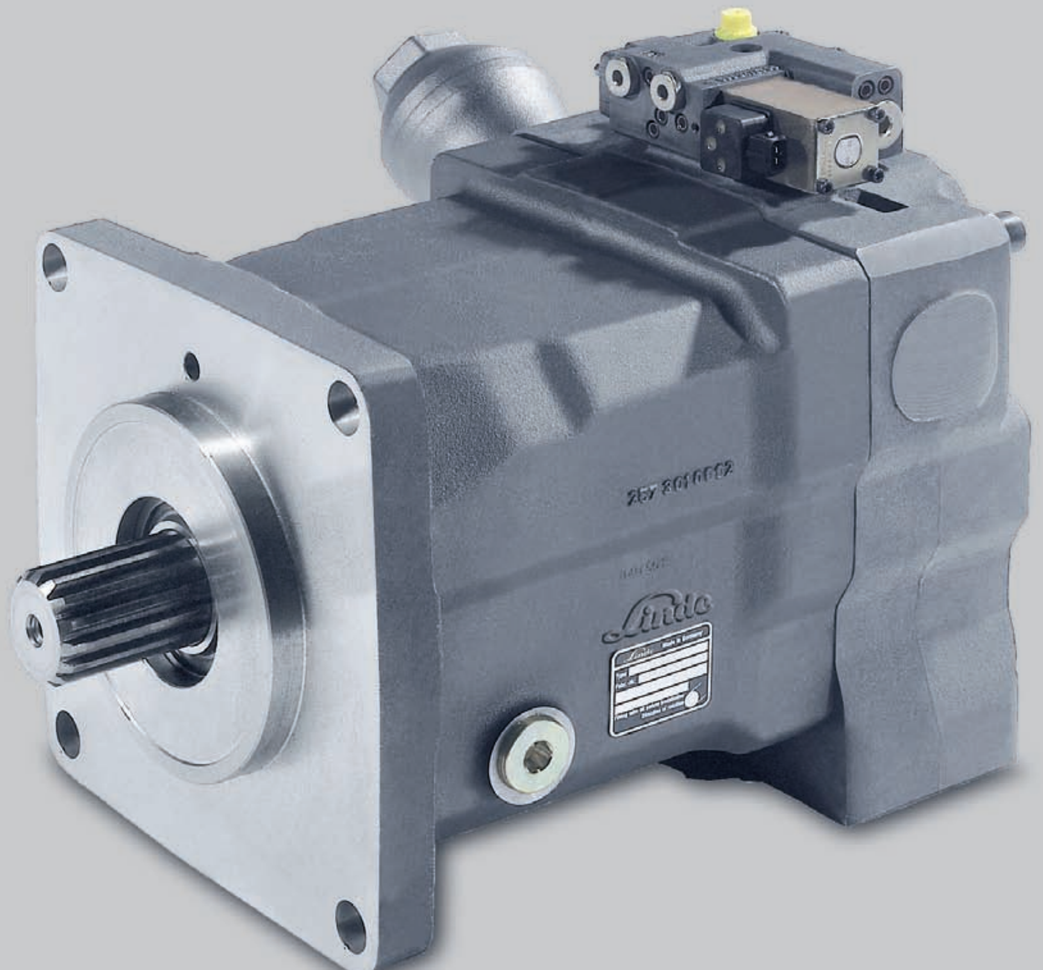
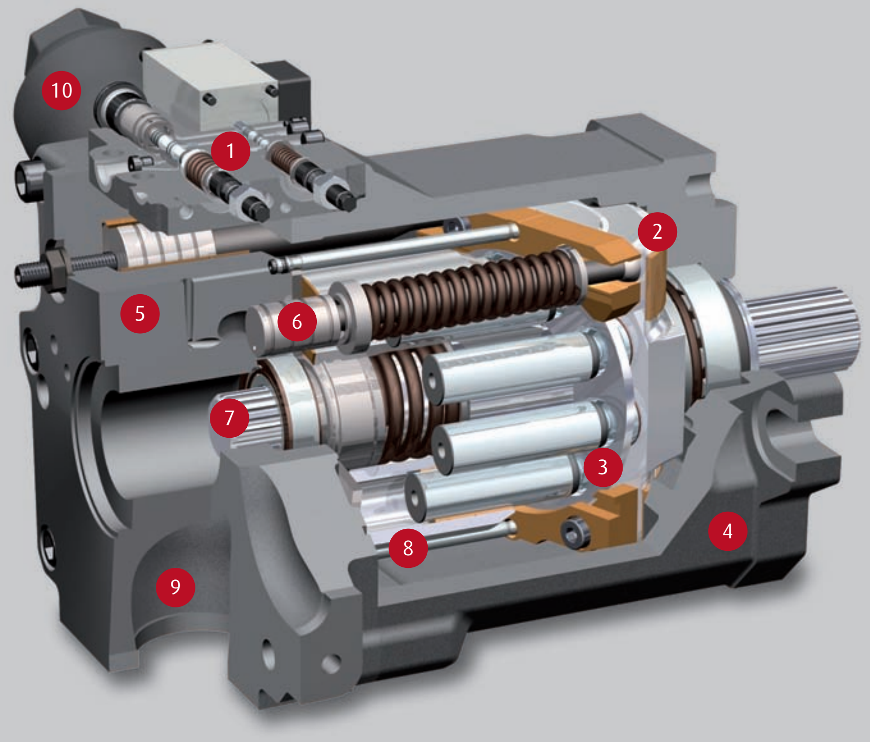
HPR-02.
Self-regulating pump for open loop operation.

Linde Hydraulics





1 **LS-regulator** optimum utilisation of power

2 **swash plate** hydrostatic bearing

3 **piston-slipper assembly** 21° swash angle

4 **housing** monoshell for high rigidity

5 **valve plate housing** highly integrated

6 **actuator piston** long-lived and precise

7 **through shaft** for additional pumps

8 **cylinder barrel** compact due to 21° technology

9 **suction port** good suction capacity also without tank pressurization

10 **SPU** reduction of pressure pulsation over the entire range of operation, maintenance-free

Design characteristics

- >> high pressure axial piston pump in swash plate design for open loop systems
- >> clockwise or counter clockwise rotation
- >> self-priming at high nominal speed
- >> higher rotating speed by tank pressurization or swash angle reduction
- >> adaptive noise optimization SPU
- >> decompression fluid is drained via pump housing for suction side stability
- >> exact and rugged load sensing controls
- >> SAE high pressure ports
- >> SAE mounting flange with ANSI or SAE spline shaft
- >> through shaft SAE A, B, B-B, C, D and E
- >> optional tandem and multiple pumps

Product advantages

- >> energy saving operation by 'flow on demand' control
- >> dynamic response
- >> excellent suction up to rated speed
- >> noise optimization over the entire range of operation
- >> optimum interaction with Linde LSC-Directional Control Vales and LinTronic
- >> compact design
- >> high power density
- >> high pressure rating
- >> high reliability
- >> long working life

Data Sheets Linde Hydraulics.

Find the right products for your application.

Product range

Product		Application	Linde product name
Pump	Self-regulating pump	for open loop operation	HPR-02
	Variable pump	for closed loop operation	HPV-02
Motor	Variable motor	for closed and open loop operation	HMV-02
	Regulating motor	for closed and open loop operation	HMR-02
	Fixed motor	for closed and open loop operation	HMF-02
		for open loop operation	HMF-02 P
		for closed and open loop operation	HMA-02
Directional control valve		for open loop operation	VW
Electronics	Electronic control	for open loop operation	CEB
		for closed and open loop operation	CED
		for closed and open loop operation	CEP
	Diagnosis software	for closed and open loop operation	LinDiag®
	Peripheral equipment	for closed and open loop operation	

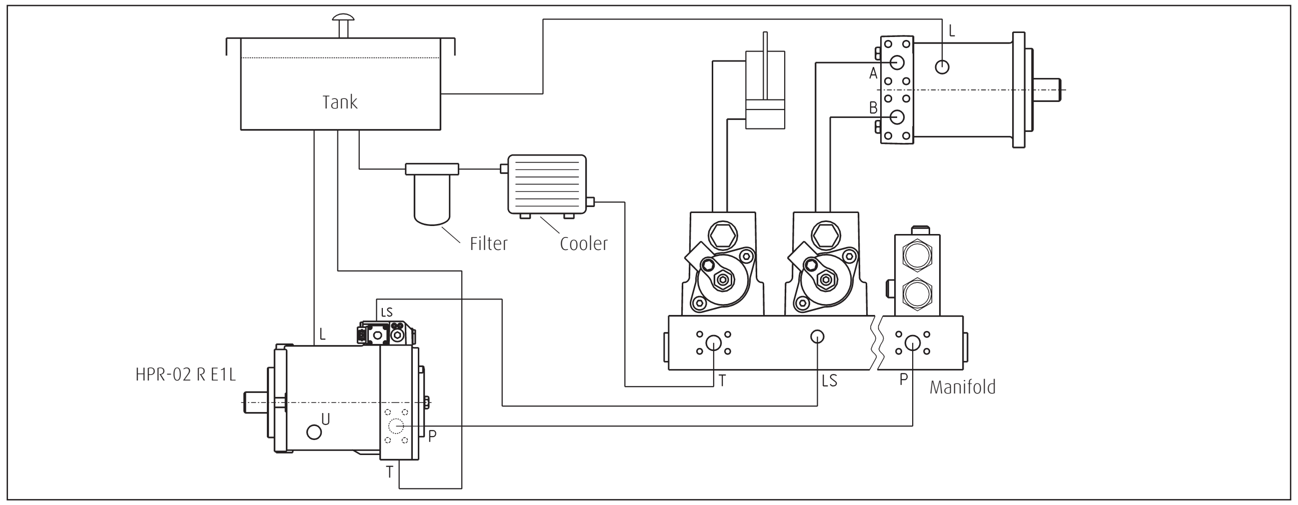
Content HPR-02.

The data on which this brochure is based correspond to the current state of development. We reserve the right to make changes in case of technical progress. The dimensions and technical data of the individual installation drawings are prevailing. The features listed in this data sheet are not available in all combinations and nominal sizes. Our sales engineers will be happy to provide advice regarding the configuration of your hydraulic system and on product selection.

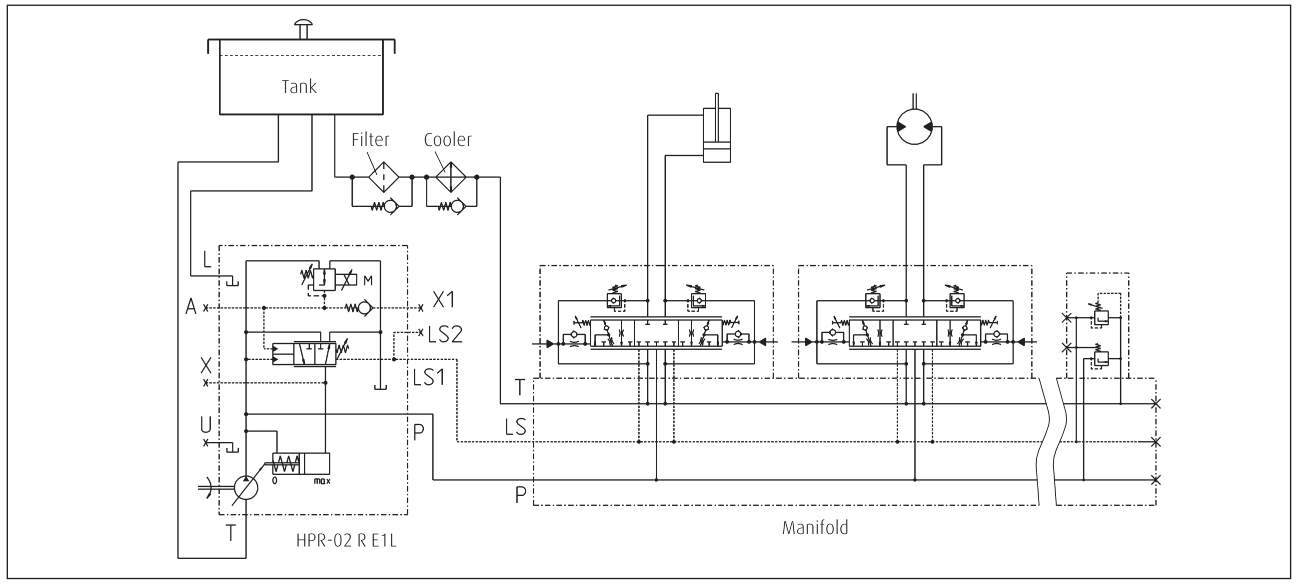
The open loop.

Representation of hydraulic components in an open loop circuit: HPR-02 regulating pump with load sensing function for energy-saving, flow on demand control and VW load sensing directional control valves for load-independent, synchronous movements of several actuators without unintentional interaction. The system is complemented with proven Linde products such as electronic controls, swing drives and hydraulic motors.

Function diagram



Circuit diagram



Standard Linde-name plate

Each Linde Hydraulics unit features a name plate showing the type and the serial number. For a single order via 'open variant' a customer-specific number or free text with up to 15 characters can be stamped on the name plate.

