6
P _{blower shaft} ^c	hp	1.9	2.3	2.7	3.1	3.5	2.9
P _{overall} ^d	kW	1.6	2.0	2.3	2.6	3.0	2.5
P _{motor shaft} ^c	hp	2.0	2.4	2.8	3.2	3.6	3.0
p _{specific} ^e	kW/(100*CFM)	7.70	6.05	5.27	4.83	4.55	4.97
eta _{isentropic} ⁱ	%	25.59	32.59	37.42	40.84	43.29	39.67
θ ₂ ^g	°F	306.2	259.8	237.9	225.5	217.8	229.5

Data Sheet KAESER Blower (Package)



- a: Machine pressure differential between inlet and outlet (compensator)
- b: Air-mass flow at machine discharge as usable volume flow at intake. Tolerance on deviation of quoted to measured data to ISO 1217 Annex C/E. Air flow at intake conditions:
 53-530 cfm: ± 5 %
 > 530 cfm: ± 4 %
- c: With consideration of the pressure losses of all flow contacting machine components
- d: Electrical motor power at nominal efficiency with consideration of the pressure losses of all flow contacting machine components
- e: Tolerance on deviation of quoted to measured performance data according to ISO 1217 C/E for specific power ($P_{overall}/\sqrt{V}$):
 53 -530 cfm: ± 6 %
 > 530 cfm: ± 5 %

Data Sheet KAESER Blower (Package)

f: DIN 1343: in physical normal state 14.7 psia, 32 °F, dry air 0% r.H. ($V'_{i.N.}$)
US-Standard (CAGI): 14.7 psia, 68°F, air 36% r.H. (V'_S)

g: Discharge temperature (calculated value)

h: DIN EN ISO 2151 and ISO 9614-2, 1m distance, figures +-3 db(A), with sound isolated pipework

i: calculated from $P_{overall}$ and V'

When measuring performance data, the values quoted under project conditions will be converted to test conditions as per the specified standard.

KAESER KOMPRESSOREN SE © 2023

v1.3.9



ODOR CONTROL TREATMENT



ENGINEERING REPORT – PROPOSED SEWAGE TREATMENT PLANT

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BOHEMIA • MANHATTAN • SARATOGA SPRINGS • MONTICELLO • SYRACUSE • SHELTON, CT

SECTION _____

ACTIVATED CARBON ADSORBER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. **General.** Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division _____, and all other related specification sections, apply to this section. The Contract Documents indicate specific *required* features of the equipment, but do not purport to cover *all* details of design and construction

1.2 DESCRIPTION OF WORK

- A. **Scope of Work.** The Contractor shall provide all labor, tools, equipment, and materials necessary to furnish and install the two (2) odor control systems in accordance with the drawings and as specified.

1.3 QUALITY ASSURANCE

- A. All components of the carbon adsorber systems shall be provided by a single manufacturer who shall have sole-source responsibility for the equipment elements detailed herein.
- B. The manufacturer of the systems shall be recognized in the design and production of carbon adsorption air treatment systems. Upon request, the manufacturer shall provide with the submittal data, a list of five (5) carbon adsorption air treatment installations associated with the treatment of hydrogen sulfide and other malodorous compounds. The list shall include contact names, telephone numbers, and length of service for each named installation.

1.4 SUBMITTALS

- A. **Product Data.** Include with product data, accessories, options, dimensions, weights, and list of special tools.
- B. **Typical Performance Data.** Submit typical performance data and curves for preliminary review of the equipment to be furnished. Such data shall be based on actual tests of similar equipment and include sufficient data to demonstrate suitability of the equipment for the conditions specified.
- C. **Shop Drawings.** Shop drawings shall be submitted showing materials, accessories, coatings, dimensional layouts, anchor bolts, sectional views of construction, specifications, wiring diagrams, and a bill of materials.
- D. **Operation and Maintenance (O&M) Manuals.** Submit O&M manuals in accordance with Section _____ prior to delivery of the equipment.
- E. **Field Service.** Submit manufacturer's installation inspection report.

