

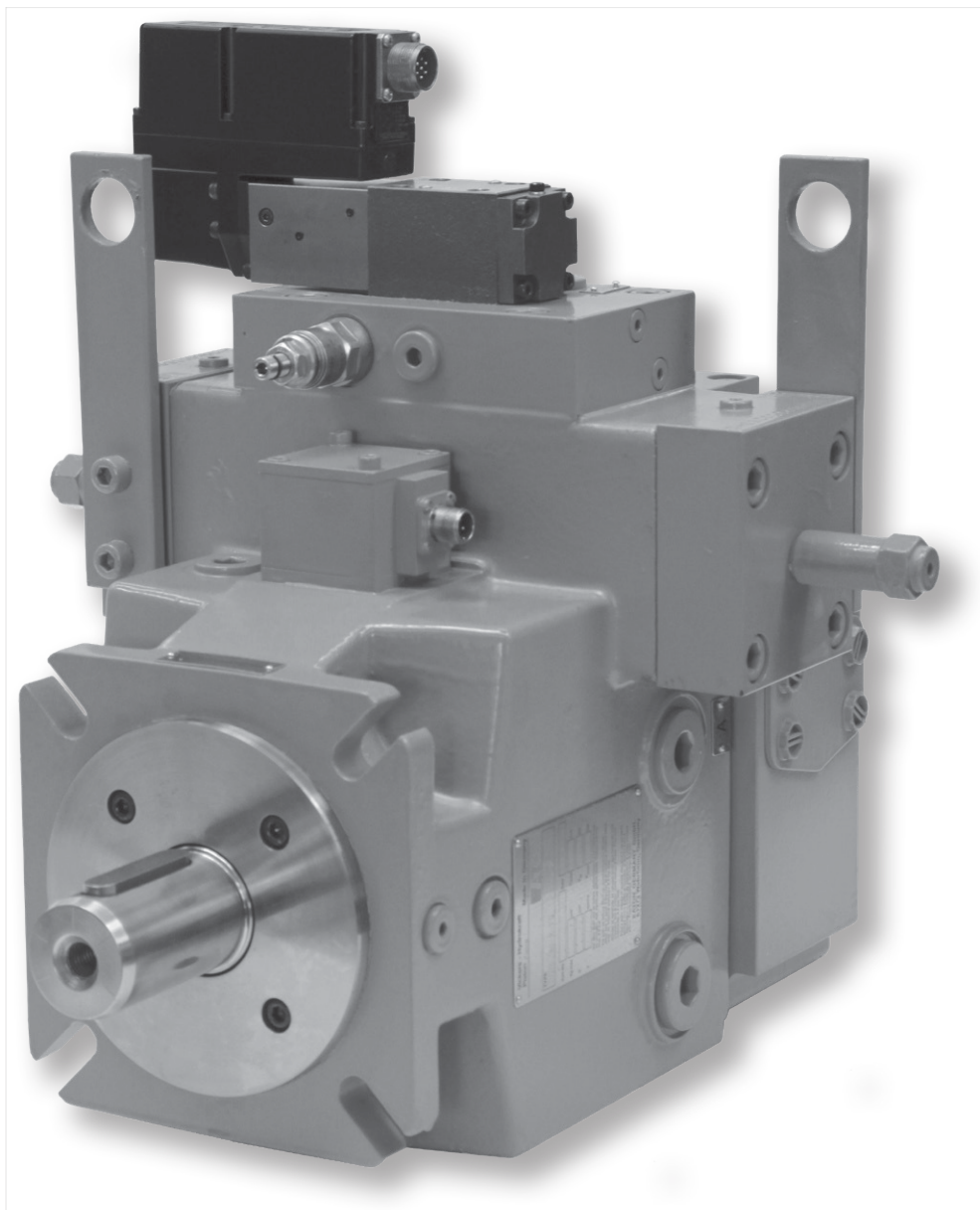


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2. General Safety Instructions

Preface

We would like to thank you for choosing a product from Danfoss.

IMPORTANT!

Please read the information carefully before you put the pump into operation.

In accordance with the state of the technology, the information in this document can be modified at anytime without prior notification.

Only if you respect the present instructions, accidents and material damages can be avoided and operating without any complications can be guaranteed.

The present instructions apply solely to the pump and do not replace the operating instructions of the complete machine.

Danfoss does not assume any guarantee or liability for errors in these instructions or any subsequent damages in relation with the delivery

2.1 Application range

These general operating instructions only apply to Danfoss Hydrokraft axial piston units PVW manufactured by Danfoss.

2.2 Limits of the partly completed machinery

The Danfoss Hydrokraft PVW pump from Danfoss is a partly completed machinery according to the machinery directive 2006/42/EC article 2g and is intended for the assembly in or with another machine

or equipment.

The limit of the partly completed machinery is in the main connections on the machine side of the aggregate.

This partly completed machinery must only be taken into operation once it has been ensured that the machine, in which the partly completed machinery is to be assembled, meets the expectations of the machinery directive.

2.3 Operating and environmental conditions

If the technical

specification does not mention any other data, the following conditions apply.

- Danfoss Hydrokraft PVW pump are usable for mineral-oil based hydraulic medium in accordance with ISO 6743-4 (for other hydraulic medium have a look in chap. Hydraulic Fluids).
- The type and model of pump is indicated on nameplate.
- For permissible operation temperatures, viscosity etc. have a look to chap. Technical Data and Hydraulic Fluids.

- Cleanliness level of hydraulic medium
The recommended purity level according to ISO 4406: 18/15/13 or better
- Operating pressure:
Please consider the maximum operating pressure in the technical documentation
- Operating in an explosion risk environment:
Danfoss Hydrokraft piston pumps cannot be operated in an explosion risk environment, beside this has been explicitly stated in the assembly notice
- Water-imperilling substances:
Hydraulic medium based on mineral oil are part of the products susceptible to pollute the water. Their taking into operation represents high danger for human-beings and the environment.
- Both the respective legal or otherwise binding regulations of the European and national legislation must be observed, as well as all rules for the prevention of accidents and for environmental protection applicable in the country of operation.

2.4 Intended use

Danfoss Hydrokraft axial piston pumps are developed and manufactured in accordance with the state of technology and the safety-related directives of MD 2006/42/EC. The pump is intended to be operated only according to the technical specifications.

During operation, endangering of users or third parties or damaging of hydraulic aggregates and other elements might be possible, especially when the assembly instructions are disregarded. Any use other than specified applies to be unintended.

The present assembly notice lapses if modifications, which have not been agreed by the manufacturer, are performed on the axial piston pumps.

WARNING!

In case of non-intended use and the damages occurred through it, no liability or material claim applies (explicit in contractual documents).

2.5 General safety advice

- The Danfoss Hydrokraft axial piston pump is manufactured and verified according to the state of technology. Even if all risks are identified and all measures to reduce the probability of damage-occurrence have been taken in the risk evaluation, remaining risks (non-apparent) can never be completely excluded.
- According to amendment II B of the machinery directive 2006/42/EC, the partly completed machinery can only be taken into operation, if the machine, in which it is assembled, meets the directives.
- When assembling, you must also consider dangers stipulated in the instruction manual of the complete machine.
- Any modification of the partly completed machinery can present important changes in the sense of machinery directive 2006/42/EC. Supplementary safety requirements must be considered. For this reason, modifications should always be approved by the manufacturer.

General Safety Instructions

- The assembling and installation of the hydraulic must be carried out by qualified staff in consideration of the basic safety instructions.
- Due to its training, the qualified staff must be in confidence with the assembling of hydraulic elements and installations.
- Operations on electric elements of machines and installations involve particular dangers. This is why such operations must only be carried out by electro-technical qualified staff, such as specialist electrician.
- Intended operating, performance data and conditions of use must remain identical.
- Installation and operating of Hydrokraft pump must only be in flawless state. The integrity and intactness of the pump must be ensured.
- Consider cleanliness of all elements. Impurity in the system may cause malfunction and break-down.
- All connected piping must be clean from swarf and other foreign material.
- Before proceeding to the test-run, the Hydrokraft pump and the fluid-technical installation should be rinsed.
- Acts of different persons must be coordinated.
- Emergency, malfunction or irregularities.
 - Turn-off and secure against restart
 - Call experts
 - Forbid the access to the operating area to unauthorized persons
- Defaults and damages must immediately be announced to the concerned department or the superior.
- Damaged elements must immediately be replaced as they might endanger safety.
- Default-research and repairing is only allowed to specialised staff.
- Default-research must only be carried out with active protection devices.
- Hydraulic systems operate under pressure and can, in case of inappropriate handling, cause dangerous accidents.



- Before undertaking any works, the pressure in the system must be relieved.
 - Cut the energy supply
 - Secure against restart
 - Relieve pressure from the system, including all hydraulic accumulators, kneel or prop up raised loads, relieve rest-energy
 - Make sure the system is at zero pressure
 - Avoid endangering caused by adjacent installations
- Make sure that the pressure has been completely relieved.

- Keep away from any possible leakages that might still be under pressure.
- The contractual agreed guaranty does not disengage the operator of the hydraulic system from the necessity and obligation to proceed preventive maintenance and repair works (beginning with taking into operation).

2.6 Handling of hydraulic medium



- The security data file of the hydraulic medium must be available, and all the stipulated instructions must be realised.
- Contact with hydraulic medium may have skin-endangering effects. Vapours of hydraulic medium can cause irritations in the respiratory system.
- The employer must regulate the skin protection and the handling of hydraulic medium in his company.
- Escaped hydraulic medium must be immediately and completely removed.

2.7 Non-controlled escape of hydraulic medium

Hydraulic medium may escape in case of line-breakage, detachment of connecting elements under pressure, damaging of flexible lines or impermissibly high forces. The following may occur:

- Eye-damaging.
- Penetration into the skin (poisoning).
- Fire danger if ignition sources, such as oil on hot surfaces, exist.
- Slip danger on working spaces and route ways.
- Endangering caused by unintentional moves.
- Environmental endangering, e.g. penetration in the earth/groundwater.

Impermissibly high forces may be caused by:

- Falsely set-up pressure valves.
- Modifications, e.g. on throttle valves.
- Falsely laid-up valves (unload to fast).
- External loads.
- Unintentional pressure conversion.

2.8 Unintentional machine-moves

Can be caused by:

- Unintentional use of command- and pilot units.
- Errors in the command.
- Energy-cut, energy-supply, rest-energy.
- Malfunction of elements.
- Pollution of the hydraulic medium.

Rest-energy may be in the installation when:

- Accumulators (hydraulic/pneumatic) exist.
- Loads are raised.
- Tensioning forces exist.
- Elements are braced against each other.

Reasons for the malfunction of elements may be:

- High pressure in the system.
- Abrasion and old material.
- Hanging valves.
- Overcharge caused by high dynamic pressure peaks.
- Inadequate or polluted hydraulic medium.

2.9 Overhung or bursting elements

Can be consequence of:

- Overcharge of the components, e.g. following too high pressure or pressure peaks.
- Old material.
- Inadequate elements.

2.10 Noise emission



Noise emission is not only caused by the Hydrokraft pump or related hydraulic aggregate. The noise caused by the working processes of machines, e.g. default-research, during the test run, can also generate a considerable sound level. For this reason, the expert staff must wear ear protection when exposed to health-damaging noise emission.

2.11 Electric endangering

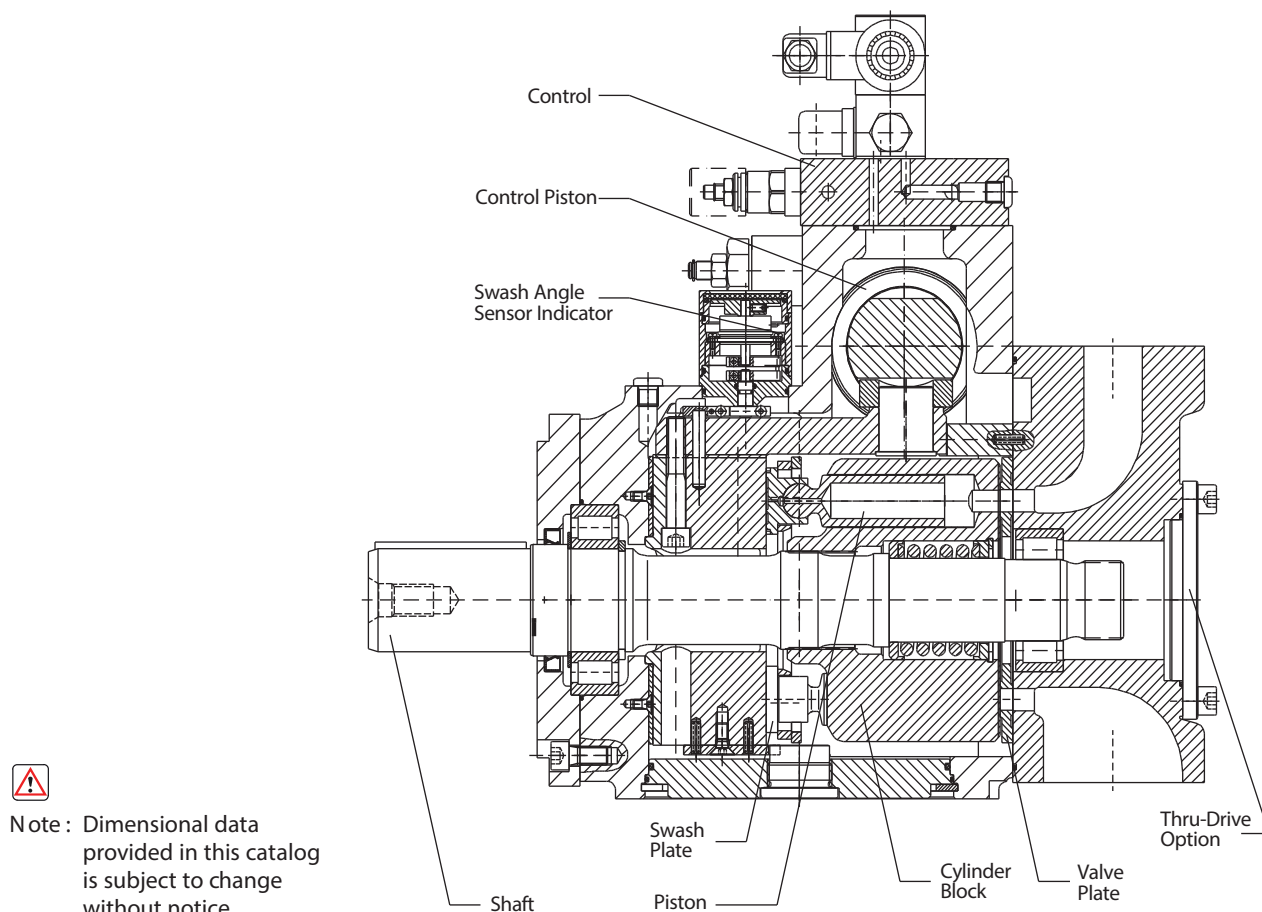


- Direct or indirect touch of elements under pressure or current-carrying elements.
- Shock currents.
- Arc discharge.
- Parasitic voltage, e.g. in case of insufficient earthing.

