BMEX

Installation and operating instructions

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Original installation and operating instructions.

CONTENTS

Warning

Prior to installation, read these installation and operating instructions. Installation and operation must comply with local regulations and accepted codes of good practice.

1. Symbols used in this document

Warning

If these safety instructions are not observed, it may result in personal injury.

Caution — If these safety instructions are not observed, it may result in malfunction or damage to the equipment.

Note — Notes or instructions that make the job easier and ensure safe operation.

2. General description

The Grundfos BMEX booster system is designed for desalination of sea water in reverse osmosis systems, so-called SWRO systems (SWRO = Sea Water Reverse Osmosis). The design of the system offers high energy recovery.

The BMEX booster system consists of:

- BME hp feed pump (hp = high-pressure)
- BM hp circulation pump (hp = high-pressure) with Variable-Frequency Drive (VFD) (the pump is installed in a sleeve)
- X-Changer module.

The BMEX units are supplied from factory in boxes in which they must remain until they are to be installed. The units are ready for installation.

2.1 Commissioning

Commissioning of the BMEX booster system must be carried out by competent and certified Grundfos employees to ensure long and trouble-free operation.

Note If this requirement is not met, the BMEX warranty will be invalidated.

The commissioning includes training on site of the people maintaining and monitoring the system.

2.2 Pumped liquids

Thin, non-explosive liquids, not containing solid particles or fibres. The liquid must not chemically attack the materials of the BMEX units. In case of doubt, contact Grundfos.

Warning

The BMEX booster system is designed solely for brackish water and sea water and must not be used for other liquids.

The raw water to the X-Changer module must be filtered to maximum 5 microns abs and the raw water to the BME hp feed pump to maximum 30 microns abs.

The BMEX system must never operate with water/liquid containing substances removing surface tension, e.g. soap. If this type of detergent is used for cleaning the system, the water/liquid must be led around the units via a bypass.

Caution During transportation and storage, the pumps must never be preserved with liquids which are aggressive to the pump materials.

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Fig. 1 BMEX booster system

3. Technical data

See motor and pump nameplates.

3.1 Sound pressure level, inlet pressure and temperatures

BMEX system	Sound pressure level	Min./max. inlet pressure		Max. liquid/ ambient temperature*
BME hp feed pump	85 dB(A)	1/35 bar		40/40 °C
BM hp circulation pump with VFD	70 dB(A)	1/80 bar		40/40 °C
X-Changer	76-91 dB(A)	Low pressure (LP)	High pressure (HP)	45/40 °C
		2/7 bar	80 bar	

* If the ambient temperature is higher than the values stated, please contact Grundfos.

4. Preparation

Before installation, the following checks should be made:

1. **Check for transport damages**
   Make sure that the BMEX units have not been damaged during transportation.
2. **Type of system**
   Check that the type designation corresponds to order. See nameplates.
3. **Power supply**
   The motor and VFD voltage and frequency details given on the nameplate should be compared with the actual power supply available.
4. **X-Changer module**
   Check that all nuts are tightened.
5. **V-belt**
   Check that the V-belt has been tightened.
   See section *14. V-belt tension*.
6. **Lubrication**
   See section *18. Motor bearings, BME hp feed pump*.
7. **Oil level**
   Check the oil level.
   See section *7.1.5 Monitoring of oil lubrication system*.
   Note: During periods of inactivity, the oil container may be empty. Check the oil level after 5 minutes of operation.

5. Installation

The BME hp feed pump and X-Changer modules can be mounted directly on the floor or a base frame. The units are adjusted by means of the four adjustable feet.

The inlet and discharge ports of the units are shown in figs 2 and 6. Pipes are connected by means of Victaulic/PJE clamp couplings.

5.1 BME hp feed pump

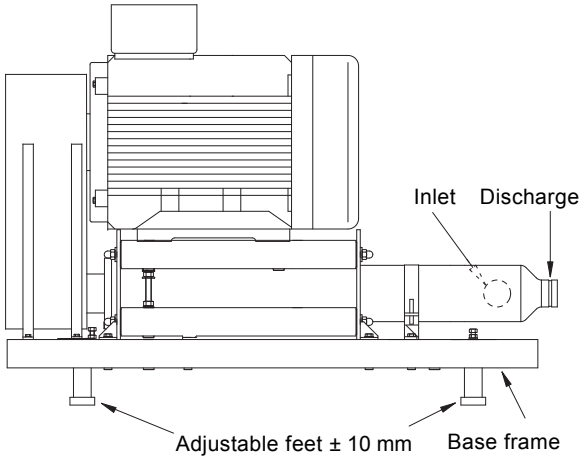


Fig. 2 BME hp feed pump

If the pump is to be fastened, the following procedure is recommended:

Note Fasten the pump with four foundation bolts. The base frame has additional holes for this purpose. The bolts can be secured to a concrete foundation or welded onto a steel floor. See figures 3 and 4.

Note Prior to startup, the nuts should be slackened. See fig. 3 concrete foundation and fig. 4 steel floor. The nuts must be counter-locked.

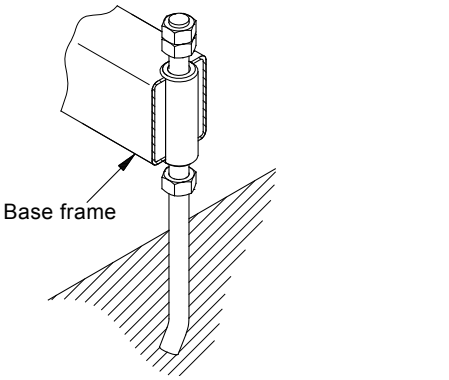


Fig. 3 Concrete foundation

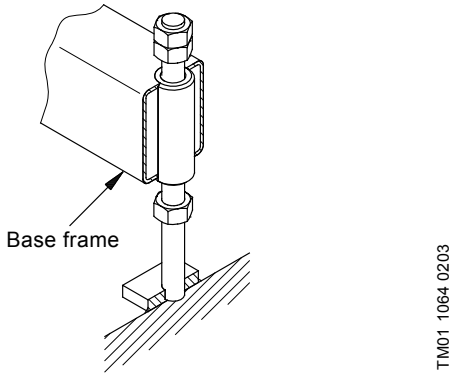


Fig. 4 Steel floor

The nuts must be tightened during transportation. See fig. 5.

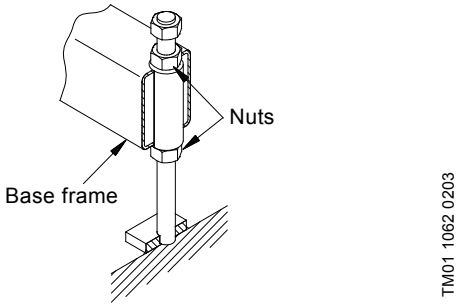


Fig. 5 Tightened nuts

5.2 X-Changer module

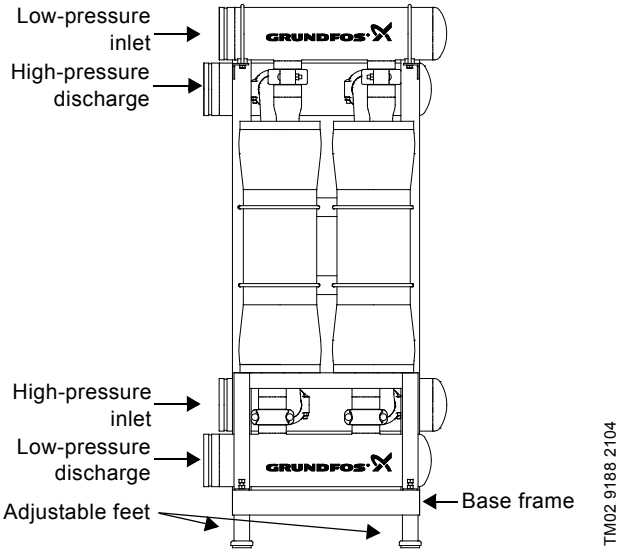
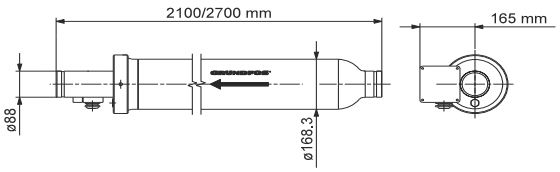


Fig. 6 Example of X-Changer module (2 x 180/220)

5.3 BM hp circulation pump

6" BM hp circulation pump



8" BM hp circulation pump

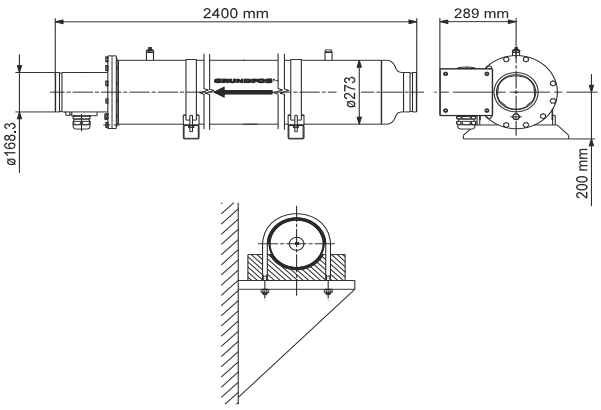


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Fig. 7 6" BM hp and 8" BM hp circulation pumps

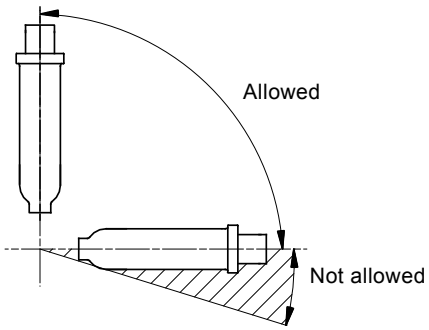

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Fig. 8 Positioning the BM hp circulation pump

6. Pipe connection

6.1 Inlet and discharge pipes

A sample connection at the low-pressure discharge of each X-Changer module in an X-Changer module array can be used to confirm the performance of individual units. When the X-Changer modules are operating normally at balanced flow, the salinity of the low-pressure discharge water from the X-Changer will be approximately equal to the salinity of the reject water from the membranes. If the X-Changer modules are not balanced, the salinity of the low-pressure discharge from the unit will be low.

