ENGINEERING
TOMORROW

Danfoss

Technical Information

3232
Closed Circuit Axial Piston Transmission

Revision history   *Table of revisions*

Date	Changed	Rev
December 2024	First edition	0101

Contents

General Description

Basic Design

The 3232 was designed as one housing U-style transmission in a U-shaft configuration. It houses a variable axial piston pump with fixed displacement axial piston motor to provide infinite gear ratio in a compact size. This design provides longer life and higher performance in the same package and is well suited for agricultural vehicles.

Key Features

- Proven and optimized 9 piston rotating group
- Compact one housing design
- Longer life kit and higher duty capability in the most compact design in its class
- Optimized for short shaft center-line distance
- Robust Cylinderblock, Piston material and Valveplate

Typical Applications

- Harvester

Schematic Diagram
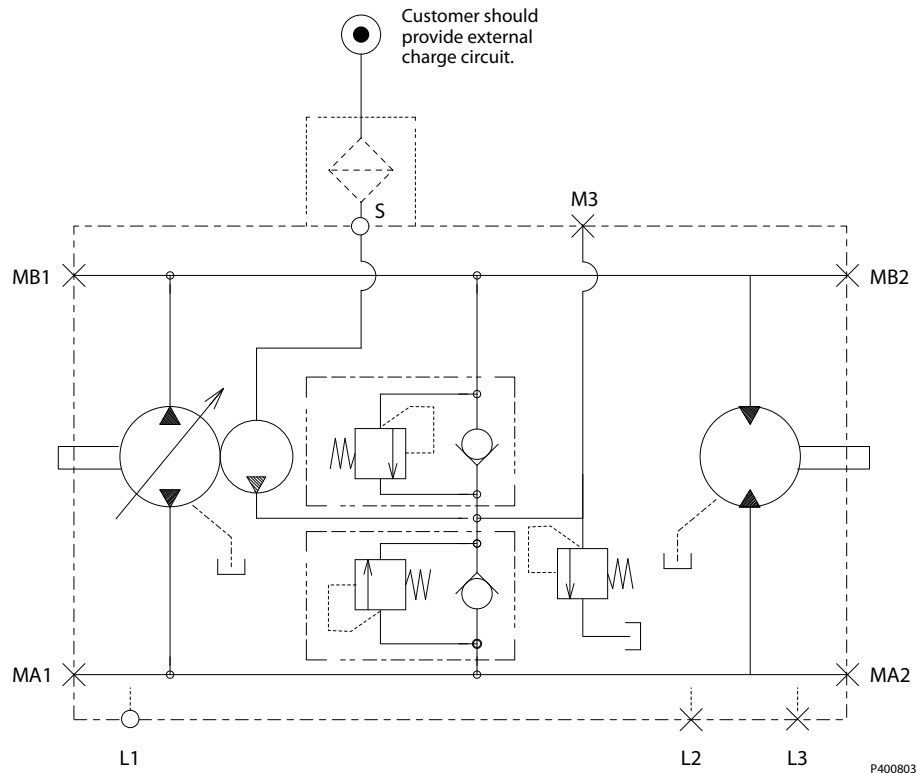
- L1, L2 and L3 are case drain ports.
- S is Suction port. Customer should provide external charge circuit.
- M3 is Charge pressure gauge port.

Technical Specification

Physical Properties

Features		Units	3232
Displacement	Pump side[1]	cm^3/rev [in^3/rev]	0-31.5 [0-1.92]
	Motor side		31.5 [1.92]
Torque at maximum displacement (theoretical)		N•m/bar [lbf•in/1000 psi]	0.50 [304.7]
Mass moment of inertia of rotating components	Pump side	kg•m^2 [slug•ft^2]	0.0019 [0.0014]
	Motor side		0.0019 [0.0014]
Weight dry		kg [lb]	22 [48.5]
Oil volume	Case only	liter [US gal]	1.5 [0.40]
	With passage		1.6 [0.42]
Installation			See *Installation Drawings 3232* on page 23
Input shaft rotation			Clockwise or Counterclockwise
Ports			See *Installation Drawings 3232* on page 23
Input shaft			See *Shaft Availability and Torque Ratings: Input Shaft* on page 25
Output shaft			See *Shaft Availability and Torque Ratings: Output Shaft* on page 27
Control type			DDC

[1] Max Swash angle is 18 deg.

Operation Parameters

Features		Units	3232
Input speed	Minimum	min^{-1} (rpm)	1000
	Rated		3200
	Maximum		3400
System pressure	Maximum working pressure	bar [psi]	300 [4350]
	Maximum pressure		345 [5004]
Input power	Maximum	kw [HP]	29.8 [40]
Charge pressure	Minimum	bar [psi]	5 [72.5]
Case pressure	Rated	bar [psi]	1 [14.5]
	Maximum		3 [43.5]

Technical Specification

Fluid Specifications

Features		Units	3232
Viscosity	Minimum	mm²/sec. [SUS]	7 [49]
	Continuous		12-60 [66-280]
	Maximum		1600 [7500]
Temperature	Minimum	Degrees C [Degrees F]	-40 [-40]
	Recommended range		+82 [+180]
	Maximum		+104 [+220]
Filtration (recommended minimum)	Cleanliness per ISO 4406		22/18/13
	Efficiency (charge pressure filtration)	β-ratio	β15-20=75(β10≥10)
	Efficiency (suction and return line filtration)		β35-45=75(β10≥2)
	Recommended inlet screen mesh size	µm	100-125

Operations

Check / High Pressure Relief Valve

The 3232 is equipped with a combination high pressure relief and charge check valve. The high-pressure relief function is a dissipative (with heat generation) pressure control valve for the purpose of limiting excessive system pressures. The charge check function acts to replenish the low-pressure side of the working loop with charge oil. Each side of the transmission loop has a dedicated HPRV valve that is non-adjustable with a factory set pressure. When system pressure exceeds the factory setting of the valve, oil is passed from the high pressure system loop, into the charge gallery, and into the low pressure system loop via the charge check.

The pump order code allows for different pressure settings to be used at each system port. HPRV valve with orifice is available to gain wider neutral dead-band. When HPRV valves with orifice are used, it is only for High pressure ports when vehicle goes in reverse. The system pressure order code for pumps with only HPRV is a reflection of the HPRV setting.

The system pressure order code for pumps configured with pressure limiter and HPRV is a reflection of the pressure limiter setting.

Check / High Pressure Relief Valve with Orifice

As an option, The 3232 offers Check / HPRV with an orifice produce a larger neutral deadband.

In some applications, it is desirable to use Check / HPRV with an orifice to expand neutral dead band, which would help provide a larger margin of safety for vehicle movement in neutral and provide easier adjustment of the vehicle linkage for machine neutral. The orifice connects the working loop, which is a main hydraulic circuit, to a charge circuit. It always allows some internal leakage to ensure the expanding neutral dead band around neutral position of control shaft. However, it decreases the volumetric efficiency, particularly at high system pressure in the working loop. Check / HPRV with an orifice has possibility to increase downhill creep. It is recommended to install the orifice in a specific working loop, which is pressurized when the vehicle moves in reverse.

