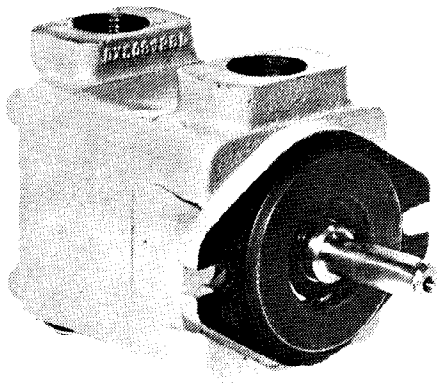
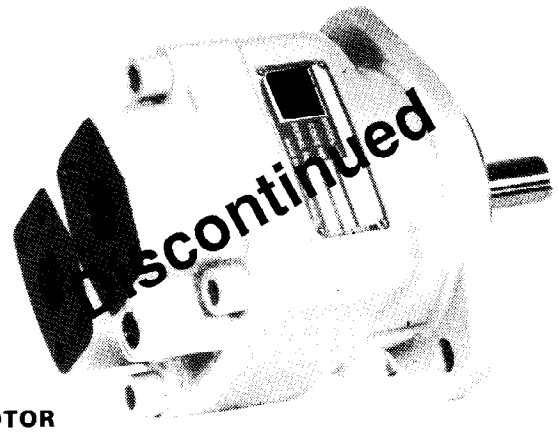


MOTOR
M3B



MOTOR
M1C

Large power range : The HÄGGLUNDS/DENISON Vane motors described in this bulletin offer a comprehensive range of vane motors in a large variety of motor sizes. Based on the individual maximum operating pressure the corresponding power range is up to 77 kW*. Depending on size the continuous operating pressure are 140 and 175 bar. All motors are lightweight and compact in design, which results in an exceptional power-to-weight ratio.

Long service life : Due to hydrostatic pressure compensation and a rigid bearing arrangement, an outstanding operational life can be achieved by using HÄGGLUNDS/DENISON Vane motors. In following the recommended operating conditions, service life results are above average.

Lower noise level : All HÄGGLUNDS/DENISON Vane motors offer a noise level below the common limits.

Continuous quality control : Vane motors as well as all other HÄGGLUNDS/DENISON components are subject to a continuous quality control program. Prior to any shipment all units are systematically checked and tested. In spite of close manufacturing tolerances, the interchangeability of components is guaranteed on a worldwide basis independent of manufacturing source.

Versalite applications : HÄGGLUNDS/DENISON Vane motors used in nearly all branches of industry can be operated with mineral oils as well as fire resistant fluids within a wide range of viscosities. For special operating conditions consult HÄGGLUNDS/DENISON.

The wide range of HÄGGLUNDS/DENISON Vane motors allows selection of a model exactly to suit any particular application. They are used industrially where there is a need to provide a relatively high torque from a power source of small dimensions and are found extensively on machine tools, plastic moulding machines, winches and hydrostatic transmissions, etc.

The low moment of inertia of the rotating group admits high acceleration and deceleration resulting in rapid response to system control signals.

A wide viscosity range allows for operation under extreme temperature conditions. Longer service life, however, can be achieved by observing the recommended operating viscosity.

Ambient temperature has little influence on the operation of HÄGGLUNDS/DENISON Vane motors providing fluid of the correct viscosity is used, and that the maximum permissible seal temperature is not exceeded.

Description

The HÄGGLUNDS/DENISON Vane motors have a hydrostatically balanced cartridge which offers flexibility in motor sizes within a single series. A firm bu light force against the vanes is provided by springs in order to follow the contour of the cam. In general, the vanes are hydrostatically balanced which results in less friction, and compensates for wear tolerances. Due to these features, a high mechanical efficiency of more than 90 % results, and a volumetric efficiency which - depending of size - is between 90 and 95 % even after long periods of operation.

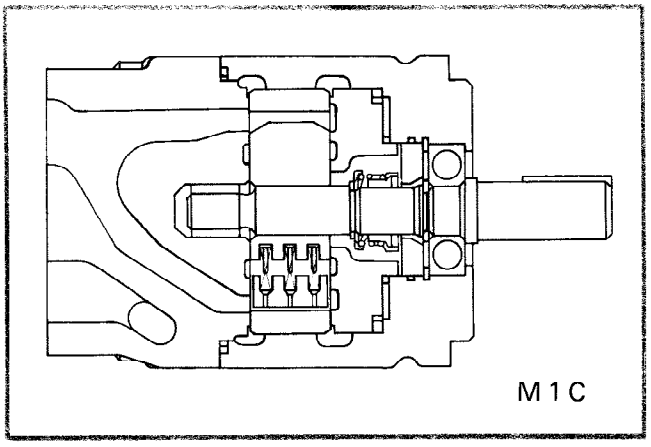
All motors can be supplied for flange or foot bracket mounting. Shafts can be supplied keyed or splined according to SAE.

2. Characteristics

Due to the hydrostatic balance the rotor carries no radial forces and, therefore, only transmits the torque generated by the operating pressure. Leakage is reduced to a minimum since the floating port plate is loaded by the system pressure.

This and the double sealing edges of the vanes are factors which considerably increase the efficiency of the motor throughout its speed range.

All HÄGGLUNDS/DENISON Vane motors are externally drained. The drain port must be directly connected to tank and the back pressure on the port should not exceed 3,5 bar except for models M 3 B and M B where the back pressure is limited to 1,5 bar.



All motors are bi-directional, and therefore, direction of rotation is determined by porting connections.

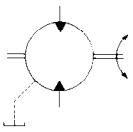
Additionally all components within the same motor frame size are interchangeable, thus permitting flexibility of installation, simplification of maintenance and reduction in spare part stock.

3. Operation

Each port plate incorporates two inlet and two outlet slots diametrically opposed, thus the radial hydraulic forces on the rotor are effectively in balance. Since the motor is bi-directional then either pair of diametrically opposed slots can be inlet or outled, depending upon the direction of rotation.

Pressure oil enters the cavity between vane and rotor opposite the inlet port, driving the rotor assembly through the first quarter cycle, at which point the same cavity has reached an outlet slot through which the decompressed oil exhausts. This action is continuous. Speed of rotation is directly proportional to oil input and torque depends upon pressure for a given motor displacement.

Item.	Characteristics	Symbolic abbrev for unit	Symbol of unit	Technical Data
1	**General**			
1.1.	Type of unit & symbol	—	—	Fixed volume Motor
1.2.	Model no	—	—	Refer to model code
1.3.	Design	—	—	Vane-type motor external drain
1.4.	Type of mouting	—	—	Flange mounted or bracket mounted
1.5.	Type of port connections	—	—	Flanges or connectors (BSPP/SAE)
1.6.	Port sizes		—	Refer to pages 15 to 18
1.7.	Direction of rotation (View on shaft end)	—	—	Bi directionnal



Symbol

		MB	M3B	M1C	M3D
1.8.	Speed range (mineral oil) n_{min} R.P.M.	100 Discontinued			
	Continuous cycle at maxi. pressure n_{max} R.P.M.	2500	3000	2500	2500
	Intermittent cycle at maxi. pressure n_{max} R.P.M.	3000	3600	3600	3000
1.9.	Dimensions of unit	mm	Refer to pages 15 to 18		
1.10.	Weight	—	Kg	Refer to pages 15 to 18	
1.11.	Mounting position	—	—	Optional preferably horizontal	
1.12.	Direction of flow and direction of rotation	—	—	P in A : clockwise, P in B : counterclockwise	
1.13.	Ambient temperature range	ϑ_m min	K	253 (− 20° C)	
		ϑ_m max	K	333 (+ 60° C)	
1.14.	Suitability for special working conditions	—	—	Further information required consult DENISON	

				MB	M3B	M1C	M3D
1.15.	Moment of inertia	I	$kgm^2 \times 10^{-4}$	2,3/4,0	3,0	6,1	21,7
1.16.	Max. side load on shaft/speed	F = f(n)	N	Refer to page 13			
2.	**Hydraulic Characteristics**						

				MB	M3B	M1C	M3D
2.1.	Pressure range outlet with internal	p max	bar	1,5	1,5	3,5	3,5
2.2.	Operating pressure range inlet	p max	bar	140	175	175	175
2.3.	Fluid temperature range	ϑ_f min	K	255 (− 18° C)			
		ϑ_f max	K	353 (+ 80° C)			
2.4.	Max. viscosity (cold start low speed and pressure)	ν	mm^2/s	860			
	Max. viscosity (full speed and pressure	ν	mm^2/s	100			
	Recommended viscosity in operation	ν	mm^2/s	30			
	Min. viscosity in operation (full speed and pressure)	ν	mm^2/s	10			
				cSt			
2.5.	Filtration	—	—	Absolute 25 µm (max life with 10 µm)			
2.6.	Nominal displacement & Torque	V/T		Refer to page 19			
2.7.	Internal leakage	Q_S = f(p)	l/mn	Refer to page 19			
2.8.	Torque/speed characteristic	T = f(n)	N.m	Refer to pages 5 to 18			
2.9.	Power output	P = f(n)	kW	Refer to pages 5 to 18			
2.10.	Replenishment pressure	p = f(n)	bar	Refer to page 16			

Internal drain : All these motors may be equipped with internal drain except series MB. Then model number will bc M3B1, M1C1, M3D1,

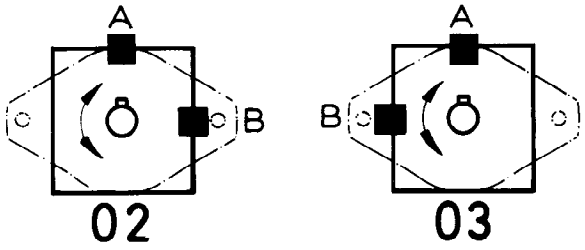
N. B.: If the performance characteristics outlined above do not meet your own particular requirements, please consult your local HÄGGLUNDS/DENISON Office.

