Scienco/FAST, a Subsidiary of Bio-Microbics, Inc.
12977 Maurer Industrial Drive
St. Louis, MO 63127-1515
Tel: 314-756-9300
Fax: 314-756-9306
E-mail: solutions@sciencofast.com

MODEL MMBR **SERIAL NO.** ____

CUSTOMER_____

VESSEL / PLATFORM_____

DATE _____

MAJOR ITEMS OF EQUIPMENT

1. FPZ SCL K04 MS Aeration Blower with 3hp TEFC 230/460/3/60 motor
2. AMT 316A-95 Screenings Pump with 3hp TEFC 230/460/3/60 motor
3. AMT369 Sludge Transfer Pump with 1hp TEFC 230/460/3/60 motor
4. Berns 105 gph Filtrate Pump with 1/2hp 115VAC/1 motor
5. Biomicrobics MA305-11 Membrane Double Stack Assembly
6. Renu Electronics Marine Biobarrier PLC
7. Indquip Engineering 35808 Control Panel

TABLE OF CONTENTS

1.0 GENERAL

This manual covers all standard Marine BioBarrier sewage treatment systems. That includes units not only of different capacities, but configured to meet different regulations, fitted with different machinery and different controls depending upon the applicable regulations and the specific requirements of the installation.

As indicated below, systems may employ primary settling tanks to reduce organic loading and/or provide a destination of long term storage of excess activated sludge together with associated pumps, controls, etc.

Standard systems are designated MBB-1, MBB-2…MBB-7. But special systems will be designated MBB-1S, MBB-2S…MBB-7S. These special systems may employ different tanks including but not limited to installation of components in ships' tanks.

IMPORTANT NOTE

The installed Screenings Pump and Sludge Transfer Pump will not be required or used during the certification effluent test due to the relatively short duration of the certification test.

Therefore, their operation is not described in detail in this Operating Instruction Manual.

2.0 DANGER

DO NOT UNDER ANY CIRCUMSTANCES ENTER ANY TANK WHICH HAS CONTAINED SEWAGE UNLESS IT HAS BEEN POSITIVELY DETERMINED THAT THE TANK IS SAFE FOR ENTRY.

THE TANK MUST BE THOROUGHLY CLEANED, DISINFECTED AND PROPERLY FORCE VENTILATED WITH A GOOD SUPPLY OF FRESH AIR.

HYDROGEN SULFIDE GAS CAN BE LETHAL. IT CAN FORM IN SEWAGE TANKS THAT ARE NOT PROPERLY AERATED OR VENTILATED.

3.0 WARNINGS

3.1 ALL UNITS

1. **The Blower and its discharge piping may be hot. Keep body, hands, clothing and foreign objects away from the blower inlet.**
2. **After coming into contact with sewage, treated or untreated, wash thoroughly with soap and water.**
3. **Unless the unit is specially equipped with the proper explosion-proof electrical equipment, do not install it in or expose it to an explosive atmosphere.**

4.0 RESTRICTIONS

4.1 DISINFECTANTS

Do not use or dispose of Pine Sol, Lysol or any other disinfectants in any toilet or other drain leading to the sewage treatment system. Any commercially available soap or detergent can be used for cleaning so long as it does not claim disinfecting properties.

Small amounts of acid or chlorine in sprays can be used to clean and bleach toilet bowls, urinals and other fixtures and surfaces. But do not use disinfectants.

Similarly, detergents, rinses and other additives used in dishwashing and laundry must not employ disinfectants. If the dishwasher temperature is less than 160° F. then the dishwasher detergent may incorporate some chlorine to enhance disinfection.

A good rule of thumb is to read the Material Safety Data Sheet (MSDS) for each chemical being considered. If the compound incorporates any quaternary ammonium compounds or if the MSDS states that it is toxic to aquatic life, do not use it.

Suitable non-toxic products are available. If you are not certain, contact Scienco/FAST.

Remember that on land, disinfectants are mixed with extremely large amounts of water before reaching a sewage treatment system. But, on a ship or offshore platform there is no such dilution.

Therefore, products normally used in land applications may not be suitable for marine use.

4.2 GREASE

Do not dispose of cooking fat or grease through drains leading to the sewage system. Galley drains should be equipped with efficient grease traps that are properly sized and maintained.

4.4 FOREIGN OBJECTS

Sanitary napkins, tampon applicators, condoms and other foreign objects should not be flushed down the toilets. Although it is unlikely that they would clog the unit, such practices should be discouraged to prevent long-term accumulation.

4.5 WASTEWATER TEMPERATURE

Wastewater temperature in the Membrane Tank should not exceed 104° F (40° C) as that is the maximum temperature that can be tolerated by the mesophilic microorganisms that treat the sewage.

These microorganisms develop in the human digestive tract and are most efficient in treatment at human body temperature, 98.6ºF (37º C).

4.6 SEAWATER

The process is intended for operation with freshwater sewage only and not with seawater. If only brackish water is available, maximum allowable salt content is 1,000 mg/l (0.1 %).

5.0 PROCESS

The BioBarrier is a membrane bioreactor (MBR). That is, it employs aerobic biological treatment with membranes to remove solids and bacteria from the effluent.

The Marine BioBarriers are complete marine sewage treatment systems employing two or more ultrafiltration Membrane Modules. The process comprises:

1. Fine screening to remove small particles that might otherwise accumulate in the unit and require excessive maintenance.
2. Suspended growth aerobic treatment to remove soluble BOD5 so that remaining BOD5 is contained in the remaining solids.
3. Membrane solid separation to produce solids-free effluent. Removing the solids also removes the remaining BOD5.
4. The membranes also reject fecal coliform bacteria so that no additional disinfection is required.

5.1 BACKGROUND

The subject systems are based upon know-how and critical components developed and working in several hundred land BioBarrier installations. The process has been adapted to the requirements of marine applications.

5.2 FOUR STANDARD MODELS

BioBarrier Models MBB-1, MBB-2, MBB-3 and MBB-4 are complete package units. Tank sizes vary based upon design flow.

Design Flows for Standard Models				
standard model number	**MBB-1**	**MBB-2**	**MBB-3**	**MBB-4**
special model number	**MBB-1S**	**MBB-2S**	**MBB-3S**	**MBB-4S**
Average Daily Flow gpd	600	1,200	2,400	3,600
Maximum Daily Flow gpd	700	1,400	2,800	4,200

5.2.1 Screening Tank

Incoming sewage passes through a wedgewire screen before entering the Membrane Tank. Accumulated screenings are stored in the Screening Tank and a pump is provided for periodic removal.

5.2.2 Membrane Tank

The Membrane Tank incorporates the Membrane Modules, associated aeration grids and level controls that provide for flow equalization and control of the filtrate pump(s). Flow equalization is required because peak inflows may exceed the flow limits of the membranes for short periods.

Within the membrane tank organics are digested by aerobic microorganisms (activated sludge). Solid organics are reduced in mass and volume and soluble (liquid) organics are converted into solids for separate removal.

5.2.3 Activated Sludge Transfer Pump

Fine screened solids enter the Membrane tank, but the effluent is completely free of solids. Even though some of the solids will be digested and converted into carbon dioxide and water, partly and fully digested solids will accumulate in the Membrane Tank.

The Membrane Tank is equipped with a sludge transfer pump for periodic removal of this waste activated sludge (WAS). The process works best when the sludge concentration (MLSS) stays within a certain range or values.

The Sludge Transfer Pump operates automatically to remove solids from the Membrane Tank based upon calculated accumulation rates.

5.2.4 Filtrate Pump(s)

The positive displacement filtrate pump(s) provide a gentle vacuum to extract solids-free effluent from the Membrane Tank and discharge the water from the system.

5.2.5 Chlorine Tank

Periodic back soaking of the membranes with a sodium hypochlorite solution cleans the membranes. This is called clean in place (CIP).

With individual filtrate pumps for each stack of modules, individual stacks can be cleaned in place while the other stacks remain in operation.

5.2.6 Membrane Modules

Each Membrane Module comprises and supports a number of flat plate membranes. Connections are provided for aeration and for extraction of solids-free effluent (filtrate).

Average flow for each module is 300 gpd and maximum flow is 350 gpd. These are very conservative ratings.

They are based upon flows that result in an absolute minimum of maintenance. The membranes will reject solids and bacteria at higher and lower flows with no reduction in effluent quality.

5.2.7 Aeration Blower

Each stack of one or two Membrane Modules is provided with an aeration grid at the bottom. The rising air bubbles transfer oxygen into the water and also tend to keep the vertical membrane surfaces clean of excess solids.

One blower is provided for each Membrane Tank. Orifices regulate flows and distribute the air evenly with multiple membrane stacks.

6.0 SPECIAL SYSTEMS

6.1 PRIMARY SETTLING TANK

In shipboard applications, a primary settling tank will normally be employed to provide flow equalization and to reduce the applied organic loading in terms of BOD5 lb/day. Excess activated sludge from the Membrane Tank may also be pumped back to the primary tank for further digestion and storage.

Many vessels have sewage holding tanks of one sort or another. But, since they can vary considerably from vessel to vessel, each must be evaluated individually.

6.2 EFFLUENT LIFT STATION

Ships have varying static lift requirements for discharge pumps and a separate lift station may be specified or provided to receive the solids and bacteria free effluent from the filtrate pump(s) and to discharge it.

6.3 SPECIAL MODEL DESIGNATIONS

Available space aboard vessels may indicate changes in standard tank dimensions. In addition, the process lends itself to building the process into ship's tanks, particularly in larger systems.

In either case, we designate these models with an "S" suffix. Such systems would have the same processing capacities and major components as the standard units, but would be arranged to suit the specific vessel requirements.

For example, special model MBB-3S would have the same rated capacity and major components as standard model MBB-3.

6.4 LARGER SYSTEMS

At present, the MBB-4 is the largest unit that we can manufacture in our shop. Models MBB-5, MBB-6 and MBB-7 employ multiple identical MBB-4 units connected in parallel.

By employing ship's or tanks provided on site by others to our specifications, the MBB-5S, MBB-6S and MBB-7S can be configured with one tank.

Marine BioBarrier Rated Capacities Hydraulic Loading							
standard model number	MBB-1	MBB-2	MBB-3	MBB-4	MBB-5	MBB-6	MBB-7
special model number	MBB-1S	MBB-2S	MBB-3S	MBB-4S	MBB-5S	MBB-6S	MBB-7S
number of tanks	1	1	1	1	2	3	4
membrane modules	2	4	8	12	24	36	48
stacks	2	2	4	6	12	18	24
rated capacities gpd							
average flow	600	1,200	2,400	3,600	7,200	10,800	14,400
max flow	700	1,400	2,800	4,200	8,400	12,600	16,800

Marine BioBarrier Rated Capacities Organic Loading							
standard model number	MBB-1	MBB-2	MBB-3	MBB-4	MBB-5	MBB-6	MBB-7
special model number	MBB-1S	MBB-2S	MBB-3S	MBB-4S	MBB-5S	MBB-6S	MBB-7S
number of tanks	1	1	1	1	2	3	4
membrane modules	2	4	8	12	24	36	48
stacks	2	2	4	6	12	18	24
rated capacities BOD5 lb/day	2.8	4.3	11	17	34	52	69

7.0 STARTUP

There are situations where startup is required:

1. A new unit or new membranes installed in an existing unit.
2. When toxic chemicals have killed the beneficial culture of microorganisms in the membrane tank.
3. When it has been necessary to open, chemically clean and/or gas-free the membrane tank for inspection, repair or any other reason.

In any of these situations, it is necessary to follow the steps specified below in order to obtain best results. There are two methods for startup:

1. Using waste activated sludge (WAS) obtained from another system.
2. Using incoming sewage.

7.1 IMPORTANT NOTE

Any wastewater or sludge added to the membrane tank must be screened to eliminate filamentous material which can accumulate and damage the membranes.

7.2 USING WASTE ACTIVATED SLUDGE (WAS)

This is the preferred method and should be used whenever WAS is or can be made available:

1. Empty the screening and membrane tanks.
2. Add the volume of WAS specified in the table below through the hatch on top of the membrane tank.
3. The WAS should be screened to remove harmful filamentous material. The WAS can be passed through a flexible window screen available at any hardware store.
4. Add the volume of water required to achieve the maximum volume specified in the table below.
5. It is desirable but not necessary to set the blower to MANUAL and aerate for not less than 24 hours before beginning automatic operation.
6. Turn the blower and filtrate pump to AUTO and begin dosing the system.

7. Depending upon the inflow of sewage to the system, t will take time for the incoming sewage to fill the screenings tank and spill over into the membrane tank. So, it may take a day or more before the filtrate pumps begin to operate automatically to discharge effluent.

Waste Activated Sludge (WAS) Required for Startup				
standard model number	MBB-1	MBB-2	MBB-3	MBB-4
special model number	MBB-1S	MBB-2S	MBB-3S	MBB-4S
WAS volume required (gal) note 1	260	420	1,100	1,700
Total volume at max mt water level gal	360	580	1,500	2,200
Add water gal note 2	100	160	400	500
Notes				
1. WAS sludge volume based upon 8,000 mg/l TSS. Adjust volume as required for other concentrations.				
2. Volume of added water based upon 8,000 mg/l TSS. Add more or less water to achieve specified total volume.				

7.3 USING INCOMING SEWAGE

Passing the sewage through the wedge wire screen installed in the screening tank will remove the undesirable filamentous material from wastewater entering the membrane tank. Add the volume of sewage specified in the table below to fill the membrane tank to the level required for startup:

1. Empty the screening and membrane tanks.
2. Set the blower to MANUAL and the filtrate pump to OFF.
3. Add sewage to the system to first fill the screening tank and then fill the membrane tank to the level required for startup.
4. Aerate the sewage with no inflow for 48 hours.
5. Adjust inflow to the system to the reduced flow for startup specified below.
6. Set the filtrate pump to AUTO. Operate the system with this reduced flow for five (5) days.
7. Reset automatic controls to process wastewater at average daily flow as shown below.
8. Perform a clean in place (CIP) at 2 weeks to 3months from startup depending upon unit performance.

Startup Using Incoming Sewage				
standard model number	MBB-1	MBB-2	MBB-3	MBB-4
special model number	MBB-1S	MBB-2S	MBB-3S	MBB-4S
Sewage volume required to fill screening tank gal	180	290	360	550
Sewage volume required in membrane tank for startup	260	420	1,100	1,700
Reduced Flow During Startup gpd note 1	90	150	380	550

8.0 OPERATION AND MAINTENANCE

8.1 GENERAL

The Marine BioBarrier is designed for long term operation with minimum attention and minimum maintenance. Some is required of course, but the system is intended for operation by vessel personnel without specialized training.

Many of the land systems are installed at single family homes for example.

Please note that the intervals stated below are based upon assumptions and experience in operation will determine the service intervals required.

Schedule of Recommended Service Intervals			
Operation	**Units**	**From**	**To**
Blower inlet filter	**months**	**1**	**3**
Membranes			
Clean in place (CIP)	**months**	**6**	**14**
Forward soak	**years**	**2**	**5**
Replace	**years**	**5**	**12**
Pump out screening tank	**months**	**3**	**6**
Clean wedgewire screen	**years**	**1**	**2**
Check membrane tank MLSS	**months**	**3**	**6**
Notes:			
1. Service interval for blower filter wash/replace subject to conditions at site.			
2. Service intervals for membranes subject to system hydraulic and organic loading.			
3. Service intervals for inlet screens depend upon primary treatment ahead of system.			

8.2 MEMBRANE MAINTENANCE VERSUS LOADING

Service intervals shown are based upon operation at rated capacity in terms of hydraulic and organic loading. Although organic loading is a factor, the primary factor is hydraulic loading.

The intervals are inversely proportional to the daily flow. For example, if the system is operated at one-half rated hydraulic capacity, maintenance intervals will be twice as long.

8.3 SCREENINGS

No pretreatment

For the unit with no pretreatment, the Screenings Tank should be pumped out at approximately three (3) month intervals. As above, if the system is operated at one-half rated capacity, this should only be required at six (6) month intervals.

The wedgewire screen should be pulled and cleaned at about one (1) year intervals.

With Pretreatment

A properly designed primary settling tank will remove about half of applied suspended solids and therefore about half of the screenings. This will double the maintenance intervals stated above, pumpout at twelve (12) month intervals and cleaning the wedgewire screen at two (2) year intervals.

8.4 WASTE ACTIVATED SLUDGE

With the automatic removal of waste activated sludge (WAS), the mixed liquor suspended solids (MLSS) in the Membrane Tank should be tested every three (3) to six (6) months or so to determine if it is within the desirable range of values, less than 12,000 mg/l.

If it is high, the timer and the automatic cycle can be adjusted to increase the removal rate. Here again, experience in operation will determine best service intervals and adjustments,

If the Membrane Tank is pumped out, there should be enough activated sludge remaining in the tank to restart the process.

8.5 MEMBRANES

Automatic Features

The blower and filtrate pump operate on automatic cycles to provide air scouring and relaxation of the membranes to minimize or prevent excess accumulation of sludge on the membrane surfaces.

Clean in Place (CIP)

After a period of time, the membranes should be chemically cleaned with a dilute solution of sodium hypochlorite laundry bleach. A chlorine feed tank and all necessary piping and valves are provided on the unit.

A solution of between 500 and 1,000 mg/l sodium hypochlorite is required. The volume required will be determined by the piping on the installed unit.

The blower and filtrate pump should be turned to OFF while this is accomplished and an overnight soak time of about eight (8) hours should do the job.

When the CIP is complete, return the valves to the normal positions and start the filtrate pump and blower on AUTO.

Forward Soak

Each time the membranes are cleaned in place, the available flow will be reduced a bit. The next step would be a forward soak.

Drain the Membrane tank and turn power to the unit OFF. Partly fill the Membrane Tank with water, add the volume of bleach specified in the table below directly to the Membrane Tank and then fill the Membrane tank to its normal water level.

An overnight soak time of about eight (8) hours should do the job. Then, set controls to AUTO and begin processing sewage.

Bleach Required for Forward Soak				
standard model number	**MBB-1**	**MBB-2**	**MBB-3**	**MBB-4**
special model number	**MBB-1S**	**MBB-2S**	**MBB-3S**	**MBB-4S**
Membrane Tank gallons	286	444	1,174	1,761
Bleach Concentration %	6%	6%	6%	6%
Dilute Solution mg/l Required	1,000	1,000	1,000	1,000
Gallons of Bleach Required	5	8	21	32

Membrane Replacement

As indicated above, estimated membrane life can vary considerably depending upon hydraulic loading but should average about eight (8) years.

9.0 SET UP FOR OPERATION

9.1 INLET AND DISCHARGE SETUP

For custom and larger units, feed flow to multiple units from a primary settling tank will be configured based upon the requirements of the individual installation. In general, multiple positive displacement or flow regulated feed pumps will divided the flow equally among the multiple standard units.

Although the Filtrate Pump develops sufficient discharge pressure for most installations, systems may be equipped with separate effluent lift stations so that membrane and discharge operations can be separately optimized.

9.2 FLOW EQUALIZATION

Membranes are normally selected for expected average flows. In actual installations, there are surge flows. The standard unit incorporates flow equalization inside the membrane tank to deal with periodic surge flows.

In cases where the surge flows are more severe than this internal flow equalization provides, the installation instructions will specify the additional pretreatment requirements specific to each installation.

9.3 CONTROL PANEL

Programmable Control Unit (PLC)

This unit is mounted on the front of the Control Panel. It controls all automatic functions of the system and provides visual displays for the operator.

The operating manual for the PLC is enclosed.

Other Controls

Set Blower, Filtrate Pump and Activated Sludge Transfer Pump controls to AUTO.

Valves

Valves should be set to permit flow through the unit to the suction connection of the Filtrate Pump and then to discharge.

10.0 TROUBLESHOOTING

The best gages of system performance are your eyes and nose. The effluent should be clear and odorless.

The Programmable Display Unit provides monitoring of critical parameters and recommended actions when indicated.

Effluent not Clear

If the effluent is not optically clear, there may be a leak in one or more membrane modules.

In most cases, the offending stack can be isolated by shutting off the associated filtrate pump and associated valves and the unit can remain in operation at a somewhat reduced capacity.

Effluent not Odorless

The aeration blower has been selected to maintain aerobic conditions under simultaneous worst case conditions of temperature and loading. If the effluent is gray or black and has the odor of rotten eggs, this indicates that aeration is impaired.

1. Check that the blower inlet filter is clean and does not obstruct airflow.
2. If this does not correct the problem the blower may be defective and require replacement or repair.

Inadequate Flow

Make sure that the filtrate pump is operating properly and that all associated valves are set correctly.

The membranes may be fouled. Run a clean in place (CIP) procedure and re-check effluent flow.

It is also possible but much less likely that the screening tank may be overfull or the wedgewire screen may be plugged. Pull, inspect and clean the wedgewire screen.

11.0 EFFLUENT SAMPLING

11.1 SHIPBOARD OR ON-SITE EVALUATION

1. Flush out the sample cock. Then, fill a clean glass jar with effluent. Let the sample stand for about 15 minutes.
2. The water should be odorless and essentially clear. A dusting of fine solids at the bottom of the jar is normal.
3. If the sample is not essentially clear and odorless, or if contains a lot of solids, refer to the Troubleshooting above.

11.2 LABORATORY ANALYSIS

Four basic tests are used to evaluate process performance; 5 day biochemical oxygen demand (BOD5), suspended solids (TSS), chemical oxygen demand (COD) and fecal coliform MPN.

Unless specifically instructed by Scienco/FAST to do so, don't take samples for laboratory analysis unless the effluent passes the simple tests in section 12.0 above. Otherwise, the lab fees will be a waste of money.

Generally, the lab will provide the sample bottles required. The lab will also provide instructions for refrigeration of the samples and other measures to ensure accurate results.

Please forward a copy of all lab analysis reports to Scienco/FAST.

11.2.1 BOD5, COD and Total Suspended Solids (TSS)

1. Thoroughly flush out the sample cock. Hose or tubing may be used to direct the water to a drain or container.
2. The sample bottle must be clean and free of any contaminants before using it. If not sure, wash and rinse thoroughly with detergent and hot water.
3. Fill the sample bottle with water from the sample cock.
4. Cap the bottle tightly and refrigerate the sample or pack it in ice for delivery to the lab. Identify and date the sample.

11.2.2 Fecal Coliform MPN

1. Thoroughly flush out the sample cock. The cock must be fully open to provide the velocity required for flushing.

2. Open the sterile sample bottle and hold the cap in a down position. Be careful not to touch the lip or interior of either the cap or the bottle.
3. Reduce the flow to a reasonable sampling velocity and fill the sample bottle.
4. Cap the bottle tightly and wrap in a plastic bag for protection. Refrigerate or pack in ice, but do not freeze. Identify the sample and note the date and time it was taken.

11.3 LABORATORY PROCEDURES

All laboratory analysis should be accordance with the latest edition of "Standard Methods for the Examination of Water and Wastewater". Fecal coliform MPN should be measured using the "Multiple Tube Fermentation" method.

12.0 SPECIAL NOTE

Regarding Effluent 'Discharge' and 'Retention': National and Local laws may prohibit the release of treated sewage. The operator MUST be aware of any National or Local laws that require holding of the BioBarrier® MarineMBR™ Series STP effluent. Examples are:

33CFR159.57(17) requires that the note quoted below be incorporated in each manual:

"Note: The EPA standards state that in freshwater lakes, freshwater reservoirs or other freshwater impoundments whose inlets or outlets are such as to prevent the ingress or egress by vessel traffic subject to this regulation, or in rivers not capable of navigation by interstate vessel traffic subject to this regulation, marine sanitation devices certified by the U.S. Coast Guard installed on all vessels shall be designed and operate to prevent the overboard discharge of sewage, treated or untreated, or of any waste derived from sewage. The EPA standards further state that this shall not be construed to prevent the carriage of Coast Guard certified flow-through treatment devices which have been secured so as to prevent such discharges. They also state that waters where a Coast Guard-certified marine sanitation device permitting discharge is allowed include coastal waters and estuaries, the Great Lakes and interconnected waterways, freshwater lakes and impoundments accessible through locks, and other flowing waters that are navigable interstate by vessels subject to this regulation (40CFR140.3)"

MARPOL Annex IV: Regulation 8 - Discharge of sewage

1) Subject to the provisions of regulation 9 of this Annex, the discharge of sewage into the sea is prohibited, except when:

a. the ship is discharging comminuted and disinfected sewage using a system approved by the Administration in accordance with regulation 3(1)(a) at a distance of more than 4 nautical miles from the nearest land, or sewage which is not comminuted or disinfected at a distance of more than 12 nautical miles from the nearest land, provided that in any case, the sewage that has been stored in holding tanks shall not be discharged instantaneously but at a moderate rate when the ship is en route and proceeding at not less than 4 knots; the rate of discharge shall be approved by the Administration based upon standards developed by the Organization; or

b. the ship has in operation an approved STP which has been certified by the Administration to meet the operational requirements referred to in regulation 3(1)(a)(i) of this Annex, and Prevention Certificate (1973);

(ii) additionally, the effluent shall not produce visible floating solids in, nor cause

discoloration of, the surrounding water; or (c) the ship is situated in the waters under the jurisdiction of a State and is discharging sewage in accordance with such less stringent requirements as may be imposed by such State.

2) When the sewage is mixed with wastes or wastewater having different discharge requirements, the more stringent requirements shall apply.

Contact your local Administration for further guidance.

