

# SPOOL VALVE HYDRAULIC MOTORS

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## GENERAL INFORMATION:

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Orbit motors convert hydraulic energy (pressure, oil flow) into mechanical energy (torque, speed). Hydraulic orbit motors operate on the principle of an internal gear (rotor) rotating within a fixed external gear (stator). The internal gear transmits the torque generated by the application of pressure from hydraulic oil fed into motor which is then delivered via the motor's output shaft. Orbit motors have high starting torque and constant output torque at wide speed range.

### DISTRIBUTOR VALVE

MM, MP, MR, SP, SR, MH, PL, RL, PK, RK, RW, HW series motors have spool valve: the distributor valve has been integrated with the output shaft. The cardan shaft rotates distributor valve and transfers mechanical energy from gerotor set to output shaft. The valve has hydrodynamic bearings and has infinite life when load ratings are not exceeded.

### GEARWHEEL SET

There are two forms of gearwheel set:

- Gerotor set has plain teeth. These type of motors are suitable for long operating periods at moderate pressures or short operating periods at high pressures. MM, MP, SP, PL and PK series motors have gerotor set.

- Roll-gerotor set has teeth fitted with rollers. The rollers reduce local stress and the tangential reaction forces on the rotor reducing friction to a minimum. This gives long operating life and better efficiency even at continuous high pressures. Roll-gerotor sets are recommended for operation with thin oil and for applications with continually reversing loads. MR, SR, RL, RK, MH, RW and HW series motors have roll-gerotor set.

## FEATURES:

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### Standard Motor

The standard motor mounting flange is located as close to the output shaft as possible. This type of mounting supports the motor close to the shaft load. This mounting flange is also compatible with many standard gear boxes.

### Wheel Motor

W mounting flange makes the motors possible to fit a wheel hub or a winch drum so that the radial load acts closer to motor bearings. This gives the best utilization of the bearing capacity and is a very compact solution.

### Needle Bearing

MPN and MRN have an output shaft supported in needle bearing. These types motors are suitable for operating conditions such as frequent start and stops, vibration on the shaft, high static and dynamic radial loads in short operating terms.

### Low Leakage

LL Series hydraulic motors are designed to operate at the whole standard range of working conditions (pressure drop and frequency of rotation), but with considerable decreased volumetric losses in the drain ports. This motors are suitable for hydraulic systems with series-connected motors with demands for low leakage.

### Low Speed Valve

LSV feature optimizes the motor for low-speed performance. Motors with this valving provide very low speed while maintaining high torque. They are designed to run continuously at low speed (up to  $200 \text{ min}^{-1}$ ) at normal pressure drop and reduced flow. Optimal run is guaranteed at frequency of rotation from 20 to  $50 \text{ min}^{-1}$ . Motors with this valving have an increased starting pressure and are not recommended for using at pressure drop less than 40 bar.

### Free Running

FR motors are with increased clearance at all friction parts, allowing the shaft to rotate more freely with less mechanical drag. The increased clearance also improves lubrication of the wear surfaces of gear set and friction parts. Additional advantages of "FR" version are prolonging of the life of the hydraulic motors at high speeds, as well as the possibility to use them in systems with wide variation of the loading. FR Series motors are designed to operate with high speed /over than  $300 \text{ min}^{-1}$  and low pressure drop. Volumetric efficiency may be reduced slightly.

### High Pressure Shaft Seal

The high pressure shaft seals allow the motors to withstand high case pressures at high speeds without external drain line.

### Motors with Speed Sensor

Motors are available with integrated inductive speed sensor. The output signal is a standardized voltage signal that can be used to control the speed of a motor. The torque and the radial load of the motor are not affected by the installation of speed sensor.

# HYDRAULIC MOTORS MM

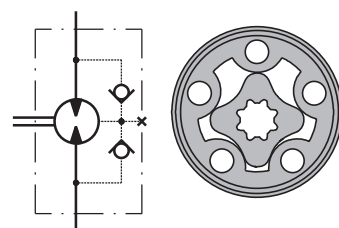


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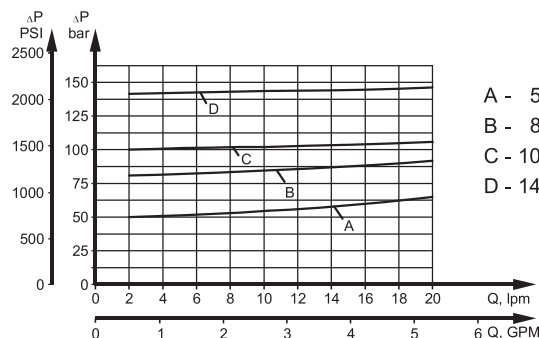
## APPLICATION

- » Conveyors
- » Textile machines
- » Mining machinery
- » Machine tools
- » Ventilators
- » Construction plant equipment and access platforms etc.



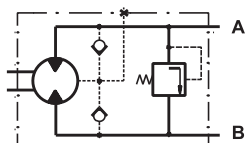
## Pressure Settings at Flow

**Q=.53 GPM [2 lpm], 150 SUS [32 mm<sup>2</sup>/s], 50°C [122°F]**



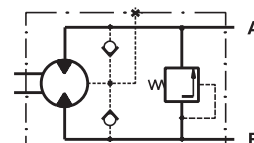
## MMP Series with Integrated Internal Crossover Relief Valve

**A → B, Δp=100 or 50 bar [1450 or 725 PSI]**

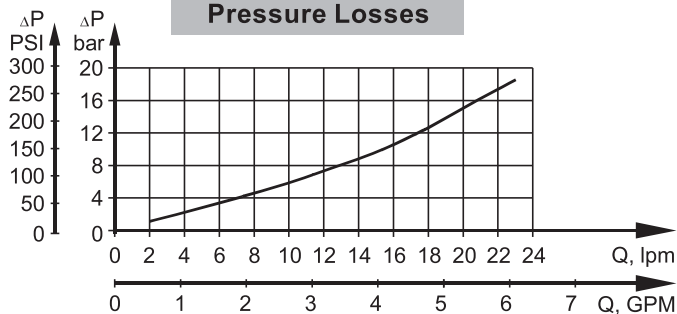


## MMP Series with Integrated Internal Crossover Relief Valve

**B → A, Δp=100 or 50 bar [1450 or 725 PSI]**

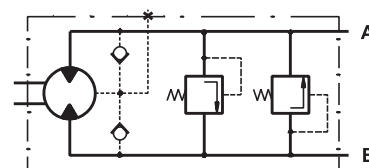


## Pressure Losses



## MMD Series with Integrated Internal Crossover Relief Valves

**A ↔ B, Δp=100 or 50 bar [1450 or 725 PSI]**



## GENERAL

|                          |                                                                  |                                         |
|--------------------------|------------------------------------------------------------------|-----------------------------------------|
| Max. Displacement,       | cm <sup>3</sup> /rev [in <sup>3</sup> /rev]                      | 50 [3.05]                               |
| Max. Speed,              | [RPM]                                                            | 2440                                    |
| Max. Torque,             | daNm [lb-in]                                                     | cont.: 4,5 [398]      int.: 5,8 [513]   |
| Max. Output,             | kW [HP]                                                          | 3,2 [4.3]                               |
| Max. Pressure Drop,      | bar [PSI]                                                        | cont.: 105 [1500]      int.: 140 [2030] |
| Max. Oil Flow,           | lpm [GPM]                                                        | 25 [6.6]                                |
| Min. Speed,              | [RPM]                                                            | 20                                      |
| Pressure fluid           | Mineral based- HLP(DIN 51524) or HM(ISO 6743/4)                  |                                         |
| Temperature range,       | °C [°F]                                                          | -40÷140 [-40÷284]                       |
| Optimal Viscosity range, | mm <sup>2</sup> /s [SUS]                                         | 20÷75 [98÷347]                          |
| Filtration               | ISO code 20/16 (Min. recommended fluid filtration of 25 microns) |                                         |

