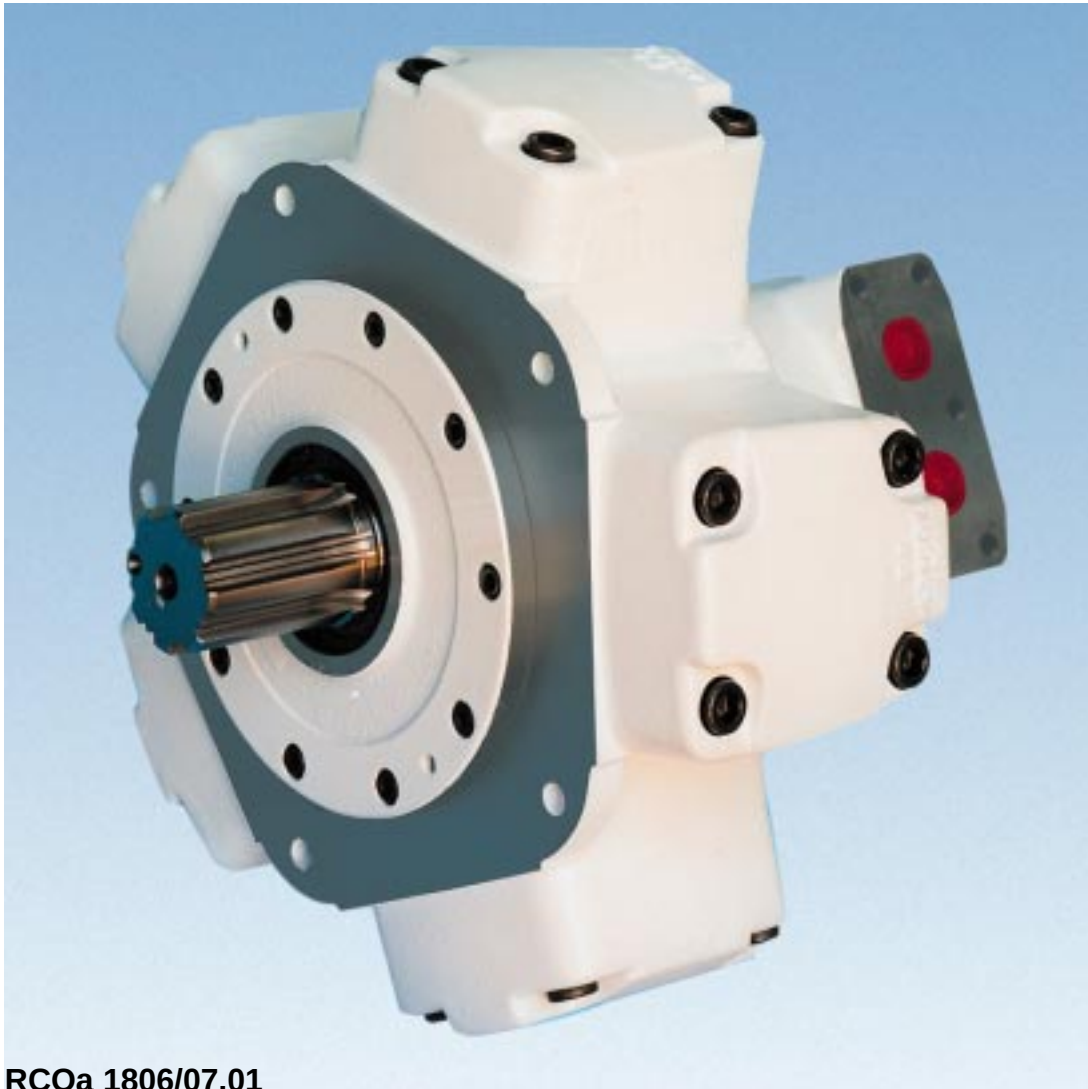


# **DENISON CALZONI**

## **Radial Piston Motor**

### **Type MR, MRE**

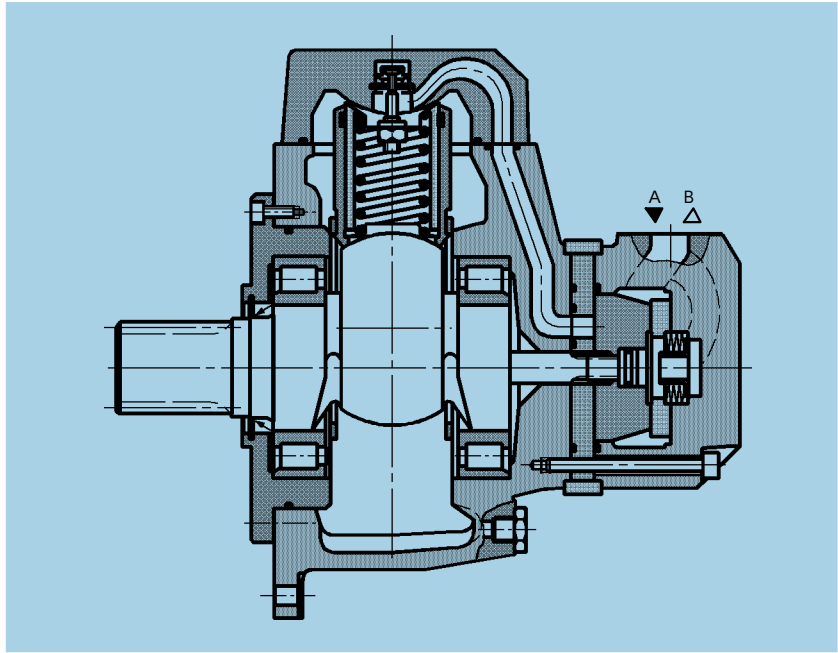


RCOa 1806/07.01

**DENISON** | CALZONI

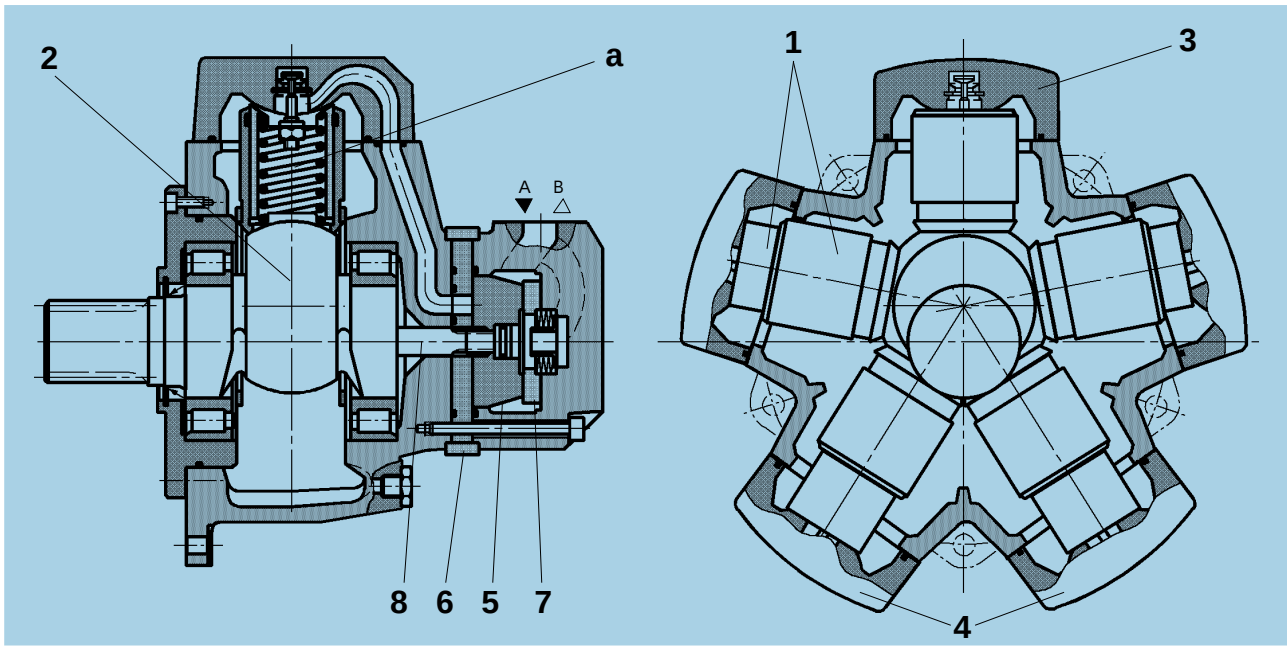
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## GENERAL CHARACTERISTICS



|                                      |                                                                                                                                                                                                                                                                                                                        |
|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CONSTRUCTION</b>                  | Fixed displacement radial piston motor                                                                                                                                                                                                                                                                                 |
| <b>TYPE</b>                          | MR ; MRE                                                                                                                                                                                                                                                                                                               |
| <b>MOUNTING</b>                      | Front flange mounting                                                                                                                                                                                                                                                                                                  |
| <b>CONNECTION</b>                    | Connection flange                                                                                                                                                                                                                                                                                                      |
| <b>MOUNTING POSITION</b>             | Any (please note the installation notes on page 34)                                                                                                                                                                                                                                                                    |
| <b>BEARING LIFE, RADIAL LOAD</b>     | See page 22 and 23                                                                                                                                                                                                                                                                                                     |
| <b>DIRECTION OF ROTATION</b>         | Clockwise, anti-clockwise - reversible                                                                                                                                                                                                                                                                                 |
| <b>FLUID</b>                         | HLP mineral oils to DIN 51 524 part 2; Fluid type HFB, HFC and Bio-fluids on enquiry.<br>FPM seals are required with phosphorous acid-Ester (HFD)                                                                                                                                                                      |
| <b>FLUID TEMPERATURE RANGE</b>       | $t^{\circ}\text{F} - 22^{\circ} \text{ a } + 176^{\circ} (-30^{\circ} \text{ a } +80^{\circ} \text{ C})$                                                                                                                                                                                                               |
| <b>VISCOSITY RANGE <sup>1)</sup></b> | $\nu = 85 \text{ to } 4635 \text{ SUS } (18 \text{ to } 1000 \text{ mm}^2/\text{s})$ ; Recommended operating range 141 to 230 SUS<br>(30 to 50 mm <sup>2</sup> /s) (see fluid selection on page 6)                                                                                                                     |
| <b>FLUID CLEANLINESS</b>             | Maximum permissible degree of contamination of fluid NAS 1638 Class 9. We therefore recommend a filter with a minimum retention rate of $\beta_{10} \geq 75$ .<br>To ensure a long life we recommend class 8 to NAS 1638.<br>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 of this motor is the result of an original and patented design. The principle is to transmit the effort from the stator to the rotating shaft (2) 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 (1) with a mechanical connection at the lips at each end which seal against the spherical surfaces of the cylinder-heads (3) and the spherical surface of the rotating shaft (4).

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 is a significant reduction in weight and overall size compared with other motors of the same capacity.

## 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.

## EFFICIENCY

The advantages of this type of valve coupled with a revolutionary cylinder arrangement produce a motor with extremely 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.

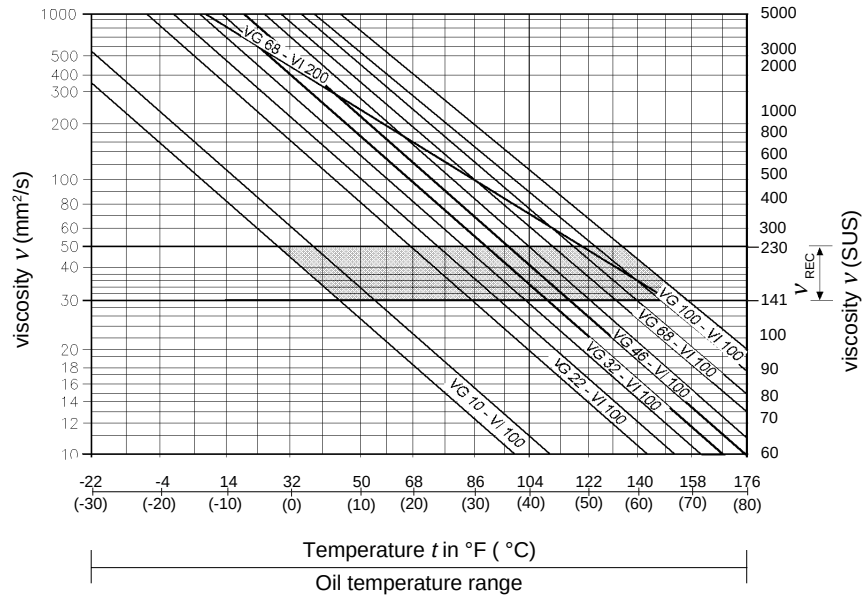
| Size<br>Motor<br>version                                                 |      | Displace-<br>ment | Moment<br>inertia of<br>rotating<br>parts | Theore--<br>tical<br>specific<br>torque | Min.<br>start.<br>torque /<br>Theore--<br>tical<br>torque | Maximum Pressure |      |      |      |                                                       | Speed range |         | Maximum<br>output<br>power |       | Weight |
|--------------------------------------------------------------------------|------|-------------------|-------------------------------------------|-----------------------------------------|-----------------------------------------------------------|------------------|------|------|------|-------------------------------------------------------|-------------|---------|----------------------------|-------|--------|
|                                                                          |      |                   |                                           |                                         |                                                           | input            |      |      |      |                                                       | flushing    |         | flushing                   |       |        |
|                                                                          |      |                   |                                           |                                         |                                                           | cont.            | int. | peak | A+B  | Drain                                                 | without     | with    | without                    | with  |        |
|                                                                          |      |                   |                                           |                                         |                                                           | V                | J    |      | %    | p                                                     | p           | p       | p                          | p     |        |
|                                                                          |      | in³               | lb.in²                                    | lb.ft/psi                               |                                                           | psi              | psi  | psi  | psi  | psi                                                   | rpm         | rpm     | Hp                         | Hp    | lb     |
| M<br>R                                                                   | 33   | 1.96              | 1.48                                      | 0.025                                   | 90                                                        | 3626             | 4351 | 6092 | 5802 | 72.5<br>(218<br>psi<br>with<br>"F1"<br>shaft<br>seal) | 1-1400      | 1-1400  | 8.9                        | 13.4  | 66.14  |
|                                                                          | 57   | 3.44              | 1.59                                      | 0.046                                   | 90                                                        |                  |      |      |      |                                                       | 1-1300      | 1-1300  | 14.8                       | 22.8  | 66.14  |
|                                                                          | 73   | 4.43              | 4.79                                      | 0.061                                   | 90                                                        |                  |      |      |      |                                                       | 1-1200      | 1-1200  | 20.2                       | 26.8  | 83.78  |
|                                                                          | 93   | 5.65              | 5.16                                      | 0.076                                   | 90                                                        |                  |      |      |      |                                                       | 1-1150      | 1-1150  | 22.8                       | 33.5  | 83.78  |
|                                                                          | 110  | 6.65              | 5.53                                      | 0.087                                   | 90                                                        |                  |      |      |      |                                                       | 1-1100      | 1-1100  | 24.1                       | 37.6  | 83.78  |
|                                                                          | 125  | 7.61              | 19.44                                     | 0.102                                   | 90                                                        |                  |      |      |      |                                                       | 1-900       | 1-900   | 22.8                       | 33.5  | 101.4  |
|                                                                          | 160  | 9.75              | 19.65                                     | 0.129                                   | 90                                                        |                  |      |      |      |                                                       | 1-900       | 1-900   | 26.8                       | 40.2  | 101.4  |
|                                                                          | 190  | 11.69             | 19.89                                     | 0.155                                   | 90                                                        |                  |      |      |      |                                                       | 1-850       | 1-850   | 32.2                       | 48.3  | 101.4  |
|                                                                          | 200  | 12.16             | 19.56                                     | 0.163                                   | 90                                                        |                  |      |      |      |                                                       | 1-800       | 1-800   | 33.5                       | 51.0  | 110.2  |
|                                                                          | 250  | 15.31             | 20.78                                     | 0.203                                   | 90                                                        |                  |      |      |      |                                                       | 1-800       | 1-800   | 42.9                       | 64.4  | 110.2  |
|                                                                          | 300  | 18.56             | 22.36                                     | 0.244                                   | 90                                                        |                  |      |      |      |                                                       | 1-750       | 1-750   | 46.9                       | 71.1  | 110.2  |
|                                                                          | 350  | 21.33             | 77.19                                     | 0.283                                   | 90                                                        |                  |      |      |      |                                                       | 1-640       | 1-640   | 55.0                       | 83.1  | 169.8  |
|                                                                          | 450  | 27.56             | 78.53                                     | 0.366                                   | 90                                                        |                  |      |      |      |                                                       | 1-600       | 1-600   | 61.7                       | 100.6 | 169.8  |
|                                                                          | 600  | 37.10             | 90.58                                     | 0.493                                   | 90                                                        |                  |      |      |      |                                                       | 1-520       | 1-520   | 75.1                       | 112.6 | 213.8  |
|                                                                          | 700  | 43.09             | 122.47                                    | 0.575                                   | 90                                                        |                  |      |      |      |                                                       | 1-500       | 1-500   | 87.2                       | 130.1 | 213.8  |
|                                                                          | 1100 | 68.7              | 154.28                                    | 0.910                                   | 90                                                        |                  |      |      |      |                                                       | 0.5-330     | 0.5-330 | 103.3                      | 159.6 | 308.6  |
|                                                                          | 1600 | 97.5              | 227.73                                    | 1.292                                   | 90                                                        |                  |      |      |      |                                                       | 0.5-260     | 0.5-260 | 128.7                      | 193.1 | 460.8  |
|                                                                          | 1800 | 110.4             | 291.86                                    | 1.465                                   | 90                                                        |                  |      |      |      |                                                       | 0.5-250     | 0.5-250 | 138.1                      | 205.2 | 460.8  |
|                                                                          | 2400 | 139.9             | 968.89                                    | 1.937                                   | 90                                                        |                  |      |      |      |                                                       | 0.5-220     | 0.5-220 | 160.9                      | 245.4 | 716.5  |
|                                                                          | 2800 | 170.4             | 1016.83                                   | 2.263                                   | 90                                                        |                  |      |      |      |                                                       | 0.5-215     | 0.5-215 | 170.3                      | 260.2 | 716.5  |
|                                                                          | 3600 | 221.9             | 1657.78                                   | 2.944                                   | 90                                                        |                  |      |      |      |                                                       | 0.5-150     | 0.5-180 | 164.9                      | 248.1 | 1120   |
|                                                                          | 4500 | 274.8             | 1713.72                                   | 2.944                                   | 91                                                        |                  |      |      |      |                                                       | 0.5-130     | 0.5-170 | 187.7                      | 281.6 | 1120   |
|                                                                          | 6500 | 394.2             | 3887.52                                   | 5.267                                   | 91                                                        |                  |      |      |      |                                                       | 0.5-110     | 0.5-130 | 221.3                      | 321.8 | 1764   |
|                                                                          | 7000 | 408.7             | 3887.52                                   | 5.665                                   | 91                                                        |                  |      |      |      |                                                       | 0.5-100     | 0.5-130 | 228                        | 335.3 | 1764   |
| M<br>R<br>E                                                              | 330  | 20.28             | 22.38                                     | 0.270                                   | 90                                                        | 3046             | 3626 | 5076 | 5802 | 72.5<br>(218<br>psi<br>with<br>"F1"<br>shaft<br>seal) | 1-750       | 1-750   | 42.9                       | 65.7  | 110.2  |
|                                                                          | 500  | 30.38             | 78.53                                     | 0.403                                   | 90                                                        |                  |      |      |      |                                                       | 1-600       | 1-600   | 61.7                       | 93.9  | 169.8  |
|                                                                          | 800  | 49.08             | 122.47                                    | 0.651                                   | 90                                                        |                  |      |      |      |                                                       | 1-450       | 1-450   | 87.2                       | 124.7 | 213.8  |
|                                                                          | 1400 | 83.6              | 154.28                                    | 1.109                                   | 92                                                        |                  |      |      |      |                                                       | 0.5-280     | 0.5-280 | 103.3                      | 136.8 | 319.7  |
|                                                                          | 2100 | 127.6             | 291.86                                    | 1.693                                   | 91                                                        |                  |      |      |      |                                                       | 0.5-250     | 0.5-250 | 134.1                      | 198.5 | 487.2  |
|                                                                          | 3100 | 189.4             | 1016.83                                   | 2.512                                   | 91                                                        |                  |      |      |      |                                                       | 0.5-215     | 0.5-215 | 167.6                      | 254.8 | 725.3  |
|                                                                          | 5400 | 329.6             | 1713.72                                   | 4.374                                   | 92                                                        |                  |      |      |      |                                                       | 0.5-120     | 0.5-160 | 187.7                      | 281.6 | 1129   |
|                                                                          | 8200 | 502               | 3887.52                                   | 6.657                                   | 92                                                        |                  |      |      |      |                                                       | 0.5-90      | 0.5-120 | 228                        | 335.3 | 1786   |
| LARGER DISPLACEMENTS ARE AVAILABLE IN THE MRT - MRTE - MRTF MOTOR SERIES |      |                   |                                           |                                         |                                                           |                  |      |      |      |                                                       |             |         |                            |       |        |

**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 34 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.

$$v_{rec} = \text{recommended operating viscosity } 141...230 \text{ SUS } (30...50 \text{ mm}^2/\text{s})$$

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.

For limit conditions the following is valid:

$$v_{min.abs.} = 45 \text{ SUS } (10 \text{ mm}^2/\text{s}) \text{ in emergency, short term}$$

$$v_{min.} = 85 \text{ SUS } (18 \text{ mm}^2/\text{s}) \text{ for continuous operation at reduced performances}$$

$$v_{max.} = 4635 \text{ SUS } (1000 \text{ mm}^2/\text{s}) \text{ short term upon cold start}$$

## LIMITS OF VISCOSITY RANGE

## 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  $\beta_5=100$ . In case the above mentioned classes can not be achieved, please consult us.