13.0 ADDITIONAL INFORMATION

For additional information or assistance, contact

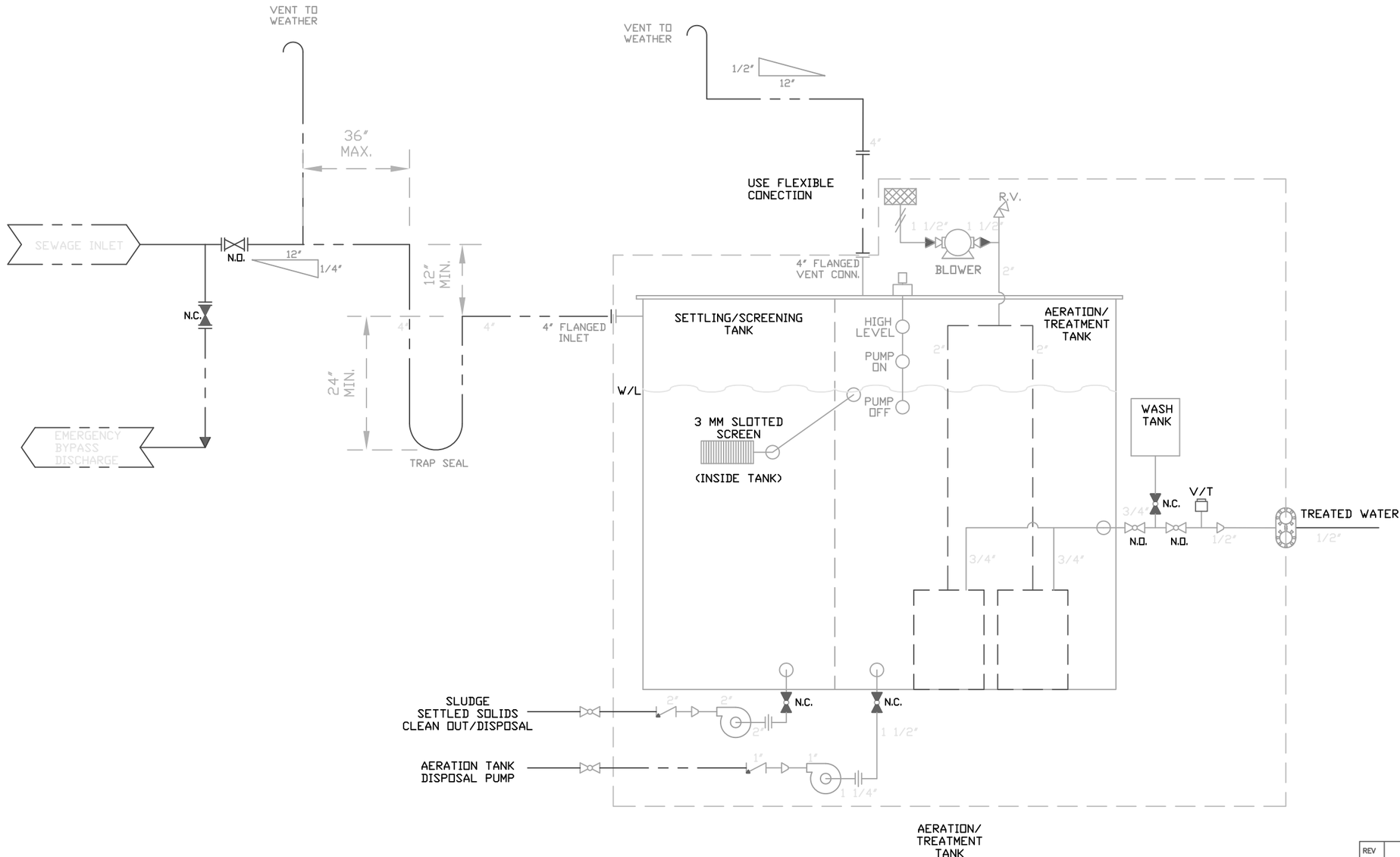
Scienco/FAST, a subsidiary of Bio-Microbics, Inc.
12977 Maurer Industrial Drive
Sunset Hills, MO 63127-1515
tel: (314)756-9300
fax: (314)756-9306
e-mail: solutions@sciencofast.com

14.0 ENCLOSURES

1. Drawing CU000 Piping Schematic
2. Drawing CU001 Dimensions
3. Drawing CU003 Installation Requirements
4. Indquip 35808 Electrical Schematic
5. AMT Specification Information & Repair Parts Catalog
6. AMT Straight Centrifugal Pump catalog cut
7. AMT Small Pump Manual
8. AMT Sewage and Trash Pump catalog cut
9. AMT Trash Pump Manual
9. FPZ SCL K03 MS Blower Catalog Cut
10. Renu Electronics Marine Biobarrier PLC Manual
15. Photo of Model MBB-2

15.0 RECOMMENDED SPARE PARTS

1. FPZ SCL K04 MS Aeration Blower with 3hp TEFC 230/460/3/60 motor
2. AMT369 Sludge Transfer Pump with 1hp TEFC 230/460/3/60 motor
3. Berns 105 gph Filtrate Pump with 1/2hp 115VAC/1 motor
4. Biomicrobics MA305-11 Membrane Double Stack Assembly



LEGEND:

- CUSTOMER PIPING
- SCIENCO/FAST PIPING
- AIR HOSE
- MEMBRANE
- FLANGED CONNECTION
- REDUCER
- UNION
- POSITIVE DISPLACMENT PUMP
- BALL VALVE, N.O. - SCREWED
- BALL VALVE, N.C. - SCREWED
- 3-WAY BALL VALVE, SHADED PORT IS OFF - SCREWED
- SWING CHECK VALVE
- RELIEF VALVE
- N.O. NORMALLY OPEN
- N.C. NORMALLY CLOSED
- C CUSTOMER SUPPLIED VALVE
- VACUM TRANSDUCER
- SLUDGE PUMP

REV	DESCRIPTION	BY	DATE

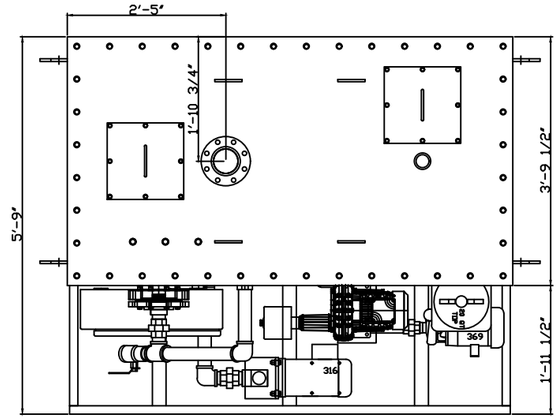
SCIENCO/FAST®
12977 MAURER INDUSTRIAL DRIVE
SUNSET HILLS, MO 63127-1515 U.S.A.
PHONE: 314-756-9300 FAX: 314-756-9306

SYSTEM	SCIENCO/FAST MEMBRANE SYSTEM
CUSTOMER	CUSTOMER NAME HERE
TITLE	MBB 2 PIPING SCHEMATIC

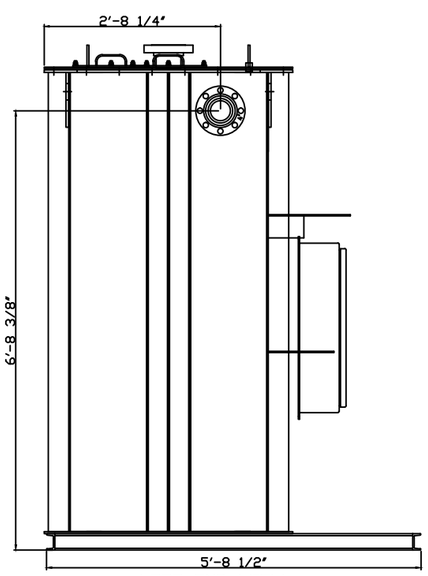
SCALE	DRAWN	CHECKED	APPROVED
1"=1'-0"	ADM		

SIZE	NEXT ASSY.	PREV. ASSY.	PLOT SCALE	DATE	REV
B			1:1	10/16/2018	

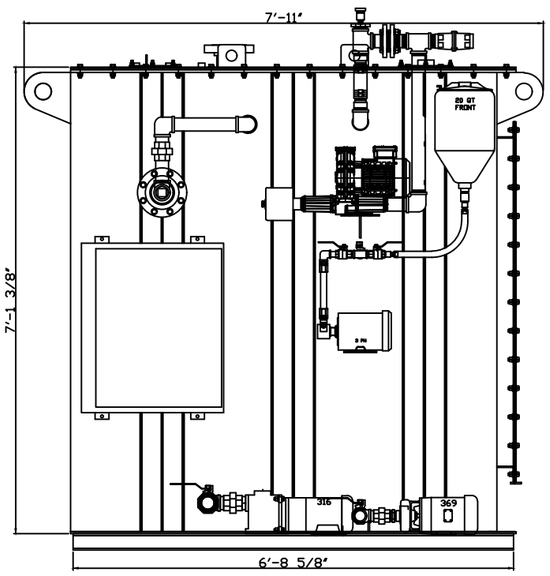
CONTRACT NO.	MODEL NO.	DRAWING NO.	SHEET NO.
MASTER	MBB 2	CU000	1 OF 1



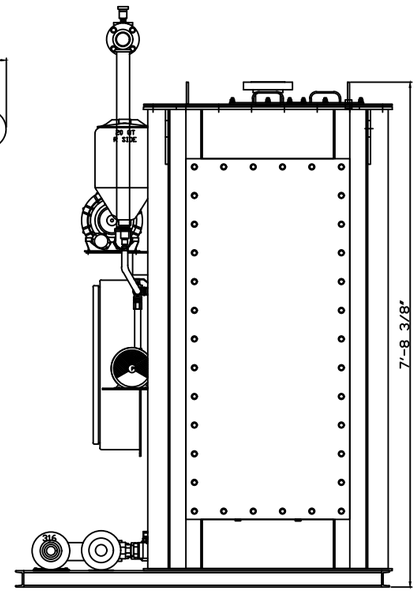
PLAN VIEW



LEFT END VIEW



FRONT VIEW



RIGHT END VIEW

REV	DESCRIPTION	BY	DATE

SCIENCO/FAST®
12977 MAURER INDUSTRIAL DRIVE
SUNSET HILLS, MO 63127-1515 U.S.A.
PHONE: 314-756-9300 FAX: 314-756-9306

SYSTEM	SCIENCO/FAST MEMBRANE SYSTEM
CUSTOMER	CUSTOMER NAME HERE
TITLE	MBB 2 EXTERNAL DIMENSIONS

SCALE	DRAWN	CHECKED	APPROVED
1"=1'-0"	ADM		
SIZE / NEXT ASSY.	PREV. ASSY.	PLOT SCALE	DATE
B		1:1	01/15/2019
CONTRACT NO.	MODEL NO.	DRAWING NO.	SHEET NO. / REV
MASTER	MBB 2	CU001	1 OF 1

Marine BioBarrier Weights, CG's and Foundation Requirements (inches, lb.)
Wednesday, April 17, 2019

Model Number	MBB-1	MBB-2	MBB-3	MBB-4
shipping weight	4,000	4,900	7,700	9,400
dry cg abl	31	39	39	40
dry cg from inlet end of skid	35	36	58	59
operating weight	7,600	10,600	20,000	28,100
operating cg abl	28	37	37	37
operating cg from inlet end of skid	35	35	58	58
reactions during rolling				
R1 vertical at uphill side	3,300	3,800	8,000	13,000
R2 vertical at downhill side	6,000	9,600	17,000	22,000
R3 total side force	4,700	7,100	13,000	19,000
total down force	8,200	11,000	22,000	30,000
foundation welding/bolting requirements				
channel size	3	3	4	4
channel flange thickness	1/4	1/4	5/16	5/16
fillet weld size	3/16	3/16	1/4	1/4
number of bolts	4	6	6	8
bolt size	1/2	1/2	5/8	5/8

Notes:
1. Reactions calculated for mepc operating weight at ± 30º roll 4 second full period ± 15º roll 3 second full period
2. Welding to deck or foundations to be 3" on 12" unless otherwise specified.
3. Minimum foundation bolts to be ASTM F593 316/316L with 45,000 psi yield strength.

Marine BioBarrier Weights, CG's and Foundation Requirements (mm, kg)
Wednesday, April 17, 2019

Model Number	MBB-1	MBB-2	MBB-3	MBB-4
shipping weight	1,800	2,200	3,500	4,250
dry cg abl	787	991	991	1,016
dry cg from inlet end of skid	889	914	1,473	1,499
operating weight	3,450	5,000	9,000	12,500
operating cg abl	700	947	928	931
operating cg from inlet end of skid	889	889	1,473	1,473
reactions during rolling				
R1 vertical at uphill side	1,500	1,700	3,600	6,000
R2 vertical at downhill side	2,700	4,350	7,500	10,000
R3 total side force	2,150	3,200	6,000	8,500
total down force	3,700	5,000	10,000	13,500
foundation welding/bolting requirements				
channel size	75	75	100	100
channel flange thickness	6	6	8	8
fillet weld size	5	5	6	6
number of bolts	4	6	6	8
bolt size	14	14	16	16

Notes:
1. Reactions calculated for mepc operating weight at ± 30º roll 4 second full period ± 15º roll 3 second full period
2. Welding to deck or foundations to be 75 mm on 300 mm unless otherwise specified.
3. Minimum foundation bolts to be ASTM F593 316/316L with 3,200 kgf/cm2 yield strength.

INSTALLATION NOTES

April 17, 2019

DANGER

1. Do not install unit or blower in any sealed compartment without a source of fresh air.
2. Inadequate ventilation can result in formation of deadly hydrogen sulfide gas.

GENERAL

1. These notes apply to standalone models MBB-1, -2, -3 and -4.
2. Where units are installed in parallel to obtain higher flows, components are installed in ship's or other tanks or a ship's holding tank is provided by others as part of the system, refer to notes specific to the installation in addition to those stated here.
3. Connecting piping shall be in accordance with applicable regulatory requirements.

EMERGENCY OVERFLOW

Overpressure relief is required to protect the tank in the event of pump or electrical failure. The method employed will depend upon the details of the installation and will be shown on the piping schematic specific to the job.

GRAVITY SEWAGE PIPING

1. Gravity flow sewage piping leading to the unit shall be equipped with a properly vented trap as shown on the piping schematic.
2. Gravity flow inlet trap shall be vented to weather and shall be provided with a cleanout.

EMERGENCY BYPASS

1. An emergency overboard bypass is required to provide sanitary facilities in the event of equipment malfunction.
2. If the bypass employs gate valves, install valves with stems upright.

VENT PIPING

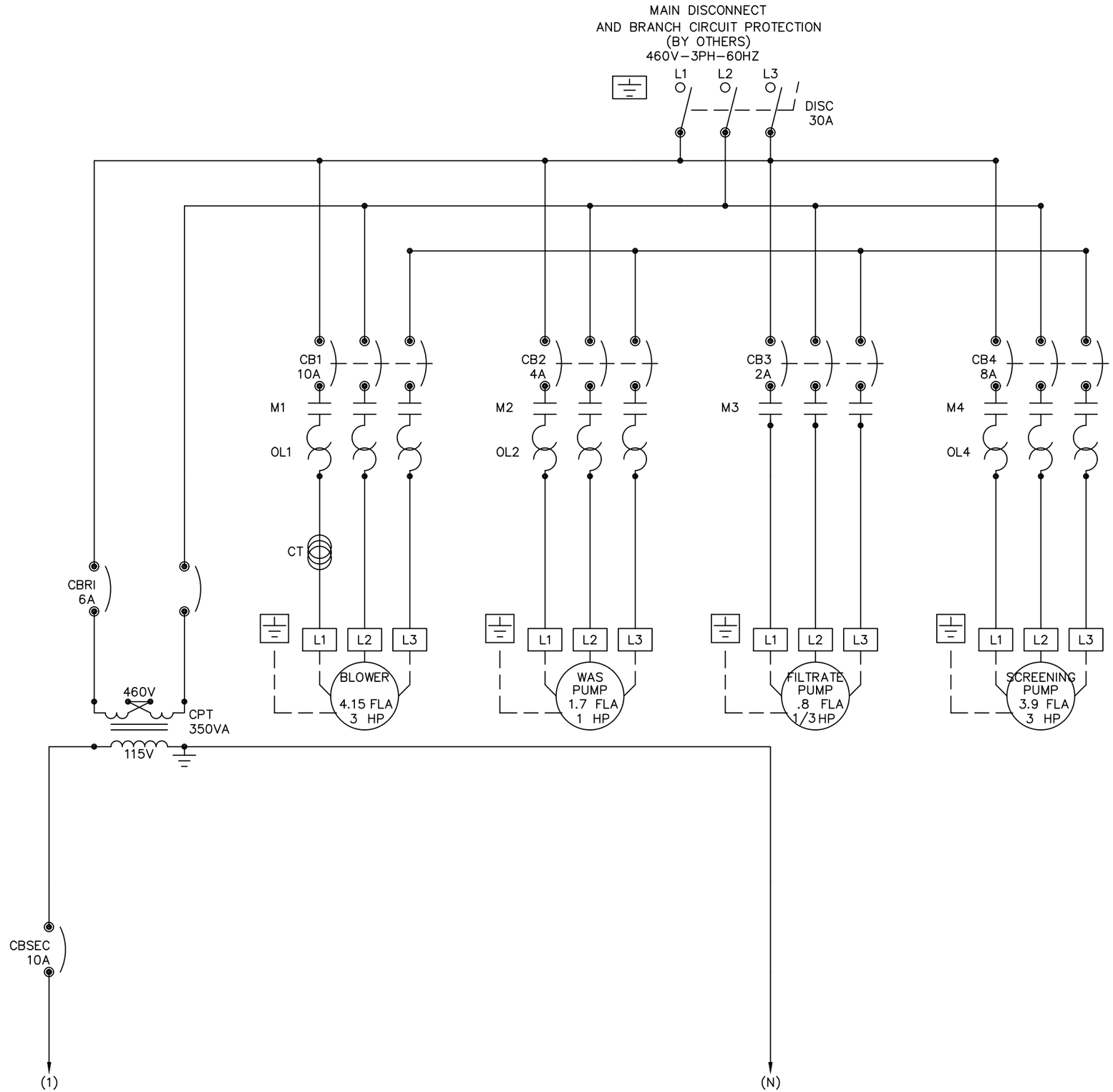
1. Do not combine tank vent with any other vent.
2. Vent to terminate not less than 10 feet (3 meters) above weather deck, from any source of ignition, from any ventilation air inlet or any window or door that might be used as a ventilation air inlet.
3. Vent to terminate high rather than low because vented air is warmer than surrounding air and will tend to rise.
4. Horizontal offsets in vent piping must slope not less than ½ inch per foot (2.39 degrees) in addition to maximum list or trim angle as applicable to the pipe run so that condensate will drain to the tank.
5. Vent piping shown on the Piping schematic is based upon an assumed vent run of 100 feet (31 meters), with 12 long radius elbows and one return bend at the weather termination.
6. If vent run is longer, contains more pipe fittings or if vacuum toilets are employed increase vent pipe by one size or consult factory with details.
7. A flame screen is not recommended as it will plug with lint and require frequent cleaning. If a flame screen is required it should be two pipe sizes larger than the vent pipe.

REV	DESCRIPTION	BY	DATE

SCIENCO/FAST®
12977 MAURER INDUSTRIAL DRIVE
SUNSET HILLS, MO 63127-1515 U.S.A.
PHONE: 314-756-9300 FAX: 314-756-9306

SYSTEM	SCIENCO/FAST 60 Lbs/day SciCHLOR
CUSTOMER	CUSTOMER NAME HERE
TITLE	INSTALLATION INSTRUCTIONS MBR

SCALE	DRAWN	CHECKED	APPROVED
1"=1'-0"	ADM		
SIZE B / **NEXT ASSY.**	**PREV. ASSY.**	**PLOT SCALE** 1:1	**DATE** 05/22/2019
CONTRACT NO. MASTER	**MODEL NO.** MBR	**DRAWING NO.** CU003	**SHEET NO.** 1 OF 1 / **REV**



ENCL	1	NEMA 4X FIBERGLASS, WALLMOUNT 30X24	
		SAGINAW	SCE–2016CHQRFG
DISC.	1	CUTLER–HAMMER	R5A3030U
HAND.	1	CUTLER–HAMMER	SHB00N4X
SHAFT	1	CUTLER–HAMMER	SF200SH5X5
CB1	1	CUTLER–HAMMER	FAZ–C10/3–NA
CB2	1	CUTLER–HAMMER	FAZ–C4/3–NA
CB3	1	CUTLER–HAMMER	FAZ–C2/3–NA
CB4	1	CUTLER–HAMMER	FAZ–C8–3–NA
CPT	1	CUTLER–HAMMER	C0350E2AFB–CHGP
CBPRI	1	CUTLER–HAMMER	FAZ–C6/2–NA
CBSEC	1	CUTLER–HAMMER	FAZ–C10/1–NA–SP
CB5	1	CUTLER–HAMMER	FAZ–C2/1–NA–SP
CB6	1	CUTLER–HAMMER	FAZ–C1/1–NA–SP
CT	1	CROMPTON	2SFT–101
M1,2	2	CUTLER–HAMMER	XTCE007B10A
M3,4	2	CUTLER–HAMMER	XTCE007B10A
OL1	1	CUTLER–HAMMER	XTOB006BC1
OL2	1	CUTLER–HAMMER	XTOB2P4BC1
OL4	1	CUTLER–HAMMER	XTOB004BC1
PS	1	IDEC	PS5R–SF24

