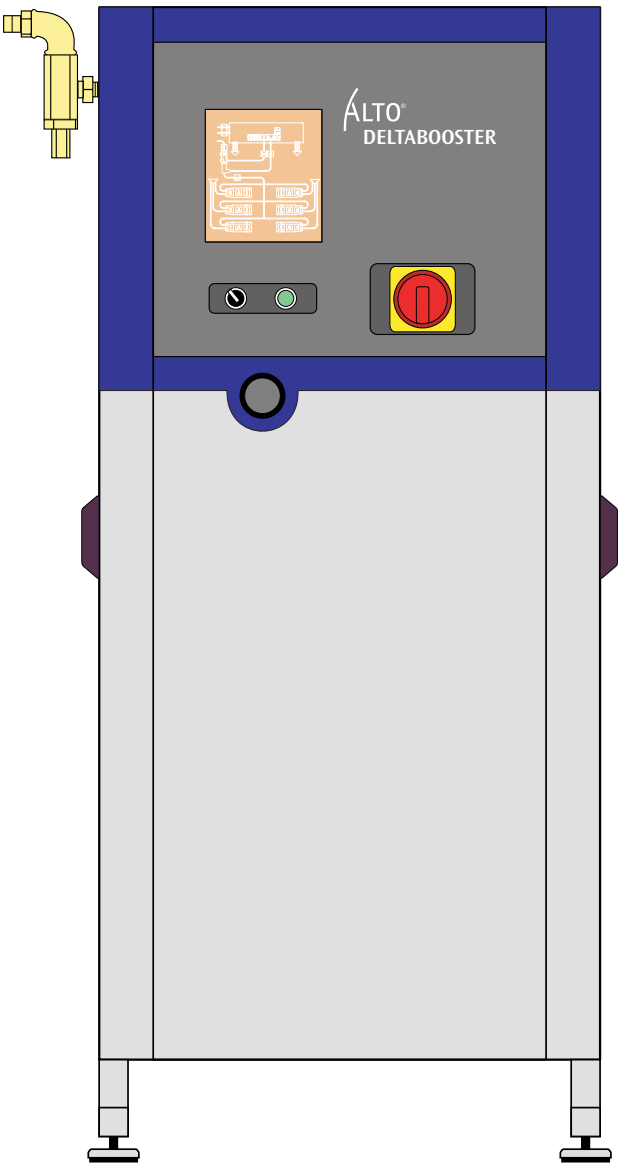
www.alto-online.com

# DELTABOOSTER




ALTO®
Why Compromise™

## Service Manual

Correction page D3
27-11-01 KEH

Wap KEW TECHNOLOGIES

# Contents

**DELTABOOSTER**

## Line Pressure 160 bar

| DELTABOOSTER, main data | Unit | General | Nominal values | | | | | Tolerances |
|---|---|---|---|---|---|---|---|---|
| Voltage | VAC | | 230 | 400 | 415 | 440 | 440 | +6 /-10% |
| Frequency | Hz | | 50 | 50 | 50 | 50 | 60 | |
| No. of phases | pcs. | | 3 | 3 | 3 | 3 | 3 | |
| Pression in pipeline | bar | 160 | 160 | 160 | 160 | 160 | 160 | |
| Max. power consumption, 2-pumps | A | | 42 | 23.5 | 21.5 | 21.5 | 21.5 | |
| Max. power absorption, 2 pumps | kW | 13.7 | 13.7 | 13.8 | 13.9 | 13.10 | 13.11 | |
| Max. power consumption, 3 pumps | A | | 62 | 35,5 | 32 | 32 | 32 | |
| Max. power absorption, 3 pumps | kW | | 20.1 | 20.1 | 20.1 | 20.1 | 20.4 | |
| Max. power consumption, 4 pumps | A | | 83 | 47.5 | 42.5 | 42.5 | 42.5 | |
| Max. power absorption, 4 pumps | kW | | 26.8 | 26.8 | 26.8 | 26.8 | 27.1 | |
| Max. power consumption, 5 pumps | A | | 104 | 58 | 53 | 53 | 53 | |
| Max. power absorption, 5 pumps | kW | | 33.5 | 33.5 | 33.5 | 33.5 | 33.8 | |
| Max. power consumption, 6 pumps | A | | 125 | 69.5 | 64.5 | 64.5 | 64.5 | |
| Max. power absorption, 6 pompes | kW | | 40.2 | 40.2 | 40.2 | 40.2 | 40.5 | |
| Control voltage | VAC | 24 | | | | | | +10/-10% |
| Max. power cons. contr.circuit, primary | A | 0.8 | | | | | | +10/-10% |
| Max. power cons. contr.circuit, secondary | A | 10 | | | | | | |
| IP classification | | 45 | | | | | | |
| High voltage test of finished plant | kV | 2.4 I 2 sec. | | | | | | |
| Insulation resistance - finished plant | Mohm | 1 | | | | | | |
| Resistance in earth circuit - finished plant | ohm | 0.2 | | | | | | |
| Adjustment - overflow valve | bar | 160 | | | | | | |
| Adjustment - pressure switch (h.p.) | bar | 120 | | | | | | |
| Adjustment - pressure switch (l.p.) | bar | 25 | | | | | | |
| Adjustment - overload switch | A | | 20.5 | 12.5 | 12.5 | 12.5 | 12.5 | |
| Volume of water tank | l | 80 / 21 | | | | | | |
| Max. ambient temperature at operation | °C / °F | 40 | | | | | | |
| Min. ambient temperature at operation | °C / °F | 3 | | | | | | |
| Max. water inlet temperature pump | °C / °F | 75 / 167 | | | | | | |
| Pression max. de l'eau à l'entrée | bar | 10 | | | | | | |
| Addition of antifreeze solution | l | 2.5 | | | | | | |
| Weight 2-pumps D.B. | kg / lb | 250 / 551 | | | | | | |
| 3-pumps D.B. | kg / lb | 300 / 661 | | | | | | |
| 4-pumps D.B. | kg / lb | 350 / 772 | | | | | | |
| 5-pumps D.B. | kg / lb | 400 / 882 | | | | | | |
| 6-pumps D.B. | kg / lb | 450 / 992 | | | | | | |
| Dimensions : l x h x w | mm / inch | 715x790x1800 / 28x31x71 | | | | | | |
| **44C3KS motor pump unit** | | | | | | | | |
| Motor, electric coupling | | | T | Y | Y | Y | Y | |
| Voltage | V | | 230 | 400 | 415 | 440 | 440 | +6/-10% |
| Frequency | Hz | | 50 | 50 | 50 | 50 | 60 | |
| No. of phases | Pcs. | 3 | | | | | | |
| No. of pistons | Pcs. | 4 | | | | | | |
| Power consumption, h.p., nominal.voltage, hot | | | 20.5 | 11.5 | 10.5 | 10.5 | 10.5 | ± 1.5 |
| No. of revolutions | min-1 | | 1440 | 1440 | 1440 | 1440 | 1730 | ±30 |
| Opening pressure, measured in machine outlet | bar | 225 | | | | | | ±5 |
| Power absorption | kW | 6.7 | | | | | | |
| Water volume, high pressure | l/min | 17.3 / 4.5 | | | | | | ±0.3 |
| Pump pressure at high pressure | bar | 160/2300 | | | | | | ±10 |
| Pressure, h.p., measured in machine outlet | bar | 152 | | | | | | ±9 |
| Cleaning power | kW | 4.45 | | | | | | ±0.32 |

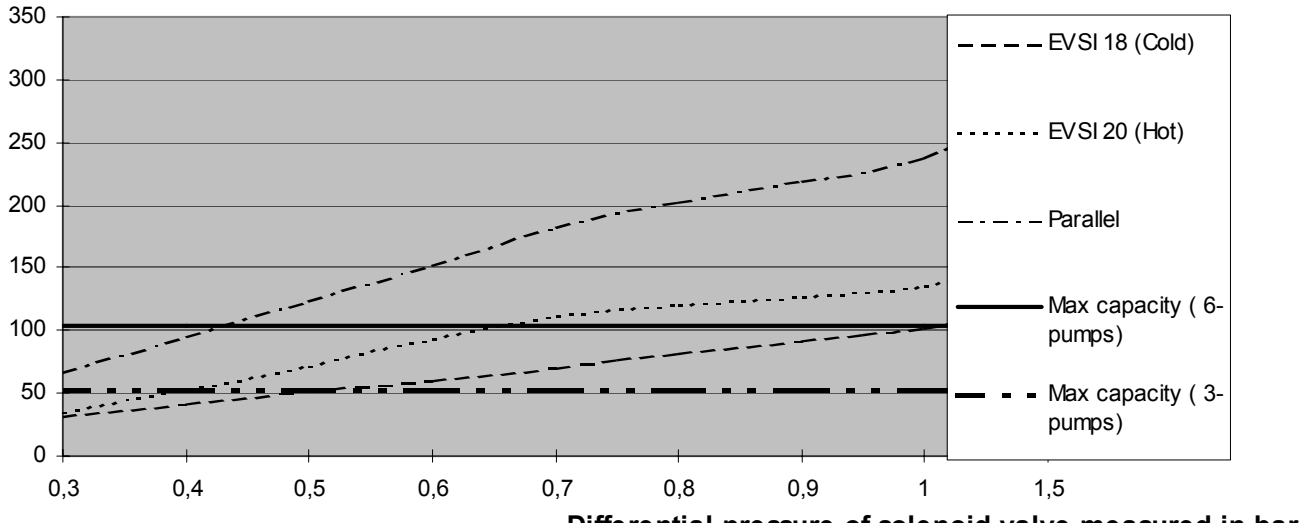
## Line Pressure 120 bar

| DELTABOOSTER, main data | Unit | General | Nominal values | | | | | Tolerances |
|---|---|---|---|---|---|---|---|---|
| Voltage | VAC | | 230 | 400 | 415 | 440 | 440 | +6 /-10% |
| Frequency | Hz | | 50 | 50 | 50 | 50 | 60 | |
| No. of phases | Pcs. | | 3 | 3 | 3 | 3 | 3 | |
| Pressure in pipeline | bar | 120 | 120 | 120 | 120 | 120 | 120 | |
| Max. power consumption, 2-pump D.B. | A | | 33.6 | 18.8 | 17.2 | 17.2 | 17.2 | |
| Max. power absorption, 2-pump D.B. | kW | 10.96 | 10.96 | 11.04 | 11.12 | 10.48 | 10.49 | |
| Max. power consumption, 3-pump D.B. | A | | 49.6 | 28.4 | 25.6 | 25.6 | 25.6 | |
| Max. power absorption, 3-pump D.B. | kW | | 16.05 | 16.05 | 16.05 | 16.05 | 16.32 | |
| Max. power consumption, 4-pump D.B | A | | 66.4 | 38 | 34 | 34 | 34 | |
| Max. power absorption, 4-pump D.B. | kW | | 21.44 | 21.44 | 21.44 | 21.44 | 21.68 | |
| Max. power consumption, 5-pump D.B | A | | 83.2 | 46.4 | 42.4 | 42.4 | 42.4 | |
| Max. power absorption, 5-pump D.B. | kW | | 26.8 | 26.8 | 26.8 | 26.8 | 27.04 | |
| Max. power consumption, 6-pump D.B. | A | | 100 | 55.6 | 51.6 | 51.6 | 51.6 | |
| Max. power absorption, 6-pump D.B. | kW | | 32.16 | 32.16 | 32.16 | 32.16 | 32.4 | |
| Control voltage | VAC | 24 | | | | | | +10/-10% |
| Max. power cons. contr.circuit, primary | A | 0.8 | | | | | | +10/-10% |
| Max. power cons. contr.circuit, secondary | A | 10 | | | | | | |
| IP-classification | | 45 | | | | | | |
| High voltage test of finished plant | kV | 2.4 I 2 sec. | | | | | | |
| Insulation resistance - finished plant | Mohm | 1 | | | | | | |
| Resistance in earth circuit - finished plant | ohm | 0.2 | | | | | | |
| Adjustment, overflow valve | bar | 120 | | | | | | |
| Adjustment, pressure switch (h.p.) | bar | 90 | | | | | | |
| Adjustment, pressure switch (l.p.) | bar | 25 | | | | | | |
| Adjustment, over load switch | A | | 20.5 | 12.5 | 12.5 | 12.5 | 12.5 | |
| Volume of water tank | l | 80 / 21 | | | | | | |
| Max. ambient temperature at operation | °C / °F | 40 | | | | | | |
| Min. ambient temperature at operation | °C / °F | 3 | | | | | | |
| Max. water inlet temperature pump | °C / °F | 75 / 167 | | | | | | |
| Max. water inlet pressure | bar | 10 | | | | | | |
| Addition of antifreeze solution | l | 2.5 | | | | | | |
| Weight 2-pump D.B.. | kg / lb | 250 / 551 | | | | | | |
| 3-pump D.B. | kg / lb | 300 / 661 | | | | | | |
| 4-pump D.B. | kg / lb | 350 / 772 | | | | | | |
| 5-pump D.B. | kg / lb | 400 / 882 | | | | | | |
| 6-pump D.B. | kg / lb | 450 / 992 | | | | | | |
| Dimensions l x w x h | mm / inch | 715x790x1800 / 28x31x71 | | | | | | |
| **44C3KS motor pump unit** | | | | | | | | |
| Motor, electric coupling | | | T | Y | Y | Y | Y | |
| Voltage | V | | 230 | 400 | 415 | 440 | 440 | +6/-10% |
| Frequency | Hz | | 50 | 50 | 50 | 50 | 60 | |
| No of phases | Pcs. | 3 | | | | | | |
| No. of pistons | Pcs. | 4 | | | | | | |
| Power consumpt., h.p., nom.voltage, hot | A | | 16.4 | 9.2 | 8.4 | 8.4 | 8.4 | ± 1.5 |
| No. of revolutions | min-1 | | 1440 | 1440 | 1440 | 1440 | 1730 | ±30 |
| Opening pressure, measured in mach.outlet | bar | 170 | | | | | | ±5 |
| Power absorption | kW | 6.7 | | | | | | |
| Water volume, high pressure | l/min | 17.3 / 4.5 | | | | | | ±0.3 |
| Pump pressure at high pressure | bar | 120/2300 | | | | | | ±10 |
| Pressure, h.p., measured in machine outlet | bar | 112 | | | | | | ±9 |
| Cleaning power | kW | 3.4 | | | | | | ±0.32 |


| Capacity diagram | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Differential pressure of solenoid valve in bar | 0,3 | 0,4 | 0,5 | 0,6 | 0,7 | 0,8 | 0,9 | 1 | 1,5 |
| EVSI 18 (cold) | 32 | 42 | 52 | 60 | 70 | 82 | 92 | 102 | 125 |
| EVSI 20 (hot) | 35 | 53 | 72 | 93 | 113 | 120 | 128 | 135 | 163 |
| Parallel | 67 | 95 | 124 | 153 | 183 | 202 | 220 | 237 | 288 |
| Max consump. ( 6-pumps) | 104 | 104 | 104 | 104 | 104 | 104 | 104 | 104 | 104 |
| Max consump. ( 3-pumps) | 52 | 52 | 52 | 52 | 52 | 52 | 52 | 52 | 52 |
| | | | | | | | | | |
| Marked values have been taken from the datasheet "Capacity diagrams" EVSI 6-100 of Danfoss | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | 2.1 | 2.2 | 2.3 | 2.4 | 2.5 | 2.6 | 2.7 | 2.8 | 2.9 |
| | | | | | | | | | |

## Capacity diagram

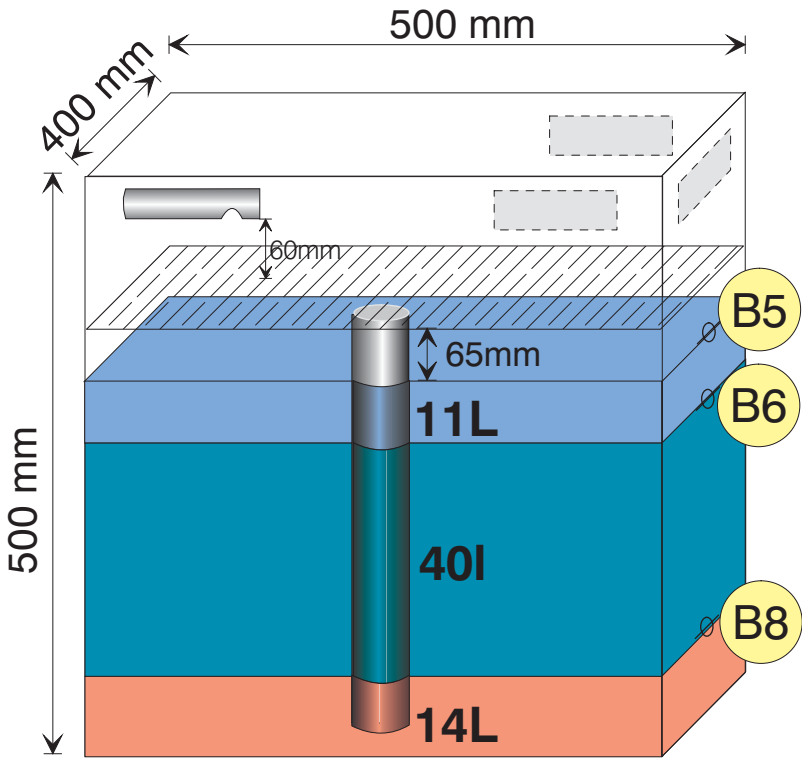
**Liter/Min**




**Differential pressure of solenoid valve measured in bar**

## Water tank

The water tank has been constructed in accordance with the current regulations concerning safety distance from max. water level to outlet of water supply and a minimum diameter of overflow pipe. The purpose is to prevent the return of water from the tank to the water supply network.
By removing the 3 knockout pieces, the construction of the water tank also conforms to BS 6281 dealing with current regulations in the United Kingdom as from 1992.




Max. water contents of the water tank up to the level of the overflow pipe is 78 litres.

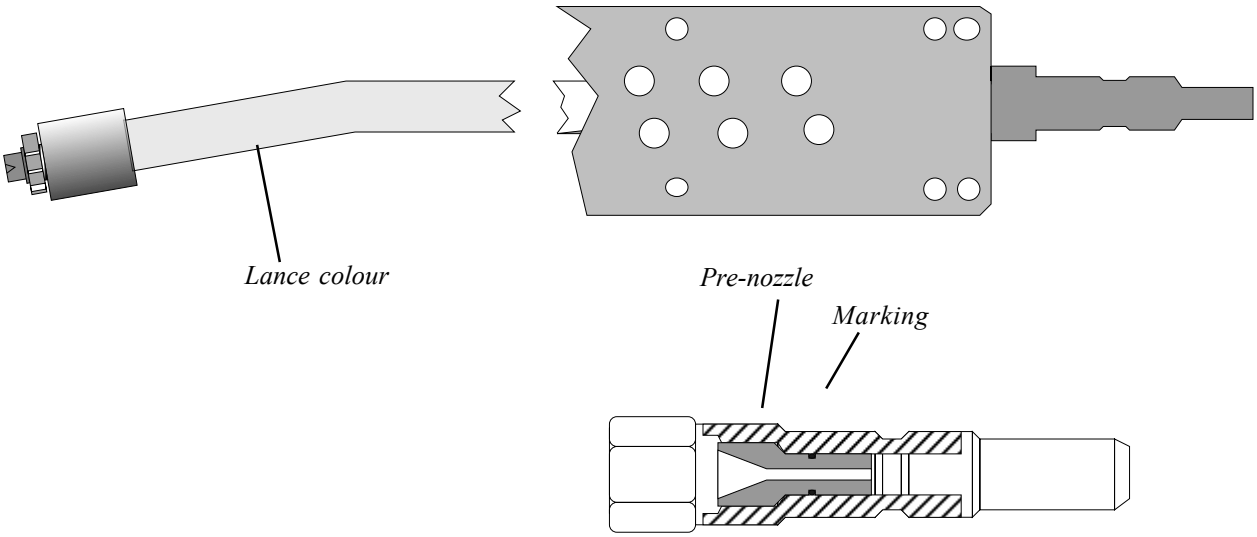
Normal contents of tank up to B5 level switch is approx. 65 litres.

During normal operation the level between the level switches B5 and B6 varies approx. 11 litres.

The safety water volume between the level switches B6 and B8 is approx. 40 litres.

Rest water volume after stop by level switch B8 is approx. 14 litres.

## Multi Pressure Lance




| PRE-NOZZLE marking | PRE-NOZZLE Ø mm | LANCE COLOUR | 160 bar | 120 bar | HP nozzle |
|---|---|---|---|---|---|
| 1 | 1.56 | White | X | | 1515 |
| 3 | 1.80 | Blue | X | | 1508 |
| 4 | 2.08 | Orange | X | | 15075 |
| 5 | 2.22 | Red | X | | 1513 |
| 5 | 2.22 | Black | X | | 1530 |
| 8 | 1.68 | Brown | X | | 1511 |
| 8 | 1.68 | White | | X | 15165 |
| 9 | 2.43 | Green | | X | 1525 |
| 9 | 2.43 | Red | | X | 1515 |
| 10 | 1.88 | Blue | | X | 1509 |
| 11 | 2.15 | Orange | | X | 1508 |
| 7 | 2.5 | Yellow | X | | 1511 |
| 13 | 2.31 | Green | X | | 1520 |
| 13 | 2.31 | Black | | X | 1531 |
| 14 | 1.73 | Brown | | X | 1511 |
| 12 | 2.74 | Yellow | | X | 1513 |

## Calculation of Cooling Air

When installing a DELTABOOSTER plant in a small room, it may be necessay to establish ventilation of the room if the temperature in the room exceeds 40°C. For the calculation of the required air renewal, the following points should be considered:

1. A DELTABOOSTER with 2 x 44C3 pumps has an emission of heat of approx. 3,000 watt.
2. The size of the room compared to the machine is very small.
3. The temperature of the ambient air is 40°C.
4. Both pumps are continuously running at max. load.

Calculation formula:

$$V = \frac{Q \times 60{,}000}{\frac{P}{R \times T}\ Cp \times (T2 - T1)} \quad (l / min)$$

According to the calculation above, a renewal of **16** $m^3$ air is required.

## Electrical Parts

Y1 K (Cold) Danfoss Evsi 18 Q = 8m³/h at 2 bar Coil 24V Pull = 44VA Hold = 21VA

Y2 V (Hot) Danfoss Evsi 20 Q = 8m³/h at 1 bar Coil 24V Pull = 44VA Hold = 21VA

Y3 Discharge valve Huba CH 8116 24V 5W.

M0 Pump for softener, type Suttner ST 15 Q 35 ml/h 24V 3W active up to 20 dH.

B1 Pressure switch (h.p.) type ALTO. The switch is open at a pressure < the working pressure - 40 bar.

B2 Pressure switch (l.p.) type ALTO. The switch is open at a pressure < 25 bar.

B4 Flow switch type ALTO. The switch is closed when there is a water flow > 10 l/min.
Reed switch type: Günter Reed 2723 12V 220V 0.5 amp.

B5 Level switch, high water level, type Gentech LS 103-12 closes at max. level.

B6 Level switch, low water level, type Gentech LS 103-12 opens at min. level.

B7 Temperature sensor PT500 - at 10°C approx. 520 Ω, at 70°C approx. 635 Ω.

B8 Level switch , water deficiency stop, type Gentech LS 103-12 closes if the water volume is too critical.

S1 Main switch BS 5419 VDE 0660 AC3 22kW.

Q A/B Current limiter, type Sprecher + Schuh KTL 3-65 Ve = 660V IV = 65 amp Icn = 50 Kamp.

Q 1-6 Overload switch, type Sprecher + Schuh KTA 3-25 10-16 amp. AC3-176 amp.
Overload switch, type Sprecher + Schuh KTA 3-25 (12)-25 amp. AC3-176 amp.

K 1-6 Contactor (relay), type Sprecher + Schuh CA3-16-10 Coil 24V 50/60Hz
(Note! for 220V: CA - 3 - 23 - 10).

V1 Overflow valve, type ALTO, spring-loaded cone opens at a pressure > the working pressure.

V2 Safety valve, type ALTO 03, spring-loaded ball - opens at a pressure > the working pressure + 50 bar - closes at a pressure < approx. 50 bar.

A1 Steering circuit board ALTO 6420029.

F1 380V-415V-440V F 0,8 amp. 250V primary size 25 x 5.
F2 380V-415V-440V F 0,8 amp. 250V primary size 25 x 5.

F1 220V F 1,0 amp 250V primary size 25 x 5.
F2 220V F 1,0 amp 250V primary size 25 x 5.

F3 F 10 amp. 250V secondary size 20 x 5.

F4 T 500 mA 250V size 20 x 5.

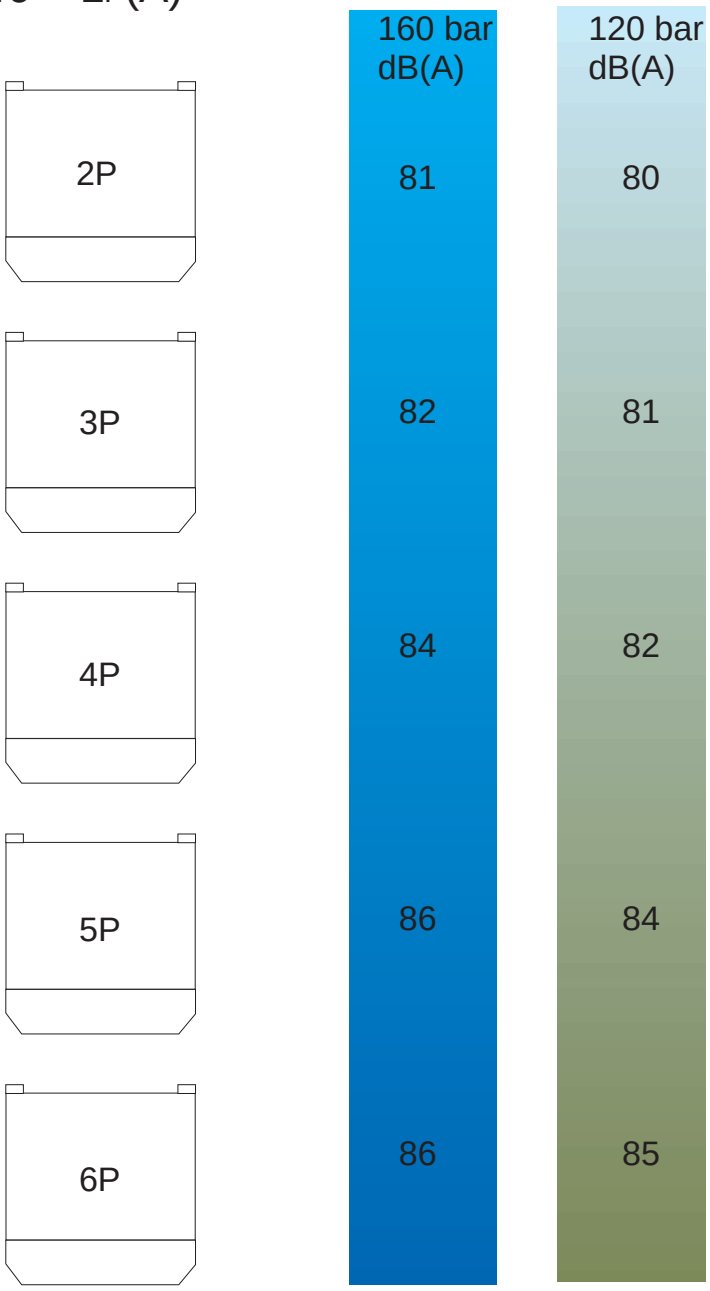
Transformer sec. 24V, type Elektrodyn, EB 120/41/240, 380V AC 50/60Hz, 346V AC 50/60Hz
Transformer sec. 24V, type Elektrodyn, EB 120/41/240, 427V AC 50/60Hz, 440V AC 50/60Hz
Transformer sec. 24V, type Elektrodyn, EB 120/41/240, 200V AC 50/60Hz, 220V AC 50/60Hz

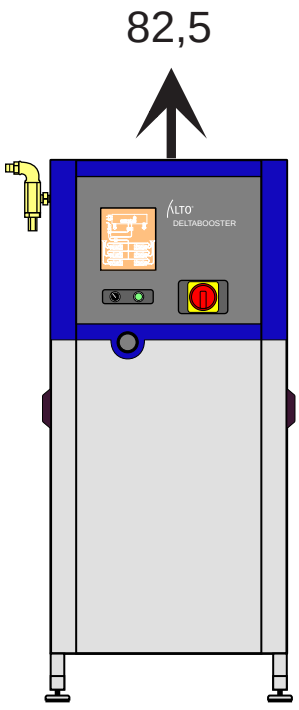
## Measurement of Sound Pressure

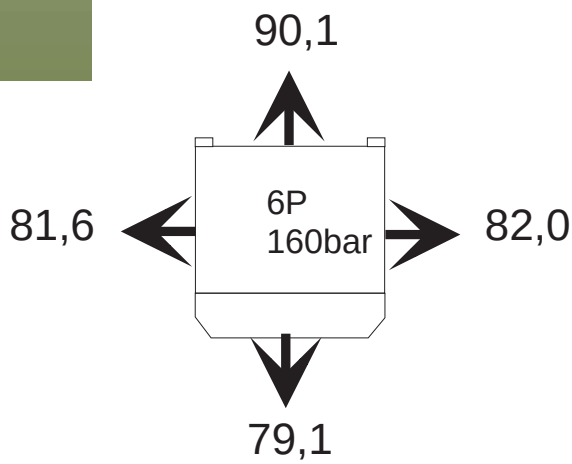
KEW test

DELTABOOSTER
ISO 3746 $L_P$(A)

Measuring distance 1m



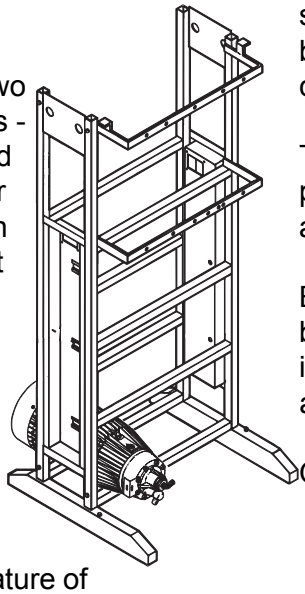



**Appeal** !
If you find that some information is missing in this section or something is not quite clear, please describe the matter on this page and forward it to TST - fax. +45 7218 2246.

