

# Drive Unit

## Häggglunds PAC/PBC

**RA 15322**

Edition: 08.2018

Replaces: 01.2018

**Valid for:**

- ▶ Flow capacity: Up to 792 gpm at 50 Hz
- ▶ Flow capacity: Up to 951 gpm at 60 Hz
- ▶ Max. operating pressure: 5076 psi
- ▶ Frame size: Small, medium, large, and extra large
- ▶ 1–3 hydraulic compartment assembly
- ▶ Pump size: 40–750 cc
- ▶ 1–4 pump assembly

**Features**

- ▶ Closed sound insulated cabinet
- ▶ Vertical assembly – small footprint
- ▶ Configurable for many applications and customer demands
- ▶ Equipped with Häggglunds advanced control system

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## Ordering code

In order to identify Hägglunds equipment, the following ordering code is used.

01      02   03      04      05      06      07      08      09      10   11      12   13   14   15  
**PAC** - **060** **3** - **250** + **250** / **250** + **250** - **350** / **350** - **2** **2** - **1** **2** **1** **0** -

### Frame Style

<b>01</b>	Cabinet style unit with Painted Panels	<b>PAC</b>
	Cabinet style unit with Stainless Panels	<b>PACS</b>
	Open sytem unit	<b>PBC</b>

### Tank Size

<b>02</b>	200 Liter (53 Gallon)	<b>020</b>
	400 Liter (106 Gallon)	<b>040</b>
	600 Liter (159 Gallon)	<b>060</b>
	800 Liter (211 Gallon)	<b>080</b>
	1000 Liter (264 Gallon)	<b>100</b>
	1200 Liter (317 Gallon)	<b>120</b>
	1600 Liter (423 Gallon)	<b>160</b>
	2000 Liter (528 Gallon)	<b>200</b>

### Number of Bays

<b>03</b>		<b>2</b>
		<b>3</b>

### Pump Size (cc)

<b>04</b> <b>06</b>	SP pumps - Top right hand side	<b>040</b>
	SP pumps - Top left hand side	<b>071</b>
		<b>125</b>
		<b>180</b>
		<b>250</b>
		<b>355</b>
		<b>500</b>
		<b>750</b>

### Pump Size (cc)

<b>05</b> <b>07</b>	SP pumps - Bottom Right Hand Side	<b>040</b>
	SP pumps - Bottom Left Hand Side	<b>071</b>
		<b>125</b>
		<b>180</b>
		<b>250</b>
		<b>355</b>
		<b>500</b>
	<b>750</b>	

01      02   03      04      05      06      07      08      09      10   11      12   13   14   15  
**PAC** - **060** **3** - **250** + **250** / **250** + **250** - **350** / **350** - **2** **2** - **1** **2** **1** **0** -

**Electric motor (hp)**

<b>08</b>	Electric power (hp) - Right hand side	<b>15</b>
<b>09</b>	Electric power (hp) - Left hand side	<b>20</b>
		<b>25</b>
		<b>30</b>
		<b>40</b>
		<b>50</b>
		<b>60</b>
		<b>75</b>
		<b>100</b>
		<b>125</b>
		<b>150</b>
		<b>200</b>
		<b>250</b>
		<b>300</b>
		<b>350</b>
		<b>400</b>
		<b>450</b>
		<b>500</b>
		<b>600</b>
		<b>700</b>
		<b>800</b>

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**PAC** - **060** **3** - **250** + **250** / **250** + **250** - **350** / **350** - **2** **2** - **1** **2** **1** **0** -

### Control System

10	None	0
	Driver Card	1
	Spider - No BUS	2
	Spider - Profibus	3
	Spider - Modbus RTU	4
	Spider - Modbus TCP	5
	Spider - ControlNet	6
	Spider - DeviceNet	7
	Spider - Ethernet IP	8

### Control System Mounting

11	None	0
	Mounted inside drive unit	1
	Mounted in drive unit door	2
	Supplied as separate item, with bracket	3
	Supplied as separate item, with flange	4
	Mounted outside on power unit (specify)	5
	Loose item	6

### High Pressure Transmitter

12	No	0
	Yes	1

### High Pressure Monitoring

13	No	0
	Yes (High Pressure Transducer)	1
	Yes (High Pressure Switch)	2

### Cabinet Feet

14	No	0
	Yes	1

### Filter

15	Single Filter	0
	Duplex Filter	1

### Oil Heater

16	No	0
	Yes	1

16 17 18 19 20 21 22 23 24 25 26 27  
**0** **X** **0** **B** **B** - **0** **0** **0** **0** - **0** - **575** / **60**

**Oil Heater Voltage**

17	None	<b>X</b>
	120 VAC	<b>B</b>
	240 VAC	<b>C</b>
	380 VAC (3Ø)	<b>D</b>
	400 VAC (3Ø)	<b>E</b>
	415 VAC (3Ø)	<b>F</b>
	440 VAC (3Ø)	<b>G</b>
	460 VAC (3Ø)	<b>H</b>
	480 VAC (3Ø)	<b>I</b>
	525 VAC (3Ø)	<b>J</b>
	575 VAC (3Ø)	<b>K</b>
	600 VAC (3Ø)	<b>L</b>
	660 VAC (3Ø)	<b>M</b>
	690 VAC (3Ø)	<b>N</b>
Other	<b>Z</b>	

**Oil Cooler**

18	Water Cooler, Standard	<b>0</b>
	Air / Oil Cooler	<b>1</b>
	None	<b>X</b>

**Water Valve or Air Cooler Voltage**

19	None	<b>X</b>
	24 VDC	<b>A</b>
	120 VAC	<b>B</b>
	240 VAC	<b>C</b>
	380 VAC (3Ø)	<b>D</b>
	400 VAC (3Ø)	<b>E</b>
	415 VAC (3Ø)	<b>F</b>
	440 VAC (3Ø)	<b>G</b>
	460 VAC (3Ø)	<b>H</b>
	480 VAC (3Ø)	<b>I</b>
	525 VAC (3Ø)	<b>J</b>
	575 VAC (3Ø)	<b>K</b>
	600 VAC (3Ø)	<b>L</b>
	660 VAC (3Ø)	<b>M</b>
690 VAC (3Ø)	<b>N</b>	
Other	<b>Z</b>	

## Ordering code

In order to identify Hägglunds equipment, the following ordering code is used.

16	17	18	19	20	21	22	23	24	25	26	27
0	X	0	B	B	0	0	0	0	0	575	/ 60

### Control Box Voltage

20	None	X
	24 VDC	A
	120 VAC	B
	240 VAC	C

### Accumulator

21	No	0
	Yes	1

### Inspection, Witness Testing, or Approvals

22	No	0
	Yes	1

### High Pressure Piping

23	No	0
	Yes	1

### Sound Package

24	No	0
	Yes	1

### Electric Motor Supplier

25	Bosch Rexroth	0
	Customer	1

### Electric motor Voltage (3Ø)

26	Main voltage	
----	--------------	--

### Electric Motor Frequency (Hz)

27		50
		60

## Function Häggglunds PAC/PBC

### General

The PAC/PBC drive unit provides the hydraulic motor(s) with required hydraulic oil flow and pressure together with system control functionality.

The drive unit is divided to 4 basic sizes depending on electric motor power and hydraulic flow requirements:

- ▶ Small (S)
- ▶ Medium (M)
- ▶ Large (L)
- ▶ X-Large (XL)

The drive units are built with one, two, or three hydraulic compartments. S, M, L, and XL can have two or three compartments depending on required number of pumps. Two and three compartment units contain one with the hydraulic oil tank and one or two with the electric motor/pump combination. All compartments are assembled in one common cabinet.

The basic combinations will be PAC/PBC S2, PAC/PBC S3, PAC/PBC M2, PAC/PBC M3, PAC/PBC L2, PAC/PBC L3, and PAC/PBC XL3.

A single compartment cabinet can be added to the M, L, and XL variants for higher flow requirements, for emergency drives or as a standby unit. The drive unit supports functionality for one or two driven machine shafts. Functions such as cold/warm flushing and brake circuits for the hydraulic motors are available as options.

The drive unit has an embedded control system with a large variety of configurable functionality to simplify the control and monitoring of the hydraulic drive. The control system is pre-programmed and easy to configure and contains functions such as:

- ▶ Variable-speed control
- ▶ Speed feedback
- ▶ Power limitation
- ▶ Industrial fieldbus communication
- ▶ Analog and digital signal monitoring
- ▶ Pressure control (torque control) and application specific functions as:
  - ▶ Friction control
  - ▶ Shedder control
  - ▶ Synchronized control

For detailed functionality and configuration, see data sheet

for Häggglunds Spider Control System, EN777. The PAC/PBC drive unit can be delivered without control system, if required. All electrical wiring for sensors and pump control will be wired to a junction box assembled on the side of the drive unit. Driver card for pump can be assembled as an alternative in the junction box or in a separate box.

Monitoring of the drive unit sensors must be handled externally according to "Fig. 3: Monitoring logic diagram" on page 12. The drive unit is available for:

- ▶ Power ranges from 15 hp to 2 x 800 hp
- ▶ Flow ranges up to 792 gpm at 1500 rpm (951 gpm at 1800 rpm)
- ▶ Working pressure max 5076 psi

### Test certificate

Test certificates for each drive unit may be provided upon request.

### Standards

Control system Spider

- ▶ EMC Directive 2014/30/EU
- ▶ Low Voltage Directive 2014/35/EU

Quality assurance system, certified to standard ISO 9001.

### Ambient temperature

#### Upper limit

A standard drive unit has an upper ambient temperature limit of 50°C (122°F).

#### Lower limit

A standard drive unit has a lower ambient temperature limit of -40°F (-40°C). (Without water-oil cooler)

**Combinations of pump and electric motor – Hägglunds PAC / PBC drive unit**

**Table 1: Single pump and electric motor combinations**

		Single pumps								
		hp(kW)	Pump SP							
			40	71	125	180	250	355	500	750
Small (S)	Electric Motor	15(11)	●							
		20(15)	●							
		25(19)	●	●						
		30(23)	●	●	●					
		40(30)	●	●	●					
		50(38)		●	●	●				
		60(45)		●	●	●				
		75(56)		●	●	●				
Medium (M)	Electric Motor	100(75)		●	●	●				
		125(94)			●	●	●	●		
		150(113)				●	●	●	●	
		200(150)				●	●	●	●	
		250(188)					●	●	●	
		300(225)					●	●	●	
Large (L)	Electric Motor	350(263)					●	●	●	
		400(300)							●	
		450(338)							●	
Extra Large (XL)	Electric Motor	500(375)							●	
		600(450)								●
		700(525)								●
		800(600)								●

● Configurable drive unit.



