

e-MPA, e-MPR, e-MPD

Horizontal Multi-Stage Pump

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1 Introduction and Safety

1.1 Introduction

Purpose of this manual

The purpose of this manual is to provide necessary information for:

- Installation
- Operation
- Maintenance



CAUTION:

Read this manual carefully before installing and using the product. Improper use of the product can cause personal injury and damage to property, and may void the warranty.

NOTICE:

Save this manual for future reference, and keep it readily available at the location of the unit.

Qualified personnel



WARNING:

This product is intended to be operated by qualified personnel only.

1.2 Safety terminology and symbols

Hazard levels

Hazard level	Indication
DANGER:	A hazardous situation which, if not avoided, will result in death or serious injury
WARNING:	A hazardous situation which, if not avoided, could result in death or serious injury
CAUTION:	A hazardous situation which, if not avoided, could result in minor or moderate injury
NOTICE:	• A potential situation which, if not avoided, could result in undesirable conditions • A practice not related to personal injury

Hazard categories

Hazard categories can either fall under hazard levels or let specific symbols replace the ordinary hazard level symbols.

Electrical hazards are indicated by the following specific symbol:



Electrical Hazard:

Hot surface hazard

Hot surface hazards are indicated by a specific symbol that replaces the typical hazard level symbols:



CAUTION:

Description of user and installer symbols

	Specific information for personnel in charge of installing the product in the system (plumbing and/or electrical aspects) or in charge of maintenance.
	Specific information for users of the product.

1.3 User safety

General safety rules

These safety rules apply:

- Always keep the work area clean.
- Pay attention to the risks presented by gas and vapors in the work area.
- Avoid all electrical dangers. Pay attention to the risks of electric shock or arc flash hazards.
- Always bear in mind the risk of drowning, electrical accidents, and burn injuries.

Safety equipment

Use safety equipment according to the company regulations. Use this safety equipment within the work area:

- Hard hat
- Safety goggles, preferably with side shields
- Protective shoes
- Protective gloves
- Gas mask
- Hearing protection
- First-aid kit
- Safety devices

NOTICE:

Never operate a unit unless safety devices are installed. Also see specific information about safety devices in other chapters of this manual.

Electrical connections

Electrical connections must be made by certified electricians in compliance with all international, national, state, and local regulations. For more information about requirements, see sections dealing specifically with electrical connections.

Precautions before work

Observe these safety precautions before you work with the product or are in connection with the product:

- Provide a suitable barrier around the work area, for example, a guard rail.
- Make sure that all safety guards are in place and secure.
- Make sure that you have a clear path of retreat.
- Make sure that the product cannot roll or fall over and injure people or damage property.
- Make sure that the lifting equipment is in good condition.
- Use a lifting harness, a safety line, and a breathing device as required.
- Allow all system and pump components to cool before you handle them.
- Make sure that the product has been thoroughly cleaned.
- Disconnect and lock out power before you service the pump.
- Check the explosion risk before you weld or use electric hand tools.

Precautions during work

Observe these safety precautions when you work with the product or are in connection with the product:

- Never work alone.
- Always wear protective clothing and hand protection.
- Stay clear of suspended loads.
- Always lift the product by its lifting device.
- Beware of the risk of a sudden start if the product is used with an automatic level control.
- Beware of the starting jerk, which can be powerful.
- Rinse the components in water after you disassemble the pump.
- Do not exceed the maximum working pressure of the pump.
- Do not open any vent or drain valve or remove any plugs while the system is pressurized. Make sure that the pump is isolated from the system and that pressure is relieved before you disassemble the pump, remove plugs, or disconnect piping.
- Never operate a pump without a properly installed coupling guard.

Wash the skin and eyes

Follow these procedures for chemicals or hazardous fluids that have come into contact with your eyes or your skin:

Condition	Action
Chemicals or hazardous fluids in eyes	1. Hold your eyelids apart forcibly with your fingers. 2. Rinse the eyes with eyewash or running water for at least 15 minutes. 3. Seek medical attention.
Chemicals or hazardous fluids on skin	1. Remove contaminated clothing. 2. Wash the skin with soap and water for at least 1 minute. 3. Seek medical attention, if necessary.

1.4 Protecting the environment

Emissions and waste disposal

Observe the local regulations and codes regarding:

- Reporting of emissions to the appropriate authorities
- Sorting, recycling and disposal of solid or liquid waste
- Clean-up of spills

Exceptional sites



CAUTION: Radiation Hazard

Do NOT send the product to Xylem if it has been exposed to nuclear radiation, unless Xylem has been informed and appropriate actions have been agreed upon.

Recycling guidelines

Always follow local laws and regulations regarding recycling.

1.5 Spare parts and pumps

**WARNING:**

Only use original spare parts to replace any worn or faulty components. The use of unsuitable spare parts may cause malfunctions, damage, and injuries as well as void the guarantee.

**CAUTION:**

Always specify the exact product type and part number when requesting technical information or spare parts from the Sales and Service Department.

1.5.1 Spare parts

Spare parts stock should be defined based on the user's risk assessment, cost of downtime and lead times for parts. If this information is not available, the following table can be used as a guideline.

Number of Pumps (including stand-by pumps)							
	2	3	4	5	6/7	8/9	10+
Impeller first stage	1	1	2	2	2	3	30%
Impeller (series)	i-1	i-1	i-1	2(i-1)	2(i-1)	3(i-1)	30%
Wear ring first stage	2	2	2	4	4	6	30%
Wear ring (series)	2(i-1)	2(i-1)	2(i-1)	4(i-1)	4(i-1)	6(-1)i	30%
Diffuser	i/2	i/2	i/2	i	i	3i/2	15%
Shaft (with keys/nuts)	1	1	2	2	2	3	30%
Ball bearing	1	1	2	2	2	3	30%
Plain bearing	1	1	2	2	2	3	30%
Balance Drum	1	1	2	2	2	3	30%
Joints for pump housing (sets)	4	6	8	8	9	12	150%
Other joints (sets)	4	6	8	8	9	10	100%
Mechanical seal	2	3	4	5	6	7	90%

i= number of stages

To ensure availability, we recommend that suitable quantities of spare parts are held in stock, especially if these parts are made from special materials (due to longer delivery times).

For more information about spare parts, contact the local sales and service representative.

1.5.2 Standby pumps

Make sure that sufficient stand-by pumps are kept ready for use in plants where the failure of a pump can endanger human life, damage property, or result in high costs. Make sure that regular inspections are carried out to make sure that such pumps are always ready for use.

2 Transportation and Storage

2.1 Inspect the delivery

1. Check the outside of the package for evident signs of damage.
2. Notify our distributor within eight days of the delivery date, if the product bears visible signs of damage.

Unpack the unit

1. Follow applicable step:
 - If the unit is packed in a carton, then remove the staples and open the carton.
 - If the unit is packed in a wooden crate, then open the cover while paying attention to the nails and straps.
2. Remove the securing screws or the straps from the wooden base.

2.1.1 Examine the unit

1. Remove packing materials from the product.
Dispose of all packing materials in accordance with local regulations.
2. To determine whether any parts have been damaged or are missing, examine the product.
3. If applicable, unfasten the product by removing any screws, bolts, or straps.
Use care around nails and straps.
4. If there is any issue, then contact a sales representative.

2.2 Transportation guidelines

Precautions



WARNING:

- Observe accident prevention regulations in force.
 - Crush hazard. The unit and the components can be heavy. Use proper lifting methods and wear steel-toed shoes at all times.
-

Check the gross weight that is indicated on the package in order to select proper lifting equipment.

Position and fastening

Keep the pump / pump unit in the same position in which it was supplied from the factory. Make sure that the pump or pump unit is securely fastened during transportation and cannot roll or fall over.

