Radial piston hydraulic motor

Hägglunds Quantum

VALID FOR

- Torque range: up to 370 kNm [up to 272 898 lb-ft]
- Speed:range: up to 125 rpm
- Power range: up to 1000 kW
- Maximum operating pressure: 350 bar [5 076 psi]
- Frame size: 280, 400, 560, 840 and 1120
- Displacement: 15 100 to 70 400 cm3/rev [920 to 4 290 in3/rev]
- Specific torque: 240 to 1120 Nm/bar [12 200 to 56 900 ft-lbs/1 000 psi]

FEATURES

- High power density
- High torque density
- High energy efficiency
- Flexible, many sizes, few mechanical interfaces
- Insensitive for shock loads
- Very low moment of inertia
- Small footprint (total occupied volume)
- Freewheeling possibility
- Through hole diameter up to 110 mm

RE 15428 10-2023 Replaces: 05-2023
Bosch Rexroth AB

HÄGGLUNDS

CONTENTS

1 Ordering code 4
2 Functional description 6
3 Fluid connections 7
3.1 Hydraulic symbol 7
3.2 Port connections 8
4 Technical data 9
4.1 Calculation fundamentals 9
4.2 General data 10
4.3 Motor data 12
4.4 Recommended charge pressure 14
4.4.1 The motor working in driving mode only 14
4.4.2 The motor working in braking mode 14
4.5 Hydraulic fluids 19
4.6 Overall efficiency 20
4.7 Pressure loss diagrams 29
4.8 Quick selection diagram 34
4.9 Draining, venting and flushing of the motor 35
4.9.1 Horizontal mounting 35
4.9.2 Vertical mounting 36
4.10 Flushing 37
4.11 External leakage 38
4.12 Viscosity factor K 38
4.13 Freewheeling 39
4.13.1 The function of freewheeling 39
4.13.2 Circuit design 39
4.13.3 Oil volume for freewheeling 40
4.13.4 Power loss freewheeling 41
4.14 Permissible external loads 42
4.14.1 External load with torque arm mounting 42
4.14.2 Permissible external dynamic loads 43
4.15 Low speed performance 48
4.16 Sound 49
5 Increased robustness 49
6 Through hole kit 50
7 Type of seal 51
8 Speed sensors 51
8.1 Inductive speed sensor SPDE 51
8.2 Speed sensor SPDC 52
8.3 Explosion proof speed sensor SPDB 2 53
8.4 Absolute Rotary Encoder, ABRA 54
9 Temperature sensor 55
10 Explosive environment 56
11 Painting system 56
12 Painting colour 56
13 Special index motors 57
13.1 Special index 11: Motor for submerged applications 57
13.2 Special index 33: Motor for marine environment 57
14 Dimensions / Interface 58
14.1 Dimensions 58
15 Mounting alternatives 63
15.1 General information 63
15.1.1 Flange mounting with splines 63
15.1.2 Torque arm mounting with splines 65
15.1.3 Torque arm mounting on plain shaft 66
16 Accessories 67
16.1 Torque arms 67
16.2 Flushing and early warning kit 68
16.3 Coupling adapter for QMX 1120 69
16.4 Valves 70
16.4.1 Counter balance valve, VCBCA 480 70
16.4.2 Cross-over valve, COCC 1200 70
16.4.3 Freewheeling valve VFWCB 600 71
16.4.4 Hydraulic quick stop valve, VQCC 800 71
16.5 Hägglunds BICA 72
16.6 Kit for harsh and marine environment 73
17 Circuit design 74
17.1 Closed circuit 74
17.2 Open circuit 75
18 Related documents 76

1 Ordering code

In order to identify Hägglunds equipment exactly, the following ordering code is used. These ordering codes should be stated in full in all correspondence e.g. when ordering spare parts.
Example Hägglunds Quantum motor:

HD	-	QM	X	-	1120	-	0920	-	S	C	A	C	0	-	N	00	1	0	-	3	2002	-	A	00
01		02	03		04		05		06	07	08	09	10		11	12	13	14		15	16		17	18

01	**Brand**	
	Hägglunds	**HD**

02	**Motor series**	
	Quantum	**QM**

03	**Feature**	
	Standard	**X**

04	**Frame size**	
	280	**0280**
	400	**0400**
	560	**0560**
	840	**0840**
	120	**1120**

05	**Nominal size , specific torque, Nm/bar**								
	Frame size 280							**0240**	**0280**
								●	●
	Frame size 400	**0240**	**0280**	**0320**	**0360**	**0400**	**0440**	**0480**	**0520**	**0560**
		●	●	●	●	●	●	●	●	●
	Frame size 560						**0440**	**0480**	**0520**	**0560**
							●	●	●	●
	Frame size 840			**0600**	**0640**	**0680**	**0720**	**0760**	**0800**	**0840**
				●	●	●	●	●	●	●
	Frame size 1120			**0880**	**0920**	**0960**	**1000**	**1040**	**1080**	**1120**
				●	●	●	●	●	●	●

06	**Mounting alternatives, drive shaft**	**H Hydraulic shrink disc**	**C Mechanical shrink disc**	**S Splines**
	Frame size 280	●	●	●
	Frame size 400	●	●	●
	Frame size 560	●	●	●
	Frame size 840	●	●	●
	Frame size 1120	–	–	●

07	**Mounting alternatives, motor case**	**280**	**400**	**560**	**840**	**1120**	
	Front flange [1]	●	●	–	–	–	**F**
	Center flange	–	–	●	●	●	**C**

08	**Motor prepared for tandem kit**		
	No	●	**A**
	Yes [2]	–	**B**

09	**Increased robustness**	
	No	**0**
	Yes	**C**

10	**Through hole kit**	
	No	**0**
	Yes	**H**

11	**Type of seal**	
	NBR (Nitrile)	**N**
	FPM (Viton)	**V**

12	**Speed sensor**	
	No	**00**
	SPDE	**11**
	SPDC	**21**
	SPDB2 1000 rev/min	**31**
	SPDB2 3600 rev/min	**32**

13	**Temperature sensor**	
	No	**0**
	Yes	**1**

14	**Explosive environment**	
	Non explosive environment	**0**
	Motor approved for ATEX gas group IIB	**1**
	Motor approved for ATEX gas group IIC	**2**

15	**Painting system**	
	C3 (corrosivity category medium)	**3**
	C5 (corrosivity category very high)	**5**
	CX (corrosivity category extreme)	**X**

16	**Painting colour**	
	std RAL 2002	**2002**
	Special RAL 1000 - 9023 **)Specify with RAL colour code	****

17	**Modification**	
	Current modification	**A**

18	**Design**	
	Standard	**00**
	Special index	**01-99**

● = Available – Not available

[1] Mounting flange on housing cover for sizes 280 and 400
[2] TA kit must be ordered separately

2 Functional description

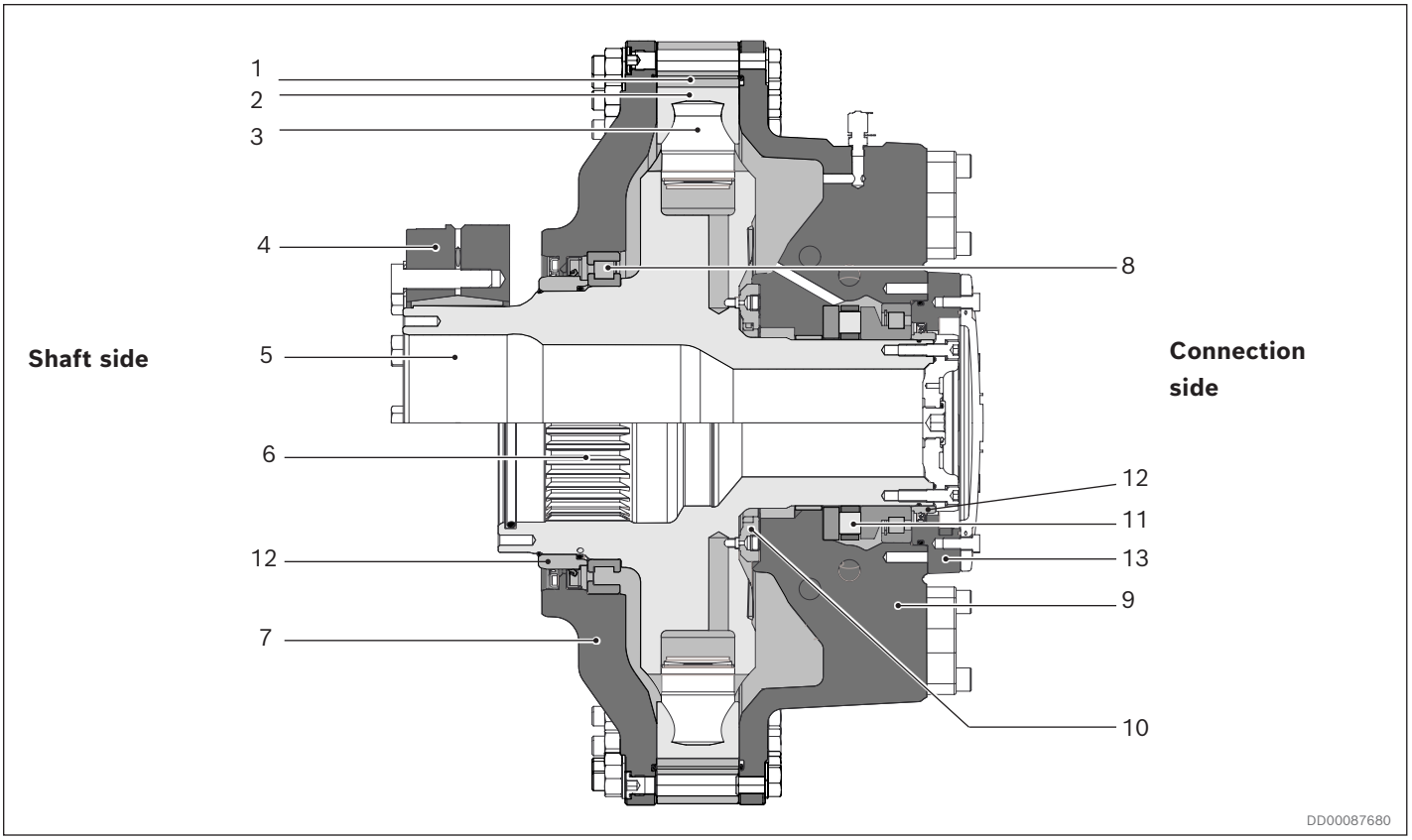


Fig. 1: Section view of radial piston hydraulic motor QMX

1. Cam ring	**8.** Cylindrical roller bearing
2. Cam roller	**9.** Connection housing
3. Piston	**10.** Distributor
4. Shrink disk	**11.** Combined axial and radial bearing
5. Cylinder block, hollow shaft	**12.** Wear ring
6. Cylinder block, spline	**13.** Seal retainer
7. Housing cover	

Bosch Rexroth‘s hydraulic industrial motor Hägglunds Quantum (QMX) is of the radial piston type with a rotating cylinder block/hollow shaft and a stationary housing. The cylinder block is mounted in fixed roller bearings in the housing. An even number of pistons are radially located in bores inside the cylinder block, and the distributor directs the incoming and outgoing oil to and from the working pistons. Each piston is working against a cam roller.

When the hydraulic pressure is acting on the pistons, the cam rollers are pushed against the slope on the cam ring that is rigidly connected to the housing, thereby producing a torque. The cam rollers transfer the reaction force to the pistons which are guided in the cylinder block. Rotation therefore occurs, and the torque available is proportional to the pressure in the system.
Oil main lines are connected to ports A and C in the connection housing and drain lines to one of the D -ports in the motor housing. (See *3.2 Port connections)*

The motor is connected to the shaft of the driven machine through the hollow shaft or spline of the cylinder block.

Quality
To assure our quality we maintain a Quality Assurance System, certified to standard ISO 9001.

3 Fluid connections

3.1 Hydraulic symbol

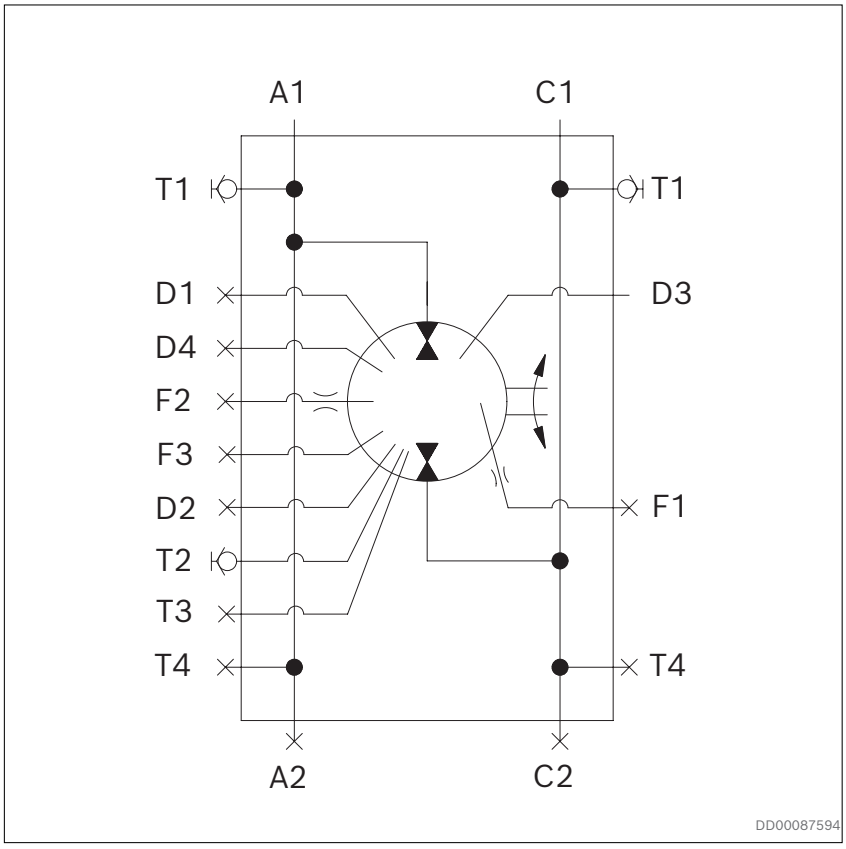


Fig. 2: Hydraulic symbol QMX

Port locations and dimensions, *see Table 1: Port dimensions*

3.2 Port connections

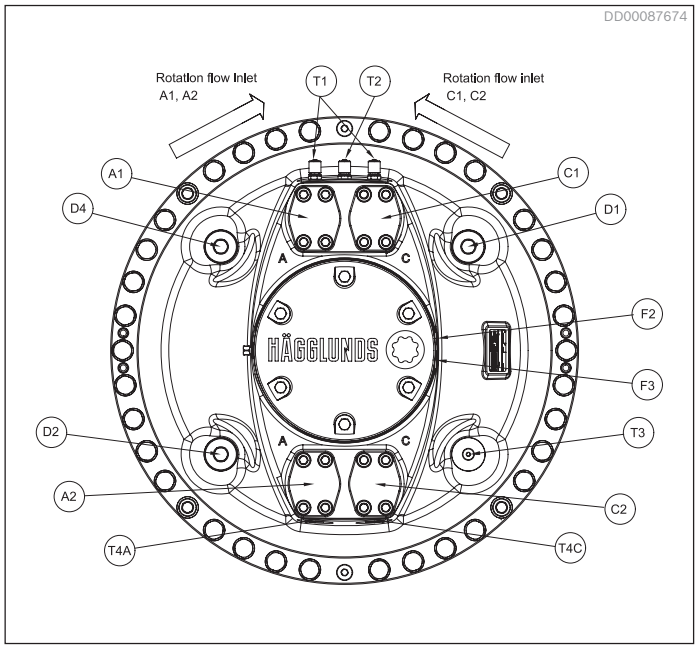


Fig. 3: Connection side of the Quantum motor

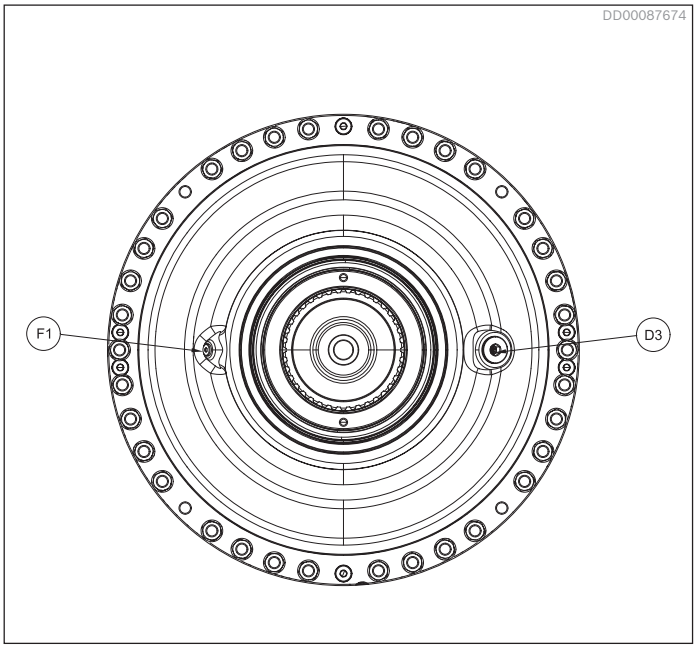


Fig. 4: Shaft side of the Quantum motor

Table 1: Port dimensions

Connection	Description	Dimensions	Remarks
A1, A2	Main connection	1 1/4"and 1 1/2" *	If A is used as the inlet, the motor shaft rotates counterclockwise, viewed from the motor shaft side.
C1, C2	Main connection	1 1/4" and 1 1/2" *	If C is used as the inlet, the motor shaft rotates clockwise, viewed from the motor shaft side.
D1	Drain connection	G 1 1/4"	
D2, D4	Alternative drain connection	G 1 1/4"	
D3	Alternative drain connection	G 1"	
T1	Test connection	G 1/4"	Used to measure pressure and/or temperature at the main connections. Minimess M16
T2	Test connection	G 1/4"	Used to measure pressure in motor casing by mounting pressure transducer R901066595.
T3	Test connection	G 1/4"	Normally plugged at delivery. Can also be used to measure temperature in motor casing.
T4A, T4C	Pressure connection	G 1/2"	Connection for double ended torque arm.
F1, F2	Flushing connections	G 1/4"	For flushing of radial lip seal. Normally plugged.
F3	Flushing connection	G 1/2"	For flushing of axial bearing and motor case.

*SAE flange J 518 , code 62, 420 bar (6000 psi).

All connections are normally plugged at delivery.

4 Technical data

4.1 Calculation fundamentals

Table 2: Calculation fundamentals.

	Metric		US	
Output power	$P=\frac{T \cdot n}{9549}$	(kW) on driven shaft	$P=\frac{T \cdot n}{5252}$	(hp) on driven shaft
Output torque (η_m=98%)	$T=T_s \cdot (p-\Delta p_l-p_c) \cdot \eta_m$	(Nm)	$T=\frac{T_s \cdot (p-\Delta p_l-p_c) \cdot \eta_m}{1000}$	(ibf·ft)
Pressure required (η_m=98%)	$p=\frac{T}{T_s \cdot \eta_m}+\Delta p_l+p_c$	(bar)	$p=\frac{T \cdot 1000}{T_s \cdot \eta_m}+\Delta p_l+p_c$	(psi)
Flow rate required	$q=\frac{n \cdot V_i}{1000}+q_l$	(l/min)	$q=\frac{n \cdot V_i}{231}+q_l$	(gpm)
Output speed	$n=\frac{q - q_l}{V_i} \cdot 1000$	(rpm)	$n=\frac{q - q_l}{V_i} \cdot 231$	(rpm)
Inlet power	$P_{in}=\frac{q \cdot (p-p_c)}{600}$	(kW)	$P_{in}=\frac{q \cdot (p-p_c)}{1714}$	(hp)

Quantity	Symbol		Metric	US
Power	P	=	kW	hp
Output torque	T	=	Nm	lbf·ft
Specific torque	T_s	=	Nm/bar	lbf·ft/1000 psi
Rotational speed	n	=	rpm	rpm
Required pressure	p	=	bar	psi
Pressure loss	Δp_l	=	bar	psi
Charge pressure	p_c	=	bar	psi
Flow rate required	q	=	l/min	gpm
Total volumetric loss	q_l	=	l/min	gpm
Displacement	V_i	=	cm^3/rev	in^3/rev
Mechanical efficiency	η_m	=	0,98 [1)]	

[1)] Not valid as starting efficiency

4.2 General data

Table 3: General data Quantum (metric)

			Frame size				
			QMX 280	**QMX 400**	**QMX 560**	**QMX 840**	**QMX 1120**
Type of mounting			See section *15: Mounting alternatives*				
Port connections			See section *3.2: Port connections*				
External loads			See section *4.14: Permissible external loads*				
Hydraulic fluids			See section *4.5: Hydraulic fluids*				
Pressure	Maximum operating pressure [1]	bar	350	350 [4]	350	350	350
	Maximum peak pressure [2]	bar	420	420	420	420	420
	Charge pressure	bar	See section *4.4: Recommended charge pressure*				
	Maximum case pressure	bar	3	3	3	3	3
	Maximum case peak pressure [3]	bar	8	8	8	8	8
Temperature limits of case drain oil Seal type: NBR (Nitrile)							
	Minimum	°C	-35	-35	-35	-35	-35
	Maximum	°C	+70	+70	+70	+70	+70
Seal type: FPM (Viton)							
	Minimum	°C	-20	-20	-20	-20	-20
	Maximum	°C	+100	+100	+100	+100	+100
Oil volume in motor case		l	15	21	19	25	32
Moment of inertia for rotary group							
	Motor with splines	$kg \cdot m^2$	7.2	15.0	18.1	31.1	42.1
	Motor with shaft coupling [6]	$kg \cdot m^2$	9.1	18.3	22.7	35.7	72.7 [5]
Weight							
	Motor with splines	kg	705	1060	1115	1445	1770
	Motor with shaft coupling	kg	800	1160	1290	1620	2340 [5]

1) The operating pressure corresponds to the maximum allowed design pressure.
2) Peak pressure 420 bar maximum, allowed to occur at a single operating period of max. 1 second. Total amount of single operation periods = 10 000 times.
3) Momentary pressure spikes t< 0.1 s of up to 8 bar are permitted.
4) Pressure limitations in some nominal motor sizes see *Table 5*
5) Motor including coupling adapter
6) Data refers to configuration with mechanical shrink disc

Table 4: General data Quantum (US)

			Frame size				
			QMX 280	**QMX 400**	**QMX 560**	**QMX 840**	**QMX 1120**
Type of mounting			See section *15: Mounting alternatives*				
Port connections			See section *3.2: Port connections*				
External loads			See section *4.14: Permissible external loads*				
Hydraulic fluids			See section *4.5: Hydraulic fluids*				
Pressure	Maximum operating pressure [1]	psi	5076	5076 [4]	5076	5076	5076
	Maximum peak pressure [2]	psi	6091	6091	6091	6091	6091
	Charge pressure	psi	See section *4.4: Recommended charge pressure*				
	Maximum case pressure	psi	44	44	44	44	44
	Maximum case peak pressure [3]	psi	116	116	116	116	116
Temperature limits of case drain oil Seal type: NBR (Nitrile)							
	Minimum	°F	-31	-31	-31	-31	-31
	Maximum	°F	+158	+158	+158	+158	+158
Seal type: FPM (Viton)							
	Minimum	°F	-4	-4	-4	-4	-4
	Maximum	°F	+212	+212	+212	+212	+212
Oil volume in motor case		US gal	4.0	5.6	5.0	6.6	8.5
Moment of inertia for rotary group							
	Motor with splines	lb·ft²	170.859	355.955	429,520	738.014	999.048
	Motor with shaft coupling [6]	lb·ft²	215.946	434.266	538.679	847.174	1725.197 [5]
Weight							
	Motor with splines	lb	1555	2335	2450	3185	3900
	Motor with shaft coupling	lb	1760	2555	2840	3570	10692 [5]

1) The operating pressure corresponds to the maximum allowed design pressure.
2) Peak pressure 420 bar maximum, allowed to occur at a single operating period of max. 1 second. Total amount of single operation periods = 10 000 times.
3) Momentary pressure spikes t< 0.1 s of up to 116 psi are permitted
4) Pressure limitations in some nominal motor sizes see *Table 6*
5) Motor including coupling adapter
6) Data refers to configuration with mechanical shrink disc

4.3 Motor data

Table 5: Specific data Quatnum (metric)

Frame size	Nominal size	Specific torque	Displacement	Maximum torque [1]	Maximum speed [5]	Maximum operating pressure [2]	Maximum operating power [3]
		Nm/bar	cm3/rev	kNm	rpm	*p* bar	kW
QMX 280	240	240	15100	79	68	350	530
	280	280	17600	92	58	350	530
QMX 400	240	240	15100	79	125	350	970
	280	280	17600	92	105	350	950
	320	320	20100	110	94	350	970
	360	360	22600	120	82	350	960
	400	400	25100	130	75	350	970
	440	440	27600	131	65	320 [4]	820
	480	480	30200	129	62	290 [4]	660
	520	520	32700	130	57	270 [4]	670
	560	560	35200	129	53	250 [4]	630
QMX 560	440	440	27600	140	65	350	930
	480	480	30200	160	62	350	970
	520	520	32700	170	57	350	960
	560	560	35200	180	53	350	970
QMX 840	600	600	37700	200	45	350	880
	640	640	40200	210	41	350	850
	680	680	42700	220	40	350	890
	720	720	45200	240	37	350	870
	760	760	47800	250	34	350	840
	800	800	50300	260	34	350	890
	840	840	52800	280	32	350	870
QMX 1120	880	880	55300	290	34	350	970
	920	920	57800	300	33	350	980
	960	960	60300	315	32	350	990
	1000	1000	62800	330	31	350	1000
	1040	1040	65300	340	29	350	980
	1080	1080	67900	355	28	350	980
	1120	1120	70400	370	27	350	980

1) Calculated as: Metric= Ts • (350-15) • 0,98

2) The motors are designed according to DNV-rules. Test pressure 420 bar. Peak pressure 420 bar maximum , allowed up to 10 000 times.

3) Flushing of motor case is required. See section *4.10: Flushing*

4) **Note!** Max pressure <350 bar

5) Viton seals are recommended for speeds above 60 rpm

Table 6: Specific data Quantum (US)

Frame size	Nominal size	Specific torque	Displacement	Maximum torque [1]	Maximum speed [5]	Maximum operating pressure [2]	Maximum operating power [3]
		lbf·ft/1000 psi	in3/rev	lbf·ft	rpm	*p* psi	hp
QMX 280	240	12200	920	58000	68	5000	710
	280	14200	1070	67000	58	5000	710
QMX 400	240	12200	920	57000	125	5000	1300
	280	14200	1070	67000	105	5000	1300
	320	16300	1230	76000	94	5000	1300
	360	18300	1380	86000	82	5000	1300
	400	20300	1530	95000	75	5000	1300
	440	22400	1690	97000	65	4600 [4]	1100
	480	24400	1840	95000	62	4200 [4]	890
	520	26400	1990	96000	57	3900 [4]	900
	560	28500	2150	95000	53	3600 [4]	840
QMX 560	440	22400	1690	100000	65	5000	1300
	480	24400	1840	110000	62	5000	1300
	520	26400	1990	140000	67	5000	1300
	560	28500	2150	130000	53	5000	1300
QMX 840	600	30500	2300	140000	45	5000	1200
	640	32500	2450	150000	41	5000	1100
	680	34600	2610	160000	40	5000	1200
	720	36600	2760	170000	37	5000	1200
	760	38700	2910	180000	34	5000	1100
	800	40700	3070	190000	34	5000	1200
	840	42700	3220	200000	32	5000	1200
QMX 1120	880	44700	3370	210000	34	5000	1300
	920	46700	3520	220000	33	5000	1300
	960	48800	3680	230000	32	5000	1300
	1000	50800	3830	240000	31	5000	1300
	1040	52800	3980	250000	29	5000	1300
	1080	54900	4140	260000	28	5000	1300
	1120	56900	4290	270000	27	5000	1300

1) Calculated as: US= Ts • (5076-215) • 0,98

2) The motors are designed according to DNV-rules. Test pressure 6000 psi. Peak pressure 6000 psi maximum , allowed up to 10 000 times.

3) Flushing of motor case is required. See section *4.10: Flushing*

4) **Note!** Max pressure <350 bar

5) Viton seals are recommended for speeds above 60 rpm

4.4 Recommended charge pressure

The hydraulic system must be such that the motor will recieve sufficient charge pressure at the charge pressure port. This applies to all types of installations.

4.4.1 The motor working in driving mode only

The pressure at the charge pressure port, should, during operation of the motor, be at least one bar above the case pressure independent of numbers of ports that are connected. Two cases to be considered:

Case 1: No shock loads

Required charge pressure = case pressure + 1 bar (14.5 psi) during operation, but shall not be below 2 bar (29.0 psi)

Case 2: With shock loads

Required charge pressure at the **outlet** port corresponds to 30% of value given in diagram. See *Fig. 5.and Fig. 6*

4.4.2 The motor working in braking mode

Required charge pressure at the **inlet** port is according to diagram. See *Fig. 5 and Fig. 6.*

Note!

The diagrams is valid for 1 bar (14.5 psi) case pressure. With increasing case pressure the charge pressure must be increased accordingly.

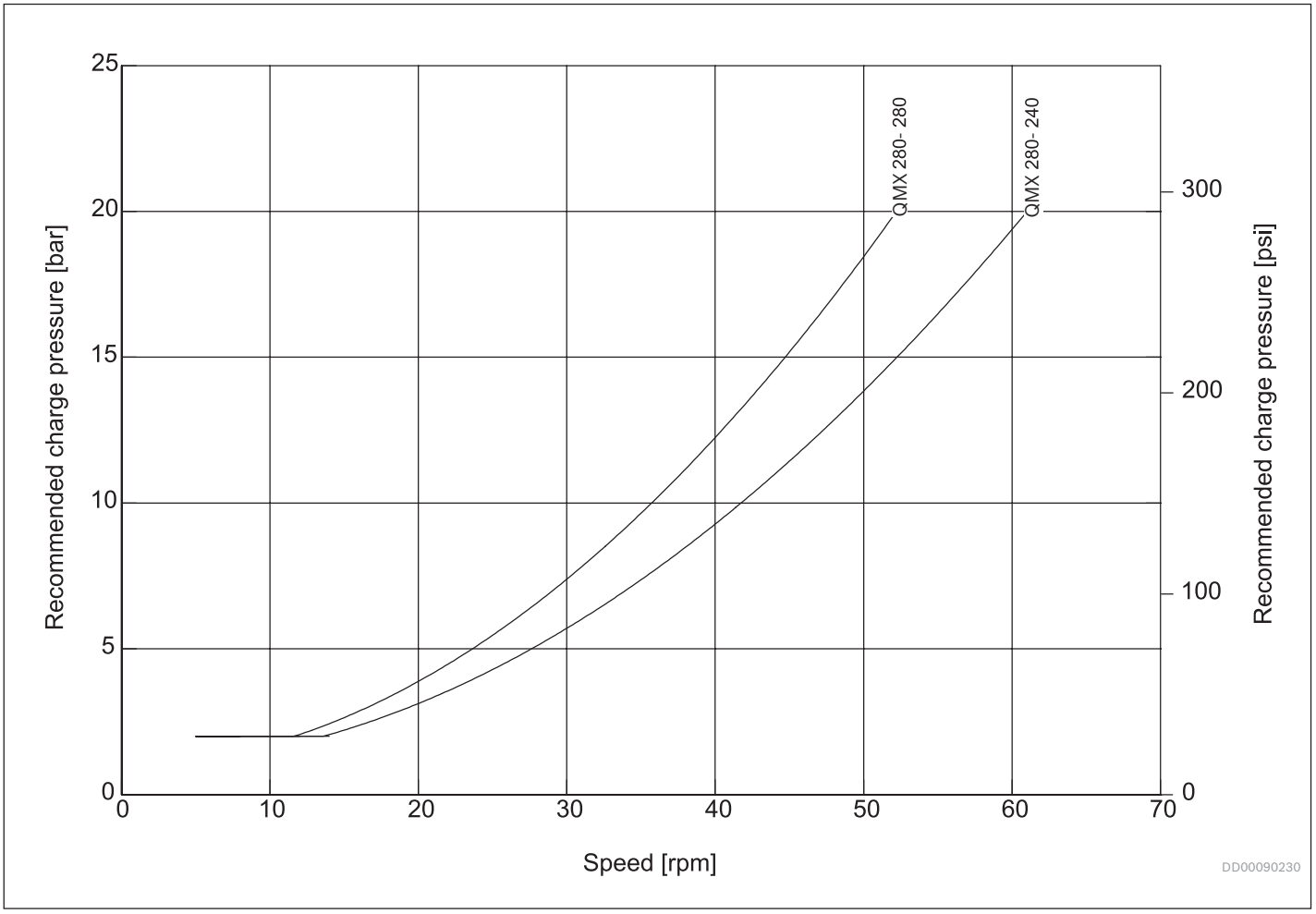


Fig. 5: Recommended charge pressure for motor workning in braking mode, QMX 280, 2-port connection. Valid for oil viscosity 40 cSt.

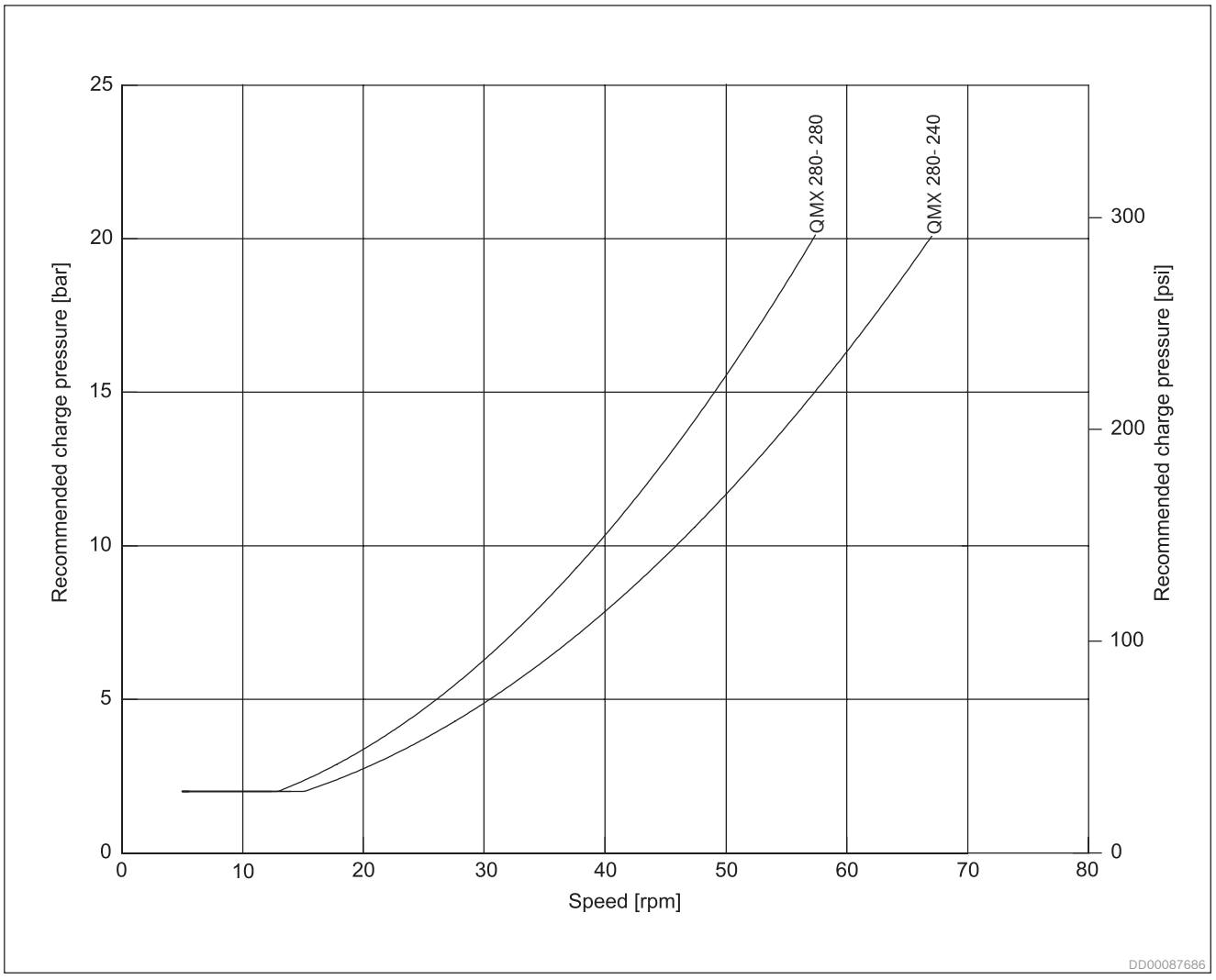


Fig. 6: Recommended charge pressure for motor workning in braking mode, QMX 280, 4-port connection. Valid for oil viscosity 40 cSt.

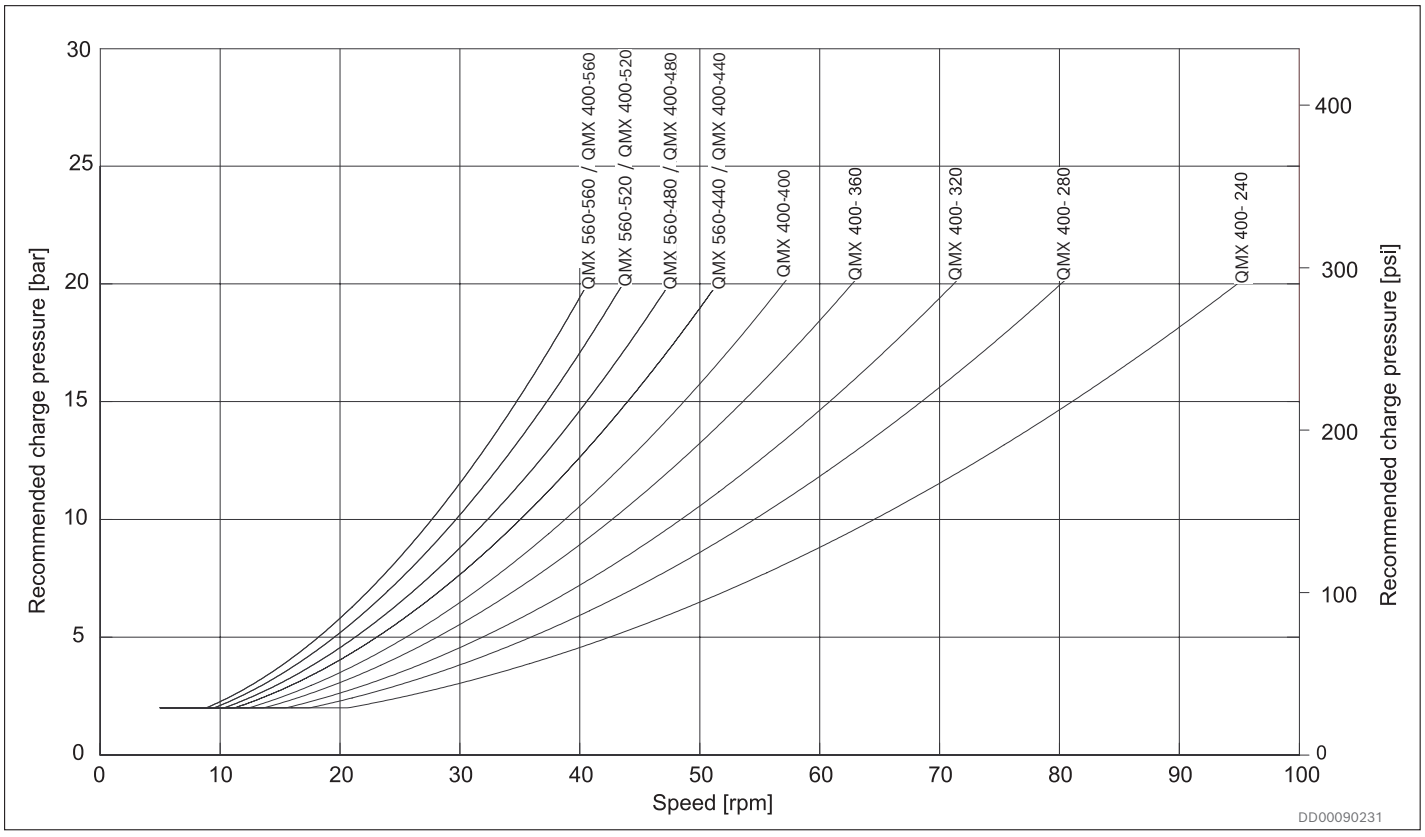


Fig. 7: Recommended charge pressure for motor workning in braking mode, QMX 400 to QMX 560, 2-port connection. Valid for oil viscosity 40 cSt.

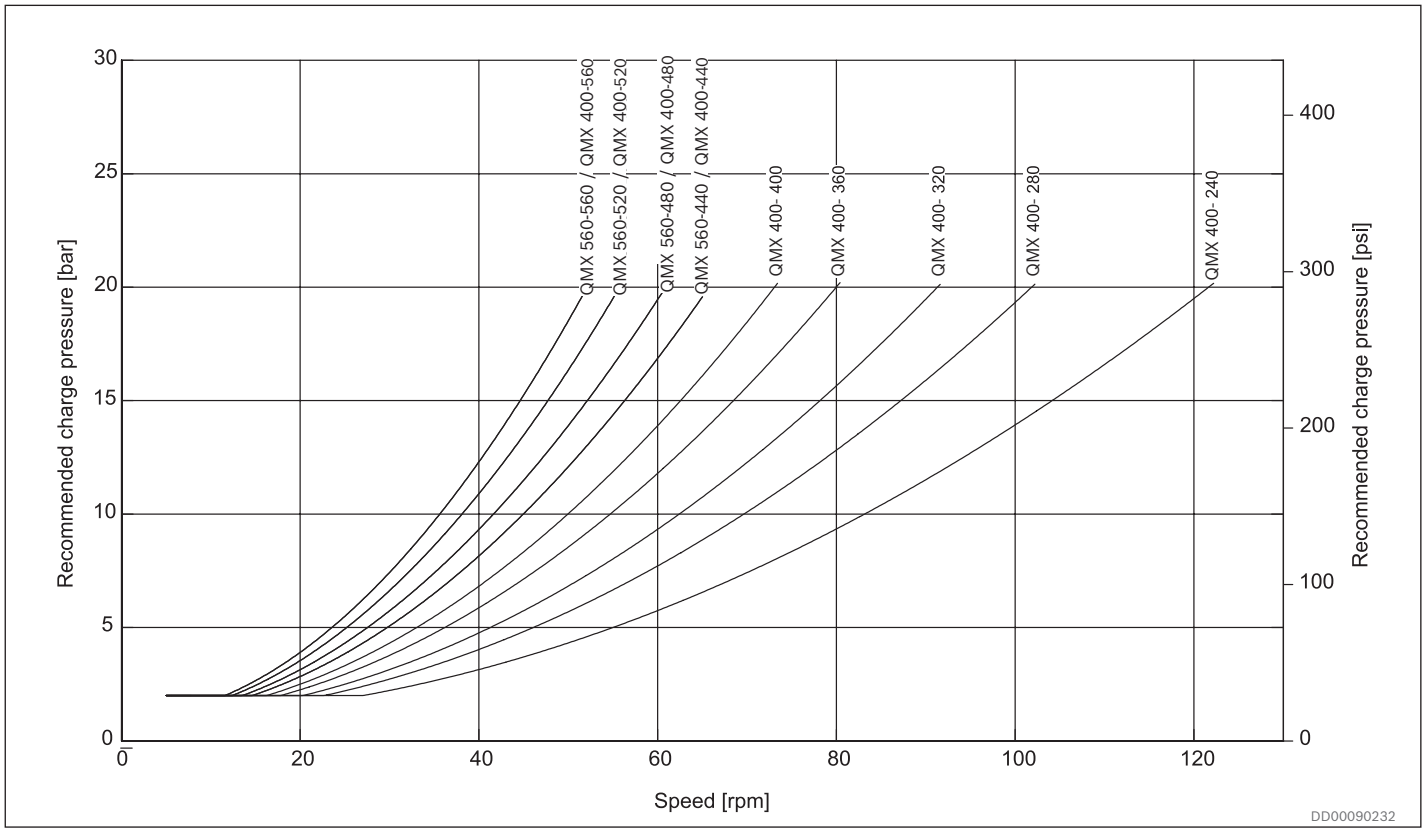


Fig. 8: Recommended charge pressure for motor workning in braking mode, QMX 400 to QMX 560, 4-port connection. Valid for oil viscosity 40 cSt.

