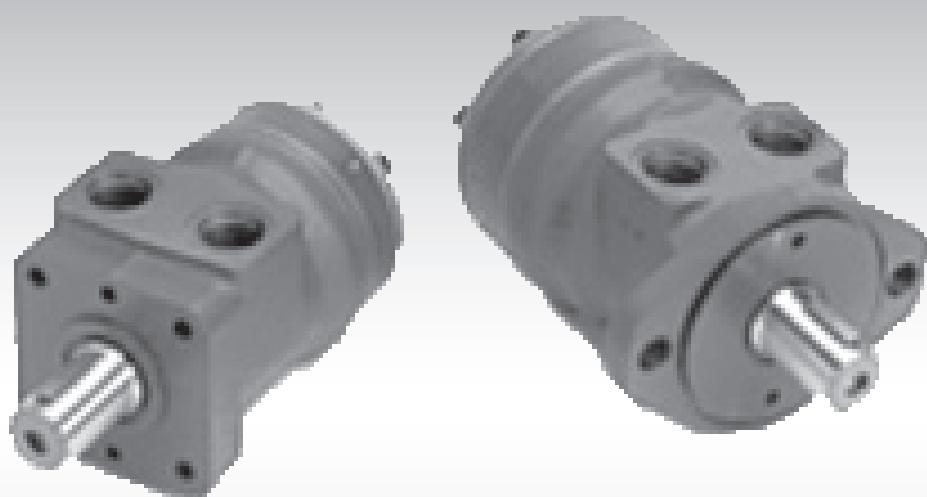


MAKING MODERN LIVING POSSIBLE



Technical Information

# Orbital Motors DH and DS





F 301 245

### A Wide Range of Orbital Motors

Danfoss Power Solutions is a world leader within production of low speed hydraulic motors with high torque. We can offer more than 3000 different hydraulic motors, categorised in types, variants and sizes (incl. different shaft versions).

The motors vary in size (rated displacement) from 8 cm<sup>3</sup> [0.50 in<sup>3</sup>] to 800 cm<sup>3</sup> [48.9 in<sup>3</sup>] per revolution.

Speeds range up to approx. 2500 min<sup>-1</sup> (rpm) for the smallest type and up to approx 600 min<sup>-1</sup> (rpm) for the largest type.

Maximum operating torques vary from 13 Nm [115 lbf-in] to 2700 Nm [24,000 lbf-in] (peak) and maximum outputs are from 2.0 kW [2.7 hp] to 70 kW [95 hp].

#### Characteristic features:

- Smooth running over the entire speed range
- Constant operating torque over a wide speed range
- High starting torque
- High return pressure without the use of drain line (High pressure shaft seal)
- High efficiency
- Long life under extreme operating conditions
- Robust and compact design
- High radial and axial bearing capacity
- For applications in both open and closed loop hydraulic systems
- Suitable for a wide variety of hydraulics fluids

**A Wide Range of Orbital Motors  
(continued)**

The programme is characterised by technical features appealing to a large number of applications and a part of the programme is characterised by motors that can be adapted to a given application. Adoptions comprise the following variants among others:

- Motors with corrosion resistant parts
- Wheel motors with recessed mounting flange
- OMP and OMR- motors with needle bearing
- OMR motor in low leakage version
- OMR motors in a super low leakage version
- Short motors without bearings
- Ultra short motors
- Motors with integrated positive holding brake
- Motors with integrated negative holding brake
- Motors with integrated flushing valve
- Motors with speed sensor
- Motors with tacho connection
- All motors are available with black finish paint

The Danfoss Orbital Motors are used in the following application areas:

- Construction equipment
- Agricultural equipment
- Material handling & Lifting equipment
- Forestry equipment
- Lawn and turf equipment
- Special purpose
- Machine tools and stationary equipment
- Marine equipment

**Survey of Literature with Technical Data on Danfoss Hydraulic Motors**

Detailed data on all Danfoss Orbital Motors can be found in our motor catalogue, which is divided into individual subcatalogues:

- General information on Danfoss Orbital Motors: function, use, selection of orbital motor, hydraulic systems, etc.
- Technical data on small motors: OML and OMM
- Technical data on medium sized motors: OMP, OMR, OMH
- Technical data on medium sized motors: DH and DS
- Technical data on medium sized motors: OMEW
- Technical data on medium sized motors: VMP
- Technical data on medium sized motors: VMR
- Technical data on large motors: OMS, OMT and OMV
- Technical data on large motors: TMT
- Technical data on large motors: TMV

A general survey brochure on Danfoss Orbital Motors gives a quick motor reference based on power, torque, speed and capabilities.

T301 123

## Contents

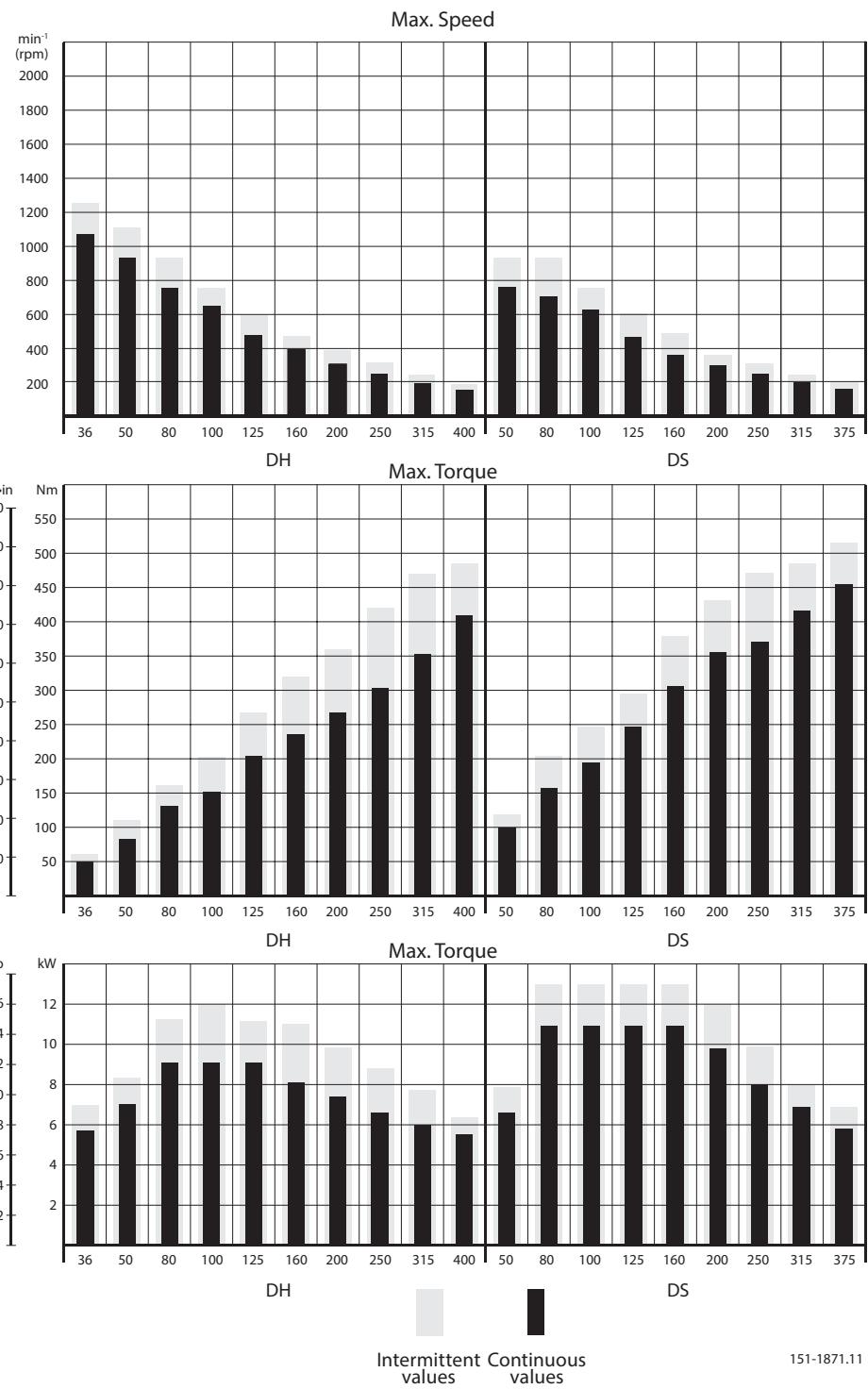
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**Speed, Torque and Output**

The bar diagrams, see page 5, are useful for a quick selection of relevant motor size for the application. The final motor size can be determined by using the function diagram for each motor size.

