

HMF/V/R-02



High-Pressure Motors
for Open and Closed
Loop Circuits

Linde Hydraulics move the worlds

Linde pioneered mobile hydrostatic transmissions.

Over the last 40 years Linde have fitted almost 2 million vehicles in the fields of:

- Earthmoving and Construction Machinery
- Agricultural and Forestry Equipment
- Municipal Vehicles
- Materials Handling Vehicles

with hydrostatic drive and gear units. By using this concept on its own forklift trucks, Linde have become the world leader in materials handling technology.

Through this in house know how Linde as the system supplier can offer you a complete carefree package:

- From initial discussions to optimum solutions
- Technical support throughout the project
- World-wide after sales service

This together with our understanding of partnership, ensures your guarantee of:

- High level technology
- Durable components
- Cost effectiveness

HMF/VR-02

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1. FEATURES AND TECHNICAL DATA



Features

- Axial piston swash plate, motor with these general advantages:
 - High degree of conformability
 - High rate of angular acceleration
 - High starting torque efficiency
- Compact design with high power density
- Superior quality
- Optimized for:
 - High reliability
 - Long working life
 - Low noise emission
 - High efficiency

Design Characteristics

- Swash plate angle 21°
- Increased working life as a result of special hydraulic cradle bearings and a unique slipper/piston swaged connection

Nominal Sizes

- 28, 35, 55*, 75, 105, 135
- 165 and 210 under development

* (Fixed Motor = 50cc)

The data on which this brochure is based correspond to the current state of development. We reserve the right to make changes. The dimensions and technical data of the individual installation drawings are binding.

Technical Data

Nominal Sizes		28	35	55 *10)	75	105	135	165	210	
Displacement	Maximum [cm ³ /rev]	28.6	35.6	54.8	75.9	105.0	135.6	Under Development		
	Minimum *1) [cm ³ /rev]	−*9)	−*9)	18.3	25.3	35.0	45.2			
Speed	Max. operating speed [rpm] (at 100% duty cycle) at maximum displacement	4500	4500	4100	3800	3500	3200			
	Highest speed (intermittent)*2) [rpm] at maximum displacement	4800	4800	4400	4100	3800	3500			
	Max. operating speed [rpm] (at 100% duty cycle) at minimum displacement	−*9)	−*9)	4700	4400	4100	3700			
	Highest speed (intermittent)*2) [rpm] at minimum displacement	−*9)	−*9)	5300	5000	4700	4000			
Pressure	Continuous pressure (delta p) [bar]	250								
	Max. operating pressure *3) [bar]	420								
	Highest pressure (intermittent) [bar]	500								
	Permissible case pressure (absolute) [bar]	2.5								
Torque	Continuous output torque *4) [Nm]	114	142	218	302	418	540			
	Max. output torque *5) [Nm]	191	238	366	508	702	907			
Power	Continuous power *6) [kW]	54	67	94	120	153	181			
	Max. power *7) [kW]	90	112	157	202	257	304			
Per. Shaft Loads	Axial input force [N]	2000								
	Axial output force [N]	2000								
	Radial [N]	on request								
Per. Housing Temperature	[°C]	90								
Weights	Fixed displacement motor *8) [kg]	16	16	19	26	33	39			
	Variable displacement and pressure regulating motor *8) [kg]	−*9)	−*9)	28	32	42	56			
	Moment of inertia [kgm ² x10 ⁻²]	0.25	0.25	0.49	0.79	1.44	2.15			
Main Dimensions		see Section 8								

- * 1) Only for variable displacement and pressure regulated motors
- * 2) Higher speed upon request
- * 3) Other values possible, dependant upon relief valve setting - see section 7
- * 4) At continuous pressure
- * 5) At maximum operating pressure

- * 6) At maximum operating, maximum displacement and continuous pressure
- * 7) At maximum operating speed, maximum displacement and maximum operating pressure
- * 8) Applies to SAE flange mounting versions (see Section 5.2)

2. HMF-02 FIXED DISPLACEMENT MOTORS

Fixed displacement motors of the HMF-02 type are suitable for both open and closed loop circuit



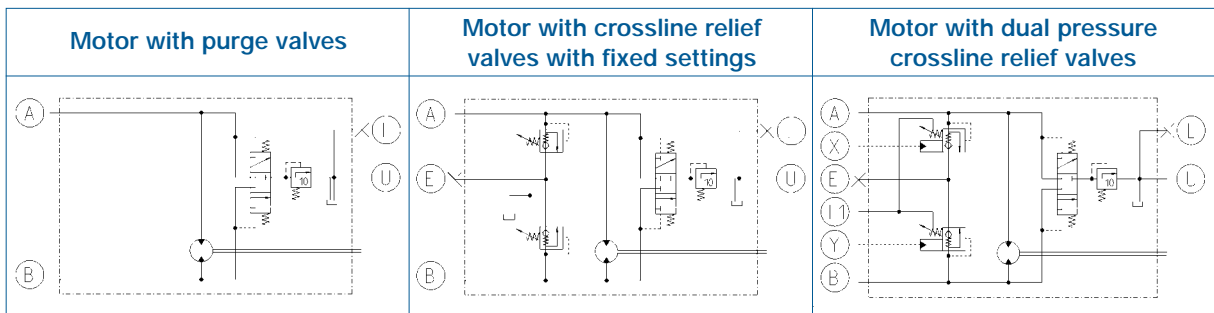
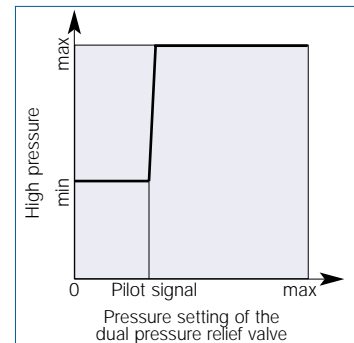
Fixed displacement motor (standard version)



Details: (top picture) Fixed setting pilot operating crossline relief valves. (lower picture) Dual pressure crossline relief valves.

Two porting options and a variety of equipment options are available for this motor (see Section 5 and 6) to ensure the best possible adaptation to your specific application.