If one of the X-Changer modules is not functioning properly, the salinity of the low-pressure discharge from the unit will be lower than the other units. If a rotor is stuck, the salinity from the stuck unit will be approximately equal to the salinity of the seawater feed.

The BMEX units are fitted with clamp liners for Victaulic/PJE clamp couplings HP-70 ES on the inlet and discharge sides. Position the clamp liners as shown in fig. 9.

During initial startup, all piping associated with the X-Changer should be thoroughly flushed to ensure that no particles enter and/or damage the X-Changer. Grundfos recommends installation of a protective strainer in the flexible couplings at the high-pressure and low-pressure inlets.

Caution Avoid any stress in the pipe system.

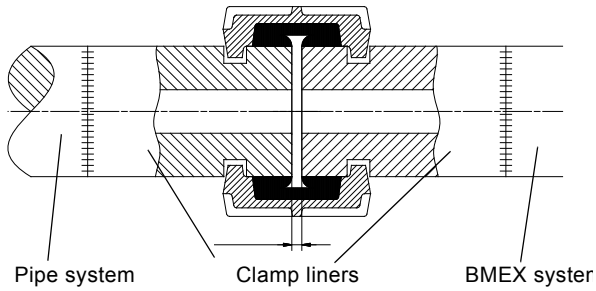

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Fig. 9 Positioning of clamp liners

7. Electrical connection

7.1 BME hp feed pump

The electrical connection must be carried out by an authorised electrician in accordance with local regulations and the diagrams for the motor protection, starter and monitoring devices used. See fig. 10. The electrical connections must be made in the terminal box.

Warning

Before making any electrical connections, make sure that the power supply has been switched off and that it cannot be accidentally switched on.

The pump must be connected to an external mains switch with a minimum contact gap of 3 mm in all poles.

The pump must be earthed.

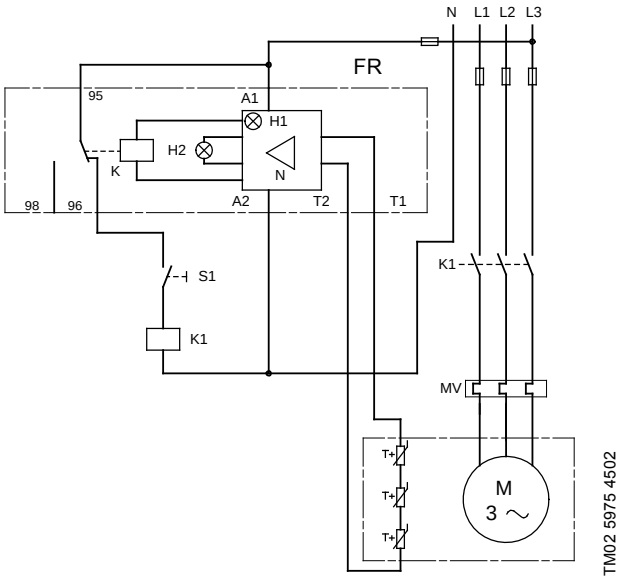

Fig. 10 Wiring diagram, BME hp feed pump

The required voltage quality measured at the motor terminals is -5 %/+ 5 % of the rated voltage during continuous operation (including variation in the supply voltage and losses in cables).

Check that there is voltage symmetry in the power supply lines, i.e. approximately same difference of voltage between the individual phases. See also section *23. Checking motor and cable*, point 1.

The motor is wound for star-delta starting.

The following starting methods can be used:

- star-delta starting
- soft starter
- frequency converter.

The maximum permissible run-up changeover time for star-delta starting is 2 seconds for motors up to and including 90 kW and 4 seconds for motors of 110 to 160 kW.

When starting up via a soft starter or frequency converter, the run-up time from 0 to 30 Hz should not exceed 6 seconds. The run-out time from 30 to 0 Hz should not exceed 6 seconds.

During frequency converter operation, it is not advisable to run the motor at a frequency higher than the rated frequency (50 or 60 Hz). See motor nameplate.

7.1.1 Motor protection

The motor must be connected to an effective motor starter (MV) and an external amplifier relay (FR). See fig. 10. This protects the motor against damage from voltage drop, phase failure, quick and slow overloading and a locked rotor.

In power supply systems where undervoltage and variations in phase symmetry may occur, a phase failure relay should be connected. See section *23. Checking motor and cable*, point 1.

7.1.2 Setting of motor starter

For cold motors, the tripping time for the motor starter must be less than 10 seconds at 5 times the rated current of the motor.

Note If this requirement is not met, the motor warranty will be invalidated.

To ensure optimum protection of the motor, the starter overload unit should be set in accordance with the following guidelines:

1. Set the starter overload to the rated current ($I_{1/1}$) of the motor.
2. Start the BME hp feed pump, and let it run for half an hour at normal performance.
3. Slowly grade down the scale indicator until the motor trip point is reached.
4. Increase the overload setting by 5 %, but not higher than the rated current ($I_{1/1}$) of the motor.

For motors wound for star-delta starting, the starter overload unit should be set as above, but the maximum setting should be as follows:

Starter overload setting = rated current ($I_{1/1}$) x 0.58.

7.1.3 Generator operation

Motor-driven generators for standard motors are often available according to standard conditions:

- maximum height above sea level: 150 metres
- maximum air intake temperature: 30 °C
- maximum air humidity: 60 %.

Please contact Grundfos for advice.

7.1.4 Thermistor

Before starting up the system, the thermistors must be connected to terminals T1 and T2 on the terminal block. See fig. 10. The thermistors protect the motor windings against thermal overload.

7.1.5 Monitoring of oil lubrication system

The oil lubrication system is monitored by a level switch positioned as shown in fig. 11. The electrical connection to 0-250 V (with a maximum 10 A back-up fuse) is made in the terminal box.

Note During periods of inactivity, the oil container may be empty. Check the oil level after 5 minutes of operation. If necessary, refill the oil container.

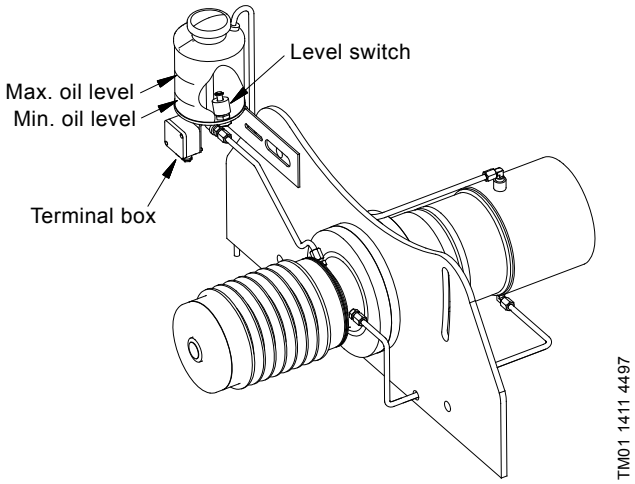

Fig. 11 Oil lubrication system

7.2 BM hp circulation pump

The electrical connection must be carried out by an authorised electrician in accordance with local regulations.

Warning

Before making any electrical connections, make sure that the power supply has been switched off and that it cannot be accidentally switched on.

The pump must be connected to an external mains switch with a minimum contact gap of 3 mm in all poles.

The pump must be earthed.

The required voltage quality measured at the motor terminals is -10 %/+ 6 % of the rated voltage during continuous operation (including variation in the supply voltage and losses in cables).

Check that there is voltage symmetry in the power supply lines, i.e. approximately same difference of voltage between the individual phases. See also section *23. Checking motor and cable*, point 1.

In order for the pump to meet the EC EMC Directive (2004/108/EC), a 0.47 µF capacitor (in accordance with IEC 384-14) must always be connected over the two phases to which the temperature transmitter is connected. See fig. 12.