1.5 JOB CONDITIONS

- A. **Coordination.** Coordinate all work with other trades to prevent delays, errors, and/or omissions.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. **Delivery.** All units shall be shipped assembled as much as practical. All units shall be labeled with all labeling intact and legible with item name, model number, size, and manufacturer's name.
- B. **Storage.** All units, accessories, and components shall be stored in the manufacturer's original package, under cover and protected from damage.
- C. **Handling.** Handle all units and components in accordance with the manufacturer's instructions. Use lifting rings and canvas harnesses for lifting to prevent scratching or abrading finished surfaces.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. The odor control system components specified under this section shall be the end products of Sierra Environmental Technologies, Wildwood, MO. (636) 273-5189 to ensure that the unit integrity and quality of the completed assembly meets the original design specification and performance criteria.
- B. Substitutions shall be considered only if the Engineer has received a written request at least two weeks prior to bid date. Bidders shall be notified by addendum if substitutions are acceptable. Requests for substitutions shall include technical and any other information required for evaluation.

2.2 CAST ALUMINUM FANS

- A. One (1) cast aluminum fan shall be as manufactured by American Fan, Model No. AF-9, flange mounted on the top of each of the two (2) carbon vessels. The fans shall be equipped with a direct-drive 1 HP 1/60/115-230V premium efficiency, wash down duty motor. The fan shall have a Teflon shaft seal and a stainless steel motor shaft. The discharge of the fan shall be equipped with a slide damper and discharge guard.

2.3 FIBERGLASS (FRP) VESSELS

- A. The vessels shall be fabricated from premium vinyl ester resin such as Hetron 922 by Ashland Chemical, or approved equal.
- B. Vessels shall be manufactured per ASTM D3299, D4097, and PS 15-69, as applicable.
- C. See Part 4, "Odor Control System Schedule" for requirements.
- D. Vessel design shall include a flat flanged bottom and a flat, gasket top with fiberglass grating media support system with polypropylene media retention screen.
- E. Vessels shall be designed to contain the specified media.
- F. Vessels shall be 36" diameter by 54" high.

- G. Each vessel shall have an 8" diameter FRP pipe stub inlet with FERNCO connectors, ¾" FNPT drain fitting with PVC ball valve, two (2) 1" diameter FNPT half coupling sample ports.
- H. All mounting hardware shall be 316SS.

2.4 MEDIA SYSTEM – TWO STAGE

- A. First Stage Media – The first stage media (lower bed) shall consist of a bed of high H₂H capacity activated carbon. The granular carbon, SWEETAIRE GC60, has an H₂H capacity of 0.2 gms H₂H/cc carbon. This equates to an H₂H capacity of 50% by weight. By comparison, caustic impregnated carbon has an H₂H capacity of only of 26% by weight. The first bed of activated carbon, 14.4 cu. Ft. (360 lbs.) will remove most of the H₂H in the system
- B. Second Stage Media – After passing through the first bed of media, the foul air will pass through a bed of potassium permanganate impregnated granular media to remove the balance of the malodors. The secondary media, SPECTRUM HS600, will provide secondary removal of any remaining H₂H as well as any other malodorous compounds that may be in the air stream. The secondary bed of media will consist of 6.7 cu.ft. (400 lbs.) of media.

2.5 ELECTRICAL CONTROL PANELS

- A. The operation of each system shall be controlled by an electrical control panel with a type 304 stainless steel NEMA 4X enclosure. Refer to the project plans for the location of the panel. Two (2) combination starter electrical control panels each with a fused disconnect switch, over load protection, auxiliary contacts, H-O-A hand control and one (1) red "power on" indicator light on the front door of the enclosure shall be provided. The electrical control panels shall be shipped loose to be field-mounted and field wired to the supply power service to the fan motors.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. **Site Verification of Conditions.** Prior to installation of equipment, verify that:
 - 1. All clearances have been met.
 - 2. Bases, anchors, supports, and openings are located correctly and are of the proper size and material.
- B. **Variations.** Any variations from the requirements shown on the drawings or required by the manufacturer shall be corrected at no additional cost to the Owner. All methods of correction shall be submitted in writing and acceptable to the Owner and/or Engineer/Architect.

3.2 INSTALLATION

- A. **General.** All odor control equipment shall be installed in accordance with the manufacturer's instruction and the conforming shop drawings, including all

gasket seals, isolation dampeners, cleanouts, drains, gauges, motors, controls, and power wiring.

- B. **Manufacturer's Field Service.** A qualified representative of the equipment manufacturer shall inspect the completed installation, service the equipment, operate the equipment under all design conditions, instruct the Owner's personnel in proper operating and maintenance procedures, and provide the Owner with a written certificate of installation approval.