Model code - Series M B

Model No: **MB-035-1 N 02-B 1 02**

- Series
- Torque
  - 013 = 0,213 Nm/bar
  - 018 = 0,316 Nm/bar
  - 025 = 0,390 Nm/bar
  - 035 = 0,579 Nm/bar
- Type of shaft
  - 1 = Keyed
- Rotation
  - N = bi-directional
- Porting combination
  - 02 = Standard
- Design letter
  - B = Series "B"
- Seals
  - 1 = S1
- Port connections
  - 01 = A and B = 3/4 " - 16 UNF-2B
    Drain = 9/16" - 18 UNF-2B
  - 02 = A ; B and drain 3/8" BSPP
- Modifications

Bracket no: S14-10785

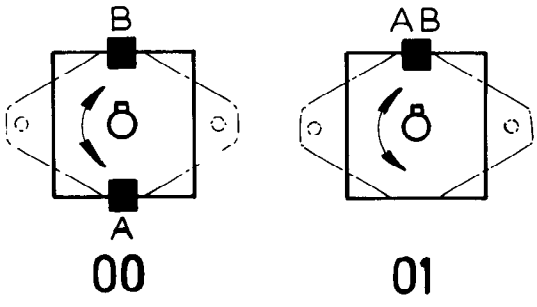


Model code - Series M 3 B

Model No: **M3B1-036-1 N 00-B 1 02**

- Series external drain
- Series internal drain
- Torque
  - 012 = 0,186 Nm/bar
  - 018 = 0,304 Nm/bar
  - 027 = 0,485 Nm/bar
  - 036 = 0,624 Nm/bar
- Type of shaft
  - 1 = Keyed
  - 3 = Splined (SAE-A)
  - 4 = Splined (SAE-B)
- Rotation
  - N = bi-directional
- Porting combination
  - 00 = Standard
- Design letter
  - B = Series " B "
- Seals
  - 1 = S1
  - 4 = S4
  - 5 = S5
- Port connections
  - 01 = A and B 3/4" SAE 4 holes
    drain 3/8" BSPP
  - 02 = A and B 3/4" BSPP
    drain 3/8" BSPP
- Modifications

Bracket no: S14-00128



Connection SAE 4 holes for A & B (01)					
Model	Size	NPTF A	BSPP B	socket weld W	semi finished X
FS4-*-12-34	3/4"	S14-66925	S14-66933	S14-66941	S14-66955

Model code - Series M 1 C

Discontinued

Model No: M1C1-024-1 N 00-A 1 02

Series external drain

Series internal drain

Torque
024 = 0,402 Nm/bar
033 = 0,553 Nm/bar
042 = 0,704 Nm/bar
052 = 0,853 Nm/bar

Type of shaft
1 = Keyed (SAE B)
3 = Splined (SAE B)

Rotation
N = bi-directional

Modifications

Port connections
02 – A and B 1" SAE 4 holes
drain 1/4 " BSPP

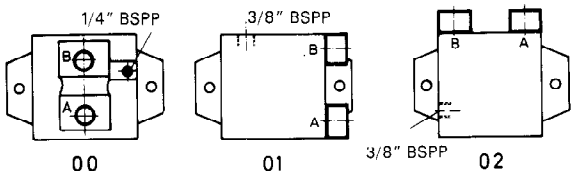
Seal
1 = S1

Design letter
A = Series " A "

Porting combination
00 = Standard

Bracket no: S14-10785

Connection SAE 4 holes for A & B					
Model	Size	NPTF A	BSPP B	socket weld W	semi finished X
FS4-* 16 17	1"	S14-66926	S14-66934	S14-66942	S14-66956



00 01 02

Back porting Side porting

Model code - Series M 3 D

Model No: M3D1-138-1 N 00-A 1 02

Series external drain

Series internal drain

Torque
074 = 1,25 Nm/bar
088 = 1,45 Nm/bar
102 = 1,69 Nm/bar
113 = 1,86 Nm/bar
128 = 2,11 Nm/bar
138 = 2,30 Nm/bar

Type of shaft
1 = Keyed
3 = Splined (SAE C)

Rotation
N – bi-directional

Porting combination
00 = Standard

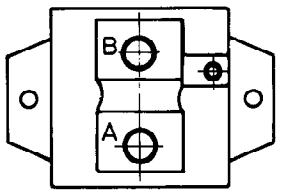
Design letter
A – Series " A "

Seals
1 = S1

Port connections
02 – A and B 1"1/4 SAE 4 holes
drain 3/8 "BSPP

Modifications

Bracket no: S14-02519

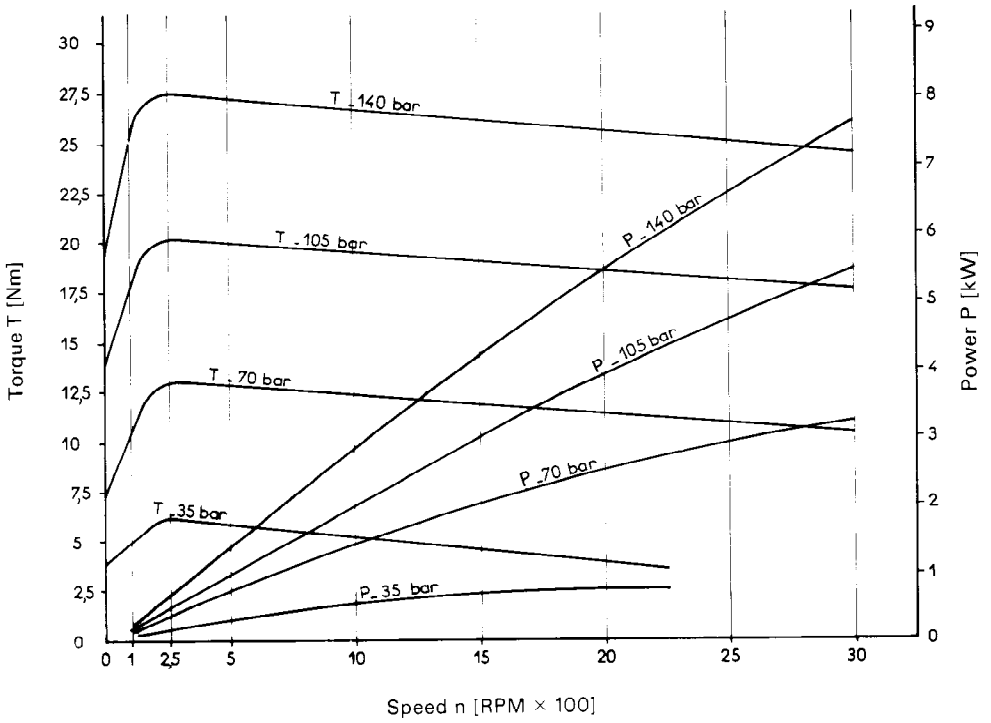


00

Connection SAE 4 holes for A & B					
Model	Size	NPTF A	BSPP B	socket weld W	semi finished X
FS4-*-20-26	1 1/4"	S14-66927	S14-66935	S14-66943	S14-66957

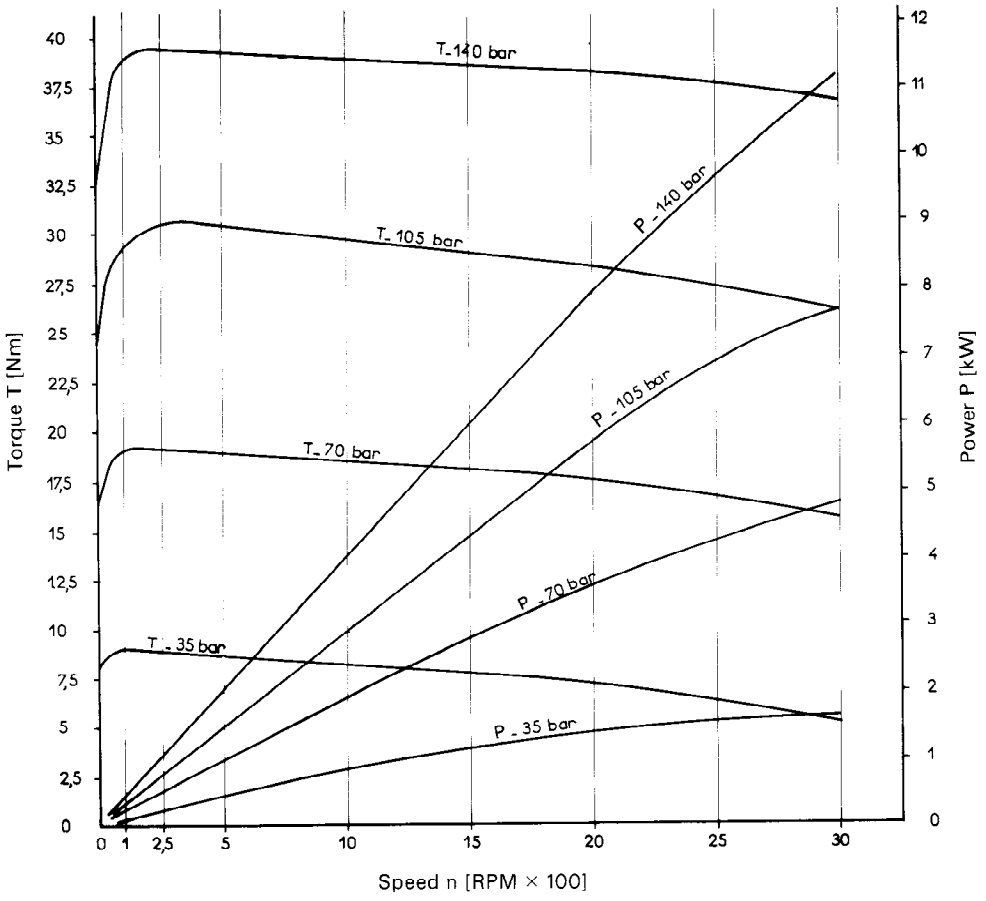
Characteristics T.n/P.n

MB-013



Starting torque is 90 % of the maximum running torque shown.

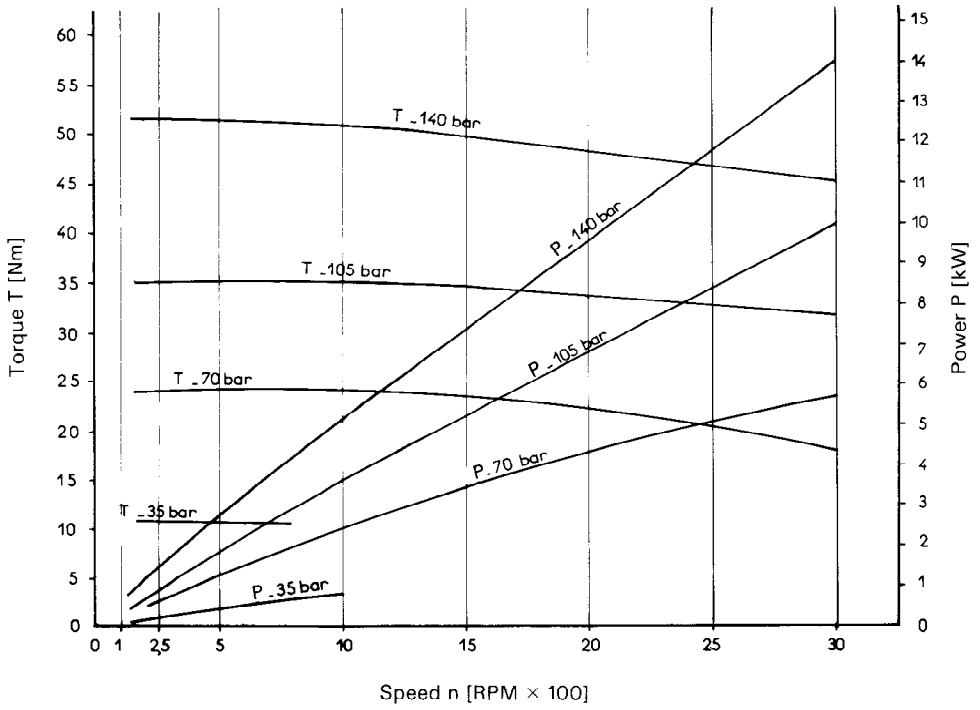
MB-018



Starting torque is 90 % of the maximum running torque shown.

