
Hydro 1000

Ⓒ GB Installation and operating instructions



Declaration of Conformity

We **Grundfos** declare under our sole responsibility that the products **Hydro 1000**, to which this declaration relates, are in conformity with the Council Directives on the approximation of the laws of the EC Member States relating to:

- Machinery (98/37/EC).
Standard used: EN ISO 12100.
- Electromagnetic compatibility (89/336/EEC).
Standards used: EN 61 000-6-2 and EN 61 000-6-3.
- Electrical equipment designed for use within certain voltage limits (73/23/EEC) [95].
Standard used: EN 60 204-1.

Bjerringbro, 1st April 2005



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Before beginning installation procedures, these installation and operating instructions should be studied carefully. The installation and operation should also be carried out in accordance with local regulations and accepted codes of good practice.

1. General

1.1 Applications

Grundfos booster sets Hydro 1000 are designed for the transfer and pressure boosting of clean water in waterworks, blocks of flats, hotels, industry, hospitals, schools, etc.

1.2 Operating conditions

Liquid temperature: Maximum +50°C.

Ambient temperature: 0°C to +40°C.

Operating pressure: Maximum 10 bar.

Minimum and maximum inlet pressures: See installation and operating instructions for CR pumps.

Liquid temperature and operating pressure may be limited by the diaphragm tank.

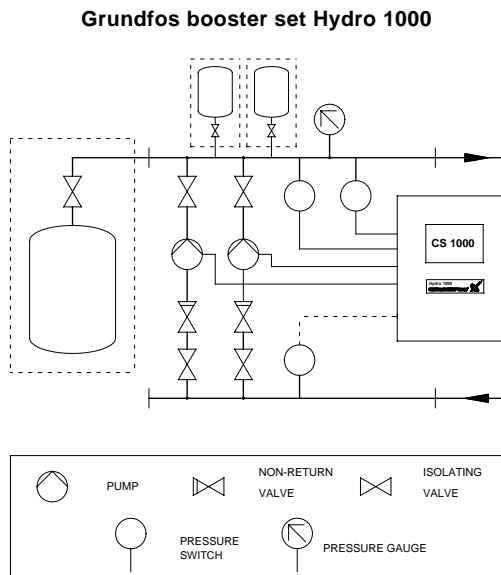
2. Product description

2.1 Grundfos Hydro 1000

The booster set consists of 2 to 4 pumps mounted on a common base frame, isolating valves, non-return valves, suction and discharge manifolds with pressure switches and a control box complete with the controller CS 1000.

Note: A diaphragm tank must be included in the installation. Diaphragm tanks can be connected directly to the discharge manifold.

Fig. 1



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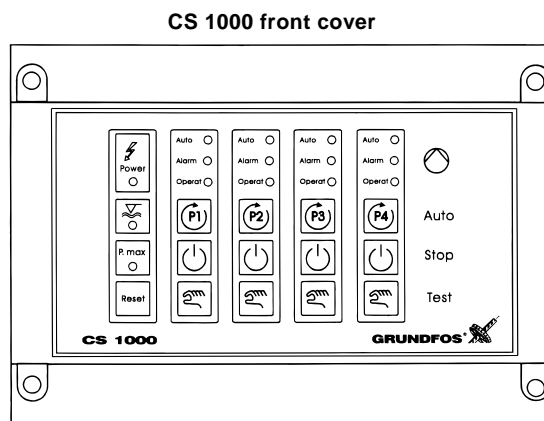
2.2 Grundfos Control 1000

The Grundfos Control 1000 controls a number of mains-operated pumps.

The Control 1000 always includes the controller CS 1000 and offers the following functions:

- Automatic cascade control of pumps.
- Manual operation.
- Pump and system monitoring functions:
 - maximum pressure,
 - pre-pressure / level,
 - motor protection.
- Display and indication functions:
 - green indicator lights for operating indications and red indicator lights for fault indications,
 - potential-free changeover contact for fault indications.

