ENGINEERING
TOMORROW

Technical Information

LDU20/24
Closed Circuit Axial Piston Transmission

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Revision history

Table of revisions

Date	Changed	Rev
March 2024	Updated check & relief valve on model code	0304
June 2023	Minor correction	0303
June 2023	Fixed typo	0302
May 2021	Added Size 24	0301
January 2021	Minor update in Physical Properties	0208
December 2020	Minor correction	0207
Novemebr 2020	Minor update	0206
June 2020	Changed document number from 'BC00000192' and 'L1124546' to 'BC152886483777'	0205
April 2019	Fixed Control Handle Requirements	0103
April 2018	Minor update	0102
June 2016	Converted to New Danfoss layout	0101
December 2014	Converted to DITA CMS	AD
March 2013	Paint and Tag	AC
March 2011	2nd edition	AB
January 2011	First edition	AA

Contents

General Description

Basic Design

LDU 20/24 is a U-style hydrostatic transmission with Z-shaft configuration, including a closed circuit variable displacement piston pump with DDC (direct displacement control) and a fixed motor. LDU 20/24 is specially designed with optimized performance, size, and cost, in order to fulfill the demand of the mobile applications marketplace. This document provides the detailed specifications and features for LDU 20/24.

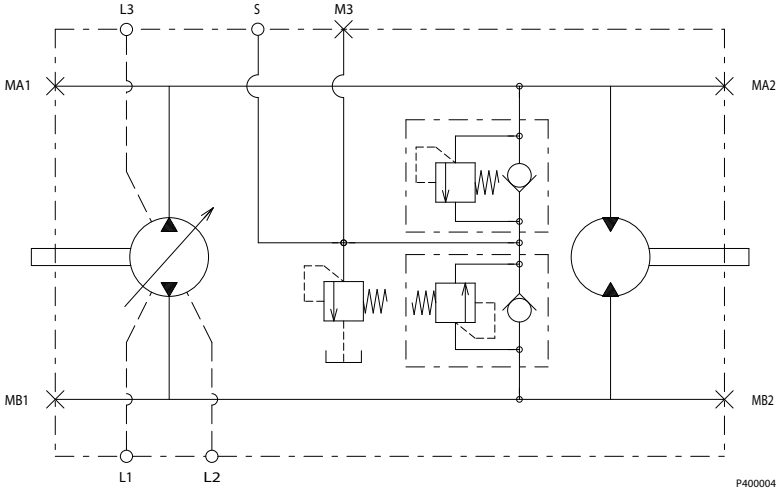
Key Features

- Easy to use design as a complete hydrostatic transmission package for turf care machines & Compact Utility Tractors up to 26 kw [35 PS]
- Compact design
- Single housing with Z-shaft configuration
- Requires external charge flow
- Bypass valve to allow the vehicle to be towed
- Same shaft center distance as BDU21 85mm…Between pump and motor shaft
- Same drive line design is available between BDU21 and LDU20/24
- Best in class efficiency, utilizing female piston and male slipper design; overall efficiency of approximately 80% is possible
- Improved kit life, higher duty cycle capability while providing the most compact design in this class of hydrostatic transmission
- Low trunnion operating force
- Serviced by Danfoss' global network

Typical Applications

- Compact utility tractor

Schematic diagram



Technical Specification

Physical properties

Features		Units	LDU20	LDU24
Displacement	Pump side[1]	cm^3/rev [in^3/rev]	0-20 [0-1.22]	0-24 [0-1.46]
	Motor side		20 [1.22]	24 [1.46]
Recommended charge pump displacement for external charge supply		cm^3/rev [in^3/rev]	6 [0.37]	
Torque at maximum displacement (theoretical)		N•m/bar [lbf•in/1000 psi]	0.32 [195.2]	0.38 [234.2]
Mass moment of inertia of rotating components	Pump side	kg•m^2 [slug•ft^2]	0.000936 [0.000693]	
	Motor side		0.000928 [0.000683]	
Weight dry		kg [lb]	14.1 [31.1]	
Oil volume	Case only	liter [US gal]	1.1 [0.28]	
	With passage		1.2 [0.32]	
Installation			See *Installation Drawings* on page 25-30	
Rotation			Clockwise or Counterclockwise	
Ports (ISO 11926-1)			See *Installation Drawings* on page 25-30	
Input shafts and PTO shafts			See *Installation Drawings* on page 23	
Output shaft			See *Installation Drawings* on page 24	
Control type			DDC	

[1] Max Swash angle is 18 deg.

Operation Parameters

Features		Units	LDU20	LDU24
Input speed	Minimum for external charge supply	min^{-1} (rpm)	500	
	Minimum for full performance		1300	
	Rated		3400	
	Maximum		3800	
System pressure	Maximum working pressure	bar [psi]	300 [4350]	
	Maximum pressure		345 [500]	
Input power	Maximum	kw [PS]	22 [30]	26 [35]
Charge pressure	Minimum	bar [psi]	5 [73]	
Case pressure	Rated	bar [psi]	1 [14.5]	
	Maximum		3 [43.5]	

Technical Specification

Fluid Specifications

Features		Units	LDU20/24
Viscosity	Minimum	$mm^2/sec.$ [SUS]	7 [49]
	Recommended range		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)		β15-20=75(β10≥10)
	Recommended inlet screen mesh size	µm	100-125

Operations

Check / High Pressure Relief Valve

LDU 20/24 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 or into the transmission case via charge pressure relief valve (CPRV).

Caution

The High Pressure Relief Valve (HRPV) function is intended for short duration over-pressure protection / regulation only.

Check/High Pressure Relief Valve with Orifice

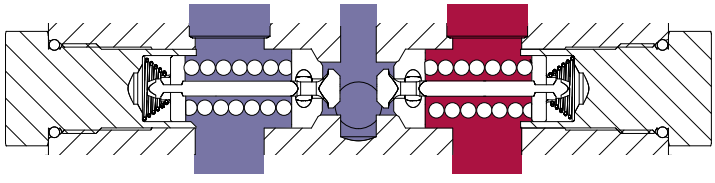
Check/High pressure relief valve with orifice

As an option, LDU 20/24 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 null 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 null 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	5 l/min [1.3 US gal/min]
Check/HPRV with orifice	17 l/min [4.5 US gal/min]



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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.