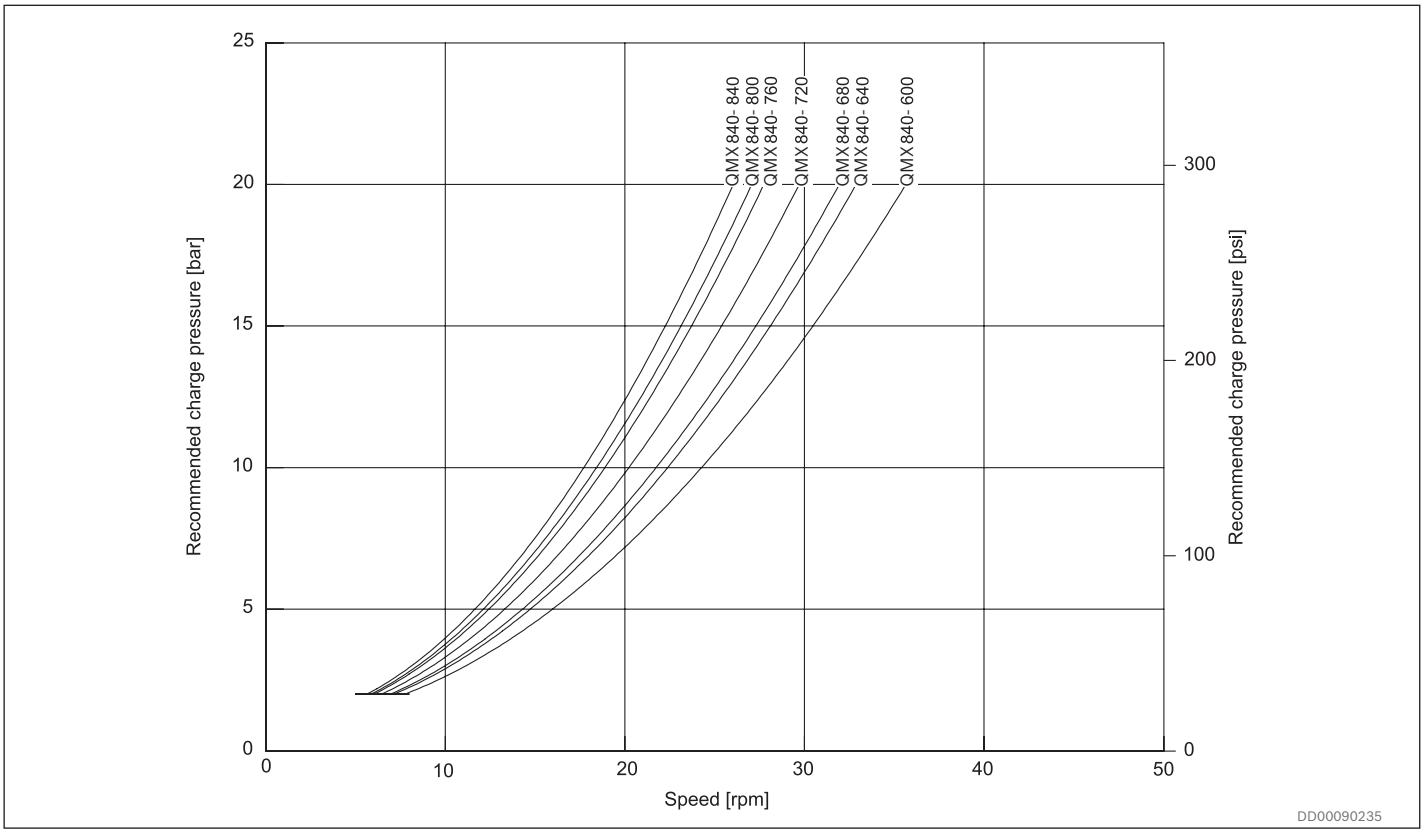


Fig. 9: Recommended charge pressure for motor workning in braking mode, QMX 840, 2-port connection. Valid for oil viscosity 40 cSt.

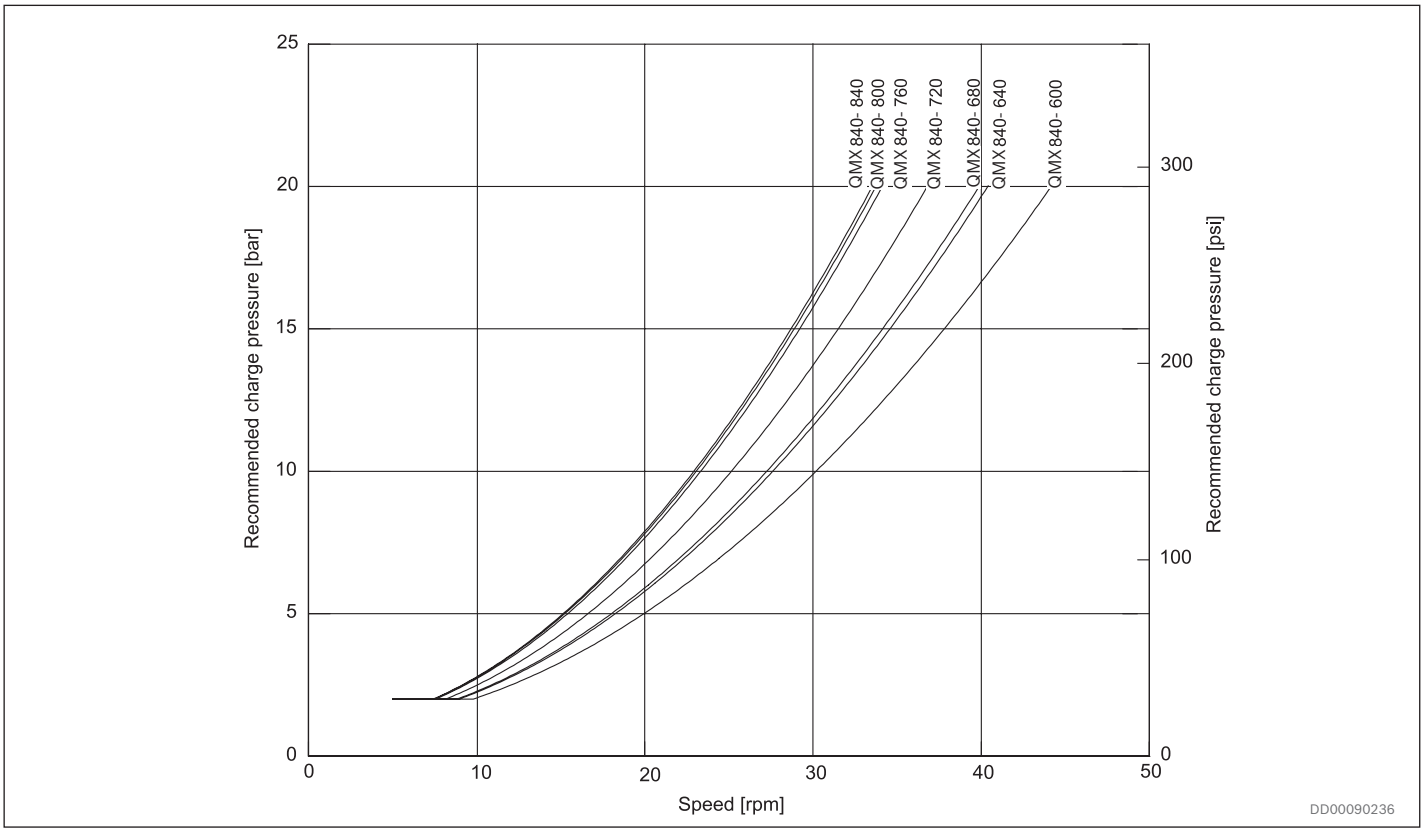


Fig. 10: Recommended charge pressure for motor workning in braking mode, QMX 840, 4-port connection. Valid for oil viscosity 40 cSt.

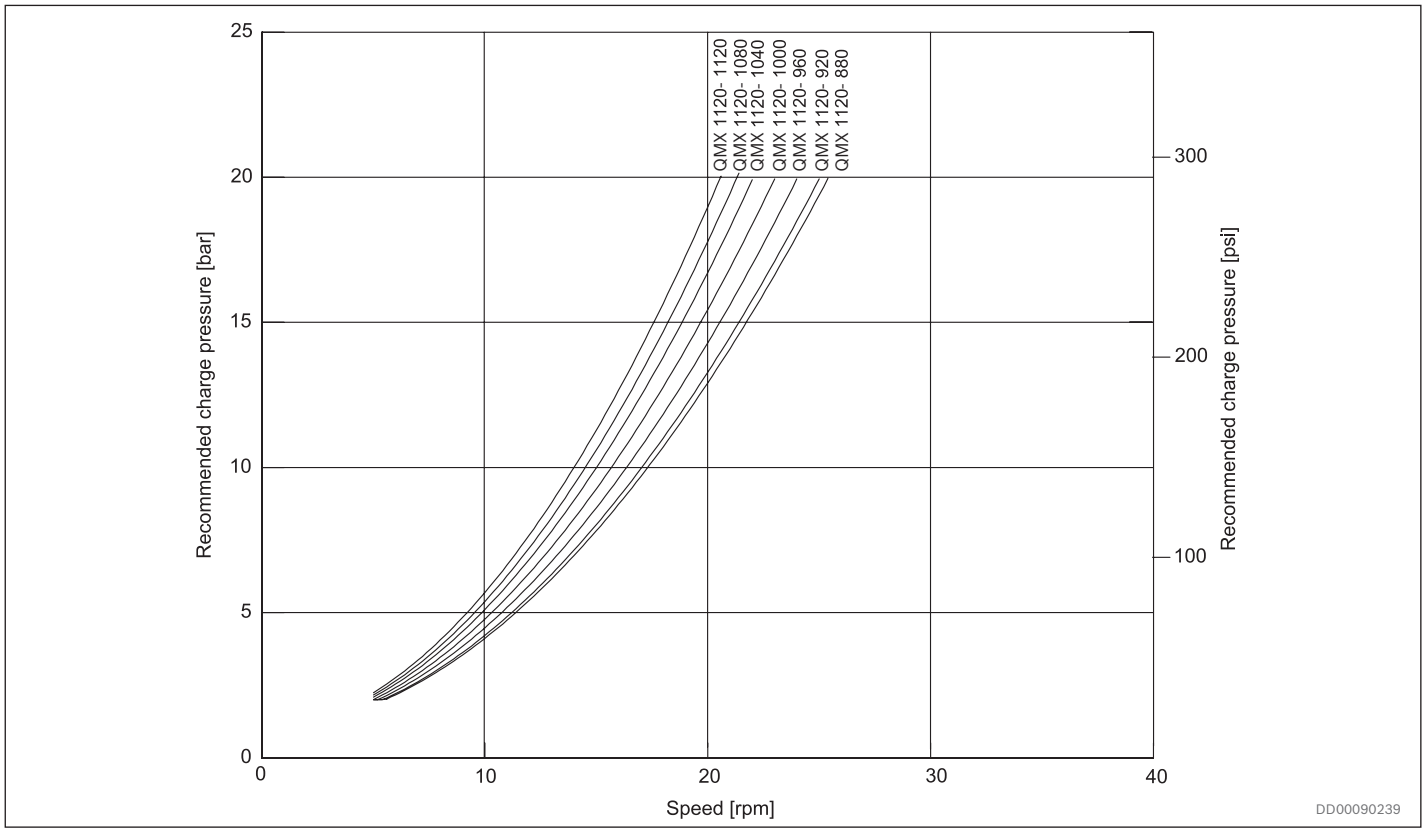


Fig. 11: Recommended charge pressure for motor workning in braking mode, QMX 1120, 2-port connection. Valid for oil viscosity 40 cSt.

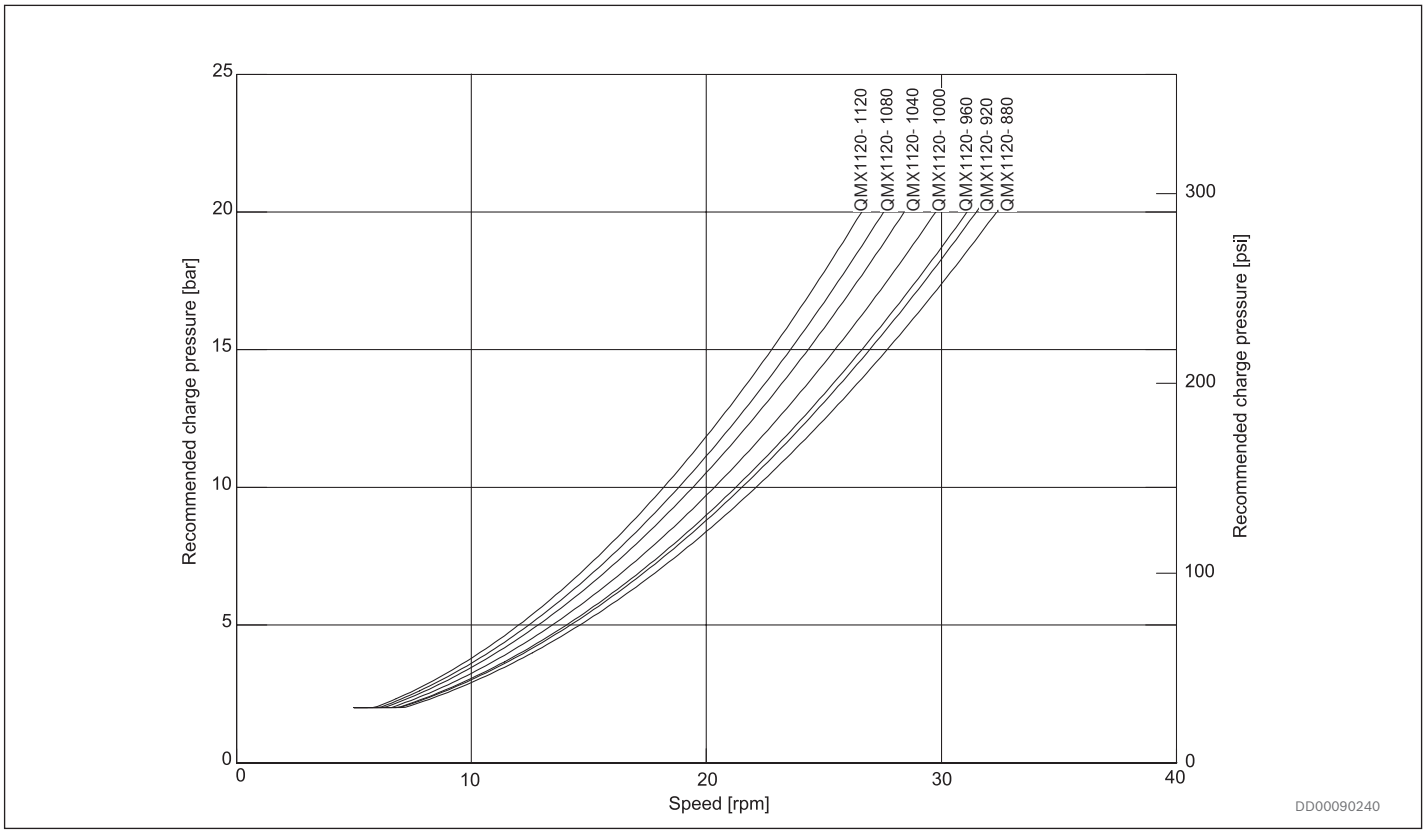


Fig. 12: Recommended charge pressure for motor workning in braking mode, QMX 1120, 4-port connection. Valid for oil viscosity 40 cSt.

4.5 Hydraulic fluids

The hydraulic motor Quantum is primarily designed for operation with hydraulic fluids according to ISO 11158 HM. Before the start of project planning, see data sheet RE 15414, Hydraulic fluid quick reference, for detailed information on hydraulic fluids and specific additional demands.

Table 7: Applicable fluids

ISO 11158	ISO 15380	ISO 12922
Mineral oil based and mineral oil related hydraulic fluids	Environmentally acceptable hydraulic fluids	Fire resistant hydraulic fluids

Within these standards, not all fluid classes are allowed, some are recommended, and there are also additional demands (see data sheet RE 15414).

Filtration of the hydraulic fluid

A contamination level better than 18/16/13 according to ISO 4406 is required.

The less contamined the fluid, the longer the service life of the hydraulic motor.

Details regarding the selection of hydraulic fluid

The hydraulic fluid should be selected such that the operating viscosity in the temperature range, as measured in the motor housing, is within optimum operation range, see *Fig. 13*. General recommendation is to have a system temperature of 50°C, see dotted line in *Fig. 13*. An ISO VG 68 fluid will render just above 40 cSt at this point.

- Optimum viscosity range is 40 to 150 cSt.
- Running above 150 cSt or below 40 cSt results in reduced efficiency.
- Running above 400 cSt results in substantial efficiency loss.
- Starting at above 10000 cSt imparts unnecessary strain on parts.
- Running below 30 cSt may impact service life.
- Running below 20 cSt may render instant seizure.

The operating temperature is also limited by the seal type, see *Table 3 or Table 4*.

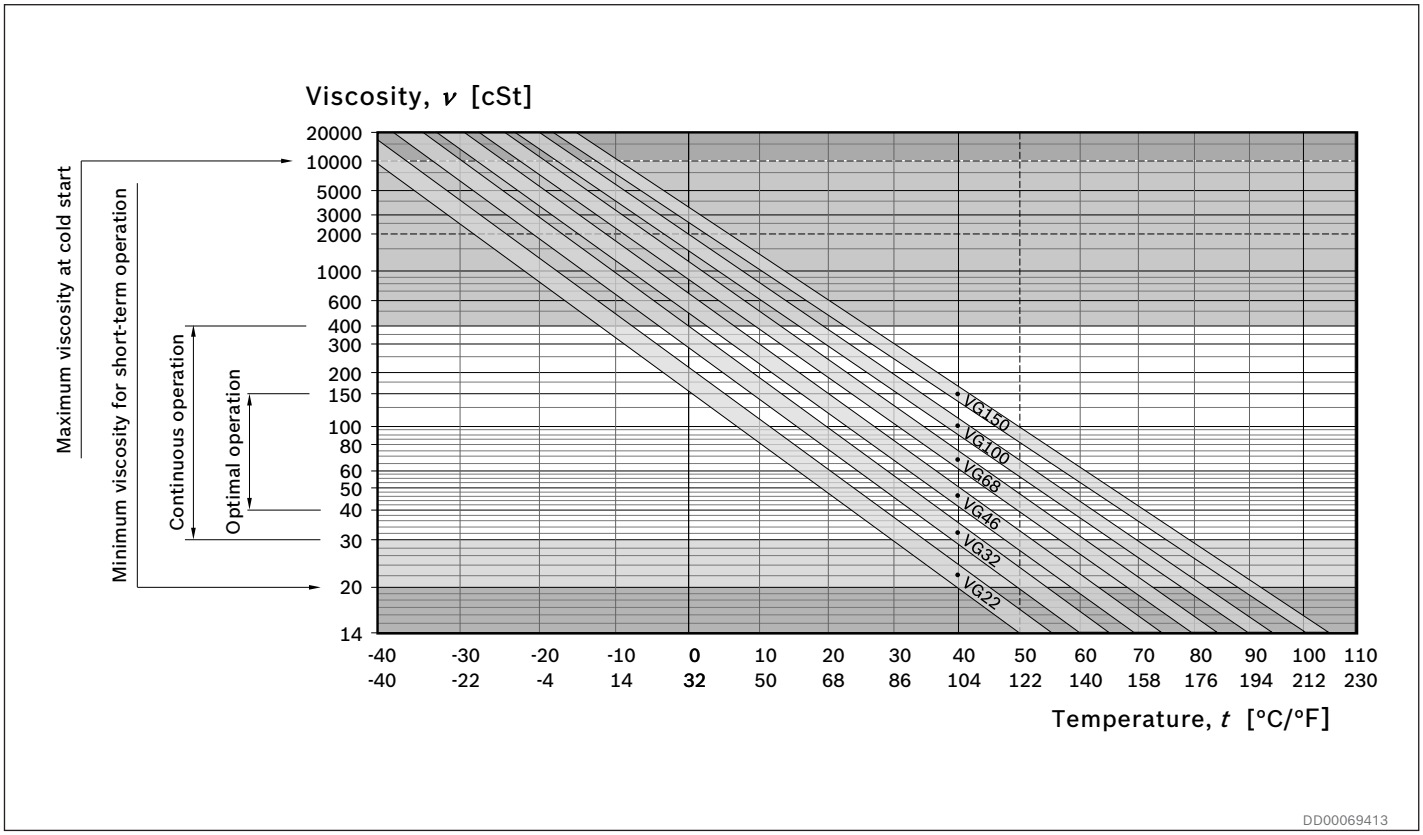


Fig. 13: Selection diagram for viscosity ranges with straight fluids, i.e. viscosity index 100

4.6 Overall efficiency

The diagrams are valid for oil viscosity 40 cSt and charge pressure 15 bar (218 psi) at the motor main ports A or C.

Each diagram has the following label definitions:

1. Constant output power [kW]
2. Constant high pressure [bar]
3. Constant overall efficiency [%]
4. Flushing of motor case is required

