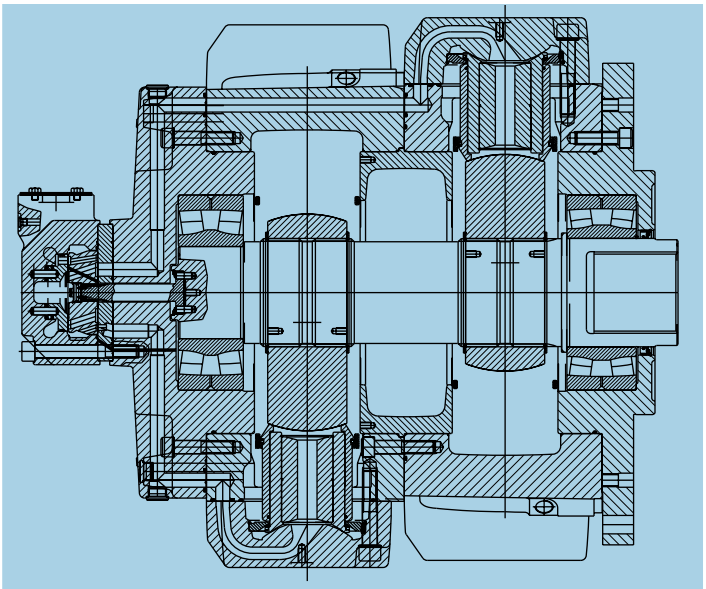
DENISON CALZONI
Radial Piston Motor
Type MRT, MRTE, MRTF

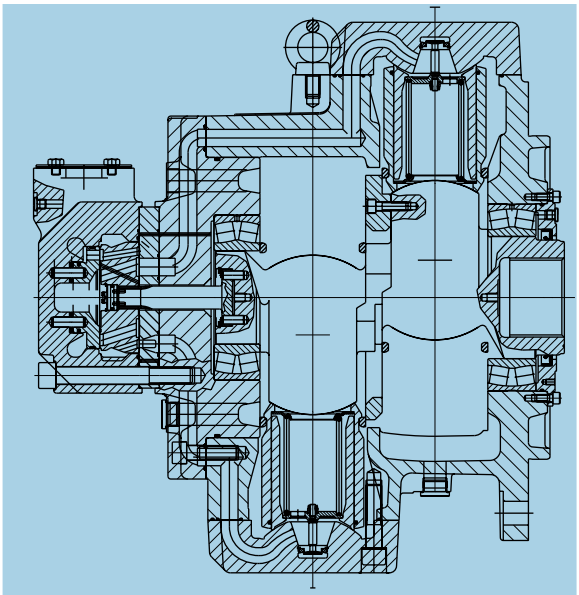
RCOa 2301/03.03

DENISON CALZONI

GENERAL CHARACTERISTICS



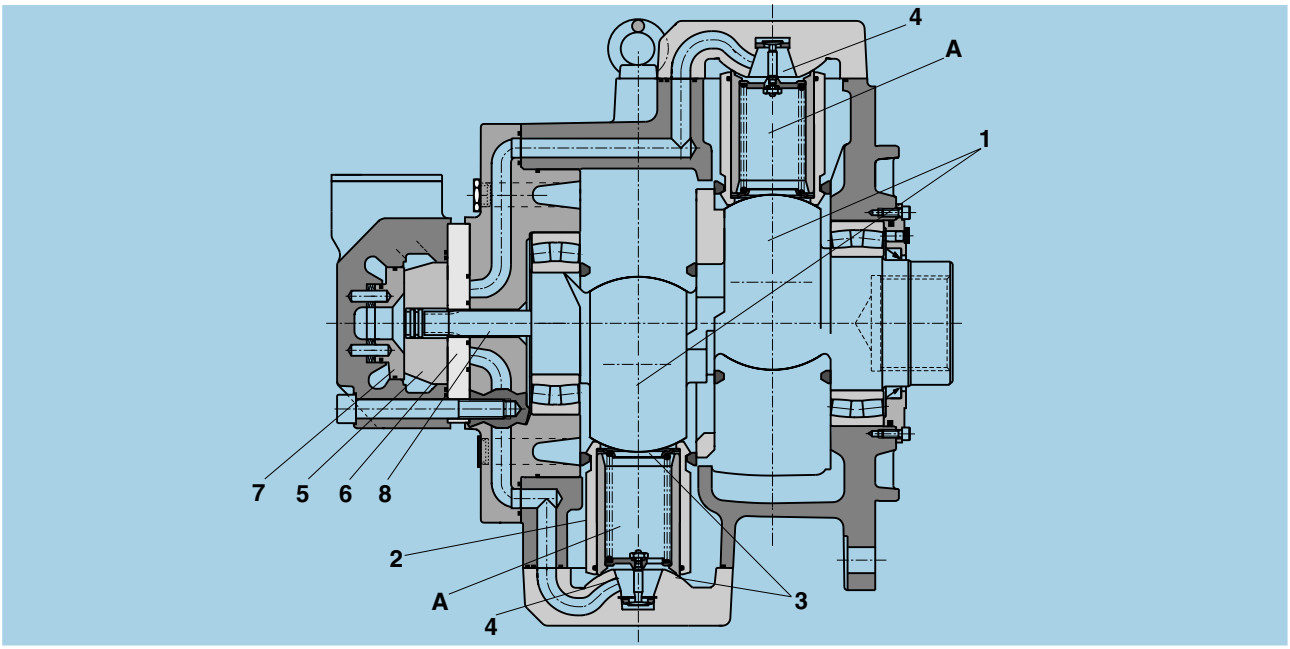
14 PISTONS MOTOR VERSION



10 PISTONS MOTOR VERSION

CONTRUCTION	Fixed displacement radial piston motor
TYPE	MRT, MRTE, MRTF
MOUNTING	Front flange mounting
CONNECTION	Connection flange
MOUNTING POSITION	Any (please note the installation notes on page 22)
DIRECTION OF ROTATION	Clockwise, anti-clockwise -reversible
FLUID	HLP mineral oils to DIN 51 524 part 2; Fluid type HFB, HFC and Bio-fluids on enquiry. FPM seals are required with phosphorous acid-Ester (HFD)
FLUID TEMPERATURE RANGE	t °F – 22° a + 176° (-30° a +80° C)
VISCOSITY RANGE [1)]	v = 85 to 4635 SUS (18 to 1000 mm²/s): Recommended operating range 141 to 230 SUS (30 to 50 mm²/s) (see fluid selection on page 6)
FLUID CLEANLINESS	Maximum permissible degree of contamination of fluid NAS 1638 Class 9. We therefore recommend a filter with a minimum retention rate of $\beta_{10} \geq 75$. To ensure a long life we recommend class 8 to NAS 1638. This can be achieved with a filter, with a minimum retention rate of $\beta_5 \geq 100$.

1) For different valves of viscosity please contact DENISON Calzoni



FUNCTIONAL DESCRIPTION

The outstanding performance, which is already known in our MR - MRE series motors, is the result of an original and patented design. The principle is to transmit the effort from the stator to the rotating shaft (1) by means of a pressurized column of oil (A) instead of the more common connecting rods, pistons, pads and pins. This oil column is contained by a telescopic cylinder (2) with a mechanical connection at the lips at each end which seal against the spherical surfaces (3) of the cylinder-heads (4) and the spherical surface of the rotating shaft (1). These lips retain their circular cross section when stressed by the pressure so there is no alteration in the sealing geometry. The particular selection of materials and optimisation of design has minimized both the friction and the leakage. Another advantage of this design stems from the elimination of any connecting rods, the cylinder can only expand and retract linearly so there are no transverse components of the thrust. This means no oval wear on the moving parts and no side forces on the cylinder joints. A consequence of this novel design as a 10 piston motor is the significant reduction in dimensions. Especially the diameter is limitated to a value of motors with half of its capacity. Performances reached by this motor type are improved with reference to other motors of same diplacement. Another advantage stems from the geometrical arrangement of the 10 - 14 pistons, that results in a static balance of the motor shaft and in a great reduction of the reaction forces on the bearings with consequent large extension of their life time.

TIMING SYSTEM

The timing system is realized by means of a rotary valve (5) driven by the rotary valve driving shaft (8) that it is connected to the rotating shaft. The rotary valve rotates between the rotary valve plate (6) and the reaction ring (7) which are fixed with the motor's housing. This timing system is also of a patented design being pressure balanced and self compensating for thermal expansion. The motor sizes from MRTE 16500 to MRTE 23000 are available with large timing system option that allows higher motor power performances as well as the possibility to have a throughhollow shaft (see pages 5, 18-19).

EFFICIENCY

The advantages of this type of valve coupled with a revolutionary cylinder arrangement produce a motor with extremly high values of mechanical and volumetric efficiency. The torque output is smooth even at very low speed and the motor gives a high performance starting under load.

STANDARD TIMING TECHINICAL DATA

Size Motor version	Displace-ment	Moment inertia of rotating parts	Theore-tical specific torque	Min. start. torque % Theore-tical torque	Maximun Pressure					Speed range		Maximum output power		Weight
					input					flushing		flushing		
					cont.	int.	peak	A+B	Drain	without	with	without	with	
	V	J		%	p	p	p	p	p	n	n	P	P	m
	in³	lb.ft²	lb.ft/psi		psi	psi	psi	psi	psi	rpm	rpm	Hp	Hp	lb
MRT 7100	433.5	19.45	5.75	91	3626	4351	6092	5802	72.5 (218 psi with "F1" shaft seal)	0.5-75	0.5-150	303.1	442.5	2028
MRTF 7800	476.5	19.45	6.32	91	3046	3626	5076	5802		0.5-70	0.5-130	256.1	375.5	2028
MRTE 8500	519.8	19.45	6.90	91	3046	3626	5076	5802		0.5-60	0.5-120	265.5	388.9	2028
MRT 9000	549.5	31.32	7.29	91	3626	4351	6092	5802		0.5-70	0.5-130	339.3	496.2	2028
MRTF 9900	604.4	31.32	8.02	91	3046	3626	5076	5802		0.5-60	0.5-120	274.9	402.3	2028
MRTE 10800	659.2	31.32	8.75	91	3046	3626	5076	5802		0.5-65	0.5-110	284.3	415.7	2028
MRT 14000	854.9	2990	11.34	91	3626	4351	6092	5802		0.5-50	0.5-80	319.2	476.1	6834
MRTF 15500	932.3	2990	12.36	91	3046	3626	5076	5802		0.5-40	0.5-75	273.6	409	6867
MRTE 16500	1009.5	2990	13.39	91	3046	3626	5076	5802		0.5-40	0.5-70	276.3	413	6900
MRT 17000	1022.7	2990	14.58	91	3626	4351	6092	5802		0.5-40	0.5-70	332.6	497.5	6834
MRTF 18000	1100.0	2990	14.59	91	3046	3626	5076	5802		0.5-40	0.5-65	288.3	429.1	6867
MRT 19500	1190.5	2990	15.79	91	3626	4351	6092	5802		0.5-35	0.5-60	332.6	497.5	6834
MRTE 20000	1207.5	2990	16.01	91	3046	3626	5076	5802		0.5-35	0.5-60	284.3	423.8	6900
MRTF 21500	1298.0	2990	17.21	91	3046	3626	5076	5802		0.5-30	0.5-55	280.3	417.1	6867
MRTE 23000	1405.6	2990	18.64	91	3046	3626	5076	5802		0.5-30	0.5-50	274.9	410.4	6900

SPECIAL TIMING TECHINICAL DATA (please contact DENISON Calzoni)

Size Motor version	Displace-ment	Moment inertia of rotating parts	Theore-tical specific torque	Min. start. torque % Theore-tical torque	Maximun Pressure					Speed range		Maximum output power		Weight
					input					flushing		flushing		
					cont.	int.	peak	A+B	Drain	without	with	without	with	
	V	J		%	p	p	p	p	p	n	n	P	P	m
	in³	lb.in²	lb.ft/psi		psi	psi	psi	psi	psi	rpm	rpm	Hp	Hp	lb
MRTE 16500	1009.5	2990	13.39	91	3046	3626	5076	5802	72.5 (218 psi with "F1" shaft seal)	0.5-50	0.5-80	316.5	472	6900
MRT 17000	1022.7	2990	13.56	91	3626	4351	6092	5802		0.5-50	0.5-80	380.9	569.9	6834
MRTF 18000	1100.0	2990	14.59	91	3046	3626	5076	5802		0.5-50	0.5-80	332.6	496.2	6867
MRT 19500	1190.5	2990	15.79	91	3626	4351	6092	5802		0.5-50	0.5-80	443.9	662.5	6834
MRTE 20000	1207.5	2990	16.01	91	3046	3626	5076	5802		0.5-45	0.5-75	355.4	529.7	6900
MRTF 21500	1298.0	2990	17.21	91	3046	3626	5076	5802		0.5-45	0.5-75	380.9	569.9	6867
MRTE 23000	1405.6	2990	18.64	91	3046	3626	5076	5802		0.5-45	0.5-75	380.9	616.9	6900

