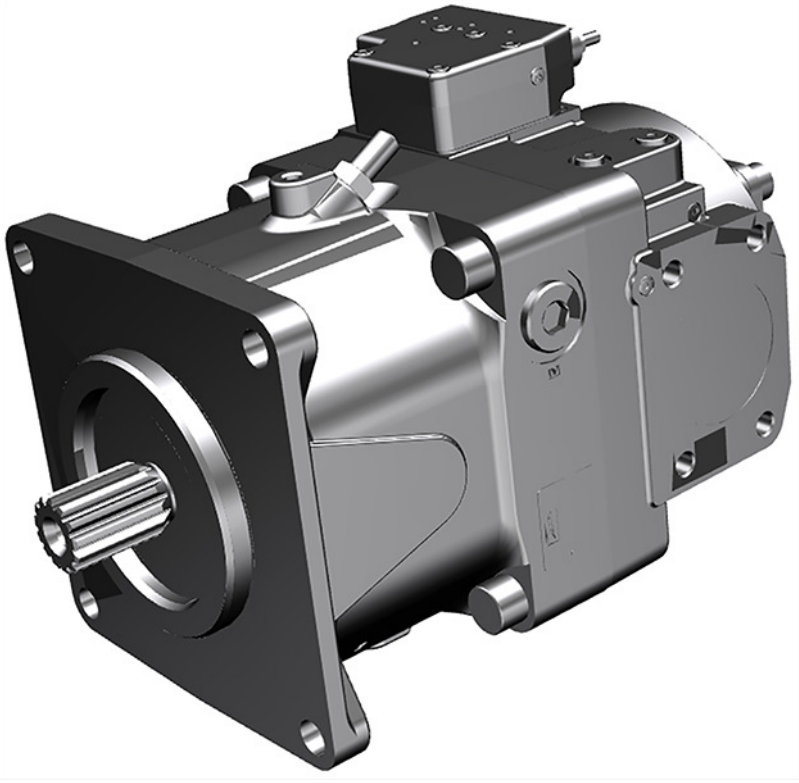
ENGINEERING
TOMORROW

Technical Information

ATEX certified

Axial piston pump, variable displacement
D1P130/D1P145/193/260



www.danfoss.com

Revision history

Table of revisions

Date	Changed	Rev
September 2021	Fixed typo	0202
August 2021	Added size 193/260, updated model code, and replaced the nameplate	0201
February 2020	Updated cover image and changed document number from BC00000404	0102
July 2018	first edition	0101

Contents

General information

ATEX Introduction....4
Explosive atmosphere....4
- Explosion triangle....4
- General zone classification....4
- Equipment category and zones....5
- Contents of marking....6
- Marking of Danfoss D1 pumps....7
- Production place and date of pump....8
- Example ATEX label - D1P....8

Maximum surface temperature

Viscosity and temperature for D1P pump....10

Model Code

Model code....11
Displacement, rotation and product version....12
Control types....12
Input shaft options....12
Mounting flange options....13
End cap and main port options....13
Auxiliary mounting flange options....13
Power control settings....14
Pressure compensated control settings....14
Load sensing control settings....15
Hydraulic displacement control setting....15
Maximum and minimum displacement settings....15
Minimum displacement settings....15
Special hardware and features....15
Tandem pump information....16

Technical specifications

Ambient temperature....17
Oil types / Operating fluids....17
- Mineral oils....17
- Oil temperature....17
- Viscosity....17

Displacement Limiter

Displacement limiter setting....18

General information

ATEX Introduction

The ATEX Directive 2014/34/EU specifies the minimum safety requirements for equipment intended for use in potentially explosive atmospheres in European Union member states. ATEX is derived from the French term **AT**mosphères **EX**plosives.

Hydraulic pump are designed for mobile and stationary applications. Some pump are used in related applications, where locations are classified as hazardous areas.

The equipment intended for use in hazardous areas are divided into two groups:

Group I: Equipment intended for use in underground parts of mines (mining equipment).