		PARTS SUPPLIED BY BIOMOCROBICS
HMI	1	RENU FP3043TN–E
EXP.MOD.	1	RENU FPEM–1212RP–A0200L

SCIENCO/FAST®
12977 MAURER INDUSTRIAL DRIVE
SUNSET HILLS, MO 63127
PHONE 314–756–9300 FAX 314–756–9306

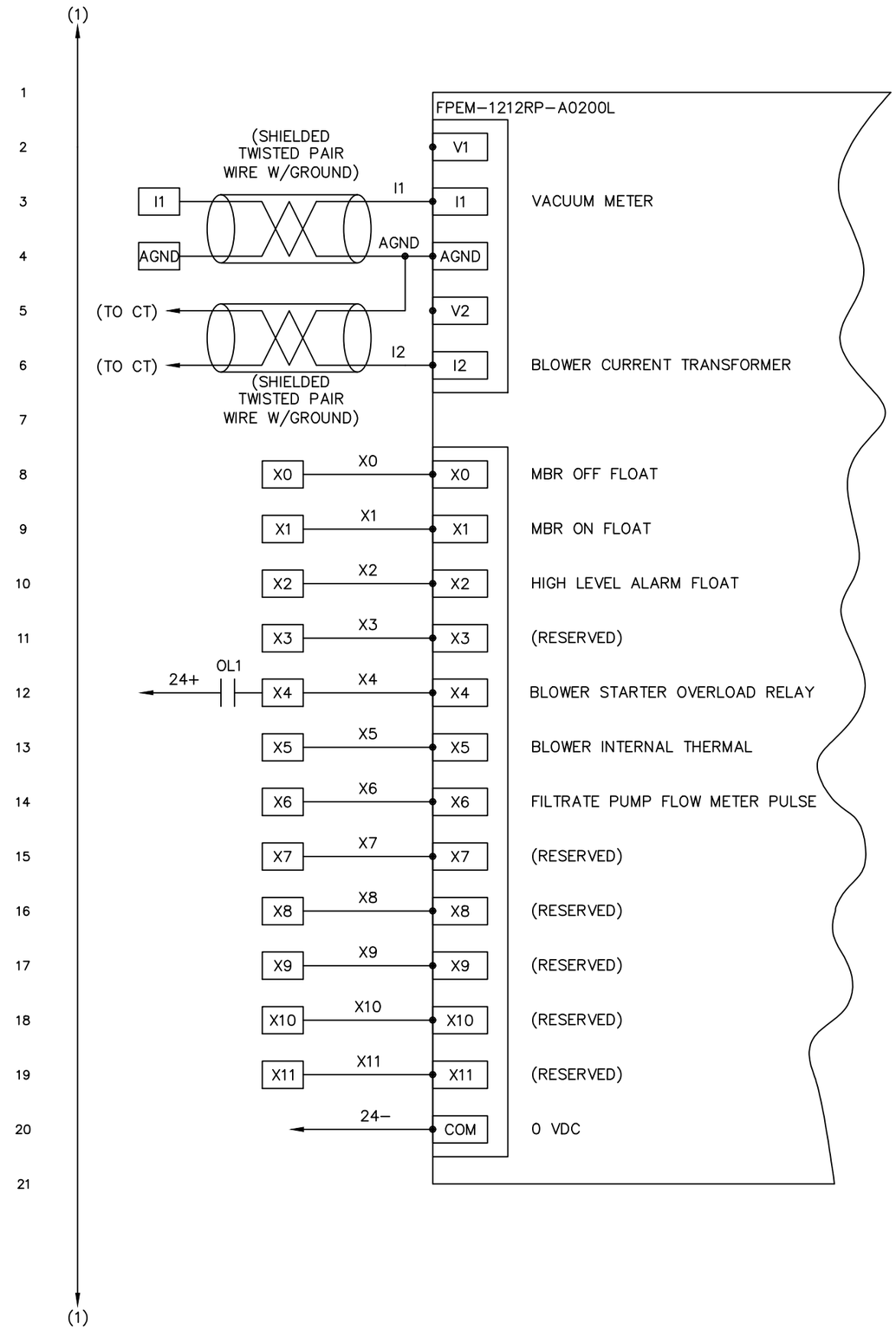
SYSTEM

CUSTOMER

TITLE
460V MBR PANEL

DRAWN BY	REV. DATE	AS–BUILT DATE
INDQUIP	10–26–18	7–29–18

MODEL NUMBER	SUBMITTAL DATE
XXXX	6–4–18
PURCHASE ORDER NUMBER	DRAWING NO.
0010400	35808–1

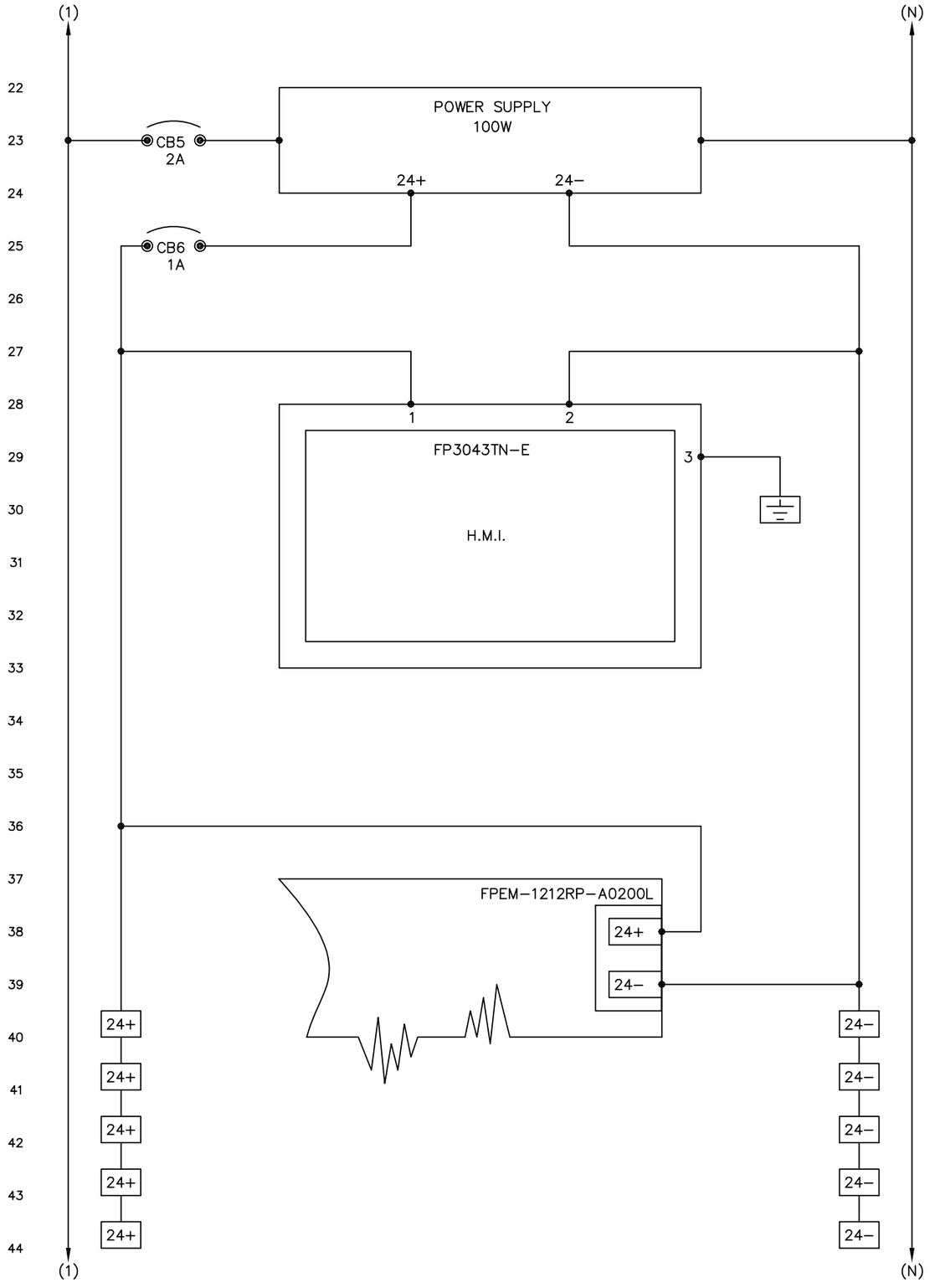


SCIENCO/FAST®
12977 MAURER INDUSTRIAL DRIVE
SUNSET HILLS, MO 63127
PHONE 314-756-9300 FAX 314-756-9306

SYSTEM	
CUSTOMER	
TITLE	460V MBR PANEL

DRAWN BY	REV. DATE	AS-BUILT DATE
INDQUIP	10-26-18	7-29-18

MODEL NUMBER	SUBMITTAL DATE
XXXX	6-4-18
PURCHASE ORDER NUMBER	DRAWING NO.
0010400	35808-2



SCIENCO/FAST®
12977 MAURER INDUSTRIAL DRIVE
SUNSET HILLS, MO 63127
PHONE 314–756–9300 FAX 314–756–9306

SYSTEM

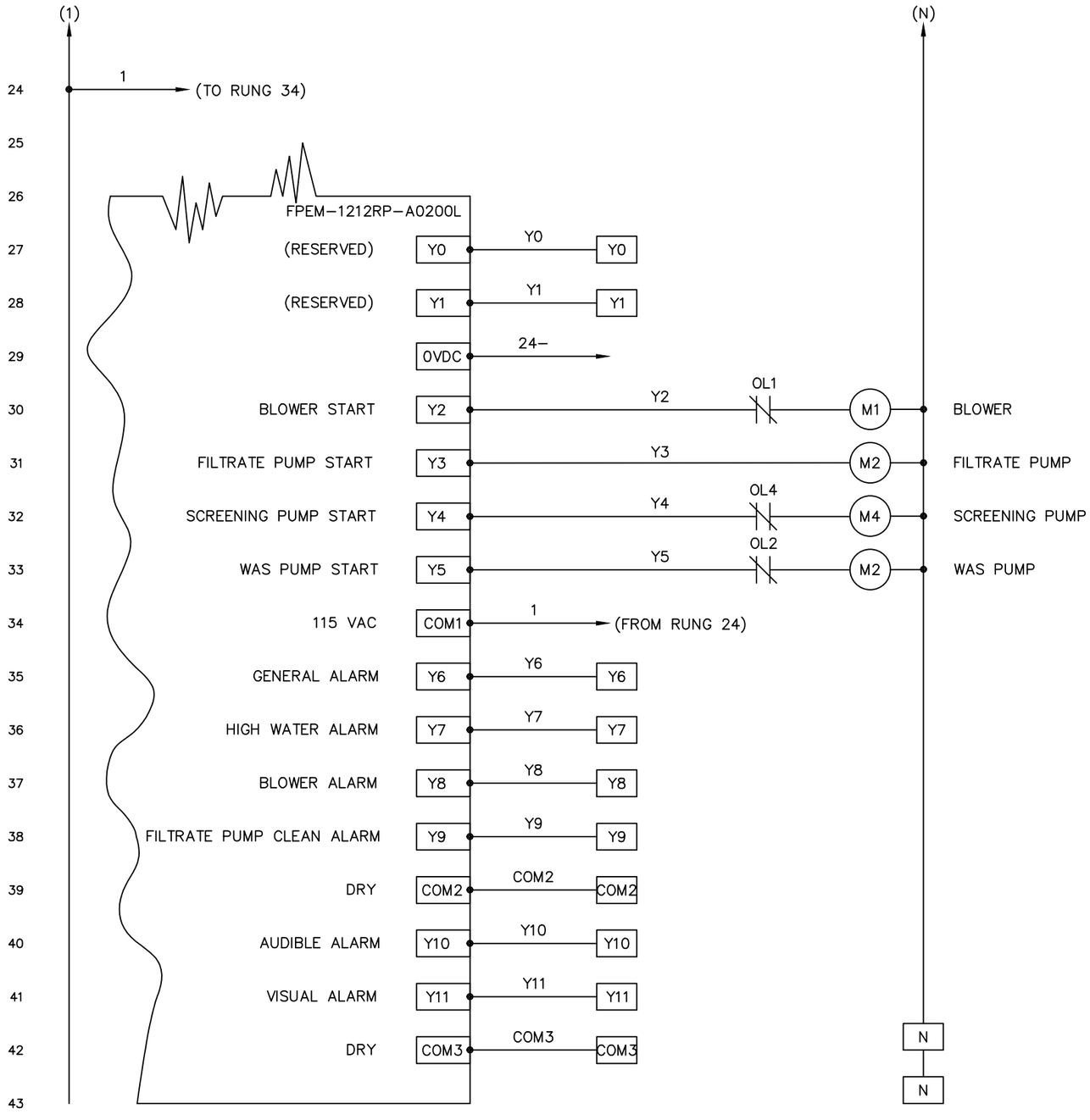
CUSTOMER

TITLE
460V MBR PANEL

DRAWN BY	REV. DATE	AS–BUILT DATE
INDQUIP	7–29–18	7–29–18

MODEL NUMBER	SUBMITTAL DATE
XXXX	6–4–18

PURCHASE ORDER NUMBER	DRAWING NO.
0010400	35808–3



SCIENCO/FAST®
12977 MAURER INDUSTRIAL DRIVE
SUNSET HILLS, MO 63127
PHONE 314-756-9300 FAX 314-756-9306

SYSTEM

CUSTOMER

TITLE
460V MBR PANEL

DRAWN BY	REV. DATE	AS-BUILT DATE
INDQUIP	7-29-18	7-29-18

MODEL NUMBER	SUBMITTAL DATE
XXXX	6-4-18

PURCHASE ORDER NUMBER	DRAWING NO.
0010400	35808-4

Please read and save this Repair Parts Manual. Read this manual and the General Operating Instructions carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. The Safety Instructions are contained in the General Operating Instructions. Failure to comply with the safety instructions accompanying this product could result in personal injury and/or property damage! Retain instructions for future reference.

Small Straight Centrifugal Pumps

Cast Iron, Bronze, and Stainless Steel Models

Refer to form 1808-634-00 for General Operating and Safety Instructions.

Description

These pumps are non self-priming (gravity feed) units designed to handle liquid transfer, heating and cooling applications, where no suction lift is required. All models feature semi-open clog-resistant impellers and continuous duty, 3450 RPM, 56J frame motors. Discharge port can be rotated in 90° increments to accommodate specific applications. Casing working pressure to 75 psi (517 kPa). These are manual units, no controls are supplied. For use with nonflammable, non-abrasive liquids compatible with pump conponent materials.

CAST IRON UNITS

Pump construction is cast iron casing and adapter. Cast 316 stainless steel impeller. Buna N type 6 mechanical shaft seal with carbon and ceramic wear faces. O-ring casing seal. Handles liquids from 40° to 180° F (4° to 82° C).

BRONZE UNITS

Pump construction is cast bronze casing and adapter. Cast 316 stainless steel impeller. Viton type 6 mechanical shaft seal with carbon and ceramic wear faces. O-ring casing seal. Handles liquids from 40° to 200° F (4° to 93° C).

316 STAINLESS STEEL UNITS

Pump construction is cast 316 stainless steel casing, adapter, and impeller. Viton type 6 mechanical shaft seal with carbon and ceramic wear faces. O-ring casing seal. Handles liquids from 40° to 200° F (4° to 93° C).

Maintenance

⚠WARNING ***Make certain that unit is disconnected from power source before attempting to service or remove any components!***

MECHANICAL SEAL REPLACEMENT:

Refer to Figures 2 & 3.

IMPORTANT: Always replace both seal seat (Ref. No. 5) and seal head (Ref. No. 6) to insure proper mating of components! Also, impeller seal (Ref. No. 9) should be replaced anytime impeller fastener (Ref. No. 10) has been removed.

1. Remove fasteners (Ref. No. 13) connecting casing (Ref. No. 12) to adapter (Ref. No. 4).
2. Remove casing.

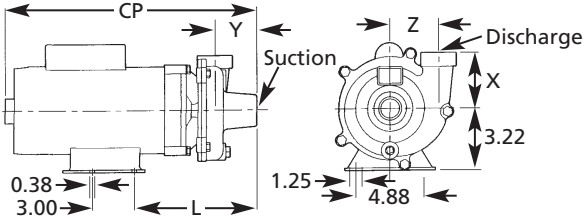


Figure 1 - Dimensions

Dimensions (Inches)

Model	Suc*	Dis*	CP†	L	X	Y	Z
3680 Series	3/4"	1/2"	12.00	6.25	1.88	1.44	1.88
3700 Series	1	3/4	12.00	6.31	2.38	1.41	2.09
3690 Series	1 1/4	1	14.00	6.31	2.50	1.28	2.03

NOTE: All dimensions have a tolerance of ±1/8".
(*) Standard NPT (female) pipe thread.
(†) This dimension may vary due to motor manufacturers specifications.

Small Straight Centrifugal Pumps

Cast Iron, Bronze, and Stainless Steel Models

Specifications

	DRIVER				PUMP Weight (lbs.)		
Model	HP	Enclosure	Power Supply @60 Hz	Suction x Discharge*	Cast Iron	Bronze	SS
3680	1/3	ODP	115/230, 1 phase	3/4" x 1/2"	26	27	26
368A	1/3	TEFC	115/230, 1 phase	3/4 x 1/2	31	32	31
368B	1/2	TEFC	115/230, 1 phase	3/4 x 1/2	33	34	33
368C	1/2	TEFC	230/460, 3 phase	3/4 x 1/2	31	32	31
3701	1/2	ODP	115/230, 1 phase	1 x 3/4	31	32	31
370B	1/2	TEFC	115/230, 1 phase	1 x 3/4	33	34	33
370F	1/2	TEFC	208-230/460, 3 phase	1 x 3/4	34	35	34
3703	1/2	ODP	230/460, 3 phase	1 x 3/4	31	32	31
3700	3/4	ODP	115/230, 1 phase	1 x 3/4	34	35	34
370A	3/4	TEFC	115/230, 1 phase	1 x 3/4	37	38	37
3702	3/4	ODP	230/460, 3 phase	1 x 3/4	32	33	32
370C	3/4	TEFC	230/460, 3 phase	1 x 3/4	35	36	35
370E	1	TEFC	115/230, 1 phase	1 x 3/4	39	40	39
370D	1	TEFC	230/460, 3 phase	1 x 3/4	36	37	36
3691	1	ODP	115/230, 1 phase	1 1/4 x 1	36	37	36
369C	1	TEFC	115/230, 1 phase	1 1/4 x 1	40	41	40
3693	1	ODP	230/460, 3 phase	1 1/4 x 1	35	36	35
369F	1	TEFC	230/460, 3 phase	1 1/4 x 1	39	40	39
3690	1 1/2	ODP	115/230, 1 phase	1 1/4 x 1	40	41	40
369A	1 1/2	TEFC	115/230, 1 phase	1 1/4 x 1	48	49	48
3692	1 1/2	ODP	230/460, 3 phase	1 1/4 x 1	38	39	38
369B	1 1/2	TEFC	230/460, 3 phase	1 1/4 x 1	40	41	40
369D	2	TEFC	115/230, 1 phase	1 1/4 x 1	52	53	52
369E	2	TEFC	230/460, 3 phase	1 1/4 x 1	50	51	50

NOTE: Driver data is subject to change without notice, see label on driver for actual specifications.
(ODP) Open Drip Proof; (TEFC) Totally Enclosed Fan Cooled; (*) Standard NPT (female) pipe thread.

Performance Chart

	GPM of Water at Total Head in Feet						Max.
Model (HP/Enclosure)	10'	20'	30'	40'	50'	60'	Head**
368A (1/3 TEFC)	29	24	17	7	—	—	45 ft.
3680, 368B, 368C (1/3 ODP, 1/2 TEFC)	35	31	26	18	9	—	57
370B, 370F (1/2 TEFC)	42	35	25	9	—	—	45
3701, 3703, 370A, 370C (1/2 ODP, 3/4 TEFC)	46	40	31	16	—	—	48
3700, 3702, 370D, 370E (3/4 ODP, 1 TEFC)	58	52	44	32	16	—	58
369C, 369F (1 TEFC)	69	60	48	27	—	—	48
3691, 3693, 369A, 369B (1 ODP, 1 1/2 TEFC)	72	63	53	35	7	—	53
3690, 3692, 369D, 369E (1 1/2 ODP, 2 TEFC)	85	76	67	57	40	17	66

(**) Shut-off; to convert to psi, divide by 2.31.

Models 3680, 3690 and 3700 Series

Maintenance (Continued)

⚠ CAUTION ***Care should be taken not to "pinch" or "shave" casing seal (Ref. No. 11) between adapter and casing.***

3. Use a box and/or socket wrench to remove impeller fastener. Remove impeller seal and impeller (Ref. No. 8).

IMPORTANT: Care should be taken to insure that the same number and thickness of shim washers (Ref. No. 7) are replaced behind impeller as was removed. Shim washers are located directly behind impeller and become loose as impeller is removed.

4. Seal head can now be pulled from shaft.
5. Pry seal seat from adapter (Ref. No. 4).

⚠ CAUTION ***The precision lapped faces on mechanical seal are easily damaged. Handle your replacement seal carefully. Do not touch polished seal faces.***

IMPORTANT: Be sure that shaft shoulder does not damage polished face (see Figure 2).

6. Thoroughly clean all surfaces of seal seat cavity in, adapter.
7. Using a clean cloth, wipe shaft and shaft sleeve and make certain that they are perfectly clean.
8. Wet the rubber portion of new seal seat with a light coating of soapy water. While wearing clean gloves or using a clean light rag, press seal seat squarely into adapter recess, use cardboard washer (usually supplied with new seal), place over polished surface and use a piece of pipe or dowel rod to press in firmly, but gently. Avoid scratching polished face.
9. Dispose of cardboard washer. Check again to see that polished surface is free of dirt and all other foreign particles and that it has not been scratched or damaged.
10. Wet inside rubber portion of new seal head with a light coating of soapy water. Slide head onto motor shaft with sealing surface facing seal seat. (See Figure 2).
11. Replace any impeller shims (Ref. No. 7) which may have been removed in disassembly. (See "Shim Adjustment" below.)

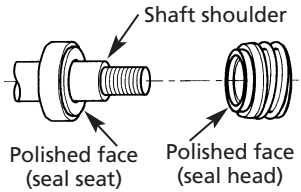


Figure 2 - Seal replacement

12. Screw impeller back into place, tightening until it is against shaft shoulder.
13. Replace impeller seal and fastener, and tighten until snug.
16. Remount casing and casing seal on adapter.

SHIM ADJUSTMENT

1. When installing a replacement adapter (Ref. No.4), impeller (Ref. No. 8), or casing (Ref. No.2) it may be necessary to vary number of impeller shims (Ref. No. 7) that will be required. This is easily done by adding one shim more than was removed and reassembling pump as described in "Mechanical Seal Replacement" section.

NOTE: When adding or removing shims, it is best to proceed with a 0.010" increment each time. While tightening unit together turn shaft; feel for shaft seizing. If shaft begins to seize before fasteners are completely tight, disassemble pump and remove one shim and repeat assembly.

2. Once having added one shim more than original, ensure that casing and adapter are firmly fitted (check fasteners Ref. No. 13). When pump shaft turns freely add shims until it does strike, then remove a 0.010"

Small Straight Centrifugal Pumps

Cast Iron, Bronze, and Stainless Steel Models

Maintenance (Continued)

shim. This should allow proper clearance.

3. Proper running clearance for impeller should be as close as possible to volute without striking; maximum clearance is 1/32" (0.032").
4. Follow above procedure until proper clearance is obtained. This will ensure maximum performance.

Notes

For Repair Parts, contact dealer where pump was purchased.

Please provide the following information:
-Model number
-Serial number (if any)
-Part description and number as shown in parts list

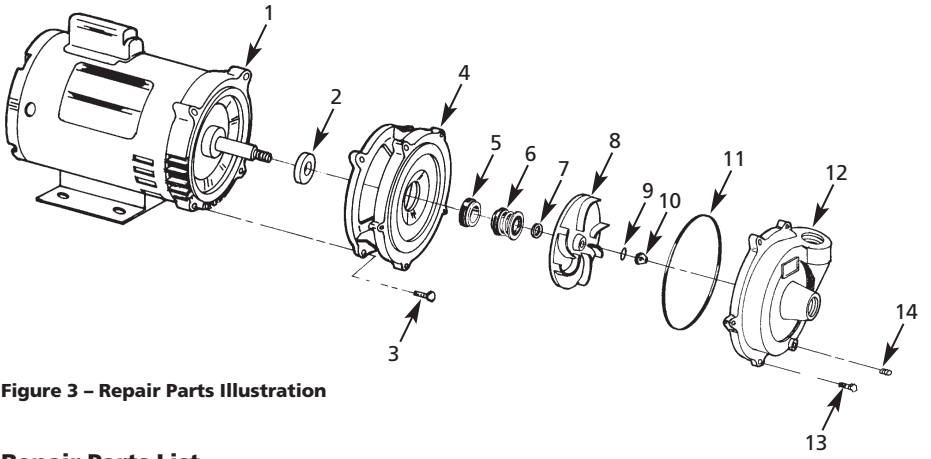


Figure 3 – Repair Parts Illustration

Repair Parts List

Ref. No.	Description		Part Number for Models: — — 368A (1/3HP) —	— 3680 (1/3HP) — 368B (1/2HP) 368C (1/2HP)	— — 370B (1/2HP) 370F (1/2HP)	3701 (1/2HP) 3703 (1/2HP) 370A (3/4HP) 370C (3/4HP)	Qty.
1	Motor	-1 Phase ODP	—	✦ 1626-008-00	—	✦ 1626-009-00	1
		-3 Phase ODP	—	—	—	✦ 1626-013-00	
		-1 Phase TEFC	✦ 1626-067-00	✦ 1626-068-00	✦ 1626-068-00	✦ 1626-051-00	
		-3 Phase TEFC	—	✦ 1626-085-00	✦ 1626-085-00	✦ 1626-052-00	
2	Slinger washer		12-117-B	12-117-B	12-117-B	12-117-B	1
3	Fastener		*	*	*	*	4
4	Adapter	-Cast iron	3680-035-09	3680-035-09	3690-035-09	3690-035-09	1
		-Bronze	3680-036-09	3680-036-09	3690-036-09	3690-036-09	
		-Stainless steel	3680-034-09	3680-034-09	3690-034-09	3690-034-09	
5&6	‡ Shaft seal assembly	-Buna N	1640-161-90	1640-161-90	1640-161-90	1640-161-90	1
		-Viton	1640-161-91	1640-161-91	1640-161-91	1640-161-91	
7	Impeller shim set (0.005", 0.020", 0.030"; one each)		1806-044-90	1806-044-90	1806-044-90	1806-044-90	1
8	Impeller		3680-015-01	3680-015-09	3700-013-02	3700-013-01	1
9	Impeller seal	-Buna N	2105-036-00	2105-036-00	2105-036-00	2105-036-00	1
		-Viton	2105-037-00	2105-037-00	2105-037-00	2105-037-00	
10	Impeller fastener		1784-001-00	1784-001-00	1784-001-00	1784-001-00	1
11	Casing seal	-Buna N	1582-000-00	1582-000-00	1567-000-00	1567-000-00	1
		-Viton	1532-000-00	1532-000-00	1567-001-00	1567-001-00	
12	Casing	-Cast iron	3680-002-09	3680-002-09	3700-002-09	3700-002-09	1
		-Bronze	3680-003-09	3680-003-09	3700-003-09	3700-003-09	
		-Stainless steel	3680-001-09	3680-001-09	3700-001-09	3700-001-09	
13	Fastener		*	*	*	*	5
14	1/8" NPT pipe plug		*	*	*	*	1

(*) Standard hardware item, available locally.
(‡) Seal head and seat available as set only.
(✦) Requires foot 1626-040-90.

For Repair Parts, contact dealer where pump was purchased.

Please provide the following information:
-Model number
-Serial number (if any)
-Part description and number as shown in parts list

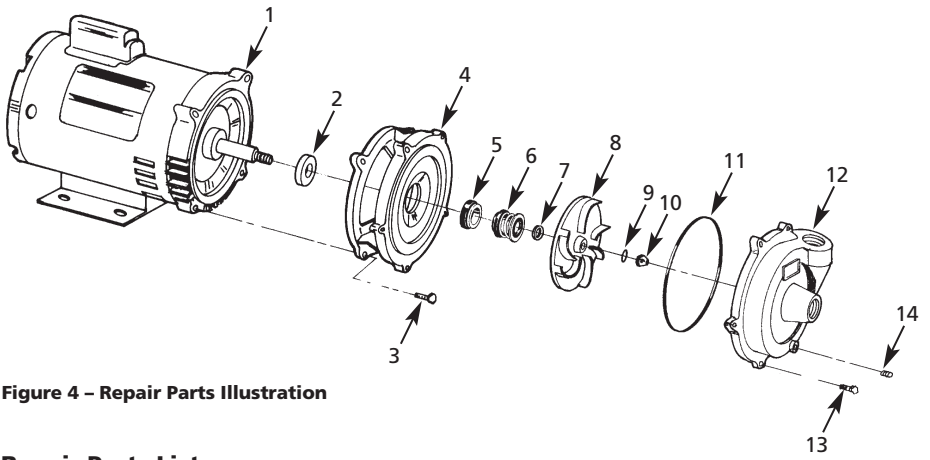


Figure 4 – Repair Parts Illustration

Repair Parts List

Ref. No.	Description		Part Number for Models: 3700 (3/4HP) 3702 (3/4HP) 370D (1HP) 370E (1HP)	— — 369C (1HP) 369F (1HP)	3691 (1HP) 3693 (1HP) 369A (11/2HP) 369B (11/2HP)	3690 (11/2HP) 3692 (11/2HP) 369D (2HP) 369E (2HP)	Qty.
1	Motor	-1 Phase ODP	✦ 1626-010-00	—	✦ 1626-011-00	✦ 1626-012-00	1
		-3 Phase ODP	✦ 1626-014-00	—	✦ 1626-015-00	✦ 1626-016-00	
		-1 Phase TEFC	✦ 1626-069-00	✦ 1626-069-00	✦ 1626-050-00	✦ 1626-070-00	
		-3 Phase TEFC	✦ 1626-077-00	✦ 1626-077-00	✦ 1626-053-00	✦ 1626-054-00	
2	Slinger washer		12-117-B	12-117-B	12-117-B	12-117-B	1
3	Fastener		*	*	*	*	4
4	Adapter	-Cast iron	3690-035-09	3690-035-09	3690-035-09	3690-035-09	1
		-Bronze	3690-036-09	3690-036-09	3690-036-09	3690-036-09	
		-Stainless steel	3690-034-09	3690-034-09	3690-034-09	3690-034-09	
5&6	‡Shaft seal assembly	-Buna N	1640-161-90	1640-161-90	1640-161-90	1640-161-90	1
		-Viton	1640-161-91	1640-161-91	1640-161-91	1640-161-91	
7	Impeller shim set (0.005", 0.020", 0.030"; one each)		1806-044-90	1806-044-90	1806-044-90	1806-044-90	1
8	Impeller		3700-013-09	3690-013-02	3690-013-01	3690-013-09	1
9	Impeller seal	-Buna N	2105-036-00	2105-036-00	2105-036-00	2105-036-00	1
		-Viton	2105-037-00	2105-037-00	2105-037-00	2105-037-00	
10	Impeller fastener		1784-001-00	1784-001-00	1784-001-00	1784-001-00	1
11	Casing seal	-Buna N	1567-000-00	1567-000-00	1567-000-00	1567-000-00	1
		-Viton	1567-001-00	1567-001-00	1567-001-00	1567-001-00	
12	Casing	-Cast iron	3700-002-09	3690-002-09	3690-002-09	3690-002-09	1
		-Bronze	3700-003-09	3690-003-09	3690-003-09	3690-003-09	
		-Stainless steel	3700-001-09	3690-001-09	3690-001-09	3690-001-09	
13	Fastener		*	*	*	*	5
14	1/8" NPT pipe plug		*	*	*	*	1

(*) Standard hardware item, available locally.
(‡) Seal head and seat available as set only.
(✦) Requires foot 1626-040-90.

Notes

Straight Centrifugal Pumps

- ***Available in : 300 Series Investment Cast Stainless Steel, Cast Bronze and Cast Iron with Stainless Steel Impeller Construction***
- ***Viton® Mechanical Seal and O-Ring with Stainless Steel and Bronze Models***
- ***Buna-N Mechanical Seal and O-Ring with Cast Iron Models***
- ***Optional Silicon Carbide Mechanical Seals Available***
- ***Discharge Port Rotates in 90˚ Increments***
- ***Maximum Working Pressure 75 PSI***
- ***Max. Temperature 200˚F***
- ***Max. Flow 90 GPM***
- ***Max. Head 65 Ft. (28 PSI)***
- ***Self-cleaning, Semi-open Impellers***
- ***Available with Totally Enclosed Fan Cooled(TEFC) 56J Motors***
- ***1/3 HP to 2 HP Single and Three Phase, 3450 RPM Motors***

This line of AMT Straight Centrifugal pumps is designed for continuous-duty low pressure OEM, Industrial/Commercial and General Service applications including circulation, chemical processing, liquid transfer and cooling. These durable and compact pumps are available in a variety of construction and seal materials to meet your specification. The line also features a wide selection of single and three phase TEFC motors, up to 2 horsepower. All models feature Type 6 mechanical seals and O-rings. Pull-from-the-rear design for easy service without disturbing any piping. Self-cleaning impellers to prevent clogging and minimize maintenance.

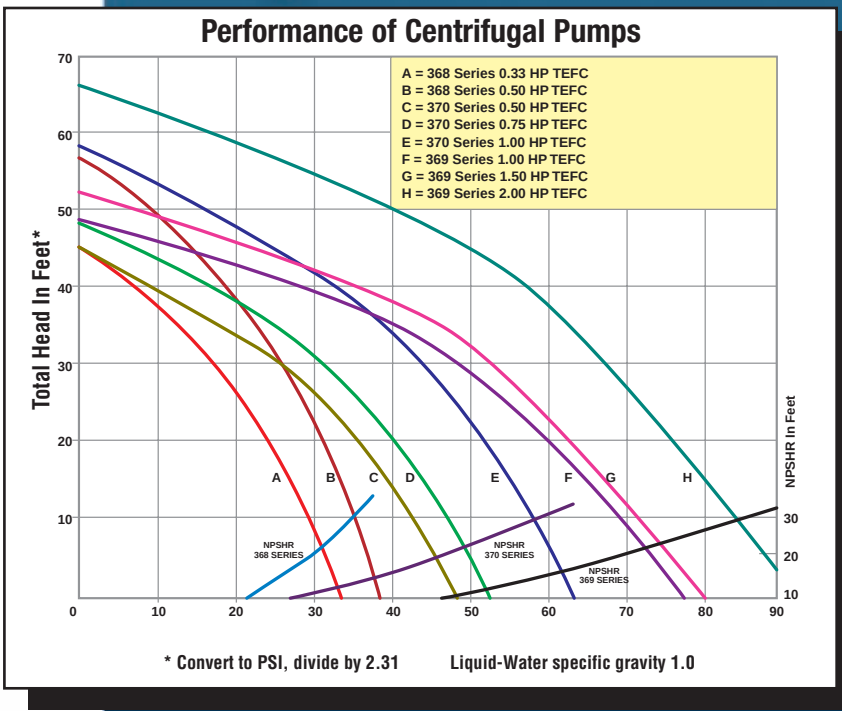
AMT Centrifugal pumps are reliable, cost effective and low maintenance. Many are readily available **"Off-the Shelf"** for fast 24 hour shipment. For use with non-flammable liquids compatible with pump component materials.

