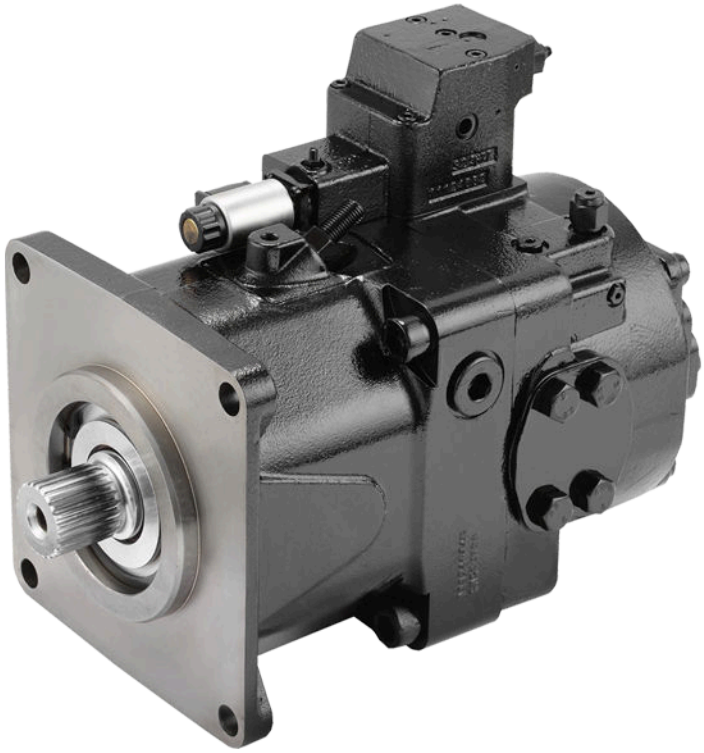
ENGINEERING
TOMORROW

Technical Information

D1 High Power Open Circuit Pumps

Size 130/145/193/260

Available only for APAC / EU regions



Revision history

Table of revisions

Date	Changed	Rev
January 2017	Added Size 130	0106
September 2016	some update of drawing and numbers	0105
May 2016	Added Size 260	0104
March 2016	minor update	0103
February 2016	minor update	0102
January 2016	Converted to Danfoss layout - DITA CMS	0101
July 2015	Updated drawings	AC
April 2015	Added 145 cc information	AB
May 2014	First edition	AA

Contents

Contents

General Information

Overview

Series D1 pump is a high performance variable axial piston pump, it is designed primarily for open circuit hydraulic system used in heavy duty mobile applications.

- Displacement: 130 cm^3; 145 cm^3; 193 cm^3; 260 cm^3
- Maximum working pressure: 350 bar, peak pressure: 400 bar.
- Speed up to 2,500 rpm.
- Variety of control options:

Power control+Pressure compensated control+Electric proportional displacement control;

Power control+Pressure compensated control+Load sensing control.

Features and Benefits

- Robust design for harsh conditions.
- Swashplate, servo-controlled design, proven reliability and performance.
- Angled piston bore design improve self-priming capability.
- The spherical valve plate and cylinderblock interface provide stable cylinderblock rotation, thus achieving high efficiency.
- Integral charge pump option allows the pump to run with higher speed and achive good cold start performance.
- Full through drive ability is suitable for adding axial piston pumps and gear pumps.
- Optimized cradle bearing improves pump service life.
- PLUS+1® compliant controls.
- Can be used together in combination with other Danfoss Power Solutions products [pumps (Like: S45, S90, H1P, gear pumps...) , PVG valves and motors (Like: S90, H1B...)] in the overall hydraulic system.

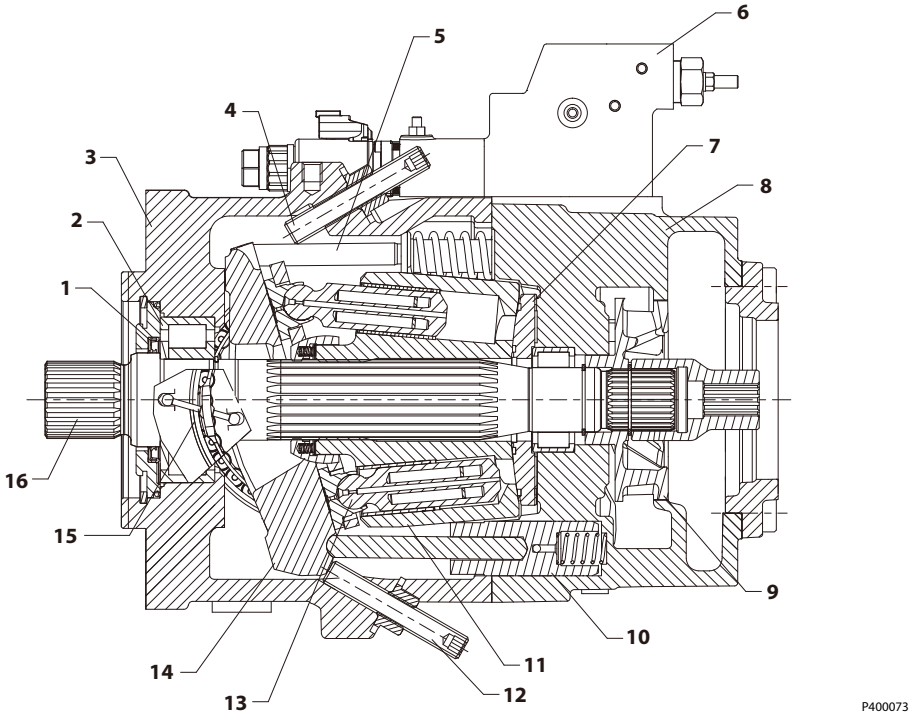
Typical Applications

- Concrete Machinery
- Mining Machinery
- Drilling Machinery
- Material Handlings
- Marine and Off-shore Machinery
- Oil Machinery
- Excavators
- Wheel Loaders
- Industrial Hydraulics

General Information

Design

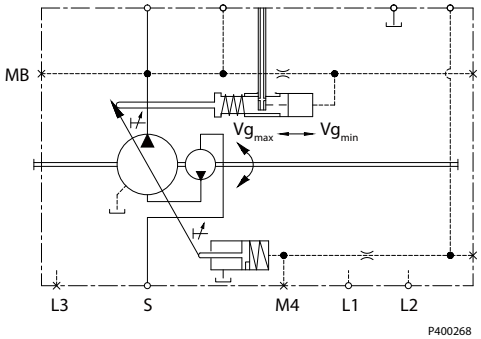
*Series D1 Pump Cross-Section View**



1. Shaft Seal
2. Roller Bearing
3. Housing
4. Minimum Displacement Limiter
5. Bias Piston
6. Control
7. Valve Plate
8. Endcap
9. Charge Pump
10. Servo Piston
11. Cylinder Block
12. Maximum Displacement Limiter
13. Piston
14. Swashplate
15. Swashplate Bearing
16. Input Shaft

*Some internal parts may be different depend on different pump size.

Basic Schematic without Control/with Charge Pump



Charge Pump

The charge pump (see schematic) is a circulating pump with which the pump is charged and therefore can be operated at higher speeds. This also simplifies cold starting at low temperatures and high viscosity

General Information

of the hydraulic fluid. Pressurized reservoir is therefore unnecessary in most cases. A reservoir pressure of a max. 2 bar is permissible with charge pump.

Technical Specification

Pump Specifications

(theoretical values, without efficiency and tolerances; values rounded)

Features		Unit	Size			
			Without Charge Pump	With Charge Pump	With Charge Pump	With Charge Pump
			130/145	130/145	193	260
Displacement	Maximum	cm^3	130/145	130/145	193	260
	Minimum		0	0	0	0
Working input speed	Maximum at Vg max	min^{-1} (rpm)	2200[1)]	2500[2)]	2500[2)]	2300[2)]
	Maximum at Vg ≤ Vg max[3)]		2500	2500	2500	2300
Flow at n max and Vg max		l/min	273/319	325/363	483	598
Working pressure	Maximum	bar	350	350	350	350
	Peak		400	400	400	400
Inlet pressure (Absolute)	Minimum	bar	0.8	0.6	0.6	0.6
	Maximum		30[4)]	2	2	2
Case pressure (Absolute)	Maximum above inlet	bar	1.2	1.2	1.2	1.2
	Maximum		2	2	2	2
Filling capacity		L	2.9	2.9	3.8	4.6
Torque at Vg max and Δp = 350 bar		N•m	724/808	724/808	1075	1448
Power at Q max and Δp = 350 bar		kw	159/186	190/211	281	349
Mass moment of inertia of internal rotating components		$kg•m^2$	0.0299	0.0306	0.0576	0.2080
Mass (approx.)		kg	68	74	106	141
External shaft loads	Me	N•m	476	476	822	1081
	Thrust in (Tin), out (Tout)	N	-2340/5073	-2340/5073	-3990/5570	-3570/7180
Mounting flange load moments	Vibratory (continuous)	N•m	4553	4553	6286	8477
	Shock (maximum)		8692	8692	13782	16338

[1)] The values apply at absolute pressure (Pabs) of at least 1 bar at the suction port S and mineral hydraulic fluid.

[2)] The values apply at absolute pressure (Pabs) of at least 0.8 bar at the suction port S and mineral hydraulic fluid.

[3)] The values apply at Vg ≤ Vg max or in case of an increase in the inlet pressure (Pabs) at the suction port S.

[4)] If the application requires the higher inlet pressure than 5 bar (up to 30 bar), please contact Danfoss Power Solutions.

Caution

Exceeding the permissible values could cause a loss of function, reduced life or the destruction of the pump.

Fluid Specifications

Features		Units	
Viscosity	intermittent[1)]	$mm^2/sec.$	5
	Minimum		7
	Recommended range		16 - 36
	Maximum (cold start)[2)]		1600
Temperature range	Minimum (cold start)[2)]	°C	-40
	Maximum intermittent[1)]		115[3)]

Technical Specification

Features		Units	
Filtration (minimum) Cleanliness per ISO 4406	-40 - 90 °C		20/18/15
	90 - 150 °C		19/17/14

[1] Intermittent = Short term t < 3min per incident.

[2] Cold start = Short term t < 3min, p ≤ 30 bar, n ≤ 1000 min-1(rpm) , please contact Danfoss Power Solutions especially when the temperature is below -25 °C.

[3] Must not be exceeded locally either (e.g. in the bearing area) . The temperature in the bearing area is (depending on pressure and speed) up to 5 °C higher than the average case drain temperature.

Model Code

Model Code

	A			B	C	D				E	F		G		H		J			K			L		M		N		P		R			S		
D1P																																				

A - Displacement

Code	Description	130	145	193	260
130	130 cm^3 max. displacement per revolution	●			
145	145 cm^3 max. displacement per revolution		●		
193	193 cm^3 max. displacement per revolution			●	
260	260 cm^3 max. displacement per revolution				●

B - Rotation

Code	Description	130	145	193	260
R	Clockwise [CW]	●	●	●	●
L	Counter Clockwise [CCW]	●	●		

C - Product Version

Code	Description	130	145	193	260
A		●	●	●	●

D - Control Type

Code	Description	130	145	193	260
TPE2	Power Control+pressure compensated control+positive electric displacement control (24V DEUTSCH,2-pin); with manual overide			●	●
TPSN	Power control + pressure compensated control+load sensing control	●	●	●	●
TPE5	Power cntrol+Pressure Compensated Control+Positive Electric Displacement Control (24V DEUTSCH, 2-pin); The control outline and size is the same with 193 TPE2 control	●	●		

Control Code Explanation:

- The first digit : Power control (Torque control) , if no power control , use “N”
- The second digit : pressure compensated control, if no pressure compensated control , use “N”
- The third together with the fourth digit : Proportional displacement control or Load sensing control , if no such control , use “NN”

E - Input Shaft

Code	Description	130	145	193	260
T	130/145&193: Spline, DIN 5480 W50x2x30x24x9g; 260: Spline, DIN 5480 W60x2x30x28x9g; Shaft seal : FKM	●	●	●	●
S	Spline, SAE J744 1 ¾ in, 13T 8/16 DP; Shaft seal: FKM	●	●	●	●

Model Code

E - Input Shaft (continued)

Code	Description	130	145	193	260
A	193: Spline, SAE J744 2 in, 15T 8/16 DP; 260: Spline, SAE J744 2 1/4 in, 17T 8/16 DP; Shaft seal: FKM			●	●
P	Straight keyed DIN 6885, 130/145: AS14x9x80 193: AS16x10x100 260: AS18x11x100 Shaft seal: FKM	●	●	●	●

F - Mounting Flange

Code	Description	130	145	193	260
D4	SAE J744 152-4 (D)	●	●		
E4	SAE J744 165-4 (E)			●	●

G - Endcap & Main Ports

Code	Description	130	145	193	260
N1	Radial, side, flange ports Inlet: 3 in port, M16x2 ; Outlet: 1 in port, M12x1.75 SAE J518 without charge pump	●	●		
Y1	Radial, side, flange ports Inlet: 3 in port, M16x2 ; Outlet: 1 1/4 in port, M14x2 SAE J518 with charge pump	●	●		
Y2	Radial, side, flange ports Inlet: 3 1/2 in port, M16x2 ; Outlet: 1 1/2 in port, M16x2 SAE J518 with charge pump			●	
Y3	Radial, side, flange ports Inlet: 4 in port, M16x2 ; Outlet: 1 1/2 in port, M16x2 SAE J518 with charge pump				●

H - Auxiliary Mounting Flange (Through-drive Flange)

Code	Description	130	145	193	260
NN	No auxiliary flange	●	●	●	●
A1	SAE J744 82-2 (A) ; spline coupling: 5/8in 9T 16/32DP	●	●	●	●
B1	SAE J744 101-2 (B) ; spline coupling: 7/8in 13T 16/32DP	●	●	●	●
C5	SAE J744 127-2&4 (C) ; spline coupling:1 1/4in 14T 12/24DP	●	●	●	●
D5	SAE J744 152-4 (D) ; spline coupling:N50x2x30x24x9H	●	●	●	●
E2	SAE J744 165-4 (E) ; spline coupling: N50x2x30x24x9H			●	●
E3	SAE J744 165-4 (E) ; spline coupling: N60x2x30x28x9H				●

J - Power Control Setting at 1500rpm (KW), "3 digit code"

Code	Description	130	145	193	260
NNN	No Power Control	●	●	●	●
XXX	xxx kW (for example : Code 090 , means 90 kW) at 1500rpm				
035~090 *	35~90 kW at 1500rpm (the increment is 5 kW)	●	●		

Model Code

J - Power Control Setting at 1500rpm (KW), "3 digit code" (continued)

Code	Description	130	145	193	260
050~120 *	50~120 kW at 1500 rpm (the increment is 5 kW)			●	
070~140 *	70~140 kW at 1500 rpm (the increment is 5 kW)				●

Note: If the speed is not 1500rpm, please make a conversion.

For example:

If the reality is110 kW at 2100 rpm, then the data here should be 110*1500/2100=79, choose 080 option.

K - Pressure Compensated Control Setting (bar), "3 digit code"

Code	Description	130	145	193	260
XXX	xxx bar (for example : Code 320 , means 320 bar)				
150~350 *	150~350 bar (the increment is 10 bar)	●	●	●	●

L - Load Sensing Control Setting (bar), "2 digit code"

Code	Description	130	145	193	260
NN	No load sensing control	●	●	●	●
XX	xx bar (for example : Code 25, means 25 bar)				
10~35	10~35 bar (the increment is 1 bar)	●	●	●	●

*For the settings out of the ranges, please contact Danfoss Power Solutions.

M - Hyraulic Displacement Control Start Pressure Setting, "2 digit code"

Code	Description	130	145	193	260
NN	No hydraulic displacement control	●	●	●	●

N - Max Displacement Setting, "2 digit code"

Code	Description	130	145	193	260
FS	Factory setting : 100%	●	●	●	●
XX	XX% (for example : Code 90 , means 90% of maximum displacement)	●	●	●	●

P - Min Displacement Setting , "2 digit code"

Code	Description	130	145	193	260
FS	0% of maximum displacement limit setting	●	●	●	●
05	5% of maximum displacement limit setting	●	●	●	●

R - Special Hardware

Code	Description	130	145	193	260
NNN	None	●	●	●	●

Model Code

S *- Special Feature*

Code	Description	130	145	193	260
NNN	Factory Setting (paint-black, tag , Danfoss, format A)	●	●	●	●
NNF	Factory Setting (paint-black, tag , Danfoss, format A) with control oil filter				●

When ordering tandem pumps, the type designations of the 1st and 2nd pumps must be connected by a "+", and tandem pump angle should be given like below.

Ordering example:

D1P193RATPE2TE4Y2E2090320NNNNFSFSNNNNNN +

D1P193RATPE2TE4Y2NN090320NNNNFSFSNNNNNN

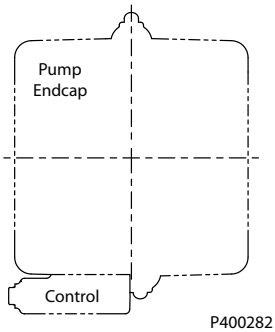
Tandem angle 0° + 180°

Model Code

Tandem Pump Direction

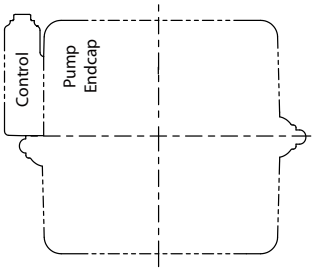
The tamdem pump rotate direction is defined as below:

Auxiliary pump
INDEX = 0°

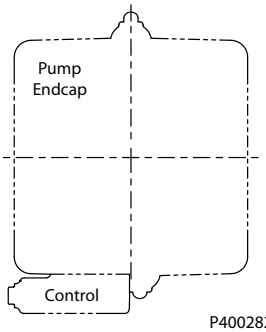


P400282

Auxiliary pump
INDEX = 90°

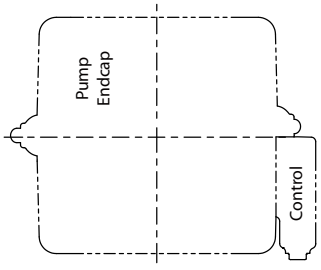


When assembling a system the first pump is always to be considered at 0° INDEX as shown below.

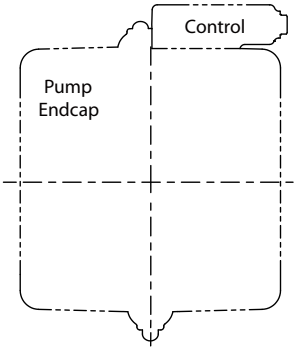


P400282

Auxiliary pump
INDEX = 270°



Auxiliary pump
INDEX = 180°



For gear pump tandem angle information, please contact Danfoss Power Solutions.

Please see *Additional Information* on page 59 for more tandem pump information.

Parameters

Pressure

Maximum working pressure is the highest recommended outlet (application) pressure. Maximum working pressure is not intended to be a continuous pressure. For all applications, the load should move below this pressure. This corresponds to the maximum allowable pressure compensated control setting.

Maximum (peak) pressure is the highest intermittent (t<1s) outlet pressure allowed. Maximum machine load should never exceed this pressure, and pressure overshoots should not exceed this pressure.

Inlet pressure is the absolute pressure in the pump suction port, it is related to pump speed. Make sure it is in the allowable range, see *Pump Specifications* on page 8.

Case pressure : The case pressure at the ports L1 and L2 may be a maximum of 1.2 bar higher than the inlet pressure at the port S but not higher than 2bar. Size drain plumbing accordingly and connect it to tank directly .The housing must always be filled with hydraulic fluid.

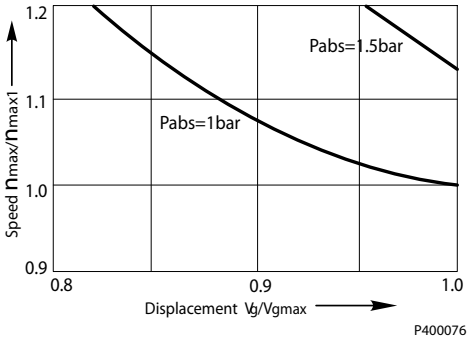
Speed

Rated speed is the fastest recommended operating speed at full displacement and at least 0.8 bar abs with charge pump (1 bar abs without charge pump) inlet pressure. Operating at or below this speed should yield satisfactory product life.

Maximum speed is the highest recommended operating speed at full power conditions. Operating at or beyond maximum speed requires positive inlet pressure and/or a reduction of pump outlet flow. Refer to "*Inlet pressure vs. speed*" chart below.

Minimum speed is the lowest operating speed allowed. Operating below this speed will not yield satisfactory performance.

Inlet pressure vs. speed



Caution

Duty cycle and pump life

Knowing the operating conditions of your application is the best way to ensure proper pump selection. With accurate duty cycle information, your Danfoss Power Solutions representatives can assist in calculating expected pump life.

Fluid

Ratings and performance data for D1 pump are based on operating with premium hydraulic fluids containing oxidation, rust, and foam inhibitors. These include premium turbine oils, API CD engine oils per SAE J183, M2C33F or G automatic transmission fluids (ATF), Dexron II (ATF) meeting Allison C-3 or Caterpillar T0-2 requirements, and certain specialty agricultural tractor fluids. For more information on hydraulic fluid selection, see Danfoss Power Solutions publications **520L0463** *Hydraulic Fluids and Lubricants*, Technical Information, and **520L0465** *Experience with Biodegradable Hydraulic Fluids*, Technical Information.

Parameters

Viscosity

Minimum Viscosity: This should only occur during brief occasions of maximum ambient temperature and severe duty cycle operation.

Maximum Viscosity: This should only occur at cold start. Pump performance will be reduced. Limit speeds until the system warms up.

Maintain fluid viscosity within the recommended range for maximum efficiency and pump life.

Temperature

Minimum temperature relates to the physical properties of the component materials. Cold oil will not affect the durability of the pump components. However, it may affect the ability of the pump to provide flow and transmit power.

Maximum temperature is based on material properties. Don't exceed it. Measure maximum temperature at the hottest point in the system. This is usually the case drain.

Fluid Velocity

Choose piping sizes and configurations sufficient to maintain optimum fluid velocity, and minimize pressure drops. This reduces noise, pressure drops, and overheating. It maximizes system life and performance.

Recommended fluid velocities

System lines	6 to 9 m/sec
Suction line	1 to 2 m/sec
Case drain	3 to 5 m/sec

Typical guidelines; obey all pressure ratings.

Velocity equations

SI units

Q = flow (l/min)

A = area (mm^2)

Velocity = (16.67•Q)/A (m/sec)

Shaft Torque Ratings

Shaft drawing section *Size 130/145: Input Shaft: T (Splined shaft DIN 5480, W50 x 2 x 30 x 24 x 9g)* on page 35, *Size 193: Input Shaft: T (Splined shaft DIN 5480, W50 x 2 x 30 x 24 x 9g)* on page 44, *Size 260: Input Shaft: T (Splined shaft DIN 5480, W60 x 2 x 30 x 28 x 9g)* on page 53 gives maximum torque ratings for available input shafts. Ensure that your application respects these limits.

Maximum torque ratings are based on shaft strength with no radial force, do not exceed them.

