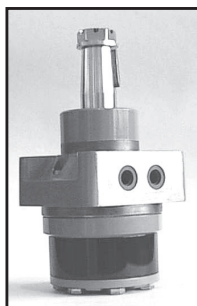
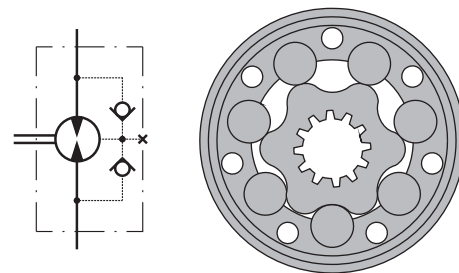


HYDRAULIC MOTORS MLHHW



APPLICATION

- » Conveyors
- » Feeding mechanism of robots and manipulators
- » Metal working machines
- » Textile machines
- » Machines for agriculture
- » Food industries
- » Mining machinery etc.



CONTENTS

Specification data	53+54
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Shaft extensions	56
Permissible shaft loads	57
Order code	57

OPTIONS

- » Model- Disk valve, roll-gerotor
- » Side port
- » Shaft - straight, splined and tapered
- » SAE and BSPP ports
- » Other special features

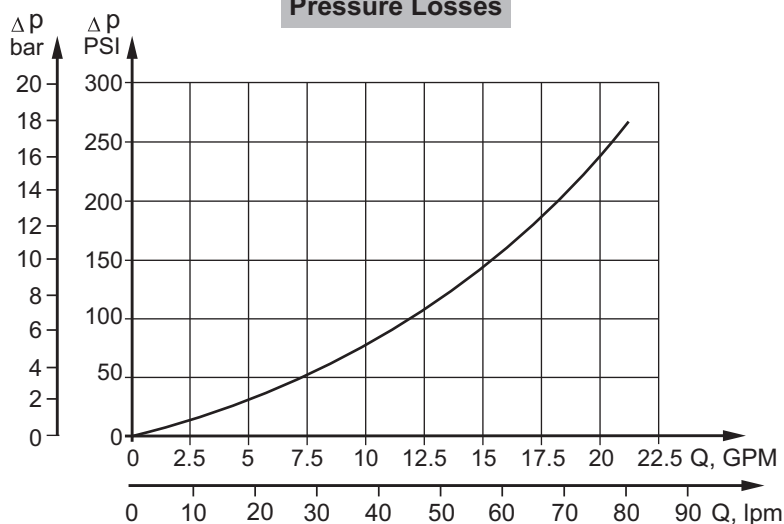
GENERAL

Max. Displacement,	in ³ /rev [cm ³ /rev]	33.55 [550]
Max. Speed,	[RPM]	475
Max. Torque,	lb-in [daNm]	cont.: 8700 [98,3] int.: 9450 [106,8]
Max. Output,	HP [kW]	29 [21,6]
Max. Pressure Drop,	PSI [bar]	cont.: 3000 [205] int. 3250 [225]
Max. Oil Flow,	GPM [lpm]	20 [75]
Min. Speed,	[RPM]	5
Pressure fluid		Mineral based- HLP(DIN 51524) or HM(ISO 6743/4)
Temperature range,	°F [°C]	-22÷194 [-30÷90]
Optimal Viscosity range,	SUS [mm ² /s]	98÷347 [20÷75]
Filtration		ISO code 20/16 (Min. recommended fluid filtration of 25 microns)