Caution

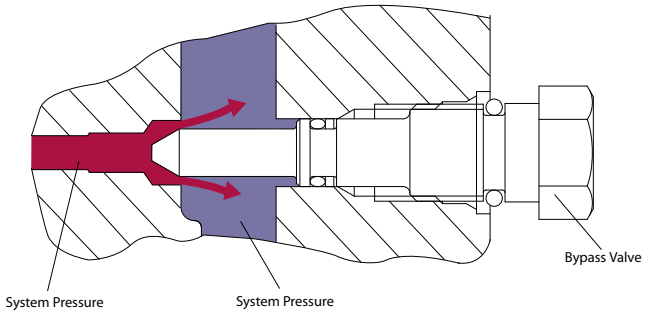
The High Pressure Relief Valve (HRPV) function is intended for short duration over-pressure protection / regulation only.

Operations

Bypass Function

The LDU20/24 contains a dedicated bypass valve option. The bypass function is activated when the bypass valve is mechanically backed out 3 full turns (maximum). The bypass function allows a machine or load to be moved without rotating the pump shaft or prime mover. In some applications, it is desirable to bypass the fluid around the variable displacement pump when pump shaft rotation is unachievable or undesired. To illustrate, an inoperable vehicle may need to be moved to the service or the repair location, or winched onto a trailer without operating the prime mover. Thus, LDU20/24 is designed with the bypass function as an option.

Bypass Function



Caution

Excessive speed or extended movement will damage the transmission.

Avoid excessive speeds and extended load/vehicle movement. Do not move the load or vehicle more than 20 % of maximum speed or for longer than 3 minutes. When the bypass function is no longer needed, reseat the bypass valve to the normal operating position.

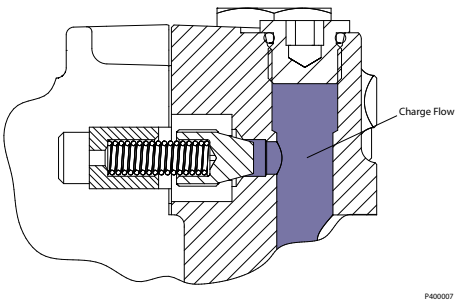
CPRV (Charge Pressure Relief Valve)

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. For external charge flow the CPRV is set according to below table. The charge pressure relief valve setting is specified on the model code of the pump.

Charge Pressure Relief Valve settings for external charge supply

	Flow, l/min [US gal/min]
LDU 20/24	10.8 [2.9]

Charge Pressure Relief Valve Function



Operations

Control

Direct Displacement Control

The LDU 20/24 features direct displacement control (DDC).The swashplate angle is set directly by a control lever or linkage attached directly to the swashplate trunnion. Control lever movement changes the speed and rotating direction of the motor by increasing or decreasing the swashplate angle.

Control Handle Requirements

Maximum allowable trunnion 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 25 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 LDU20/24* on page 24.

Input shaft rotation	CW				CCW			
Trunnion location	Right		Left		Right		Left	
Trunnion rotation	CW	CCW	CW	CCW	CW	CCW	CW	CCW
Output rotation	CCW	CW	CW	CCW	CW	CCW	CCW	CW
High pressure port	MA	MB	MB	MA	MB	MA	MA	MB
Low pressure port	MB	MA	MA	MB	MA	MB	MB	MA

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 LDU 20/24 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 excluding PTO output power.

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

[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.

System Design Parameters

Filtration

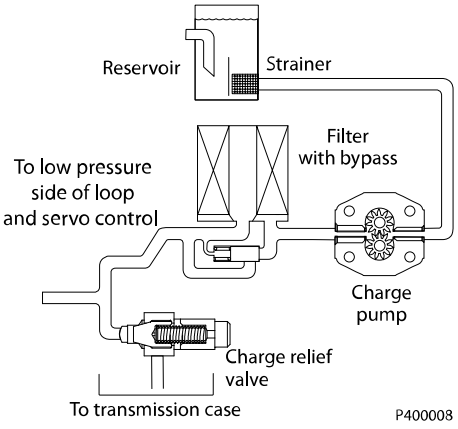
Charge Filtration

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.

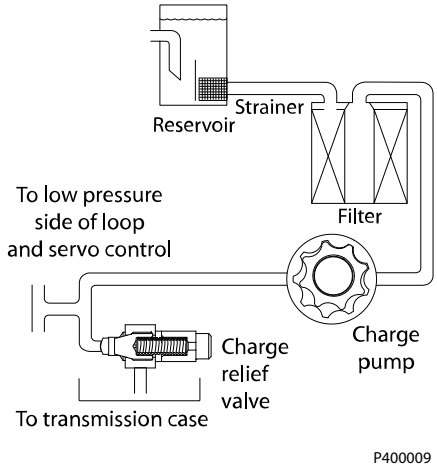
Charge filtration



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 requirements for the LDU 20/24 should be equivalent to a 6-8cc/rev charge pump, depending on pump input speed. Charge flow must not exceed 30 l/min.

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

LDU 20/24 is designed with bearings that can accept external radial and, in some cases, axial (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. Pump orientation is also a consideration to alleviate net loading on the shaft from the external load.

- 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.
- LDU 20/24 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.