Fig. 2



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2.3 Monitoring and indication functions

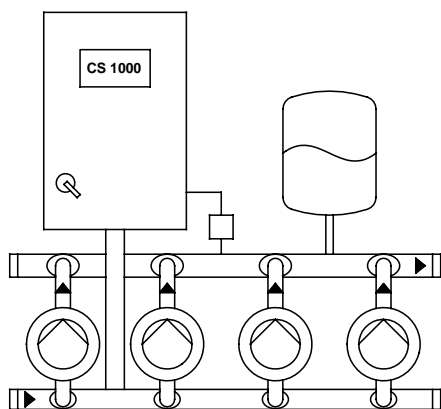
The following functions are available:

- Red indicator lights (LED) for indication of fault conditions:
 - maximum pressure (if a pressure switch is installed),
 - dry-running protection (if a pressure switch is installed),
 - motor protection.
- Green indicator lights (LED) for indication of operating conditions:
 - power on,
 - automatic operation,
 - pump in operation.
- Potential-free changeover contact for fault indications.

2.4 Example of booster set Hydro 1000

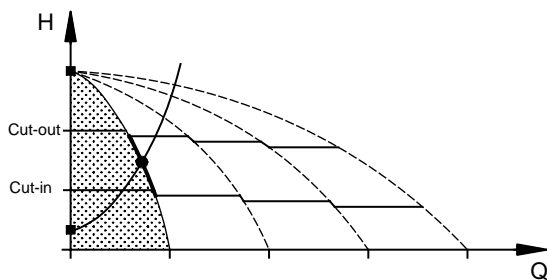
Grundfos Hydro 1000 CS

Four identical full-size mains-operated pumps and a diaphragm tank.



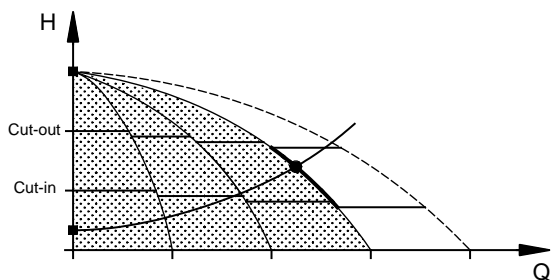
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One pump in operation.



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Three pumps in operation.



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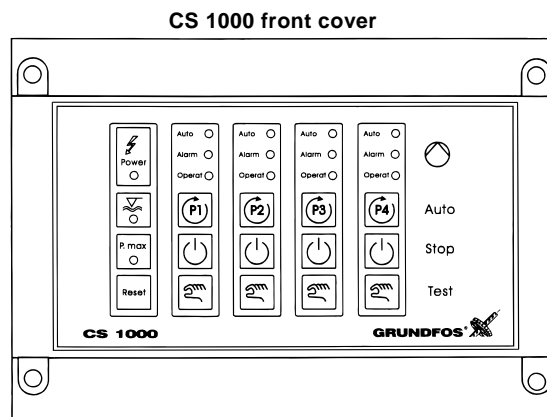
Grundfos Hydro 1000 CS maintains an almost constant pressure by cutting in/out the required number of pumps. The CS 1000 alters the starting sequence of the pumps after each pump stop, thus giving all pumps equal operating time. Pump changeover is automatic and depends on load and fault.

3. Operation











3.1 CS 1000 front cover

The CS 1000 front cover shows all possible operating conditions.

Fig. 3



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Button/ indicator light	Function
	Power indication. The green indicator light is on when the electricity supply to the CS 1000 is connected.
	Dry-running alarm. The red indicator light is on when the dry-running alarm is activated. The light goes out when the alarm is reset. If automatic resetting is chosen, the indicator light goes out automatically when normal operating conditions are achieved.
	Maximum pressure alarm. The red indicator light is on when maximum pressure is activated. The light goes out when the alarm is reset. If automatic resetting is chosen, the indicator light goes out automatically when normal operating conditions are achieved.
	Reset button. Resets the dry-running alarm and the maximum pressure alarm if automatic resetting has not been chosen.
	Automatic operation. The green indicator light is on when the pump is released and ready for operation.
	Pump alarm. The red indicator light is on when the thermal relay of the pump is activated. The pump is out of operation. The alarm can be reset on the thermal relay.
	Pump in operation. The green indicator light is on when the pump is operating.
	Auto button. When the auto button is pressed, the pump will be released for operation and the indicator light for automatic operation will be lit.
	Stop button. When the stop button is pressed, the pump will be taken out of operation and the indicator light for automatic operation goes out.
	Test button. The pump is operating as long as the test button is pressed. The maximum pressure and the dry-running protection are not activated as long as the button is pressed.

