Service Manual

H1F 060/080/110/160/210/250
H1F Bent Axis Fixed Displacement Motor

Revision history

Table of revisions

Date	Changed	Rev
April 2024	Added information for 60cc	0201
December 2023	Updated title	0102
November 2023	First edition - and next various changes.	0101

Contents

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Introduction

H1F About this manual

This manual includes information for the installation, maintenance, and minor repair procedures for H1 bent axis fixed motors. It includes a description of the unit and its individual components, troubleshooting information, and minor repair procedures.

Performing minor repairs may require removal from the vehicle/machine. Thoroughly clean the unit before beginning maintenance or repair activities. Since dirt and contamination are the greatest enemies of any type of hydraulic equipment, follow cleanliness requirements strictly. This is especially important when changing the system filter and when removing hoses or plumbing.

Only Danfoss global service partners (GSPs) are authorized to perform major repairs.Danfoss trains Global Service Partners and certifies their facilities on a regular basis. You can locate your nearest service partner at **www.danfoss.com** > **Contact us** > **Danfoss sales and services** > **Distributor and service partners**

Warranty

Performing installation, maintenance, and minor repairs according to the procedures in this manual will not affect your warranty. Major repairs requiring the removal of a unit's rear cover voids the warranty unless done by a Danfoss Global Service Partner.

H1F General instructions

When repairing H1 fixed displacement closed circuit motors follow these general procedures:

Remove the unit	Chock the wheels on the vehicle or lock the mechanism to inhibit movement. Prior to performing repairs, remove the unit from the vehicle/machine. Be aware that hydraulic fluid may be under high pressure and/or hot. Inspect the outside of the motor and fittings for damage. Cap hoses after removal to prevent contamination.
Keep it clean	Cleanliness is a primary means of assuring satisfactory motor life, on either new or repaired units. Clean the outside of the motor thoroughly before disassembly. Take care to avoid contamination of the system ports. Cleaning parts with a clean solvent wash and air drying is usually adequate. Keep all parts free of foreign materials and chemicals. Protect all exposed sealing surfaces and open cavities from damage and foreign material.
Lubricate moving parts	During assembly, coat all moving parts with a film of clean hydraulic oil. This assures that these parts are lubricated during start-up.
Replace all O-rings and gaskets	Danfoss recommends you replace all O-rings and gaskets during repair. Lightly lubricate O-rings with clean petroleum jelly prior to assembly.
Secure the unit	For repair, place the unit in a stable position with the shaft pointing downward. Secure the motor while removing and torquing components and fasteners.

Safety precautions

Always consider safety precautions before beginning a service procedure. Protect yourself and others from injury. Take the following general precautions whenever servicing a hydraulic system.

Unintended machine movement

Warning

Unintended movement of the machine or mechanism may cause injury to the technician or bystanders. To protect against unintended movement, secure the machine or disable/disconnect the mechanism while servicing.

Introduction

Flammable cleaning solvents

Warning

Some cleaning solvents are flammable. To avoid possible fire, do not use cleaning solvents in an area where a source of ignition may be present.

Fluid under pressure

Warning

Escaping hydraulic fluid under pressure can have sufficient force to penetrate your skin causing serious injury and/or infection. This fluid may also be hot enough to cause burns. Use caution when dealing with hydraulic fluid under pressure. Relieve pressure in the system before removing hoses, fittings, gauges, or components. Never use your hand or any other body part to check for leaks in a pressurized line. Seek medical attention immediately if you are cut by hydraulic fluid.

Personal safety

Warning

Protect yourself from injury. Use proper safety equipment, including safety glasses, at all times.

Hazardous material

Warning

Hydraulic fluid contains hazardous material. Avoid prolonged contact with hydraulic fluid. Always dispose of used hydraulic fluid according to environmental regulations.

H1 general information

About the H1F motors

Series H1 fixed displacement motors are bent axis design, incorporating spherical pistons.

These motors are designed to be combined with other products in closed or open circuit systems to transfer hydraulic power.

High performing 32 degree maximum angle, creates opportunities to easily improve the machine performance for:

- Multi-motor applications requiring optimized work and transport modes (i.e. wheel loader, mobile crane, drill rigs, winches, harvestors).

SAE, Cartridge and DIN flange with axial, side or twin high pressure port configurations are available. Loop flushing is also available with these options.

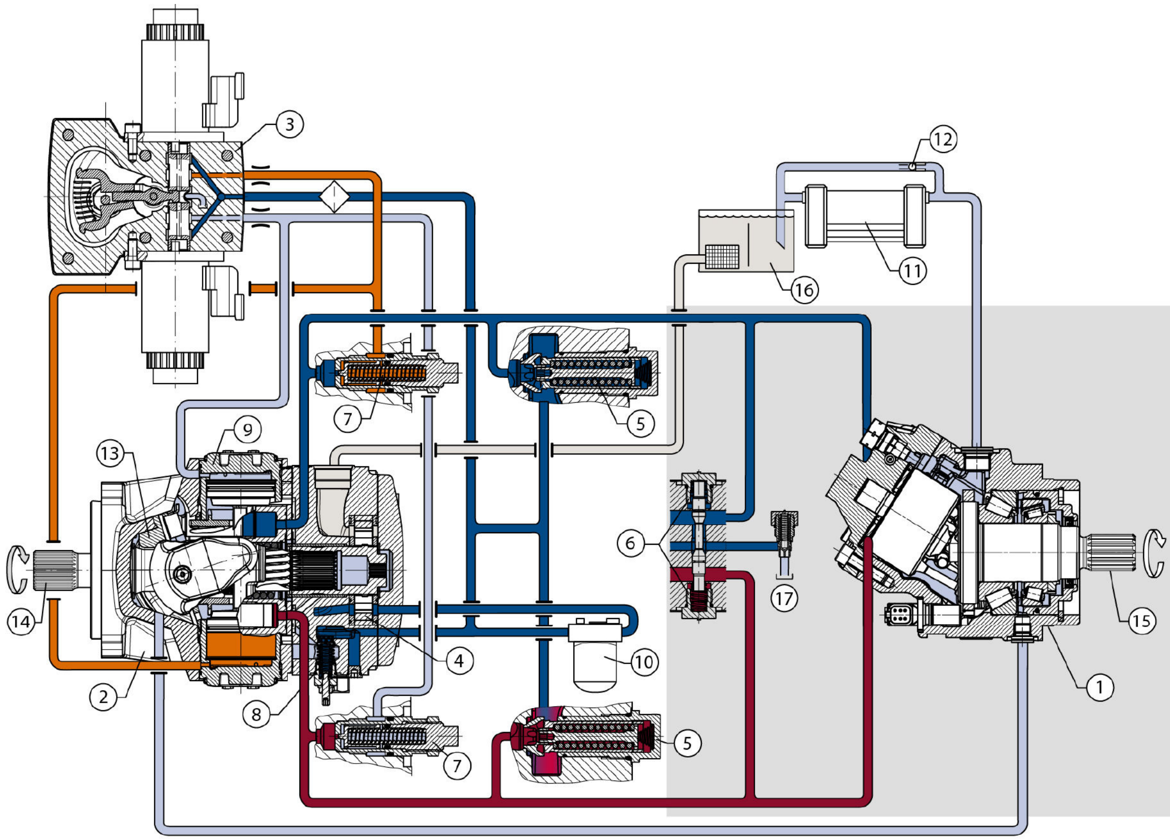
Speed sensor options are available to cover all frame sizes and flange styles.