Viton® is a registered trademark of E.I. DuPont

INDUSTRIAL DUTY

Bronze Centrifugal Pump

Stainless Steel Centrifugal Pump



Straight Centrifugal Pumps

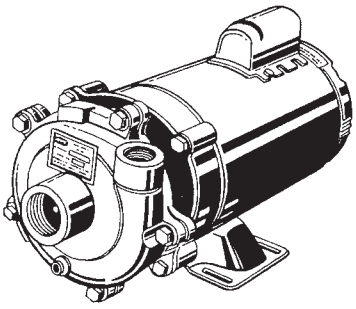
Pump Dimensional & Specification Data

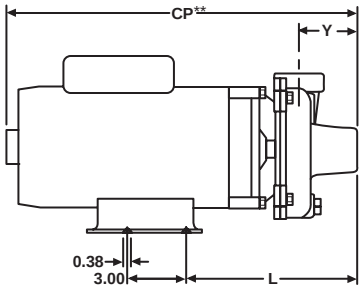
MODEL ‡	CURVE	HP	PH	ENG	60 HZ +	AMPS	SUC*	DIS*	AB**	CP**	L	X	Y	Z	ZZ	SHIPPING WT. XCI ‡ (-95)	SHIPPING WT. XB ‡ (-97)	SHIPPING WT. XSS ‡ (-98)
368A	A	1/3	1	TEFC	115/230	7 / 4	3/4"	1/2"	2.4	13.4	6.3	1.9	1.4	1.9	2.9	31 lbs.	32 lbs.	31 lbs.
368B	B	1/2	1	TEFC	115/230	9 / 5	3/4"	1/2"	2.4	13.3	6.3	1.9	1.4	1.9	2.9	33 lbs.	34 lbs.	33 lbs.
368C	B	1/2	3	TEFC	230/460	3 / 2	3/4"	1/2"	2.4	13.1	6.3	1.9	1.4	1.9	2.9	31 lbs.	32 lbs.	31 lbs.
370B	C	1/2	1	TEFC	115/230	9 / 5	1"	3/4"	3.0	13.3	6.3	2.4	1.4	2.1	3.3	33 lbs.	34 lbs.	33 lbs.
370F	C	1/2	3	TEFC	230/460	3 / 2	1"	3/4"	3.0	13.2	6.3	2.4	1.4	2.1	3.3	34 lbs.	35 lbs.	34 lbs.
370A	D	3/4	1	TEFC	115/230	9 / 5	1"	3/4"	3.0	13.8	6.3	2.4	1.4	2.1	3.3	37 lbs.	38 lbs.	37 lbs.
370C	D	3/4	3	TEFC	230/460	3 / 2	1"	3/4"	3.0	13.2	6.3	2.4	1.4	2.1	3.3	35 lbs.	36 lbs.	35 lbs.
370E	E	1	1	TEFC	115/230	12 / 6	1"	3/4"	3.0	15.1	6.3	2.4	1.3	2.1	3.3	39 lbs.	40 lbs.	39 lbs.
370D	E	1	3	TEFC	230/460	4 / 2	1"	3/4"	3.0	14.2	6.3	2.4	1.3	2.1	3.3	36 lbs.	37 lbs.	36 lbs.
369C	F	1	1	TEFC	115/230	12 / 6	1-1/4"	1"	3.0	14.2	6.3	2.5	1.3	2.0	3.4	40 lbs.	N/A.	40 lbs.
369F	F	1	3	TEFC	230/460	4 / 2	1-1/4"	1"	3.0	13.8	6.3	2.5	1.3	2.0	3.4	39 lbs.	N/A.	39 lbs.
369A	G	1-1/2	1	TEFC	115/230	18 / 9	1-1/4"	1"	3.0	15.1	6.3	2.5	1.3	2.0	3.4	48 lbs.	N/A.	48 lbs.
369B	G	1-1/2	3	TEFC	230/460	5 / 3	1-1/4"	1"	3.0	14.2	6.3	2.5	1.3	2.0	3.4	40 lbs.	N/A.	40 lbs.
369D	H	2	1	TEFC	115/230	22 / 11	1-1/4"	1"	3.0	15.4	6.3	2.5	1.3	2.0	3.4	52 lbs.	N/A.	52 lbs.
369E	H	2	3	TEFC	230/460	6 / 3	1-1/4"	1"	3.0	14.3	6.3	2.5	1.3	2.0	3.4	50 lbs.	N/A.	50 lbs.

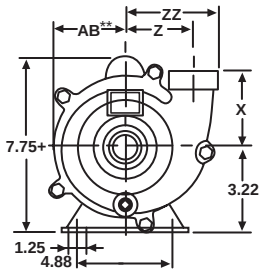
(*) Standard NPT (female) pipe thread.
(**) This dimension may vary due to motor manufacturer's specifications.
(+) 3-Phase motors can also operate on 50 Hz. (This will change Full Load Amps, Service Factor and RPM)
NOTE: Dimensions have a tolerance of ±1/8".
NOTE: Electric supply for ALL motors must be within ±10% of nameplate voltage rating(Ex. 230V ±10%= 207 to 253)

‡ *When Ordering Add the Correct-9x Suffix to Model Number Indicating Material Selection (ex: 368A-95)*

XCI (-95)=Cast Iron Construction with SS Impeller and Buna-N Seals, Max. Temperature 180˚F
XB (-97)=Cast Bronze Construction with Viton® Seals, Max. Temperature 200˚F
XSS (-98)=Stainless Steel Construction with Viton® Seals, Max. Temperature 200˚F







Standard Features

- Stainless Steel, Bronze & Cast Iron Construction
- Buna-N or Viton® Mechanical Seals and O-Rings Depending on Model
- Stainless Steel Hardware
- NEMA 56J TEFC Single and Three Phase Motors
- Stainless Steel Motor Shaft
- NEMA Base Mounted Motor
- Self-cleaning Impeller
- Discharge Rotates in 90˚ Increments
- Maximum Working Pressure to 75 PSI
- Max. Temperature 200˚F(Viton®), 180˚F (Buna-N)
- Front Drain Plug
- **"Off-the-Shelf"** Availability for Many Models

OFF THE SHELF PUMPS

Viton® is a registered trademark of E.I. DuPont

See price book pages 30 & 31

Please read and save this Repair Parts Manual. Read this manual and the General Operating Instructions carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. The Safety Instructions are contained in the General Operating Instructions. Failure to comply with the safety instructions accompanying this product could result in personal injury and/or property damage! Retain instructions for future reference. AMT reserves the right to discontinue any model or change specifications at any time without incurring any obligation.

Periodic maintenance and inspection is required on all pumps to ensure proper operation. Unit must be clear of debris and sediment. Inspect for leaks and loose bolts. Failure to do so voids warranty.

Small Straight Centrifugal Pedestal Pumps

Refer to pump manual 1808-635-00 for General Operating and Safety Instructions.

DESCRIPTION

These pumps are for continuous duty, low pressure applications that do not require self-priming. Discharge port rotates 360º in 90º increments. Pumps incorporate a mechanical shaft seal and O-ring casing seal. All units for use with nonflammable, non-abrasive liquids compatible with pump component materials.

STAINLESS STEEL UNITS (300 Series SS)
Pump construction is cast 316 stainless steel with shaft seal of stainless steel, carbon, ceramic, and Viton elastomers. Handle liquids from 40° to 200° F (4° to 93° C).

BRONZE UNITS
Pump construction is cast bronze casing with cast 316 stainless steel impeller and pedestal. Includes shaft seal of stainless steel, carbon, ceramic and Viton elastomers. Handle liquids from 40° to 200° F (4° to 93 ° C). (Model 3682-97 has bronze casing and pedestal)

CAST IRON UNITS (3682-95 ONLY)
Pumps are cast iron with cast 316 stainless steel impeller and bronze pedestal. Shaft seal is stainless steel, carbon, ceramic and Buna N elastomers. Handle liquids from 40° to 180° F (4° to 82°C).

Specifications

Description	3682	3704	3694
Suction Inlet	3/4" NPT	1" NPT	1 ¼" NPT
Discharge Outlet	½" NPT	3/4" NPT	1" NPT
Shaft Diameter	5/8"	5/8"	5/8"
Keyway	3/16" x 1"	3/16" x 1"	3/16" x 1"
Dimensions (overall)	6 ⅜" L x 5 ⅛" W x 6 ⅛" H	6" L x 6 ⅝" W x 6 ¾" H	6 ⅛" L x 6 ⅝" W x 6 ¾" H
Weight (approximate)	10 lbs.	11 lbs.	13 lbs.

Performance Chart

				GPM at Total Head in Feet						
Model	Port Size	Pump RPM	BHP Required	10'	20'	30'	40'	50'	60'	*Max. Head
3682	3/4" x 1/2"	3450	0.58	36	32	27	20	90	–	57 ft.
		3000	0.33	30	25	17	5	–	–	42 ft.
		2600	0.25	24	16	1	-	-	–	31 ft.
		1750	0.25	8	-	-	-	-	-	13 ft.
3704	1" x 3/4"	3450	1.13	57	51	43	35	21	0	60 ft.
		3000	0.65	48	39	30	15	–	–	46 ft.
		2600	0.25	37	21	4	-	-	–	32 ft.
		1750	0.25	17	-	-	-	-	-	14 ft.
3694	1 ¼" x 1"	3450	2.00	88	81	72	62	48	25	68 ft.
		3000	1.5	75	65	53	38	5	–	51 ft.
		2600	0.75	62	49	25	-	-	–	37 ft.
		1750	0.25	27	-	-	-	-	-	17 ft.

(*) Shut-off; to convert to psi, divide by 2.31.

Small Straight Centrifugal Pedestal Pumps

MAINTENANCE

⚠WARNING

Make certain that unit is disconnected from power source before attempting to service or remove any components!

MECHANICAL SEAL REPLACEMENT

Refer to Figure 1.

IMPORTANT: Always replace both seal seat (Ref. No.8) and seal head (Ref. No. 7) to insure proper mating of components! Also, impeller seal (Ref. No. 10) should be replaced anytime impeller fastener (Ref. No. 11) has been removed.

1. Remove fasteners (Ref. No. 14) connecting casing (Ref. No. 13) to pedestal (Ref. No. 5).
2. Remove casing and casing seal (Ref. No. 12).

⚠ CAUTION

Care should be taken not to "pinch" or "shave" casing seal between pedestal and casing.

3. Use a box and/or socket wrench to remove impeller fastener. Remove impeller seal and impeller (Ref. No. 9). Seal seat can now be pried from impeller.

IMPORTANT: Care should be taken to ensure that same number and thickness of shim washers (Ref. No. 8A) are replaced behind impeller as was removed. Shim washers are located directly behind impeller and become loose as impeller is removed.

4. To free shaft assembly (Ref. No. 4), see “Bearing Housing Service”.
5. After shaft assembly is removed, press seal head from pedestal.

⚠ CAUTION

The precision lapped faces on mechanical seal are easily damaged. Handle your replacement seal carefully. Do not touch polished seal faces.

IMPORTANT: Be sure that shaft shoulder does not damage polished seal face.

6. Thoroughly clean all surfaces of seal seat cavity in pedestal and impeller.
7. While wearing clean gloves or using a clean light rag, press seal head squarely into pedestal recess, use cardboard washer (usually supplied with new seal), place over polished surface and use a piece of pipe or dowel rod to press in firmly, but gently. Avoid scratching polished face.
8. Dispose of cardboard washer. Check again to see that polished surface is free of dirt and all other foreign particles and that it has not been scratched or damaged.
9. Wet rubber portion of new seal seat with a light coating of soapy water. While wearing clean gloves or using a clean light rag, press seal seat squarely into impeller recess, use cardboard washer (usually supplied with new seal), place over polished surface and use a piece of pipe or dowel rod to press in firmly, but gently. Avoid scratching polished face.

NOTE: A short "run-in" period may be necessary to provide completely leak free seal operation.

10. Replace any shim washers which may have been removed in disassembly.
11. Screw impeller back in place, tightening until it is against shaft shoulder. Install impeller seal and impeller fastener.
12. Remount casing seal and casing on pedestal.

IMPORTANT: Always inspect casing seal (Ref. No. 12) whenever unit is disassembled. Replace when cracked or worn.

IMPORTANT: After pump is completely assembled it is necessary to rotate pump shaft by hand to check for striking of impeller. If striking or rubbing occurs, adjust impeller shims as required (see “Shim Adjustment”).

BEARING HOUSING SERVICE

1. Remove casing (Ref. No. 13) and impeller (Ref. No. 9) as described under “Mechanical Seal Replacement”.
2. Remove shaft assembly (Ref. No. 4) by first removing snap ring (Ref. No. 1) and shims (Ref. No. 2). Push shaft assembly out of pedestal by rapping on threaded end of shaft with a soft mallet, or block of wood and a hammer. Slinger washer (Ref. No. 6) will come loose at this time.
3. Replace shaft assembly by sliding assembly into pedestal (be sure to align slinger washer), threaded end first. Push assembly completely in by gently tapping on keyway end of shat with a soft mallet. Replace shims and snap ring.
4. Reassemble pump as described under “Mechanical Seal Replacement”.

SHIM ADJUSTMENT

When installing a replacement impeller (Ref. No. 9) or shaft assembly (Ref. No. 4), it may be necessary to adjust number of shims (Ref. No. 8A) to ensure proper running clearance between impeller and casing (Ref. No. 13). Proceed as follows:

NOTE: A proper running clearance is less than 0.010".

1. For impeller replacement, add one 0.010" shim in addition to those removed originally.
2. For shaft assembly replacement, add two 0.010" shims in addition to those removed during disassembly.
3. Reassemble pump using “Mechanical Seal Replacement” for reference.

IMPORTANT: Be sure that casing is snugly in place and check shaft to make sure it is turning freely. If it turns freely, check to be sure that pedestal (Ref. No. 5) and casing are fitted "metal to metal" where they meet on outside. If they are not "metal to metal" tighten fasteners (Ref. No. 14) and recheck shaft for free turning. Tighten carefully turning shaft while tightening so that bearings are not damaged in the event that too many shims were installed. If shaft seizes before fasteners are completely tight, disassemble pump and remove one 0.010" shim and repeat reassembly.

For Repair Parts contact dealer where pump was purchased.

Please provide following information:
-Model Number
-Serial Number (if any)
Part description and number as shown in parts list

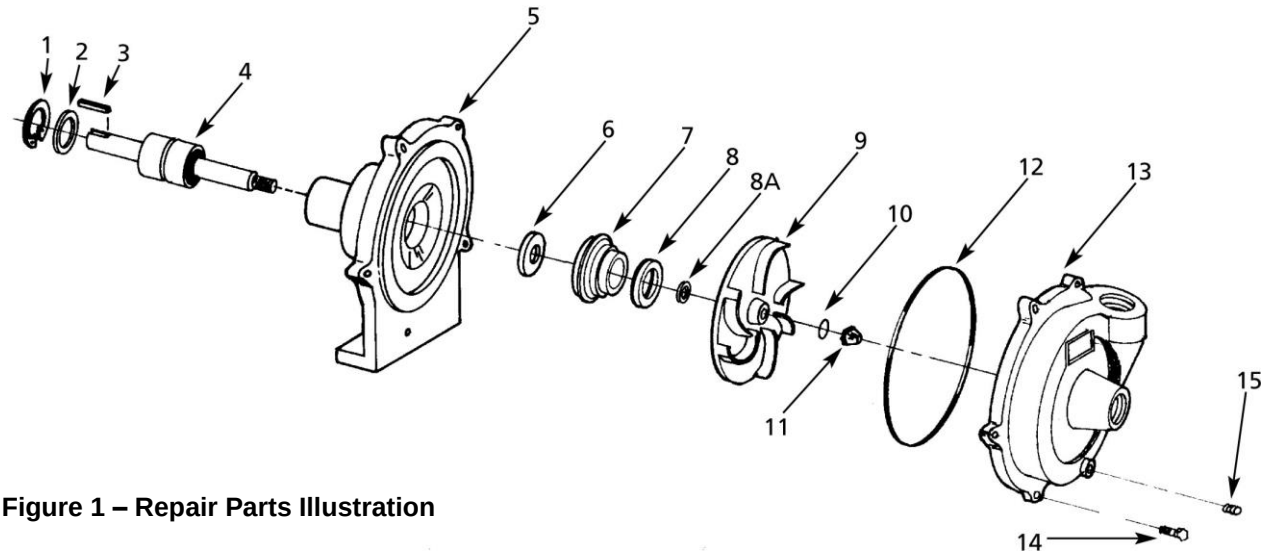


Figure 1 – Repair Parts Illustration

Repair Parts List

Ref. No.	Description		Part Number for Models: 3682	3704	3694	Qty.
1	Snap Ring		1806-062-00	1806-062-00	1806-062-00	1
2	Bearing Shim Package	-for Cast Iron & Bronze Pumps	1696-003-90	1696-003-90	1696-003-90	1
		-for Stainless Steel Pumps	1806-080-90	1806-080-90	1806-080-90	
3	Shaft Key		1517-000-00	1517-000-00	1517-000-00	1
4	Shaft and Bearing Assembly	-for Cast Iron & Bronze Pumps	1509-140-90	1509-140-90	1509-140-90	1
		-for Stainless Steel Pumps	3682-140-00	3682-140-00	3682-140-00	
5	Pedestal	-Cast Iron (3682 ONLY)	3682-092-09	Replace Pump	Replace Pump	1
		-Bronze	3682-092-09	3694-090-09	3694-090-09	
		-Stainless Steel	3682-090-09	3694-090-09	3694-090-09	
6	5/8" Slinger Washer (not required)		1534-000-00	1534-000-00	1534-000-00	1
7,8	✧Seal Assembly, Buna-N		1640-161-92	1640-161-92	1640-161-92	1
	✧Seal Assembly, Viton		1640-161-95	1640-161-95	1640-161-95	1
8A	Impeller Shim Kit		1806-044-90	1806-044-90	1806-044-90	1
9	Impeller		3680-010-09	3700-010-09	3690-010-09	1
10	O-ring, Buna-N		2105-036-00	2105-036-00	2105-036-00	1
	O-ring, Viton		2105-037-00	2105-037-00	2105-037-00	
11	7/16" - 20 UNF SS Acorn Nut		1784-001-00	1784-001-00	1784-001-00	1
12	O-ring, Buna-N		1582-000-00	1582-000-00	1582-000-00	1
	O-ring, Viton		1532-000-00	1567-001-00	1567-001-00	
13	Casing	-Cast Iron	3680-002-09	N/A	N/A	1
		-Bronze	3680-004-09	3700-003-09	3690-003-09	
		-Stainless Steel	3680-001-09	3700-001-09	3690-001-09	
14	1/4" - 20 UNC x 7/8" Hex Head Cap Screw		*	N/A	N/A	5
	5/16" - 18 UNC x 7/8" Hex Head Cap Screw		N/A	*	*	5
15	1/8" Pipe Plug		*	*	*	1

(*) Standard Hardware Item, Available Locally

(✧) Seal assembly available as set only (includes seal head and seat).

AMT Pump Company
(herein "AMT")
400 Spring Street
Royersford, PA 19468
Phone: (610) 948-3800
Fax: (610) 948-5300
www.amtpump.com

General Information

SALES POLICY: AMT products are sold through our established Distributors. We do not sell direct to the consumer or organization not entitled to trade recognition. Therefore, possession of our catalogs and/or price list(s) does not infer an offer to sell.

MINIMUM ORDER: We appreciate your order, however, all orders are subject to a minimum $35.00 net invoice charge (excluding freight). This applies to all pump and parts purchase orders.

PRICES: Prices are subject to change without notice. All orders accepted are subject to prices in effect at time of shipment.

PAYMENT TERMS: Terms, upon establishment of credit, are Net 30 days. Past due accounts may be subject to a service charge of 1.5% per month. Domestic or assignable letter of credit is required for all export trade.

PAST DUE ACCOUNTS: AMT reserves the right to withhold open account shipments on any past due account. Invoices are considered past due after thirty (30) days. In the interest of sound business, all orders are subject to approval of the Credit Department.

SHIPPING INSTRUCTIONS: All shipments will be made F.O.B. the factory. Where instructions for shipment do not appear on the order, the shipment will be made according to our best judgment. Full risk of loss (including transportation delays and losses) shall pass to the customer upon delivery of the products to the carrier at the F.O.B. point. When loss or delay occurs, primary responsibility for tracing rests with the customer. When there is LOSS or APPARENT VISIBLE DAMAGE to a shipment, when tendered for delivery, *DO NOT* give the carrier a clear receipt. Note such damage on the carrier's delivery receipt and *HAVE THE DRIVER SIGN THE RECEIPT.*

PRODUCT REVISIONS: AMT reserves the right to discontinue, change or improve its products or any portions thereof without being obligated to provide such a change or improvement for units sold and/or shipped prior to such a change or improvement.

LEAD TIME: Products designated "Quick Ship Product", also referred to as "QSP" will normally be shipped within 24 hours of receipt of a non-cancellable purchase order. Only limited quantities of "QSP" pumps are available.

STANDARD LEAD TIME: Lead time is two weeks for all non "QSP" product. AMT reserves the right to revise lead times as required due to availability of materials and all other causes beyond our control.

VIP SHIPMENT: Select AMT and IPT branded pumps are available for next day shipment for non-QSP (Quick Ship Products) items and subjected to a specific model surcharge per unit noted in the respective price book. Requires calling for availability, confirmation and a non-cancellable purchase order or credit card payment prior to shipment. The expedited shipping charges are an additional cost added separately from the VIP charges per item. AMT reserves the right to revise lead times as required due to availability of materials and all other causes beyond our control. QSP quantities are limited as determined by AMT.

ALL purchase orders must be submitted via hard copy sent to AMT customer service department by fax, EDI or e-mail.

RETURN GOODS POLICY: Goods shall not be returned without a return goods authorization number (RGA) issued by AMT customer service. The RGA number must be listed on the packing list. Only current model and part numbers with a valid date code may be returned (within one year from date of purchase). **A 20% restocking and packaging charge will apply to all returns. All shipping charges must be pre-paid. No exceptions.**

ORDER CHANGES BY CUSTOMER: Orders in process may not be changed except with written consent and may be subject to special charges.

12 Month Limited Warranty

EXTENT AND DURATION OF LIMITED WARRANTY

Coverage: AMT Pump Company (herein "AMT") or IPT Pumps by Gorman-Rupp (herein "IPT") or Gorman-Rupp Industries Division of the The Gorman-Rupp Company, Patterson, or the Gorman-Rupp Company (herein referred to as "G-R Unit) each individually warrants that its products and parts shall be free from defects in material and workmanship for twelve (12) months from the date of purchase by the original end user when installation is made and maintenance is performed in accordance with G-R Unit's recommendations. Wear and tear resulting from use and items normally consumed in use are not covered.

EXCEPTIONS

(A) This Limited Warranty shall not apply to mechanical seals in AMT or IPT pumps and the following products and parts: engines, motors, trade accessories and all other products, components, parts and materials not manufactured by the G-R Units. These items may, however, be covered by the warranties of their respective manufacturers. (B) This warranty does not extend to or apply to any unit which has been repaired or altered at any place other than by a G-R Unit, or by persons not expressly approved by a G-R Unit to make repairs or alterations, nor to any unit the serial number, model number or identification of which has been removed, defaced or altered. (C) This warranty does not extend to any product manufactured by a G-R Unit, which has been subjected to mis-use, neglect, accident, improper installation, or use in violation of instructions furnished by a G-R Unit. (D) Pump Kits: This warranty does not extend to any product sold by a G-R Unit unassembled as a Pump Kit. Pump Kits are warranted against defects in material and workmanship for 60 days from the date of shipment from a G-R Unit. Any Pump Kit parts deemed defective by a G-R Unit will be replaced free of charge within 60 days of shipment. Pump Kits are not returnable for credit.

LIMITATIONS

THE G-R UNITS' SOLE AND EXCLUSIVE WARRANTY WITH RESPECT TO THEIR PRODUCTS AND PARTS IS THIS LIMITED WARRANTY. THIS LIMITED WARRANTY IS IN LIEU OF ALL OTHER EXPRESS AND/OR IMPLIED WARRANTIES, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSE.

EXCLUSIVE REMEDY AND DAMAGES

The sole and exclusive remedy for breach of this Warranty by a G-R Unit and the entire extent of its liability for such breach or for damages arising from the use of the products and parts covered under this Limited Warranty, shall be as follows:

1. **Repair or Replacement:** If inspection shows that any G-R Unit product or part covered under this Limited Warranty is defective in materials or workmanship, the G-R Unit shall repair or replace the defective or non-conforming product or part without charge, whichever the G-R Unit chooses. You must have properly maintained and used the product or part claimed to be defective in accordance with the maintenance schedule or manual, which comes with the product. No allowance will be made for labor, installation, removal, transportation or other charges incurred by you in connection with such repair or replacement.
2. To obtain the above remedy:
    A. Immediately notify the G-R Unit upon discovery of the claimed defect in materials or workmanship and provide the serial number or date code of the product and/or part(s) or provide the G-R Unit with the invoice or bill of sale referencing the product by no later than the expiration date of the warranty period.
    B. The G-R Unit will advise whether inspection will be necessary and how whether repair or replacement will be made. If inspection by the G-R Unit is necessary, the pump or defective part must be sent freight pre-paid to the G-R Unit. Return shipment will be F.O.B. the G-R Unit's plant.
    C. **Return Goods Authorization Requirement:** No product will be accepted for return or replacement without the prior written authorization of the G-R Unit. Upon such authorization, and in accordance with instructions from the G-R Unit, the product will be returned to the G-R Unit, shipping charges prepaid by the Buyer.

3. **Damages:** The G-R Unit's liability for damages for breach of this Limited Warranty shall not exceed the amount of the purchase price of the product or part(s) in respect to which Such damages are claimed. **IN NO EVENT SHALL THE G-R UNITS BE LIABLE FOR INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES FOR BREACH OF THIS LIMITED WARRANTY.**

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This Limited Warranty gives you specific legal rights, and you may also have other rights, which vary from state to state.

Cast Iron Sewage & Trash Pumps

Cast Iron Sewage & Trash Pump

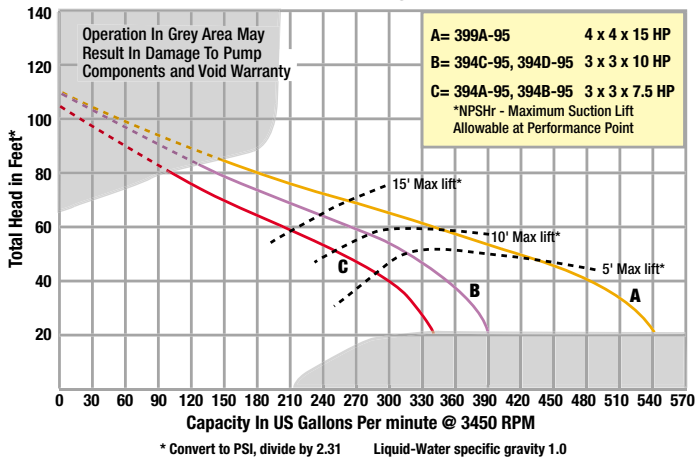
- ***Cast Iron** Construction*
- ***Silicon Carbide/Viton Mechanical Seal***
- ***2", 3" & 4" NPT Port Sizes***
- ***Self-Priming up to 20 ft.***
- ***Maximum Temperature 180º F***
- ***Maximum Working Pressure 150 PSI***
- ***Stainless Steel Semi-open, Clog Resistant Impeller***
- ***Buna-N Check Valve & O-Ring***
- ***Removable Cast Iron Volute/ Wearplate***
- ***Easy Cleanout Design***
- ***Pull-from-Rear Design***
- ***3" & 4" Models Feature Front Cleanout***
- ***Available with 3 to 15 HP Totally Enclosed Fan Cooled (TEFC) Electric Motors***
- ***Single and Three Phase, 3450 RPM Motors***
- ***Seal Flush Port Provided on 5 HP and Larger***
- ***Optional Mounting Base Available***

AMT Cast Iron Sewage/Trash pumps are designed for trouble free and economical handling of solids laden liquids and slurries. Pumps are available in three NPT port sizes; 2", 3" and 4". Cast iron construction with 2 vane Stainless Steel self-cleaning impellers, Silicon Carbide mechanical seals for abrasion resistance and Buna-N O-rings and check valves. Built-in check valve allows pump to reprime automatically in an open system, without a foot valve. The solids handling capabilities of the pumps make them ideally suited for a variety of industrial applications including: sewage treatment, canneries, chemical processing, wineries, tanneries, meat packing, breweries, pulp, wood chips, process water, sludge and slime, waste water, white water and other applications.