## CASE DRAIN PRESSURE

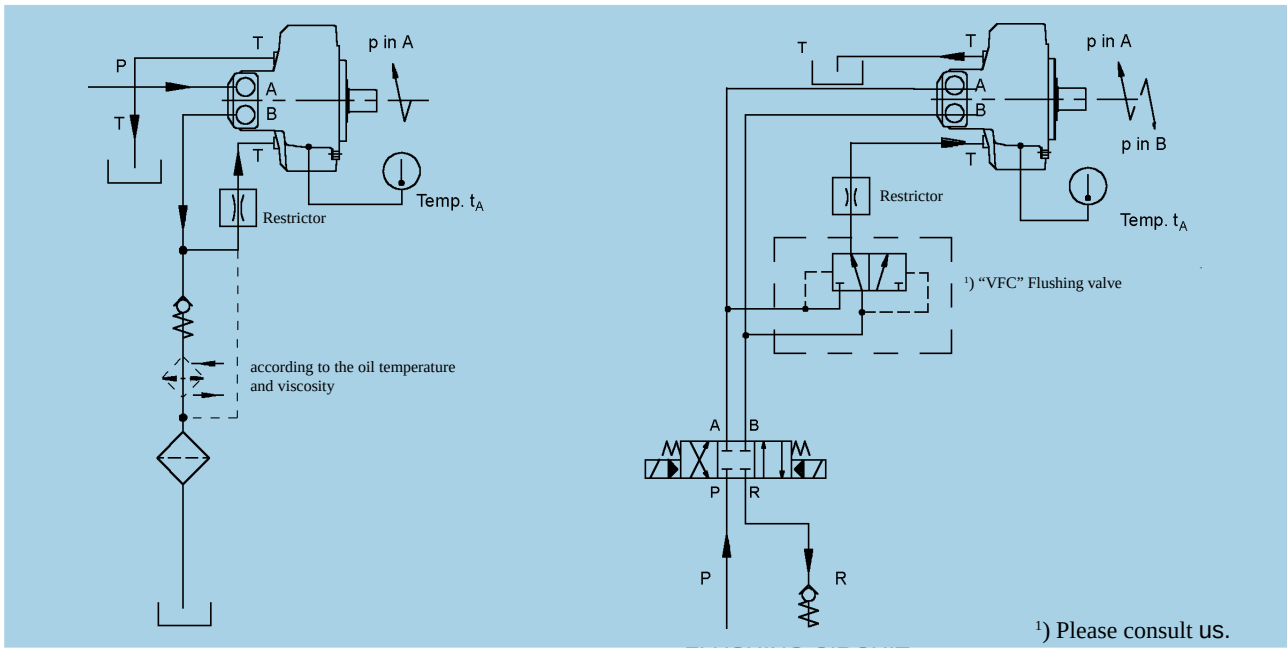
The lower the speed and the case drain pressure, the longer the life of the shaft seal. The maximum permissible housing pressure is

$$p_{max} = 72.5 \text{ psi}$$

If the case drain pressure is higher than 72.5 psi it is possible to use a special 218 psi shaft seal (see page 35, 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 35, Seals, Code "V1"). These "FPM" seals should be used with HFD fluids.



FLUSHING CIRCUIT  
(MONO-DIRECTIONAL ROTATION)

FLUSHING CIRCUIT  
(BI-DIRECTIONAL ROTATION)

## FLUSHING

The motor case must be flushed when the continuous operating performances of the motor are inside the "Continuous operating area with flushing" (see Operating Diagram from page 8 to page 18), in order to assure the minimum oil viscosity inside the motor case of 141 SUS (30 mm<sup>2</sup>/s) (see page 6 - Fluid Selection). The flushing can be necessary also when the operating performances are outside the "Continuous operating area with flushing", but the system is not able to assure the minimum viscosity conditions requested by the motor as specified at page 6.

### NOTE1:

The oil temperature inside the motor case is obtainable by adding 5° F (3°C) to the motor surface temperature ( $t_A$ , see figures).

### NOTE2:

With the standard shaft seal the maximum drain case pressure is 72.5 psi. For the selection of the restrictor, please consult us.

## FLOW

| TYPE     | MOTOR VERSION                                        | FLUSHING FLOW |
|----------|------------------------------------------------------|---------------|
| MR       | 33, 57, 73, 93, 110                                  | Q = 1.3 gpm   |
| MR - MRE | 125, 160, 190, 200, 250, 300, 330                    | Q = 1.6 gpm   |
| MR - MRE | 350, 450, 500                                        | Q = 2.0 gpm   |
| MR - MRE | 600, 700, 800, 1100, 1400                            | Q = 2.5 gpm   |
| MR - MRE | 1600, 1800, 2100                                     | Q = 4.0 gpm   |
| MR - MRE | 2400, 2800, 3100, 3600, 4500, 5400, 6500, 7000, 8200 | Q = 5.3 gpm   |



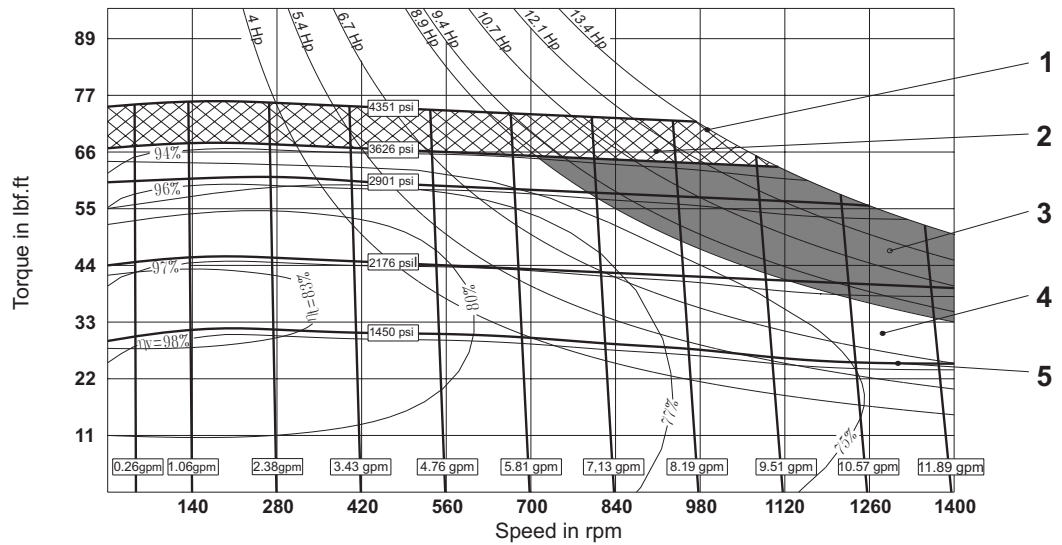
OPERATING DIAGRAM

(average values) measured at  $V = 167 \text{ SUS}$  ( $36 \text{ mm}^2/\text{s}$ );  $t = 113^\circ\text{F}$  ( $45^\circ\text{C}$ );

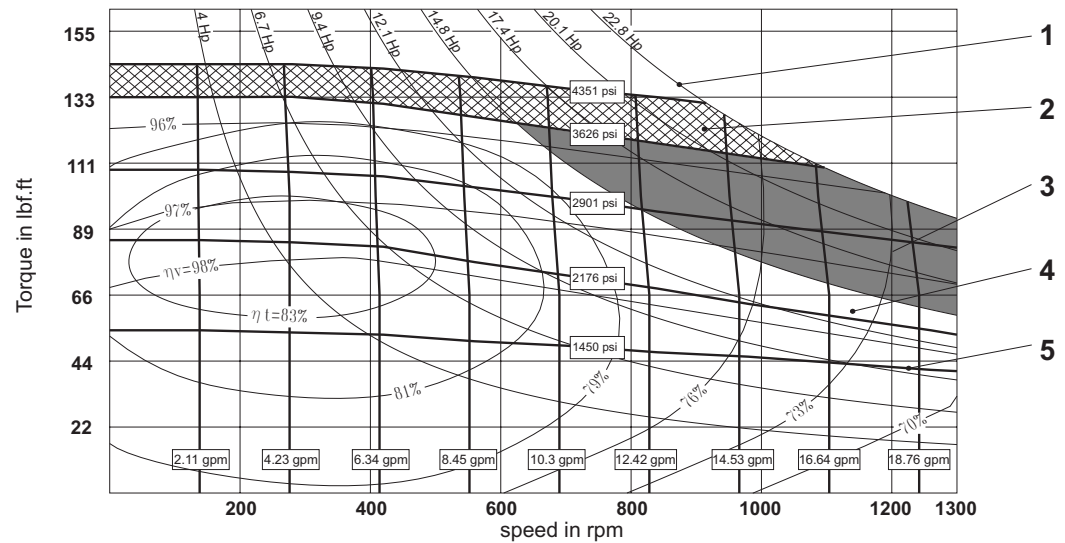
$p_{\text{outlet}} = 0 \text{ psi}$  (0 bar)

- 1 Output power      2 Intermittent operating area      3 Continuous operating area with flushing  
4 Continuous operating area      5 Inlet pressure       $\eta_t$  Total efficiency       $\eta_v$  Volumetric efficiency

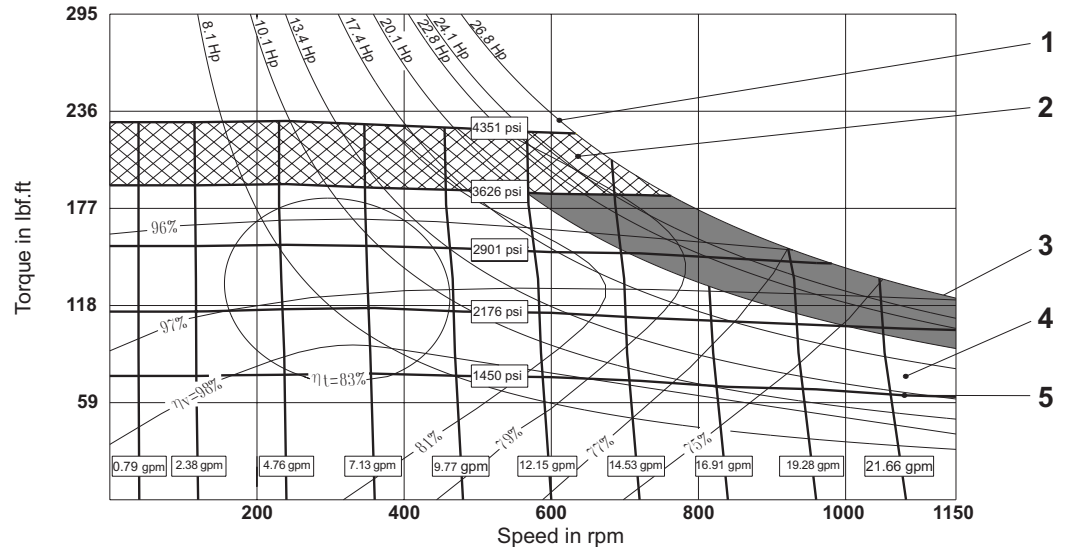
MR 33



MR 57



MR 73





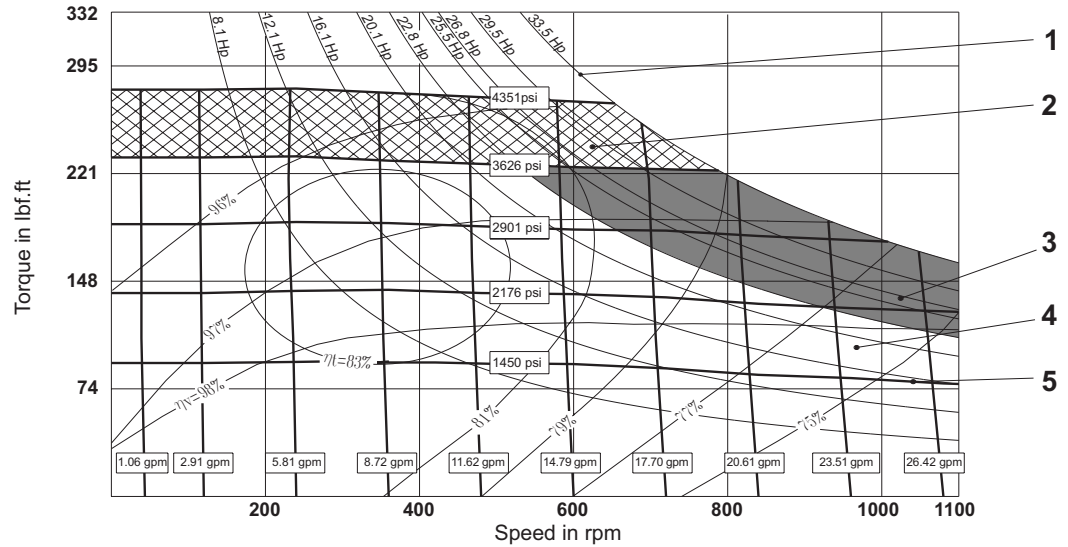
OPERATING DIAGRAM

(average values) measured at  $V = 167 \text{ SUS}$  ( $36 \text{ mm}^2/\text{s}$ );  $t = 113^\circ\text{F}$  ( $45^\circ\text{C}$ );

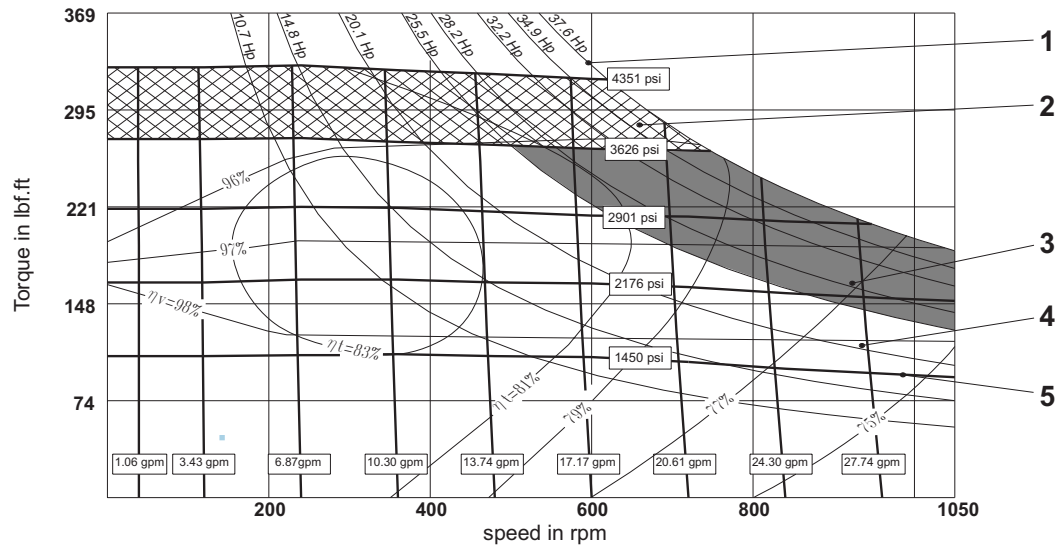
$p_{\text{outlet}} = 0 \text{ psi}$  (0 bar)

- 1 Output power      2 Intermittent operating area      3 Continuous operating area with flushing  
4 Continuous operating area      5 Inlet pressure       $\eta_t$  Total efficiency       $\eta_v$  Volumetric efficiency

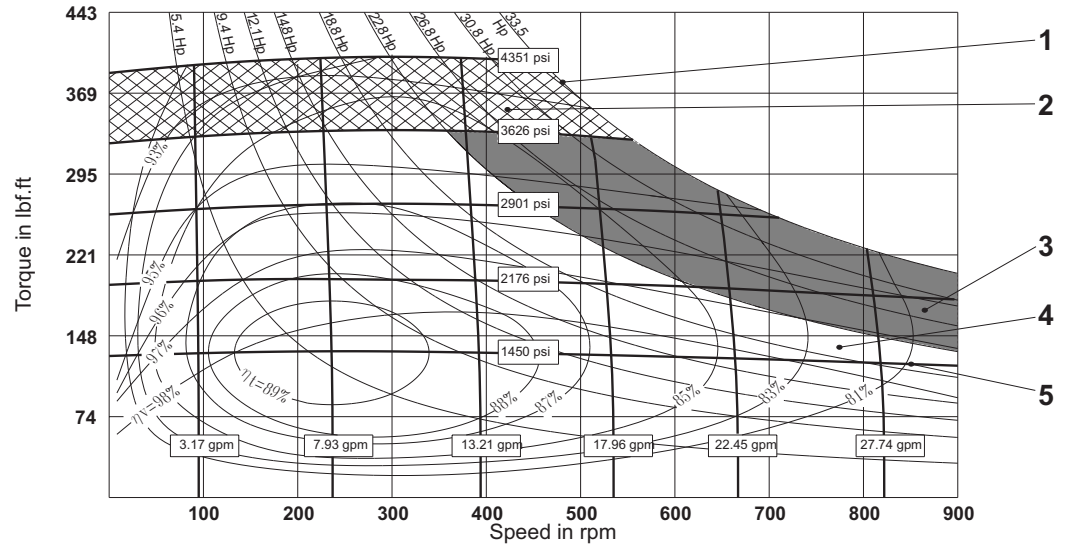
MR 93



MR 110



MR 125



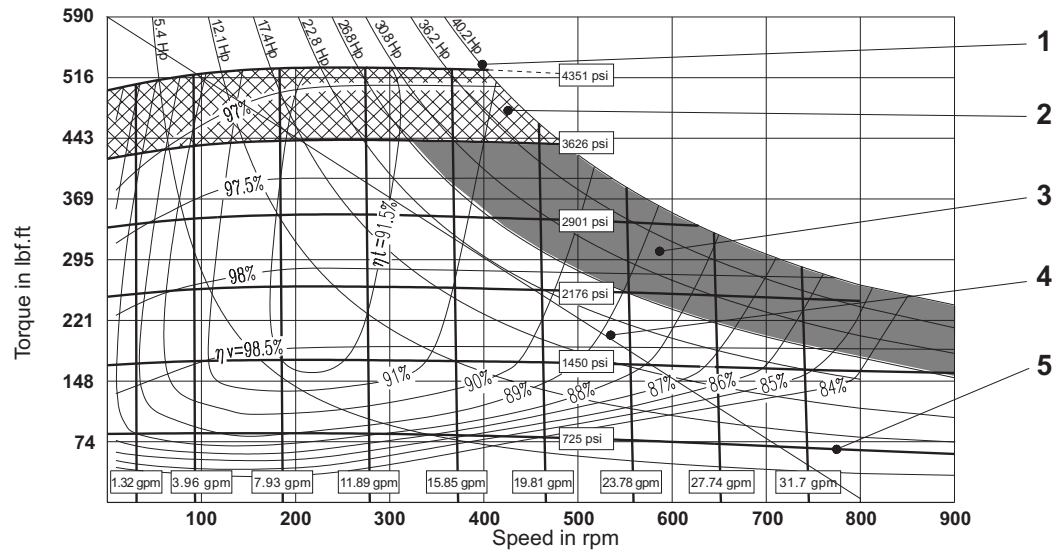
OPERATING DIAGRAM

(average values) measured at  $V = 167 \text{ SUS}$  ( $36 \text{ mm}^2/\text{s}$ );  $t = 113^\circ\text{F}$  ( $45^\circ\text{C}$ );

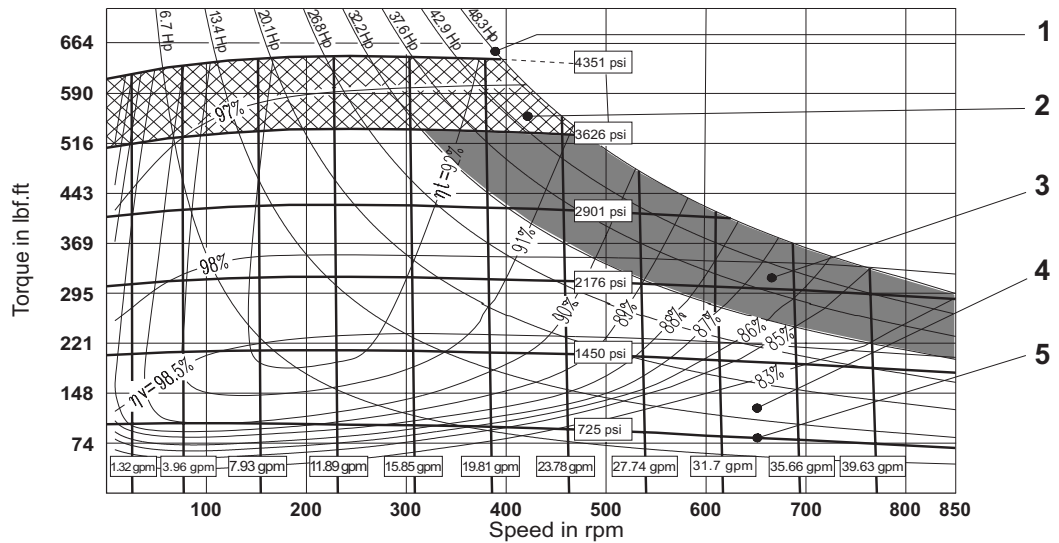
$p_{\text{outlet}} = 0 \text{ psi}$  (0 bar)

- 1 Output power      2 Intermittent operating area      3 Continuous operating area with flushing  
4 Continuous operating area      5 Inlet pressure       $\eta_t$  Total efficiency       $\eta_v$  Volumetric efficiency

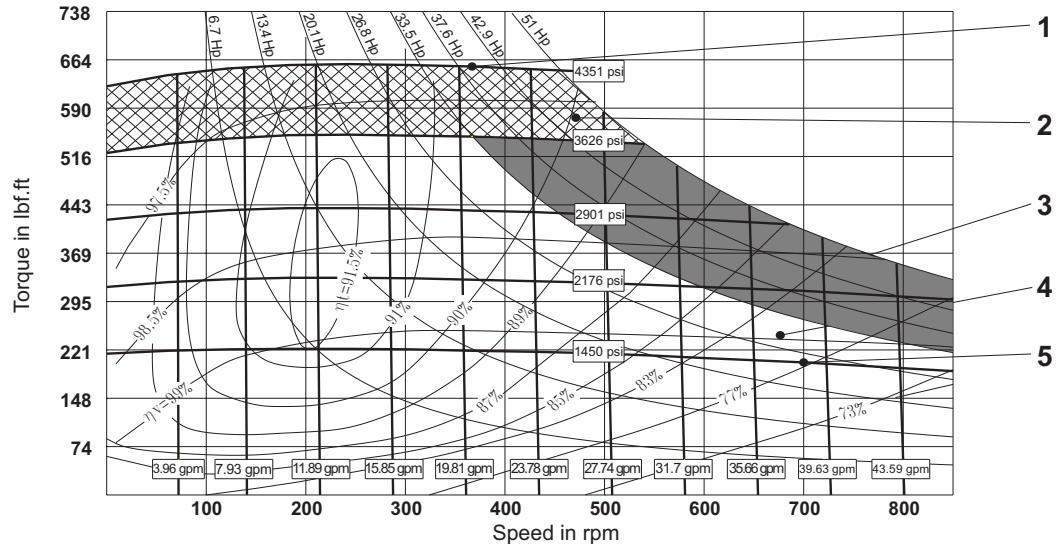
MR 160



MR 190



MR 200



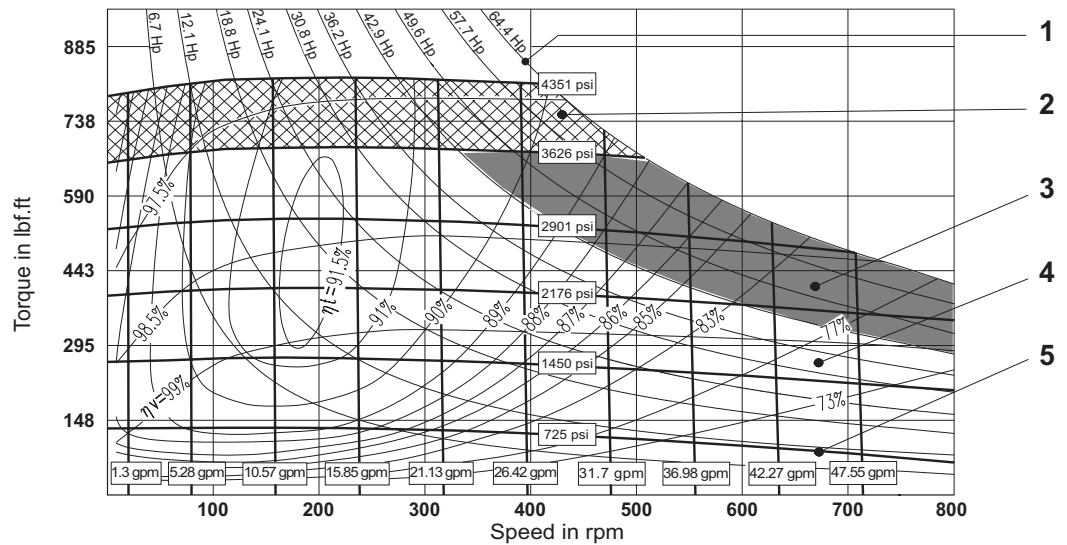
OPERATING DIAGRAM

(average values) measured at  $V = 167 \text{ SUS}$  ( $36 \text{ mm}^2/\text{s}$ );  $t = 113^\circ\text{F}$  ( $45^\circ\text{C}$ );