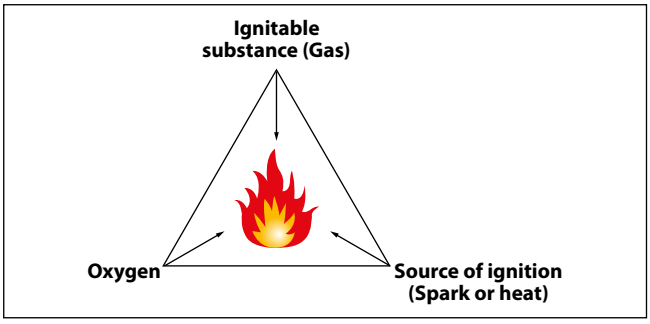
Group II: Equipment intended for use in other places than mines (non-mining equipment).

The Danfoss hydraulic pump, type D1P are intended for use in Group II applications.

Explosive atmosphere

Explosion triangle

A “hazardous area” is defined as an area in which the atmosphere contains, or may contain in sufficient quantities, flammable or explosive gases, dusts or vapours. In such an atmosphere a fire or explosion is possible when three basic conditions are met. This is often referred to as the “hazardous area” or “explosion” triangle.



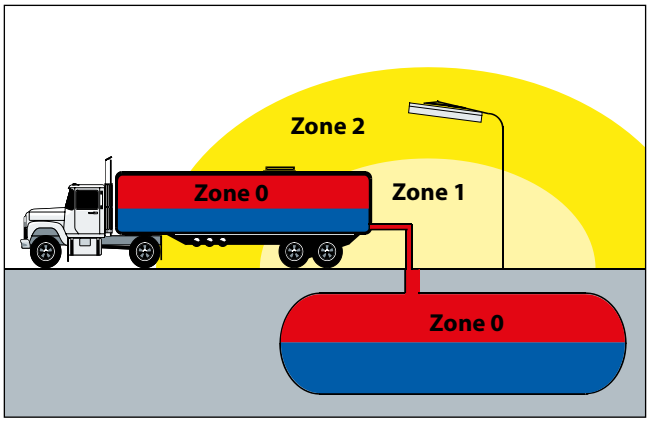
P301 800

An atmosphere with the potential to become an explosive atmosphere during operating conditions and/or under the influence of the surroundings is defined as a potentially explosive atmosphere. Products covered by directive 2014/34/EU are defined as intended for use in potentially explosive atmospheres. Removing one of the elements eliminates all risk of explosion.

General zone classification

Directive 99/92/EC divides the Hazardous areas into zones and defines criteria by which products are categorized within these zones; Zone 0 / 20 is the most restrictive and Zones 1 / 21 and 2 / 22 are less restrictive. The following table describes the zones in an installation where there is a potential for explosive atmospheres. The owner of the installation must analyze and assess the area in which the explosive gas/dust mixture may occur, and if necessary must divide it into zones. This process of zoning then allows the correct plant and equipment to be selected for use in the area.

General information



F301 801

Zones		Presence of potentially explosive atmosphere	Type of risk
Gas (G)	Dust (D)		
0	20	Present continuously or for long periods	Permant
1	21	Likely to occur in normal operation occasionally	Potential
2	22	Not likely to occur in normal operation but. If it does occur, will persist for a short period of time	Minimal

Equipment category and zones

Mechanical components with potential ignition sources e.g. components containing non-conductive materials or layers or components with hot surface are covered by the ATEX-directive.

Non-mining equipment for potentially explosive atmosphere is classified as:

Equipment Group II – this group comprises three categories according to the level of safety provided:

- Category 1
- Category 2
- Category 3

Category 1 equipment has the highest degree of protection – see the following below.

Degree of protection	Protection	Category
Very high	Two independent protection measures or safe if two errors occur independently	**Category 1**
High	Safe in normal operation and in anticipated case of commonly occurring errors	**Category 2**
Normal	Safe in normal operation	**Category 3**

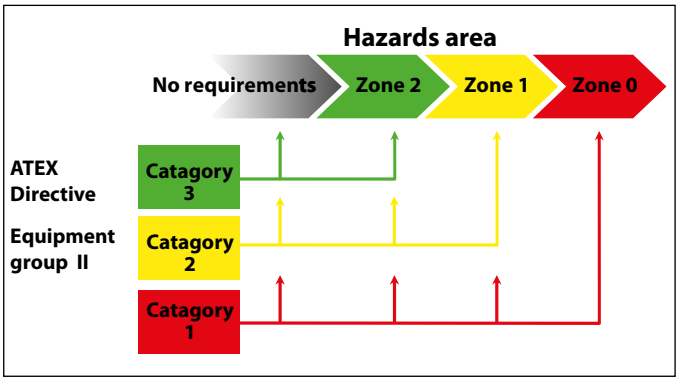
P301 802

These products have to fulfil all requirements in the ATEX directive, and have to be marked with the required “Ex” marking.