The use of dual pressure crossline relief valves broadens the spectrum of possible applications. The low setting of the relief valve permits soft gentle braking of the motor. When the relief valve is triggered to its high setting, maximum acceleration and braking torque is available at the motor. A typical application of this type is a turning and boring mill drive.



A, B Working port connections
L, L1, U Case drain, vent connections

E Make up connection
X, Y Control connections for dual pressure crossline relief valve

3. HMV-02 VARIABLE DISPLACEMENT MOTORS

3.1 Two-position control (flip-flop)



Two-position motor with electric control

Two position motors are suitable for both open and closed loop circuits. They default to maximum displacement (V_{max}) with no control signal and make a smooth transition to minimum displacement when a control signal is applied.

The control signal can either be:

- **hydraulic** with pilot pressure
- **electric** with a direct current electric signal

Servo supply pressure can be provided externally or internally, depending on the motor's design configuration (see Section 6.3)

Technical Data

Rating				The values listed below are applicable for all nominal sizes		
Servo Pressure Supply *1)	externally supplied at port (E)	minimum	[bar]	20		
		maximum permissible	[bar]	40		
Hydraulic Pilot Signal *2)	Pressure at port (X)	minimum	[bar]	20		
		maximum permissible	[bar]	40		
Electric *2) Control Signal	Connector type *3)			Hirschmann		
	Voltage (=continuous limit voltage)			[V]	12	24
	Voltage type			Direct current		
	Power consumption (cold power)			[W]	≤ 26	
	Relative duty cycle			[%]	100	
	Protection class			IP 6K6K, Part 9		
Response Time		minimum *4)	[sec]	0.5		

*1) connection E in the circuit diagram shown below

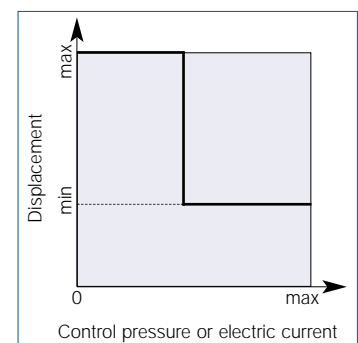
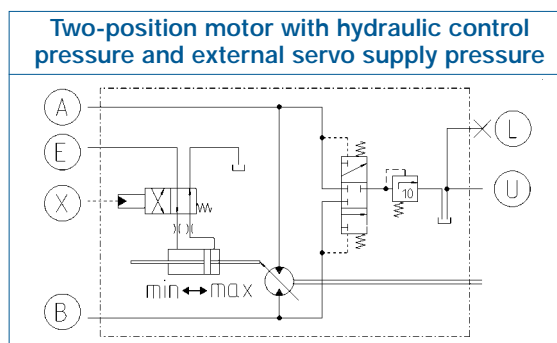
*2) connection X in the circuit diagram shown below

*3) other connector versions on request

*4) other response times are possible by using special nozzles

Circuit Diagram and Adjustment Characteristics

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



3.2 HMV-02 Stepless Variable Control



Stepless variable motor with hydraulic displacement control

Motors with stepless variable displacement control are suitable for both open and closed loop circuits. They are at maximum displacement (V_{max}) with no control signal and shift proportionally to minimum displacement with a proportional control signal.

The control signal can be either:

- **hydraulic** using a proportional control pressure, or
- **electric** applying variable direct current to a proportional solenoid.

Servo supply pressure can be provided externally or internally, depending on the motor's design configuration (see Section 6.3).

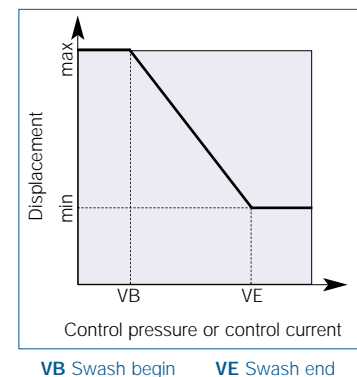
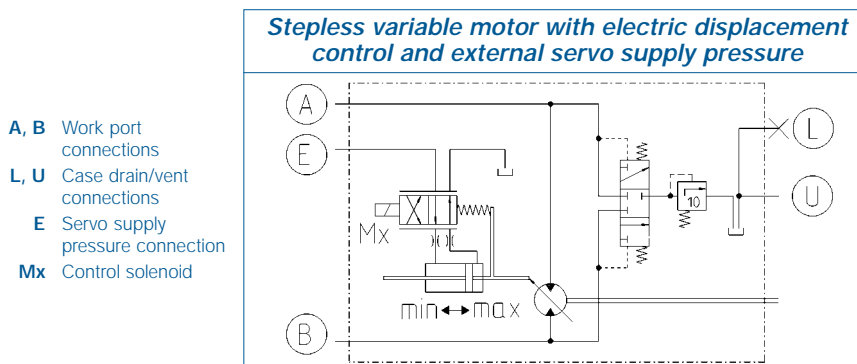
Technical Data

Rating			The values listed below are applicable for all rated sizes		
Ext. servo supply pressure *1)	minimal	[bar]	20		
	maximum permissible	[bar]	40		
Hydraulic control signals	Control range	[bar]	8 to 14		
	maximum permissible pressure	[bar]	40		
Electric control signals *2)	Connector type *3)		Hirschmann		
	Nominal voltage (=continuous limit voltage) [V]		12	24	
	Voltage type		Direct current		
	Power consumption [W]		15.6		
	Nominal current (=continuous limit current) [mA]		1300		
	Control current	Swash begin	[mA]	450	225
		Swash end	[mA]	1200	600
	Relative duty cycle [%]		100		
Protection class		IP 6K6K, Part 9			
Response time	minimum *4)	[sec]	0.5		

*1) connection E in the circuit diagram shown below
*2) connection Mx in the circuit diagram shown below

*3) other connector versions on request
*4) other response times are possible by using special orifices

Circuit Diagram and Adjustment Characteristics



3.3 HMV-02 Stepless Variable Control with Pressure Override



Variable motor with pressure override

This motor is used primarily in closed loop circuits.