Circuit diagram

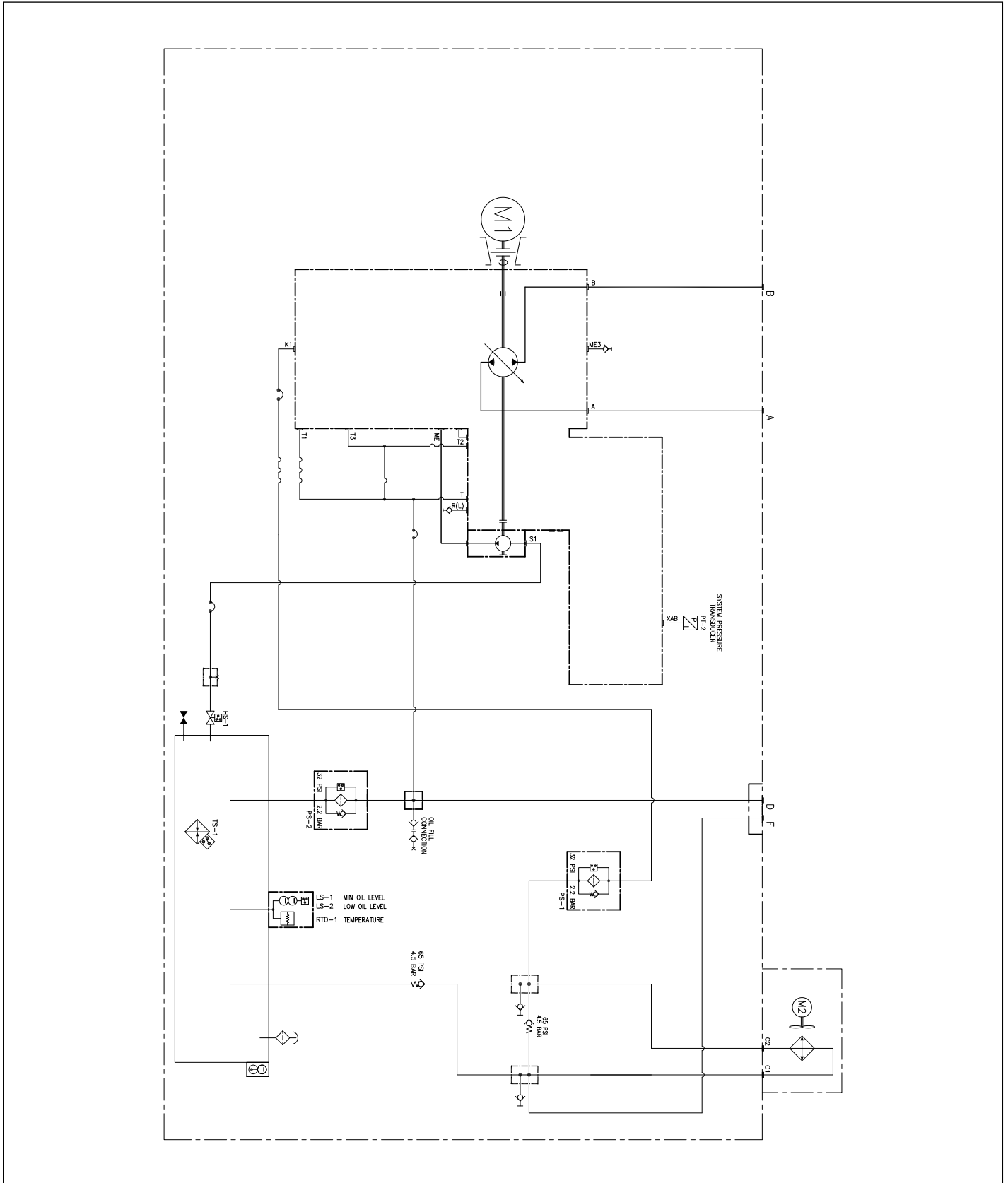


Fig. 1: Simplified hydraulic circuit single pump



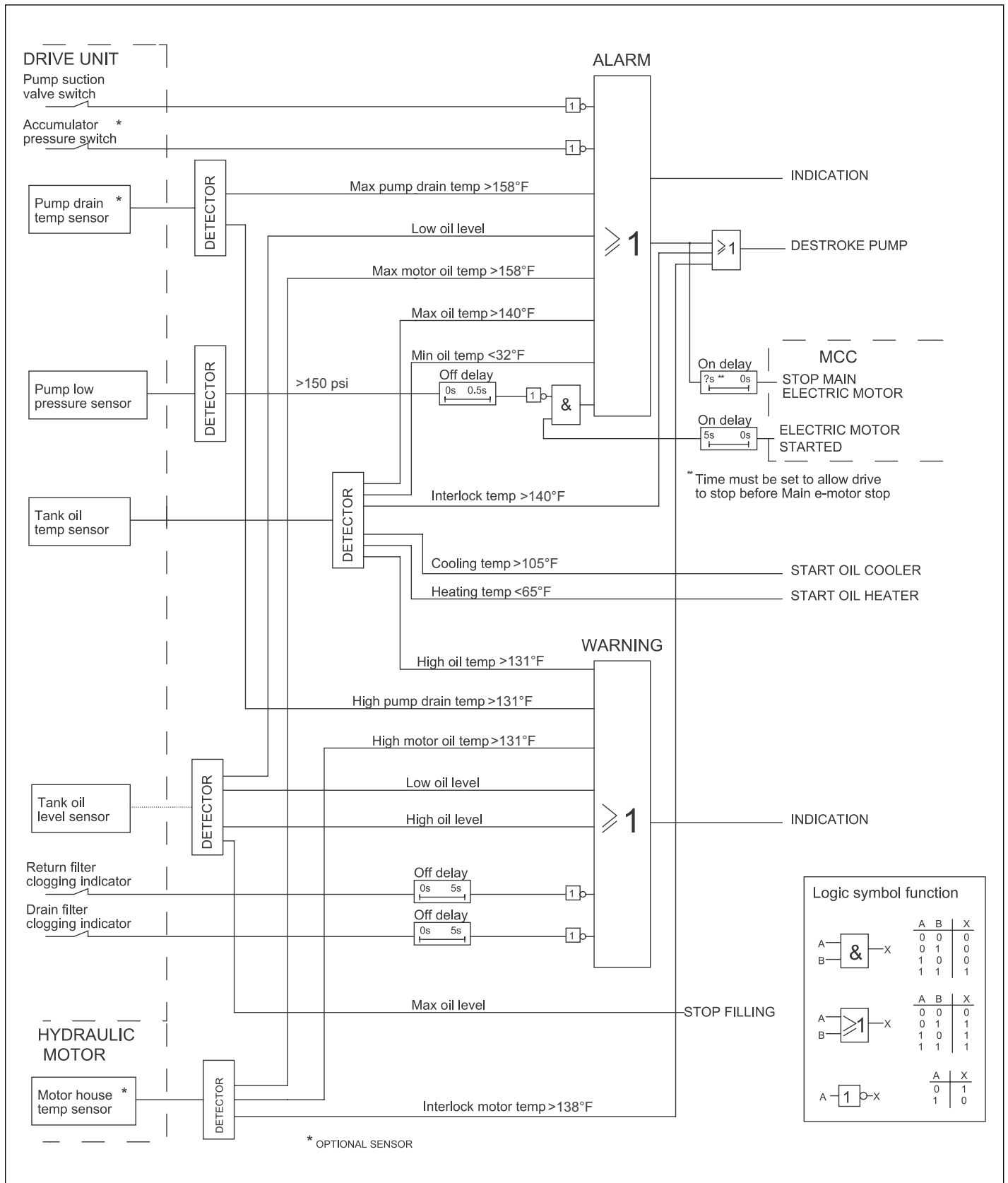


Fig. 3: Monitoring logic diagram

## Technical Data

### Drive Unit (PAC/PBC)

#### Weights

**Table 3: Weight drive unit (PAC)**

Cabinet size	Weight without oil, electric motor, tank, pump, and cooler
	lb.*
PAC S2	1450
PAC S3	2200
PAC M2	2500
PAC M3	3500
PAC L3	4700
PAC XL3	6800

\* Values are rounded to the higher number fifty.

**Table 4: Weight drive unit (PBC)**

Cabinet size	Weight without oil, electric motor, tank, pump, and cooler
	lb.
PBC S2	675
PBC S3	1629
PBC M2	1475
PBC M3	1854
PBC L3	3100
PBC XL3	4269

**Table 5: Weight tank**

Tank size	Weight
l	lb.
200	250
400	300
600	400
800	550
1000	650
1200	800
1600	1100

**Table 6: Weight electric motor**

WEG	Weight
hp	lb.
15	251
20	291
25	388
30	437
40	492
50	536
60	869
75	1118
100	1140
125	1590
150	1675
200	2094
250	2094
300	2381
350	2674
450	3395
500	3461
550	4334
600	4334
650	4394
700	4583
750	4951

**Table 7: Weight pump**

Pump	Weight	Attachment kit	Weight	Pump	Weight
	lb.		lb.		lb.
SP40	163	SP40 + SP40	9		
SP71	216	SP71 + SP71	11	HD6S	335
SP125	331	SP125 + SP125	22	HD7S	335
SP180	348	SP180 + SP180	22	HD11S	485
SP250	589	SP250 + SP250	55	HD14S	485
SP355	611	SP355 + SP355	64	HD24S	754
SP500	869	SP500 + SP500	73	HD30S	787
SP750	1191				

**Table 8: Weight air cooler**

<b>Air cooler type</b>	<b>Weight lb.</b>
BOL-16	55
BOL-30	125
BOL-725	170
BOL-950	300
BOL-1200	430
BOL-1600	515
BOL-2000	582

**Table 9: Weight tube cooler**

<b>Cooler type</b>	<b>Weight lb.</b>
B-700	30
B-1000	65
B-1200	160
B-1600	400

**Example**

Given:

Cabinet type, PAC M3 with 600 gal tank and

B-1200 tube cooler.

Electric motors, 150 hp and 200 hp

Pumps, SP250 and SP250+SP125

Solution:

Weights from tables:

Power unit without e-motors and pumps 3500 lb.

Tank 400 lb.

Cooler 160 lb.

Electric motors, from table 1675 lb. and 2094 lb.

Pumps, from table 589 lb. and 942 lb. (589+331+22)

Total weight :

$3500+400+160+1675+2094+589+942 = 9360$  lb.

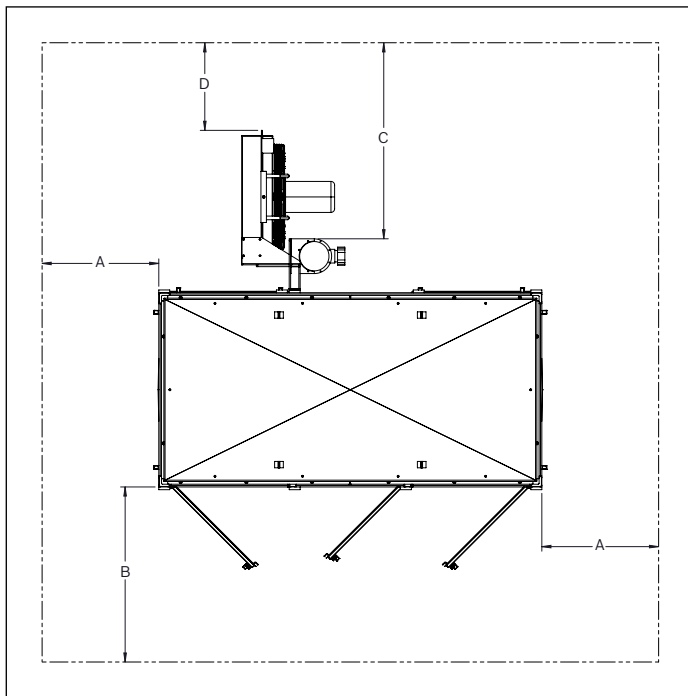
Round the value to the higher number hundred (for small cabinets the higher number fifty): 9400 lb.

## Positioning the PAC/PBC

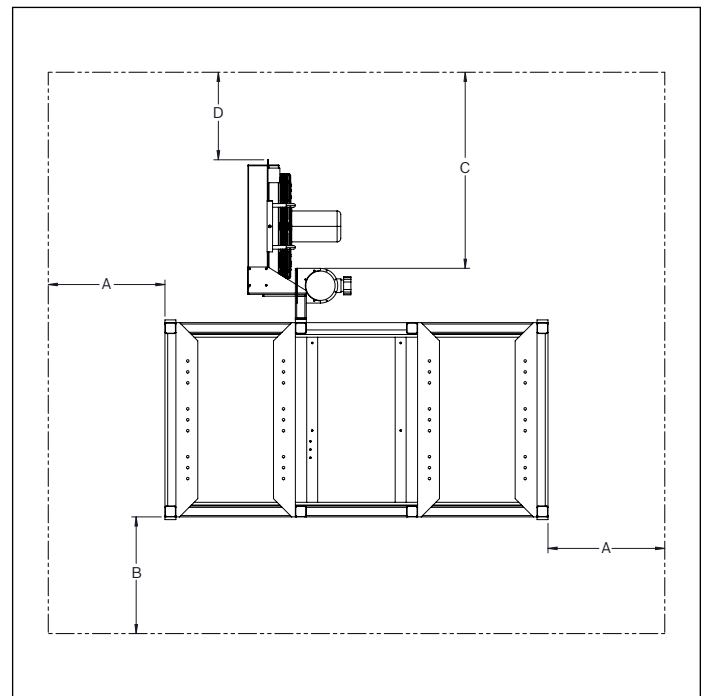
The following space must be left free around the drive unit, to allow free ventilation and to provide sufficient working space for maintenance. Heavier maintenance such as change of motor/pump will demand more working space. The drive units shall not be installed side by side with facing panels removed. It is important that all pipes (both for water and hydraulics) are arranged to provide sufficient working space for maintenance.

**Table 10: Recommended space around drive unit**

Minimum space	PAC (in.)	PBC (in.)
A	32	32
B	48	32
C	32	32
D	24	24



**Fig. 4: Recommended minimum space around drive unit, PAC**



**Fig. 5: Recommended minimum space around drive unit, PBC**

## Dimensions PAC

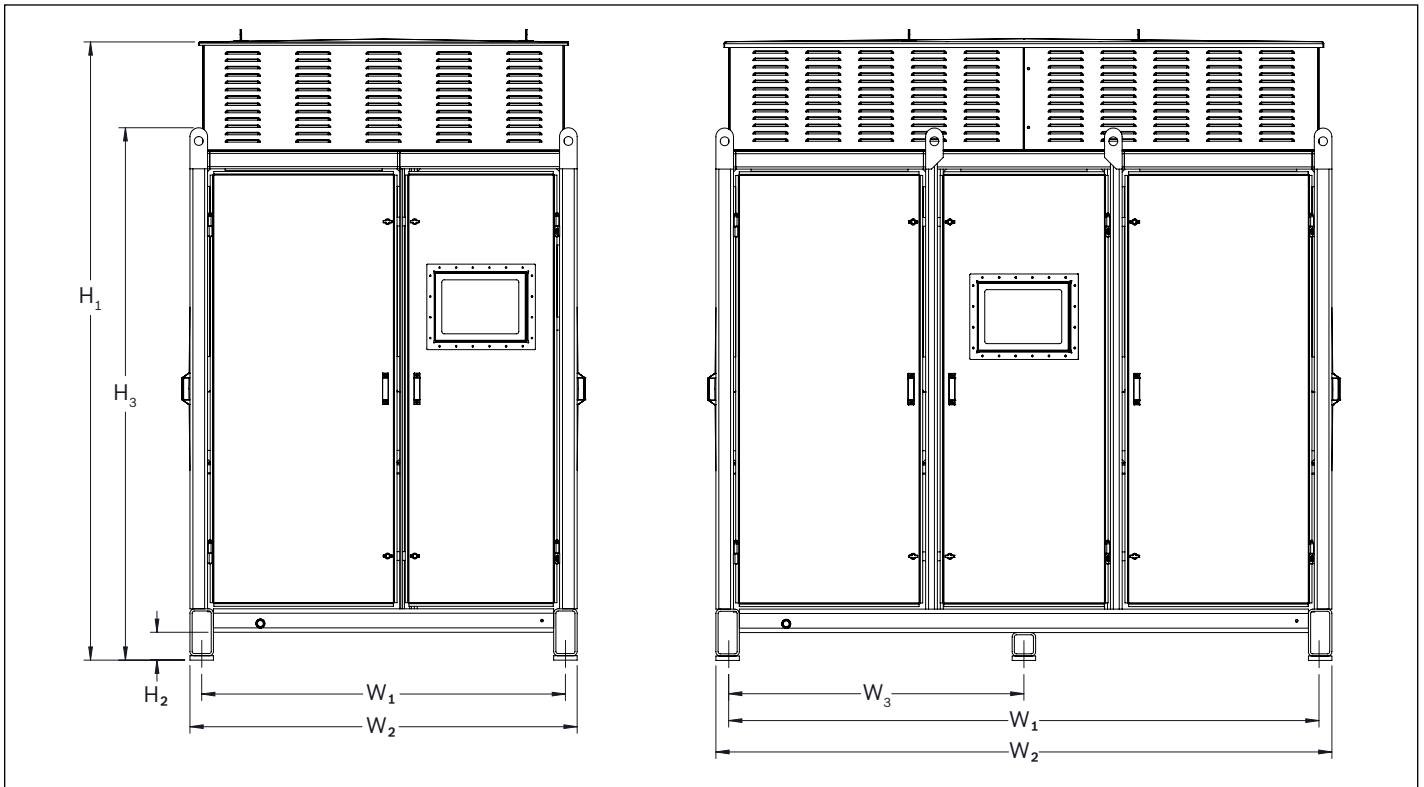


Fig. 6: Front view, example PAC with two compartments and PAC with three compartments