The HPRV are set at the following flow rates

Check / HPRV without orifice	6 l/min [1.4 US gal/min]
Check / HPRV with orifice	18 l/min [4.8 US gal/min]
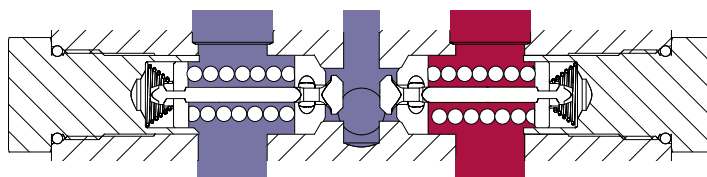
P400005

⚠️ **Caution**

HPRVs are factory set at a low flow condition. Any application or operating condition which leads to elevated HPRV flow will cause a pressure rise with flow above a valve setting. Consult factory for application review.

Operations

CPRV (Charge Pressure Relief Valve)

The charge pressure relief valve maintains charge pressure at a designated level above case pressure. The charge pressure relief valve is a direct acting poppet valve which opens and discharges fluid to the HST case when pressure exceeds a designated level. 3232 is equipped with a gerotor charge pump and the CPRV is set at 2300 rpm. The charge pressure relief valve setting is specified on the model code of the 3232.

Charge Pressure Relief Valve Function (Suction Filtration)

Charge Flow

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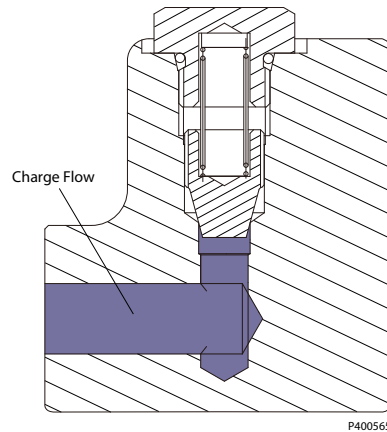
Charge Pressure Relief Valve Function (Charge Filtration)

Charge Flow

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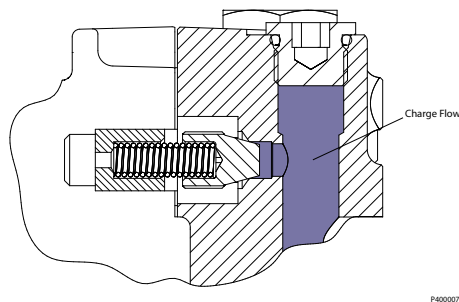
Operations

Control

Direct Displacement Control

The 3232 features Direct Displacement Control (DDC) . The swashplate angle is set directly by a control lever or linkage attached directly to the swashplate control arm. Control lever movement changes the speed and rotating direction of the motor by increasing or decreasing the swashplate angle.

The control input shaft is configurable on both of left and right hand side of the 3232.

Control Handle Requirements

Maximum allowable control arm torque is 79.1 N•m [700 lbf•in]. The approximate torque necessary to rotate the control arm at 300 bar system operating pressure and 3000 rpm is 30 N•m with the standard valveplate. Minimum torque necessary to hold the swashplate at a zero angle for neutral is 2.3 N•m [20 in•lbf]. The actual value will vary due to the influence of pump operating conditions. For mating dimensions, see *Installation Drawings 3232* on page 23.

Input shaft rotation	CW				CCW			
Control arm location	**Right**		**Left**		**Right**		**Left**	
Control arm rotation	CW	CCW	CW	CCW	CW	CCW	CW	CCW
Output rotation	CW	CCW	CCW	CW	CCW	CW	CW	CCW
High pressure port	MA	MB	MB	MA	MB	MA	MA	MB
Low pressure port	MB	MA	MA	MB	MA	MB	MB	MA

Left hand side viewing from input shaft (when pump located upside)
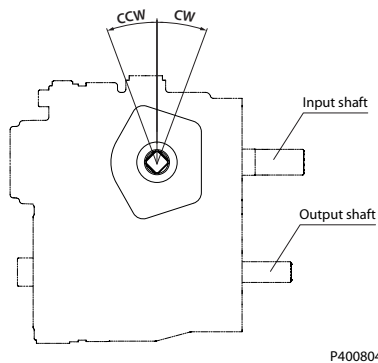
Right hand side viewing from input shaft (when pump located upside)
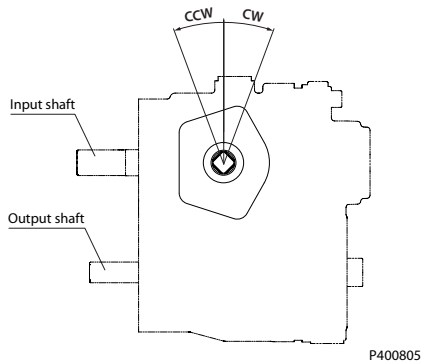
Operations

⚠️ **Warning**

With no external forces applied to the swashplate trunnion, internal hydraulic forces may not return the swashplate to the neutral position under all conditions of operation.

Operating Parameters

Overview

This section defines the operating parameters and limitations for 3232 with regard to input speeds and pressures. For actual parameter data, refer to the *operating parameters table* in the Technical Specifications section.

Input / Output Speed

Minimum speed is the lowest input speed recommended during engine idle condition. Operating below minimum speed limits pump's ability to maintain adequate flow for lubrication and power transmission.

Rated speed is the highest input speed recommended at full power condition. Operating at or below this speed should yield satisfactory product life.

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

Operating conditions between rated speed and maximum speed should be restricted to less than full power and to limited periods of time. For most drive systems, maximum unit speed occurs during downhill braking or negative power conditions.

⚠️ **Warning**

Unintended vehicle or machine movement hazard.

Exceeding maximum speed may cause a loss of hydrostatic drive line power and braking capacity. An independent braking system is required, redundant to the hydrostatic transmission, which is sufficient to stop and hold the vehicle or machine under all conditions of operation in the event of hydrostatic drive power loss.

System Pressure

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

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 (peak) is the highest intermittent pressure allowed under any circumstances. Applications with applied pressures between maximum working and maximum intermittent require factory approval with complete application, duty cycle, and life expectancy analysis.

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

Input Power

Maximum continuous input power is the highest recommended input power to HST.

Charge Pressure

An internal charge relief valve regulates charge pressure. Charge pressure maintains a minimum pressure in the low side of the transmission loop. Charge pressure is the differential pressure above case pressure.

Minimum charge pressure is the lowest pressure safe working conditions allow in the system.

Operating Parameters

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.

> ❗ **Caution**
>
> **Possible component damage or leakage**
> Operation with case pressure in excess of stated limits may damage seals, gaskets, and/or housings, causing external leakage. Performance may also be affected since charge and system pressure are additive to case pressure.

Viscosity

Maintain fluid viscosity within the recommended range for maximum efficiency and bearing life. **Minimum viscosity** should only occur during brief occasions of maximum ambient temperature and severe duty cycle operation. **Maximum viscosity** should only occur at cold start. Limit speeds until the system warms up. Refer to the *fluid specifications table*.

