HMF/V/R-02

High-Pressure Motors for Open and Closed Loop Circuits

Becoming a World Market Leader with Linde Hydraulics

Linde – **the pioneer in mobile hydraulics** – discovered and perfected hydrostatics as the ideal drive for mobile working machines. Since 1959, Linde has equipped two million vehicles in the fields of

- Construction machinery
- Agricultural and forestry machinery
- Municipal vehicles
- Fork lift trucks

with hydrostatic transmissions and working drives. The use of hydrostatic transmissions in its own fork lift trucks has made Linde the **world market leader!**

HMF/V/R-02

CONTENTS **Page**

1. Features and technical data **2**

2. HMF-02 fixed displacement motors **4**

3. HMV-02 variable displacement motors

3.1 Two-position control (flip/flop) **5**

3.2 Infinitely variable control **6**

3.3 Infinitely variable control with pressure override **7**

4. HMR-02 pressure regulating motors **8**

5. Design Configurations

5.1 High-pressure porting **9**

5.2 Mountings **9**

6. Control Options

6.1 Displacement control **10**

6.2 Displacement override **10**

6.3 Servo supply pressure feed **11**

6.4 Purge and case flushing **11**

6.5 Crossover relief protection **12**

6.6 Brake pressure shut off **12**

6.7 Counterbalance valve **13**

6.8 Speed sensor **13**

7. Model codes **14**

8. General dimensions **17**

9. Special motors **19**

10. Pressure fluids and filtration **20**

11. Areas of application **21**

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 swedge connection
- Optimized power flow as a result of swash plate design
- User friendly to fit a wide variety of applications as a result of
  - Modular design for easy conversion

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 *8)	75	105	135	165	210
Displacement	Maximum [cm³/rev]	28.6	35.6	54.8	75.9	105.0	135.6	Under Development	
	Minimum *1) [cm³/rev]	–*7)	–*7)	18.3	25.3	35.0	45.2		
Speed	Max. operating speed (at 100% duty cycle) at maximum displacement [rpm]	4500	4500	4100	3800	3500	3200		
	Highest speed (intermittent) at maximum displacement [rpm]	4800	4800	4400	4100	3800	3500		
	Max. operating speed (at 100% duty cycle) at minimum displacement [rpm]	–*7)	–*7)	4700	4400	4100	3700		
	Highest speed (intermittent) at minimum displacement [rpm]	–*7)	–*7)	5300	5000	4700	4000		
Pressure	Continuous pressure (delta p) [bar]	250							
	Max. operating pressure [bar]	420							
	Highest pressure (intermittent) [bar]	500							
	Permissible case pressure (absolute) [bar]	2.5							
Torque	Continuous output torque *2) [Nm]	114	142	218	302	418	540		
	Max. output torque *3) [Nm]	191	238	366	508	702	907		
Power	Continuous power *4) [kW]	54	67	94	120	153	181		
	Max. power *5) [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 *6) [kg]	16	16	19	26	33	39		
	Variable displacement and pressure regulating motor *6) [kg]	–*7)	–*7)	28	32	42	56		
	Moment of inertia [kgm²x10⁻²]	0.25	0.25	0.49	0.79	1.44	2.15		
Main Dimensions		see Section 8							

* 1) For variable displacement and pressure regulating motors only
* 2) At continuous pressure
* 3) At maximum operating pressure
* 4) At maximum operating speed, maximum displacement and continuous pressure
* 5) At maximum operating speed, maximum displacement and maximum operating pressure
* 6) Applies to standard SAE mount versions (see Section 5.2)
* 7) Version is under development
* 8) Fixed displacement motor is 51.3 cm³/rev; as a result there will be corresponding different values for torques and power

2. HMF-02 FIXED DISPLACEMENT MOTORS

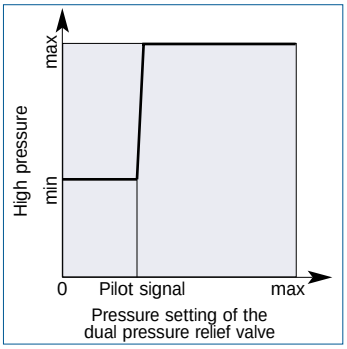
Fixed displacement motors of the HMF-02 type are suitable for both open and closed loop circuit

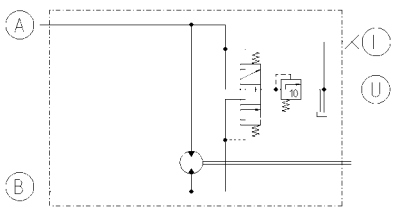
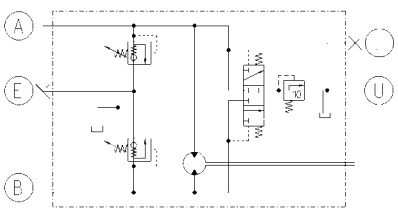
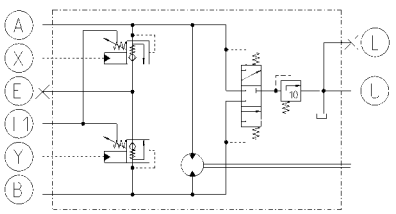
Fixed displacement motor (standard version)

Details: (top picture) Fully adjustable pilot operating crossover relief valves. (lower picture) Dual pressure pilot operated crossover 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 crossover 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.