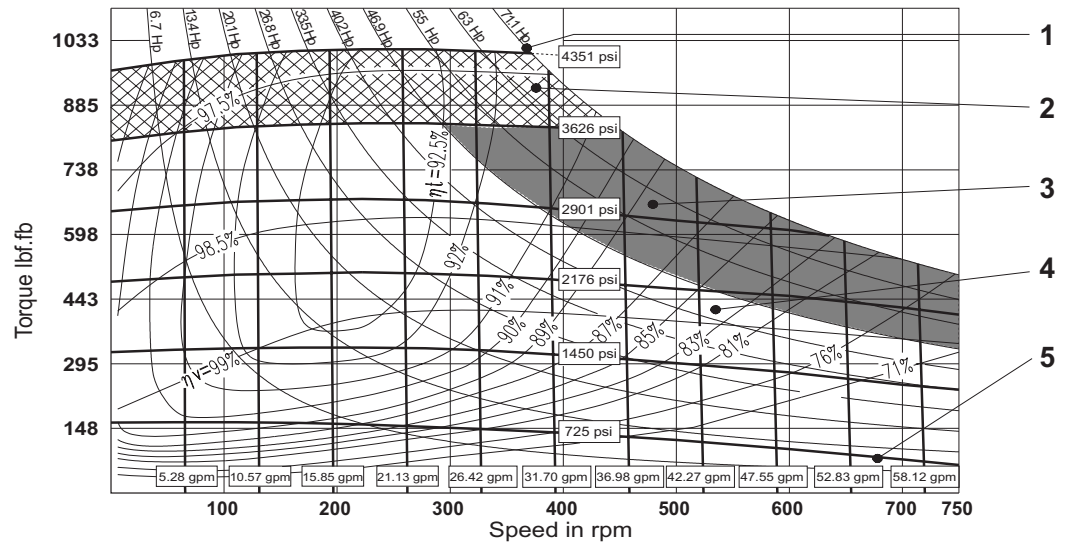
$p_{\text{outlet}} = 0 \text{ psi}$  (0 bar)

- 1 Output power      2 Intermittent operating area      3 Continuous operating area with flushing  
4 Continuous operating area      5 Inlet pressure       $\eta_t$  Total efficiency       $\eta_v$  Volumetric efficiency

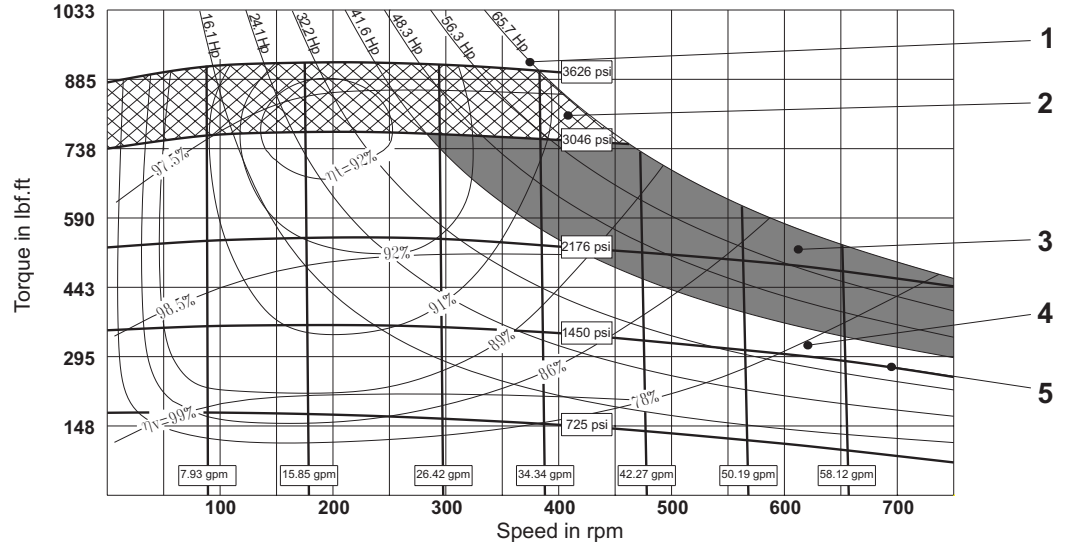
MR 250



MR 300



MRE 330



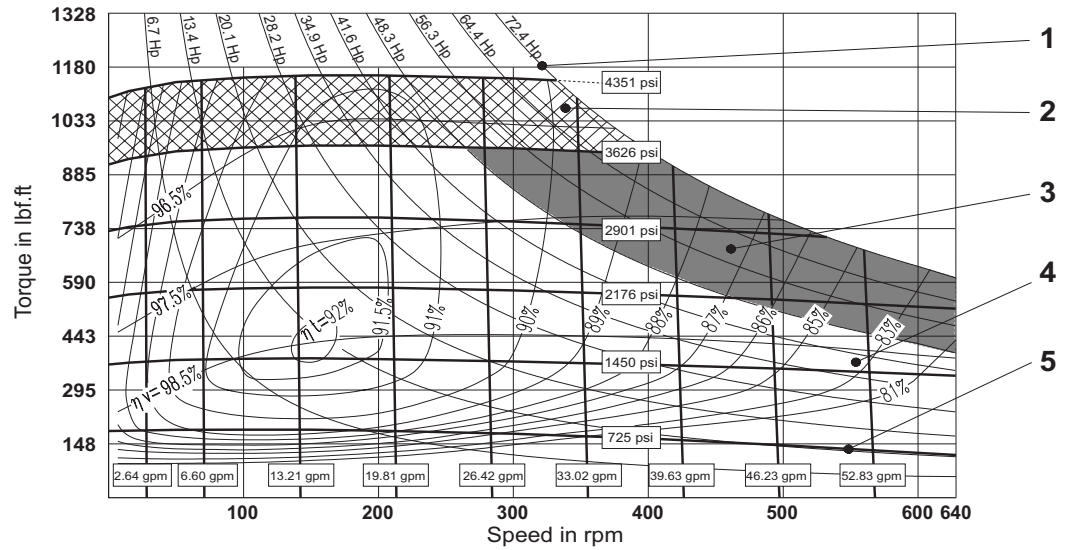
OPERATING DIAGRAM

(average values) measured at  $V = 167 \text{ SUS}$  ( $36 \text{ mm}^2/\text{s}$ );  $t = 113^\circ\text{F}$  ( $45^\circ\text{C}$ );

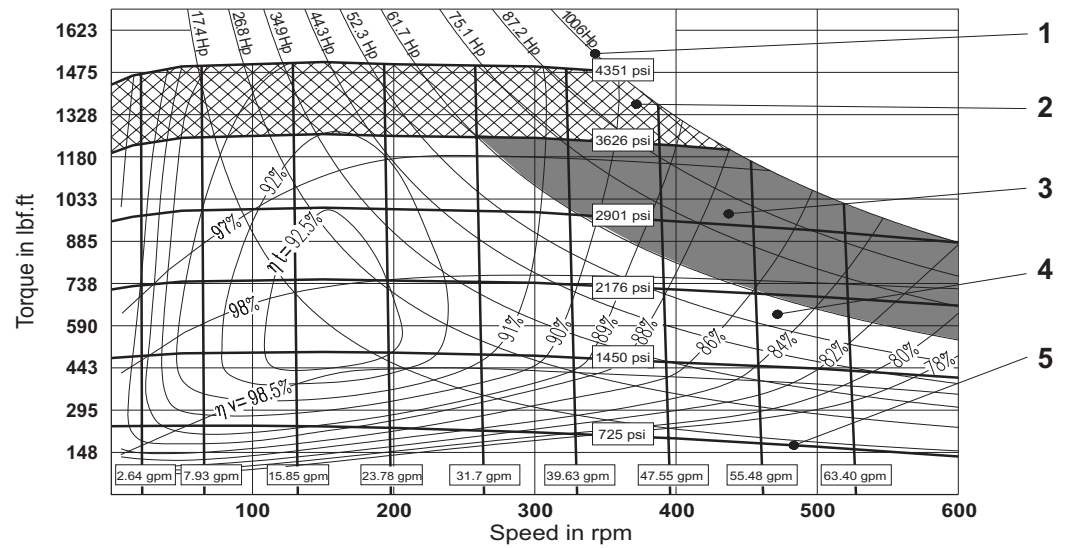
$p_{\text{outlet}} = 0 \text{ psi}$  (0 bar)

- 1 Output power
- 2 Intermittent operating area
- 3 Continuous operating area with flushing
- 4 Continuous operating area
- 5 Inlet pressure
- $\eta_t$  Total efficiency
- $\eta_v$  Volumetric efficiency

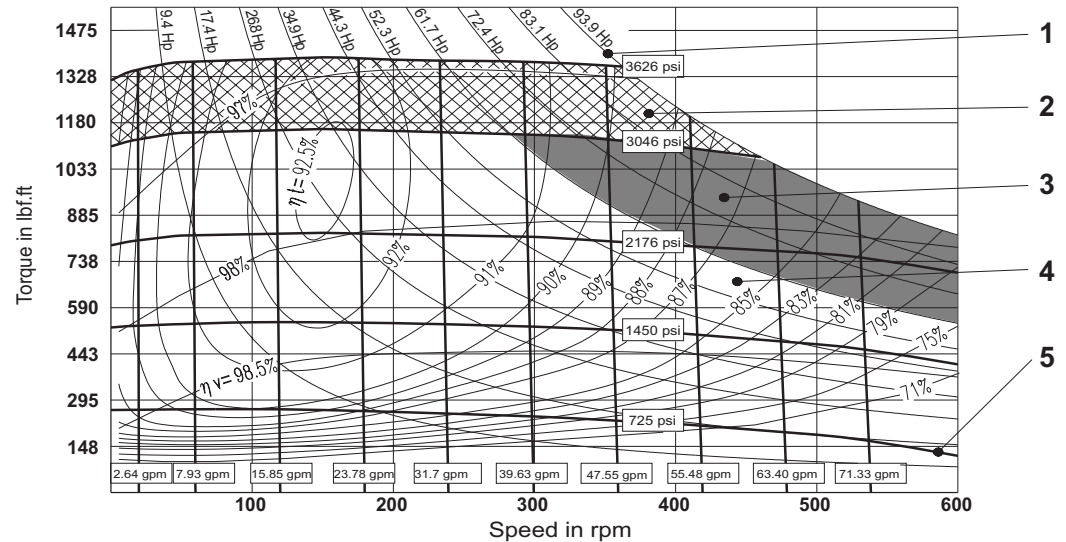
MR 350



MR 450



MRE 500





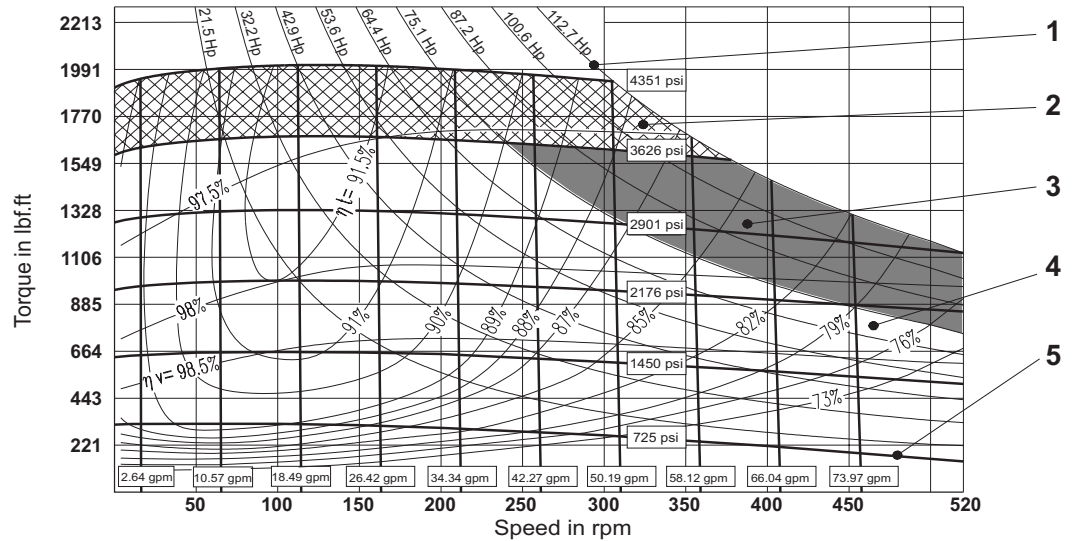
OPERATING DIAGRAM

(average values) measured at  $V = 167 \text{ SUS}$  ( $36 \text{ mm}^2/\text{s}$ );  $t = 113^\circ\text{F}$  ( $45^\circ\text{C}$ );

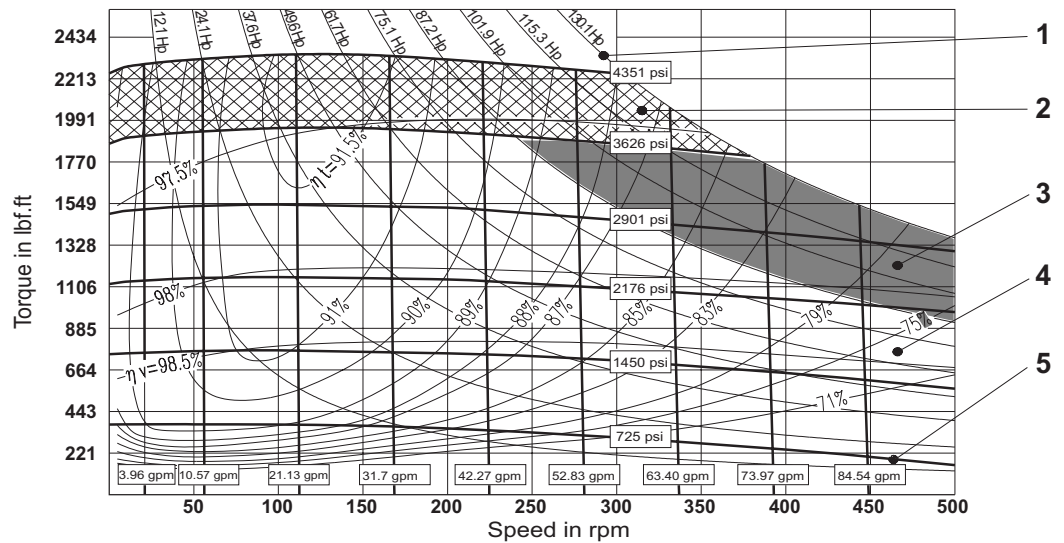
$p_{\text{outlet}} = 0 \text{ psi}$  (0 bar)

- 1 Output power
- 2 Intermittent operating area
- 3 Continuous operating area with flushing
- 4 Continuous operating area
- 5 Inlet pressure
- $\eta_t$  Total efficiency
- $\eta_v$  Volumetric efficiency

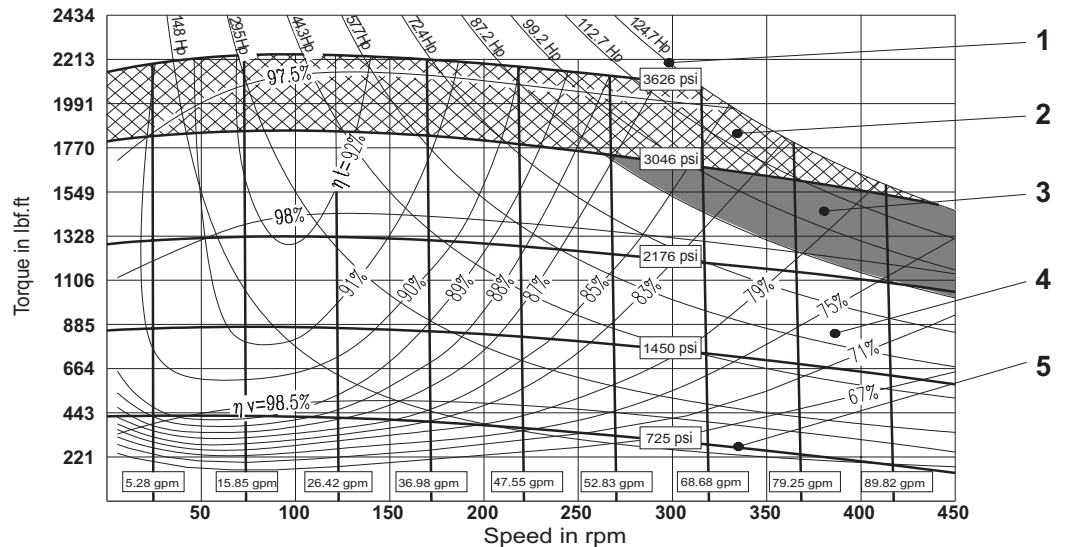
MR 600



MR 700



MRE 800



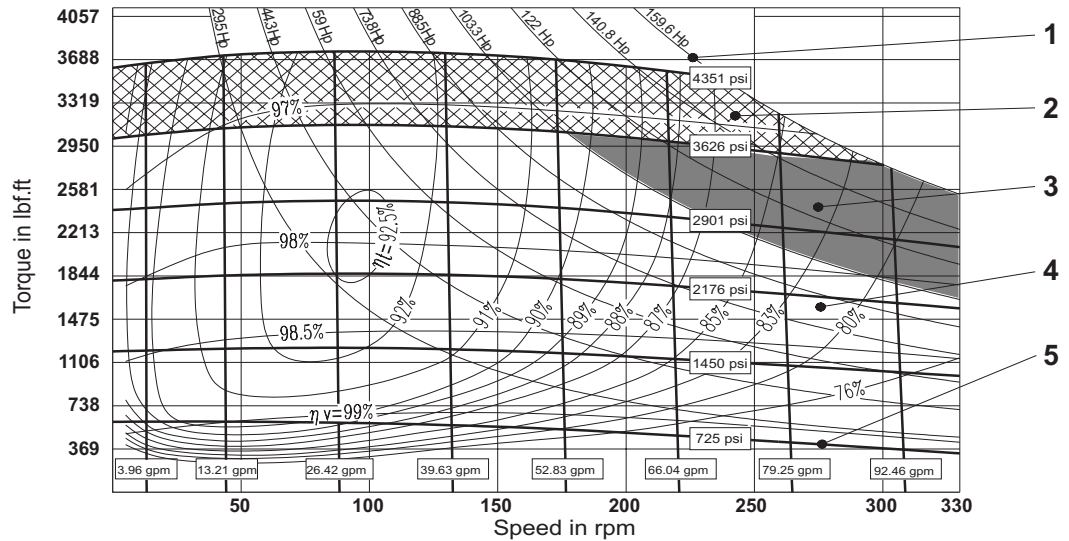
OPERATING DIAGRAM

(average values) measured at  $V = 167 \text{ SUS}$  ( $36 \text{ mm}^2/\text{s}$ );  $t = 113^\circ\text{F}$  ( $45^\circ\text{C}$ );

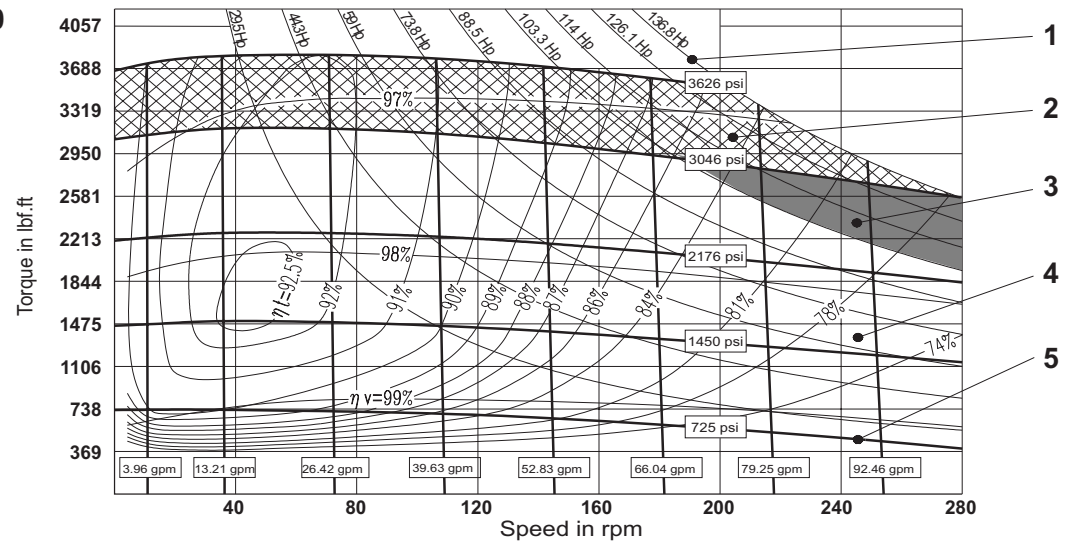
$p_{\text{outlet}} = 0 \text{ psi}$  (0 bar)

- 1 Output power      2 Intermittent operating area      3 Continuous operating area with flushing  
4 Continuous operating area      5 Inlet pressure       $\eta_t$  Total efficiency       $\eta_v$  Volumetric efficiency