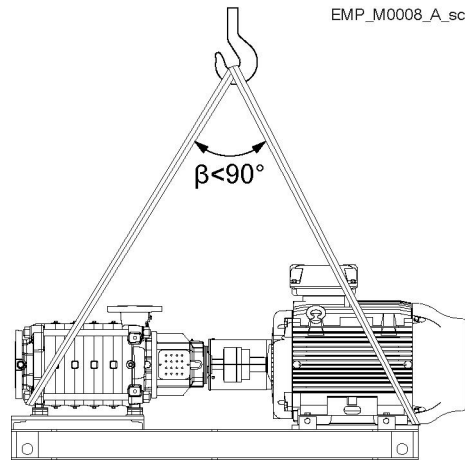


WARNING:

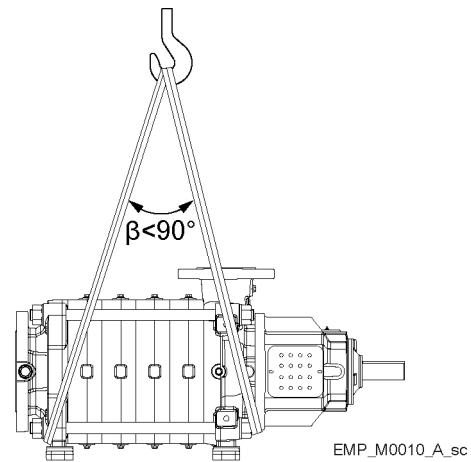
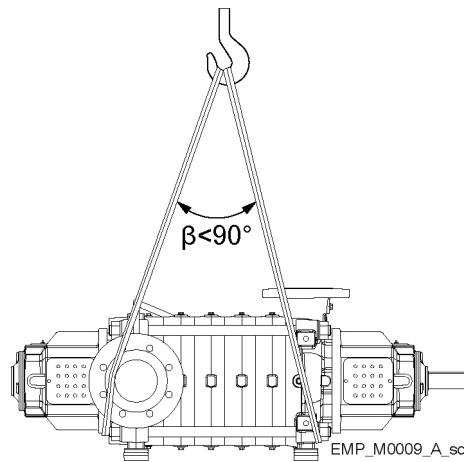
- Do not use eyebolts screwed on the motor for handling the whole electric pump unit.
 - Do not use the shaft end of the pump or of the motor to handle the pump, the motor or the unit.
-

Eyebolts screwed onto the motor may be exclusively used to handle the individual motor or, in case of a not balanced distribution of weights, to partially lift the unit vertically starting from a horizontal displacement.

Pump unit must always be fixed and transported as shown.



Pump without motor must be fixed and transported as shown.



2.3 Storage guidelines

Storage location

The product must be stored in a covered and dry location free from heat, dirt, and vibrations.

NOTICE:

Protect the product against humidity, heat sources, and mechanical damage.

NOTICE:

Do not place heavy weights on the packed product.

2.3.1 Long-term storage

If the unit is stored for more than 6 months, these requirements apply:

- Store in a covered and dry location.
- Store the unit free from heat, dirt, and vibrations.
- Rotate the shaft by hand several times at least every three months.

Refer to the drive unit and coupling manufacturers for their long-term storage procedures.

For questions about possible long-term storage treatment services, please contact your local sales and service representative.

Ambient temperature

The product must be stored at an ambient temperature from 23°F to 104°F (-5°C to +40°C).

3 Product Description

3.1 General description

The pump is a high pressure multistage, radially split, segmented casing pump with the first stage impeller specially designed for a low NPSHr value.

The pump can be used for handling:

- Cold or warm water
- Clean liquids
- Clean or aggressive fluids which are not chemically or mechanically aggressive to the pump materials

The product can be supplied as a pump unit (pump and electric motor) or only as a pump.

NOTICE:

If you have purchased a pump without motor, make sure that the motor is suitable for coupling to the pump.

Intended use

The pump is suitable for:

- Water supply and water treatment
- Cooling and hot water supply in industries and building services
- Irrigation and sprinkler systems
- Heating systems
- Fire-fighting applications
- Snow making applications
- Nanofiltrations
- Boiler feed

Improper use



WARNING:

Improper use of the pump may create dangerous conditions and cause personal injury and damage to property.

An improper use of the product leads to the loss of the warranty.

Examples of improper use:

- Liquids not compatible with the pump construction materials
- Hazardous liquids (such as toxic, explosive, flammable, or corrosive liquids)
- Potable liquids other than water (for example, wine or milk)

Examples of improper installation:

- Hazardous locations (such as explosive, or corrosive atmospheres).
- Location where the air temperature is very high or there is poor ventilation.
- Outdoor installations where there is no protection against rain or freezing temperatures.



DANGER:

Do not use this pump to handle flammable and/or explosive liquids.

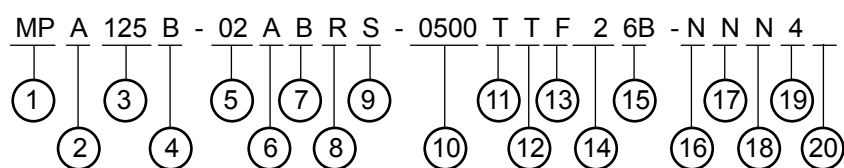
NOTICE:

- Do not use this pump to handle liquids containing abrasive, solid, or fibrous substances.
- Do not use the pump for flow rates beyond the specified flow rates on the data plate.

Special applications

Contact the local sales and service representative in the following cases:

- If the density and/or viscosity value of the pumped liquid exceeds the value of water, such as water with glycol; as it may require a more powerful motor.
- If the pumped liquid is chemically treated (for example softened, deionized, demineralized etc.).
- Any situation that is different from the ones that is described and relate to the nature of the liquid.

3.2 Pump denomination

1. Pump type
2. Configuration
3. Pump size
4. Hydraulic design
5. Number of stages
6. Combination of full diameter and trimmed impellers
7. Flange orientation
8. ANSI suction flange class
9. ANSI discharge flange class
10. Motor HP
11. Motor enclosure
12. Frame size
13. Motor type
14. Number of poles
15. Motor frequency and voltage
16. Casing material
17. Impeller material
18. Diffuser material
19. Mechanical seal and o-ring material
20. Seal type

3.3 Nameplate

- The nameplate is located on the bearing frame.
- The nameplate lists key product specifications.
- The nameplate provides information regarding the materials of impeller, casing, and mechanical seal.

The diagram shows a rectangular data plate for a Goulds Water Technology pump. It contains the following fields and units:

- Top Left:** GOULDS WATER TECHNOLOGY logo.
- Top Right:** No./Date
- Model:** A field for the pump model number.
- Code:** A field for the pump code.
- MAWP:** Maximum Allowable Working Pressure in psi.
- t max:** Maximum operating liquid temperature in °F.
- t min:** Minimum operating liquid temperature in °F.
- lb:** Bare Pump Weight.
- øF mm:** Full impeller diameter in mm.
- øT mm:** Trimmed impeller diameter in mm.
- Q gmp:** Rated flow in gallons per minute.
- H ft:** Rated head in feet.
- RPM:** Input power at rated conditions.
- HP:** Speed in revolutions per minute.
- PEICL=** Pump Energy Index.
- BEP%:** Pump efficiency at BEP (60 Hz).

Numbered callouts (1-15) point to the following fields:

1. Pump model
2. Pump code
3. Rated flow
4. Rated head
5. Input power at rated conditions
6. Speed
7. Serial number, or order number + order position number
8. Full impeller diameter (only filled in for full impeller diameter)
9. Trimmed impeller diameter (only filled in for trimmed impellers)
10. Minimum operating liquid temperature
11. Maximum operating liquid temperature basis for MAWP
12. Maximum allowable working pressure
13. Pump efficiency at BEP (60 Hz)
14. Pump Energy Index
15. Bare Pump Weight

1. Pump model
2. Pump code
3. Rated flow
4. Rated head
5. Input power at rated conditions
6. Speed
7. Serial number, or order number + order position number
8. Full impeller diameter (only filled in for full impeller diameter)
9. Trimmed impeller diameter (only filled in for trimmed impellers)
10. Minimum operating liquid temperature
11. Maximum operating liquid temperature basis for MAWP
12. Maximum allowable working pressure
13. Pump efficiency at BEP (60 Hz)
14. Pump Energy Index
15. Bare Pump Weight

3.4 Pump design

- Suction casing: horizontal with radial flanges
- Discharge casing: horizontal with radial flanges
- Closed impeller
- Balance drum at discharge side incorporated in discharge casing
- Motors - standard design NEMA
- Flanges drilled according to ANSI B16.5, Class 150, 300 and 600
- Couplings: flexible without spacer as standard. Optional with spacer on customer request
- Coupling guard: totally enclosed and position-adjustable

3.5 Material

The metallic parts of the pump that come in contact with water are made of the following:

Item	Material Code									
	CCC	CBC	CNC	DCC	DBC	DNC	NNN	RNN	RRR	TTT
Impeller	Cast Iron	Bronze	Stainless Steel	Cast Iron	Bronze	Stainless Steel	Stainless Steel	Stainless Steel	Duplex	Super Duplex
Diffuser		Cast Iron			Cast Iron	Cast Iron				
Casing				Ductile Iron	Ductile Iron	Ductile Iron	Duplex			
Shaft	Stainless Steel									
Shaft sleeve										
Relief pipe										
Plain bearing	Tungsten Carbide									

3.6 Mechanical seal

- Standard mechanical seal according to EN12756 or
- Cartridge seal or
- Soft packing

3.7 Application limits

The following performance curves show the maximum allowable working pressure depending on the pump model and the temperature of the pumped liquid.