Oil flow in drain line

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

Pressure Losses



SPECIFICATION DATA

Type		MLHHW 125	MLHHW 160	MLHHW 200	MLHHW 235	MLHHW 250	MLHHW 300	MLHHW 315	MLHHW 350
Displacement, in³/rev [cm³/rev]		7.69 [126]	9.64 [157,8]	12.28 [201,3]	14.33 [235,3]	15.37 [252]	18.3 [300]	19.21 [314,9]	21.21 [347,8]
Max. Speed, [RPM]	Cont. for LL/LSV vers	357/200	380/200	373/200	319/200	298/200	250/200	238/200	216/200
	Int.* for LL/LSV vers.	476/250	475/250	497/250	425/250	397/250	333/250	318/250	288-250
Max. Torque	Cont.	4000 [35]	3900 [44]	4870 [55]	5710 [64,5]	6110 [69]	7170 [81]	7520 [85]	8320 [94]
lb-in [daNm]	Int.*	3410 [38,5]	4250 [48]	5310 [60]	6200 [70]	6640 [75]	7880 [89]	8230 [93]	9030 [102]
Max. Output HP [kW]	Cont. for LL version	21.7 [16,2]	23.6 [17,6]	24.9 [18,6]	24.4 [18,2]	22.5 [16,8]	22.1 [16,5]	22 [16,4]	18.2 [16,5]
	Cont. for LSV version	7.2 [5,4]	10.3 [7,7]	13 [9,7]	15 [11,2]	16.1 [12]	18.1 [13,5]	19.3 [14,4]	23.9 [16]
	Int.* for LL version	25.5 [19,8]	29 [21,6]	31 [23,1]	30.3 [22,6]	27.9 [20,8]	27.9 [20,8]	27.9 [20,8]	27.9 [20,8]
	Int.* for LSV version	9.5 [7,1]	14.8 [11]	17.6 [13,1]	19.4 [14,5]	20.9 [15,6]	21.2 [15,8]	21.6 [16,1]	21.7 [16,2]
Max. Pressure	Cont.	3000 [205]	3000 [205]	3000 [205]	3000 [205]	3000 [205]	3000 [205]	3000 [205]	3000 [205]
Drop, PSI [bar]	Int.*	3250 [225]	3250 [225]	3250 [225]	3250 [225]	3250 [225]	3250 [225]	3250 [225]	3250 [225]
Max. Oil Flow GPM [lpm]	Cont. for LL version	11.9 [45]	16 [60]	20 [75]	20 [75]	20 [75]	20 [75]	20 [75]	20 [75]
	Cont. for LSV version	6.6 [25]	8.5 [32]	10.6 [40]	12.4 [47]	13.2 [50]	16 [60]	16.6 [63]	18.5 [70]
	Int.* for LL version	15.8 [60]	20 [75]	26.4 [100]	26.4 [100]	26.4 [100]	26.4 [100]	26.4 [100]	26.4 [100]
	Int.* for LSV version	8.5 [32]	10.6 [40]	13.2 [50]	15.6 [59]	16.6 [63]	20 [75]	20.9 [79]	23 [87]
Max. Inlet Pre- ssure, PSI [bar]	Cont.	3050 [210]	3050 [210]	3050 [210]	3050 [210]	3050 [210]	3050 [210]	3050 [210]	3050 [210]
	Int.*	3625 [250]	3625 [250]	3625 [250]	3625 [250]	3625 [250]	3625 [250]	3625 [250]	3625 [250]
Max. Starting Pressure with Unloaded Shaft, PSI [bar]		145 [10]	145 [10]	145 [10]	145 [10]	145 [10]	145 [10]	145 [10]	145 [10]
Min. Starting Torque, lb-in [daNm]	At max.press.drop Cont	2540 [28,7]	3185 [36]	3990 [45,1]	4670 [52,8]	5000 [56,5]	5875 [66,4]	6170 [69,7]	6820 [77]
	At max.press.drop Int.*	2790 [31,5]	3480 [39,3]	4355 [49,2]	5080 [57,4]	5443 [61,5]	6450 [72,9]	6745 [76,2]	7400 [83,6]
Min. Speed***, [RPM]		10	10	10	10	10	10	10	8
Weight, lb [kg]		26.2 [11,9]	20.9 [12,2]	28 [12,7]	28.9 [13,1]	29.3 [13,3]	30.2 [13,7]	30.6 [13,9]	31.5 [14,3]

* 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.

- Intermittent speed and intermittent pressure drop 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 70 SUS [13 mm²/s] at 122°F [50°C].
- Recommended maximum system operating temperature is 180°F [82°C].
- To assure optimum motor life fill with fluid prior to loading and run at moderate load and speed for 10-15 minutes.

SPECIFICATION DATA

Type		MLHHW 370	MLHHW 400	MLHHW 470	MLHHW 500	MLHHW 535	MLHHW 550
Displacement, in³/rev [cm³/rev]		22.51 [369,2]	24.2 [396,8]	28.71 [470,6]	30.65 [502,4]	32.7 [535]	33.55 [550]
Max. Speed,	Cont.	203	189	159	149	140	136
[RPM]	Int.*	271	252	244	229	215	209
Max. Torque	Cont.	8495 [96]	8495 [96]	8140 [92]	8055 [91]	7965 [90]	7877 [89]
lb-in [daNm]	Int.*	9290 [105]	8675 [98]	8940 [101]	8940 [101]	9205 [104]	9290 [105]
Max. Output	Cont.	17.7 [13,2]	16.8 [12,5]	14.2 [10,6]	14.5 [10,8]	12.6 [9,4]	12.1 [9,0]
HP [kW]	Int.*	25.7 [19,2]	24.8 [18,5]	23.3 [17,4]	23.9 [17,8]	22 [16,4]	21.2 [15,8]
Max. Pressure	Cont.	3000 [205]	2685 [185]	2175 [150]	2030 [140]	1885 [130]	1810 [125]
Drop, PSI [bar]	Int.*	3250 [225]	2755 [190]	2390 [165]	2250 [155]	2175 [150]	2100 [145]
Max. Oil Flow	Cont.	20 [75]	20 [75]	20 [75]	20 [75]	20 [75]	20 [75]
GPM [lpm]	Int.*	26 [100]	26 [100]	30 [115]	30 [115]	30 [115]	30 [115]
Max. Inlet Pressure	Cont.	3050 [210]	3050 [210]	3050 [210]	3050 [210]	3050 [210]	3050 [210]
PSI [bar]	Int.*	3625 [250]	3625 [250]	3625 [250]	3625 [250]	3625 [250]	3625 [250]
Max. Starting Pressure with Unloaded Shaft, PSI [bar]		145 [10]	145 [10]	145 [10]	145 [10]	145 [10]	145 [10]
Min. Starting Torque,	At max.press.dropCont	7035 [79,5]	6965 [78,7]	6670 [75,4]	6600 [74,6]	6530 [73,8]	6450 [72,9]
lb-in [daNm]	At max.press.drop Int.*	7610 [86]	7110 [80,3]	7330 [82,8]	7330 [82,8]	7540 [85,2]	7470 [84,4]
Min. Speed***, [RPM]		8	8	8	8	5	5
Weight, lb [kg]		31.9 [14,5]	32.8 [14,9]	34.6 [15,7]	35.3 [16]	36.1 [16,4]	36.4 [16,5]