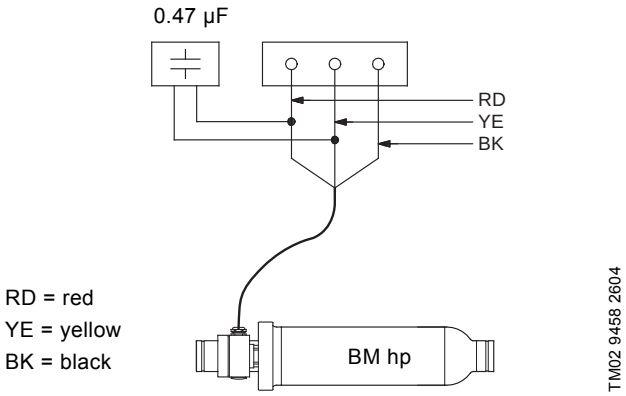

Fig. 12 Electrical connection, BM hp circulation pump

The electrical connections must be made in the terminal box. See figures 13, 14 and 15.

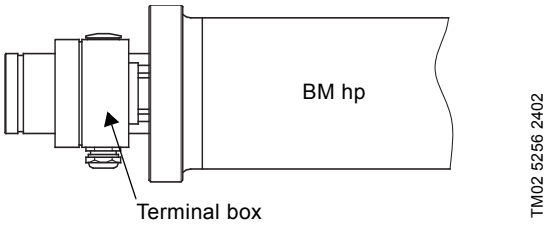

Fig. 13 Position of terminal box, BM hp circulation pump

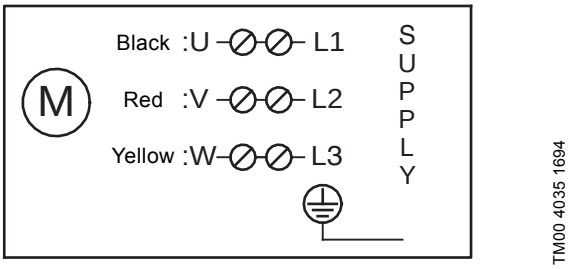

Fig. 14 BM hp circulation pump, direct-on-line starting

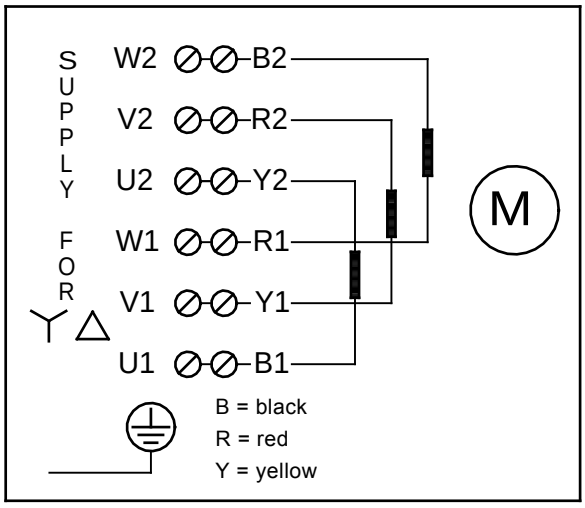

Fig. 15 BM hp circulation pump, star-delta starting

7.2.1 Frequency converter operation

Three-phase Grundfos MS motors can be connected to a frequency converter.

Note If an MS motor with temperature transmitter is connected to a frequency converter, a fuse incorporated in the transmitter will melt and the transmitter will be inactive. The transmitter cannot be reactivated. This means that the motor will operate like a motor without a temperature transmitter.

If a temperature transmitter is required, a Pt100 sensor for fitting to the motor can be ordered from Grundfos.

Caution During frequency converter operation, it is not advisable to run the motor at a frequency higher than the rated frequency (50 or 60 Hz). In connection with pump operation, it is important never to reduce the frequency (and consequently the speed) to such a level that the necessary flow of cooling liquid past the motor is no longer ensured.

The permissible frequency ranges are 30-50 Hz and 30-60 Hz, respectively.

During starting, the maximum acceleration time from 0 to 30 Hz is 1 second.

During stopping, the maximum deceleration time from 30 to 0 Hz is 1 second.

Depending on the frequency converter type, it may expose the motor to detrimental voltage peaks.

The above disturbance can be abated by installing an **RC filter** between the frequency converter and the motor.

Possible increased acoustic noise from the motor can be abated by installing an **LC filter** which will also eliminate voltage peaks from the frequency converter.

For further details, please contact your frequency converter supplier or Grundfos.

7.2.2 Motor protection

The motor must be connected to an effective motor starter which must protect the motor against damage from voltage drop, phase failure, overload and a locked rotor.

In power supply systems where undervoltage and variations in phase symmetry may occur, a phase failure relay should also be fitted. See section *23. Checking motor and cable*, point 1.

The control circuit must always be made in such a way that all pumps of the BMEX system are stopped if one pump fails.

7.2.3 Setting of motor starter

For cold motors, the tripping time for the motor starter must be less than 10 seconds (Class 10) at 5 times the rated current ($I_{1/1}$/I_{SFA}) of the motor. See motor nameplate.

Note If this requirement is not met, the motor warranty will be invalidated.

To ensure optimum protection of the motor, the starter overload unit should be set in accordance with the following guidelines:

1. Set the starter overload to the rated current ($I_{1/1}$/I_{SFA}) of the motor.
2. Start the BM hp circulation pump, and let it run for half an hour at normal performance. See section *9.7 BM hp circulation pump*.
3. Slowly grade down the scale indicator until the motor trip point is reached.
4. Increase the overload setting by 5 %, but not higher than the rated current ($I_{1/1}$/I_{SFA}) of the motor.

For motors wound for star-delta starting, the starter overload unit should be set as above, but the maximum setting should be as follows:

Starter overload setting = rated current ($I_{1/1}$/I_{SFA}) x 0.58.

The maximum permissible run-up changeover time for star-delta starting is 2 seconds.

8. Before starting the BMEX

Check the following:

- Oil level (BME hp feed pump only).
  See section *7.1.5 Monitoring of oil lubrication system*.
- Belt tension (BME hp feed pump only).
  See section *14. V-belt tension*.
- Greasing (BME hp feed pump only).
  See section *18. Motor bearings, BME hp feed pump*.
- Power supply in accordance with nameplate.
- Free movability (BME hp feed pump only).
  Rotate the motor and pump shafts manually by means of the V-belt.
- Pipework according to the diagram, fig. 16.
- Slacken the foundation bolt nuts.

In addition, flush all pipes to remove all impurities before connecting the system units.

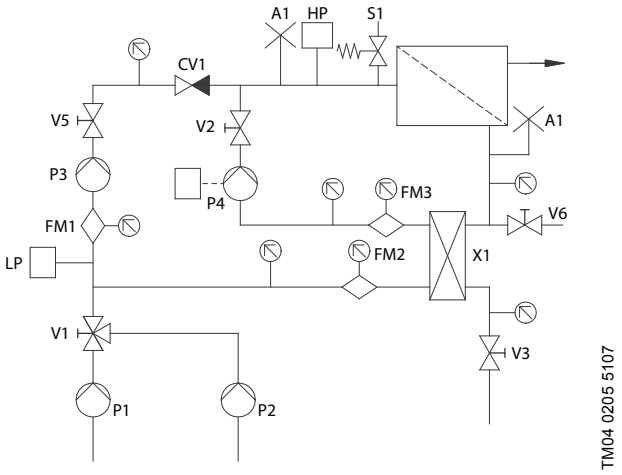

Fig. 16 Example of piping and instrumentation

Pos.	Description
P1	Sea-water feed pump
P2	Cleaning/flush pump
P3	BME hp feed pump
P4	BM hp circulation pump with variable-frequency drive
V1	Three-way valve for feed water and cleaning
V2	Control valve for controlling pressure and flow
V3	Low-pressure reject-water valve
V5	Control valve for controlling pressure and flow
V6	Cleaning/flush valve
CV1	Non-return valve
FM1-3	Flowmeter for balancing the system
X1	X-Changer module
HP	High-pressure switch
LP	Low-pressure switch
S1	Pressure relief valve

9. Startup and operation

9.1 BMEX

This section and the subsequent subsections make references to the piping and instrumentation diagram, fig. 16.

To start up the BMEX system, proceed as follows:

1. All valves should be in their normal operating positions.
2. Start the sea-water feed pump (P1). The feed flow (max. 6 bar, min. 2 bar feed pressure) through the X-Changer module may or may not cause the rotor to begin to rotate. This rotation will be confirmed by a humming noise.
3. Vent air from the system.
4. After the X-Changer has run with sea water for 5 to 10 minutes, start the BM hp circulation pump (P4). See section *9.7 BM hp circulation pump*. Rotor speed will increase and remaining air will be released from the X-Changer. Vent any remaining air from the system.
5. Start the BME hp feed pump (P3). See section *9.8 BME hp feed pump*. The BMEX system pressure will increase to the point where the permeate flow will equal the flow from the BME hp feed pump.
   The sound pressure level from the X-Changer will increase. Small variations in sound pressure level and rotor speed are normal.
6. The system is running.

