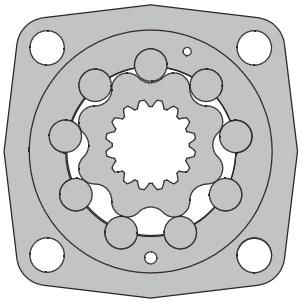
# HYDRAULIC MOTORS MV

## APPLICATION

- » Conveyors
- » Metal working machines
- » Machines for agriculture
- » Road building machines
- » Mining machinery
- » Food industries
- » Special vehicles
- » Plastic and rubber machinery etc.



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## OPTIONS

- » Model- Disc valve, roll-gerotor
- » Flange and wheel mount
- » Short motor
- » Tacho connection
- » Speed sensoring
- » Side ports
- » Shafts- straight, splined and tapered
- » Metric and BSPP ports
- » Other special features

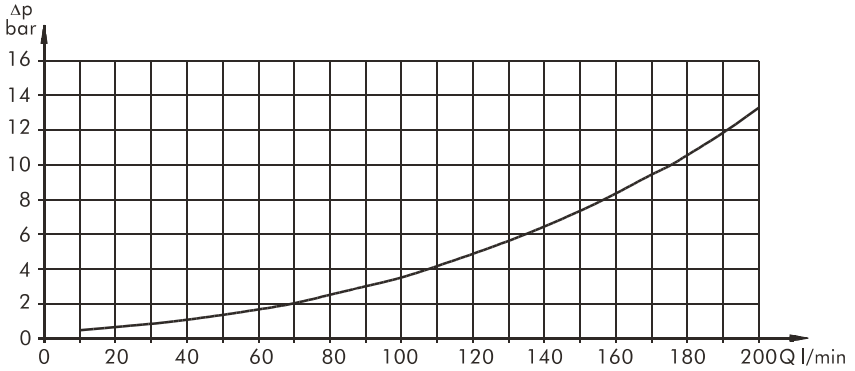
## GENERAL

| | |
|---|---|
| **Displacement,** [$cm^3$/rev.] | 314,5÷801,8 |
| **Max. Speed,** [RPM] | 250÷510 |
| **Max. Torque,** [daNm] | 92÷188 |
| **Max. Output,** [kW] | 42,5÷53,5 |
| **Max. Pressure Drop,** [bar] | 160÷200 |
| **Max. Oil Flow,** [l/min] | 160÷200 |
| **Min. Speed,** [RPM] | 5÷10 |
| **Permissible Shaft Loads,** [daN] | $P_a$=1500 |
| **Pressure fluid** | Mineral based- HLP(DIN 51524) or HM(ISO 6743/4) |
| **Temperature range,** [°C] | -30÷90 |
| **Optimal Viscosity range,** [$mm^2$/s] | 20÷75 |
| **Filtration** | ISO code 20/16 (Min. recommended fluid filtration of 25 micron) |

### Oil flow in drain line

| Pressure drop (bar) | Viscosity ($mm^2$/s) | Oil flow in drain line (l/min) |
|---|---|---|
| 140 | 20 | 3 |
| | 35 | 2 |
| 210 | 20 | 6 |
| | 35 | 4 |

### Pressure Losses



MV MOTORS

## SPECIFICATION DATA

| Type | | MV 315 | MV 400 | MV 500 | MV 630 | MV 800 |
|---|---|---|---|---|---|---|
| Displacement [$cm^3$/rev.] | | 314.5 | 400,9 | 499,6 | 629,1 | 801,8 |
| Max. Speed, [RPM] | cont. | 510 | 500 | 400 | 315 | 250 |
| | Int.* | 630 | 600 | 480 | 380 | 300 |
| Max. Torque [daNm] | cont. | 92 | 118 | 146 | 166 | 188 |
| | Int.* | 111 | 141 | 176 | 194 | 211 |
| | peak** | 129 | 164 | 205 | 221 | 247 |
| Max. Output [kW] | cont. | 42,5 | 53,5 | 53,5 | 48 | 42,5 |
| | int.* | 51 | 64 | 64 | 56 | 48 |
| Max. Pressure Drop [bar] | cont. | 200 | 200 | 200 | 180 | 160 |
| | Int.* | 240 | 240 | 240 | 210 | 180 |
| | peak** | 280 | 280 | 280 | 240 | 210 |
| Max. Oil Flow [l/min] | cont. | 160 | 200 | 200 | 200 | 200 |
| | Int.* | 200 | 240 | 240 | 240 | 240 |
| Max. Inlet Pressure [bar] | cont. | 210 | 210 | 210 | 210 | 210 |
| | Int.* | 250 | 250 | 250 | 250 | 250 |
| | peak** | 300 | 300 | 300 | 300 | 300 |
| Max. Return Pressure without Drain Line or Max. Pressure in Drain Line , [bar] | cont. 0-100 RPM | 60 | 60 | 60 | 60 | 60 |
| | cont. 100-300 RPM | 30 | 30 | 30 | 30 | 30 |
| | cont. >300 RPM | 20 | 20 | 20 | 20 | 20 |
| | Int.* 0-max. RPM | 75 | 75 | 75 | 75 | 75 |
| Max. Return Pressure with Drain Line [bar] | cont. | 140 | 140 | 140 | 140 | 140 |
| | Int.* | 175 | 175 | 175 | 175 | 175 |
| | peak** | 210 | 210 | 210 | 210 | 210 |
| Max. Starting Pressure with Unloaded Shaft, [bar] | | 8 | 8 | 8 | 8 | 8 |
| Min. Starting Torque [daNm] | at max. press. drop cont. | 71 | 91 | 113 | 133 | 151 |
| | at max. press. drop Int.* | 85 | 109 | 136 | 155 | 170 |
| Min. Speed***, [RPM] | | 10 | 9 | 8 | 6 | 5 |
| Weight, avg. [kg] | MV | 31,8 | 32,6 | 33,5 | 34,9 | 36,5 |
| | MVW | 32,4 | 33,2 | 34,1 | 35,5 | 37,1 |
| | MVS | 22,7 | 23,5 | 24,4 | 25,6 | 27,7 |

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

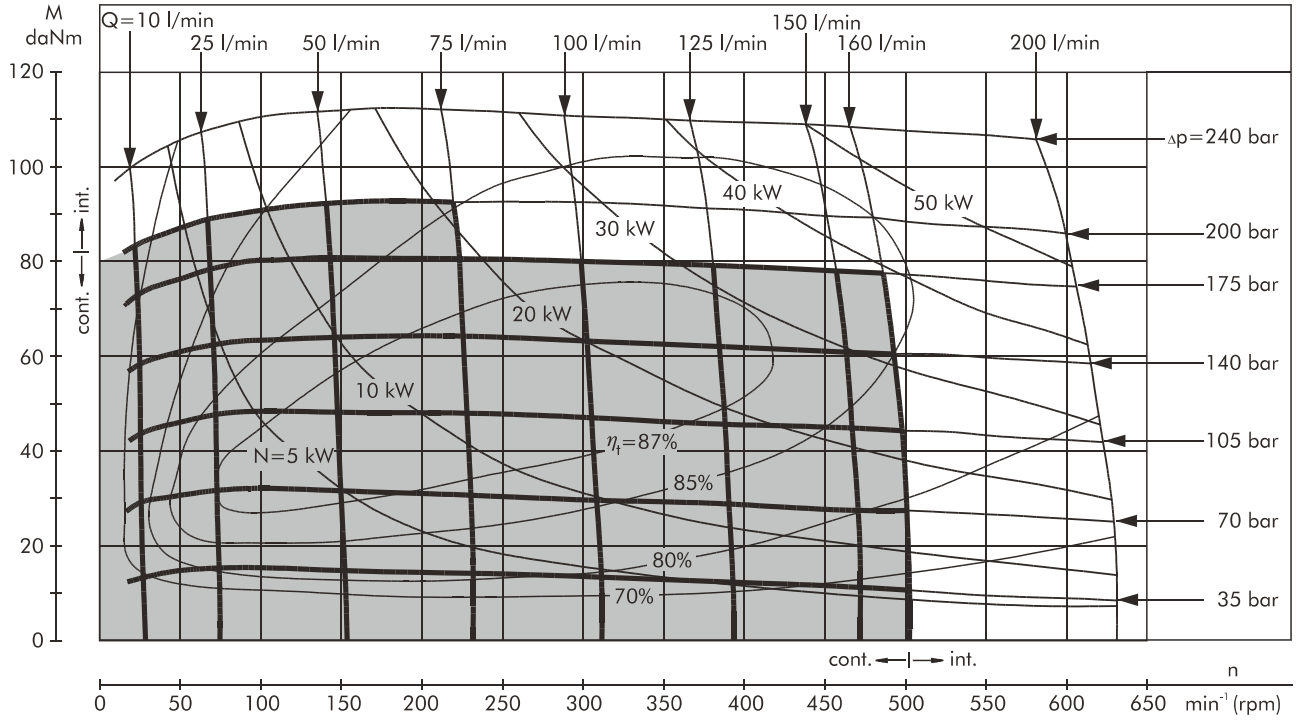
** Peak load: the permissible values may occur for max. 1% of every minute.