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

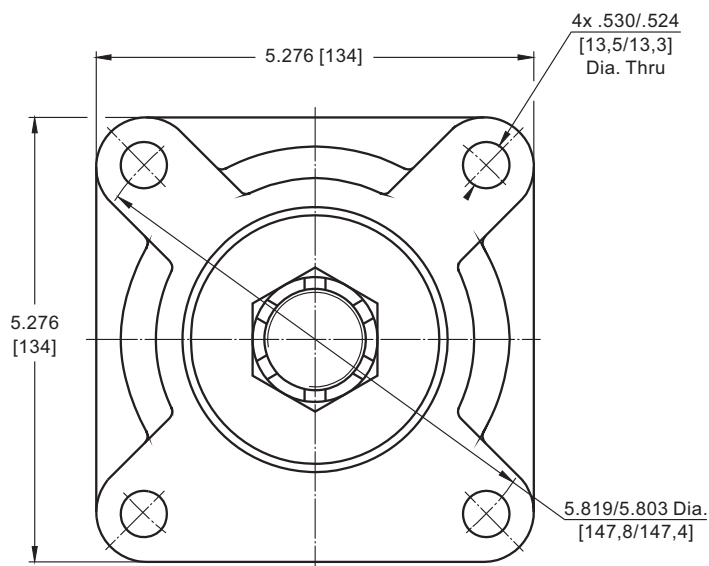
** Peak load: the permissible values may occur for max. 1% of every minute.

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

- Intermittent speed and intermittent pressure drop 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 70 SUS [13 mm²/s] at 122°F [50°C].
- Recommended maximum system operating temperature is 180°F [82°C].
- 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

MLHHW...



Type	L _{max} in [mm]	L _{Kmax} in [mm]	L ₁ in [mm]
MLHHW[K] 125	4.72 [120]	5.00 [127]	.68 [17,4]
MLHHW[K] 160	4.92 [125]	5.16 [131]	.86 [21,8]
MLHHW[K] 200	5.16 [131]	5.39 [137]	1.09 [27,8]
MLHHW[K] 235	5.35 [136]	5.59 [142]	1.28 [32,5]
MLHHW[K] 250	5.43 [138]	5.67 [144]	1.37 [34,8]
MLHHW[K] 300	5.67 [144]	5.94 [151]	1.63 [41,4]
MLHHW[K] 315	5.79 [147]	6.02 [153]	1.71 [43,5]
MLHHW[K] 350	5.94 [151]	6.18 [157]	1.89 [48,0]
MLHHW[K] 370	6.06 [154]	6.30 [160]	2.01 [51,0]
MLHHW[K] 400	6.22 [158]	6.46 [164]	2.16 [54,8]
MLHHW[K] 470	6.61 [168]	6.85 [174]	2.56 [65,0]
MLHHW[K] 500	6.77 [172]	7.05 [179]	2.73 [69,4]
MLHHW[K] 535	6.97 [177]	7.20 [183]	2.92 [74,1]
MLHHW[K] 550	7.05 [179]	7.28 [185]	2.99 [76,0]

