Eaton Closed and Open Loop Hydraulic Motor
DuraForce™ HMV / HMR / HMF / HMA

Powering Business Worldwide

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Eaton
Open and Closed Loop Motor

Product Characteristics

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Optional swashing to 0 cm^3/rev

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Hydrostatic bearing

3. Piston-slipper Assembly
21° swash angle

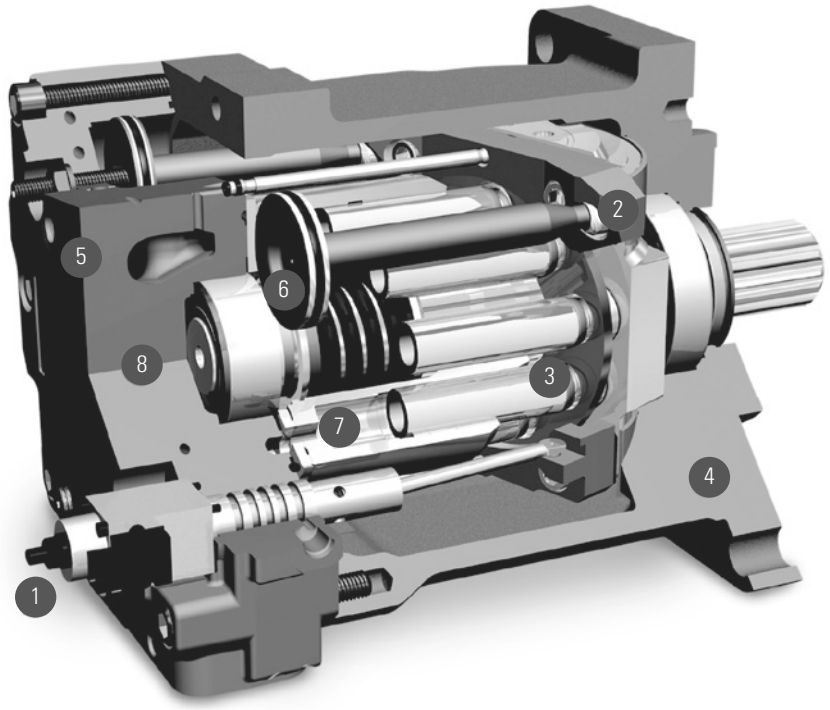
4. Housing
Monoshell for high rigidity

5. Valve Plate Housing
Highly integrated

6. Control Piston
Integrated, hydraulically captured

7. Rotating Group
Precise torque transmission even at low speeds

8. Optional Through-Drive
Available with two shaft ends for torque transmission



Product Range

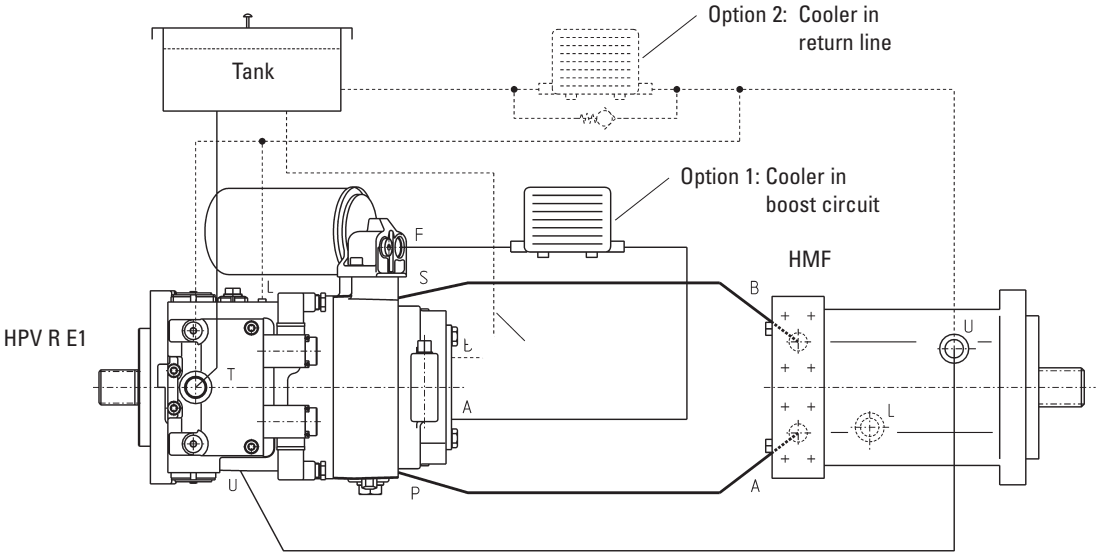
Find the right products for your application.

Product	Application	Product Name
Pump		
Self-regulating pump	Open loop operation	HPR
Variable pump	Closed loop operation	HPV
Motor		
Variable motor	Closed and open loop operation	HMV
Regulating motor	Closed and open loop operation	HMR
Fixed motor	Closed and open loop operation	HMF
	Open loop operation	HMF P
	Closed and open loop operation	HMA

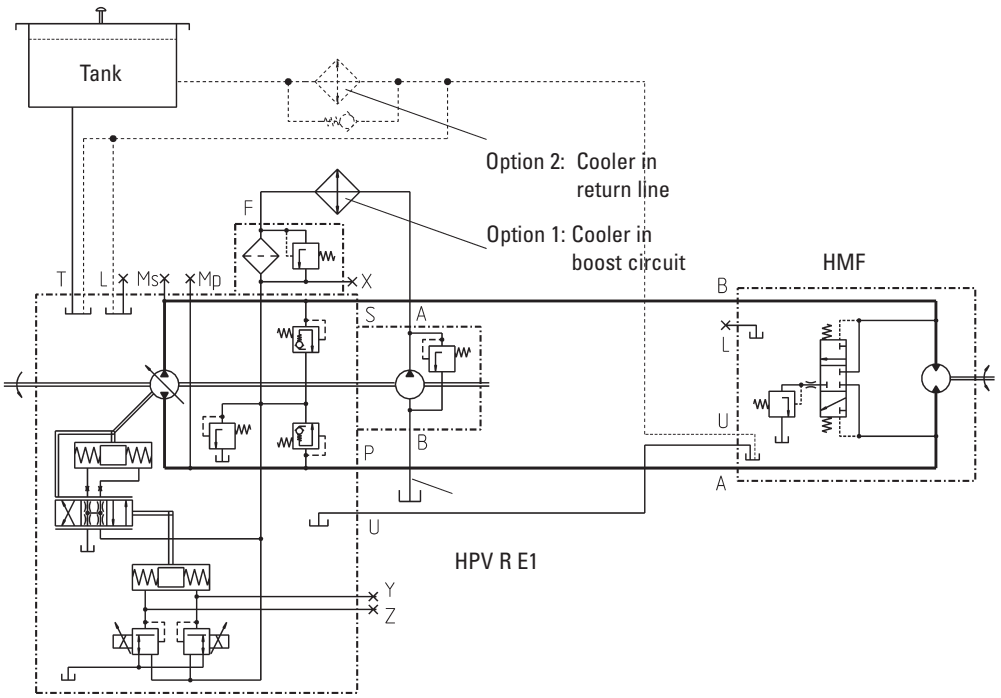
The Closed Loop

Representation of the hydraulic components of a closed loop hydrostatic drive: Variable electrohydraulic controlled pump HPV E1 and fixed displacement motor HMF plus filter, cooler and oil tank. The function diagram and the circuit diagram show two types of cooling.

Function Diagram



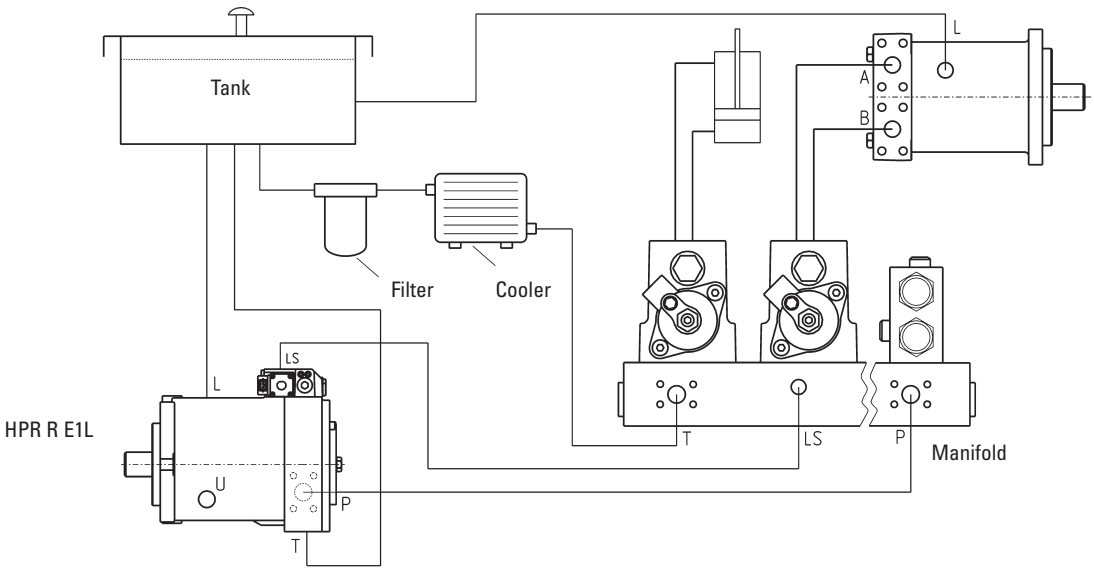
Circuit Diagram



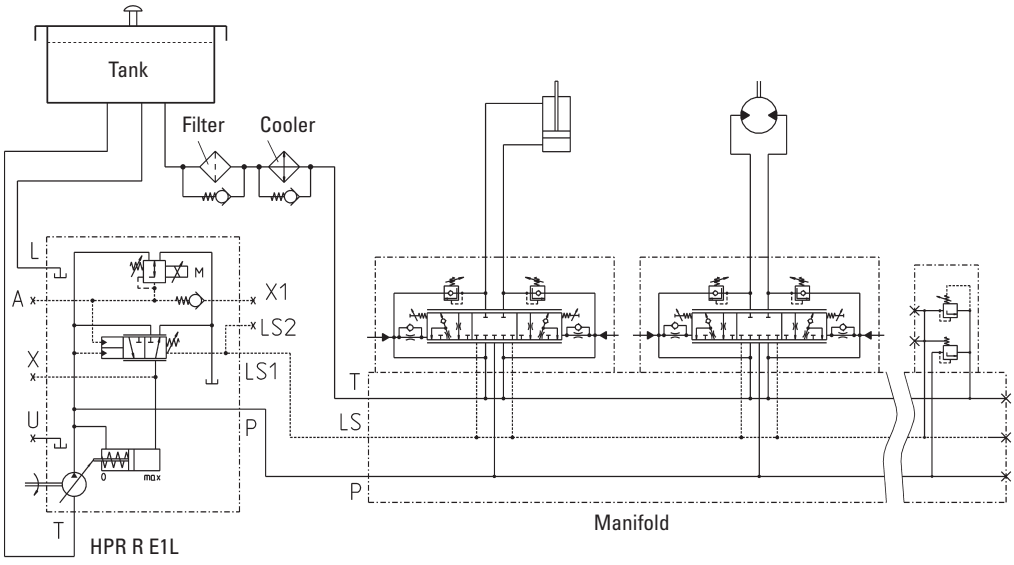
The Open Loop

Representation of hydraulic components in an open loop circuit, based on the LSC system as an example: A HPR regulating pump with load sensing function for energy-saving flow on demand control and VW load sensing directional control valves for load independent and simultaneous movements of several consumers without mutual influencing. The system is complemented with proven Eaton products such as electronic controllers and hydraulic motors.

Function Diagram



Circuit Diagram



Further information about the LSC system is available in the HPR data sheet or directly from our sales engineers.

Specifications and Technical Data

Overview Displacements 28-105

Specifications

Model			28	35	50/55	75	105
Rated Size Displacement HMV can be set to 0 cm^3/rev displacement	Maximum V_{max} HMF 50 (w/o directional control valve) have 51.3 cm^3/rev displacement, thus torque and power change accordingly	cm^3/rev	28.6	35.6	51.3/54.7	75.9	105.0
	Minimum V_{min} only for variable and regulating motors	cm^3/rev	–	–	18.3	25.3	35.0
Speed	Max. continuous speed (100 % duty cycle) at maximum displacement	min^{-1}	4500	4500	4100	3800	3500
	Max. speed (intermittent) at maximum displacement, higher speed on request	min^{-1}	4800	4800	4400	4100	3800
	Max. continuous speed (100 % duty cycle) at min. displacement	min^{-1}	–	–	4700	4400	4100
	Max. speed (intermittent) at minimum displacement, higher speed on request	min^{-1}	–	–	5300	5000	4700
Pressure	Nominal pressure other values on request	bar			420		
	Peak pressure	bar			500		
	Permissible Housing pressure (Absolute)	bar		250	2.5		
Torque (Theoretical)	Continuous output torque at continuous pressure	Nm	114	142	204/218	302	418
	Max. output torque at maximum operating pressure	Nm	191	238	343/366	507	702
Power (Theoretical)	Continuous power at maximum continuous speed, maximum displacement and continuous pressure	kW	54	67	88/93	120	153
	Maximum Power at max. continuous speed, max. displacement and max. operating pressure	kW	90	112	147/157	202	257
Permissible Shaft Loads	Axial input /output force	N			2000		
	Radial	N			on request		
Perm. Housing Temp.	Perm. housing temperature with minimum perm. viscosity > 10 cSt	°C °F			90°C 194°F		
Weights	Fixed displacement motor with 2-hole mounting flange	kg	16	16	19	26	33
	Variable and regulating motor with 2- or 4-hole mounting flange	kg	–	–	28	32	42
	Max. moment of inertia	$kgm^2 \times 10^{-2}$	0.25	0.25	0.49	0.79	1.44

Specifications and Technical Data

Overview Displacements 135-135D

Specifications

Model			135	165	210	280	135D
Rated Size Displacement HMV can be set to 0 cm^3/rev displacement	Maximum V_{max} HMF 50 (w/o directional control valve) have 51.3 cm^3/rev displacement, thus torque and power change accordingly	cm^3/rev	135.6	165.6	210	281.9	271.2
	Minimum V_{min} only for variable and regulating motors	cm^3/rev	45.2	55.2	70	93	67
Speed	Max. continuous speed (100 % duty cycle) at maximum displacement	min^{-1}	3200	3100	2700	2400	3200
	Max. speed (intermittent) at maximum displacement, higher speed on request	min^{-1}	3500	3400	3000	2700	3500
	Max. continuous speed (100 % duty cycle) at minimum displacement	min^{-1}	3700	3500	3200	2900	3700
	Max. speed (intermittent) at minimum displacement, higher speed on request	min^{-1}	4000	3900	3500	3200	4000
Pressure	Nominal pressure other values in request	bar			420		
	Peak pressure	bar			500		
	Permissible housing pressure (absolute)	bar			2.5		
Torque (Theoretical)	Continuous output torque at continuous pressure	Nm	540	659	836	1122	1079
	Max. output torque at maximum operating pressure	Nm	906	1107	1404	1884	1748
Power (Theoretical)	Continuous power at maximum continuous speed, maximum displacement and continuous pressure	kW	181	214	236	282	362
	Maximum power at max. continuous speed, max. displacement and max. operating pressure	kW	304	359	397	474	586
Permissible Shaft Loads	Axial input / output force	N			2000		
	Radial	N			on request		
Perm. housing temperature	Perm. housing temperature with minimum perm. viscosity > 10 cSt	°C °F			90°C 194°F		
Weights	Fixed displacement motor with 2-hole mounting flange	kg	39	75	100	-	-
	Variable and regulating motor with 2- or 4-hole mounting flange	kg	56	76	101	146	149
	Max. moment of inertia	$kgm^2 \times 10^{-2}$	2.15	3.06	4.68	9.36	2.15

Model Code

HMV Variable Displacement Motors (Open & Closed Loop Operation)

The following 31 digit coding system has been developed to identify preferred feature options for the Eaton Closed or Open Loop Hydraulic Motor. Use this code to specify a motor with the desired features. All 31-digits of the code must be present to release a new product number for ordering. Please contact your local customer service representative for leadtime questions.

