

# BMS



BMS hs, BMS hp, BMST, BMSX

**Pressure boosting and reverse osmosis systems**

50/60 Hz



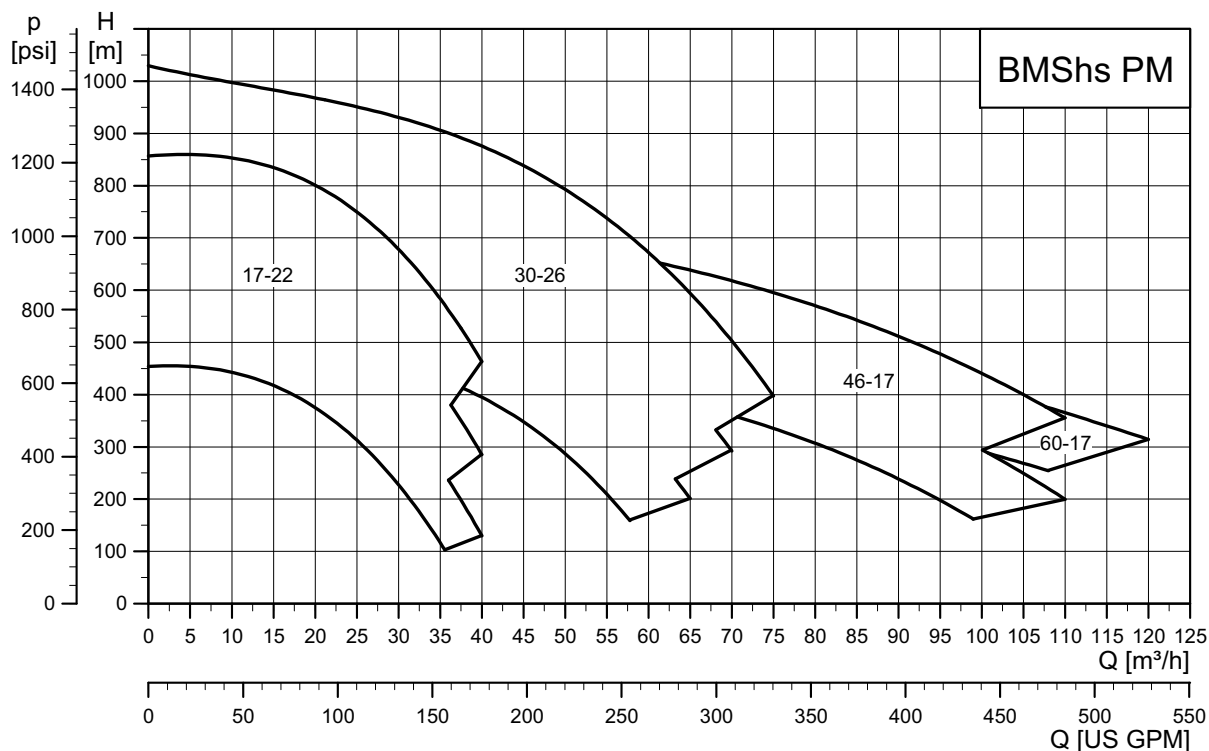
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**LENNTECH**  
info@lennotech.com Tel. +31-152-610-900  
www.lennotech.com Fax. +31-152-616-289