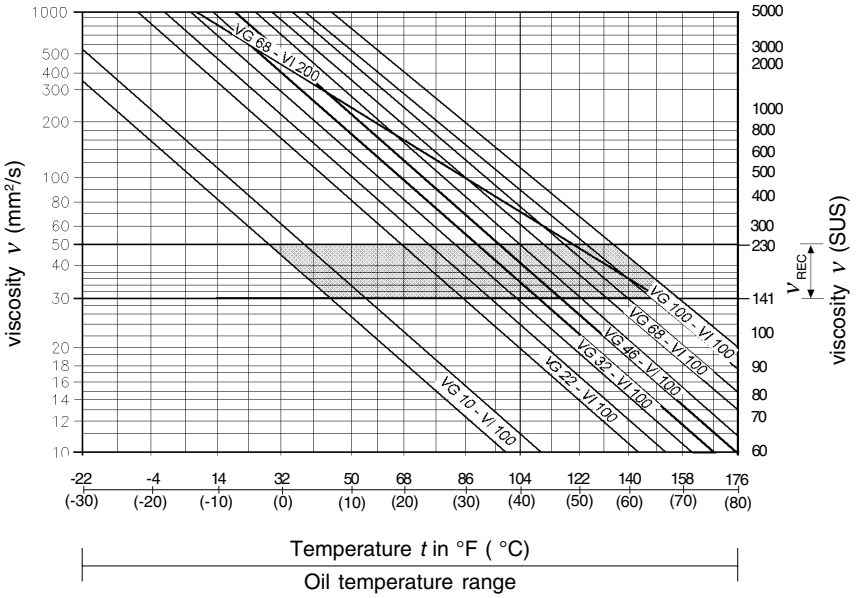
(*) Please contact DENISON Calzoni

EXAMPLE: At a certain ambient temperature, the operating temperature in the circuit is 122°F (50°C). In the optimum operating viscosity range (v_{rec}; shaded section), this corresponds to viscosity grades VG 46 or VG 68; VG 68 should be selected.

IMPORTANT: The drain oil temperature is influenced by pressure and speed and is usually higher than the circuit temperature or the tank temperature. At no point in the system, however, may the temperature be higher than 176°F (80°C).

If the optimum conditions cannot be met due to the extreme operating parameters or high ambient temperature, we always recommend flushing the motor case in order to operate within the viscosity limits.

Should it be absolutely necessary to use a viscosity beyond the recommended range, you should first contact DENISON Calzoni for confirmation.



GENERAL NOTES

More detailed information regarding the choice of the fluid can be requested to DENISON Calzoni. Further notes on installation and commissioning can be found on page 22 of this data sheet. When operating with HF pressure fluids or bio-degradable pressure fluids possible limitations of the technical data must be taken into consideration, please see information sheet TCS 85, or consult DENISON Calzoni.

OPERATING VISCOSITY RANGE

The viscosity, quality and cleanliness of operating fluids are decisive factors in determining the reliability, performance and life-time of an hydraulic component. The maximum life-time and performance are achieved within the recommended viscosity range. For applications that go beyond this range, we recommend to contact DENISON Calzoni.

$v_{rec.}$ = recommended operating viscosity 141...230 SUS (30...50 mm²/s)

This viscosity refers to the temperature of the fluid entering the motor, and at the same time to the temperature inside the motor housing (case temperature). We recommend to select the viscosity of the fluid based on the maximum operating temperature, to remain within the recommended viscosity range. To reach the value of maximum continuous power the operating viscosity should be within the recommended viscosity range of 30 - 50 cSt.

LIMITS OF VISCOSITY RANGE

For limit conditions the following is valid:

$v_{min.abs.}$ = 45 SUS (10 mm²/s) in emergency, short term

$v_{min.}$ = 85 SUS (18 mm²/s) for continuous operation at reduced performances

$v_{max.}$ = 4635 SUS (1000 mm²/s) short term upon cold start

CHOOSING THE TYPE OF FLUID ACCORDING TO THE OPERATING TEMPERATURE

The operating temperature of the motor is defined as the greater temperature between that of the incoming fluid and that of the fluid inside the motor housing (case temperature).We recommend that you choose the viscosity of the fluid based on the maximum operating temperature, to remain within the recommended viscosity range (see diagram). We recommend that the higher viscosity grade must be selected in each case.

FILTRATION

The motor life also depends on the fluid filtration. At least it must correspond to one of the following cleanliness.

class 9	according to NAS 1638
class 6	according to SAE, ASTM, AIA
class 18/15	according to ISO/DIS 4406

In order to assure a longer life a cleanliness class 8 to NAS 1638 is recommended, achieved with a filter of β_5=100. In case the above mentioned classes can not be achieved, please consult us.

CASE DRAIN PRESSURE

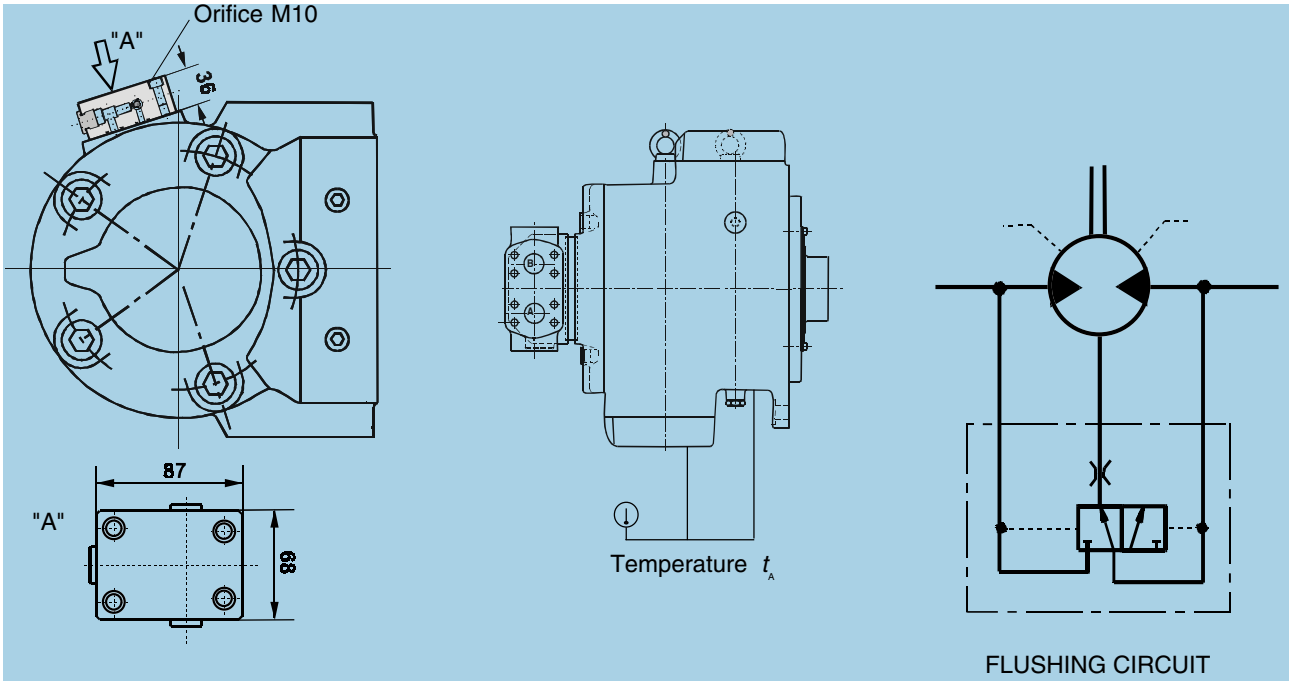
The lower the speed and the case drain pressure, the longer the life of the shaft seal. The maximum permissible housing pressure is

p_{max} = 72.5 psi

If the case drain pressure is higher than 72.5 psi it is possible to use a special 218 psi shaft seal (see page 23, Seals, Code"F1").

"FPM" SEALS

In case of operating conditions with high oil temperature or high ambient temperature, we recommend to use "FPM" seals (see page 23, Seals, Code "V1"). These "FPM" seals should be used with HFD fluids.



FLUSHING PROCEDURE

In order to achieve the maximum continuous performance values the flushing of the housing is necessary (see diagrams pages 8 to 12).
Under special conditions, in order to achieve the recommended operating viscosity of 141-230 SUS (30 - 50 mm²/s) in the motor housing, the flushing of the motor may be necessary also in the "operating area without flushing" see page 6 and the "operating diagram" page 7 to12.

NOTE1:

The oil temperature inside the motor housing is obtainable by adding 5°F (3° C) to the motor housing surface temperature, measured between two cylinders (t_A, see figures).

FUNCTION:

The flushing valve takes the flushing flow always from the low pressure line of the motor.
The diameter of the orifice has to be chosen in order to supply the recommended quantity of flushing flow of 6 gpm (23 l/min).

BACK PRESSURE (psi)	ORIFICE DIAMETER (inch)
43.5	0.189
87.0	0.158
130.5	0.142
217.6	0.126
290.1	0.118
362.6	0.114
435.1	0.110

NOTE2:

The flushing valve is delivered with a "closed" orifice.

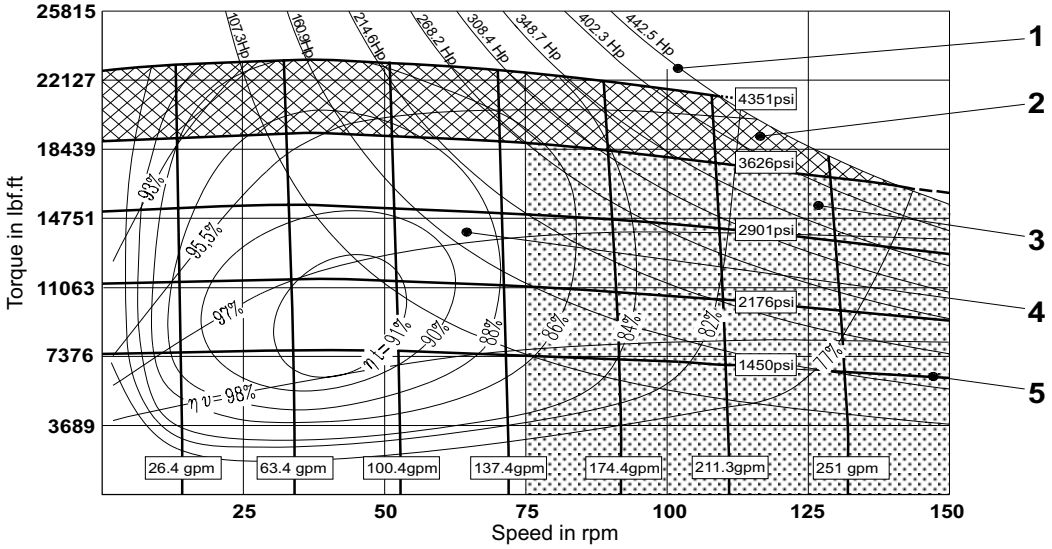
Caution: Flushing does not work until the "closed" orifice is replaced by the proper one.