Temperature

1. Maintain fluid temperature within the limits shown in the Technical Specification section.

   Minimum temperature relates to the physical properties of the component materials. Cold oil may affect the ability of the transmission to provide flow and transmit power.

   Continuous temperature should not be exceeded for longer than 2 minutes (single event) or for more than 2% of the application duty cycle. Operating the unit at or below continuous temperature should yield satisfactory unit life. The application's cooling system shall be designed to maintain the oil temperature below the continuous temperature limit.

   Maximum intermittent temperature: is based on material properties. Don't exceed it.

2. Measure maximum temperature at the hottest point in the system.

   Refer to the *fluid specifications table* for data.

3. Ensure fluid temperature and viscosity limits are concurrently satisfied.

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 after transport.

Filtration strategies include suction or pressure filtration. The selection of a filter 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[1] (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. Please see *Design Guidelines for Hydraulic Fluid Cleanliness Technical Information,* **BC152886482150** for more information.

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

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[1] 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.

Technical Information
3232 Closed Circuit Axial Piston Transmission

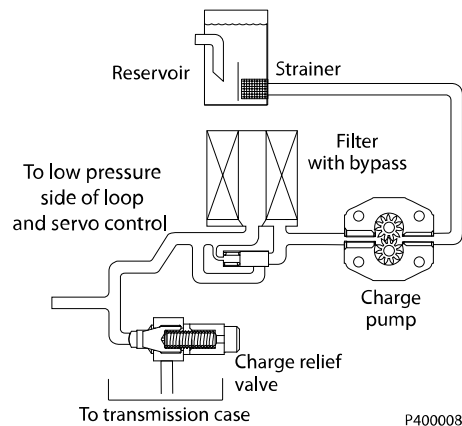## System Design Parameters

Filtration

Charge Filtration

The pressure filter is remotely mounted in the circuit after the charge pump, as shown in the accompanying illustration.

Filters used in charge pressure filtration circuits must be rated to at least 34.5 bar [500 psi] pressure. Danfoss recommends locating a 100 - 125 μm screen in the reservoir or in the charge inlet line when using charge pressure filtration.

A filter bypass valve is necessary to prevent damage to the system. In the event of high pressure drop associated with a blocked filter or cold start-up conditions, fluid will bypass the filter. Avoid working with an open bypass for an extended period. We recommend a visual or electrical bypass indicator. Proper filter maintenance is mandatory.
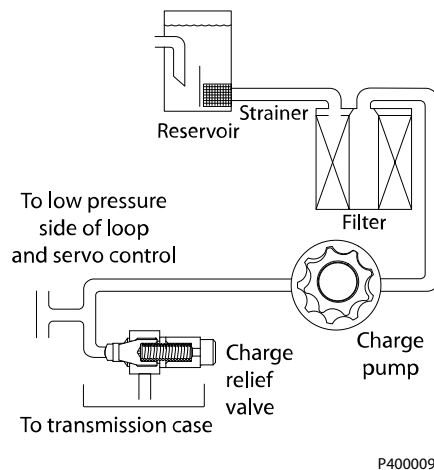
Charge filtration

Suction Filtration

The suction filter is placed in the circuit between the reservoir and the inlet to the charge pump as shown in the accompanying illustration.

Suction filtration

System Design Parameters

Independent Braking System

Vehicle propel applications may require a provision for non-linear control input to reduce control sensitivity near neutral. Damping or frictional forces may be necessary to produce the desired control feeling.

These units do not include any neutral centering device for the swashplate. It is necessary to provide a force in the machine's control system that will hold the swashplate at the desired angle. A "fail safe" which will return the swashplate to the neutral in the event of linkage failure is recommended.

It is necessary for the application to have an independent braking system which is capable of stopping the vehicle in all working conditions. In the event of control linkage or direct displacement control sub-system failure (trunnion shaft, bearings, carriers, etc.), the independent braking system must be capable of stopping the vehicle which may be operating at full hydrostatic load.

⚠ **Warning**

Unintended vehicle or machine movement hazard.

The loss of hydrostatic drive line power, in any mode of operation (forward, neutral, or reverse) may cause the system to lose hydrostatic braking capacity. An independent braking system is required, redundant to the hydrostatic transmission, which is sufficient to stop and hold the vehicle or machine under all conditions of operation in the event of hydrostatic drive power loss.

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 the components.

❗ **Caution**

Never mix hydraulic fluids of different types.

Reservoir

The hydrostatic system reservoir should accommodate maximum volume changes during all system operating modes and promote 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 fluid dwell for removing entrained air at the maximum return flow. This is usually adequate to allow for a closed reservoir (no breather) in most applications.

Locate the reservoir outlet (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 μm screen over the outlet port is recommended.

Position the reservoir inlet (fluid return) to discharge below the normal fluid level, toward the interior of the tank. A baffle (or baffles) will further promote de-aeration and reduce surging of the fluid.

Case Drain

A case drain line must be connected to one of the case outlets to return internal leakage to the system reservoir. Use the higher of the outlets to promote complete filling of the case and ensure that the housing remains full of oil at all times.

Since case drain fluid is typically the hottest fluid in the system, it is a good idea to return this flow to the reservoir via the heat exchanger

System Design Parameters

Charge Pump

Charge flow is required on 3232. The charge pump provides flow to make up for system leakage, maintain a positive pressure in the main circuit, and provide flow for cooling and filtration.

Many factors influence the charge flow requirements and the resulting charge pump size selection. These factors include system pressure, pump input speed, pump swashplate angle, type of fluid, temperature, length and size of hydraulic lines, etc.

Bearing Loads and Life

Bearing life is a function of speed, system pressure, charge pressure, and swashplate angle, plus any external side or thrust loads. The influence of swashplate angle includes displacement as well as direction. External loads are found in applications where the pump is driven with a side/thrust load (belt or gear) as well as in installations with misalignment and improper concentricity between the pump and drive coupling. All external side loads will act to reduce the normal bearing life of a pump. Other life factors include oil type and viscosity.

Applications with External Shaft Loads

The 3232 is designed with bearings that can accept some external radial and thrust loads. When external loads are present, the allowable radial shaft loads are a function of the load position relative to the Housing surface, 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. Optimum pump orientation is a consideration of the net loading on the shaft from the external load, the pump rotating group.

- In applications where the pump is operated such that nearly equal amounts of forward vs. reverse swashplate operation is experienced; bearing life can be optimized by orientating the external side load at 90° or 270° such that the external side load acts 90° to the rotating group load (for details see drawing below).
- In applications where the pump is operated such that the swashplate is predominantly (> 75 %) on one side of neutral (ie vibratory, conveyor, typical propel), bearing life can be optimized by orientating the external side load opposite of the internal rotating group load. The direction of internal loading is a function of rotation and which system port has flow out.
- The 3232 is designed with bearings that can accept some thrust load such that incidental thrust loads are of no consequence. When thrust loads are anticipated the allowable load will depend on many factors and it is recommended that an application review be conducted.

