ENGINEERING
TOMORROW

Technical Information

H1F 080
H1F Bent Axis Fixed Displacement Motor

www.danfoss.com

Revision history

Table of revisions

Date	Changed	Rev
September 2023	Updated title and speed sensor information	0102
September 2023	Initial Release	0101

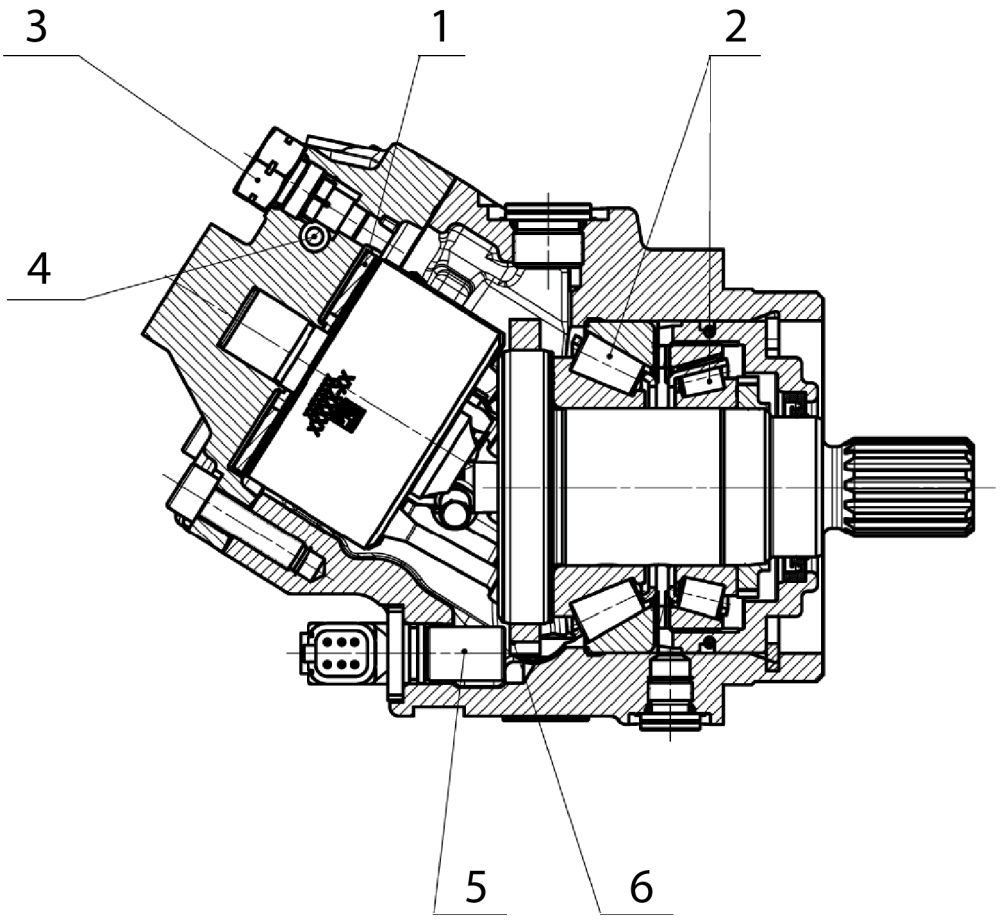
Contents

Contents

General information

Design of H1F motor

Cross-section of H1F motor



1. Bearing plate
2. Tapered roller bearing
3. Loop flushing relief valve
4. Loop flushing shuttle spool
5. Speed sensor
6. Speed ring

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 radial or axial high pressure port configurations are available. Loop flushing is also available with these options.

General information

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")