- DH can be found on pages 12-16
- DS can be found on pages 28-32

The function diagrams are based on actual tests on a representative number of motors from our production. The diagrams apply to a return pressure between 5 and 10 bar [75 and 150 psi] when using mineral based hydraulic oil with a viscosity of 35 mm<sup>2</sup>/s [165 SUS] and a temperature of 50°C [120°F]. For further explanation concerning how to read and use the function diagrams, please consult the paragraph "Selection of motor size" in the technical information "General" 520L0232.

**DH and DS Orbital Motor  
Data Survey**
**Speed, Torque and Output**


151-1871.11

**DH**
**Versions**

<b>Mounting flange</b>	<b>Shaft</b>	<b>Port size</b>	<b>European version</b>	<b>US version</b>	<b>Side port version</b>	<b>End port version</b>	<b>Flange port version</b>	<b>Standard shaft seal</b>	<b>High pressure shaft seal</b>	<b>Drain connection</b>	<b>Check valve</b>	<b>Specials</b>	<b>Main type designation</b>
2 hole oval flange (A2-flange)	Cyl. 1 in	7/8 - 14 UNF		<input type="radio"/>	<input type="radio"/>				<input type="radio"/>	No	No		DH
		7/8 - 14 UNF		<input type="radio"/>	<input type="radio"/>				<input type="radio"/>	Yes	No		DH
		1/2 - 14 NPTF		<input type="radio"/>	<input type="radio"/>				<input type="radio"/>	No	No		DH
	1 in - 6B spl.	7/8 - 14 UNF		<input type="radio"/>	<input type="radio"/>				<input type="radio"/>	No	No		DH
Square flange (C-flange)	Cyl. 1 in	7/8 - 14 UNF		<input type="radio"/>	<input type="radio"/>				<input type="radio"/>	No	No		DH
		1/2 - 14 NPTF		<input type="radio"/>	<input type="radio"/>				<input type="radio"/>	No	No		DH

Function diagram - see page : →

*Features available (options):*

- Reverse rotation
- Drain port
- Painted

**Code Numbers**

CODE NUMBERS	DISPLACEMENT [cm <sup>3</sup> ]										Technical data - Page	Dimensions - Page
	36	50	80	100	125	160	200	250	315	400		
<b>151-</b>	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	8	19
<b>151-</b>	-	3401	3402	3403	-	-	-	3407	3408	3409	8	20
<b>151-</b>	2080	2081	2082	2083	-	2085	2086	2087	2088	2089	8	19
<b>151-</b>	2010	2011	2012	2013	-	2015	2016	2017	2018	2019	8	19
<b>151-</b>	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	8	21
<b>151-</b>	2120	2121	2122	2123	2124	2125	2126	2127	2128	2129	8	21
→	12	12	13	13	14	14	15	15	16	16		

*Ordering*

Add the four character prefix "151-" to the four digit numbers from the chart for complete code number.

*Example:*

151-2000 for an DH 36 with A2-flange, cyl. 1 in shaft, port size 7/8 - 14 UNF and without drain connection.

Orders will not be accepted without the four character prefix.

**Technical Data**
*Technical Data for DH with 1 in Cylindrical and 1 in-6b Splined Shaft*

<b>Type Motor size</b>		<b>DH</b>	<b>DH</b>	<b>DH</b>	<b>DH</b>	<b>DH</b>	<b>DH</b>	<b>DH</b>	<b>DH</b>	<b>DH</b>	
		<b>36</b>	<b>50</b>	<b>80</b>	<b>100</b>	<b>125</b>	<b>160</b>	<b>200</b>	<b>250</b>	<b>315</b>	<b>400</b>
Geometric displacement	cm <sup>3</sup> [in <sup>3</sup> ]	36.0 [2.20]	48.6 [2.97]	77.8 [4.76]	97.3 [5.95]	125.0 [7.65]	155.7 [9.53]	194.6 [11.91]	242.3 [14.83]	306.1 [18.73]	389.2 [23.82]
Max. speed	min <sup>-1</sup> [rpm]	cont. int. <sup>2)</sup>	1050 1270	930 1090	780 975	620 780	485 605	390 485	310 390	250 315	200 245
Max. torque <sup>1)</sup>	Nm [lbf·in]	cont. int. <sup>2)</sup>	59 [520] 76 [670]	79 [700] 106 [940]	125 [1110] 163 [1440]	158 [1400] 214 [1890]	203 [1800] 270 [2390]	235 [2080] 320 [2830]	267 [2360] 360 [3190]	305 [2700] 415 [3670]	355 [3140] 470 [4160]
Max. output	kW [hp]	cont. int. <sup>2)</sup>	5.8 [7.9] 7.0 [9.5]	6.8 [9.3] 8.2 [11.2]	8.8 [12.0] 11.4 [15.5]	8.8 [12.0] 11.8 [16.0]	8.8 [10.9] 11.0 [15.0]	8.1 [10.9] 11.1 [14.1]	7.4 [9.0] 9.8 [13.1]	6.6 [8.9] 8.8 [11.8]	6.0 [8.0] 7.8 [10.5]
Max. pressure drop	bar [psi]	cont. int. <sup>2)</sup>	124 [1800] 166 [2400]	124 [1800] 166 [2400]	124 [1800] 166 [2400]	124 [1800] 166 [2400]	117 [1700] 159 [2300]	103 [1500] 141 [2050]	97 [1400] 131 [1900]	90 [1300] 121 [1750]	83 [1200] 97 [1400]
Max. oil flow	l/min [US gal/min]	cont. int. <sup>2)</sup>	38 [10.0] 45 [11.9]	45 [11.9] 55 [14.5]	60 [15.9] 75 [19.8]	60 [15.9] 75 [19.8]	60 [15.9] 75 [19.8]	60 [15.9] 75 [19.8]	60 [15.9] 75 [19.8]	60 [15.9] 75 [19.8]	60 [15.9] 75 [19.8]
Max. starting pressure with unloaded shaft	bar [psi]		10 [145]	10 [145]	10 [145]	10 [145]	10 [145]	7 [100]	7 [100]	7 [100]	7 [100]
Min. starting torque	at max. press. drop cont. Nm [lbf·in]		53 [470]	72 [635]	115 [1020]	144 [1275]	185 [1640]	217 [1920]	240 [2125]	279 [2470]	330 [2920]
	at max. press. drop int. <sup>1)</sup> Nm [lbf·in]		66 [585]	96 [850]	154 [1360]	192 [1700]	247 [2185]	295 [2610]	327 [2895]	379 [3355]	444 [3930]

<sup>1)</sup> 6B splined shaft is recommended for operating torque of 280 Nm [2500 lbf·in] or more.

<sup>2)</sup> Intermittent operation: the permissible values may occur for max. 10% of every minute.