They are capable of sensing the following, all in one package:

- Speed
- Direction (Group "J": option "S" and option "B")
- Temperature (Group "J": options "S" and option "B")

H1 general information

H1F pictorial diagram



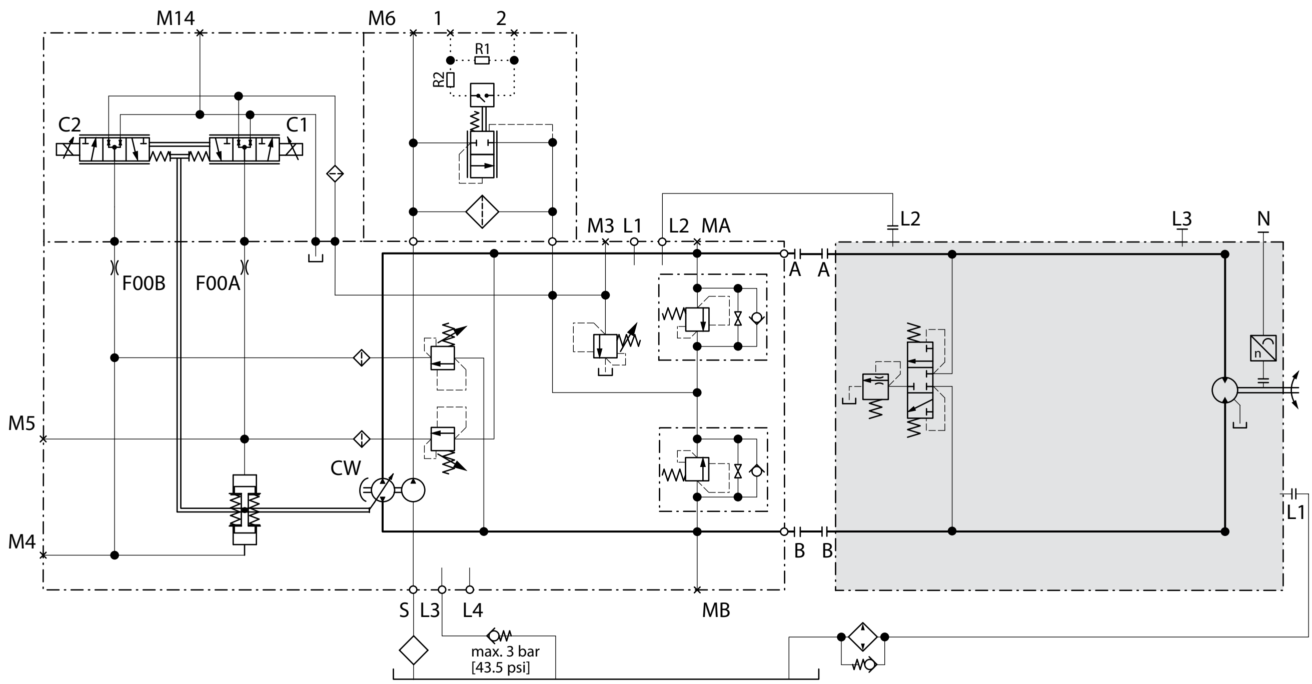
Dark blue	Working loop A (Low pressure) and charge pressure
Dark red	Working loop B (High pressure)
Orange	Servo pressure
Light blue	Case drain
Light grey	Suction

1. Bent Axis Fixed Displacement Motor
2. Axial Piston Variable Displacement Pump
3. Electric Displacement Control (EDC)
4. Charge Pump
5. Charge Check / High Pressure Relief Valve
6. Loop Flushing Valve
7. Pressure Limiter Valve
8. Charge Pressure Relief Valve
9. Servo Cylinder
10. Charge Pressure Filter
11. Heat Exchanger
12. Heat Exchanger Bypass Valve
13. Pump Swashplate
14. Input Shaft
15. Output Shaft
16. Reservoir
17. to Motor Case

H1 general information

H1F system schematic

System schematic H1 pump and H1F motor



The schematic above shows the function of a hydrostatic transmission using an H1 axial variable displacement pump with electric proportional displacement control (EDC) and an H1 fixed displacement motor with integrated loop flushing device.

Technical specifications

H1F General specifications

General specifications

Design	Piston motor with fixed displacement bent axis design
Direction of rotation	Bi-directional
Pipe connections	*Main pressure ports:* ISO split flange boss *Remaining ports:* SAE straight thread O-ring boss
Recommended installation	Discretionary, the housing must always be filled with hydraulic fluid

H1F Physical properties

Physical properties

Features		Unit	Size	
			060	080
Displacement (max)		cm^3[in^3]	60.1 [3.67]	80.8 [4.93]
Theoretical flow at max. displ.	at max. speed	l/min [US gal/min]	330 [87.2]	400 [105.7]
Theoretical torque at max. displacement		N•m/bar [lb•in/1000 psi]	0.96 [583]	1.27 [777]
Theor. corner power at rated speed and max. working pressure (Δp = 450 bar [6527 psi])		kW [hp]	248 [332.6]	330 [442.5]
Mass moment of inertia of rotating components		$kg•m^2$ [$slug•ft^2$]	0.0031 [0.0023]	0.0063 [0.0047]
Case volume		l [US Gal]	0.8 [.21]	

Weight dry

Configuration	Size	
	060	080
SAE	-	22.1 kg [48.7 lb]
DIN	18.2 kg [40.1 lb]	22.9 kg [50.5 lb]
Cartridge	18.5 kg [40.8]	-

Mounting flange

Configuration	Size	
	060	080
SAE ISO 3019/1	-	127-4 (SAE C) 4-bolt
DIN ISO 3019/2, B4	Flange 125 B4 HL 4-bolt	140 HL 4-bolt
Cartridge	Pilot dia 160mm, 2-bolt (200 dist) M16	-

Technical specifications

Customer ports

Configuration	Size	
	060	**080**
Axial and radial[1)]	DN19 typ 1	DN25 typ 1
L1, L2[2)]	M22x1,5	M22x1,5
Bleed port[3)]	M14x1,5	M14x1,5

[1)] Split flange Boss per ISO6162, 40 MPa series

[2)] Metric O-ring boss

[3)] Countersink may be deeper that specified in the standard.