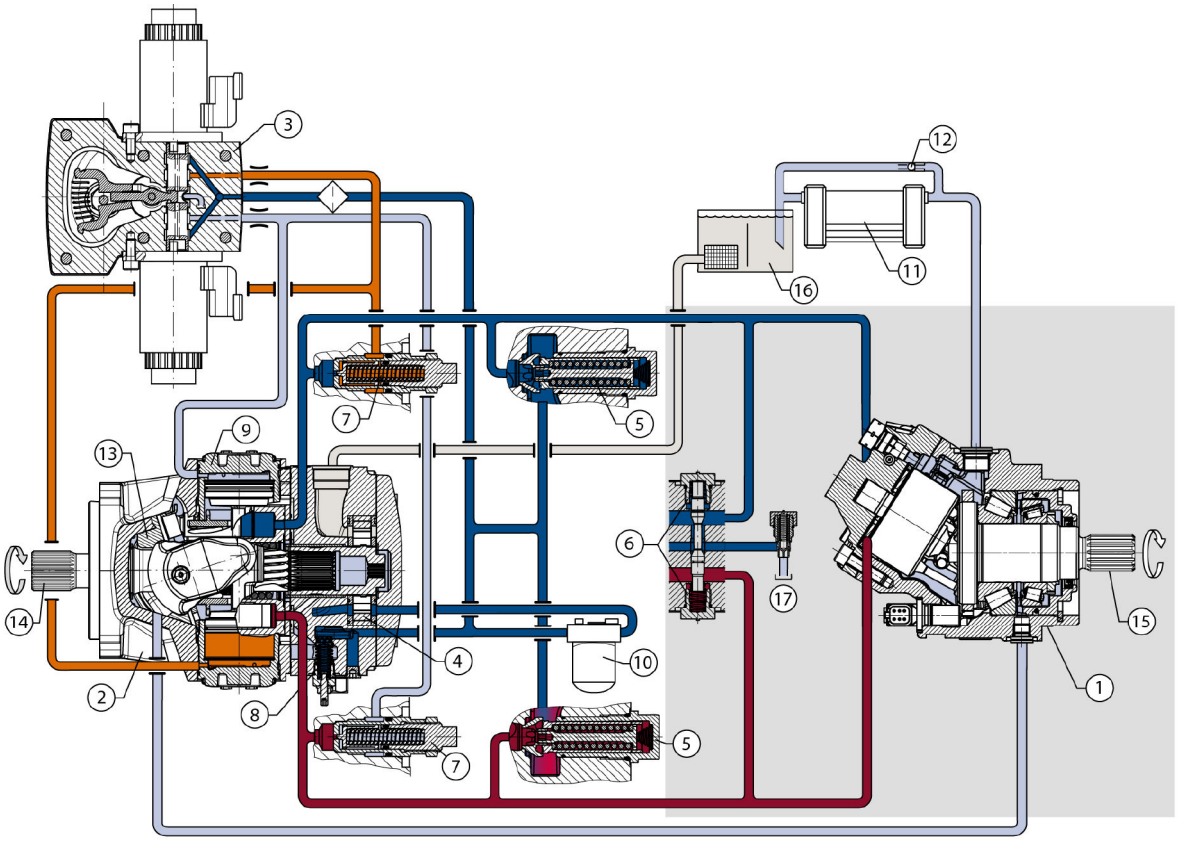
H1F range of products

A growing family based on the success of the H1B product family:

- Initial release of 060 cm^3, 080 cm^3 displacement size.
- Development plans include 110 cm^3, 160 cm^3, 210 cm^3 and 250 cm^3 displacement sizes.

General information

H1F pictorial diagram



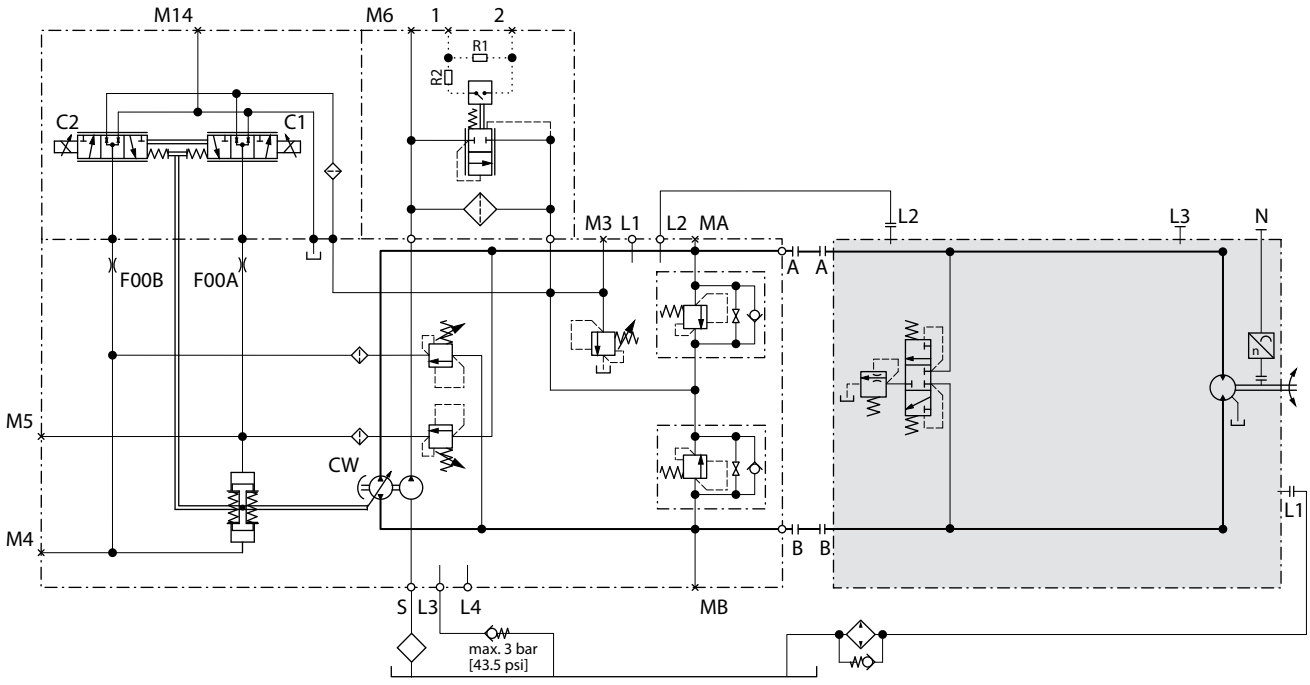
- Working loop A (Low pressure) and charge pressure
- Working loop B (High pressure)
- Servo pressure
- Case drain
- Suction

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

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**
			080
Displacement (max)		$cm^3[in^3]$	80.8 [4.93]
Theoretical flow at max. displ.	**at rated speed**	l/min [US gal/min]	320 [84.5]
	at max. speed		400 [105.7]
Theoretical torque at max. displacement		N•m/bar [lb•in/1000 psi]	1.27 [777]
Theor. corner power at rated speed and max. working pressure (Δp = 450 bar [6527 psi])		kW [hp]	330 [442.5]
Mass moment of inertia of rotating components		$kg•m^2$ $[slug•ft^2]$	0.006320 [0.00466]
Case volume		l [US Gal]	0.8 [.21]

Weight dry

Configuration	**Size**
	080
SAE	22.1 kg [48.7 lb]
DIN	22.9 kg [50.5 lb]
Cartridge	23.3 kg [51.4 lb]

Mounting flange

Configuration	**Size**
	080
SAE ISO 3019/1	127-4 (SAE C) 4-bolt
DIN ISO 3019/2, B4	140 HL 4-bolt

Technical specifications

Customer ports

Configuration	Size
	080
Axial and radial[1)]	DN25 typ 1
L1, L2[2)]	M22x1,5
Bleed port[3)]	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
			080
Rated	Maximum 32°	min^{-1} (rpm)	4500
Maximum	Maximum 32°		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)

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 Required outlet pressure diagrams (minimum for short time usage)

80cc

Speed (RPM)	Pressure (Bar)
1500	2
2600	3
3400	4

The required outlet pressure (above case pressure) makes sure, that there is no pulling between piston and shaft.