## 2. Performance range

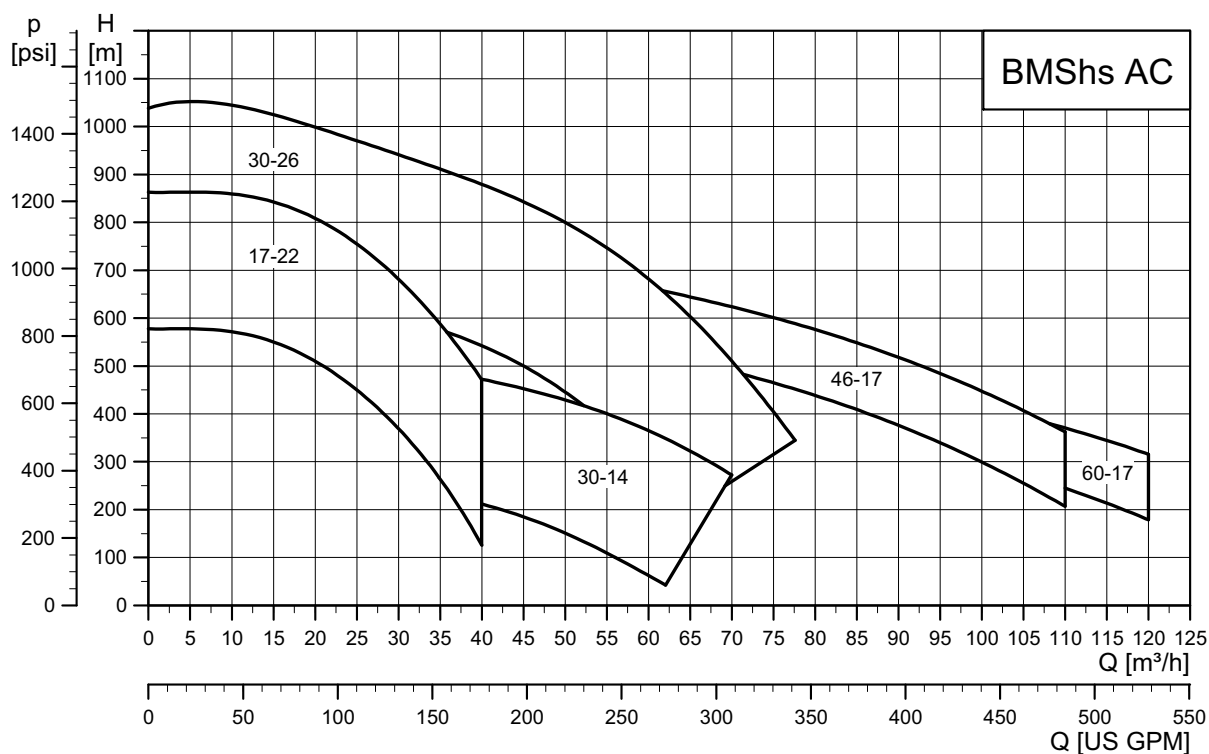
### BMS hs PM booster system



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Fig. 3 Performance range, BMS hs, PM

### BMS hs AC booster system



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Fig. 4 Performance range, BMS hs AC