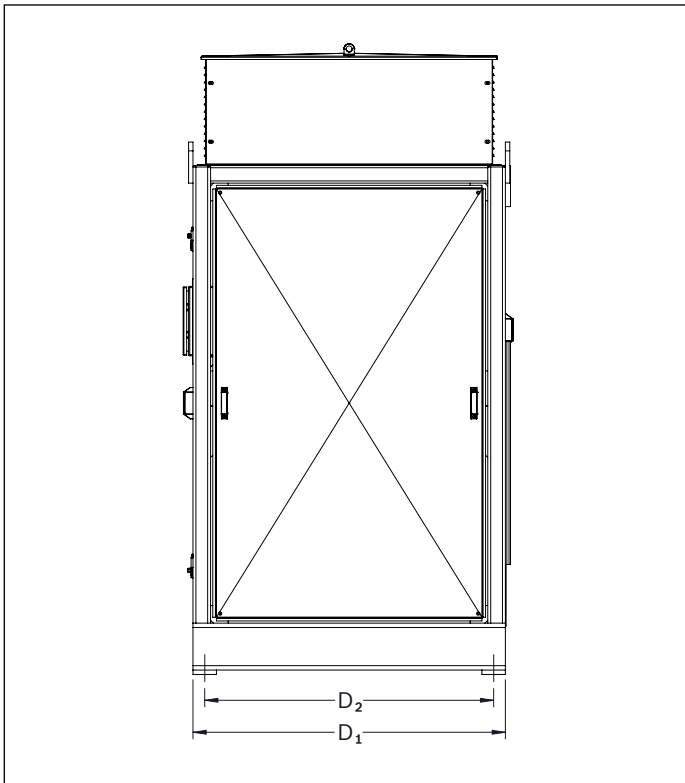
Table 11: Dimensions Hägglunds PAC

Type	Dimensions, height (H)*			Dimensions, width (W)		
	H <sub>1</sub> ** in.	H <sub>2</sub> in.	H <sub>3</sub> in.	W <sub>1</sub> in.	W <sub>2</sub> in.	W <sub>3</sub> in.
PAC S2	93/97	3.75	84.75	52.13	55	–
PAC S3	93	3.75	84.75	79.63	83	39.81
PAC M2	116/128	4.75	90.75	65	69	–
PAC M3	106/126	4.75	90.75	101	105	50.31
PAC L3	118/136	4.75	103.75	117.75	122	38.56
PAC XL3	125/161	4.75	104.75	138	144	44.25

\* Usage of machine feet will increase height by 1.56 in.

\*\* Min./Max. height

**Dimensions PAC (cont.)**



**Fig. 7: Side view PAC**

**Table 12: Häggglunds PAC, frame depth**

Type	Dimensions, depth (D)	
	D <sub>1</sub>	D <sub>2</sub>
	in.	in.
PAC S2	39	36
PAC S3	39	36
PAC M2	53	49
PAC M3	53	49
PAC L3	60	56
PAC XL3	72	66

## Dimensions PBC

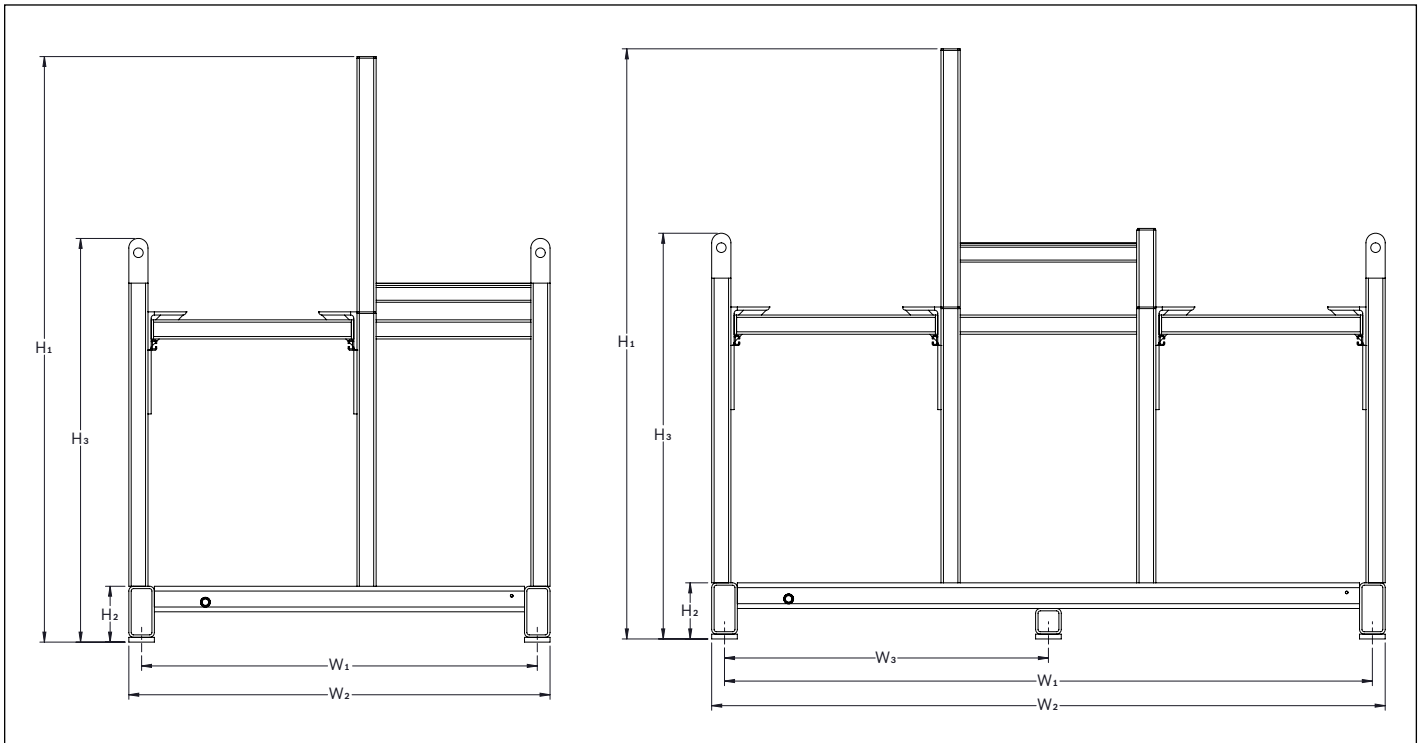
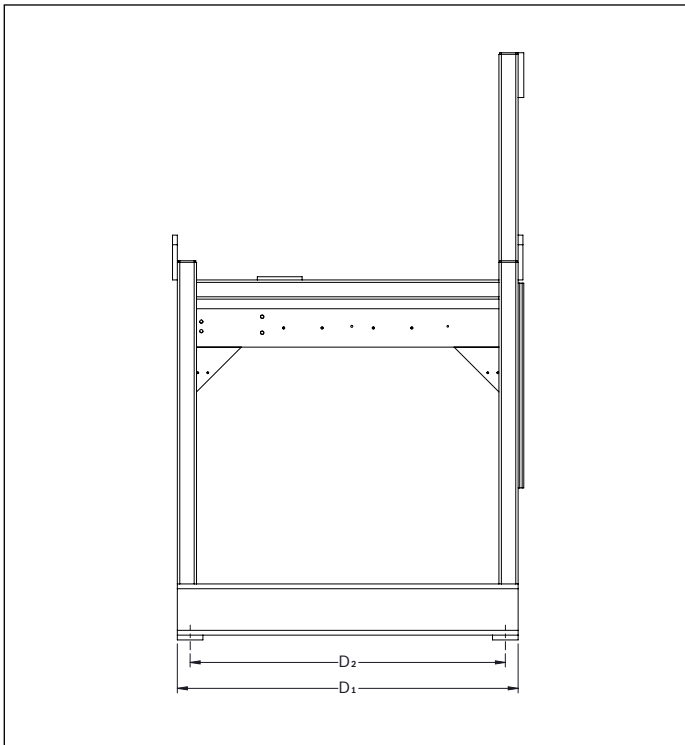


Fig. 8: Front view, example PBC with two compartments and PBC with three compartments

Table 13: Dimensions Hägglunds PBC

Single Pumps							
Type	Dimensions, height (H)*			Dimensions, width (W)			
	H <sub>1</sub> ** in.	H <sub>2</sub> in.	H <sub>3</sub> in.	W <sub>1</sub> in.	W <sub>2</sub> in.	W <sub>3</sub> in.	
PBC S2	80.75	3.75	44.75	52.13	55	–	
PBC S3	80.75	3.75	44.75	79.63	83	39.81	
PBC M2	86.75	4.75	55.75	65	69	–	
PBC M3	86.75	4.75	55.75	101	105	50.31	
PBC L3	99.75	4.75	59.5	117.75	122	38.56	
PBC XL3	100.75	4.75	66.5	138	144	44.25	
Tandem Pumps							
Type	Dimensions, height (H)*			Dimensions, width (W)			
	H <sub>1</sub> ** in.	H <sub>2</sub> in.	H <sub>3</sub> in.	W <sub>1</sub> in.	W <sub>2</sub> in.	W <sub>3</sub> in.	
PBC S2	80.75	3.75	56.75	52.13	55	–	
PBC S3	80.75	3.75	56.75	79.63	83	39.81	
PBC M2	86.75	4.75	75.75	65	69	–	
PBC M3	86.75	4.75	75.75	101	105	50.31	
PBC L3	99.75	4.75	78.75	117.75	122	38.56	
PBC XL3	100.75	4.75	78.75	138	144	44.25	

**Dimensions PBC (cont.)**

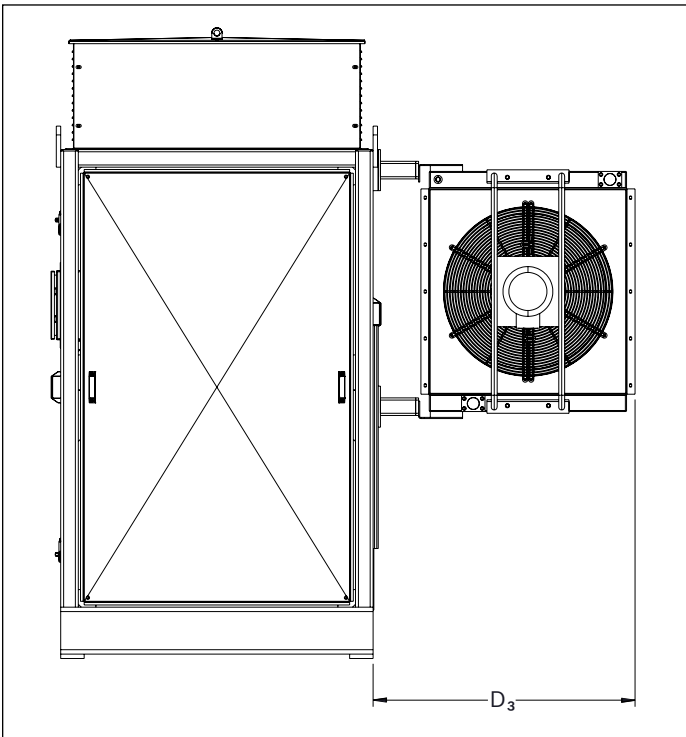


**Fig. 9: Side view, PBC**

**Table 14: Hägglungs PBC Frame Depth**

Type	Dimensions, depth (D)	
	D <sub>1</sub> in.	D <sub>2</sub> in.
PBC S2	39	36
PBC S3	39	36
PBC M2	53	49
PBC M3	53	49
PBC L3	60	56
PBC XL3	72	66

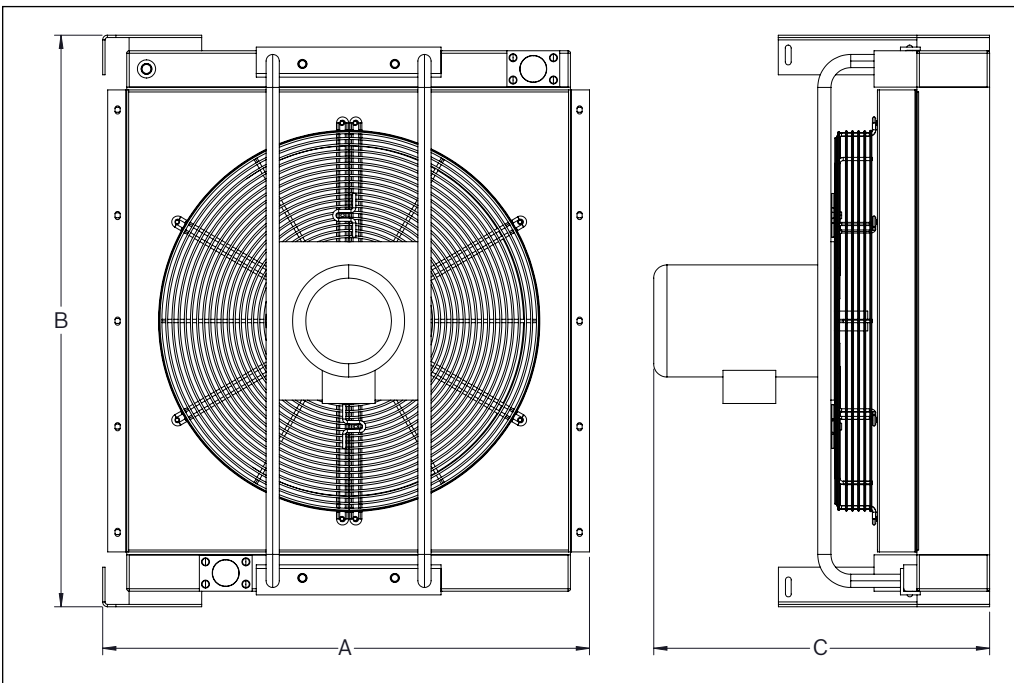
**Dimensions PAC/PBC with air-oil cooler**