3. Product description

3.1 General pump description

An axial piston pump (short: pump) is a hydraulic displacement machine. It converts mechanical input energy into hydraulic output energy. An electric or diesel engine drives the shaft of the pump. As a result, the cylinder barrel undergoes a rotational movement. In the cylinder bores, the pistons make a translatory movement. This periodic movement is caused by the angular position of the swash plate on which the pistons slide. As the pistons move out of the cylinder bores, negative pressure is created on the suction side (low pressure side) of the pump and hydraulic oil is sucked into the cylinder bores. Once the pistons move into the cylinder bores, the oil is forwarded to the consumer on the high-pressure side of the pump. Depending on the swashplate angular position, the displacement of the pump increases or decreases



Axial piston pumps with swash plate design for reliable operation and long life:

- Pressure up to 420 bar.
- Rated speed up to 1800 rev/min. Higher speeds possible.
- Oversized shafts and bearings.
- Rotating and pressure-loaded parts are pressure balanced.
- Through-drive enables multiple pump installations from a single shaft. Multiple pump combinations are also available.
- Integrated pilot pump, filter and pressure relief valves available.

- Modular design gives these pumps a wide range of applications.

- Fast response times.

Following control options are available:

DF - Pressure compensator controlled

LR - Power control with pressure limiter

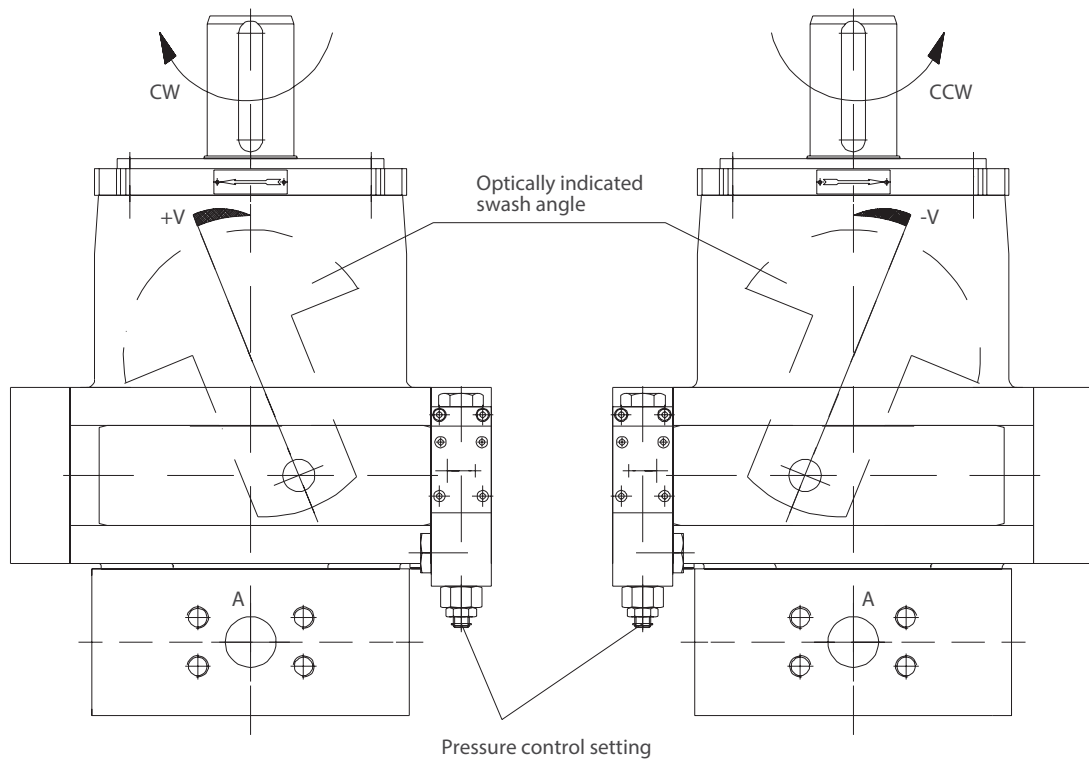
SP/ST - Displacement proportional to electric signal

DP - Displacement proportional to pressure signal

ES - Displacement adjustment via electric motor

Typical section of open loop PVW pump

Definition of shaft direction of rotation, swash angle direction and actuator piston movement



Product Description

3.2 Description of available control options

3.2.1 DF control

General Description: Energy-saving hydraulic drives are possible with pressure compensated pumps, especially in combination with the loadsensing option.

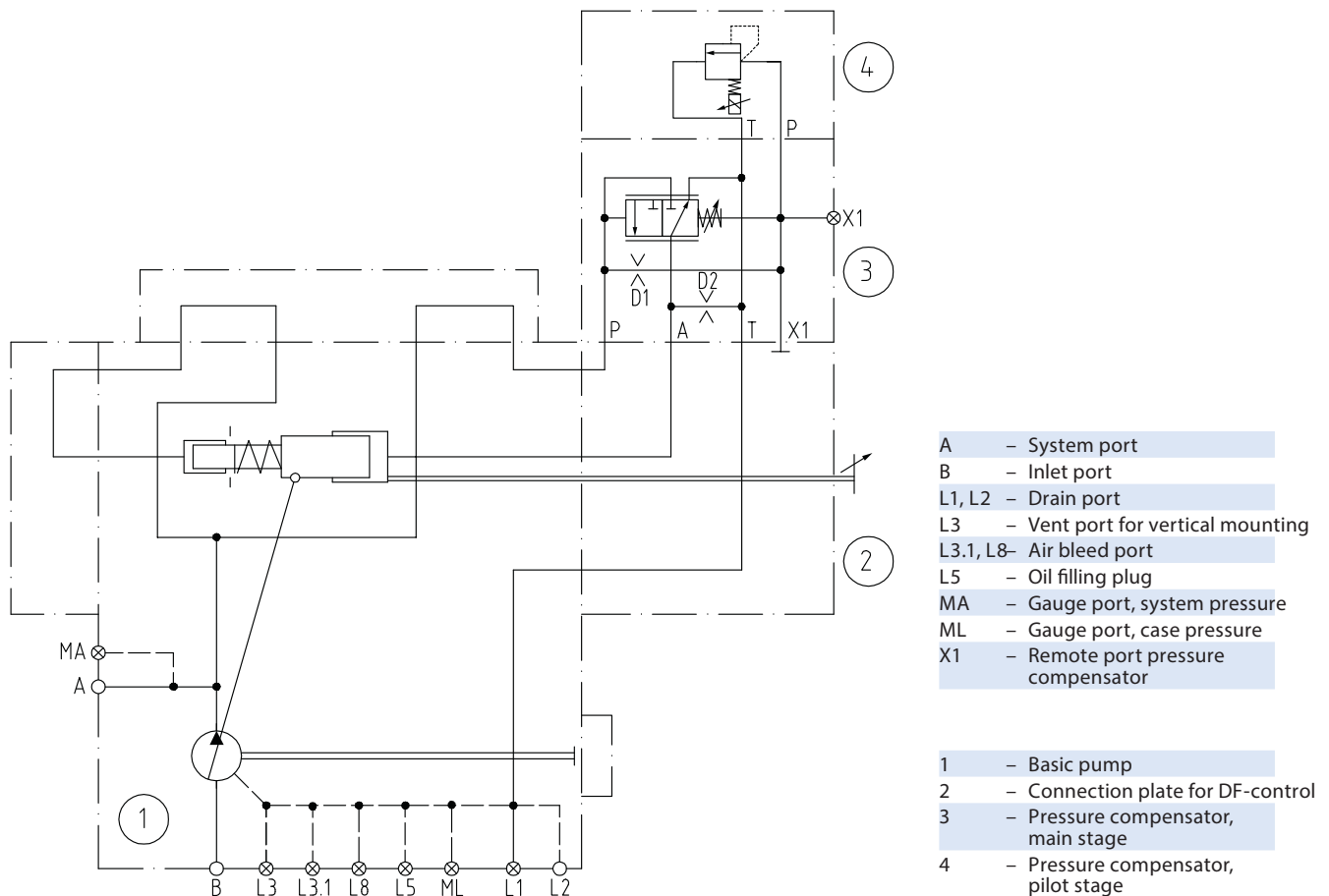
Principle of function:

System pressure remains constant for the entire volume flow rate. System pressure can be set manually, hydraulically or electronically. The standard Hydrokraft pressure compensator is pilot operated, has a remote port and is very stable.

Maximum pump flow can be limited mechanically to between 50% and 100% by a screw.

A DF controlled pump can be combined with following options:

- Pilot operated by proportional valve (with el. card or with on board electronics)
- Pilot operated via remote port only option
- Additional option for slow upstroke adjustment screw for each of above options
- Power control
- Flow control



Circuit shown is just an example, other options available. For circuit of individual pumps please contact technical support

3.2.2 LR control

General Description: Energy-saving hydraulic drives are possible with power controlled pumps, especially in combination with the loadsensing option.

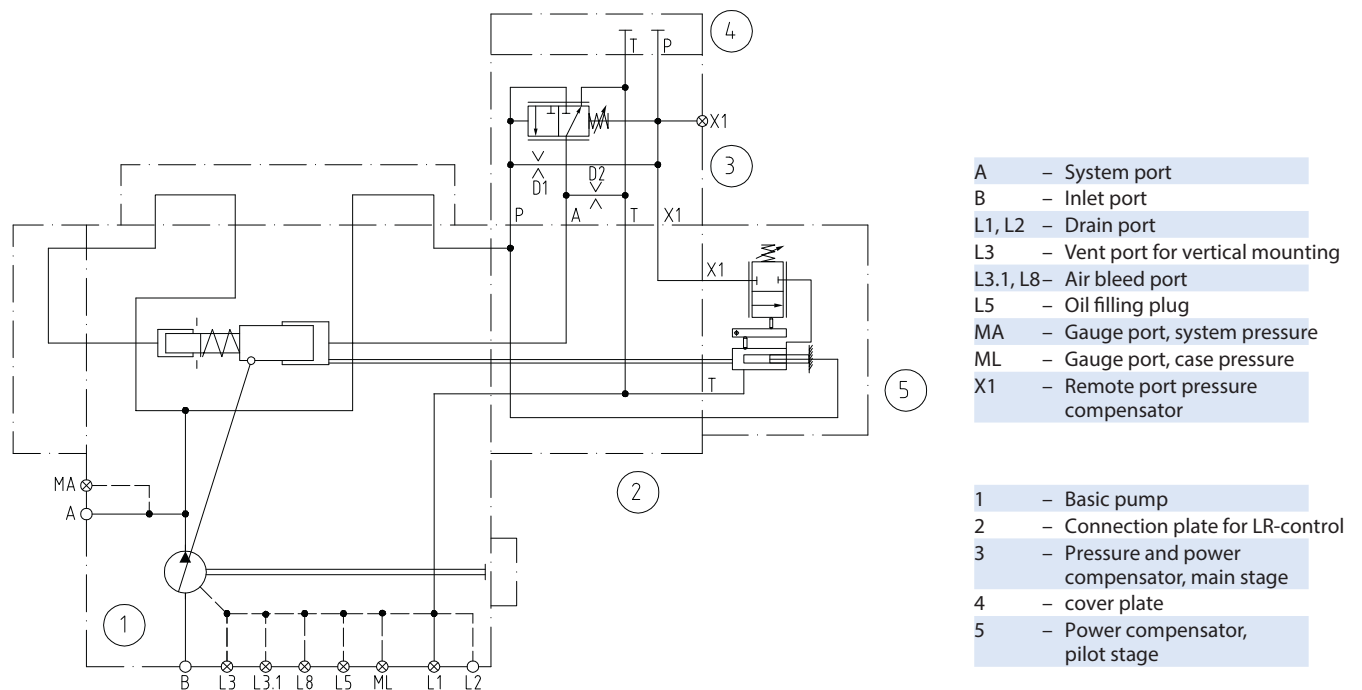
Principle of function:

The typical p/Q curve is a hyperbola. For constant speed, the drive torque, i.e. the power used, is held constant. The power hyperbola can be continuously adjusted between

P_{min} and P_{max}. P_{min} is given by the minimum setting of the control main stage (20 bar approx.) and power loss of the pump.