3.3 REPAIRS/RESTORATION

- A. **Damages.** Any damage to the equipment, or chips, dents, scratches, stains, or other disfiguring of surrounding floors, walls, and/or accessories shall be repaired or replaced to the satisfaction of the Owner and/or Engineer/Architect at no additional cost to the Owner.

3.4 CLEANING

- A. **Surface.** The equipment and surrounding areas shall be cleaned of all foreign material, grease, and oil stains.
- B. **Protection.** After cleaning, provide protective covering for each piece of equipment.

3.5 FIELD QUALITY CONTROL

A. **Manufacturer's Field Service**

1. Perform field inspection of all components prior to placing in operation and submit manufacturer's installation inspection report addressing the following:
 - a. List of deficiencies found.
 - b. Recommended corrective action for all deficiencies.
 - c. Certification by manufacturer's representative that items are properly installed, aligned, and adjusted.

3.6 DEMONSTRATION

- A. **Visual.** The Contractor, Owner, and/or Engineer/Architect shall inspect the equipment for visual deficiencies.
- B. **Tests.** Dry and wet tests shall be performed and the equipment adjusted as specified. Verify and note in the operational demonstration log that all design conditions for schedule requirements and motor nameplate data have not been equaled or exceeded for the entire demonstration period.
- C. **System Start-up.** Start-up of the system shall be the responsibility of the manufacturer who shall furnish competent personnel to complete this activity. Start-up will commence following a visual inspection and check out of the system by the manufacturer's technical representative. The start-up person shall be on-site for a minimum of one (1) day.

- D. **Operator Training.** Operator training on the carbon adsorber system shall be conducted in accordance with Section -----.

3.7 **PROTECTION**

- A. **Requirements.** The Contractor shall be responsible for provisions to protect the equipment after installation, but prior to acceptance by the Owner. The Contractor shall remove all protective measures installed at completion and acceptance of the project.

PART 4 – SCHEDULE

4.1 **ODOR CONTROL SYSTEM (OCS)**

A. **Overall System**

1.	Foul Air Flow Rate (acfm)	496
2.	Inlet H ₂ S – ave. (ppmv)	TBD
3.	H ₂ S Removal Efficiency (%)	> 99.0

B. **Fan**

1.	Capacity (acfm)	496
2.	Total Static Pressure (in. wcg.)	7.0
3.	Fan Speed (rpm)	3450
4.	Fan BHP – Max.	0.56
5.	Motor	
a.	Hp	1.0
b.	Speed (rpm)	3450
c.	Enclosure	TEFC
d.	Voltage (V) –single phase 60 Hz	115

C. **Odor Control Media**

First Stage

Type:	SWEET-AIRE GC60
Base Material:	Coal based Activated Carbon
Size:	Granular, 4 x 8 mesh
Volume of Media (lbs.):	360
Bed depth (ft.):	2.0
Media Pressure Drop (in. weg.):	3.0
Media Bulk Density (lbs./cu.ft.):	25

Second Stage

Type:	SPECTRUM HS600
Base Material:	Potassium Permanganate Impregnated zeolite
Size:	Granular, 4 x 8 mesh
Volume of Media (lbs.):	400
Bed depth (ft.):	1.0
Media Pressure Drop (in. weg.):	1.5
Media Bulk Density (lbs./cu.ft.):	60

END OF SECTION



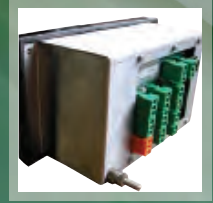
FLOW MONITORING STATION LEVEL PROBES, FLOW METER & CHART RECORDER



ENGINEERING REPORT – PROPOSED SEWAGE TREATMENT PLANT

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Product Overview



Ultra Range

Ultra 3

Ultra sophistication in a smart package, Ultra 3 combines reliable non-contacting ultrasonic level and volume measurement, high specification pump control and open channel flow measurement to international standards. Three control or alarm relays, optional data logging, Pulsar's world-leading DATEM echo processing software and a choice of wall, fascia, panel or 19" rack mounting.

Ultra 5

Ultra 5 continues where Ultra 3 leaves off, maintaining the same reliability, flexibility and menu-driven programming simplicity, with two extra relays, extra features for advanced pump control, differential level and open channel flow, plus the option of RS485 digital communication and 4–20 mA input.