## SPECIFICATION DATA

| Type                                                                                          |                           | MM<br>8    | MM<br>12.5 | MM<br>20    | MM<br>32    | MM<br>40    | MM<br>50   |
|-----------------------------------------------------------------------------------------------|---------------------------|------------|------------|-------------|-------------|-------------|------------|
| Displacement, cm <sup>3</sup> /rev [in <sup>3</sup> /rev]                                     |                           | 8,2 [.50]  | 12,5 [.77] | 19,9 [1.22] | 31,6 [1.93] | 39,8 [2.43] | 50 [3.08]  |
| Max. Speed,<br>[RPM]                                                                          | Cont.                     | 1950       | 1550       | 1000        | 630         | 500         | 400        |
|                                                                                               | Int.*                     | 2450       | 1940       | 1250        | 800         | 630         | 500        |
| Max. Torque<br>daNm [lb-in]                                                                   | Cont.                     | 1,1 [95]   | 1,6 [140]  | 2,5 [220]   | 4,0 [350]   | 4,5 [400]   | 4,6 [410]  |
|                                                                                               | Int.*                     | 1,5 [135]  | 2,3 [200]  | 3,5 [310]   | 5,7 [500]   | 7,0 [620]   | 8,8 [780]  |
|                                                                                               | Peak**                    | 2,1 [187]  | 3,3 [293]  | 5,1 [453]   | 6,4 [568]   | 8,2 [725]   | 10,0 [885] |
| Max. Output<br>kW [HP]                                                                        | Cont.                     | 1,8 [2.4]  | 2,4 [3.2]  | 2,4 [3.2]   | 2,4 [3.2]   | 2,2 [3.0]   | 1,8 [2.4]  |
|                                                                                               | Int.*                     | 2,6 [3.5]  | 3,2 [4.3]  | 3,2 [4.3]   | 3,2 [4.3]   | 3,2 [4.3]   | 3,2 [4.3]  |
| Max. Pressure Drop<br>bar [PSI]                                                               | Cont.                     | 100 [1450] | 100 [1450] | 100 [1450]  | 100 [1450]  | 90 [1310]   | 70 [1020]  |
|                                                                                               | Int.*                     | 140 [2030] | 140 [2030] | 140 [2030]  | 140 [2030]  | 140 [2030]  | 140 [2030] |
|                                                                                               | Peak**                    | 200 [2900] | 200 [2900] | 200 [2900]  | 160 [2320]  | 160 [2320]  | 160 [2320] |
| Max. Oil Flow<br>lpm [GPM]                                                                    | Cont.                     | 16 [4.2]   | 20 [5.3]   | 20 [5.3]    | 20 [5.3]    | 20 [5.3]    | 20 [5.3]   |
|                                                                                               | Int.*                     | 20 [5.3]   | 25 [6.6]   | 25 [6.6]    | 25 [6.6]    | 25 [6.6]    | 25 [6.6]   |
| Max. Inlet Pressure<br>bar [PSI]                                                              | Cont.                     | 140 [2030] | 140 [2030] | 140 [2030]  | 140 [2030]  | 140 [2030]  | 140 [2030] |
|                                                                                               | Int.*                     | 175 [2540] | 175 [2540] | 175 [2540]  | 175 [2540]  | 175 [2540]  | 175 [2540] |
|                                                                                               | Peak**                    | 225 [3260] | 225 [3260] | 225 [3260]  | 225 [3260]  | 225 [3260]  | 225 [3260] |
| Max. Return Pressure<br>without Drain Line or<br>Max. Pressure<br>in Drain Line,<br>bar [PSI] | Cont. 0-100 RPM           | 140 [2030] | 140 [2030] | 140 [2030]  | 140 [2030]  | 140 [2030]  | 140 [2030] |
|                                                                                               | Cont. 100-400 RPM         | 105 [1500] | 105 [1500] | 105 [1500]  | 105 [1500]  | 105 [1500]  | 105 [1500] |
|                                                                                               | Cont. 400-800 RPM         | 50 [725]   | 50 [725]   | 50 [725]    | 50 [725]    | 50 [725]    | 50 [725]   |
|                                                                                               | Cont. >800 RPM            | 20 [290]   | 20 [290]   | 20 [290]    | -           | -           | -          |
|                                                                                               | Int.* 0-max. RPM          | 140 [2030] | 140 [2030] | 140 [2030]  | 140 [2030]  | 140 [2030]  | 140 [2030] |
| Max. Return Pressure<br>with Drain Line<br>bar [PSI]                                          | Cont.                     | 140 [2030] | 140 [2030] | 140 [2030]  | 140 [2030]  | 140 [2030]  | 140 [2030] |
|                                                                                               | Int.*                     | 175 [2540] | 175 [2540] | 175 [2540]  | 175 [2540]  | 175 [2540]  | 175 [2540] |
|                                                                                               | Peak**                    | 225 [3260] | 225 [3260] | 225 [3260]  | 225 [3260]  | 225 [3260]  | 225 [3260] |
| Max. Starting Pressure with<br>Unloaded Shaft, bar [PSI]                                      |                           | 4 [60]     | 4 [60]     | 4 [60]      | 4 [60]      | 4 [60]      | 4 [60]     |
| Min. Starting Torque<br>daNm [lb-in]                                                          | At max. press. drop Cont. | 0,7 [60]   | 1,2 [105]  | 2,1 [185]   | 3,4 [300]   | 3,8 [335]   | 4,1 [365]  |
|                                                                                               | At max. press. drop Int.* | 1,0 [90]   | 1,7 [150]  | 2,9 [255]   | 4,8 [425]   | 6,2 [550]   | 7,9 [700]  |
| Min. Speed***, [RPM]                                                                          |                           | 50         | 40         | 30          | 30          | 25          | 20         |
| Weight, kg [lb]<br>For "F" flange:<br>+ 0,200 [.441]                                          | MM                        | 1,9 [4.2]  | 2,0 [4.41] | 2,1 [4.63]  | 2,2 [4.85]  | 2,3 [5.07]  | 2,5 [5.51] |
|                                                                                               | MMF(S)                    | 2,0 [4.41] | 2,1 [4.63] | 2,2 [4.85]  | 2,3 [5.07]  | 2,4 [5.29]  | 2,6 [5.73] |
|                                                                                               | MMP                       | 2,2 [4.85] | 2,3 [5.07] | 2,4 [5.29]  | 2,5 [5.51]  | 2,6 [5.73]  | 2,8 [6.17] |
|                                                                                               | MMD                       | 2,6 [5.73] | 2,7 [5.95] | 2,8 [6.17]  | 2,9 [6.39]  | 3,0 [6.61]  | 3,2 [7.05] |