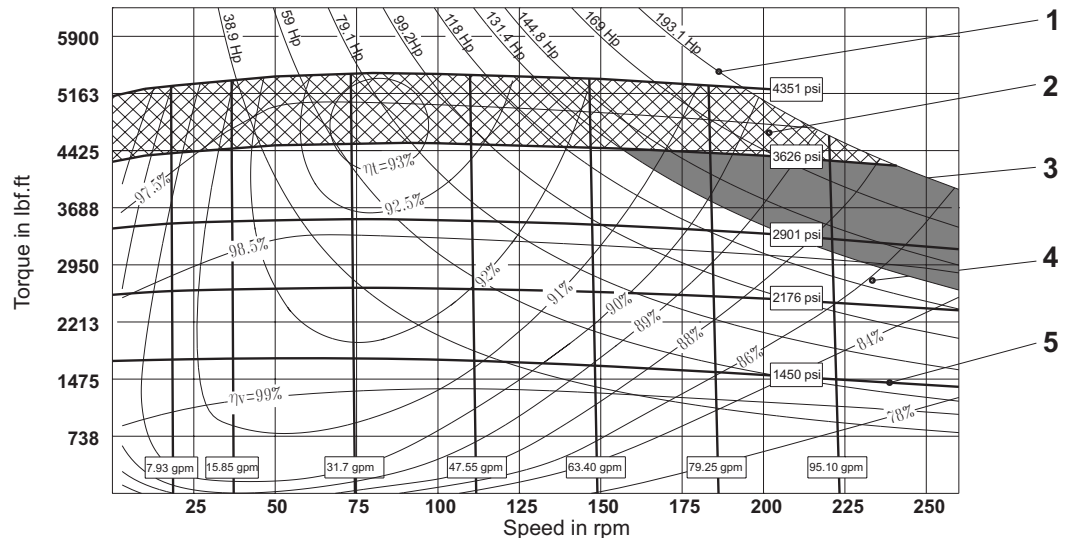
MR 1100



MRE 1400



MR 1600



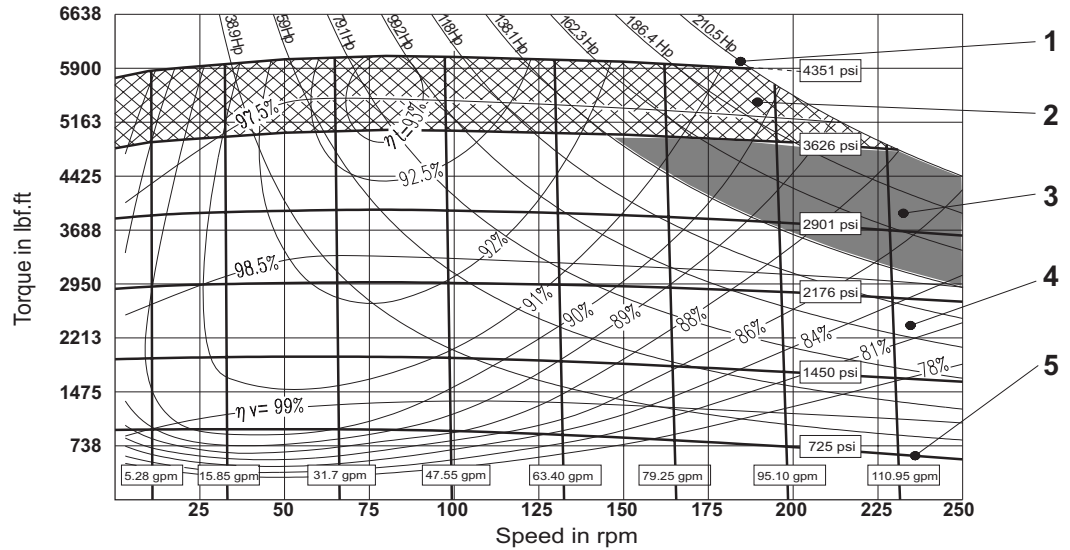
OPERATING DIAGRAM

(average values) measured at  $V = 167 \text{ SUS}$  ( $36 \text{ mm}^2/\text{s}$ );  $t = 113^\circ\text{F}$  ( $45^\circ\text{C}$ );

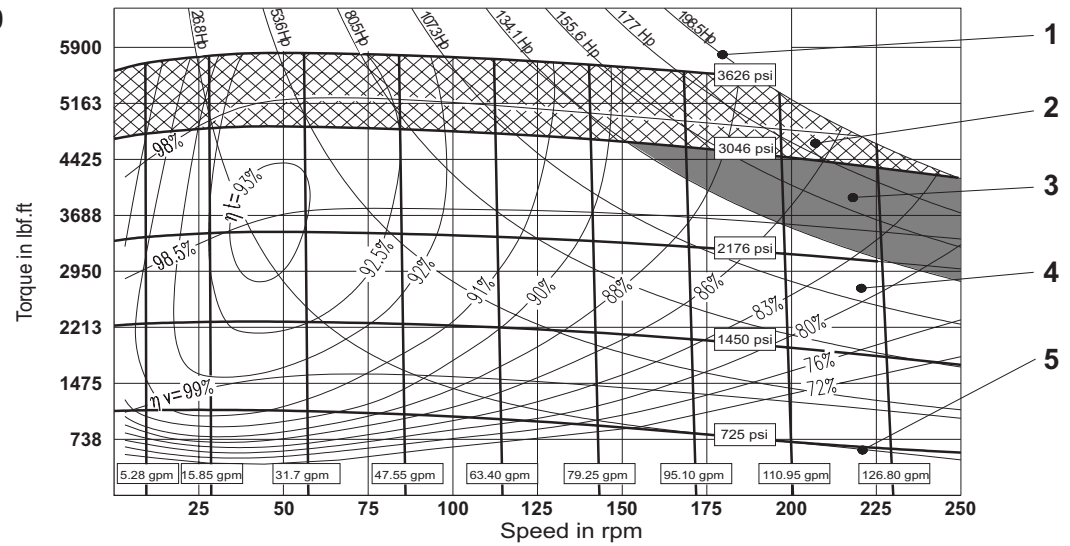
$p_{\text{outlet}} = 0 \text{ psi}$  (0 bar)

- 1 Output power      2 Intermittent operating area      3 Continuous operating area with flushing  
4 Continuous operating area      5 Inlet pressure       $\eta_t$  Total efficiency       $\eta_v$  Volumetric efficiency

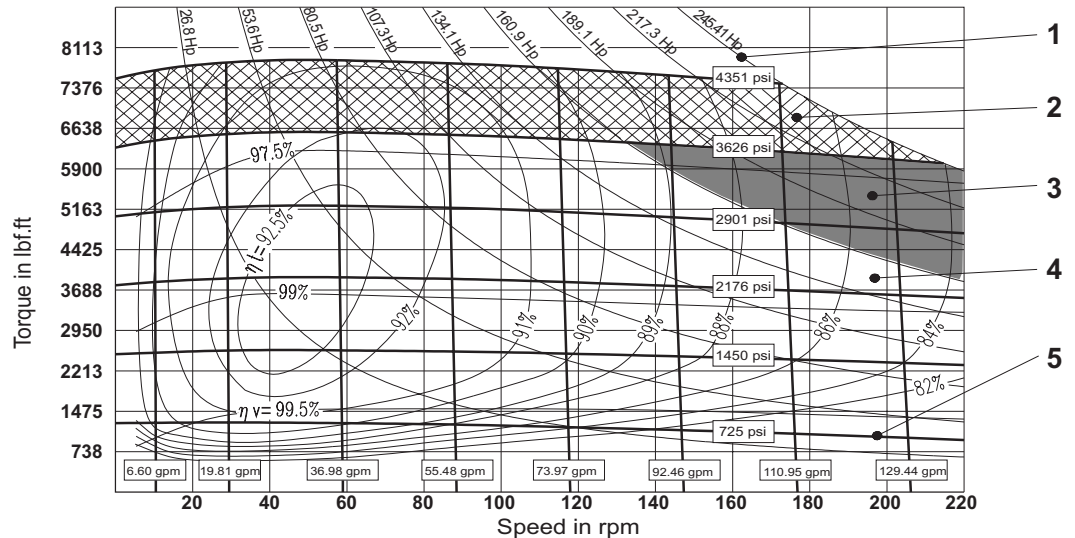
MR 1800



MRE 2100



MR 2400





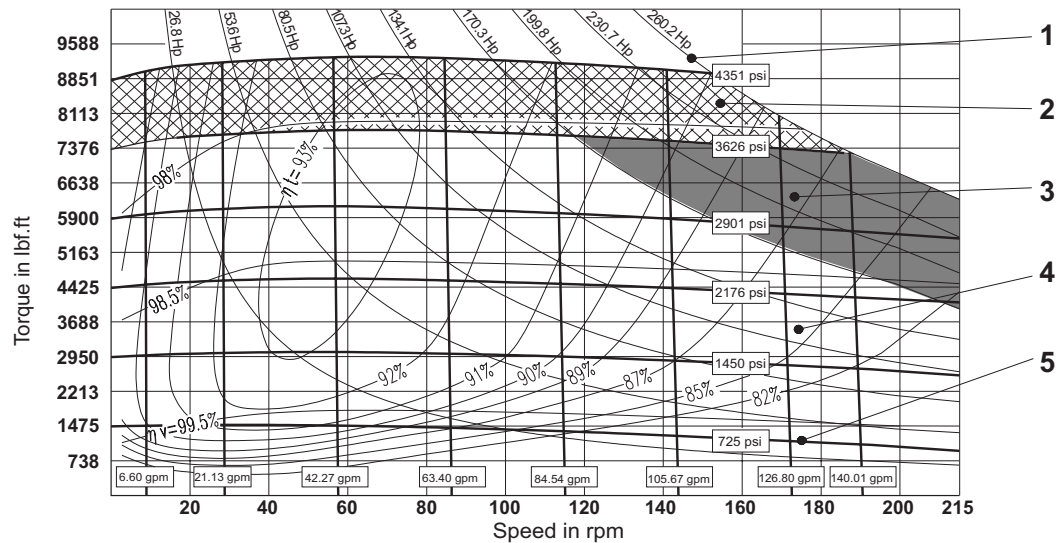
OPERATING DIAGRAM

(average values) measured at  $V = 167 \text{ SUS}$  ( $36 \text{ mm}^2/\text{s}$ );  $t = 113^\circ\text{F}$  ( $45^\circ\text{C}$ );

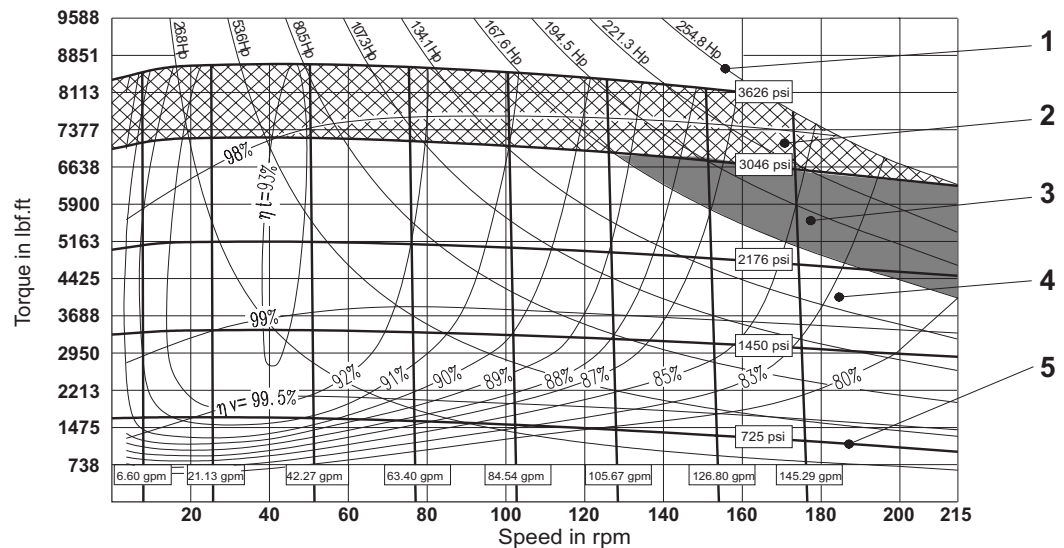
$p_{\text{outlet}} = 0 \text{ psi}$  (0 bar)

- 1 Output power      2 Intermittent operating area      3 Continuous operating area with flushing  
4 Continuous operating area      5 Inlet pressure       $\eta_t$  Total efficiency       $\eta_v$  Volumetric efficiency

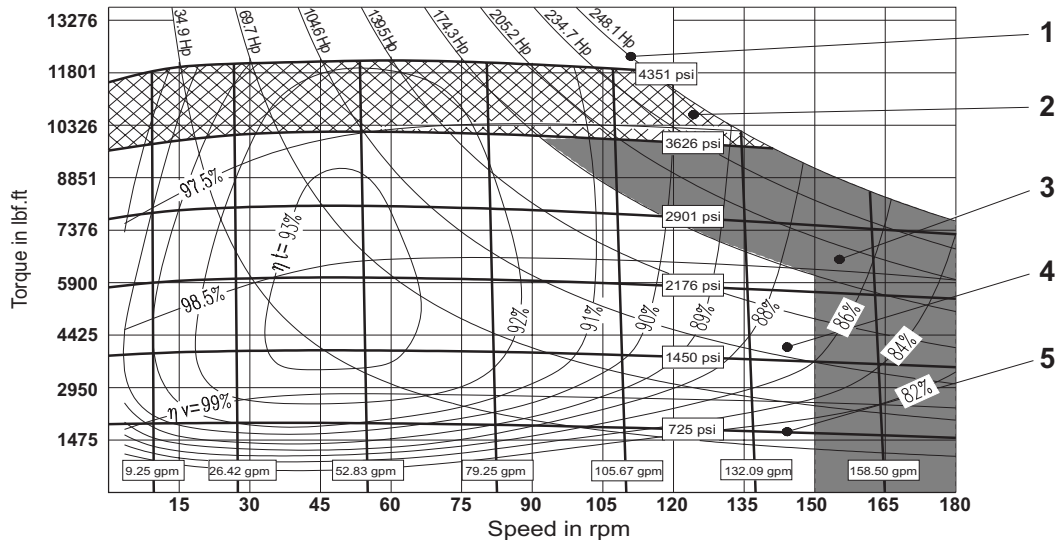
MR 2800



MRE 3100



MR 3600



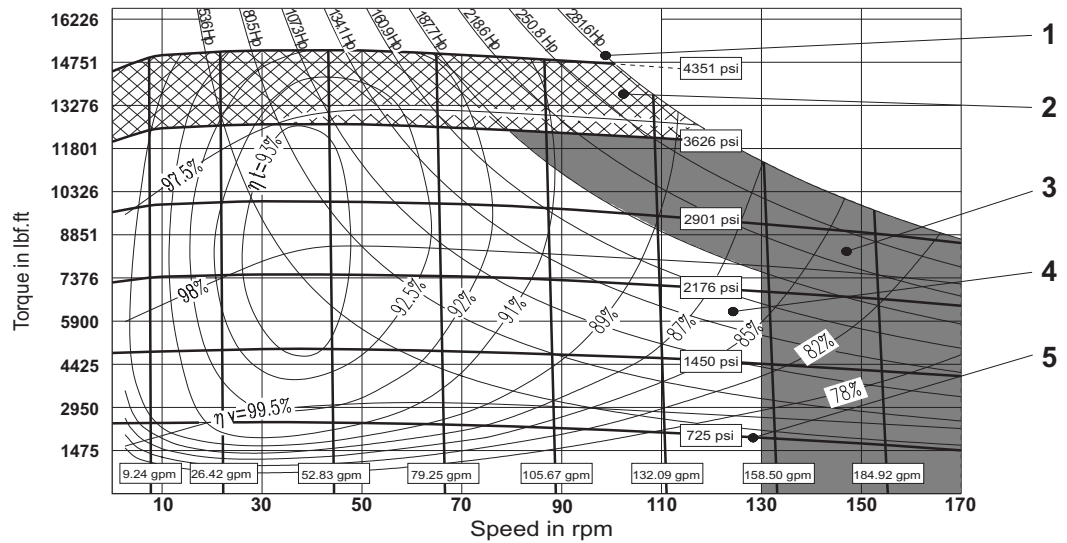
OPERATING DIAGRAM

(average values) measured at  $V = 167 \text{ SUS}$  ( $36 \text{ mm}^2/\text{s}$ );  $t = 113^\circ\text{F}$  ( $45^\circ\text{C}$ );

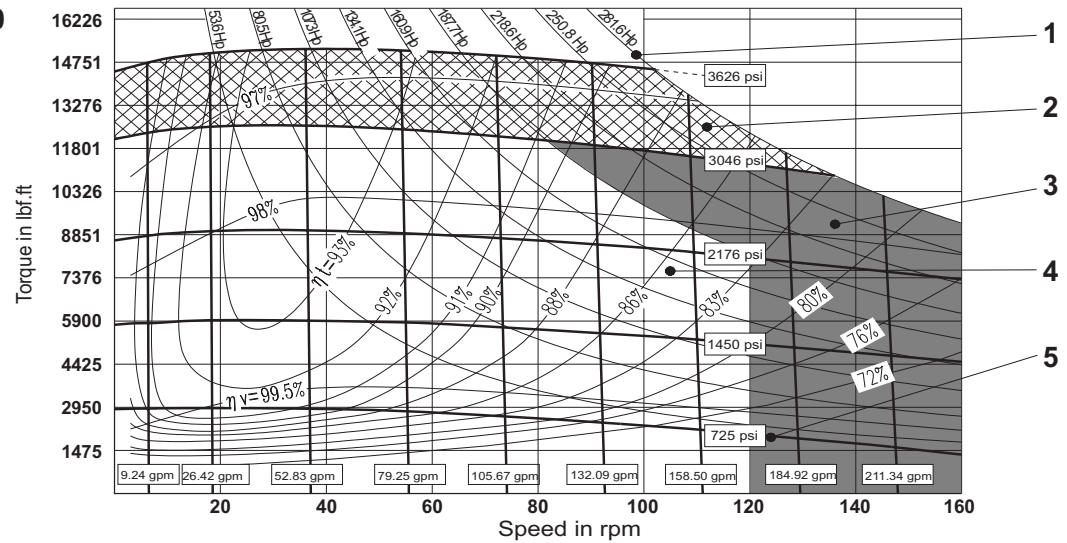
$p_{\text{outlet}} = 0 \text{ psi}$  (0 bar)

- 1 Output power      2 Intermittent operating area      3 Continuous operating area with flushing  
4 Continuous operating area      5 Inlet pressure       $\eta_t$  Total efficiency       $\eta_v$  Volumetric efficiency

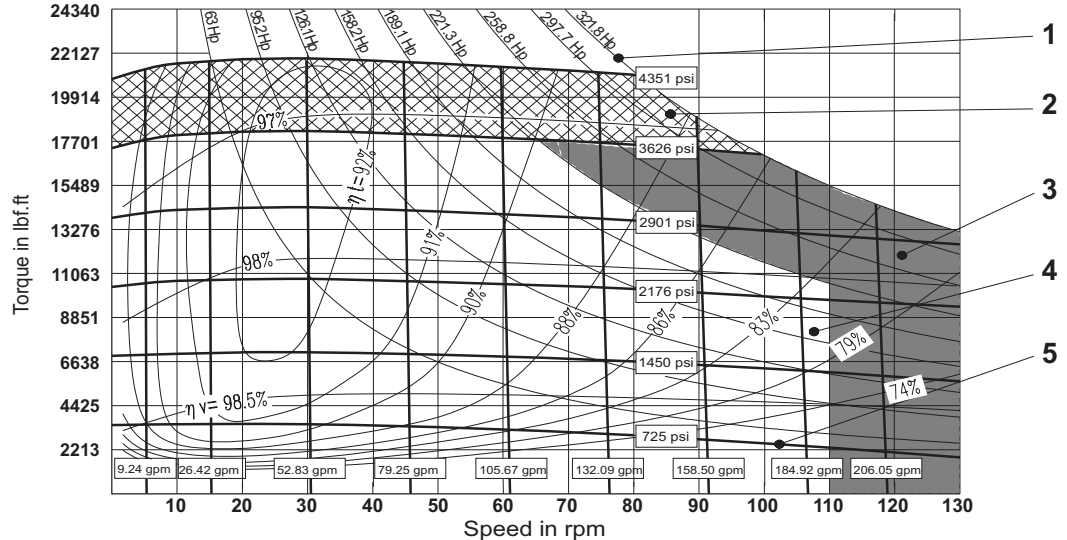
MR 4500



MRE 5400



MR 6500



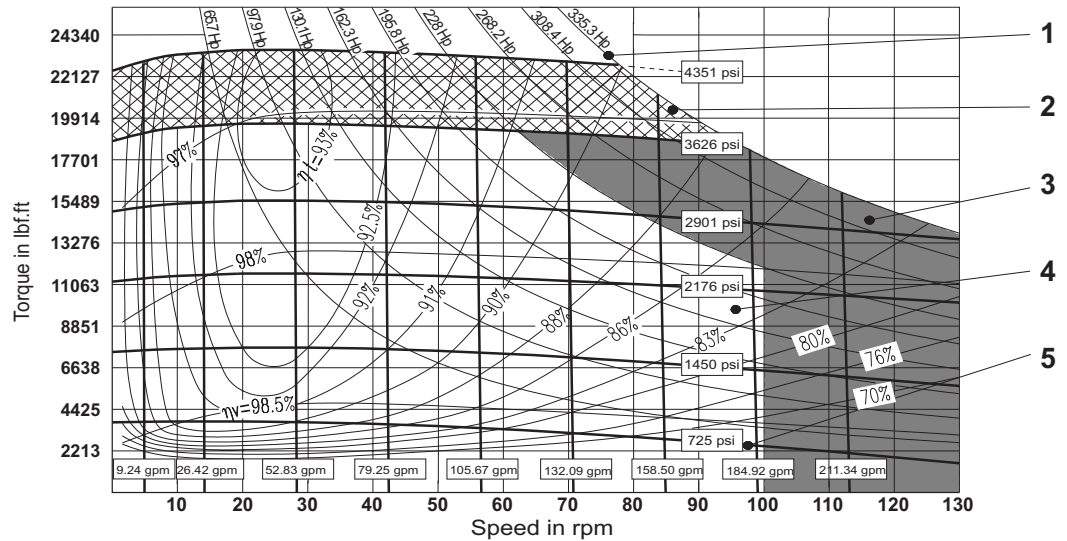
OPERATING DIAGRAM

(average values) measured at  $V = 167 \text{ SUS}$  ( $36 \text{ mm}^2/\text{s}$ );  $t = 113^\circ\text{F}$  ( $45^\circ\text{C}$ );

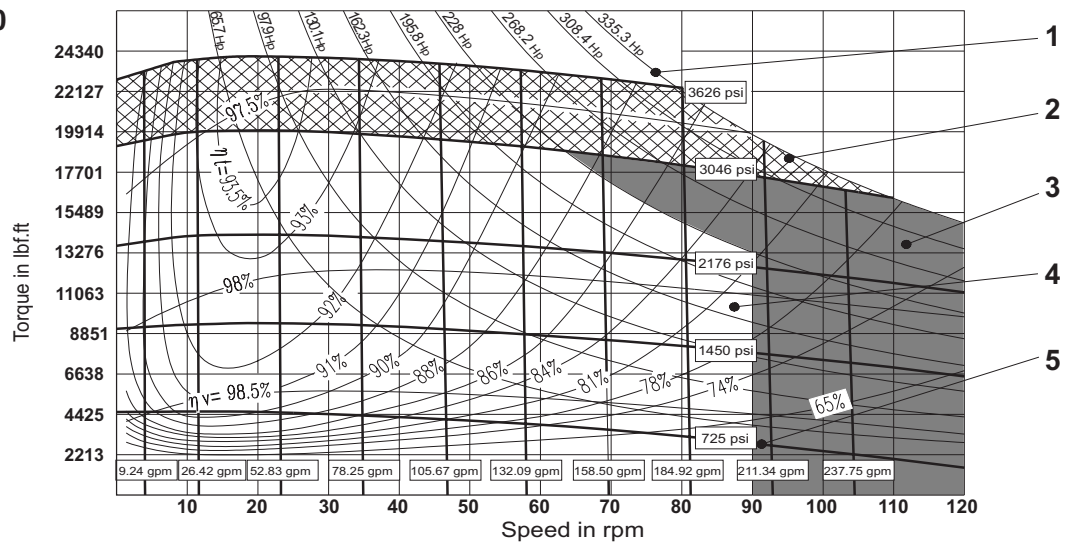
$p_{\text{outlet}} = 0 \text{ psi}$  (0 bar)