H1F Operating Parameters

Output Speed

Output Speed	Displacement	Unit	Size	
			060	**080**
Rated	Maximum 32°	min^{-1} (rpm)	5000	4500
Maximum	Maximum 32°		5500	5000

System and Case Pressure, Ambient Temperature

Parameter		All sizes
System pressure	Maximum working delta	450 bar [6527 psi]
	Maximum working abs	480 bar [6962 psi]
	Max delta	480 bar [6962 psi]
	Max abs	510 bar [7397 psi]
	Min low loop	7.5 bar [109 psi]
Case pressure	Rated	3 bar [44 psi]
	Maximum	5 bar [73 psi]
	Minimum	0.3 bar [4 psi]
Ambient temperature[1)]	Maximum	70 °C [158 °F]
	Minimum	-40 °C [-40 °F]

[1)] Air temperature close to the unit.

H1F Required inlet pressure table (for cylinder block filling)

60cc / 80cc

Speed (RPM)	Pressure (Bar)
900	2
1400	5
2100	10
2800	15
3200	20
4000	30

This pressure ensures that the cylinder block will be properly filled and that there is no pulling between piston and shaft.

The required pressure is 0 bar at 0 rpm and increases with rpm.

Technical specifications

For **open circuit** applications it is not allowed to operate above rated speed. For **closed circuit** applications operating between rated and max. speed, please contact your local Danfoss Power Solutions representative.

H1F Open circuit requirements

H1 bent axis motors may be used in Open Circuit (OC) applications.

Since loop flushing is typically not used in OC-applications it is essential to provide sufficient cooling capacity. This can be done by motor case cross flushing. The flow rate needs to be adjusted to the cooling demand.

The highest case drain outlet port must always be used for the return flow to the cooler or tank.

The motor case and the working lines connected to Port A and B must be kept full of oil at all times, whether in a dynamic or static condition.

The plumbing must not allow the oil to drain down and be replaced with air in the rotating group.

The minimum pressure in the inlet port and the outlet port, must be equal or higher as shown in the tables.*H1F Required inlet pressure table (for cylinder block filling)* on page 11 .

Counter balance valves may be used to maintain the minimum pressure requirements. Danfoss meter-in / meter-out PVG technology may be used. Check valves and sufficient charge pressure supply are also possible.

At no time shall the motor be allowed to operate above the rated speed limits. If flow limiter valves are used, they must be selected accordingly. This ensures proper function under all conditions.

Valve blocks, such as counter balance valves attached to the inlet and/or outlet ports, must not interfere with any part of the motor. A review of the outline drawings or appropriate 3D models must be completed.

Technical specifications

Fluid specifications

Fluid specifications

Features		Unit	All sizes
Viscosity	Minimum intermittent	mm^2/s [SUS]	7 [49]
	Recommended range		12-80 [66-366]
	Maximum intermittent		1600 [7416]
Temperature range[1)2)]	Minimum	°C [°F]	-40 [-40]
	Rated		104 [220]
	Maximum intermittent		115 [240]
Cleanliness and Filtration	Required cleanliness per ISO 4406	-	22/18/13
	Efficiency (charge pressure filtration)	β-ratio	$\beta_{15\text{-}20} = 75$ ($\beta_{10} \geq 10$)
	Efficiency (suction / return line filtration)		$\beta_{35\text{-}45} = 75$ ($\beta_{10} \geq 2$)
	Recommended inlet screen mesh size	µm	100 – 125

[1)] At the hottest point, normally case drain port.

[2)] Minimum: cold start, short term t<3 min, p<50 bar, n<1000 rpm.

Determination of nominal motor size

Based on SI units

$$Q_e = \frac{V_g \cdot n}{1000 \cdot \eta_v}$$

$$M_e = \frac{V_g \cdot \Delta p \cdot \eta_{mh}}{20 \cdot \pi}$$

$$P_e = \frac{M_e \cdot n}{9550} = \frac{Q_e \cdot \Delta p \cdot \eta_t}{600}$$

$$n = \frac{Q_e \cdot 1000 \cdot \eta_v}{V_g}$$

Where:

Q_e	Input flow (l/min)
M_e	Output torque (N•m)
P_e	Output power (kW)
n	Speed (min^{-1})
V_g	Motor displacement per rev. (cm^3/rev)
p_{high}	High pressure (bar)
p_{low}	Low pressure (bar)
Δp	High pressure minus Low pressure (bar)
η_v	Motor volumetric efficiency
η_{mh}	Mechanical-hydraulic efficiency
η_t	Motor total efficiency ($\eta_v \cdot \eta_{mh}$)

Based on US units

$$Q_e = \frac{V_g \cdot n}{231 \cdot \eta_v}$$

$$M_e = \frac{V_g \cdot \Delta p \cdot \eta_{mh}}{2 \cdot \pi}$$

$$P_e = \frac{V_g \cdot n \cdot \Delta p \cdot \eta_t}{396\,000}$$

$$n = \frac{Q_e \cdot 231 \cdot \eta_v}{V_g}$$

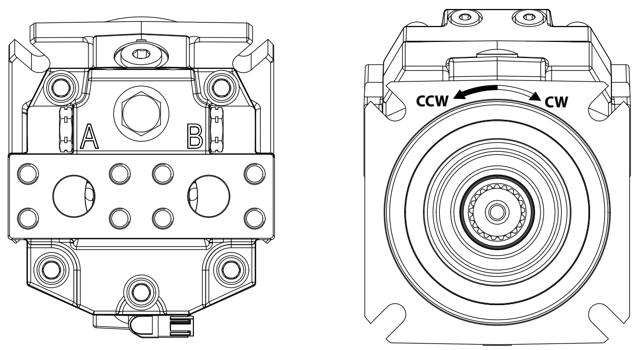
Where:

Q_e	Input flow [US gal/min]
M_e	Output torque [lb•in]
P_e	Output power [hp]
n	Speed [rpm]
V_g	Motor displacement per rev. [in^3/rev]
p_{high}	High pressure [psi]
p_{low}	Low pressure [psi]
Δp	High pressure minus Low pressure [psi]
η_v	Motor volumetric efficiency
η_{mh}	Mechanical-hydraulic efficiency
η_t	Motor total efficiency ($\eta_v \cdot \eta_{mh}$)

Operation

H1F Shaft rotation direction

Shaft rotation direction is determined with a view from the shaft end.

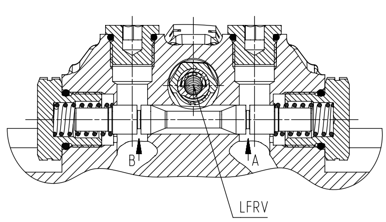


Flow into port A	Clockwise
Flow into port B	Counterclockwise

H1F Loop flushing shuttle spool

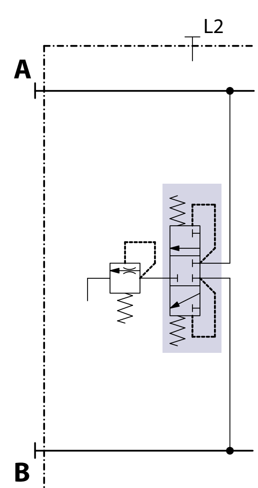
An integral loop flushing shuttle spool is used to separate system A and system B pressures.