The DELTABOOSTER has been built up with an all-welded frame in a solid construction of stainless steel. The motor pumps have been suspended on a rubber damper with flexible connections to power and water.

The water tank has two water inlets - one for cold and one for hot water. These inlets can be placed either on the left side or the right side as you require.
The water tank has been placed at the top with the purpose of feeding the pumps with water under a certain pressure. Thus it will be possible to operate with water up to a temperature of 75°C.



The control system containing all the electronics for control has been arranged in a waterproof box of stainless steel placed at a thermal distance to the water tank. The door has been secured by two triangular locks and a lock in the main switch ensuring that the door can only be opened when the current has been switched off.

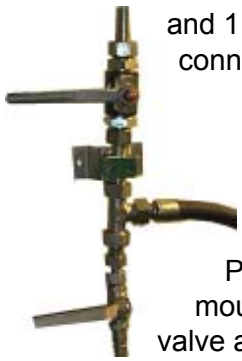
The two sides of the frame contain the wire terminals and cables of the motor, which have been covered by a screw lid of water- and stainless steel. On the outside the machine has been covered with stainless steel plates. The front door can be opened either from the right or the left side as you require or be completely dismounted without using any tools. The motor pumps have been placed with the pump parts exposed to view to ease the access to inspecting the wearing parts of the pumpe.

The pumps are 4 cylinder axial piston pumps with solid ceramic pistons and valves of stainless steel. The pump has been prepared for a continuous working pressure of 210 bar.

The DELTABOOSTER can be delivered with pressure settings from 90 to a max. of 160 bar according to your wishes.

Before the delivery the DELTABOOSTER has been subjected to a 24 hours' optimal test and is therefore 100% ready for operation with no ajustments required.

On delivery the DELTABOOSTER is fitted with 2 Heavy Duty water inlet hoses and 1 pressure outlet hose for connection to the pipeline (arrow).

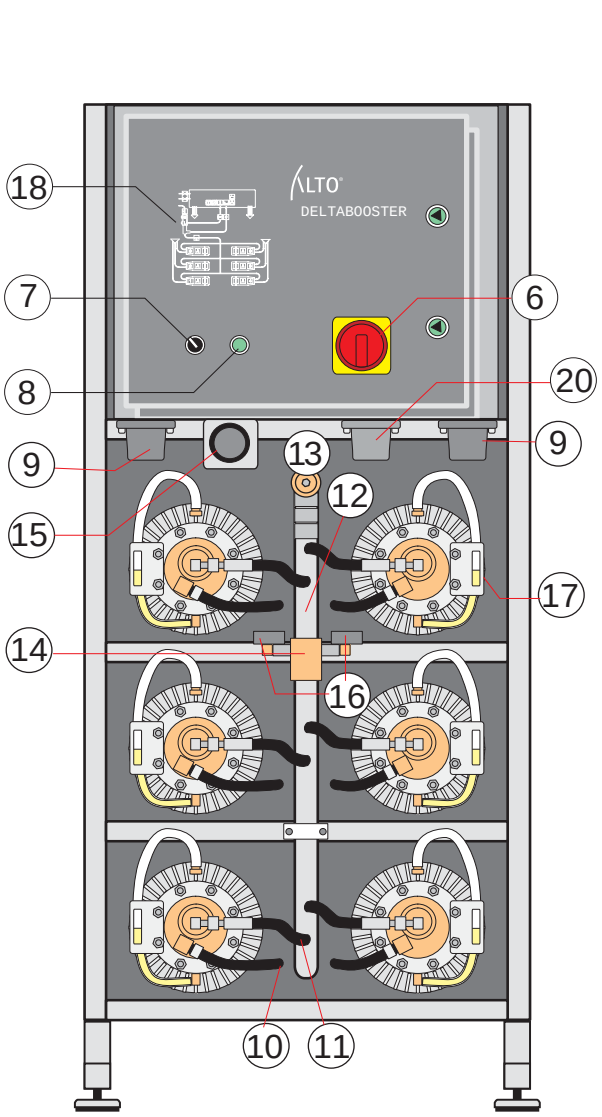


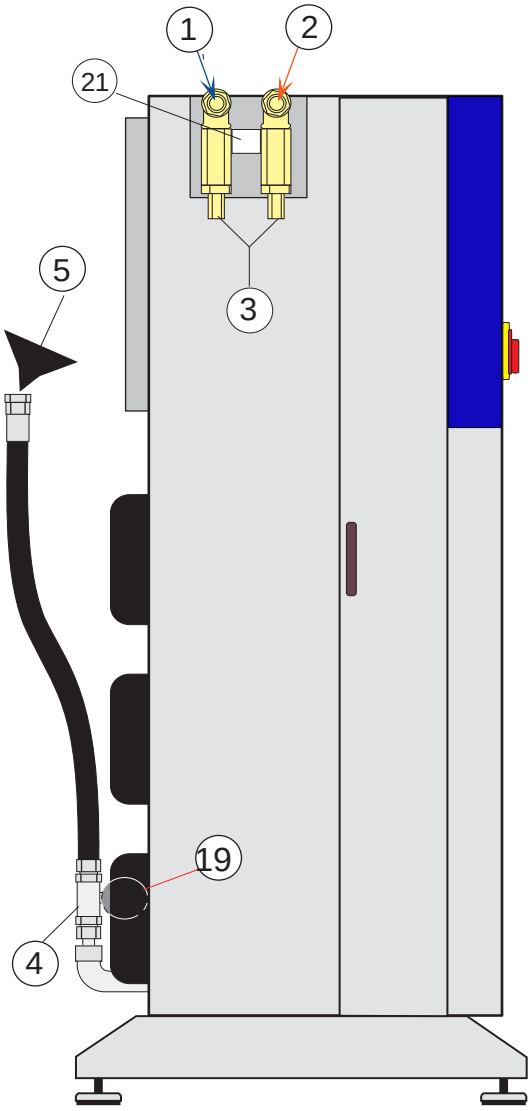
*From machine*

Photo shows correct mounting of emergency stop valve at the top and test valve at the bottom.

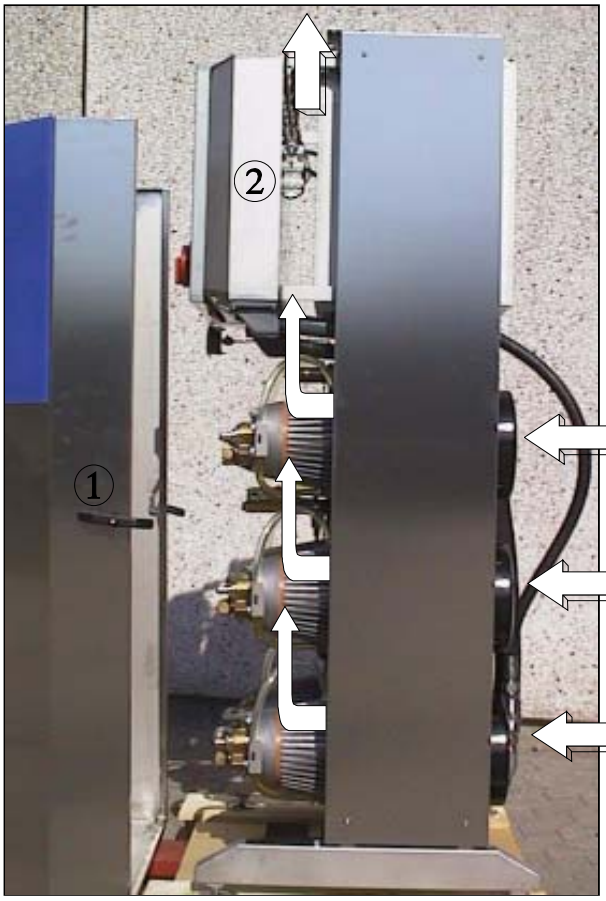
The DELTABOOSTER is fitted with 4 vibration absorbing rubber supports which can be adjusted separately so that the machine stands evenly and firmly.

For a further fixation to the floor, 2 or 4 fittings can be used (see illustration).




1: Connection of cold water supply
2: Connection of hot water supply
3: Filter housing drain
4: Non-return valve HP outlet
5: HP outlet hose for the pipeline
6: Main switch
7: Switch for control current
8: Starting switch
9: Cable connection to motor pumps
10: Water inlet from water tank
11: Pressure outlet to central manifold
12: Central manifold HP
13: Overflow valve
14: Distribution block, pressure system
15: Pressure gauge HP
16: Pressure switches
17: Level indicator for pump lubricating oil
18: Control panel
19: Pressure equalizer (damper)
20: Cable connection box
21: Model tag




As it appears from the illustration, the whole front door (1) can be removed by turning both fasteners into horizontal position.

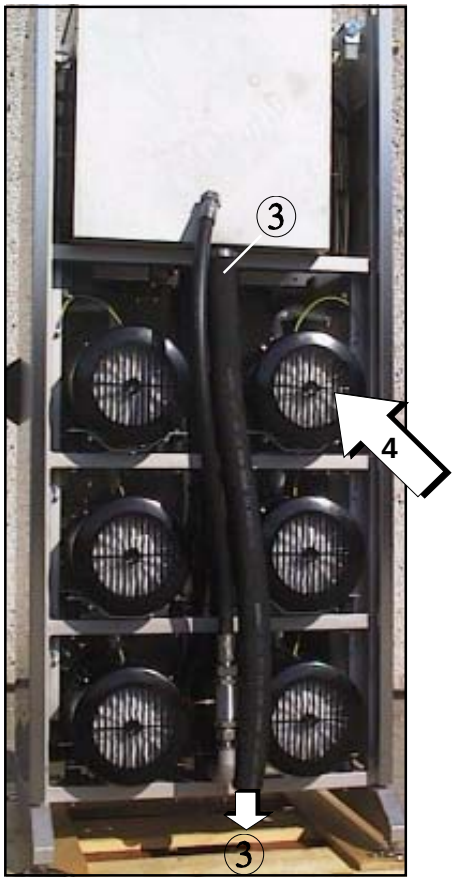
The control system (2) is mounted at a distance to the water tank so that neither heat or cold is transferred from the tank to the power module box.

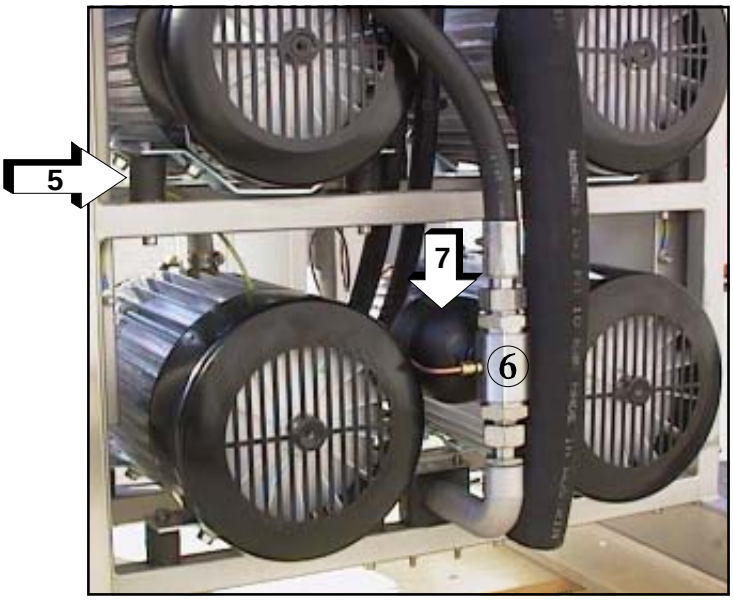
The fans (4) of the motor provides the cooling. They take air from the back of the machine and press it forwards past the fins of the motor and on to the space between the water tank and the power module box.

The internal overflow pipe of the water tank is connected to a rubber hose (3) which leads the water to the floor if a fault should arise in the control system.

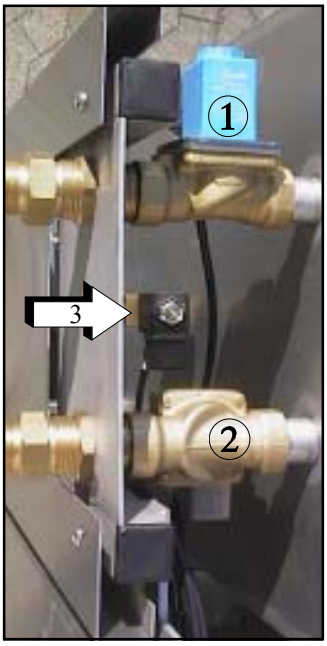
Each motor is suspended in four rubber dampers (5).

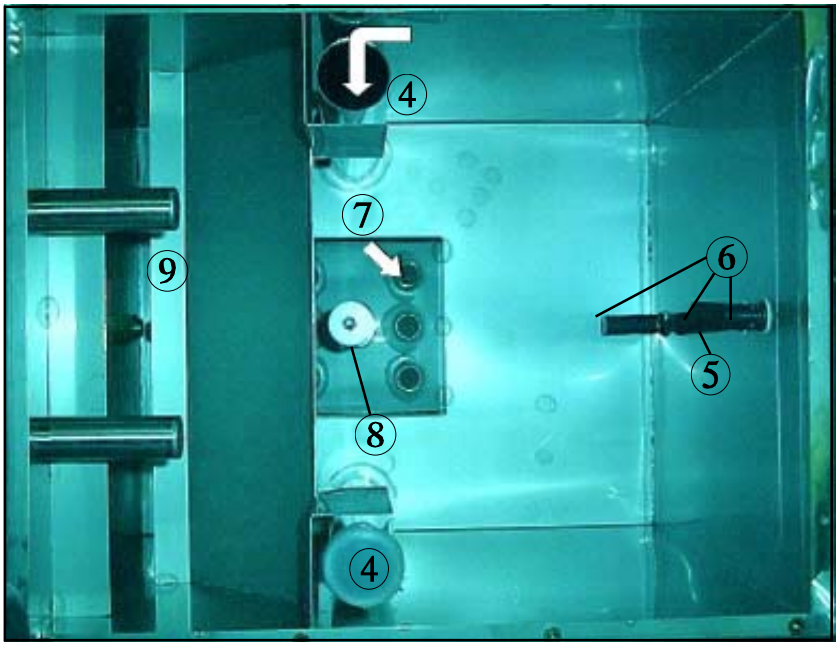
On the pressure outlet of the machine a non-return valve (6) and a pressure accumulator (7) are mounted.



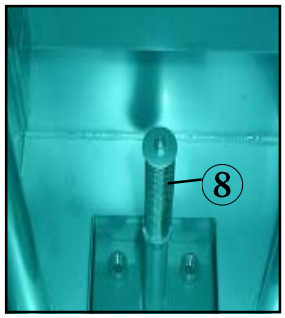



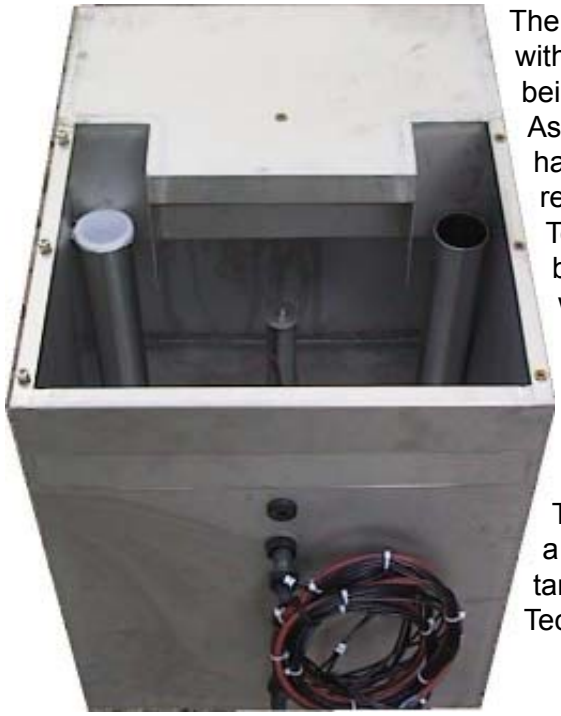
The water tank seen from above and without cover.
On the left side you will see the water inlet with the solenoid valves for hot and cold water respectively.
On the right side you will see the interior of the water tank with the inlet pipes to the left.




(1) Solenoid valve (100 l/min at 1 bar) for cold water
(2) Solenoid valve (135 l/min at 1 bar)) for hot water
(3) Solenoid valve for pressure relief in case of interruption
(4) Overflow, only the posterior valve is open (turning of tank)
(5) Temperature sensor
(6) 3 level switches - the lower for alarm for low water level
(7) 6 suction pipes for the pumps covered by a steel wire netting
(8) Inlet for return water from overflow valve mounted with a steel wire netting.



The water tank has been constructed in accordance with very strict requirements to prevent water from being siphoned from the tank and back into the mains. As these rules do not apply in all countries, the tank has been fitted with knock-out pieces which can be removed if required.

To reduce splashes from the water inlet pipes, the back of the water tank has been screened and fitted with glance off plates. Thus you will also avoid the ingress of air bubbles.

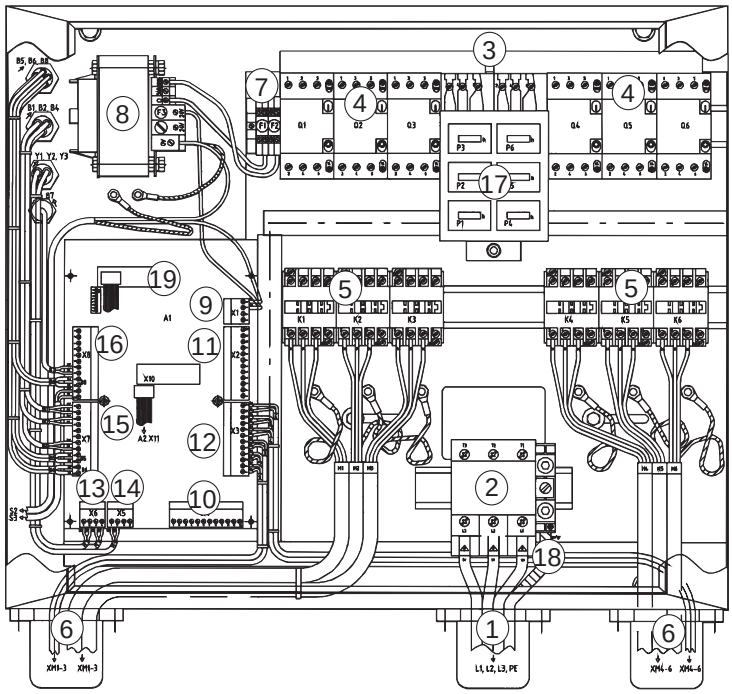
The tank has been prepared for mounting with water inlet in either the left or the right side. Therefore the one of the overflow pipes has been sealed with a plug.

The sucking ports for each pump are protected with a filter screen placed in a hollow at the bottom. The tank has been subjected to a modification (see Technical Information no. 293, page I4).


The power module box is made of stainless steel in accordance with very strict requirements for safety and with a tightness of IP55. This version is mounted with 6 pumps and with the latest version of circuit board (see Technical Information no. 307, page I6).

The power supply cable is lead from the back of the DELTABOOSTER through the cable sleeve (1).

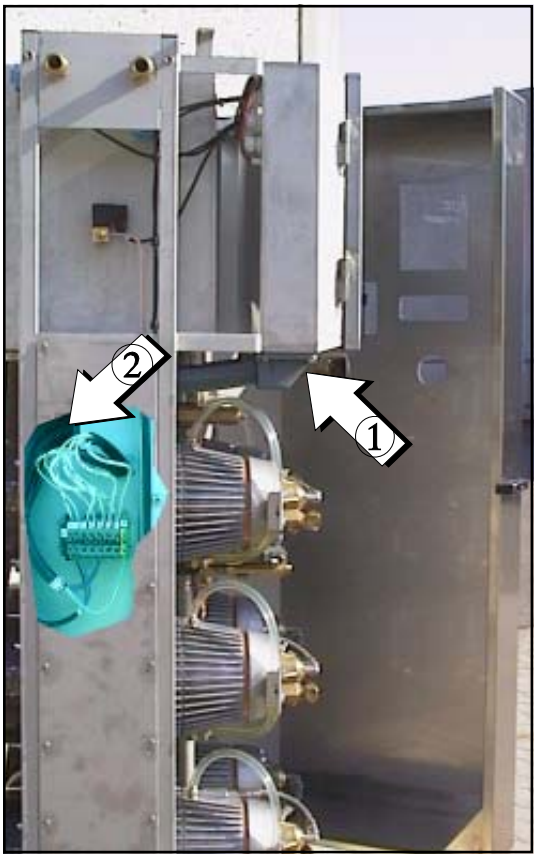
(2) The main switch also works as a lock for the door and is capable of breaking max. 125 amp. Therefore the pre-fuse must not exceed this level. From the main switch the connection is distributed on to (3).
(3) Current limiters, 2 pcs., are automatic safety cut-outs (in case of a short circuit). From here the connection is lead on to (4) by means of the integrated conductor rail.
(4) Overload switches secure each of the motors against overload. Adjusted to the full load current.
(5) The contactors of the motors are motor relays with a 24 volt coil.
(6) The cables for the motors are lead via the left and the right channels to the motor terminals.
(7) Primary fuses F1 F2 for protection of the steering transformer against overload.
(8) Steering transformer 24 volt 10 amp. Note that O is connected to the frame (safety requirement)

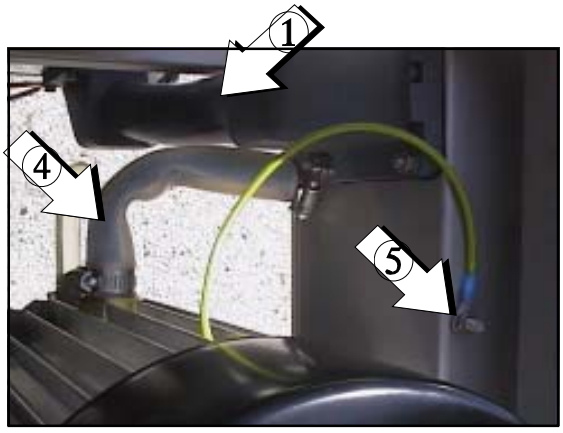


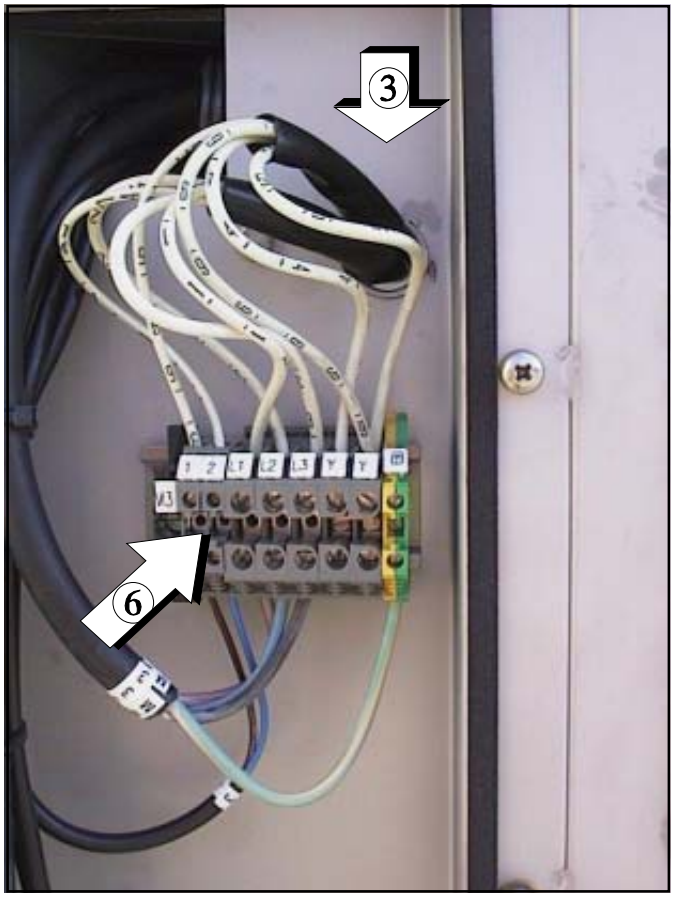

(9) X1. 24 volt supply from the steering transformer via turnable knob on the front door
(10) X4. 24 volt control system for the motor relays (5)
(11) X2. signal lead from the overload switches of the motor (4)
(12) X3. signal lead from the temperature sensors of the motors placed in the windings
(13) X6. 24 volt control current for the solenoid valves for hot and cold inlet water
(14) X5. 24 volt supply to by-pass valve on tank + supply to softener pump
(15) X7. signal lead from level sensors in tank, by-pass switch and pressure switches
(16) X8. 24 volt start signal, level in tank (alarm), temperature sensor in tank
(17) 24 volt hour counters connected to the contactors
(18) earth connection to frame - please note that the whole back plate and the circuit board are connected to the frame
(19) flat cable connection to PCB of lamp for display and PCB of remote control

From the control system the cables are lead to the motors (3) via the panels in the sides, through the cable boxes and the flexible hoses (1) in the left and also the right side.

From the motor the cables are lead to the terminal (6) through a flexible silicone hose (4) which has been made tight by means of hose clamps.



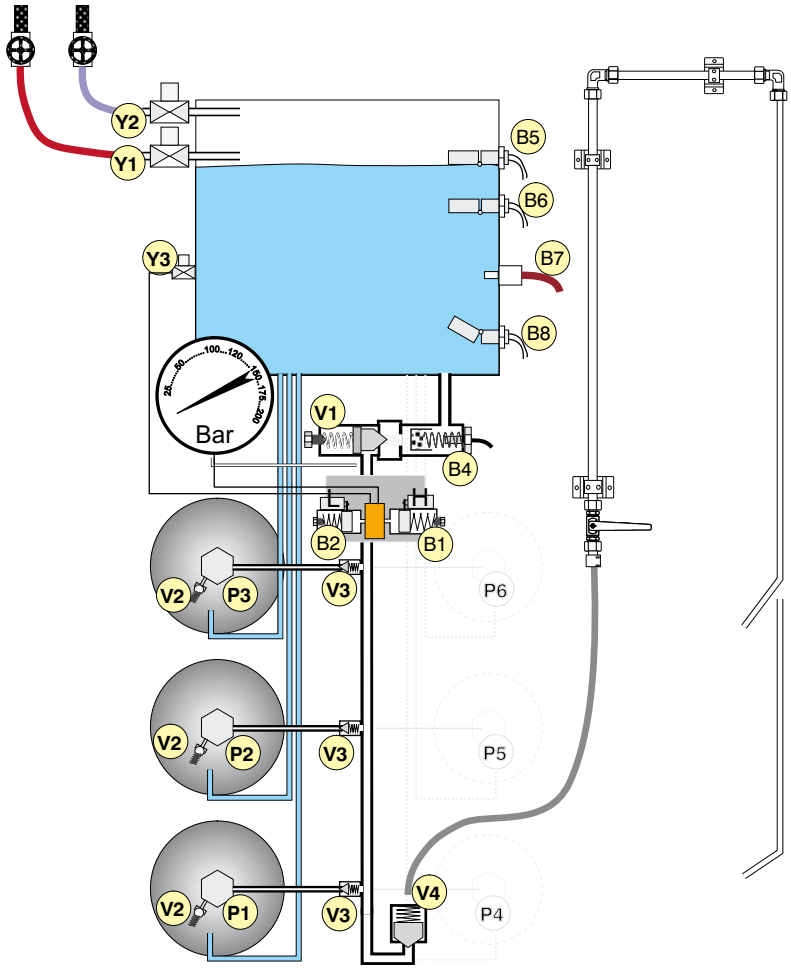




This terminal (6) has been connected in a star with the neutral point in the terminals marked Y.
The terminals 1 and 2 make up the connection for the temperature sensor with the motor cables marked 9 and 14.
(5) The earth/frame connection for the motor.

**Appeal** !
If you find that some information is missing in this section or something is not quite clear, please describe the matter on this page and forward it to TST - fax. +45 7218 2246.