*** For speeds of 5 RPM lower than given, consult factory or your regional manager.

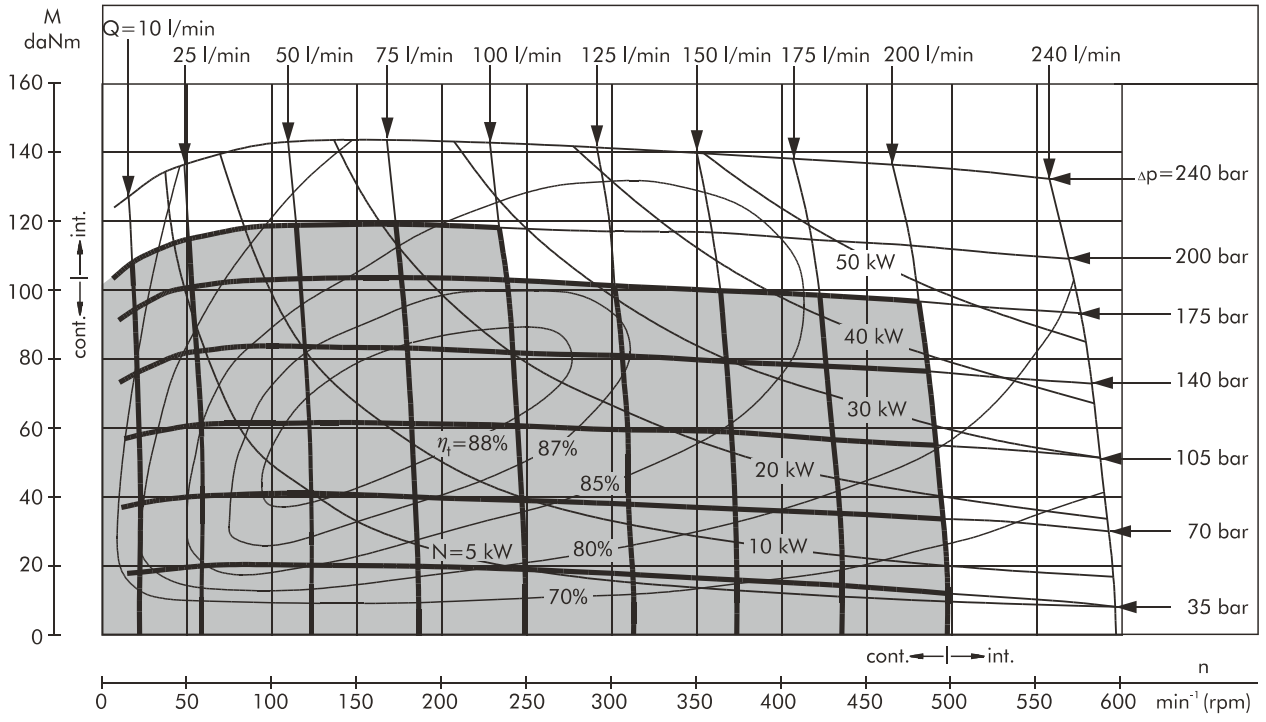
1) Intermittent speed and intermittent pressure must not occur simultaneously.
2) Recommended filtration is per ISO cleanliness code 20/16. A nominal filtration of 25 micron or better.
3) Recommend using a premium quality, anti-wear type mineral based hydraulic oil, HLP(DIN51524) or HM(ISO6743/4). If using synthetic fluids consult the factory for alternative seal materials.
4) Recommended minimum oil viscosity 13 $mm^2/s$ at 50°C.
5) Recommended maximum system operating temperature is 82°C.
6) To assure optimum motor life fill with fluid prior to loading and run at moderate load and speed for 10-15 minutes.

## FUNCTION DIAGRAMS

### MV 315




### MV 400

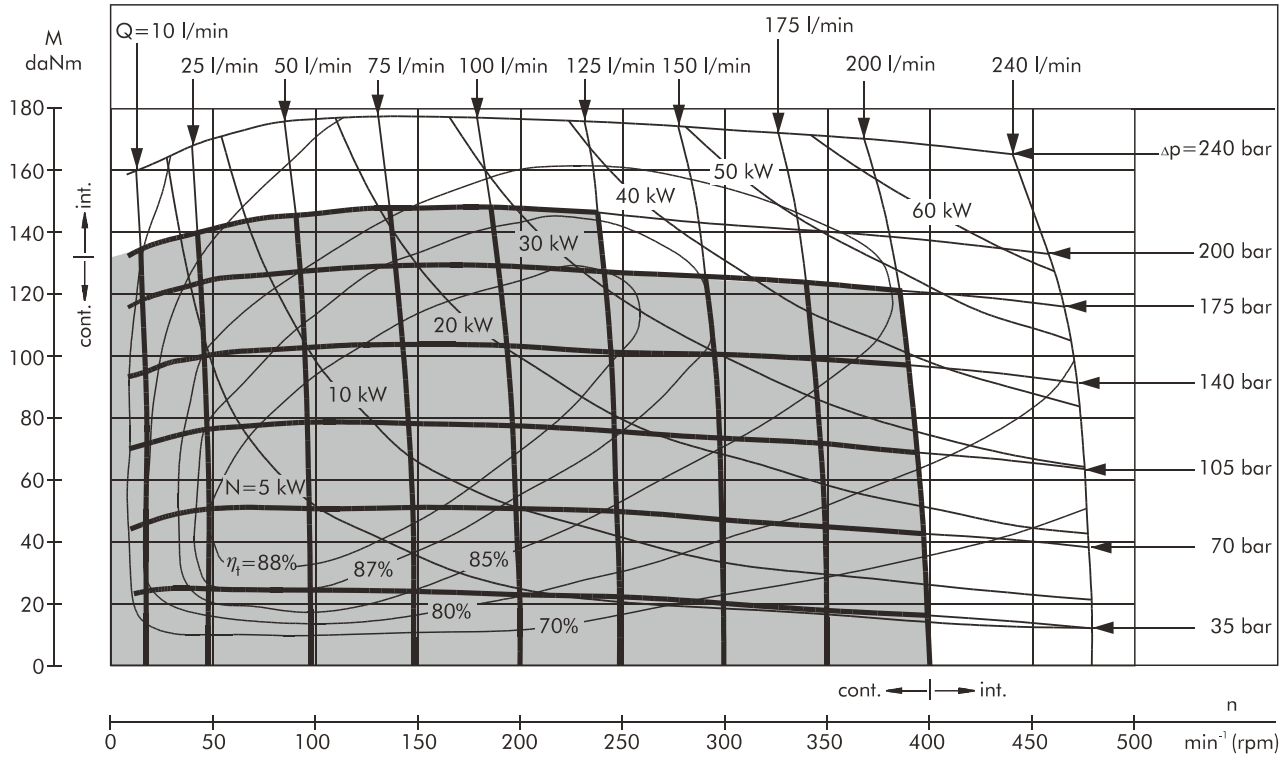



The function diagrams data was collected at back pressure 5÷10 bar and oil with viscosity of 32 mm²/s at 50° C.