It is at maximum displacement (V_{max}) with no control signal. Variable displacement control to lower displacement is accomplished hydraulically with the application of a proportional control pressure signal by the operator.

The motor is also equipped with a system pressure override (POR) which increases the motor's displacement in response to system-related demands for torque when a predefined system pressure setting is reached, overriding the operator's command for lower displacement.

In addition, this motor has

- electric maximum displacement override (DOR) that makes it possible to shift the motor to its maximum displacement independently of the control pressure, and to lock it there, (as with the fixed displacement motor.
- electric brake pressure shut off (BPS). It prevents abrupt reactions and response by the system pressure override control to dynamic braking pressures, and thus makes it possible for a more controlled deceleration of the vehicle.

Technical Data

Rating			The values listed below are applicable for all rated sizes
Hydraulic control signal *1)	Control range	[bar]	8 to 14
	Maximum permissible pressure	[bar]	40
Hydraulic pressure override	Start of pressure RB *2)	[bar]	190 - 260
	End of pressure RE	[bar]	5% above start of pressure
Switching magnet	All electrical data *4)		See table on page 5
Response time	Minimum *3)	[sec]	0.5

*1) connection X in the circuit diagram shown below

*3) other response times are possible by using special orifices

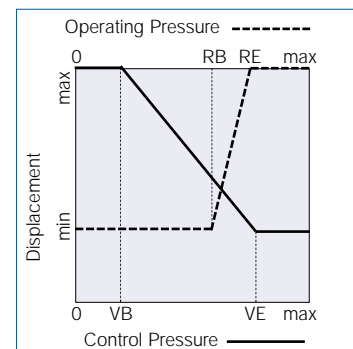
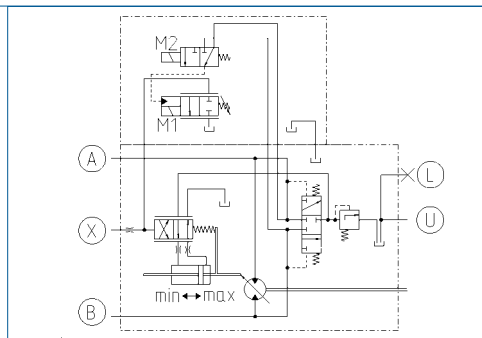
*2) adjustable, please indicate when ordering (see Section 7.3)

*4) other control options are available to control DOR. (see Section 6.2, page 10)

Circuit Diagram and Adjustment/Control Characteristics

Stepless variable displacement control motor with pressure override, electric maximum displacement override, and brake pressure shut off.

- A, B Working port
- 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

4. HMR-02 Pressure Regulated Motors



Pressure regulated motor with electric maximum displacement override and cross over relief valve protection



Pressure regulated motor with electric maximum displacement override and brake pressure shut off.

Linde pressure regulated motors are suitable for both open and closed loop circuits. They are high-pressure controlled, and are at minimum displacement (V_{min}) when system pressure is below the pressure regulation set point of regulation begin (RB). When the pressure regulation set point is reached, the motor smoothly increases displacement in response to system-dependent demands for torque. The additional maximum displacement override control makes it possible to shift the motor to maximum displacement independently of the pressure regulating control, and locks it there as with a fixed displacement motor.

The maximum displacement override signal can be either:

- **pneumatic** shifted with a low pressure air signal
- **hydraulic** shift with a hydraulic pressure signal
- **electric** shift with a direct current electric signal.

The typical configuration of pressure regulated motors for use in open or closed loop circuits is as follows:

- Open loop circuit: with cross over relief valve protection and counter balance valve (see Section 6.7)
- Closed loop circuit: with electric brake pressure shut off (see Section 6.6)

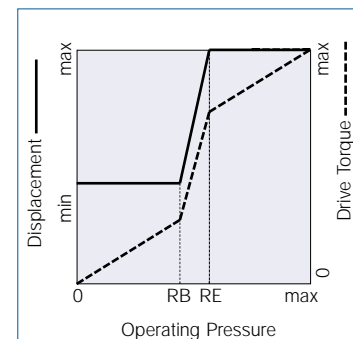
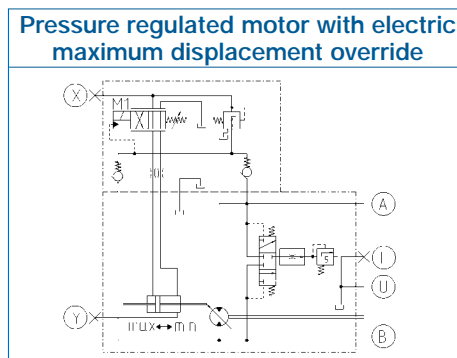
Technical Data

Rating	The values listed below are applicable for all nominal sizes		
Pressure regulating control	Regulation begin (RB) *1)	[bar]	190 to 260
	Regulation end (RE)	[bar]	5% above regulation begin (RB)
Pneumatic max. displ. override	Shifting pressure min/max	[bar]	4 to 8
Hydraulic pilot pressure max. displ. override	Shifting pressure min/max	[bar]	20 to 30
Hydraulic high-pressure max. displ. override	Shifting pressure min/max	[bar]	30 to 420
Electric max. displ. override	All electrical data		See table page 5
Electric brake pressure shut off			

*1) adjustable, please indicate when ordering (see Section 7.4)

Circuit Diagram and Control Characteristics

- A, B** Works port connections
- L, U** Case drain/vent connections
- M1** Solenoid for maximum displacement override regulation
- X, Y** Gauge ports





RB Regulation Begin RE Regulation End

5. DESIGN CONFIGURATIONS

Depending on the installation situation and accessibility, optional rear or side high-pressure ports are available. SAE flange mounts or plug in style are





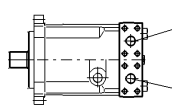
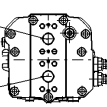
also available. The following tables show the suitability and availability.