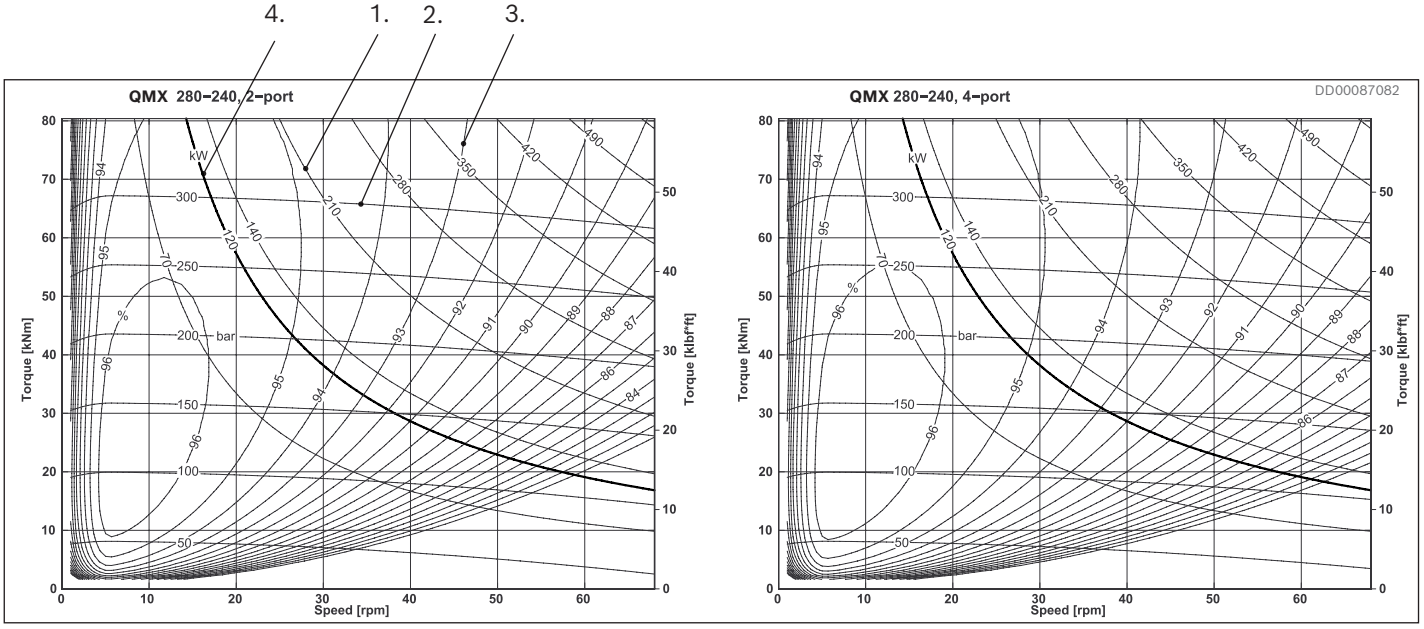


Fig. 14: QMX 280-240

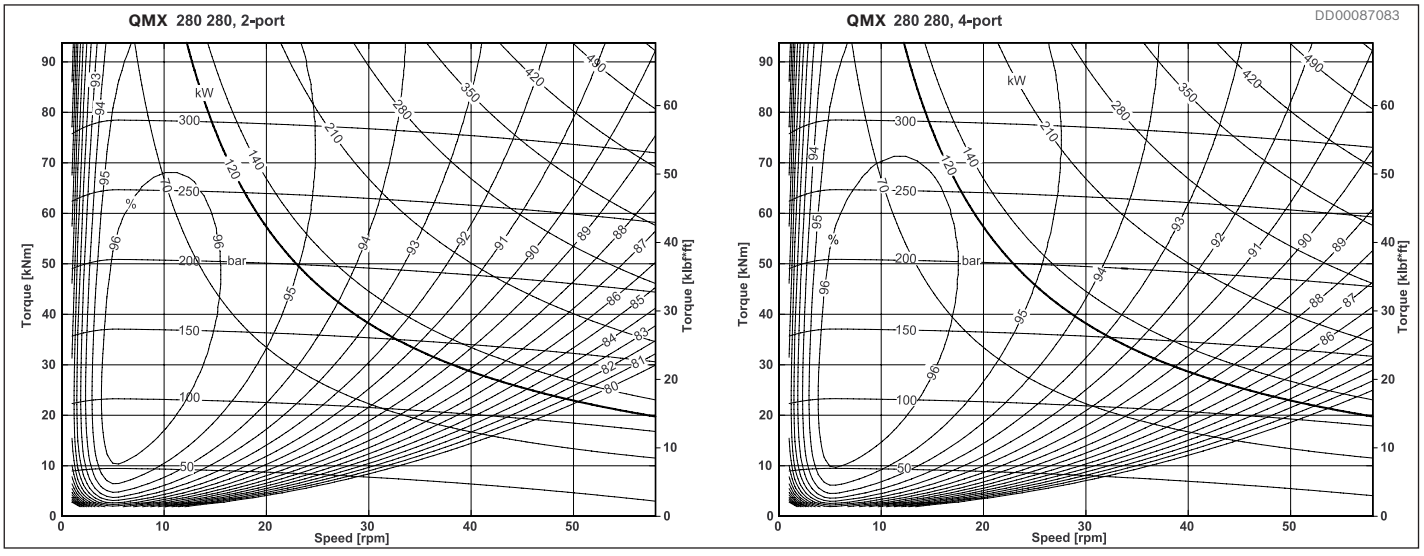


Fig. 15: QMX 280-280

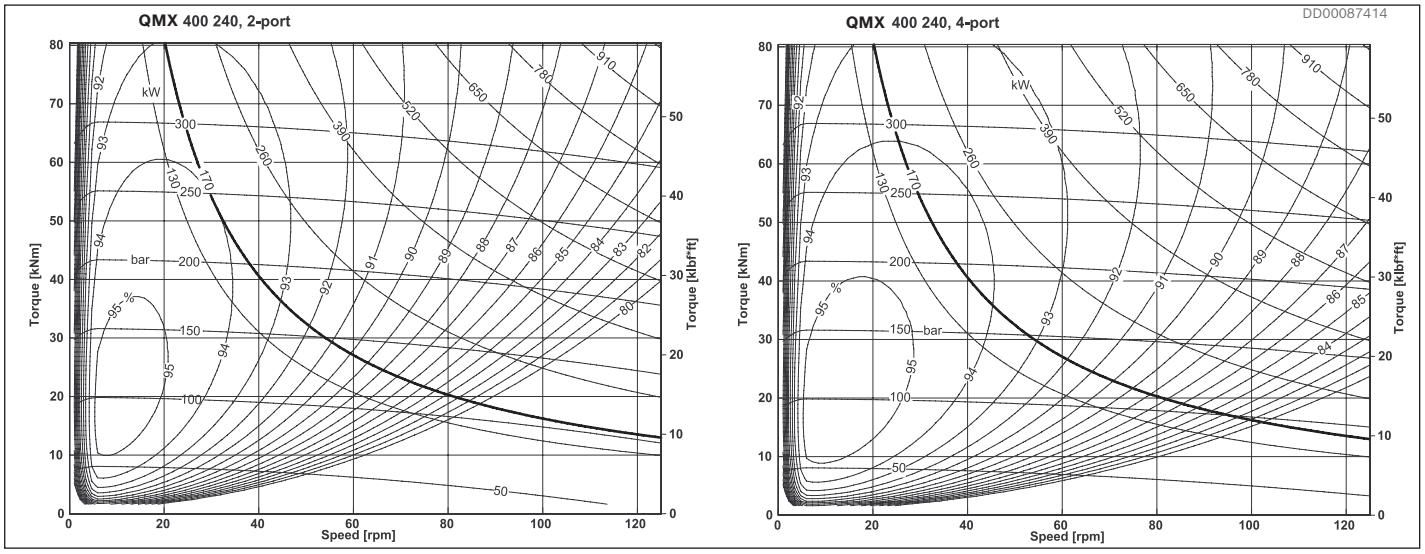


Fig. 16: QMX 400-240

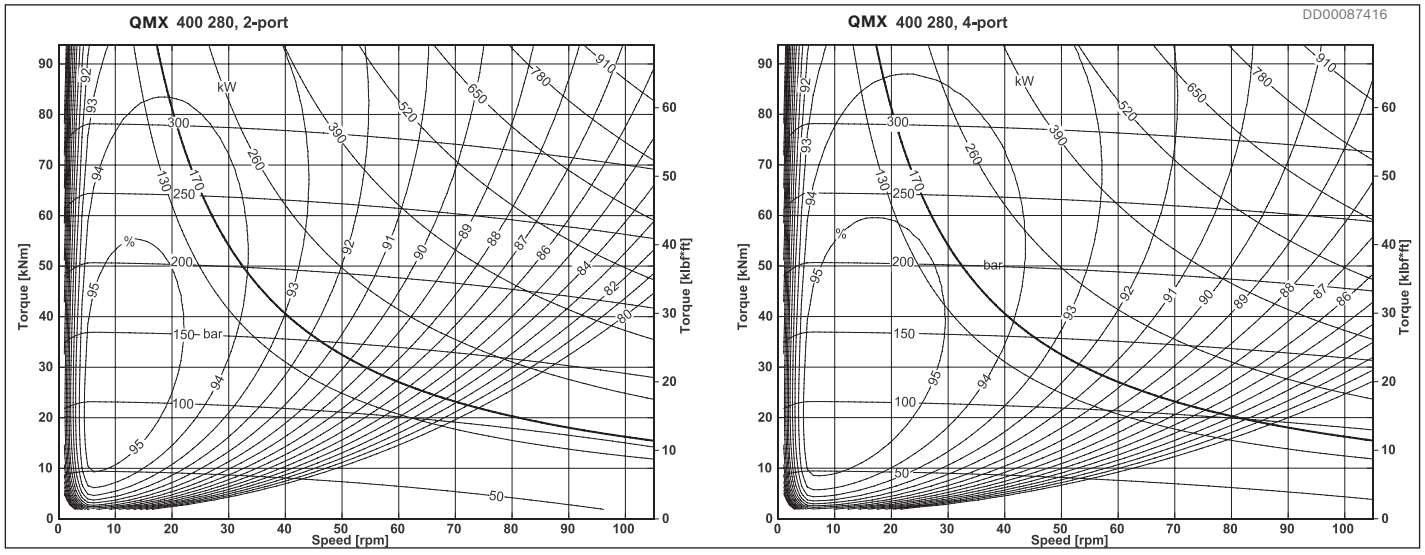


Fig. 17: QMX 400-280

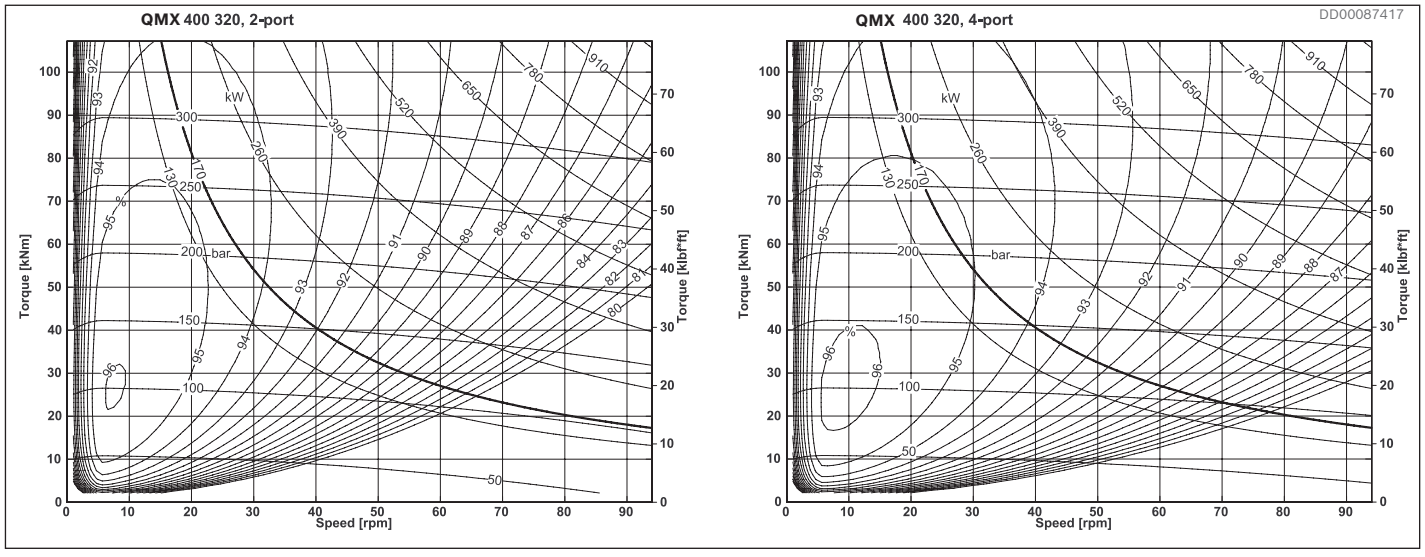


Fig. 18: QMX 400-320

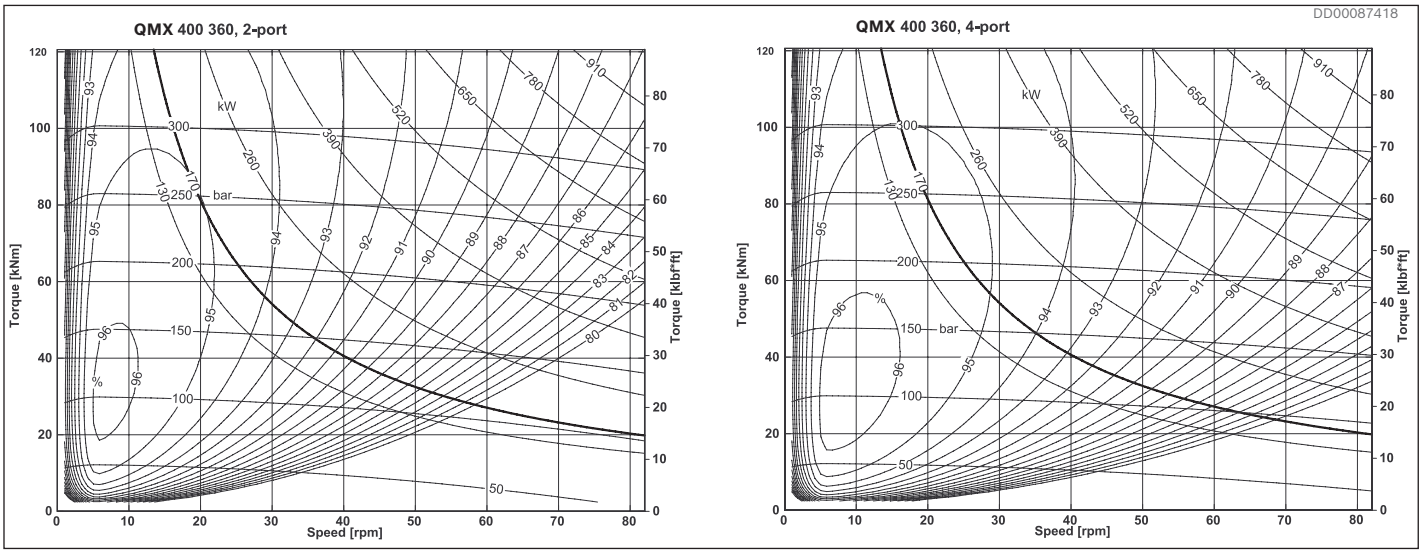


Fig. 19: QMX 400-360

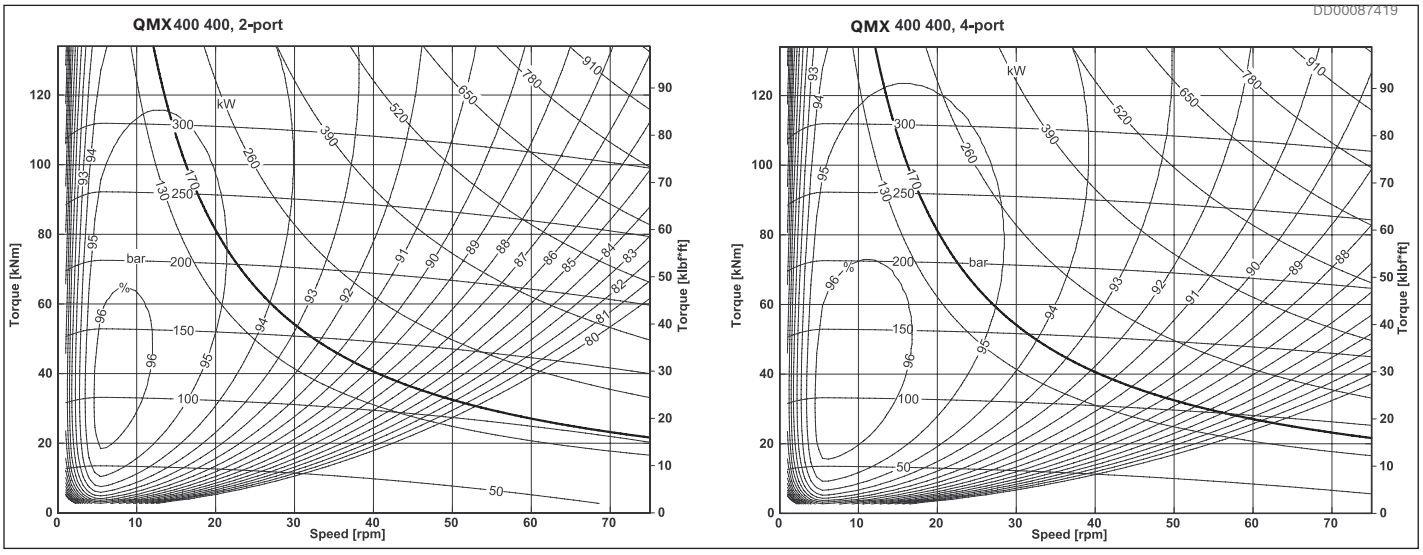


Fig. 20: QMX 400-400

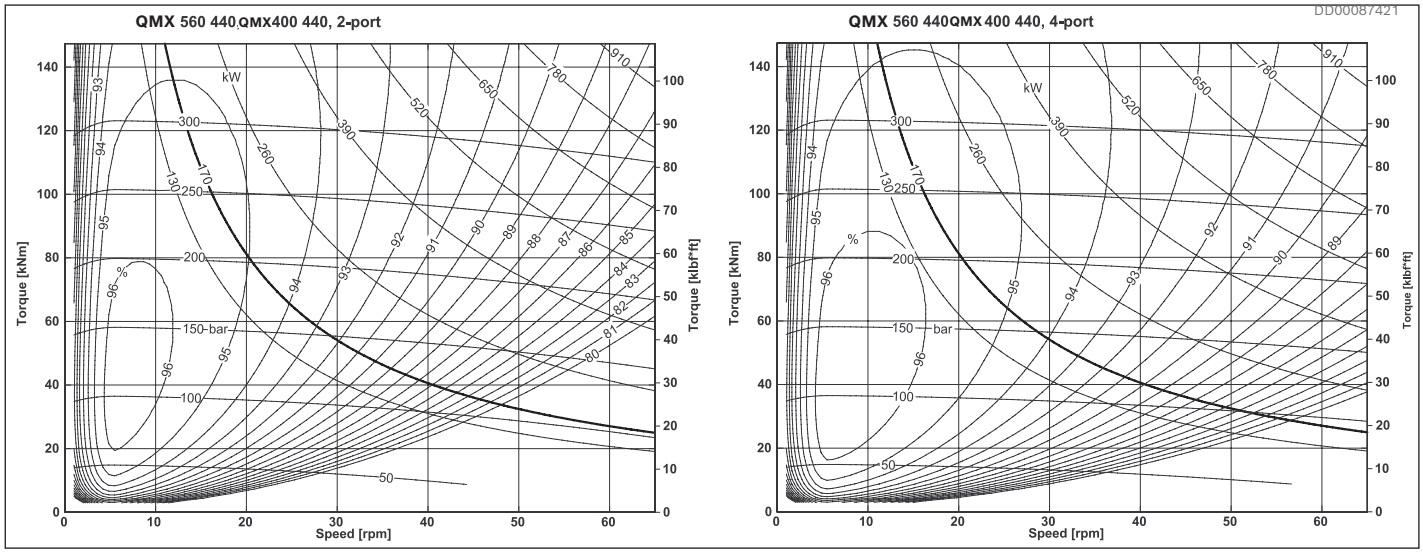


Fig. 21: QMX 560-440, QMX 400-440

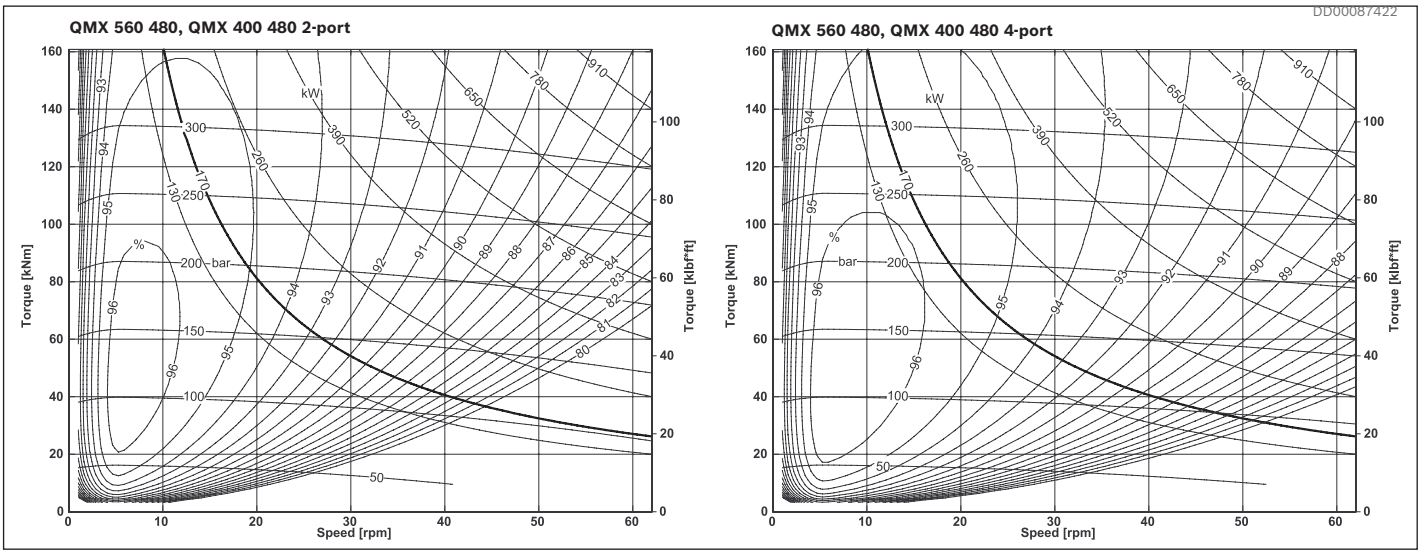


Fig. 22: QMX 560 480, QMX 400-480

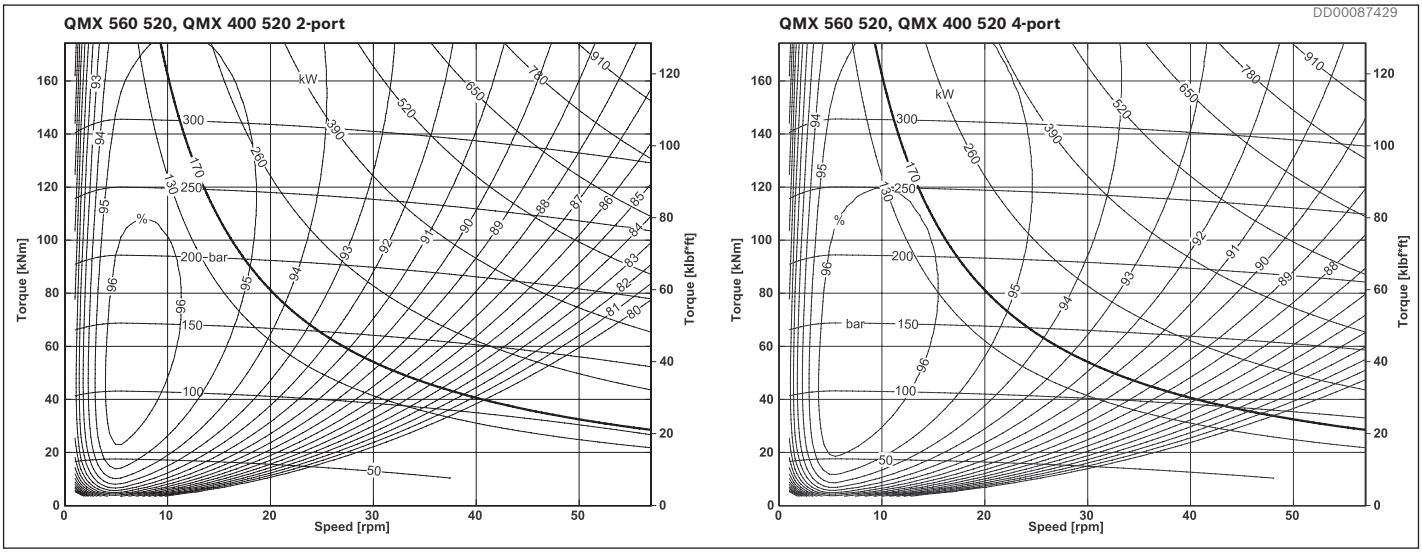


Fig. 23: QMX 560-520, QMX 400-520

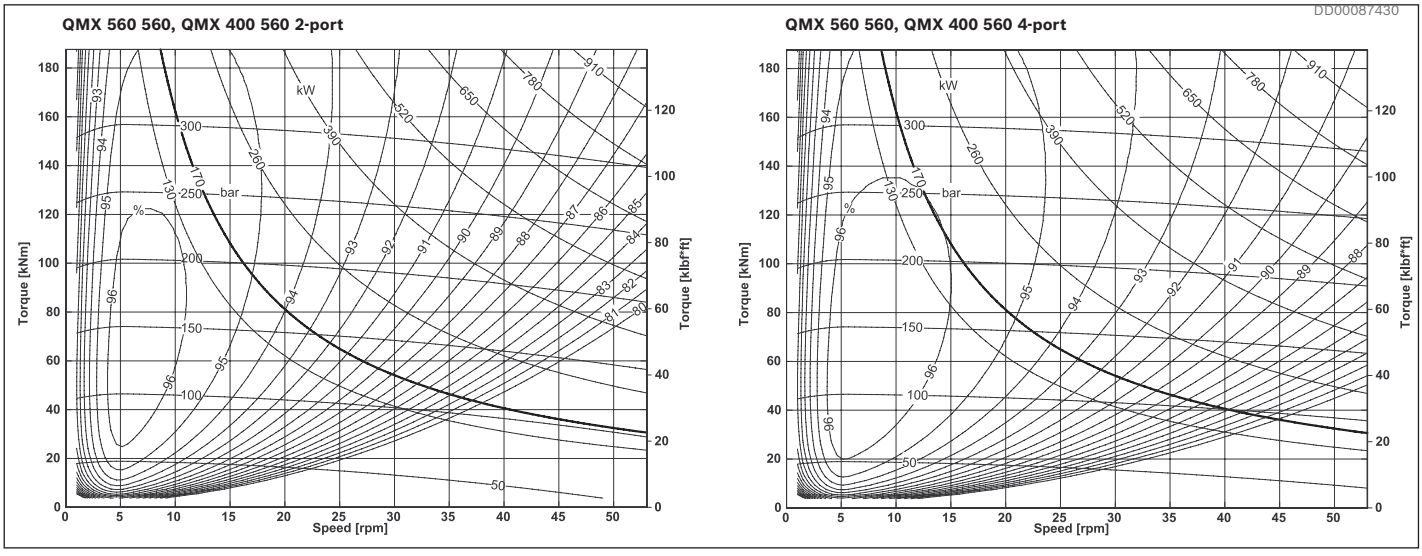


Fig. 24: QMX 560-560, QMX 400-560

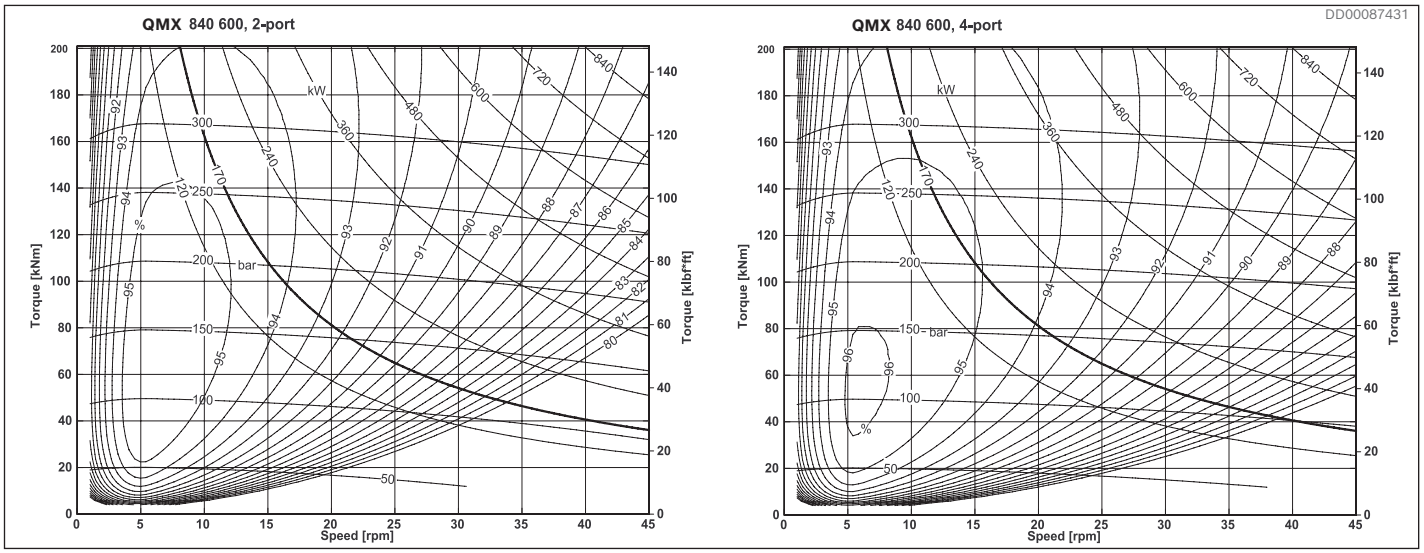


Fig. 25: QMX 840-600

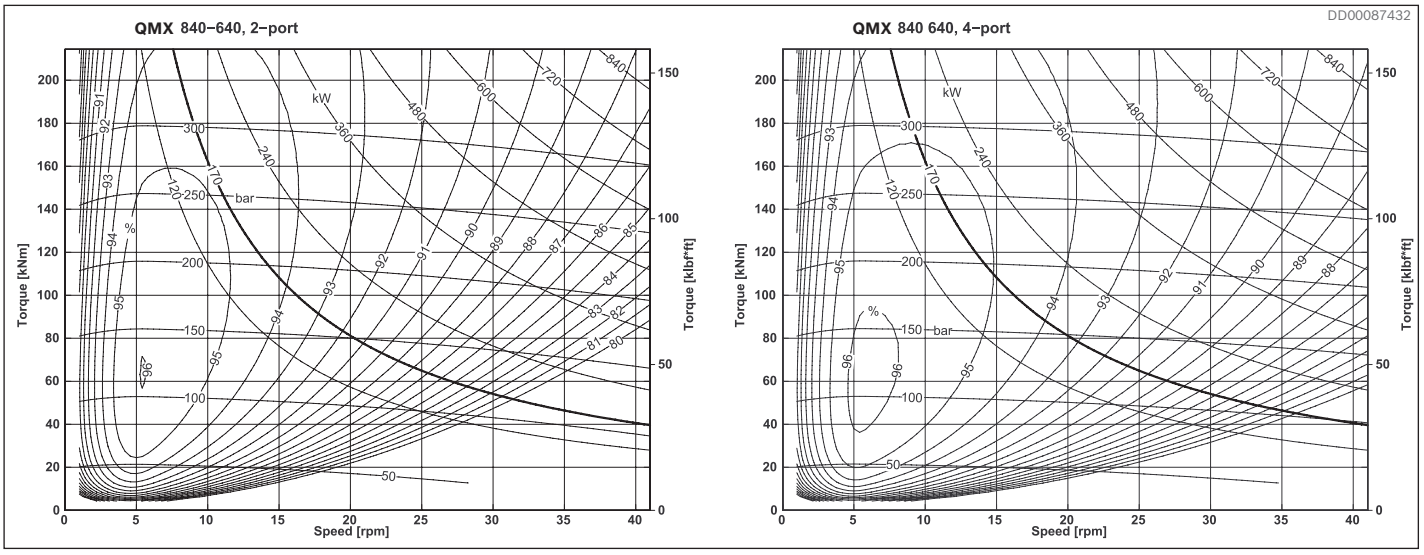


Fig. 26: QMX 840-640

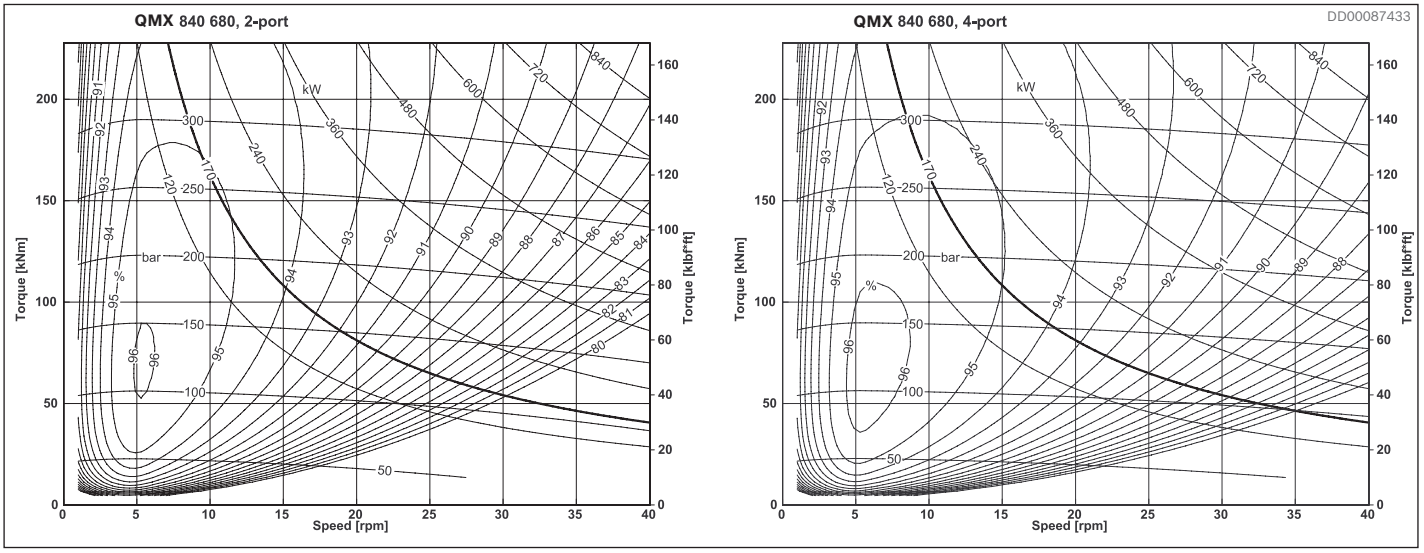


Fig. 27: QMX 840-680

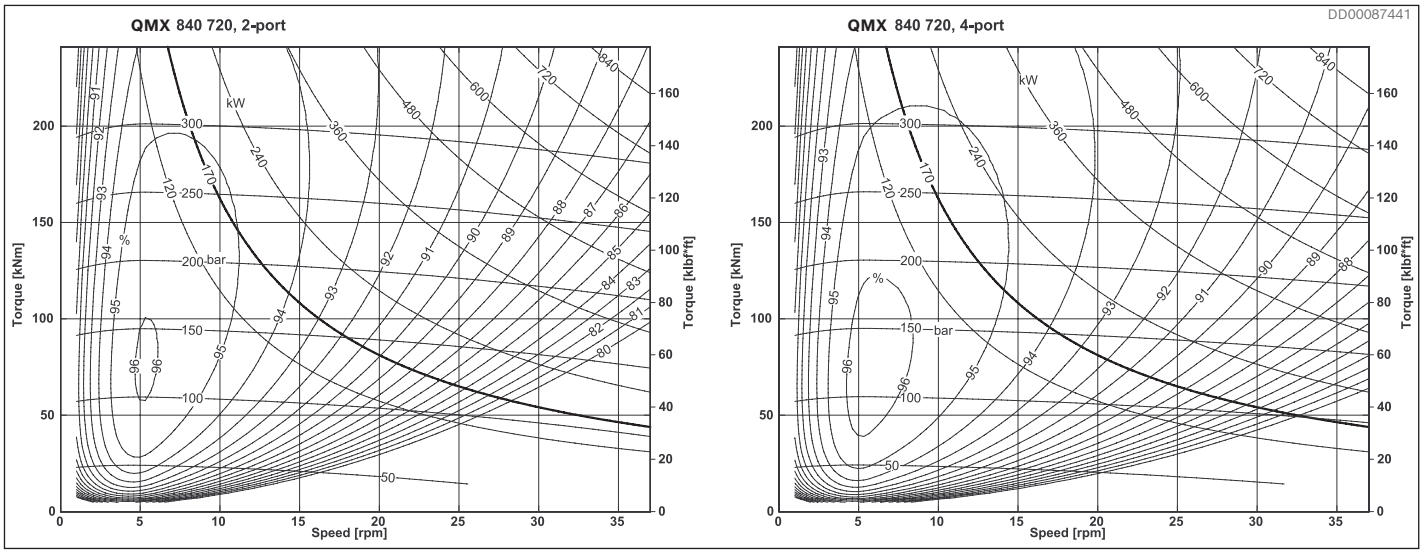


Fig. 28: QMX 840-720

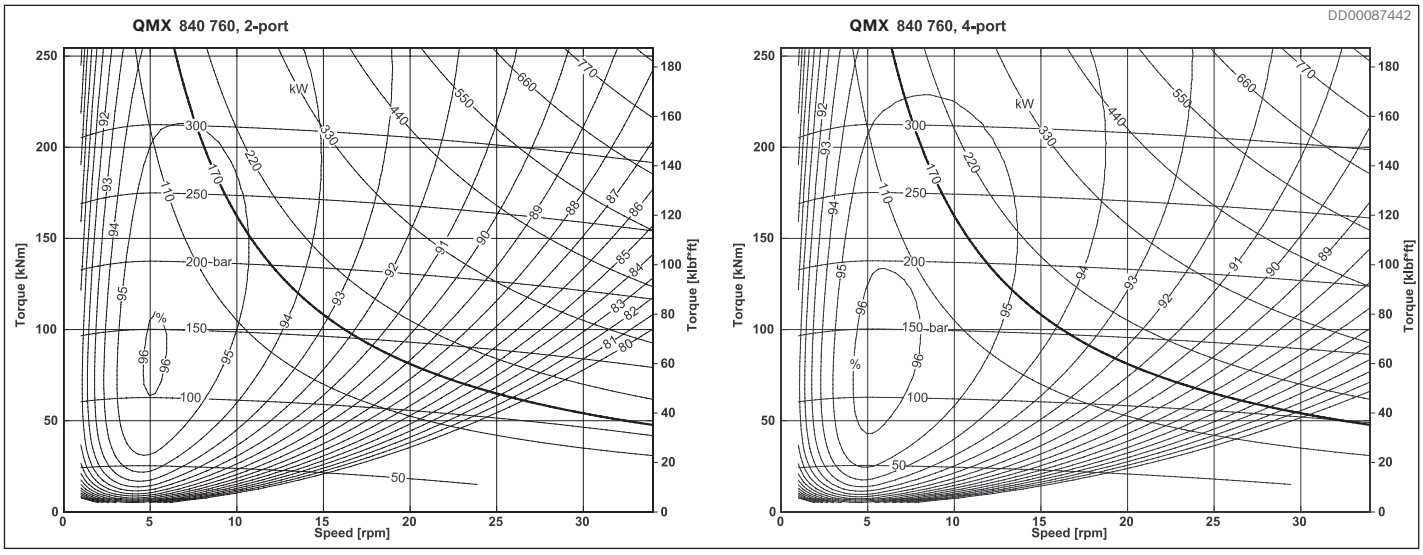


Fig. 29: QMX 840-760

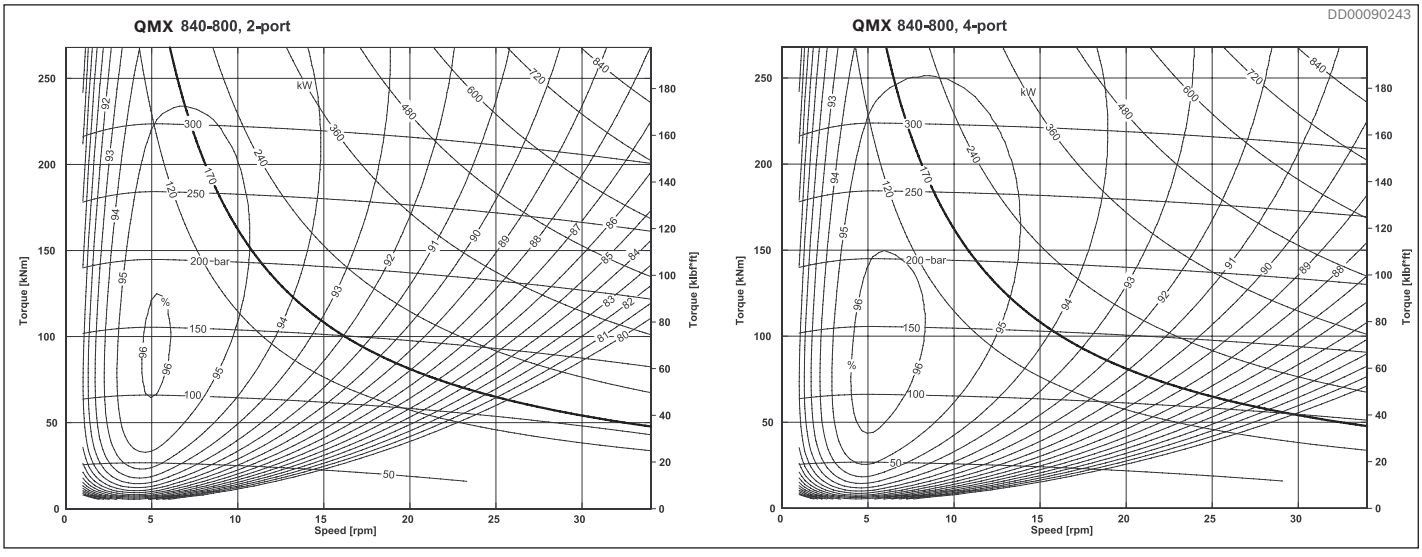


Fig. 30: QMX 840-800

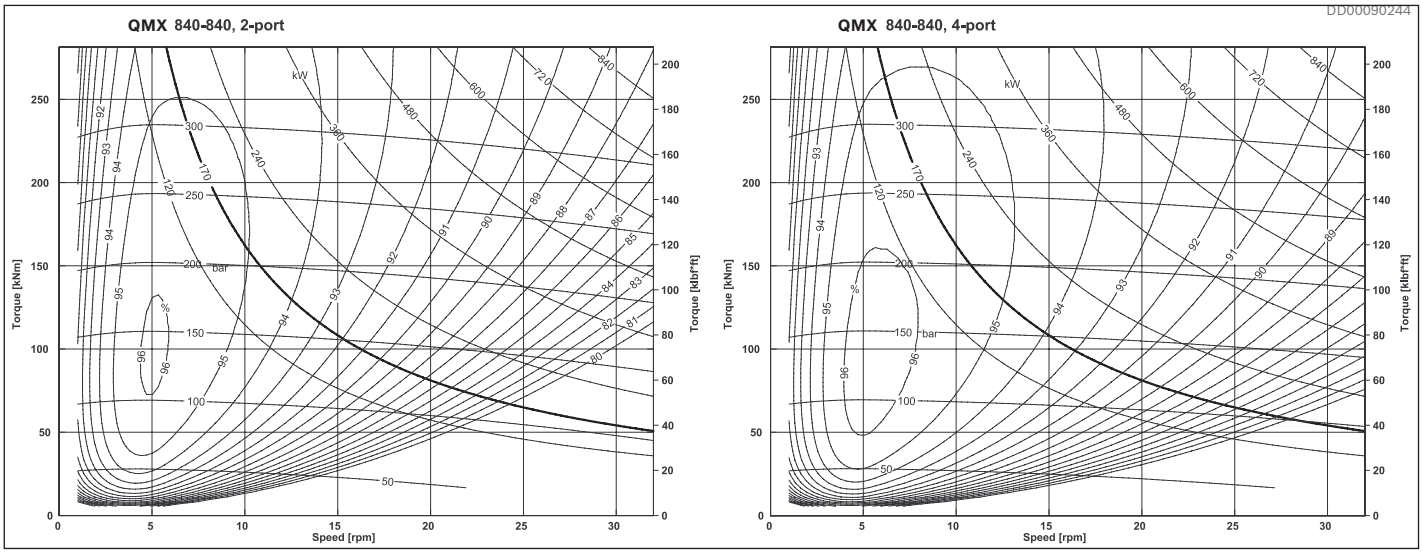


Fig. 31: QMX 840 840

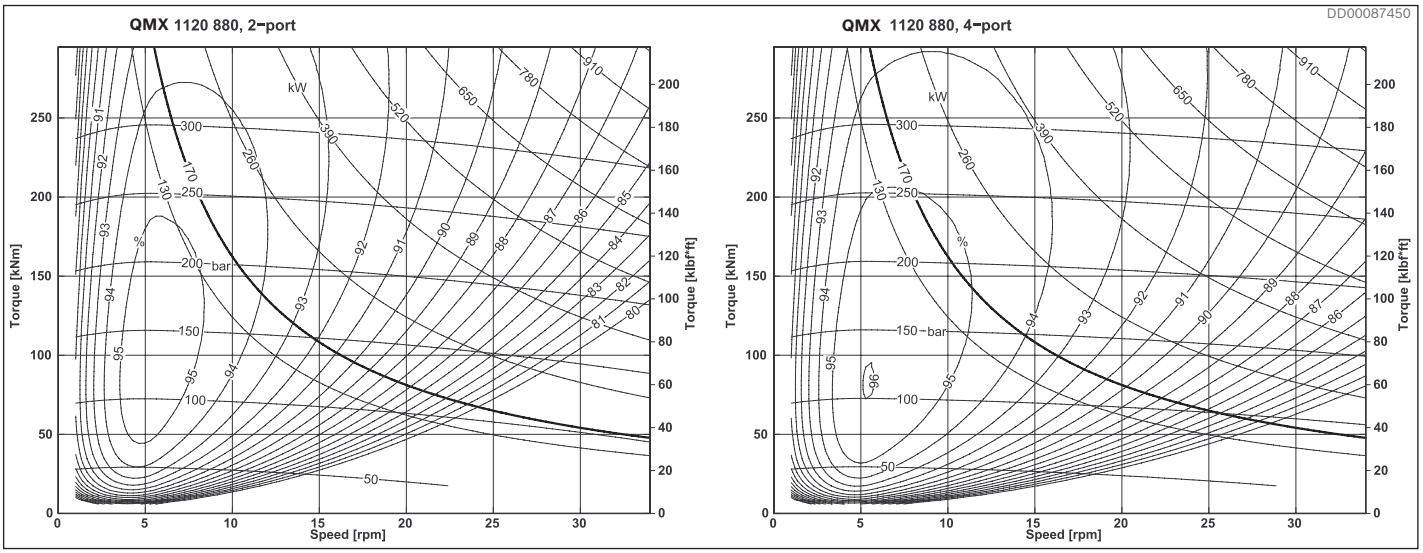


Fig. 32: QMX 1120 880

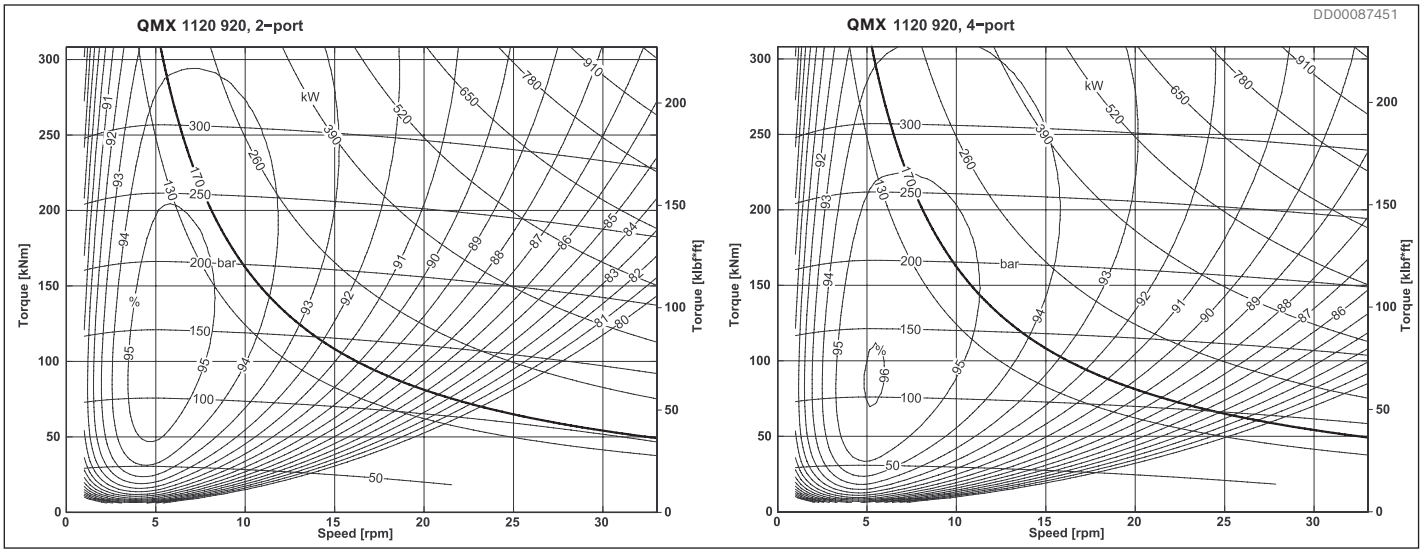


Fig. 33: QMX 1120 920

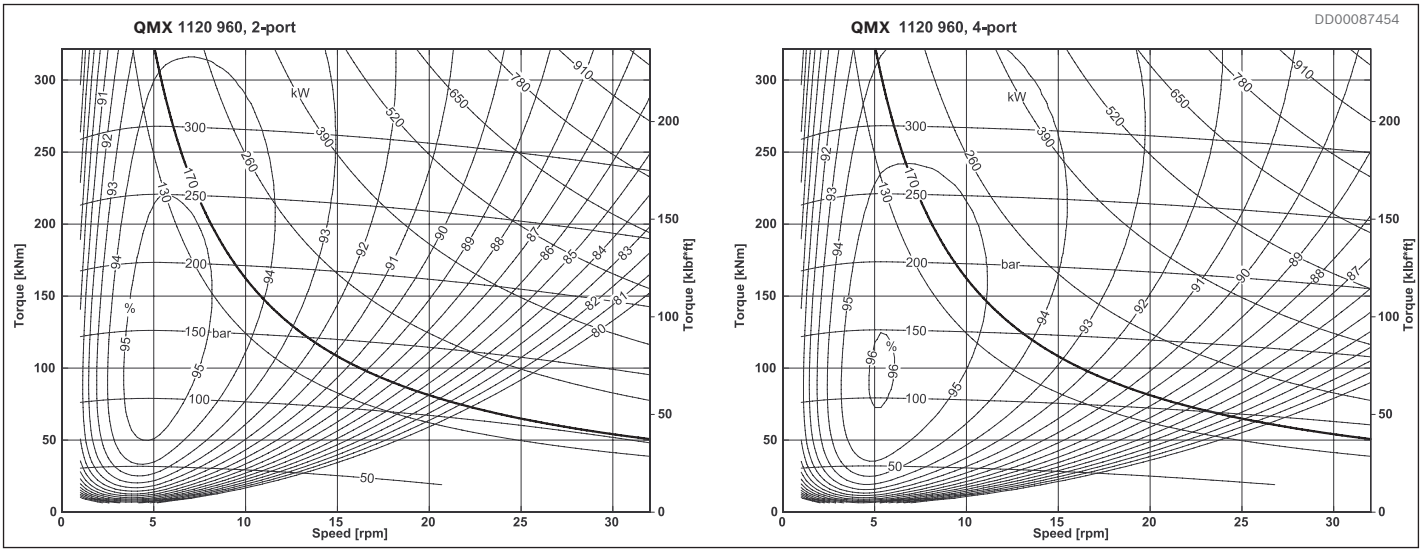


Fig. 34: QMX 1120 960

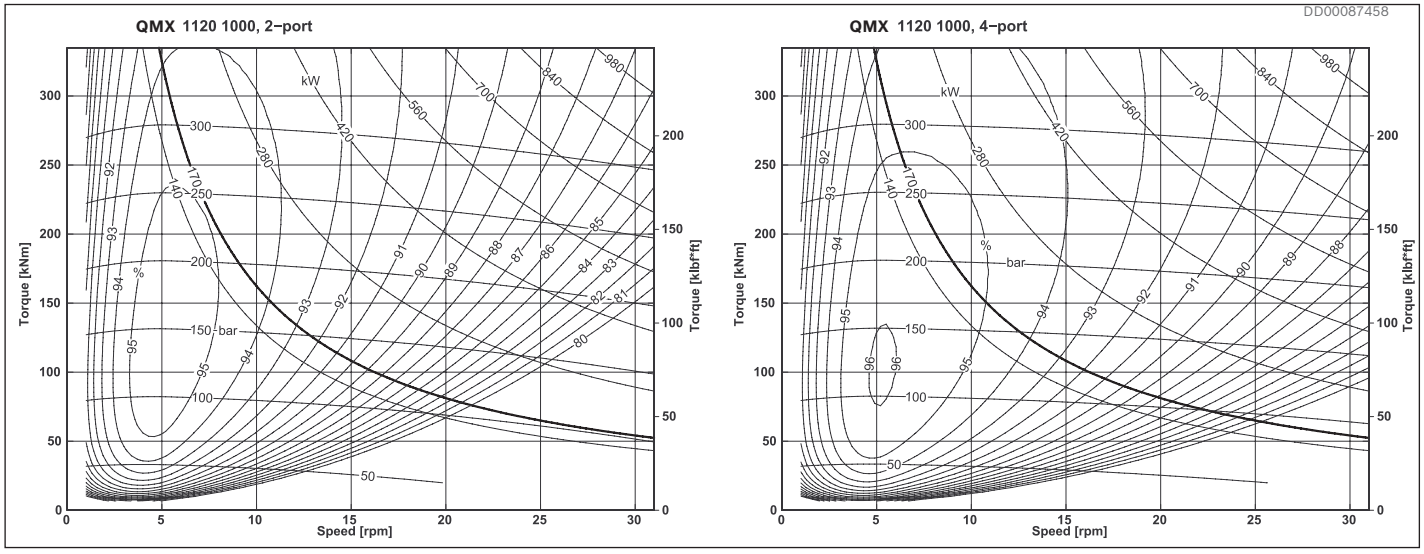


Fig. 35: QMX 1120 1000

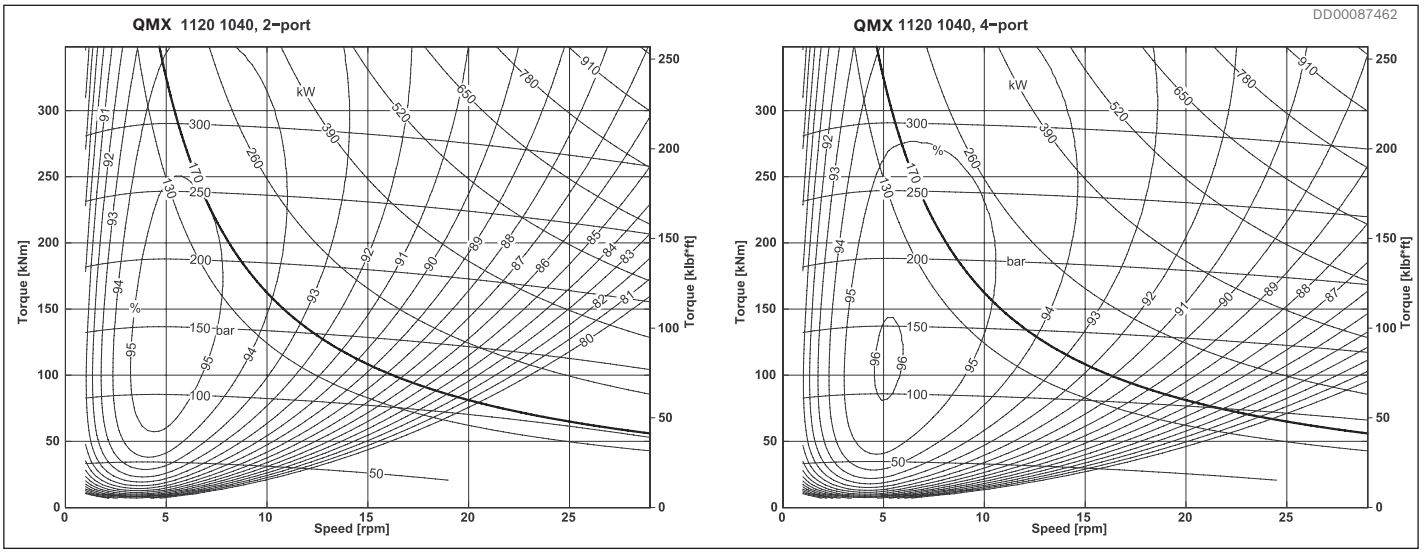


Fig. 36: QMX 1120 1040

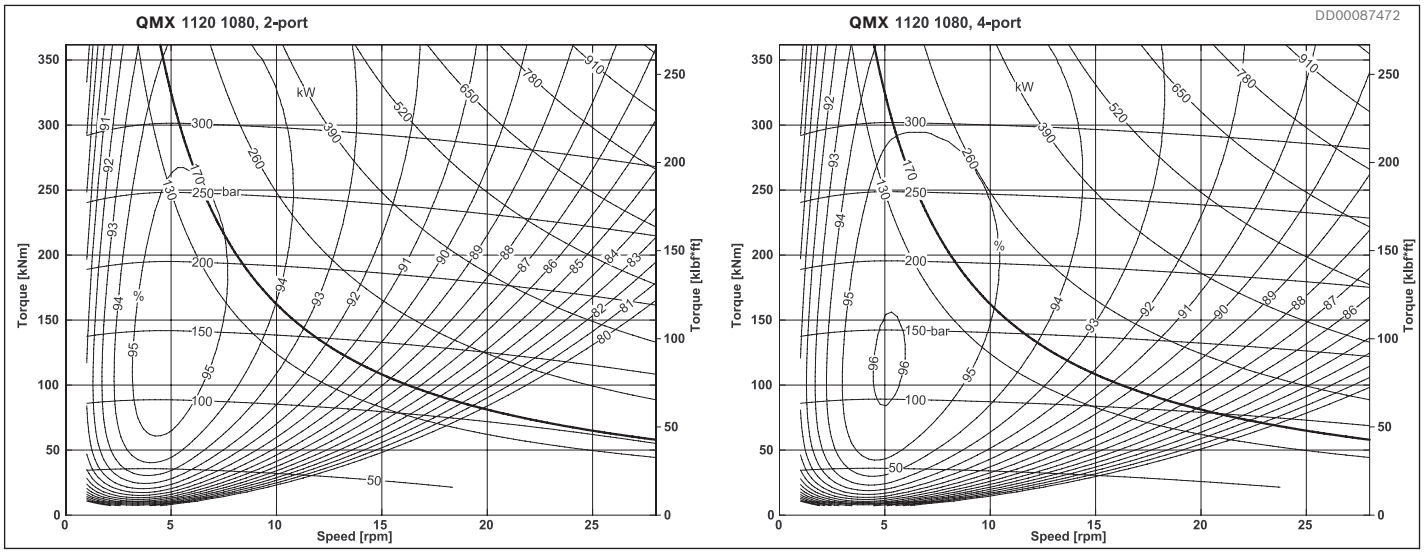


Fig. 37: QMX 1120-1080

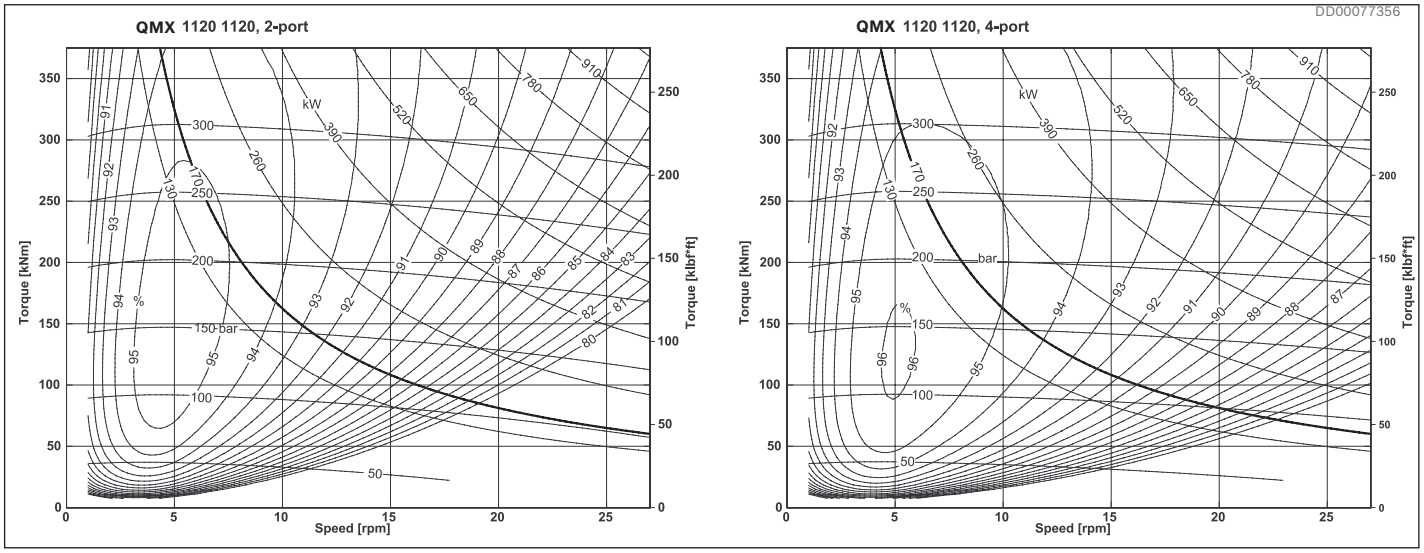


Fig. 38: QMX 1120-1120

4.7 Pressure loss diagrams

Pressure loss, oil viscosity 40 cSt

Actual pressure difference = $\frac{\text{output torque}}{\text{specific torque} \cdot \text{mechanichal effiency}}$ + pressure loss