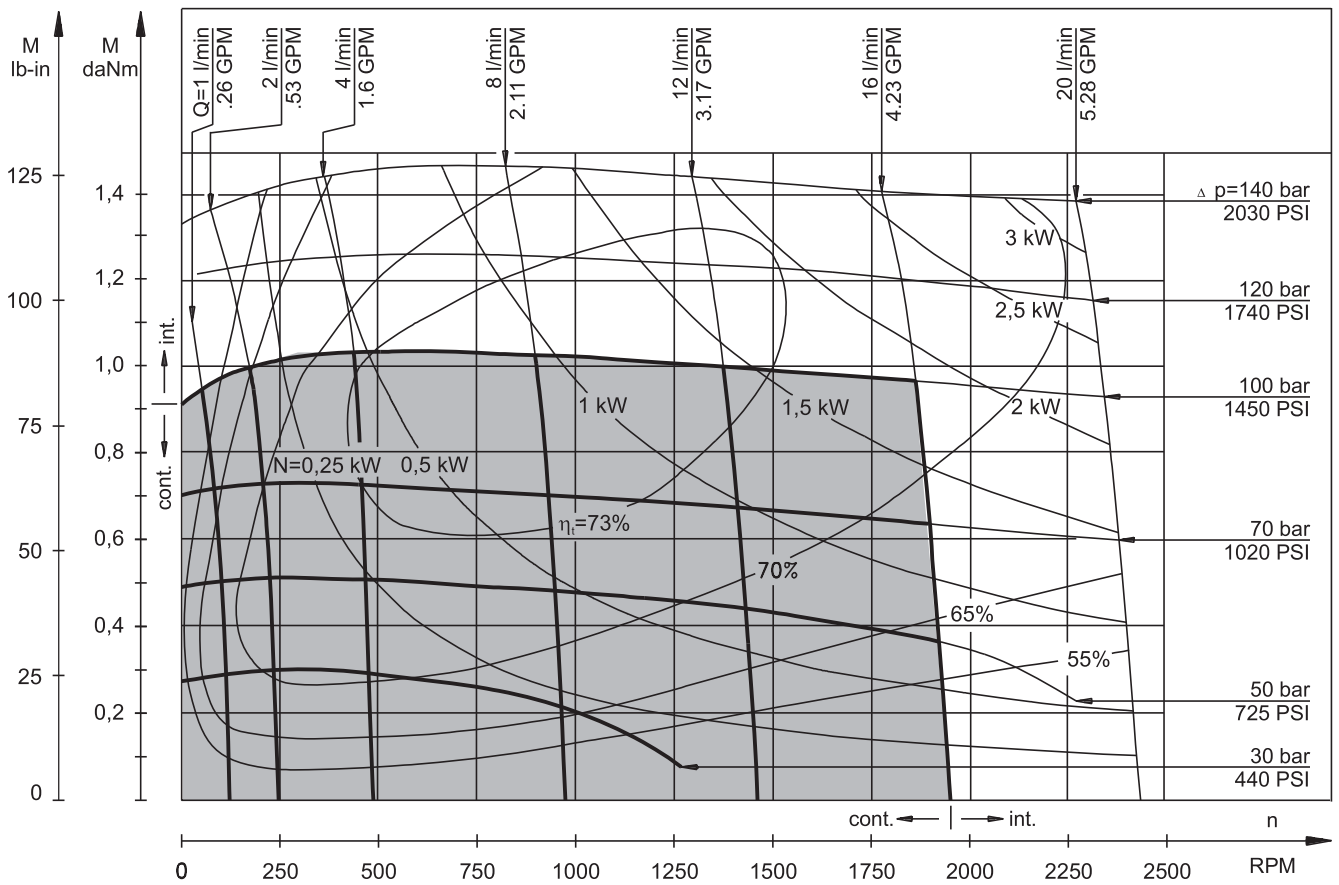
\* Intermittent operation: the permissible values may occur for max. 10% of every minute.

\*\* Peak load: the permissible values may occur for max. 1% of every minute.

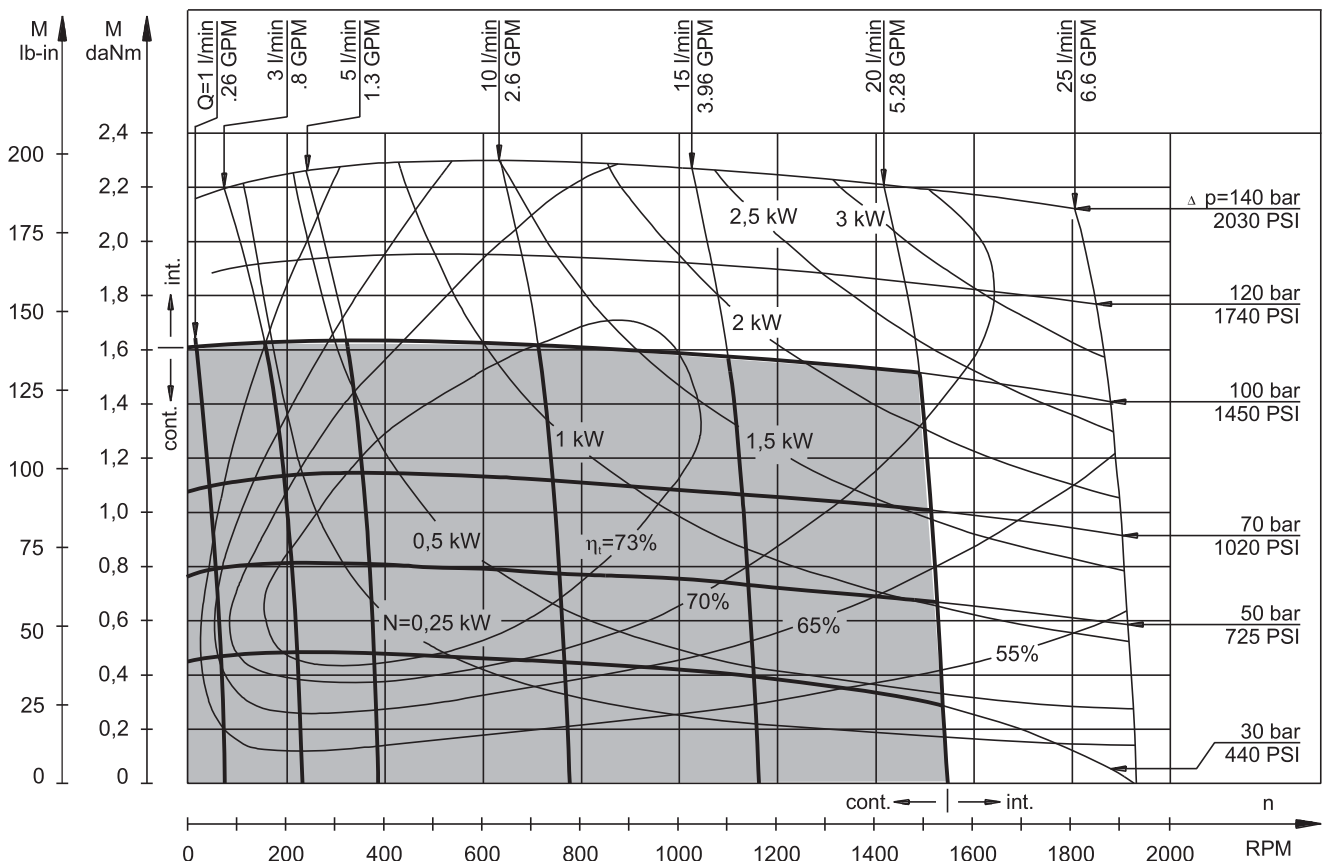
\*\*\* For speeds lower than given, consult factory or your regional manager.

- Intermittent speed and intermittent pressure must not occur simultaneously.
- Recommended filtration is per ISO cleanliness code 20/16. A nominal filtration of 25 micron or better.
- Recommend using a premium quality, anti-wear type mineral based hydraulic oil HLP(DIN51524) or HM (ISO 6743/4).  
If using synthetic fluids consult the factory for alternative seal materials.
- Recommended minimum oil viscosity 13 mm<sup>2</sup>/s [70 SUS] at 50°C [122°F].
- Recommended maximum system operating temperature is 82°C [180°F].
- To assure optimum motor life fill with fluid prior to loading and run at moderate load and speed for 10-15 minutes.