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

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 required low pressure diagrams (minimum for extended usage)

80cc

Speed (RPM)	Pressure (Bar)
2300	10
3000	15
3600	20
4000	25
4500	30

These minimum pressures are required for a high duty cycle, defined as 200 hours at 350 bar. Similarly, a duty cycle of 200 hours at 250 bar requires 50% of these pressures.

This low pressure (above case pressure) is required to prevent cavitation, which comes from the pressure change in the cylinder block. There is very high flow velocity in the porting grooves of the valve segment, which causes cavitation.

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 10 .

Technical specifications

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.

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	$\beta_{15-20} = 75$ ($\beta_{10} \geq 10$)
	Efficiency (suction / return line filtration)		$\beta_{35-45} = 75$ ($\beta_{10} \geq 2$)
	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.

Technical specifications

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

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

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

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

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

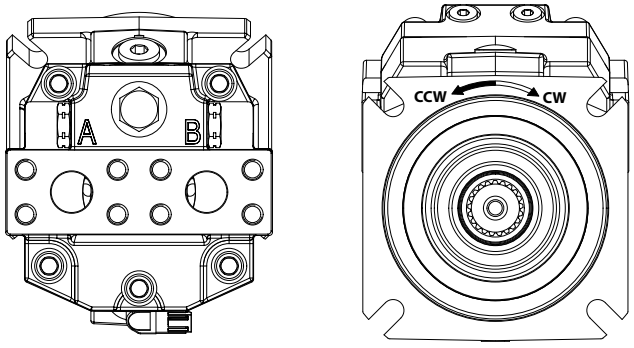
Where:

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.

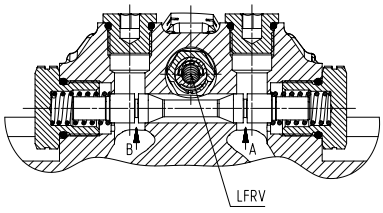


Flow into port A	Clockwise
Flow into port B	Counterclockwise

H1F Loop flushing shuttle spool

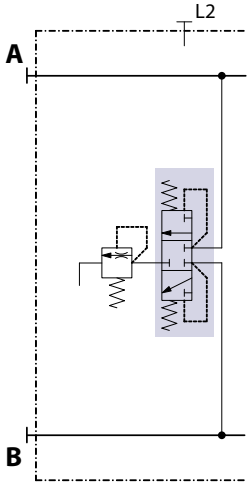
An integral loop flushing shuttle spool is used to separate system A and system B pressures.

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.

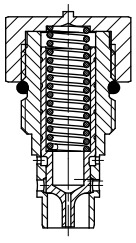
The loop flushing relief valve is also used to facilitate the removal of contaminants from the loop.

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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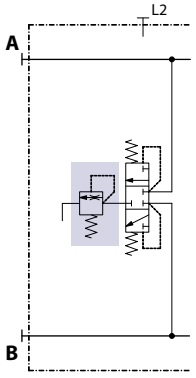
Loop flushing relief valve schematic



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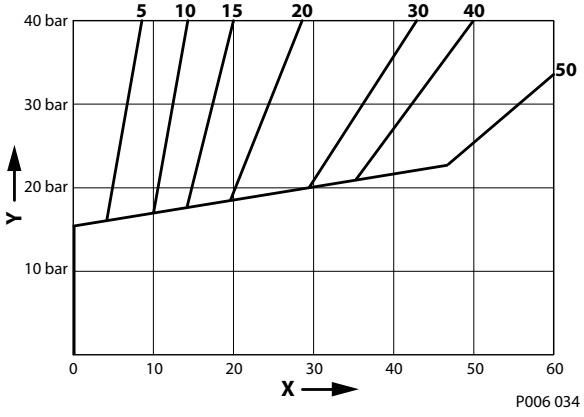
Loop flushing relief valve sizes



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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**.

Temperature Range

Parameter	Minimum	Maximum
Operation temperature range	-40 °C	104 °C

115°C intermittent = short term; t < 1min per incident and not exceeding 2 % of duty cycle based load-life.

Protection Characteristics

Parameter	Data
Protection Code (IP class) according IEC 60529 and DIN 40050	IP 67 (without connector installed) IP 69k (with connector installed)
EMC Emission	EN 61000-6-3
EMC Immunity (EMI)	100 V/m incl. 1 kHz AM 80 %; ISO 11452-5 and -2
ESD	EN 61000-4-2 Air discharge: 15 kV Contact discharge: 8 kV
Vibration	30 G (294 m/s^2)
Shock	50 G (490 m/s^2)
Case maximum pressure	5 bar [72.5 psi]

Mating connectors

There are available two types of mating connectors Assembly Bag DEUTSCH DTM06-6S, Black and Grey.

Ordering number	
11033865	**11033863**
Assembly Bag, DEUTSCH DTM06-6S-E004; black, (24-20 AWG) 0.21 -0.52 mm^2	Assembly Bag, DEUTSCH DTM06-6S, gray, (24-20 AWG) 0.21 -0.52 mm^2

Available Sensors

There are two speed sensors available according to different supply voltage range: 4.5 to 8 V_{DC} and 7 to 32 V_{DC}.

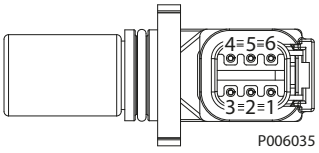
Description	Order number	
	149055	**11232698**
Supply voltage	4.5 – 8 V	7 – 32 V
Speed signals	Two, 90° Phase shift	Two, 90° Phase shift
Direction signal	One	One
Temperature signal	One	One

For more information, see below.