HMV 210 A F M 1 0 A 1 0 A A 1 000 000 000 00 A A A

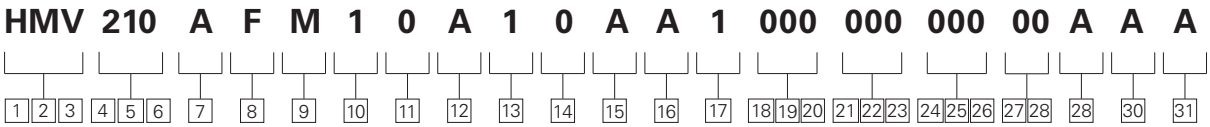
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 28 30 31

	55	75	105	135	165	210	280
1 2 3 Product							
HMV– Adjustable Fixed Displacement Motors	●	●	●	●	●	●	●
4 5 6 Displacement							
055 – 055 cc	●						
075 – 075 cc		●					
105 – 105 cc			●				
135 – 135 cc				●			
165 – 165 cc					●		
210 – 210 cc						●	
280 – 280 cc							●
7 Mounting Flange							
A – SAE J744 standard	●	●	●	●	●	●	●
P – Plug-in (*d)		●	●	●			
8 Output Shaft							
C – Splined ANSI B92.1 12/24 - 14 teeth (SAE J744 C)	●	●	●				
D – Splined ANSI B92.1 8/16 - 13 teeth (SAE J744 D&E)				●	●		
F – Splined ANSI B92.1 8/16 - 15 teeth (SAE J744 F)						●	●
K – Splined ANSI B92.1 16/32 - 21 teeth	●	●					
L – Splined ANSI B92.1 16/32 - 23 teeth			●				
M – Splined ANSI B92.1 16/32 - 27 teeth				●	●	●	
N – Splined ANSI B92.1 16/32 - 33 teeth							●
P – Shaft coupling flange size 4			•	•	•	•	•
9 Porting							
M – ISO 6149 metric	●	●	●	●	●	●	●
D – DIN 3852	•	•	•	•			
10 Auxiliary Mount and Port Locations							
1 – radial ports / without PTO	●	●	●	●	●	●	●
2 – axial ports / without PTO			•	•	•		
4 – radial ports / splined PTO shaft ANSI B92.1 16/32 - 21 teeth				•			
5 – radial ports / splined PTO shaft ANSI B92.1 16/32 - 22 teeth					•		
6 – radial ports / splined PTO shaft ANSI B92.1 16/32 - 24 teeth						•	
7 – radial ports / splined PTO shaft ANSI B92.1 16/32 - 27 teeth							•
8 – radial ports / PTO shaft coupling flange size 4						•	•
9 – radial ports / PTO speed sensor 35 impulses	•	•	•	•	•	•	•
A – radial ports / tandem unit: attachment of a HMV210 (H1)/ (*s)						•	•
B – radial ports / tandem unit: attachment of a HMV280 (H1)/ (*s)							•
11 Attachments to Service Ports							
0 – without	●	●	●	●	●	●	●
1 – crossover relief block 250 bar (*p)					●	●	●
2 – crossover relief block 300 bar (*p)					●	●	●
3 – crossover relief block 380 bar (*p)					●	●	●
4 – crossover relief block 420 bar (*p)					●	●	●
12 Motor Control							
A – H1: hydraulic proportional / standard mounting	●	●	●	●	●	●	●
B – E1: electro-proportional/ standard mounting (*y)	●	●	●	●	●	●	●
C – E2: electric two position/ standard mounting (*y)	•	•	•	•	•	•	•
D – E4: electro-proportional/ Vmin = 0 / standard mounting (*y)	•	•	•	•	•	•	•
E – E6: electro-proportional/ Vmin = 0 / standard mounting (*y)			•	•	•	•	•
F – E1F: electro-proportional/ side-mounted (*y)			•				
J – E6F electro-proportional/ Vmin = 0 / side-mounted (*y)			•				
K – EH1P: hydraulic proportional/ PCO (*y)		•	•	•	•		
L – H1-CA: hydraulic proportional/ CA operation (*m)					•	•	
M – EH1P-CA: hydraulic proportional/ PCO / CA operation (*z)			•	•	•	•	
Q – H4 hydraulic proportional/ Vmin = 0	•	•	•	•	•	•	•
13 Control Threshold Pressure							
0 – not applicable (E1; E2; E4; E6(F))	●	●	●	●	●	●	●
1 – 7,0 bar (H1; EH1P; E1H1P-CA)	●	●	●	●	●	●	●
2 – 7,5 bar (H1; EH1P; H1-CA)	●	●	●	●	●	●	●
3 – 8,0 bar (H1; EH1P)	●	●	●	●	●	●	●
4 – 8,5 bar (H1, EH1P)	●	●	●	●	●	●	●
5 – 9,0 bar (H1, EH1P)	●	●	●	●	●	●	●
6 – 9,5 bar (H1, H4, EH1P)	●	●	●	●	●	●	●
8 – 4,0 bar (H4)	●	●	●	●	●	●	●
14 Control Solenoids							
0 – not applicable (H1; H1-CA; H2)	●	●	●	●	●	●	●
A – AMP / 12V	•	•	•	•	•	•	•
B – AMP / 24 V	•	•	•	•	•	•	•
C – DIN / 12 V	•	•	•	•	•	•	•
D – DIN / 24 V	•	•	•	•	•	•	•
E – Deutsch / 12V (E1(F); E2; E4(F); E6(F); EH1P-CA)	●	●	●	●	●	●	●
F – Deutsch / 24V (E1(F); E2; E4(F); E6(F); EH1P-CA)	●	●	●	●	●	●	●
15 Response Orifices							
A – 0,6 mm	•	•	•	•	•	•	•
B – 0,7 mm	•	•	•	•	•	•	•
C – 0,8 mm	•	•	•	•	•	•	•
D – 0,9 mm	•	•	•	•	•	•	•
E – 1,0 mm	•	•	•	•	•	•	•
F – 1,1 mm	•	•	•	•	•	•	•
G – 1,2 mm	•	•	•	•	•	•	•
H – 1,3 mm	•	•	•	•	•	•	•
J – 1,5 mm	•	•	•	•	•	•	•
K – 1,8 mm	•	•	•	•	•	•	•
L – 2,1 mm	•	•	•	•	•	•	•
M – 1,4 mm	•	•	•	•	•	•	•
16 Purge Relief Valve							
0 – without purge devices		•	•				
A – 10 bar standard purge flow	●	●	●	●	●	●	●
B – 14 bar standard purge flow	●	●	●	●	●	●	●
C – 10 bar reduced purge flow	•	•	•	•	•	•	•
D – 14 bar reduced purge flow	•	•	•	•	•	•	•
E – 10 bar increased purge flow	•	•	•	•	•	•	•
F – flow controlled 6 l/min (*o)	●	●	●	●	●	●	●
G – blank plug instead of relief valve (*v)	•	•	•	•	•	•	•

Model Code

HMV Variable Displacement Motors (Open & Closed Loop Operation)

The following 31 digit coding system has been developed to identify preferred feature options for the Eaton Closed or Open Loop Hydraulic Motor. Use this code to specify a motor with the desired features. All 31-digits of the code must be present to release a new product number for ordering. Please contact your local customer service representative for leadtime questions.



	55	75	105	135	165	210	280
17 **Purge Relief Valve**							
0 – Without purge devices		•	•				
1 – Standard shuttle valve	●	●	●	●	●	●	●
2 – Damped shuttle valve	•	•	•	•	•	•	•
3 – Shuttle valve blocked	•	•	•	•	•	•	•
18 19 20 **Minimum Displacement Setting**							
000 – Catalog Motor Rating	●	●	●	●	●	●	●
value Numeric three digit, setting range see positions 4,5,6	•	•	•	•	•	•	•
21 22 23 **Maximum Displacement Setting**							
000 – Catalog Motor Rating	●	●	●	●	●	●	●
24 25 26 **Pressure Override Setting**							
000 – not applicable	●	●	●	●	●	●	●
value 150 -260 bar (numeric 3 digits / EH1P; EH1P-CA only)	•	•	•	•	•	•	•
27 28 **Special Requirements**							
00 – Without (default)	●	●	●	●	●	●	●
29 **Surface Coating**							
0 – anti-rust conservation oil (default)	●	●	●	●	●	●	●
A – primer blue	●	●	●	●	●	●	●
30 **Unit Identification**							
A – Eaton	●	●	●	●	●	●	●
31 **Type Code Release**							
A – Revision Level	●	●	●	●	●	●	●

(*d) DIN porting only (see position 9)
(*e) Availability depends on controller type (see position 12)
(*m) ISO metric porting only (see position 9)
(*o) Open loop operation only
(*p) Radial service ports only (see position 10)
(*s) Second motor unit has to be specified separately
(*v) With blocked purge shuttle valve only (see position 17)
(*y) Solenoids with square cross section
(*z) Solenoids with circular cross section

Model Code

HMR Regulated Variable Displacement Motors (Open & Closed Loop Operation)

The following 36 digit coding system has been developed to identify preferred feature options for the Eaton Closed or Open Loop Hydraulic Motor. Use this code to specify a motor with the desired features. All 36-digits of the code must be present to release a new product number for ordering. Please contact your local customer service representative for leadtime questions.

HMR 135 A J M 1 0 A P 0 0 0 A 00 A 1 0 000 000 000 00 A A A

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36

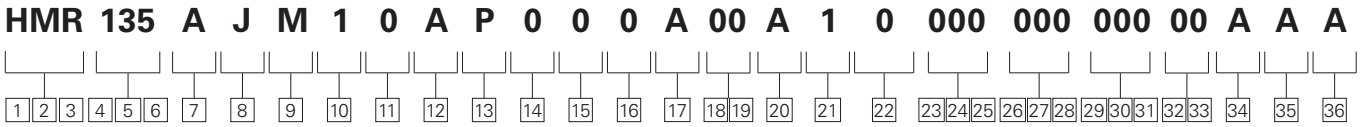
	75	105	135	165	210	280
1 2 3 Product						
HMV – Regulated Variable Displacement Motors	●	●	●	●	●	●
4 5 6 Displacement						
075 – 075 cc	●					
105 – 105 cc		●				
135 – 135 cc			●			
165 – 165 cc				●		
210 – 210 cc					●	
280 – 280 cc						
7 Mounting Flange						
A – SAE J744 standard	●	●	●	●	●	●
P – Plug-in (*d)		•	•			
8 Output Shaft						
D – splined ANSI B92.1 12/24 - 14 teeth (SAE J744 C)	●	●				
C – splined ANSI B92.1 8/16 - 15 teeth (SAE J744 F)					●	●
J – splined ANSI B92.1 8/16 - 13 teeth (SAE J744 D&E)			●	●		●
K – splined ANSI B92.1 16/32 - 21 teeth	●					
L – splined ANSI B92.1 16/32 - 23 teeth		●				
M – splined ANSI B92.1 16/32 - 27 teeth			●	●	●	
N – splined ANSI B92.1 16/32 - 33 teeth						●
P – shaft coupling flange size 4					•	•
9 Porting						
M – ISO 6149 metric			●	●	●	●
D – DIN 3852	●	●	●			
10 Auxiliary Mount and Port Locations						
1 – Radial ports / without PTO	●	●	●	●	●	●
2 – Axial ports / without PTO	•	•	•	•		
11 Attachments to Service Ports						
0 – Without	●	●	●	●	●	●
1 – crossover relief block 250 bar (*p)				●	●	●
2 – crossover relief block 300 bar (*p)				•	•	•
3 – crossover relief block 380 bar (*p)				•	•	•
4 – crossover relief block 420 bar (*p)				●	●	●
12 Motor Control						
0 – Not Applicable	●	●	●	●	●	●
13 Motor Control						
P – pressure regulated	●	●	●	●	●	●
14 Displacement Override						
0 – without	●	●	●	●	●	●
E – electric	●	●	●	●	●	●
H – hydraulic high pressure (*o)	●	●	●	●	●	●
L – hydraulic low pressure (*o)	•	•	•	•	•	•
15 Regulating Pressure Selection						
0 – highest srevice port pressure	•	•	•	•	•	•
E – electric (*c)	•	•	•	•	•	•
B – through brake valve (*o)	•	•	•	•	•	•
16 Control Solenoids						
0 – not applicable	●	●	●	●	●	●
A – AMP / 12V	•	•	•	•	•	•
B – AMP / 24 V	•	•	•	•	•	•
C – DIN / 12 V	•	•	•	•	•	•
D – DIN / 24 V	•	•	•	•	•	•
E – Deutsch / 12V	●	●	●	●	●	●
F – Deutsch / 24V	●	●	●	●	●	●
17 Response Orifices						
A – 0,6 mm	•	•	•	•	•	•
B – 0,7 mm	•	•	•	•	•	•
C – 0,8 mm	•	•	•	•	•	•
D – 0,9 mm	•	•	•	•	•	•
E – 1,0 mm	•	•	•	•	•	•
F – 1,1 mm	•	•	•	•	•	•
G – 1,2 mm	•	•	•	•	•	•
H – 1,3 mm	•	•	•	•	•	•
J – 1,4 mm	•	•	•	•	•	•
K – 1,5 mm	•	•	•	•	•	•
L – 1,8 mm	•	•	•	•	•	•
M – 2,1 mm	•	•	•	•	•	•
18 19 Crossover Relief Valves Integrated						
00 – Without	•	•	•	•	●	●
AG – 350 bar (*q) frame sizes 75;165: (*l)	●	●	●	●		
AH – 420 bar (*q) frame sizes 75;165: (*l)	●	●	●	●		
AC – 250 bar (*q) frame sizes 75;165: (*l)	●	●	●	●		
AD – 270 bar (*q) frame sizes 75;165: (*l)	●	●	●	●		
AE – 300 bar (*q) frame sizes 75;165: (*l)	●	●	●	●		
AF – 330 bar (*q) frame sizes 75;165: (*l)	●	●	●	●		
20 Purge Relief Valve						
0 – Without purge devices	●	●	●	●		
A – 10 bar standard purge flow	●	●	●	●	●	●
B – 14 bar standard purge flow	●	●	●	●	●	●
C – 10 bar reduced purge flow	•	•	•	•	•	•
D – 14 bar reduced purge flow	•	•	•	•	•	•
E – 10 bar increased purge flow	•	•	•	•	•	•
F – flow controlled 6 l/min (*o)	●	●	●	●	●	●
G – blank plug instead of relief valve	•	•	•	•	•	•
21 Purge Shuttle Valve						
0 – Without purge devices	●	●	●	●		
1 – Standard shuttle valve	●	●	●	●	●	●
2 – Damped shuttle valve	•	•	•	•	•	•
3 – Shuttle valve blocked	•	•	•	•	•	•
22 Brake/Counterbalance Valve Preparation						
0 – Without brake / counterbalance valve preparation	●	●	●	●	●	●
A – With propel brake valve preparation (*o)		•	•	•	•	•
23 24 25 Minimum Displacement Setting						
000 – Catalog Motor Displacement	●	●	●	●	●	●
value – 022 - 055 (numeric 3 digit)	•					
value – 031 - 075 (numeric 3 digit)		•				
value – 041 - 089 (numeric 3 digit)			•			
value – 052 - 108 (numeric 3 digit)				•		
value – 055 - 150 (numeric 3 digit)					•	

• Available Option ● Preferred Option

Model Code

HMR Regulated Variable Displacement Motors (Open & Closed Loop Operation)

The following 36 digit coding system has been developed to identify preferred feature options for the Eaton Closed or Open Loop Hydraulic Motor. Use this code to specify a motor with the desired features. All 36-digits of the code must be present to release a new product number for ordering. Please contact your local customer service representative for leadtime questions.



	75	105	135	165	210	280
value – 085 - 175 (numeric 3 digit)						•
26 27 28 **Maximum Displacement Setting**						
000 – Catalog Motor Displacement	●	●	●	●	●	●
29 30 31 **Pressure Override Setting**						
000 – 150 - 260 bar (numeric 3 digits)	●	●	●	●	●	●
32 33 **Special Requirements**						
00 – Without (default)	●	●	●	●	●	●
34 **Surface Coating**						
0 – anti-rust conservation oil (default)	●	●	●	●	●	●
A – primer blue	●	●	●	●	●	●
35 **Unit Identification**						
A – Eaton	●	●	●	●	●	●
35 **Type Code Release**						
A – Revision Level	●	●	●	●	●	●

(*c) Closed loop operation only

(*d) DIN porting only (see position 9)

(*l) Axial service ports only (see position 10)

(*m) ISO metric porting only (see position 9)

(*o) Open loop operation only

(*p) Radial service ports only (see position 10)

(*q) Without purging devices only (see position 20 and 21)

(*v) With blocked purge shuttle valve only (see position 21)

Model Code

HMF Fixed Displacement Motors (Open & Closed Loop Operation)

The following 21 digit coding system has been developed to identify preferred feature options for a HMF Closed or Open Loop Hydraulic Motor. Use this code to specify a motor with the desired features. All 21-digits of the code must be present to release a new product number for ordering. Please contact your local customer service representative for leadtime questions.

