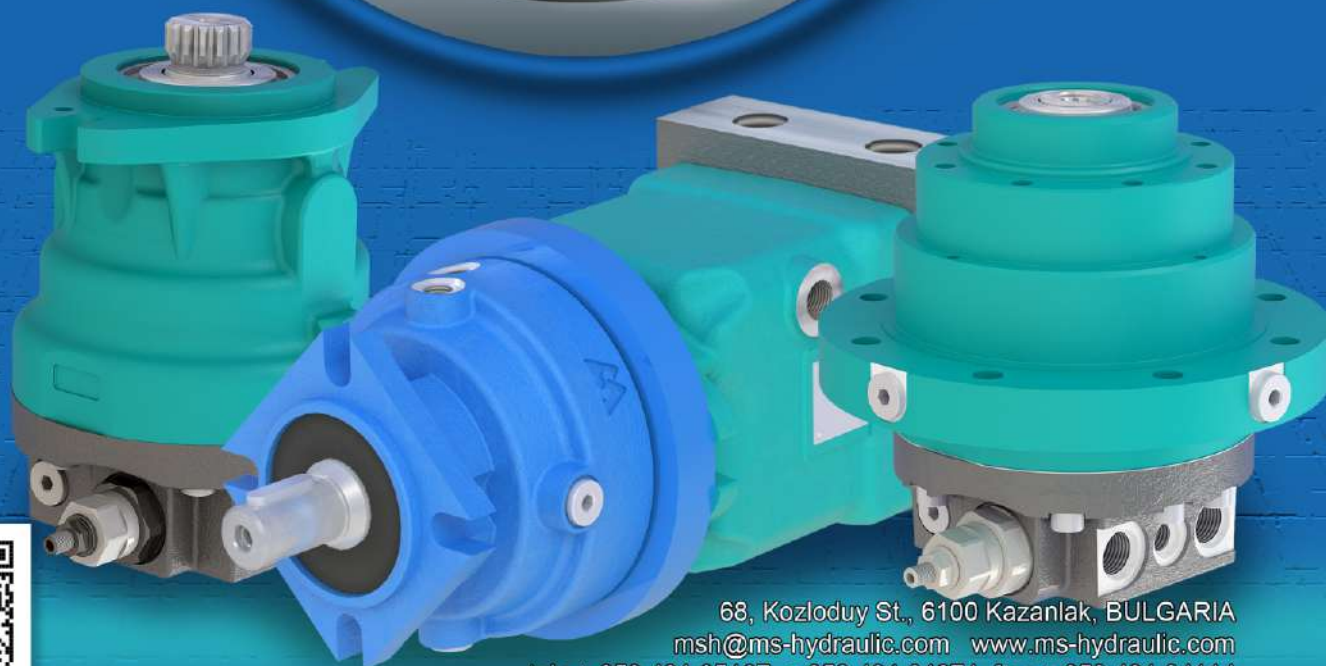




M+S HYDRAULIC

AXIAL PISTON MOTOR-BRAKES MEDIUM DUTY FIXED DISPLACEMENT

In cooperation with  **HES**
HYDRAULIC ELEMENTS & SYSTEMS



68, Kozloduy St., 6100 Kazanlak, BULGARIA
msh@ms-hydraulic.com www.ms-hydraulic.com
tel.: + 359 431 65167, + 359 431 64271, fax: + 359 431 64114

Axial Piston Motors Fixed Displacement With Integrated Brakes and Valves

<u>Technical Data of B/MAMB.....</u>	<u>3</u>
<u>Specification Dat of B/MAMB.....</u>	<u>5</u>
<u>Overall Dimensions and Ports B/MAMB.....</u>	<u>6</u>
<u>Shafts Mounting of B/MAMB.....</u>	<u>10</u>
<u>Shaft Types and Dimension</u>	<u>11</u>
<u>Ordering Code of B/MAMB21.....</u>	<u>13</u>
<u>Technical Data of B/MAMCB21.....</u>	<u>14</u>
<u>Specification Data of B/MAMCB21.....</u>	<u>16</u>
<u>Overall Dimensions and Ports B/MAMCB21....</u>	<u>17</u>
<u>Ordering Code of B/MAMCB21.....</u>	<u>21</u>
<u>MAP and MAM with LB/288 brake.....</u>	<u>22</u>
<u>Function Diagrams.....</u>	<u>23</u>
<u>Speed Sensors</u>	<u>24</u>
<u>Installation</u>	<u>26</u>
<u>Fluid Viscosity Limits</u>	<u>28</u>
<u>Basic Formulas</u>	<u>29</u>

Version history

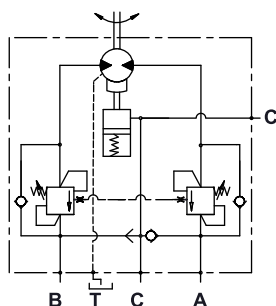
Date	Page	Changed	Ver.
April 2024		First official edition	1.1

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 provided that such alterations can be made without subsequential changes being necessary in specifications already agreed.



Hydraulic Motors Type B/MAMB

Medium Duty Axial Piston Motor Brake Fixed Displacement



APPLICATION

- » Winch drives
- » Wheel drives

OPTIONS

- » Port options
- » Shaft options
- » Integrated valves

ADVANTAGES

- » Smooth operation
- » High power density
- » Compact size



open drain line is always required

TECHNICAL DATA OF MOTOR

GENERAL

Displacement,	cm ³ /rev [in ³ /rev]	20.5÷49.2 [1.25÷3]
Max. Speed,	RPM	3600
Max. Torque,	Nm [lb-in]	195 [1725]
Max. Output,	kW [HP]	50 [67]
Max. Pressure Drop,	bar [PSI]	300 [4350]
Max. Oil Flow,	l/min [GPM]	160 [42]
Min. Speed,	RPM	500
Fluid	Mineral based- HLP(DIN 51524) or HM(ISO 6743/4)	
Temperature Range,	°C [°F]	-40÷82 [-40÷180]
Optimal Viscosity Range,	mm ² /s [SUS]	12÷68 [66÷311]
Filtration	ISO code 18/16/13 (Min. recommended fluid filtration of 10 micron)	

TECHNICAL DATA OF BRAKE

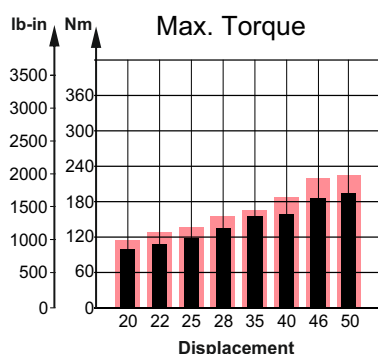
GENERAL

Static Torque,	Nm [lb-in]	300 [2655]
Opening Pressure,	bar [PSI]	min 20 [290] - max 300 [4350]
Max. Pressure in drain space,	bar [PSI]	5 [72.5]

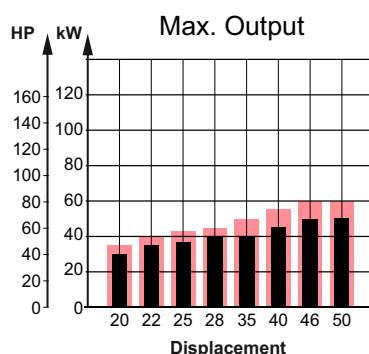
TECHNICAL DATA OF OVERCENTER VALVES

GENERAL

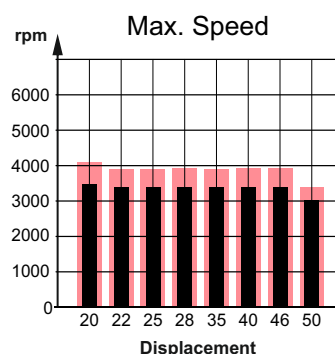
Max. Flow Rate,	l/min [GPM]	90 [23.8]
Max. Rated Pressure,	bar [PSI]	350 [5076]
Pilot Ratio,	bar [PSI]	4.25:1



Intermittent values

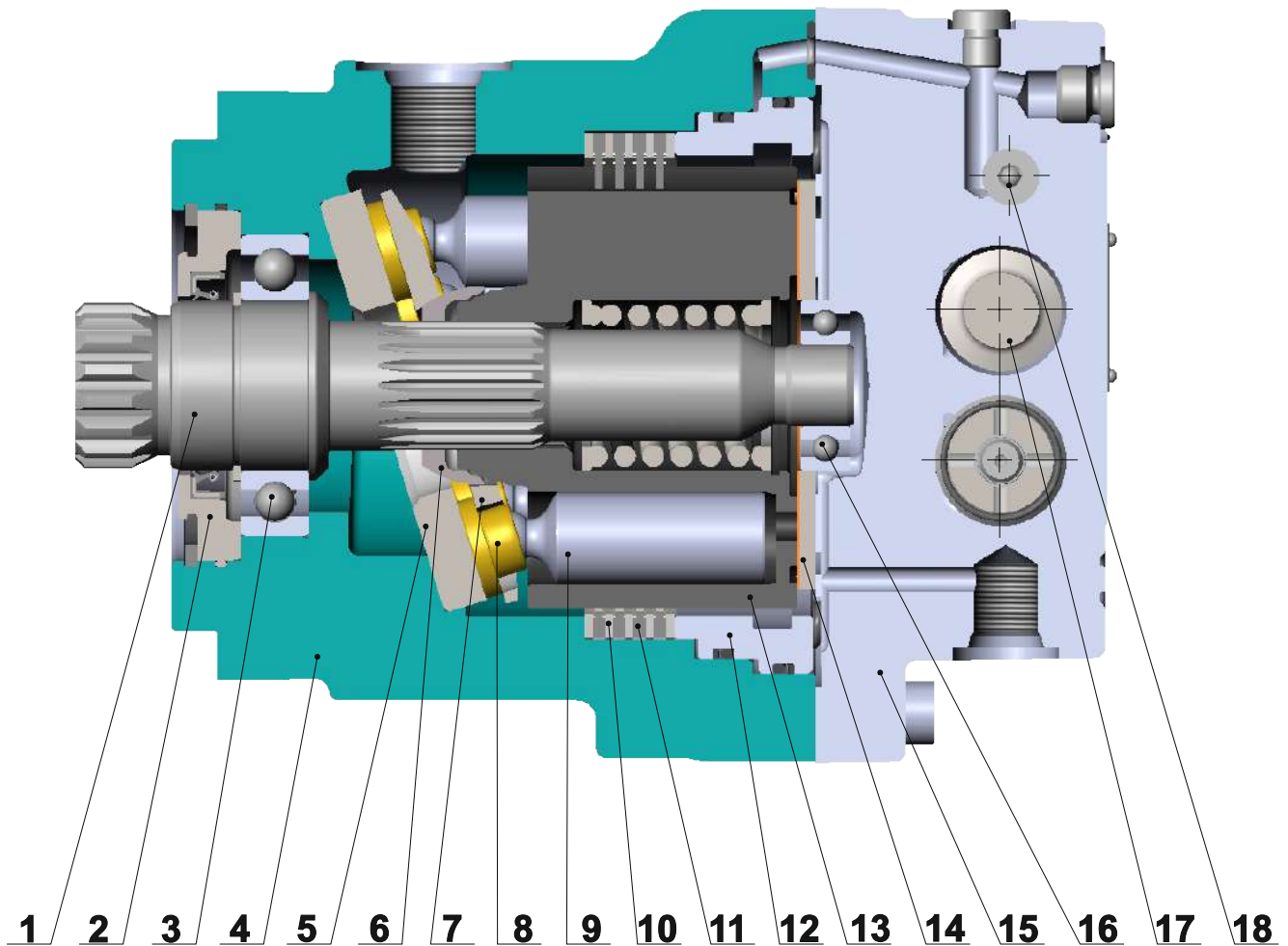


Continuous values





SECTION VIEW



1. Hardened shaft
2. Front cover
3. Ball bearing
4. Cast iron body
5. Thick support plate
6. Hardened sphere
7. Retainer plate
8. Piston shoes
9. Pistons

10. Brake discs
11. Friction discs
12. Control system
13. Cylinder block
14. Bimetal distributor
15. Cast iron end cover
16. Ball bearing
17. Overcenter valve
18. Shuttle valve

The medium duty design of the B/MAMB is fix displacement motor for open and closed circuits. The motor compact construction is cost effective and has high power/weight ration. The design of the motor is maintenance friendly. We use swash plate which insures low levels of pulsation and noise.



SPECIFICATION DATA

Type		B/MAMB 20	B/MAMB 22	B/MAMB 25	B/MAMB 28	B/MAMB 35	B/MAMB 40	B/MAMB 46	B/MAMB 50
Displacement, cm³/rev [in³/rev]		20.5 [1.25]	22.9 [1.4]	24.5 [1.49]	27.9 [1.7]	34.5 [2.11]	39.4 [2.4]	46.1 [2.81]	49.2 [3]
Max. Speed, [RPM]	Cont.	3600	3500	3500	3500	3500	3500	3500	3000
	Int.*	4100	3900	3900	3900	3900	3900	3900	3500
Max. Torque,** Nm [lb-in]	Cont.	98 [870]	109 [965]	117 [1035]	133 [1180]	154 [1360]	157 [1390]	185 [1630]	195 [1725]
	Int.**	114 [1010]	128 [1130]	136 [1200]	154 [1360]	165 [1460]	188 [1664]	220 [1950]	226 [2000]
Output, kW [HP]	Cont.	30 [40]	35 [40]	37 [50]	40 [54]	40 [54]	45 [60]	50 [67]	50 [67]
	Int.**	35 [47]	40 [54]	42 [56]	45 [60]	50 [67]	55 [74]	60 [80]	60 [80]
Max. Pressure, bar [PSI]	Cont.	300 [4350]	300 [5080]	300 [5080]	300 [5080]	280 [4060]	250 [3625]	250 [3625]	250 [3625]
	Int.**	350 [5080]	350 [5080]	350 [5080]	350 [5080]	300 [4350]	300 [4350]	300 [4350]	290 [4200]
	Peak	400 [5800]	400 [5800]	400 [5800]	400 [5800]	350 [5080]	350 [5080]	350 [5080]	320 [4640]
Max. Oil Flow, l/min [GPM]	Cont.	75 [19.8]	80 [21.1]	85 [22.5]	97 [25.6]	120 [31.7]	137 [36.2]	160 [42.3]	147 [38.8]
	Int.*	85 [22.5]	90 [23.8]	95 [25.1]	110 [29.1]	135 [35.7]	153 [40.4]	180 [47.6]	172 [45.4]
Torque Constant ***** Nm/bar [lb-in/PSI]		0.29 [0.18]	0.33 [0.2]	0.35 [0.214]	0.4 [0.244]	0.5 [0.302]	0.564 [0.344]	0.66 [0.403]	0.704 [0.43]
Speed Constant ***** RPM/(l/min) [RPM/GPM]		46.3 [175.4]	41.5 [156.9]	38.9 [147.1]	34.1 [128.9]	27.5 [104.3]	24.1 [91.4]	20.6 [78]	19.3 [73.2]
Permissible Shaft Load									
max Axial**** N[lb]		Fa=800 [180]							
max Radial**** N[lb]		Fr=250 [56]							
Min. Speed, [RPM]		500							
Max. Pressure in Drain Line, bar [PSI]		5 [70] open drain line is always required							
Weight, kg [lb]		16.3[35.9]							
Static Brake Torque, Nm [lb-in]		300 [2655]							
Opening Brake Pressure, bar [PSI]		min 20 [290] - max 300 [4350]							
Max. Flow Rate of overcenter valve,	l/min [GPM]	90 [23.8]							
Max. Rated Pressure of overcenter valve,	bar [PSI]	350 [5076]							
Pilot Ratio of overcenter valve,	bar [PSI]	4.25:1							

Peak pressure is the highest allowable pressure, may occur for max. 1% of every minute.

* Intermittent speed (flow): for pressure up to 150[2200] bar [PSI].

** Intermittent load: the permissible values may occur for max. 10% of motor lifetime.

*** Theoretical torque.

**** The calculated max values are based on the optimal direction of the forces Fr, Fa and optimal position of the shaft.

***** The constant values are used for calculation of torque and speed with motor efficiencies $\eta_v=0.95$ and $\eta_{mh}=0.9$.