## Disconnected

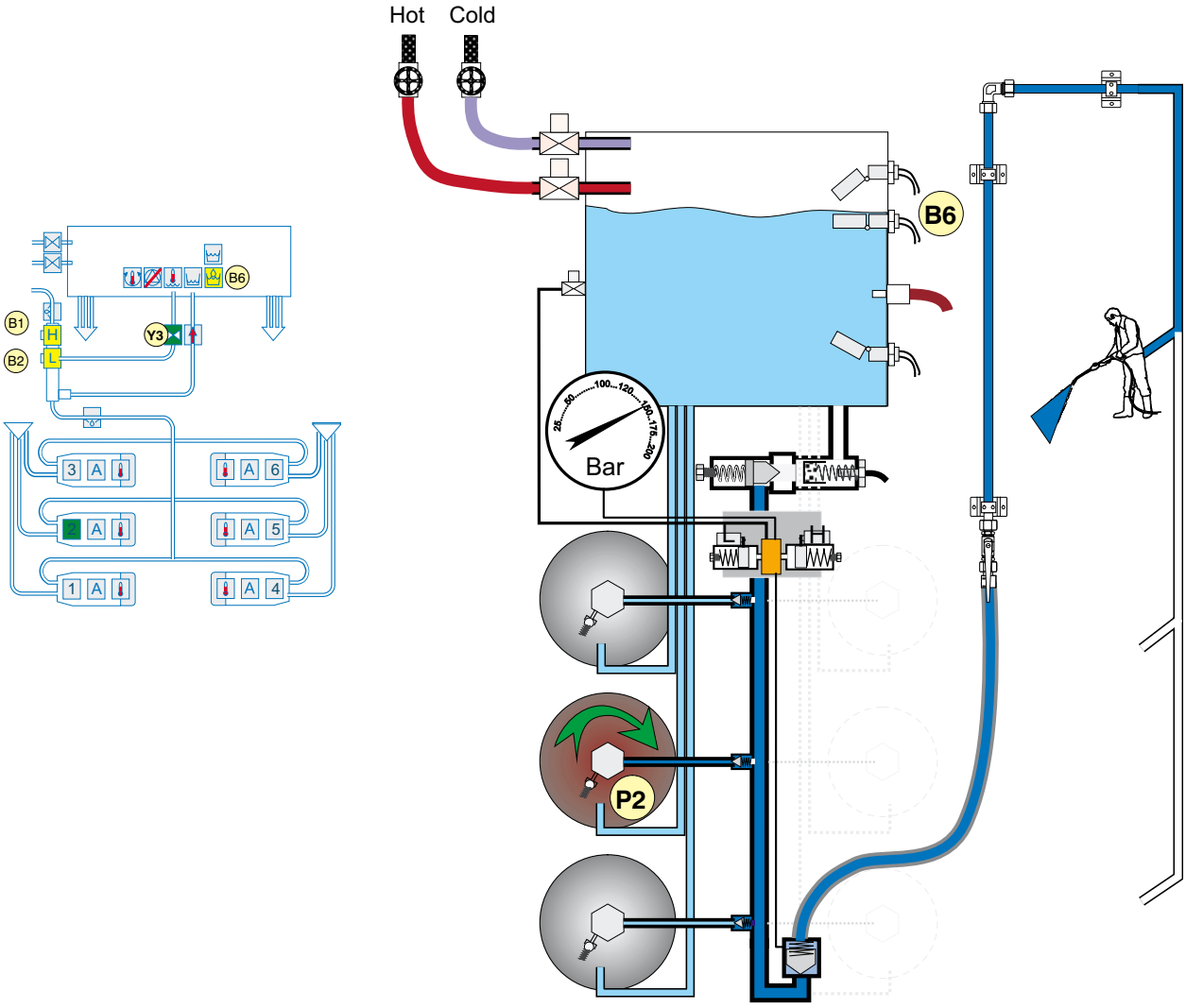
The flow system is illustrated in pressure-relieved disconnected condition. The water tank, however, is full. Of practical reasons only 3 of the pumps appear disticntly. The reference numbers will be used in the rest of the manual. (P1), (P2), and (P3) are the pumps.




(Y1) & (Y2) Solenoid valves for hot and cold water
(Y3) Relief valve, relieves the external pipeline of pressure when the machine is stopped
(B1) & (B2) Pressure switches with high and low adjustment. Primary function: to start up the pumps
(B4) Overflow switch closes when there is a flow. Function: to stop the pumps
(B5) Level switch closes at max. water level. Function: to stop the water inlet.
(B6) Level switch opens when the water level is low. Function: to start the water inlet
(B7) Temperature sensor max./min. temperature. Function: to control Y1 & Y2
(B8) Level switch closes if the water level is extremely low. Function: to stop the machine
(V1) Overflow valve opens at a pressure > the working pressure. Function: to lead water to the water tank
(V2) Safety valve. One on each pump. Opens at working pressure + 40 bar
(V3) Non-return valve. One for each pump. Function: To prevent water flow from other pumps
(V4) Main non-return valve. Function: to protect against backflash and water flow from other plants.

## One User Operation

The machine is in operation and one user works with a standard nozzle of size 006 corresponding to 17.3 l/min. (1038 l/h) or the water volume of one pump.
The water temperature is set at cold, meaning that only the solenoid valve for cold water is activated when there is a requirement for water.

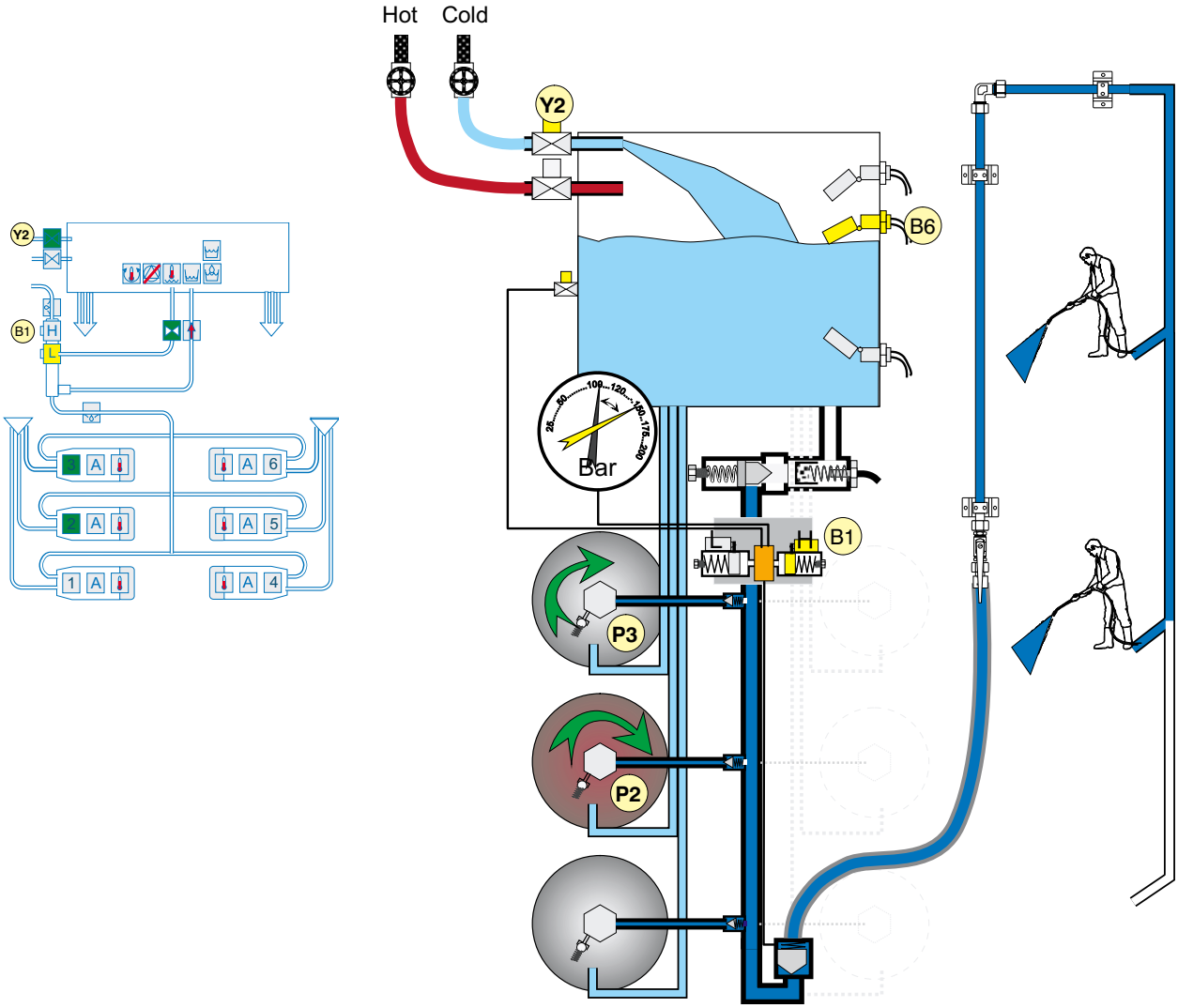



Pump P2 is in operation. The pressure in the system is 160 bar. The water is drawn from the tank and the pump pumps it through the non-return valve into the central pipe, through the main non-return valve and into the system. On the display the two lights of the pressure switches (B1) and (B2) are on, and the light of the pressure relief valve (Y3) signals that the valve is closed.
(B6) indicates that the level in the water tank is not so low that more more water is required. The system is stable.

To be continued on page 3.

## Operation, User No. 2, starts

From the situation on page 2. The water level in the tank is now so low that the (B6) switch opens, the light goes out and thus the solenoid valve Y2 is activated and cold water is lead into the tank. Yet another user with nozzle 006 has started a consumption.



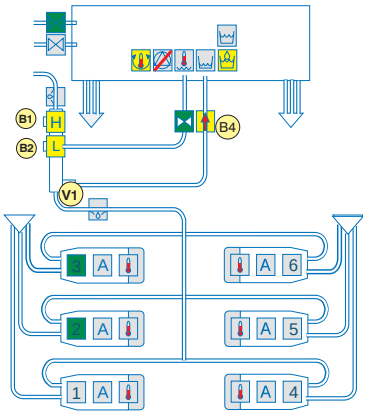

The situation is that (P2) is running, user no. two starts a consumption. Thus the pressure in the systems drops under the adjustment of the pressure switch (B1), the light goes out and gives signal to start the next pump, which - in this case - is pump (P3).
The pressure is re-established. The light of pressure switch (B1) will then turn on and the operation of the system is stable.

To be continued on page 4.

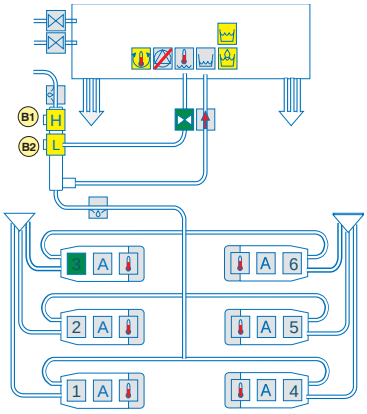
## Operation, User No. 2 stops

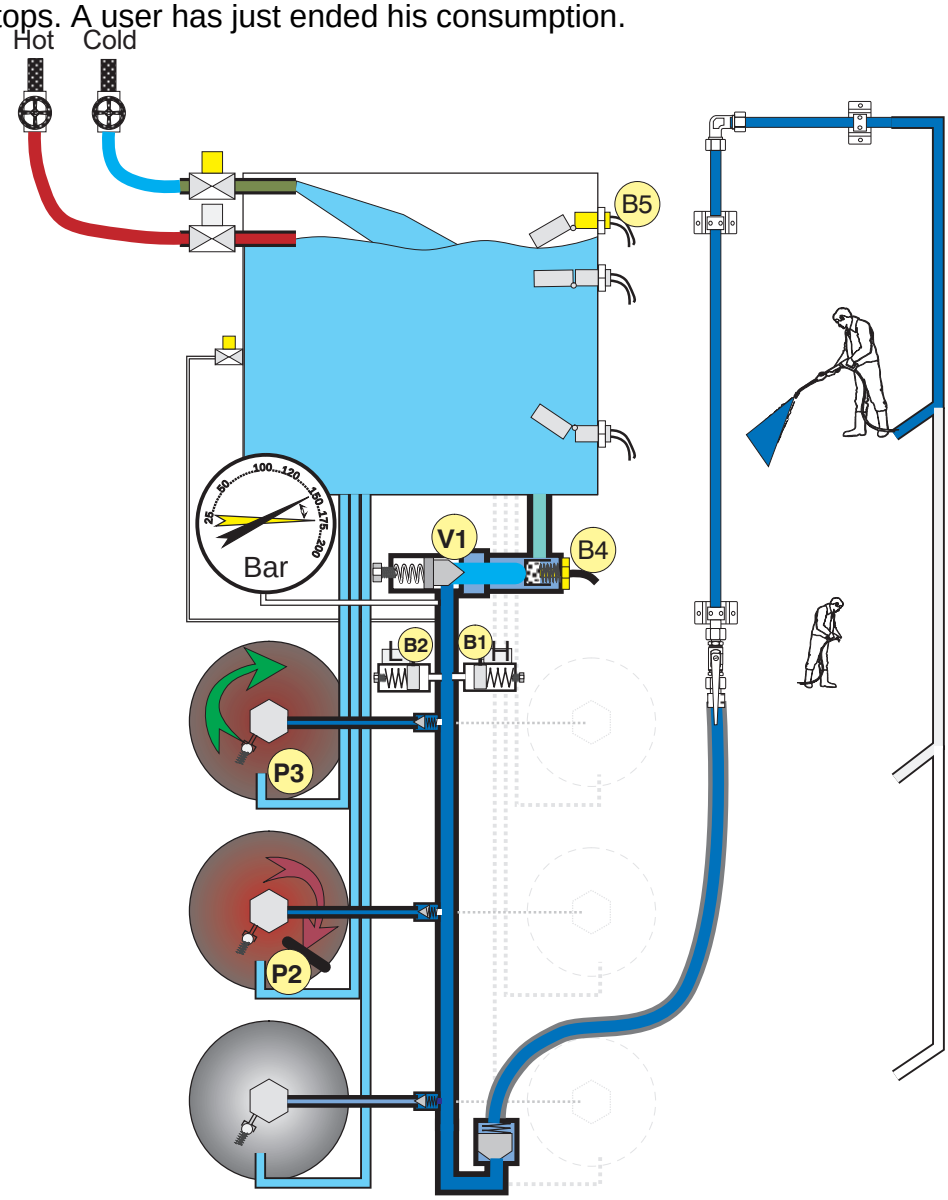
From the situation on page 3.
The water tank is now almost full. At the moment the level switch (B5) closes, the light will turn on and the filling stops. A user has just ended his consumption.

*Unstable*



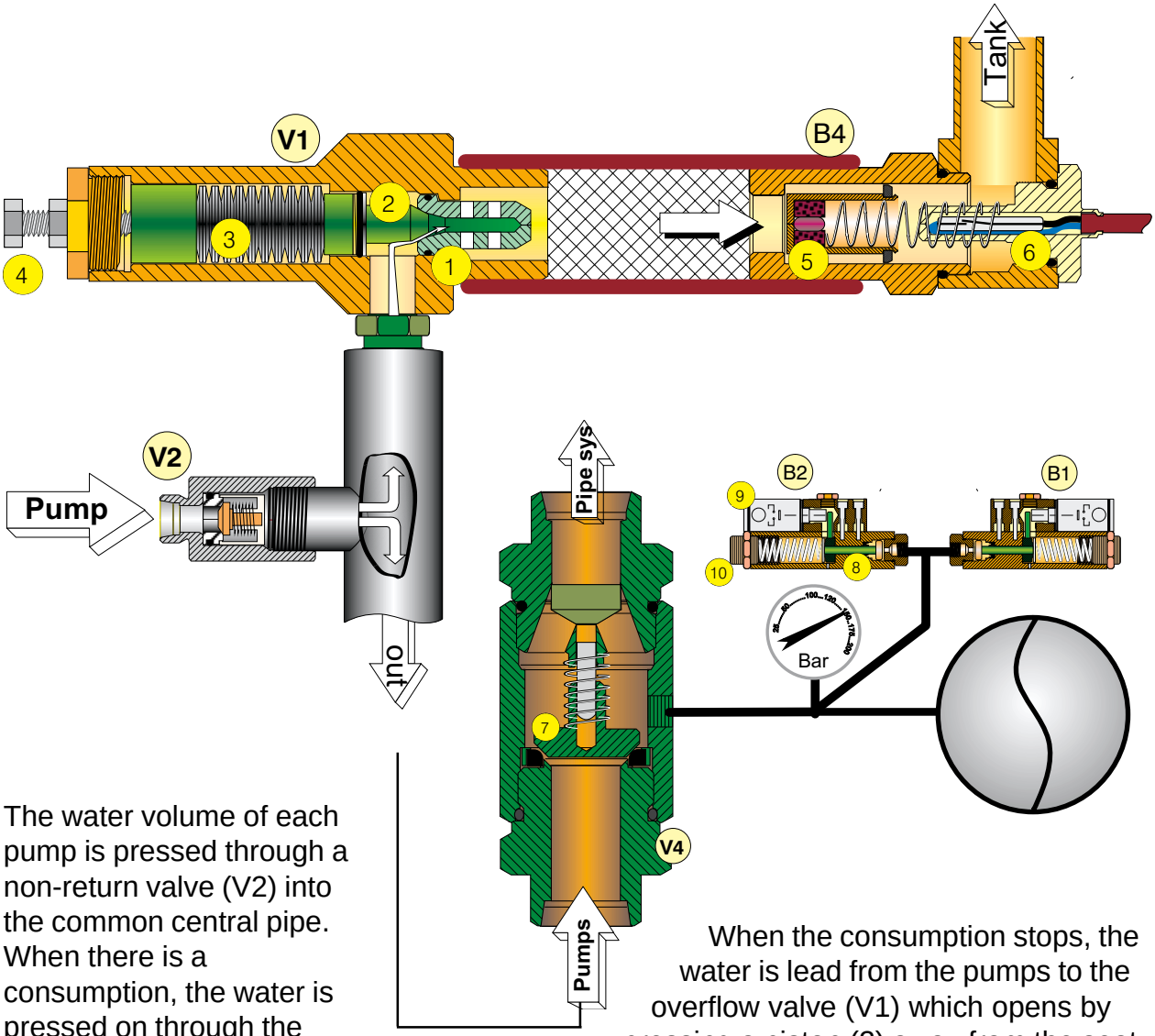

*Stable*




At the moment a user stops, the pressure will increase by approx. 10 bar and the unused water, which in this case is the water volume of one pump, will now be lead back to the water tank through the overflow valve (V1) and the flow valve (B4).
Via a timer (B4) will give signal to stop one pump (P2) which will stop after approx. 15 sec. The stable operation will continue with one user.
When the last user stops the same will happen as described above, and the last pump will stop. Now the machine is standing with pressure (working pressure) ready for operation.
At the moment a user starts a consumption, the pressure will drop to the level of the pressure switch (B2) which is approx. 25 bar as standard. That means that the lights (B1) and (B2) goes out before the start signal to a pump is released, and one pump will start.
If it takes more than approx. 3 sec. to build up the pressure to (B1) level, another pump will be started. This situation often appears in big pipelines or if there is air in the system.

## Valve System

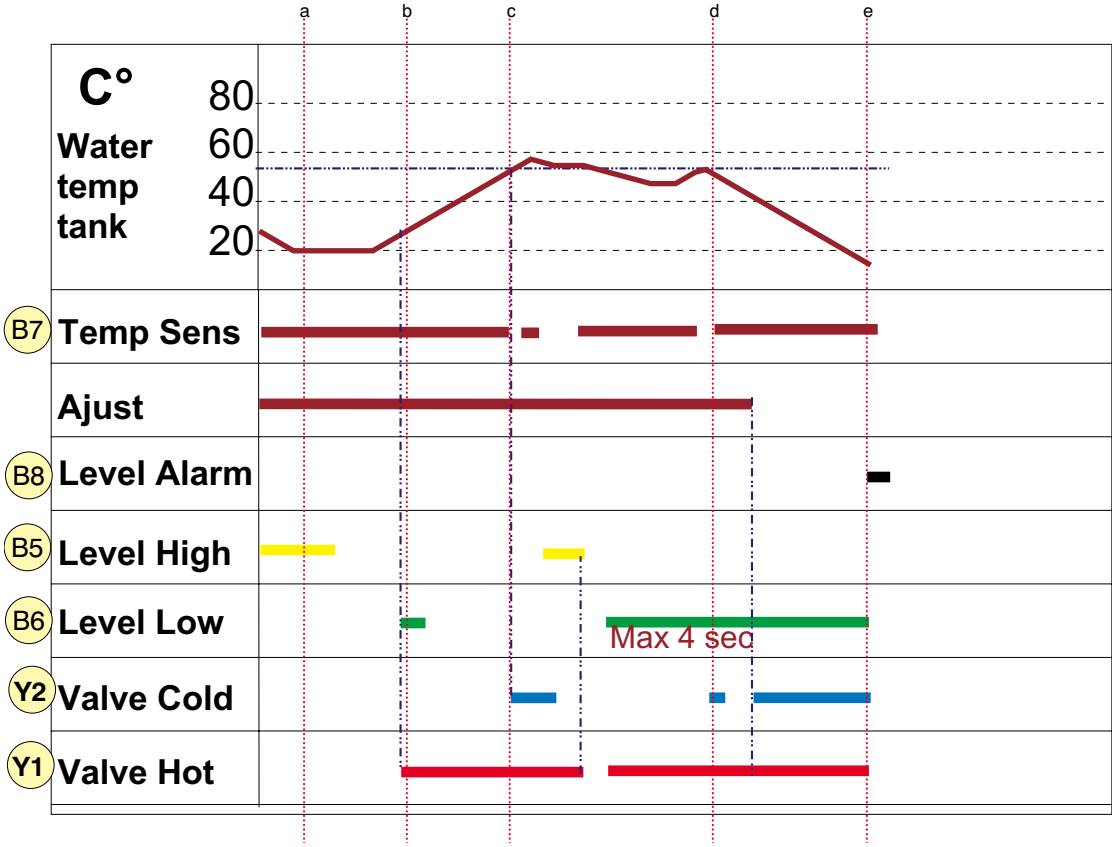



The water volume of each pump is pressed through a non-return valve (V2) into the common central pipe. When there is a consumption, the water is pressed on through the valve flap (7) of the main non-return valve (V4) and into the pipeline outside the machine.
The pressure switches (B1 and B2), pressure gauge and pressure accumulator are connected to the pipeline outside the machine. The pressure switches are identical but differently adjusted with the setting screw (10).
The function is simple. A piston (8) presses against a spring and with an arm on the microswitch (9) which closes at the adjusted pressure.

When the consumption stops, the water is lead from the pumps to the overflow valve (V1) which opens by pressing a piston (2) away from the seat (1) towards the spring washers (3).
The water proceeds into the flow switch (B4) where it presses a piston with a magnet up against a reed-switch which then closes.
The water then runs into the tank and further on as long as the machine is running in by-pass mode.

## Water Tank, Control

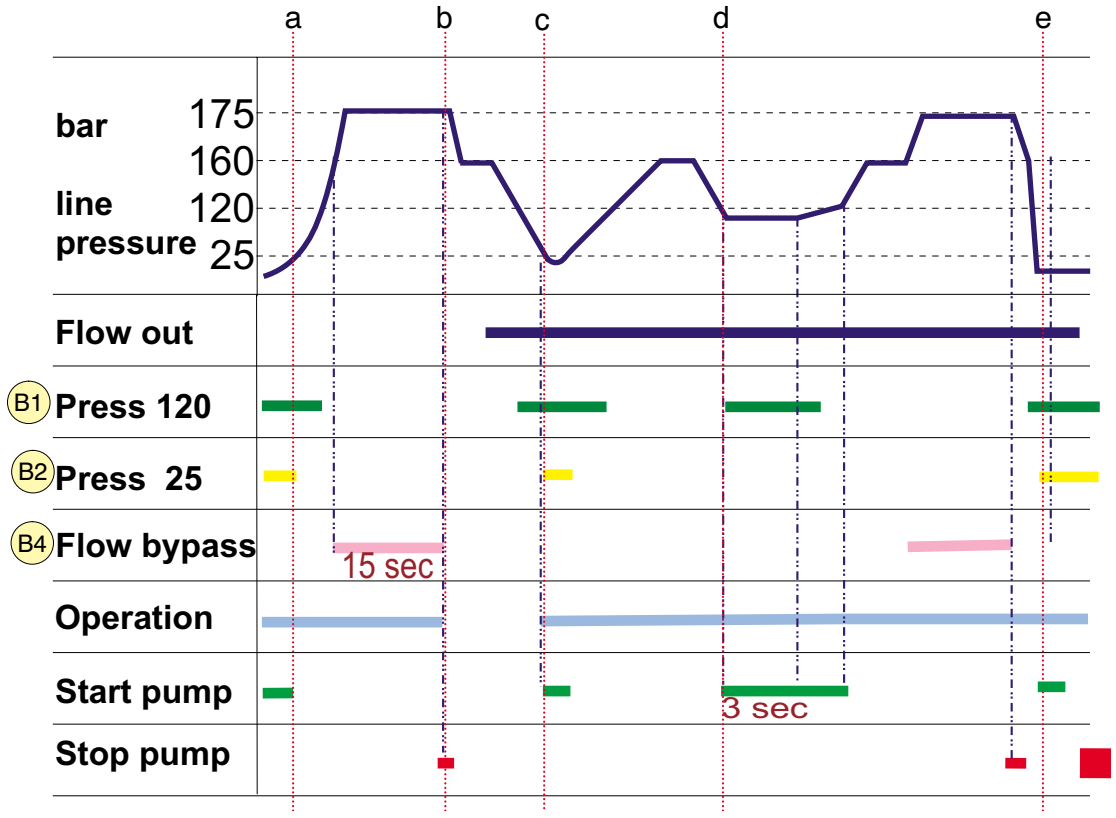
The diagram illustrates the control functions of the water tank in some given situations - a, b, c, d, e.
The water temperature is adjusted to 55°C.
The top curve illustrates the actual temperature of the water tank.
**Temp Sens,** the line indicates that the sensor measures a deviation from the set value.
**Adjust,** the line indicates that the electronics requires an adjustment of the temperature.
**Level Alarm,** the line indicates that the level in the water tank has reached the lowest level (machine stops).
**Level High** , the line indicates that the water tank is full (stop of water intake).
**Level Low,** the line indicates that more water is required (start of water intake).
**Valve Cold**, the line indicates that the solenoid valve with cold water is open.
**Valve Hot**, the line indicates that the solenoid valve with hot water is open.




a: There has been no consumption on the machine, and the temperature has therefore fallen to approx. 20°C. (B5) shows that the water tank is full.
b: A consumption has started. (B6) requires more water. (B7) requires a higher temperature, the adjustment is activated and Y1 opens.
c: The temperature set is reached. (B5) is still not activated, (Y2) gives access to the cold water to stabilize the temperature.
d: (B6) requires more water and (B7) requires hot water. The water supply is unsufficient to fill the tank. After 4 seconds in this condition, the temperature adjustment will be interrupted and (Y1) as well as (Y2) are kept open irrespective of the water temperature (on the display of the machine, the temperature light is on).
e: The water supply is insufficient. (B8) is activated and the machine stopped.

## Pressure Control

The diagram illustrates the pressure regulation system of the machine in some given situations - a, b, c, and e.
The working pressure is 160 bar and the by-pass pressure approx. 175 bar. The curve indicates the system pressure.
**Flow out** - indicates that there is a consumption out of the machine.
**Press 120** - indicates that (B1) is active and requires more pressure.
**Press 25** - indicates that (B2) is active and requires more pressure.
**Flow bypass** - indicates that (B4) is active and requires less water.
**Operation** - indicates that one er more pumps are in operation.
**Start pump** - indicates a requirement from (B1) and/or (B2) to start a pump.
**Stop Pump** - indicates a requirement from (B4) to stop a pump.

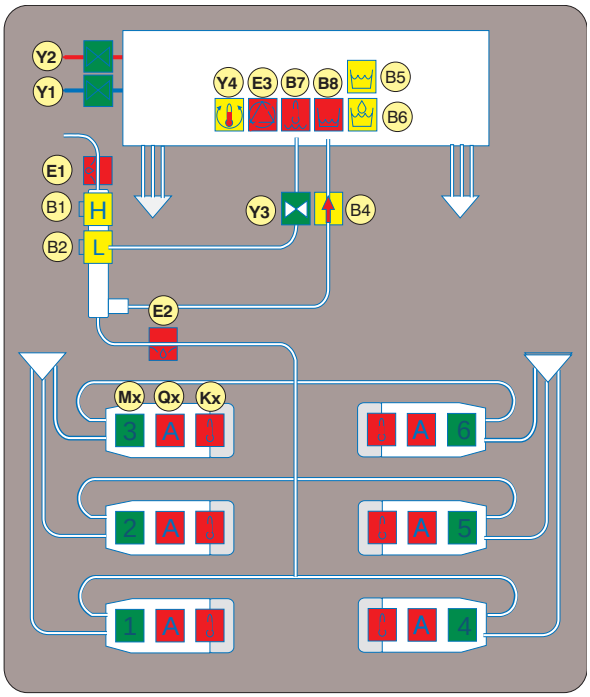



a: The machine has just been started manually and is building up a pressure. If (B2) pressure level (25 bar) is reached within 2 sec., only one pump will start, as in this case. As there is no consumption, the water volume returns from one pump to the tank through (B4). If this condition is kept for 15 sec., a stop signal will be sent to a pump.
b: Machine is now stopped and ready for operation with pressure in the whole system (working pressure).
c: A consumption has started and as the pressure falls to (B2) level, a signal for start is sent to a pump which increases the pressure to working pressure (160 bar).
d: Yet another user has started a consumption. The pressure goes down under (B1) level (120 bar). (B1) becomes active and sends a signal to start one more pump. If the pressure is not increased over (B1) level within 3 sec. another pump will start.
e: An extremely heavy consumption has started (pipe burst). The pressure falls below (B2) level. All pumps stop one by one. If the pressure does not rise to a level over (B2) within 25 sec., the whole plant will stop and indicate a fault condition.