## BMS hp MG/MGE booster system

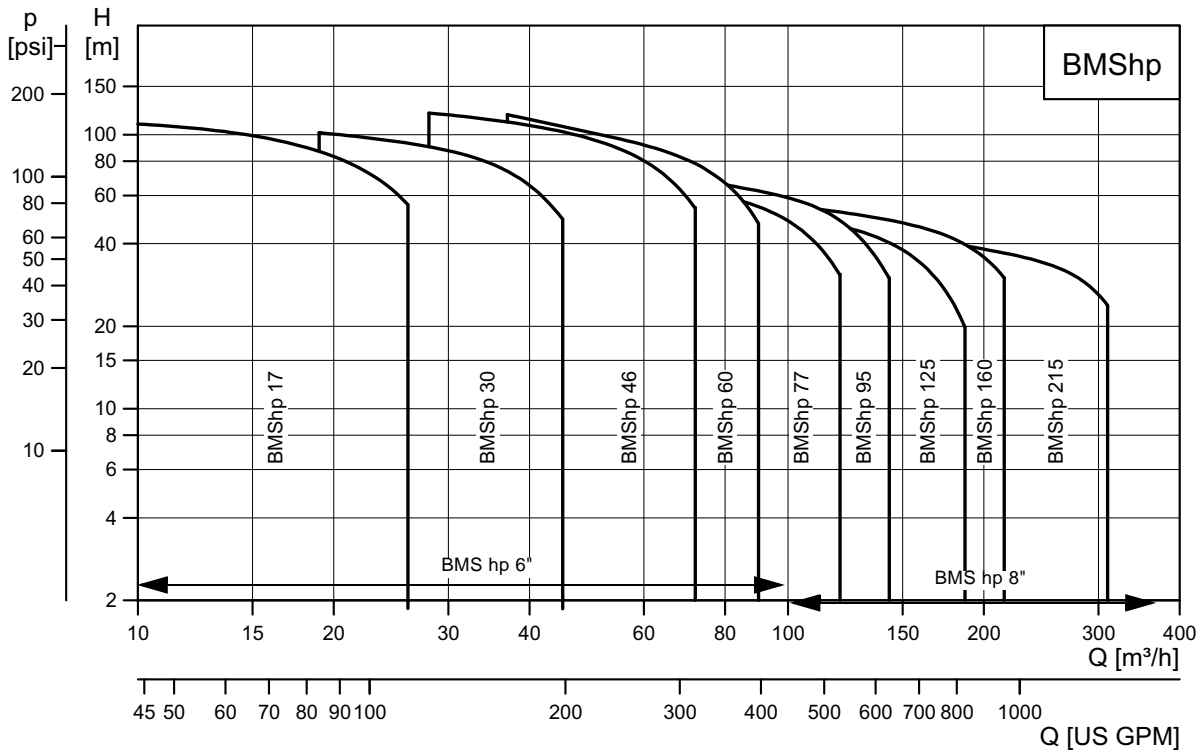


Fig. 5 Performance range, BMS hp MG/MGE, 60 Hz

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فشار ورودی و خروجی پمپها بالا بوده و به ترتیب 80 تا 83 بار می باشد

### 3. General description, BMS hs and BMS hp

The sections below describe the common details for BMS hs and BMS hp.

#### Type key

Example	BMS	30	-26	hs	-E	-C	-P	-A
<b>Pump</b>	BMS							
BMSX	Includes pressure exchanger and BM hp pump							
BMST	Includes BMT pump							
<b>Rated flow rate [m<sup>3</sup>/h]</b>								
<b>Number of stages</b>								
<b>Type</b>								
hs	High-pressure pump with high speed							
hp	Pump with high pressure inlet							
<b>Motor*</b>								
A	MG							
B	MMG							
C	MGE							
D	MMGE							
E	PM							
X	No motor							
<b>Materials</b>	Pump							
C	1.4539/904L							
<b>Code for rubber parts</b>								
P	NBR							
V	FKM							
<b>Shaft seal</b>								
A	Silicon carbide and carbon							

**Note:** \* Grundfos motors

Grundfos MG and MMG:

- With external frequency converter.

Grundfos PM (permanent-magnet motor):

- With external frequency converter.

Grundfos MGE and MMGE:

- With integrated frequency converter.

#### Pumped liquids

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

The pumps must never operate with liquid containing substances that would remove the surface tension, e.g. soap. If you use this type of detergent to clean the system, lead the liquid around the pumps via a bypass.

If the density and/or viscosity of the pumped liquid is higher than that of water, it may be necessary to use motors with a higher output than the standard output stated.

BMS hs booster systems are designed for brackish water and seawater.

#### Maximum liquid temperature

40 °C (104 °F).

Contact Grundfos in case of higher temperatures.

#### Curve conditions

The guidelines below apply to the curves on the following pages.

- All curves are based on average values according to ISO 9906: 2012 3B.
- If a minimum performance is required, carry out individual measurements.
- The curves apply to a kinematic viscosity of 1 mm<sup>2</sup>/s (1 cSt).
- The power curve P2 (hp) shows pump input power per stage.
- The efficiency curve  $\eta$  shows pump efficiency, including BMS hs pump, motor and frequency converter.
- The performance tests have been made at a water temperature of 20 °C (68 °F).
- Test liquid: airless water.

The conversion between head H (m) and pressure p (kPa) has been made for water with a density of  $\rho = 1000 \text{ kg/m}^3$  (62.4 lb/ft<sup>3</sup>). If the density differs from this value, the created pressure will be proportional to the density.

**Note**

**BMS hs AC curves shown with slip compensation.**

#### Parallel operation

If a flow rate higher than that of a single module is required, several modules are connected in parallel. Find the resulting flow rate by adding the flow rate of each individual module. The pressure will be the same as for one pump.