Maximum working pressure

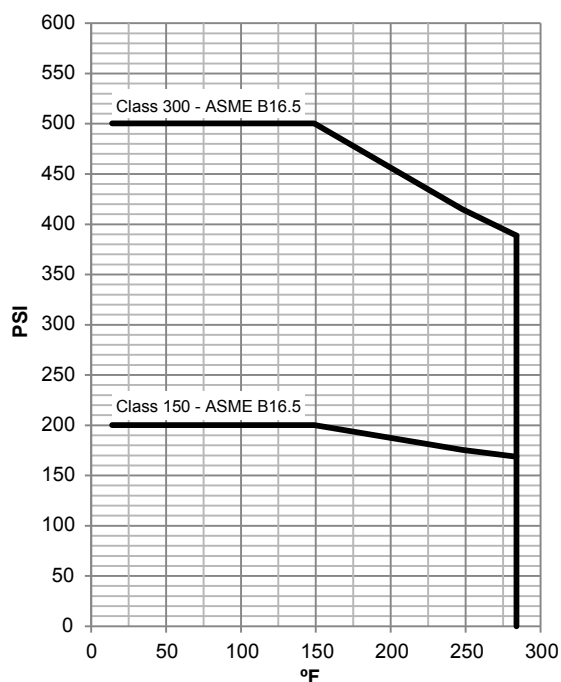


Figure 1: Cast Iron (JL 1040)

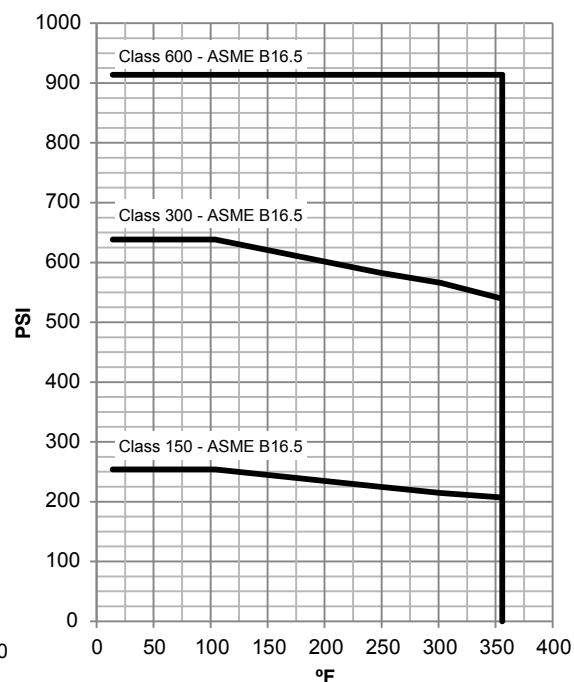


Figure 2: Ductile Iron (JS 1030)

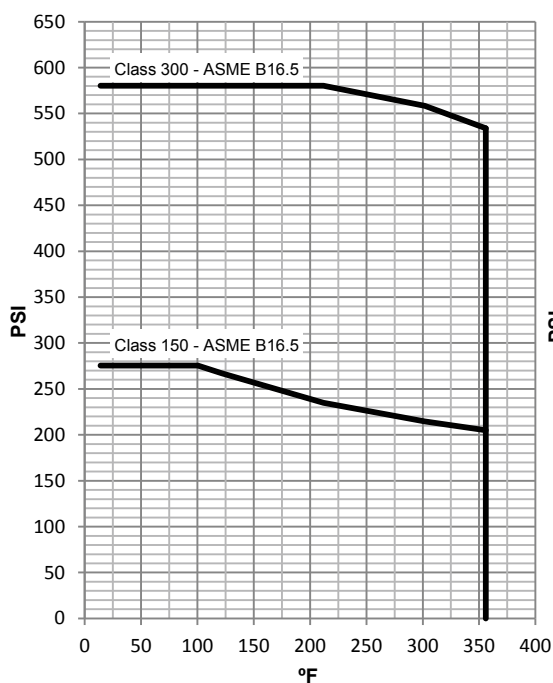


Figure 3: Austenitic Stainless Steel (1.4408)

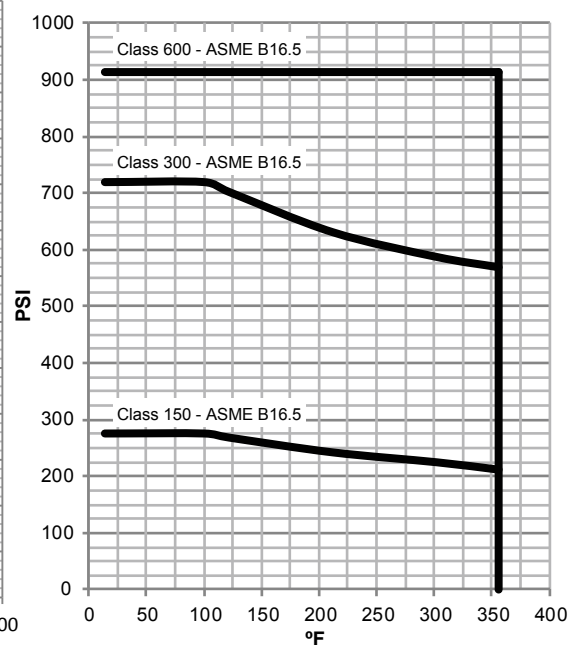


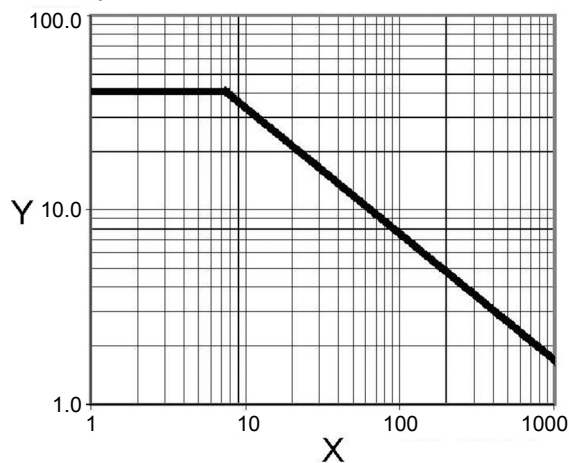
Figure 4: Duplex (1.4517) & Super Duplex (1.4469)

Liquid temperature intervals

The previous performance curves show the working temperature ranges.

For special requirements, contact the sales and service representative.

Maximum number of starts per hour



X Motor power [kW]

Y Maximum permitted starts/h

Noise level

Table 1: Sound pressure levels for pump without motor

LpA [dB(A)]				
P [HP]	Speed [RPM]			
	2950	1450	3550	1750
3	57.2	56.2	57.4	56.5
4	58.6	57.7	58.9	58.0

L _{pA} [dB(A)]				
P [HP]	Speed [RPM]			
	2950	1450	3550	1750
5.5	60.0	59.1	60.2	59.3
7.5	61.5	60.5	61.7	60.8
10	62.9	62.0	63.2	62.3
15	64.8	63.8	65.0	64.1
20	66.2	65.3	66.5	65.6
25	67.2	66.3	67.5	66.6
30	68.1	67.1	68.3	67.4
40	69.5	68.6	69.8	68.9
50	70.5	69.6	70.8	69.9
60	71.5	70.5	71.7	70.8
75	72.4	71.4	72.6	71.7
100	73.8	72.9	74.1	73.2
125	74.8	73.8	75.0	74.1
150	75.7	74.7	75.9	75.0
180	76.5	75.6	76.7	75.8
220	77.4	76.5	77.6	76.7
270	78.5	77.6	78.7	77.8
340	79.5	78.6	79.8	78.8
430	80.6		80.9	79.9
480	81.2		81.4	80.5
540	81.8		82.0	81.1
610	82.4		82.6	
680	82.8		83.1	
760	83.4		83.6	
860	83.9		84.2	
980	84.5		84.7	
1070	85.0		85.2	
1210	85.7		85.9	
1340	86.1		86.4	
1500	86.6		86.8	
1680	87.2		87.5	

L_{pA} Sound pressure level measured in a free field at one meter distance from the pump

P Pump power

4 Installation

Precautions



WARNING:

- Observe accident prevention regulations in force.
- Use suitable equipment and protection.
- Always refer to the local and/or national regulations, legislation, and codes in force regarding the selection of the installation site, plumbing, and power connections.



Electrical Hazard:

- Make sure that all connections are performed by qualified installation technicians and in compliance with the regulations in force.
- Before starting work on the unit, make sure that the unit and the control panel are isolated from the power supply and cannot be energized. This applies to the control circuit as well.