**Fig. 10: PAC/PBC air cooler**

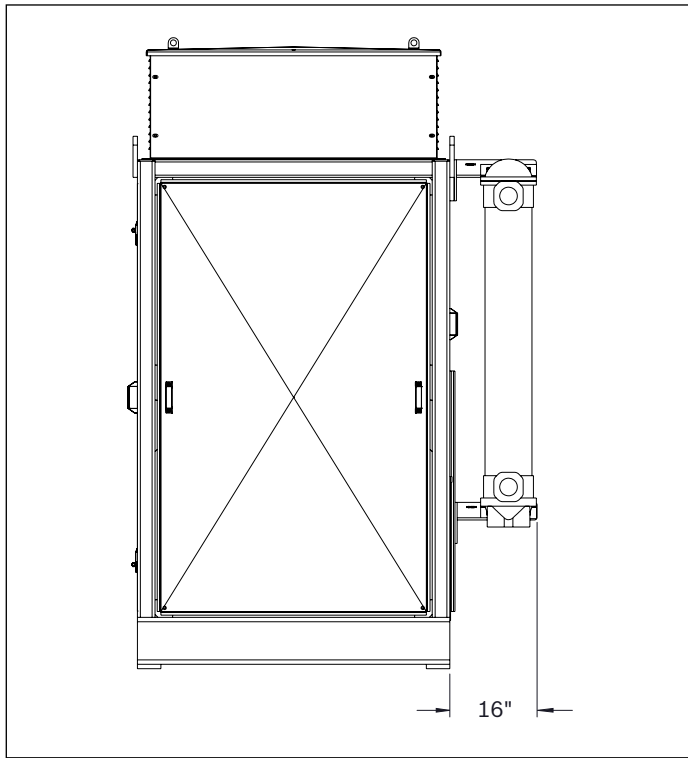
**Table 15: Dimensions air-oil cooler**

Cooler size	A	B	C	D <sub>3</sub>
	in.	in.	in.	in.
BOL-16	16.63	19.69	16.16	24.38
BOL-30	21.09	26.38	18.23	28.84
BOL-725	23.49	30.32	18.60	31.24
BOL-950	27.94	37.03	22.69	35.69
BOL-1200	27.94	40.96	24.07	35.69
BOL-1600	36.01	40.96	25.45	43.76
BOL-2000	39.53	50.79	26.77	47.28



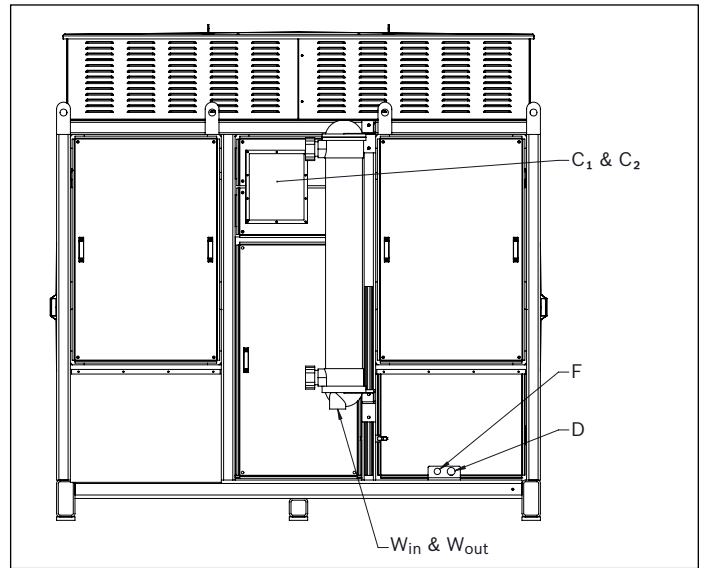
**Fig. 11: Dimensions air-oil cooler**

**Dimensions PAC/PBC with water-oil tube cooler**



**Fig. 12: PAC/PBC tube cooler**

**Connections**

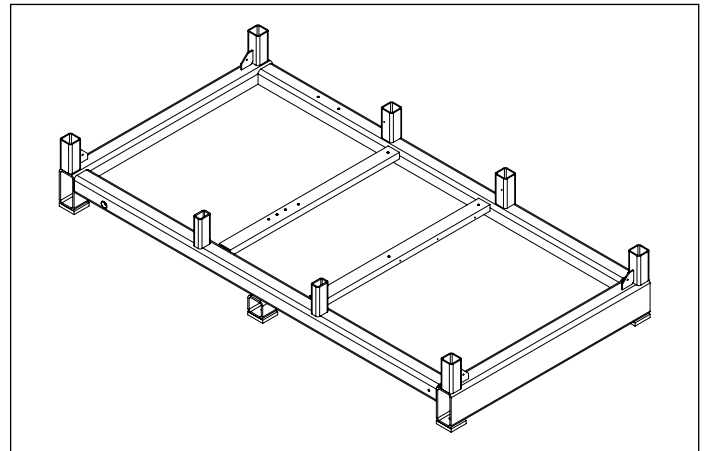


**Fig. 13: Connections PAC**

**Table 16: Connections PAC**

	Function
C <sub>1</sub>	Oil OUT to cooler
C <sub>2</sub>	Oil IN from cooler
F	Oil OUT flushing motor(s)
D	Drain from hydraulic motor(s)
W <sub>in</sub>	Water in oilcooler
W <sub>out</sub>	Water out oilcooler

**PAC/PBC oil pan volume**



**Fig. 14: Oil pan volume (PAC/PBC)**

**Table 17: Oil pan volume (PAC/PBC)**

S2	S3	M2	M3	L3	XL3
60 liter	94 liter	147 liter	234 liter	306 liter	450 liter
16 gallon	25 gallon	39 gallon	62 gallon	81 gallon	119 gallon

## Main components

### Electric motor

#### Function

The electric motor is a totally enclosed, fan cooled TEFC squirrel-cage, 4-pole 3-phase motor. If the Häggglunds PAC/PBC will be operating in damp environment, it is advised to use an anti-condensation heater to reduce the risk of short circuit in the electric motor.

The electric motors used as standard in the drive unit are manufactured by WEG. It is possible to select other customer supplied brands of electric motors as long as the limitations in electric motor dimensions and maximum weight are withheld.

#### Output power

15–450 hp

#### Voltage Frequency

380 V 50 Hz	440 V 60 Hz
400 V 50 Hz	460 V 60 Hz
415 V 50 Hz	480 V 60 Hz

#### Technical Data

**Table 18: Technical data electric motor**

Operating Duty:	S1
Method of mounting:	Vertical, F1 conduit box
Degree of protection:	IP55
Cooling form:	Fan
Insulation class:	F
Greasing:	Zerk style
Heater elements:	120 VAC 50/60 Hz
Painting:	ISO 12944 "C2"
Sound press. level Lp:	≤ 80 dB(A)

#### Standards

**Table 19: Standards electrical motor**

Standard:	NEMA MG1
EU Efficiency classes:	Premium efficiency class IE3

#### Required conditions, voltage

The motors can withstand a continuous voltage deviation of 5% and a maximum deviation of up to 10% for a short time.

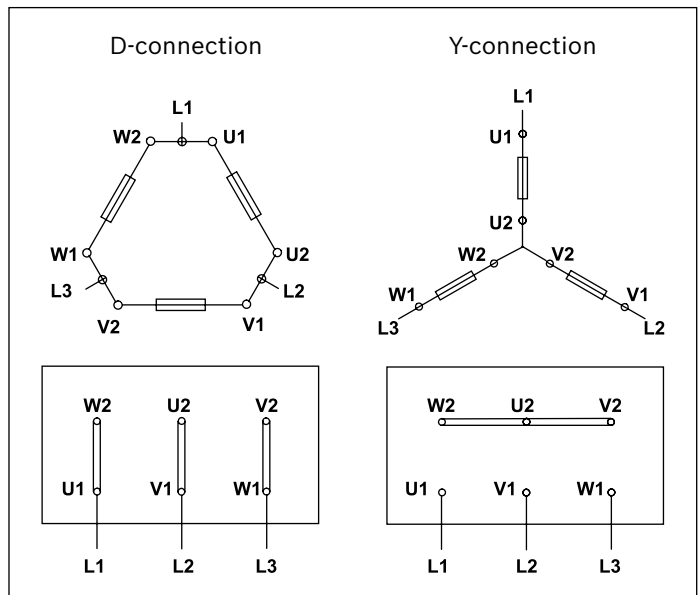
#### Required conditions, altitude

Ambient temperature: –4°F – 105°F (–40°F optional)

Altitude above sea level: 3280 ft. (higher altitude optional)

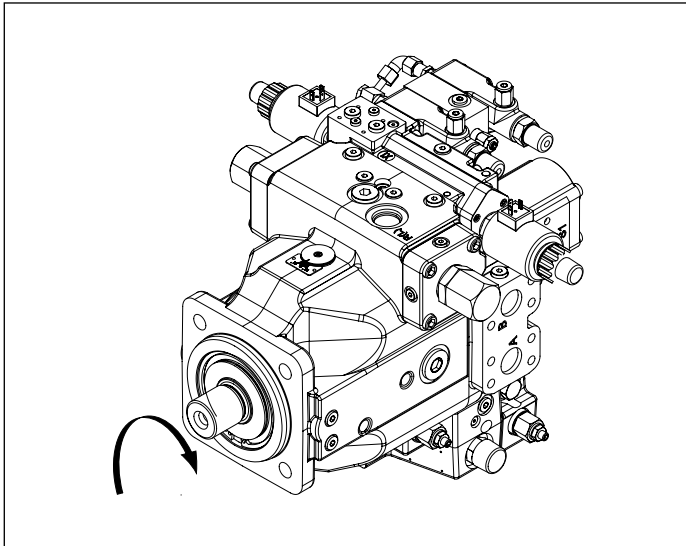
#### D and Y-connections

The three windings of the motor can be connected inside the terminal box to the three phase supply net in two different ways, Y-(star-) or D-(Δ-) connection.



**Fig. 15: D and Y connections**

## Main pump SP

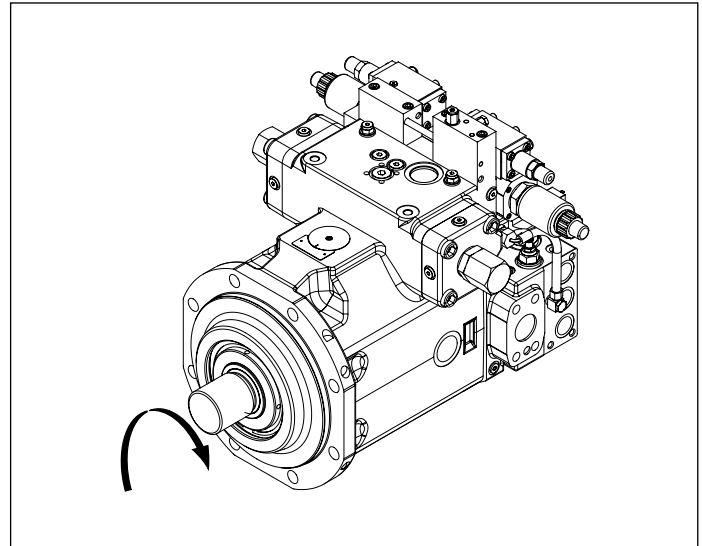


**Fig. 16: Pump SP size 40 to 180**

Nominal pressure: 5076 psi  
 Peak pressure: 5800 psi  
 Closed hydraulic circuit operation

### Features

- ▶ Variable displacement axial piston pump of swashplate design for hydrostatic closed circuit transmissions
- ▶ Flow is proportional to speed and displacement and is infinitely variable through adjustment of the swivel angle
- ▶ Output flow increases with swivel angle from 0 to its maximum value
- ▶ Swivelling the pump over center smoothly changes the direction of flow
- ▶ A highly adaptable range of control and regulating devices are available
- ▶ The pump is equipped with two pressure relief valves on the high pressure ports to protect the hydrostatic transmission (pump and motor) from overloads
- ▶ One common pump for charge and EP displacement control



**Fig. 17: Pump SP size 250 to 750**

### Pump size 40 to 180

Auxiliary charge pump and control valves

### Pump size 250 to 750

Charge pump and control valves are integrated.

- ▶ Compact overall design
- ▶ Low noise level
- ▶ Long service life
- ▶ High efficiency
- ▶ Throughdrive for multiple pump combinations also possible with integrated charge pump up to 100%
- ▶ SP pumps can be tandem mounted to the same electric motor in combinations according to "Table 2: Tandem pump and electric motor combinations" on page 9

### Technical data SP 40-750

Valid for operation on mineral oil.

#### Operating pressure range

Depending on the behavior of the transmitted hydraulic energy in the system, charge pressure fluctuations can occur. In order to prevent damage to the system, charge pressure protection, which monitors the static charge pressure part is necessary. Port Mk4 is suitable to monitor the charge pressure. It is recommended to check regularly the charge pressure for the permissible max. and min. spikes with suitable measuring equipment.