Maximum pump flow can be limited mechanically to between 50% and 100% by a screw.

A LR controlled pump can be combined with all pressure limiter options, as well as flow control.



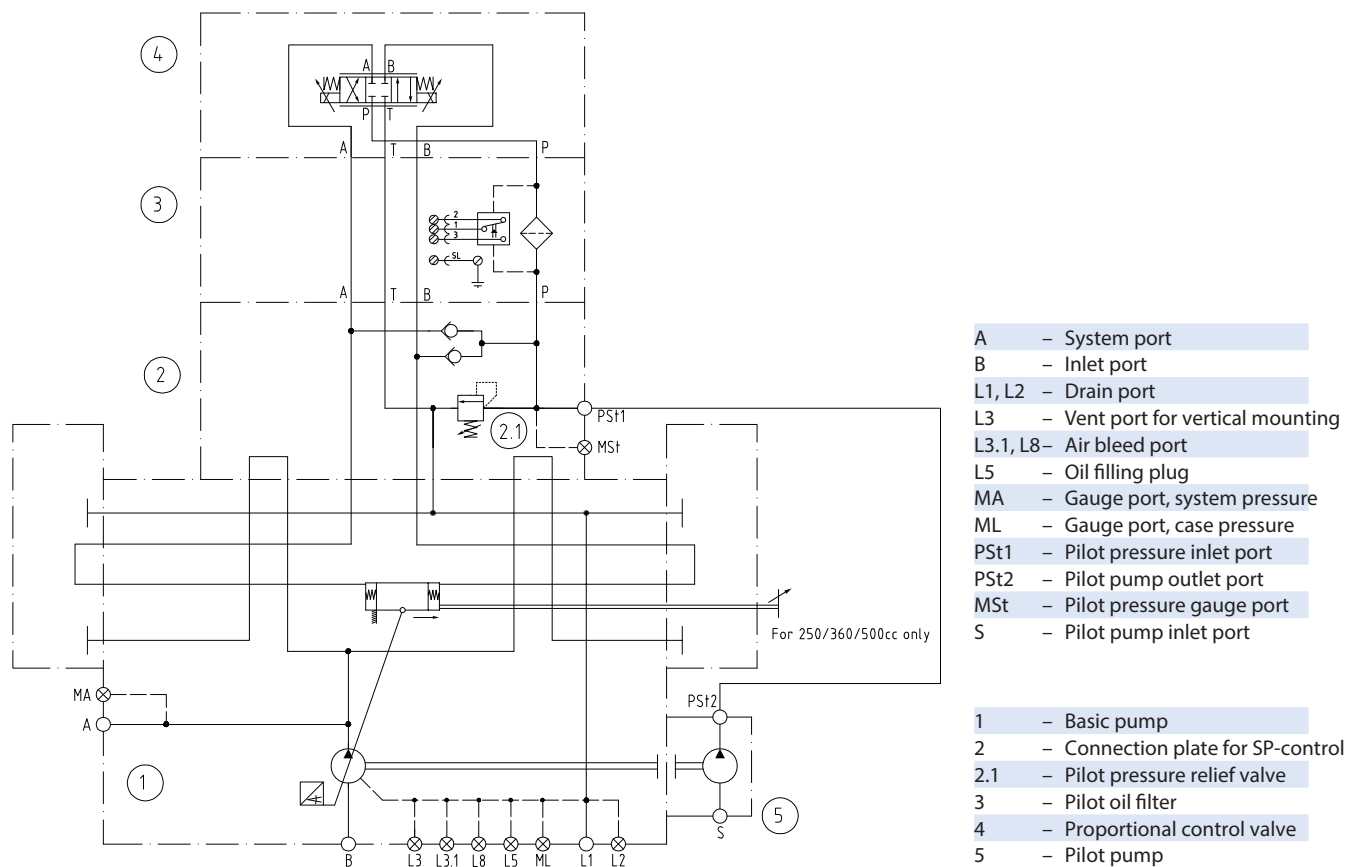
Circuit shown is just an example, other options available. For circuit of individual pumps please contact technical support.

Product Description

3.2.3 SP control

The energy-saving electrohydraulic displacement control type SP efficiently adjusts pump output by acting on the swashplate within electrically adjustable limits. The swashplate angle value is fed back to the controller unit via an electrical closed loop system. A proportional valve and servo piston use the controller output signal to

apply the required setting, resulting in a highly accurate dynamic control system. Hysteresis is approximately 1% of end value. The SP control can also be combined with hydromechanical relief valves for pressure and/or power control. Maximum pump flow can be limited mechanically to between 50% and 100% by a screw.

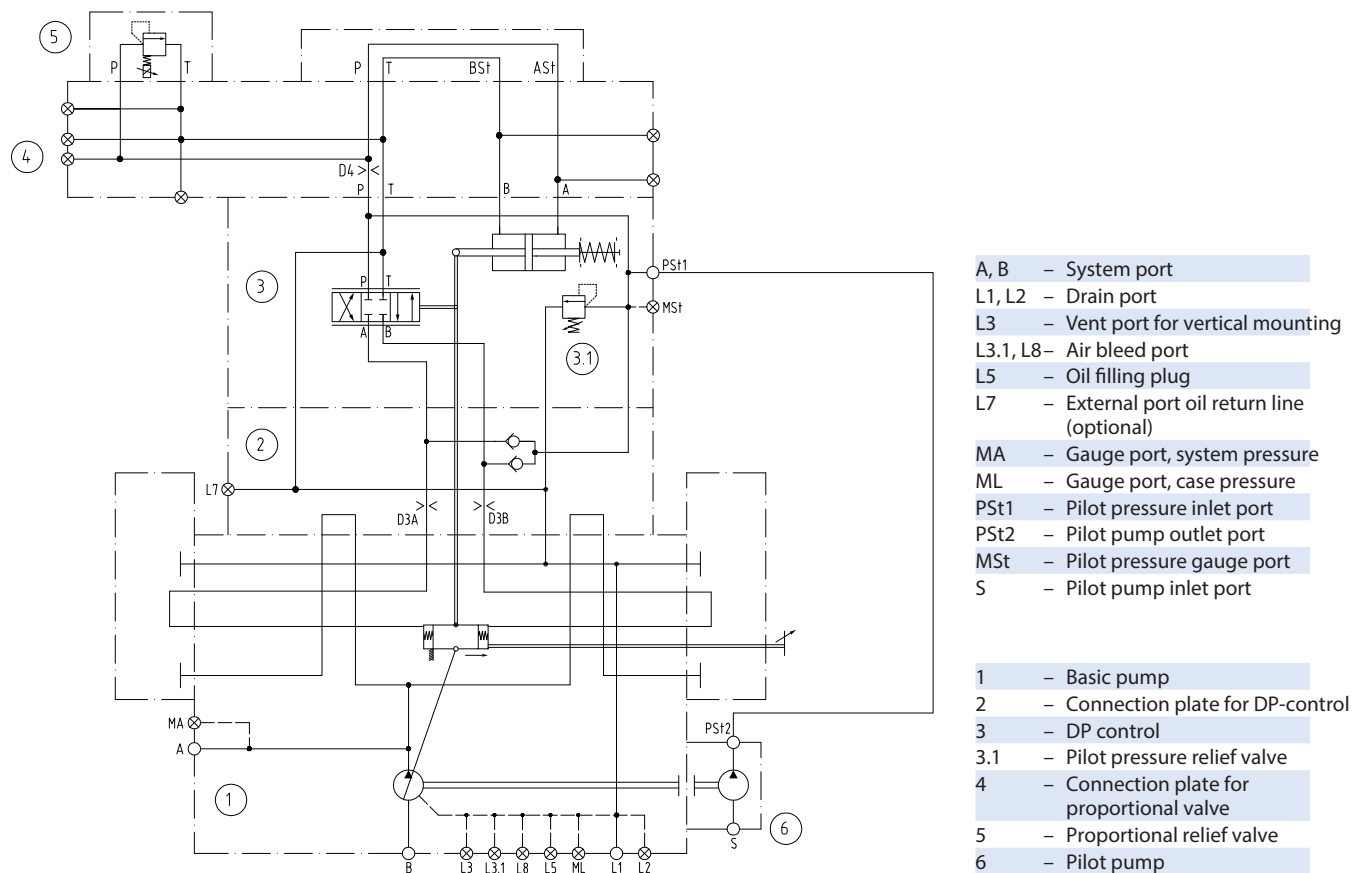


Circuit shown is just an example, other options available. For circuit of individual pumps please contact technical support.

3.2.4 DP control

Pump output flow is proportional to pilot pressure. A separate pilot oil circuit is required to reduce control pressure to the set value, using a suitable relief valve in line P-T and throttle valve in line P, Ø 0,8 (0.03 in). The DP control can be used for stepless flow control with standard requirements for dynamics and accuracy. Hysteresis is approximately 3% of end value.

No feedback signal is needed; an optical indicator is recommended. The DP control can also be combined with hydromechanical relief valves for pressure and/or power control. Maximum pump flow can be limited mechanically to between 50% and 100% by a screw.



Circuit shown is just an example, other options available. For circuit of individual pumps please contact technical support.

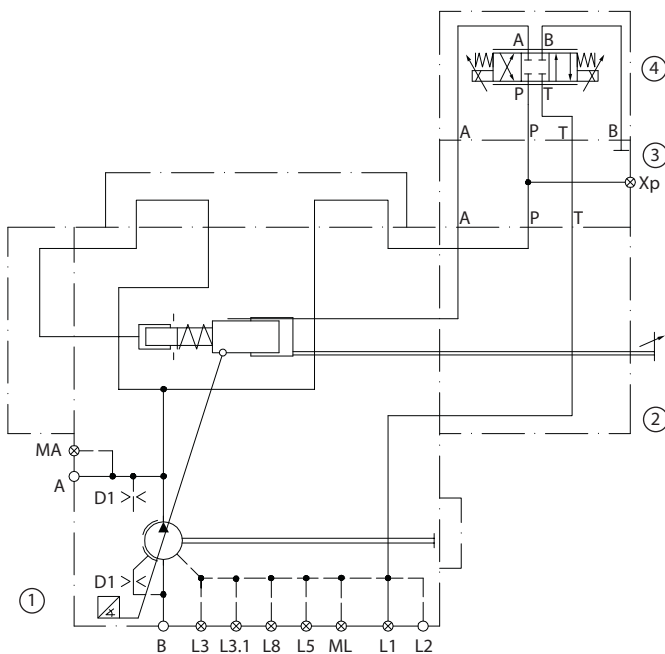
Product Description

3.2.5 ST Control

The ST control operates a hydrostatic drive and works without throttle losses within electrically adjustable limits. This is done by controlling delivery flow with electrical swashplate angle feedback (electric closed-loop control). All control values are recorded as an electrical signal and lead back to the control card. The proportional valve and servo piston transform the output signal of the control card to the desired setting. This results in a very precise

and dynamic control. Pressure and power limiter override available on request. Hysteresis is approximately 1% of end value.

ST-controlled pumps start at max. displacement. They can work with internal pilot oil supply only, but require a min. operation pressure of >25 bar for operation. Below this min. pressure value pump will automatically go on max. displacement.



- A – System port
- B – Inlet port
- L1, L2 – Drain port
- L3 – Ventilation port for vertical mounting
- L3.1, L8 – Air bleeding port
- L5 – Oil filling plug
- MA – Gauge port - system pressure
- ML – Gauge port of case pressure
- Xp – Gauge port of pilot pressure

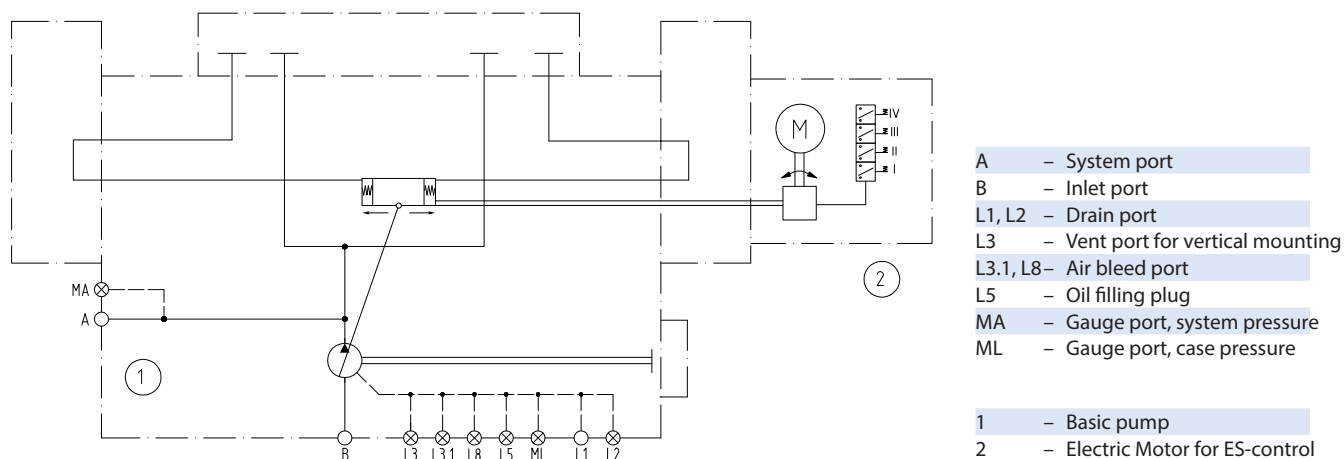
- 1 – Basic pump
- 2 – Connection plate for ST-control
- 3 – Adapter plate ST-control
- 4 – Proportional control valve

Circuit shown is just an example, other options available. For circuit of individual pumps please contact technical support.

