7.1.4. Grease Lubricated Type.

Keeping the bearing lubricant in top condition is extremely important in the maintenance of bearings. It is a prerequisite of extended bearing life to replenish grease using the correct grade, quantity and time interval, please do not mix different types of grease.

The reasons for grease replenishment are:

a. Assure the rolling contact surface has no metal to metal contact.
b. Form a lubrication membrane on the rolling contact surface to reduce noise.
c. Purge the motor of old and contaminated grease, please ensure that the grease in the discharge chute is pliable and will allow new grease to enter.
d. The presence of the correct grade and quantity of grease reduces corrosion, protects and seals the bearing and lowers vibration.

7.1.5. Grease replenishment period:

The life of grease varies depending on model, speed, temperature, operational conditions etc., it is, therefore, impossible to determine the exact time interval for replenishment.

However, under normal conditions the greasing interval is shown in Table 3 can be used as a guide.

Bearing Number		Speed(RPM)									
		600	720	750	900	1000	1200	1500	1800	3000	3600
62XX	10	19000	18000	17500	16500	15500	14500	12500	11000	6000	4500
63XX	12	18000	17000	16500	15000	14500	13000	11000	9000	4500	3500
72XX	13	17500	16500	16000	14500	14000	12000	10000	8500	4000	3000
73XX	14	16500	15500	15000	13500	12500	11000	9000	7000	3500	2500
	15	16500	15500	15000	13500	12500	11000	9000	7000	3000	2000
	16	16000	15000	14500	13000	12000	10500	8500	6500	2500	1500
	17	16000	14500	14000	12500	11500	10000	8000	6000	2500	1500
	18	15500	14000	13500	12000	11000	9500	7500	5500	2500	1500
	20	14500	13000	12500	11000	10000	8500	6000	4500		
	22	13500	12000	11500	10000	9000	7500	5500	4000		
	24	13000	11500	11000	9000	8000	6500	4500	3500		
	26	12000	10500	10000	8500	7500	6000	4000	3000		
	28	11500	10000	9500	8000	7000	5500	3500	2500		
	30	11000	9500	9000	7000	6500	4500	3000	2000		
	32	10500	8500	8500	6500	5500	4000	3000	2000		
	34	10000	8000	8000	6000	5500	4000	2500	1500		
	36	9500	7500	7500	5500	5000	3500				
	38	9000	7000	7000	5000	4500	3000				

Bearing Number		Speed(RPM)							
		600	720	750	900	1000	1200	1500	1800
NU2XX	14	14000	12500	12000	10500	9500	8000	6000	4500
NU3XX	15	13500	12000	11500	11000	9000	7000	5500	4000
	16	13000	11500	11000	9500	8500	6500	5000	3500
	17	12500	11000	10500	9000	8000	6000	4500	3000
	18	12000	10500	10000	8500	7500	5500	4000	2500
	20	11000	9500	9000	7000	6000	4500	3000	2000
	22	10000	8500	8000	6000	5500	4000	2500	1500
	24	9000	7500	7000	5500	4500	3500	2000	1500
	26	8500	7000	6500	5000	4000	3000	1500	1000
	28	8000	6000	6000	4500	3500	2500	1000	500
	30	7000	5500	5500	4000	3000	2000	1000	500
	32	6500	5000	5000	3500	2500	1500	500	500
	34	6000	4500	4500	3000	2500	1500	500	
	36	5500	4000	4000	2500	2000	1000	500	
	38	5000	4000	3500	2500	1500	1000	500	
	40	5000	3500	3000	2000	1500	1000		
	44	4000	3000	2500	1500	1000	500		
	48	3500	2500	2500	1000	1000	500		

Table 3.

Remarks:

a. Please refer to lubrication nameplate fitted and follow the recommended schedule stated.

b. The data as shown in Table 3 and/or lubrication nameplates are the maximum recommended intervals under good conditions, please consider site conditions, as a shortening of these periods may be necessary.

7.1.6. Type of grease:

TECO motors can utilise different types of grease including Shell Gadus & Mobil Polyrex EM Grease which has been selected based on the proposed application.

Please check on the lubrication nameplate to confirm the type of grease installed. Please use identical grease when servicing or alternatively lubricants of different brands that have been established as being equivalent in the areas of composition, physical properties and thickeners.

7.1.7. Amount of grease replenishment:

Amount of grease replenishment depends on the type, size and construction and the bearings. For the maximum quantity used in one replenishment of each bearing, as a guide, please refer to Table 4.

Please refer to lubrication nameplate fitted and follow the recommended quantity stated.

7.1.8. Key points to note with grease filling:

Filling method for grease relief type bearing.

Use a good quality grease gun to pump grease through the grease nipple into the bearings. The old contaminated grease is forced to drain out of the discharge chute. While greasing it is recommended that the greasing procedure is undertaken whilst the motor is running. The discharge outlet may not be visible on some models, grease should be pumped in at the recommended quantity and the sound of bearing should return to normal. It is advisable to grease when the motor is operating as old grease is expelled more easily.

Bearing No.		Amount of replenishment	Bearing No.		Amount of replenishment
62XX 72XX NU2XX 222XX	6210	30g	63XX 73XX NU3XX 223XX	6310	40g
	6212	40		6312	60
	6213	50		6313	80
	6214	50		6314	80
	6215	60		6315	100
	6216	60		6316	100
	6217	80		6317	120
	6218	80		6318	120
	6220	100		6320	160
	6222	120		6322	220
	6224	120		6324	270
	6226	140		6326	300
	6228	160		6328	400
	6230	180		6330	450
	6232	200		6332	500
	6234	250		6334	600
	6236	300		6336	700
	6238	350		6338	800
	6240	400		6340	900
	6244	450		6344	900
	6248	500		6348	900

Table 4.

*Fill new grease until it displaces the old grease completely.

Do not grease the motor whilst it is at standstill. If there is a draw-out device for grease, draw out the used grease after greasing, please leave excess grease on the rake as this will further protect the exit port from moisture entry.

WARNING

Stay clear of rotating parts while relubricating motor when it is in operation.

7.1.9. Temperature of bearing.

Temperature of the bearing will rise slightly, but this is temporary while greasing and will return to normal a few minutes after greasing. Brief temperature variations are of no concern, grease should be pumped in sparingly to avoid excess temperatures being experienced.

7.1.10. Selection of grease gun.

There are two types of grease gun. High pressure lever type and hand press type. As the hand press type has a lower force, grease replacement will take more time. Greasing can be achieved quickly by using a lever type gun, however, care should be taken to adjust the pressure and rate to avoid excessive grease entry which may enter the motor’s interior.

7.2. NOISE OF BEARING.

a. Normal noise.

Noise is congenital to movement of the bearing. Generally bearing noise that has a continuous rhythm with no sudden change is normal.

b. Abnormal noise.

It is difficult to detect the early stages of bearing failure with the human ear. It takes a lot of experience and a sharp ear to detect abnormal noise. Any sudden change in bearing noise should be investigated. Motors with roller bearings at the drive end can emit more rotational noise than a ball bearing and it is normal to hear skating/skidding of the rolling elements.

7.3. VIBRATION.

If the vibration of the bearing is unusually high, please test with vibroscope. The preferred level for vibration should be below 2.8mm/sec. If the values exceed this figure, an investigation should be undertaken to find and rectify the problem.

7.4. REGULAR INSPECTION.

7.4.1. Regular monthly inspection.

Grease replenishment (refer to Section 7.1) and the motor lubrication plate.

7.4.2. Regular yearly inspection.

It is important to undertake regular inspection every year when the machine is out of service for maintenance.

7.4.3. Inspection Notes.

a. Electrical etching.

When there are dark spots on bearing surface or outside the face of outer ring and / or inside face of bearing housing, please check with a microscope to see if they look like pock marks or fish scales which could be the result of electrical etching due to poor installation etc.

b. Motors on VVVF Drives.

All TECO motors are suitable for running on VVVF drives, however, this does depend on the application, kilowatt demand and speed range. TECO recommend that when motors of 280/315 frame and above be fitted with at least an insulated bearing at the non drive end and rotor grounding brush fitted at the drive end, this is not categorical that this feature must be fitted, purely a recommendation based on TECO's experience, please consult with the engineering specification whether the motor supplied requires this feature.

c. Precision of installation.

The degradation of the bearing may be the result of misalignment due to sinking foundations etc, after the motor has been in use for a long period. Regularly check and record the alignment of couplings, and make adjustments as necessary.

CAUTION

The bearing is a high precision component, it is important to avoid ingress of dust, moisture and foreign matter. A hammer or similar object must not be used during the cleaning and installation of the bearing.

Chapter 8: Troubleshooting.

8.1. FAULT FINDING & RECOGNITION

Kind of Fault	***Symptom***	***Cause***	***Remedy***
Fail to start without load	Motionless And soundless	Power-off	Consult power company
		Switch-off	Switch-on
		No fuse	Install fuse
		Broken wires	Check wires and repair
		Broken lead	Check leads and repair
		Faulty winding	Check winding and repair
	Fuse blowing – (Circuit Breaker trips off, slow start with electromagnetic noise	Short circuit	Check circuit
		Incorrect wiring	Check wiring
		Poor contact in circuit switches	Check and repair
		Broken wiring	Check and repair
		Poor contact of starting switch	Check and repair
		Incorrect connection of starting switch	Check and repair
Overload after start	Fuse blowing – Fail to restart due to circuit breaker tripping	Insufficient capacity of fuse or breaker	Replace fuse or breaker
		Overload	Lighten load
		High load at low voltage	Check circuit capacity and reduce load

Kind of Fault	***Symptom***	***Cause***	***Remedy***
Overload after start	Overheating of Motor	Overload or Intermittent Overload	Lighten Load
		Under-voltage	Check circuit capacity and power source
		Over-voltage	Check power source
		Ventilation duct clogged	Remove the foreign matter in the duct
		Ambient temperature exceeds 45^0C	Lower ambient temperature
		Friction between rotor and stator	Repair
		Fuse blowing (Single phase rotating)	Install the specified fuse
		Poor contact of circuit switches	Check and repair
		Poor contact of starting switch	Check and repair
		Unbalanced three phase voltage	Check circuit or consult power company
	Speed falls sharply	Voltage drop	Check circuit and power source
		Sudden overload	Check machine
		Single phase rotating	Check circuit and repair
	Switch overheat	Insufficient capacity of switch	Replace switch
		High load	Lighten load

Kind of Fault	***Symptom***	***Cause***	***Remedy***
Overload after start	Bearing Overheat	Misalignment between motor and load	Re-align
		Not enough grease	Fully purge bearings with grease
		High bearing noise	Replace damaged bearing
Noise	Electro-magnetic noise induced by electricity	Occurrence from first operation	Check noise not normal
		Sudden sharp noise and smoking	Short circuit of windings. Repair.
	Bearing noise	Not enough grease	Fully purge bearings with grease
		Deterioration of grease	Clean bearing and re-grease
		Excessive noise	Replace the damaged bearing
	Mechanical noise caused by machinery	Loose belt sheaf	Adjust key and lock the screw
		Loose coupling	Adjust the position of couplings and tighten
		Loose screw	Tighten screw
		Fan rubbing	Adjust fan position

Kind of Fault	***Symptom***	***Cause***	***Remedy***
Noise	Mechanical noise caused by machinery	Rubbing as a result of ingress of foreign matter	Clean motor interior and ventilation ducts
		Wind noise	Noise induced by air flowing through ventilation ducts
		Induced by conveyance machine	Repair machine
Vibration	Electro-magnetic vibration	Short circuit of windings	Repair
		Open circuit of rotor	Repair
	Vibration	Unbalanced rotor	Repair
		Unbalanced fan	Repair
	Mechanical vibration	Broken fan blade	Replace fan
		Un-symmetrical centres between belt sheaf	Align central points
		Central points of couplings do not lie on the same level	Adjust the central points of couplings on the same level
		Improper mounting installation	Lock the mounting screw
		Motor mounting bed is not strong	Reinforce mounting bed

Remarks:

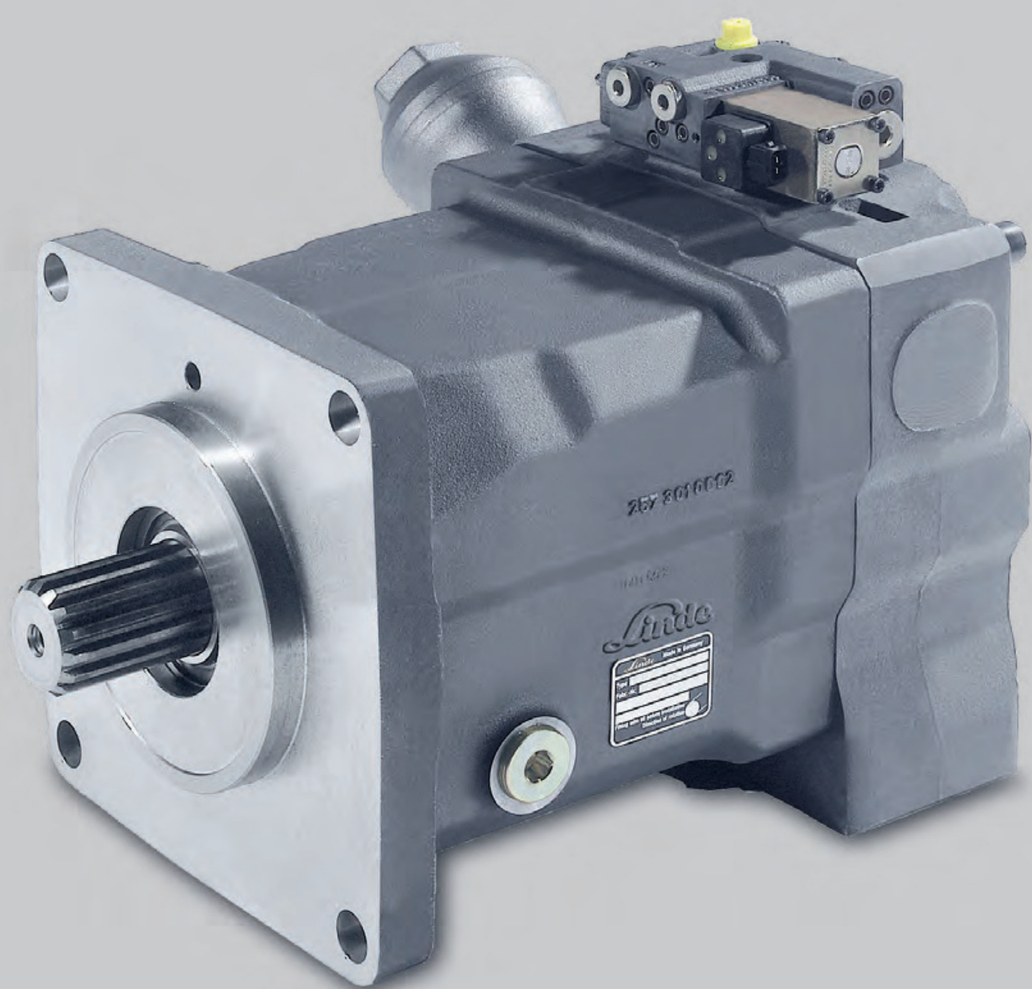
i. Circuit switches: This includes knife switch, electromagnetic switch, fuse and other connection switches etc.

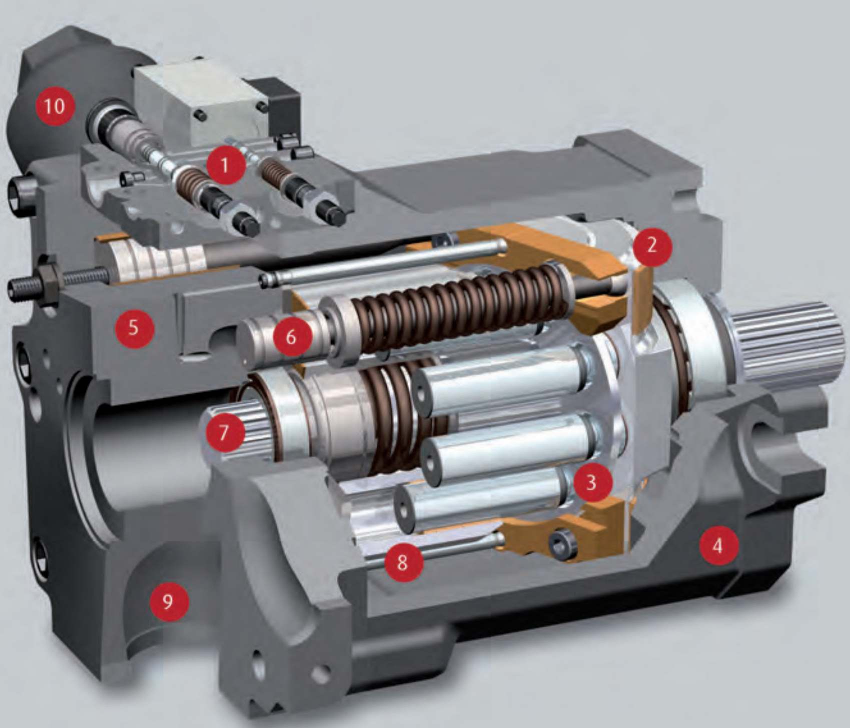
ii. Starting switches: This includes Delta-Star starter, compensate starter, reactance starter, resistor starter, starting controllers etc.

APPENDIX D7: HPU PUMP

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

Linde Hydraulics





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

2 **swash plate**
hydrostatic bearing

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

4 **housing**
one-piece design for high rigidity

5 **valve plate housing**
highly integrated

6 **two control pistons**
servo-controlled swash plate

7 **power take-off**
for mounting of additional pumps

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

9 **suction channel**
optimized suction capacity
without tank pressurization

10 **SPU**
reduced pressure pulsation
over the entire operating range

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
>> optimal interaction with Linde LSC-directional control valves and LinTronic
>> compact design
>> high power density
>> high pressure rating
>> high reliability
>> long working life

Linde Hydraulics product range

Find the right products for your application.

Product range

Product		Application	Linde product name
Pump	Self-regulating pump	open loop operation	HPR-02
	Variable pump	closed loop operation	HPV-02
Motor	Variable motor	closed and open loop operation	HMV-02, CMV
	Regulating motor	closed and open loop operation	HMR-02
	Fixed motor	closed and open loop operation	HMF-02, CMF
		open loop operation	HMF-02 P
		closed and open loop operation	HMA-02
Valve technology	LSC manifold plate	open loop operation	VT modular
	Monoblock	open loop operation	Monoblock
Electronics	Electronic control unit	closed and open loop operation	iCon
	Software	diagnosis and configuration	LinDiag®

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.

General technical data.

Overview of technical data

Rated size				55	75	105	135	165	210	280	105D	125D	165D
	Max. displacement		cc/rev	55	75.9	105	135.7	165.6	210.1	281.9	210	250	331.2
Speed	Max. operating speed Without tank pressurization*		rpm	2700	2500	2350	2300	2200	2100	2000	2450	2400	2100
Volume flow**	Max. oil flow		l/min	148.5	189.8	246.8	312.1	364.3	441.2	563.8	514.5	600.0	695.5
Pressure	Nominal pressure		bar	420	420	420	420	420	420	420	420	380	420
	Max. pressure***		bar	500	500	500	500	500	500	500	500	420	500
	Perm. housing pressure		bar	2.5									
Torque**	Max. input torque Max. oper. pressure and Vmax		Nm	368	507	702	907	1107	1404	1884	1245	1245	1964
Power**	Corner power (theoretical) at nominal pressure & max. operating speed		kW	104.0	132.8	172.7	218.5	255.0	308.8	394.7	319.4	337	431.8
Response times Measured at fluid viscosity 20 cSt and input speed 1500 rpm	V_{max} -> V_{min} Swashing at constant max. system pressure HP	HP 100 bar	ms	120	120	120	140	150	200	300	200	140	150
		HP 200 bar	ms	70	70	70	70	130	170	270	170	120	130
	V_{min} -> V_{max} Swashing from stand-by pressure and zero flow to system pressure HP	HP 100 bar	ms	180	180	180	180	180	180	430	160	180	180
		HP 200 bar	ms	160	160	160	160	160	160	350	160	160	160
Permissible shaft loads	Axial		N	2000									
	Radial		N	on request									
Permissible housing temp.	Perm. housing temp. With min. perm. viscosity > 10 cSt		°C	90									
Weights	HPR-02 without Oil (approx.)		kg	39	39	50	65	89	116	165	96	113	177
	Max. moment of inertia		$kgm^2 x 10^{-2}$	0.79	0.79	1.44	2.15	3.41	4.68	8.34	2.88	2.95	6.88

*) Higher rotating speed by tank pressurization or swash angle reduction. See <<Suction speed>>
**) Theoretical data of a single unit without efficiency effects
***) Highest transient pressure, that can temporarily occur

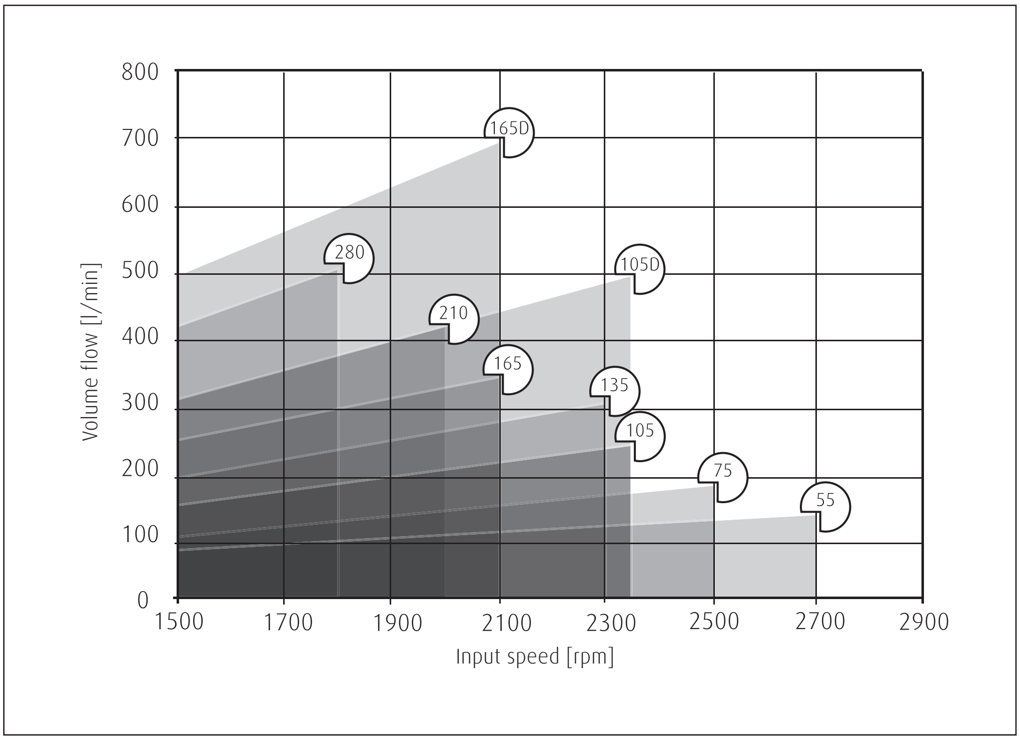
Standard Linde-name plate

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.

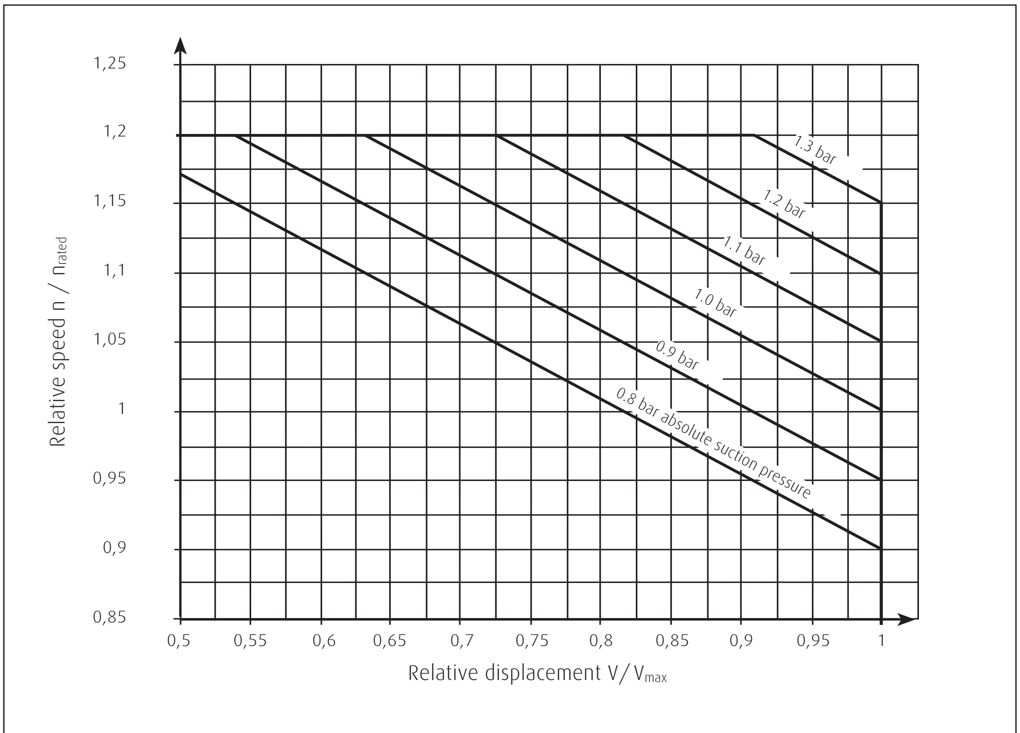
Type	HPR 105-02	Series 02 self-regulating pump, rated size 105
	R	Right hand rotation
	2683	The last 4 figures of the Bill of Material
Serial-No.	H2X	
	254	Type number of HPR 105-02
	T	Letter indicating year of production
	12345	Serial Number
Part No.	12345678	Free text field for up to 15 characters

General technical data.

Selection diagram



Suction speeds



Operational parameters. Life time recommendations

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. Tank connection, filtration, mounting orientation

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.

Filtration

High purity oil can extend the service time of the hydraulic system significantly. 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.

>> 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

Mounting orientation

The preferred mounting orientation is generally horizontal. Pump configurations for vertical mounting with the shaft pointing upwards have an additional drain port "R" at the mounting flange. These units are available with certain combinations of features and have to be requested separately.

For further information concerning the installation of the unit please refer to the operating instructions manual.

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 51524-2
>> Biodegradable fluids in accordance with ISO 15380 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 [mm^2/s] = [cSt] at 40 °C
approx. 30 to 40	22
approx. 40 to 60	32
approx. 60 to 80	46 or 68

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. SPU silencer

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

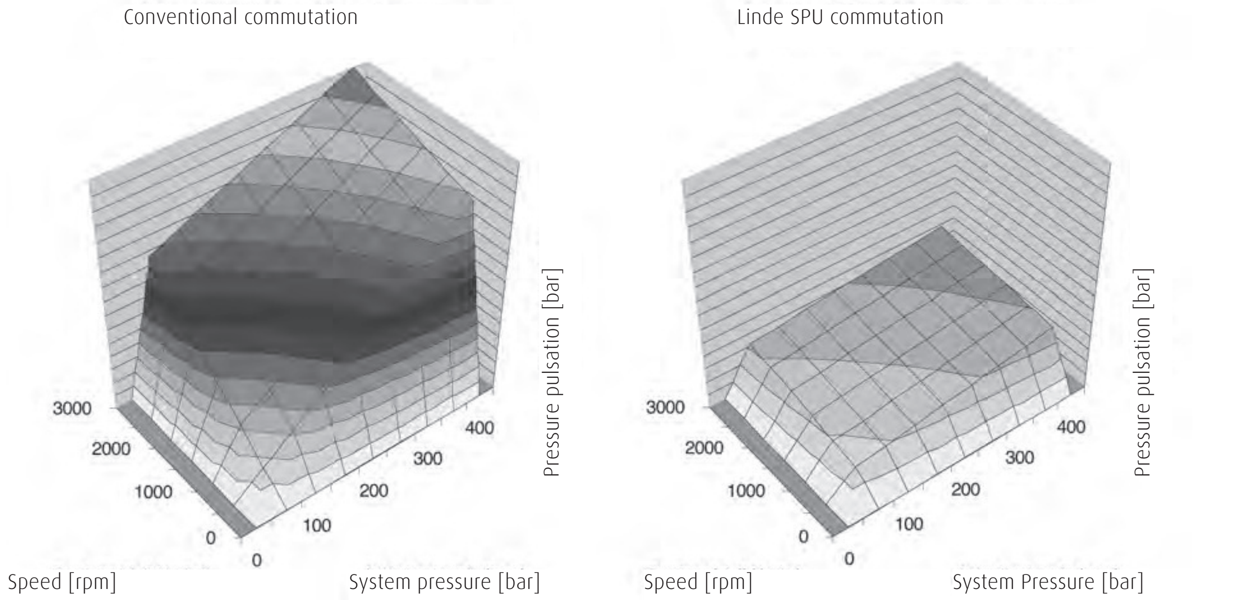
Noise Generation

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

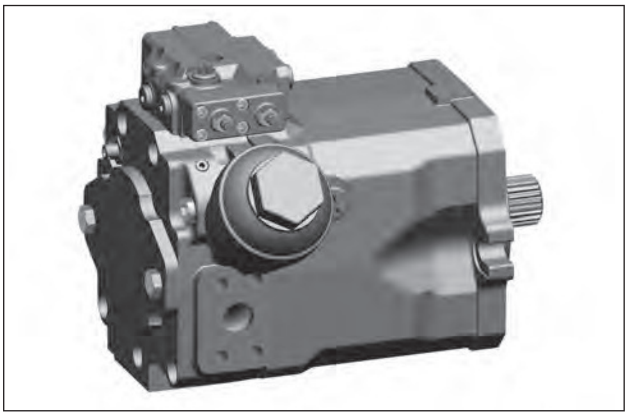


Noise reduction. SPU silencer

SPU silencer function

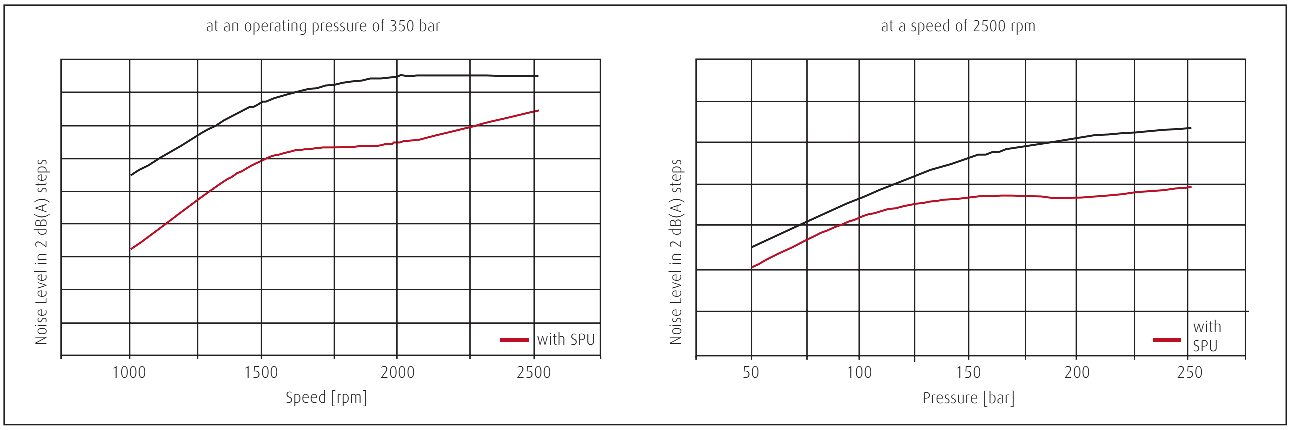
- >> Reduction of pressure pulsations over the entire operating range
- >> Reduction of noise emission by approx. 50 % (equals approx. 3 dB(A))
- >> Reduction of volume flow fluctuations
- >> No impairment of efficiency
- >> Ready for use immediately, no maintenance required
- >> Simple and rugged design
- >> Minimum increase in weight and volume

HPR-02 with SPU



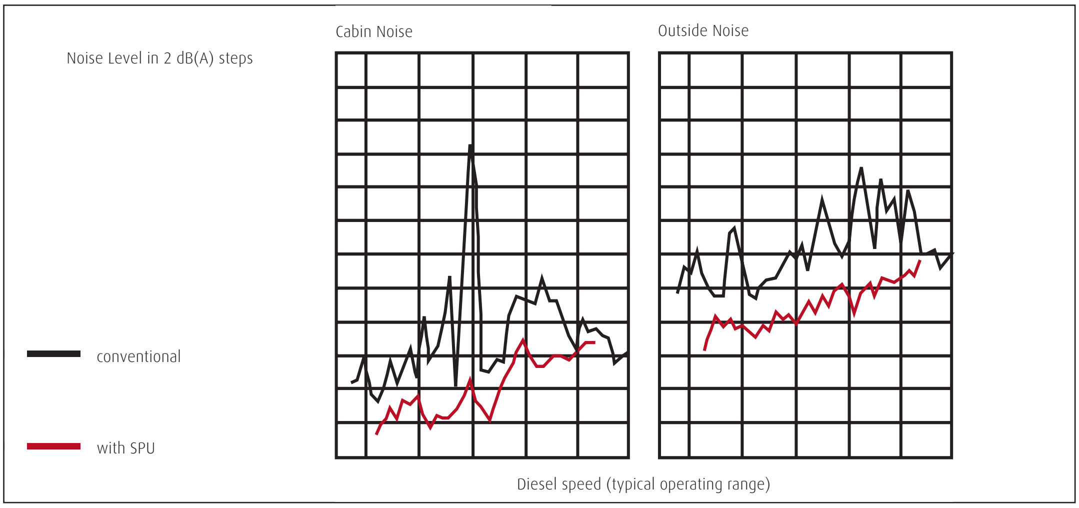
The following diagrams illustrate the immediate effect of pulsation level reduction via SPU on the sound pressure level and therefore the perceived noise emission.

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



Comparison of resulting noise emission

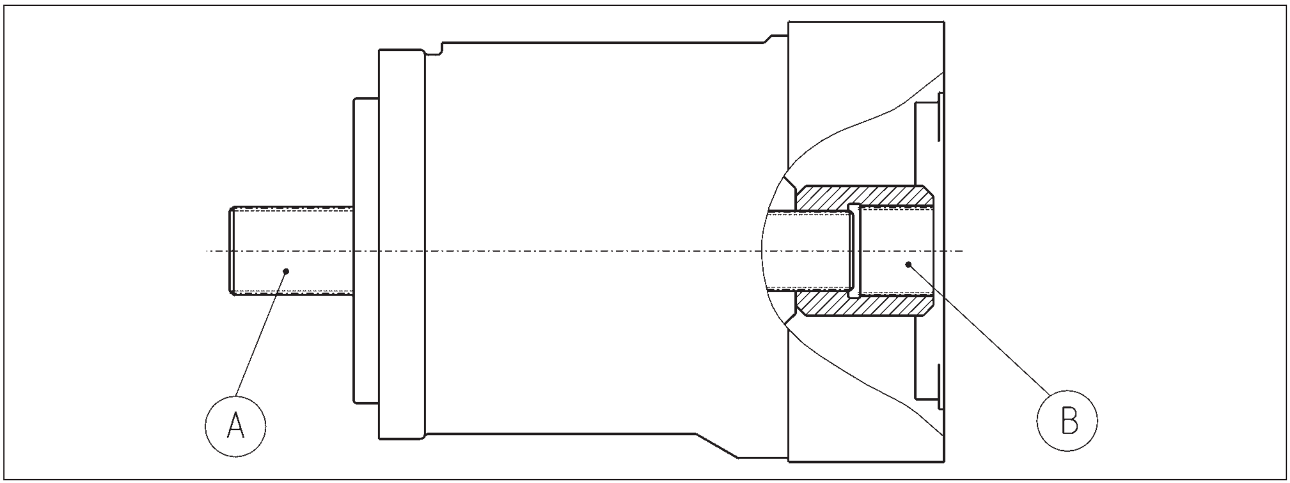
Shown in 2 dB(A) steps over a typical diesel engine operating speed range.