System delta pressure will cause the shuttle spool to shift, allowing the low side system pressure to flow to the loop flushing relief valve.



Legend:

A	System loop A
B	System loop B
LFRV	to loop flushing relief valve



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Warning

Unintended vehicle or machine movement hazard.

Excessive motor loop flushing flow may result in the inability to build required system pressure in some conditions. Maintain correct charge pressure under all conditions of operation to maintain pump control performance in hydrostatic systems.

Operation

H1F loop flushing relief valve

The loop flushing relief valve is incorporated into all H1 motors used in closed circuit applications to remove fluid from the low pressure side of the system circuit to meet cooling requirements.

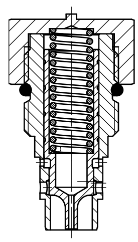
The loop flushing relief valve is also used to facilitate the removal of contaminants from the loop.

The loop flushing valve is equipped with an orificed charge pressure relief valve designed with a cracking pressure of 16 bar [232 psi].

Valves are available with several orifice sizes to meet the flushing flow requirements of all system operating conditions.

A loop flushing defeat option is available.

Loop flushing relief valve (cross section)



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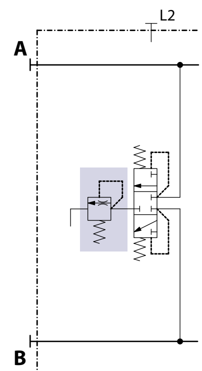
Loop flushing relief valve schematic



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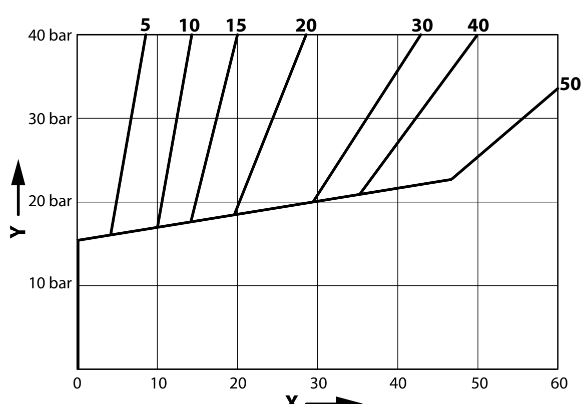
Loop flushing relief valve sizes



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X Loop flushing flow (l/min)

Y Low system pressure minus case pressure (bar)

Operation

Speed sensor

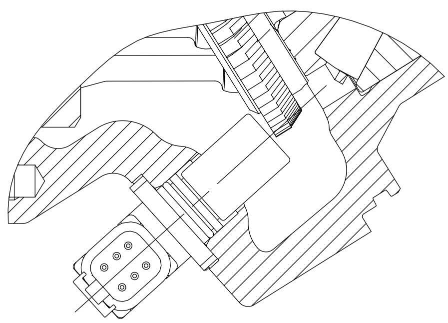
The speed sensor is designed for rugged outdoor, mobile or heavy industrial speed sensing applications. The detection of the speed is contactless and does not need any calibration or adjustments.

For more information, see *Speed and Temperature Sensor, Technical Information,* **BC152886482203**.

H1F speed sensor position

Sensor position in cartridge housing

Cartridge housing



H1F target ring

Speed (target) rings vary according to the diameter of the cylinder block or shaft on which they are installed. The number of teeth is shown in the table below.

The number of speed (target) ring teeth

H1F size	060	080
Teeth	71	78

Excessive axial shaft loading during installation of motors with speed sensors and cartridge housings must be avoided. High axial shaft loads during installation of motors can lead to a movement of the shaft and damage the speed sensor.

Operating parameters

H1F output speed

Start and low speed stability. The motor produces maximum starting torque at maximum displacement. Stable operation can be achieved at 15–34 rpm, ± 5 %, depending on system pressure, in applications that require low speed stability. Motor output speed becomes more stable as speed increases.

Rated speed is the highest output speed recommended at full power condition. Operating at, or below this speed will yield satisfactory product life. Do not exceed rated speed in open circuit applications.

Maximum speed is the highest operating speed permitted. Exceeding maximum speed reduces the product life and can cause loss of hydrostatic power and dynamic braking capacity. Never exceed the maximum speed limit under any operating conditions.

Operation between rated and maximum speed is reserved for **intermittent operation** (see*H1F Operating Parameters* on page 11) not to exceed 10 minutes durations, 2% of duty cycle based load-life, and 310 bar system delta pressure. Speed above rated are anticipated to occur during downhill braking (negative power). Contact factory for any operation above Rated speed when negative power is not involved.

During hydraulic braking and downhill conditions, the prime mover must be capable of providing sufficient braking torque in order to avoid pump over speed. This is especially important to consider for turbocharged and Tier 4 engines.

Warning

Unintended vehicle or machine movement hazard.

Exceeding maximum speed may cause a loss of hydrostatic drive line power and braking capacity. You must provide a braking system, redundant to the hydrostatic transmission, sufficient to stop and hold the vehicle or machine in the event of hydrostatic drive power loss. The braking system must also be sufficient to hold the machine in place when full power is applied.

H1F system pressure

System pressure is the differential pressure between high pressure system ports. It is the dominant operating variable affecting hydraulic unit life. High system pressure, which results from high load, reduces expected life. Hydraulic unit life depends on the speed and normal operating, or weighted average, pressure that can only be determined from a duty cycle analysis.

Application pressure is the high pressure relief or pressure limiter setting normally defined within the order code of the pump. This is the applied system pressure at which the driveline generates the maximum calculated pull or torque in the application.

Maximum working pressure is the highest recommended application pressure. Maximum working pressure is not intended to be a continuous pressure. Propel systems with application pressures at, or below, this pressure should yield satisfactory unit life given proper component sizing.

Maximum pressure is the highest allowable application pressure under any circumstance. For applications which are above the maximum working pressure, please contact Danfoss

Minimum pressure must be maintained under all operating conditions to avoid cavitation.

All pressure limits are differential pressures referenced to low loop (charge) pressure. Subtract the low loop gauge pressure from the high loop gauge pressure readings to compute the differential.

Summing pressure is the sum of both the low and high loop pressures. Summing pressure above 30 bar [435 psi] guarantees reliable use within the rated speed.

Case pressure

Under normal operating conditions, **the rated case pressure** must not be exceeded. During cold start, case pressure must be kept below maximum intermittent case pressure. Size drain plumbing accordingly.