9.2 Flow control and balancing

Flow rates and pressures in a typical BMEX system vary slightly over the life of the system due to temperature variations, membrane fouling or feed salinity variations. The X-Changer rotor is powered by the flow of fluid through the unit. The speed of the rotor is self-adjusting over the operating range of the X-Changer module.

9.3 High-pressure flow control

The flow through the BM hp circulation pump (P4) is adjusted with control valve (V2) or a variable-frequency drive to control the flow rate of the high-pressure sea-water discharge from the X-Changer module and high-pressure brine inlet to the X-Changer module. The high-pressure sea-water discharge flow equals the high-pressure brine inlet flow.

9.4 Low-pressure flow control

The low-pressure reject-water valve (V3) on the discharge side of the system must be adjusted to control the flow rate of the low-pressure sea-water inlet and low-pressure brine discharge (min. 1 bar back-pressure). This valve also adds back-pressure on the X-Changer module required to prevent destructive cavitation. The low-pressure sea-water inlet flow equals the high-pressure brine-reject water inlet flow.

9.5 Operation settings

The flow and discharge pressure of the BMEX system should always be kept within the ranges for which it was originally designed. See the "Technical specification" supplied with the system.

If the system requires flows and pressures outside the design range, changes are possible. Please contact Grundfos.

9.6 Balancing the X-Changer module

Note The following procedure should be applied to achieve balanced flows.

This section and the subsequent subsections make references to the piping and instrumentation diagram, fig. 16.

Procedure:

1. Start the sea-water feed pump (P1).
2. Adjust the low-pressure reject-water valve (V3) on the discharge side of the X-Changer (X1) until the low-pressure sea-water inlet flow (FM2) equals the calculated sea-water discharge flow (FM3).
3. Start the BM hp circulation pump (P4). See section *9.7 BM hp circulation pump*.
4. Adjust the variable-frequency drive on the BM hp circulation pump (P4) or control valve (V2) until the desired flow rate is achieved as indicated by the high-pressure flowmeter (FM3). FM3 = FM2 (= balanced flow).

To achieve balanced flow through the X-Changer (X1), use flowmeters installed on the low-pressure sea-water inlet piping and high-pressure sea-water discharge piping. All flows in and out of the X-Changer should be balanced to within 5 % for optimum operation.

Note If any doubt exists in reading the flowmeter, the low-pressure sea-water inlet should be the greater of the two flows (FM2 > FM3).

Note Operating the X-Changer with unbalanced flows may result in contamination of the sea-water feed by the brine reject and consequently lower efficiency.

The X-Changer module is designed to operate at fluid mixing levels below 5 %. Balanced flows control the mixing of concentrate with the feed. Flowing the sea-water inlet much less than the sea-water discharge will result in lower-quality permeate, increased feed pressure and higher energy consumption.

Recommended practice for the BM hp circulation pump is to use a slightly oversized pump to handle projected membrane concentrate flows, taking into account seasonal variations, membrane fouling and manifold losses. The flow and pressure of the BM hp circulation pump can be controlled with a variable-frequency drive (P4) or control valve (V2).

Caution The low-pressure and high-pressure flows through the X-Changer must never exceed the rated maximum flow. The only reliable way to determine this flow is to use a low-pressure flowmeter (FM2) or a high-pressure flowmeter (FM3), respectively.

9.7 BM hp circulation pump

This section and the subsequent subsections make references to the piping and instrumentation diagram, fig. 16.

Note The BM hp circulation pump must be filled with water before startup.

Warning

The BM hp circulation pump is not allowed to run against a closed discharge valve for more than 5 seconds as this will cause an increase in temperature/formation of steam in the pump which may cause damage to the pump and motor.

If there is any risk of the BM hp circulation pump running against a closed discharge valve or no flow, a minimum liquid flow through the pump should be ensured by connecting a bypass/a drain to the discharge side of the pump. The drain can for instance be connected to a tank.

To start up the BM hp circulation pump, proceed as follows:

1. Ensure an inlet pressure on the pump (min. 1 bar and max. 80 bar).
2. Start the BM hp circulation pump.

In systems involving the risk of water hammer in connection with start/stop, the necessary measures must be taken to reduce this risk, e.g. by installing a diaphragm tank.

During operation, the inlet pressure must be checked in accordance with section *9.5 Operation settings*.

The BM hp circulation pump is now ready for operation.

9.7.1 Checking the direction of rotation

Procedure:

1. Close the control valve (V2) on the discharge side of the BM hp circulation pump (P4) to approx. 1/3 of maximum flow.
2. Start the BM hp circulation pump, and record discharge pressure and flow readings.
3. Stop the pump, and interchange two of the phases to the motor.
4. Restart the pump, and re-record discharge pressure and flow readings.
5. Stop the pump.
6. Compare the results recorded under points 2 and 4. The connection which gave the larger pressure and flow is the correct direction of rotation.

The check for the direction of rotation should last for the shortest possible time.

9.8 BME hp feed pump

To start up a BME hp feed pump, proceed as follows:

1. Start the sea-water feed pump (P1), and check that the inlet pressure of the pump is higher than **1.0** bar (10 metres head) and lower than **35** bar (350 metres head).
2. Vent the BME hp feed pump. See section *9.9 Liquid filling, venting and checking direction of rotation*.
3. Start the BM hp circulation pump (P4). See section *9.7 BM hp circulation pump*.
   Check that the oil level in the oil container stabilises between minimum and maximum.
4. Check the direction of rotation as described in section *9.9 Liquid filling, venting and checking direction of rotation*.
5. Start the BME hp feed pump.
6. Set the discharge pressure of the BME hp feed pump to the desired value by means of either a variable-frequency drive or a control valve (V5).
7. Check that the **inlet** pressure of the BME hp feed pump is higher than **1.0** bar (10 metres head) and lower than **35** bar (350 metres head).

9.9 Liquid filling, venting and checking direction of rotation

Procedure:

1. Open the valve on the inlet side of the pump. The pump is normally primed by the pressure from the sea-water feed pump.
2. Open the air escape valve on the discharge side of the pump.
3. Continue the filling procedure until water runs out of the air escape valve.
4. If the system is fitted with an isolating valve on the discharge side of the BM hp circulation pump, open this valve approx. 1/4.
5. Start the pump (for 1 sec. only), and check the direction of rotation. The correct direction of rotation is indicated on the cover of the V-belt screen. If necessary, interchange two phases to the motor.

10. Checking the operation of the BMEX system

Check the following at suitable intervals:

- Flow and pressure.
- Current consumption.
- Lubricating oil level.
- Whether the oil container contains water (the lubricating oil should be changed every 2,000 operating hours or every 6 months, whichever comes first).
- Whether the motor ball bearings are being greased (check that excessive grease can escape through the drain hole in bearing cover).
- Whether the bearings are worn.
- Whether the V-belts are tightened correctly.
  Check every 6 months. See section *12. Pulleys and V-belts*.
- Whether the shaft seal is leaky.
  The drain hole underneath the pulley must be free from deposits. If required, flush with clean fresh water at a minimum pressure of 1 bar.
  The shaft seal is lubricated by the pumped liquid. Small quantities of liquid are therefore drained via the drain hole.
- Whether the sound pressure level has changed.

We recommend that you write the operating data in the log book supplied with the pump. The data can be useful for maintenance purpose. The log books are shown on pages 23 to 25.

11. Limitations to operation, BM hp circulation pump

The flow limits stated in the table below apply to the optimum operating ranges of the pumps as regards efficiency and cooling:

Recommended flow rates at 25 °C (77 °F)

Type of BM hp	m^3/h		US GPM	
	50 Hz	60 Hz	50 Hz	60 Hz
BM 17	8-24	8-29	35-106	35-128
BM 30	15-38	18-45	66-167	79-198
BM 46	24-60	28-72	106-264	123-317
BM 60	35-75	40-90	154-330	176-396
BM 77	50-95	70-110	220-418	308-484
BM 95	60-110	80-125	264-484	352-550
BM 125	70-160	80-180	308-704	352-792
BM 160	140-195	150-215	616-858	660-946
BM 215	160-265	200-310	704-1166	880-1364

11.1 Cooling

The temperature and flow limits stated in the table below must be observed to ensure sufficient cooling of the motor:

Maximum permissible liquid temperature

Motor	Maximum liquid temperature		Minimum flow velocity past the motor	Minimum flow
	°C	°F	m/s (ft/s)	m^3/h (US GPM)
Grundfos MS 6"	40	104	≥ 0.15 (0.49)	≥ 5.5 (24)

12. Pulleys and V-belts

12.1 Inspection of pulleys

Inspect the pulley grooves for wear. See fig. 17. Belt life will be reduced if the grooves are worn.

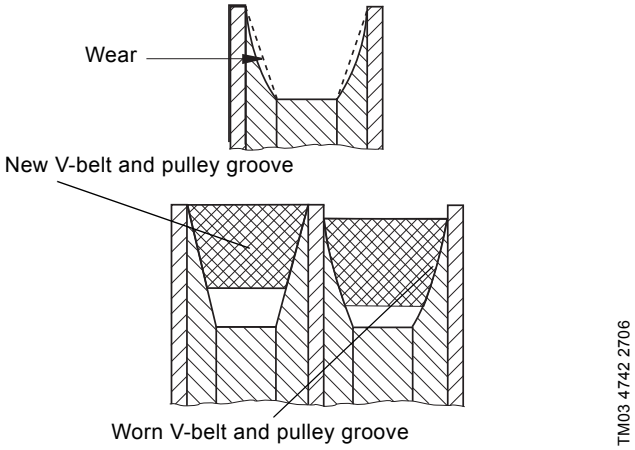

Fig. 17 Examples of new and worn pulley grooves

Use, for instance, pulley gauges to determine whether the grooves are worn. See fig. 18.