HMF 105 C D M R 0 00 A 1 0 00 A A A

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21

	28	35	50	55	63	75	105	135
1 2 3 **Product**								
HMF– Fixed Displacement Motors	●	●	●	●	●	●	●	●
4 5 6 **Displacement**								
028 – 28 cc	●							
035 – 35 cc		●						
050 – 50 cc			●					
055 – 55 cc				●				
063 – 63 cc					●			
075 – 75 cc						●		
105 – 105 cc							●	
135 – 135 cc								●
7 **Mounting Flange**								
B – SAE B, 2-Bolt	●	●						
C – SAE C, 2-Bolt			●	●	●	●	●	
D – SAE D, 2-Bolt								●
8 **Output Shaft**								
C – splined ANSI B92.1 16/32 - 15 teeth (SAE J744 B-B)	●	●						
D – splined ANSI B92.1 12/24 - 14 teeth (SAE J744 C)			●	●	●	●	●	
J – splined ANSI B92.1 8/16 - 13 teeth (SAE J744 D&E)								●
K – splined ANSI B92.1 16/32 - 21 teeth			●	●	●	●	•	
L – splined ANSI B92.1 16/32 - 23 teeth							●	
M – splined ANSI B92.1 16/32 - 27 teeth								●
9 **Porting**								
M – ISO 6149 metric	●	●	●	●	●	●	●	●
D – DIN 3852	•	•	•	•	•	•	•	•
10 **Port Orientation**								
R – radial ports	●	●	●	●	●	●	●	●
L – axial ports				●	●	●	●	
11 **Attachments to Service Ports**								
0 – without	●	●	●	●	●	●	●	●
12 13 **Crossover Relief Valves Integrated**								
00 – without	●	●	●	●	●	●	●	●
AA – single-stage 210 bar (*p) (*q)	●	●	●	●	●	●	●	●
AB – single-stage 230 bar (*p)(*q)	●	●	●	●	●	●	●	●
AC – single-stage 420 bar (*p) (*q)	●	●	●	●	●	●	●	●
AD – single-stage 270 bar (*p)(*q)	●	●	●	●	●	●	●	●
AE – single-stage 420 bar (*p) (*q)	●	●	●	●		●	●	●
AF – single-stage 330 bar (*p)(*q)	●	●	●	●		●	●	●
AG – single-stage 350 bar (*p) (*q)	●	●	●	●		●	●	●
AH – two-stage 90/280 bar (*p)(*q)	●	●	●	●	●	●	●	●
AJ – two-stage 110/230 bar (*p)(*q)	●	●	●	●	●	●	●	●
AK – two-stage 110/280 bar (*p)(*q)	●	●	●	●	●	●	●	●
AL – two-stage 110/310 bar (*p)(*q)	●	●	●	●	●	●	●	●
AM – two-stage 140/280 bar (*p)(*q)	●	●	●	●	●	●	●	●
AN – two-stage 180/280 bar (*p)(*q)	●	●	●	●	●	●	●	●
AP – two-stage 200/380 bar (*p)/(*q)	●	●	●	●	●	●	●	●
AQ – single-stage 300 bar (*p) (*q)	●	●	●	●	●	●	●	●
14 **Purge Relief Valve**								
0 – without purge devices	●	●	●	●	●	●	●	●
A – 10 bar standard purge flow	●	●		●	●	●	●	●
B – 14 bar standard purge flow	●	●		●	●	●	●	●
C – 10 bar reduced purge flow	•	•		•	•	•	•	•
D – 14 bar reduced purge flow	•	•	•		•	•	•	•
E – 10 bar increased purge flow	•	•	•		•	•	•	•
F – flow controlled 6 l/min (*o)	●	●	●		●	●	●	●
G – blank plug instead of relief valve (*v)	•	•	•		•	•	•	•
15 **Purge Shuttle Valve**								
0 – Without purge devices	●	●	●	●	●	●	●	●
1 – Standard shuttle valve	●	●	●		●	●	●	●
2 – Damped shuttle valve	•	•	•		•	•	•	•
3 – Shuttle valve blocked	•	•	•		•	•	•	•
16 **Speed Sensor in Motor Housing**								
0 – Without	●	●	●	●	●	●	●	●
A – 7 impulses		●		●				
B – 7 impulses						●		
17 18 **Special Requirements**								
00 – Without (default)	●	●	●	●	●	●	●	●
19 **Surface Coating**								
0 – Anti-rust conservation oil (default)	●	●	●	●	●	●	●	●
A – Primer blue	●	●	●	●	●	●	●	●
20 **Unit Identification**								
A – DuraForce	●	●	●	●	●	●	●	●
21 **Type Code Release**								
A – Revision Level	●	●	●	●	●	●	●	●

• Available Option ● Preferred Option

♦ Separate Specification Required

(*d) DIN porting only (see position 9)

(*m) ISO metric porting only (see position 9)

(*o) Open loop operation only

(*p) Radial service ports only (see position 10)

(*q) Without purging devices only (see position 14 and 15)

(*v) With blocked purge shuttle valve only (position 15)

Model Code

HMA
Adjustable Fixed Displacement Motors
(Open & Closed Loop Operation)

The following 21 digit coding system has been developed to identify preferred feature options for a HMF Closed or Open Loop Hydraulic Motor. Use this code to specify a motor with the desired features. All 21-digits of the code must be present to release a new product number for ordering. Please contact your local customer service representative for leadtime questions.

HMA 165 A J M R 0 A 1 000 00 A A A

1 2 3 | 4 5 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 15 16 | 17 18 | 19 | 20 | 21

	75	105	135	165	210	280
1 2 3 **Product**						
HMA– Adjustable Fixed Displacement Motors				●	●	●
4 5 6 **Displacement**						
165 – 165.0 cc/r (10.06 cir)				●		
210 – 210 cc/r (12.81 cir)					●	
280 – 280 cc/r (17.08 cir)						●
7 **Mounting Flange**						
A – SAE J744 standard				●	●	●
8 **Output Shaft**						
C – splined ANSI B92.1 8/16 15 teeth (SAE J744 F)					●	●
J – splined ANSI B92.1 8/16 13 teeth (SAE J744 D&E)				●		
M – splined ANSI B92.1 16/32 27 teeth				●	●	
N – splined ANSI B92.1 16/32 33 teeth						●♦
9 **Porting**						
M – ISO 6149 metric				●	●	●
10 **Port Orientation**						
R – Radial ports / without PTO				●	●	●
11 **Attachments to Service Ports**						
0 – without				●	●	●
12 **Purge Relief Valve**						
A – 10 bar standard purge flow				●	●	●
B – 14 bar standard purge flow				●	●	●
C – 10 bar reduced purge flow				•	•	•
D – 14 bar reduced purge flow				•	•	•
E – 110 bar increased purge flow				•	•	•
F – Flow controlled 6 l/min (*o)				●	●	●
13 **Purge Shuttle Valve**						
1 – Standard shuttle valve				●	●	●
2 – Damped shuttle valve				•	•	•

	75	105	135	165	210	280
14 15 16 **Displacement Setting**						
000 – Standard Displacement				●	●	●
value 135 - 165 cc (numeric 3 digits), setting range see positions 4,5,6				●		
value 165 - 210 cc (numeric 3 digits), setting range see positions 4,5,6					●	
value 210 - 280 cc (numeric 3 digits), setting range see positions 4,5,6						●
17 18 **Special Requirements**						
00 – without special requirements (default)				●	●	●
19 **Surface Coating**						
0 – Anti-rust conservation oil (default)				●	●	●
A – Primer blue				●	●	●
20 **Unit Identification**						
A – Eaton				●	●	●
21 **Type Code Release**						
A – Revision Level				●	●	●

(*o) Open loop operation only

(*p) Radial service ports only (see position 10)

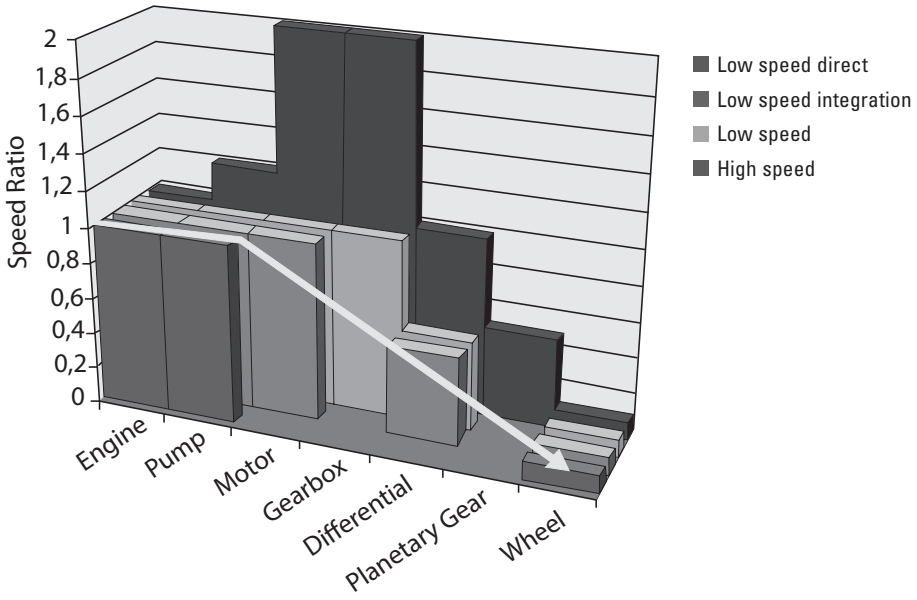
• Available Option ● Preferred Option

♦ Separate Specification Required

Transmission Concept

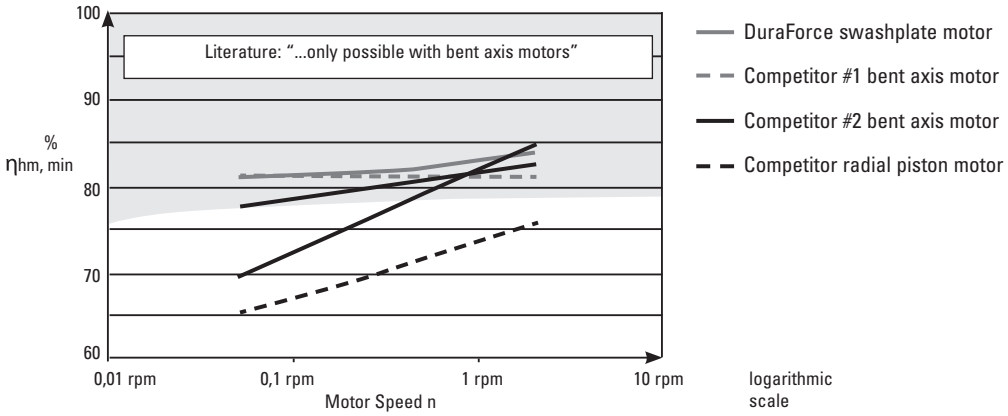
Equipment manufacturers profit by the Eaton transmission concept. Due to the direct conversion of the prime mover speed into wheel speed it is possible to reduce the number of drive line components and the energy losses in the operating cycle.

Speed Steps of Transmission Concepts



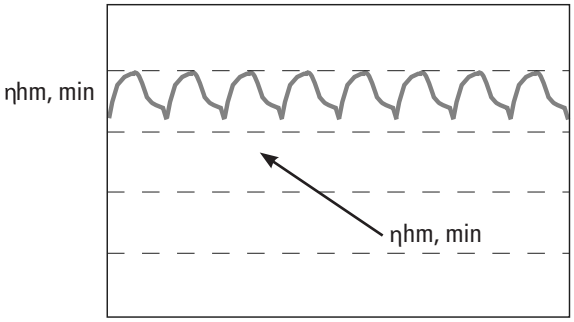
Starting Torque

DuraForce hydraulic motors offer uniformly high torque for smooth start up. Right from the start.

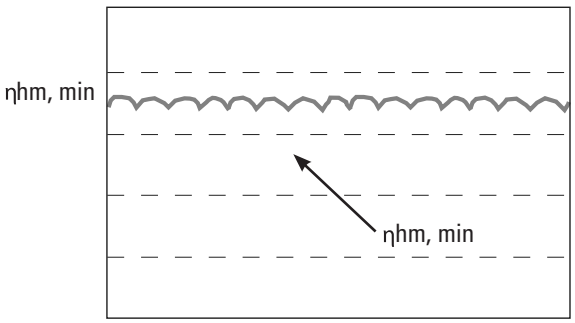


Torque at 350 bar and 2 rpm

of a bent axis motor



of a DuraForce swashplate motor



Operational Parameters

Lifetime Recommendations

Eaton high pressure units are designed for excellent reliability and long service life. The actual service life of a hydraulic unit is determined by numerous factors. It can be extended significantly through proper maintenance of the hydraulic system and by using high-quality hydraulic fluid.

Beneficial Conditions For Long Service Life

Speed	Lower continuous maximum speed
Operating Pressure	Less than 300 bar Δp on average
Maximum Pressure	Only at reduced displacement
Viscosity	15 ... 30 cSt
Power	Continuous power or lower
Purity of Fluid	18/16/13 in accordance with ISO 4406 or better

Adverse Factors Affecting Service Life

Speed	Between continuous maximum speed and intermittent maximum speed
Operating Pressure	More than 300 bar Δp on average
Viscosity	Less than 10 cSt
Power	Continuous operation close to maximum power
Purity of Fluid	Lower than 18/ 16/ 13 in accordance with ISO 4406

Operational parameters.
Filtration

In order to guarantee long-term proper function and high efficiency of the hydraulic pumps the cleanliness level of the lubricant must comply with the following criteria according to Eaton Hydraulic Fluid Recommendation 03-401-2010. Maintaining the recommended cleanliness level can extend the service life of the hydraulic system significantly.

For reliable proper function and long service life

18/16/13 in accordance with ISO 4406 or better

Commissioning

The minimum cleanliness level requirement for the hydraulic oil is based on the most sensitive component. For commissioning we recommend a filtration in order to achieve the required cleanliness level.

Filling and operation of hydraulic systems

The required cleanliness level of the hydraulic oil must be ensured during filling or topping up. When drums, canisters, or large-capacity tanks are used the oil generally has to be filtered. We recommend the implementation of suitable filters to ensure that the required cleanliness level of the oil is achieved and maintained during operation.

International standard

Code number according to ISO 4406
18/16/13

Filtration

For Reliable Proper Function and Long Service Life	18/16/13 in accordance with ISO 4406 or better
Minimum Requirements	20/18/15 in accordance with ISO 4406
Commissioning	The minimum purity requirement for the hydraulic oil is based on the most sensitive system component. For commissioning we recommend a filtration in order to achieve the required purity.
Filing in Operation of Hydraulic Systems	The required purity of the hydraulic oil must be ensured during filling or topping up. When drums, canisters or large-capacity tanks are used the oil generally has to be filtered. We recommend the implementation of suitable measures (e.g. filters) to ensure that the required minimum purity of the oil is also achieved during operation
International Standard	Code number according to ISO 4406 purity class according to SAE AS 4059 18/16/13 corresponds to 8A/7B/7C 20/18/15 9A/8B/8C

Operational Parameters

Pressure Fluids

In order to ensure the functional performance and high efficiency of the hydraulic motors the viscosity and purity of the operating fluid should meet the different operational requirements. Eaton recommends using only hydraulic fluids which are confirmed by the manufacturer as suitable for use in high pressure hydraulic installations or approved by the original equipment manufacturer.

Permitted Pressure Fluids

- Mineral oil HLP to DIN 51 524-2
- Biodegradable fluids in accordance with ISO 15 380 on request
- Other pressure fluids on request

Eaton offers an oil testing service in accordance with VDMA 24 570 and the test apparatus required for in-house testing. Prices available on request.

Recommended Viscosity Ranges

Pressure Fluid Temperature Range	[°C]	-20 to +90
Working viscosity range	[mm²/s] = [cSt]	10 to 80
Optimum working viscosity	[mm²/s] = [cSt]	15 to 30
Max. viscosity (short time start up)	[mm²/s] = [cSt]	1000

In order to be able to select the right hydraulic fluid it is necessary to know the working temperature in the hydraulic circuit. The hydraulic fluid should be selected such that its optimum viscosity is within the working temperature range (see tables).

The temperature should not exceed 90°C (194°F) in any part of the system. Due to pressure and speed influences the leakage fluid temperature is always higher than the circuit temperature. Please contact Eaton if the stated conditions cannot be met in special circumstances.

Viscosity Recommendations

Working Temperature	Viscosity Class
Temperature	[mm²/s] = [cSt] at 40°C (104°F)
Approx. 30 to 40°C (86 to 104°F)	22
Approx. 40 to 60°C (104 to 140°F)	32
Approx. 60 to 80°C (140 to 176°F)	46 or 68

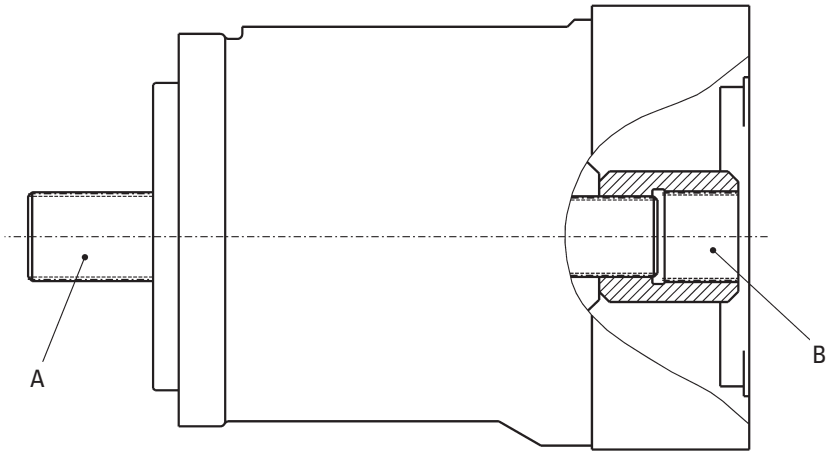
Further information regarding installation can be found in the operating instructions.

Torque Transmission

Mounting Flange

Depending on the selected components, different torques may be transferred. Please ensure that the load transfer components such as mounting flange and PTO through-shaft are designed adequately. Our sales engineers will be pleased to provide design advice.

Torque Transmission of HMF / A / V / R



The diagram Torque transmission of HMF / A / V / R shows the output side (A) and the PTO through-shaft (B) of a motor.

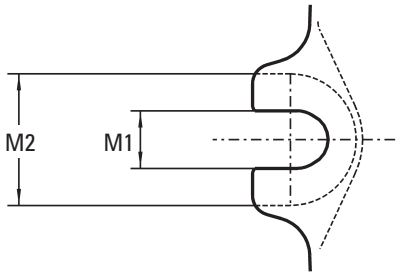
The information on the following pages refers to:

- Mounting flange and drive shaft (A)
- PTO flange and through shaft (B)

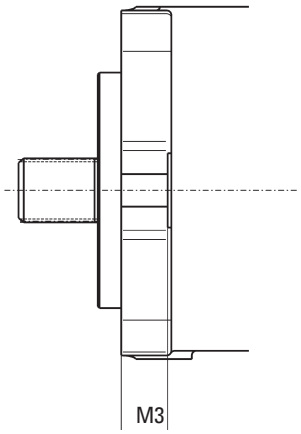
A) Flange Profile

Bolt Hole Dimensions		Rated Size HMF / A / V /R							
	Dim.	50/55	75	105	135	165	210	280	135D
M1 Inside Diameter	mm	17.5	17.5	17.5	21.5	21.5	22.0	22.0	21.5
M2 Outside Diameter	mm	40.0	34.0	34.0	40.0	40.0	–	—	40.0
M3 Length	mm	20.0	20.0	20.0	20.0	25.0	30.0	30.0	20.0

Bolt Hole Diameter



Bolt Hole Length



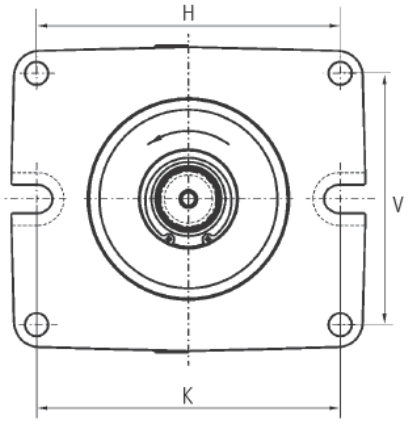
A) Mounting Flange Dimensions

Rated Size HMF /A / V / R

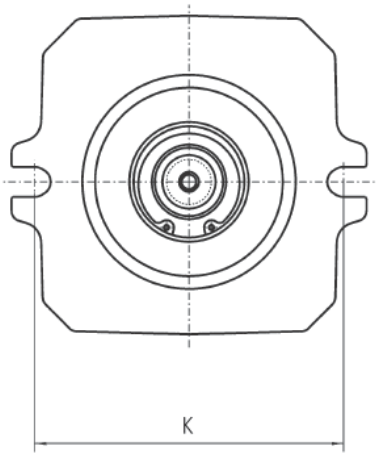
Mounting Flange Dimensions in Accordance/SAE J744	For rated Size	Washer	Mounting Screw	Torque (8.8) [Nm]	Torque (10.9)* [Nm]	Dimensions K [mm]	H [mm]	V [mm]
SAE B, B-B	28 - 35	12.5x25x4	M12	80	110	146.0	-	-
SAE C, C-C 2-hole	50 -105	17x33x10	M16	195	275	181.0	-	-
SAE D 2-hole	135 - 165	21x37x8	M20	385	540	228.6	-	-
SAE D 2-hole with 4 additional bolt holes	135 D	-	M16	-	275	228.6	230	190
SAE E 4-hole	210 - 280	-	M20	385	540	224.5	-	-

* Options for standard design, necessary for tandem units.