$$\Delta p = \frac{T}{Ts \cdot \eta_m} + \Delta p_l$$

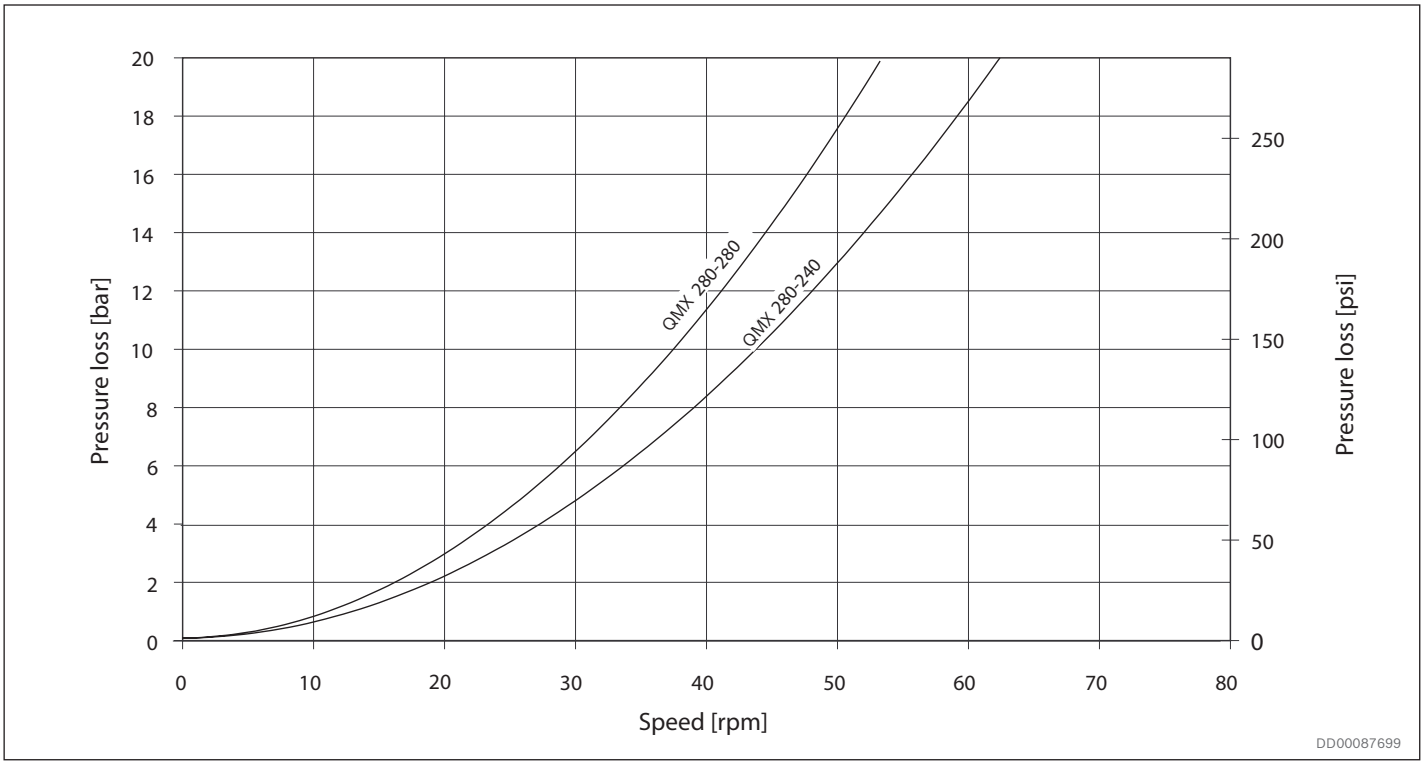


Fig. 39: QMX 280 pressure loss 2 ports

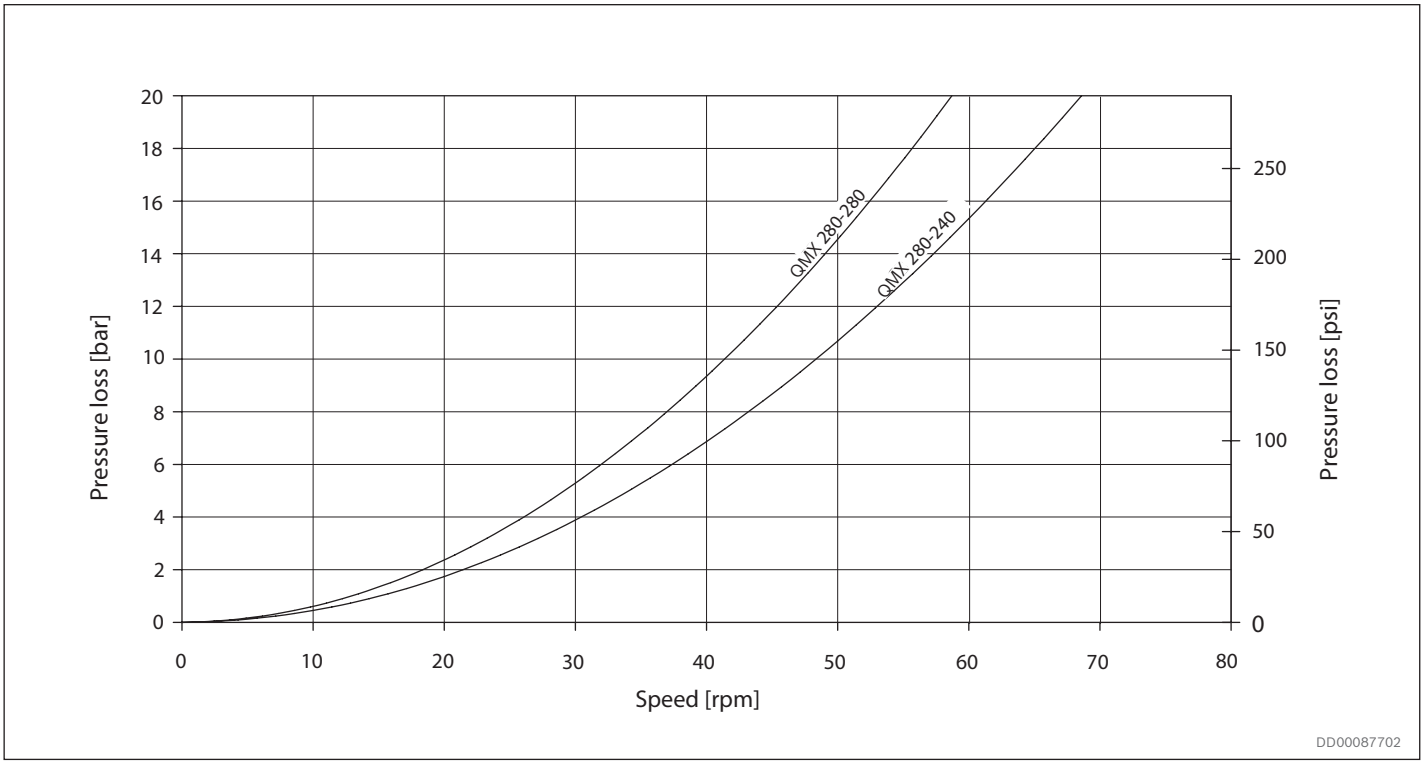


Fig. 40: QMX 280 pressure loss 4 ports

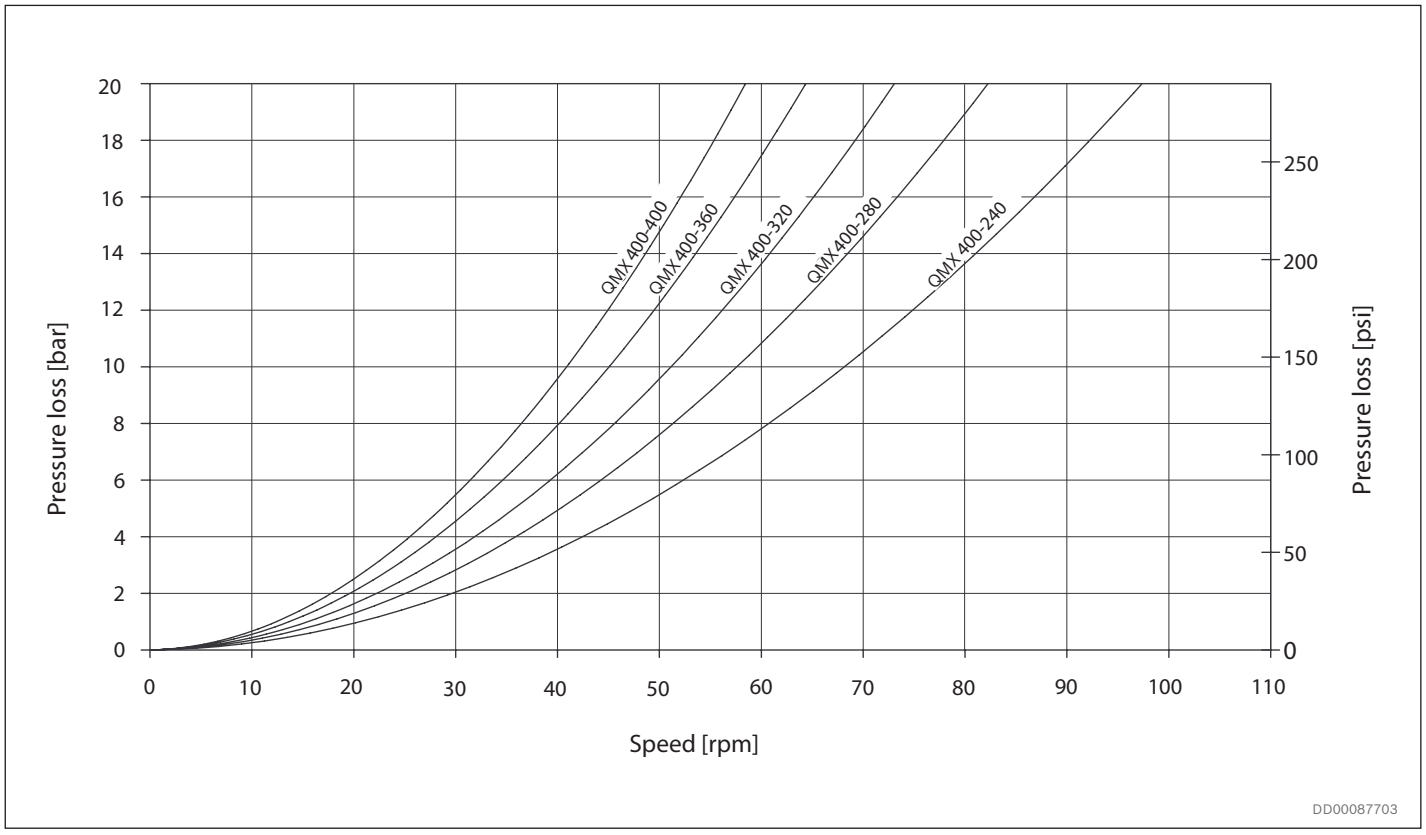


Fig. 41: QMX 400-240 to QMX 400-400 pressure loss 2 ports

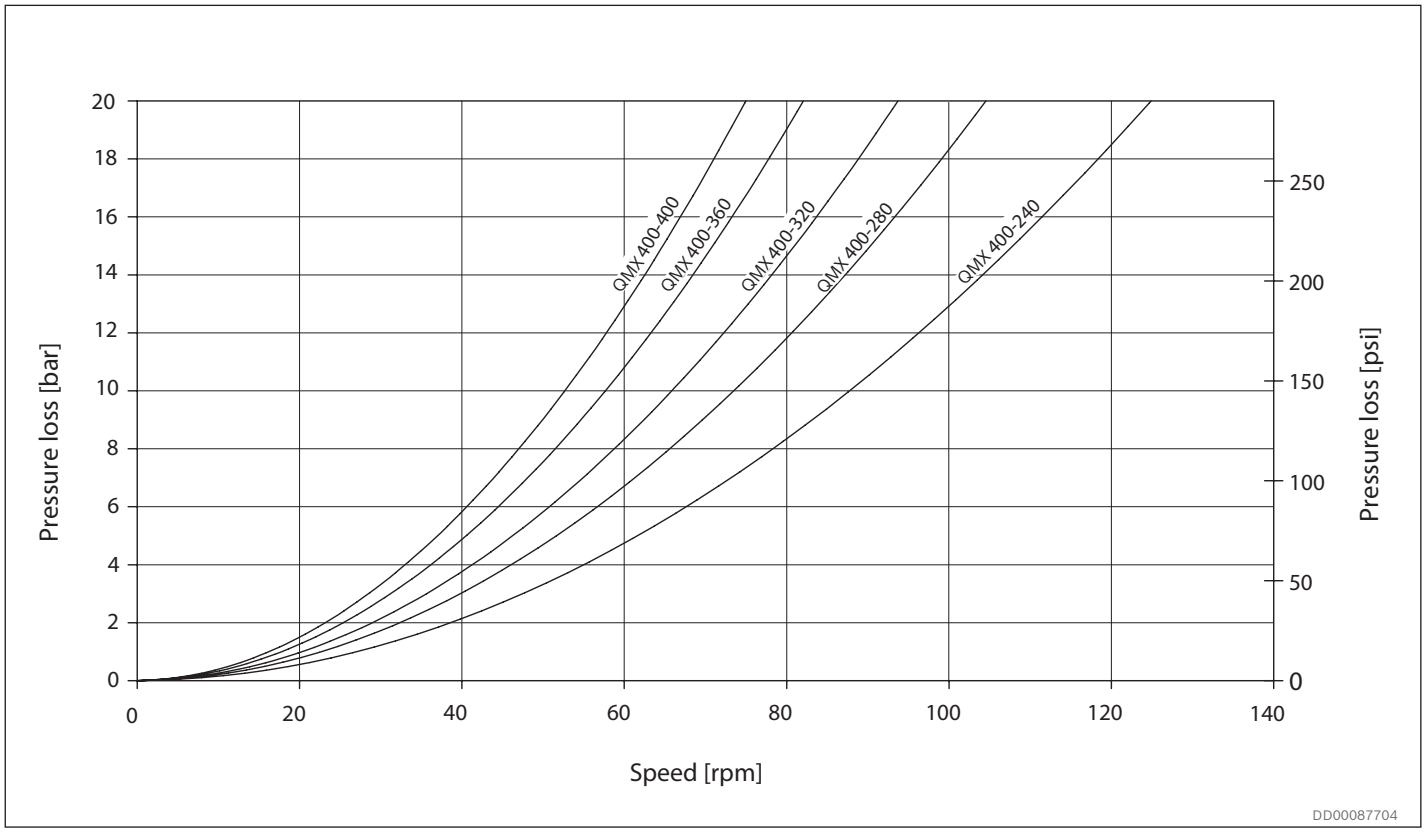


Fig. 42: QMX 400-240 to QMX 400-400 pressure loss 4 ports

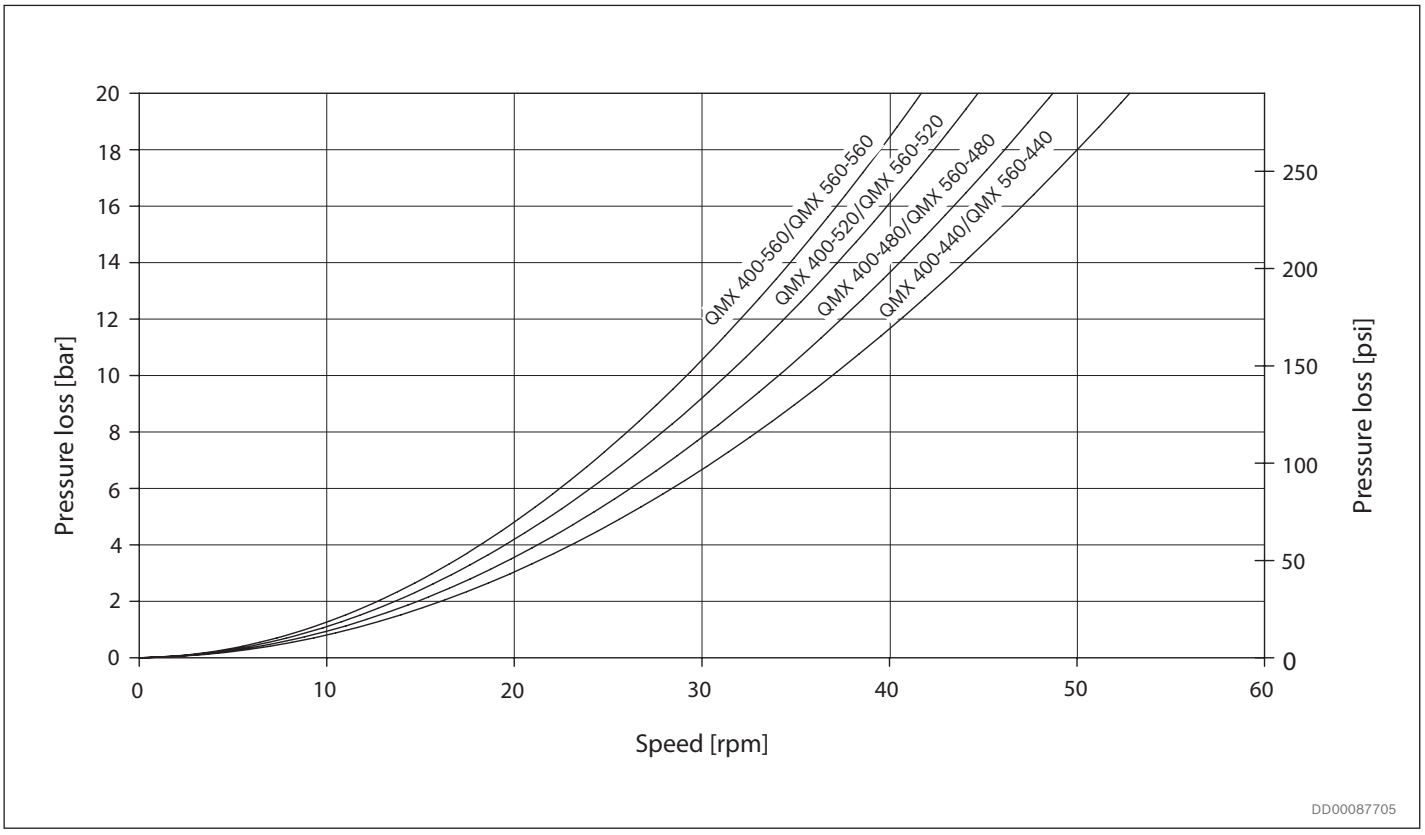


Fig. 43: QMX 400-440 to QMX 400-560, QMX 560 pressure loss 2 ports

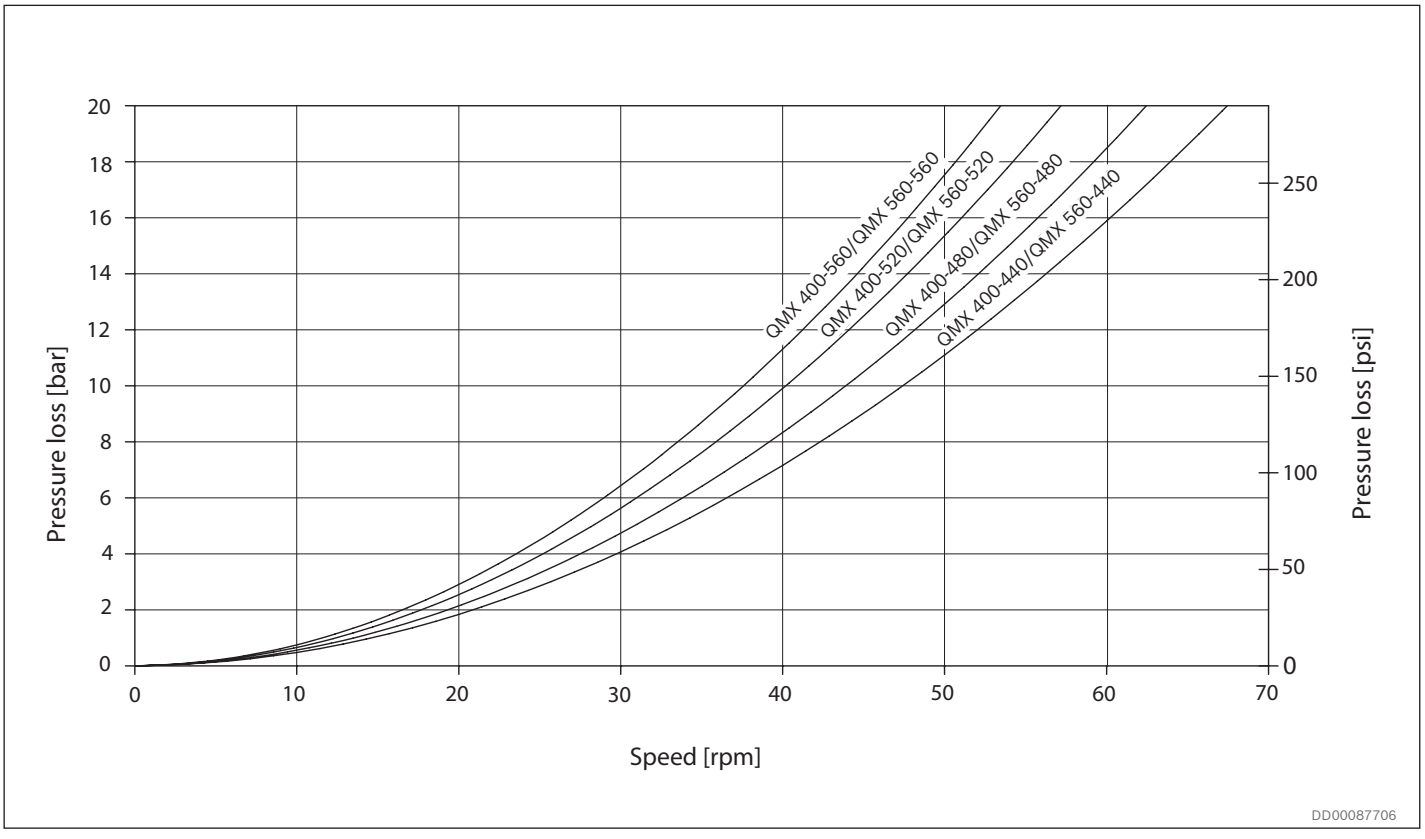


Fig. 44: QMX 400-440 to QMX 400-560, QMX 560 pressure loss 4 ports

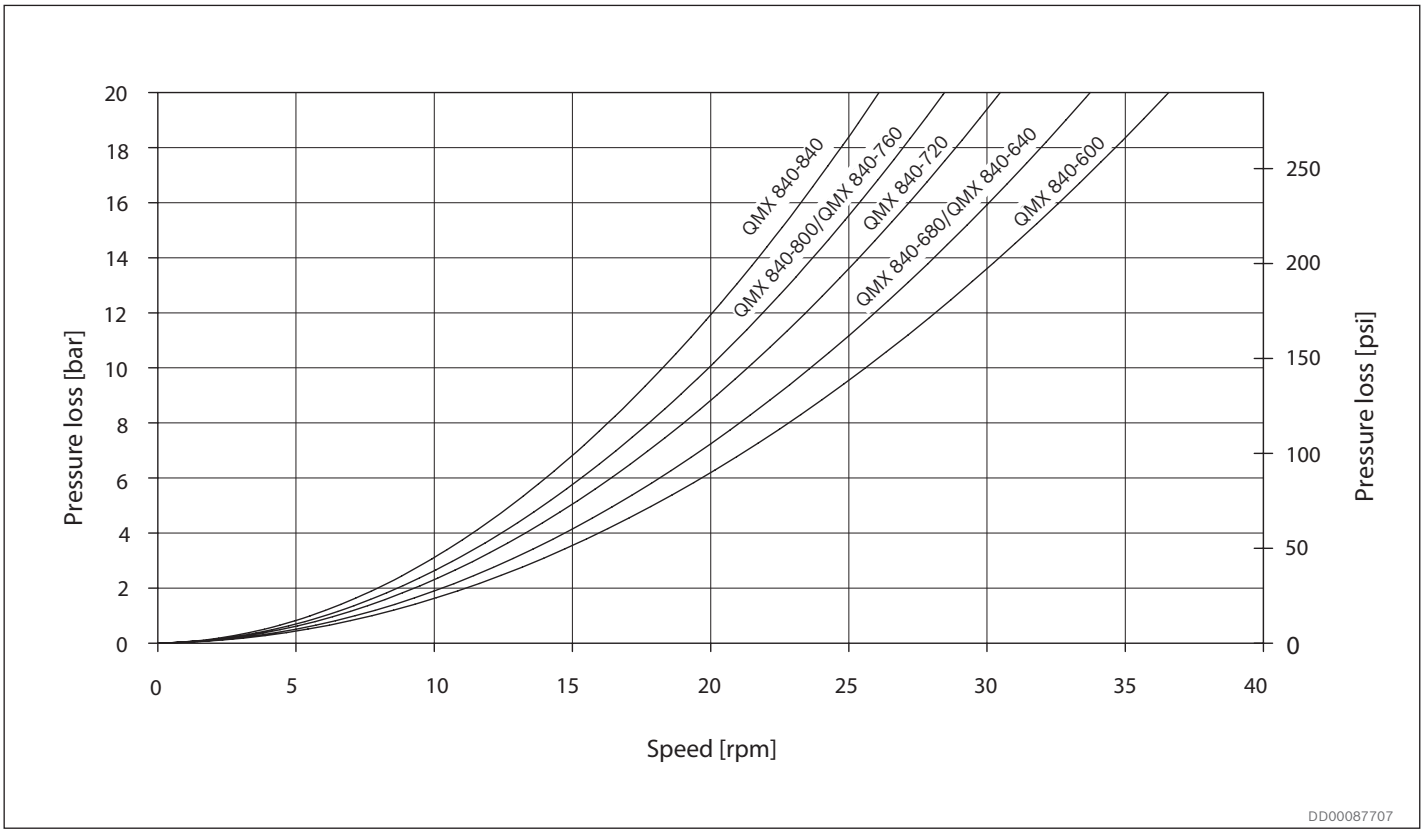


Fig. 45: QMX 840 pressure loss 2 ports

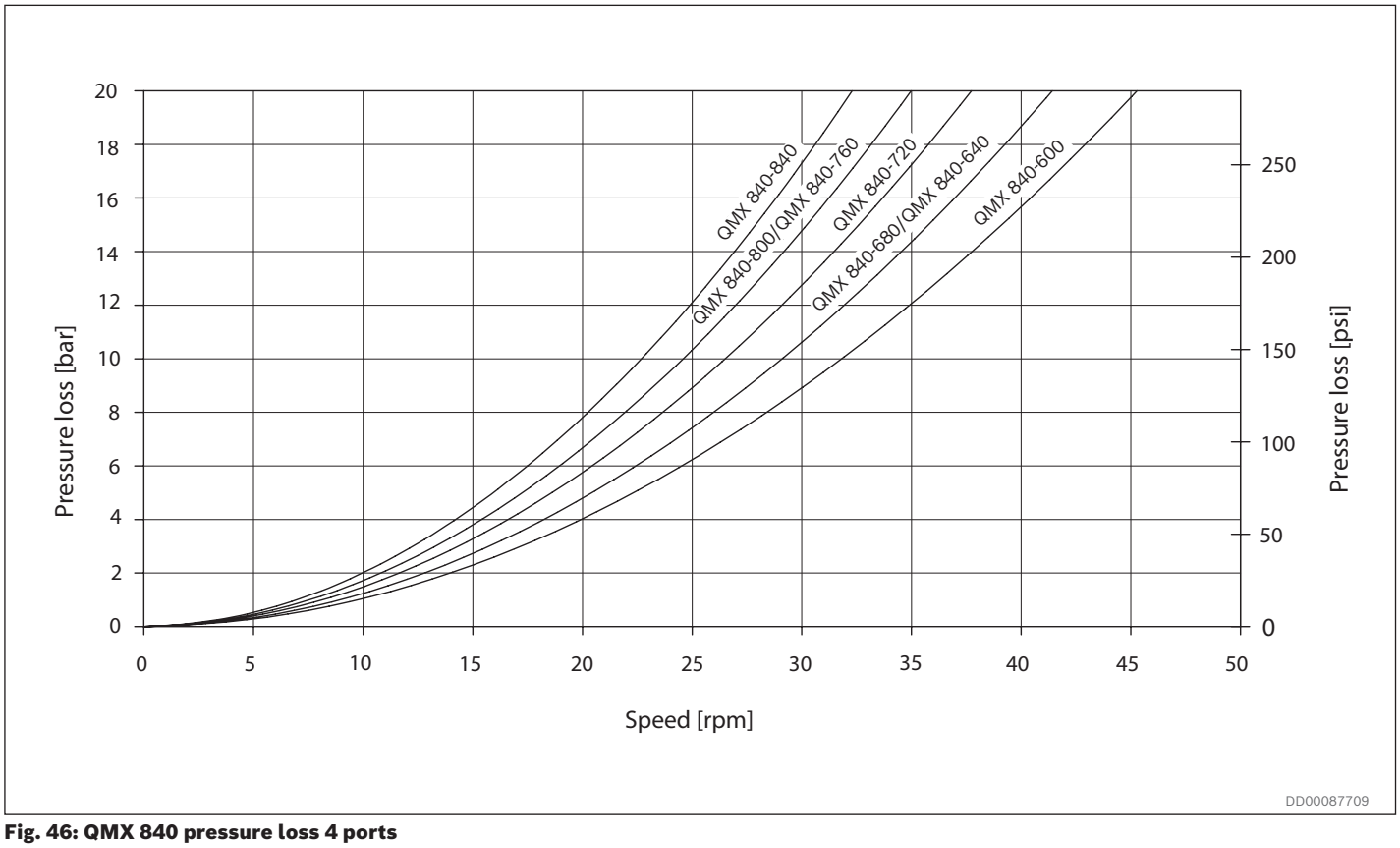


Fig. 46: QMX 840 pressure loss 4 ports

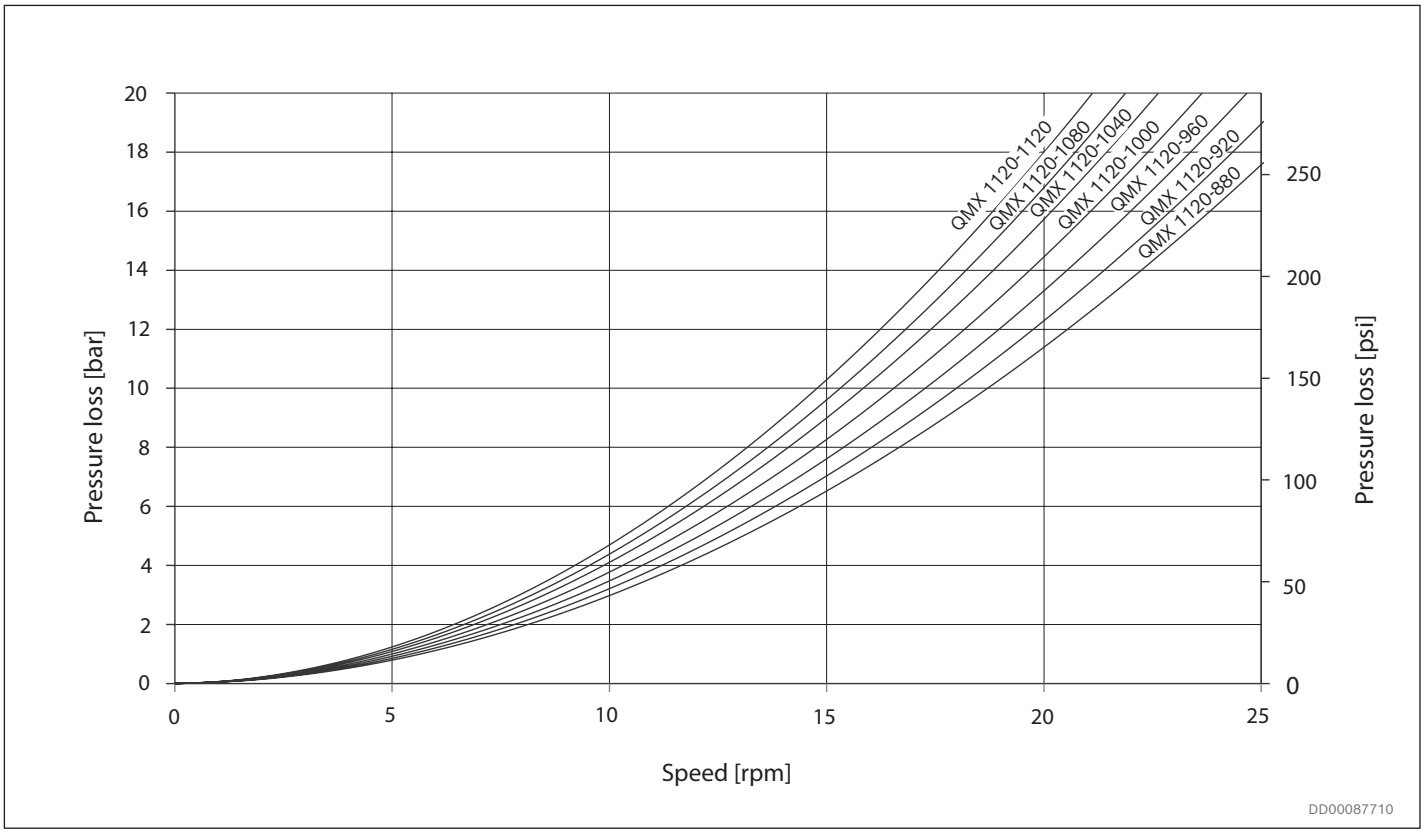


Fig. 47: QMX 1120 pressure loss 2 ports

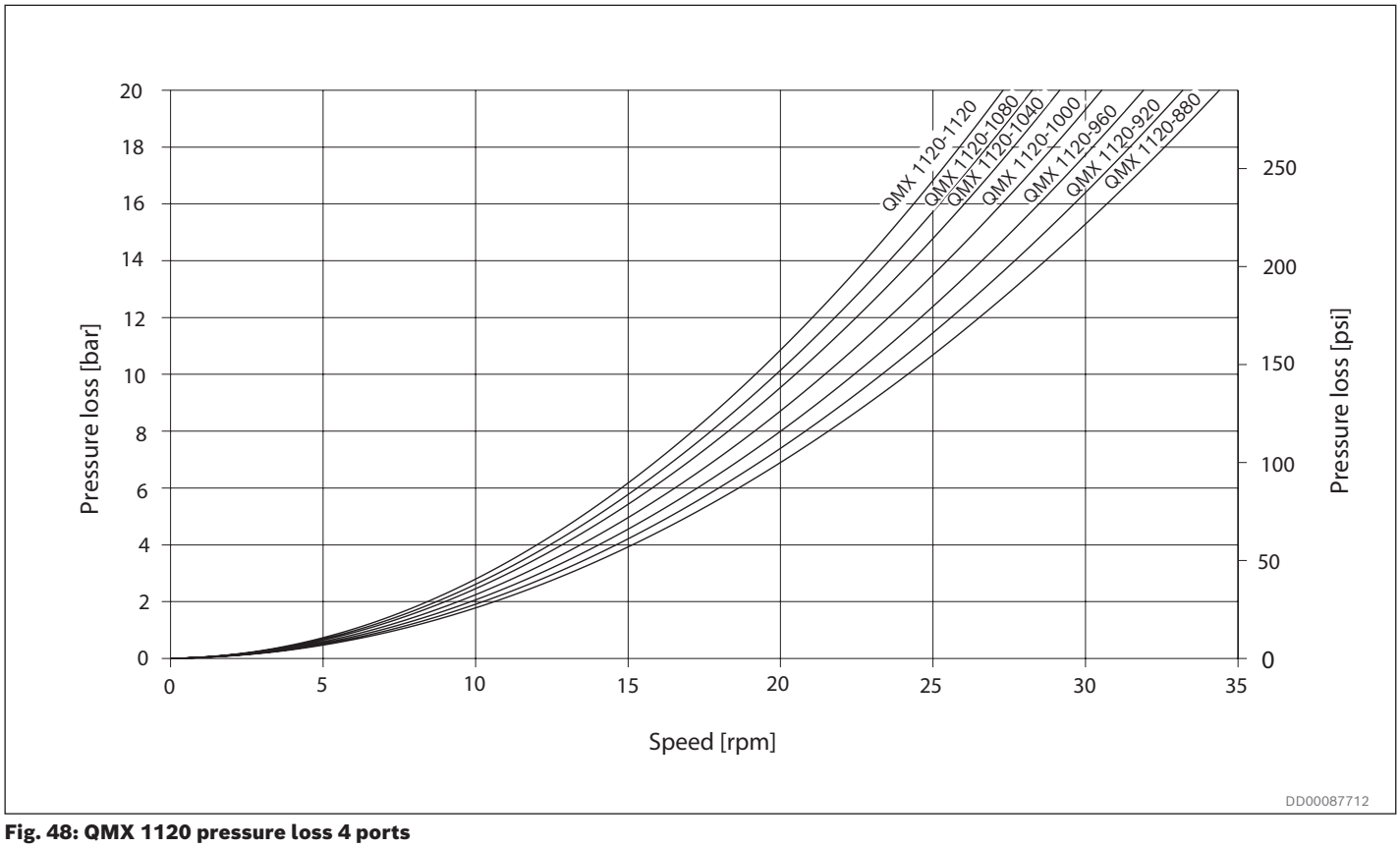


Fig. 48: QMX 1120 pressure loss 4 ports

4.8 Quick selection diagram

Rated life for Hägglunds QMX is calculated according to DIN ISO 281 Apendix 1.

The diagram below represents the torque and speed, corresponding to a modified rating life L10mh = 40 000 h. Oil viscosity in motor case 40 cSt. Contamination level not exceeding ISO 4406 18/16/13 (NAS 1638, class 7).
The diagram is based on a charge pressure of 15 bar (218 psi).

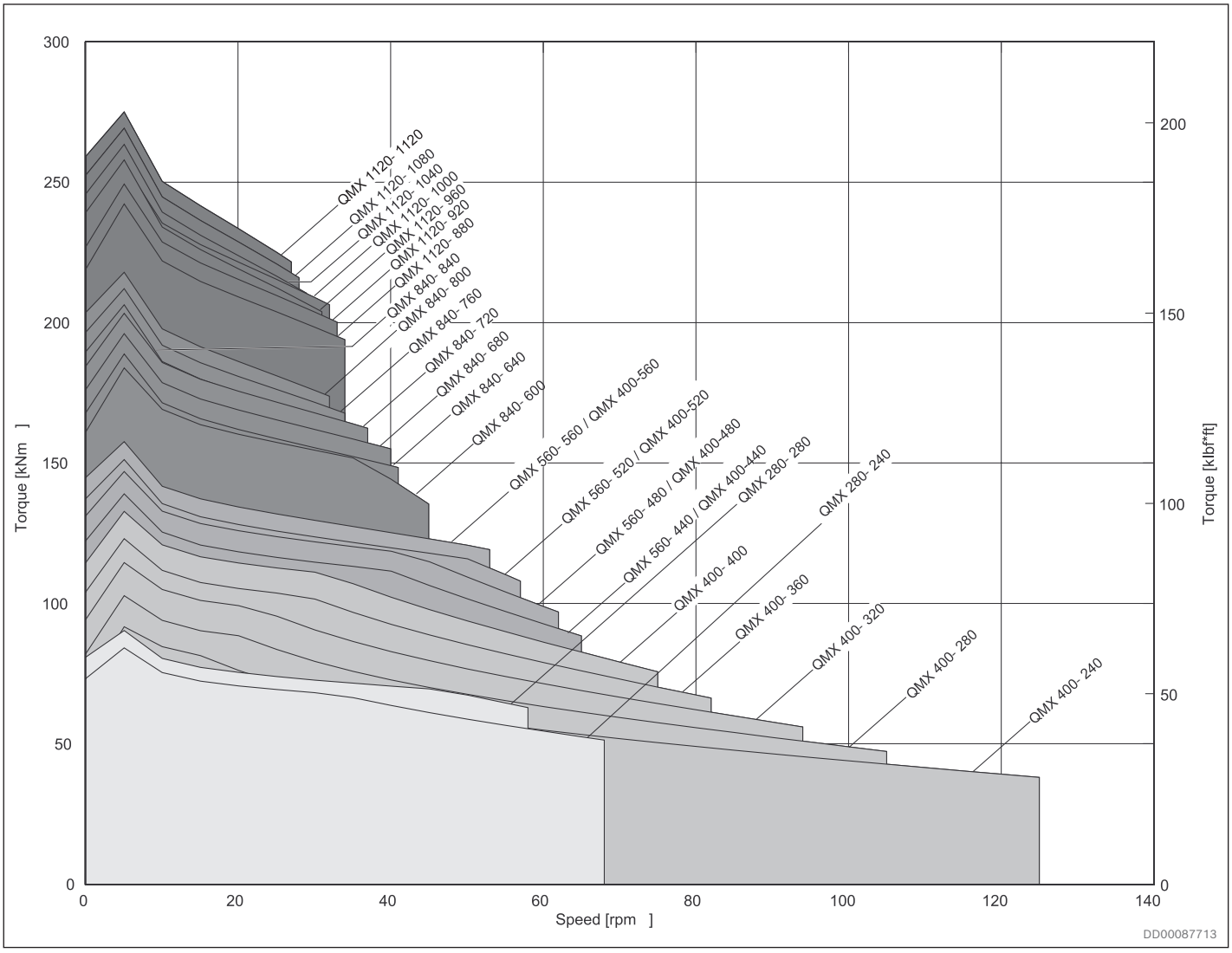


Fig. 49: Quick selection diagram

Note!
Higher case oil viscosity increases the motor rating life considerably. Reduced temperature in the motor case, increase rating life for the motor.

4.9 Draining, venting and flushing of the motor

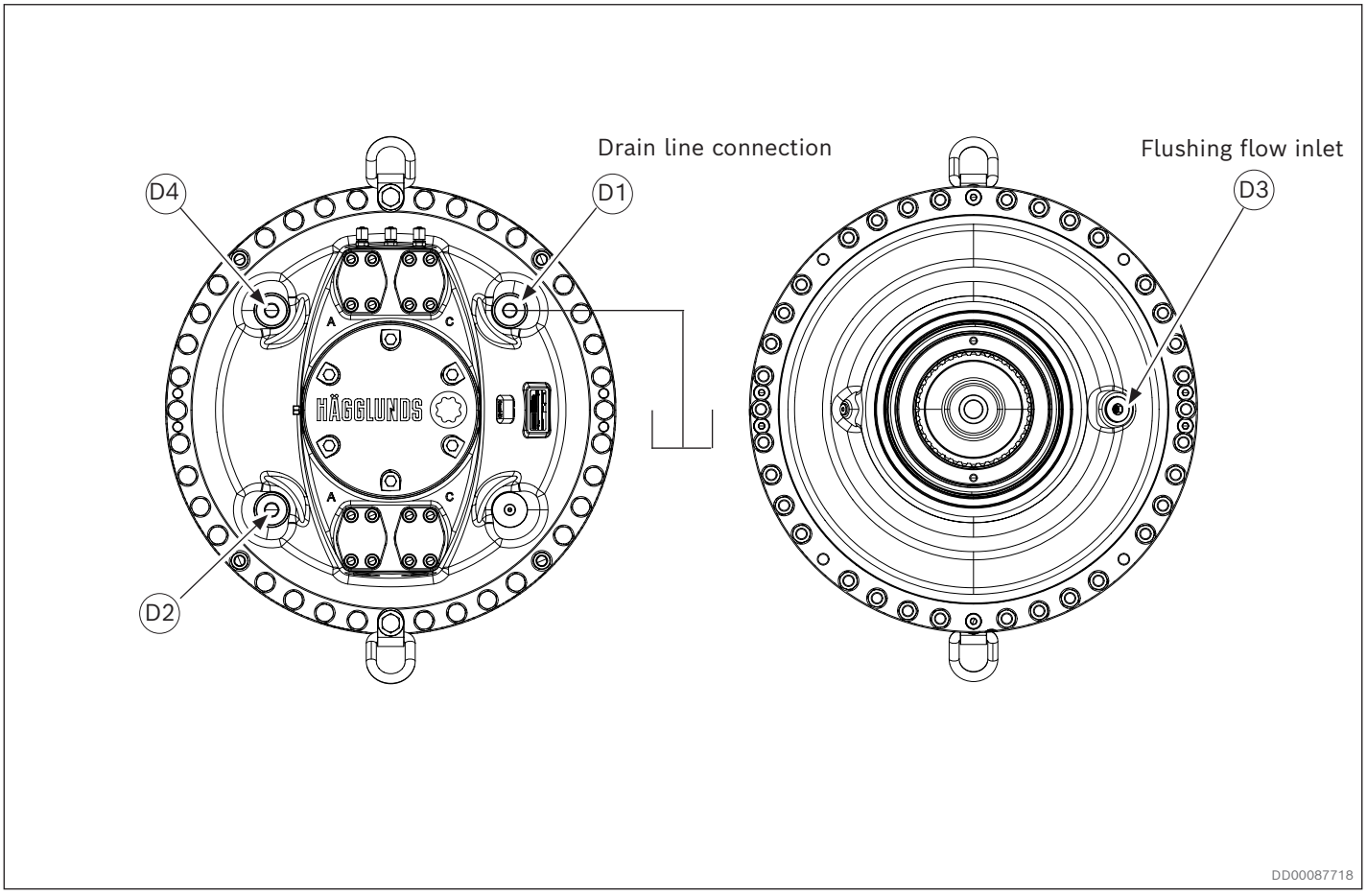


Fig. 50: Horizontal mounting

4.9.1 Horizontal mounting

When the motor is installed with the shaft in the horizontal plane, the highest of the four drain outlets D1, D2, D3 or D4 must always be used (see *Fig. 50*).
Drain line must be connected to the tank with a minimum of restrictions, to ensure that the maximum case pressure is not exceeded.

Connect the input flushing line at the lowest drain port, D1 to D4 at opposite side compared to the drain outlet in order to obtain a cross flushing flow through the motor, see *Fig. 50 and Fig. 51*.