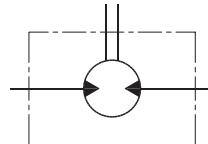
<b>Type</b>	<b>Max. inlet pressure</b>			<b>Max return pressure with drain line</b>
DH 36 - 400	bar [psi]		cont.	138 [2000]
	bar [psi]		int. <sup>1)</sup>	172 [2500]

**Technical Data**
**Max. Permissible Shaft Seal Pressure**

*DH with HPS and without drain connection:*

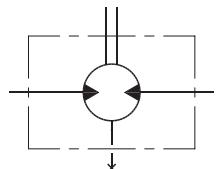
The shaft seal pressure equals the average of input pressure and return pressure.

$$P_{\text{seal}} = \frac{P_{\text{in}} + P_{\text{return}}}{2}$$

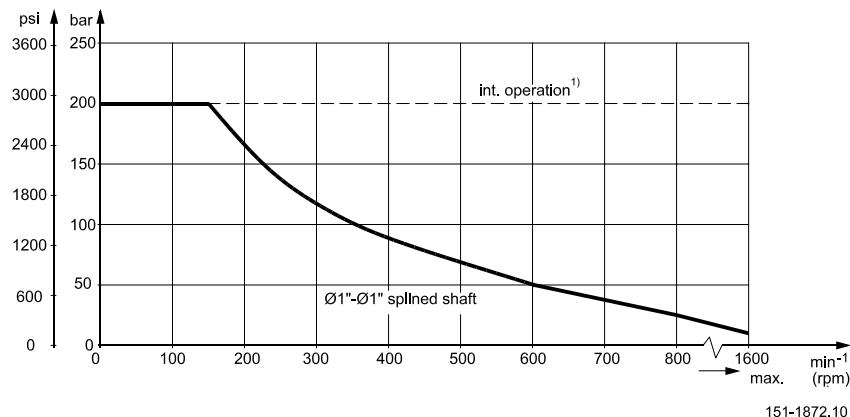


151-1743.10

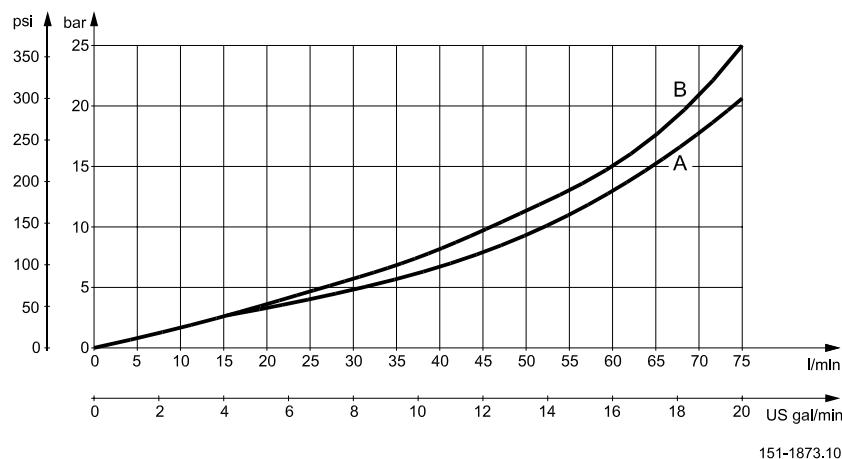
*DH with HPS and drain connection:*  
The shaft seal pressure equals the pressure in the drain line.



151-1855.10

**Max. permissible shaft seal pressure**


151-1872.10

**Pressure Drop in Motor**


151-1873.10

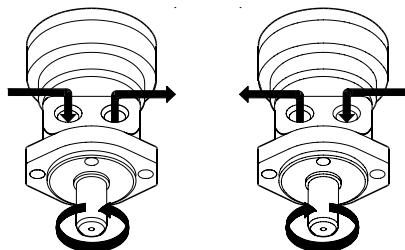
The curve applies to an unloaded motor shaft and an oil viscosity of 35 mm²/s [165 SUS]

- A: DH 80 - 400
- B: DH 36-50

**Technical Data**
**Oil Flow in Drain Line**

The table shows the max. oil flow in the drain line at a return pressure less than 5-10 bar [75-150 psi].

Pressure drop bar [psi]	Viscosity mm <sup>2</sup> /s [SUS]	Oil flow in drain line l/min [US gal/min]
100 [1450]	20 [100]	2.5 [0.66]
	35 [165]	1.8 [0.78]
140 [2030]	20 [165]	3.5 [0.93]
	35 [165]	2.8 [0.74]

**Direction of Shaft Rotation**


151-1874.10

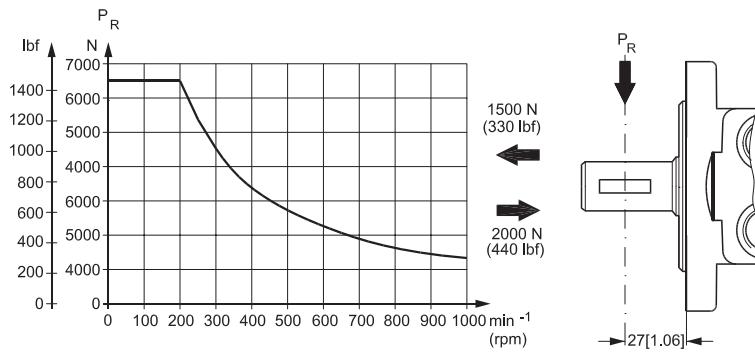
**Technical Data**
**Permissible Shaft Loads for DH**

The permissible radial shaft load ( $P_R$ ) depends on

- speed (n)
- distance (l) from the point of load to the mounting flange
- mounting flange version
- shaft version

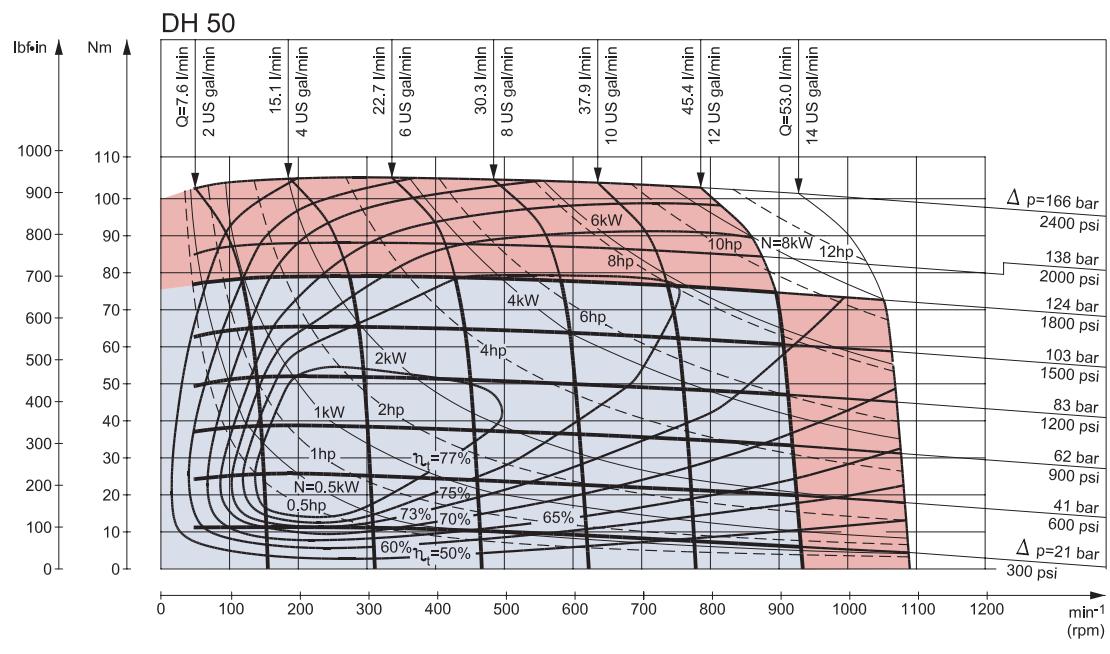
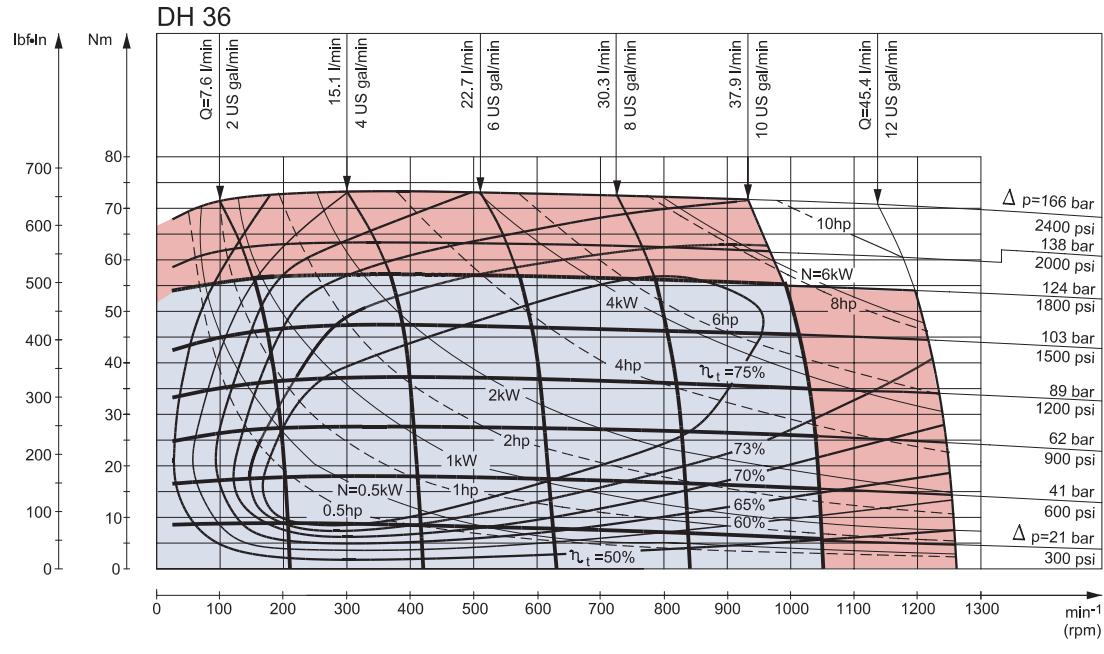
Mounting flange	Square flange 2-hole oval flange (US version)
Shaft version	1 in cylindrical shaft 1 in 6B splined shaft
Permissible shaft load ( $P_R$ ) l in mm	$\frac{650 \times 22800}{n + 87 + l} N^*$
Permissible shaft load ( $P_R$ ) l in inch	$\frac{1460 \times 898}{n + 3.425 + l} lbf^*$