5.1 Arrangement of the High-Pressure Ports



Suitability and availability for motor types		Fixed displ. motor		Variable displ. motor		Var displ. motor + override control	Pressure regulated motor	
		open	closed	open	closed		open	closed
	Picture	Circuit loop						
Side		✓	✓	✓	✓	✓	✓	✓
Rear *1)		✓	✓	✓	✓	✓	✓	✓

*1) selected sizes available

Input Flow vs. Shaft Output Rotation

Identification of Ports		Shaft Output Direction of Rotation	
			
		Motor Type	Input Flow Into Port
		HMF-02	A B
		HMR-02	B A
		HMV-02	B A

5.2 Mounting Versions

Suitability and availability for motor types		Fixed displ. motor		Variable displ. motor		Var displ. motor + override control	Pressure regulated motor	
		open	closed	open	closed		open	closed
	Picture	Circuit loop						
SAE flange *1)		✓	✓	✓	✓	✓	✓	✓
Plug-in *1) *2)				✓	✓	✓	✓	✓

*1) see Section 8.5 for dimensions

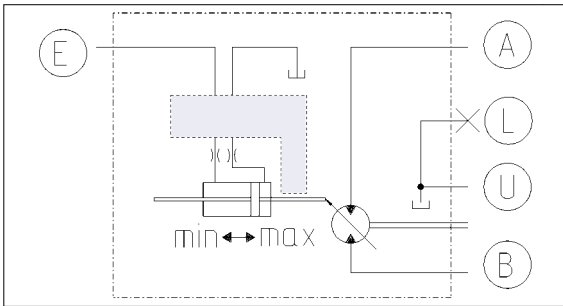
*2) selected sizes available (see Section 8.4)

6. CONTROL OPTIONS

Linde motors can be optimally adapted to the widest possible variety of applications and prevailing conditions by means of a wide range of control

options. The tables show the specific suitability and availability.

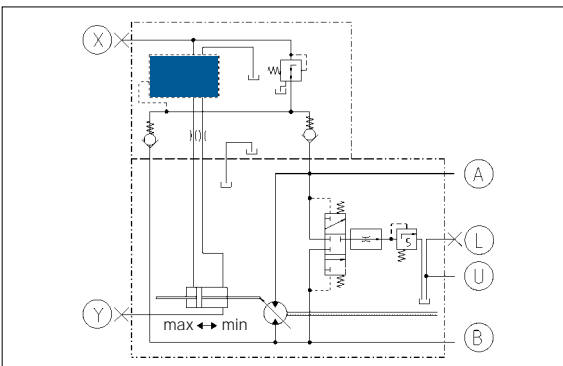
6.1 Displacement Control



Control of variable displacement motors is achieved by varying the position of the motor's swash plate. (see Section 3 for functional descriptions.) Swash controls shown are available in various options for servo supply pressure feed (see Section 6.3).

Suitability and availability for motor types		Fixed displ. motor	Variable displ. motor		Var. displ. motor + override control	Pressure regulated motor	
	Circuit diagram		open	closed	closed		
Hydraulic two position			✓	✓	-		
Electric two position			✓	✓	-		
Hydraulic proportional			✓	✓	✓		
Electrical proportional 12 v or 24 V			✓	✓	-		

6.2 Displacement Override (DOR)

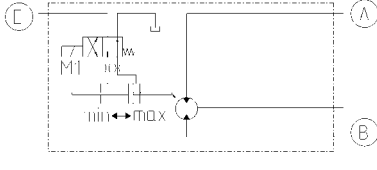
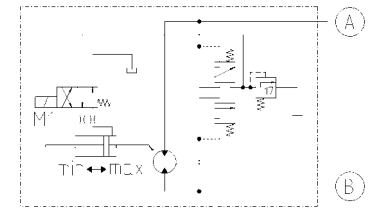
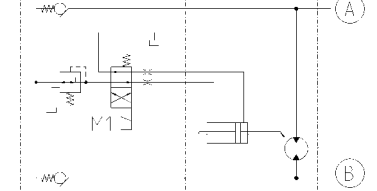


Linde pressure regulated motors are system-pressure controlled, consequently, the swash plate control pressure is supplied internally via the high-pressure circuit. Pressure regulated motors have a Vmax maximum displacement override circuit (see Section 4 for a functional description). Available maximum displacement override options are listed below.

Suitability and availability for motor types		Fixed displ. motor	Variable displ. motor	Var. displ. motor + override control	Pressure regulating motor	
	Circuit diagram			closed	open	closed
DOR circuit						
Pneumatic				-	✓	✓
Hydraulic pilot pressure				-	✓	✓
Hydraulic high pressure				-	✓	✓
Electric 12 V or 24 V				✓	✓	✓

6.3 Servo Supply Pressure Feed

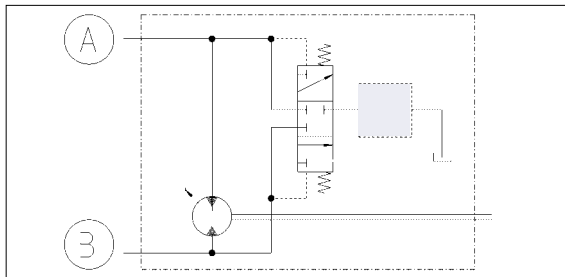
Servo supply pressure delivers the force needed to change the position of the swash plate in variable displacement and pressure regulated motors.