OPERATING DIAGRAM (average values) measured at ν = 167 SUS (36 mm²/s); t = 113°F (45° C); p_{outlet} = 0 psi (0 bar)

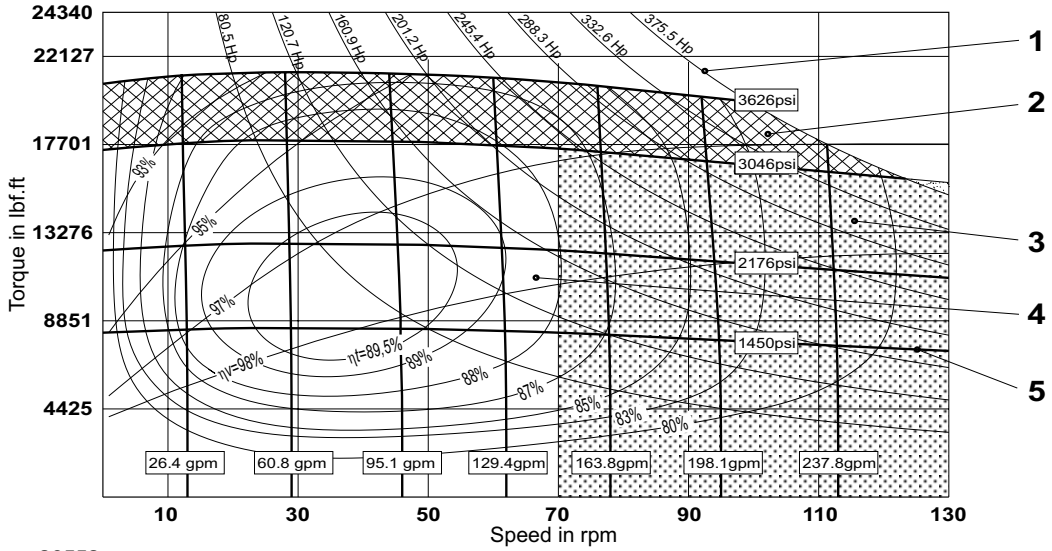
1 Output power **2** Intermittent operating area **3** Continuous operating area with flushing

4 Continuous operating area **5** Inlet pressure ηt Total efficiency ηv Volumeter efficiency

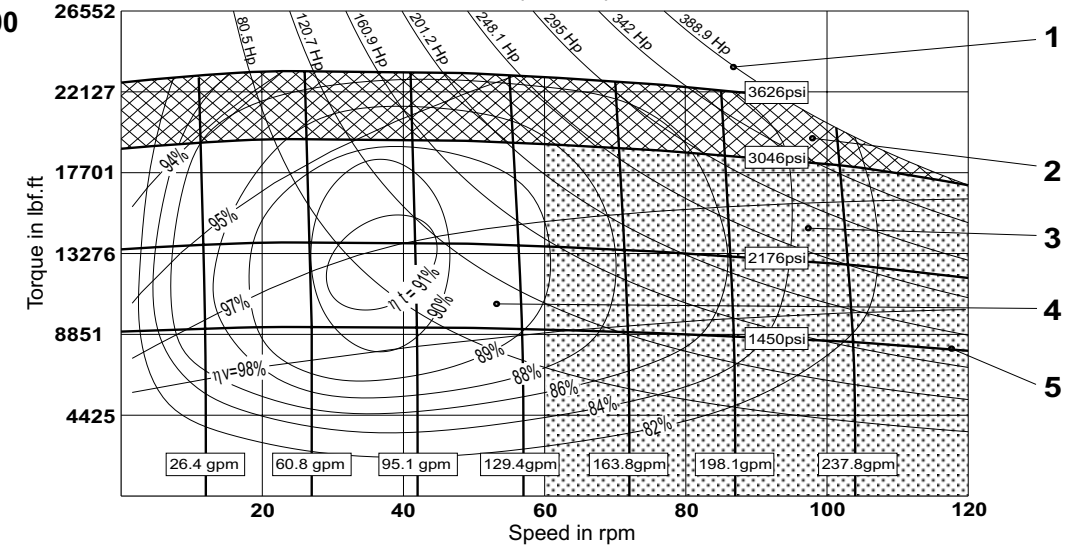
MRT 7100



MRTF 7800



MRTE 8500

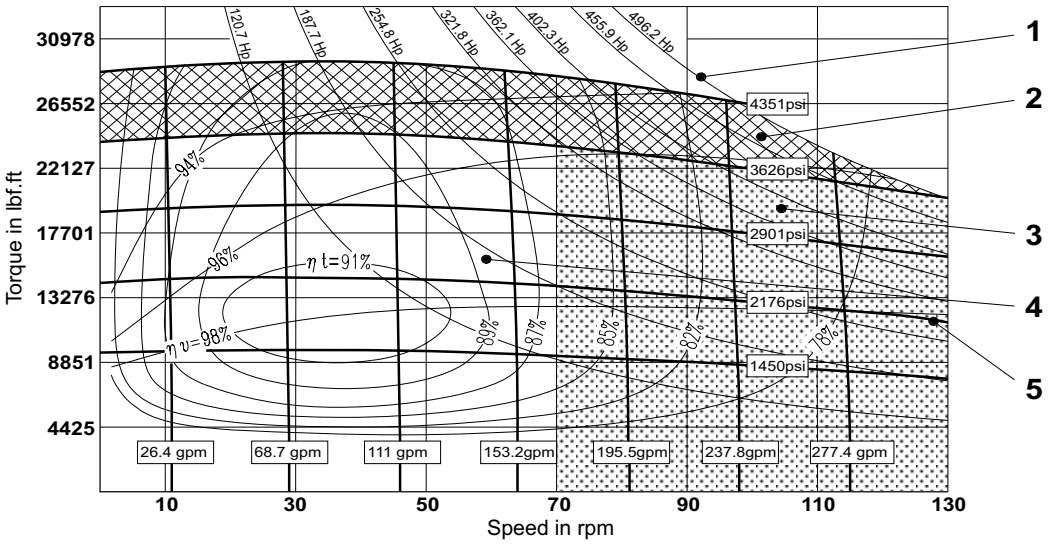


OPERATING DIAGRAM (average values) measured at ν = 167 SUS (36 mm²/s); t = 113°F (45° C); p_{outlet} = 0 psi (0 bar)

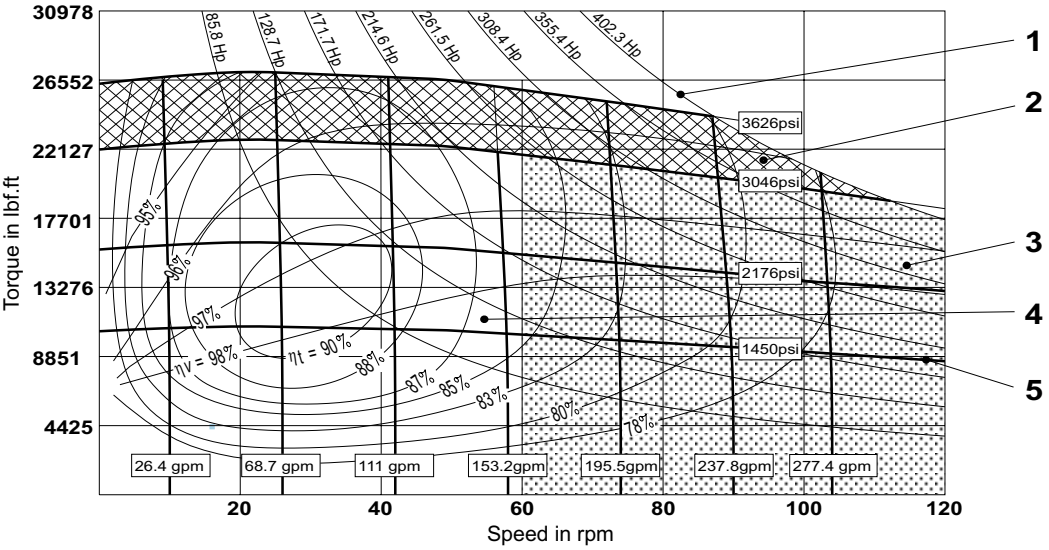
1 Output power **2** Intermittent operating area **3** Continuous operating area with flushing

4 Continuous operating area **5** Inlet pressure ηt Total efficiency ηv Volumeter efficiency

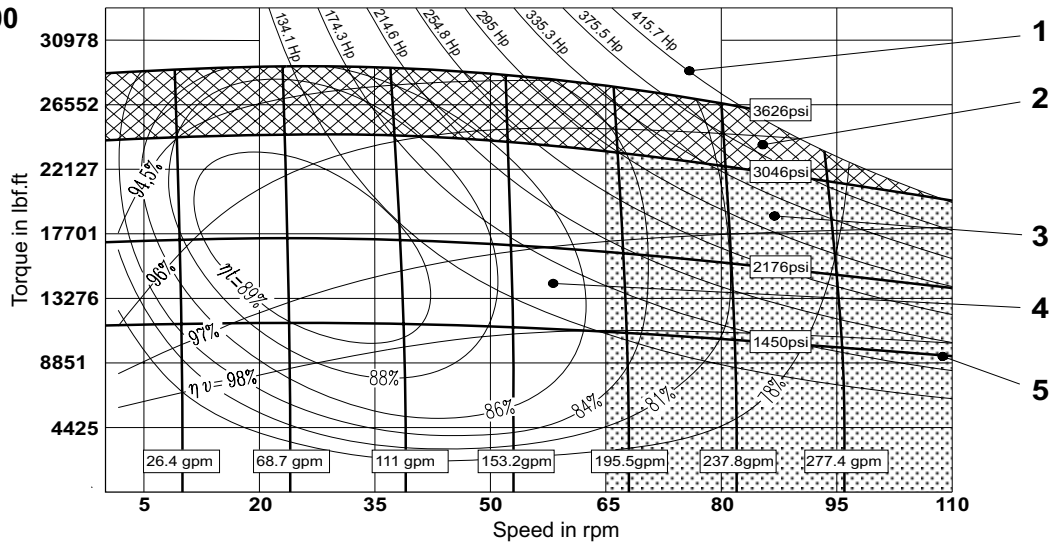
MRT 9000



MRTF 9900



MRTE 10800

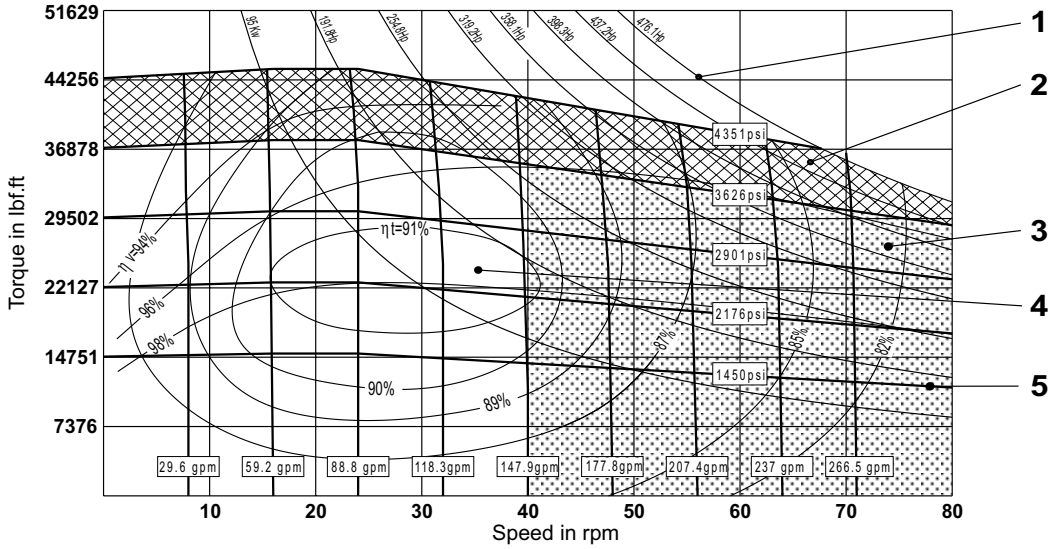


OPERATING DIAGRAM (average values) measured at V = 167 SUS (36 mm²/s); t = 113°F (45° C); p_{outlet} = 0 psi (0 bar)

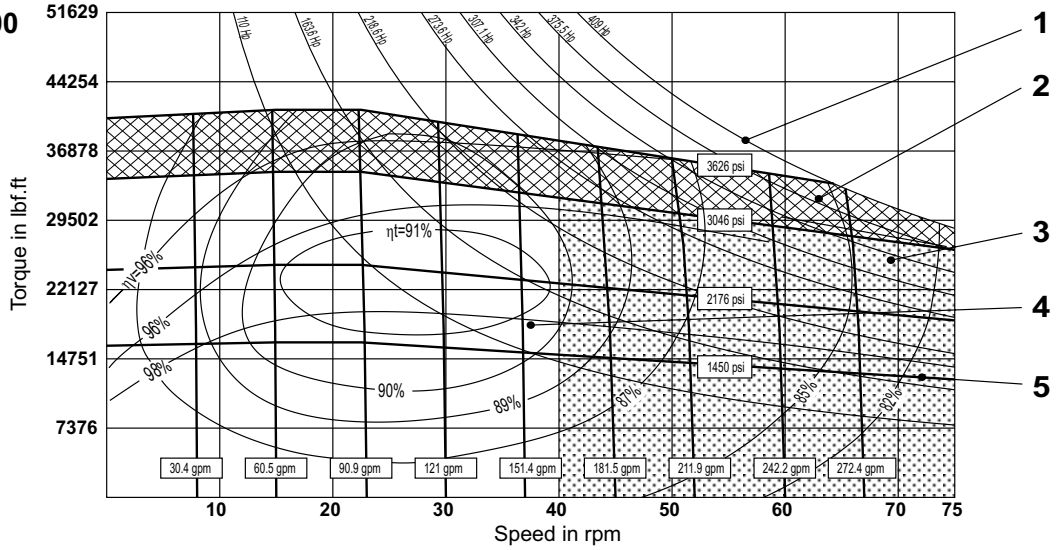
1 Output power **2** Intermittent operating area **3** Continuous operating area with flushing