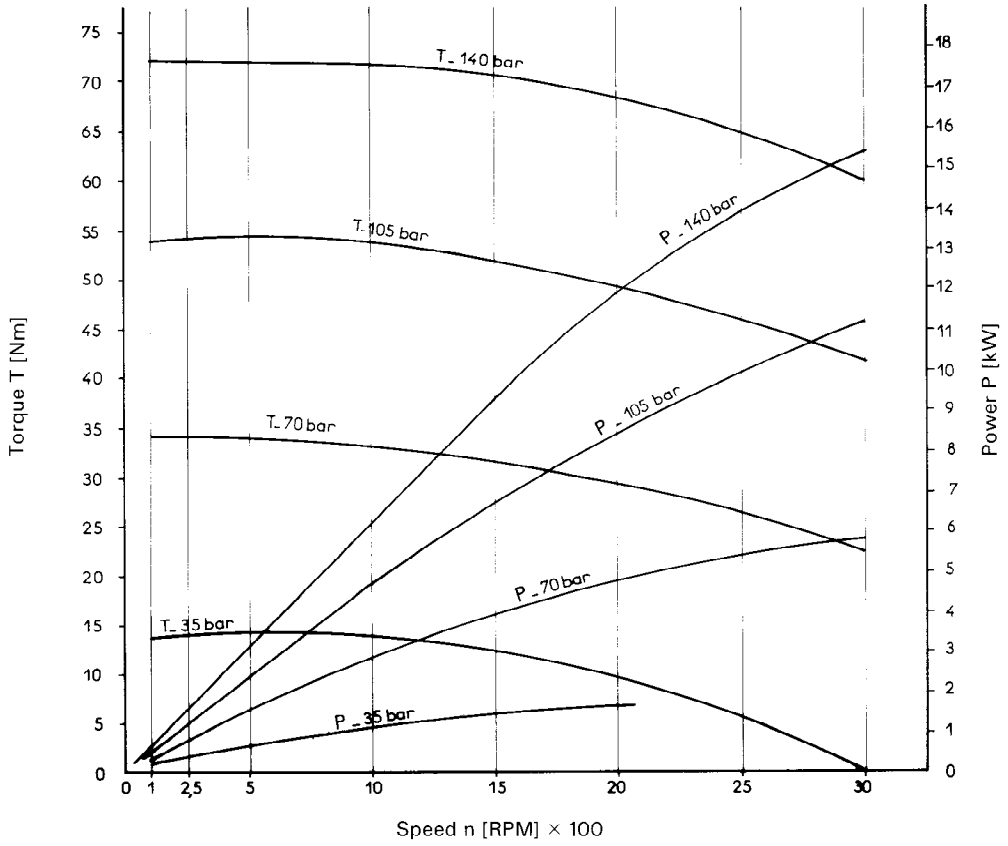
Characteristics T.n/P.n

MB-025



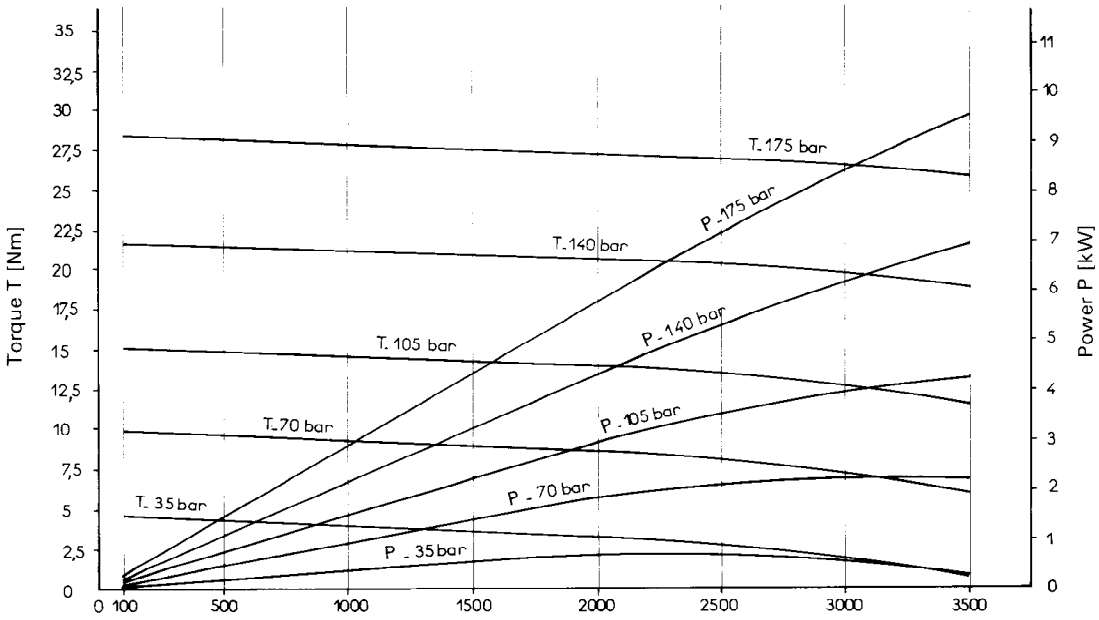
Starting torque is 90 % of the maximum running torque shown.

MB-035



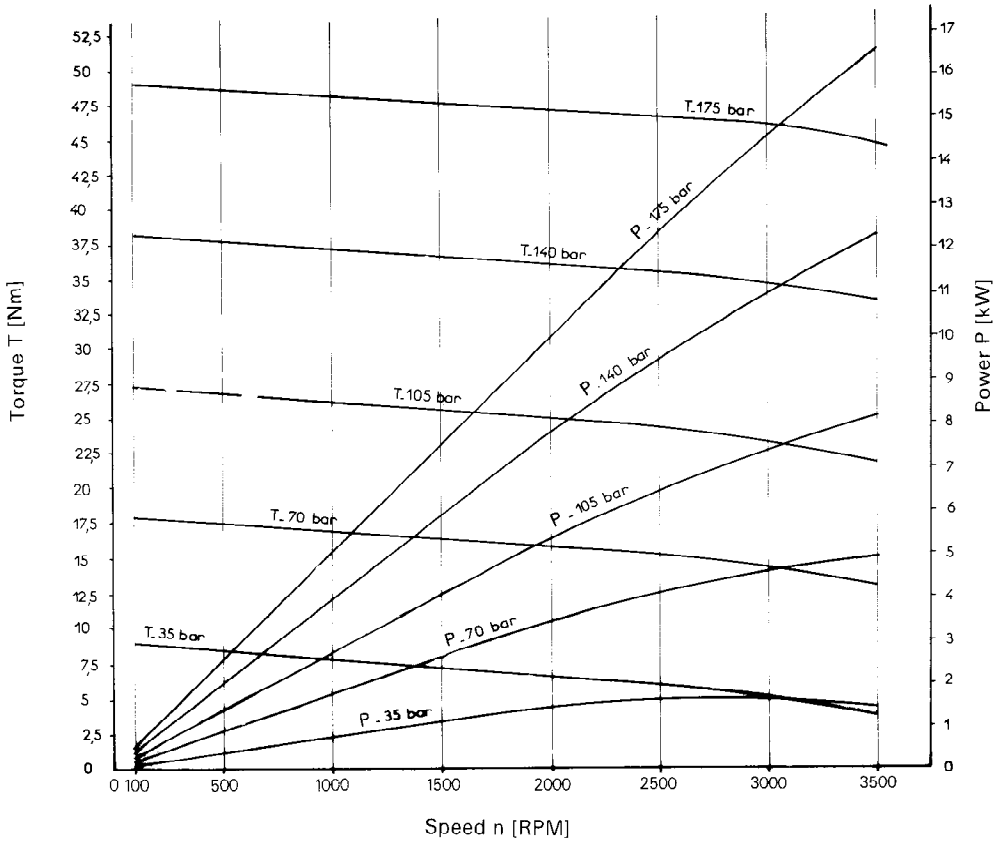
Starting torque is 90 % of the maximum running torque shown.

M3B-012



Starting torque is 90 % of the maximum running torque shown.

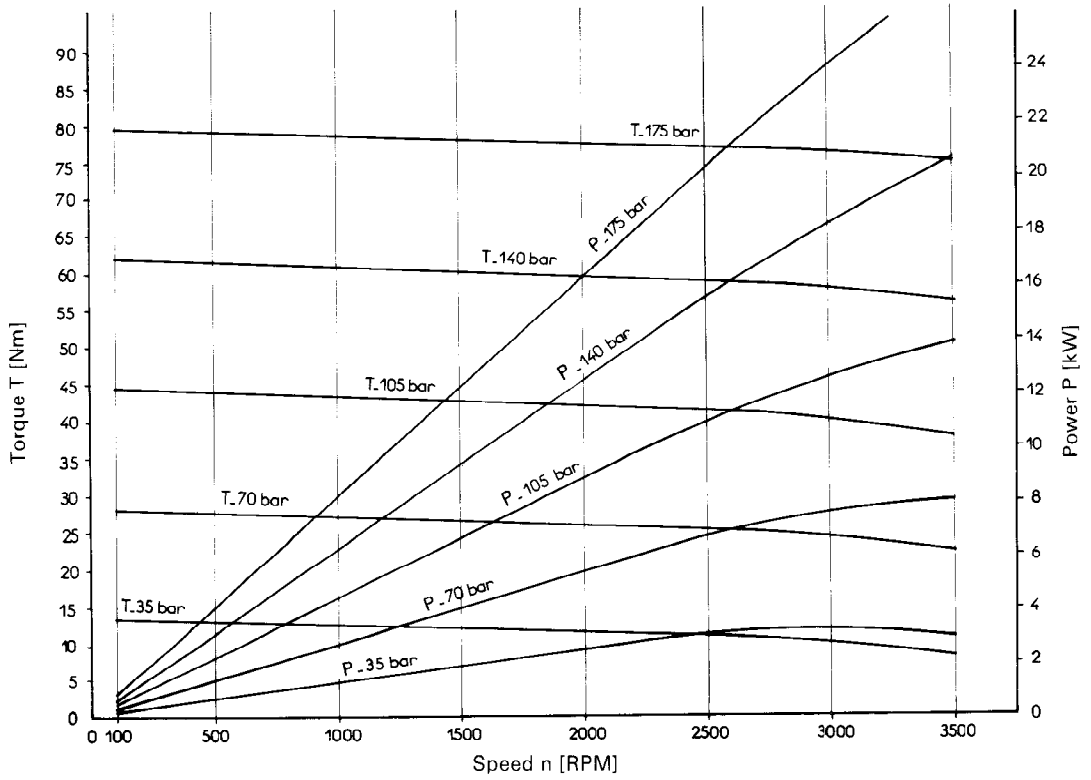
M3B-018



Starting torque is 90 % of the maximum running torque shown.

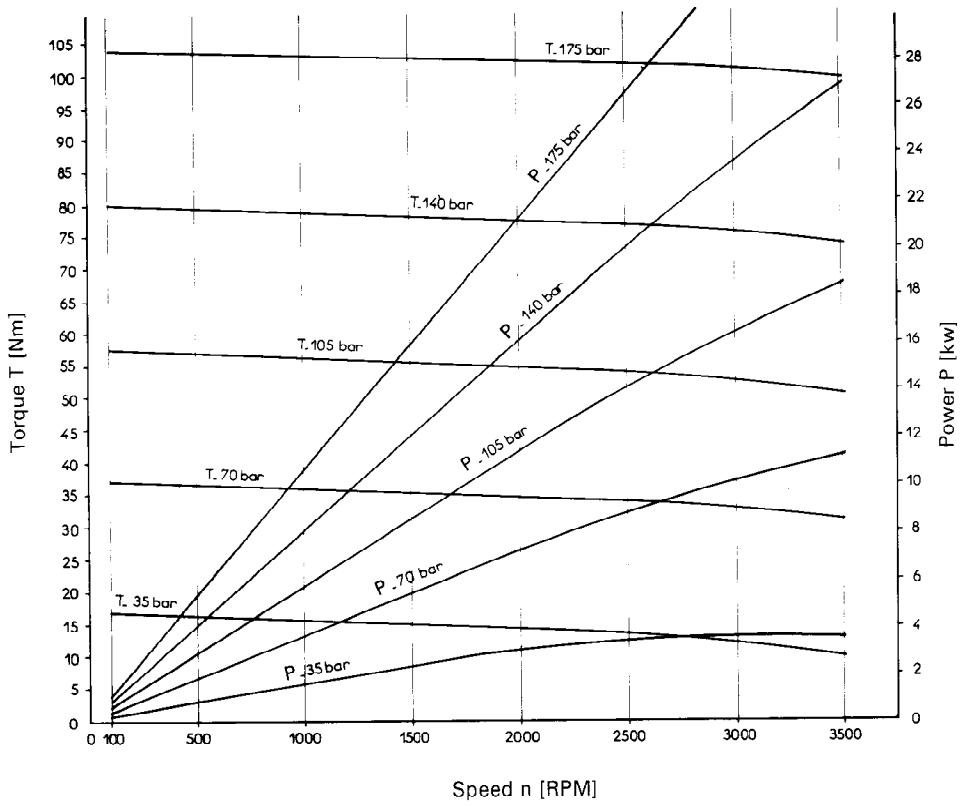
Characteristics T.n/P.n

M3B-027



Starting torque is 90 % of the maximum running torque shown.