**MM 8**



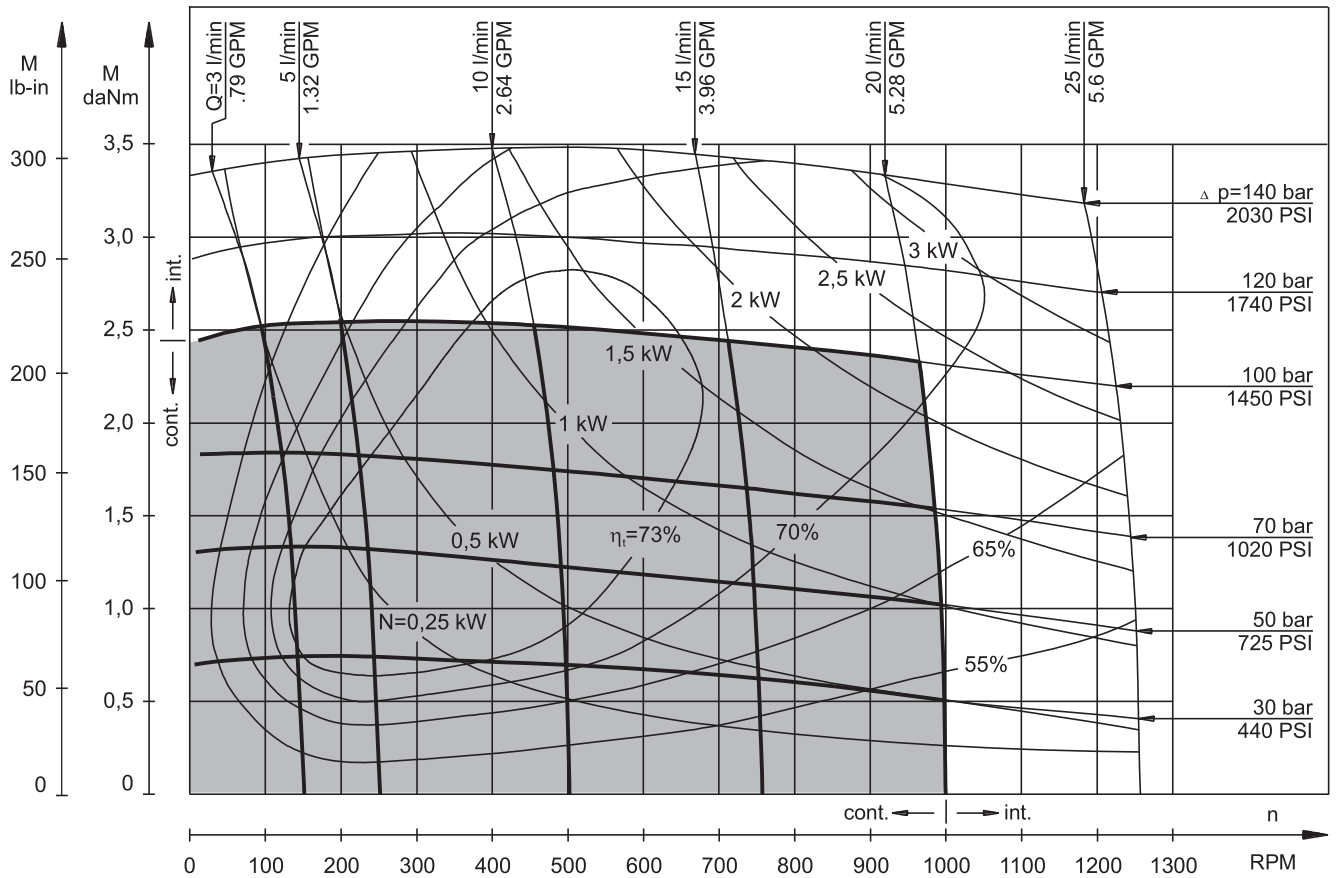
**MM 12,5**



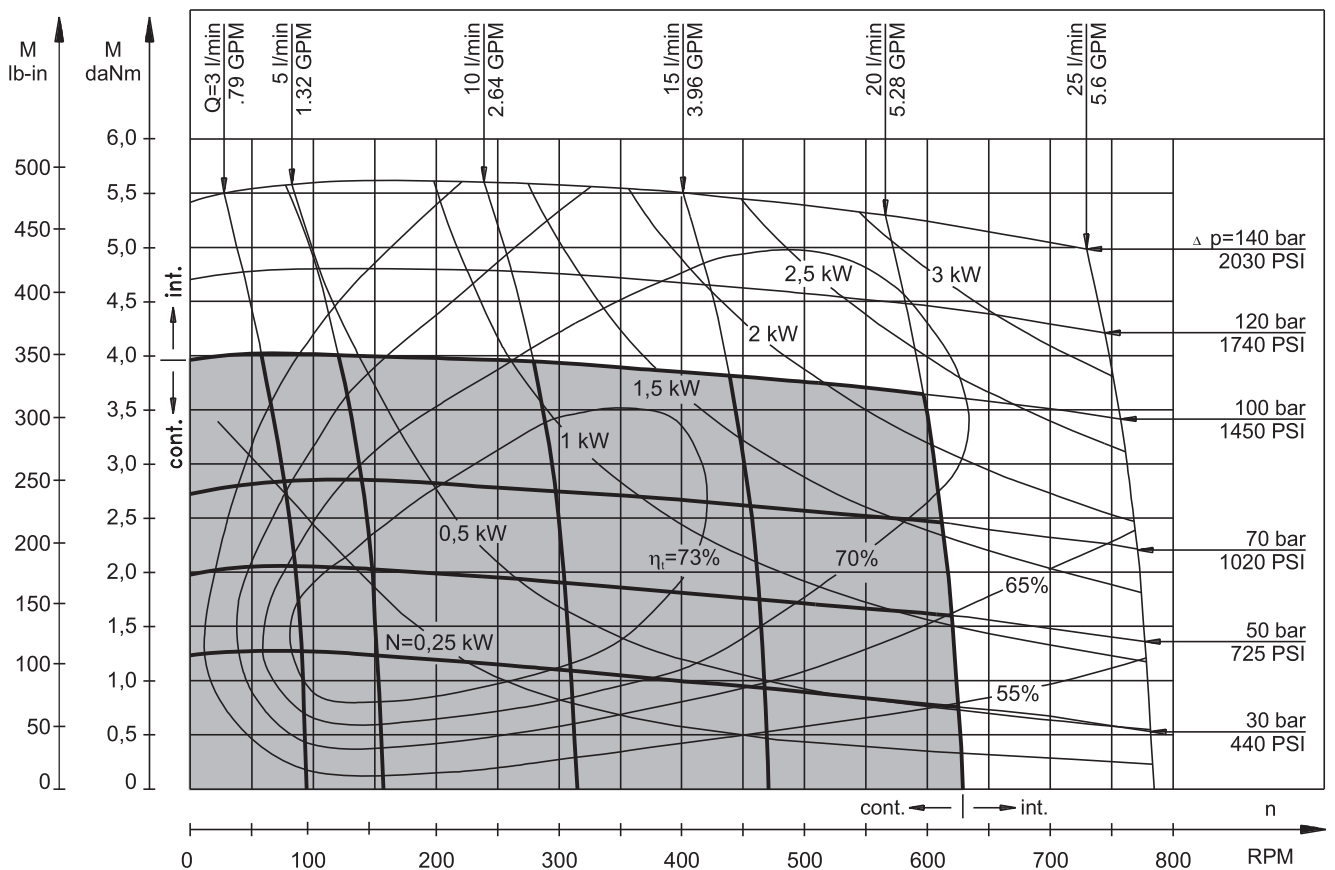
The function diagrams data is for average performance of randomly selected motors at back pressure 5÷10 bar [72.5÷145 PSI] and oil with viscosity of 32 mm<sup>2</sup>/s [150 SUS] at 50°C [122°F].