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

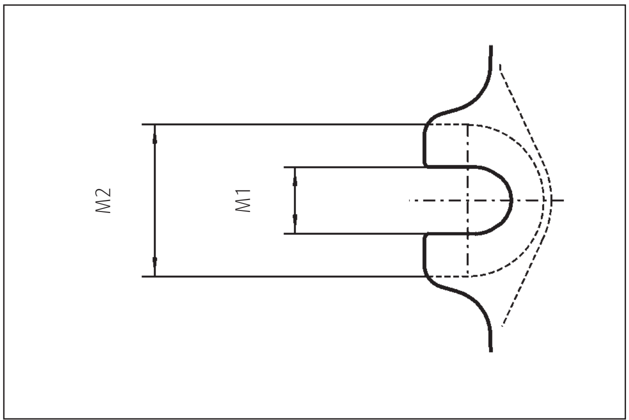
>> mounting flange and drive shaft (A)

>> PTO flange and through shaft (B)

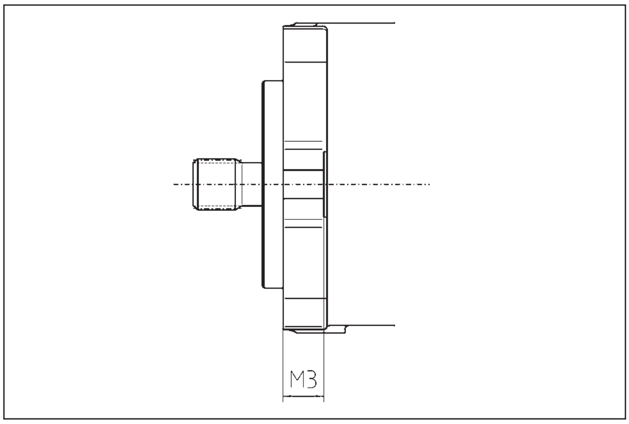
A) Flange profile

Bolt hole dimensions		Rated size HPR-02								
		55	75	105	135	165	210	105 D	280	165 D
M1 inside diameter	mm	17.5	17.5	17.5	21.5	21.5	22	17.5	22	17.5
M2 outside diameter	mm	34	34	40	40	40	-	40	-	-
M3 bolt hole length	mm	20	20	20	20	25	26	20	30	25

Bolt hole diameter



Bolt hole length

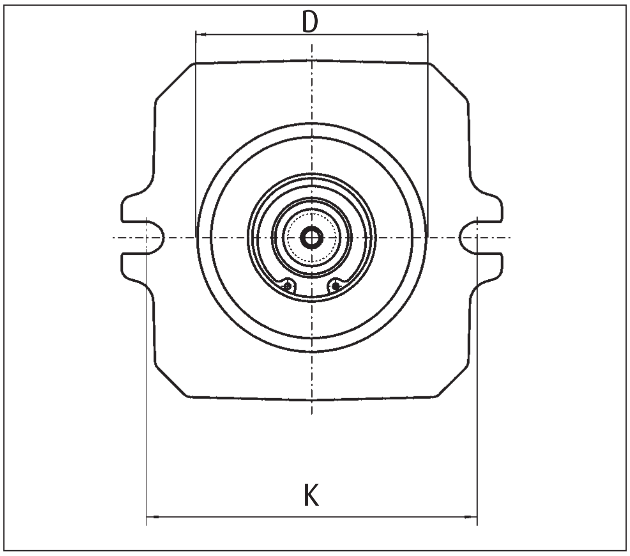


Torque transmission. Mounting flange

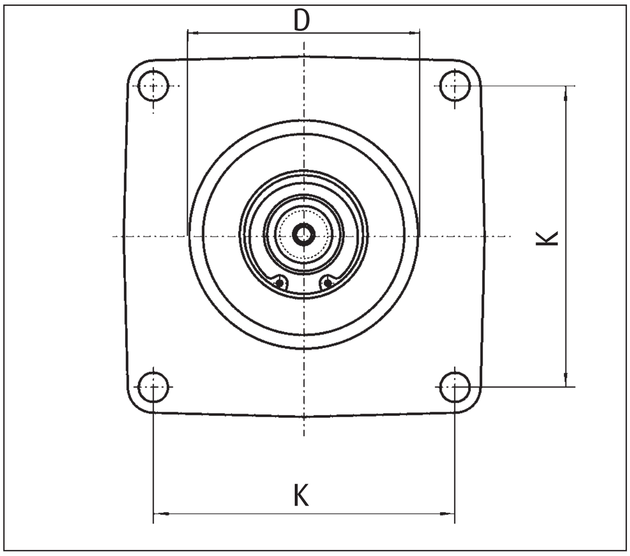
Mounting flange in accordance with SAE J744	For rated size	Mounting				Dimensions				
		Washer	Screw	Torque (8.8) [Nm]	Torque (10.9)* [Nm]	K [mm]	D [mm]	H [mm]	V [mm]	G [mm]
SAE C, 2 hole	55, 75, 105	17x33x10	M16	195	275	181.0	127	-	-	-
SAE C, 2 hole with 4 additional threads M12	105	17x33x10	M16	195	275	181.0	127	-	-	114
SAE C, 2 hole with 4 additional holes (d=10.5 mm)	105D	17x33x10	M16	195	275	181.0	127	178	178	-
SAE D, 2 hole	135	21x37x8	M20	385	540	228.6	152.4	-	-	-
SAE D, 2 hole with 4 additional threads M16	135	21x37x8	M20	385	540	228.6	152.4	-	-	138
SAE D 2 hole with additional bolt holes (d=17.5 mm)	165 & 165D	21x37x8	M20	385	540	228.6	152.4	230	190	-
SAE E, 4 hole	210 & 280	-	M20	385	540	224.5	165.1	-	-	-

*) Option for standard design, necessary for tandem units

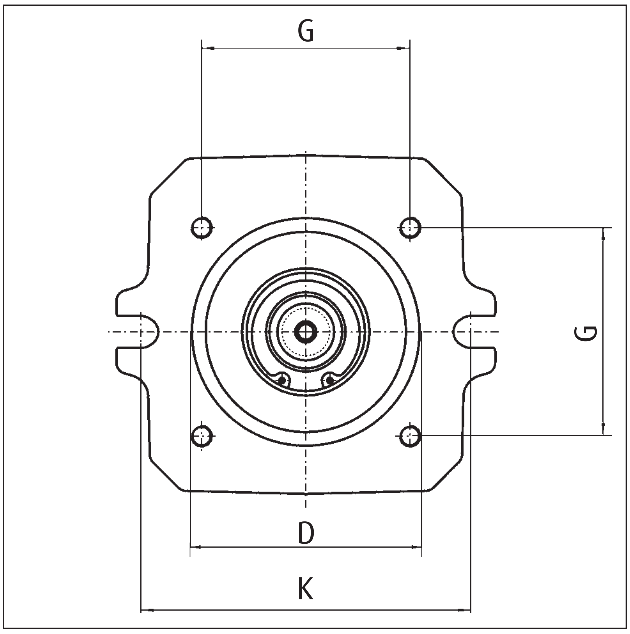
2-hole flange



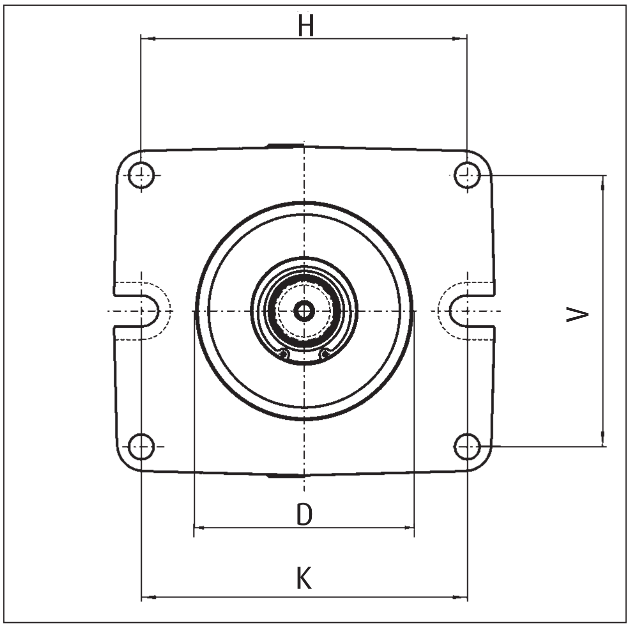
4-hole flange



2-hole flange with 4 additional threaded holes



2-hole flange with 4 additional bolt holes



Torque transmission. Drive shaft

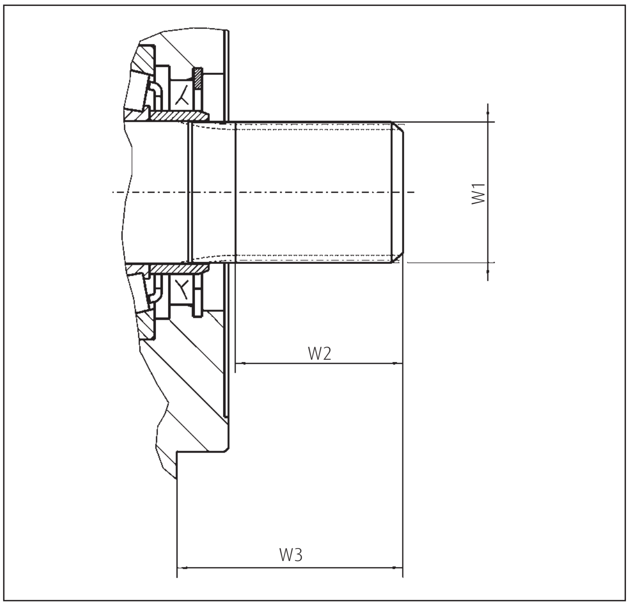
A) Dimensions drive shafts

Shaft spline (in accordance with ANSI B92.1)	SAE-J744 Code (for centring and shaft)	Outside diameter W1 [mm]	Useable spline length W2 [mm]	Shaft type	Available for rated size								
					55	75	105	105D	135	165	165D	210	280
12/24, 14 t	C	31.22	30	2	x	x	x	-	-	-	-	-	-
16/32, 21 t		34.51	39.5	1	-	x*	-	-	-	-	-	-	-
12/24, 17 t	C-C	37.68	30	2	-	-	x	x	x	-	-	-	-
16/32, 23 t		37.68	38.5	1	-	-	x*	x	-	-	-	-	-
8/16, 13 t	D, E	43.71	50	2	-	-	-	-	x	x	x	-	-
16/32, 27 t		44.05	62	1	-	-	-	-	x	x*	x	x	-
8/16, 15 t	F	50.06	58	1	-	-	-	-	-	-	-	x*	x

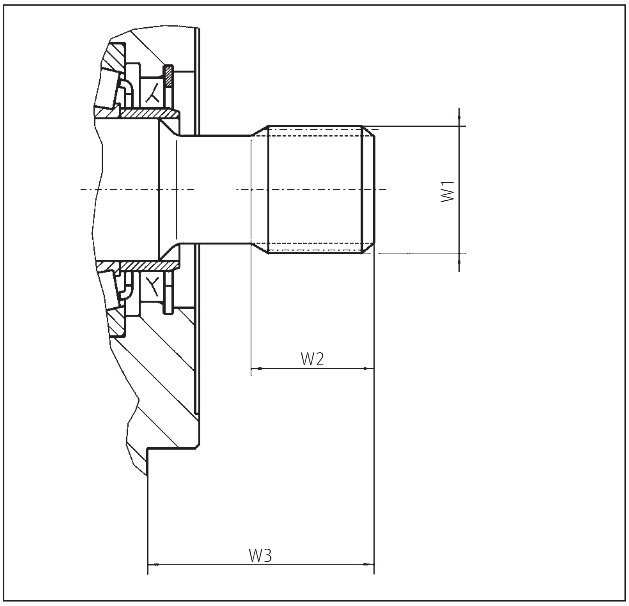
*) Recommended for tandem configurations

A) Linde Hydraulics shaft types

Type 1. Without undercut



Type 2. With undercut



Rated size		55	75	105	105D	135	165	165D	210	280
Excess length W3	mm	54	55	55	61.3	75	75	75	75	75

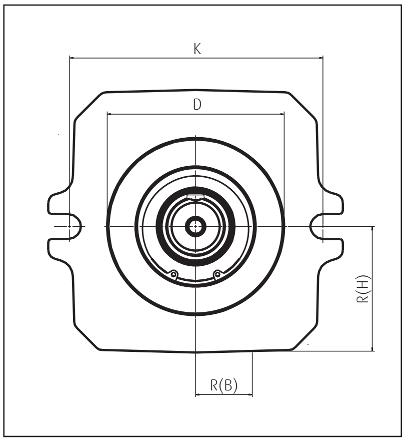
Torque transmission. Pumps according to ISO 3019-2 and SAE J617a

The previously given information and dimensions refer to pumps according to ISO 3019-1 (SAE J 744). In addition to that, certain configurations are available according to ISO 3019-2. These units offer an additional drain port "R" at the mounting flange for upright installation and a keyed drive shaft.

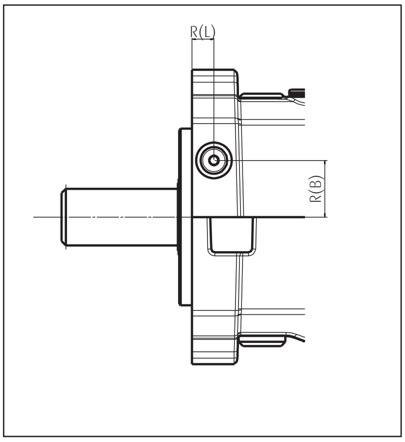
Rated size		105	280
Mounting flange		125A2SW	224B4SW
Mounting		2-hole	4-hole
Screw hole diameter	M1	17.5	22
Screw contact surface	M2	40	40
Clamping length	M3	30	30
Centring	D	125	224
Mounting hole distance	K	180	198
Shaft diameter	W1	40	60
Key acc. to DIN 6885	W2	12x8x80	18x11x100
Excess length	W3	92	115
Height	W4	23	53
Port R	Size	M14x1.5 13 deep	
	Position	bottom, as port "T"	side, as port "U"
	R(L)	15.5	15
	R(H)	approx. 80	50
	R(B)	40	152

>> Further dimensions and position of the other ports, see <<Dimensions. Single pumps HPR-02 for TL2, LEP, ETP>>

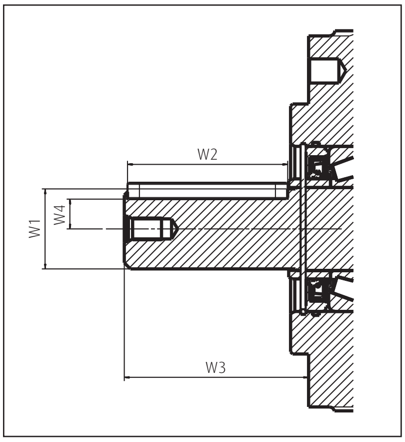
Detailed shaft view



View on R



Mounting flange



Linde HPR pumps can be delivered matching a flange according to SAE J617a. The pumps are therefore equipped with an adaptor. Depending on the rated size, the base unit is a standard HPR-02 or a plug-in type HPR-02. The plug-in-flange is shown in section <<Dimensions. Double pumps and plug-in pumps>>.

According to SAE J617a	Rated size	Base unit
SAE 3	105, 105D, 135	plug-in
SAE 3	165, 165D	SAE D 2-hole with 4 additional bolt holes
SAE 4	105, 105D, 135	plug-in
SAE 5	55, 75, 105	SAE C 2-hole

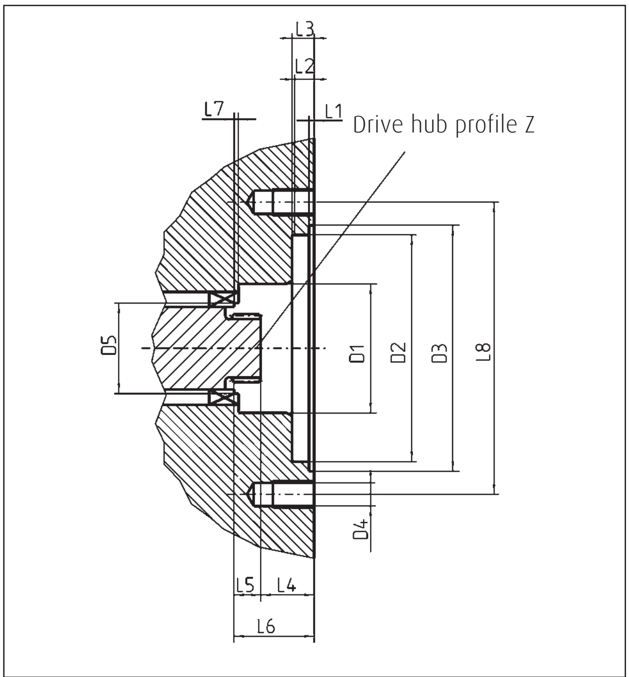
Torque transmission. PTO through drive

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	165	210	280
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 23 t	16/32, 24 t	16/32 27 t
D1	mm	47	47	48	54	55	63	72
D2 spigot pilot diameter	mm	82.55						
D3	mm	89.5						
D4		M 10						
D5 max. bearing clearance	mm	30	35	38	43	42	46	51
L1	mm	1.5				1.9	1.9	1.9
L2 adapter length	mm	7				8	8	8
L3	mm	9						
L4 minimum distance	mm	35	39	33	35	57.8	46	47.5
L5 usable spline length	mm	18	18	24	15.8	24.4	29.5	39
L6 distance to bearing	mm	48	48	52.7	54.2	83.3	46	86
L7 min. bearing clearance	mm	3				5		0.7
L8 hole distance 2-hole	mm	106.4						

B) Dimensions PTO



Torque transmission. PTO flange and output shaft

Beside the combination of the HPR with other HPRs or HPVs to create multiple and tandem units (see section <<Dimensions. Multiple pumps>>), single HPRs can be prepared ex works for the combination with other pumps. Depending on the rated size, we offer different centrings for the rear pump. A matching coupling muff for the drive shaft can also be selected. Currently, the following combinations are available. For more information about the output torque, see annotations to table at chapter <<General technical data>>.

B) PTO mounting possibilities

Centring symbol acc. to SAE J 744	Coupling muff, acc. to ANSI B92.1	Rated size						
		55	75	105	135	165	210	280
Directly mounted Linde gear pumps		X	X	X	X	X	X	X
A	without	X	X	X	X	X	X	X
A	16/32 9 t (A)	X	X	X	X	X	X	-
A	16/32 11 t	-	-	-	-	-	X	-
A	16/32 13 t	-	-	X	X	-	X	X
B	without	X	X	X	X	X	X	X
B	16/32 13 t (B)	X	X	X	X	X	X	X
B	16/32 15 t (B-B)	X	X	X	X	-	-	X
C	without	X	X	X	X	X	X	X
C	12/24 14 t (C)	X	X	X	X	X	X	X
C	16/32 21 t	-	X	X	X	-	X	-
C	16/32 23 t	-	-	X	X	X	X	-
D	without	-	-	-	X	X	X	X
D	8/16 13 t (D)	-	-	-	X	-	-	-
D	12/24 17 t	-	-	-	X	-	-	-
D	16/32 27 t	-	-	-	X	X	X	-
E	without	-	-	-	-	-	X	X
E	16/32 27 t	-	-	-	-	-	X	-

B) Output shaft transfer torque

Rated size		55	75	105	135	165	210	280
Continuous transfer torque	Nm	219	302	418	540	659	836	1122
Max. transfer torque	Nm	433	598	763	1069	1069	1655	2221

Gear pumps.

The gear pumps are available in two designs. Internal gear pumps (IGP) and external gear pumps (EGP). Both types can be used for the control circuits as well as the cooling circuit. The suction is always external for both types, when used in combination with a HPR-02. The internal connection of the IGP is closed.
Internal gear pumps offer a cold start valve and a PTO interface for mounting further pumps. The possible combinations of IGPs and EGPs are determined by PTO option and the permitted shaft torque.

Overview gear pumps

Displacement	cc/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					
Max. perm. operating pressure Observe max permissible rated pressures for filter and cooler	bar	40	210	40	165	275	220
Supply pressures min.	bar	0.8 (absolut)					
Supply pressures max.	bar	3.0 (absolut)					
Cold start relief valve		integrated	-	integrated	-	-	-

>> Port names clockwise rotation: A pressure port, B suction port (as shown)

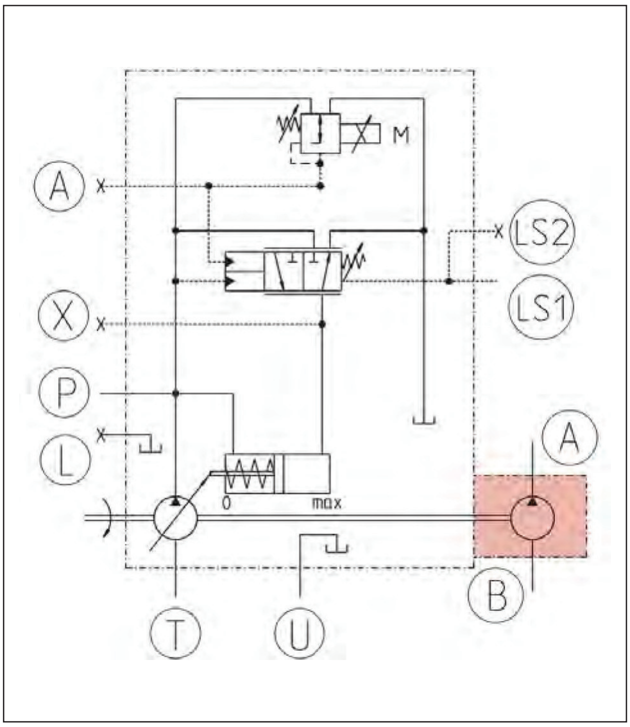
>> Port names counter-clockwise rotation: A suction port, B pressure port (not shown)

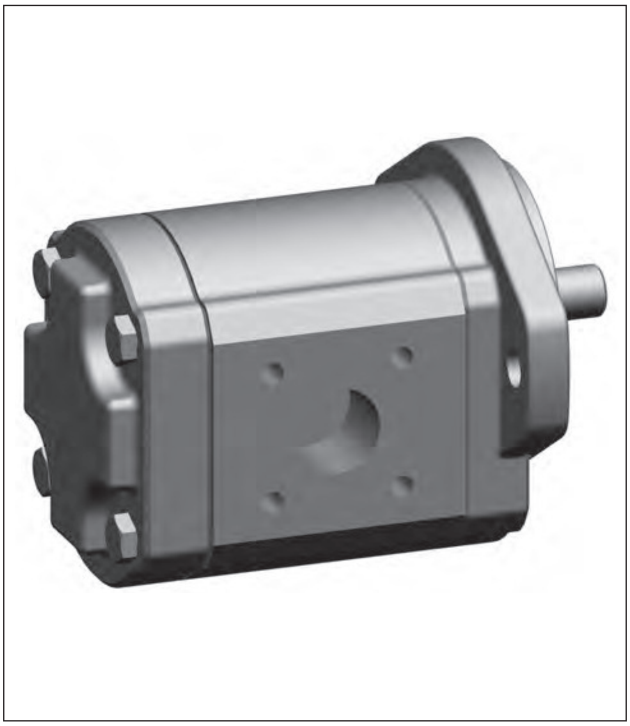
>> Ports according to ISO 6149-1

>> Alternatively DIN 3852-1

>> Suction port of the IGP according to ISO 8434-1 L28

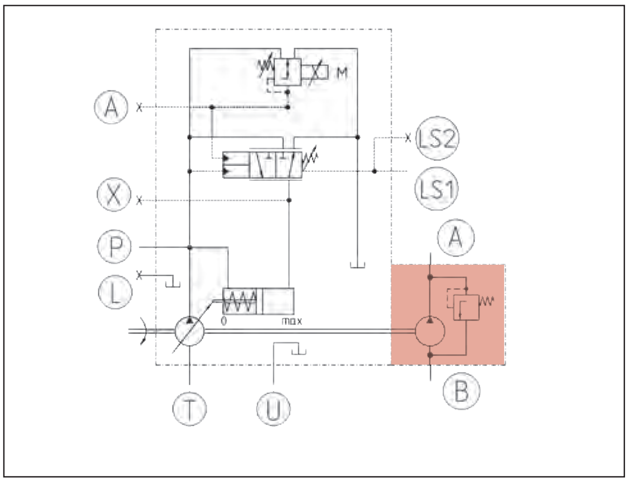
External gear pump EGP

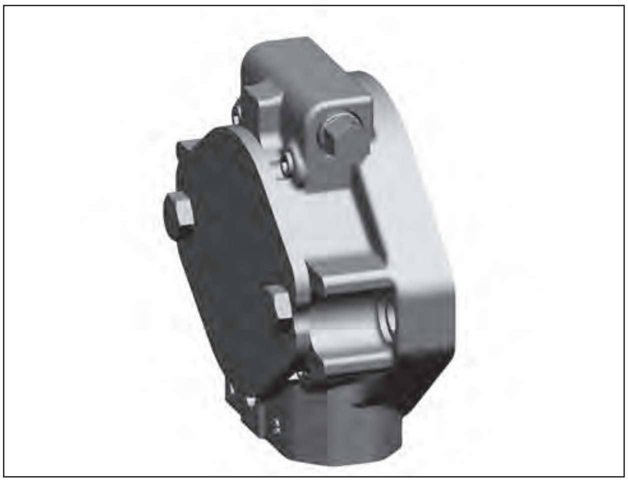




Gear pumps.

Internal gear pump IGP with external suction

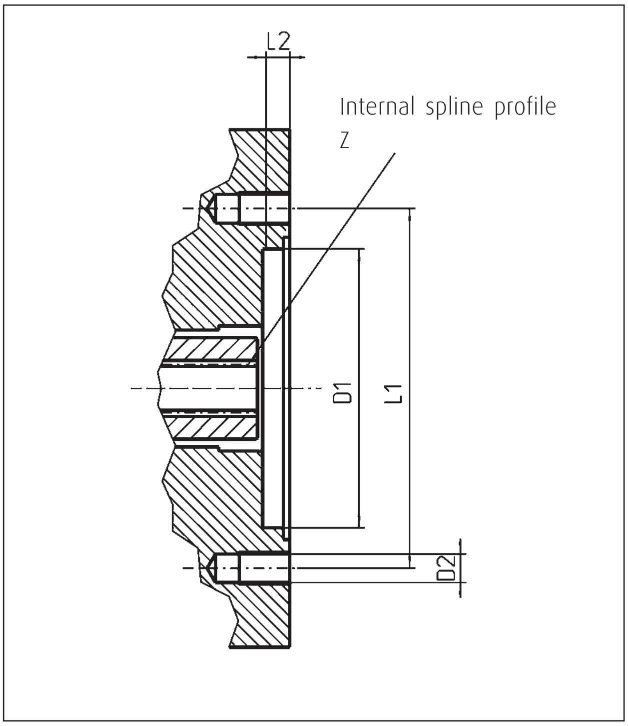




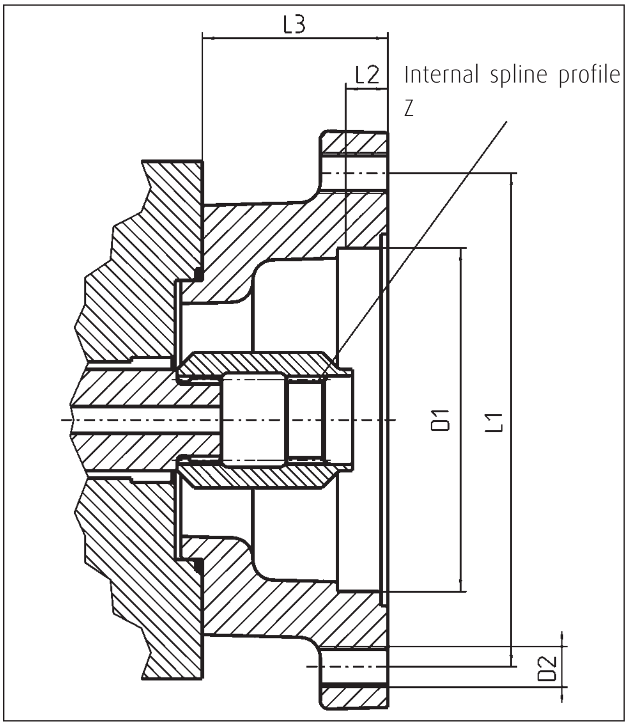
PTO flange with IGP

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		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



Controllers.

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

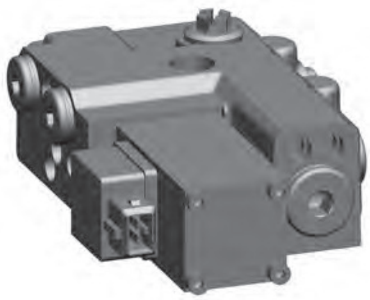
Technical data

Type of regulation	Additional function	Swashplate position feedback	Name
Load Sensing	With pressure cut-off	without	LP
	with ΔpLS override	without	E1L/H1L
	with hyperbolic power limiting	with	TL2
	electro-proportional flow limitation and pressure cut-off	with	LEP
Control	electro proportional flow setting, power limitation and pressure cut-off	with	ETP

Controllers without swashplate position feedback.
Mounting on the port plate housing

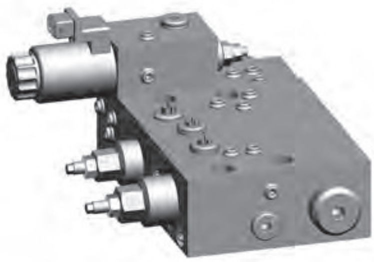

LP-controller

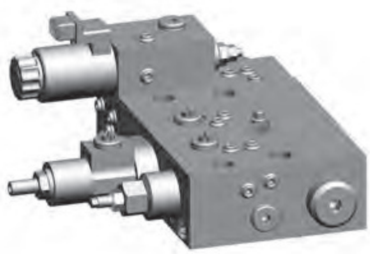

H1L-controller


E1L-controller

Controllers with swashplate position feedback.
Mounting on the pump housing


TL2-controller

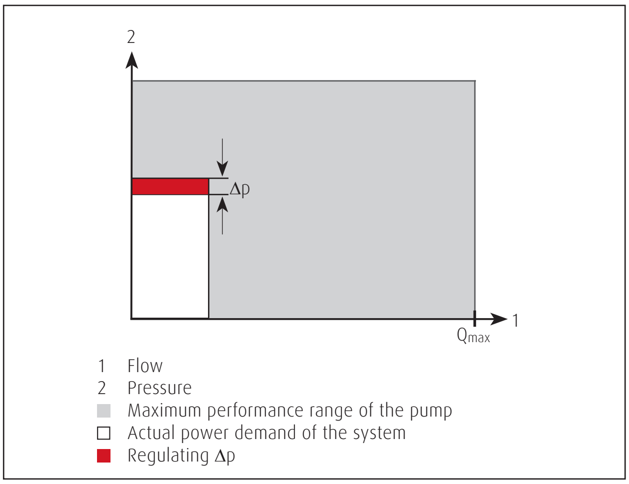

LEP-controller


ETP-controller

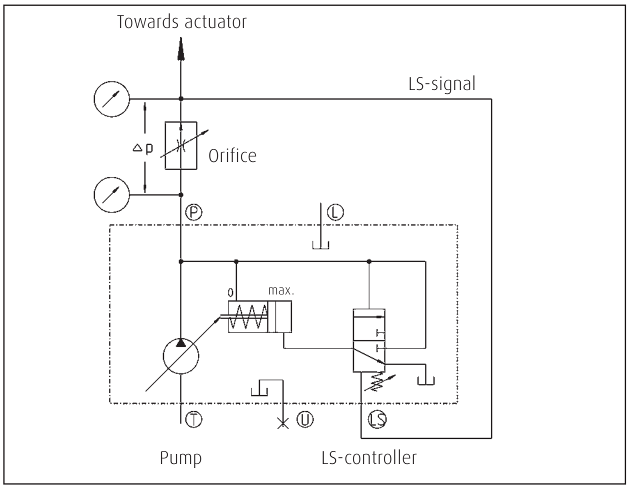
Controllers. LS. Load Sensing

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 controller of the hydraulic pump.

Load Sensing. Flow on demand control



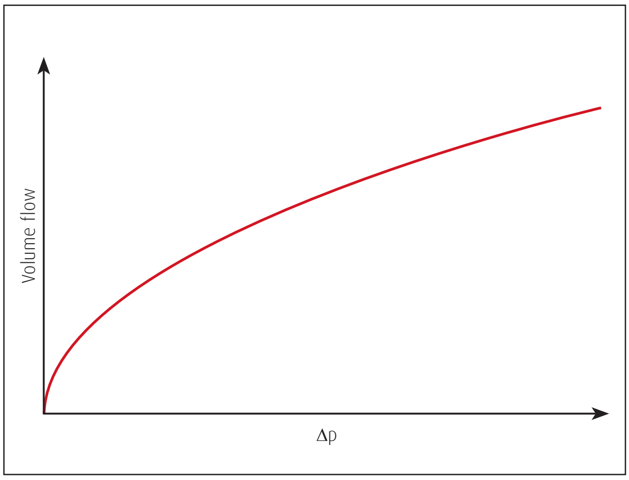
Self-regulating pump with LS-controller and measure orifice (in valve)



A pressure gradient is set at the controller, 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-controller, 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

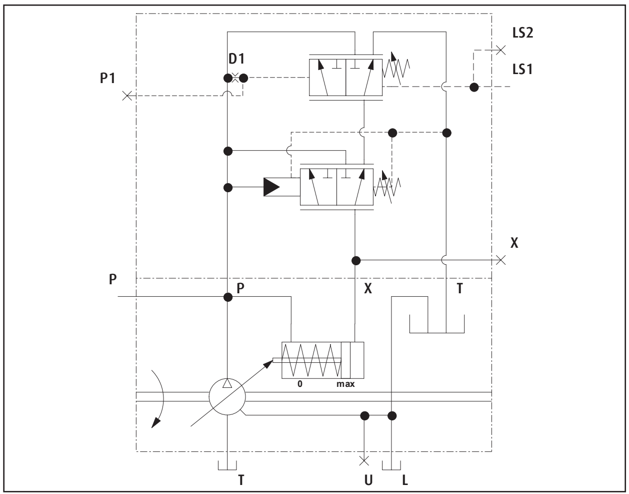
Demand-oriented pump control offers the following benefits

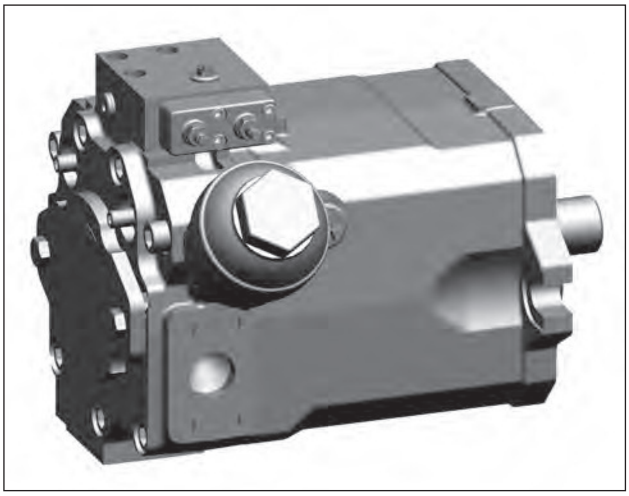
- >> Load-independent machine control
- >> Minimum heat generation
- >> Increased pump service life
- >> Low noise generation in the whole system
- >> Fewer components for the control mechanism
- >> Lower energy consumption, particularly with partial volume flow

Controllers. LP. Load Sensing with hydraulic pressure cut-off

In addition to the load sensing function the LP-controller offers maximum pressure limitation. Once the system pressure reaches the set pressure of the pressure cut-off valve, the LS-controller 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

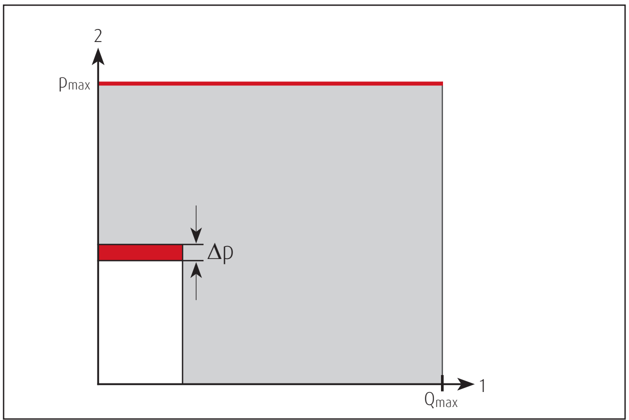




The maximum pressure cut-off valve prevents prolonged operation of pressure relief valves installed in the hydraulic system for protection. This has the following benefits for the hydraulic system:

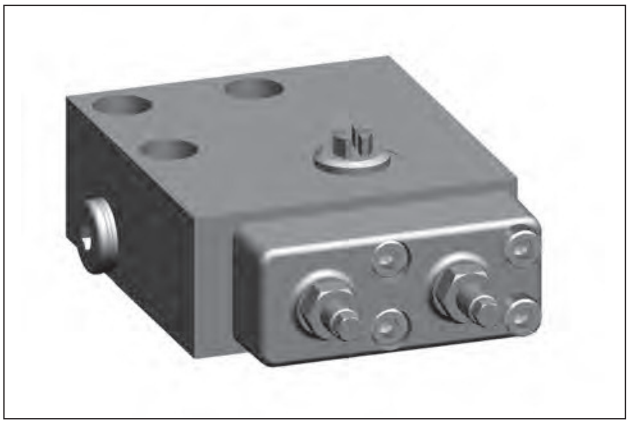
- >> Operating pressure is maintained
- >> No operation in the overload range
- >> Any operating point under the power curve remains accessible
- >> Demand-oriented volume flow generation
- >> Minimum power loss
- >> Reduced heat and noise generation
- >> Longer service life of the pump and the entire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

LP-characteristic curve



1 Flow
2 Pressure
Maximum performance range of the pump
Actual power demand of the system
Regulating Δp
Pressure cut-off characteristic

LP-controller



Possible maximum pressure control setting ranges

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

Controllers. E1L/H1L. Load Sensing with electric / hydraulic override

In addition to the load sensing function, HPR-02 pumps with H1L or E1L controllers offer the possibility of overriding the Δp LS-signal hydraulically or electrically. This enables a so called mode control for selecting different operating points or enables a power limit regulation (underspeed control). The integration of all functions in the pump controller enables direct signal transfer without delay. The controller-specific data are independent of the nominal pump size.