3.2.6 ES control

This unit is used for flow adjustment. It has a 3-phase electric servo-motor, worm-gear and a switchbox with 4 or (optional) 8 limit switches for different positions. A potentiometer for continuous adjustment and/or position monitoring is also available. Response times from

zero to maximum depend on the ratio selected and on the (fixed) speed of the servo-motor, with the result that once the control is specified and built, response time are not variable in operation. Explosion Protection versions are also available. No Pressure/Power Limiter possible!



Circuit shown is just an example, other options available. For circuit of individual pumps please contact technical support.

Product Description

3.3 Nameplate and Identification

EATON
Vickers Hydrokraft Piston

Serial number: V*****

TYPE: []

Part No.: [] Date: []

Vg max: [] cm³ n_{max}: [] min⁻¹

V: [] cm³ P_N: 350 bar

✓: 12...75 mm²/s P_{max}: 420 bar

Vor dem Start mit Öl füllen. (Anschluss=L) Leckölleitung so verlegen, daß Gehäuse gefüllt bleibt. Gehäusedruck max. 0,5 bar.
 Fill with oil before start up. (connection=L) Mount drain line in such a manner that housing remains filled with oil. Internal pressure 0,5 bar max.
 Avant de demarrer, remplissez le carter avec d'huile. Monter la conduite de récupération des fuites de telle manière que le carter reste rempli d'huile. Pression intérieure: 0,5 bar max.
 Prima della messa in marcia riempire il corpo della pompa con il fluido in circuito. (Foro=L) Fare il drenaggio in modo da mantenere il corpo sempre

Part No. = Partnumber as per your order

Vg max = Max. geometric displacement

V = Displacement of this specific unit (if different to Vg max)

✓ = Allowed (kinematic) viscosity range for continuous operation

Workorder (Serial Number): V0ABCD

"ABCD" = consecutively number

Type: []

Short form modelcode of pump

Manufacturing date code:

B – Feb

17 – 2017

W – Wehrheim

(A–Jan, B–Feb, C–Mar...

P_N = Rated Pressure (100% duty cycle)

P_{max} = Max. pressure to ISO 5598:2008

With "Type" short form of modelcode pump is not uniquely identifiable. Please use always Part No. or Serial Number for communication with Hydrokraft customer support.

3.4 Technical data

Model			PF/VW 130/180	PF/VW 250	PF/VW 360	PF/VW 500	PF/VW 750
Design			Swashplate – Axial piston pump				
Type of mounting			Flange or foot-mounted - Combination units foot mounted only				
Pipe connection ISO 6162-1 (SAE J518)	psi		P64M (2½" - 500)	P89M (3½" - 500)	P89M (3½" - 500)	P127M (5" - 500)	P127M (5" - 500)
SAE Flange ISO 6162-2 (SAE J518)	A		P32M (1¼" - 6000)	P32M (1¼" - 6000)	P32M (1¼" - 6000)	P51M (2" - 6000)	P51M (2" - 6000)
Direction of rotation			Clockwise or counterclockwise				
Mounting attitude			Optional, see relevant Dimensions page				
Ambient temperature range	min max	°C	-20 +50				
Mass	m	kg	130 / 140	212	220	340	395
Moment of inertia	J	kg m ²	0,045	0,146	0,152	0,5	0,55

Hydraulic characteristics			PF/VW 130/180	PF/VW 250	PF/VW 360	PF/VW 500	PF/VW 750
Rated pressure (100% duty cycle)	p _N	bar	350				
Inlet pressure	p _{1 min} p _{1 max}	bar	1 abs 20				
Max. pressure to ISO 5598:2008	p _{2 max}	bar	420				
Hydraulic fluid			Hydraulic oil to DIN 51524 part 2 See Fluid Recommendations in Application Data				
Hydraulic fluid temperature range	min max	°C	-25 +90				
Viscosity range for continuous operation	min max	cSt	10 75				
Maximum permissible start viscosity	max	cSt	1000				
Cleanliness	ISO 4406		18/15/13				
Maximum geometric displacement at shaft speed	V _g	cm ³ /rev					
n = 1200 rev/min			130 / 180	250	360	500	750
n = 1500 rev/min			130 / 180	250	360	500	625/750 [▲]
n = 1800 rev/min			130 / 180	250	270	410/500 [▲]	—
Case pressure (overpressure)	p _{case}	bar					
n = 1200 rev/min			3,2	2,8	2,8	2,35	2,1
n = 1500 rev/min			2,6	2,2	2,2	1,85	1,7
n = 1800 rev/min			2,0	1,6	1,6	1,35	—

Drive			PF/VW 130/180	PF/VW 250	PF/VW 360	PF/VW 500	PF/VW 750
Driving torque (p 350 bar, V _g at 1500 rev/min, η _v = 100%)	M _{1 single}	Nm	724/1002	1392	2005	2785	3481/4177
Power consumption (p 350 bar, V _g at 1500 rev/min, η _v = 100%)	P _{1 single}	kW	113 / 157	218	315	437	546/656

Combination units			PF/VW 130/180	PF/VW 250	PF/VW 360	PF/VW 500	PF/VW 750
Maximum driving torque ISO splined shaft only	M1	Nm	2x870/2x1204	2 x 1670	2 x 2405	5000	5000

▲ Larger displacement/higher speed on request only. Contact Danfoss Technical Support.

System oil viscosity between 20-40cSt is recommended for optimal volumetric efficiency Case flushing oil viscosity between 40-50cSt is recommended for optimal bearing life and mechanical efficiency

Lifetime of shaft seal is depending on shaft speed of the pump, fluid, case drain pressure and others. It is recommended that the average, continuous case drain pressure acc. technical data shown above should not be exceeded (maximum permissible case pressure 4 bar absolute at min. speed). Short pressure peaks (< 0,1 sec) of up to 5-10 bar absolute are permitted. The lifetime of shaft seal will be negatively influenced by increase offrequency of pressure peaks. Case pressure must always be equal to or greater than the outside pressure to shaft seal.

All technical data above are general values and/or guidelines; restrictions may be necessary under certain operating conditions. Please be aware that pumps cannot always be operated at all limits of operation conditions shown above at the same time.

Product Description

US

Model			PF/VW 130/180	PF/VW 250	PF/VW 360	PF/VW 500	PF/VW 750
Design			Swashplate – Axial piston pump				
Type of mounting			Flange or foot-mounted - Combination units foot mounted only				
Pipe connection ISO 6162-1 (SAE J518)	B	psi	P64M (2½" - 500)	P89M (3½" - 500)	P89M (3½" - 500)	P127M (5" - 500)	P127M (5" - 500)
SAE Flange ISO 6162-2 (SAE J518)	A		P32M (1¼" - 6000)	P32M (1¼" - 6000)	P32M (1¼" - 6000)	P51M (2" - 6000)	P51M (2" - 6000)
Direction of rotation			Clockwise or counterclockwise				
Mounting attitude			Optional, see relevant Dimensions page				
Ambient temperature range	min	°F	-4				
	max		+122				
Mass	m	lb	215	467	485	750	871
Moment of inertia	J	lb ft²	3.46	3.46	3.61	11.9	13.1
Hydraulic Characteristics			PF/VW 130/180	PF/VW 250	PF/VW 360	PF/VW 500	PF/VW 750
Rated pressure (100% duty cycle)	p _N	psi	5075				
Inlet pressure	p _{1 min}	psi	14.5 abs				
	p _{1 max}		290				
Max. pressure to ISO 5598:2008	p _{2 max}	psi	6090				
Hydraulic fluid			Hydraulic oil to DIN 51524 part 2 See Fluid Recommendations in Application Data				
Hydraulic fluid temperature range	min	°F	-13				
	max		+194				
Viscosity range for continuous operation	min	cSt	10				
	max		75				
Maximum permissible start viscosity	max	cSt	1000				
Cleanliness	ISO 4406		18/15/13				
Maximum geometric displacement	V _g	in³/rev					
at shaft speed = 1200 rev/min			7.9/11	15.2	22	30.5	45.7
n = 1500 rev/min			7.9/11	15.2	22	30.5	38.1/45.7▲
n = 1800 rev/min			7.9/11	15.2	16.4	25/30.5▲	—
Case pressure (overpressure)	p _{case}	psi					
n = 1200 rev/min			46	40	40	34	30
n = 1500 rev/min			38	32	32	27	25
n = 1800 rev/min			29	23	23	20	—
Drive			PF/VW 130/180	PF/VW 250	PF/VW 360	PF/VW 500	PF/VW 750
Driving torque (p _N = 5075 psi, V _g at 1500 rev/min, η _v = 100%)	M _{1 single}	lbfft	534/739	1027	1479	2054	2567/3081
Power consumption (p _N = 5075 psi, V _g at 1500 rev/min, η _v = 100%)	P _{1 single}	hp	152/211	293	422	586	733/880
Combination Units			PF/VW 130/180	PF/VW 250	PF/VW 360	PF/VW 500	PF/VW 750
Maximum driving torque	M1	lbfft	2x642/2x888	2 x 1232	2 x 1774	3688	3688
ISO splined shaft only							

▲ Larger displacement/higher speed on request only. Contact Danfoss Technical Support.

System oil viscosity between 20-40cSt is recommended for optimal volumetric efficiency Case flushing oil viscosity between 40-50cSt is recommended for optimal bearing life and mechanical efficiency

Lifetime of shaft seal is depending on shaft speed of the pump, fluid, case drain pressure and others. It is recommended that the average, continuous case drain pressure acc. technical data shown above should not be exceeded (maximum permissible case pressure 4 bar absolute at min. speed). Short pressure peaks (< 0,1 sec) of up to 5-10 bar absolute are permitted. The lifetime of shaft seal will be negatively influenced by increase offrequency of pressure peaks. Case pressure must always be equal to or greater than the outside pressure to shaft seal.

All technical data above are general values and/or guidelines; restrictions may be necessary under certain operating conditions. Please be aware that pumps cannot always be operated at all limits of operation conditions shown above at the same time.

4. Transport and storage

4.1 Packaging and transport

- Remove cardboard boxes, wooden boxes, foil, fixing material
- Proper disposal in accordance with the national directives
- Transport damages must be immediately announced to the carrier
- Due to the large dimensions and mass of Hydrokraft pumps, adequate lifts and sling gears must be used for installation and transport
- The general safety instructions must be respected when transporting!
- Piping and pump or other installations must not be used as sling gears
- Always transport Hydrokraft pumps without hydraulic medium. Due to the production test carried out by the manufacturer, oil residues might be in the product

4.1.1 Health risk and risk of damage

- Health Risk: Never stand or walk under suspended loads!
- Risk of Damage: Hard hits to pump and especially shaft can damage the pump (especially bearings can be pre-damaged)
Never set or place pump on the drive shaft!
Never use hammer or similar tools to mount coupling on drive shaft!
- Ensure that lifting device (fork lift truck or similar) has adequate lifting capacity!
- Ensure that lifting straps/chains or ring screws has adequate lifting capacity and are without damage!

4.1.2 Dimensions and weights

Estimated weights for basic pumps with DF,LR,ST,SP and DP control, without aux.pumps

Model			PF/VW 130/180	PF/VW 250	PF/VW 360	PF/VW 500	PF/VW 750
Mass	m	kg	130/140	212	220	340	395

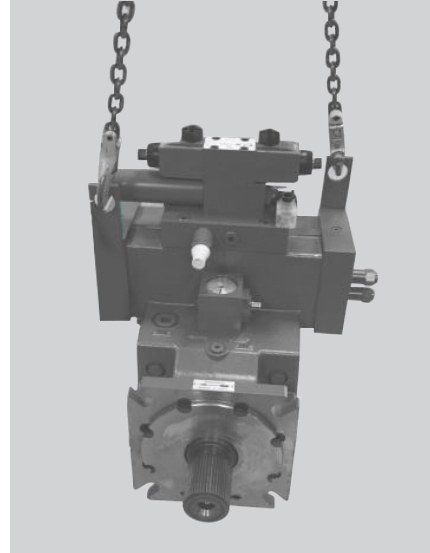
Please be aware that mass can vary depending on pump options significantly.

For exact mass data contact your Danfoss Hydrokraft Technical Support team or weight pump separately before lifting.