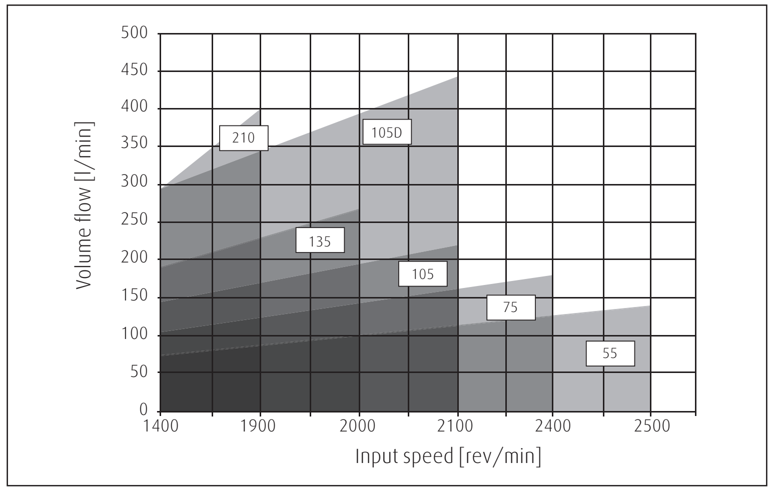
Type	HPR 105-02	Series 02 self-regulating pump with the rated size of 105
	R	Right hand rotation
	2683	The last 4 figures of the Bill of Material 2540002683
Serial-No.	H2X	
	254	Type number of HPR 105-02
	T	Letter indicating year of production
	12345	Serial number
Part No.	12345678	Free text field for up to 15 characters

General technical data

The table shows the complete capacity range of the pumps, while the diagram below shows the recommended practical range for the different nominal sizes of the HPR-02 pump with control limit between 200 bar Δp minimum and 280 bar Δp maximum. It enables initial selection of the required nominal pump size.

Overview of technical data

Rated Size				55	75	105	135	210	105 D
	Maximum displacement		cm^3/rev	54.8	75.9	105	135.6	210	2x 105
Speed	Max. operating speed (rated speed) without tank pressurization Operating speed with tank pressurization see chapter operational parameters		min^{-1}	2700	2600	2300	2300	2000	2300
Volume flow	Max. oil flow		l/min	147.9	197.3	241.5	311.9	420	483
Pressure	Max. operating pressure		bar	420					
	Max. intermittent pressure		bar	500					
	Permissible housing pressure (absolute)		bar	2.5					
Input torque	Max. Input torque at max. operating pressure and V_{max}		Nm	366	508	702	907	1404	1090
Response times Measured at fluid viscosity 20 cSt	$V_{max} \rightarrow V_{min}$ Swashing from high pressure (HP) to stand-by pressure	HP 100 bar at 1500 rev/min, V_{max}	ms		120 at 2000 rpm	120	130	200	
		HP 200 bar at1500 rev/min, V_{max}	ms		70 at 2000 rpm	70	70	70	
	$V_{max} \rightarrow V_{min}$ Swashing from stand-by pressure to high pressure (HP)	HP 100 bar at 1500 rev/min, V_{max}	ms		400 at 2000 rpm	450	300	160	
		HP 200 bar at 1500 rev/min, V_{max}	ms		300 at 2000 rpm	350	300	130	
Permissible shaft loads	Axial input force		N	2000					
	Axial output force		N	2000					
	Radial		N	on request					
Perm. housing temperature	Perm. housing temperature with minimum perm. viscosity > 10 cSt		°C	90					
Weights	HPR-02 without oil (approx.)		kg	39	39	50	65	116	107
	Maximum moment of inertia		$kgm^2 x 10^{-2}$	0.79	0.79	1.44	2.15	4.68	2.88



Recommended operating range of HPR-02

Optimum operating range.
Permissible speed and power values can be found in the above table.

Operational parameters. Life time recommendations

Linde 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.

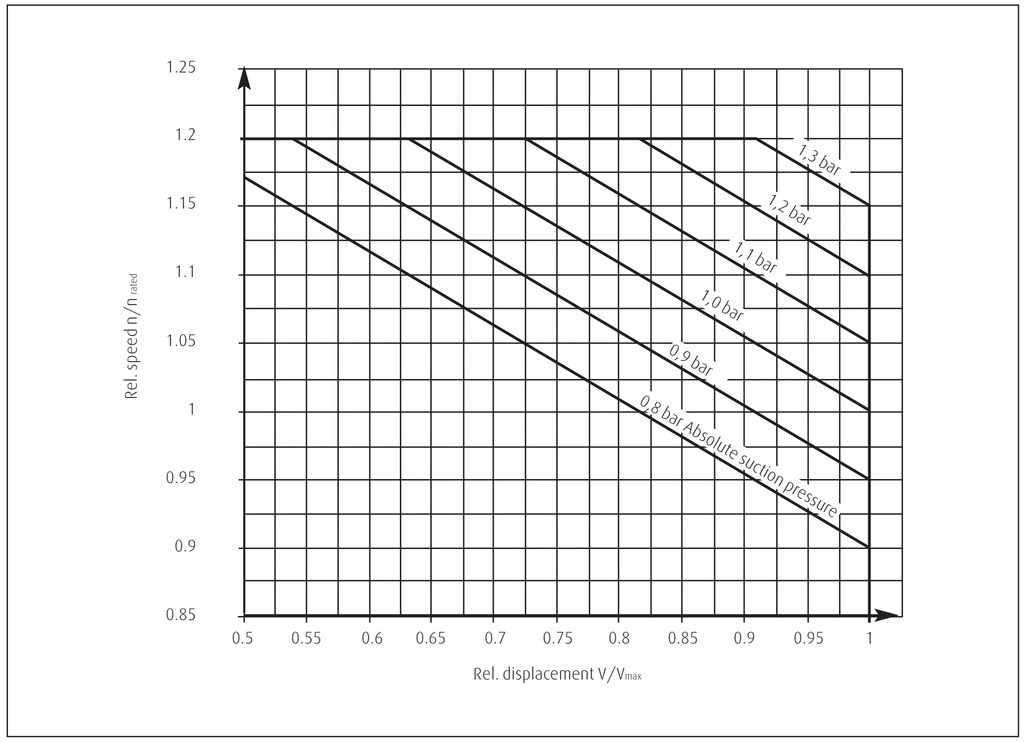
Beneficial conditions for long service life

>> Speed	lower continuous maximum speed
>> Operating pressure	less than 300 bar Δp on average
>> Max. 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. HPR-02 suction speed



Operational parameters. Tank connection

The leakage and decompression oil generated during pump operation is drained from the rotating group into the pump housing. Excessive housing pressure must be avoided through suitably dimensioned piping between the housing and the tank.

Operational parameters. Filtration

In order to guarantee long-term proper function and high efficiency of the hydraulic pumps the purity of the pressure fluid must comply with the following criteria according to Linde Works Standard WN 51 210. High purity oil can extend the service time of the hydraulic system significantly.

>> 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.
>> Filling and 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 pumps the viscosity and purity of the operating fluid should meet the different operational requirements. Linde 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

Linde 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	[mm^2/s] = [cSt]	10 to 80
Optimum working viscosity	[mm^2/s] = [cSt]	15 to 30
Max. viscosity (short time start up)	[mm^2/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 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 Linde if the stated conditions cannot be met or in special circumstances.

Viscosity recommendations

Working temperature [°C]	Viscosity class [mm^2/s] = [cSt] at 40 °C
approx. 30 to 40	22
approx. 40 to 60	32
approx. 60 to 80	46 or 68

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

Linde LSC-System.

The Linde Synchron Control-System (LSC-System) for open loop hydraulic circuits enables demand-orientated pump volume control based on load sensing technology (LS technology). A LSC-System compensates the effect of varying loads, varying numbers of actuators and different load levels at different actuators. This happens automatically, thereby making machine operation more convenient since, unlike in other systems, continuous corrective action is no longer required. The LSC-System enables high-efficiency hydraulic systems to be realized that are strictly orientated to the machine functions. Our application specialists will be happy to provide advice for individual machine configurations.

Functionality

- >> Demand-oriented pump control
- >> Excellent precision control characteristics without readjustment
- >> Exact reproducibility of machine movements through exact control of actuators
- >> Dynamic response characteristics
- >> Load-independent, synchronous movements of several actuators
- >> "Social" oil distribution even in the event of overload
- >> Automatic venting of directional control valve end caps
- >> Optimum movement continuity even for combined movements

Further optional functions such as

- >> Priority control of individual actuators
- >> Output control
- >> High-pressure protection
- >> Regeneration function
- >> Combined function shuttle valve
- >> Load holding function

Machine equipment

- >> Customized system design for optimum implementation of customer requirements
- >> Optimum utilization of the installed power with simultaneous improvement of energy consumption
- >> High flexibility through manifold plates
- >> Compact, integrated solutions
- >> Modular design of valve sections
- >> Add-on cylinder valves for direct and fast cylinder supply, no additional hose burst protection required
- >> Optimized piping

Benefits

- >> Perfect matching of the individual operating functions for customized machine characteristics
- >> Efficient and dynamic machine control for short operating cycles
- >> Optimized energy balance for reduced fuel consumption and enhanced handling performance
- >> Simple and safe machine operation for non-fatigue and efficient working
- >> Unsurpassed reliability even under harsh operating conditions
- >> Reduced installation times

Noise reduction.

In hydraulic systems pressure pulsations can lead to noise emission. These pressure pulsations are a result of the inherent non-uniformity of the volume flow in rotary piston pumps. In open loop hydraulic circuits pressure pulsations primarily originate from within the hydraulic pump during the compression stroke, i.e. when a piston coming from the low-pressure side (suction side) enters the high-pressure side, where it is suddenly subjected to high pressure. The higher the pump speed and the pressure difference between the low-pressure and high-pressure side, the more pulsation energy is added to the hydraulic system via the hydraulic fluid. Pressure pulsations can cause components of the hydraulic system or the machine to oscillate, thereby generating noise that is perceivable for the human ear.

In principle noise emissions from machinery with hydraulic systems can be reduced in the following ways:

>> Reduction of operating pressure and speed. This reduces the pulsation energy introduced into the hydraulic system

>> Primary measures for optimizing the compression stroke in rotary piston machines with the aim of reducing pulsation

>> Secondary measures such as vibration-optimized design and installation of machine components and sound-proofing for noise suppression

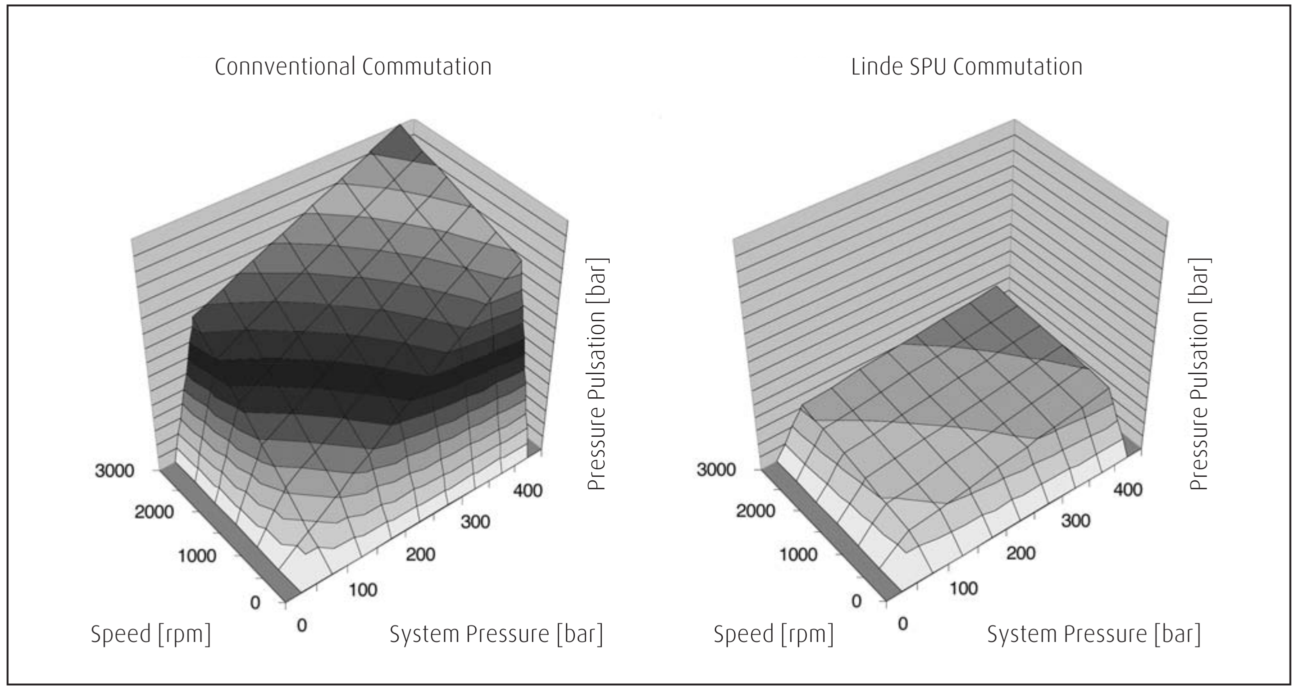
Noise Generation

Flow Ripple
▼
Pressure Ripple
▼
Fluid Borne Noise
▼
System Excitation
▼
Structure Borne Noise
▼
Noise Radiation

Noise reduction. SPU silencer

All Linde hydraulic pumps are optimized with respect to pulsation characteristics and therefore noise generation. In addition to common primary measures such as exclusive use of pulsation-optimized port plates, Linde Hydraulics offers the SPU silencer for HPR-02 open loop pumps. Without affecting the functionality and efficiency of the pump, this system reduces pressure pulsations by up to 70%, irrespective of pressure, speed or temperature. The SPU system is adaptive over the entire operating range. No setting up or maintenance is required.

Pressure pulsations with and without SPU

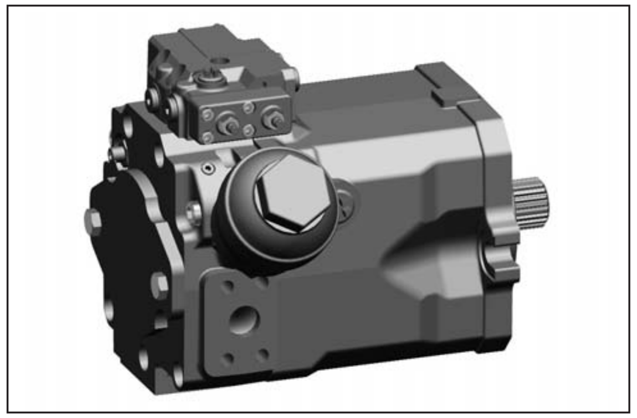


Noise reduction.