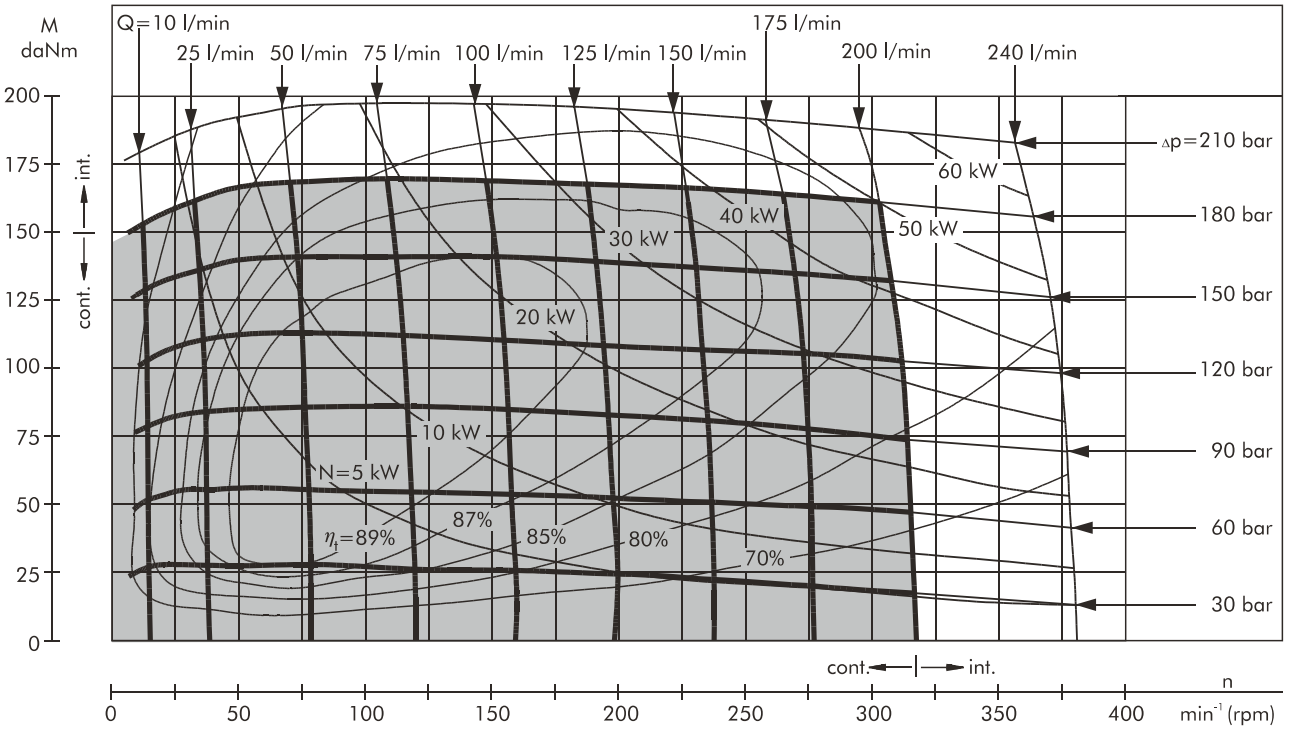
MV MOTORS

# FUNCTION DIAGRAMS

## MV 500



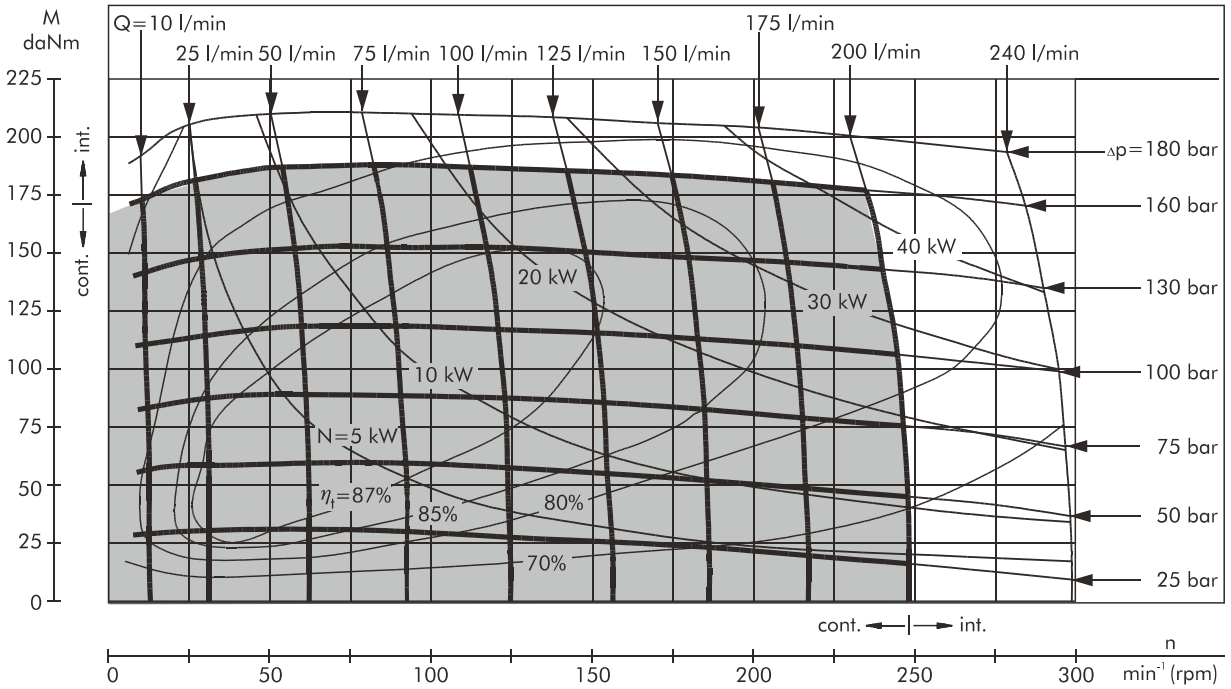

## MV 630




The function diagrams data was collected at back pressure 5÷10 bar and oil with viscosity of 32 mm²/s at 50° C.

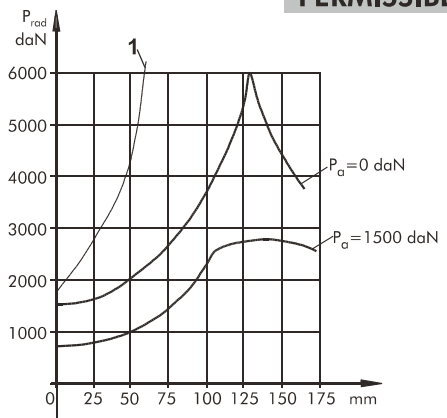
## FUNCTION DIAGRAMS

### MV 800

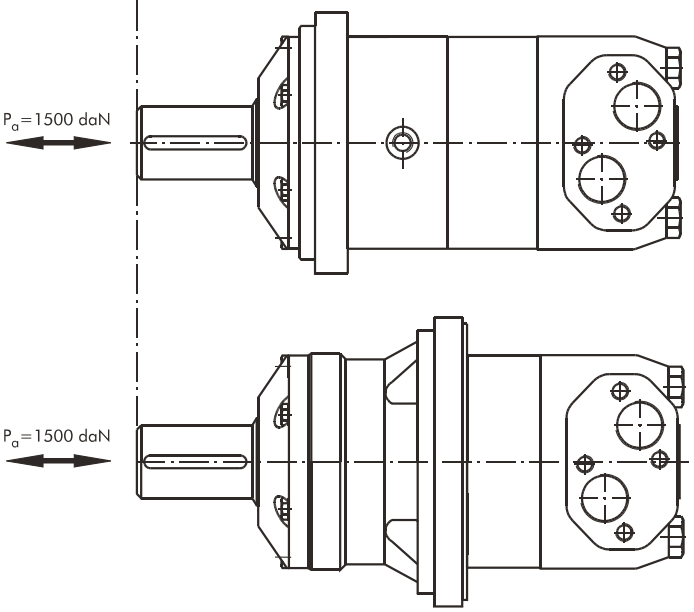



The function diagrams data was collected at back pressure 5÷10 bar and oil with viscosity of 32 mm²/s at 50° C.

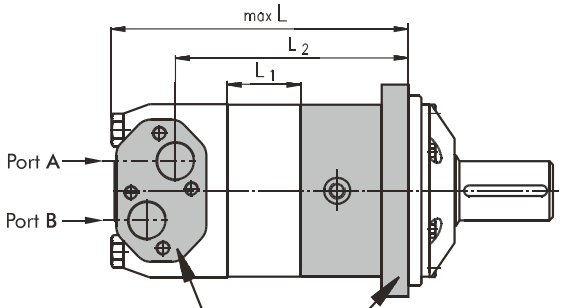
## PERMISSIBLE SHAFT LOADS




The output shaft runs in tapered bearings that permit high axial and radial forces. Curve "**1**" shows max. radial shaft load. Any shaft load exceeding the values quoted in the curve will seriously reduce motor life. The two other curves apply to a B10 bearing life of 3000 hours at 200 RPM.