For dimension information please have a look in appropriate documentation (installation drawing, product catalogue)

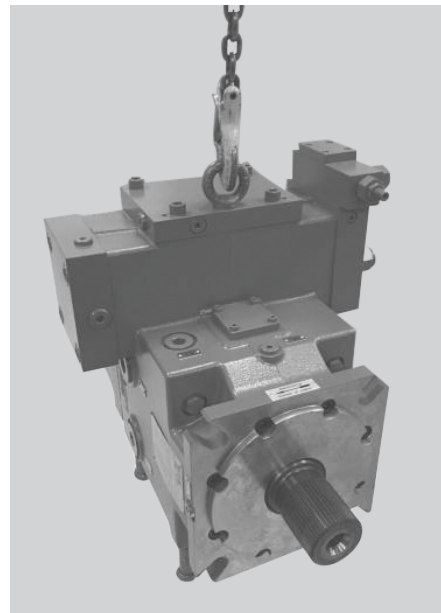
4.1.3 Transport with lifting straps or chains

Hydrokraft PVW pumps with SP, DP or ES control are foreseen to be transported with lifting straps or chains. Please use appropriate lashing lugs provided together with pump.



4.1.4 Transport with ring screw

Hydrokraft PVW pumps with DF, LR or ST control are foreseen to be transported with lifting straps or chains. Please use appropriate ring screw provided together with pump.



Transport and storage

4.2 Storage

4.2.1. Corrosion protection ex works

Danfoss Hydrokraft axial piston units are tested with mineral oil HLP 46 acc. DIN 51524 T2 by default. The oil film kept inside the unit covering all internal parts provides an internal corrosion protection which last ca. 3-6 month, depending on storage conditions.

4.2.2 Extended protection for inner parts

An extended protection for inner parts can be achieved by filling the units with a special corrosion protection oil, which keeps inside of the unit. All open ports need to be covered by flanges or plugs. remark: such need to be defined in advance (order entry) and will be charged separately.

4.2.3 storage time (in months, depending on storage conditions) with extended protection for inner parts

preliminary note: pumps should be stored horizontally. It is recommended to rotate pumps manually every 6 months for some turns and fill/spray some corrosion protection oil in suction and/or pressure port in parallel.

4.2.3.1 storage in dry rooms with a constant ambient temperature)

- standard wooden box (no seafreight packaging)
- possible storage time ca. 18-24 months

4.2.3.2 storage in dry rooms with a constant ambient temperature

- standard wooden box (seafreight packaging)
- possible storage time ca. 24-36 months

4.2.3.3 Storage outdoor

- standard wooden box (no seafreight packaging)
- possible storage time ca. 6-12 months

4.2.3.4 Storage outdoors

- standard wooden box (seafreight packaging)
- possible storage time ca. 9-12 months

4.2.3.5 Long-time storage

If stored significantly longer, axial piston units need to be disassembled and – by use of a suitable cleaning liquid – to be cleaned from conservation oil residues. Eventually seals need to be exchanged additionally.

5. Assembly and installation

5.1 Unpacking and control

- Please check the delivery on its integrity and transport damages. In case of loss or damage, we refer to our general sales and delivery conditions;

5.2 Preparation

- Before starting the assembly of the pump, all technical documentations, such as the hydraulic circuit diagram or assembly drawing must be available.
- The assembly area must be clean and free of obstacles
 - Necessary and adequate tools and lifting devices must be available
 - Only use the indicated threads and fixing holes
- Due to the power dissipation which is radiated over the surface of Hydrokraft pump, ensure sufficient air ventilation for the heat release.
- The electric and hydraulic connections of the Hydrokraft pump must be connected with the connections on the machine, according to the circuit diagram.
- Particularly unfavourable conditions
 - During the transport
 - From the manufacturer to the assembly area
 - Eventually necessary intermediate storage period under unfavourable conditions
 - Installation on the assembly area

may cause pollution in the pump (water, dust, etc.). Any residues must be removed (do not use fibre cleaning cloths!)

- If the Hydrokraft pump is lacquered again, all elastic materials (flexible lines, sealing), optical displays and electronic devices must be covered
- The Hydrokraft pump should be easily accessible for maintenance works. This includes routine works, such as inspection of leakage, re-adjustment of controls and replacing of filter-elements.
- Before taking the Hydrokraft pump into operation, the unit must be completely filled with oil.

5.3 Filtering of hydraulic medium

- An adequate filtering of the hydraulic medium is an indispensable condition for a failure-free functioning and a long life-cycle of all hydraulic components and the entire machine/installation
- Please consider the control and replacing intervals of the filter
- In case of a later installation of supplementary filters, ensure an arrangement which makes it easy accessible for maintenance works outside the danger zones
- Standard hydraulic medium often do not have the required purity level when delivered
- Before proceeding to the test-run of installations with actuation in open or closed control loops, the installation and hydraulic medium must be cleaned according to the indications of the manufacturer, in order to attempt a steady purity level. Unless otherwise specified, the rinsing of the assembled installation must be carried out in accordance with ISO 23309.

5.4 Screwed fittings & flexible lines

WARNING!

Do never couple or uncouple flexible lines or pipes under pressure or when the Hydrokraft pump is running! There is a considerable risk of injury caused by lashing flexible lines and/or escaping liquids!

- Inaccurate connections, screwed fitting, pipes and flexible lines under pressure may cause serious injuries.
- Use with preference screwed fittings and tailpieces with elastomeric seals
- Pipes should be in steel. Metric pipes with an external diameter until 50mm should correspond to ISO 10763.
- When choosing the flexible lines and pipes, make sure that, concerning pressure and flow, they are accurate for the intended use.
- Flexible lines should, if possible, be purchased completely tailored from the manufacturer
- When installing flexible lines or pipes, you must consider the installation directives from the manufacturer, e.g. minimum bending radius, lapping torsion moments. You will find the necessary information in the respective product catalogue from the manufacturer.
- You should proceed to a visual inspection of all flexible lines before taking into operation. Defective bonding, aging, mechanical defaults may cause burst of flexible lines.

WARNING!

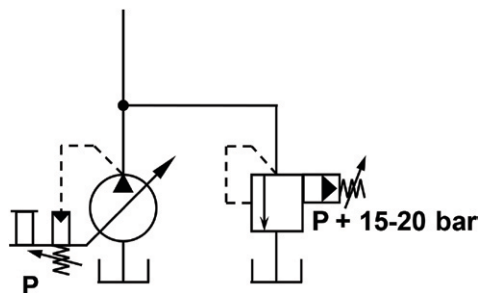
Defective flexible lines must be replaced immediately

- Flexible lines from unknown manufacturers or incomplete identification should not be used

Assembly and installation

5.5 Relief valves

As in most hydraulic installations, a separate safety relief valve should be fitted to protect the system. However it is normally unnecessary to fit a relief valve to protect against pressure spikes, therefore the relief valve can be sized to suit maximum flow rather than dynamic response. The relief valve should be set 15 – 20 bar higher than the pump compensator.



5.6 Natural frequency/resonances/couplings

⚠ WARNING!

Care should be taken that mechanical and hydraulic resonances are avoided in the application of the pump. Such resonances can seriously compromise the life and/or safe operation of the pump. Especially elastic couplings with or w/o rubber materials need to be designed carefully in this regard!

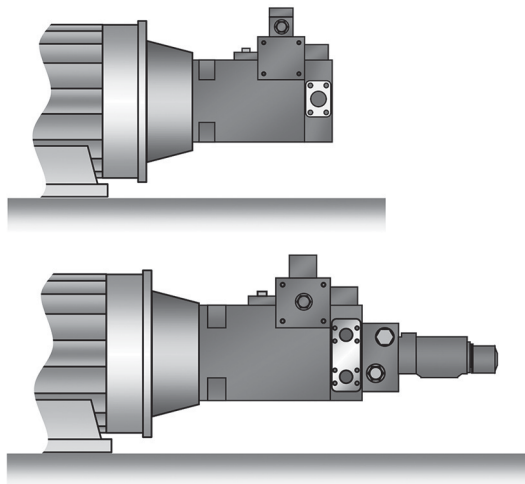
Direct coaxial drive through a flexible coupling is recommended. No side load must be applied to the drive shaft of Hydrokraft pumps and motors. In some cases, limited side loads are permissible under specific conditions. Contact Hydrokraft technical support for examination. Axial loads to shaft must be avoided.

5.7 Installation position

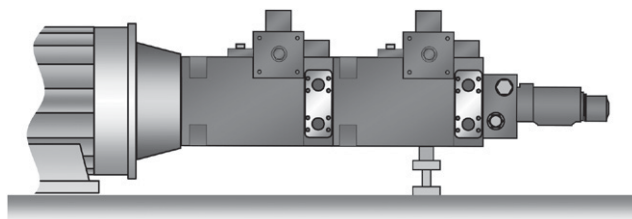
- Mounting attitude should be horizontal using the appropriate case drain ports to ensure that the case remains full of fluid at all times.
- Vertical mount is possible, but would need special attention for venting. Refer to # 5.14 / 5.15.
- Below tank installation is the preferred installation position, i.e. outside of tank below the minimum oil level in hydraulic reservoir. Minimum suction pressure is defined with 1 bar absolute.

5.8 Mechanical installation

The pump/motor flanges are strong enough to cope with the weight of single pump arrangements (including pilot and charge pumps).



In general however, the bell-housing or mounting flange may not be strong enough to carry the weight of multiple pump assemblies so some form of support will be required. Tapped holes are provided on the underside of the pumps for this purpose.



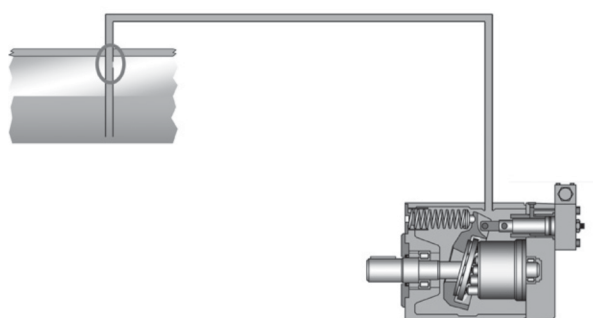
5.9 Case drain and Case pressure

5.9.1 Drain line requirements

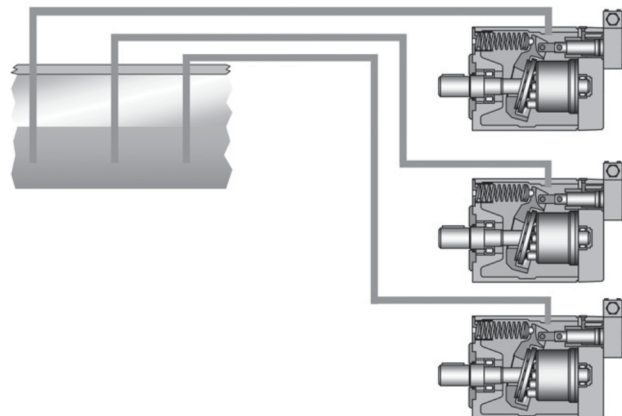
Looping the drain from the highest point will ensure that air is purged, and all parts are bathed with oil.

The case drain must be taken from the highest drain port on the unit and looped above the reservoir oil level. Momentary high drain flows however may cause foaming of the reservoir fluid so drain lines should terminate below oil level. If necessary, a small anti-siphon hole can be drilled into the drain line to prevent fluid loss when the pump is removed.

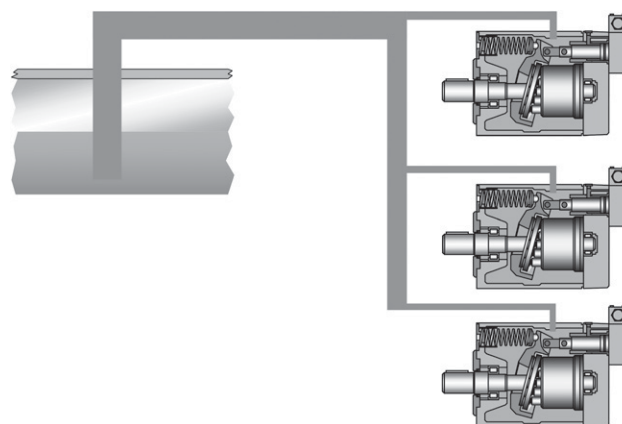
Standard check valves should not be fitted into the drain line, especially at larger pumps, due to the increased back pressure created and the fact that in certain instances, a reverse fluid flow in the drain line is necessary.



Individual connection of drain line of each single pump is the preferred option, to avoid pressure peaks by backpressure or dynamic flow impacts.



If a collecting line is used, a suitable diameter must be chosen. Depending on length of drain line, flow velocity should not exceed 1 m/s at max. drain flow.



Recommended drain line sizes

Drain line sizes	drain port size L1	drain port size L2	max drain flow [l/min] at 300 bar	min. internal pipe diameter in mm for v max=1,0 m/sec	pipng short distance - length < 2 m + max. 2x 90 ° pipe elbows	pipng long distance length > 2 m or shorter + > 2 pcs 90 ° pipe elbows
PVWS-250	15/8"-12	G1 1/4"	16-20	20,6	28x2	35x2
PVWS-360	15/8"-12	G1 1/4"	20-25	23,0	28x2	35x2

5.9.2 Case pressure specification

Max. case pressure is mainly defined by pressure capability of shaft seal.