Suitability and availability for motor types		Circuit diagram	Circuit loop	Fixed displ. motor		Variable displ. motor		Var. displ. motor + override control	Pressure regulated motor	
				open	closed	open	closed	closed	open	closed
External supply				-	✓ ^{*1)}	-	-	-	-	-
Internal supply from the purge circuit				-	✓	-	✓	-	-	-
Internal supply from the high-pressure circuit				✓ ^{*2)}	-	-	-	✓	✓	✓

*1) standard configuration for variable closed loop motors

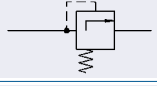
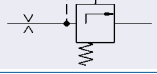
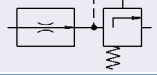
*2) special two-position motor

6.4 Purge and Case Flushing



Purge and case flushing circuitry 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

Suitability and availability for motor types			Fixed displ. motor		Variable displ. motor		Var. displ. motor + override control	Pressure regulated motor	
Purge valve types	Fiflow [l/min]	Schematic symbol	open	closed	open	closed	closed	open	closed
None	0	-	✓ ^{*6)}	- ^{*4)}	✓ ^{*6)}	- ^{*4)}	-	✓ ^{*6)}	- ^{*4)}
Standard	10 ^{*1)}		-	✓ ^{*5)}	-	✓ ^{*5)}	✓ ^{*2)}	-	✓ ^{*5)}
Restricted	5 ^{*1)}		-	✓	-	✓	-	-	✓
Flow controlled	4 ^{*3)}		✓	- ^{*4)}	✓	- ^{*4)}	-	✓	- ^{*4)}

*1) at 16 bar feed pressure and 10 bar purge relief valve

*2) at 20 bar feed pressure and 14 bar purge relief valve

*3) at 5 bar purge relief valve; independent of low pressure

*4) suitability under certain conditions on request

*5) standard version for motors in closed loop circuit

*6) standard version for motors in open loop circuit

6.5 Crossline Relief Protection

HMF/HMV/HMR-02 motors are available with integrated crossline relief valves to protect the system against pressure overloads. Relief valves are pilot operated reliefs in combination with anti-cavitation checks. The use of these relief valves is recommended whenever pressure limiting control has not been provided in some other way (e.g. by means of primary pressure relief or pressure cut off at the pump or LSC valves).

Anti-cavitation is facilitated through connection E, shown in the circuit diagrams. This may be needed in open loop circuits if the motor requires more oil than can be supplied to it, especially in dynamic braking situations. For special installations (e.g. for turning and boring mill drive), the use of dual pressure cross over relief valves should be considered. (see Section 2)

Suitability and availability for motor types		Fixed displ. motor		Variable displ. motor		Var. displ. motor + override control	Pressure regulated motor	
	Circuit diagram	open	closed	open	closed	closed	open	closed
Without crossline relief valve		✓	✓	✓	✓	✓	✓	✓
With crossline relief valve protection *1)		✓ *1)	✓ *1)	-	-	-	✓	✓
With dual pressure relief valve protection *2)		✓ *1)	-	-	-	-	-	-

*1) availability on request

*2) connection X and Y in the circuit diagram

6.6 Brake Pressure Shut Off (BPS)

Pressure regulated motors shift towards maximum displacement if the operating pressures are equal to or above the regulation begin (RB) pressure setting, irrespective of which working port the pressure is generated. With propel systems, this can lead to unpleasant effects if, for example, during dynamic braking high pressures are generated above the regulation begin setting, the motor will shift to

maximum displacement and an extremely strong braking effect will occur.

Brake pressure shutoff prevents the braking pressure or deceleration pressure from reaching the regulator. Only the drive pressure or acceleration pressure is felt by the motor's pressure regulator, and thus the motor will remain in minimum displacement during braking.


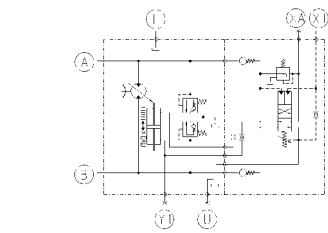

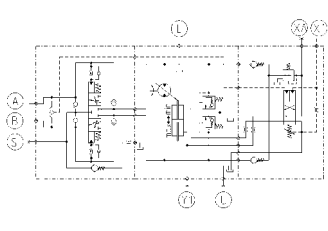
Suitability and availability for motor types		Fixed displ. motor		Variable displ. motor		Var. displ. motor + override control	Pressure regulated motor	
	Circuit diagram	open	closed	open	closed	closed	open	closed
Without brake pressure shut off		✓	✓	✓	✓	-	✓	-
With brake pressure shut off		-	-	-	-	✓	-	✓

6.7 Counter Balance

The counter balance valve prevents over speeding the motor during an over running condition. To achieve this, the motor's exhaust oil is automatically metered to restrict its escape. With integrated anti-cavitation circuitry, cavitation can be prevented.

In addition, a flushing valve can be incorporated to allow motor case flushing.

Counter balance valves are typically used in drive systems in open loop circuits.





Suitability and availability for motor types			Fixed displacement motor		Variable displacement motor		Variable displ. motor + override control	Pressure regulated motor	
	Circuit diagram	Circuit loop	open	closed	open	closed	closed	open	closed
			Without counter-balance			✓	✓	✓	✓
With counter-balance valve *1)			✓	-	-	-	-	✓	-

*1) the rear mount is shown; side mount is also possible.

6.8 Speed Sensor

Motors can be equipped with speed sensors. Please consult factory as not all models and sizes are currently adapted for this option. Speed sensors

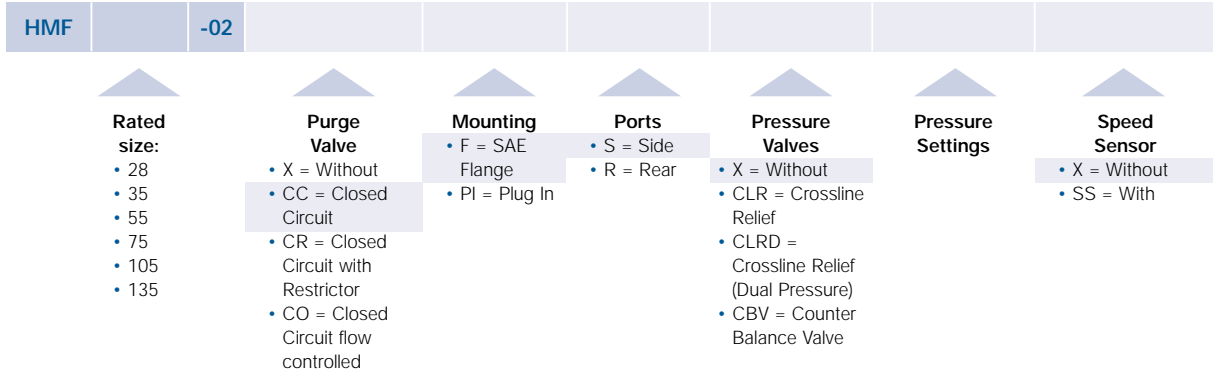
detect the motor speed electronically and supply it to an electronic control device in the form of an input signal.