1. The recommended output power for continuous operations should not be exceeded.
2. Recommended filtration as per ISO 4406 cleanliness code 18/16/13 or better. This filtration corresponds to SAE AS 4059 8A/7B/7C. Nominal filtration - 10 micron or better.
3. Recommended a premium quality, anti-wear type mineral based hydraulic oil, HLP(DIN51524) or HM(ISO6743/4).
4. Recommended oil viscosity - 12...68 cSt.
5. Recommended maximum system operating temperature - 82°[180°] C[F].
6. To ensure optimum life of the motor, fill it up with fluid prior to load it and run with moderate load for about 10-15 minutes.

Hint: Motor Torque = Torque Constant * Pressure Drop
The constant values are approximate.

Rotation Speed = Speed Constant * Oil Flow
The constant values are approximate.

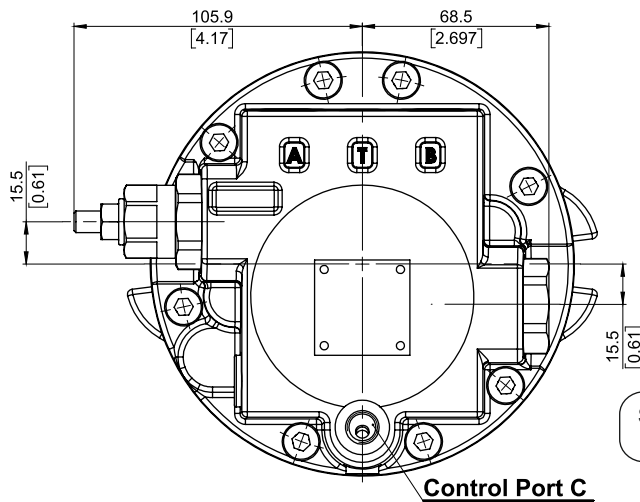


OVERALL DIMENSIONS AND PORTS

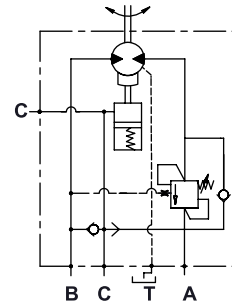
Single Overcenter Valve placed on Port A

Side ports, port size 6,7 and 8

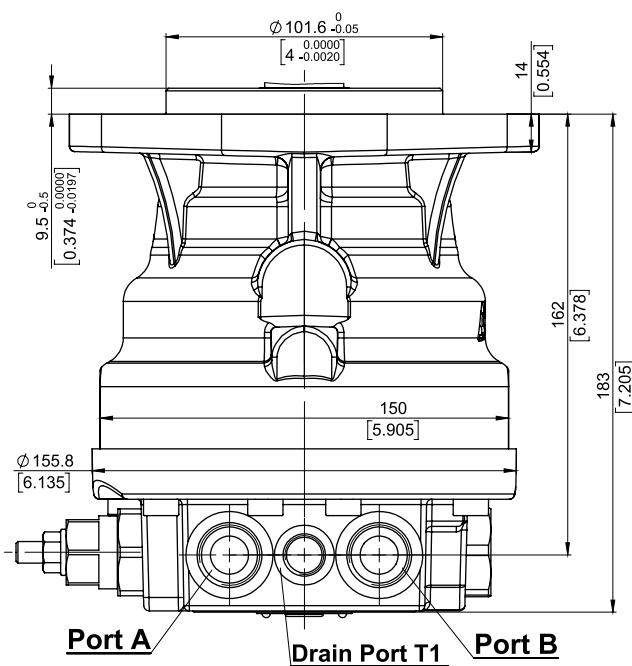
Standard Rotation
Viewed from shaft end
Port A Pressurized - CW
Port B Pressurized - CCW



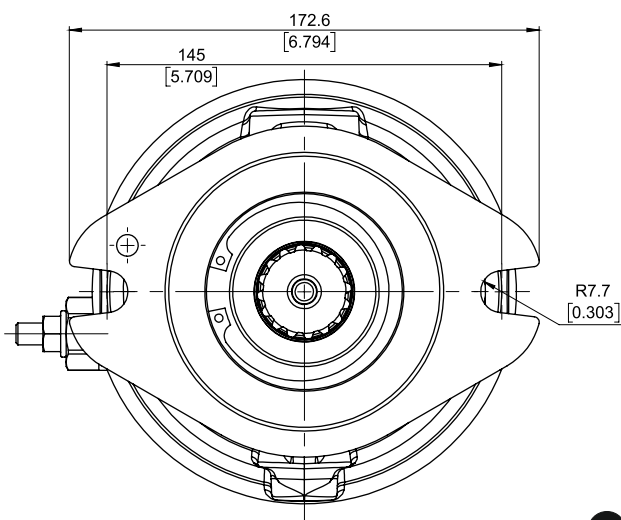
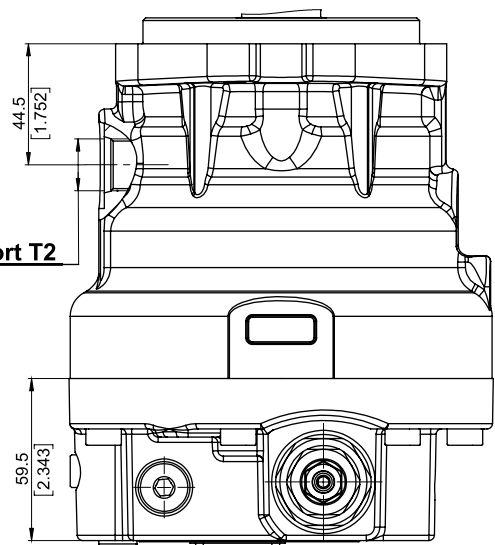
Shaft Mounting
see page 10



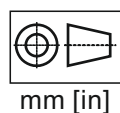
open drain line is always required



Drain Port T2



	Port Size		
	6	7	8
P _(A,B)	2xG 1/2	2xM22x1.5	2x 7/8-14UNF
T1	G 1/4	M14x1.5	9/16-18UNF
T2	G 1/2	M18x1.5	3/4-16UNF
C	G 1/8	M10x1	7/16-20UNF



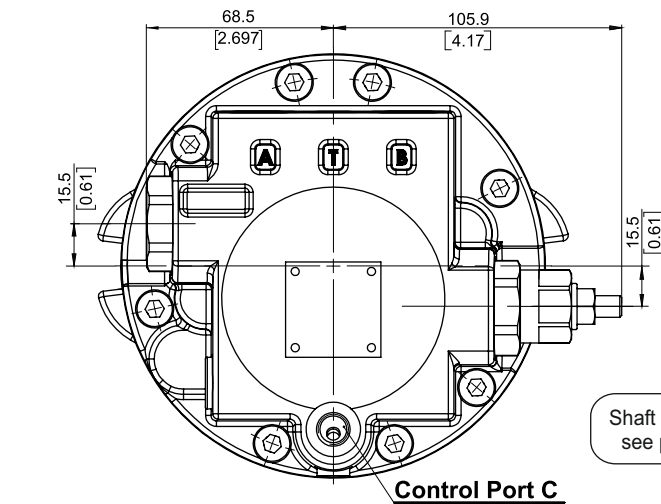


OVERALL DIMENSIONS AND PORTS

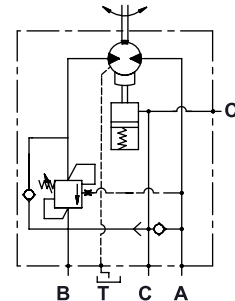
Single Overcenter Valve placed on Port B

Side ports, port size 6,7 and 8

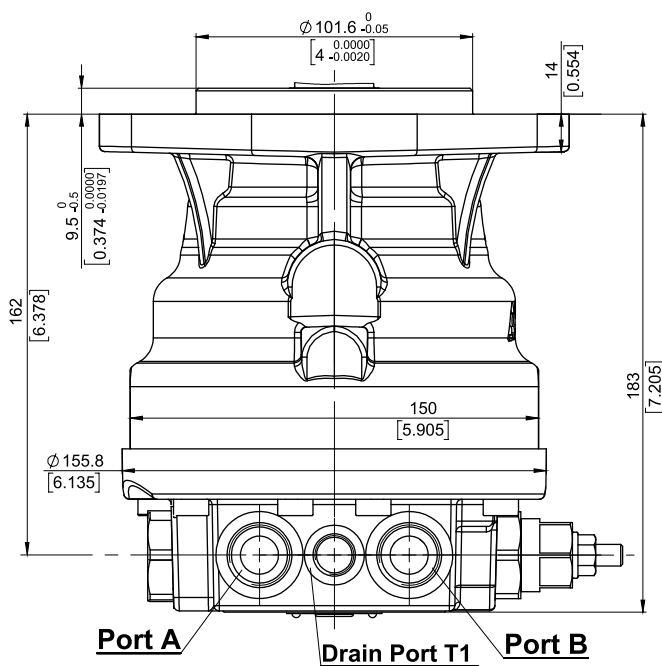
Standard Rotation
Viewed from shaft end
Port A Pressurized - CW
Port B Pressurized - CCW



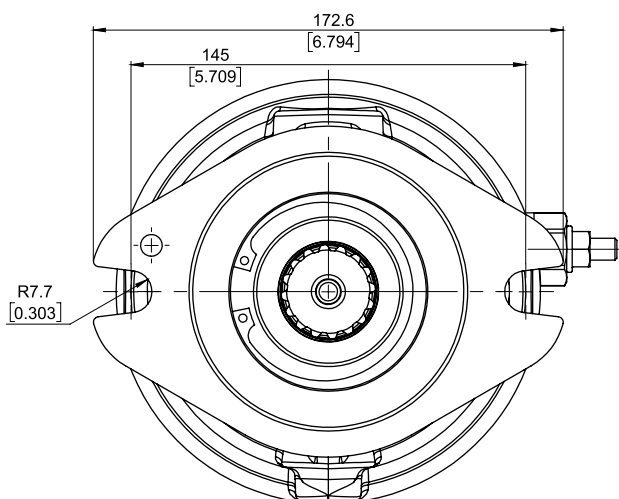
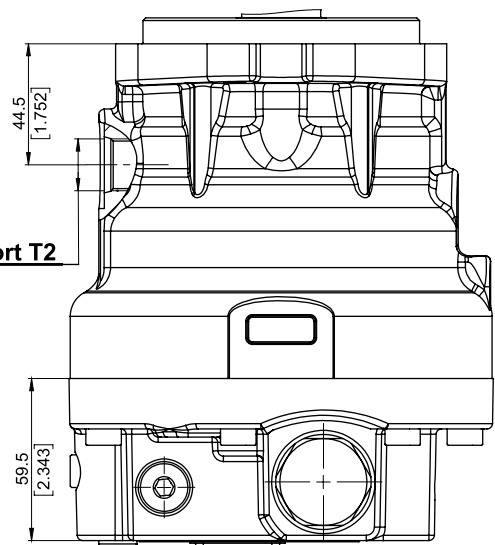
Shaft Mounting
see page 10



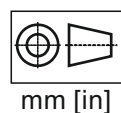
open drain line is always required



Drain Port T2



	Port Size		
	6	7	8
P _(A,B)	2xG 1/2	2xM22x1.5	2x 7/8-14UNF
T1	G1/4	M14x1.5	9/16-18UNF
T2	G 1/2	M18x1.5	3/4-16UNF
C	G1/8	M10x1	7/16-20UNF



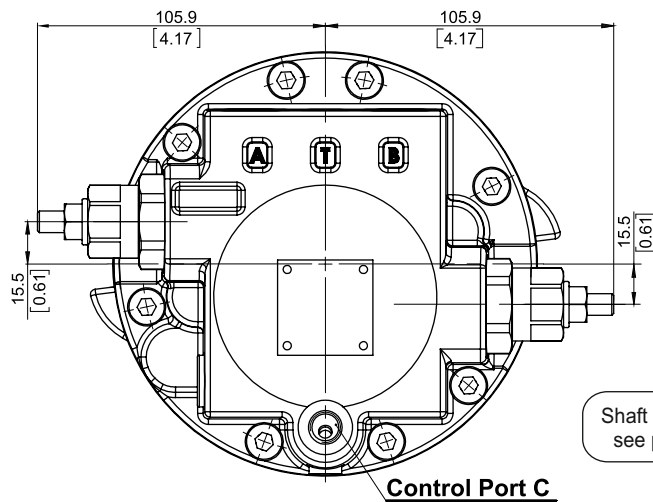


OVERALL DIMENSIONS AND PORTS

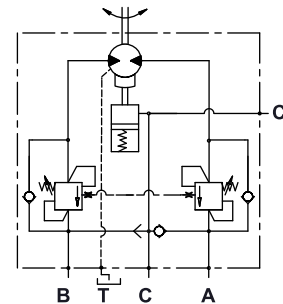
Dual Overcenter Valves

Side ports, port size 6,7 and 8

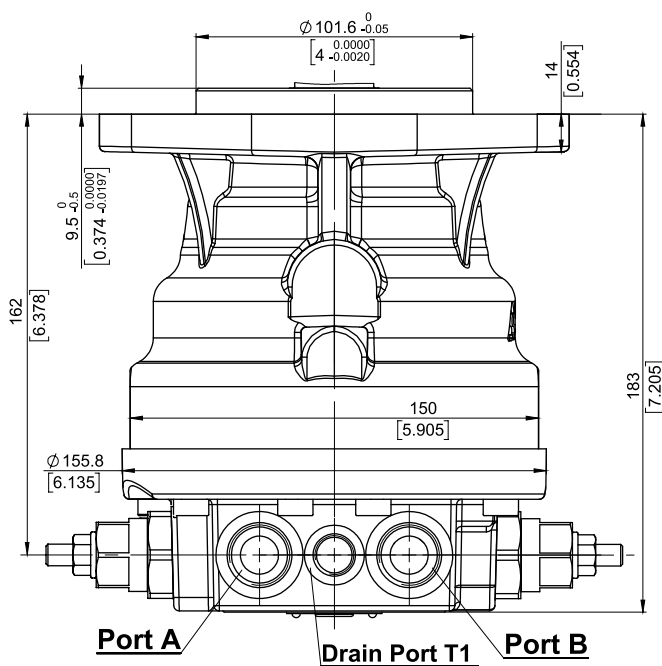
Standard Rotation
Viewed from shaft end
Port A Pressurized - CW
Port B Pressurized - CCW



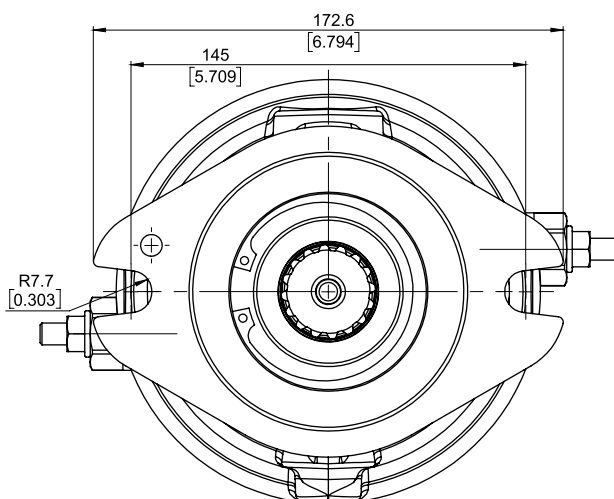
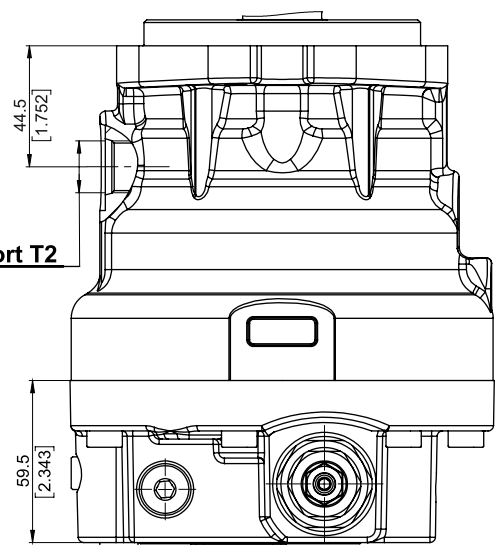
Shaft Mounting
see page 10



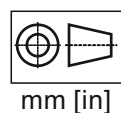
open drain line is always required



Drain Port T2



	Port Size		
	6	7	8
P _(A,B)	2xG 1/2	2xM22x1.5	2x 7/8-14UNF
T1	G1/4	M14x1.5	9/16-18UNF
T2	G 1/2	M18x1.5	3/4-16UNF
C	G1/8	M10x1	7/16-20UNF