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

Thrust loads should be avoided. Contact your Danfoss representative to discuss applications where thrust loads are anticipated.
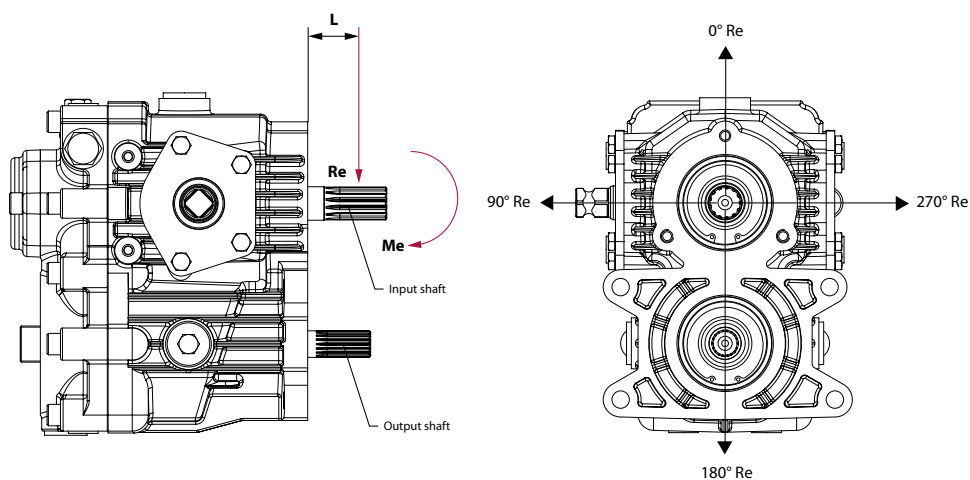
System Design Parameters

Input Shaft

The **maximum allowable radial load (Re)** is based on the maximum external moment (Me) and the distance (L) from the mounting flange to the load. It is shown in the chart below.

Re = Me / L

Me	Shaft moment
L	Flange distance
Re	External force to the shaft

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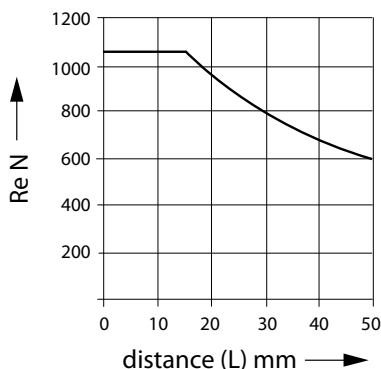
P400011

Danfoss recommends clamp-type couplings for applications with radial shaft loads

Contact your Danfoss representative for an evaluation of unit bearing life if you have continuously applied external loads exceeding 25 % of the maximum allowable radial load (Re) or the pump swashplate is positioned on one side of center all or most of the time.

Output shaft

Avoid any load in either direction.

System Design Parameters

Shaft Torque Rating and Spline Lubrication

Maximum torque ratings are based on torsional fatigue strength considering 100,000 full load reversing cycles. However, a spline running in an oil-flooded environment provides superior protection from oxygen in addition to contaminant flushing. The rated torque of a flooded spline can increase to that of the maximum published rating. A flooded spline would be indicative of a pump driven by a pump drive or plugged into an auxiliary pad of a pump.

Maintaining a spline engagement at least equal to the pitch diameter will also maximize spline life. Spline engagements of less than ¾ pitch diameter are subject to high contact stress and spline fretting.

Shaft Availability

Alignment between the mating spline's pitch diameters is another critical factor in determining the operating life of a splined drive connection. *Plug-in*, or *rigid* spline drive installations can impose severe radial loads on the shaft. The radial load is a function of the transmitted torque and shaft eccentricity. Increased spline clearance will not totally alleviate this condition, but increased spline clearance will prevent mechanical interference due to misalignment or radial eccentricity between the pitch diameters of the mating splines. Maximize spline life by adding an intermediate coupling between the bearing supported splined shafts.

System Design Parameters

Sizing Equations

The following equations are helpful when sizing hydraulic transmissions. Generally, the sizing process is initiated by an evaluation of the machine system to determine the required transmission speed and torque to perform the necessary work function. Refer to *Selection of drive line components*, BC157786484430, for a more complete description of hydrostatic drive line sizing.

	Based on SI units		**Based on US units**	
Input torque	$M_p = \dfrac{V_{gp} \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mp}}$	Nm	$M_p = \dfrac{V_{gp} \cdot \Delta p}{2 \cdot \pi \cdot \eta_{mp}}$	[lbf•in]
Input power	$P_p = \dfrac{M_p \cdot n_p}{9550}$	kW	$P_p = \dfrac{V_{gp} \cdot n_p \cdot \Delta p}{396\,000 \cdot \eta_{tp}}$	[hp]
Output torque	$M_m = \dfrac{V_{gm} \cdot \Delta p \cdot \eta_{mm}}{20 \cdot \pi}$	Nm	$M_m = \dfrac{V_{gm} \cdot \Delta p \cdot \eta_{mm}}{2 \cdot \pi}$	[lbf•in]
Output power	$P_m = \dfrac{M_m \cdot n_m}{9550}$	kW	$P_m = \dfrac{V_{gm} \cdot n_m \cdot \eta_{tm}}{396\,000}$	[hp]

Where;

V_{gp}	Pump displacement per rev. cm³ [in³]
V_{gm}	Motor displacement per rev. cm³ [in³]
Δ_p	$p_{HD} - p_{ND}$ bar [psi]
η_{mp}	Pump Mechanical-hydraulic (Torque) efficiency
η_{mm}	Motor Mechanical-hydraulic (Torque) efficiency
η_{tp}	Pump Overall efficiency
η_{tm}	Motor Overall efficiency
p_{HD}	High pressure bar [psi]
p_{ND}	Low pressure bar [psi]
n_p	Input speed
n_m	Output speed

Model Code

Model Code: A - H
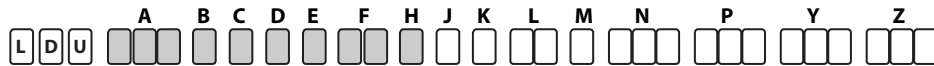
A - Displacement

Code	Description
32U	31.5 cc/rev displacement at maximum angle, U-shaft configuration, Mounting location: Housing

B - Pump Rotation

Code	Description
L	Counter-Clockwise rotation viewing from input shaft (CCW)
R	Clockwise rotation viewing from input shaft (CW)

C - Valve Plate Pump

Code	Description
A	Standard neutral seeking
B	High neutral seeking

D - Control Arm Position

Code	Description
L	Left-hand side viewing from input shaft (when pump located upside)
R	Right-hand side viewing from input shaft (when pump located upside)

E - Control Arm

Code	Description
D	M10 x2 with Detent
K	20mm OD Straight Keyed
S	17mm Square

F - Pump Shaft (Input/PTO Shaft)

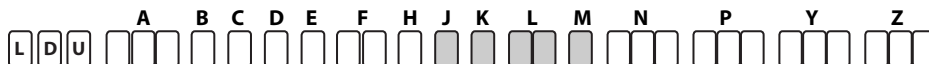| Code	Description
JA	JIS 25x18x1.25 (Input), None (PTO)
JB	JIS 25x18x1.25, short (Input), None (PTO)
JN	JIS 25x13x1.667 (Input), None (PTO)