Grounding (earthing)



Electrical Hazard:

- Always connect the external protection conductor to ground (earth) terminal before making other electrical connections.
- You must ground (earth) all electrical equipment. This applies to the pump equipment, the driver, and any monitoring equipment. Test the ground (earth) lead to verify that it is connected correctly.
- If the motor cable is jerked loose by mistake, the ground (earth) conductor should be the last conductor to come loose from its terminal. Make sure that the ground (earth) conductor is longer than the phase conductors. This applies to both ends of the motor cable.
- Add additional protection against lethal shock. Install a high-sensitivity differential switch (30 mA) [residual current device RCD].

4.1 Facility requirements

4.1.1 Pump location



DANGER:

Do not use this unit in environments that may contain flammable/explosive or chemically aggressive gases or powders.

Guidelines

Observe the following guidelines regarding the location of the product:

- Make sure that no obstructions hinder the normal flow of the cooling air that is delivered by the motor fan.
- Make sure that the installation area is protected from any fluid leaks, or flooding.
- If possible, place the pump slightly higher than the floor level.
- The ambient temperature must be between +32°F (0°C) and +104°F (+40°C).
- Contact the Sales and Service Department if:
 - The room temperature exceeds +104°F (+40°C).
 - The unit is located more than 3000 ft (1000 m) above the sea level. The motor performance may need to be de-rated or replaced with a more powerful motor. See Table 2.

Table 2:

H		0°C	10°C	20°C	30°C	40°C	45°C	50°C	55°C	60°C
m	ft	32°F	50°F	68°F	86°F	104°F	113°F	122°F	131°F	140°F
0	0	1.00	1.00	1.00	1.00	1.00	0.95	0.90	0.85	0.80
500	1640	1.00	1.00	1.00	1.00	1.00	0.95	0.90	0.85	0.80
1000	3280	1.00	1.00	1.00	1.00	1.00	0.95	0.90	0.85	0.80
1500	4921	0.97	0.97	0.97	0.97	0.97	0.92	0.87	0.82	0.78
2000	6561	0.95	0.95	0.95	0.95	0.95	0.90	0.85	0.80	0.76

Pump positions and clearance

Provide adequate light and clearance around the pump. Make sure that it is easily accessible for installation and maintenance operations.

Installation above liquid source (suction lift)

The theoretical maximum suction height of any pump is 33.9 ft (10.33 m). In practice, the following affect the suction capacity of the pump:

- Temperature of the liquid
- Elevation above the sea level (in an open system)
- System pressure (in a closed system)
- Resistance of the pipes
- Own intrinsic flow resistance of the pump
- Height differences

The following equation is used to calculate the maximum height above the liquid level which the pump can be installed:

$h_p + h_z \geq (\text{NPSHr} + 2) + h_f + h_{pv}$ where:

h_p (ft) is the absolute pressure applied to the free liquid surface in the suction tank;

h_z (ft) is the suction lift between the pump axis and the free liquid surface in the suction tank; h_z is negative when the liquid level is lower than the pump axis;

h_f (ft) is the flow resistance in the in the suction line and its accessories (fittings, foot valve, gate valve, elbows, etc);

h_{pv} (ft) is the vapor pressure of the liquid at the operating temperature; See Table 3.

2 (ft) is the minimum recommended safety margin.

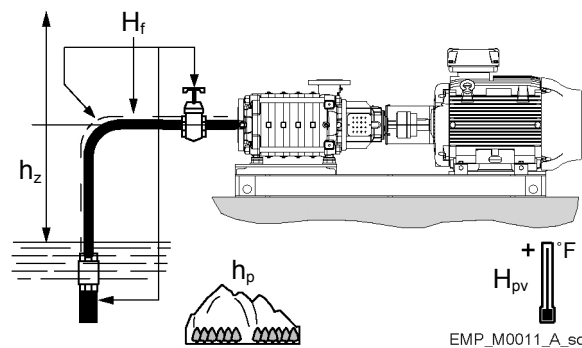


Table 3:

T [°F]	T [°C]	h_{pv} [ft]
60	15.6	0.6
80	26.7	1.2
100	37.8	2.2
120	48.9	3.9
140	60	6.7

T [°F]	T [°C]	h_{pv} [ft]
160	71.1	11
180	82.2	17.3
200	93.3	26.6
220	104.4	39.7
240	115.6	57.7
260	126.7	81.8
284	140	121

NOTICE:

Do not exceed the pumps suction capacity as this could cause cavitation and damage the pump.

4.1.2 Piping requirements

Precautions

**WARNING:**

- Use pipes suited to the maximum working pressure of the pump. Failure to do so can cause the system to rupture, with the risk of injury.
- Make sure that all connections are performed by qualified installation technicians and in compliance with the regulations in force.

NOTICE:

Observe all regulations issued by authorities having jurisdiction and by companies managing the public water supplies if the pump is connected to a public water system. If required, install appropriate backflow-prevention device on the suction side.

Piping checklist

Check that the following requirements are met:

- All piping is independently supported, pump unit must not be used to support the weight of the piping.
- Flexible pipes or unions are used, in order to avoid transmission of pump vibrations to the pipes and vice versa.
- Use wide bends, avoid using elbows which cause excessive flow resistance.
- The suction piping is perfectly sealed and airtight.
- If the pump is used in an open circuit, then the diameter of the suction pipe is suited to the installation conditions. The suction pipe must not be smaller than the diameter of the suction port.
- If the suction piping must be larger than the suction side of the pump, then an eccentric pipe reducer is installed.
- If the pump is placed above liquid level, a foot valve is installed at the end of the suction piping.
- The foot valve is fully immersed into the liquid so that air cannot enter through the suction vortex, when the liquid is at the minimum level and the pump is installed above the liquid source.
- Appropriately sized on-off valves are installed on the suction piping and on the delivery piping (downstream to the check valve) for regulation of the pump capacity, for pump inspection, and for maintenance.

- Appropriately sized on-off valve is installed on the delivery piping (downstream to the check valve) for regulation of the pump capacity, for pump inspection, and for maintenance.
- In order to prevent back flow into the pump when pump is turned off a check valve is installed on the delivery piping.

**WARNING:**

Do not use the on-off valve on the discharge side in the closed position in order to throttle the pump for more than a few seconds. If the pump must operate with the discharge side closed for more than a few seconds, a bypass circuit must be installed to prevent overheating of the liquid inside the pump.

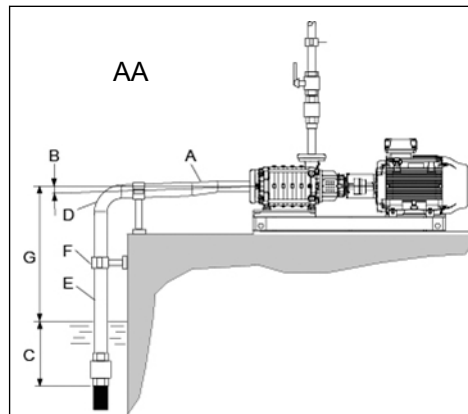


Figure 5: Correct Installation

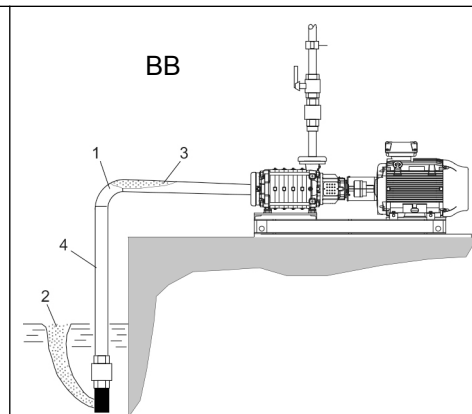


Figure 6: Incorrect Installation

- AA Correct installation
- A Eccentric reduction
- B Positive gradient
- C Good immersion
- D Large bend
- E Suction pipe diameter > pump port diameter
- F Pipe clamp
- G Suction lift depends on the pump and installation.
- BB Incorrect installation
- 1 Sharp bend; high flow resistance
- 2 Insufficient immersion; sucking air
- 3 Negative gradient; air pockets
- 4 Pipe diameter < pump port diameter; high flow resistance

4.2 Electrical requirements

- The local regulations in force overrule these specified requirements.
- In the case of fire fighting systems (hydrants and/or sprinklers), check the local regulations in force.

Electrical connection checklist

Check that the following requirements are met:

- The electrical leads are protected from high temperature, vibrations, and collisions.
- The power supply line is provided with:
 - A short-circuit protection device
 - A mains isolator switch with a contact gap of at least 0.120" (3 mm).

The electrical control panel checklist

NOTICE:

The control panel must match the ratings of the electric pump. Improper combinations could fail to guarantee the protection of the motor.