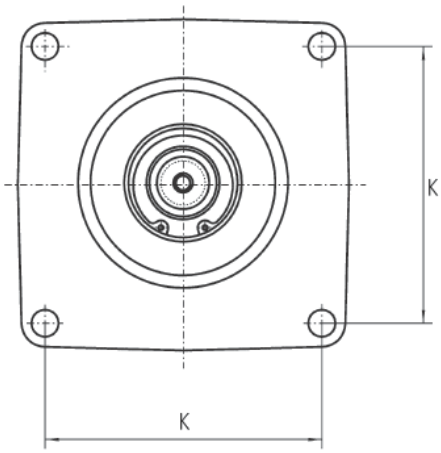
2-hole Flange with 4 Additional Bolt Holes



2 Bolt Flange



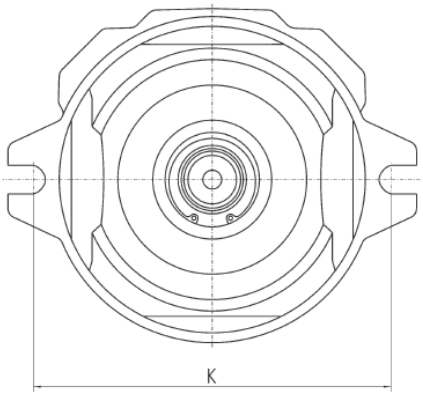
4 Bolt Flange



Torque Transmission

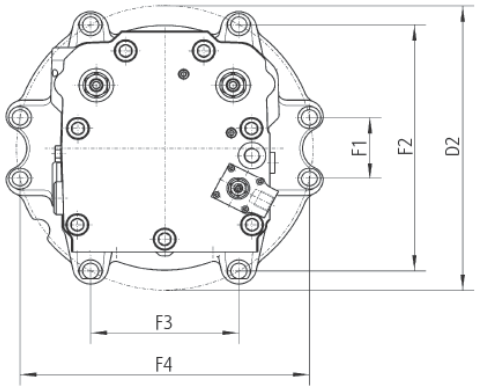
Mounting Flange

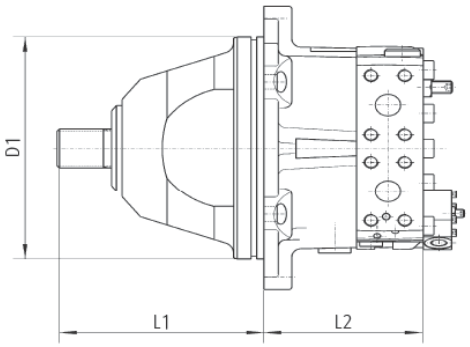
Plug-in housing for HMF/V/R 75



Rated Size	75
D1 [mm]	190
D2 [mm]	251
K [mm]	224
L1 [mm]	143
L2 [mm]	124

Plug-in housing for HMF/V/R 105 and 135





Rated Size	105	135
D1 [mm]	216	216
D2 [mm]	282	282
F1 [mm]	55.8	55.8
F2 [mm]	223.4	223.4
F3 [mm]	129	129
F4 [mm]	251.8	251.8
L1 [mm]	169	169
L2 [mm]	132	175

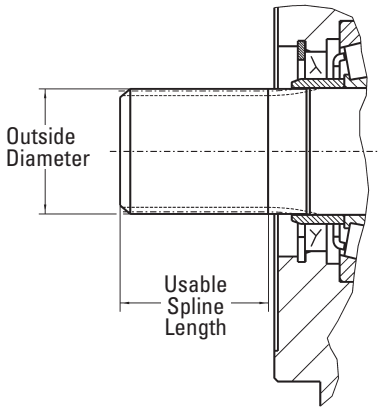
A) Dimensions – Drive Shafts

Shift Spline (in accordance with ANSI B92.1)	SAE J744 Code for Centering and Shaft	Outside Diameter	Usable Spline Length	Shaft Type	Available for Rated Size								
		(mm)	(mm)		28/35	50/55	75	105	135	165	210	280	135D
16/32, 15 t	B-B	24.98	29	1	x								
16/32, 21 t	C	34.51	39.5	1		x	x						
16/32, 23 t	C	37.68	38.5	1				x					
16/32, 27 t	D	44.05	62	1					x	x			x
12/24, 14 t	C	31.22	30	2			x						
8/16, 13 t	D	43.71	50	2					x	x			
8/16, 15 t	F	50.06	58	1							x	x	
16/32, 33 t	F	53.57	58	1								x*	

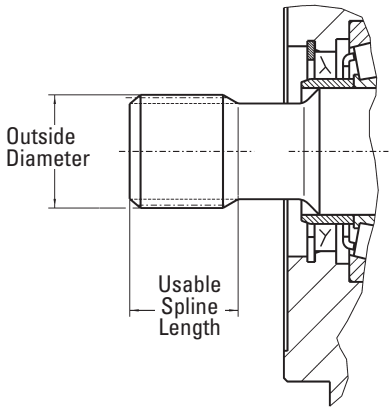
* Recommended shaft for Tandem configurations

A) Eaton Hydraulics Shaft Types

Type 1 without Undercut



Type 2 with Undercut



A) Output Shaft Torque

The transferable torque of the drive shaft at PTO through-shaft (B) corresponds to the torque of the drive shaft (A).

Shaft		16/32 15 t	16/32 21 t	16/32 21 t	16/32 23 t	16/32 27 t	16/32 27 t	8/16 15 t	16/32 33 t
Continuous Torque	Nm	283	435	604	836	1079	1318	1671	2243
Maximum Torque	Nm	422	649	900	1245	1608	1964	2490	3343

Torque Transmission

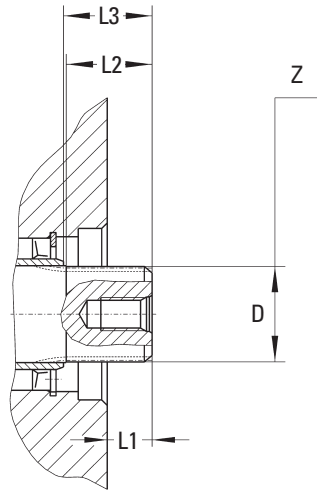
PTO Through-Drive Motor

Based on a standard Eaton variable hydraulic motor with single shaft end, the PTO Through-Drive Motor features two shaft ends for torque transfer. This enables the hydraulic motor to be installed directly in the drive line without transfer gearbox, reducing noise emission and fuel consumption. At the same time the overall efficiency increases.

B) PTO Dimensions for HMV

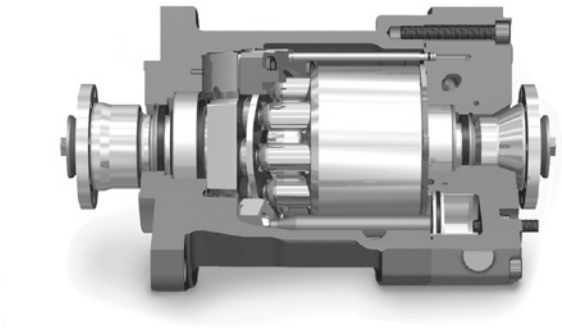
Rated Size	Unit	105	135	165	210	280
Z Drive Shaft Profile In Accordance with ANSI B92.1	**mm**	**16/32, 19 t**	**16/32, 21 t**	**16/32, 22 t**	**16/32, 24 t**	**16/32, 27 t**
D Shaft Diameter	mm	31.2	34.51	36.05	39.27	44.05
L1 Shaft End Length-Housing	mm	30.1	16.2	-0.5	20.9	180
L2 Usable Spline Length	mm	41.5	31.0	31.0	44.0	47.0
L3 Bearing Stop	mm	49.6	32.0	32.8	57.2	62.0
Continous Torque	Nm	418	540	659	836	1122
Max. Torque	Nm	736	1068	1305	1654	2221

B) PTO Dimensions



PTO Through-Drive Motor with Coupling Flanges

For a direct installation into the drive line



Functions – Purge and Case Flushing

Purge and case flushing is used:

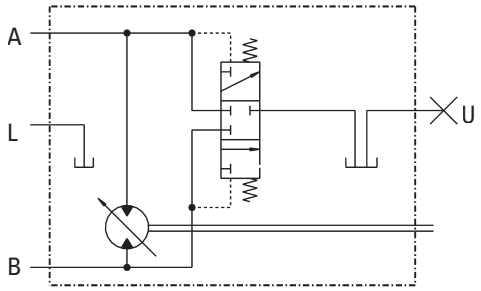
- For reducing the temperature of the motor and the system in the open and closed loop circuits
- For replacing the oil in the circuit
- To enhance filtration and
- For removing air from the system

For equipment options for Eaton motors please refer to the function overview.

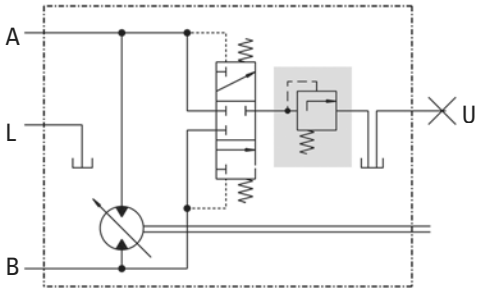
Purge Flow in Closed Loop Circuit

Version	Purge Valve Pressure CBV Setting	Diagram	Purge Flow	Diameter of Orifice
Standard	10 bar with 20 bar feed pressure	3	10 l/min	2.5 mm
Standard	14 bar with 20 bar feed pressure	2	10 l/min	without orifice
Restricted	10 bar with 20 bar feed pressure	3	5 l/min	2 mm
Restricted	14 bar with 20 bar feed pressure	3	5 l/min	2.5 mm
Increased	10 bar with 20 bar feed pressure	2	20 l/min	without orifice
Flow Controlled	14 bar with > 20 bar feed pressure	4	4 l/min	with flow regulator

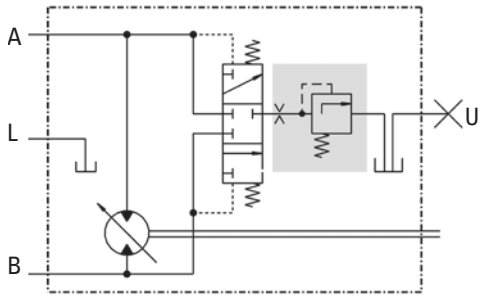
Purge Valve 1 without (0 l/min)



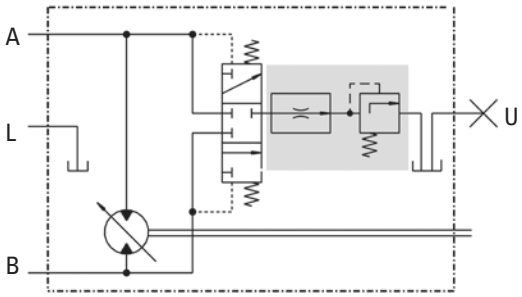
Purge Valve 2 Standard and Increased



Purge Valve 3 Restricted



Purge Valve 4 Flow Controlled



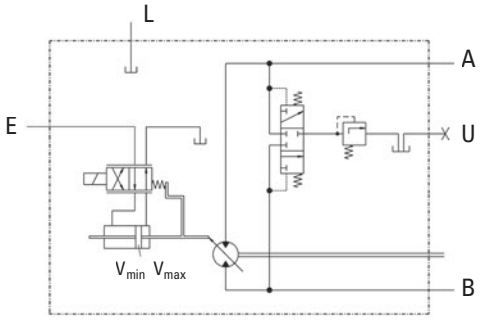
Flow-controlled purge flushing in an open loop circuit approx. 4 l/min at 5 bar set pressure (independent of low pressure) diagram 4

Functions – Servo Supply Pressure Feed

Servo supply pressure delivers the force needed to change the position of the swash plate in variable displacement and pressure regulated motors. For equipment options for Eaton motors please refer to the function overview.

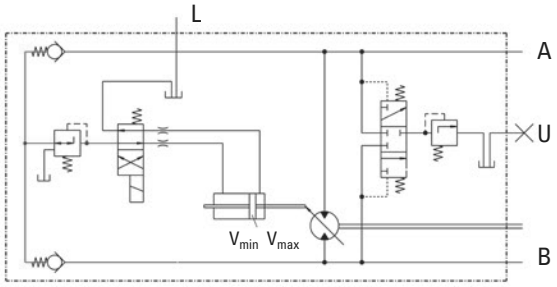
For HMV Variable Motors

External Supply



For HMR Regulating Motors

Internal Supply. High Pressure Circuit

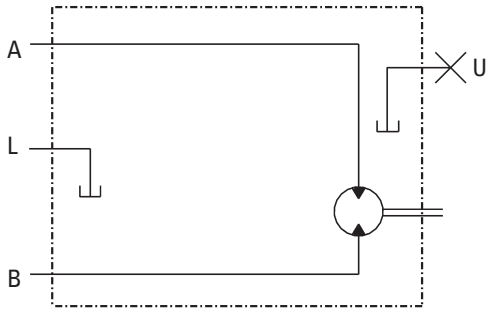


Functions – Crossline Relief (Secondary) Protection

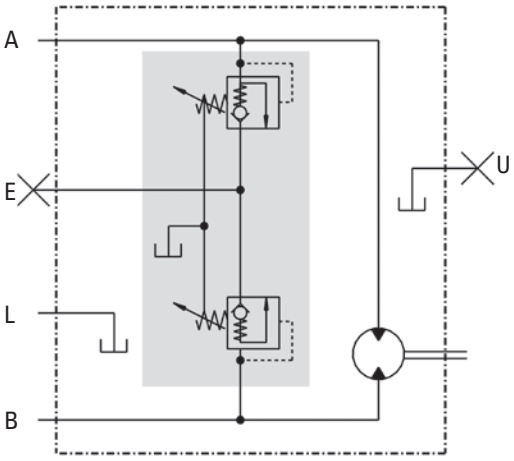
The secondary valves (crossline relief valves) protect the system from pressure overload by using two interlinked pressure relief valves (combined with check valves). It is recommended for applications where this protective function is not provided by other means (e.g. through primary protection at the pump or LS valves). The secondary protection includes a make up function. It prevents cavitation and is required in an open loop circuit if the motor requires more oil than is supplied. For special situations like in the swing gear drive the installation of controllable secondary valves is recommended. For equipment options for Eaton motors please refer to the function overview.

Secondary Protection

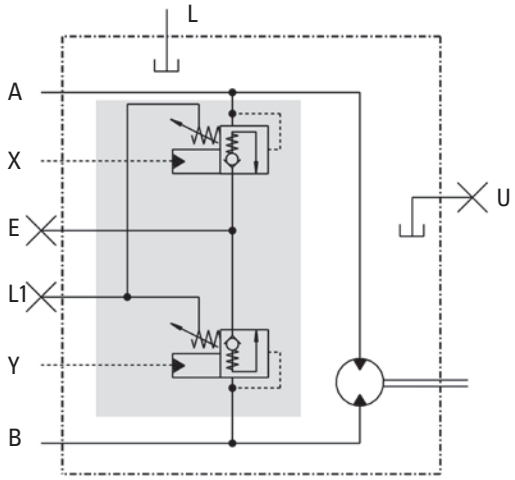
Without Crossline Relief Valve



With Crossline Relief Valve Protection



With Dual Pressure Crossline Relief Valve Protection

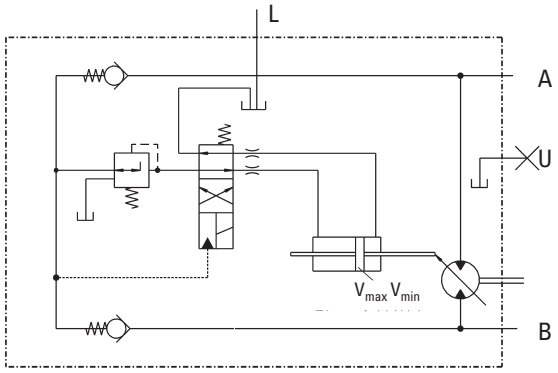


A, B	Work ports
L, L1, U	Case drain / vent connections
X, Y	Control connection for dual pressure crossline relief valve
E	Make up connection

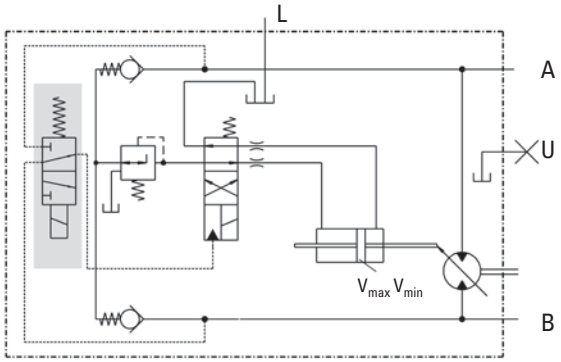
Functions – Signal Selection for Pressure Regulator

Pressure regulated motors shift to maximum displacement at high operating pressure, irrespective of which side is under pressure and in propel situations this can have undesirable effects. For example, if the motor shifts to maximum displacement during the transition phase from downhill travel (low system pressure) to overrun (high pressure on the reverse side) an extremely strong vehicle braking effect will occur. The brake pressure shut off valve prevents the regulator being subjected to this braking pressure and, therefore, ensures that the motor remains at minimum displacement. For equipment options for Eaton motors please refer to the function overview.