Shaft Load

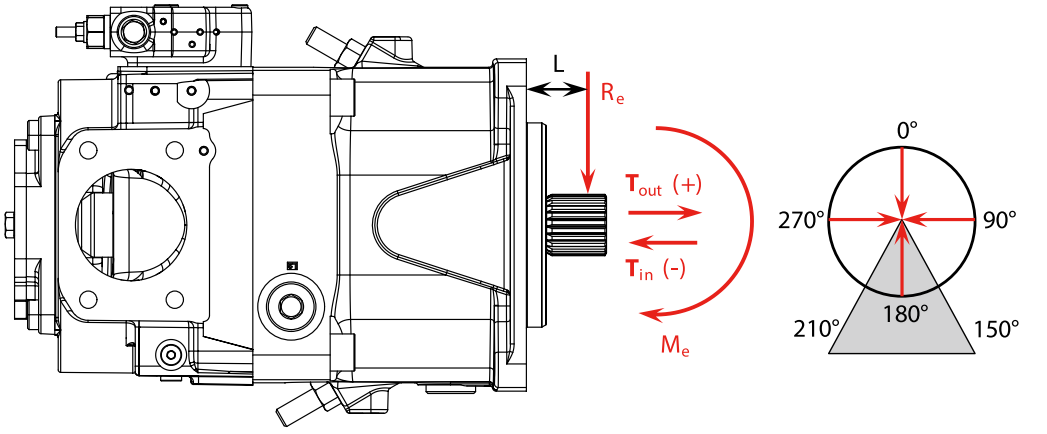
Series D1 pump bearing is capable of accepting external radial and thrust (axial) loads. The external radial shaft load limits are a function of the load position, orientation, and the operating conditions of the pump.

The maximum allowable radial load (R_e) is based on the maximum external moment (M_e) and the distance (L) from the mounting flange to the load. Compute radial loads using the formula below. *Pump Specifications* on page 8 gives maximum external radial load (R_e) and thrust (axial) load (T_{in} , T_{out}) limits .

Parameters

$M_e = R_e \cdot L$

L = Distance from mounting flange to point of load
M_e = Maximum external moment
R_e = Maximum radial side load



P400077

All shaft loads affect bearing life. In applications where external shaft loads can not be avoided, maximize bearing life by orientating the load between the 150° and 210° positions, as shown.

Mounting Flange Loads

Adding auxiliary pumps and/or subjecting pumps to high shock loads may overload the pump mounting flange. *Pump Specifications* on page 8 gives allowable continuous and shock load moments. Applications with loads outside allowable limits require additional pump support.

- **Shock load moment** (M_S) is the result of an instantaneous jolt to the system.
- **Continuous load moments** (M_C) are generated by the typical vibratory movement of the application.

Auxiliary Mounting Pads

Auxiliary mounting pads are available . Since the auxiliary pad operates under case pressure, use an O-ring to seal the auxiliary pump mounting flange to the pad. Oil from the main pump case lubricates the drive coupling.

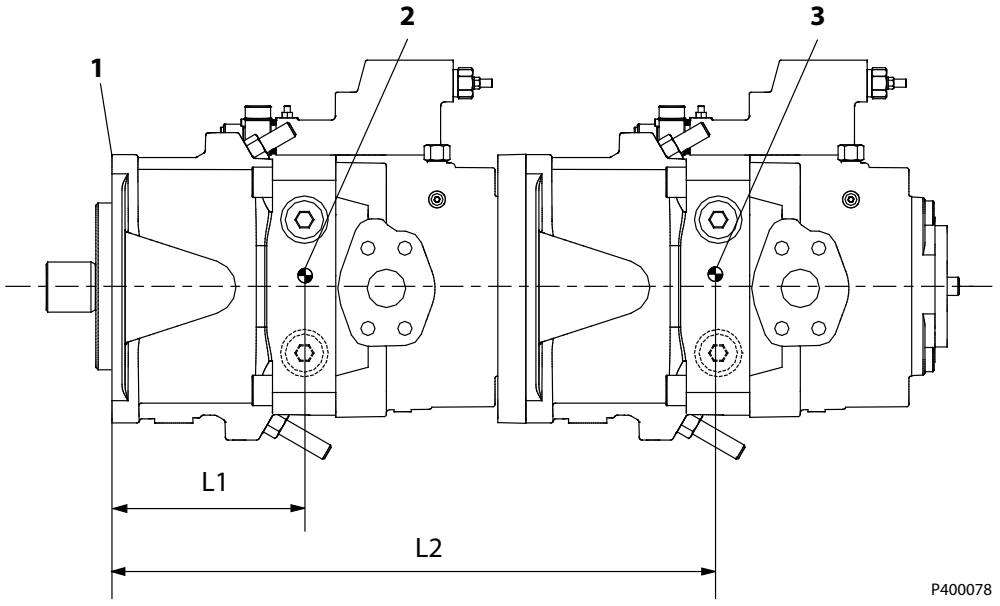
- The combination of auxiliary shaft torque and main pump torque must not exceed the maximum pump input shaft rating. Shaft drawing section on *Installation Drawing* on page 27 gives input shaft torque ratings
- Applications subject to severe vibratory or shock loading may require additional support to prevent mounting flange damage. The *Pump Specifications* on page 8 table gives allowable continuous and shock load moments.

Estimating Overhung Load Moments

Use the equations below to estimate the overhung load moments for multiple pump mounting. See *Installation Drawing* on page 27 section to find the distance from the mounting flange to the center of gravity. Refer to the *Pump Specifications* on page 8 to find pump weight.

Parameters

Overhung load example



1. Mounting Flange **2.** Center of Gravity (CG), Pump 1 **3.** Center of Gravity (CG), Pump 2

- **Shock load formula** $M_S = G_S \cdot K \cdot (W_1 \cdot L_1 + W_2 \cdot L_2 + ... W_n \cdot L_n)$
- **Continuous load formula** $M_C = G_C \cdot K \cdot (W_1 \cdot L_1 + W_2 \cdot L_2 + ... W_n \cdot L_n)$

SI units

M_S = Shock load moment (N•m)

M_C = Continuous (vibratory) load moment (N•m)

G_S = Acceleration due to external shock (G's)

G_C = Acceleration due to continuous vibration (G's)

K = Conversion factor = 0.00981

W_n = Mass of n^{th} pump (kg)

L_n = Distance from mounting flange to n^{th} pump CG (mm)

Understanding and Minimizing System Noise

Noise is transmitted in fluid power systems in two ways: as fluid borne noise, and structure borne noise.

Fluid-borne noise (pressure ripple or pulsation) is created as pumping elements discharge oil into the pump outlet. It is affected by the compressibility of the oil, and the pump's ability to transition pumping elements from high to low pressure. Pulsations travel through the hydraulic lines at the speed of sound (about 1400 m/s in oil) until there is a change (such as an elbow) in the line. Thus, amplitude varies with overall line length and position.

Structure-borne noise is transmitted wherever the pump casing connects to the rest of the system. The way system components respond to excitation depends on their size, form, material, and mounting.

System lines and pump mounting can amplify pump noise. Follow these suggestions to help minimize noise in your application:

- Use flexible hoses.
- Limit system line length.

Parameters

- If possible, optimize system line position to minimize noise.
- If you must use steel plumbing, clamp the lines.
- If you add additional support, use rubber mounts.
- Test for resonants in the operating range, if possible avoid them.

Installation

Series D1 pumps may be installed in any position. To optimize inlet conditions, install the pump at an elevation below the minimum reservoir fluid level. Design inlet plumbing to maintain inlet pressure within prescribed limits (see Inlet pressure limits on *Pump Specifications* on page 8)

Fill the pump housing and inlet line with clean fluid during installation. Connect the case drain line to the uppermost drain port (L1, L2 or L3) to keep the housing full during operation.

To allow unrestricted flow to the reservoir, use a dedicated drain line. Connect it below the minimum reservoir fluid level and as far away from the reservoir outlet as possible. Use plumbing adequate to maintain case pressure within prescribed limits (see case pressure limits on *Pump Specifications* on page 8).

Filtration

To prevent damage to the pump, including premature wear, fluid entering the pump inlet must be free of contaminants. Series D1 pumps require system filtration capable of maintaining fluid cleanliness at class 20/18/15 according to ISO 4406-1999 or better.

Danfoss Power Solutions does not recommend suction line filtration. Suction line filtration can cause high inlet vacuum, which limits pump operating speed. Instead we recommend a 125 µm (150 mesh) screen in the reservoir covering the pump inlet. This protects the pump from coarse particle ingestion.

Return line filtration is the preferred method for open circuit systems. Consider these factors when selecting a system filter:

- Cleanliness specifications
- Contaminant ingression rates
- Flow capacity
- Desired maintenance interval

Typically, a filter with a beta ratio of β10 = 10 is adequate. However, because each system is unique, only a thorough testing and evaluation program can fully validate the filtration system.

For more information, see Danfoss Power Solutions publication **520L0467** *Design Guidelines for Hydraulic Fluid Cleanliness*.

Reservoir

The reservoir provides clean fluid, dissipates heat, and removes entrained air from the hydraulic fluid. It allows for fluid volume changes associated with fluid expansion and cylinder differential volumes. Minimum reservoir capacity depends on the volume needed to perform these functions. Typically, a capacity of one to three times the pump flow (per minute) is satisfactory.

Locate the reservoir outlet (suction line) near the bottom, allowing clearance for settling foreign particles. Place the reservoir inlet (return lines) below the lowest expected fluid level, as far away from the outlet as possible.

Parameters

Sizing Equations

Use these equations to help choose the right pump size and displacement for your application.

Based on SI units

Flow Output flow $Q = \frac{V_g \cdot n \cdot \eta_v}{1000}$ (l/min)

Torque Input torque $M = \frac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_m}$ (N•m)

Power Input power $P = \frac{M \cdot n \cdot \pi}{30\,000} = \frac{Q \cdot \Delta p}{600 \cdot \eta_t}$ (kW)

Variables

SI units

V_g = Displacement per revolution cm^3/rev

p_O = Outlet pressure bar

p_i = Inlet pressure bar

$\Delta p = p_O - p_i$ (system pressure) bar

n = Speed min^{-1} (rpm)

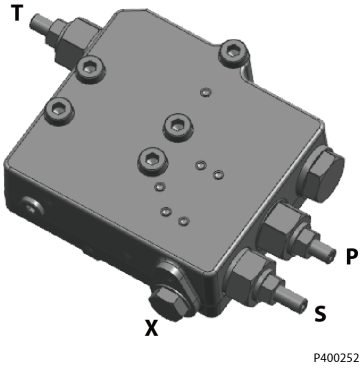
η_v = Volumetric efficiency

η_m = Mechanical efficiency

η_t = Overall efficiency ($\eta_v \cdot \eta_m$)

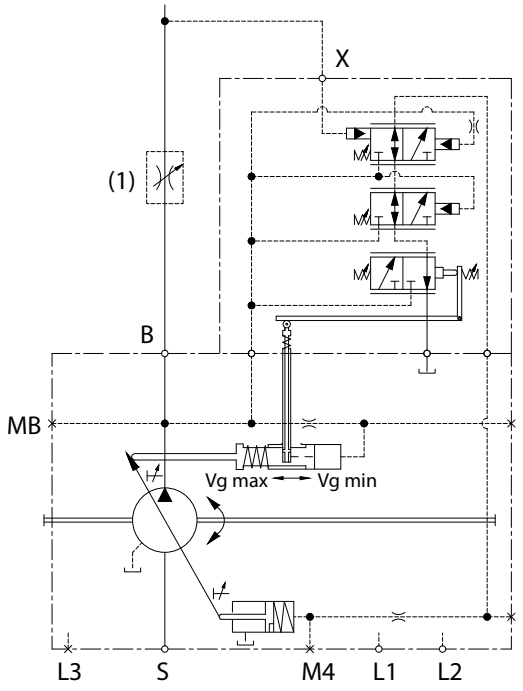
Control Type

TPSN (Power Control + Pressure Compensated Control + Load Sensing Control)

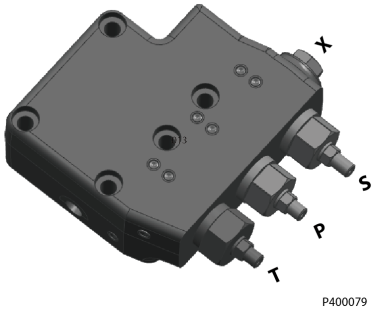


P400252

D1P 130/145+TPSN



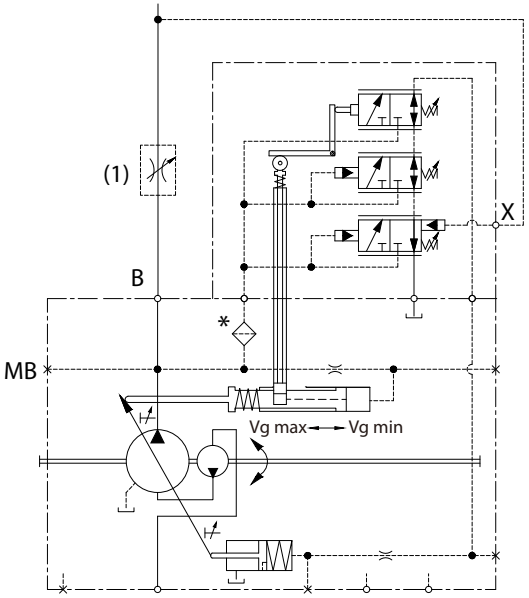
P400251



P400079

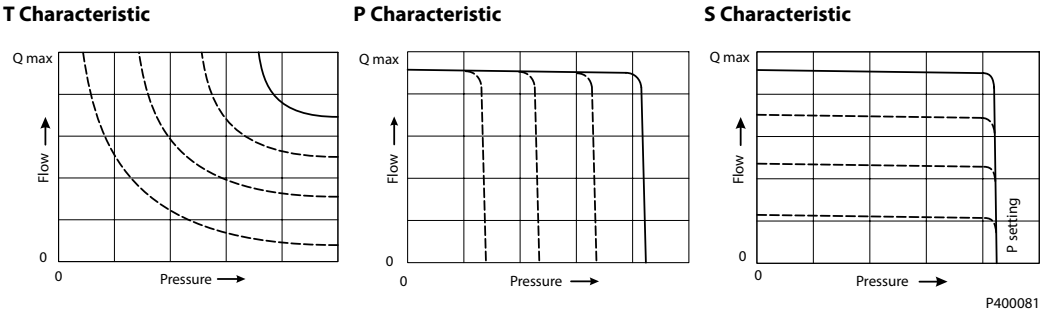
D1P193/260+TPSN

*Control oil filter is optional



P400080

Control Type



Power Control (T) Principle

The power control regulates the displacement of the pump depending on the working pressure so that a given drive power is not exceeded at constant drive speed, this function can prevent engine stall or protect electric generator.

$P_B \cdot V_g = C$

P_B = working pressure
V_g = displacement
C = constant

The precise control with a hyperbolic control characteristic, provides an optimum utilization of available power.

Power Control (T) Operation

The working pressure acts on a rack-pivot via a roller jack which produce a rotate torque, an externally adjustable spring force counteracts this which determines the power setting.

If the moment generated by working pressure exceeds the moment generated by spring force, the control valve is actuated by the rack-pivot, pump reduces displacement. The lever length at the rack-pivot is shortened and the working pressure can increase at the same rate as the displacement decreases without the drive powers being exceeded.

($P_B \cdot V_g = C$).

The hydraulic output power (characteristic T) is influenced by the efficiency of the pump.

Pressure Compensated Control (P) Principle

The P control design maintains a constant pressure in the hydraulic circuit as flow varies. The P control modulates pump flow accordingly to maintain system pressure at the P setting as the P adjusting screw and spring defines.

Pressure Compensated Control (P) Operation

When system pressure, acting on the non-spring end of the P spool ,overcomes the force of the P spring, the spool shifts porting system pressure to the servo piston and the swashplate angle decreases. When system pressure drops below the P setting, the P spring shifts the spool in the opposite direction connecting the servo piston to pump case and the swashplate angle increases. The swashplate is maintained at whatever angle is required to keep system pressure at the P setting.

Load Sensing Control (S) Principle

The S control design matches pump flow with system demand. The S control senses the flow demand of the system as a pressure drop across the external control valve (1).

As the (1) opens and closes, the pressure delta across the valve changes. When opening, the delta decreases. When closing, the delta increases. The S control then increases or decreases pump flow to the

Control Type

system until the pressure delta becomes equal to the S setting as defined by the S adjusting screw and spring .

Load Sensing Control (S) Operation

Through internal porting, system pressure [upstream of (1)] is applied to the non-spring end of the S spool, and through hydraulic line connected at port X, load pressure [downstream of (1)] is applied to the spring end. This arrangement allows the S spool to act on the delta between system pressure and load pressure. The S spring sets the threshold of operation (S setting).

Because the swashplate is biased to maximum angle, the pump attempts to deliver full flow to the hydraulic system. When the flow being delivered exceeds demand, the pressure delta across the (1) is great enough to overcome spring force and shift the S spool porting system pressure to the servo piston. The pump de-strokes reducing flow until the delta across the (1) becomes equal to the S setting.

When flow being delivered is less than demand, the delta across the (1) drops below the S setting and the S spring shifts the spool connecting the servo piston to pump case. The pump strokes increasing flow until the delta across the (1) becomes equal to the S setting.

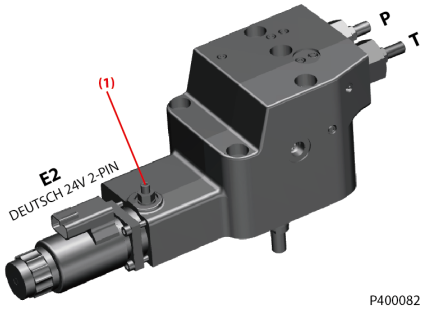
When the external control valve (1) is placed in neutral, it connects the LS signal line to drain. With no LS pressure acting on the non-spring end of the LS spool, the pump adjusts stroke to whatever position necessary to maintain system pressure at the LS setting. The pump is now in low pressure standby mode. (1) is not in the scope of supply.

TPSN Priority

The Pressure Compensated Control (P) has priority over the Power Control (T), and the Power Control (T) has priority over the Load Sensing (S).

Control Type

TPE2/TPE5 (Power Control + Pressure Compensated Control + Electric Displacement Control)



P400082

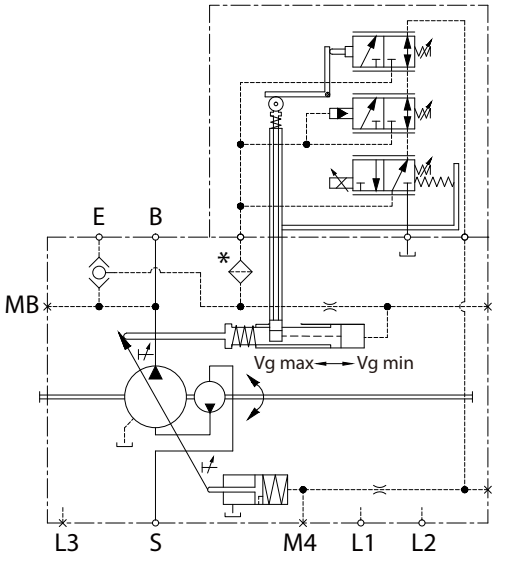
Warning

(1) Adjustment is not permissible

D1P 130/145+TPE5

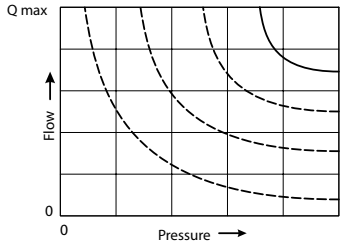
D1P 193/260+TPE2

*Control oil filter is optional

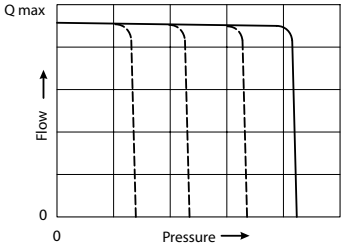


P400074

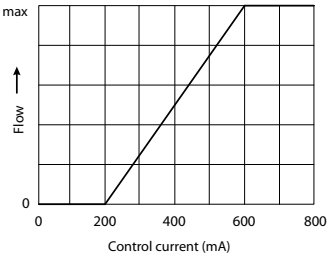
T Characteristic



P Characteristic



E2/E5 Characteristic



P400083

Power Control (T) Principle and Operation

Please refer *TPSN (Power Control + Pressure Compensated Control + Load Sensing Control)* on page 21

Pressure Compensated Control (P) Principle and Operation

Please refer *TPSN (Power Control + Pressure Compensated Control + Load Sensing Control)* on page 21

Electric Displacement Control (E2/E5) Principle

The electric displacement control uses an electric proportional solenoid valve to vary the pump's displacement from minimum displacement to maximum displacement or from maximum displacement to minimum displacement. The swashplate angle (pump displacement) is proportional to the electrical input signal (control current).

Control Type

Electric Displacement Control (E2/E5) Operation

E2/E5 is current driven control requiring a Pulse Width Modulated (PWM) signal. Pulse width modulation allows more precise control of current to the solenoid. The PWM signal causes the solenoid pin to push against the E2/E5 spool, which depressurizes the end of servo piston, the swashplate angle increases under the force of bias piston .

A swashplate feedback link provides swashplate position force to the solenoid through E2/E5 spool linear spring. The control reaches equilibrium when the position of the swashplate spring feedback force exactly balances the input command solenoid force from the operator. As working pressure changes with load, the control and servo/swashplate system work constantly to maintain the commanded position of the swashplate.

Electric Displacement Control (E2/E5) Operating Instruction

To make sure the electric displacement control works properly, a minimum control pressure of 30 bar is required. The required control pressure is taken either from the working pressure, or from the externally applied control pressure at the E port.

If you can't make sure that the working pressure is above 30 bar all the time, then 30bar pressure at the E port is mandatory.

If E port is not connected , remove the shuttle valve.

MOR

The electric displacement control with Manual Over Ride (MOR) fuction for temporary actuation of the control to aid in diagnostics.

Warning

Do not actuate MOR unless the machine is in a "SAFE" mode.

Solenoid specification

Technical data - Solenoid

Voltage	24V (±20%)
Start current at Vg min	200 mA
End Current at Vg max	600 mA
Maximum current	770 mA
Coil resistance @ 20 °C [70 °F]	22.7 Ω
PWM Range	70~200 Hz
PWM Frequency (preferred)*	100 Hz
IP Rating (IEC 60 529) + DIN 40 050, part 9	IP 67
IP Rating (IEC 60 529) + DIN 40 050, part 9 with mating connector	IP 69K

* PWM signal required for optimum control performance

Mating connector for Solenoid

Description	Ordering Number	Quantity
Danfoss mating connector kit	K29657	1
The mating connector is not included in the delivery contents, this can be delivered by Danfoss on request.		

Control Type

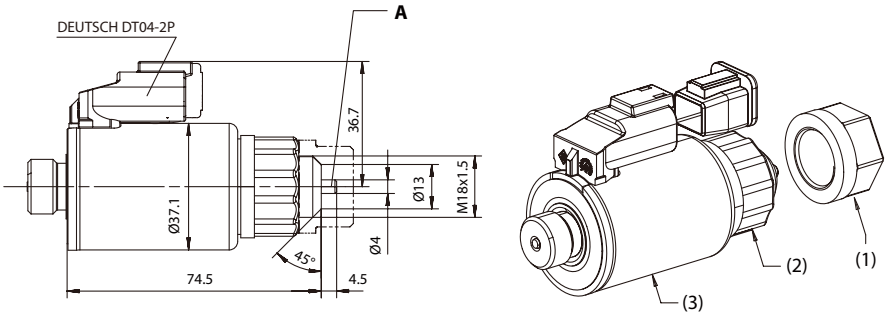
Below compatible PLUS+1® controllers are available:

MC012	L1301095
MC024	L1315302
MC038	11051653
MC050	L1301752
MC088	11006645

For further information:

You can see *http://www.danfoss.com/Products/MobileElectronics/index.htm*

Standard EDC Valve



- A: At first actuation breakaway force max.45N; Repeat of actuation max.25N.