Standard Rotation

Viewed from Shaft End

Port A Pressurized - **CW**

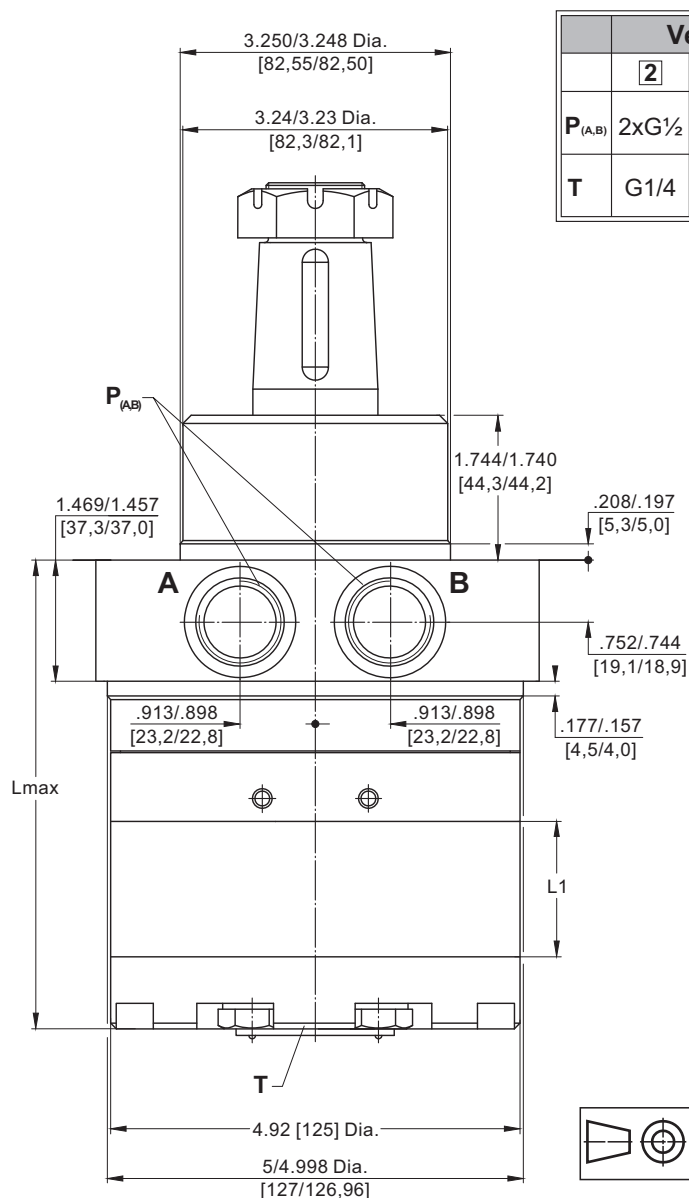
Port B Pressurized - **CCW**

Reverse Rotation

Viewed from Shaft End

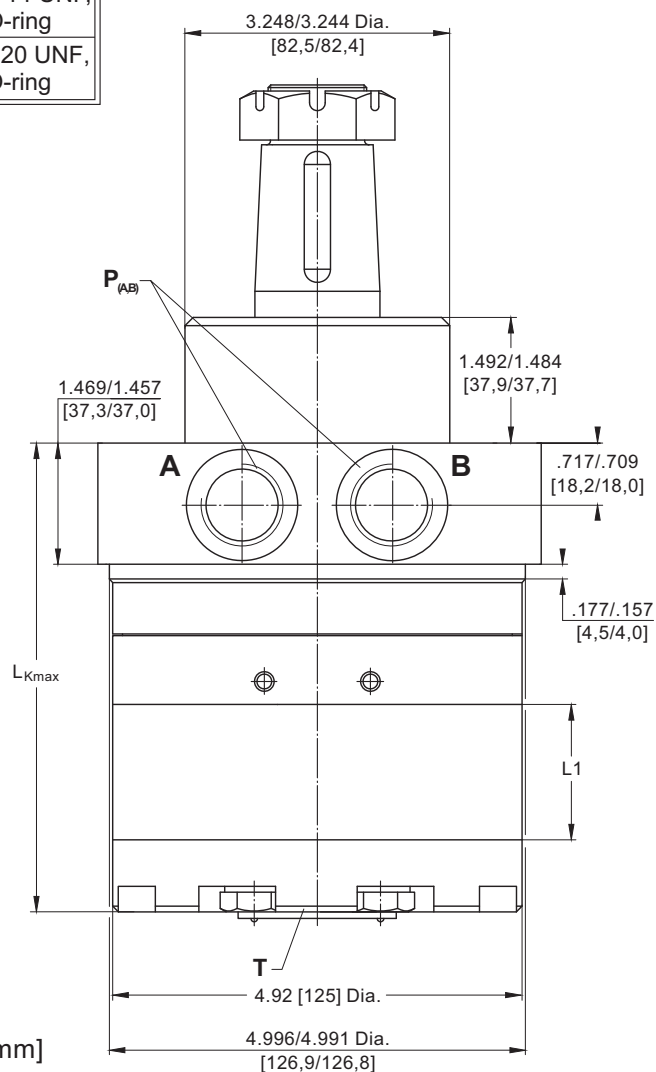
Port A Pressurized - **CCW**

Port B Pressurized - **CW**



Versions	
2	4
P _(A,B)	2xG1/2 2x7/8-14 UNF, O-ring
T	G1/4 7/16-20 UNF, O-ring

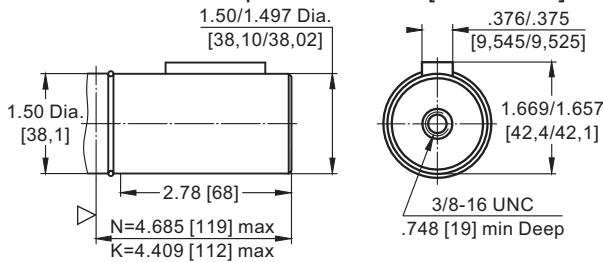
MLHHWK...



SHAFT EXTENSIONS

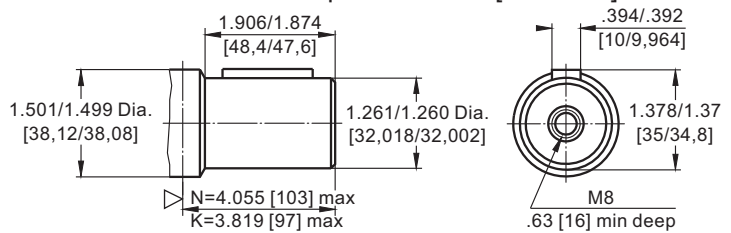
C

ø38,1 straight, Parallel key $\frac{3}{8} \times \frac{3}{8} \times 1\frac{1}{2}$ BS46
Max. Torque 10630 lb-in [120 daNm]