SPU silencer function

>> Reduction of pressure pulsations over the entire operating range
>> Reduction of volume flow fluctuations
>> No impairment of efficiency
>> Ready for use immediately, no maintenance required
>> Simple and rugged design
>> Minimum increase in weight and volume

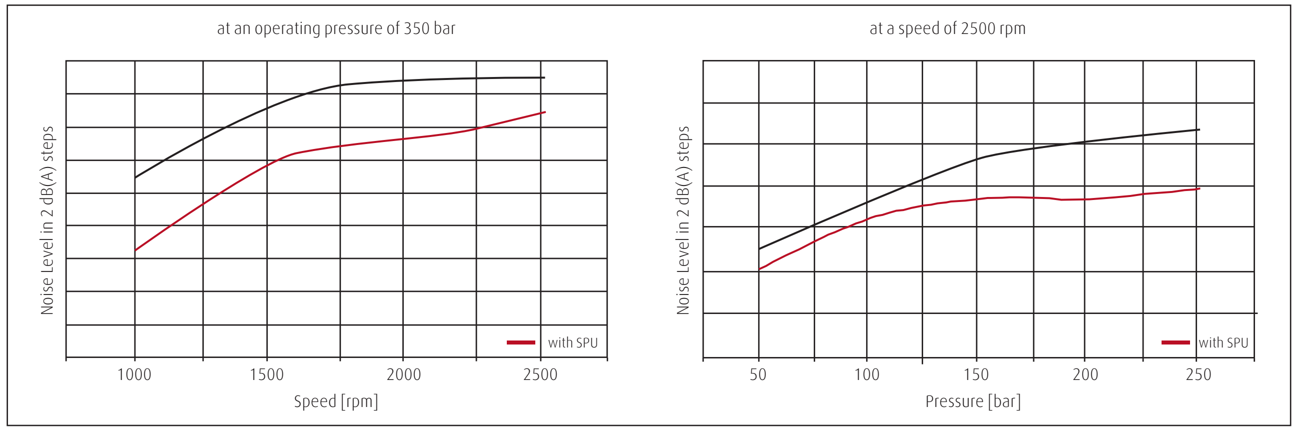
HPR-02 with SPU



Noise reduction SPU silencer

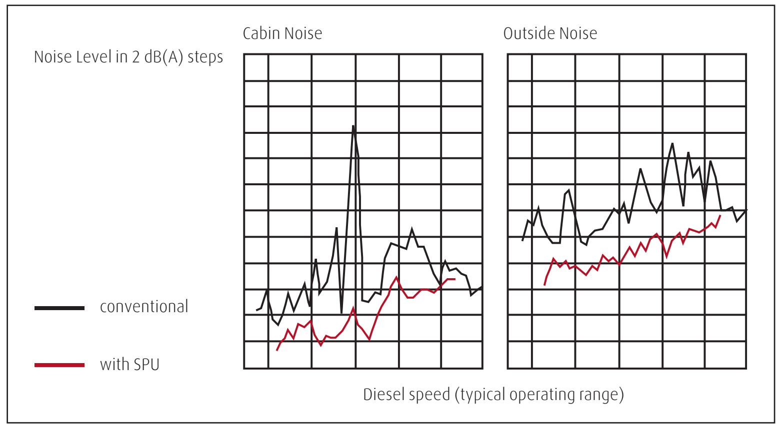
The following diagrams illustrate the immediate effect of pulsation level reduction via SPU on the sound pressure level and therefore the perceived noise emission.

Comparison of sound pressure levels for a HPR 75-02 pump with and without SPU



Comparison of resulting noise emission

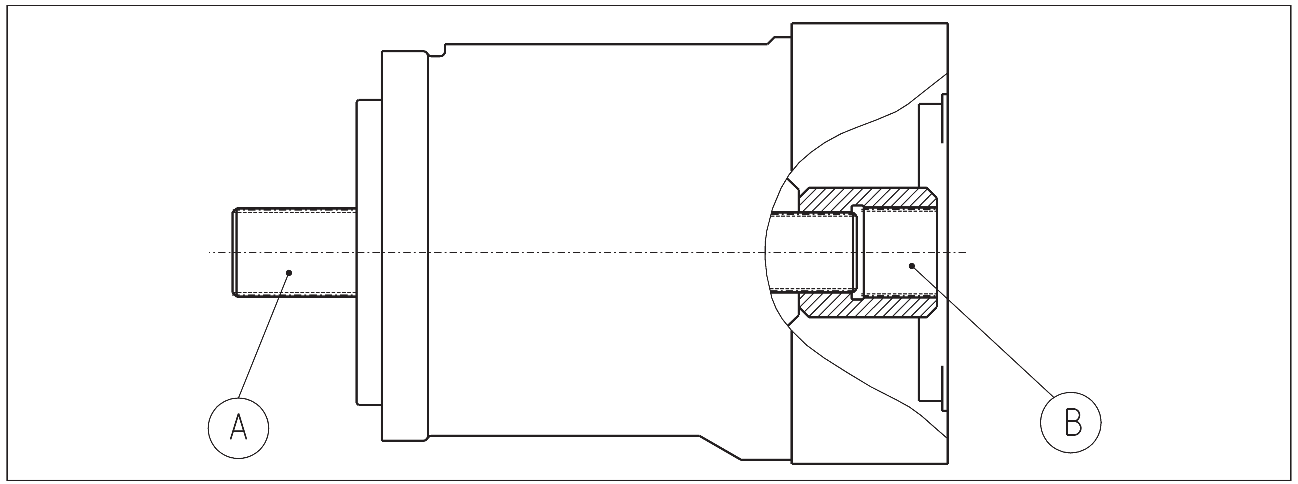
Shown in 2 dB(A) steps over a typical diesel engine operating speed range.



Torque transmission.

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

Torque transmission of HPR-02



This shows the input side (A) and PTO-/output side (B) of a HPR-02 pump.
The information on the following pages refers to

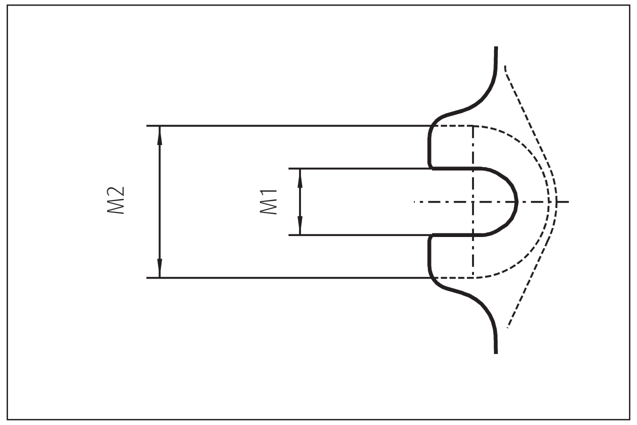
>> mounting flange and drive shaft (A)

>> PTO flange and through shaft (B).

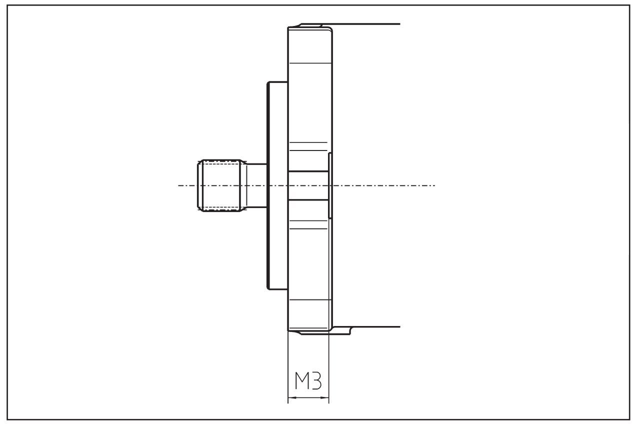
A) Flange profile

Bolt hole dimensions		Rated size HPR-02							
		55	75	105	135	210	105D 2-hole	105D plug-in	105D SAE 3
M1 inside diameter	mm	17.5	17.5	17.5	21.5	22	17.5	14	11
M2 outside diameter	mm	34	34	34	40	-	40	20	22
M3 bolt hole length	mm	20	20	20	20	26	20	20	12

Bolt hole diameter



Bolt hole length



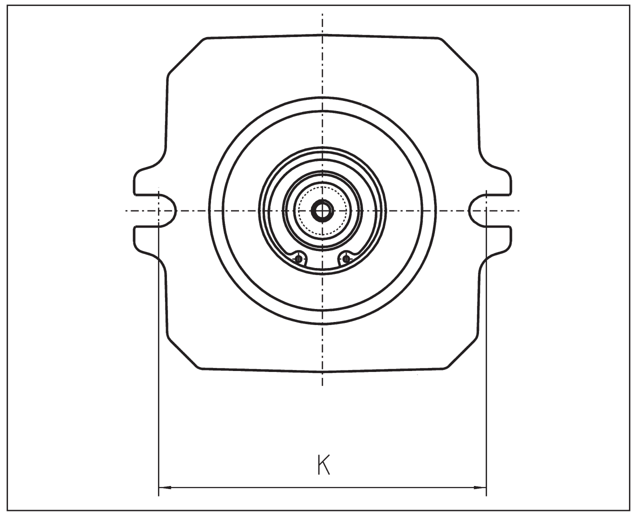
Torque transmission. Mounting flange

A) Mounting flange dimensions

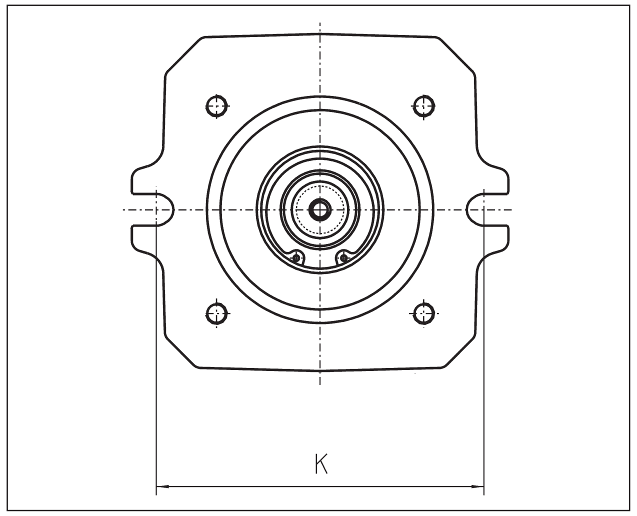
Mounting flange dimensions in accordance with SAE J74	Dimension K [mm]	Rated size HPR-02					
		55	75	105	135	210	105 D
SAE C, C-C 2-hole	181.0	x	x	x			
SAE C, C-C 2-hole with 4 additional threaded holes	181.0			x			
SAE C, C-C 2-hole with 4 additional bolt holes	181.0						x
SAE D 2-hole	228.6				x		
SAE E 4-hole	224.5					x	
Plug-in flange	251.8						x
SAE 3 bell-housing	428.6						x

A) Fixing hole distance K

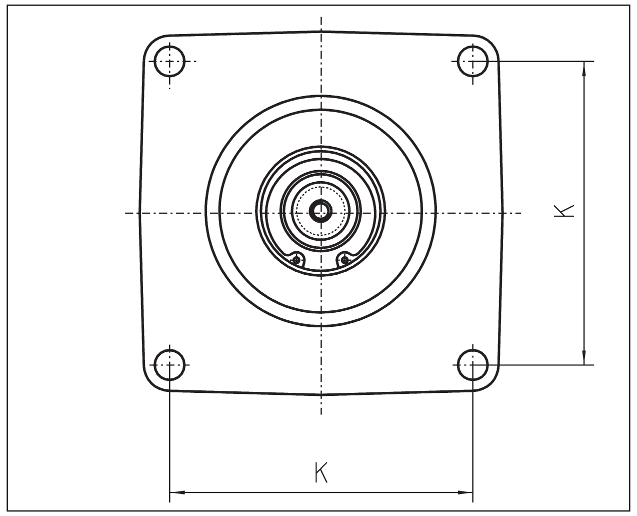
2-hole flange



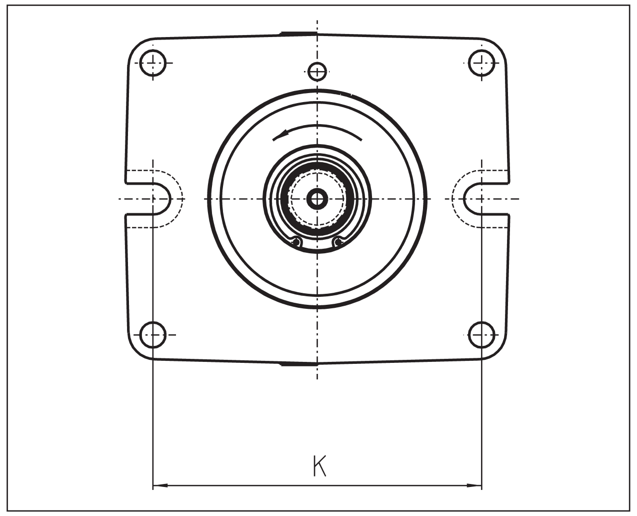
2-hole flange with 4 additional threaded holes