- 1 Output power      2 Intermittent operating area      3 Continuous operating area with flushing  
4 Continuous operating area      5 Inlet pressure       $\eta_t$  Total efficiency       $\eta_v$  Volumetric efficiency

MR 7000



MRE 8200



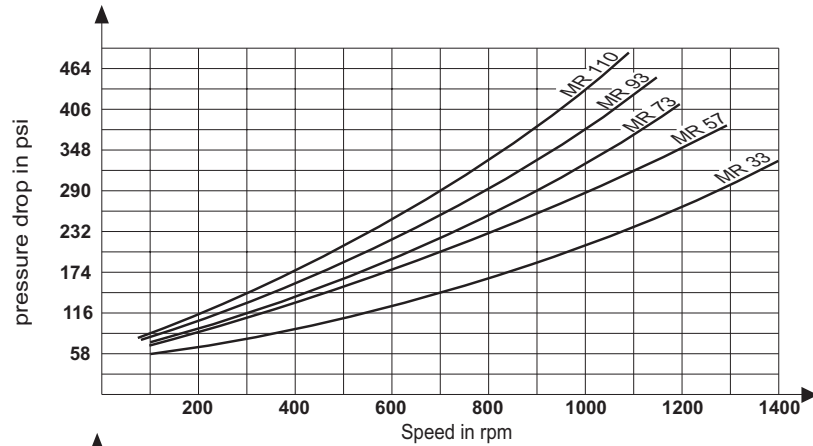
OPERATING DIAGRAM

(average values) measured at  $V = 167 \text{ SUS (36 mm}^2\text{/s)}$ ;  $t = 113^\circ\text{F (45}^\circ\text{C)}$ ;

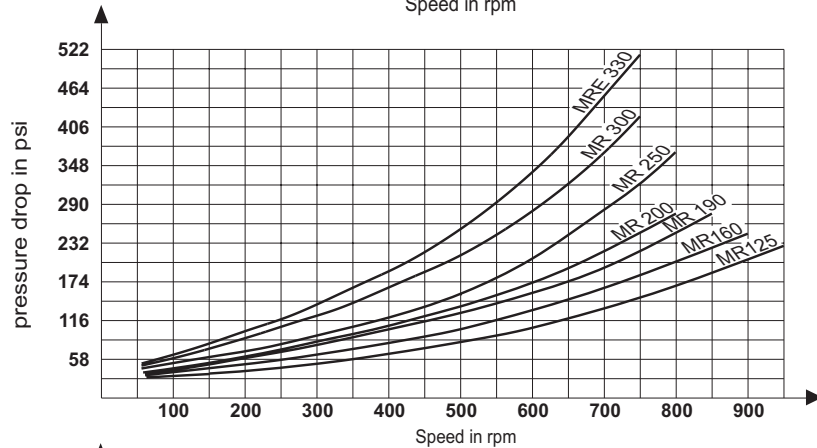
Min. required pressure difference  $\Delta p$  with idling speed (shaft unloaded)

$p_{\text{outlet}} = 0 \text{ psi (0 bar)}$

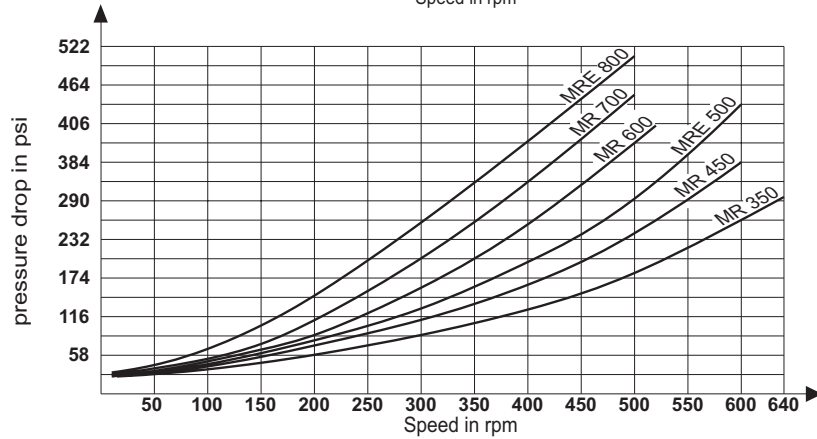
**MR**  
**33 - 110**



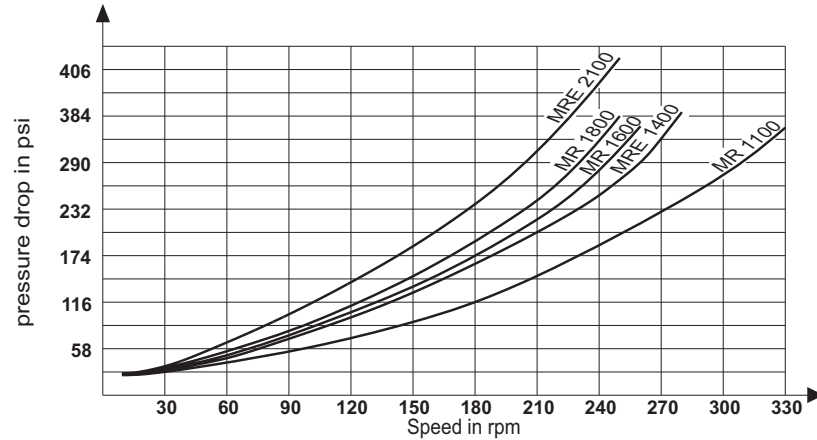
**MR - MRE**  
**125 - 330**



**MR - MRE**  
**350 - 800**



**MR - MRE**  
**1100 - 2100**



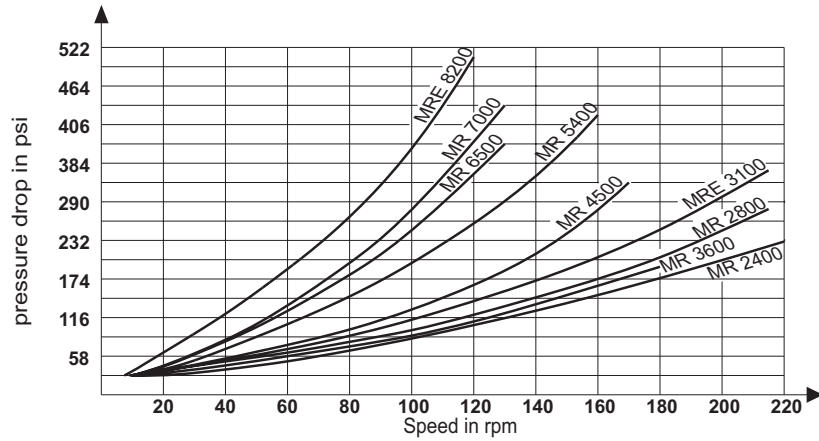
OPERATING DIAGRAM

(average values) measured at  $V = 167 \text{ SUS}$  ( $36 \text{ mm}^2/\text{s}$ );  $t = 113^\circ\text{F}$  ( $45^\circ\text{C}$ );

Min. required pressure difference  $\Delta p$  with idling speed (shaft unloaded)

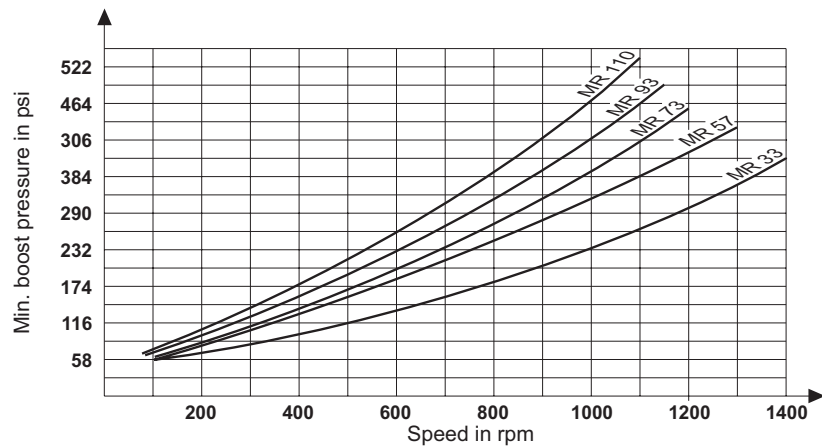
$p_{\text{outlet}} = 0 \text{ psi}$  (0 bar)

**MR - MRE  
2400 - 8200**

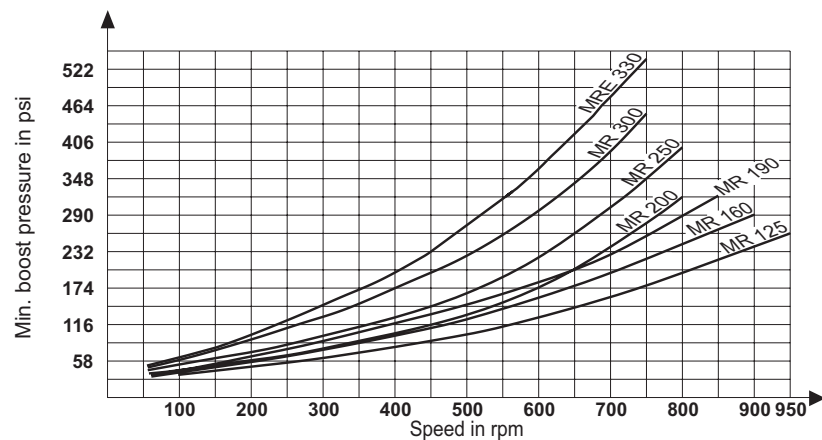


Minimum boost pressure during pump operation

**MR  
33 - 110**



**MR - MRE  
125 - 330**





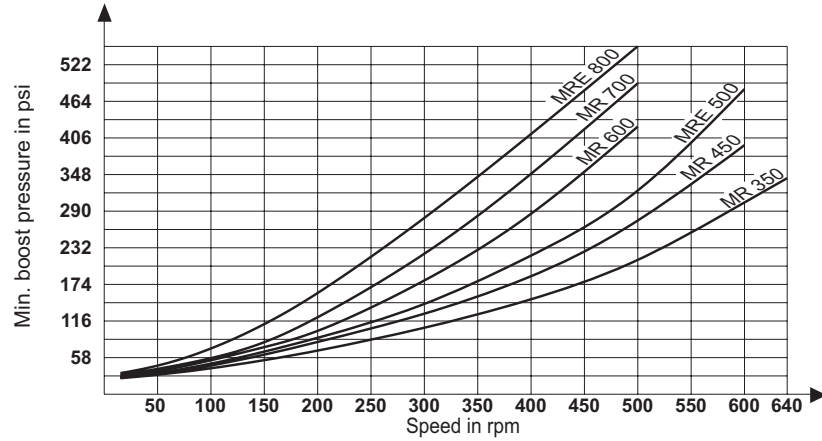
OPERATING DIAGRAM

(average values) measured at  $V = 167 \text{ SUS}$  ( $36 \text{ mm}^2/\text{s}$ );  $t = 113^\circ\text{F}$  ( $45^\circ\text{C}$ );

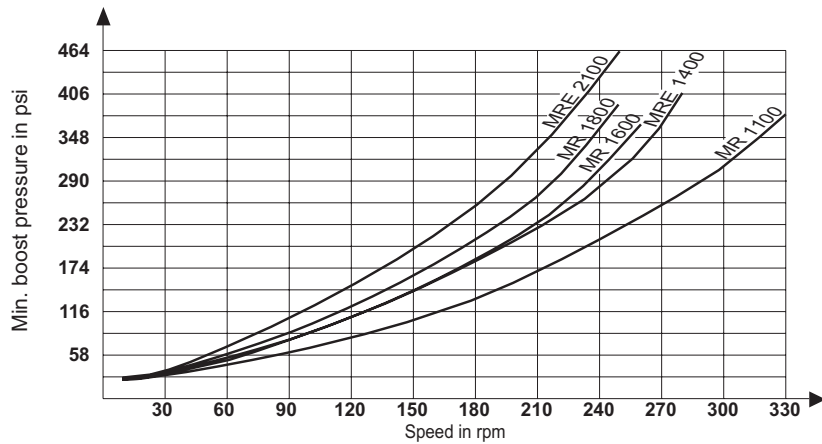
Minimum boost pressure during pump operation

$p_{\text{outlet}} = 0 \text{ psi}$  (0 bar)

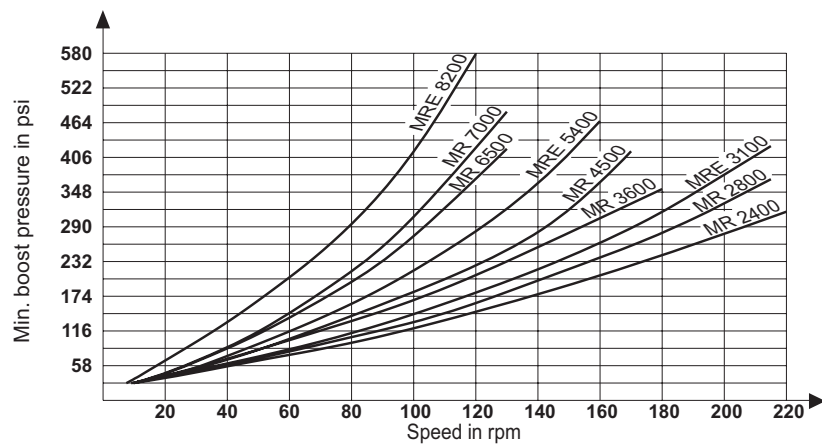
**MR - MRE  
350 - 800**



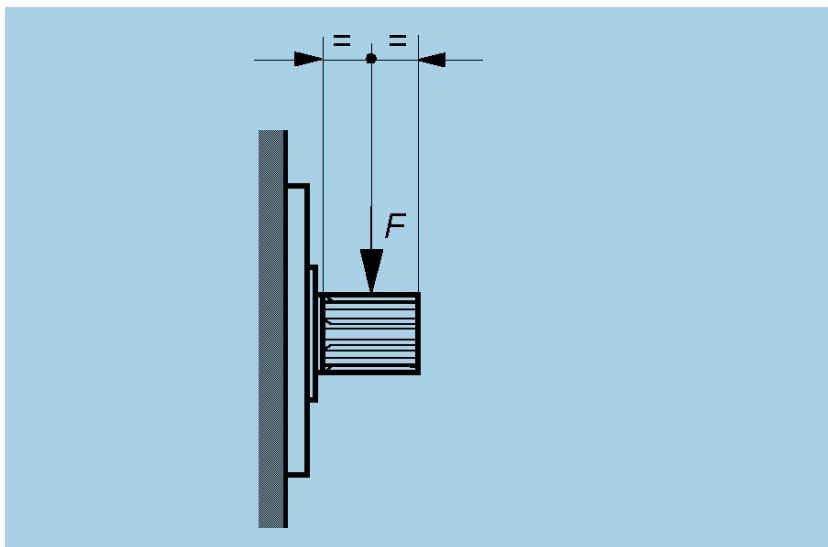
**MR - MRE  
1100 - 2100**



**MR - MRE  
2400 - 8200**

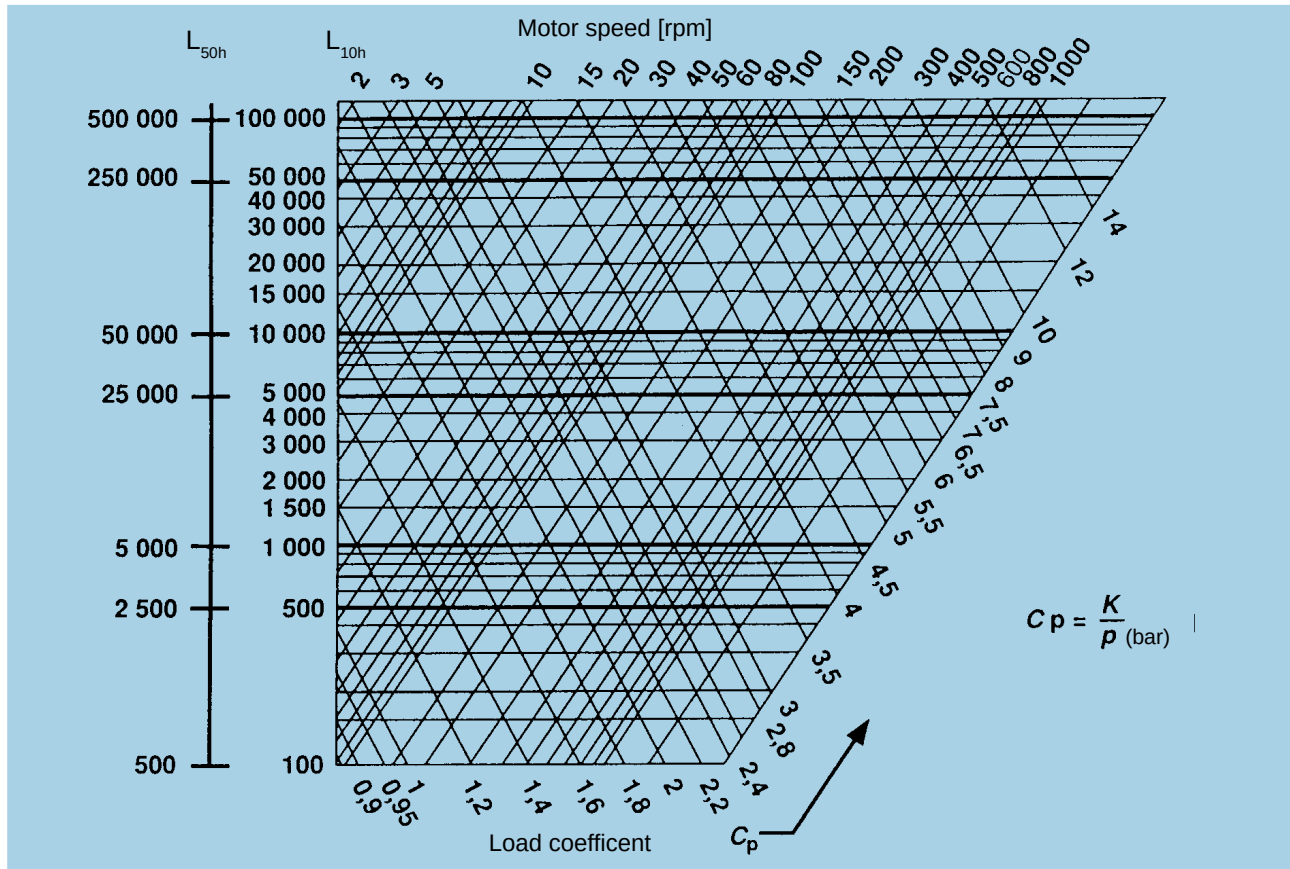


RADIAL LOAD



| MOTOR TYPE                                                                                          | RADIAL FORCE <sup>1</sup> <sub>MAX</sub><br>BRIEFLY<br>PERMITTED WITH<br>DYNAMIC LOAD<br>F in lbf *) | MAX. PERMITTED RADIAL FORCE IN SHAFT CENTRE<br>BASED ON L <sub>H10</sub> 5000 HOURS |                                        |                                        | speed in<br>rpm |
|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------|----------------------------------------|-----------------|
|                                                                                                     |                                                                                                      | INPUT PRESSURE<br>2901 psi<br>F in lbf                                              | INPUT PRESSURE<br>2176 psi<br>F in lbf | INPUT PRESSURE<br>1450 psi<br>F in lbf |                 |
| MR 33                                                                                               | 4271.37                                                                                              | 2135.69                                                                             | 2293.05                                | 2382.98                                | 400             |
| MR 57                                                                                               | 4271.37                                                                                              | 2135.69                                                                             | 2293.05                                | 2382.98                                | 400             |
| MR 73                                                                                               | 5058.20                                                                                              | 2023.28                                                                             | 2607.78                                | 3034.92                                | 350             |
| MR 93                                                                                               | 5058.20                                                                                              | 2023.28                                                                             | 2607.78                                | 3034.92                                | 350             |
| MR 110                                                                                              | 5058.20                                                                                              | 2023.28                                                                             | 2607.78                                | 3034.92                                | 350             |
| MR 125                                                                                              | 5058.20                                                                                              | 1124.05                                                                             | 2225.61                                | 2900.04                                | 275             |
| MR 160                                                                                              | 5058.20                                                                                              | 1124.05                                                                             | 2225.61                                | 2900.04                                | 275             |
| MR 190                                                                                              | 5058.20                                                                                              | 1124.05                                                                             | 2225.61                                | 2900.04                                | 275             |
| MR 200 *                                                                                            | -                                                                                                    | -                                                                                   | -                                      | -                                      | -               |
| MR 250                                                                                              | 6294.65                                                                                              | 1258.93                                                                             | 2225.61                                | 2832.59                                | 250             |
| MR 300                                                                                              | 6294.65                                                                                              | 1258.93                                                                             | 2225.61                                | 2832.59                                | 250             |
| MR 350                                                                                              | 7868.31                                                                                              | 3259.73                                                                             | 4136.49                                | 4765.95                                | 225             |
| MR 450                                                                                              | 7868.31                                                                                              | 3259.73                                                                             | 4136.49                                | 4765.95                                | 225             |
| MR 600                                                                                              | 9666.78                                                                                              | 3372.13                                                                             | 5058.20                                | 6137.28                                | 200             |
| MR 700                                                                                              | 9666.78                                                                                              | 3372.13                                                                             | 5058.20                                | 6137.28                                | 200             |
| MR 1100                                                                                             | 12139.7                                                                                              | 4158.97                                                                             | 6407.06                                | 7913.28                                | 150             |
| MR 1600                                                                                             | 15287                                                                                                | 5889.99                                                                             | 9127.24                                | 11240.45                               | 125             |
| MR 1800                                                                                             | 15287                                                                                                | 5889.99                                                                             | 9127.24                                | 11240.45                               | 125             |
| MR 2400                                                                                             | 19108.76                                                                                             | 11262.93                                                                            | 14837.39                               | 17265.33                               | 110             |
| MR 2800                                                                                             | 19108.76                                                                                             | 12139.68                                                                            | 15511.82                               | 17849.83                               | 100             |
| MR 3600                                                                                             | 24279.37                                                                                             | 12364.50                                                                            | 20232.8                                | 23155.32                               | 100             |
| MR 4500                                                                                             | 24279.37                                                                                             | 17535.1                                                                             | 21806.47                               | 24504.17                               | 85              |
| MR 6500                                                                                             | 30124.4                                                                                              | 16635.86                                                                            | 27651.5                                | 31698.06                               | 50              |
| MR 7000                                                                                             | 30124.4                                                                                              | 16635.86                                                                            | 27651.5                                | 31698.06                               | 50              |
| MRE 330                                                                                             | 6294.65                                                                                              | 1011.64                                                                             | 1910.88                                | 2675.23                                | 250             |
| MRE 500                                                                                             | 7868.31                                                                                              | 2787.63                                                                             | 3889.20                                | 4676.03                                | 225             |
| MRE 800                                                                                             | 9666.78                                                                                              | 1910.87                                                                             | 4451.22                                | 5912.48                                | 200             |
| MRE 1400                                                                                            | 12139.7                                                                                              | 1933.35                                                                             | 5395.42                                | 7553.58                                | 140             |
| MRE 2100                                                                                            | 15287                                                                                                | 2810.11                                                                             | 8003.20                                | 10858.27                               | 120             |
| MRE 3100                                                                                            | 19108.76                                                                                             | 10116.4                                                                             | 14500.18                               | 17445.17                               | 100             |
| MRE 5400                                                                                            | 24279.37                                                                                             | 14162.96                                                                            | 20277.77                               | 24122                                  | 80              |
| MRE 8200                                                                                            | 30124.4                                                                                              | 15287.01                                                                            | 24728.98                               | 28775.54                               | 50              |
| *) in accordance with the dynamic condition, higher values can be accepted - MR 200* only code "F1" |                                                                                                      |                                                                                     |                                        |                                        |                 |

