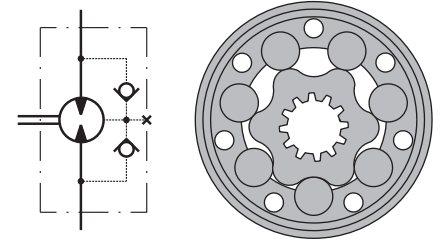


# HYDRAULIC MOTORS SR

M+S Hydraulic introduces a new version of hydraulic motors, type SR with new housing, integrated output shaft to the spool valve, check valves, high pressure shaft seal. The SR motors are suitable for a wide range of applications where compact and high efficient motors are required.

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## APPLICATION

- » Conveyors
- » Feeding mechanism of robots and manipulators
- » Metal working machines
- » Textile machines
- » Agriculture machines
- » Food industries
- » Grass cutting machinery etc.

## OPTIONS

- » Model - Spool valve, geroller
- » Flange mount - 2 hole oval flange; 6 hole oval flange; square flange
- » Side BSPP ports
- » Shafts- straight, splined and tapered
- » Shaft seal for high and low pressure
- » Other special features

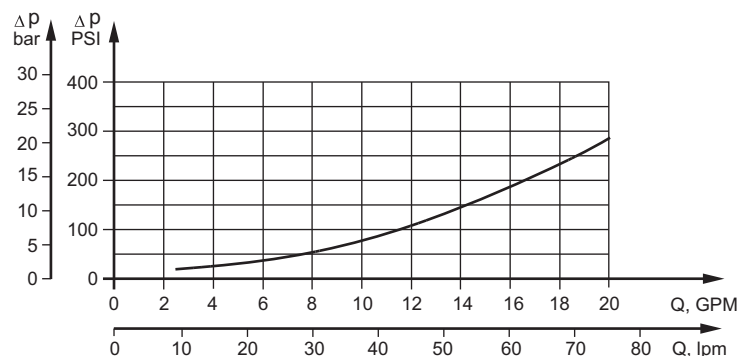
## GENERAL

<b>Max. Displacement,</b> cm <sup>3</sup> /rev [in <sup>3</sup> /rev]	397 [24.4]
<b>Max. Speed,</b> [RPM]	970
<b>Max. Torque,</b> daNm [lb-in]	cont.: 60 [5310] int.: 69 [6107]
<b>Max. Output,</b> kW [HP]	15 [20.1]
<b>Max. Pressure Drop,</b> bar [PSI]	cont.: 175 [2540] int.: 200 [2900]
<b>Max. Oil Flow,</b> lpm [GPM]	75 [19.8]
<b>Min. Speed,</b> [RPM]	10
<b>Pressure fluid</b>	Mineral based- HLP(DIN 51524) or HM(ISO 6743/4)
<b>Temperature range,</b> °C [°F]	-30÷90 [-22÷194]
<b>Optimal Viscosity range,</b> mm <sup>2</sup> /s [SUS]	20÷75 [98÷347]
<b>Filtration</b>	ISO code 20/16 (Min. recommended fluid filtration of 25 micron)

### Oil flow in drain line

Pressure drop bar [PSI]	Viscosity mm <sup>2</sup> /s [SUS]	Oil flow in drain line lpm [GPM]
100 [1450]	20 [98]	2,5 [.660]
	35 [164]	1,8 [.476]
140 [2030]	20 [98]	3,5 [.925]
	35 [164]	2,8 [.740]

### Pressure Losses



## SPECIFICATION DATA

Specification Data for SR... motors with **C** and **CO** shafts.

Type		SR 50	SR 80	SR 100	SR 125	SR 160	SR 200	SR 250	SR 315	SR 400
<b>Displacement, cm<sup>3</sup>/rev [in<sup>3</sup>/rev]</b>		51,5 [3.14]	80,3 [4.90]	99,8 [6.09]	125,7 [7.67]	159,6 [9.74]	199,8 [12.19]	250,1 [15.26]	315,7 [19.26]	397 [24.4]
<b>Max. Speed, [RPM]</b>	Cont.	775	750	600	475	375	300	240	190	150
	Int.*	970	940	750	600	470	375	300	240	190
<b>Max. Torque daNm [lb-in]</b>	Cont.	10 [900]	20 [1770]	24 [2125]	30 [2655]	29 [2566]	29 [2566]	30 [2655]	30 [2655]	30 [2655]
	Int.*	13 [1150]	22 [1947]	28 [2480]	34 [3010]	39 [3450]	39 [3450]	39 [3450]	42 [3717]	40 [3540]
	Peak**	17 [1505]	27 [2390]	32 [2832]	37 [3275]	46 [4070]	56 [4960]	60 [5310]	61 [5400]	61 [5400]
<b>Max. Output kW [HP]</b>	Cont.	7 [9,4]	12,5 [17]	13 [17.4]	12,5 [17]	9 [12]	7,5 [10]	6 [8.1]	5 [6.7]	3,8 [5.1]
	Int.*	8,5 [11,4]	15 [20.1]	15 [20.1]	14,5 [19.5]	12,5 [17]	10 [13.4]	8 [10.7]	6,5 [8.7]	6,1 [8.2]
<b>Max. Pressure Drop bar [PSI]</b>	Cont.	140 [2030]	175 [2540]	175 [2540]	175 [2540]	120 [1740]	105 [1520]	80 [1160]	70 [1015]	55 [798]
	Int.*	175 [2540]	200 [2900]	200 [2900]	200 [2900]	175 [2540]	140 [2030]	110 [1600]	100 [1450]	70 [1015]
	Peak**	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]	200 [2900]	150 [2175]	115 [1668]
<b>Max. Oil Flow lpm [GPM]</b>	Cont.	40 [10.5]	60 [15.8]	60 [15.8]	60 [15.8]	60 [15.8]	60 [15.8]	60 [15.8]	60 [15.8]	60 [15.8]
	Int.*	50 [13.2]	75 [19.8]	75 [19.8]	75 [19.8]	75 [19.8]	75 [19.8]	75 [19.8]	75 [19.8]	75 [19.8]
<b>Max. Starting Pressure with Unloaded Shaft, bar [PSI]</b>		10 [145]	10 [145]	10 [145]	9 [130]	7 [102]	5 [73]	4 [58]	3 [43.5]	3 [43.5]
<b>Min. Starting Torque, daNm [lb-in]</b>		8 [710]	15 [1330]	20 [1770]	24 [2124]	23 [2035]	23 [2035]	24 [2124]	26 [2300]	26 [2300]
<b>Max. Inlet Pressure bar [PSI]</b>	Cont.	175 [2540]	175 [2540]	175 [2540]	175 [2540]	175 [2540]	175 [2540]	175 [2540]	175 [2540]	175 [2540]
	Int.*	200 [2900]	200 [2900]	200 [2900]	200 [2900]	200 [2900]	200 [2900]	200 [2900]	200 [2900]	200 [2900]
	Peak**	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]

\* 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.