4-hole flange

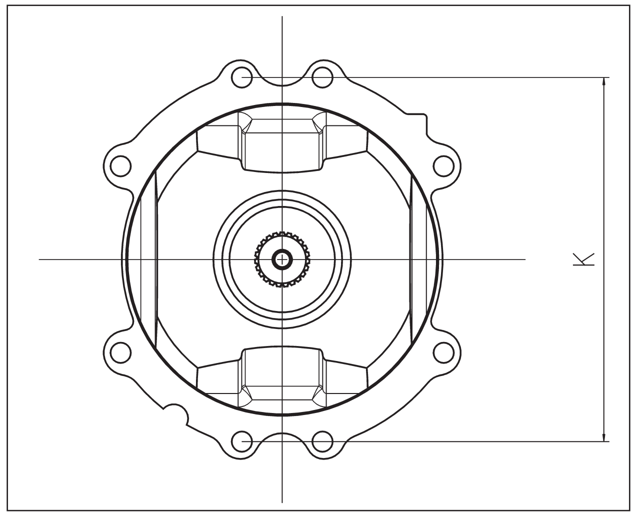


2-hole flange with 4 additional bolt holes

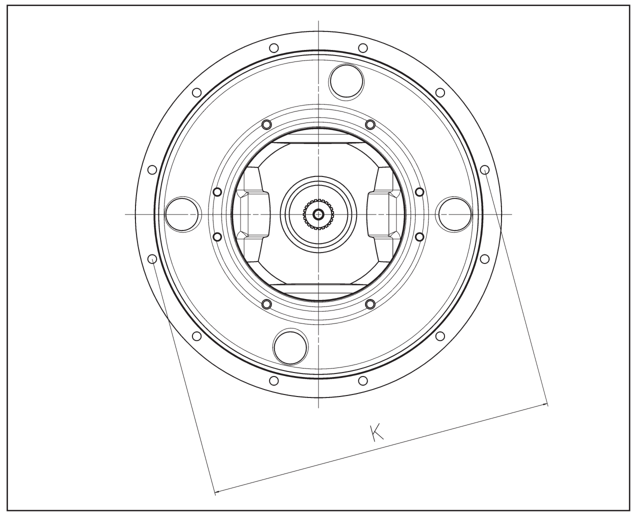


Torque transmission. Mounting flange

Plug-in flange



SAE 3 bell housing



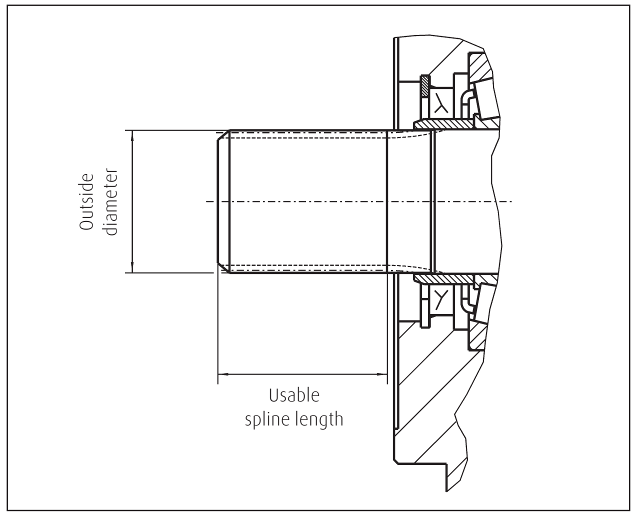
Torque transmission. Drive shaft

A) Dimensions drive shafts

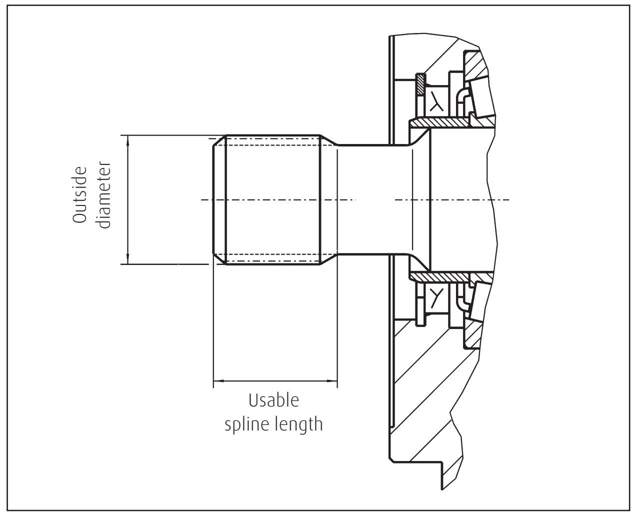
Shaft spline in accordance with ANSI B92.1	SAE J744 code for centring and shaft	Outside diameter [mm]	Usable spline length [mm]	Shaft length up to bearing [mm]	Shaft type	Available for rated size					
						55	75	105	135	210	105 D
16/32, 23 Z		37.68	38.5	47.6	1			x			x
16/32, 27 Z		44.05	62	66.7	1				x	x	
12/24, 14 Z	C	31.22	30	47.5	2	x	x	x			
12/24, 17 Z	C-C	37.57	38	53.8	2			x	x		x
8/16, 13 Z	D	43.71	50	66.7	2				x		
8/16, 15 Z		50.06	58	66.7	1					x	

A) Linde Hydraulics shaft types

Type 1. Without undercut



Type 2. With undercut



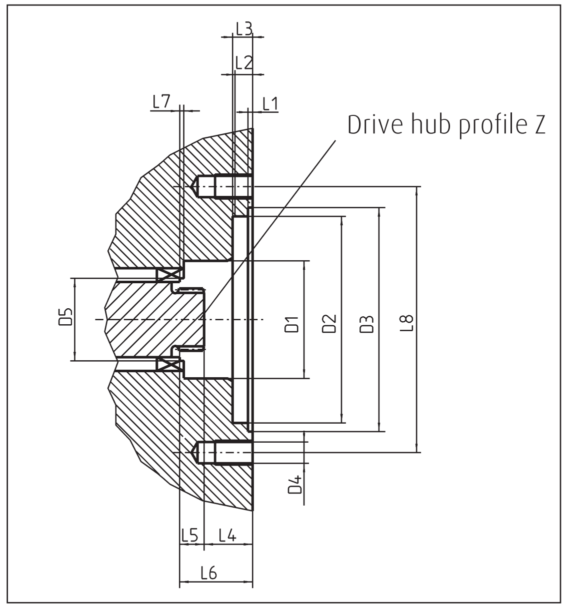
Torque transmission. PTO through drive

Linde pumps can be combined into tandem and multiple pumps. The combination options are determined by the permitted transfer torque. The following data refers to the PTO (pump output side, without further attachments).

B) Dimensions PTO

Rated size		55	75	105	135	210
Z drive hub profile in accordance with ANSI B92.1		16/32, 18 t	16/32, 18 t	16/32, 19 t	16/32, 21 t	16/32, 24 t
D1	mm	47	47	48	54	63
D2 spigot pilot diameter	mm	82.55				
D3	mm	89.5				
D4		M 10				
D5 max. bearing clearance	mm	30	35	38	43	46
L1	mm	1.5				1.9
L2 adapter length	mm	7				8
L3	mm	9				
L4 minimum distance	mm	35	39	33	35	46
L5 usable spline length	mm	18	18	24	15.8	29.5
L6 distance to bearing	mm	48	48	52.7	54.2	46
L7 min. bearing clearance	mm	3				5
L8 hole distance 2-hole	mm	106.4				

B) Dimensions PTO



Torque transmission. Output shaft

B) Output shaft transfer torque

Rated size		55	75	105	135	210
Continuous transfer torque	Nm	220	305	420	540	840
Max. transfer torque	Nm	350	485	670	870	1340

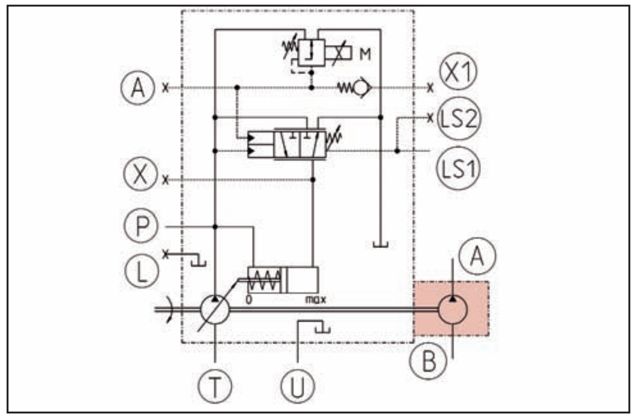
Gear pumps.

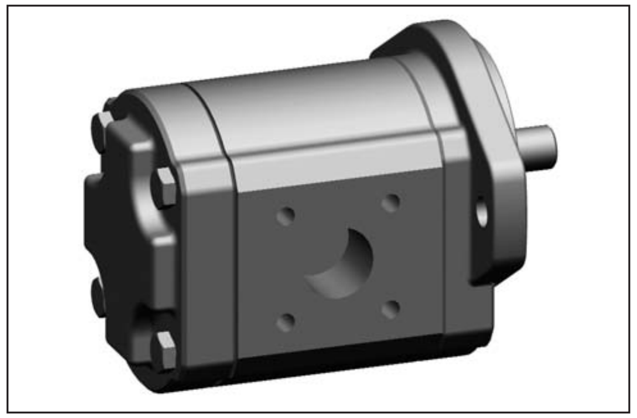
Two types of gear pumps are available: internal gear pump IGP and external gear pump EGP. The possible combinations of and with IGP and EGP are determined by the PTO option and the permitted shaft torque. Both types can be used for the control circuit and the cooling circuit. The suction limit of 0.8 bar min. (absolute) must be adhered to.

Technical data

Max. displacement volume	cm³/rev	16	19	22.5	31	38	44
Type of gear pump		IGP	EGP	IGP	EGP	EGP	EGP
Mounting flange and drive shaft profile		SAE A 16/32, 18 t	SAE A 16/32, 9 t	SAE A 16/32, 18 t	SAE A 16/32, 9 t	SAE A 16/32, 13 t	SAE A 16/32, 13 t
Type of suction in conjunction with HPR-02		external					
Maximum permissible operating pressure observe max. permissible rated pressures for filter and cooler	bar	40	250	40	165	275	220
Standard PTO flange and shaft spline		SAE A 16/32, 9 t	-	SAE A 16/32, 9 t	-	-	-
Continuous output torque	Nm	175 75 Nm with SAE A	-	175 75 Nm with SAE A	-	-	-
Max. output torque	Nm	250 107 Nm with SAE A	-	250 107 Nm with SAE A	-	-	-
Cold start relief valve		integrated	-	integrated	-	-	-

External gear pump EGP





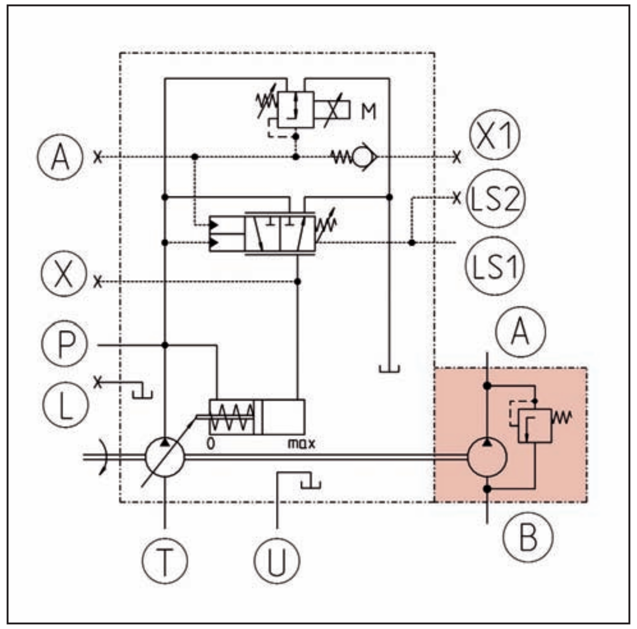
The EGP type features external suction.
Available nominal sizes

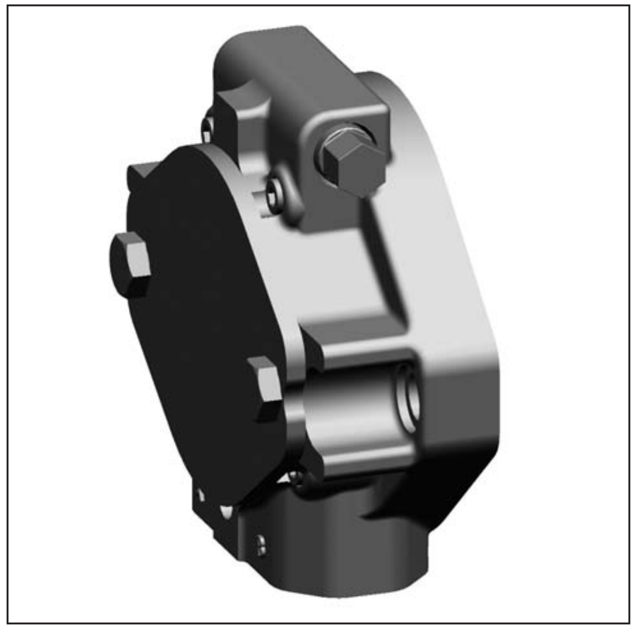
- >> 19 cm³/rev
- >> 31 cm³/rev
- >> 38 cm³/rev
- >> 44 cm³/rev

Gear pumps.

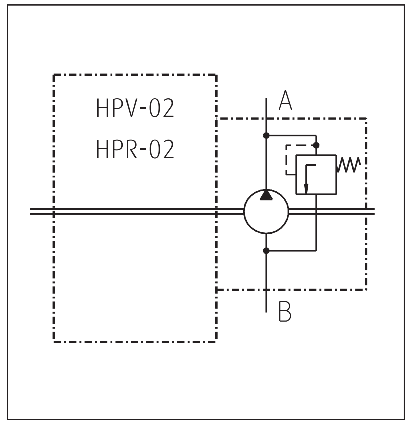
The IGP gear pumps include a cold start relief valve and a through drive for attaching additional pumps. In conjunction with an HPR-02 regulating pump suction is always external. IGP types are available in rated sizes of 16 cm³/rev and 22.5 cm³/rev.