Operation

Speed sensor 4.5 – 8 V

Speed sensor connector, 6-pin



1. Speed signal 2
2. Direction signal
3. Speed signal 1
4. Supply
5. Ground
6. Temperature

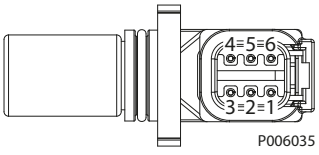
Technical data

Parameter	Min.	Nom.	Max.	Note
Supply voltage	4.5 V_{DC}	5 V_{DC}	8 V_{DC}	Regulated supply voltage. Reverse polarity protected.
Supply protection	–	–	30 V_{DC}	Shuts off above 9 V.
Max. required supply current	–	–	25 mA	At supply voltage
Max. output current	–	–	50 mA	
Operation mode	**NPN & PNP**			Push-Pull amplifier
Temperature signal	-40°C = 2.318V	–	100°C = 0.675V	
Output low	5 %	8.5 %	12 %	Ratiometric output voltage Low state > 0 V to provide wire fault detection
Output high	88 %	91.5 %	95 %	
Detectable frequency range	1 Hz	–	10 000 Hz	
Ordering number	**149055**			
Color of connector	Black			

Speed Sensor 7 – 32 V

Speed Sensor 7 – 32 V_{DC} technical data and information about connector.

Speed sensor connector, 6-pin



Pinout:
1. Speed signal 2
2. Direction signal
3. Speed signal 1
4. Supply
5. Ground
6. Temperature

Technical data

Parameter	Min.	Max.	Note
Supply voltage range	7 V_{DC}	32 V_{DC}	
Supply protection	–	36 V_{DC}	36 V_{DC} over voltage protection -36 V_{DC} permanent reverse polarity protection
Max. required supply current	–	30 mA	
Max. output current	–	50 mA	
Operation mode	**NPN open collector**		Internal 2k7 pull-up resistor to supply

Operation

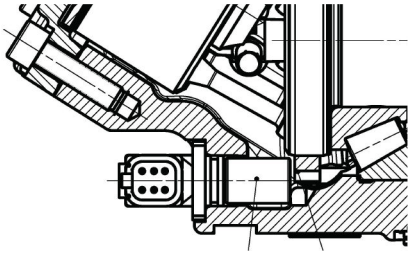
Technical data (continued)

Parameter	Min.	Max.	Note
Output low signal range	2 %	10 %	Max. output voltage 24 V_{DC}
Output high signal range	55 %	85 %	
Detectable frequency range	1 Hz	10 000 Hz	
Speed sensor order number	**11232698**		
Color of connector	Yellow		

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	080
Teeth	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 10) 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.

Operating parameters

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.

Viscosity

For maximum efficiency and bearing life, ensure that the fluid viscosity remains in the **recommended range**.

The **minimum viscosity** should be encountered only during brief periods of maximum ambient temperature and severe duty cycle operation.

The **maximum viscosity** should be encountered only at cold start.

System design parameters

Filtration system

To prevent premature wear, ensure that only clean fluid enters the hydrostatic transmission circuit. A filter capable of controlling the fluid cleanliness to ISO 4406, class 22/18/13 (SAE J1165) or better, under normal operating conditions, is recommended.These cleanliness levels cannot be applied for hydraulic fluid residing in the component housing/case or any other cavity upon delivery from the factory.

The filter may be located on the pump (integral) or in another location (remote or suction). The integral filter has a filter bypass sensor to signal the machine operator when the filter requires changing. Filtration strategies include suction or pressure filtration. The selection of the filter strategy depends on a number of factors including the contaminant ingression rate, the generation of contaminants in the system, the required fluid cleanliness, and the desired maintenance interval. Filters are selected to meet the above requirements using rating parameters of efficiency and capacity.

Filter efficiency can be measured with a Beta ratio (β_X). For simple suction-filtered closed circuit transmissions and open circuit transmissions with return line filtration, a filter with a β-ratio within the range of $\beta_{35\text{-}45} = 75$ ($\beta_{10} \geq 2$) or better has been found to be satisfactory. For some open circuit systems, and closed circuits with cylinders being supplied from the same reservoir, a higher filter efficiency is recommended. This also applies to systems with gears or clutches using a common reservoir. For these systems, a charge pressure or return filtration system with a filter β-ratio in the range of $\beta_{15\text{-}20} = 75$ ($\beta_{10} \geq 10$) or better is typically required.

Because each system is unique, only a thorough testing and evaluation program can fully validate the filtration system. For more information, see *Design Guidelines for Hydraulic Fluid Cleanliness, Technical Information* **BC152886482150**.

Filter β_x-ratio is a measure of filter efficiency defined by ISO 4572. It is defined as the ratio of the number of particles greater than a given diameter ("x" in microns) upstream of the filter to the number of these particles downstream of the filter.

Filtration, cleanliness level and β_x-ratio (recommended minimum)

Cleanliness per ISO 4406	22/18/13
Efficiency β_x (charge pressure filtration)	$\beta_{15\text{-}20} = 75$ ($\beta_{10} \geq 10$)
Efficiency β_x (suction and return line filtration)	$\beta_{35\text{-}45} = 75$ ($\beta_{10} \geq 2$)
Recommended inlet screen mesh size	100 – 125 µm

Reservoir

Proper sizing of the hydrostatic system reservoir will allow maximum volume changes during all system operating modes and increase de-aeration of the fluid as it passes through the tank. A suggested minimum total reservoir volume is $^5/_8$ of the maximum charge pump flow per minute with a minimum fluid volume equal to ½ of the maximum charge pump flow per minute. This allows 30 seconds of fluid dwell time for removing entrained air at the maximum return flow. This is usually adequate to allow for a closed reservoir having no breather in most applications.

Locate the reservoir outlet to the charge pump inlet above the bottom of the reservoir to take advantage of gravity separation and prevent large foreign particles from entering the charge inlet line. A 100-125 mesh screen over the reservoir outlet port is recommended. Position the reservoir inlet for the fluid return to discharge below the normal fluid level and toward the interior of the tank. A baffle or baffles, between the inlet and outlet of the reservoir will further increase de-aeration and reduce surging of the fluid.