Operating parameters

Caution

Possible component damage or leakage.

Operation with case pressure in excess of stated limits may damage seals, gaskets, speed sensors and/or housings, causing external leakage. Performance may also be affected since charge and system pressures are referenced to case pressure.

External shaft seal pressure

In certain applications, the output shaft seal may be exposed to external pressures. The shaft seal is designed to withstand an external pressure up to 0.25 bar [3.6 psi] above the case pressure. The case pressure limits must also be followed to ensure the shaft seal is not damaged.

Temperature

The high temperature limits apply at the hottest point in the transmission, which is normally the motor case drain. The system should generally be run at or below the published **rated temperature**.

The **maximum intermittent temperature** is based on material properties and should never be exceeded.

Cold oil will generally not affect the durability of the transmission components, but it may affect the ability of oil to flow and transmit power. Therefore, temperatures should remain 16 °C [30 °F] above the pour point of the hydraulic fluid.

The **minimum temperature** relates to the physical properties of component materials.

Size heat exchangers too keep the fluid within these limits. Danfoss recommends testing to verify that these temperature limits are not exceeded.

Fluid and filter maintenance

Fluid and filter recommendations

To ensure optimum life, perform regular maintenance of the fluid and filter. Contaminated fluid is the main cause of unit failure. Take care to maintain fluid cleanliness when servicing.

Check the reservoir daily for proper fluid level, the presence of water, and rancid fluid odor. Fluid contaminated by water may appear cloudy or milky or free water may settle in the bottom of the reservoir. Rancid odor indicates the fluid has been exposed to excessive heat. Change the fluid immediately if these conditions occur. Correct the problem immediately.

Inspect vehicle for leaks daily.

Change the fluid and filter per the vehicle/machine manufacturer's recommendations or at these intervals. We recommend first fluid change occur at 500 hours of operation. Change the fluid more frequently if it becomes contaminated with foreign matter (dirt, water, grease, etc) or if the fluid is subjected to temperature levels greater than the recommended maximum.

Fluid and filter change interval

Reservoir type	Max oil change interval
Sealed	2000 hours
Breather	500 hours

Caution

High temperatures and pressures accelerate fluid aging. This may require more frequent fluid changes.

Change filters when changing fluid or when the filter indicator directs. Replace all fluid lost during filter change

Warning

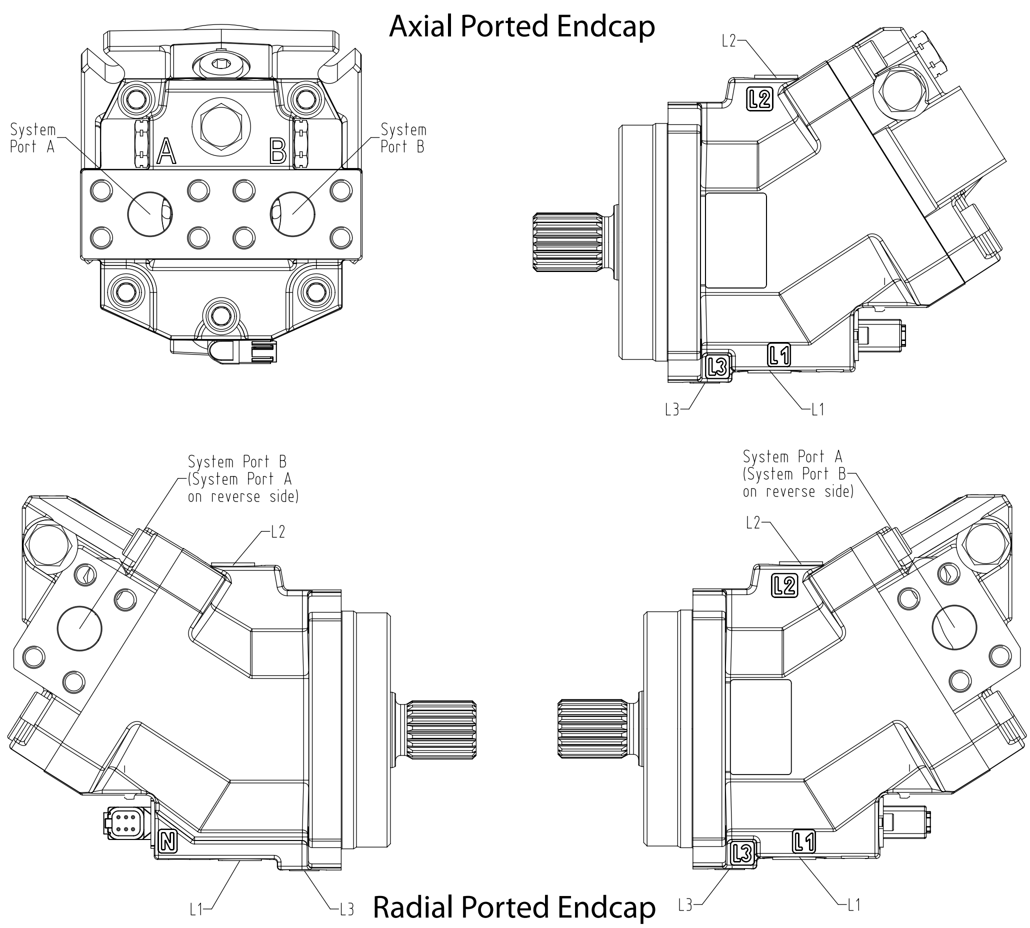
Hydraulic fluid contains hazardous material. Avoid contact with hydraulic fluid. Always dispose of used hydraulic fluid according to state, and federal environmental regulations. Never reuse hydraulic fluid.

Pressure measurements

H1F Ports and gage information

The following drawing with accompanying table show the port locations and gauge sizes needed for installation.

Ports locations



System split flange boss ports, A/B: Code 62 per ISO 6162, Type 1

Port	Size 060	Size 080
A, B	3/4 in; *Thread:* M10 x 1.5 min. 18 mm [0.71 in]	1 in; *Thread:* M12 x 1.75 min. 24 mm [0.94 in]

Ports and gauge Information

Port	Size 060/080	Pressure obtained
L1, L2	M22 x 1.5 *Wrench (int. hex):* 17 mm	10 bar [145 psi] Case drain
L3	M14 x 1.5 *Wrench (int. hex):* 12 mm	

Initial startup procedures

Procedure

Warning

This service procedure may require disabling the vehicle / machine (raising the wheels off the ground, disconnecting work function) while performing, to prevent injury to the technician and bystanders. Take the necessary safety precautions.

Always follow this procedure when starting-up a new H1 installation or when the motor has been removed.