4. Installation

4.1 Location

The booster set should be placed in a well-ventilated room to ensure adequate cooling of the pump motors. It should be placed with a 1 metre clearance in front and on the two sides.

Use a fork-lift truck to move the booster set.

4.2 Foundation

The booster set does not require a special foundation, but it should be positioned on a plane and solid surface, e.g. a concrete floor.

4.3 Pipework

Arrows on the pump bases show the flow direction of the water through the pumps.

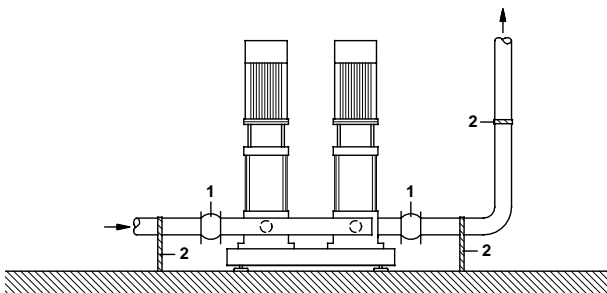
The pipes connected to the booster set must be of adequate size. To avoid resonance, expansion joints should be fitted in the suction and discharge pipes, see fig. 4.

The pipes are connected to the manifolds of the booster set. Either end can be used. Apply sealing compound to the unused end of the manifold and fit a screw cap. For manifolds with flanges, a blind flange with gasket is fitted.

The booster set should be tightened up before start-up.

The pipes must be fastened to parts of the building to ensure that they cannot move or be twisted.

Fig. 4



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1. Expansion joint.

2. Pipe hanger.

Expansion joints, pipe hangers and vibration dampers shown in fig. 4 are not included in the standard booster set.

4.4 Dry-running protection

It is possible to install a pressure switch on the suction side of the booster set to monitor the inlet pressure and to prevent the booster set from running dry (a level switch can be used if the suction side is connected to an open tank).

The booster set should not be started until a dry-running protection has been installed. When the inlet pressure/level drops below the set value, the pumps are cut out. When the correct pressure/level value is restored, the pumps can be reset to operation automatically or manually.

4.5 Priming

Do not start the pumps until they have been filled with water. See installation and operating instructions for CR pumps.

4.6 Electrical connection

The electrical connection should be carried out by an authorized electrician in accordance with local regulations.

The wiring diagram and motor labels show required values for the electricity supply.

No additional motor protection is required as the control box incorporates motor protection.



Before making any connections in pumps, terminal boxes or control box, the electricity supply must be switched off.

5. Settings

5.1 Timers

The three timers incorporated in the controller CS 1000 can be used to optimize the operation of the booster set. The timers are to be adjusted individually.

Start-up delay TR 1 (0-5 secs.)

Defined as: The minimum time between starts of individual pumps.

Prevents: simultaneous start of all pumps in case of:

- momentary power failure,
- peak of water demand,
- automatic resetting of dry-running.

negative pressure in suction manifold.
overload of power mains.
water hammer.

Stop delay TR 2 (0-5 secs.)

Defined as: The minimum time between stops of individual pumps.

Prevents: simultaneous stop of all pumps in case of:

- rapid fall of water demand.

water hammer.

Reduces: number of starts and stops per hour.