UltraTWIN

Two independent ultrasonic systems in one unit. Each channel is user-configurable to operate in any combination of: a full function open channel flow monitor calculating flow rate to BS ISO standards, a pump control system or as a level and volume monitoring unit for liquids or solids, calculating volumes and providing alarms. UltraTWIN features six relays configurable for either channel as well as four digital inputs and 2 x 4-20mA outputs.

Ultra Range:

Ultra 3

Features

- Solids or liquids level measurement
- Choice of wall, panel, fascia or 19" rack mount controllers
- RS232 standard with optional 485 Modbus and Profibus
- AC or DC supply as standard
- No special interconnection cable
- Up to 1000m separation
- Ultra Wizard easy set up
- Backlit display
- DATEM Software



PANEL MOUNT OPTION



19" RACK MOUNT OPTION

Ultra 3 combines several full-function, world-beating ultrasonic level measurement instruments into one. Pulsar engineers have created devices that can be simply configured by the user to provide top-drawer performance. Through the use of ULTRA WIZARD, an integrated high level software configuration tool, you choose your application and the Ultra unit leads you through the set-up process for that specific operation. Full control functions are available: open channel flow is calculated to BS ISO 1438 and 4359. Pump control features are built into Ultra 3, and an extensive set of volume calculations and linearisation facilities are available for a tank or silo level measurement task.

Ultra 3 features the benefits of DATEM, the world's most advanced echo processing software, for level measurement.

Level

Perfect for the wide range of level measurement applications in solids and liquids found in the food, pharmaceutical, chemical, power generation and many more industries. In level measurement configuration, Ultra 3 has three control relays and a measurement range from 125mm to 40m.

Volume

Ultra 3 features pre-programmed tank shape conversion for a wide variety of standard tank shapes including: cylindrical, rectangular, cone base, pyramid base, sloped base, horizontal including parabolic ended tanks and spherical. Unusual shapes are also accommodated through the 32 point linearisation function.

Display:

- 8 digit on-board totaliser
- 6 digit display of flowrate or head
- Bar indicator displaying head or flow

Pump control

Pulsar pump control units are used throughout the global water and waste industries. Ultra 3 gives you sophisticated pump control on changing level or rate of level change to provide:

- **Power on delay**, allows to delay switching on pumps when power resumes.
- **Pump start delay**, allows delay switching on pumps after another has started.
- **Fixed duty assist**
- **Fixed duty back up**
- **Alternate duty assist**
- **Alternate duty back up**
- **Duty back up and assist**
- **Service ratio duty assist**
- **Service ratio duty back up**
- **FOFO (alternate first on first off duty assist)**

Open Channel Flow

Ultra 3 in open channel flow mode provides non-contacting, maintenance free flow measurement and control in a wide range of flumes and weirs by calculating flow from the measured head preceding a primary element. Flow calculation to BS ISO 1438 and 4359. Three control relays for control choices.

A data logging board is an optional extra with RS485 connection and large data log capability together with Profibus DP V0 and V1 or Modbus communications.



WALL MOUNT ULTRA 3 and 5

Product Overview



Transducers



Standard Range

A range of compact high acoustic output, non contacting transducers are designed for liquids or solids level measurement use. All have ATEX EEx m as standard for use in zone 1 flammable atmospheres.



Threaded Range

These incorporate the performance features of the standard products, but additionally offer a front thread mount option to suit threaded nozzles or flanged tank entries.



GENERATOR



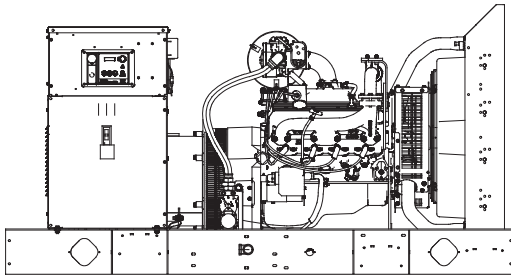


EPA-Certified for 60 Hz Stationary Emergency Applications

EPA certification not applicable at 50 Hz

Ratings Range

Standby:	kW kVA	60 Hz	50 Hz
		44- 63 44- 79	40- 63 40- 66



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 generator set meets NFPA 110, Level 1, when equipped with the necessary accessories and installed per NFPA standards.
- A one-year limited warranty covers all generator set systems and components. Two- and five-year extended limited warranties are also available.
- Alternator features:
 - The unique Fast-Response® X excitation system delivers excellent voltage response and short-circuit capability using a rare-earth, permanent magnet (PM)-excited alternator.
 - The brushless, rotating-field alternator has broadrange reconnectability.