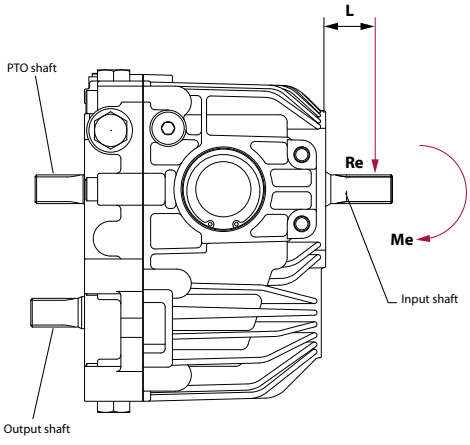
System Design Parameters

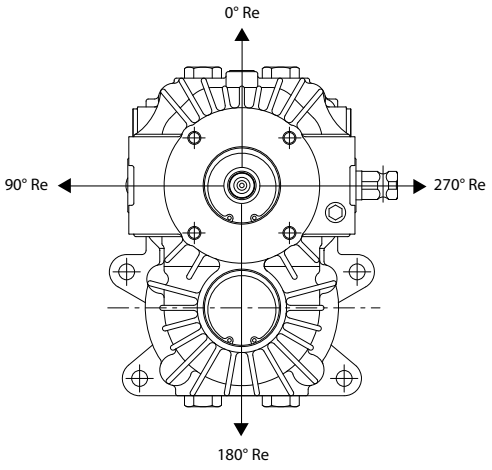
Input Shaft

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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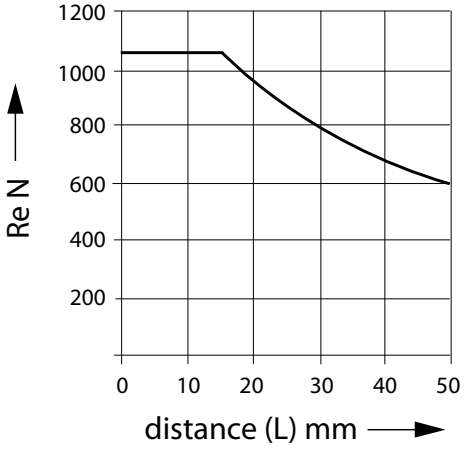

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Danfoss recommends clamp-type couplings for applications with radial shaft loads

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.

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

Where;

V_{gp} Pump displacement per rev. cm^3 [in^3]

V_{gm} Motor displacement per rev. cm^3 [in^3]

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
20D	Displacement: 20 cc/rev / Block type : standard Block
24D	Displacement: 24 cc/rev / Block type : standard Block

B - Rotation

Code	Description
L	Left hand side viewing from input shaft (CCW)
R	Right hand side viewing from input shaft (CW)

C - Valve Plate

Code	Description
A	Standard

D - Control Arm Position

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

E - Control Arm Configuration

Code	Description
S	Square

F - Pump Shaft Configuration (Input Shaft/PTO Shaft)

Code	Description
JJ	JIS 14T (Input) / JIS 14T (PTO)
AA	ANSI 16/32-13T (Input) / ANSI 16/32-13T (PTO)

H - Output Shaft Configuration)

Code	Description
J	JIS 14T
A	ANSI 16/32-13T

Model Code

Model Code: J - M

J - Centersection Configuration

Code	Description			
	Drain port: 9.8mm on centersection (A) Charge port : 9.8mm on centersection(A)		Drain port: 3/4-16 drain port on housing Charge port : 9/16-18 on centersection	
	Without Bypass valve	With Bypass valve on left valve	Without Bypass valve	With Bypass valve on left side
A	X			
B			X	
F		X		
H				X

(A) Connect charge inlet and drain line directly from LDU20 centersection with trans axle. See *Installation Drawings* on page 27-30 for detail.

K - Charge Pump Displacement

Code	Description
N	None

L - Charge Relief Setting

Code	Description
07	7 bar at 10.8 l/min [102 psi at 2.9 US gal/min]

M - Bypass Valve

Code	Description
N	None
C	w/Bypass Valve Left hand side

Model Code

Model Code: N - Z

N - Check & Relief Valve Side A

P - Check & Relief Valve Side B

The following two tables are used to selection for ports “A” and “B”

(Orifice must not be used for both side (A or B))

****N**	Check & Relief valve without orifice
14N	140 bar [2030 psi]
17N	175 bar [2538 psi]
21N	210 bar [3045 psi]
23N	230 bar [3285 psi]
25N	250 bar [3625 psi]
28N	280 bar [4060 psi]
30N	300 bar [4351 psi]
32N[1]	325 bar [4713 psi]
34N[1]	345 bar [5003 psi]
00N	Poppet type check valve

[1] Duty cycle analysis and Factory approval is needed. See Maximum Pressure in *System Pressure* on page 10.

****A**	Check & Relief valve with orifice (∅0.85)
14A	140 bar [2030 psi]
17A	175 bar [2538 psi]
21A	210 bar [3045 psi]

Y - Special Hardware Features

Code	Description
NNN	Housing Configuration : Standard

Z - Paint and Tag

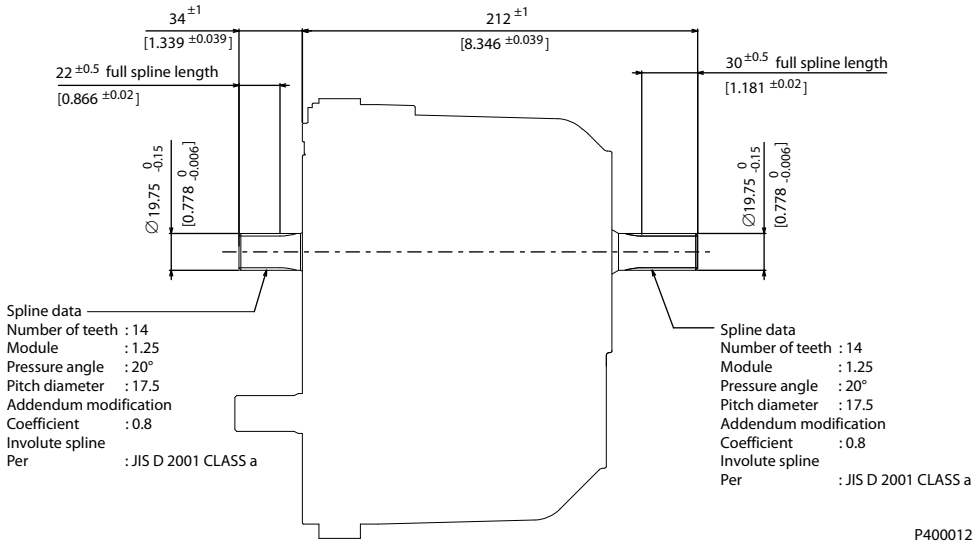
Code	Description
NNN	No Paint (corrosion protection), Danfoss Logo
NAN	No Paint (corrosion protection), Daikin Logo
BNN	Black Paint, Danfoss Logo
BAN	Black Paint, Daikin Logo