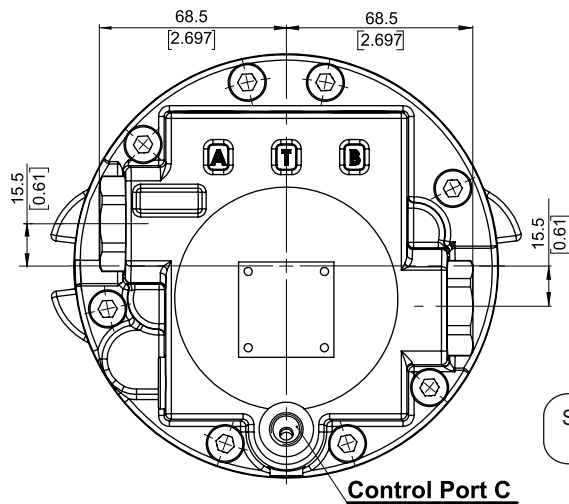


OVERALL DIMENSIONS AND PORTS

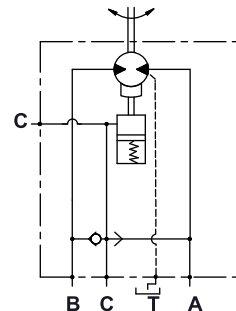
Without Overcenter Valve

Side ports, port size 6,7 and 8

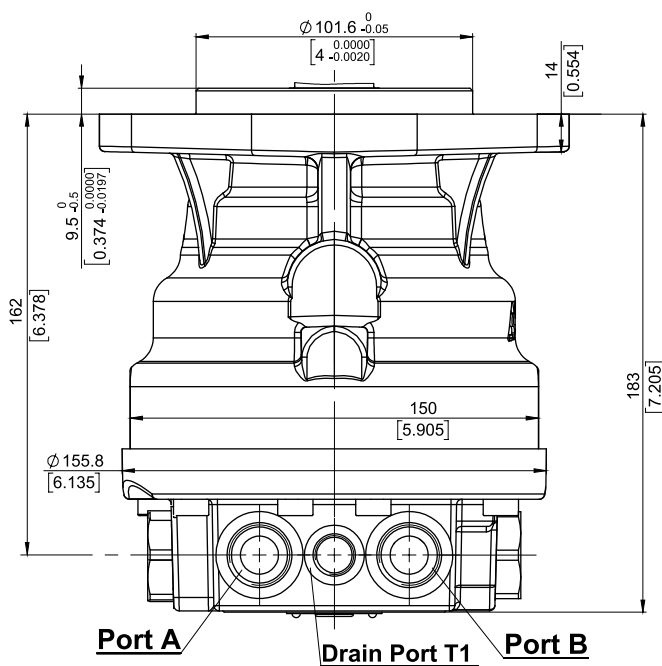
Standard Rotation
Viewed from shaft end
Port A Pressurized - CW
Port B Pressurized - CCW



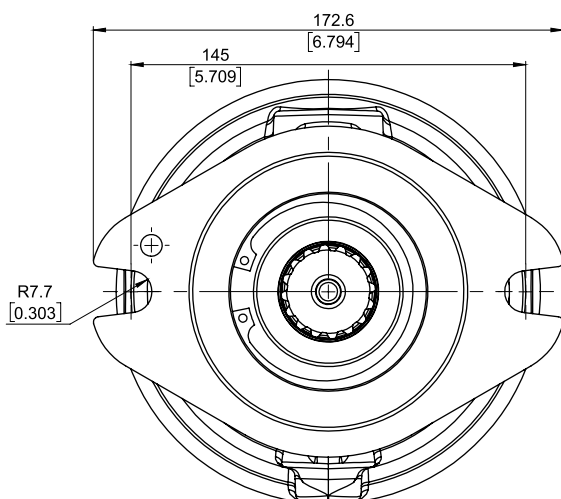
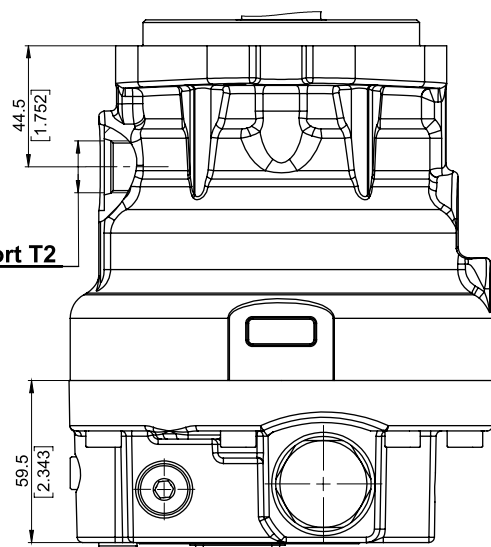
Shaft Mounting
see page 10



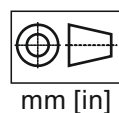
open drain line is always required



Drain Port T2



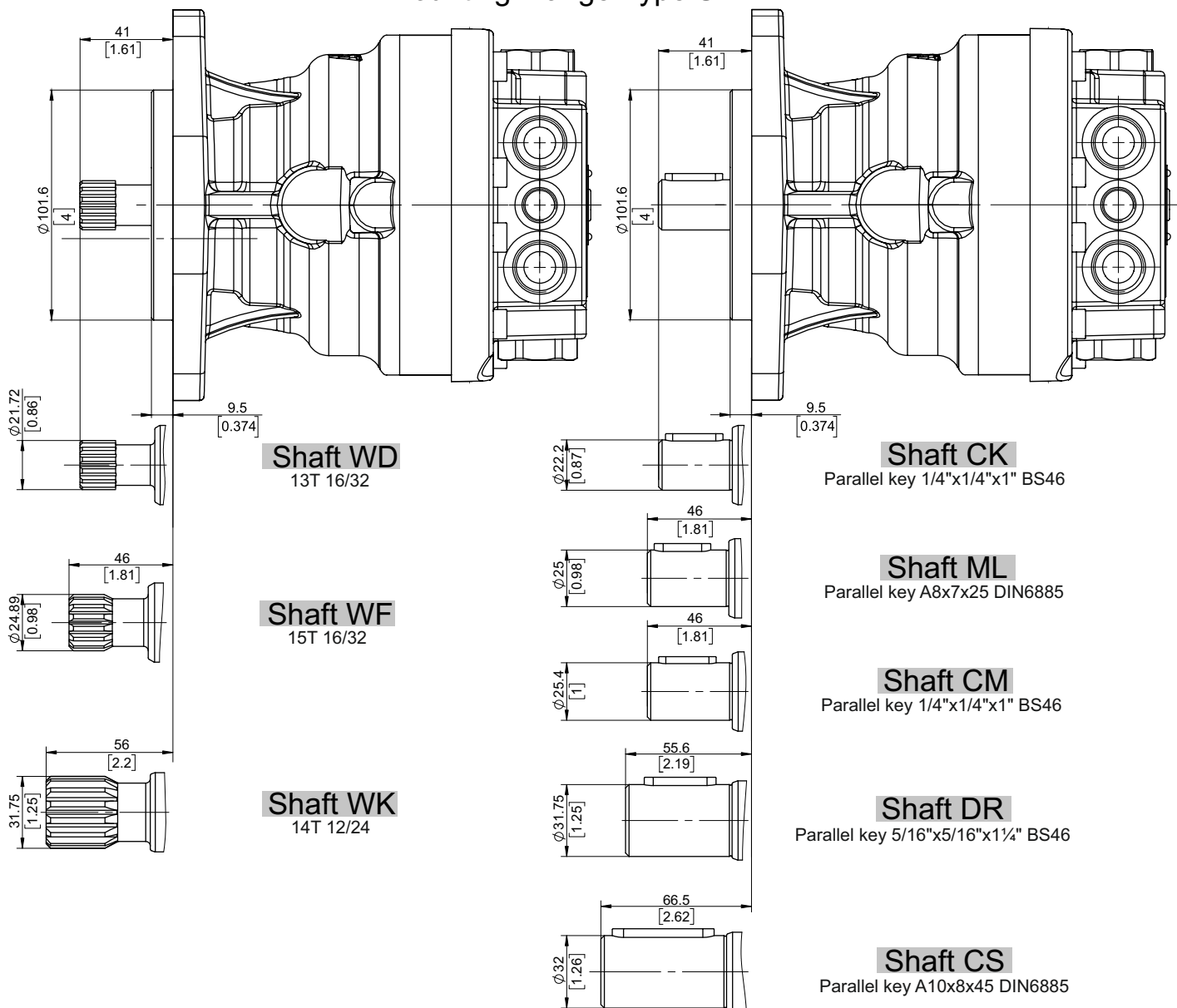
	Port Size		
	6	7	8
P _(A,B)	2xG 1/2	2xM22x1.5	2x 7/8-14UNF
T1	G1/4	M14x1.5	9/16-18UNF
T2	G 1/2	M18x1.5	3/4-16UNF
C	G1/8	M10x1	7/16-20UNF





SHAFTS MOUNTING

Mounting Flange-Type SAE-B



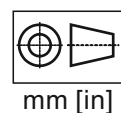
Shaft Dimensions
See Page [11+12](#)

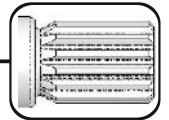
PERMISSIBLE SHAFT LOAD

Permissible shaft load		
max Axial	N[lb]	Fa=800 [180]
max Radial	N[lb]	Fr=250 [56]

The calculated max values are based on the optimal direction of the forces Fr, Fa and optimal position of the shaft.

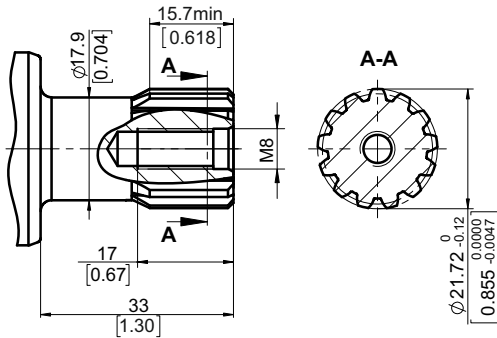
For more information, please, feel free to contact us.





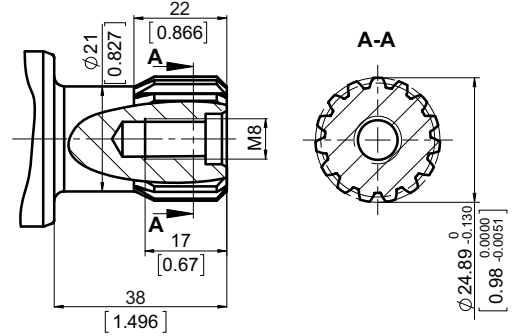
WD

ø21.72 [0.855], M8 thread
13T 16/32 DP splined ANSI B92.1-1970
Max. torque 200 Nm [1770 lb-in]



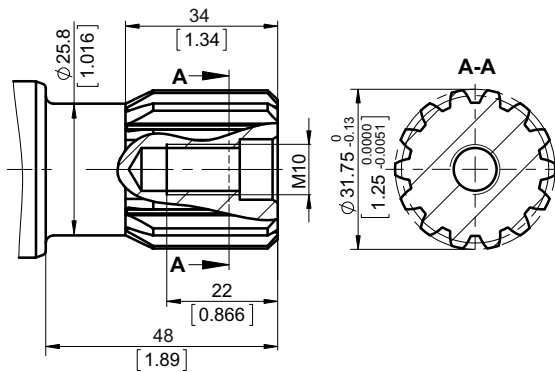
WF

ø24.89 [0.98], M8 thread
15T 16/32 DP splined ANSI B92.1-1970
Max. torque 330 Nm [2920 lb-in]



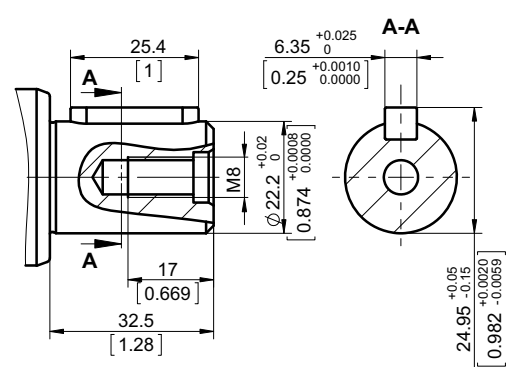
WK

ø31.75 [1.25], M10 thread
14T 12/24 DP splined ANSI B92.1-1970
Max. torque 380 Nm [3360 lb-in]



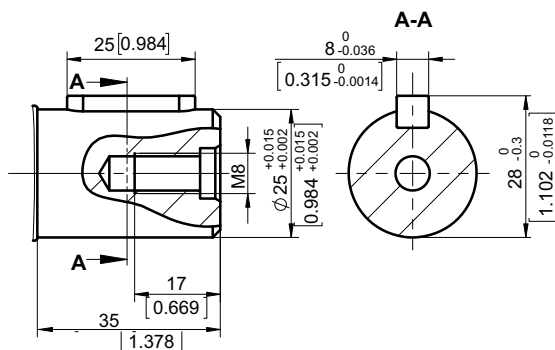
CK

ø22.2 [7/8] straight, M8 thread
Parallel key **1/4"x1/4"x1"** BS46
Max. torque 180 Nm [1600 lb-in]



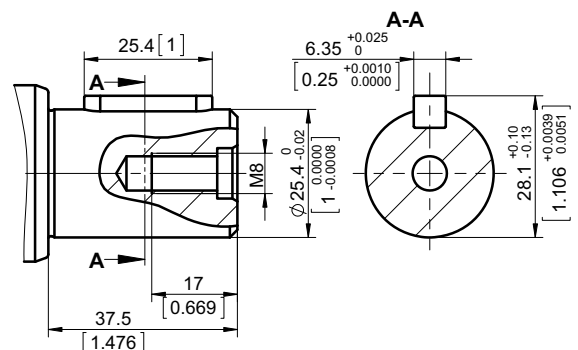
ML

ø25 [0.984] straight, M8 thread
Parallel key **A8x7x25** DIN6885
Max. torque 250 Nm [2210 lb-in]

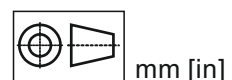


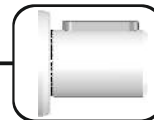
CM

ø25.4 [1] straight, M8 thread
Parallel key **1/4"x1/4"x1"** BS46
Max. torque 250 Nm [2210 lb-in]



The required max. torque must not be exceeded

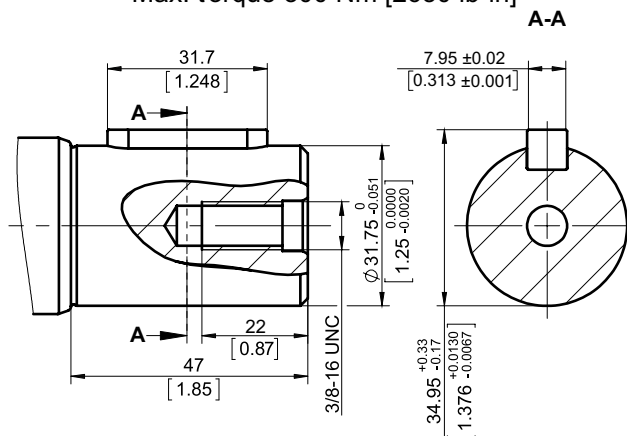




SHAFT TYPES AND DIMENSIONS

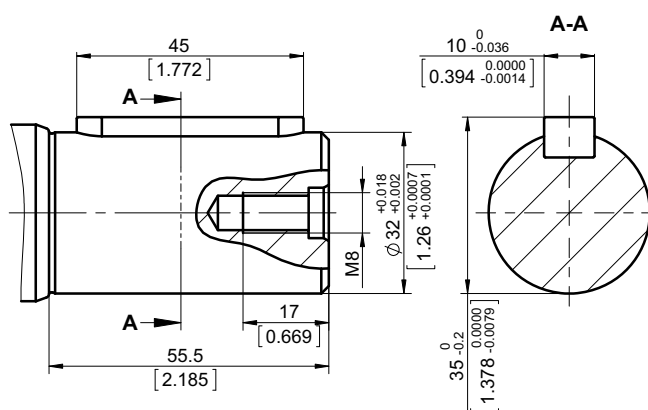
DR

ø31.75 [1.25] straight, 3/8-16 UNC thread
Parallel key **5/16"x5/16"x1¼"**
Max. torque 300 Nm [2650 lb-in]