#### Flushing

When the booster system is used in a reverse osmosis system or similar applications pumping seawater or aggressive water, install a flush pump to avoid corrosion. Flush the system with clean fresh water until the salinity is lower than 1000 ppm TDS in the entire system.

#### Filtration

BMS hs, BMS hp, BMST: Filter the raw water to maximum 30 microns.

BMSX: Filter the raw water to maximum 10 microns.

Pump type	Filter [micron absolute]
BMS hs	
BMS hp	30
BMST	
Pressure exchanger	10

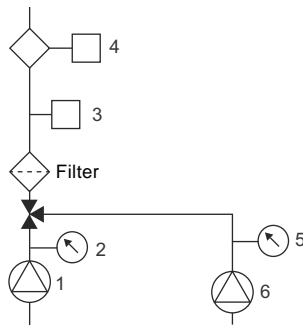


Fig. 6 Filtration

Pos.	Description
1	Raw-water feed pump
2	Pressure gauge (raw-water)
3	Low-pressure switch
4	Flowmeter
5	Pressure gauge (fresh-water pump)
6	Fresh-water flush pump

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## Automatic control devices

To protect the pumps against dry running, fit the system with flow and pressure control devices.

A pressure switch on the inlet side is sized in accordance with the estimated inlet pressure. At a pressure lower than 1 bar (14.5 psi), an alarm is given and the pump will stop.

We recommend that you fit all outlet connections of the system with flow switches that will stop the system at the set minimum flow rate.

The control devices ensure a correct inlet pressure.

Flow switch cutting-in is adjusted for a minimum time delay corresponding to the maximum starting frequency of the system.

## Automatic safety devices

The safety devices below must be built into the system to protect the pump. See fig. 7.

- Flow switch and/or low-pressure switch to ensure a minimum flow of water and lubricate the thrust bearing and pump bearings.
- Flowmeter in each outlet pipe.
- Low-pressure switch on the booster system inlet sized in accordance with the estimated inlet pressure. At a pressure lower than 1 bar (14.5 psi), an alarm is given, and the pump will stop.
- High-pressure switch on the outlet pipe. The high-pressure switch will stop the pump at a set maximum pressure.

The above safety devices ensure a correct inlet pressure and a minimum flow for lubrication.

A minimum time delay equivalent to the maximum starting frequency of the system has been set for flow switch cutting-in.

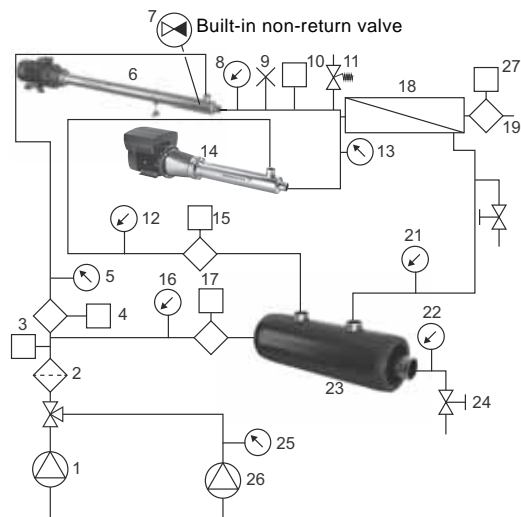


Fig. 7 Example of BMSX booster system

Pos.	Description
1	Raw-water feed pump
2	Filter
3	Low-pressure switch
4	Flowmeter
5	Pressure gauge (raw water)
6	BMS hs pump with built-in non-return valve
7	Non-return valve (built into BMS hs)
8	Pressure gauge (BMS hs outlet pressure)
9	Air vent
10	High-pressure switch
11	Pressure relief valve
12	Pressure gauge (BMS hp inlet pressure)
13	Pressure gauge (BMS hp outlet pressure)
14	BMS hp pump
15	Flowmeter (high-pressure raw water)
16	Pressure gauge (low-pressure raw water)
17	Flowmeter (low-pressure raw water)
18	Membrane filter
19	Permeate
20	Cleaning flush valve
21	Pressure gauge (high-pressure concentrate)
22	Pressure gauge (low-pressure concentrate)
23	Pressure exchanger
24	Concentrate valve
25	Pressure gauge (fresh-water)
26	Fresh-water flush pump
27	Flowmeter for permeate