Installation Drawings

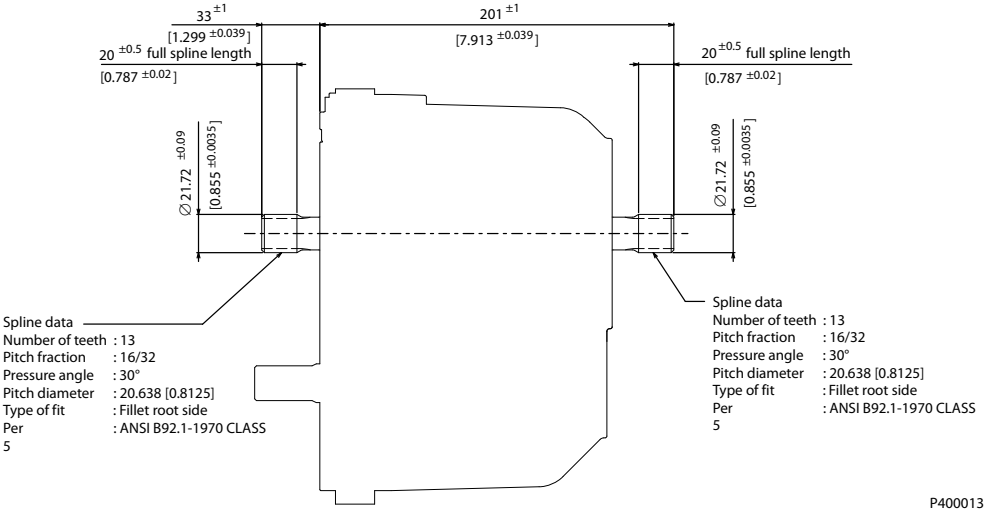
Shaft Availability and Torque Ratings: Input Shaft/PTO Shaft

Input shaft/PTO Shaft

Option	Spline	Torque Rating N•m [lbf•in]	
		Rated Torque	Maximum Torque
JJ	14 teeth, 1.25 module (Input)	122 [1080]	314 [2779]
	14 teeth, 1.25 module (PTO)	89 [788]	310 [2743]



Option	Spline	Torque Rating N•m [lbf•in]	
		Rated Torque	Maximum Torque
AA	13 theeth, 16/32 pitch (Input)	106 [938]	245 [2168]
	13 theeth, 16/32 pitch (PTO)	106 [938]	226 [2000]

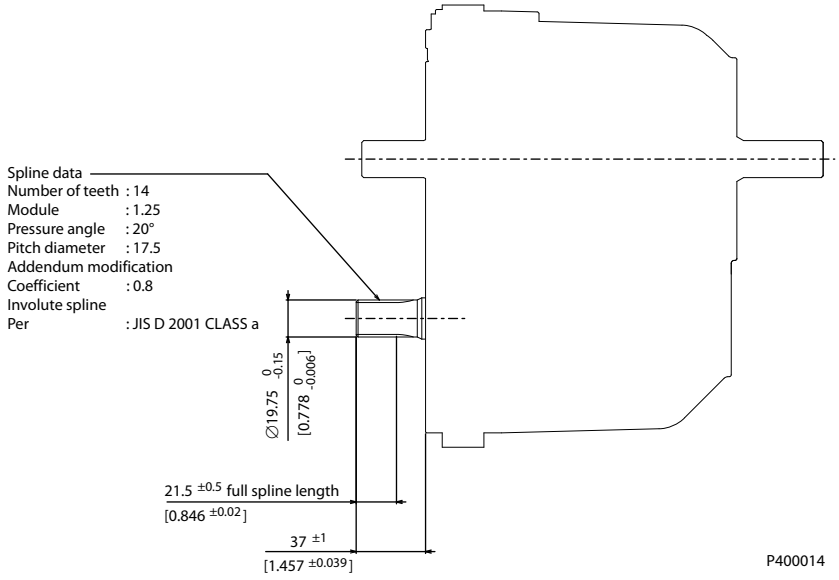


Installation Drawings

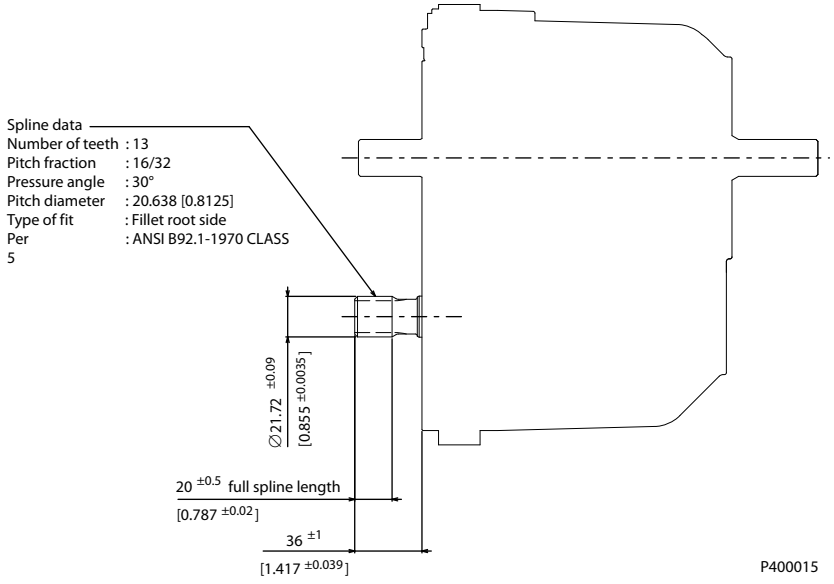
Shaft Availability and Torque Ratings: Output Shaft