## FUNCTION DIAGRAMS

**MM 20**

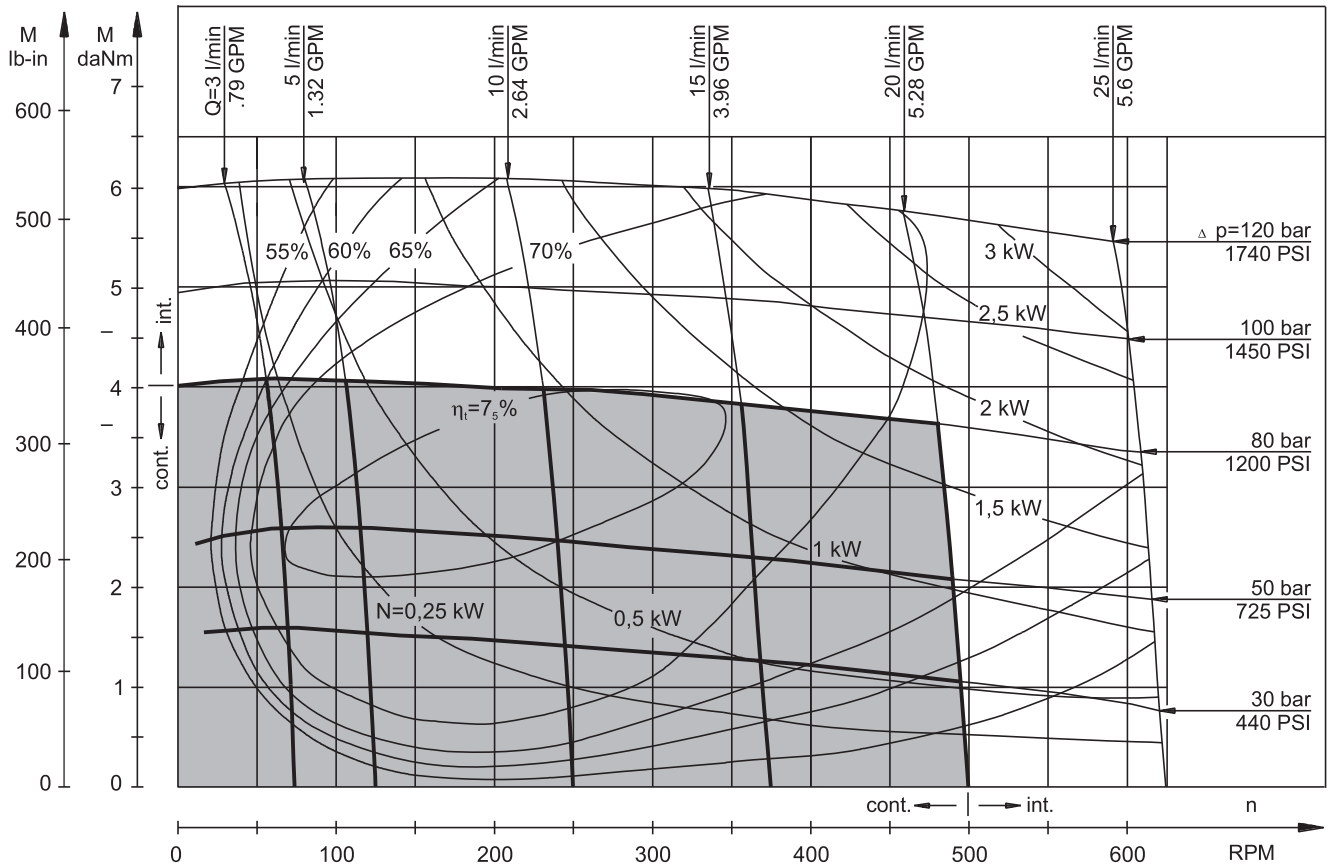


**MM 32**

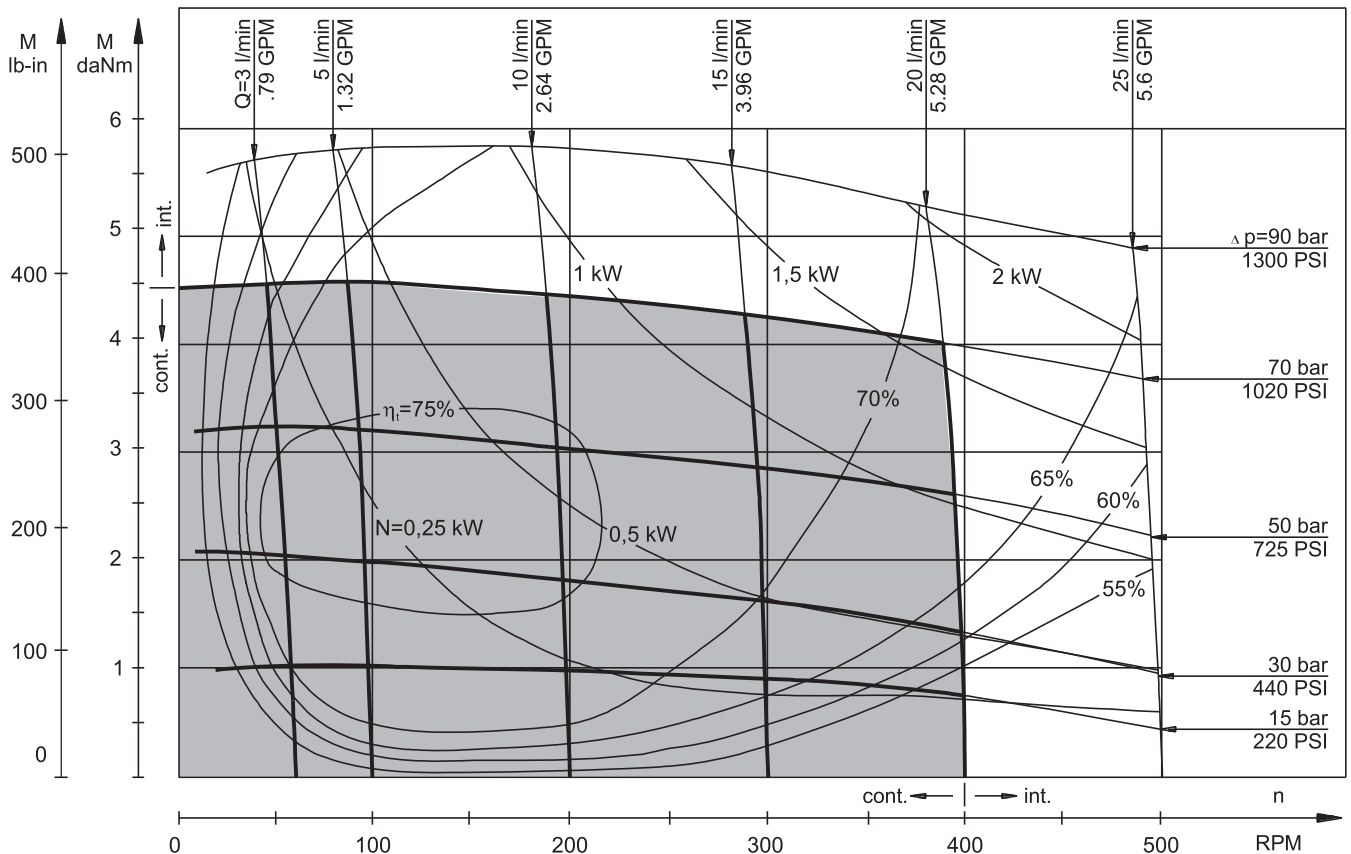


The function diagrams data is for average performance of randomly selected motors at back pressure 5÷10 bar [72.5÷145 PSI] and oil with viscosity of 32 mm<sup>2</sup>/s [150 SUS] at 50°C [122°F].

**MM 40**



**MM 50**



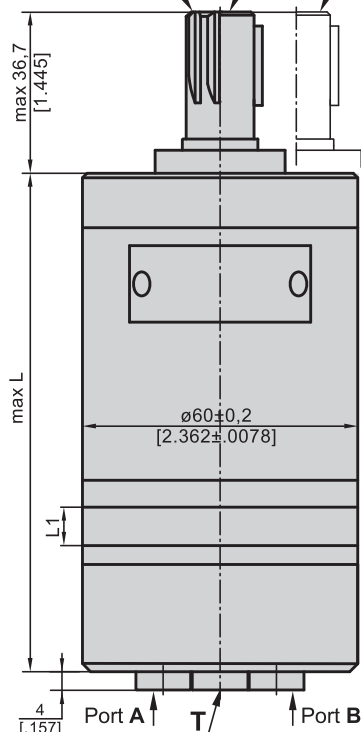
The function diagrams data is for average performance of randomly selected motors at back pressure 5÷10 bar [72.5÷145 PSI] and oil with viscosity of 32 mm<sup>2</sup>/s [150 SUS] at 50°C [122°F].