In order to prevent excessive charge pressure spikes, a low pressure accumulator can be connected to port K4. Accumulator sizing as well as the selection for the best connecting location depend on the system behavior and the operating conditions under consideration of the available charge flow. Depending on the total systems leakage flow, it may be necessary to increase the charge flow by means of a larger or additional charge pump, see Inlet pressure at port S1 (auxiliary pump).

### Technical data SP 40-180

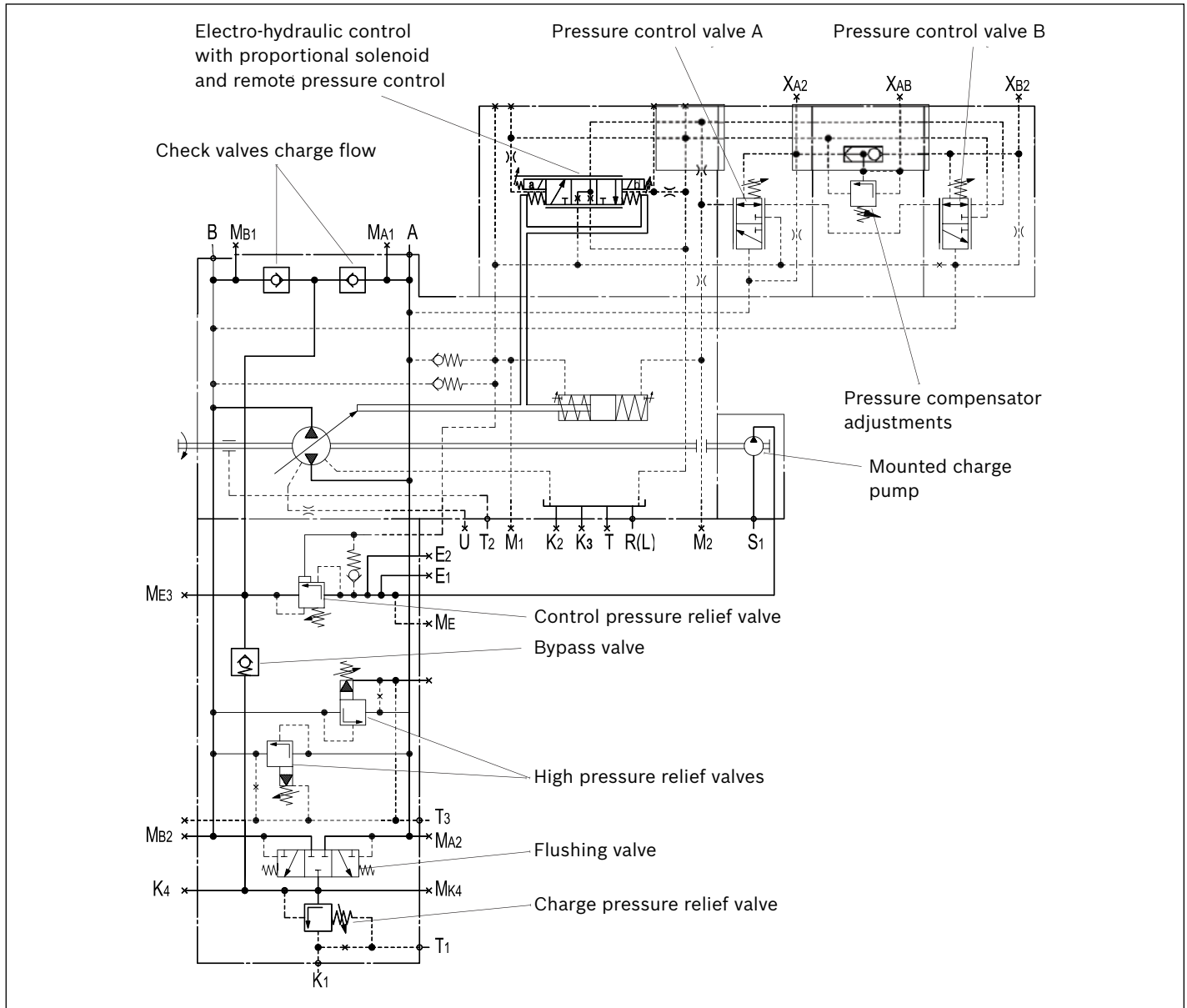
**Table 21: Technical data SP 40-180**

Size				40	71	125	180
Displacement	Variable pump	$V_{g\ max}$	cm <sup>3</sup>	40	71	125	180
	Auxiliary pump	$V_{g\ H}$	cm <sup>3</sup>	20	25	38	45
Speed	max. speed	$n_{\max}$	rpm	1800	1800	1800	1800
	min. speed	$n_{\min}$	rpm	1500	1500	1500	1500
Flow	at $n_E=1800$ rpm		gpm	18.8	33.4	58.8	85.6
	at $n_E=1500$ rpm		gpm	15.6	27.8	48.9	71.3
Power, max. at ( $D_p=5076$ psi)	at $n_E=1800$ rpm		hp	60	100	175	250
	at $n_E=1500$ rpm		hp	50	75	150	200
Torque at $V_{g\ max}$	$D_p=5076$ psi	$T_{\max}$	ft-lbs	164	291	513	739
Case volume			gal	0.53	0.66	1.32	1.06

**Table 20: Operating pressure range, according to DIN 24312**

Inlet operating pressure	psi
Required static charge pressure (MK4), pc min	15
Heavy duty pressure, pc max	20
Static charge pressure (short periods), relief valve setting, pc min. Min.	8
Static charge pressure, pc max. Max.	20
Dynamic charge pressure (fluctuations) Min.	4
Dynamic charge pressure (fluctuations) Max.	40
Inlet pressure at port S1 (auxiliary pump) Ps. Min.	≥ 0,8 bar abs
Inlet pressure at port S1 (auxiliary pump) Ps. Max.	2
Outlet operating pressure, variable pump	bar
Pressure at port A or B	
Nominal pressure pN	350
Peak pressure pmax	400
Case drain pressure	bar
Max. case pressure (housing pressure):	
pL continuous	5
PL max	8
T1 ,T2 and T3 must be unloaded to tank.	

**Hydraulic circuit**



**Fig. 18: Principal hydraulic circuit for SP pump size 40–180**

**Table 22: Ports**

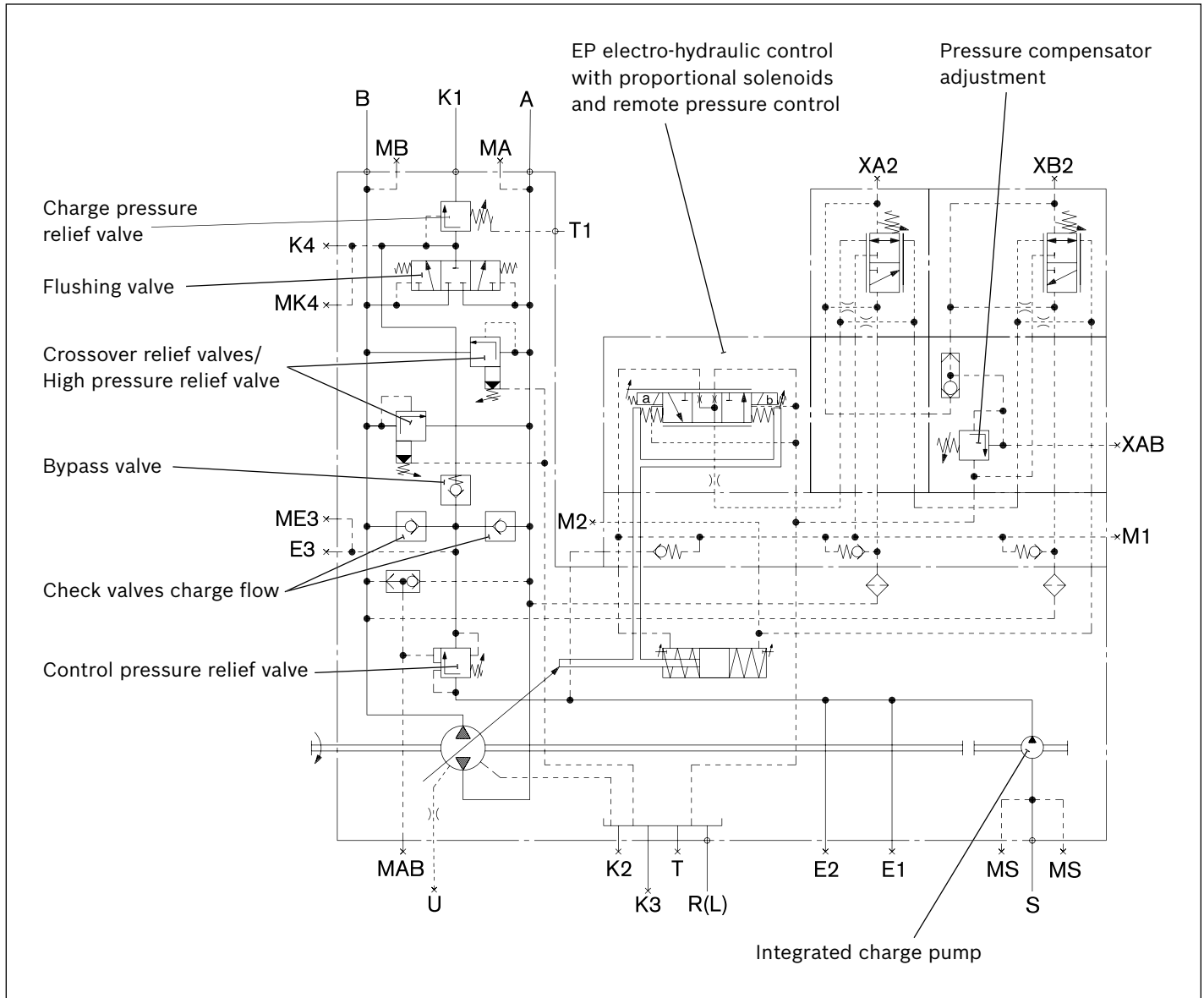
Ports	Description	Ports	Description
A, B	Pressure port	U	Bearing flushing port (plugged)
S	Inlet port	ME, ME3	Test points charge pressure (plugged)
MA1, MA2, MB1, MB2	Test points operating pressure	K4	Accumulator port (plugged)
T	Oil drain port	MK4	Test point charge pressure (plugged)
E1	To filter	M1, M2	Test point control pressure (plugged)
E2	From filter	XA2, XB2, XAB	Ports for remote pressure pilot valves (plugged)
K1	Flushing port	T1, T3	Ports for unloading of high pressure relief valves and charge pressure relief valve
K2, K3	Flushing port	T2	Port for unloading of shaft seal
R(L)	Oil fill and air bleed		

**Technical data SP 250-750**

**Table 23: Technical data SP 250-750.**

<b>Size</b>				<b>250</b>	<b>355</b>	<b>500</b>	<b>750</b>
Displacement	variable pump	$V_{g \max}$	cm <sup>3</sup>	250	355	500	750
	charge pump	$V_{g \max}$	cm <sup>3</sup>	63	80	98	143
Speed	max. speed	$n_{\max}$	rpm	1800	1800	1800	1500
	min. speed	$n_{\min}$	rpm	1500	1500	1500	1500
Flow	at $n_E=1800$ rpm		gpm	119	169	238	–
	at $n_E=1500$ rpm		gpm	99	141	198	297
Power , max. at (Dp = 5076 psi)	at $n_E=1800$ rpm		hp	350	500	700	–
	at $n_E=1500$ rpm		hp	300	400	600	875
Torque at $V_{g \max}$	Dp = 5076 psi	$T_{\max}$	ft-lbs	1026	1457	2052	3078
Case volume			gal	2.64	2.11	3.70	5.02

**Hydraulic circuit**



**Fig. 19: Principal hydraulic circuit for SP pump size 250–750**

**Table 24: Ports**

Ports	Description	Ports	Description
A, B	Pressure port	ME3	Measuring port ex. charge pressure (plugged)
S	Inlet port	MK4	Measuring port flushing pressure (plugged)
E1	To filter (plugged)	M1, M2	Measuring ports control pressure (plugged)
E2	From filter (plugged)	R(L)	Oil fill and air bleed port
E3	External charge port (plugged)	T	Oil drain port (plugged)
K1	Flushing port	T1	Oil drain pressure relief valve
K2, K3	Flushing port (plugged)	U	Bearing flushing port (plugged)
K4	Accumulator port (plugged)	T2	Drain port shaft seal
MA, MB, MAB	Measuring ports operating pressure (plugged)	XA2, XB2, XAB	Pilot port pressure control (plugged)
MS	Measuring port inlet pressure (plugged)		

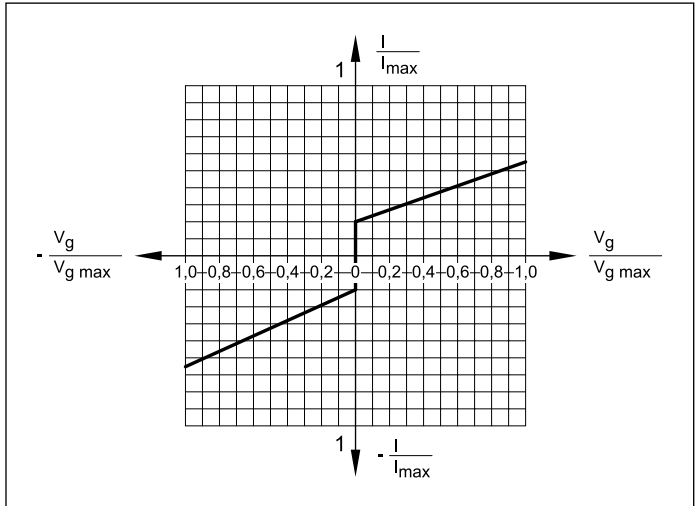
**Control and adjustment devices**

**EP – Electro-hydraulic control with proportional solenoid**

The EP control adjusts the pump displacement proportional to the solenoid current. The pump displacement is therefore step-less variable. One proportional solenoid is assigned to each direction of flow.

