MicroClear®

MANUAL

FILTER MCXS2 and MCXL2
COMPACT FILTER HOUSING MA-/MB-SERIES

Directions for Installation, Operation and Maintenance

Revised: 12.10.2015

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MicroClear®

MANUAL

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1. Product Specification

1.1. Designated application

The wastewater treatment plant must be operated with specified wastewater only.

For membrane bioreactor applications the feed water may not contain any materials harmful for, or even kill, the micro-organisms in the biological treatment stage. Do not feed the plant with disinfectants or similar substances.

Only specified wastewater with specified capacity is permitted to be fed into the plant. It is not permitted to feed the plant with excessive amounts of:

- surface water,
- cooling water, or
- rain water

as this will lead to plant overloading and malfunction.

The unit is intended exclusively for the above specified use. Any additional use or re-building of the equipment without prior written approval by the manufacturer does not comply with the intended use. The manufacturer will not assume liability for consequential damage to the plant or the environment. The operator alone will bear the risk.

Do not start up the plant before it has been ensured that all safety devices are completely mounted and operable, and that the plant complies with the rules.

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1.2. General safety instructions

This **Installation, Operating and Maintenance Manual** has to be kept available at all times. Any person who has to perform work on the wastewater treatment plant must have access to this manual.

In addition to this manual, common legal instructions in the sense of the labour protection law and ordinance regulating the use of tools have to be available.

As this manual contains fundamental instructions to be observed when installing, operating and servicing the filter housing, the responsible staff must read the instructions prior to machine installation and start-up. Not only the general safety instructions contained in this chapter have to be observed but also the special safety instructions added under the main items.

1.2.1. Definition of safety, warning and instruction signs

General warning sign

This symbol will accompany all important instructions or warnings associated with risks of life or limb as well as severe damage to equipment. Follow these instructions and proceed carefully! At the same time, follow all applicable laws, general safety and accident prevention regulations.

Attention symbol

Special attention is required to ensure compliance with instructions concerning correct operating sequences to prevent damage to the plant or its function.

Notice symbol

This symbol is found where an action or a procedure is recommended to ensure the correct handling of equipment or units.

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Safety and instruction signs must be strictly followed and should be directly attached to the plant.

These signs should be kept in absolutely readable condition. Signs or labels that have become unreadable must be replaced immediately.

1.2.2. Obligation and duty for operational care

To achieve operational safety, it is necessary to obey the following procedures. It is the operator's obligation to plan these procedures and control their implementation.

The operator must especially ensure that

- Equipment is employed according to its intended use (see chapter "Product Specification"). Any use not in compliance with the plant's specified intended use will invalidate the warranty.
- Regular maintenance and the checkups are carried out according to the chapter "Maintenance". The operator is responsible for the effluent quality.
- The filter housing should be operated only in a perfect ready-to-operate condition.
- This operation and maintenance manual is permanently available on site in complete and legible condition.
- Only sufficiently qualified and authorized personnel are in charge of unit operation, maintenance and repair.
- Any safety or warning symbols attached to the plant remain there in a legible condition.
- All relevant data is recorded at least once per day, especially filtration pressure and effluent output.

1.2.3. Qualification of operating and maintenance staff

Only well-trained and briefed persons who know this manual and act according to this manual are authorized to operate the unit. The individual areas of responsibility of operating staff must be defined clearly.

The training of personnel must be held in the beginning under the supervision of an experienced person. Successfully completed training and briefing must be confirmed in writing.

Non-observance of this instruction will invalidate any warranty.

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Any person performing work on the wastewater treatment plant must read this installation, operation and maintenance manual and confirm by signature that the manual has been completely understood.

Maintenance personnel must be trained specifically for plant maintenance works, beyond the standard of knowledge that the operating staff has already, preferably well trained and experienced staff.

1.3. Safety instructions for installation, inspection and maintenance

The following points should be recalled and ensured by the operator during the installation, inspection or maintenance works:

- Switch off all current-carrying equipment before starting work.
- Sealed or closed rooms of the wastewater treatment plant which need to be entered for service and maintenance have to be aerated in order to prevent a dangerous explosive atmosphere, lack of oxygen and presence of harmful concentrations of gas or vapour.
- Follow the instructions from the plant manufacturer for the exact work procedure.

It is in the operator's own interest to clean the plant prior to working on it, this helps to prevent the danger of infections.

When cleaning the plant, avoid direct contact with wastewater, organic material, etc. Always wear protective clothing, e.g. waterproof protective gear, boots, gloves, to keep these materials from your body. If possible, also wear face protection.

Do not use a high pressure cleaner but only a soft water jet.

Before starting the machine again, check the items mentioned in chapter "Starting up". Reattach all equipment or components completely to their original place and assure that they are properly and completely reattached.

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2. Installation

2.1. Preparation of the installation

Observe once more the following instructions when installing the equipment to avoid any damage to the equipment and other physical damage.

- Only qualified persons are permitted to perform installation work, observing the safety instructions.
- Check the unit for transport damage prior to starting any installation work.
- Make sure only authorized persons have access to the working area and that installation work does not endanger any other persons.
- Read also the chapter "General Safety Instructions".

2.1.1. Acceptable environmental conditions

MicroClear® filters must be protected against frost. In operation, the optimum working temperature is between 15 and 35 °C. The use of filters at lower temperatures is possible, but results in less flux (please contact us for an exact estimation).

2.1.2. Requirements on the minimum dimensions of the tank

Following dimension details of the tank should be used as a design guideline.

Filter housing	No. of filters	Filter-area [m²]	Typical max. flow* [m³/day]	Size of the filter housing [L x W x H in cm]	Min. size of the filtration tank [L x W x H in cm]	Min. water depth [cm]
MA03-S	1 MCXS2	3.5	2.0	28.3 x 32 x 68.4	50 x 50 x 150	120
MA03-M	2 MCXS2	7	4.0	28.3 x 32 x 117.4	50 x 50 x 200	170
MA03-XL	1 MCXL2	8	5.0	43 x 35 x 64.5	70 x 50 x 150	120
MA03-XL2	2 MCXL2	16	10.0	43 x 35 x 113	70 x 50 x 200	170
MB2-S	4 MCXL2	32	20.0	59.8 x 49.6 x 135.5	100 x 100 x 200	170
MB2-M	6 MCXL2	48	30.0	80.8 x 49.6 x 135.5	120 x 100 x 200	170

* Values depend on the wastewater characteristics and regular chem. cleaning

It is important to maintain a minimum distance between filter housings and the tank's side wall to ensure a low pressure loss for the runoff of water that rises inside the filter housing.

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2.2. General instructions

Installation must be carried out in accordance with these instructions if installation is not part of the supply contract with newterra GmbH, or an authorized trader or maintenance company. If the installation is not performed according to this installation, operation and maintenance manual, newterra GmbH cannot accept responsibility for incorrect offloading or installation.

Installation should be performed by qualified and experienced personnel.

The following actions should be carried out in order to maintain optimal operation of the MicroClear®- filter cassettes and compact MA/MB- series:

- Completely read this manual. It contains important information how to prevent damage caused by lack of knowledge.
- Make sure that the tank is leak-proof and has a correct dimension according to the guidelines of newterra GmbH.
- The tank must be emptied and cleaned before beginning the installation work inside the tank.

2.3. Assembly

Be careful not to mix up any lines as air in the permeate line would destroy the module.

In some cases the membrane surface can stick together on new filters. Don´t pull the plates apart, otherwise the active layer will be damaged.

Sticking membranes are no quality issue, the membrane will come apart as soon as the surface ist wet.

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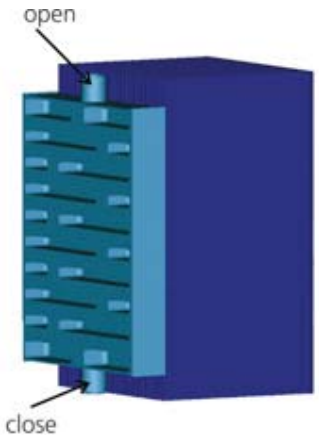
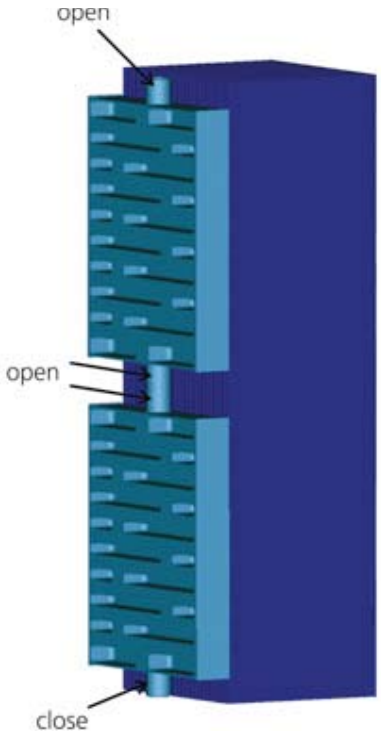
2.3.1. Arrangement of the filters

Individual filter (one layer)



- Check the permeate nozzles of the filter. The open nozzle must be used at the top side of the filter.
- Plug the lower nozzle according to the instructions below.
- Attach and fix a hose with inner diameter 25 mm to the open nozzle.
- Connect the other end of the hose with the permeate extraction unit.
- If required, use reduction.
- Operate the MicroClear cassettes only in original MicroClear® filter housings.

Arrangement of filters in multiple layers



- Check the open permeate nozzles of the filters.
- The filter to be used at the bottom of the stack must have only one open nozzle. Plug the lower nozzle according to the instructions below.
- Make sure that the filter to be used at the top of the stack has open nozzles on both sides.
- Arrange the filters as shown in the illustration.
- Connect and fix the open nozzle of the bottom filter with the open nozzle of the top filter by using a hose with inner diameter 25 mm. Alternatively use a 25 mm PVC connector, see below.
- Attach and fix a hose with inner diameter 25 mm to the open nozzle of the top filter and connect with the permeate extraction unit.
- If required, use reduction.
  Operate the MicroClear cassettes only in original MicroClear® filter housings.

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2.3.2. Installation of a plug

Notice

From the factory, the MicroClear® filter bottom nozzle is open.
To close, follow the instructions given below!
Needed parts are given with each single filter.

a. Install 2 o-rings (15,6 x 1,78, EPDM) into the two grooves of the plug.

b. Add lubricant certified for connecting systems in drinking water to the plug and the o-rings.

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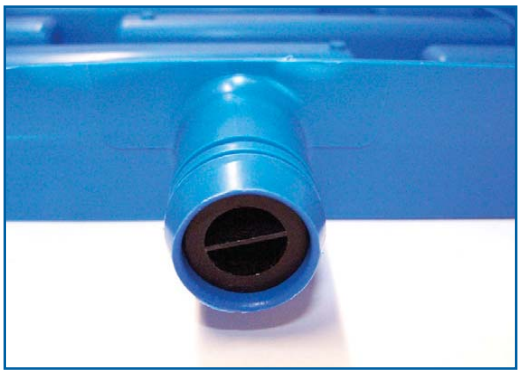
c. Insert the plug with the o-rings into the nozzle. Press gently and make sure, that the o-rings stay in the grooves and are not squeezed away.

d. Press the plug all the way into the nozzle until it cannot be moved any further. The friction holds the plug in place up to a tested back-flush pressure of 1,5 bar (max. allowable back-flush pressure is 0,1 bar). If necessary, the plug can be removed with pliers.



e. The MicroClear® MCXL is now ready for use.

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2.3.3. Connection of two MicroClear® using a PVC fitting and O-rings

MicroClear® filters can be connected with Standard PVC fittings nominal size 25 mm. The O-rings made of EPDM have a size of 21,95 x 1,78 mm and can be ordered with Art.-No. 30100360. It is mandatory to use a lubricant as shown above for the mounting of the O-ring and the fitting.

Permeate withdrawal is always from the top of the filter! Filters are mounted in upward direction into a closed frame. Aeration is from below.

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3. Starting Up

3.1. Procedure of starting up

3.1.1. Checks prior to operation

1. Check the horizontal alignment of filter housings.
2. Check that filter modules and filters are secured against buoyancy.

3.1.2. Clear water test

1. The filtration tank should be filled with clear water prior to starting the filtration unit.
2. Switch on the blower and check for an even distribution of air across the complete filter area.
3. Switch on permeate removal at a filtration pressure of 0.05 bar.

If all components function normally, empty the tank and fill with mixed liquor.

3.1.3. Prerequisites for operation with sewage

	Make sure that the biomass concentration of activated sludge is below 12 g/l at start-up.
	Screening the water with a 2 mm punchhole screen is essential to prevent the build-up of a blockage beneath the filters. This could result in an uneven distribution of air and damage filters. Industrial water and an unusual amount of fibres require special design for pre-treatment.
	No untreated wastewater should enter the membrane. Make sure water is completely biologically treated before it gets to the membrane.

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4. Operation and Control

4.1. Operating a new filter

When starting the system, the trans-membrane pressure (TMP) should be set to max 0.07 bar in order to prevent irreversible blockage of the membranes. After one to two days the suction pressure can be increased until the design output is reached. The run-in period, due to a so-called “dirt layer” that develops, is terminated when output of the unit will only decrease over a period of a couple of days.

4.2. Continuous operation

4.2.1. Filtration pressure

In continuous operation, filters are operated with a transmembrane pressure (TMP) of 0.1 to 0.15 bar. Exact regulation of suction pressure is essential for long-term operation. Fluctuating pressure should be avoided as it leads to an early blocking of membranes.

The filtration pressure, filtrate flow and air flow must be recorded daily and given to the manufacturer in the case of guarantee claims.

4.2.2. Temperature

The filter can be operated within a wide range of ambient temperature. However, the following maximum limit should be observed.

Maximum short term	50 °C
Maximum long term operation	40 °C
Standard operation	15 °C - 35 °C

Furthermore the filter may not be exposed to frost.

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4.2.3. Aeration

The air blower for scouring must always be in operation when the filtration process is running. A failure in blower operation will lead to severe blockage of the membranes.

The recommended value for the amount of air for scouring the membrane at operating pressure is given in the following table.

“At operating pressure” means, that the resistance of the water column (e.g. 2 m = 200 mbar) has to be added to the resistance of the diffuser (e.g. 80 mbar). For this example, the blower has to deliver the following amount of air at 280 mbar (see blower curve).

Filter module	Aeration rate (Nm³/h)		Flange connection [DN/NPS]
	Relax	Filtration	
MA03-S, MA03-M	6	3	19 / ¾”
MA03-XL, MA03-XL2	10	5	19 / ¾”
MB2-S	20	10	80 / 3”
MB2-M	30	15	80 / 3”

Exceeding these values will lead to abnormal wear or damage of the filters or of the diffusers.
The aeration must be switched off for 20 minutes per day to allow for a relaxation of the diffuser membrane.

The air blower for scouring must always be in operation when the filtration process is running. A failure in blower operation will lead to severe blockage of the membranes.

Exceeding these values can lead to abnormal wear of the filters or of the diffusers.

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5. Maintenance

Never expose the filter to frost, dust, rain or direct sunlight.

5.1. Cleaning of the MicroClear® Filter

If permeability has decreased below 50 l/m²hbar, a basic chemical cleaning of filters is necessary (depending on the application once or twice per year). The filter must be put into a cleaning tank, in which the cleaning chemicals are filled. In the case of an external filter setup, the filter tank must be emptied and filled with clear water.

Maintenance is only to be carried out by qualified and trained personnel! Chemicals can lead to serious injuries. Always wear protective glasses, clothing and, if possible, gloves. Obey the safety data sheet of the chemical manufacturer!

The following procedures are recommended for chemical cleaning of the ultrafiltration membrane. Keep the working temperature between 20 to 25 °C for all steps.

- Step 1: Immerse the filter inside a tank of NaOH solution, pH 11 for 3 hours.
- Step 2: Immerse the filter inside a tank of NaOCl 200 ppm (max. 500 ppm) (calculated as active chlorine) for 8 hours.
- Step 3: Rinse the filter with tap water.

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Rinse thoroughly with clear water to avoid the formation of chlorine gas!

- Step 4: Immerse the filter inside a tank of citric acid, pH 2 for 1 hour.
- Step 5: Finally, check permeability with tap water.

Normal permeability after cleaning: 150 to 300 l/m²hbar. If this value is not attained, repeat cleaning or use different detergents after contacting newterra GmbH.

5.2. Spare parts

Common spare parts such as permeate collector pipe, air diffuser, or filter module can be ordered directly from newterra GmbH or from a related partner of newterra GmbH.

Do not use any replacement parts other than those recommended by newterra GmbH. Use of third-party parts without informing or consulting with newterra GmbH will invalidate the warranty.

5.3. Persistence of the membrane

The raw water should comply with the attached compatibility chart. Furthermore, it must be:

Lipophilic substances average	< 25 mg/l
Lipophilic substances maximum	< 50 mg/l

Silicones and solvents must be avoided completely. Long molecules in general result in membrane blockage and should be avoided. This is especially true of flocculation aids based on polymers (polyelectrolyte) and antifoaming agents. Antifoaming agents based on silicone must be avoided completely as the can block membranes irreversibly.

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MicroClear® Compatibility chart

Group		SP-Type membrane
Chlorinated solvents	Methylene Chloride, Chloroform, Carbon Tetrachloride, Chlorobezene, Trichloroethane (< 1%)	--
Esters	Ethyl Acetate, Butyl Acetate, Butyl Acrylate (< 1%)	--
Ethers	Ethyl Ether, Polyethylene Oxide (< 1%)	--
H_2O_2	< 2000 ppm	++
Inorganic acids	HF, HCl, H_2SO_4	pH 0 - 14
Ketones	Acetone, Methyl Ethyl Ketone	--
NaOCl	< 500 ppm, 50.000 ppmxh	++
Organic acids	Sulfamic Acid, Formic Acid, Oleic Acid, Sulfonic Acid, Acetic Acid, Acrylic Acid, Lactic Acid	pH 0- 14
Phenols		--
Silicones		--
Alcohols	Ethanol, Butanol, Isopropranol (< 50%)	
Aldehydes	Formaldehyde (< 1%)	++
Alkali		pH 0- 14
	Dimethyl Formamide, Dimethyl, Acetamide, Dioxane, N-Methyl, Pyrrolidone, Tetramethyl Acetamide	--
Aprotic solvents	Benzene, Toluene, Xylene, Anthracene, Naphathalene, Gasoline	--
Aromatic hydrocarbon	Methoxyethanol, Ethoxyethanol, Buthoxyethanol	?

++ = very good
+ = good
- = fair
-- = not recommended

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6. Additional information

If any additional information is required, please contact newterra GmbH, contact see below.