## DIMENSIONS AND MOUNTING DATA

### MM, MMS, MMP, MMD

Three Bolts Mount

SH Shaft C Shaft CK Shaft



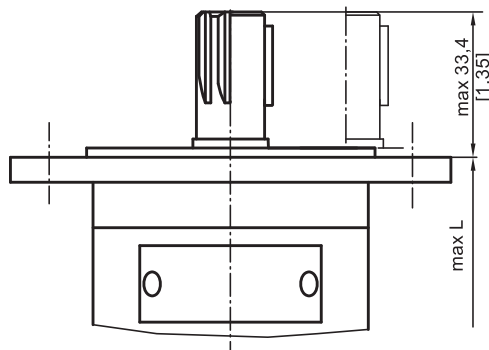
Rear Ports

Shaft Dim.  
See Page 11

Flange Dim.  
See Page 10

Port Dim.  
See Page 10

**F** Oval Mount (2 Holes)



**Standard Rotation**

Viewed from Shaft End

Port A Pressurized - **CW**

Port B Pressurized - **CCW**

**Reverse Rotation**

Viewed from Shaft End

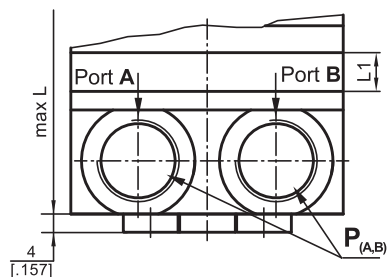
Port A Pressurized - **CCW**

Port B Pressurized - **CW**

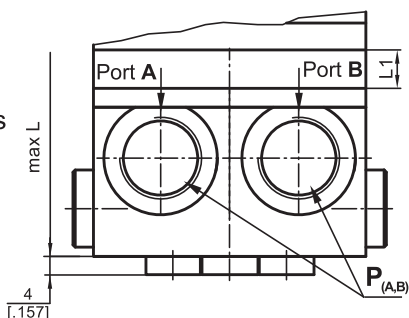
$P_{(A,B)}$ : 2xG3/8 or 2xM18x1,5 - 12 mm [.47 in] depth

$T$ : G1/8 or M10x1 - 10 mm [.39 in] depth

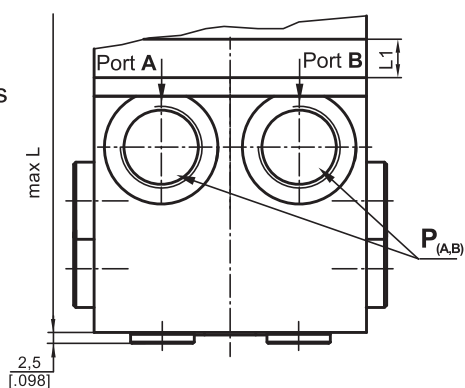
**S** Side Ports



**P** Side Ports



**D** Side Ports



| Type    | L, mm [in]    | Type     | L, mm [in]    | L <sub>1</sub> , mm [in] |
|---------|---------------|----------|---------------|--------------------------|
| MM 8    | 104 [4.094]   | MMS 8    | 105 [4.134]   | 3,5 [.138]               |
| MM 12,5 | 106 [4.173]   | MMS 12,5 | 107 [4.213]   | 5,5 [.217]               |
| MM 20   | 109 [4.291]   | MMS 20   | 110 [4.331]   | 8,5 [.335]               |
| MM 32   | 114 [4.488]   | MMS 32   | 115 [4.528]   | 13,5 [.531]              |
| MM 40   | 117,5 [4.626] | MMS 40   | 118,5 [4.665] | 17 [.669]                |
| MM 50   | 121,5 [4.783] | MMS 50   | 122,5 [4.823] | 21 [.827]                |

| Type     | L, mm [in]    | Type     | L, mm [in]    | L <sub>1</sub> , mm [in] |
|----------|---------------|----------|---------------|--------------------------|
| MMP 8    | 115 [4.528]   | MMD 8    | 134 [5.276]   | 3,5 [.138]               |
| MMP 12,5 | 117 [4.606]   | MMD 12,5 | 136 [5.354]   | 5,5 [.217]               |
| MMP 20   | 120 [4.724]   | MMD 20   | 139 [5.472]   | 8,5 [.335]               |
| MMP 32   | 125 [4.921]   | MMD 32   | 144 [5.669]   | 13,5 [.531]              |
| MMP 40   | 128,5 [5.039] | MMD 40   | 147,5 [5.807] | 17 [.669]                |
| MMP 50   | 132,5 [5.217] | MMD 50   | 151,5 [5.965] | 21 [.827]                |

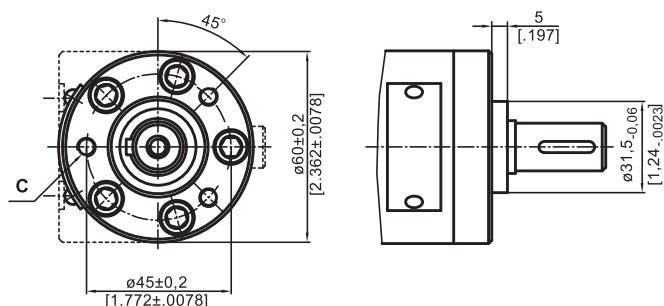
For "F" Flange +3,5 mm



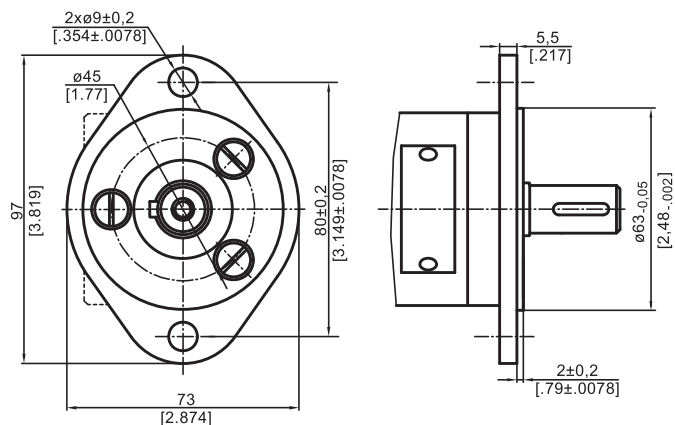
mm [in]