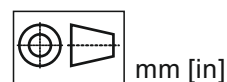


CS

ø32 [1.26] straight, M8 thread
Parallel key **A10x8x45** DIN6885
Max. torque 350 Nm [3100 lb-in]



The required max. torque
must not be exceeded





ORDERING CODE

	1	2	3	4	5	6	7	8	9	10		11	12	13	14	14	14
B / M A M	B								W		-				[		]

Pos.1 - Mounting Flange

- B** - SAE B, 2-Bolt flange, spigot dia.101.6 mm [4"]
Bolt circle 146 mm [5.75"]

Pos.2 - Port Type

- omit - Twin (Two) side ports on one side

Pos.3 - Displacement Code

- 20** - 20.5 cm³/rev [1.25 in³/rev]
22 - 22.9 cm³/rev [1.4 in³/rev]
25 - 24.5 cm³/rev [1.49 in³/rev]
28 - 27.9 cm³/rev [1.7 in³/rev]
35 - 34.5 cm³/rev [2.11 in³/rev]
40 - 39.4 cm³/rev [2.4 in³/rev]
46 - 46.1 cm³/rev [2.81 in³/rev]
50 - 49.2 cm³/rev [3 in³/rev]

Pos.4 - Shaft Extensions**

- WD** - ø21.72 [0.855"] Spline SAE 13T 16/32 DP, M8
WF - ø24.9 [0.98"] Spline SAE 15T 16/32, M8 thread
WK - ø31.75 [1.25"] Spline SAE 14T 12/24 DP, M10
CK - ø22.2 [ø7/8"] Straight, M8 thread
Parallel key 1/4"x1/4"x1" BS46
ML - ø25 [ø0.984"] Straight, M8 thread
Parallel key A8x7x25 DIN6885
CM - ø25.4 [ø1"] Straight, M8 thread
Parallel key 1/4"x1/4"x1" BS46
DR - ø31.75 [ø1.25"] Straight, 3/8-16UNC
Parallel key 5/16"x5/16"x1 1/4" BS46
CS - ø32 [ø1.26"] Straight, M8 thread
Parallel key A10x8x45 DIN6885

Pos.5 - Improved radial load

- omit - standard bearing
N - Improved bearing

Pos.6 - Port Size

- 6** - 2xG1/2, drain ports G1/2
7 - 2xM22x1.5, drain ports M18x1.5
8 - 2x7/8-14 UNF Ports, drain ports 3/4-16 UNF

Pos.7 - Seal, Corrosion Resistant Seal Surface

- omit - NBR seal type material
V - FKM seal type material

Pos.8 - Integrated Valves

- omit - None
BV - Single Overcenter Valve
DV - Dual Overcenter valve

Pos.9 - Brake control with switch valve

- W** - Brake control with switch valve

Pos.10 - Valve's Port for single overcenter valve

- omit - None (for dual or without overcenter valve)
A - Port A
B - Port B

Pos.11 - Pressure Setting of Integrated Valves

- omit - None (if not overcenter valve selected from Pos.8)
250 - 250 bar
300 - 300 bar
350 - 350 bar

Pos.12 - Special Features

- omit - None
R2S - Speed Sensor Two Directional
RS - Speed Sensor

Pos.13 - Paint and Coating

- omit - No paint or coating
P - Painted
PC - Corrosion protected paint

If a painting option is required, the standard color is black-Alkyd-Styrenated Enamel, Black RAL 9005.
Other color by customer's request.

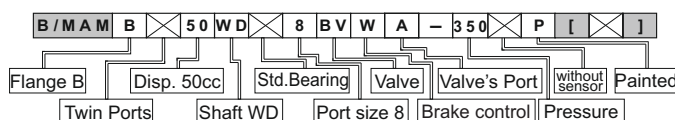
Pos.14 - Design Series

- omit - Factory specified

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

EXAMPLE

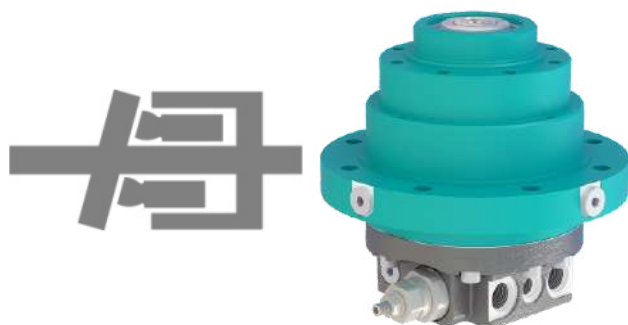
B / M A M B 50 W D 8 B V W A - 3 50 P





Hydraulic Motors Type B/MAMCB21

Medium Duty Axial Piston Motor Brake Fixed Displacement



APPLICATION

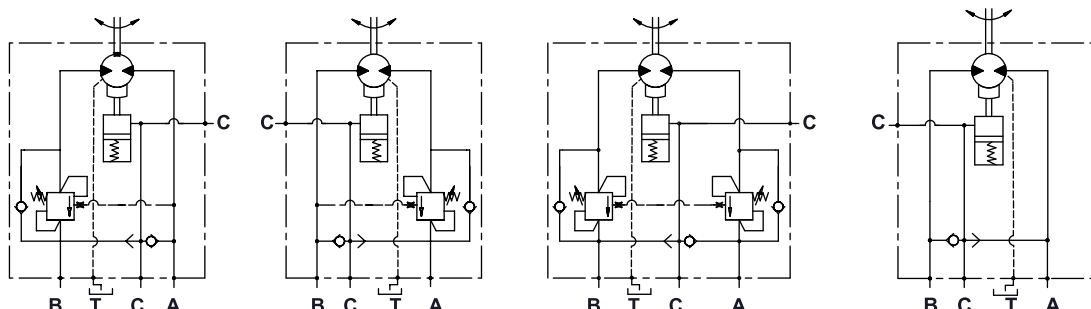
- » Winch drives
- » Wheel drives

ADVANTAGES

- » Smooth operation
- » High power density
- » Compact size

OPTIONS

- » Port options
- » Shaft options
- » Integrated valves



open drain line is always required

TECHNICAL DATA OF MOTOR

GENERAL

Displacement,	cm ³ /rev [in ³ /rev]	20.5 [1.25]
Max. Speed,	RPM	3600
Max. Torque,	Nm [lb-in]	91 [805]
Max. Output,	kW [HP]	50 [67]
Max. Pressure Drop,	bar [PSI]	280 [4060]
Max. Oil Flow,	l/min [GPM]	75 [19.8]
Min. Speed,	RPM	500
Fluid	Mineral based- HLP(DIN 51524) or HM(ISO 6743/4)	
Temperature Range,	°C [°F]	-40÷82 [-40÷180]
Optimal Viscosity Range,	mm ² /s [SUS]	12÷68 [66÷311]
Filtration	ISO code 18/16/13 (Min. recommended fluid filtration of 10 micron)	

TECHNICAL DATA OF BRAKE

GENERAL

Static Torque,	Nm [lb-in]	190 [1681]
Opening Pressure,	bar [PSI]	min 20 [290] - max 300 [4350]
Max. Pressure in drain space,	bar [PSI]	5 [72.5]

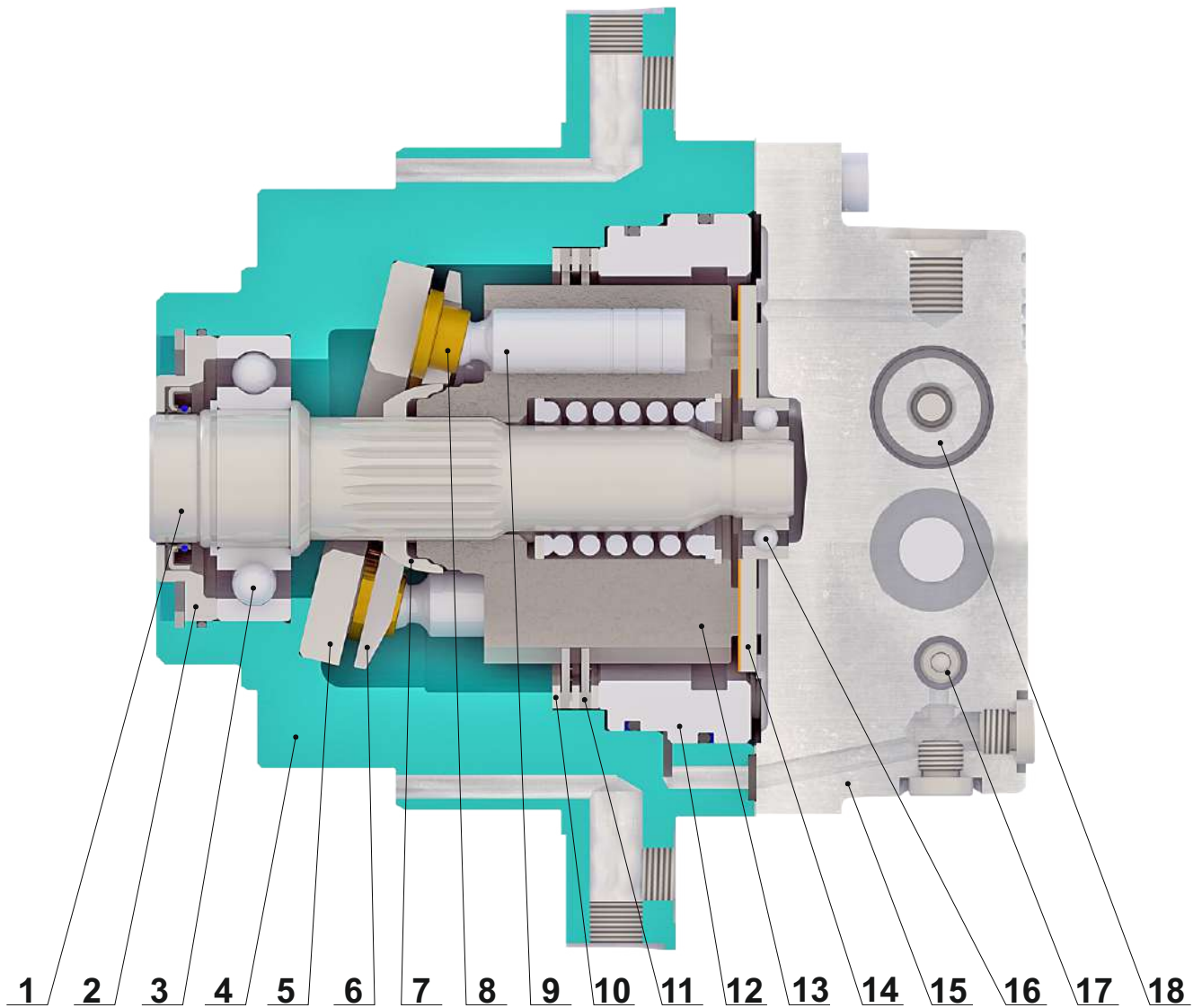
TECHNICAL DATA OF OVERCENTER VALVES

GENERAL

Max. Flow Rate,	l/min [GPM]	90 [23.8]
Max. Rated Pressure,	bar [PSI]	350 [5076]
Pilot Ratio,	bar [PSI]	4.25:1



SECTION VIEW



1. Hardened shaft
2. Front cover
3. Ball bearing
4. Cast iron body
5. Thick support plate
6. Retainer plate
7. Hardened sphere
8. Piston shoes
9. Pistons

10. Brake discs
11. Friction discs
12. Control system
13. Cylinder block
14. Bimetal distributor
15. Cast iron end cover
16. Ball bearing
17. Shuttle valve
18. Overcenter valve

The medium duty design of the B/MAMB is fix displacement motor for open and closed circuits. The motor compact construction is cost effective and has high power/weight ration. The design of the motor is maintenance friendly. We use swash plate which insures low levels of pulsation and noise.


TECHNICAL DATA OF MOTOR

Type		B/MAMCB21
Displacement, cm. ³ /rev.[in. ³ /rev.]		20.5 [1.25]
Max. Speed, [RPM]	Cont.	3600
	Int.*	4100
Max. Torque,*** Nm [lb-in]	Cont.	91 [805]
	Int.**	98 [867]
Max. Output, kW [HP]	Cont.	30 [40]
	Int.**	40 [54]
Max. Pressure, bar [PSI]	Cont.	280 [4060]
	Int.**	300 [4350]
Max. Oil Flow, lpm [GPM]	Cont.	75 [19.8]
	Int.*	85 [22.5]
Permissible shaft load		
max. Axial**** N[lb]		Fa=1000 [225]
max. Radial**** N[lb]		Fr=300 [68]
Min. Speed [RPM]		500
Weight kg [lb]		18.14 [39.99]

TECHNICAL DATA OF BRAKE

Static Torque, Nm [lb-in]	190 [1682]
Static Torque at 5 bar drain pressure, Nm [lb-in]	140 [1239]
Opening Pressure, bar [PSI]	min. 20 [290]
Fully Opening Pressure, bar	max. 300 [4350]
Max. Pressure in drain space, bar [PSI]	27 [392]

TECHNICAL DATA OF OVERCENTER VALVES

Max. Flow Rate, lpm [GPM]	90 [23.8]
Max. Rated Pressure, bar [PSI]	350 [5076]
Plot Ratio	4.25:1

Peak pressure is the highest allowable pressure, may occur for max. 1% of every minute.

* Intermittent speed (flow): for pressure up to 150[2200] bar [PSI].

** Intermittent load: the permissible values may occur for max. 10% of motor lifetime.

*** Theoretical torque.

**** The calculated max values are based on the optimal direction of the forces Fr, Fa and optimal position of the shaft.

***** The constant values are used for calculation of torque and speed with motor efficiencies $\eta_v=0.95$ and $\eta_{mh}=0.9$.

1. The recommended output power for continuous operations should not be exceeded.
2. Recommended filtration as per ISO 4406 cleanliness code 18/16/13 or better. This filtration corresponds to SAE AS 4059 8A/7B/7C. Nominal filtration - 10 micron or better.
3. Recommended a premium quality, anti-wear type mineral based hydraulic oil, HLP(DIN51524) or HM(ISO6743/4).
4. Recommended oil viscosity - 12...68 cSt .
5. Recommended maximum system operating temperature - 82°[180°] C[F].
6. To ensure optimum life of the motor, fill it up with fluid prior to load it and run with moderate load and speed for about 10-15 minutes.

Hint: Motor Torque = Torque Constant * Pressure Drop

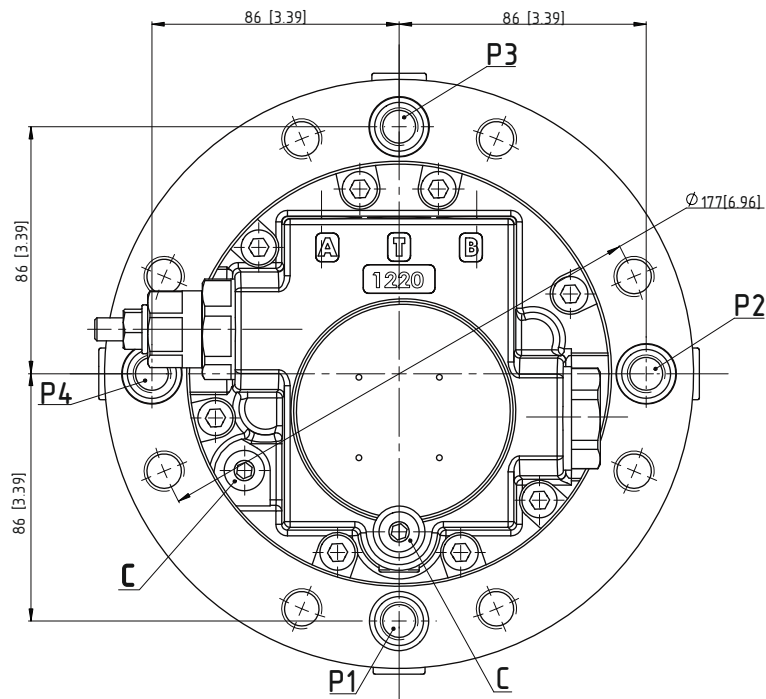
Rotation Speed = Speed Constant * Oil Flow

The constant values are approximate. Motor torque and rotation speed for a particular project are depending on the real operating conditions.