Possible applications of the LS signal override

>> Mode-control

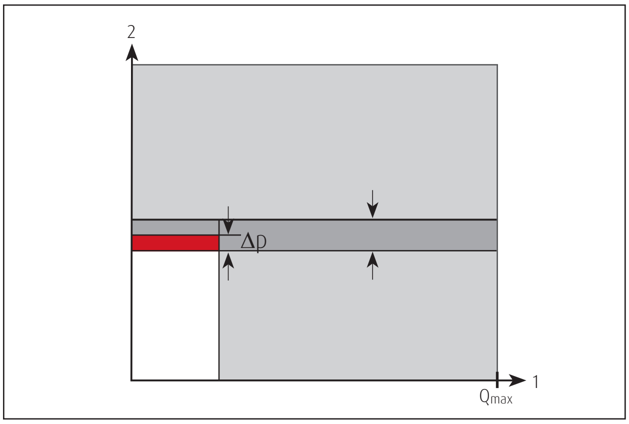
A mode control (mode selection) modulates electrically the Δp LS-signal at an orifice (e.g. directional control valve). The current Δp LS value is reduced proportionally or in steps and the pump output adjusted via the pressure reducing valve (see the diagrams on following pages.) In this way the volume 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.

>> Power limit regulation

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

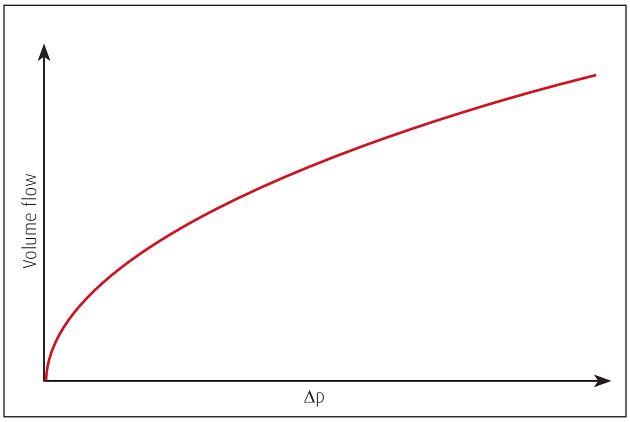
In principle, the Δp LS value acting at the LS-pilot can be modulated down to zero, whereas modified response times of the pump system should be expected in the operating range near zero.

E1L/H1L-characteristic curve



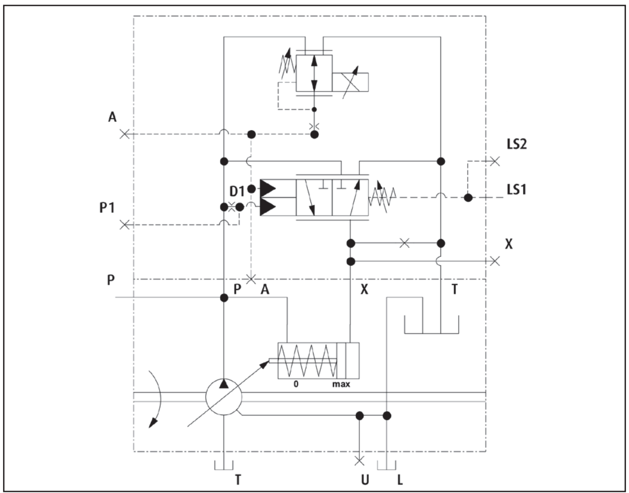
1 Flow
2 Pressure
- Maximum performance range of the pump
- Actual power demand of the system
- Mechanical Δp basic setting
- Effective, modulated regulating Δp

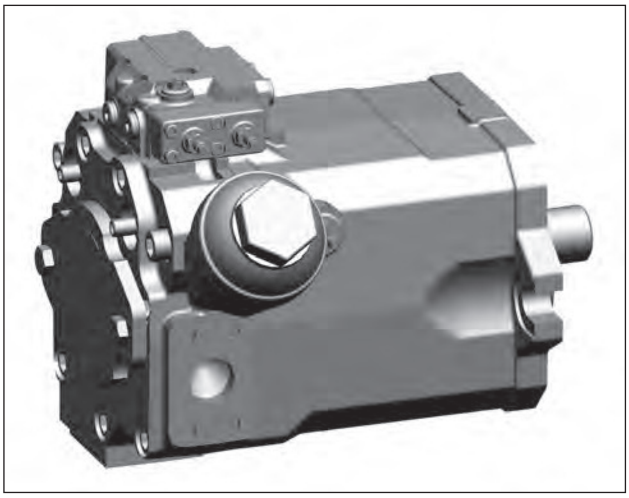
Pump volume flow at fixed orifice (e.g. directional control valve opening)



Controllers. E1L. Load Sensing with electric override

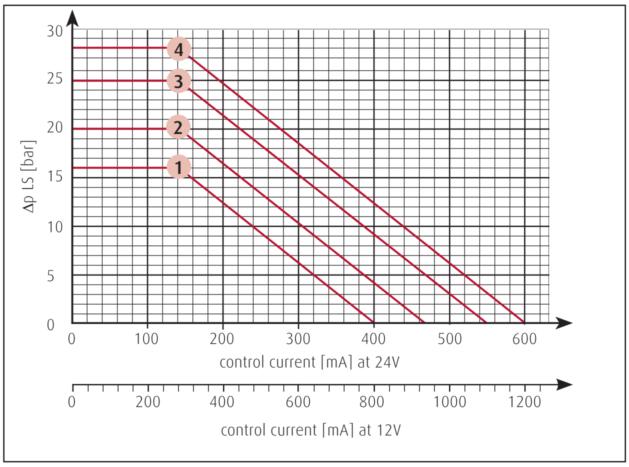
In addition to the load sensing function, the HPR-02 E1L offers an electric override for mode selection and power limit regulation (underspeed control). The integration of all functions in the pump controller enables direct signal transfer without delays. The controller-specific data are independent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





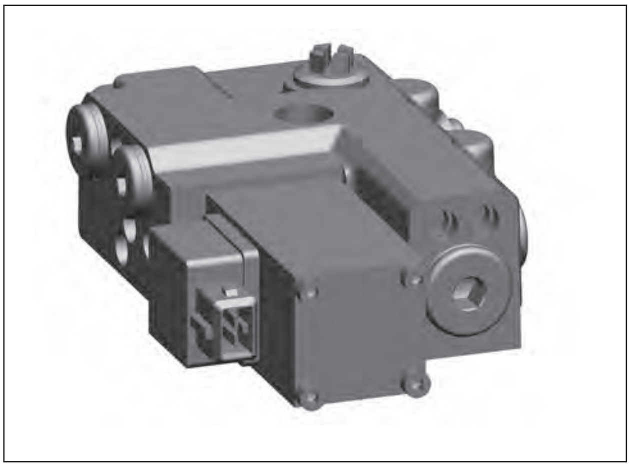
In the event of an electric override of the LS-signal, a pressure reducing valve is activated via the proportional solenoid. The control pressure generated in this way acts proportionally against the LS-spring, and the effect of the Δp LS signal is modulated accordingly. This causes the pump to swash back, thereby reducing its output. The function between control current (I) at the control solenoid and the associated Δp LS value is shown in the diagram. At the port "A", the control pressure can be picked up and forwarded to an H1L controller at another HPR pump, which follows the first pump with the E1L controller (master-slave-operation).

Δp LS-reduction



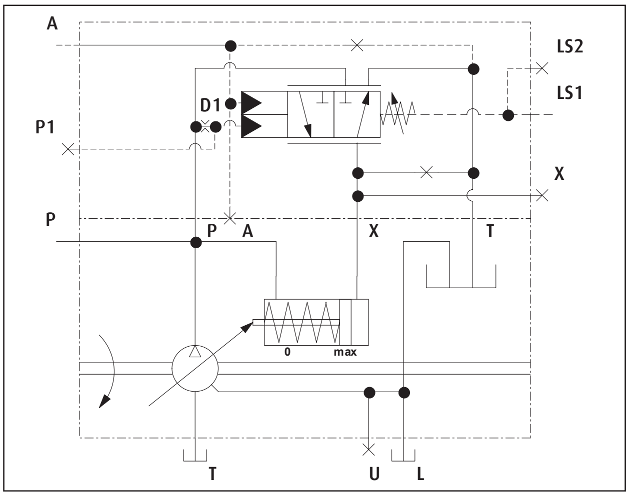
1. 16 bar Δp setting
2. 20 bar Δp setting
3. 25 bar Δp setting
4. 28 bar Δp setting

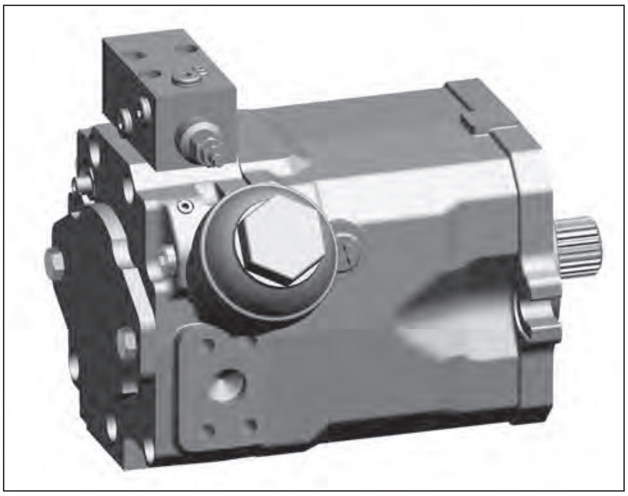
E1L-controller



Controllers. H1L. Load Sensing with hydraulic override

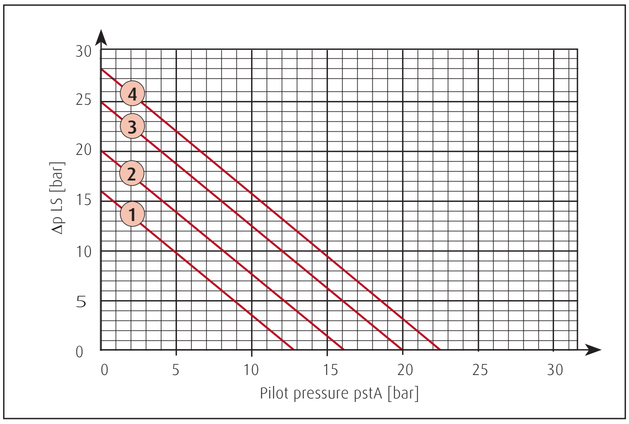
In addition to the load sensing function, HPR-02 pumps with H1L-controller offer the possibility of overriding the Δp LS-signal hydraulically. This enables either a so called mode control for selecting different operation points or establish a power limit regulation (underspeed control). The integration of all functions in the pump controller enables direct signal transfer without delay. The controller-specific data are independent of the nominal pump size. The H1L-controller is particularly useful for tandem configurations of two HPR-02 pumps, in which the first is equipped with an E1L-controller. The second pump with H1L-controller uses the resulting hydraulic signal of the first controller and follows the first pump's actions (master-slave-configuration).





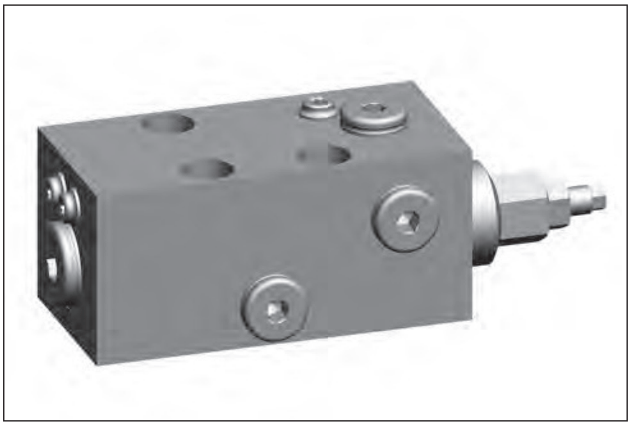
In the event of hydraulically overriding the LS-signal, a control pressure is applied to the port "A" of the controller. This pressure acts proportionally against the LS-spring, and the LS signal is modulated accordingly. This causes the pump to swash back, thereby reducing its output. The function between control pressure at the port A and the associated Δp LS value is shown in the following diagram.

Δp LS-reduction



1 16 bar Δp setting
2 20 bar Δp setting
3 25 bar Δp setting
4 28 bar Δp setting

H1L-controller

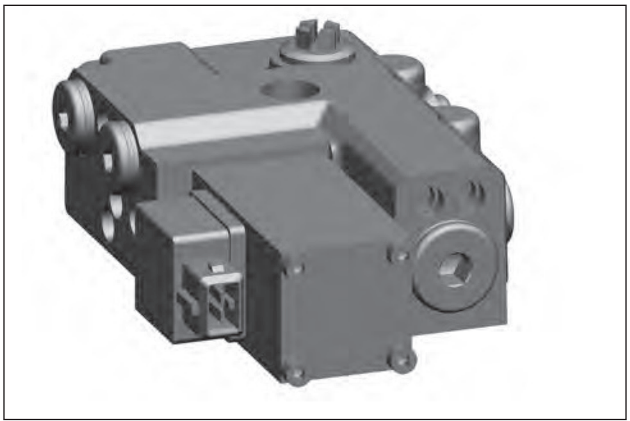


Controllers. Electrical properties

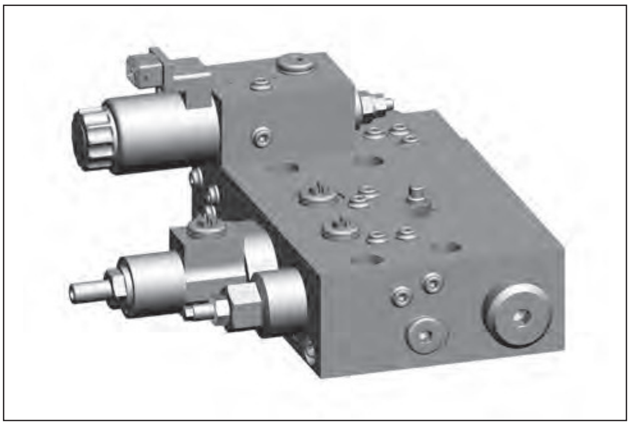
Supply voltage = limiting voltage		V	12	24
Control types	Digital control via Pulse Width Modulation PWM		100 Hz rectangle, pulse duty ratio variable over control range	
	Analogue		Direct current with dither overlay (dither frequency nom. 35 Hz, duty cycle 1:1). Further details on request	
Connector type			DIN EN 175301-803, Deutsch, AMP Junior Timer (2-pin)	
Protection class			IP54 (DIN), IP67 (Deutsch), IP6K6K (AMP)	
Voltage type			Direct Current (DC)	
Power consumption		W	15.6	
Rated current = limiting current		mA	1200	600
Relative duty cycle		%	100	

Further details on request

E1L-controller.
Rectangular solenoid and AMP-connector



ETP-controller.
Tubular solenoid and AMP-connector

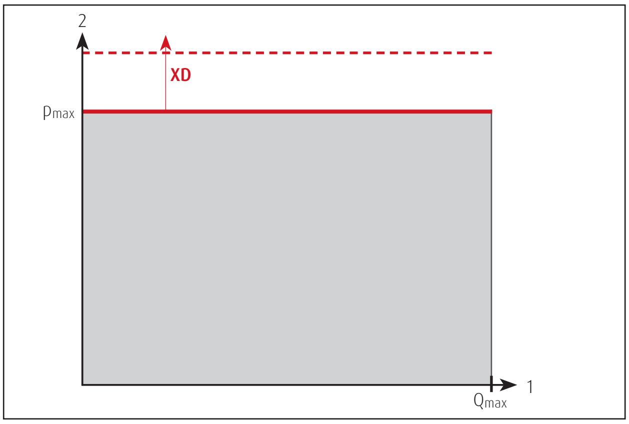


Pump controllers with position feedback

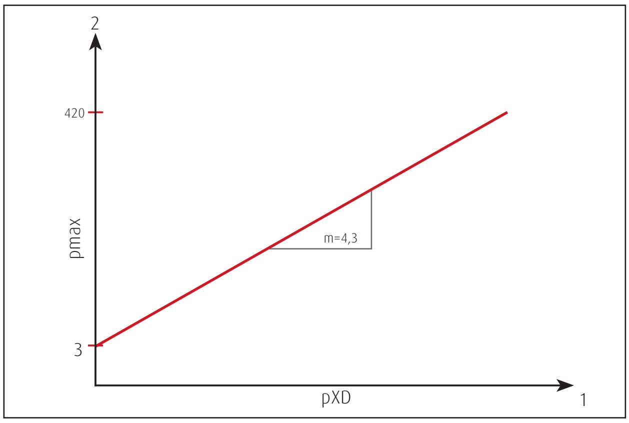
TL2-, LEP- and ETP-controllers offer a feedback of the swashplate position. Therefore they are – unlike LP-, E1L- and H1L-controllers – not mounted on the valve plate housing, but on the pump housing. Besides their individual characteristics, these controllers have some similar features.

P-axis (LEP/ETP): Pressure cut-off characteristic

LEP- and ETP-controllers offer a pressure cut-off (PCO), just like the LP-controller. This prevents the pump pressure exceeding a previously set maximum. The PCO is set to a customer-specific value between 125 bar and 420 bar ex works. Using a control signal at the XD port, the actual response pressure of the PCO valve of LEP- and ETP-controllers can be increased steplessly. The response pressure of the valve is increased by 4.3 bar by every bar increase at the XD port. The maximum pressure of 420 bar must not be exceeded.



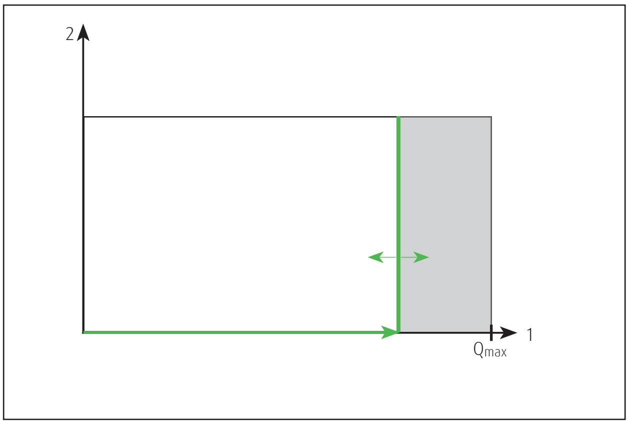
1 Displacement volume
2 Pressure
Maximum performance range of the pump
Pressure cut-off basic setting
Characteristic shifting by control signal



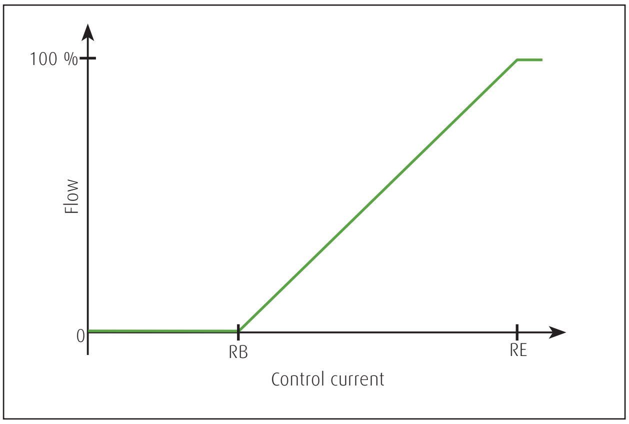
1 Control pressure at XD port
2 Pressure cut-off response pressure
3 Pressure cut-off basic setting

E-Axis (LEP/ETP): Electric flow setting

The swash angle and thus the flow of the pump is set by means of an electric signal with the LEP and ETP controller. The actual current depends on the voltage-level of the application and the nominal size of the pump.
Without an electric signal, the pump swashes to minimal displacement.



1 Displacement
2 Pressure
Maximum performance range of the pump
Electro-proportional flow setting
Provided power



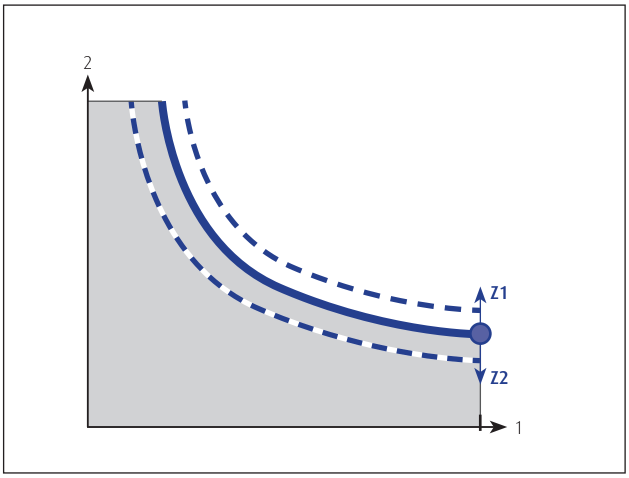
Rated size		Control current	
		12 V	24 V
RB Regulation begin	105,135	464 mA	232 mA
	210	490 mA	245 mA
	280	524 mA	262 mA
RE Regulation end	105 - 280	1200 mA	600 mA

Pump controllers with position feedback

T-Axis (TL2/ETP): hydraulic movement of the regulation begin

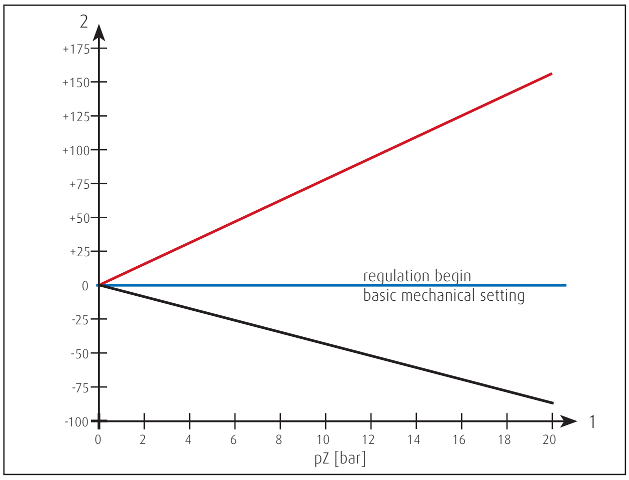
Controllers of the TL2 and ETP type offer a power limitation with a hyperbolical characteristic. The controller is set ex works to a customer specific power limit value. The volume flow is restricted, when this limit is exceeded. By means of control ports at the controller, the point at which the power limiter sets in can be raised, as well as lowered during operation.
Dependent on the rated size of the unit, there is a minimum value for the power limitation which must not be underrun, neither by the ex work setting, nor by shifting. The maximum mechanically set value at which the power limitation sets in, is 250 bar, independent of the pump's rated size and speed. The pump must never be operated with more than its maximum power.

Power limiter characteristic curve



1 Displacement
2 Pressure
Power range of the pump
Regulation begin power limitation

Shifting of the regulation begin



1 Pilot pressure port Z1, Z2
2 Displacement of the regulation begin [bar]
Pilot pressure port Z1
Pilot pressure port Z2

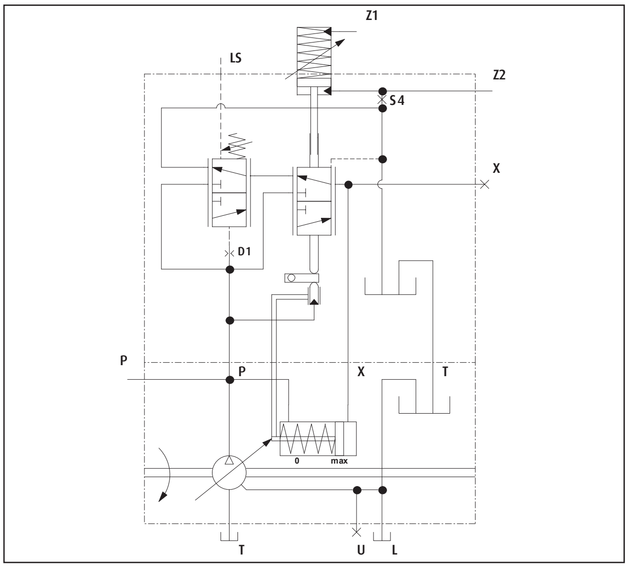
Power limiter performance

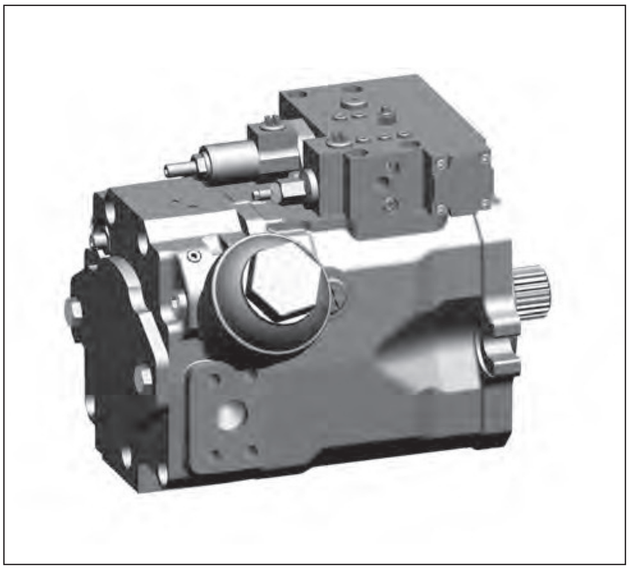
		Rated size				
		75	105	135	210	280
Ex works setting [kW]		6 - 82	9 - 106	12 - 136	24 - 184	32 - 221
Shifting of the regulation begin [bar/bar]	Z1	7.1	7.1	7.1	7.4	7.8
	Z2	-3.2	-3.2	-3.2	-3.3	-3.4
Regulation begin minimum [bar]		60	60	60	80	80
Regulation begin [bar] (mechanically set)		250				
Max. pressure at Z1/Z2 [bar]		25				

Controllers. TL2. Load Sensing 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.

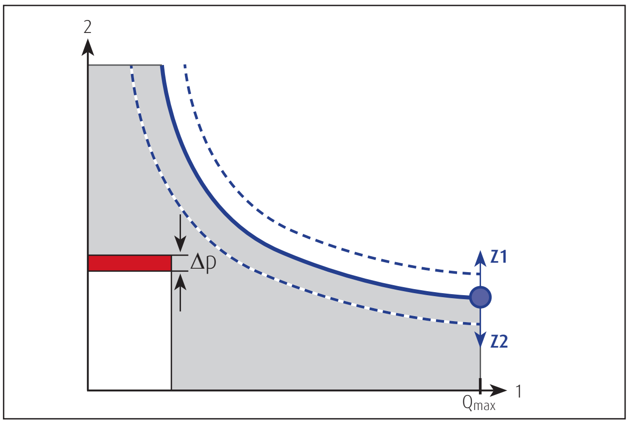
TL2. LS with hyperbolic power limitation





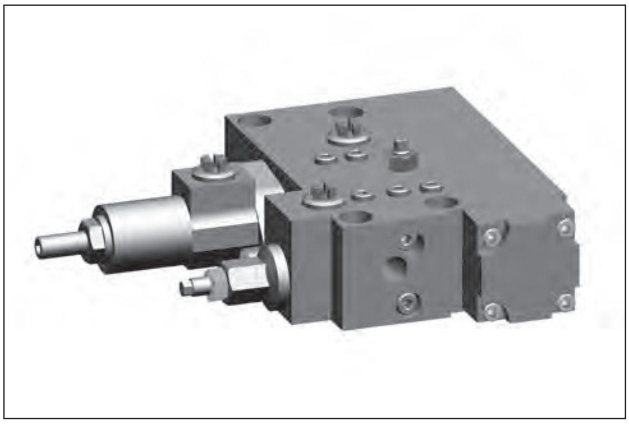
The TL2 controller offers a so called hydraulic power mode function. This means, that the regulation begin of the power limitation / torque control can be shifted from its mechanical basic setting by means of a remote control port Z1/Z2 at the controller. If the regulation begin is intended to be below the basic setting, which means that the pump performance is reduced, then the port Z2 is used while S4 is closed. If the mode function is not used at all, or only with the Z1 port, S4 is equipped with an orifice. Z2 is then sealed pressure tight. For details, see <<Pump controllers with position feedback. T-axis>>

TL2-characteristic curve



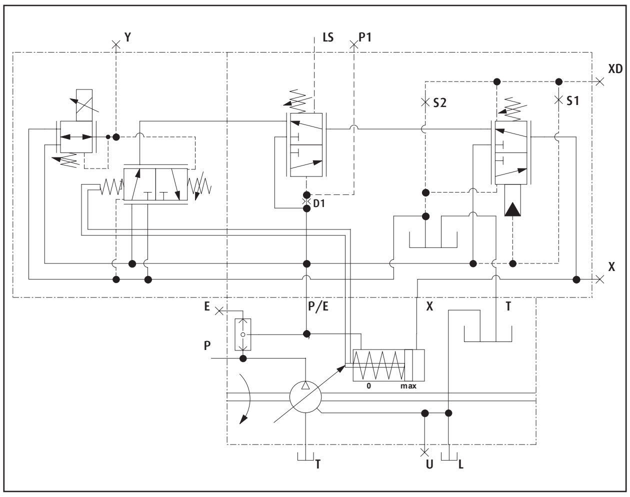
1 Flow
2 Pressure
Maximum performance range of the pump
Actual power demand of the system
Regulating Δp
Power limitation regulation begin
Power limitation basic setting
Characteristic shifting by control signal

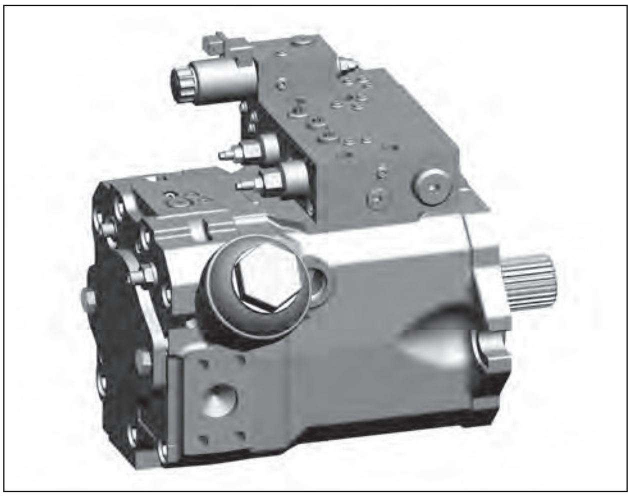
TL2-controller



Controllers. LEP. Load Sensing with electro-proportional flow limitation and pressure cut-off

The HPR with LEP-controller offers an on-demand load sensing flow control. The actual volume flow, delivered by the pump can be restricted by an electrical signal in certain points of operation. A pressure cut-off function protects the hydraulic system from overload.

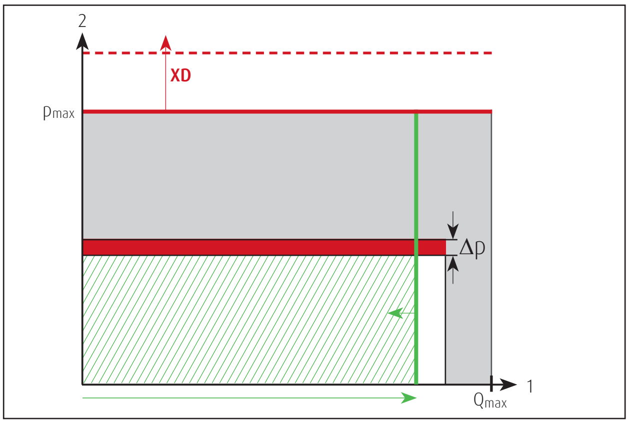




Without any signal at the solenoid or the LS-port, the pump is swashed back to stand-by position. Both signals at the same time are required for the pump to leave stand-by position. The actual swash angle of the pump is determined by the signal with the lower target value.

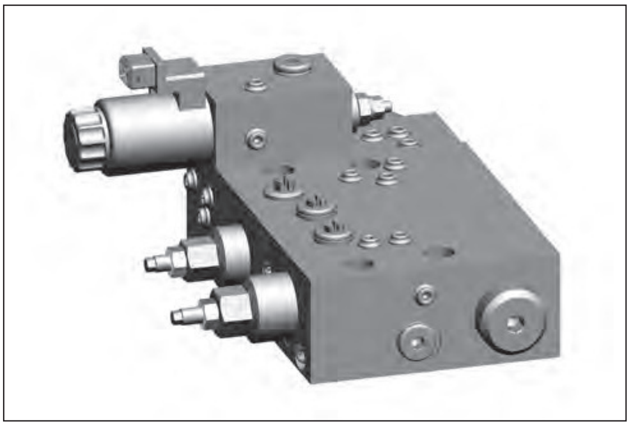
The responding behaviour of the pressure cut-off can be remote-controlled by a hydraulic signal at the XD port as an option. S1 is then equipped with an orifice and S2 is sealed. If only the mechanical preset of the PCO is used, S1 is sealed and S2 is not equipped. Details, see <<Pump controllers with position feedback. P-axis>>

Characteristic LEP controller



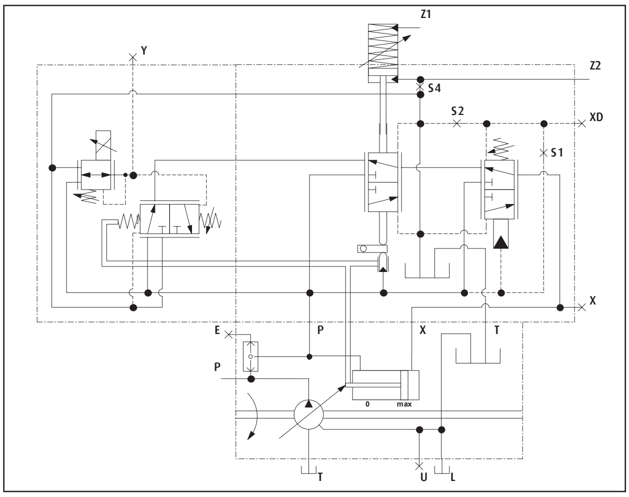
1 Flow
2 Pressure
Maximum performance range of the pump
Actual power demand of the system
Regulating Δp
Provided power
Pressure cut-off basic setting
Characteristic shifting by control signal
Electro-proportional flow setting

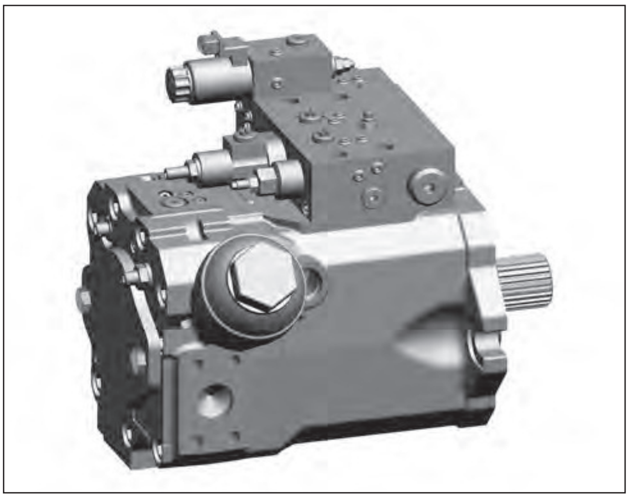
LEP-controller



Controllers. ETP. Electro-proportional flow setting, power limitation and pressure cut-off

The HPR with ETP-controller delivers a volume flow which is exactly proportional to the electric control signal. Superposed, the controller offers a hyperbolic power limitation, which optimally exploits the power of the prime mover and also protects it from overload. In addition to this, a pressure cut-off protects the hydraulic system.
The controller is supplied via a feed port "E" at the port plate housing.