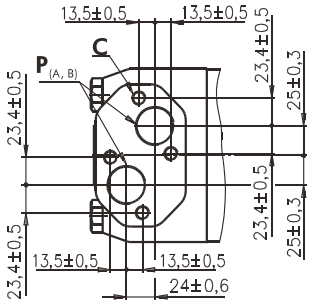


# DIMENSIONS AND MOUNTING DATA




## Porting

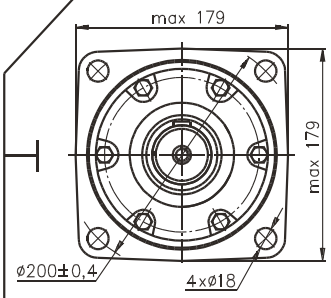
Side Ports

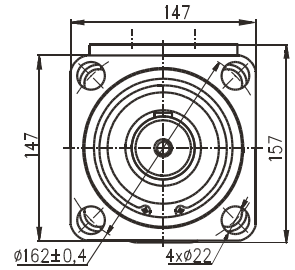


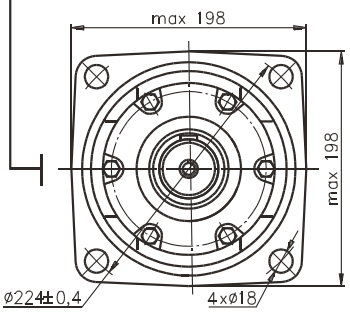

**C:** 4xM12- 12 mm depth
**P(A,B):** 2xG1 - 20 mm depth
**T:** G 1/4 - 12 mm depth

**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**

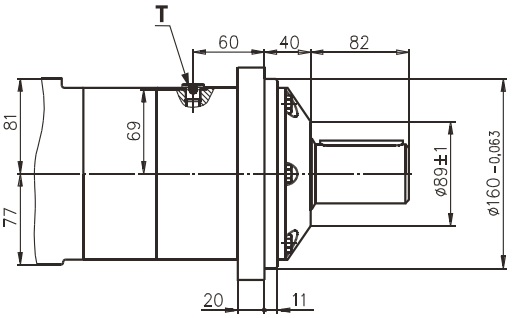


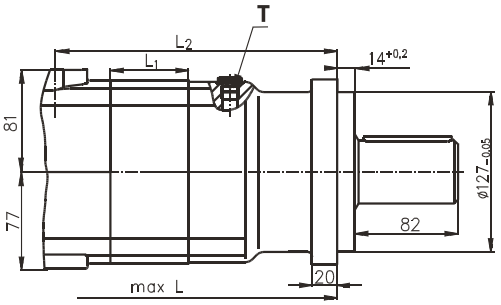




## Mounting

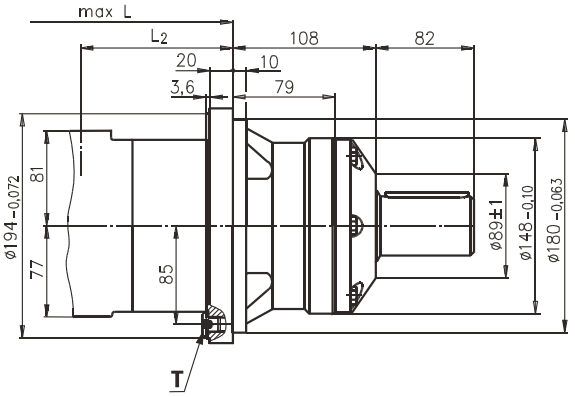
Square Mount (4 Holes)




**C** SAE C Mount




**W** Wheel Mount

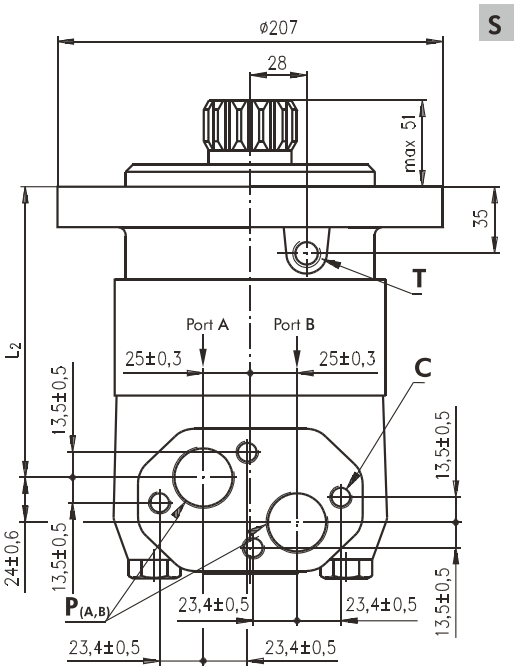


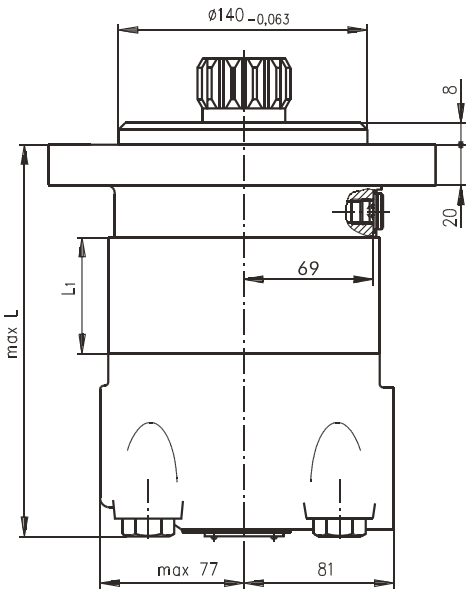

| Type | L, mm | $L_2$, mm | Type | L, mm | $L_2$, mm | Type | L, mm | $L_2$, mm | *$L_1$, mm |
|---|---|---|---|---|---|---|---|---|---|
| MV 315 | 214,5 | 160 | MVC 315 | 238,25 | 184,26 | MVW 315 | 146 | 92 | 21,5 |
| MV 400 | 221,5 | 167 | MVC 400 | 245,25 | 191,26 | MVW 400 | 153 | 99 | 28,5 |
| MV 500 | 229,5 | 175 | MVC 500 | 253,25 | 199,26 | MVW 500 | 161 | 107 | 36,5 |
| MV 630 | 240,0 | 186 | MVC 630 | 263,75 | 209,76 | MVW 630 | 172 | 118 | 47,0 |
| MV 800 | 254,0 | 200 | MVC 800 | 277,75 | 223,76 | MVW 800 | 185 | 132 | 61,0 |

* The width of the gerolor is 4 mm greater than $L_1$.

## DIMENSIONS AND MOUNTING

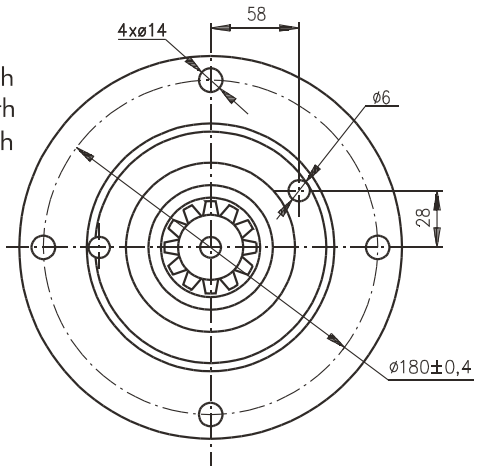
**S** Short Mount




| Type | L, mm | *$L_1$, mm | $L_2$, mm |
|---|---|---|---|
| MVS 315 | 171 | 22,0 | 117 |
| MVS 400 | 179 | 29,0 | 124 |
| MVS 500 | 186 | 37,0 | 132 |
| MVS 630 | 197 | 47,5 | 143 |
| MVS 800 | 211 | 61,5 | 157 |

**C:** 4xM12- 12 mm depth
**$P_{(A,B)}$:** 2xG1 - 20 mm depth
**T:** G 1/4 - 12 mm depth



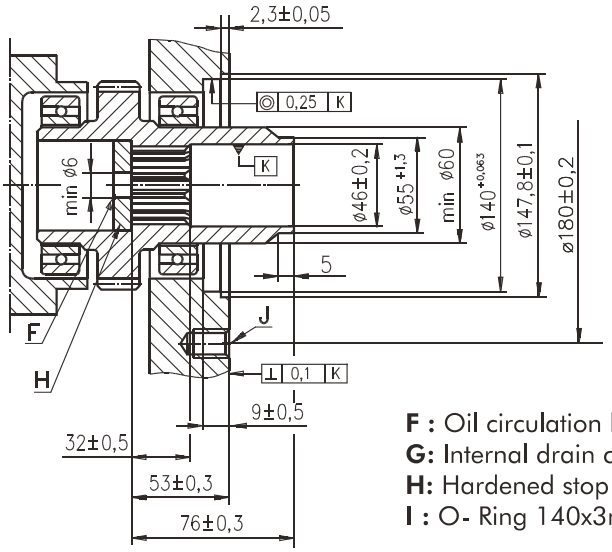

* The width of the gerolor is 4 mm greater than $L_1$.