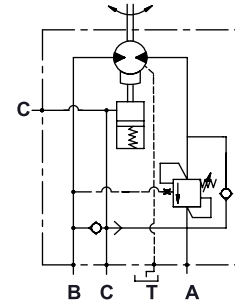


OVERALL DIMENSIONS AND PORTS

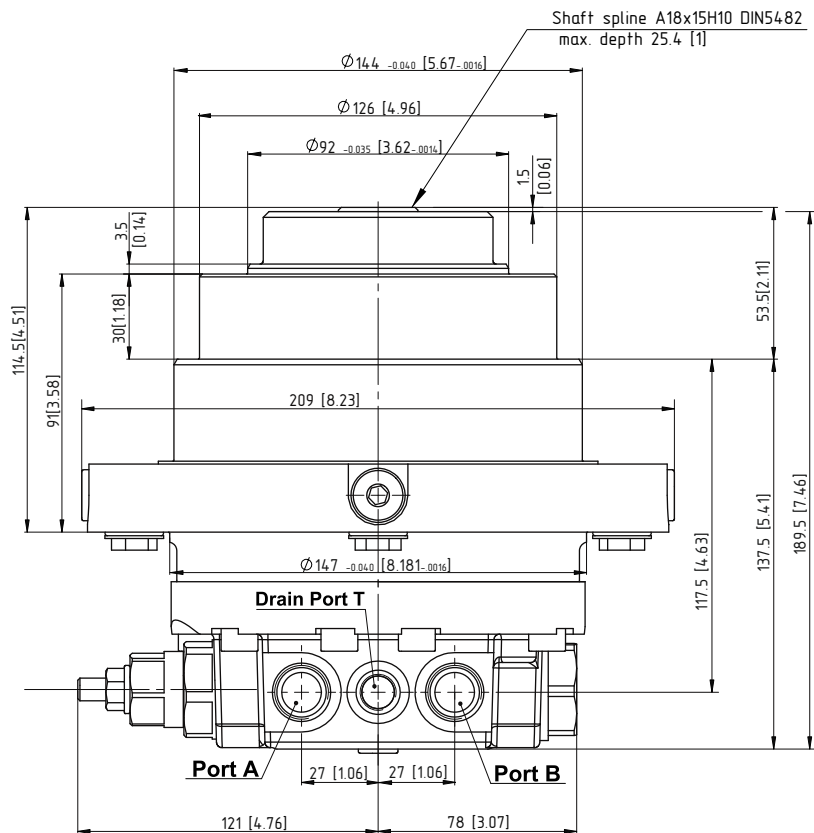
Single Overcenter Valve placed on Port A



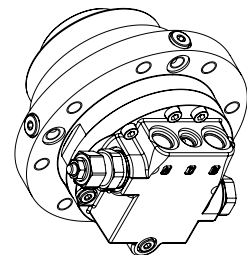
Standard Rotation
Viewed from shaft end
Port A Pressurized - CW
Port B Pressurized - CCW



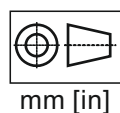
open drain line is always required



Involute spline data	A18x15 H10 DIN5482
Module	m 1.6
Number of teeth	Z 10
Pressure angle	α 30°
Base diameter	db 13.856
Pitch diameter	d 16
Circular pitch	p 5.027
Addendum modification	xm 0.4
Circular tooth space	E 2.975 ^{+0.04} _{-0.00}
Common normal Length	
Pin diameter	D _M Ø3 ±0.001
Measurement between pins	M _i 12.058 ^{+0.087} _{-0.000}



Port A, B	3/4-16 UNF
Drain Port T	1/2-16 UNF
Control Port C	G1/8
Oil filling Port P1; P2; P3; P4	G1/4

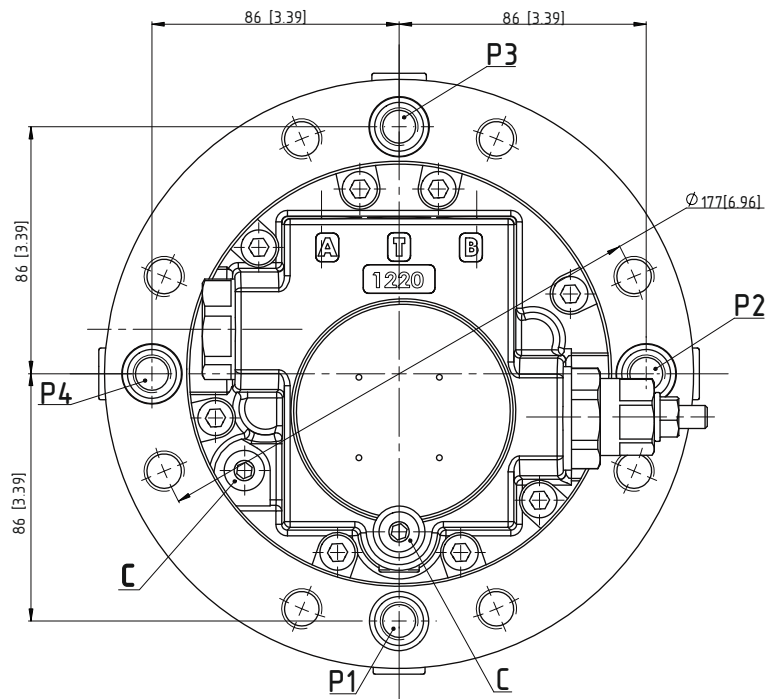


mm [in]

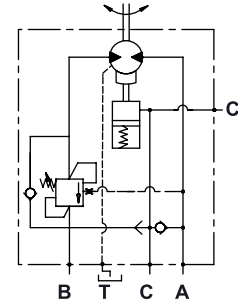


OVERALL DIMENSIONS AND PORTS

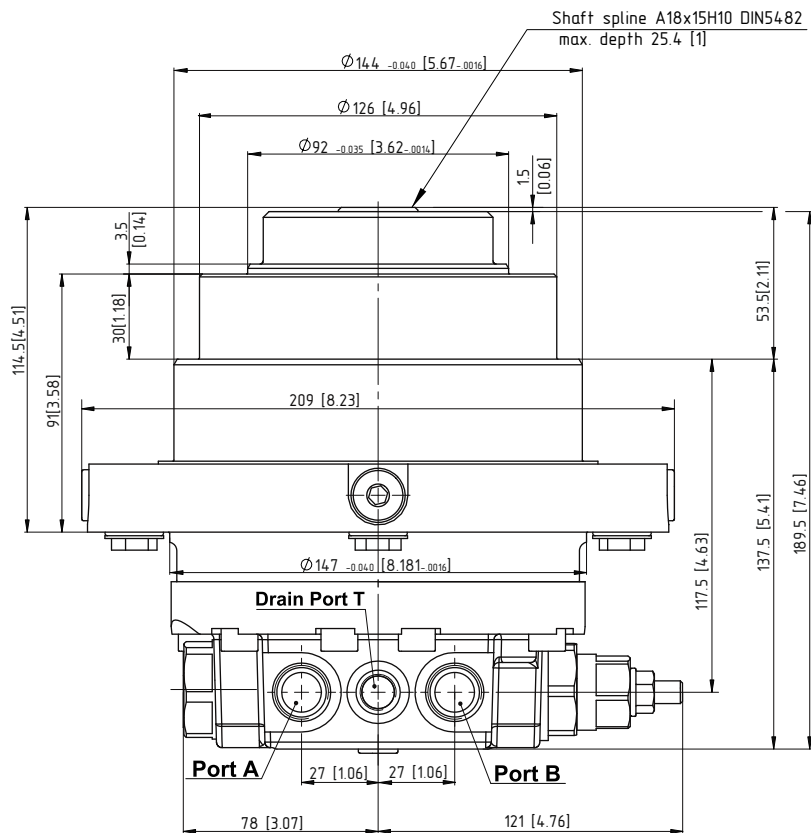
Single Overcenter Valve placed on Port B



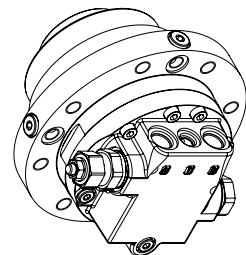
Standard Rotation
Viewed from shaft end
Port A Pressurized - CW
Port B Pressurized - CCW



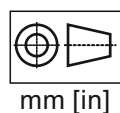
open drain line is always required



Involute spline data		A18x15 H10 DIN5482
Module	m	1.6
Number of teeth	Z	10
Pressure angle	α	30°
Base diameter	db	13.856
Pitch diameter	d	16
Circular pitch	p	5.027
Addendum modification	xm	0.4
Circular tooth space	E	2.975 ^{+0.04} _{-0.00}
Common normal Length		
Pin diameter	D _M	Φ3 ±0.001
Measurement between pins	M _i	12.058 ^{+0.087} _{-0.000}



Port A, B	3/4-16 UNF
Drain Port T	1/2-16 UNF
Control Port C	G1/8
Oil filling Port P1; P2; P3; P4	G1/4

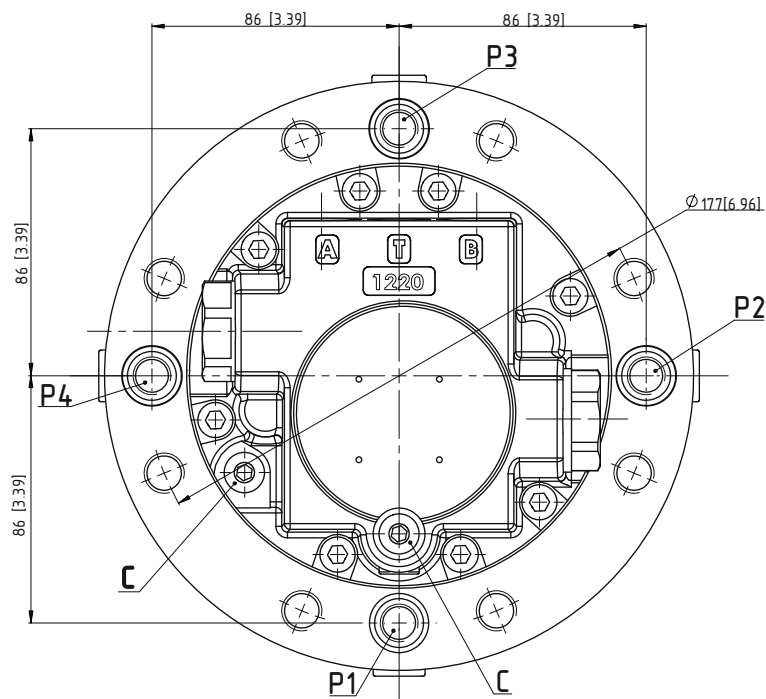


mm [in]

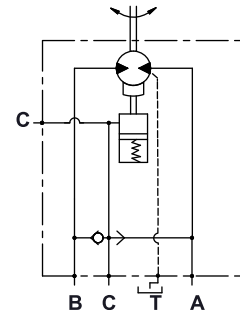


OVERALL DIMENSIONS AND PORTS

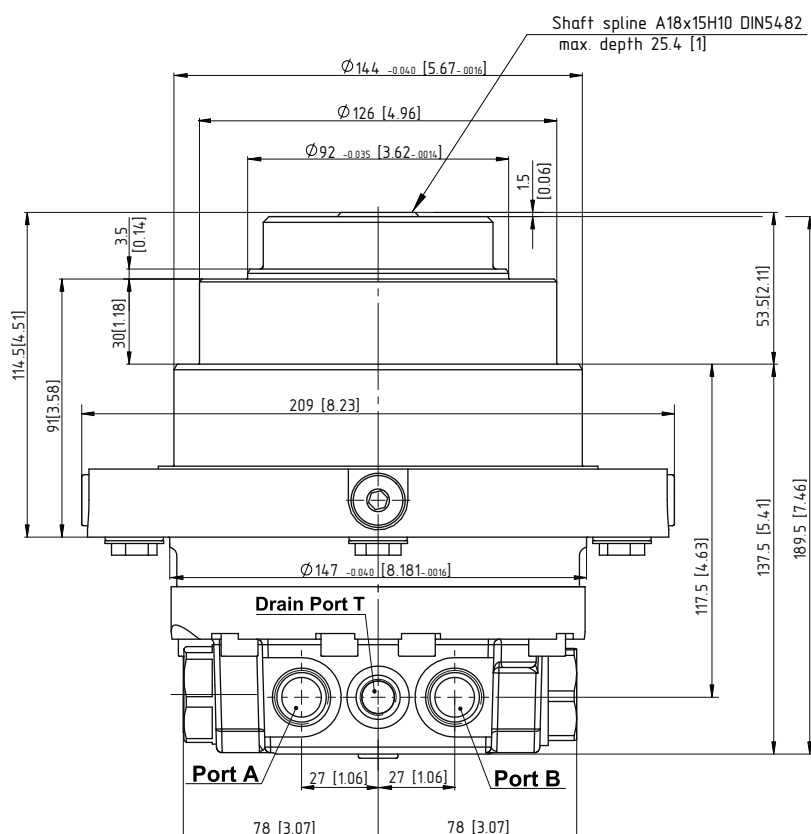
Without Overcenter Valve



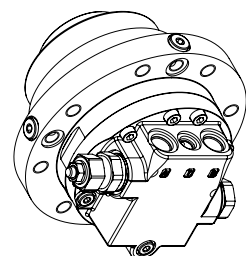
Standard Rotation
Viewed from shaft end
Port **A** Pressurized - **CW**
Port **B** Pressurized - **CCW**



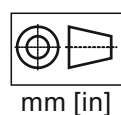
open drain line is always required



Involute spline data		A18x15 H10 DIN5482
Module	m	1.6
Number of teeth	Z	10
Pressure angle	α	30°
Base diameter	db	13.856
Pitch diameter	d	16
Circular pitch	p	5.027
Addendum modification	xm	0.4
Circular tooth space	E	2.975 _{+0.04} _{-0.00}
Common normal Length		
Pin diameter	D _M	∅ 3 ± 0,001
Measurement between pins	M _i	12.058 _{+0.087} _{-0.000}



Port A, B	3/4-16 UNF
Drain Port T	1/2-16 UNF
Control Port C	G1/8
Oil filling Port P1; P2; P3; P4	G1/4