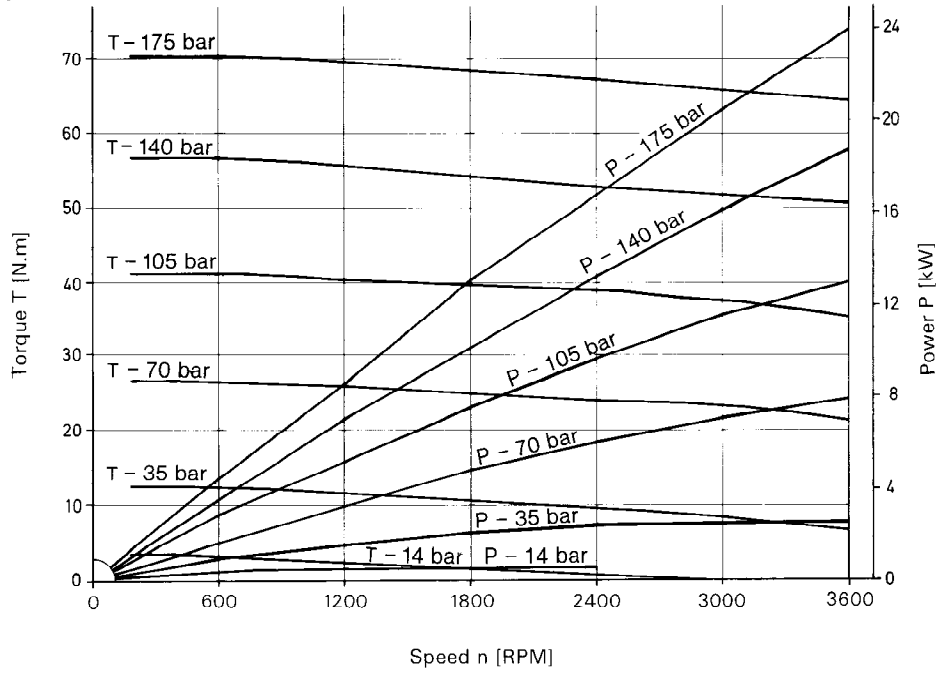
M3B-036



Starting torque is 90 % of the maximum running torque shown.

Discontinued

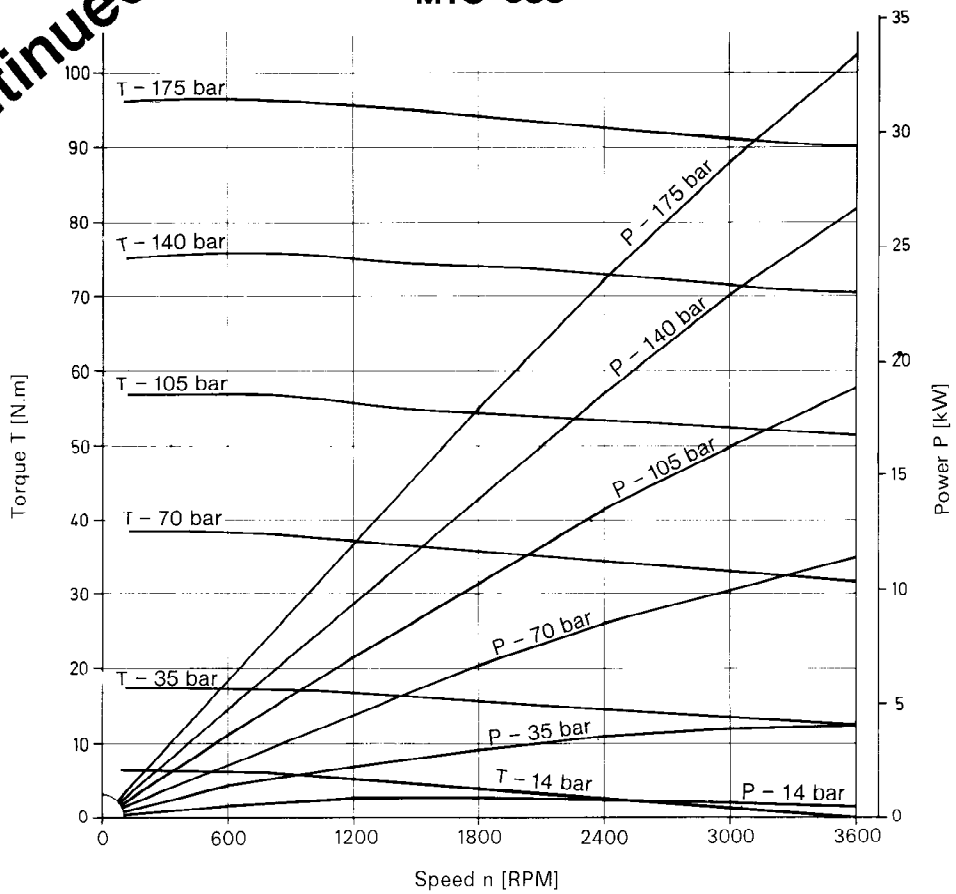
M1C-024



Starting torque is 90 % of the maximum running torque shown.

Discontinued

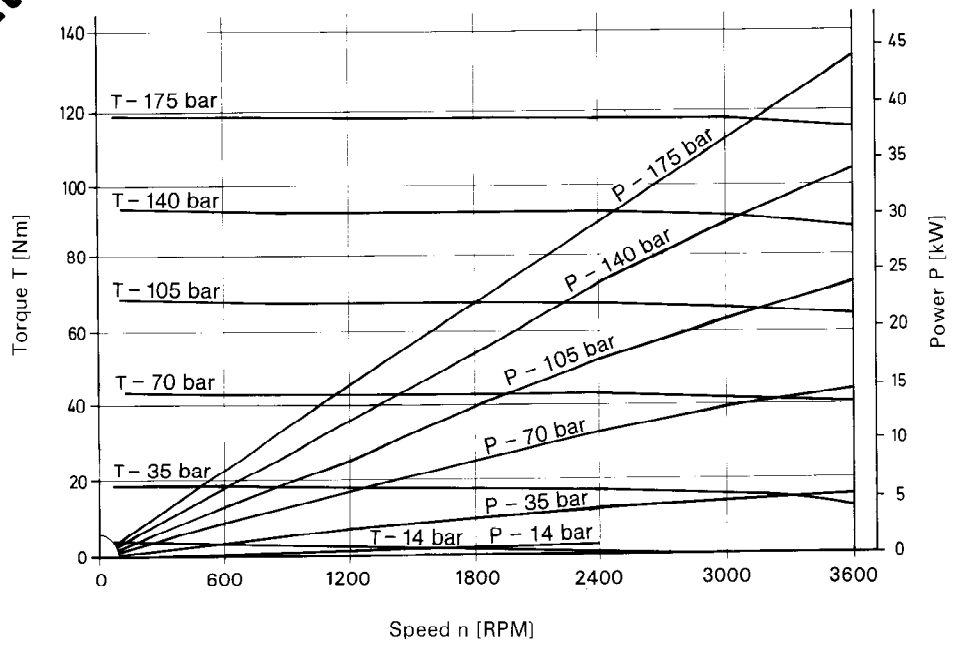
M1C-033



Starting torque is 90 % of the maximum running torque shown.

Discontinued

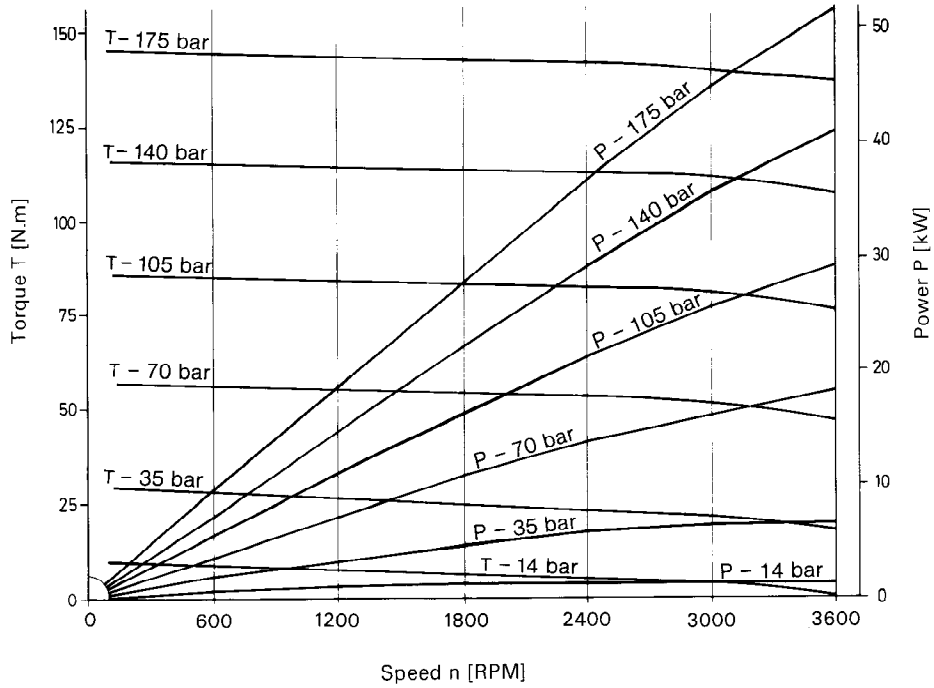
M1C-042



Starting torque is 90 % of the maximum running torque shown.