Suitability and availability for motor types			Fixed displ. motor		Variable displ. motor		Var. displ. motor + override control	Pressure regulated motor	
	Circuit loop	Circuit loop	open	closed	open	closed	closed	open	closed
			Without speed sensor			✓	✓	✓	✓
With speed sensor *1)			✓	✓	✓	✓	-	✓	✓

*1) Illustration is one example, other versions are available. Please consult factory for availability and technical data.

7. PRODUCT CODE

7.1 HMF-02 Fixed Displacement Motor

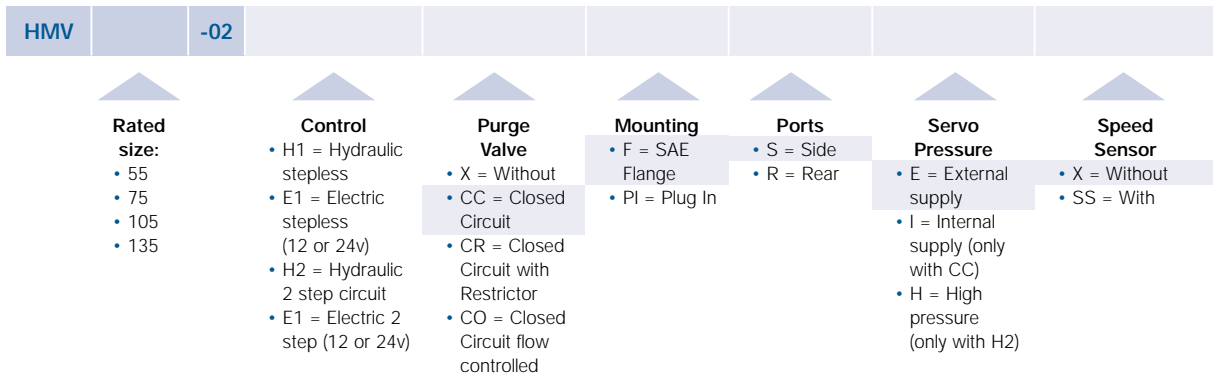


Note - Not all configurations are available, check suitability and availability before ordering. Standard configuration supplied unless otherwise specified.

Examples

HMF 105-02 CC F S X - X	<ul style="list-style-type: none"> • Rated Size 105 cm³/rev • Standard configuration
HMF 75-02 X F S CLR 300 X	<ul style="list-style-type: none"> • Rated Size 75 cm³/rev • Without Purge Valve • SAE Flange Mounting • Side Ports • With Crossline Relief Valve set to 300 bar • Without Speed Sensor

7.2 HMV-02 Variable Displacement Motor

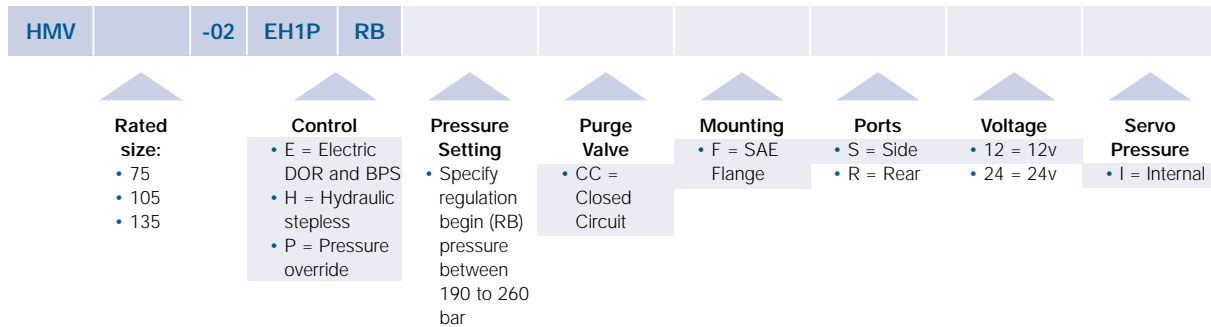


Note - Not all configurations are available, check suitability and availability before ordering. Standard configuration supplied unless otherwise specified.

Examples

HMV 75-02 H2 CC F S E X	<ul style="list-style-type: none"> • Rated Size 75 cm³/rev • Hydraulic 2 Step Control • Standard Configuration
HMV 105-02 E1 (12V) CC PI S E SS	<ul style="list-style-type: none"> • Rated Size 105 cm³/rev • Electric Stepless Control (12v) • Plug In Mounting • Side Ports • Servo Pressure External Supply • With Speed Sensor