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## 4. Grundfos BMS hs



Fig. 8 BMS hs pump

### Applications

The BMS hs booster system is suitable for the following applications:

- water treatment plants
  - reverse osmosis in domestic water supply systems
  - hospitals, laboratories as well as chemical, electronics and metal industries
  - ultra-filtration in chemical and galvanic industries
  - painting workshops, metal and mineral industries
- pressure boosting
- liquid transfer.

### Reverse osmosis systems

Grundfos offers three different booster systems for reverse osmosis:

- Grundfos BMS hs
- Grundfos BMST
- Grundfos BMSX.

### Standard pumps

#### BMS hs booster system

The following standard pumps are used for the BMS hs booster system:

- SP 17-22
- SP 30-14
- SP 30-26
- SP 46-17
- SP 60-17.

**Note:** The pumps are supplied with non-return valves.

### Operating limits

We recommend that you always keep the capacity of the booster systems within the recommended flow rate and pressure range of each individual pump.

#### BMS hs booster system

Recommended flow rate at 25 °C (77 °F)						
Type	[m <sup>3</sup> /h]		US [gpm]			
BMS hs 17-22	4-40		17.6 - 176			
BMS hs 30-14	7-70		31-308			
BMS hs 30-26	7.5 - 75		33-330			
BMS hs 46-17	11-110		48.2 - 482			
BMS hs 60-17	12-120		53-530			

Recommended pressure						
Type	Inlet pressure				Outlet pressure	
	Min. [bar]	Min. [psi]	Max. [bar]	Max. [psi]	Max. [bar]	Max. [psi]
BMS hs 17-22						
BMS hs 30-14						
BMS hs 30-26	1	14.5	35	507.6	82.7	1200
BMS hs 46-17						
BMS hs 60-17						

**Note:** If there is a risk of exceeding the maximum inlet or outlet pressure, we recommend that you install a safety valve.

**Note:** Maximal permissible liquid temperature is 40 °C (104 °F). If you have an application for higher temperature, contact Grundfos.

## Operating conditions

### Sound pressure level

The sound pressure level of pumps with a 4500 rpm motor is lower than 80 dB(A).

The sound pressure level of pumps with a 5000 or 5500 rpm motor is lower than 85 dB(A).

## Construction

Modified standard submersible pumps are used for the BMS hs booster systems. The pumps are centred in the stainless-steel (Duplex) sleeve.

BMS hs pumps are supplied with a high speed motor which need to be controlled by a frequency converter.

Inlet and outlet: 3" Victaulic couplings.

## Motor types

### Permanent-magnet high speed motor (PM)

The BMS hs PM booster system is supplied with a high-class synchronous permanent-magnet motor and a lightweight product. The weight is approx. 1/4 and the size 1/3 of a standard asynchronous motor.



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**Fig. 9** Example of a permanent-magnet motor

The permanent-magnet motor is controlled by a frequency converter (POWERDRIVE MD or FX) and as standard protected by PTC sensors.

Enclosure class: IP55.

Power P2: 44-180 kW (59-241 HP).

Optional: PT100.

Optional: space heater/anti-condensation heater.

#### Rated speed

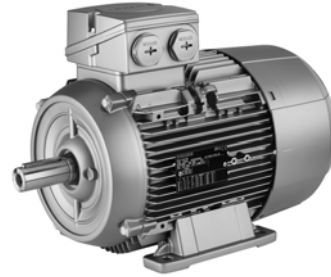
Normal operation: 4000-5500 min<sup>-1</sup>.

Flush operation: down to 1700 min<sup>-1</sup>.

The motor is controlled by factory-set ramp times.

### Asynchronous high speed motor (AC)

The BMS hs AC booster system is supplied with an asynchronous high speed motor. The motor is smaller and lighter than a standard asynchronous motor.