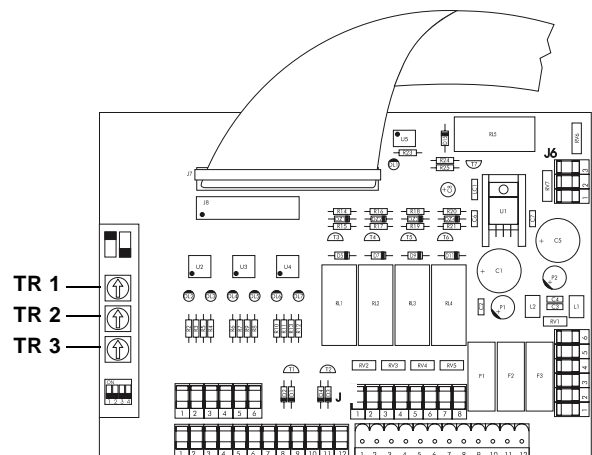
After-run delay TR 3 (0-5 secs.)

Defined as: The time that pumps are kept in operation after the cut-out pressure is reached.

Keeps: pumps in operation when the cut-out pressure is reached.

Reduces: number of starts and stops per hour.

Fig. 5



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5.2 Operation selection

All operating possibilities for the pumps in your booster set are listed below:

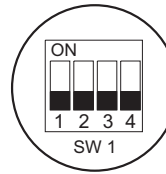
To select operation, proceed as follows:

- Switch off the electricity supply to the Control 1000.
- Open the control box and set the DIP switches according to the desired selection.
- Close the control box, switch on the electricity supply and press buttons as indicated in column "Front panel selection".



Before changing DIP switch setting, switch off the electricity supply.

Fig. 6



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Number of pumps installed	Front panel selection	DIP switch setting	Pumps in operation	Pumps to be alternated	Pilot pump
4 pumps	P1 P2 P3 P4		P1 P2 P3 P4	P1 P2 P3 P4	
	- - - -		P1 P2 P3 P4	- - - -	
	- - - -		P1 P2 P3 P4	- P2 P3 P4	P1
3 pumps	P1 P2 P3		P1 P2 P3	P1 P2 P3	
	- - - -		P1 P2 P3	- - - -	
	P4		P1 P2 P3	- P2 P3	P1
2 pumps	P1 P2		P1 P2	P1 P2	
	- - - -		P1 P2	- -	
	P3 P4		P1 P2	- -	

Note: A pilot pump is the pump that:

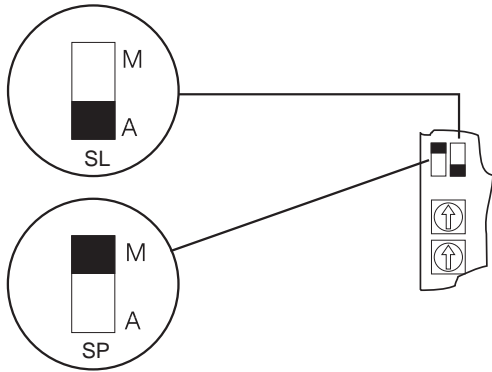
- starts first / stops last.
- is generally smaller than the other pumps (smaller flow - higher head).
- is not to be alternated.
- must be installed in position P1.

5.3 Alarm resetting

There are two possible resetting modes which can be selected by means of each of the switches SL and SP.

- SL: Dry running.
- SP: High pressure.

Fig. 7



- M (Manual). When acceptable conditions have been restored, the pumps are started by pressing the reset button on the front cover.
- A (Automatic). When the pressure/level has reached an acceptable value, the pumps start automatically.

5.4 Pressure setting

The pumps are cut in and out according to the pressures set on the pressure switches.

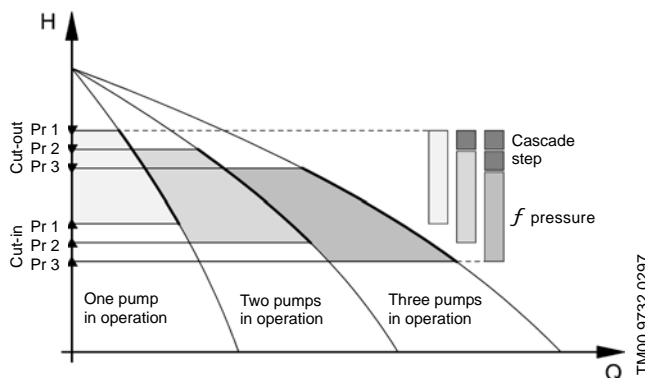
A common differential (*f*) pressure (cut-out pressure – cut-in pressure = *f* pressure) must be set on the pressure switches. The cut-out pressures differ 0.3 to 0.5 bar respectively (cascade step).