BEARING LIFE

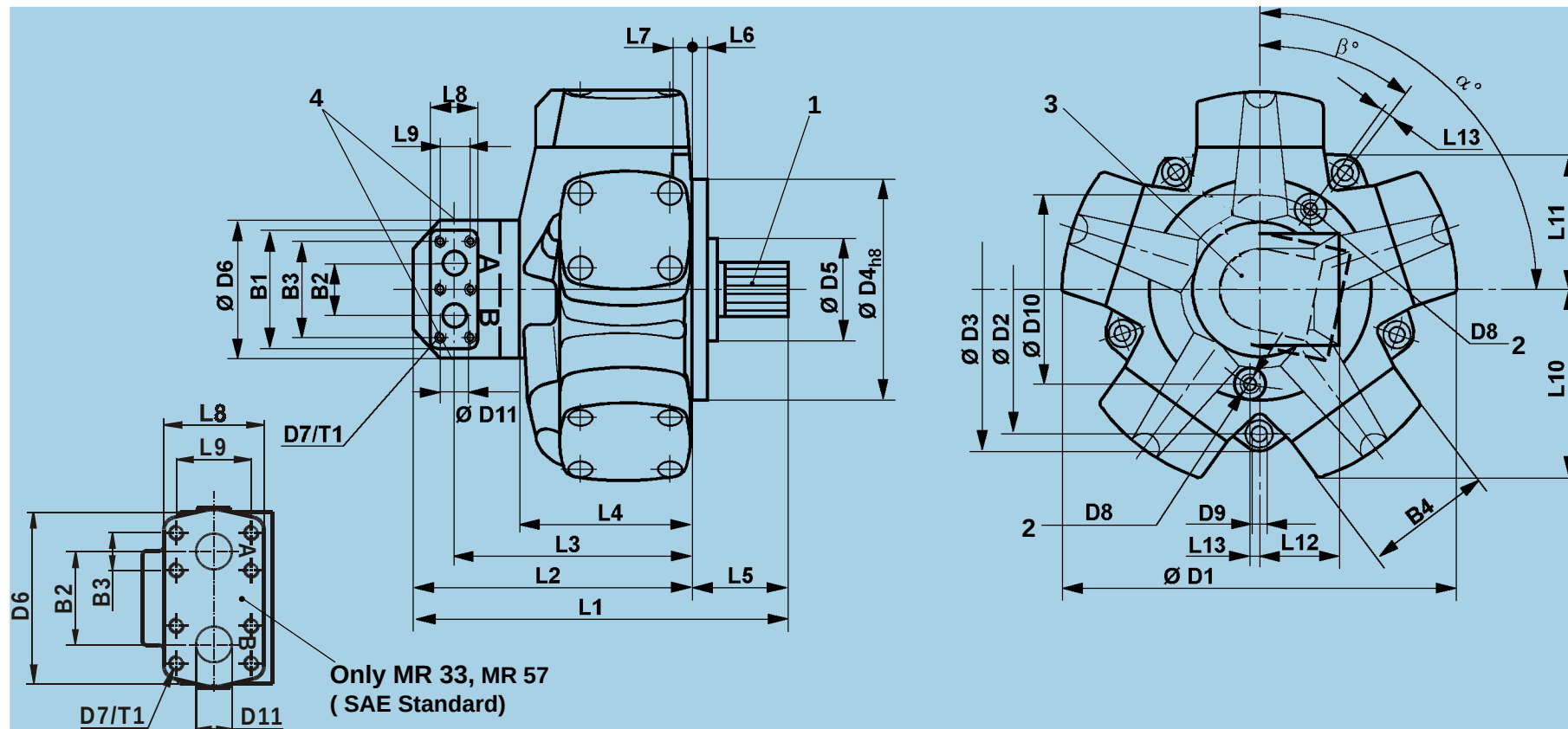


$C_p$  = Load coefficient  
 $K$  = Service life coefficient for standard bearing  
 $p$  = operating pressure in bar  
 Convert pressure 1psi = 0.0690 bar

$L_{10h}$  is the theoretically service life value normally reached or exceeded by the 90% of the bearings.

50 % of the bearings reach the value  $L_{50h} = 5$  times  $L_{10h}$ .

| MOTOR TYPE | K    | MOTOR TYPE | K    | MOTOR TYPE | K   |
|------------|------|------------|------|------------|-----|
| MR 33      | 2150 | MRE 330    | 850  | MRE 2100   | 722 |
| MR 57      | 2150 | MR 350     | 1126 | MR 2400    | 924 |
| MR 73      | 1320 | MR 450     | 1126 | MR 2800    | 924 |
| MR 93      | 1320 | MRE 500    | 1021 | MRE 3100   | 828 |
| MR 110     | 1320 | MR 600     | 920  | MR 3600    | 709 |
| MR 125     | 950  | MR 700     | 920  | MR 4500    | 709 |
| MR 160     | 950  | MRE 800    | 808  | MRE 5400   | 591 |
| MR 190     | 950  | MR 1100    | 844  | MR 6500    | 710 |
| MR 200     | 950  | MRE 1400   | 693  | MR 7000    | 710 |
| MR 250     | 950  | MR 1600    | 835  | MRE 8200   | 550 |
| MR 300     | 950  | MR 1800    | 835  |            |     |

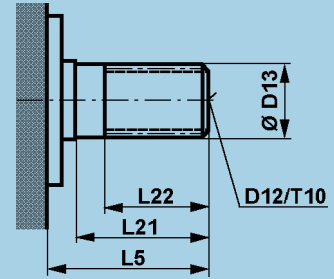
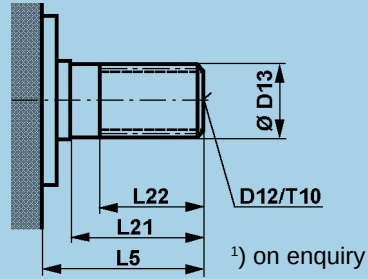
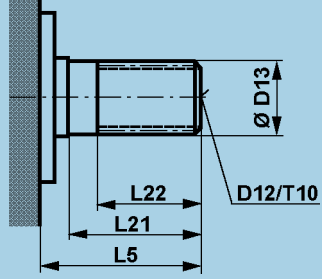


- 1 Splined shaft with flank contact  
(for dimension see page 26)  
Ordering code "N1"  
(for further shaft ends see page 26 - 27)
- 2 Case drain port  
BSP threads to ISO 228/1
- 3 On request the port flange can be rotated by  $72^\circ$   
(For MR 33, MR 57, MR 73, MR 93, MR 110, MR 125, MR 160, MR 190, MR 200, MR 250, MR 300, MRE 330, MR 350, MR 450, MRE 500, MR 600, MR 700, MRE 800 can be rotated by  $36^\circ$ )  
For standard position see angle  $\alpha$ .
- 4 Port 1/4" BSP threads to ISO 228/1 for pressure reading.

| Dir. of Rotation<br>(Viewed on shaft end) | Port inlet | ordering code<br>(see page35) |
|-------------------------------------------|------------|-------------------------------|
| clockwise                                 | A          | "N"                           |
| anti-clockwise                            | B          |                               |
| clockwise                                 | B          |                               |
| anti-clockwise                            | A          | "S"                           |

| MOTOR TYPE                                                        | L1<br>(in) | L2<br>(in) | L3<br>(in) | L4<br>(in) | L5<br>(in) | L6<br>(in) | L7<br>(in) | L8<br>(in) | L9<br>(in) | L10<br>(in) | L11<br>(in) | L12<br>(in) | L13<br>(in) | B1<br>(in) | B2<br>(in) | B3<br>(in) | B4<br>(in) | Ø D1<br>(in) | Ø D2<br>(in) | Ø D3<br>(in) | Ø D4 <sub>h8</sub> <sup>*</sup><br>(in)              | Ø D5<br>(in) | Ø D6<br>(in) | D7<br>(mm) | T1<br>(in) | D8    | D9<br>(in) | Ø D10<br>(in) | Ø D11<br>(in) | α    | β   |
|-------------------------------------------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|-------------|------------|------------|------------|------------|--------------|--------------|--------------|------------------------------------------------------|--------------|--------------|------------|------------|-------|------------|---------------|---------------|------|-----|
| <b>MR 33</b><br><b>MR 57</b>                                      | 9.97       | 7.72       | 5.83       | 4.21       | 2.25       | 0.55       | 0.75       | 2.76       | 2.06       | 4.34        | 3.09        | 2.76        | 0.78        | 4.88       | 2.56       | 1.03       | 2.73       | 9.27         | 6.3          | 7.09         | 4.9212<br>4.9188<br>(125 mm)                         | -            | 4.72         | M10        | 0.98       | G1/4  | 0.35       | 3.82          | 0.98          | 108° | 36° |
| <b>MR 73</b><br><b>MR 93</b><br><b>MR 110</b>                     | 11.69      | 9.00       | 7.50       | 5.18       | 2.70       | 0.67       | 0.79       | 2.13       | 1.34       | 4.72        | 3.70        | 2.84        | -           | 4.72       | 1.97       | 3.94       | 3.54       | 9.84         | 8.03         | 8.84         | 5.7086<br>5.7062<br>(145 mm)                         | -            | 5.08         | M8         | 0.59       | G3/8  | 0.43       | -             | 0.79          | 90°  | 36° |
| <b>MR 125</b><br><b>MR 160</b><br><b>MR 190</b>                   | 12.17      | 9.53       | 8.03       | 5.71       | 2.64       | 0.55       | 0.63       | 2.13       | 1.34       | 5.81        | 4.06        | 2.84        | 0.26        | 4.72       | 1.97       | 3.94       | 3.94       | 12.33        | 8.86         | 9.80         | 6.2991<br>6.2967<br>(160 mm)                         | -            | 5.08         | M8         | 0.59       | G 3/8 | 0.43       | 6.30          | 0.79          | 90°  | 36° |
| <b>MR 200</b><br><b>MR 250</b><br><b>MR 300</b><br><b>MRE 330</b> | 12.72      | 9.53       | 8.03       | 5.71       | 3.19       | 0.59       | 0.63       | 2.13       | 1.34       | 6.04        | 4.69        | 2.84        | 0.30        | 4.72       | 1.97       | 3.94       | 3.94       | 12.91        | 9.13         | 10.08        | 6.8897<br>6.8873<br>(175 mm)                         | 3.54         | 5.08         | M8         | 0.59       | G 3/8 | 0.43       | 6.38          | 0.79          | 90°  | 36° |
| <b>MR 350</b><br><b>MR 450</b><br><b>MRE 500</b>                  | 14.8       | 10.98      | 9.25       | 6.57       | 3.82       | 0.59       | 0.71       | 2.77       | 1.57       | 6.87        | 5.12        | 3.31        | 0.37        | 5.59       | 2.36       | 4.72       | 4.69       | 14.49        | 10.47        | 11.65        | 7.4802<br>7.4775<br>(190 mm)                         | 3.78         | 6.14         | M10        | 0.71       | G 3/8 | 0.51       | 7.64          | 0.98          | 90°  | 36° |
| <b>MR 600</b><br><b>MR 700</b><br><b>MRE 800</b>                  | 15.75      | 11.77      | 10.04      | 7.36       | 3.98       | 0.59       | 0.79       | 2.77       | 1.57       | 7.56        | 5.63        | 3.31        | 0.31        | 5.59       | 2.36       | 4.72       | 5.24       | 15.95        | 11.42        | 12.60        | 8.6614<br>8.6586<br>(220 mm)                         | 4.02         | 6.14         | M10        | 0.71       | G 3/8 | 0.51       | 8.15          | 0.98          | 90°  | 36° |
| <b>MR 1100</b><br><b>MRE 1400</b>                                 | 18.03      | 13.43      | 11.54      | 7.99       | 4.61       | 0.79       | 0.87       | 3.23       | 1.97       | 8.78        | 6.50        | 4.13        | 0.35        | 6.38       | 2.87       | 5.35       | 5.83       | 18.50        | 12.99        | 14.45        | 9.8425<br>9.8397<br>(250 mm)                         | 4.72         | 6.77         | M12        | 0.83       | G 1/2 | 0.59       | 8.98          | 1.22          | 104° | 36° |
| <b>MR 1600</b><br><b>MR 1800</b><br><b>MRE 2100</b>               | 19.92      | 14.72      | 12.83      | 9.29       | 5.20       | 0.83       | 0.94       | 3.23       | 1.97       | 10.39       | 7.76        | 4.13        | 0.43        | 6.38       | 2.87       | 5.35       | 6.61       | 21.97        | 14.96        | 16.65        | 11.4173<br>11.4141<br>(290 mm)                       | 5.83         | 6.77         | M12        | 0.83       | G 1/2 | 0.67       | 10.47         | 1.22          | 90°  | 36° |
| <b>MR 2400</b><br><b>MR 2800</b><br><b>MRE 3100</b>               | 24.37      | 18.35      | 15.43      | 11.22      | 6.02       | 0.94       | 1.02       | 3.86       | 2.44       | 11.93       | 8.70        | 4.84        | 0.59        | 8.19       | 3.39       | 7.09       | 7.48       | 25.28        | 17.32        | 19.45        | 13.1889<br>13.1854<br>(335 mm)                       | 5.51         | 8.46         | M14        | 1.10       | G 1/2 | 0.75       | 12.36         | 1.46          | 90°  | 36° |
| <b>MR 3600</b><br><b>MR 4500</b><br><b>MRE 5400</b>               | 27.54      | 19.27      | 16.48      | 12.11      | 8.27       | 1.34       | 1.10       | 3.86       | 2.68       | 14.15       | 9.72        | 5.51        | 0.75        | 9.06       | 4.57       | 7.87       | 9.45       | 30.16        | 21.26        | 23.50        | 15.7479<br>15.7457<br>(400 mm)<br>* D4 <sub>h7</sub> | -            | 8.46         | M16        | 1.26       | G 1/2 | 0.91       | 14.96         | 1.50          | 108° | 36° |
| <b>MR 6500</b><br><b>MR 7000</b><br><b>MRE 8200</b>               | 31.34      | 22.28      | 19.49      | 15.12      | 9.06       | 1.46       | 1.18       | 3.86       | 2.68       | 16.04       | 9.72        | 5.51        | 0.83        | 9.06       | 4.57       | 7.87       | 10.39      | 34.02        | 23.62        | 25.93        | 17.7165<br>17.714<br>(450 mm)<br>* D4 <sub>h7</sub>  | 7.48         | 8.46         | M16        | 1.25       | G 1/2 | 0.98       | 17.72         | 1.50          | 108° | 36° |

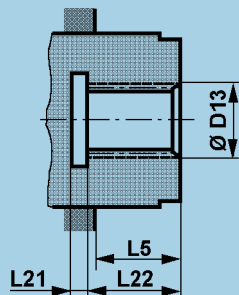


**Code D 1 - DIN 5480 - (Standard)****Code B 1 - BS 3550 - <sup>1)</sup>****Code N 1 (Standard)**

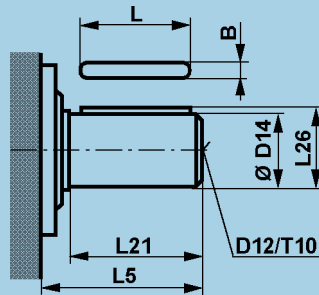
| Version                        | N1         |             |             |             |             |                             | B1         |             |             |             |             |                 | D1         |             |             |             |             |                          |
|--------------------------------|------------|-------------|-------------|-------------|-------------|-----------------------------|------------|-------------|-------------|-------------|-------------|-----------------|------------|-------------|-------------|-------------|-------------|--------------------------|
| Type                           | L5<br>(in) | L21<br>(in) | L22<br>(in) | D12<br>(mm) | T10<br>(in) | ØD13<br>ex DIN 5463<br>(mm) | L5<br>(in) | L21<br>(in) | L22<br>(in) | D12<br>(mm) | T10<br>(in) | ØD13<br>BS 3550 | L5<br>(in) | L21<br>(in) | L22<br>(in) | D12<br>(mm) | T10<br>(in) | ØD13<br>DIN 5480<br>(mm) |
| MR 33<br>MR 57                 | 2.24       | 1.57        | 1.10        | -           | -           | B6x26x32                    | -          | -           | -           | -           | -           | -               | 2.24       | 1.57        | 1.10        | -           | -           | W32x1,5x20-8e            |
| MR 73<br>MR 93<br>MR 110       | 2.70       | 2.03        | 1.24        | M12         | -           | B6x28x34                    | -          | -           | -           | -           | -           | -               | 2.70       | 2.03        | 1.24        | M12         | -           | W35x2x16-8e              |
| MR 125<br>MR 160<br>MR 190     | 2.64       | 1.97        | 1.40        | M12         | 0.79        | B8x32x38                    | 2.64       | 1.97        | 1.40        | M12         | 0.79        | 12/24-17        | 2.64       | 1.97        | 1.40        | M12         | 0.79        | W38x2x18-8e              |
| MR 200 *                       | -          | -           | -           | -           | -           | -                           | -          | -           | -           | -           | -           | -               | -          | -           | -           | -           | -           | -                        |
| MR 250<br>MR 300<br>MRE 330    | 3.19       | 2.36        | 1.81        | M12         | 0.98        | B8x42x48                    | 3.19       | 2.36        | 1.77        | M12         | 0.98        | 12/24-21        | 3.19       | 2.36        | 1.81        | M12         | 0.98        | W48x2x22-8e              |
| MR 350<br>MR 450<br>MRE 500    | 3.82       | 2.91        | 2.22        | M12         | 0.98        | B8x46x54                    | 3.82       | 2.91        | 2.40        | M12         | 0.98        | 8/16-17         | 3.82       | 2.91        | 2.36        | M12         | 0.98        | W55x3x17-8e              |
| MR 600<br>MR 700<br>MRE 800    | 3.98       | 3.07        | 2.44        | M12         | 0.98        | B8x52x60                    | 3.98       | 3.07        | 2.44        | M12         | 0.98        | 8/16-17         | 3.98       | 3.07        | 2.44        | M12         | 0.98        | W60x3x18-8e              |
| MR 1100<br>MRE 1400            | 4.61       | 3.46        | 2.72        | M12         | 0.98        | B8x62x72                    | 4.61       | 3.46        | 2.64        | M12         | 0.98        | 6/12-14         | 4.61       | 3.46        | 2.83        | M12         | 0.98        | W70x3x22-8e              |
| MR 1600<br>MR 1800<br>MRE 2100 | 5.20       | 3.94        | 3.11        | M12         | 0.98        | B10x72x82                   | 5.20       | 3.94        | 2.99        | M12         | 0.98        | 6/12-20         | 5.20       | 3.94        | 3.15        | M12         | 0.98        | W80x3x25-8e              |
| MR 2400<br>MR 2800<br>MRE 3100 | 6.02       | 4.72        | 3.90        | M12         | 0.98        | B10x82x92                   | 6.02       | 4.72        | 2.99        | M12         | 0.98        | 6/12-20         | 6.02       | 4.72        | 3.94        | M12         | 0.98        | W90x4x21-8e              |
| MR 3600<br>MR 4500<br>MRE 5400 | 8.27       | 6.81        | 5.67        | M12         | 0.98        | B10x102x112                 | 8.27       | 6.81        | 5.61        | M12         | 0.98        | 6/12-20         | 8.27       | 6.81        | 5.67        | M12         | 0.98        | W110x4x26-8e             |
| MR 6500<br>MR 7000<br>MRE 8200 | 9.06       | 7.40        | 5.91        | M12         | 0.98        | B10x112x125                 | 9.06       | 7.40        | 6.02        | M12         | 0.98        | 6/12-26         | 9.06       | 7.40        | 6.02        | M12         | 0.98        | W120x4x28-8e             |

NOTE: the threaded holes (D12/T10) for the shaft versions "N1", "B1" and "D1" must be considered as service holes. In case the holes dimensions required by the application are different from the ones listed here above, please contact DENISON Calzoni.  
MR 200 \* only code "F1"