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**Fig. 10** Example of AC motor

The asynchronous high speed motor is controlled by a frequency converter and as standard protected by PT100 sensors.

Enclosure class: IP54.

Power P2: 44-180 kW (59-241 HP).

Certificate: cURus approval.

Optional: space heater/anti-condensation heater.

Other options on request

#### Rated speed

Normal operation: 4000-5500 min<sup>-1</sup>.

Flush operation: down to 1700 min<sup>-1</sup>.

The motor is controlled by ramp times.

## 5. Grundfos BMS hp



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Fig. 19 BMS hp pump

### Applications

The Grundfos BMS hp booster system is suitable for industrial and water supply applications where the inlet pressure is high, up to 82.7 bar (1200 psi). The BMS hp booster systems are used to increase the system pressure up to 82.7 bar (1200 psi).

The BMS hp booster system is the optimum solution for applications requiring the following:

- pumps capable of coping with high system pressures
- a minimum of maintenance.

### Typical applications

BMS hp booster systems are suitable for the following typical applications:

- Water treatment where energy recovery devices (ERD), like pressure exchangers are used, such as:
  - reverse osmosis in domestic water supply systems
  - hospitals, laboratories as well as chemical, electronics and metal industries
  - ultra-filtration in chemical and galvanic industries
  - painting workshops, metal and mineral industries.
- Liquid transfer.
- Pressure boosting.
- Closed circulation systems with a high static pressure.

### Standard pumps

The following standard pumps are available for the BMS hp booster systems:

- SP 17-3, 17-5 and 17-7
- SP 30-3, 30-5 and 30-7
- SP 46-2, 46-4 and 46-6A
- SP 60-2, 60-4 and 60-6
- SP 77-2 and 77-3
- SP 95-2 and 95-3
- SP 125-1 and 125-2
- SP 160-1 and 160-2
- SP 215-1.

SP standard pumps are with a 6" sleeve in range 17-60 and 8" sleeve in range 77-215.

**Note:** The BMS hp booster systems come without non-return valves.

### Operating limits

We recommend that you always keep the capacity of the booster systems within the recommended flow rate and pressure range of each individual pump.

### BMS hp

Recommended flow rate at 25 °C (77 °F)		
Type	[m <sup>3</sup> /h]	US [gpm]
BMS hp 17-3, 17-5 and 17-7	10-26	44 - 114.5
BMS hp 30-3, 30-5 and 30-7	19-45	83.7 - 198
BMS hp 46-2, 46-4 and 46-6A	28-72	123-317
BMS hp 60-2, 60-4 and 60-6	37-90	163 - 396.3
BMS hp 77-2 and 77-3	47-120	207-528
BMS hp 95-3	57-143	251-629
BMS hp 125-2	75-187	330-823
BMS hp 160-2	90-215	396-946
BMS hp 215-1	115-310	506-1364

Recommended pressure						
Type	Inlet pressure				Outlet pressure	
	Min. [bar]	Min. [psi]	Max. [bar]	Max. [psi]	Max. [bar]	Max. [psi]
BMS hp 17-3, 17-5 and 17-7	1	14.5	80	1160	82.7	1200
BMS hp 30-3, 30-5 and 30-7	1	14.5	80	1160	82.7	1200
BMS hp 46-2, 46-4 and 46-6A	1	14.5	80	1160	82.7	1200
BMS hp 60-2, 60-4 and 60-6	1	14.5	80	1160	82.7	1200
BMS hp 77-3	1	14.5	80	1160	82.7	1200
BMS hp 95-3	1	14.5	80	1160	82.7	1200
BMS hp 125-2	1	14.5	80	1160	82.7	1200
BMS hp 160-2AA	1	14.5	80	1160	82.7	1200
BMS hp 215-1	1	14.5	80	1160	82.7	1200

**Note:** If there is a risk of exceeding the maximum inlet or outlet pressure, we recommend that you install a safety valve.

**Note:** Maximal permissible liquid temperature is 40 °C (104 °F). If you have an application for higher temperature, contact Grundfos.