Lifetime of shaft seal is depending on shaft speed of the pump, fluid, case drain pressure and others. For max. allowable values please refer to Ch 3.4 "Technical data"

In addition to the overall case pressure limit, defined by shaft seal limit, for open circuit pumps there is an additional limit related to the differential between case pressure and inlet pressure. This should not exceed 0.5 bar. Excessive case pressure over inlet increases forces between shoe and piston and might affect/decrease lifetime of this combination

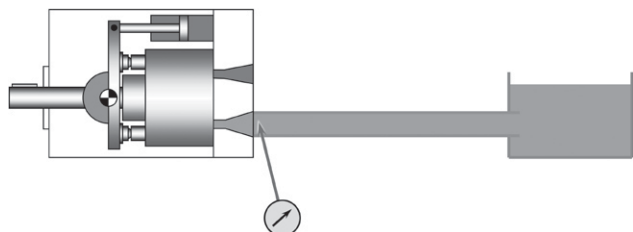
Assembly and installation

5.10 Suction line

To avoid cavitation damage, the inlet pressure should be at or slightly above 1 bar absolute at all times. Smaller pumps can tolerate some degree of vacuum but larger pumps must have a minimum pressure of 1 bar absolute at the inlet.

Guideline for suction line diameter:

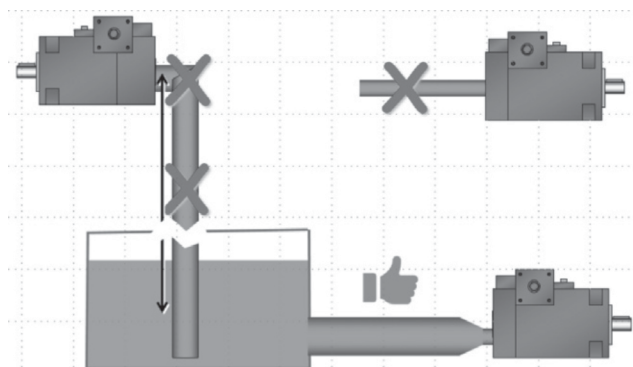
$v_{\text{max oil (suction line)}} < 1 \text{ m/sec}$



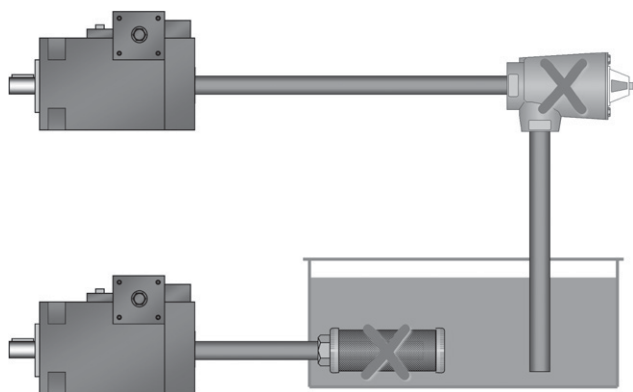
250 cm³/r & larger = 1 bar (14.5 psi) MINIMUM

Avoid long vertical suction lines, sharp elbow joints or small diameter lines.

The suction line should be of the largest possible diameter, reducing to inlet port size at or near the port itself. It should also use swept bends rather than sharp elbow joints.

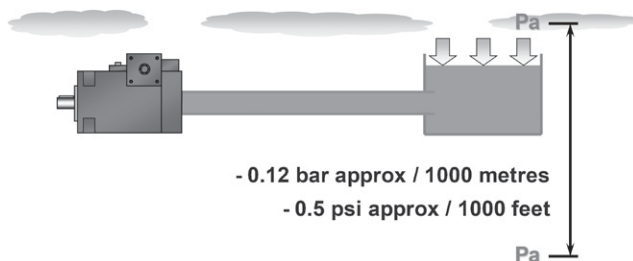


Suction filters and strainers should not be fitted as the pressure drop required to draw fluid across them further lowers the inlet pressure.



5.11 Atmospheric pressure

The sensitivity of the pumps to inlet conditions is even more relevant at greater altitudes and lower atmospheric pressures.

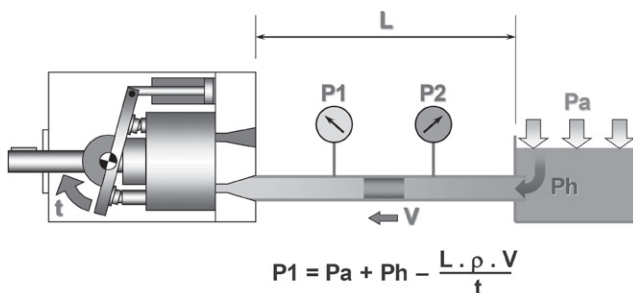


5.12 Acceleration of oil in suction line

Consider the effect of drawing oil along a suction line under conditions of rapidly changing swash angle.

As the pump moves from zero flow to maximum flow, fluid has to be accelerated from low speed (or rest) by the pressure difference acting across it.

The pressure required to accelerate the fluid is determined by the length of the inlet line, the fluid density, the inlet flow velocity and the on-stroke response time of the pump.

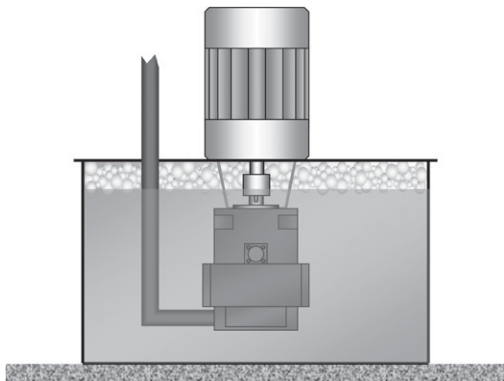


To reduce or avoid this negative pressure, the length of the inlet line could be reduced in order to reduce the mass of fluid to be accelerated.

Or, if this is not possible, the on-stroke response time of the pump could be increased either by using the slow on-stroke adjustment option or a ramp signal if electronically controlled.

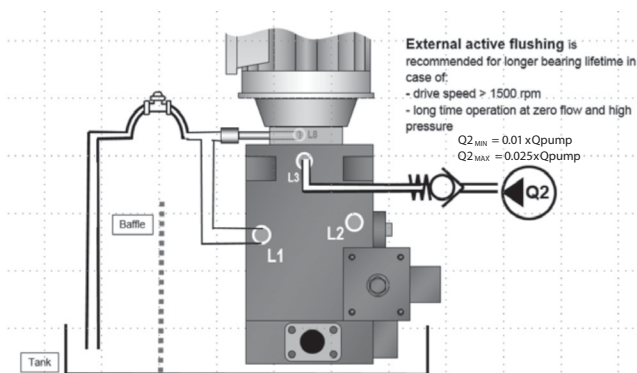
5.13 Shaft coupling – immersed pump

- When pumps are mounted inside the reservoir ensure that the coupling remains above the oil level to avoid churning or splashing of the oil which can lead to aeration (and mess).

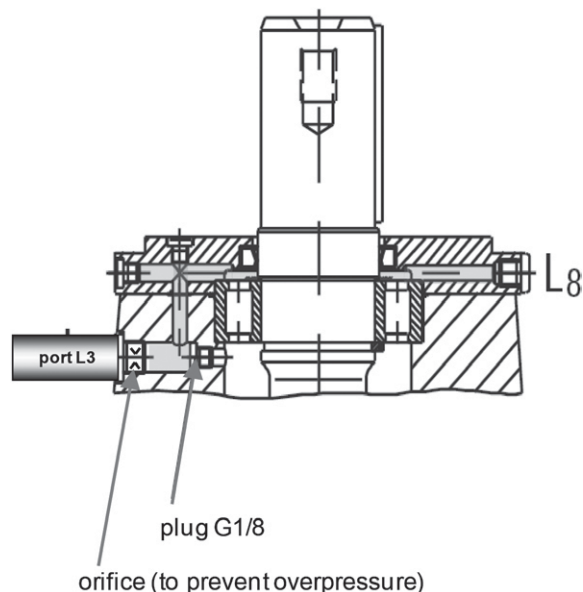


5.14 Installation position shaft up

- Venting line connected to L8 opposite side of L3.
- Tube extension might be necessary to adapt at L8 to mount standard fitting due to limited space
- Venting valve should be mounted above pump level
- Whenever possible the Drain line should be mounted into the tank return area (opposite side of the baffle)
- Take care that inlet pressure at port L3 does not exceed 16 bar, otherwise permissible values of shaft seal pressure (2,2 bar overpressure at 1500 rpm) might be exceeded and shaft seal damage/leakage might occur. This shaft seal pressure can be measured at port L8.
- Shaft seal pressure can be limited by diameter of orifice, depending on pressure level in flushing supply line

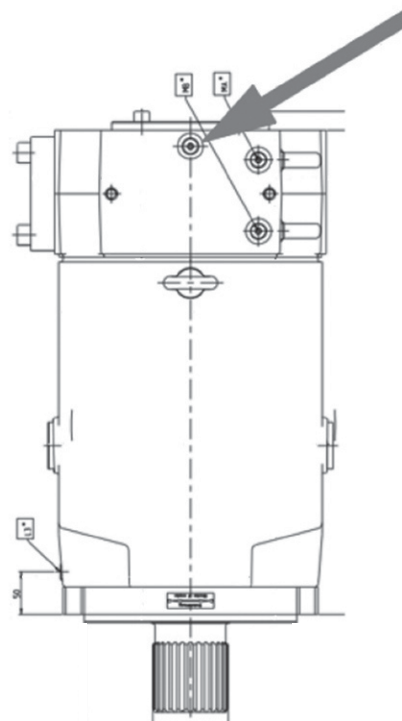


In case external bearing flushing will be applied, L3 must be closed inside the housing by plug G1/8 :



5.15 Installation position shaft down

- for venting and flushing of rear bearing it is strongly recommended to connect Lx port if pump will be mounted in shaft down position vertically. Please be aware that Lx port is optional and, depending on size and model of pump, available on request only.



Assembly and installation

5.16 Active bearing flushing – W-design

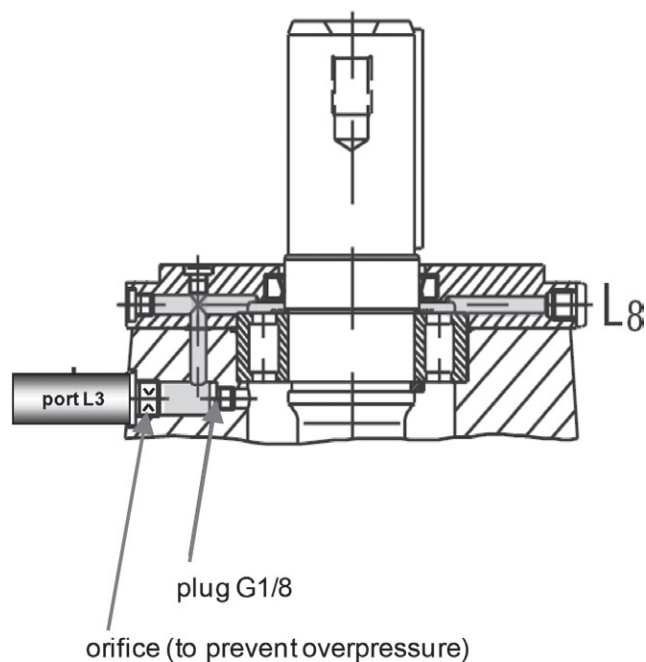
Active Bearing Flushing is mandatory for

- applications using fluids with limited lubrications capabilities (eg. HFC) and strongly recommended for pumps which
- are vented to low pressure for long periods of time or
- pumps running at zero flow with high pressure for longer terms or
- when the control requires no pilot oil flow (eg. ES or manual Flow controls)
so that pilot flow cannot be used for case/
bearing flushing ...

Active Bearing Flushing should be no less than 1% of maximum pump flow.

Take care that pressure directly at shaft seal area does not exceed permissible values (depending on speed, refer to below), otherwise leakage or shaft seal damage might occur.

This critical pressure can be measured at port L8. Pressure can be defined by diameter of orifice, depending on pressure level in flushing supply line



Case pressure (overpressure)	P_{case}	bar	
		PF/VW 250	PF/VW 360
n = 1200 rev/min		2,8	2,8
n = 1500 rev/min		2,2	2,2
n = 1800 rev/min		1,6	1,6

6. Comissioning

6.1 Preparation

Check that your operation conditions (speed, pressure, fluid etc.) will meet the specifications of the pump given in the documentation.



Operation of Hydrokraft pumps outside of specifications shown in catalogue and other technical documents will exclude any warranty, liability or guarantee for the pump (special application conditions above standard ratings may be possible, but would need written approval from Danfoss to become valid)

- The assembly area must be clean and free of obstacles.
- Due to the power dissipation which is radiated over the surface of Hydrokraft pump, ensure sufficient air ventilation for the heath release.
- The electric (if applicable) and hydraulic connections of the Hydrokraft pump must be connected with the connections on the machine, according to the circuit diagram.
- Before taking the Hydrokraft pump into operation, the unit must be filled with oil. Do only use the indicated connections (see application information).



The Hydrokraft pump is delivered without hydraulic medium. Before proceeding to the test-run, fill the unit with the adequate medium according to the specification! An air-cushion trapped in one of the bearings might result in damage of bearing and pump after very short operation time.

- Take also care that suction line is always filled with hydraulic fluid during operation of pump.

Check suction line in regard of trapped air areas and/or air leaks to avoid air suction problems which could damage the pump in short time.

- Standard hydraulic medium often do not have the required purity level when delivered.
- Before proceeding to the test-run of installations with actuation in open or closed control loops, the installation and hydraulic medium must be cleaned according to the indications of the manufacturer, in order to attempt a steady purity level. Unless otherwise specified, the rinsing of the assembled installation must be carried out in accordance with ISO 23309.
- Check the fluid level in the reservoir with the indicated test medium (Reservoir-level display, fluid level measure instrument).