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aeration parts for all brands

DIFFUSER EXPRESS

Diffuser Express Parts & Tools

Installation, Operation & Maintenance

MANUAL

For:

T-Type Disc Diffusers

Environmental Dynamics International
5601 Paris Road
Columbia MO 65202

P: +1-573-474-9456
www.EnvironmentalDynamics.com

M-CP005D-EN
Rev A

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Notice

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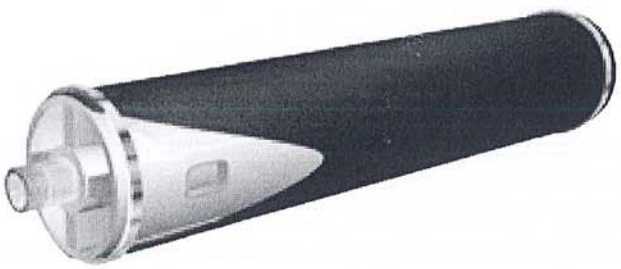
PRODUCT SPECIFICATIONS

FlexAir™ T-Series Tube Diffuser

Fine Bubble Flexible Membrane



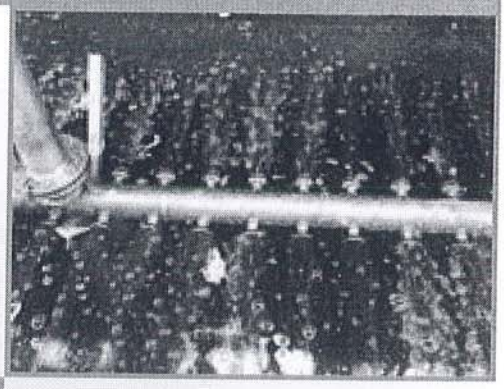
- 62 mm and 91 mm diameter tube diffusers with standard length options from 250 mm to 1000 mm
- Choice of PVC or CPVC material diffuser tubes available
- Stainless Steel ¾" male pipe thread or plastic ¾" female pipe thread connections available
- Premium quality membranes available in EPDM, PU, PTFE Matrix™ or PTFE-coated, silicone, or other materials
- Triple-check design minimizes entry of liquid/solids into air feed piping
- High-capacity membrane option available for maximum airflow and low operating pressure
- Non-buoyant flo-thru design for reduced uplift and stress on mounting connection

Model	Membrane Performance	Design Airflow (membrane)		Overall Length (membrane)		Active Surface Area (membrane)		Dry Weight (diffuser)		Net Operating Buoyancy (diffuser)	
		scfm	m^3_N/h	in	mm	ft^2	m^2	lb	kg	lb	kg
Magnum 91–1003	Micro	0–20	0–32	39.5	1003	2.64	0.245	5.4	2.4	1.7	0.76
	High-Cap	0–35	0–55	39.5	1003	2.64	0.245	5.4	2.4	1.7	0.76
Magnum 91–762	Micro	0–15	0–24	30.0	762	1.97	0.183	4.3	2.0	1.2	0.55
	High-Cap	0–26	0–41	30.0	762	1.97	0.183	4.3	2.0	1.2	0.55
Magnum 91–502	Micro	0–9	0–15	19.8	502	1.25	0.116	3.1	1.4	0.73	0.33
	High-Cap	0–17	0–26	19.8	502	1.25	0.116	3.1	1.4	0.73	0.33
Standard 62–1003	Micro	0–13	0–21	39.5	1003	1.71	0.159	3.9	1.8	1.9	0.85
	High-Cap	0–23	0–36	39.5	1003	1.71	0.159	3.9	1.8	1.9	0.85
Standard 62–762	Micro	0–10	0–15	30.0	762	1.27	0.118	3.4	1.5	1.1	0.50
	High-Cap	0–17	0–27	30.0	762	1.27	0.118	3.4	1.5	1.1	0.50
Standard 62–650	Micro	0–8.0	0–13	25.6	650	1.07	0.099	3.2	1.4	0.76	0.35
	High-Cap	0–14	0–22	25.6	650	1.07	0.099	3.2	1.4	0.76	0.35
Standard 62–610	Micro	0–7.6	0–12	24.0	610	1.00	0.092	3.1	1.4	0.63	0.29
	High-Cap	0–13	0–21	24.0	610	1.00	0.092	3.1	1.4	0.63	0.29

Environmental Dynamics International

FlexAir™ T-Series: Tube Membrane Diffuser

Processes:
Biological Aeration
Activated Sludge Processes
Oxidation Ditch
Sequence Batch Reactors (SBR)
Membrane Bio Reactors (MBR)
Moving Bed Bio Reactors (MBBR)
Sludge Stabilization/Digestion
Package Plants

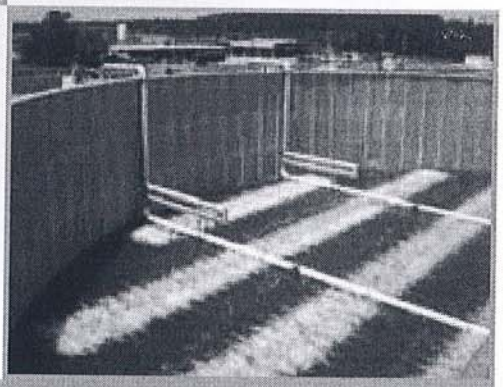


Applications:
Municipal Wastewater
Industrial Wastewater
Fixed Grid Systems
Lift-Out Systems
Floating Systems
Tank Mixing
High Oxygen Transfer
Low Head Loss

Industries:
Food and Drink
Dairy and Cheese
Pulp and Paper
Oil and Gas
Animal Processing
Leachate
Energy and Power
Pharmaceutical

EDI has demonstrated success in more than 7,000 installations in over 100 countries worldwide—serving over 400 million people.

Please contact your local office below for details of our proven products, systems, and processes.



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Storage Instructions

Receiving Inspection

R.2015-06-17

(FOB EDI only)
Inspect shipments for damage upon receipt. The recipient/receiver is responsible for all damages. EDI offers to act on behalf of the recipient / receiver in filing a claim for damage incurred during shipment. To file a claim against the freight company, a damage report must be submitted to EDI within 24 hours of delivery.

(FOB Jobsite only)
Inspect shipments for damage upon receipt. Any damages observed upon receipt must be noted with the freight company at the time of delivery and reported to EDI within 24 hours of delivery. EDI will repair or replace damaged goods when notified within this notification period.

(Ex-Works only)
Inspect shipments for damage upon receipt. The recipient/receiver is responsible for all damages. To file a claim against the freight company, file a damage report directly with the shipping company.

Note
A full inventory of shipped components shall be completed within 14 days of the receipt of shipment. Any deficiencies in the shipment that are clearly deemed to be the result of EDI will be reconciled by EDI when notified within this time period.

Pre-Installation Storage Requirements

R.2015-06-17

Pipe sections are furnished with end caps to minimize the entry of foreign materials (dirt, debris, etc.) into the pipe. Any foreign materials that are allowed to contaminate the pipe will need to be removed from the system prior to installation and start-up.

Piping Storage Requirements:

- Store Piping on a flat surface.
- Accessories must be protected from excessive moisture and rain.
- Storage is acceptable provided the ambient air temperature is below 140°F (60°C).
- Avoid impact loads and moisture when storing below 32°F (0°C).

Note
Piping and components are to be shaded from sunlight if stored for longer than 6 months.

Diffuser Storage Requirements:

- Boxes must be protected from excessive moisture and rain.
- Storage is acceptable provided the ambient air temperature is below 100°F (40°C).
- Shade or move Components indoors if the Ambient air temperature exceeds 100°F (40°C).
- Indoor storage is acceptable if the ambient air temperature does not exceed 125°F (52°C).

Note
Storage of diffuser membrane components shall be limited to one year.

Post-Installation Storage Requirements for a Flexible Membrane System

R.2015-06-17

If the reactor is drained and the aeration system is exposed for a short period of time (less than 4 weeks), the system shall be protected from foreign objects including but not limited to paint or weld splatter, falling objects, etc.

A gray fabric tarp should be suspended above the aeration system approximately 6" (150 mm) if the ambient air temperature is above 100°F (40°C).

Warning ⚠
Do not use any form of plastic to cover the aeration components. Plastic can create a hotter environment and/or fuse to the surface of the equipment.

If the aeration system is idle for an extended period time (greater than 4 weeks), the system should be submerged in approximately 4 feet of clean water provided the ambient air temperature is greater than 32°F (0°C).
If the ambient air temperature is below 32°F (0°C), the water level may need to be increased so that the ice layer does not contact the aeration system.

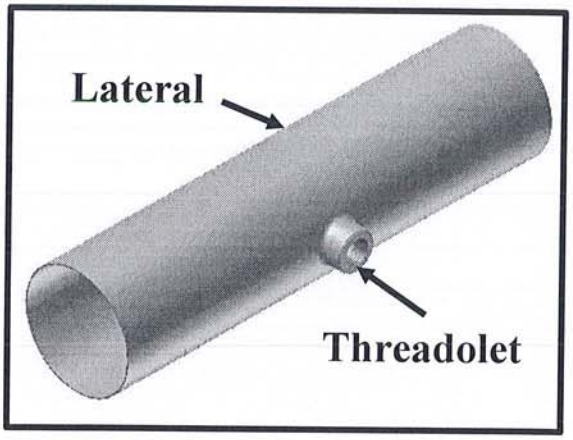
When reactivating a system where ice exists, operate the system at a minimum airflow to avoid movement of ice and maintain this airflow condition until the ice is no longer present. The water level should never be lowered if ice is present. The weight of the ice may damage the system

Installation Instructions

FlexAir T-Series Installation

R.2015-12-07

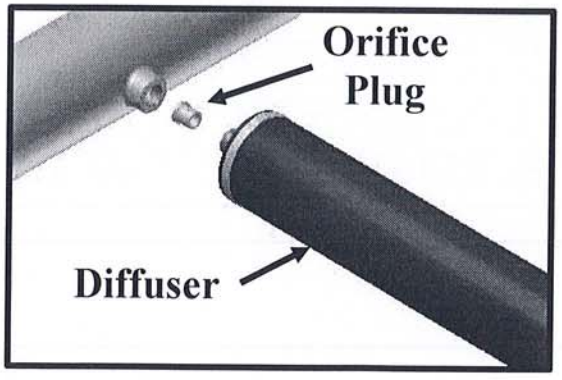
Inventory all parts to ensure no shortages and familiarize yourself with the layout drawings and installation details.



Note

PTFE thread sealant tape should be applied to all steel to steel threaded connections. EDI recommends Hercules Mega-Loc brand pipe dope on all plastic to plastic or plastic to steel threaded connections for lubricant and sealant (pipe dope containing PTFE is potentially damaging to plastic parts).

1) Apply thread sealant to the threads of the T-Series.
2) Insert the orifice plug into the T-series diffuser (if provided).



3) Thread diffuser into threadolet until hand-tight.

Note

The T-series diffuser should be oriented with the unperforated sections on top and bottom.

4) Repeat steps 1-3 for remaining diffusers.

Leveling of Diffusers

Air distribution through the aeration system is a function of the relative elevation of the individual aeration units and the leveling tolerance of the air supply piping. Excessive variation in pipe elevation (see Start-up Instructions) may result in poor air distribution during normal operation.

Start-Up Instructions

General Aeration/Mixing Systems Start-Up Instructions

R.2015-11-24

These instructions cover the general start-up requirements for the aeration system. Special start-up requirements outlined in the Engineer's specifications, contract documents, or instructions offered by EDI shall be supplementary to or take precedence over these general instructions.

General Air Piping Inspection

Contractor is to confirm the cleanliness of the air piping. If existing header piping is used, the air purge or water flush cleaning procedure is recommended prior to installation of diffuser units to remove any internal debris that may have accumulated in the header piping.

Inspect air piping and diffuser connections for loose fittings or damaged pipe. Damaged piping sections and connections should be repaired prior to commencing system operations.

Confirm that piping and diffusers are level by filling the basin with water until the diffusers are 1" to 2" under water. Diffuser elevation tolerance should be within the approved tolerance for the respective diffusers. Adjust supports as required to level the air supply piping (on which the diffusers are mounted) to within a tolerance of ±1/4".

Blower Components

See the blower installation and start-up instructions to assure all blower components are mounted properly and ready for operation. When EDI provides the blower assemblies, detailed installation and start-up instructions are provided in the blower submittal package.

Blower components should be fully installed and fully serviced prior to making final electrical connections and starting up the aeration system.

Precautions should be taken throughout system installation to minimize the discharge of airborne particles to the aeration system. As a minimum, an air inlet filter should be installed and operated during blower servicing procedures. EDI recommends a filter efficiency of 93% of 10-microns. Any solvents used to clean blower should be bypassed from the aeration piping. The discharge of airborne particulate matter or solvent into aeration piping may result in damage to diffuser membranes.

Upon completion of blower manufacturer's recommended service, the subsequent start-up procedures may be followed.

Initial System Start-Up

To start the system, completely open all valves in the air supply system, including blower shut-off valves, header valves and lateral isolation/throttling valves. This instruction assumes that uniform water level is present in all aerated basins served by a common blower. If varying water levels are present, basins with lower water levels will need to have the valve to that basin throttled back to avoid improper air distribution. Failure to completely open all valves may result in over-pressuring blower unit, release of pressure relief valve, motor overload, or poor air distribution in aeration system with the potential of exceeding airflow capacity to diffuser units and damaging the diffuser membranes.

Once valve positions have been confirmed, the blower unit may be started. EDI does not recommend starting multiple blower units at initial system start-up. Subsequent blowers should be brought on-line after the system has equalized and uniform diffuser activity is observed throughout the system.

Use the blower manufacturer's recommended start-up procedures. EDI recommends that initial pressure surge be reduced through PRV or blow-off valve.

Start-up procedures should follow the basic guidelines as listed below:

- When starting initial blower, the PRV or blow-off valve should be used to reduce the start-up pressure surge. This is accomplished by removing weights and the cap from the PRV or by opening the blow-off valve.
- When the basin has been filled, note the operating pressure at the blowers. The pressure relief valve should be adjusted to free-flow at approximately 1 psig above the normal operating pressure of the system.
- To confirm the PRV operates, partially close blower shut-off valve until PRV releases air. Reopen the shut-off valve to confirm that PRV will reseat. If required, readjust the PRV to the recommended setting per instructions in the Blower IOM manual.
- To properly assess the airflow distribution on the aeration system, the blower system must be operating at the design operating point. On dual blower systems, design airflow is typically achieved by operating one blower at 100%. On three-blower systems, design airflow is typically based on operating two blowers at 100%.
- Airflow distribution adjustment between aeration grids should not be conducted until the full operating depth is obtained and the blower system has been in operation for several days. Small adjustments may be made to the isolation/throttling valves on the laterals receiving the most air. System balancing should be completed on an incremental basis. Changes in airflow distribution may require 2-8 hours to fully

stabilize when fine-tuning a system. In addition, in situations where multiple basins are employed and varying water levels exist, adjustments of lateral valves will be required to maintain air distribution in the tanks.

EDI recommends that the system Operator contact EDI at 573-474-9456 prior to making any adjustments to the airflow distribution.

Active Aeration Inspection

With the blower system active, operate the aeration system at 50% design air capacity. At this setting, check piping and diffusers for obvious leaks, and repair as required. Open any manual purge valves to expel water that may be in the piping. Close the purge valves once all water has been expelled.

Check for minor leaks by completing the following steps:

- Turn the airflow down to very minimal release. If the system employs separate drop valves, each grid can be checked separately by throttling the valve one at a time. Again, take care not to exceed airflow capacities in neighboring aeration grids when reducing airflow by this method.
- The airflow will not be uniform at this low level. This is acceptable, as this test is only used to check for small leaks that are not visible with the design amount of airflow. Check for any observed leaks and repair as required.

Leaks commonly occur due to:

- Missing or misaligned O-ring
- Torn membranes
- Loose disc retainer ring

Optional Water Flush and Air Purge Cleaning of Piping

R.2015-06-17

These instructions cover the general procedure that may be used to clean the piping in a fine or medium bubble diffuser system prior to diffuser installation. Special pipe cleaning requirements outlined in the Engineer's specifications, contract documents, or instructions offered by EDI shall be supplementary to or take precedence over the general instructions outlined below.

If both water flush and air purge cleaning are used, the water flush procedure should be implemented first.

Water Flush Cleaning

To water-flush the system, connect a water supply to the air header or make individual connections to each lateral. If flush water is piped to the header, it is imperative that the header be valved or stubbed such that water does not flood the blowers.

Clean water must be used. It is not necessary to use potable water, but the flush water must be free of silt or debris.

Flush header assembly prior to water flushing the laterals. To flush the header, fill it with water and open the end lateral to create a flush velocity in the header of at least two feet per second.

The laterals are to be individually flushed at a recommended velocity of five to six feet per second. This is done by sequentially opening and closing the isolation valves on the individual laterals.

Opening one isolation valve will produce a significant flushing action in the lateral as water is pumped through the header. One or two drilled air outlet holes should be uncapped to allow water and debris to be flushed out of the piping.

As an alternative to using the main header/lateral flush procedure, the individual laterals may be cleaned independently of the main header. For this operation, the laterals are disconnected from the main header and cleaned individually.

Air Purge Cleaning

Remove weights and cap from the pressure relief valve during initial start-up of the system. This prevents potential damage to the blowers from blocked valves or obstructions in piping system. Cap and weights can be added back to the pressure relief valve as necessary to provide proper operating pressure capability.

Note

When a blow-off valve is provided for the blower system, it may be operated in lieu of using the pressure relief valve procedure listed above.

Open all lateral valves prior to start-up of the blowers. Provide an opening at the end of the air laterals to allow air and foreign materials to be discharged from the system. The opening may be made at the end of the air lateral by leaving the end cap off of the lateral or by removing two orifice/outlet plugs at the end of the lateral.

In order to increase the velocity of air through the header and air laterals, it may be desirable to operate at maximum blower capacity. In addition, it may be necessary to close some of the lateral throttling valves to achieve a high velocity through the balance of the laterals that are open to the atmosphere. A high velocity is required in order to blow out any accumulated foreign materials.

As laterals are consecutively cleaned, the isolation valves are operated in a manner that allows the remaining laterals to be cleaned by an air purge.

Upon completion of the air purge, the blowers are shut down and the laterals are capped. Diffuser units are installed on the laterals and all isolation valves are opened prior to filling the basin with water.

If only an air purge is used to clean the piping, the basins are now ready to be filled with water to check the operation of the diffuser units

Safety Considerations

General Safety Considerations

R.2015-06-17

The diffused aeration system supplied on this project has no moving parts and poses little to no risk of injury. However, routine maintenance may expose personnel to potential hazards. EDI has listed below potential hazards and recommended precautions when maintenance procedures are required for the aeration components.

Tank Hazards (at full liquid depth):

- *Turbulent liquid action.*

Precautions:

- *Provide access to emergency throw rope or life ring.*
- *Use buddy system and follow standard safety procedures.*

Tank Hazards (empty):

- *Falling into tank.*
- *Objects falling onto personnel in the tank.*
- *Slippery basin floor.*

Precautions:

- *Avoid access ways without railings.*
- *Provide emergency exit/access.*
- *Appropriate personal safety equipment*

Personal Protection Measures

Wastewater has a potential for health hazards because it may carry disease producing organisms and a variety of chemical wastes. It is important to employ good personal hygiene practices to prevent oral and skin contact with wastewater.

The following is a list of methods to prevent direct contact entry of pathogenic organisms:

- Wash hands frequently with soap and water after contacting wastewater, visiting restrooms, before eating, drinking, or smoking; and at the end of jobsite visit. When soap and water are not available use anti-bacterial hand wash specifically formulated for use when soap and water is not convenient.
- Promptly treat cuts and abrasions using appropriate first aid measures.
- Handle sharp items with extra care to prevent accidental injuries.
- Clean contaminated tools after use.
- Follow good common sense and exercise extra caution whenever there is contact with contaminated water or sludge.
- Never touch face, mouth, eyes, ears, or nose while working with wastewater or sludge.

Personal Protective Equipment

Wear heavy-duty gloves (or double gloving) and boots that are waterproof and puncture resistant. When practical, use thin disposable latex gloves for light work. Use reinforced rubber gloves for heavy activities.

Discard gloves that become torn and try not to submerge hand below top of glove during service activities. When it is not feasible to use gloves while installing or inspecting equipment, make sure to follow personal hygiene practice listed above.

Wear goggles in the presence of heavy aerosols, dust, or when splashing of wastewater might occur.

Wear protective clothing; if possible, shower and change clothes before leaving plant site. If work clothes are washed at home, separate from the family wash and use chlorine bleach.

Confined Space Hazard

Verify the designation of the tank before entering. Wastewater tanks or basins can be considered confined spaces and contain potential hazards. Flammable, explosive, toxic, or other hazardous substances or the absence of sufficient oxygen could cause injury, acute illness, disability, or death.

Particular care should be exercised to assure NO hydrogen sulfide, chlorine or other heavier than air gases have accumulated in the basins or tanks. DO NOT ENTER ANY CONFINED SPACE until your supervisor has verified that proper safety precautions have been met. Do not enter a confined space without someone else present on the outside and do not enter a confined space without proper rescue equipment outside the confined space. Every confined space entry has a unique set of hazards, but atmospheric monitoring and proper entrance procedures can minimize the hazards entry personnel typically encounter.

Operation Instructions

Description of the Aeration-Mixing System

R.2015-06-17

The aeration-mixing system employs a main air header and valved lateral piping system to distribute air throughout the basin. EDI normally designs the aeration system piping to provide uniform air distribution without adjustment to the isolation/throttling valves on the laterals. However, these valves are typically provided for direct control of airflow distribution on large aeration systems or for process control. If process demands dictate a revised airflow distribution pattern, contact EDI for guidance on modification to the system.