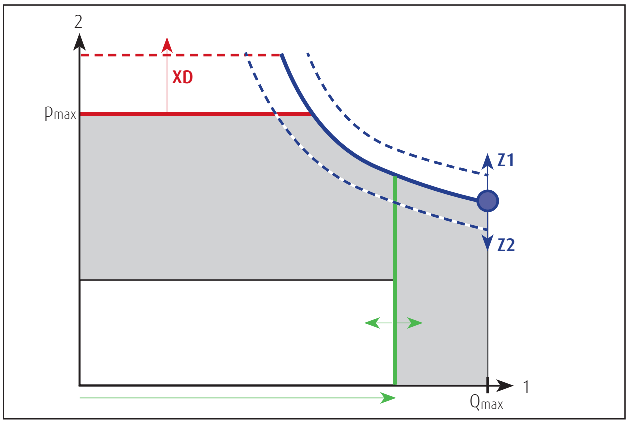




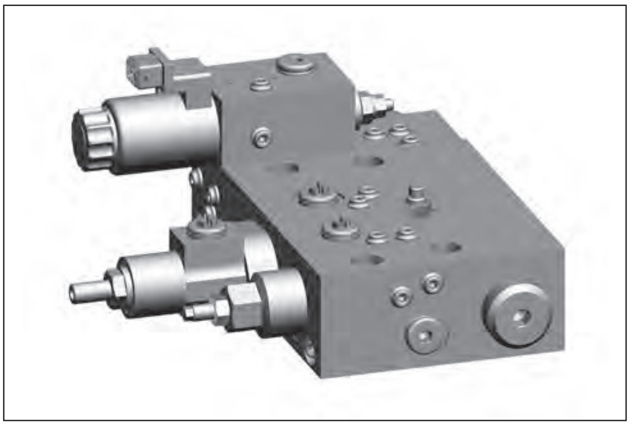
The ETP-controller offers a so called hydraulic power mode function. This means, that the regulation begin of the power limitation can be shifted from its mechanical basic setting by means of a remote control port Z1/Z2 at the controller. If the regulation begin is intended to be below the basic setting, which means that the pump performance is reduced, then the port Z2 is used, S4 is closed. If the mode function is not used at all, or only with the Z1 port, S4 is equipped with an orifice. Z2 is then sealed pressure tight. For details, see <<Pump controllers with position feedback. T-axis>>

The responding behaviour of the pressure cut-off can be remote-controlled by an hydraulic signal at the XD port as an option. S1 is then equipped with an orifice and S2 is sealed. If only the mechanical preset of the PCO is used, S1 is sealed and S2 is not equipped. Details, see <<Pump controllers with position feedback. P-axis>>

Characteristic ETP-controller

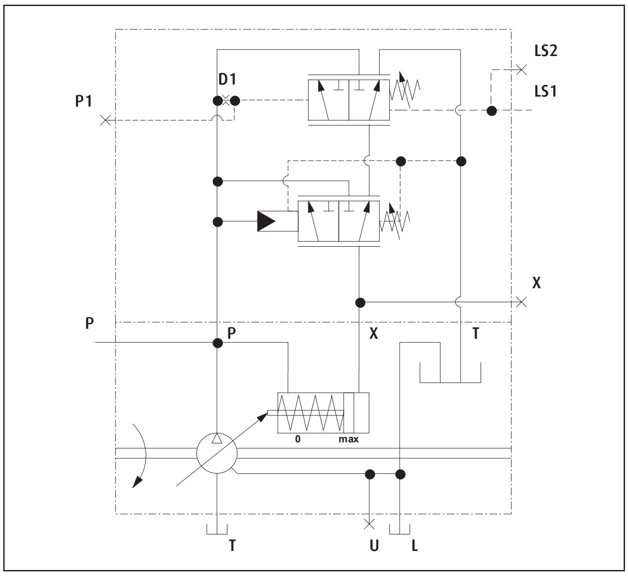


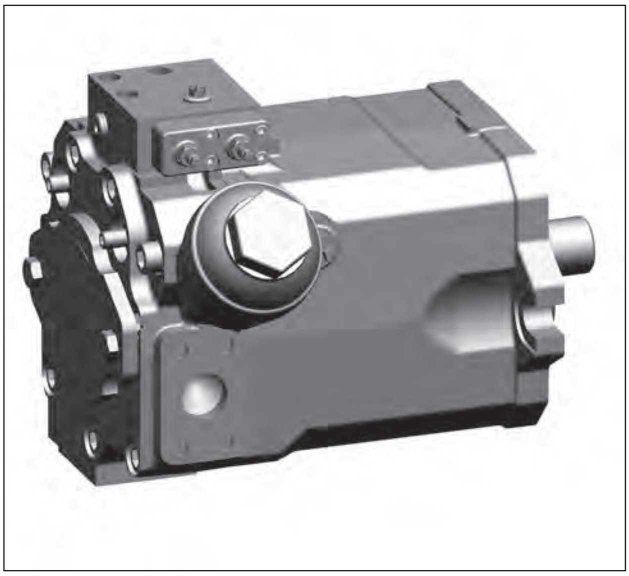
ETP Regler

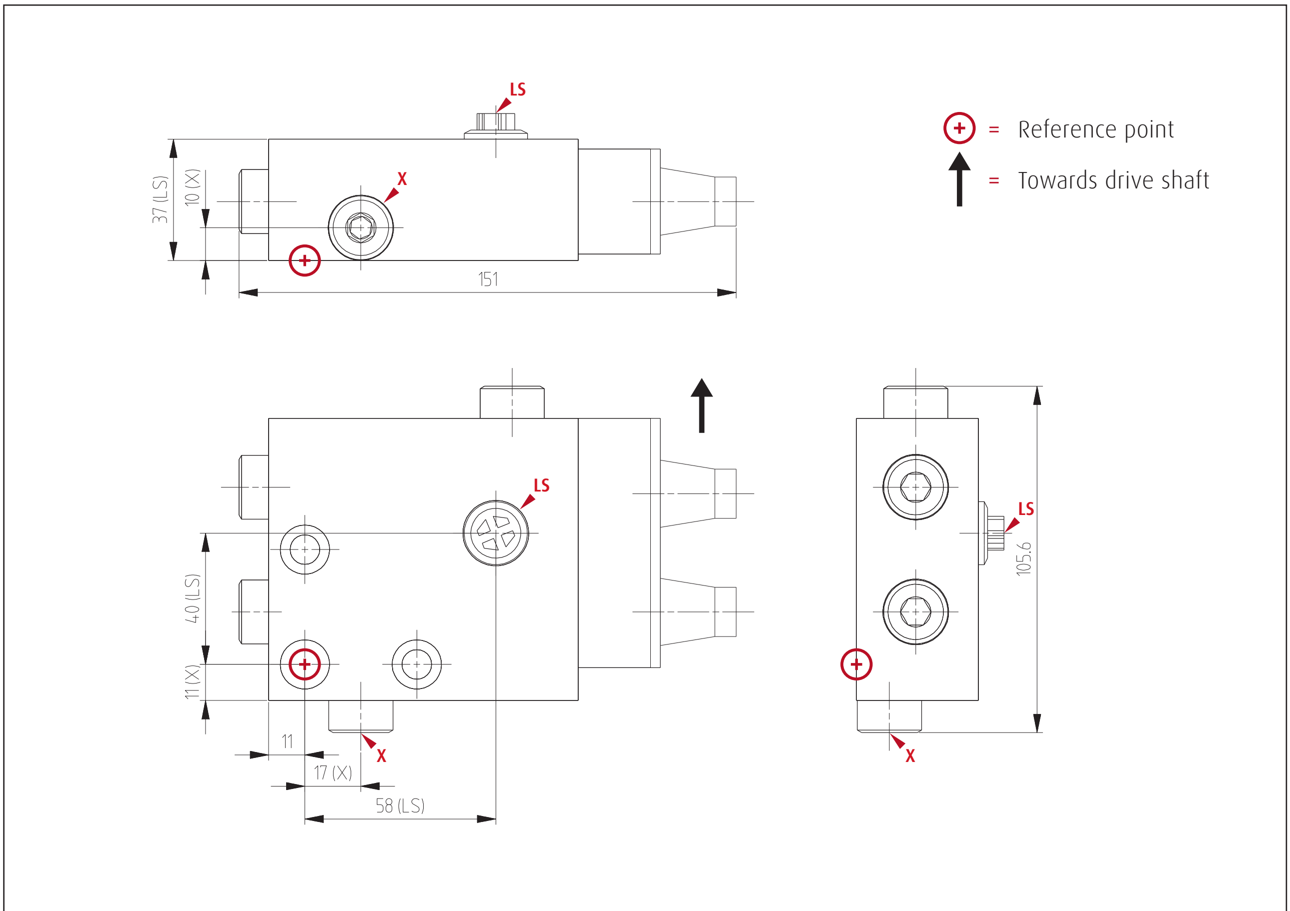


1 Displacement
2 Pressure
Maximum performance range of the pump
Electro-proportional flow setting
Provided power
Regulation begin power limitation
Pressure cut-off basic setting
Characteristic shifting by control signal
Pressure cut-off basic setting
Characteristic shifting by control signal

Dimensions. LP-controller

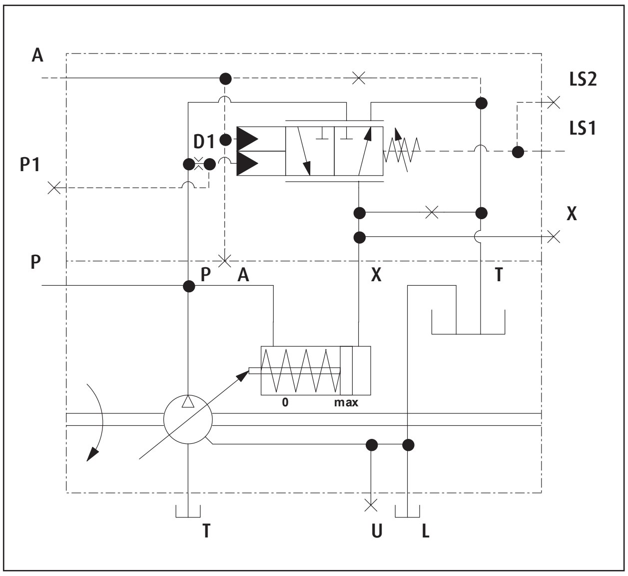


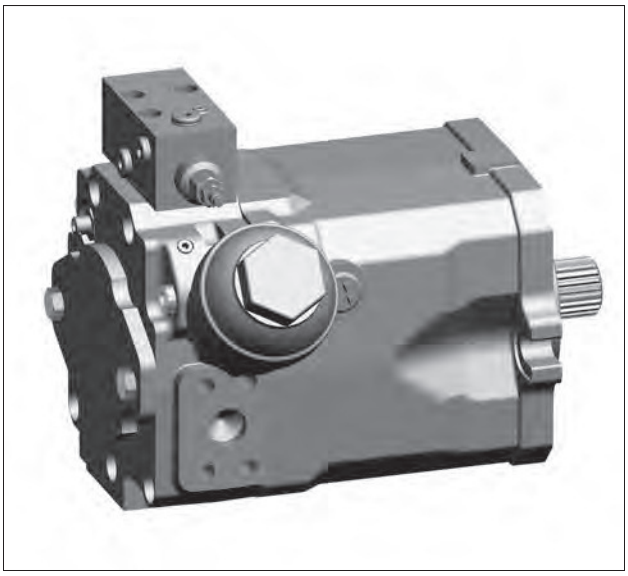


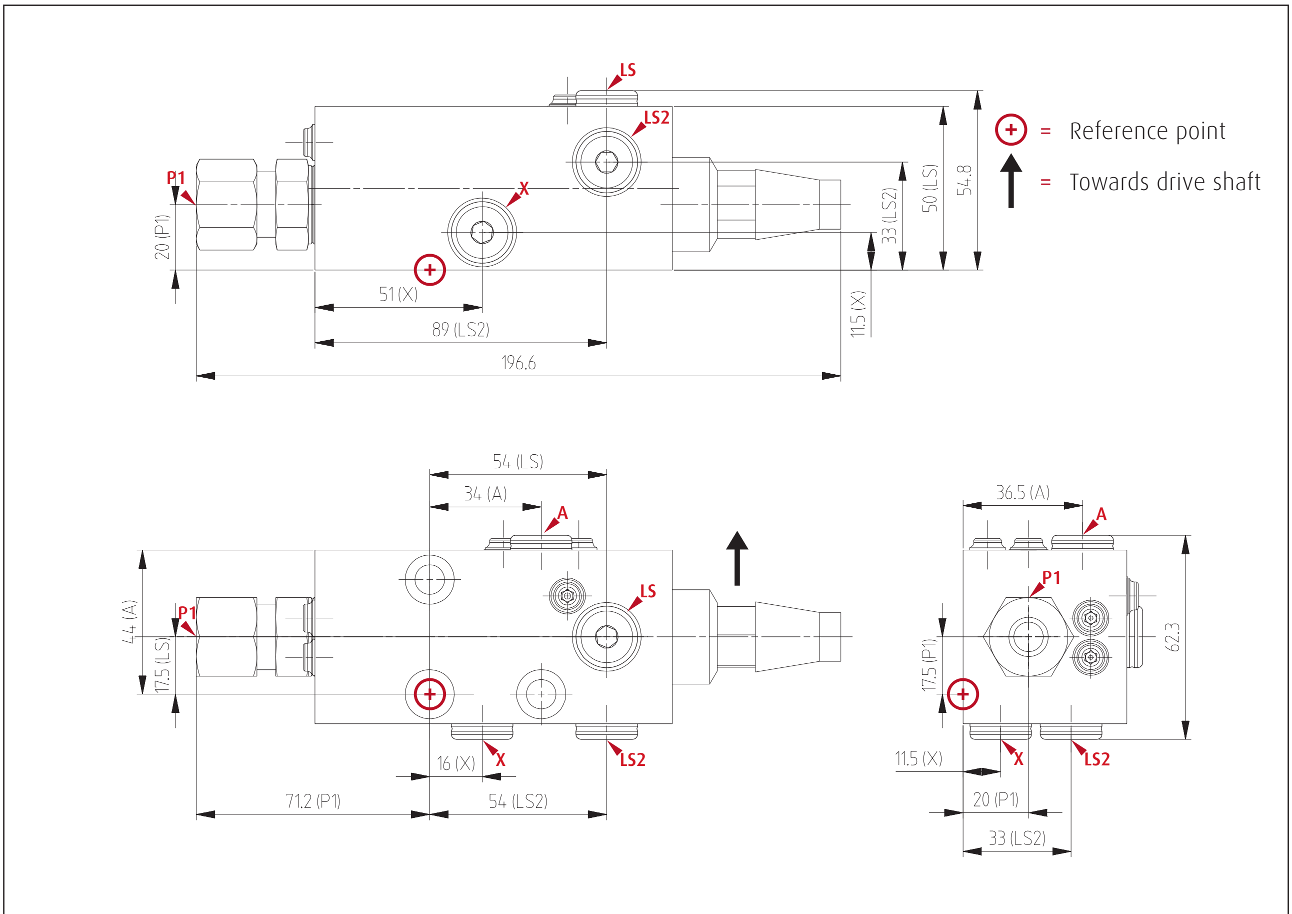


Dimensions:		approx. 151 x 105.6 x 37 mm	
Connections:	X	Test port actuating pressure	M14x1.5
	LS1, 2	Load sensing signal / test port	M14x1.5
	P1	Test port pump pressure	M14x1.5

Dimensions. H1L-controller

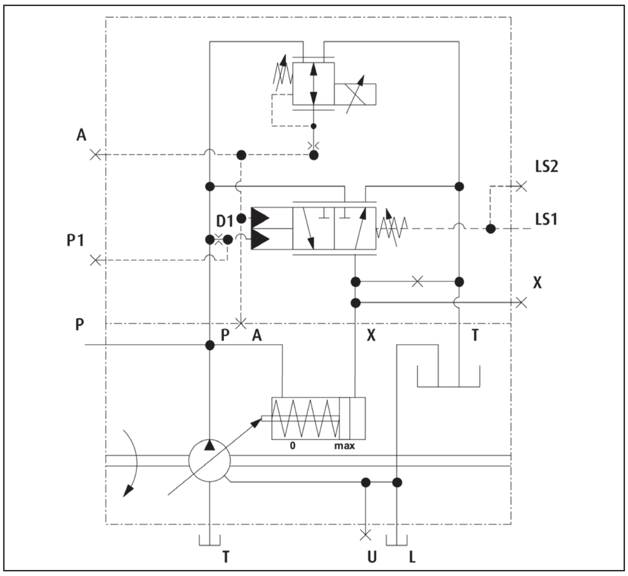


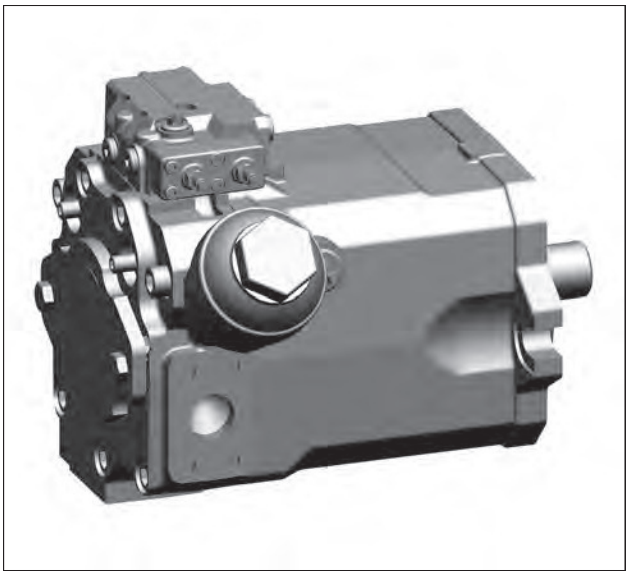


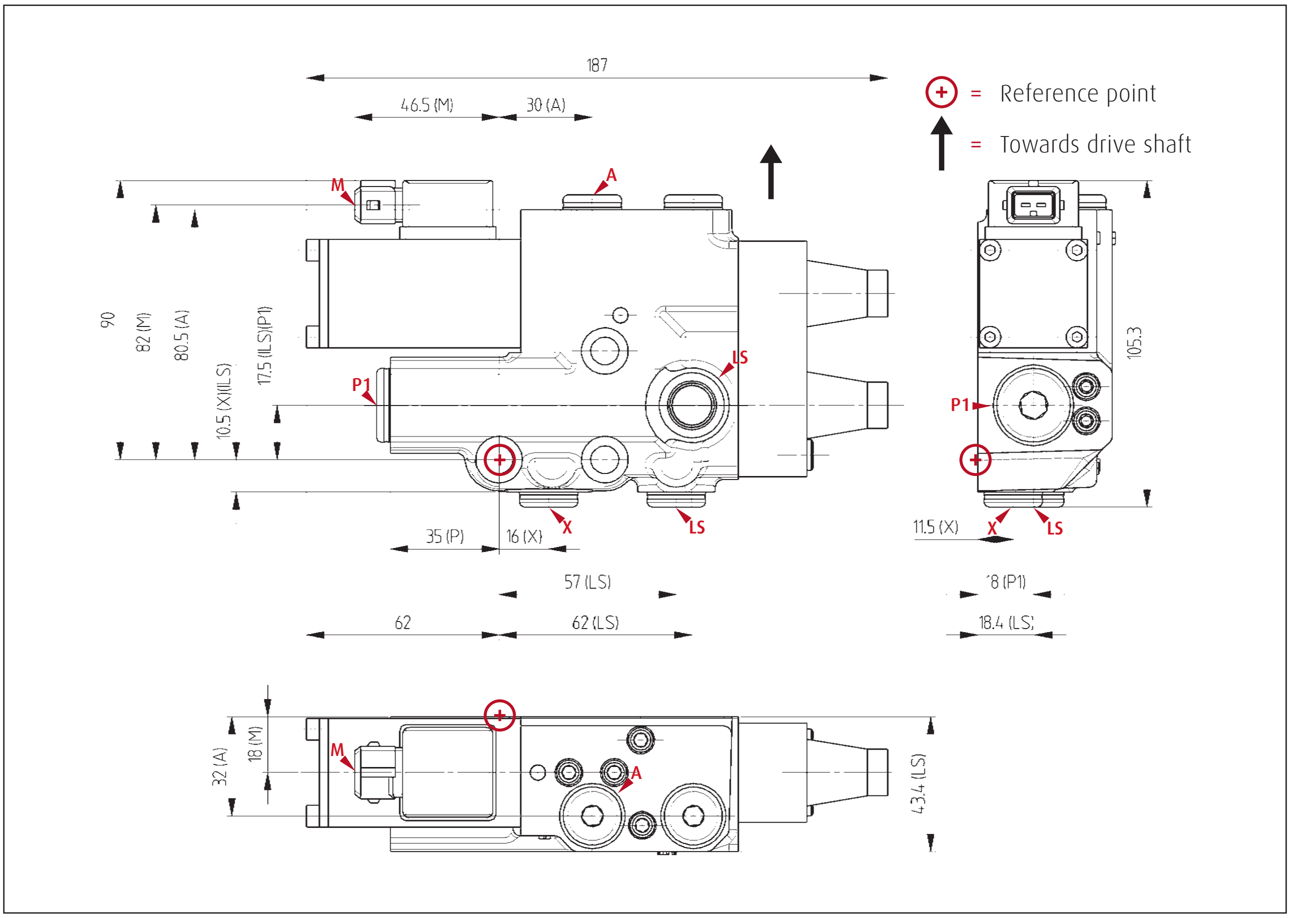


Dimensions:		approx. 196.6 x 62.3 x 54.8 mm	
Connections:	A	Test port control pressure	M14x1.5
	X	Test port actuating pressure	M14x1.5
	LS/LS2	Load sensing signal / test port	M14x1.5
	P1	Test port pump pressure	12 S (ISO 8434-1)

Dimensions. E1L-controller



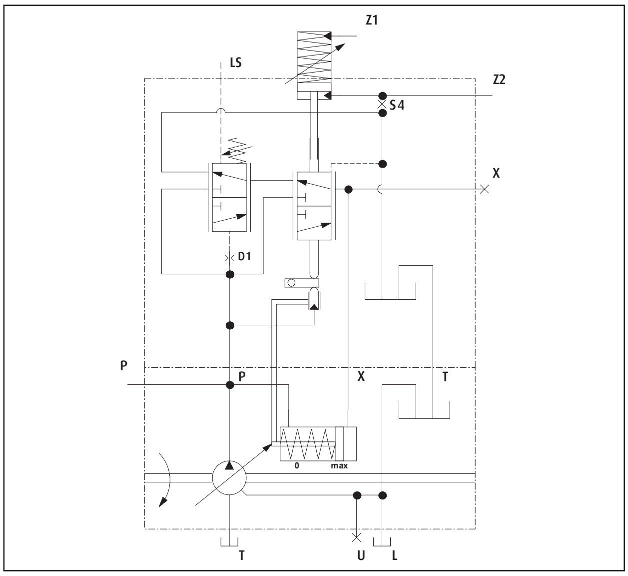


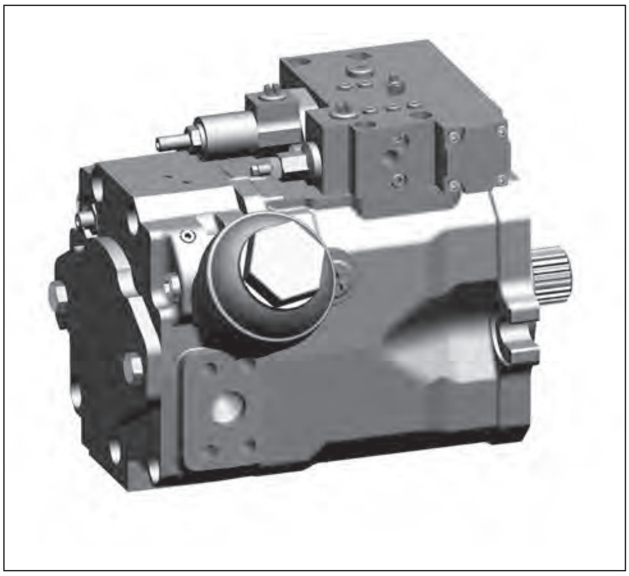


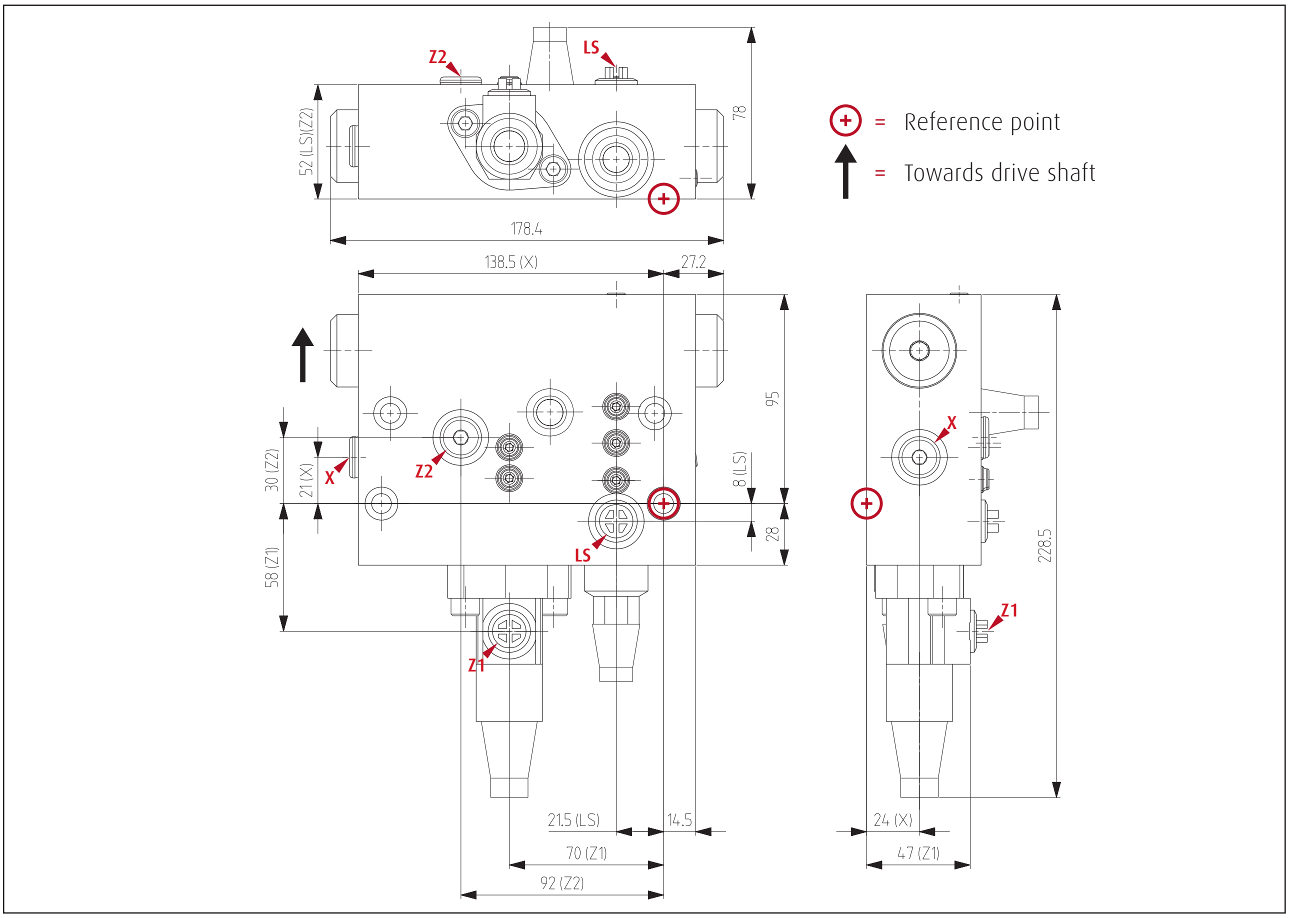
Dimensions:		approx. 187 x 105.3 x 43.4 mm	
Connections:	A	Test port control pressure	M14x1.5
	X	Test port actuating pressure	M14x1.5
	LS1,2	Load sensing signal / test port	M14x1.5
	P1	Test port pump pressure	M18x1.5
	M	Solenoid with AMP-JPT connector (example)	

Further information, see <<Controllers. Electrical properties>>

Dimensions. TL2-controller

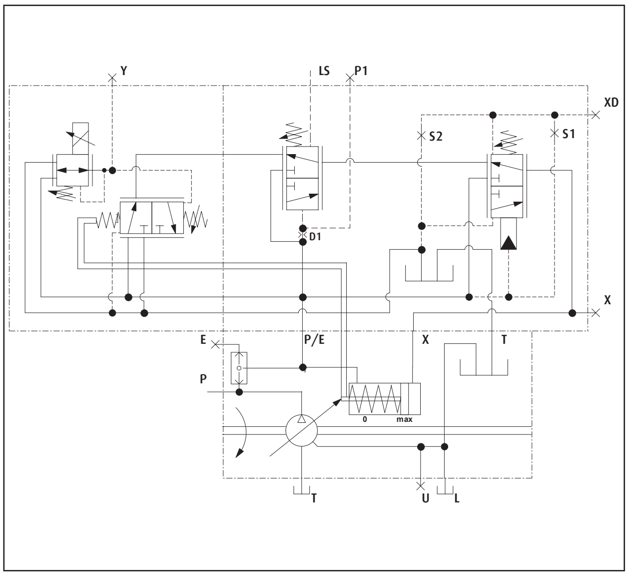


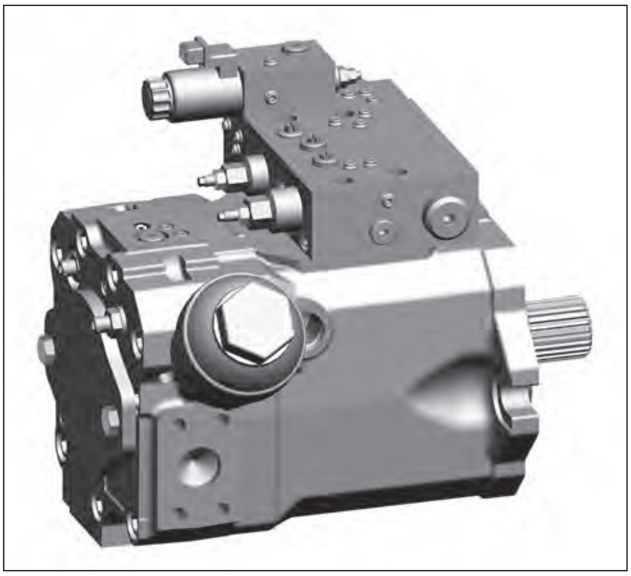


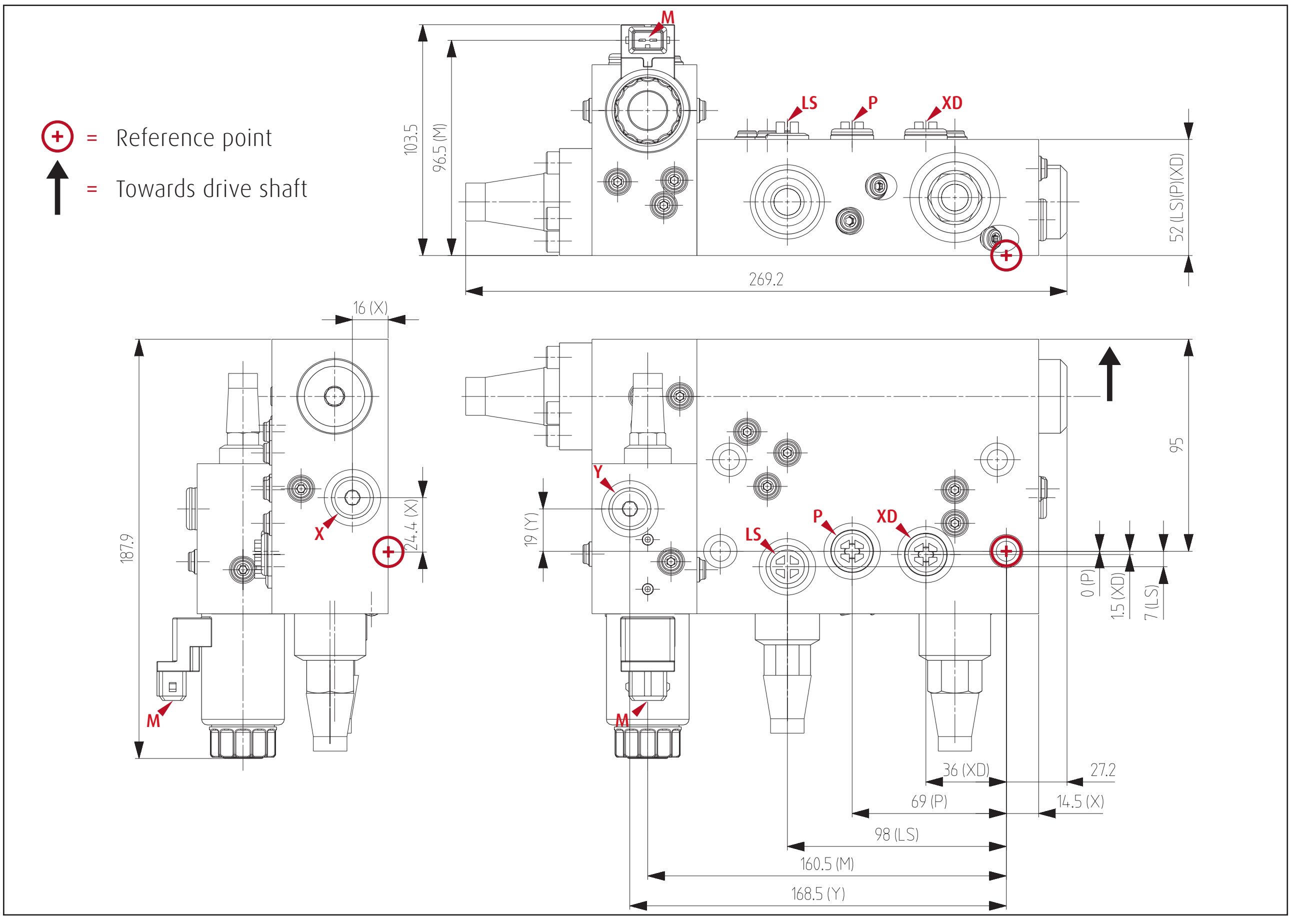


Dimensions:		approx. 178.4 x 228.5 x 78 mm	
Connections:	X	Test port actuating pressure	M14x1.5
	LS	Load sensing signal	M14x1.5
	Z1/Z2	Remote control for power limitation	M14x1.5