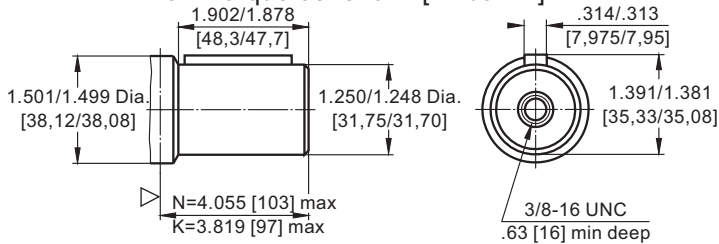
M

ø32 straight, Parallel key A10x8x32 DIN 6885
Max. Torque 6815 lb-in [77 daNm]



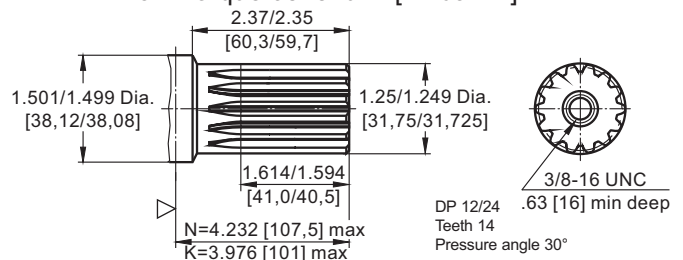
K

1¼" [31,75] straight, Parallel key $\frac{5}{16} \times \frac{5}{16} \times 1\frac{1}{2}$ BS46
Max. Torque 6815 lb-in [77 daNm]



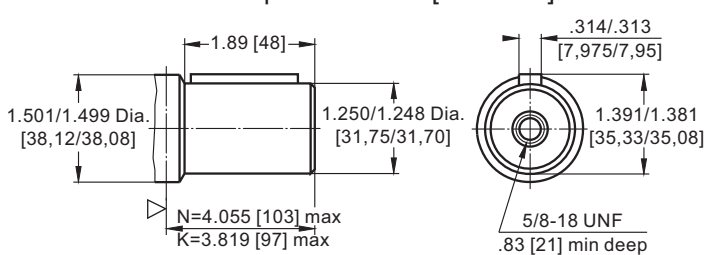
L

1¼" [31,75] splined 14T, ANSI B92.1-1976
Max. Torque 6815 lb-in [77 daNm]



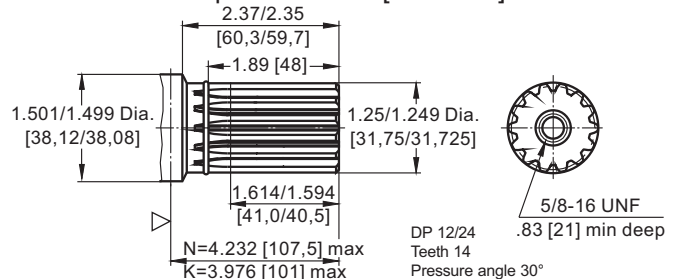
KD

1¼" [31,75] straight, Parallel key $\frac{5}{16} \times \frac{5}{16} \times 1\frac{1}{2}$ BS46
Max. Torque 6815 lb-in [77 daNm]



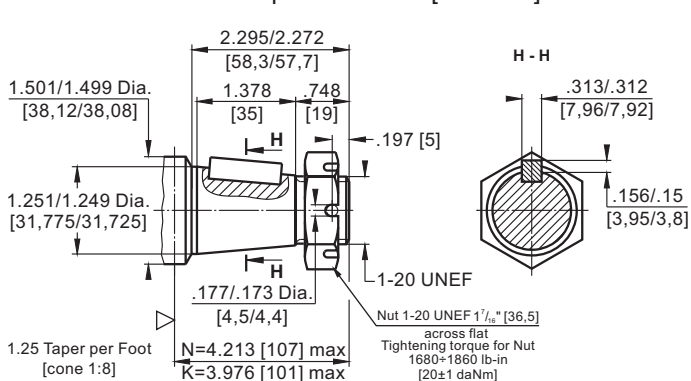
LD

1¼" [31,75] splined 14T, ANSI B92.1-1976
Max. Torque 6815 lb-in [77 daNm]



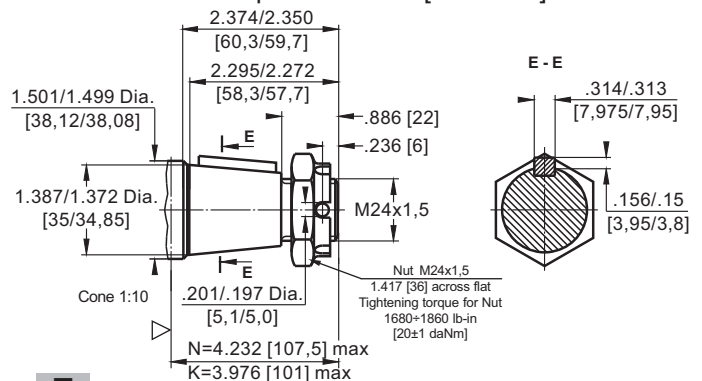
R

1½" [38,1] SAE J501 Tapered, Parallel key $\frac{5}{16} \times \frac{5}{16} \times 1$ BS46
Max. Torque 6815 lb-in [77 daNm]