Normal Operation of the Aeration System

The following procedures should be followed on a regular basis to assure consistent and satisfactory performance of the aeration-mixing system.

The air rate to the system may be adjusted to maintain the desired dissolved oxygen levels in the basin. When adjusting the airflow rate, the diffusers should be operated within the normal operating range of the diffuser. Excessive airflow rates will result in high pressure drops across the diffuser and reduced oxygen transfer performance. Low airflow rates may result in incomplete utilization of the diffuser membrane and reduced air distribution.

The aeration-mixing system is designed to provide uniform aeration. Positive dissolved oxygen concentrations should be present throughout the entire system during normal operation.

A dissolved oxygen profile analysis may be used to confirm the performance of the aeration system. Typically, the dissolved oxygen levels are measured at the inlet, the outlet, and the midpoint locations of each basin to determine the aeration system performance. In regulating the system airflow to control dissolved oxygen levels, the diffuser units should be operated within their minimum and maximum airflow limits.

In applications where water level variations may exist between aeration basins supplied by a single blower, the isolation valves may need to be adjusted to maintain adequate airflow distribution. This normally requires valving back the air to the basin with the reduced water level.

Note

It is important to confirm the operating airflow range of the diffuser units before valving back any isolation valve. Damage could result to the aeration diffuser if airflow is above the recommendations noted in the Product Specification Sheet. Please consult EDI to confirm operating procedure before adjusting any aeration isolation/throttling valve.

Normal Operation of the Blower System

The Aeration-Mixing System normally utilizes a centrifugal or positive displacement (PD) blower system consisting of one or more blower units for normal operation plus one on-line spare unit. All blower units including the spare unit must be operated on a regular basis to maintain their proper working condition. EDI recommends that blower units be operated sequentially with idle blower units brought on-line weekly. EDI does not recommend the simultaneous operation of on-line and spare blowers for an extended period. This operating condition may deliver airflows exceeding the air capacity of the diffuser units.

All blower components should be serviced on a regular basis. For additional information concerning proper blower operation, service requirements or service intervals, reference the Blower Operation and Maintenance manual.

Shutdown Conditions

If air service is interrupted at any time, it should be restored as soon as possible. When restarting positive displacement blower units, the start-up pressure surge should be reduced by down-weighting the pressure relief valve (PRV) or operating the blow-off valve. Once the blower is operational, reset the PRV or slowly close the blow-off valve over a five- to ten-minute period. The PRV must be set properly to prevent overloading of the blower system. Operate manual water purge devices if provided. If the PRV releases air for an extended period of time, the relief setting should be checked.

Normal Operation of the Diffuser Unit

The diffuser unit has no moving parts and requires very little maintenance for long-term operation. EDI recommends that the air supply to the diffusers be maintained at all times for optimum performance. The airflow to the diffuser units must be kept within the ranges noted in the Product Specification Sheet to maintain the structural and operating characteristics of the diffuser membrane. Continuous application of high airflows, greater than denoted for normal operation, may result in physical damage to the diffuser membrane.

Note

Use caution when adjusting several lateral throttling valves in the same piping system. This procedure can result in elevated airflows in sections of the basin, exceeding the maximum allowable airflow to each diffuser unit.

Normal Operation of the Purge Assembly

Condensation will accumulate in the subheader and lateral piping due to the cooling of the air when it reaches the EDI aeration system. EDI has provided a purge assembly to remove this accumulation from the pipe while the system is in operation. If a manual purge assembly has been provided, open the ball valve at the top of the purge assembly on a monthly basis. Allow the water to exit through the valve until only air remains. Close the ball valve once the purging process has been completed.

Preventive Maintenance

Maintenance Schedule

R.2015-06-17

In order to be covered by the manufacturer's warranty the FlexAir aeration system must be maintained. EDI recommends to visually inspect the overall system and clean the membranes to remove any accumulated foulants on an annual basis. This activity is beneficial to the Owner, as a reduction in the uniformity of air release or an increase in backpressure will impact the power use. The FlexAir aeration system is designed to allow the system to be accessed by dropping the water level in the basin being serviced.

Note

To prevent solids from entering the system, it is important to keep the air flowing through the system until the water level has dropped below the lateral piping.

The air to the basin being serviced should be turned off after the water has dropped below the lateral piping and diffusers to prevent the possibility of excessive airflows to the units or damage to the blower unit.

The following items may be helpful in servicing the FlexAir aeration system during periodic inspections or maintenance procedures:

- Protective gloves and clothing
- Long-handled soft bristle brush for cleaning assembly for observation
- Spare FlexAir membranes

All system components should be inspected for general wear or damage. This includes but is not limited to:

- Pipe supports including anchor bolts, pipe straps and fasteners.
- Pipe connection including fasteners, shifts in alignment of pipes and joints.
- Diffuser assembly including position, membrane integrity, membrane clamps / retainer ring, etc.
- Purge assembly components including all connections, anchor points, and wear at any contact points.
- Any worn or damaged components need to be repaired or replaced. Please contact EDI for assistance in identifying a root cause and solution.

In Situ Cleaning of Membrane

Typically membrane diffuser units will require cleaning because of two common types of surface build-up; biological and inorganic scaling.

Biological build-up is a moss-like growth. The recommended cleaning procedure is to physically dislodge the growth either by gently brushing the substance off with a soft plastic bristle brush or by using low-pressure hosing. Care should be taken not to abrade the rubber membrane surface during the cleaning procedure.

In Situ Acid Cleaning

When standard cleaning methods do not produce desired results, inorganic scaling may be present and may require an alternate cleaning technique. Inorganic scaling is a granular mineral-like precipitate that can form on the membrane surface.

Warning ⚠

Read all applicable SDS (Safety Data Sheets) carefully and follow all instructions given therein. Always have new users familiarize themselves with the SDS before handling chemicals. Wear personal protective equipment (including, but not limited to, rubber gloves, safety goggles, and other protective clothing) as required.

The foulant adhered to a membrane can be tested with a solution of muriatic acid (20° Baume Hydrochloric Acid, 31.45% by weight HCl) for reactivity. This may indicate the nature of the foulant and its propensity for chemical cleaning. Ensure that the air supply has been turned off from the diffusers being serviced. Afterwards, place a small amount of acid on the surface of the membrane where fouling is most prevalent. If the foulant is reactive to acid, this is indicative of inorganic fouling, such as calcium deposits, and acid cleaning is recommended. Otherwise, the foulant is typically organic and acid cleaning may not prove effective.

If it is determined that the foulant does respond to acid, the membrane may be cleaned with acid in addition to manual cleaning. This technique involves applying Muriatic Acid directly to the membrane surface after the manual cleaning procedure followed by rinsing with a low-pressure hose. In the case of ceramic diffusers, the acid is typically applied both on the surface and pumped through the diffuser using air.

Note

EDI can provide an acid injection system, upon request, for cleaning aeration systems without process interruptions. Contact EDI for more information.

Membrane Protection

The diffuser membranes should be protected from chemicals that may be harmful to the material. If using a cleaning aid or other substance on or around the membranes, please contact EDI for chemical compatibility.

Corrective Maintenance

Troubleshooting

R.2015-06-17

The FlexAir aeration system requires very little maintenance for long-term operation. Periodic visual inspection of the system should allow the Operator to determine if the system is performing at optimum levels.

Operating airflows below the design condition will also reduce the uniformity of air distribution. If operating conditions warrant airflow rates below the design condition, contact EDI for additional operational guidelines.

Below are symptoms and procedures to follow if inspection of the aeration system reveals abnormal operating characteristics:

Large volume of air in localized area	
Possible Cause	**Procedure**
Air leak in aeration piping.	Access area in question. Inspect joints for evidence of breakage.
Diffuser membrane damaged or missing.	Inspect diffuser units for membrane damage. Repair as required.

Decreased diffuser activity and increased back pressure noted at blower	
Possible Cause	**Procedure**
Diffusers becoming fouled or deformed.	Access diffusers and inspect for external or internal fouling or deformation.
Reduced blower discharge air volume.	Confirm blower operating point and rpm reading.
Restriction in air header.	Confirm isolation valve position on header and drops.

Dissolved oxygen profile not satisfactory throughout basin	
Possible Cause	**Procedure**
Increased loading to system.	Confirm loading to system.
Reduced blower discharge air volume.	Confirm blower operations.
Improper distribution of air in system.	Inspect piping for leaks, both in-basin piping and out of basin piping leading from the blower system.
Air leak in system.	
Excessive foulant accumulated on diffuser.	Access diffusers and inspect for external fouling.

Replacing Diffuser Assembly

R.2015-12-15

If routine inspections reveal the need to replace a diffuser assembly, revert back to the installation instructions for the removal and reinstallation of components. Any parts damaged during removal should be replaced.

Questions regarding the aeration-mixing system operation, maintenance, etc. should be forwarded to Environmental Dynamics International, 5601 Paris Road, Columbia, Missouri 65202. +1(573)474-945

AerationWorks™

Global Maintenance & Installation Services

Customer Support Services

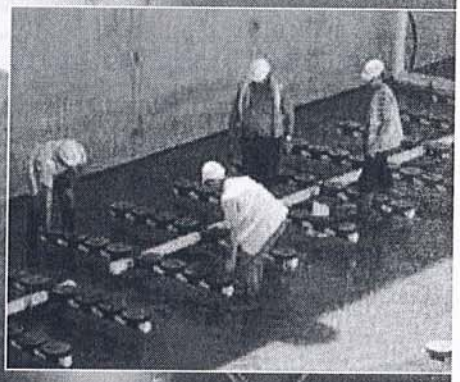
- **Install New Aeration Systems**
- **Maintain or Refurbish Existing Aeration Systems**
- **Develop and Implement Long-Term Maintenance Programs**
- **Service and Support for all Brands of Aeration Systems**

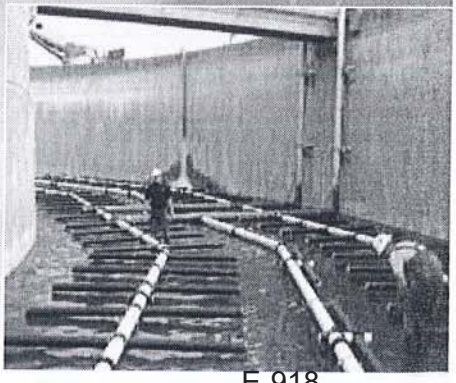
"The EDI Aeration Works division provides experts in the installation and maintenance of any aeration system, including supervision and/or the skilled labor pool to perform the actual service"

- Chuck Tharp, PE
Chairman • Environmental Dynamics Inc.

Aeration Works maintains special equipment, tools and skilled crews for installation and service on any aeration construction or maintenance project.

Contractors, owners and operating companies can better utilize their own personnel, equipment and resources by enlisting the support of the EDI Aeration Works Division.





EDI Aeration Works personnel have the experience and knowledge to handle unique systems and offers a cost effective alternative for installation and maintenance of your aeration system.

AerationWorks™

Global Maintenance & Installation Services

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Environmental Dynamics International

Service Department

Quality In-House & On-Site Customer Service

EDI provides Field & Customer Service directly from its worldwide headquarters located in Columbia, Missouri, while maintaining Authorized Field Service offices around the globe.

Services may include visits made by an Authorized EDI Service Representative to a project site and may provide any or all of the following:

Train on-site personnel in the proper installation and assembly of all EDI equipment.

Inspect installation to provide verification of general conformance to EDI specifications and requirements.

Provide startup services to ensure that the equipment is operating satisfactorily after installation.

Train plant Owners/Operators in long term operation and maintenance procedures for the EDI equipment that has been installed.

Provide troubleshooting investigation or inspection when requested by the customer, with regards to EDI equipment installation

MotorSaver®
THREE-PHASE ELECTRIC MOTOR PROTECTOR

INSTALLATION INSTRUCTIONS FOR SYMCOM'S MOTORSAVER®
MODEL 460

DANGER!

HAZARDOUS VOLTAGES MAY BE PRESENT DURING INSTALLATION.
Electrical shock can cause death or serious injury.
Installation should be done by qualified personnel following all national, state and local electrical codes.

BE SURE POWER IS DISCONNECTED PRIOR TO INSALLATION!
FOLLOW NATIONAL, STATE, AND LOCAL CODES!
READ THESE INSTRUCTIONS ENTIRELY BEFORE INSTALLATION!

! WARNING !

UNEXPECTED OUTPUT ACTUATION CAN OCCUR.
Use hard-wired safety interlocks where personnel and/or equipment hazards exist.
Failure to follow this instruction can result in death, injury or equipment damage.

The Model 460 MotorSaver® is an auto ranging voltage monitor designed to protect three-phase motors regardless of size. The MotorSaver® is used on 190-480 VAC, 50 to 60 Hz motors to protect from damage caused by single phasing, low voltage, high voltage, phase reversal, and voltage unbalance.

CONNECTIONS

1. Mount the MotorSaver® in a convenient location in or near the motor control panel. If the location is wet or dusty, the MotorSaver® should be mounted in a NEMA 4 or 12 enclosure. The MotorSaver® can be mounted to a back panel using two #6 or #8 x 5/8 screws or can be snapped onto a DIN rail.
2. Connect L1, L2 and L3 on the MotorSaver's terminal strip to the LINE SIDE of the motor starter. (See Figure No. 1).
3. Connect the output relay to the circuitry to be controlled. For motor control, connect the normally open contact in series with the magnetic coil of the motor starter as shown in Figure No. 1. For alarm operation, connect the normally closed contact in series with the control circuit as shown in Figure No. 2.

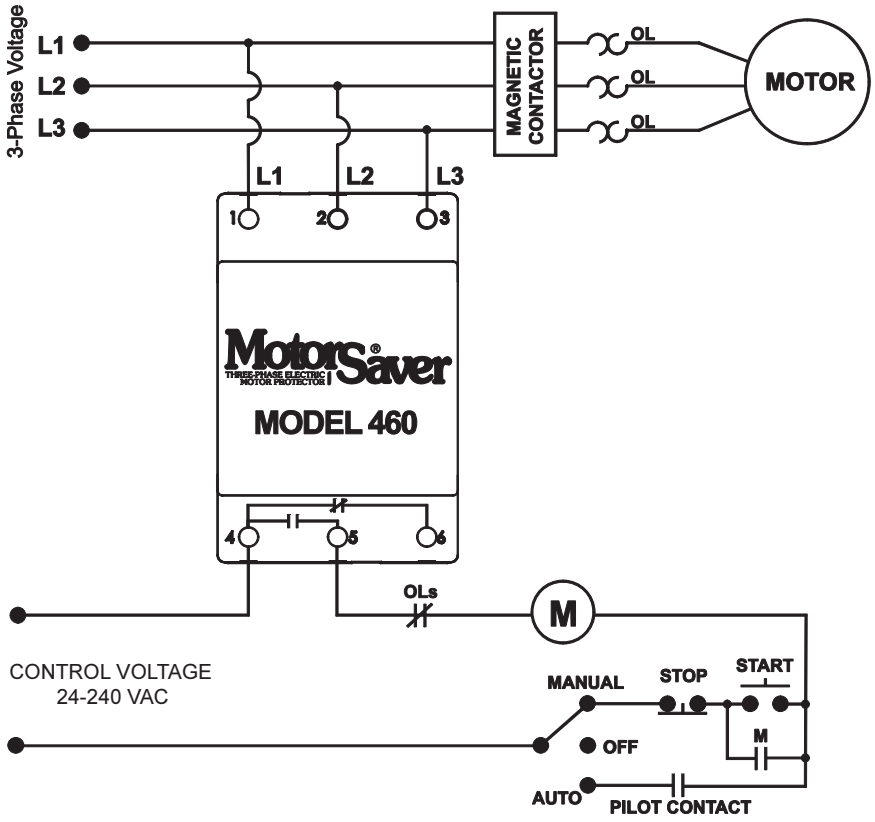


FIGURE NO. 1: CONTROL WIRING DIAGRAM

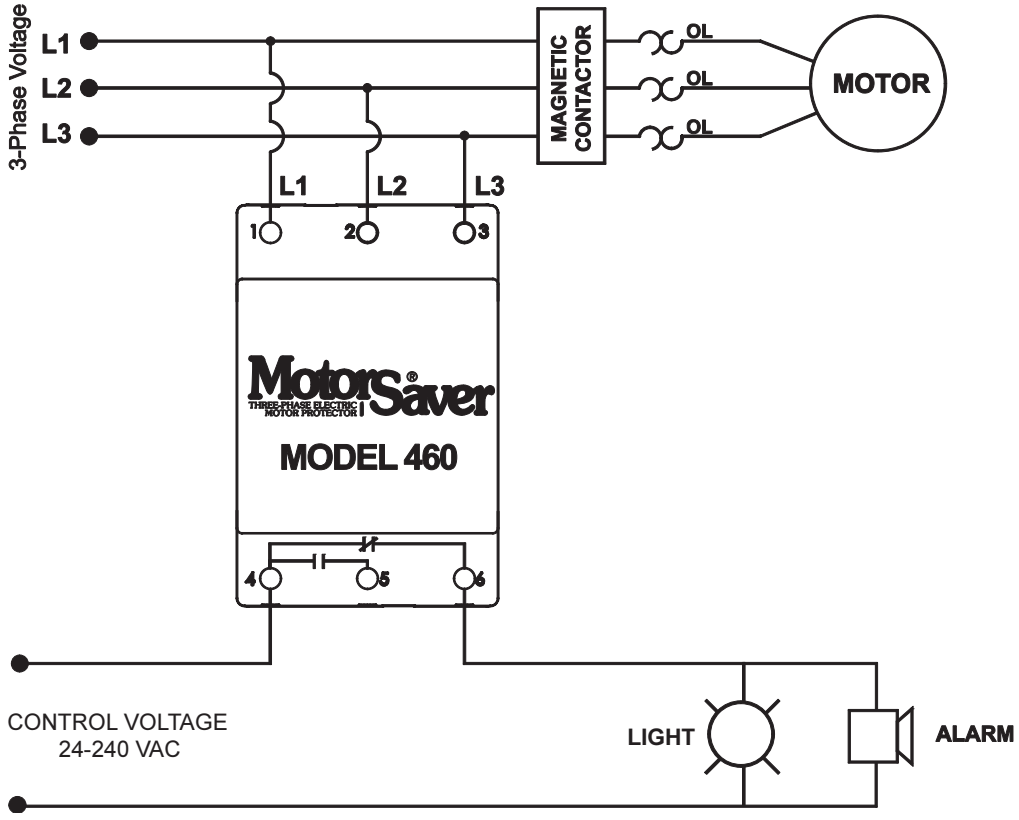
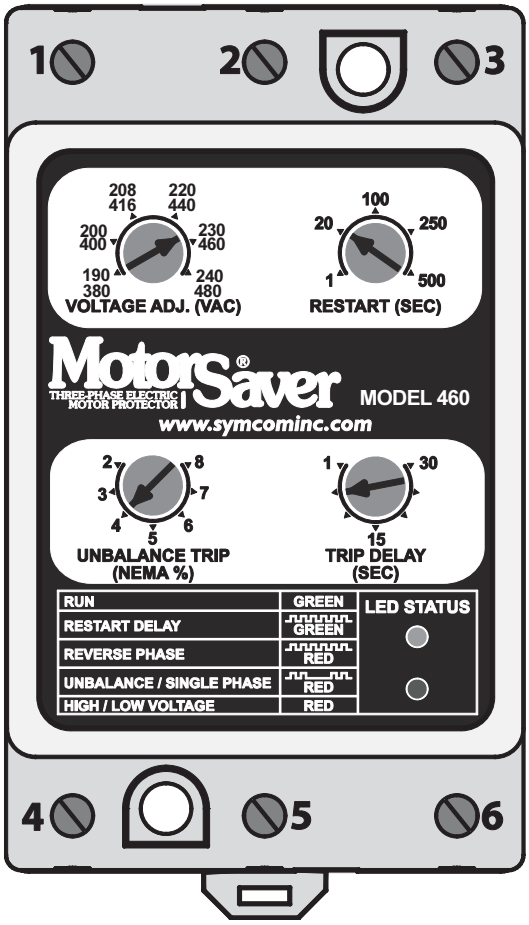


FIGURE NO. 2: ALARM WIRING DIAGRAM

SETTINGS



1. Line voltage adjustment: Rotate the **"VOLTAGE ADJ. (VAC)"** to the nominal three-phase line voltage feeding the motor to be protected.
2. Restart delay adjustment: Rotate the **"RESTART (SEC)"** adjustment to the desired position. The restart delay is the time between MotorSaver® seeing acceptable voltage and the MotorSaver® closing its output contacts. For compressor applications, the restart delay should be set for the approximate time it takes for the head pressure to bleed off of the compressor. For other applications, the restart delay is typically set between 2 and 10 seconds.
3. Trip delay adjustment: Rotate the **"TRIP DELAY (SEC)"** adjustment to the desired setting. This adjustment does not affect the trip delay on phasing faults. Typically, the trip delay adjustment is set between 1 and 5 seconds. In areas where voltage fluctuations are frequent, the trip delay adjustment may be set greater than 10 seconds.
4. Voltage unbalance adjustment: Rotate the **"UNBALANCE TRIP (NEMA%)"** adjustment to the desired unbalance trip level. The NEMA MG1 standard does not recommend operating a motor above 1% voltage unbalance without <u>derating</u> the motor. The NEMA MG1 standard also recommends against operating a motor above a 5% voltage unbalance under any circumstances. SymCom recommends consulting the motor manufacturer for specific tolerances.

$$\text{Percent Unbalance} = \frac{\text{Maximum Deviation from the Average}}{\text{Average}} \times 100$$

Example: The measured line-to-line voltages are 203, 210, and 212.

$$\text{Average} = \frac{203 + 210 + 212}{3} = 208.3$$

The maximum deviation from the average is the largest difference between the average voltage (208.3) and any one voltage reading.