AMT Sewage/Trash pumps will easily handle liquids containing sewage, stone, sticks, mud, and other solids. Minimum liquid requirement must be above 85%. Failure to do so may damage pump and void warranty. These pumps are reliable, cost effective and low maintenance. Many are readily available **"Off-the-Shelf"** for fast 24 hour shipment. For use with non-flammable liquids compatible with pump component materials.

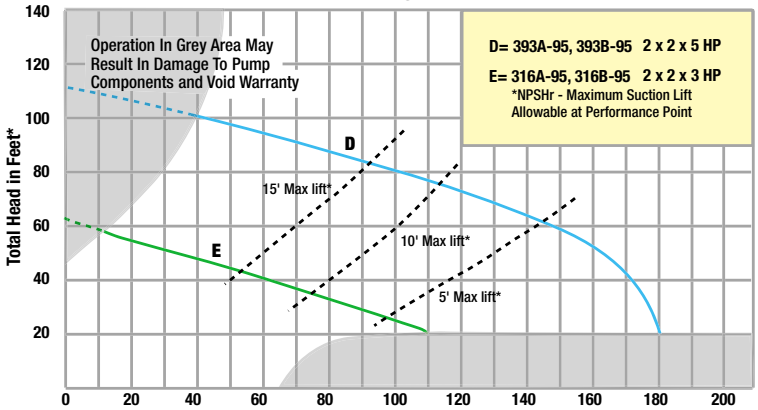
Maximum 15% Solids

Performance of Sewage & Trash Pump



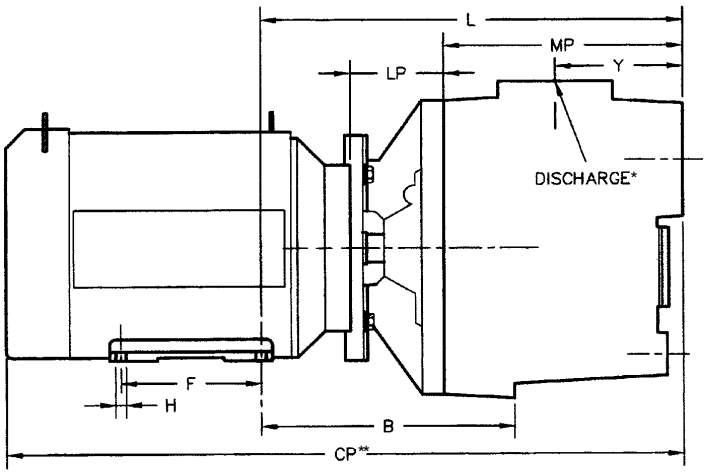
* Convert to PSI, divide by 2.31 Liquid-Water specific gravity 1.0

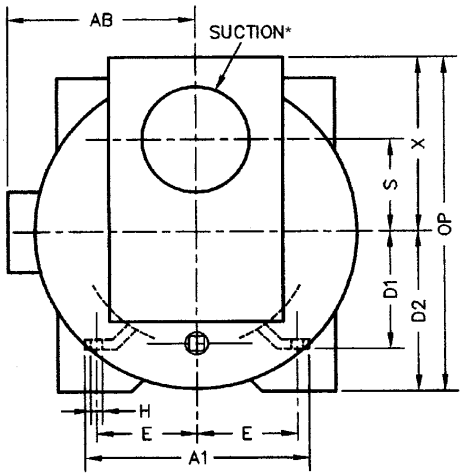
Performance of Sewage & Trash Pump



* Convert to PSI, divide by 2.31 Liquid-Water specific gravity 1.0

Cast Iron Sewage & Trash Pumps





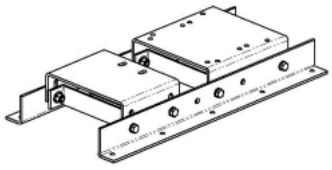
Pump Dimensional Chart

Model No.	HP	SUC*	DIS*	CP**	A1	Width	AB	B	D1	D2	E	F	H	L	LP	MP	OP	S	X	Y	Ship Wt.
316A-95	3	2"	2"	21.0	6.5	9.0	5.0	N/A	3.5	N/A	2.4	3.0	0.88 x 0.34	11.0	2.3	6.1	8.2	2.1	4.7	3.1	87 lbs.
316B-95	3	2"	2"	21.0	6.5	9.0	5.0	N/A	3.5	N/A	2.4	3.0	0.88 x 0.34	11.0	2.3	6.1	8.2	2.1	4.7	3.1	94 lbs.
393A-95	5	2"	2"	25.0	6.4	13.5	8.6	9.7	4.5	5.2	3.7	5.5	0.4	14.8	4.4	6.9	10.	2.1	4.7	3.1	146 lbs.
393B-95	5	2"	2"	25.0	6.4	13.5	8.6	9.7	4.5	5.2	3.7	5.5	0.4	14.8	4.4	6.9	10.	2.1	4.7	3.1	170 lbs.
394A-95	7.5	3"	3"	26.5	6.4	15.5	9.4	10.0	4.5	5.7	3.7	5.5	0.4	16.5	3.7	9.3	12.4	3.5	6.6	5.0	200 lbs.
394B-95	7.5	3"	3"	31.0	9.5	15.5	9.4	10.8	5.2	5.7	4.2	7.0	0.4	17.4	3.7	9.3	12.4	3.5	6.6	5.0	255 lbs.
394C-95	10	3"	3"	31.0	9.5	15.5	9.5	10.8	5.2	5.7	4.2	7.0	0.4	17.4	3.7	9.3	12.4	3.5	6.6	5.0	215 lbs.
394D-95	10	3"	3"	31.0	9.5	15.5	9.5	10.8	5.2	5.7	4.2	7.0	0.4	17.4	3.7	9.3	12.4	3.5	6.6	5.0	285 lbs.
399A-95	15	4"	4"	32.0	9.5	15.5	9.5	11.2	5.2	6.1	4.2	7.0	0.4	18.5	3.7	10.3	14.3	3.5	8.1	6.6	287 lbs.

Pump Specification Chart

Model No.	Curve	HP	PH	ENC	Frame	Voltage @ 60 Hz+	Full Load Amps	Max Solids
316A-95	E	3	3	TEFC	56J	230/460	8/4	1"
316B-95	E	3	1	TEFC	56J	230	16	1"
393A-95	D	5	3	TEFC	184JM	230/460	17/9	1"
393B-95	D	5	1	TEFC	184JM	230	20	1"
394A-95	C	7-1/2	3	TEFC	184JM	230/460	22/11	1-1/2"
394B-95	C	7-1/2	1	TEFC	215JM	230	31	1-1/2"
394C-95	B	10	3	TEFC	215JM	230/460	26/13	1-1/2"
394D-95	B	10	1	TEFC	215JM	230	40	1-1/2"
399A-95	A	15	3	TEFC	215JM	230/460	47/24	2"

(*) Standard NPT (female) pipe thread.
(**) This dimension may vary due to motor manufacturer's specifications.
(+) 3-Phase motors can operate on 50 Hz. (This will change Full Load Amps, Service Factor, RPM and Priming Capabilities)
NOTE: Dimensions have a tolerance of ±1/8".
NOTE: Electric supply for ALL motors must be within ±10% of nameplate voltage rating(Ex. 230V ±10%= 207 to 253)



Optional Mounting Base Model # A200-90

Standard Features

- Cast Iron Construction for Abrasive Resistance and Durability
- Self-cleaning Stainless Steel Impellers Resist Clogging and Wear
- Pull-from-Rear Design Permits Clean Out and Repair Without Removing Piping
- Silicon Carbide/Viton Mechanical Seal
- Built in Buna-N Check Valve
- Buna-N O-Ring Casing Seal Reusable After Clean Out Maintenance
- Replaceable Cast Iron Volute/Wearplate Designed for Solids Handling
- Motor Includes Stainless Steel Shaft or Stainless Steel Shaft Sleeve
- 3" & 4" Models Feature Front Cleanout
- Available with 3 to 15 HP Totally Enclosed Fan Cooled (TEFC) Electric Motors
- Single and Three Phase, 3450 RPM Motors
- Optional Mounting Base Available for 184/215 JM Frames (Reference pgs. 41-42)

OFF THE SHELF PUMPS

See price book page 26

Please read and save this Repair Parts Manual. Read this manual and the General Operating Instructions carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. The Safety Instructions are contained in the General Operating Instructions. Failure to comply with the safety instructions accompanying this product could result in personal injury and/or property damage! Retain instructions for future reference. AMT reserves the right to discontinue any model or change specifications at any time without incurring any obligation.

Periodic maintenance and inspection is required on all pumps to ensure proper operation. Unit must be clear of debris and sediment. Inspect for leaks and loose bolts. Failure to do so voids warranty.

Sewage/Trash Pumps

Refer to pump manual 1808-634-00 for General Operating and Safety Instructions.

AMT® A Gorman-Rupp Company

DESCRIPTION

This sewage/trash pump is a heavy duty, centrifugal, motor driven, self-priming (to 20 ft. lift) unit, after initially filling casing with liquid. Pump is equipped with a silicon carbide mechanical seal, cast iron wear surfaces and a stainless steel clog-resistant impeller. Units are used to handle water containing sewage, stones, sticks, mud and other solids: maximum diameter ½ the discharge NPT size. Handle liquids from 40º to 180º F (4º to 82º C) for use with nonflammable fluids compatible with pump component materials. All units come with built-in suction check valve to aid priming efficiency and easily removable casing/clean out cover and volute for quick debris clean out. An NPT threaded seal wash port is provided on Models 393A-95, 393B-95, 394A-95, 394B-95, 394C-95, 394D-95 and 399A-95. Units are powered by totally enclosed fan cooled (TEFC) motors, single or three phase power. Motor includes stainless steel shaft or stainless steel shaft sleeve.

⚠WARNING

Pumps must be operated in specific ranges as noted on respective curves on page 3 (Figure 3). Failure to adhere to curve will result in damage and cavitation to pump thus voiding warranty.

UNPACKING

Refer to Repair Parts Illustration and Repair Parts List to aid in identifying parts. Unpack and separate all pump components from container making sure all parts are accounted for.

Package should contain:

1. Pump and motor completely assembled.
2. Suction strainer.
3. Specifications Information & Repair Parts Manual.
4. General Operating Instructions & Maintenance Manual.

MAINTENANCE

Note: For information pertaining to the motor and motor parts, consult the motor manual or contact the nearest authorized service representative or the manufacturer.

⚠WARNING

Make certain that the unit is disconnected from the power source before attempting to service or remove any component.

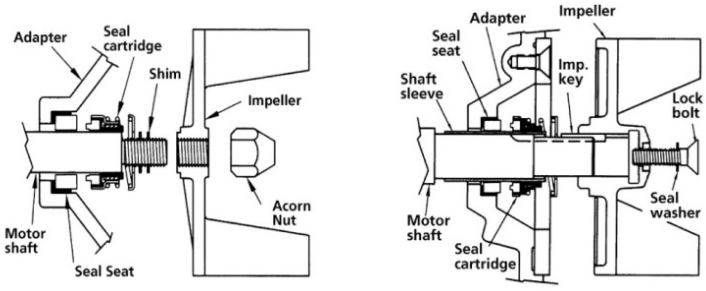


Figure 1 & 2 - Mechanical Seal Replacement

MECHANICAL SEAL REPLACEMENT

Should the mechanical seal, which consists of seal seat (Ref. No. 6), seal cartridge (Ref. No. 5), and shaft sleeve (Ref. No. 19, if applicable) require replacement, proceed as follows and refer to Figures 1 and 2. The seal should also be replaced if the adapter (Ref. No. 8) is to be replaced.

NOTE: Always replace the seal seat, seal cartridge, and shaft sleeve to ensure proper mating of mechanical seal components!

1. Unthread bolts (Ref. No. 9) and remove casing (Ref. No. 1) from adapter.
2. Unthread screw(s) (Ref. No. 11) and remove volute from adapter.
3. 316A-95 and 316B-95 (Figure 1): Remove impeller lock nut (Ref. No. 18). Unscrew impeller (Ref. No. 3) from the motor shaft. Use a rubber mallet or soft block of wood to loosen impeller. Turn it counterclockwise. Remove the impeller shim (Ref. No. 4) and seal cartridge (Ref. No. 5).
4. 393A-95, 393B-95, 394A-95, 394B-95, 394C-95, 394D-95, and 399A-95 (Figure 2): Using an Allen wrench, remove the impeller lock bolt (Ref. No. 18) and o-ring (Ref. No. 25). Slide impeller off motor shaft. Remove the impeller shim (Ref. No. 4), shaft sleeve (Ref. No. 19) and seal cartridge (Ref. No. 5).

IMPORTANT: Care should be taken to ensure that the same number of impeller shims (Ref. No. 4) are replaced behind the impeller as were removed. These impeller shims are located directly behind impeller. These shims as well as the impeller key (Ref. No. 21) become loose as the impeller is removed.

5. Unthread cap screws (Ref. No. 13) and remove adapter from motor.
6. Push seal seat (Ref. No. 6) from the adapter recess with a screwdriver.
7. Clean adapter recess before inserting a new seal seat.

⚠ CAUTION

The precision lapped faces on the mechanical seal are easily damaged. Handle your replacement seal carefully.

8. Carefully wipe the polished surface of the new seal seat with a clean cloth.
9. Wet rubber portion of the seal seat with a light coating of soapy water.
10. While wearing clean gloves or using a clean rag, press seal seat squarely into adapter recess. Avoid scratching the polished surface. If seal seat will not position properly, place a cardboard washer over the polished surface and use a piece of pipe to press in, firmly but gently.
11. After seal seat is in place, dispose of cardboard washer. Check that seat is clean and has not been marred.
12. Using a clean cloth, wipe the shaft and make certain that it is perfectly clean.
13. Secure the adapter on the motor mounting surface with fasteners.

Sewage/Trash Pumps

14. Wet the inside rubber portion of the new seal cartridge with a light coating of soapy water. 316A-95 and 316B-95: Slide cartridge onto motor shaft until cartridge meets seal seat. 393A-95, 393B-95, 394A-95, 394B-95, 394C-95, 394D-95 and 399A-95: Slide cartridge onto shaft sleeve. Slide shaft sleeve with seal cartridge onto motor shaft until cartridge meets seal seat. Reinstall impeller key.

I**MPORTANT:** Before installing new shaft sleeve, apply a bead of non-hardening, pliable sealant (such as Permatex® Form-A-Gasket® No. 2) to motor shaft shoulder.

15. Reinstall any impeller shims that have been removed. (See "Shim Adjustment" section).
16. 316A-95 and 316B-95: Screw impeller back in place, tightening until it is seated against shims and shaft shoulder. 393A-95, 393B-95, 394A-95, 394B-95, 394C-95, 394D-95 and 399A-95: Replace impeller key, impeller, o-ring and impeller lock bolt. Tighten lock bolt until impeller is seated against shims and shaft sleeve.
17. Remount volute with fasteners.
18. Refer to section entitled Shim Adjustment at this time if shaft sleeve or any other parts listed have been replaced.
19. Inspect position of flapper valve to ensure proper movement and sealing.
20. Replace o-ring seal on volute rabbet.

NOTE: Always inspect o-ring seals. Replace when cracked or worn. Wet o-ring with soapy water for ease of assembly.

21. Remount casing.
22. Remount any other parts and reconnect power.

SHIM ADJUSTMENT

When installing a replacement impeller, motor, shaft sleeve, adapter or volute, it may be necessary to adjust the number of impeller shims (Ref. No. 4) to ensure proper running clearance between impeller and the volute wear surface. Proceed as follows:

NOTE: Proper running clearance is 0.010".

1. For impeller replacement, add one (1) shim in addition to those removed originally.
2. For motor replacement, add one (1) shim in addition to the shims removed during disassembly.
3. Reassemble the pump as described in steps 15, 16, and 17. (See "Mechanical Seal Replacement" section).

IMPORTANT: Check the shaft to make sure it is turning freely (rotate the impeller by the impeller lock bolt with an Allen wrench or by the acorn nut with a socket wrench). If it turns freely, check to ensure that the volute and adapter are fitted metal-to-metal where they meet on the outside. If they are not metal-to-metal, tighten fasteners and recheck the shaft for free turning. Tighten carefully, turning the shaft while tightening so that the motor bearings are not damaged in the event that too many shims were installed. If shaft seizes before fasteners are completely tight, disassemble the pump and remove one (1) shim and repeat reassembly.

NOTE: When adding or removing shims, it is best to proceed with a 0.010" increment each time. If motor shaft does turn freely, add shims until it does strike, then remove a 0.010" shim. This will ensure maximum performance.

IMPELLER, WEARPLATE, AND VOLUTE REPLACEMENT

Impeller (Ref. No. 3), wear plate (Ref. No. 23) and volute (Ref. No. 2) are subject to wear only by abrasive sand or sediment laden liquids. If badly worn, all these parts can be replaced easily and the pump thus restored to full efficiency.

NOTE: When the clearance between the impeller and the volute exceeds 1/16" at the face of the impeller or 1/8" on the outside diameter of the impeller, it may be necessary to take corrective action. The increased clearance can cause lengthened priming times and reduce pumping capacity. If both the priming and capacity of your unit are satisfactory for your application, it is recommended that no corrective maintenance be performed regardless of what clearances on your unit may have developed, since the increased clearances in themselves are not generally harmful to your pump.

Normally, new pump clearances can be restored by simply shimming behind the impeller. (Add impeller shims (Ref. No. 4). If the impeller is badly worn, it is recommended that the impeller be replaced. This is usually all that is required since only on unusually abrasive service does the cast iron wear plate and volute show deterioration. Occasionally a stone or hard object might get caught in the impeller and cause damage to the volute. In these cases, follow the instructions below for replacement and refer to the associated Repair Parts Illustration.

1. Disassemble pump for access as described in MECHANICAL SEAL REPLACEMENT, steps 1, 2, 3 and 4.
2. Replace parts as necessary.

NOTE: When replacing volute, attach flapper valve to new volute.

To replace rear wear plate (Ref. No. 23), remove impeller (Ref. No. 3) and fasteners (Ref. No. 24).

NOTE: Before installing new parts, clean all mating surfaces thoroughly.

CLEANING

These units are designed with a removable volute and suction cleanout cover (394A-95, 394B-95, 394C-95, 394D-95 and 399A-95) enabling the pump to be cleaned or unclogged with ease. Remove the suction clean out cover plate (Ref. No. 26) and gasket and/or remove the casing and volute. Remove any debris found inside the unit, reassemble as described in MECHANICAL SEAL REPLACEMENT steps 17 to 22.

NOTE: When replacing clean out cover plate, carefully wipe clean all surfaces on which the gasket has contact. Also, make sure the gasket is in position.

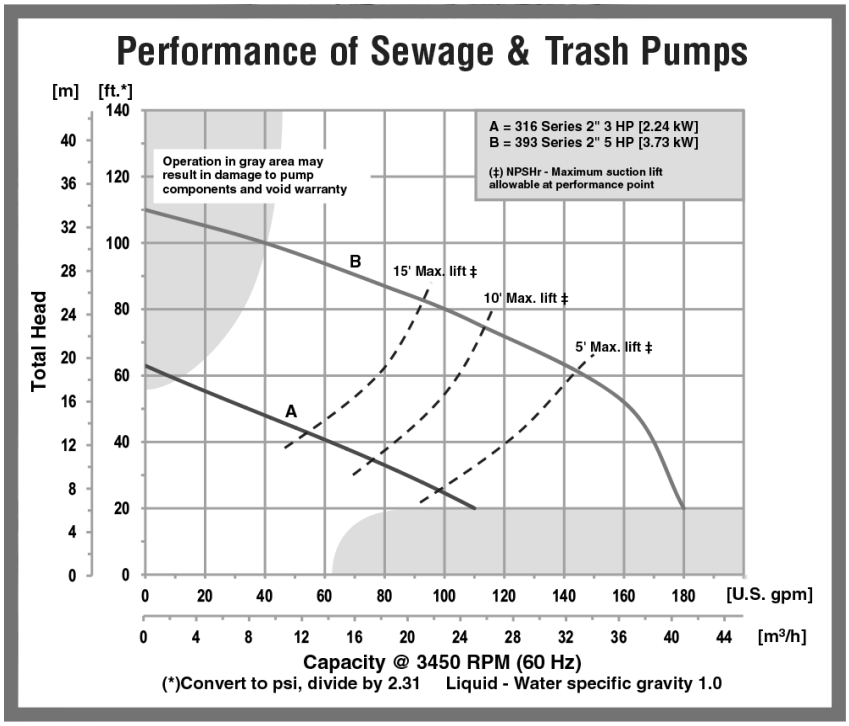
FLAPPER VALVE CLEANING

If debris clogging the flapper valve becomes a constant problem, the flapper area can be cut from the perimeter gasket area and removed from the pump. It is important that the perimeter of the flapper valve remains to seal the inlet area of the casing/volute from the discharge area.

NOTE: Priming efficiency will be reduced if flapper portion is removed.

NOTE: Do not remove entire flapper valve. Perimeter of valve must remain; remove only the flapper area. The pump will not prime and performance will be affected if entire flapper valve is removed.

Sewage/Trash Pumps



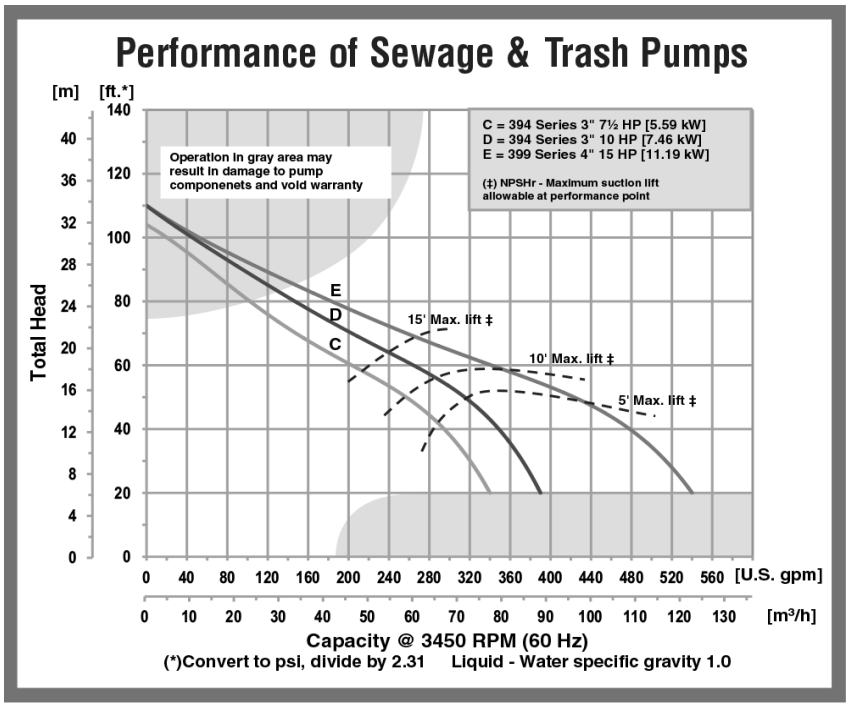


Figure 3 - Performance Curve

Sewage/Trash Pumps

For Repair Parts contact dealer where pump was purchased.

Please provide following information:
-Model Number
-Serial Number (if any)

Part description and number as shown in parts list

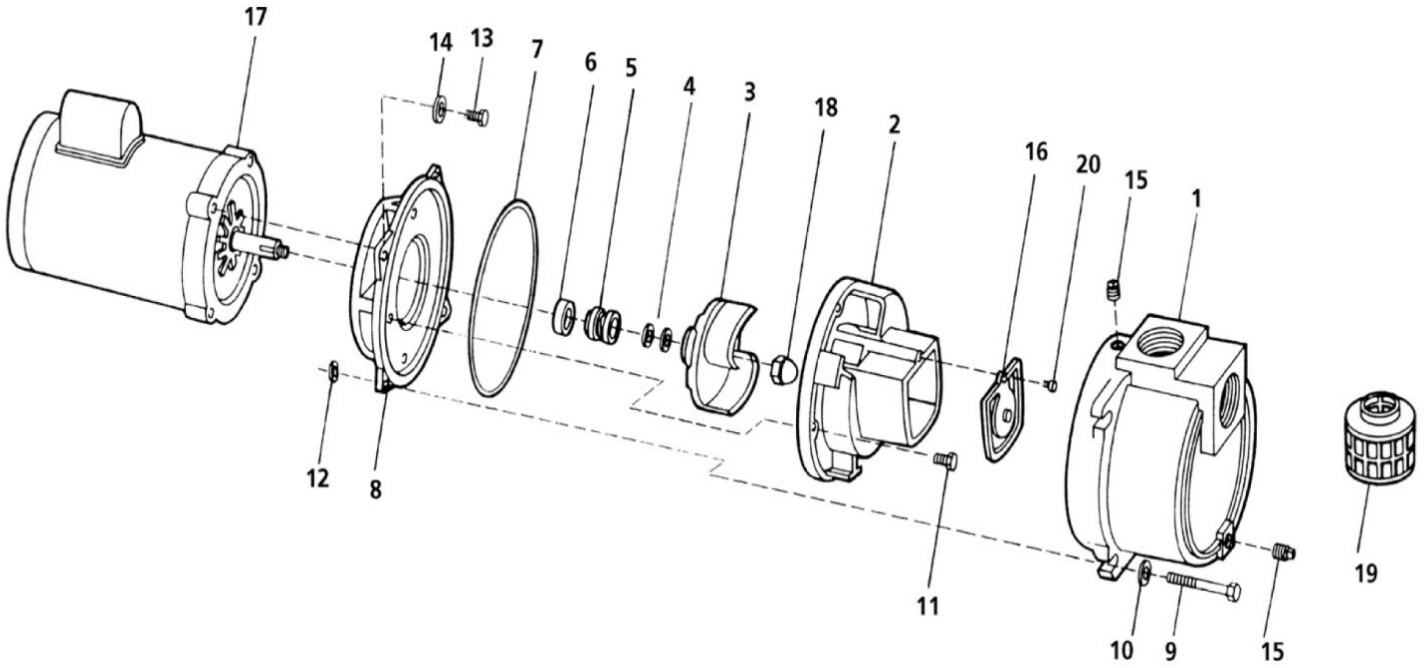


Figure 4 - Repair Parts Illustrations

Repair Parts List

Ref No.	Description	Part Number for Models 316A-95	316B-95	Qty
1	Casing	2111-001-02	2111-001-02	1
2	Volute	3163-150-09	3163-150-09	1
3	Impeller	3163-011-01	3163-011-01	1
4	Impeller Shim Set	1806-044-90	1806-044-90	1
5 & 6	Seal Assembly – Viton and Silicon Carbide	1640-165-90	1640-165-90	1
7	O-Ring – Buna-N	Incl. w/Ref. 21	Incl. w/Ref. 21	1
8	Adapter	1608-011-00	1608-011-00	1
9	3/8"-16 UNC x 2-3/4" Hex Head Bolt	*	*	4
10	3/8" Flat Washer	*	*	4
11	#10-24 UNC x 7/8" S.S. Socket Head Cap Screw	*	*	1
12	3/8"-16 UNC Hex Nut	*	*	4
13	3/8"-16 UNC x 1" Hex Head Cap Screw	*	*	4
14	3/8" Split Lock Washer	*	*	4
15	½" NPT Pipe Plug	*	*	2
16	Flapper Valve Assembly – Buna-N	Incl. w/Ref. 21	Incl. w/Ref. 21	1
17	Motor	1626-312-00	1626-306-00	1
18	Impeller Lock Nut	1784-001-00	1784-001-00	1
19	Suction Strainer	1679-001-00	1679-001-00	1
20	#10-24 UNC x 3/8" Flat Head Machine Screw	*	*	1
21	Gasket Kit – Buna-N (Includes Ref. Nos. 7 & 16)	3163-300-90	3163-300-90	1

(*) Standard hardware item, available locally.