Motor with purge valves	Motor with crossover relief valves with fixed settings	Motor with dual pressure crossover relief valves
		

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

E Anti-cav connection
X, Y Control connections for dual pressure crossover relief valve

3. HMV-02 TWO-POSITION 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 are at maximum flow displacement (Vmax) with no control signal and make a smooth transition to minimum displacement when a control signal is applied.

The control can either be:

- **hydraulic** shifted with pilot pressure
- **electric** shifted 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

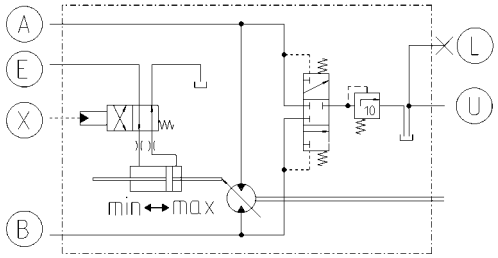
Rating				**The values listed below are applicable for all nominal sizes**	
Adjustable Pressure Supply *1)	externallly supplied at port (E)	minimum	[bar]	20	
		maximum permissible	[bar]	40	
Hydraulic Control Signal *2)	Pressure at port (X) to shift	minimum	[bar]	20	
		maximum permissible	[bar]	40	
Electric *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	

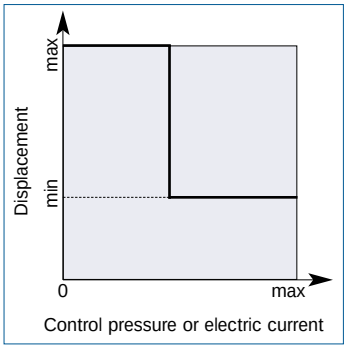
*1) connection E in the circuit diagram shown below
*2) connection X in the circuit diagram shown below
*3) other connector versions on request
*4) other response times are possible by using special nozzles

Circuit Diagram and Adjustment Characteristics

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

Two-position motor with hydraulic control pressure and external servo supply pressure





3.2 HMV-02 Infinitely Variable Control

Infinitely variable motor with hydraulic displacement control

Motors with infinitely variable displacement control are suitable for both open and closed loop circuits. They are at maximum displacement (Vmax) 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

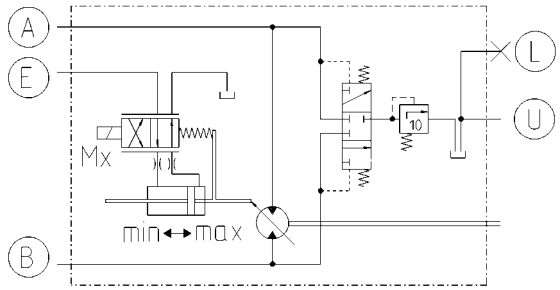
Rating				**The values listed below are applicable for all rated sizes**	
Ext. servo supply pressure *1)	minimal		[bar]	20	
	maximum permissible		[bar]	40	
Hydraulic control signals	Control range		[bar]	8 to 14	
	maximum permissible pressure		[bar]	40	
Electric control signals *2)	Connector type *3)			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	

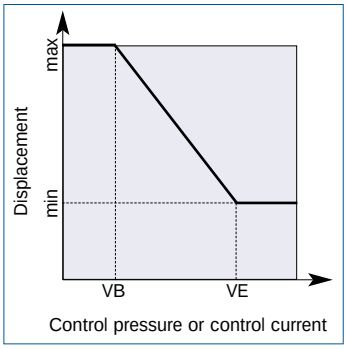
*1) connection E in the circuit diagram shown below
*2) connection Mx in the circuit diagram shown below
*3) other connector versions on request
*4) other response times are possible by using special orifices

Circuit Diagram and Adjustment Characteristics

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

Infinitely variable motor with electric displacement control and external servo supply pressure





VB Swash begin **VE** Swash end

3.3 HMV-02 Infinitely Variable Control with Pressure Override

Variable motor with pressure override

This motor is used primarily in closed loop circuits.

It is at maximum displacement (Vmax) 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.

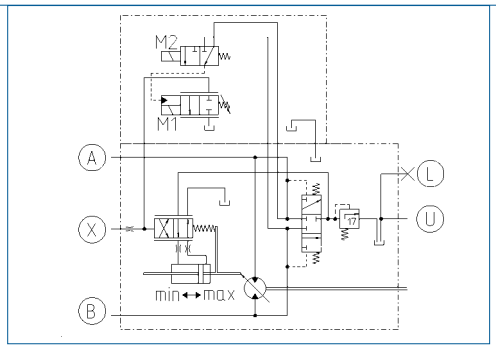
Technical Data

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

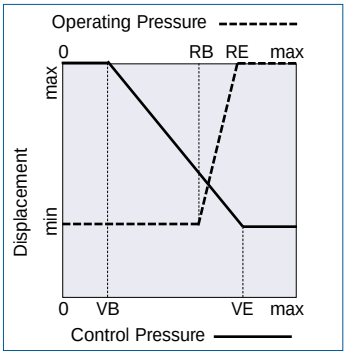
*1) connection X in the circuit diagram shown below
*2) adjustable, please indicate when ordering (see Section 7.3)
*3) other response times are possible by using special orifices
*4) other control options are available to control DOR and BPS. (see Section 6.2, page 10)

Circuit Diagram and Adjustment/Control Characteristics

Infinitely 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 Regulating Motors