Equipment located in zone specified areas must fulfil the following requirements (see also the following figure):

- Category 3 – approved equipment can be installed in hazardous areas zone 2 / 22 and outside zone categorized areas.
- Category 2 – approved equipment can be installed in hazardous areas zone 1 / 21, zone 2 / 22 and outside zone categorized areas.
- Category 1 – approved equipment can be installed in hazardous areas zone 0 / 20, zone 1 / 21, zone 2 / 22 and outside zone categorized areas.

General information



Contents of marking

The rules for the marking of systems, equipment and components are uniformly defined in the standards relating to the general technical requirements – EN 13463-1 for mechanical equipment.

A priority for all Ex equipment and protective systems is that the marking should show the areas of their designated use. Components covered within the scope of the ATEX directive have to be CE-marked, and marked with the specific "Ex"-sign.

Principle

The marking must indicate the following:

- The manufacturer who has put the item of equipment on the market
- Manufacturer's type identification
- Year in which the equipment was manufactured
- A serial number

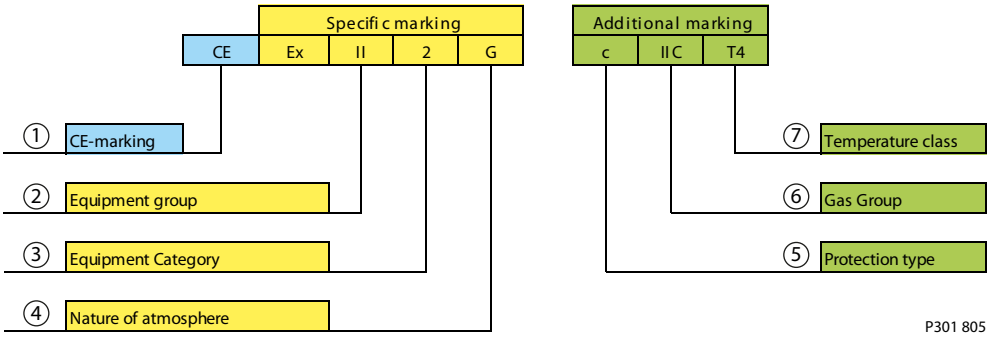
And further the ignition protection marking

- Symbol of the equipment group and category (M1 or M2 for group I mining equipment, or 1 or 2 or 3 for Group II non-mining equipment).

  Additionally for Group II equipment only:

  1. The letter "G" where explosive atmospheres caused by gases, vapours or mists are concerned; and/or

  2. The letter "D" where explosive atmospheres caused by dusts are concerned.
- Type of ignition protection system.
- Where appropriate, symbol of explosion group of the equipment.
- For Group II equipment, the symbol indicating the temperature class or the maximum surface temperature in °C, or both.



General information

Callout	Description	
1	CE marking	
Specific marking		
2	Equipment group	I - Mining
		II - Non-mining
3	Equipment category	1 (zone 0/20)
		2 (zone 1/21)
		3 (zone 2/22)
4	Nature of atmosphere	G - Gas
		D - Dust
Additional marking		
5	Protection type	fr - Protection by flow restricting enclosure
		d - Protection by flameproof enclosure
		c - Protection by constructional safety
		b - Protection by control of ignition sources
		p - Protection by pressurized enclosures
		k - Protection by liquid immersion
6	Gas group	IIA
		IIB
		IIC
		Equipment without any explosion group maring can be used for explosive atmosphere of explosive group IIA, IIB and IIC provided the equipment is not marked for specific atmosphere.
7	Temperature class	T1 to T6 TX; where the maximum surface temperature depends not on the equipment itself, but mainly on operating conditions (like heated fluid) the relevant information shall be given in the instruction for use in order to inform the user about this special situation.

Marking of Danfoss D1 pumps

The Danfoss hydraulic pumps are marked as equipment for Group II, category 2 for gas and dust environment and with ignition protection **constructional safety** and **liquid immersion**.

Temperature class/Maximum surface temperature depends on the operating conditions (ambient and fluid temperature).