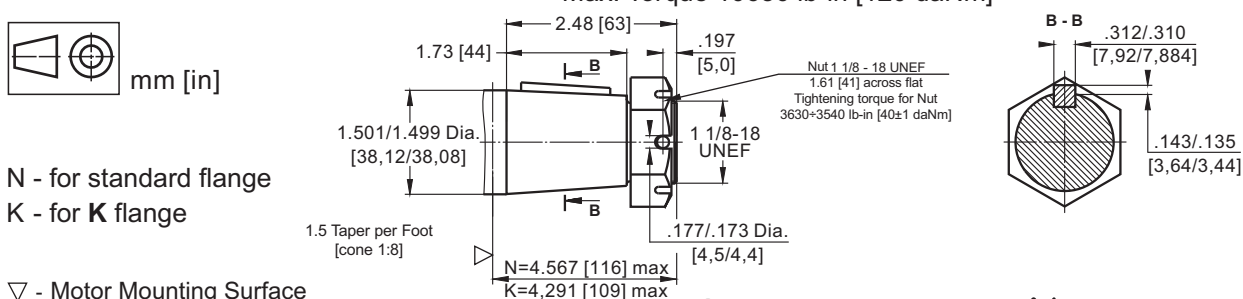
KB

ø35 tapered 1:10, Parallel key $\frac{5}{16} \times \frac{5}{16} \times 1\frac{1}{4}$ BS46
Max. Torque 8410 lb-in [95 daNm]



T

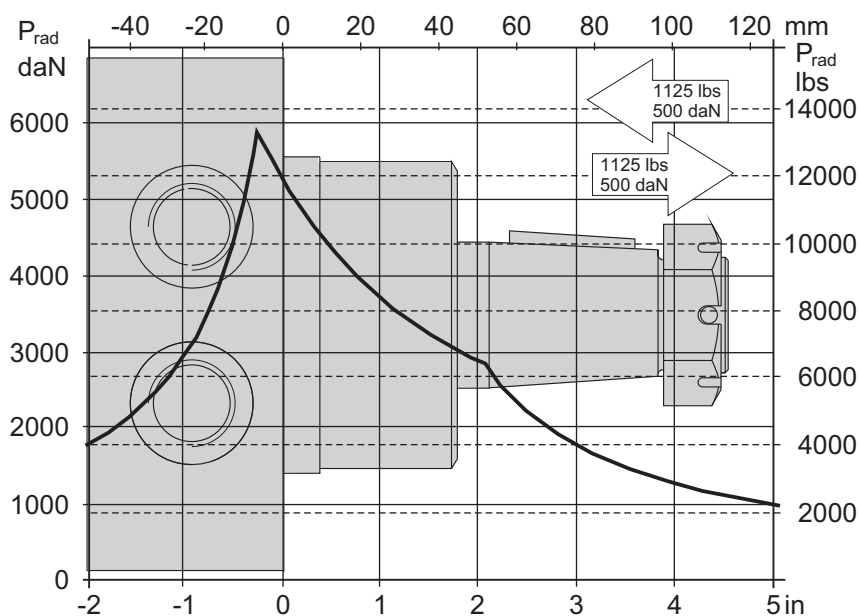
1½" [38,1] Tapered, Parallel key $\frac{5}{16} \times \frac{5}{16} \times 1\frac{1}{4}$ BS46
Max. Torque 10630 lb-in [120 daNm]



N - for standard flange
K - for K flange

▽ - Motor Mounting Surface

PERMISSIBLE SHAFT LOADS



ORDER CODE

	1	2	3	4	5	6	7
MLHHW							

Pos.1 - Mounting Flange

- omit - Standard flange, four holes
- K** - Smaller flange, four holes

Pos.2 - Displacement code

125	- 7.69 in ³ /rev [126,0 cm ³ /rev]
160	- 9.63 in ³ /rev [157,8 cm ³ /rev]
200	- 12.28 in ³ /rev [201,3 cm ³ /rev]
235	- 14.36 in ³ /rev [235,3 cm ³ /rev]
250	- 15.38 in ³ /rev [252,0 cm ³ /rev]
300	- 18.31 in ³ /rev [300,0 cm ³ /rev]
315	- 19.22 in ³ /rev [314,9 cm ³ /rev]
350	- 21.22 in ³ /rev [347,8 cm ³ /rev]
370	- 22.53 in ³ /rev [369,2 cm ³ /rev]
400	- 24.21 in ³ /rev [396,8 cm ³ /rev]
470	- 28.72 in ³ /rev [470,6 cm ³ /rev]
500	- 30.66 in ³ /rev [502,4 cm ³ /rev]
535	- 32.65 in ³ /rev [535,0 cm ³ /rev]
550	- 33.56 in ³ /rev [550,0 cm ³ /rev]