Generator Set Ratings

Alternator	Voltage	Ph	Hz	Natural Gas 130°C Rise Standby Rating		LP Gas 130°C Rise Standby Rating	
				kW/kVA	Amps	kW/kVA	Amps
4P7BX	120/208	3	60	54/68	189	54/68	189
	127/220	3	60	57/71	187	57/71	187
	120/240	3	60	54/68	164	54/68	164
	120/240	1	60	44/44	184	44/44	184
	139/240	3	60	60/75	181	60/75	181
	220/380	3	60	49/61	93	49/61	93
	277/480	3	60	60/75	91	60/75	91
	347/600	3	60	57/71	69	57/71	69
	110/190	3	50	44/55	168	44/55	168
	115/200	3	50	47/59	171	47/59	171
	120/208	3	50	46/58	161	46/58	161
	110/220	3	50	47/59	155	47/59	155
	110/220	1	50	40/40	182	40/40	182
	220/380	3	50	44/55	84	44/55	84
4P8X	230/400	3	50	47/59	86	47/59	86
	240/415	3	50	46/58	81	46/58	81
	120/208	3	60	60/75	209	62/78	217
	127/220	3	60	60/75	197	62/78	205
	120/240	3	60	60/75	181	62/78	188
	120/240	1	60	57/57	238	57/57	238
	139/240	3	60	60/75	181	62/78	188
	220/380	3	60	60/75	114	62/78	119
	277/480	3	60	60/75	91	62/78	94
	347/600	3	60	60/75	73	62/78	76
	110/190	3	50	48/60	183	50/63	192
	115/200	3	50	48/60	174	50/63	182
	120/208	3	50	45/56	156	45/56	156
	110/220	3	50	48/60	158	50/63	166
110/220	1	50	48/48	219	50/50	228	
220/380	3	50	48/60	92	50/63	96	
230/400	3	50	48/60	87	50/63	91	
240/415	3	50	45/56	78	45/56	78	

RATINGS: All three-phase units are rated at 0.8 power factor. All single-phase units are rated at 1.0 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. 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. For dual fuel engines, use the natural gas ratings for both the primary and secondary fuels.

Alternator	Voltage	Ph	Hz	Natural Gas 130°C Rise Standby Rating		LP Gas 130°C Rise Standby Rating	
				kW/kVA	Amps	kW/kVA	Amps
4P10X	120/208	3	60	60/75	209	63/79	220
	127/220	3	60	60/75	197	63/79	208
	120/240	3	60	60/75	181	63/79	191
	120/240	1	60	60/60	250	63/63	263
	139/240	3	60	60/75	181	63/79	191
	220/380	3	60	60/75	114	63/79	121
	277/480	3	60	60/75	91	63/79	96
	347/600	3	60	60/75	73	63/79	77
	110/190	3	50	53/66	201	53/66	201
	115/200	3	50	53/66	191	53/66	191
	120/208	3	50	53/66	184	53/66	184
	110/220	3	50	53/66	174	53/66	174
	110/220	1	50	50/50	228	63/63	287
	220/380	3	50	53/66	101	53/66	101
	230/400	3	50	53/66	96	53/66	96
	240/415	3	50	53/66	92	53/66	92
	4Q10X	120/240	1	60	60/60	250	60/60
110/220		1	50	53/53	241	53/53	241

Alternator Specifications

Specifications	Alternator
Manufacturer	Kohler
Type	4-Pole, Rotating-Field
Exciter type	Brushless, Rare-Earth Permanent Magnet
Leads: quantity, type	
4P7BX, 4P8X, 4P10X	12, Reconnectable
4Q10X	4, 110- 120/220- 240 V
Voltage regulator	Solid State, Volts/Hz
Insulation:	NEMA MG1
Material	Class H
Temperature rise	130°C, Standby
Bearing: quantity, type	1, Sealed
Coupling	Flexible Disc
Amortisseur windings	Full
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, 400 V 4P7BX (12 lead)	180 (60 Hz), 136 (50 Hz)
480 V, 400 V 4P8X (12 lead)	261 (60 Hz), 218 (50 Hz)
480 V, 400 V 4P10X (12 lead)	275 (60 Hz), 220 (50 Hz)
240 V, 220 V 4Q10X (4 lead)	144 (60 Hz), 132 (50 Hz)

- The unique Fast-Response® X excitation system delivers excellent voltage response and short-circuit capability using a rare-earth, permanent magnet (PM)-excited alternator.
- The brushless, rotating-field alternator has broadrange reconnectability.
- 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.