When filling for the first time, the MAXIMUM fluid level of the reservoir must not be exceeded.

During the test-run, the fluid level of the reservoir will decrease as the hydraulic medium will disperse in the line system. For this reason, hydraulic medium must be immediately refilled.



The fluid level in the reservoir must not fall below the indicated MINIMUM fluid level

- When the installation is switched-off, dangerous outflow of hydraulic medium in the reservoir must be avoided.
- You should proceed to a visual inspection of all flexible lines before taking into operation. Defective bonding, aging, mechanical defaults may cause burst of flexible lines.



Defective flexible lines must be replaced immediately

6.2 Securing of the environment in case of malfunction of flexible lines



Please consider that in case of malfunction of flexible lines, e.g. close to working spaces or route ways, serious danger may be caused, e.g.

- Escape of hydraulic medium under high pressure
- Lashing
- Fire danger

For this reason, you should take additional measures to secure the environment in case of malfunction of flexible lines, e.g. in form of supplementary tear-off protection or shielding.

6.3 Rotation direction

Before starting operation, check always that rotating direction of drive (E-motor, diesel engine) and pump are in line with each other;

6.4 Hydraulic accumulators

Hydraulic accumulators are apparatuses for which the manufacturer and the operator must meet specific safety-related conditions.

Special European or other Standards and regulations need to be respected where appropriate, both in regard of system design and component certification regulations.

Hydraulic accumulators need to be checked regularly according to relevant specifications.

6.5 Hydraulic fluids

Fluid Type	DIN/ISO Classification	Rated Pressure p _n (bar)	Maximum Speed (rev/min)			Recommended Seal Material	Maximum Operating Temperature (°C)	Bearing Life
			130 & 180 cm ³	250 & 360 cm ³	500 & 750 cm ³			
Water Glycol	HFC	250	1800	1500	1250	NBR	45	25-100%
HFDR (phosphate ester based)	HFDR	350	1500	1200	1000	FKM	60	100%▼
HFDU (glycol based)	HFDU	350	1500	1200	1000	FKM	60	100%▼
HFDE (ester based)	HFDE	350	1800	1500	1250	FKM	60	100%▼
HEES (synthetic ester)	HEES	350	1800	1500	1250	FKM	60	100%▼

■ See general specifications for speed limitation depending on displacement.

▲ For HFC operation, bearing flushing is mandatory. Highest speed only recommended at optimized application conditions. Use Model Code [L] = L for seal option, and contact your Danfoss Representative for validation. Seal material can differ on an individual pump depending on specific seal function. Bearing life with HFC fluid depends significantly on fluid temperature, cleanliness, quality, flushing and application parameters. Typical values vary between 25% and 100% compared to mineral oil.

▼ Only fluids with fully saturated esters (iodine value <10) should be used. HFDE and HEES fluids can be used at full ratings, but need to be monitored continuously to maintain quality and performance. The following important values should always be checked:

- Water content (<= 500 ppm)
- Fluid cleanliness (18/15/13 per ISO 4406)
- TAN value (no significant change from new oil)
- Viscosity (no significant change from new oil)
- Additives (no significant change from new oil)

Under harsh operation conditions, especially with regard to temperature and water content, ester-based HFDE and HFDR fluids are prone to hydrolysis, the resulting chemical processes and products of which could damage seals and other pump components. In general, the susceptibility to temperature and contamination is significantly higher than with standard mineral oils. In line with Danfoss T&C warranty conditions covering use of HFDR/HFDE/HEES fluids, fluid-related damage is excluded.

6.6 Filtration

Filtration is an essential component for the proper function of the Hydrokraft pump. If filters are used at Hydrokraft pumps, the manufacturer's instructions must be observed.

Standard hydraulic medium often do not have the required purity level when delivered. Before proceeding to the test-run of installations with actuation in open or closed control loops, the installation and hydraulic medium must be cleaned according to the indications of the manufacturer, in order to attempt a steady purity level. Unless otherwise specified, the rinsing of the assembled installation must be carried out in accordance with ISO 23309.

6.7 Fluid cleanliness

Hydrokraft pumps are rated in anti-wear petroleum fluids with a contamination level of 18/15/13 per ISO 4066. Operation in fluids with levels more contaminated than this is not recommended. Fluids other than petroleum, severe service cycles, or temperature extremes are cause for adjustment of these codes. Please contact your Danfoss Representative for specific duty cycle recommendation. Danfoss Hydrokraft pumps, as with any variable displacement piston pumps, will operate with apparent satisfaction in fluids up to the rating specified here. Experience has shown however, that pump and hydraulic system life is not optimized with high fluid contamination levels (high ISO cleanliness codes). Proper fluid condition is essential for long and satisfactory life of hydraulic components and systems. Hydraulic fluid must have the correct balance of cleanliness, materials, and additives for protection against wear of components, elevated viscosity and inclusion of air. Essential information on the correct methods for treating hydraulic fluid is included in Eaton publication 561 "Danfoss Guide to Systemic Contamination Control" available from your local Danfoss distributor. In this publication,

filtration and cleanliness levels for extending the life of axial piston pumps and other system components are listed. Included is an excellent discussion of the selection of products needed to control fluid condition.

6.8 Air bleeding

Systems having large oil volumes and/or long pipe runs are to be bled at the highest points. The initially loud noise produced by the hydraulic pump, caused by rest of air in the systems, should fall to a normal noise level after short time. If not, check inlet piping for restrictions, obstructions, air leaks etc. Once the pump is started, it should prime within a few seconds. If the pump does not prime, check to make sure that there are no restrictions between the reservoir and the inlet to the pump, and that the pump is being rotated in the proper direction, and that there are no air leaks in the inlet line and connections. Also check to make sure that trapped air can escape at the pump outlet. After the pump is primed, operate for five to ten minutes (unloaded) to remove all trapped air from the circuit. If the reservoir has a sight gage, make sure the fluid is clear – not milky.



Running the pump with air (indicated by loud noise) during commissioning for longer time (> 1-2 min) might result in a complete damage of pump

6.9 Long term operation at no load during commissioning

Continuous operation for long time (> 30 min) should be avoided due to missing internal lubrication of pump in that operation mode. If this cannot be avoided, external case/bearing flushing need to be installed (refer to 5.16).

6.10 Commissioning at low temperature

Units installed in low temperature conditions must first be run at low power until the oil has warmed up sufficiently be in the viscosity range for continuous operation. Refer to chap. Technical Data 3.4 for details

6.11 Pressure adjustments

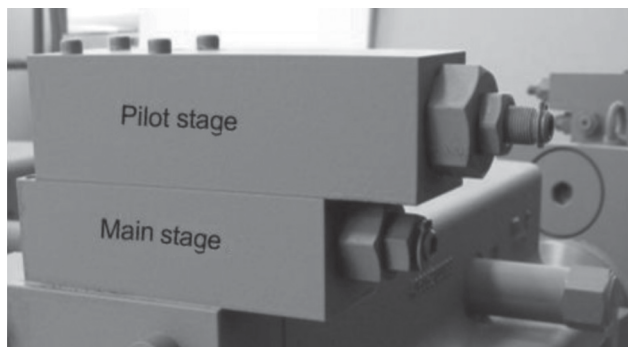
Before start-up check pressure adjustments of Pressure Relief valves of pump and system. Standard pressure adjustment for Hydrokraft pump with pressure limiter is 90bar, unless otherwise specified in customer adjustment specification in pump description.

pressure limiter pilot stage:

- factory standard setting 90 bar
- adjustable from 0...350 bar by customer

pressure limiter main stage:

- factory standard setting 20 bar
- adjustment range ca. 0...40 bar
- should not be dis-adjusted
- incl. remote port (standard)



WARNING!

Do NOT misadjust factory setting of main stage, otherwise pump control might not work anymore



Care should be taken when making adjustments. From a setting of 350 bar, a half turn of the compensator adjuster might cause the setting to rise to around 500 bar. Although in most cases there is a physical limit to the amount it can be turned which would prevent this, component tolerances are such that in some cases it may be possible to over-pressurise the unit.

6.12 Stopping the pump

When stopping the E-motor, system should be depressurized. Otherwise pressurized oil might drive E-motor in opposite direction, creating massive cavitation damage inside the pump.



Continuous inverse rotation of pump will cause cavitation and will lift the piston slipper off the swash plate. Shoulder of piston shoe will be pushed against retaining ring causing at first increasing clearance between shoe and piston and ultimately severe damage and overall pump failure!

6.13 Maximum adjustment stop

If you need to reduce max. displacement of pump by screw (optional, depending on size and control type, refer to catalog), and measurement of flow is not possible, below table gives you an indication regarding the change of flow per turn of max. adj. screw

W-design					
size of pump	250	360	500	750	ccm/U
control piston movement	18	25	22	30	mm
adjustment screw thread lead	1,5	1,5	1,5	1,5	mm/U
change of displacement per 1x turn of adjustment screw	20,83	21,6	34,1	37,5	cm³/U
max. flow at 1500 rpm	375	540	750	1125	l/min
max. flow at 1800 rpm	450	648	900	1350	l/min
delta flow per turn of adjustment screw					
at 1470 rpm	30,6	31,8	50,1	55,1	l/min
at 1770 rpm	36,9	38,2	60,4	66,4	l/min

6.14 Tightening torques

6.14.1 Purpose

This standard provides tables of recommended tightening torque for metal plugs, ISO metric socket head cap screws, tie rods and valves applied in steel or cast iron.

Note: Specific tightening torques need to be taken into consideration before applying torque. Refer also to VDI 2230, if tightening torque values not available from manufacturer instruction.

Tightening torques for leakage plugs max. 150 Nm.

6.14.2 Recommendation

- 1.) Lubricate threads (stud/screw) with hydraulic oil before screwing in
- 2.) Lubricate O-ring with light coating of hydraulic oil or compatible lubricator
- 3.) Inspect components to ensure that male and female port threads and sealing surfaces are free of burrs, nicks and scratches or any foreign material

Comissioning

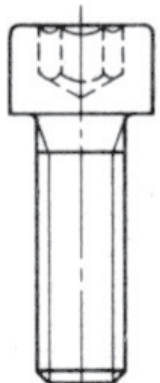
6.14.3 Metric socket head cap screws to ISO 4762

Maximum possible induced assembly pre-loads and tightening torque with:

▲ thread friction coefficients: $\mu_{ges} = 0,125$

▲ utilisation of yield load: 90%

Torque for valve assembly with lubricated threads

Size	ALU		STEEL		Picture
	MA (Nm)	MA (Nm)	MA (Nm)	MA (Nm)	
	Class 10.9	Class 12.9	Class 10.9	Class 12.9	
M4	3	4	4,1	4,9	
M5	7	8	8,4	9,8	
M6	11	13	14,1	16,6	
M8	28	32	34,2	40,2	
M10	55	65	67,3	78,9	
M12	95	110	116	136	
M14	150	175	184	216	
M16	230	270	286	336	
M18	315	370	393	461	
M20	450	525	559	656	
M22	610	715	759	891	
M24	770	905	963	1130	
M30	1550	1800	1920	2250	

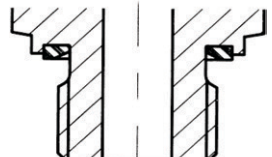
6.14.4 Tie rods

▲ thread friction coefficients: $\mu_{ges} = 0,125$

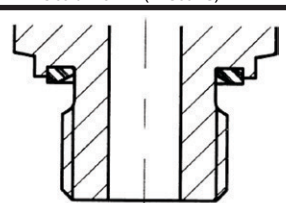
Tightening torques of tie-rods	
Size	
130/180	280 Nm
250/360	280 Nm
500/750	600 Nm

6.14.5 Metal plugs, male stud per ISO 1179 (BSPP), with elastomeric profile sealing

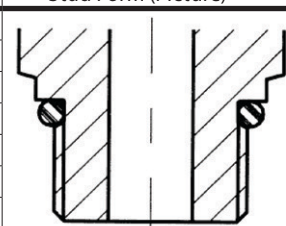
▲ thread friction coefficients: $\mu_{ges} = 0,125$

Size	ALU	STEEL	Stud Form (Picture)
	MA (Nm)	MA (Nm)	
G 1/8	9	11	
G 1/4	25	30	
G 3/8	40	50	
G 1/2	65	80	
G 3/4	105	130	
G 1	160	200	
G 1 1/4	320	400	
G 1 1/2	360	450	

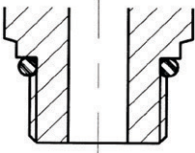
6.14.6 Metal plugs, stud per ISO 9974 (Metric), with elastomeric profile sealing

Size	ALU	STEEL	Stud Form (Picture)
	MA (Nm)	MA (Nm)	
M10 x 1	10	12	
M12 x 1,5	20	25	
M14 x 1,5	28	35	
M16 x 1,5	45	55	
M18 x 1,5	50	65	
M20 x 1,5	65	80	
M22 x 1,5	70	90	
M26 x 1,5	105	130	
M27 x 2	110	135	
M33 x 2	180	225	
M42 x 2	290	360	
M48 x 2	290	360	