Example:

- 3 pumps.
- *f* pressure = 1.5 bar.
- Cascade step = 0.3 bar.
- Pr 1, 2, 3 = Pressure switch 1, 2, 3.
- P 1, 2, 3 = Pump 1, 2, 3.

Pressure switch and pump numbers	Cut-in pressure [bar]	Cut-out pressure [bar]	<i>f</i> pressure [bar]
Pr 1 / P 1	2.6	4.1	1.5
Pr 2 / P 2	2.3	3.8	1.5
Pr 3 / P 3	2.0	3.5	1.5

Fig. 8



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The settings of the pressure switches Pr 2 and Pr 3 are in a decreasing sequence as shown in the table and fig. 8.

When water is consumed, this is first tapped from the diaphragm tank. Then the pressure drops to the first cut-in pressure, and the first pump is cut in. If the consumption is still rising, more pumps will be cut in until the performance of the pumps in operation corresponds to the requirements.

When the water consumption falls, the discharge pressure rises to the cut-out pressure and the CS 1000 cuts out one pump. If the consumption is still falling, more pumps will be cut out.

Note: Each pressure switch is related to one pump only and not necessarily to the same pump when pump alternation is selected on the DIP switch, see section 5.2 *Operation selection*.

Pressure switch Pr 1 must be set to the highest cut-in and cut-out values.

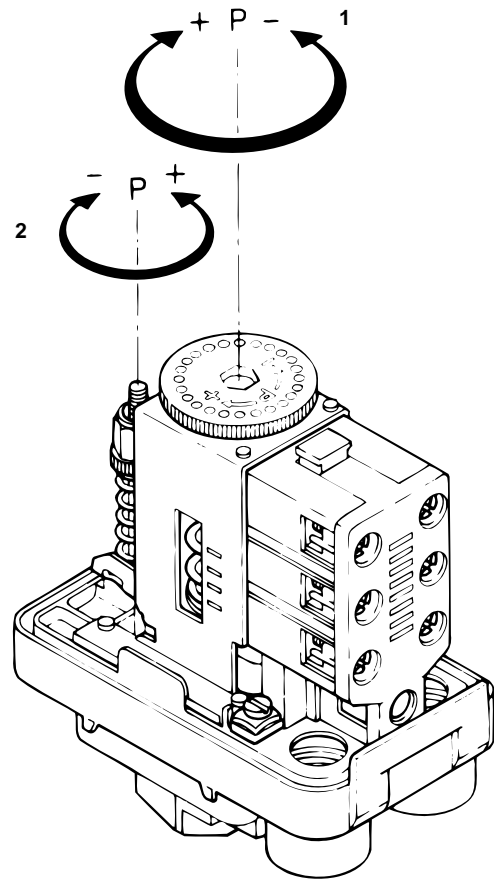
5.5 Pressure switch

On each pressure switch, the following settings must be made:

- Cut-out pressure.
- *f* pressure (differential pressure).

Note: The cut-in pressure is set as the cut-out pressure minus *f* pressure.

Fig. 9



1. Cut-out pressure:
 - + to increase.
 - to decrease.
2. *f* pressure (differential pressure):
 - + to increase.
 - to decrease.

5.6 Tank precharge pressure

The precharge pressure is equal to the minimum cut-in pressure.

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6. Start-up

To start up a booster set Hydro 1000, follow this procedure:

1. Connect water and electricity supplies.
2. Check that the precharge pressure in the diaphragm tank is equal to the minimum cut-in pressure.
3. Close the discharge valves of the pumps and prime the booster set and the suction pipe.
4. Adjust the pressure switches according to the desired discharge pressure.
5. Check that the DIP switch setting corresponds to the number of pumps installed.
6. Switch on the electricity supply.
7. Start pump 1 by pressing the button on the front cover.