Sewage/Trash Pumps

For Repair Parts contact dealer where pump was purchased.

Please provide following information:
-Model Number
-Serial Number (if any)

Part description and number as shown in parts list

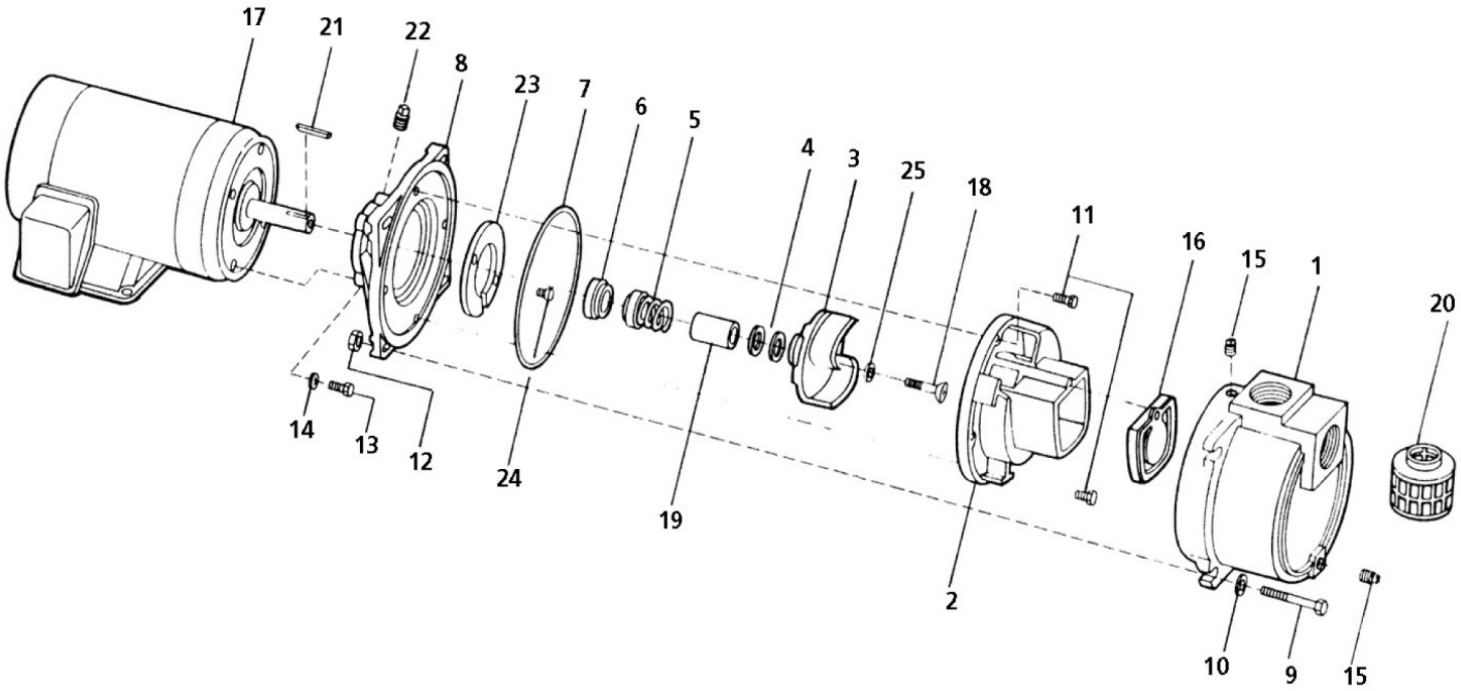


Figure 5 - Repair Parts Illustrations

Repair Parts List

Ref No.	Description	Part Number for Models 393A-95	393B-95	Qty
1	Casing	2111-001-02	2111-001-02	1
2	Volute	2182-002-01	2182-002-01	1
3	Impeller Kit	3935-011-98	3935-011-98	1
	(Includes Ref. Nos. 3, 4, 18, & 21)			
4	Impeller Shim Set	1664-000-90	1664-000-90	1
5 & 6	Seal Assembly – Viton and Silicon Carbide	1640-167-90	1640-167-90	1
7	O-Ring – Buna-N	Incl. w/Ref. 26	Incl. w/Ref. 26	1
8	Adapter	3655-030-01	3655-030-01	1
9	3/8"-16 UNC x 3-1/2" Hex Head Bolt	*	*	4
10	3/8" Flat Washer	*	*	4
11	#10-24 x 7/8" Machine Screw, SS	*	*	2
12	3/8"-16 Hex Nut	*	*	4
13	3/8"-16 x 1-1/4" Hex Head Cap Screw	*	*	4
14	3/8" Helical Split Lock Washer	*	*	4
15	½"-14 NPT Pipe Plug	*	*	2
16	Flapper Valve Assembly – Buna-N	1609-002-00 & Incl. w/Ref. 26	1609-002-00 & Incl. w/Ref. 26	1
17	Motor	1626-352-00	1626-078-00	1
18	Impeller Screw	Incl. w/Ref. 3	Incl. w/Ref. 3	1
19	Shaft Sleeve	1555-140-02	1555-140-02	1
20	Suction Strainer	1679-001-00	1679-001-00	1
21	Impeller Key	1471-030-00 & Incl. w/Ref. 3	1471-030-00 & Incl. w/Ref. 3	1
22	1/8” Pipe Plug	*	*	1
23	Wear Plate	3655-032-01	3655-032-01	1
24	5/16"-18 x ½" Flat Head Machine Screw	*	*	2
25	O-Ring – Buna-N	Incl. w/Ref. 26	Incl. w/Ref. 26	1
26	Gasket Kit – Buna-N	393A-300-90	393A-300-90	1
	(Includes Ref. Nos. 7, 16, & 25)			

NOTE: When replacing a seal assembly, a new O-ring (Ref. No. 25) should be also replaced.

(*) Standard hardware item, available locally.

Sewage/Trash Pumps

For Repair Parts contact dealer where pump was purchased.

Please provide following information:
-Model Number
-Serial Number (if any)

Part description and number as shown in parts list

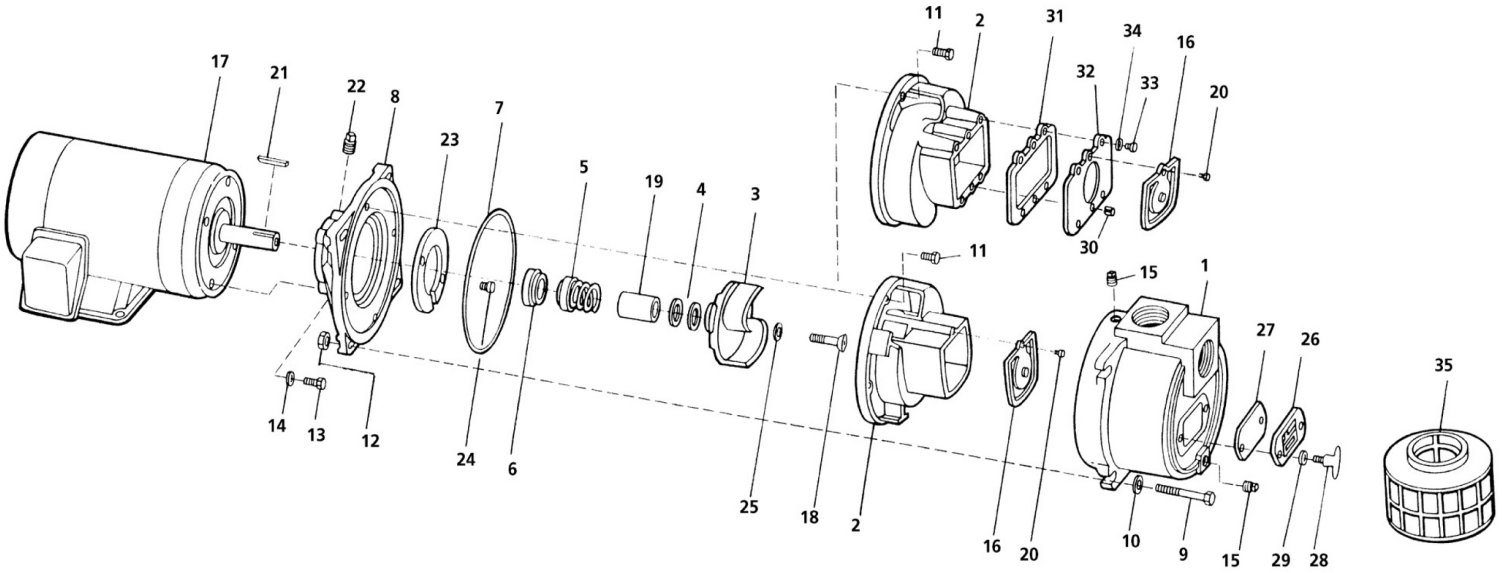


Figure 6 - Repair Parts Illustrations

Repair Parts List

Ref No.	Description	Part Number for Models 394A-95 394B-95	394C-95 394D-95	Qty
1	Casing	2113-003-01	2113-003-01	1
2	Volute	2184-002-01	1990-002-02	1
3	Impeller	3945-011-01	3945-010-02	1
4	Impeller Shim Set	1664-000-90	1664-000-90	1
5 & 6	Seal Assembly – Viton and Silicon Carbide	1640-167-90	1640-167-90	1
7	O-Ring – Buna-N	2185-000-00	2185-000-00	1
8	Adapter	1990-031-01	1990-031-02	1
9	1/2"-13 x 4-1/2" Hex Bolt	*	*	4
10	½" Flat Washer	*	*	4
11	1/4"-20 x 7/8" Hex Screw (stainless steel)	*	*	2
12	1/2"-13 Hex Nut	*	*	4
13	3/8"-16 x 1-1/4" Hex Screw	*	*	4
13	1/2"-13 x 1-1/2" Hex Screw	*	*	4
14	3/8" Helical Spring Lock Washer	*	*	4
14	½" Helical Spring Lock Washer	*	*	4
15	3/4"-14 NPT Pipe plug	*	*	2
16	Flapper Valve Assembly – Neoprene	3590-070-90	399C-070-90	1
17	Motor – 3 Phase	1626-353-00	1626-354-00	1
17	Motor – 1 Phase	1626-079-00	1626-080-00	1
18	Impeller Screw	*	*	1
19	Shaft Sleeve	1555-140-02	1555-140-02	1
20	#10-24 x 3/8" Flat Head Machine Screw	*	*	1
21	Impeller Key	1471-030-00	1471-030-00	1
22	1/8”NPT Pipe Plug	*	*	1
23	Wear Plate	2182-004-01	2182-004-01	1
24	5/16"-18 x ½" Flat Head Machine Screw	*	*	2
25	O-Ring – Buna-N	3150-301-00	3150-301-00	1
26	Clean Out Cover	2115-002-01	2115-002-01	1
27	Clean Our Gasket – Neoprene	2115-003-00	2115-003-00	1
28	Clean Out Handle	1601-000-00	1601-000-00	2
29	3/8” Flat Washer	*	*	2
30	1/8” DIA X 3/8” Lg Spring Pin	N/A	*	2
31	Volute Adapter Gasket – Buna-N	N/A	1990-300-00	1
32	Volute Suction Adapter	N/A	1990-151-01	1
33	#10-24 UNC x ½” S.S. Hex Head Cap Screw	N/A	*	4
34	S.S. Split Lock Washer #10	N/A	*	4
35	Suction Strainer	1681-000-00	1681-000-00	1

NOTE: When replacing a seal assembly, a new O-ring (Ref. No. 25) should be also replaced.

(*) Standard hardware item, available locally.

Sewage/Trash Pumps

For Repair Parts contact dealer where pump was purchased.

Please provide following information:
-Model Number
-Serial Number (if any)

Part description and number as shown in parts list

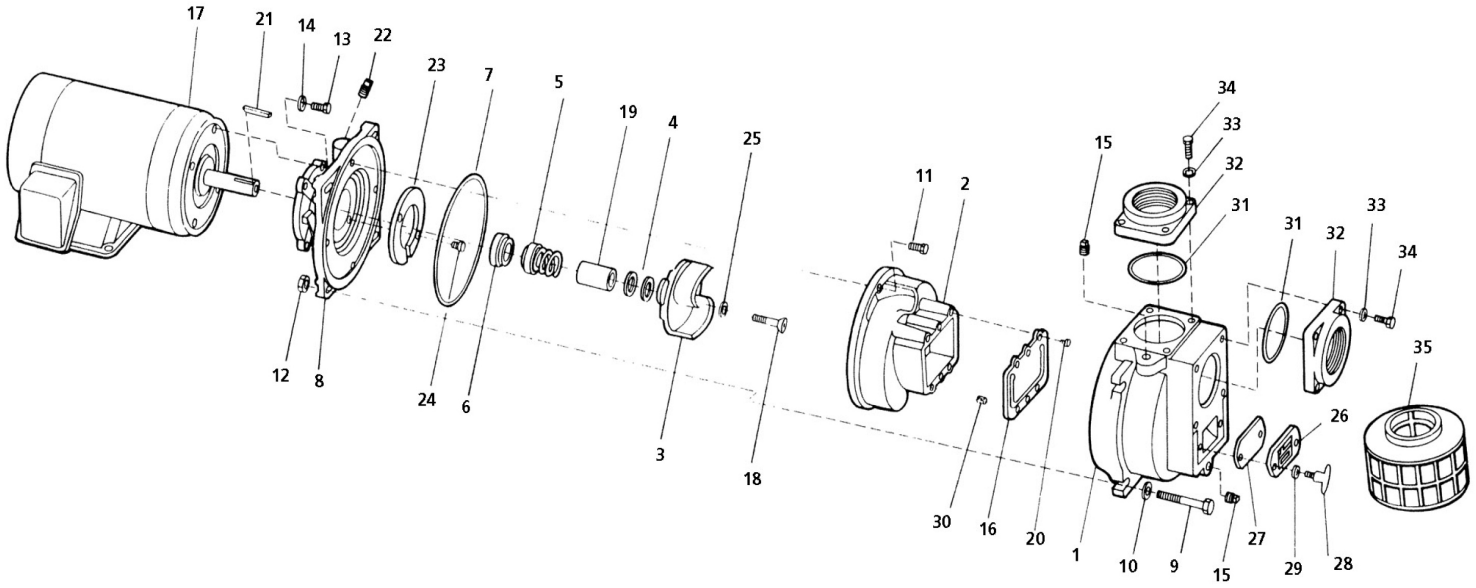


Figure 7 - Repair Parts Illustrations

Repair Parts List

Ref No.	Description	Part Number for Models 399A-95	Qty
1	Casing	2116-002-01	1
2	Volute	1990-002-01	1
3	Impeller	3945-010-03	1
4	Impeller Shim Set	1664-000-90	1
5 & 6	Seal Assembly – Viton and Silicon Carbide	1640-167-90	1
7	O-Ring – Buna-N	2185-000-00	1
8	Adapter	1990-031-02	1
9	1/2"-13 x 4-3/4" Hex Bolt	*	4
10	½" Flat Washer	*	4
11	1/4"-20 x 7/8" Hex Screw (stainless steel)	*	2
12	1/2"-13 Hex Nut	*	4
13	1/2"-13 x 1-1/2" Hex Screw	*	4
14	½" Lock Washer	*	4
15	3/4"- NPT Pipe plug	*	2
16	Flapper Valve – Buna-N	1696-033-90	1
17	Motor – 1PH	1626-355-00	1
18	Impeller Screw	1756-004-00	1
19	Shaft Sleeve	1555-140-02	1
20	#10-24 x 3/8" Flat Head Machine Screw	*	1
21	Impeller Key	1471-030-00	1
22	1/8” NPT Pipe Plug	*	1
23	Wear Plate	2182-004-01	1
24	5/16"-18 x ½" Flat Head Machine Screw	1741-000-00	2
25	O-Ring – Buna-N	3150-301-00	1
26	Clean Out Cover	2115-002-01	1
27	Clean Our Gasket – Neoprene	2115-003-00	1
28	Clean Out Handle	1601-000-00	2
29	3/8” Flat Washer	*	2
30	1/8" Diameter x 3/8" Long Pin	*	4
31	O-Ring – Buna-N	1990-008-00	2
32	Connection Flange	1990-004-01	2
33	7/16" Lock Washer	*	8
34	7/16"-14 x 1-1/2" Hex Screw	*	8
35	Suction Strainer	1681-000-00	1
33	#10-24 UNC x ½” S.S. Hex Head Cap Screw	N/A	4
34	S.S. Split Lock Washer #10	N/A	4
35	Suction Strainer	1681-000-00	1

NOTE: When replacing a seal assembly, a new O-ring (Ref. No. 25) should be also replaced.

(*) Standard hardware item, available locally.

AMT Pump Company
(herein "AMT")
400 Spring Street
Royersford, PA 19468
Phone: (610) 948-3800
Fax: (610) 948-5300
www.amtpump.com

General Information

SALES POLICY: AMT products are sold through our established Distributors. We do not sell direct to the consumer or organization not entitled to trade recognition. Therefore, possession of our catalogs and/or price list(s) does not infer an offer to sell.

MINIMUM ORDER: We appreciate your order, however, all orders are subject to a minimum $35.00 net invoice charge (excluding freight). This applies to all pump and parts purchase orders.

PRICES: Prices are subject to change without notice. All orders accepted are subject to prices in effect at time of shipment.

PAYMENT TERMS: Terms, upon establishment of credit, are Net 30 days. Past due accounts may be subject to a service charge of 1.5% per month. Domestic or assignable letter of credit is required for all export trade.

PAST DUE ACCOUNTS: AMT reserves the right to withhold open account shipments on any past due account. Invoices are considered past due after thirty (30) days. In the interest of sound business, all orders are subject to approval of the Credit Department.

SHIPPING INSTRUCTIONS: All shipments will be made F.O.B. the factory. Where instructions for shipment do not appear on the order, the shipment will be made according to our best judgment. Full risk of loss (including transportation delays and losses) shall pass to the customer upon delivery of the products to the carrier at the F.O.B. point. When loss or delay occurs, primary responsibility for tracing rests with the customer. When there is LOSS or APPARENT VISIBLE DAMAGE to a shipment, when tendered for delivery, *DO NOT* give the carrier a clear receipt. Note such damage on the carrier's delivery receipt and *HAVE THE DRIVER SIGN THE RECEIPT.*

PRODUCT REVISIONS: AMT reserves the right to discontinue, change or improve its products or any portions thereof without being obligated to provide such a change or improvement for units sold and/or shipped prior to such a change or improvement.

LEAD TIME: Products designated "Quick Ship Product", also referred to as "QSP" will normally be shipped within 24 hours of receipt of a non-cancellable purchase order. Only limited quantities of "QSP" pumps are available.

STANDARD LEAD TIME: Lead time is two weeks for all non "QSP" product. AMT reserves the right to revise lead times as required due to availability of materials and all other causes beyond our control.

VIP SHIPMENT: Select AMT and IPT branded pumps are available for next day shipment for non-QSP (Quick Ship Products) items and subjected to a specific model surcharge per unit noted in the respective price book. Requires calling for availability, confirmation and a non-cancellable purchase order or credit card payment prior to shipment. The expedited shipping charges are an additional cost added separately from the VIP charges per item. AMT reserves the right to revise lead times as required due to availability of materials and all other causes beyond our control. QSP quantities are limited as determined by AMT.

ALL purchase orders must be submitted via hard copy sent to AMT customer service department by fax, EDI or e-mail.

RETURN GOODS POLICY: Goods shall not be returned without a return goods authorization number (RGA) issued by AMT customer service. The RGA number must be listed on the packing list. Only current model and part numbers with a valid date code may be returned (within one year from date of purchase). **A 20% restocking and packaging charge will apply to all returns. All shipping charges must be pre-paid. No exceptions.**

ORDER CHANGES BY CUSTOMER: Orders in process may not be changed except with written consent and may be subject to special charges.

12 Month Limited Warranty

EXTENT AND DURATION OF LIMITED WARRANTY

Coverage: AMT Pump Company (herein "AMT") or IPT Pumps by Gorman-Rupp (herein "IPT") or Gorman-Rupp Industries Division of the The Gorman-Rupp Company, Patterson, or the Gorman-Rupp Company (herein referred to as "G-R Unit) each individually warrants that its products and parts shall be free from defects in material and workmanship for twelve (12) months from the date of purchase by the original end user when installation is made and maintenance is performed in accordance with G-R Unit's recommendations. Wear and tear resulting from use and items normally consumed in use are not covered.

EXCEPTIONS

(A) This Limited Warranty shall not apply to mechanical seals in AMT or IPT pumps and the following products and parts: engines, motors, trade accessories and all other products, components, parts and materials not manufactured by the G-R Units. These items may, however, be covered by the warranties of their respective manufacturers. (B) This warranty does not extend to or apply to any unit which has been repaired or altered at any place other than by a G-R Unit, or by persons not expressly approved by a G-R Unit to make repairs or alterations, nor to any unit the serial number, model number or identification of which has been removed, defaced or altered. (C) This warranty does not extend to any product manufactured by a G-R Unit, which has been subjected to mis-use, neglect, accident, improper installation, or use in violation of instructions furnished by a G-R Unit. (D) Pump Kits: This warranty does not extend to any product sold by a G-R Unit unassembled as a Pump Kit. Pump Kits are warranted against defects in material and workmanship for 60 days from the date of shipment from a G-R Unit. Any Pump Kit parts deemed defective by a G-R Unit will be replaced free of charge within 60 days of shipment. Pump Kits are not returnable for credit.

LIMITATIONS

THE G-R UNITS' SOLE AND EXCLUSIVE WARRANTY WITH RESPECT TO THEIR PRODUCTS AND PARTS IS THIS LIMITED WARRANTY. THIS LIMITED WARRANTY IS IN LIEU OF ALL OTHER EXPRESS AND/OR IMPLIED WARRANTIES, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSE.

EXCLUSIVE REMEDY AND DAMAGES

The sole and exclusive remedy for breach of this Warranty by a G-R Unit and the entire extent of its liability for such breach or for damages arising from the use of the products and parts covered under this Limited Warranty, shall be as follows:

1. **Repair or Replacement:** If inspection shows that any G-R Unit product or part covered under this Limited Warranty is defective in materials or workmanship, the G-R Unit shall repair or replace the defective or non-conforming product or part without charge, whichever the G-R Unit chooses. You must have properly maintained and used the product or part claimed to be defective in accordance with the maintenance schedule or manual, which comes with the product. No allowance will be made for labor, installation, removal, transportation or other charges incurred by you in connection with such repair or replacement.
2. To obtain the above remedy:
    A. Immediately notify the G-R Unit upon discovery of the claimed defect in materials or workmanship and provide the serial number or date code of the product and/or part(s) or provide the G-R Unit with the invoice or bill of sale referencing the product by no later than the expiration date of the warranty period.
    B. The G-R Unit will advise whether inspection will be necessary and how whether repair or replacement will be made. If inspection by the G-R Unit is necessary, the pump or defective part must be sent freight pre-paid to the G-R Unit. Return shipment will be F.O.B. the G-R Unit's plant.
    C. **Return Goods Authorization Requirement:** No product will be accepted for return or replacement without the prior written authorization of the G-R Unit. Upon such authorization, and in accordance with instructions from the G-R Unit, the product will be returned to the G-R Unit, shipping charges prepaid by the Buyer.

3. **Damages:** The G-R Unit's liability for damages for breach of this Limited Warranty shall not exceed the amount of the purchase price of the product or part(s) in respect to which Such damages are claimed. **IN NO EVENT SHALL THE G-R UNITS BE LIABLE FOR INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES FOR BREACH OF THIS LIMITED WARRANTY.**

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This Limited Warranty gives you specific legal rights, and you may also have other rights, which vary from state to state.

FPZ BLOWER TECHNOLOGY

REGENERATIVE BLOWERS - PRESSURE

SCL K03 / K04 / K05 / K06

MS SERIES

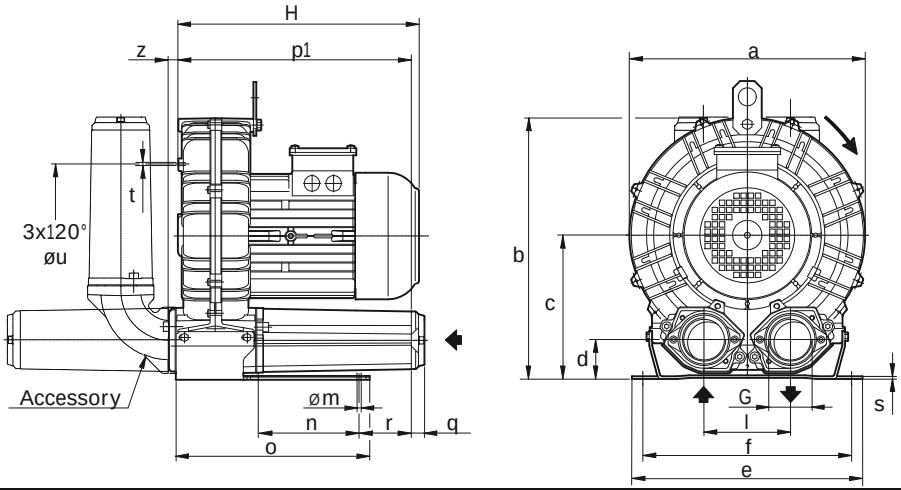
SN 1874-9 1/2

TECHNICAL CHARACTERISTICS
- Aluminium alloy construction
- Smooth operation
- High efficiency impeller
- Maintenance free
- Mountable in any position
- Recognized TEFC - cURus motor

OPTIONS
- Special voltages (IEC 38)
- Surface treatments

ACCESSORIES
- Inlet and/or inline filters
- Additional inlet/outlet silencers
- Safety valves
- Flow converting device
- Optional connectors

Dimensions in inches.
Dimension for reference only.