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 ( ISO 6743/4).  
If using synthetic fluids consult the factory for alternative seal materials.
4. Recommended minimum oil viscosity 13 mm<sup>2</sup>/s [70 SUS] at 50°C [122°F].
5. Recommended maximum system operating temperature is 82°C [180°F].
6. To assure optimum motor life fill with fluid prior to loading and run at moderate load and speed for 10-15 minutes.

## SPECIFICATION DATA

Specification Data for SR... motors with **SH** shafts.

Type		SR 50	SR 80	SR 100	SR 125	SR 160	SR 200	SR 250	SR 315	SR 400
<b>Displacement, cm<sup>3</sup>/rev [in<sup>3</sup>/rev]</b>		51,5 [3.14]	80,3 [4.90]	99,8 [6.09]	125,7 [7.67]	159,6 [9.74]	199,8 [12.19]	250,1 [15.26]	315,7 [19.26]	397 [24.4]
<b>Max. Speed, [RPM]</b>	Cont.	775	750	600	475	375	300	240	190	150
	Int.*	970	940	750	600	470	375	300	240	190
<b>Max. Torque daNm [lb-in]</b>	Cont.	10 [900]	20 [1770]	24 [2125]	30 [2655]	39 [3450]	38,5 [3410]	38 [3360]	39 [3450]	38 [3360]
	Int.*	13 [1150]	22 [1947]	28 [2480]	34 [3010]	43 [3805]	46 [4070]	47 [4160]	48 [4248]	47 [4160]
	Peak**	17 [1505]	27 [2390]	32 [2832]	37 [3275]	46 [4070]	56 [4960]	60 [5310]	61 [5400]	61 [5400]
<b>Max. Output kW [HP]</b>	Cont.	7 [9.4]	12,5 [17]	13 [17.4]	12,5 [17]	11,5 [15.4]	9 [12]	8 [10.7]	5 [6.7]	4,8 [6.4]
	Int.*	8,5 [11.4]	15 [20.1]	15 [20.1]	14,5 [19.5]	14 [18.8]	12 [16.1]	9,5 [12.7]	8 [10.7]	6,8 [9.1]
<b>Max. Pressure Drop bar [PSI]</b>	Cont.	140 [2030]	175 [2540]	175 [2540]	175 [2540]	175 [2540]	140 [2030]	110 [1600]	85 [1232]	70 [1015]
	Int.*	175 [2540]	200 [2900]	200 [2900]	200 [2900]	200 [2900]	175 [2540]	140 [2030]	115 [1668]	90 [1305]
	Peak**	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]	200 [2900]	150 [2175]	115 [1668]
<b>Max. Oil Flow lpm [GPM]</b>	Cont.	40 [10.5]	60 [15.8]	60 [15.8]	60 [15.8]	60 [15.8]	60 [15.8]	60 [15.8]	60 [15.8]	60 [15.8]
	Int.*	50 [13.2]	75 [19.8]	75 [19.8]	75 [19.8]	75 [19.8]	75 [19.8]	75 [19.8]	75 [19.8]	75 [19.8]
<b>Max. Starting Pressure with Unloaded Shaft, bar [PSI]</b>		10 [145]	10 [145]	10 [145]	9 [130]	7 [102]	5 [73]	4 [58]	3 [43.5]	3 [43.5]
<b>Min. Starting Torque, daNm [lb-in]</b>		8 [710]	15 [1330]	20 [1770]	24 [2124]	32 [2832]	33 [2920]	31 [2740]	31,5 [2788]	31,5 [2788]
<b>Max. Inlet Pressure bar [PSI]</b>	Cont.	175 [2540]	175 [2540]	175 [2540]	175 [2540]	175 [2540]	175 [2540]	175 [2540]	175 [2540]	175 [2540]
	Int.*	200 [2900]	200 [2900]	200 [2900]	200 [2900]	200 [2900]	200 [2900]	200 [2900]	200 [2900]	200 [2900]
	Peak**	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]

\* 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.

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 ( ISO 6743/4).  
If using synthetic fluids consult the factory for alternative seal materials.
4. Recommended minimum oil viscosity 13 mm<sup>2</sup>/s [70 SUS] at 50°C [122°F].
5. Recommended maximum system operating temperature is 82°C [180°F].
6. To assure optimum motor life fill with fluid prior to loading and run at moderate load and speed for 10-15 minutes.

## SPECIFICATION DATA

Specification Data for SR... motors with **K, CB, CA** shafts.

Type		SR 50	SR 80	SR 100	SR 125	SR 160	SR 200	SR 250	SR 315	SR 400
<b>Displacement, cm<sup>3</sup>/rev [in<sup>3</sup>/rev]</b>		51,5 [3.14]	80,3 [4.90]	99,8 [6.09]	125,7 [7.67]	159,6 [9.74]	199,8 [12.19]	250,1 [15.26]	315,7 [19.26]	397 [24.4]
<b>Max. Speed, [RPM]</b>	Cont.	775	750	600	475	375	300	240	190	150
	Int.*	970	940	750	600	470	375	300	240	190
<b>Max. Torque daNm [lb-in]</b>	Cont.	10 [900]	20 [1770]	24 [2125]	30 [2655]	39 [3450]	45 [3983]	57 [5045]	57 [5045]	60 [5310]
	Int.*	13 [1150]	22 [1947]	28 [2480]	34 [3010]	43 [3805]	50 [4425]	61 [5400]	69 [6107]	69 [6107]
	Peak**	17 [1505]	27 [2390]	32 [2832]	37 [3275]	46 [4070]	56 [4960]	71 [6284]	84 [7434]	87 [8700]
<b>Max. Output kW [HP]</b>	Cont.	7 [9,4]	12,5 [17]	13 [17.4]	12,5 [17]	11,5 [15.4]	11 [14.7]	10 [13.4]	9 [12]	7,8 [10.5]
	Int.*	8,5 [11,4]	15 [20.1]	15 [20.1]	14,5 [19.5]	14 [18.8]	13 [17.4]	12 [16.1]	10 [13.4]	10,6 [14.2]
<b>Max. Pressure Drop bar [PSI]</b>	Cont.	140 [2030]	175 [2540]	175 [2540]	175 [2540]	175 [2540]	175 [2540]	175 [2540]	135 [1958]	110 [1600]
	Int.*	175 [2540]	200 [2900]	200 [2900]	200 [2900]	200 [2900]	200 [2900]	200 [2900]	175 [2540]	140 [2030]
	Peak**	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]	210 [3045]	175 [2540]
<b>Max. Oil Flow lpm [GPM]</b>	Cont.	40 [10.5]	60 [15.8]	60 [15.8]	60 [15.8]	60 [15.8]	60 [15.8]	60 [15.8]	60 [15.8]	60 [15.8]
	Int.*	50 [13.2]	75 [19.8]	75 [19.8]	75 [19.8]	75 [19.8]	75 [19.8]	75 [19.8]	75 [19.8]	75 [19.8]
<b>Max. Starting Pressure with Unloaded Shaft, bar [PSI]</b>		10 [145]	10 [145]	10 [145]	9 [130]	7 [102]	5 [73]	4 [58]	3 [43.5]	3 [43.5]
<b>Min. Starting Torque, daNm [lb-in]</b>		8 [710]	15 [1330]	20 [1770]	24 [2124]	32 [2832]	41 [3630]	50 [4425]	50 [4425]	50 [4425]
<b>Max. Inlet Pressure bar [PSI]</b>	Cont.	175 [2540]	175 [2540]	175 [2540]	175 [2540]	175 [2540]	175 [2540]	175 [2540]	175 [2540]	175 [2540]
	Int.*	200 [2900]	200 [2900]	200 [2900]	200 [2900]	200 [2900]	200 [2900]	200 [2900]	200 [2900]	200 [2900]
	Peak**	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]