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

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

Linde pressure regulating motors are suitable for both open and closed loop circuits. They are high-pressure controlled, and are at minimum displacement (Vmin) 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 regulating 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 *2)			

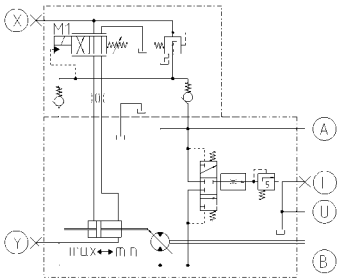
*1) adjustable, please indicate when ordering (see Section 7.4)

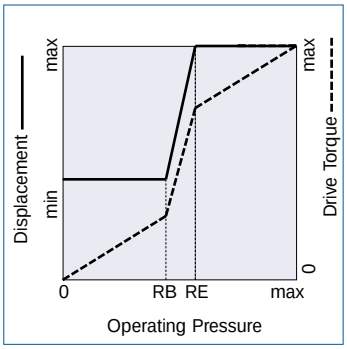
*2) other options are available for brake pressure shut off. (see Section 6.2)

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

Pressure regulating motor with electric maximum displacement override





RB Regulation Begin **RE** Regulation End

5. DESIGN CONFIGURATIONS

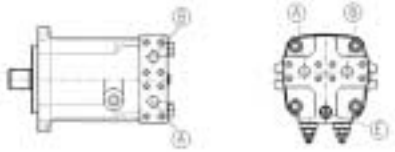
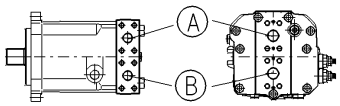
Depending on the installation situation and accessibility, optional rear or side high-pressure ports are available. SAE flange mounts or plug in style are also available. The following tables show the suitability and availability.

5.1 Arrangement of the High-Pressure Ports

Suitability and availability for motor types	Picture / Circuit loop	Fixed displ. motor		Variable displ. motor		Var displ. motor + override control	Pressure regulating motor	
		open	closed	open	closed	closed	open	closed
Side	 Figure 9	✓	✓	✓	✓	✓	✓	✓
Rear *1)	 Figure 10	✓	✓	✓	✓	✓	✓	✓

*1) selected sizes available

Input Flow vs. Shaft Output Rotation

Identification of Ports	Motor Type	Shaft Output Direction of Rotation: 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	Picture / Circuit loop	Fixed displ. motor		Variable displ. motor		Var displ. motor + override control	Pressure regulating motor	
		open	closed	open	closed	closed	open	closed
SAE flange *1)	 Picture 19	✓	✓	✓	✓	✓	✓	✓
Plug-in *1) *2)	 presently reversed left to right Picture 20			✓	✓	✓	✓	✓

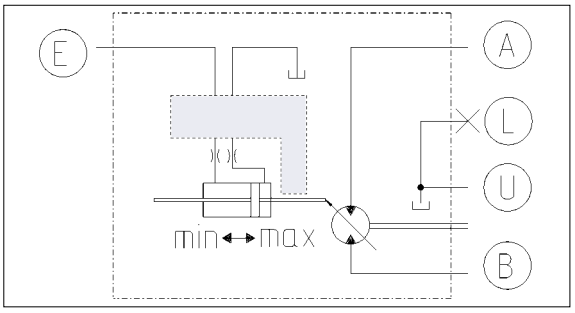
*1) see Section 8.5 for dimensions

*2) selected sizes available (see Section 8.5)

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.

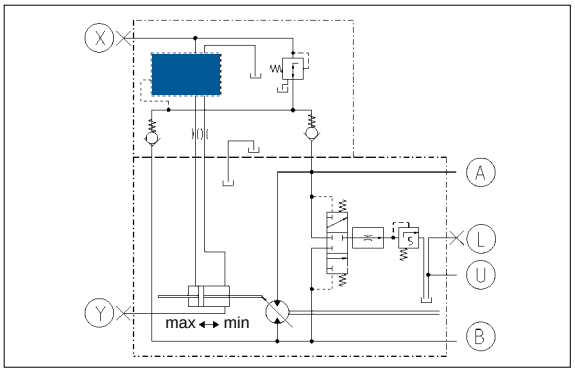
6.1 Displacement Control



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 regulating motor
Circuit diagram / Circuit loop		open	closed	closed	
Hydraulic two position		✓	✓	-	
Electric two position		✓	✓	-	
Hydraulic proportional		✓	✓	✓	
Electrical proportional 12 v or 24 V		✓	✓	-	

6.2 Displacement Override (DOR)

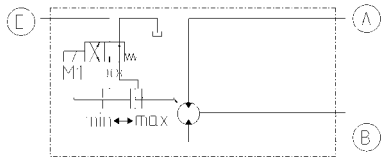
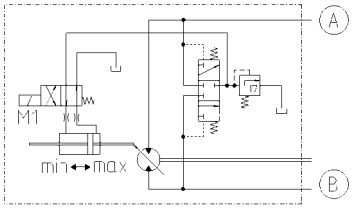
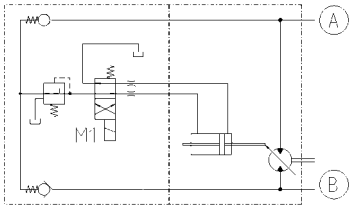


Linde pressure regulating motors are system-pressure controlled, consequently, the swash plate control pressure is supplied internally via the high-pressure circuit. Pressure regulating motors have a Vmax maximum displacement override circuit (see Section 4 for a functional description). Available maximum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

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

6.3 Servo Supply Pressure Feed

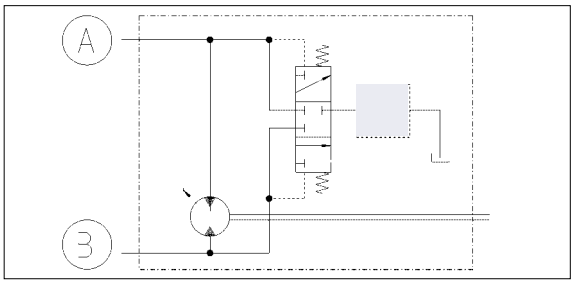
Servo supply pressure delivers the force needed to change the position of the swash plate in variable displacement and pressure regulating motors.