Output Shaft

Option	Spline	Torque Rating N•m [lbf•in]	
		Rated Torque	Maximum Torque
J	14 teeth, 1.25 module	87 [770]	310 [2743]

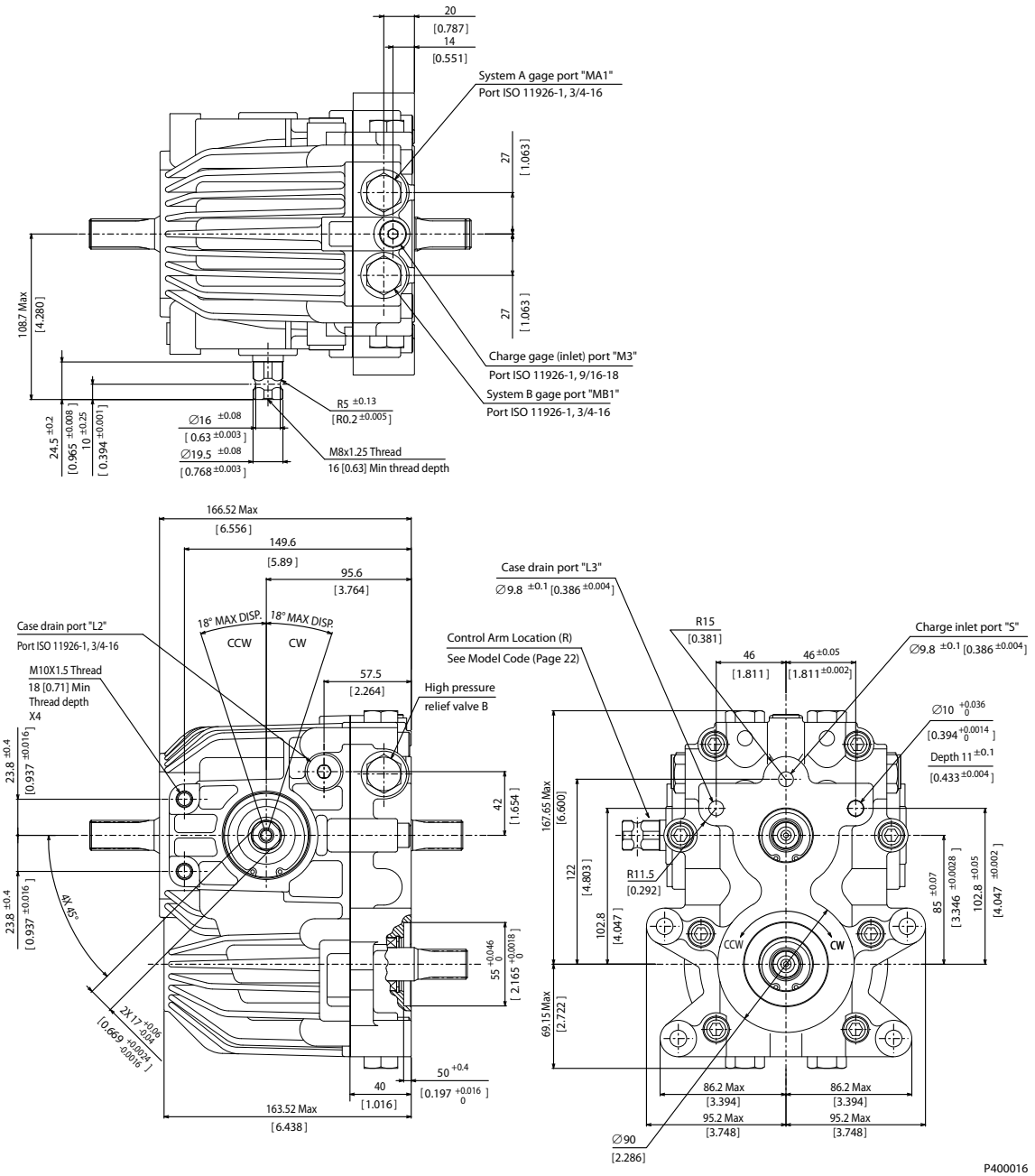


Option	Spline	Torque Rating N•m [lbf•in]	
		Rated Torque	Maximum Torque
A	13 teeth, 20mm pitch	106 [938]	226 [2000]