The motor pulley groove is 38 ° and the pump pulley groove is 34 °.

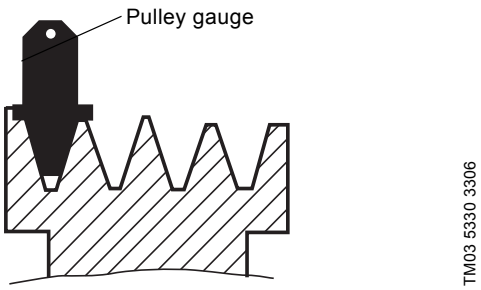

Fig. 18 Use of pulley gauges

A torch may be useful when inspecting the grooves. Do not be misled by shiny grooves. Grooves that are shiny are often polished because of heavy wear. Inspect the pulley grooves for corrosion or pitting. If corroded or pitted surfaces are found, the pulley should be replaced.

Note Worn pulleys must be replaced to ensure trouble-free operation.

Checking and correcting pulley alignment

Misaligned pulleys will accelerate wear of belts and pulley grooves.

Check the alignment by placing a steel straightedge across the pulley faces so that it touches all four contact points. See fig. 19.

Correct the alignment, if required.

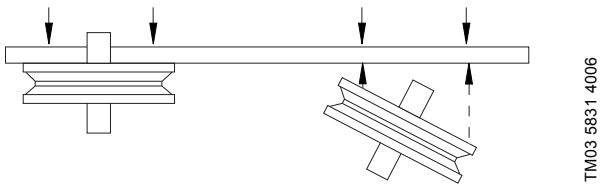

Fig. 19 Correct alignment

13. Replacement of V-belts

Procedure:

Caution All V-belts must be replaced by new belts.

1. Remove oil and impurities from the pulley grooves.
2. Place the V-belts loosely in the pulley grooves without using force or tools of any kind.
3. Adjust the V-belt tension to the value stated in section *14. V-belt tension*.

14. V-belt tension

Correct belt tension is decisive for long and trouble-free operation.

This section refers to section *16. Recommended V-belt tension*.

1. Move the motor towards or away from the pump until the correct tension has been obtained, i.e. between $T_{min.}$-$T_{max.}$.
2. Rotate the motor and pump shafts a few times by means of the V-belt before checking the $T_{min.}$-$T_{max.}$ value.
3. Adjust the V-belt tension to the value stated.
4. Check the V-belt tension after 1 to 4 hours of operation at full load.
5. Adjust the V-belt tension to the value stated.
6. The belt tension should be checked regularly according to the recommended values.

The belt tension can be measured through a hole in the protective guard.

V-belts and pulleys must be checked every 6 months.

We recommend that you replace the V-belts once a year.

15. Using the tension tester

The tension tester supplied with the BMEX system should be used as described below.

The use of the tension tester is illustrated in figs 20, 21 and 22.

The position numbers in this section refer to fig. 20.

1. Rotate the motor and pump shafts a few times before checking the belt tension.
2. Reset the pointer, pos. 1, and place the tension tester on the belt between the pulleys, pos. 4.
3. Use only one finger to operate the tension tester, pos. 2.
4. Gently press the tension tester until a "click" indicates that the tester has been activated.
5. Remove the tester from the belt, and read the tension measured, pos. 3.
6. Adjust the V-belt tension to the value stated in section *16. Recommended V-belt tension*.

Note Rotate the motor and pump shafts after each tension adjustment.

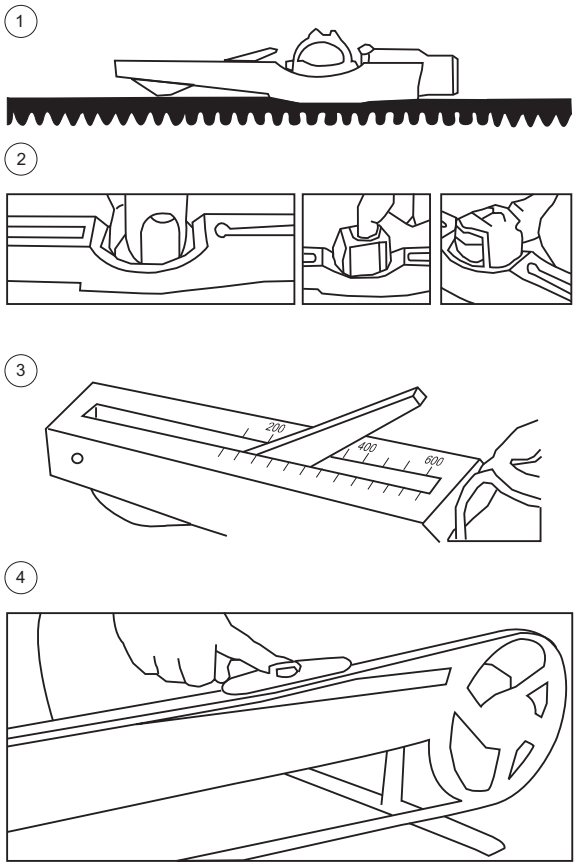

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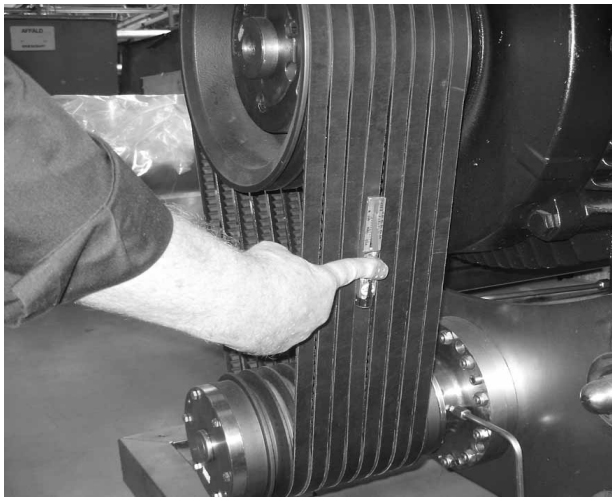
Fig. 20 Tension tester



TM03 8109 0107

Fig. 21 Using the tension tester

TM03 8110 0107

Fig. 22 Reading the tension tester

16. Recommended V-belt tension

16.1 V-belt tension, 50 Hz

The table below shows the recommended tension of V-belts for the BME hp feed pump:

V-belt tension, 50 Hz

Diameter of pulley [mm]		Number of V-belts	Belt length	V-belt tension [N]	
Motor	Pump		[mm]	New belts* $T_{min.}$-$T_{max.}$	Check** $T_{min.}$-$T_{max.}$
160 kW, 50 Hz, 400 V, 2976 min^{-1}					
300	150	9	1650	900-1000	650-700
280			1600	800-900	
265					600-700
250			1550		
236					
224					
132 kW, 50 Hz, 400 V, 2977 min^{-1}					
300	150	8	1650	850-900	650-700
280			1600	800-900	600-700
265					
250			1550		
236				700-800	
224					
212			1500		
110 kW, 50 Hz, 400 V, 2979 min^{-1}					
300	150	6	1650	900-1000	700-800
280			1600	800-900	650-700
265					
250		7	1550		
236				700-800	
224		8			500-600
212			1500		
90 kW, 50 Hz, 400 V, 2970 min^{-1}					
300	150	6	1550	800-900	600-700
280					
265			1500	700-800	
250					
236					500-600
224			1450		
212					
200			1400		
190					
75 kW, 50 Hz, 400 V, 2974 min^{-1}					
300	150	5	1550	800-900	600-700
280					
265			1500	700-800	
250					
236					500-600
224			1450		
212					
200			1400		
190					

Diameter of pulley [mm]		Number of V-belts	Belt length	V-belt tension [N]	
Motor	Pump		[mm]	New belts* $T_{min.}$-$T_{max.}$	Check** $T_{min.}$-$T_{max.}$
55 kW, 50 Hz, 400 V, 2960 min^{-1}					
300	150	4	1500	800-900	600-700
280					
265			1400	700-800	500-600
250					
236					
224					
212			1320	600-700	
200					
190					
45 kW, 50 Hz, 400 V, 2970 min^{-1}					
300	150	3	1500	800-900	600-700
280			1400	700-800	
265					
250					
236			1320		500-600
224					
212			1250		
200					
190					
37 kW, 50 Hz, 400 V, 2955 min^{-1}					
300	150	3	1400	800-900	600-700
280					
265			1320	700-800	500-600
250					
236					
224			1250	600-700	
212					400-500
200					
190					
30 kW, 50 Hz, 400 V, 2955 min^{-1}					
300	150	2	1400	800-900	600-700
280				700-800	
265			1320		
250					500-600
236					
224			1250		
212					
200					
190					

* V-belt tension within the first hour of operation.