1. Before installing the motor, inspect the units for possible damage incurred during shipping and handling.
2. Make certain all system components (reservoir, hoses, valves, fittings, heat exchanger, and so forth) are clean before filling with fluid.
3. Fill the reservoir with recommended hydraulic fluid. Pass this fluid through a 10 micron (nominal, no bypass) filter before it enters the reservoir.
4. Fill the inlet line leading from the reservoir to the pump.
5. Check inlet line for properly tightened fittings. Make sure the inlet line is free of restrictions and air leaks.
6. Fill the motor and pump housings with clean hydraulic fluid before start up. Fill by pouring filtered oil into the upper case drain port.

   Caution

   Never start the prime mover unless the motor and pump housings are filled completely with clean hydraulic fluid.

7. For closed loop systems, install a 0-60 bar [0-1000 psi] pressure gauge in the charge pressure gauge port of the pump to monitor the charge pressure during start-up.

   For open circuit systems, use gauges in system ports.

8. Disconnect any external control input signal from the pump control until after initial start-up. This ensures that the pump remains in its neutral position.
9. Jog (slowly rotate) prime mover until charge pressure starts to rise.
10. Start the prime mover and run at the lowest possible speed until charge pressure builds.

    Warning

    Do not start the prime mover unless the pump is in neutral position (swash plate at 0° angle). Take necessary precautions to prevent machine movement in case pump is actuated (in stroke) during initial start-up.

    If necessary, bleed excess air from the high pressure lines through the high pressure system gauge ports.

11. Once charge pressure is established, increase to normal operating speed. Charge pressure should be as indicated in the pump model code. If charge pressure is low, shut down and determine cause.

    Caution

    Low charge pressure may affect ability to control the machine.

12. Shut down the prime mover.
13. Connect the external control input signal.
14. Reconnect the machine function if disconnected earlier.
15. Start the prime mover, checking to ensure the pump remains in neutral.

Initial startup procedures

16. Check for forward and reverse machine operation, with the prime mover at normal operating speed.

    Charge pressure may decrease slightly during forward or reverse operation.

17. Continue to cycle slowly between forward and reverse for at least five minutes.
18. Shut down prime mover.
19. Remove gauges. Replace plugs at the gauge ports.
20. Check reservoir level. Add filtered fluid if needed.

The motor/transmission is now ready for operation.

Troubleshooting

Overview

This section provides general steps to follow if you observe undesirable system conditions. Follow the steps until you solve the problem. Some of the items are system specific. Always observe the safety precautions in the *Introduction* section.

Warning

Unintended movement of the machine or mechanism may cause injury to the technician or bystanders. To protect against unintended movement, secure the machine or disable/disconnect the mechanism while servicing.

H1F Sluggish operation

Check		Cause	Corrective action
1.	Internal leakage	Excessive leakage will cause lower charge pressure and affect performance.	Install loop flushing defeat option and measure case flow. If case flow is excessive, motor may require major repair. Contact your Danfoss authorized service center.

System operating hot

Check		Cause	Corrective action
1.	Oil level	Insufficient hydraulic fluid may cause overheating.	Fill reservoir to proper level.
2.	Heat exchanger	Blocked heat exchanger or low air flow may cause system overheating.	Check temperature upstream and downstream of heat exchanger. Clean, repair, or replace heat exchanger if necessary.
3.	Loop flushing flow	Restricted orifice in loop flushing cartridge reduces flow.	Measure case drain flow. Clean or replace orifice cartridge.
4.	Loop flushing shuttle	Loop flushing shuttle may be sticking in one direction.	Ensure shuttle moves freely in its bore.
5.	Air in system	Entrained air generates heat under pressure	Look for foam or bubbles in reservoir. Check for leaks on inlet side of charge pump.
6.	Internal leakage	Excessive internal leakage may overheat the system.	Install loop flushing defeat option and monitor case flow. If case flow is excessive, motor may require major repair. Contact your Danfoss authorized service center.

Excessive noise or vibration

Check		Cause	Corrective action
1.	Oil level in reservoir	Insufficient hydraulic fluid may cause cavitation.	Fill reservoir to proper level.
2.	Air in system	Air bubbles may lead to cavitation.	Look for foam or bubbles in reservoir. Check for leaks on inlet side of charge pump.
3.	Shaft coupling	Loose shaft coupling may create excess noise.	Replace loose shaft coupling. Replace or repair motor if shaft splines show excessive wear.
4.	Shaft alignment	Misaligned shafts may create excessive noise and vibration and can damage motor.	Correct shaft misalignment.

Troubleshooting

Motor operates normally in one direction only

Check		Cause	Corrective action
1.	Charge pressure	If charge pressure is low in one direction, the loop flushing shuttle spool may be sticking to one side.	Measure charge pressure in forward and reverse. If pressure drops significantly lower in one direction, inspect and repair loop flushing shuttle spool.

Improper output speed

Check		Cause	Corrective action
1.	Oil level in reservoir	Insufficient hydraulic fluid may reduce system efficiency.	Fill reservoir to proper level.
8.	Internal leakage	Excess internal leakage may cause lower charge pressure and affect motor performance including output speed.	Install loop flushing defeat option and measure case flow. If case flow is excessive, motor may require major repair. Contact your Danfoss authorized service center.

H1F Low output Torque

Check		Cause	Corrective action
8.	Internal leakage	Excess internal leakage may cause charge pressure to decay, reducing output torque.	Install loop flushing defeat option and monitor case flow. If case flow is excessive, motor may require major repair. Contact your Danfoss authorized service center.

Required tools and standard procedures

Required tools

The service procedures described in this manual can be performed using common mechanic's hand tools. Special tools, if required, are shown. When testing system pressures, calibrate pressure gauges frequently to ensure accuracy. Use snubbers to protect gauges.

Standard procedures

Caution

Contamination can damage internal components and void the manufacturer's warranty. Take precautions to ensure system cleanliness when removing and reinstalling system lines

1. With the prime mover off, thoroughly clean all dirt and grime from the outside of the motor. Ensure the surrounding areas are clean and free of contaminants such as dirt and grime.
2. If removing the motor, tag each hydraulic line connected to the motor. If you disconnect hydraulic lines, plug each open port to keep dirt and contamination out of the motor.
3. Inspect the system for contamination. Look at the hydraulic fluid for signs of system contamination, such as oil discoloration, foam in the oil, sludge, or small metal particles.
4. Remove the motor as a single unit.

   Caution

   Be careful not to damage solenoids and electrical connections when using straps or chains to remove motor from machine.
5. Perform motor function test.
6. Before re-installing the motor on the machine, drain the system, flush all lines, replace all filters, and fill with new hydraulic fluid.

Minor repair

Shaft seal

H1F Removal

1. Using snap ring pliers, remove retaining ring (G0030).
2. Pull front cover (G0025). Be careful not to damage the shaft or seal bore when removing. Discard o-ring.
3. Press shaft seal (G0020) out of front cover, discard seal.