ATEX marking

Marking	For model code option[1]
CE Ex II 3G Ex h IIA T3 Gc	AN3 (temperature class T3)
CE Ex II 3G Ex h IIA T4 Gc	AN4 (temperature class T4)
CE Ex II 3G Ex h IIA T5 Gc	AN5 (temperature class T5)

[1] See Model Code for additional information.

See *Viscosity and temperature for D1P pump* on page 10 for more information about temperature classes.

For detailed information on selecting the appropriate T-codes, please see *D1P ATEX User Manual*, BC376161003883.

General information

Production place and date of pump

The production location and date of the pump is shown at the first 5 digits of the serial no.

Example: Serial no: N45123094

Five first digits are N4512

N is the manufacturing location (N=Nordborg ; H = Haiyan(China))

4 is the year (It stands for the last digit in the possible decade).

51 is the week

2 is the day (2 = Tuesday)

The last four digits are a consecutive number.

The ATEX certification of the units are done under the scope of:

"Directive 2014/34/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres."

With following parameters:

- Equipment group: II
- Zone: 2 (gas)
- Equipment Category: 3G
- Temperature class: T3...T5
- Explosion protection group: II A

According to this classification, the Conformity Assessment Procedure has to be executed according to Directive 2014/34/EU, annex VIII, Modul A: Internal Production Control (see article 13, section 1 (c)) The EU declaration of conformity has to be prepared and issued with regard to annex X of /1/. The “Essential Health and Safety Requirements” defined by /1/, annex II, have to be considered.

Example ATEX label - D1P

Examples of ATEX pump labels – Pump produced in People's republic of China



1. Manufacturer
2. Location of production
3. ATEX code

General information

4. Material number
5. Model code, including unit and displacement
6. Production code

Maximum surface temperature

Viscosity and temperature for D1P pump

Features		Data
Viscosity	Intermittent[1)]	5 mm^2/sec [42 SUS]
	Minimum	7 mm^2/sec [49 SUS]
	Recommended range	16-36 mm^2 [81-168 SUS]
	Maximum (cold start)[2)]	1600 mm^2/sec [7416 SUS]
Temperature	Minimum (cold start)[2)]	-40°C [-40°F]
	Maximum intermittent[1)]	115°C [239°F][3)]

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

[2)] Cold start = Short term t < 3 min; p ≤ 30 bar; n ≤ 1000 min^{-1}(rpm); please contact Danfoss Power Solutions especially when the temperature is below -25 °C [-13 °F].

[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 [41 °F] higher than the average case drain temperature.

Above maximum surface temperatures are without any deposited dust on the product. The possible insulation effect of a dust layer on the surface has to be taken into account by the safety margin to the minimum ignition temperature of the dust concerned. For up to 5 mm [1.97 in] layer thickness the safety margin is 75°C [167°F]. For further information please see IEC 60079-14.

Warning

The above operating temperatures (ambient and oil) of the pump must be guaranteed by the end user.