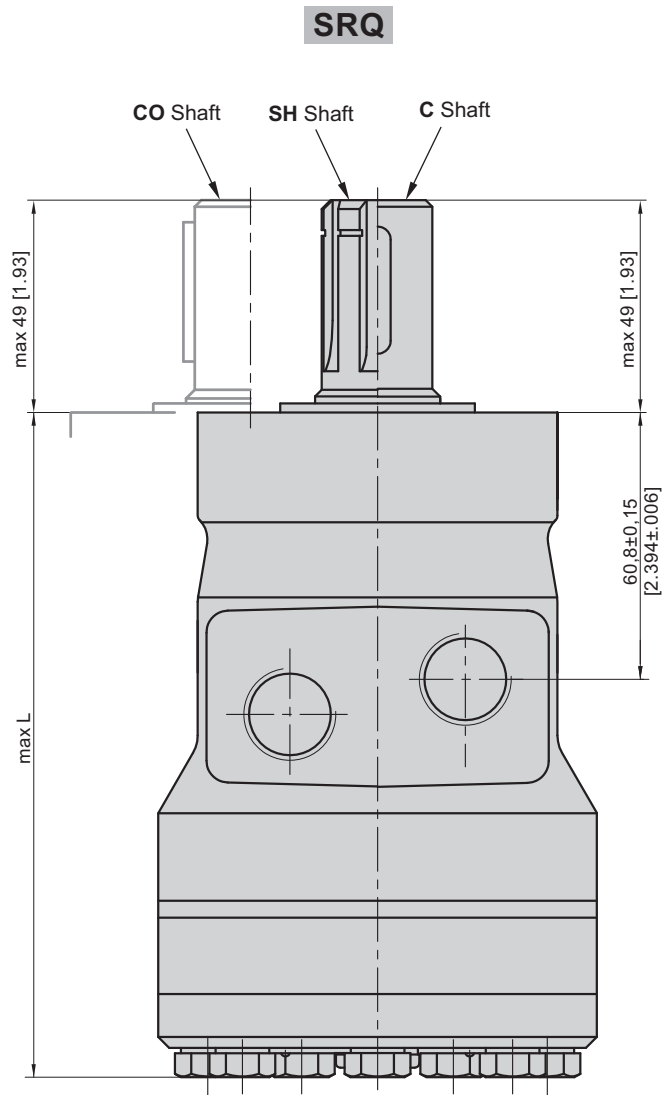
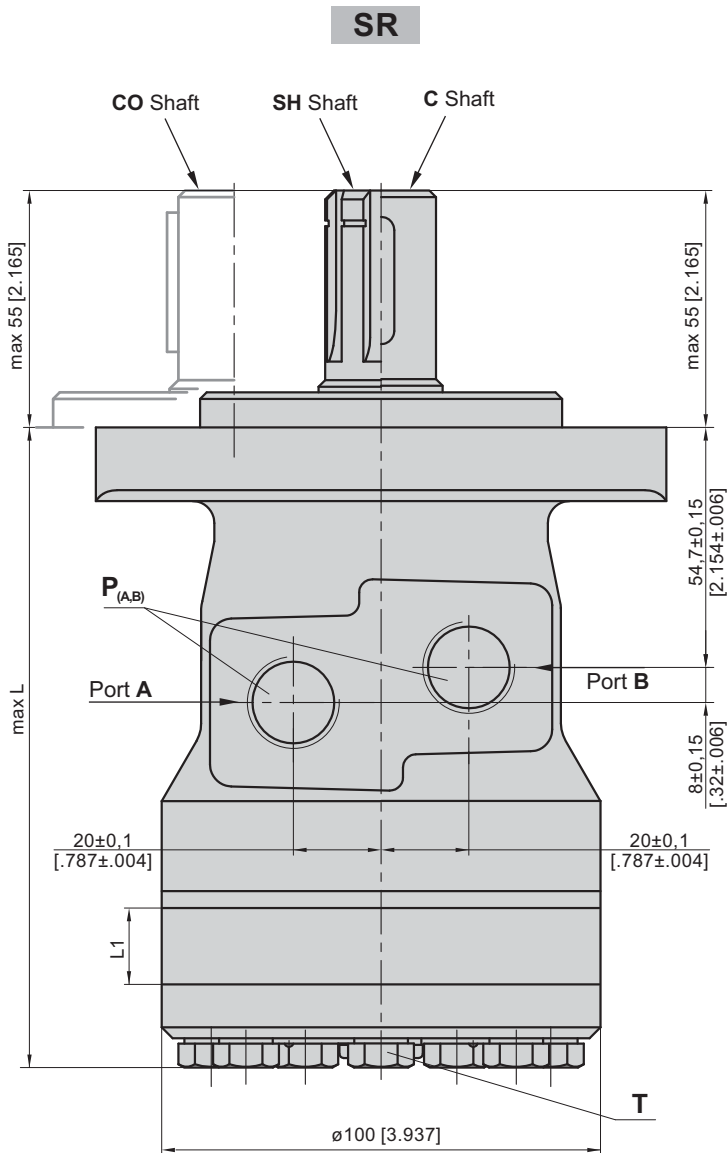
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\*\* Peak load: the permissible values may occur for max. 1% of every minute.

\*\*\* For speeds 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 ( ISO 6743/4).  
If using synthetic fluids consult the factory for alternative seal materials.
4. Recommended minimum oil viscosity 13 mm<sup>2</sup>/s [70 SUS] at 50°C [122°F].
5. Recommended maximum system operating temperature is 82°C [180°F].
6. To assure optimum motor life fill with fluid prior to loading and run at moderate load and speed for 10-15 minutes.