Note for round solenoids

The position of the connector can be changed by turning the solenoid body.

Proceed as follows:

1. Loosen protect cap (1).
2. Loosen lock nut (2).
3. Turn the solenoid body (3) to the desired position.
4. Tighten the lock nut (2).
5. Tighten the protect cap (1).

Tightening torque of lock nut: 5±1 N•m.

TPE2/TPE5 Priority

The Pressure Compensated Control (P) has priority over the Power Control (T), and the Power Control (T) has priority over Electric Dispalcement Control (EDC) .

Installation Drawing

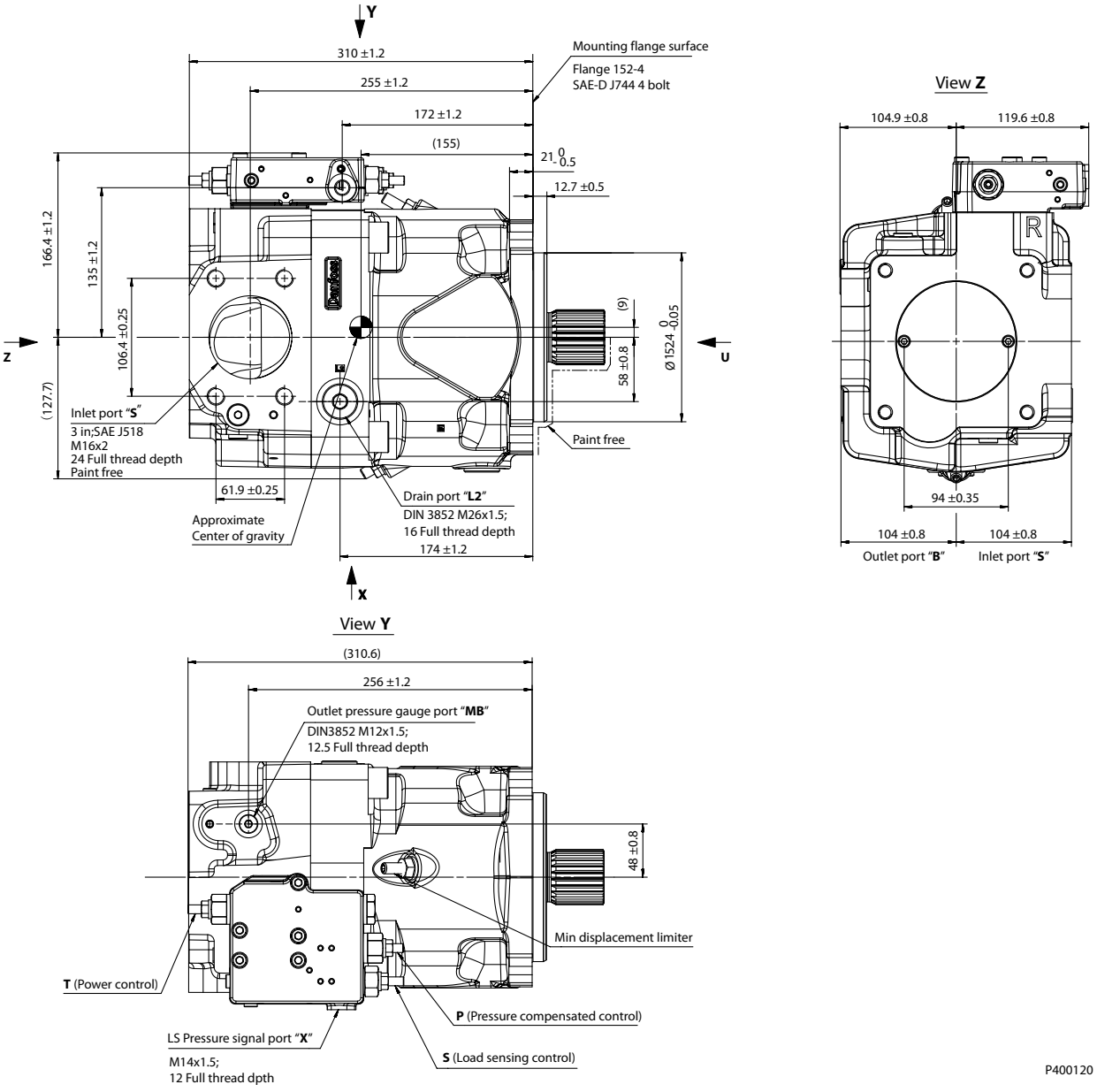
Size 130/145: (TPSN) Dimensions and Port Descriptions

Control : TPSN

Power control (T) + Pressure compensated control (P) + Load sensing control (S)

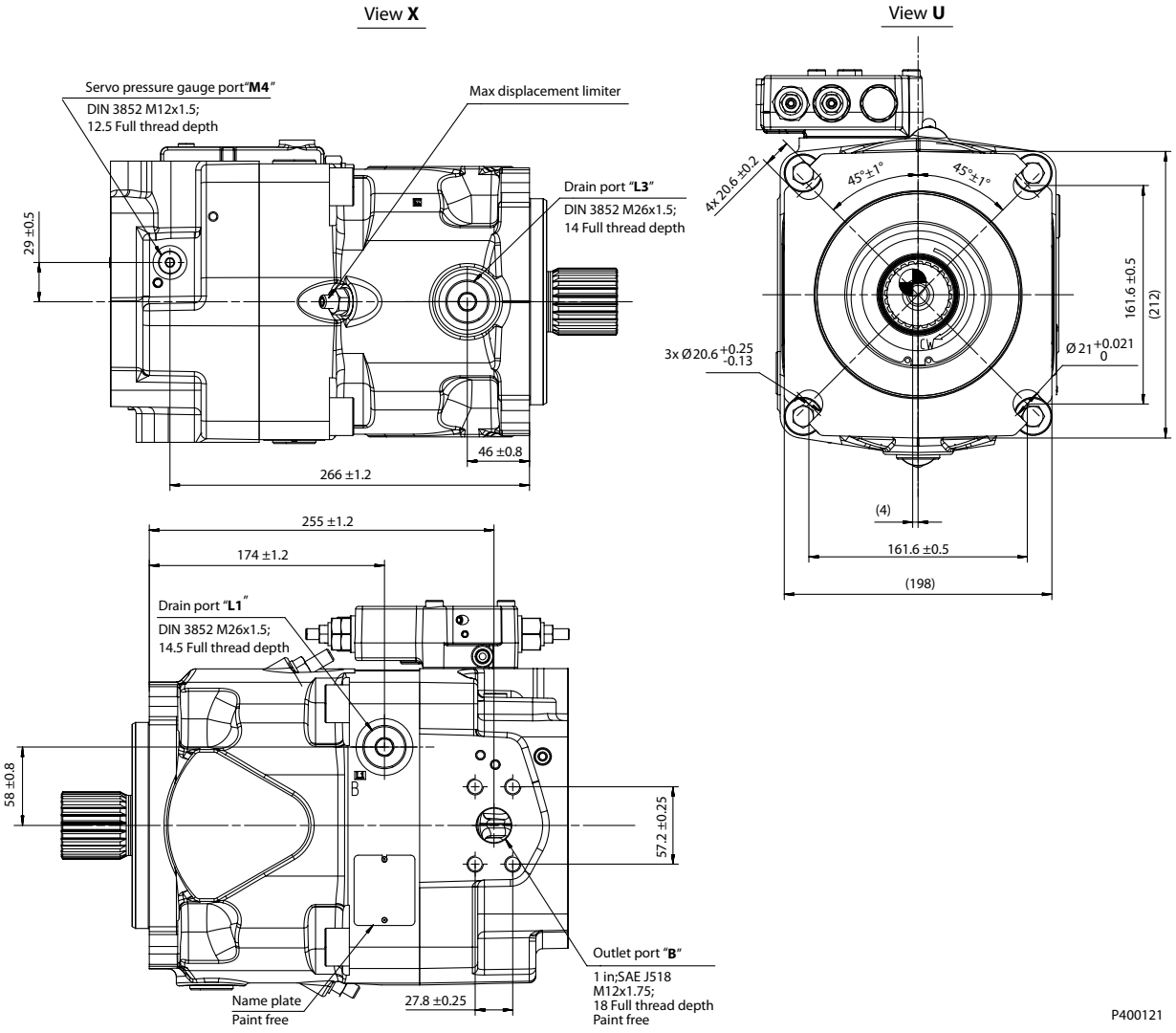
Auxiliary flange : NN

Charge pump : Without



Before finalizing your design, please request a certified drawing.

Installation Drawing



Before finalizing your design, please request a certified drawing.

Port Descriptions

Ports	Description	Standard	Size[1)]	Max. pressure (bar)	State[2)]
B	Outlet port, Fixing thread	SAE J518, DIN13	1 in, M12 x 1.75; 18 deep	400	O
S	Suction port, Fixing thread	SAE J518, DIN13	3 in, M16 x 2; 24 deep	2	O
L_1, L_2, L_3	Drain port	DIN 3852	M26 x 1.5; 14.5, 16, 14 deep	2	X[3)]
M_4	Measurement point,servo-piston chamber	DIN 3852	M12 x 1.5; 12.5 deep	400	X
M_B	Measurement point, outlet port	DIN 3852	M12 x 1.5; 12.5 deep	400	X
X	LS port	DIN 3852	M14 x 1.5; 12.5 deep	400	O

1) For required torque, please refer to *Tightening Torque* on page 59.

2) O = Open, must be connected (closed by plastic plug on delivery) / X = Closed (closed by metal plug on delivery).

3) Depending on installation position, one of L_1 ,L_2 and L_3 must be connected (please refer to *Installation Notes* on page 61).

Installation Drawing

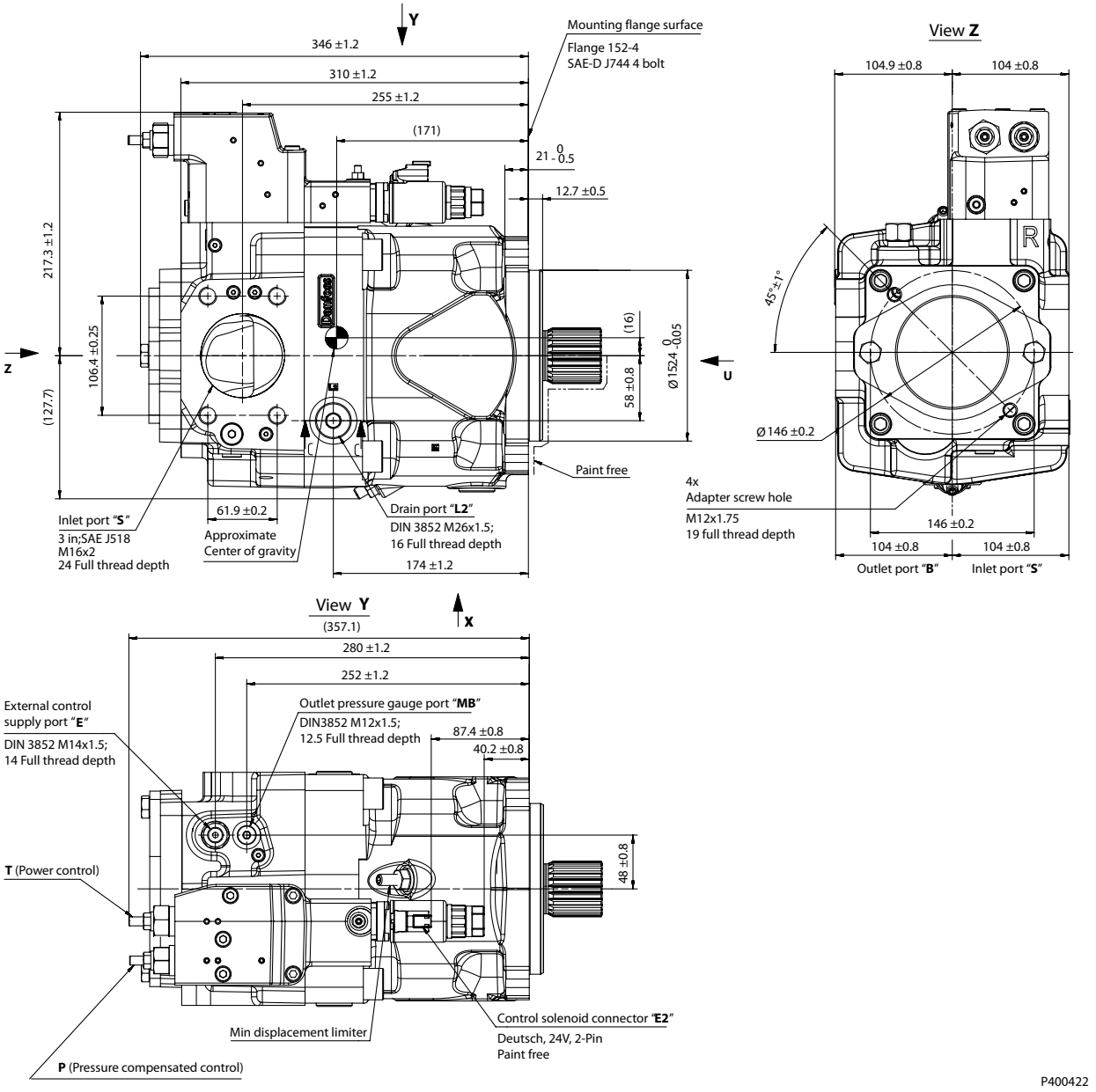
Size 130/145: (TPE5) Dimensions and Port Descriptions

Control : TPE5

Power control (T) + Pressure compensated control (P) + Electric displacement control (E5)

Auxiliary flange : B1

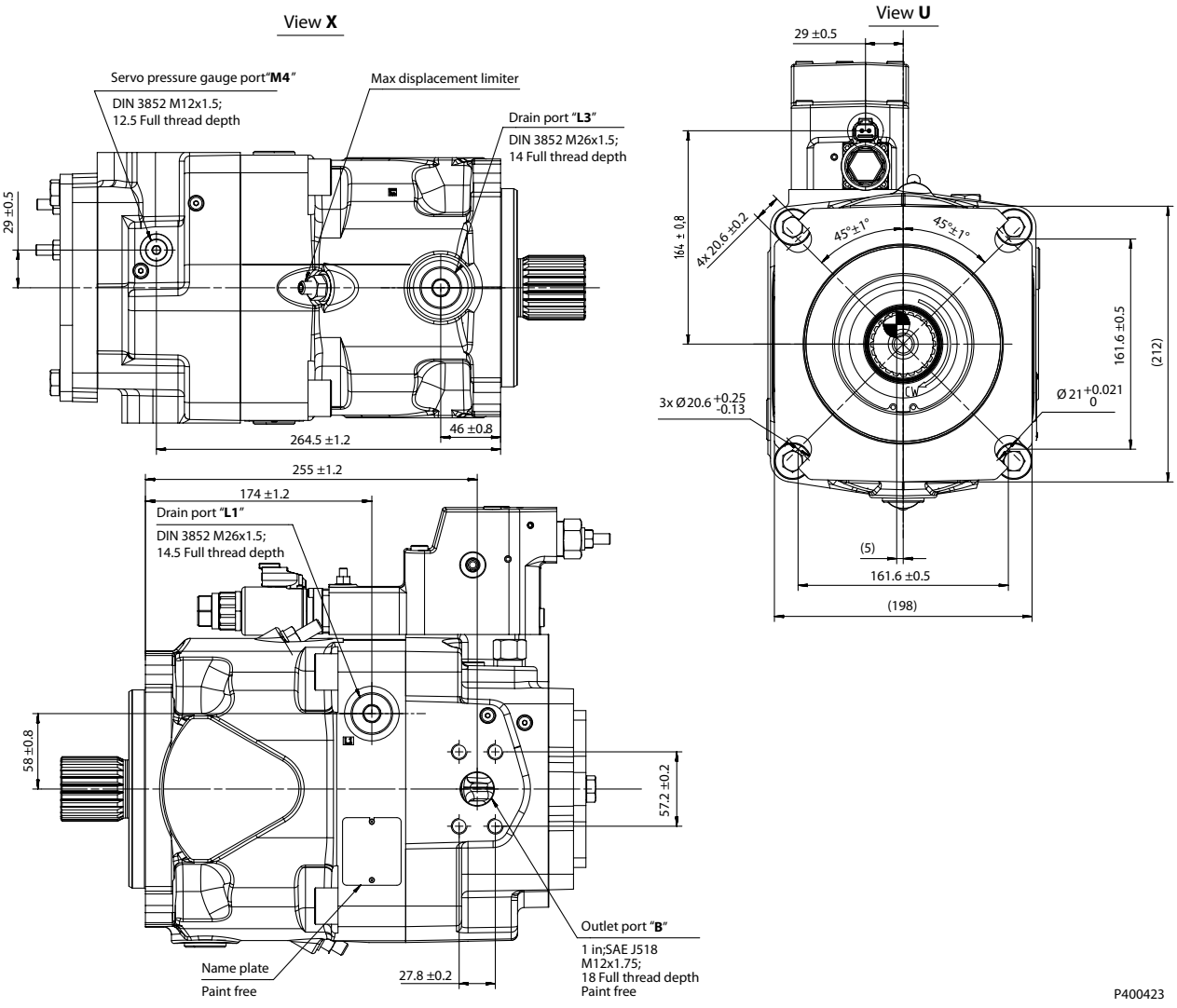
Charge pump : Without



P400422

Before finalizing your design, please request a certified drawing.

Installation Drawing



Before finalizing your design, please request a certified drawing.

Port Descriptions

Ports	Description	Standard	Size[1)]	Max. pressure (bar)	State[2)]
B	Outlet port, Fixing thread	SAE J518, DIN13	1 in, M12 x 1.75; 18 deep	400	O
S	Suction port, Fixing thread	SAE J518, DIN13	3 in, M16 x 2; 24 deep	2	O
L_1, L_2, L_3	Drain port	DIN 3852	M26 x 1.5; 14.5, 16, 14 deep	2	X[3)]
M_4	Measurement point,servo-piston chamber	DIN 3852	M12 x 1.5; 12.5 deep	400	X
M_B	Measurement point, outlet port	DIN 3852	M12 x 1.5; 12.5 deep	400	X
E	External control port	DIN 3852	M14 x 1.5; 12 deep	200	X

[1)] For required torque, please refer to *Tightening Torque* on page 59.

[2)] O = Open, must be connected (closed by plastic plug on delivery) / X = Closed (closed by metal plug on delivery).

[3)] Depending on installation position, one of L_1 ,L_2 and L_3 must be connected (please refer to *Installation Notes* on page 61).

Installation Drawing

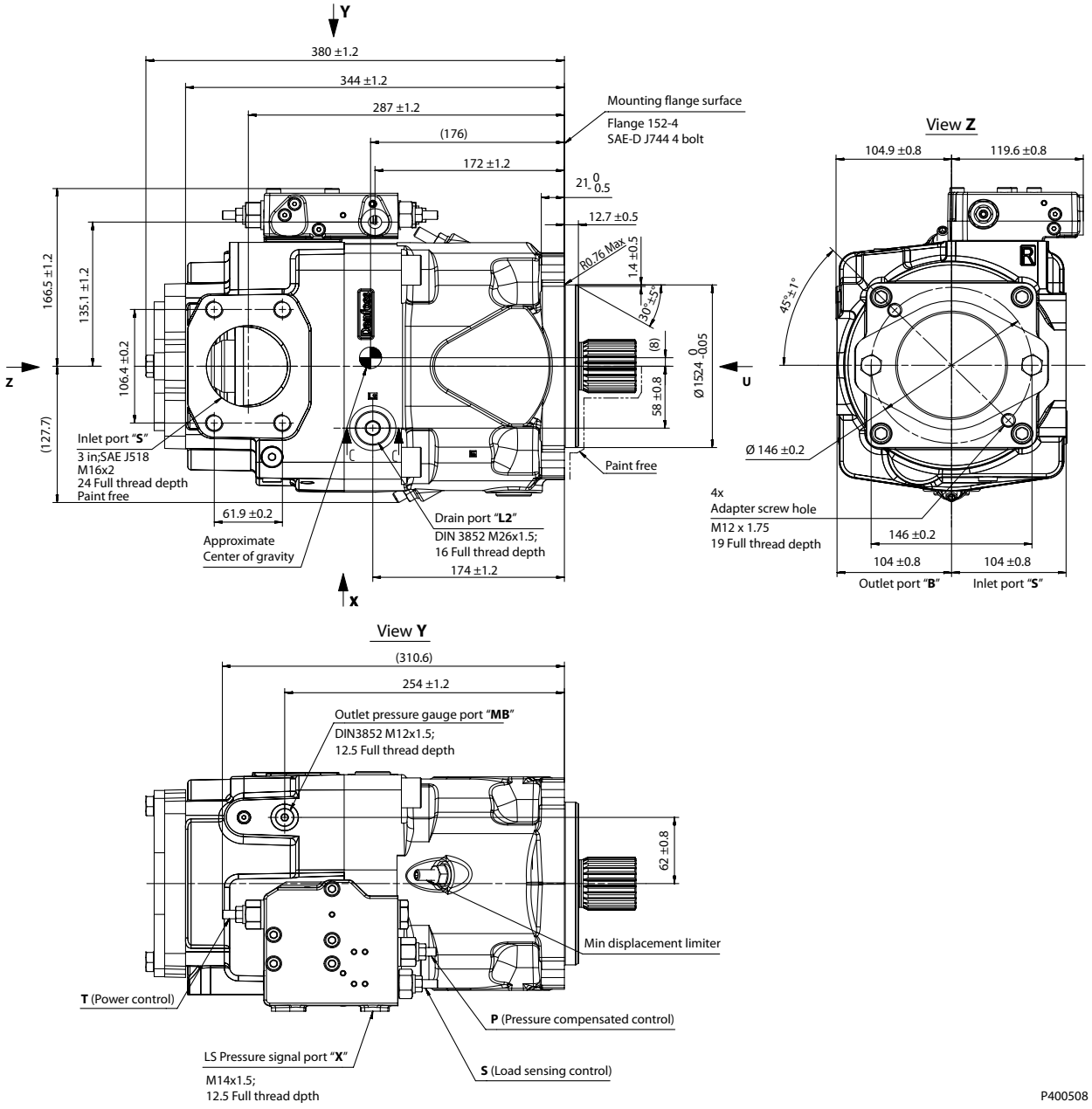
Size 130/145: (TPSN with Charge pump) Dimensions and Port Descriptions

Control : TPSN

Power control (T) + Pressure compensated control (P) + Load sensing control (S)

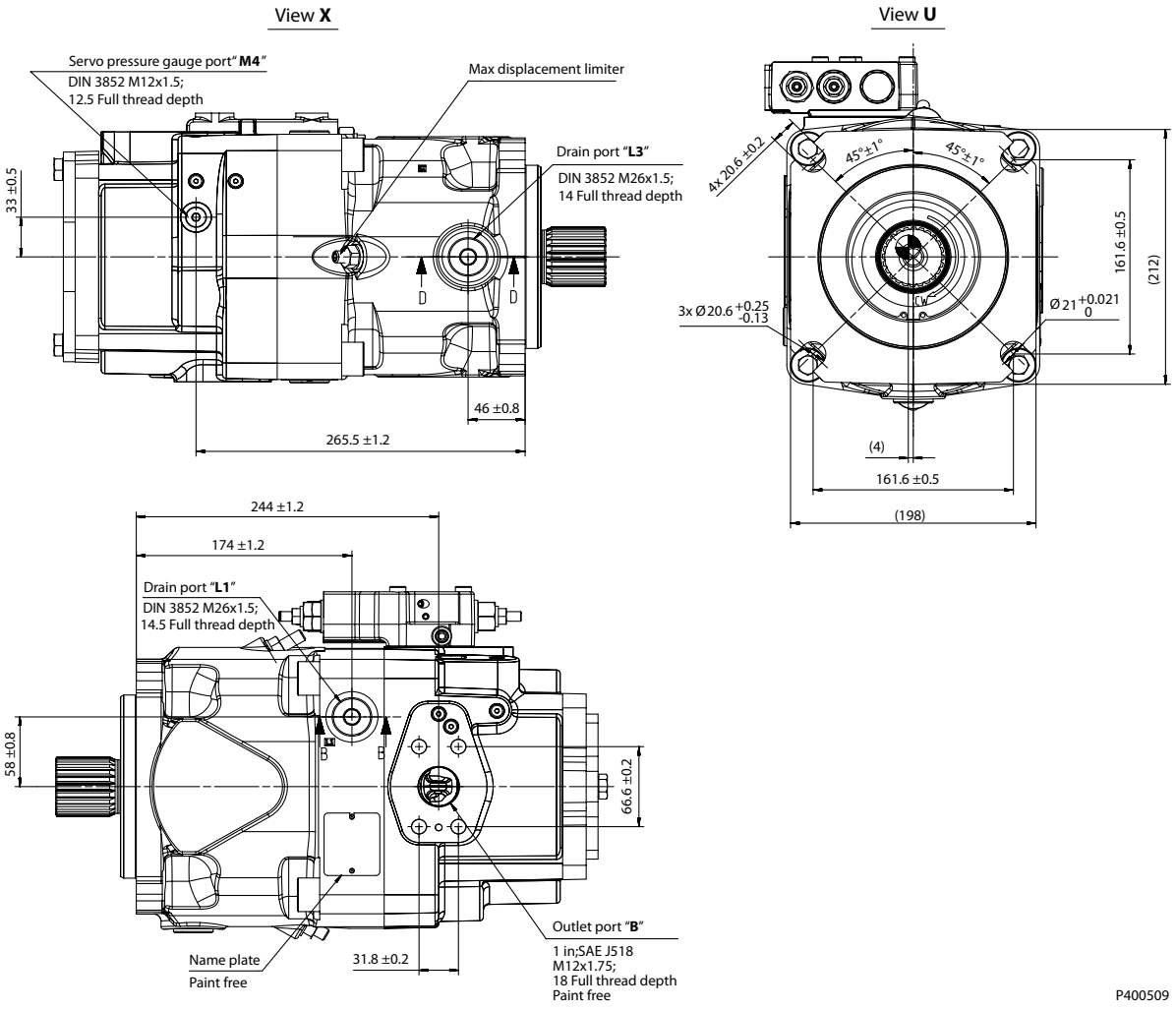
Auxiliary flange : B1

Charge pump : With



Before finalizing your design, please request a certified drawing.