4 Continuous operating area **5** Inlet pressure ηt Total efficiency ηv Volumeter efficiency

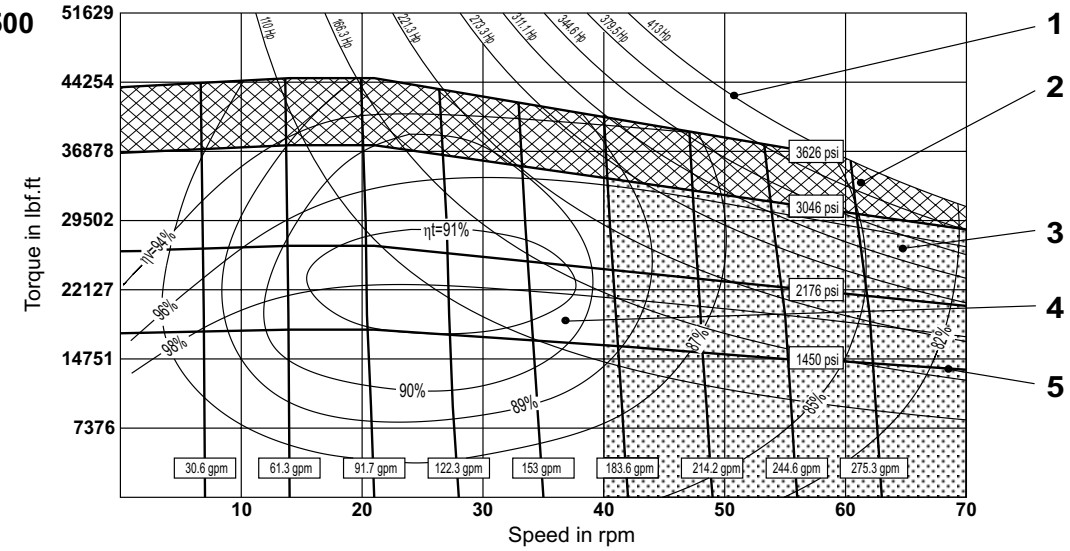
MRT 14000



MRTF 15500



MRTE 16500

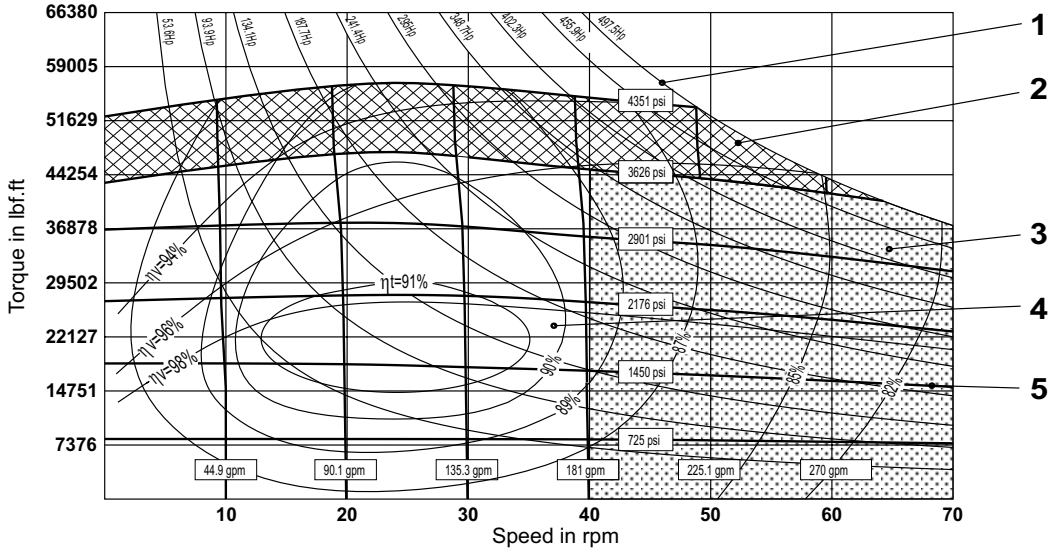


OPERATING DIAGRAM (average values) measured at ν = 167 SUS (36 mm²/s); t = 113°F (45° C); p_{outlet} = 0 psi (0 bar)

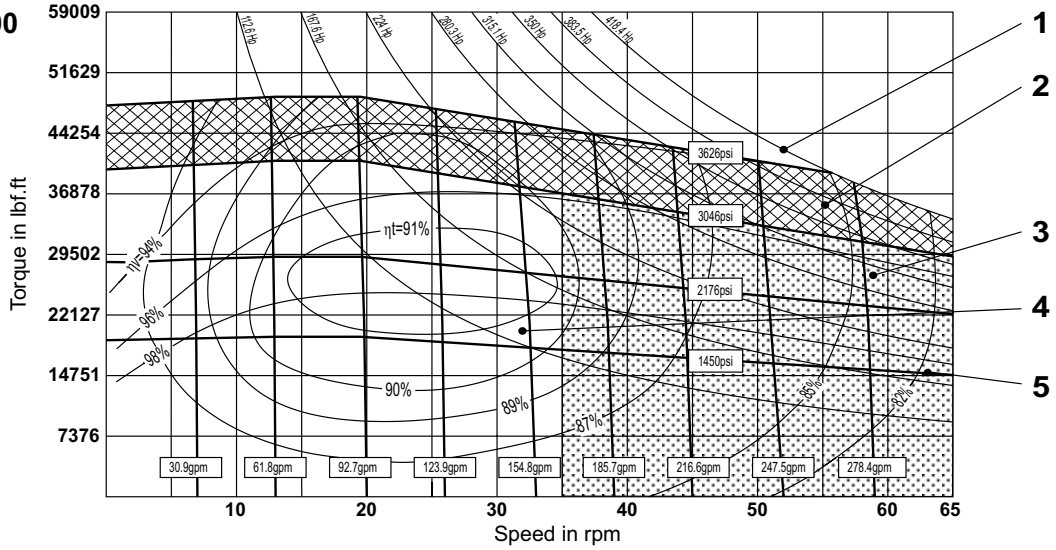
1 Output power **2** Intermittent operating area **3** Continuous operating area with flushing

4 Continuous operating area **5** Inlet pressure ηt Total efficiency ηv Volumeter efficiency

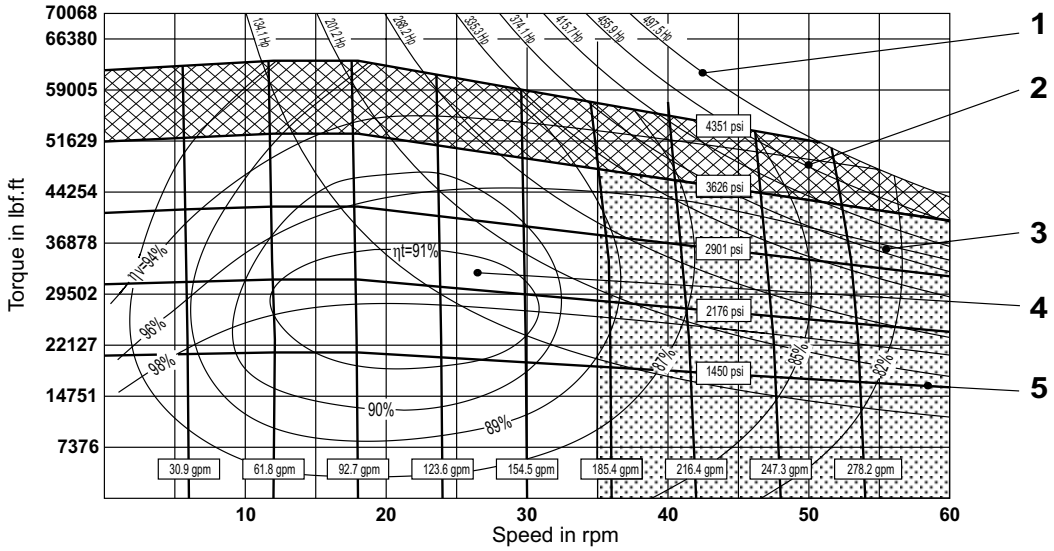
MRT 17000



MRTF 18000



MRT 19500

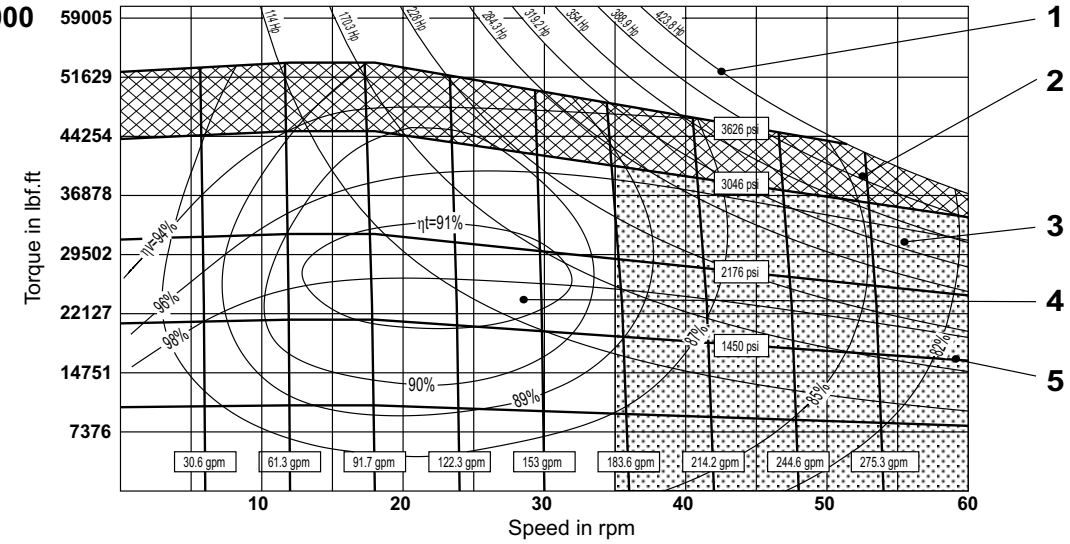


OPERATING DIAGRAM (average values) measured at ν = 167 SUS (36 mm²/s); t = 113°F (45° C); p_{outlet} = 0 psi (0 bar)

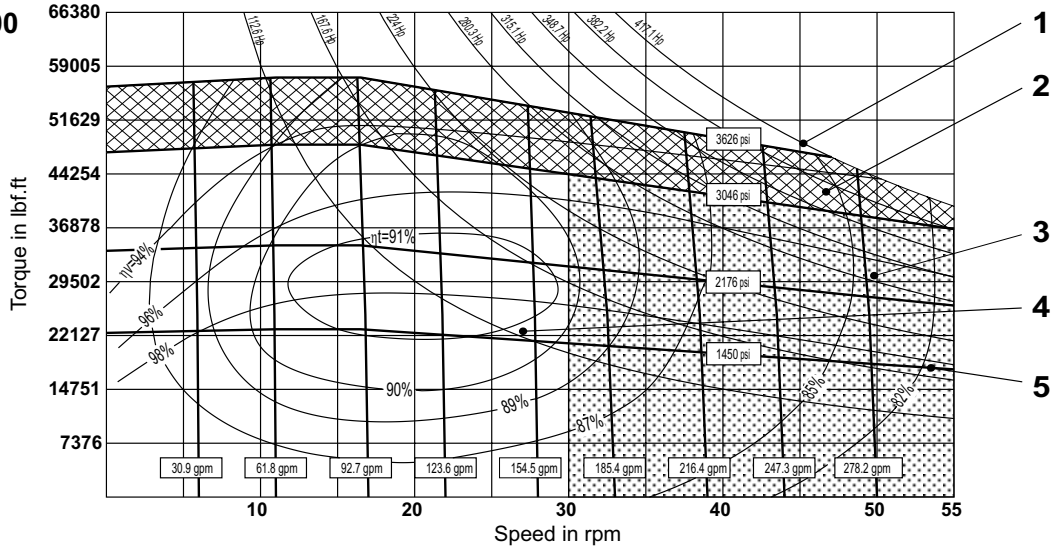
1 Output power **2** Intermittent operating area **3** Continuous operating area with flushing