H - Output Shaft

Code	Description
B	JIS 20x18x1.0
F	JIS 25x18x1.25 w/ groove

Model Code

Model Code: J - M

J - Centersection

Code	Description
J	Drain port: None (7/8-UNF on housing only), Charge port: None, Suction filter for charge pump
R	Drain port: None (7/8-UNF on housing only), Charge port: G1/2, Remote filter for charge pump

K - Charge Pump Displacement

Code	Description
6	6 cc/rev

L - Charge Relief Setting

Code	Description
05	5 bar
08	8 bar

M - Bypass Valve

Code	Description
N	None

Model Code

Model Code: N - Z

| | | A | B | C | D | E | F | H | J | K | L | M | N | P | Y | Z |
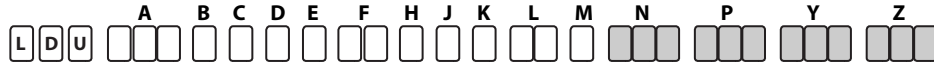
N - Check & Relief Valve (Left-hand side viewing from Housing)

Code	Description
14N	High Pressure Relief Valve 140 bar
14A	High Pressure Relief Valve 140 bar w/ orifice
17N	High Pressure Relief Valve 175 bar
17A	High Pressure Relief Valve 175 bar w/ orifice
21N	High Pressure Relief Valve 210 bar
23N	High Pressure Relief Valve 230 bar
25N	High Pressure Relief Valve 250 bar
28N	High Pressure Relief Valve 280 bar
30N	High Pressure Relief Valve 300 bar

P - Check & Relief Valve (Right-hand side viewing from Housing

Code	Description
14N	High Pressure Relief Valve 140 bar
14A	High Pressure Relief Valve 140 bar w/ orifice
17N	High Pressure Relief Valve 175 bar
17A	High Pressure Relief Valve 175 bar w/ orifice
21N	High Pressure Relief Valve 210 bar
23N	High Pressure Relief Valve 230 bar
25N	High Pressure Relief Valve 250 bar
28N	High Pressure Relief Valve 280 bar
30N	High Pressure Relief Valve 300 bar

Y - Special Hardware Features

Code	Description
SNN	Housing configuration: Small flange, pilot dia. 62
NNN	Housing configuration: Standard

Z - Paint and Tag

Code	Description
BNN	Black Paint, Danfoss Logo
NNN	No Paint, Danfoss Logo

Installation Drawings

Installation Drawings 3232
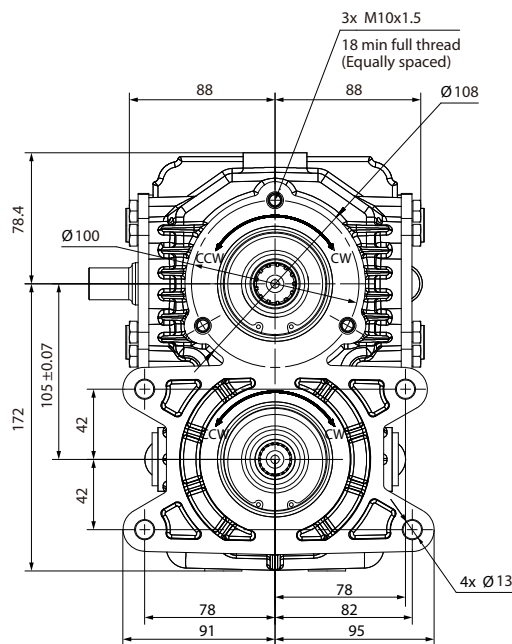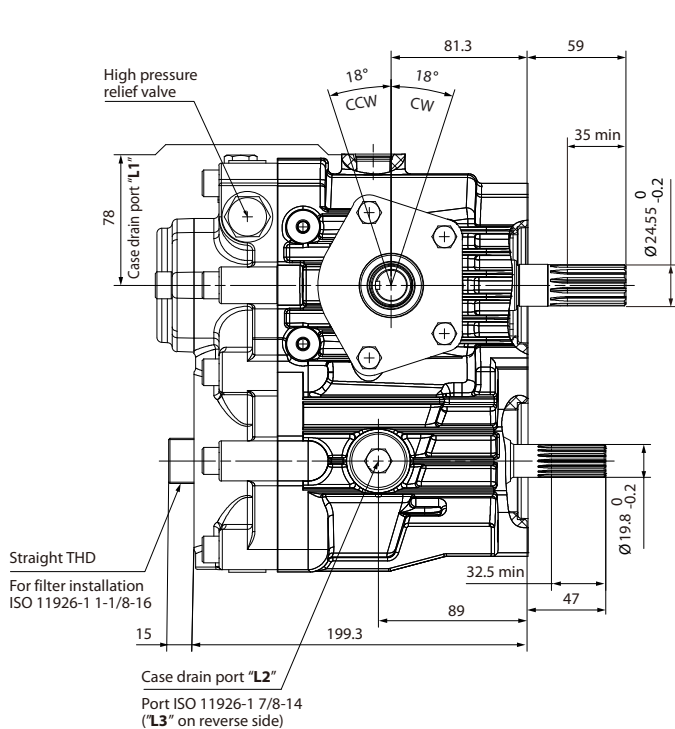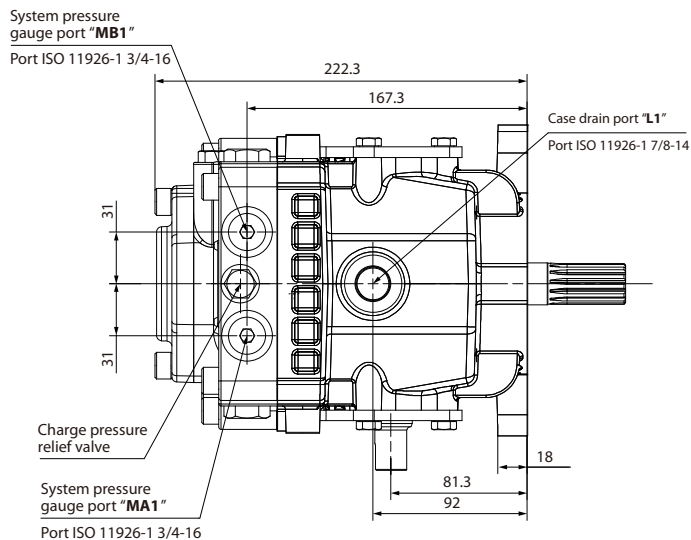
P400812

Input shaft rotation	CW		CCW	
Control arm location	Left			
Control arm rotation	CW	CCW	CW	CCW
Output rotation	CCW	CW	CW	CCW
High pressure port	MB	MA	MA	MB
Low pressure port	MA	MB	MB	MA

Installation Drawings

High pressure relief valve

188.3

22

Name tag
Paint free

111.5

Full R

168.5

Suction port "**S**"