Dimensions. LEP-controller



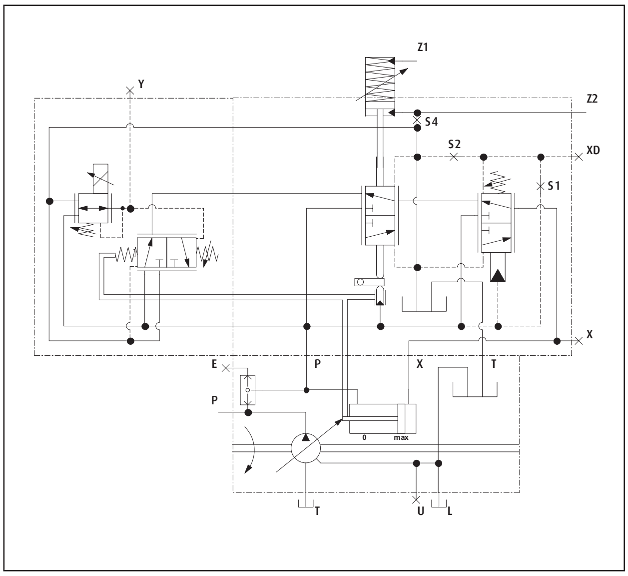


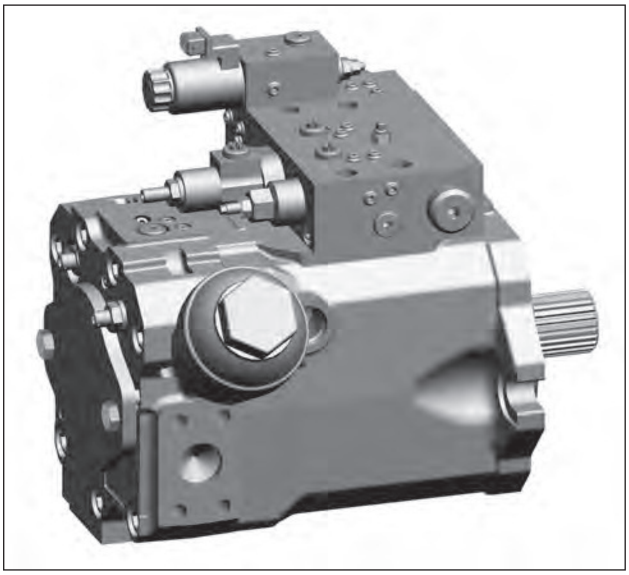


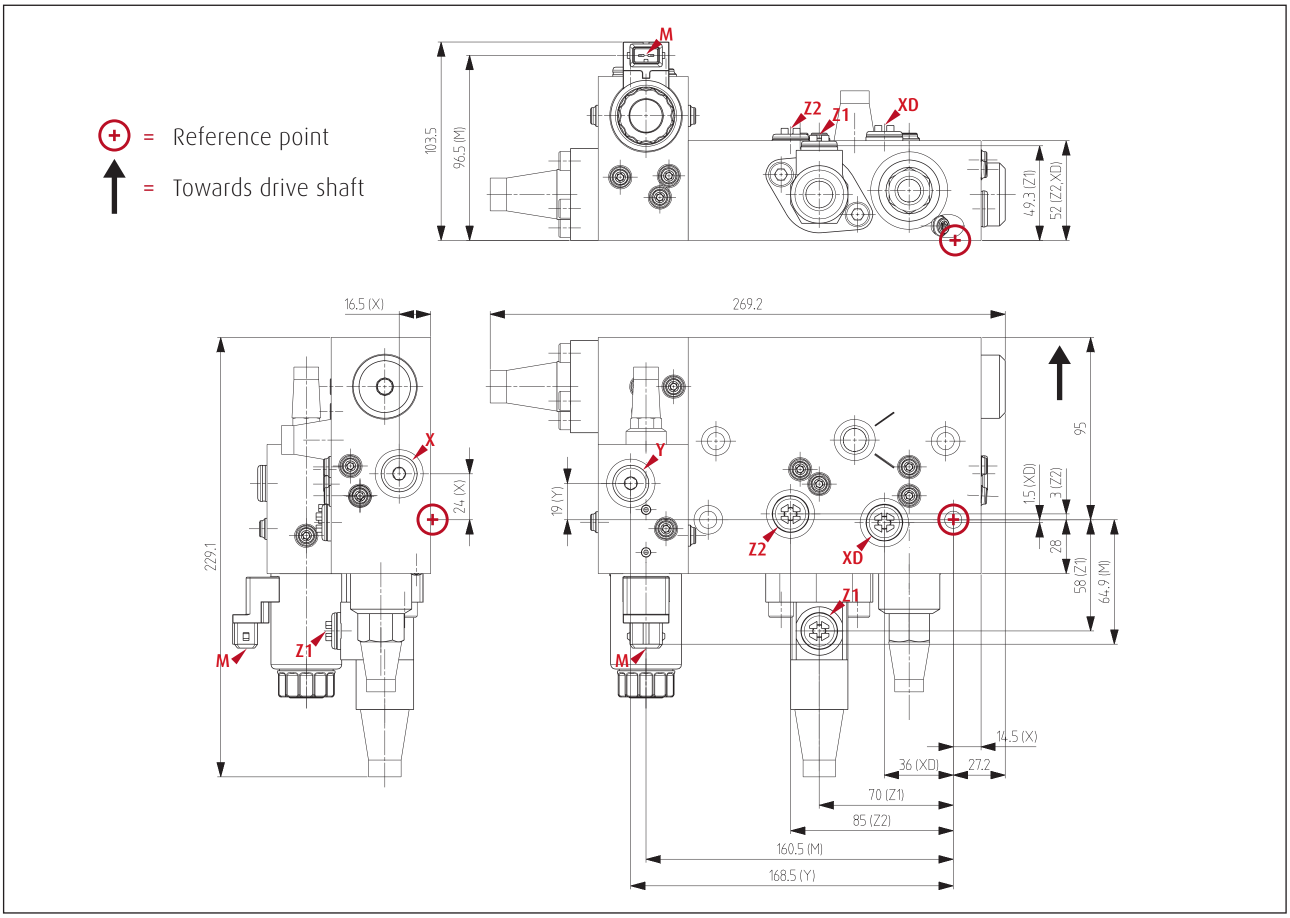
Dimensions: approx. 269.2 x 187.9 x 103.5 mm

Connections:	X	Test port actuating pressure	M14x1.5
	Y	Test port pressure-reducing valve	M14x1.5
	XD	Port for external pressure cut-off	M14x1.5
	LS	Load sensing signal	M14x1.5
	P	Test port pump pressure	M14x1.5
	M	Solenoid with AMP-JPT connector (example)	
		Further information, see <<Controllers. Electrical properties>>	

Dimensions. ETP-controller







Dimensions:		approx. 269.2 x 229.1 x 103.5 mm	
Connections:	X	Test port set pressure	M14x1.5
	Y	Test port actuating pressure	M14x1.5
	XD	Connection for external pressure cut-off	M14x1.5
	Z1/Z2	Remote control for power limitation	M14x1.5
	M	Solenoid with AMP-JPT connector (example)	
		Further information, see <<Controllers. Electrical properties>>	

Dimensions. Single pumps HPR-02 for LP, E1L, H1L

The dimensioning is shown by one exemplary pump configuration. The external dimensions are determined by the individual configuration, including the choice of a controller, direction of rotation, optional SPU and the settings of the pump. Further information can be found in the specific sections of this datasheet, in particular the sections <<Torque transmission. Mounting flange>> and <<Torque transmission. Drive shaft>>.

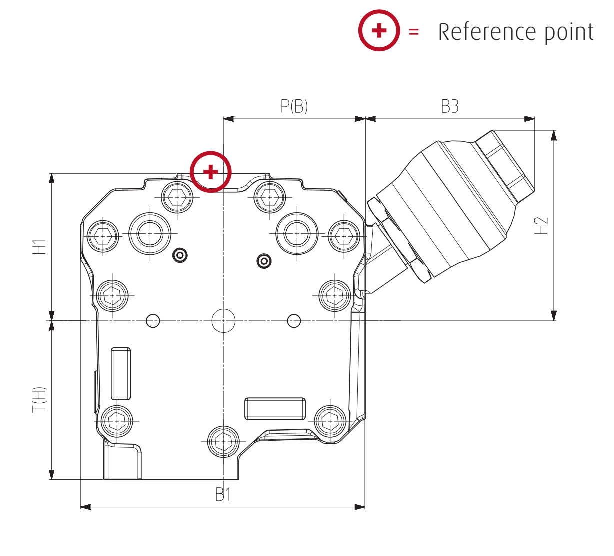
Dimensions of the pump without controller

Rated size	55	75	105	135	165	210	280
D	127	127	127	152.4	152.4	165.1	224
L1	220.3	231.8	262	284.5	333.1	348	403
L2	259.3	270.8	301	323.5	372.1	387	442
L3	207.3	220.3	241	263.5	317.1	333	375
H1	100	102	103.5	111.5	128.5	134.5	152
H2	146	146	136	145.5	152.4	143.5	238
B1	111	190.3	199.6	216	251.5	268	306.1
B2	208	208	207	256	269	268.8	314.5
B3	120	111	122	129	128.9	126.5	125.1
B4	21	21	21	21	19	21	21

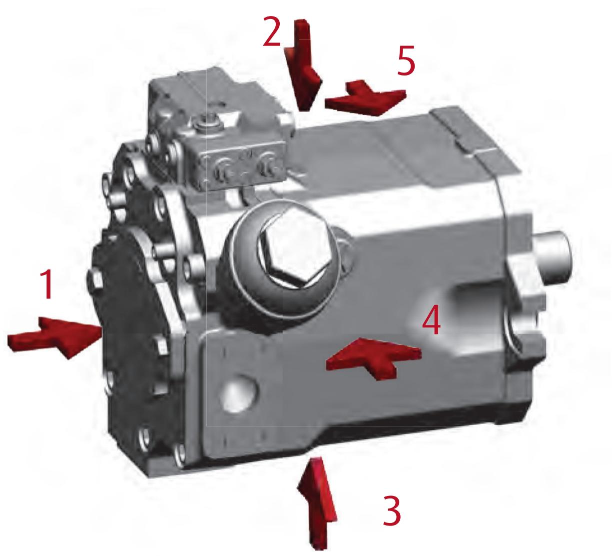
Ports

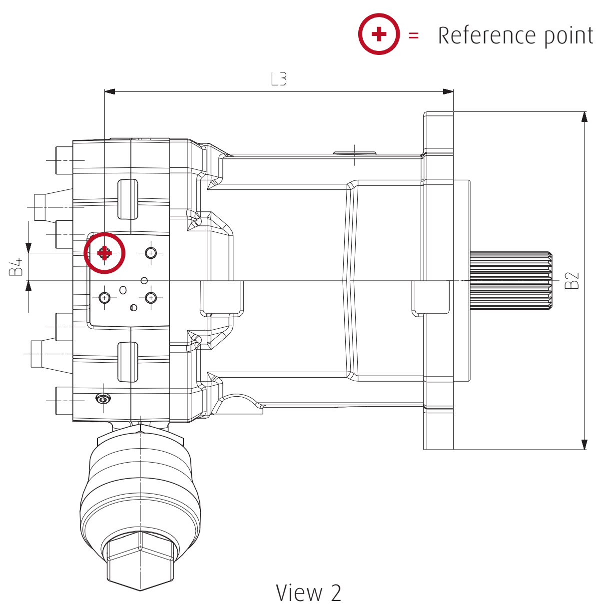
Rated size	55	75	105	135	165	210	280
P	¾"	¾"	1"	1 ¼"	1 ¼"	1 ½"	1 ½"
P(L)	182.8	194.3	218	243.5	283.1	295	344.5
P(H)	23.5	23.5	26	30	43	27	46
P(B)	91	90.5	100	107	134.5	134.5	149.5
T	1 ½"	1 ½"	2"	2"	2 ½"	3"	3 ½"
T(L)	189.8	201.3	227	249.5	285.6	298	344.5
T(H)	94	94	103.5	120	119	149	167
T(B)	21	21	25	30	0	57	57
L/U	M22x1.5	M22x1.5	M22x1.5	M27x2	M27x2	M27x2	M33x2
L(L)	112.8	124.3	142	164	180.6	197.5	215.5
L(H)	52	52	53	61	65	71.5	80.5
L(B)	86.5	86.5	85	101.5	108	128	145
U(L)	72	72	72	74.5	81.1	83	109
U(H)	44	44	54	54	62	60	68
U(B)	78.5	78.5	92.5	92.5	101	118	129.5

Dimensions. Single pumps HPR-02 for LP, E1L, H1L

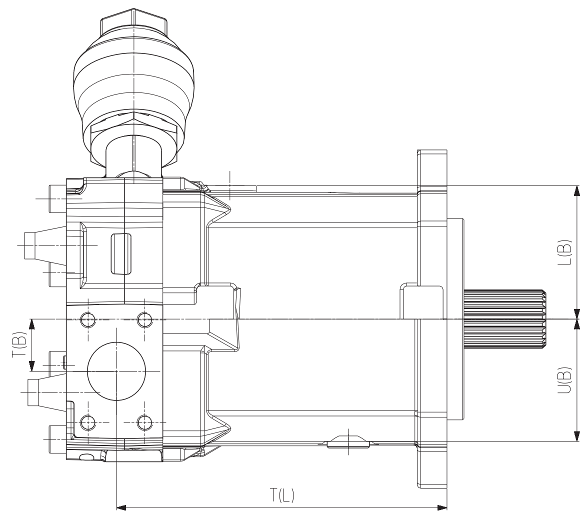


View 1





View 2



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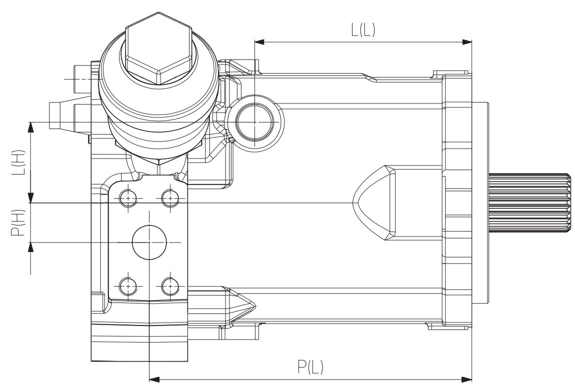

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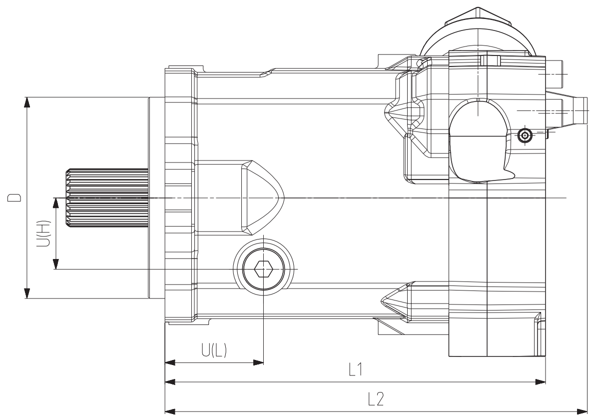


View 5

Dimensions. Single pumps HPR-02 for TL2, LEP, ETP

The dimensioning is shown with one exemplary pump configuration. The external dimensions are determined by the individual configuration, including the choice of a controller, direction of rotation, optional SPU and the settings of the pump. Further information can be found in the specific sections of this datasheet, in particular the sections <<Torque transmission. Mounting flange>> and <<Torque transmission. Drive shaft>>.

Dimensions of the pump without controller

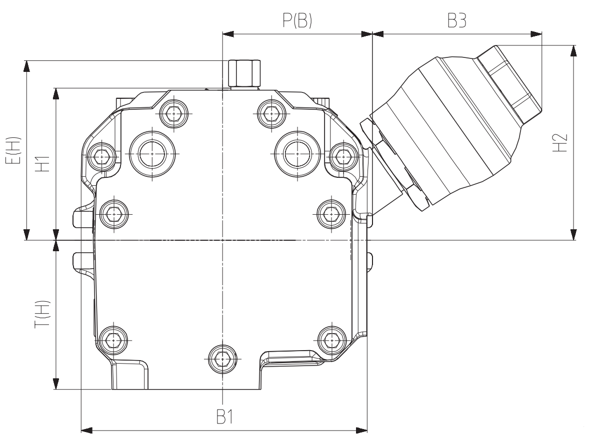
Rated size	105	105	135	210	280	280
In accordance with ISO 3019	-1	-2	-1	-1	-1	-2
D	127	125	125.4	165.1	165	224
L1	262	272	284.5	348	403	403
L2	301	311	323.5	387	442	442
L3	108.9	118.5	82.8	138.5	168	168
H1	104.5	104.5	111.5	134.5	152	152
H2	134	134	144	144.3	200.7	238
H3	104.5	104.5	104	135	135	144.5
B1	194.5	194.5	214.8	266.3	314.5	314.5
B2	208	208	256.5	269	272	272
B3	118	116	106.7	102.4	119.5	120.2
B4	64	64	64	64	82.5	82.5

Ports

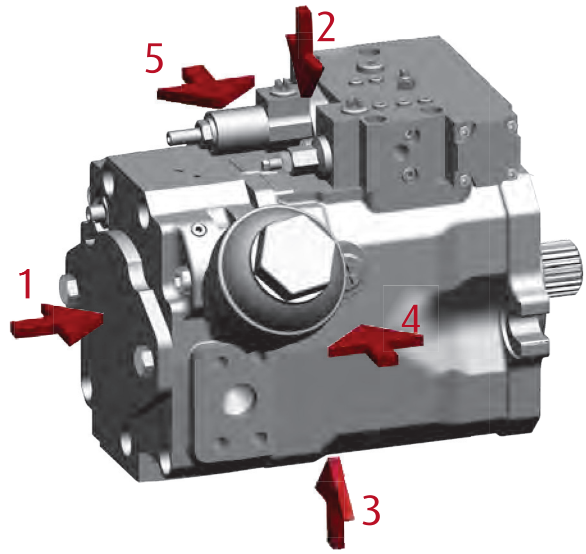
P	1“	1“	1 ¼“	1 ½“	1 ½“	1 ½“
P(L)	218	228	243.5	295	344.5	344.5
P(H)	26	26	30	27	46	46
P(B)	100	100	107	144.5	154.1	155.5
T	2“	2“	2“	3“	3 ½“	3 ½“
T(L)	227	237	249.5	298	344.5	344.5
T(H)	104	104	120	149	167	167
T(B)	25	25	39.5	27	44	57
L/U	M22x1.5	M22x1.5	M27x2	M27x2	M33x2	M33x2
L(L)	142	152	164	191	215.5	215.5
L(H)	53	53	61	97.5	80.5	80.5
L(B)	92.5	92.5	101	128	129.5	144.9
U(L)	72	82	74.5	83	109	109
U(H)	54	54	54	60	68	68
U(B)	85	85	92	118	159.5	131.3
E*	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5
E(L)	240.8	250.8	249.5	303	375	346
E(H)	135.6	135.6	142.6	165.6	183.1	183.1
E(B)	15	15	16	20	20	20

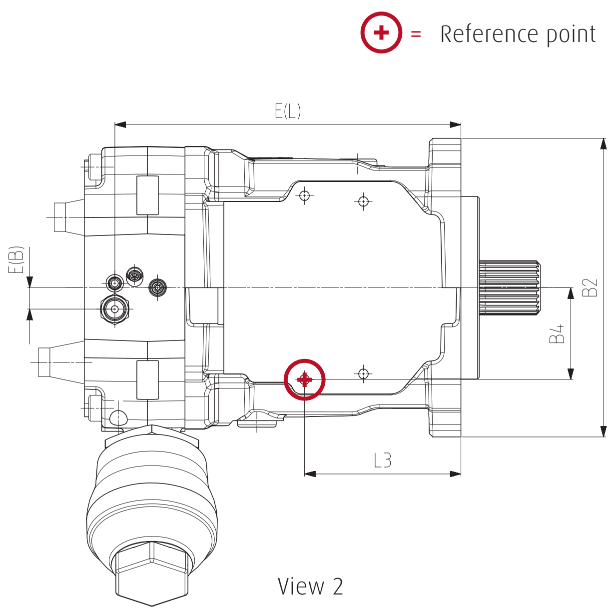
*) ETP-controller only: External supply pressure

Dimensions. Single pumps HPR-02 for TL2, LEP, ETP

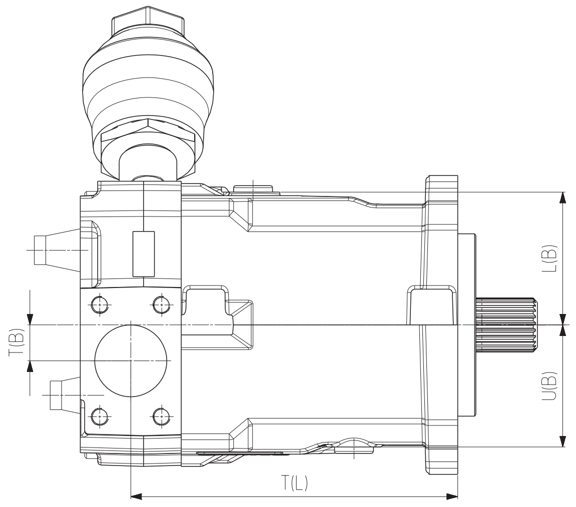


View 1

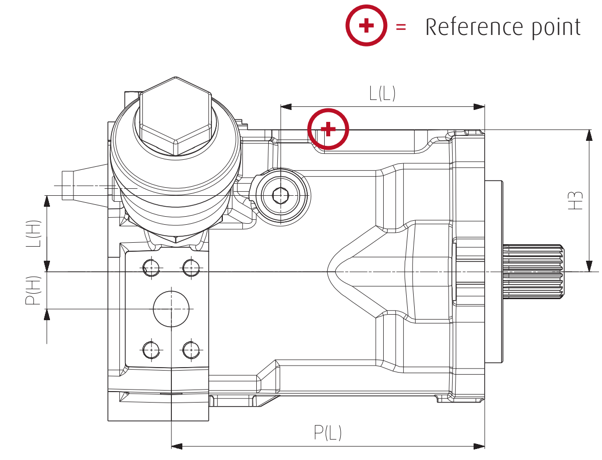




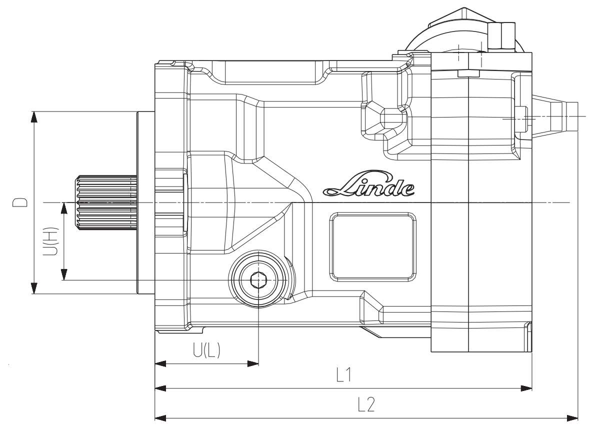
View 2



View 3



View 4



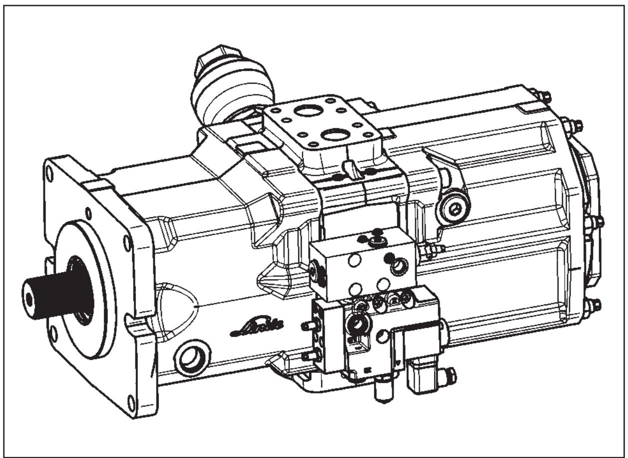
View 5

Dimensions. Double pumps and plug-in pumps

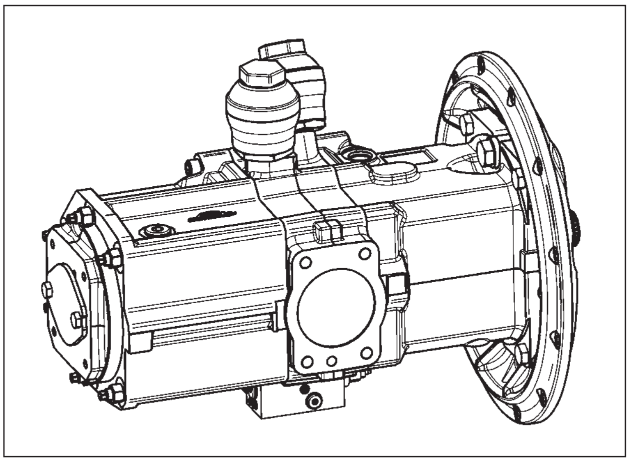
Double pumps consist of two HPR rotating groups, arranged back-to-back to a common port plate housing, sharing one common suction port. They are thus more compact than two standard pumps in a tandem configuration. Compared to a pump of equal rated size with a single rotating group, double pumps offer higher speed and more narrow radial dimensions. They also provide a PTO option. The position of the ports, controllers and SPU differs from the previously shown pumps.
Further details on request.

Rated size	105D	105D	105D	165D	165D
Circuit	Single circuit pump			Single or dual circuit pump	
Flange	SAE C with 4 additional bolt holes	plug-in version	SAE 3 / SAE 4	SAE D with 4 additional bolt holes	SAE 3
D1 [mm]	127	216	SAE J617a	152.4	SAE J617a
D2 [mm]	-	-		-	
D3 [mm]	-	-		-	
B1 [mm]	124	124	124	147	147
B2 [mm]	120	120	120	136	136
B4 [mm]	-	222	222	162.3	162.3
H1 [mm]	107	141	141	116	116
H2 [mm]	107	141	141	116	116
H3 [mm] (105:LP, 165 E1L)	138	144	144	170	170
H4 [mm]	-	137	137	255	255
H5 [mm] port P	75	75	75	80	80
H6 [mm] port T	38	38	38	0	0
H7 [mm]	195	196	196	260	260
L1 [mm]	474	358	450	587.6	587.6
L2 [mm]	478	376	468	601	625
L3 [mm]	61.3	171	79	74.6	50.1
L4 [mm]	232	116	208	286.1	310.6
P (SAE)	2 x 1″	2 x 1″	2 x 1″	2 x 1 ¼“	2 x 1 ¼“
T (SAE)	1 x 3″	1 x 3″	1 x 3″	1 x 4“	1 x 4“
L	M22x1.5	M22x1.5	M22x1.5	M27x2	M27x2
U	M22x1.5	M22x1.5	M22x1.5	M27x2	M27x2

Double pump with SAE J744 flange



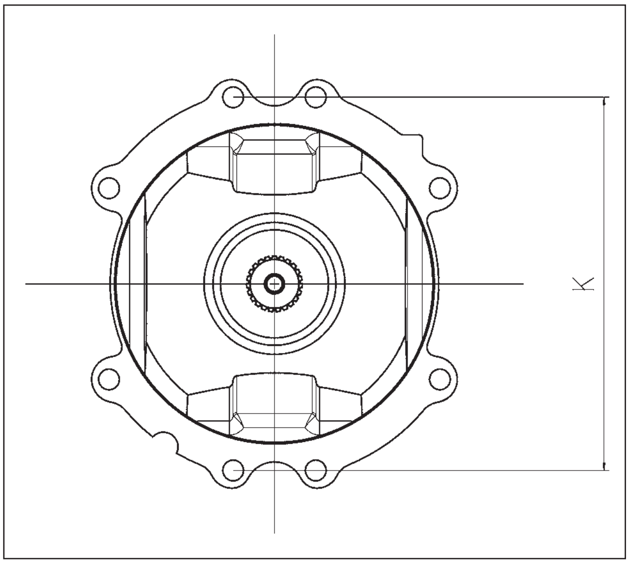
Double pump with SAE J617a flange

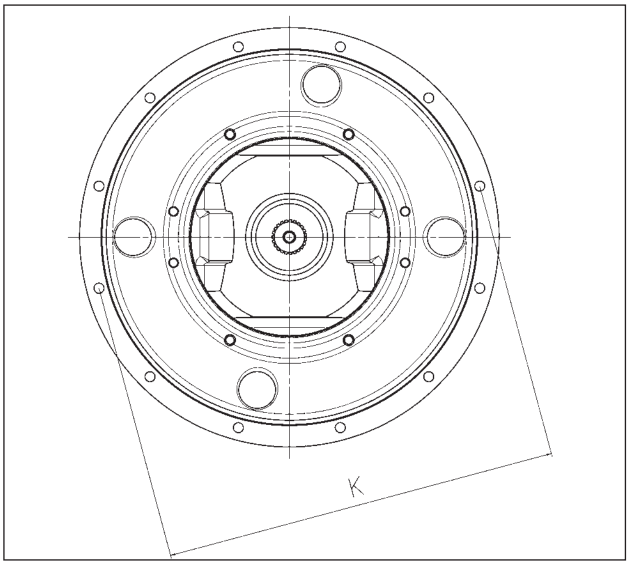


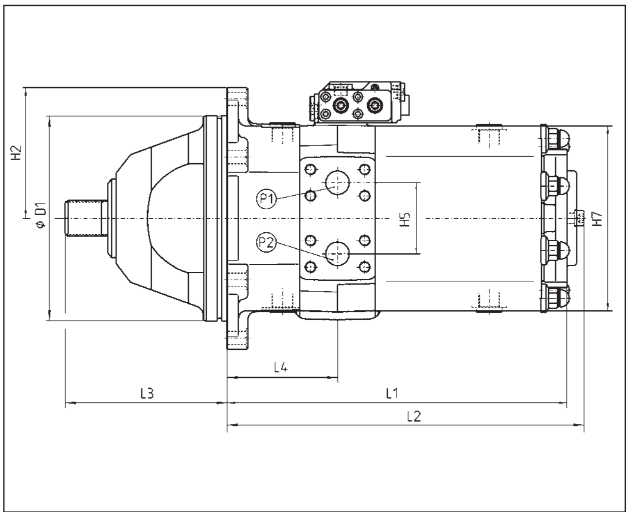
Dimensions. Double pumps and plug-in pumps

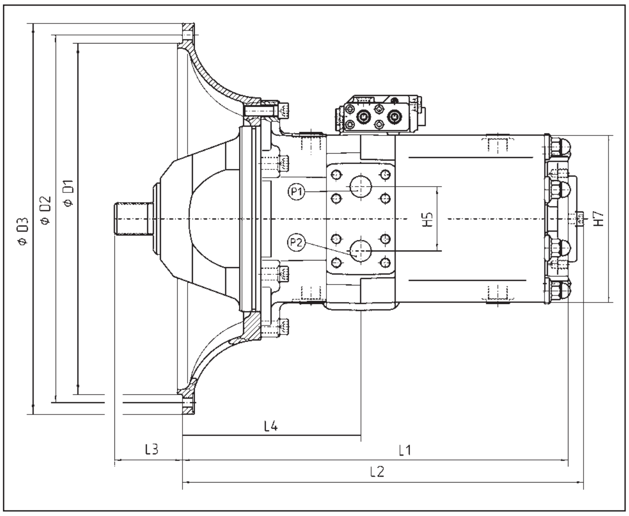
Plug-in flange

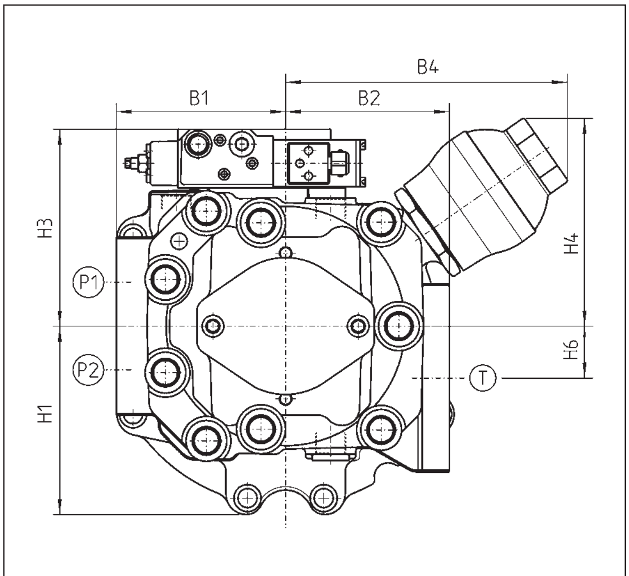
SAE bell housing

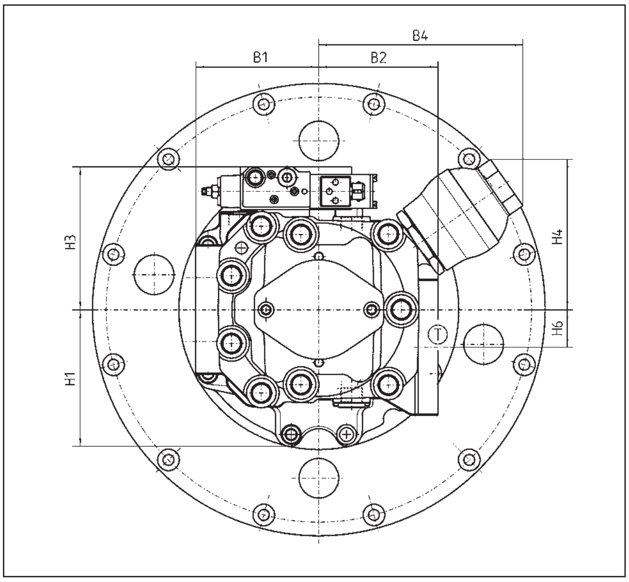








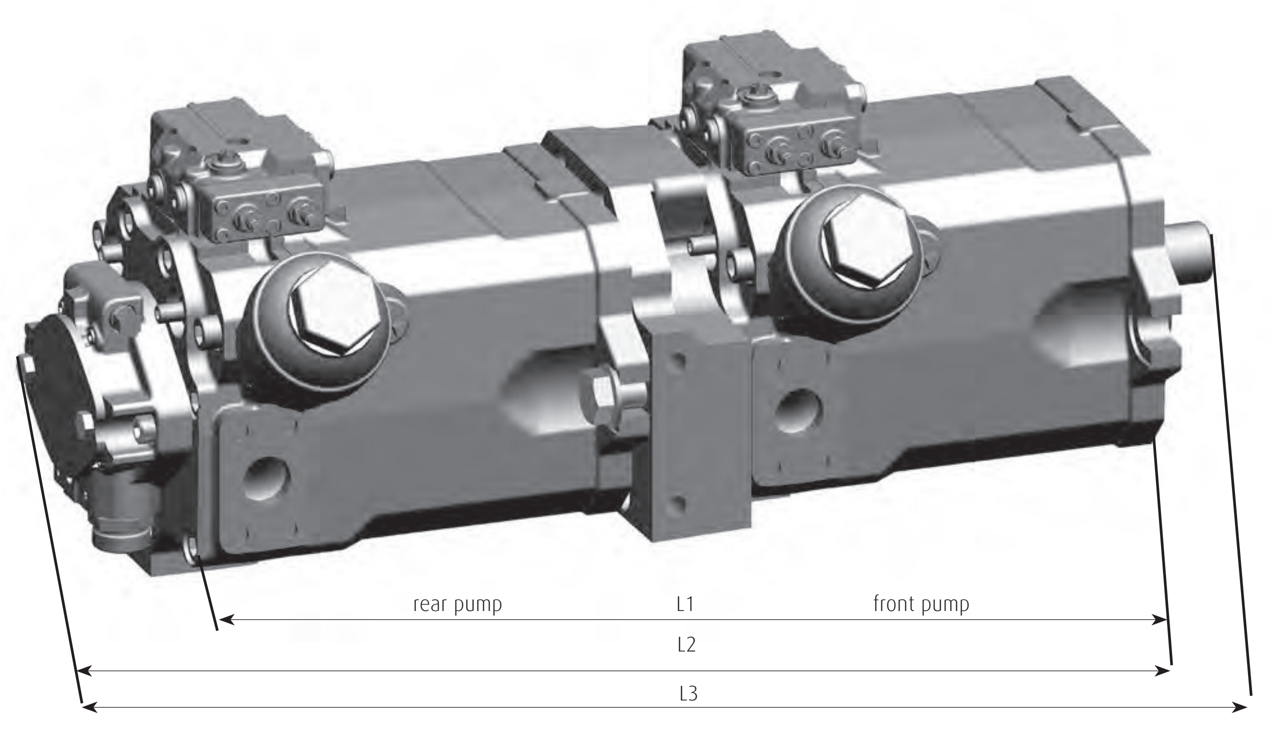




Dimensions. Multiple pumps

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



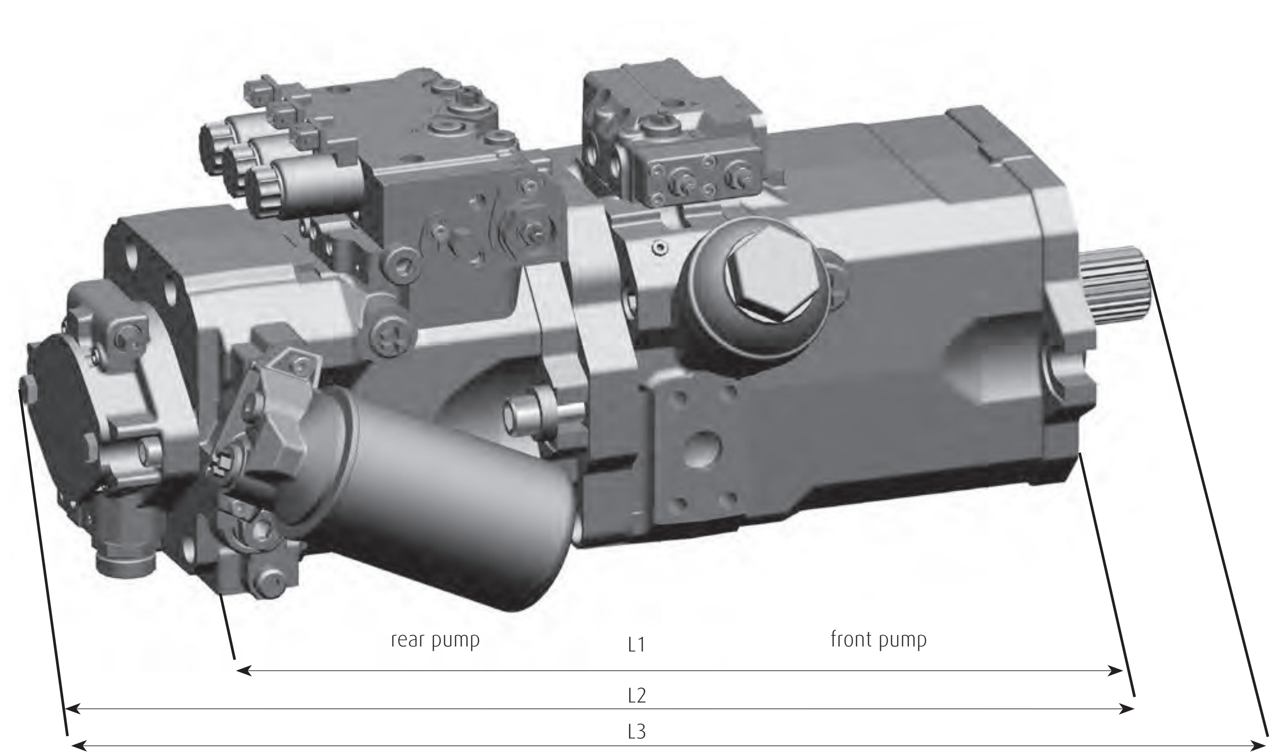
Overall length of multiple pump HPR-HPR-02

Rated size	Rear pump	HPR 55	HPR 75	HPR 105	HPR 135	HPR 165	HPR 210	HPR 280
Front pump	Charge pump	16 cc/rev	22.5 cc/rev	22.5 cc/rev	22.5 cc/rev	38 cc/rev	38 cc/rev	38 cc/rev
HPR 55	L1	488	-	-	-	-	-	-
	L2	548	-	-	-	-	-	-
	L3	602	-	-	-	-	-	-
HPR 75	L1	500	511	-	-	-	-	-
	L2	565	576	-	-	-	-	-
	L3	620	631	-	-	-	-	-
HPR 105	L1	520	531	562	-	-	-	-
	L2	585	596	627	-	-	-	-
	L3	640	651	682	-	-	-	-
HPR 135	L1	536	547	578	619	-	-	-
	L2	596	612	643	684	-	-	-
	L3	671	667	698	759	-	-	-
HPR 165	L1	579	591	621	679	728	-	-
	L2	754	766	796	854	903	-	-
	L3	829	841	871	929	978	-	-
HPR 210	L1	600	612	642	701	749	751	-
	L2	775	787	817	876	924	926	-
	L3	850	862	892	951	999	1001	-
HPR 280	L1	669	680	711	727	775	790	845
	L2	844	855	886	902	950	965	1020
	L3	919	930	961	977	1025	1040	1095

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

Rated size	Rear pump	HPV 55	HPV 75	HPV 105	HPV 135	HPV 165	HPV 210	HPV 280
Front pump	Charge pump	16 cc/rev	22.5 cc/rev	22.5 cc/rev	22.5 cc/rev	38 cc/rev	38 cc/rev	38 cc/rev
HPR 55	L1	493	-	-	-	-	-	-
	L2	553	-	-	-	-	-	-
	L3	607	-	-	-	-	-	-
HPR 75	L1	504	521	-	-	-	-	-
	L2	569	586	-	-	-	-	-
	L3	624	641	-	-	-	-	-
HPR 105	L1	525	542	567	-	-	-	-
	L2	590	607	632	-	-	-	-
	L3	645	662	687	-	-	-	-
HPR 135	L1	541	558	583	623	-	-	-
	L2	601	623	648	688	-	-	-
	L3	676	678	703	763	-	-	-
HPR 165	L1	584	601	626	683	715	-	-
	L2	759	776	801	858	890	-	-
	L3	834	851	876	933	965	-	-
HPR 210	L1	605	622	647	704	736	749	-
	L2	780	797	822	879	911	924	-
	L3	855	872	897	954	986	999	-
HPR 280	L1	674	691	716	730	762	788	834
	L2	849	866	891	905	937	963	1009
	L3	924	941	966	980	1012	1038	1048

Modular system features.