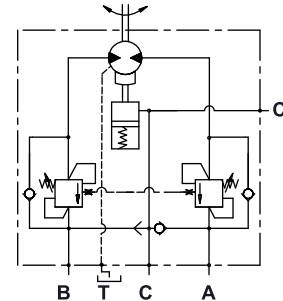




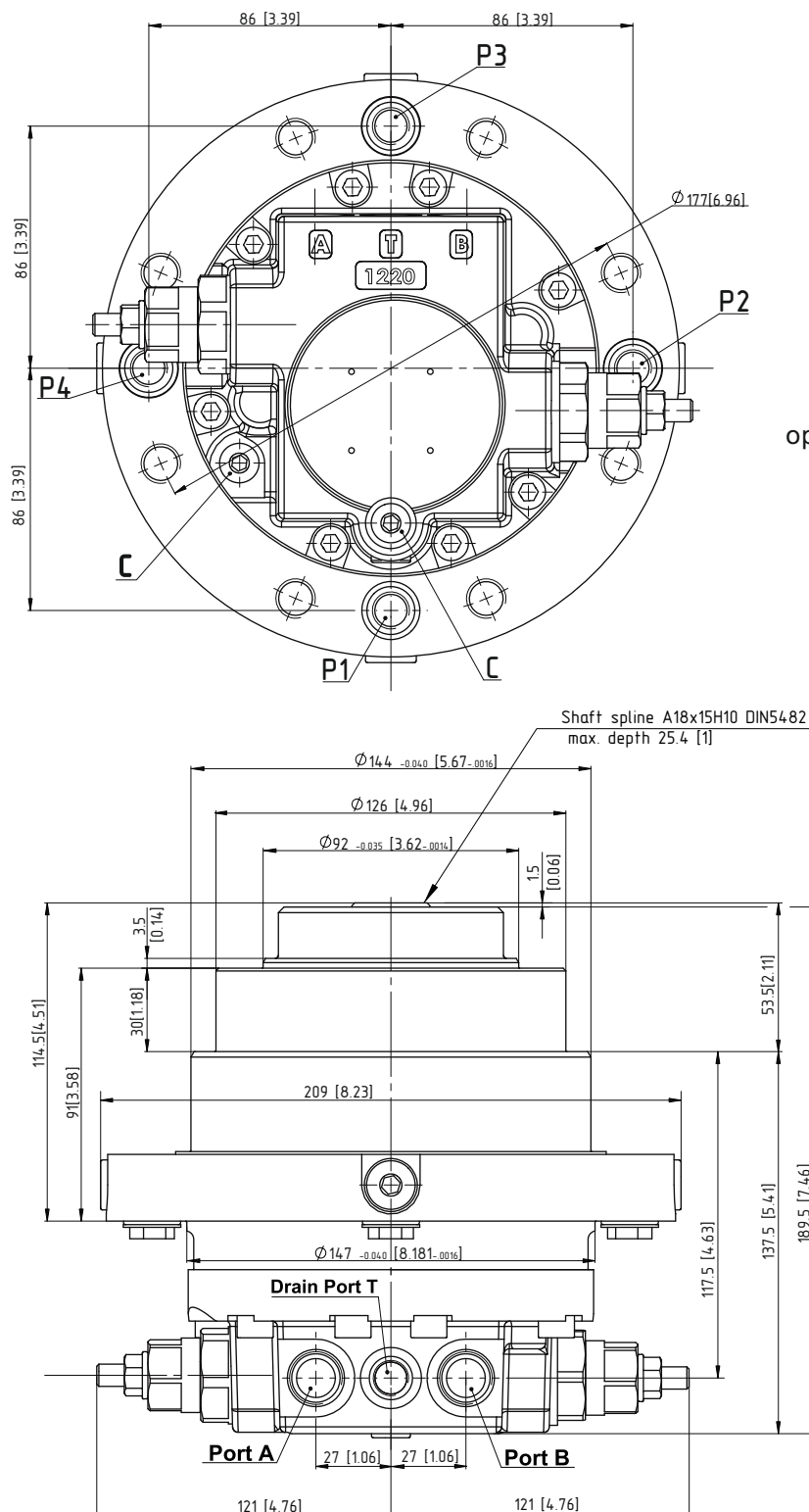
OVERALL DIMENSIONS AND PORTS

Dual Overcenter Valves

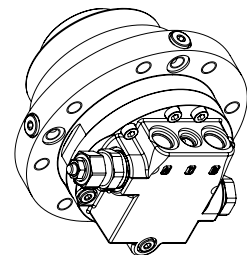
Standard Rotation
Viewed from shaft end
Port **A** Pressurized - **CW**
Port **B** Pressurized - **CCW**



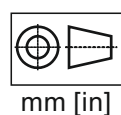
open drain line is always required



Involute spline data		A18x15 H10 DIN5482
Module	m	1.6
Number of teeth	Z	10
Pressure angle	α	30°
Base diameter	db	13.856
Pitch diameter	d	16
Circular pitch	p	5.027
Addendum modification	xm	0.4
Circular tooth space	E	2.975 ^{+0.04} _{+0.00}
Common normal Length		
Pin diameter	D _M	$\phi 3 \pm 0,001$
Measurement between pins	M _i	12.058 ^{+0.087} _{+0.000}



Port A, B	3/4-16 UNF
Drain Port T	1/2-16 UNF
Control Port C	G1/8
Oil filling Port P1; P2; P3; P4	G1/4





ORDERING CODE

1	2	3	4	5	6	7	8	9	10	11	12	13	13	13
B / M A M	C B	2 1					-		W		-		[	]

Pos.1 - Mounting Flange

CB - 8-Bolt flange, spigot dia.144 mm [5.67"]
Bolt circle 177mm [6.96"]

Pos.2 - Port Type

omit - Twin (Two) side ports on one side

Pos.3 - Displacement Code

21 - 20.5 cm³/rev [1.25 in³/rev]

Pos.4 - Shaft Extensions**

omit - Spline A18x15 H10 DIN 5482

Pos.5 - Improved radial load

omit - standard bearing

N - Improved bearing

Pos.6 - Port Size

omit - 2x3/4-16UNF, drain port 1/2-16UNF, control port G1/8

Pos.7 - Seal, Corrosion Resistant Seal Surface

omit - NBR seal type material

V - FKM seal type material

Pos.8 - Integrated Valves

omit - None

BV - Single Overcenter Valve

DV - Dual Overcenter valve

Pos.9 - Brake control with switch valve

W - Brake control with switch valve

Pos.10 - Valve's Port for single overcenter valve

omit - None (for dual or without overcenter valve)

A - Port A

B - Port B

Pos.11 - Pressure Setting of Integrated Valves

omit - None (if not overcenter valve selected from Pos.8)

250 - 250 bar

300 - 300 bar

350 - 350 bar

Pos.12 - Paint and Coating

omit - No paint or coating

P - Painted

PC - Corrosion protected paint

If a painting option is required, the standard color is black-Alkyd-Styrenated Enamel, Black RAL 9005.

Other color by customer's request.

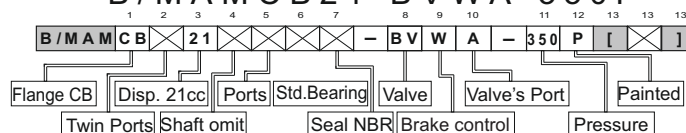
Pos.13 - Design Series

omit - Factory specified

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

EXAMPLE

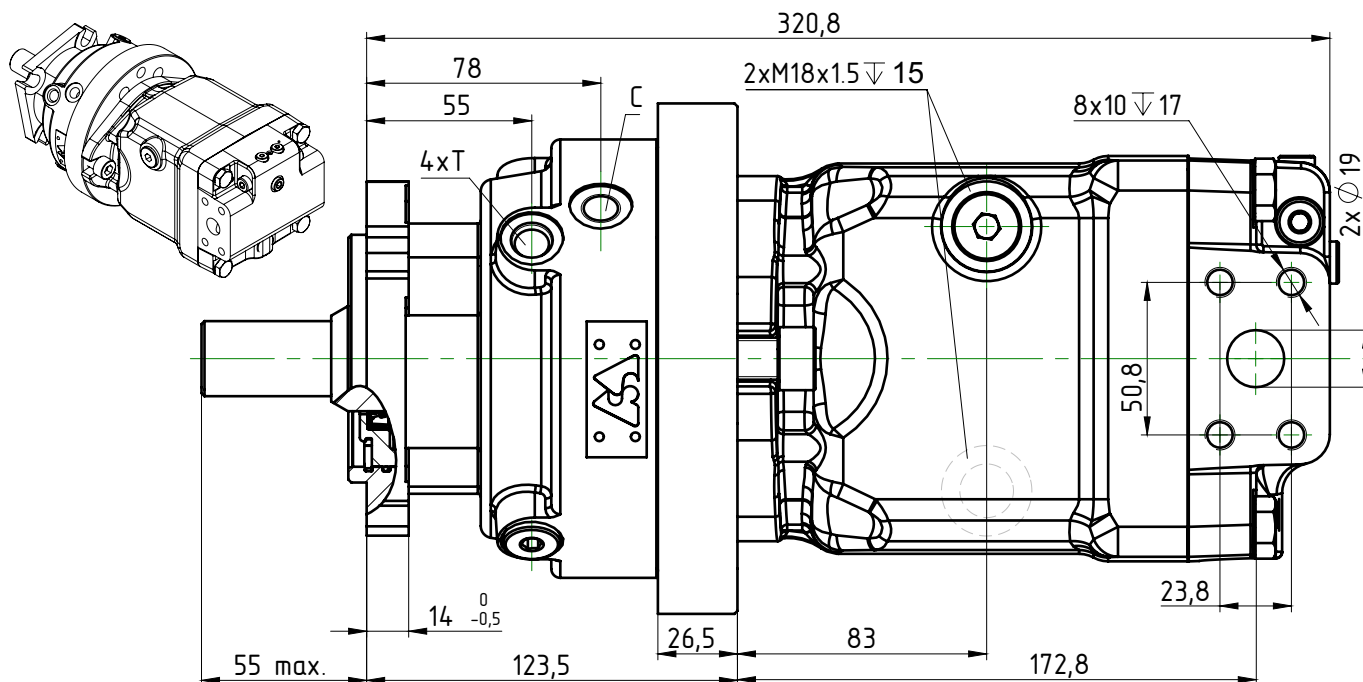
B / M A M C B 2 1 - B V W A - 3 5 0 P





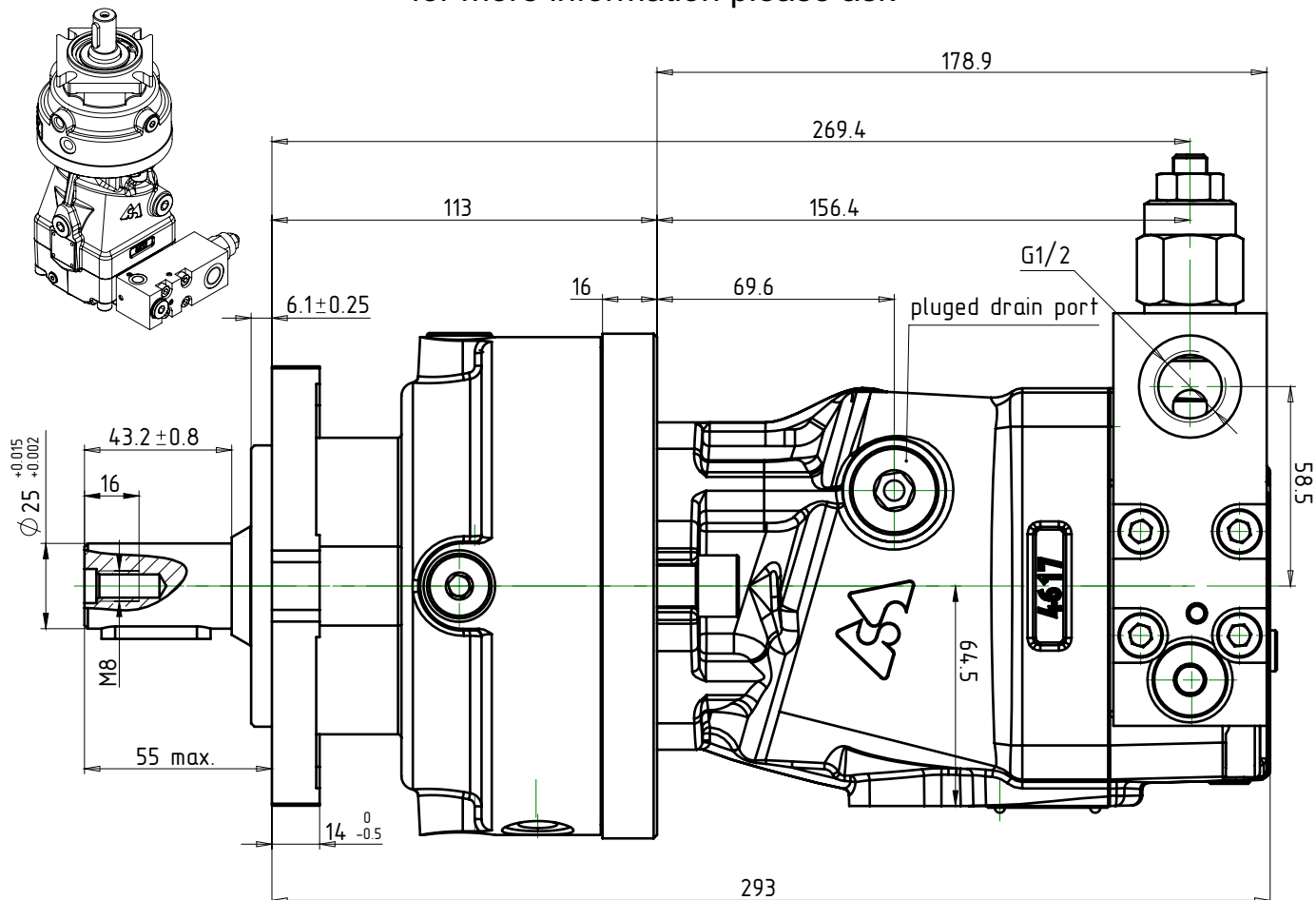
MAP + LB/288

Example of motor MAP62 with external brake LB/288
for more information please ask



MAM + LB/288

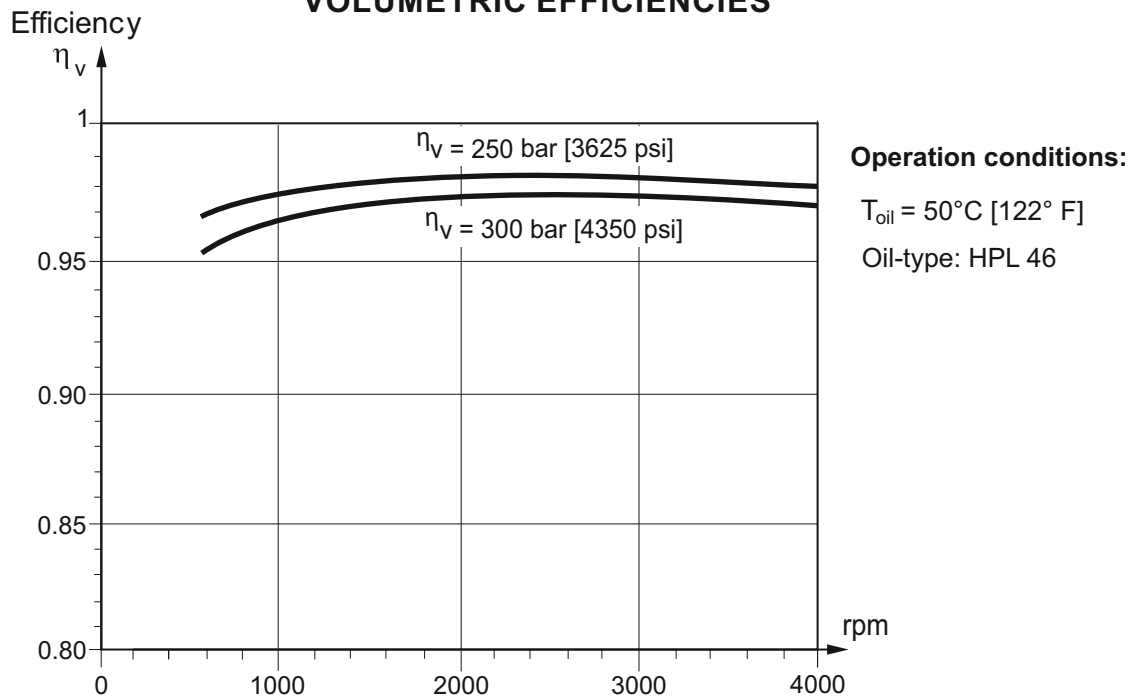
Example of motor MAM50 with external brake LB/288 and overcenter valve
for more information please ask



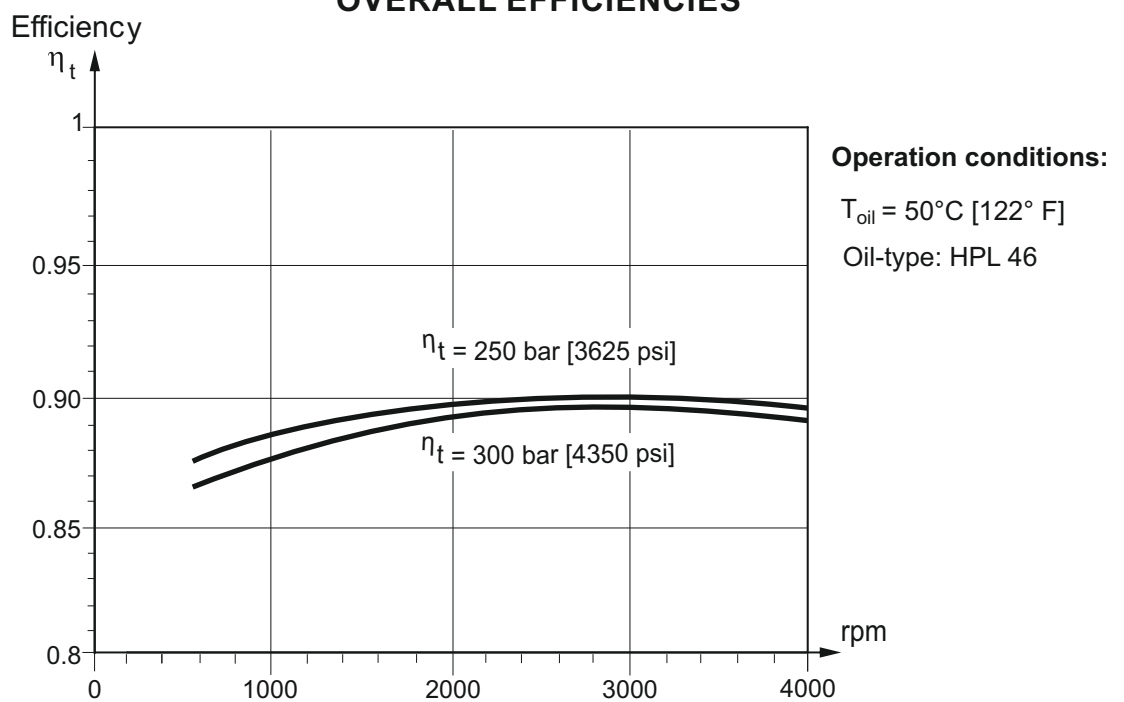


The below efficiencies are applied to all displacements and motor series.