4.76 $^{+0.03}_{0}$

Ø 19.05 $^{+0.012}_{0}$

14

Charge pressure gauge port "**M3**"
Port ISO 11926-1 7/16-20

Ø 104

System pressure gauge port "**MB2**"
Port ISO 11926-1 3/4-16

180.3

31

31

Suction port "**S**"
Port ISO 11926-1 7/8-14

System pressure gauge port "**MA2**"
Port ISO 11926-1 3/4-16
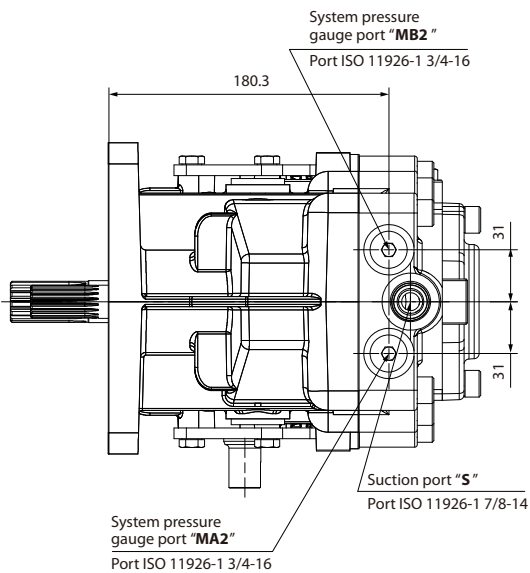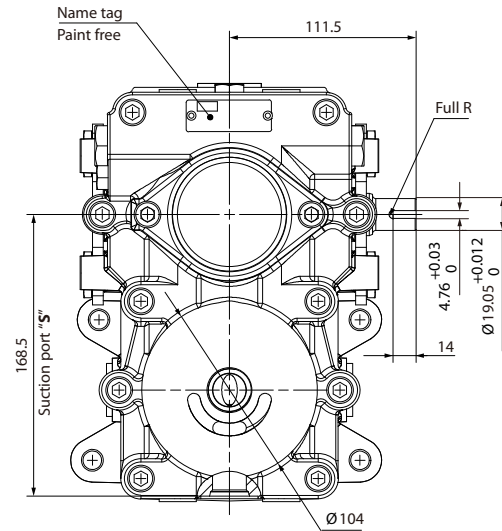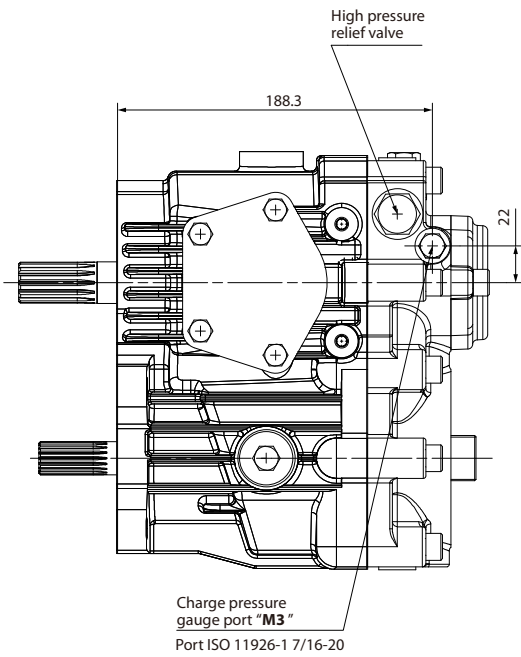
P400813

Installation Drawings

Shaft Availability and Torque Ratings: Input Shaft

Input shaft

Option	Spline	Torque Rating N•m [lbf•in]	
		Rated Torque	**Maximum Torque**
JA	JIS 25x18x1.25 (Input), None (PTO)	264 [2336.6]	672 [5947.7]

Spline data
Number of teeth : 18
Module   : 1.25
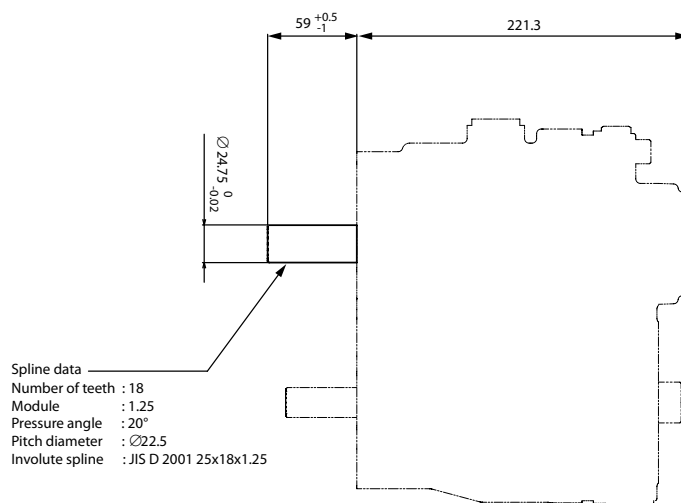Pressure angle : 20°
Pitch diameter : ⌀22.5
Involute spline : JIS D 2001 25x18x1.25

P400808

Option	Spline	Torque Rating N•m [lbf•in]	
		Rated Torque	**Maximum Torque**
JB	JIS 25x18x1.25, Short (Input), None (PTO)	264 [2336.6]	672 [5947.7]

Spline data
Number of teeth : 18
Module   : 1.25
Pressure angle : 20°
Pitch diameter : ⌀22.5
Involute spline : JIS D 2001 25x18x1.25
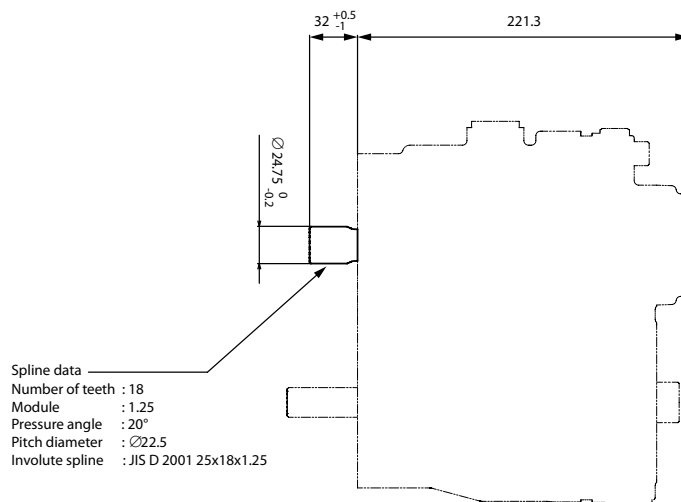
P400809

Installation Drawings

Option	Spline	Torque Rating N•m [lbf•in]	
		Rated Torque	**Maximum Torque**
JN	JIS 25x13x1.667 (Input), None (PTO)	230 [2035.67]	584 [5168.84]