208.3 - 203 = 5.3 210 - 208.3 = 1.7 212 - 208.3 = 3.7

The maximum deviation from the average is 5.3.

$$\frac{5.3}{208.3} \times 100 = 2.5\% \text{ Unbalance}$$

POWER-UP

Turn on the 3∅ power to the motor. The MotorSaver's green RUN light will blink during the RESTART delay. After the RESTART delay, the MotorSaver® will energize its output contacts and the green RUN light will illuminate. If the contacts do not energize and the RUN light does not illuminate, see the TROUBLESHOOTING section.

DIAGNOSTIC INDICATOR LIGHTS	
RUN	GREEN
RESTART DELAY	 GREEN
REVERSE PHASE	 RED
UNBALANCE / SINGLE PHASE	 RED
HIGH / LOW VOLTAGE	RED

CONGRATULATIONS!!
YOU HAVE JUST INSTALLED THE FINEST MOTOR PROTECTION AVAILABLE!!

TROUBLESHOOTING

SYMPTOM	LIGHT PATTERN	SOLUTION
No lights are on. The unit seems completely dead.	N / A	Measure the three line-to-line voltages. If any of the voltages are below 150 VAC, the MotorSaver® does not have enough power to operate its internal electronics. This may occur on a single-phased system. If the voltages are correct, call SymCom at 1-800-843-8848 or 1-605-348-5580.
Red light is blinking (on initial power up).	 RED	Turn off the three-phase power. Swap any two leads powering the MotorSaver® (L1, L2, or L3). There is a 50-50 chance of connecting L1, L2, and L3 correctly the first time. Re-apply the three-phase power.
Red light is blinking (after the motor has been previously running).	 RED	The incoming lines have been reverse phased. The MotorSaver® is preventing the motor from running backwards. Correct the phase sequence.
Red light is blinking in this pattern.	 RED	The voltage is unbalanced or single-phased. Measure the incoming line voltages and calculate the % unbalance. If the voltage unbalance does not exceed the % unbalance reset value, call SymCom at 1-800-843-8848 or 1-605-348-5580.
Red light is on steady.	RED	The voltage is out of tolerance. Measure the three line-to-line voltages. Calculate the average of the three voltages. If the average is 7% above or below the nominal voltage as selected by the LINE VOLTAGE ADJUST, the MotorSaver® is functioning properly. If the voltage is within ±7% of the selected line voltage, call SymCom at 1-800-843-8848 or 1-605-348-5580.
Green light blinks and motor is not running.	 GREEN	The MotorSaver® is in restart delay.
Green light is on steady, but motor does not start.	GREEN	The MotorSaver® is in run mode. Ensure other control devices are allowing the motor to start. Check control circuit for loose wires or malfunctioning switches.

Any questions or comments call SymCom at 1-800-843-8848 or 1-605-348-5580

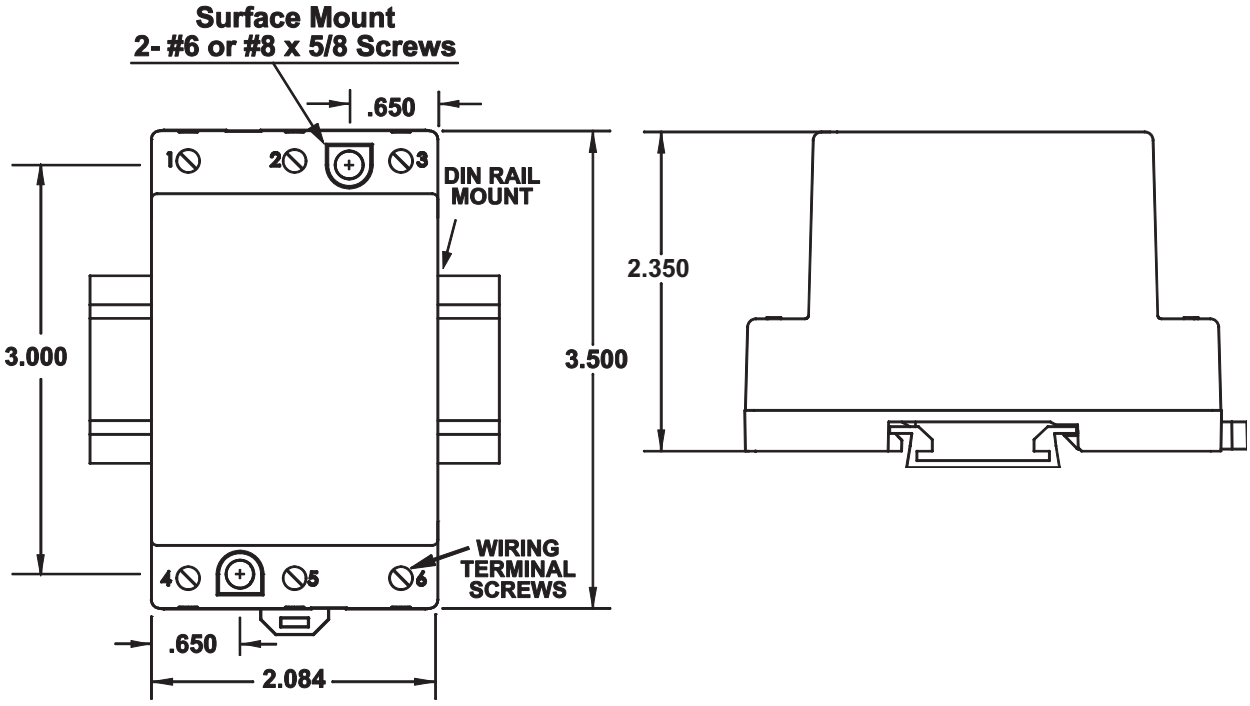
SPECIFICATIONS

3 - Phase Line Voltage	190 - 480 VAC
Frequency	50* - 60 Hz
Low Voltage (% of setpoint)	
Trip	90% ± 1%
Reset	93% ± 1%
High Voltage (% of setpoint)	
Trip	110% ±1%
Reset	107% ±1%
Voltage Unbalance (NEMA)	
Trip	2 - 8% Adjustable
Reset	Trip Setting minus 1% (5 - 8%)
	Trip Setting minus 0.5% (2 - 4%)
Trip Delay Time	
Low, High, and Unbalanced Voltage	1 - 30 Seconds Adjustable
Single-phasing faults (>25% UB)	1 Second Fixed
Restart Delay Time	
After a fault or complete power loss	1 - 500 Seconds Adjustable
Output Contact Rating - SPDT	
Pilot Duty	480 VA @ 240 VAC
General Purpose	10 A @ 240 VAC
Power Consumption	6 Watts (maximum)
Weight	14 oz
Enclosure	Polycarbonate
Terminal	
Torque	6 Inch-Pounds Max.
Wire AWG	12 - 20 AWG
Safety Marks	
UL	UL508 (File # E68520)
CE	IEC 60947-6-2
Standards Passed	
Electrostatic Discharge (ESD)	IEC 1000-4-2, Level 3, 6 kv contact, 8 kv air
Radio Frequency Immunity, Radiated	159 MHz, 10 V/m
Fast Transient Burst	IEC 1000-4-4, Level 3, 3.5 kv input power and controls

*NOTE: 50 Hz will increase all delay timers by 20%

Surge	
IEC	IEC 1000-4-5, Level 3, 4kv line-to-line; Level 4, 4kv line-to-ground
ANSI / IEEE	C62.41 Surge and Ring Wave Compliance to a level of 6kv line-to-line
Hi-potential Test	Meets UL508 (2 x rated V +1000V for 1 minute)
Environmental	
Temperature Range	Ambient Operating: -20° - 70° C (-4° - 158°F) Ambient Storage: -40° - 80° C (-40° - 176°F)
Class of Protection	IP20, NEMA 1 (Finger Safe)
Relative Humidity	10-95%, non-condensing per IEC 68-2-3

DIMENSIONS



SymCom warrants its microcontroller based products against defects in material or workmanship for a period of five (5) years* from the date of manufacture. All other products manufactured by SymCom shall be warranted against defects in material and workmanship for a period of two (2) years from the date of manufacture. For complete information on warranty, liability, terms, and conditions, please refer to the SymCom Terms and Conditions of Sale document.

Visit our website at www.symcominc.com for our complete catalog and new product listings!

SymCom Inc
Motor Protection & Controls Since 1974

2880 North Plaza Drive, Rapid City, SD 57702
Phone: (800) 843-8848 or (605) 348-5580
FAX: (605) 348-5685

P-201/2 - Pump, Centrifugal, Price Pump 1hp 460V 3ph 3600RPMPN: RC200AI-300-26566-100-36-3X6

P-301/2 - Pump, Centrifugal, Price Pump 3/4hp 460V 3ph 3600RPMPN: RC200AI-250-26566-75-36-3T7

P-401/2 - Pump, Centrifugal, Price, Misc"RC300AI-4.33-26566-500-36-3T7200GPM @ 60 FEET PRESSURE3600RPM 5HP TEFC 460v3P"

P-501/2 - Pump, Centrifugal, Price Pump 2hp 460V 3ph 3600RPMPN: RC200AI-388-26566-200-36-3T6

P503 - Pump, Centrifugal, Price Pump 1/4hp 460V 3ph 1800RPMPN: RC200AI-388-26566-25-18-3T6

P-551/2 - Pump, Centrifugal, Price Pump 3/4hp 460V 3ph 3600RPMPN: RC200AI-250-26566-75-36-3T7

P-553/4 - Pump, Centrifugal, Price Pump 2hp 460V 3ph 3600RPMPN: RC200AI-388-26566-200-36-3T6

INSTALLATION, OPERATING AND MAINTENANCE MANUAL

TYPE RC CENTRIFUGAL PUMPS

MODELS: RC 200/300

PLEASE FILL IN FROM PUMP NAMEPLATE

Pump Model_____

BOM. No._____

Serial No._____

RETAIN MANUAL FOR REFERENCE

Price® Pump Company
21775 8th. Street East
Sonoma, CA 95476
Tel: 707-938-8441
Fax 707-938-0764
Email: sales@pricepump.com

Congratulations

You are now the owner of a Price® Pump Co. Centrifugal Pump. This pump was carefully inspected and subjected to final performance tests before being released for shipment. In order to achieve maximum performance and reliability, please follow the simple instructions in this manual.

RECOMMENDED PRECAUTIONS

1. For satisfactory operation and safety, maximum system pressure must not exceed 350 psi* (24.6kg/sq cm).

2. For satisfactory operation and safety, maximum fluid temperature must not exceed 300°F* (121°C).

3. No modifications, additions or deletions should be made to the pump without prior approval of the factory.

4. Drain pump completely and flush with water before servicing a pump handling volatile or harmful liquids.

READ CAREFULLY THE CAUTION BELOW

The performance of your Price® Pump Co. Centrifugal Pump is based on clean, room temperature, water with suction conditions as shown on the performance curves. If used to pump liquids other than water, pump performance may differ from rated performance based on the different specific gravity, temperature, viscosity, etc. of the liquid being pumped. A standard pump, however, may not be safe for pumping all types of liquids, such as toxic, volatile or chemical liquids, or liquids under extreme temperatures or pressures.

Please consult Price® Pump Co. technical specifications as well as local codes and general references to determine the appropriate pump for your particular application. Since it is impossible for us to anticipate every application of a Price® Centrifugal pump, if you plan to use the pump for a non-water application, contact Price® Pump Co. beforehand to determine whether such application may be appropriate and safe under the operating conditions. Failure to do so could result in property damage or personal harm.

* Depends on seal materials and seal type

Visit our website for product information and technical support

www.pricepump.com

INSTALLATION / OPERATING INSTRUCTIONS
CENTRIFUGAL PUMPS

Warning

Before installing, repairing or performing maintenance on this pump, read these instructions completely.

Disconnect power to pump before servicing to avoid dangerous or fatal electrical shock.

Match supply voltage and frequency to motor nameplate values. Incorrect voltage can cause fire or serious motor damage and void warranty.

Ground motor before connection to electrical power supply! Failure to ground motor can cause severe or fatal electrical shock!

Do not ground to gas supply line!

Before disassembling pump, be certain all liquid has been removed. If pump was used to pump hazardous or toxic fluid, it must be decontaminated prior to disassembly.

Close Coupled Motor Pumps

It is suggested that these pumps be firmly bolted to a level surface. Adequate air movement around motor will help prevent overheating.

Do not over tighten inlet and outlet piping or volute may be damaged.

Power Frame Mounted Pumps

Power Frame mounted pumps must be mounted on a rigid base that will not warp or flex. Each pump must be mounted such that the pump shaft centerline is in-line with the driver shaft centerline. Pads and/or shims will be required on the pump, the driver or both to insure proper alignment. The two shafts should not touch each other (end to end) and the distance between them depends on the coupling used to connect them.

Misalignment will cause vibration, bearing failure and void warranty. Pumps are rough aligned at the factory but must be realigned after shipment and installation.

Pulley driven pump must have pulleys inline and proper belt tightness practices followed.

Direction of Rotation

Note: Motor shaft rotation is viewed from the suction end of pump. A rotational arrow is shown on the front of the pump volute casing. Incorrect rotation can cause pump damage, failure or reduced performance, voiding warranty. It is best to check rotation by momentarily energizing or jogging the motor prior to filling pump with liquid.

Warning! Do not operate pump without liquid as damage may result to the pump internal wear surfaces.

Plumbing

All piping needs to be supported independently of the pump. Piping connections should not exert any stress on the pump volute or fittings.

Suction Piping (Inlet)

(Horizontal Pumps)

Suction line must provide adequate suction pressure and even (Laminar) liquid flow for proper pump operation. Air, entrapped in the suction line due to leaks or improper piping design, may cause the pump to lose prime. Non-priming pumps must have their suction 'flooded' at start up (see datasheets for minimum NPSHR). Also, the suction line must provide sufficient pressure (NPSH) and even flow to pump inlet to prevent pump cavitation. The suction pipe entering the pump should be straight and a minimum length of 5 times and preferably 10 times the pump inlet diameter. Elbows, fittings or valves installed close to the pump inlet can disrupt liquid flow and cause cavitation. Suction lines must be at least the same diameter as the pump inlet or larger if possible.

Price Pump Company recommends against using foot valves in the suction line to maintain liquid in the pump when it's not operating. If foot valves are used, due to suction lift conditions, they must be properly maintained to avoid leaks resulting from wear or fouling. Suction piping must be designed to prevent vapor from being trapped in high spots in the piping. This condition may cause the pump to vapor lock.

Discharge Piping (Outlet)

To control flow and discharge head, it is advisable to install a valve (globe, ball, or other adjustable and non-leak type) in the discharge line adjacent to the pump. The valve may be closed during system repairs to prevent backflow. By installing a check valve in the discharge line, backflow can also be prevented during maintenance or during periods of pump stoppage.

Operation

All centrifugal pumps must be filled with liquid prior to start up. It is suggested that during initial start up the discharge valve be closed and then opened as the motor reaches full rpm's. If pump does not build up pressure as motor speed increases, shut down and make sure that liquid flow into pump is not restricted (see "Troubleshooting").

Note: A centrifugal pumps flow rate and head (pressure) will vary with the amount of resistance (pipe friction and flow restrictions) in the discharge line. As the valve on the discharge line opens, the flow rate and motor amperes draw will increase and head (pressure) will decrease. As the valve on the discharge line is closed, the flow rate and amperes draw will decrease and the head (pressure) will increase.

If resistance in the discharge line is not sufficient, the pump will operate at a condition of maximum flow, sometimes called "end of curve" performance. Maximum horse-power is required to operate at this point and motor overload may result. If excessive amperes draw and motor overload is occurring, reduce the system flow rate by installing a valve or orifice in the discharge line to control (restrict) the pumps flow rate. Alternatively, reduce pump head by trimming impeller to a smaller diameter.

Consult Price Pump or a local Price Pump distributor for assistance.

www.appsupport@pricepump.com

1. Pump fails to build head pressure:

Check for:

a. Pump not primed.

b. Incorrect pump rotation.

c. Driver speed too low.

d. Suction line restricted.

e. Driver failure.

f. Plugged or damaged impeller.

g. Pump or impeller undersized.

h. Pump cavitation.

i. Improper impeller clearance.

2. Pump fails to provide enough flow rate.

Check for:

a. System resistance too high.

b. Pump undersized.

c. Pump not primed.

d. Driver speed too low.

e. Poor suction conditions.

f. Improper impeller clearance.

3. Excessive noise or vibration during operation.

Check for:

a. Motor bearing failing.

b. Pump cavitation.

c. Improper impeller clearance.

4. Leaking mechanical seal.

Check for:

a. Improper assembly.

b. Worn or cracked seal faces.

c. Abrasive material in fluid.

d. Liquid flashing at seal faces (Fluid temperature too high).

e. Seal pressure rating too low for the service.

f. Chemical attack of seal components.

g. Seal operated dry or with a liquid having poor lubricating properties.

5. Pump gradually loses pressure and head.

Check for:

a. Increasing temperature causing cavitation or liquid vaporization.

b. Driver failure.

c. Suction lift too high.

d. Air entering suction line.

6. Motor overheating.

Check for:

a. Excessive flow and amp draw (Throttle discharge).

b. Low voltage or frequency.

c. Flow rate too low with resulting heat rise.

d. Bearing failure.

e. System temperature too high.

Before attempting any repairs under warranty, contact Price Pump to obtain factory authorization. Repairs carried out without authorization may void warranty. Many causes of pump failure are due to improper system design. Refer to the trouble shooting list in this manual before carrying out pump inspection or repair.

DISASSEMBLY

1. Disconnect power source to motor.

2. Disconnect electrical connections tagging wires carefully to preserve correct rotation. Loosen motor base.

3. Remove pump and motor assembly to repair area.

4. Remove volute from pump.

5. Unscrew and remove impeller lockdown bolt and lock washers. Slide impeller off shaft. (If 'keyed' shaft design, do not throw away the shaft key).

6. Remove seal head from the shaft. **Type 6A:** Remove seal head from bracket. **Type 21:** Slide seal head from the shaft. **Type 9:** Loosen set screws and slide seal head off shaft.

7. Remove four motor bolts and remove bracket from motor.

8. Remove seal seat from bracket. Use wooden or plastic dowel to remove the seat from the bracket.

REASSEMBLY

If PEO (pump end only) go assembling PEO.

1. Thoroughly clean the seat cavity of the bracket.

2. Thoroughly clean pump shaft. Assure that the shaft is not grooved and that there is no evidence of pitting or scoring. If the shaft is grooved, scored or worn, replace it.