6.14.7 Metal plugs, stud per ISO 6149 (Metric), with O-ring sealing

Size	ALU	STEEL	Stud Form (Picture)
	MA (Nm)	MA (Nm)	
M10 x 1	16	20	
M12 x 1,5	28	35	
M14 x 1,5	35	45	
M16 x 1,5	45	55	
M18 x 1,5	55	70	
M20 x 1,5	65	80	
M22 x 1,5	80	100	
M27 x 2	135	170	
M33 x 2	250	310	
M42 x 2	255	330	
M48 x 2	340	420	

6.14.8 Metal plugs, stud per ISO 11926 (UN/UNF thread), with O-ring sealing

P max bar	Plug Size	UNF / Inch thread ISO 11926		ALU	STEEL	Stud Form (Picture)
				MA (Nm)	MA (Nm)	
420	2	5/16 – 24 UNF	0.3125 – 24 UNF	3	4	
420	3	3/8 – 24 UNF	0.375 – 24 UNF	6	7	
420	4	7/16 – 20 UNF	0.438 – 20 UNF	12	15	
420	5	1/2 – 20 UNF	0.500 – 20 UNF	15	20	
420	6	9/16 – 18 UNF	0.562 – 18 UNF	20	25	
420	8	3/4 – 16 UNF	0.750 – 16 UNF	50	60	
420	10	7/8 – 14 UNF	0.875 – 14 UNF	80	100	
420	12	1 1/16 – 12 UN	1.062 – 12 UN	90	115	
380	14	1 3/16 – 12 UN	1.188 – 12 UN	140	175	
380	16	1 5/16 – 12 UN	1.312 – 12 UN	145	185	
280	20	1 5/8 – 12 UN	1.625 – 12 UN	240	300	
210	24	1 7/8 – 12 UN	1.875 – 12 UN	270	340	

6.14.9 Orifice

Thread Size	Attention		ALU	STEEL
			MA (Nm)	MA (Nm)
M5	Note: Orifice and cavity-thread must be free of oil and dry before assembling (or equivalent).	LOCTITE 243"	2	3
M6			3	4,5
M8	Removal from leftover Loctite required!		6	8
M10			9	11

6.15 Other installation torque specification

6.15.1 Purpose

Below references provide tables of recommended tightening torque for metal plugs, fittings, ISO metric socket head cap screws (SHCS), valves, etc., related to different counterpart material.

6.15.2 Validity

These references are not under control of Danfoss change management.

6.15.3 References

- VS 9.1.1.8 Torque-Assembly - Metric Fasteners – Coarse Pitch
- Vickers Cartridge Catalogue 5043.00/**/0496/A
- Vickers Component Catalogue 5117.02./EN/0198/A

6.15.4 Recommendation

Note :

- 1.) Lubricate threads (stud/screw) with hydraulic oil before screwing in!
- 2.) Lubricate O-ring with light coating of hydraulic oil or compatible lubricator!
- 3.) Inspect components to ensure that male and female port threads and sealing surfaces are free of burrs, nicks and scratches or any foreign material (see also VS .3.3.1).

Torque to tables are for counterpart block material:

STEEL: Steel & Ductile iron natural & Steel & Ductile iron zinc plated and chromated (A3C)

ALU: Aluminium natural & Aluminium anodized

Tolerance of tightening torques listed in the tables : + 10%

Troubleshooting

7. Troubleshooting

Troubleshooting chart

Find the SYMPTOM being experienced, then read down that column. The < arrows will point out the most likely CAUSES. The following pages list repairs that may eliminate each of the numbered CAUSES.

CAUSE	SYMPTOM									
	Pump making noise	No system pressure	Breakage of parts inside pump housing	External oil leakage around the pump	Pump not pumping	Excessive wear	Heating caused by power unit (reservoir, pump, relief valves, coolers)	Heating because of system	Erratic action	Leakage
1. Restricted inlet	<		<		<	<			<	
2. Air leaks	<				<				<	
3. Air entrainment	<					<			<	
4. Reservoir air vent plugged	<									
5. Pump rotation or speed incorrect					<					
6. Oil viscosity too high	<		<		<		<			
7. Oil viscosity too low						<			<	<
8. Filter or strainer too dirty or filter too small	<		<			<				
9. Pump out of line with driving motor	<		<			<				
10. Pump head too loose or faulty head gasket	<	<								<
11. Pump head too tight			<							
12. Stuck pump vane	<	<							<	
13. Cavitation	<		<			<				
14. Pump malfunction	<	<	<		<	<	<	<	<	<
15. Relief valve not functioning properly		<	<			<	<	<	<	
16. Incorrect control valve setting		<								
17. Internal leakage in valves, cylinders, or pumps		<					<	<	<	
18. Excessive pressure above maximum pump rating			<			<				<
19. Low fluid level in reservoir			<		<	<			<	
20. Dirt in pump	<	<	<							
21. Packing worn or damaged				<						<
22. Fluid contaminated with dirt or water	<		<			<				
23. Oil cooler clogged							<	<		
24. Restricted lines			<			<				
25. Reservoir too small	<		<		<	<			<	
26. Valve deposits									<	
27. Pilot pressure too low									<	
28. Electrical solenoid problems									<	
29. Loosened fittings										<
30. Dried or worn seals or O-rings	<								<	<
31. Line breakage			<			<				<

Suggested countermeasures

7.1 Restricted inlet:

Check line from reservoir to pump.

7.2 Air leaks:

- (a) At pump intake piping joints. Test by pouring oil on joints while listening for change in sound of operation. Tighten as required.
- (b) At pump shaft, test by pouring oil on shaft seal while listening for change in sound of operation. Follow manufacturer's recommendation when changing packing.
- (c) Air drawn in through inlet pipe opening. Check to be certain suction and return lines are well below oil level in reservoir. Add oil to reservoir if necessary.

7.3 Air entrainment:

If oil level is low or return line to reservoir is installed above oil level, air bubbles will form in oil in reservoir. Check oil level and position of return line.

7.4 Reservoir air vent plugged:

Air must be allowed to be breathed into reservoir. Clean or replace breather.

7.5 Pump rotation or speed incorrect:

Check pump rotation and pump speed is in rated range.

7.6 Oil viscosity too high:

Check that oil viscosity and oil type are as per fluid recommendations.

See chp.:

- 3.4 Technical data
- 6.5 Hydraulic fluids

7.7 Filter or strainer too dirty or filter too small:

Filter and strainer must be kept clean enough to permit adequate flow. Check filter capacity. Be sure that original filter has not been replaced with one of smaller capacity. Use oil of quality high enough to prevent rapid sludge formation.

7.8 Pump out offline with driving motor:

Check alignment. Misalignment may be caused by temperature variation. Coupling may not have been installed properly. For couplings with elastomeric elements check natural frequency. Change elastomeric material, if critical. natural frequency of pump [Hz]: $(\text{rpm} \times 9) / 60\text{s}$.

7.9 Cavitation (formation of vacuum in pump):

Check for clogged or restricted intake line, plugged air vent in reservoir. Oil viscosity may be too high. Check recommendations.

7.10 Pump malfunction:

Install pressure gauge and block system just beyond relief valve. If no appreciable pressure is developed and relief valve is OK, look for mechanical trouble in pump. Contact Hydrokraft tech. support.

7.11 Internal leakage in valves, cylinders, or pumps:

Determine location. Progressively block off various parts of circuit.

7.12 Excessive pressure above maximum pump rating:

Check relief or regulator valve maximum setting.

Troubleshooting

7.13 Low fluid level in reservoir:

Add recommended oil and check level on both sides of tank baffle to be certain pump suction line is submerged. If oil supply is low, less of will be available to carry away just as much heat. This will cause rise in oil temperature, especially in machines without oil coolers. Be sure oil is up to proper level.

7.14 Fluid contaminated with dirt or water:

Install adequate filter or replace oil more often. Determine source of material and correct.

7.15 Oil cooler clogged:

On any machine equipped with oil cooler, high temperatures are probably expected. Temperatures that run high normally will go even higher if oil cooler passages are clogged.

7.16 Restricted lines:

Check for crimped lines or obstructions, especially in drain lines.

7.17 Reservoir too small (may vortex or fail to provide adequate cooling):

Replace with larger reservoir, or install cooler.

7.18 Valve deposits:

Check valve in regard offunction and cleanliness, especially valve orifices repair or replace valves. Malfunction usually caused by high sediment level or oil oxidation.

7.19 Pilot pressure too low:

Consult manufacturer's instructions.

7.20 Electrical solenoid problems:

Check solenoids in regard offunction with respect to company/national requirements for safety and personnel.

7.21 Loosened fittings:

Tighten, reseal, or replace O-rings, if present. Check fittings for signs of cracks or improper installation.

7.22 Dried or worn seals or O-rings:

Replace or tighten worn components.

7.23 Line Breakage:

Hose configuration:

- Check for twists, tight bends, sags, etc. Install hose supports.

Hose quality:

- Check hoses in regard of lifetime/exchange requirements with respect to company/national laws and regulations..
- Install spiral shielding or armor.
- Inspect for correct size, and check for kinked or crimped hose.

8. Maintenance and repair

8.1 Cleaning and care

⚠ IMPORTANT

Damage caused by solvents and aggressive detergents

Aggressive detergents maybe damage the seals and surface on the Hydrokraft pump.

Please do not use solvents and aggressive detergents.

A high-pressure cleaner can also damage the unit

8.2 Inspection

In order to have a long and reliable life time of the axial piston unit,

Danfoss recommends the inspection of the Hydrokraft pump and the hydraulic System.

Inspection schedule :		
Task:		interval
Hydraulic system	check level of hydraulic fluid in the tank	daily
	check operating temperature	daily
	check quality of the hydraulic fluid	after 3000h
	check filter	weekly
	check Hydrokraft pump for daily leakage	
Hydrokraft pump	check Hydrokraft pump for daily not allowed noise	
	check fixing elements for tight seating	monthly

8.3 Maintenance

If the Hydrokraft pump are used under recommended conditions maintenance requirements will be low. The life time of the Hydrokraft unit is depending on the fluid quality.

Oil change intervals are depending on operation conditions and may vary between 3000h and 16000h Depending on operation conditions.

The life time of the Hydrokraft pump is limited by service life of the build-in bearings. Life time of bearings can be requested based on load cycle from Hydrokraft technical support. Adjustment and maintenance points must be located outside danger zones.

8.4 Repair

Danfoss provides a complete range of service and repair.

If it is required Danfoss can provide a complete offer for service and repair.

Repairs during the warranty period must be made by Danfoss or authorized service stations only, otherwise warranty claims will not be accepted.

Adjustment, maintenance, repair, cleaning and maintenance work must be performed by trained personnel.

Only original Hydrokraft spare parts have to be used. The availability of spare part kits shown on our spare parts lists.

⚠ IMPORTANT

Damage to persons and property due to faulty spare parts!

Spare parts which are not meeting specifications by Hydrokraft may cause damage to person and property.

To ensure a fast response to inquiries and that the correct spare parts are supplied, always provide the model code, part no. and the serial no. as shown on the name plate.

If it is possible to get photos (included name plate) of the pump it would be helpful.

V****Serial number

Vickers Hydrokraft Piston

TYPEShort form model code

Part No. ← Date ←Part number

Vg max cm³nmax min⁻¹

V cm³PN 350 bar

✓ 12...75 mm²/sPmax 420 bar

Vor dem Start mit Öl füllen. (Anschluss=L) Leckölleitung so verlegen, daß Gehäuse gefüllt bleibt. Gehäusedruck max. 0,5 bar.

Fill with oil before start up. (connection=L) Mount drain line in such a manner that housing remains filled with oil. Internal pressure 0,5 bar max.

Avant de demarrer, remplissez le carter avec d'huile. Monter la conduite de récupération des fuites de telle manière que le carter reste rempli d'huile. Pression intérieure: 0,5 bar max.

Prima della messa in marcia riempire il corpo della pompa con il fluido in circuito. (Foro=L) Fare il drenaggio in modo da mantenere il corpo sempre

9. Extension and converting

9.1 Extension and converting

Do not make any changes to the Hydrokraft pump.

Warranty is valid for the original delivered configuration only.

In case of any not authorized modification, warranty will be denied.

10. Disassembly and replacement

10.1 Tools

Disassembly can be done with conventional standard tools. No special tools necessary.

10.2 Preparation



Hydrokraft pumps must be De-pressurized and disconnected from power supply.

- Shutdown the complete system according to the manual of the system.
- De-pressurize the hydraulic system according to the manual from the manufacturer.

10.3 Disassembly

To Disassemble the Hydrokraft pump:

- Make sure the system is pressure-free
- Make sure the temperature of the Hydrokraft pump is cold enough to touch safe.
- Use a collector to collect resigning hydraulic fluid



Save the environment

- Remove all electric cable
- Remove the hydraulic lines and collect resigning hydraulic fluid
- Remove the Hydrokraft pump. Use proper lifting strap (see ch 4) to empty the complete Hydrokraft pump
- Close all open ports
- Prepare the Hydrokraft pump for storage.

11. Decommissioning

The Hydrokraft pump does not require any special instructions.

If you want to disassemble and replace the Hydrokraft pump, see chapter 10.

If you want to dispose, see chapter 12.

12. Proper disposal

In terms of health-and environment protection measures, the different waste types (e.g. hydraulic fluid, metals, synthetic materials, electronic devices, cables, etc.) has to be disposed separately.

The national valid laws and regulations for the use of lubricants and the proper disposal must be taken into consideration. The competent authority will provide assistance.

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