Inspection

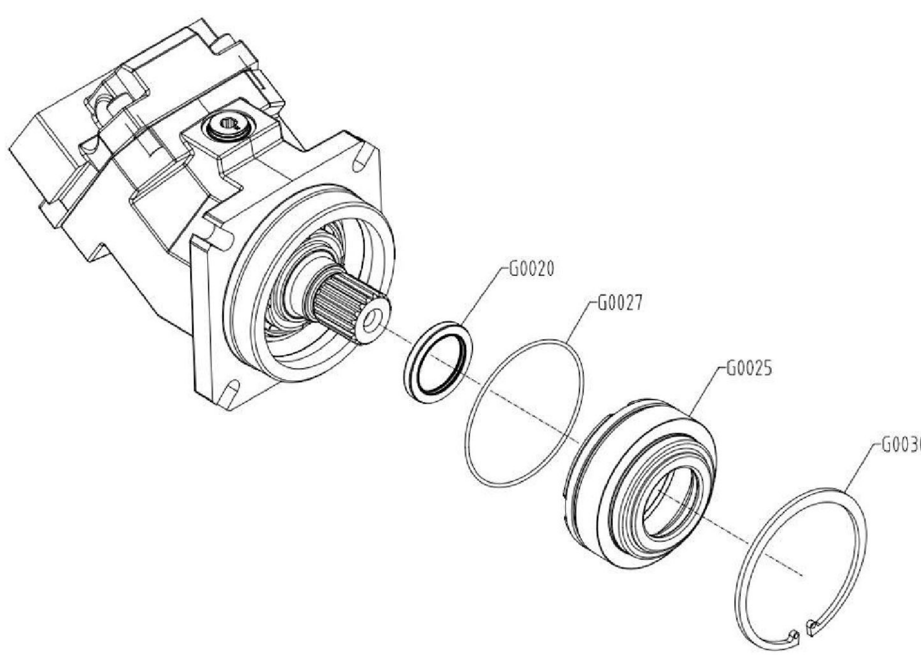
Inspect retaining ring for wear or damage. Replace if necessary. Inspect shaft for wear or groove at seal area.

H1F Assembly

1. Lubricate inside diameter of new seal.
2. Using seal installation tool, press seal into front cover bore.
3. Install o-ring on front cover o-ring groove, lubricate o-ring (G0080).
4. Cover the shaft splines with shaft cover or packing tape to avoid damaging the seal during installation.
5. Install front cover (G0025) into housing (G0010).
6. Using snap pliers, install retaining ring ((G0030).
7. Press front cover and retaining ring into housing until retaining ring snaps into its groove.

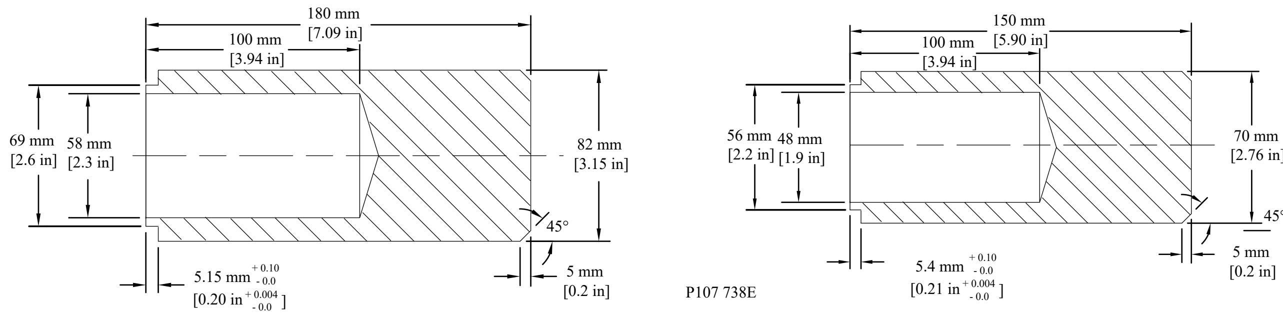
If not using seal installation tool: Do not press seal beyond snap-ring groove. Stop pressing just when you have room to install the retaining ring into the bore. Pressing the seal and snap-ring together ensures proper installation depth. Using the seal installation tool prevents pressing the seal too deeply.

Shaft seal



Minor repair

110/160/210/250 - Seal installation tool dimensions, 060/080 - Seal installation tool dimensions



Minor repair

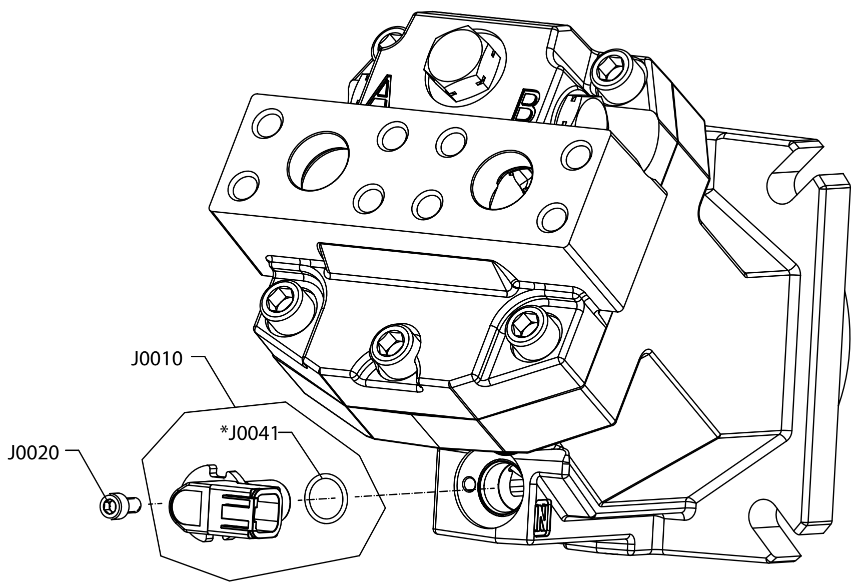
Replace speed sensor

H1F Speed Sensor Removal

1. Using a 5 mm internal hex wrench, remove screw (J0020).
2. Remove speed sensor (J0010).
3. Discard O-ring (J0041).

H1F speed sensor reassembly

Speed sensor assembly



1. Lubricate and install new O-ring (J0041).
2. Install speed sensor (J0010).
3. Install screw (J0020) using a 5 mm internal hex wrench with torque to 8 N•m [6 lbf•ft].