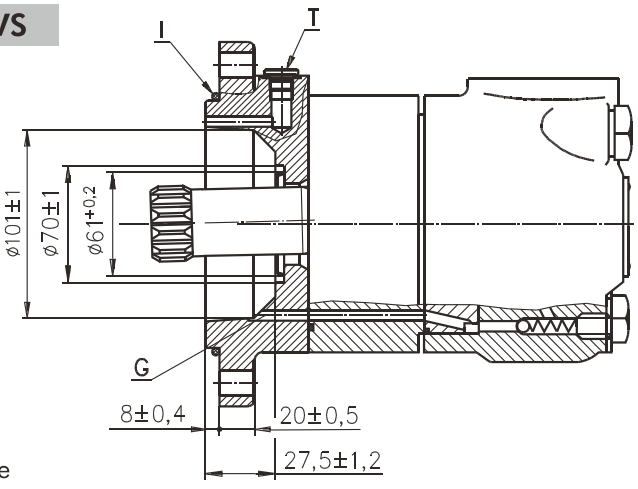
**Standard Rotation**
Viewed from Shaft End
Port **A** Pressurized - **CW**
Port **B** Pressurized - **CCW**

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

## DIMENSIONS OF THE ATTACHED COMPONENT

**MVS**



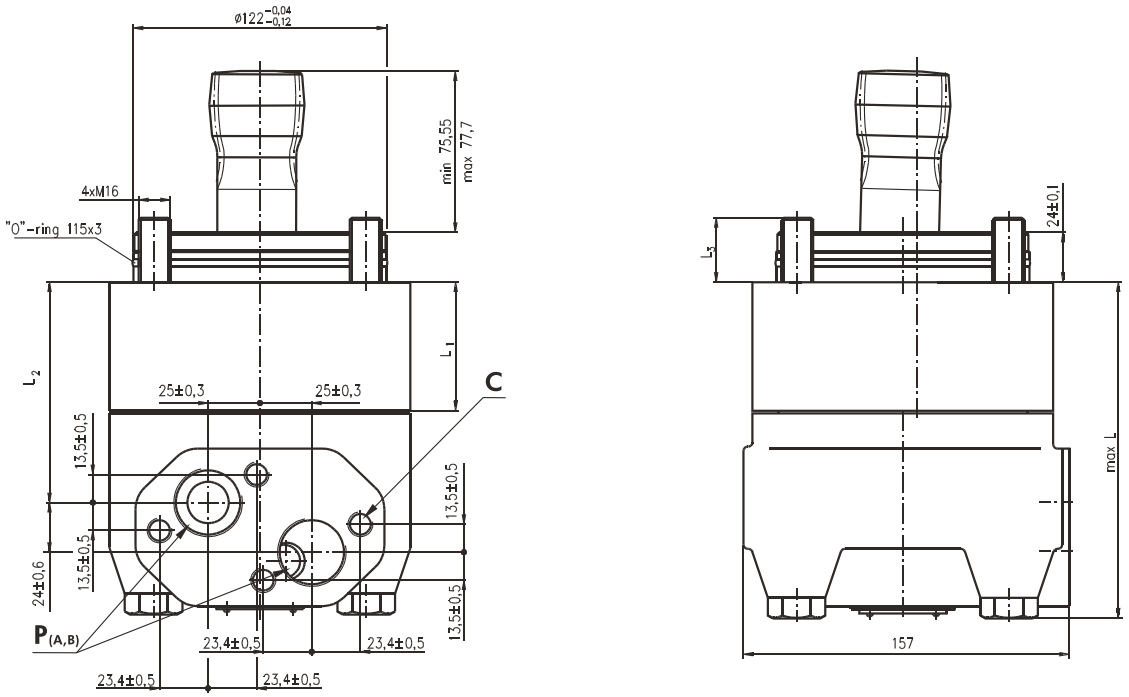

**F :** Oil circulation hole
**G:** Internal drain channel
**H:** Hardened stop plate
**I :** O- Ring 140x3mm

**J:** 4xM12-18 mm depth, 90°
**T:** Drain connection G1/4 - 12 mm depth

MV MOTORS

## DIMENSIONS AND MOUNTING

**V** Very Short Mount



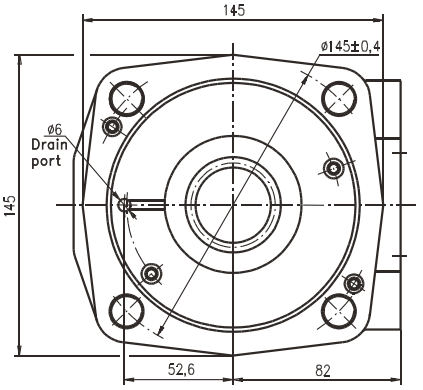

**C:** 4xM12- 12 mm depth
**$P_{(A,B)}$:** 2xG1 - 20 mm depth

| Type | L, mm | *$L_1$, mm | $L_2$, mm | $L_3$, mm |
|---|---|---|---|---|
| MVV 315 | 121,5 | 22,0 | 68,0 | 29,5 |
| MVV 400 | 128,5 | 29,0 | 75,0 | 32,5 |
| MVV 500 | 136,5 | 37,0 | 83,0 | 34,5 |
| MVV 630 | 147,0 | 47,5 | 93,0 | 34,0 |
| MVV 800 | 161,0 | 61,5 | 107,5 | 30,0 |

* The width of the gerolor is 4 mm greater than $L_1$.

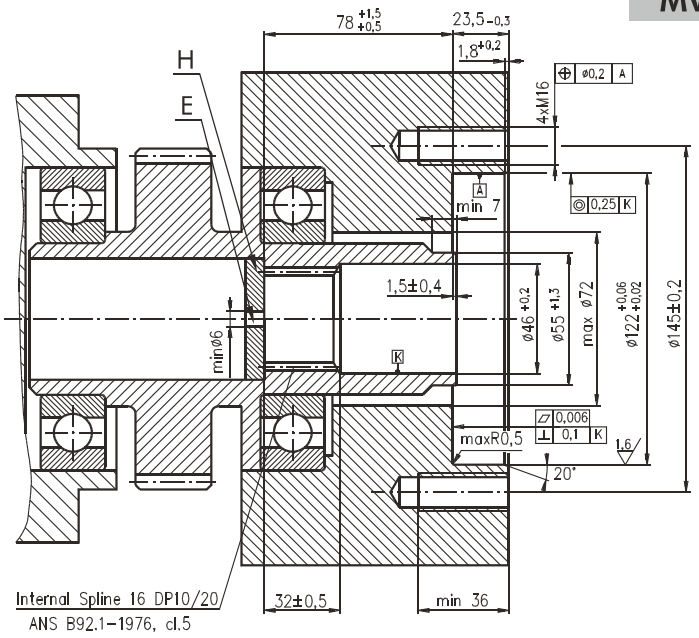
**Standard Rotation**
Viewed from Shaft End
Port **A** Pressurized - **CW**
Port **B** Pressurized - **CCW**

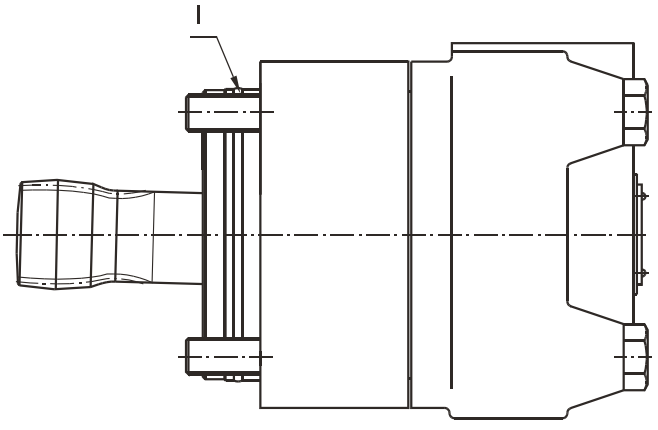
**Reverse Rotation**
Viewed from Shaft End
Port **A** Pressurized - **CCW**
Port **B** Pressurized - **CW**




## DIMENSIONS OF THE ATTACHED COMPONENT

### MVV




**E:** External drain channel
**H:** Hardened stop plate
**I :** O- Ring 115x3mm

## DRAIN CONNECTION

A drain line ought to be used when pressure in the return line can exceed the permissible pressure. It can be connected:

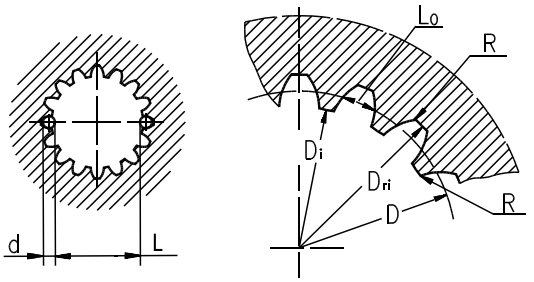
- For MVS at the drain port of the motor;
- For MVV at the drain connection of the attached component. The maximum pressure in the drain line is limited by the attached component and its shaft seal.