8. Pump 1 will now start.
9. Check the direction of rotation of the pump. In case of incorrect rotation, interchange two phases of the electricity supply.
10. Vent the pump while slowly opening its discharge valve.
11. Repeat points 7 to 10 for all pumps.
12. Release the pumps for operation by pressing the buttons on the front cover.



Hydro 1000 is now ready for operation.

7. Maintenance

7.1 Maintenance of booster set

See installation and operating instructions for CR pumps.

7.2 Maintenance of Control 1000

The Control 1000 is maintenance-free.

7.3 Checking the precharge pressure

To ensure reliable and correct operation, including the frequency of starts and stops, the precharge pressure of the diaphragm tank should be checked regularly (at least twice a year).

8. Fault finding chart



Before making any connections in pumps, terminal boxes or control box, the electricity supply must be switched off.

Fault	Cause	Remedy
1. Motor does not run when started.	a) Electricity supply disconnected.	Connect the electricity supply.
	b) Automatic circuit breakers cut out.	Correct the fault and cut in the automatic circuit breakers.
	c) Fuse in the CS 1000 defective.	Replace the fuse.
	d) Motor defective.	Repair/replace the motor.
2. Motor starts, but stops immediately afterwards.	a) Incorrect setting of pressure switch.	Increase the cut-out pressure and/or differential pressure.
	b) Wrong diaphragm tank precharge pressure.	Check the diaphragm tank precharge pressure.
3. Frequent starts and stops.	a) Incorrect setting of time delay TR 2.	Set the time delay TR 2 accordingly.
	b) Incorrect setting of pressure switch.	Increase the cut-out pressure and/or differential pressure.
	c) Diaphragm tank defective.	Repair the diaphragm tank.
4. Pumps are running but deliver no water.	a) Suction pipe/pumps blocked by impurities.	Clean the suction pipe/pumps.
	b) Non-return valve blocked in closed position.	Clean the non-return valve.
	c) Suction pipe leaky.	Repair the suction pipe.
	d) Air in suction pipe/pumps.	Vent the pumps. Check the suction pipe for leakages.
	e) Motors running with the wrong direction of rotation.	Change the direction of rotation.
5. Leakage from the shaft seal.	a) Shaft seal defective.	Replace the shaft seal.
	b) Height adjustment of the pump shaft inaccurate.	Readjust the shaft height. See installation and operating instructions for CR pumps.
6. Noise.	a) The pumps are cavitating.	Clean the suction pipe/pumps and possibly the suction strainer.
	b) The pumps do not rotate freely (frictional resistance) due to inaccurate height adjustment of the pump shaft.	Readjust the shaft height. See installation and operating instructions for CR pumps.

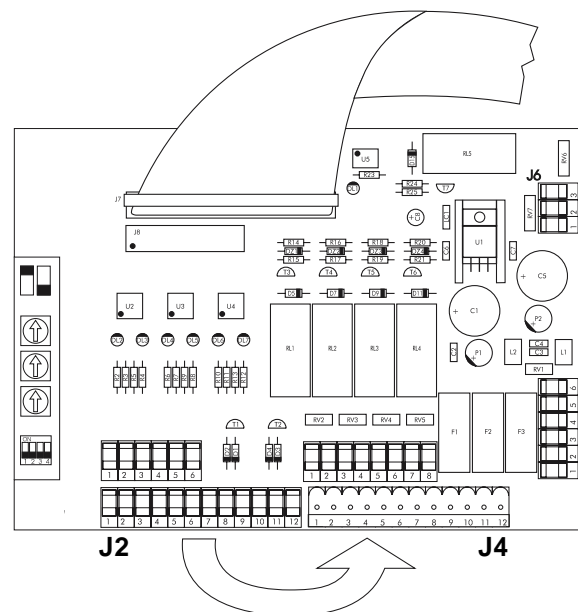
8.1 Emergency operation

In case of damage to electronic components belonging to the printed circuit board, the system can be operated by moving the multiplug from J2 to J4, see fig. 10.

Pumps will still operate automatically by pressure switches but without LED indications and the alternation function.