** V-belt tension after more than one hour of operation.

16.2 V-belt tension, 60 Hz

The table below shows the recommended tension of V-belts for the BME hp feed pump:

V-belt tension, 60 Hz

Diameter of pulley [mm]		Number of V-belts	Belt length	V-belt tension [N]	
Motor	Pump		[mm]	New belts* $T_{min.}$-$T_{max.}$	Check** $T_{min.}$-$T_{max.}$
148 kW, 60 Hz, 440 V, 3572 min^{-1}					
250	150	9	1550	850-900	650-700
236				800-900	
224			1500		
123 kW, 60 Hz, 440 V, 3575 min^{-1}					
250	150	8	1550	850-900	650-700
236				800-900	600-700
224			1500		
212					
200				700-800	
190			1450		
180					
101 kW, 60 Hz, 440 V, 3564 min^{-1}					
250	150	6	1500	900-1000	700-800
236			1450	800-900	650-700
224		8		700-800	
212					500-600
200			1400		
190				600-700	
180					
84 kW, 60 Hz, 440 V, 3568 min^{-1}					
250	150	5	1500	800-900	650-700
236			1450		600-700
224		6		700-800	
212					500-600
200			1400		
190					
180					
62 kW, 60 Hz, 440 V, 3568 min^{-1}					
250	150	4	1450	800-900	600-700
236			1400		
224					
212			1320		
200				700-800	
190					
180		5		600-700	500-600

Diameter of pulley [mm]		Number of V-belts	Belt length	V-belt tension [N]	
Motor	Pump		[mm]	New belts* $T_{min.}$-$T_{max.}$	Check** $T_{min.}$-$T_{max.}$
51 kW, 60 Hz, 440 V, 3564 min^{-1}					
250	150	4	1400	800-900	600-700
236			1320		
224					
212					
200			1250	700-800	
190					
180		5		600-700	500-600
42 kW, 60 Hz, 440 V, 3546 min^{-1}					
250	150	3	1320	800-900	600-700
236					
224			1250	700-800	
212					
200					500-600
190					
33 kW, 60 Hz, 440 V, 3546 min^{-1}					
250	150	2	1320	900-1000	700-800
236				800-900	600-700
224		3	1250	700-800	
212					500-600
200				600-700	
190					

* V-belt tension within the first hour of operation.

** V-belt tension after more than one hour of operation.

17. Oil lubrication system, BME hp feed pump

The BME hp feed pump has an oil lubrication system for the two ball bearings in the pulley head.

During operation, there must be a continuous flow of oil to the oil container. Check the flow by looking into the container. See fig. 23.

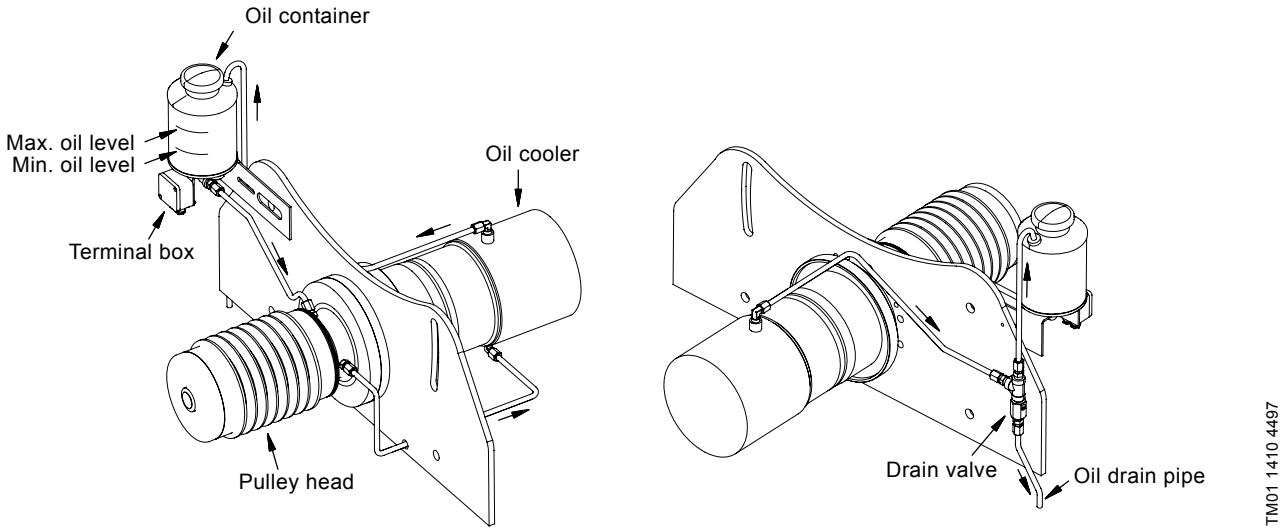


Fig. 23 Oil lubrication system, BME hp feed pump

17.1 Oil change

The hydraulic oil should be changed every 2,000 operating hours or every 6 months, whichever comes first. Total quantity of oil: Approx. 1.5 litres.

During operation, the oil must be changed as follows:

1. Switch off the level switch in the oil container or establish a time delay of approx. 10 minutes.
2. Open the drain valve. See fig. 23. Oil will now run out of the oil drain pipe.
3. Close the drain valve when the oil container is almost empty.
4. Fill the oil container with new oil.
5. Open the drain valve.
6. Close the drain valve when the oil container is almost empty.
7. Fill the oil container with oil.
8. Open the drain valve.
9. Close the drain valve when the oil container is almost empty.
10. Fill in oil up to the maximum level mark on the oil container. Approx. 2 litres of hydraulic oil has now been filled into the container.
11. Check the oil level after 1 to 2 hours of operation and refill, if required.

The oil has now been changed.

If the oil lubrication system has been dismantled during repair, the system must be filled as follows:

1. Check that the drain valve is closed. See fig. 23.
2. Fill new oil into the oil container, approx. 0.5 litres, and wait approx. 10 minutes until the oil level has fallen.
3. Fill in oil up to the maximum level mark on the oil container.
4. Start up the BME hp feed pump.
   The oil level in the oil container will now fall.
5. During operation, fill in oil up to the maximum level mark on the oil container.
6. Check the oil level after 1 to 2 hours of operation and refill, if required.
   The oil lubrication system is now filled with oil.
   During operation, the oil level in the container must lie between the minimum and maximum marks.
   During inactivity, the oil level in the container may fall below the minimum mark.

The oil lubrication system is now filled with oil.

17.2 Type of lubricating oil

The oil system is factory-filled with hydraulic oil, type **Mobil DTE 24**.

Other types of hydraulic oil with a viscosity of 32 can be used.

18. Motor bearings, BME hp feed pump

Under optimum operating conditions, the operating life of the motor ball bearings is approx. 20,000 operating hours. After that time, the bearings must be replaced. The new ball bearings must be filled with grease.

BME hp feed pumps have grease nipples for manual greasing. For greasing intervals, etc., see motor nameplate or the installation and operating instructions supplied with the motor.

19. Automatic monitoring devices, BME hp feed pump

The system **must** be fitted with a low-pressure switch on the inlet pipe to the BM hp circulation pump to ensure a minimum/ maximum inlet pressure.

The **inlet** pressure switch should be set to:

Min.: 1 bar

Max.: 35 bar.

Furthermore, it is recommended to install a high-pressure switch on the discharge side. This switch stops the system if the normal operating pressure is exceeded to an unacceptable level.

The discharge high-pressure switch should be set to:

BME hp feed pump: max. 80 bar (without time delay).

BM hp circulation pump: max. 80 bar (without time delay).

20. Shutting down the BMEX

To prevent overpressurisation, suitable pressure relief valves should be fitted and procedures implemented to ensure that the high-pressure side of the X-Changer module is depressurised prior to isolation of the low-pressure side.

20.1 Shut-down procedure

See section *21. Periods of inactivity* for precautions to be taken when shutting down the system. These precautions must be taken to protect the system and ensure long life of all the system components.

This section makes references to the piping and instrumentation diagram, fig. 16.

Procedure:

1. Stop the BME hp feed pump (P3).
2. Wait until the system pressure drops below 28 bar (400 psi).
3. Stop the BM hp circulation pump (P4).
4. Stop the sea-water feed pump (P1).
5. To avoid corrosion in the BME hp feed pump, flush the system with fresh water (P2) for minimum 10 minutes (min. 2 bar for flushing) or until the salinity is below 500 ppm, Total Dissolved Salinity, TDS.
6. Start the BM hp circulation pump (P4). Run the system for 5 to 10 minutes until all the sea water is purged. A minimum pressure of 2.0 bar (29 psi) is required to feed the X-Changer low-pressure inlet. The fresh-water flush will not occur without this minimum pressure. Continuous operation of the BME hp feed pump (P3) is not recommended during the fresh-water flush procedure, however, momentary operation of the pump will help purge sea water from the X-Changer module and membranes.
7. Stop the BM hp circulation pump (P4).
8. If a BME hp feed pump is to be shut down for an extended period of time, the system must be thoroughly flushed with fresh water to remove any salt. Precautions should also be taken to inhibit biological growth. The system units should receive a final flush with the same solution used to preserve the membranes.