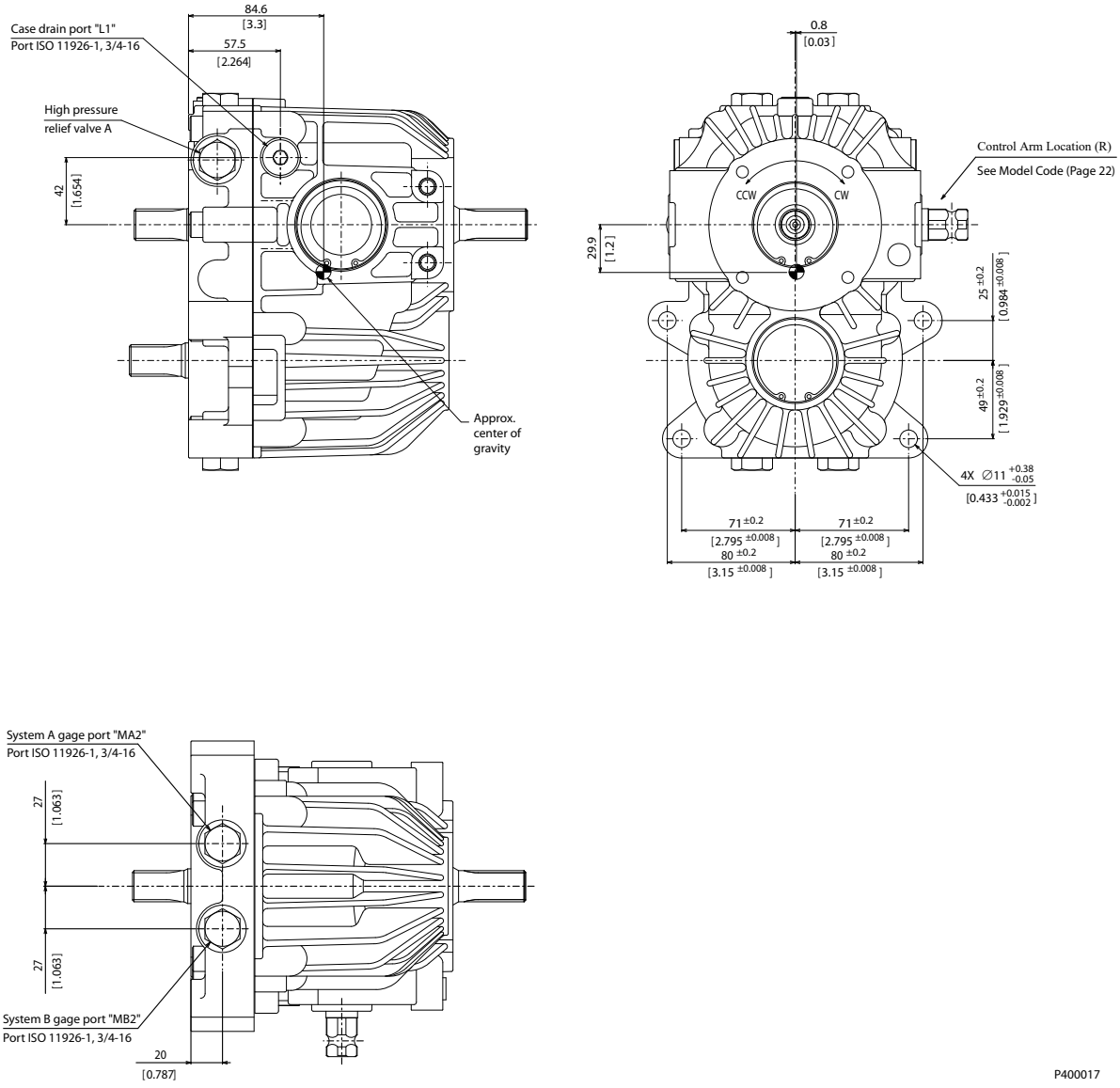
Installation Drawings

Installation Drawings LDU20/24



Input shaft rotation	CW		CCW	
Trunnion location	Right			
Trunnion rotation	CW	CCW	CW	CCW
Output rotation	CCW	CW	CW	CCW
High pressure port	MA	MB	MB	MA
Low pressure port	MB	MA	MA	MB

Installation Drawings



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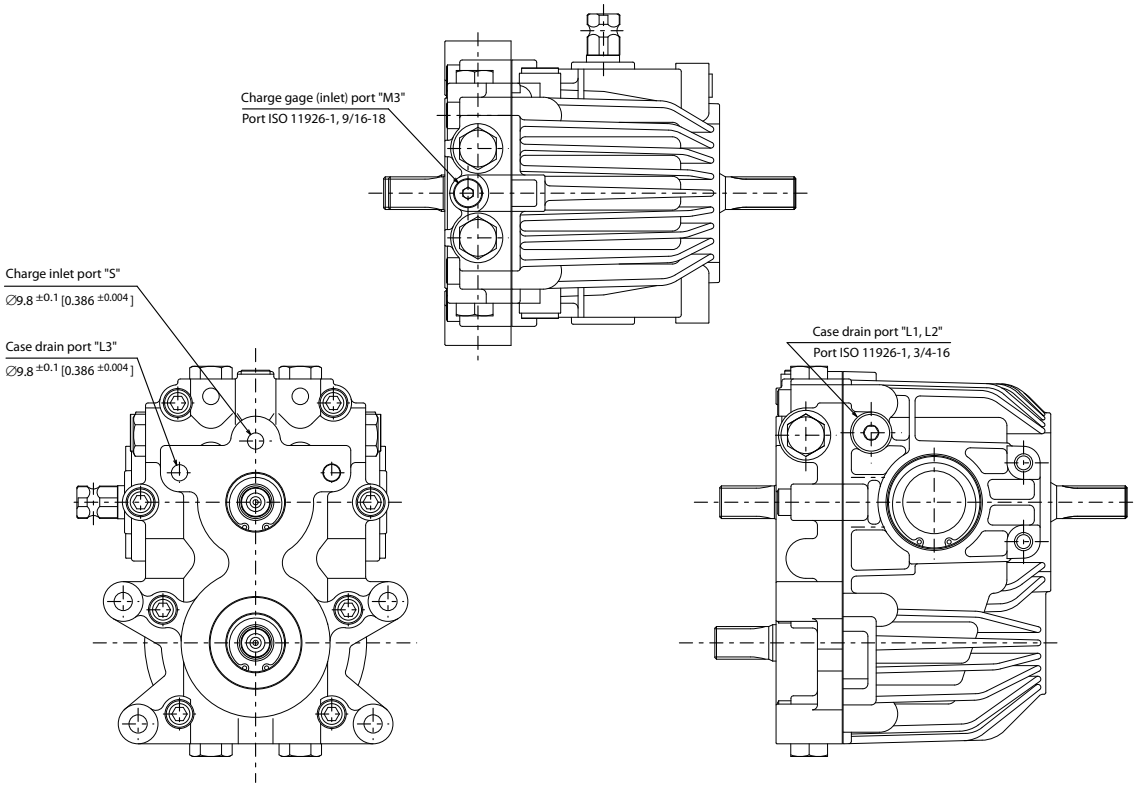
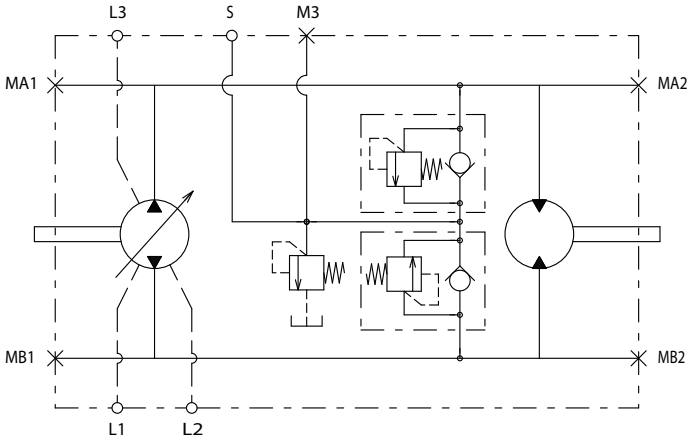
Installation Drawings