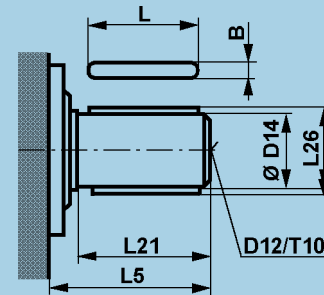
Code F 1 - DIN 5480 -



Code P 1



Code P 1 \*\*\*



Only MR 6500, MR 7000,  
MRE 8200

| Version                        | F       |          |          |                     | P       |          |             |          |          |                              |                |       | Transmitted torque (lbf.ft) |  |
|--------------------------------|---------|----------|----------|---------------------|---------|----------|-------------|----------|----------|------------------------------|----------------|-------|-----------------------------|--|
| Type                           | L5 (in) | L21 (in) | L22 (in) | Ø D13 DIN 5480 (mm) | L5 (in) | L21 (in) | L26 (in)    | D12 (mm) | T10 (in) | Ø D14 <sub>k6</sub> ** (in)  | Key (mm) L x B |       |                             |  |
| MR 33<br>MR 57                 | 0.67    | 0.20     | 0.83     | N28x1,25x21-9H      | -       | -        | -           | -        | -        | -                            | -              | -     |                             |  |
| MR 73<br>MR 93<br>MR 110       | 0.67    | 0.20     | 1.02     | N32x2x14-9H         | -       | -        | -           | -        | -        | -                            | -              | -     |                             |  |
| MR 125<br>MR 160<br>MR 190     | 0.55    | 0.20     | 1.10     | N35x2x16-9H         | 2.64    | 1.97     | 1.69        | M12      | 0.79     | 1.5755<br>1.5749<br>(40 mm)  | 45 x 12        | 366   |                             |  |
| MR 200 *                       | 1.06    | 0.20     | 1.42     | N40x2x18-9H         | -       | -        | -           | -        | -        | -                            | -              | -     |                             |  |
| MR 250<br>MR 300<br>MRE330     | 1.06    | 0.20     | 1.42     | N40x2x18-9H         | 3.19    | 2.36     | 2.11        | M12      | 0.98     | 1.9692<br>1.9686<br>(50 mm)  | 56 x 14        | 662   |                             |  |
| MR 350<br>MR 450<br>MRE 500    | 1.10    | 0.20     | 1.50     | N47x2x22-9H         | 3.82    | 2.91     | 2.32        | M12      | 0.98     | 2.1661<br>2.1655<br>(55 mm)  | 70 x 16        | 1042  |                             |  |
| MR 600<br>MR 700<br>MRE 800    | 1.10    | 0.20     | 1.73     | N55x3x17-9H         | 3.98    | 3.07     | 2.52        | M12      | 0.98     | 2.3630<br>2.3623<br>(60 mm)  | 70 x 18        | 1498  |                             |  |
| MR 1100<br>MRE 1400            | 1.50    | 0.31     | 1.97     | N65x3x20-9H         | 4.61    | 3.46     | 3.01        | M12      | 0.98     | 2.7567<br>2.7560<br>(70 mm)  | 80 x 20        | 1984  |                             |  |
| MR 1600<br>MR 1800<br>MRE 2100 | 1.85    | 0.31     | 2.24     | N75x3x24-9H         | 5.20    | 3.94     | 3.35        | M12      | 0.98     | 3.1504<br>3.1497<br>(80 mm)  | 90 x 22        | 2965  |                             |  |
| MR 2400<br>MR 2800<br>MRE 3100 | 1.89    | 0.31     | 2.44     | N85x3x27-9H         | 6.02    | 4.72     | 3.74        | M12      | 0.98     | 3.5442<br>3.5434<br>(90 mm)  | 110 x 25       | 4578  |                             |  |
| MR 3600<br>MR 4500<br>MRE 5400 | 1.97    | 0.55     | 2.68     | N100x3x32-9H        | 8.27    | 6.81     | 4.57        | M12      | 0.98     | 4.3316<br>4.3308<br>(110 mm) | 160 x 28       | 7934  |                             |  |
| MR 6500<br>MR 7000<br>MRE 8200 | 1.97    | 0.55     | 2.99     | N110x3x35-9H        | 9.06    | 7.40     | 5.43<br>*** | M12      | 0.98     | 4.8716<br>4.8691<br>(124 mm) | N°2-180 x 32   | 20850 |                             |  |

**NOTE**  
For higher values of the torque to be transmitted, please consult DENISON Calzoni

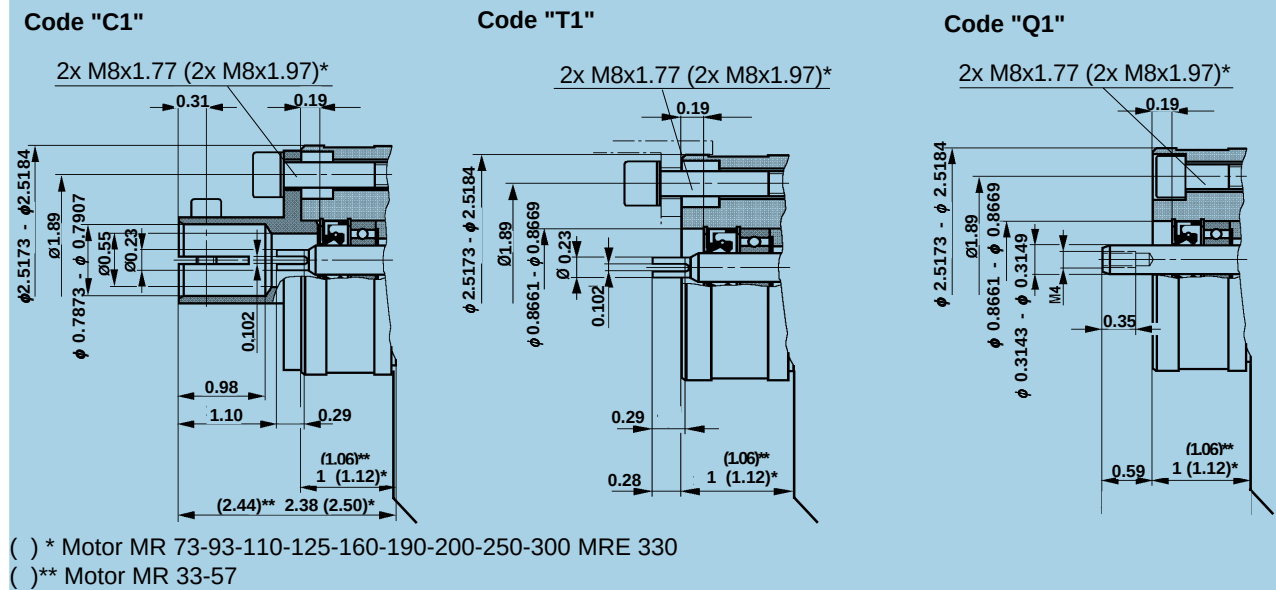
NOTE: the threaded holes (D12/T10) for the shaft versions "P1" must be considered as service holes. In case the holes dimensions required by the application are different from the ones listed here above, please contact DENISON Calzoni.  
MR 200 \* only code "F1"

\*\* ØD14<sub>k6</sub> for MR 6500, MR 7000, MRE 8200

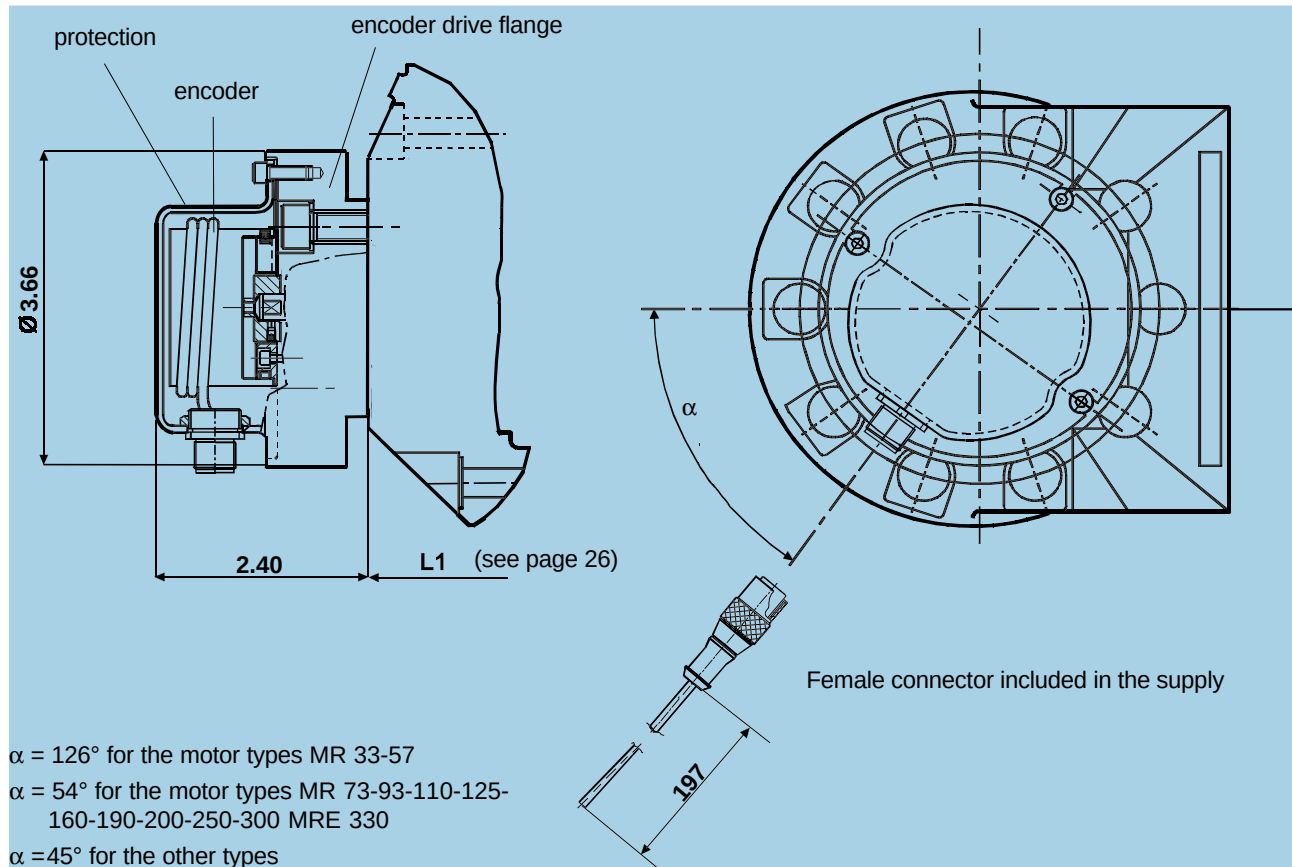
\*\*\*This dimension includes two keys

MECHANICAL  
TACHOMETER DRIVETACHOGENERATOR  
DRIVEENCODER  
DRIVE

Dimensions in inch (threaded holes in mm)

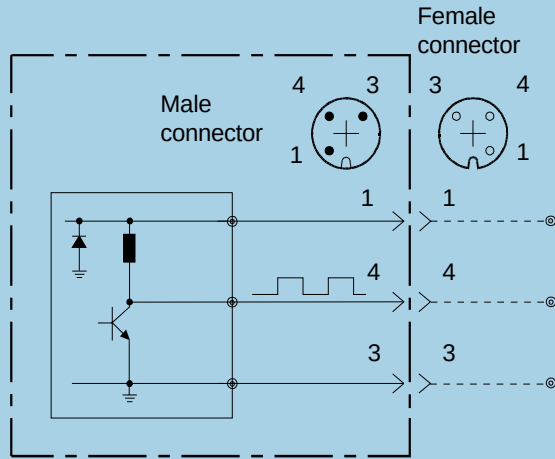
INCREMENTAL ENCODER  
DIMENSIONS

Dimensions in inch (in)

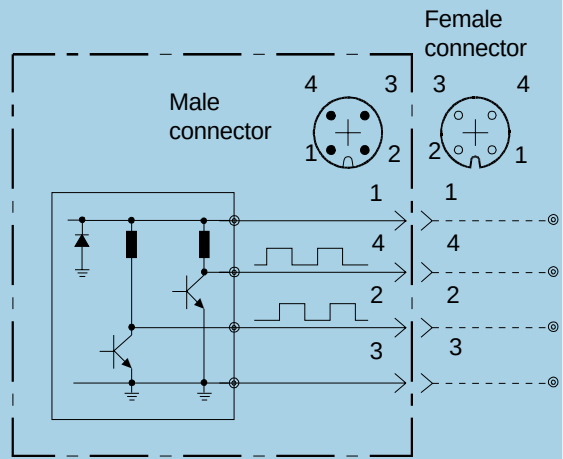


## INCREMENTAL ENCODER CONNECTION DIAGRAMS

### Monodirectional



### Bidirectional



#### Color wires and function

|          |              |                                     |
|----------|--------------|-------------------------------------|
| <b>1</b> | <b>Brown</b> | Power Supply (8 to 24 Vdc)          |
| <b>2</b> | <b>White</b> | Output B phase (MAX 10 mA - 24 Vcc) |
| <b>3</b> | <b>Blue</b>  | Power Supply (0 Vdc)                |
| <b>4</b> | <b>Black</b> | Output A phase (MAX 10 mA - 24 Vcc) |

## INCREMENTAL ENCODER TECHNICAL DATA

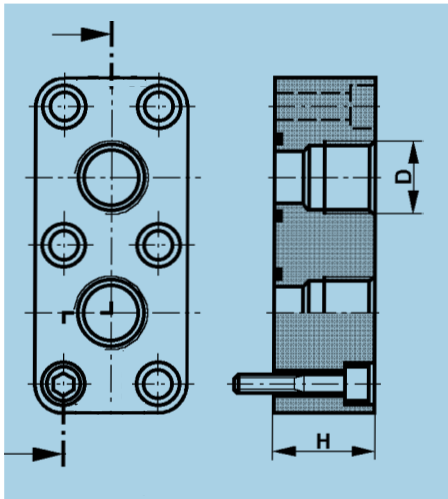
|                              |                                                          |
|------------------------------|----------------------------------------------------------|
| Encoder type:                | ELCIS mod. 478                                           |
| Supply voltage:              | 8 to 24 Vcc                                              |
| Current consumption:         | 120 mA max                                               |
| Current output:              | 10 mA max                                                |
| Output signal:               | A phase- MONODIRECTIONAL<br>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 <sup>9</sup> rpm                                  |
| Weigth:                      | 0,220 lb                                                 |
| Protection degree:           | IP 67 (with protection and connector assembled)          |
| Connectors:                  |                                                          |
| MONODIRECTIONAL              | RSF3/0.5 M (Lumberg) male<br>RKT3-06/5m (Lumberg) female |
| BIDIRECTIONAL                | RSF4/0.5 M (Lumberg) male<br>RKT4-07/5m (Lumberg) female |

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

# STANDARD CONNECTION FLANGE

Code "C1"

Flange is supplied complete with screws and seals.



| MR<br>MRE                                         | D<br>(BSP) | H<br>(inch) | CODE<br>NBR | CODE<br>FPM |
|---------------------------------------------------|------------|-------------|-------------|-------------|
| <b>125 - 160</b><br>190<br>200 - 250<br>300 - 330 | 3/4"       | 1.42        | 262 098     | 229 394     |
| <b>350 - 450</b><br>500<br>600 - 700<br>800       | 1 1/4"     | 1.57        | 262 089     | 229 395     |
| <b>1100 - 1400</b><br>1600 - 1800<br>2100         | 1 1/2"     | 1.77        | 262 093     | 229 396     |
| <b>2400 - 2800</b><br>3100                        | 1 1/2"     | 2.36        | 264 572     | 229 397     |
| <b>3600 - 4500</b><br>5400<br>6500 - 7000<br>8200 | 2"         | 2.36        | 272 724     | 229 398     |

BSP threads to ISO 228/1

Permitted up to 6000 PSI

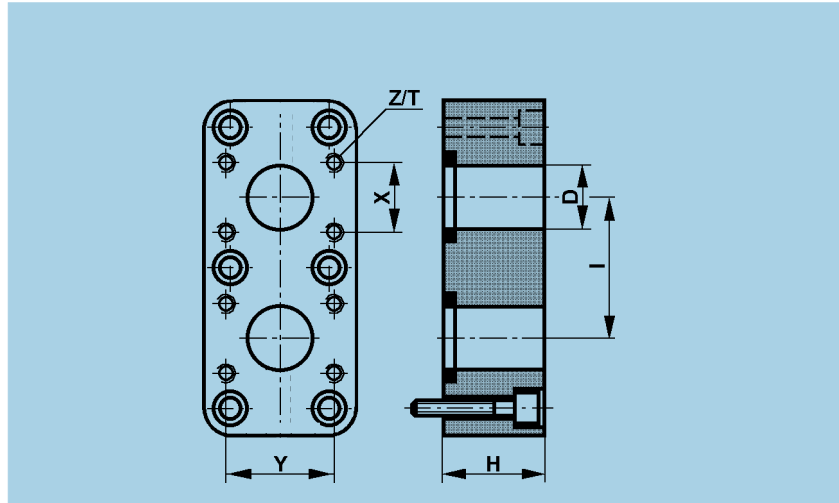
# SAE CONNECTION FLANGE

Codice "S1"

Codice "T1"

Codice "G1"

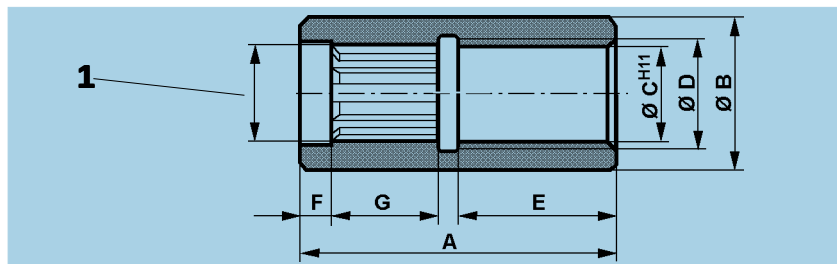
Codice "L1"



Flange is supplied complete with screws and seals. FPM seals enquiry.

| MR<br>MRE                                         | SAE<br>PSI | D      |                  | H<br>(inch) | I<br>(inch) | X<br>(inch) | Y<br>(inch) | METRIC            |                                      | UNC      |              |                                      |
|---------------------------------------------------|------------|--------|------------------|-------------|-------------|-------------|-------------|-------------------|--------------------------------------|----------|--------------|--------------------------------------|
|                                                   |            | "      | (inch)           |             |             |             |             | Z (mm)<br>T(inch) | Denison<br>Calzoni<br>part N°<br>NBR | Z (")    | T(inc-<br>h) | Denison<br>Calzoni<br>part N°<br>NBR |
| <b>125 - 160</b><br>190<br>200 - 250<br>300 - 330 | 5000       | 3/4"   | 0.748<br>(19 mm) | 1.42        | 2.17        | 0.87        | 1.87        | M10/0.98          | 277 295                              | 3/8"-16  | 0.984        | 223 335                              |
| <b>350 - 450</b><br>500<br>600 - 700<br>800       | 5000       | 1"     | 0.984<br>(25 mm) | 1.57        | 2.36        | 1.03        | 2.06        | M10/0.98          | 277 297                              | 3/8"- 16 | 0.984        | 223 336                              |
| <b>1100 - 1400</b><br>1800 - 1600<br>2100         | 4000       | 1 1/4" | 1.220<br>(31 mm) | 1.77        | 2.95        | 1.19        | 2.31        | M10/0.98          | 277 299                              | 7/16-14  | 1.18         | 223 337                              |
|                                                   | 6000       | 1"     | 0.984<br>(25 mm) | 1.77        | 2.80        | 1.09        | 2.25        | M12/0.87          | 230 166                              | 7/1614   | 1.18         | 342 092                              |
| <b>2400 - 2800</b><br>3100                        | 3000       | 1 1/2" | 1.457<br>(37 mm) | 2.36        | 3.39        | 1.41        | 2.75        | M12/1.18          | 277 301                              | 1/2"- 13 | 1.18         | 223 338                              |
|                                                   | 6000       | 1 1/2" | 1.457<br>(37 mm) | 2.36        | 3.84        | 1.44        | 3.13        | M16/1.18          | 230 168                              | 5/8"-11  | 1.37         | 349068                               |
| <b>3600 - 4500</b><br>5400<br>6500 - 7000<br>8200 | 3000       | 2"     | 1.969<br>(50 mm) | 2.36        | 4.41        | 1.69        | 3.06        | M12/1.18          | 277 303                              | 1/2"-13  | 1.18         | 223 339                              |
|                                                   | 6000       | 2"     | 1.969<br>(50 mm) | 2.36        | 4.57        | 1.75        | 3.81        | M20/1.38          | 230 170                              | 3/4"- 10 | 1.49         | 342 547                              |

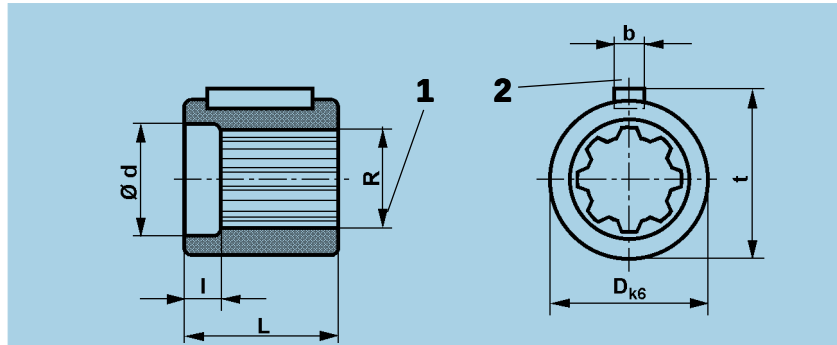
# COUPLINGS



1 For standard male splined shaft version "N1" (see page 26).

| MR<br>MRE           | ORDERING<br>CODE | A<br>(inch) | B<br>(inch) | C <sub>CH</sub><br>(inch)    | D<br>(inch) | E<br>(inch) | F<br>(inch) | G<br>(inch) |
|---------------------|------------------|-------------|-------------|------------------------------|-------------|-------------|-------------|-------------|
| 125 - 160<br>190    | 465 203          | 4.49        | 2.20        | 1.5417<br>1.5354<br>(39 mm)  | 1.85        | 2.13        | 0.61        | 1.36        |
| 250 - 300<br>330    | 465 202          | 5.31        | 2.80        | 1.9354<br>1.9291<br>(49 mm)  | 2.36        | 2.52        | 0.59        | 1.77        |
| 350 - 450<br>500    | 465 201          | 6.10        | 3.15        | 2.1728<br>2.1653<br>(55 mm)  | 2.68        | 2.68        | 0.73        | 2.19        |
| 600 - 700<br>800    | 465 200          | 6.73        | 3.54        | 2.4090<br>2.4016<br>(61 mm)  | 2.95        | 3.15        | 0.75        | 2.32        |
| 1100<br>1400        | 464 785          | 7.32        | 4.17        | 2.8814<br>2.8740<br>(73 mm)  | 3.48        | 3.37        | 0.79        | 2.58        |
| 1600 - 1800<br>2100 | 465199           | 8.82        | 4.65        | 3.2763<br>3.2677<br>(83 mm)  | 3.86        | 4.21        | 0.87        | 3.07        |
| 2400 - 2800<br>3100 | 465 198          | 10.43       | 5.20        | 3.6700<br>3.6614<br>(93 mm)  | 4.41        | 5           | 0.91        | 3.82        |
| 3600 - 4500<br>5400 | 474 692          | 13.98       | 5.91        | 4.4574<br>4.4488<br>(113 mm) | 4.96        | 6.50        | 1.18        | 5.51        |
| 6500 - 7000<br>8200 | 422 544          | 15.35       | 7.68        | 4.9704<br>4.9606<br>(126 mm) | 5.51        | 7.28        | 1.50        | 5.79        |