\*  $n \geq 200 \text{ min}^{-1}$  (rpm);  $l \leq 55 \text{ mm}$  [2.2 in]  
 $n < 200 \text{ min}^{-1}$  (rpm);  $\Rightarrow P_{Rmax} = 6500 \text{ N}$  [1460 lbf], when using above formulas n has to be  $200 \text{ min}^{-1}$  (rpm).



The curve shows the relation between  $P_R$  and n

- when  $l = 27 \text{ mm}$  [1.06 in] for motors with oval and square mounting flange

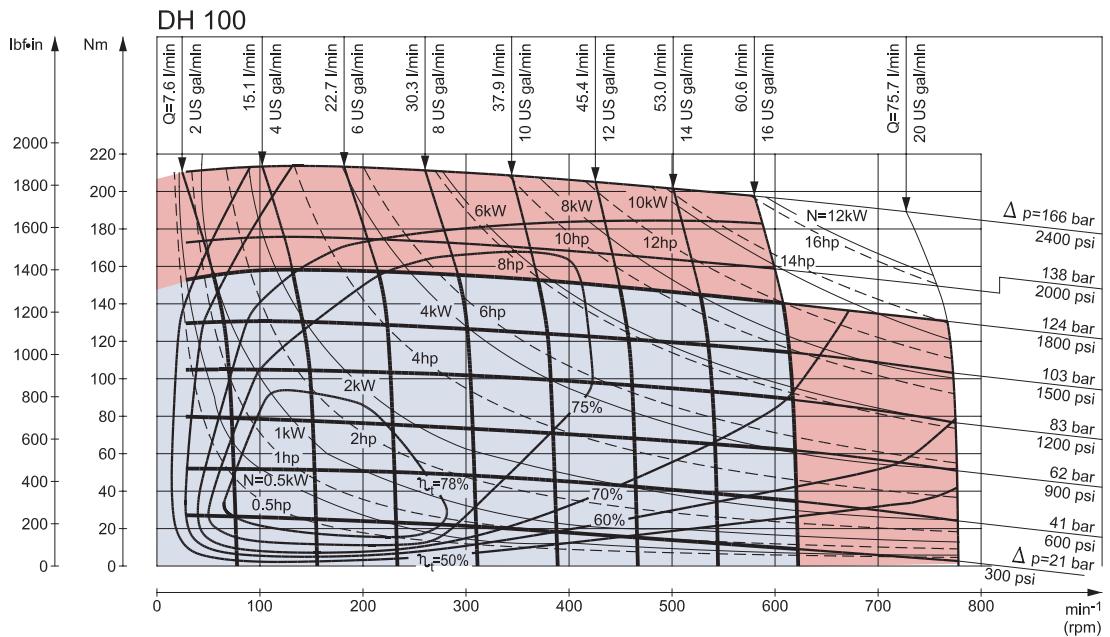
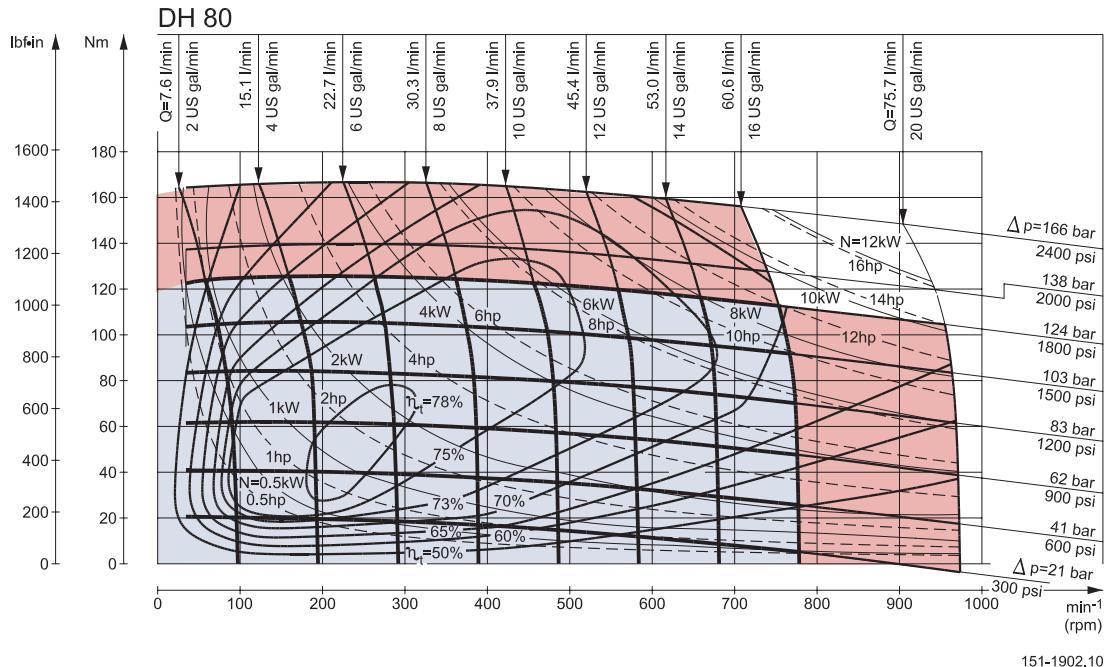
**Technical Data**
**Function Diagrams**


Explanation of function diagram use, basis and conditions can be found on page 4.

- A: Continuous range
- B: Intermittent range (max. 10% operation every minute)

Max. permissible continuous/intermittent pressure drop for the actual shaft version can be found on page 8.

Intermittent pressure drop and oil flow must not occur simultaneously.