Check that the following requirements are met:

- The control panel must protect the motor against overload and short-circuit.
- Install the correct overload protection (thermal relay or motor protector).

Pump Type	Protection
Three phase electric pump ¹	- Thermal protection (must be supplied by the installer) - Short circuit protection (must be supplied by the installer)²

- The control panel must be equipped with a dry-running protection system to which a pressure switch, float switch, probes, or other suitable device is connected.
- The following devices are recommended for use on the suction side of the pump:
 - When the liquid is pumped from a water system, use a pressure switch.
 - When the liquid is pumped from a storage tank or reservoir, use a float switch or probes.
- When thermal relays are used, relays that are sensitive to phase failure are recommended.

The motor checklist



WARNING:

- Read the operating instructions in order to ensure whether a protection device is provided if another motor other than the standard is used.
- If the motor is equipped with automatic thermal protectors, be aware of the risk of unexpected starts in connection to overload. Do not use such motors for fire-fighting applications.

NOTICE:

- The mains voltage and frequency must agree with the specifications on the data plate.

In general, motors can operate under the following mains voltage tolerances:

Frequency Hz	Phase ~	UN [V] ± %
50	3	230/400 ± 10
		400/690 ± 10
60	3	220/380 ± 5
		380/660 ± 10

Use cable according to rules that apply for single phase and three phase versions.

4.3 Install the pump

4.3.1 Mechanical installation

Check the following before installation:

- Use a concrete of compressive strength class C12/15 which meets the requirements of exposure class XC1 to EN 206-1. The subframe must withstand all loads that arise during operation. To prevent vibrations being transmitted to adjoining components,

¹ fuses aM (motor starting), or magneto-thermal switch with curve C and I_{cn} ≥ 4,5 kA or other equivalent device.

² Overload thermal relay with trip class 10A + fuses aM (motor starting) or motor protection magneto-thermal switch with starting class 10A.

the foundation should be laid on a suitable insulating base. The size of the insulating panels should be determined by an experienced specialist.

- The mounting surface must have set and must be completely horizontal and even.
- Observe the weights indicated.

4.3.1.1 Install the pump set

Check the following:

- The suction lift line has been laid with a rising slope, at positive suction head line with a downward slope towards the pump.
- The nominal diameters of the pipelines are at least equal to the nominal diameters of the pump ports.
- The pipelines have been anchored in close proximity to the pump and connected without transmitting any stresses or strains.

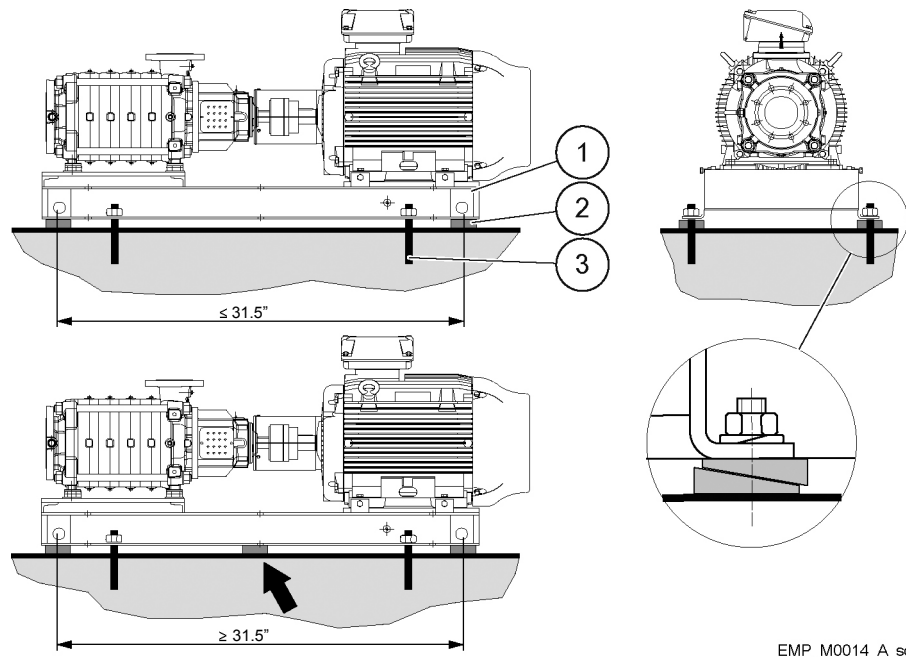


CAUTION:

Welding beads, scale and other impurities in the piping damage the pump.

- Free the piping from any impurities.
- If necessary, install a filter.

Check that the foundation has been prepared in accordance with the dimensions given in the outline drawing/general arrangement drawing.



1. Baseplate (pump set)
2. Shims
3. Foundation bolts

Figure 7: Pump base and anchor holes

1. Position the pump set on the foundation and level it with the help of a spirit level that is placed on the discharge port.
The permissible deviation is 0.005" /ft.
2. Remove the plugs covering the ports.
3. Align the pump and piping flanges on both sides of the pump. Check the alignment of the bolts.
4. Fasten the piping with bolts to the pump. Do not force the piping into place.

5. Use shims for height compensation, if necessary.
Always fit shims, if any, immediately to the left and right of the foundation bolts between the baseplate/foundation. For a bolt-to-bolt distance (L) > 31.5", fit extra shims halfway between the bolt holes.
6. Make sure that all shims lie perfectly flush.
7. Insert the foundation bolts into the holes provided.
8. Use concrete to set the foundation bolts into the foundation.
9. Wait until the concrete has set firmly, and then level the baseplate.
10. Tighten the foundation bolts evenly and firmly.
11. Grout the baseplate with low-shrinkage concrete.

NOTE: If the transmission of vibrations can be disturbing, provide vibration-damping supports between the pump and the foundation.

Mount the pump to a base frame

Be sure to check that the following are adhered to:

- Solid base frame which does not twist or vibrate during operation (resonance).
- Mounting surfaces of the pump feet and the motor on the base frame must be flat (machining is recommended).
- Safe fastening of pump and motor must be guaranteed.
- Adequate space between pump and motor shaft must be left depending on the used coupling.
- Between pump and base frame must be an adequate shimming, so that in case of replacement the same height between bottom and centerline can be adjusted (recommended vertical adjustment 0.160"-0.240").

4.4 Install the coupling



WARNING:

Make sure that nobody can start the motor when work is being carried out on the coupling. In accordance with the Accident Prevention Regulations, the pump unit may only be operated when the coupling guard is mounted.

1. Clean shaft ends and coupling components.
2. Pull coupling hub onto motor shaft end.
The coupling may be heated beforehand in an oil bath to approximately 212°F (100°C). The motor hub will need to be mounted flush to the motor shaft.
3. Keep the pump hub loose for adjusting the elastomer element.
The motor coupling hub will have an interference fit and the pump coupling hub will have a clearance fit. The clearance allows the pump hub to be adjusted on the pump shaft.
4. Place half of the coupling elastomer element around the hubs and secure with self-locking capscrews.
The elastomer element will space the pump hub.
5. Secure the pump hub to the shaft.
6. Mount the other half of the elastomer element.
7. Tighten all capscrews to recommended torques.
8. Mount coupling guard.

4.4.1 Recommended torque values

Recommended Capscrew Torques	Coupling Size	Torque-Dry	
		In-lb	Ft-lb
IMPORTANT Capscrews have self-locking patches which should not be reused more than twice. Capscrews can be further used with applications of a thread-locking adhesive. Do Not Lubricate Capscrew Threads!	2	204	17
	3		
	4		
	5		
	10		
	20	360	30
	30		
	40		
	50		
	60	900	75

4.5 Coupling alignment

After mounting to the foundation and the connection of the piping, the coupling must be adjusted again, even if the unit was delivered completely mounted on the frame.

Remove the coupling guard

- Unscrew the fixing devices.
- Remove the coupling guard – upper half (1).
- Remove the coupling guard – lower half (2).
- Open and lift the supporting/adjusting ring (3).