Suitability and availability for motor types	Circuit diagram / Circuit loop	Fixed displ. motor	Variable displ. motor		Var. displ. motor + override control	Pressure regulating motor	
			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

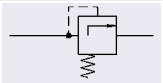
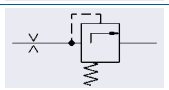
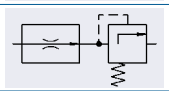
*2) special two-position motor

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 regulating motor	
Purge valve types	Flow [l/min]	Schematic symbol / Circuit loop	open	closed	open	closed	closed	open	closed
None	0	-	✓ *6)	- *4)	✓ *6)	- *4)	-	✓ *6)	- *4)
Standard Relief	10 *1)		-	✓ *5)	-	✓ *5)	✓ *2)	-	✓ *5)
Orificed relief	5 *1)		-	✓	-	✓	-	-	✓
Flow controlled	4 *3)		✓	- *4)	✓	- *4)	-	✓	- *4)

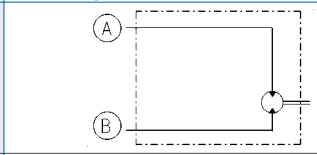
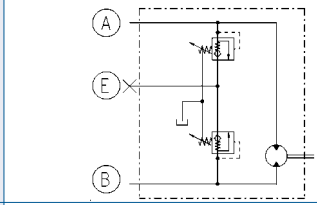
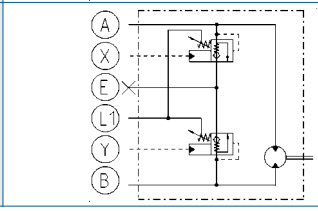
*1) at 16 bar feed pressure and 10 bar purge relief valve
*2) at 20 bar feed pressure and 14 bar purge relief valve
*3) at 5 bar pressure control valve; independent of low pressure
*4) suitability under certain conditions on request

*5) standard version for motors in closed loop circuit
*6) these motors are normally equipped with cross over relief valves instead of purge valves

6.5 Cross Over Relief Protection

HMF/HMV/HMR-02 motors are available with integrated cross over 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 regulating motor	
Circuit diagram / Circuit loop		open	closed	open	closed	closed	open	closed
Without crossover relief valve		✓	✓	✓	✓	✓	✓	✓
With crossover relief valve protection *1)		✓ *1)	✓ *1)	-	-	-	✓	✓
With dual pressure relief valve protection *2)		✓ *1)	-	-	-	-	-	-

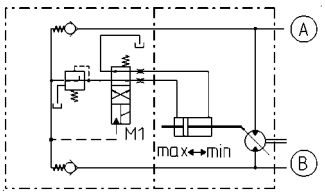
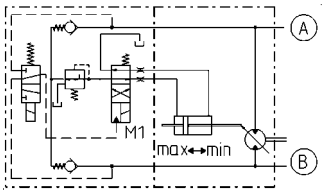
*1) availability on request

*2) connection X and Y in the circuit diagram

6.6 Brake Pressure Shut Off (BPS)

Pressure regulating 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 regulating motor	
Circuit diagram / Circuit loop		open	closed	open	closed	closed	open	closed
Without brake pressure shut off		✓	✓	✓	✓	-	✓	-
With brake pressure shut off		-	-	-	-	✓	-	✓

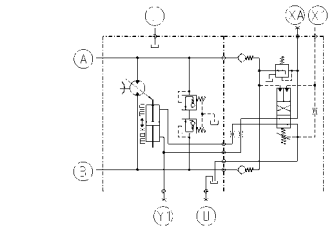
6.7 Counter Balance

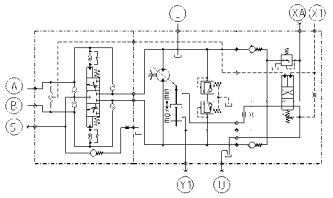
The counter balance valve prevents over speeding the motor during an over running condition. To achieve this, the motor's exhaust oil is automatically metered to restrict its escape. With integrated anti-cavitation circuitry, cavitation can be prevented.