VOLUMETRIC EFFICIENCIES

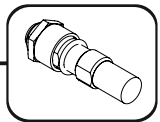


OVERALL EFFICIENCIES



The motor size, pressure, torque, speed of rotation and flow rate required for a specific application can be calculated using the formulas.

Efficiencies for a particular motor may vary from the shown in the diagram depending on the operating conditions.



SPEED SENSORS R2S

TECHNICAL DATA OF THE DUAL CHANNEL HALL SPEED SENSOR

TECHNICAL DATA

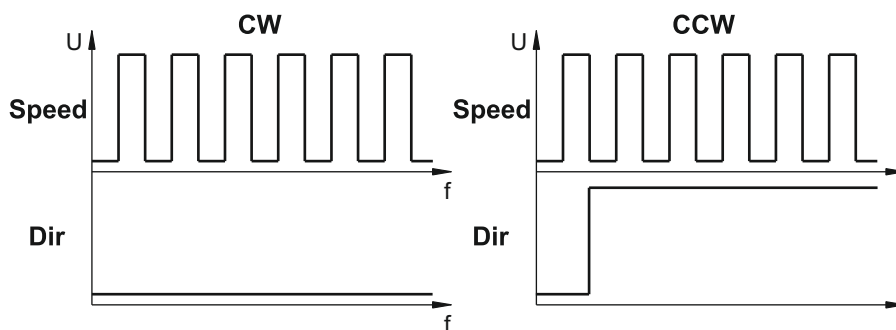
Frequency range	0 ... 15 000 Hz
Output measurements	Speed, Direction
Power supply	4.5 ... 30 VDC
Output maximum current	100 mA
Resident output voltage	1.5 V with 100 mA of the output 0.5 V without load of the output
Power consumption	< 15 mA without load
Temperature	-40 ... + 100 °C
Degree of protection	IP 67
Pin connector	universal /PUSH-PULL/ 4P Delphi Connector DJ3042-2.5-21
Humidity	0 ... 95% RH

OUTPUT PULSES

per revolution

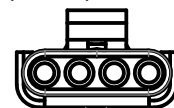
Motor Type	MAM20-50
Output Pulses	45

OUTPUT DIAGRAMS



PIN CONNECTOR

4 pin Delphi Connector

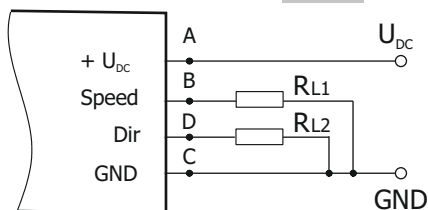


Pin	Connection	Cable Output
A	Power+	Red
B	Speed	White
C	Ground	Black
D	Direction	Green

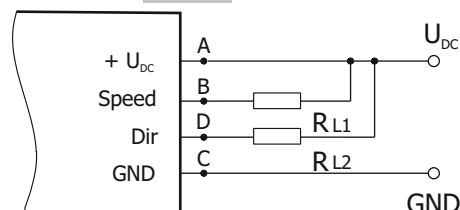
WIRING DIAGRAMS

Sensor could be in use for both type of connections - PNP or NPN

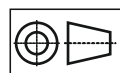
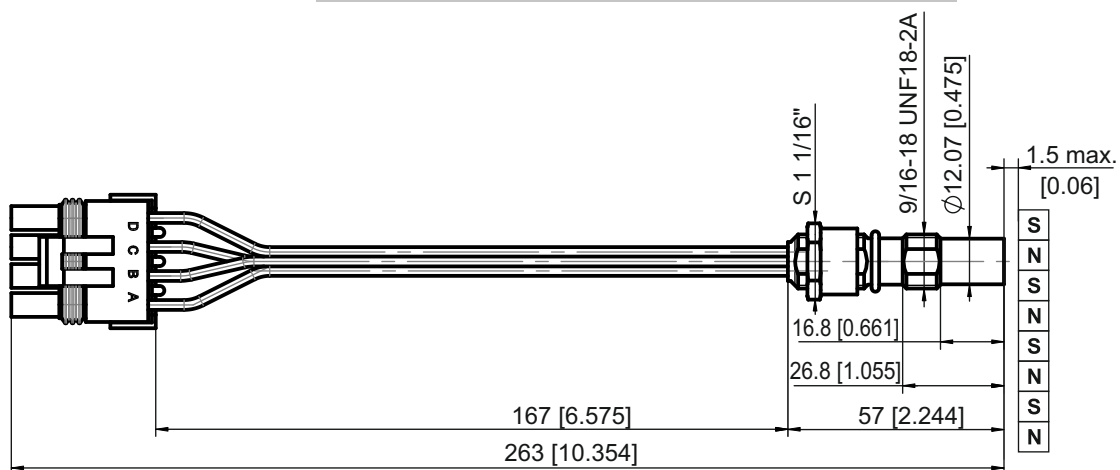
PNP

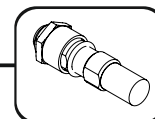


NPN



SENSOR R2S OVERALL DIMENSIONS





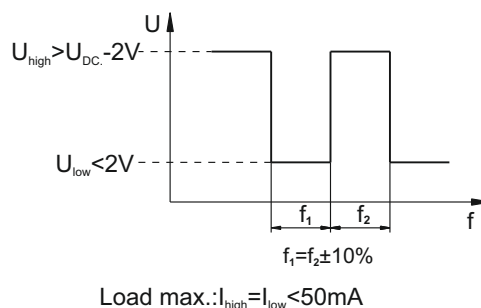
SPEED SENSORS RS

TECHNICAL DATA OF THE SINGLE CHANNEL HALL SPEED SENSOR

TECHNICAL DATA

Frequency range	0...15 000 Hz
Output measurements	Speed
Power supply	10...36 VDC
Output maximum current	50 mA
Current input	20 mA
Temperature	-40...+125°C [-40...+257°F]
Degree of protection	IP 67
Pin connector	M12-Series
Mounting principle	ISO 6149
Humidity	0 ... 95% RH

OUTPUT DIAGRAMS



OUTPUT PULSES

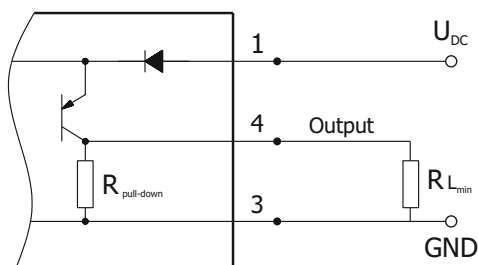
per revolution

Motor Type	MAM20-50
Output Pulses	9

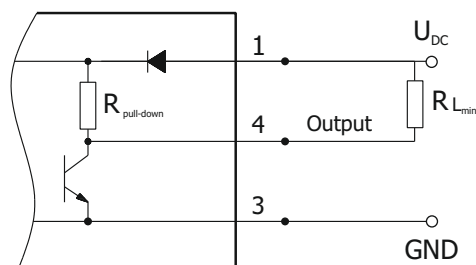
WIRING DIAGRAMS

Sensor could be in use for both type of connections - PNP or NPN

PNP

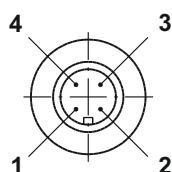


NPN



$$R_L [\text{k}\Omega] = U_{\text{DC}} [\text{V}] / I_{\text{max}} [\text{mA}]$$

PIN CONNECTOR

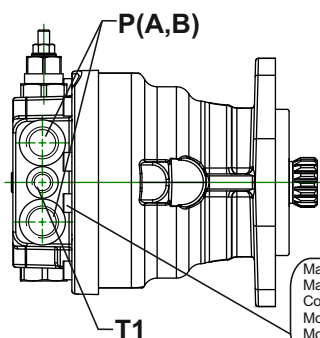


Pin	Connection	Cable Output
1	+U _{DC}	Brown
2	No connection	White
3	GND	Blue
4	Output signal	Black



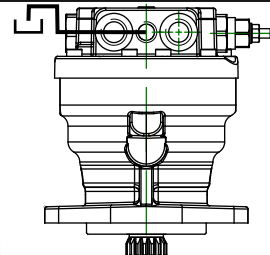
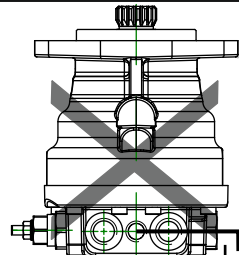
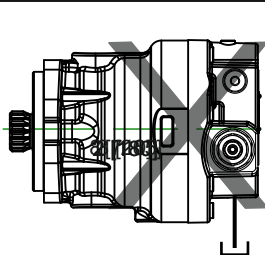
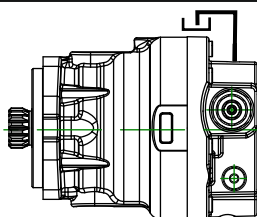
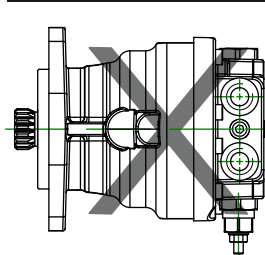
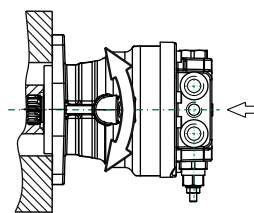
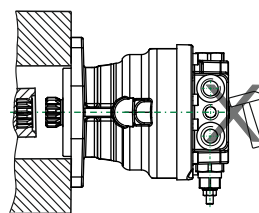
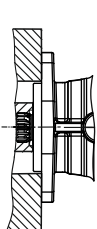
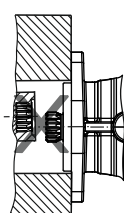
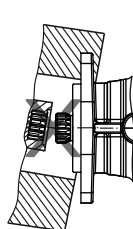
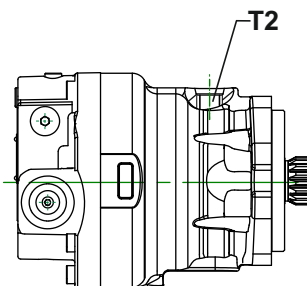
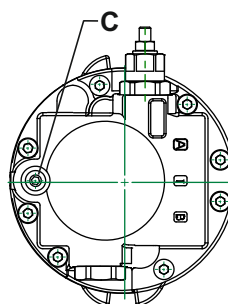
INSTALLATION

B/MAMB50

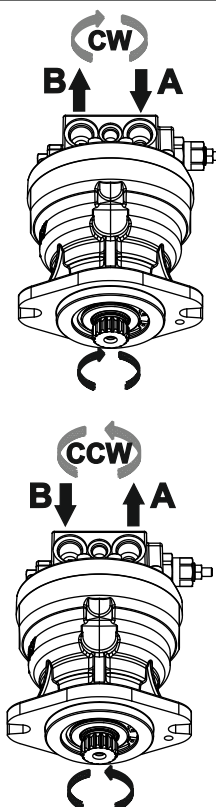


Port Size			
	6	7	8
P _(A,B)	2xG 1/2	2xM22x1.5	2x 7/8-14UNF
T1	G1/4	M14x1.5	9/16-18UNF
T2	G 1/2	M18x1.5	3/4-16UNF
C	G1/8	M10x1	7/16-20UNF

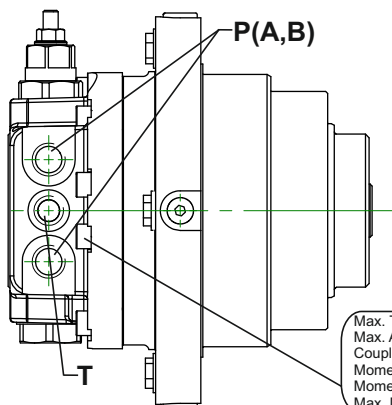
Max. Torque for Screwing
Max. Anzugsmoment
Couple de serrage maxi 3.5 daNm
Momento di serraggio max. [310 lb-in]
Momento d'apretadura max.
Max. Момент Закручивания



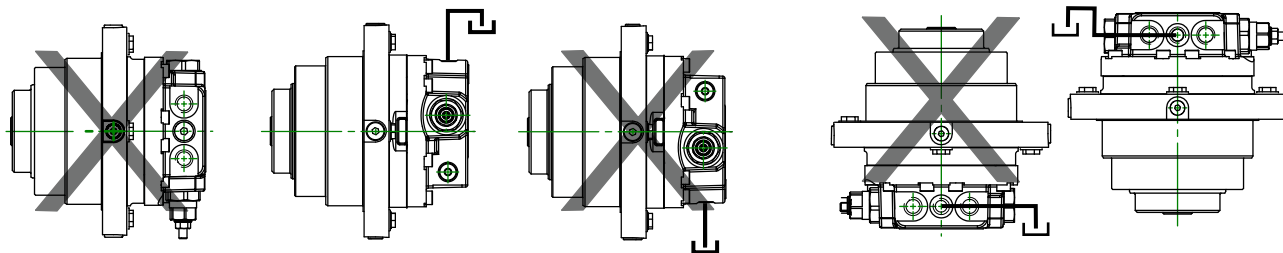
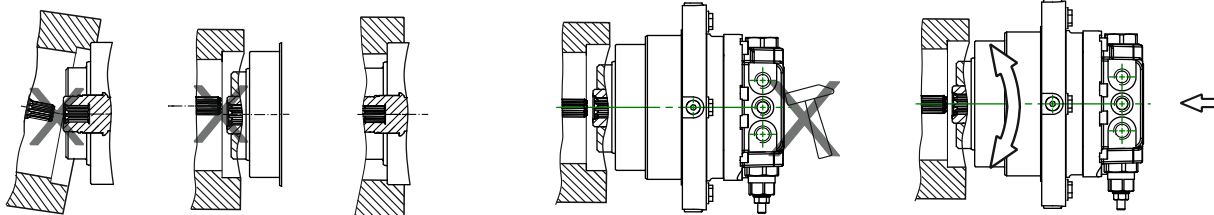
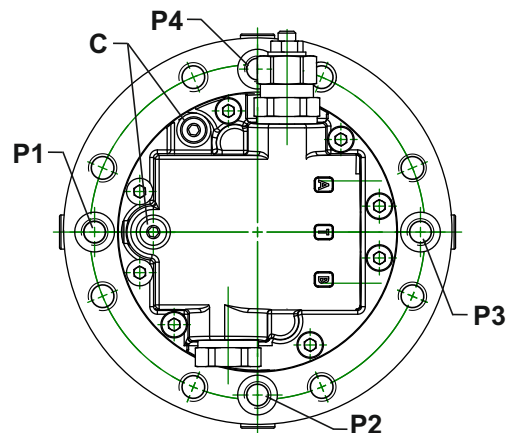
Screwed connection Anschlussart Raccord Tipo di collegamento Especie de unir Присоединительные резьбы	Max. Tightening Torque X, daNm [lb-in] Max. Anzugsmoment X, daNm [lb-in] Couple de serrage maxi X, daNm [lb-in] Momento di serraggio max. X, daNm [lb-in] Momento d'apretadura max. X, daNm [lb-in] Момент затяжки X, daNm [lb-in]			
	With copper washer Mit Kupferscheibe Avec rondelle en cuivre Con rondella di rame De arandela de cobre С медной шайбой	With aluminium washer Mit Aluminiumscheibe Avec rondelle en aluminium Con rondella di alluminio De arandela d'aluminio С алюминиевой шайбой	With cutting edge Mit Dichtkante Tranchant Con tagliente di guarnizione De borde compactar С крутым бортиком	With "O" ring Mit "O" Ring Avec joint torique Con "O"-anello De "O"-anillo С резиновым кольцом
M10x1	3.2 [300]	1 [88.5]	2 [180]	
M14x1.5	4 [360]	3 [265]	4 [360]	3 [265]
M18x1.5	6 [550]	5 [450]	6 [550]	5 [450]
M22x1.5	10 [900]	8 [700]	10 [885]	8 [700]
G1/8	1.6 [150]	1 [88.5]	2 [180]	
G1/4	4 [360]	3 [265]	4 [360]	2 [180]
G1/2	8 [710]	8 [700]	10 [885]	3 [265]
7/16-20UNF				2[180]
9/16-18UNF				2[180]
3/4-16UNF				6[550]
7/8-14UNF				7[620]
M8	4[360]			