Installation Drawing



Before finalizing your design, please request a certified drawing.

Port Descriptions

Ports	Description	Standard	Size[1)]	Max. pressure (bar)	State[2)]
B	Outlet port, Fixing thread	SAE J518, DIN13	1 ¼ in, M14 x 2; 23 deep	400	O
S	Suction port, Fixing thread	SAE J518, DIN13	3 in, M16 x 2; 24 deep	2	O
L_1, L_2, L_3	Drain port	DIN 3852	M26 x 1.5; 14.5, 16, 14 deep	2	X[3)]
M_4	Measurement point,servo-piston chamber	DIN 3852	M12 x 1.5; 12.5 deep	400	X
M_B	Measurement point, outlet port	DIN 3852	M12 x 1.5; 12.5 deep	400	X
X	LS port	DIN 3852	M14 x 1.5; 12.5 deep	400	X

[1)] For required torque, please refer to *Tightening Torque* on page 59.

[2)] O = Open, must be connected (closed by plastic plug on delivery) / X = Closed (closed by metal plug on delivery).

[3)] Depending on installation position, one of L_1 ,L_2 and L_3 must be connected (please refer to *Installation Notes* on page 61).

Installation Drawing

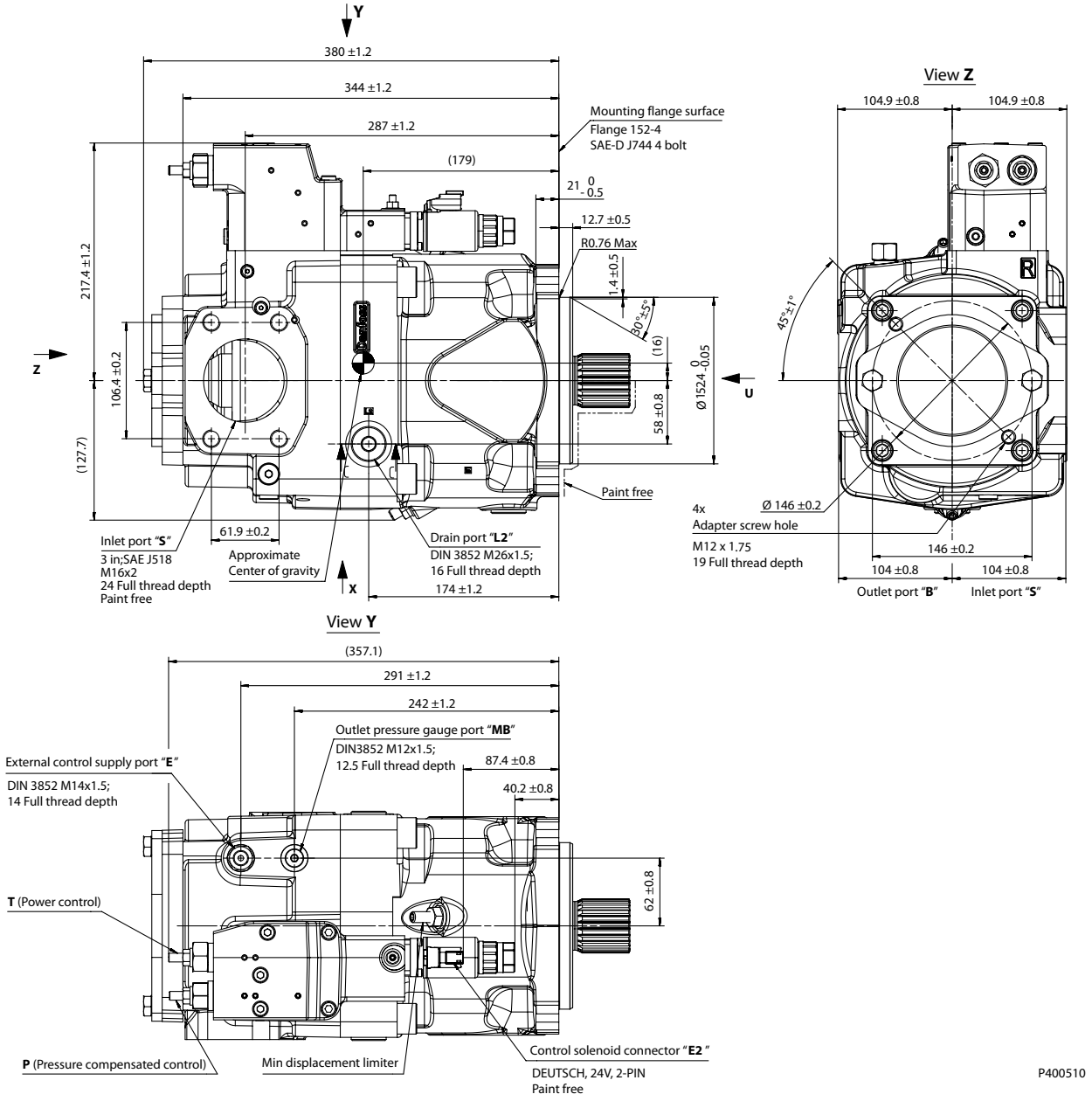
Size 130/145: (TPE5 with Charge pump) Dimensions and Port Descriptions

Control : TPE5

Power control (T) + Pressure compensated control (P) + Electric displacement control (E5)

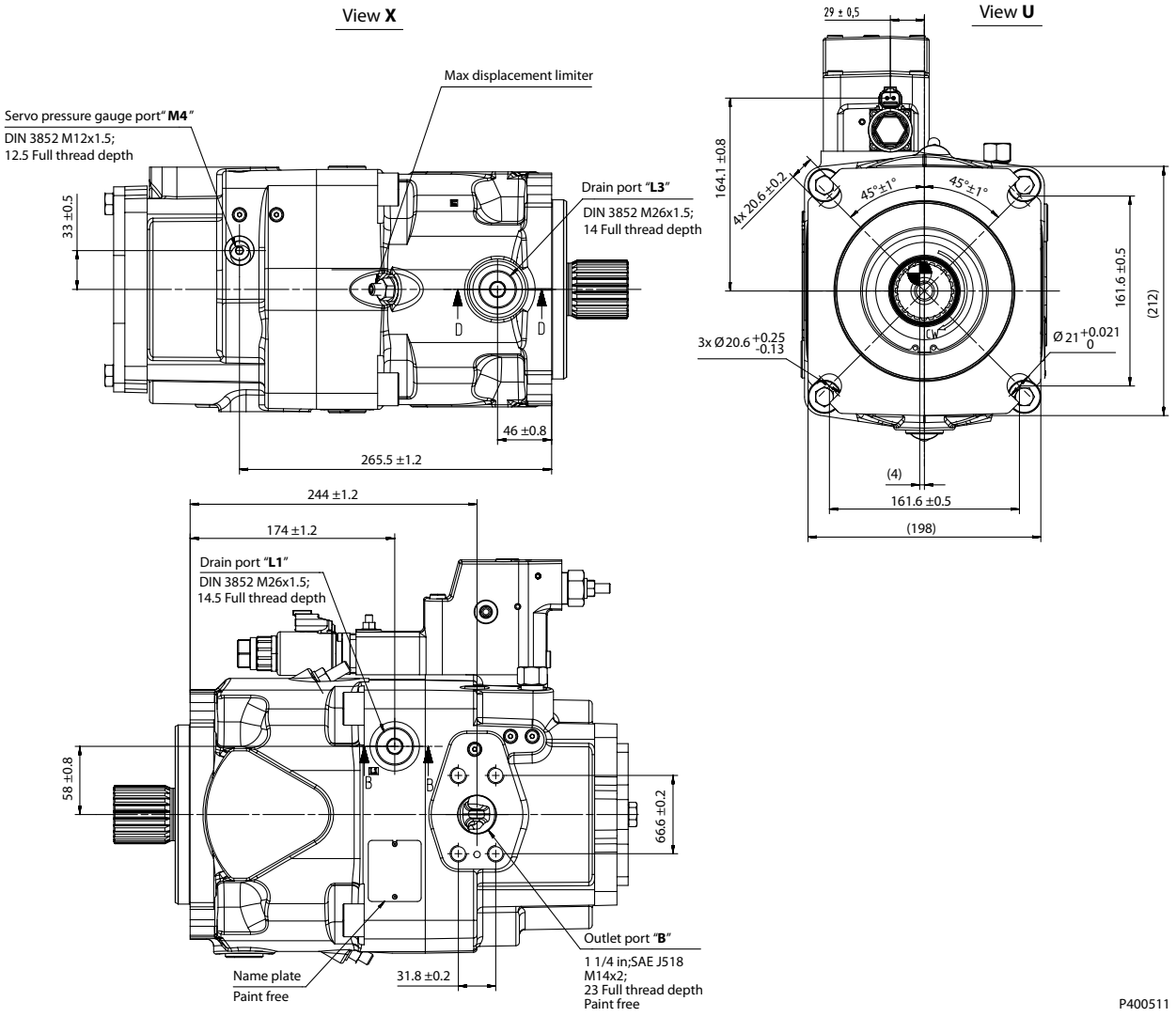
Auxiliary flange : B1

Charge pump : With



Before finalizing your design, please request a certified drawing.

Installation Drawing



Before finalizing your design, please request a certified drawing.

Port Descriptions

Ports	Description	Standard	Size[1)]	Max. pressure (bar)	State[2)]
B	Outlet port, Fixing thread	SAE J518, DIN13	1 ¼ in, M14 x 2; 23 deep	400	O
S	Suction port, Fixing thread	SAE J518, DIN13	3 in, M16 x 2; 24 deep	2	O
L_1, L_2, L_3	Drain port	DIN 3852	M26 x 1.5; 14.5, 16, 14 deep	2	X[3)]
M_4	Measurement point,servo-piston chamber	DIN 3852	M12 x 1.5; 12.5 deep	400	X
M_B	Measurement point, outlet port	DIN 3852	M12 x 1.5; 12.5 deep	400	X
E	External control port	DIN 3852	M14 x 1.5; 12 deep	200	X

1) For required torque, please refer to *Tightening Torque* on page 59.

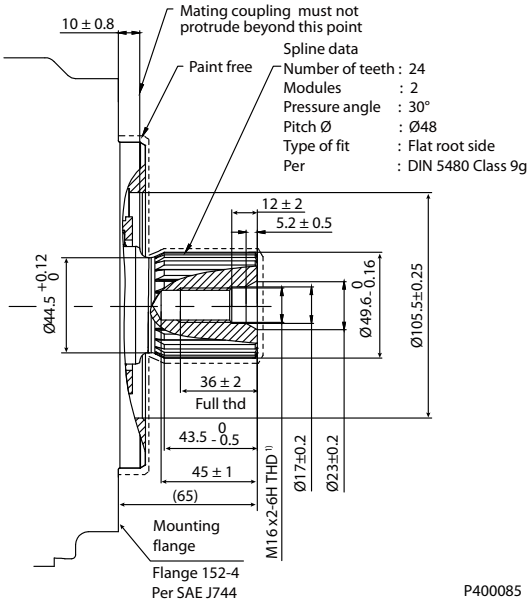
2) O = Open, must be connected (closed by plastic plug on delivery) / X = Closed (closed by metal plug on delivery).

3) Depending on installation position, one of L_1 ,L_2 and L_3 must be connected (please refer to *Installation Notes* on page 61).

Installation Drawing

Size 130/145: Input Shaft: T (Splined shaft DIN 5480, W50 x 2 x 30 x 24 x 9g)

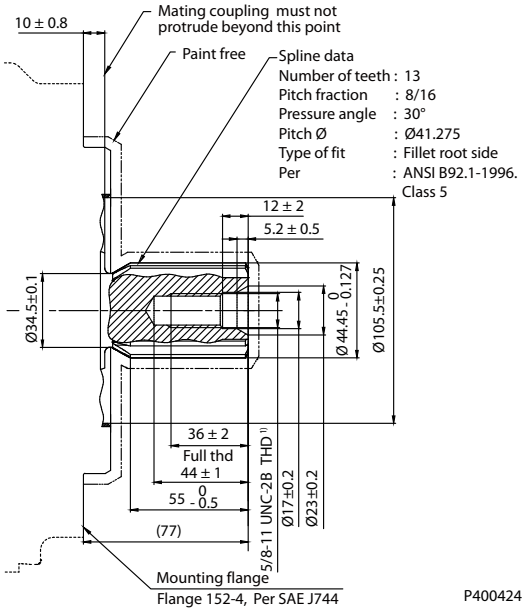
*Maximum torque rating : 3140 N•m (Please see *Shaft Torque Ratings* on page 16)



1) Center bore according to DIN 332 (thread acc. to DIN 13).

Size 130/145: Input Shaft: S (Splined shaft SAE J744, 13/4 in. 13T, 8/16 DP)

*Maximum torque rating : 1640 N•m (Please see *Shaft Torque Ratings* on page 16)

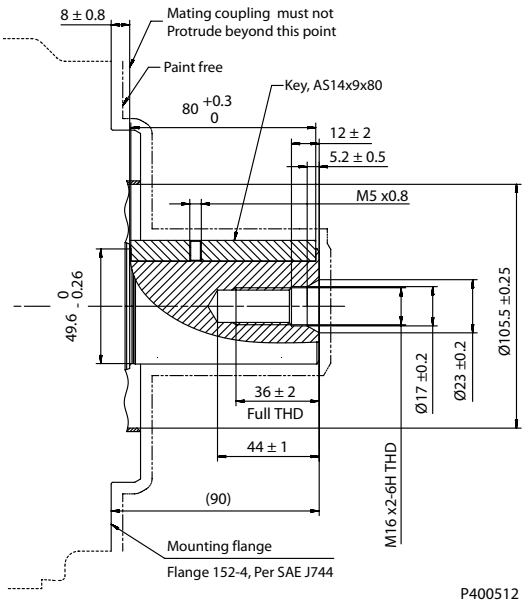


1) Center bore according to DIN 332 (thread acc. to DIN 13).

Installation Drawing

Size 130/145: Input Shaft: P (Straight keyed shaft, DIN 6885, AS14x9x80)

*Maximum torque rating : 1448 N•m (Please see *Shaft Torque Ratings* on page 16)

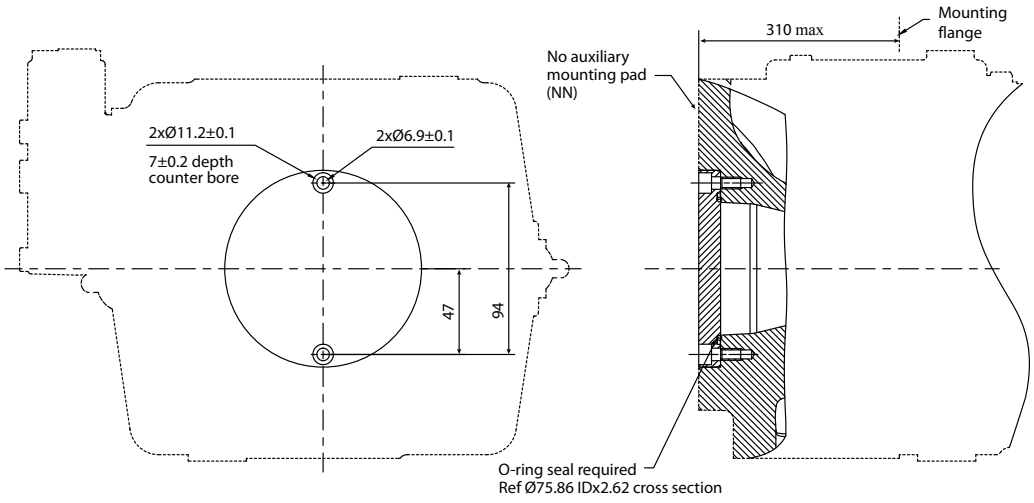


1) Center bore according to DIN 332 (thread acc. to DIN 13).

Before finalizing your design, please request a certified drawing.

Installation Drawing

Size 130/145: Aux Mounting Flange: Option NN (No Coupling)

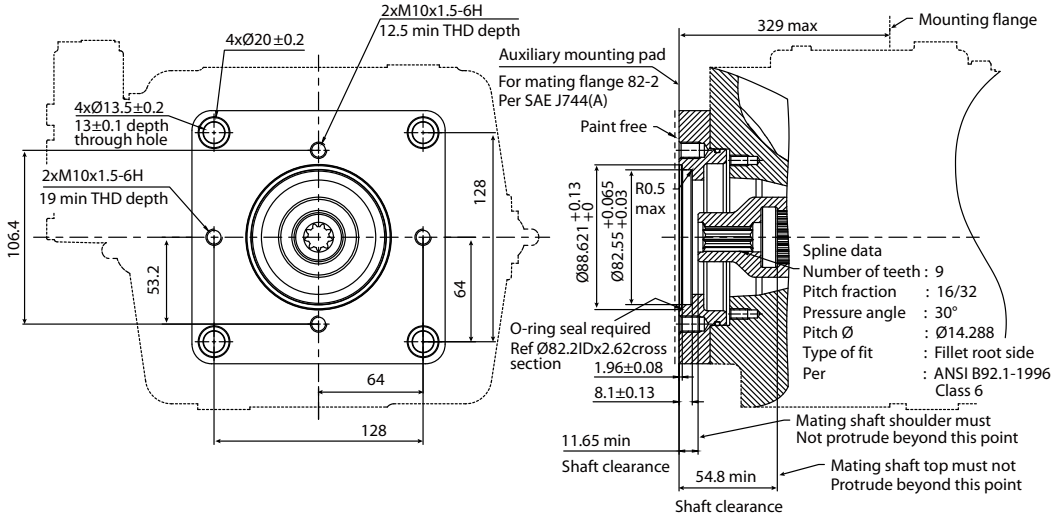


P400269

Specifications

Option	Coupling
NN	No coupling

Size 130/145: Aux Mounting Flange: Option A1 (SAE-A, 9 theeth)



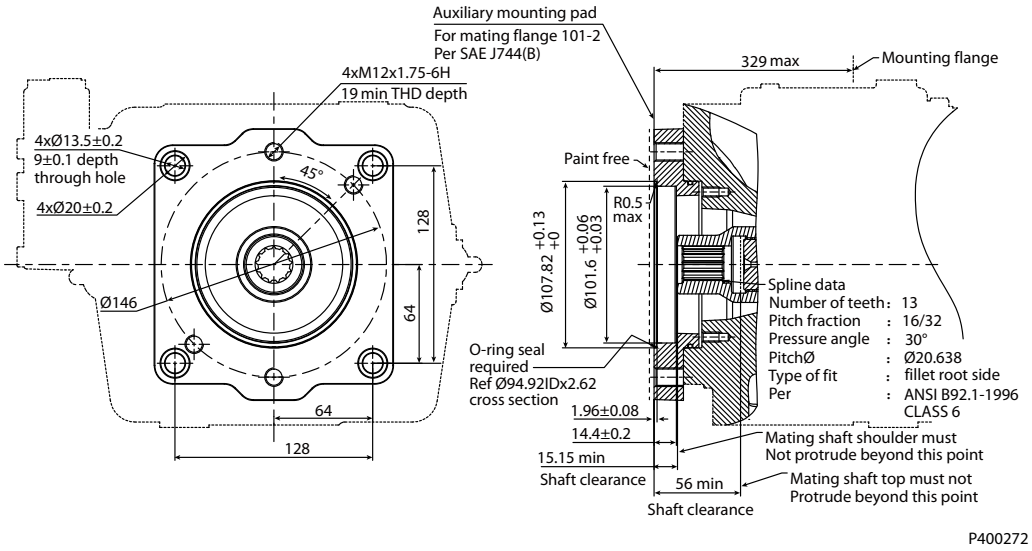
P400271

Specifications

Option	Coupling	Max torque
A1	5/8 in, 9T, 16/32 DP	205 N•m

Installation Drawing

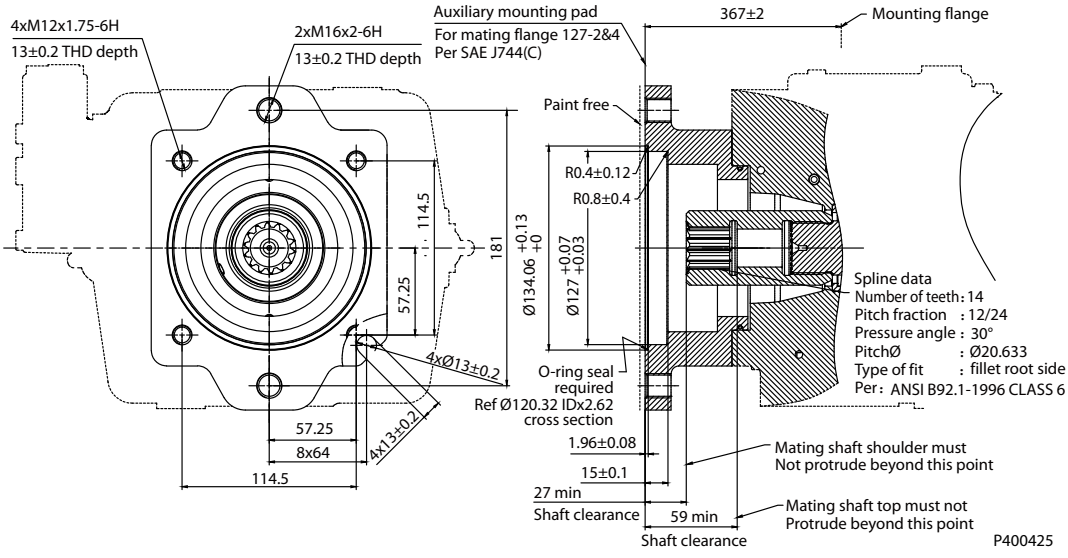
Size 130/145: Aux Mounting Flange: Option B1 (SAE-B, 13 teeth)