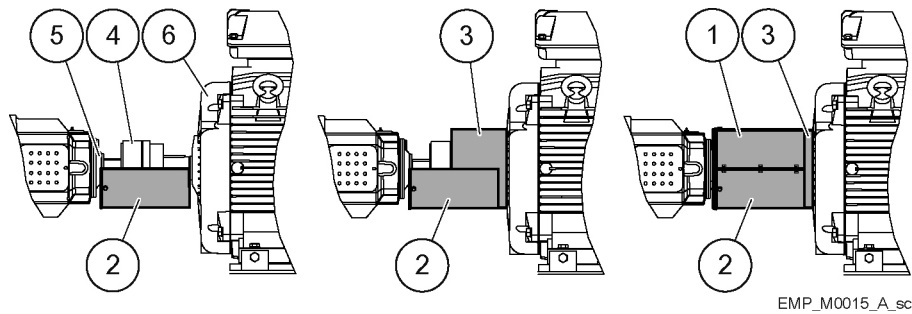


Figure 8: Coupling

1. Coupling guard, upper half
2. Coupling guard, lower half
3. Adjusting ring
4. Coupling
5. Bearing cover
6. Motor

Alignment

- Loosen screws of the motor foot.
- Place the ruler (1) axially on both coupling halves.
- Leave the ruler (1) in this position and turn the coupling by hand.
 - The coupling is aligned correctly if the distances 'a' and 'b' to the respective shafts are the same at all points around the circumference.
 - The radial and axial deviation between the two coupling halves must not exceed the values set by the manufacturer, during standstill as well as at operating temperature and under inlet pressure.

- Check the distance between the two coupling halves around the circumference with a gauge (2).
 - The coupling is aligned correctly if the distance between the two coupling halves is the same at all points around the circumference.
 - The radial and axial deviation between the two coupling halves must not exceed the values set by the manufacturer, during standstill as well as at operating temperature and under inlet pressure.
- Re-tighten screws of the support and pump foot without transmitting any stresses and strains.

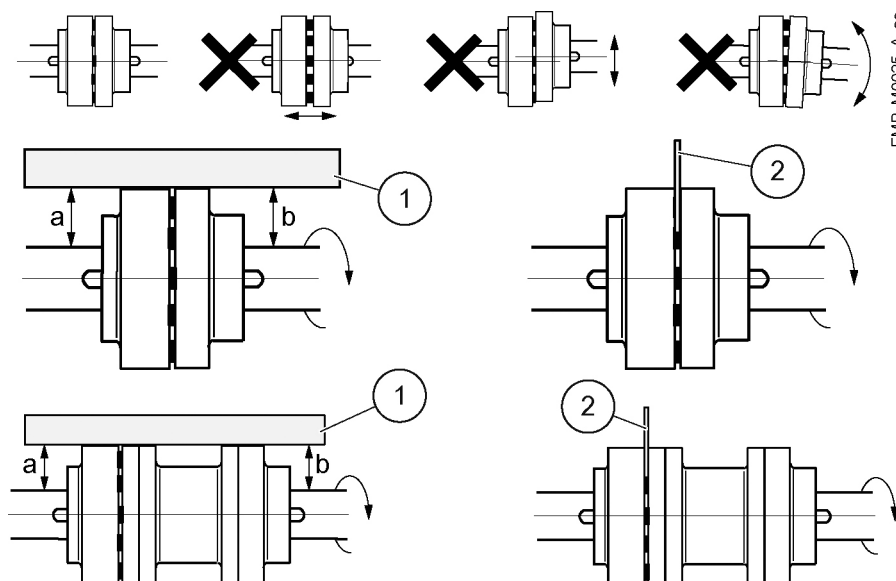


Figure 9: Alignment checks

1. Ruler
2. Thickness gauge

Dial gauges can be used in the place of ruler and thickness gauge.

Contact the local sales and service representative for any requests or information.

NOTE: Check alignment of coupling again in operation warm condition and on system pressure if available and correct, if necessary. Be sure that the unit can be easily turned by hand.

NOTICE:

Improper alignment of the unit can lead to damages at coupling and unit.

Install the coupling guard



CAUTION:

Never operate the pump without the coupling guard correctly installed.

1. Place the coupling guard – lower half (2) by using the fixing devices – low (2).
2. Insert the adjusting ring (3) with slot downward and press it axially to the motor.
3. Place the coupling guard – upper half (1) using the fixing devices.
4. Screw the fixing devices.

4.6 Connect the power supply

1. Remove the screws of the terminal box cover.
2. Connect and fasten the power cables according to the applicable wiring diagram on the back of the terminal box cover.
 - a) Connect the ground (earth) lead.

Make sure that the ground (earth) lead is longer than the phase leads.
 - b) Connect the phase leads.
3. Mount the terminal box cover.

NOTICE:

Tighten the cable glands carefully to ensure protection against cable slipping and humidity entering the terminal box.

4. If the motor is not equipped with automatic reset thermal protection, then adjust the overload protection according to the list below.
 - If the motor is used with full load, then set the value to the nominal current value of electric pump (data plate)
 - If the motor is used with partial load, then set the value to the operating current (for example measured with a current pincer).
 - If the pump has a star-delta starting system, then adjust the thermal relay to 58% of the nominal current or operating current (only for three-phase motors).

5 Commissioning, Startup, Operation, and Shutdown

5.1 Precautions



WARNING:

- Make sure that the drained liquid does not cause damage or injuries.
 - The motor protectors can cause the motor to restart unexpectedly. This could result in serious injury.
 - Never operate the pump without the coupling guard correctly installed.
-



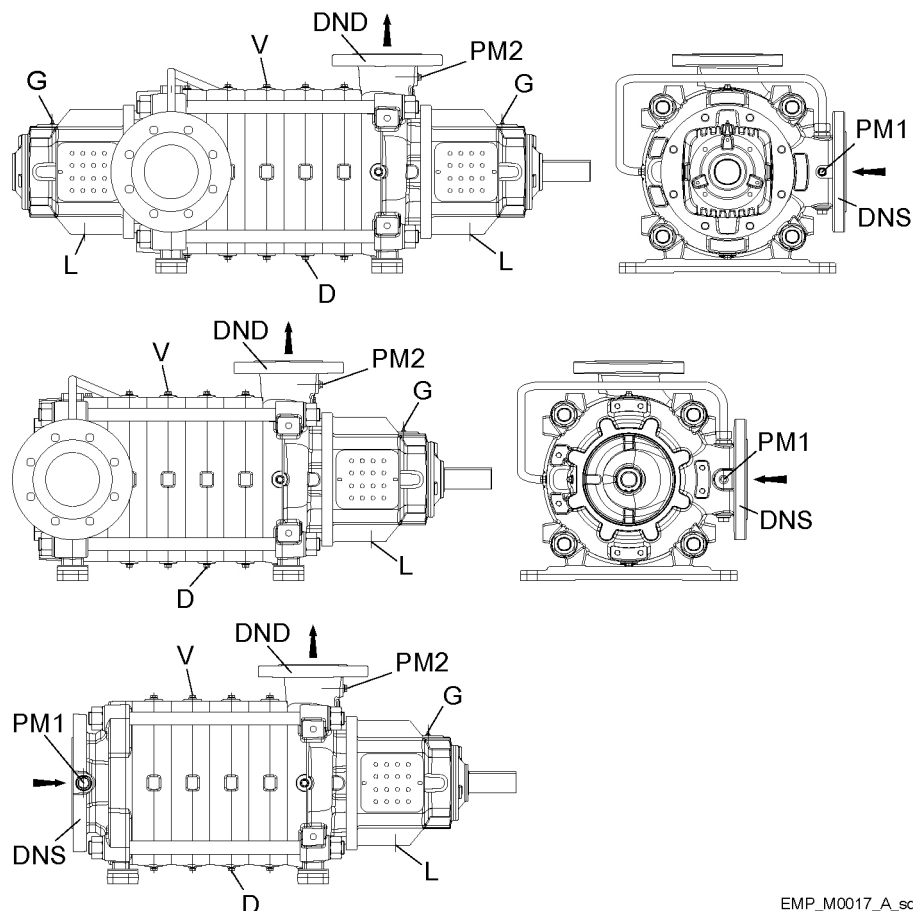
CAUTION:

- The outer surfaces of the pump and motor can exceed 104°F (40°C) during operation. Do not touch with any part of the body without protective gear.
 - Do not put any combustible material near the pump.
-

NOTICE:

- Never operate the pump below the minimum rated flow, when dry, or without prime.
 - Never operate the pump with the delivery ON-OFF valve closed for longer than a few seconds.
 - Never operate the pump with the suction ON-OFF valve closed.
 - Do not expose an idle pump to freezing conditions. Drain all liquid that is inside the pump. Failure to do so can cause liquid to freeze and damage the pump.
 - The sum of the pressure on the suction side (mains, gravity tank) and the maximum pressure that is delivered by the pump must not exceed the maximum working pressure that is allowed (nominal pressure PN) for the pump.
 - Do not use the pump if cavitation occurs. Cavitation can damage the internal components.
-

5.2 Fill the pump



EMP_M0017_A_sc

Figure 10: Pump connections

PM1	Pressure tapping point, suction
PM2	Pressure tapping point, discharge
D	Drain
L	Leakage
G	Grease nipple
DND	Pressure joint
DNS	Suction joint

Installations with liquid level above the pump (suction head)

1. Close the on-off valve located downstream from the pump.
2. Open the screwed plugs (PM2)
3. Open the on-off valve upstream until the water flows out of the hole.
4. Close the screwed plugs.