Operating voltage: 24 V  
 Nominal current: 800 mA  
 Current range 210...740 mA  
 Nominal resistance at 68 °F: 19 Ω

Standard control



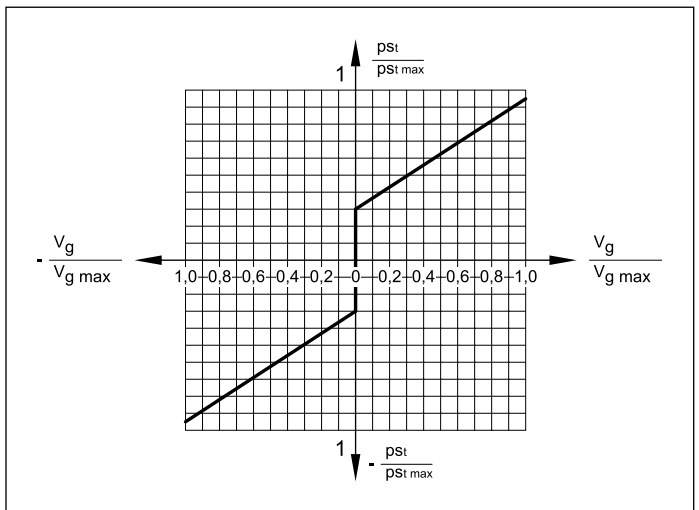
**Fig. 20: EP, hydraulic control**

**HD – Hydraulic control, pilot pressure dependent**

The positioning cylinder of the pump and therefore the swivel angle is varied in proportion to the difference in pilot pressure applied to the two control ports (X1 and X2). The pump displacement is therefore step-less variable. One pilot line is assigned to each direction of flow.

Operating pressure: 100–45 bar (145–652 psi)  
 Pilot pump needed for pilot pressure.

Used when hydraulic control is needed.



**Fig. 21: HD, hydraulic control**

**Mounted charge pressure and control valves**

**High pressure relief valves**

**Two pilot operated relief valves.**

The valves prevent pump damage from excessive pressure levels. Each pressure side has its own relief valve, which is vented to the low pressure side of the loop.

**Charge pressure relief valve**

The charge pressure relief valve is direct operated.

T<sub>1</sub> needs external drain.

Setting range P<sub>c</sub>: 12-21 bar (174-305 psi).

Standard setting 15 bar (218 psi).

**Control pressure relief valve**

Control pressure relief valve is direct operated with unloading function.

Setting pressure range: 30-45 bar (435-653 psi)

Normal setting range: 35-42 bar (508-610 psi) depending on pump size.

**Bearing flushing**

For the following operating conditions bearing flushing is required for reliable continuous operation:

- ▶ Applications with special fluids (non mineral oils), due to limited lubricity and narrow operating temperature range
- ▶ Operation with critical conditions of temperature and viscosity with mineral oil

Flushing is carried out via U-port, which is located in the front flange area of the pump. The flushing oil flows through the front bearing and leaves the system together with the leakage oil at the case drain port.

Recommended flushing flows for the various pump sizes: These flushing flows create a pressure drop of approximately 3 bar between U-port and pump housing (including fitting).

**Note.** When using bearing flushing at U-port the throttle screw, which can be found at U-port, has to be turned in all the way to the stop.

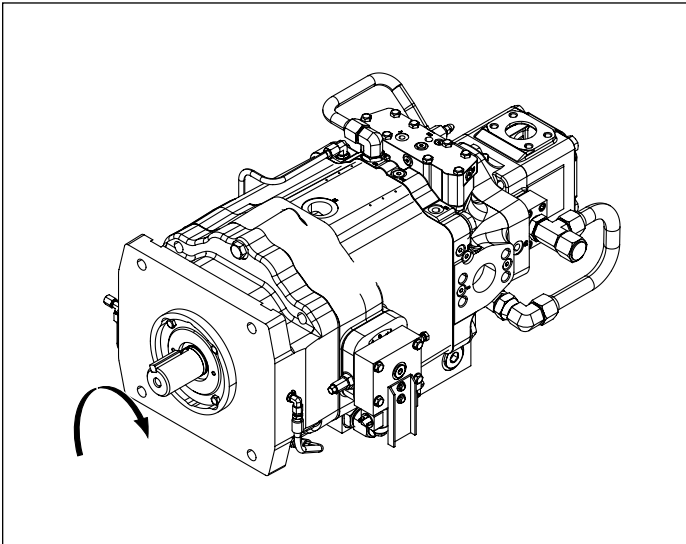
**Table 25: Recommended flushing flows**

Size	Flushing flow, gpm
40	0.79
71	1.06
125	1.32
180	1.85
250	2.64
355	3.96
500	5.28
750	7.93

**Table 26: Installed electric motor power when flushing needed**

Size	Installed electric motor power, hp
40	67
71	93
125	145
180	178
250	249
355	324
500	406
750	597

## Main pump HD



**Fig. 22: Pump HD30**

### Function

The main pump (HD) is an axial piston pump with either electro- or proportional hydraulic controlled displacement. The rotating part of the pump package consists of a shaft driven cylinder barrel with seven pistons except the HD24S and HD30S pumps that have nine pistons. The pistons are following the rocker cam, which controls the pump displacement.

The HD6S/HD7S- and HD24S/HD30S-pumps have a single internal charge- and servo-pump. The internal pump for HD6S/HD7S is of gerotor type and for HD24S/HD30S it's of vane type. HD11S/HD14S-pumps have one internal charge pump and one internal servo pump, both of gerotor type. All pump sizes also have an external additional charge pump of vane type.

The rotary servo displacement controls are located on the both sides of the rocker cam. Each of them has a chamber separated by a stroking vane, connected to the movable rocker cam.

The strokers (electro-hydraulic or proportional hydraulic) control the servo pressure oil that is fed into one half of the chamber making the rocker cam move until the pump displacement corresponds to the applied current or pressure.

### Standards

The pump is certified to meet Military specifications MIL-P-17869A and MIL-S-901C grade A (HD30S pending). The mounting pads and shafts are all within full conformance of SAE standards.

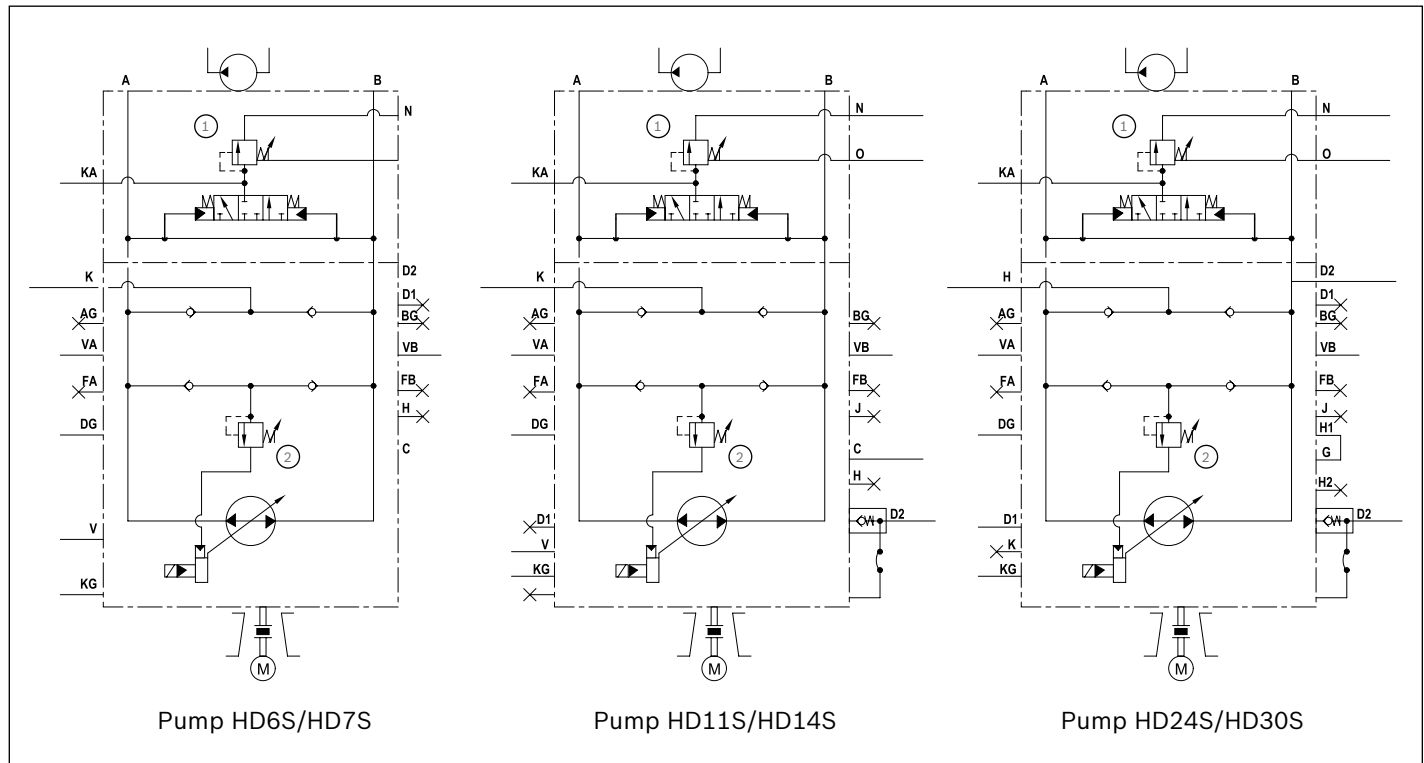
**Main pump**

**Table 27: Technical data HD pump**

Basic data		Pump type					
		HD6S	HD7S	HD11S	HD14S	HD24S	HD30S
Displacement	(in <sup>3</sup> /min)	6.00	7.25	11.00	14.00	24.60	30.60
	(cm <sup>3</sup> /rev)	98.3	118.8	180.3	229.4	403.1	501.4
Theoretical flow at 1470 rpm	(gpm)*	38	46.2	70	89	165.3	194.6
	(l/min)*	144	175	265	337	593	737
Theoretical flow at 1780 rpm	(gpm)*	45.9	56	84.7	107.7	189.3	235.5
	(l/min)*	174	212	321	408	717	892
Speed max, cont.	(rpm)	3 000	3 000	2 400	2 400	2 100	1 800
Peak pressure max (not to exceed 6 sec./min.)	(psi)	6 000	6 000	6 000	6 000	5 000	5 000
	(bar)	420	420	420	420	350	350
Pressure max continuous	(psi)	5 000	5 000	5 000	5 000	5 000	5 000
	(bar)	345	345	345	345	345	345
Max. case pressure, cont.	(psi)	75	75	75	75	75	75
	(bar)	5.2	5.2	5.2	5.2	5.2	5.2
Max. case pressure, int.	(psi)	125	125	125	125	125	125
	(bar)	8.6	8.6	8.6	8.6	8.6	8.6

\* Actual flow = Theoretical flow · Volumetric efficiency

**Hydraulic circuit (simplified)**



**Fig. 23: General hydraulic circuit, HD pump.**  
 1) Charge pressure relief valve  
 2) Compensator valve

## Water-oil cooler – tube type

### Function

The tube water-oil cooler consists of several tubes in a tubestack for heat exchange. The tube cooler is easy to clean and it is suitable for contaminated water. The oil and water is flowing in opposite directions. The water flow is switched on and off by a temperature controlled valve.

**Table 28: Material tube cooler**

Part	Material
Housing:	Steel
End cover:	Cast iron
Tube stack:	Copper

### Recommended max temperature

For oil viscosity 68 cSt the maximum recommended temperature of the inlet oil is limited to 63 °C (145 °F) and for 100 and 150 cSt limited to 66 °C (151 °F).

The temperature is limited by:

- ▶ The life of the hydraulic motor
- ▶ The recommended min. viscosity of the hydraulic fluid

**Table 29: Acceptable water chemical content**

Chemical	Level
Free Chlorine	1.0 – 3.0 ppm
Calcium Hardness	200 – 400 ppm
pH	7.2 – 7.8
Alkalinity	100 – 150 ppm
Bromine	2.0 – 4.0 ppm
Chloride	> 150 ppm

## Air-oil cooler

### Function

- ▶ The air-oil cooler consists of a fan driven by an electric motor, blowing air through the cooler matrix.
- ▶ The air-oil cooler features bar and plate brazed aluminum core to expose a maximum heat-emitting area and to allow low air pressure drop.
- ▶ All coolers have a 65 psi by-pass function to limit the oil pressure in the cooler.
- ▶ The electric motor is a 3-phase asynchronous motor.

### Note:

When the air-oil cooler is separated from the Power unit, the pressure drop through the piping hoses is not allowed to exceed 1 bar (14 psi).

### Recommended max temperature

For oil viscosity 68 cSt the maximum recommended temperature of the inlet oil is limited to 63 °C (145 °F) and for 100 and 150 cSt limited to 66 °C (151 °F).