Application Data

Engine

Engine Specifications	60 Hz	50 Hz
Manufacturer	Kohler	
Engine: model, type	KG6208 6.2 L Natural Aspiration	
Cylinder arrangement	V-8	
Displacement, L (cu. in.)	6.2 (378)	
Bore and stroke, mm (in.)	101.6 x 95.25 (4.00 x 3.75)	
Compression ratio	10.5:1	
Rated rpm	1800	1500
Max. power at rated rpm, kW (HP)	77.0 (103)	64.3 (86)
Cylinder head material	Cast Aluminum	
Piston type and material	High Silicon Aluminum	
Crankshaft material	Cast Iron	
Valve (exhaust) material	Forged Steel	
Governor type	Electronic	
Frequency regulation, no-load to full-load	Isochronous	
Frequency regulation, steady state	±1.0%	
Frequency	Fixed	
Air cleaner type, all models	Dry	

Application Data

Exhaust

Exhaust System	60 Hz	50 Hz
Exhaust manifold type	Dry	
Exhaust flow at rated kW, m ³ /min. (cfm)	13.5 (478)	11.3 (399)
Exhaust temperature at rated kW, dry exhaust, °C (°F)	690 (1274)	
Maximum allowable back pressure, kPa (in. Hg)	10.2 (3.0)	
Exhaust outlet size at engine hookup, mm (in.)	76 (3.0) OD	

Engine Electrical

Engine Electrical System	60 Hz	50 Hz
Ignition system	Electronic, Distributor	
Ignition system	Electronic	
Battery charging alternator:		
Ground (negative/positive)	Negative	
Volts (DC)	12	
Ampere rating	130	
Starter motor rated voltage (DC)	12	
Battery, recommended cold cranking amps (CCA):		
Qty., rating for -18°C (0°F)	1, 630	
Battery voltage (DC)	12	

Fuel

Fuel System	60 Hz	50 Hz
Fuel type	Natural Gas, LP Gas, or Dual Fuel	
Fuel supply line inlet	1 NPTF	
Natural gas fuel supply pressure, kPa (in. H ₂ O)	1.74-2.74 (7-11)	
LPG vapor withdrawal fuel supply pressure, kPa (in. H ₂ O)	1.24-2.74 (5-11)	
Dual fuel engine, LPG vapor withdrawal fuel supply pressure, kPa (in. H ₂ O)	1.24 (5)	

Fuel Composition Limits *	Nat. Gas	LP Gas
Methane, % by volume	90 min.	—
Ethane, % by volume	4.0 max.	—
Propane, % by volume	1.0 max.	85 min.
Propene, % by volume	0.1 max.	5.0 max.
C ₄ and higher, % by volume	0.3 max.	2.5 max.
Sulfur, ppm mass	25 max.	
Lower heating value, MJ/m ³ (Btu/ft ³), min.	33.2 (890)	84.2 (2260)

* Fuels with other compositions may be acceptable. If your fuel is outside the listed specifications, contact your local distributor for further analysis and advice.

Lubrication

Lubricating System	60 Hz	50 Hz
Type	Full Pressure	
Oil pan capacity, L (qt.) §	5.7 (6.0)	
Oil pan capacity with filter, L (qt.) §	7.1 (7.5)	
Oil filter: quantity, type §	1, Cartridge	

§ Kohler recommends the use of Kohler Genuine oil and filters.

Cooling

Radiator System	60 Hz	50 Hz
Ambient temperature, °C (°F) *	50 (122)	
Engine jacket water capacity, L (gal.)	7.3 (1.93)	
Radiator system capacity, including engine, L (gal.)	20.8 (5.5)	
Engine jacket water flow, Lpm (gpm)	129 (34.1)	108 (28.5)
Heat rejected to cooling water at rated kW, dry exhaust, kW (Btu/min.)	64.0 (3640)	56.0 (3185)
Water pump type	Centrifugal	
Fan diameter, including blades, mm (in.)	533 (21)	
Fan, kWm (HP)	2.2 (2.9)	1.3 (1.7)
Max. restriction of cooling air, intake and discharge side of radiator, kPa (in. H ₂ O)	0.125 (0.5)	

* Enclosure with enclosed silencer reduces ambient temperature capability by 5°C (9°F).