Pos.3 - Shaft Extensions*

- C** - $\varnothing 38,1$ straight, Parallel key $\frac{3}{8}$ "x $\frac{3}{8}$ "x1 $\frac{1}{2}$ " BS46
- K** - 1 $\frac{1}{4}$ "[31,75] straight, Parallel key $\frac{5}{16}$ "x $\frac{5}{16}$ "x1 $\frac{1}{2}$ " BS46
- KB** - $\varnothing 35$ tapered 1:10, Parallel key $\frac{5}{16}$ "x $\frac{5}{16}$ "x1 $\frac{1}{4}$ " BS46
- KD** - 1 $\frac{1}{4}$ "[31,75] straight, Parallel key $\frac{5}{16}$ "x $\frac{5}{16}$ "x1 $\frac{1}{2}$ " BS46 [5/8-18 UNF-2B ANSI B1.1-82]
- M** - $\varnothing 32$ straight, Parallel key 10x8x32 DIN 6885
- L** - 1 $\frac{1}{4}$ " [31,75] splined 14T, ANSI B92.1-1976 [3/8-16 UNC-2B ANSI B1.1-82]
- LD** - 1 $\frac{1}{4}$ " [31,75] splined 14T, ANSI B92.1-1976 [5/8-18 UNF-2B ANSI B1.1-82]
- R** - 1 $\frac{1}{2}$ " [38,1] Tapered, Parallel key $\frac{5}{16}$ "x $\frac{5}{16}$ "x1" BS46
- T** - 1 $\frac{1}{2}$ " [38,1] Tapered, Parallel key $\frac{5}{16}$ "x $\frac{5}{16}$ "x1 $\frac{1}{4}$ " BS46

Pos.4 - Ports

- 2** - side ports, 2xG1/2, G1/4, BSP thread, ISO 228
- 4** - side ports, 2x7/8-14 UNF, O-ring, 7/16-20 UNF

Pos.5 - Shaft Seal Version

- omit - Standard shaft seal
- U** - High pressure shaft seal (2175 PSI [150 bar])

Pos.6 - Additional Options [see page 58]

Pos.7 - Design Series

- omit - Factory specified

NOTES:

- * The permissible output torque for shafts must not be exceeded!
- ** Color at customer's request.

The hydraulic motors are manganophosphatized as standard.

MOTOR ADDITIONAL OPTIONS

Additional Options Description	Order Code	Motor type			
		MLHS	MLHT	MLHV	MLHHW
Speed Sensor*	RS	O	O	O	O
Tacho Connection**	T	O	O	O	O
Reinforced motor	HD	-	O	O	O
Reinforced motor (with check valves)	1HD	-	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
Special Paint****	PS	O	O	O	O
	PCS				

O	Optional
-	Not applicable

* For sensor ordering see pages 59÷60.

** For side ports only!

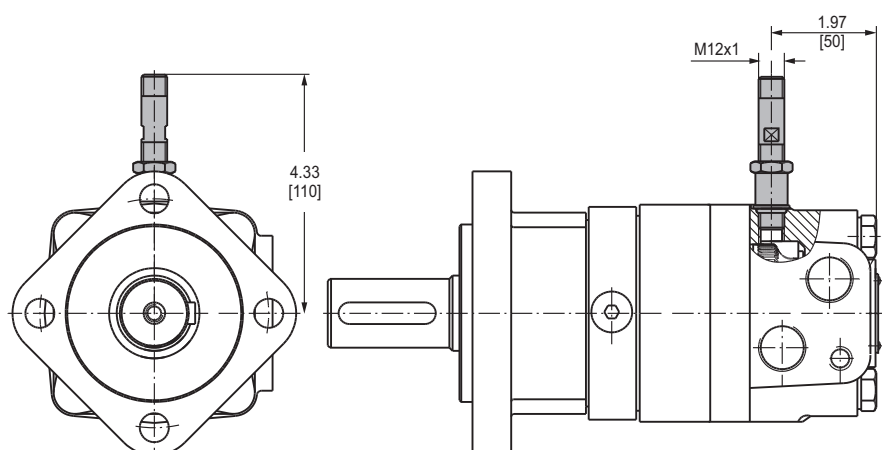
*** Colour at customer's request.

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

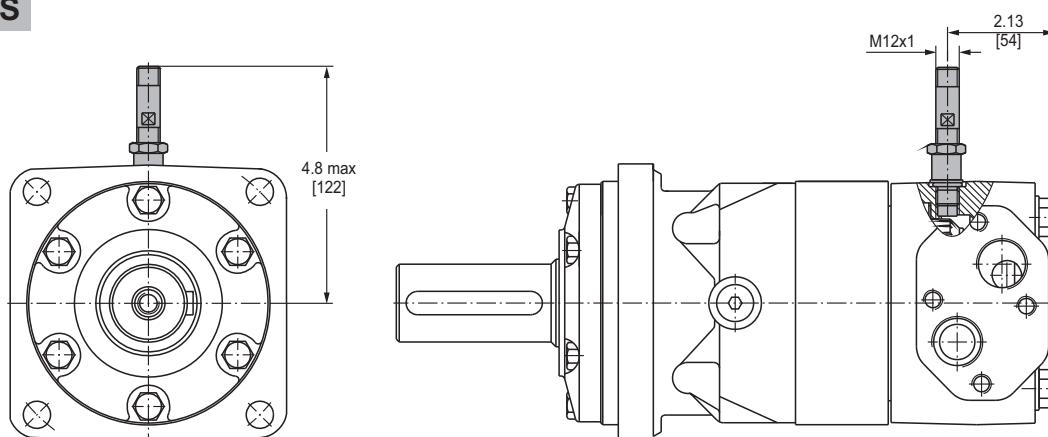
△ For more information about HD option please contact with "M+S Hydraulic".