The temperature is limited by:

- ▶ The life of the hydraulic motor
- ▶ The recommended min. viscosity of the hydraulic fluid

### Mechanical data

Electric motor:

- ▶ Insulation: Class F
- ▶ Temperature rise: Class B
- ▶ Protection standard: IP55

**Table 30: Material types**

Part	Material
Matrix	Aluminum
Fan blades	Plastic
Fan housing	Steel
Fan guard	Steel
Other parts	Steel
Coating	Painted black RAL 9005

**Air-oil cooler, electric motor data / sound data**

**Table 31: Air-oil cooler and electric motor data / sound data**

Cooler ordering code	Driving power		Speed		Amperage	Protection	Noise	Mass	Max. perm. static pressure
	hp		rpm		Full load Amps (230 V)	Standard	dBA @ 3H	lb.	psi
	50 Hz	60 Hz	50 Hz	60 Hz					
BOL-16	0.5	0.5	3000	3450	2.2	IP55	85	55	250
BOL-30	0.5	0.5	1500	1725	2.0	IP55	85	125	250
BOL-725	1.5	1.5	3000	3450	4.8	IP55	100	170	250
BOL-950	1.5	1.5	1500	1725	4.6	IP55	92	300	250
BOL-1200	3.0	3.0	1500	1725	8.8	IP55	94	430	250
BOL-1600	5.0	5.0	1500	1725	13.4	IP55	96	515	250
BOL-2000	7.5	7.5	1500	1725	24.8	IP55	98	582	250

**Electrical data**

**Table 32: Rated data electric motors**

Frequency (Hz)	Voltage (V)
50	415
50	380
50	400
60	208
60	230
60	440

## Tank

### Function

The tank contains cooled clean oil for the continuous oil exchange in the hydraulic system.

The tank (stainless steel construction) is equipped with:

- ▶ Visual level gauge
- ▶ Level sensor
- ▶ Temperature sensor
- ▶ Drain tap
- ▶ Filling point with quick release coupling (oil filling via drain filter)
- ▶ Air breather filter
- ▶ Oil heater (option)
- ▶ Bladder (option)

Leakage test by supplier:

Die penetrant testing.

### Mechanical data

**Table 33: Tank volume**

Frame variant/version	Tank volume (l)
Small / 2 compartments	200
Small /3 compartments	200
Medium /2 compartments	200, 400, 600
Medium /3 compartments	200, 400, 600
Large /3 compartments	600, 800, 1000
XLarge /3 compartments	1000, 1200, 1600

**Table 34: Material, tank**

Part	Material	
Tank	Stainless steel	
Fluid level gauge	Lens	Polyamid
	Lens base	Nylon
	Shroud	Polystyrene

### Fluid level temperature gauge

The fluid level gauge is resistant to mineral and petroleum based fluids.

### Standards

Welding according to AWS D1.6

## Other components

### Water valve

#### Function

The water valve is a two-way, normally closed, pilot operated solenoid valve with a floating diaphragm. The water valve shall be connected to turn the cooling water on at the preset oil temperature in the tank. For proper operation, water must be filtered to 44 µm before entering the water valve.

#### Mechanical data

**Table 35: Pressure, water valve**

Water valve size	Max. Differential pressure psi	Max. pressure psi
1-1/4"	100	125
1-1/2"	100	125
2"	50	125

**Table 36: Material, water valve**

Part	Material
Body	Brass
Core tube	Stainless steel
Core and plug nut	Stainless steel
Springs	Stainless steel
Seat	Brass
Seal, diaphragm & disc	NBR
Shading coil	Copper

#### Electrical data

**Table 37: Electrical characteristics, water valve**

Coil insulation class	F
Connector	Spade plug
Connector specification	EN 175301-803 (DIN 43650)-A
Coil safety	IEC 335
Coil enclosure protection	Moulded IP65 (EN 60529)
Control voltage	24 VDC

**Table 38: Power ratings, water valve**

Water valve size	Power ratings	
	holding (W)	hot/cold (W)
1-1/4"	4	11.6
1 1/2"	6	11.6
2"	6	11.6

### Suction line valve

#### Function

The suction line valve will separate the pump from the tank at service. The suction line indicator is a limit switch with forced breaking contact that opens when the suction line valve is closed. It shall be connected to stop the power unit when the switch is open.

#### Mechanical data

Protection class:

Protection class IP64

**Table 39: Material, suction line valve**

Part	Material
Cage, valve	Aluminium
Shifter	Aluminium
Seals	Nitrile rubber
Valve, other parts	Steel galvanized
Cage and lifter, limit switch	Thermoplast glass-fiber reinforced

#### Electrical connections

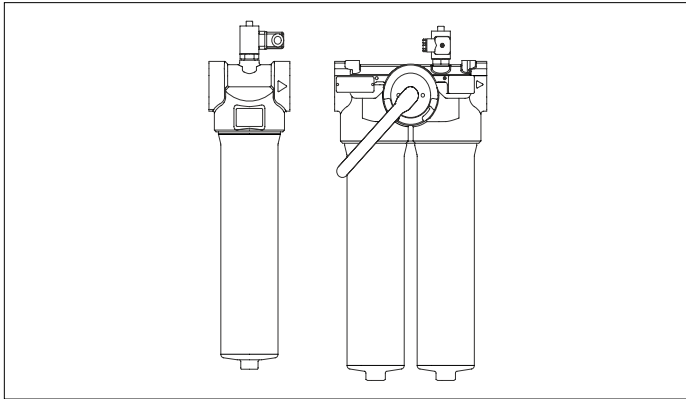
The cable is connected on screw terminals inside the housing.

#### Electrical data

**Table 40: Electrical characteristics, suction line valve**

Max. voltage	Max. cont. current
250 VAC	10A

## Oil Filter



### Function

The filters are used in drain and return lines. The filter housing is equipped with a bypass valve and an electrical and visual contamination indicator. Single or duplex filters can be selected. There is a contamination indicator that gives indication if the differential pressure is above 31.9 psi.

A single filter has one filter element and a duplex filter has two filter elements but only one filter is used at any one time. On duplex filters the filter elements can easily be replaced without interrupting operation. The filter elements are  $\beta$ -stable (See "Separation characteristics" on page 36), have a multi-layered structure and are compatible with HFA, HFB, and HFC fluids. The opening pressure for the by-pass valve  $\Delta P = 50.8 \text{ psi} + 10\%$ .

### Standards – filters

The filter elements are manufactured and tested in accordance with the following international standards:

Item	Standard
Verification of collapse/burst resistance	ISO 2941
Determination of fabrication integrity	ISO 2942
Verification of material compatibility with hydraulic fluids	ISO 2943
Verification of flow fatigue characteristics	ISO 3724
Evaluation of pressure drop versus flow	ISO 3968.2
Test of end cap load	ISO 3723
Test of filter performance	ISO 4572

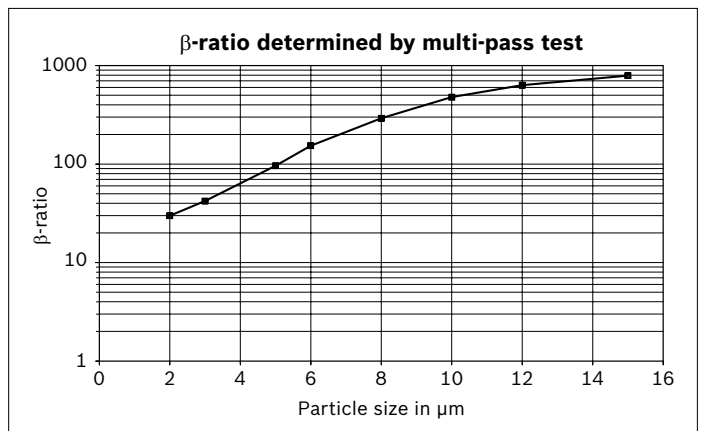
### Mechanical data

**Table 41: Material, filters**

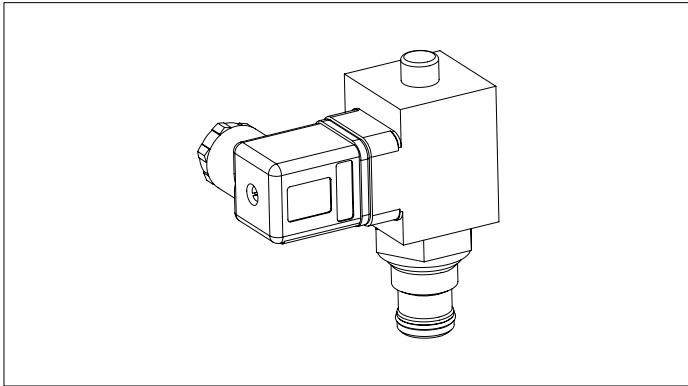
Part	Material		
Filter complete:	Filter head	Aluminum alloy	
	Filter bowl	Aluminum	
	Seals	Nitrile rubber	
	Low pressure type	360 psi	
	bypass $\Delta p$	50 psi + 10%	
	Type	Single Duplex	
Max flow		66 gpm 106 gpm 160 gpm	
	Filter element:	Filtration grade	10 $\mu\text{m}$ (standard) 3 $\mu\text{m}$ (optional)
		Filter	Inorganic glass fibre material
	End shields	Tin plated	
	Inside tube	Tin plated	
Filter switch:	Filter switch	See section: "Clogging Indicator"	

### Separation characteristics

The  $\beta$ -ratio for the particle size 10 ( $\mu\text{m}$ ) fulfills ISO 4572 ( $\beta_{10} \geq 75$ ).



## Clogging Indicator – Oil Filter



### Function

A contamination indicator is mounted in the oil filter housing to indicate when the filter element must be changed. Both a visual and an electric indication are obtained. When the level of contamination in the filter element is increased, the pressure drop over the filter will increase. Indication takes place at a differential pressure across the filter of 32 psi for return and drain filters.

The visual indicator is reset automatically. The electrical indication is internally interlocked by a thermo switch below 86 °F rising temperature to avoid indication due to high viscosity. The interlock is activated at 68 °F falling temp.

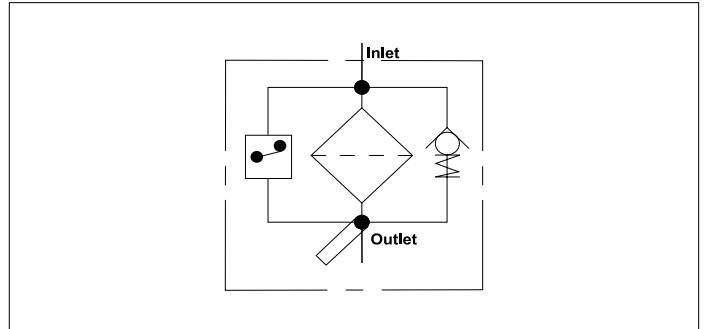
### Mechanical data

Table 42: Material, clogging indicator

Part	Material
Lower section	Aluminum alloy, Steel
Upper section	Polyamide
Seals	Nitrile rubber

### Clogging Indicator

Max. operating pressure	6000 psi
Temperature range	-40 °F...212 °F
Protection class	IP65



▲ Hydraulic symbol (oil filter with indicator)

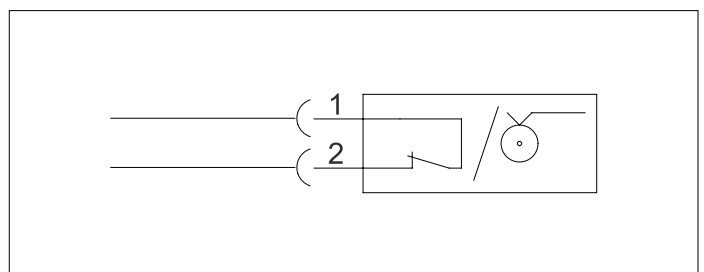
### Electrical data

Table 43: Electrical characteristics, clogging indicator

Switch type	Normally closed
Switching voltage	24 VDC / 250 VAC
Max. making capacity at resistive load	20 VA/20 W
Cold start suppression	86 °F, rising 68 °F, falling
Min. switching current	1 mA

### Electrical connections

Configuration of plug according to DIN 43650 / ISO 4400



▲ Electrical symbol

## Air Breather

The air breathing of the tank is via an air filter element to prevent contamination of the oil by particles in the air.

The filter element

- ▶ Has a filtration degree of 10 µm (0.00039 inch)
- ▶ Has a high dirt holding capacity
- ▶ Is resistant against all hydraulic fluids
- ▶ Can easily be replaced
- ▶ Maximal air flow rate 106 gpm

### Mechanical data

**Table 44: Mechanical, air breather**

Part	Material	
Air Breather filter complete	Housing	Glass-fiber reinforced Polyamide
	Seal	NBR
Filter Element	Filter	Foam

### Service life

The service life of the filter element depends on the degree of contamination of the air. The filter element shall be changed according to the maintenance chart found in the I&M manual.

## Electronic Level Sensor

### Function

The tank oil level sensor gives signals for two switch points.

### Mechanical data

**Table 45: Mechanical, electronic level sensor**

Sensing method	Reed contacts
Material in contact with media	Brass/Buna N
Probe Length	13"
Medium temperature range	-40 °F...250 °F
Protection Class	IP65

### Electrical data

**Table 46: Electrical characteristics, electronic level sensor**

Supply voltage V	10...30 VDC / 120 VAC / 250 VAC
Output signal	Switch
Max Load	0.3 A / 0.13 A / 0.08 A
Electrical Connection	DIN 43650
Pin Connection	Pin 1 +V
	Pin 2 Min Oil Level
	Pin 3 Low Oil Level

## Electronic Temperature Sensor

### Function

The tank temperature sensor gives analog output for oil temperature. Sensor readings and threshold levels are set in the control system.

### Mechanical data

**Table 47: Mechanical, electronic temperature sensor**

Sensing Method	Pt 100
Material in contact with media	Stainless steel
Probe Length	20"
Medium temperature range	-40 °F...212 °F
Protection class	IP66

### Electrical data

**Table 48: Electrical characteristics, electronic temperature sensor**

Supply voltage V	10...30 VDC
Output signal	4...20 mA
Max Load	0.023A
Temperature Range	-40 °F...212 °F
Accuracy	±0.1%
Electrical Connection	Screw terminals
Pin Connection	Pin 4 +V
	Pin 5 signal output

## Accumulator

### Function

The hydro-pneumatic accumulator (optional) has bladder and gaskets for operating with mineral oil or non aggressive fluids. The pre-charge pressure is 125 psi. It feeds the closed hydraulic circuit at low pressure side to:

- ▶ Damp hydraulic pressure pulses at the low pressure side.
- ▶ Supply the low pressure side with oil to prevent cavitation.