Warning

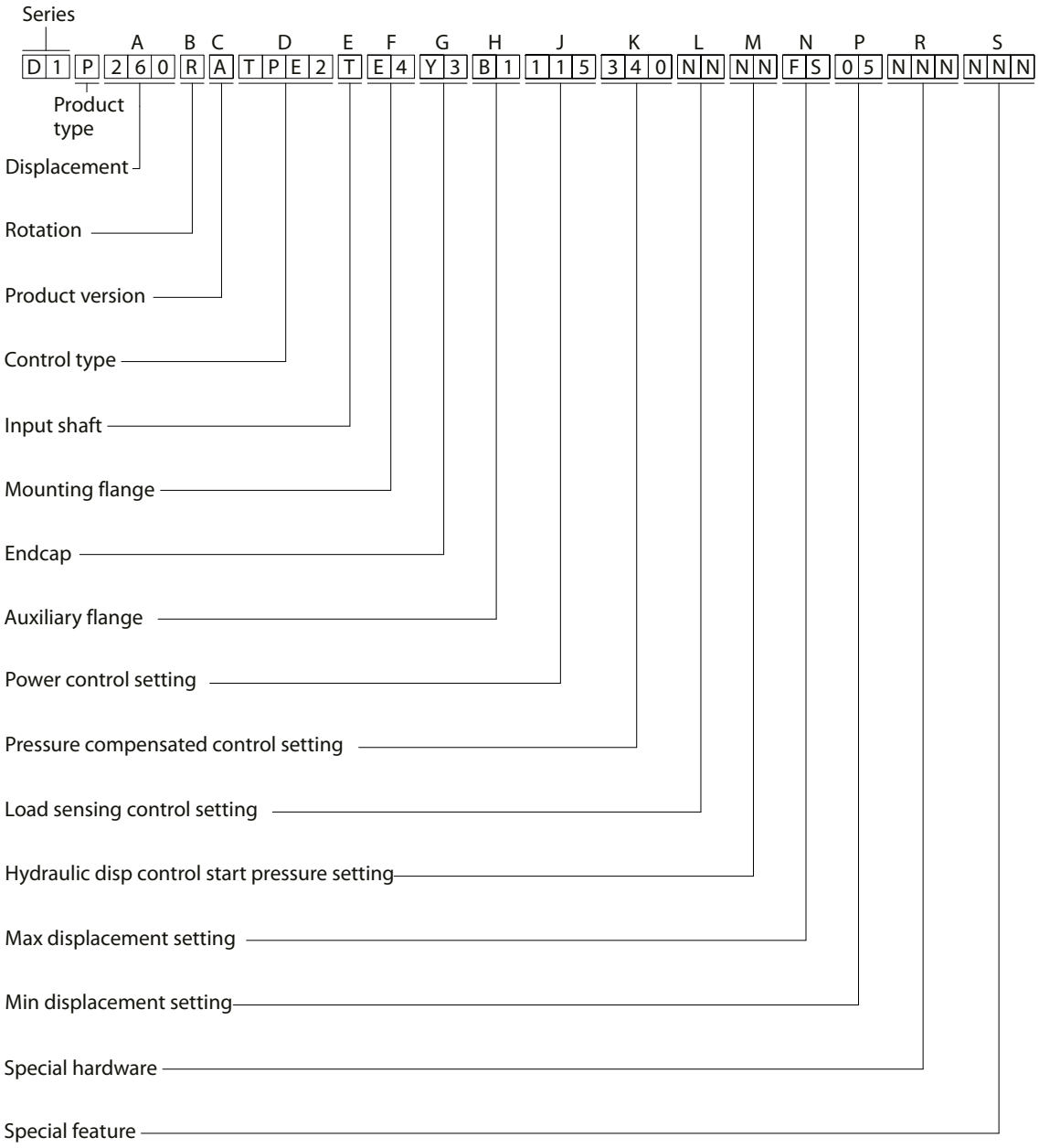
It is compulsory to use oils whose inflammable degree is at least 50K above the maximum surface temperature of the pump. See also *Oil types / Operating fluids* on page 17.

Model Code

D1P model code

The below illustration and the following sections describe how to identify parts of the model code and availability of certain part options based on frame size.

Example model code; D1P 260 shown



Model Code

D1P 130-260 displacement, rotation and product version

Displacement

Code	Description	130	145	193	260
130	130 cm^3 [7.93 in^3] max. displacement per revolution	●			
145	145 cm^3 [8.85 in^3] max. displacement per revolution		●		
193	193 cm^3 [11.78 in^3] max. displacement per revolution			●	
260	260 cm^3 [15.87 in^3] max. displacement per revolution				●

Rotation

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

Product Version

Code	Description	130	145	193	260
A		●	●	●	●

D1P 130-260 control types

Code	Description	130	145	193	260
NPNN	Pressure Compensated Control	●	●	●	●
NPSN	Pressure Compensated Control + Load Sensing Control	●	●	●	●
NPNR	Pressure Compensated Control + Remote Pressure Compensated Control	●	●	●	●
TPSN	Power Control + Pressure Compensated Control + Load Sensing Control	●	●	●	●
TPH1	Power Control + Pressure Compensated Control			●	●

Control Code Explanation:

- First digit: Power control (Torque control) , "N" means no power control.
- Second digit: Pressure compensated control, "N" means no pressure compensated control.
- Third & Fourth digits: Proportional displacement control or Load sensing control , "NN" means no control in either category.

Warning

A relief valve is required to be installed in the pump outlet for additional system protection. Failure to install the relief valve can lead to system damage and/or injury.