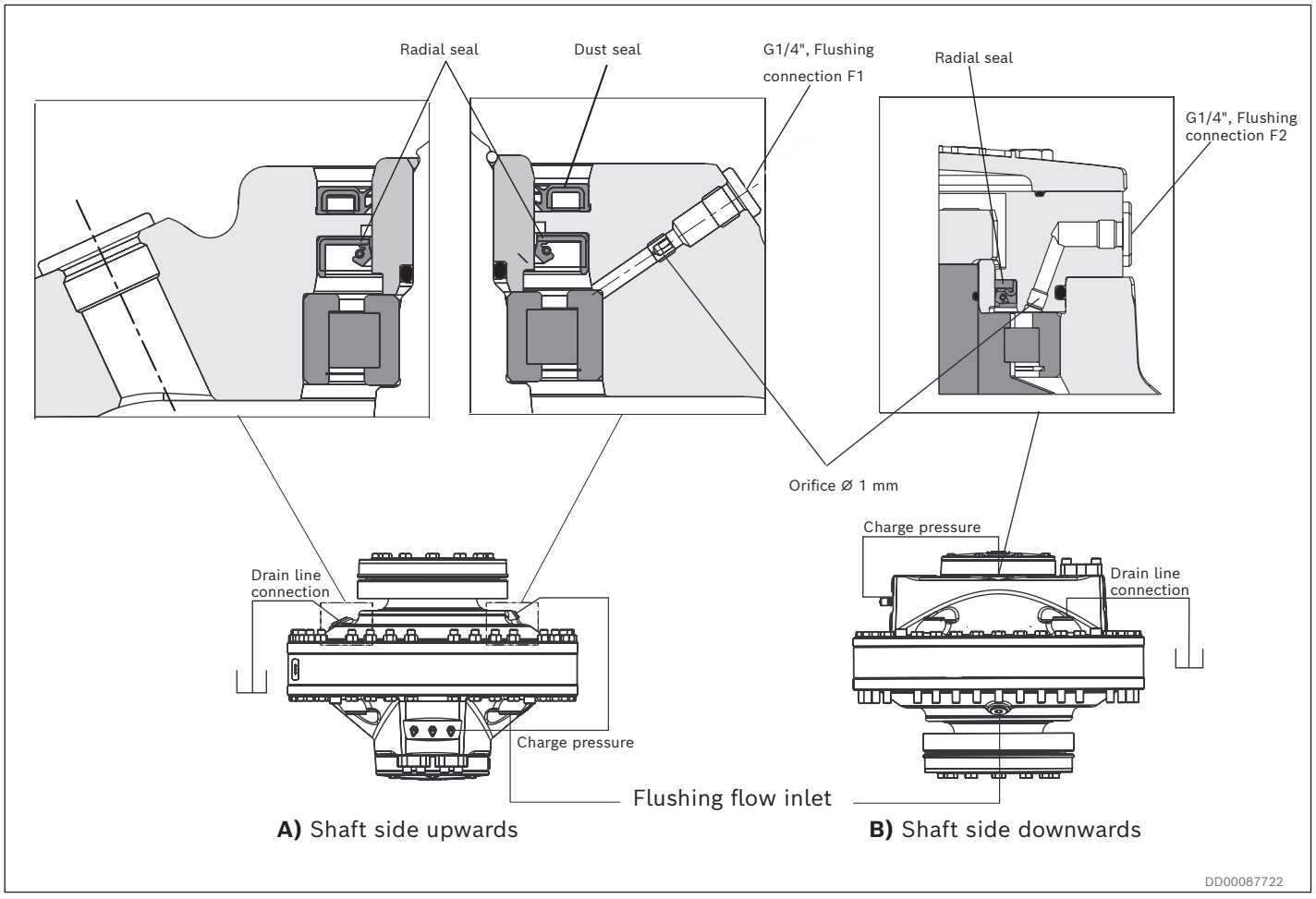


Fig. 51: Vertical mounting

4.9.2 Vertical mounting

When the motor is mounted vertically, the highest of four drain ports D1 to D4 must be used.
Flushing (lubrication) of radial seal from charge pressure is necessary.

A) Motor shaft pointing upwards

The drain line must be connected to the drain port D3 in the housing cover (See *Fig. 51*, *alt.: A) Shaft side upwards*). The flushing connection F1 on the housing cover should be connected to the charge pressure. With bidirectional drives, use the connection with lowest average pressure.
(Connecting to high pressure will increase the motor drain flow).

B) Motor shaft pointing downwards

The drain line must be connected to one of the drain ports D1, D2, D4 in the connection block. (See *Fig. 51* alt.*: B) Shaft side downwards*).

The flushing connection F2 shall be connected to charge pressure. With bidirectional drives, use the connection with lowest average pressure. (Connecting to high pressure will increase the motor drain flow).

4.10 Flushing

Flushing of motor case

The QMX motors have very high overall efficiency, and they are frequently used in applications with high power.
To avoid high temperature in the case, the losses generated in the motors must be cooled away. High temperature gives lower viscosity and this gives reduction in basic rating life and max allowed power for the motor.
Flushing flow inlets, see *Fig. 50* and *Fig. 51*.
For continuous duty the motors must be flushed when the shaft power exceed the following max power:

Table 8: Maximum motor power without flushing

Frame size	Flushing limit power, E_{FL}	
	kW	hp
QMX 280	120	160
QMX 400/560/840/1120	170	227

When the motor have to be flushed, the required flushing flow can be calculated according to following:
E_1 = Power loss due to mechanical losses = c • motor power
E_2 = Power loss due to volumetric losses

Table 9: Heat transmitted to air at ambient temperature +20°C (68°F) and motor case temperature +50°C (122°F)

Frame size	Heat transmitted to air	
	kW	hp
QMX 280	0.6	0.8
QMX 400/560/840/1120	0.9	1.2

Required flushing to keep motor case maximum 10°C (18°F) warmer than flushing oil:
q flushing = 3.4 · (E_1 + E_2 - Heat transmitted to air) l/min.
q flushing $_{US}$ = 0.67 · (E_{1US} + E_{2US} - Heat transmitted to air) gpm.
Viscosity in the motor case must be controlled according to diagram, *Fig. 13*.

Exemple:
Hägglunds QMX 400 400 working at 250 bar and n = 20 rpm.

$$E_1 = \frac{c \cdot p_{high} \cdot n \cdot V_i}{600 \cdot 1000} \text{ (kW)}$$

$$E_2 = \frac{q_1 \cdot p_{high}}{600} \text{ (kW)}$$

$$E_{1US} \quad \frac{c \cdot p_{high} \cdot n \cdot V_i}{1714 \cdot 231} \text{ (hp)}$$

$$E_{2US} \quad \frac{q_1 \cdot p_{high}}{1714} \text{ (hp)}$$

p_{high} = motor high pressure [bar] [psi]
n = motor speed [rpm]
V_i = motor displacement [cm³/rev] [in³/rev]
q_l = motor leakage [l/min] [gpm] (see *Fig. 52)*
c = 0,01

Total power = $\frac{p_{high} \cdot n \cdot V_i}{600 \cdot 1000} = \frac{250 \cdot 20 \cdot 25100}{600 \cdot 1000}$ = 209.2 kW . The motor case must be flushed

E_1 = 0.01 · 209.2 = 2.1 kW (2.8 hp)

$E_2 = \frac{3 \cdot 250}{600}$ = 1.25 kW (1.7 hp)

q flushing = 3.4 · (E_1 + E_2 - Heat transmitted to air) = 3.4 · (2.1 + 1.25 - 0.9) = 8.3 l/min
q flushing $_{US}$ = 0.67 · (E_{1US} + E_{2US} - Heat transmitted to air) = 0.67 · (2.8 + 1.7 - 1.2) = 2.2 gpm

4.11 External leakage

External leakage is from the distributor to the motor case and from the piston assembly to the motor case.
Valid for 40 cSt and at 1/3 of max speed.

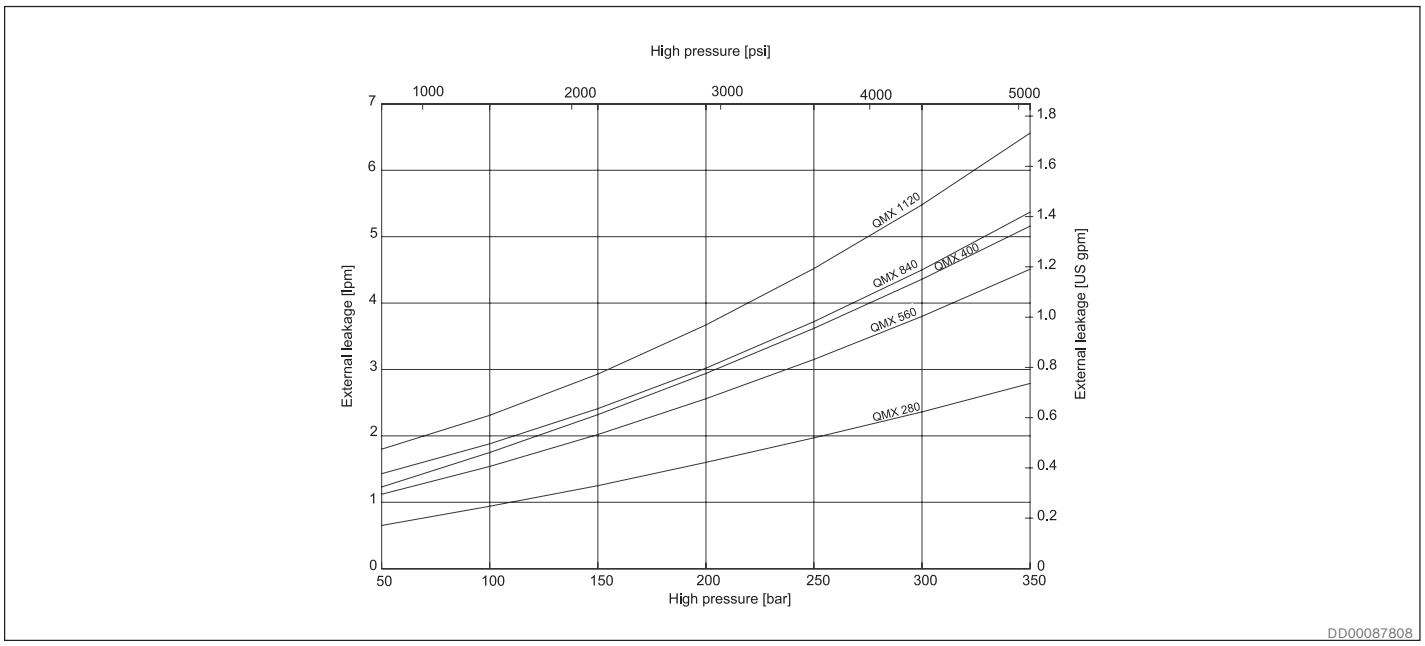


Fig. 52: External leakage

4.12 Viscosity factor K

Variation in external leakage at different oil viscosities. When calculating external leakage using other viscosities than 40 cSt, multiply the value given in the external leakage diagram by the factor K.

$$Q_{leak}(v) = Q_{leak}(40) * K(v)$$

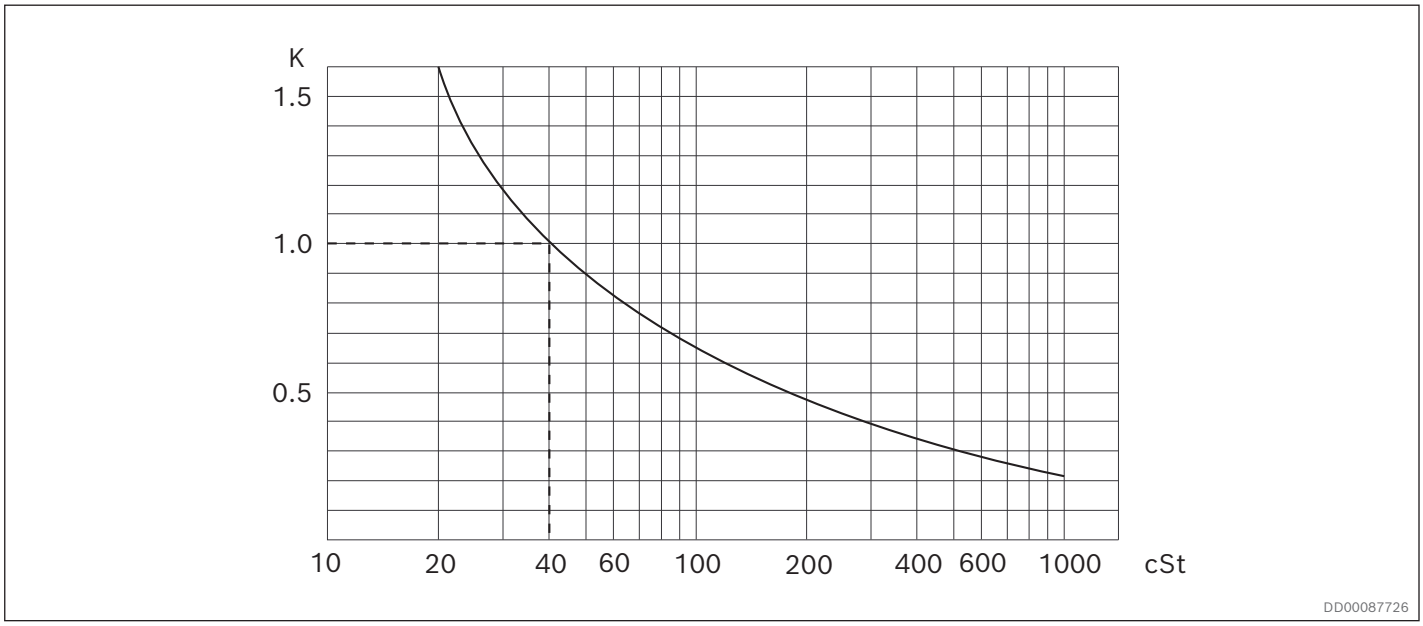


Fig. 53: Viscosity factor K

4.13 Freewheeling

4.13.1 The function of freewheeling

Hägglunds QMX motors can be operated in freewheeling mode.

Principally this is performed by disengaging the pistons, allowing the rotating group to rotate as a flywheel on its main bearings. The piston units are not engaged and thus there is no oil flow to cause a flow loss, Hägglunds motors of standard design are suitable for this performance due to the following facts:

1. Pistons are not actuated by any return springs.
2. The motor case can withstand sufficient case pressure to force the pistons toward the bottom of each cylinder bore and keep them in this position.

The basic function of the freewheeling is to have the drain ports D1 - D4 lightly pressurized (see *Fig. 56*) while main ports A and C are without restriction drained directly to the fluid reservoir. See *Fig. 55*. The case pressure introduced in the normal drain connection will then act on the outer surface of each piston assembly pressing them towards the motor centre.

The rotating part of the motor (cylinder block with piston and cam roller) can now rotate on its main bearings without any pumping of oil, as the piston with cam rollers have lost any contact with the cam ring. See *Fig. 54*.

During freewheeling periods, the following functions must be performed:

1. Main connections A & C of the motor drained to reservoir.
2. Fail-safe type brake released, if used.
3. An adequate pressure introduced into the drain ports of the motor. *See Fig. 56 (*required case pressure).

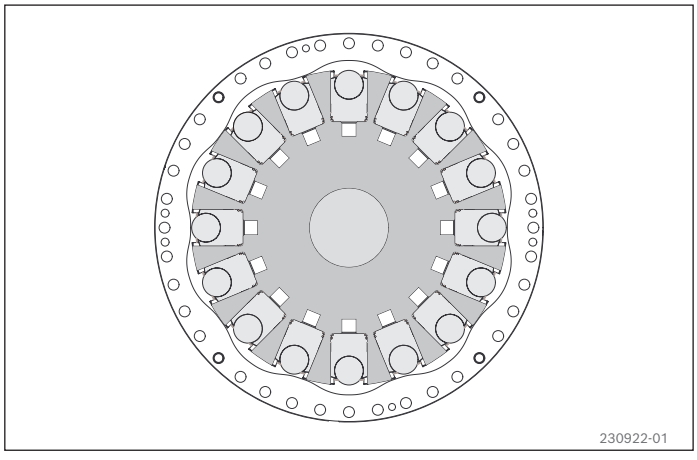


Fig. 54: Freewheeling

4.13.2 Circuit design

The following schematic explains a system (closed/open) with freewheeling (activated mode illustrated) as a permanent feature for the application.

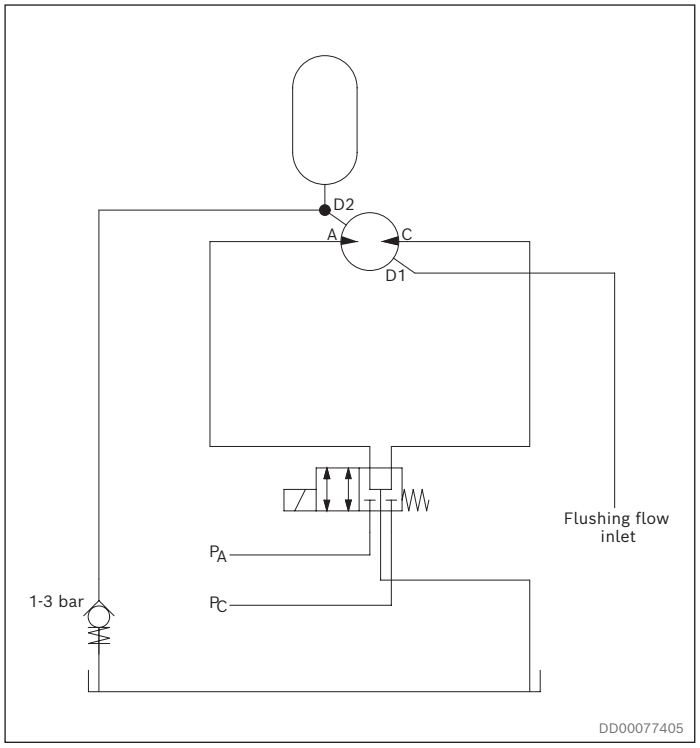


Fig. 55: Schematic principle freewheeling.

Freewheeling valve function, see *section 16.4.3 page 71*.

Note!
It is not allowed for the pistons to extend back to the camring, until the motor has reached a complete standstill

4.13.3 Oil volume for freewheeling

Freewheeling conditions are obtained by pressurizing the case via the drain connections and drain the main ports to tank. To retract all pistons completely, a certain oil volume is required depending upon motor type. This oil volume can be calculated from the following:

$$V_F = \frac{V_i}{2\ N_L}$$

V_F = Needed Freewheeling volume [cm^3] or(in^3)
V_i = Total displacement of the motor [cm^3] or(in^3)
N_L = 10 (No of lobes for one camring in the QMX motor)

To use QMX motor in freewheeling mode must following be maintained:

- The motor must be pressurized all the time when the motor is in freewheeling mode, see *Fig. 56*.
- The motor must be flushed all the time when the motor is in frewheeling mode, see *Fig. 56*.

An accumulator can be added into the circuit to shorten the time to retract all the pistons completely, see *Fig. 56*.

An accumulator can be added into the circuit to reduce the pressure spikes in the motor case when the pistons are extracted, see *Fig. 55*.

4.13.4 Power loss freewheeling

Even if the freewheeling operation takes place with lowest possible friction in the main bearings and with no flow losses in the main ports of the motor, a powerloss must take place in the motor case due to viscous friction between moving and fixed parts. This powerloss is expressed in diagram, *Fig. 56*.
Case flushing is required to prevent overheating, see diagram *Fig. 56*
Required case pressure 1-3 bar (15-44 psi).
Case oil temperatur to be below 50°C (122°F).

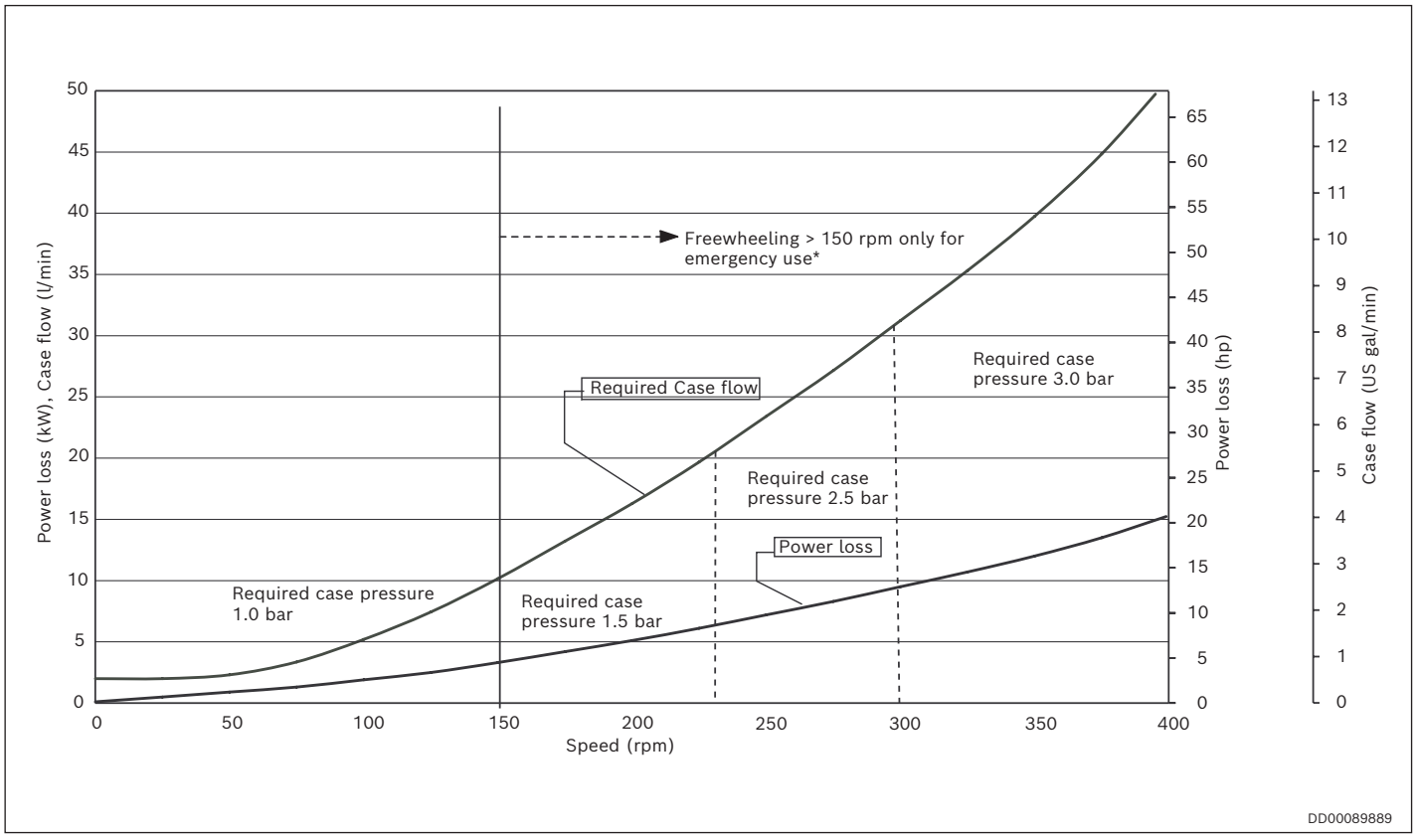


Fig. 56: Power loss freewheeling, oil viscosity 40 cSt (187 SSU)

*) Viton seals are recomended for speeds above 60 rpm.

Note!
Freewheeling will require exchange of oil in the housing to prevent overheating.

In order to accomplish proper freewheeling, a case pressure according to *Fig. 56* has to be maintained. On the other hand, a higher casing pressure than 2 bar (29 psi) should be avoided in order to achieve good life of the main radial shaft seal.

Note!
Continuous freewheeling is allowed up to 53 rpm.

4.14 Permissible external loads

4.14.1 External load with torque arm mounting

Shaft mounted motor with torque arm.

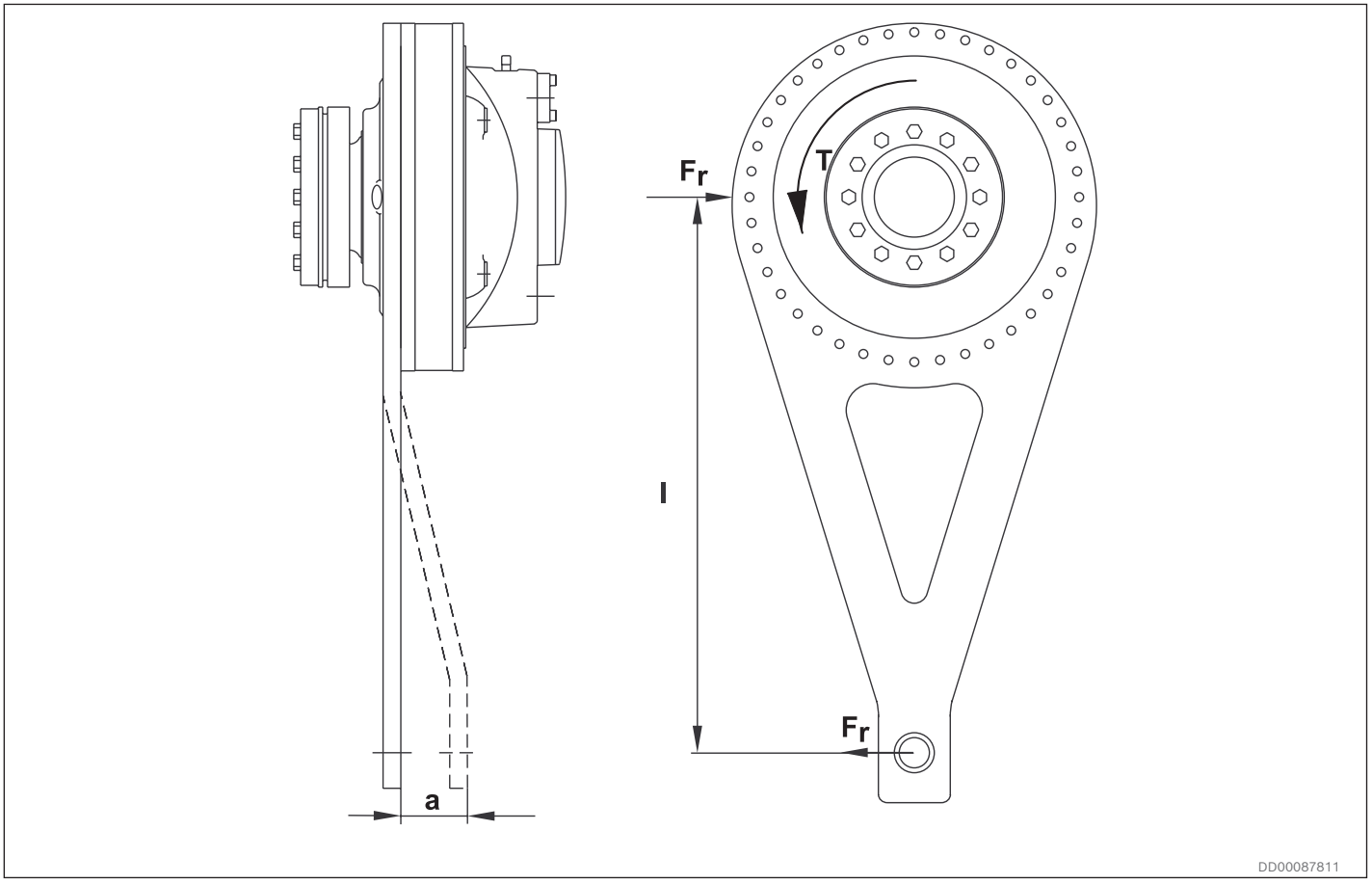


Fig. 57: Shaft mounted motor with torque arm.

If non standard torque arms TC A are used, forces must be checked for main bearings and coupling.

$$F_r = \frac{T}{l}$$

F_r = Total radial force on fixed motor mounting

T = Output torque for motor

l = Lever length

a = The axial distance for action point of radial force

4.14.2 Permissible external dynamic loads

Permissible external dynamic loads QMX 280
Torque arm mounted motor. (Figure and diagram are not scaled to each other).
Viscosity 40 cSt/187 SSU, speed 20 rpm.

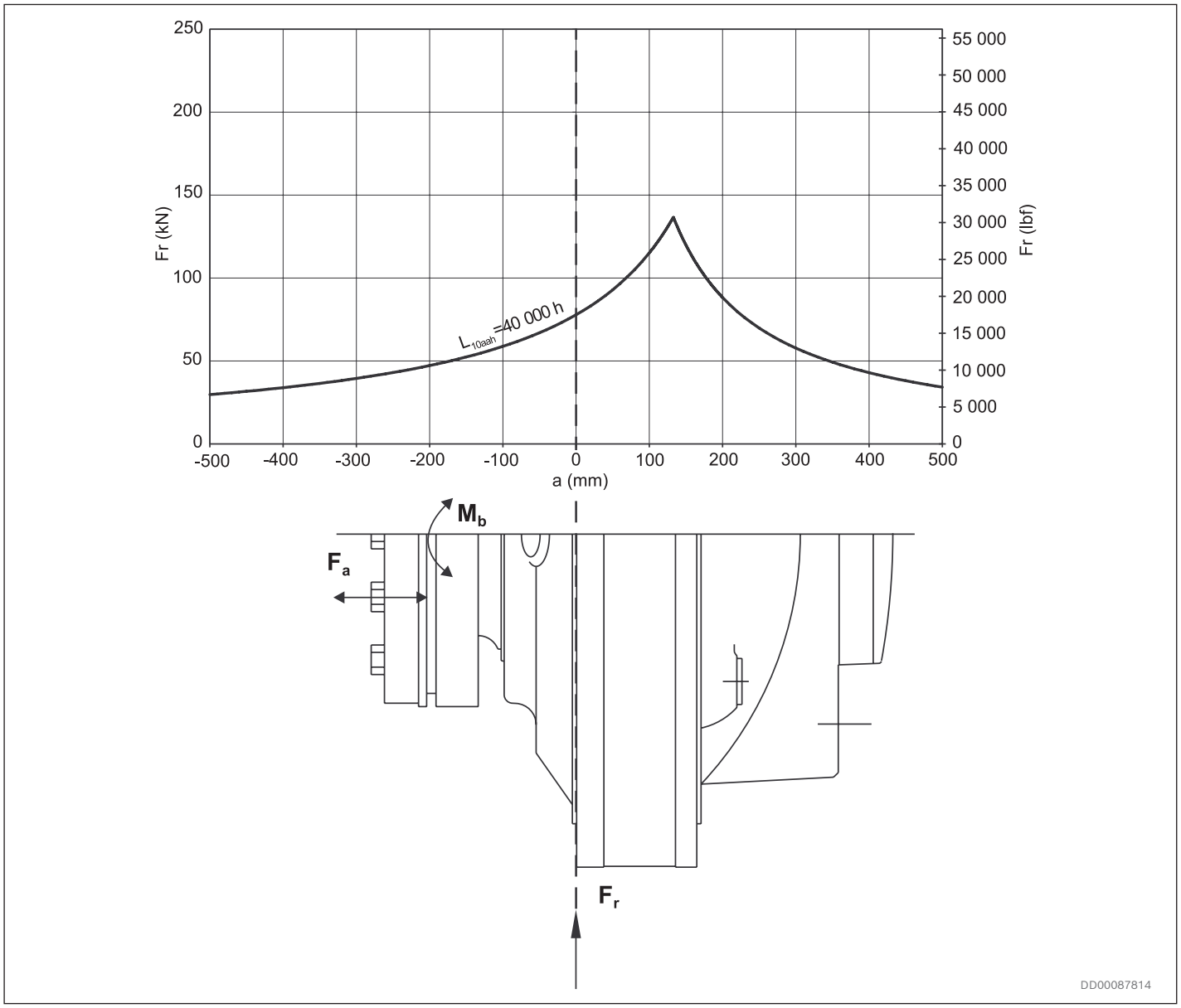


Fig. 58: Permissable external dynamic loads Hägglunds QMX 280

Note!
When flange mounted motor, please contact Bosch Rexroths representative.

Axial loads: Permissible axial load for intermittent duty F_a = 30 000 N (6 750 lbf).

Remark: For continuous axial load applications, please contact your Bosch Rexroth representative.

Bending: Permissible bending moment M_b for motor with shrink disk coupling is 30 000 Nm (22 110 lbf·ft).

Permissible external dynamic loads QMX 400

Torque arm mounted motor. (Figure and diagram are not scaled to each other).
Viscosity 40 cSt/187 SSU, speed 25 rpm.

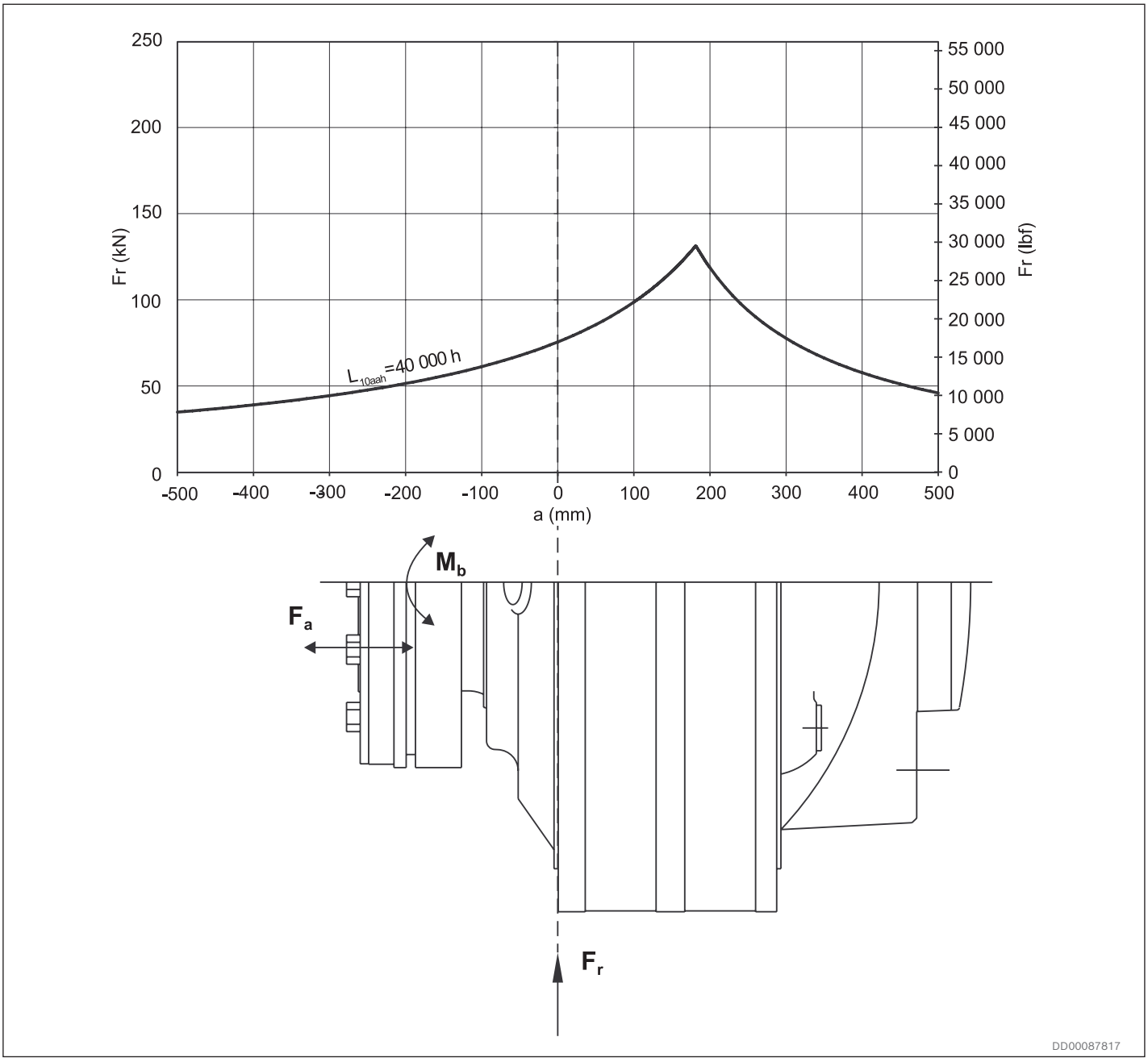


Fig. 59: Permissable external dynamic loads Hägglunds QMX 400

Note!
When flange mounted motor, please contact Bosch Rexroths representative.

Axial loads: Permissible axial load for intermittent duty F_a = 30 000 N (6 750 lbf).

Remark: For continuous axial load applications, please contact your Bosch Rexroth representative.

Bending: Permissible bending moment M_b for motor with shrink disk coupling is 30 000 Nm (22 110 lbf·ft).

Permissible external dynamic loads QMX 560

Torque arm mounted motor.(Figure and diagram are not scaled to each other).
Viscosity 40 cSt/187 SSU, speed 20 rpm.

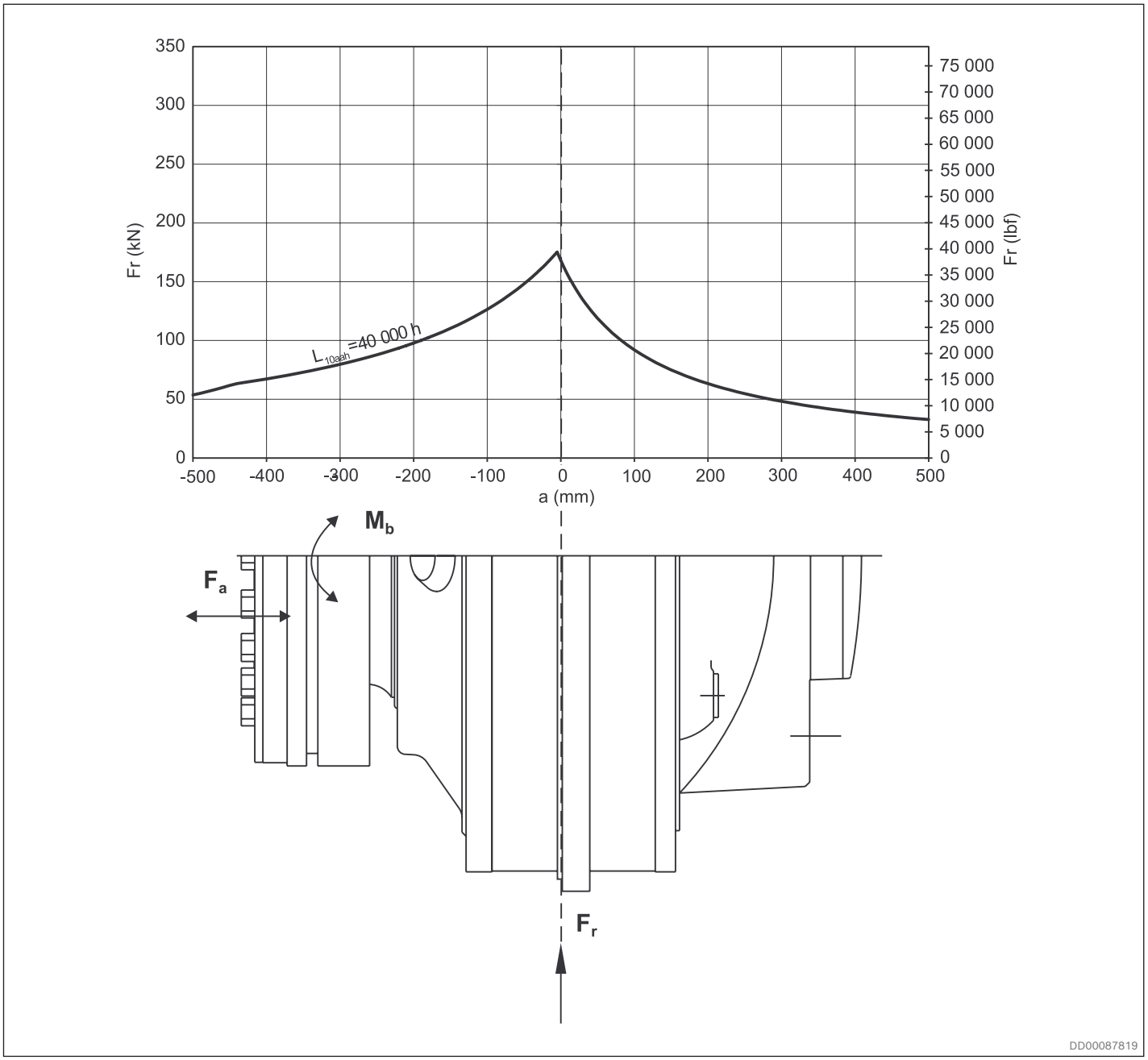


Fig. 60: Permissable external dynamic loads Hägglunds QMX 560

Note!
When flange mounted motor, please contact Bosch Rexroths representative.

Axial loads: Permissible axial load for intermittent duty F_a = 30 000 N (6 750 lbf).

Remark: For continuous axial load applications, please contact your Bosch Rexroth representative.

Bending: Permissible bending moment M_b for motor with shrink disk coupling is 55 000 Nm (40 560 lbf·ft).

Permissible external dynamic loads QMX 840

Torque arm mounted motor. (Figure and diagram are not scaled to each other).
Viscosity 40 cSt/187 SSU, speed 10 rpm.

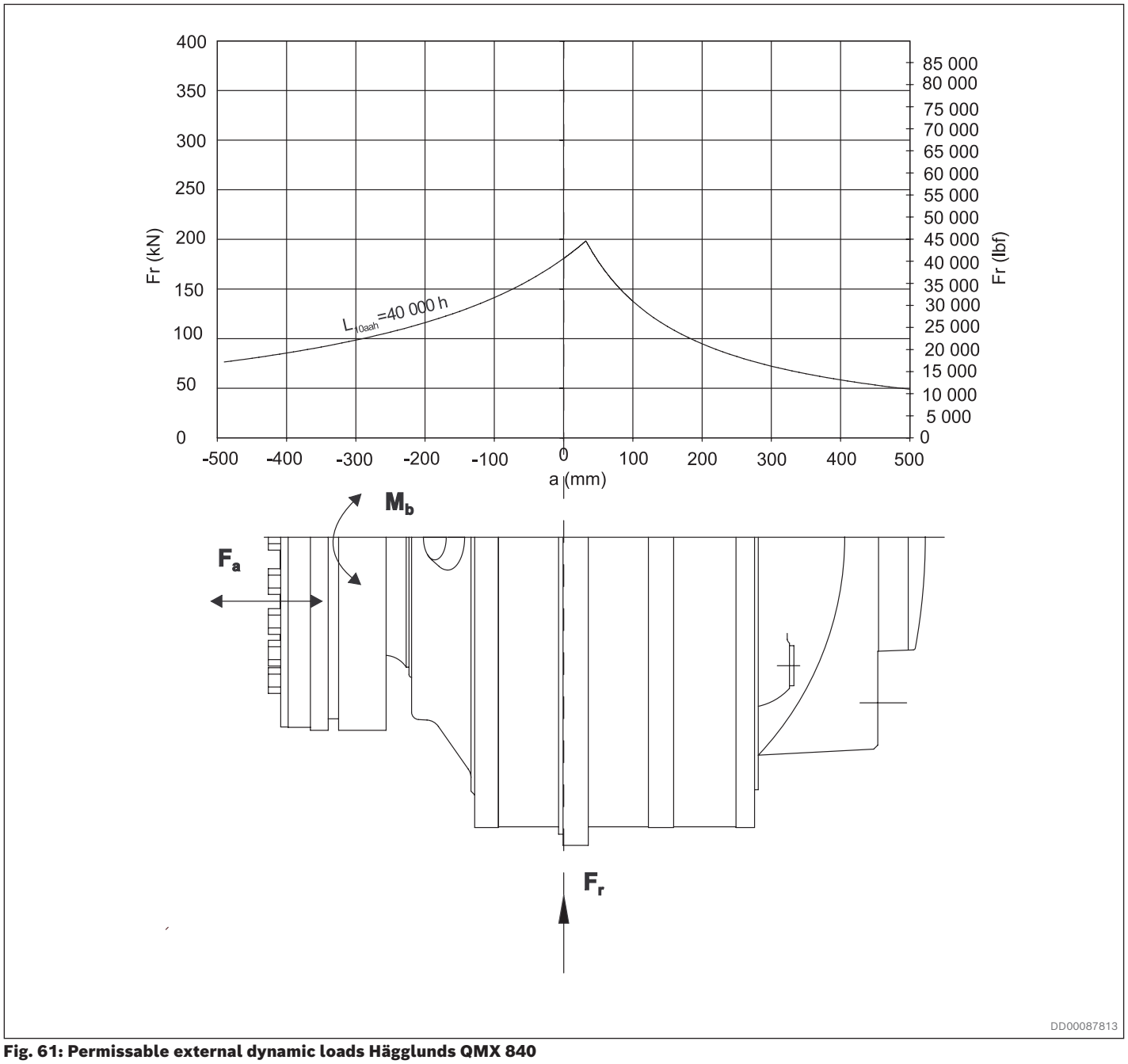


Fig. 61: Permissable external dynamic loads Hägglunds QMX 840

Note!
When flange mounted motor, please contact Bosch Rexroths representative.