Available size is 1 gallon. The accumulator pressure is monitored via an optional pressure switch.

### Mechanical data

**Table 49: Material, accumulator**

Part	Material
Shell	Carbon steel
Bladder	NBR (Bunan)
Gas	Dry nitrogen

### Limits

Maximum allowed working pressure 3000 psi.  
 Maximum allowed oil flow 160 gpm.

The optional pressure switch is monitoring the pre-loading pressure in the accumulator bladder. If the pressure falls below

100 psi the switching contact is opened. The contact shall be connected in the interlock circuit for the hydraulic drive to permit restart of the system.

### Delivery

Accumulators in PAC/PBC delivered by air freight are delivered empty (= pre-charged to 15–30 psi) and need to be charged with N<sub>2</sub> (Nitrogen gas) to 125 psi before start of system. Empty accumulators are marked with a tag at delivery.

## Pressure Sensor

### Function

The pressure sensor gives information about the pressure level in different parts of the hydraulic system. The signal is used for information about the system and/or used to control functions.

### Mechanical data

**Table 50: Mechanical, pressure sensor**

Medium temp range	–40 °F...185 °F
Protection class	IP67

### Electrical data

**Table 51: Electrical characteristics, pressure sensor**

Measuring range	Work pressure	0...5800 psi
	Low pressure	0...725 psi
Supply voltage U <sub>b</sub>	16...36 VDC	
Output	4...20 mA	
Max load (ohm)	(U <sub>b</sub> -8.5V)/20 mA	
Connector	4 pole M12	
Pin connection	Pin 1	+U <sub>b</sub>
	Pin 2	signal output

## Oil Heater

### Mechanical Data

**Table 52: Mechanical, oil heater**

Element	Steel Sheath
Probe Length	9"

### Electrical Data

**Table 53: Electrical characteristics, oil heater**

Supply Voltage V	120VAC or 240VAC Single Phase
Output W	500 W...1500 W
Thermostat	Integral SPST Set at 65 °F

### Cold Weather Package 1

In addition to an oil heater suction line heat tracing will be used.

### Mechanical Data

**Table 54: Mechanical, heat tracing**

Temperature Range	-40 °F...150 °F
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### Electrical Data

**Table 55: Electrical characteristics, heat tracing**

Supply Voltage V	120VAC or 240VAC
Thermostat	Self-regulating
Output Power W	8 Watts/ft

### Cold Weather Package 2

In addition to an oil heater and suction line heat tracing a heater in the control box will be provided if a driver card is selected.

### Cold Weather Package 3

In addition to an oil heater, suction line heat tracing, and control box heater (if driver card is selected) wire and conduit will be supplied to comply with a low ambient of -40 °F.

## Sound

Hägglunds low speed hydraulic motors generate very low sound levels due to the low speed. The dominating sound sources in a hydraulic drive system are the drive unit and the piping system.

Hägglunds offers three options with regard to the drive unit sound levels. Sound levels below are an average and do not include external piping.

- PAC with panels, 82-85 dB(A) – standard solution
- PAC with noise reduction solution, reduces the sound level an average of 2.5 dB(A) – optional solution
- PBC without panels, 85-90 dB(A) – standard solution



Sound levels are calculated for drive units with water cooler.

## Environment options

### Low temperature

#### < 32°F

It is recommended to equip the oil tank with a heater.

#### < 20°F (Cold weather package 1)

It is mandatory to equip the oil tank with a heater.

It is mandatory to equip the suction lines with heat tracing.

#### < -4°F (Cold weather package 2)

It is mandatory to equip the oil tank with a heater.

It is mandatory to equip the suction lines with heat tracing.

All electric motors will be specified for temperatures < -4°F.

Spider control unit will be equipped with heater and a VFD display is required for the control panel.

#### < -22°F (Cold weather package 3)

It is mandatory to equip the oil tank with a heater.

It is mandatory to equip the suction lines with heat tracing.

All electric motors will be specified for temperatures < -22°F.

Spider control unit will be equipped with heater and a VFD display is required for the control panel.

Special wire and conduit will be used.

#### < -40°F

The drive unit has to be placed indoors.

### High temperature

Ambient temperatures above 40°C (104°F) limits the permitted output power for the electric motor. Usage of air-oil cooler requires lower cooling air flow temperature.

An oil temperature of 60°C (140°F) is the standard setting where the drive unit must be interlocked to stop because of service life for nitrile rubber seals.

### Sound protection

When selecting sound package, the hydraulic unit is fitted with a sound trap at the outlet of the electric motor air. The sound trap has sound absorbing material applied to the inside to reduce the noise level. Rubber membranes for outlet of the hose is replaced with a 1.5 in. thick insulation. High pressure hoses are connected to the pump(s), which represents a connection interface outside the unit. The hose is tight fitted through the 1.5 in. thick insulation to prevent airborne sound.

The weighted sound power and sound pressure levels are in average 2.5 dB(A) lower than without sound package.

## Machine feet

It is recommended to use machine feet to isolate vibrations and to compensate for uneven surfaces. They have an adjustment range of 1.56–2.56 in.

## Oil pan

The bottom part of the PAC/PBC is designed to work as an oil pan for leakage oil. The oil can be removed from the pan via a drain tap on the front.

## Painting

Two different corrosivity categories regarding corrosion protection are available:

- ▶ Corrosivity category Medium (Normal urban and industrial atmosphere)  
Frame and external brackets: RAL 9005 Black  
Doors, hoods and panels: RAL 2002 Orange
- ▶ Corrosivity category Very High (Marine environment with high salt load or other aggressive atmosphere)  
Frame and external brackets: RAL 9005 Black  
Doors, hoods and panels: Stainless steel

All external bolts, washers and nuts are plated steel.

## Hazardous environments

For most applications that require hydraulic motor operation inside of a classified area, the drive unit is able to be located outside of the classified boundary which negates the need to adhere to NEC regulations for equipment installed within a hazardous area. For applications where this is not possible, Hägglunds will engineer and construct a drive unit to meet or exceed NEC requirements for the specific area classification as prescribed in NFPA 70, Article 500. This includes the use of rated instrumentation and equipment that is intended for use in classified hazardous areas.

Remote mounting (outside of the classified area) of the Hägglunds standard controls system, as well as utilization of proper Intrinsically Safe (IS) isolation practices provides control and monitoring interface from the customers control system to the Hägglunds PAC/PBC.

To ensure the PAC/PBC meets this requirement Hägglunds will utilize third-party consultation to approve equipment and instrumentation, and to provide final as-built testing to ensure the unit meets requirements for use in hazardous areas. Once the PAC/PBC unit passes testing, the third-party company will certify the unit as acceptable for installation into the required classified area.

## External pipe work General

The Drive unit should be placed close to the hydraulic motor in order to minimize piping if it is possible, See "Positioning the PAC/PBC" on page 15.

### Pipe size

The pipe work between motor and the Drive unit shall be dimensioned for at least four times the maximum pressure, the equipment may be re-adjusted to higher pressures in service. It is important that the lines between the main connections of the motor and Drive unit are as short as possible. The total pressure drop in the main and return line must not exceed 5% of the normal working pressure.

The pipe shall be sized to give the following approximate flow rates:

Main lines	< 15–25 ft/s
Return lines	< 10–15 ft/s
Drain & suction lines	< 4 ft/s

It is particularly important that the pressure in drain lines does not exceed the max. case pressure for motor/pump.

### Material in hydraulic pipes

Use a high-grade steel as per ISO 3304, DIN 2391/C or ASTM A 519 1010 for the hydraulic pipes.

### Pipe couplings

For pipes with:

$d \leq 1$  in.: SAE J514 (SAE-16)

$2.5 \leq d \leq 4$  in.: SAE J518 (SAE-16)

### Pipe clamps

The pipes shall be clamped with uniformly spaced clamps. The distance between the clamps depends on the type of clamps but it may not exceed the following values:

$0.5 \text{ in.} \leq d \leq 1.5 \text{ in.}$  max. 6 ft.

$d \geq 1.5 \text{ in.}$  max. 9 ft.

In addition, the pipes must be clamped immediately before and after a bend and immediately before transition to a hose. The pipe clamps shall be secured to a stable and non vibrating surface. The pipe clamps must be of a type permitting a certain amount of axial and radial motion in the clamped joint and have good vibration-absorbing property.

## Welded couplings

Welded couplings should be avoided because of the high possibility of system contamination due to the welding process.

## Hoses

- ▶ Hoses shall always be used between piping and hydraulic motor/pump.
- ▶ Use flexible hoses to prevent imposing stress from moving/vibrating equipment.
- ▶ Connect hoses with attention to bending radius, adequate slack for machine movement and select to hang without stressing the end fittings.
- ▶ Use hoses, if it is possible, to connect direct between unit and machine to ease fitting and reduce transmission of noise.
- ▶ The hoses must be short and have the smallest possible diameter in order to obtain a small compression volume. Maximum flow velocities listed under "Pipe size" must however be taken into consideration.

## Hydraulic fluids

The Häggglunds PAC/PBC is primarily designed for operation with hydraulic fluids according to ISO 11158 HM. Before the start of project planning, see data sheet RE 15414, Hydraulic fluid quick reference, for detailed information on hydraulic fluids and specific additional demands.

ISO 11158	ISO 15380	ISO 12922
Mineral oil based and mineral oil related hydraulic fluids	Environmentally acceptable hydraulic fluids	Fire resistant hydraulic fluids

Within these standards, not all fluid classes are allowed, some are recommended, and there are also additional demands (see data sheet RE 15414).

## Accessories

### Spidercom

Spidercom is a windows program for communication with Spider control system.

It is used for:

- ▶ Uploading and conversion of log data
- ▶ Uploading, editing and downloading of setup parameters

The program requires a PC with a standard serial port and Windows XP, Vista, 7 or 8. An external USB to serial converter can be used.

### VCI

The emitter VpCI (Vapor phase Corrosion Inhibitor) is mounted inside electrical and electronic enclosures to protect against oxidation. The emitter (containing a pulverous substance) emits a vapor that covers all components with a protective layer when the air inside the enclosure is saturated.

The Emitter can be stored for 2 years before installation if the protective bag is air tight. Life time after installation is one (1) year.

## Logistics

### General

This chapter describes the standard procedure for packing of Häggglunds PAC/PBC with accessories. It also describes how Häggglunds products are shipped and how they should be handled during transportation and installation. It also points out requirements for storage of Häggglunds products on site.

### Shipping

All items are not assembled in the PAC/PBC due to practicality, safety, and logistical reasons.

#### Items not assembled at delivery

The main electrical motor is not assembled if the electric motor is above 200 hp. If the main electric motor is not assembled, the top cover will also not be assembled.

#### Optional item not assembled at delivery

Optional items that aren't assembled are anti-vibration feet, leveling pipes, and high pressure hoses.

### Domestic packaging

Häggglunds products are packed on wooden pallets that give adequate protection against mechanical damage and atmospheric corrosion during shipping, transportation, handling, and storage. Desiccant bags are placed inside the PAC/PBC to absorb moisture thus atmospheric corrosion is avoided during shipping and storage.

#### Packing procedure other items

Items are placed in separate wooden crates or on pallets that give adequate protection against atmospheric corrosion during shipping and storage.

#### Crates/Pallets

The crates/pallets are made of wood that conforms to ISPM No. 15.

### Export packaging

Häggglunds products are packed in wooden crates according to ISPM No. 15. This will give adequate protection against mechanical damage and atmospheric corrosion during shipping, transportation, handling, and storage. Desiccant bags are placed inside the PAC/PBC to absorb moisture thus atmospheric corrosion is avoided during shipping and storage.

#### Packing procedure other items

Items are placed in separate wooden crates. This gives an adequate protection against atmospheric corrosion during shipping and storage.

#### Crates

The crates are made of wood that conforms to ISPM No. 15.

### Lifting methods

The PAC/PBC package is designed for forklift truck handling and an unpacked PAC/PBC can also be lifted with ropes/chains. Items that are delivered in separate crates or on pallets, these are only designed for forklift truck handling and are always marked with the weight.

### Storage conditions at site

The PAC/PBC (including parts delivered separately) should be stored indoors. The plastic film in a crate or on a pallet should not be open or removed before installation.

#### Storage condition on site for PAC/PBC

At delivery, the PAC/PBC is protected with desiccant bags to absorb moisture and sealed with a plastic film. This provides sufficient atmospheric corrosion protection for indoor storage up to 12 months from delivery date.

If storage time exceeds 12 months, the desiccant bags have to be exchanged. The crate must be opened to access the plastic film.

#### Storage condition on site for other item

At delivery, the separate delivered items are protected with VCI foam pads and sealed with a plastic hood. This provides sufficient atmospheric corrosion protection for indoor storage up to 18 months from delivery date.

If storage time exceeds 18 months, the VCI protection has to be extended.

## Required and additional documents

<b>Title</b>	<b>Document no</b>	<b>Document type</b>
Technical Appendix, Hägglunds PAC/PBC	RA 15322-TA	Technical Appendix
Product catalog, PAC/PBC	RA 15322-01	Catalog
Installation and maintenance manual, Hägglunds PAC/PBC	RE 15322-WA	Instruction
Engineering manual Hägglunds Spider	EN 777	Engineering manual
Sound and vibration	RE 15411	Data sheet
Hydraulic fluid quick reference	RE 15414	Data sheet
Hydraulic fluids based on mineral oils and related hydrocarbons	RE 90220	Data sheet
Environmentally acceptable hydraulic fluids	RE 90221	Data sheet



**Bosch Rexroth Corporation**

Hägglunds Drives  
3940 Gantz Road, Suite F  
Grove City, OH 43123  
Tel: (614) 305-4999  
Fax: (614) 305-4911  
hagglunds@boschrexroth-us.com  
www.boschrexroth-us.com



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