**DIMENSIONS AND MOUNTING DATA**



P<sub>(A,B)</sub>: 2xG1/2 - 18 mm [.709 in] depth  
 T : G1/4 - 12 mm [.47 in] depth

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

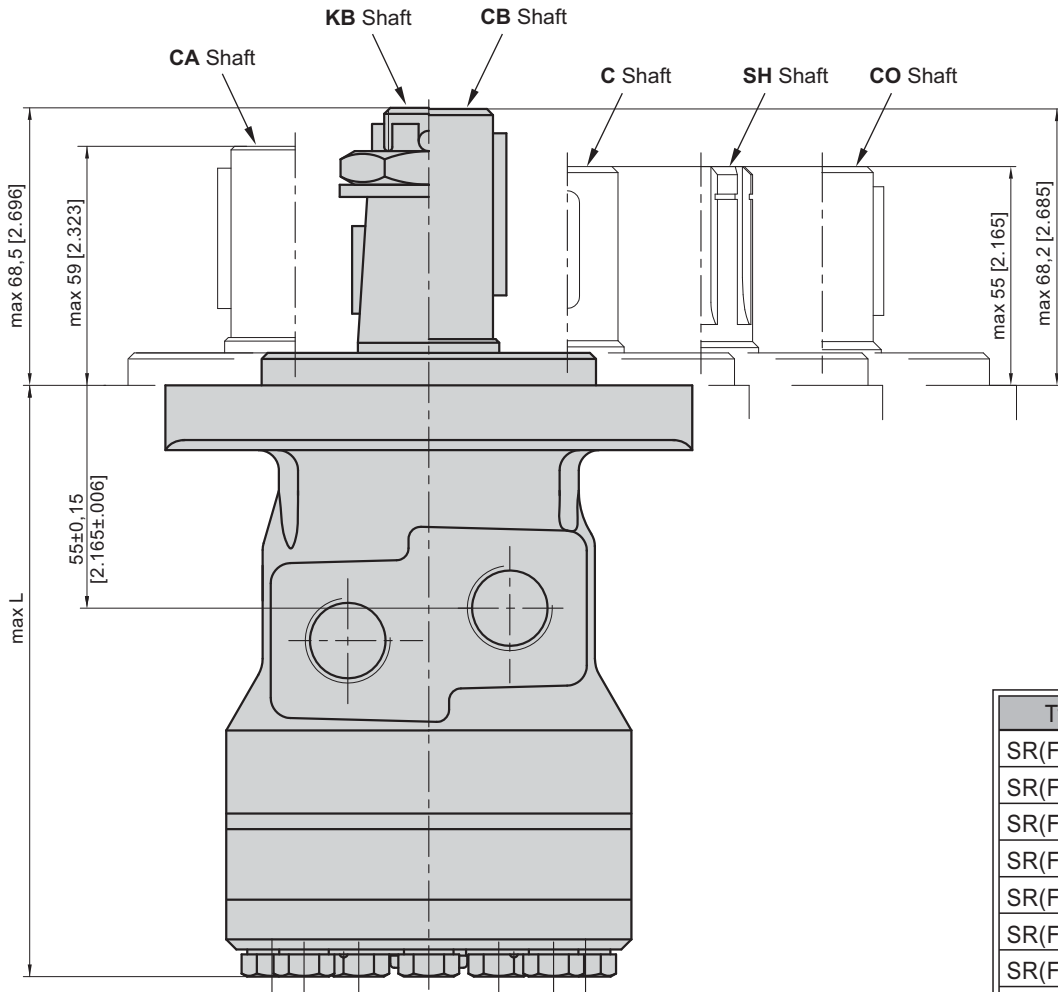
**Reverse Rotation**  
 Viewed from Shaft End  
 Port A Pressurized - CCW  
 Port B Pressurized - CW

Type	L <sub>max</sub> , mm [in]	Type	L <sub>max</sub> , mm [in]	L <sub>1</sub> , mm [in]
SR(F) 50	138 [5.43]	SRQ 50	144 [5.67]	9,0 [.35]
SR(F) 80	143 [5.63]	SRQ 80	149 [5.87]	14,0 [.55]
SR(F) 100	146,5 [5.77]	SRQ 100	152,6 [6.0]	17,4 [.69]
SR(F) 125	151 [5.94]	SRQ 125	157 [6.18]	21,8 [.89]
SR(F) 160	157 [6.18]	SRQ 160	163 [6.42]	27,8 [1.09]
SR(F) 200	164 [6.46]	SRQ 200	170 [6.69]	34,8 [1.37]
SR(F) 250	172,5 [6.79]	SRQ 250	178,5 [7.03]	43,5 [1.71]
SR(F) 315	184 [7.24]	SRQ 315	190 [7.48]	54,8 [2.16]
SR(F) 400	198,5 [7.81]	SRQ 400	205,5 [8.9]	69,4 [2.73]



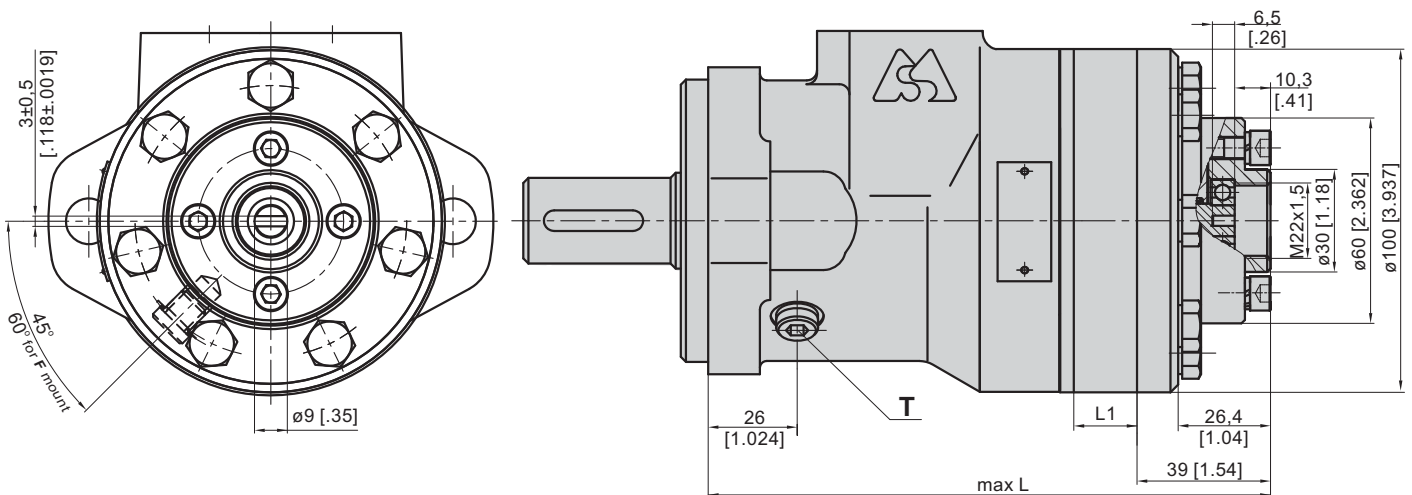
**DIMENSIONS AND MOUNTING DATA**

**SRF...**



Type	L <sub>max</sub> , mm [in]	L <sub>1</sub> , mm [in]
SR(F) 50 T	157 [6.18]	9,0 [.35]
SR(F) 80 T	162 [6.38]	14,0 [.55]
SR(F) 100 T	166 [6.53]	17,4 [.69]
SR(F) 125 T	170 [6.69]	21,8 [.89]
SR(F) 160 T	176 [6.93]	27,8 [1.09]
SR(F) 200 T	183 [7.20]	34,8 [1.37]
SR(F) 250 T	191 [7.52]	43,5 [1.71]
SR(F) 315 T	203 [7.99]	54,8 [2.16]
SR(F) 400 T	217 [8.54]	69,4 [2.73]