Without



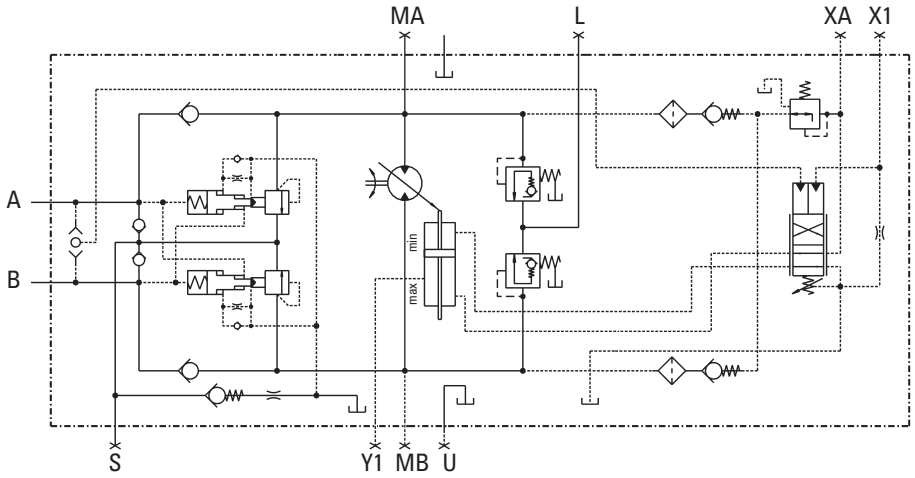
With

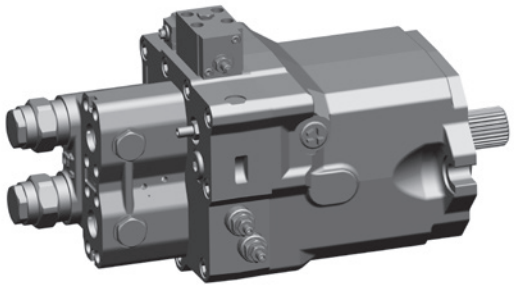


Functions – Counterbalance Valve

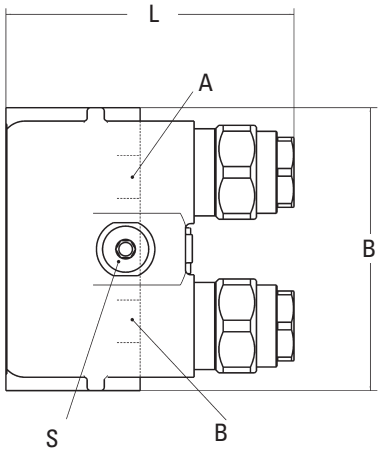
The counterbalance (brake) valve prevents the motor over speeding during an over-run situation. To achieve this, the motor return flow is automatically and continuously metered such that it always matches the input flow. Different braking responses are possible. The integrated make-up function simultaneously prevents cavitation. A purge and case flushing function is also integrated. Counterbalance (brake) valves are typically used for drive systems in open loop circuits. Further types of counterbalance valves are shown in section Dimensions. HMR.

With Counterbalance (Brake) Valve, Here: Axial Attachment





Dimensions



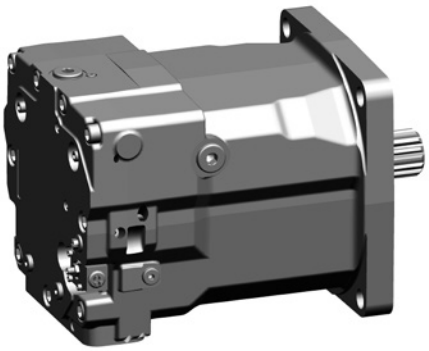
Brake Valve	1"	1¼"
Length L	168.5	168.5
Width B	165.7	195
Height	136.6	143

Functions – Speed Sensor

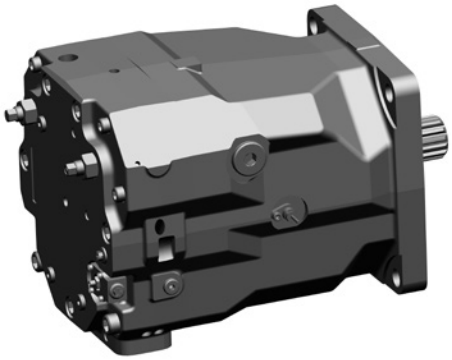
Speed sensors electronically register the motor speed and send an associated input signal to electronic drive controls.

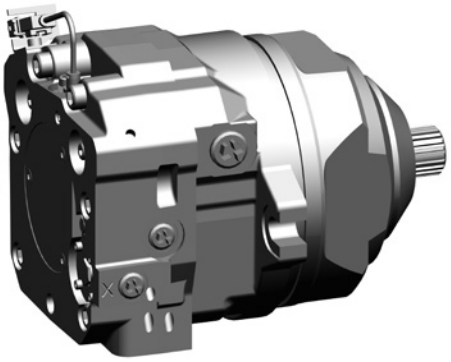
Speed Sensor

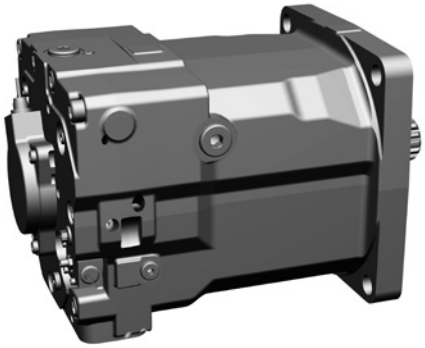
Without Speed Sensor



With Speed Sensor





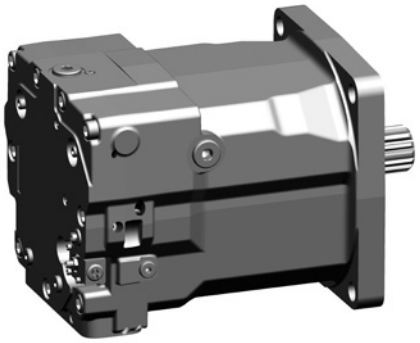


Motor Types

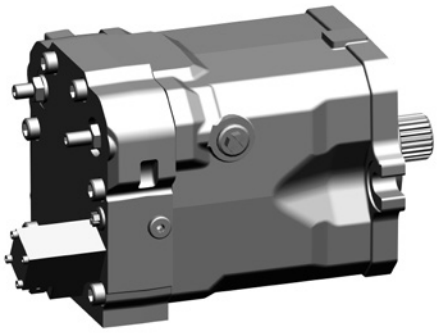
Based on the respective system requirements, Eaton offers fixed displacement, variable displacement and regulating motors with high starting torque for open and closed loop operation. Optional auxiliary functions, zero displacement capacity and PTO through-shaft enable higher machine design flexibility and increase the efficiency of the travel drive. The motors are optionally controlled electrically, hydraulically or pneumatically.

Motor Type	Control/Function	Product Name
Fixed Displacement Motor		HMF
	With Swing Drive Function	HMF P
	Displacement Adjustable	HMA
Regulating Motor	V_{max} Pneumatic	HMR
	V_{max} Hydraulic, Low Pressure	HMR
	V_{max} Hydraulic, High Pressure	HMR
	V_{max} Electric	HMR
Variable Displacement Motor	Stepless Variable Control, Hydraulic	HMV H1, H4
	Stepless Variable Control, Electric	HMV E1, E4, E6
	Two Position Control (Flip-Flop), Hydraulic	HMV H2
	Two Position Control (Flip-Flop), Electric	HMV E2
	Stepless Variable Control with Pressure Override and electric override pressure selection	HMV EH1P, EH1P-CA

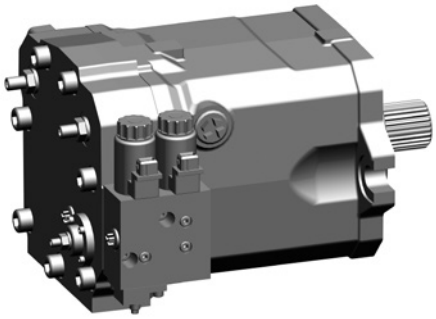
HMV H



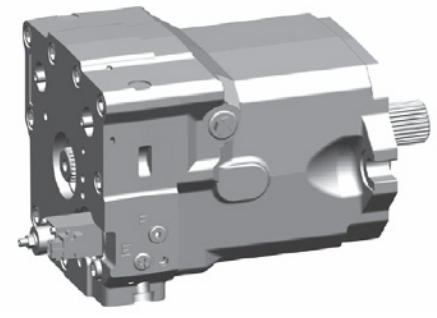
HMV E



HMV EH1P

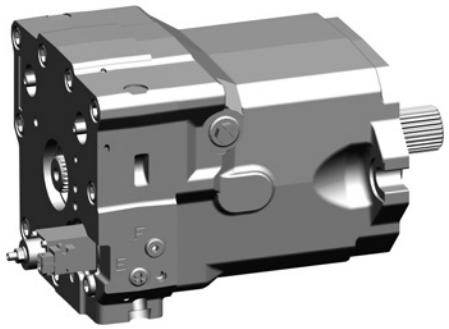


HMV PTO

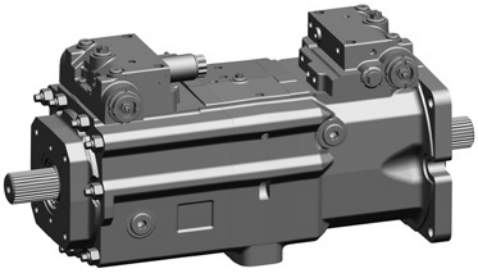


Motor Types

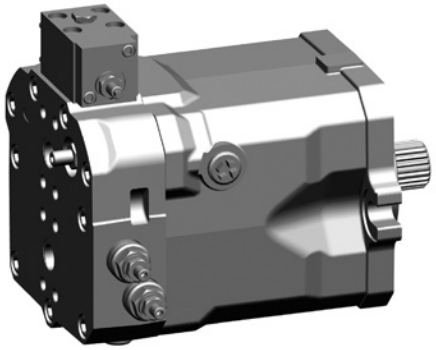
HMV PTO



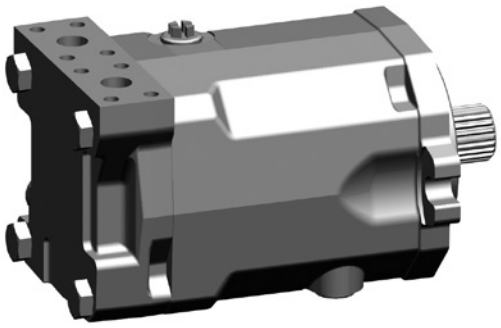
HMV D



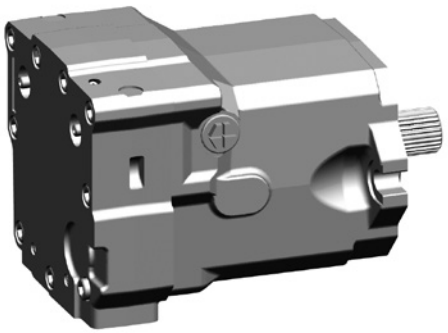
HMR



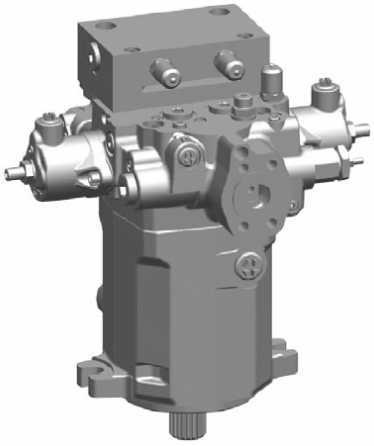
HMF



HMA



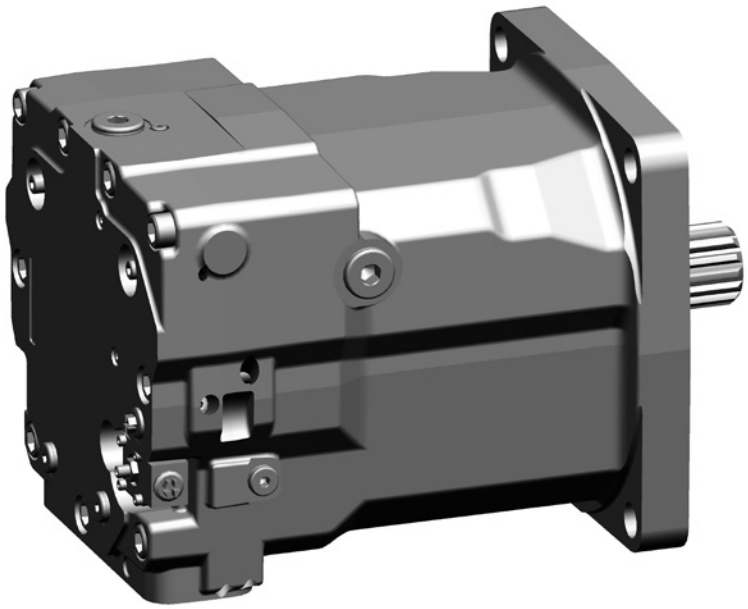
HMF-P



Motor Types – HMV

Variable Displacement Motor

HMV
Variable Displacement Motor



Features

- Stepless or two position control
- Electric or hydraulic control
- Override pressure control possible
- Brake pressure shut off possible
- Can be set to 0 cm^3/rev
- Double motor available

Benefits

- Smooth low-speed operation
- High starting torque
- Wide torque / speed conversion range
- Highly dynamic response characteristics
- Compact design
- High power density
- High reliability
- Long service life
- Simplified drive line

Motor Types – HMV

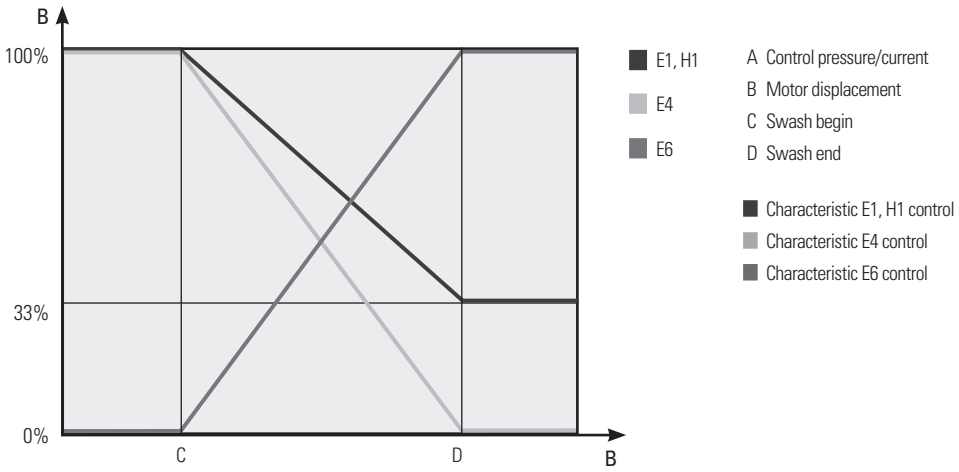
H1 and E1 Stepless Variable Control

Motors with stepless variable control are suitable for open and closed loop circuit. Without control signal they shift to maximum displacement V_{max}. Displacement control is hydraulic or via an electric proportional control signal. Servo pressure supply is optionally internal or external, see section Functions. Servo pressure supply. The following data are independent of the nominal motor size.

Stepless Variable Control Features

External Servo Pressure Supply	Minimum Tripping		bar	20	
	Maximum Permissible		bar	40	
Hydraulic Control If $V_{max, Eff} > V_{min, Nominal}$, is the Resolution Lower	Control Range		bar	Δ=6	
	Control Begin		bar	7, 8, 9 or 9.5	
	Maximum Permissible Pressure		bar	40	
Electric Control	Connector Type			Hirschmann, Deutsch AMP Junior Timer, 2-pin	
	Rated Voltage = Max. Continuous Voltage		V	12	24
	Voltage Type			DC voltage	
	Power Input		W	15.6	
	Rated Current = Max. Continuous Current		mA	1300	
	Control Current	Swash Begin	mA	450	225
		Swash End	mA	1200	600
	Relative Duty Cycle		%	100	
	Protection Class			IP54 (DIN), IP67 (Deutsch), IP 6K6K (AMP	
	Control Types	Digital Control Via Pulse Width Modulation Pwm With Eaton Transducers		100 Hz rectangle, Pulse duty ratio variable over control range	
		Analog Control with Alternative Transducers		Direct Current with dither overlay (dither frequency nom. 35 Hz, duty cycle 1:1)	

Minimum Response Time with Standard Orifice with 20 Bar Servo Pressure		s	0.5 - 1



Motor Types – HMV
H2 and E2 Two Position

Two position motors are suitable for open and closed loop operation. Without control signal they are set to maximum displacement Vmax. Adjustment between Vmin and Vmax is smooth and with short response time. The required switching signal can optionally be hydraulic or electric, the servo pressure supply internal or external, see section Functions. Servo pressure supply. The following data are independent of the rated motor size.