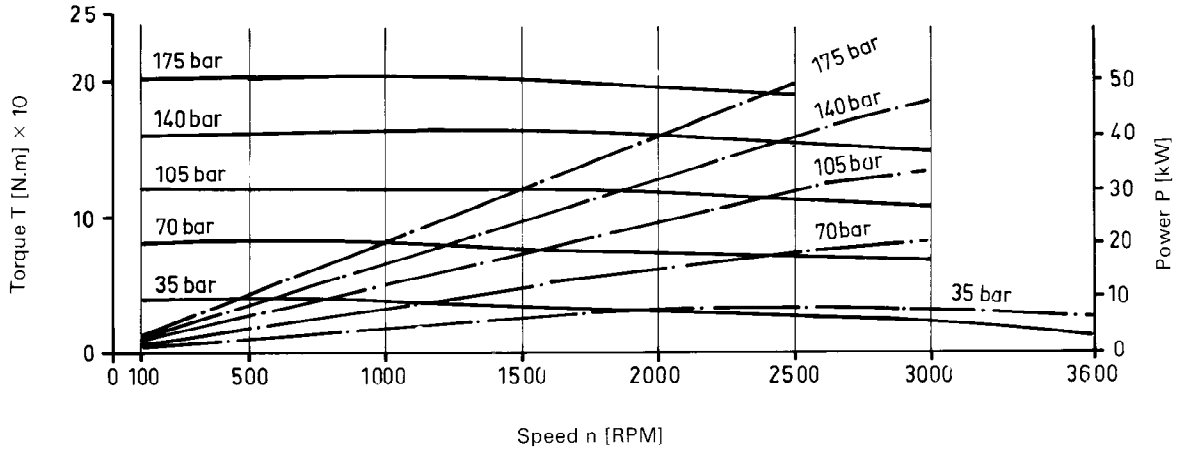
Discontinued

M1C-052



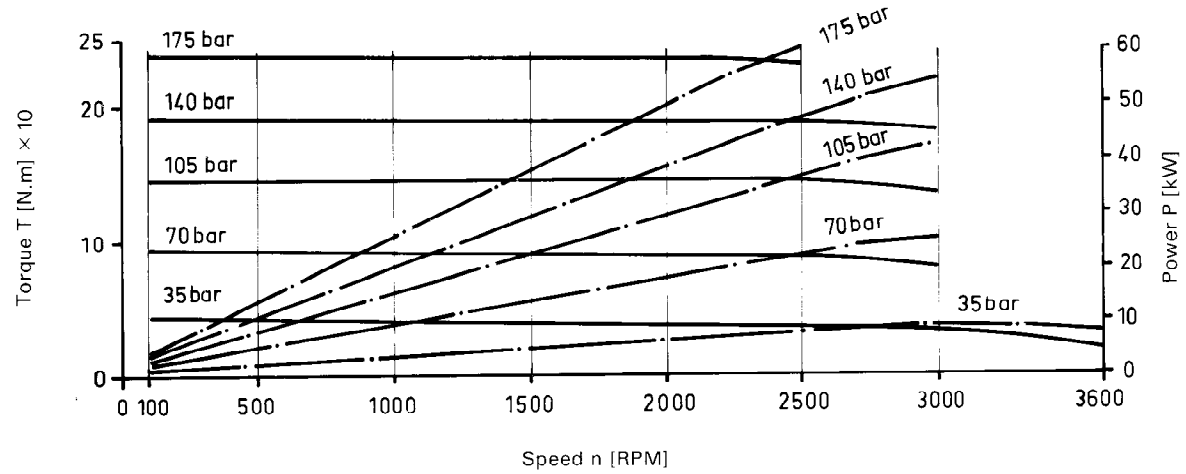
Starting torque is 90 % of the maximum running torque shown.

M3D-074



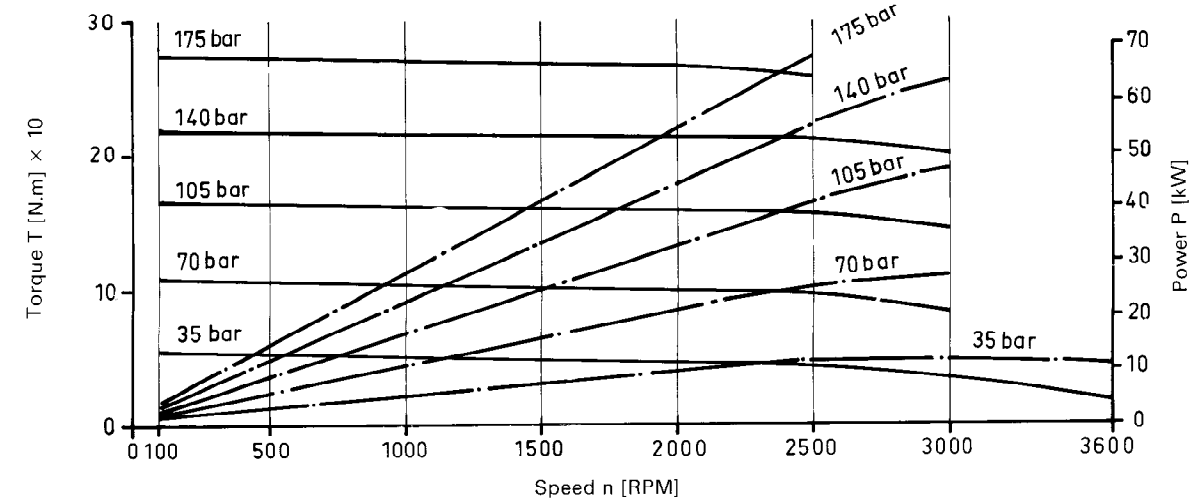
Starting torque is 90 % of the maximum running torque shown.

M3D-088



Starting torque is 90 % of the maximum running torque shown.

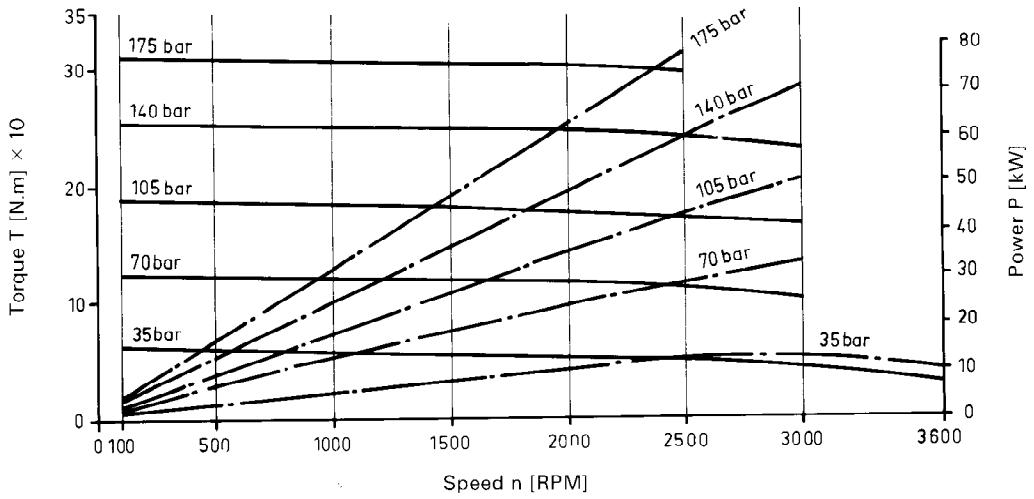
M3D-102



Starting torque is 90 % of the maximum running torque shown.

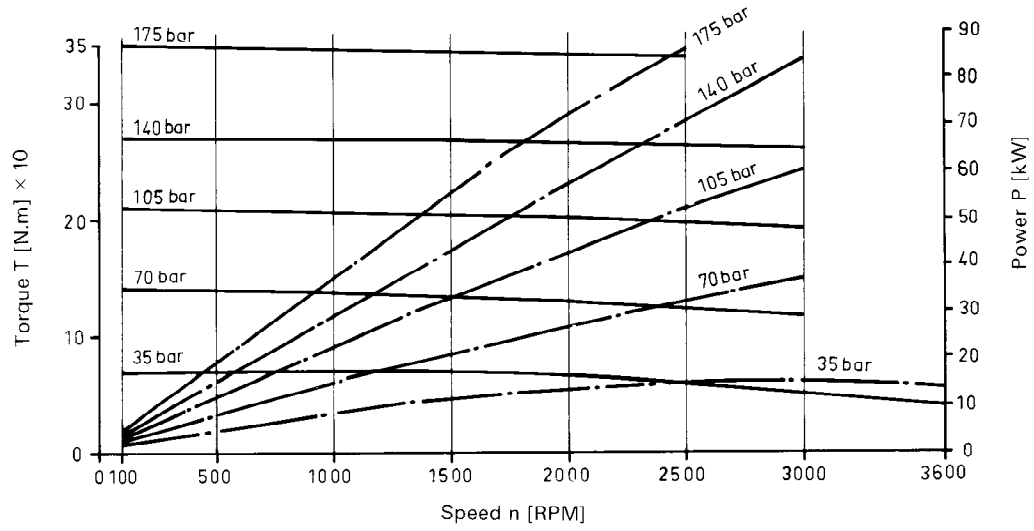
Characteristics T.n/P.n

M3D-113



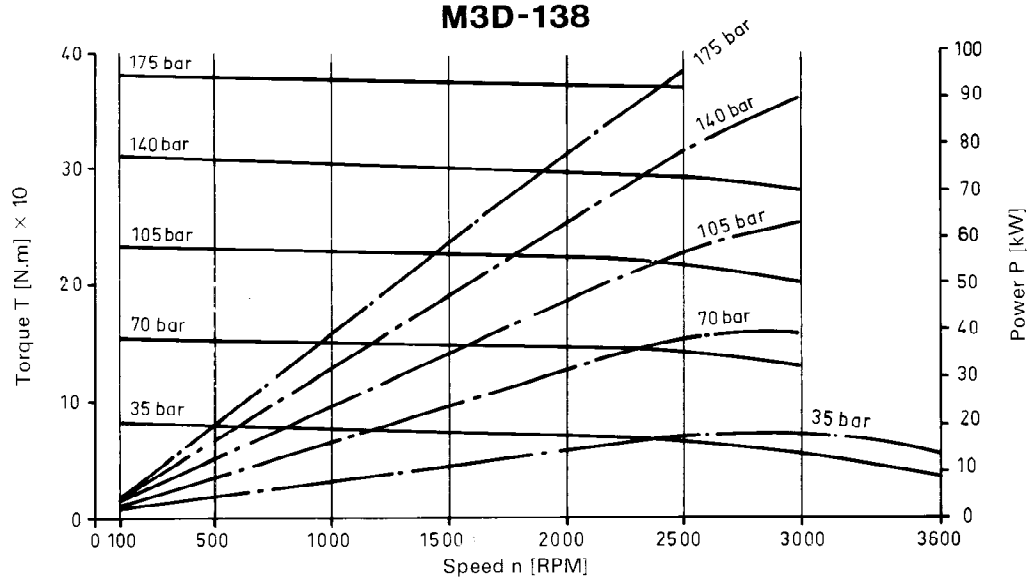
Starting torque is 90 % of the maximum running torque shown.

M3D-128



Starting torque is 90 % of the maximum running torque shown.

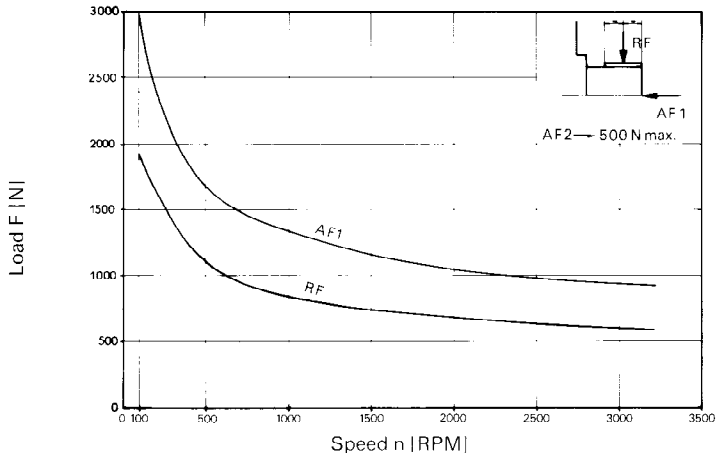
M3D-138



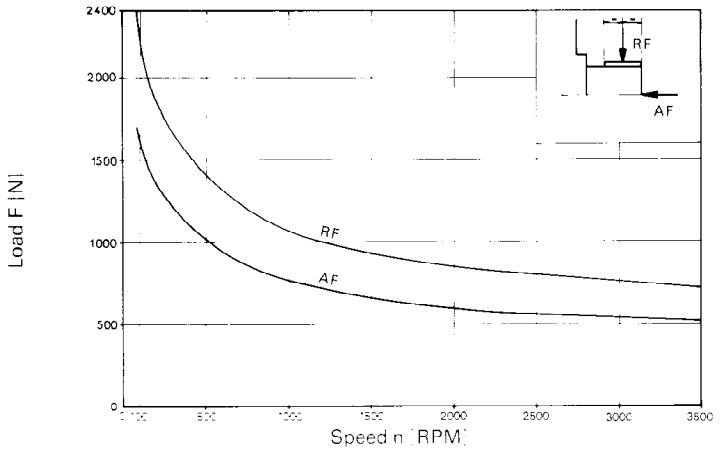
Starting torque is 90 % of the maximum running torque shown.