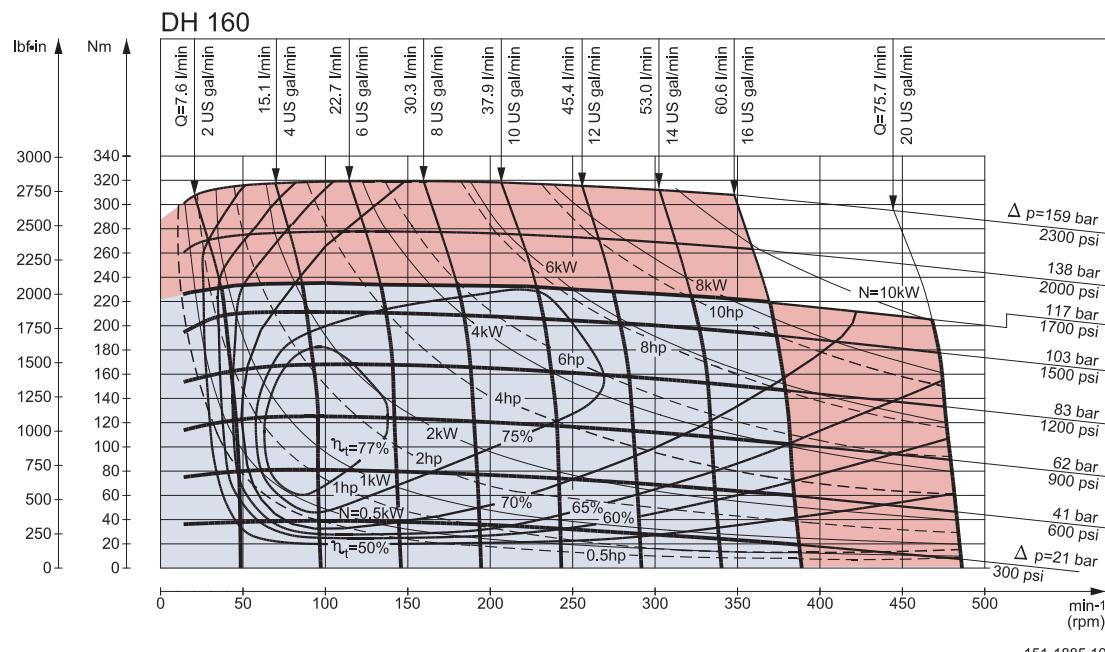
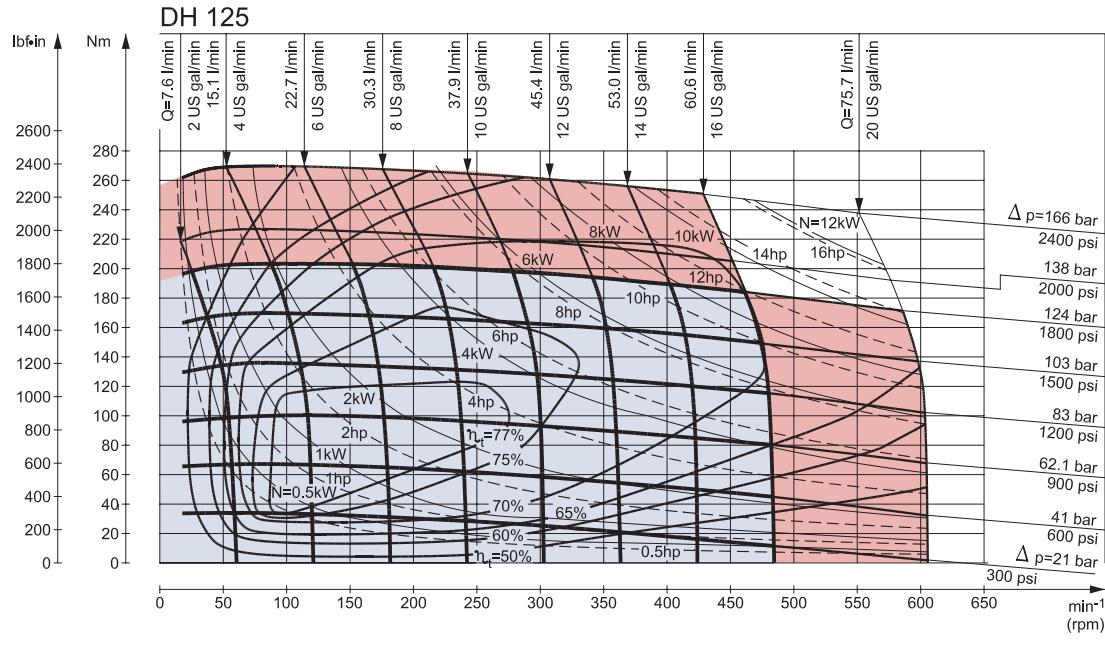
**Technical Data**
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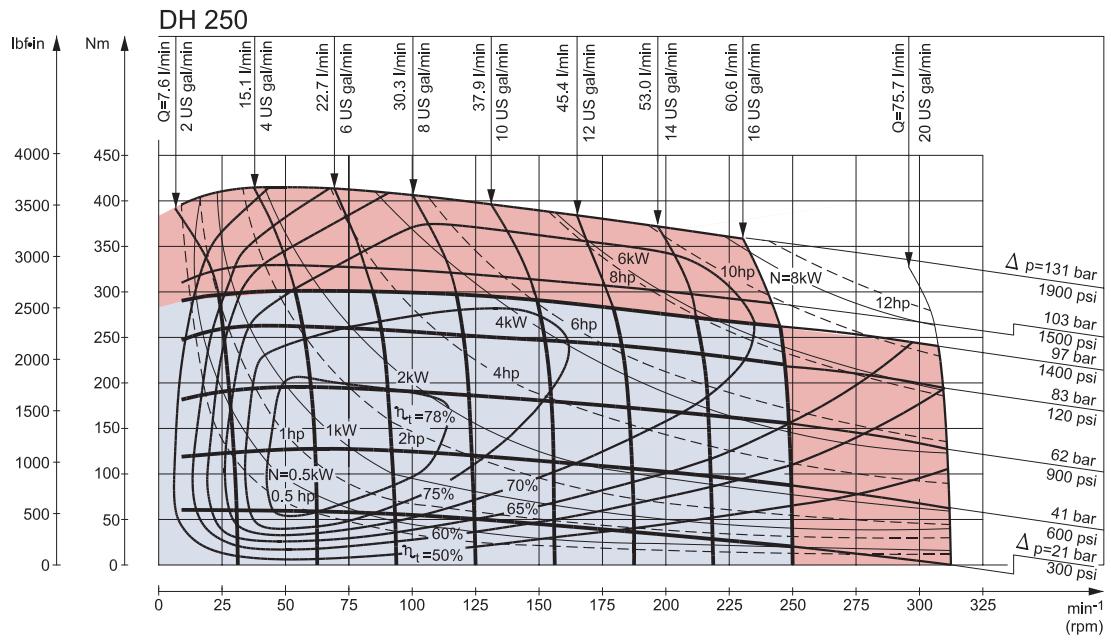
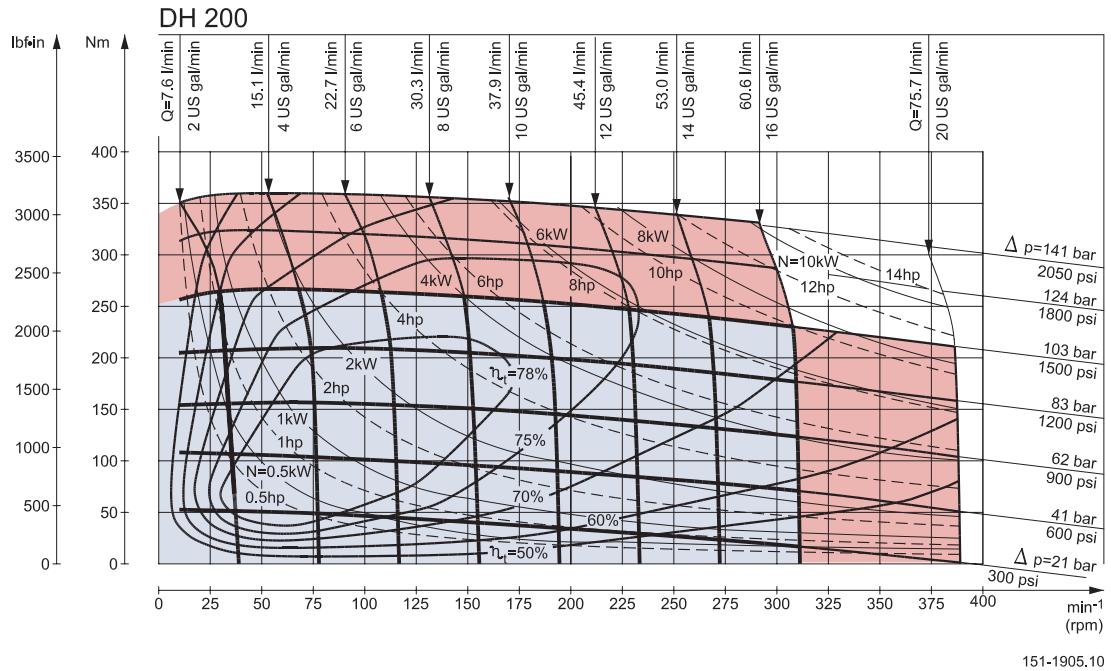
**Technical Data**
**Function Diagrams**