7.3 HMV-02 Variable Motor with Pressure Override

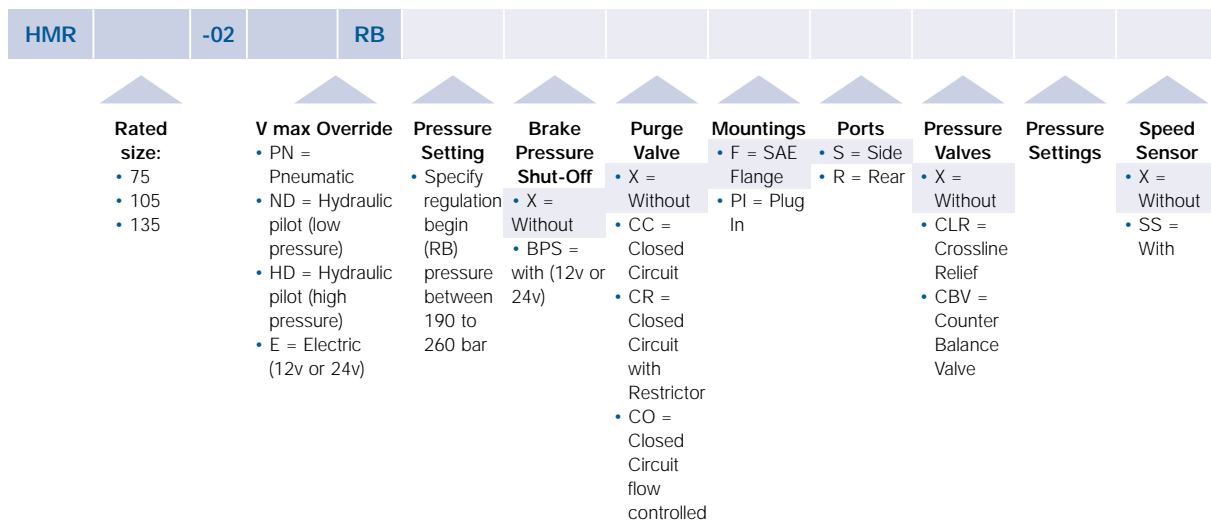


Note - Not all configurations are available, check suitability and availability before ordering. Standard configuration supplied unless otherwise specified.

Examples

HMV 75-02 EH1P RB 200 CC F S 12 I	<ul style="list-style-type: none"> • Rated Size 75 cm³/rev • Standard configuration
HMV 135-02 EH1P RB 190 CC F R 24 I	<ul style="list-style-type: none"> • Rated Size 135 cm³/rev • Regulation begin 190 bar • Rear Ports • DOR and BPS 24v

7.4 HMR-02 Pressure Regulated Motor



Note - Not all configurations are available, check suitability and availability before ordering. Standard configuration supplied unless otherwise specified.

Examples

HMR 105-02 PN RB 260 X X F S H X -X	<ul style="list-style-type: none"> • Rated Size 105 cm³/rev • Standard configuration
HMR 75-02 E (12v) RB 210 BPS (12v) CC F R X X -X	<ul style="list-style-type: none"> • Rated Size 75 cm³/rev • With Brake Pressure Shut-Off (12v) • With Purge Valve • Closed Circuit • With Rear Ports

8. GENERAL DIMENSIONS

8.1 HMF-02 Fixed Displacement Motors (SAE Flange Version)

Side Ports	Rear Ports	Rated Sizes	28	35	50	75	105	135	165	210
			2-Bolt mount							
		Flange profile	SAE B		SAE C			SAE D		
			ANSI B92.1; 16/32 spline pitch							
		Shaft profile								
		Number of teeth	15		21			23		27
		D1 [mm]	101,6		127			156,4		182,8
		B1 [mm]	146		181			228,6		276,2
		B2 [mm]	162		200			250		300
		B3 [mm]	146		166					
		B4 [mm]	149		169					
		H1 [mm]	61		70		82		86	
		H2 [mm]	61		70		83		86	
		H3 [mm]	67		72		78		83	
		H3 [mm]	w/o crossover relief valves		72		78		83	
			w/ crossover relief valves		108		119		128	
			w/ dust pressure crossover relief val.		129		140		149	
		H4 [mm]	69		79		83		88	
		H5 [mm]	64		69		75		80	
		L1 [mm]	41		56			75		
		L2 [mm]	193		202		229		254	
		L3 [mm]	191		200		227		252	
		L, U	M22x1,5							
		E *1)	M18x1,5				M22x1,5			

*1) Connection for anti-cavitation oil supply

Under development

8.2 HMV-02 Variable Displacement Motors (SAE Flange Version)

Side Ports	Rear Ports	Rated Sizes	35	55	75	105	135	165	210	
			2-Bolt mount							
		Flange profile	SAE C		SAE D					
			ANSI B92.1; 16/32 spline pitch							
		Shaft profile								
		Number of teeth	21		23			27		
		D1 [mm]	127		156,4			182,8		209,4
		B1 [mm]	181		228,6			276,2		323,8
		B2 [mm]	208		258			308		358
		B3 [mm]	86		95		96		108	
		B4 [mm]	85		95		96		108	
		B5 [mm]	86		95		96		108	
		B6 [mm]	85		95		96		108	
		B7 [mm]	-		180		181		193	
		B8 [mm]	-		180		181		193	
		H1 [mm]	80		86		91		96	
		H2 [mm]	83		93		99		103	
		H3 [mm]	84		93		95		108	
		H4 [mm]	90		105		106		114	
		H5 [mm]	84		93		96		107	
		H6 [mm]	90		105		105		114	
		H7 [mm]	-		88					
		H8 [mm]	-		92					
		L1 [mm]	41		56		75			
		L2 [mm]	212		226		247		270	
		L3 [mm]	hydraulic control		23					
			electric control		75					
		L4 [mm]	217		231		252		275	
		L5 [mm]	hydraulic control		18					
			electric control		70					
		L6 [mm]	-		33					
		L7 [mm]	-		28					
		L8 [mm]	-		80					
		L, U	M22x1,5				M26x1,5			
		E *1)	M14x1,5							
		X *2)	M14x1,5							
		M, M1 *3)	Specification: s. S. 5							
		M2 *4)	Specification: s. S. 5							

*1) Connection for external servo supply pressure feed

*2) Connection for hydraulic control

*3) Solenoid for electric control

*4) Solenoid for brake pressure shut off

All metric threaded connections per DIN 3852
Threaded connections per ISO 6149 on request.

Please consult factory for dimensions
of the versions with speed sensors.