4 Continuous operating area **5** Inlet pressure ηt Total efficiency ηv Volumeter efficiency

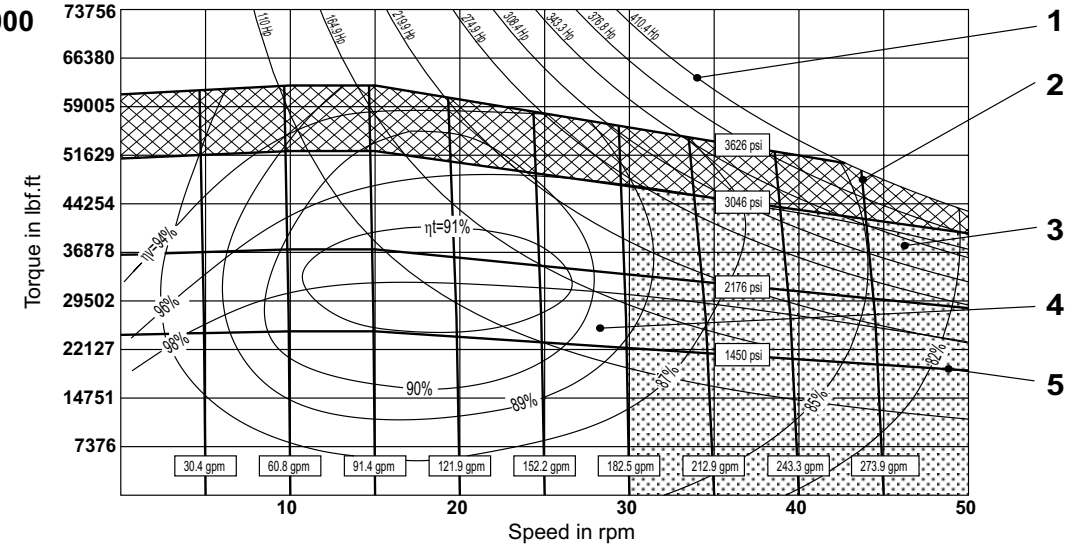
MRTE 20000



MRTF 21500



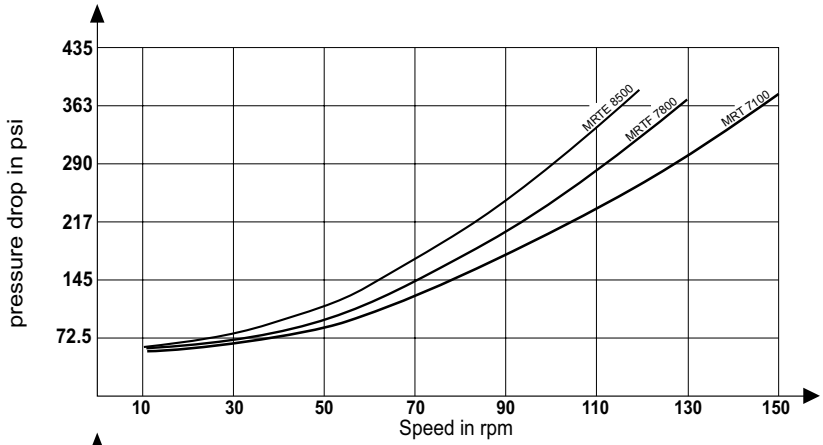
MRTE 23000



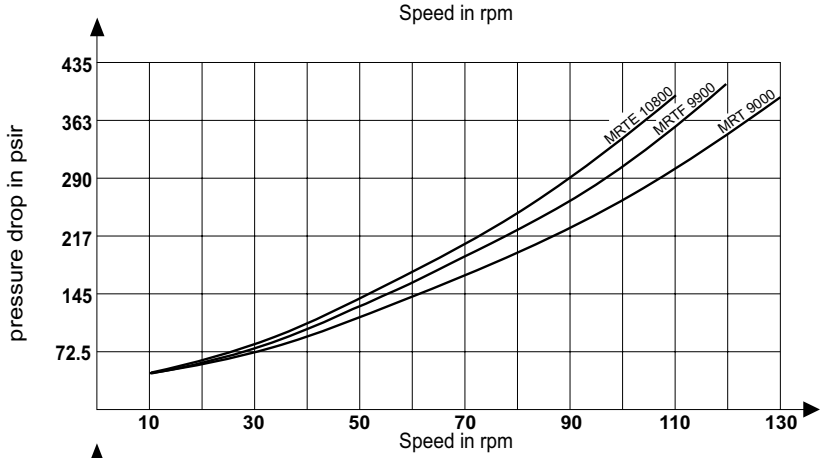
OPERATING DIAGRAM (average values) measured at V = 167 SUS (36 mm²/s); t = 113°F (45° C);

Min. required pressure difference Δp with idling speed (shaft unloaded) p_{outlet} = 0 psi (0 bar)

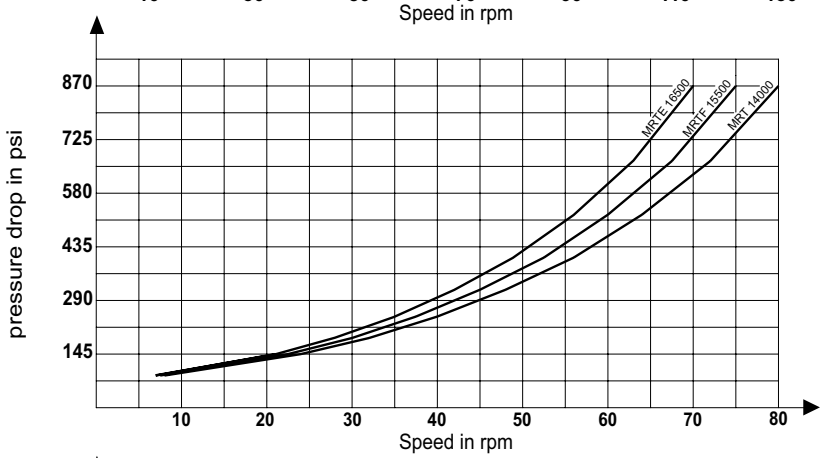
MRT - MRTE - MRTF 7100 - 8500



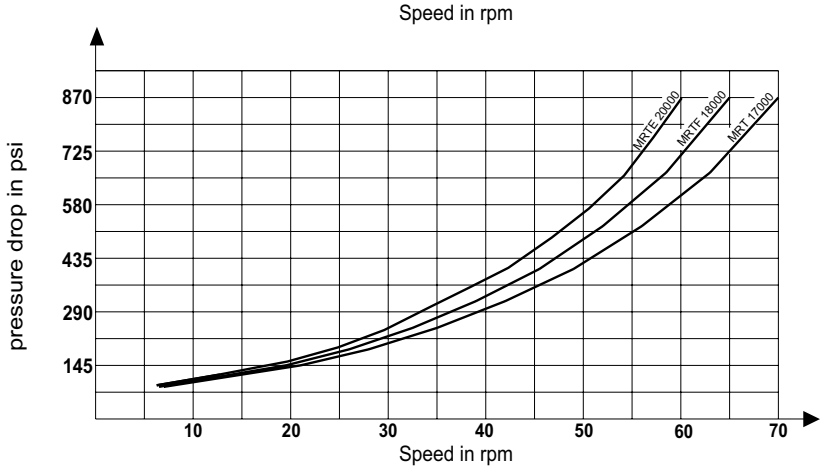
MRT - MRTE - MRTF 9000 - 10800



MRT - MRTE - MRTF 14000 - 16500



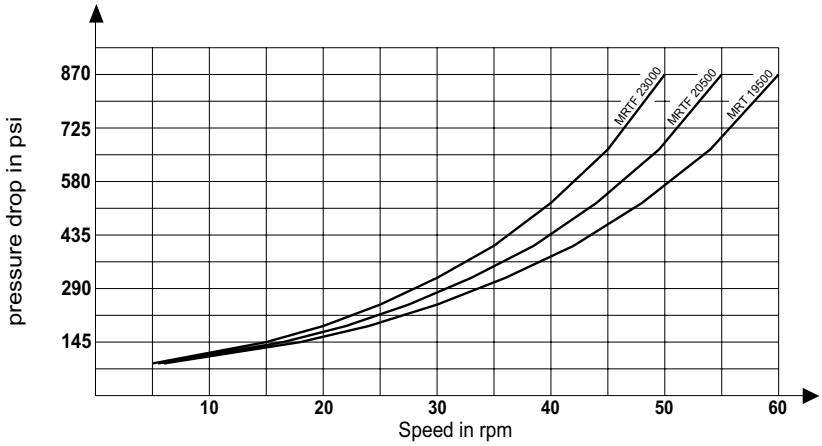
MRT - MRTE - MRTF 17000 - 20000



OPERATING DIAGRAM (average values) measured at V = 167 SUS (36 mm²/s); t = 113°F (45° C);

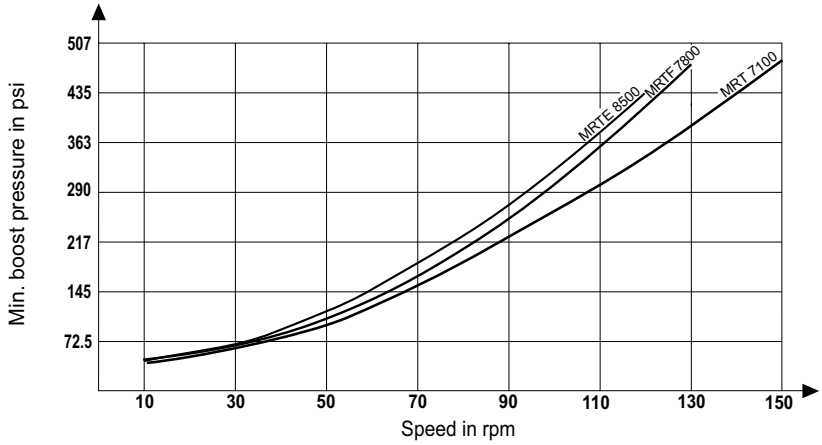
Min. required pressure difference Δp with idling speed (shaft unloaded) p_{outlet} = 0 psi (0 bar)