Internal gear pump IGP with external suction





External suction



>> External suction

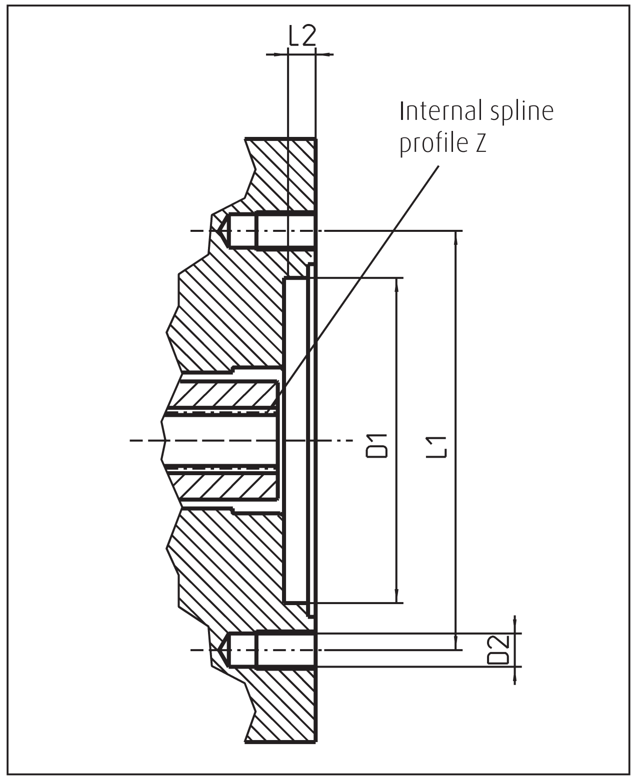
The gear pump supplies the main circuit with oil from the oil tank.
The internal connection is closed.

Gear pumps.

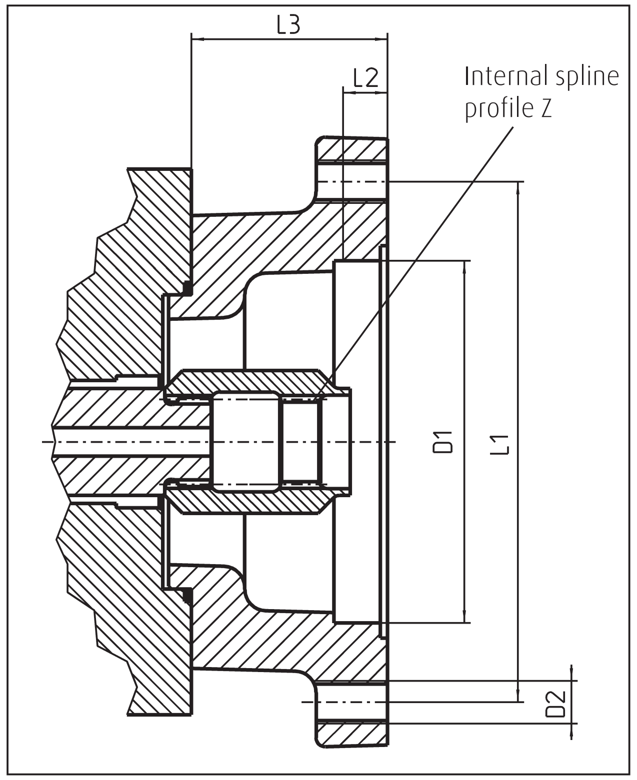
PTO flange with IGP

Flange profile 2-hole		SAE A	SAE B	SAE B-B	SAE C
Z internal spline profile in accordance with ANSI B92.1		16/32, 9 t	16/32, 13 t	16/32, 15 t	12/24, 14 t
D1 spigot pilot diameter	mm	82.55	101.6		127
D2 thread size	mm	M 10	M 12		M 16
L1 hole distance	mm	106.4	146		181
L2 adapter length	mm	7	11		13
L3 flange length	mm	-	55		72
Continuous transfer torque	Nm	75	175		
Maximum transfer torque	Nm	107	250		

PTO SAE A with IGP



PTO SAE B, B-B and C with IGP



Type of control.

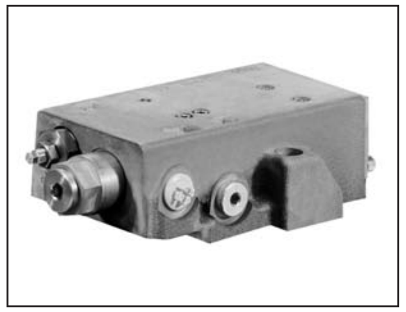
The modular regulator unit enables a wide range of functional system requirements to be met. In all regulator unit versions, the regulating functions are integrated in a housing in order to ensure direct signal transfer without delays and with maximum compactness. All regulators equipped with load sensing function are fully compatible with the Linde Synchron Control-System (see section Linde LSC-System).

Technical data

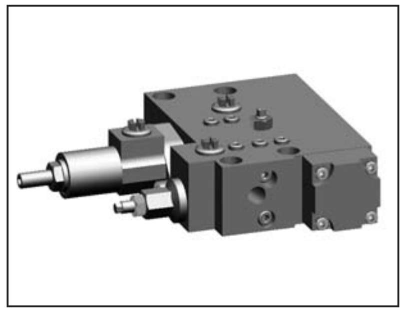
Type of Control	Additional option	Name of regulator
Load sensing	with pressure cut-off	LP
	with power limitation, linear approximated	TL1
	with power limitation, hyperbolic	TL2
	with electric override	E1L

LP-regulator

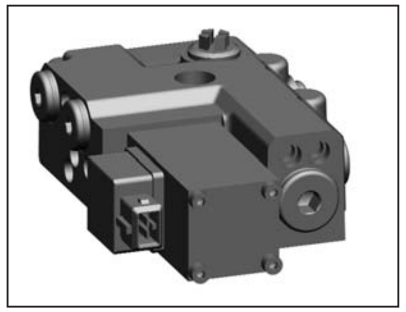
TL1-regulator



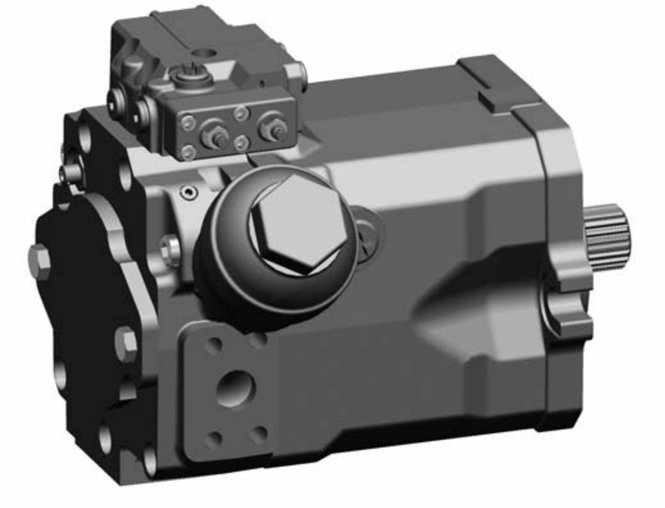
TL2-regulator



E1L-regulator



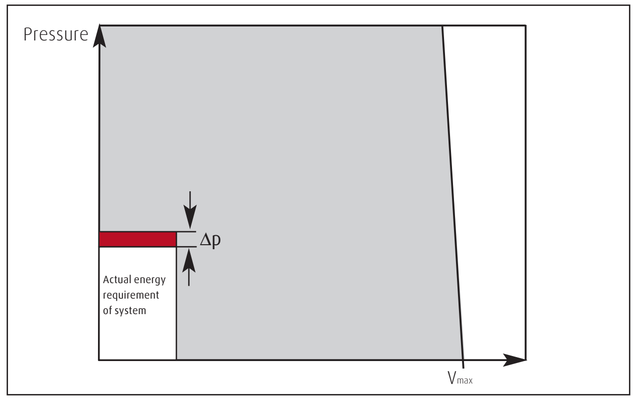
HPR-02 E1L



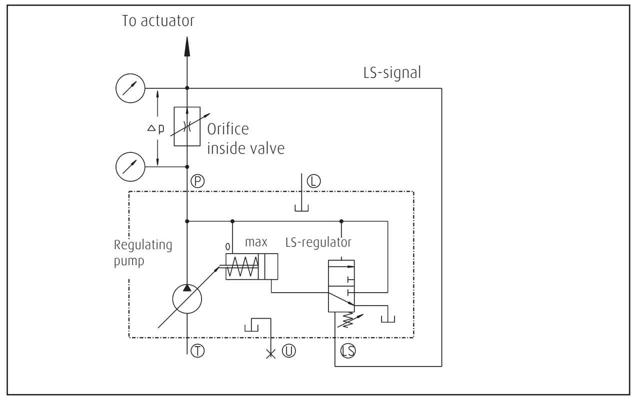
Type of control. Load sensing

Linde pumps with load sensing control enable the movement speed required of the selected actuator, e.g. of a boom, to be specified via the valve opening. The measured pump and load pressures are continuously balanced by the load sensing regulator of the hydraulic pump.

Load sensing. Flow on demand control.

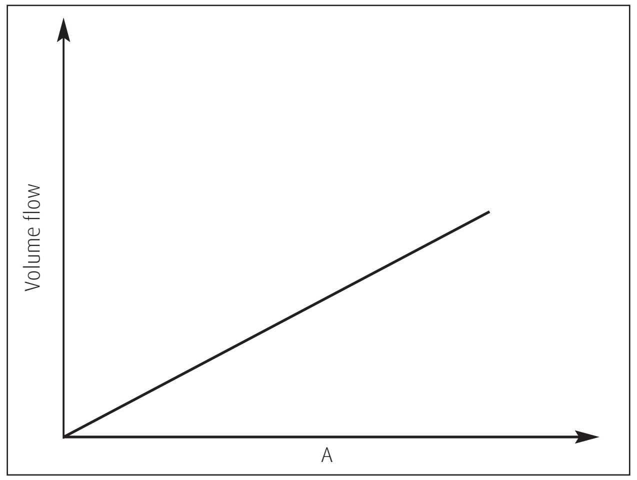


Regulating pump with LS-regulator and measure orifice (in valve)

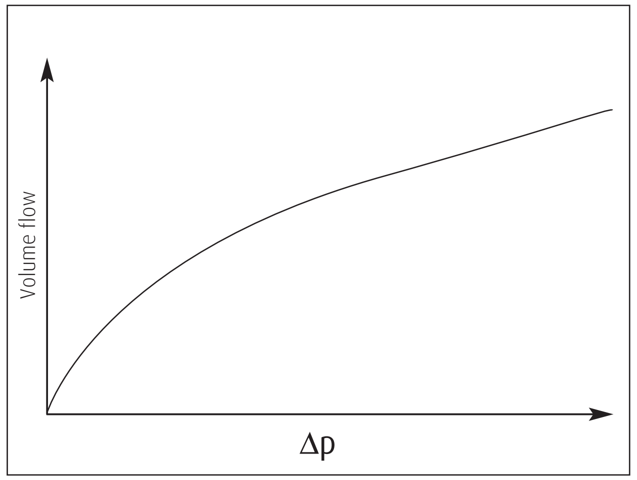


At the regulator a pressure gradient is set which is defined by the actuator requirements. The volume flow results from the orifice A of the control valve and the actual pressure gradient. Due to the LS-regulator, the Δp corresponds to the setting value. If the required volume flow differs, the pump displacement is changed accordingly. This happens automatically and reduces the effort required by the operator. Since varying loads and varying numbers of actuators are compensated automatically. The Δp LS basic setting is possible from 16 to 27 bar with 20 bar as standard (the LS differential pressure influences the response times of the pump system).

LS-function at Δp = constant



LS-function at area A = constant



Benefits of LS-control

- >> Any volume flow below the pump’s maximum can be set
- >> Response speed of the machine can be defined
- >> OEM-specific machine response is possible
- >> Optimum precision control capability

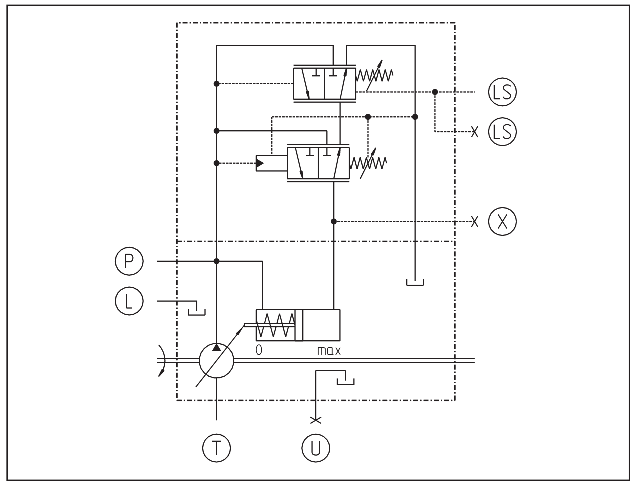
Demand-oriented pump control offers the following benefits

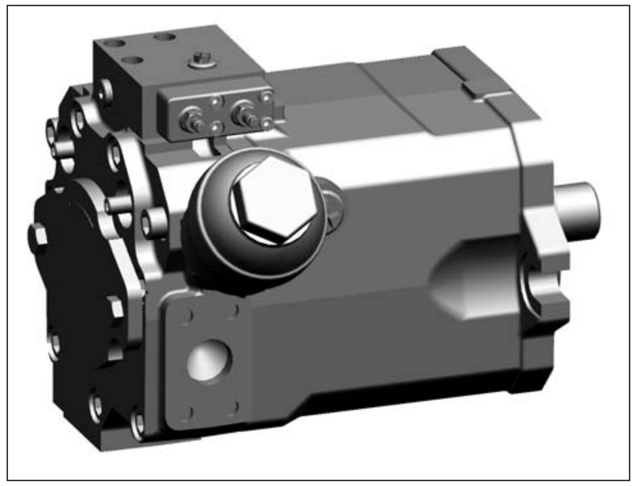
- >> Load-independent machine control
- >> Minimum heat generation
- >> Increased pump service life
- >> Low noise generation in the whole system
- >> Fewer components for the control mechanism
- >> Lower energy consumption, particularly with partial volume flow

Type of control. LS with hydraulic pressure cut-off

In addition to the load sensing function the LP-regulator offers maximum pressure limitation. Once the system pressure reaches the set pressure of the pressure cut-off valve, the LS-regulator is overridden and the pump swashes back, whilst maintaining the system's regulating pressure. The hydraulic pump remains in this state until the system pressure falls below the set pressure. The hydraulic pump then returns to normal LS operation.