The HPR-02 is based on a modular system with the following characteristics. This enables our distribution partners to configure the product according to your requirements. The latest characteristics and available options can be taken from the model code, which is available on our homepage.

- Rated size
- V_{max}
- Direction of rotation
- Pump controller
- Solenoid connector type
- Solenoid operating voltage
- Noise reduction SPU
- Port threads
- Mounting flange
- Drive Shaft
- PTO through-drive
- PTO attachment
- Gear pumps
- Gear pump PTO
- Pump settings like speed, LS-setting, pressure cut-off, power-limitation
- Pressure cut-off remote control
- Power limitation remote control
- Surface treatment
- Name plate

Print media overview.

Product Catalogue

>> Turning Power into Motion

Brochures

>> Drive systems for construction machines.

>> Drive systems for agricultural machines.

Datasheets

>> Model Code. Configuration of the series 02

>> HMF/A/V/R-02. Hydraulic motors for closed and open loop operation

>> HPR-02. Self-regulating pumps for open loop operation

>> HPV-02. Variable pumps for closed loop operation

>> VT modular. Modular system for LSC manifold valve plate

>> Linde pressure definitions. According to DIN 24312

>> Mineral-oil-based hydraulic fluids

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LHY.HPR.11/17.e

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APPENDIX D8: SLEW MOTOR

MAKING MODERN LIVING POSSIBLE

Technical Information

Orbital Motors
OMS, OMT and OMV

powersolutions.danfoss.com

Revision history

Table of revisions

Date	Changed	Rev
February 2016	Corrected Hardening specification for OMSS, OMTS, OMVS	0601
November 2014	Converted to Danfoss layout - DITA CMS	FA
December 2013	Table updated	EL
June 2013	Drawing corrected	EK
April 2013	Drawing corrected	EJ
January 2013	Correct drawing	EI
November 2012	Planetary Gears deleted	EH
July 2012	Typo in 'Major dia'	EG
November 2010	Dimensions changed	EF
November 2009	conversions, and layout adjusted	ED

Contents

Orbital motors

OMS, OMT and OMV

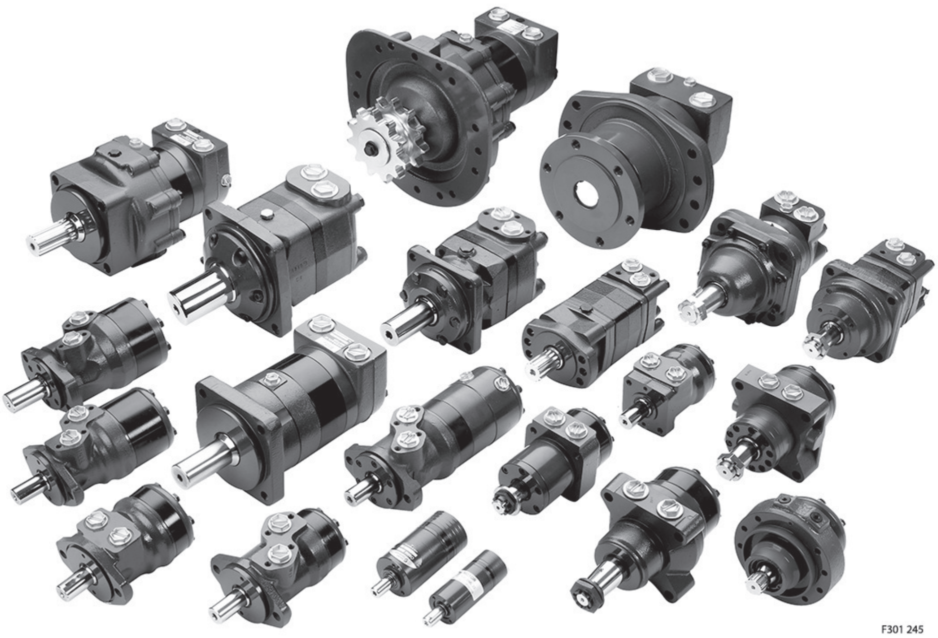
~~OMS~~

OMT

Contents

Orbital motors

Characteristic, features and application areas of Orbital Motors



F301 245

Danfoss is a world leader within production of low speed orbital motors with high torque. We can offer more than 3,000 different orbital motors, categorised in types, variants and sizes (including different shaft versions).

The motors vary in size (rated displacement) from 8 cm^3 [0.50 in^3] to 800 cm^3 [48.9 in^3] per revolution.

Speeds range up to approximate 2,500 min^{-1} (rpm) for the smallest type and up to approximate 600 min^{-1} (rpm) for the largest type.

Maximum operating torques vary from 13 N•m [115 lbf•in] to 2,700 N•m [24,000 lbf•in] (peak) and maximum outputs are from 2.0 kW [2.7 hp] to 70 kW [95 hp].

Characteristic features of Danfoss Orbital Motors

- Smooth running over the entire speed range
- Constant operating torque over a wide speed range
- High starting torque
- High return pressure without the use of drain line (High pressure shaft seal)
- High efficiency
- Long life under extreme operating conditions
- Robust and compact design
- High radial and axial bearing capacity
- For applications in both open and closed loop hydraulic systems
- Suitable for a wide variety of hydraulics fluids

Technical features of Danfoss Orbital Motor

The programme is characterised by technical features appealing to a large number of applications and a part of the programme is characterised by motors that can be adapted to a given application. Adaptions comprise the following variants among others:

Orbital motors

- Motors with corrosion resistant parts
- Wheel motors with recessed mounting flange
- OMP, OMR- motors with needle bearing
- OMR motor in low leakage version
- OMR motors in a super low leakage version
- Short motors without bearings
- Ultra short motors
- Motors with integrated positive holding brake
- Motors with integrated negative holding brake
- Motors with integrated flushing valve
- Motors with speed sensor
- Motors with tacho connection
- All motors are available with black finish paint

The Danfoss Orbital Motors are used in the following application areas:

- Construction equipment
- Agricultural equipment
- Material handling & Lifting equipment
- Forestry equipment
- Lawn and turf equipment
- Special purpose
- Machine tools and stationary equipment
- Marine equipment

Survey of literature with technical data on Danfoss Orbital Motors

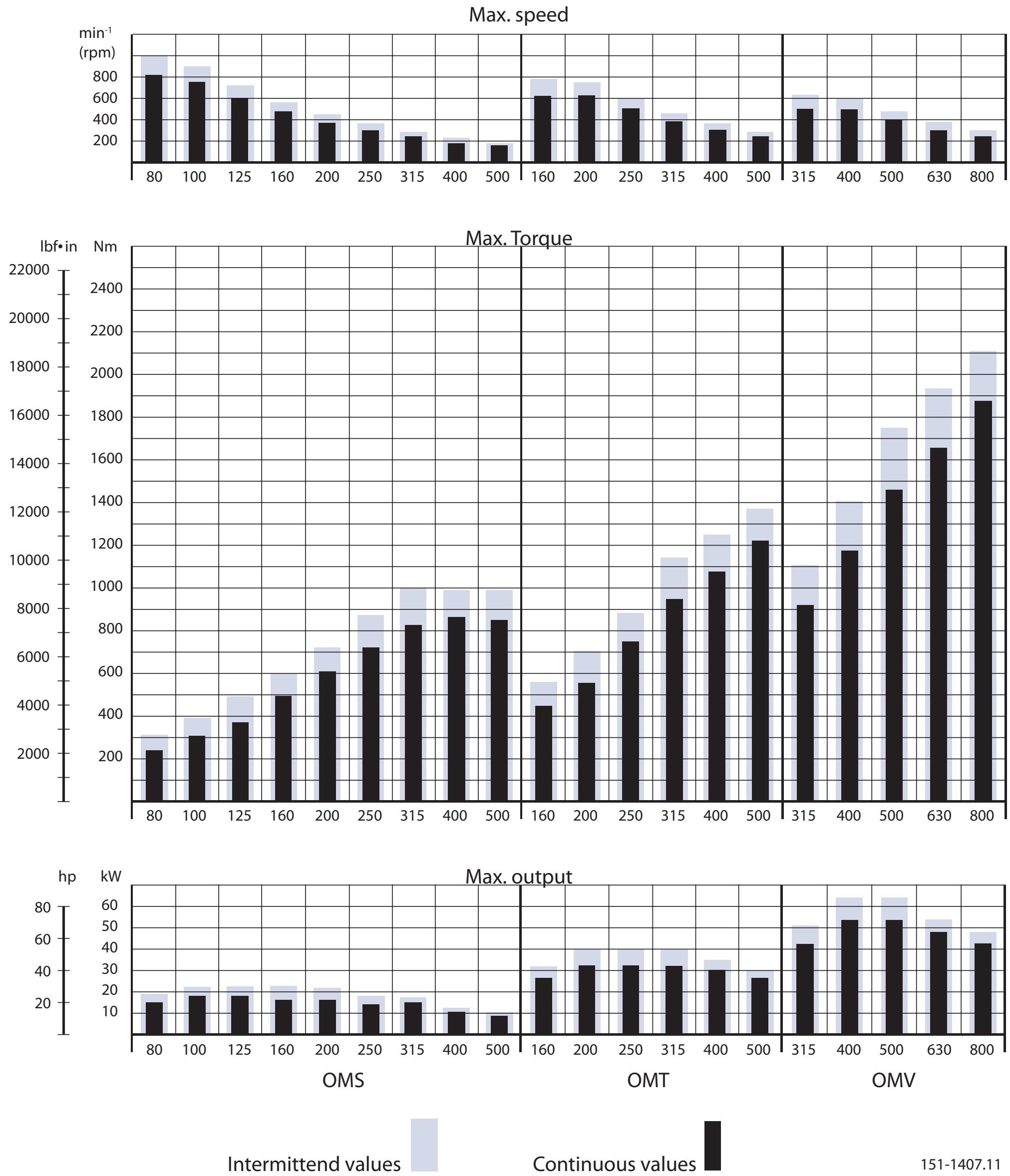
Detailed data on all Danfoss Orbital Motors can be found in our motor catalogue, which is divided into more individual subcatalogues:

- General information on Danfoss Orbital Motors: function, use, selection of orbital motor, hydraulic systems, etc.
- Technical data on small motors: OML and OMM
- Technical data on medium sized motors: OMP, OMR, OMH
- Technical data on medium sized motors: DH and DS
- Technical data on medium sized motors: OMEW
- Technical data on medium sized motors: VMP
- Technical data on medium sized motors: VMR
- Technical data on large motors: OMS, OMT and OMV
- Technical data on large motors: TMK
- Technical data on large motors: TMT
- Technical data on large motors: TMTHW
- Technical data on large motors: TMVW

A general survey brochure on Danfoss Orbital Motors gives a quick motor reference based on power, torque, speed and capabilities.

OMS, OMT and OMV

Speed, torque and output



The bar diagrams above are useful for a quick selection of relevant motor size for the application. The final motor size can be determined by using the function diagram for each motor size.

- OMS *Function diagrams* on page 18
- OMT *Function diagrams* on page 54

OMS, OMT and OMV

- OMV *Function diagrams* on page 81

The function diagrams are based on actual tests on a representative number of motors from our production. The diagrams apply to a return pressure between 5 and 10 bar [75 and 150 psi] when using mineral based hydraulic oil with a viscosity of 35 mm^2/s [165 SUS] and a temperature of 50°C [120°F]. For further explanation concerning how to read and use the function diagrams, please consult the paragraph "Selection of motor size" in the technical information "General Orbital motors" 520L0232.

OMS

Versions

OMS versions

Mounting flange	Shaft	Port size	European version	US version	Drain connection	Check valve	Main type designation
Standard flange	Cyl. 32 mm	G 1/2	X		Yes	Yes	OMS
	Cyl. 1.25 in	7/8-14 UNF		X	Yes	Yes	OMS
	Splined 1.25 in	G 1/2	X		Yes	Yes	OMS
		7/8-14 UNF		X	Yes	Yes	OMS
	Tapered 35 mm	G 1/2	X		Yes	Yes	OMS
	Tapered 1.25 in	7/8-14 UNF		X	Yes	Yes	OMS
	P.t.o.	G 1/2	X		Yes	Yes	OMS
Special flange	Splined 1.25 in	G 1/2	X		Yes	Yes	OMS
A-2 flange	Cyl. 1 in	7/8-14 UNF		X	Yes	Yes	OMS
	Cyl. 1.25 in	7/8-14 UNF		X	Yes	Yes	OMS
	Splined 1 in	7/8-14 UNF		X	Yes	Yes	OMS
	Splined 1.25 in	7/8-14 UNF		X	Yes	Yes	OMS
	Tapered 1.25 in	7/8-14 UNF		X	Yes	Yes	OMS
Magneto flange	Cyl. 1 in	7/8-14 UNF		X	Yes	Yes	OMS
	Cyl. 1.25 in	7/8-14 UNF		X	Yes	Yes	OMS
	Splined 1 in	7/8-14 UNF		X	Yes	Yes	OMS
	Splined 1.25 in	7/8-14 UNF		X	Yes	Yes	OMS
SAE B flange	Splined 1.25 in	7/8-14 UNF		X	Yes	Yes	OMS
	Splined 0.875 in	7/8-14 UNF		X	Yes	Yes	OMS
Wheel	Cyl. 32 mm	G 1/2	X		Yes	Yes	OMSW
	Cyl. 1.25 in	7/8-14 UNF		X	Yes	Yes	OMSW
	Tapered 35 mm	G 1/2	X		Yes	Yes	OMSW
	Tapered 1.25 in	7/8-14 UNF		X	Yes	Yes	OMSW
Short	No output shaft	G 1/2	X		Yes	Yes	OMSW

Features

Features available (options):

- Speed sensor
- Motor with tacho connection
- High pressure shaft seal
- Viton shaft seal
- Painted
- Ultra short
- Motor with drum brake

OMS

Code numbers

OMS code numbers

Code Numbers	Displacement [cm³]								
	80	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**
151F	0500	0501	0502	0503	0504	0505	0506	0605	-
151F	2200	2201	2202	2203	2204	2205	2206	2261	2268
151F	0507	0508	0509	0510	0511	0512	0513	-	-
151F	2207	2208	2209	2210	2211	2212	2213	2262	2269
151F	0514	0515	0516	0517	0518	0519	0520	-	-
151F	2214	2215	2216	2217	2218	2219	2220	2264	2270
151F	0560	0561	0562	0563	0564	0565	0566	-	-
151F	0542	0543	0544	0545	0546	0547	0548	-	-
151F	2300	2301	2302	2303	2304	2305	2306	2307	2345
151F	2316	2317	2318	2319	2320	2321	2322	2323	2347
151F	2308	2309	2310	2311	2312	2313	2314	2315	2346
151F	2324	2325	2326	2327	2328	2329	2330	2331	2348
151F	2332	2333	2334	2335	2336	2337	2338	2339	2349
151F	2377	2378	2379	2380	2381	2382	2383	2384	2385
151F	2368	2369	2370	2371	2372	2373	2374	2375	2376
151F	2359	2360	2361	2362	2363	2364	2365	2366	2367
151F	2350	2351	2352	2353	2354	2355	2356	2357	2358
151F	2395	2396	2397	2398	2399	2400	2401	2402	2403
151F	2413	2414	2415	2416	2417	-	-	-	-
151F	0521	0522	0523	0524	0525	0526	0527	0610	-
151F	2235	2236	2237	2238	2239	2240	2241	2265	2266
151F	0528	0529	0530	0531	0532	0533	0534	0609	-
151F	2242	2243	2244	2245	2246	2247	2248	2263	2267
151F	0535	0536	0537	0538	0539	0540	0541	0608	-

Ordering

Add the four digit prefix “151F” to the four digit numbers from the chart for complete code number.

Example:

151F0504 for an OMS 200 with standard flange, cyl. 32 mm shaft and port size G 1/2.

Orders will not be accepted without the four digit prefix.

OMS

Technical data

Type			OMS OMSW OMSS	OMS OMSW OMSS	OMS OMSW OMSS	OMS OMSW OMSS	OMS OMSW OMSS	OMS OMSW OMSS	OMS OMSW OMSS	OMS OMSW OMSS	OMS OMSW OMSS
Motor size			**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**
Geometric displacement	cm^3 [in^3]		80.5 [4.91]	100.0 [6.10]	125.7 [7.67]	159.7 [9.75]	200.0 [12.20]	250.0 [15.26]	314.9 [19.22]	393.0 [23.98]	488.0 [29.78]
Max. speed	min^{-1} [rpm]	cont.	810	750	600	470	375	300	240	190	155
		int[1)]	1000	900	720	560	450	360	285	230	185
Max. torque	Nm [lbf·in]	cont.	240 [2120]	305 [2700]	375 [3320]	490 [4340]	610 [5400]	720 [6370]	825 [7300]	865 [7660]	850 [7520]
		int.[1)]	310 [2740]	390 [3450]	490 [4340]	600 [5310]	720 [6370]	870 [7700]	1000 [8850]	990 [8760]	990 [8760]
Max. output	kW [hp]	cont.	15.5 [20.8]	18.0 [24.1]	18.0 [24.1]	16.5 [22.1]	16.5 [22.1]	14.5 [19.4]	15.0 [20.1]	11.0 [14.8]	9.0 [12.1]
		int.[1)]	19.5 [26.2]	22.5 [30.2]	22.5 [30.2]	23.0 [30.8]	22.0 [29.5]	18.0 [24.1]	17.0 [22.8]	12.5 [16.8]	10.5 [14.1]
Max. pressure drop	bar [psi]	cont.	210 [3050]	210 [3050]	210 [3050]	210 [3050]	210 [3050]	200 [2900]	200 [2900]	160 [2320]	120 [1740]
		int.[1)]	275 [3990]	275 [3990]	275 [3990]	260 [3770]	250 [3630]	250 [3630]	240 [3480]	190 [2760]	140 [2030]
		peak2)	295 [4280]	295 [4280]	295 [4280]	280 [4060]	270 [3920]	270 [3920]	260 [3770]	210 [3050]	160 [2320]
Max. oil flow	l/min [USgal/min]	cont.	65 [17.2]	75 [19.8]	75 [19.8]	75 [19.8]	75 [19.8]	75 [19.8]	75 [19.8]	75 [19.8]	75 [19.8]
		int.[1)]	80 [21.1]	90 [23.8]	90 [23.8]	90 [23.8]	90 [23.8]	90 [23.8]	90 [23.8]	90 [23.8]	90 [23.8]
Max. starting pressure with unloaded shaft	bar [psi]		12 [175]	10 [145]	10 [145]	8 [115]	8 [115]	8 [115]	8 [115]	8 [115]	8 [115]
Min. starting torque	at max. press. drop cont. Nm [lbf·in]		180 [1590]	230 [2040]	290 [2570]	370 [3270]	470 [4160]	560 [4960]	710 [6280]	710 [6280]	660 [5840]
	at max. press. drop int.[1)] Nm [lbf·in]		235 [2080]	300 [2660]	380 [3360]	460 [4070]	560 [4960]	700 [6200]	850 [7520]	840 [7430]	770 [6820]

Type			Max. inlet pressure	Max. return pressure with drain line
OMS OMSW OMSS	bar [psi]	cont.	230 [3340]	140 [2030]
	bar [psi]	int.[1)]	295 [4280]	175 [2540]
	bar [psi]	peak[2)]	300 [4350]	210 [3050]

			Splined 1 in	Cyl. 1 in	Splined 0.875 in
*Max torque for shaft type	Nm [lbf·in]	cont.	360 [3190]	300 [2660]	200 [1770]
		int.[1)]	450 [3980]	410 [3630]	200 [1770]

[1)] Intermittent operation: the permissible values may occur for max. 10% of every minute.

[2)] Peak load: the permissible values may occur for max. 1% of every minute.

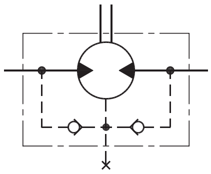
For max. permissible combination of flow and pressure, see function diagram for actual motor.

OMS

Maximum permissible shaft seal pressure

Motor with check valves and without use of drain connection

The pressure on the shaft seal never exceeds the pressure in the return line.

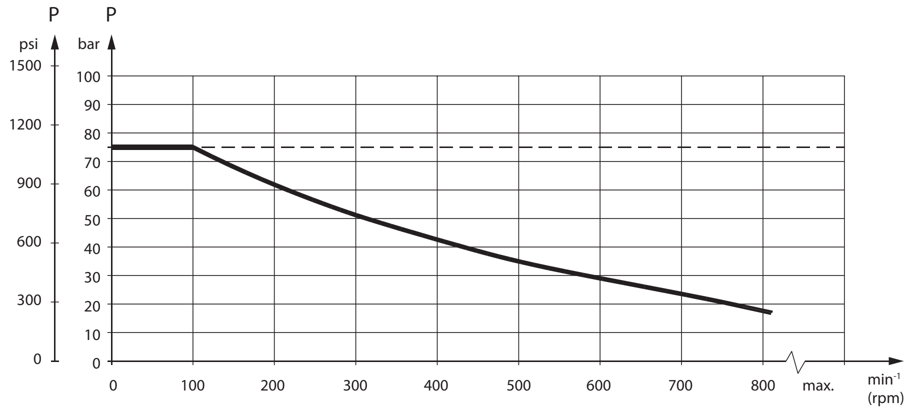


151-320.10

Maximum return pressure

The shaft seal pressure equals the pressure on the drain line.

Maximum return pressure without drain line or maximum pressure in the drain line



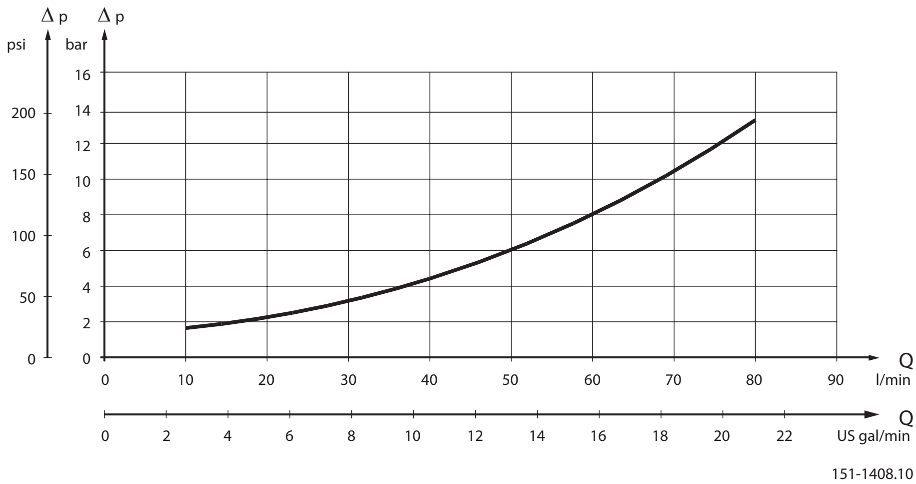
151-1674.10

– – – – Intermittent operation: the permissible values may occur for max. 10% of every minute.

——— Continuous operation

OMS

Pressure drop in motor



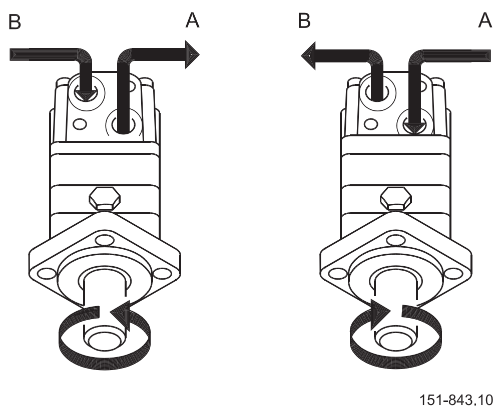
The curve applies to an unloaded motor shaft and an oil viscosity of 35 mm^2/s [165 SUS]

Oil flow in drain line

Maximum oil flow in the drain line at a return pressure less than 5-10 bar [75-150 psi]

Pressure drop bar [psi]	Viscosity mm^2/s [SUS]	Oil flow in drain line l/min [US gal/min]
140 [2030]	20 [100]	1.5 [0.40]
	35 [165]	1.0 [0.26]
210 [3050]	20 [100]	3.0 [0.79]
	35 [165]	2.0[0.53]

Direction of shaft rotation



Permissible shaft loads for OMS

Mounting flange:

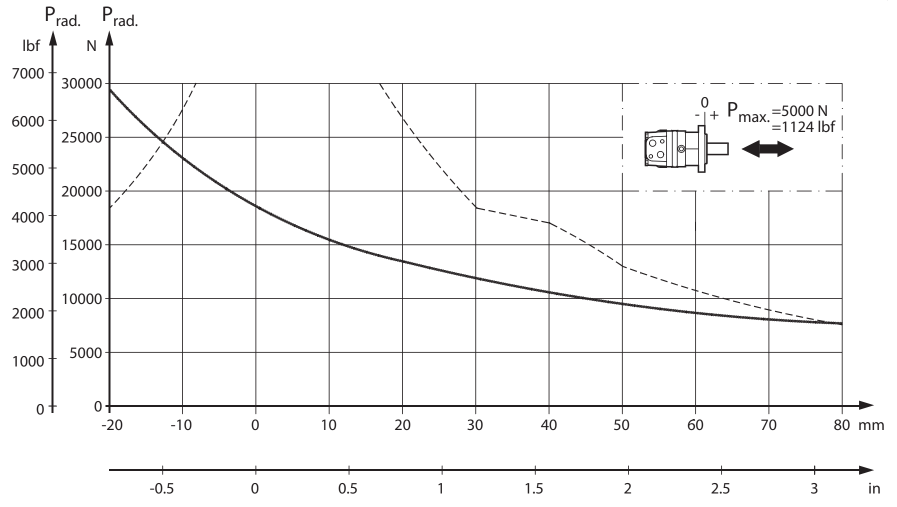
Standard – A-2 – Magneto – SAE B

OMS

Shaft:

Cyl. 32 mm – Cyl. 1.25 in – Splined 1.25 in.

Tapered 35 mm – Tapered 1.25 in – P.t.o.



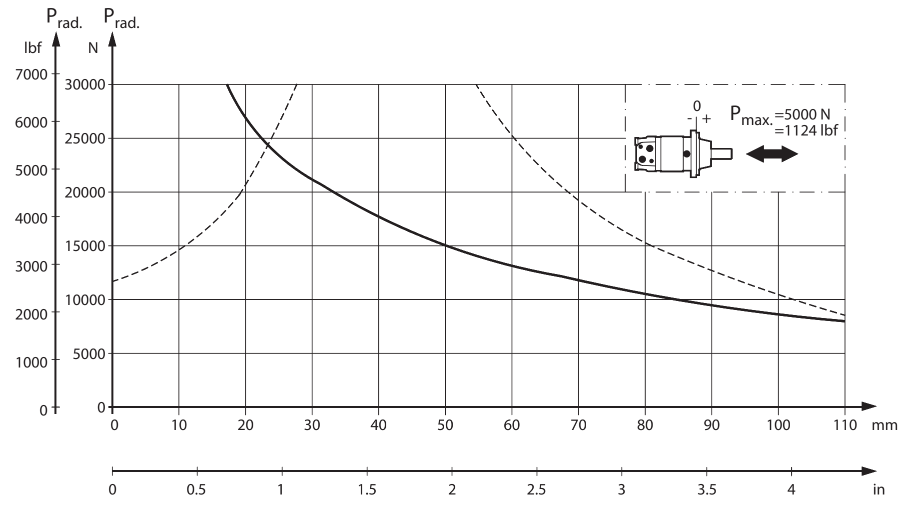
151-1962.10

Mounting flange:

Wheel

Shaft:

All shaft types



151-1964.10

The output shaft runs in tapered roller bearings that permit high axial and radial forces.

The permissible radial load on the shaft is shown for an axial load of 0 N as a function of the distance from the mounting flange to the point of load application.

OMS

The curve is based on B10 bearing life (2000 hours or 12,000,000 shaft revolutions at 100 min^{-1}) at rated output torque, when mineral-based hydraulic oil with a sufficient content of anti-wear additives, is used.

For 3,000,000 shaft revolutions or 500 hours – increase these shaft loads with 52%.

The dash curve shows maximum radial shaft load. Any shaft load exceeding the values shown in the curve will involve a risk of breakage.

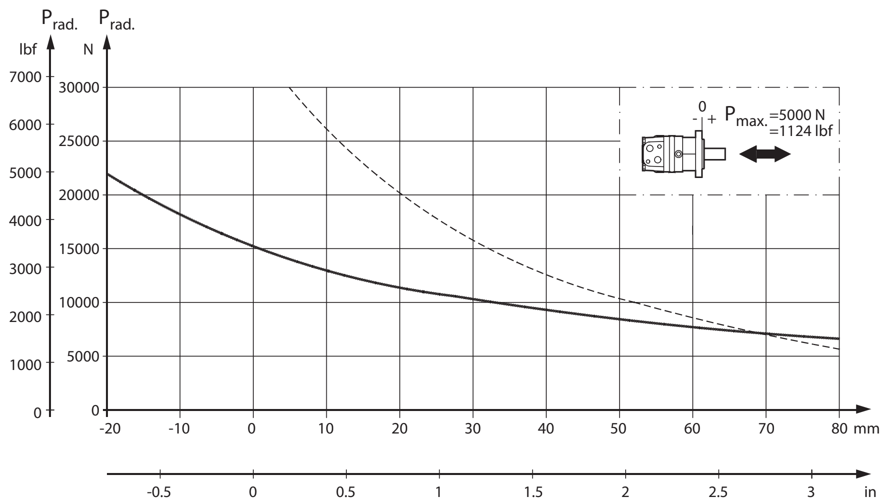
Bearing life calculations can be made using the explanation and formula provided in the chapter "Bearing dimensioning" in the technical information "General Orbital motors" 520L0232.

Mounting flange:

Special

Shaft:

Splined 1.25 in



151-1960.10

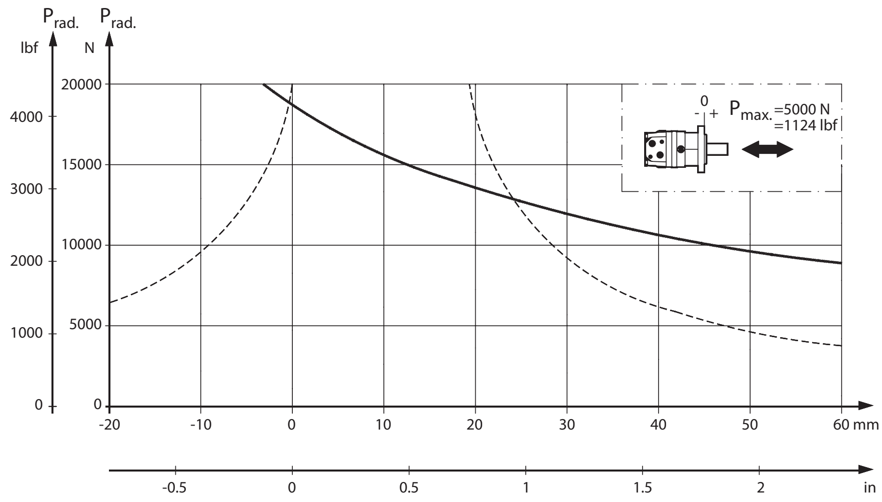
Mounting flange:

A-2 – Magneto

Shaft:

Cyl. 1 in – Splined 1 in

OMS



151-1961.10

The output shaft runs in tapered roller bearings that permit high axial and radial forces.