The drain line must be possible for oil to flow freely between motor and attached component and must be led to the tank. The maximum pressure in the drain line is limited by the attached component and its seal.

## INTERNAL SPLINE DATA FOR THE ATTACHED COMPONENT

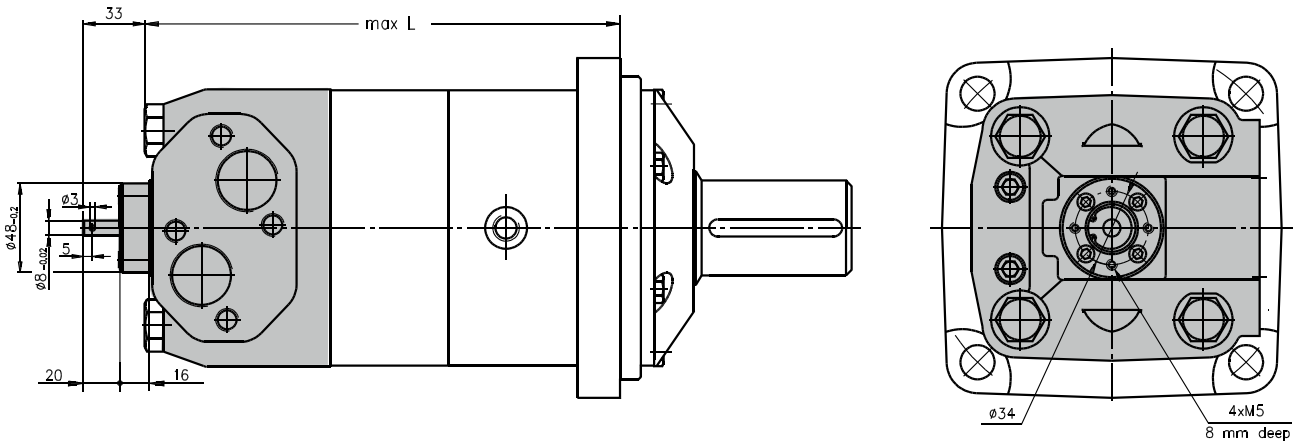
*Standard ANSI B92.1-1976, class 5*
*[m=2.54; corrected x.m=+1,0]*

| Fillet Root Side Fit | | mm |
|---|---|---|
| Number of Teeth | z | 16 |
| Diametral Pitch | DP | 10/20 |
| Pressure Angle | | $30^{\circ}$ |
| Pitch Dia. | D | 40,640 |
| Major Dia. | Dri | $45{,}2^{+0{,}4}$ |
| Minor Dia. | Di | $38{,}5^{+0{,}039}$ |
| Space Width [Circular] | Lo | 5,18±0,037 |
| Fillet Radius | R | 0,4 |
| Max. Measurement between Pin | L | $32{,}47^{+0{,}15}$ |
| Pin Dia. | d | 5,5±0,001 |




*Hardening Specification:*
HRC 60±2
HRC 52
0,7±0,2 mm effective case depth
Material 20 MoCr4 DIN 17210 or better

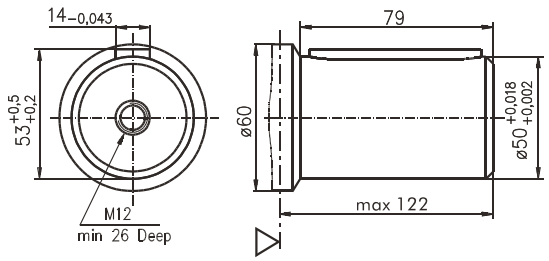
## MOTOR WITH TACHO CONNECTION



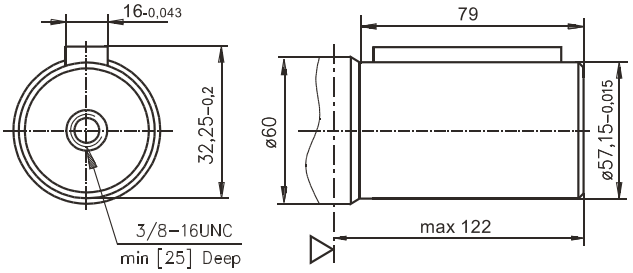
MV MOTORS

## SHAFT EXTENSIONS

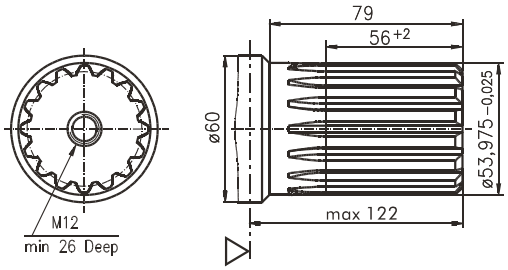
**C** - ø50 straight, Parallel key A14x9x70 DIN 6885



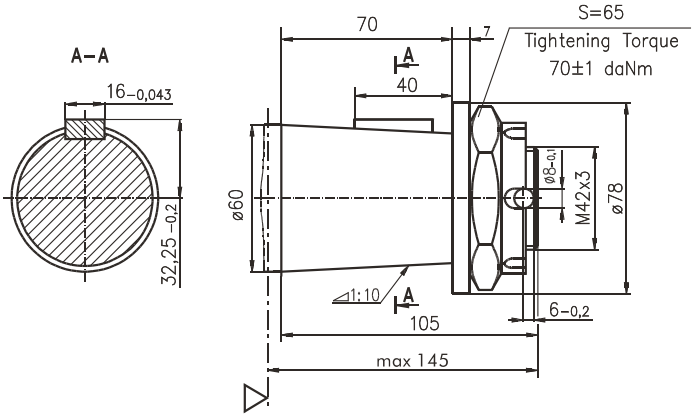

**CO** - ø2¼"[57,15] straight,Parallel key ½ "x½"x 2¼" BS46




**SH** -ø2 1/8"splined, 16 DP 8/16 ANSI B92.1-1976




**K** -tapered 1:10, Parallel key B16x10x32 DIN 6885




▽ - Motor Mounting Surface

## ORDER CODE

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **M V** | | | | | |

**Pos.1 - Mounting Flange**

omit - Square mount, four holes

| | |
|---|---|
| **C** | - SAE C mount |
| **W** | - Wheel mount |
| **S** | - Short mount |
| **V** | - Very short mount |

**Pos.2 - Displacement code**

| | |
|---|---|
| **315** | - 314,5 [cm³/rev] |
| **400** | - 400,9 [cm³/rev] |
| **500** | - 499,6 [cm³/rev] |
| **630** | - 629,1 [cm³/rev] |
| **800** | - 801,8 [cm³/rev] |

**Pos. 3 - Shaft extensions***

| | |
|---|---|
| **C** | - ø50 straight, Parallel key A14x9x70 DIN6885 |
| **CO** | - ø2¼" straight, Parallel key ½ "x½"x 2¼" BS46 |
| **SH** | - ø2 1/8" splined, ANSI B92.1-1976 |
| **K** | - ø60 tapered 1:10, Parallel key B16x10x32 DIN6885 |

**Pos. 4 - Special Features** (see page 50)

**Pos. 5 - Design Series**

omit - Factory specified

**NOTES:**

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

The hydraulic motors are mangano- phosphatized as standard.