Maximum pressure and dry-running protection are not active when the booster set is in emergency operation.

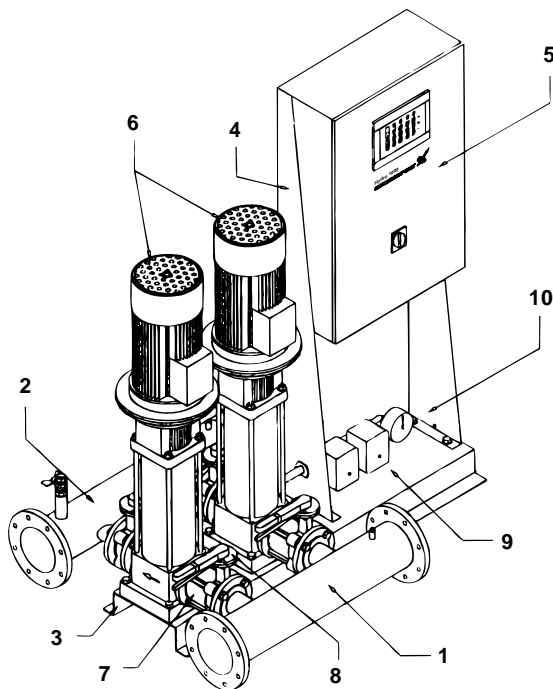
Fig. 10



9. Parts list

Pos.	Description	Number
1	Suction manifold	1
2	Discharge manifold	1
3	Base frame	1
4	Stand	1
5	Control box	1
6	CR pump	2-4
7	Non-return valve	1 per pump
8	Isolating valve	2 per pump
9	Pressure switch	1 per pump
10	Pressure gauge	1

Fig. 11



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10. Technical data

10.1 Sound pressure level

For sound pressure level, see installation and operating instructions for CR pumps.

The sound pressure level for a number of pumps can be calculated as follows:

$$L_{\max.} = L_{\text{pump}} + (n - 1) \times 3.$$

$L_{\max.}$ = Maximum sound pressure level.

L_{pump} = Sound pressure level for one pump.

n = Number of pumps.

10.2 Hydraulic data

Minimum pre-pressure:

The minimum pre-pressure "H" in metres head required to avoid cavitation in the pumps is calculated as follows:

$$H = p_b \times 10.2 - \text{NPSH} - H_f - H_v - H_s$$

p_b = Barometric pressure in bar.

Barometric pressure can be set to 1 bar.

NPSH = **Net Positive Suction Head** i metres head (to be read from the NPSH curve at the highest flow). See installation and operating instructions for CR pumps.

H_f = Friction loss in suction pipe in metres head.

H_v = Vapour pressure in metres head, t_m = liquid temperature.

See installation and operating instructions for CR pumps.

H_s = Safety margin of minimum 0.5 metres head.

10.3 Electrical data

Supply Voltage: 3 x 400 V +6%/-10%, 50 Hz, PE.

Terminal designation or number	Function CS 1000	Technical data
1	Input for thermal relay pump 1	
2	Input for thermal relay pump 2	
3	Input for thermal relay pump 3	
4	Input for thermal relay pump 4	
5		
6	Common terminal for multiplug J1	
1 - 2	Input for dry-running protection	
3 - 4	Input for maximum pressure protection	
5 - 6	Input for pressure switch 1	
7 - 8	Input for pressure switch 2	
9 - 10	Input for pressure switch 3	
11 - 12	Input for pressure switch 4	
1 - 2	Output for contactor K1	AC 24 V
3 - 4	Output for contactor K2	AC 24 V
5 - 6	Output for contactor K3	AC 24 V
7 - 8	Output for contactor K4	AC 24 V
1 - 2	Electricity supply for CS 1000	AC 24 V
3 - 4	Electricity supply for CS 1000	AC 18 V
5 - 6	Electricity supply for CS 1000	AC 8 V
J6	1 - 3 Fault relay	Potential-free changeover contacts. Maximum contact load: 250 V / 3.0 A, AC 1

Subject to alterations.

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