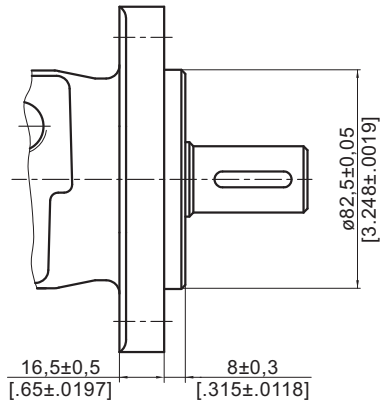
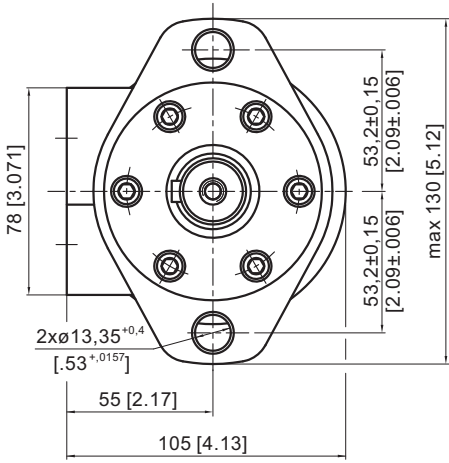
**SR(F)...T**



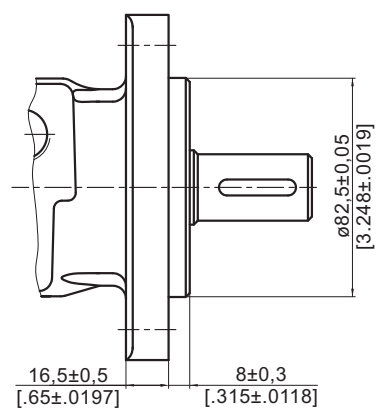
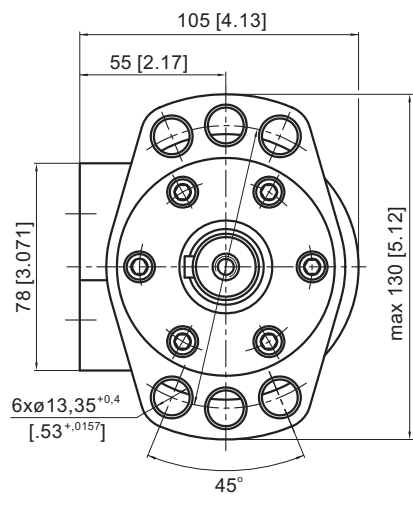
T : G1/8 - 10 mm [.39 in] depth for SR(F)...T

**MOUNTING**

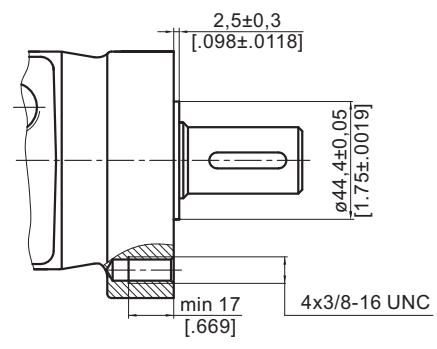
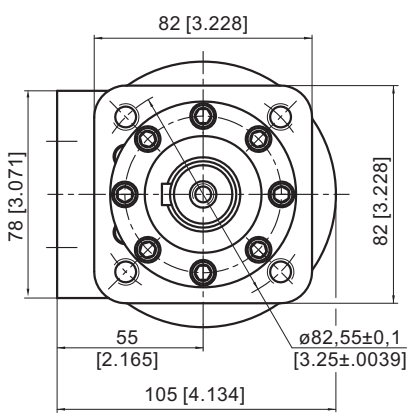
Oval Mount (2 Holes)



**F** Oval Mount (6 holes)



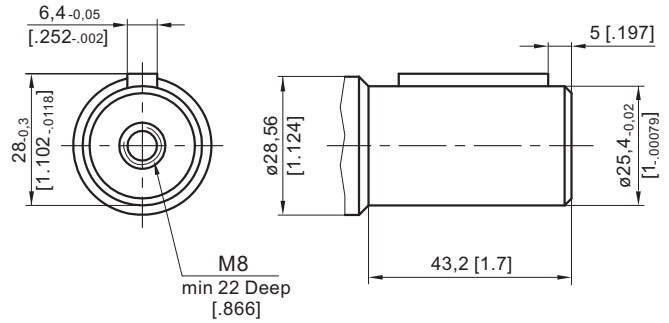
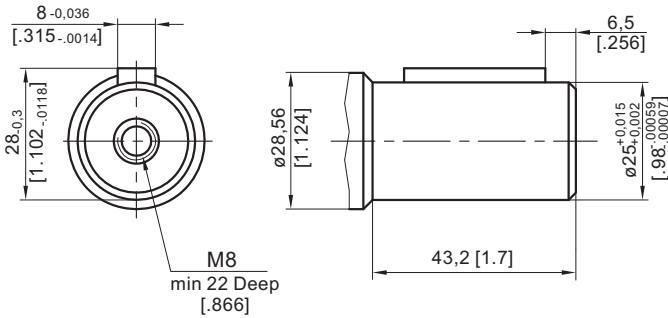
**Q** Square Mount (4 bolts)