Operation Requirements

Air Requirements	60 Hz	50 Hz
Radiator-cooled cooling air, m ³ /min. (scfm) †	136 (4800)	113 (4000)
Combustion air, m ³ /min. (cfm)	5.2 (185)	4.4 (155)
Heat rejected to ambient air:		
Engine, kW (Btu/min.)	30.9 (1760)	26.5 (1510)
Alternator, kW (Btu/min.)	7.7 (440)	6.9 (390)

† Air density = 1.20 kg/m³ (0.075 lbm/ft³)

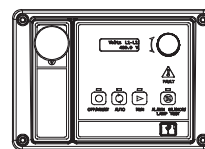
Fuel Consumption ‡	60 Hz	50 Hz
Natural Gas, m³/hr. (cfh) at % load	Standby Ratings	
100%	27.6 (975)	22.9 (810)
75%	21.8 (770)	16.9 (600)
50%	15.1 (533)	11.4 (402)
25%	8.3 (292)	6.3 (221)
LP Gas, m³/hr. (cfh) at % load	Standby Ratings	
100%	11.6 (410)	10.3 (365)
75%	9.3 (330)	6.5 (229)
50%	6.0 (213)	4.8 (168)
25%	3.9 (141)	3.0 (107)

‡ Nominal fuel rating: Natural gas, 37 MJ/m³ (1000 Btu/ft.³)
LP vapor, 93 MJ/m³ (2500 Btu/ft.³)

LP vapor conversion factors:

8.58 ft.³ = 1 lb.
0.535 m³ = 1 kg.
36.39 ft.³ = 1 gal.

Controllers



APM402 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
- Controller supports Modbus® protocol
- Integrated hybrid voltage regulator with ±0.5% regulation
- Built-in alternator thermal overload protection
- NFPA 110 Level 1 capability

Refer to G6-161 for additional controller features and accessories.

Standard Features

- Alternator Protection
- Battery Rack and Cables
- Electronic, Isochronous Governor
- Gas Fuel System (includes fuel mixer, electronic secondary gas regulator, gas solenoid valve, and flexible fuel line between the engine and the skid-mounted fuel system components)
- Integral Vibration Isolation
- Local Emergency Stop Switch
- Oil Drain Extension
- Operation and Installation Literature

Available Options

Approvals and Listings

- CSA Approval
- IBC Seismic Certification
- UL 2200 Listing
- Hurricane Rated Enclosure

Enclosed Unit

- Sound Enclosure (with enclosed critical silencer)
- Weather Enclosure (with enclosed critical silencer)

Open Unit

- Exhaust Silencer, Critical (kit: PA-352663)
- Flexible Exhaust Connector, Stainless Steel

Fuel System

- Dual Fuel NG/LPG (automatic changeover)
- Flexible Fuel Line (required when the generator set skid is spring mounted)
- Fuel Filter Kit

Controller

- Common Fault Relay
- Two Input/Five Output Module
- Remote Annunciator Panel
- Remote Emergency Stop
- Run Relay
- Manual Speed Adjust

Cooling System

- Block Heater, 1500 W, 110-120 V
Required for ambient temperatures below 10°C (50°F)
- Radiator Duct Flange

Electrical System

- Alternator Strip Heater
- Battery
- Battery Charger
- Battery Charger Temperature Compensation
- Battery Heater
- Line Circuit Breaker (NEMA1 enclosure)
- Line Circuit Breaker with Shunt Trip (NEMA1 enclosure)

Miscellaneous

- Air Cleaner Restrictor Indicator
- Certified Test Report
- Engine Fluids (oil and coolant) Added
- Rated Power Factor Testing
- Rodent Guards
- Open Unit Accessory Kit (stone guards, radiator duct flange, flexible exhaust)

Literature

- General Maintenance
- NFPA 110
- Overhaul
- Production

Warranty

- 2-Year Basic Limited Warranty
- 5-Year Basic Limited Warranty
- 5-Year Comprehensive Limited Warranty

Other Options

- _____
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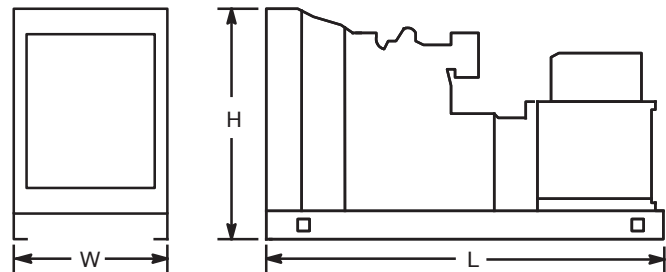
Dimensions and Weights