D1P 130-260 input shaft options

Code	Description	130	145	193	260
T	130/145/193: Spline, DIN 5480 W50 x 2 x 30 x 24 x 9g; 260: Spline, DIN 5480 W60 x 2 x 30 x 28 x 9g; Shaft Seal Material: FKM	●	●	●	●
S	Spline, SAE J744 1 3/4in, 13T 8/16 DP; Shaft Seal Material: FKM	●	●	●	●

Model Code

Code	Description	130	145	193	260
A	193: Spline, SAE J744 2in, 15T 8/16 DP; 260: Spline, SAE J744 2 1/4in, 17T 8/16 DP; Shaft Seal Material: FKM			●	●
P	Straight Keyed DIN 6885, 130/145: AS14 x 9 x 80 193: AS16 x 10 x 100 260: AS18 x 11 x 100 Shaft Seal Material: FKM	●	●	●	●
K*	SAE J744 (D/E) 3in straight keyed shaft 0.4375x3.000in			●	●

* There is no impeller option for sizes 130 and 145 with this shaft.

D1P 130-260 mounting flange options

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

D1P 130-260 end cap and main port options

End cap and main ports

Code	Description	Rotation	130	145	193	260
Y1	Radial, side, flange ports Inlet: 3in port, M16 x 2; Outlet: 1 1/4in port, M14 x 2 SAE J518 With impeller	CW [R] CCW [L]	●	●		
Y2	Radial, side, flange ports Inlet: 3 1/2in port, M16 x 2; Outlet: 1 1/2in port, M16 x 2 SAE J518 With impeller	CW [R] CCW [L]			●	
Y3	Radial, side, flange ports Inlet: 4in port, M16 x 2; Outlet: 1 1/2in port, M16 x 2 SAE J518 With impeller	CW [R] CCW [L]				●

D1P 130-260 auxiliary mounting flange options

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	●	●	●	●
A2	SAE J744 82-2 (A); Spline coupling: 3/4in 11T 16/32DP	●	●		
A3	SAE J744 82-2 (A); Spline coupling: 7/8in 13T 16/32DP			●	●
B1	SAE J744 101-2 (B) ; Spline coupling: 7/8in 13T 16/32DP	●	●	●	●
B2	SAE J744 101-2 (B); Spline coupling: 1in 15T 16/32DP	●	●	●	●
BA	SAE J744 101-2 (B); Spline coupling: 7/8in 13T 16/32DP; Adapter 90°	●	●	●	●
BB	SAE J744 101-2 (B); Spline coupling: 7/8in 13T 16/32DP; Cover 45°			●	●

Model Code

Auxiliary mounting flange (through-drive flange) (continued)

Code	Description	130	145	193	260
C5	SAE J744 127-2&4 (C) ; Spline coupling:1 1/4in 14T 12/24DP	●	●	●	●
C9	SAE J744 127-2&4 (C); Spline coupling: 1 3/4in 13T 8/16DP			●	●
D2	SAE J744 152-4 (D); Spline coupling: 1 3/4in 13T 8/16DP	●	●	●	●
D5	SAE J744 152-4 (D) ; Spline coupling: N50x2x30x24x9H	●	●	●	●
E2	SAE J744 165-4 (E) ; Spline coupling: N50 x 2 x 30 x 24 x 9H			●	●
E3	SAE J744 165-4 (E) ; Spline coupling: N60 x 2 x 30 x 28 x 9H				●

D1P 130-260 power control settings

Power control setting at 1500rpm (kW), "3 digit code"

Code[1]	Description	130	145	193	260
NNN	No Power Control	●	●	●	●
XXX	xxx kW between ranges specified below (For example: Code "090" means 90kW) at 1500 rpm				
030-115	30-115 kW [40-154 hp] at 1500 rpm[2]	●	●		
035-155	35-155 kW [47-208 hp] at 1500 rpm[2]			●	
040-210	40-210 kW [54-282 hp] at 1500 rpm[2]				●

[1] For settings out of these ranges, please contact Danfoss Power Solutions.

[2] Only increments of 5kW [6.7 hp] are allowed. E.g. 035, 040, 045, etc.)

If the speed is not 1500rpm, please make a conversion using the following formula, assuming constant torque:

$$P_{setting@1500\ rpm} = P_{actual} * \frac{1500}{n_{actual}}$$

For example:

If actual power is 110 kW at 2100 rpm, the conversion to obtain the power control setting at 1500 rpm should be 110*1500/2100=79, choose 080 option (round to closest 5 kW increment option).