Characteristics F.n

MB

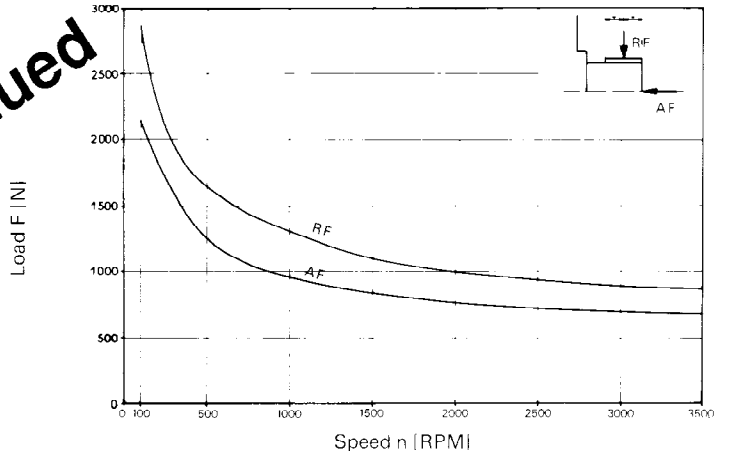


M3B

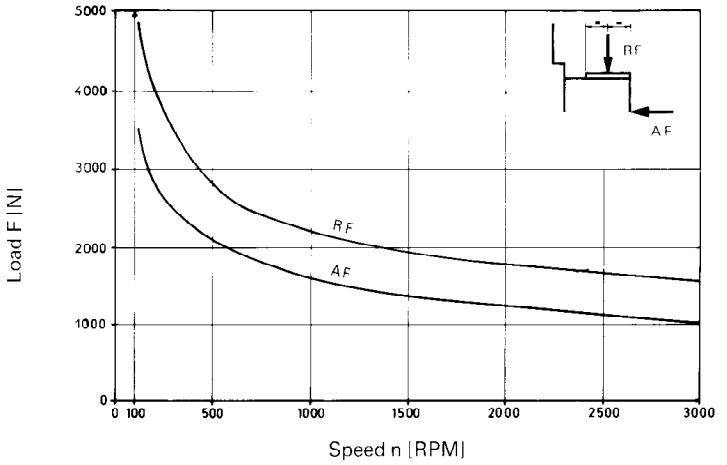


M1C

Discontinued



M3D



Characteristics T.n/P.n

EXTERNALLY DRAINED SINGLE CARTRIDGE MOTORS may be alternately pressurized at Ports A & B to 175 bar max. Whichever port is at low pressure should not be subject to more than 35 bar. If it is necessary to exceed these limitations please contact DENISON for application assistance.

INTERNALLY DRAINED MOTORS may be alternately pressurized at Ports A & B to 175 bar max. Whichever port is at low pressure must not be subject to more than 3,5 bar.

For optimum operating efficiency and life, minimum continuous operating speeds should be above 500 RPM.

MINIMUM REPLENISHMENT PRESSURE

The inlet port of the fluid motor must be supplied with replenishment pressure as listed below to prevent cavitation during dynamic braking.

Series	SPEED RPM - Oil viscosity 32 cSt					
	500	1000	1500	2000	2500	3000
	bar	bar	bar	bar	bar	bar
MB	0,5	1,0	2,0	4,0	5,0	7,0
M3B	0,6	1,0	1,4	1,9	2,5	3,5
M1C	0,7	1,2	1,9	2,7	3,5	4,5
M3D	0,7	1,4	2,1	3,1	4,2	5,5

These filling pressures are for motors only. Pressure drop in pipes must be added.

Specifications for Couplings and Female Spline

Splines

1. The mating female spline should be free to float and find its own center. If both members are rigidly supported they must be aligned within .006" (.15 mm) or less to reduce fretting. The angular alignment of two splined axes must be less than + .002"/1 radius.

2. The coupling must be lubricated with lithium molydisulfide or a similar lubricant.

3. The coupling must be hardened to a hardness between 27 and 45 Rockwell C.

4. The female spline must be made to conform to the class 1 fit as described in SAE-J-498 b. This is described as a flat root side fit.

Keyed shafts

HÄGGLUNDS/DENISN supplies keyed shaft motors with high strength heat-treated keys. Therefore, when installing or replacing these motors the heat-treated keys must be used in order to insure maximum life. If the key is replaced in must be a heat-treated key with a hardness between 27 and 34 Rockwell C.

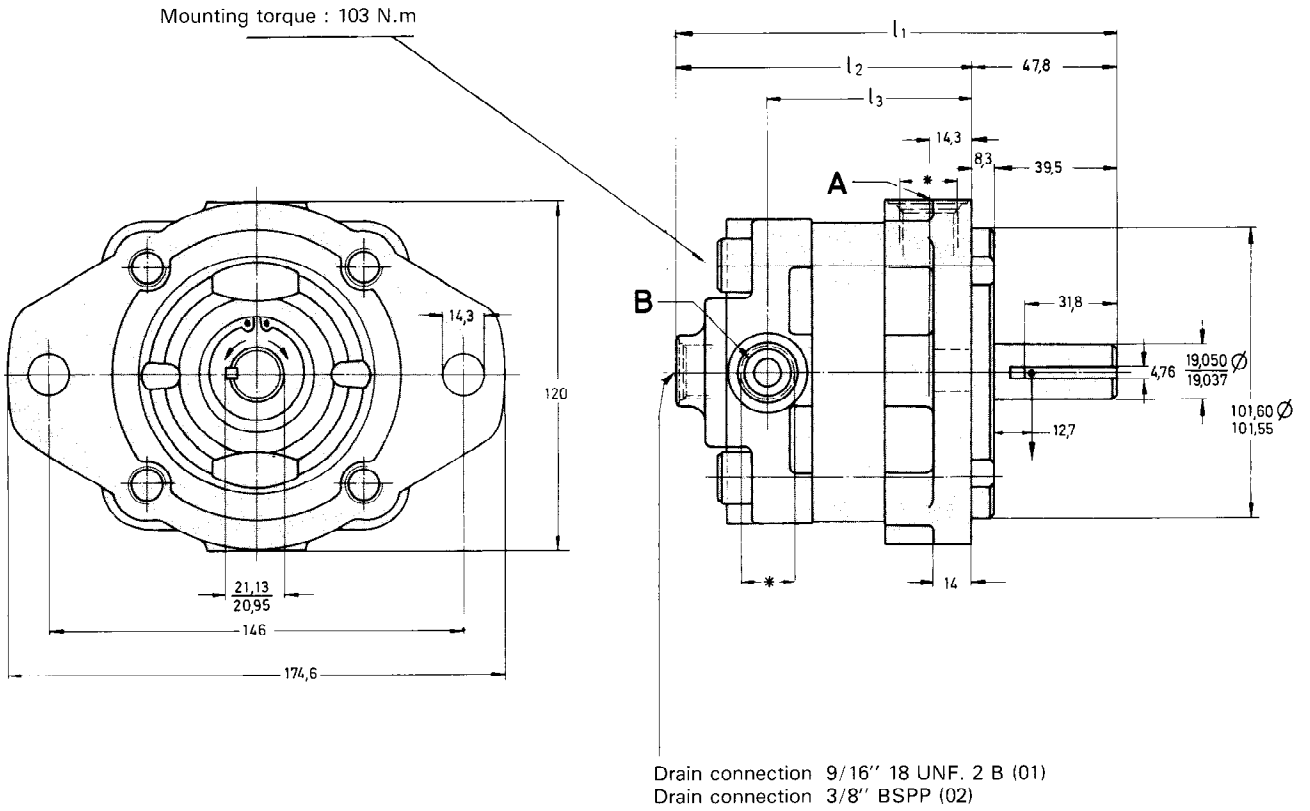
NOTE

Alignment of keyed shafts must be within tolerances given splined shafts.

Series MB - Dimensions and operating characteristics

MB - 013 / MB - 018 Weight : 3,2 kg ; with bracket : 8,8 kg

MB - 025 / MB - 035 Weight : 4,1 kg ; with bracket : 9,7 kg



* A & B 3/4" 16 UNF - 2B (01)
A & B 3/8" BSPP (02)

Model N°	l_1	l_2	l_3
MB-013	137,5	89,7	59,5
MB-018			
MB-025	149,4	101,6	71,4
MB-035			

View from shaft end :

CW rotation A = inlet B = outlet

CCW rotation A = outlet B = inlet

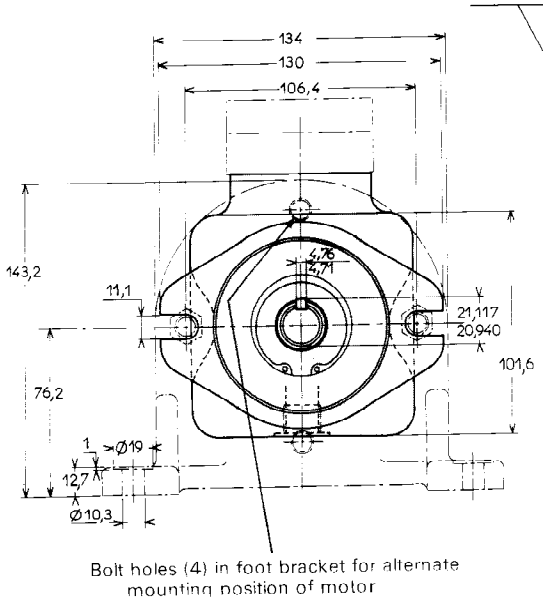
Operating characteristics

Model	Displacement (ml/Rev.)	Input Flow at 2500 RPM (l/min)		Torque T at 2500 RPM (Nm)	Power output at 2500 RPM (kW)
		Theoretical	at 140 bar	at 140 bar	at 140 bar
MB - 013	13,37	33,4	42,9	25,0	6,55
MB - 018	19,83	49,6	59,1	37,7	9,87
MB - 025	24,53	61,3	72,4	46,8	12,30
MB - 035	36,38	91,0	102,0	64,4	16,90

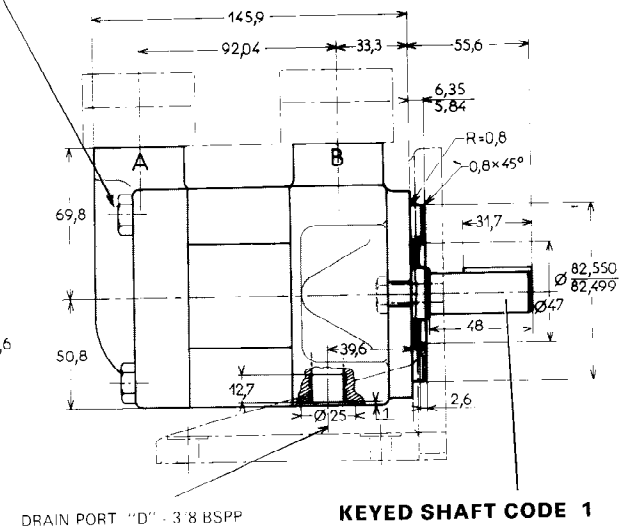
Series M3B - Dimensions and operating characteristics