Model	a	b	c	d	e	f	G	l	m	n	o	p1	q	r	s	t	u	z
K03-MS	9.49	10.55	5.79	1.69	9.06	8.07	1"1/4 NPT	3.39	0.39	3.27	5.59	8.07	0.71	2.95	0.16	M6	5.51	0.47
K04-MS	11.22	12.40	6.77	1.93	10.04	8.86	1"1/2 NPT	4.02	0.47	3.74	6.73	8.74	0.71	2.76	0.16	M6	6.89	0.71
K05-MS	12.87	14.37	7 87	2.13	12.60	10.24	2" NPT	4.72	0.59	4.53	10.43	12.60	0.71	3.86	0.16	M8	7.87	0.75
K06-MS	14.80	15.47	8.07	2.13	12.80	11.42	2" NPT	4.92	0.59	5.51	10.71	13.15	0.71	3.35	0.16	M8	9.45	0.75

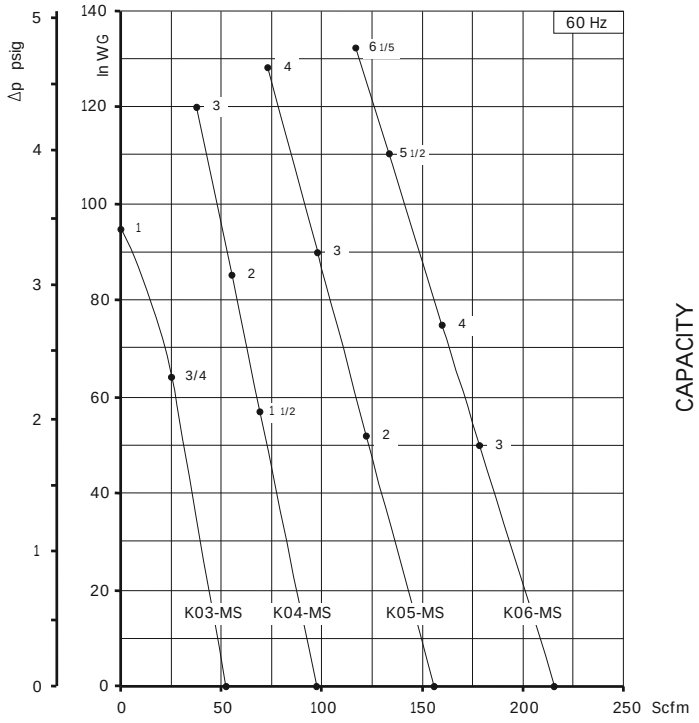
Model	Maximum flow Scfm		Installed power Hp		Maximum differential pressure △p (In WG)		Noise level Lp dB (A) (1)		Overall dimensions H	Weight
	60 Hz 3500 rpm	50 Hz 2900 rpm	60 Hz 3500 rpm	50 Hz 2900 rpm	60 Hz 3500 rpm	50 Hz 2900 rpm	60 Hz 3500 rpm	50 Hz 2900 rpm	Inches	Lbs
K03-MS	52	43	3/4	3/4	64	60	62.0	60.0	10.43	24.30
			1	1	95	77	62.3	60.3	11.97	26.50
K04-MS	98	81	1 ½	1 ½	58	80	64.8	62.8	11.65	36.40
			2	2	85	100	65.0	63.0	13.78	43.00
			3	-	120	-	65.2	-	13.78	49.60
K05-MS	156	129	2	2	52	70	70.5	68.5	13.20	51.80
			3	3	90	110	70.8	68.8	13.20	58.40
			4	4	128	120	71.1	69.1	14.40	67.20
K06-MS	216	179	3	3	50	65	73.0	71.0	13.54	68.70
			4	4	75	95	73.3	71.3	14.17	71.65
			5 ½	5 ½	110	140	73.6	71.6	14.17	77.60
			6 1/5 (2)	-	132	-	73.9	-	14.45	77.60

(1) Noise measured at 1 m distance with inlet and outlet ports piped, in accordance to ISO 3744.
(2) No cURus motor

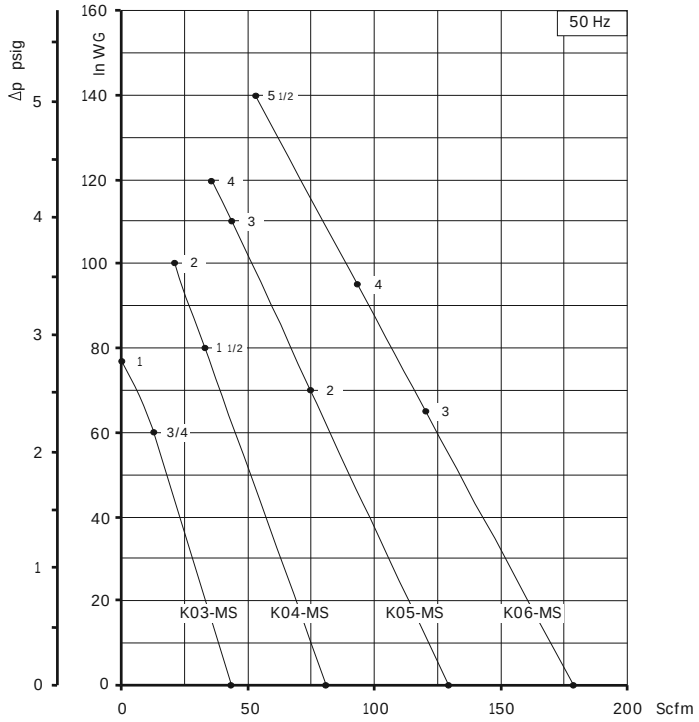
- For proper use, the blower should be equipped with inlet filter and safety valve; other accessories available on request.
- Ambient temperaturefrom +5° to +104°F.
- Specifications subject to change without notice.

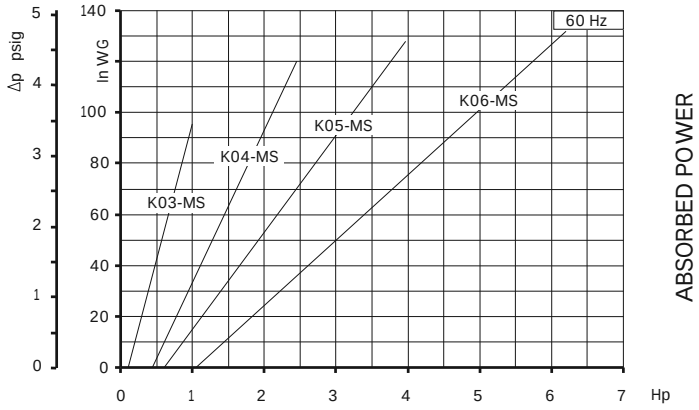
SCL K03 / K04 / K05 / K06
MS SERIES

SN 1874-9 2/2

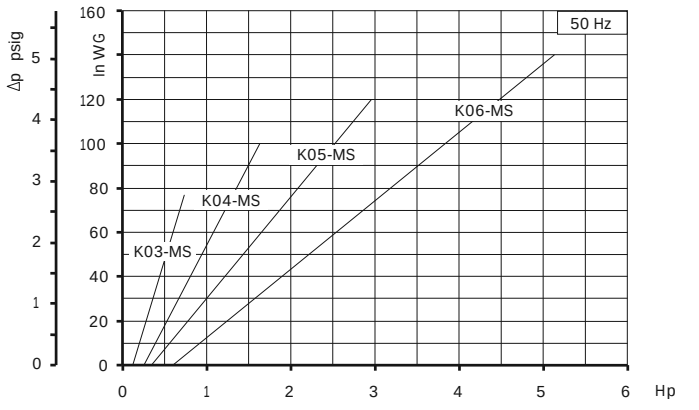


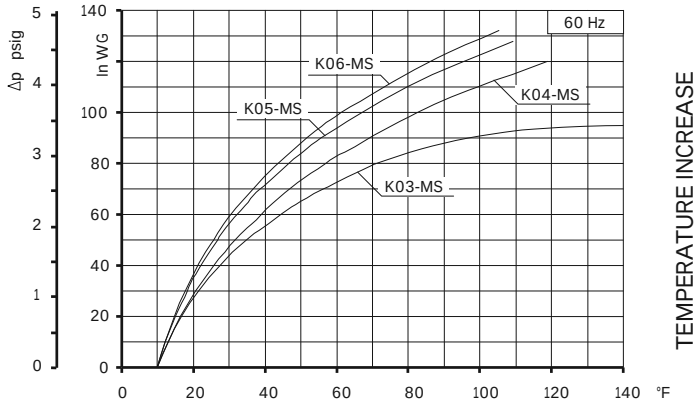
CAPACITY



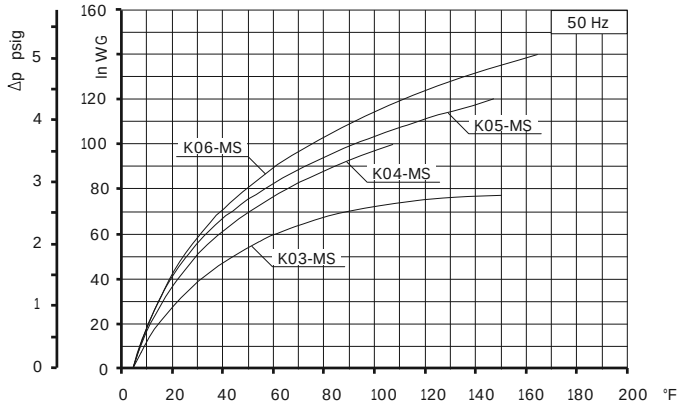


ABSORBED POWER





TEMPERATURE INCREASE



Curves refer to air at 68°F temperature and 29.92 In Hg atmospheric pressure (abs) measured at inlet port.
Values for flow, power consumption and temperature rise: +/- 10% tolerance.
Data subject to change without notice.

BioBarrier® MarineMBR™ PLC Manual

The Marine BioBarrier MBR control system uses a programmable logic controller (PLC) and touchscreen human-machine interface (HMI) to setup and operate the wastewater treatment system. The PLC program is configurable to the specific treatment system equipment installed. The program controls the operation of the following components:

Aeration Blower – The blower provides mixing of the liquid in the wastewater treatment processing, oxygen transfer for the biological process, and air scouring of the membrane filter assemblies.

Filter Pump – The filter pump draws treated water through the membrane filters and is controlled by float switches in the processing tank to produce treated effluent in batches based on the demand of the treatment system. A filtration batch is determined by the water volume between the lower float and upper float. The lower float ends a filtration cycle when in the "down" position, and a filtration cycle is started when the upper float is in the "up" position. An alarm float positioned above the upper float triggers a high-water level alarm condition if influent surge flows exceed the filtration capacity of the treatment system. The vacuum pressure on the inlet of the filter pump is monitored by the control system and will generate an alarm if an excessive vacuum pressure occurs due to fouled membrane filters.

Waste Activated Sludge (WAS) Pump – The WAS pump can be set up to periodically waste activated sludge from the processing tank in order to control the concentration of biological suspended solids.

Screen Tank Pump – The screening tank pump allows the operator to waste solids and liquid in the screening tank compartment preceding the treatment processing tank. This pump only needs to be operated manually from the control system when the operator determines the screening tank needs to be evacuated.

1. Home Screen

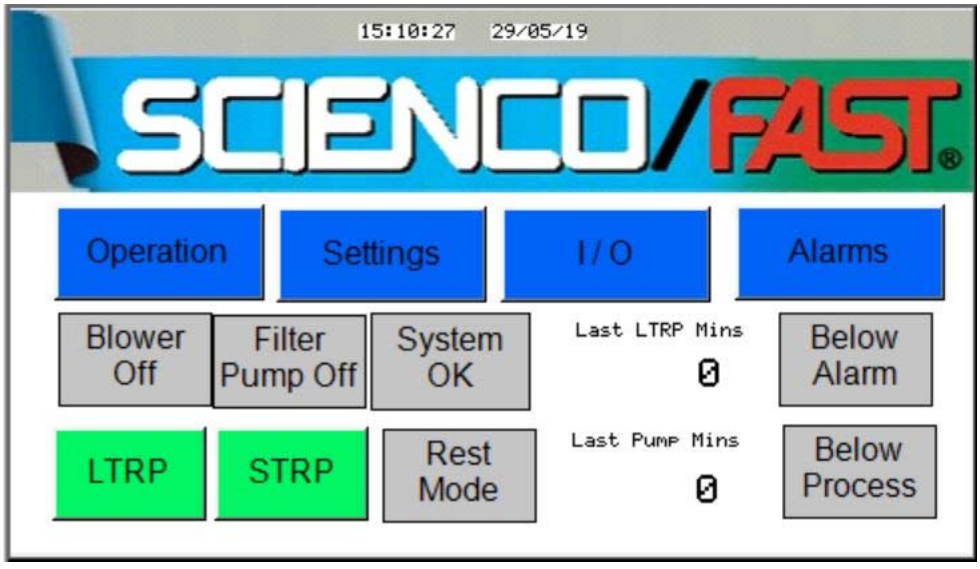


Figure 1 Home Screen

The home screen of the HMI contains menu buttons (presented in blue on the top row) for navigating to the operational functions and readouts, settings, input and output wiring connection list, and alarms.

The icons below the menu buttons are indicators for an overview of the operational status of the treatment system.

The “Blower Off” or “Blower On” icon displays the status of the aeration blower during operation. The blower operates on a timer setting defined in the “Settings” menu screens (see section 3. Settings) during the relaxation period when the system is not in filtration mode. The blower operates continuously when the system is in filtration mode. The “Blower On” indicator is green when the blower is operating.

The “Filter Pump Off” or “Filter Pump On” indicator displays the status of the filter pump. During a rest mode period, the filter pump does not operate.

The “System OK” indicator displays the general alarm status of the treatment system. Any alarm condition present will cause the color of this indicator to change to red and will display “Alarm” in the indicator box.

There are two resting period operational modes which indicate the state of the treatment system corresponding to the filtration and aeration processes.

The “LTRP” status indicator stands for “Long Term Relaxation Period” and is indicated in green when the water level in the MBR aeration tank is below the level that triggers the start of a filtration batch. When the LTRP state is triggered, the blower will operate on a timer setting.

The “STRP” status indicator stands for “Short Term Relaxation Period” and is indicated in green when activated. The STRP period is an operating status during filtration mode which shuts off the pump for a user-set period. The filter pump is shut off for a short time during the filtration cycle as a means of reducing stress on the membrane filters.

The “Rest Mode” or “Filter Mode” indicator displays the current status of the treatment system filtration process.

The “Last LTRP Mins” indicator displays the time elapsed in minutes for the most recent complete Long Term Relaxation Period.

The “Last Pump Mins” indicator displays the time elapsed in minutes during the most recent complete filtration cycle.

The “Below Alarm” or “High Level” indicator displays the status of the high-water level alarm float. The indicator turns green during a high-water level alarm condition.

The “Below Process” or “Process Level” indicator displays the status of the upper control float. The indicator turns green when the upper float is in the “up” position at the start of a filtration cycle.

2. Input/Output Screens

The Input/Output (I/O) screens are displayed when the “I/O” menu button on the home screen is pressed. The first I/O screen displays the list of input and output wiring connections to the PLC module terminals for the various components.

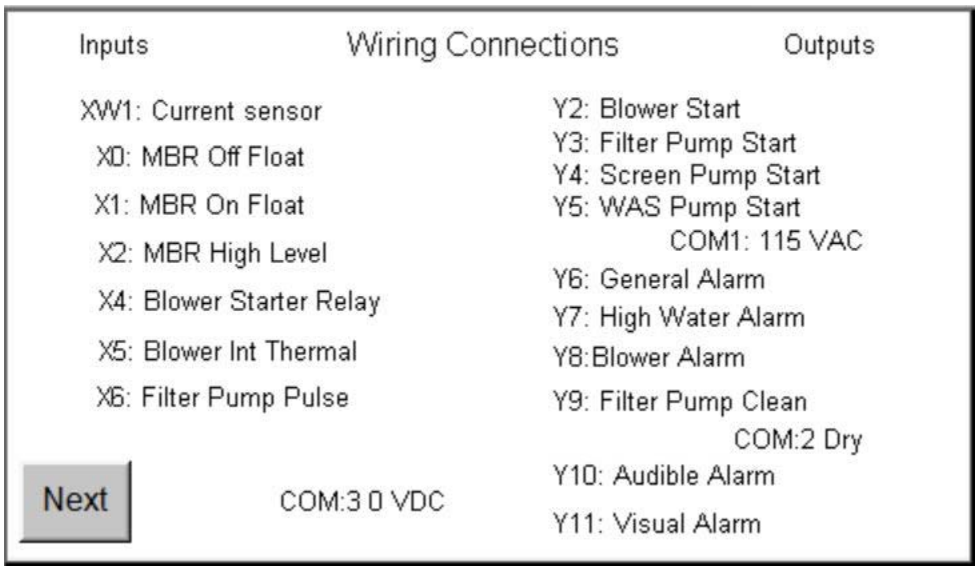


Figure 2. Input/Output Reference List Screen

The second I/O screen displays indicators for the status of the digital input and output components. This screen can be used for troubleshooting and confirmation that components are working properly. The digital input/output terminal indicators turn green when a digital signal is supplied to or from the corresponding components. The number displayed below the “Vacuum Sensor” label is an integer corresponding to the analog input voltage signal from the vacuum sensor. The value should be greater than zero when the filter pump is in operation.

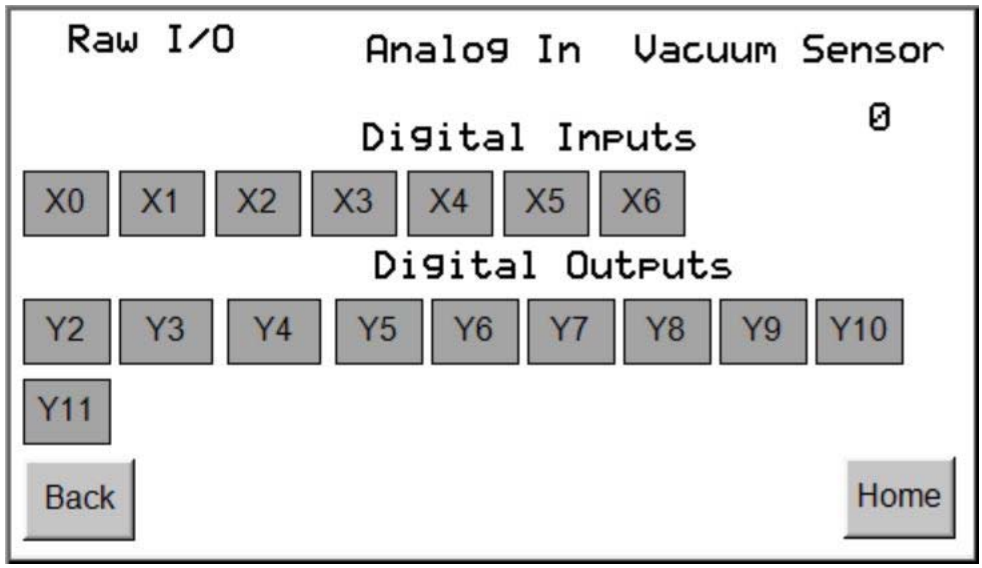


Figure 3. Input/Output Indicator Screen

3. Settings

The “Settings” button on the home screen navigates to a series of screens to input settings for the various components of the treatment system. Proper settings for the specific application and installation should be input prior to operation of the treatment systems.

a. Blower Settings

The first settings screen displays the setup for the aeration blower. The blower may be wired through a motor starter in the control cabinet. If this is the case, the “Use Starter” button should be selected to change the indicator below this button to display “Enable”. Some blower motors are supplied with thermal overload protection wiring. If this wiring is connected in the control cabinet, the “Use Thermal” button should be selected to change the indicator below this button to display “Enable”.

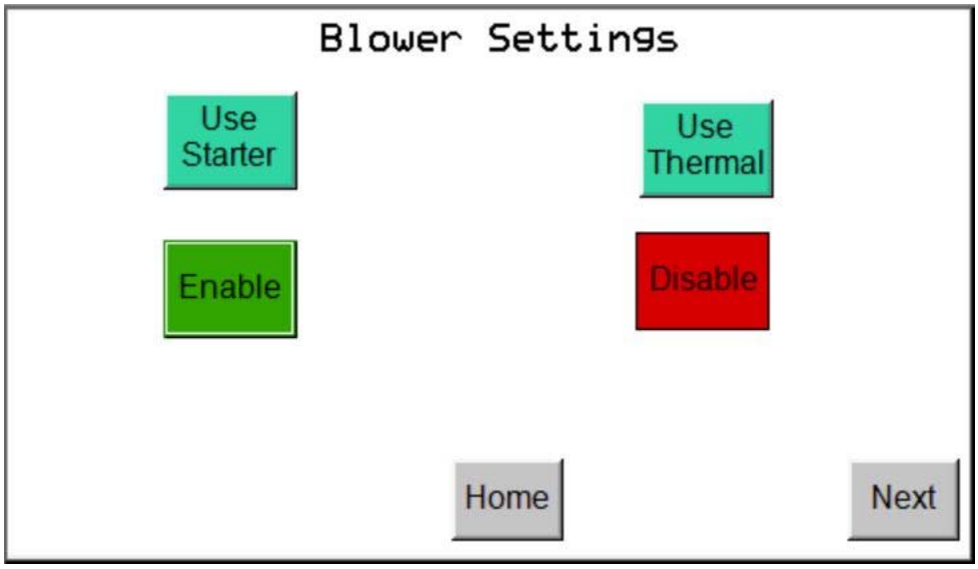


Figure 4. Blower Settings Screen

b. Float Settings

The Float Settings screen allows the operator to define the time in seconds that an input signal from the float switches must maintain without changing before the status of the float position changes in the PLC program. Typical settings for these values are displayed below. The settings are changed by pressing the number field, which triggers a keypad input to be displayed.

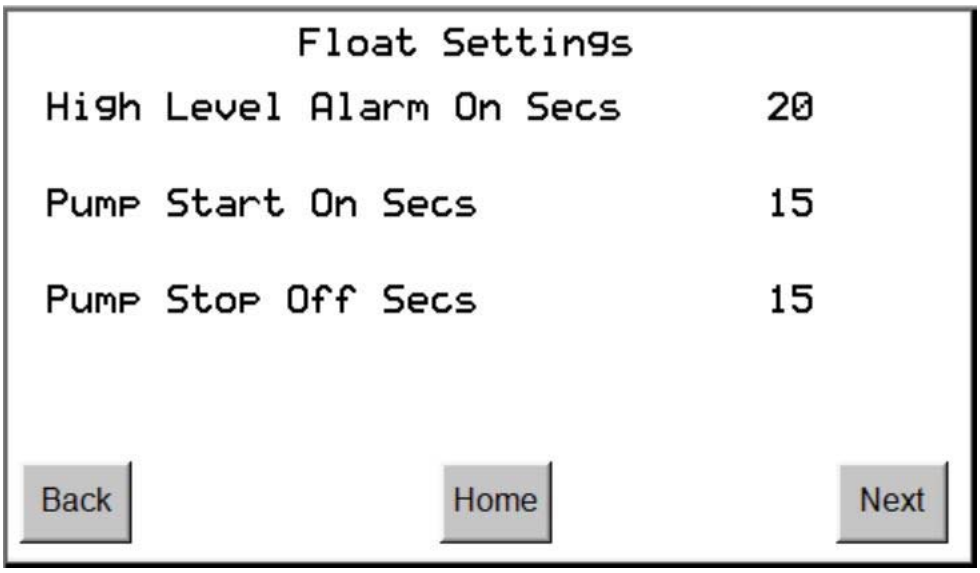


Figure 5. Float Settings Screen

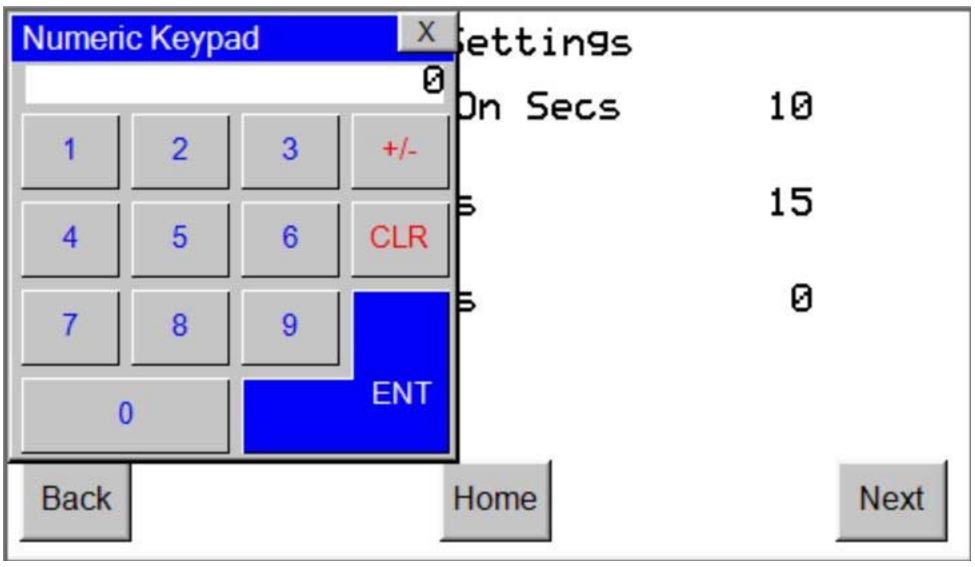


Figure 6. Numeric Keypad Input

c. WAS Pump Settings

The Waste Activated Sludge (WAS) Pump settings are used to determine the frequency and duration of the WAS pump operation. During the startup period of the treatment system when biological solids accumulate, this pump does not need to operate. Once a desired level of biological solids in the treatment processing tank is achieved, the WAS pump settings can be tuned to maintain a consistent level of biological solids by periodically wasting the liquid in the processing tank. A cycle in this screen is defined as a filtration batch from the start of an event when the upper float is in the on (up) position to when the lower float is in the off (down) position. The settings are changed by pressing the number field on the screen and entering the values in the numeric keypad.

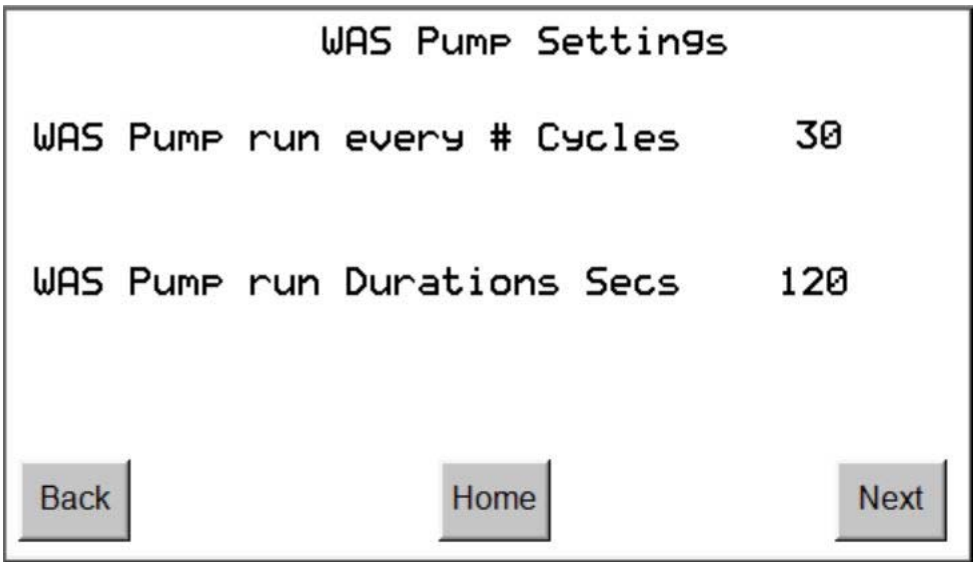


Figure 7. WAS Pump Settings Screen

d. Filtrate Pump Settings

The Filtrate Pump Settings screen allows the operator to determine a timer setting for when the filter pump should automatically resume operation after a clean-in-place (CIP) procedure is performed on the membrane filters. The time in minutes that the pump will be prevented from operating during the cleaning procedure is entered by pressing the number field and setting the value using the numeric keypad. A typical timer setting for this function is four hours (480 minutes).

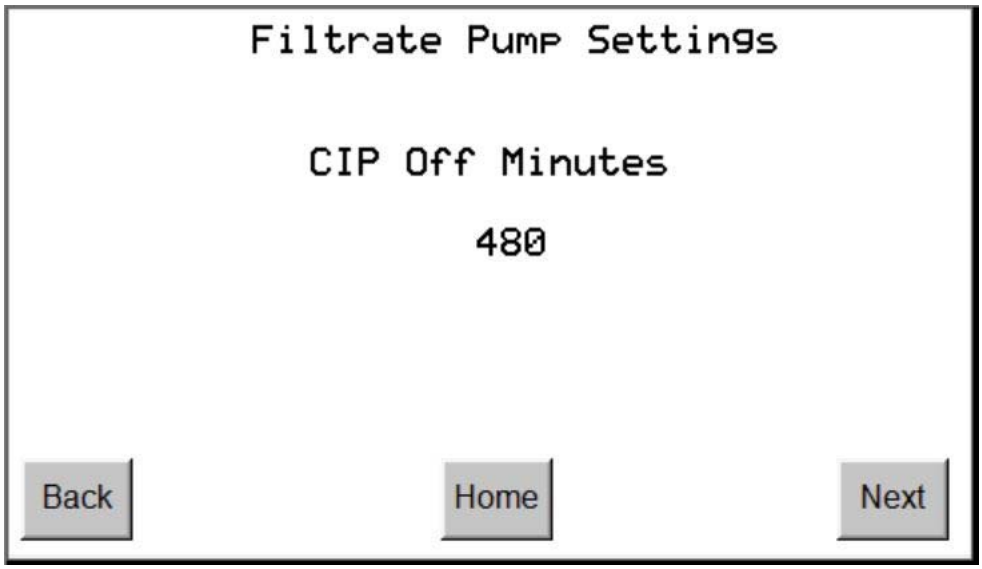


Figure 8. Filtrate Pump Settings Screen

.

e. Short Term Relaxation Period Settings

The Short Term Relaxation Period Screen allows the operator to set the filter pump timer settings during the STRP. The "Filter Time Minutes" field sets the time that the filter pump will run before turning off for a short term rest period. The value is input by pressing the number field and inputting the value using the numeric keypad. The "Current Filter Time" field displays the time in minutes that has elapsed when the filter pump is running during a filtration cycle.