System design parameters

Fluid Selection

Ratings and performance data are based on operating with hydraulic fluids containing oxidation, rust and foam inhibitors. These fluids must possess good thermal and hydrolytic stability to prevent wear, erosion, and corrosion of motor components.

Caution

Never mix hydraulic fluids of different types.

Case Drain

A case drain line must be connected to the case outlets of each motor to return the internal leakage oil to the system reservoir. When filling the case before start up, use the highest case drain outlet to promote complete filling of the case. The case drain fluid is typically the hottest fluid in the system. It is highly recommended to route the case drain flow through a heat exchanger before it is returned to the reservoir.

In some applications, it may be required to provide additional cross-flushing of the motor. If the motor is used mainly in a high speed application, higher cooling requirements may be needed for the rotating kit and tapered roller bearings. Use the lowest case drain port as the inlet port and the highest case drain port as the outlet port. This will ensure that the case is full of oil at all times.

Apply unit case pressure ratings to case drain routing and design.

Independent braking system

Unintended vehicle or machine movement hazard.
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.

Bearing loads and life

Bearing life is a function of speed, system pressure, motor angle and any external side or thrust loads. The influence of motor angle includes displacement as well as direction. External side loads are found in some applications such as a helical gear without its own support bearings, installed directly on to the motor shaft. All external side loads will act to reduce the normal bearing life of the motor. Other life factors include oil type and viscosity.

When external side loads are present, the allowable radial shaft loads are a function of the load position relative to the mounting flange, the load orientation relative to the internal loads and the operating pressures of the hydraulic unit. In applications where external shaft loads cannot be avoided, the impact on bearing life can be minimized by proper orientation of the load. Optimal motor orientation is a consideration of the net loading on the shaft from the external load and the motor rotating kit.

Contact Danfoss for a bearing life review if external side loads and thrust loads are present.

Shaft Torque

Available shafts are capable to transmit the maximum torque capability at maximum working pressure. Lubrication or similar treatment of splined motor shaft is recommended for proper torque transmission.

For more information, see **Lubrication of Splined Shafts, Data Sheet, AI152986482538**.

Master Model Code

H1F size, version, port options

H1F frame size

Code	Displacement
060	60 cm³ [3.66 in³] Coming soon
080	80 cm³ [4.88 in³]
110	110 cm³ [6.71 in³] Coming soon
160	160 cm³ [9.76 in³] Coming soon
210	210 cm³ [12.81 in³] Coming soon
250	250 cm³ [15.25 in³] Coming soon

A – Product version

A	Revision code

Z – Port configuration

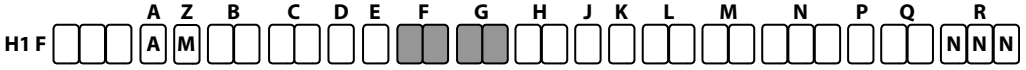
M	Metric, Customer O-Ring ports sealing according to ISO 6149-1

H1F B, C, D, E Options

B, C, D, E

Code	Note:
NN	Not used

H1F endcap, flange and housing options



F – End-cap (ISO 6162, type 2)

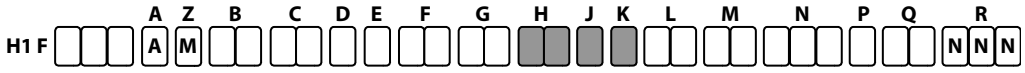
Code	Description	Port type
FS	Endcap w/ loop flushing	side port
FA		axial port
FT		twin port
tbd	Endcap w/o loop flushing	axial port
tbd		side port
tbd		twin port
tbd	Endcap w/ HPRV, w/o loop flushing	twin port
tbd	Endcap w/o HPRV, w/o loop flushing	twin port

Master Model Code

G – Flange and housing

Code	Description	080
VS	SAE flange motor housing (ISO 3019/1), with speed sensor port	●
DS	DIN flange motor housing (ISO 3019/2), with speed sensor port	●
CS	Cartridge flange motor housing, with speed sensor port	-

H1F shaft, sensor, loop flushing shuttle system options



H – Shaft options according to speed ring

Code	Speed ring	Description	080
AN	No	14 teeth 12/24 pitch ANSI 92.1 1970 class 5	●
AS	Yes		
BN	No	21 teeth 16/32 pitch ANSI 92.1 1970 class 5	●
BS	Yes		
CN	No	23 teeth 16/32 pitch ANSI 92.1 1970 class 5	●
CS	Yes		
HN	No	W35x2x30x16x9g DIN 5480	●
HS	Yes		
JN	No	W40x2x30x18x9g DIN 5480	●
JS	Yes		

J – Sensor

N	Plugged no speed sensor ring
B	Speed sensor, 7 V to 32 V, DEUTSCH DTM04-6P connector
S	Speed sensor, 4.5 V to 8 V,DEUTSCH DTM 04-6P connector
P	Plugged with speed sensor ring

K – Loop flushing shuttle system

Code	Description	080
A	Standard 6.5 bar [94 psi] shift pressure	●
N	No loop flushing function	●
W	No loop flushing function, option w/o parts	-

H1F loop flushing, special hardware options

Master Model Code

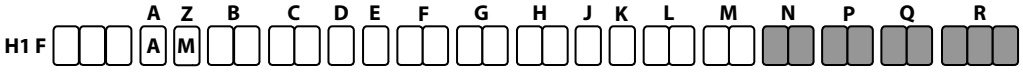
L – Loop flushing relief valve (non-adjustable)

Code	Flow	080
05	5 l/min [1.321 US gal/min], 16 bar [232 psi] cracking pressure	●
10	10 l/min [2.642 US gal/min], 16 bar [232 psi] cracking pressure	●
NN	No loop flushing function	●
WN	No loop flushing function, option w/o parts	-