## Display

The control panel has been built-up as a schematic drawing of the DELTABOOSTER. A number of warning lamps indicate the operational condition of the plant and any fault situations. The warning lamps are divided into three categories:

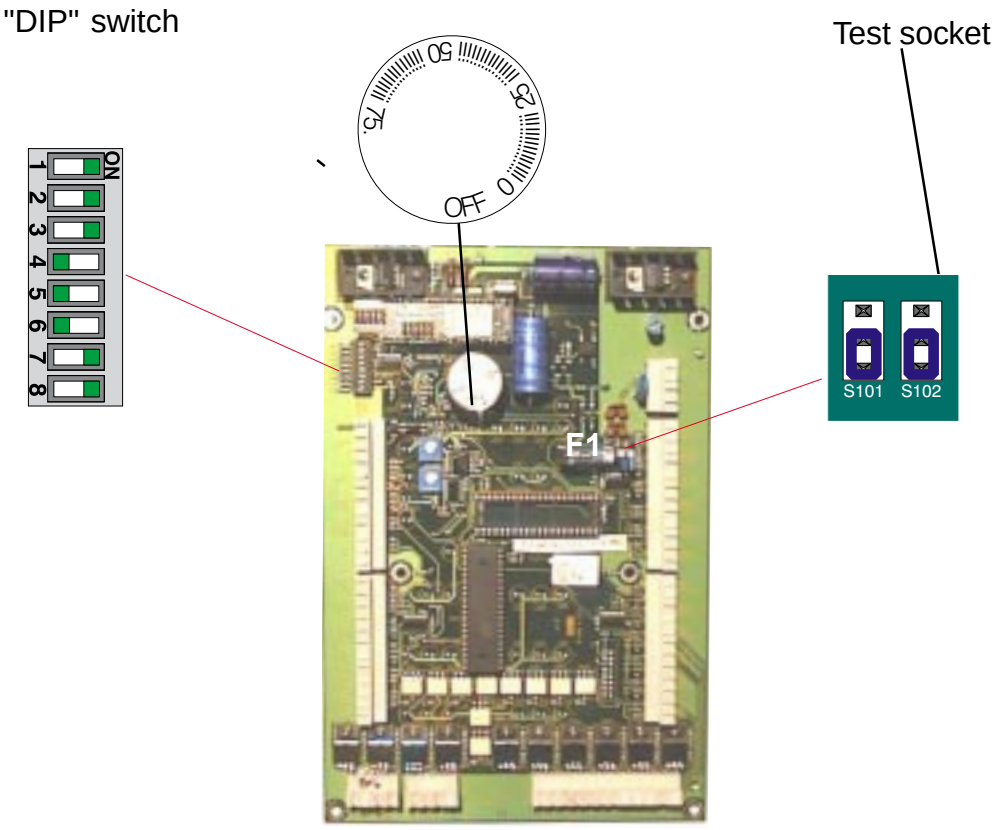
Green: indicates a motor or a valve in operation.
Yellow: indicates an activated sensor (pressure switch, flow switch, level switch).
Red: indicates a serious fault (leakage, overheating, low water level).




If a fault arises, the concerned red light will turn on and the plant stop. The status of the opereational condition of the machine at the moment the fault arised will be kept until the current is switched off. Faults on the individual pumps can be by-passed so that the other pumps can continue their operation. This is achieved by stopping and re-starting the machine.

Y1 and Y2 turn on when the cold/hot water inlet is open.
Y3 turns on when the relief valve is closed.
E1 and E2 turn on if there is a leakage on the system.
B1 and B2 turn on when the pressure is higher than the setting point of the pressure switches.
B4 turns on when the flow switches registrate a return of water to tank (over 10 l/min.).
Y4 turns on when the temperature adjustment is on. Flashes if the water supply is insufficient.
E3 turns on in case of an illegal sensor combination. Example: B1 turn on but not B2 (see diagram on page C10).
B7 turns on if the temperature of the water in the water tank is too high, max. 80°C.
B8 turns on if the water level is too low.
B5 and B6 turn on if the water level is either too high or too low.
Mx turns on when the motor pump is in operation.
Qx turns on in the case of an overload or phase breaking (motor protection disconnects).
Kx turns on if the temperature in the windings is too high (over 160°C).

## Printed Circuit Board




The configuration of the DELTABOOSTER is set at the control with an eight-pole DIP-switch. This position applies to a 3-pump plant.
The switches 1-6 are set at ON if the DELTABOOSTER has 6 pumps.
The switches 7 and 8 are for the linking of one er more plants (see Linking on page I2).
On single machines both switches are set at ON.

Temperature adjustment (water temperature in tank). The turnable knob can either be set at OFF (click) as shown with the scale facing downwards, or at the required temperature.

For testing of the lamp function and the output signals, a 3-pin plug S 102 has been placed on the printed circuit board. By moving the socket to the upper 2 pins, the circuit board makes a self-test. At first the lights go on one by one at an interval of 1 second. Then Y1, Y1 and Y3 and each motor is activated one by one.
Note: Do not forget to turn off the water supply, as there will be a risk of overflow.

The fuse (F1) on the circuit board is for protection against fire. If this fuse blows, the circuit board has become defective.

## Working Diagram

The diagram illustrates the various situations that theoretically may arise.

| Con-dition | B4 By-pass switch | Pump operation | B2 Pres. (low) | B1 Pres. (high) | Status | Delay Sec. | Function |
|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | Start signal | 0 ,1 | Manual start pump |
| 1 | 0 | 1 | 0 | 1 | Illegal | 15 | Stop plant (fault) |
| 2 | 0 | 1 | 1 | 0 | Consump-tion | 2 | Start pumps |
| 3 | 0 | 1 | 1 | 1 | Consump-tion | 15 | Operation stable |
| 4 | 0 | 1 | 0 | 0 | Leakage | 25 | Stop plant (fault) |
| 5 | 1 | 0 | 0 | 0 | Illegal | 15 | Stop plant (fault) |
| 6 | 1 | 0 | 0 | 1 | Illegal | 15 | Stop plant (fault) |
| 7 | 1 | 0 | 1 | 0 | Illegal | 15 | Stop plant (fault) |
| 8 | 1 | 0 | 1 | 1 | Illegal | 15 | Stop plant (fault) |
| 9 | 1 | 1 | 0 | 1 | Illegal | 15 | Stop plant (fault) |
| 10 | 1 | 1 | 1 | 0 | Illegal | 15 | Stop plant (fault) |
| 11 | 1 | 1 | 1 | 1 | By-pass | 15 | Stop one pump |

As an example condition 4 illustrates: Pump operation (one or more pumps in operation). B1 and B2 are not activated, meaning that the pressure is lower than 25 bar and there is no by-passing. Thus there will be no outlet of water from the system and there must be a leakage. The plant will be stopped after 25 seconds in this condition.
Condition 10 illustrates that water is by-passing, a pump is in operation and there is a system pressure of at least 25 bar. This is only possible if the overflow valve V1 is adjusted lower than B1, i.e. an illegal situation.

**Appeal** !
If you find that some information is missing in this section or something is not quite clear, please describe the matter on this page and forward it to TST - fax. +45 7218 2246.

## Functional Requirements

To ensure a problem-free operation, the following requirements must be fulfilled:

1. Machine and pipeline must be free of air and tight.
2. The water temperature must not exceed 80°C.
3. The water must be without any impurities as for instance running sands > 50 µ.
4. The water supply must always be sufficient.
5. The ambient temperature must not exceed 40°C.
6. Variations in the mains voltage must be max. ±10% of the rated value.

If the above-mentioned requirements are met, it must be possible, at any time, to tap off 17 l/min. x the number of pumps under a steady pressure of 160 bar (120 bar in the case of reduced plants) on a pipeline connected to a DELTABOOSTER and equipped with original standard nozzles.

If these requirements are met and you still experience operational break-downs, there are faults on the system.

# Trouble-shooting



## Starting-up Problems

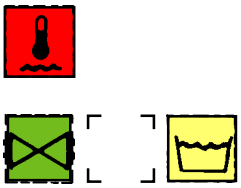
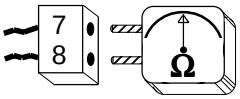
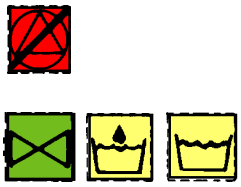
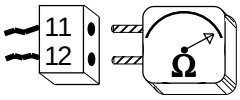
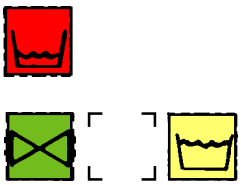
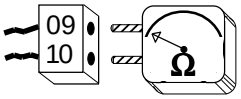
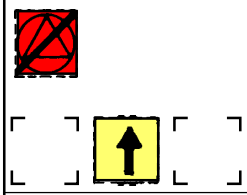
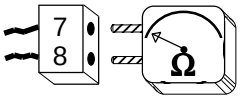
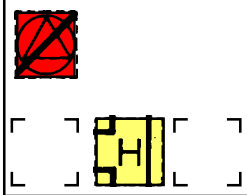
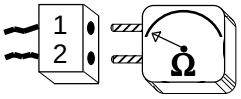
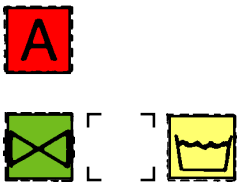
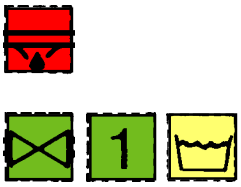
The first time a DELTABOOSTER is started up, either because it is a new plant or because it has undergone some changes or a repair, the following typical faults may occour:

| | | |
|---|---|---|
| Symptom: | No light in the display. The machine does not react to a starting signal. | Check the mains voltage by manually pressing a motor switch. |
| Reason 1: | No voltage for the machine. | Check the mains voltage by manually pressing a motor switch.<br>Check fuses F1 and F2. |
| Reason 2: | 24 volt from transformer missing. | Check fuse F3 on transformer. |
| Symptom | Light in display is OK. Machine does not react to a starting signal. | Check microswitch on circuit board (see section C page 9). |

| | | |
|---|---|---|
| Symptom: | The pumps shake and make a noise.<br>The pressure is too low and fluctuating. | Stop the machine immediately. |
| Reason 1: | Air in the pumps. | Turn on the water tap, loosen the venting screws of the pumps, start the machine (you may subject the plant to the test programme in section C page 9). |
| Reason 2: | Dirt in the suction valves or pressure valves. | Clean the valves and check that the filter in the tank is positioned correctly. |

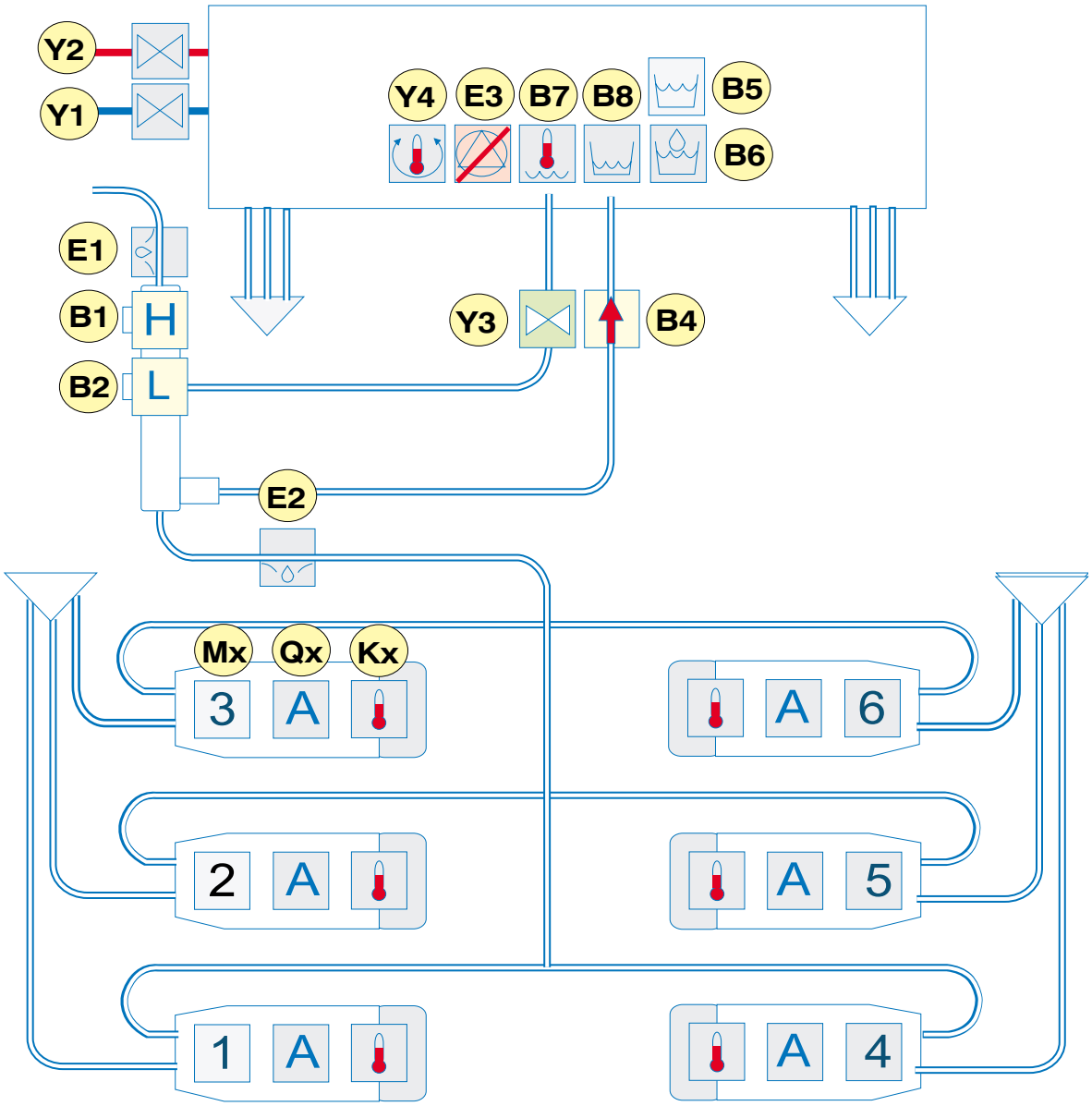
| | | |
|---|---|---|
| Symptom: | 4 or more pumps start up. | Check that all taps are closed.<br>It may be necessary to close the main valve. |
| Reason 1: | Air in the pipeline. | Vent the whole pipeline. |
| Reason 2: | There are disproportionately many, long hoses connected. | Reduce the number of connected hoses to a minimum. |

## Starting-up Problems

| Red light turns on - machine does not start up | | |
|---|---|---|
| **Symptom** | **Reason** | **Check** |
|  | Temperature in tank > 80°C<br>Temperature sensor B7 defective/ short-circuited/ interrupted | Disconnect plug X8 from circuit board A1<br>  <br>See technical data, page A7 |
|  | Level switch in B6 or connection defective/interrupted/sticks. | Disconnect plug X7 from circuit board<br>In case of a full tank, B6 must be connected.<br>  <br>See page C1 |
|  | Level switch B8 or connection defective/short-circuited/blocked/placed wrongly. | Disconnect plug X8 from circuit board<br>In case of a full tank, B8 must be disconnected.<br>  <br>See page C1 |
|  | Overflow switch B4 or connection defective/short-circuited/stuck. | Disconnect plug X7 from circuit board.<br>OK if connection broken off.<br>  <br>Overflow switch - see page E11 |
|  | Pressure switch (HP) B1 or supply lines short-circuited/stuck. | Disconnect plug X7 from circuit board.<br>In pressure-relieved condition, broken connection must appear.<br>  <br>Pressure switch - see page E13 |
|  | Motor protection Q1 disconnected.<br>Voltage too low. Motor short-circuited.<br>Motor missing phase.<br>Motor protection adjusted too low. | Adjustment according to model tag.<br>Measurement of insulations and winding resistance<br><br>See page F4 |
|  | Water leakage | |

## Interruption of Operation

**Display-status**
Re-start not possible: See “Starting-up problems”.
Re-start possible: If the plant stops during operation, the status of various signal lamps will be stored on the display for function indication so that the reason of the stop can be reconstructed.
Therefore it is of a great help to note this status before trying to re-start the plant. When attempting to re-start the plant, the status will be deleted.
Please make a copy of this page, place the copy over the display of the machine and tick off the illuminated lamps. Send the fax page to your nearest technical supporter.




Pressure gauge, bar: _____ Steady _____ Falling _____

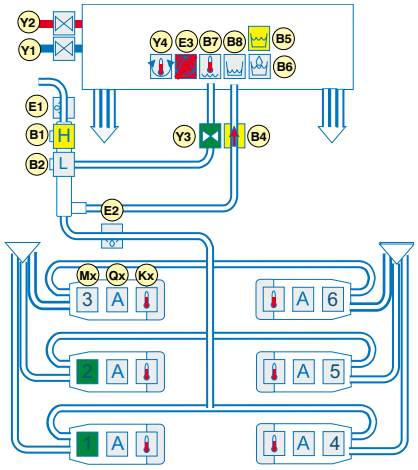
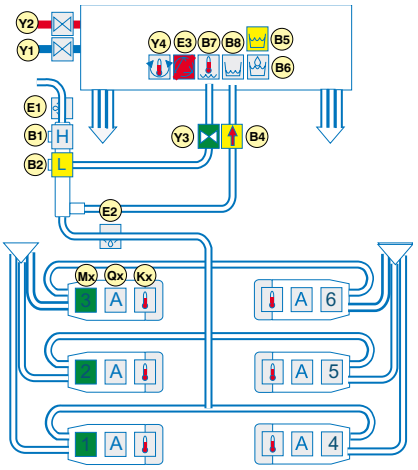
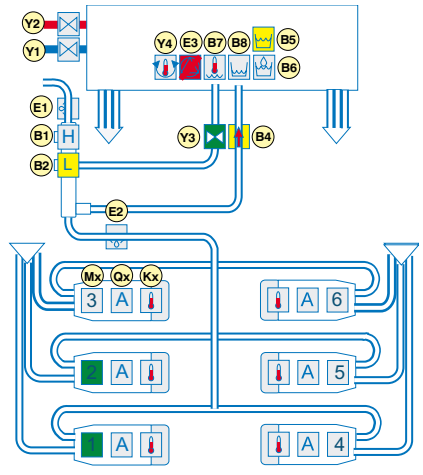
Comments: _____

_____

Sender: _____

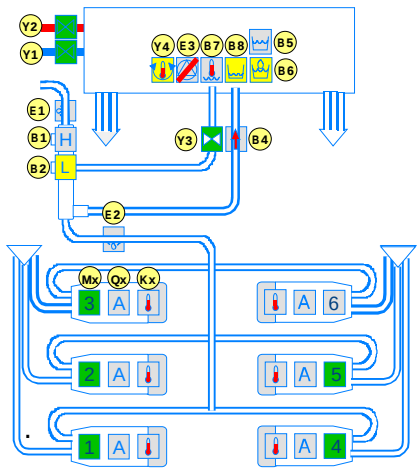
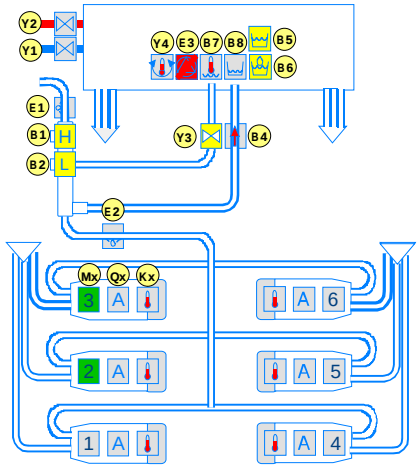
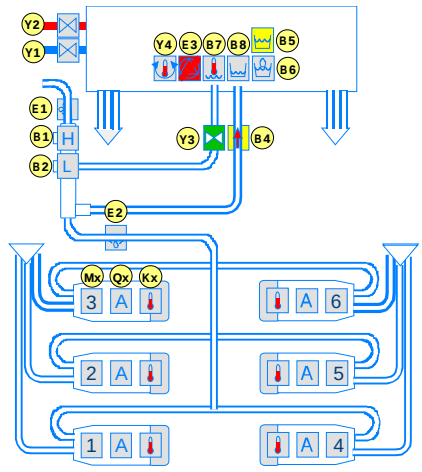
## Interruption of Operation

Symptom: The machine stops shortly after start and display illustrates status.
The examples below may vary from the actual status of the machine, as for instance the number of pumps in operation.

| Status | Reason | Repair |
|---|---|---|
|  | Pressure switch (LP) B2 out of operation | Disassemble, clean and lubricate pressure switch B2.<br><br>Check cable connection.<br><br>Replace microswitch.<br><br>See page E13. |
|  | Pressure switch (HP) B1 defective or adjusted too high | Adjust N1<br>See page F2<br><br>Check/replace sleeve<br>See page E13 |
|  | Overflow valve V1 defective<br><br>Cone sticks | Disassemble, clean, and lubricate valve V1.<br><br>Check water tank and suction hoses for impurities/scale deposits.<br><br>If necessary, descale<br><br>If necessary, replace suction hoses. |

## Interruption of Operation

Symptom: The machine stops shortly after start and display illustrates status.
The examples below may vary from the status of the actual machine, as for instance the number of pumps.

| Status | Reason | Repair |
|---|---|---|
|  | Water deficiency<br><br>Filter clogged up<br><br>Solenoid valve defective | Check water pressure.<br><br>Clean the filters.<br><br>Check that both valves open.<br><br>See page F1 |
|  | Level switch B5 sticks or has short-circuited. | Check level switch. |
|  | Overflow switch | Disassemble, clean, descale and check reedswitch<br><br>See page E12 |

## Pump Pressure Low

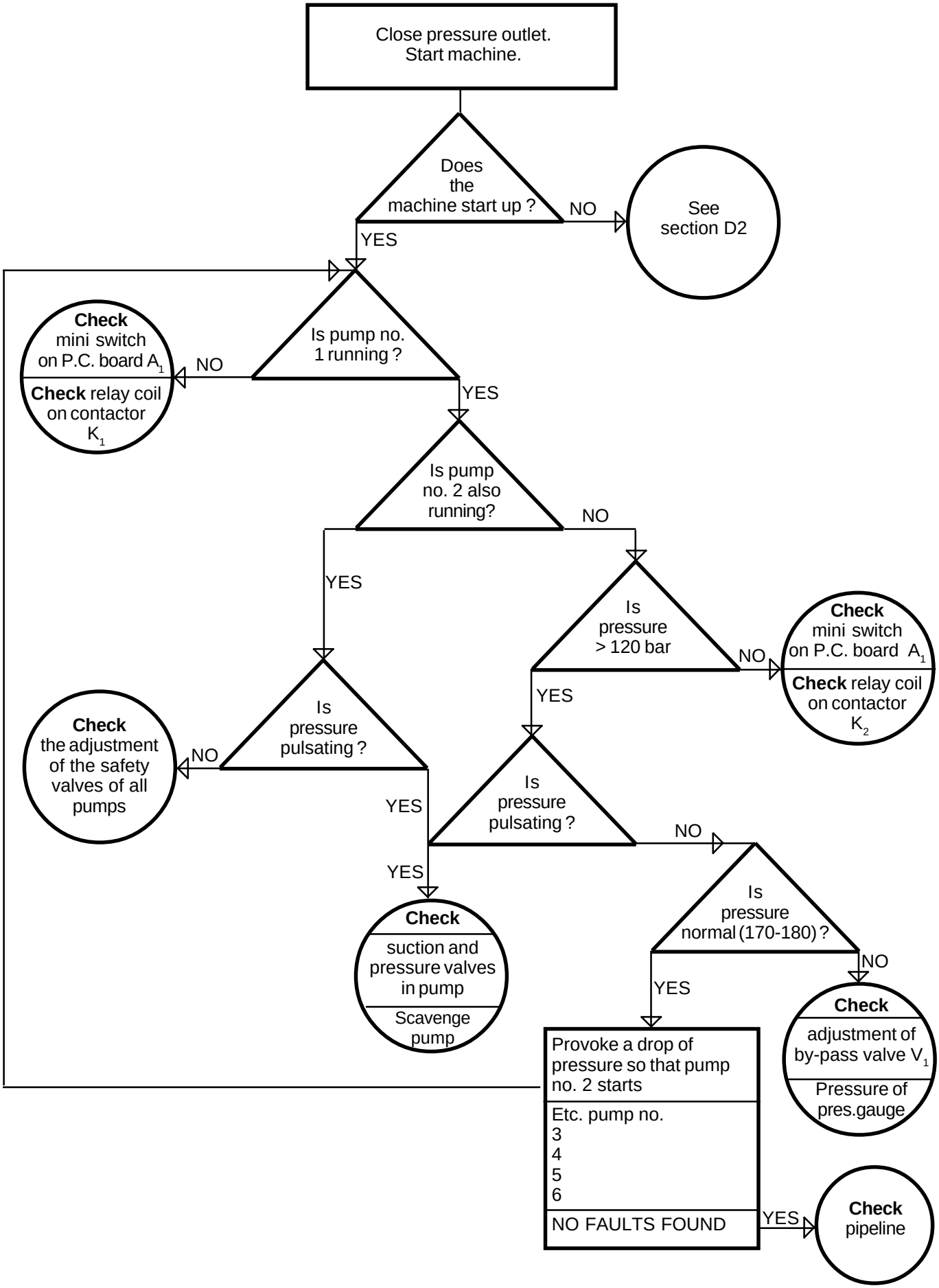
The reason why the pump pressure is too low may have been one of the following:

1. The number of nozzles in use exceeds the pump capacity, or the nozzles used may be worn.
2. Pipeline narrowed due to scale or dirt.
3. Pre-nozzle of multipressure spray lance clogged up.
4. Pipeline leaky.
5. A pump does not run.
6. Safety valve V2 of pump adjusted too low or defective.
7. Overflow valve V1 adjusted too low, worn or clogged up.
8. Suction and/or pressure valves worn or clogged up.
9. Pressure sleeves worn.
10. Air in the pump.

For the encirclement of the fault reason, the following diagram can be used.

The plant is a 160 bar plant. In the case of a 120 bar plant, proportionally lower values apply.

**Pump Pressure too Low**



## Printed Circuit Coard

### Fault in the electrical control system

Interruptions of operation where the fault cannot be assigned to the previous pages 1 to 9 may be due to faults in the electrical control system, the circuit board.

The printed circuit board is protected against an overloading by means of a fuse F4, which has been placed on the P.C. board. If this fuse blows more than once, the P.C. board must be considered to be defective.

For protection of the outlet X4 to motor relays, X5 for the softener pump + relief valve and X6 for the solenoid valves, hot and cold, fuse F3 has been placed on the secondary side of the transformer in the upper part of EPM. If this fuse blows too, when the plugs X4-X5-X6 are dismounted, the P.C. board must be considered to be defective. If not, check various connections.
See section F page 4.

# Trouble-shooting

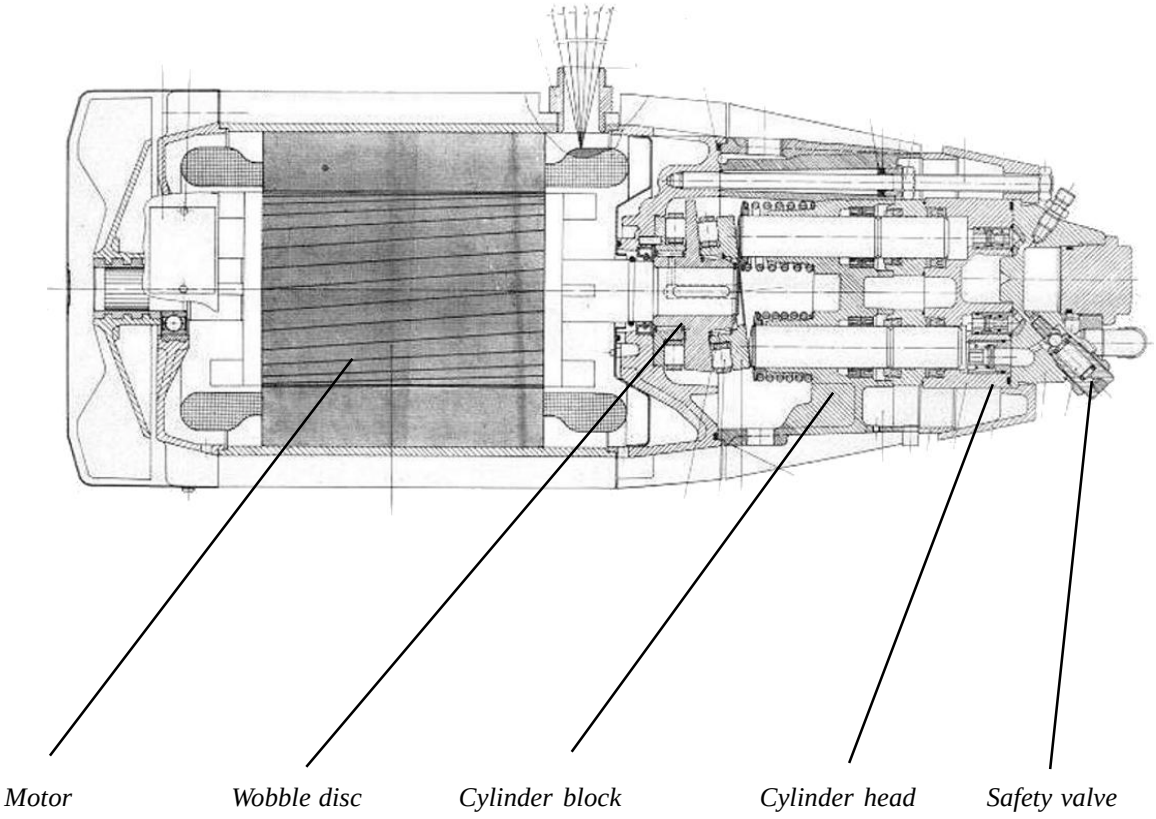


**Appeal** !
If you find that some information is missing in this section or something is not quite clear, please describe the matter on this page and forward it to TST - fax. +45 7218 2246.