D1P 130-260 pressure compensated control setting

Pressure compensated control setting (bar), "3 digit code"

Code*	Description	130	145	193	260
NNN	No Pressure compensated control	●	●	●	●
XXX	xxx bar between the range specified below (For example: Code "320" means 320 bar [4641 psi])				
150~350	150~350 bar [2176~5076 psi] (Please select pressure compensated control setting in increments of 10 bar [145 psi]. E.g. 150 or 160 or 170, etc.)	●	●	●	●

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

Model Code

D1P 130-260 load sensing control settings

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

Code	Description	130	145	193	260
NN	No load sensing control	●	●	●	●
XX	xx bar between the range specified below (For example: Code "25" means 25 bar [363 psi])				
10~35*	10~35 bar [145~508 psi] (Please select load sensing control setting in increments of 1 bar [14.5 psi]. E.g. 10 or 11 or 12, etc.)	●	●	●	●

* For settings out of these ranges, please contact Danfoss Power Solutions. Range allowed for NPNR (Pressure compensated + Remote Pressure compensated control) is 15-35 bar

D1P 130-260 hydraulic displacement control setting

Hydraulic displacement control start pressure setting, "2 digit code"

Code	Description	130	145	193	260
NN	No hydraulic displacement control	●	●	●	●
04-10	4-10 bar			●	●

D1P 130-260 maximum displacement settings

Maximum displacement setting, "2 digit code"

Code	Description	130	145	193	260
FS	Factory setting : 100%	●	●	●	●
XX[1]	XX% of maximum displacement (For example: Code "90" means 90% of maximum displacement)[2]	●	●	●	●

[1] Please consider frame sizing and increments when selecting a maximum displacement setting (see *displacement limiter* for more information).

[2] Only increments of 5% are allowed. (E.g. 70, 75, 80 etc.)

D1P 130-260 minimum displacement settings

Minimum displacement setting, "2 digit code"

Code	Description	130	145	193	260
FS	0% of maximum displacement limit setting	●	●	●	●
XX	XX% of maximum displacement limit setting[1]	●	●	●	●

[1] Only increments of 5% are allowed. (E.g. 70, 75, 80 etc.)

If a different minimum displacement setting is required, please contact Danfoss Power Solutions.

D1P ATEX special hardware and features

Special features

Code	Description	130	145	193	260
AN3	Factory Setting (black paint, ATEX tag T3, format A w/o filter)	●	●	●	●
AN4	Factory Setting (black paint, ATEX tag T4, format A w/o filter)	●	●	●	●
AN5	Factory Setting (black paint, ATEX tag T5, format A w/o filter)	●	●	●	●

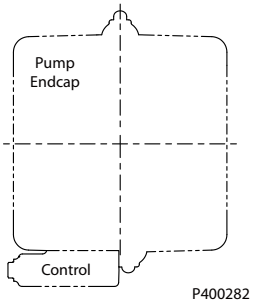
Model Code

D1P tandem pump information

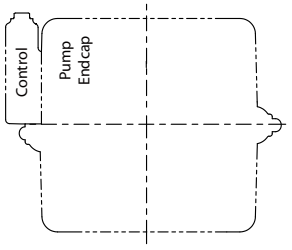
Information about tandem pump direction and ordering instructions are found below.

Pump direction

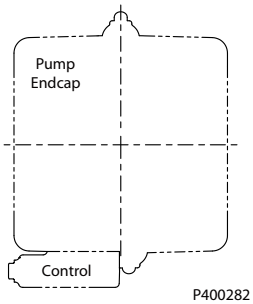
Auxiliary pump
INDEX = 0°



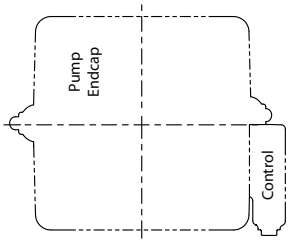
Auxiliary pump
INDEX = 90°



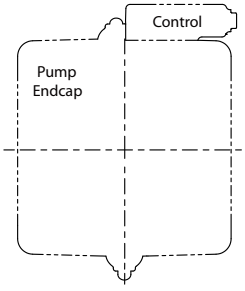
When assembling a system the first pump is always to be considered at 0° INDEX as shown below.