Spline data
Number of teeth : 13
Module : 1.667
Pressure angle : 20°
Pitch diameter : ∅21.667
Involute spline : JIS D 2001 25x13x1.667
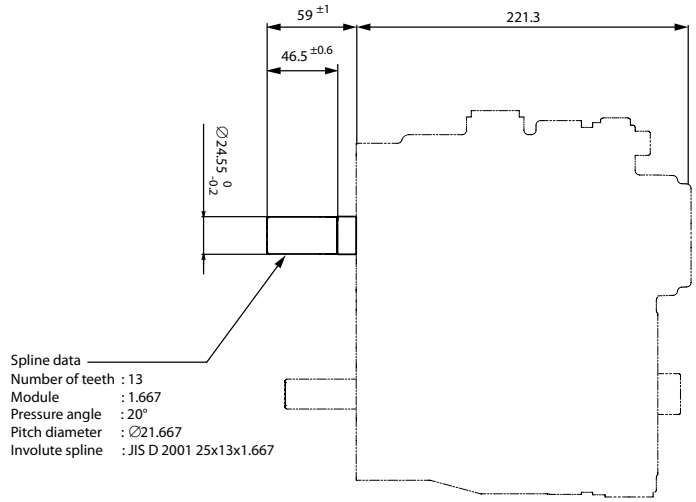
P400807

Installation Drawings

Shaft Availability and Torque Ratings: Output Shaft

Output Shaft

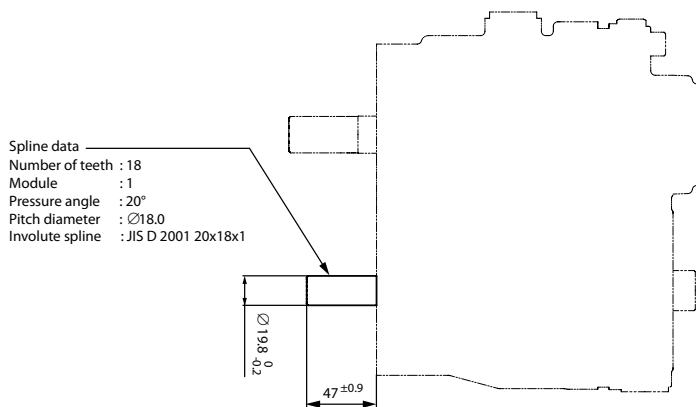| Option	Spline	Torque Rating N•m [lbf•in]	
		Rated Torque	**Maximum Torque**
B	JIS 20x18x1.0	135 [1194.85]	344 [3044.66]

Spline data
Number of teeth : 18
Module : 1
Pressure angle : 20°
Pitch diameter : ∅18.0
Involute spline : JIS D 2001 20x18x1

$\varnothing 19.8 \, ^{0}_{-0.2}$

$47 \, ^{\pm 0.9}$

P400810

Option	Spline	Torque Rating N•m [lbf•in]	
		Rated Torque	**Maximum Torque**
F	JIS 25x18x1.25 w/ groove	264 [2336.6]	672 [5947.7]

Spline data
Number of teeth : 18
Module : 1.25
Pressure angle : 20°
Pitch diameter : ∅22.5
Involute spline : JIS D 2001 25x18x1.25

$\varnothing 24.75 \, ^{0}_{-0.02}$

$\varnothing 22.9 \, ^{0}_{-0.21}$

3.5

$1.35 \, ^{+0.14}_{0}$

$47 \, ^{\pm 0.7}$
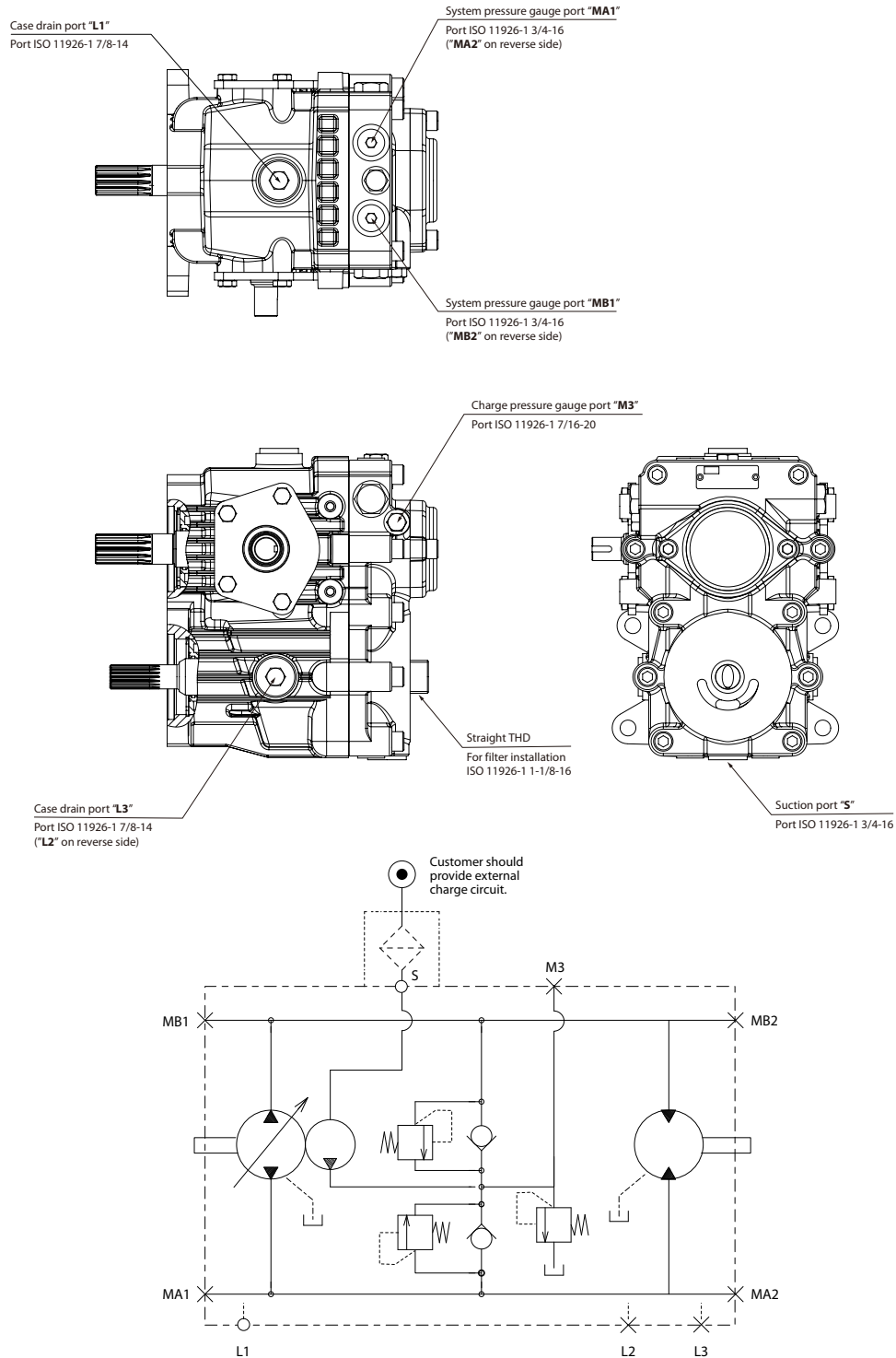
$53 \, ^{\pm 0.5}$
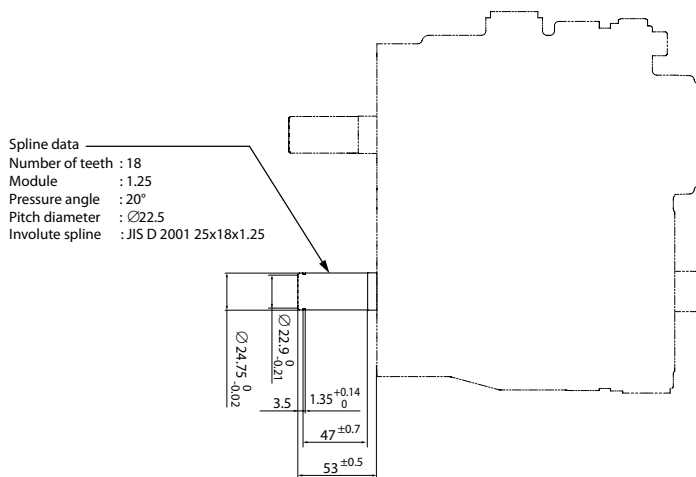
P400811