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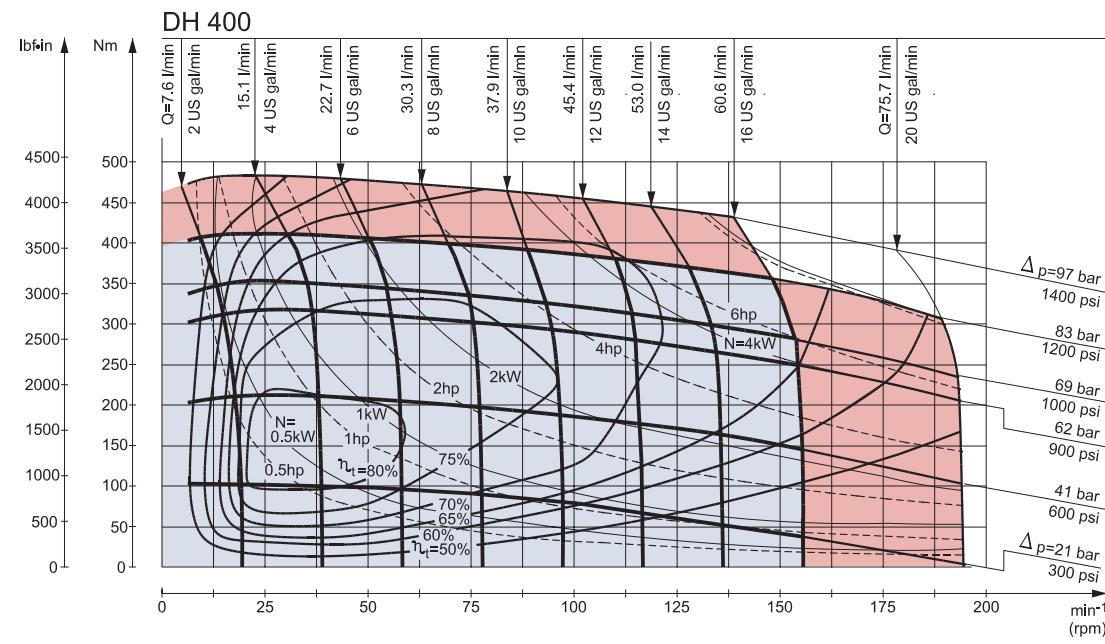
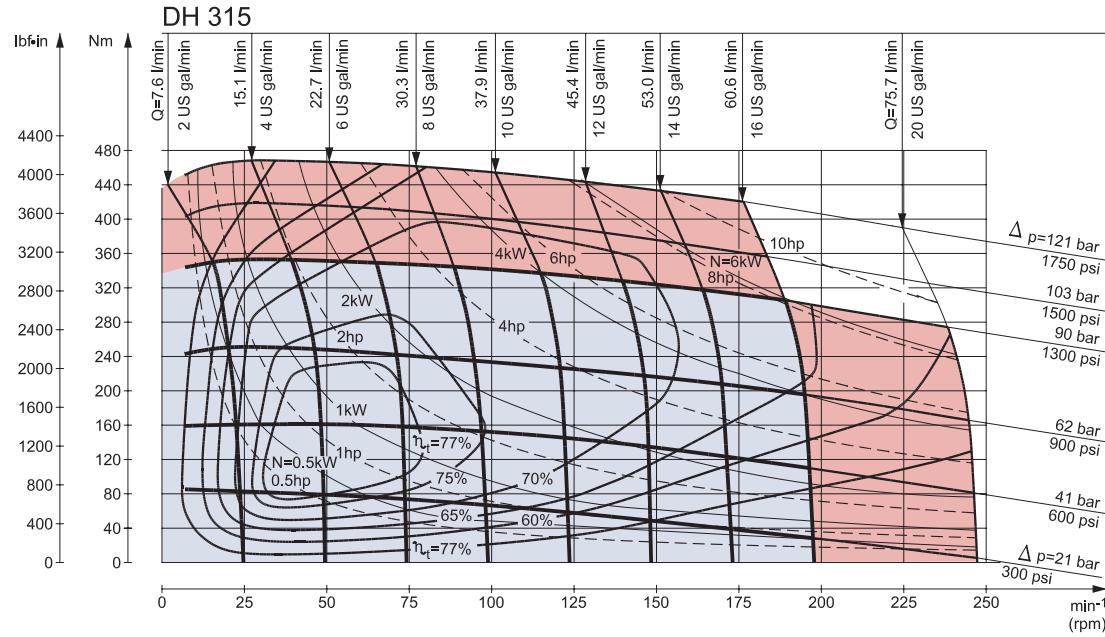
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- A: Continuous range
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Intermittent pressure drop and oil flow must not occur simultaneously.

**Technical Data**
**Function Diagrams**


Explanation of function diagram use, basis and conditions can be found on page 4.

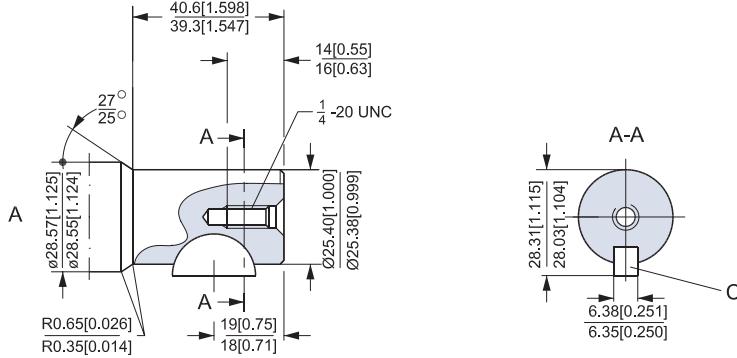
- A: Continuous range
- B: Intermittent range (max. 10% operation every minute)

Max. permissible continuous/intermittent pressure drop for the actual shaft version can be found on page 8.

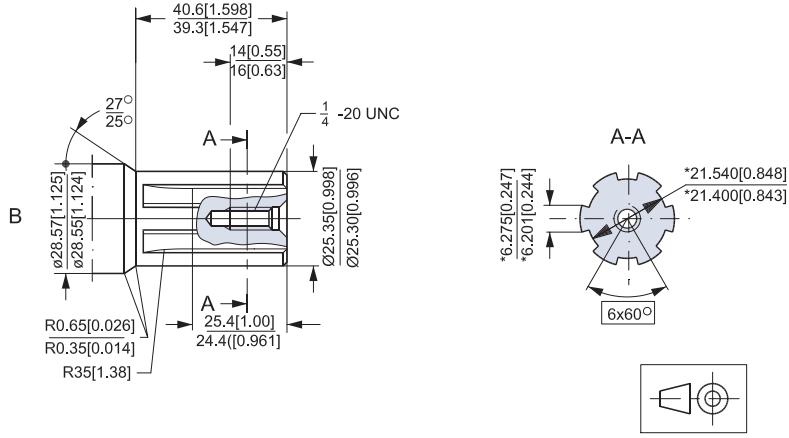
Intermittent pressure drop and oil flow must not occur simultaneously.

**Technical Data**
**Shaft Version**
**US version**

A: Cylindrical shaft  
1 in  
C: Woodruff key  
 $\frac{1}{4} \times 1$  in  
SAE J502

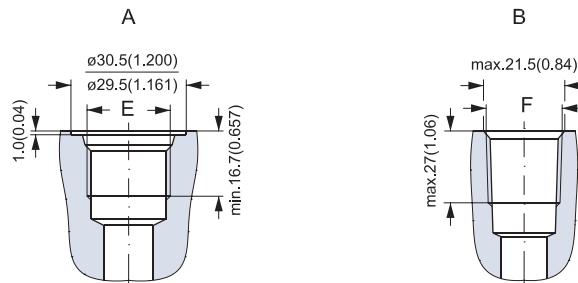

**US version**

B: Splined shaft  
1 in - SAE 6B  
\* Deviates from B.S. 2059  
(SAE 6B)

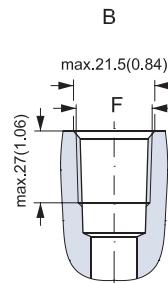


151-1876.10

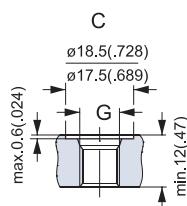
6B splined shaft is recommended for operating torque of 280 Nm [2500 lbf.in] or more.