20.2 Flushing the BME hp feed pump

The pump must be stopped during flushing.

The pump can be flushed through in or against the flow direction. See fig. 16.

Flush the system through with fresh water for approx. 10 minutes or until the salinity is below 500 ppm. The pressure during flushing must be minimum 2 bar. The flushing must be continued until the pump is completely filled with clean fresh water.

Note If the flushing takes more than 10 minutes, the flow must be reduced to maximum 10 % of the rated flow.

Note The pump must be filled with clean fresh water during periods of inactivity.

Note To flush the pulley head of the BME hp feed pump, start the pump for 30 seconds to allow the fresh water to enter into the pulley head.

20.3 Flushing the BM hp circulation pump

The pump must be stopped during flushing.

When a BM hp circulation pump is flushed, the flow must be reduced to maximum 10 % of the rated flow rate if flushing takes more than 10 minutes.

21. Periods of inactivity

In the case of periods of inactivity, various precautions must be taken to protect the system and ensure long life.

The precautions to be taken if the system is to be inactive for a certain period appear in the table:

Action	30 min.	1 month	3 months	6 months
Flushing, see section *20.2 Flushing the BME hp feed pump*.	x	x	x	x
Fill the pumps with fresh water.	x	x	x	x
Preserve the pump.*		x	x	x
Slacken and remove the V-belts. Preserve the pulleys against corrosion, see section *21.1 Preservation of pulleys and belts*.		x	x	x
Rotate pump and motor shafts manually once a month.			x	x

* Use the same solution that is used to preserve the membranes.

Caution The normal stop procedure must be followed step by step.

21.1 Preservation of pulleys and belts

When the belts have been removed, lubricate the pulleys with an anti-corrosive lubricating oil.

The belts must be kept at a temperature not exceeding 30 °C and at a relative air humidity not exceeding 70 %.

The belts must not be exposed to direct sunlight.

21.2 Startup after a period of inactivity

The precautions to be taken if the system has been inactive for a certain period appear in the table:

Action	1 month	3 months	6 months
Remove preservative from the pulleys, see section *21.3 Removal of preservative before restarting*.	x	x	x
Check the V-belts.	x	x	x
Mount the V-belts, and adjust the tension according to the values in section *16. Recommended V-belt tension*	x	x	x

Caution The normal startup procedure must be followed step by step. For greasing of motor bearings, see section *18. Motor bearings, BME hp feed pump*.

21.3 Removal of preservative before restarting

Before restarting the system, remove the preservative with a suitable solvent. The pulleys must be completely free from oil before the belt is refitted.

21.4 Frequency of starts and stops, BMEX

Minimum 1 per year is recommended.

Maximum 5 per hour.

Maximum 20 per day.

22. Fault finding

22.1 BME hp feed pump

Warning
Before starting work on the BME hp feed pump, make sure that the power supply has been switched off and that it cannot be accidentally switched on.

Fault	Possible cause	Remedy
1. The pump starts/stops occasionally during operation.	a) No water supply. The low-pressure switch has cut out.	Check that the low-pressure switch functions normally and is adjusted correctly. Check that the minimum inlet pressure is correct. If not, check the sea-water feed pump. See section *9. Startup and operation*.
	b) The lubricating oil level is too low.	Check that the oil level switch functions normally. If it is OK, check the oil system for leakage. See section *17. Oil lubrication system, BME hp feed pump*.
2. The pump stops during operation.	a) The fuses are blown.	After a cut-out, the cause of a possible short-circuit must be found. If the fuses are blown, check whether the motor starter has been set correctly or is faulty. If the fuses are hot when they are replaced, check that the load of the individual phases does not exceed the motor current during operation. Identify the cause of the load. If the fuses are not hot immediately after the cut-out, the cause of a possible short-circuit must be identified. Possible fuses in the control circuit must be checked, and defective fuses must be replaced.
	b) The motor starter overload unit has tripped.	Reset the starter overload. See also sections *7. Electrical connection*, *7.1.1 Motor protection* and *8. Before starting the BMEX*.
	c) The magnetic coil of the motor starter/ contactor is defective (not cutting in).	Replace the coil. Check the coil voltage.
	d) The control circuit has cut out or is defective.	Check the control circuit and the contacts in the monitoring devices (low-pressure switch, flow switch, etc.).
	e) The motor/supply cable is defective.	Check motor and cable. See section *7.2.3 Setting of motor starter*.
3. The pump runs, but gives no water nor develops any pressure.	a) No or insufficient water supply at the pump inlet.	Check that the inlet pressure during operation is at least 1 bar. See section *5.1 BME hp feed pump*. Restart the pump as described in section *9. Startup and operation*. Check the function of the sea-water feed pump.
	b) The piping system or the pump is choked up.	Check the piping system and the pump.
	c) The pre-filter is choked up.	Clean the pre-filter.
4. The pump runs at reduced capacity.	a) Wrong direction of rotation.	See section *9.9 Liquid filling, venting and checking direction of rotation*.
	b) The valves on the discharge side are partly closed or blocked.	Check the valves.
	c) The discharge pipe is partly blocked by impurities.	Clean or replace the discharge pipe. Measure the discharge pressure, and compare the value with the calculated data. See "Technical specification", supplied with the system.
	d) The pump is partly blocked by impurities.	Pull the pump out of the sleeve. Dismantle, clean and check the pump. Replace defective parts.
	e) The pump is defective.	Pull the pump out of the sleeve. Dismantle, clean and check the pump. Replace defective parts.
	f) The pre-filter is choked up.	Clean the pre-filter.

22.2 BM hp circulation pump

Warning
Before starting work on the BM hp circulation pump, make sure that the power supply has been switched off and that it cannot be accidentally switched on.

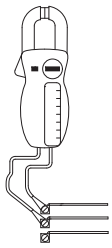
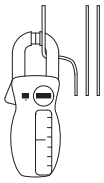
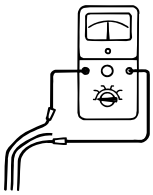
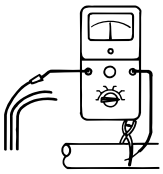
Fault	Possible cause	Remedy
1. The pump stops occasionally.	a) No or insufficient water supply. The pressure switch has cut out.	Check that the pressure switch functions normally (without delay) and is adjusted correctly. Check that the minimum inlet pressure is correct.
	b) The capacity is too small. The flow switch has cut out.	The discharge pipe is totally or partly blocked due to incorrectly adjusted manually operated valve, or failure in the solenoid or motor-operated valve. Check these valves. The flow switch is faulty or incorrectly adjusted. Check/ adjust the switch.
2. The pump does not run.	a) The fuses are blown.	After a cut-out, the cause of a possible short-circuit must be found. If the fuses are blown, check whether the motor starter has been set correctly or is faulty. If the fuses are hot when they are replaced, check that the load of the individual phases does not exceed the motor current during operation. Identify the cause of the load. If the fuses are not hot immediately after the cut-out, the cause of a possible short-circuit must be identified. Possible fuses in the control circuit must be checked, and defective fuses must be replaced.
	b) The motor starter overload unit has tripped.	Reset the starter overload. If it trips again, check the voltage.
	c) The magnetic coil of the motor starter/ contactor is short-circuited (not cutting in).	Replace the coil. Check the coil voltage.
	d) The control circuit has cut out or is defective.	Check the control circuit and the contacts in the monitoring devices (pressure switch, flow switch, etc.).
	e) The motor/supply cable is defective.	Check motor and cable. See also section *7. Electrical connection*.
3. The pump runs, but gives no water nor develops any pressure.	a) No or insufficient water supply at the pump or air in the system.	Check that the inlet pressure during operation is at least 0.5 bar. If so, the water supply is OK. Stop and vent the system. Restart the system as described in section *9. Startup and operation*. If the pump is defective, it should be dismantled and repaired/replaced.
	b) Suction parts are blocked.	Pull the pump out of the sleeve, and clean the suction parts.
4. The pump runs at reduced capacity (flow and pressure).	a) Wrong direction of rotation.	See section *9.7.1 Checking the direction of rotation*.
	b) The valves on the discharge side are partly closed or blocked.	Check the valves.
	c) The discharge pipe is partly blocked by impurities.	Measure the discharge pressure and compare the value with the calculated data. Clean or replace the discharge pipe.
	d) The pump is partly blocked by impurities.	Pull the pump out of the sleeve. Dismantle, clean and check the pump. Replace defective parts.
	e) The pump is defective.	Pull the pump out of the sleeve. Dismantle, clean and check the pump. Replace defective parts.

22.3 X-Changer

Warning
Before starting work on the X-Changer modules, make sure that the power supply has been switched off and that it cannot be accidentally switched on.