# MOTOR SPECIAL FEATURES

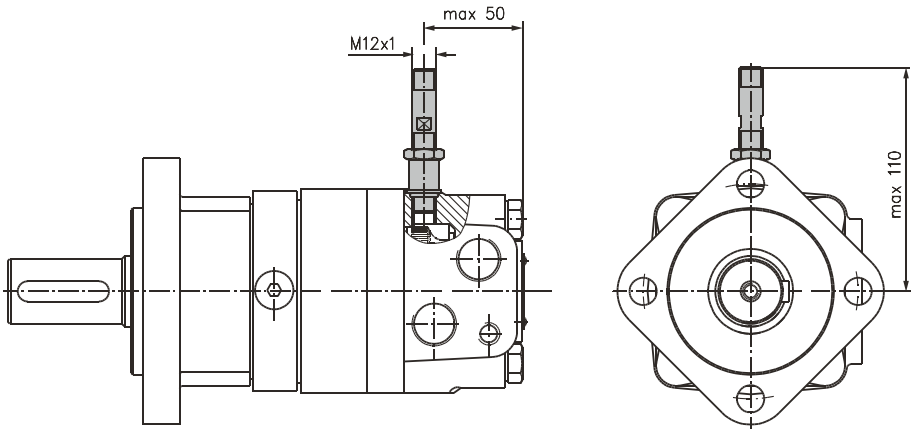
| Special Feature Description | Order Code | Motor type | | | |
|---|---|---|---|---|---|
| | | MS | MSY | MT | MV |
| Motor for Speed Sensor* | RS | O | O | O | O |
| Tacho Connection** | T | O | O | O | O |
| Low Leakage | LL | O | O | O | O |
| Low Speed Valving | LSV | O | O | O | O |
| Free Running | FR | O | O | O | O |
| Reverse Rotation | R | O | O | O | O |
| Paint*** | P | O | O | O | O |
| Corrosion Protected Paint*** | PC | O | O | O | O |
| Check Valves | | S | S | S | S |

**O** Optional
**S** Standard

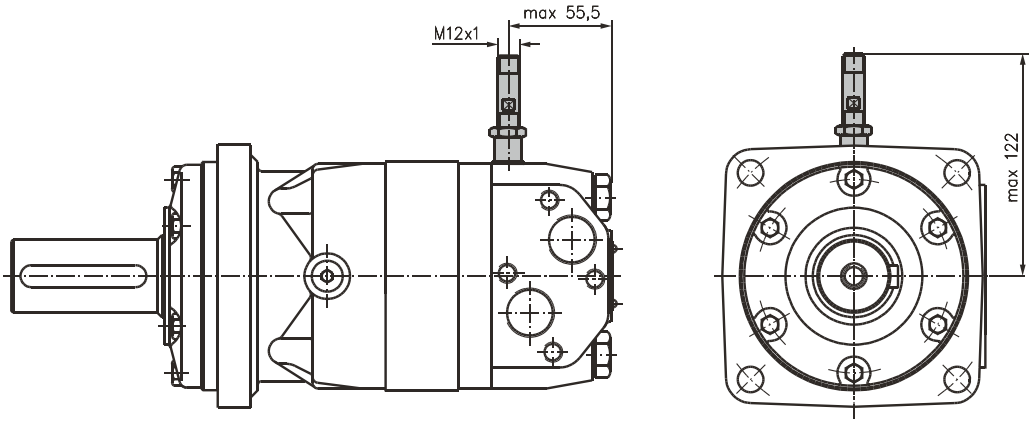
* for sensor ordering see pages 51-52.
** only for side ports.
*** color at customer's request.

# MOTORS WITH SPEED SENSOR

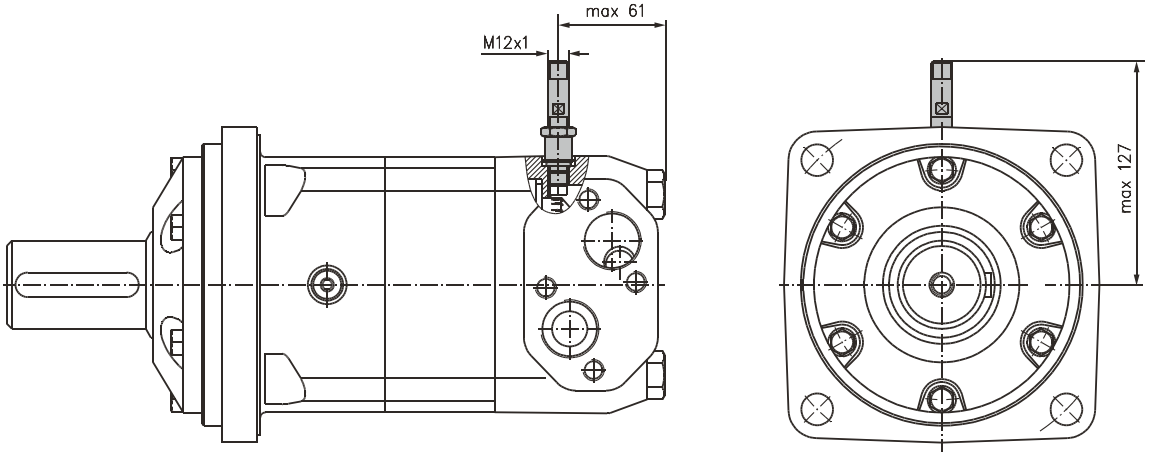
## MS(Y)...RS




## MT...RS




## MV...RS



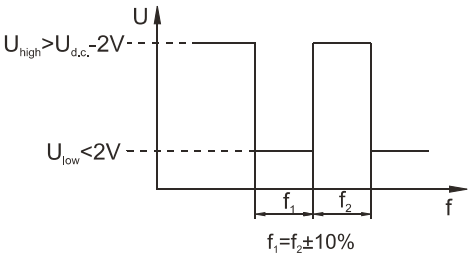
SPEED SENSOR MOTORS

# TECHNICAL DATA OF THE SPEED SENSOR

## Technical data

| | |
|---|---|
| Frequency range | 3...20 000 Hz |
| Output | PNP, NPN |
| Power supply | 10...36 VDC |
| Current input | 20 mA (@24 VDC) |
| Current load | 500 mA (@24 VDC;24°C) |
| Ambient Temperature | minus 40... plus 125°C |
| Protection | IP 67 |
| Plug connector | M12-Series |
| Mounting principle | ISO 6149 |

## Output signal



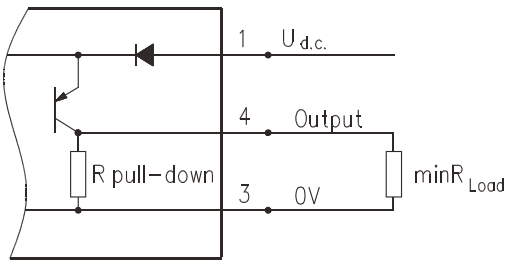

Load max.:$I_{high}$=$I_{low}$<50mA

No load current, max: 20 mA

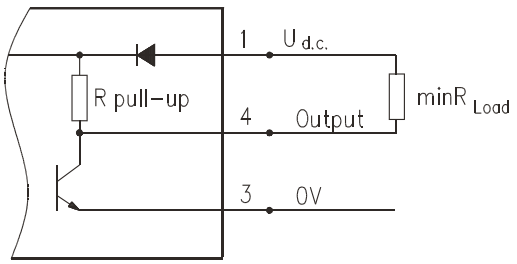
| Motor type | MS | MT | MV |
|---|---|---|---|
| Pulses per revolution | 54 | 84 | 102 |

## Wiring diagrams

### PNP

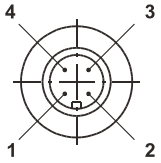



### NPN




$R_{Load}$=$U_{d.c.}$/$I_{max}$ (=50mA)

## Stick type




| Terminal No. | Connection | Cable Output |
|---|---|---|
| 1 | $U_{d.c.}$ | Brown |
| 2 | No connection | White |
| 3 | 0V | Blue |
| 4 | Output signal | Black |

## Order Code for Speed Sensor

| Sensor Code | Output type | Electric connection |
|---|---|---|
| **RSN** | NPN | Connector BINDER 713 series |
| **RSP** | PNP | Connector BINDER 713 series |
| **PSNL5** | NPN | Cable output 3x0,25; 5m long |
| **RSPL5** | PNP | Cable output 3x0,25; 5m long |

**NOTE:** *- The speed sensor is not fitted at the factory, but is supplied in a plastic bag with the motor. For installation see enclosed instructions.