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 regulating motor	
Circuit diagram / Circuit loop		open	closed	open	closed	closed	open	closed
Without counter-balance	 Figure 26	✓	✓	✓	✓	✓	✓	✓
With counter-balance valve *1)	 Figure 27	✓	-	-	-	-	✓	-





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

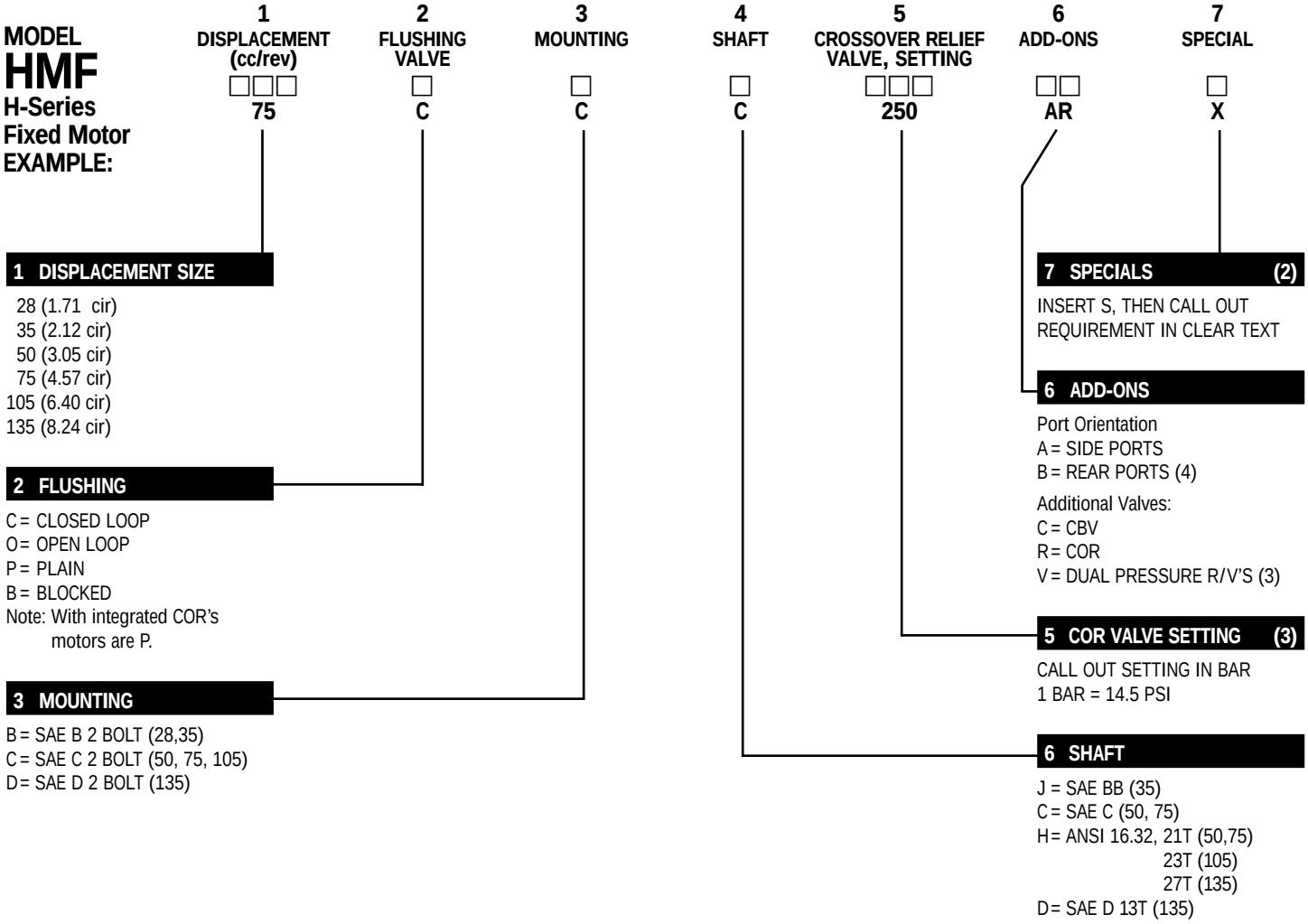
6.8 Speed Sensor

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 regulating motor	
Photo / Circuit loop		open	closed	open	closed	closed	open	closed
Without speed sensor	 Figure 7	✓	✓	✓	✓	✓	✓	✓
With speed sensor *1)	 Figure 8	✓	✓	✓	✓	-	✓	✓

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

Model Codes for H-Series-02 Fixed Displacment Motors



NOTES: (1) If codes **are not** used, insert the letter "X"
(2) If a unit is a **special execution**, insert "S" at the end of the code description
(3) Specify lower setting in bar in position 5, then call out in clear text higher setting.
(4) Side ports are standard. End ports are not normally available. Consult factory.

Model Codes for H-Series-02 Regulated Motors

	1	2	3	4	5	6	7	8	9	10	11
MODEL	DISPLACEMENT (cc/rev)	FLUSHING VALVE	CONTROL	CONTROL OPTIONS	MOUNTING	SHAFT	RB	DISP. MAXIMUM	DISP. MINIMUM	ADD-ONS	SPECIALS
HMR	□□□	□	□	□	□□□	□□	□□□	□□□	□□	□□□	□
EXAMPLE:	135	P	R	B	D	H	260	X	41	BRN	S

1 DISPLACEMENT (CC/REV)

75 (4.63 cir)
105 (6.41 cir)
135 (8.27 cir)

2 FLUSHING

C = CLOSED LOOP
O = OPEN LOOP
P = PLAIN
B = BLOCKED
Note: With integral COR's motors are P.

3 CONTROL

R = SYSTEM PRESSURE REGULATED (STD)
2 = REGULATOR SET UP FOR TWO POSITION CONTROL (default is max; shift to min.)
Z = REGULATOR SET UP FOR TWO POSITION CONTROL (default is min; shift to max.)