**Port Thread Versions**


A: UNF main ports  
 E:  $\frac{7}{8}$  - 14 UNF  
 O-ring boss port



B: NPTF main ports  
 F:  $\frac{1}{2}$  - 14 NPTF



C: UNF drain port  
 G:  $\frac{7}{16}$  - 20 UNF  
 O-ring boss port

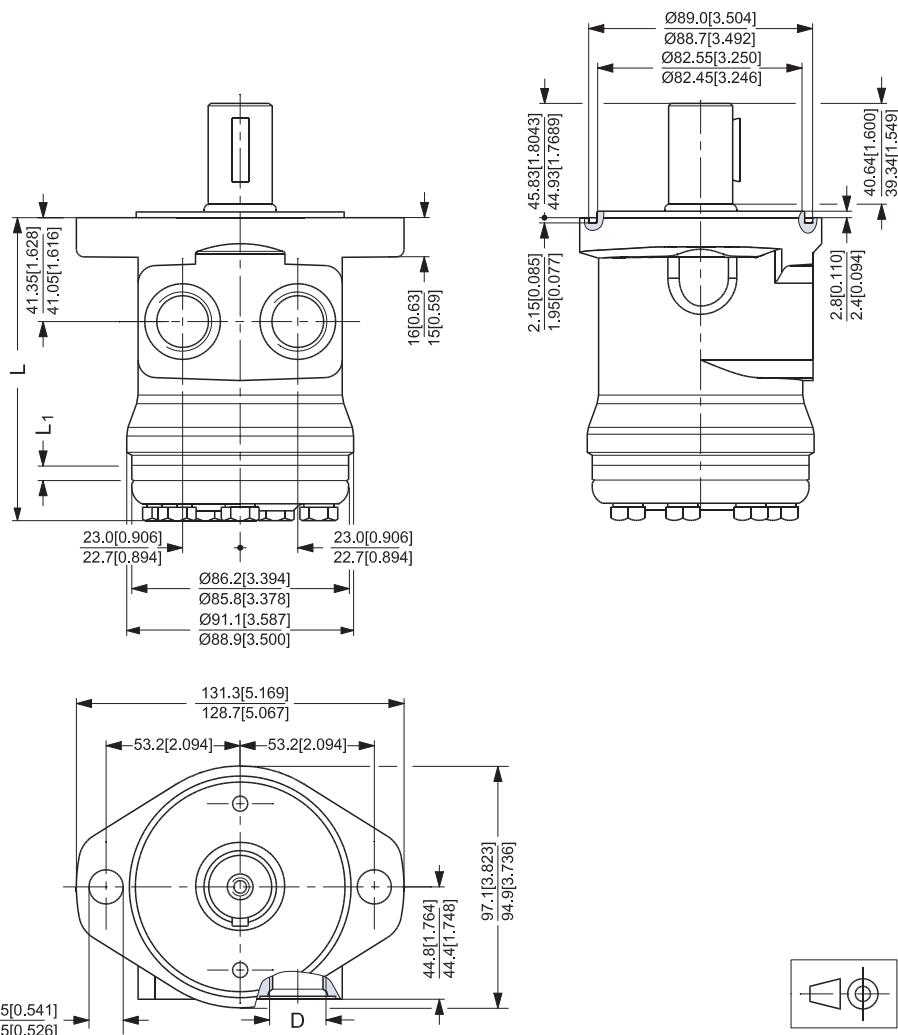
### Dimensions

#### Dimensions – US Version

Side port version with 2 hole oval mounting flange (A2-flange).  
Port thread version.

Type	L mm [in]	L <sub>1</sub> mm [in]
DH 36	119.7 [4.71]	5.9 [0.23]
DH 50	120.3 [4.74]	6.5 [0.26]
DH 80	124.2 [4.89]	10.4 [0.41]
DH 100	126.8 [4.99]	13.0 [0.51]
DH 125	130.5 [5.14]	16.7 [0.66]
DH 160	134.6 [5.30]	20.8 [0.82]
DH 200	139.8 [5.50]	26.0 [1.02]
DH 250	146.3 [5.76]	32.5 [1.28]
DH 315	154.7 [6.09]	40.9 [1.61]
DH 400	165.8 [6.53]	52.0 [2.05]

D: 7/8 - 14 UNF,  
16.7 mm [0.66 in] deep  
O-ring boss port or  
1/2 - 14 NPTF



151-1877.10

## Dimensions

## *Dimensions – US Version*

Side port version with 2 hole oval mounting flange (A2-flange).  
With drain connection.  
Port thread version.

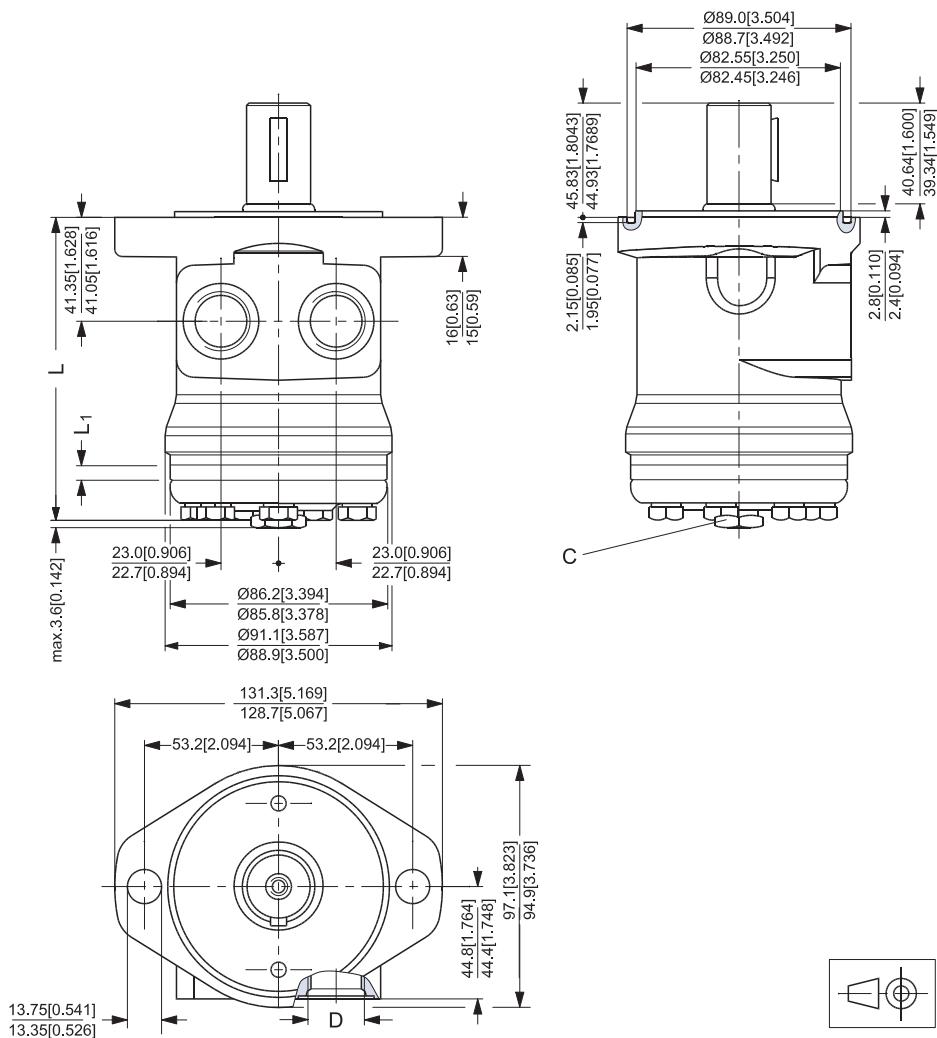
Type	L <sub>mm</sub> [in]	L <sub>mm</sub> [in]
DH 36	119.7 [4.71]	5.9 [0.23]
DH 50	120.3 [4.74]	6.5 [0.26]
DH 80	124.2 [4.89]	10.4 [0.41]
DH 100	126.8 [4.99]	13.0 [0.51]
DH 125	130.5 [5.14]	16.7 [0.66]
DH 160	134.6 [5.30]	20.8 [0.82]
DH 200	139.8 [5.50]	26.0 [1.02]
DH 250	146.3 [5.76]	32.5 [1.28]
DH 315	154.7 [6.09]	40.9 [1.61]
DH 400	165.8 [6.53]	52.0 [2.05]