Axial loads: Permissible axial load for intermittent duty F_a = 30 000 N (6 750 lbf).

Remark: For continuous axial load applications, please contact your Bosch Rexroth representative.

Bending: Permissible bending moment M_b for motor with shrink disk coupling is 55 000 Nm (40 560 lbf·ft).

Permissible external dynamic loads QMX 1120

Torque arm mounted motor.(Figure and diagram are not scaled to each other).
Viscosity 40 cSt/187 SSU, speed 10 rpm.

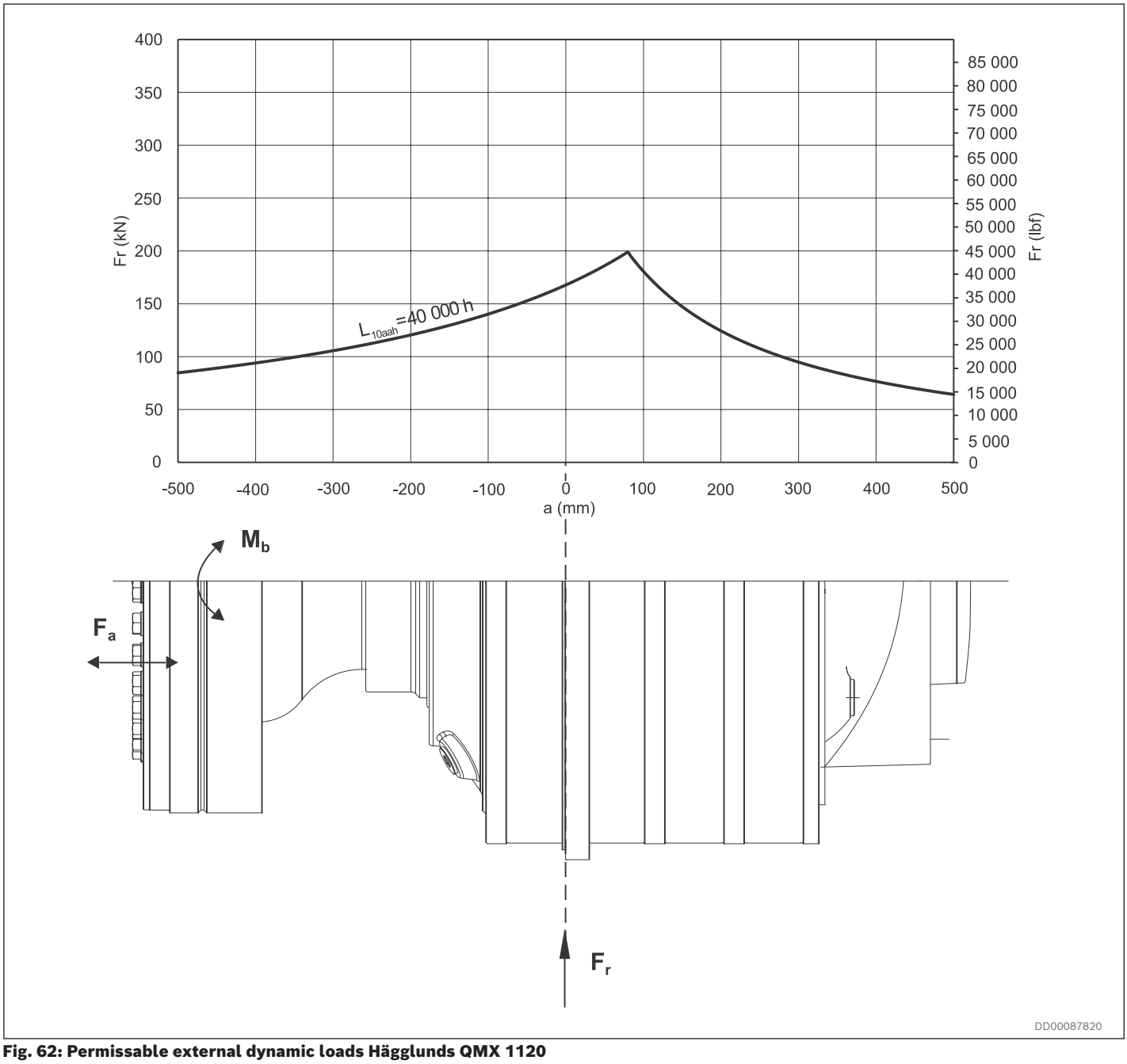


Fig. 62: Permissable external dynamic loads Hägglunds QMX 1120

Note!
When flange mounted motor, please contact Bosch Rexroths representative.

Axial loads: Permissible axial load for intermittent duty F_a = 30 000 N (6 750 lbf).

Remark: For continuous axial load applications, please contact your Bosch Rexroth representative.

Bending: Permissible bending moment M_b for motor with shrink disk coupling is 130 000 Nm (95 880 lbf·ft).

4.15 Low speed performance

For QMX 280 to QMX 1120

Fig. 63 and *Fig. 64* shows speed deviation factor "i" as function of n_{av}.
A is max. deviation from average speed in r/min.
n_{av} is average speed in r/min.
A = $n_{av} \cdot i$ (rpm)
n_{max} = n_{av} + A (rpm)
n_{min} = n_{av} - A (rpm)

The figures refers to 40 cSt viscosity, and moment of inertia 36 kgm² (850 lb·ft²).

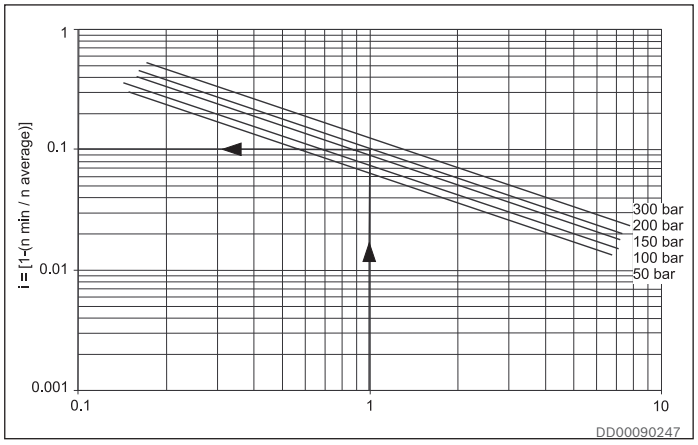


Fig. 63: Speed deviation QMX 280

Exemple:Presume: n_{av} = 1 rpm and p_{max} = 200 bar
n_{av} = 1 gives i = 0,1 (*see Fig. 63*) and A = 1 · 0,1 = 0,1 rpm.
Obtained amplitude value shall be reduced to two decimals.
n_{max} = 1,0 + 0,1 = 1,1
n_{min} = 1,0 - 0,1 = 0,9

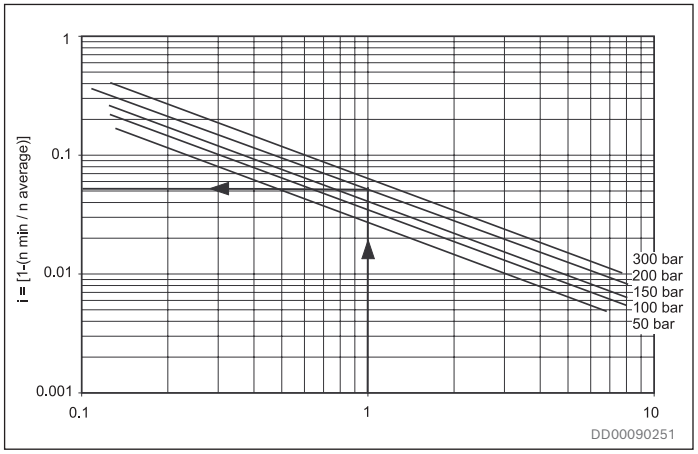


Fig. 64: Speed deviation QMX 400, QMX 560, QMX 840, QMX 1120

Exemple:Presume: n_{av} = 1 rpm and p_{max} = 200 bar
n_{av} = 1 gives i = 0,05 (*see Fig. 64*) and A = 1 · 0,05 = 0,05 rpm.
Obtained amplitude value shall be reduced to two decimals.
n_{max} = 1,0 + 0,05 = 1,05
n_{min} = 1,0 - 0,1 = 0,95

Speed variation data was acquired according to ISO 4392-3 where torque on the shaft and flow into the motor is held constant.

In order to obtain smooth operation at low speed it is important to understand that the mechanisms behind speed variation are governed by leakage and friction variation in the motor together with characteristics of the load and the hydraulic system.

When the theoretical flow needed to rotate the motor is in the same order of magnitude or less than the leakage flow there is a risk for speed variation. Friction losses in the motor will increase at low speed due to reduced oil film thickness. Any variation in these friction losses may result in speed variation.

- Speed variation resulting from both friction and leakage will be lower with high case oil viscosity. Recomendation is to have a case oil viscosity between 100-150 cSt.

  The load characteristics on the shaft will also affect speed variation, for example moment of inertia, friction effects and natural frequency.

- Smooth operation at low speed is enhanced by a constant flow source, like a flow control valve or a small pump that is not operating in its lower displacement range.

  Compressibility of hydraulic oil volume between flow source and motor and deformation of hoses may also result in speed variation, especially if the natural frequency of the hydraulic system and the load is close to each other.

- Therefore, smooth operation is enhanced by a stiff hydraulic system connecting the flow source and the motor, i.e. using short pipings with small dimension.

4.16 Sound

The emission sound pressure and sound power level have been calculated according to ISO/DIS 11203 for unattended machines. All values refer to a position of the test object > 1 m (3,28 ft)

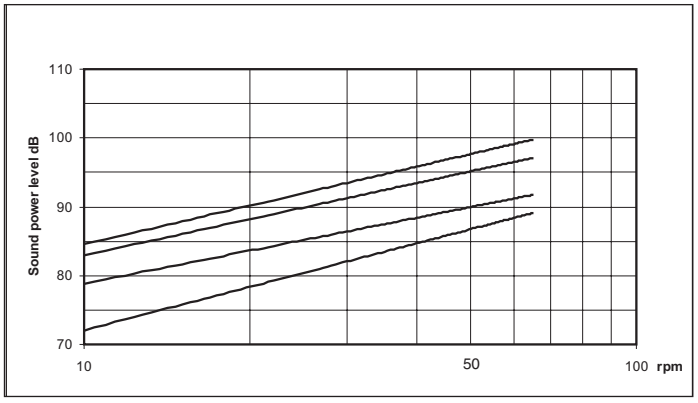


Fig. 65: A-weighted sound power level of QMX 280

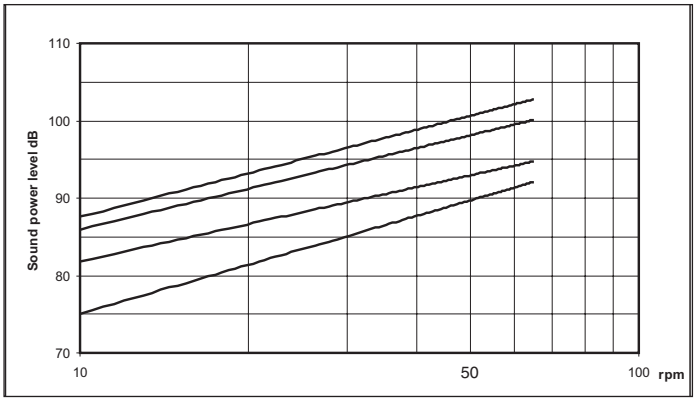


Fig. 67: A-weighted sound power level of QMX 400, 560 and 840

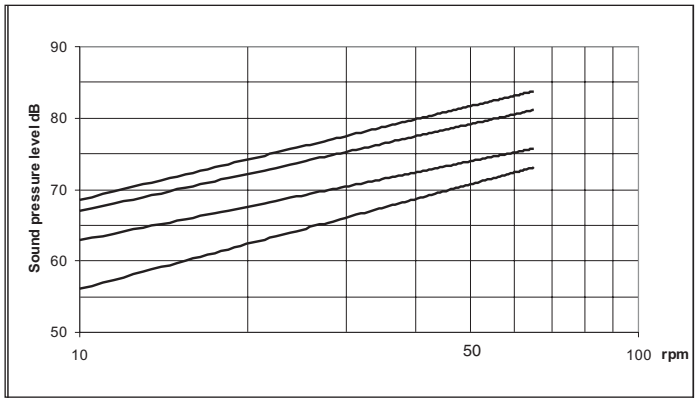


Fig. 66: A-weighted emission sound pressure level of QMX 280

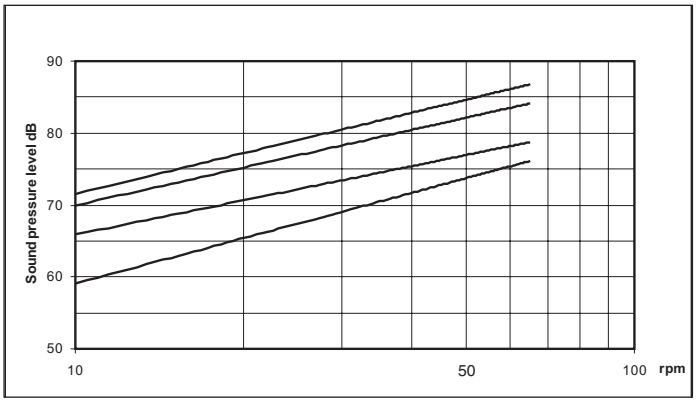


Fig. 68: A-weighted emission sound pressure level of QMX 400, 560 and 840

5 Increased robustness

Option 0:
QMX has un-coated piston assemblies and DLC-coated piston rings as standard.

Option C:
DLC-coated piston assemblies shall always be used in the following cases:
- If operating speed ≤3rpm
- If operating parameters (eg. viscosity) are unclear

DLC-coated piston assemblies is recommended to be used in the following cases:
- When replacing an existing MB-motor with a QMX-motor
- If there is a risk for cavitation in combination with chock loads

6 Through hole kit

Option 0:
Motor delivered without through hole.
Option H:
Through hole kit enables e.g. flushing through the motor to the driven machine or the possibility to draw electric cables through the motor. The through hole kit is prepared for rotation speed sensor.

Dimension drawing
See chapter*18: Related documents*

Ordering code
See ordering code for Hägglunds QMX section *1: Ordering code*.

Table 10: Dimensions QMX with through hole kit

	L1			
	Splines		Shrink disk	
Motor	mm	in	mm	in
QMX 280	490	19.29	599	23.58
QMX 400	608	23.94	726	28.58
QMX 560	658	25.91	752	29.61
QMX 840	776	30.55	870	34.25
QMX 1120	894	35.20	988	38.90

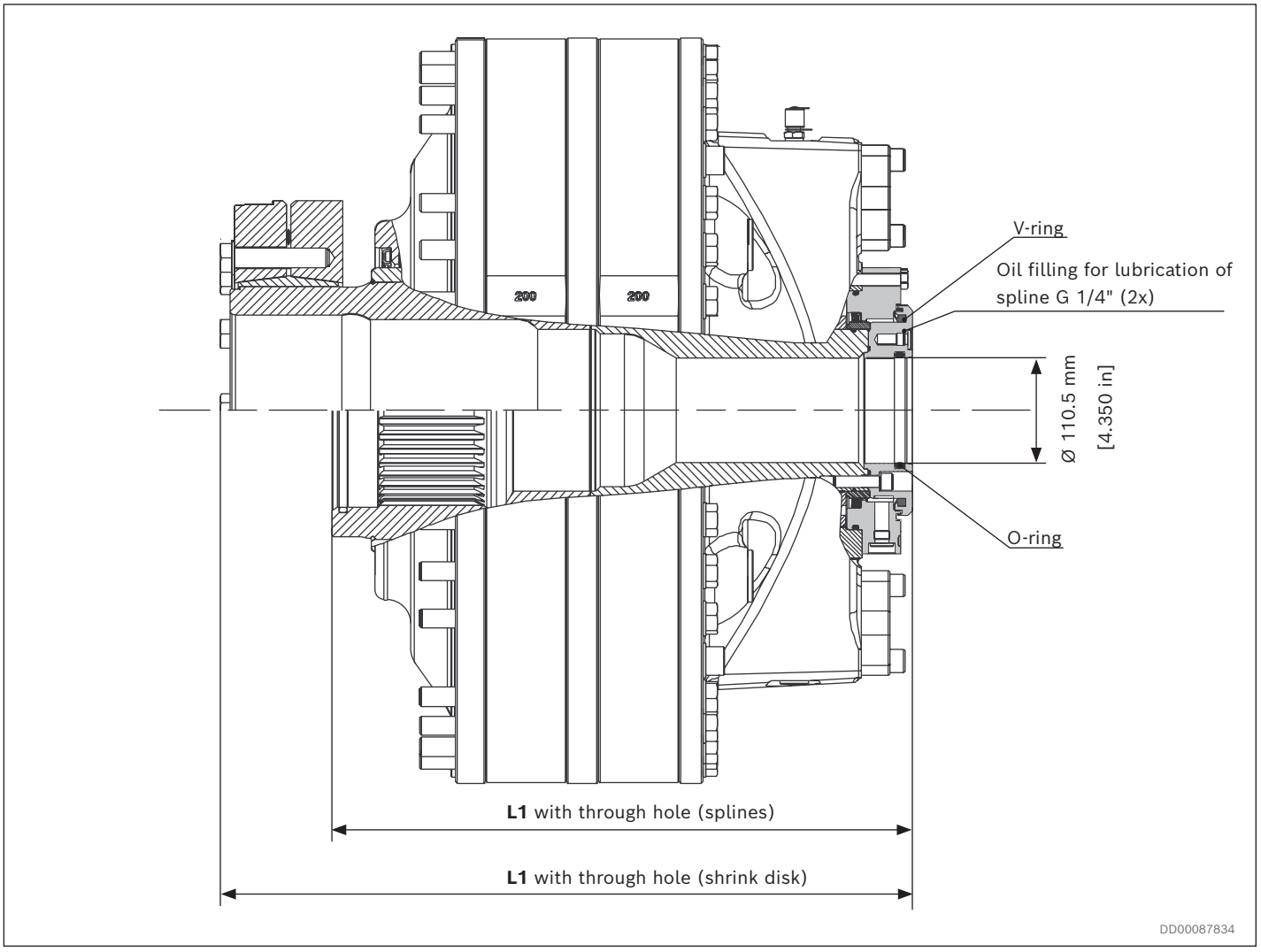


Fig. 69: Example: Hägglunds QMX 400 with through hole kit.

7 Type of seal

Option N:
NBR (Nitrile) Preferred alternative at low ambient temperatures and moderate case oil temperatures.
See section *4.2: General data*

Option V:
FPM (Viton) Preferred alternative at higher case oil temperatures, speed or freewheeling above 60 rpm or operating with fire resistant fluids. See section *4.2: General data*, *4.13.4: Power loss freewheeling* and *4.5: Hydraulic fluids*

8 Speed sensors

8.1 Inductive speed sensor SPDE

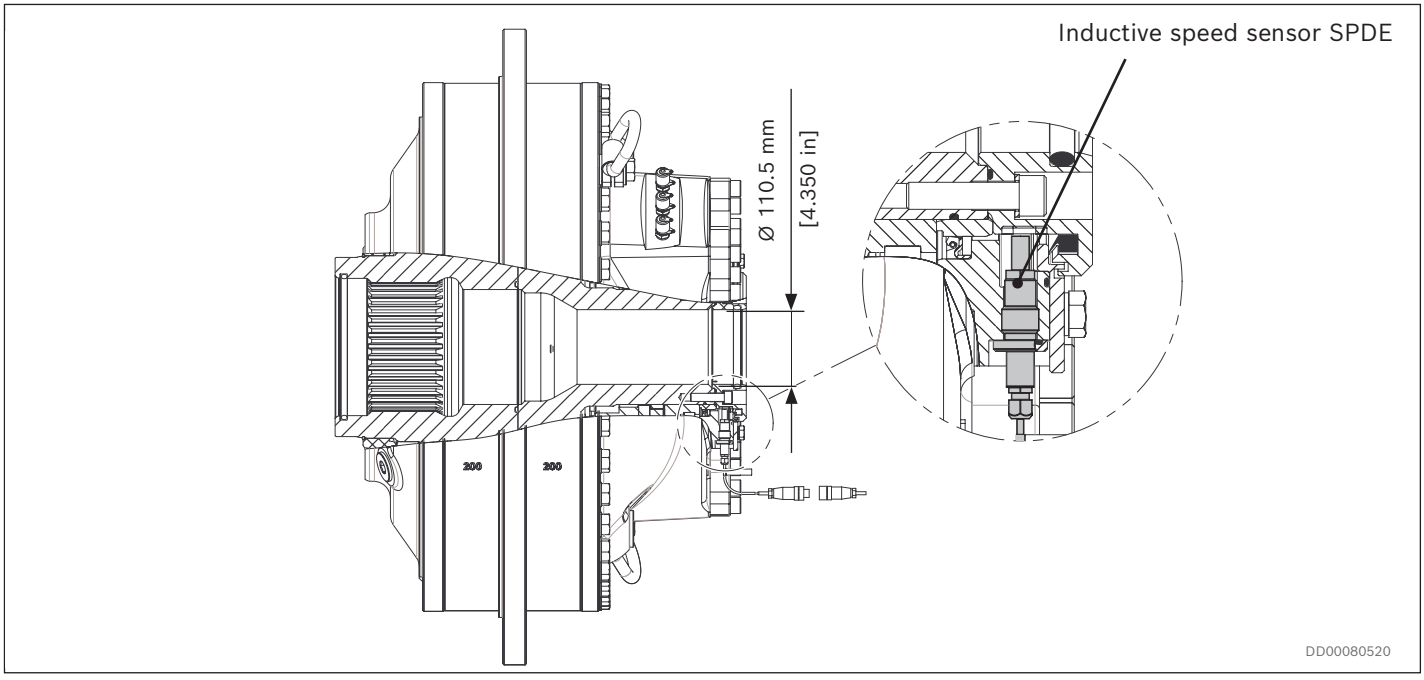


Fig. 70: Example inductive speed sensor SPDE with trough hole unit

For technical data, see document nr: **RE 15351**

Features

- Non-contact, wear free system
- Robust design
- ATEX/IECEx -version available
- Through hole version available
- 40 pulses per revolution

Description

Two types of sensors are available.

- The standard type has a PNP output for direct driving of load or digital input.
- The ATEX/IECEx type (explosion proof) needs an isolation amplifier outside explosive area.

The sensor is mainly intended for speed indication. Direction of rotation cannot be indicated.

Mounting is done by replacing a plug on the motor with the sensor and tighten to 35 Nm.

8.2 Speed sensor SPDC

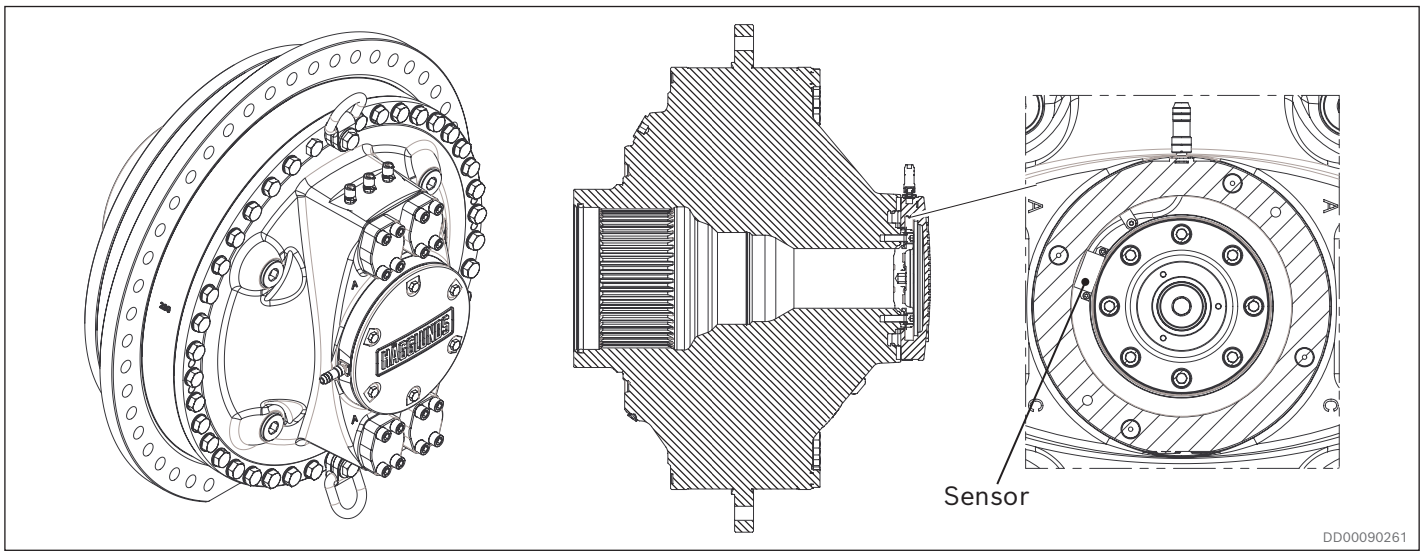


Fig. 71: No through hole

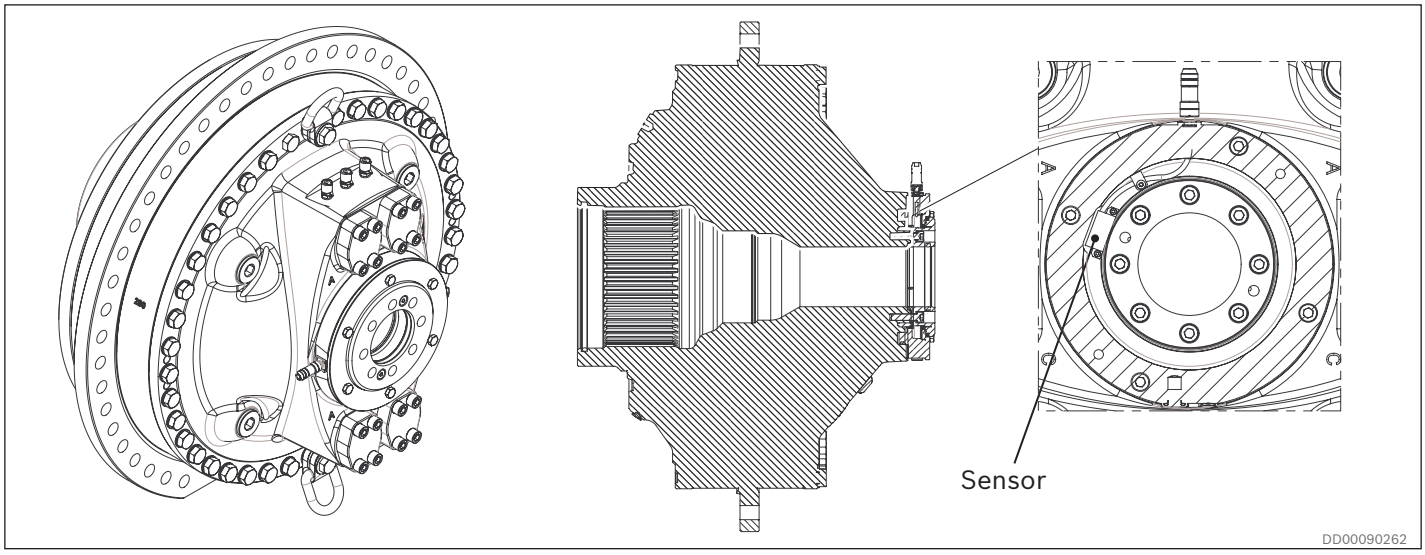


Fig. 72: With through hole

For technical data, see document nr: **RE 15350**

Features

- Possibility with through hole
- Slim design fully integrated in motors.
- Non-contact, wear free sensing system
- Possibility to read directions of rotation from sensor
- 1856 pulses per revolution for good speed control possibility
- Protection class IP67

Description

Speed sensing unit, Hägglunds SPDC, is a digital incremental encoder using magnetic sensing technology.

The sensor generates two square wave signals with 90° phase shift for detection of speed and direction of rotation.

8.3 Explosion proof speed sensor SPDB 2

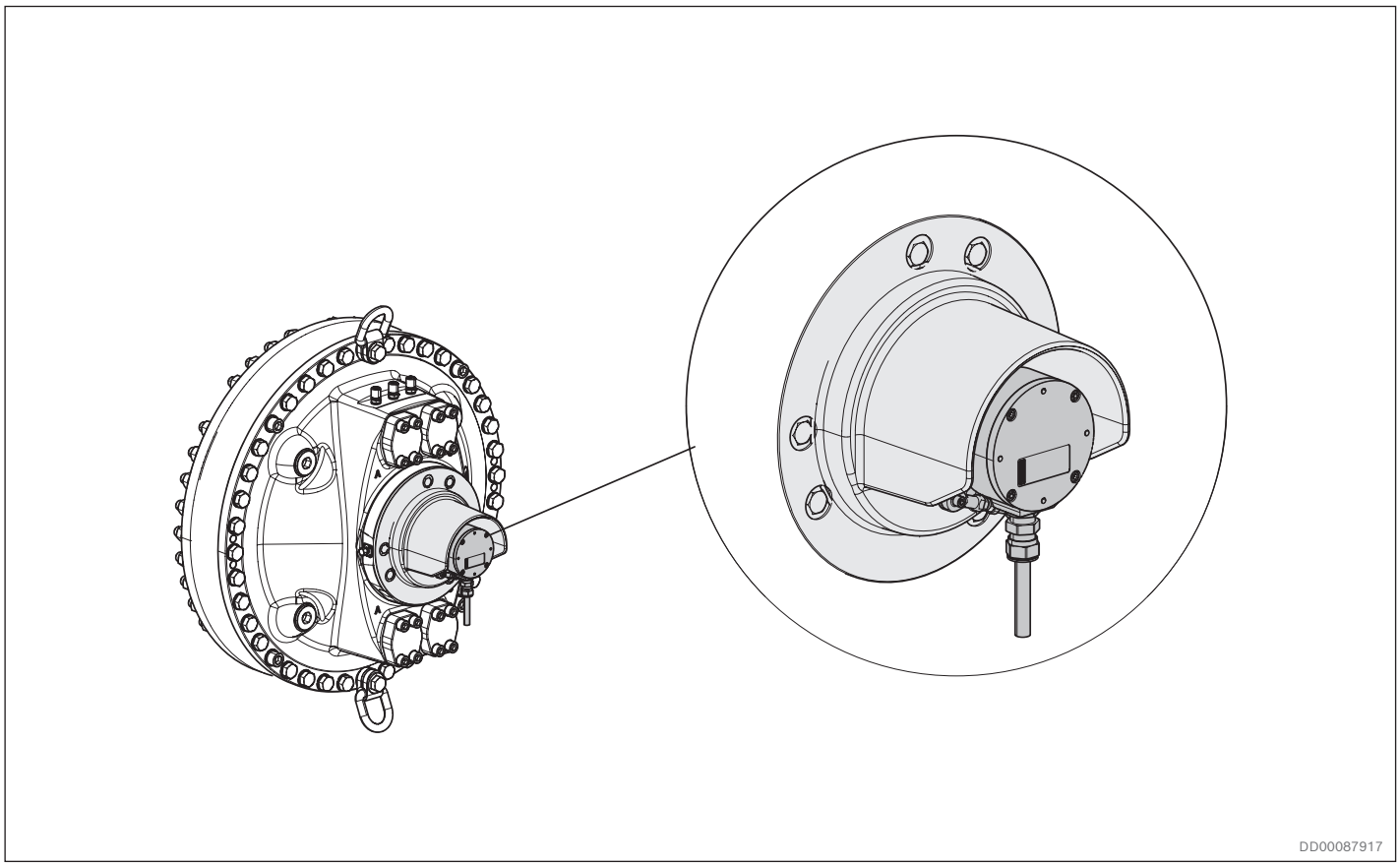


Fig. 73: SPDB 2

For technical data, see document nr: **RE 15352**

Features

- ATEX/IECEx approved
- 1000 and 3600 pulses per revolution for good speed control possibility.
- Possibility to read directions of rotation from sensor
- Sensor is equipped with zero pulse
- Protection class IP65
- Optional cable set with juction box to simplify connection

Description

Digital incremental hollow shaft sensor with torque arm mounting.

Recommendations:
1000 pulses for speed 6 rpm and above.
3600 pulses for speed below 6 rpm.

8.4 Absolute Rotary Encoder, ABRA

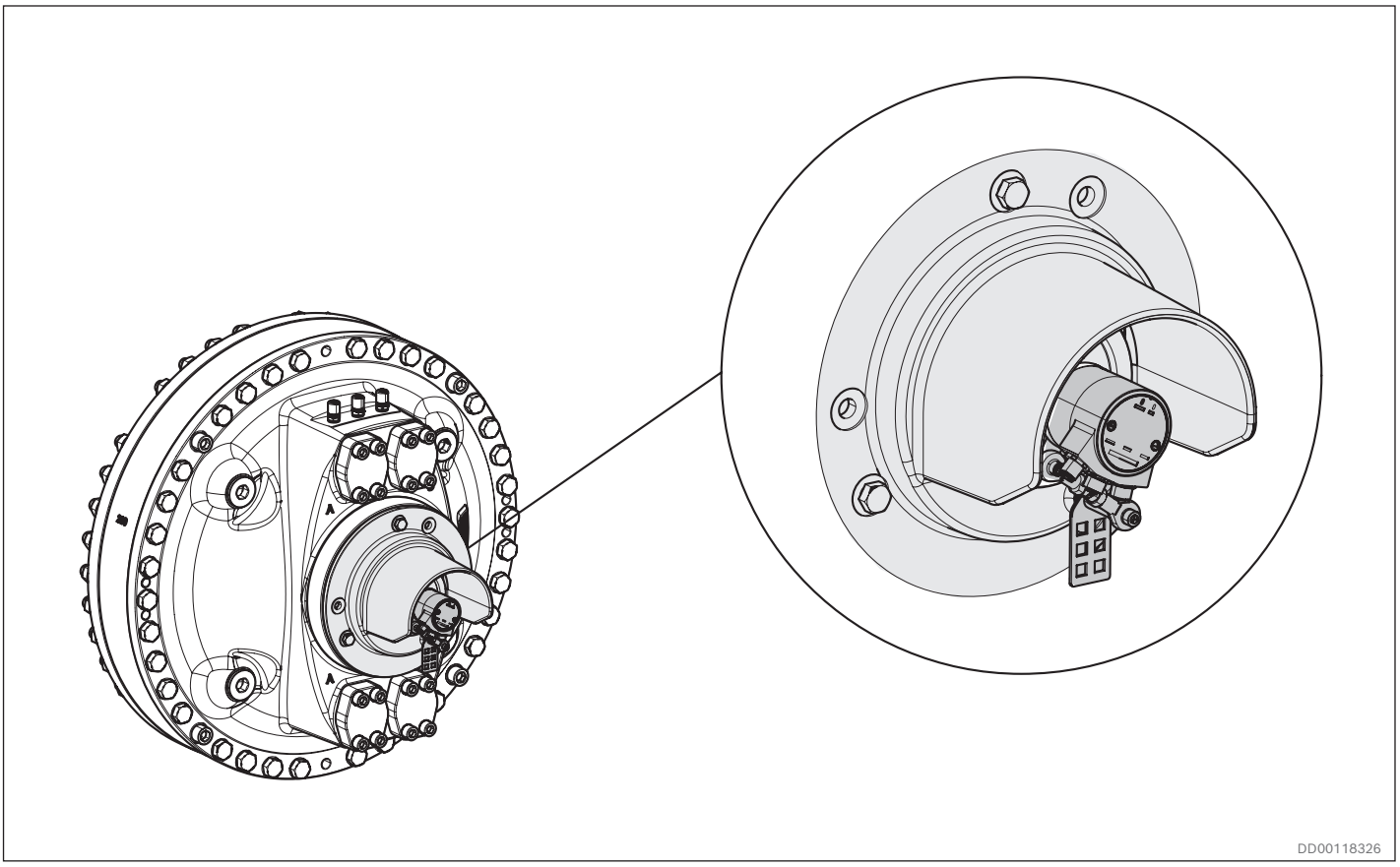


Fig. 74: Absolute Rotary Encoder, ABRA

For technical data, see document nr: **RE 15367**

Features

- Robust with inductive sensing principle
- 8192 steps per revolution for good positioning capabilities
- Singleturn or multiturn
- Many communication interfaces available to facilitate system integration
- Encoder protection class IP67 / IP66

Description

The advantage of absolute rotary encoders is that they, unlike incremental encoders, directly outputs the exact position of the shaft as soon as they are switched on. Every point of rotation has a unique position value and it can keep the position information even if power temporarily is lost, which means that there is no need to turn the shaft to a reference point to determine the position.

Note! Must be ordered separately!

9 Temperature sensor

Function

The temperature sensor is mounted in port T3, see *Fig. 76* and meassure fluid temperature in the motor case. The sensor element is a Pt100 resistance sensor, which change resistance in relation to the fluid temperature in the motor case

Table 11: Technical data, Pt 100/4-20 mA sensor

Sensor length l	60 mm (2.36“)
Process connection	G 1/4“ 100
Degree of protection	IP65
Ambient temperature	- 40...+85 ºC (-40...185 ºF)
Type of sensor element	Pt 100
Output	4-20 mA / 0..100 ºC (32...212 ºF)
Connector	DIN 43650 screw terminals
Cable connection	Pg9 cable Ø6-8 mm
Electrical connection	2-wire connection
Connection	Pin 1 - Ub Pin 2 – 4-20 mA output
Supply voltage Ub	7.5 - 30 VDC
Reverse polarity protection	Yes
Max, load	750 Ω at 24 V ((Ub - 7.5 V)/0.022)

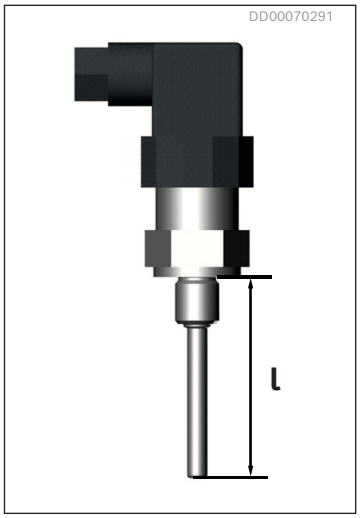


Fig. 75: Temperature sensor

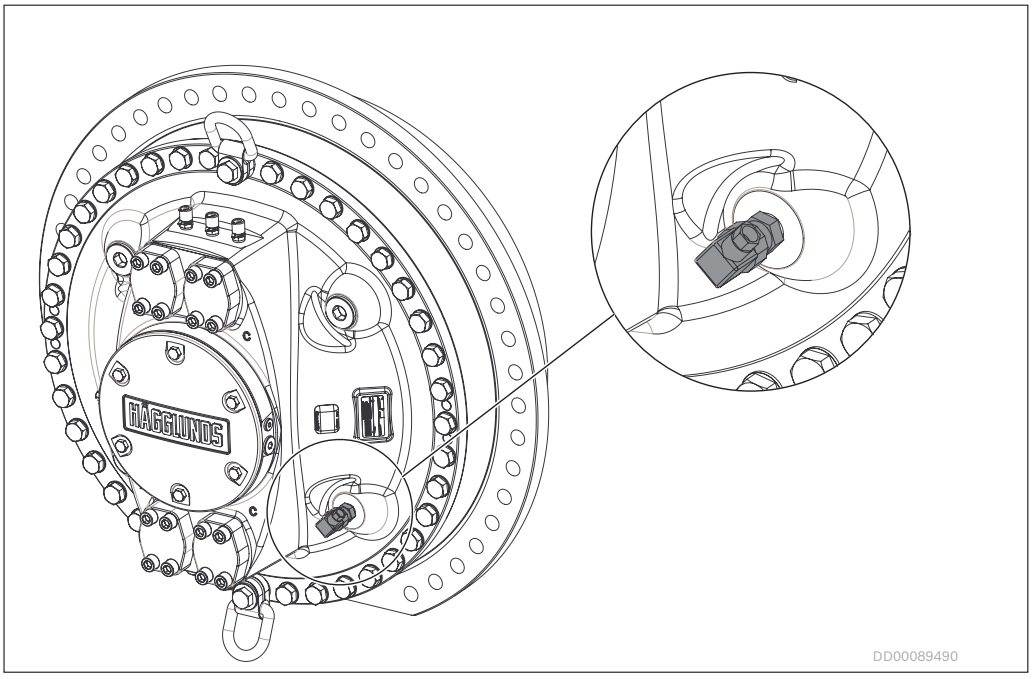


Fig. 76: Temperature sensor

10 Explosive environment

The motor can be adapted to work in hazardous areas. In order to comply with the requirements for certification particular components are needed.
Note! This has to be specified in the order information!

Table 12: Explosion protection information ATEX

Area of application according to ATEX directive 2014/34/EU	IM2, II2G, II2D, II3G, II3D
Protection of the motor by liquid immersion and constructional safety according to	EX h (EN ISO 80079-37.2016)
Maximum surface temperature	+ 135 ℃ (+275 ℉)
Temperature class	T4
Conforms to “Equipment and components intended for use in potentially explosive atmospheres and in underground mines”	EN ISO/IEC 80079-38.2016
ATEX Classification	II 2G Ex h IIC T4 Gb II 2D Ex h IIIC T135°C Db I M2 Ex h I Mb
Ambient temperature range	-20....+40 ℃ (-4....+104 ℉)

11 Painting system

Corrosion protection
The painting system of Hägglunds motors and accessories are avalible in three different corrosivity categories regarding corrosion protection in accordance with SS-EN ISO 12944:

- C3 - Corrosivity category Medium - which is recommended for normal urban and industrial atmosphere
- C5 - Corrosivity category Very High - which is recommended for coastal environment with high salinity or aggressive industrial atmosphere
- CX - Corrosivity category Extreme - which is recommended for extreme industrial areas, offshore environment with high salinity or extreme humidity

12 Painting colour

Colour
Standard colour for Hägglunds motors and accessories is orange (RAL 2002)

13 Special index motors

13.1 Special index 11: Motor for submerged applications

- Available for QMX 280 to QMX 1120.
- Available for splines motors
- Motor partly sealed off
- Max depth in water is 70 m (230 ft)

Recommended to be flange mounted with o-ring according to *Fig. 77* For dimension drawing for design of flange, see section *18 Related documents*.

To be ordered separately

- O-rings, see *Table 13*
- Suitable painting must be ordered separately. Corrosivity category CX or C5 is recommended for submerged usage, see *11: Painting system*.