Installations with liquid level below the pump (suction lift)

1. Open the on-off valve located upstream from the pump.
2. Close the on-off valve located downstream from the pump.
3. Open the screwed plugs (PM2).
4. Fill the pump until the water flows out of the hole.
5. Close the screwed plugs.

5.3 Check the rotation direction

Follow this procedure before start-up.

1. Locate the arrows on the adaptor or the motor fan cover to determine the correct rotation direction.
2. Start the motor.
3. Quickly check the direction of rotation through the coupling guard or through the motor fan cover.
4. Stop the motor.

5.4 Start the pump

The responsibility for checking the correct flow and the temperature of the pumped liquid rests with the installer or owner.

- The bearings are already filled with grease and therefore ready for operation.
- Pump and suction pipe must be filled completely with liquid when starting up (for instructions see Fill the pump)
- Turn pump unit once again by hand and check that it moves smoothly and evenly.
- Check that coupling guard is installed and that all safety devices are operational.
- Switch on any sealing, flushing or cooling devices that are provided.
- Open valve in suction/intake pipe.
- Set the pressure-side on-off valve to approx. 25% of the pump rate for which the system was designed. For pumps with a drive output lower than 40 HP, the on-off valve may also remain closed briefly upon startup.
- Make sure that unit is electrically connected according to all regulations and with all safety devices.
- Start the pump. At the expected operating conditions, the pump must run smoothly and quietly. If not, refer to Troubleshooting.

6 Maintenance

Precautions



Electrical Hazard:
Disconnect and lock out electrical power before installing or servicing the unit.



WARNING:

- Maintenance and service must be performed by skilled and qualified personnel only.
- Observe accident prevention regulations in force.
- Use suitable equipment and protection.
- Make sure that the drained liquid does not cause damage or injuries.

6.1 Service

If the user wishes to schedule regular maintenance deadlines, they are dependent on the type of pumped liquid and on the operating conditions of the pump.
Contact the local sales and service representative for any requests or information regarding routine maintenance or service.
Extraordinary maintenance may be necessary to clean the liquid end and/or replace worn parts.

Pumps with regreaseable bearings

- Regrease at 4000 operating hours, but at least once per year. Clean lubrication nipples (SN) first.
 - Use NLGI Grade 2 grease or equivalent.
- Contact the local sales and service representative for any requests or information.

Motor bearings

After approximately five years, the grease in the motor bearings is so aged that a replacement of the bearings is recommended. The bearings must be replaced after 25000 operating hours or according to the motor supplier maintenance instructions, whichever is shorter.

Motor with greased for life bearings

Motors with greased for life bearings do not require any scheduled routine maintenance.

Motor with regreaseable bearings

Follow motor supplier maintenance instructions.

Coupling

Check the clearance in the coupling elements regularly, at least once a year. We recommend checking every 1000 operating hours or every three months, whichever comes first.

6.2 Inspection checklist

Check the coupling	Check the flexible elements of the coupling. Replace the relevant parts if there is any sign of wear and check the alignment.
Check the mechanical seal	Check for leakage of the mechanical seal. Replace the mechanical seal if leakage is found.

Checking the bearing seals	Check correct seating of axial seal rings mounted on the shaft. Only gentle contact of the sealing lip shall be established.
Check for quiet running	Check frequently for quiet running of the pump with vibration measurements tools.

6.3 Disassemble and replace the pump parts

For more information about spare parts and assembly and disassembly of the pump, contact the local sales and service representative.

6.4 Repairs



WARNING:

Maintenance and service must be performed by skilled and qualified personnel only.

Trained Customer Service engineers are available to assist with installation and repair work on request. When removing the pump, you must comply with all safety, transport, handling and dismantling instructions included in this manual.

7 Troubleshooting

7.1 Troubleshooting for users

The main switch is on, but the electric pump does not start.

Cause	Remedy
The thermal protector incorporated in the pump (if any) has tripped.	Wait until the pump has cooled down. The thermal protector will automatically reset.
The protective device against dry running has tripped.	Check the liquid level in the tank, or the mains pressure.

The electric pump starts, but the thermal protection trips a varying time after.

Cause	Remedy
There are foreign objects (solids or fibrous substances) inside the pump which have jammed the impeller.	Contact the Sales and Service Department.
The pump is overloaded because it is pumping liquid that is too dense and viscous.	Check the actual power requirements based on the characteristics of the pumped liquid and then contact the Sales and Service Department.

The pump runs but delivers too little or no liquid.

Cause	Remedy
The pump is clogged.	Contact the Sales and Service Department.

The troubleshooting instructions in the tables below are for installers only.

7.2 The main switch is on, but the electric pump does not start

Cause	Remedy
There is no power supply.	- Restore the power supply. - Make sure all electrical connections to the power supply are intact.
The thermal protector incorporated in the pump (if any) has tripped.	Wait until the pump has cooled down. The thermal protector will automatically reset.
The thermal relay or motor protector in the electric control panel has tripped.	Reset the thermal protection.
The protective device against dry running has tripped.	Check the: - liquid level in the tank, or the mains pressure. - protective device and its connecting cables.
The fuses for the pump or auxiliary circuits are blown.	Replace the fuses.

7.3 The electric pump starts, but the thermal protector trips or the fuses blow immediately after

Cause	Remedy
The power supply cable is damaged.	Check the cable and replace as necessary.
The thermal protection or fuses are not suited for the motor current.	Check the components and replace as necessary.
The electric motor is short circuit.	Check the components and replace as necessary.

Cause	Remedy
The motor overloads.	Check the operating conditions of the pump and reset the protection.

7.4 The electric pump starts, but the thermal protector trips or the fuses blow a short time after

Cause	Remedy
The electrical panel is situated in an excessively heated area or is exposed to direct sunlight.	Protect the electrical panel from heat source and direct sunlight.
The power supply voltage is not within the working limits of the motor.	Check the operating conditions of the motor.
A power phase is missing.	Check the • power supply • electrical connection

7.5 The electric pump starts, but the thermal protector trips a varying time after

Cause	Remedy
There are foreign objects (solids or fibrous substances) inside the pump which have jammed the impeller.	Contact the local sales and service representative.
The pumps delivery rate is higher than the limits specified on the data plate.	Partially close the on-off valve down stream until the delivery rate is equal or less than the limits specified on the data plate.
The pump is overloaded because it is pumping liquid that is too dense and viscous.	Check the actual power requirements based on the characteristics of the pumped liquid and replace the motor accordingly.
The motor bearings are worn.	Contact the local sales and service representative.

7.6 The electric pump starts, but the system's general protection is activated

Cause	Remedy
A short circuit in the electrical system.	Check the electrical system.

7.7 The electric pump starts, but the system's residual current device (RCD) is activated

Cause	Remedy
There is an ground (earth) leakage.	Check the insulation of the electrical system components.

7.8 The pump runs but delivers too little or no liquid

Cause	Remedy
There is air inside the pump or the piping.	• Bleed the air

Cause	Remedy
The pump is not correctly primed.	Stop the pump and repeat the prime procedure. If the problem continues: • Check that the mechanical seal is not leaking. • Check the suction pipe for perfect tightness. • Replace any valves that are leaking.
The throttling on the delivery side is too extensive.	Open the valve.
Valves are locked in closed or partially closed position.	Disassemble and clean the valves.
The pump is clogged.	Contact the local sales and service representative.
The piping is clogged.	Check and clean the pipes.
The rotation direction of the impeller is wrong. (three-phase version)	Change the position of two of the phases on the terminal board of the motor or in the electric control panel.
The suction lift is too high or the flow resistance in the suction pipes is too great.	Check the operating conditions of the pump. If necessary, do the following: • Decrease the suction lift • Increase the diameter of the suction pipe.

7.9 The electric pump stops, and then rotates in the wrong direction

Cause	Remedy
There is a leakage in one or both of the following components: • The suction pipe • The foot valve or the check valve	Repair or replace the faulty component.
There is air in the suction pipe.	Bleed the air.

7.10 The pump starts up too frequently

Cause	Remedy
There is a leakage in one or both of the following components: • The suction pipe • The foot valve or the check valve	Repair or replace the faulty component.
There is a ruptured membrane or no air pre-charge in the pressure tank.	See the relevant instructions in the pressure tank manual.