MOTORS WITH SPEED SENSOR

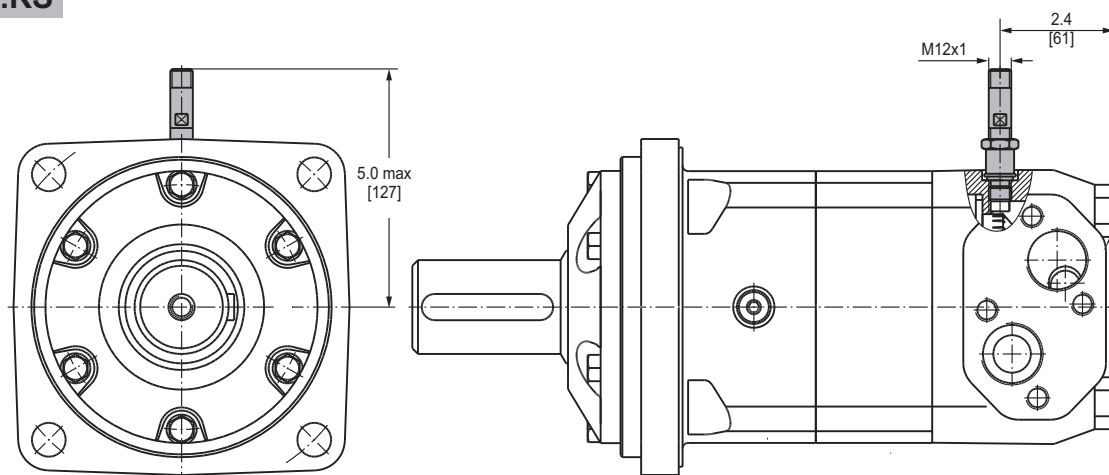
MLHS...RS



MLHT...RS

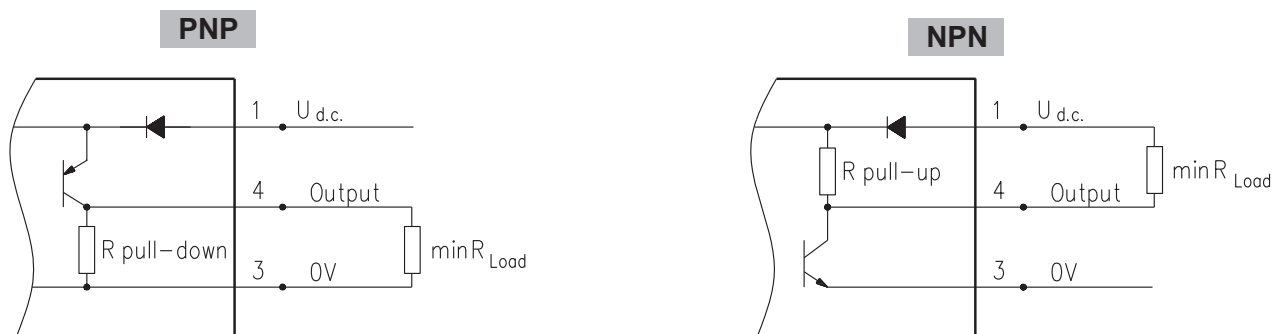


MLHV...RS



TECHNICAL DATA OF THE SPEED SENSOR

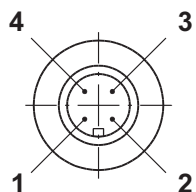
Wiring diagrams



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

Motor type	MLHS	MLHT	MLHV
Pulses per revolution	54	84	102

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	Electric connection
RS	Connector BINDER 713 series
RSL2,5	Cable output 3x0,25; 98 in [2,5 m] long
RSL3,5	Cable output 3x0,25; 138 in [3,5 m] long
RSL5	Cable output 3x0,25; 196 in [5 m] long
RSL10	Cable output 3x0,25; 394 in [10 m] 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

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

v_{km} - vehicle speed, km/h;
 v_{mi} - vehicle speed, mile/h;
 R_m - wheel rolling radius, m;
 R_{in} - wheel rolling radius, in;
 i - gear ratio between motor and wheels.
 If no gearbox, use $i=1$.

2. Rolling resistance: RR , lbs [daN]

The resistance force resulted in wheels contact with different surfaces:

$$RR = G \times \rho$$

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

ρ - rolling resistance coefficient (Table 1).

Table 1

Rolling resistance coefficient In case of rubber tire rolling on different surfaces	
Surface	ρ
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 , lbs [daN]

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

α - gradient negotiation angle (Table 2)

Table 2

Grade %	α Degrees	Grade %	α 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 , lbs [daN]

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

$$FA = \frac{v_{mi} \times G}{22 \times t}, [\text{lbs}]; \quad FA = \frac{v_{km} \times G}{36 \times t}, [\text{daN}]$$

FA - acceleration force, lbs [daN];

t - time, [s].

5. Tractive effort: DP , lbs [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 , lbs [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 moment: M , lb-in [daNm]

Necessary torque moment for every hydraulic motor:

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

N - motor numbers;

η_M -mechanical gear efficiency (if it is available).

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

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

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

f - frictional factor;

G_w - total weight over the wheels, lbs [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

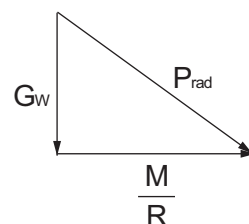
9.Radial motor loading: P_{rad} , lbs [daN]

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.