Table 13: Material ID O-ring

Motor type	Material ID
QMX 280	R913018686
QMX 400	
QMX 560	R913018686 + R939006997
QMX 840	
QMX 1120	

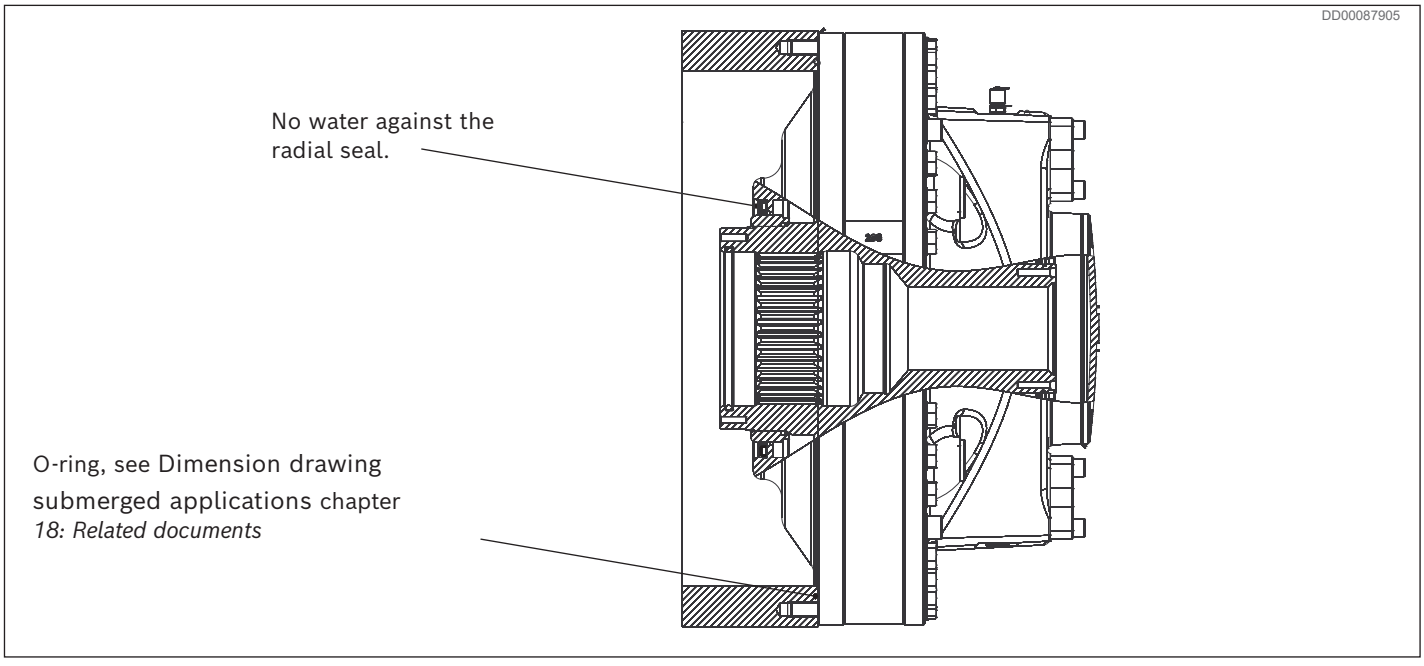


Fig. 77: QMX motor for submerged application

13.2 Special index 33: Motor for marine environment

- Available for QMX 280 to QMX 1120
- Motor equipped with shaft side wear ring of stainless steel
- Motor equipped with test connections of stainless steel

To be ordered separately

- Suitable painting must be ordered separately. Corrosivity category CX or C5 is recommended for submerged usage, see *11: Painting system*

14 Dimensions / Interface

14.1 Dimensions

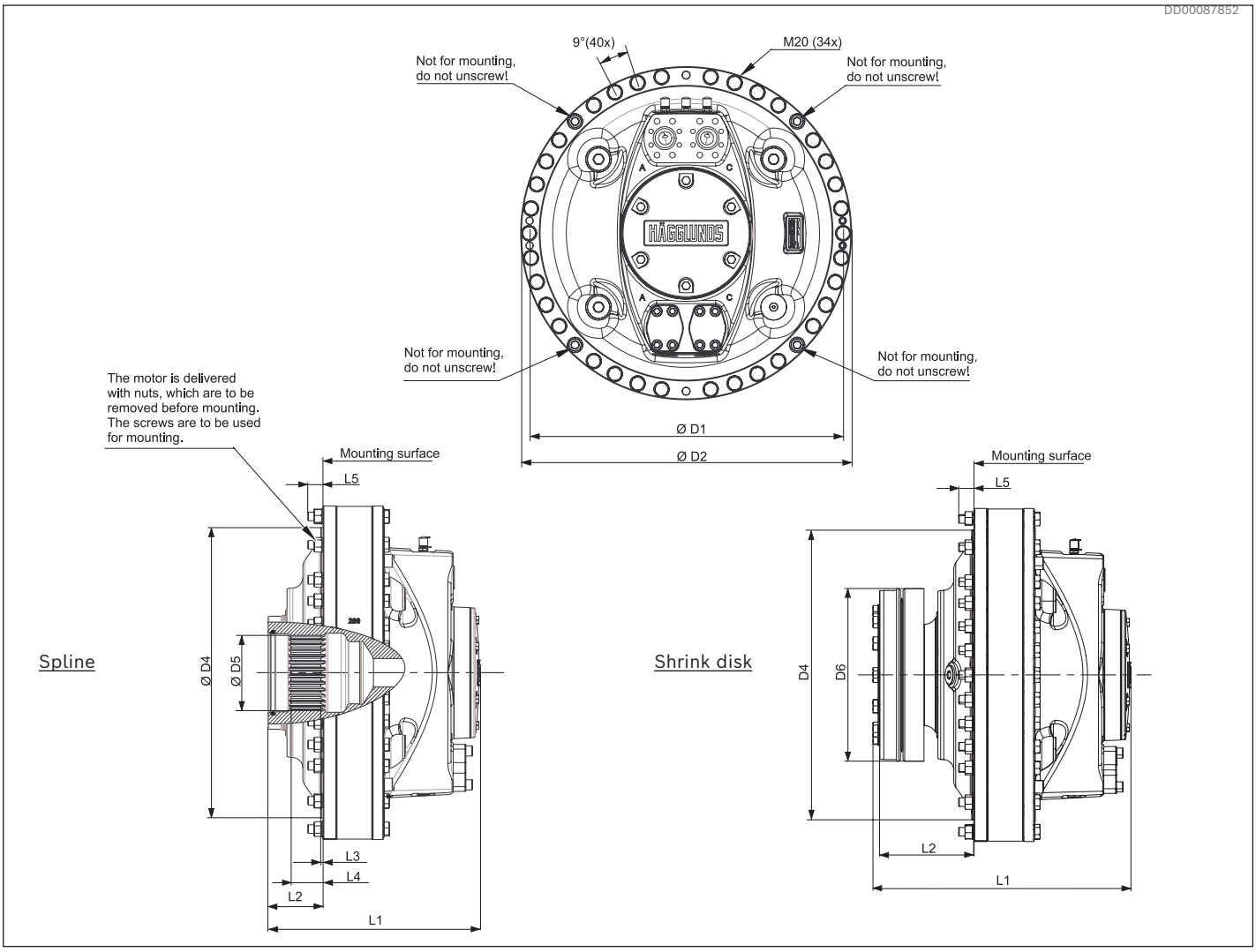


Fig. 78: QMX 280

Table 14: Dimensions QMX 280

			Dimensions			
			Splines		Shrink disk	
			mm	in	mm	in
D1	Pitch diameter		742	29.21	742	29.21
D2	Outer diameter		782	30.79	782	30.79
D4	Guide diameter		680	26.77	680	26.77
D5	Spline size	DIN 5480	N200 x 5 x 30 x 38 x 9H		-	-
D6	Shrink disk diameter		-	-	405	15.94
L1	Total length	***Without through hole***	494	19.45	603	23.74
L2	Length to hollow shaft		130	16.38	227	8.94
L3	Length to spline end		6	0.24	-	-
L4	Length to spline		76	2.99	-	-
L5	Protruding length of screws		36	1.42	36	1.42

For dimensional drawings QMX 280, see chapter *18: Related documents*

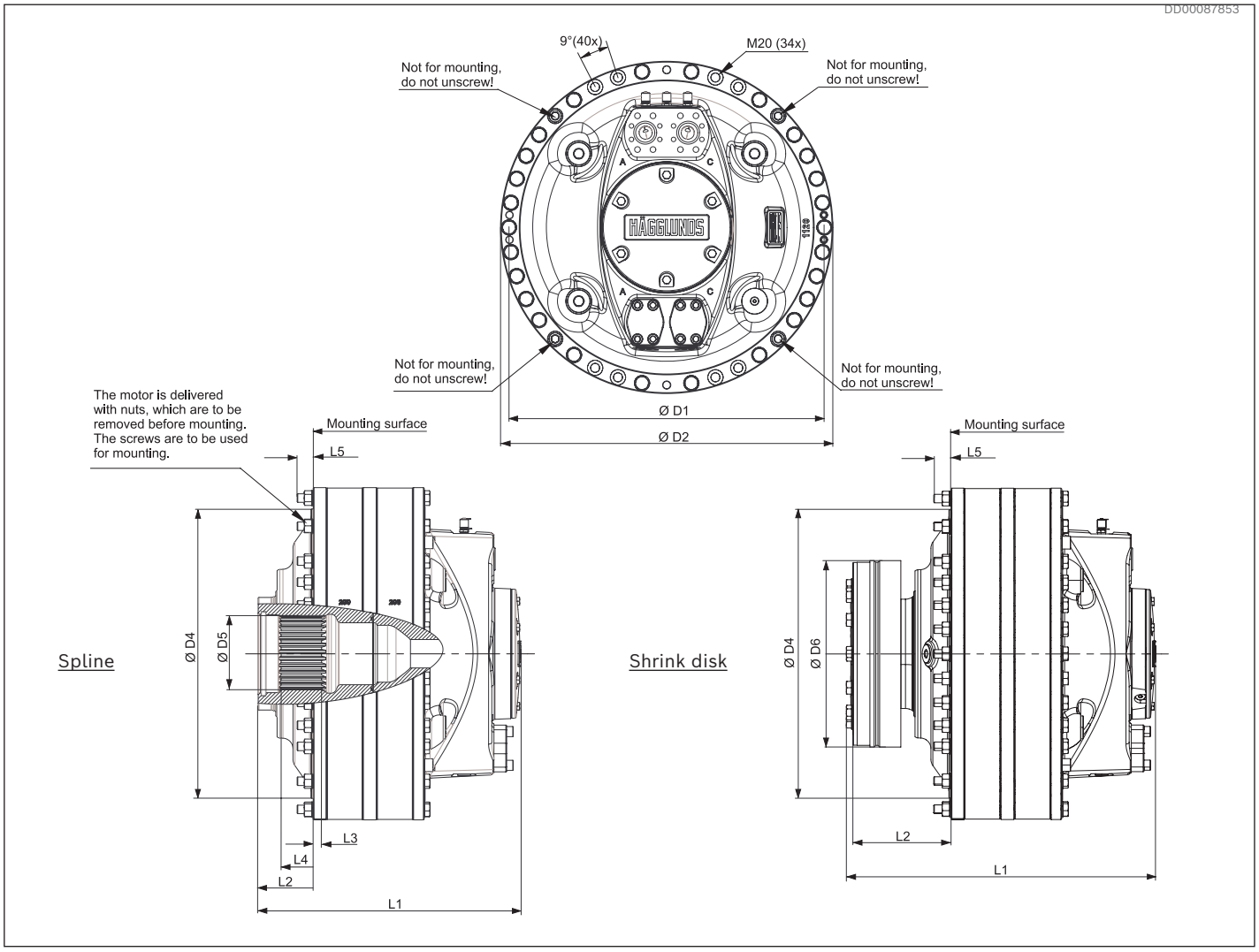


Fig. 79: QMX 400

Table 15: Dimensions QMX 400

			Dimensions			
			Splines		Shrink disk	
			mm	in	mm	in
D1	Pitch diameter		742	29.21	742	29.21
D2	Outer diameter		782	30.79	782	30.79
D4	Diameter of guide edge		680	26.77	680	26.77
D5	Spline size	DIN 5480	N200 x 5 x 30 x 38 x 9H		-	-
D6	Shrink disk diameter		-	-	440	17.32
L1	Total length	***Without through hole***	612	24.09	729	28.70
L2	Length to hollow shaft		129	5.08	237	9.33
L3	Length to spline end		20	0.79	-	-
L4	Length to spline		75	2.95	-	-
L5	Produting length of screws		38	1.50	38	1.50

For dimensional drawings QMX 400, see chapter *18: Related documents*

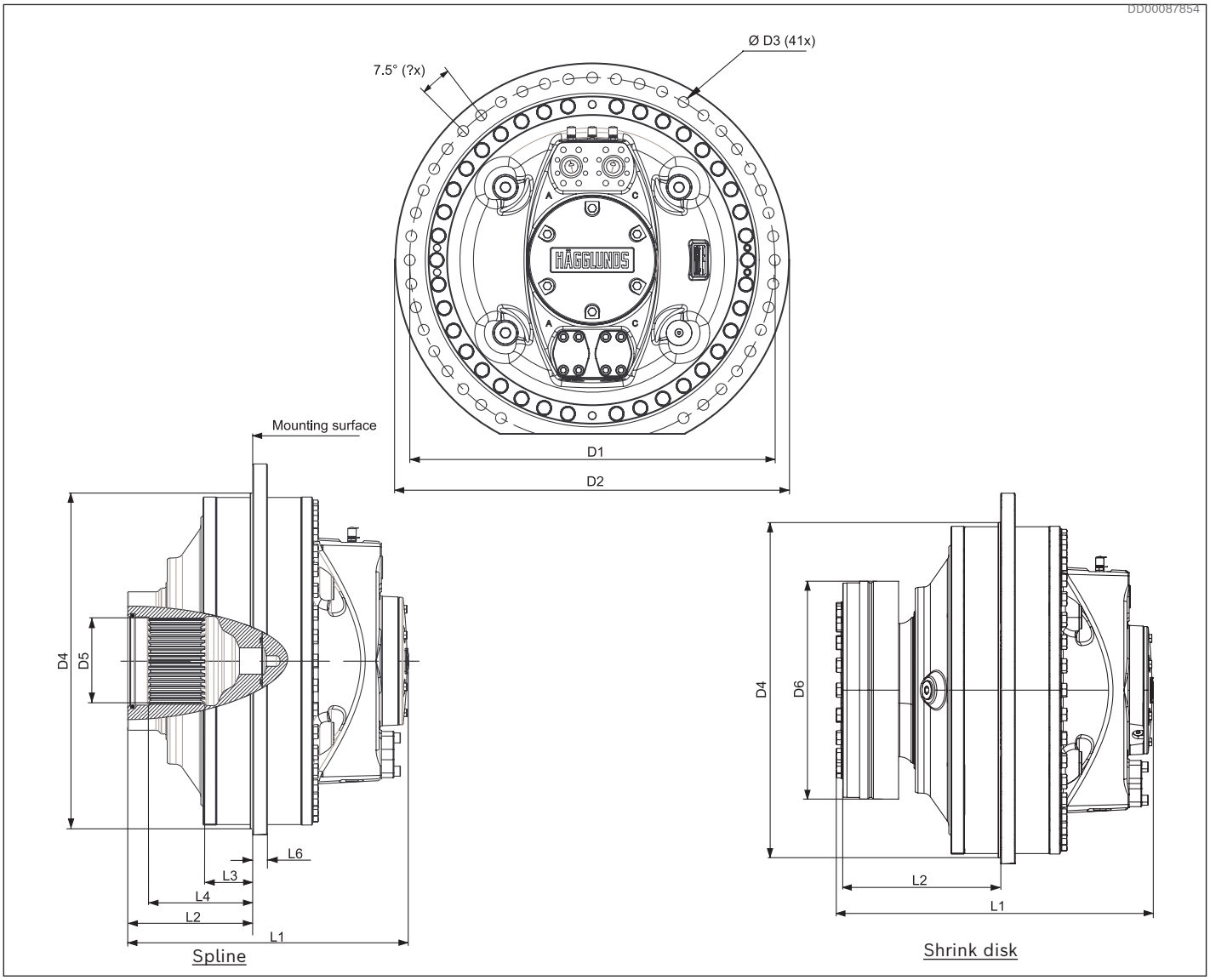


Fig. 80: QMX 560

Table 16: Dimensions QMX 560

			Dimensions			
			Splines		Shrink disk	
			mm	in	mm	in
D1	Pitch diameter		870	34.25	870	34.25
D2	Outer diameter		940	37.01	940	37.01
D3	Screw hole		26	1.02	26	1.02
D4	Guide diameter		800	31.50	800	31.50
D5	Spline size	DIN 5480	N260 x 5 x 30 x 50 x 9H		-	-
D6	Shrink disk diameter		-	-	520	20.47
L1	Total length	***Without through hole***	662	26.06	756	29.76
L2	Length to hollow shaft		298	11.73	381	15,00
L3	Length to spline end		124	4.88	-	-
L4	Length to spline		244	9.61	-	-
L6	Thickness of mounting ring		35	1.38	35	1.38

For dimensional drawings QMX 560, see chapter *18: Related documents*

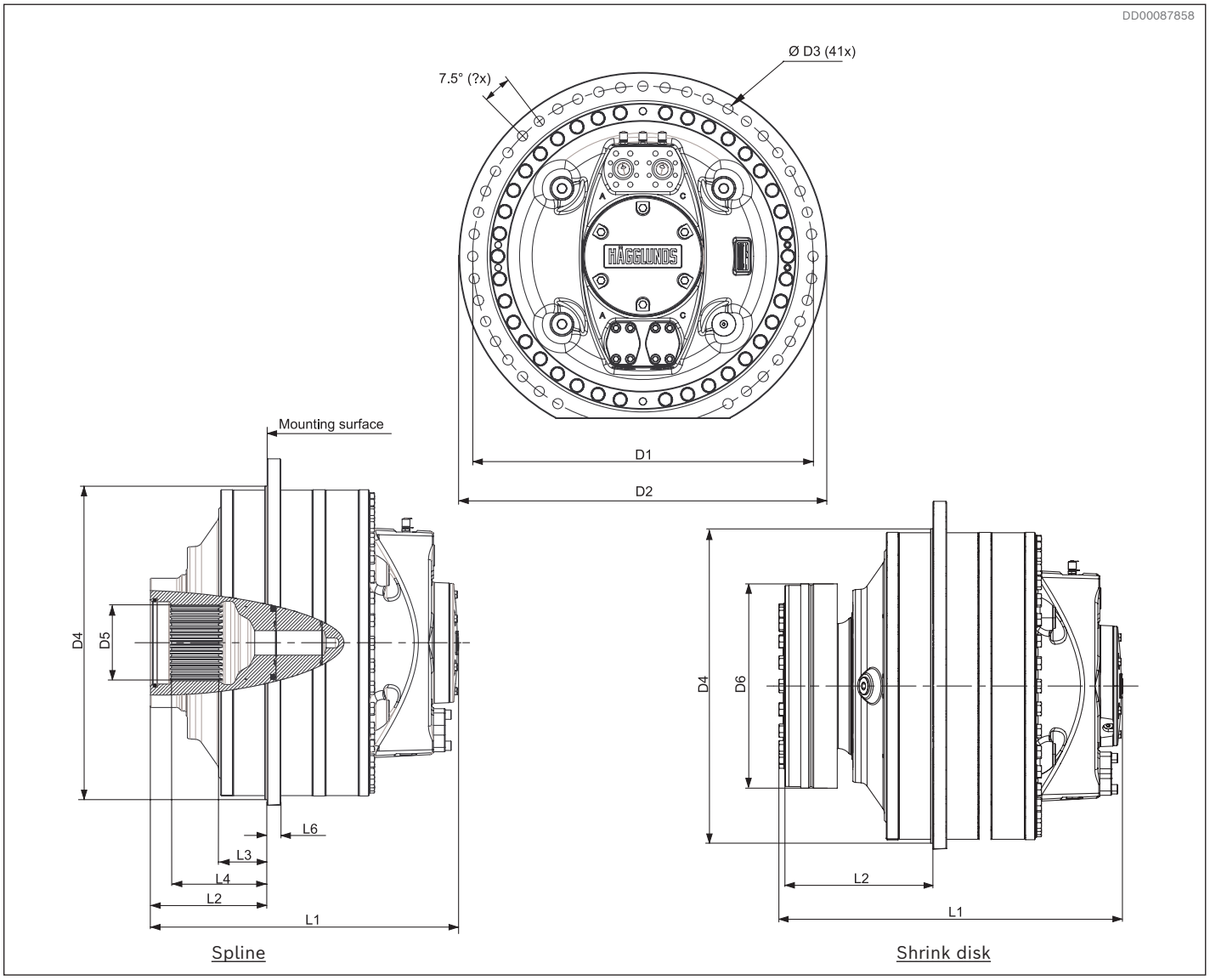


Fig. 81: QMX 840

Table 17: Dimensions QMX 840

		Dimensions			
		Splines		Shrink disk	
		mm	in	mm	in
D1	Pitch diameter	870	34.25	870	34.25
D2	Outer diameter	940	37.01	940	37.01
D3	Screw hole	26	1.02	26	1.02
D4	Guide diameter	800	31.50	800	31.50
D5	Spline size DIN 5480	N260 x 5 x 30 x 50 x 9H		-	-
D6	Shrink disk diameter	-	-	520	20.47
L1	Total length ***Without through hole***	780	30.71	874	34.41
L2	Length to hollow shaft	298	11.73	381	15,00
L3	Length to spline end	124	4.88	-	-
L4	Length to spline	244	9.61	-	-
L6	Thickness of mounting ring	35	1.38	35	1.38

For dimensional drawings QMX 840, see chapter *18: Related documents*

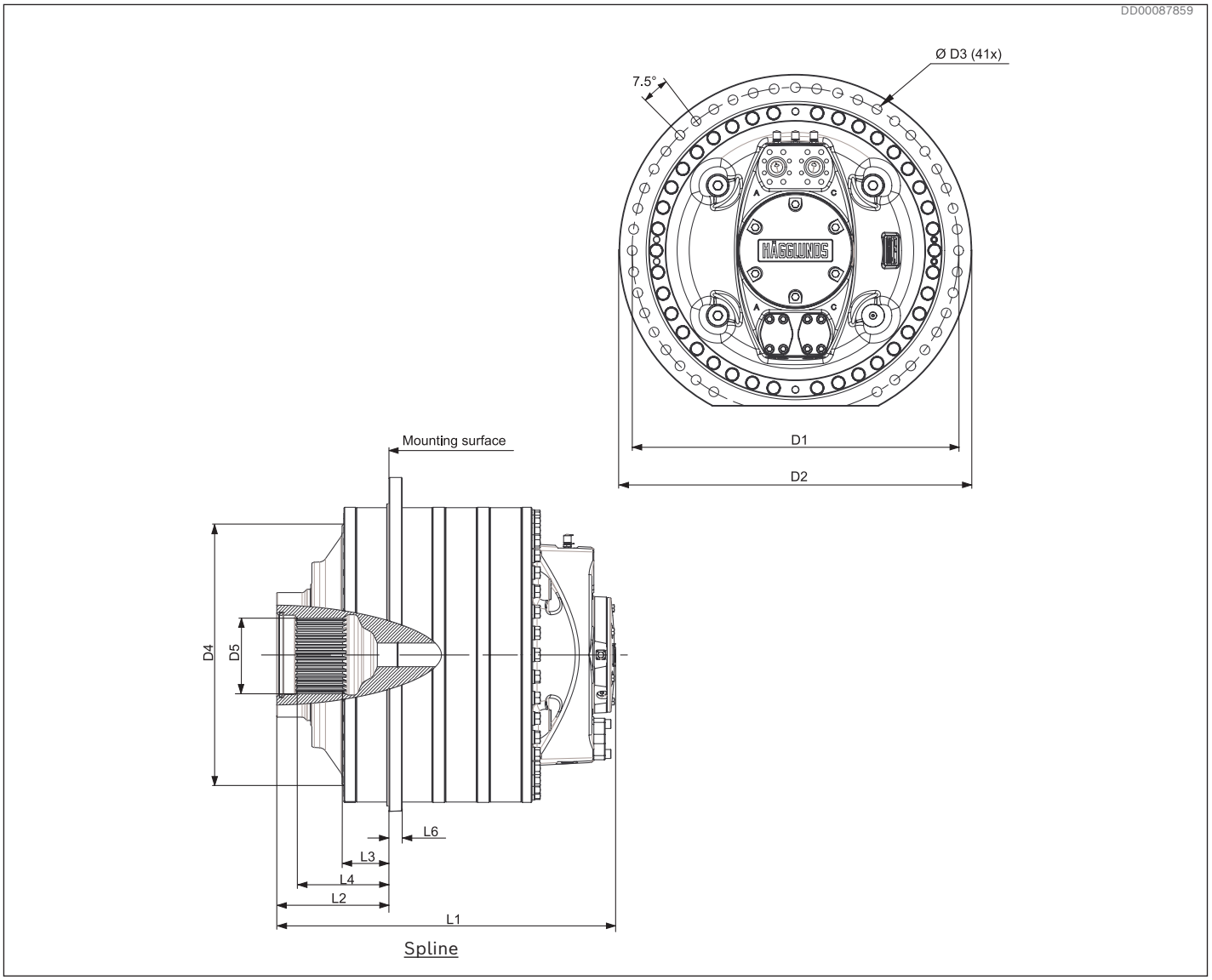


Fig. 82: QMX 1120

Table 18: Dimensions QMX 1120

		Dimensions Splines	
		mm	**in**
D1	Pitch diameter	870	34.25
D2	Outer diameter	940	37.01
D3	Screw hole	26	1.02
D4	Guide diameter	800	31.50
D5	Spline size DIN 5480	N260 x 5 x 30 x 50 x 9H	
L1	Total length ***Without through hole***	898	35.35
L2	Length to hollow shaft	298	11.73
L3	Length to spline end	124	4.84
L4	Length to spline	244	9.57
L6	Thickness of mounting ring	35	1.38

For dimensional drawings QMX 1120, see chapter *18: Related documents*

15 Mounting alternatives

15.1 General information

With splines for flange or torque arm mounting.
The splines shall be lubricated, and filled with hydraulic oil at assembly, or filled with transmission oil from the connected gearbox. To avoid wear in the splines, the installation must be within the specified tolerances in *Fig. 83*
For requirements of spline shaft, see chapter *18: Related documents*

Table 19: Mounting flange dimensions

	øi	
QMX 280/400	680	+0,20 +0,05
QMX 560/840/1120	800	+0,20 +0,05

15.1.1 Flange mounting with splines

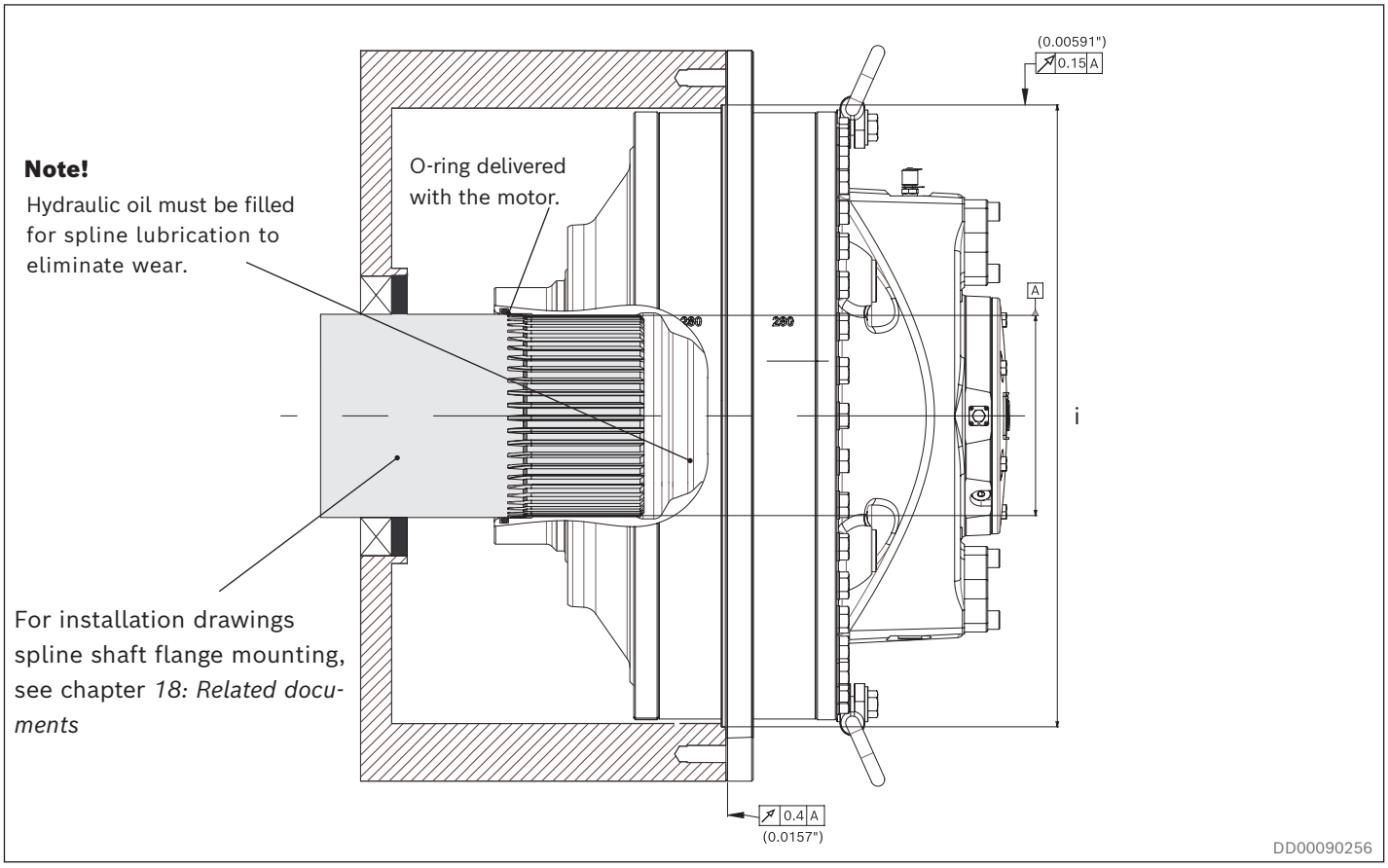


Fig. 83: Flange mounting for QMX 280 to QMX 1120.

Features

- Possibility to use the motor as a one side shaft support bearing.
- Oil lubrication of splines give no wear.
- Easy mounting of motor to driven shaft.

Note!
Flange mounting gives high risk for overloading of motor main bearings. Always check that the shaft and motor bearings are statically determined.

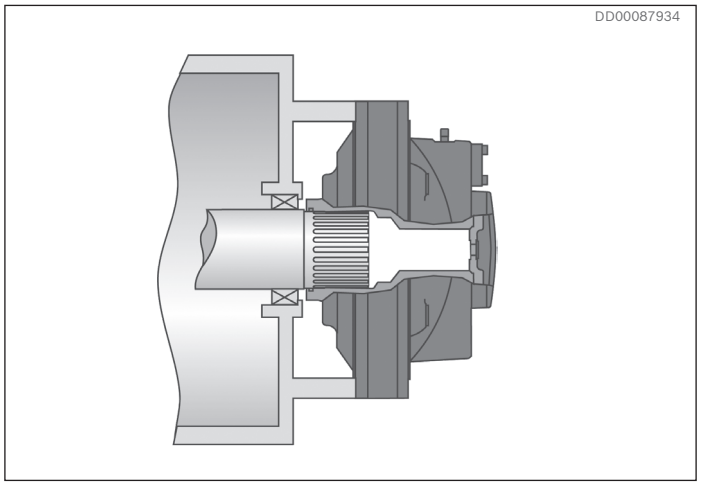


Fig. 84: Flange mounted motor with splines and low radial load from driven shaft.

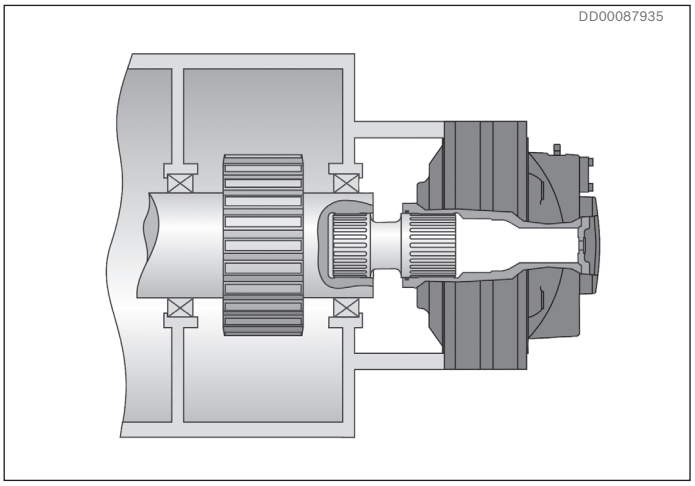


Fig. 85: Flange mounted motor with splines to avoid high radial load from driven shaft.

Table 20: Recommended material in the spline shaft

Drive	Steel with yield strenght
Unidirectional drive	Rel_{min} = 450 N/mm² (65 000 lb/ft²)
Bidirectional drive	Rel_{min} = 700 N/mm² (101800 lb/ft²)

Table 21: Spline designation shaft

	Spline				
Frame size	**QMX 280**	**QMX 400**	**QMX 560**	**QMX 840**	**QMX 1120**
Designation: Standard DIN 5480	W200x5x30x38x9H		W260x5x30x50x9H		

15.1.2 Torque arm mounting with splines

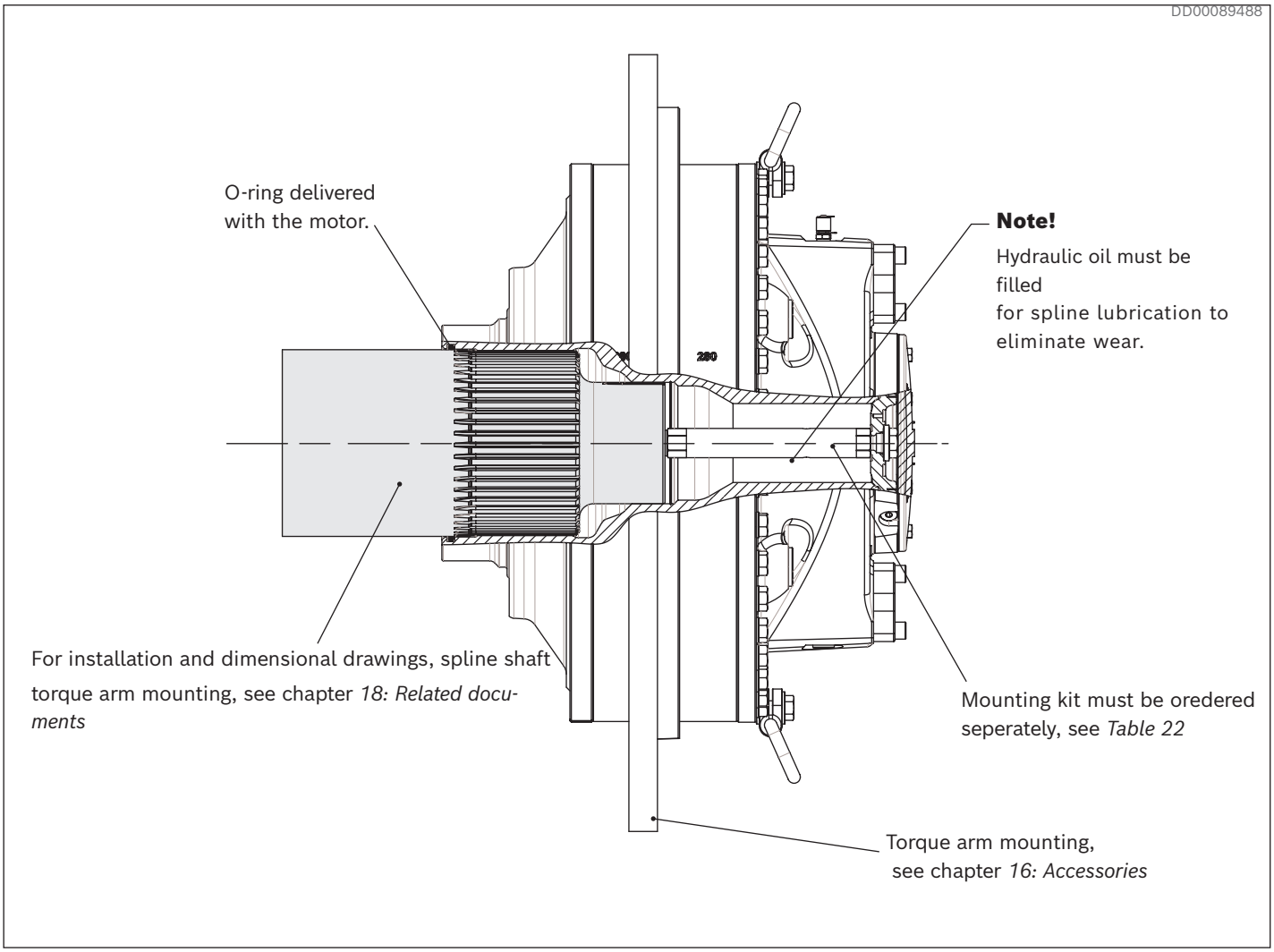


Fig. 86: Torque arm mounting motor with splines

Recommended material in the shaft, see *Table 20*.
Spline designation shaft, see *Table 21*.

Table 22: Material ID mounting kit for QMX 280 to QMX 1120

Motor type	**Material ID Mounting kit** (Must be ordered separatly)
QMX 280	R939002612
QMX 400	R939002613
QMX 560	R939002614
QMX 840	R939002615
QMX 1120	R939055284

15.1.3 Torque arm mounting on plain shaft

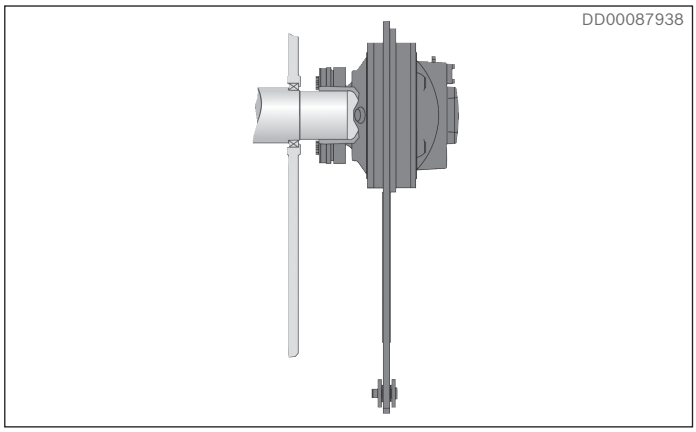


Fig. 87: Torque arm mounted motor with shrink disk.

Dimensions and material for shaft end, plain shaft

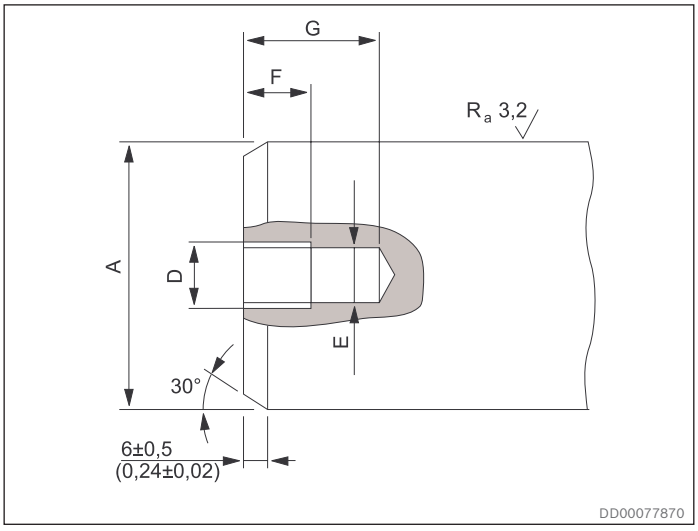


Fig. 88: Shaft end, normally loaded

Design of driven shaft end on normally loaded shaft
In drives with only one direction of rotation and/or load where the stresses in the shaft are moderate, the shaft can be plain.

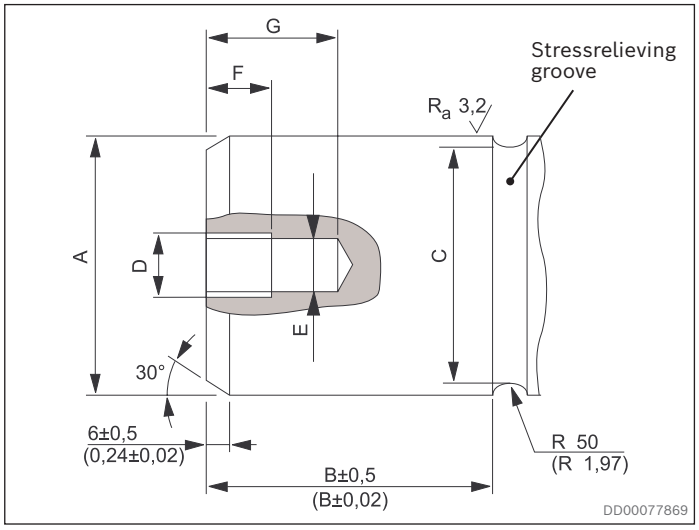


Fig. 89: Shaft end, heavily loaded

Design of driven shaft end on heavily loaded shaft.
Where the driven shaft is heavily loaded and is subject to high stresses, for example for changes in the direction of rotation and/or load, it is recommended that the driven shaft should have a stress relieving groove.

Table 24: Threads for assembly tool (plain shaft)

Measures	Dimensions, threads for assembly tool			
D	M20		UNC 5/8"	
E	>17 mm	0,67 in	>13,5 mm	0,53 in
F	25 mm	0,98 in	22 mm	0,87 in
G	50 mm	1,97 in	30 mm	1,18 in

Table 25: Recommended material in the shaft

Drive	Steel with yield strenght
Unidirectional drive	Rel_{min} = 300 N/mm²
Bidirectional drives	Rel_{min} = 450 N/mm²

Table 23: Shaft recommendations

Dim		QMX 280		QMX 400		QMX 560/840		QMX 1120 with coupling adapter	
A	**mm**	ø180	-0,014 -0,054	ø200	-0,015 -0,061	ø260	-0,017 -0,069	ø340	-0,018 -0,075
	in	ø7,0866	-0,00055 -0,00215	ø18,1102	-0,00059 -0,00240	ø10,2362	-0,00067 -0,00272	ø13.3858	-0,00068 -0,00292
B	mm	106		117		153		215	
	in	4,17		4,61		6,02		8.46	
C	mm	174		194		254		334	
	in	6,85		7,64		10,00		13.15	

Note! The dimensions are valid at +20 °C (68 °F)

16 Accessories

16.1 Torque arms

Mounting alternatives

Dimensions, techical data, order code and material ID for torque arms, see separate data sheet: **RE 15355**

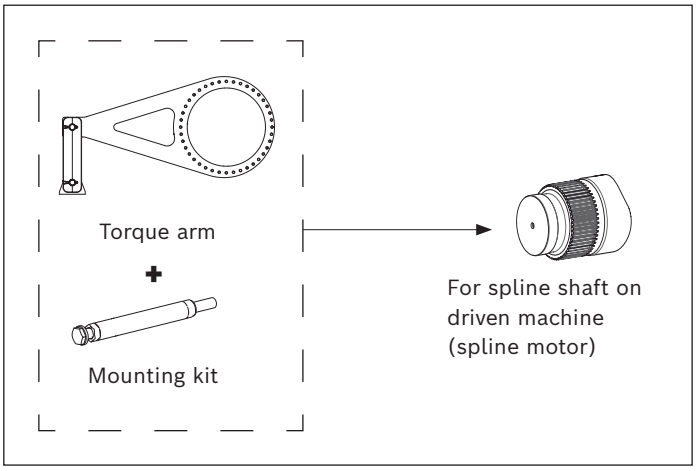


Fig. 90: Single ended torque arm mounting for spline shaft

Features

- Easy mounting i.e. no alignment problems.
- Quick mounting of motor to driven shaft
- Robust torque-transmitting.
- Controlled external forces on driven shaft.
- Space saving. i.e. close mounting to the driven machine.

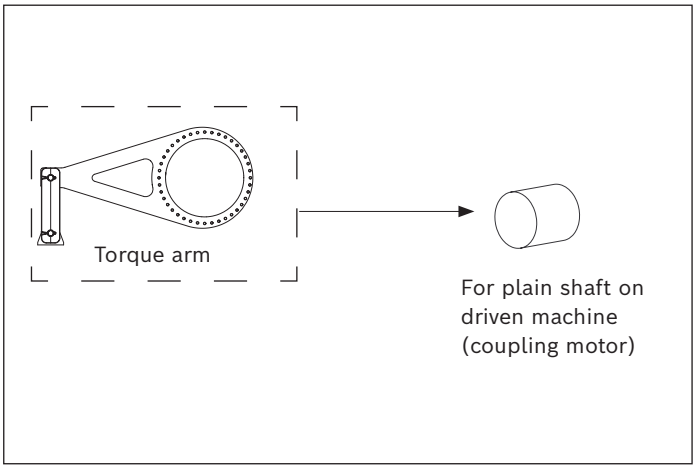


Fig. 91: Single ended torque arm mounting for plain shaft

Features

- Easy mounting i.e. no alignment problems.
- Simplified machining of customer shaft.
- Controlled external forces on driven shaft.