7.11 The pump vibrates and generates too much noise

Cause	Remedy
Pump cavitation	Reduce the required flow rate by partially closing the on-off valve downstream from the pump. If the problem persists check the operating conditions of the pump (for example height difference, flow resistance, liquid temperature).
The motor bearings are worn.	Contact the local sales and service representative.
There are foreign objects inside the pump.	Contact the local sales and service representative.
Impeller rubs on the wear ring	Contact the local sales and service representative.
Coupling misaligned	Check the coupling alignment.
Flexible elements of the coupling worn	Check and replace the relevant parts if there is any sign of wear.

For any other situation, refer to the local sales and service representative.

8 Log files

8.1 Plant manager list

Each plant manager should sign below to confirm that he has received, read and understood these Operating Instructions. He undertakes to follow the instructions conscientiously. If these instructions are not followed the manufacturer's guarantee and liability shall cease to apply.

Name	Date	Signature

8.2 Log Book

Plant operators shall duly enter all maintenance and service work that has been carried out, and shall see that the person responsible confirms such work by signing below:

Maintenance work	Date	Plant operator sinature	Confirmed by (person responsible)

9 Product warranty

Commercial warranty

Warranty. For goods sold to commercial buyers, Seller warrants the goods sold to Buyer hereunder (with the exception of membranes, seals, gaskets, elastomer materials, coatings and other "wear parts" or consumables all of which are not warranted except as otherwise provided in the quotation or sales form) will be (i) be built in accordance with the specifications referred to in the quotation or sales form, if such specifications are expressly made a part of this Agreement, and (ii) free from defects in material and workmanship for a period of twelve (12) months from the date of installation or eighteen (18) months from the date of shipment (which date of shipment shall not be greater than thirty (30) days after receipt of notice that the goods are ready to ship), whichever shall occur first, unless a longer period is specified in the product documentation (the "Warranty").

Except as otherwise required by law, Seller shall, at its option and at no cost to Buyer, either repair or replace any product which fails to conform with the Warranty provided Buyer gives written notice to Seller of any defects in material or workmanship within ten (10) days of the date when any defects or non-conformance are first manifest. Under either repair or replacement option, Seller shall not be obligated to remove or pay for the removal of the defective product or install or pay for the installation of the replaced or repaired product and Buyer shall be responsible for all other costs, including, but not limited to, service costs, shipping fees and expenses. Seller shall have sole discretion as to the method or means of repair or replacement. Buyer's failure to comply with Seller's repair or replacement directions shall terminate Seller's obligations under this Warranty and render the Warranty void. Any parts repaired or replaced under the Warranty are warranted only for the balance of the warranty period on the parts that were repaired or replaced. Seller shall have no warranty obligations to Buyer with respect to any product or parts of a product that have been: (a) repaired by third parties other than Seller or without Seller's written approval; (b) subject to misuse, misapplication, neglect, alteration, accident, or physical damage; (c) used in a manner contrary to Seller's instructions for installation, operation and maintenance; (d) damaged from ordinary wear and tear, corrosion, or chemical attack; (e) damaged due to abnormal conditions, vibration, failure to properly prime, or operation without flow; (f) damaged due to a defective power supply or improper electrical protection; or (g) damaged resulting from the use of accessory equipment not sold or approved by Seller. In any case of products not manufactured by Seller, there is no warranty from Seller; however, Seller will extend to Buyer any warranty received from Seller's supplier of such products.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ANY AND ALL OTHER EXPRESS OR IMPLIED WARRANTIES, GUARANTEES, CONDITIONS OR TERMS OF WHATEVER NATURE RELATING TO THE GOODS PROVIDED HEREUNDER, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WHICH ARE HEREBY EXPRESSLY DISCLAIMED AND EXCLUDED. EXCEPT AS OTHERWISE REQUIRED BY LAW, BUYER'S EXCLUSIVE REMEDY AND SELLER'S AGGREGATE LIABILITY FOR BREACH OF ANY OF THE FOREGOING WARRANTIES ARE LIMITED TO REPAIRING OR REPLACING THE PRODUCT AND SHALL IN ALL CASES BE LIMITED TO THE AMOUNT PAID BY THE BUYER FOR THE DEFECTIVE PRODUCT. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY OTHER FORM OF DAMAGES, WHETHER DIRECT, INDIRECT, LIQUIDATED, INCIDENTAL, CONSEQUENTIAL, PUNITIVE, EXEMPLARY OR SPECIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOSS OF PROFIT, LOSS OF ANTICIPATED SAVINGS OR REVENUE, LOSS OF INCOME, LOSS OF BUSINESS, LOSS OF PRODUCTION, LOSS OF OPPORTUNITY OR LOSS OF REPUTATION.

Limited consumer warranty

Warranty. For goods sold for personal, family or household purposes, Seller warrants the goods purchased hereunder (with the exception of membranes, seals, gaskets, elastomer materials, coatings and other "wear parts" or consumables all of which are not warranted except as otherwise provided in the quotation or sales form) will be free from defects in material and workmanship for a period of twelve (12) months from the date of installation or eighteen (18) months from the product date code, whichever shall occur first, unless a longer period is provided by law or is specified in the product documentation (the "Warranty").

Except as otherwise required by law, Seller shall, at its option and at no cost to Buyer, either repair or replace any product which fails to conform with the Warranty provided Buyer gives written notice to Seller of any defects in material or workmanship within ten (10) days of the date when any defects or non-conformance are first manifest. Under either repair or replacement option, Seller shall not be obligated to remove or pay for the removal of the defective product or install or pay for the installation of the replaced or repaired product and Buyer shall be responsible for all other costs, including, but not limited to, service costs, shipping fees and expenses. Seller shall have sole discretion as to the method or means of repair or replacement. Buyer's failure to comply with Seller's repair or replacement directions shall terminate Seller's obligations under this Warranty and render this Warranty void. Any parts repaired or replaced under the Warranty are warranted only for the balance of the warranty period on the parts that were repaired or replaced. The Warranty is conditioned on Buyer giving written notice to Seller of any defects in material or workmanship of warranted goods within ten (10) days of the date when any defects are first manifest.

Seller shall have no warranty obligations to Buyer with respect to any product or parts of a product that have been: (a) repaired by third parties other than Seller or without Seller's written approval; (b) subject to misuse, misapplication, neglect, alteration, accident, or physical damage; (c) used in a manner contrary to Seller's instructions for installation, operation and maintenance; (d) damaged from ordinary wear and tear, corrosion, or chemical attack; (e) damaged due to abnormal conditions, vibration, failure to properly prime, or operation without flow; (f) damaged due to a defective power supply or improper electrical protection; or (g) damaged resulting from the use of accessory equipment not sold or approved by Seller. In any case of products not manufactured by Seller, there is no warranty from Seller; however, Seller will extend to Buyer any warranty received from Seller's supplier of such products.

THE FOREGOING WARRANTY IS PROVIDED IN PLACE OF ALL OTHER EXPRESS WARRANTIES. ALL IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED TO TWELVE (12) MONTHS FROM THE DATE OF INSTALLATION OR EIGHTEEN (18) MONTHS FROM THE PRODUCT DATE CODE, WHICHEVER SHALL OCCUR FIRST. EXCEPT AS OTHERWISE REQUIRED BY LAW, BUYER'S EXCLUSIVE REMEDY AND SELLER'S AGGREGATE LIABILITY FOR BREACH OF ANY OF THE FOREGOING WARRANTIES ARE LIMITED TO REPAIRING OR REPLACING THE PRODUCT AND SHALL IN ALL CASES BE LIMITED TO THE AMOUNT PAID BY THE BUYER FOR THE DEFECTIVE PRODUCT. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY OTHER FORM OF DAMAGES, WHETHER DIRECT, INDIRECT, LIQUIDATED, INCIDENTAL, CONSEQUENTIAL, PUNITIVE, EXEMPLARY OR SPECIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOSS OF PROFIT, LOSS OF ANTICIPATED SAVINGS OR REVENUE, LOSS OF INCOME, LOSS OF BUSINESS, LOSS OF PRODUCTION, LOSS OF OPPORTUNITY OR LOSS OF REPUTATION.

Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above exclusions may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which may vary from state to state.

To make a warranty claim, check first with the dealer from whom you purchased the product or visit www.xyleminc.com for the name and location of the nearest dealer providing warranty service.

Xylem |'zīləm|

- 1) The tissue in plants that brings water upward from the roots;
- 2) a leading global water technology company.

We're a global team unified in a common purpose: creating advanced technology solutions to the world's water challenges. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. Our products and services move, treat, analyze, monitor and return water to the environment, in public utility, industrial, residential and commercial building services, and agricultural settings. With its October 2016 acquisition of Sensus, Xylem added smart metering, network technologies and advanced data analytics for water, gas and electric utilities to its portfolio of solutions. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise with a strong focus on developing comprehensive, sustainable solutions.

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