3. Install the pump shaft onto the motor shaft, aligning set screws of the pump shaft with the keyway of the motor shaft. Install slinger between the pump shaft setscrews.

4. **Type 6A**

a. Place bracket on firm surface with seat cavity (pump end) up. Using a tool (1-19/64" ID x 1-5/8" OD x 1/2" deep), press seal into seal cavity with carbon face of seal (volute end up) up. Press until flange is seated in seal cavity of bracket. Press only on outer flange of seal. Avoid touching carbon surface.

b. Place bracket on motor (aligning the base if applicable). Secure bracket with four motor bolts.

c. Pull pump shaft forward until shoulder of pump shaft contacts back of bracket and slightly snug one setscrew to hold shaft in place.

d. Apply small amount of oil (vegetable or other light oil) on the pump shaft and I.D. of seat elastomer. Gently place seat on end of shaft with ceramic face down toward seal. After sliding impeller onto shaft, seat will be properly located.

e. Slide impeller onto shaft ensuring seat is pushed flush with shoulder of shaft and impeller hub.

f. Install shaft key (if applicable), impeller flat washer, lock washers and lockdown bolt. Tighten securely to 10ft.lbs. Caution: Serviceable Loctite (or equivalent) must be used on lockdown bolt. Lock washer pairs must be assembled 'cam face' to 'cam face'. See diagram.

g. Loosen pump shaft set screw.

h. Install new volute gasket or o-ring and mount volute to bracket. Secure with bolts and tighten evenly.

i. **Setting impeller clearance:**

Slide pump shaft forward until impeller touches volute. Slide shaft back .010-.015". Tighten pump shaft set screws. Turn shaft by hand to ensure impeller does not rub against volute. Proceed to step 9.

5. **For Type 21, 8, 9 seals:**

a. Place the bracket on a firm surface with the seat cavity (pump end) up.

b. Place a small amount of light oil on the seat cup or o-ring seat. Place the seat in the seat cavity with the polished face up toward the pump end.

c. Evenly push seat into cavity with fingers then gently tap seat into place with a wooden dowel or plastic rod (1-1/8" outside diameter). To help ensure the seat is not damaged place the cardboard disk supplied with the seal over the seat face.

6. Place bracket on motor (aligning the base if applicable). Secure bracket with four motor bolts.

7. Pull pump shaft forward until shoulder of pump shaft contacts back of bracket and slightly snug one setscrew to hold shaft in place

8. Install seal head assembly

For Type 21 Seals:

a. Lubricate shaft and seal elastomer with oil (vegetable or other light oil).

b. Install rotary seal head onto pump shaft and slide toward seat until carbon face contacts ceramic seat.

c. Install seal spring and retainer.

d. Installing impeller. Install key in pump shaft. Slide impeller onto shaft ensuring that the spring retainer does not slip between the shoulder of the shaft and the hub of the impeller. Install impeller flat washer, lock washers and lockdown. Tighten securely to 10 ft. lbs. **Caution:** Serviceable Loctite (or equivalent) must be used on lockdown bolt. Lock washer pairs must be assembled 'cam face' to 'cam face'. See diagram

e. Loosen pump shaft set screw.

f. Install new volute gasket/o-ring and mount volute to bracket. Secure with bolts and tighten evenly.

g. Slide pump shaft forward until impeller touches volute. Slide shaft back with a screwdriver **.010"-.015".** Tighten pump shaft set screws. Turn shaft by hand to ensure impeller does not rub against volute. Proceed to step 9.

For Type 8 & 9 Seals:

a. Install impeller. Install key in pump shaft. Slide impeller onto shaft and install impeller washer and lockdown bolt. Tighten securely.

b. Loosen pump shaft set screw.

c. Install new volute gasket/o-ring and mount volute to bracket. Tighten at least two bolts at this time.

d. Slide pump shaft forward until impeller touches volute. Slide shaft back **.010"-.015".** Tighten pump shaft set screws. Turn shaft by hand to ensure impeller does not rub against volute.

Remove volute and impeller.

e. Install seal head onto pump shaft sliding gently past shoulder of shaft. Slide seal head toward seat until carbon face contacts ceramic seat. Tighten seal head setscrews to pump shaft. **Remove clips in seal head and discard.**

j. Reinstall impeller, flat washer, lock washers and lockdown bolt. Tighten securely (10 ft. lbs.)

Caution: Serviceable Loctite (or equivalent) must be used on lockdown bolt. Lock washer pairs must be assembled 'cam face' to 'cam face'. See diagram

k. Install new volute gasket or o-ring and mount volute to bracket. Secure with bolts and tighten evenly.

l. Rotate pump shaft by hand to ensure impeller does not rub against volute.

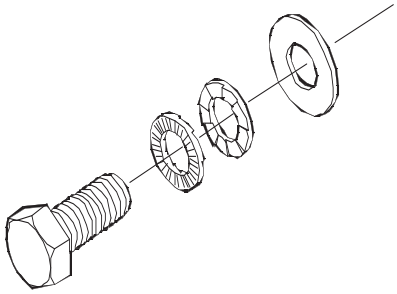
9. Return pump to installation, reconnect electric connections.

10. Start pump momentarily to observe shaft rotation. If rotation corresponds to the rotation arrow, pump may be put into service. If rotation is incorrect, switch any two leads on 3-phase motors. Check wiring diagram of motor for proper single phase rotation.

11. Remove top pipe plug (if applicable) from the front of volute and prime pump thoroughly, making sure all entrapped air is purged.

12. Start pump allowing adequate time to purge all air from system. Observe any gauges, flow meters, etc. to see of pump performs properly.

DIAGRAM OF
LOCKDOWN ASSEMBLY



INSTALLING A PEO (PUMP END ONLY)

a. Place the bracket on a firm surface, loosen stub shaft setscrews and carefully remove shipping plug.

b. Place motor in an upright position with motor shaft pointing upward. Make sure motor shaft and end bell flange are free of burrs and surfaces are clean.

c. Align PEO stub shaft setscrews with motor shaft keyway and carefully slid the PEO onto the motor shaft until it sits firmly onto the motor end bell flange.

d. Oriented the PEO's discharge port or base to preferred motor configuration while referencing the motors electrical box position.

e. Install flange bolts and tighten. (Install pump base if applicable)

f. Reposition pump back onto motor base.

g. Refer to pump Reassembly Instructions and proceed to **setting the impeller clearance**.

Type 21 C Face Style Double Seal Installation

(For Type CD, RC, LT & MS Series Pumps)

Double Seal pumps are generally used for one of these reasons:

1. To avoid seal damage when pumping abrasives.

2. To manage seal temperature when pumping hot liquids.

3. To prevent pump fluid from leaking to atmosphere when pumping toxic or other hazardous liquids.

A double seal must have pressure to the seal chamber at a minimum of 5 PSI preferable 10 PSI above pump pressure.

Flow rate through seal chamber will depend upon pump fluid temperature. Minimum flow should be 1 GPM for CD, RC, LT & MS Series Pumps. Flow rates may have to be increased with higher temperatures. Check the seal chamber discharge fluid temperature to be sure fluid is below boiling. We suggest a 140°F to 150°F temperature range. If seal cooling liquid flashes, seal may become damaged. Seal chamber fluid should enter at the bottom and discharge at the top to avoid entrapped air in the chamber. Be sure to prime the secondary pumping system properly as you would any other system.

CAUTION: Always Pressurize the Seal Chamber before starting the main pump!

In a pumping system that starts and stops automatically, insure that both pumps start at the same time.

REASSEMBLY:

1. Clean seat cavity of the bracket and seal plate thoroughly.

2. Thoroughly clean pump shaft. Assure that the shaft is not grooved and that there is no evidence of pitting or fretting. Polish the shaft with extra fine emery cloth and clean the keyway. If the shaft is grooved, fretted or worn, replace it.

3. Install the pump shaft onto the motor shaft, aligning set screws of the pump shaft with the keyway of the motor shaft. Ensure all debris and burrs are removed from the motor shaft and that the slinger is in place.

4. Place bracket on motor (aligning the base if applicable). Secure bracket with four motor bolts.

5. Pull out pump shaft as far as it will go toward volute end and slightly tighten one set screw to hold shaft in place

6. Place a small amount of vegetable oil (or equivalent) on the seat cup. Install seats into seat plate and bracket with polished faces up. Evenly push seat into seat cavity with fingers, then gently tap seat into place with a wooden dowel or plastic rod (1-1/8" outside diameter). To help ensure the seat is not damaged, place the cardboard disk supplied with the seal under the end of the dowel to prevent damaging the seat face.

7. Install seal head assembly:

For Type 21:

a. Lubricate shaft and elastomer with vegetable oil or equivalent.

b. Install first rotary seal head onto pump shaft and slide toward seat using a twisting motion until carbon face touches seal seat.

c. Install second rotary seal head onto shaft sleeve with carbon facing towards pump end.

8. Install seal plate onto pump end of bracket with new gasket and tighten cap screws evenly (note: use pipe sealant on bolts).

9. Install impeller:

a. Install key in pump shaft.

b. Slide impeller onto shaft.

c. Install impeller washer and lockdown. Tighten to 10 ft-lbs.

10. Loosen pump shaft set screw.

11. Install new volute gasket or o-ring and mount volute. Secure with bolts and tighten evenly.

12. Move shaft back with a screwdriver **.010"-.015"**. Tighten pump shaft set screws. Turn shaft by hand to ensure impeller does not rub against volute.

13. Return pump to installation, reconnect electric connections.

14. Start pump momentarily to observe shaft rotation. If rotation corresponds to the rotation arrow on the pump, it may be put into service. If rotation is incorrect, switch any two leads on 3-phase motors to change rotation. Check wiring diagram of motor for single phase rotation correction.

15. Remove top pipe plug (if applicable) from the front of volute and prime pump thoroughly, making sure all air is purged. Turn shaft one revolution and then refill. Replace the pipe plug.

16. Start pump allowing adequate time to purge all air from system. Observe any gauges, flow meters, etc., to see if pump performs properly.

Double Seal Flush Piping Installation

1. Piping of the double seal arrangement should be done in accordance with all governmental regulations and safety codes.

2. All double seals require a barrier flush between the seals for proper lubrication and cooling. The barrier liquid must be maintained at 10-15 PSIG above the discharge pressure of the pump and it must be chemically compatible with the pumped liquid, material construction of the pump, and seals (5/8" double seals have 18-8 parts).

3. The barrier flush shall have a minimum flow rate in accordance with the graph below. If water is used as a fluid, the inlet temperature should not exceed 140°F.

4. A positive pressure must be maintained to the barrier flush between the seal faces even when the pump is not running. To conserve the barrier liquid a solenoid valve (Item 1) may be installed and connected electrically in parallel with the motor so the barrier fluid flows only when the pump is running. Note: The maximum pressure of the barrier fluid at the inlet is 150 PSIG.

5. The inlet should be connected to the bottom and the outlet to the top of the seal cavity.

Procedures for Checking Double Seals for Internal Leakage

Option 1 - for use with 2 flow meters.

Install flow meters on the inlet and outlet lines. Normal operating conditions will be indicated by equal or near equal flow on both flow meters. If the inlet flow meter shows more flow than the outlet, this could indicate excessive leakage.

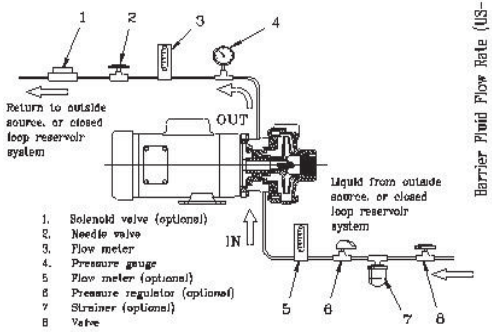
Option 2 - for use with 1 flow meter.

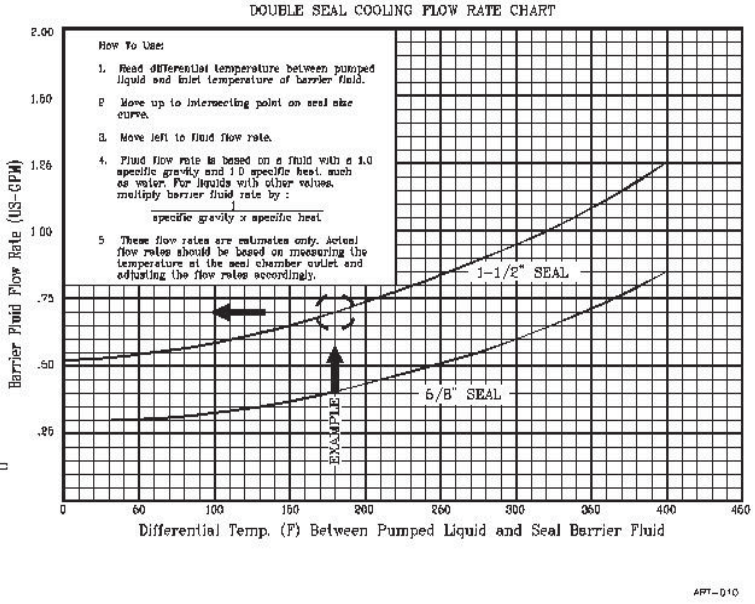
1. Shut off flow at outlet needle valve (Item 2).

2. Shut off inlet gate valve (Item 8) - for 15 seconds maximum.

3. If pressure in seal cavity drops rapidly rather than gradually while the gate valve is shut, the seal is leaking excessively.

4. To restart open gate valve first then reset valve on outlet.





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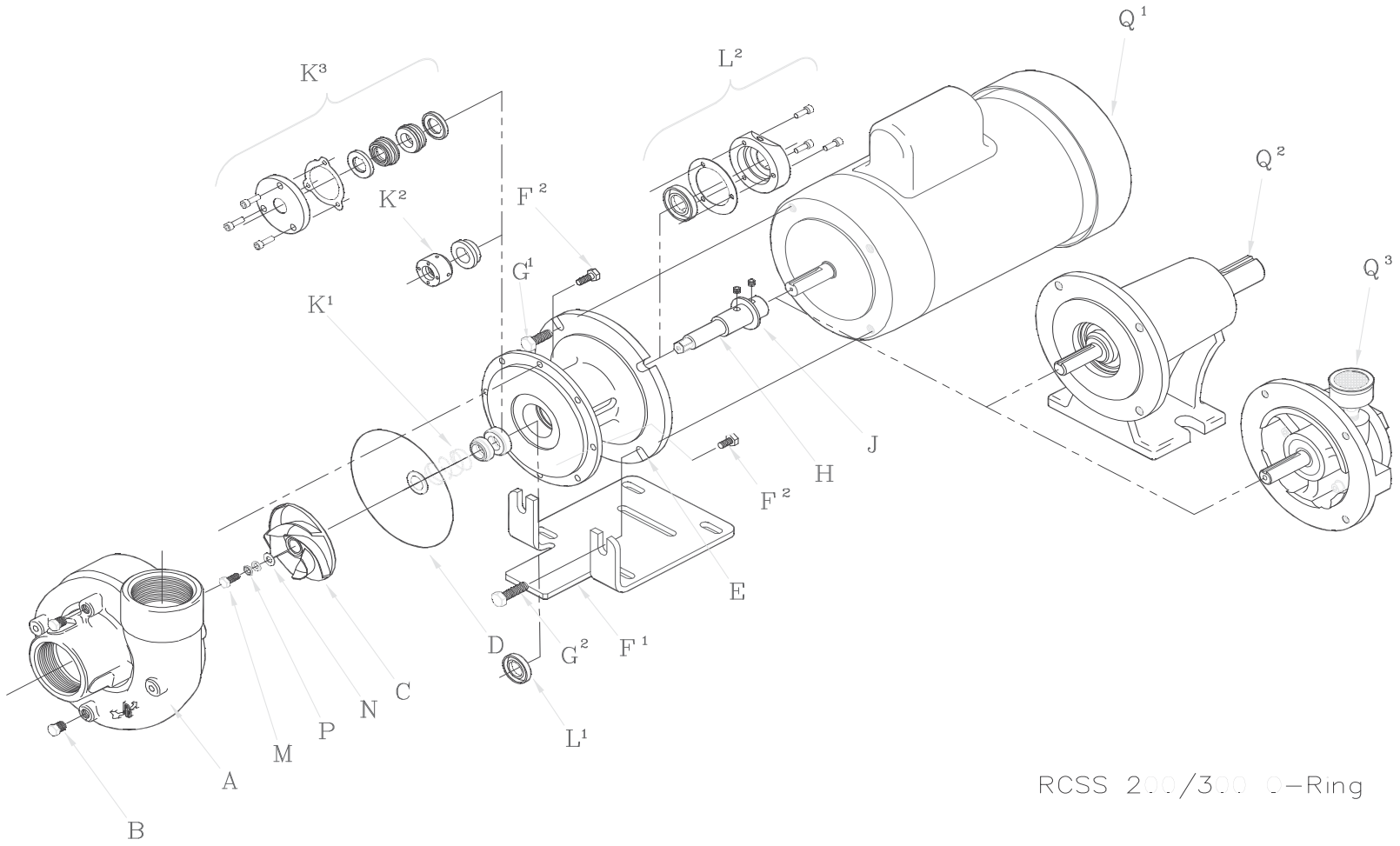
Key #	Description	Quantity	RC200 Part #	RC300 Part #
A.	Volute SS	1	3710-0	3712-0
B.	Pipe Plugs 1/8”	2	0559	0559
C.	Impeller Specify diameter **			
	SS (Hex bore)	1	3711- (specify dia.)	3713- (specify dia.)
D.	O-ring, Viton	1	3070	3070
E.	Bracket	1	0972	0972
F[1]	Mounting Base	1	0197	0197
F[2]	Volute Bolts	8	0917	0917
G[1]	Motor Bolts		0593	0593
	Base	2		
	No Base	4		
G[2]	Motor Bolts		0673	0673
	Base	2		
	No Base	0		
H.	Hex Shaft w/ setscrews 5/8” ID (56C motor)	1	3714-1	3714-1
H.	Hex Shaft w/ setscrews 7/8” ID (143TC, 145TC, 182C, 184C motor)	1	3715-1	3715-1
J.	Slinger (For 5/8” shaft pumps only)	1	0522	0522
	Seal with Seat			
K[1]	T.21 Fluorocarbon (std.)	1	0553	0553
K[2]	T.9 PTFE (optional)	1	1150	1150
K[3]	Double Seal/Seat (opt):			
	T.21 Fluorocarbon	2	0985	0985
	T.21 Neoprene	2	0984	0984
	T.21 EPR	2	1023	1023
	Double Seal Plate	1	0973	0973
	Plate Gasket, PTFE	1	0974	0974
	Seal Plate Cover Bolts	3	0256	0256
L.	T.21 Quench Opt (For 5/8” shaft pumps only) Fluorocarbon Lip Seal	1	0891	0891
M.	Impeller Lockdown Bolt	1	0596	0596
N.	Impeller Lockdown Washer	1	2423	2423
P.	Impeller Lock Washer	2	2344	2344
Q[1]	Motor, Electric (For 5HP 184C or other footed motors, only use bracket.)	1	Specify P/N	Specify P/N
Q[2]	Power Frames			
	For use with 5/8” ID Shaft	1	5478	5478
	For use with 7/8” ID Shaft	1	5501	5501
Q[3]	Air Motor	1	Specify P/N	Specify P/N
RC - Repair Parts Kit				
	For **56C 5/8” Hex** shaft	1	2207	--------
	For **56C 7/8” Hex** shaft	1	--------	2207-1

(Includes: Hexed Shaft w/ SS , Slinger (5/8” shaft only), Impeller Lockdown Bolt, 2ea. Impeller Lockdown Washers)

** Double seal pumps use double seal impellers, for example; P/N 3711DS - (specify dia.)

PRICE® PUMP CO.