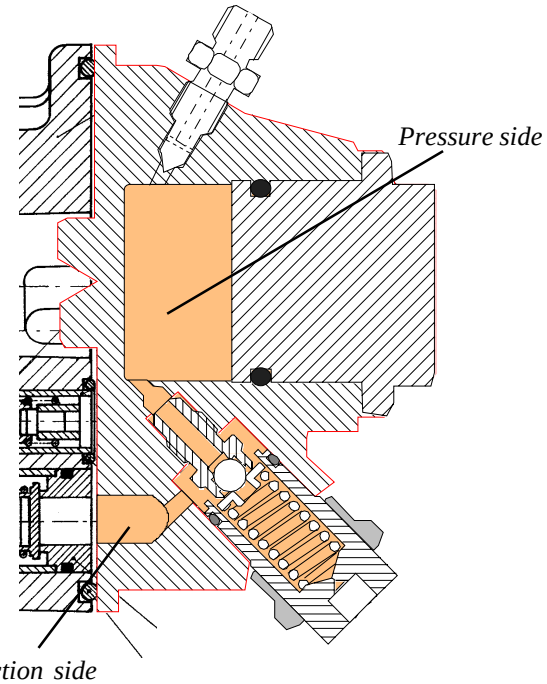
## Repair Times

| Page | Contents | Service time / 6 pumps |
|---|---|---|
| E3 | Safety valve | 1 hour |
| E4-5 | Valve cylinder head | 2 hours |
| E6-7 | Cylinder block | 2.5 hours |
| E8-9 | Wobble disc / motor | 3 hours |
| E11 | Overflow valve V1 | ½ hour |
| E12 | Overflow switch B4 | ½ hour |
| E13 | Pressure switches B1/B2 | ½ hour |
| F1 | Starting-up of plant | 1 hour |
| F2 | Basic adjustment | 1 hour |
| F3 | Regulating down | 1½ hour |
| F4 | Electric test | 1½ hour |

## Survey



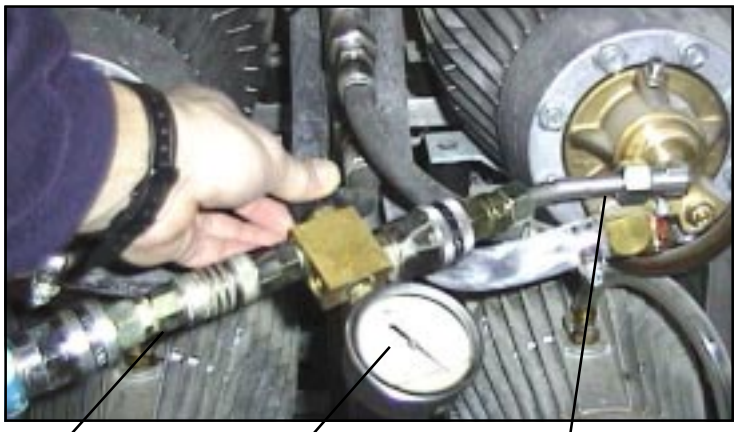
## Safety Valve




At the factory the safety valve has been set at opening pressure = working pressure + 50 bar.
When checking-up the machine the adjustment should be checked and maybe adjusted.
When mounting, use grease to make the ball and the thrust plate stick to the spring.
The seat is screwed on by a 10 mm box spanner (no gasket required).
Before testing with a pressure gauge, you should make sure that 2 threads are visible behind the lock nut.
Disconnect the other motors on the motor protection.
NOTE: Before starting up the pump, ensure that the valve of the test pressure gauge is open. Slowly close the valve. Never exceed 250 bar.

*10 mm special key no:1206754*

*6 mm hexagon box wrench*

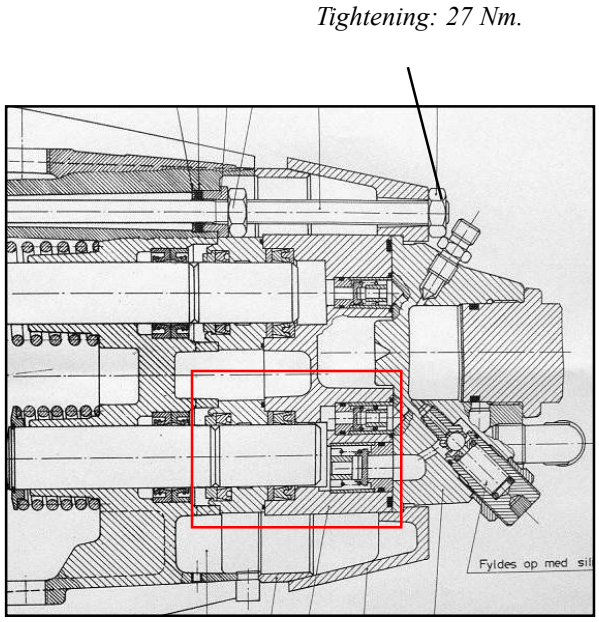


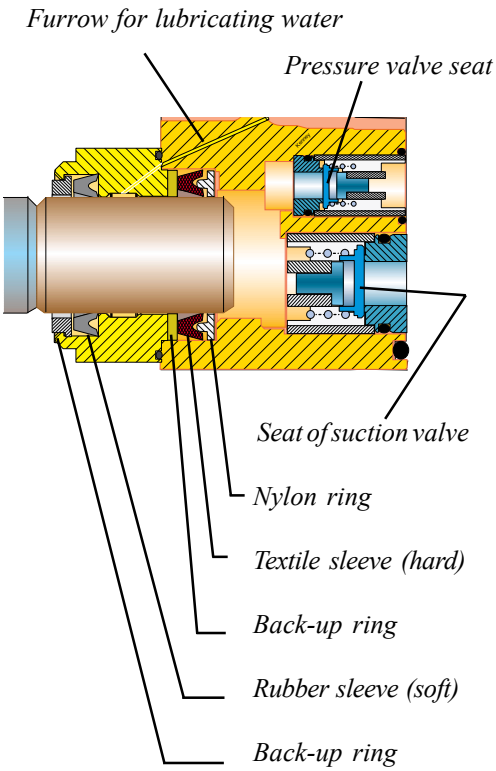
*Adaptor no:1220126*

*Test pressure gauge no:1206358*

*Test tube no: 1211994*

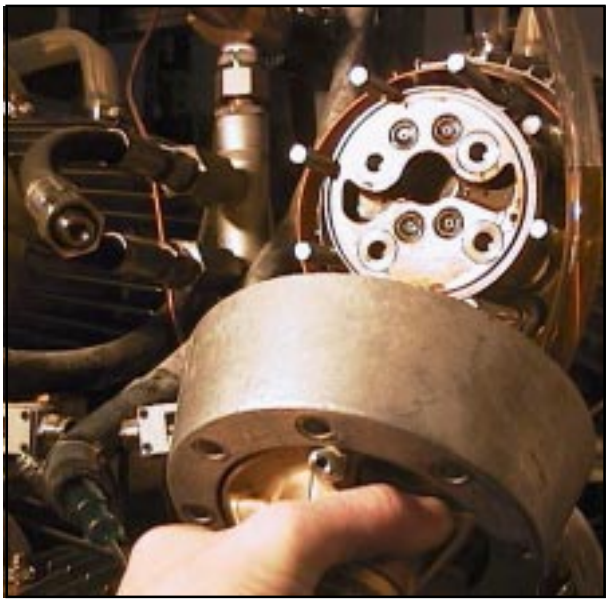
## Cylinder Head 1

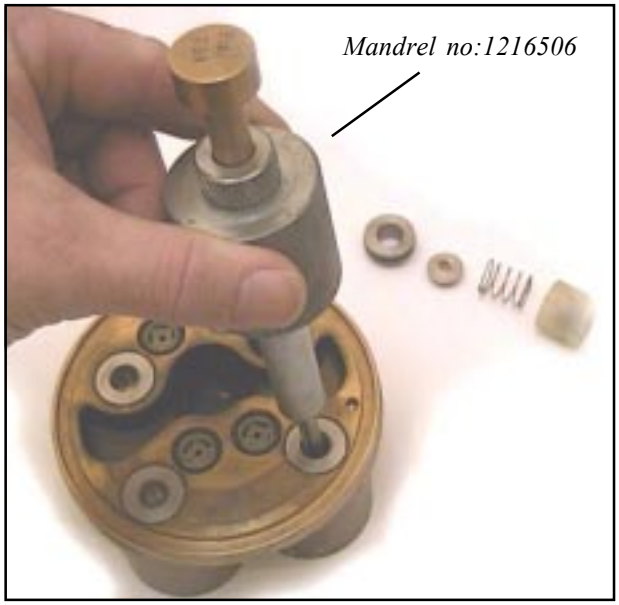


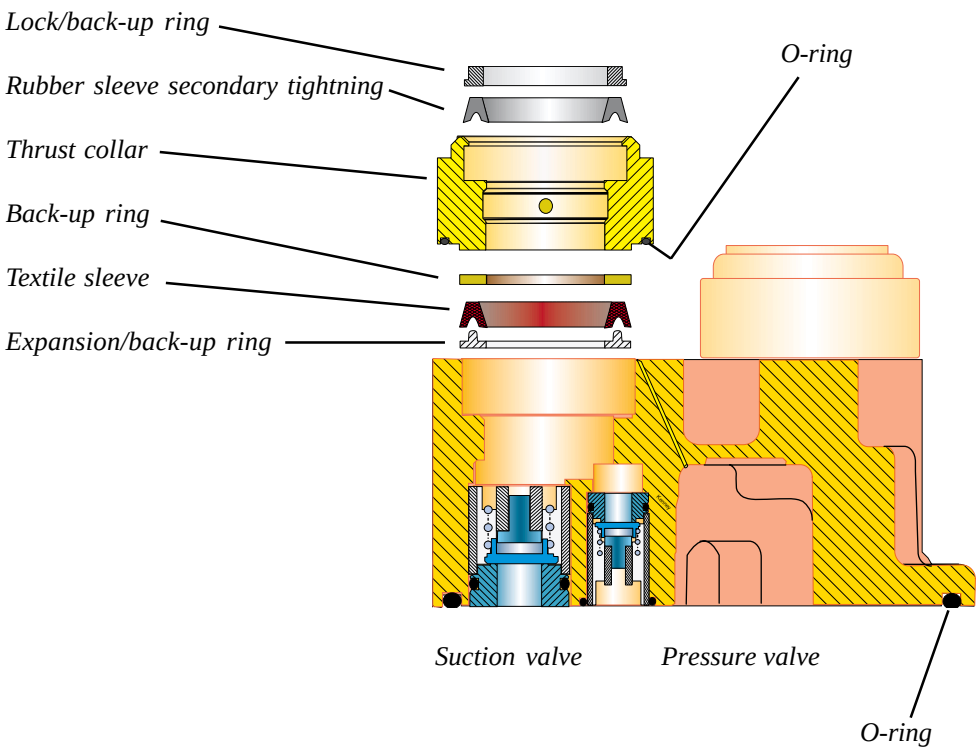

Dismounting and mounting by hand. Stick big O-ring fast with grease. Note position of the casting "smile".

Dismount suction valve seat with a mandrel. Now press out the pressure valve with a 2 mm punch. Check the surface of the seats. Mounting only by hand.



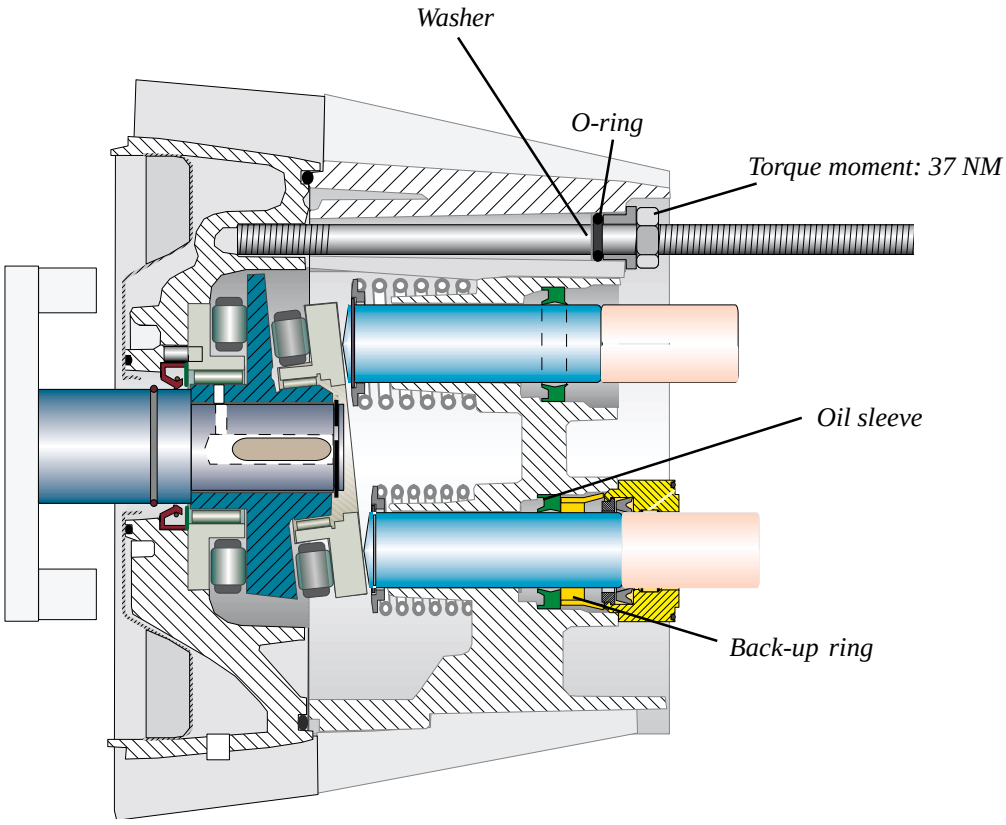


## Cylinder Head 2




Mounting of textile sleeves by means of tool no. 1220090. It is an advantage if the sleeves have been in a water bath for 3-4 hours before mounting them. Do not forget to blow through the ducts.

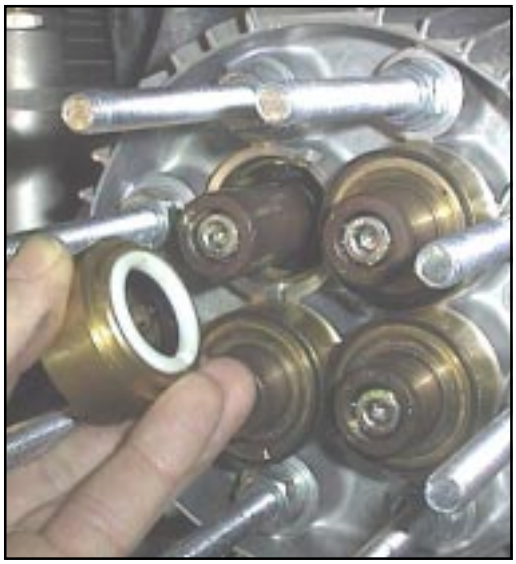
## Cylinder Block 1




Drain off the oil. Loosen the 8 bolts gradually (because of the spring load). Special box head no. 1206762 may be used.

Mount new O-rings on studs with tool no. 1206812.

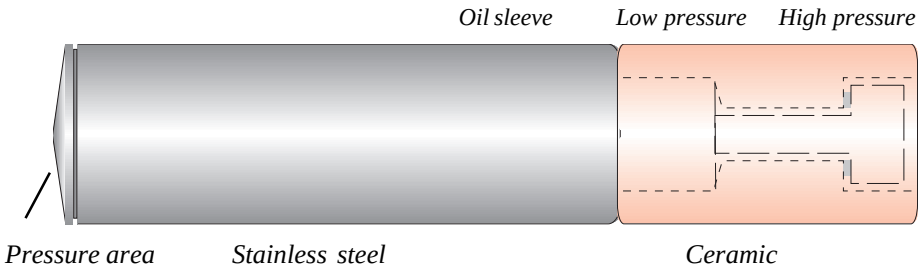
Always replace secondary sleeves when replacing pressure sleeves.
Check that there is a free passage from the drain holes.



## Cylinder Block 2

Carefully tip out the oil sleeves with an adequate screwdriver and discard them.
Be careful not to scratch the surface.

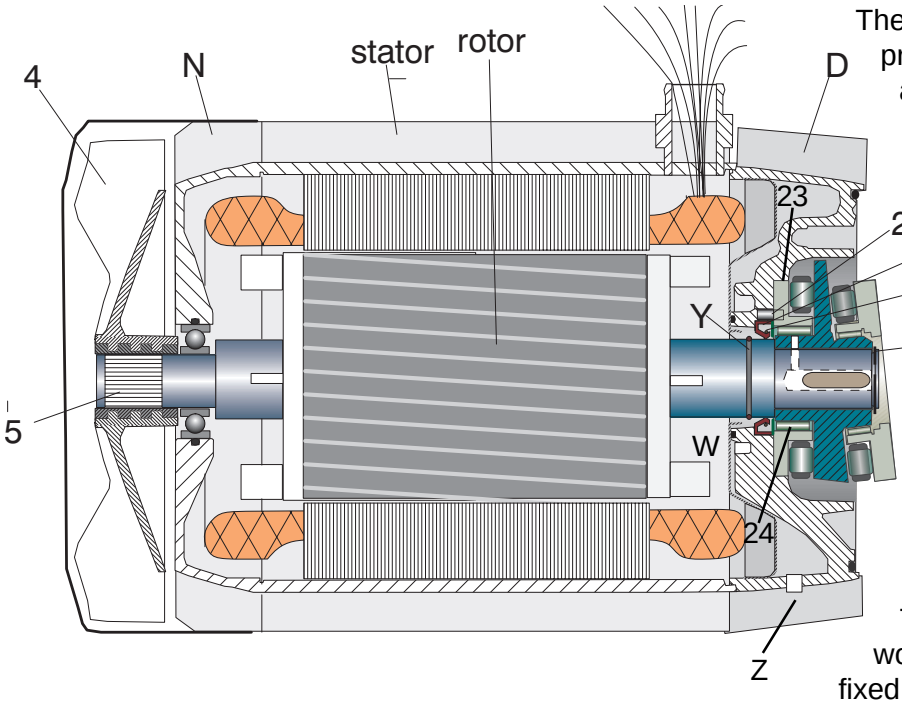
Before mounting the new sleeves, it will be a good idea to moisten the sleeves with soapy water.
Mount new oil sleeves with punch no. 1220429.
Carefully knock or press them home.




Check the piston for wear in the pressure area and the area for oil sleeves.
Check the ceramic for cracks. Remove any coating.

## Motor / Wobble Disc 1

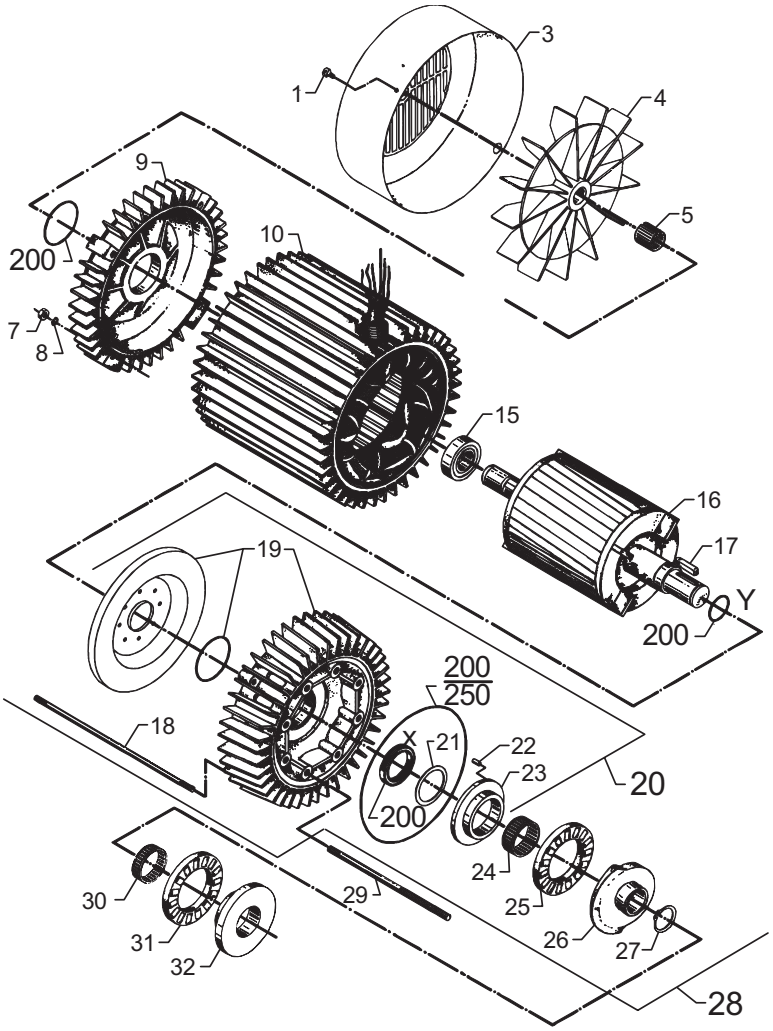
The motor consists of a stator with windings and a rotor with shaft which are kept in the right place with a bearing in the N bearing cover and the inner needle bearing of the wobble disc in the D bearing cover.




The fan blade 4 has been pressed on to the rotor with a locking ring 5 and mounted with 2 pointed screws.

On the rotor an O-ring Y has been placed in a groove. Its function is to sling any oil discharge out into the shield W, from where it will run down and escape through the drain hole Z. If this happens, the oil gasket X should be replaced.

The thrust plate of the wobble disc 23 has been fixed with the tape 22. Washer 21 ensures that the needle bearing 24 is kept free of the oil sleeve x.

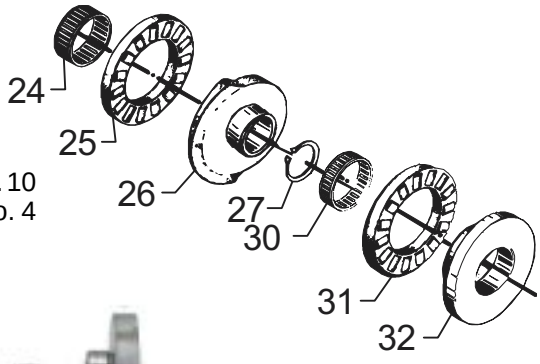



Dismount locking ring 27. The wobble disc is easily dismounted with puller no. 1205715 and special legs no. 1206150/1206168.
Do not forget to remove key 17 before dismounting the D bearing cover.
Check bearing surfaces of wear. If in doubt, replace kit 28 complete after approx. 1400 hours.

## Motor / Wobble Disc

*1206598*

When mounting the D bearing cover complete, protect the U sleeve with tool no. 1206598, which is placed on the shaft, before placing the cover.




50 Hz wobble disc no. 10
60 Hz wobble disc no. 4

When mounting the wobble disc, lubricate the bearings with oil. The big roller bearings 25 and 31 are identical. Do not forget to mount the circlip 27 on the shaft. Refill with ½ l oil type Castrol Alphasynt ISO 150 or BP Bartran HV ISO 150.

*Part no. 26*

*Part no. 32*

Check the bearing surfaces for wear. As long as the wear is even and shiny without pittings or grooves, the wobble disc can be re-used.

N.B.: The illustrated wobble disc has been working for 1,000 hours with a pressure of 180 bar.

## Motor / Technical Data

The motor is protected against overload by a motor protection device (overload cut-out), which is adjusted to the nominal power consumption at working pressure + 1 amp.

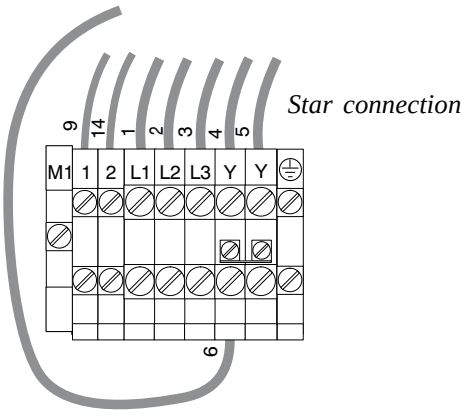
Class: F

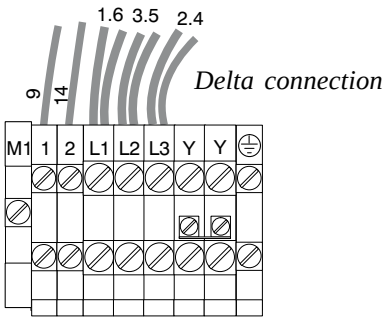
IP 45 (front cabinet closed)

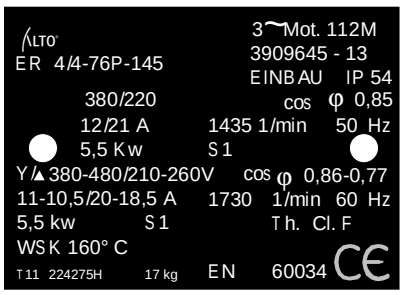
Thermal switch (bimetalic type) mounted in the windings between 2 phases. Opens at 160 ±10°C. Leads out of motor are marked 9 and 14.

| | |
|---|---|
| Power absorption of motor: | 6.7 kW |
| Output of motor: | 5.5 kW |
| Rev. of motor at 1/1 load, 50 Hz: | 1,440 rev./min. |
| Rev. of motor at 1/1 load, 60 Hz: | 1,730 rev./min. |
| COSφ of motor: | 0.83 |
| Efficiency of motor: | 0.79 |

Motor leads assembled in terminals placed in both sides of the machine.



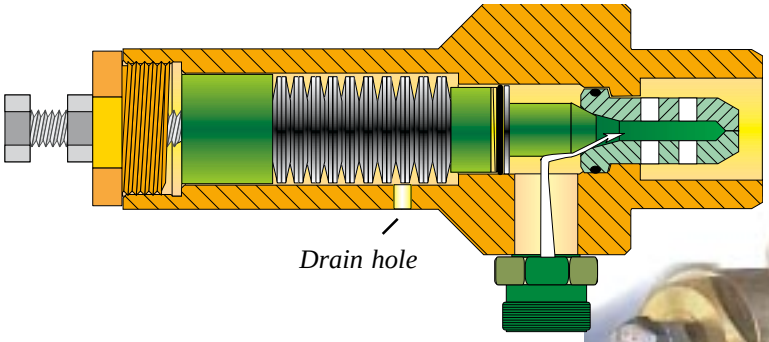



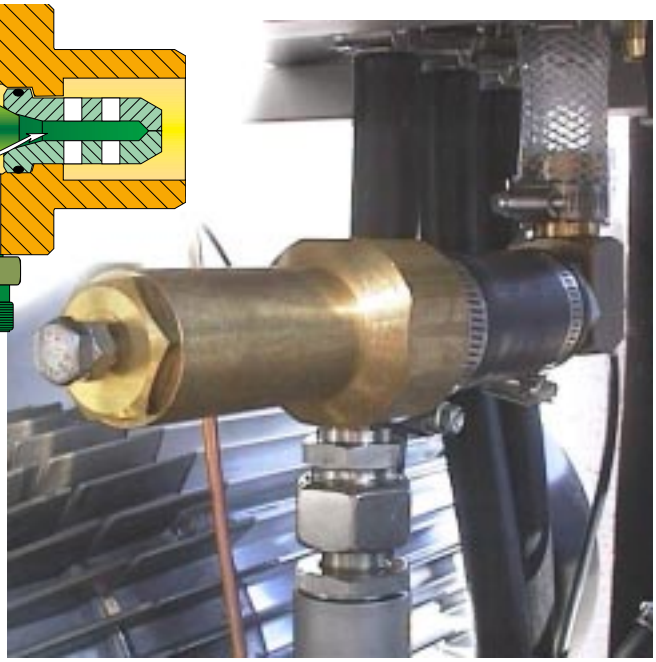



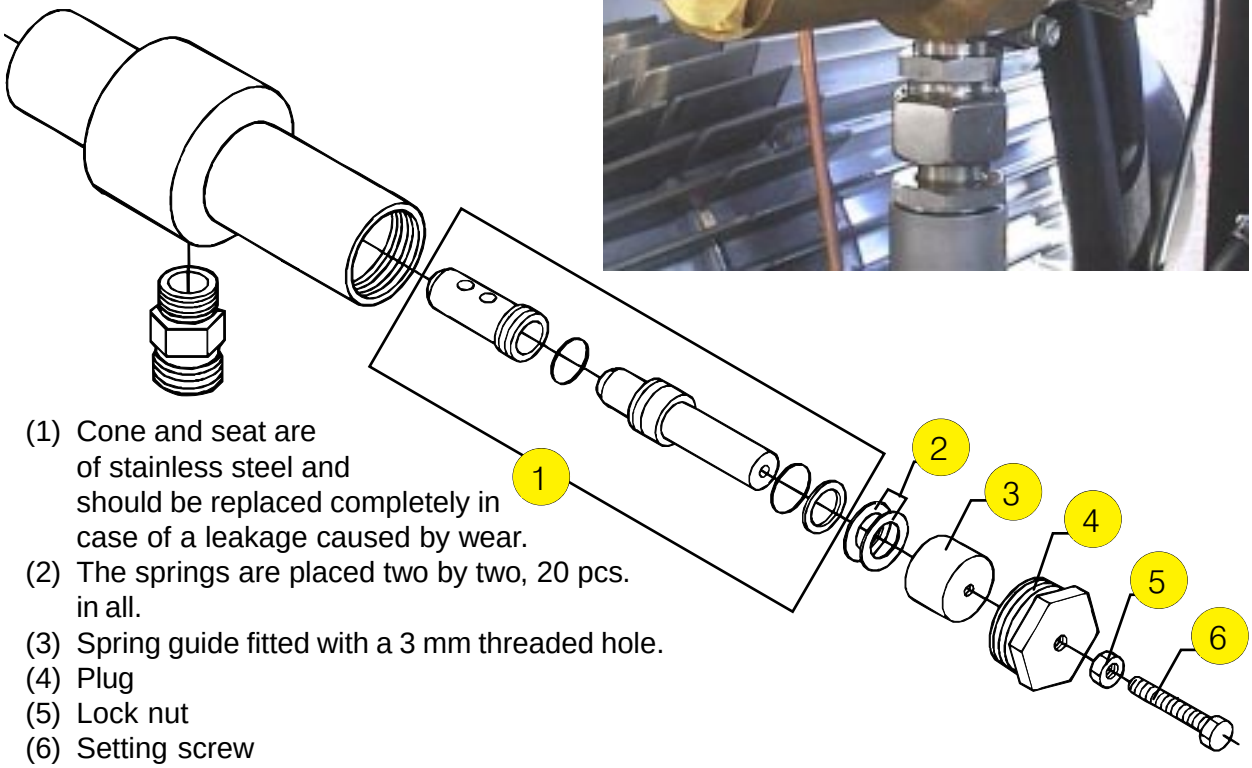


The motors are fitted with model tags of the 2 variant above.