The permissible radial load on the shaft is shown for an axial load of 0 N as a function of the distance from the mounting flange to the point of load application.

The curve is based on B10 bearing life (2000 hours or 12,000,000 shaft revolutions at 100 min^{-1}) at rated output torque, when mineral-based hydraulic oil with a sufficient content of anti-wear additives, is used.

For 3,000,000 shaft revolutions or 500 hours – increase these shaft loads with 52%.

The dash curve shows max. radial shaft load. Any shaft load exceeding the values shown in the curve will involve a risk of breakage.

Bearing life calculations can be made using the explanation and formula provided in the chapter "Bearing dimensioning" in the technical information "General Orbital motors" 520L0232.

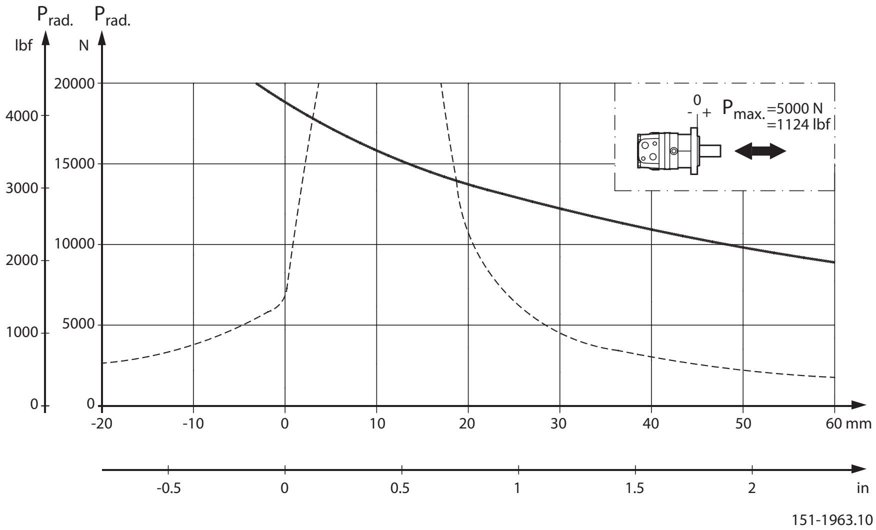
Mounting flange:

SAE B

Shaft:

Splined 0.875 in

OMS



The output shaft runs in tapered roller bearings that permit high axial and radial forces.

The permissible radial load on the shaft is shown for an axial load of 0 N as a function of the distance from the mounting flange to the point of load application.

The curve is based on B10 bearing life (2000 hours or 12,000,000 shaft revolutions at 100 min^{-1}) at rated output torque, when mineral-based hydraulic oil with a sufficient content of anti-wear additives, is used.

For 3,000,000 shaft revolutions or 500 hours – increase these shaft loads with 52%.

The dash curve shows max. radial shaft load. Any shaft load exceeding the values shown in the curve will involve a risk of breakage.

Bearing life calculations can be made using the explanation and formula provided in the chapter "Bearing dimensioning" in the technical information "General Orbital motors" 520L0232.

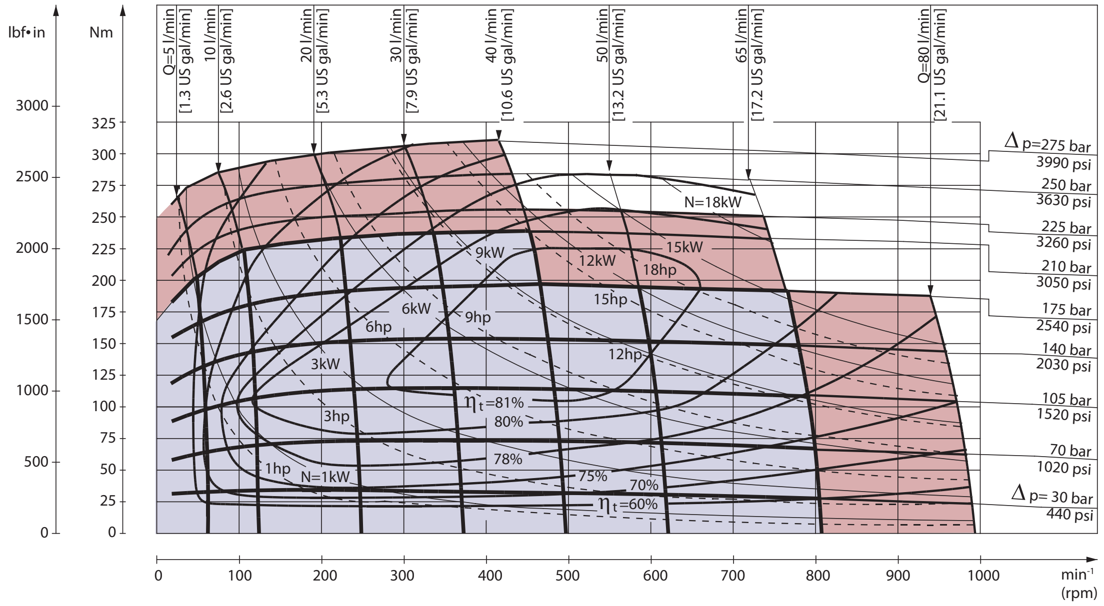
OMS

Function diagrams

Continuous range

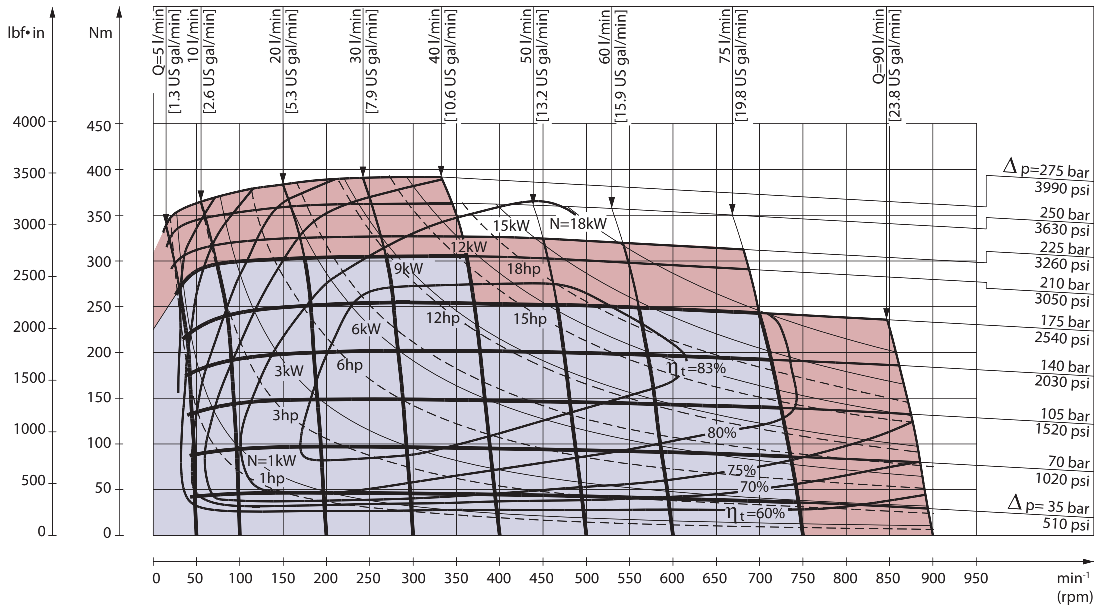
Intermittent range (maximum 10% operation every minute)

OMS 80



151-901.10

OMS 100

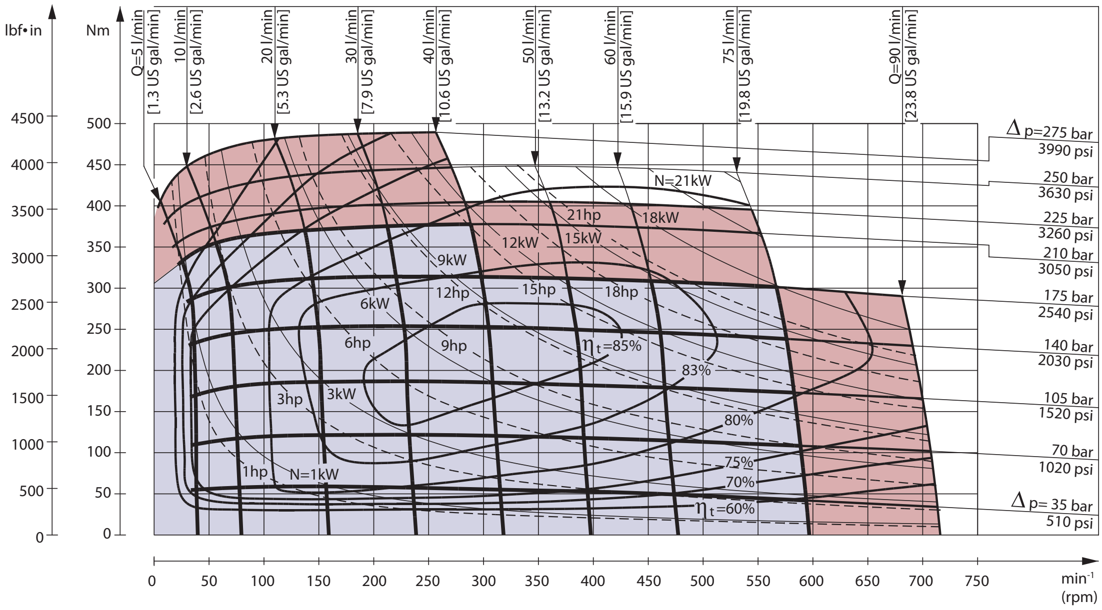


151-902.10

9hp

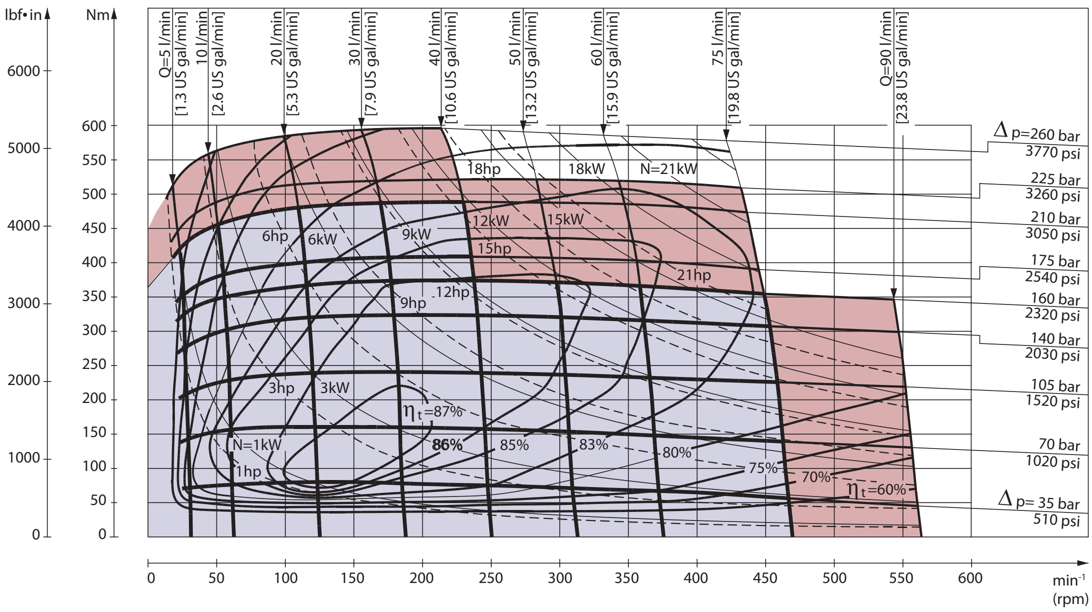
OMS

OMS 125



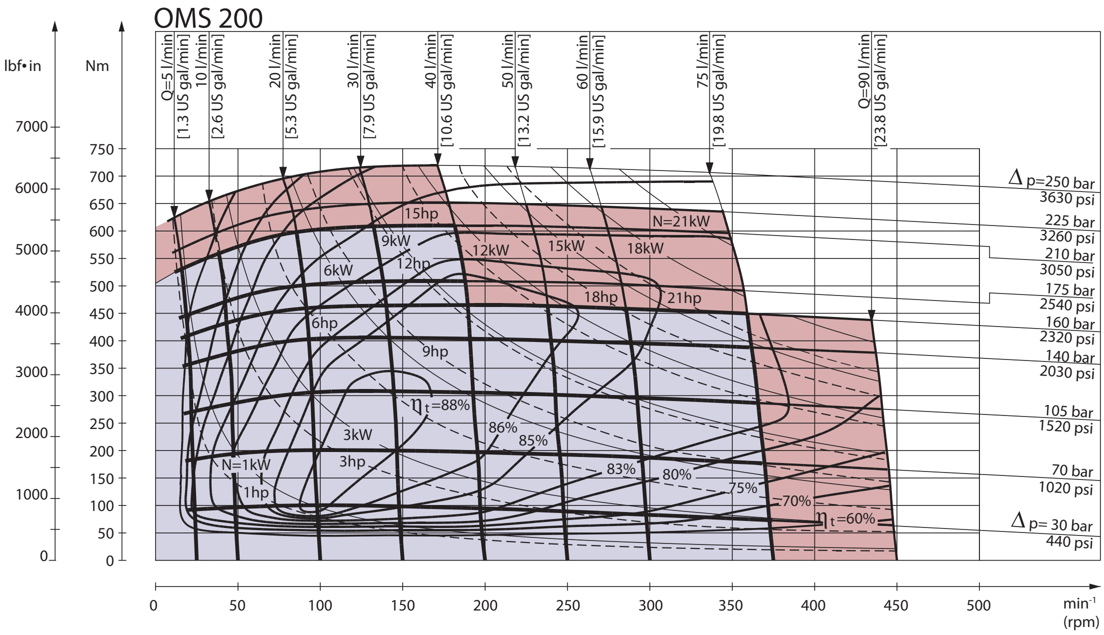
151-903.10

OMS 160

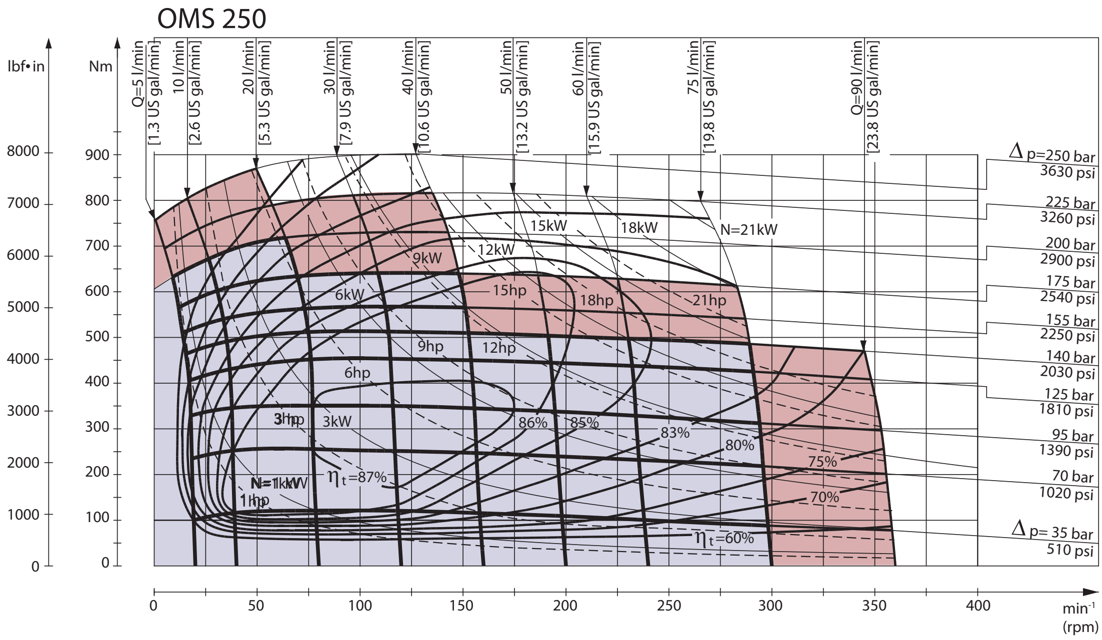


151-904.11

OMS

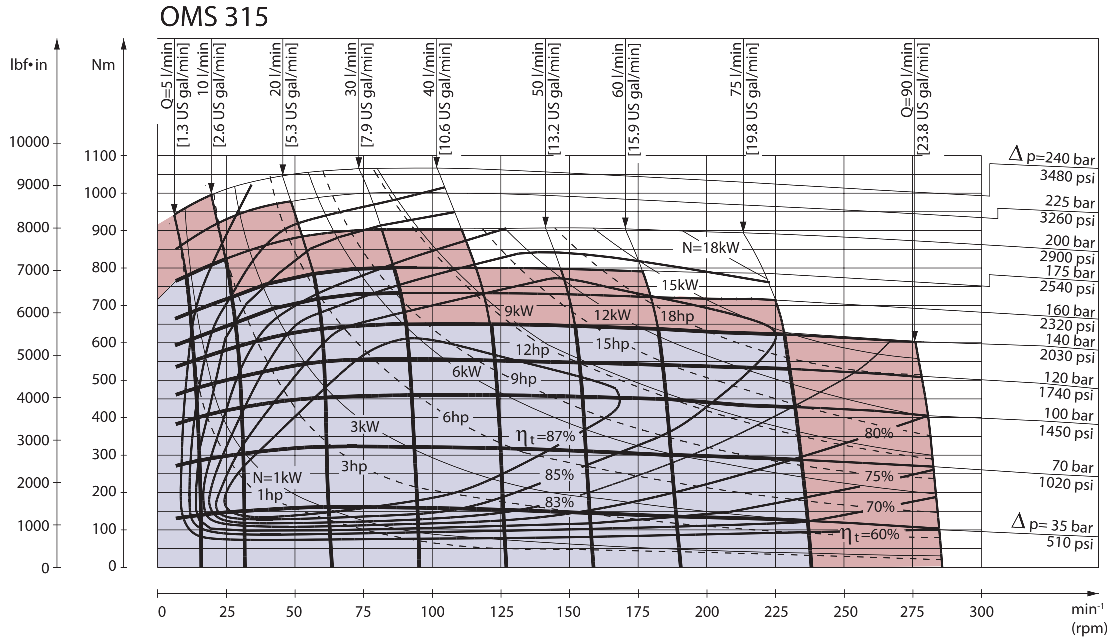


151-905.10

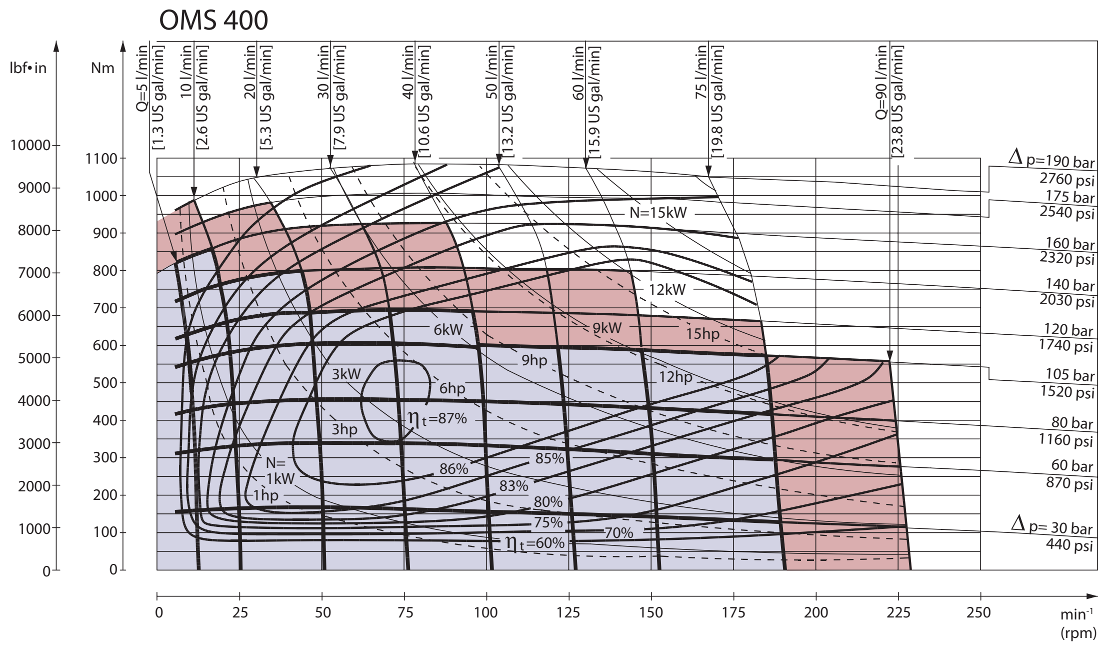


151-1039.10

OMS

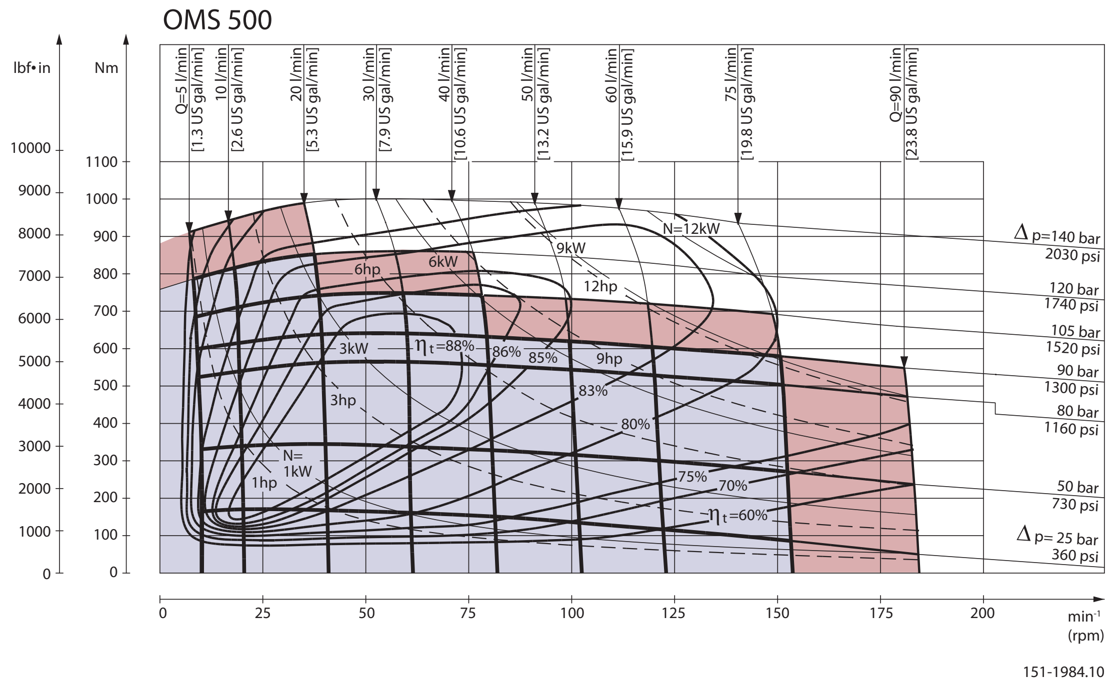


151-906.10



151-1491.10

OMS



Function diagram use

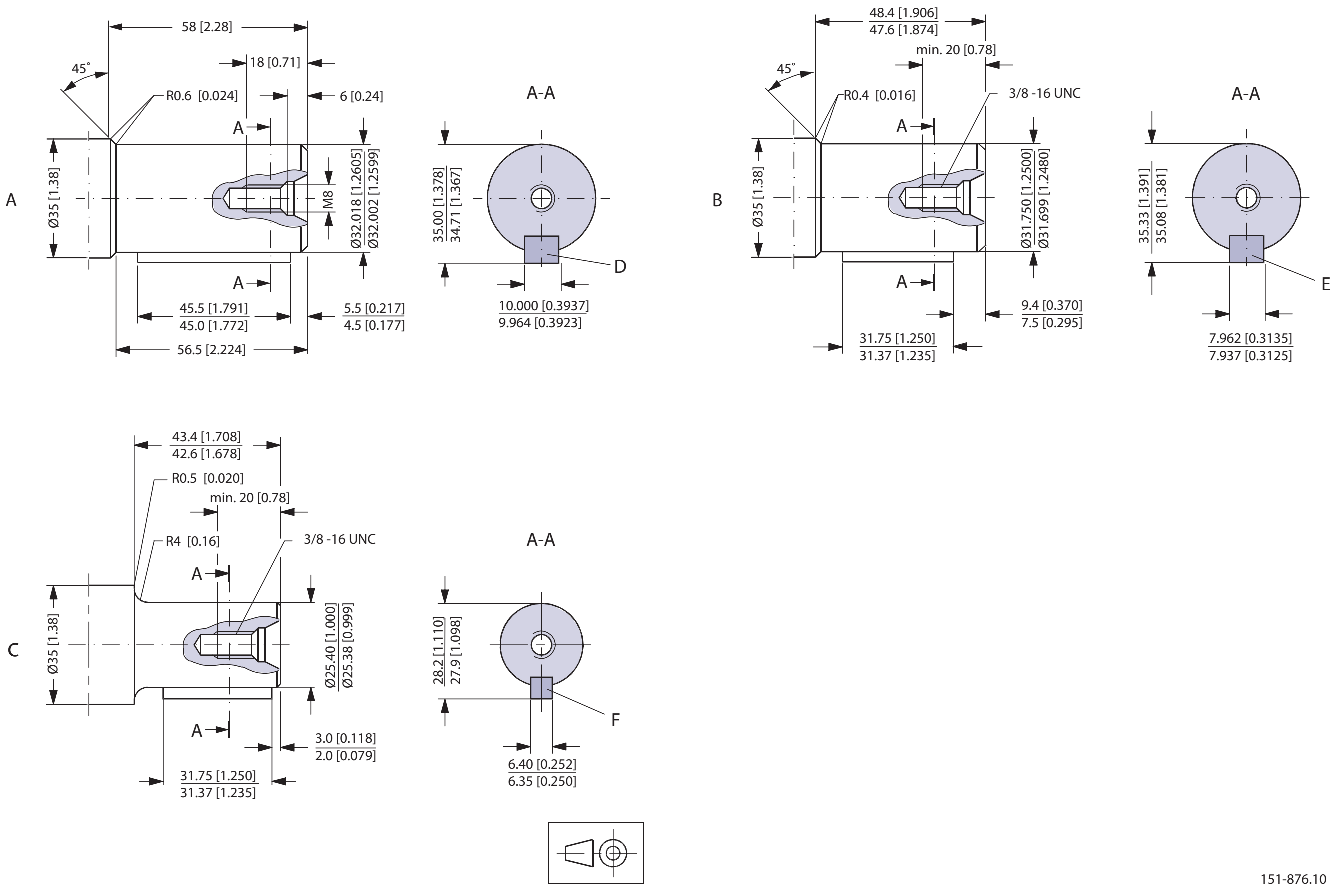
Explanation of function diagram use, basis and conditions, see *Speed, torque and output* on page 7.

Maximum permissible continuous/intermittent torque for the actual shaft version, see *Technical data* on page 11.

Intermittent pressure drop and oil flow must not occur simultaneously.

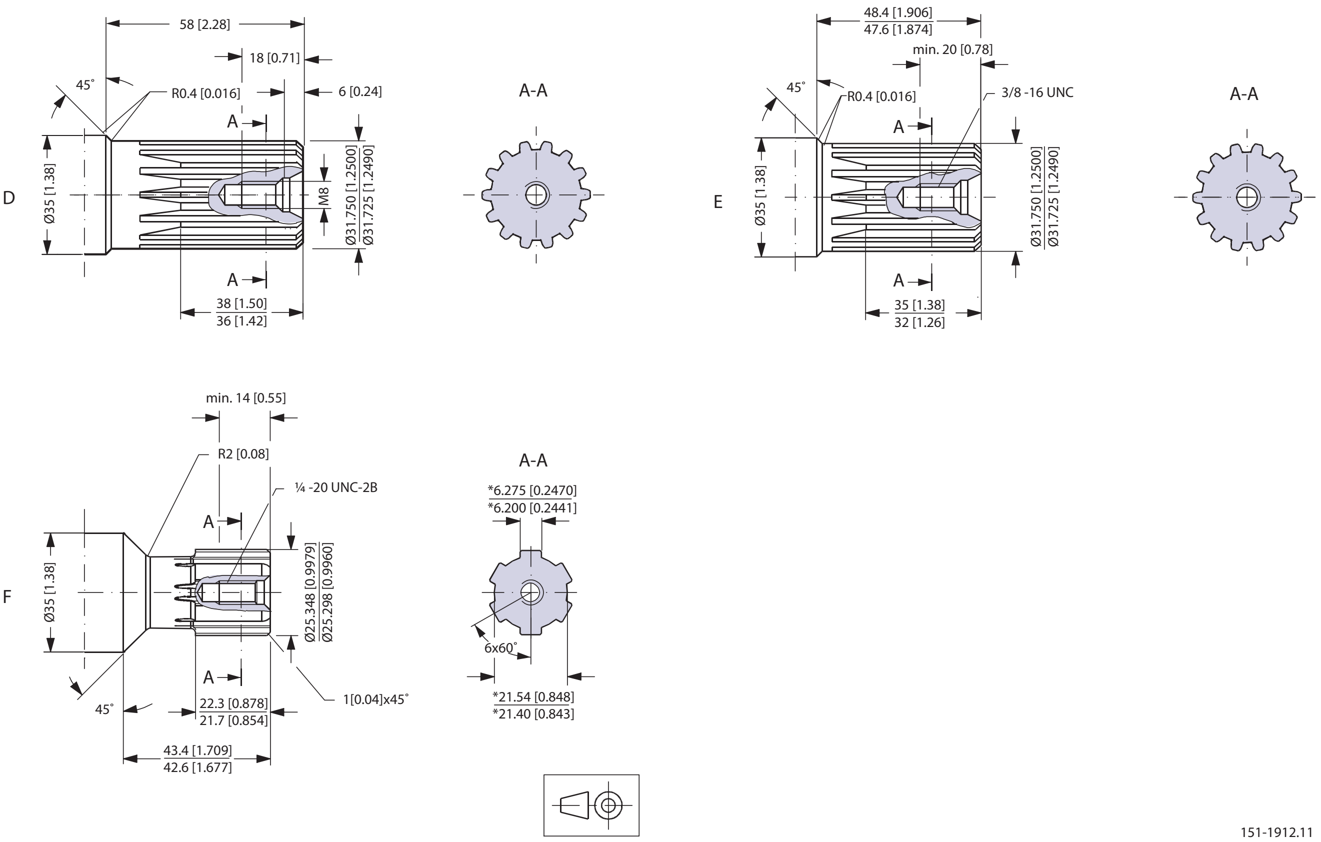
OMS

Shaft version



A	Cylindrical 32 mm shaft	**B**	Cylindrical 1.25 in shaft	**C**	Cylindrical 1 in shaft
D	Parallel key A10 × 8 × 45 DIN 6885 Keyway deviates from standard	**E**	Parallel key 5/16 × 5/16 × 11/4 in SAE J744 Keyway deviates from standard	**F**	Parallel key 1/4 × 1/4 × 11/4 in B.S. 46 Keyway deviates from standard

OMS

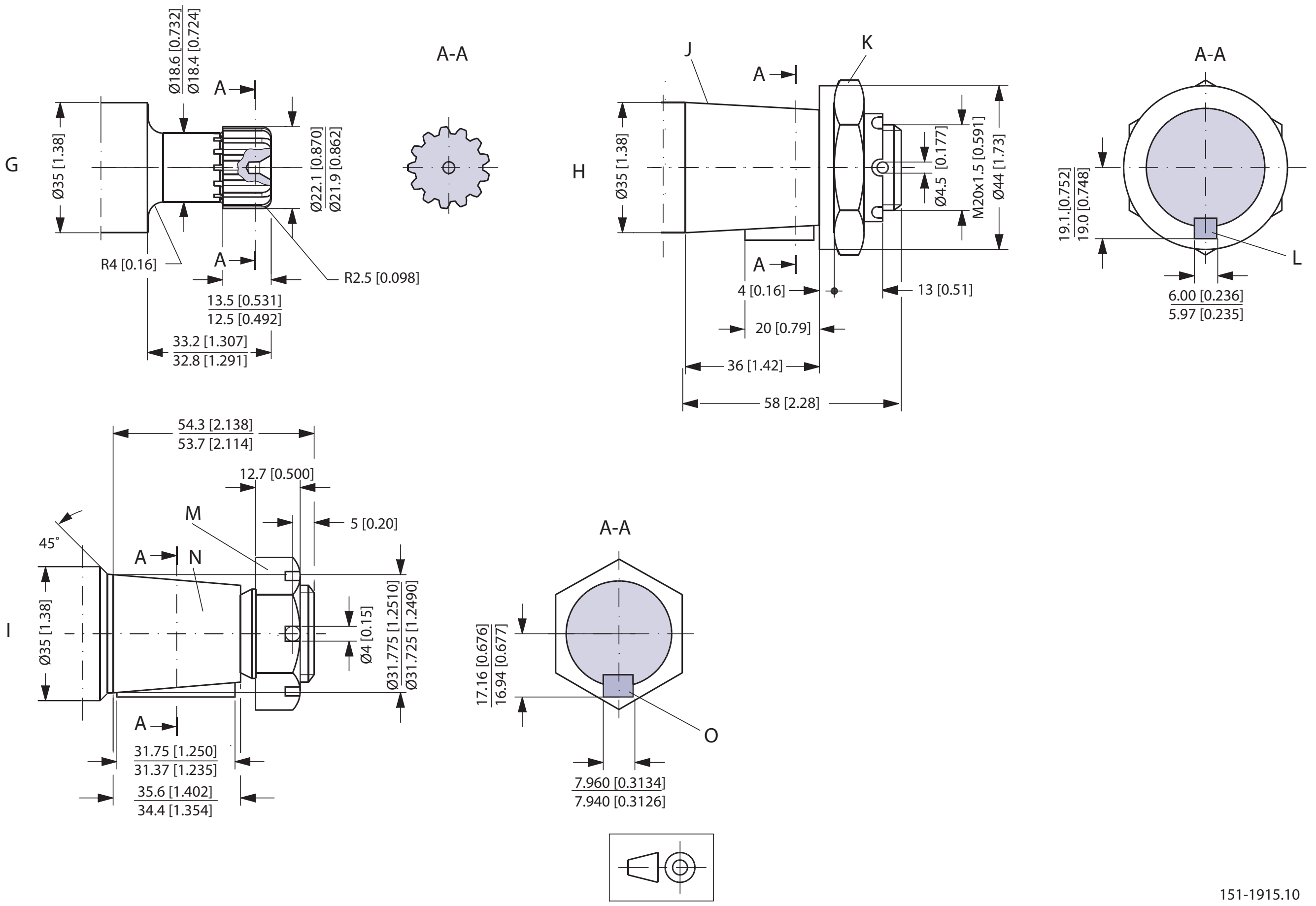


D Involute splined shaft
ANS B92.1 - 1970 standard
Flat root side fit
Pitch 12/24
Teeth 14
Major diameter 1.25 in
Pressure angle 30°

E **US version**
Involute splined shaft
ANS B92.1 - 1970 standard
Flat root side fit
Pitch 12/24
Teeth 14
Major diameter 1.25 in
Pressure angle 30°

F Splined shaft
SAE 6 B (B.S. 2059)
Straight-sided, bottom fitting, deep
Fit 2
Nominal size 1 in
*Deviates from SAE 6 B (B.S. 2059)

~~OMS~~



G Involute splined shaft
ANS B92.1 - 1970 standard
Flat root side fit
Pitch 16/32
Teeth 13
Major dia. 0.875 in
Pressure angle 30°

I Tapered 1 1/4 in shaft

H Tapered 35 mm shaft
(ISO/R775)

K DIN 937
Across flats: 41 mm
Tightening torque: 200 ± 10 Nm [1770 ±85 lbf·in]