Price® Pump Co.
21775 Eighth Street East * Sonoma, CA 95476-0329 * (707) 938-8441 * Fax (707) 938-0764

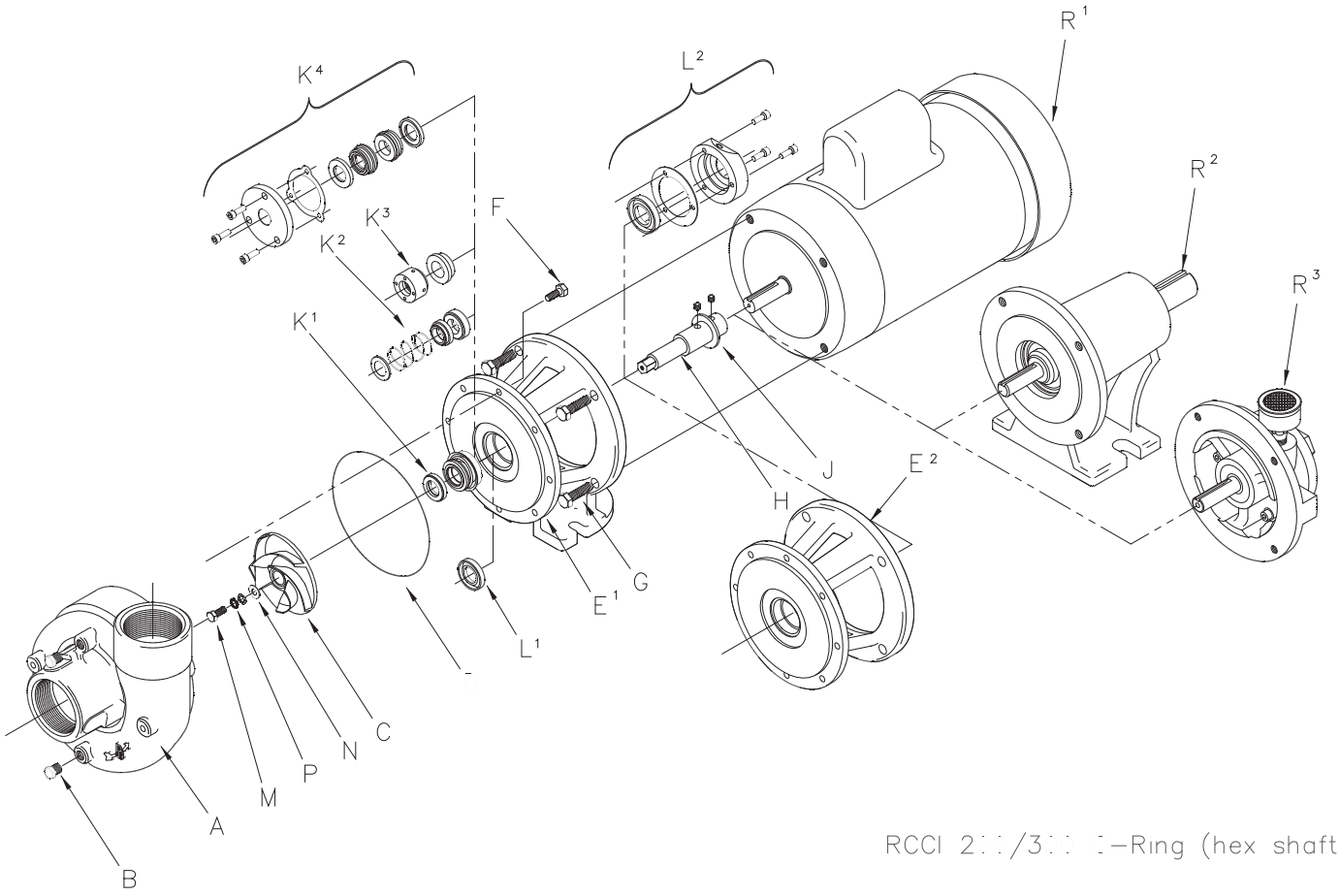
Key #	Description	Quantity	RC200 Part #	RC300 Part #
A.	Volute Cast Iron	1	0183-0	0120-0
A.	Volute Bronze	1	3716-0	3717-0
B.	Pipe Plugs 1/8"	2	0557	0557
C.	Impeller - Specify diameter **			
	Cast Iron (Hex Bore)	1	4185 - (specify dia.)	4186 - (specify dia.)
	Bronze (Hex Bore)	1	4115 - (specify dia.)	4116 - (specify dia.)
	Stainless Steel (Hex Bore)	1	3711- (specify dia.)	3713 - (specify dia.)
D.	O-ring (Buna std.)	1	3074	3074
E[1]	Bracket w/ Foot	1	2426	2426
E[2]	Bracket w/o Foot	1	2428	2428
F.	Volute Bolts	8	0573	0573
G.	Motor Bolts	4	0588	0588
H.	Shaft w/ setscrews 5/8" ID, Hex (56C motor)	1	3714-1	3714-1
H.	Shaft w/ setscrews 7/8" ID, Hex (143TC, 145TC, 182C, 184C motor)	1	3715-1	3715-1
J.	Slinger (For 5/8" shaft pumps only)	1	0522	0522
	Seal with Seat			
K[1]	T.6A Buna (std.)	1	0538	0538
K[2]	T.21 Fluorocarbon (optional)	1	0553	0553
K[3]	T.9 PTFE (optional)	1	1150	1150
K[4]	Double Seal/Seat (opt):			
	T.21 Fluorocarbon	2	0985	0985
	T.21 Neoprene	2	0984	0984
	T.21 EPR	2	1023	1023
	Double Seal Plate	1	0973	0973
	Plate Gasket, PTFE	1	0974	0974
	Seal Plate Cover Bolts	3	0256	0256
L[1]	T.6A Quench Lip Seal, Fluorocarbon	1	0899	0899
L[2]	T.21 Quench (5/8" shaft pumps only)			
	Quench Plate	1	0308	0308
	Plate Gasket, Syn. Fiber	1	0504	0504
	Seal Plate Cover Bolts	3	0267	0267
	Fluorocarbon Lip Seal	1	0891	0891
M.	Impeller Lockdown Bolt	1	0596	0596
N.	Impeller Lockdown Washer	1	2423	2423
P.	Impeller Lock Washer	2	2344	2344
R[1]	Motor, Electric (For 5HP 184C or other footed motors, use P/N 2428 bracket.)	1	Specify P/N	Specify P/N
R[2]	Power Frames			
	For use with 5/8" ID Shaft	1	5478	5478
	For use with 7/8" ID Shaft	1	5501	5501
R[3]	Air Motor	1	Specify P/N	Specify P/N
RC - Repair Parts Kit				
	For **56C 5/8" Hex** shaft	1	2207	--------
	For **56C 7/8" Hex** shaft	1	--------	2207-1

(Includes: Hex Shaft w/ SS Slinger (5/8" shaft only), Impeller Lockdown Bolt , Washer and Key)

** Double seal pumps use d ouble seal impellers, for example ; P/N 4185DS - (specify dia.)

PRICE® PUMP CO.

RCCI_P.dwg rev. C



RCCI 2::/3:: :-Ring (hex shaft)

Price® Pump C:.
21775 Eighth Street East * Sonoma, CA 95476-0329 * (707) 938-8441 * Fax (707) 938-0764

PRICE CENTRIFUGAL PUMP CAUTIONS & WARNINGS

- **CAUTION:** Price Pump centrifugal pumps must be operated above minimum flow rate to avoid damage.
- **CAUTION:** All Price Pump centrifugal pumps require the suction to be flooded.
- **CAUTION:** It is recommended that all piping connections to the pump be flexible.
- **WARNNING:** Verify chemical compatibility of the pump materials of construction with the fluid being pumped.
- **WARNNING:** Price centrifugal pumps are not designed for use in sanitary or food applications.
- **CAUTION:** Use only Price Pump original equipment factory replacement parts.
- **WARNNING:** Price pump fluid temperature limits must be observed. Maximum operating temperature is 300°F.
- **CAUTION:** The pump should be thoroughly flushed and drained before disassembly.
- **CAUTION:** For larger pump motor units, weight may exceed 65 1bs. (30 kg).

CAUTION: Maximum working pressure for seals:

- Type 6 Seal **75 PSI** (5.2 bar)
- Type 6A Seal **75 PSI** (5.2 bar)
- Type 8 Seal **325 PSI** (22.4 bar)
- Type 9 Seal **350 PSI** (24.1 bar)
- Type 21 Seal **150 PSI** (10.3 bar)
- Type 2106 Seal **150 PSI** (10.3 bar)

CAUTION: Maximum solid size by pump

- HP75 / MS50 **0.030"** (0.76mm)
- SP150 **0.060"** (1.50mm)
- LT25 **0.120"** (3.05mm)
- F50/75/95 **0.150"** (3.81mm)
- OH75 **0.150"** (3.81mm)
- CD100/150 **0.150"** (3.81mm)
- CL150 **0.150"** (3.81mm)
- RC200/300 **0.380"** (9.60mm)
- XJ-JB100 **0.120"** (3.05mm)
- XJ-JB150 **0.250"** (6.40mm)
- XJ-JB200 **0.440"** (11.2mm)
- XL-XT100 **0.120"** (3.05mm)
- XL-XT150 **0.250"** (6.40mm)
- XL-XT200 **0.440"** (11.2mm)

- HP75 / MS50 **0.5 GPM** (1.9 LPM)
- SP150 **10 GPM** (38 LPM)
- LT25 **0.5 GPM** (1.9 LPM)
- F50/75/95 **5.0 GPM** (19 LPM)
- OH75 **7.0 GPM** (26 LPM)
- CD100 **12 GPM** (45 LPM)
- CD150 **25 GPM** (94 LPM)
- CL150 **40 GPM** (150 LPM)
- RC200 **10 GPM** (38 LPM)
- RC300 **50 GPM** (189 LPM)
- XJ-JB150 **20 GPM** (75 LPM)
- XJ-JB150 **40 GPM** (150 LPM)
- XJ-JB200 **90 GPM** (340 LPM)
- XL-XT100 **10 GPM** (38 LPM)
- XL-XT150 **35 GPM** (132 LPM)
- XL-XT200 **50 GPM** (189 LPM)

GENERAL TERMS OF SALE FOR PRODUCTS

1. GENERAL

A. Seller's price is based on these sales terms and conditions. The agreement and inclusion of other or amended terms in this contract will result in a change (including increase) in Seller's pric e (as may be contained in any price books or quotations) to reflect such other or amended terms . This contract shall represent the final, complete and exclusive statement of the agreement between the parties and may not be modified, supplemented, explained or waived by parole evidence, any Terms and Conditions contained in Buyer's purchase order or request for quotation, any course of dealings between the parties, Seller's performance or delivery, or in any other way. The Terms and Conditions of this contr act may only be modified or waived in a written document signed by an Officer of Seller. These terms are intended to cover all activity of Seller and Buyer hereunder, including sales and use of products, parts and work and all related matters (references t o products include parts and references to work include construction, installation and start -up). Any reference by Seller to Buyer's specifications and similar requirements are only to describe the products and work covered hereby and no warranties or oth er terms therein shall have any force of effect. Any information provided by Seller including, but not limited to, suggestions as to specific equipment does not imply any guarantee of specific suitability and/or material compatibility in a particular appl ication, since many factors outside the control of Seller may affect the suitability of products in a particular application. Catalogs, circulars, similar pamphlets and information contained on websites of the Seller are issued for general information pur poses only and shall not be deemed to modify the provisions hereof.

B. The agreement formed hereby and the language herein shall be construed and enforced under the Uniform Commercial Code as in effect in the State of California on the date hereof.

2. TAXES

Any sales, use or other similar type taxes imposed on this sale or on this transaction and/or any import or export duties or fees as may be assessed or imposed on or as a result of deliveries under this transaction are not included in the price . Such taxes shall be billed separately to the Buyer. Seller will accept a valid exemption certificate from the Buyer if applicable; however, if an exemption certificate previously accepted is not recognized by the governmental taxing authority involved and the Seller is required to pay the tax covered by such exemption certificate. Buyer agrees to promptly reimburse Seller for the taxes paid.

3. PERFORMANCE, INSPECTION AND ACCEPTANCE

A. Unless Seller specifically assumes installation, construction or start-up responsibility, all products shall be finally inspected and accepted within thirty (30) days after arrival at point of delivery. Where seller has responsibility for installation, construction or start -up all work shall be finally inspected and accepted with thirty (30) days after completion of the applicable work by Seller. All claims whatsoever by Buyer, (including claims for shortages) except only those provided for under the WARRANTY AND LIMITATION OF LIABILITY and PATENTS Clauses, hereof, must be asserted in writing by Buyer within said thirty (30) day period or they are waived. If this contract involves partial performance, all such claims must be asserted within said thirty - (30) day period for each partial performance. There shall be n o revocation of acceptance. Rejection may be only for defects substantially impairing the value of products or work and Buyer's remedy for lesser defects shall be those provided for under the WARRANTY AND LIMITATION OF LIABILITY Clause.

B. Seller shall not be responsible for non -performance or for delays in performance occasioned by any causes beyond Seller's reasonable control, including, by way of example and not limitation, to labor difficulties, delays of vendors or carriers, fires, governmental act ions, or shortages of material, components, labor, or manufacturing facilities. Any delays so occasioned shall affect a corresponding extension of Seller's performance dates, which are, in any event, understood to be approximate. IN NO EVENT SHALL BUYER BE ENTITLED TO INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR LATE PERFORMANCE OR FOR A FAILURE TO PERFORM. Seller reserves the right to make partial shipments and to ship products, parts or work which may be completed prior to the scheduled performance date.

C. In the event that Seller has agreed to mount motors, turbines, gears, or other products which are not manufactured by Seller and which are not an integral part of Seller's manufactured product, and a delay in the delivery of such products to Seller occ urs that will cause a delay in Seller's performance date, Seller reserves the right to ship its product upon completion of manufacture and to refund an equitable portion of the amount originally included in the purchase price for mounting without incurring liability for non -performance.

D. Seller reserves to itself the right to change its specifications, drawings and standards if such changes will not impair the performance of its products, and parts, and further those products , and parts, will meet any of Buyer's specifications and other specific product requirements which are a part of this agreement. Seller is a global supplier of products and utilizes parts and products obtained worldwide, and Seller's products supplied under this contract shall be s ubject to Seller's sole determination as to all manufacturing, sourcing, assembly and supply unless otherwise specifically agreed in writing.

E. The manufacture and inspection of products and parts shall be to Seller's Engineering and Quality Assurance st andards, plus such other inspections or tests of documentation as are specifically agreed to by Seller. Requirements for any additional inspection, tests, documentation, or Buyer witness of manufacture, test, and/or inspection shall be subject to addition al charges.

4. TITLE AND RISK OF LOSS

Title and risk of loss shall pass to buyer upon delivery of products at the designated "Ex Works" as defined by Incoterms, unless other wise agreed by the parties.

5. EROSION AND CORROSION

It is specifically unde rstood that products and parts sold hereunder are not warranted for operation with erosive or corrosive fluids or for operation with any fluid or under any operating condition in variance with the specifications of this contract . No product or part shall b e deemed to be defective by reason of failure to resist erosive or corrosive action of any fluid and Buyer shall have no claim whatsoever against Seller therefore. No product shall be deemed defective by reason of any effect on Seller's products of the ac tion or results (such as vibration) of any goods or system (such as piping) not supplied by Seller.

6. BUYER'S RESPONSIBILITY

The design specifications of the equipment require the operation of the equipment within certain parameters and m ay call for the use of speed controls, safety devices, set points or other control devices to insure that the operation remains within design parameters. Buyer agrees and understands that the equipment must be operated and maintained within design specific ations and operated within the specifications of the contract, irrespective of whether controls or devices are otherwise required.

7. WARRANTY AND LIMITATION OF LIABILITY.

A. Seller warrants only that its product and parts, when shipped, will be free fr om defects in materials and workmanship. All claims for defective products or parts under this warranty must be made in writing immediately upon discovery and, in any event, within two (2) years of shipment by seller and all claims for defective work must be made in writing immediately upon discovery. Defective items must be held for Seller's inspection and returned to the sellers' point of original shipment upon request.

ANY UNAUTHORIZED DISSASSEMBLY, ALTERATION OF OR TAMPERING WITH ANY PRODUCT OR COMPONENT MAY "VOID" THE WARRANTY, IN THAT SUCH ACTION WILL RESULT IN SELLER BEING RELEASED AND RELIEVED FROM ITS OBLIGATIONS UNDER THIS WARRANTY AND FOR ANY FURTHER COSTS OR ACTIONS UNDER CLAUSE 7.C, FOLLOWING, AND THE BUYER ASSUMING SOLE RESPONSIBILITY FOR THE COSTS AND RESULTS OF SUCH ACTION.

THE FOREGOING IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES WHATSOEVER, EXPRESS, IMPLIED AND STATUTORY, INCLUDING WITHOUT LIMITATION, THE IMPLIED, WARRANTIES OF MERCHANTABILITY AND FITNESS.

B. ANY PRODUCT (S) SOLD HEREU NDER WHICH ARE NOT MANUFACTURED BY SELLER ARE NOT WARRANTED BY SELLER and shall be covered only by the express warranty, if any, of the manufacturer thereof. With respect to products and parts not manufactured by Seller, Seller's only obligation shall be to assign to Buyer, to the extent possible, whatever warranty Seller obtains from the manufacturer.

C. Upon Buyer's submission of a claim as provided above and its substantiation, Seller shall at its option either (i) repair or replace its product, part o r work at the original place of shipment, or (ii) refund an equitable portion of the purchase price.

D. THE FOREGOING IS SELLER'S ONLY OBLIGATION AND BUYER'S EXCLUSIVE REMEDY FOR BREACH OF WARRANTY AND, EXCEPT FOR THE REMEDIES PERMITTED UNDER THE PERFORMANCE, INSPECTION AND ACCEPTANCE AND THE PATENTS CLAUSES HEREOF, THE FOREGOING IS BUYER EXCLUSIVE REMEDY AGAINST SELLER FOR ALL CLAIMS ARISING HEREUNDER OR RELATING HERETO WHETHER SUCH CLAIMS ARE BASED ON BREACH OF CONTRACT, TORT (INCLUDING NEGLIGENCE OR S TRICT LIABILITY) , INDEMNITY OR OTHER THEORIES. BUYER'S FAILURE TO SUBMIT A CLAIM AS PROVIDED ABOVE SHALL SPECIFICALLY WAIVE ALL CLAIMS FOR DAMAGES OR OTHER RELIEF, INCLUDING BUT NOT LIMITED TO CLAIMS BASED ON LATENT DEFECTS. IN NO EVENT SHALL BUYER BE EN TITLED TO INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES, NOR FOR DAMAGES FOR LOSS OF USE, LOST PROFITS OR REVENUE, INTEREST, LOST GOODWILL, WORK OR PRODUCTION STOPPAGE, IMPAIRMENT OF OTHER GOODS, INCREASED EXPENSES OF OPERATION, OR THE COST OF PURCHASING REPLACEMENT POWER OR OTHER SERVICES BECAUSE OF SERVICE INTERRUPTIONS. FURTHERMORE, IN NO EVENT SHALL SELLER'S TOTAL LIABILITY FOR DAMAGES OF BUYER EXCEED THE PURCHASE PRICE OF THE PRODUCTS OR PARTS MANUFACTURED BY SELLER AND UPON WHICH SUCH LIABIL ITY IS BASED. ANY ACTION ARISING HEREUNDER RELATED HERETO, WHETHER BASED ON BREACH OF CONTRACT, TORT (INCLUDING NEGLIGENCE) OR OTHER THEORIES, MUST BE COMMENCED WITHIN ONE (1) YEAR AFTER THE CAUSE OF ACTION ACCRUES OR IT SHALL BE BARRED.

8. PURCHASER'S R EPRESENTATIONS & WARRANTIES

Purchaser represents and warranties that the products(s) covered by this contract shall not be used in or in connection with a nuclear facility or application. The parties agree that this representation and warranty is material and is being relied on by seller. This provision may be modified in a separate writing signed by an officer of Price Pump Co.