Installation Drawings

Center Section: Option J

Drain port: None (7/8-UNF on housing only)

Charge port: None (Suction filter for charge pump)

Case drain port "**L1**"
Port ISO 11926-1 7/8-14

System pressure gauge port "**MA1**"
Port ISO 11926-1 3/4-16
("**MA2**" on reverse side)

System pressure gauge port "**MB1**"
Port ISO 11926-1 3/4-16
("**MB2**" on reverse side)

Charge pressure gauge port "**M3**"
Port ISO 11926-1 7/16-20

Straight THD
For filter installation
ISO 11926-1 1-1/8-16

Case drain port "**L3**"
Port ISO 11926-1 7/8-14
("**L2**" on reverse side)

Suction port "**S**"
Port ISO 11926-1 3/4-16

Customer should
provide external
charge circuit.

S

M3

MB1   MB2

MA1   MA2

L1   L2   L3
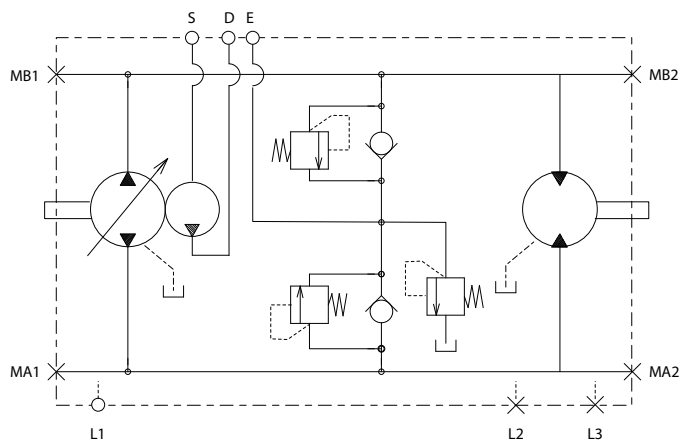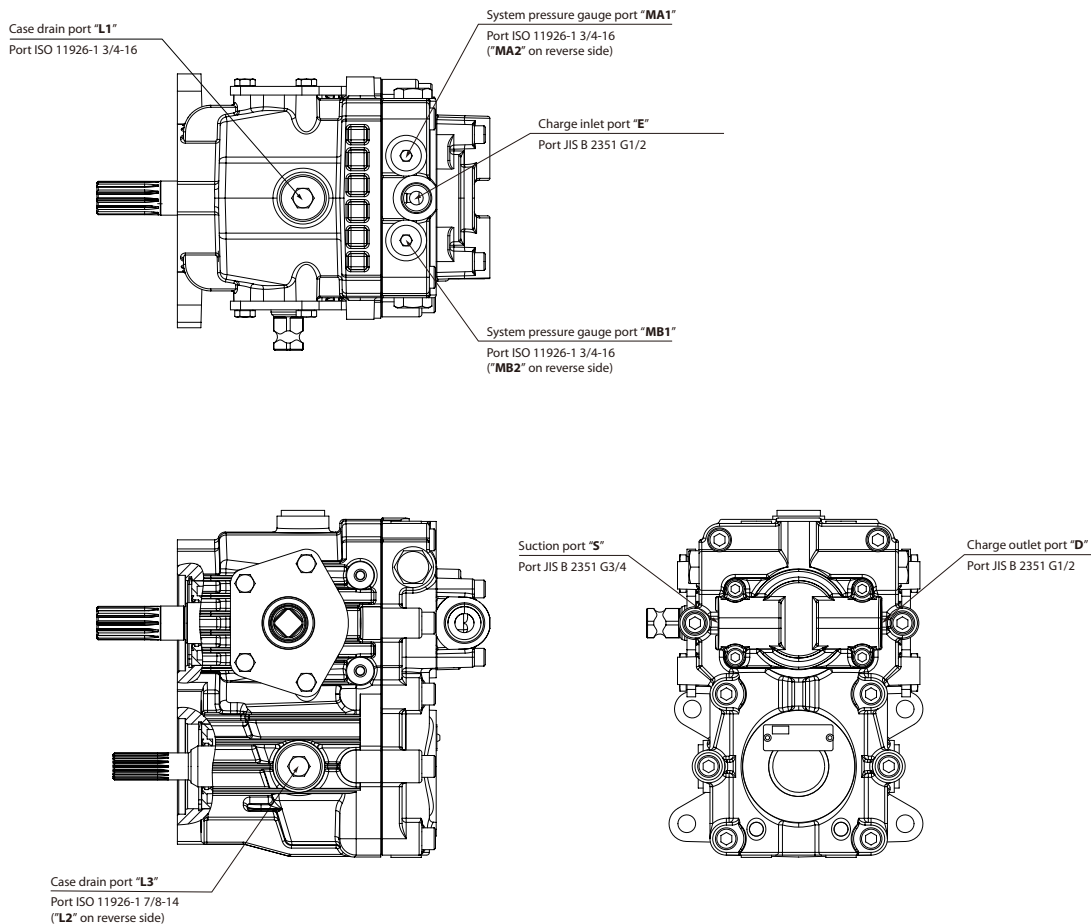
P400814

Installation Drawings

Center Section: Option R

Drain port: None (7/8-UNF on housing only)

Charge port: G1/2 (Remote filter for charge pump)

Case drain port "**L1**"
Port ISO 11926-1 3/4-16

System pressure gauge port "**MA1**"
Port ISO 11926-1 3/4-16
("**MA2**" on reverse side)

Charge inlet port "**E**"
Port JIS B 2351 G1/2

System pressure gauge port "**MB1**"
Port ISO 11926-1 3/4-16
("**MB2**" on reverse side)

Case drain port "**L3**"
Port ISO 11926-1 7/8-14
("**L2**" on reverse side)

Suction port "**S**"
Port JIS B 2351 G3/4

Charge outlet port "**D**"
Port JIS B 2351 G1/2

P400815

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