Specifications

Option	Coupling	Max torque
B1	7/8 in, 13T, 16/32 DP	411 N•m

Size 130/145: Aux Mounting Flange: Option C5 (SAE-C, 14 teeth)

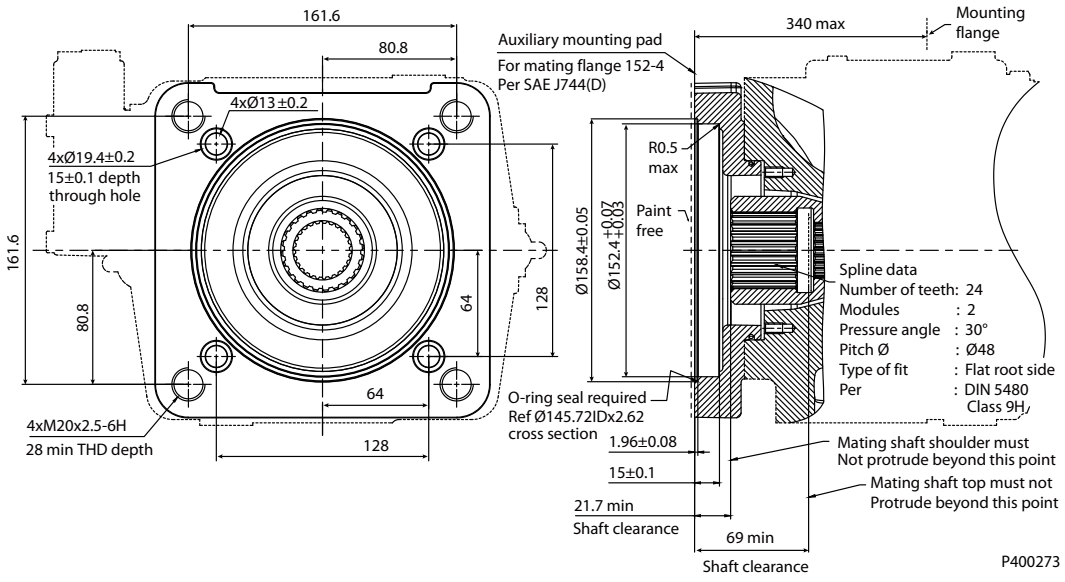


Specifications

Option	Coupling	Max torque
C5	1 ¼ in, 14T 12/24 DP	1164 N•m

Installation Drawing

Size 130/145: Aux Mounting Flange: Option D5 (SAE-D, 24 teeth)



Specifications

Option	Coupling	Max torque
D5	N50x2x30x24x9H	1164 N•m

Before finalizing your design, please request a certified drawing.

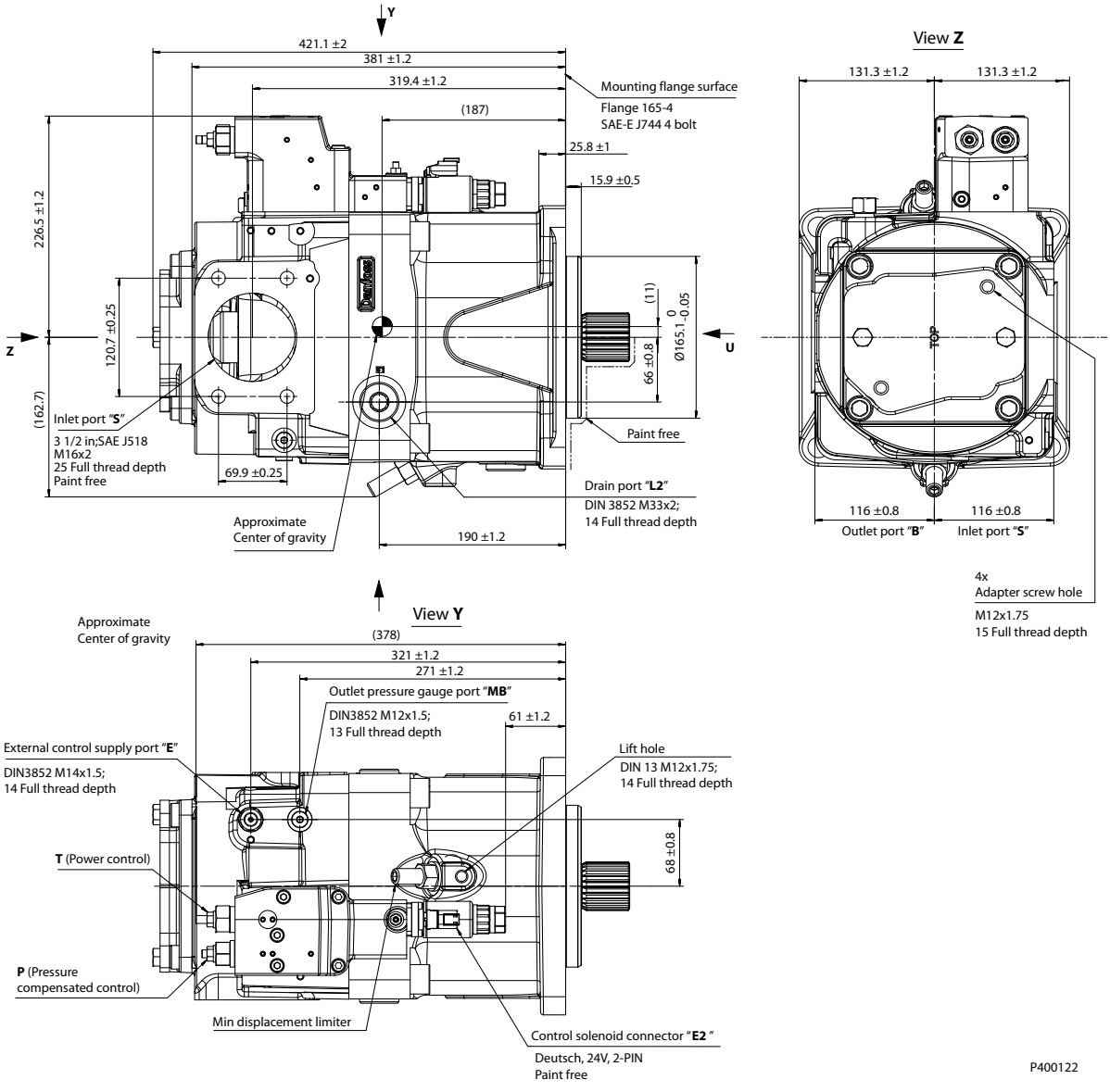
Installation Drawing

Size 193: (TPE2) Dimensions and Port Descriptions

Control : TPE2

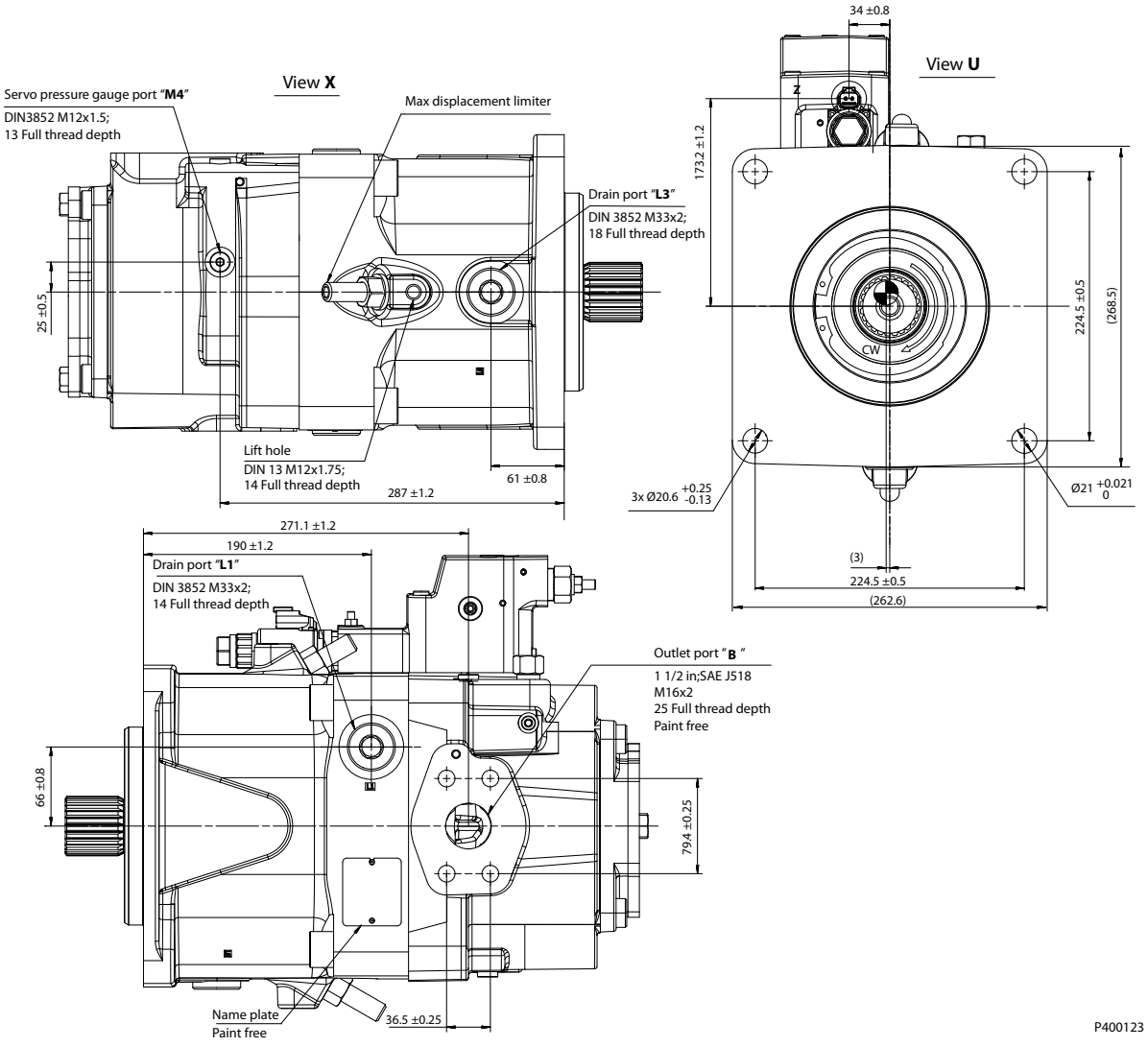
Power control (T) + Pressure compensated control (P) + Electric displacement control (E2)

Auxiliary flange : B1



Before finalizing your design, please request a certified drawing.

Installation Drawing



Before finalizing your design, please request a certified drawing.

Port Descriptions

Ports	Description	Standard	Size[1)]	Max. pressure (bar)	State[2)]
B	Outlet port, Fixing thread	SAE J518, DIN13	1 1/2 in, M16 x 2; 25 deep	400	O
S	Suction port, Fixing thread	SAE J518, DIN13	3 1/2 in, M16 x 2; 25 deep	2	O
L_1, L_2, L_3	Drain port	DIN 3852	M33 x 2; 14,14, 18 deep	2	X[3)]
M_4	Measurement point,servo-piston chamber	DIN 3852	M12 x 1.5; 13 deep	400	X
M_B	Measurement point, outlet port	DIN 3852	M12 x 1.5; 13 deep	400	X
E	External control port	DIN 3852	M14 x 1.5; 14 deep	200	X[4)]

[1)] For required torque, please refer to *Tightening Torque* on page 59

[2)] O = Open, must be connected (closed by plastic plug on delivery) / X = Closed (closed by metal plug on delivery)

[3)] Depending on installation position, one of L_1 ,L_2 and L_3 must be connected (please refer to *Installation Notes* on page 61).

[4)] If E port is not used, remove the shuttle valve and lock port by seal plug.

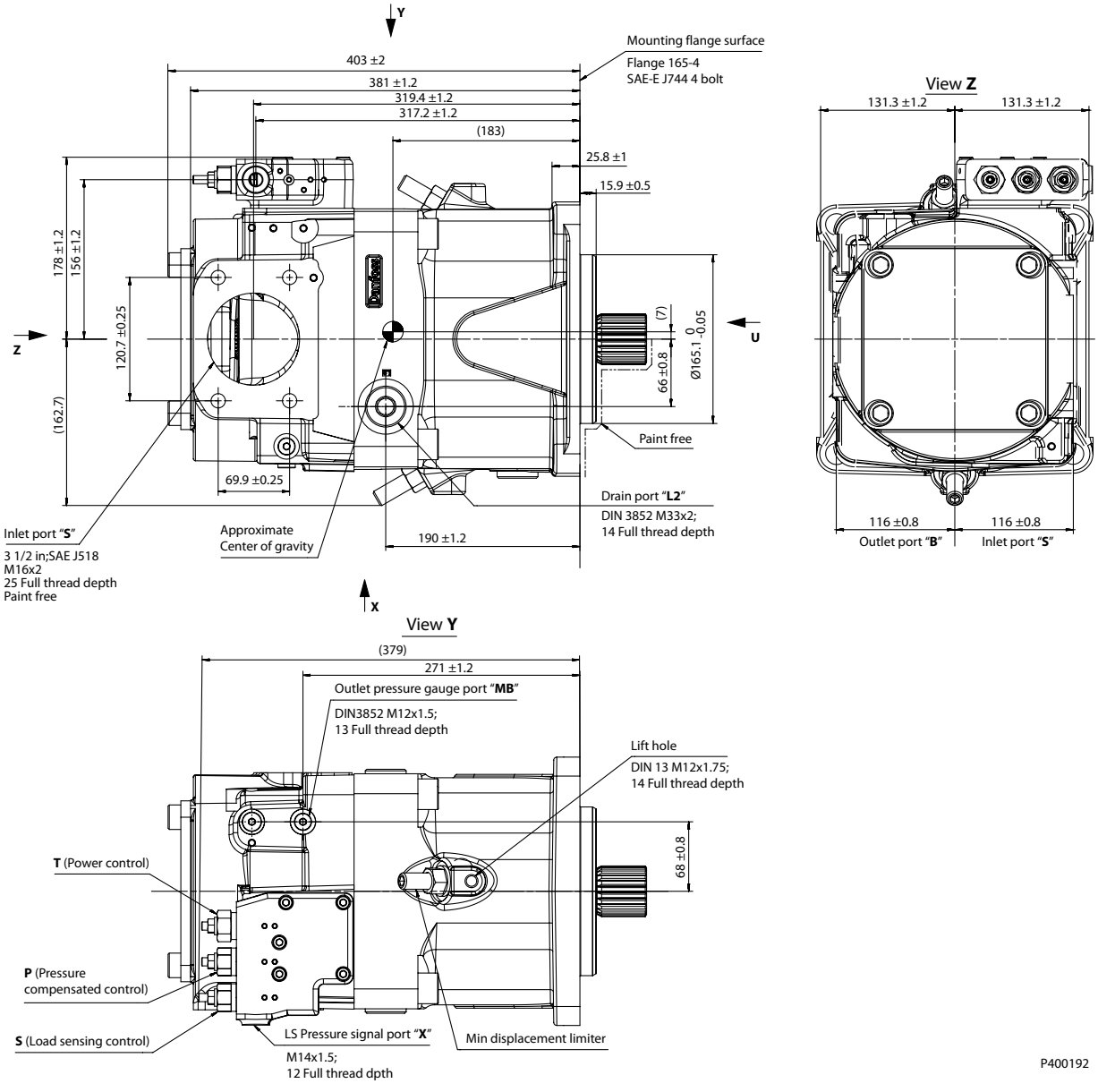
Installation Drawing

Size 193: (TPSN) Dimensions and Port Descriptions

Control : TPSN

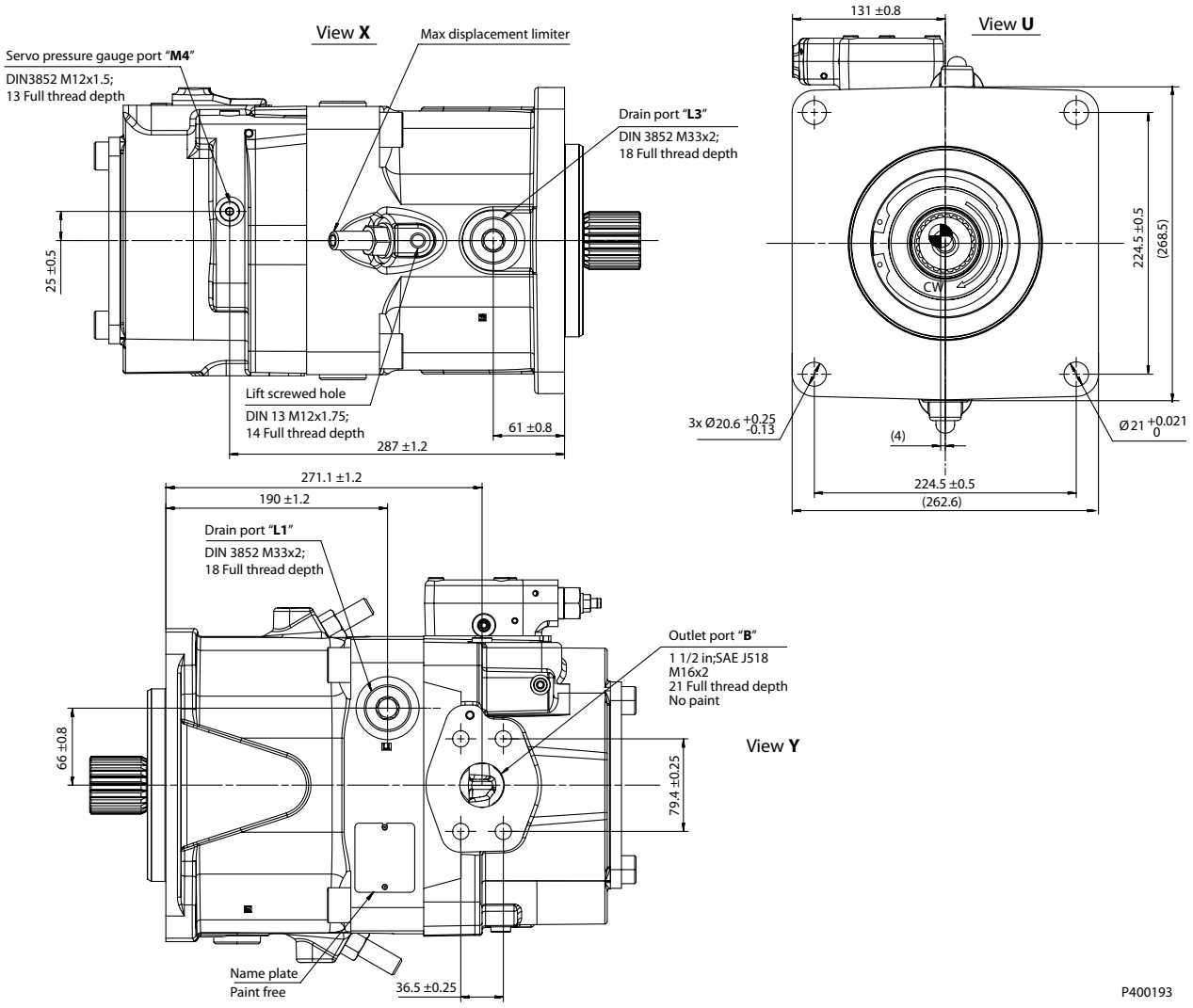
Power control (T) + Pressure compensated control (P) + Load sensing control (S)

Auxiliary flange : NN



Before finalizing your design, please request a certified drawing.

Installation Drawing



Before finalizing your design, please request a certified drawing.

Port Descriptions

Ports	Description	Standard	Size[1)]	Max. pressure (bar)	State[2)]
B	Outlet port, Fixing thread	SAE J518, DIN13	1 1/2 in, M16 x 2; 25 deep	400	O
S	Suction port, Fixing thread	SAE J518, DIN13	3 1/2 in, M16 x 2; 25 deep	2	O
L_1, L_2, L_3	Drain port	DIN 3852	M33 x 2; 14, 14, 18 deep	2	X[3)]
M_4	Measurement point,servo-piston chamber	DIN 3852	M12 x 1.5; 13 deep	400	X
M_B	Measurement point, outlet port	DIN 3852	M12 x 1.5; 13 deep	400	X
X	LS port	DIN 3852	M14 x 1.5; 12 deep	400	O

[1)] For required torque, please refer to *Tightening Torque* on page 59.

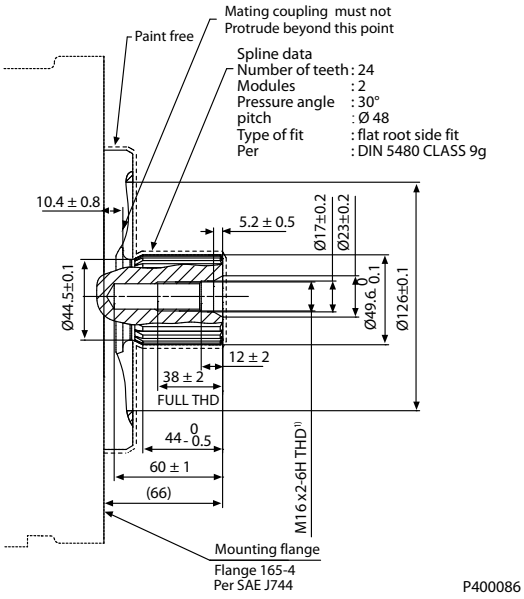
[2)] O = Open, must be connected (closed by plastic plug on delivery) / X = Closed (closed by metal plug on delivery).

[3)] Depending on installation position, one of L_1 ,L_2 and L_3 must be connected (please refer to *Installation Notes* on page 61).

Installation Drawing

Size 193: Input Shaft: T (Splined shaft DIN 5480, W50 x 2 x 30 x 24 x 9g)

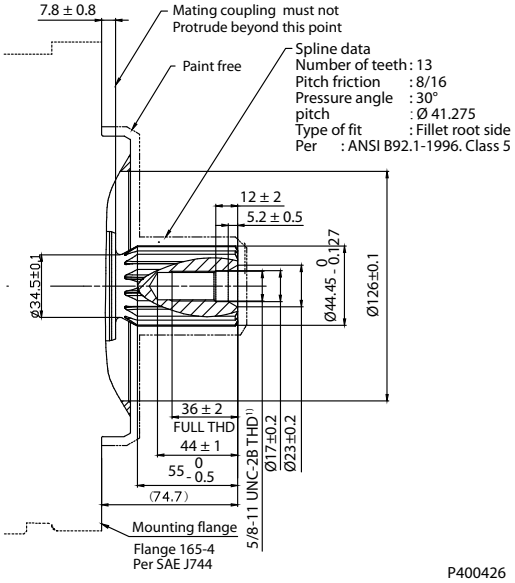
*Maximum torque rating : 3140 N•m (Please see *Shaft Torque Ratings* on page 16)



1) Center bore according to DIN 332 (thread acc. to DIN 13).