M – Special hardware feature

NN	Standard hardware fixed
SN	Special hardware fixed

H1F HPRV and paint options



P – HPRV A Setting

Code	Description
NN	Other
38	HPRV 380 bar (TBD)

Q – HPRV B Setting

Code	Description
NN	Other
38	HPRV 380 bar (TBD)

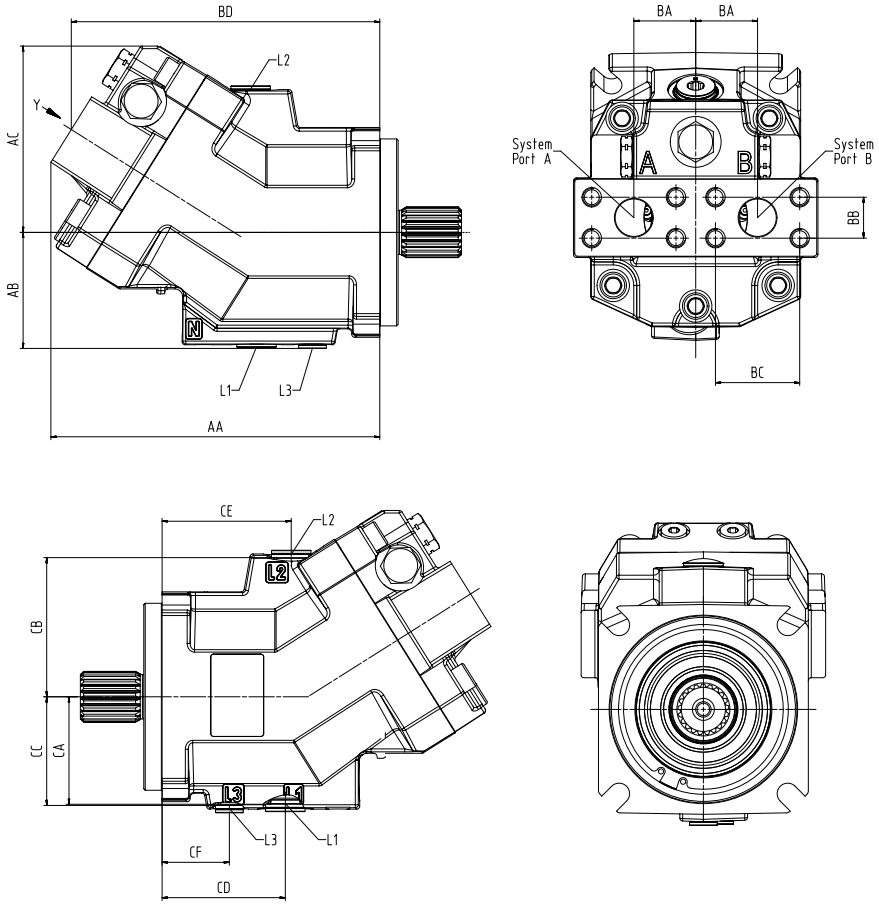
R – Paint options

Code	Description
NNN	Black paint and Danfoss nametag

Flange and housing dimensions

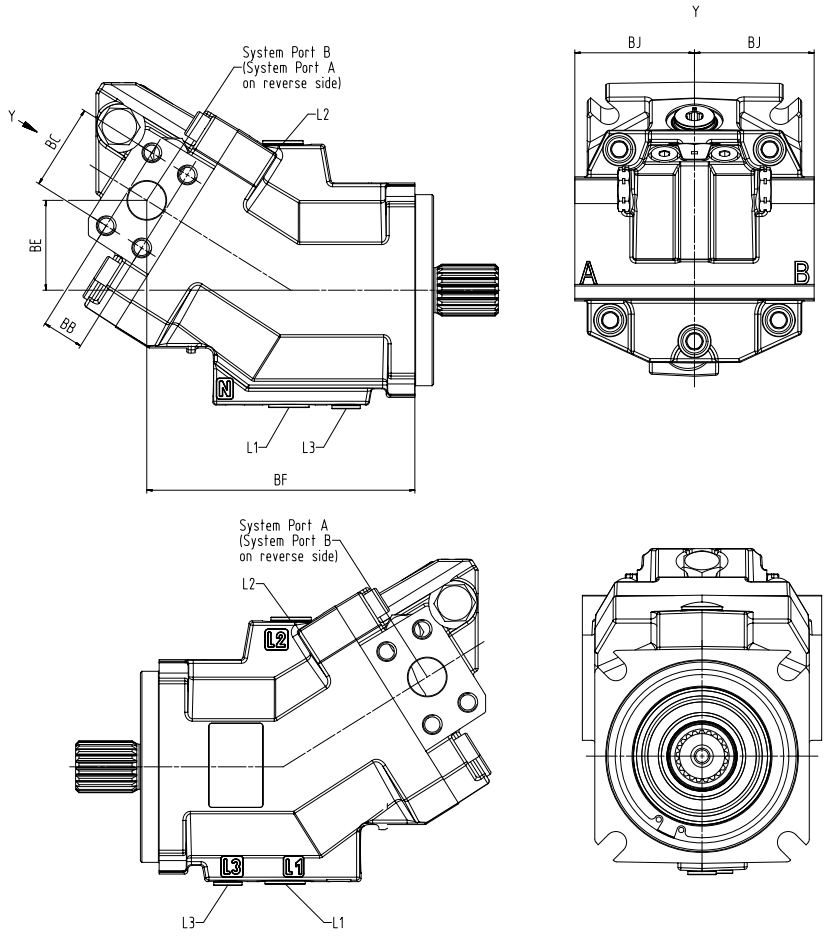
H1F SAE flange design

Axial ports



Flange and housing dimensions

Radial ports



Axial and radial ports dimensions, mm [in]