Fault	Possible cause	Remedy
1. Excessive sound pressure levels.	a) The X-Changer module operates above rated flow rates on low-pressure side, high-pressure side or both.	Immediately reduce flow rate by adjustment of the BM hp circulation pump and control valve (V2). Balance the system as described in section *9.6 Balancing the X-Changer module*. To increase system capacity, add X-Changer module(s) in parallel to existing units.
	b) The X-Changer module operates with little or no back-pressure.	Increase the back-pressure by adjusting the low-pressure reject-water valve (V3). Re-balance the system as described in section *9.6 Balancing the X-Changer module*.
	c) Air in system.	Vent the system.
2. Excessively high recovery in the SWRO system.	a) The BME hp feed pump is operating at too high a flow rate.	Verify that main BME hp feed pump flow rate does not exceed the membrane array production capacity for a given temperature, salinity and fouling factor.
	b) Excessively high recovery in the SWRO system.	Increase and balance flows through the X-Changer module. Do not exceed recommended maximum flow rates. To increase capacity, add X-Changer module(s) in parallel to existing modules.
	c) Low-pressure flow is less than high-pressure flow resulting in mixing and high feed water salinity.	See section *9.6 Balancing the X-Changer module*.
3. High salinity in high-pressure sea-water feed stream.	a) Unbalanced system.	See section *9.6 Balancing the X-Changer module*.
	b) A jammed or stalled rotor short circuits high-pressure reject water with high-pressure feed water. No exchange occurs; no audible rotation.	See fault number 5.
4. Low-pressure flow is less than high-pressure flow resulting in mixing and high SWRO feed water salinity.	a) Operating X-Changer module below rated flow rate results in low rotor rotation and increased mixing.	Increase and balance flows through the X-Changer module. Do not exceed recommended maximum flow rates. To increase capacity, add X-Changer module(s) in parallel to existing units. See section *9.6 Balancing the X-Changer module*.
	b) Malfunctioning and/or stalled BM hp circulation pump.	Check BM hp circulation pump rotation, operation, flow rates and pressures.
5. Stalled rotor (no audible rotation).	a) Operating system above rated pressure or below rated flow capacity.	See section *9.6 Balancing the X-Changer module*.
	b) Foreign debris or particles lodged in device.	Contact Grundfos Service.
	c) System is not properly flow-balanced.	See section *9.6 Balancing the X-Changer module*.
6. Low reject flow.	a) Excessive pressure losses through the SWRO system.	Contact Grundfos.
	b) Malfunctioning and/or stalled BM hp circulation pump.	Check operation, flow rates and pressures of the BM hp circulation pump.

23. Checking motor and cable

1. Supply voltage	 TM00 1371 3597	Measure the voltage between the phases with a voltmeter. Connect the voltmeter to the terminals in the motor starter.	The voltage should, **when the motor is loaded**, be within ± 5 % of the rated voltage. The motor may burn if there are larger variations in voltage. If the voltage is constantly too high or too low, the motor must be replaced by one corresponding to the supply voltage. Large variations in the supply voltage indicate poor power supply, and the module should be stopped until the defect has been found. Resetting of the motor starter may be necessary.
2. Current consumption	 TM00 1372 3597	Measure the current of each phase while the module is operating at a constant discharge pressure (if possible at the capacity where the motor is most heavily loaded). For normal operating current, see the "Technical specification".	The difference between the current of the phase with the highest amp consumption and the one with the lowest amp consumption must not exceed 10 % of the lowest amp consumption. If so, or if the current exceeds the rated current, check these possible faults: • A damaged pump is causing the motor to be overloaded. Pull the pump out of the sleeve for overhaul. • The motor windings are short-circuited or partly disjointed. • Too high or too low supply voltage. • Poor connection in leads. Weak cables.
Points 3 and 4: Measurement not needed if supply voltage and current consumption are normal.			
3. Winding resistance	 TM00 1373 3597	Remove the phase leads from the terminal box. Measure the winding resistance as shown on the drawing.	The highest value must not exceed the lowest value by more than 5 %. If the deviation is higher and the supply cable is OK, the motor should be overhauled.
4. Insulation resistance	 TM00 1374 3597	Remove the phase leads from the terminal box. Measure the insulation resistance from each phase to earth (frame). (Make sure that the earth connection is made carefully.)	The insulation resistance for a new, cleaned or repaired motor must be approx. 10 MΩ measured to earth. For a given motor the critical insulation resistance (R_{crit}) can be calculated as follows: $R_{crit} = U_N$ [kV] x 0.5 [MΩ/kV]. If the measured insulation resistance is lower than R_{crit}, the motor must be overhauled.

24. Disposal

This product or parts of it must be disposed of in an environmentally sound way:

1. Use the public or private waste collection service.
2. If this is not possible, contact the nearest Grundfos company or service workshop.

Subject to alterations.

Log books

BME hp feed pump

LOG BOOK for BME hp feed pump

Note: Daily data must be collected and maintained to support any warranty claims.
Initial data must be submitted within 24 hours of startup.

Product no.:	**Installation date:**	**Company/your ref.:**	
		Country:	
Type:	**Start of operation:**	**City:**	
		VFD/Softstart: **Brand**	

Date	Amb. temp.	Liquid temp.	Feed flow/ pressure	Concent. flow/ pressure	Permeat flow	Current [A]	Voltage [V]	Comments

GRUNDFOS

LOG BOOK for BM hp circulation pump

Note: Daily data must be collected and maintained to support any warranty claims.
Initial data must be submitted within 24 hours of startup.

Product no.:	**Installation date:**	**Company/your ref.:**
		Country:
Type:	**Start of operation:**	**City:**
		VFD/Softstart: Brand

Date	Amb. temp.	Liquid temp.	Feed flow/ pressure	Discharge flow/ pressure	Current [A]	Voltage [V]	Comments

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LOG BOOK for X-Changer module(s)

Note: Daily data must be collected and maintained to support any warranty claims.
Initial data must be submitted within 24 hours of startup.

Total number of X-Changer module(s):	**Model of X-Changer module(s):**	**Company/your ref.:**
		Country:
	Start of operation:	**City:**
		Serial number:

Units (please circle): bar/m^3/h psi/gpm

Date	Total hours	HP inlet pressure	HP discharge pressure	LP inlet pressure	LP discharge pressure	HP flow	LP flow	LP inlet salinity	HP discharge salinity

GRUNDFOS

BMEX system sketch

Please include **all** accessories for the BMEX system.

GB: EC declaration of conformity

We, Grundfos, declare under our sole responsibility that the product BMEX, to which this declaration relates, is in conformity with these Council directives on the approximation of the laws of the EC member states:

DK: EF-overensstemmelseserklæring

Vi, Grundfos, erklærer under ansvar at produktet BMEX som denne erklæring omhandler, er i overensstemmelse med disse af Rådets direktiver om indbyrdes tilnærmelse til EF-medlemsstaternes lovgivning:

DE: EG-Konformitätserklärung

Wir, Grundfos, erklären in alleiniger Verantwortung, dass das Produkt BMEX, auf das sich diese Erklärung bezieht, mit den folgenden Richtlinien des Rates zur Angleichung der Rechtsvorschriften der EU-Mitgliedsstaaten übereinstimmt:

GR: Δήλωση συμμόρφωσης EC

Εμείς, η Grundfos, δηλώνουμε με αποκλειστικά δική μας ευθύνη ότι τα προϊόντα BMEX, στα οποία αναφέρεται η παρούσα δήλωση, συμμορφώνονται με τις εξής Οδηγίες του Συμβουλίου περί προσέγγισης των νομοθεσιών των κρατών μελών της ΕΕ:

ES: Declaración CE de conformidad

Nosotros, Grundfos, declaramos bajo nuestra propia responsabilidad que el producto BMEX, al cual se refiere esta declaración, está conforme con las Directivas del Consejo en la aproximación de las leyes de los Estados Miembros del EM:

FR: Déclaration de conformité CE

Nous, Grundfos, déclarons sous notre seule responsabilité, que le produit BMEX, auquel se réfère cette déclaration, est conforme aux Directives du Conseil concernant le rapprochement des législations des Etats membres CE relatives aux normes énoncées ci-dessous :

IT: Dichiarazione di conformità CE

Grundfos dichiara sotto la sua esclusiva responsabilità che il prodotto BMEX, al quale si riferisce questa dichiarazione, è conforme alle seguenti direttive del Consiglio riguardanti il riavvicinamento delle legislazioni degli Stati membri CE:

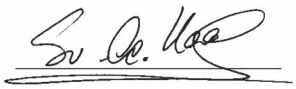
AR: لمطابقة من EC (المجموعة الأوروبية)

الذي BMEX، نقر نحن، جروندفوس، بمقتضى مسؤوليتنا الفردية بأن المنتج يختص به هذا الإقرار، يكون مطابقا لتوجيهات المجلس بشأن التقريب بين قوانين الدول أعضاء المجموعة الأوروبية (EC):

— Machinery Directive (2006/42/EC).
Standard used: EN 809:1998 + A1:2009.

This EC declaration of conformity is only valid when published as part of the Grundfos installation and operating instructions (publication number 96551125 0915).

Bjerringbro, 23 September 2015



Svend Aage Kaae
Director
Grundfos Holding A/S
Poul Due Jensens Vej 7
8850 Bjerringbro, Denmark

Person authorised to compile the technical file and empowered to sign the EC declaration of conformity.