4 CONTROL OPTIONS

B = BI-DIRECTIONAL REGULATOR SHUTTLE (STD)
U = UNI-DIRECTIONAL (3)
N = NONE (Ext. fed to regulator)

5 MOUNTING

C = SAE C 2 BOLT MTG (75, 105)
D = SAE D 2 BOLT MTG (135)
S = SPECIAL PLUG IN MOUNT (105, 135)

6 SHAFT

H = ANSI 21T 16/32 P (75)
23T 16/32 P (105)
27T 16/32 P (135)
C = SAE C 14T 12/24 P (OPT 75, 105)
D = SAE E 13T 8/16 P (OPT 75, 105)

7 REGULATION BEGIN

SPECIFY SETTING IN BAR
1 BAR = 14.5 PSI

8 MAX. DISPLACEMENT

IF NOT DESTROKED, ENTER X. OTHERWISE, SPECITY SETTING IN CC/REV.

9 MIN. DISPLACEMENT)

SPECIFY SETTING IN CC/REV
22 = MIN. DISPL. FOR 75
31 = MIN. DISPL. FOR 105
41 = MIN. DISPL. FOR 135

10 ADD-ONS

Port Orientation
A = SIDE PORTS
B = REAR PORTS (4)

Additional Valves:
A = BRAKE CBV ON "A" PORT
B = BRAKE CBV ON "B" PORT
C = CLOSED CENTER CBV (1)
O = ORIFICED CENTER CBV (1)
R = COR (NO CBV) (1)
X = NONE

Dor Options:
D = PILOT PRESS DOR
H = SYSTEM PRESS DOR
E = ELECT DOR w/BPS (2)
F = ELECT DOR w/o BPS (2)
N = PNEUM. DOR
X = NONE

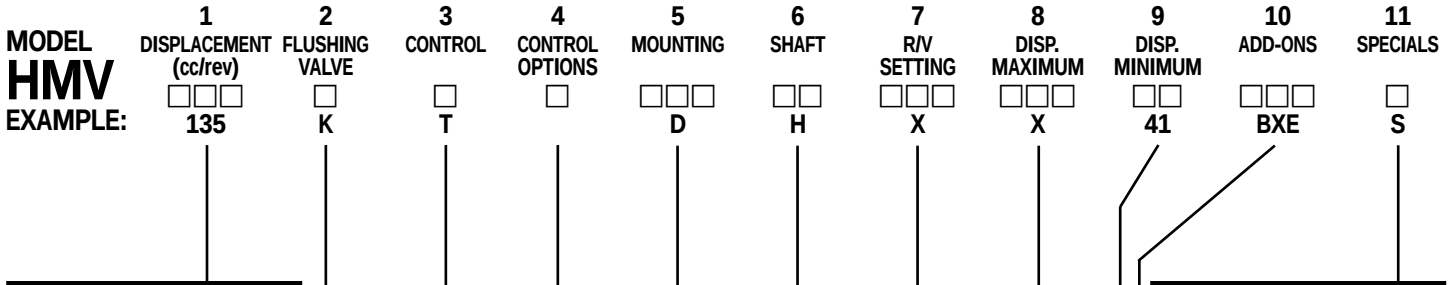
NOTE: Check with factory for availability of add-on options for desired unit size.

11 SPECIALS (2)

INSERT S, THEN CALL OUT REQUIREMENT IN CLEAR TEXT

NOTES: (1) If motor has COR _____, enter "S" in column 1 and specify relief valve setting in bar.
(2) Enter "S" in column 11 and specify either 12 or 24 VDC solenoids.
Reference: BPS = Brake Pressure Shut-off.
(3) Enter "S" in column 11 and specify which pressure port should feed regulator.
(A or B, see installation drawings).

Model Codes for H-Series-02 Variable Motors



1 DISPLACEMENT (CC/REV)

55 (3.36 cir)
75 (4.63 cir)
105 (6.41 cir)
135 (8.27 cir)

2 FLUSHING

C = CLOSED LOOP
K = 14 BAR CLOSED LOOP (1)
O = OPEN LOOP
B = BLOCKED
P = PLAIN
Note: With integral COR's motors are P.

3 CONTROL

T = HYD. INFINITELY VARIABLE
E = ELECT INFINITELY VARIABLE
2 = TWO POSITION
1 = SINGLE LINE TWO POSITION (4)
F = ELECT TWO POSITION
L = SINGLE LINE ELECT TWO POSITION (4)

4 CONTROL OPTIONS

1 = 12 VDC
2 = 24 VDC
Option is only applicable if control is "E", "F" or "L"

D = pilot to shift
H = System press to shift
Option is only applicable if control is "1".

5 MOUNTING

C = SAE C 2 BOLT MTG (55, 75, 105)
D = SAE D 2 BOLT MTG (135)
S = SPECIAL PLUG IN MOUNT (105, 135)

6 SHAFT

H = ANSI 21T 16/32 P (75)
23T 16/32 P (105)
27T 16/32 P (135)
C = SAE C 14T 12/24 P (55) (OPT 75, 105)
D = SAE E 13T 8/16 P (OPT 75, 105)

7 RELIEF SETTING

IF NO COR, ENTER "X" OTHERWISE, SPECIFY SETTING IN BAR. (1 BAR = 14.5 PSI)

8 MAX. DISPLACEMENT

IF NOT DESTROKED, ENTER X. OTHERWISE, SPECITY SETTING IN CC/REV.