## MOUNTING

Three Bolts Mount

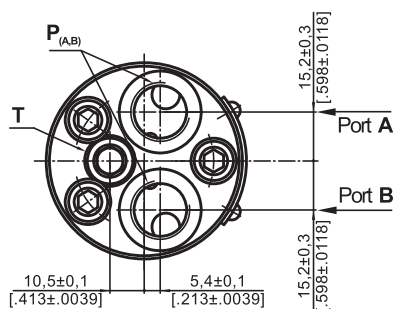


**F** Oval Mount (2 Holes)

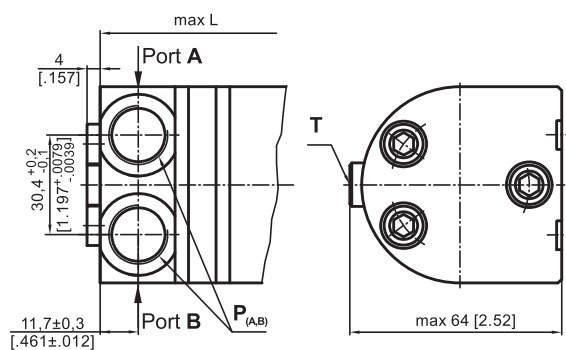


## PORTS

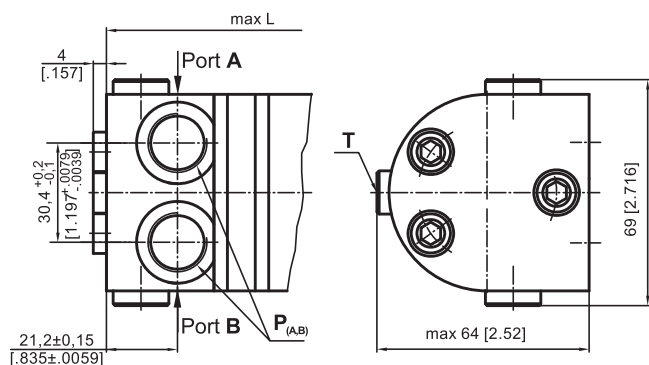
Rear Ports



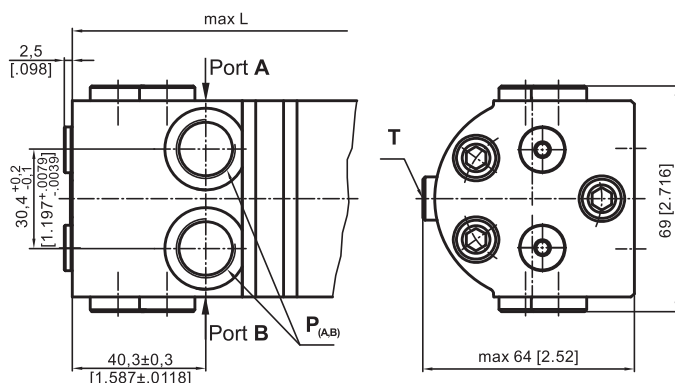
**S** Side Ports



**P** Side Ports with Single Crossover Relief Valve



**D** Side Ports with Dual Crossover Relief Valve



mm [in]

**Standard Rotation**  
Viewed from Shaft End  
Port A Pressurized - CW  
Port B Pressurized - CCW

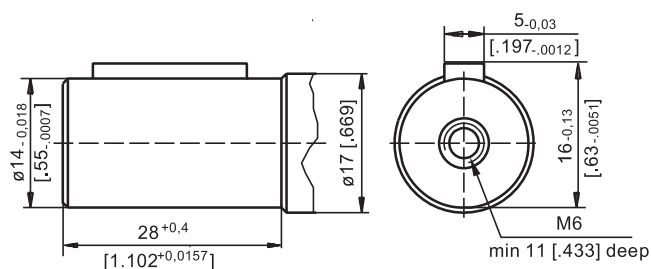
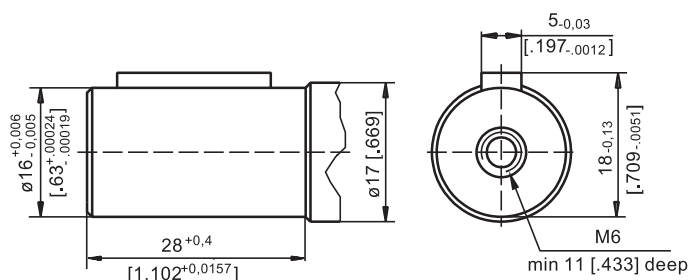
**Reverse Rotation**  
Viewed from Shaft End  
Port A Pressurized - CCW  
Port B Pressurized - CW

**C** : 3xM6 - 12 mm [.47 in] depth  
**P<sub>(A,B)</sub>** : 2xG3/8 or 2xM18x1,5 - 12 mm [.47 in] depth  
**T** : G1/8 or M10x1 - 10 mm [.39 in] depth

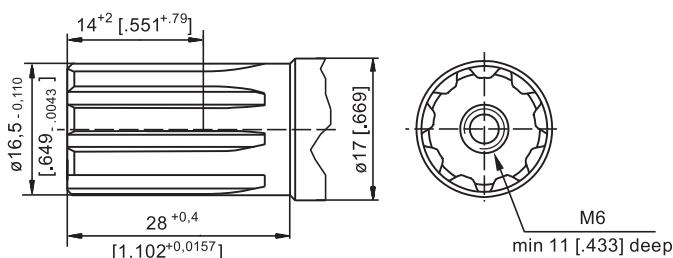
## SHAFT EXTENSIONS

**C** -  $\varnothing 16$  straight, Parallel key 5x5x16 DIN 6885  
Max. Torque 3,9 daNm [345 lb-in]

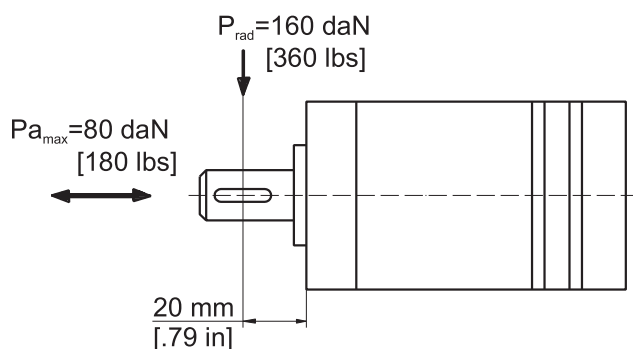
**CK** -  $\varnothing 14$  straight, Parallel key 5x5x16 DIN 6885  
Max. Torque 3 daNm [265 lb-in]



**SH** -  $\varnothing 16,5$  Splined, B17x14 DIN 5482  
Max. Torque 4,4 daNm [390 lb-in]



## PERMISSIBLE SHAFT LOAD



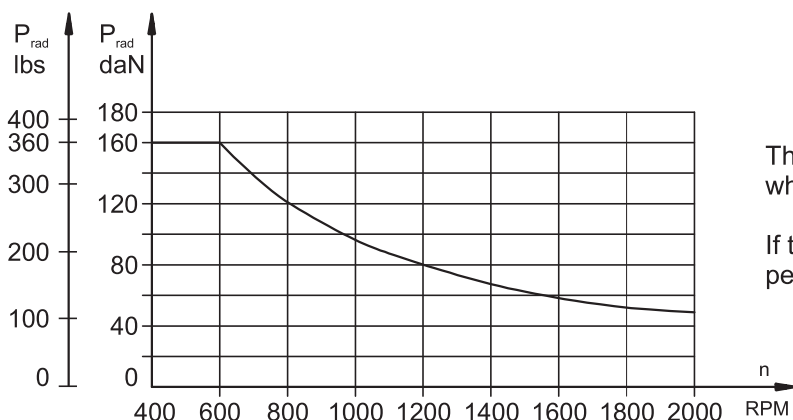
The permissible radial shaft load [Prad] is calculated from the distance [L] between the point of load application and the mounting surface:

$$P_{rad} = \frac{600}{n} \times \frac{13040}{61,5 + L}, [\text{daN}]$$

[L in mm;  $L \leq 80$  mm]

$$P_{rad} = \frac{600}{n} \times \frac{1155}{2,42 + L}, [\text{lbs}]$$

[L in inch;  $L \leq 3,15$  in]



The drawing shows the permissible radial load when  $L=20$  mm [0.79 in].

If the calculated shaft load exceeds the permissible, a flexible coupling must be used.