9. PATENTS

Seller agrees to assume the defense of any suit for infringement of any patents brought against Buyer to the extent of such suit charges infringement of an apparatus or product claim by Seller's product in and of itself, provided (i) said product is built entirely to Seller's design, (ii) Buyer notifies Seller in writing of the filing of such suit within ten (10) days a fter the service of process thereof, and (iii) Seller is given complete control of the defense of such suit, including the right to defend, settle and make changes in the product for the purpose of avoiding infringement of any process or method claims. Pr ovided however, Seller will not defend any suit for infringement of a claimed patent where such alleged infringement is the result of following specific instruction furnished by Seller.

10. EXTENT OF SUPPLY

Only products as listed in Seller's proposal are included in this agreement. It must not be assumed that Seller has included anything beyond same.

11. MANUFACTURING SOURCES

To maintain delivery schedules, Seller reserves the right to have all or any part of the Buyer's order manufactured at an y of Sellers', sellers' licensees or sub contractors' plants, globally.

12. TERMS OF PAYMENT

Net 30 days from date of invoice .

13. ARBITRATION

In the event a dispute arises between the parties relating to or arising out of this agreement, the parties agree to attempt to have their senior management amicably settle the matter. In the event that the matter cannot be settled, the parties shall submit all disputes relating to this Agreement (whether contract, tort, products liability or otherwise) to bind ing Arbitration before a panel of arbitrators under the Commercial Dispute Resolution Procedures of the American Arbitration Association. Each party shall appoint an arbitrator and the third shall be selected in accordance with the rules of the American A rbitration Association. Judgment upon the award may be entered in any court having jurisdiction. The parties shall cooperate in providing reasonable disclosure of relevant documents. Each party shall bear its own expenses, and the costs and fees of the ar bitration shall be borne as allocated by the Arbitrator.

P-6101,2,3 - Beta - BT4b - BT4B0708PVT2000UD010A01Flow: 1.88GPH / 7.10L/HPressure: 102PSI / 07BAR"

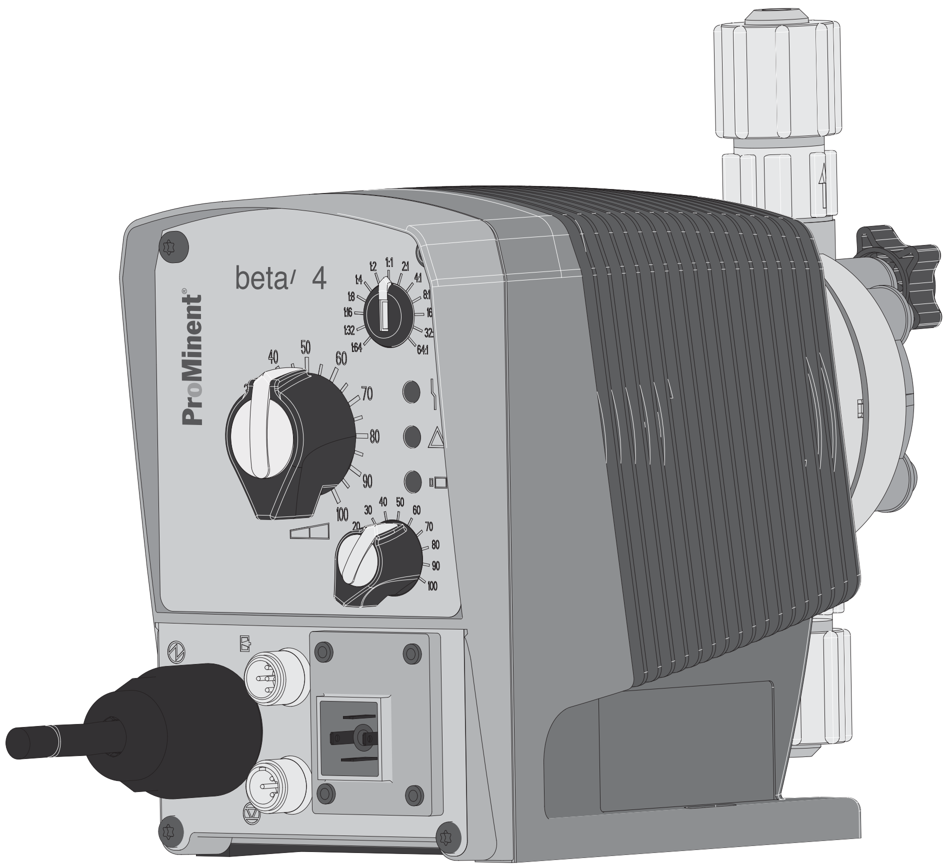
ProMinent®

Operating instructions

Solenoid Metering Pump

Beta® b BT4b and BT5b

EN



Please carefully read these operating instructions before use. · Do not discard.
The operator shall be liable for any damage caused by installation or operating errors.
The latest version of the operating instructions are available on our homepage.

Supplementary information

Fig. 1: Please read!

Read the following supplementary information in its entirety! You will benefit more from using the operating instructions should you already know this information.

The following are highlighted separately in the document:

- Enumerated lists

→ Instructions

⇨ Outcome of the instructions

↳ *'State the identity code and serial number' on page 2*: Links to points in this chapter

- refer to ... : References to points in this document or another document

[Keys]

Information

This provides important information relating to the correct operation of the unit or is intended to make your work easier.

Safety Information

Safety information is identified by pictograms - see Safety Chapter.

Validity

These operating instructions conform to current EU regulations applicable at the time of publication.

State the identity code and serial number

Please state identity code and serial number, which you can find on the nameplate when you contact us or order spare parts. This enables us to clearly identify the unit type and material versions.

Table of contents

1 Identity code

Product range Beta b							
BT4b	Type	Capacity					
		bar	l/h				
	1000	10	0.74				
	1601	16	1.10				
	1602	16	2.20				
	1604	16	3.60				
	0708	7	7.10				
	0413	4	12.30				
	0220	2	19.00				
BT5b							
	2504	25	2.90				
	1008	10	6.80				
	0713	7	11.00				
	0420	4	17.10				
	0232	2	32.00				
		Material of dosing head/valves					
		PP	Polypropylene/PVDF. With the self-bleeding version (SEK): polypropylene/polypropylene				
		NP	Clear acrylic/PVDF. With the self-bleeding version (SEK): Clear acrylic/PVC				
		PV	PVDF/PVDF				
		TT	PTFE/PTFE				
		SS	Stainless steel 1.4404/1.4404				
			Material of seals/diaphragm				
			T	PTFE/PTFE coated			
			E	EPDM/PTFE coated, only for PP and NP self-bleeding (SEK)			
			B	FPM-B/PTFE coated, only for PP and NP self-bleeding (SEK)			
			W	Diaphragm additionally with FPM coating for media containing silicate			
				Dosing head design			
				0	without bleed valve, without valve spring only for NP, TT, SS and type 0232		
				1	without bleed valve, with valve spring only for NP, TT, SS and type 0232		
				2	with bleed valve, without valve spring only for PP, PV, NP not for type 0232		
				3	with bleed valve, with valve spring only for PP, PV, NP not for type 0232		
				4	version for higher-viscous media only for PVT, type 1604, 2504, 0708, 1008, 0413, 0713, 0220, 0420		
				7	self-bleeding (SER) only for PV/NP, not for types 1000, 1601 and 0232		
				9	self-bleeding (SEK) only for PP/NP, not for types 1000 and 0232		
					Hydraulic connector		
					0	Standard connection in line with technical data	
					5	Connector for 12/6 tube, discharge side only	
					9	Connector for 10/4 tube, discharge side only	

Product range Beta b	
Design	
0	Standard
Logo	
0	with ProMinent logo
Electrical connections	
U	100 ... 230 V ± 10%, 50/60 Hz*
Cable and plug	
A	2 m European
B	2 m Swiss
C	2 m Australian
D	2 m USA
1	2 m open end
Relay	
0	No relay
1	fault indicating relay (NC) (change-over relay)
3	fault indicating relay (NO) (change-over relay)
4	as 1 + pacing relay, (ONE each)
5	as 3 + pacing relay, (ONE each)
Accessories	
0	without accessories
1	with foot and injection valve, 2 m PVC suction line, 5 m PE metering line
Control type	
0	no lock
1	with lock: manual operation locked when external cable plugged in
H	External without PCS stop
Control version	
0	Standard
A	External analogue 0...20 mA / 4...20 mA
Options	
00	no options

2 About this pump

Properties of the device

This solenoid metering pump Beta b is equipped with all adjustment and activation functions for modern water treatment and the dosing of chemicals. It has pulse step-up and pulse step-down compared with the preceding model. This enables it to adapt more precisely to external signal generators. The result is the simpler and more precise adjustment of chemical consumption to the actual need. It also has a 10 percent increase in efficiency and energy efficiency over the preceding model. The Beta b can be simply adjusted during operation.

3 Safety Chapter

Identification of safety notes

The following signal words are used in these operating instructions to denote different severities of danger:

Signal word	Meaning
WARNING	Denotes a possibly dangerous situation. If this is disregarded, you are in a life-threatening situation and this can result in serious injuries.
CAUTION	Denotes a possibly dangerous situation. If this is disregarded, it could result in slight or minor injuries or material damage.

Warning signs denoting different types of danger

The following warning signs are used in these operating instructions to denote different types of danger:

Warning signs	Type of danger
	Warning – automatic start-up.
	Warning – high-voltage.
	Warning – danger zone.

Intended Use

- Only use the pump to meter liquid feed chemicals.
- Only use the pump after it has been correctly installed and started up in accordance with the technical data and specifications contained in the operating instructions.
- Observe the general limitations with regard to viscosity limits, chemical resistance and density - see also ProMinent resistance list in the Product Catalogue or at www.prominent.com!
- All other uses or modifications are prohibited.
- The pump is not intended for the metering of gaseous media and solids.
- The pump is not intended for the metering of flammable media without implementing suitable protective measures.
- The pump is not intended for the metering of explosive media.
- The pump is not intended for operation in areas at risk from explosion.
- The pump is not intended for exterior applications without the implementation of suitable protective measures.
- The pump should only be operated by trained and authorised personnel, see the following "Qualifications" table.
- You are obliged to observe the information contained in the operating instructions at the different phases of the unit's service life.

Safety Information

WARNING!

Warning about personal and material damage

The pump can start to pump, as soon as it is connected to the mains voltage.

– Install an emergency cut-off switch in the pump power supply line or integrate the pump in the emergency cut-off management of the system.

WARNING!

Danger of electric shock

A mains voltage may exist inside the pump housing.

– If the pump housing has been damaged, you must disconnect it from the mains immediately. It may only be returned to service after an authorised repair.

WARNING!

Warning of dangerous or unknown feed chemical

Should a dangerous or unknown feed chemical be used: It may escape from the hydraulic components when working on the pump.

– Take appropriate protective measures before working on the pump (e.g. safety glasses, safety gloves, ...). Observe the safety data sheet for the feed chemical.
– Drain and flush the liquid end before working on the pump.

WARNING!

Fire danger

When pumping inflammable media the operator must take suitable safety precautions.

WARNING!

Danger from hazardous substances!

Possible consequence: Fatal or very serious injuries.

Please ensure when handling hazardous substances that you have read the latest safety data sheets provided by the manufacture of the hazardous substance. The actions required are described in the safety data sheet. Check the safety data sheet regularly and replace, if necessary, as the hazard potential of a substance can be re-evaluated at any time based on new findings.

The system operator is responsible for ensuring that these safety data sheets are available and that they are kept up to date, as well as for producing an associated hazard assessment for the workstations affected.

CAUTION!

Warning of feed chemical spraying around

Feed chemical can spray out of the hydraulic components if they are manipulated or opened due to pressure in the liquid end and adjacent parts of the system.

– Disconnect the pump from the mains power supply and ensure that it cannot be switched on again by unauthorised persons.
– Depressurise the system before commencing any work on hydraulic parts.

CAUTION!

Warning of feed chemical spraying around

The metering pump can generate a multiple of its rated pressure. Hydraulic parts can rupture if a discharge line is blocked.

– Correctly install a relief valve in the discharge line downstream of the metering pump.

CAUTION!

Warning of feed chemical spraying around

An unsuitable feed chemical can damage the wetted parts of the pump.

– Take into account the resistance of the wetted materials when selecting the feed chemical - see the ProMinent Product Catalogue or visit our homepage.

CAUTION!

Danger of injury to personnel and material damage

The use of untested third party components can result in injury to personnel and material damage.

– Only fit parts to metering pumps that have been tested and recommended by ProMinent.

CAUTION!

Danger from incorrectly operated or inadequately maintained pumps

Danger can arise from a poorly accessible pump due to incorrect operation and poor maintenance.

– Ensure that the pump is accessible at all times.
– Adhere to the maintenance intervals.

CAUTION!

Danger from incorrect metering

Should a different liquid end size be fitted, this will change the metering behaviour of the pump.

– Have the pump reprogrammed in the works.

CAUTION!

Warning against illegal operation

Observe the regulations that apply where the device is installed.

Fixed separating protective equipment

- Dosing head
- Housing
- Hood (houses the control elements)

The dosing head may only be removed by the customer in accordance with the "Repair" chapter.

The housing and the hood may only be removed by ProMinent customer service department.

Information in the event of an emergency

In an emergency, either pull out the mains plug, turn the multifunctional switch to "Stop" or press the Emergency Stop switch installed on the customer's side or disconnect the pump from the mains power supply in line with the emergency shut-down management guidelines for your system!

If feed chemical escapes, additionally ensure that the hydraulic system around the pump is at atmospheric pressure. Adhere to the safety data sheet for the feed chemical.

Qualification of personnel

Task	Qualification
Storage, transport, unpacking	Instructed person
Assembly	Technical personnel, service
Planning the hydraulic installation	Qualified personnel who have a thorough knowledge of metering pumps
Hydraulic installation	Technical personnel, service
Installation, electrical	Electrical technician
Operation	Instructed person
Maintenance, repair	Technical personnel, service
Decommissioning, disposal	Technical personnel, service
Troubleshooting	Technical personnel, electrical technician, instructed person, service

Explanation of the table:

Qualified personnel

A qualified employee is deemed to be a person who is able to assess the tasks assigned to him and recognise possible dangers based on his/her technical training, knowledge and experience, as well as knowledge of pertinent regulations.

Note:

A qualification of equal validity to a technical qualification can also be gained by several years of employment in the relevant field of work.

Electrical technician

An electrical technician is able to complete work on electrical systems and recognise and avoid possible dangers independently based on his/her technical training and experience, as well as knowledge of pertinent standards and regulations.

The electrical technician should be specifically trained for the working environment in which he is employed and know the relevant standards and regulations.

An electrical technician must comply with the provisions of the applicable statutory directives on accident prevention.

Instructed person

An instructed person is deemed to be a person who has been instructed and, if required, trained in the tasks assigned to him/her and possible dangers that could result from improper behaviour, as well as having been instructed in the required protective equipment and protective measures.

Service

The Service department refers to service technicians, who have received proven training and have been authorised by ProMinent to work on the system.

Sound pressure level

Sound pressure level LpA < 70 dB according to EN ISO 20361

at maximum stroke length, maximum stroke rate, maximum back pressure (water)

4 Storage, Transport and Unpacking

Safety Information

WARNING!

The transporting of pumps which have been used with radioactive feed chemicals is forbidden!

They will also not be accepted by ProMinent!

WARNING!

Only return metering pumps for repair in a cleaned state and with a flushed liquid end - refer to "Decommissioning!

Only return metering pumps with a completed Decontamination Declaration form. The Decontamination Declaration constitutes an integral part of an inspection / repair order. A unit can only be inspected or repaired when a Declaration of Decontamination Form is submitted that has been completed correctly and in full by an authorised and qualified person on behalf of the pump operator.

The "Decontamination Declaration Form" can be found on our homepage.

CAUTION!

Danger of material damage

The device can be damaged by incorrect or improper storage or transportation!

- The unit should only be stored or transported in a well packaged state - preferably in its original packaging.
- The packaged unit should also only be stored or transported in accordance with the stipulated storage conditions.
- The packaged unit should be protected from moisture and the ingress of chemicals.

Ambient conditions

Data	Value	Unit
Minimum storage and transport temperature	-20	°C
Maximum storage and transport temperature	+60	°C
Maximum air humidity *	95	% rel. humidity

* non-condensing

Scope of delivery

Compare the delivery note with the scope of delivery:

- Metering pump with mains cable
- Connector kit for hose/pipe connection (optional)
- Product-specific operating instructions with EC Declaration of Conformity
- Optional accessories

5 Overview of Equipment and Control Elements

5.1 Overview of Equipment

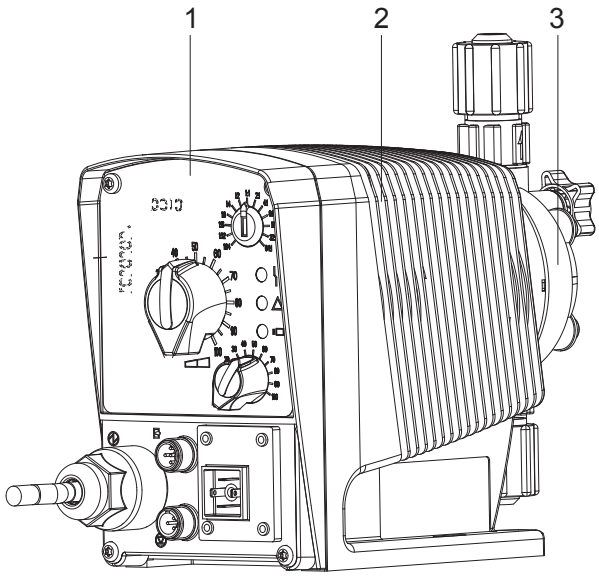


Fig. 2: Complete overview

1 Control unit
2 Drive unit
3 Liquid end

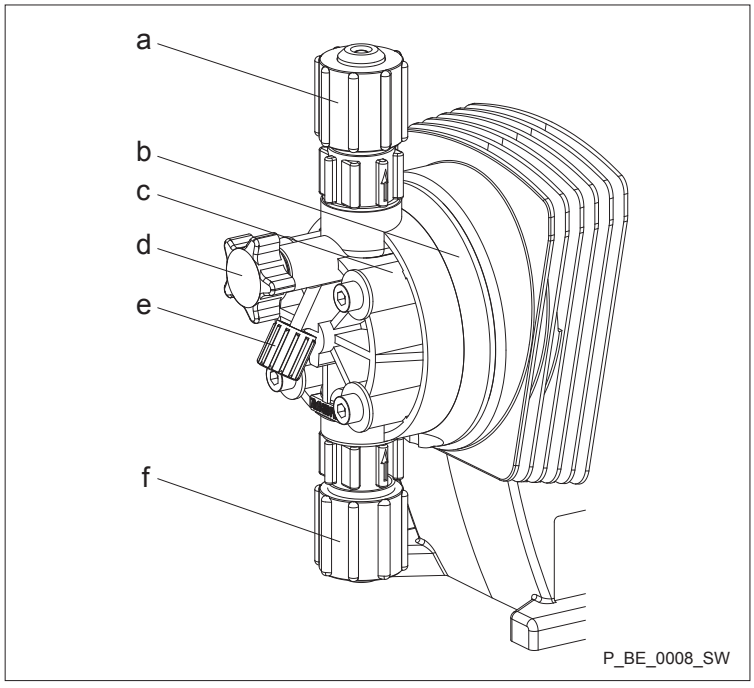
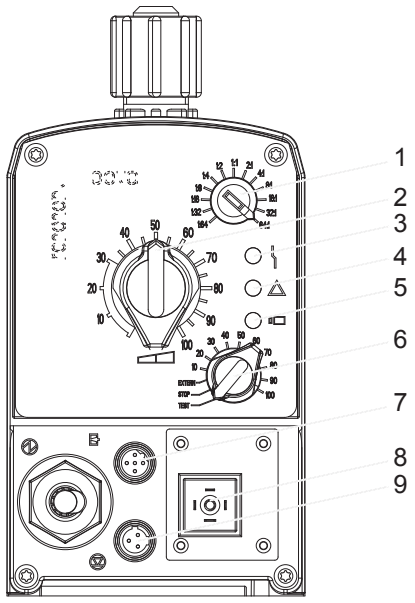


Fig. 3: Overview of liquid end (PV)

a Discharge valve
b Backplate
c Dosing head
d Bleed valve
e Bypass hose sleeve
f Suction valve

5.2 Control Elements



P_BE_0011_SW

Fig. 4

1 Pulse control switch
2 Stroke Length Adjustment Button
3 Fault indicator (red)
4 Warning indicator (yellow)
5 Operating indicator (green)
6 Multifunctional Switch
7 "External control" terminal
8 Relay connection (optional)
9 "Level switch" terminal

5.2.1 Pulse control switch

In **"External Contact" operating mode**, the pulse control switch either triggers a series of strokes or steps down an incoming series of contacts by a single contact (at the "external control" terminal).