**SHAFT EXTENSIONS**

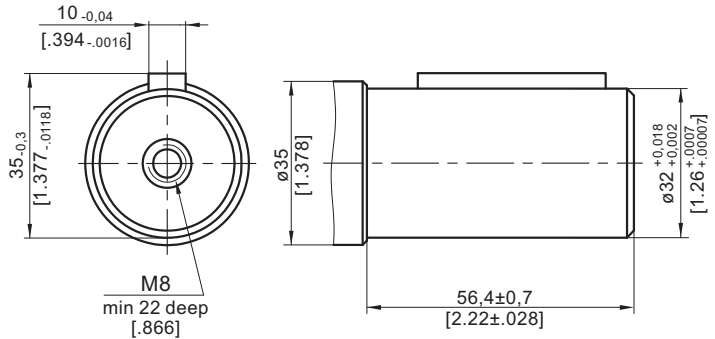
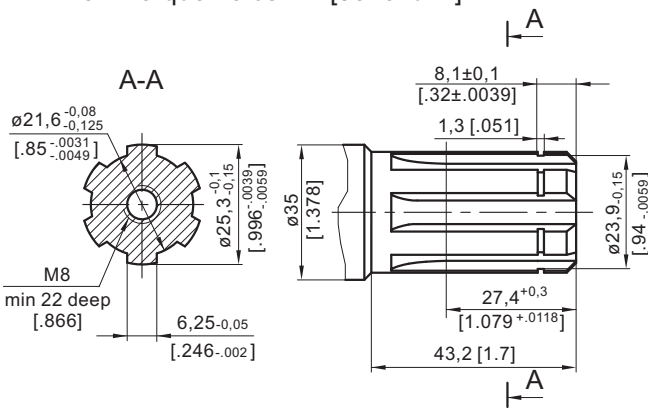
**C** -  $\varnothing 25$  straight, Parallel key A8x7x30 DIN 6885  
Max. Torque 34 daNm [3010 lb-in]

**CO** -  $\varnothing 1"$  straight, Parallel key  $\frac{1}{4} \times \frac{1}{4} \times 1\frac{1}{4}$  BS46  
Max. Torque 34 daNm [3010 lb-in]



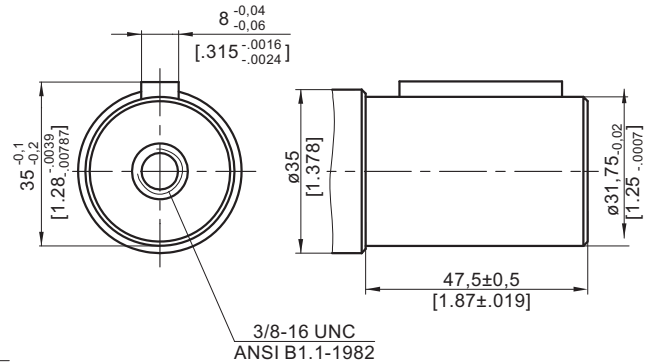
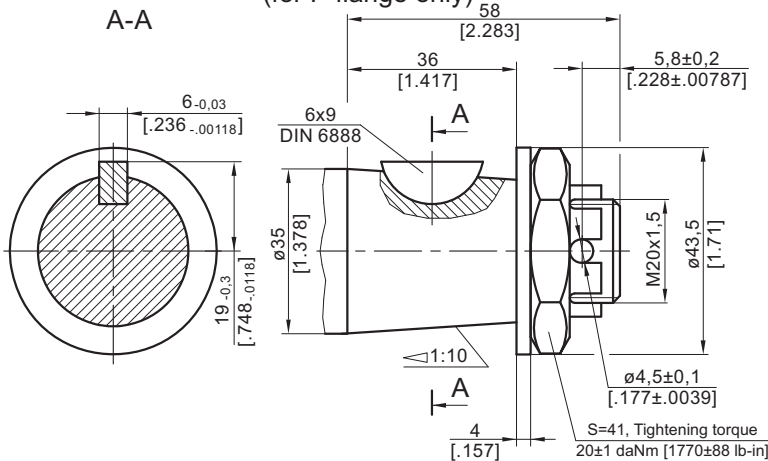
**SH** - splined, BS 2059 (SAE 6B)  
Max. Torque 40 daNm [3540 lb-in]

**CB** -  $\varnothing 32$  straight, Parallel key 10x8x40 DIN 6885  
Max. Torque 77 daNm [6815 lb-in]  
(for F-flange only)

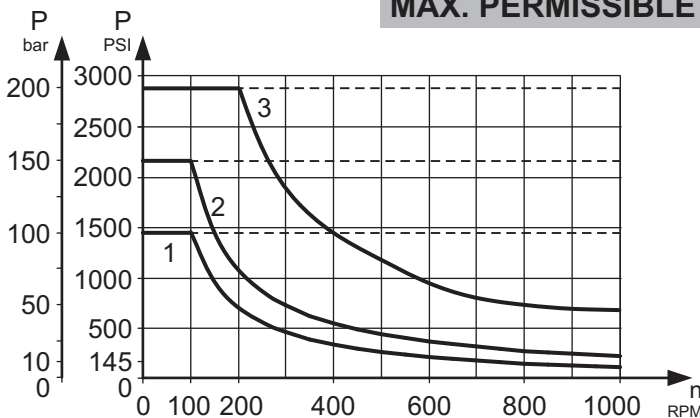


**K** - tapered 1:10, Woodruff key 6x9 DIN 6888  
Max. Torque 95 daNm [8410 lb-in]  
(for F-flange only)

**CA** -  $\varnothing 1\frac{1}{4}"$  straight, Parallel key  $\frac{5}{16} \times \frac{5}{16} \times 1\frac{1}{4}$  BS46  
Max. Torque 77 daNm [6815 lb-in]  
(for F-flange only)



**MAX. PERMISSIBLE SHAFT SEAL PRESSURE**



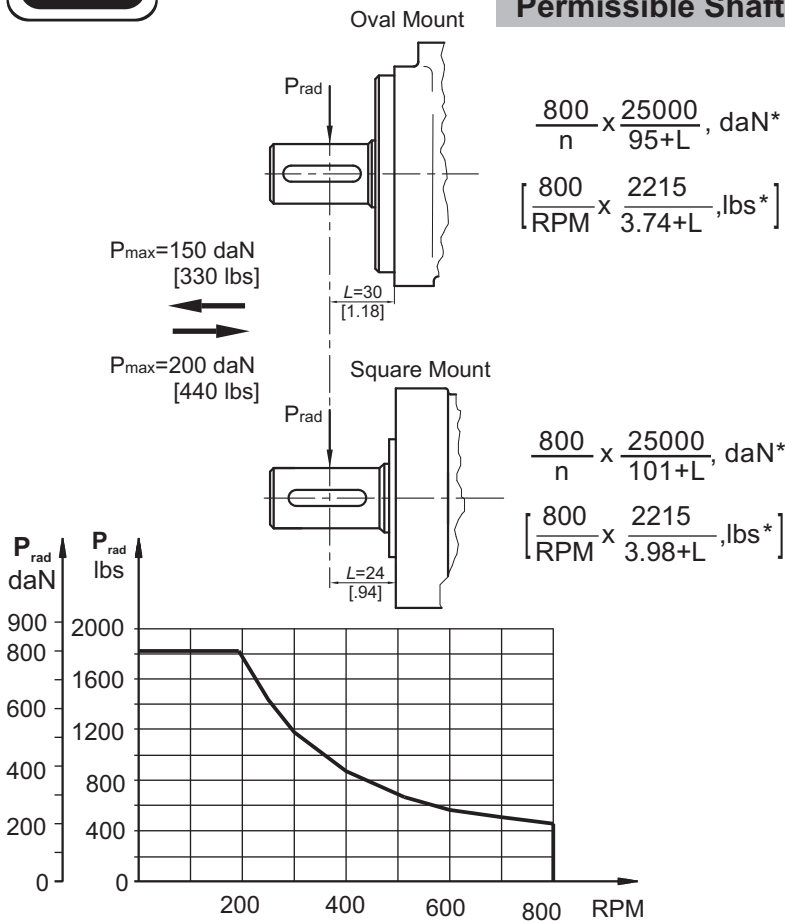
Max return pressure without drain line or max. pressure in drain line