8.3. HMR-02 Pressure Regulating Motors (SAE Flange Version)

Side Ports		Rear Ports	Rated Sizes	35	55	75	105	135	165	210		
		Rear Ports		35		55		75		105		
		Rear Ports		135		165		210				
			Flange profile	SAE		2-Bolt mount		SAE C		SAE D		
			Shaft profile			ANSI B92.1;		16/32 spline pitch				
			Number of teeth			21		23		27		
			D1 [mm]			127		156,4				
			B1 [mm]			181		228,6				
			B2 [mm]			208		258				
			B3 [mm]	without/with secondary relief valve		95		99		108		
			B4 [mm]	without/with secondary relief valve		135		136		140		
			B5 [mm]	without/with secondary relief valve		95		99		108		
			B6 [mm]			135		139		141		
			B7 [mm]	pneumatic		102		105		114		
			B7 [mm]	hydraulic		74						
			B8 [mm]			62						
			B9 [mm]			78						
			B9 [mm]			103						
			B10 [mm]			89						
			B11 [mm]			130						
			H1 [mm]			86		91		96		
			H2 [mm]			93		99		100		
			H3 [mm]			93		98		108		
			H4 [mm]			102		102		110		
			H5 [mm]			56						
			H6 [mm]			91		96		107		
			H7 [mm]			102		102		109		
			H8 [mm]			81						
			H9 [mm]			85						
			L1 [mm]			56		75				
			L2 [mm]			229		247		270		
			L3 [mm]			231		252		275		
			L4 [mm]			53						
			L5 [mm] *4)			80						
			L6 [mm]			127						
			L, U			M22x1,5						
			X1 *1)			M14x1,5						
			M1 *2)			Specification: see pg. 5						
			M2 *3)			Specification: see pg. 5						
			with Counter Balance Valve									

*1) Connection for hydraulic or pneumatic maximum displacement override
 *2) Solenoid for electric maximum displacement override

*3) Solenoid for brake pressure shut off
 *4) Regulator with electric maximum displacement override and brake pressure shut off

8.4. Plug-in Motors

Variable displacement motor *1)	Rated sizes	35	55	75	105	135	165	210
	D1 [mm]	Under development		190	216		Under development	
	D2 [mm]			251	282			
	F1 [mm]			- *2)	55,8			
	F2 [mm]			0 *2)	223,4			
	F3 [mm]			- *2)	129			
	F4 [mm]			224 *2)	251,8			
	L1 [mm]			143	169			
	L2 [mm]			124	132		175	

*1) Some of the dimensions in Sections 8.1 through 8.3 may be applicable

*2) Size 75 has a 2-bolt SAE flange.

8.5. High-Pressure Connections

	Rated sizes	28	35	55	75	105	135	165	210
	F1 [mm]	50,8		57,2				Under Development	
	F2 [mm]	74		84					
	F3 [mm]	23,8		27,8					
	A, B	3/4"		1"					
	S *1)	M10		M12					

*1) 8 threaded holes, 17mm deep

All metric threaded connections per DIN 3852.
 Threaded connections per ISO 6149 on request.

Please consult factory for dimensions of the versions with speed sensors.

9. SPECIAL MOTORS

Along with the motor versions shown in Sections 2 through 4, Linde also offers custom solutions for special requirements. If you don't see a solution that

fits your requirements, please check with our application specialists.

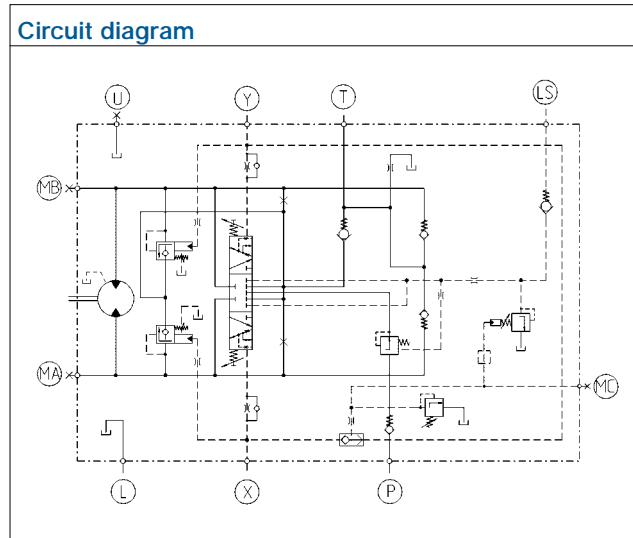
9.1 Fixed Displacement Motor with Integrated Controls

This motor offers an integrated

- Directional control valve
- Torque control
- Priority function
- Crossover relief valve protection with anti-cavitation function

- Case flushing function
- Dual pressure relief valves ideal for use in turning and boring mill drives and swing drives in an open loop circuit.

Note: Must be used with a load sensing (LS) pump.



P, T Work port connections
L, U Case drain/vent connections

LS LS pressure connection
MA, MB, MC Gauge ports

9.2 Double Motor

With:

- Two rotating groups coupled together
- A large range of displacement

- This motor offers an ideal solution for applications that need to have high starting torque but also require high speed



Double motor in isometric view



Double motor in side view

10. PRESSURE FLUIDS AND FILTRATION

Permissible Pressure Fluids

- HLP mineral oil per DIN 51524
- Biodegradable oils on request
- Other pressure media on request

Technical Data

Pressure fluid temperature range	[°C]	-20 to +90
Operating viscosity range	[mm ² /s] = [cSt]	10 to 80
Optimum operating viscosity range	[mm ² /s] = [cSt]	15 to 30
Maximum viscosity (temporary, during startup)	[mm ² /s] = [cSt]	1000

Viscosity Recommendations

Operating temperature [°C]	Viscosity class [mm ² /s] = [cSt] at 40°
Approx. 30 to 40	22
Approx. 60 to 80	46 or 68

Linde recommends using only pressure fluids which are confirmed by the producer as suitable for use in high pressure hydraulic installations. For the correct choice of suitable pressure fluid it is necessary to know the working temperature in the hydraulic circuit (closed loop). The pressure fluid chosen must allow the working viscosity to be within the optimum viscosity range (refer to above table).

Attention:

Due to pressure and speed influences, the leakage fluid temperature is always higher than the circuit temperature. The temperature must not exceed 90°C in any part of the system. Under special circumstances, if the stated conditions cannot be observed, then please consult Linde.

Filtration

In order to guarantee functions and efficiency of the hydraulic motors the purity of the pressure fluid over the entire operating period, must comply to at least class 18/13 according to ISO 4406.

With modern filtration technology, however, much better values can be achieved which contributes significantly to extending the life and durability of the hydraulic motors and complete system.

11. AREAS OF APPLICATION





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