**ORDER CODE**

|            | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|------------|---|---|---|---|---|---|---|---|---|----|
| <b>M M</b> |   |   |   |   |   |   |   |   |   |    |

**Pos.1 - Adjustment Option**

omit - without valve

**P\*** - Side ports with single crossover relief valve

**D\*** - Side ports with dual crossover relief valve

**Pos.2 - Mounting Flange**

omit - Three bolts mount

**F** - Oval mount, two holes

**Pos.3 - Port type (not valid for P and D version)**

omit - Rear ports

**S** - Side ports

**Pos.4 - Displacement code**

**8** - 8,2 cm<sup>3</sup>/rev [ .5 in<sup>3</sup>/rev]

**12.5** - 12,9 cm<sup>3</sup>/rev [ .79 in<sup>3</sup>/rev]

**20** - 20,0 cm<sup>3</sup>/rev [1.22 in<sup>3</sup>/rev]

**32** - 31,8 cm<sup>3</sup>/rev [1.93 in<sup>3</sup>/rev]

**40** - 40,0 cm<sup>3</sup>/rev [2.44 in<sup>3</sup>/rev]

**50** - 50,0 cm<sup>3</sup>/rev [3.05 in<sup>3</sup>/rev]

**Pos. 5 - Shaft Extensions\***

**C** - ø16 straight, Parallel key A5x5x16 DIN6885

**VC** - ø16 straight, Parallel key A5x5x16 DIN6885  
with corrosion resistant bushing

**CK** - ø14 straight, Parallel key 5x5x16 DIN6885

**SH** - ø16,5 splined, B17x14 DIN 5482

**Pos. 6 - Ports**

omit - BSPP (ISO 228)

**M** - Metric (ISO 262)

**Pos. 7 - Line to control\*\* (see page 4)**

**/L** - B → A (left running)

**/R** - A → B (right running)

**Pos. 8 - Valve Rated Pressure\*\*\***

**/50** - Δp=50 bar [725 PSI]

**/80** - Δp=80 bar [1160 PSI]

**/100** - Δp=100 bar [1450 PSI]

**/140** - Δp=140 bar [2030 PSI]

**Pos. 9 - Special Features (see page 120)**

**Pos.10 - Design Series**

omit - Factory specified

**NOTES:**

\* The permissible output torque for shafts must not be exceeded!

\*\* For P option useful only.

\*\*\* For P and D option useful only.

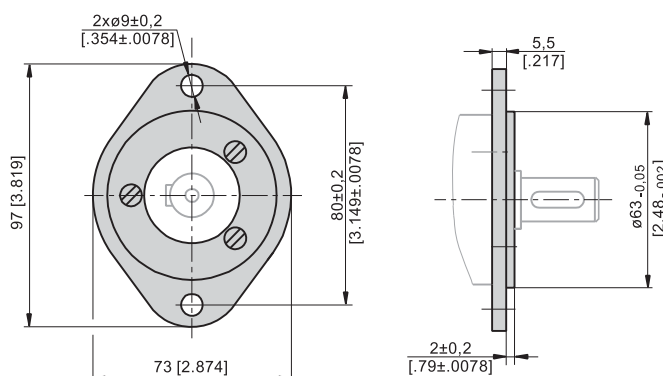
⚠ **MMP** and **MMD** are available with new crossover relief valves with improved characteristics. The new valves allow easier pressure setting in a wider range: from 50 bar [725 PSI] to 140 bar [2030 PSI]. For more information about MMP and MMD - series 2 please contact with "M+S Hydraulic".

The Valve pressure setting must be at flow rate of 2 lpm [.53 GPM].

The hydraulic motors are mangano - phosphatized as standard.

**F - FLANGE (2 Holes)**

Order No for Flange:48443 014 00



**F** Flange is mounted to the motor with 3 screws - M6x14. Tightening Torque: 5-6 Nm [44-53 lb-in].

# MOTOR SPECIAL FEATURES

| Special Feature Description | Order Code | Motor type |       |       |        |       |     |     |        |    |    |       |    |       |       |    |
|-----------------------------|------------|------------|-------|-------|--------|-------|-----|-----|--------|----|----|-------|----|-------|-------|----|
|                             |            | MM         | MP    | MPW   | MP(W)N | MR    | MRN | MRB | SP, SR | PL | RL | PK(Q) | RK | RW    | MH    | HW |
| Speed Sensor*               | RS         | O          | O     | -     | -      | O     | -   | -   | -      | -  | -  | -     | -  | -     | O     | -  |
| Tacho connection            | T          | -          | -     | -     | -      | O     | O   | -   | -      | -  | -  | -     | -  | -     | O     | -  |
| Low Leakage                 | LL         | O          | -     | -     | -      | O     | O   | -   | -      | -  | O  | -     | O  | O     | O     | O  |
| Low Speed Valving           | LSV        | -          | -     | -     | -      | O     | -   | -   | -      | -  | -  | -     | -  | -     | O     | O  |
| Free Running                | FR         | O          | O     | O     | O      | O     | O   | -   | -      | O  | O  | O     | O  | O     | O     | -  |
| Reverse Rotation            | R          | O          | O     | O     | O      | O     | O   | O   | O      | O  | O  | O     | O  | O     | O     | O  |
| Paint**                     | P          | O          | O     | O     | O      | O     | O   | O   | O      | O  | O  | O     | O  | O     | O     | O  |
| Corrosion Protected Paint** | PC         | O          | O     | O     | O      | O     | O   | O   | O      | O  | O  | O     | O  | O     | O     | O  |
| Special Paint***            | PS         | O          | O     | O     | O      | O     | O   | O   | -      | O  | O  | O     | O  | O     | O     | O  |
|                             | PCS        | O          | O     | O     | O      | O     | O   | O   | -      | O  | O  | O     | O  | O     | O     | O  |
| Check Valves                |            | S          | S**** | S**** | S      | S**** | S   | S   | S      | S  | S  | S     | S  | S**** | S**** | S  |

|          |                |
|----------|----------------|
| <b>O</b> | Optional       |
| <b>-</b> | Not applicable |
| <b>S</b> | Standard       |

\* For sensor ordering see pages 121÷122.

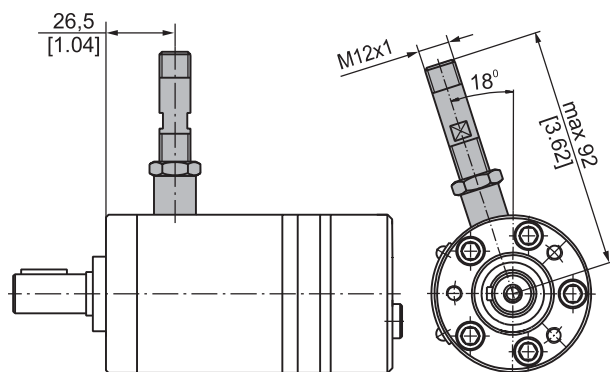
\*\* Colour at customer's request.

\*\*\* Non painted feeding surfaces, colour at customer's request.

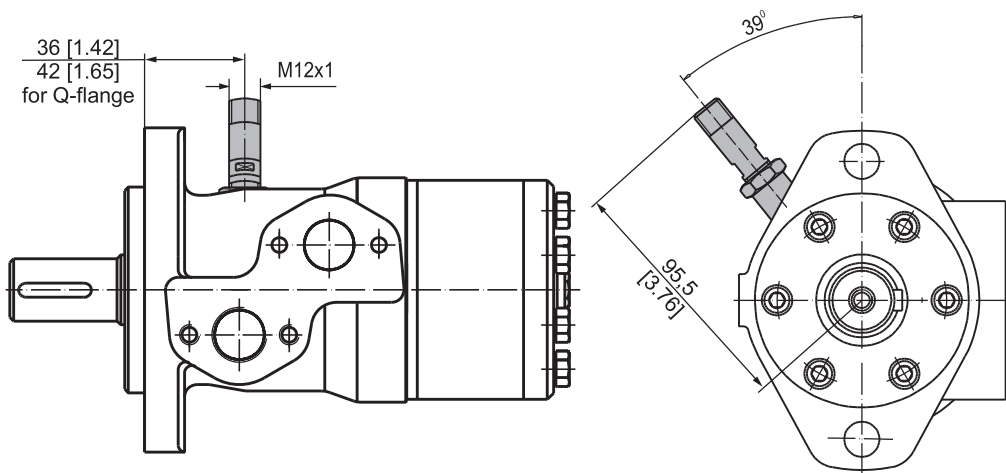
\*\*\*\* Without check valves for "U" shaft seal versions.

# MOTORS WITH SPEED SENSOR

## MM...RS



## MP...RS and MR...RS



## MH...RS