## Overflow Valve V1





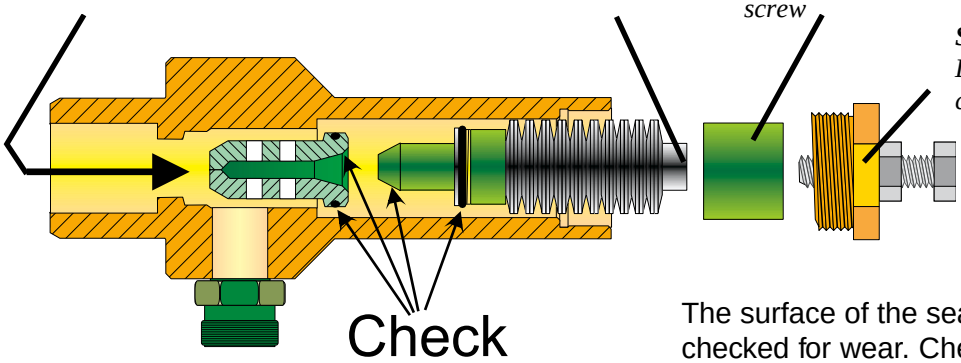

(1) Cone and seat are of stainless steel and should be replaced completely in case of a leakage caused by wear.
(2) The springs are placed two by two, 20 pcs. in all.
(3) Spring guide fitted with a 3 mm threaded hole.
(4) Plug
(5) Lock nut
(6) Setting screw

***Step 4***
*Press out the cone from behind*

***Step 3***
*Pull out cone with spring by means of a 3 mm screw*

***Step 2***
*Pull out spring guide by means of a 3 mm screw*

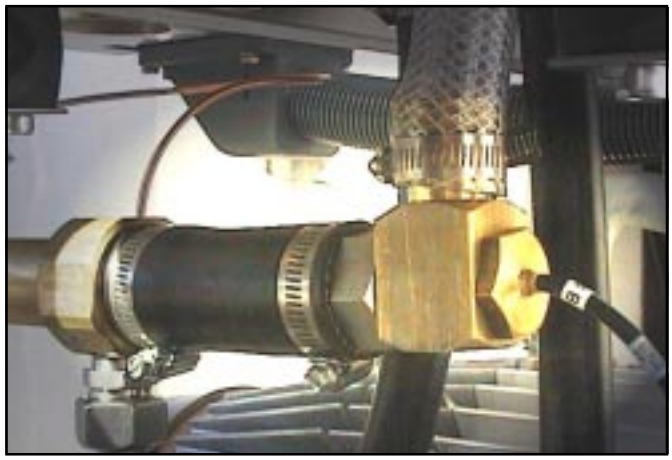
***Step 1***
*Dismount without changing the setting*

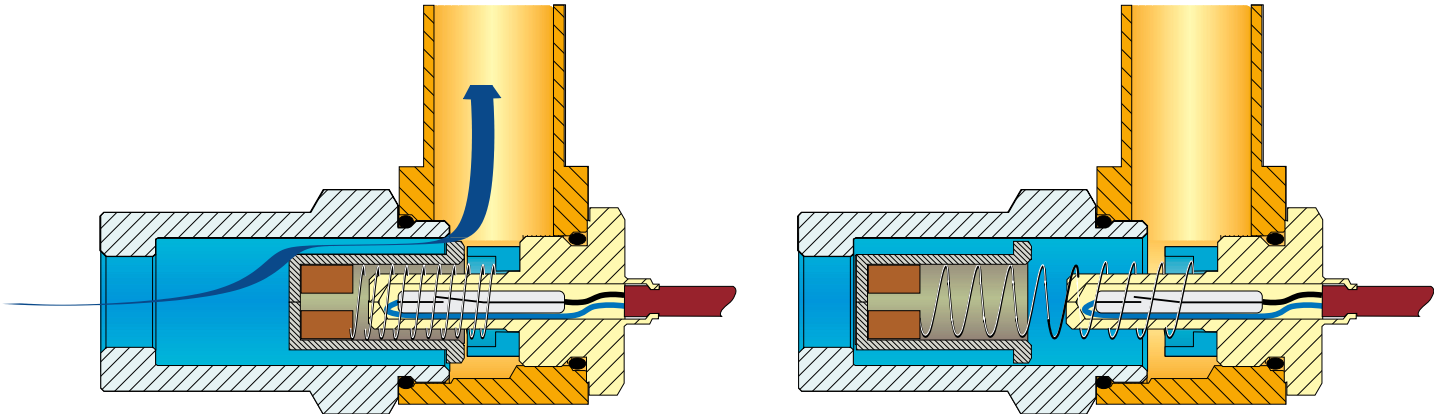



The surface of the seats should be checked for wear. Check the O-ring and lubricate with grease before assembling.

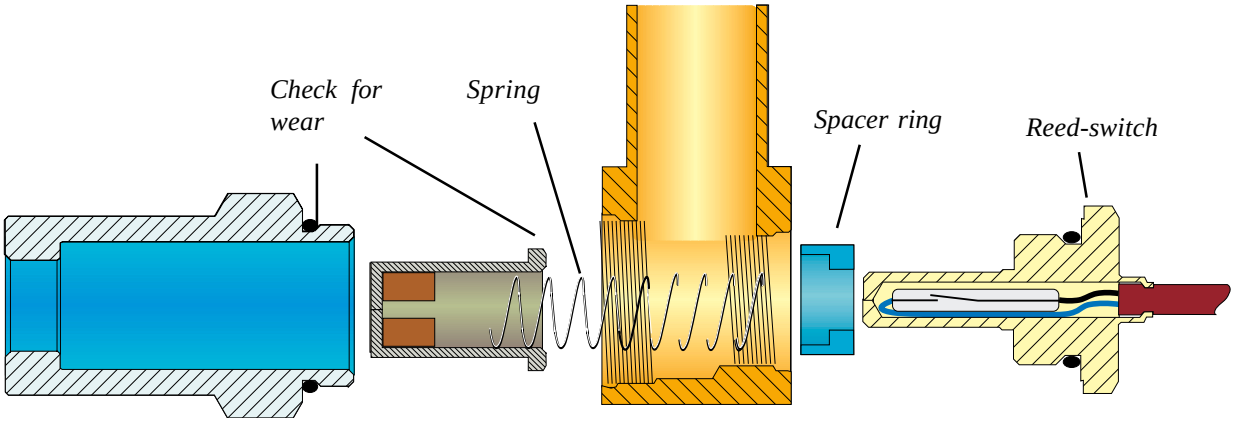
## Overflow Switch B4

The overflow switch B4 is placed under the water tank. The photo illustrates a view from the back of the machine.



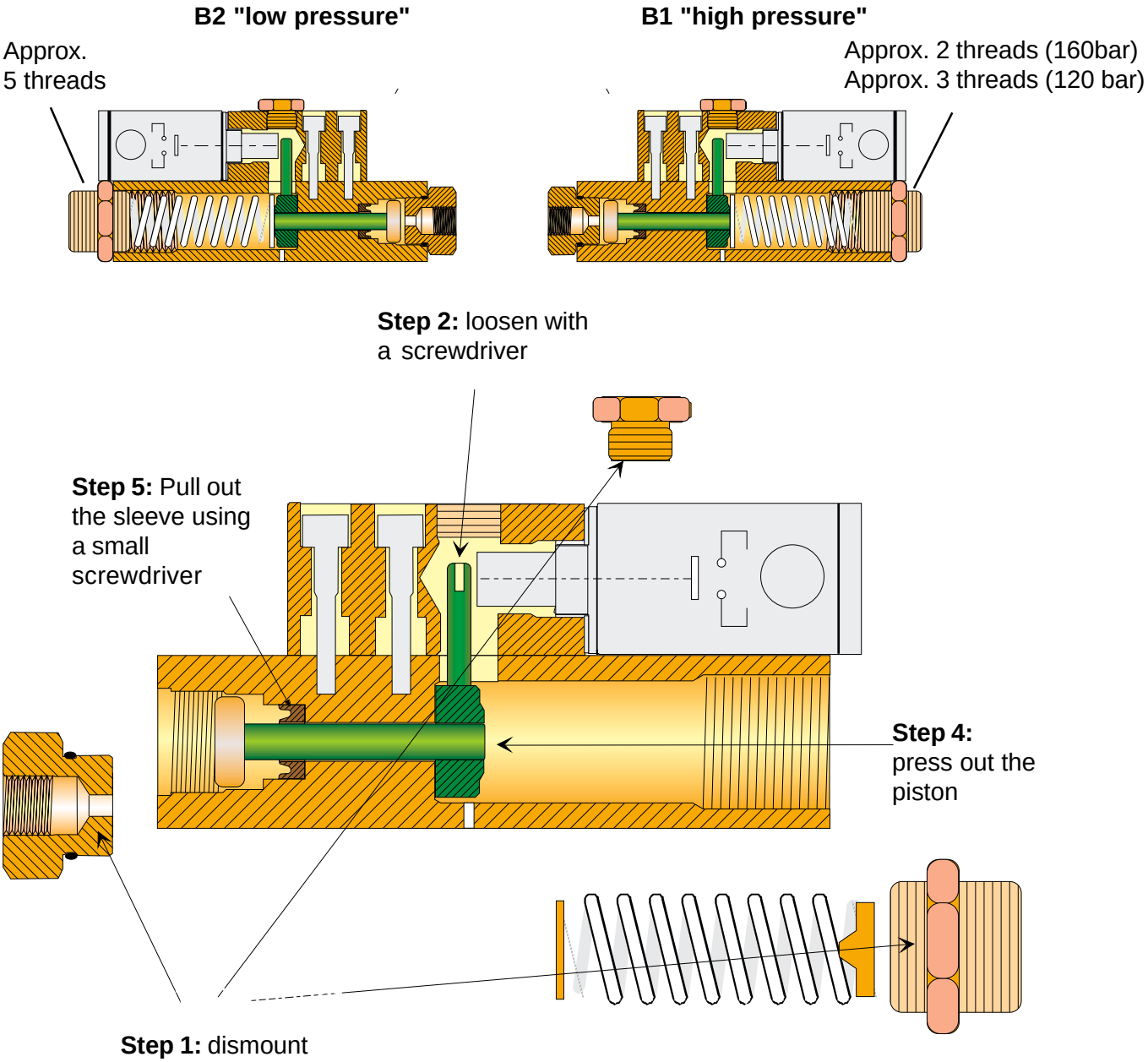


In the case of a water volume of approx. 10 l/min. the piston will be pressed towards the reed-switch establishing a connection.
As from 1.12.98 a modification was introduced, which ensures that the magnet in the piston does not knock against the reed-switch. See Technical Information No. 299 in section I page 5.



## Pressure Switches B1, B2

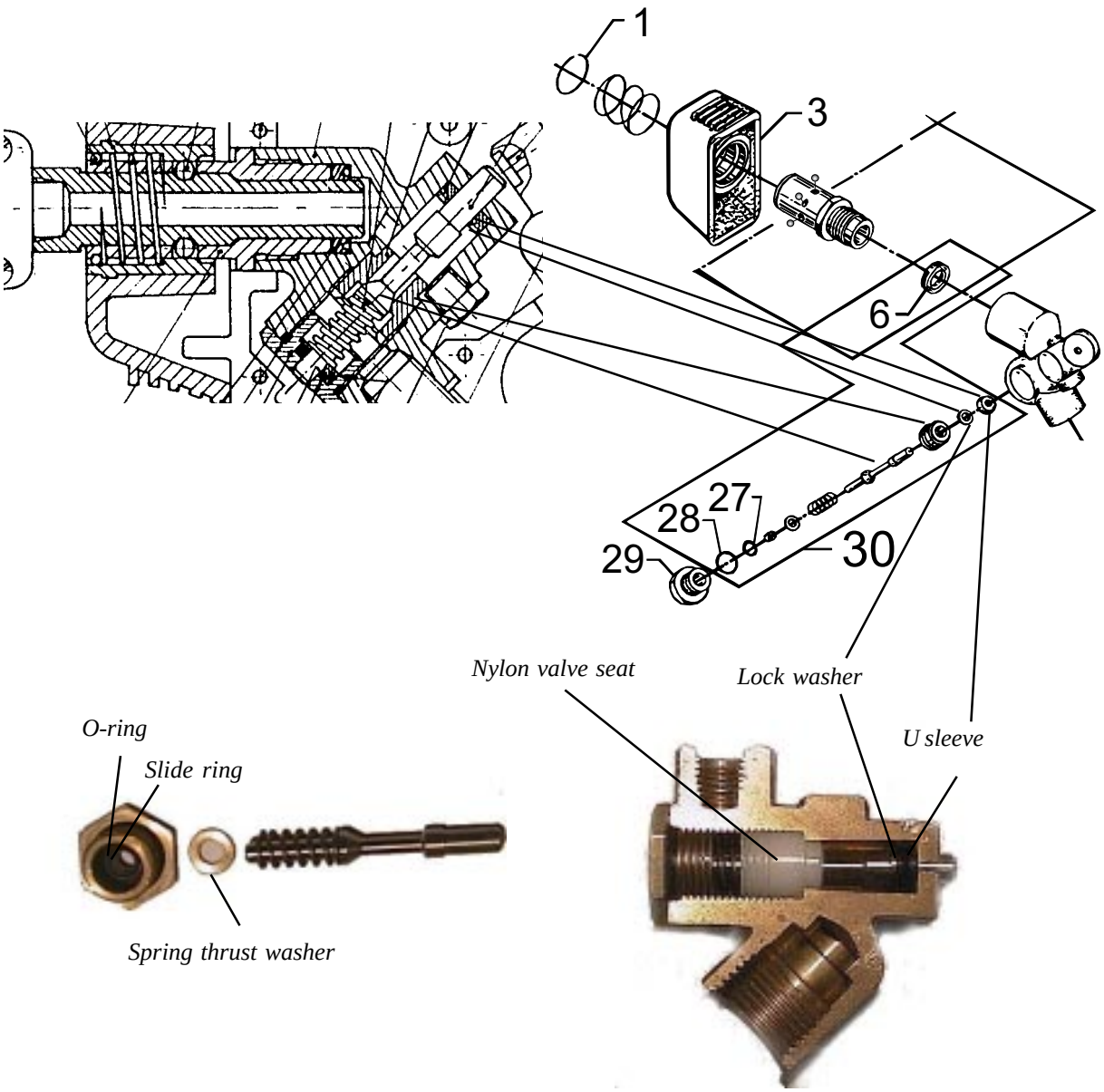
The construction of the two pressure switches is identical, only the settings differ. In pressure relieved condition the microswitch is off. On a 160 bar machine B1 is set at 120 bar corresponding to approx. 2 visible threads, and B2 is set at 25 bar corresponding to approx. 5 visible threads.
On a 120 bar machine, B1 should be set at 90 bar corresponding to approx. 3 visible threads.




Mounting in reverse order. Do not forget to lubricate the piston with grease.

## Pressure Relieved Spray Handle

The pressure relieved valve differs from the normal type in the way that the valve plunger sticks out of the valve housing in both ends. Because of the difference in diameters the pressure relief is achieved. The cost of this construction is that there are more gaskets where a leak may occur.




For mounting of O-ring / slide ring and U sleeve, tool no. 1206747 can be used with success. The function of the lock washer is to keep the U sleeve in position.

**Appeal** !
If you find that some information is missing in this section or something is not quite clear, please describe the matter on this page and forward it to TST - fax. +45 7218 2246.

# Adjustment/Test



## Start of Machine Just Installed

From the factory the DELTABOOSTER has been adjusted to the pressure stated on the model tag. Typically 160 bar or 120 bar and in some cases 90 bar.
Before leaving the factory the machine was subjected to a test run of approx. 20 hours under maximum working conditions. The test time for the individual pumps is a little shorter and appears from the hour counters.

**Washing through of water inlet pipe:**

Before starting up the DELTABOOSTER it will be a good idea to rinse the water inlet filters and thoroughly clean them. Test the capacity of the water supply network by measuring the time between the lowest and the highest water level (approx. 51 l). A 6 pump plant consumes approx. 105 l/min. Therefore the tank should be filled in less than 30 sec. by the cold or the hot water inlet respectively.

**Venting of pumps:**

Open more take off points. Start the machine. All pumps will then start up. The pressure is kept under 25 bar. Loosen the venting screws of the pumps one by one. The leakage stop function will stop the machine after approx. 20 sec., so more starting-ups may be necessary.

**Venting / washing through of pipeline:**

Connect the water supply, preferably hot water directly to the pipe installation and wash the system systematically through to the remotest take off point. When all air has escaped from the system, the pressure hose of the DELTABOOSTER is connected to the pipeline and the machine can be started.
Another method for venting is to use the DELTABOOSTER to wash air out of the pipes. If using this method it is important that the pressure is kept as low as possible, max. 20-25 bar, meaning that at least one take off point is open during the washing through.

**Test air in system / density:**

Close all take off points. Start the machine. On extensive pipelines, 100 m and more, usually 2-3 pumps will start and build up the pressure to max. in a few seconds (max. 5 sec.). If more pumps start up or the 5 sec. are exceeded, a new venting should be carried through. Let the machine stop automatically. Check that the pressure remains unchanged for at least 10 min.

**Pressure drop in pipe test:**

If you have any doubts about the pipe installation concerning the dimensioning, it will be a good idea to test the pressure drop in the pipeline before delivering the plant.
Place the test pressure gauge 1206358 with adaptor 1220126 on the doubtful take off point (remotest). Attach hose and spray lance to be used, open the valves completely and start the consumption. The pressure drop must not exceed 15 bar.

## Basic Adjustment

If you are in doubt about the conditions of the machine, it will be a good idea to go through all adjustments systematically.

### Prior to starting up

1: Check that the DIP switch and the test plug have been correctly adjusted, see page C9.
2: Check that all terminals and plugs have been correctly mounted.
3: Check all settings of motor protection, see page A1.
4: Check that all 3 phases are alive and that theres is 24V on the secondary side of the transformer.

* Close the main valve on the HP side to cut off the machine from the pipeline.

5: Check the setting of the pressure switches. There should be 2-3 visible threads on the right side and 5 threads on the left side, see page E13.

* Roughly adjust the overflow valve V1. Adjust the screw, pos. 6 (see page E11) as far as it will go and then 2 ¾ turns backwards.

* Only let <u>one</u> pump start (disconnect the other pumps on the motor protection device by pressing in the red test button).

### Starting up

6: Test the safety valves of all the pumps, see page E3.

* Let the pump run until it stops automatically with pressure.

7: Check the setting of the pressure switch B1 by shortly disconnecting the current on the starting switch until the set pressure has been reached, see page E13 (160 bar system, **<u>120 bar</u>**). Turn the adjusting screw of the pressure switch until the light (H) on the display turns on/goes out.

8: Check the pressue switch B2. Continue to lower the pressure to approx. 25 bar. Turn the set screw until the light (L) on the display illuminates/goes out.

9: Fine adjust the overflow valve. Start up <u>one</u> pump. Adjust the pressure to working pressure + 10 bar.

10: Check non-return valve V4 . Start up the pump and let it run until it stops. The system is now pressurized. Loosen the venting screw of one of the pumps.
. If the pressure on the pressure gauge remains unchanged, the non-return valve is in order.

* Connect all motor protection devices.

**The machine is now ready for operation.**

## Down Regulation 160-120 bar

The DELTABOOSTER is delivered according to wishes with a pre-set pressure of 160 bar or 120 bar, in some cases even 90 bar.

If you want a lower pressure than the one with which the machine is delivered, you can regulate it dow in the following way:

***Step 1:***
Adjust pressure switch B1 (right) down to approx. 90 bar corresponding to one turn outwards to the point where the light (H) flashes/goes out.

**Step 2:**
With one pump in by-pass mode (disconnect the other pumps on the motor Protection device), the overflow valve should be adjusted down from 175 bar to 130 bar

***Step 3:***
***Adjust all safety valves*** to max. opning pressure 120 bar + 50 bar = 170 bar. See page E3.

## Electric Test

### Before starting up with a new PC board or another new component

In situations where a component has burned, short-circuited or does not react, the following points should be checked to make sure that the problem does not recur.

1: Check that no leads are worn through to frame and that the control box is dry.

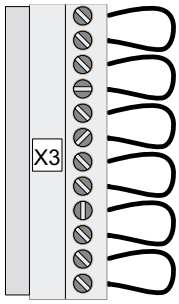
2: Check the solenoid valves Y1, Y2, Y3. If you are in doubt, dismount plugs X5, X6 from the circuit board.

3: Check the temperature sensor B7. Bring the two leads together and check whether there is contact to the frame by means of an ohmmeter. If you are in doubt, replace temperature sensor.

4: Check the temperature sensors of each motor. Open the side panels and bring the motor leads marked 9 and 14 together. Bring the other motor leads together. Measure between these two points and between the gathered motor leads and the frame with a high-voltage tester. If you are in doubt, remove leads from plug X3 on the PC board and instead place a lead on each terminal as illustrated.

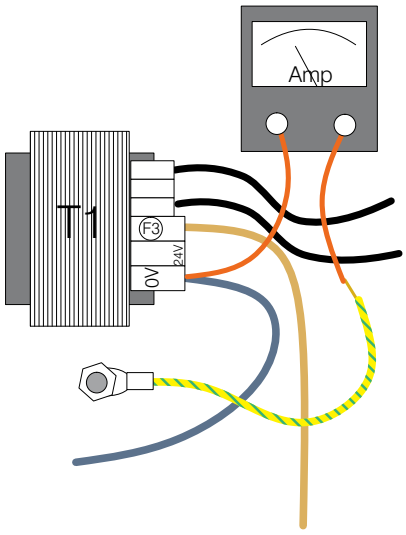
5: Remove plugs X7 and X8 and messure with an ohmmeter from each terminal on plug that there is no contact to the frame. Re-mount plug.

6: Remove ground lead from the 0 terminal of the transformer. Place an ammeter (0-10 amp) between the earth lead (frame) and the 0 terminal of the transformer. (Warning: Do not touch the PC board when the earth lead is dismounted).




7: Turn the main switch S1. Measure that there is voltage on all three phases of the contactors K1, K2 etc. Measure the secondary side of the transformer. The voltage hould be approx. 24 V.

8 Turn knob S2 on the front panel. Check that there is no voltage sent to the ampmeter.




* If everything is OK, the machine can be started.

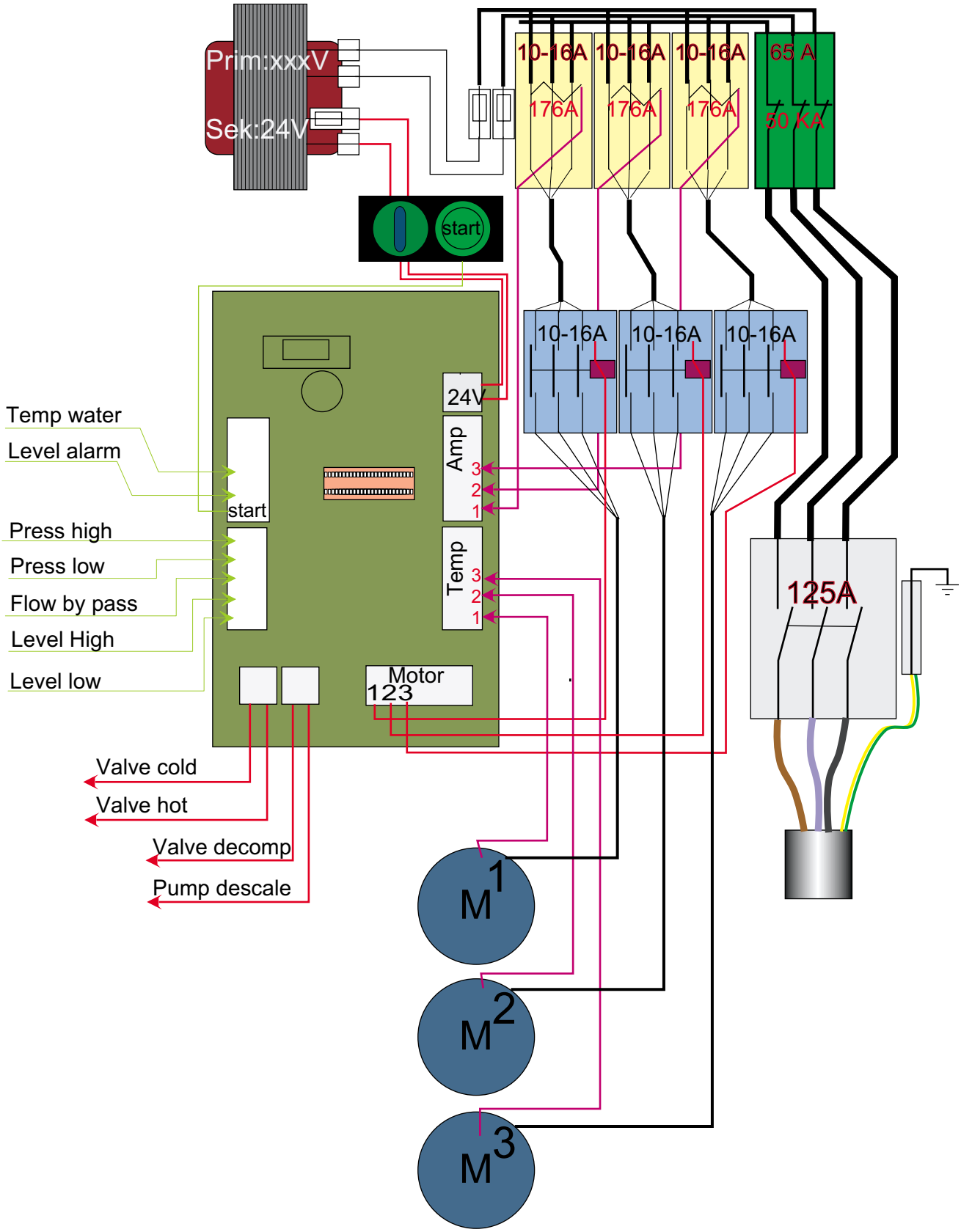
If the machine does not start, contact ALTO service HQ.

**Appeal** !
If you find that some information is missing in this section or something is not quite clear, please describe the matter on this page and forward it to TST - fax. +45 7218 2246.