Overall Size, L x W x H, mm (in.):

Wide Skid 2200 x 1040 x 1172 (86.6 x 40.9 x 46.1)

Narrow Skid 2200 x 864 x 1172 (86.6 x 34.0 x 46.1)

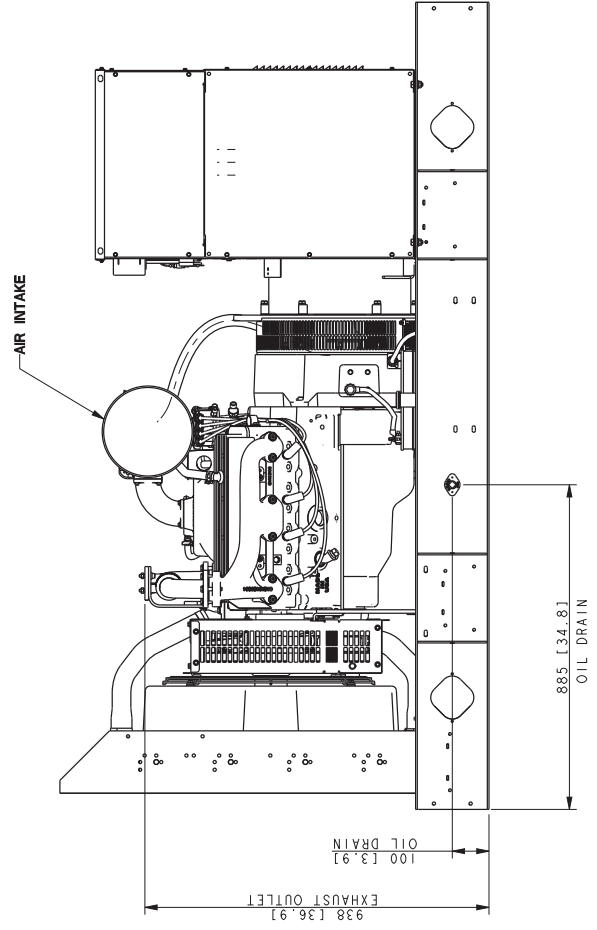
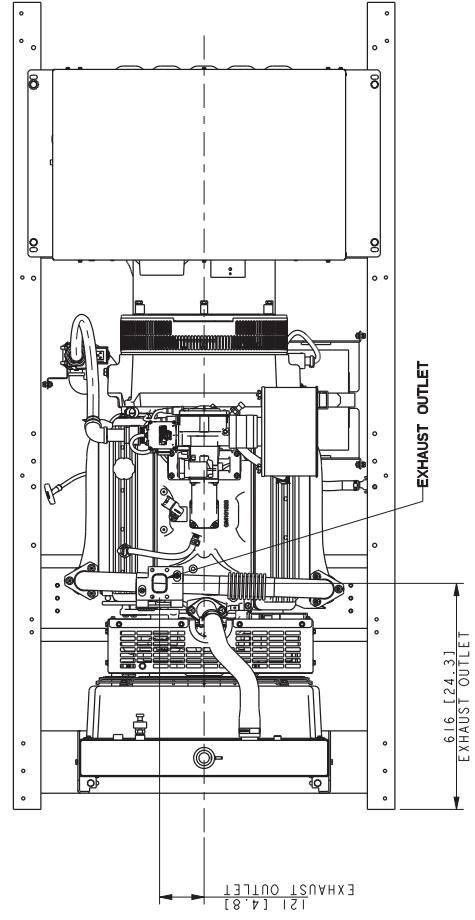
Weight (radiator model), wet, kg (lb.): 755 (1665)



NOTE: This drawing is provided for reference only and should not be used for planning installation. Contact your local distributor for more detailed information.

DISTRIBUTED BY:

1 2 3 4 5 6 7 8



NOTES:
 1. IF IBC CERTIFICATION IS APPLICABLE OR REQUIRED SEE SEISMIC ADV FOR INSTALLATION INSTRUCTIONS.
 2. DIMENSIONS IN [] ARE ENGLISH STANDARD EQUIVALENTS.
 3. * - ASTERISK DENOTES STANDARD EQUIVALENTS.
 3. * 864 [34.0] SKID WIDTH.

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