— - continuous operations  
- - - - intermittent operations

- 1: Curve for Standard Shaft Seal for **K**, **CA**, **CB** shafts
- 2: Curve for Standard Shaft Seal for **C**, **CO**, **SH** shafts
- 3: Curve for High Pressure Seal ("U" Seal) for **C**, **CO**, **SH** shafts. Not applicable for **K**, **CA** and **CB** shafts!



**Permissible Shaft Loads SR**



Radial Shaft Load  $P_{rad}$  for C, CO Shaft Extensions by  $L=30$  mm [1.18 in] (24 mm [.94 in])

The permissible radial shaft load  $P_{rad}$  depends on the speed  $n$ , RPM, distance  $L$  from the point of load to the mounting flange and shaft version.

\*  $n \leq 200$  RPM; max  $P_{rad}=800$  daN [1800 lbs]  
 $n \geq 200$  RPM;  $L < 55$  mm [2.2 in]

**ORDER CODE**

	1	2	3	4	5	6	7
<b>SR</b>							

**Pos.1 - Mounting Flange**

- omit - Oval mount, two holes
- F** - Oval mount, six holes
- Q** - Square mount, four bolts - 3/8-16 UNC

**Pos.2 - Displacement code\*\***

- 50** - 51,5 cm<sup>3</sup>/rev [ 3.14 in<sup>3</sup>/rev]
- 80** - 80,3 cm<sup>3</sup>/rev [ 4.90 in<sup>3</sup>/rev]
- 100** - 99,8 cm<sup>3</sup>/rev [ 6.09 in<sup>3</sup>/rev]
- 125** - 125,7 cm<sup>3</sup>/rev [ 7.67 in<sup>3</sup>/rev]
- 160** - 159,6 cm<sup>3</sup>/rev [ 9.74 in<sup>3</sup>/rev]
- 200** - 199,8 cm<sup>3</sup>/rev [12.19 in<sup>3</sup>/rev]
- 250** - 250,1 cm<sup>3</sup>/rev [15.26 in<sup>3</sup>/rev]
- 315** - 315,7 cm<sup>3</sup>/rev [19.26 in<sup>3</sup>/rev]
- 400** - 397,0 cm<sup>3</sup>/rev [24.40 in<sup>3</sup>/rev]

**Pos.3 - Shaft Extensions\*\***

- C** -  $\phi 25$  straight, Parallel key A8x7x30 DIN6885
- CO** -  $\phi 1$ " straight, Parallel key  $1/4$ "x $1/4$ "x $1 1/4$ " BS46
- SH** -  $\phi 25,3$  splined, BS 2059 (SAE 6B)
- K\*** - tapered 1:10, Woodruff key 6x9 DIN 6888
- CA\*** -  $\phi 1 1/4$ " straight, Parallel key  $5/16$ "x $5/16$ "x $1 1/4$ " Bs46
- CB\*** -  $\phi 32$  straight, Parallel key 10x8x40 DIN 6885

**Pos.4 - Shaft Seal Version**

- omit - Standard shaft seal
- U** - High pressure shaft seal (Not for **K, CA, CB** Shafts)

**Pos.5 - Tacho Connection\*\*\***

- omit - Without Tacho Connection
- T** - With Tacho Connection (Not for **Q** flange and **K, CA, CB** shafts)

**Pos.6 - Special Features (see page 119)**

**Pos.7 - Design Series**

- omit - Factory specified

**NOTES:**

- \* For "F"-flange only!
- \*\* The permissible output torque for shafts must not be exceeded!
- \*\*\* Radial or axial load on tacho shaft must be avoided. Max. torque on tacho shaft 0,1 daNm [.885 lb-in]. Max. cont. return pressure without drain line 20 bar [290 PSI].

For the Function Diagrams data please look at "M+S Hydraulic" Catalogue for MR motors, pages 35÷39.

The hydraulic motors are manganese-phosphatized as standard.

# MOTOR SPECIAL FEATURES

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

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

\* For sensor ordering see pages 120÷121.

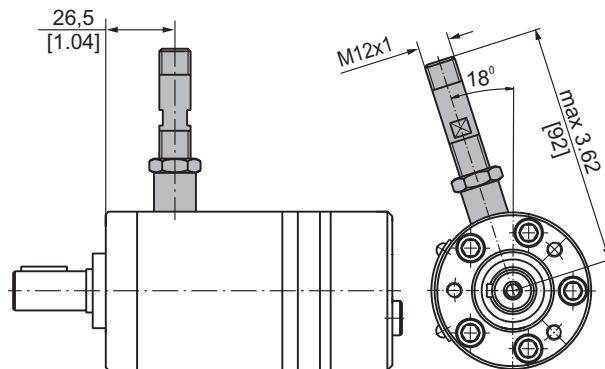
\*\* Colour at customer's request.

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

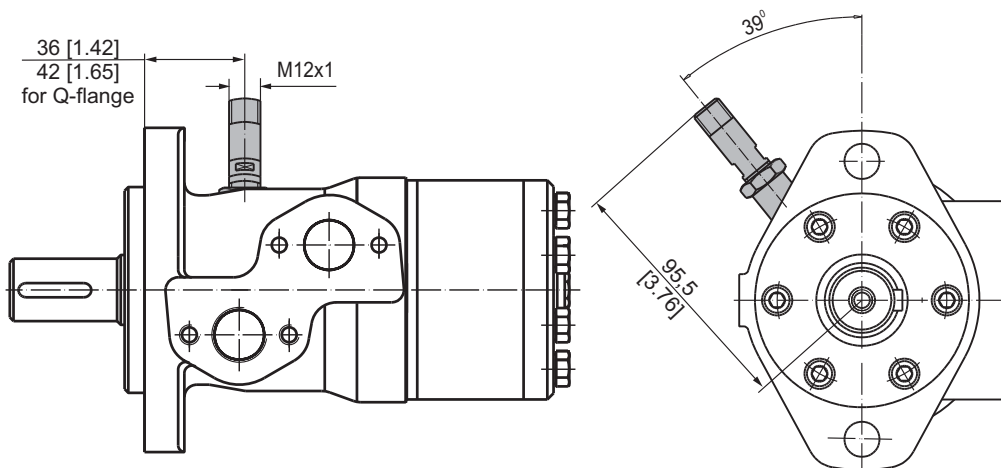
\*\*\*\* Without check valves for "U" shaft seal versions.