The "Relax Time Minutes" field sets the time that the filter pump will remain off during the STRP. The "Current Relax Time" displays the time elapsed in minutes during the STRP.

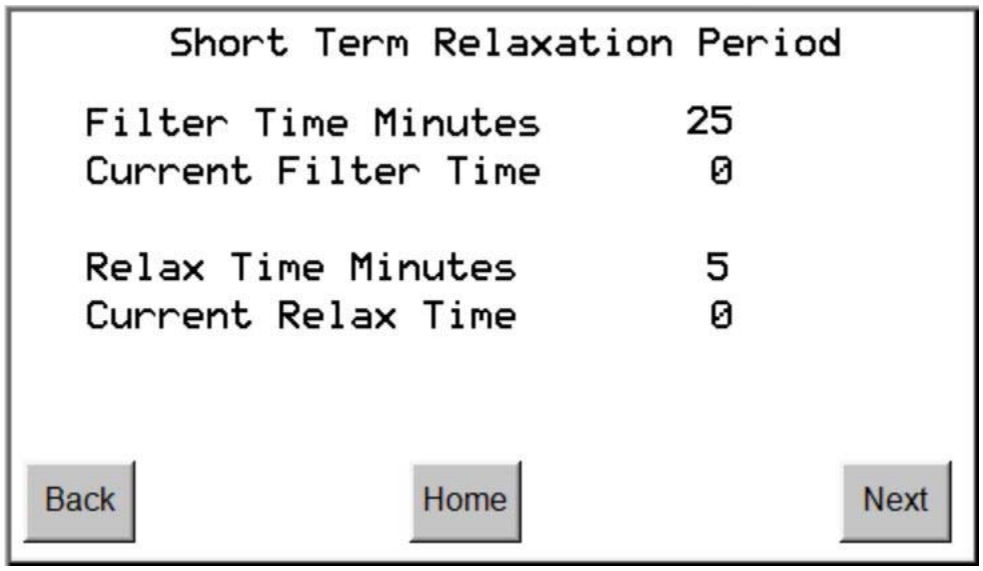


Figure 9. STRP Settings Screen

f. Vacuum Settings

The Vacuum Settings screen allows the operator to set up the control system for the specific vacuum transmitter supplied. A vacuum sensor transmitting a 0-10V analog signal will be scaled to the range of the sensor. For example, a vacuum transmitter with a range of 0-15 PSI where 15 PSI corresponds to a 10V signal will be set up using values displayed in the "Vacuum Sensor Min" and "Vacuum Sensor Max" fields.

The vacuum sensor measures the suction pressure on the inlet of the filter pump. The suction pressure is an important parameter to monitor as an excessive vacuum will damage the membrane filters. **The maximum vacuum that the supplied BioBarrier membrane filter can tolerate is 7 PSIG. This value needs to be input on the Vacuum Settings screen.** A lower maximum threshold can be used to minimize the possibility of damaging the membrane. When the "Vac Max" input value is exceeded for the measured vacuum, the filter pump will stop operating, and the system will generate an alarm condition. The "Vac Min" input setting needed may vary with the installation conditions such as location of the filter pump. This value should be set to a reasonable minimum during the initial startup of the treatment system. The "Vac CIP" input value is used to alert the operator to an increasing vacuum measurement, which can indicate the need for a clean-in-place procedure. This value should always be somewhere between the "Vac Min" and "Vac Max" values. The "Vacuum debounce time" field is set as the time in seconds that the measured vacuum must exceed the "Vac Max" setpoint before the alarm condition is triggered. Five seconds is a typical value for this setting.

Note: Make sure that the input values for the vacuum settings are given in the correct units for the range of the vacuum sensor used and are consistent with the required operating conditions of the filter pump and membrane filters.

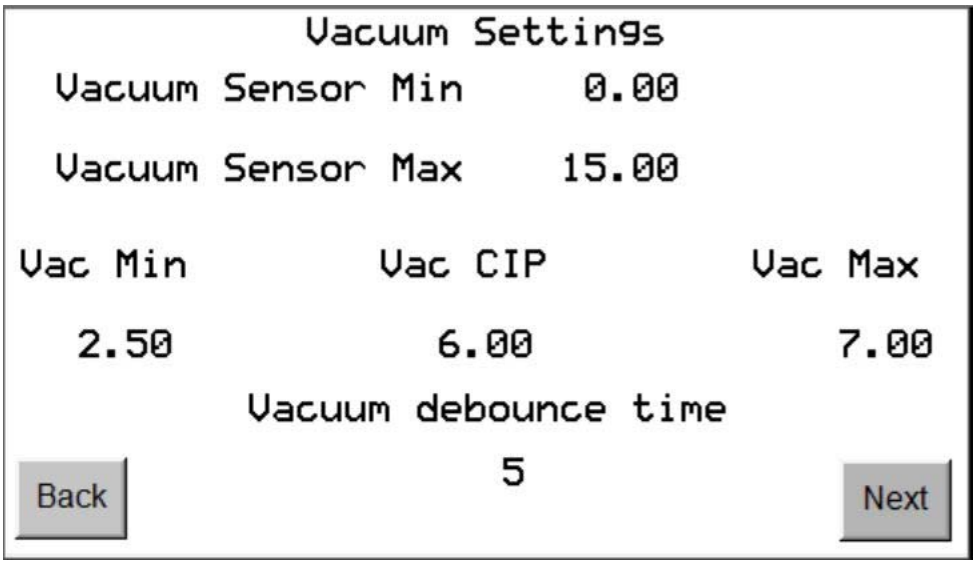


Figure 10. Vacuum Settings Screen

g. Long Term Relaxation Period Settings

The Long Term Relaxation Period settings screen defines the blower operation timer settings for the LTRP condition. Typical values for the LTRP blower timer settings are 30 minutes on and 90 minutes off. The values are set by pressing the number fields corresponding to the "Blower Run Time Minutes" and "Blower Off Time Minutes" labels. The "Current run time" and "Current off time" fields display the time elapsed for the blower when running or resting, respectively.

Figure 11. LTRP Settings Screen

h. Time and Date Settings

The time and date can be set using the last settings screen. The time and date are set using the "Inc" and "Dec" buttons below the values for each time and date component.

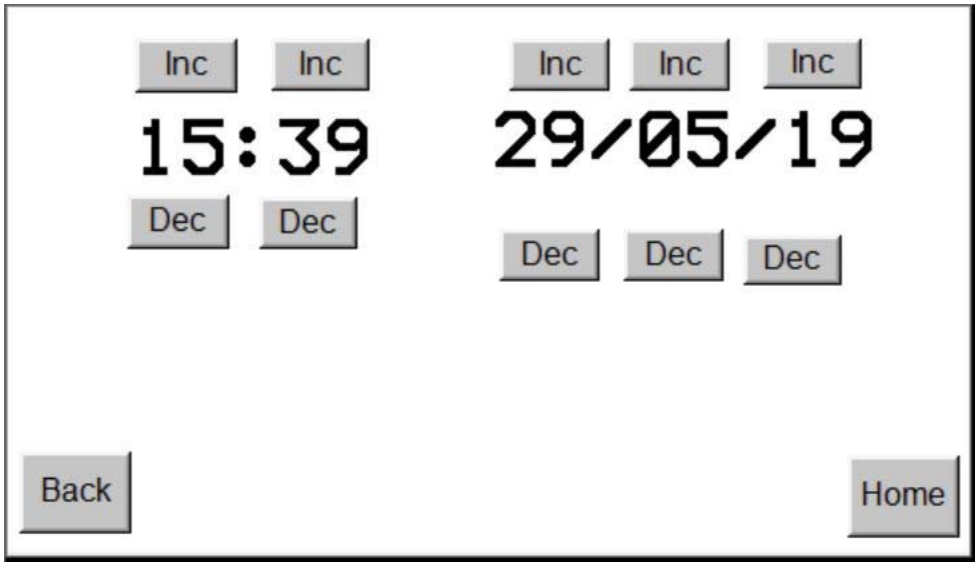


Figure 12. Time and Date Settings Screen

4. Operation

a. Blower Operation

The Blower operation screen presents the operator with two buttons labeled “Auto/Manual” and “Run/Stop” along with several status indicators.

The “Auto/Manual” button enables and disables the blower timer settings for the Long Term Relaxation Period. The status indicator below the button will display “Auto” and be colored green when the automatic mode for the blower is enabled. The indicator will display “Manual” and be colored red when the manual mode is enabled.

The indicator to the right of the “Auto/Manual” button will display “Blower Running” and be colored green when the blower is on, and it will display “Blower Stopped” and be colored red when the blower is off. The motor starter indicator for the blower will display “Starter OK” and be colored green if the motor starter overload is not tripped. If the overload is tripped, the indicator will be colored red and display “Starter Trip”. The thermal shutoff indicator for the blower motor displays “Thermal OK” and is colored green when the thermal shutoff switch is inactivated and will display “Thermal Trip” and be colored red when the thermal shutoff switch is activated. The “Run Mode” or “Stop Mode” indicator below the “Run/Stop” button displays the current state of the “Run/Stop” button. The “Run/Stop” button can be used to turn the blower on or off during manual mode.

The “Run” and “Rest” fields display the blower timer settings in minutes set in the Blower Settings screen on the top number fields for each label and display the current run time or rest time of the blower in the bottom fields.

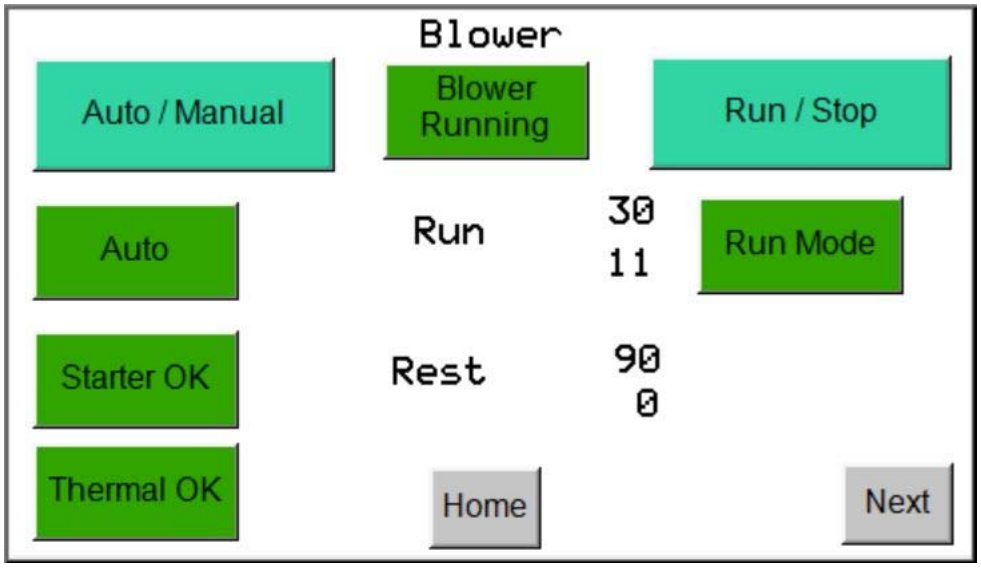


Figure 13. Blower Operation Screen Auto Mode

Figure 14. Blower Operation Screen Manual Mode

b. Float Switch Status

The float switches in the processing tank can be monitored on this screen. The float labels and corresponding digital input labels are shown next to indicators that display the current status of each float, where "Off" and red indicators are displayed for a float in the "down" position. The float switch debounce times in seconds that were set on the Float Settings screen are shown in the top number fields for each float, and the current time that a float has been in the "On" position is displayed below each setting value. Indicators for the debounced float input signals are displayed on the right.

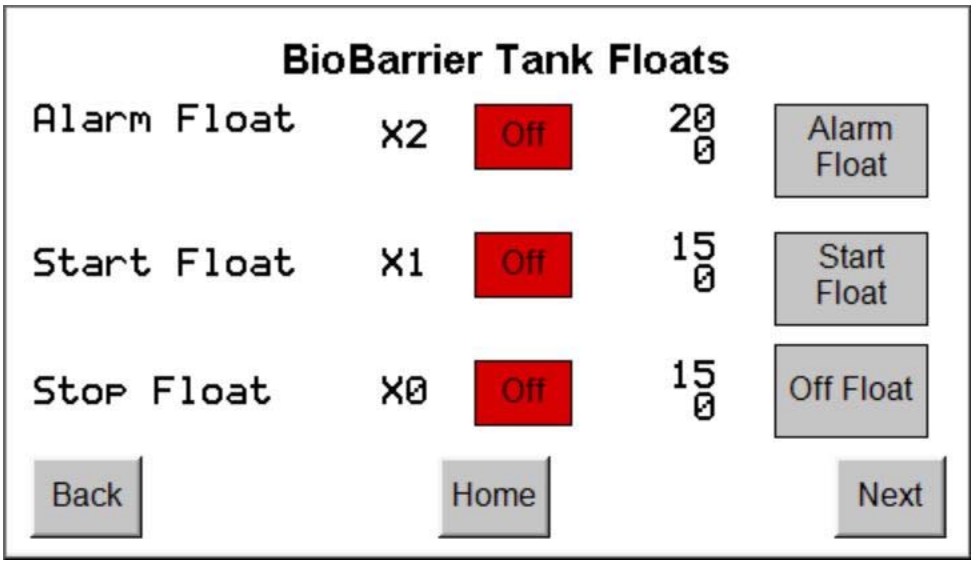


Figure 15. Float Switch Status Screen

c. Screening Tank Pump Operation

This screen allows the operator to manually operate the screening tank pump using the “Run/Stop” button with the corresponding status indicator given below the button. **Do not run pump dry. Be sure to stop the pump on the HMI screen when done.**

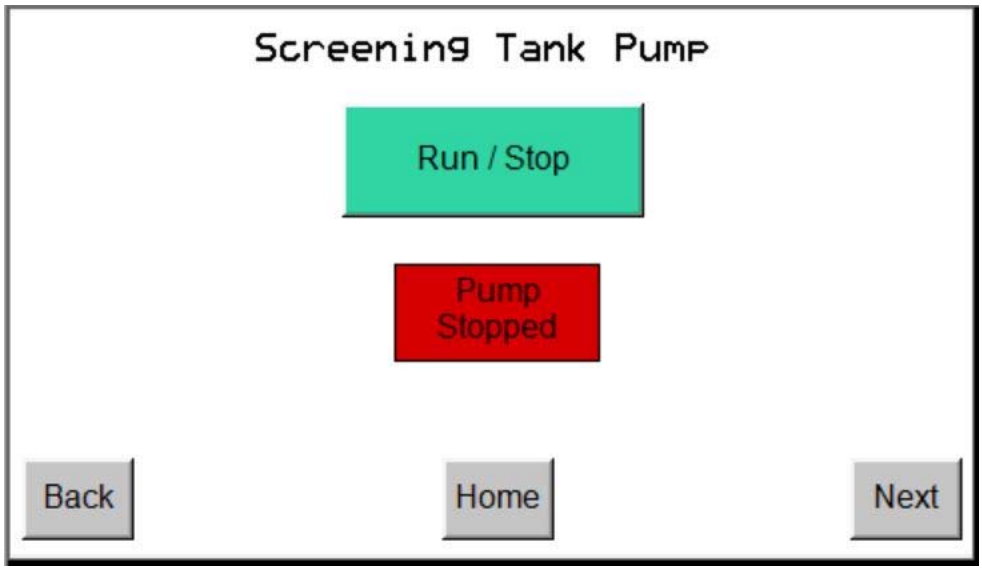


Figure 16. Screening Tank Pump Operation Screen

d. WAS Pump Operation

The WAS pump operation screen allows the operator to control the WAS pump on the timer settings programmed in the WAS Pump Settings screen by pressing the “Auto/Manual” button to change the indicator lamp below this button to display “Auto”. The indicator below the “Run/Stop” button displays the status of the manual “Run/Stop” switch. The indicator below that shows the status of the blower. **The WAS pump will be prevented from operating if the blower is stopped.**

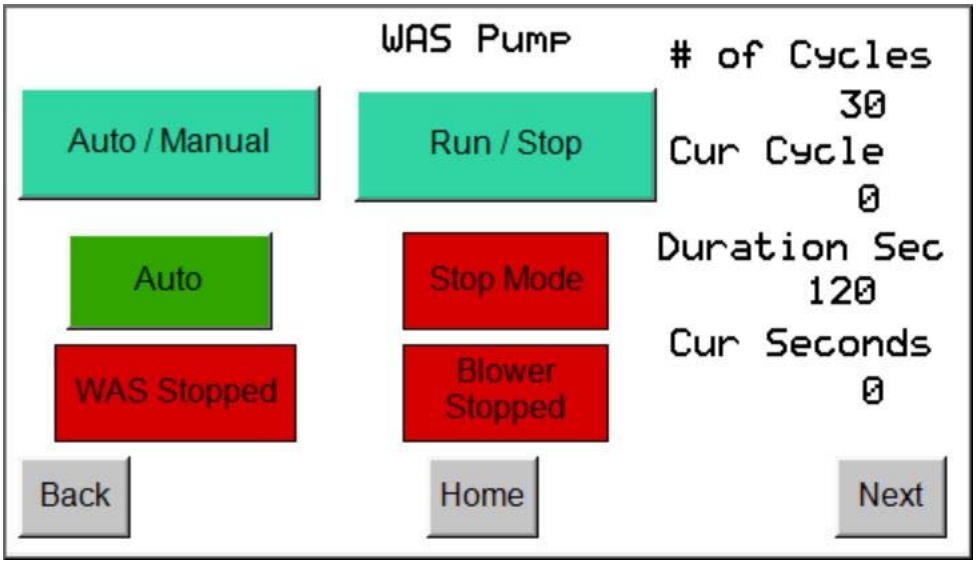


Figure 17. WAS Pump Operation Screen

e. Filtrate Pump Operation

The filtrate pump operation screen allows the operator to control and monitor the filtrate pump. The filtrate pump should normally operate in “Auto” mode which controls the pump based on the float switch positions. The filtrate pump is prevented from operating when the blower is not running or when the maximum vacuum setting is exceeded. A blower status indicator lamp is shown on this screen along with a graphical display of the vacuum reading on a real-time bar graph and numerically to the right of the graph.

Below the blower status indicator are indicators that display “Filter Mode” (top indicator) and “STRP Mode” (bottom indicator) when each of the corresponding events occur. The number below each indicator displays the time elapsed in minutes since the start of the respective mode.

Two indicators and a button are shown next to the filter pump operational status indicator near the bottom of the screen. If the button labeled “CIP On” is pressed, the indicator displaying “CIP Off” in blue will change to display “CIP On” in yellow. The filtrate pump will remain off for the amount of time set in the Filtrate Pump Settings screen unless the “CIP On” button is pressed again. The “CIP OK” indicator changes to display “CIP Time” in blue if the “CIP Vac” setting is exceeded for the measured vacuum.

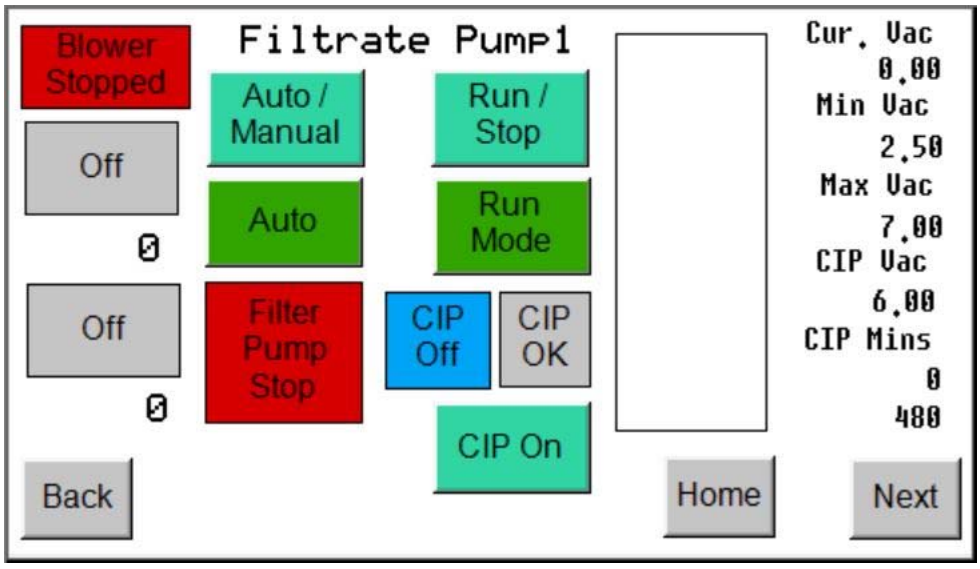


Figure 18. Filtrate Pump Operation Screen

f. Run Data/Hours Operational Summary

The last screen in the Operation screens displays run times in hours for the system overall and each motor component. The number of batches filtered is displayed in the “Process Cycles” field.

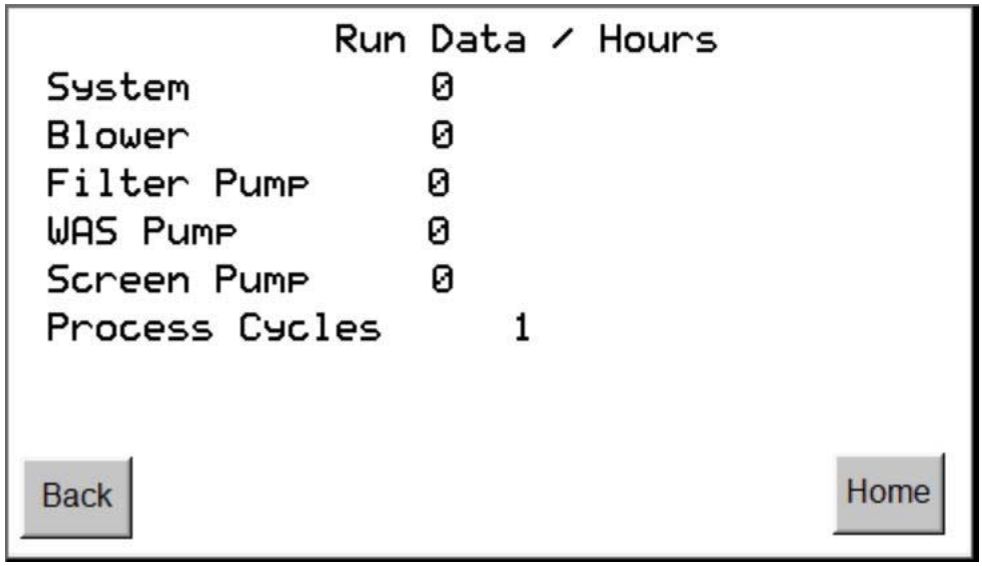


Figure 19. Run Data Operation Screen

5. Alarms and Event Log

Pressing the “Alarms” menu button on the home screen allows the operator to view the alarm status for the blower, high-water float switch, and filtrate pump vacuum sensor. Each alarm indicator will be green if there is no alarm condition and red if there is an alarm condition. The “Alarm Silence” button shuts off the alarm buzzer but does not change the alarm status indicators.

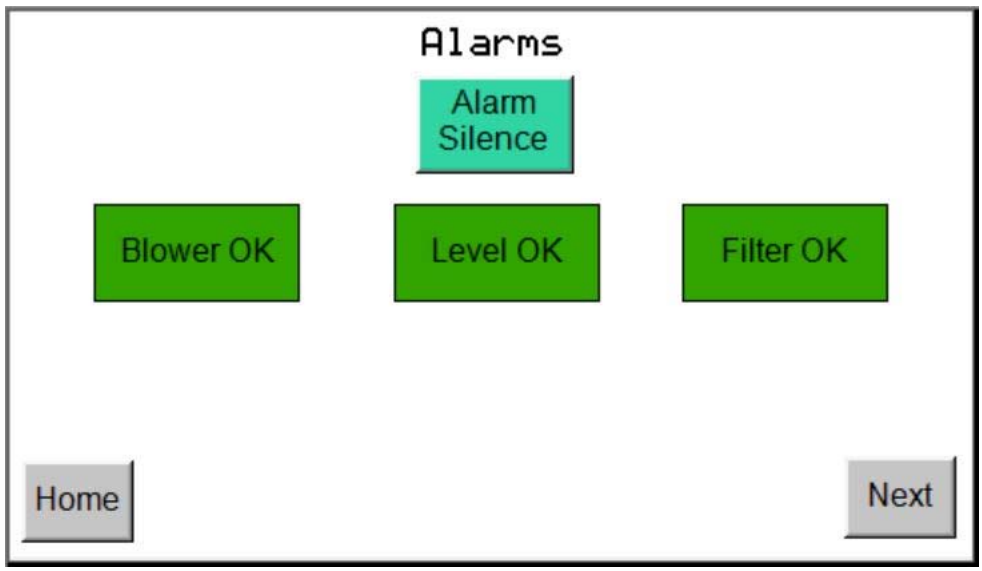


Figure 20. Alarm Status Screen

The Events Log screen displays the historical events for the operation of the system, including alarm triggers and changes in operation status such as the start and end of a filtration cycle or manual changes to system operation such as the CIP procedure. The log can be cleared by pressing the “Clear Log” button.

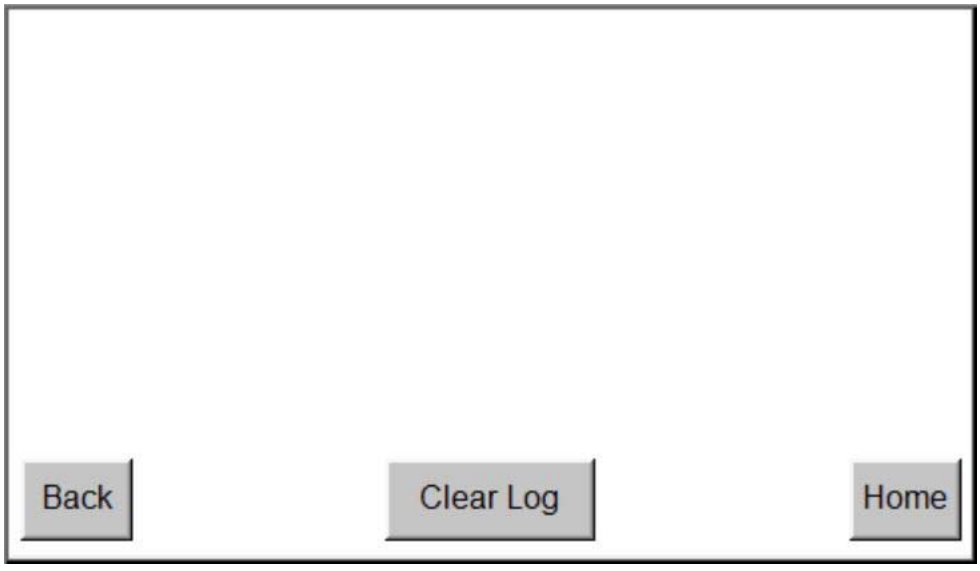


Figure 21. Event Log Screen