Size 193: Input Shaft: S (Splined shaft SAE J744, 1 3/4 in, 13T, 8/16 DP)

*Maximum torque rating : 1640 N•m (Please see *Shaft Torque Ratings* on page 16)

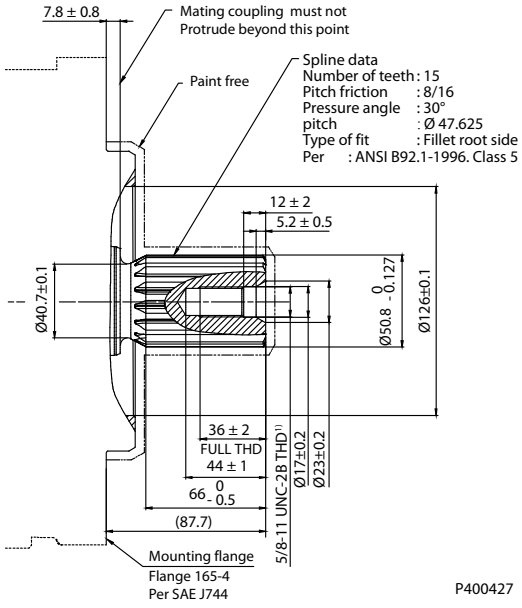


1) Center bore according to DIN 332 (thread acc. to DIN 13).

Installation Drawing

Size 193: Input Shaft: A (Splined shaft SAE J744, 2 in, 15T, 8/16 DP)

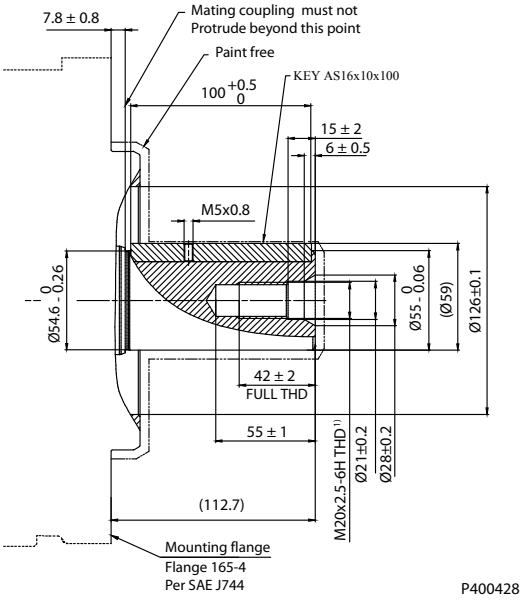
*Maximum torque rating : 2670 N•m (Please see *Shaft Torque Ratings* on page 16)



1) Center bore according to DIN 332 (thread acc. to DIN 13).

Size 193: Input Shaft: P (Straight keyed shaft, DIN 6885, AS16x10x100)

*Maximum torque rating : 2226 N•m (Please see *Shaft Torque Ratings* on page 16)

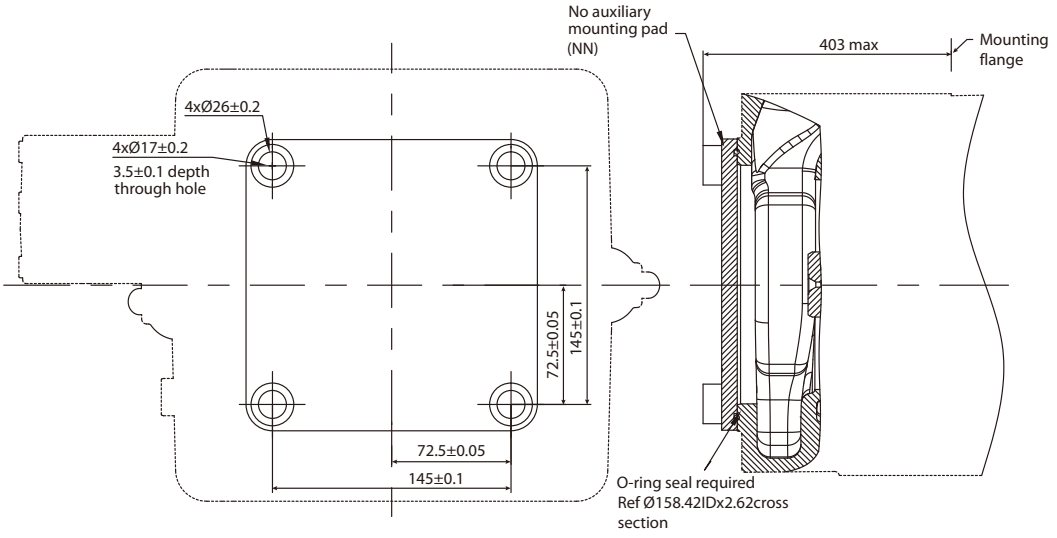


1) Center bore according to DIN 332 (thread acc. to DIN 13).

Before finalizing your design, please request a certified drawing.

Installation Drawing

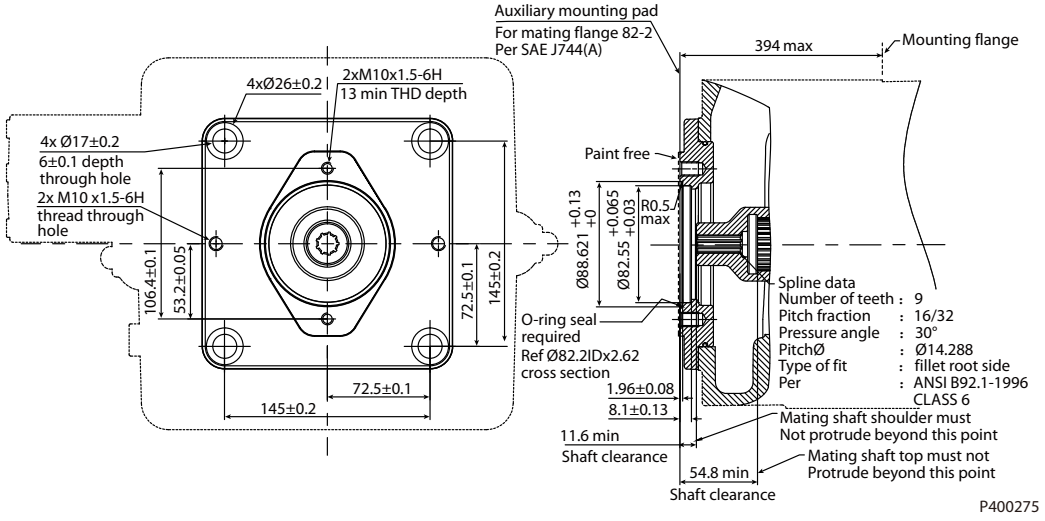
Size 193: Aux Mounting Flange: Option NN (No Coupling)



Specifications

Option	Coupling
NN	No coupling

Size 193: Aux Mounting Flange: Option A1 (SAE-A, 9 teeth)

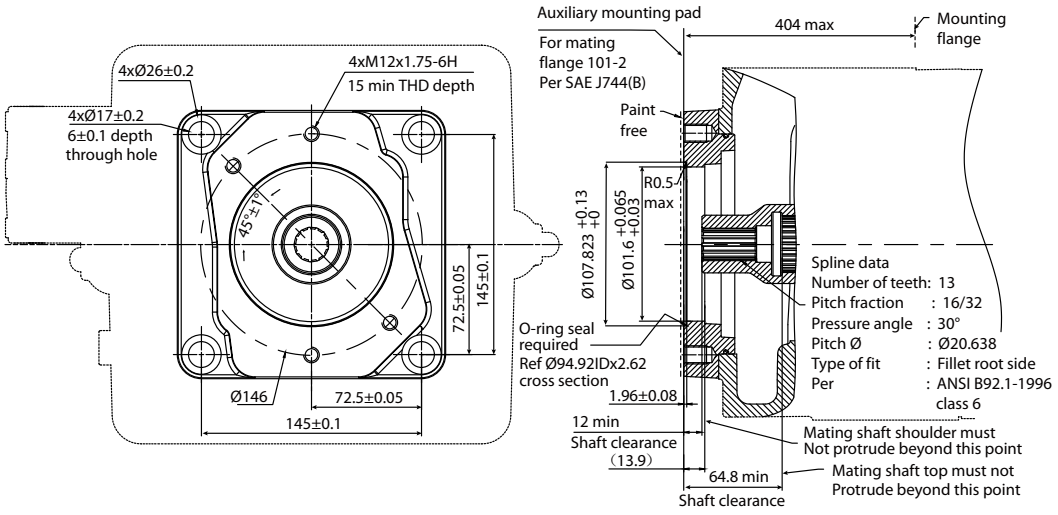


Specifications

Option	Coupling	Max torque
A1	5/8 in, 9T, 16/32 DP	205 N•m

Installation Drawing

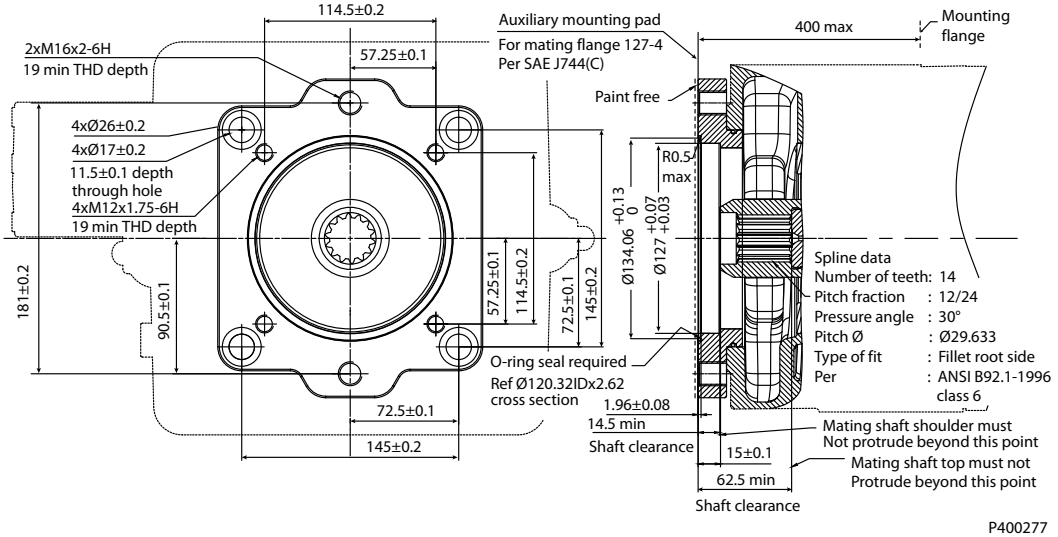
Size 193: Aux Mounting Flange: Option B1 (SAE-B, 13 teeth)



Specifications

Option	Coupling	Max torque
B1	7/8 in, 13T, 16/32 DP	411 N•m

Size 193: Aux Mounting Flange: Option C5 (SAE-C, 14 teeth)

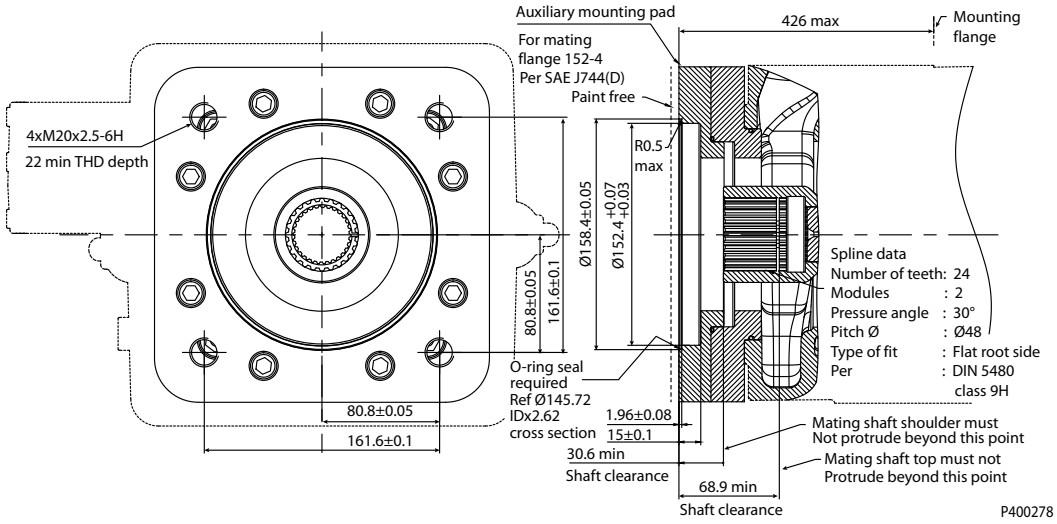


Specifications

Option	Coupling	Max torque
C5	1 1/4 in, 14T, 12/24 DP	1289 N•m

Installation Drawing

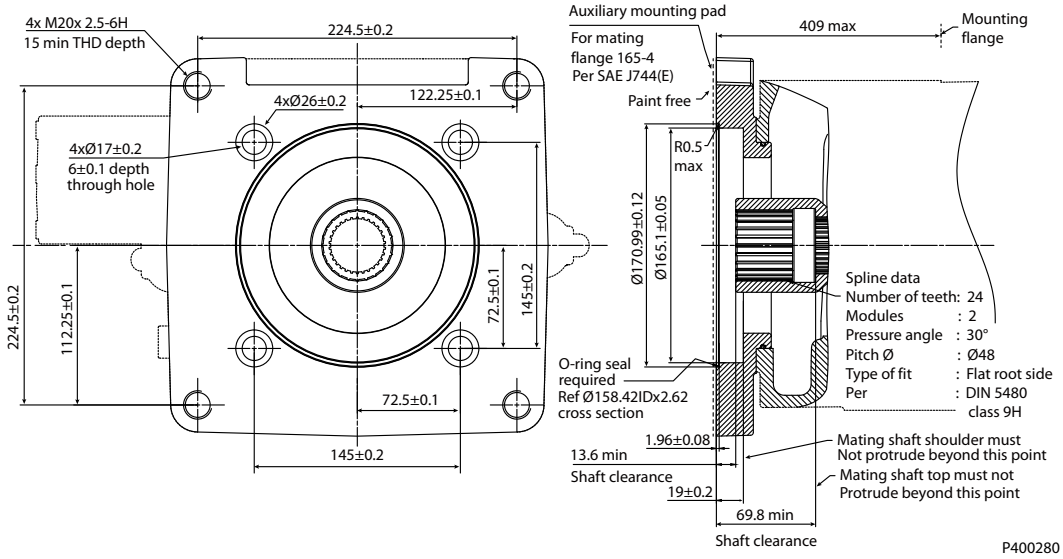
Size 193: Aux Mounting Flange: Option D5 (SAE-D, 24 teeth)



Specifications

Option	Coupling	Max torque
D5	N50 x 2 x 30 x 24 x 9H	1790 N•m

Size 193: Aux Mounting Flange: Option E2 (SAE-E, 24 teeth)



Specifications

Option	Coupling	Max torque
E2	N50 x 2 x 30 x 24 x 9H	1790 N•m

Before finalizing your design, please request a certified drawing.

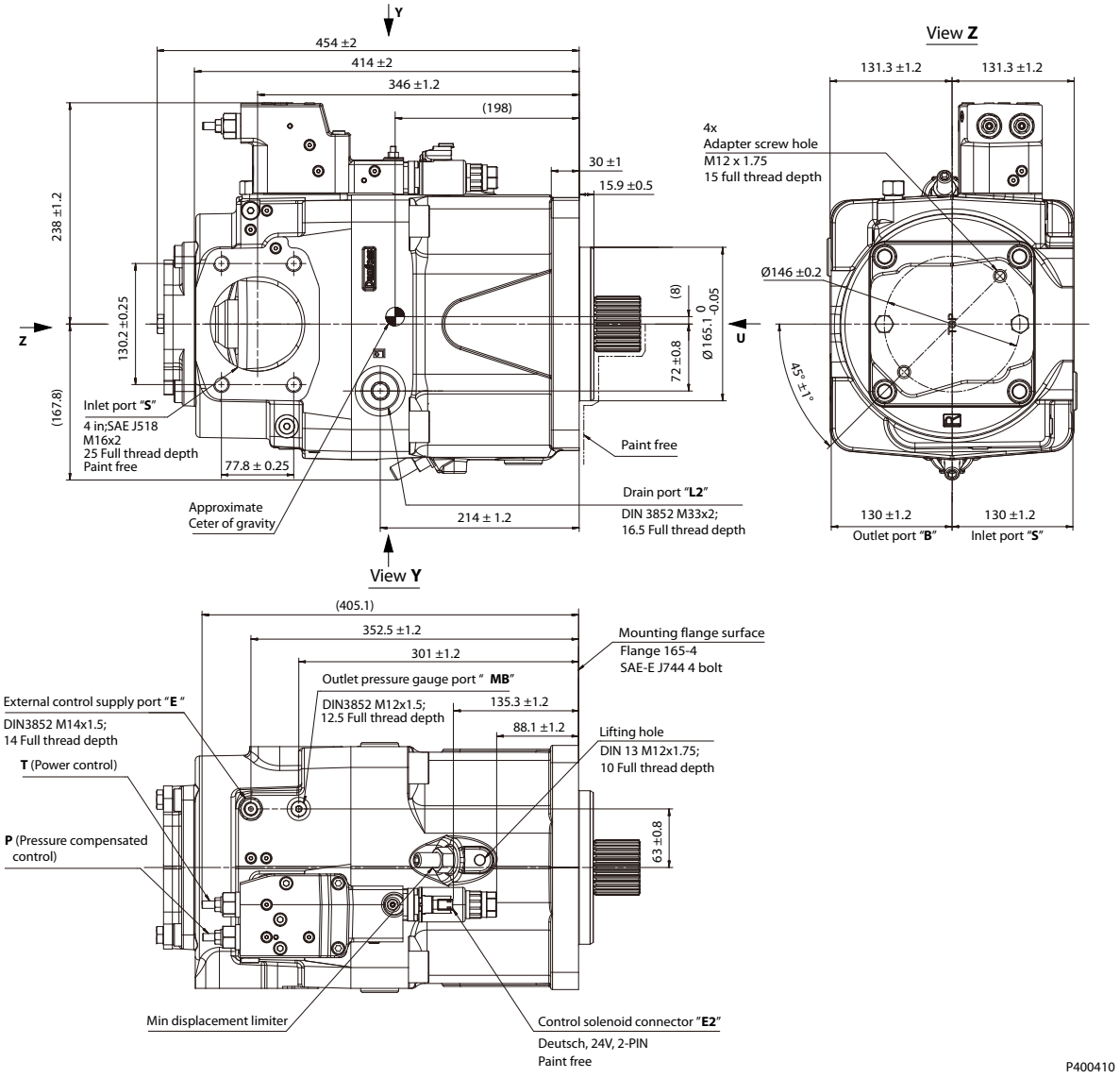
Installation Drawing

Size 260: (TPE2) Dimensions and Port Descriptions

Control : TPE2

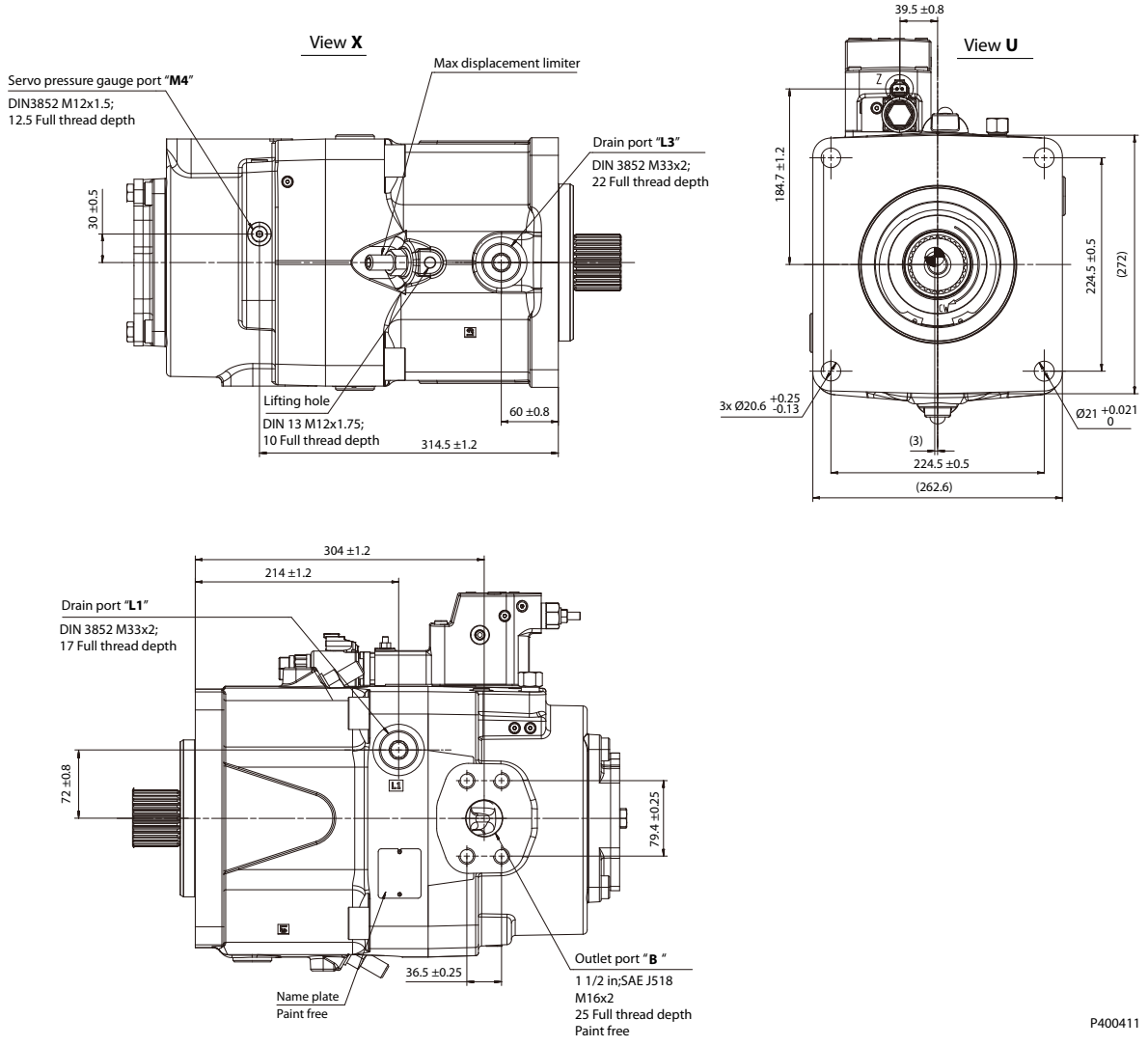
Power control (T) + Pressure compensated control (P) + Electric displacement control (E2)

Auxiliary flange : B1



Before finalizing your design, please request a certified drawing.

Installation Drawing



Before finalizing your design, please request a certified drawing.