In **"External Analogue" operating mode**, the stroke rate can be controlled by an mA signal via the pulse control switch. To do so, the multifunctional switch has to be turned to "Extern".

5.2.2 Stroke Length Adjustment Button

The stroke length adjustment button can be used to adjust the stroke length.

5.2.3 Multifunctional Switch

The multifunctional switch can be used to set the following functions, operating modes and stroke rate.

The operating modes that can be set are:

- Test (priming function)
- Stop (optionally missing)
- Extern (Contact)
- External (analogue, optional)
- Manual (setting stroke rate in 10% increments)

5.2.4 Functional and Fault Indicators

Fault indicator (red)

The fault indicator lights up if the fluid level in the dosing tank falls below the second switching point of the level switch (20 mm residual filling level in the dosing tank).

The fault indicator lights up if the current falls below 3.8 mA (only with 4...20 mA) or exceeds 23 mA in "External Analogue" operating mode.

This LED flashes in the event of an undefined operating status.

Warning indicator (yellow)

The warning indicator lights up if the fluid level in the dosing tank falls below the first switching point of the level switch.

Operating indicator (green)

The operating indicator lights up if the pump is ready for operation and there are no fault or warning alerts. It goes out quickly as soon as the pump has performed a stroke.

5.2.5 "External control" terminal

The "external control" terminal is a five-pole panel terminal.

It enables the following functions and operating modes to be used:

- Pause
- External contact
- External Analogue (optional)
- Auxiliary frequency (external frequency changer)

The two- and four-pole cables used to date can continue to be used. The "Auxiliary frequency" function can, however, only be used with a five-pole cable.

5.2.6 "Level switch" terminal

A 2-stage level switch with pre-warning and end switch-off can be connected.

6 Functional description

6.1 Liquid End

The dosing process is performed as follows: The diaphragm is pressed into the dosing head; the pressure in the dosing head closes the suction valve and the feed chemical flows through the discharge valve out of the dosing head. The diaphragm is now drawn out of the dosing head; the discharge valve closes due to the negative pressure in the dosing head and fresh feed chemical flows through the suction valve into the dosing head. One cycle is completed.

6.2 Drive Unit

The diaphragm is driven by an electromagnet, which is controlled by an electronic controller.

6.3 Capacity

The capacity is determined by the stroke length and the stroke rate.

The stroke length is adjusted by the stroke length adjustment knob within a range of 0 ... 100 %. A stroke length of between 30 ... 100 % (SEK type: 50 ... 100 %) is recommended to achieve the specified reproducibility!

Data	Value	Unit
Recommended stroke length, standard type	30 ... 100	%
Recommended stroke length, SEK type	50 ... 100	%

The stroke rate can be set within a range of 10 ... 100 % using the multifunctional switch.

6.4 Self-Bleeding

Self-bleeding liquid ends (SEK types) are capable of independent priming when a discharge line is connected and diverting existent air pockets via a bypass. During operation they are also capable of conveying away gases which are produced, independently of the operating pressure in the system. It is also possible to dose precisely in a depressurised state due to the integral back pressure valve.

6.5 Operating modes

The operating modes are selected by means of the multifunctional switch.

"Manual" operating mode

As soon as the stroke rate has been set by the multifunctional switch, the pump finds itself in "Manual" operating mode. 100% corresponds to 180 strokes/min.

"External contact" operating mode

The "External Contact" operating mode is described below in the "Operation" and "Installation, Electrical" chapters.

"External Analogue" operating mode

The "External Analogue" operating mode is described below in the "Operation" and "Installation, Electrical" chapters.

6.6 Functions

The functions are described below in the "Operation" chapter.

6.7 Relay

The pump has two connecting options.

Fault indicating relay option

The relay can switch a connected power circuit (e.g. for an alarm horn) in the event of warnings or fault messages (e.g. warning levels).

The relay can be retrofitted with the retrofit kit via a knock-out opening in the pump foot - refer to "Retrofitting relays".

Fault indicating and pacing relay option

This combined relay can generate a contact with each stroke via its pacing relay in addition to its function as a fault indicating relay.

The relay can be retrofitted with the retrofit kit via a knock-out opening in the pump foot - refer to "Retrofitting relays".

6.8 Hierarchy of Operating Modes, Functions and Fault Statuses

The different operating modes, functions and fault statuses have a different effect on if and how the pump reacts.

The following list shows the order:

1. - Test (priming)
2. - Fault, Stop, Pause
3. - Auxiliary frequency (external frequency changeover)
4. - Manual, Extern Contact

Comments:

re 1 - "Priming" can take place in any mode of the pump (providing it is functioning).

re 2 - "Fault", "Stop" und "Pause" stop everything apart from "Priming".

re 3 - The stroke rate of "Auxiliary frequency" always has priority over the stroke rate specified by an operating mode in 4.

7 Assembly

– *Compare the dimensions on the dimension sheet with those of the pump.*

WARNING!

Danger of electric shock

If water or other electrically conducting liquids penetrate into the drive housing, in any other manner than via the pump's suction connection, an electric shock may occur.

– Position the pump so that it cannot be flooded.

CAUTION!

Danger from incorrectly operated or inadequately maintained pumps

Danger can arise from a poorly accessible pump due to incorrect operation and poor maintenance.

– Ensure that the pump is accessible at all times.
– Adhere to the maintenance intervals.

Capacity too low

The liquid end valves can be disturbed by vibrations.

– *Secure the metering pump so that no vibrations can occur.*

Capacity too low

If the valves of the liquid end are not vertical, they cannot close correctly.

– *Suction and discharge valves must stand vertically upwards (for self-bleeding liquid end, the bleed valve).*

Mount the metering pump with the pump foot on a horizontal, level and load-bearing supporting surface.

8 Installation, hydraulic

Safety Information

CAUTION!

Warning of feed chemical spraying around

An unsuitable feed chemical can damage the wetted parts of the pump.

– Take into account the resistance of the wetted materials when selecting the feed chemical - see the ProMinent Product Catalogue or visit our homepage.

CAUTION!

Warning of feed chemical spraying around

Pumps which are not fully installed hydraulically can pump feed chemical from the outlet opening of the discharge valve as soon as they are connected to the mains power supply.

– First install the pump hydraulically, then electrically.
– In the event that you have failed to do so, turn the multi-functional switch to *[Stop]* (if fitted) or press an On / Off switch or Emergency Stop switch on site.

CAUTION!

Warning of feed chemical spraying around

Feed chemical can spray out of the hydraulic components if they are manipulated or opened due to pressure in the liquid end and adjacent parts of the system.

– Disconnect the pump from the mains power supply and ensure that it cannot be switched on again by unauthorised persons.
– Depressurise the system before commencing any work on hydraulic parts.

CAUTION!

Danger from rupturing hydraulic components

Peak loads during the dosing stroke can cause the maximum permissible operating pressure of the system and pump to be exceeded.

– The discharge lines are to be properly designed.

CAUTION!

Danger of personnel injury and material damage

The use of untested third party parts can result in personnel injuries and material damage.

– Only fit parts to metering pumps, which have been tested and recommended by ProMinent.

8.1 Installing hose lines

8.1.1 Installation of Metering Pumps Without Bleed Valve

Safety Information

CAUTION!

Warning of feed chemical spraying around

The pipes can loosen or rupture if they are not installed correctly.

- Route all hose lines so they are free from mechanical stresses and kinks.
- Only use original hoses with the specified hose dimensions and wall thicknesses.
- Only use clamp rings and hose nozzles that are intended for the hose diameter in question to ensure the long service life of the connections.

CAUTION!

Danger from rupturing hydraulic components

Hydraulic components can rupture if the maximum permissible operating pressure is exceeded.

- Always adhere to the maximum permissible operating pressure of all hydraulic components - please refer to the product-specific operating instructions and system documentation.
- Never allow the metering pump to run against a closed shut-off device.
- Install a relief valve.

CAUTION!

Hazardous feed chemicals can escape

Hazardous or extremely aggressive feed chemicals can leak out when using conventional bleeding procedures with metering pumps.

- Install a bleed line with return line into the storage tank.

CAUTION!

Hazardous feed chemicals can escape

Hazardous or extremely aggressive feed chemicals can leak out in the event that the metering pump is removed from the installation.

- Install a shut-off valve on the metering pump's pressure and discharge sides.

CAUTION!

Uncontrolled flow of feed chemical

Feed chemical can press through a stopped metering pump if there is back pressure.

- Use an injection valve or a vacuum breaker.

CAUTION!

Uncontrolled flow of feed chemical

Feed chemicals can leak through the metering pump in an uncontrolled manner in the event of excessive priming pressure.

– Do not exceed the maximum permissible priming pressure for the metering pump.

Align the pipes so that the metering pump and the liquid end can be removed from the side if necessary.

Installing hose lines - PP, NP, PV, TT designs

1. Cut off the ends of the hoses at right angles.
2. Pull the union nut (2) and clamp ring (3) over the hose (1) - see figure Fig. 5.
3. Push the hose end (1) up to the stop over the nozzle (4) and widen, if necessary.

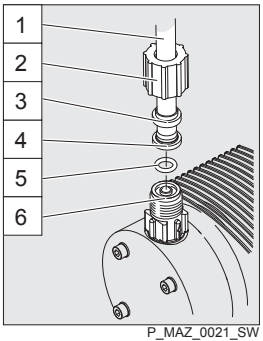
Ensure that the O-ring and flat seal (5) is properly fitted to the valve (6).

Never re-use used PTFE seals. An installation sealed in this way is not watertight.

This type of seal is permanently distorted when subjected to pressure.

In order to enable it to be distinguished from the EPDM flat seal, the FPM flat seal PV design has a dot.

4. Place the hose (1) with the nozzle (4) onto the valve (6).
5. Clamp the hose connector: Tighten the union nut (2) while simultaneously pressing on the hose (1).
6. Re-tighten the hose connector: Pull on the hose (1) briefly, which is fastened to the dosing head and then tighten the union nut (2) once more.

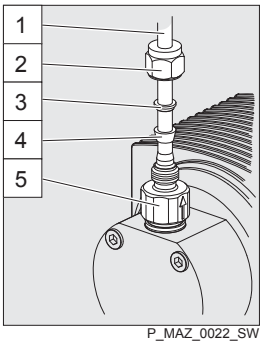


1 Hose
2 Union nut
3 Clamp ring
4 Nozzle
5 O-ring or flat seal
6 Valve

Fig. 5: PP, NP, PV and TT designs

Installing stainless steel pipe - SS design

1. Pull the union nut (2) and clamp rings (3, 4) over the pipe (1) with approx. 10 mm overhang - see *'Installing stainless steel pipe - SS design' on page 23*.
2. Insert the pipe (1) up to the stop in the valve (5).
3. Tighten the union nut (2).



1 pipe
2 Union nut
3 Rear clamp ring
4 Front clamp ring
5 Valve

Fig. 6: SS design

Installing hose lines - SS design

CAUTION!

Warning of feed chemical spraying around

Connections can come loose in the event that hose lines are installed incorrectly on stainless steel valves.

– Only use PE or PTFE hose lines.
– In addition, insert a stainless steel support insert into the hose line.

8.1.2 Installation of Metering Pumps With Bleed Valve

Safety Information

CAUTION!

– All the installation and safety notes for metering pumps without bleed valves also apply.

Installation of the return line

A return line is also connected in addition to the suction and discharge line.

1. Attach the hose line to the return hose nozzle or to the liquid end bleed valve. PVC hose, soft, 6x4 mm is recommended.
2. Feed the free end of the return line back to the storage tank.
3. Shorten the return line so that it is not immersed in the feed chemical in the storage tank.

8.1.3 Installation of Metering Pumps With Self-bleeding (SEK Type)

Safety Information

CAUTION!

- All of the installation and safety notes for metering pumps without self-bleeding also apply.
- Do not exceed the maximum values for priming lift, priming pressure and viscosity of the feed chemical.
- Do not allow the suction side line cross-section to exceed the line cross-section on the suction valve.

Information about priming pressure

- *Make sure that the priming pressure on the suction end is at least equal to the return line pressure.*
- *Priming pressure in the return line restricts the bleeding function.*
- *However, operation with priming pressure in the return line and the suction end at atmospheric pressure is possible.*

Installation of the return line

A return line is also connected in addition to the suction and discharge line.

- *The return line is connected to the vertical valve on the upper side of the liquid end. It is factory-labelled with a red sleeve - see ‘Installation of the return line’ on page 24.*
- *The discharge line is connected to the horizontal valve.*

1. Attach the hose line to the return hose nozzle or to the liquid end bleed valve. PVC hose, soft, 6x4 mm is recommended.
2. Feed the free end of the return line back to the storage tank.
3. SEK only: Insert the return line into the anti-kink device on the bleed valve and screw it in place until the anti-kink device engages.

The anti-kink device prevents the return line from kinking, avoiding the risk of self-bleeding failure.

4. Shorten the return line so that it is not immersed in the feed chemical in the storage tank.

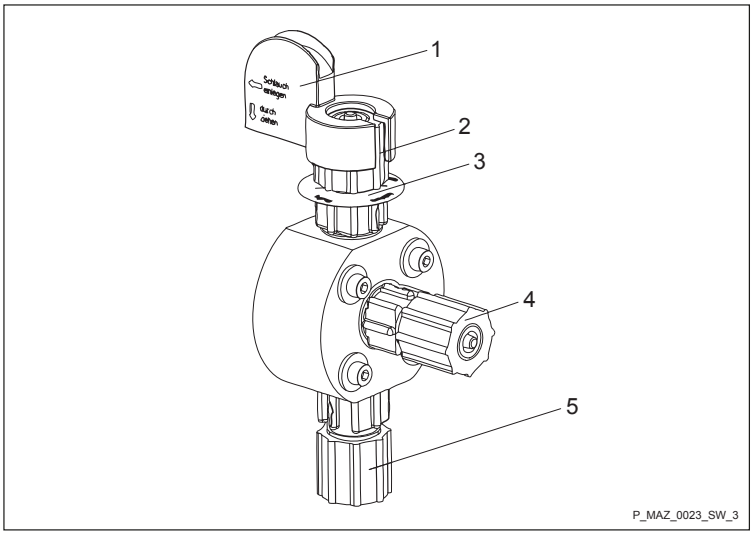


Fig. 7: SEK liquid end

1 Anti-kink device
2 Bleed valve for the return line into the storage tank, 6/4 mm
3 Red sleeve
4 Discharge valve for discharge line to the injection point, 6/4 - 12/9 mm
5 Suction valve for suction line in the storage tank, 6/4 - 12/9 mm

8.1.4 Basic installation notes

Safety notes

CAUTION!

Danger resulting from rupturing hydraulic components

Hydraulic components can rupture if the maximum permissible operating pressure is exceeded.

– Never allow the metering pump to run against a closed shut-off device.
– With metering pumps without integral relief valve: Install a relief valve in the discharge line.

CAUTION!

Hazardous feed chemicals can escape

With hazardous feed chemicals: Hazardous feed chemical can leak out when using conventional bleeding procedures with metering pumps.

– Install a bleed line with a return into the storage tank.

→ Shorten the return line so that it does not dip into the feed chemical in the storage tank.

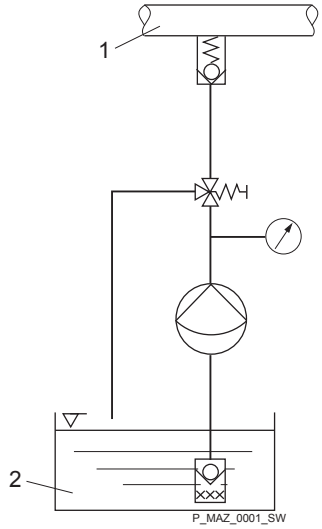


Fig. 8: Standard installation

1 Main line
2 Storage tank

Legend for hydraulic diagram

Symbol	Explanation	Symbol	Explanation
	Metering pump		Foot valve with filter meshes
	Injection valve		Level switch
	Multifunctional valve		Manometer

9 Electrical Installation

WARNING!

Danger of electric shock

A mains voltage may exist inside the device.

– Before any work, disconnect the device's mains cable from the mains.

WARNING!

Risk of electric shock

This pump is supplied with a grounding conductor and a grounding-type attachment plug.

– To reduce the risk of electric shock, ensure that it is connected only to a proper grounding-type receptacle.

WARNING!

Risk of electric shock

In the event of an electrical accident, the pump must be quickly disconnected from the mains.

– Install an emergency cut-off switch in the pump power supply line or
– Integrate the pump in the emergency cut-off management of the system and inform personnel of the isolating option.

WARNING!

Danger of electric shock

A mains voltage may exist inside the pump housing.

– If the pump housing has been damaged, you must disconnect it from the mains immediately. It may only be returned to service after an authorised repair.

CAUTION!

Material damage possible due to power surges

Should the pump be connected to the mains power supply in parallel to inductive consumers (such as solenoid valves, motors), inductive power surges can damage the controller when it is switched off.

– Provide the pump with its own contacts and supply with voltage via a contactor relay or relay.

Personnel: ■ Electrician

→ Install the pump in line with best working practice and in accordance with the operating instructions and applicable regulations.

9.1 Supply voltage connector

WARNING!

Unexpected startup is possible

As soon as the pump is connected to the mains, the pump may start pumping and consequently feed chemical may escape.

– Prevent dangerous feed chemicals from escaping.
– If you have not successfully prevented this, immediately press the *[STOP/START]* key or disconnect the pump from mains, e.g. via an emergency cu-off switch.

CAUTION!

If the pump is integrated into a system: Design the system so that potential hazardous situations are avoided by pumps starting up automatically subsequent to unintended power interruptions.

CAUTION!

Provide an option to disconnect the pump without Emergency Stop switch from the mains power supply.

9.1.1 Mains voltage

Parallel connection to inductive consumers

Should the pump be connected to the mains in parallel to inductive consumers (e.g. solenoid valves, motor), the pump must be electrically isolated when these consumers are switched off.

- Supply the pumps with voltage via a contactor relay or relay using separate contacts for the pump.
- If this is not possible then connect a varistor (part no. 710912) or an RC member, 0.22 µF / 220 Ω in parallel.

Interference suppression aids

Product	Part no.
Varistor:	710912
RC Gate, 0.22 µF / 220 Ω:	710802

9.2 Supply voltage connector - low voltage

WARNING!

Danger of electric shock

– For safety reasons, the low voltage pumps must be operated using only protective low voltage (SELV in accordance with EN 60335-1).

CAUTION!

Supply voltages that are too high destroy the pump.

– Do not connect the low voltage pump to voltages > 30 V.

- *The pump will generate a fault ("switch-off threshold for supply") in the event that the supply voltage to the pump is insufficient to ensure reliable function. The pump will recommence operation as soon as the supply voltage is restored.*
- *The fault indicator flashes additionally if the supply voltage is interrupted during a stroke, ("threshold for stroke abort"). Aborted strokes are not counted by the stroke counter. In doing so, the pump's electronic controller periodically checks the supply voltage ("wait time after stroke abort": 10 min). The pump will recommence operation if the supply voltage is sufficient.*
- *The pump's electrical system will shut down completely in the event that the supply voltage undershoots another threshold. The pump will come out of standby mode and recommence operation as soon as sufficient supply voltage is restored.*
- *The programmed thresholds apply to standard lead-acid batteries. ProMinent can match these to customer requirements.*
- *Use short large-diameter power leads in order to minimise faults. Use batteries with low internal resistance.*
- *If the pump is connected with incorrect polarity, it will not run because the polarity protection does not allow any current to flow.*

9.3 Description of the Terminals

9.3.1 "External control" terminal

The "external control" socket is a five-pin panel socket. It is compatible with two- and four-pole cables.

The "Auxiliary rate" function can only be used with a five conductor cable.