9 MIN. DISPLACEMENT

SPECIFY SETTING IN CC/REV
18 = MIN. DISPL. FOR 55
22 = MIN. DISPL. FOR 75
31 = MIN. DISPL. FOR 105
41 = MIN. DISPL. FOR 135

10 ADD-ONS

Port Orientation
A = SIDE PORTS
B = REAR PORTS (4)

Additional Valves:
C = CLOSED CENTER CBV (2)
O = ORIFICED CENTER CBV (2)
R = COR (NO CBV) (2)
X = NONE

Additional Control Options:
Y = F PORT ACTIVE
X = NONE
P = POR w/o DOR (3)
D = POR w/ PILOT PRESS DOR (3)
H = POR w/ SYSTEM PRESS DOR (3)
E = POR w/ ELECT DOR w/BPS (3)
F = POR w/ ELECT DOR w/o BPS (3)
N = POR w/ PNEUM. DOR (3)

NOTE: Check with factory for availability of add-on options for desired unit size.

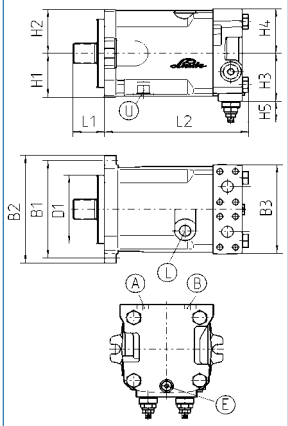
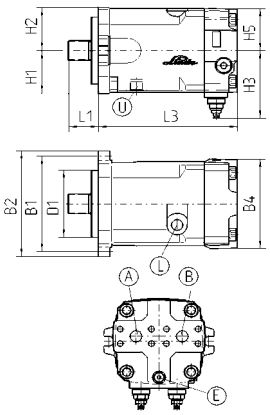
11 SPECIALS (2)

INSERT S, THEN CALL OUT REQUIREMENT IN CLEAR TEXT

NOTES:
(1) Standard for HMV 55, 75, 105 and 135 with "T" control with factory POR option.
(2) If motor has COR, specify setting in bar in column 7.
(3) These are factory POR options and only available on HMV 75, 105 and 135 with "T" control. Enter "S" in column 11 and specify POR setting in bar. For POR options "E" or "F", include specification or 12 or 24 VDC solenoids. Reference: BPS = Brake Pressure Shut-off.
(4) Single line two position motors are special executions. Options are limited based on standard configuration available from production. Please consult factory.

8. GENERAL DIMENSIONS

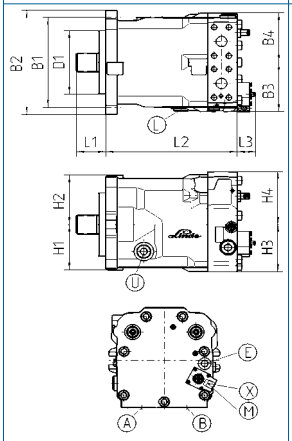
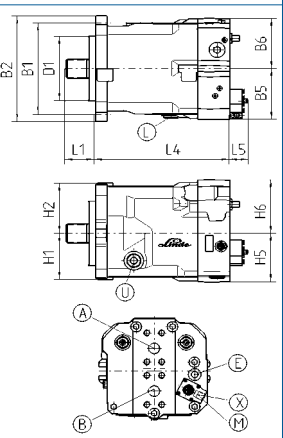
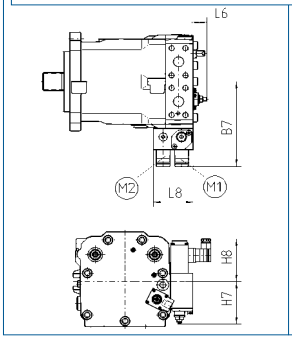
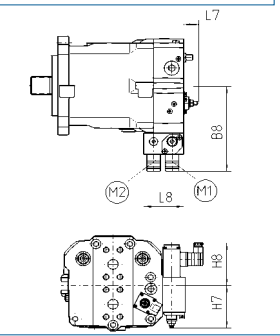
8.1 HMF-02 Fixed Displacement Motors (SAE Flange Version)

Side Ports	Rear Ports
	

Rated Sizes		28	35	50	75	105	135	165	210
Flange profile		2-Bolt mount						Under development	
SAE		SAE B		SAE C			SAE D		
Shaft profile		ANSI B92.1; 16/32 spline pitch							
Number of teeth		15		21		23	27		
D1 [mm]		101,6		127			156,4		
B1 [mm]		146		181			228,6		
B2 [mm]		162		200			250		
B3 [mm]		146			166				
B4 [mm]		149			169				
H1 [mm]		61		70	73	82	86		
H2 [mm]		61		70	73	82	86		
H3 [mm]	w/o crossover relief valves	67		72	78	83	89		
	w/ crossover relief valves	108		116	119	128	137		
	w/ dual pressure crossover relief val.	129		137	140	149	158		
H4 [mm]		69			79	83	88		
H5 [mm]		64		69	75	80	86		
L1 [mm]		41			56		75		
L2 [mm]		193		202	229	254	277		
L3 [mm]		191		200	227	252	275		
L, U		M22x1,5							
E *1)		M18x1,5				M22x1,5			