Callout	Size 080
AA	223.4 [8.795]
AB	76.9 [3.028]
AC	126.5 [4.980]
BA	42.0 [1.654]
BB	27.8 [1.094]
BC	57.2 [2.252]
BD	209.5 [8.248]
BE	59.9 [2.358]
BF	178.5 [7.028]
BJ	79.5 [3.130]
CA	73.0 [2.874]
CB	94.5 [3.720]
CC	73.8 [2.906]
CD	83.7 [3.295]

Flange and housing dimensions

Axial and radial ports dimensions, mm [in] (continued)

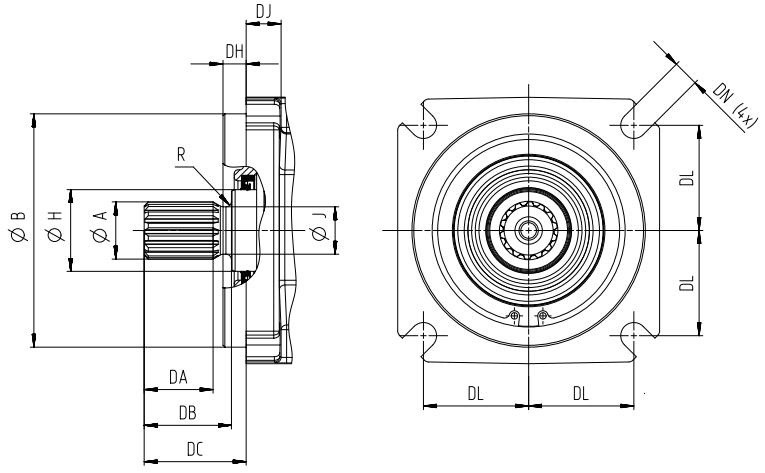
Callout	Size 080
CE	87.7 [3.488]
CF	45.7 [1.799]

H1F SAE flange design ports per ISO 11 926-1

Ports dimensions per ISO 11 926-1; mm [in]

Ports		Size 080
L1, L2 Case drain	**Inch**	$^{7}/_{8}$-14; Ø41.5 [1.634]
	Metric	M22x1.5; Ø44 [1.732]
L3 Case drain	**Inch**	$^{9}/_{16}$-18; Ø25 [0.984]
	Metric	M14x1.5;Ø 26 [1.024]
A, B Split flange boss system		DN 25 (Ø25.4 mm) M12x1.75; 24 [0.94]

H1F SAE mounting flange design per ISO 3019/1



SAE flange dimensions mm [in]

Measure	Size 080
ØB	126.975 [4.999]
DH	12.540 [0.494]
DJ	17.800 [0.7]
DL	57.250 [2.254]
DN	14.300 [0.563]

Shaft options overview (Number of teeth)

Size	AN/AS (14T)	BN/BS (21T)	CN/CS (23T)
080	●	●	●

● = available option, – = not available option

Flange and housing dimensions

Shaft dimensions; mm [in]

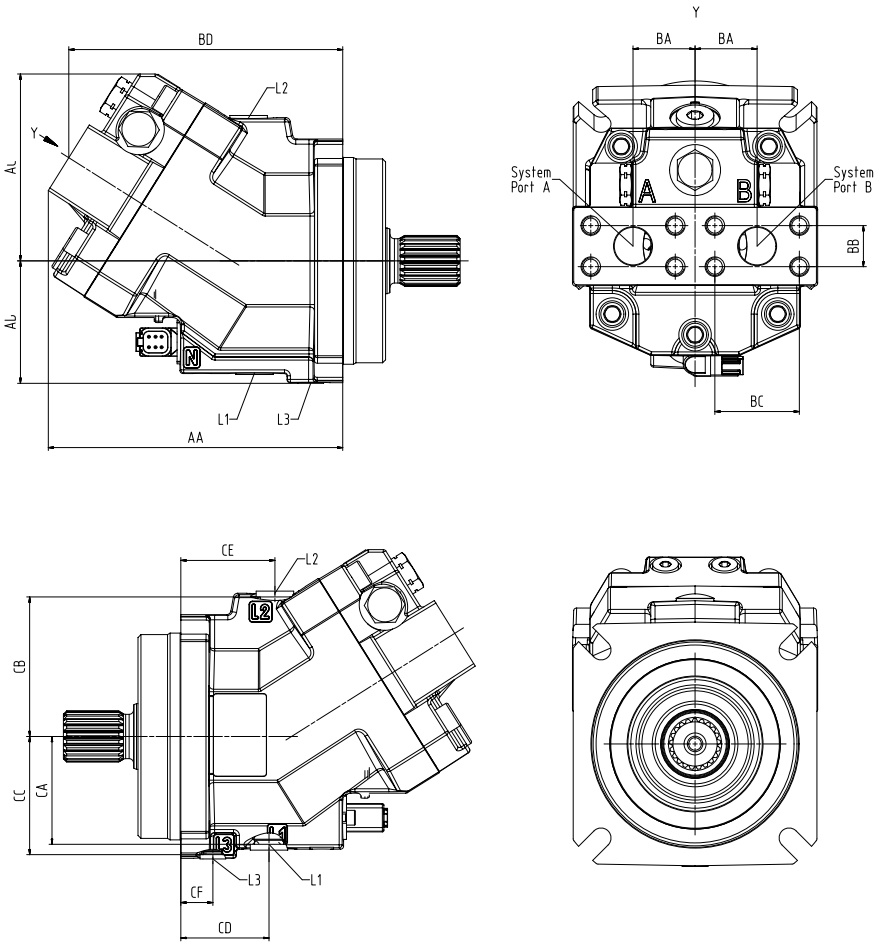
Shaft option	AN/AS	BN/BS	CN/CS
Teeth	**14**	**21**	**23**
Module	12/24	16/32	16/32
Pitch-Ø	29.633 [1.167]	33.337 [1.312]	36.513 [1.438]
Spline	ANSI B92.1-1970 Class 5 flat root side fit		
ØA	31.2 [1.228]	34.4 [1.315]	37.61 [1.48]
ØH	44.5 [1.752]	44.5 [1.752]	44.5 [1.752]
ØJ	25.8 [1.016]	30.0 [1.181]	32.0 [1.260]
DA	37.5 [1.476]	37.5 [1.476]	37.5 [1.476]
DB	47.5 [1.870]	47.5 [1.870]	47.5 [1.870]
DC	55.5 [2.185]	55.5 [2.185]	55.5 [2.185]
R	3.0 [0.118]	3.0 [0.118]	3.0 [0.118]
V	M10	M10	M12
Angle	Pressure angle 30°		

For DIN 5480 shaft used in combination with SAE flanges, please contact your local Danfoss Power Solutions representative.