MRT - MRTE - MRTF 19500 - 23000

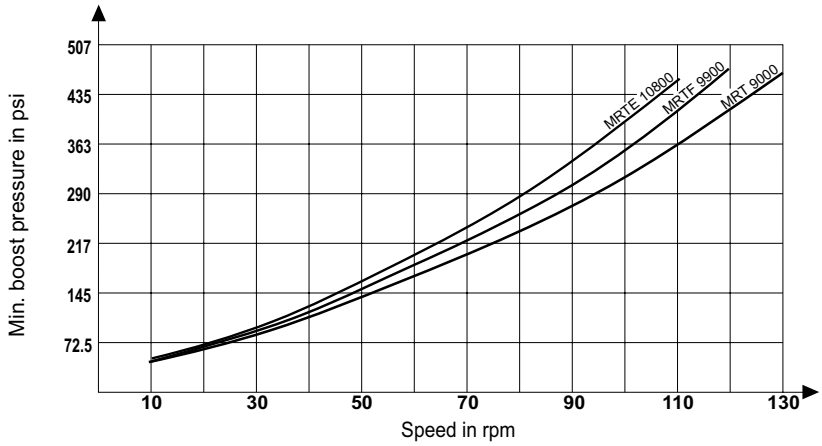


Minimum boost pressure during pump operation

MRT - MRTE - MRTF 7100 - 8500



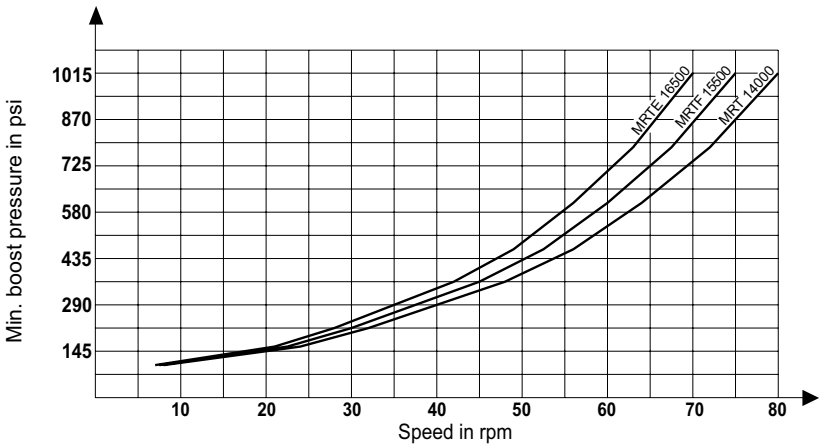
MRT - MRTE - MRTF 9000 -10800



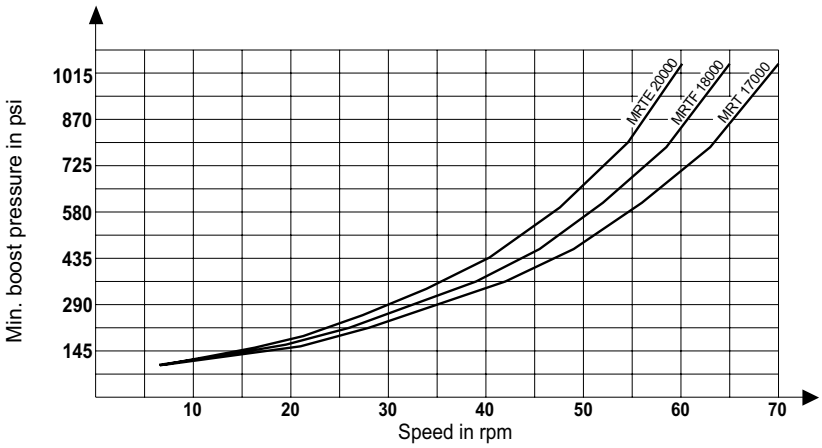
OPERATING DIAGRAM (average values) measured at V = 167 SUS (36 mm²/s); t = 113°F (45° C);

Minimum boost pressure during pump operation p_{outlet} = 0 psi (0 bar)

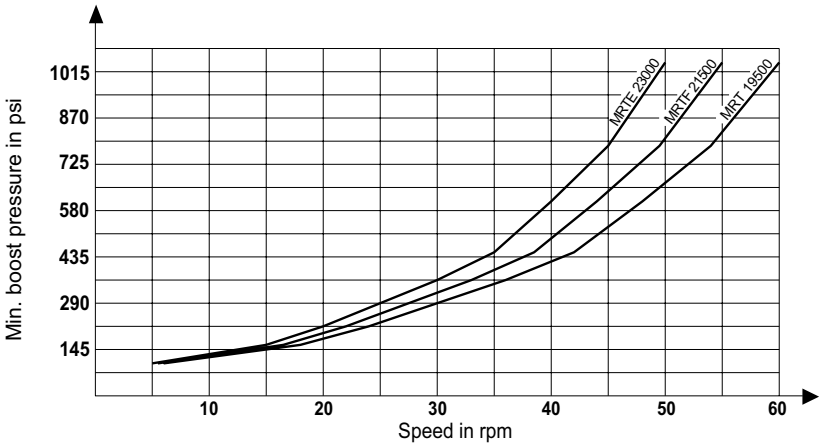
MRT - MRTE - MRTF 14000 - 16500

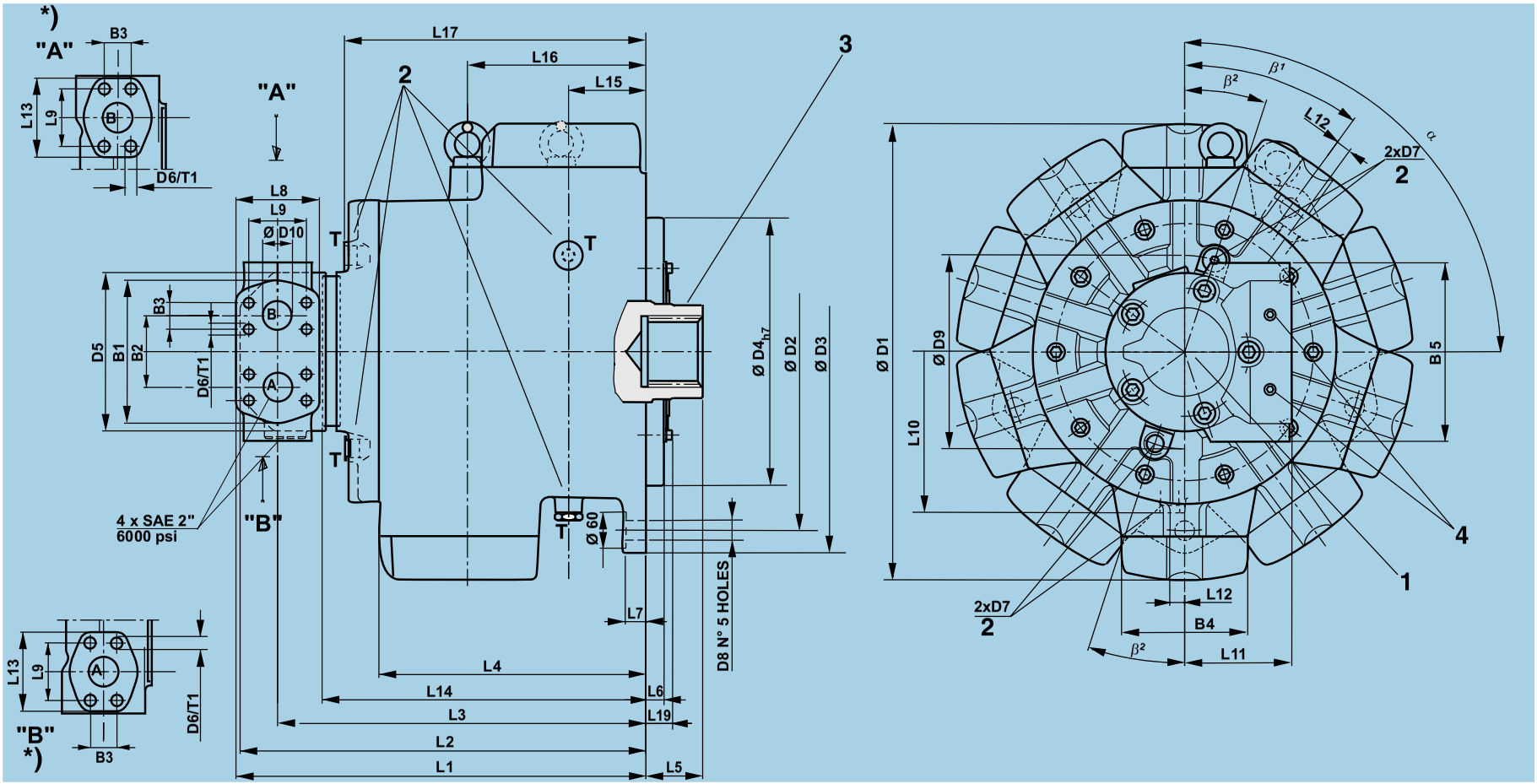


MRT - MRTE - MRTF 17000 - 20000



MRT - MRTE - MRTF 19500 - 23000





1 On request port flange can be rotated by 72°

*) These SAE ports are present only in the MRT 9000P, MRTF 9900P, MRTE 10800P, MRT 14000Q, MTRF15500Q, MRTE16500, MRT 17000Q, MRTF 18000Q, MRT 19500Q, MRTE 20000Q, MRTF 21500Q e MRTE 23000Q

2 Case drain port BSP threads to ISO 228/1

3 See dimensions at page 17

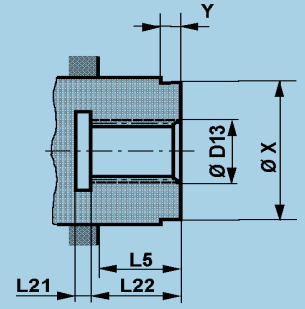
4 Port 1/4“ BSP threads to ISO 228/1 for pressure reading.

Dir. of Rotation (Viewed on shaft end)	Port inlet	ordering code (see page23)
clockwise	A	"N"
anti-clockwise	B	
clockwise	B	"S"
anti-clockwise	A	

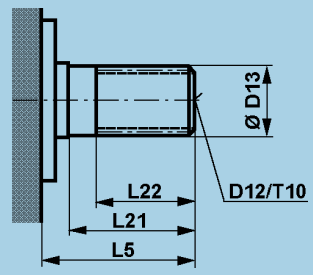
MOTOR TYPE	L1 (inch)	L2 (inch)	L3 (inch)	L4 (inch)	L6 (inch)	L7 (inch)	L8 (inch)	L9 (inch)		L10 (inch)	L11 (inch)	L12 (inch)	L13 (inch)	L14 (inch)	L15 (inch)	L16 (inch)	L17 (inch)	L19 (inch	B1 (inch)	B2 (inch)	B3 (inch)		B4 (inch)	B5 (inch)
								SAE 3000 psi	SAE 6000 psi												SAE 3000 psi	SAE 6000 psi		
MRT 7100 MRTF 7800 MRTE 8500 MRT 9000 MRTF 9900 MRTE 10800	27.106	26.831	24.35	17.657	1.181	1.378	5.512	3.062	3.811	10.63	7.087	0.984	5.236	21.319	5.118	11.811	19.823	1.732	9.449	4.724	1.688	1.748	8.346	11.811

MOTOR TYPE	Ø D1 (inch)	Ø D2 (inch)	Ø D3 (inch)	Ø $D4_{h7}$ (inch)	Ø D5 (inch)	D6(mm)		T1(inch)		D7	Ø D8 (inch)	Ø D9 (inch)	Ø D10 (inch)	α	β¹	β²
						SAE 3000 psi	SAE 6000 psi	SAE 3000 psi	SAE 6000 psi							
MRT 7100 MRTF 7800 MRTE 8500 MRT 9000 MRTF 9900 MRTE 10800	30.157	23.622	26.614	17.7164 17.7140 (450 mm)	10.472	M12	M20	1.10	1.575	G1"	1.299 (x5)	12.795	1.969	90°	36°	18°