# MOTORS WITH SPEED SENSOR

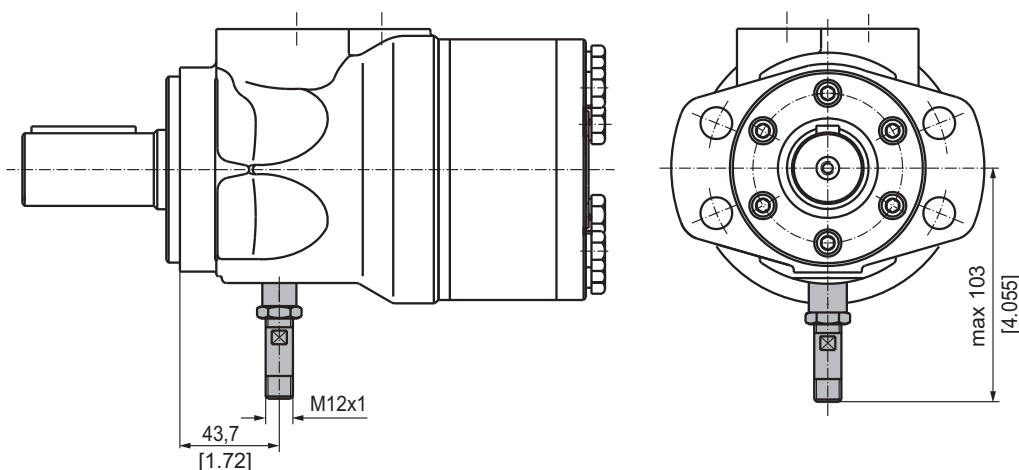
## MM...RS



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



## MH...RS

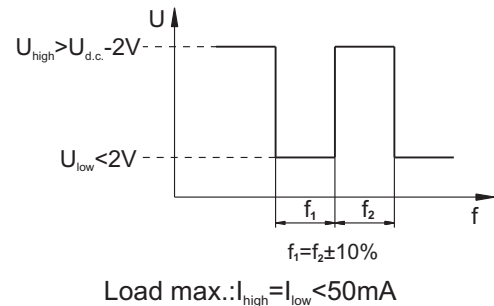


**TECHNICAL DATA OF THE SPEED SENSOR**

**Technical data**

Frequency range	0...15 000 Hz
Output	PNP, NPN
Power supply	10...36 VDC
Current input	20 mA (@24 VDC)
Ambient Temperature	-40...+125°C [-40...+257°F]
Protection	IP 67
Plug connector	M12-Series
Mounting principle	ISO 6149

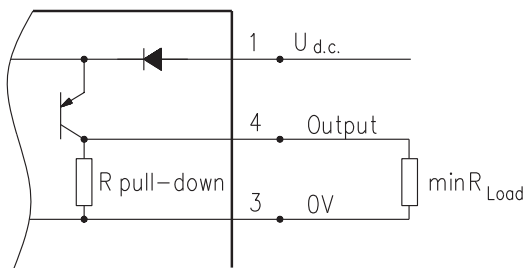
**Output signal**



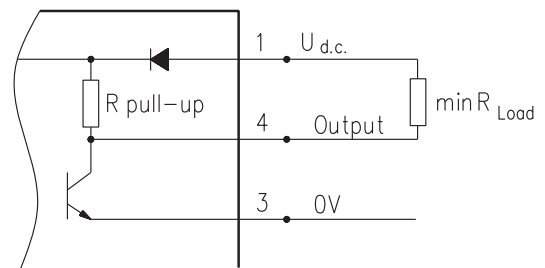
Motor type	MM	MP	MR	MH
Pulses per revolution	30	36	36	42

**Wiring diagrams**

**PNP**

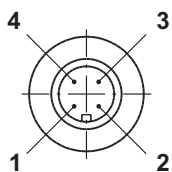


**NPN**



$$R_{Load} [\text{k}\Omega] = U_{d.c.} [\text{V}] / I_{max} [\text{mA}]$$

**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
<b>RSN</b>	NPN	Connector BINDER 713 series
<b>RSP</b>	PNP	Connector BINDER 713 series
<b>RSNL5</b>	NPN	Cable output 3x0,25; 5 m [196 in] long
<b>RSPL5</b>	PNP	Cable output 3x0,25; 5 m [196 in] 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.

# APPLICATION CALCULATION

## VEHICLE DRIVE CALCULATIONS

### 1. Motor speed: n, RPM

$$n = \frac{2,65 \times v_{km} \times i}{R_m} \quad n = \frac{168 \times v_{mi} \times i}{R_m}$$

$v_{km}$ - vehicle speed, km/h;

$v_{mi}$ - vehicle speed, mil/h;

$R_m$ - wheel rolling radius, m;

$R_m$ - wheel rolling radius, in;

$i$ - gear ratio between motor and wheels.

If no gearbox, use  $i=1$ .

### 2. Rolling resistance: RR, daN [lbs]

The resistance force resulted in wheels contact with different surfaces:

$$RR = G \times \rho$$

$G$ - total weight loaded on vehicle, daN [lbs];

$\rho$ - 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 [lbs]

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

$\alpha$ - 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. Acceleration force: FA, daN [lbs]

Force  $FA$  necessary for acceleration from 0 to maximum speed  $v$  and time  $t$  can be calculated with a formula:

$$FA = \frac{v_{km} \times G}{3,6 \times t}, [daN] \quad FA = \frac{v_{mi} \times G}{22 \times t}, [lbs];$$

$FA$ - acceleration force, daN [lbs];

$t$ - time, [s].

### 5. Tractive effort: DP, daN [lbs]

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 [lbs]

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 moment: M, daNm [in-lb]

Necessary torque moment for every hydraulic motor:

$$M = \frac{TE \times R_{in}[R_m]}{N \times i \times \eta_m}$$

$N$ - motor numbers;

$\eta_m$ -mechanical gear efficiency (if it is available).

### 8. Cohesion between tire and road covering: $M_w$ , daNm [in-lb]

$$M_w = \frac{G_w \times f \times R_{in}[R_m]}{i \times \eta_m}$$

To avoid wheel slipping, the following condition should be observed  $M_w > M$

$f$  - frictional factor;

$G_w$ - total weight over the wheels, daN [lbs].

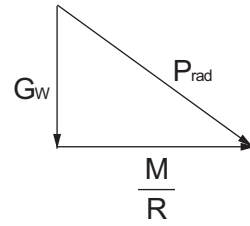
Table 3

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 [lbs]**

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.