Flange and housing dimensions

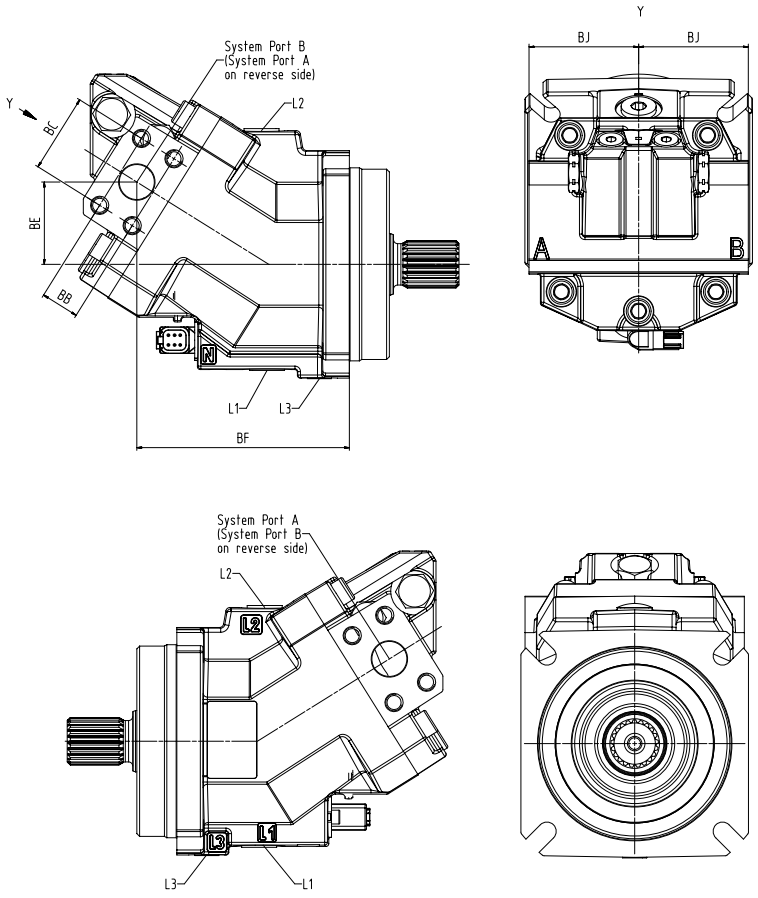
H1F DIN flange design

Axial ports



Flange and housing dimensions

Radial ports



Axial and radial ports dimensions, mm [in]

Callout	Size 080
AA	199.3 [7.846]
AB	82.9 [3.264
AC	126.5 [4.980]
BA	42.0 [1.654]
BB	27.8 [1.94]
BC	57.2 [2.252]
BD	185.5 [7.303]
BE	59.9 [2.358]
BF	154.5 [6.083]
BJ	79.5 [3.130]
CA	73.0 [2.874]
CB	94.5 [3.720]
CC	80.0 [3.150]
CD	59.7 [2.350]

Flange and housing dimensions

Axial and radial ports dimensions, mm [in] (continued)

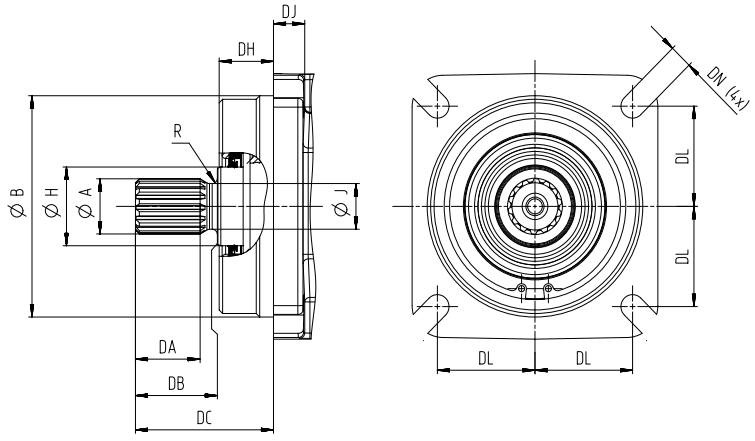
Callout	Size 080
CE	63.7 [2.508]
CF	21.7 [0.854]

H1F DIN flange design ports per ISO 11 926-1

Ports dimensions per ISO 11 926-1; mm [in]

Ports		Size 080
L1, L2 Case drain	**Inch**	$^{7}/_{8}$-14; Ø41.5 [1.634]
	Metric	M22x1.5; Ø44 [1.732]
L3 Case drain	**Inch**	$^{9}/_{16}$-18; Ø25 [0.984]
	Metric	M14x1.5;Ø 26 [1.024]
A, B Split flange boss system		DN 25 (Ø25.4 mm) M12x1.75; 24 [0.94]

H1F DIN mounting flange design per ISO 3019/2



DIN mounting flange per ISO 3019/2 dimensions, mm [in]

Measure	Size 080
ØB	140.000 [5.512]
DH	29.000 [1.142]
DJ	19.000 [.748]
DL	63.650 [2.506]
DN	13.500 [0.531]

Shaft options overview

Size	Shaft option (Number of teeth)	
	HN/HS (16T)	**JN/JS (18T)**
080	●	●

● = available option, – = not available option

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