### Construction

Modified standard submersible pumps are used for the BMS hp booster systems. The pumps are centred in the stainless-steel (Duplex) sleeve.

Inlet and outlet:

- BMS hp 6": 3" Victaulic couplings
- BMS hp 8": 6" Victaulic couplings.



## 7. Reverse osmosis systems

The following subsections describe three systems typically used for the reverse osmosis process.

### BMS hs system

You can use the BMS hs booster system in reverse osmosis systems.

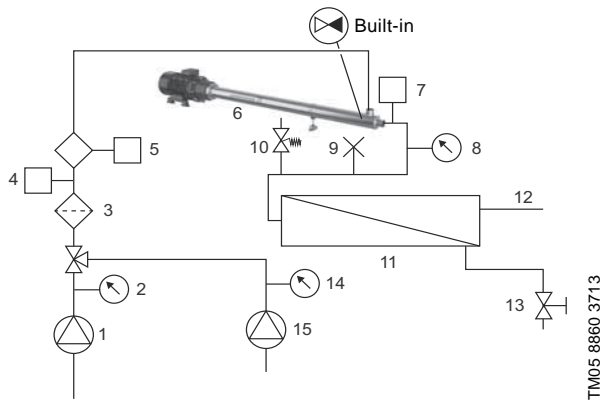


Fig. 23 Example of BMS hs booster system

Pos.	Description
1	Raw-water feed pump
2	Pressure gauge (raw water)
3	Filter
4	Low-pressure switch
5	Flowmeter
6	BMS hs pump with built-in non-return valve
7	High-pressure switch
8	Pressure gauge (BMS hs outlet pressure)
9	Air vent
10	Pressure relief valve
11	Membrane filter
12	Permeate
13	Pressure control valve
14	Pressure gauge (fresh-water)
15	Fresh-water flush pump

### How does it work?

The BMS hs pump creates the needed flow rate and pressure through the membranes of the system. The frequency converter ensures low operating costs and safe ramp-up and ramp-down. The factory-set ramp times prevent damage due to water hammer.

### BMST system

A BMST booster system consists of a BMS hs pump and a BMT pump.

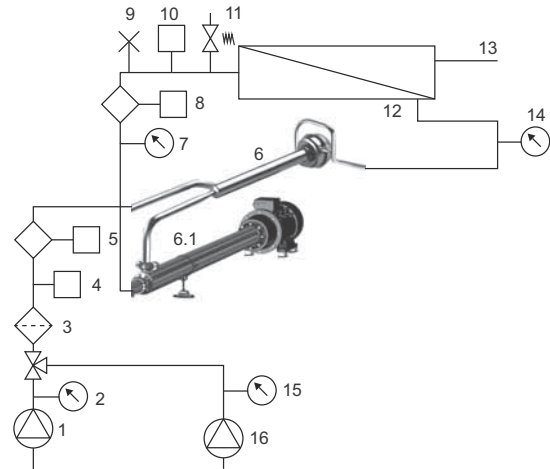


Fig. 24 Example of BMST booster system

Pos.	Description
1	Raw-water feed pump
2	Pressure gauge (raw water)
3	Filter
4	Low-pressure switch
5	Flowmeter
6	BMT pump
6.1	BMS hs pump
7	Pressure gauge (BMST outlet pressure)
8	Flowmeter
9	Air vent
10	High-pressure switch
11	Pressure relief valve
12	Membrane filter
13	Permeate
14	Pressure gauge (high-pressure concentrate)
15	Pressure gauge (fresh-water)
16	Fresh-water flush pump

A BMST system makes it possible to deliver the same performance as with a standard centrifugal pump, but saves up to 35 % of the total power consumption.

### How does it work

The BMS hs pump creates the needed flow rate and pressure through the membranes of the system. 65 % of the energy needed are generated by the BMS hs pump, and the remaining 35 % are provided by the Pelton turbine. The turbine is driven by the high-pressure concentrate outlet. The BM pump driven by the Pelton turbine increases the inlet pressure of the BMS hs pump.

This makes it possible to save up to 35 % of the total power consumption.