Auxiliary pump
INDEX = 270°



Auxiliary pump
INDEX = 180°



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

Ordering tandem pumps

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 as indicated below.

Ordering example:

D1P193RATPE2TE4Y2E2090320NNNNFSFSNNNNNN +

D1P193RATPE2TE4Y2NN090320NNNNFSFSNNNNNN

Tandem angle 0° + 180°

Technical specifications

Ambient temperature

Maximum ambient temperature depends on the requested ATEX class needed.

In general the ambient temperature should lie between -30 °C [-22 °F] and +90 °C [+210 °F] to ensure that the shaft seal retains its sealing capacity.

Oil types / Operating fluids

In a hydraulic system the most important task of the oil is to transfer energy. At the same time the oil must lubricate moving parts in hydraulic components, protect them from corrosion, and transport dirt particles and heat out of the system. To ensure that hydraulic components operate without problems and have long operating life it is therefore vital to select the correct oil type with the necessary additives.

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 pump components.

Mineral oils

For systems containing Danfoss hydraulic pumps, type D1P, mineral hydraulic oil with anti-wear additives, type HLP [DIN 51524] or HM (ISO 11158) **must be used**. Mineral oils without anti-wear additives or engine oils can also be used, provided operating conditions are suitable.

Warning

It is compulsory to use oils whose inflammable degree is at least 50K above the maximum surface temperature of the pump. Maximum surface temperature for Group IIG and IID can be found under: *Viscosity and temperature for D1P pump* on page 10.

Oil temperature

Maximum oil temperature depends on the requested ATEX class needed (in this case T3)..

Under normal operating conditions it is recommended to keep the temperature in the range of 30 °C [86 °F] and 60 °C [140 °F].

Fluid temperature affects the viscosity of the fluid and resulting lubricity and film thickness. High temperatures can also limit seal life, at most non-metallic materials are adversely affected by use at elevated temperatures.

Fluids may break down or oxidize at high temperature, reducing their lubricity and resulting in reduced life of the unit. Oil life is greatly reduced if its temperature exceeds +60 °C [+140 °F]. As a general rule, oil life is halved for each 8 °C [46 °F] its temperature exceeds +60 °C [+140 °F].

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.

Fluid viscosity limits

Conditions	mm^2/s (cSt)	SUS
Minimum	12	66
Continuous	20 - 80	98 - 370
Maximum	1500	6950

We recommend the use of an oil type having a viscosity of 35 mm^2/s at the actual operating temperature.

Displacement Limiter

D1P displacement limiter

Series D1 pumps feature maximum and minimum displacement limiters, which limit displacement mechanically.

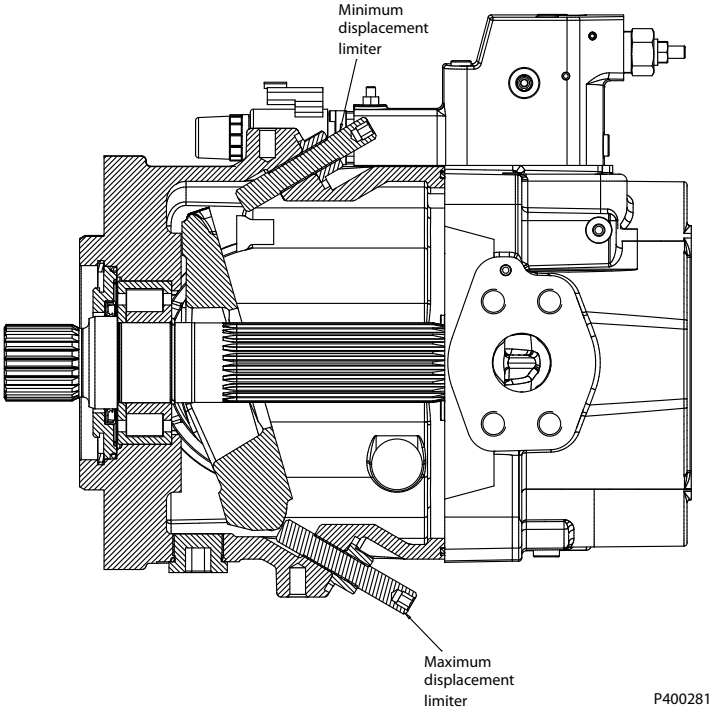
Maximum Displacement Limiter

Frame	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

Frame	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



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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 2080 6201

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