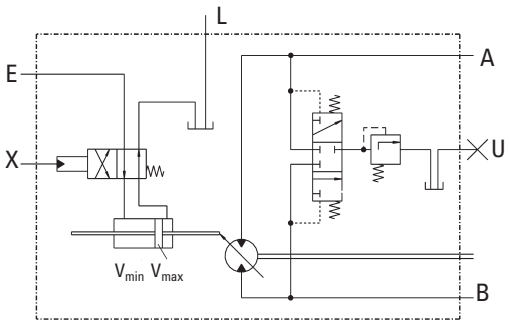
HMV
Two Position
Features

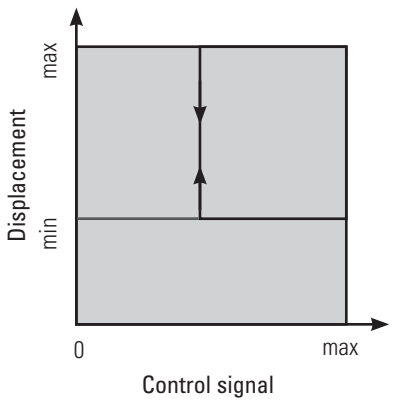
Two Position	Features		
External Servo Pressure Supply	Minimum Tripping	bar	20
	Maximum Permissible Tripping	bar	40
Hydraulic Control	Shifting Pressure Minimum Tripping	bar	20
	Shifting Pressure Maximum Permissible Tripping	bar	40
Electric Control	Connector Type		Hirschmann, Deutsch AMP Junior Timer, 2-pin
	Rated Voltage = Max. Continuous Voltage	V	12 24
	Voltage Type		Dc Voltage
	Power Input (Old)	W	≤ 26
	Relative Duty Cycle	%	100
	Protection Class		IP54 (DIN), IP67 (Deutsch), IP 6K6K (AMP
Minimum Response Time with Standard Orifice With 20 Bar Servo Pressure		s	0.5 - 1

Two Position Motor

With Hydraulic Control Pressure and External Servo Supply Pressure

A,B Work port connections
L,U Case drain / vent connections
E Servo supply pressure connection
X Control connection





Motor Types – HMV

EH1P Stepless with Pressure Override

This motor is used primarily for closed loop operation together with speed-dependent hydraulic pump, type HPV CA. Alternatively, with hydraulically or electro-hyraulically pilot-operated drives for which a high pressure regulating function is also required. Without control signal the motor shifts to maximum displacement Vmax. Stepless variable control to lower displacement is hydraulic, with control pressure generated by the speed dependent pump. The motor is also equipped with a system pressure override which, at a predefined setting, automatically increases its displacement in response to system related torque demand. The following data are independent of the rated motor size.

Stepless Variable Control with Pressure Override Features

Stepless Variable Control with Pressure Override	Features		
Hydraulic control signal	Control pressure range	bar	8 to 14
	Maximum permissible pressure	bar	40
Hydraulic pressure override	Regulation begin pressure adjustable, please specify with order	bar	150-260
	Regulation end pressure	bar	5 % above regulation begin pressure
Electric control signal	Connector type		Hirschmann, Deutsch AMP Junior Timer, 2-pin
	Rated voltage = max. continuous voltage		12 24
	Voltage type		DC voltage
	Power input (cold)	W	≤26
	Relative duty cycle	%	100
	Protection class		IP54 (DIN), IP67 (Deutsch), IP 6K6K (AMP
Minimum Response Time with Standard Orifice with 20 bar servo pressure		s	0.5 - 1

Auxiliary Functions

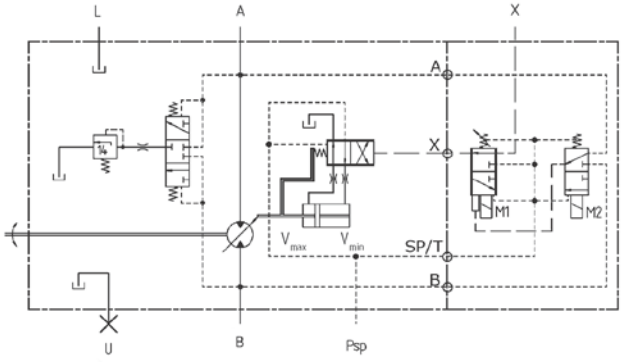
- Electric V_{max} control, independent of signal pressure, for maximum displacement motor operation
- Electric brake pressure shut off for controlled deceleration

Stepless Variable Displacement Control Motor

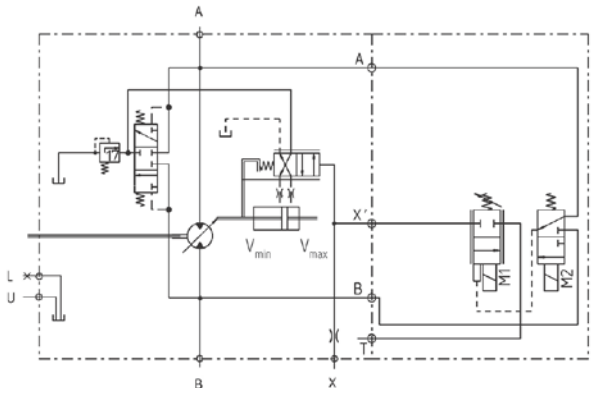
With pressure override, electric maximum displacement override and brake pressure shut off

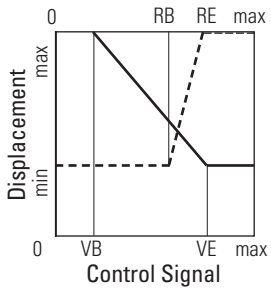
A,B Work port connections
L,U Case drain / vent connections
X Pressure connection for infinitely variable control
M1 Solenoid for maximum displacement override
M2 Solenoid for brake pressure shut off
VB Swash begin
VE Swash end
RB Start of pressure override
RE End of pressure override
— Operating pressure
___ Control pressure

EH1P-CA Feed Pressure as Reference, Non Bleed Regulation



EH1P Case Pressure as Reference, Bleed Regulation





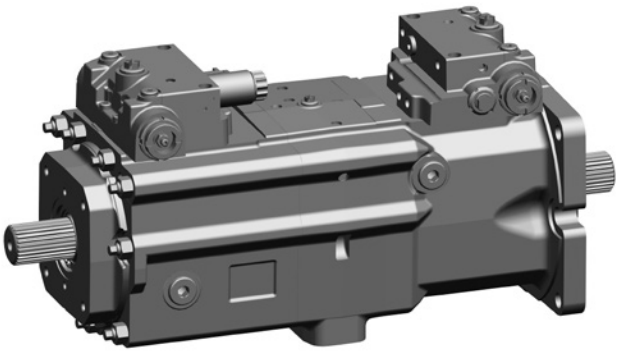
Motor Types – HMV

D Double Motor

The double motor consists of two Eaton variable motors arranged back-to-back. In addition to a wide torque/ speed conversion range it offers the option of direct installation in the drive line, since one or two shaft ends are optionally available for torque output. Noise emission and fuel consumption are reduced because no transfer gearbox is required. At the same time the overall efficiency increases. The performance comparison diagram shows the required drive capacity for different design variants at four operating points.

HMV
D Double Motor

Note: The HMV double motor is a highly specialized motor and is not configurable using the model code. Please contact your Customer Service Representative to specify and purchase an HMV double motor.



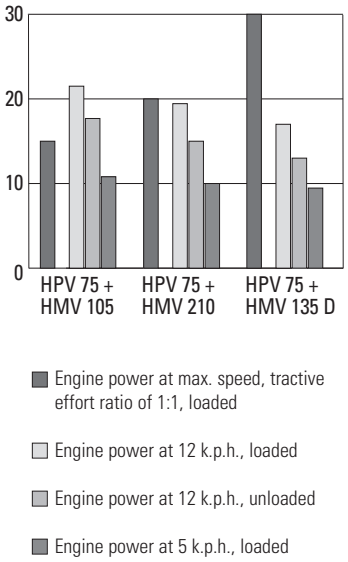
Features

- Two HMV- 02 arranged back-to-back
- Connection for high pressure, servo and control pressure for each motor
- Motor control optionally through 1 signal or 2 separate signals
- Both motors can be set to 0 cm³/rev
- Possible conversion ratio 1:6
- Optionally 2 shaft ends for direct installation in the drive line

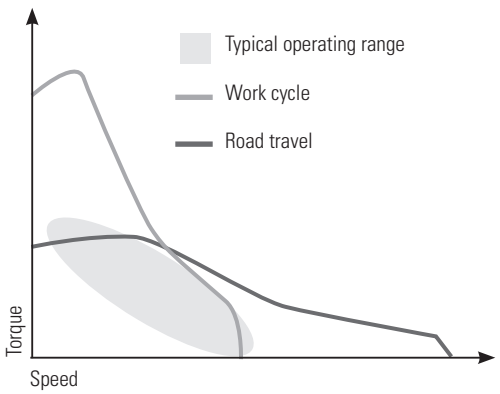
Benefits

- Wide conversion range for stepless acceleration
- Simplified drive line
- High tractive effort and high terminal speed
- Highly dynamic response characteristics
- High starting torque

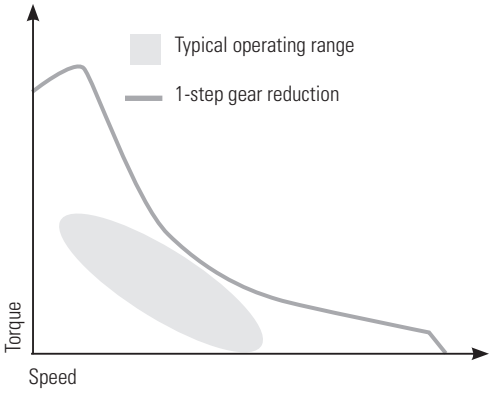
Performance Comparison



2-Position Gearbox with Conventional Transmission

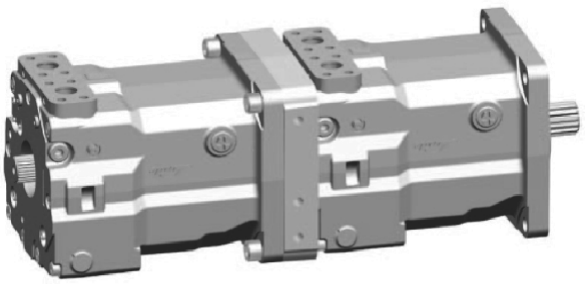


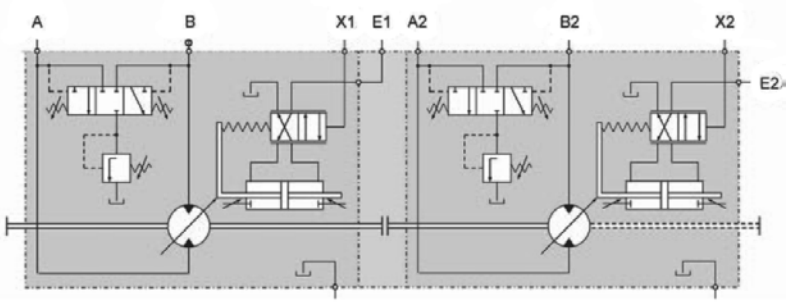
Stepless with Double Motor



Motor Types – HMV Tandem Motor

The Tandem motor consist of two HMV, arranged face-to-back and connected with a Tandem flange. Alike the double motor, the Tandem motor can also be integrated directly into the driveline and is available with one or two shaft ends.





Features

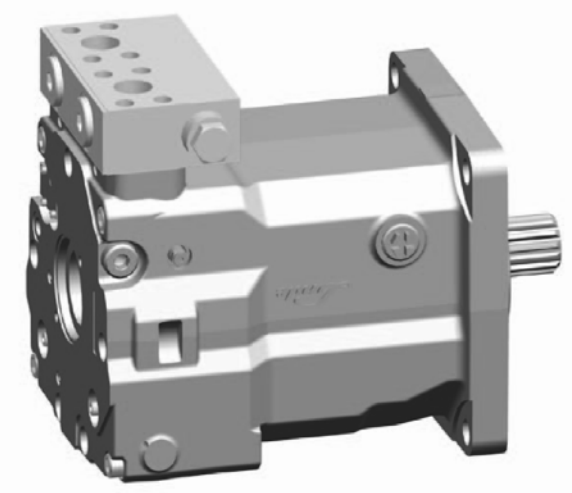
- Two HMV arranged face-to-back
- Separate connections for high pressure and feed pressure
- Individual control
- Both motors can be set to 0 cc/rev
- Same mounting flange as single motor
- Contact your area sales representative for available configurations

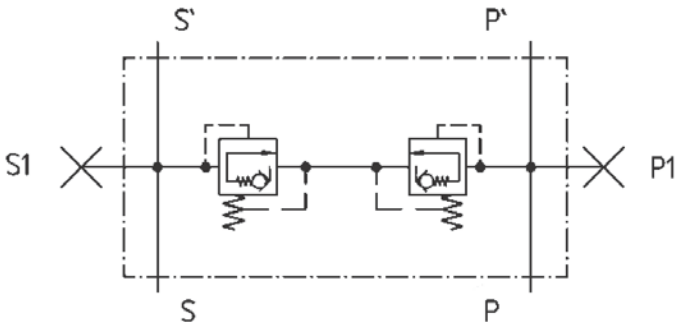
Benefits

- Double torque at same gearbox interface
- Simple torque increase in existing applications
- Higher speed as with single motors of the same size and as with bent axis motors
- More slender outlines as single motors of the same size
- Direct driveline integration, no need for gearbox

Motor Equipment – Cross Over Relief Valve Block

The cross over relief valve block offers additional high pressure protection for the motors. It is mounted to the radial high pressure ports. As well as this protective function, the block offers tee connectors for the high pressure connections in order to connect an additional motor to the system without the need for long hoses.





Features

- Modular add-on functionality
- For radial high pressure connections
- For all HMV/HMR/HMA motors

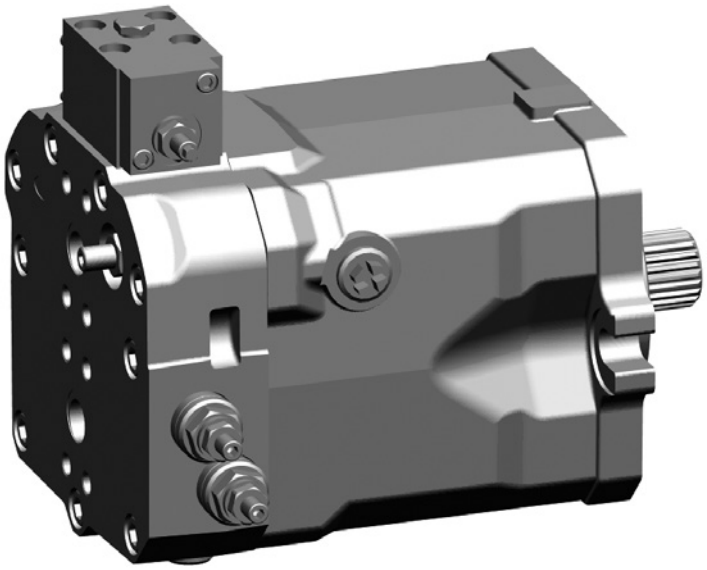
Benefits

- Additional high pressure relief in close circuit application
- Pressure relief exceeding the pump relief valve capability, for example while breaking hydraulically with high displacement ration HMV V_{min}/V_{max}
- Connection of a second motor with minimized hydraulic hose length, for example tandem motors

Motor Types – HMR

Regulating Motor

HMR
Regulating Motor



Features

- Optionally with purge valve for circuit and case flushing in closed loop circuit
- System pressure regulation, no external control lines required
- Brake pressure shut off for closed loop circuit
- Counterbalance (brake) valve CBV optional

Benefits

- Smooth low-speed operation
- High starting torque
- Wide conversion range
- Compact design
- High power density
- High reliability
- Long service life
- Highly dynamic response characteristics
- Simplified drive line

Motor Types – HMR

Regulating Motor

Eaton regulating motors are suitable for open and closed loop operation. They are high-pressure regulated and shift to minimum displacement Vmin at system pressures below the regulation begin point. When the defined high pressure regulation set point is reached, the motor smoothly increases displacement to match the torque required by the system. The following data are independent of the rated motor size.

HMR Features

Typical equipment options

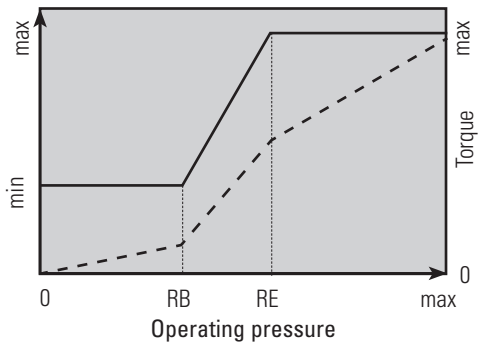
- Open loop circuit. Secondary (crossline relief) valves or counterbalance (brake) valves
- Closed loop circuit. Electric brake pressure shut off

Regulating Motor	Features			
Hydraulic regulation	Regulation begin pressure adjustable, please specify with the order	bar		150-260
	Regulation end pressure	bar		5% above regulation begin pressure
Pneumatic Vmax override control	Shift pressure min / max	bar		4 to 8
Hydraulic Vmax override control	Shift pressure min / max Low pressure	bar		20 to 30
	Shift pressure min / max High pressure	bar		30 to 420
Electronic control signal	Connector type			DIN EN 175301-803, Deutsch, AMP Junior Timer (2-pin, Cod. 2)
	Rated voltage = max. continuous voltage	V	12	24
	Voltage type			DC Voltage
	Power input (cold)	W		≤ 26
	Relative duty cycle	%		100
	Protection class			IP54 (DIN), IP67 (Deutsch), IP 6K6K (AMP
Minimum reponse time with standard orifice (with 20 bar servo pressure)		s		0.3-0.6

V_{max} Control

The additional Vmax control enables fixed displacement motor operation independent of the control pressure.