LP. LS with hydraulic pressure cut-off





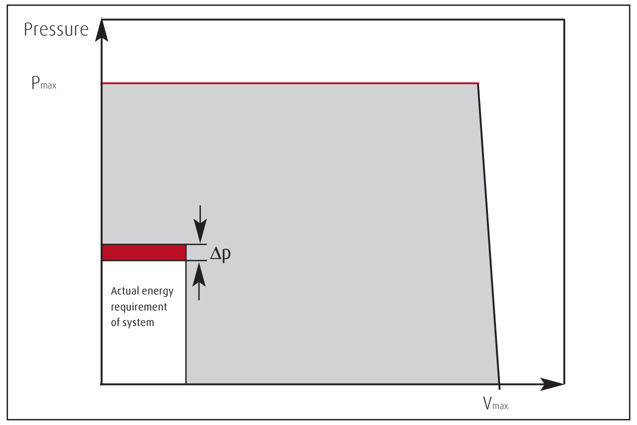
The maximum pressure cut-off valve prevents prolonged operation of pressure relief valves installed in the hydraulic system for protection. This has the following benefits for the hydraulic system:

- >> Operating pressure is maintained
- >> No operation in the overload range
- >> Any operating point under the power curve remains accessible
- >> Demand-oriented volume flow generation
- >> Minimum power loss
- >> Reduced heat and noise generation
- >> Longer service life of the pump and the entire hydraulic system
- >> Improved energy consumption of the overall system

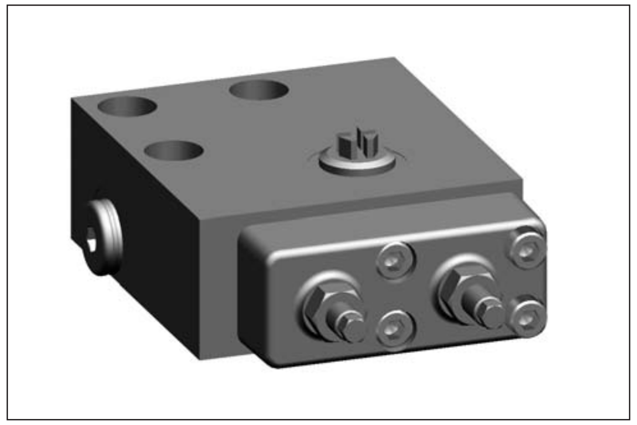
Possible maximum pressure control setting ranges

- >> 125 - 230 bar
- >> 231 - 350 bar
- >> 351 - 420 bar

LP-characteristic curve



LP-regulator

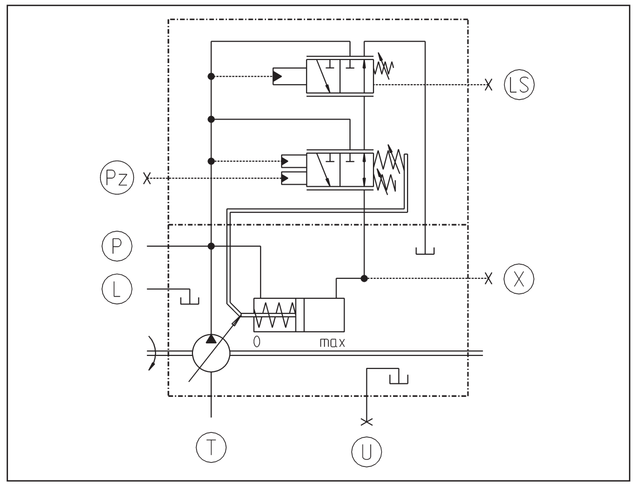


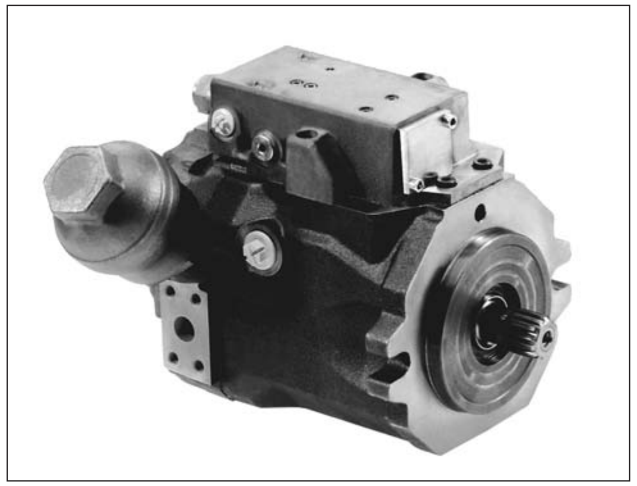
Type of control. LS with linear approximated power limitation

In addition to the load sensing function, the TL1-regulator offers power limitation with linear approximation of the power limit characteristics. Below the power limit set at the pump regulator the hydraulic pump operates in normal LS-mode. If a power value is requested via the system pressure at a given pump flow that exceeds the power limit, the LS-regulator is overridden and the pump swashes back along the power limit curve. Once the system pressure falls again, the hydraulic pump swashes out again along the power limit curve, i.e. it returns to normal LS-mode. Starting from the set value, the characteristic power limit curve can be moved towards lower power limits via a separate control pressure connection (hydraulic mode switching).

Power limitation limits the power input of the pump, thereby protecting the prime mover from overload or allocating a defined ratio of the available power capacity to the pump.

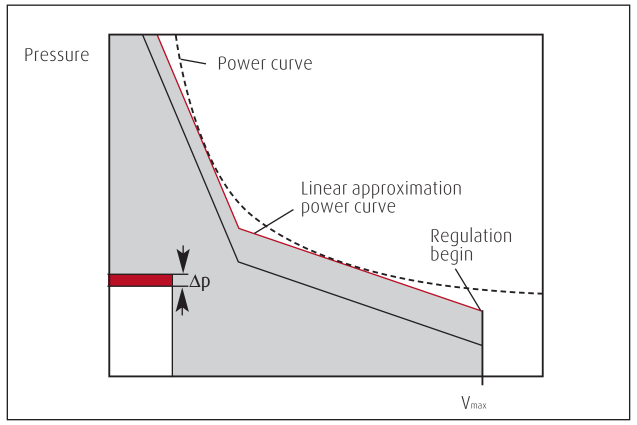
TL1. LS with linear approximated power limitation



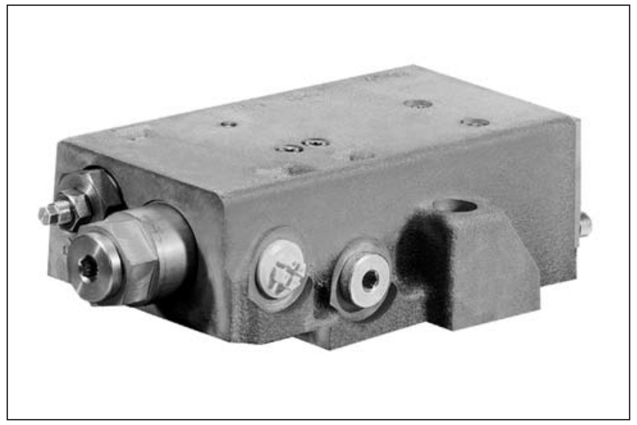


The power limiter of the TL1-regulator features integrated load-controlled feedback of the swash plate position. The power limitation feature follows a multi-spring characteristic. If the power input of the system remains below the value set at the power limiter, the pump is controlled solely via the LS-regulation characteristic. In this way the pump/valve system can reach any operating point under the power curve. The operating range is only limited if the set power limit is reached, in which case the power limiter overrides the LS-regulator. This avoids overload of the prime mover.

TL1-characteristic curve



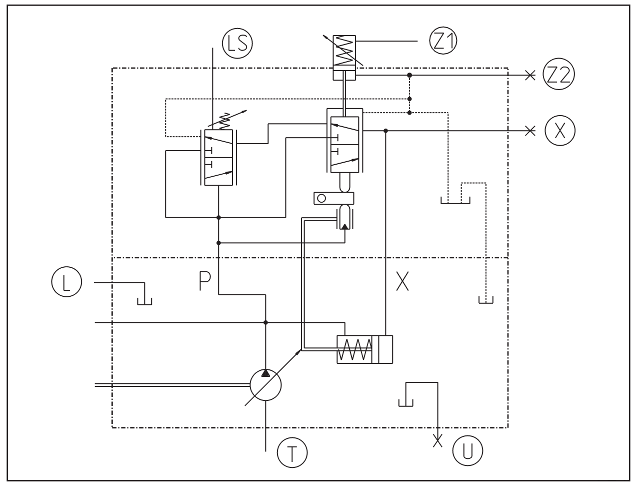
TL1-regulator

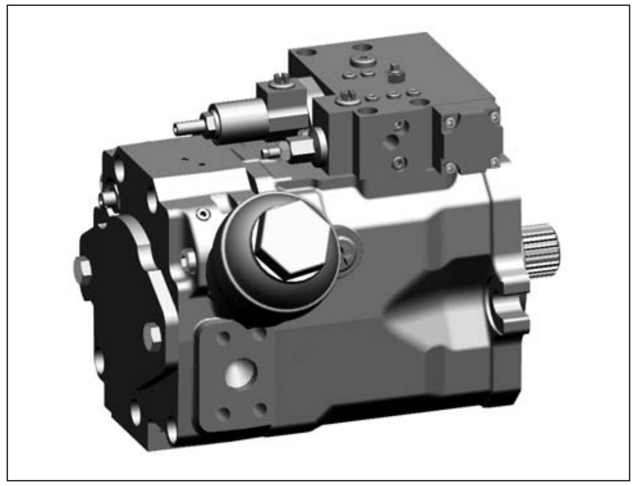


Type of control. LS with hyperbolic power limitation

The control principle with power limitation is used to optimize power utilization of the prime mover in applications where less than the full power capacity is available for the hydraulic system. In addition to the load sensing function the HPR-02 TL2 offers hyperbolic power limitation. The volume flow is limited when the set value is reached.

TL2. LS with hyperbolic power limitation

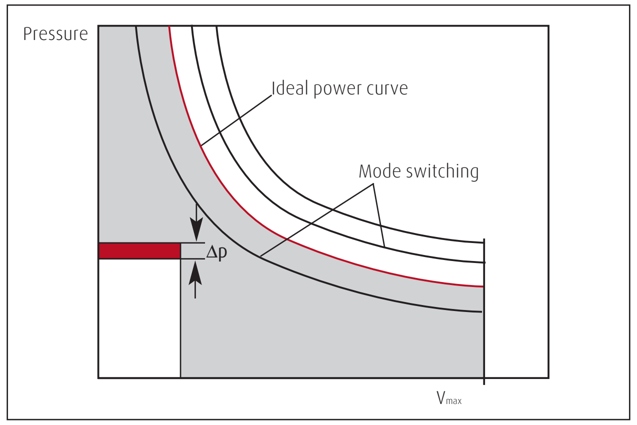




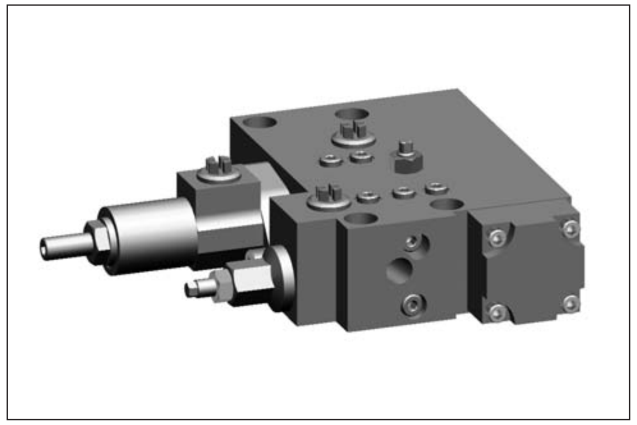
Starting from the set value, the characteristic power limit curve can be moved towards lower or higher power limits via a separate control pressure connection (hydraulic mode switching).

Due to the ideal hyperbolic characteristics, the output of the prime mover can be utilized optimally, or the pump can be allocated a constant output.