Center section: Option A

Drain port: 9.8mm on centersection

Charge port: 9.8mm on centersection



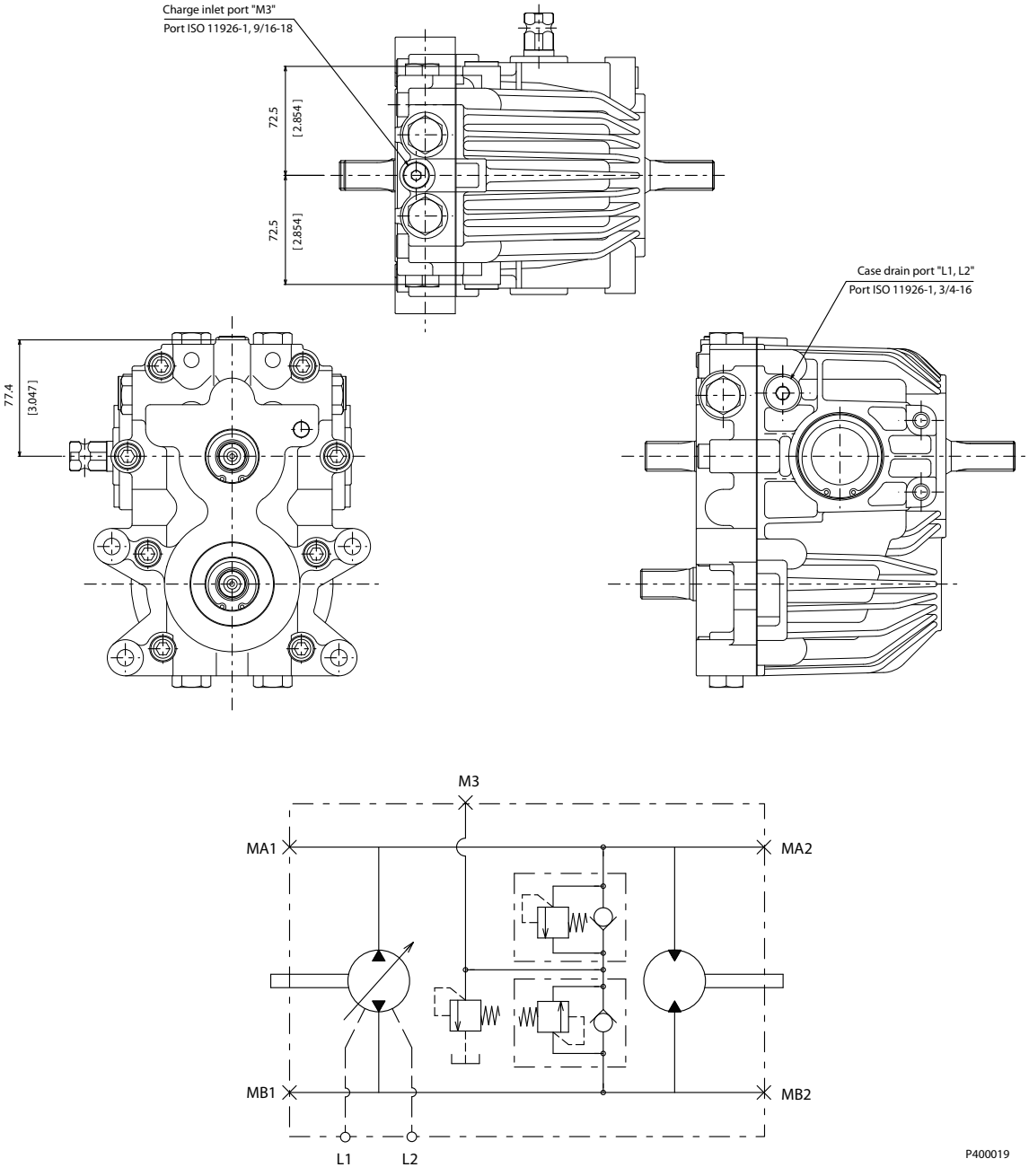


Installation Drawings

Center section: Option B

Drain port: 3/4-16 on Housing.