Regulating Motor Characteristic

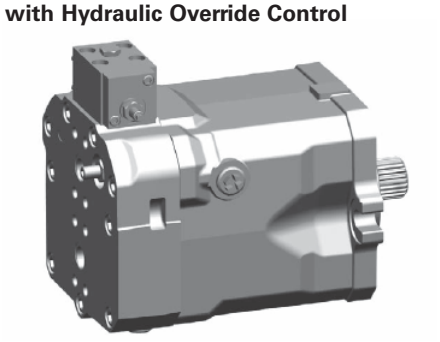


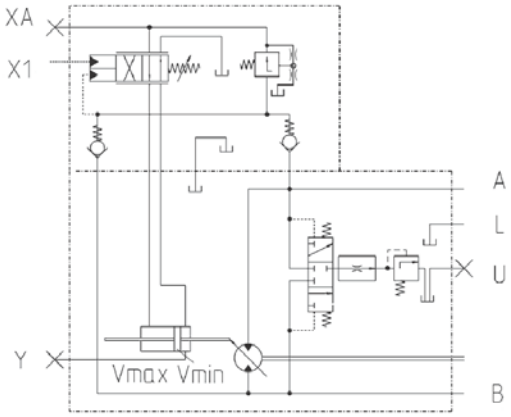
RB Regulation begin
RE Regulation end
—— Displacement
- - - Torque

Motor Types – HMR with Override Control

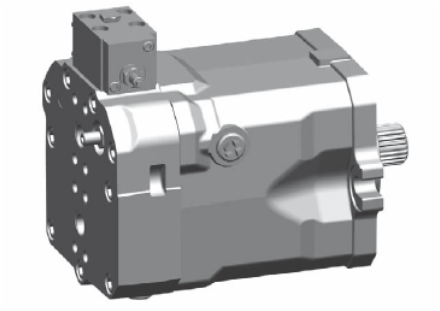
The additional Vmax control enables fixed displacement motor operation independent of the control pressure.

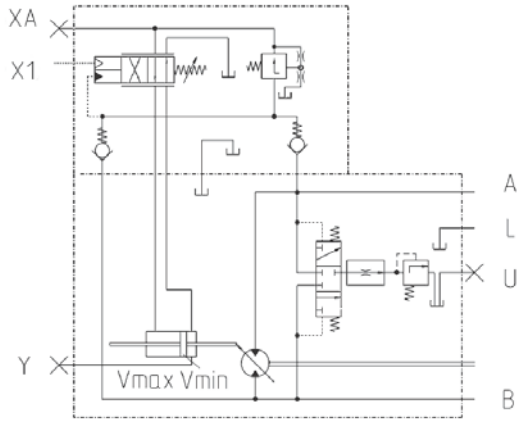
Regulating Motor with Hydraulic Override Control



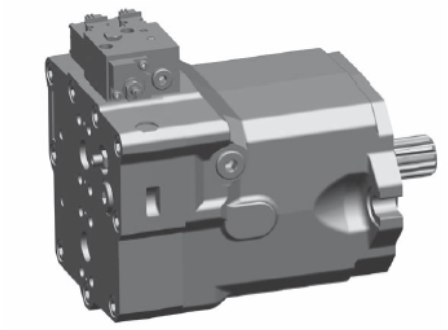


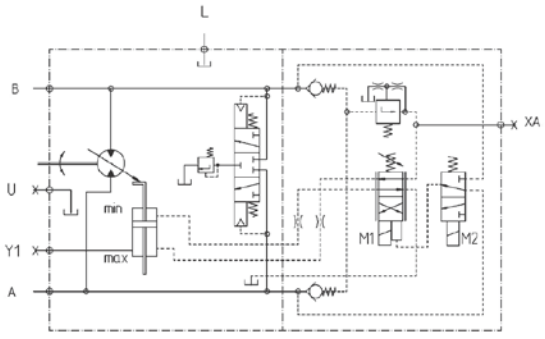
Regulating Motor with Pneumatic Override Control



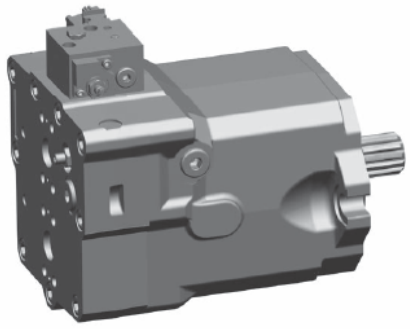


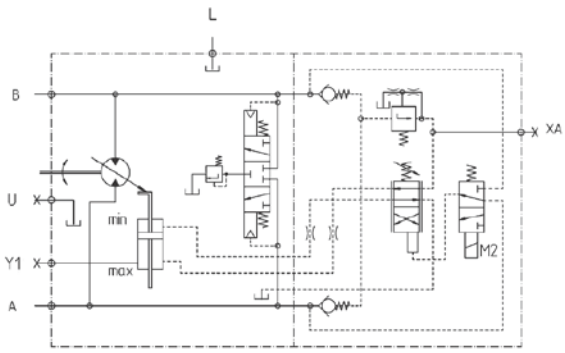
HMR with Electric Override Control and Signal Selection for Pressure Regulator





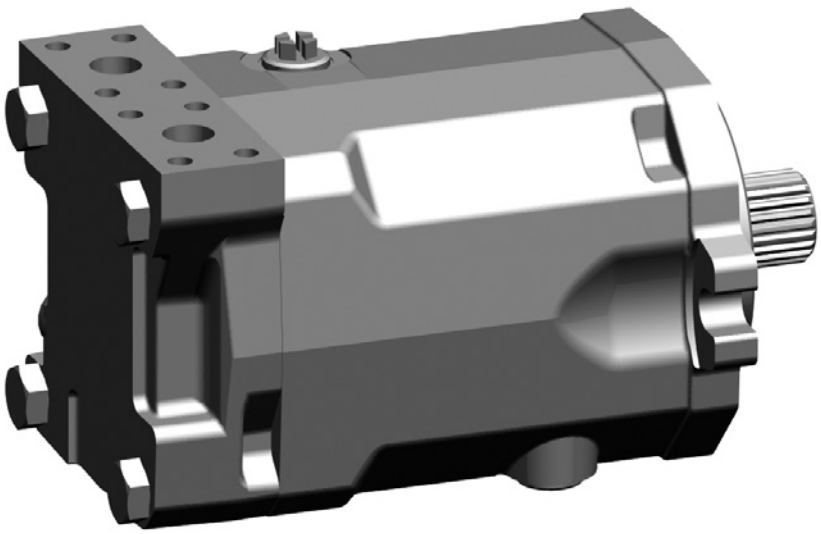
HMR with Electric Signal Selection for Pressure Regulator





Motor Types – HMF

Fixed Displacement Motor



Features

- Optimized start-up and low-speed characteristics
- Optionally with purge valves for purge and case flushing
- Fixed and dual setting secondary valves optional

Benefits

- Smooth low-speed operation
- High starting torque
- Compact design
- High power density
- High reliability
- Long service life

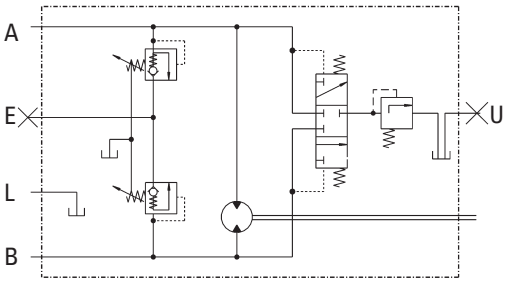
Motor Types – HMF

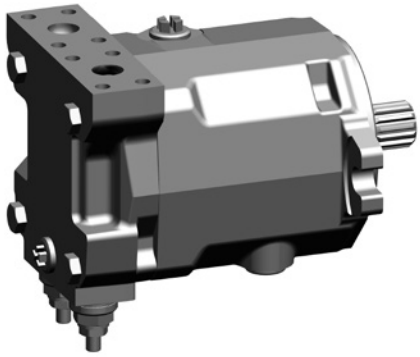
Fixed Displacement Motor

The HMF motor is a high-pressure fixed displacement motor for open and closed loop operation. Secondary valves enable customised definition of soft motor start-up and slowdown. With dual setting secondary valves the maximum acceleration and braking torque is additionally available. The settings and shifting ranges can be adjusted according to project-specific requirements, see section Function. Secondary protection and HMF P.

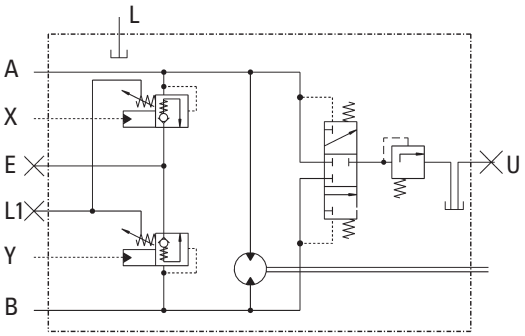
HMF
Fixed Displacement Motor

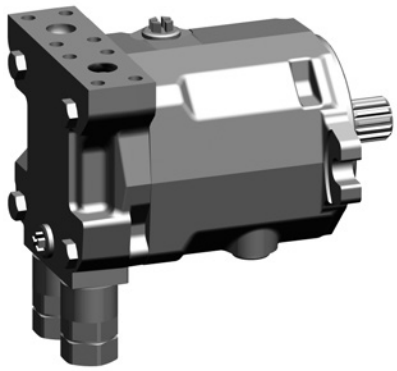
With Crossline Relief Valves
Fixed Setting





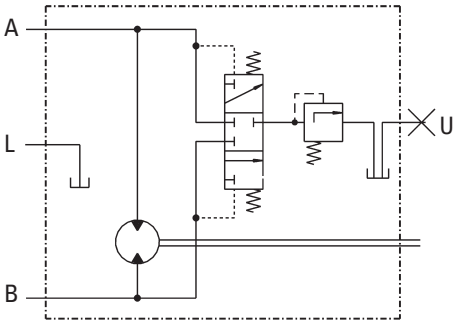
With Dual Pressure Crossline Relief Valves



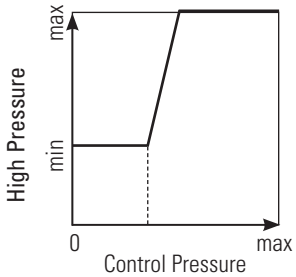


HMF
Fixed Displacement Motor

A, B	Work ports
L, L1, U	Case drain/vent connections
X, Y	Control connections for dual pressure crossline relief valve
E	Make up connection



Dual Pressure Relief Valve, Pressure Setting

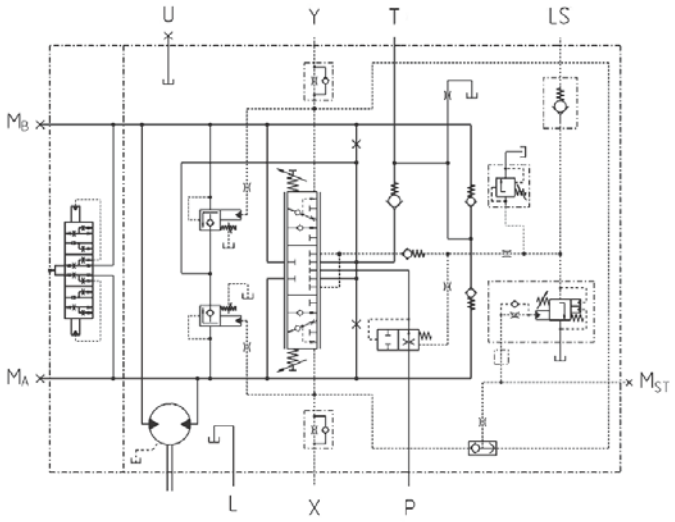


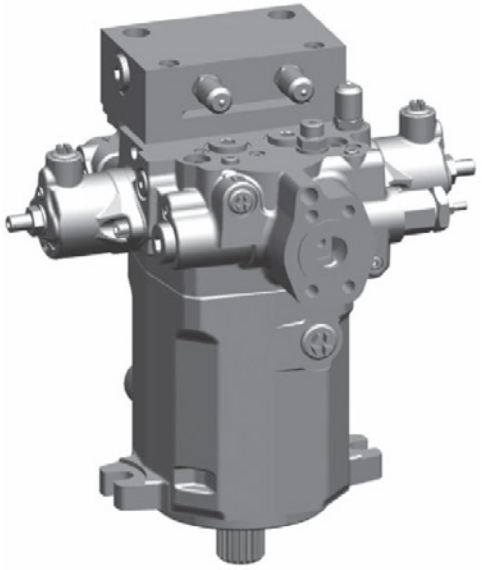
Motor Types – HMF-P

Fixed Displacement Motor

The HMF-P motor is a high-pressure fixed displacement motor for open loop operation. With integrated LS directional control valve and TC torque control it combines the benefits of DuraForce technology with all auxiliary functions typically required for application in swing and winch drives. The HMF-P is available in the rated sizes 35, 55, 75 and 105. Differing from the standard HMF, the nominal pressure is 280 bar, the peak pressure is 300 bar.

HMF-P with integrated swing function





Features

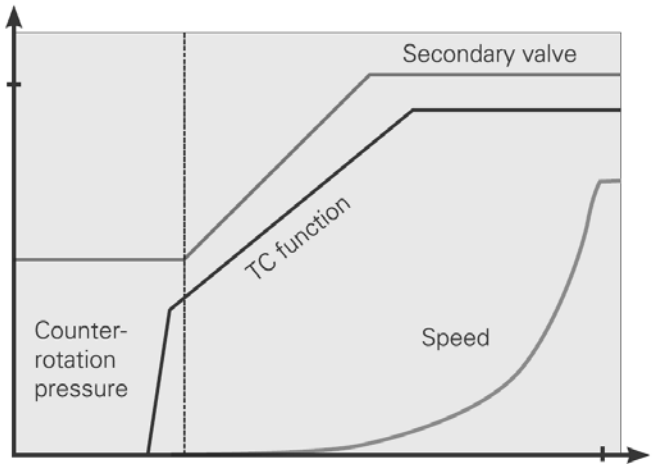
- Directional control valve function
- Torque control function
- HP valves with controllable characteristic curves
- Priority function
- Secondary protection combined with make-up function
- Purge and case flushing function
- Anti reaction valve

Benefits

- Smooth low-speed operation
- High starting torque
- Torque and speed control
- Controllable counter rotation
- Compact design
- High power density
- High reliability
- Long service life

TC Function

For powerful and dynamic application in swing drives the TC function enables control pressure-dependent acceleration. Once the maximum rotating speed is received, torque control is superimposed and pressure level is reduced for energy-saving operation. If the control valve is reset to the neutral position, no additional control signal is generated and the rotary motion slows down uniformly. Active counter-rotation is possible with controllable valves. A counteractive signal is generated, and the rotary motion is decelerated along the characteristic counter-rotation pressure curve.



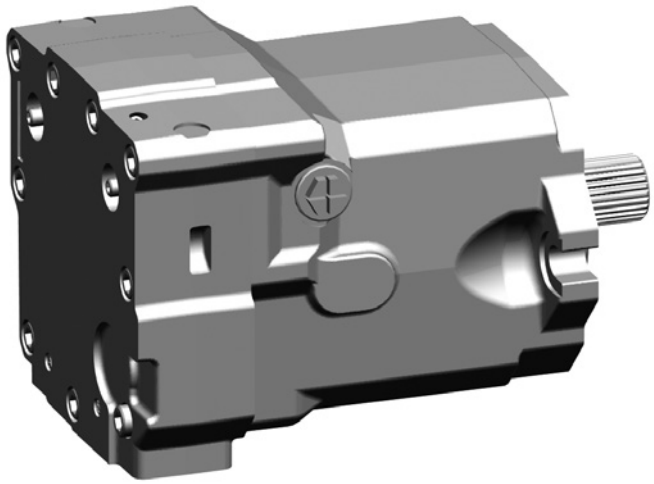
P, T Work port connections
L, U Case drain / vent connections
L, S LS-pressure connection
M Gauge ports

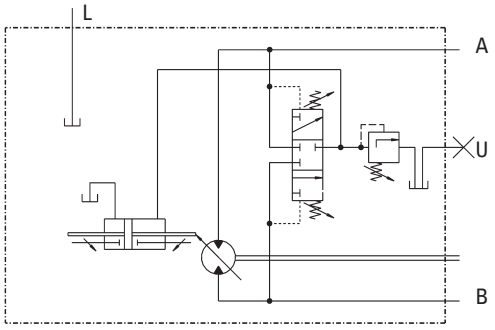
Motor Types – HMA

Adjustable - Fixed Displacement Motor

The HMA motor is a high-pressure motor with adjustable displacement for open and closed loop operation. For application which requires dependent on the situation a reduced or increased displacement, the HMA offers the expected flexibility. Since the displacement can be adjusted on request stepless at a screw. For a well-adjusted torque.