Code F 1 - DIN 5480

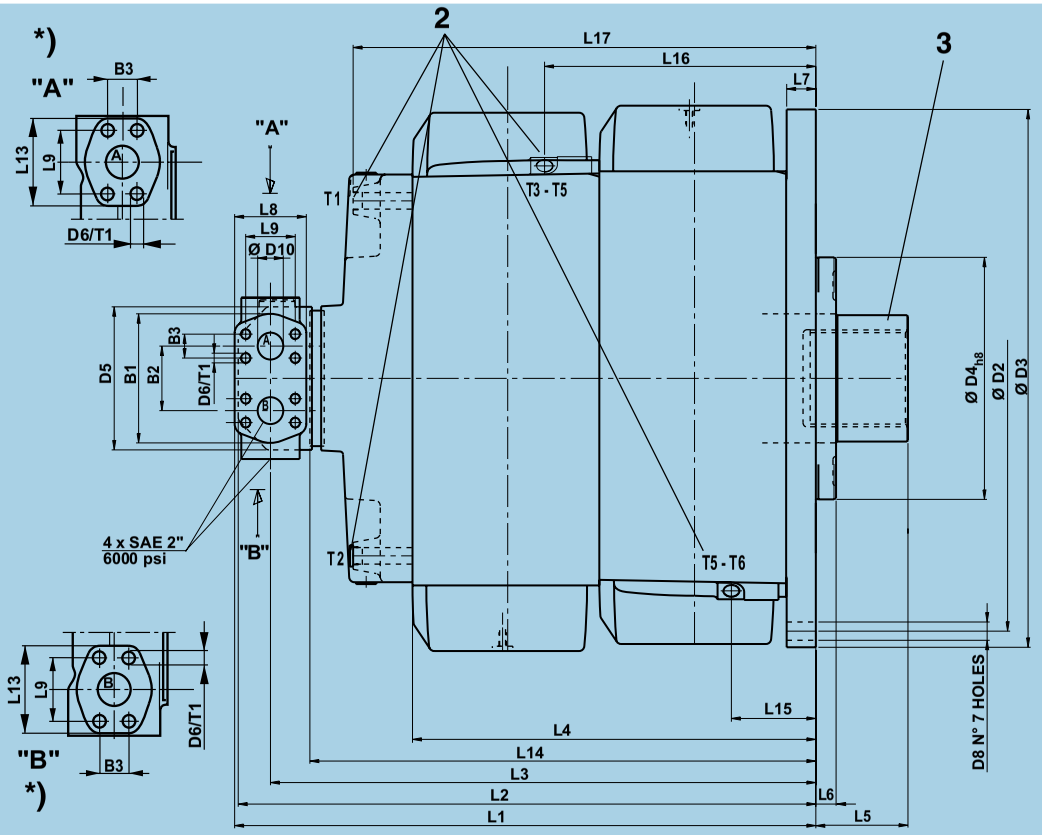


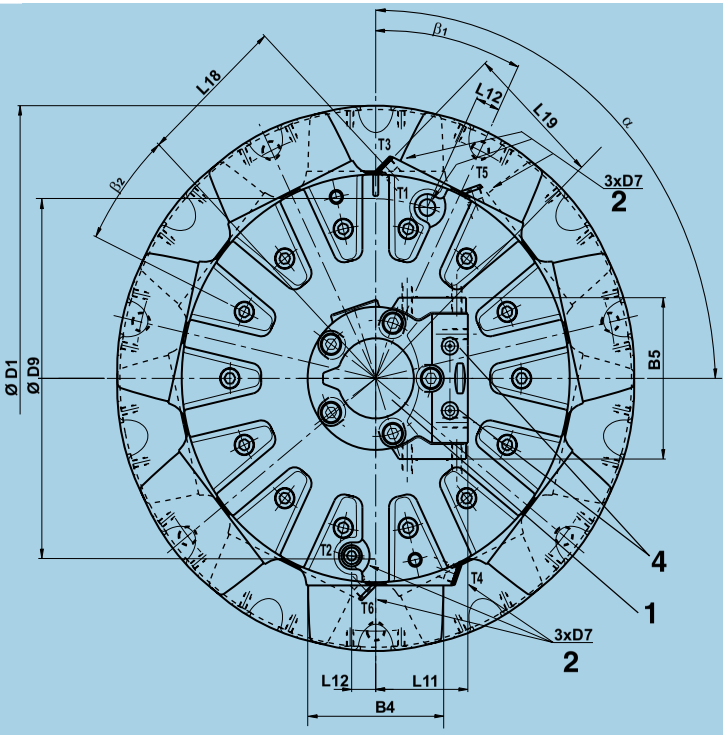
Code D 1 - DIN 5480

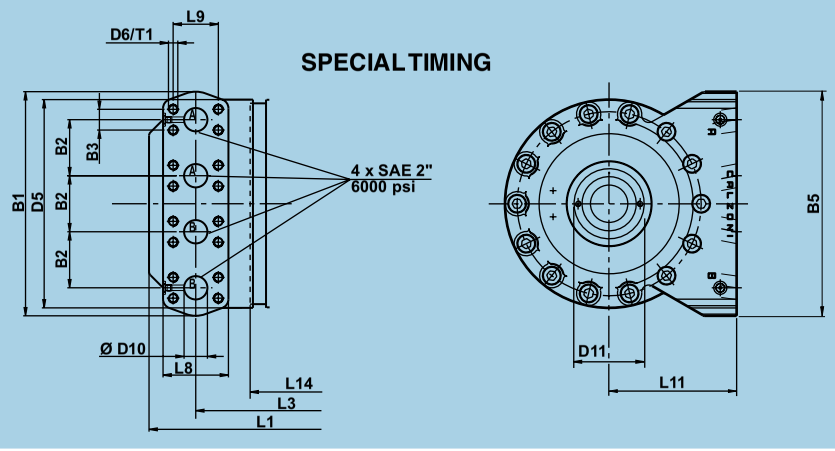


MOTOR TYPE	F1						D1					
	L5 (inch)	L21 (inch)	L22 (inch)	Ø D13 DIN 5480	Ø X_{h8} (inch)	Ø Y (inch)	L5 (inch)	L21 (inch)	L22 (inch)	Ø D13 DIN 5480	D12 (mm)	T10 (inch)
MRT 7100 MRTF 7800 MRTE 8500	1.969	0.4724	3.071	N 110x3x35 - 9H	5.3543 5.352 (136 mm)	0.196	--	--	--	--	--	--
MRT 9000 MRTF 9900 MRTE 10800	3.740	0.4724	3.071	N 120x4x28 - 9H	5.3543 5.352 (136 mm)	1.968	9.843	8.071	6.575	W 140x5x26 - 8f	M12	0.984

NOTE: the threaded holes (D12/T10) for the shaft versions ""D1"" must be considered as service holes. In case the holes dimensions required by the application are different from the ones listed here above, plese contact DENISON Calzoni.







1 On request port flange can be rotated by 72°

*) These SAE ports are present only in the MRT 14000Q, MTRF15500Q, MRTE16500, MRT 17000Q, MRTF 18000Q, MRT 19500Q, MRTE 20000Q, MRTF 21500Q e MRTE 23000Q

2 Case drain port BSP threads to ISO 228/1

3 See dimensions at page 19

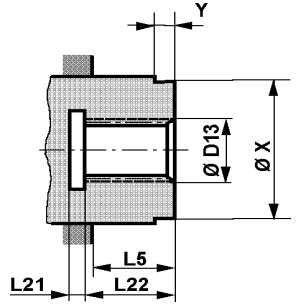
4 Port 1/4“ BSP threads to ISO 228/1 for pressure reading.

Dir. of Rotation (Viewed on shaft end)	Port inlet	ordering code (see page23)
clockwise	A	"N"
anti-clockwise	B	
clockwise	B	"S"
anti-clockwise	A	

MOTOR TYPE	L1 (inch)	L2 (inch)	L3 (inch)	L4 (inch)	L5 (inch)	L6 (inch)	L7 (inch)	L8 (inch)	L9 (inch) SAE 3000 psi	L9 (inch) SAE 6000 psi	L11 (inch)	L12 (inch)	L13 (inch)	L14 (inch)	L15 (inch)	L16 (inch)	L17 (inch)	L18 (inch)	L19 (inch)	B1 (inch)	B2 (inch)	B3 (inch) SAE 3000 psi	B3 (inch) SAE 6000 psi	B4 (inch)	B5 (inch)	α	β_1	β_2
MRT 14000 MRTF 15500 MRTE 16500 MRT 17000 MRTF 18000 MRT 19500 MRTE 20000 MRTF 21500 MRTE 23000	44.705	44.429	41.949	31.024	3.150	1.555	2.284	5.512	3.062	3.811	7.087	1.850	5.236	38.917	6.496	20.866	35.59	11.378	10.63	9.449	4.724	1.688	1.748	10.63	11.811	90°	25°41'	20°

MOTOR TYPE	Ø D1 (inch)	Ø D2 (inch)	Ø D3 (inch)	Ø $D4_{h8}$ (inch)	Ø D5 (inch)	D6 (mm) SAE 3000 psi	D6 (mm) SAE 6000 psi	T1 (inch) SAE 3000 psi	T1 (inch) SAE 6000 psi	D7	Ø D8 (inch)	Ø D9 (inch)	Ø D10 (inch)
MRT 14000 MRTF 15500 MRTE 16500 MRT 17000 MRTF 18000 MRT 19500 MRTE 20000 MRTF 21500 MRTE 23000	39.921	33.701	36.634	17.7165 17.7128 (450 mm)	10.472	M12	M20	1.10	1.575	G1"	1.339 (x7)	26.260	1.969

Code F 1 - DIN 5480

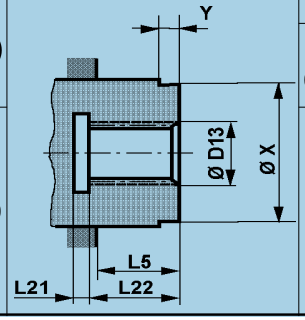


F1 L5 (inch)	L21 (inch)	L22 (inch)	Ø D13 DIN 5480	Ø X_{h8} (inch)	Y (inch)
3.150	0.551	6.102	N 150x4x36 - 9H	9.2519 9.2491 (235 mm)	1.575

SPECIAL TIMING DIMENSIONS (please contact DENISON Calzoni)

MOTOR TYPE	L1 (inch)	L3 (inch)	L5 (inch)	L8 (inch)	L9 (inch) SAE 3000 psi	L9 (inch) SAE 6000 psi	L11 (inch)	L14 (inch)	B1 (inch)	B2 (inch)	B3 (inch) SAE 3000 psi	B3 (inch) SAE 6000 psi	B5 (inch)	D6 (mm) SAE 3000 psi	D6 (mm) SAE 6000 psi	T1 (inch) SAE 3000 psi	T1 (inch) SAE 6000 psi	D7	Ø D9 (inch)	Ø D10 (inch)	Ø D11 (inch)
MRTE 16500 MRT 17000 MRTF 18000 MRT 19500 MRTE 20000 MRTF 21500 MRTE 23000	46.338	42.401	3.228	5.512	3.062	3.811	10.748	37.815	18.898	4.724	1.688	1.748	17.559	M12	M20	1.10	1.575	G1"	26.260	1.969	3.150

Code F 1 - DIN 5480



F1 L5 (inch)	L21 (inch)	L22 (inch)	Ø D13 DIN 5480	Ø X_{h8} (inch)	Y (inch)
3.228	0.551	6.102	N 150x4x36 - 9H	7.6771 7.6743 (195 mm)	1.575

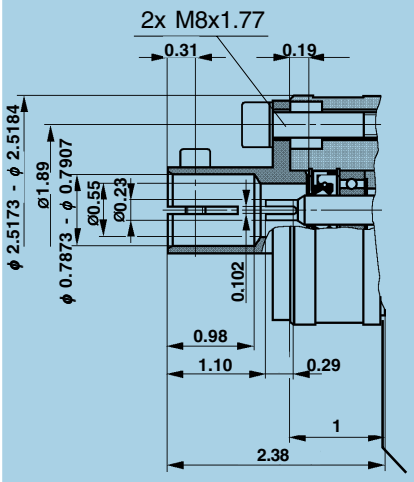
MECHANICAL TACHOMETER DRIVE

TACHOGENERATOR DRIVE

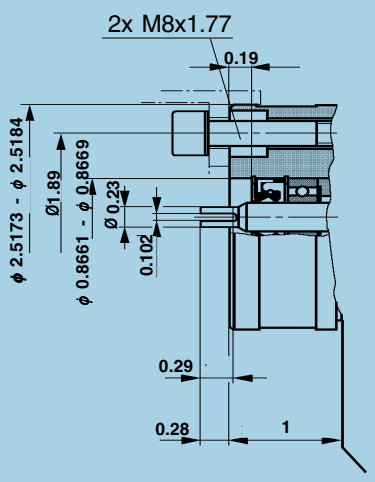
ENCODER DRIVE

Dimensions in inch (threaded holes in mm)

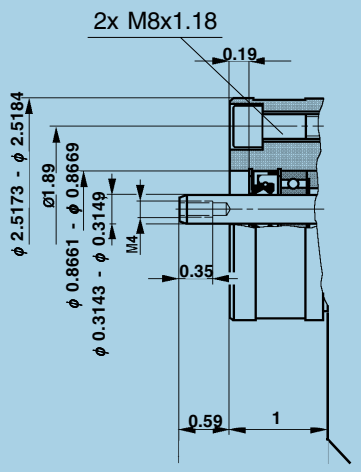
Code "C1"



Code "T1"