Minor repair

Loop flushing spool

H1F Loop Flushing Spool Removal

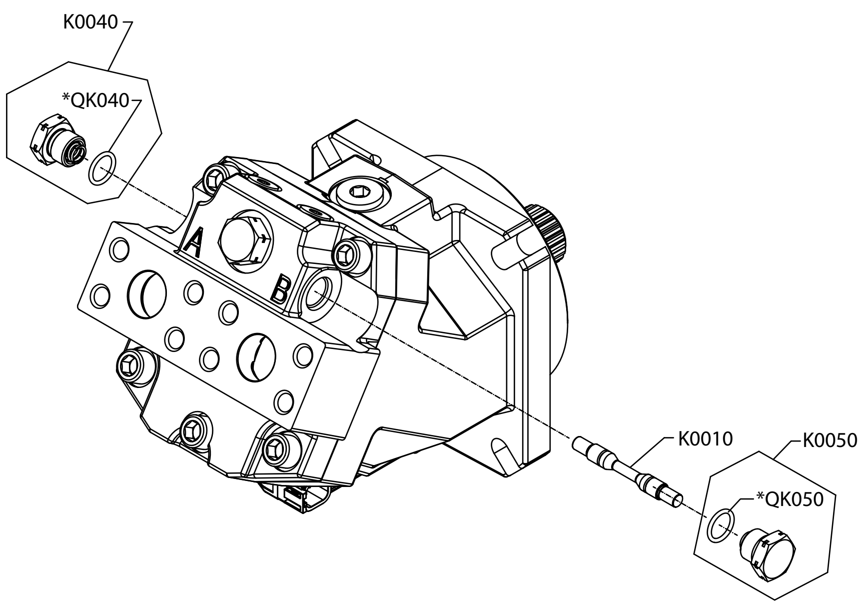
1. Remove plugs (K0040 & K0050) using a 24 mm hex wrench.
2. Remove and discard O-rings (QK040 & QK050).
3. Use a magnet to remove springs (K0020) and spool (K0010).

Inspection

Clean and inspect spool (K0010). If spool is damaged or worn replace it. Replace springs if they are cracked or bent.

H1F Loop Flushing Reassembly

Loop flushing reassembly



1. Lubricate and install spool (K0010).
2. Lubricate and install springs (K0020).
3. Lubricate and install new O-rings (QK040 & QK050).
4. Install plugs (K0040 & K0050) using a 24 mm hex wrench with torque to 67 N•m [49 lbf•ft].

H1F Loop Flushing Charge Relief Removal

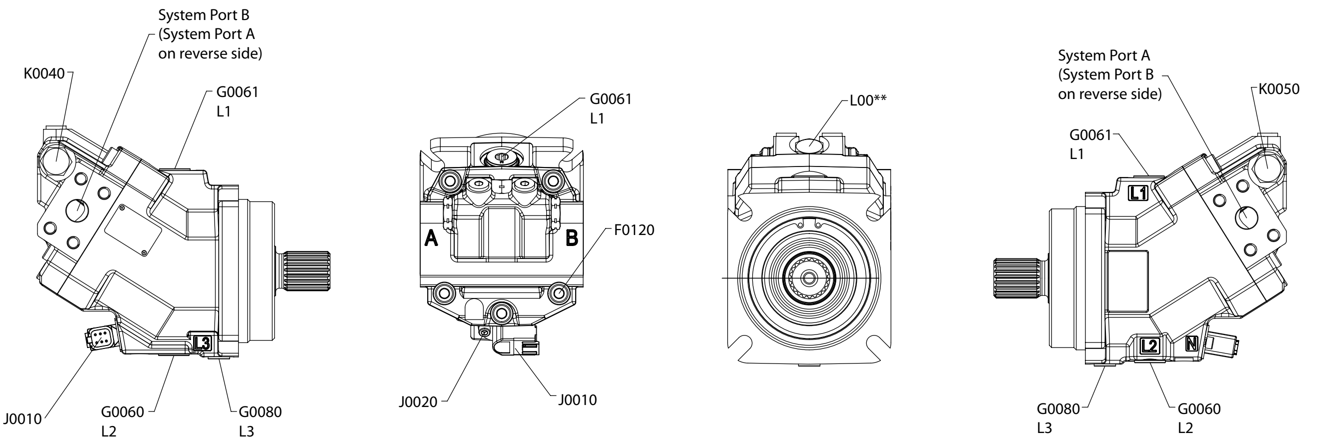
1. Using a 24 mm hex wrench remove valve (L00**)
2. Remove and discard O-ring (L0150).

Do not disassemble valve. If you suspect malfunction, replace valve.

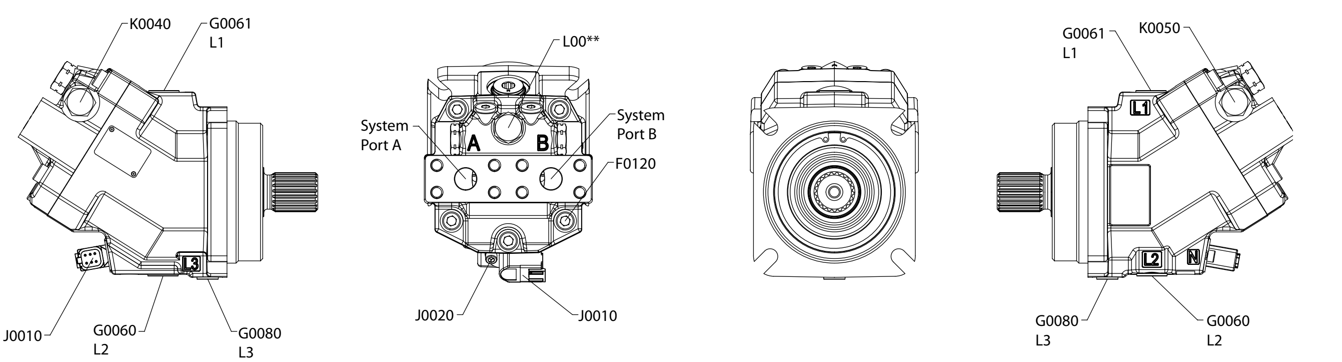
Torque chart

H1F Fasteners, plugs with torque chart

Port, plug and fasteners (with radial ported endcap)



Port, plug and fasteners (with axial ported endcap)



Fastener size and torque chart

Options	Frame size	Description	Wrench size	Torque
J0020	All	Speed sensor screw	5 mm internal hex	8 N•m [6 lbf•ft]
F0120	080	Endcap screw	10 mm internal hex	111 N•m [82 lbf•ft]
F0120	060	Endcap screw	8 mm internal hex	75 N•m [55 lbf•ft]

Plug size and torque chart

Item	Frame size	O-ring plug	Wrench size	Torque
F0160	060/080	9/16-18 UNF	1/4 internal hex	40 N•m [30 lbf•ft]
G0080	060/080	M14 - 1.5 (SAE and DIN flange)	12 mm internal hex	47 N•m [35 lbf•ft]
G0060/G0061	060/080	M22-1.5	17 mm internal hex	70 N•m [52 lbf•lb]

Torque chart

Plug size and torque chart (continued)

Item	Frame size	O-ring plug	Wrench size	Torque
K0040/K0050	All	M18 - 1.5	24 mm hex	67 N•m [49 lbf•ft]
L0100	All	M18 - 1.5	24 mm hex	67 N•m [49 lbf•ft]

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