TL2-characteristic curve



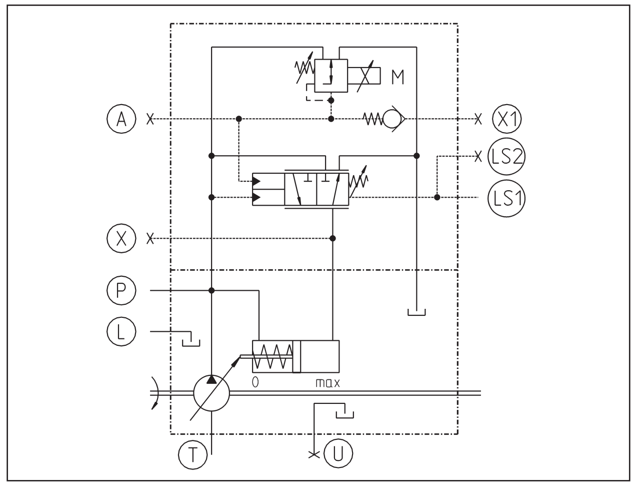
TL2-regulator

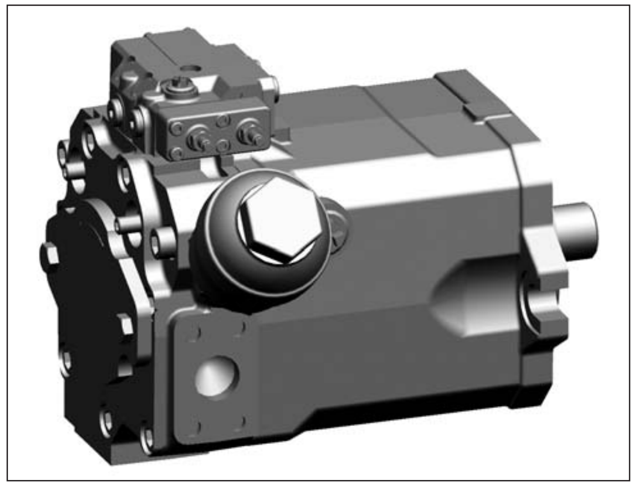


Type of control. LS with electric override

In addition to the load sensing function, the HPR-02 E1L offers electric mode switching override for mode selection and power limit regulation (reduction control). The integration of all functions in the pump regulator enables direct signal transfer without delays. The regulator-specific data are independent of the nominal pump size.

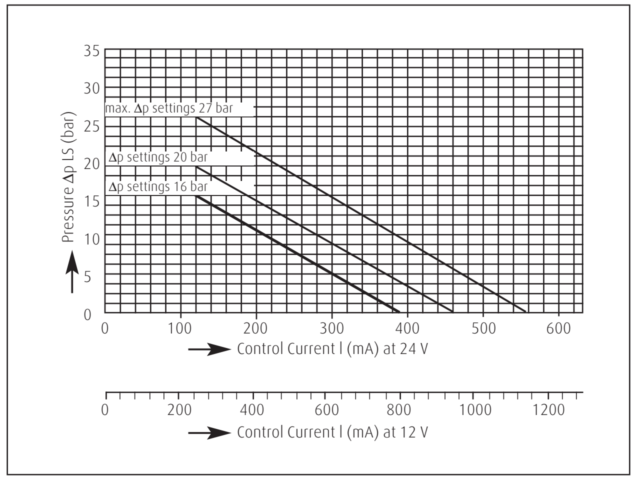
E1L. LS with electric override



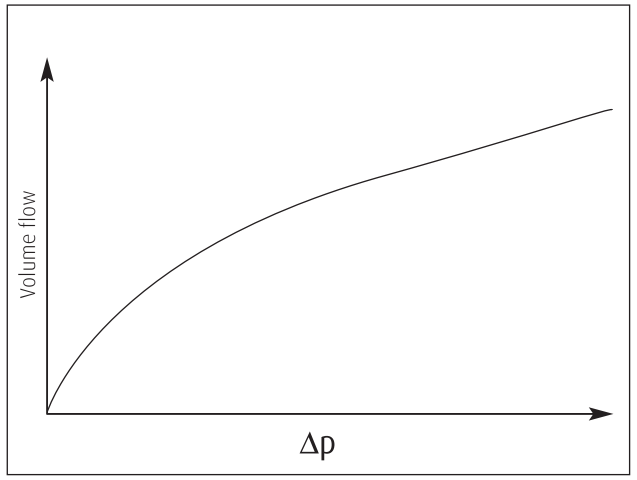


In the event of electric override of the LS-signal, a pressure reducing valve is activated via the proportional solenoid. The control pressure generated in this way acts proportionally against the LS-spring, and the electrical signal is modulated accordingly. This causes the pump to swash back, thereby reducing its output. The operational availability of the pump control which is a typical Linde feature, is based on an additional external control feature for the LS-axis. This ensures that full pump capacity is available in the event of electronic management irregularities. The relationship between control current (I) at the control solenoid and the associated Δp LS value and the dependence of Δp LS of the pump at constant orifice are shown in the following diagrams.

Δp LS-reduction



Pump volume flow at fixed orifice (e.g. directional control valve opening)



Type of control. LS with electric override

Connector type	Hirschmann or AMP Junior Timer, 2-pole
Solenoid voltage	12V or 24V
Supply	from on-board supply system (mobile applications) or external supply (usually stationary applications)
Standard mounting direction	see HPR-02 E1L representation

>> E1L. Mode switching

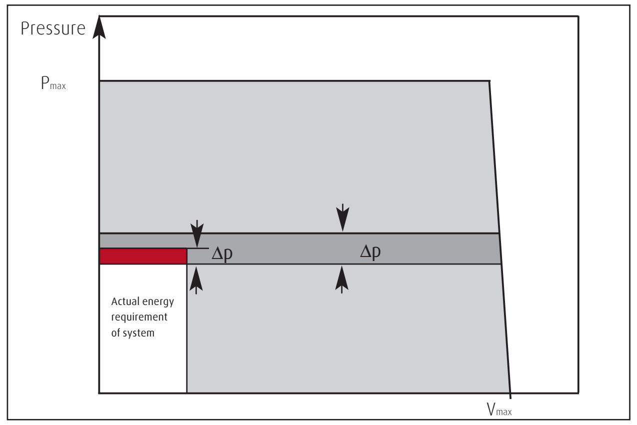
A mode switching (mode selection) modulates electrically the falling Δp LS-signal at an orifice (e.g. directional control valve). The current Δp LS value is reduced proportionally or in steps and the pump output adjusted via the pressure reducing valve (see the diagrams on previous page). In this way the volume flow of the pump can be reduced using the same orifice. In applications with proportional valves this leads to enhanced control resolution, enabling particularly precise and sensitive actuator movement.

In principle, the Δp LS value acting at the LS-pilot can be modulated almost down to zero, whereas modified response times of the pump system should be expected in the operating range near zero.

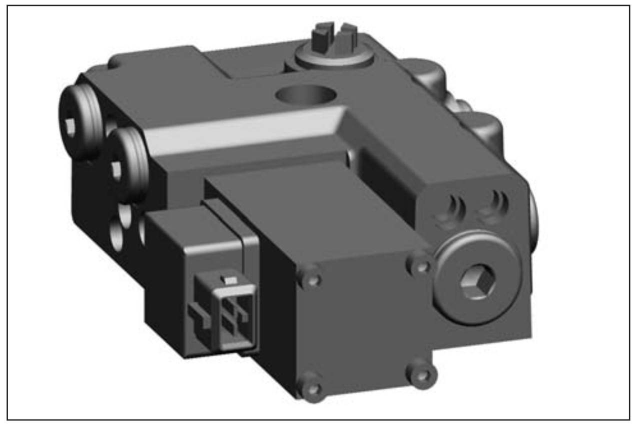
>> E1L. Power limit regulation

Any reduction in the prime mover speed is detected in conjunction with an electronic control unit, and the pump delivery volume is limited through modulation of the Δp LS value to ensure that the maximum power capacity is not exceeded. The volume reduction is the same for all actuators, so that the ratio remains unchanged. The maximum prime mover power is thus available at all times, irrespective of ambient influences and the number of actuators.

E1L-characteristic curve
$\Delta p = \Delta p\ LS_{max}$ with $\Delta p\ LS = f(I)$



E1L-regulator with AMP-connector



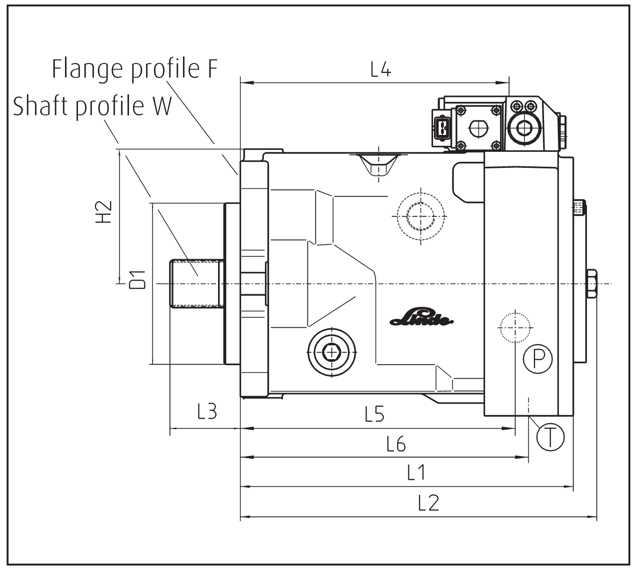
Dimensions. Single Pumps HPR-02

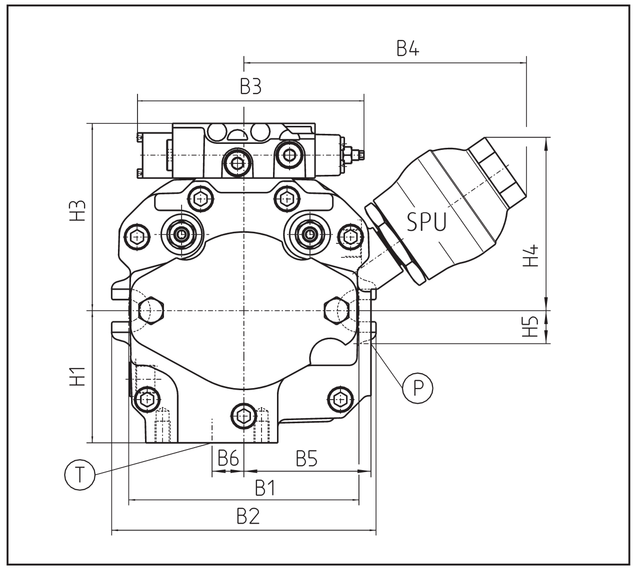
Port sizes and dimensions HPR-02 Single Pumps

Size	55	75	105	135	210
F flange profile	SAE C			SAE D	SAE E
	2-hole mounting flange				4-hole
W shaft profile in accordance with ANSI B92.1	12/24 spline pitch		16/32 spline pitch		
	14 teeth		23 teeth	27 teeth	
D1 [mm]	127			152.4	165.1
B1 [mm]	181			229	225
B2 [mm]	208			256	269
B3 [mm] LP-regulator	140			141	
B3 [mm] E1L-regulator	176			173	180
B4 [mm]	215		222	236	262
B5 [mm] port P	91		100	107	145
B6 [mm] port T	21		25	40	57
H1 [mm]	94		104	120	145
H2 [mm]	93		106	100	135
H3 [mm] LP-regulator	139		142	149	
H3 [mm] E1L-regulator	145		148	155	178
H4 [mm]	147		137	146	145
H5 [mm] port P	24		26	30	27
L1 [mm]	232		262	285	346
L2 [mm]	250		280	303	370
L3 [mm]	55			75	
L4 [mm] SPU	192		215	236	278
L5 [mm] port P	194		218	244	293
L6 [mm] port T	201		227	250	296
P high pressure (SAE)	3/4″		1″	1 1/4″	1 1/2″
T standard (SAE)	1 1/2″		2″	2″	3″
L	M22x1.5			M27x2	
U	M22x1.5			M27x2	

Threads metric as per ISO 6149
Threads for SAE high pressure port metric as per ISO 261
Socket cap screw as per ISO 4762

Further threads on request





Dimensions. Double Pumps HPR D-02 Back-to-Back

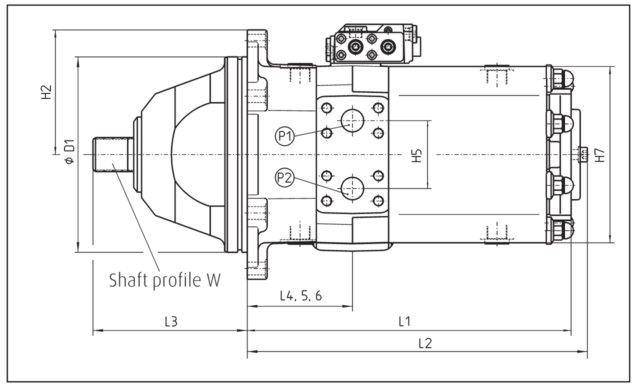
Port sizes and dimensions HPR D-02 Double Pumps

Size	105D	105D	135D
F flange profile	plug-in version	plug-in version	in development
	-	bell housing	
W shaft profile in accordance with ANSI B92.1	16/32 spline pitch		
	23 teeth		
D1 [mm]	216	409.6	
D2 [mm]	-	428.6	
D3 [mm]	-	456	
B1 [mm]	124	120	
B2 [mm]	120		
B3 [mm] LP-regulator	176		
B4 [mm]	222		
H1 [mm]	141		
H2 [mm]	141		
H3 [mm] LP-regulator	144		
H4 [mm]	137		
H5 [mm] port P	75		
H6 [mm] port T	38		
H7 [mm]	196		
L1 [mm]	358	450	
L2 [mm]	376	468	
L3 [mm]	171	79	
L4 [mm]	116	208	
L5 [mm] port P	116	208	
L6 [mm] port T	116	208	
P high pressure (SAE)	2 x 1"	2 x 1"	
T standard (SAE)	1 x 3"		
L	M22x1.5		
U	M22x1.5		

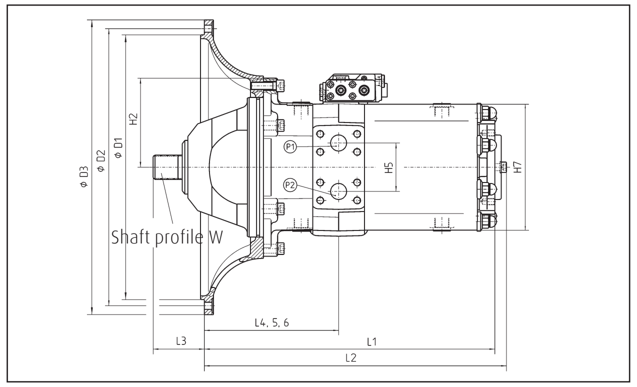
Threads metric as per ISO 6149
Threads for SAE high pressure
port metric as per ISO 261
Socket cap screw as per ISO 4762