Weight : 8 kg ; with bracket : 11 kg

Mounting torque : 54 N.m

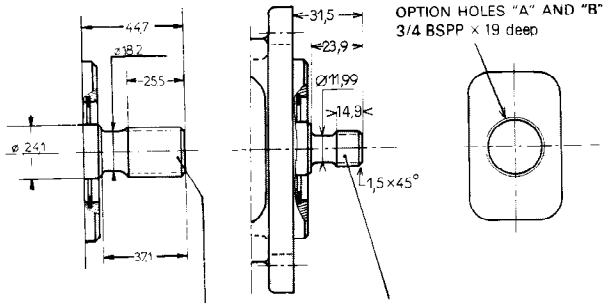


Bolt holes (4) in foot bracket for alternate mounting position of motor



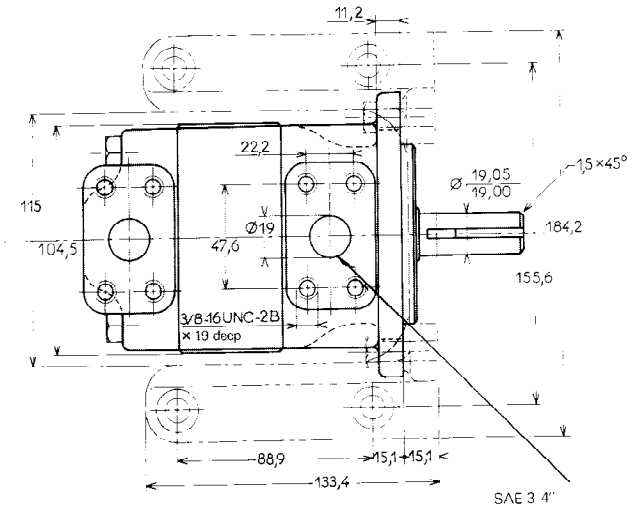
DRAIN PORT "D" - 3/8 BSPP

KEYED SHAFT CODE 1



SPLINED SHAFT CODE 4
Spline SAE "B"
class 1 J 498 b
16/32 d.p. 13 teeth
30° pressure angle
flat root side fit

SPLINED SHAFT CODE 3
Spline SAE "A"
class 1 J 498 b
16/32 d.p. 9 teeth
30° pressure angle
flat root side fit



View from shaft end:

CW rotation A = inlet
B = outlet

CCW rotation A = outlet
B = inlet

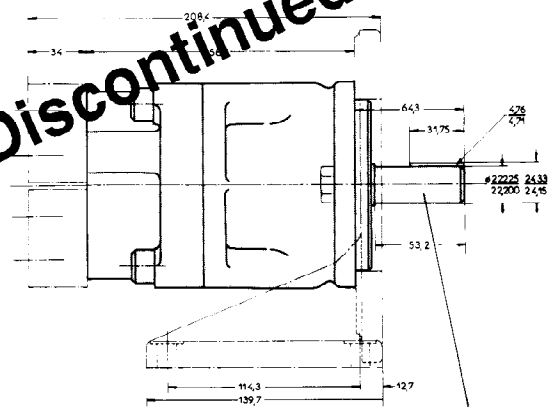
Operating characteristics

Model	Displacement (ml/Rev.)	Input Flow at 2500 RPM (l/min)		Torque T at 2500 RPM (Nm)	Power output at 2500 RPM (kW)
		Theoretical	at 175 bar	at 175 bar	at 175 bar
M3B - 012	11,70	29,3	40,6	26,9	7,04
M3B - 018	19,10	47,8	59,1	46,6	12,20
M3B - 027	30,50	76,3	87,6	76,9	20,10
M3B - 036	39,20	98,0	109,0	102,0	26,70

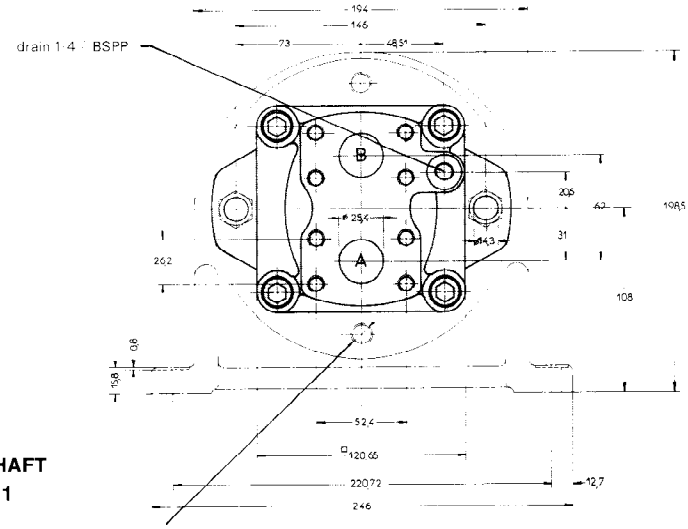
Series M1C - Dimensions and operating characteristics

Weight : 13,6 kg ; with bracket : 19,2 kg

Discontinued

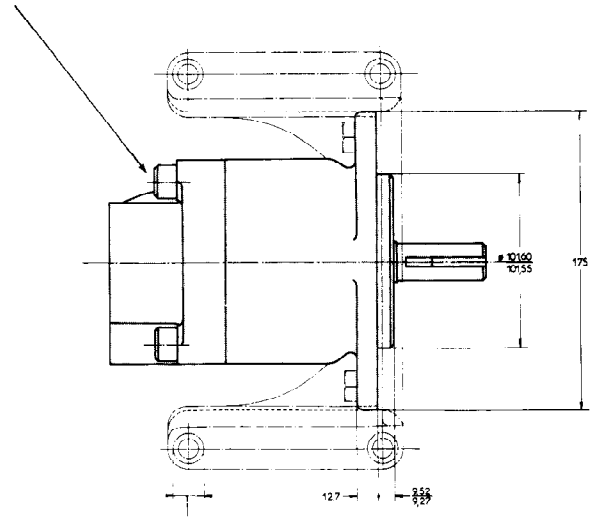


KEYED SHAFT
CODE 1



Bolt holes (4) in foot bracket for alternate mounting position of motor

Mounting torque : 102 N.m

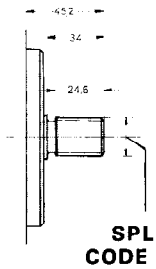


4 Holes ⌀ 11,2 counter bore ⌀ 19 × 0,8 deep

View from shaft end :

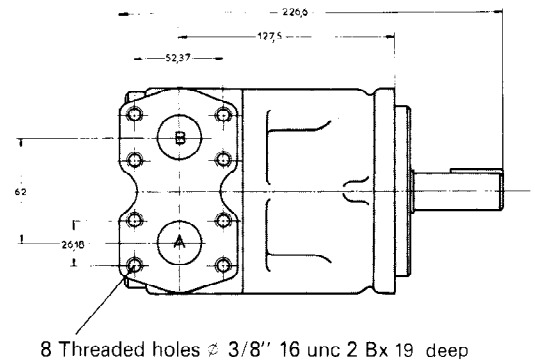
CW rotation A = inlet
B = outlet

CCW rotation A = outlet
B = inlet

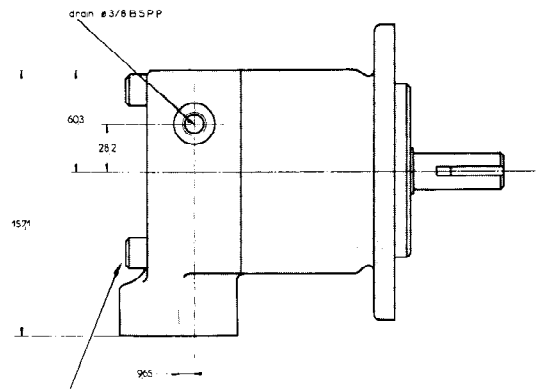


SPLINED SHAFT
CODE 3 Spline SAE"B"
class 1 J 498 b
16/32 d. p. 13 teeth
30° pressure angle
flat root side fit

Porting combination "01-02"



8 Threaded holes ⌀ 3/8" 16 unc 2 Bx 19 deep



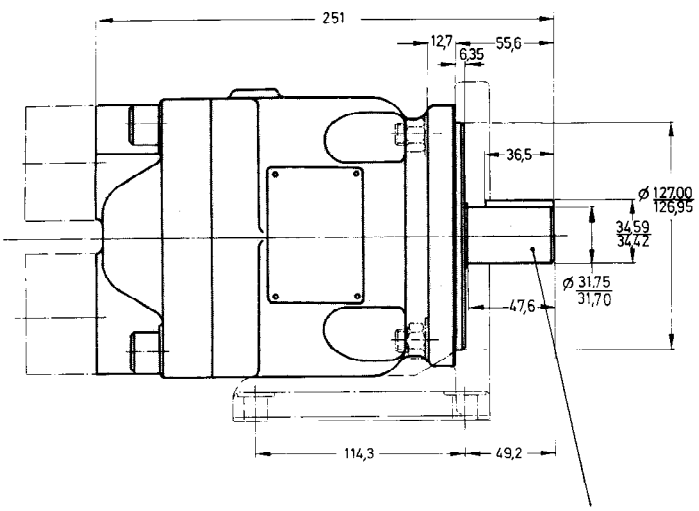
Mounting torque : 110 N.m

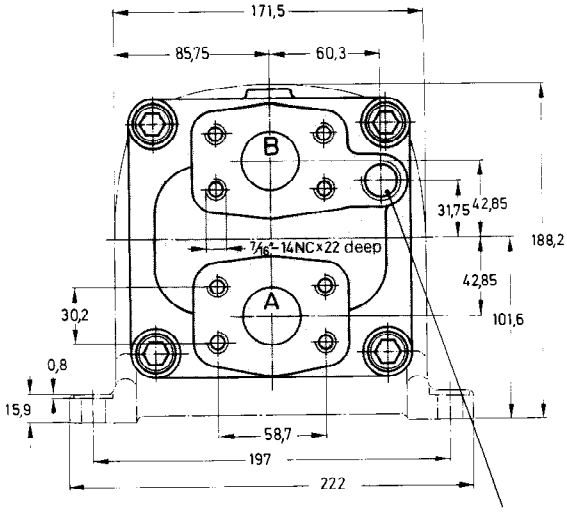
Operating characteristics

Model	Displacement (ml/Rev.)	Input Flow at 2500 RPM (l/min)		Torque T at 2500 RPM (Nm)	Power output at 2500 RPM (kW)
		Theoretical	at 175 bar	at 175 bar	at 175 bar
M1C - 024	25,24	63,1	80,5	66,9	17,51
M1C - 033	34,74	86,9	104,0	92,3	24,20
M1C - 042	44,24	111,0	128,0	116,0	30,40
M1C - 052	53,58	134,0	151,0	141,0	36,90