# ADAPTERS WITH KEY



1 For standard male splined shaft version "N1" (see page 26).

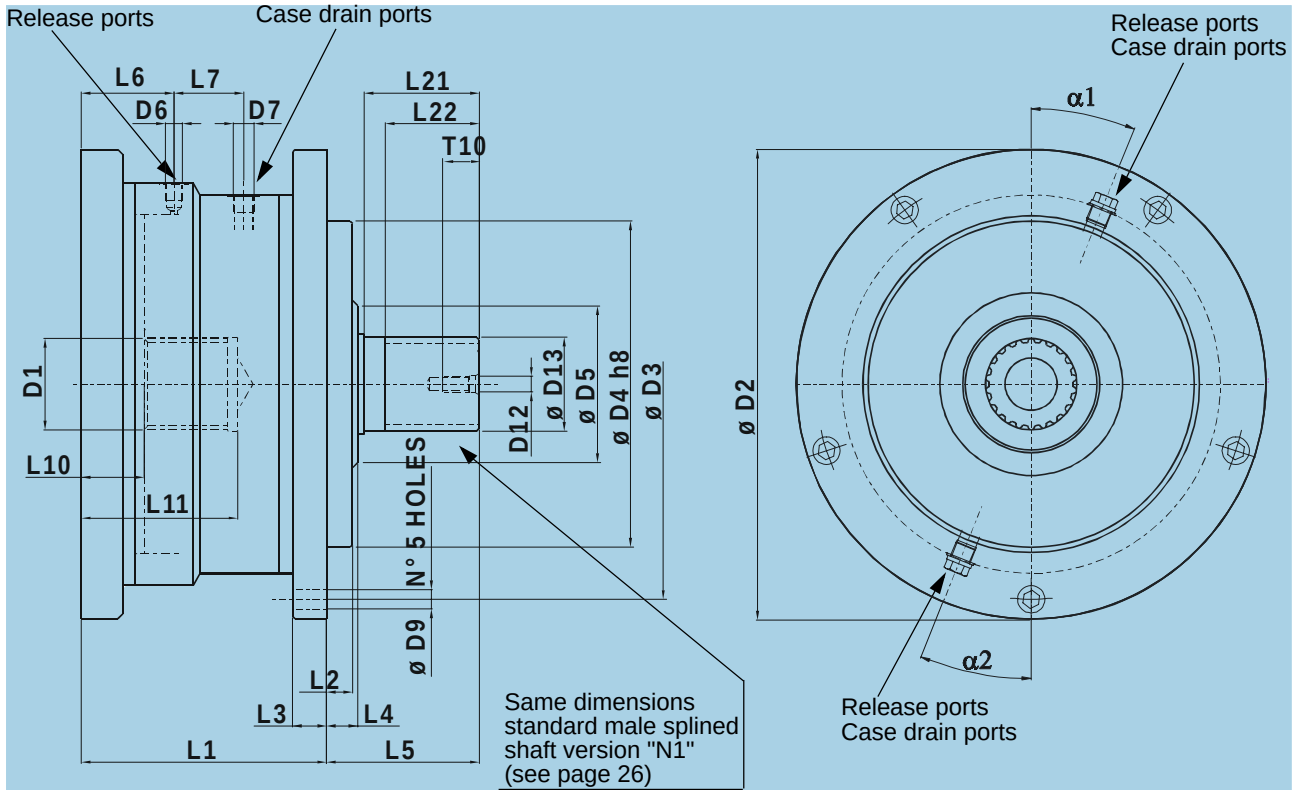
2 Key to DIN 6885

| MR<br>MRE           | ORDERING<br>CODE | R<br>EX DIN 5463<br>(mm) | d<br>(inch) | l<br>(inch) | D <sub>k6</sub><br>(inch)   | L<br>(inch) | b<br>(inch) | t<br>(inch) | Key (mm)<br>DIN 6885 |
|---------------------|------------------|--------------------------|-------------|-------------|-----------------------------|-------------|-------------|-------------|----------------------|
| 125 - 160<br>190    | 271 117          | A8x32x38                 | 1.508       | 0.61        | 2.2842<br>2.2835<br>(58 mm) | 1.97        | 0.39        | 2.40        | 10x8x45              |
| 250 - 300<br>330    | 271 118          | A8x42x48                 | 1.902       | 0.59        | 2.7567<br>2.7560<br>(70 mm) | 2.36        | 0.55        | 2.89        | 14x9x56              |
| 350 - 450<br>500    | 271 119          | A8x46x54                 | 2.138       | 0.73        | 3.1504<br>3.1497<br>(80 mm) | 2.95        | 0.63        | 3.31        | 16x10x70             |
| 600 - 700<br>800    | 271 120          | A8x52x60                 | 2.374       | 0.75        | 3.5442<br>3.5434<br>(90 mm) | 3.15        | 0.71        | 3.70        | 18x11x70             |
| 1100 - 1400         | 271 121          | A8x62x72                 | 2.846       | 0.79        | 4.1348<br>4.1340<br>(105mm) | 3.54        | 0.79        | 4.311       | 20x12x90             |
| 1600 - 1800<br>2100 | 271 122          | A10x72x82                | 3.24        | 0.87        | 4.6466<br>4.6457<br>(118mm) | 4.65        | 0.87        | 4.84        | 22x14x110            |
| 2400 - 2800<br>3100 | 271 123          | A10x82x92                | 3.634       | 0.91        | 5.1191<br>5.1182<br>(130mm) | 5.83        | 0.98        | 5.32        | 25x14x140            |
| 3600 - 4500<br>5400 | 272 719          | A10x102x112              | 4.421       | 1.18        | 6.3002<br>6.2993<br>(160mm) | 7.40        | 1.10        | 6.54        | 28x16x180            |
| 6500 - 7000<br>8200 | 223 476          | A10x112x125              | 4.944       | 1.50        | 7.2847<br>7.2836<br>(185mm) | 7.40        | 1.77        | 7.68        | 45x25x180            |



# HOLDING BRAKE UNIT DIMENSIONS - MOTOR TYPE MR - MRE

| BRAKE TYPE             | B 190            | B 300            | B 450            | B 700            | B 1100      | B 1800              | B 2800              |
|------------------------|------------------|------------------|------------------|------------------|-------------|---------------------|---------------------|
| MOTOR TYPE<br>MR - MRE | 125 - 160<br>190 | 250 - 300<br>330 | 350 - 450<br>500 | 600 - 700<br>800 | 1100 - 1400 | 1600 - 1800<br>2100 | 2400 - 2800<br>3100 |



**α1, α2** Corresponding angles to the release ports 1 and 2, to case the drain ports 1 and 2

| BRAKE TYPE | L1<br>(inch) | L2<br>(inch) | L3<br>(inch) | L4<br>(inch) | L5<br>(inch) | L6<br>(inch) | L7<br>(inch) | L10<br>(inch) | L11<br>(inch) | L21<br>(inch) | L22<br>(inch) | D1<br>(mm)                | D2<br>(inch) | D3<br>(inch) | D4 <sub>h8</sub><br>(inch)     | D5<br>(inch) | D6<br>(BSP) | D7<br>(BSP)  | D9<br>(inch) | D12<br>(inch) | D13<br>(mm)               | T10<br>(inch) | α1     | α2     |
|------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|---------------|---------------|---------------|---------------|---------------------------|--------------|--------------|--------------------------------|--------------|-------------|--------------|--------------|---------------|---------------------------|---------------|--------|--------|
| B 190      | 4.76         | -            | 0.87         | 0.55         | 2.64         | 1.61         | 1.15         | 0.79          | 2.84          | 1.97          | 1.40          | N 38x 2x18-9H<br>DIN 5480 | 9.84         | 8.86         | 6.2991<br>6.2967<br>(160 mm)   | -            | 1/4"        | 3/8"         | 0.41         | M12           | B 8x32x38<br>ex DIN 5463  | 1.10          | 22°30' | 22°30' |
| B 300      | 5.35         | -            | 0.98         | 0.59         | 3.19         | 1.65         | 1.56         | 0.83          | 3.39          | 2.36          | 1.81          | N 48x2x22-9H<br>DIN 5480  | 10.08        | 9.13         | 6.8897<br>6.8872<br>(175 mm)   | -            | 1/4"        | 3/8"         | 0.41         | M12           | B 8x42x48<br>ex DIN 5463  | 1.10          | 22°30' | 22°30' |
| B 450      | 5.79         | -            | 1.06         | 0.59         | 3.82         | 1.95         | 1.42         | 0.95          | 3.94          | 2.91          | 2.22          | N 55x3x17-9H<br>DIN 5480  | 11.65        | 10.47        | 7.4802<br>7.4774<br>(190 mm)   | -            | 1/4"        | 3/8"         | 0.53         | M12           | B 8x46x54<br>ex DIN 5463  | 1.10          | 22°30' | 22°30' |
| B 700      | 6.77         | -            | 1.10         | 0.59         | 3.98         | 2.17         | 1.81         | 0.98          | 4.13          | 3.07          | 2.44          | N 60x3x18-9H<br>DIN 5480  | 12.60        | 11.42        | 8.6613<br>8.6585<br>(220 mm)   | -            | 1/4"        | 3/8"         | 0.53         | M12           | B 8x52x60<br>ex DIN 5463  | 1.10          | 22°30' | 22°30' |
| B 1100     | 7.40         | 0.79         | 1.02         | 0.95         | 4.61         | 2.80         | 2.11         | 1.89          | 4.72          | 3.47          | 2.84          | N 70x3x22-9H<br>DIN 5480  | 14.17        | 12.99        | 9.8424<br>9.8396<br>(250 mm)   | 4.72         | 1/4"        | M16x-<br>1.5 | 0.59         | M12           | B 8x62x72<br>ex DIN 5463  | 1.10          | 0°     | 0°     |
| B 1800     | 8.50         | -            | 1.10         | 0.83         | 5.20         | 2.50         | 2.30         | 1.34          | 5.32          | 3.94          | 3.11          | N 80x3x25-9H<br>DIN 5480  | 16.65        | 14.96        | 11.4172<br>11.4141<br>(290 mm) | -            | 1/4"        | 1/2"         | 0.69         | M12           | B 10x72x82<br>ex DIN 5463 | 1.10          | 22°30' | 22°30' |
| B 2800     | 10.35        | -            | 1.18         | 0.95         | 6.02         | 3.43         | 2.64         | 1.67          | 6.50          | 4.72          | 3.90          | N 90x4x21-9H<br>DIN 5480  | 19.45        | 17.32        | 13.1889<br>13.1854<br>(335 mm) | -            | 1/4"        | 2"           | 0.75         | M12           | B 10x82x92<br>ex DIN 5463 | 1.10          | 22°30' | 22°30' |

## TECHNICAL DATA

(For operation outside these parameters, please consult **DENISON Calzoni**)

| CHARACTERISTICS                     |         | BRAKE TYPE        |                   |                   |                   |              |                      |                      |
|-------------------------------------|---------|-------------------|-------------------|-------------------|-------------------|--------------|----------------------|----------------------|
|                                     |         | B 190             | B 300             | B 450             | B 700             | B 1100       | B 1800               | B 2800               |
| STATIC BRAKING TORQUE               | lbf.ft  | 922               | 1328              | 1955              | 2950              | 4573         | 8408                 | 12612                |
| DYNAMIC BRAKING TORQUE              | lbf.ft  | 642               | 885               | 1069              | 1623              | 3098         | 4610                 | 8851                 |
| RELEASE PRESSURE                    | psi     | 406               | 406               | 392               | 392               | 392          | 435                  | 435                  |
| MAX. OPERATING PRESSURE             | psi     | 6092              | 6092              | 6092              | 6092              | 6092         | 6092                 | 6092                 |
| MOMENT OF INERTIA OF ROTATING PARTS | lbf.ft² | 0.112             | 0.147             | 0.688             | 1.020             | 1.448        | 4.746                | 6.407                |
| WEIGHT                              | lb      | 70.5              | 86                | 119               | 163               | 220,5        | 348.5                | 577.5                |
| MOTOR TYPE MR MRE                   |         | 125<br>160<br>190 | 250<br>300<br>330 | 350<br>450<br>500 | 600<br>700<br>800 | 1100<br>1400 | 1600<br>1800<br>2100 | 2400<br>2800<br>3100 |

## CODE

Example: BRAKE - B 450 - N1 V1 \*\*

1. BRAKE - B 450 NI V1 \*\*

## BRAKE TYPE

|               |                          |
|---------------|--------------------------|
| <b>B 190</b>  | Brake for motor size "C" |
| <b>B 300</b>  | Brake for motor size "D" |
| <b>B 450</b>  | Brake for motor size "E" |
| <b>B 700</b>  | Brake for motor size "F" |
| <b>B 1100</b> | Brake for motor size "G" |
| <b>B 1800</b> | Brake for motor size "H" |
| <b>B 2800</b> | Brake for motor size "I" |

2. BRAKE - B 450 - N1 V1 \*\*

## SHAFT

|                                         |                                      |
|-----------------------------------------|--------------------------------------|
| <b>N1</b>                               | Spline ex DIN 5463 (see page 26)     |
| <b>D1 *</b>                             | Spline DIN 5480 (see page 26)        |
| <b>F1 *</b>                             | Female spline DIN 5480 (see page 27) |
| <b>* please contact DENISON Calzoni</b> |                                      |

3. BRAKE - B 450 - N1 V1 \*\*

## SEALS

|                                         |                           |
|-----------------------------------------|---------------------------|
| <b>N1</b>                               | NBR: mineral oil          |
| <b>V1 *</b>                             | FPM seals                 |
| <b>U1</b>                               | No shaft seal (for brake) |
| <b>* please contact DENISON Calzoni</b> |                           |

4. BRAKE - B 450 - N1 V1 \*\*  
SPECIAL

|           |                                   |
|-----------|-----------------------------------|
| <b>**</b> | Space reserved to Denison Calzoni |
|-----------|-----------------------------------|

## 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

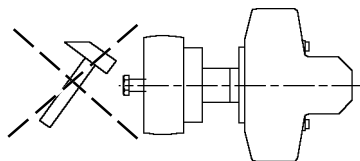
- Please note manufacturing data!

Before operation fill with hydraulic fluid

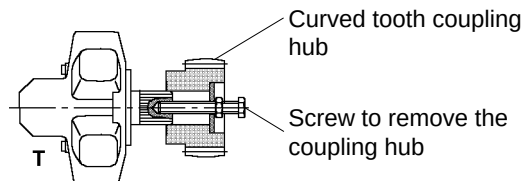
- Use the prescribed filter!

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

## Coupling



- Mounting with screws
- Use threaded bore in the drive shaft
- Take apart with extractor



Curved tooth coupling hub

Screw to remove the coupling hub

## DRAIN AND FLUSHING LINK INSTALLATION EXAMPLES

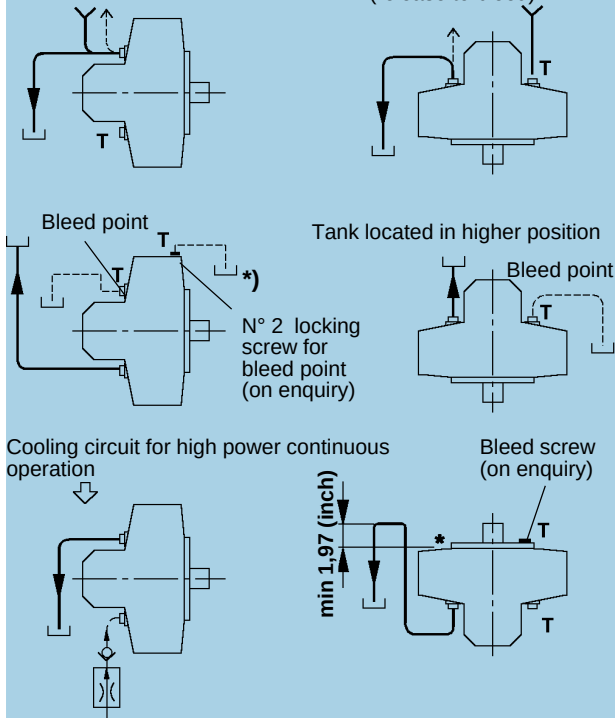
**Note:** Position the case drain pipe, so that the motor **cannot run empty**.

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

### Installation instructions for motors of the series "MR - MRE"

Low pressure case drain returns to tank.

(release to bleed)

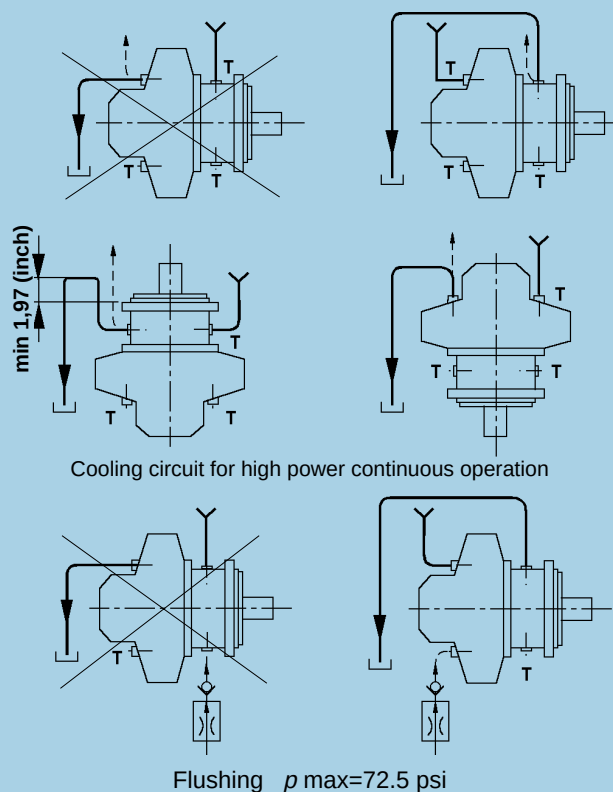


Flushing  $p_{max}=72.5$  psi

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

### Installation instructions for motors of the series "MR - MRE with brakes"

Low pressure case drain returns to tank.



Flushing  $p_{max}=72.5$  psi

Motors without shaft seal used with brake

## CODE

Example: MR 160C - N1 M1 F1 N1 N \*\*

1. MR 160C - N1 M1 F1 N1 N \*\*  
SERIES

|            |                                   |
|------------|-----------------------------------|
| <b>MR</b>  | standard 3626 psi max. continuous |
| <b>MRE</b> | expanded 3046 psi max. continuous |

2. MR 160C - N1 M1 F1 N1 N \*\*

## SIZE &amp; DISPLACEMENT

|          |                 |                  |                   |                   |                  |
|----------|-----------------|------------------|-------------------|-------------------|------------------|
| <b>A</b> | code            | <b>MR 33 A</b>   | <b>MR 57 A</b>    |                   |                  |
|          | in <sup>3</sup> | 1.96             | 3.44              |                   |                  |
| <b>B</b> | code            | <b>MR 73 B</b>   | <b>MR 93 B</b>    | <b>MR110 B</b>    |                  |
|          | in <sup>3</sup> | 4.43             | 5.65              | 6.65              |                  |
| <b>C</b> | code            | <b>MR 125 C</b>  | <b>MR 160 C</b>   | <b>MR 190 C</b>   |                  |
|          | in <sup>3</sup> | 7.61             | 9.75              | 11.69             |                  |
| <b>D</b> | code            | <b>MR 200 D</b>  | <b>MR 250 D</b>   | <b>MR 300 D</b>   | <b>MRE 330 D</b> |
|          | in <sup>3</sup> | 12.16            | 15.31             | 18.56             | 20.28            |
| <b>E</b> | code            | <b>MR 350 E</b>  | <b>MR 450 E</b>   | <b>MRE 500 E</b>  |                  |
|          | in <sup>3</sup> | 21.33            | 27.56             | 30.38             |                  |
| <b>F</b> | code            | <b>MR 600 F</b>  | <b>MR 700 F</b>   | <b>MRE 800 F</b>  |                  |
|          | in <sup>3</sup> | 37.10            | 43.09             | 49.08             |                  |
| <b>G</b> | code            | <b>MR 1100 G</b> | <b>MRE 1400 G</b> |                   |                  |
|          | in <sup>3</sup> | 68.7             | 83.6              |                   |                  |
| <b>H</b> | code            | <b>MR 1600 H</b> | <b>MR 1800 H</b>  | <b>MRE 2100 H</b> |                  |
|          | in <sup>3</sup> | 97.5             | 110.4             | 127.6             |                  |
| <b>I</b> | code            | <b>MR 2400 I</b> | <b>MR 2800 I</b>  | <b>MRE 3100 I</b> |                  |
|          | in <sup>3</sup> | 139.9            | 170.4             | 189.4             |                  |
| <b>L</b> | code            | <b>MR 3600 L</b> | <b>MR 4500 L</b>  | <b>MRE 5400 L</b> |                  |
|          | in <sup>3</sup> | 221.9            | 274.8             | 329.6             |                  |
| <b>M</b> | code            | <b>MR 6500 M</b> | <b>MR 7000 M</b>  | <b>MRE 8200 M</b> |                  |
|          | in <sup>3</sup> | 394.2            | 408.7             | 502               |                  |

3. MR 160C - N1 M1 F1 N1 N \*\*

## SHAFT

|           |                                      |
|-----------|--------------------------------------|
| <b>N1</b> | spline ex DIN 5463 (see page 26)     |
| <b>D1</b> | spline DIN 5480 (see page 26)        |
| <b>F1</b> | female spline DIN 5480 (see page 27) |
| <b>P1</b> | shaft with key (see page 27)         |
| <b>B1</b> | spline B.S. 3550 (see page 26)       |

4. MR 160C - N1 M1 F1 N1 N \*\*

## SPEED SENSOR OPTION

|           |                                                          |                 |
|-----------|----------------------------------------------------------|-----------------|
| <b>N1</b> | none                                                     |                 |
| <b>Q1</b> | encoder drive (see page 28)                              |                 |
| <b>C1</b> | mechanical tachometer drive (see page 28)                |                 |
| <b>T1</b> | tachogenerator drive (see page 28)                       |                 |
| <b>M1</b> | incremental Elcis encoder ( 500 pulse/rev) (see page 28) | Uni-directional |
| <b>B1</b> |                                                          | Bi-directional  |

5. MR 160C - N1 M1 F1 N1 N \*\*

## SEALS

|           |                           |
|-----------|---------------------------|
| <b>N1</b> | NBR mineral oil           |
| <b>F1</b> | NBR, 218 psi shaft seal   |
| <b>V1</b> | FPM seals                 |
| <b>U1</b> | no shaft seal (for brake) |

6. MR 160C - N1 M1 F1 N1 N \*\*

## CONNECTION FLANGE

|           |                                        |
|-----------|----------------------------------------|
| <b>N1</b> | none                                   |
| <b>C1</b> | standard DENISON Calzoni (see page 30) |
| <b>S1</b> | standard SAE metric (see page 30)      |
| <b>T1</b> | standard SAE UNC (see page 30)         |
| <b>G1</b> | SAE 6000 psi metric (see page 30)      |
| <b>L1</b> | SAE 6000 psi UNC (see page 30)         |

7. MR 160C - N1 M1 F1 N1 N \*\*  
ROTATION

|          |                                                     |
|----------|-----------------------------------------------------|
| <b>N</b> | standard rotation (CW: inlet in A, CCW: inlet in B) |
| <b>S</b> | reversed rotation (CW: inlet in B, CCW: inlet in A) |

8. MR 160C - N1 M1 F1 N1 N \*\*  
SPECIAL

|           |                                   |
|-----------|-----------------------------------|
| <b>**</b> | space reserved to Denison Calzoni |
|-----------|-----------------------------------|

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