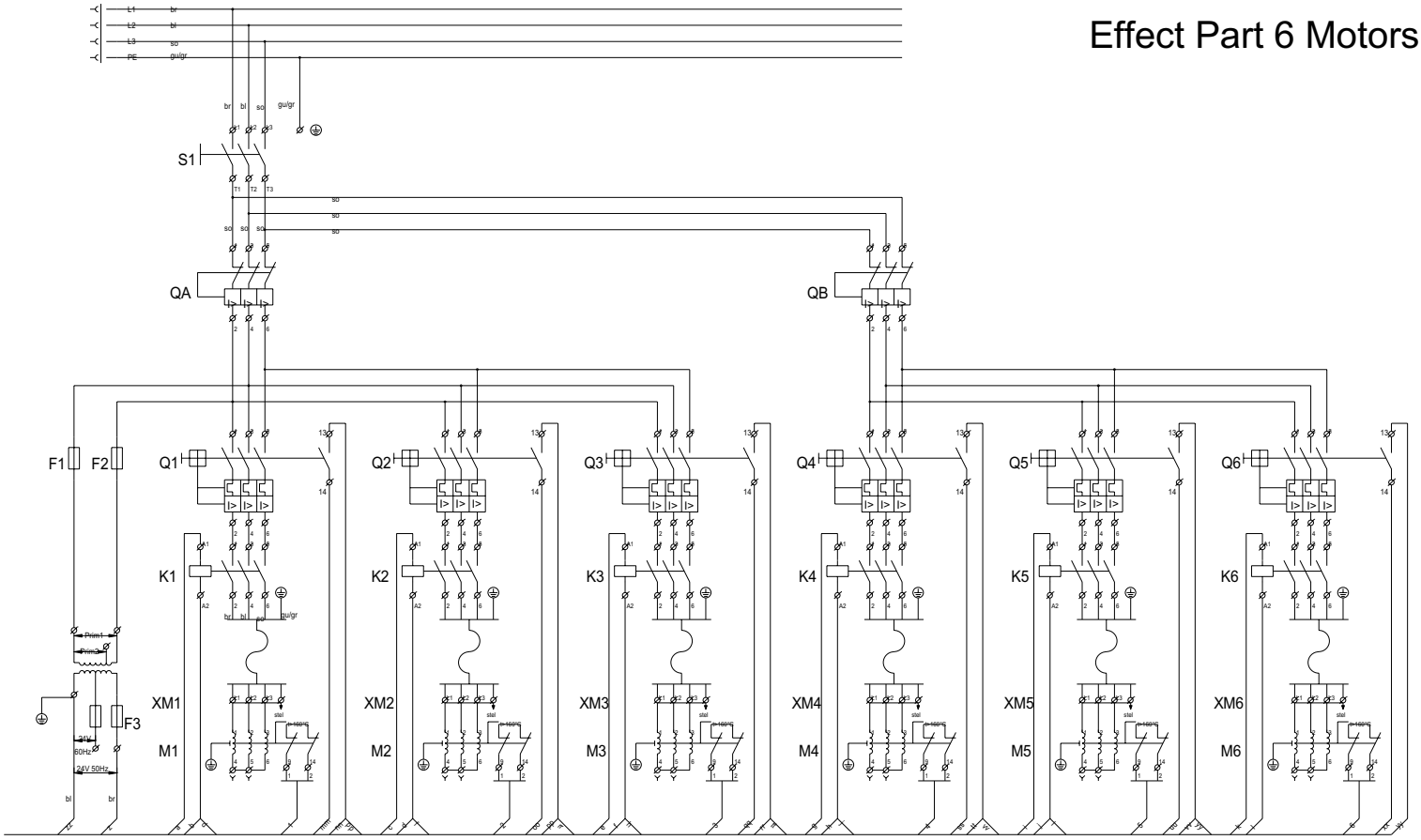
# Wiring Diagram



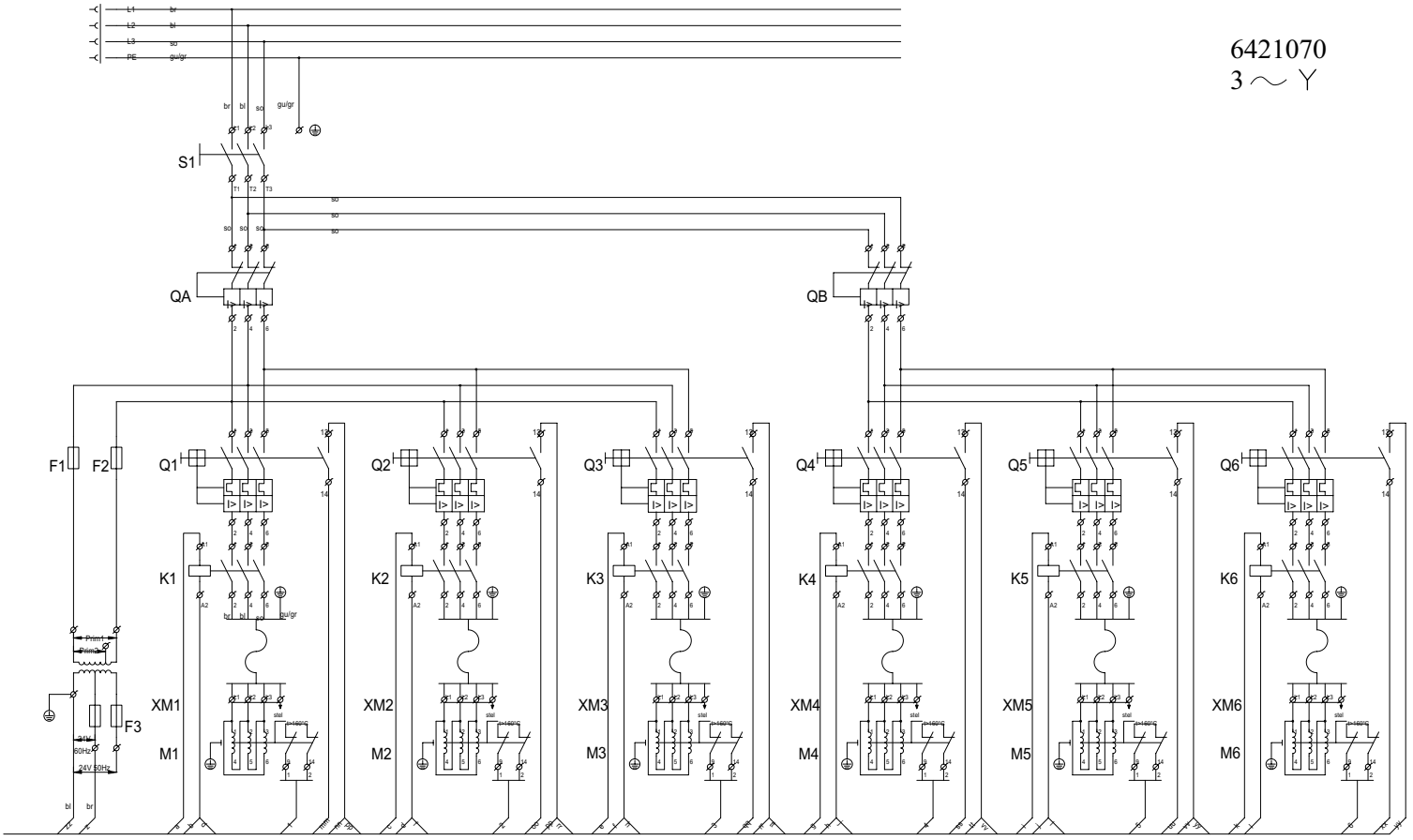
## Schematic Wiring System



## Effect Part 6 Motors



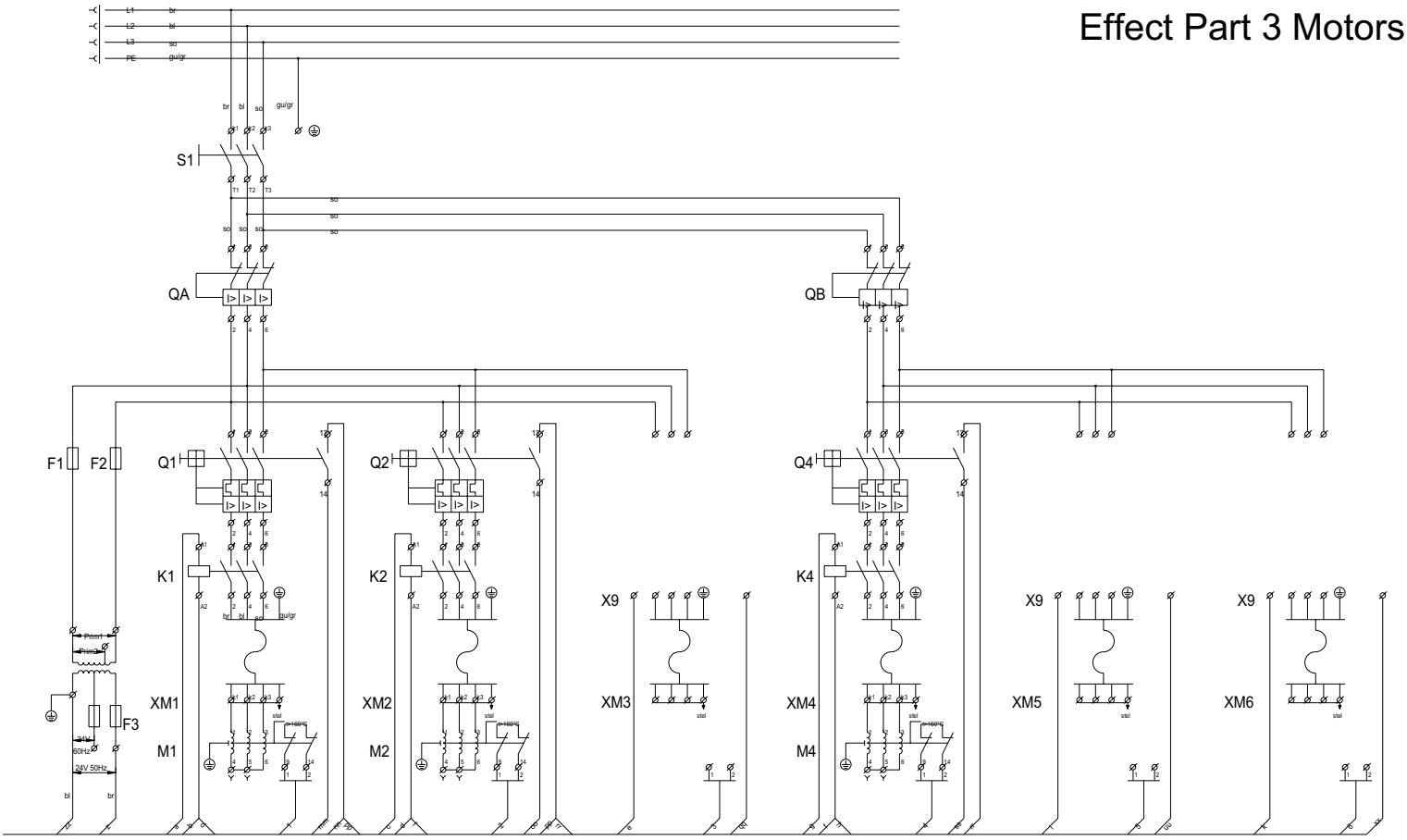

6421070
3 ~ Y




6421071
3 ~ △

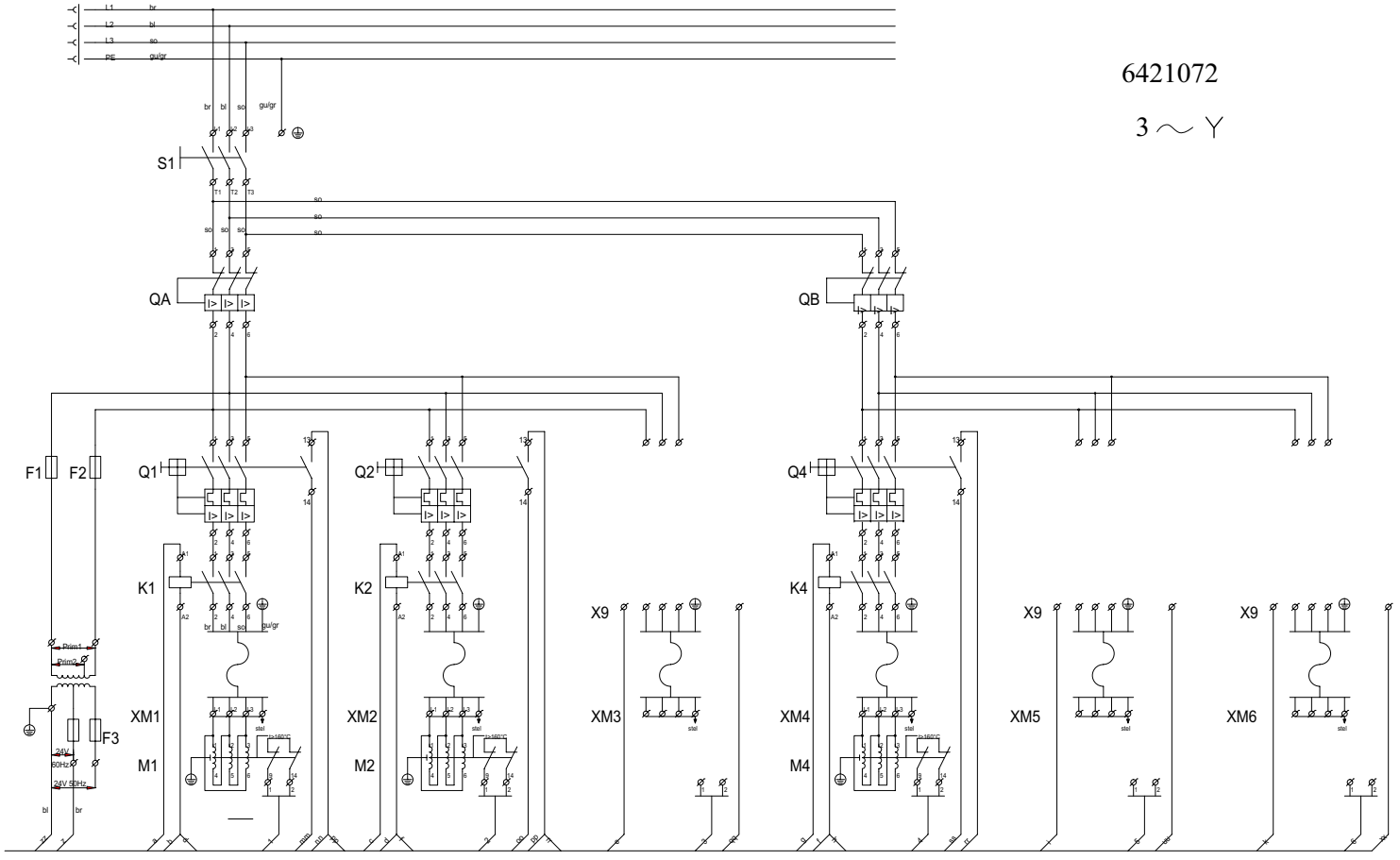
| | DANSK | ENGLISCH | DEUTSCH | FRANCAIS |
|---|---|---|---|---|
| Stel | Stel | Chassis | Rahmen | Châssis |
| F1-F3 | Smeltesikring | Fuse (melting) | Sicherung | Fusible |
| K1-K6 | Kontaktor | Contactor | Kontaktor | Relais |
| M1-M6 | Motor | Motor | Motor | Moteur |
| QA-QB | Strømbegrænser | Current limiter | Strombegrenzer | Limiteur de courant |
| Q1-Q6 | Maximalafbryder | Maximum current breaker | Maximalausschalter | Interrupteur à maximum |
| S1 | Hovedafbryder | Line breaker | Hauptschalter | Interrupteur principal |
| T1 | Transformator | Transformer | Transformator | Transformateur |
| X | Klemrække | Terminal strip | Klemmen-Reihe | Barette de raccordement |
| br | brun | brown | braun | brun |
| bl | blå | blue | blau | bleu |
| so | sort | black | schwartz | noir |
| hv | hvid | white | weiss | blanc |
| ro | rød | red | rot | rouge |
| gu/gr | gul/grøn | yellow/green | gelbe/grün | jaune/vert |

## Effect Part 3 Motors




6421072

3 ~ Y

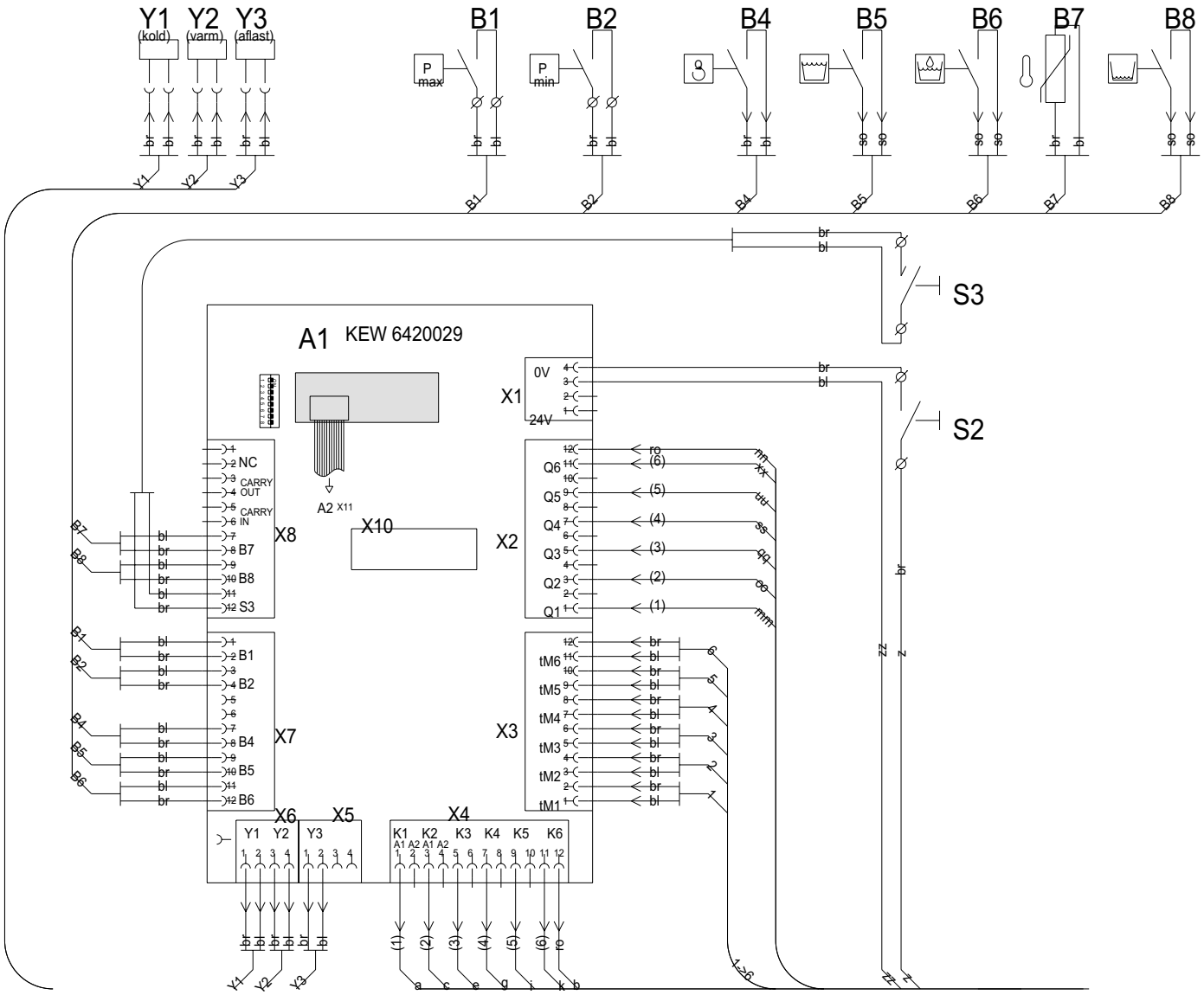



| Stel | DANSK<br>Stel | ENGLISCH<br>Chassis | DEUTSCH<br>Rahmen | FRANCAIS<br>Châssis |
|---|---|---|---|---|
| F1-F3 | Smeltesikring | Fuse (melting) | Sicherung | Fusible |
| K1-K3 | Kontaktor | Contactor | Kontaktor | Relais |
| M1-M3 | Motor | Motor | Motor | Moteur |
| QA-QB | Strømbegrænser | Current limiter | Strombegrenzer | Limiteur de courant |
| Q1-Q3 | Maximalafbryder | Maximum current breaker | Maximalausschalter | Interrupteur à maximum |
| S1 | Hovedafbryder | Line breaker | Hauptschalter | Interrupteur principal |
| T1 | Transformator | Transformer | Transformator | Transformateur |
| X | Klemrække | Terminal strip | Klemmen-Reihe | Barette de raccordement |
| br | brun | brown | braun | brun |
| bl | blå | blue | blau | bleu |
| so | sort | black | schwartz | noir |
| hv | hvid | white | weiss | blanc |
| ro | rød | red | rot | rouge |
| gu/gr | gul/grøn | yellow/green | gelbe/grün | jaune/vert |

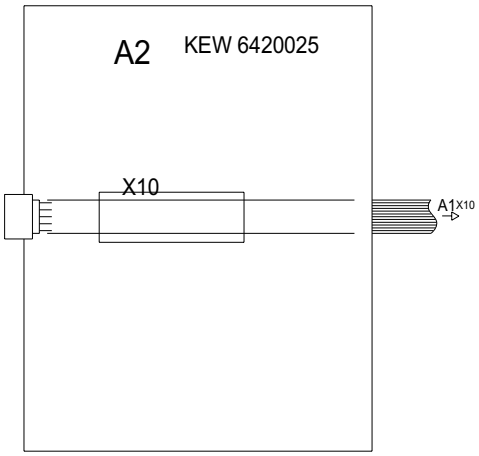
6421073

3 ~ △

## Control Part




Effekt-del 3-fase : 6421070, 6421072
Effekt-del 3-fase : 6421071, 6421073




| | DANSK | ENGLISCH | DEUTSCH | FRANCAIS |
|---|---|---|---|---|
| Kold | Kold | Cold | Kalt | Froid |
| Varm | Varm | Hot | Heiss | Chaut |
| Aflast | Aflast | Relief | Entlastung | Déchargement |
| A1 | Elektronisk styring | Electronic control | Elektronische Steuerung | Commande électronique |
| A2 | Display | Display | Display | Display |
| B1-B2 | Pressotat | Pressure switch | Druckschalter | Pressostat |
| B4 | Strømningskontrol, retur | Flow sensor, bypass | Strömungswächter | Contrôle de bit d'eau |
| B5,B6,B8 | Niveaukontakt | Level switch | Schwimmer Magnetschalter | Interrupteur flotteur |
| B7 | Termoføler | Thermo sensor | Temparature Kontrolle | Detecteur de température |
| S2 | Drejekontakt, on-off | Rotary switch | Drehschalter | Interrupteur a rotation |
| S3 | Trykkontakt, start | Push button | Druckschalter | Interrupteur |
| Y1-Y3 | Magnetventil | Magnet valve | Magnet ventil | Vanne magnetique |
| X | Klemrække | Terminal strip | Klemmen-Reihe | Barette de raccordement |
| br | brun | brown | braun | brun |
| bl | blå | blue | blau | bleu |
| so | sort | black | schwartz | noir |
| hv | hvid | white | weiss | blanc |
| ro | rød | red | rot | rouge |
| gu/gr | gul/grøn | yellow/green | gelbe/grün | jaune/vert |

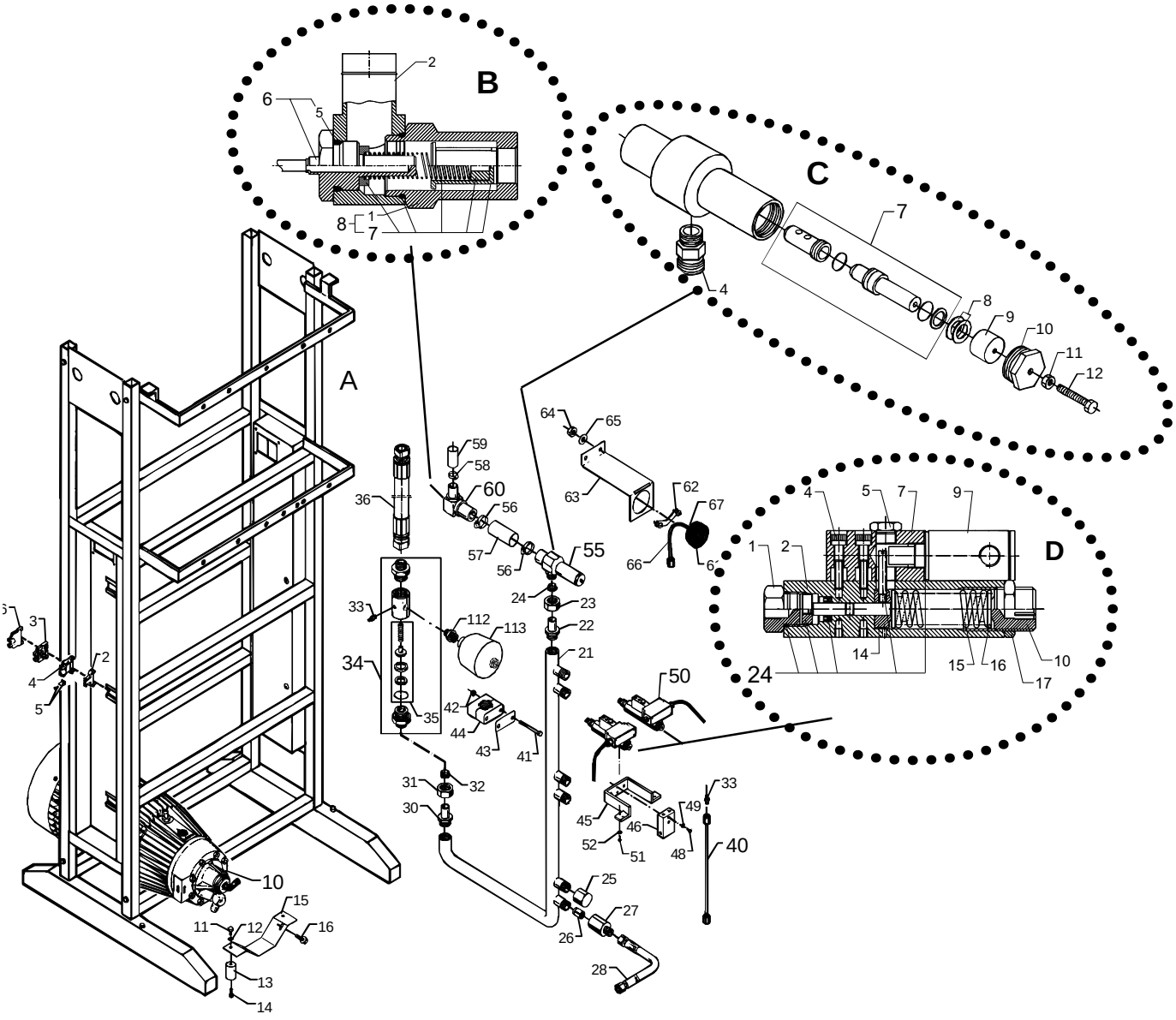
**Appeal** !
If you find that some information is missing in this section or something is not quite clear, please describe the matter on this page and forward it to TST - fax. +45 7218 2246.

## Extension from 2 Pumps

| Description | Part no. | Number | |
|---|---|---|---|
| Valve complete | 6300080 | 1 | |
| House for non-return valve | 7302029 | 1 | |
| H.P. hose complete | 7302031 | 1 | |
| Timer | 7306010 | 1 | |
| Cable hose for motor | 2406468 | 1 | |
| Hose clip | 1810191 | 1 | |
| L.P. hose L1040 | 6200918 | 1 | |
| Hose circlip | 1810191 | 2 | |
| Hose circlip | 7306027 | 2 | |
| Pump bracket complete | 1800788 | 4 | |
| | 1810274 | 8 | |
| | 1803048 | 4 | |
| | 1810266 | 4 | |
| | 6300300 | 2 | |
| | 1802651 | 4 | |
| | | | |
| Kit for contactor 400-415V | 6423553 | 1 | Not required for 4 pumps |
| Kit for contactor 220-230V | 6423554 | 1 | Not required for 4 pumps |

**NB:** The spare part numbers may have been up-dated. Therefore always check them up in the spare parts catalogue.

## Wearing Parts of Frame and Valves




1st degree wearing parts are exposed to the worst wear and tear. Dependent on the conditions, life times of 400 - 800 hours are anticipated.

2nd degree wearing parts are worn moderately and the life time is between 800 - 1200 hours.

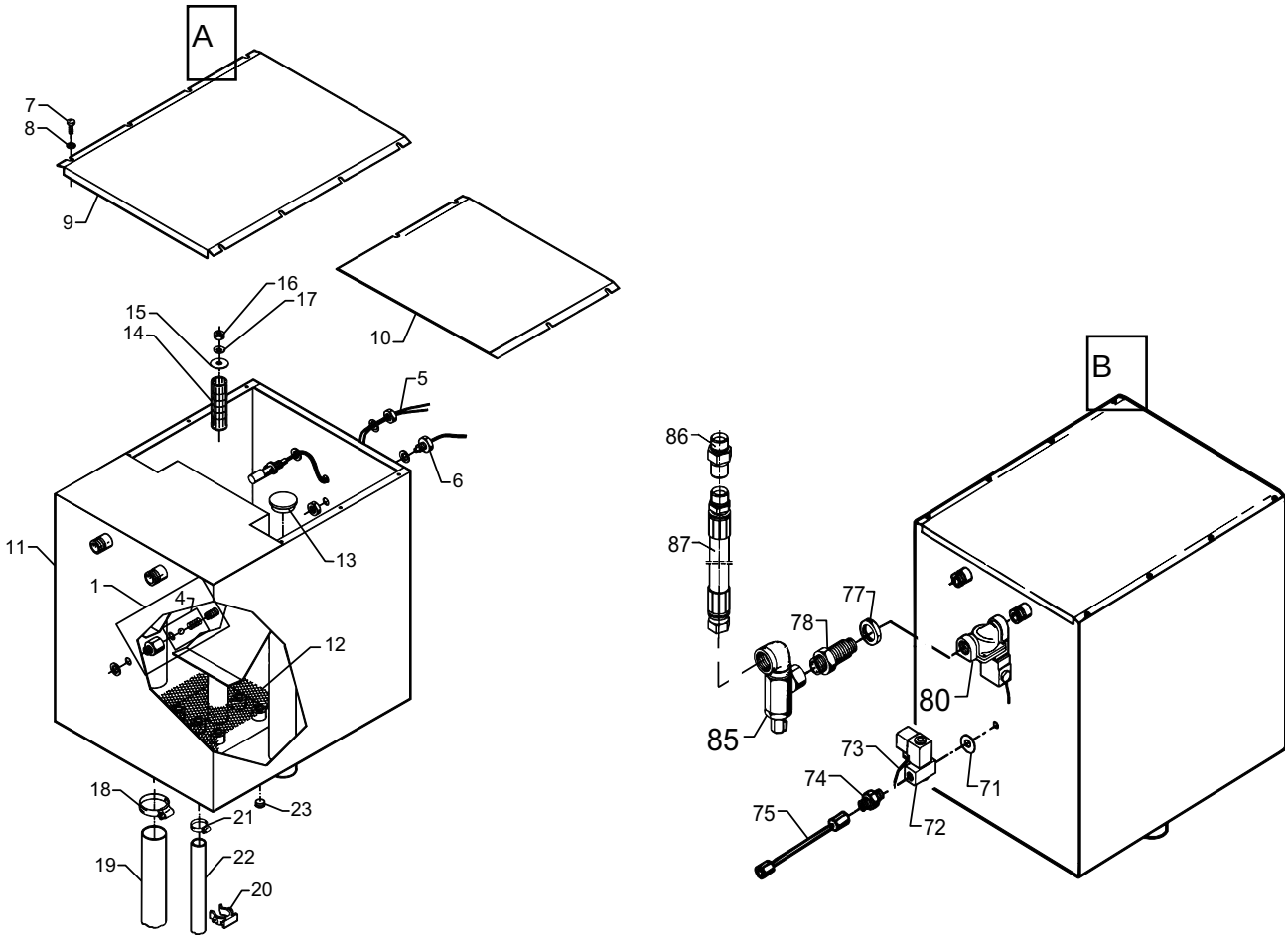
3rd degree wearing parts wears slowly or ages because of heat stress. Dependent on the load, life times of 1200 - 1500 hours are anticipated.