B/MAMCB

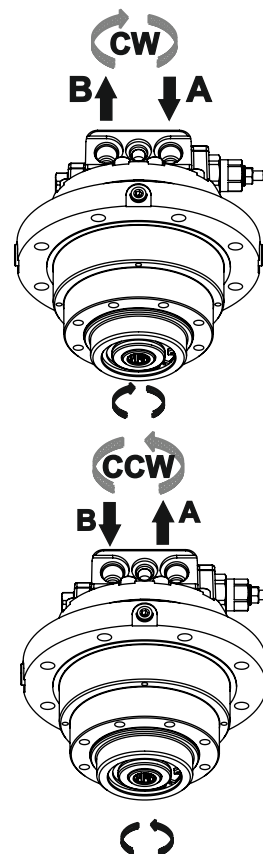


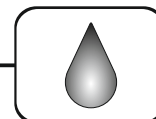
Max. Torque for Screwing
Max. Anzugsmoment
Couple de serrage maxi 3.5 daNm
Momento di serraggio max. [310 lb-in]
Momento d'apretadura max.
Max. Момент Закручивания



Screwed connection Anschlussart Raccord Tipo di collegamento Especie de unir Присоединительные резьбы	Max. Tightening Torque X, daNm [lb-in] Max. Anzugsmoment X, daNm [lb-in] Couple de serrage maxi X, daNm [lb-in] Momento di serraggio max. X, daNm [lb-in] Momento d'apretadura max. X, daNm [lb-in] Момент затяжки X, daNm [lb-in]			
	With copper washer Mit Kupferscheibe Avec rondelle en cuivre Con rondella di rame De arandela de cobre С медной шайбой	With aluminium washer Mit Aluminiumscheibe Avec rondelle en aluminium Con rondella di alluminio De arandela d'aluminio С алюминиевой шайбой	With cutting edge Mit Dichtkante Tranchant Con tagliante di guarnizione De borde compactar С крутым бортиком	With "O" ring Mit "O" Ring Avec joint torique Con "O"-anello De "O"-anillo С резиновым кольцом
G1/8	2[180]	1[88.5]	2[180]	1.5[130]
G1/4	4[360]	3[265]	4[360]	2[180]
1/2-20UNF				3[270]
3/4-16UNF				6[550]
M8	4[360]			

Port A, B	3/4-16 UNF
Drain Port T	1/2-20 UNF
Control Port C	G 1/8
Oil filling Port P1,P2,P3,P4	G 1/4

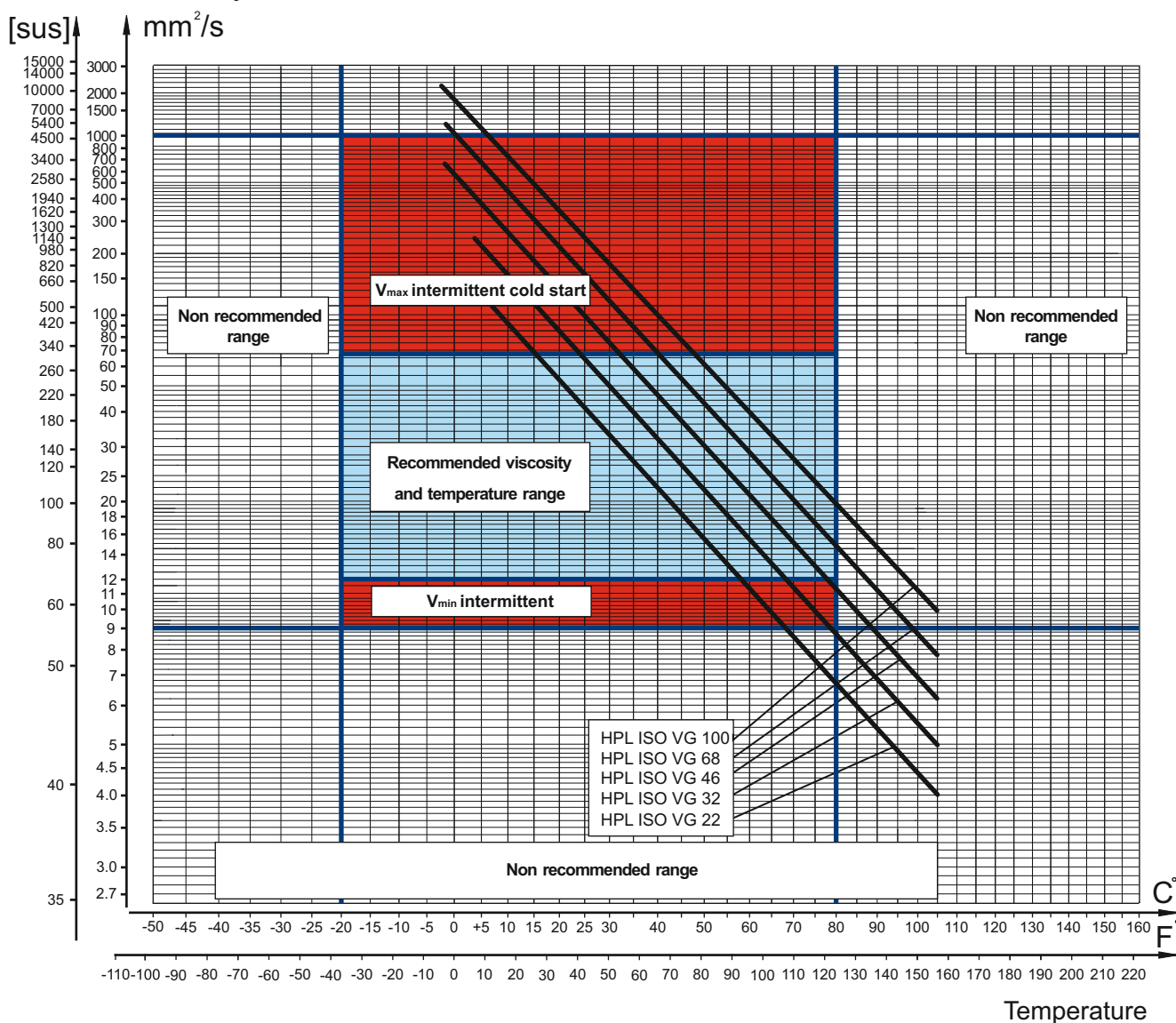




FLUID VISCOSITY LIMITS

In order to obtain optimum efficiency and service life, we recommend to select the operating viscosity (at operating temperature) within the range shown on diagram below.

Kinematic viscosity



The above - shown viscosity characteristics are for reference only. Please, check the actual viscosity with the manufacturer of the fluid.

BASIC FORMULAS

The motor size, pressure and flow required for a specific application can be calculated using the formulas below.

Metric System

Efficiency $\eta_t = \eta_{mh} \cdot \eta_v$ $\eta_{mh} = \frac{\eta_t}{\eta_v}$ $\eta_v = \frac{\eta_t}{\eta_{mh}}$

Input flow $Q = \frac{Vg \cdot n}{1000 \cdot \eta_v}$ [l/min]

Output torque $M = \frac{Vg \cdot \Delta p \cdot \eta_{mh}}{62,8}$ or $M = \Delta p \cdot T_{con.}$ [Nm]

Output power $P = \frac{M \cdot n}{9550} = \frac{Q \cdot \Delta p \cdot \eta_t}{600}$ [kW]

Speed $n = \frac{Q \cdot 1000 \cdot \eta_v}{Vg}$ or $n = Q \cdot N_{con.}$ [min⁻¹]

Vg = Displacement per rev. [cm³]

Δp = $p_{HP} - p_{LP}$ [bar]

p_{HP} = High pressure [bar]

p_{LP} = Low pressure [bar]

n = Rotation speed [RPM]

Q = Oil flow [l/min]

$T_{con.}$ = Toque constant [Nm/bar]

$N_{con.}$ = Speed constant [RPM/(l/min)]

η_v = Volumetric efficiency

η_{mh} = Mechanical-hydraulic efficiency

η_t = Overall efficiency

Inch System

Efficiency $\eta_t = \eta_{mh} \cdot \eta_v$ $\eta_{mh} = \frac{\eta_t}{\eta_v}$ $\eta_v = \frac{\eta_t}{\eta_{mh}}$

Input flow $Q = \frac{Vg \cdot n}{231 \cdot \eta_v}$ [GPM]

Output torque $M = \frac{Vg \cdot \Delta p \cdot \eta_{mh}}{2 \cdot \pi}$ or $M = \Delta p \cdot T_{con.}$ [lb-in]

Output power $P = \frac{Vg \cdot n \cdot \Delta p \cdot \eta_t}{396000}$ [hp]

Speed $n = \frac{Q \cdot 231 \cdot \eta_v}{Vg}$ or $n = Q \cdot N_{con.}$ [min⁻¹]

Vg = Displacement per rev. [in³]

Δp = $p_{HP} - p_{LP}$ [PSI]

p_{HP} = High pressure [PSI]

p_{LP} = Low pressure [PSI]

n = Rotation speed [RPM]

Q = Oil flow [GPM]

$T_{con.}$ = Toque constant [lb-in/PSI]

$N_{con.}$ = Speed constant [RPM/GPM]

η_v = Volumetric efficiency

η_{mh} = Mechanical-hydraulic efficiency

η_t = Overall efficiency

Depending on the results of the load calculations, the most appropriate type of motor from the catalogue is selected.

Table 1

Rolling resistance coefficient In case of rubber tire rolling on different surfaces			
Surface	ρ	Surface	ρ
Concrete- faultless	0.010	Macadam- bad	0.037
Concrete- good	0.015	Snow- 5 cm	0.025
Concrete- bad	0.020	Snow- 10 cm	0.037
Asphalt- faultless	0.012	Polluted covering- smooth	0.025
Asphalt- good	0.017	Polluted covering- sandy	0.040
Asphalt- bad	0.022	Mud	0.037÷0.150
Macadam- faultless	0.015	Sand- Gravel	0.060÷0.150
Macadam- good	0.022	Sand- loose	0.160÷0.300

APPLICATION FORMULAS

1. Motor speed: n , RPM

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

v_{km} - vehicle speed [km/h]

v_{mi} - vehicle speed [mi/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 , daN [lbs]

The resistance force resulted in wheels contact with different surfaces:

$$RR = G \cdot \rho$$

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

ρ - rolling resistance coefficient (Table 1).

3. Grade resistance: GR , daN [lbs]

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

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°

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

$$FA = \frac{v_{km} \cdot G}{36 \cdot t \cdot 10} \text{ [daN]} \quad FA = \frac{v_{mi} \cdot G}{2.2 \cdot t} \text{ [lbs]}$$

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.

$$TE = 1.1 \cdot (RR + GR + FA + DP)$$

RR - force required to overcome the rolling resistance;

GR - force required to slope upwards;

FA - force required to accelerate (acceleration force);

DP - additional tractive effort (trailer).

7. Motor Torque moment: M , daNm [in-lb]

Necessary torque moment for every hydraulic motor:

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

N - motor numbers;

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

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

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

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].

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

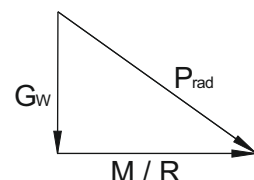
When the motor is used for motion with a ring or gear mounted directly on the motor shaft, the total radial load of the motor shaft P_{rad} is the sum of the motion force and the weight force acting on the ring.

G_w - Weight held by wheel;

P_{rad} - Total radial loading of motor shaft;

M/R - Motion force.

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



Depending on the results of the load calculations, the most appropriate type of motor from the catalogue is selected.

Notes

[illegible]

Notes

[illegible]

WARRANTY

M+S Hydraulic warrants, that its products, supplied directly to original equipment manufacturer, authorized distributor or other customer, will be free of defects in material or workmanship at the time of shipment from M+S Hydraulic and will conform to the products technical documentation (drawings and specifications) under sale agreement with Buyer.

This warranty will apply only to defects appearing within applicable Warranty period, mentioned below. If Buyer notifies M+S Hydraulic within the Warranty period about any such defects, M+S, at its sole option will replace or repair the defective products or their parts found by M+S Hydraulic to be defective in material or workmanship.

THE FOREGOING LIMITED WARRANTY IS AVAILABLE ONLY IF "M+S HYDRAULIC" IS PROMPTLY NOTIFIED IN WRITTEN OF THE ALLEGED DEFECT AND DOES NOT COVER FAILURE TO FUNCTION CAUSED BY DAMAGE TO THE PRODUCT, IMPROPER INSTALLATION, UNREASONABLE USE OR ABUSE OF THE PRODUCT, FAILURE TO PROVIDE OR USE OF IMPROPER MAINTENANCE OR USUAL, DEGRADATION OF THE PRODUCT DUE TO PHYSICAL ENVIRONMENTS OF AN USUAL NATURE. THE FOREGOING REMEDIES ARE THE SOLE AND EXCLUSIVE REMEDIES AVAILABLE TO CUSTOMER. To facilitate the inspection, M+S Hydraulic may require return of the product/part, which Buyer claims to be defective.

M+S Hydraulic shall not be liable for labor costs or any other expenses incurred during the disassembling or reinstalling of the product/part.

In case the claimed products are returned to M+S Hydraulic in bad condition: dirty, disassembled, with damaged or missing parts during transportation, the warranty will be considered as not applicable and the products will not be liable to repair.

Warranty periods

New products: The Warranty period is limited to 24 consecutive months (2 years) from the date of production of the product.

Repaired products: If the product is repaired in M+S Hydraulic during its warranty period, the warranty period of the repaired item shall continue for the balance of original Warranty period or for a period equal to 50% of the original new product Warranty period, whichever is later.

Spare parts: The Warranty period for Spare parts is 12 consecutive months (1 year) from the dispatch date of such parts from M+S Hydraulic.

LIMITATION OF LIABILITY M+S Hydraulic's liability for claim of any kind, for loss or damage arising out of, connected with or resulting from an order, or from the performance or branch thereof, or from the design, manufacture, sale delivery, operation or use of any of its products shall be limited to, at M+S 's sole option, replacement, repair of any defective product or the issuance of a credit to Customer against any future purchases. Cash refunds will not be made under any circumstances and Customer will not be entitled to recover any damages of any kind against M+S Hydraulic, including but not limited to incidental or consequential damages, whether direct or indirect, known or unknown, foreseen or unforeseen.

HES HYDRAULIC ELEMENTS AND SYSTEMS OVERVIEW



Hydraulic Elements and Systems PLC is a public stock company located in the town of Yambol, South-East Bulgaria. The factory has a long history and traditions in the design and manufacture of hydraulic cylinders. The product range includes Piston cylinders, Telescopic cylinders, Plunger cylinders and Rack cylinders.

M+S HYDRAULIC OVERVIEW



M+S Hydraulic is a leading manufacturer of Hydraulic Motors, Hydrostatic Steering Units and accessories, Hydraulic brakes Motor-brakes and Valve Blocks in Europe and all over the world.

The main advantage of our company is that we offer hydraulic solutions to the specific needs of the customers meeting their technical requirements thanks to the various product's options. M+S Hydraulic commodities are guaranteed with after-sales services, technical support and warranty period of 24 months.

M+S Hydraulic has an enlarging world-wide distributors' network. The company has Agency contracts and Consignment agreements with more than 35 companies in the world. We have the know-how to develop solutions for productivity and efficiency on every continent.