HMA
Adjustable - Fixed
Displacement Motor





A, B Work port connections
L, U Case drain / vent connections

Dimensions – HMV

Rated Size	**55**	**75**	**105**	**135**	**165**	**210**	**280**
Flange Profile			**2-hole Mounting Flange**			**4-hole**	**4-hole**
	SAE C	SAE C	SAE C	SAE D	SAE D	SAE E	SAE E
Shaft Profile in accordance with ANSI B92.1	21 teeth	21 teeth	16/32 spline pitch 23 teeth	23 teeth	23 teeth	8/16DP 15 teeth	15 teeth
D1 (mm)	127	127	127	152.4	152.4	165.1	165.1
B1 (mm)	181	181	181	228.6	228.6	224.5	224.5
B2 (mm)	208	208	208	258.0	258.0	269.0	269.0
B3 (mm)	86	95	96	108.0	125.0	134.0	156.0
B4 (mm)	95	95	96	108.0	125.0	134.0	156.0
B5 (mm)	86	95	96	108.0	125.0	on demand	on demand
B6 (mm)	85	95	96	108.0	125.0	on demand	on demand
B7 (mm) with electric override control	—	180	181	193	on demand	on demand	on demand
B8 (mm) with electric override control	—	180	181	193	on demand	on demand	on demand
H1 (mm)	80	86	91	98	98	135.0	135.0
H2 (mm)	83	93	99	103	98	135.0	135.0
H3 (mm)	84	93	95	108	120	134.0	151.5
H4 (mm)	90	105	106	114	132	133.0	152.5
H5 (mm)	84	93	96	107	118	on demand	on demand
H6 (mm)	90	105	105	114	132	on demand	on demand
H7 (mm) with electric override control	—	88	88	88	on demand	on demand	on demand
H8 (mm) with electric override control	—	92	92	92	on demand	on demand	on demand
L1 (mm)	41	56	56	75	75	75	75
L2 (mm)	212	226	247	270	314	336	381
L3 (mm) control hydraulic control	33	33	33	33	5	5	8
L3 (mm) control electric control	75	75	75	75	58	55	59
L4 (mm)	217	231	252	275	305	on demand	on demand
L5 (mm) control hydraulic control	18	18	18	18	5	on demand	on demand
L5 (mm) control electric control	70	70	70	70	58	on demand	on demand
L6 (mm) with electric override control	—	33	33	33	on demand	on demand	on demand
L7 (mm) with electric override control	—	28	28	28	on demand	on demand	on demand
L8 (mm) with electric override control	—	80	80	80	on demand	on demand	on demand
L, U	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M27x2	M27x2	M33x2
E Connection for external servo supply pressure feed				M14x1.5			
X Connection for hydraulic control				M14x1.5			
M, M1 Solenoid for electric control			see section Motor Types. HMV stepless				
M2 Solenoid for brake pressure shut off			see section Motor types. HMV stepless				

Metric connection thread according to ISO 6149

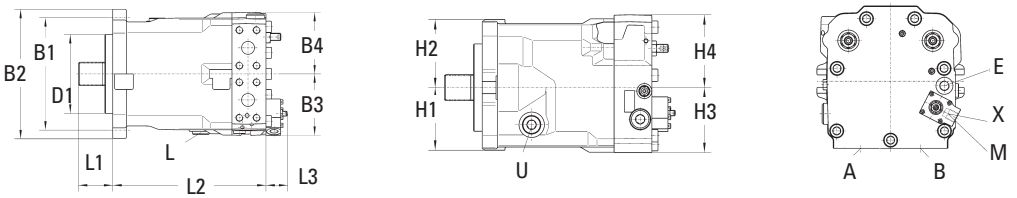
Locking thread for the SAE high pressure-connections, metric according to ISO 261

Hexagon socket head cap screws according to ISO 4762

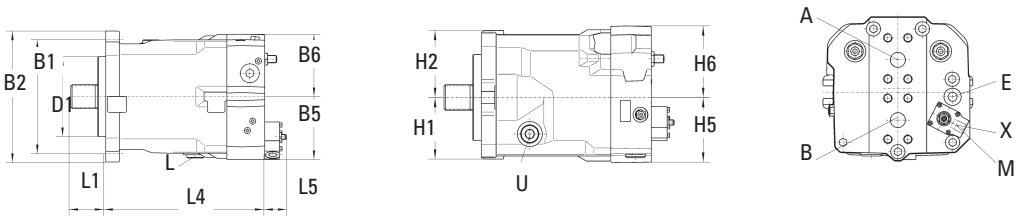
Dimensions – HMV & HMR

HMV

Radial High Pressure-Connections

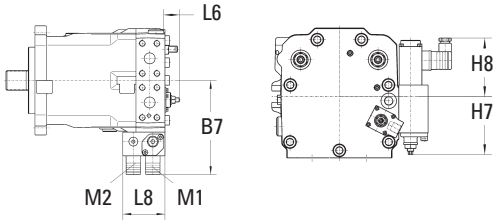


Axial High Pressure-Connections

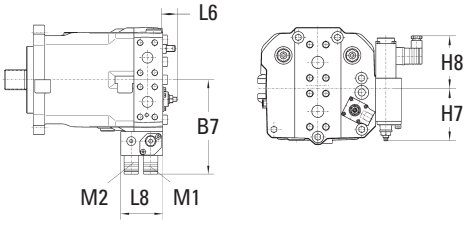


HMV with Electric Override Control

Radial High Pressure-Connections

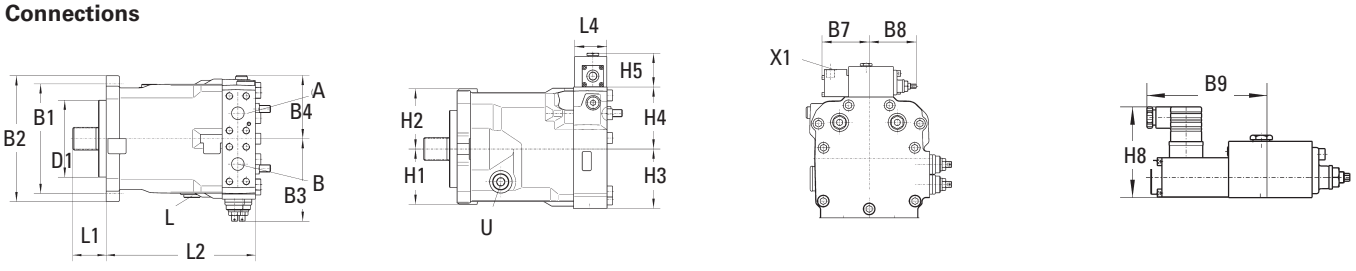


Axial High Pressure-Connections

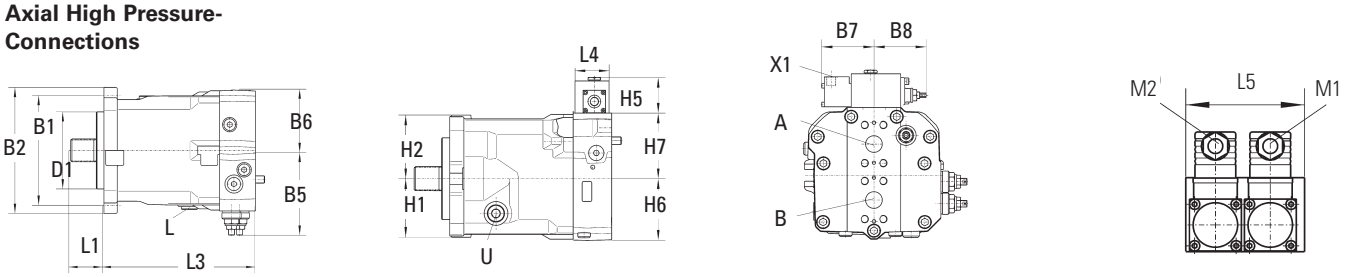


HMR

Radial High Pressure-Connections



Axial High Pressure-Connections



Dimensions – HMR

With Brake Valve – High Pressure-Connections

Rated Size		75	105	135	165
Flange Profile			**2-hole mounting Flange**		
		SAE C	SAE C	SAE D	SAE D
Shaft Profile			16/32 spline pitch		
in accordance with ANSI B92.1		21 teeth	21 teeth	23 teeth	23 teeth
D1 (mm)		127	127	152.4	152,4
B1 (mm)		181	181	228,6	228,6
B2 (mm)		208	208	256	256
B3 (mm) sec. relief valve	without	95	99	108	—
	with	135	136	140	—
B4 (mm) sec. relief valve	without	95	105	108	—
	with	12	105	114	—
B5 (mm) sec. relief valve	without	95	99	108	108
	with	135	139	141	148
B6 (mm)		102	105	114	125
B7 (mm)	pneumatic	74	74	74	—
	hydraulic	62	62	46	46
B8 (mm)		78	78	78	78
B9 (mm)		103	103	103	103
B10 (mm)		89	89	169	169
B11 (mm)		130	130	107	107
H1 (mm)		86	91	96	98
H2 (mm)		93	99	100	105
H3 (mm)		93	98	108	—
H4 (mm)		102	102	110	—
H5 (mm)		56	56	56	56
H6 (mm)		91	96	107	118
H7 (mm)		102	107	109	125
H8 (mm)		81	81	81	81
H9 (mm)		85	85	102	102
L1 (mm)		56	56	75	75
L2 (mm)		229	247	270	—
L3 (mm)		231	252	275	304
L4 (mm)		53	53	53	53
L5 (mm) regulator with el. maximum displacement override and brake pressure shuf off		80	80	80	80
L6 (mm)		127	127	120	120
L, U		M22x1.5	M22x1.5	M27x2	M27x2
X1 port for hyd. / pneum. max. displ. override			M14x1.5		
M1 solenoid for electric maximum displacement override			see section Motor Types. HMR		
M2 solenoid for brake pressure shut off			see section Motor Types. HMR		

Metric connection thread according to ISO 6149

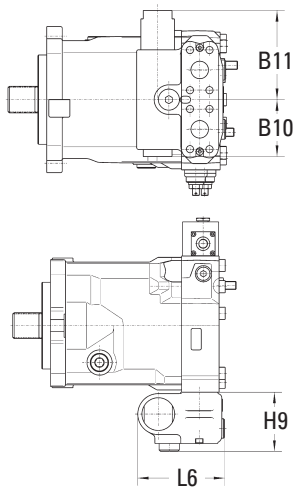
Locking thread for the SAE high pressure-connections, metric according to ISO 261

Hexagon socket head cap screws according to ISO 4762

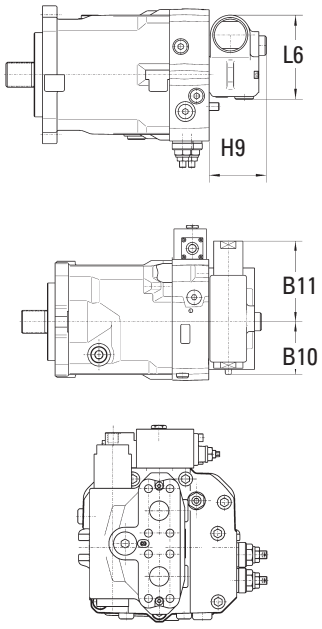
Further threads, dimensions and versions with speed sensor are available on request

HMR with Brake Valve

Radial High Pressure-Connections



Axial High Pressure-Connections



Dimensions – HMF

High Pressure-Connections

Rated Size		28	35	50	75	105	135	165 HMA	210 HMA
Flange Profile				**2-hole Mounting Flange**					**4-hole**
		SAE B	SAE B	SAE C	SAE C	SAE C	SAE D	SAE D	SAE E
Shaft Profile in accordance with ANSI B92.1		15 teeth	15 teeth	16/32 spline pitch 21 teeth	21 teeth	23 teeth	23 teeth	23 teeth	8/16DP 15 teeth
D1 (mm)		101.6	101.6	127	127	127	152.4	152.4	165.1
B1 (mm)		146	146	181	181	181	228.6	228.6	224.5
B2 (mm)		162	162	200	200	200	250	258	269
B3 (mm)		146	146	146	166	166	166	250	268
B4 (mm)		149	149	149	169	169	169	250	268
H1 (mm)		61	61	70	73	82	86	98	135
H2 (mm)		61	61	70	73	82	86	98	135
H3 (mm)	without	67	67	72	78	83	89	120	134
Crossover relief valves	with fixed setting	108	108	116	119	128	137	—	—
	with dual pressure setting	129	129	137	140	149	158	—	—
H4 (mm)		69	69	69	79	83	88	132	133
H5 (mm)		64	64	69	75	80	86	132	133
L1 (mm)		41	41	56	56	56	75	75	75
L2 (mm)		193	193	202	229	254	277	314	336
L3 (mm)		191	191	200	227	252	275	305	336
L, U		M22x1.5						M27X2	M27X2
E Connection for anti-cavitation oil supply		M18x1.5			M22x1.5			—	—

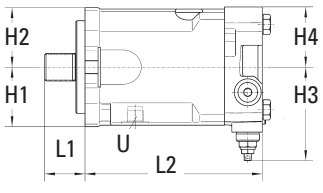
Metric connection thread according to ISO 6149

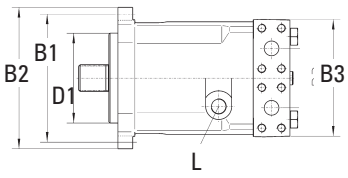
Locking thread for the SAE high pressure-connections. Metric according to ISO 261

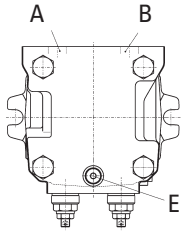
Hexagon socket head cap screws according to ISO 4762

HMF
High Pressure-Connections

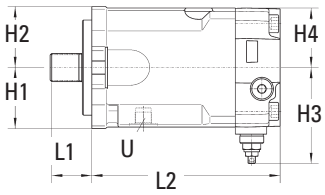
Radial High Pressure-Connections

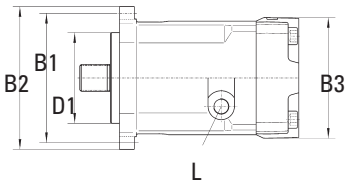


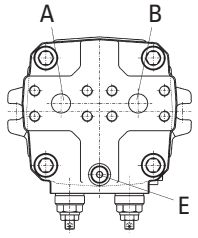




Axial High Pressure-Connections





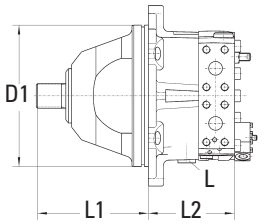


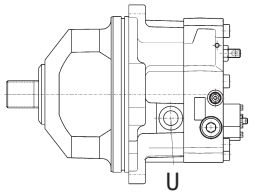
Dimensions – Plug-in Motors and Connections

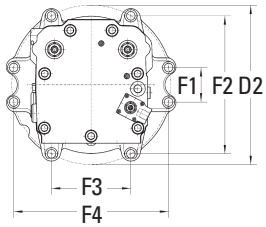
Plug-in Motors

Here variable motor as example. For dimensions not listed please see tables before.

Rated Sizes	75	105	135
D1 (mm)	190.0	216.0	216.0
D2 (mm)	251.0	282.0	282.0
F1 (mm) 2-hole flange	—	55.8	55.8
F2 (mm) 2-hole flange	0.0	223.4	223.4
F3 (mm) 2-hole flange	—	129.0	129.0
F4 (mm) 2-hole flange	224.0	251.8	251.8
L1 (mm)	143.0	169.0	169.0
L2 (mm)	124.0	132.0	175.0

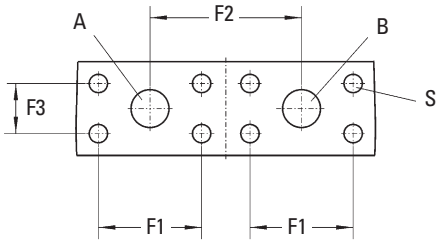




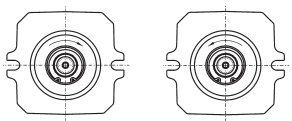


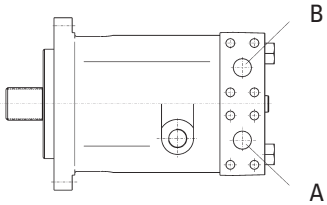
Dimensions – Connections

Rated Size	28/35	50/55	75	105	135	165	210	280	135D
F1 (mm)	50.8	50.8	57.2	57.2	57.2	66.6	66.6	66.6	57.2
F2 (mm)	74.0	74.0	84.0	84.0	84.0	102.0	102.0	102.0	84.0
F3 (mm)	23.8	23.8	27.8	27.8	27.8	31.8	31.8	31.8	27.8
A,B (mm)	¾″	¾″	1″	1″	1"	1 ¼″	1 ¼″	1 ¼″	1″
S (mm)	M10	M10	M12	M12	M12	M14	M14	M14	M12

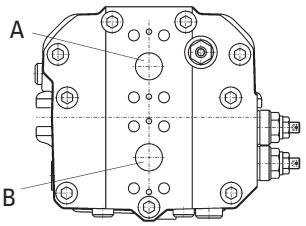


Input Flow and Drive Shaft Rotation





High Pressure at Port	Shaft Output Direction of Rotation	Right Hand	Left Hand
	HMV	B	A
	HMR	B	A
	HMF	A	B



Modular System Features

The Eaton motors are based on a modular system with the following characteristics. This enables our distribution partners to configure the product according to your requirements. The modular system is expanded continuously. Please consult our sales department for the latest characteristics.

Modular System

Features

- V_{min}
- Mounting flange
- Drive shaft
- V_{max} control
- Control orifice
- Secondary valves
- Direction of HP-connections
- Purge valve setting
- Shuttle valve
- Drain port U, L1, L2
- Coupling flange
- PTO through-Drive
- Port threads
- Type of control
- Remote control pressure
- Start of control
- Voltage for E-controls
- Connectors for E-controls
- Displacement fixing
- Speed sensor
- Pilot pressure compensation
- Surface treatment

Notes

Notes

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Powering Business Worldwide

Printed in USA
Document No. E-MOPI-MC003-E3
March 2014