Series M3D - Dimensions and operating characteristics

Weight : 29,5 kg ; with bracket : 36,7 kg

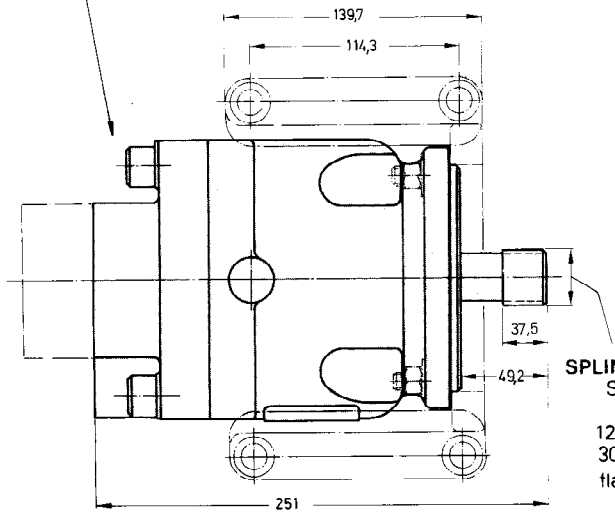




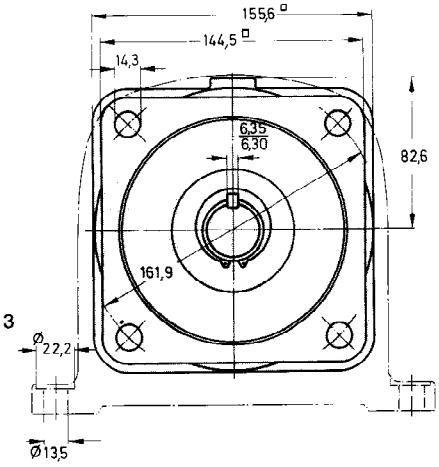
Mounting torque : 180 N.m

KEYED SHAFT CODE 1

Drain port 3/8" BSPP



SPLINED SHAFT CODE 3
Spline SAE "C"
class 1 J 498 b
12/24 d. p 14 teeth
30° pressure angle
flat root side fit



View from shaft end :

CW rotation A = inlet, B = outlet

CCW rotation A = outlet, B = inlet

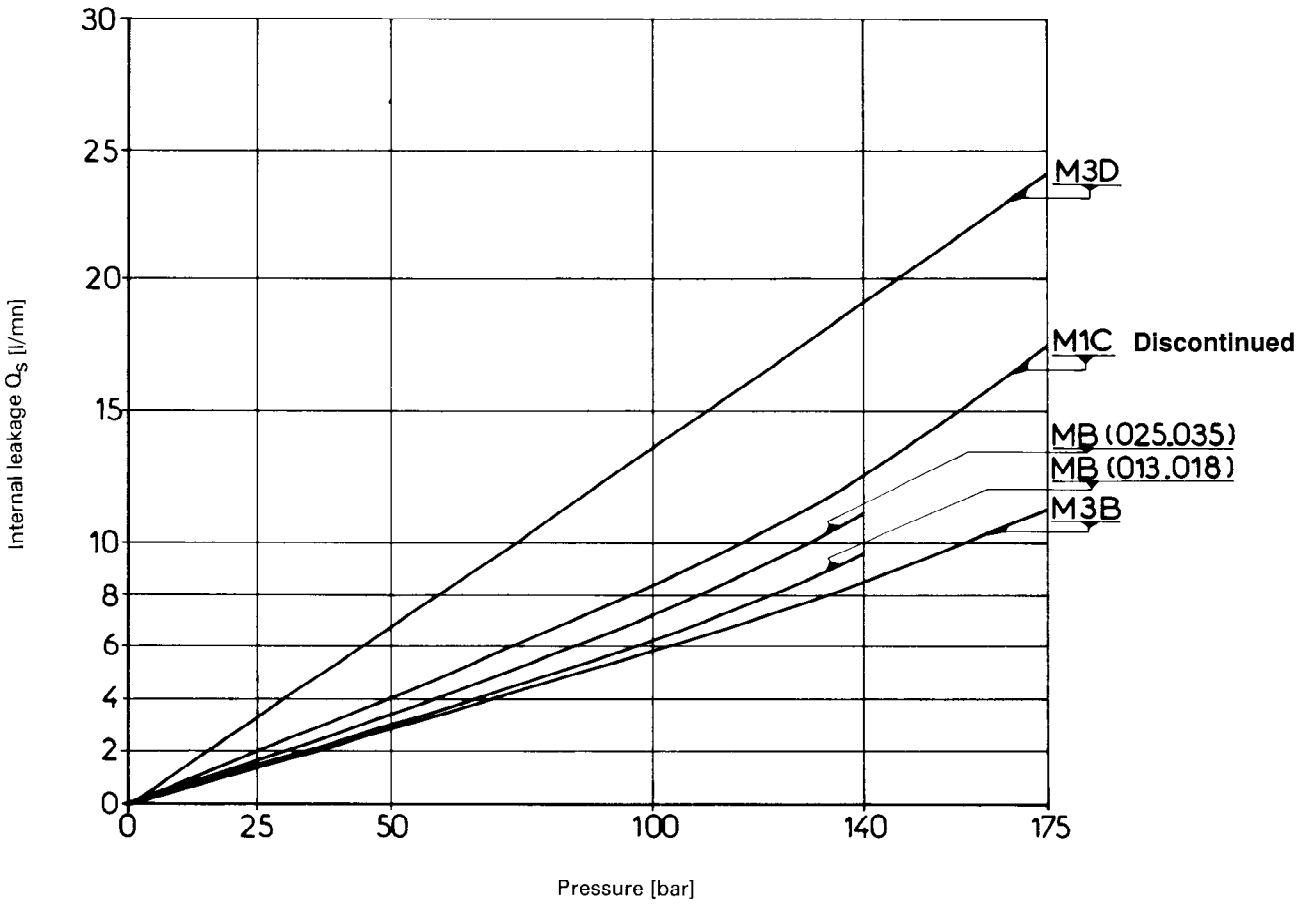
Operating characteristics

Model	Displacement (ml/Rev.)	Input Flow at 2500 RPM (l/min)		Torque T at 2500 RPM (Nm)	Power output at 2500 RPM (kW)
		Theoretical	at 175 bar	at 175 bar	at 175 bar
M3D - 074	78,54	157	181	195	40,8
M3D - 088	91,10	182	206	233	48,8
M3D - 102	105,90	212	236	263	55,1
M3D - 113	116,60	233	257	303	63,5
M3D - 128	132,50	265	289	342	71,6
M3D - 138	144,30	289	313	370	77,5

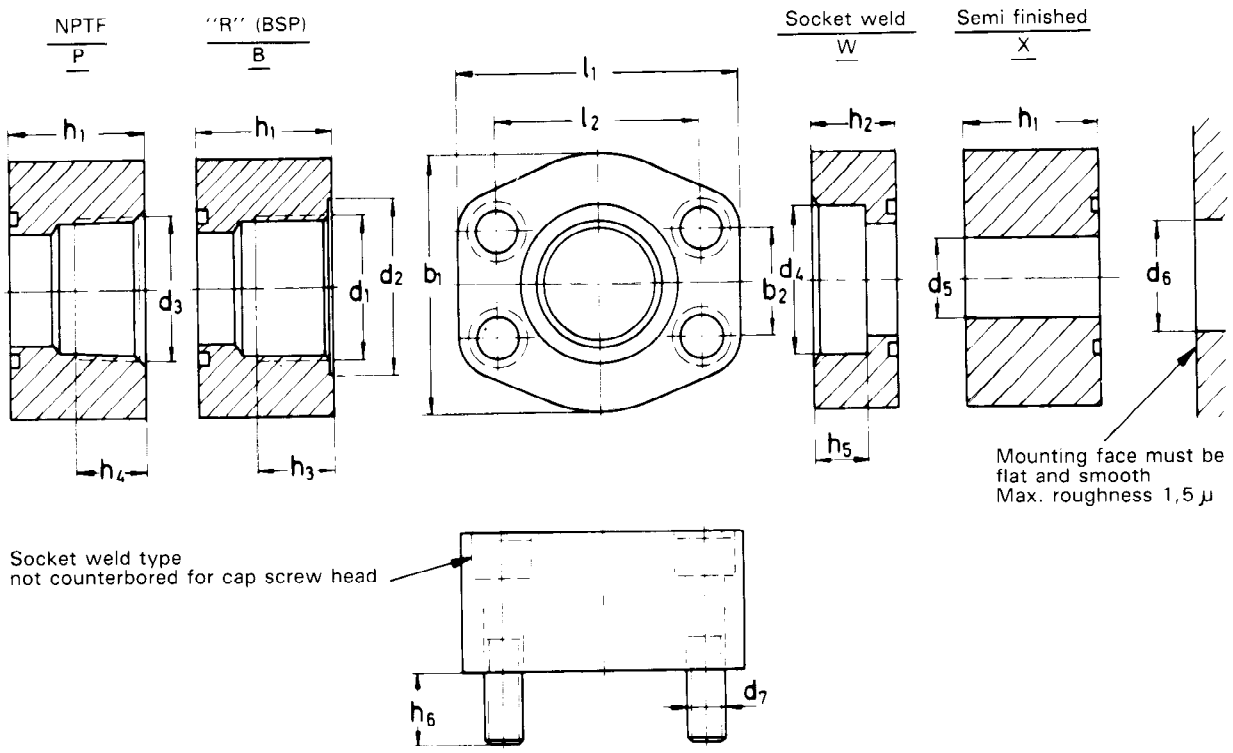
Theoritical displacement and torque

Cam ring	DISPLACEMENT		TORQUE n 100 bar	Series
	ml/Rev	ml/rad	N.m	
012	11,70	1,862	18,6	M3B
013	13,37	2,128	21,3	MB
018	19,10	3,040	30,4	M3B
018	19,83	3,156	31,6	MB
024	25,24	4,017	40,2	M1C
025	24,53	3,904	39,0	MB
027	30,50	4,854	48,5	M3B
033	34,74	5,529	55,3	M1C
035	36,38	5,790	57,9	MB
036	39,20	6,239	62,4	M3B
042	44,24	7,041	70,4	M1C
052	53,58	8,528	85,3	M1C
074	78,54	12,50	125,0	M3D
088	91,10	14,50	145,0	M3D
102	105,91	16,86	168,6	M3D
113	116,58	18,55	185,5	M3D
128	132,49	21,09	210,9	M3D
138	144,26	22,96	229,6	M3D

Notes



Substract internal leakage from theoretical flow supplied to the motor at given pressure to get motor speed.



Port Size	l_1	l_2	h_1 + 1	h_2	h_3	h_4	h_5	h_6 max.	b_1	b_2	d_1 R"	d_2	d_3 NPTF	d_4	d_5	d_6	d_7 UNC
3/4"	67	47,6	34	19	15,9	15,9	12	19	52	22,2	3/4"	40	3/4"	27	18	19	3/8" - 16
1"	72	52,4	34	24	20	19	14	15	58	26,2	1"	46	1"	33,7	23	25	3/8" - 16
1 1/4"	80	58,7	39	24	22	20,6	14	21	73	30,2	1 1/4"	54	1 1/4"	42,6	23	32	7/16" - 14

Model N°	Port Size	Code				To be fitted on :	Qty.
		NPTF P	R" (BSP) B	Socket weld W	Semi-finished X		
FS4-*-12-34	3/4"	S14-66925	S14-66933	S14-66941	S14-66955	M3B - M3B1	2
FS4-*-16-17	1"	S14-66926	S14-66934	S14-66942	S14-66956	M1C - M1C1	2
FS4-*-20-26	1 1/4"	S14-66927	S14-66935	S14-66943	S14-66957	M3D - M3D1	2

* NB - When selecting replace * by corresponding code e.g., P = NPTF,B = R" (BSP)
W = Socket weld, X = Semi finished.
If connections are used with special fluid add S4 or S5 ; for example S14-66938-S5

Standard-Flange