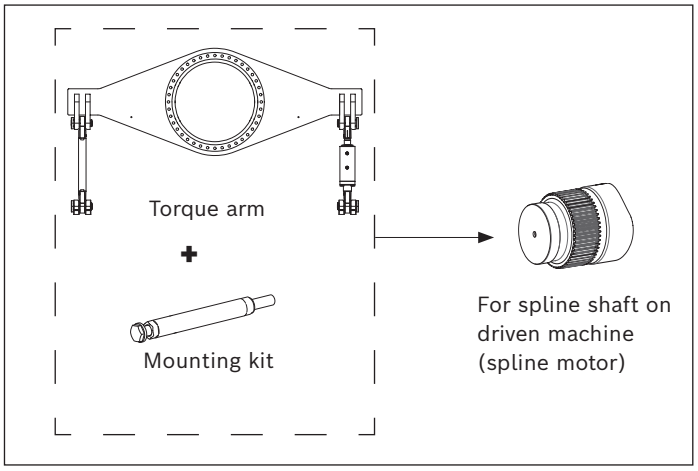


Fig. 92: Double ended torque arm mounting for spline shaft

Features

- Easy mounting i.e. no alignment problems.
- Quick mounting of motor to driven shaft
- Robust Torque-transmitting.
- Reduction of external forces on driven shaft.

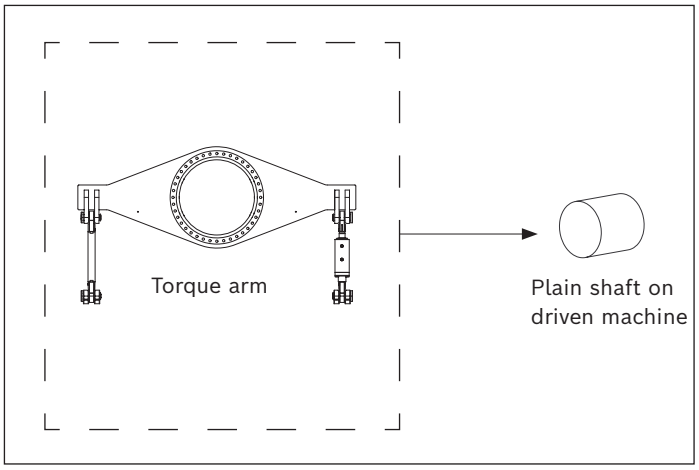


Fig. 93: Double ended torque arm mounting with plain shaft

Features

- Easy mounting i.e. no alignment problems..
- Simplified machining of customer shaft.
- Reduction of external forces on driven shaft.

16.2 Flushing and early warning kit

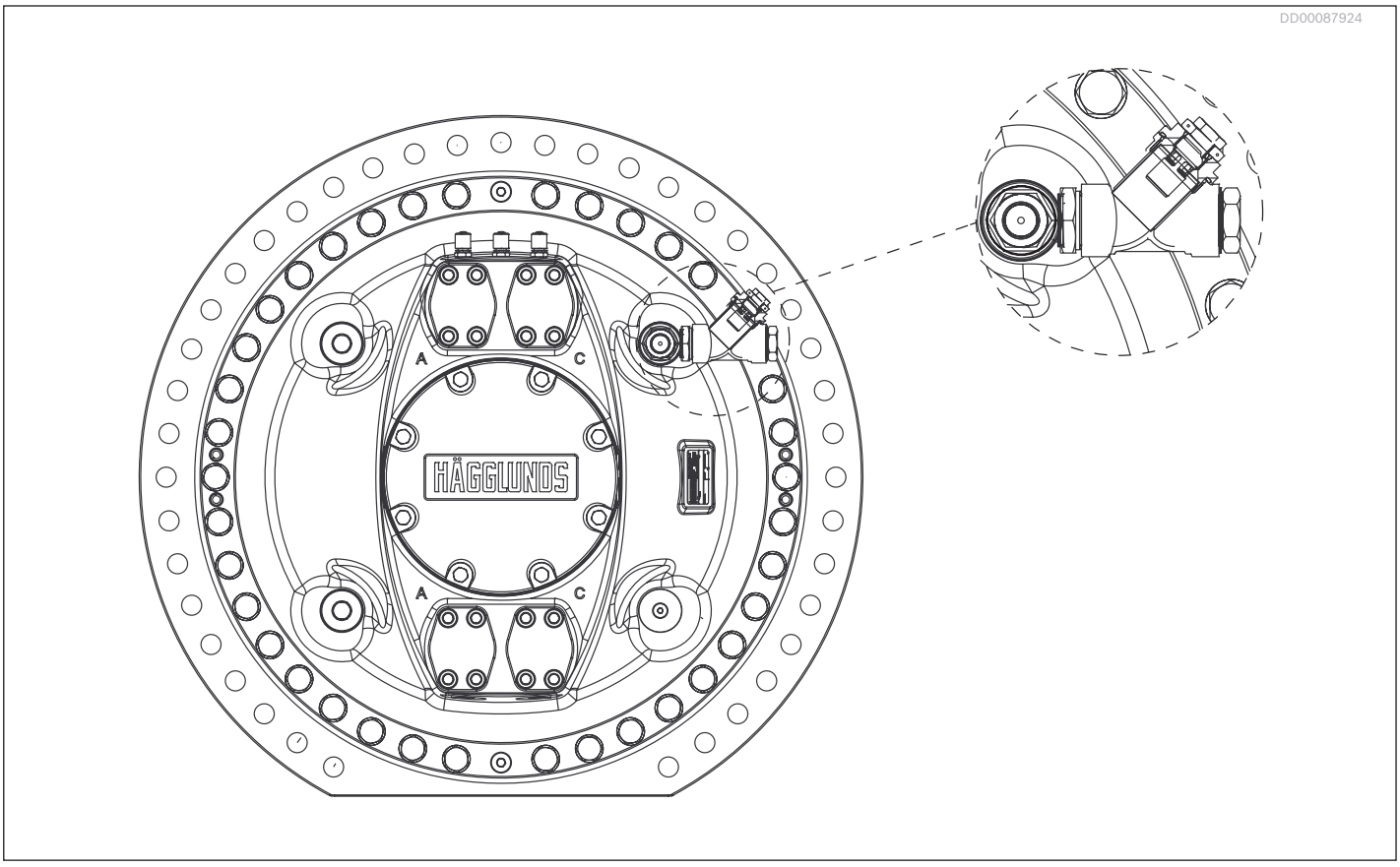


Fig. 94: Magnetic plug mounted on QMX

For technical data, see document nr: **RE 15359** (not available yet. Please contact your Bosch Rexroth representative)

For inspection and maintenance routines, see Installation and maintenance manual: **RE 15428-WA-A**.

Features

- Easy inspection of motor condition
- Early detection of potential failures

Description

The flushing set is basically a magnetic plug installed in the drain line. By regularly inspecting the magnetic plug a malfunction of the hydraulic motor can be detected and corrected and a total breakdown can be avoided. It can be used for Hägglunds QMX 280 to QMX 1120.

16.3 Coupling adapter for QMX 1120

The coupling adapter includes shrink disk and adapter shaft. Mounting kit must be ordered separately.
The coupling adapter is designed for a plain driven shaft.

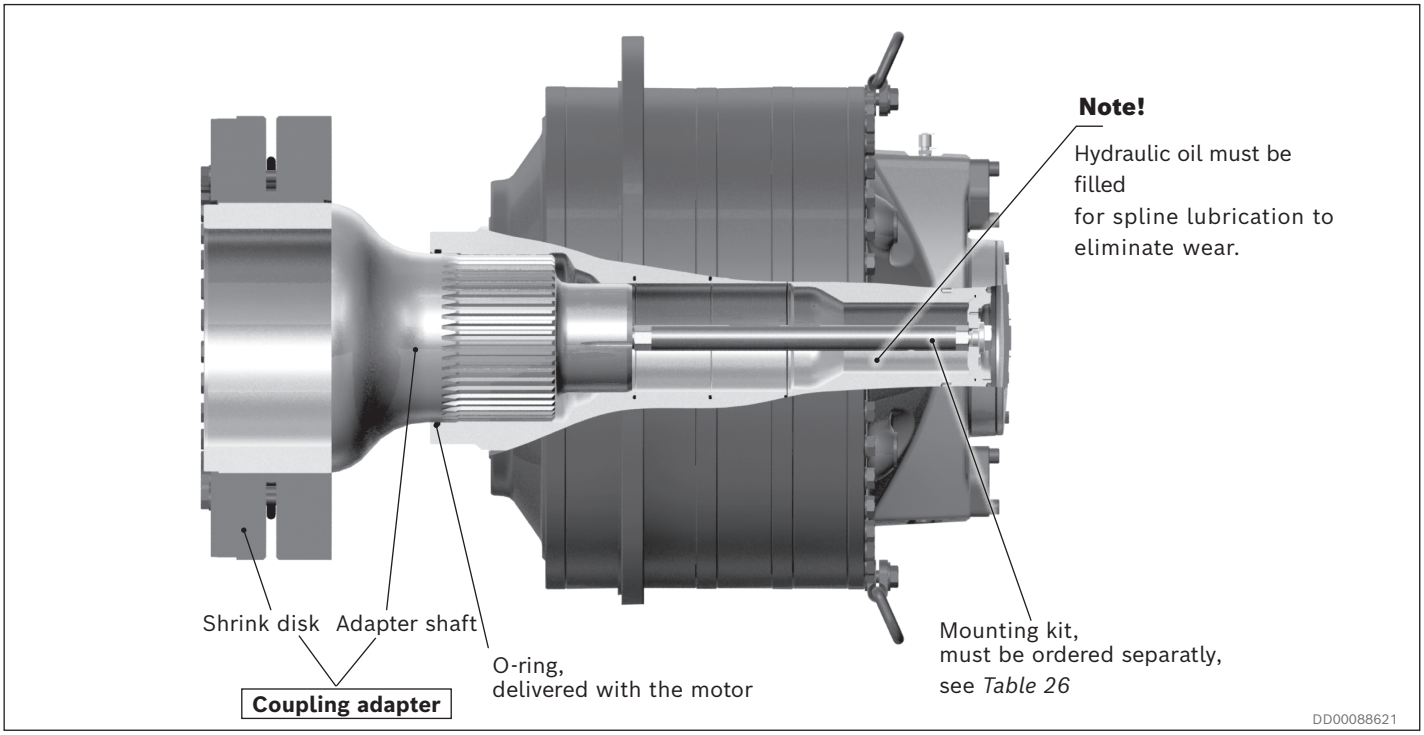


Fig. 95: QMX 1120 motor with coupling adapter

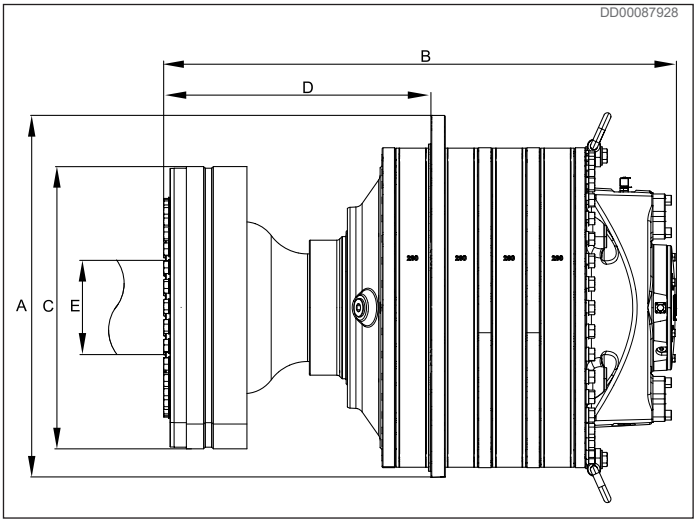


Fig. 96: QMX 1120 motor with coupling adapter

Table 26: Material ID coupling adapter and mounting kit

	Coupling adapter	**Mounting kit** (Must be ordered separatly)
Material ID Unidirectional and bidirectional drive	R939000328	R939055284

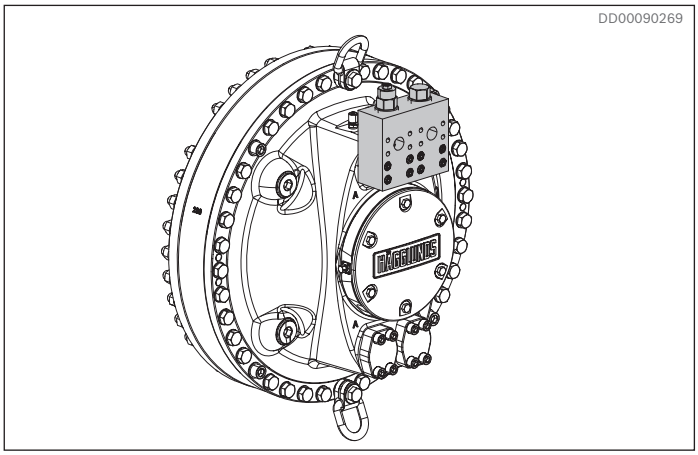
Table 27: Dimensions QMX 1120 motor with coupling adapter

A		**B**		**C**		**D**		**E**	
mm	**in**	**mm**	**in**	**mm**	**in**	**mm**	**in**	**mm**	**in**
940	57.48	1 251	47.68	690	28.35	650	30.43	340	14.17

For dimensional drawings QMX 1120 with coupling adapter, see chapter *18: Related documents*

16.4 Valves

16.4.1 Counter balance valve, VCBCA 480



For technical data, see document nr: **RE 15378**

Features

- Compact and robust design
- Mounted directly on Hägglunds motors
- Counter balance function with low pilot pressure
- Pilot pressure independent of load pressure

The VCBCA 480 valve is designed for Hägglunds motors and provides counter balance function on one or both motor lines depending on the configuration. The maximum operating pressure is 350 bar (5076 psi) and maximum flow 480 l/min (127 gpm).

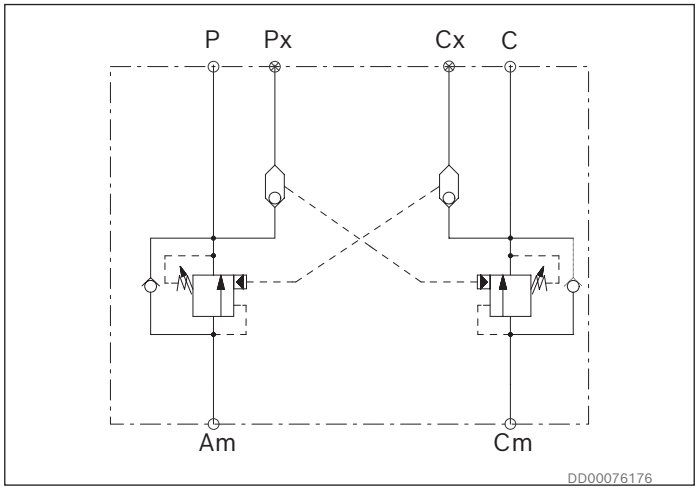
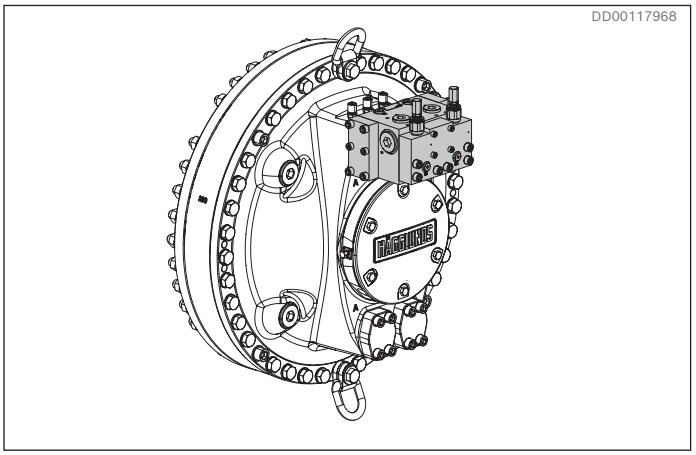


Fig. 97: Hydraulic circuit VCBCA 480 00 00 A

16.4.2 Cross-over valve, COCC 1200



For technical data, see document nr: **RE 15392**

Features

- Compact and robust design
- Mounted directly on Hägglunds motors
- Protects the motor from high pressure peaks
- Provides cavitation protection
- Oil exchange system for closed loop as option
- ATEX version as option

The valve COCC is designed for Hägglunds motors and provides cross-line relief at pressure shocks and cavitation protection. The relief valves has a standard setting of 350 bar (5076 psi) but can be delivered with preset level 280 bar (4061 psi), 300 bar (4351 psi) and 330 bar (4786 psi). Pressure setting is made without charge pressure.
The charge pressure relief valve has a standard setting of 15 bar (218 psi) but is adjustable down to 3 bar (44 psi).

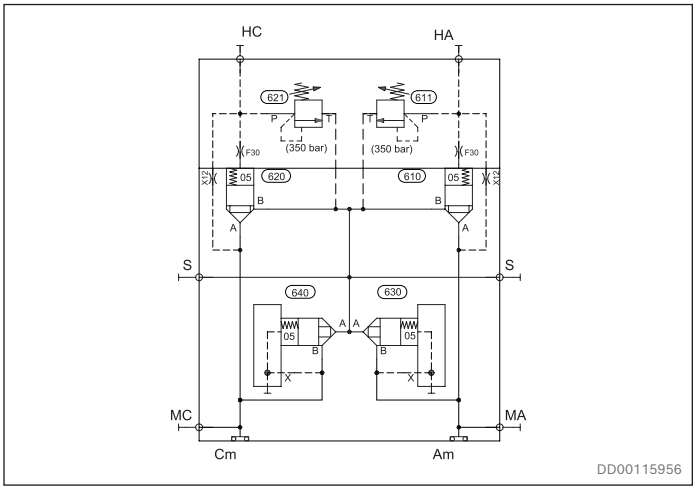
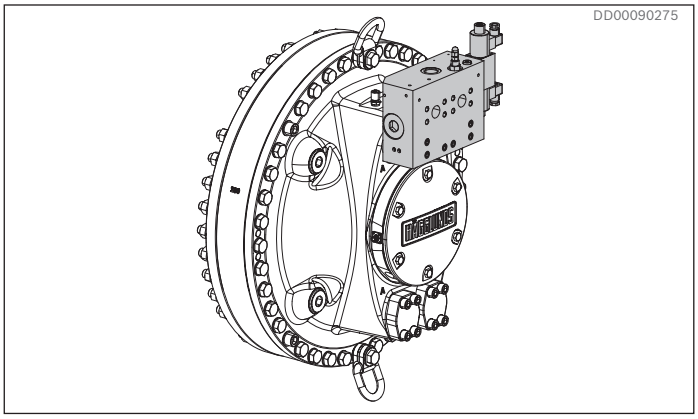


Fig. 98: Hydraulic circuit COCC 1000 1

16.4.3 Freewheeling valve VFWCB 600



For technical data, see document nr: **RE 15380**

Features

- Compact and robust design
- Multifunctional
- Mounted directly on Hägglunds motors
- Detent function on pilot valve
- Possible for remote control

The VFWCB 600 valve is designed for Hägglunds motors and provides freewheeling of the motor by means of disconnecting the motor from the main lines and connect both motor ports to T which has to be drained to tank.
The valve can be mounted directly onto the motor and can be used in both open and closed loop applications.
Maximum operating pressure is 350 bar (5076 psi) and maximum flow 1000 l(min (264 gpm). Nominal flow is 600 l/min (156 gpm).
The valve is available in three main configurations:

VFWCB 600 E Freewheeling valve electrically operated
VFWCB 600 H Freewheeling valve hydraulically operated
VFWCB 600 M Freewheeling valve manually operated

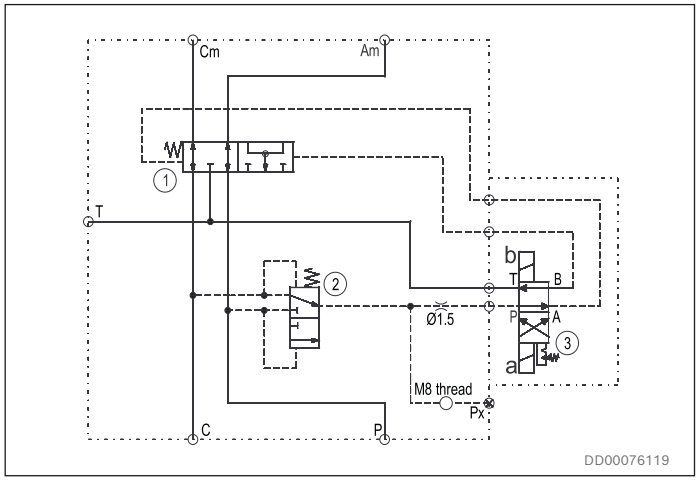
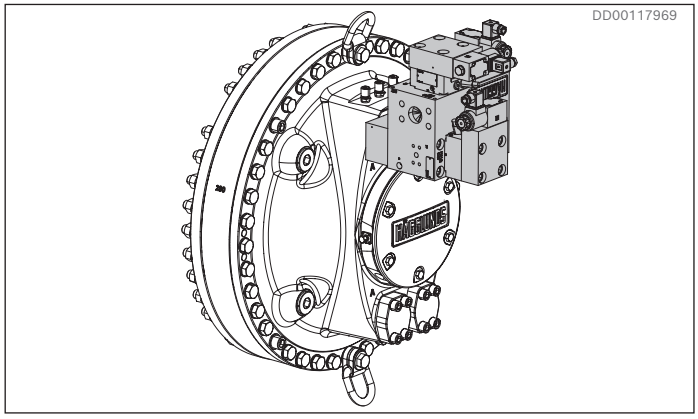


Fig. 99: Hydraulic circuit VFWCB 600

16.4.4 Hydraulic quick stop valve, VQCC 800



For technical data, see document nr: **RE 15374**

Features

- Compact and robust design
- Mounted directly on Hägglunds motors
- Fulfills performance level D category 3 according to EN ISO 13849
- Low pressure loss

The hydraulic quick stop valve VQCC 800 is designed to stop a roll mill without stopping the electric motor and without any need of a mechanical brake.
The quick stop valve VQCC 800 is equipped with two active stop cartridge valves to achieve performance level D and category 3 according to EN ISO 13849 and to fulfill DIN EN 1417.
The stop is done by blocking the oil flow from the Hägglunds hydraulic motor. A very short braking time is possible due to the small moment of inertia and very quick response from the hydraulic valve.

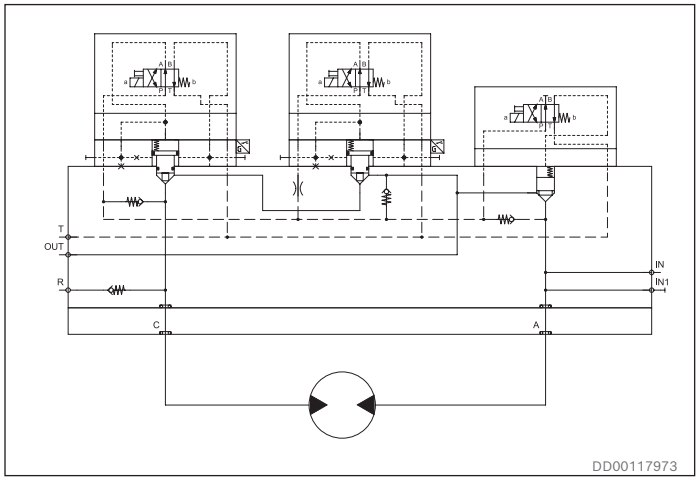


Fig. 100: Hydraulic circuit VQCC 800

16.5 Hägglunds BICA

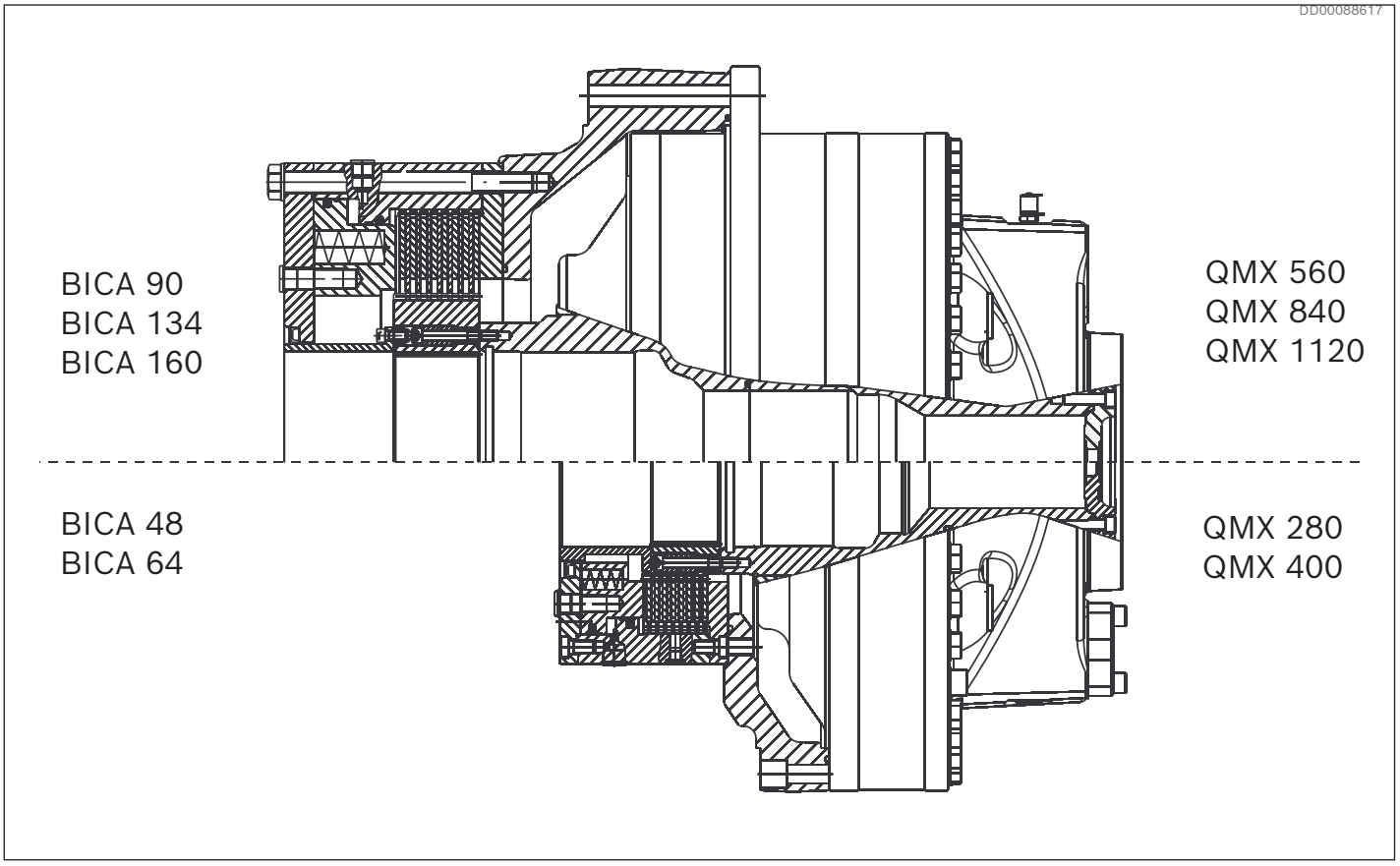


Fig. 101: QMX motor with BICA brake

For technical data, see document nr: **RE 15366**

Features

- Robust design, industrial HD design
- Possibility for on – off sensor
- Torque range between 48 – 160 kNm

Description

The brakes are designed for industrial applications together with Quantum motors. The brake is made for dry operation of the discs and is not allowed for hanging load applications. BICA brakes are designed to be mounted on motors QMX 280 - QMX 1120. The brake is designed to be used as parking brake only.

16.6 Kit for harsh and marine environment

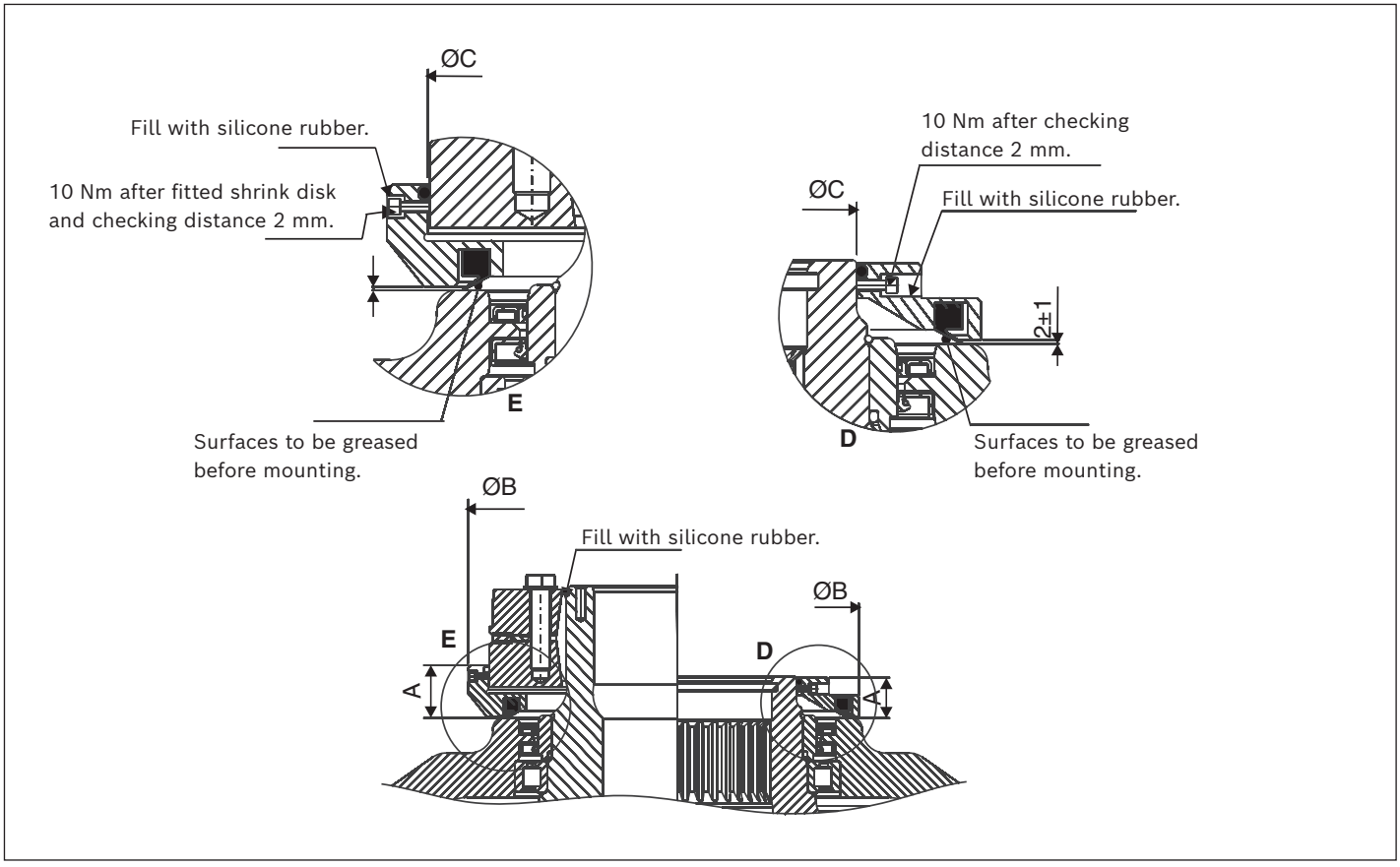


Fig. 102: Kit for harsh and marine environment

For technical data, see document nr: **RE 15364**

Features

- Protects the motor main seal
- Designed for harsh and marine environments
- Elongate the life time of the main sealings

Description

To protect the main seal, a kit with a v-ring can be mounted on the motors.

The kit is made for motors with splines and standard shrink disk coupling or hydraulic shrink disk.

17 Circuit design

17.1 Closed circuit

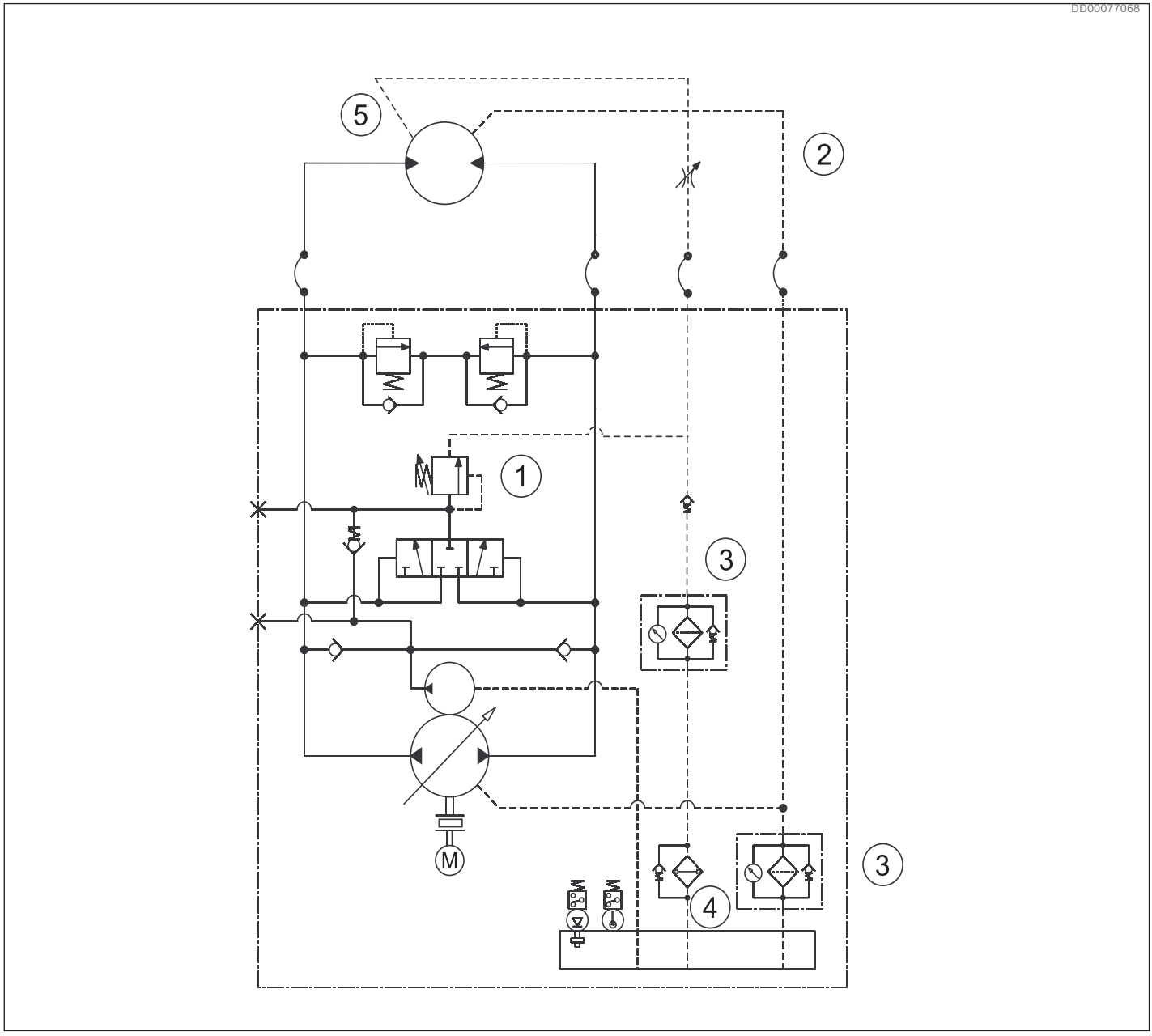


Fig. 103: Closed circuit

Things to consider:

1. Level of charge pressure.
2. Case drain flow
3. Filter
4. Cooler
5. Case flushing

17.2 Open circuit

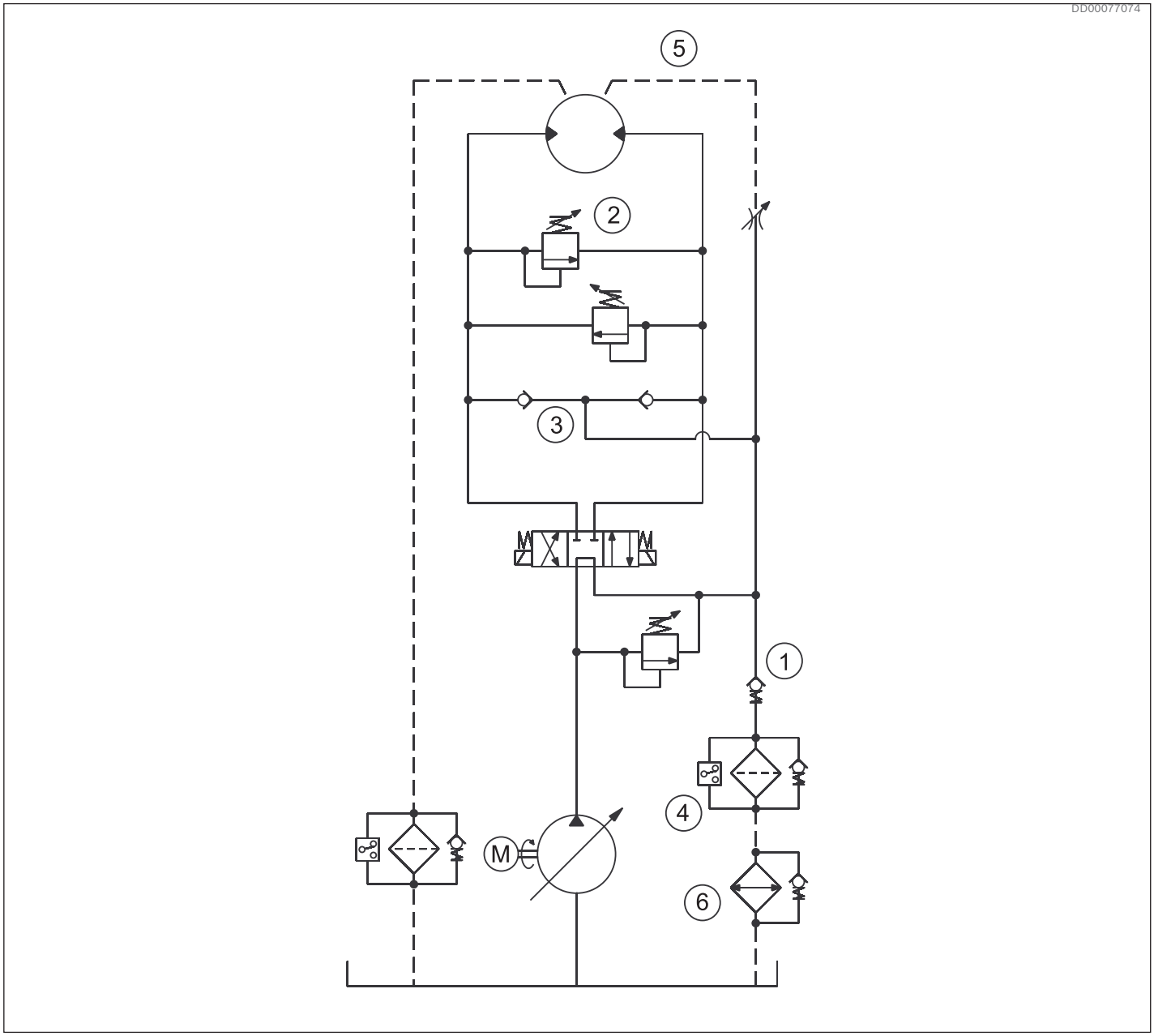


Fig. 104: Open circuit

Things to consider:

1. Counter pressure required minimum 2 bar to ensure recommended charge pressure.
2. Cross over relief valves for reduction of pressure spikes.
3. Anticavitation valves.
4. Return line filter.
5. Case flushing
6. Cooler

18 Related documents

	Title	Document no	Document type
🕮	Hägglunds Quantum	RE 15428-WA-A	Installation & maintenance manual
🕮	QMX 280 S	078 5006	Dimension drawing
🕮	QMX 400 S	078 5007	Dimension drawing
🕮	QMX 560 S	078 5008	Dimension drawing
🕮	QMX 840 S	078 5009	Dimension drawing
🕮	QMX 1120 S	078 5012	Dimension drawing
🕮	QMX 280 C	078 5002	Dimension drawing
🕮	QMX 400 C	078 5003	Dimension drawing
🕮	QMX 560 C	078 5004	Dimension drawings
🕮	QMX 840 C	078 5005	Dimension drawings
🕮	QMX 1120 splines, with coupling adapter	078 5011	Dimension drawings
🕮	Spline shaft QMX 280 / QMX 400 for external load and torque arm	278 5023	Dimension drawings
🕮	Spline shaft QMX 280 / QMX 400 flange mounted	278 5024	Dimension drawings
🕮	Spline shaft QMX 560 to QMX 1120 for external load and torque arm	278 5025	Dimension drawings
🕮	Spline shaft QMX 560 to QMX 1120 flange mounted	278 5026	Dimension drawings
🕮	Spline shaft QMX 280 for external load and torque arm mounted with brake	041 0194	Dimension drawings
🕮	Spline shaft QMX 280 / QMX 400 flange mounted with brake	041 0195	Dimension drawings
🕮	Spline shaft QMX 560 to QMX 1120 for external load and torque arm mounted with brake	041 0196	Dimension drawings
🕮	Spline shaft QMX 560 to QMX 1120 flange mounted mounted with brake	041 0197	Dimension drawings
🕮	Submerged application QMX 280 QMX 400	078 0606	Dimension drawings
🕮	Submerged application QMX 560 - QMX 1120	078 0600	Dimension drawings
🕮	Speed sensor, Hägglunds SPDC	RE 15350	Data Sheet
🕮	Speed sensor inductiv, Hägglunds SPDE	RE 15351	Data Sheet
🕮	Speed sensor explosion proof, Hägglunds SPDB 2 with mounting set	RE 15352	Data Sheet
🕮	Absolute Rotary Encoder, Hägglunds ABRA with mounting set	RE 15367	Data Sheet
🕮	Torque arms Hägglunds TCA, DTCA, DTCB	RE 15355	Data Sheet
🕮	Early warning kit	RE 15359	Data Sheet
🕮	Kit for harsh and marine environment	RE 15364	Data Sheet
🕮	Disc brake for Compact motors, Hägglunds BICA	RE 15366	Data Sheet
🕮	Hydraulic quick stop valve, Hägglunds VQCC 800	RE 15374	Data Sheet
🕮	Cross-over valve, Hägglunds COCC 1200	RE 15392	Data Sheet
🕮	Counter balance valve Hägglunds VCBCA 480	RE 15378	Data Sheet
🕮	Freewheeling valve, Hägglunds VFWCB 600	RE 15380	Data Sheet
🕮	Hydraulic fluid quick reference	RE 15414	Data sheet

Dimension drawings at Bosch Rexroth MyRexroth

HÄGGLUNDS
Bosch Rexroth AB
SE-895 80 Mellansel
tel: +46 (0)660 870 00
www.hagglunds.com
Hägglunds is a brand of Rexroth, a leading global supplier of drive and control technologies. Hägglunds solutions enrich a comprehensive Rexroth portfolio.

© This document, as well as the data, specifications and other information set forth in it, are the exclusive property of Bosch Rexroth AB. It may not be reproduced or given to third parties without its consent.

The data specified above only serve to describe the product. As our products are constantly being further developed, no statements concerning a certain condition or suitability for a certain application can be derived from our information. The information given does not release the user from the obligation of own judgment and verification. It must be remembered that our products are subject to a natural process of wear and aging.