1st degree: A35-A61-A26-D24

2nd degree: A28-A36-A113-B6-B7-C7

3rd degree: A34-A55-A60-A3-A4-A13-D9

## Wearing Parts, Water Tank



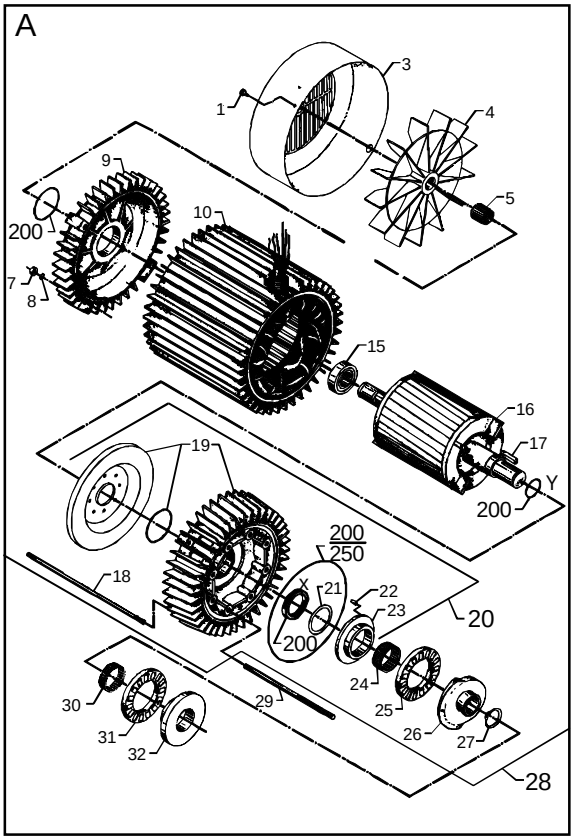

1st degree wearing parts are exposed to the worst wear and tear. Dependent on the conditions, life times of 400 - 800 hours are anticipated.

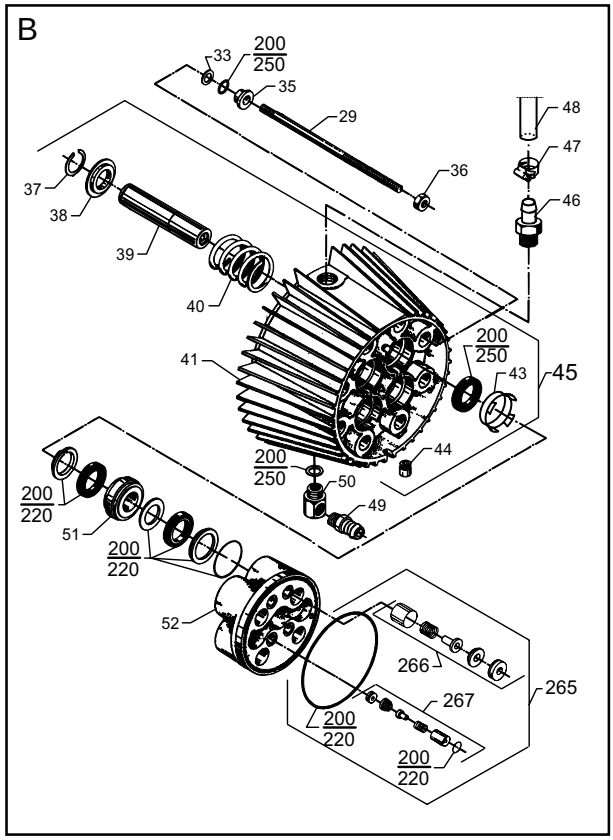
2nd degree wearing parts are worn moderately and the life time is between 800 - 1200 hours.

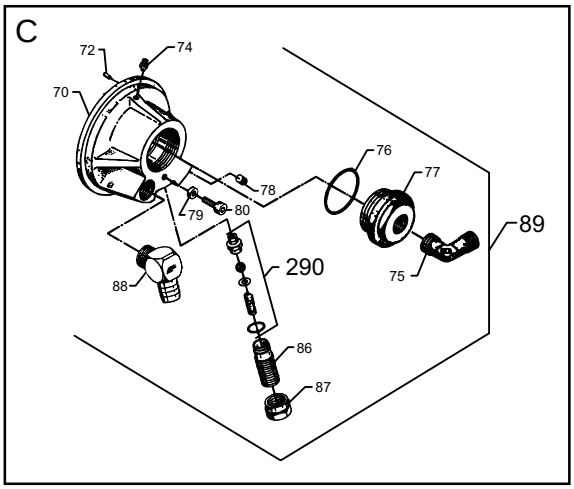
3rd degree wearing parts wears slowly or ages because of heat stress. Dependent on the load life times of 1200 - 1500 hour are anticipated.

| | |
|---|---|
| 1st degree: | B85 (filter) |
| 2nd degree: | A5-A6-B88 |
| 3rd degree: | A22-A14-B80-B72 |

## Wearing Parts, Pump




1st degree wearing parts are exposed to the worst wear and tear. Dependent on the conditions, life times of 400 - 800 hours are anticipated.

2nd degree wearing parts are worn moderately and the life time is between 800 - 1200 hours.

3rd degree wearing parts wears slowly or ages because of heat stress. Dependent on the load life times of 1200 - 1500 hour are anticipated.

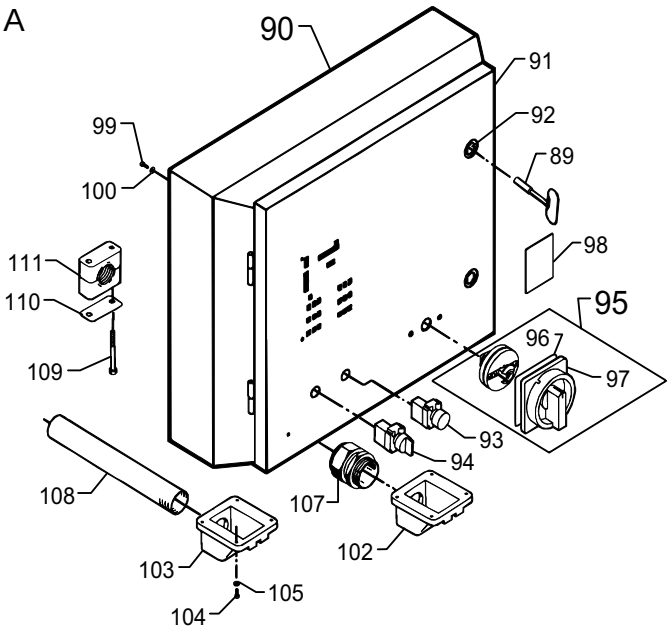
1st degree: B220 B266 B267 C 290

2nd degree: B52 B200 B48 B250

3rd degree: A (23-24-25-26-30-31-32) or A28. A4 A5 B (37-38-39) B52.

## Wearing Parts, Control System

A

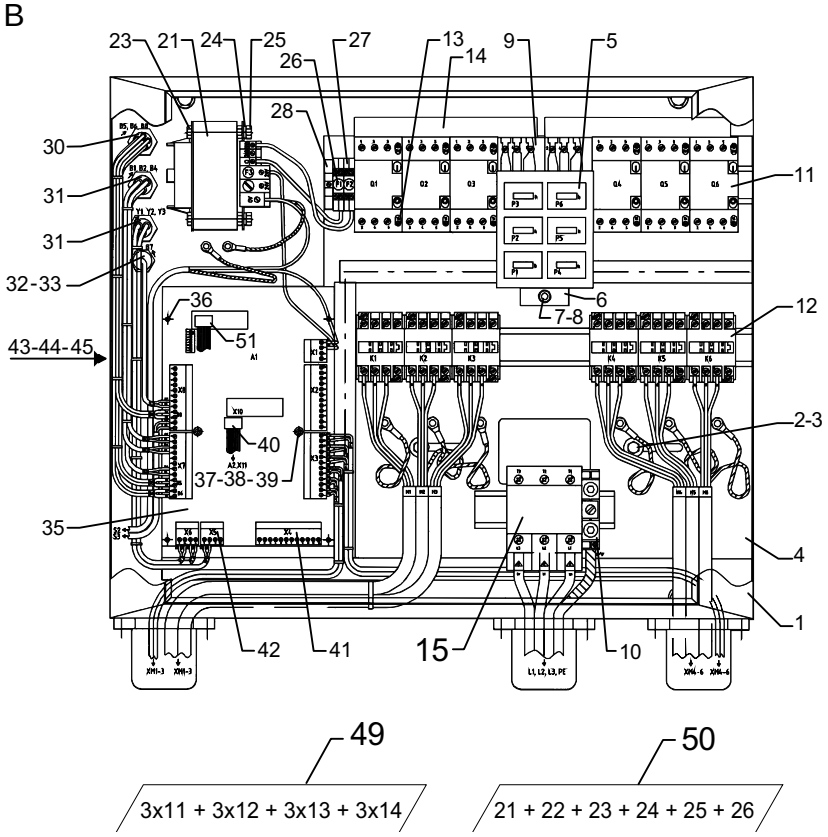



1st degree wearing parts are exposed to the worst wear and tear. Dependent on the conditions, life times of 400 - 800 hours are anticipated.

2nd degree wearing parts are worn moderately and the life time is between 800 - 1200 hours.

3rd degree wearing parts wears slowly or ages because of heat stress. Dependent on the load life times of 1200 - 1500 hour are anticipated.

B




1st degree: NONE

2nd degree: A94-B5

3rd degree: B12

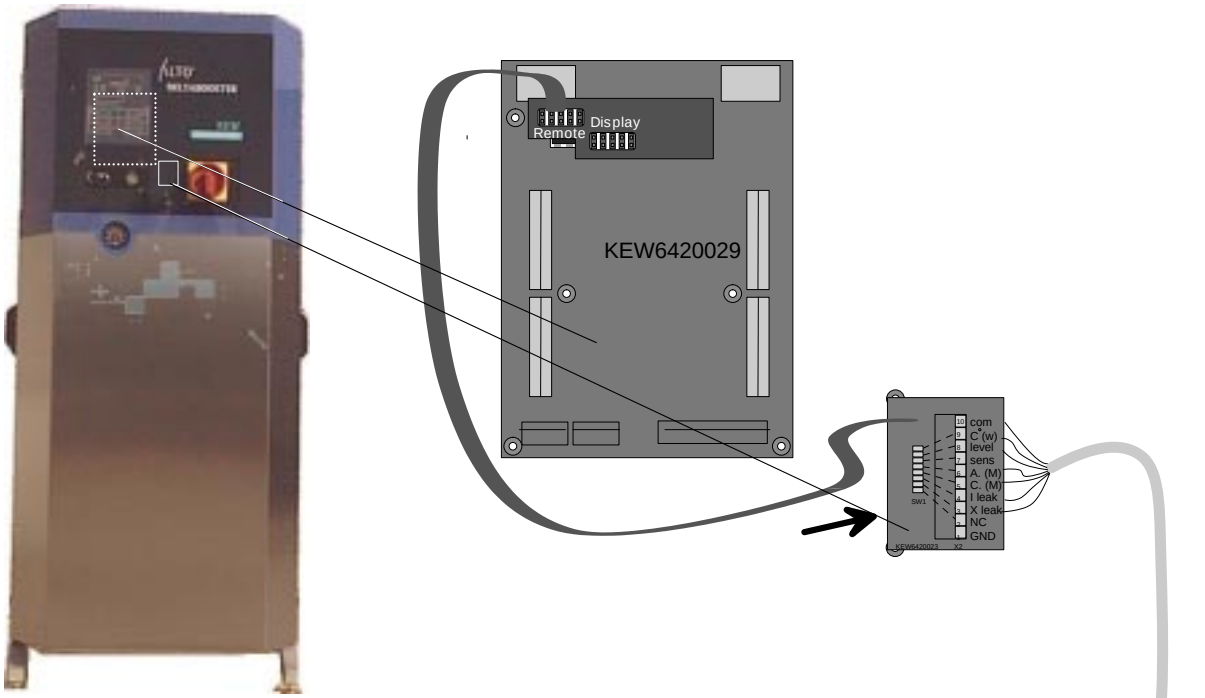
**Appeal** !
If you find that some information is missing in this section or something is not quite clear, please describe the matter on this page and forward it to TST - fax. +45 7218 2246.

# Special Information

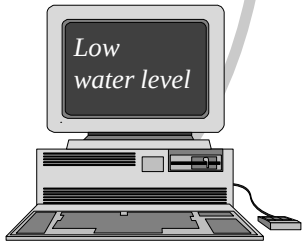


## Remote Control

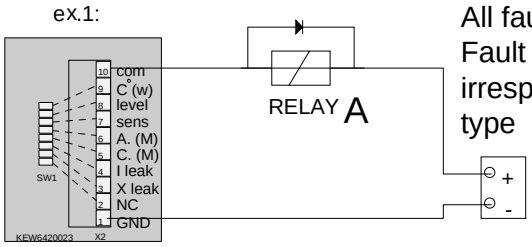
If you want to control the DELTABOOSTER installation, an additional P.C. board can be mounted, see illustration. The main P.C. board of the machine already has been prepared for this connection and only requires that the enclosed cable is plugged in, see illustration.
It is optional whether all faults should be connected to one alarm or whether each fault should be indicated. Reading may take place on a computer. However, for that purpose a coupling unit and software are required (can be purchased locally). The outlets of the P.C. board are potential free and galvanically separated from the control of the DELTABOOSTER.




All of the outlets are of the open collector transistor type and therefore require an external supply of max. 30 Volt DC, max. load 35 mA.

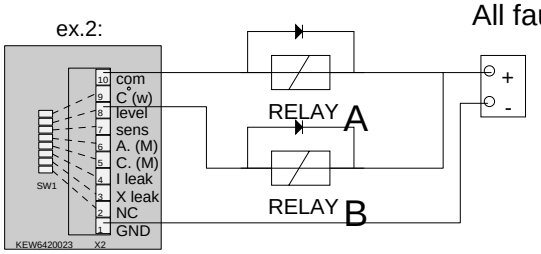



ex.1:




All faults
Fault indication irrespective of fault type

ex.2:




All faults and low water level

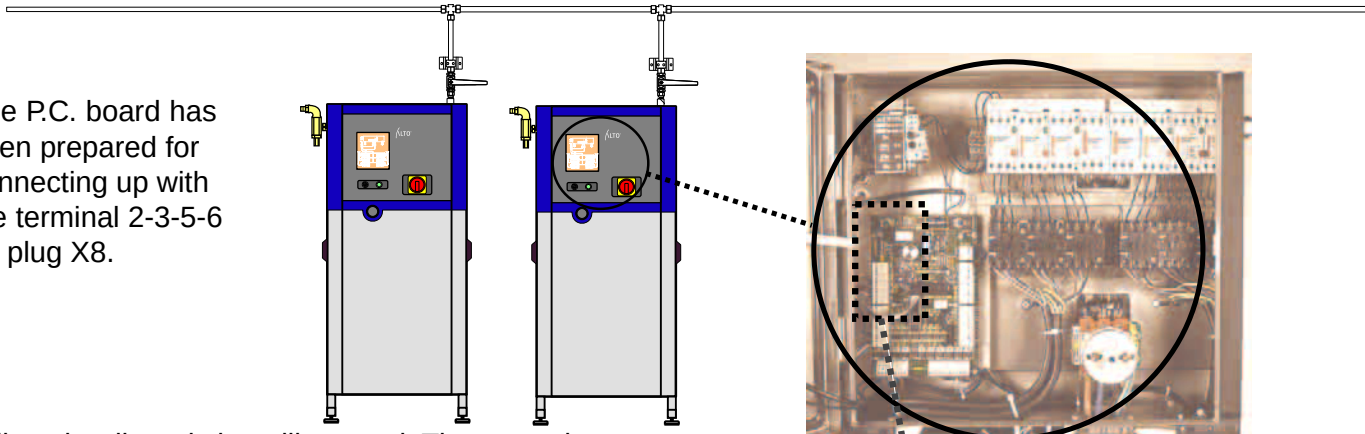
# Special Information



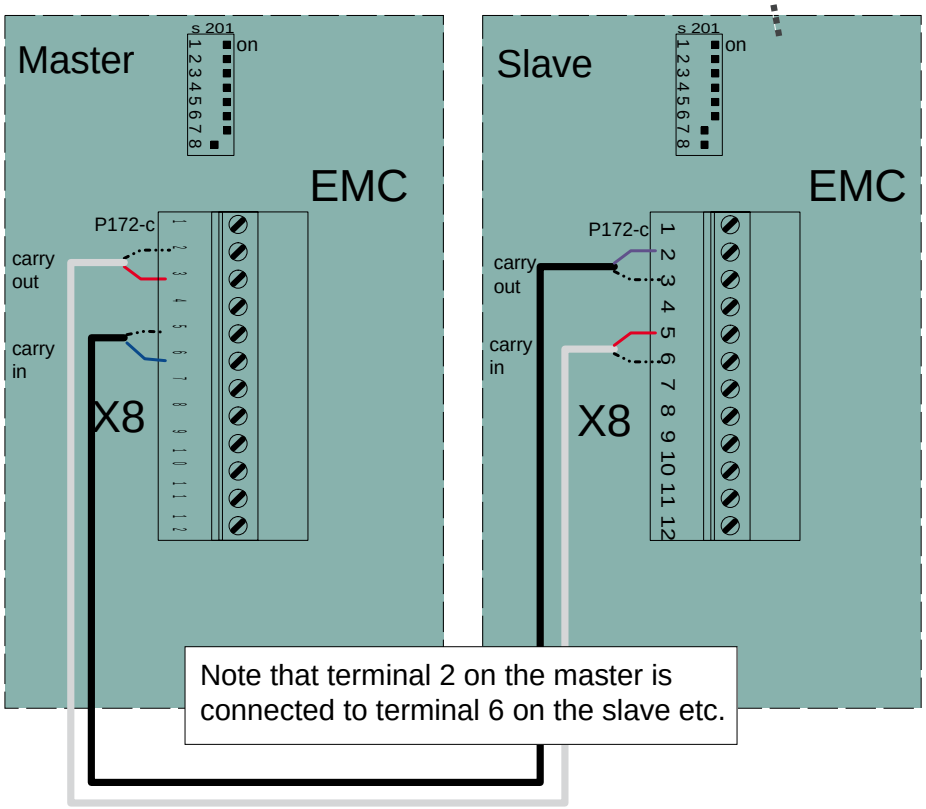
## Connecting up

It will be possible to connect up of 2-3-4 or more DELTABOOSTERs on the same pipeline. See illustration below.

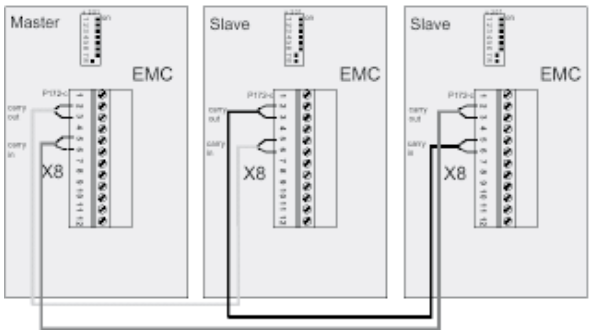
The P.C. board has been prepared for connecting up with the terminal 2-3-5-6 on plug X8.



Adjust the dip switch as illustrated. Thus you choose a master (the one starting up at first) and one or more slaves.




Connected up the machines work as a common unit. When the machine is started up manually, the master starts at first. If more pumps are required, or if all of the pumps of the master have been in operation, the signal will jump to the slave which then starts pumps according to requirements, etc.



## SERVICE/TECHNICAL INFORMATION

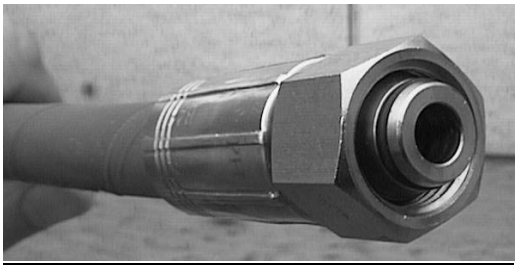
No. **290** - 27/06/00- KEH/RiL

**Subject: Delta Booster HP-hoses (pump)**

**Problem:** Leaky between jacket and hose (in some cases the hose is pressed off).

**Cause:** To gain tightness at the locking ring it was necessary to tighten very strongly, which caused a torsion between hose and jacket.

**Solution:** A new type hoses are introduced, which instead of the locking ring are mounted with an O-ring, and a new type of fitting, which only needs an easy tightening to gain 100% tightness.



**Period**: The hose is mounted on all Delta-Boosters produced after 15.08.98.

**Action**: Replacement is only to be done, if a leak is found.

**Spare part**: Spare part no.: 7302031 has not been changed, since the new hose is 100% compatible with the old hoses.

Best regards,
**ALTO Danmark A/S**

Kenney Hørbye
*Technical Supporter*

**Service Information**

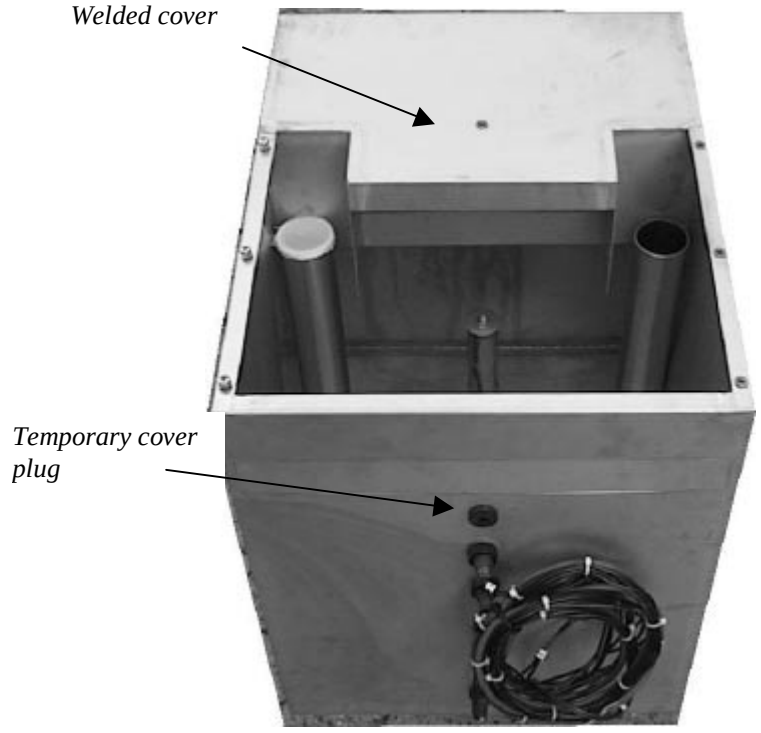
No. **293** - 26/06/00- KEH/RiL

## Subject: Delta Booster Water Tank

**Problem:** Water droplets from overflow and knock-out-pieces. Especially on installations with water pressure > 3 bar it has been noticed that water was leaking.

**Cause**: Water splash from the inflowing water was running under the cover and dripping down into the overflow, seeping down along the sides and out at the knock-out-pieces.
In some cases we have seen that water bubbles have lifted the water surface up to the overflow.

**Solution**: The water tank is divided in 2 zones, where the injection zone is designed with a welded cover. This to prevent droplets from the injection zone to come into the other zone. The problem with the rushing water has been solved by moving the 2 upper level sensors 50 mm down and by that lowering the max. water level.




**Action**: Since only in a very few places the problem will have practical effect, you have to evaluate yourself, if a replacement of the existing water tank is necessary.

**Spare part**: Only the cover of the water tank has got a new number – 7305033.

**Service information**

**No.** 299 **- 14/01/99- KEH/RiL**

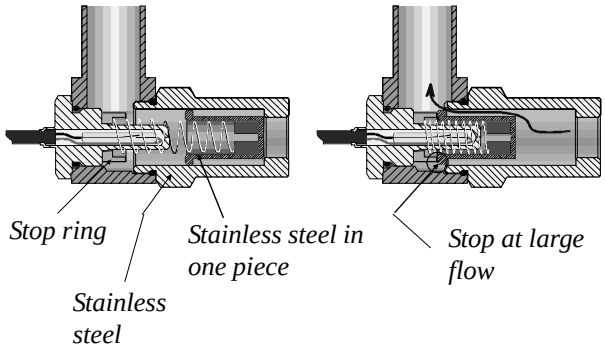
## Subject: DELTABOOSTER Overflow Switch

**Problem:** In large plants, where more pumps are often stopping at the same time, the magnet might hit the Reed-switch and get damaged. Also the valve is exposed to an extreme wear on the cylinder of the housing.

**Symptom:** The machine will stop because of a too high water temperature in the tank due to the fact that one or more pumps are not stopping (running by-pass).

**Cause:** When the DELTABOOSTER was introduced replacing the MPS-plant, a change was made in the programme, which secures that the pumps are starting quickly after each other, until a pressure of 25 bar is reached. Also because the system is more and more used in connection with pipings with larger capacity this secondary effect has turned up.

**Solution:** Introduced 01.12.98. The overflow switch is equipped with a stop ring, which is preventing the magnet from touching the Reed-switch. Housing and piston are made of stainless steel.




**Spare parts:** New kit no.1119404 contains: Cylinser housing, stop ring, piston, magnet, spring.

**Action:** Only to be replaced where there are problems.

**<u>Important</u>:** The stop ring is not allowed to be used alone in old type of flow switch, since a pressure rise in the intermediate hose might cause the hose to be pressed off.

**Best regards,**
**ALTO Danmark A/S**

**Service Information**

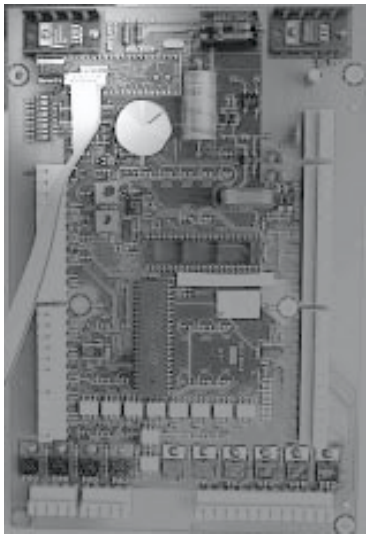
## No. 307 - 25/01/99- KEH/RiL

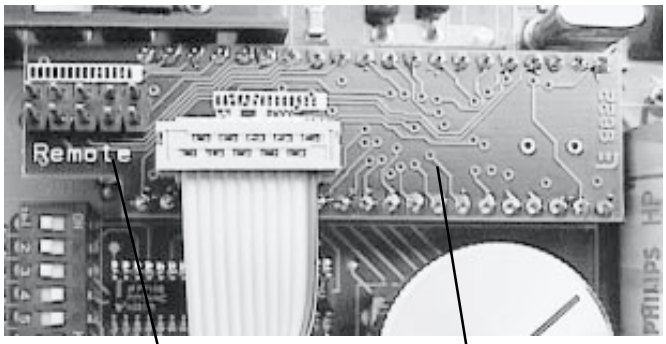
## Subject: DELTABOOSTER Print Kit

**Problem**: Supplier of micro controller for PC board for MPS and DELTABOOSTER has stopped the production.

**Solution**: **For DELTABOOSTER** PC board, no. 6420024, we have found a new supplier of a new type of micro controller, which further to the original function - which remains unchanged - makes it possible to couple an external fault control directly.

**Introduction**: 12.01.99.






*Plug for external fault control*

*New controller*

**Solution**: **For MPS,** PC board no. 6420020, we have built up a stock making it possible to find the old type of PC boards for many years ahead.

**Spare parts**: DELTABOOSTER PC board no. 6420024 to be replaced by **kit no. 7306029,** containing new PC board and new type of flat cable.

**New possibilities:** With the new PC board it is possible to recode the micro controller and by that adapting the functions to the needs of the customer.

Best regards,
**ALTO Danmark A/S**