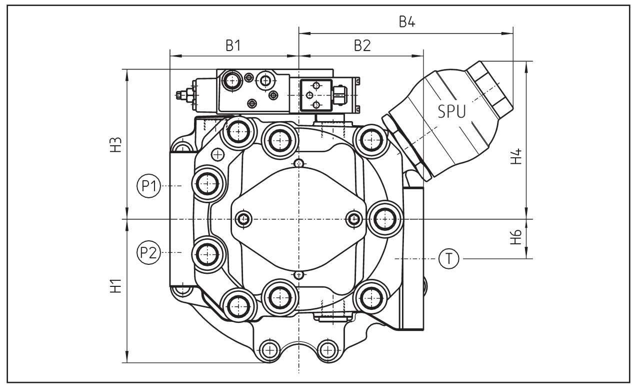
Further threads on request

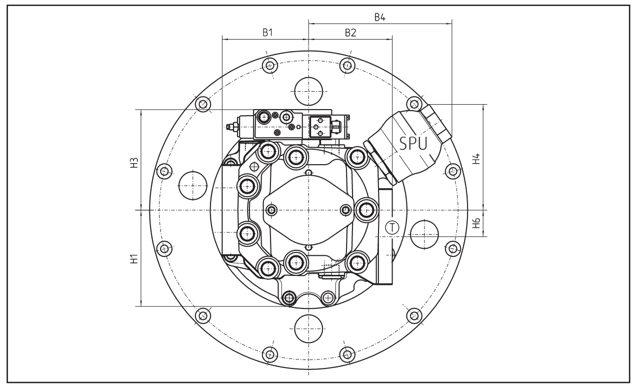
Plug-in version



with SAE bell housing



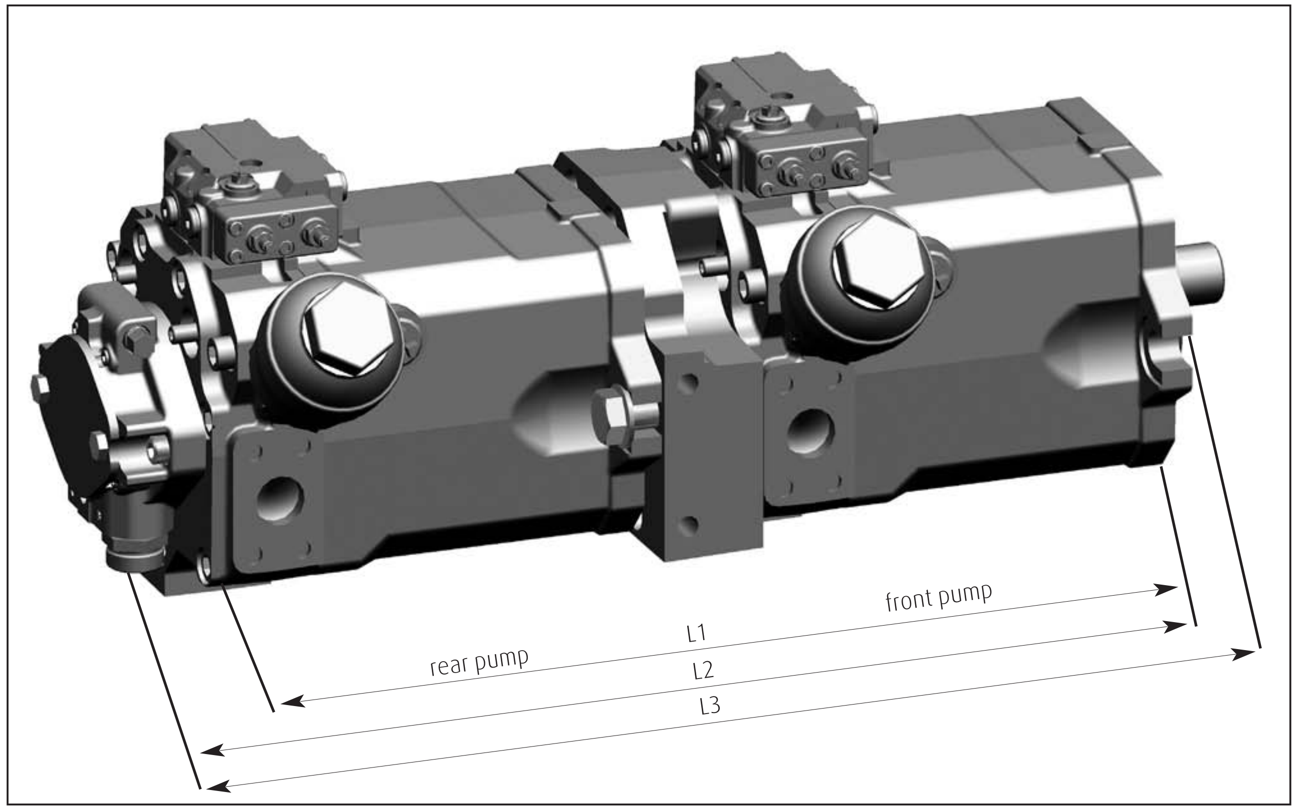




Dimensions. Multiple pumps

Multiple pumps are created by connecting individual pump units in series, with the pumps arranged by capacity. Positioning the gear pump(s) at the end of the tandem ensures optimum space utilisation, output allocation and load distribution. The following table is based on the attached gear pump acting as a pilot pressure pump for the control circuit.

Multiple pump HPR-HPR-02



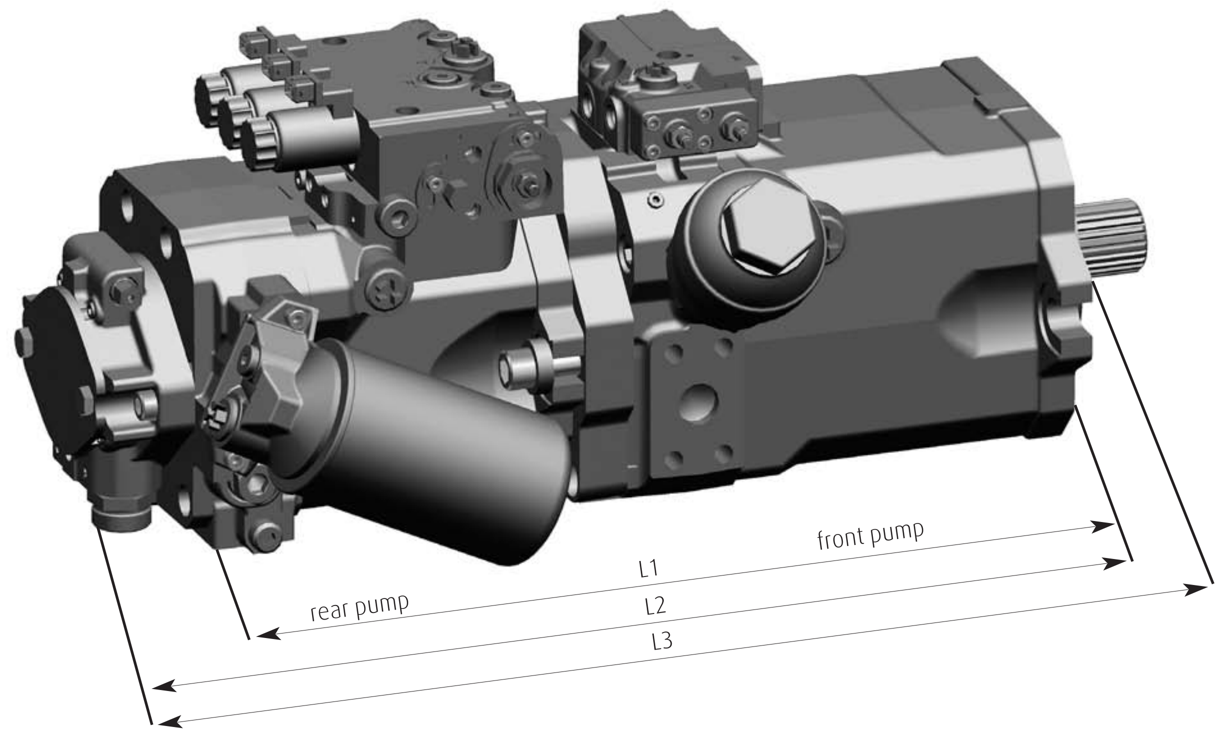
Overall length of multiple pump HPR-HPR-02

Size	Rear pump	HPR 55 with IGP 16 cm³	HPR 75 with IGP 22.5 cm³	HPR 105 with IGP 22.5 cm³	HPR 135 with IGP 22.5 cm³	HPR 210 with EGP 38 cm³
Front pump	Lengths [mm]					
HPR 55	L1	490	-	-	-	-
	L2	547	-	-	-	-
	L3	602	-	-	-	-
HPR 75	L1	501	512	-	-	-
	L2	558	574	-	-	-
	L3	613	629	-	-	-
HPR 105	L1	521	532	562	-	-
	L2	578	594	624	-	-
	L3	633	649	679	-	-
HPR 135	L1	540	551	581	641	-
	L2	597	613	643	651	-
	L3	572	688	718	778	-
HPR 210	L1	601	612	642	691	735
	L2	658	674	704	753	752
	L3	733	749	779	828	827

Dimensions. Multiple pumps

Multiple pumps are created by combining individual pump units in series, with the pumps arranged by capacity. Positioning the gear pump(s) at the end of the unit ensures optimum space utilization, output allocation and load distribution. The following table is based on the gear pump acting as boost pump for the HPV-02 variable pump.

Multiple pump HPR-HPV-02



Overall length of multiple pump HPR-HPV-02

Size	Rear pump	HPV 55 with IGP 16 cm³	HPV 75 with IGP 22.5 cm³	HPV 105 with IGP 22.5 cm³	HPV 135 with IGP 22.5 cm³	HPV 210 with EGP 38 cm³
Front pump	Lengths [mm]					
HPR 55	L1	494	-	-	-	-
	L2	551	-	-	-	-
	L3	606	-	-	-	-
HPR 75	L1	505	522	-	-	-
	L2	562	584	-	-	-
	L3	617	639	-	-	-
HPR 105	L1	525	542	567	-	-
	L2	582	604	629	-	-
	L3	637	659	684	-	-
HPR 135	L1	544	561	586	641	-
	L2	601	623	648	703	-
	L3	676	698	723	778	-
HPR 210	L1	605	622	647	691	733
	L2	662	684	709	753	903
	L3	739	759	784	828	978

Modular system features.

The HPR-02 is based on a modular system and offers the features listed below. This enables our distribution partners to configure the product according to your requirements. The modular system is expanded continuously. Please ask our sales department for the latest characteristics.

- >> Size
- >> V_{max}
- >> Mounting flange
- >> Coupling flange
- >> Drive shaft
- >> Direction of rotation
- >> PTO-direct mounting
- >> Tandem pump
- >> Internal gear pump
- >> External gear pump
- >> Suction internal gear pump
- >> Direction of gear pump suction
- >> PTO-mounting on internal gear pump
- >> Port threads
- >> Silencer SPU
- >> Type of control
- >> Maximum pressure setting
- >> Electrical voltage
- >> Solenoid connector
- >> Arrangement of solenoid connector
- >> Power settings for TL-regulator
- >> Tamper proof for control
- >> Swash speed
- >> Drain port U + L
- >> Surface treatment
- >> Name plate

Your notes.

How to reach us.
Linde Hydraulics. Sales and service partners.

Internet	www.linde-hydraulics.com
Phone	+49.60 21.99-42 01 +49.60 21.99-0 switchboard
Fax	+49.60 21.99-42 02 +49.60 21.99-42 30
Email	info@linde-hydraulics.com
Mail	Linde Material Handling GmbH Linde Hydraulics Grossostheimer Str. 198 63741 Aschaffenburg P.O. Box 100136 63701 Aschaffenburg

LHY.HPR.05/07.e

Linde Hydraulics. Sales companies.

(E) Linde Material Handling Ibérica S. A.
Avda. Prat de la Riba, 181, 08780 Palleja (Barcelona), phone +34.9 36 63 32 32, hidraulica@linde-mh.es

(F) Fenwick Linde, Activité Linde Hydraulique
1, rue du Maréchal de Lattre de Tassigny, 78854 Elancourt Cedex, Telefon +33.1 30 68 46 47, contact.hydraulics@fenwick-linde.fr

(GB) Linde Hydraulics Ltd.
7, Nuffield Way, Abingdon, Oxon OX14 1RJ, phone +44.12 35.52 28 28, enquiries@lindehydraulics.co.uk

(I) Linde Material Handling Italia SPA.
Via Luguzzone, 21020 Buguggiate (VA), phone +39.03 32.877 111, vendita.idraulica@linde-mh.it

(USA) Linde Hydraulics Corporation
P.O.Box 82, 5089 Western Reserve Road, Canfield Ohio 44 406, phone +1.330.5 33 68 01, info@lindeamerica.com

(BR) Linde Hydraulics do Brasil
Rua Anhanguera, 897, Jd. Piratininga - CEP 06230-110, Osasco SP, phone +55.11.36 04 47 56, wilian.jorge@linde-mh.com.br

(VRC) Linde (China) Forklift Truck Corporation Ltd., Division Hydraulics
No. 89 Jinshang Road, 361009 Xiamen, phone +86.592.55 33 291, haas@linde-china.com

Excellence at work.

Linde Hydraulics