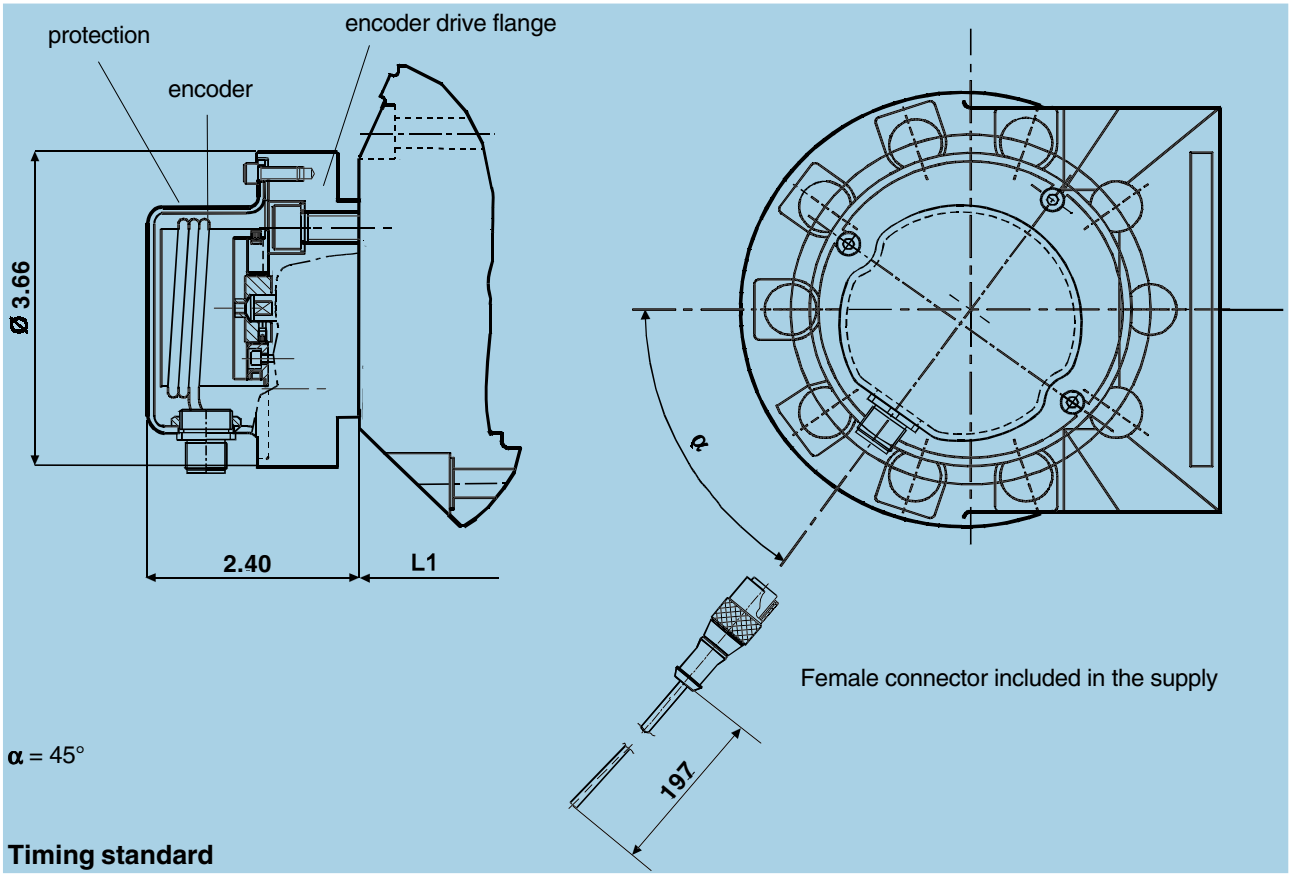
Code "Q1"



Timing standard

INCREMENTAL ENCODER DIMENSIONS

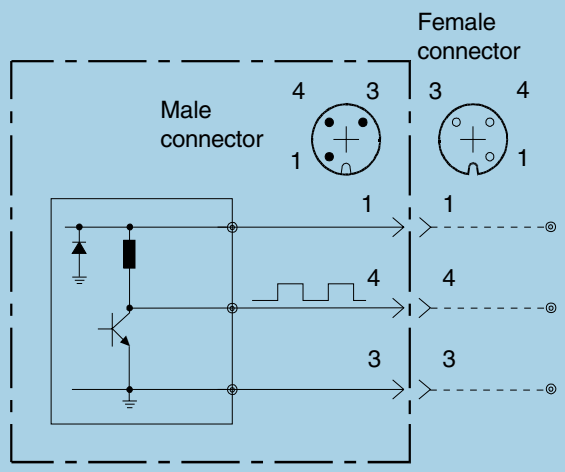
Dimensions in inch (threaded holes in mm)



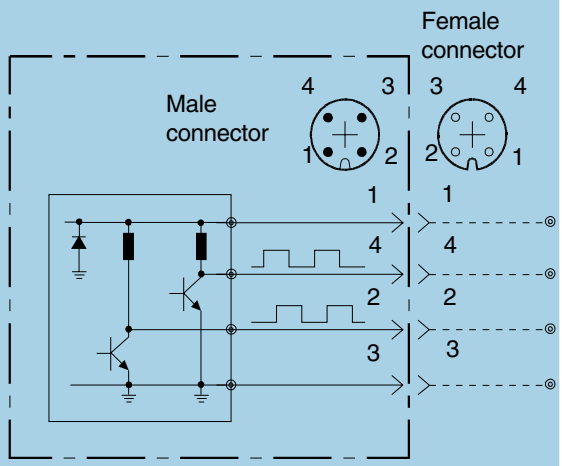
Timing standard

INCREMENTAL ENCODER
CONNECTION DIAGRAMS

Monodirectional



Bidirectional



Color wires and function		
1	**Brown**	Power Supply (8 to 24 Vdc)
2	**White**	Output B phase (MAX 10 mA - 24 Vcc)
3	**Blue**	Power Supply (0 Vdc)
4	**Black**	Output A phase (MAX 10 mA - 24 Vcc)

INCREMENTAL ENCODER
TECHNICAL DATA

Encoder type:	**ELCIS mod. 478**
Supply voltage:	**8 to 24 Vcc**
Current consumption:	**120 mA max**
Current output:	**10 mA max**
Output signal:	**A phase- MONODIRECTIONAL A and B phase BIDIRECTIONAL**
Response frequency:	**100 KHz max**
Number of pulses:	**500 (others on request - max 2540)**
Slew speed:	**Always compatible with maximum motor speed**
Operating temperature range:	**from 32 to 158 °F**
Storage temperature range:	**from -22 to +185 °F**
Ball bearing life:	**$1.5x10^9$ rpm**
Weigth:	**0,220 lb**
Protection degree:	**IP 67 (with protection and connector assembled)**

Connectors:

MONODIRECTIONAL	**RSF3/0.5 M (Lumberg)**	**male**
	RKT3-06/5m (Lumberg)	**female**
BIDIRECTIONAL	**RSF4/0.5 M (Lumberg)**	**male**
	RKT4-07/5m (Lumberg)	**female**

Note: Female connectors cable length equal to 16.4 foot (ft).

Mounting

Any mounting position
- Note the position of the case drain port (see below)

Install the motor properly
- Mounting surface must be flat and resistant to bending

Min. tensile strength of mounting screws to DIN 267 Part 3 class 10.9
- Note the prescribed fastening torque

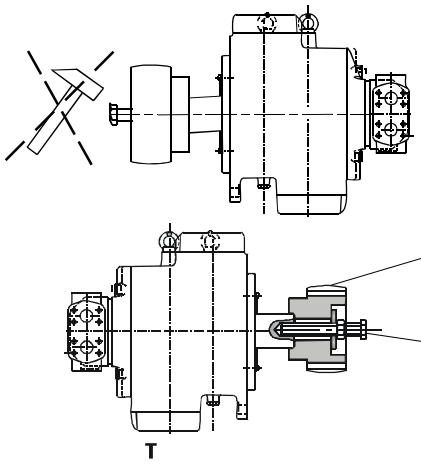
Pipes, pipe connections

Use suitable screws!
- Depending on type of motor use either threaded or flange connection

Choose pipes and hoses suitable for the installation
- Please note manufacturing data!

Before operation fill with hydraulic fluid
- Use the prescribed filter!

Coupling



Mounting with screws

Use thread bore in the drive shaft

Take apart with extractor

Curved tooth coupling hub

Screw to remove the coupling hub

Note: Two of the mounting screws must be precisely located/fitted if operation is started and stopped frequently or if high reversible frequencies exist.

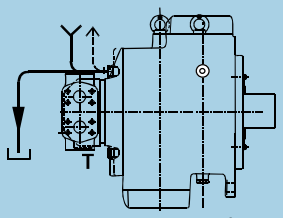
DRAIN AND FLUSHING LINK INSTALLATION EXAMPLES

Note: Install leakage line in such a way that motor **cannot** run empty.

T = Seal
Y = Motor housing feeding point
← = Bleed

Note: Install leakage line in such a way that motor **cannot** run empty.

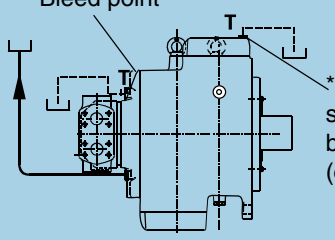
Low pressure case drain returns to tank



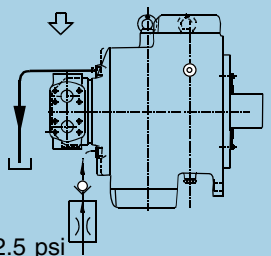
2 alternative case drain ports in the first cilinder row at 120° one from another

Cooling circuits for heavy duty continuous operation

Bleed point

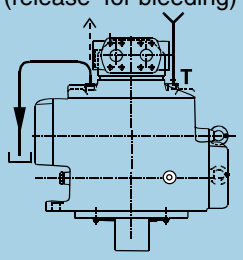


*) N° 2 Bleed screws for bleeding (on request)



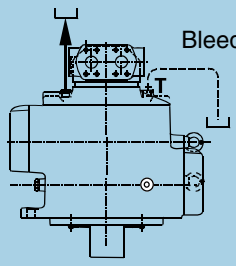
Flushing
p_{max} = 72.5 psi
with standard shaft seal

(release for bleeding)

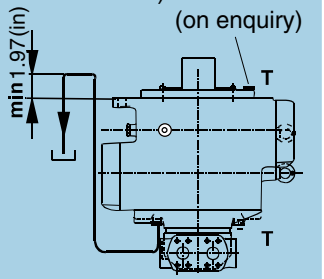


Overhead tank

Bleed point



*) Bleed screw (on enquiry)



Choose drain port in order to allow the complete filling of the housing with hydraulic fluid.

***)** Special designs for applications, where the equipment needs to be filled with oil.(e.g. in a salty atmosphere)

CODE

Example: MRT 7100P - D1 M1 F1 S1 N **

1. **MRT** 7100P - D1 M1 F1 S1 N **
SERIES

MRT	standard 3626 psi max. continuous
MRTF - MRTE	expanded 3046 psi max. continuous

2. MRT **7100P** - D1 M1 F1 S1 N **
SIZE & DISPLACEMENT

P	code	**MRT 7100 P**	**MRTF 7800 P**	**MRTE 8500 P**
	in^3	433.3	476.5	519.8
	code	**MRT 9000 P**	**MRTF 9900 P**	**MRTE 10800 P**
	in^3	549.5	604.4	659.2
Q	code	**MRT 14000 Q**	**MRTF 15500 Q**	**MRTE 16500 Q**
	in^3	854.9	932.3	1009.5
	code	**MRT 17000 Q**	**MRTF 18000 Q**	**MRT 19500 Q**
	in^3	1022.7	1100.0	1190.5
	code	**MRTE 20000 Q**	**MRTF 21500 Q**	**MRTE 23000 Q**
	in^3	1207.5	1298.0	1405.6

3. MRT 7100P - **D1** M1 F1 S1 N **
SHAFT

D1	spline DIN 5480 (see page 17)
F1	female spline DIN 5480 (see page 17-19)

4. MRT 7100P - D1 **M1** F1 S1 N **
SPEED SENSOR OPTION

N1	none	
Q1	encoder drive (see page 20)	
C1	mechanical tachometer drive (see page 20)	
T1	tachogenerator drive (see page 20)	
M1	incremental Elcis encoder (500 pulse/rev) (see page 20)	Uni-directional
B1		Bi-directional

5. MRT 7100P - D1 M1 **F1** S1 N **
SEALS

N1	NBR mineral oil
F1	NBR,218 psi shaft seal
V1	FPM seals
U1	no shaft seal (for brake)

6. MRT 7100P - D1 M1 F1 **S1** N **
CONNECTION FLANGE

S1	standard SAE metric (see page 16-19)
G1	SAE 6000 psi metric (see page 16-19)
M1	SAE 6000 psi metric special timing (see page 16-19)

7. MRT - 7100P - D1 M1 F1 S1 **N** **
ROTATION

N	standard rotation (CW: inlet in A, CCW: inlet in B)
S	reversed rotation (CW: inlet in B, CCW: inlet in A)

8. MRT 7100P - D1 M1 F1 S1 N ******
SPECIAL

******	space reserved to Denison Calzoni

International Distributors

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Korea
Malaysia
New Zealand
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Brazil
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