Port Descriptions

Ports	Description	Standard	Size[1)]	Max. pressure (bar)	State[2)]
B	Outlet port, Fixing thread	SAE J518, DIN13	1 1/2 in, M16 x 2; 25 deep	400	O
S	Suction port, Fixing thread	SAE J518, DIN13	4 in, M16 x 2; 25 deep	2	O
L_1, L_2, L_3	Drain port	DIN 3852	M33 x 2; 17, 16.5, 22 deep	2	X[3)]
M_4	Measurement point,servo-piston chamber	DIN 3852	M12 x 1.5; 12.5 deep	400	X
M_B	Measurement point, outlet port	DIN 3852	M12 x 1.5; 12.5 deep	400	X
E	External control port	DIN 3852	M14 x 1.5; 14 deep	200	X[4)]

[1)] For required torque, please refer to *Tightening Torque* on page 59

[2)] O = Open, must be connected (closed by plastic plug on delivery) / X = Closed (closed by metal plug on delivery)

[3)] Depending on installation position, one of L_1 ,L_2 and L_3 must be connected (please refer to *Installation Notes* on page 61).

[4)] If E port is not used, remove the shuttle valve and lock port by seal plug.

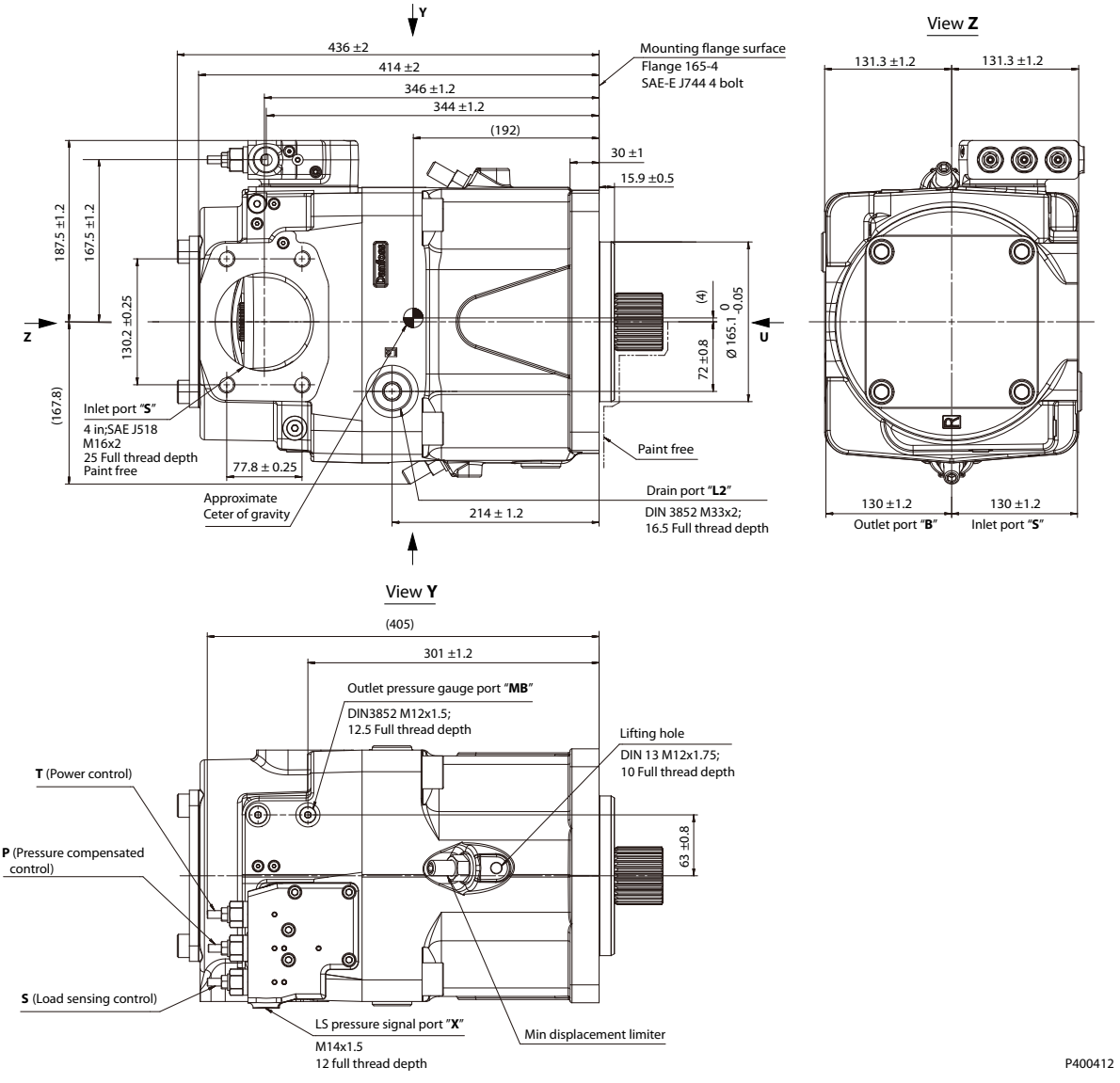
Installation Drawing

Size 260: (TPSN) Dimensions and Port Descriptions

Control : TPSN

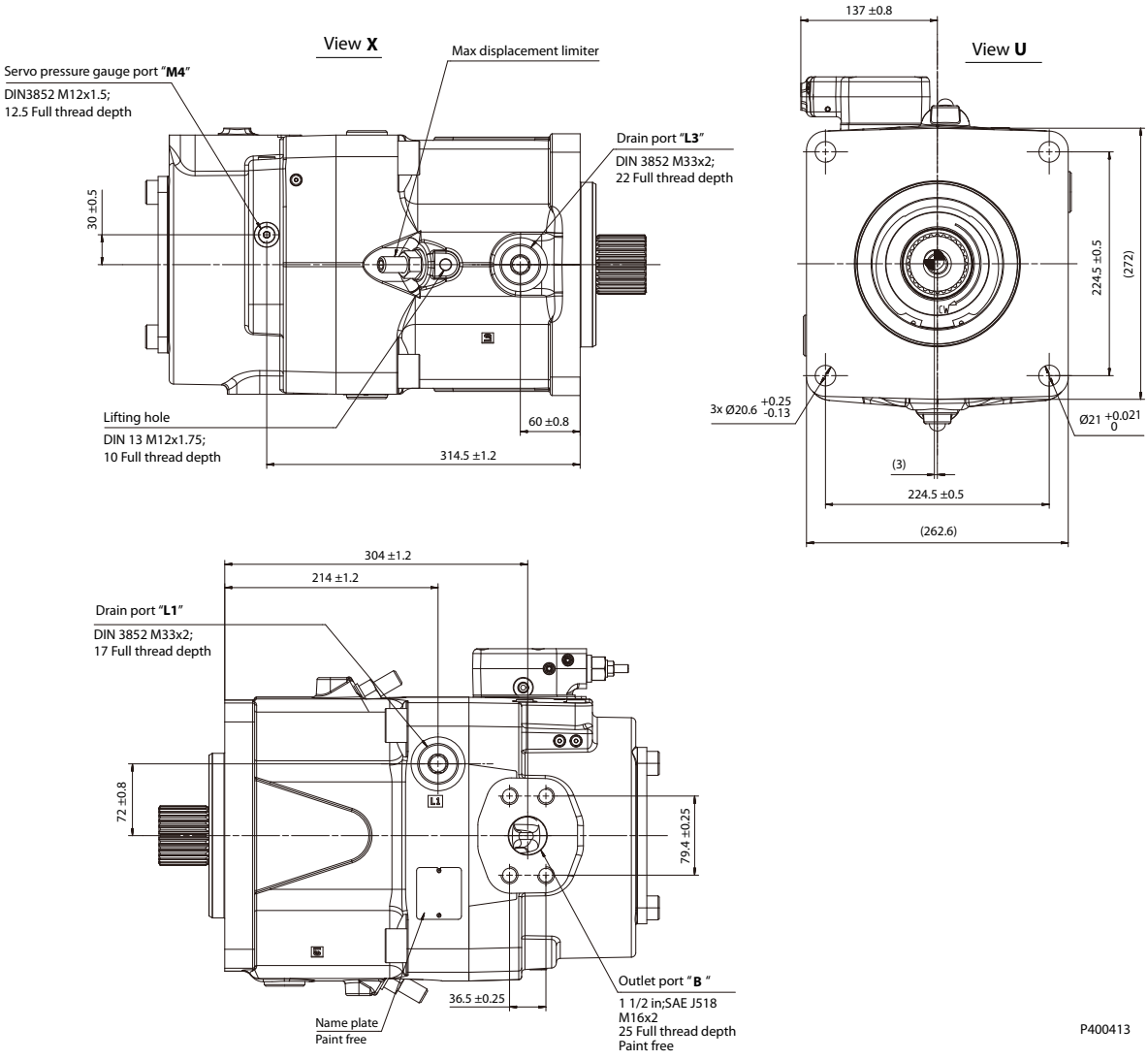
Power control (T) + Pressure compensated control (P) + Load sensing control (S)

Auxiliary flange : NN



Before finalizing your design, please request a certified drawing.

Installation Drawing



Before finalizing your design, please request a certified drawing.

Port Descriptions

Ports	Description	Standard	Size[1)]	Max. pressure (bar)	State[2)]
B	Outlet port, Fixing thread	SAE J518, DIN13	1 1/2 in, M16 x 2; 25 deep	400	O
S	Suction port, Fixing thread	SAE J518, DIN13	4 in, M16 x 2; 25 deep	2	O
L_1, L_2, L_3	Drain port	DIN 3852	M33 x 2; 17,16.5, 22 deep	2	X[3)]
M_4	Measurement point,servo-piston chamber	DIN 3852	M12 x 1.5; 12.5 deep	400	X
M_B	Measurement point, outlet port	DIN 3852	M12 x 1.5; 12.5 deep	400	X
X	LS port	DIN 3852	M14 x 1.5; 12 deep	400	O

[1)] For required torque, please refer to *Tightening Torque* on page 59.

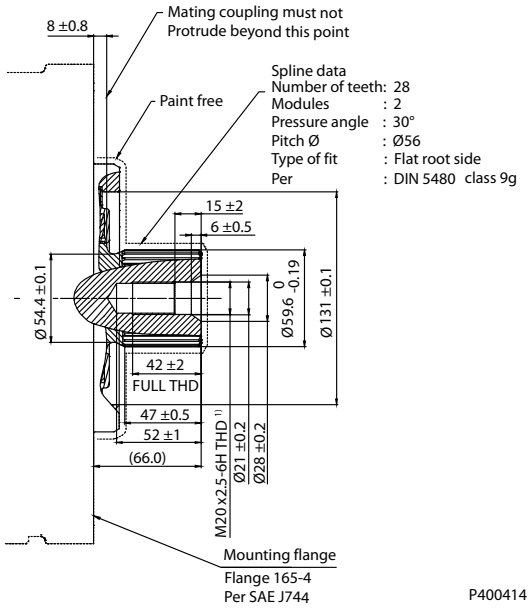
[2)] O = Open, must be connected (closed by plastic plug on delivery) / X = Closed (closed by metal plug on delivery).

[3)] Depending on installation position, one of L_1 ,L_2 and L_3 must be connected (please refer to *Installation Notes* on page 61).

Installation Drawing

Size 260: Input Shaft: T (Splined shaft DIN 5480, W60 x 2 x 30 x 28 x 9g)

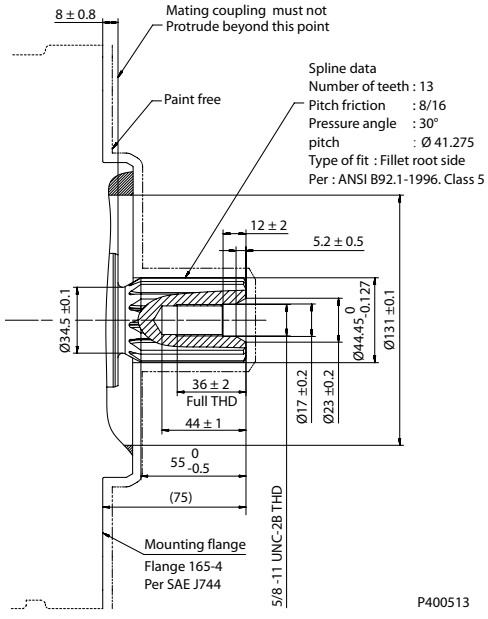
*Maximum torque rating : 5780N•m (Please see *Shaft Torque Ratings* on page 16)



1) Center bore according to DIN 332 (thread acc. to DIN 13).

Size 260: Input Shaft: S (Splined shaft SAE J744, 1 3/4 in. 13T, 8/16 DP)

*Maximum torque rating : 1640N•m (Please see *Shaft Torque Ratings* on page 16)

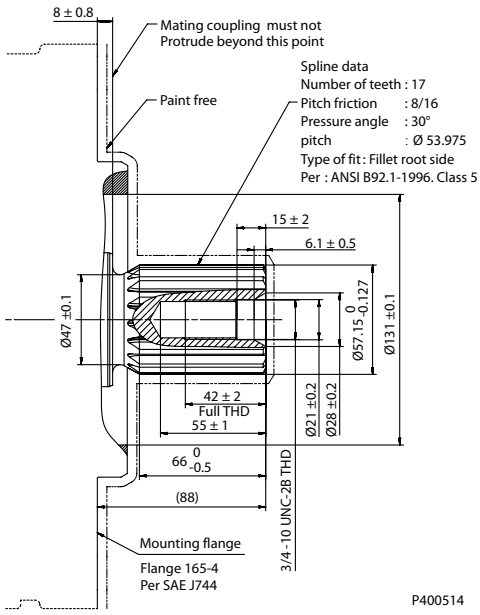


1) Center bore according to DIN 332 (thread acc. to DIN 13).

Installation Drawing

Size 260: Input Shaft: A (Splined shaft SAE J744, 2 1/4 in. 17T, 8/16 DP)

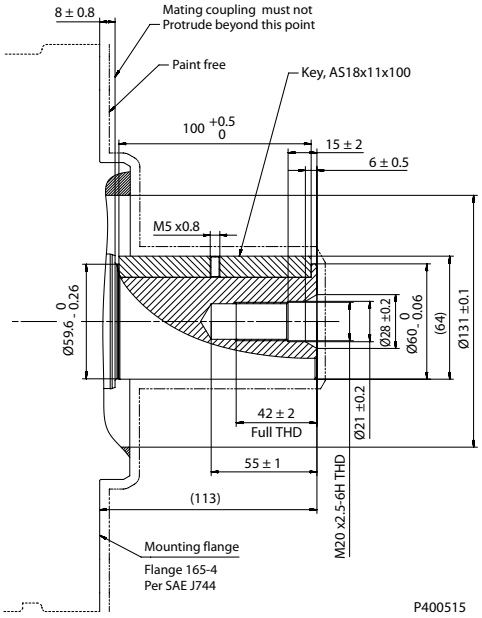
*Maximum torque rating : 4070N•m (Please see *Shaft Torque Ratings* on page 16)



1) Center bore according to DIN 332 (thread acc. to DIN 13).

Size 260: Input Shaft: P (Straight keyed shaft, DIN 6885, AS18x11x100)

*Maximum torque rating : 2787 N•m (Please see *Shaft Torque Ratings* on page 16)

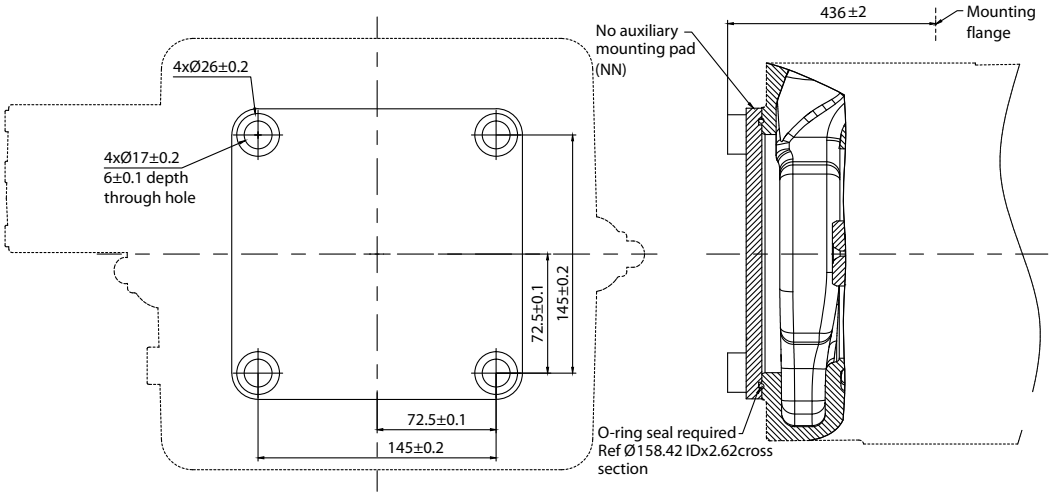


1) Center bore according to DIN 332 (thread acc. to DIN 13).

Before finalizing your design, please request a certified drawing.

Installation Drawing

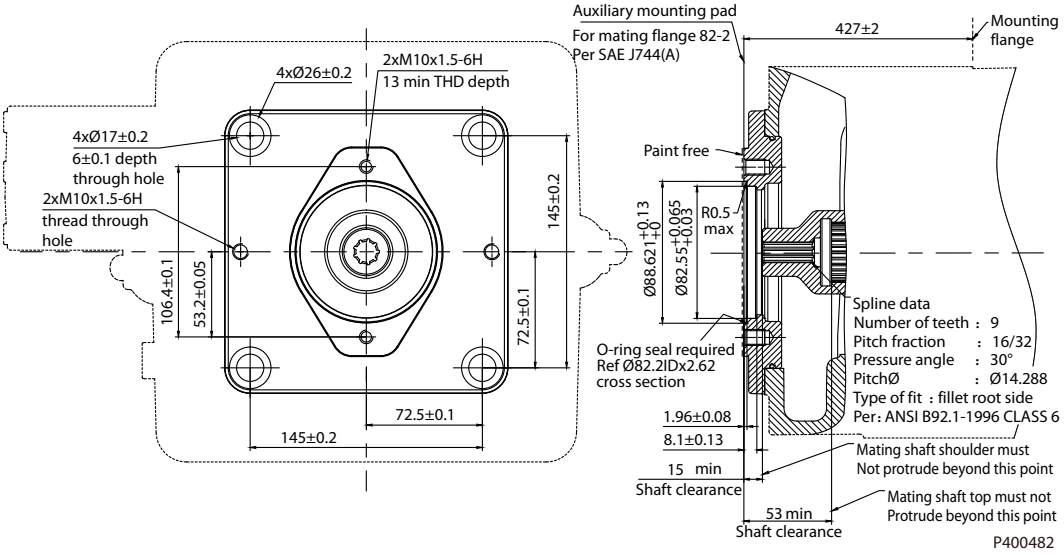
Size 260: Aux Mounting Flange: Option NN (No Coupling)



Specifications

Option	Coupling
NN	No coupling

Size260: Aux Mounting Flange: Option A1 (SAE-A, 9 teeth)

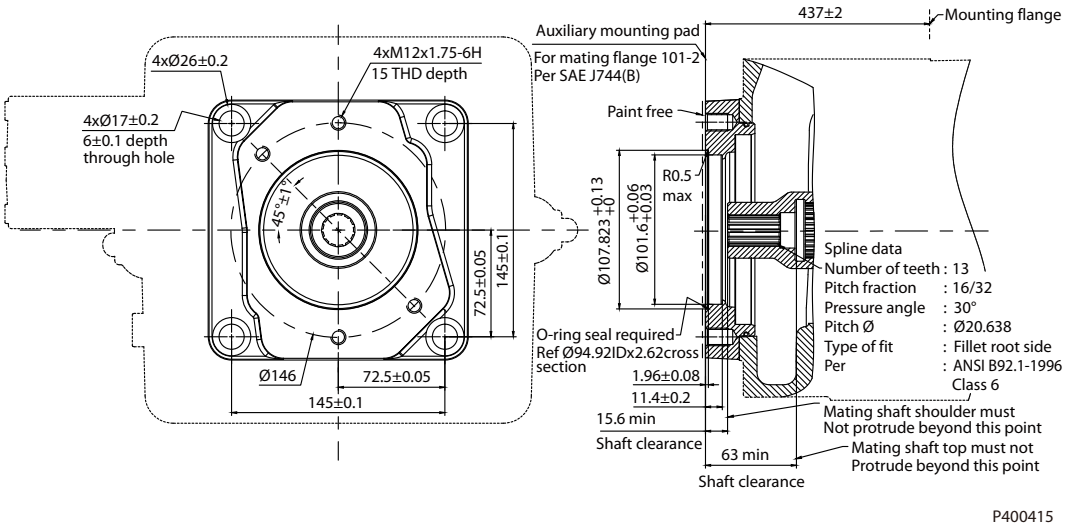


Specifications

Option	Coupling	Max torque
A1	5/8 in, 9T, 16/32 DP	205 N•m

Installation Drawing

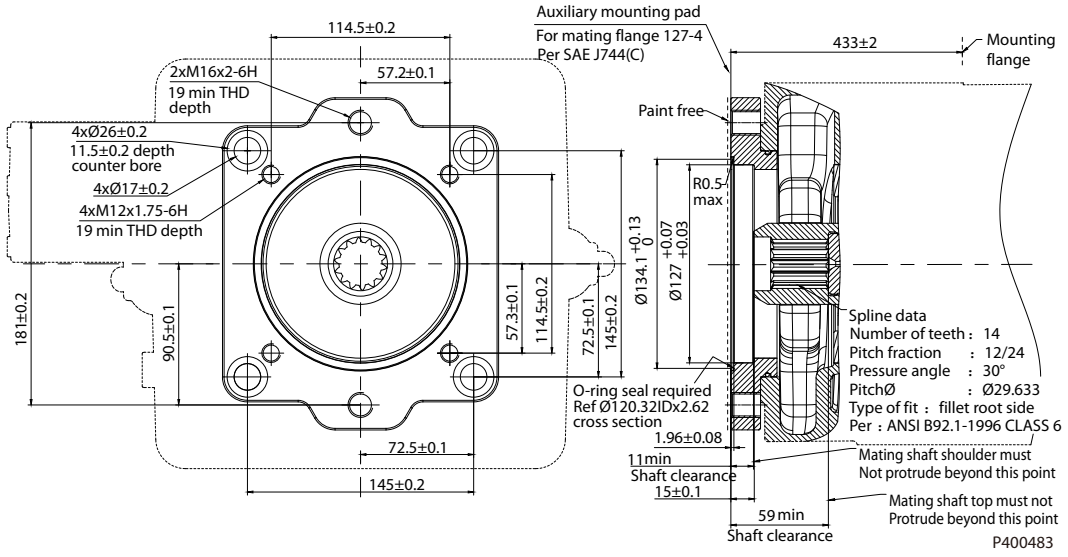
Size 260: Aux Mounting Flange: Option B1 (SAE-B, 13 teeth)



Specifications

Option	Coupling	Max torque
B1	7/8 in, 13T, 16/52 DP	411 N•m

Size260: Aux Mounting Flange: Option C5 (SAE-C, 14 teeth)