# MOTOR APPLICATION

## VEHICLE DRIVE CALCULATIONS

**1.Motor speed: n,** [$min^{-1}$]

$$n=\frac{2,65 \times v \times i}{R}$$

**v-** vehicle speed, [km/h];
**R-** wheel rolling radius, [m];
**i-** gear ratio between motor and wheels.
If no gearbox, use i=1.

**2.Rolling resistance: RR,** [daN]
The resistance force resulted in wheels contact with different surfaces:

$$RR=G \times \rho$$

**G-** total weight loaded on vehicle, [daN];
$\rho$- rolling resistance coefficient (Table 1).

Table 1

| Rolling resistance coefficient In case of rubber tire rolling on different surfaces | |
|---|---|
| **Surface** | $\rho$ |
| Concrete- faultless | 0,010 |
| Concrete- good | 0,015 |
| Concrete- bad | 0,020 |
| Asphalt- faultless | 0,012 |
| Asphalt- good | 0,017 |
| Asphalt- bad | 0,022 |
| Macadam- faultless | 0,015 |
| Macadam- good | 0,022 |
| Macadam- bad | 0,037 |
| Snow- 5 cm | 0,025 |
| Snow- 10 cm | 0,037 |
| Polluted covering- smooth | 0,025 |
| Polluted covering- sandy | 0,040 |
| Mud | 0,037÷0,150 |
| Sand- Gravel | 0,060÷0,150 |
| Sand- loose | 0,160÷0,300 |

**3.Grade resistance: GR,** [daN]

$$GR=G \times (\sin\alpha + \rho \times \cos\alpha)$$

$\alpha$- gradient negotiation angle (Table 2)

Table 2

| Grade % | $\alpha$ Degrees | Grade % | $\alpha$ Degrees |
|---|---|---|---|
| 1% | 0° 35' | 12% | 6° 5' |
| 2% | 1° 9' | 15% | 8° 31' |
| 5% | 2° 51' | 20% | 11° 19' |
| 6% | 3° 26' | 25% | 14° 3' |
| 8% | 4° 35' | 32% | 18° |
| 10% | 5° 43' | 60% | 31° |

**4. Accelerate force: FA,** [daN]
Force **FA** necessary for acceleration from 0 to maximum speed v and time t can be calculated with a formula:

$$FA=\frac{v \times G}{3,6 \times t}, \text{ [daN]}$$

**FA-** accelerate force, [daN];
**t-** time, [s].

**5.Tractive effort: DP,** [daN]
Tractive effort **DP** is the additional force of trailer. This value will be established as follows:
-acc.to constructor's assessment;
-as calculating forces in items 2, 3 and 4 of trailer; the calculated sum corresponds to the tractive effort requested.

**6.Total tractive effort: TE,** [daN]
Total tractive effort **TE** is total effort necessary for vehicle motion; that the sum of forces calculated in items from 2 to 5 and increased with 10 % because of air resistance.

$$TE=1,1 \times (RR + GR + FA + DP)$$

**RR -** force acquired to overcome the rolling resistance;
**GR-** force acquired to slope upwards;
**FA-** force acquired to accelerate (acceleration force);
**DP-** additional tractive effort (trailer).

**7.Motor Torque: M,** [daNm]
Necessary torque moment for every hydraulic motor:

$$M=\frac{TE \times R}{N \times i \times \eta_M}$$

**N-** motor numbers;
$\eta_M$- mechanical gear efficiency (if it is available).

**8.Cohesion between tire and road covering: $M_W$,** [daNm]

$$M_W=\frac{G_W \times f \times R}{i \times \eta_M}$$

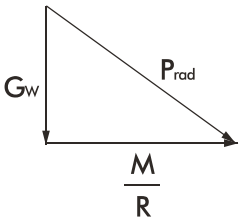
To avoid wheel slipping, it should be observed the following condition $M_W > M$
**f** - frictional factor;
$G_W$- total weight over the wheels, [daN].

Table 3

| Surface | Frictional factor f |
|---|---|
| Steel on steel | 0,15 ÷ 0,20 |
| Rubber tire on polluted surface | 0,5 ÷ 0,7 |
| Rubber tire on asphalt | 0,8 ÷ 1,0 |
| Rubber tire on concrete | 0,8 ÷ 1,0 |
| Rubber tire on grass | 0,4 |

**9.Radial motor loading: $P_{rad}$ , [daN]**

When motor is used for vehicle motion with wheels mounted directly on motor shaft, the total radial loading of motor shaft $P_{rad}$ is a sum of motion force and weight force acting on one wheel.



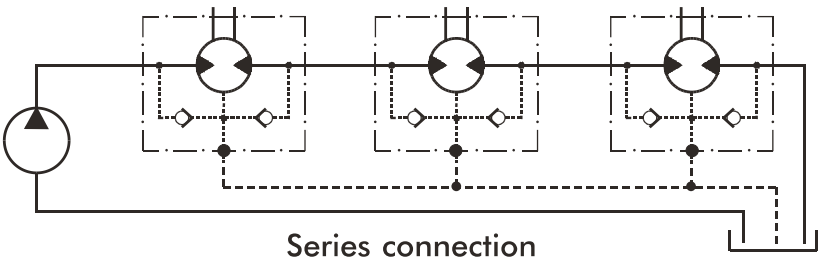

$G_w$ - Weight held by wheel;
$P_{rad}$ - Total radial loading of motor shaft;
M/R- Motion force.

$$P_{rad} = \sqrt{G_w^2 + \left(\frac{M}{R}\right)^2}$$

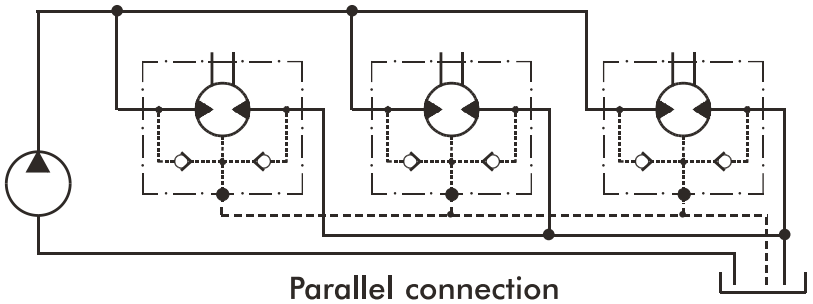
In accordance with calculated loadings the suitable motor from the catalogue is selected.

## DRAINAGE SPACE AND DRAINAGE PRESSURE

Advantages in oil drainage from drain space: Cleaning; Cooling and Seal lifetime prolonging.



Series connection



Parallel connection

# SPOOL VALVE HYDRAULIC MOTORS

The operating principle of the motors is based on an internal gear design, consisting of a stator and rotor through which the output torque and speed are transmitted. The distributor valve is driven synchronously by the rotor through a cardan shaft ensuring that each one of the chambers of the motor are filled and emptied precisely.
PL , RL, RW and HW motors have a Spool Valve.

**SPOOL VALVE -** The distributor valve has been integrated with the output shaft. The valve has hydrodynamic bearings, and has infinite life when load ratings are not exceeded.

**GEAR SET -** There are two forms of stator, hence and of gear set:

EPML have plain teeth. These types motors are suitable for long operating periods at moderate pressures- or short operating periods at high pressures.

EPRML have 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. Roller Gear Sets are recommended for operation with thin oil and for applications having continually reversing loads.

**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.

**Low Leakage**

**LL** Series hydraulic motors have been 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 drainage ports. Their main purpose is to operate as series-connected motors in hydraulic systems. For this version is permissible decreasing of the maximal torque with up to 5% (at middle speed) and up to 10 % (at high speed) in comparison to the standard versions of motors.

**Low Speed Valve**

**LSV** Series hydraulic motors have been designed to operate with normal pressure drop and to ensure smooth run at low speed (up to 200 $min^{-1}$), as the best security for operation is guaranteed at frequency of rotation 20 ÷ 50 $min^{-1}$ . They have an increased starting pressure drop and are not recommended for using at pressure less than 40 bar.

**Free Running**

**FR** Series hydraulic motors have been designed to operate with high frequencies of rotation /over than 300 $min^{-1}$/ and low pressure drop. These motors are produced with increased clearance at all friction parts.
Additional advantages of "FR" version are prolonging of the life of the hydraulic motors at high frequencies of rotation, as well as the possibility to use them in systems with big variation of the loading. Volumetric efficiency can be affected.