C: 7/16 - 20 UNF,

12 mm [0.47 in] deep

D: 7/8 - 14 UNF,

16.7 mm [0.66 in] deep  
O-ring boss port or  
1/2 - 14 NPTF



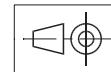
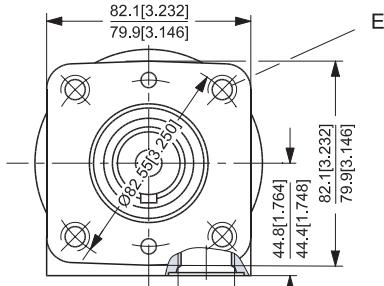
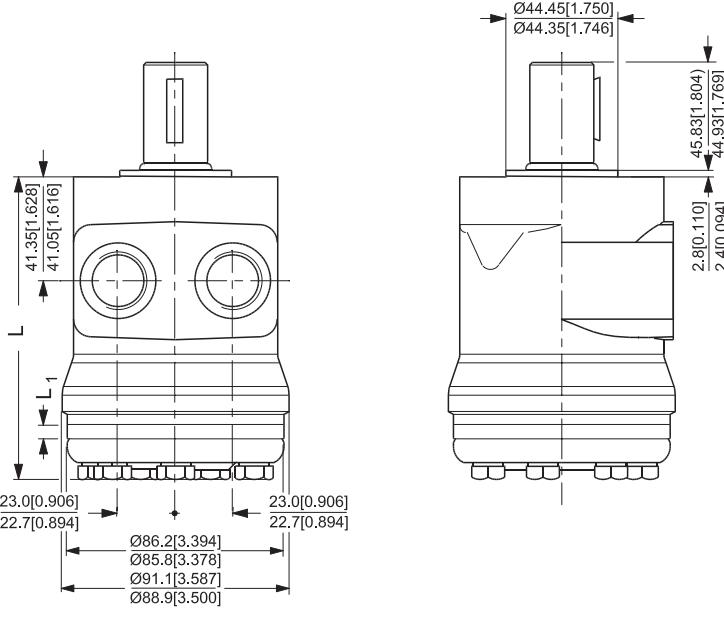
151-1890.10

**Dimensions**
*Dimensions – US Version*

Side port version with square mounting flange (C-flange).  
Port thread version.

Type	L mm [in]	L <sub>1</sub> mm [in]
DH 36	119.7 [4.71]	5.9 [0.23]
DH 50	120.3 [4.74]	6.5 [0.26]
DH 80	124.2 [4.89]	10.4 [0.41]
DH 100	126.8 [4.99]	13.0 [0.51]
DH 125	130.5 [5.14]	16.7 [0.66]
DH 160	134.6 [5.30]	20.8 [0.82]
DH 200	139.8 [5.50]	26.0 [1.02]
DH 250	146.3 [5.76]	32.5 [1.28]
DH 315	154.7 [6.09]	40.9 [1.61]
DH 400	165.8 [6.53]	52.0 [2.05]

D: 7/8 - 14 UNF;  
16.7 mm [0.66 in] deep  
or 1/2 - 14 NPTF  
E: 3/8 - 16 UNC;  
15 mm [0.59 in] deep  
(4-off)



151-1879.10

## Hydraulic Systems

### Installation of the Danfoss Orbital Motors

#### *About the design*

- To ensure efficient operation all hydraulic components must be installed according to their individual instructions.
- The pump line must include a gage connection.
- To ensure designed contact and minimize the stress all mounting flanges must be flat.
- Hydraulic lines must be fitted correctly to prevent air entrapment.

#### *About the assembly*

- Follow the mounting instructions printed on the inside of the cardboard box.
- To prevent contamination, do not remove the plastic plugs from the connection ports until the fittings are ready to be assembled.
- Check that there is full face contact between the motor mounting flange and the mating part.
- Do not force the motor into place when tightening the mounting screws.
- Avoid unsuitable sealing material on fittings such as pack twine, Teflon and others.
- Use only bonded seals, O-rings, steel washers and the like.
- When tightening the fittings never use a torque higher than the max. tightening torque stated in the instructions.
- Make sure that the cleanliness of the oil used is better than 20/16 (ISO 4406). Always use a filter for oil refilling.

### Starting Up and Running in the Hydraulic System

- Through a small-meshed filter fill up the tank with oil to the upper oil level mark .
- Start the drive engine, and if possible, let it work at its lowest speed. If the motor is provided with bleed screws, keep these open until the emerging oil is non-foaming.
- Check that all components are correctly connected (pump following the right direction of rotation etc.).
- In load-sensing systems, also make sure that the signal lines are free of entrapped air.
- Indications of air in the hydraulic system:
  - foam in the tank
  - jerky movements of motor and cylinder
  - noise
- If required, refill with oil.
- Connect the system to a separate tank that includes a filter (fineness max. 10 µm) with twice the capacity of the max. oil flow. Let the entire system run without load (no pressure) for about 30 minutes.
- Do not load the system until it is all bled and clean.
- Check the tightness of the system and make sure that its performance is satisfactory.
- Change the oil filter, and if required, refill with oil.

### Operation

- Do not expose the motor to pressures, pressure drops and speeds above the max. values stated in the catalogue.
- Filter the oil to ensure that the contamination level 20/16 (ISO 4406) or better.

### Maintenance

- When working with hydraulic systems, the main criteria of operating safety and endurance is careful maintenance
- Always renew and replace oil, oil filters and air filters according to the instructions given by the respective manufacturers
- Regularly check the condition of the oil
- Frequently check system tightness and oil level

**Weight of Motors**

<b>Code no</b>	<b>Weight</b>	
	<b>kg</b>	<b>[lb]</b>
151-2000	5.1	11.2
151-2001	5.1	11.2
151-2002	5.2	11.5
151-2003	5.4	11.9
151-2004	5.5	12.1
151-2005	5.7	12.6
151-2006	5.9	13.0
151-2007	6.1	13.4
151-2008	6.4	14.1
151-2009	6.9	15.2
151-2010	5.1	11.2
151-2011	5.1	11.2
151-2012	5.2	11.5
151-2013	5.4	11.9
151-2015	5.7	12.6
151-2016	5.9	13.0
151-2017	6.1	13.4
151-2018	6.4	14.1
151-2019	6.9	15.2
151-2040	4.8	10.6
151-2041	4.8	10.6
151-2042	4.9	10.8
151-2043	5.1	11.2
151-2044	5.2	11.5
151-2045	5.4	11.9
151-2046	5.6	12.3
151-2047	5.8	12.8
151-2048	6.1	13.4
151-2049	6.6	14.6
151-2080	5.1	11.2
151-2081	5.1	11.2
151-2082	5.2	11.5
151-2083	5.4	11.9
151-2085	5.7	12.6
151-2086	5.9	13.0
151-2087	6.1	13.4
151-2088	6.4	14.1
151-2089	6.9	15.2
151-2120	4.8	10.6
151-2121	4.8	10.6
151-2122	4.9	10.8
151-2123	5.1	11.2
151-2124	5.2	11.5
151-2125	5.4	11.9
151-2126	5.6	12.3
151-2127	5.8	12.8
151-2128	6.1	13.4
151-2129	6.6	14.6
151-2301	5.9	13.0
151-2302	6.1	13.4
151-2303	6.1	13.4
151-2304	6.2	13.7
151-2305	6.4	14.1
151-2306	6.7	14.8
151-2307	7.2	15.9
151-2308	7.7	17.0
151-2309	8.2	18.1
151-2312	6.1	13.4
151-2313	6.1	13.4
151-2314	6.2	13.7
151-2316	6.7	14.8
151-2318	7.7	17.0
151-2319	8.2	18.1
151-2341	5.6	12.3
151-2342	5.8	12.8
151-2343	5.8	12.8



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