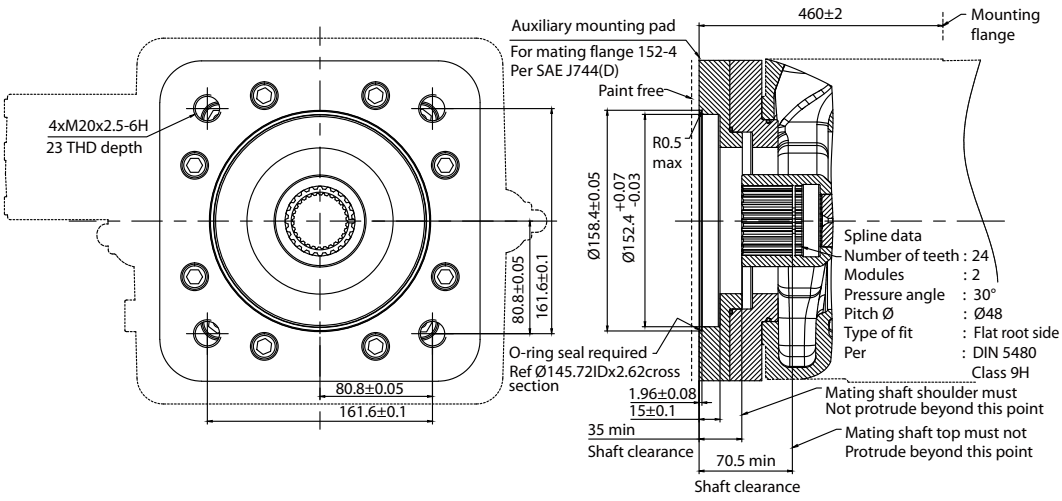


Specifications

Option	Coupling	Max torque
C5	11/4 in, 14T, 12/24 DP	1638 N•m

Installation Drawing

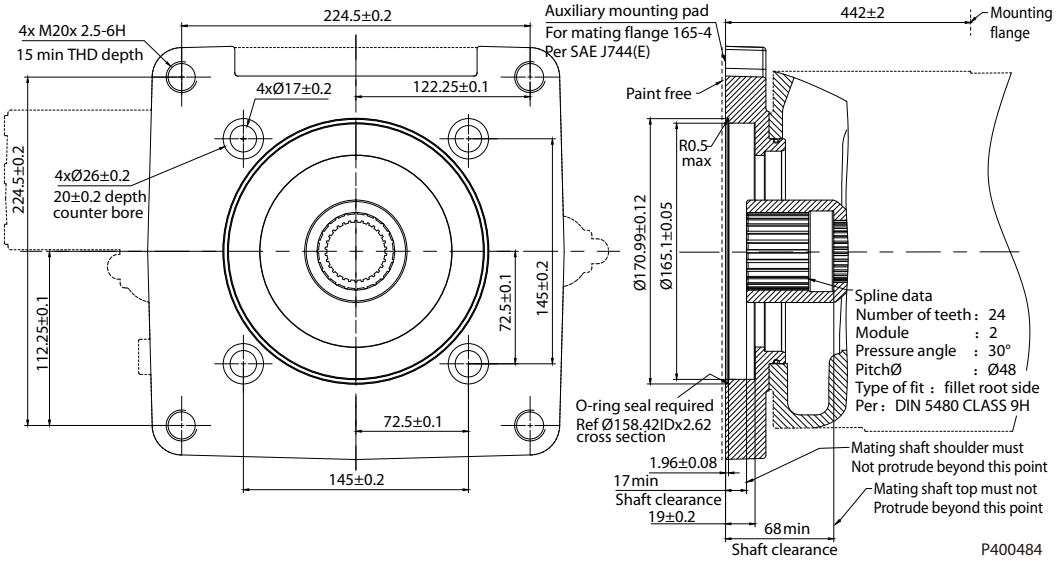
Size 260: Aux Mounting Flange: Option D5 (SAE-D, 24 teeth)



Specifications

Option	Coupling	Max torque
D5	N50 x 2 x 30 x 24 x 9H	1936 N•m

Size 260: Aux Mounting Flange: Option E2 (SAE-E, 24 teeth)

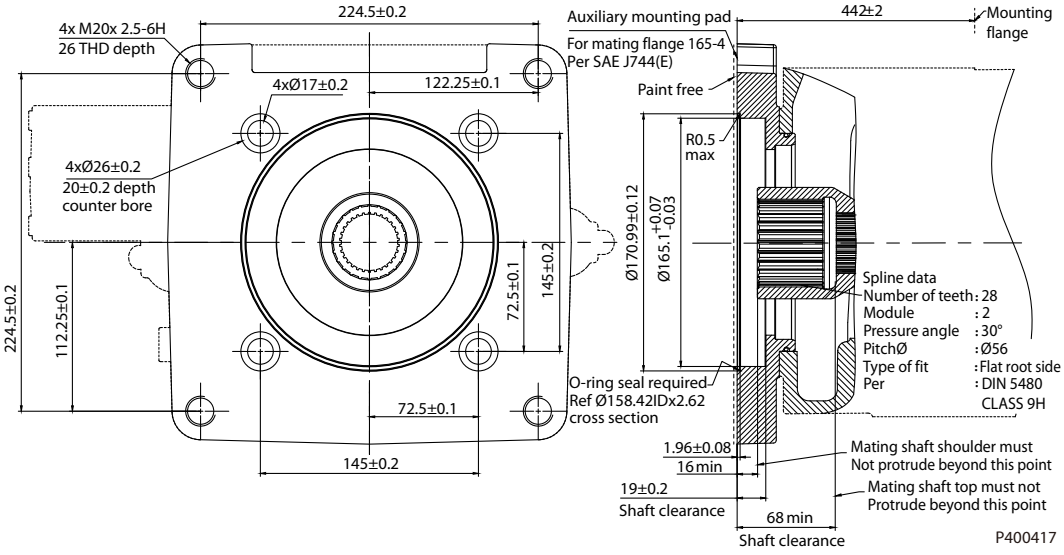


Specifications

Option	Coupling	Max torque
E2	N50 x 2 x 30 x 24 x 9H	1936 N•m

Installation Drawing

Size 260: Aux Mounting Flange: Option E3 (SAE-E, 28 teeth)



Specifications

Option	Coupling	Max torque
E3	N60 x 2 x 30 x 28 x 9H	1936 N•m

Before finalizing your design, please request a certified drawing.

Additional Information

Tandem with Danfoss Pumps

1st Pump			2nd Pump						
D1P (OC) Through Drive			D1P (OC)	S45 (OC)	S90 (CC)	H1P (CC)	S42 (CC)	S40 (CC)	Gear Pump
Flange	Coupling	Code	Size (shaft)	Size (shaft)	Size (shaft)	Size (shaft)	Size (shaft)	Size (shaft)	Size (shaft)
82-2 A	5/8 in 9T	A1							4 ~ 45 (SA, SM, SE)
101-2 B	7/8 in 13T	B1		25, 30, 38, 45 (C2)		45, 53 (G4)	28, 32, 41, 51 (C)	25, 35, 44, 46 (A)	7 ~ 90 (SA, SL, SH)
127-2&4 C	1 1/4 in 14T	C5		45, 51, 60, 65, 74, 75, 90, 100, 130, 147 (S1)	55, 75, 100 (S1)	60, 68, 69, 78, 89, 100 (G1)			17 ~ 200 (RA, RD, S0)
152-4 D	W50	D5	130/145 (T)						
165-4 E	W50	E2	193 (T)						
165-4 E	W60	E3	260 (T)						

Tandem Pump Torque

Maximum torque rating and tandem pump torque

D1 Pump Displacement		130/145	193	260
Torque at Vg max and Δp = 350 bar		724/808	1075	1448
Max torque rating of input shaft	T	3140	3140	5780
	S	1640	1640	1640
	A	-	2670	4070
	P	1448	2226	2787
Max torque rating of different aux mounting flange option	A1	205	205	205
	B1	411	411	411
	C5	1164	1289	1638
	D5	1164	1790	1936
	E2	-	1790	1936
	E3	-	-	1936

Tightening Torque

The following tightening torques apply:

- ***Fittings:*** Observe the manufacturer's instruction regarding the tightening torques of the used.
- ***Fixing screws:*** For fixing screws according to DIN 13, we recommend checking the tightening torque individually according to VDI 2230.
- ***Locking screws:*** For the metal locking screws supplied with the D1 pump, the required torques see the following table.

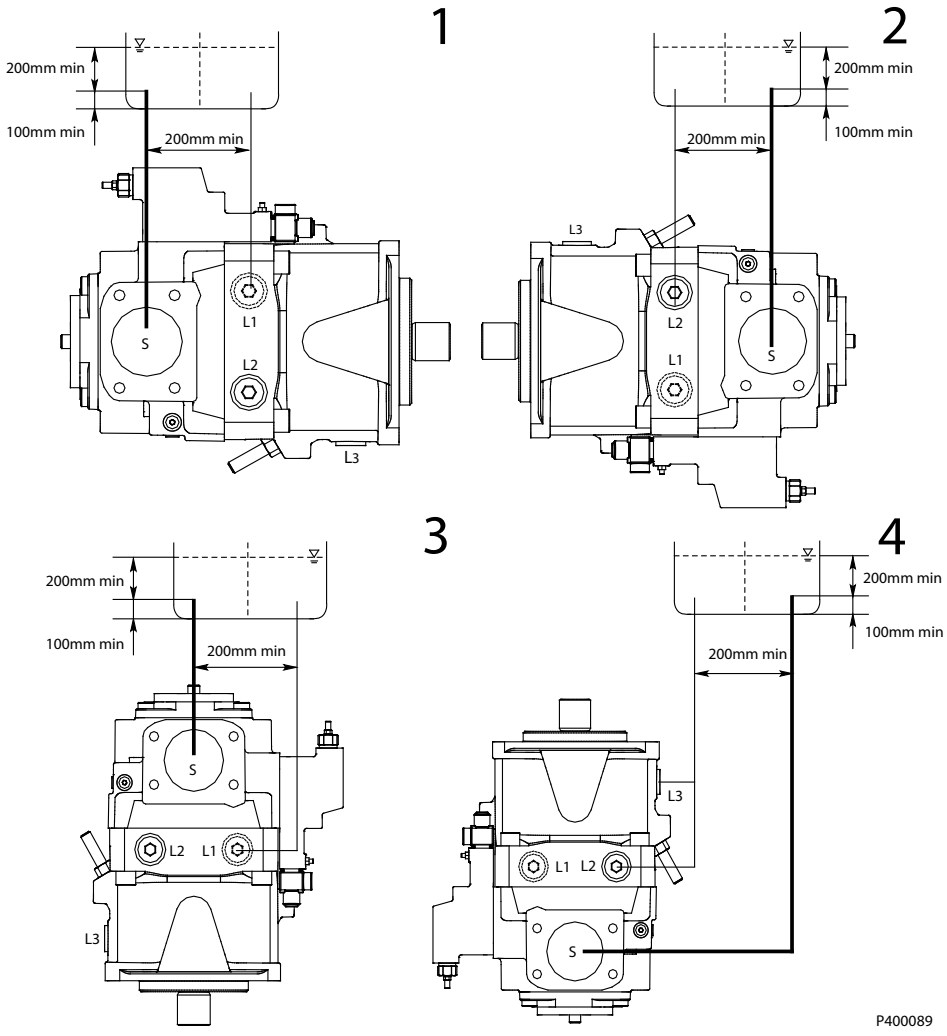
Additional Information

Thread size	Standard	Required torque	Wrench size
M12 x 1.5	DIN 3852	25 Nm	6 mm
M14 x 1.5		34 Nm	6 mm
M26 x 1.5		60 Nm	12 mm
M33 x 2		225 Nm	17 mm

Installation Notes

Below-Reservoir (Standard)

Recommended arrangements : 1 and 2 .



Fill pump case with clean oil before start !

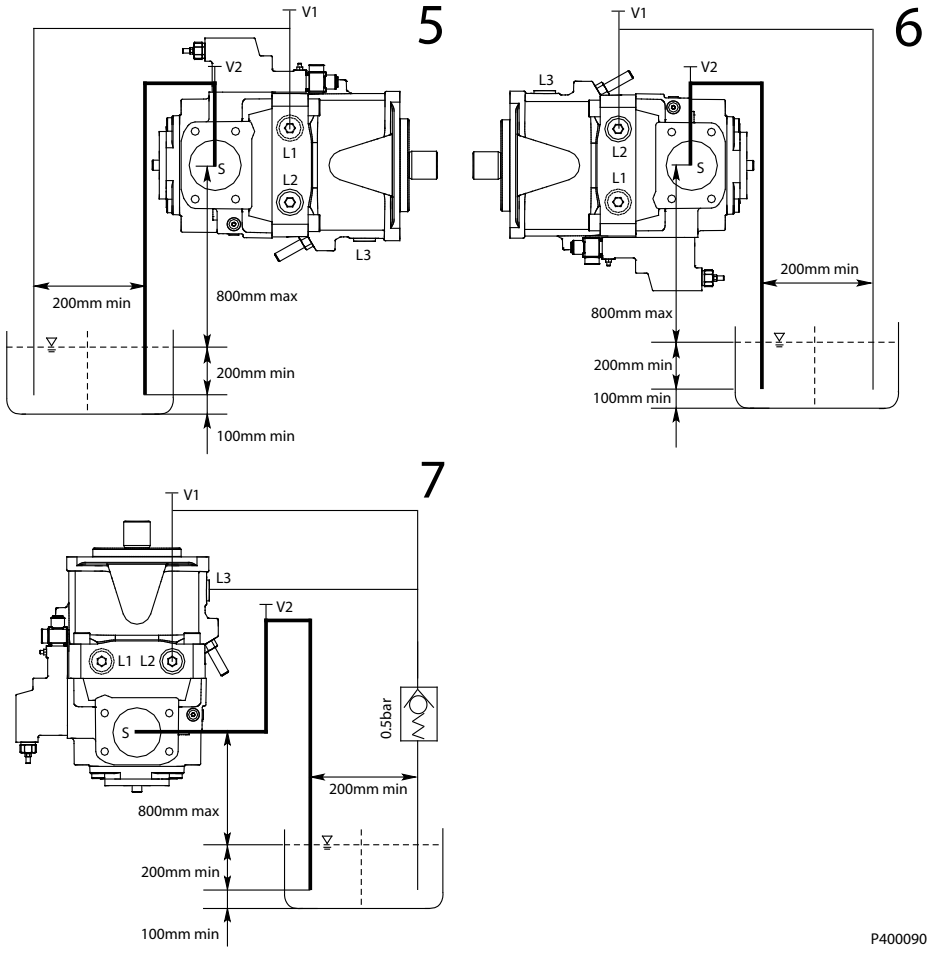
Suction (absolute) : P min = 0.8 bar with charge pump (1 bar without charge pump), P max = 2 bar, Do not restrict suction line !

Drain (absolute) :P max = 2 bar, Do not restrict drain line, Do not combine drain line

Arrangements	Air Bleeding	Filling
1	L1	S + L1
2	L3	S + L2
3	L1 / L2	S + L1 / L2
4	L3	S + L1 / L2

Installation Notes

Above-Reservoir



Fill pump case with clean oil before start !

Suction (absolute) : P min = 0.8 bar with charge pump (1 bar without charge pump), P max = 2 bar, Do not restrict suction line !

Drain (absolute) :P max = 2 bar, Do not restrict drain line, Do not combine drain line !

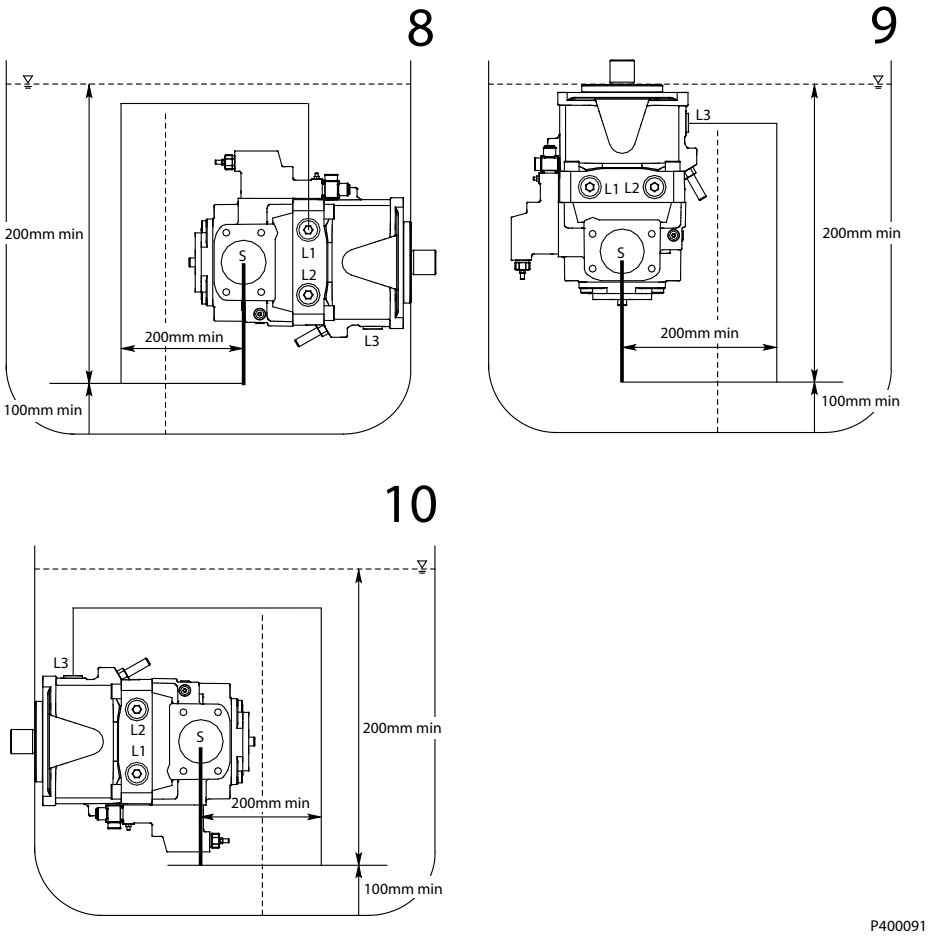
Arrangements	Air Bleeding	Filling
5	V1 + V2	V2 (S) + V1 (L1)
6	L3 + V2	V2 (S) + V1 (L2)
7	V1 + V2	V2 (S) + V1 (L1 / L2)

Caution

- Caution the maximum allowable suction height is 0.8m. The allowable suction height is derived from the total pressure loss.
- Caution the D1 pump with charge pump is not designed for above-Reservoir installation.
- Caution for control options with pressure controllers, proportional displacement control, the minimum displacement setting must be Vg ≥ 5% Vg max.
- Recommendation for arrangement 7 (shaft upwards): A check valve in the case drain line (cracking pressure 0.5 bar) can prevent draining of the case interior.

Installation Notes

Reservoir Installation



Fill pump case with clean oil before start !

Suction (absolute) : P min = 0.8 bar with charge pump (1 bar without charge pump), P max = 2 bar, Do not restrict suction line !

Drain (absolute) : P max = 2 bar, Do not restrict drain line, Do not combine drain line !

Arrangements	Air Bleeding	Filling
8	L1	Automatically via all open L1, L2, L3 and S ports, though position below the hyraulic fluid level.
9	L3	
10	L3	

Caution

- Recommendation is fitting suction pipe to the suction port S and fitting a pipe to case drain port L1, L2 or L3, the other case drain ports must be plugged in this situation. The pump should be filled
- before fitting the pipe and filling the tank with hydraulic fluid.
- It is only permissible to install the tank of an pump with solenoids(e.g. E2), if used hydraulic fluids based on mineral oil and the oil temperature in the tank does not exceed 80° C.

Displacement Limiter

Displacement Limiter

Series D1 pump configurates maximum and minimum displacement limiters, they can limit displacement mechanicallly.

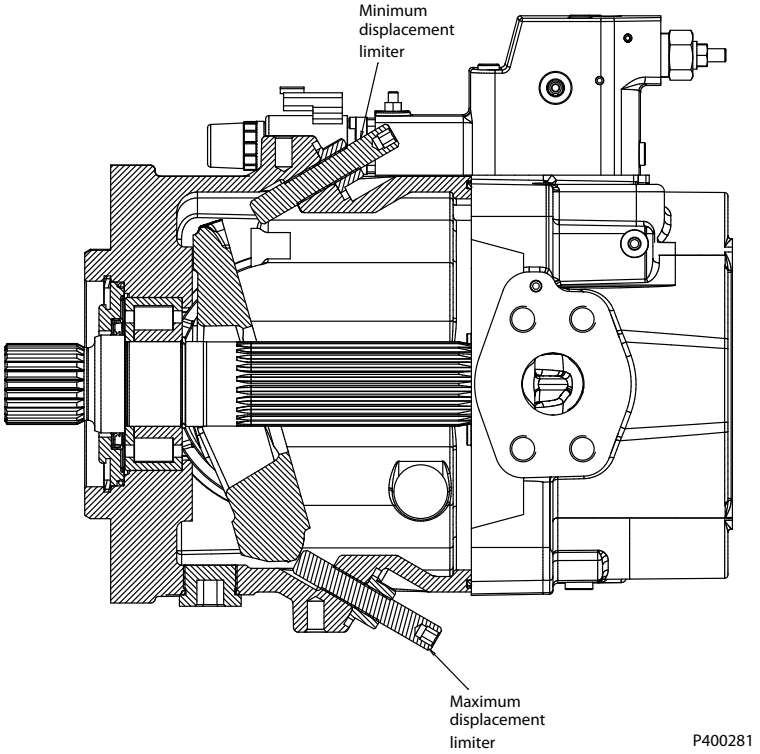
Maximum Displacement Limiter

	Setting range	Displacement change per turn
130	72 cm^3 ~ 130 cm^3	11 cm^3/rev
145	72 cm^3 ~ 145 cm^3	11 cm^3/rev
193	0 cm^3 ~ 193 cm^3	16 cm^3/rev
260	56 cm^3 ~ 260 cm^3	19 cm^3/rev

Minimum Displacement Limiter

	Setting range	Displacement change per turn
130	0 cm^3 ~ 124 cm^3	9 cm^3/rev
145	0 cm^3 ~ 124 cm^3	9 cm^3/rev
193	0 cm^3 ~ 193 cm^3	15 cm^3/rev
260	0 cm^3 ~ 260 cm^3	18 cm^3/rev

Displacement Limiter Cross-Section View



ENGINEERING
TOMORROW

Products we offer:

- Bent Axis Motors
- Closed Circuit Axial Piston Pumps and Motors
- Displays
- Electrohydraulic Power Steering
- Electrohydraulics
- Hydraulic Power Steering
- Integrated Systems
- Joysticks and Control Handles
- Microcontrollers and Software
- Open Circuit Axial Piston Pumps
- Orbital Motors
- PLUS+1® GUIDE
- Proportional Valves
- Sensors
- Steering
- Transit Mixer Drives

Danfoss Power Solutions is a global manufacturer and supplier of high-quality hydraulic and electronic components. We specialize in providing state-of-the-art technology and solutions that excel in the harsh operating conditions of the mobile off-highway market. Building on our extensive applications expertise, we work closely with our customers to ensure exceptional performance for a broad range of off-highway vehicles.

We help OEMs around the world speed up system development, reduce costs and bring vehicles to market faster.

Danfoss – Your Strongest Partner in Mobile Hydraulics.

Go to www.powersolutions.danfoss.com for further product information.

Wherever off-highway vehicles are at work, so is Danfoss. We offer expert worldwide support for our customers, ensuring the best possible solutions for outstanding performance. And with an extensive network of Global Service Partners, we also provide comprehensive global service for all of our components.

Please contact the Danfoss Power Solution representative nearest you.

Comatrol
www.comatrol.com

Turolla
www.turollaocg.com

Hydro-Gear
www.hydro-gear.com

Daikin-Sauer-Danfoss
www.daikin-sauer-danfoss.com

Local address:

Danfoss
Power Solutions (US) Company
2800 East 13th Street
Ames, IA 50010, USA
Phone: +1 515 239 6000

Danfoss
Power Solutions GmbH & Co. OHG
Krokamp 35
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
Phone: +86 21 3418 5200