Charge port: 9/16-18 on centersection

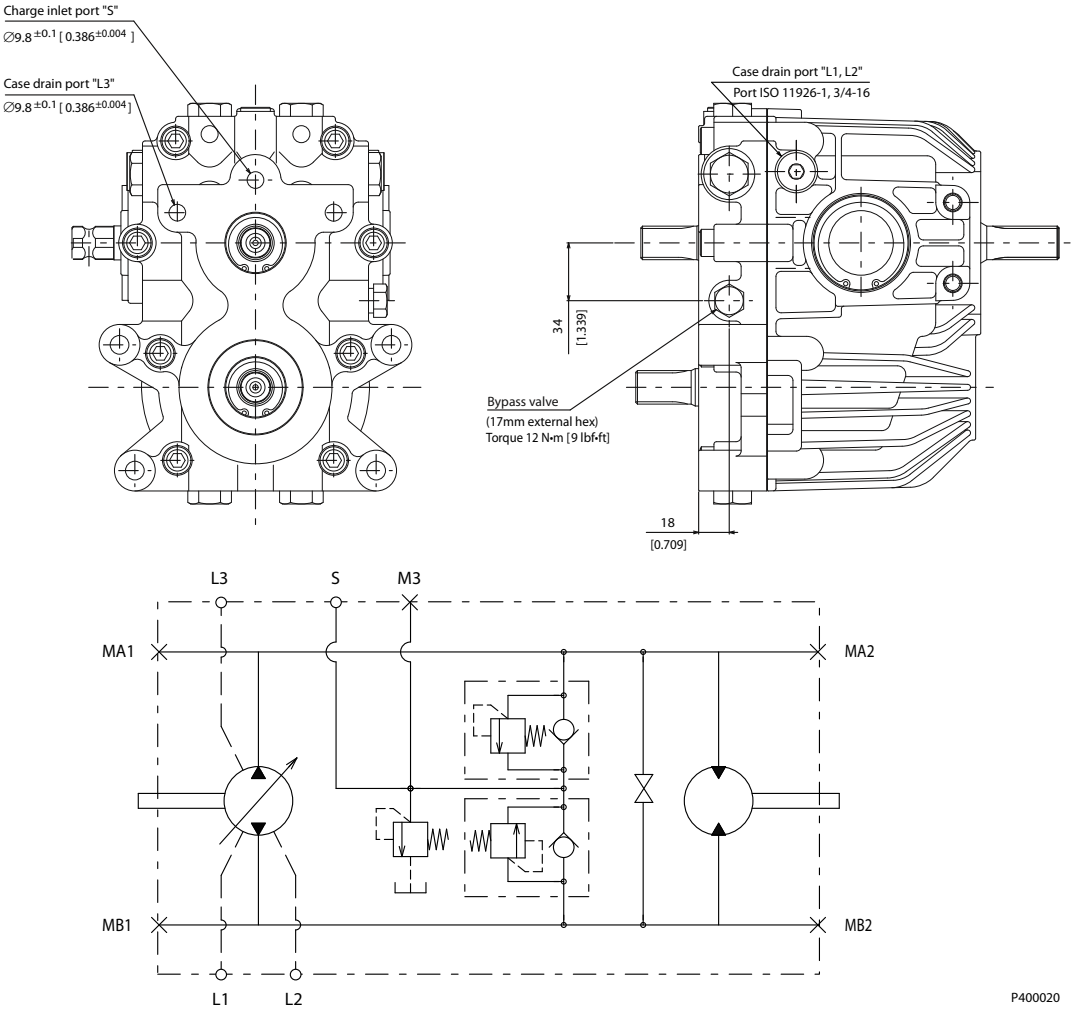


Installation Drawings

Center section: Option F

Drain port: 9.8mm on centersection

Charge port: 9.8mm on centersection With Bypass valve

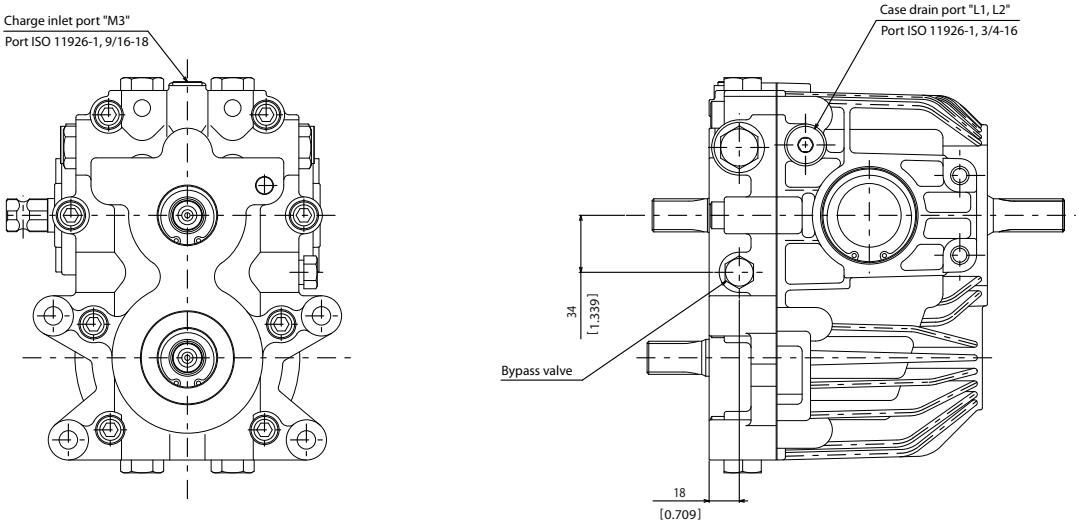


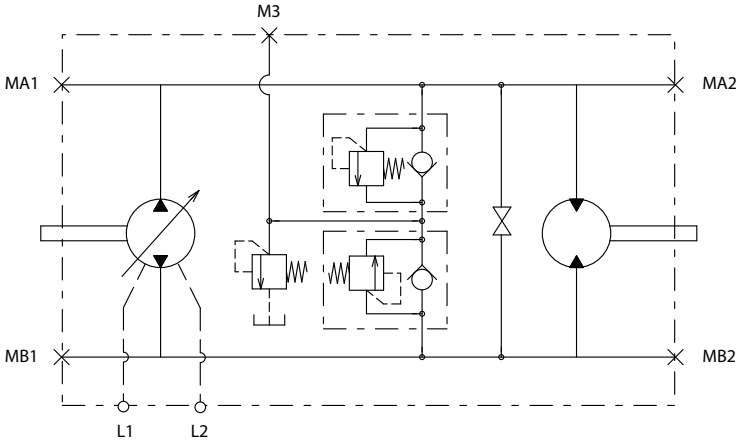
Installation Drawings

Center section: Option H

Drain port: 3/4-16 on Housing

Charge port: 9/16-18 on centersection With Bypass valve





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Danfoss
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Danfoss
Power Solutions GmbH & Co. OHG
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D-24539 Neumünster, Germany
Phone: +49 4321 871 0

Danfoss
Power Solutions ApS
Nordborgvej 81
DK-6430 Nordborg, Denmark
Phone: +45 7488 2222

Danfoss
Power Solutions Trading (Shanghai) Co., Ltd.
Building #22, No. 1000 Jin Hai Rd
Jin Qiao, Pudong New District
Shanghai, China 201206
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