*1) Connection for anti-cavitation oil supply

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

Side Ports	Rear Ports
	
With electric override control	
	

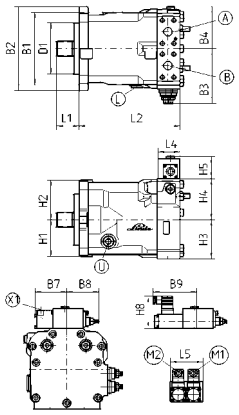
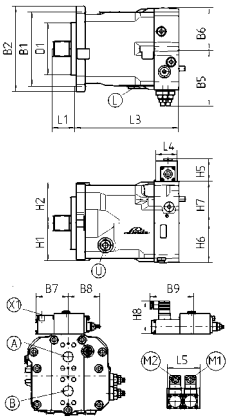
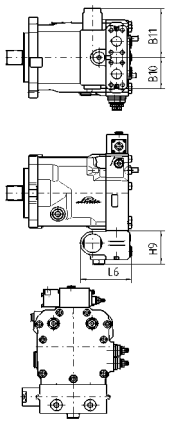
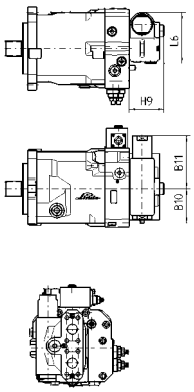
Rated Sizes		35	55	75	105	135	165	210
Flange profile		Under development	2-Bolt mount				Under development	
SAE			SAE C			SAE D		
Shaft profile			ANSI B92.1; 16/32 spline pitch					
Number of teeth			21		23	27		
D1 [mm]			127			156,4		
B1 [mm]			181			228,6		
B2 [mm]			208			258		
B3 [mm]			86	95	96	108		
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.

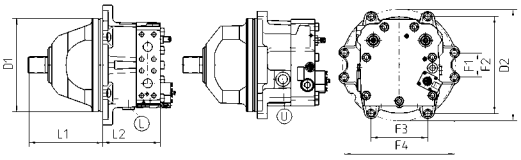
Please consult factory for dimensions
of the versions with speed sensors.

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

Side Ports	Rear Ports	Rated Sizes		35	55	75	105	135	165	210
		Flange profile		Under development		2-Bolt mount				Under development
			SAE			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		
						135	136	140		
		B4 [mm]	without/with secondary relief valve			95	105	108		
						102	105	114		
		B5 [mm]	without/with secondary relief valve			95	99	108		
						135	139	141		
		B6 [mm]				102	105	114		
		B7 [mm]	pneumatic			74				
			hydraulic			62				
		B8 [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										
										

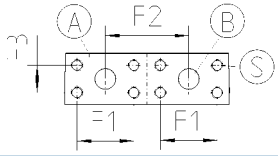
*1) Connection for hydraulic or pneumatic maximum displacement override
*2) Solenoid magnet for electric maximum displacement override
*3) Solenoid magnet for brake pressure shut off
*4) Regulator with electric maximum displacement override and brake pressure shut off

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) 17 mm deep, 8 places

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.

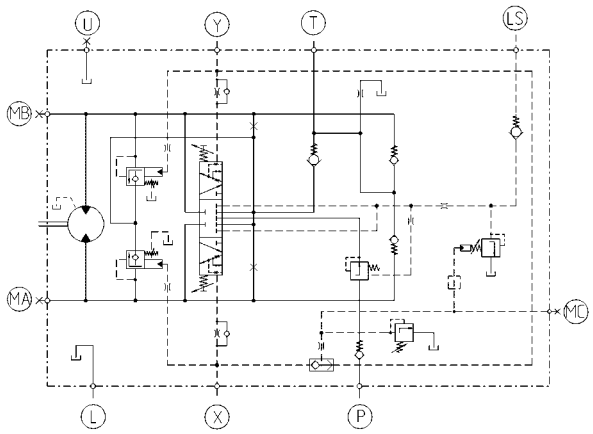
9.1 Fixed Displacement Motor with Integrated Controls

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.

Circuit diagram



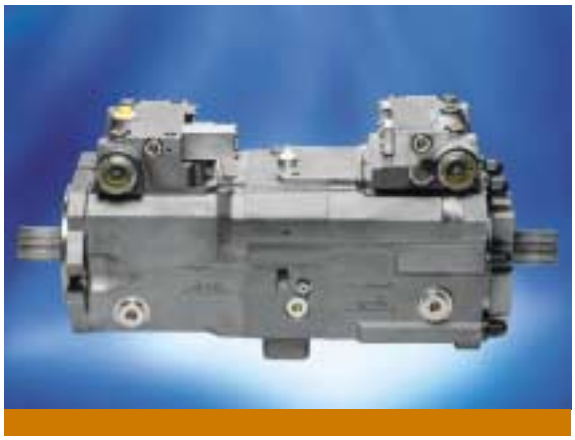
P, T Work port connections
L, U Case drain/vent connections
LS LS pressure connection
MA, MB, MC Gauge ports

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	[mm²/s] = [cSt]	10 to 80
Optimum operating viscosity range	[mm²/s] = [cSt]	15 to 30
Maximum viscosity (temporary, during startup)	[mm²/s] = [cSt]	1000

Viscosity Recommendations

Operating temperature [°C]	**Viscosity class [mm²/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

Linde Hydraulics Corporation
P.O. Box 82 • 5089 Western Reserve Road • Canfield, Ohio 44406-0082
Telephone (330) 533-6801 • Fax (330) 533-6893
Email info@lindeamerica.com • Internet http://www.lindeamerica.com

LFH-HMF/V/R-02 04/00D

P/N 888 006 6483