J Taper 1:10

L Parallel key
B6 × 6 × 20
DIN 6885
Keyway deviates from standard

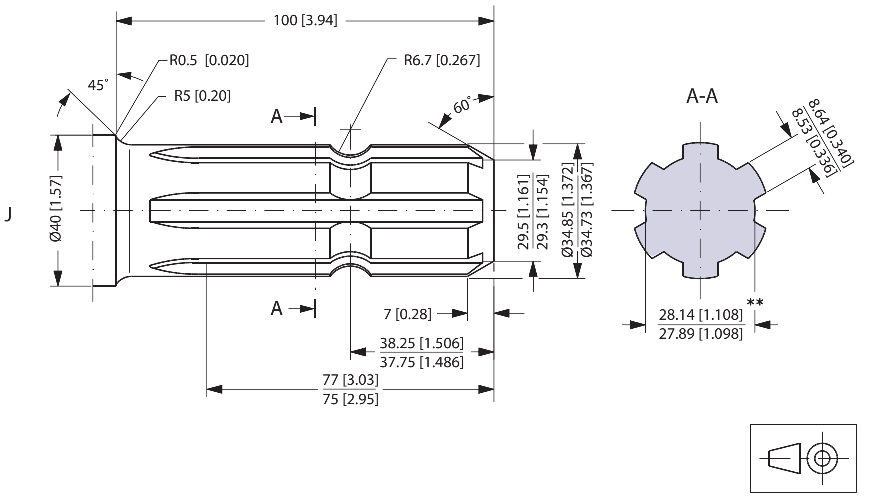
I Tapered 1 1/4 in shaft

M 1 - 20 UNEF
Across flats 1 7/16 in
Tightening torque: 200 ± 10 Nm (1770 ±85 lbf·in)

N Cone 1:8
SAE J501

O Parallel key
5/16 × 5/16 × 1 1/4
SAE J501
Keyway deviates from standard

OMS



151-1948.10

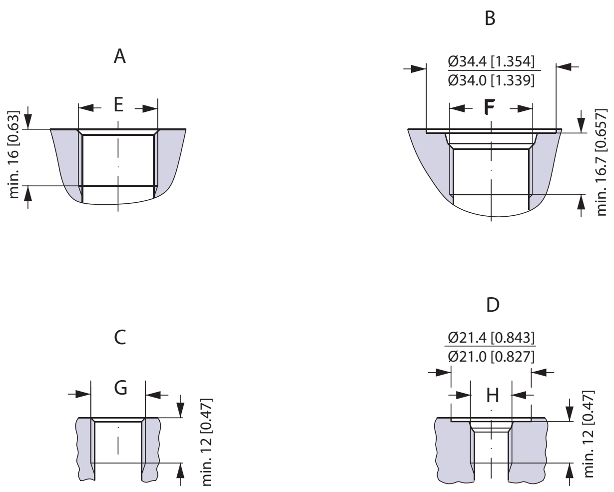
J P.t.o. shaft

DIN 9611 Form 1

(ISO/R500 without pin hole)

** Deviates from DIN 9611

Port thread versions



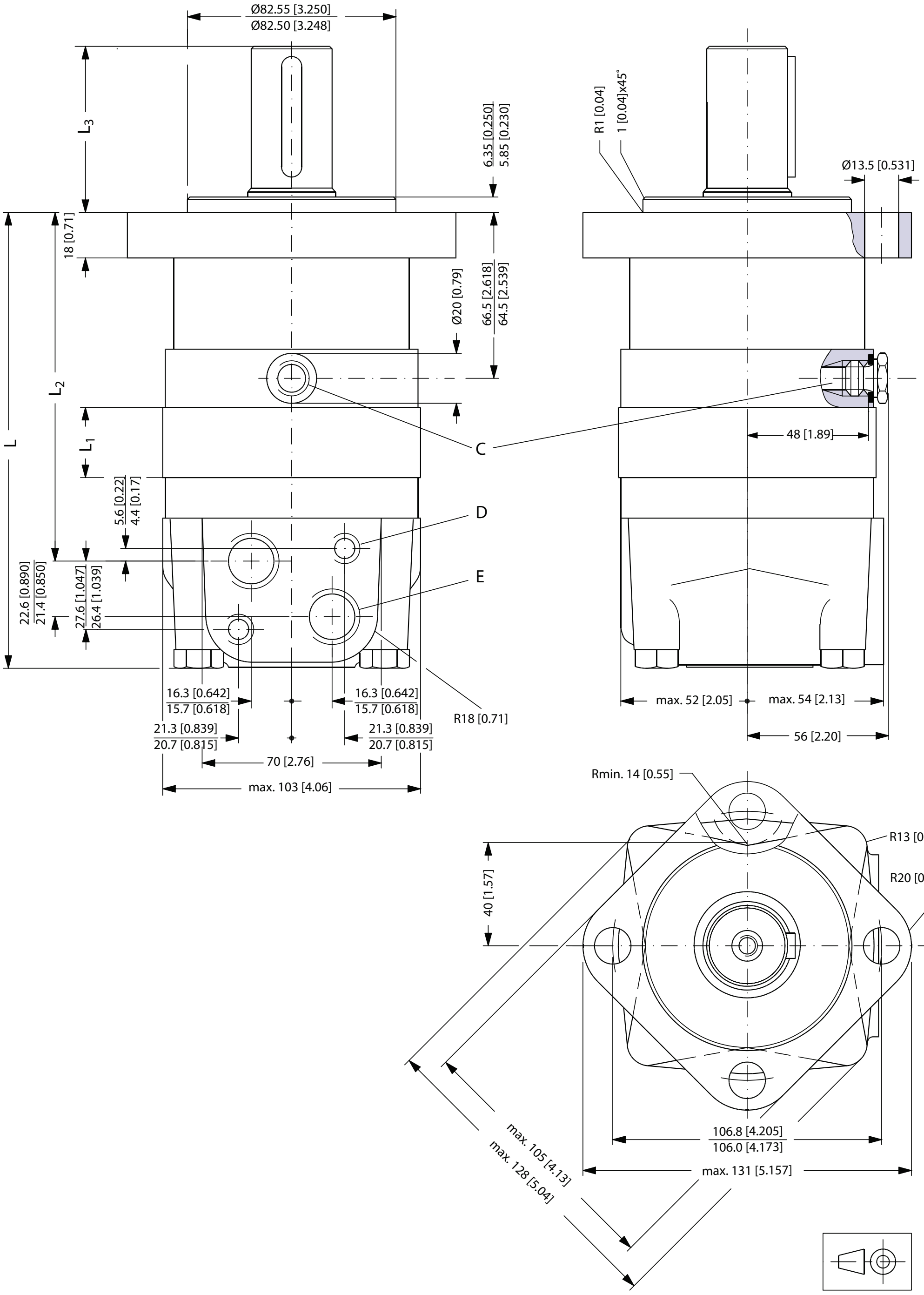
151-1971.11

A	G main ports	**B**	UNF main ports
E	ISO 228/1 - G1/2 O-ring boss port	**F**	7/8 - 14 UNF
C	G drain port	**D**	UNF drain port
G	ISO 228/1 - G1/4 O-ring boss port	**H**	7/16 - 20 UNF

Dimensions

OMS

Standard flange—European version



151-1809.10

C: Drain connection
G 1⁄4; 12 mm [0.47 in] deep

E: G 1⁄2; 15 mm [0.59 in] deep

D: M10; 13 mm [0.51 in] deep

OMS

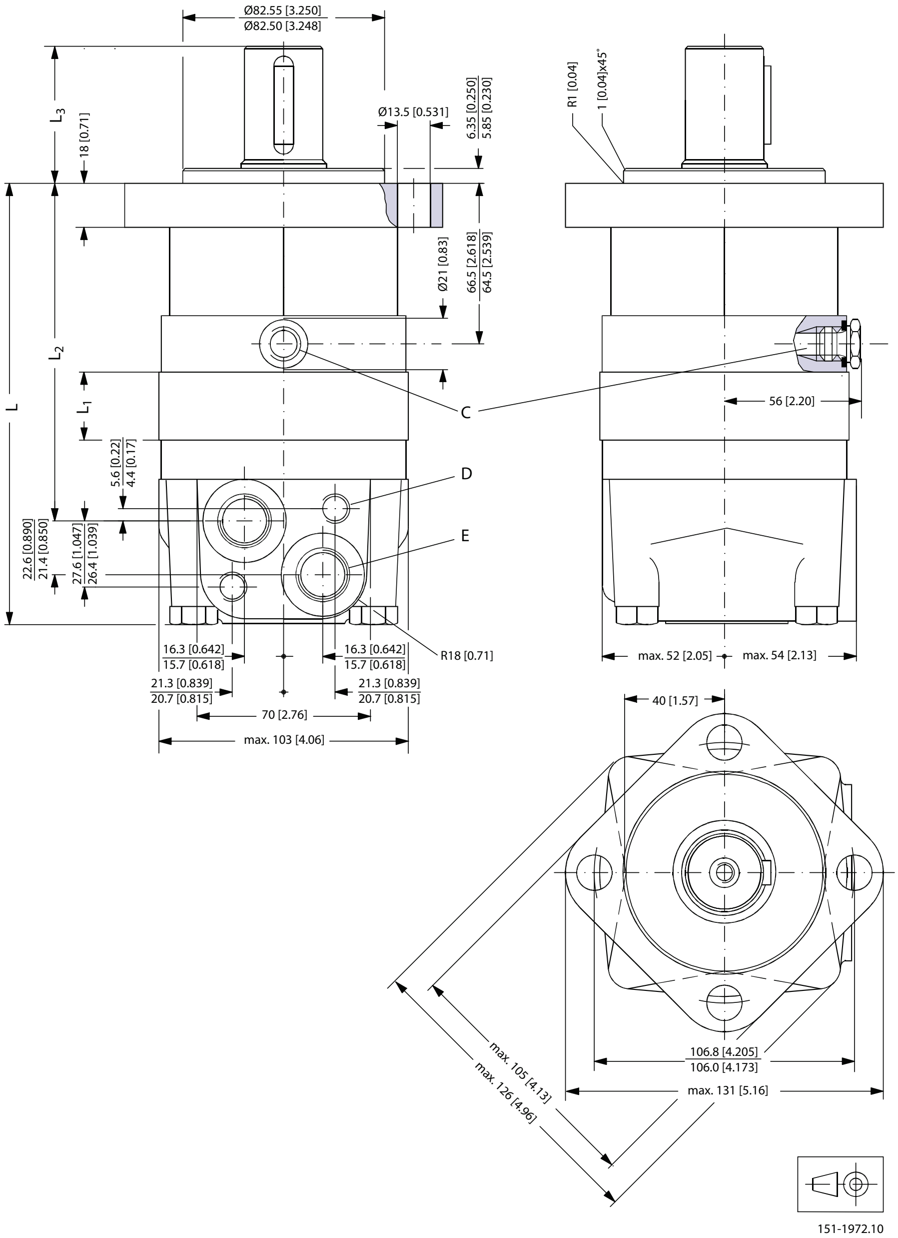
Type	L_{max} mm [in]	L_1 mm [in]	L_2 mm [in]
OMS 80	167 [6.57]	14.0 [0.551]	124 [4.88]
OMS 100	170 [6.69]	17.4 [0.685]	127 [5.00]
OMS 125	175 [6.89]	21.8 [0.858]	132 [5.20]
OMS 160	181 [7.13]	27.8 [1.094]	138 [5.43]
OMS 200	188 [7.40]	34.8 [1.370]	145 [5.71]
OMS 250	196 [7.72]	43.5 [1.713]	153 [6.02]
OMS 315	208 [8.19]	54.8 [2.157]	165 [6.50]
OMS 400	221 [8.70]	68.4 [2.693]	178 [7.01]

Output shaft		L_3 mm [in]
All shafts except P.t.o. shaft	max	67 [2.64]
	min	65 [2.56]
P.t.o. shaft	max	109 [4.29]
	min	107 [4.21]

OMS

Standard flange—US version

Standard flange



C: Drain connection
7⁄16 - 20 UNF;
12 mm [0.47 in] deep
O-ring boss port

D: M10; 13 mm [0.51 in] deep

E: 7⁄8 - 14 UNF;
16.7 mm [0.657 in] deep
O-ring boss port

Type	L_{max} mm [in]	L_1 mm [in]	L_2 mm [in]
OMS 80	167 [6.57]	14.0 [0.551]	124 [4.88]
OMS 100	170 [6.69]	17.4 [0.685]	127 [5.00]
OMS 125	175 [6.89]	21.8 [0.858]	132 [5.20]

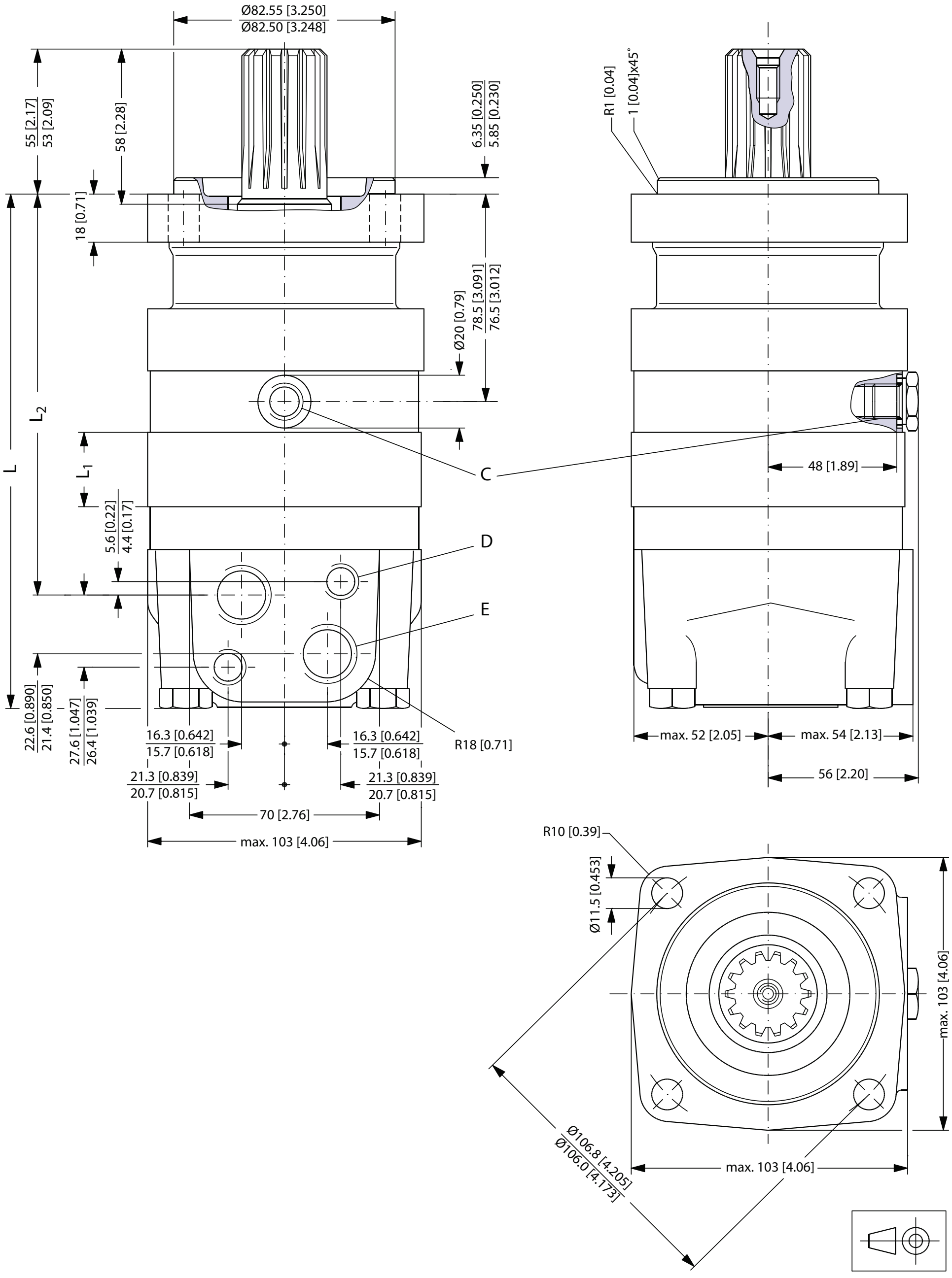
OMS

Type	L_{max} mm [in]	L_1 mm [in]	L_2 mm [in]
OMS 160	181 [7.13]	27.8 [1.094]	138 [5.43]
OMS 200	188 [7.40]	34.8 [1.370]	145 [5.71]
OMS 250	196 [7.72]	43.5 [1.713]	153 [6.02]
OMS 315	208 [8.19]	54.8 [2.157]	165 [6.50]
OMS 400	221 [8.70]	68.4 [2.693]	178 [7.01]
OMS 500	221 [8.70]	68.4 [2.693]	178 [7.01]

Output shaft		L_3 mm [in]
Cyl.1.25 in Splined 1.25 in	max	57 [2.24]
	min	55 [2.17]
Tapered 1.25 in	max	67 [2.64]
	min	65 [2.56]

OMS

Special flange—European version



151-1810.10

C: Drain connection
G 1⁄4; 12 mm [0.47 in] deep

D: M10; 13 mm [0.51 in] deep

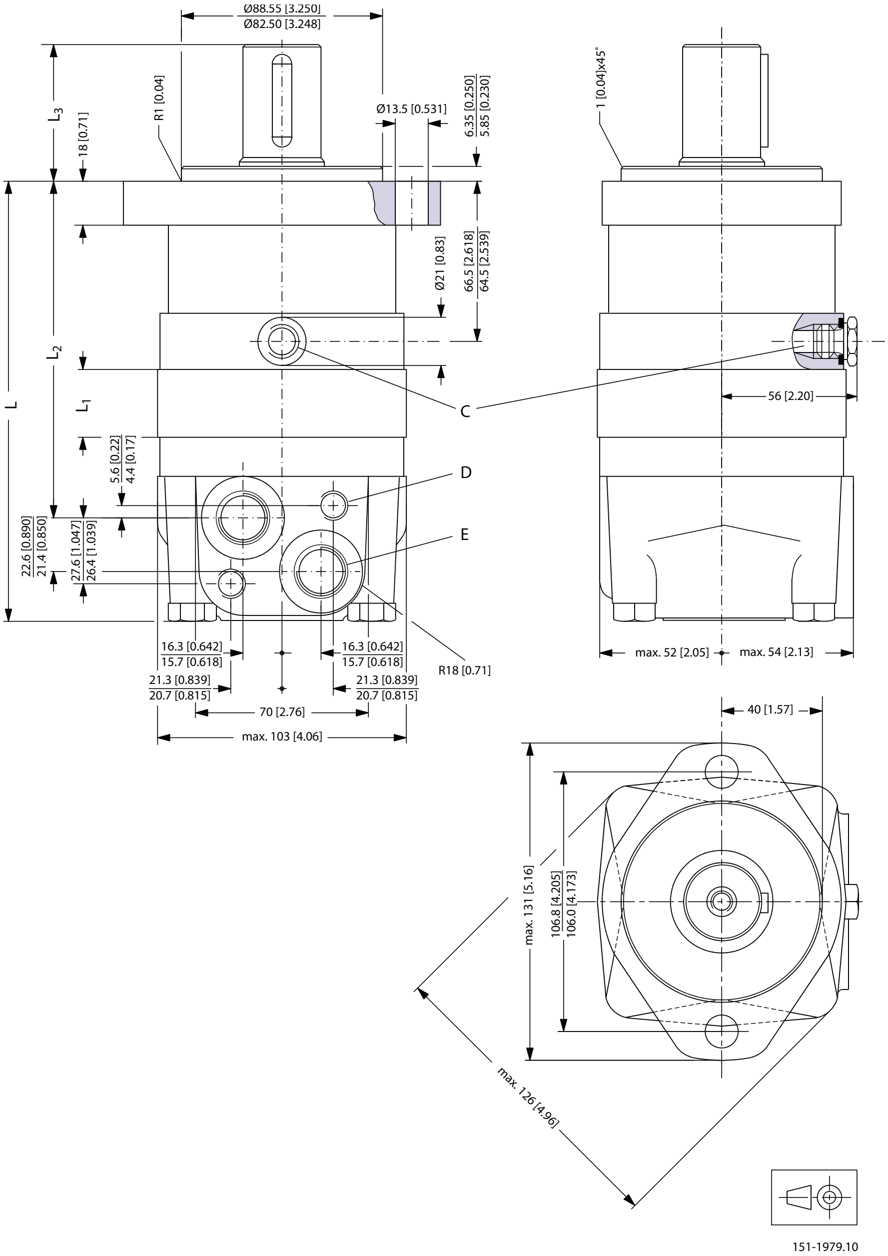
E: G 1⁄2; 15 mm [0.59 in] deep

Type	L_{max} mm [in]	L_1 mm [in]	L_2 mm [in]
OMS 80	178 [7.01]	14.0 [0.551]	136 [5.35]
OMS 100	182 [7.17]	17.4 [0.685]	140 [5.51]

OMS

Type	L_{max} mm [in]	L_1 mm [in]	L_2 mm [in]
OMS 125	186 [7.32]	21.8 [0.858]	144 [5.67]
OMS 160	192 [7.56]	27.8 [1.094]	150 [5.91]
OMS 200	199 [7.83]	34.8 [1.370]	157 [6.18]
OMS 250	208 [8.19]	43.5 [1.713]	166 [6.54]
OMS 315	219 [8.62]	54.8 [2.157]	177 [6.97]
OMS 400	232 [9.13]	68.4 [2.693]	190 [7.48]

A-2 flange—US version



C: Drain connection
7/16 - 20 UNF;

D: M10; 13 mm [0.51 in] deep

OMS

12 mm [0.47 in] deep
O-ring boss port

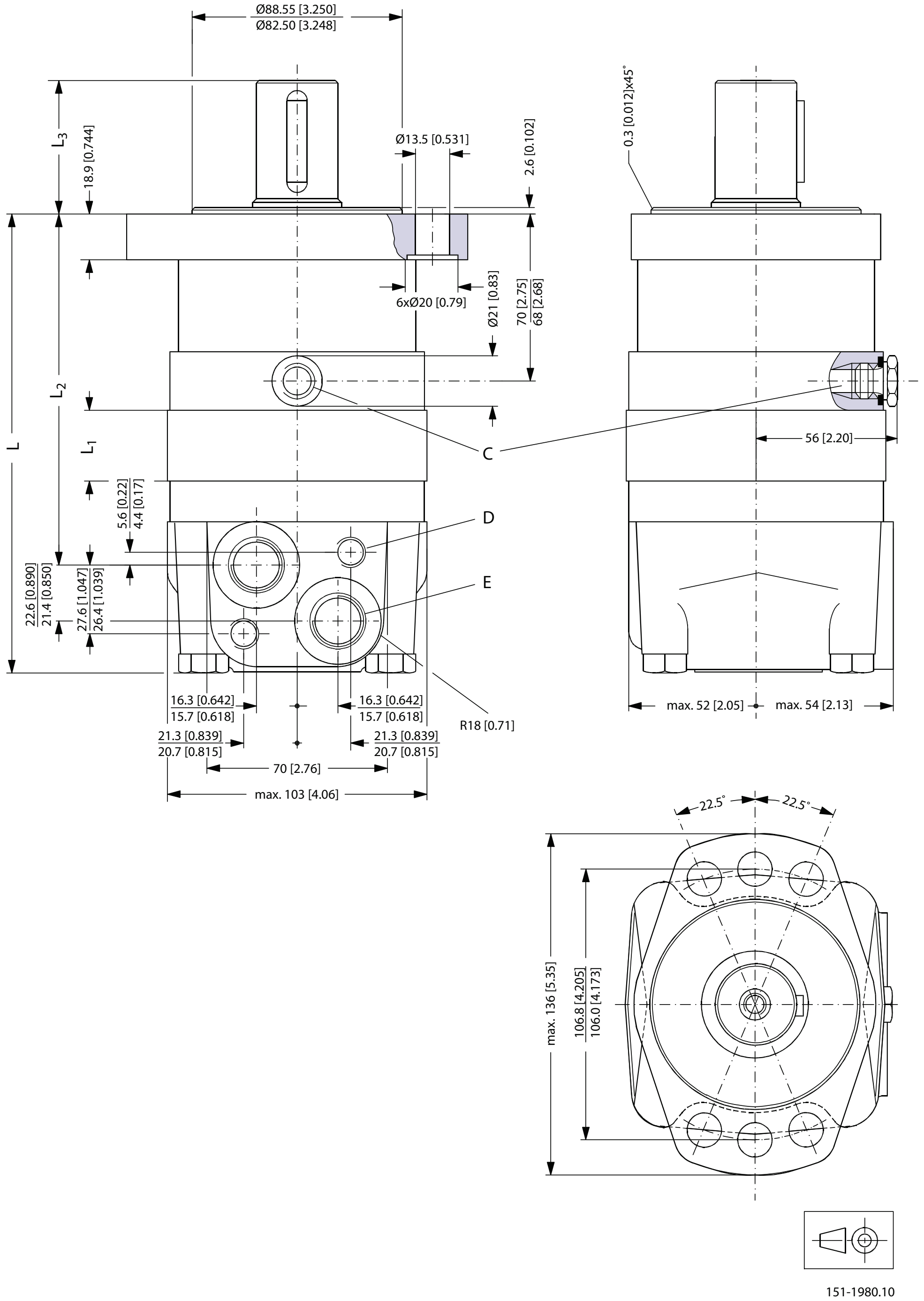
E: 7⁄8 - 14 UNF;
16.7 mm [0.657 in] deep
O-ring boss port

Type	L_{max} mm [in]	L_1 mm [in]	L_2 mm [in]
OMS 80	167 [6.57]	14.0 [0.551]	124 [4.88]
OMS 100	170 [6.69]	17.4 [0.685]	127 [5.00]
OMS 125	175 [6.89]	21.8 [0.858]	132 [5.20]
OMS 160	181 [7.13]	27.8 [1.094]	138 [5.43]
OMS 200	188 [7.40]	34.8 [1.370]	145 [5.71]
OMS 250	196 [7.72]	43.5 [1.713]	153 [6.02]
OMS 315	208 [8.19]	54.8 [2.157]	165 [6.50]
OMS 400	221 [8.70]	68.4 [2.693]	178 [7.01]
OMS 500	221 [8.70]	68.4 [2.693]	178 [7.01]

Output shaft		L_3 mm [in]
Cyl.1 in Splined 1 in	max	52 [2.05]
	min	50 [1.97]
Cyl.1.25 in Splined 1.25 in	max	57 [2.24]
	min	55 [2.17]
Tapered 1.25 in	max	67 [2.64]
	min	65 [2.56]

OMS

Magneto flange—US version



C: Drain connection
7⁄16 - 20 UNF;
12 mm [0.47 in] deep
O-ring boss port

D: M10; 13 mm [0.51 in] deep

E: 7⁄8 - 14 UNF;
16.7 mm [0.657 in] deep
O-ring boss port

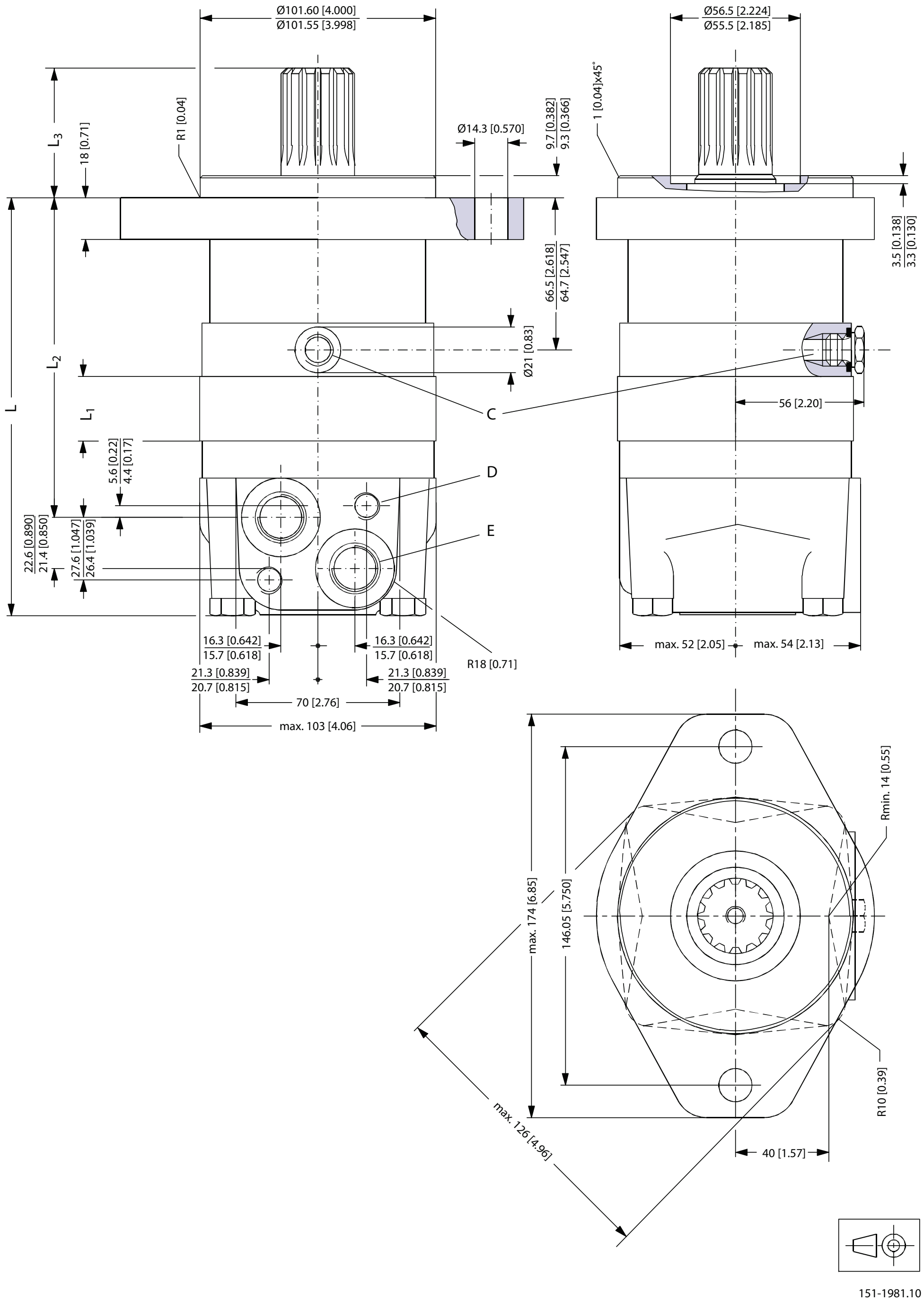
OMS

Type	L_{max} mm [in]	L_1 mm [in]	L_2 mm [in]
OMS 80	171 [6.73]	14.0 [0.551]	128 [5.04]
OMS 100	174 [6.85]	17.4 [0.685]	131 [5.16]
OMS 125	179 [7.05]	21.8 [0.858]	136 [5.35]
OMS 160	185 [7.28]	27.8 [1.094]	142 [5.59]
OMS 200	192 [7.56]	34.8 [1.370]	149 [5.87]
OMS 250	200 [7.87]	43.5 [1.713]	157 [6.18]
OMS 315	212 [8.35]	54.8 [2.157]	169 [6.65]
OMS 400	225 [8.86]	68.4 [2.693]	182 [7.17]
OMS 500	225 [8.86]	68.4 [2.693]	182 [7.17]

Output shaft		L_3 mm [in]
Cyl.1 in Splined 1 in	max	49 [1.93]
	min	47 [1.85]
Cyl.1.25 in Splined 1.25 in	max	54 [2.13]
	min	52 [2.05]

OMS

SAE-B flange—US version



C: Drain connection
7⁄16 - 20 UNF;
12 mm [0.47 in] deep
O-ring boss port

E: 7⁄8 - 14 UNF;
16.7 mm [0.657 in] deep
O-ring boss port

D: M10; 13 mm [0.51 in] deep

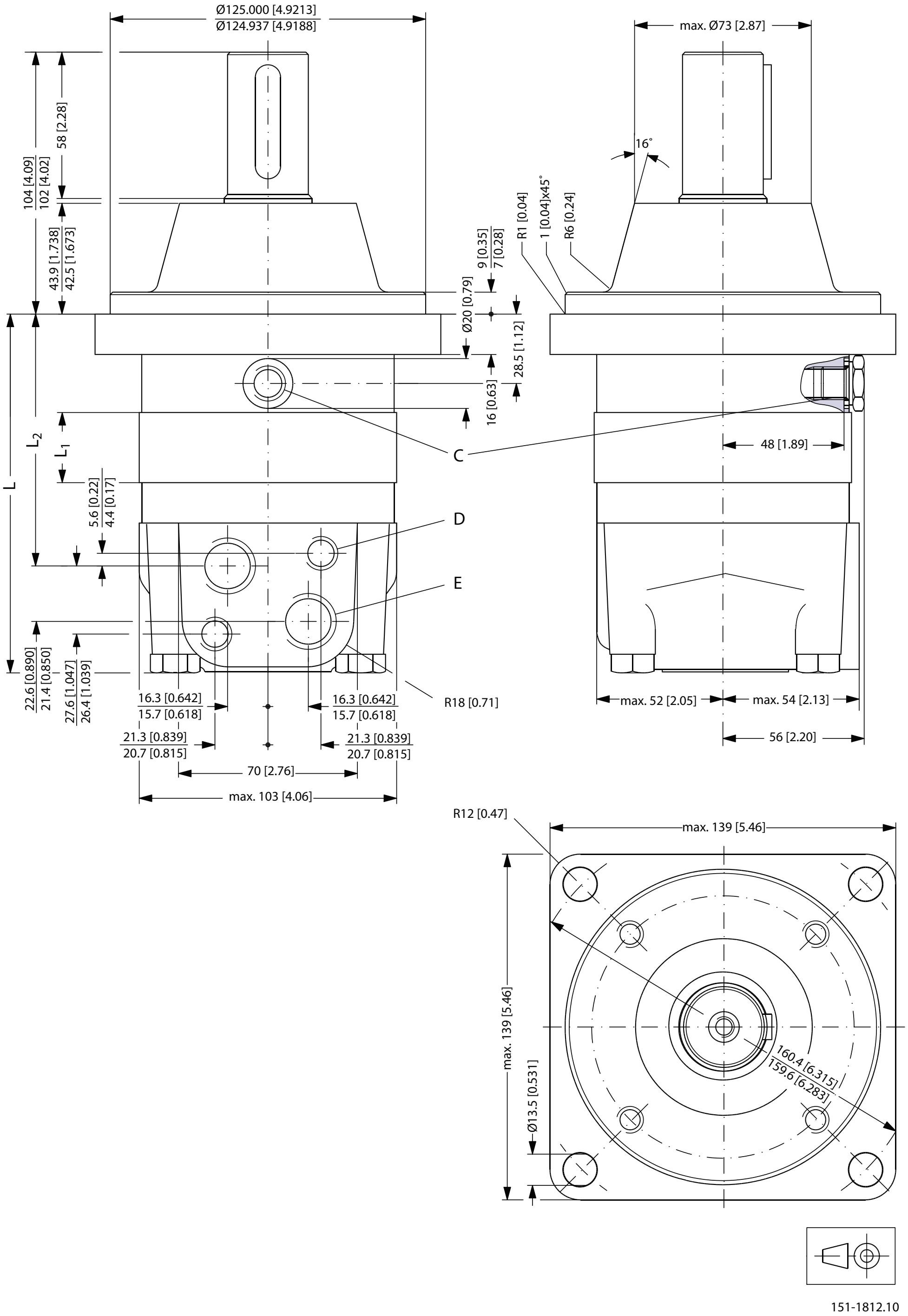
OMS

Type	L_{max} mm [in]	L_1 mm [in]	L_2 mm [in]
OMS 80	167 [6.57]	14.0 [0.551]	124 [4.88]
OMS 100	170 [6.69]	17.4 [0.685]	127 [5.00]
OMS 125	175 [6.89]	21.8 [0.858]	132 [5.20]
OMS 160	181 [7.13]	27.8 [1.094]	138 [5.43]
OMS 200	188 [7.40]	34.8 [1.370]	145 [5.71]
OMS 250	196 [7.72]	43.5 [1.713]	153 [6.02]
OMS 315	208 [8.19]	54.8 [2.157]	165 [6.50]
OMS 400	221 [8.70]	68.4 [2.693]	178 [7.01]
OMS 500	221 [8.70]	68.4 [2.693]	178 [7.01]

Output shaft		L_3 mm [in]
Splined 1.25 in	max	57 [2.24]
	min	55 [2.17]
Splined 0.875 in	max	42 [1.65]
	min	40 [1.57]

OMS

Wheel—European version



C: Drain connection
G 1⁄4; 12 mm [0.47 in] deep

E: G 1⁄2; 15 mm [0.59 in] deep

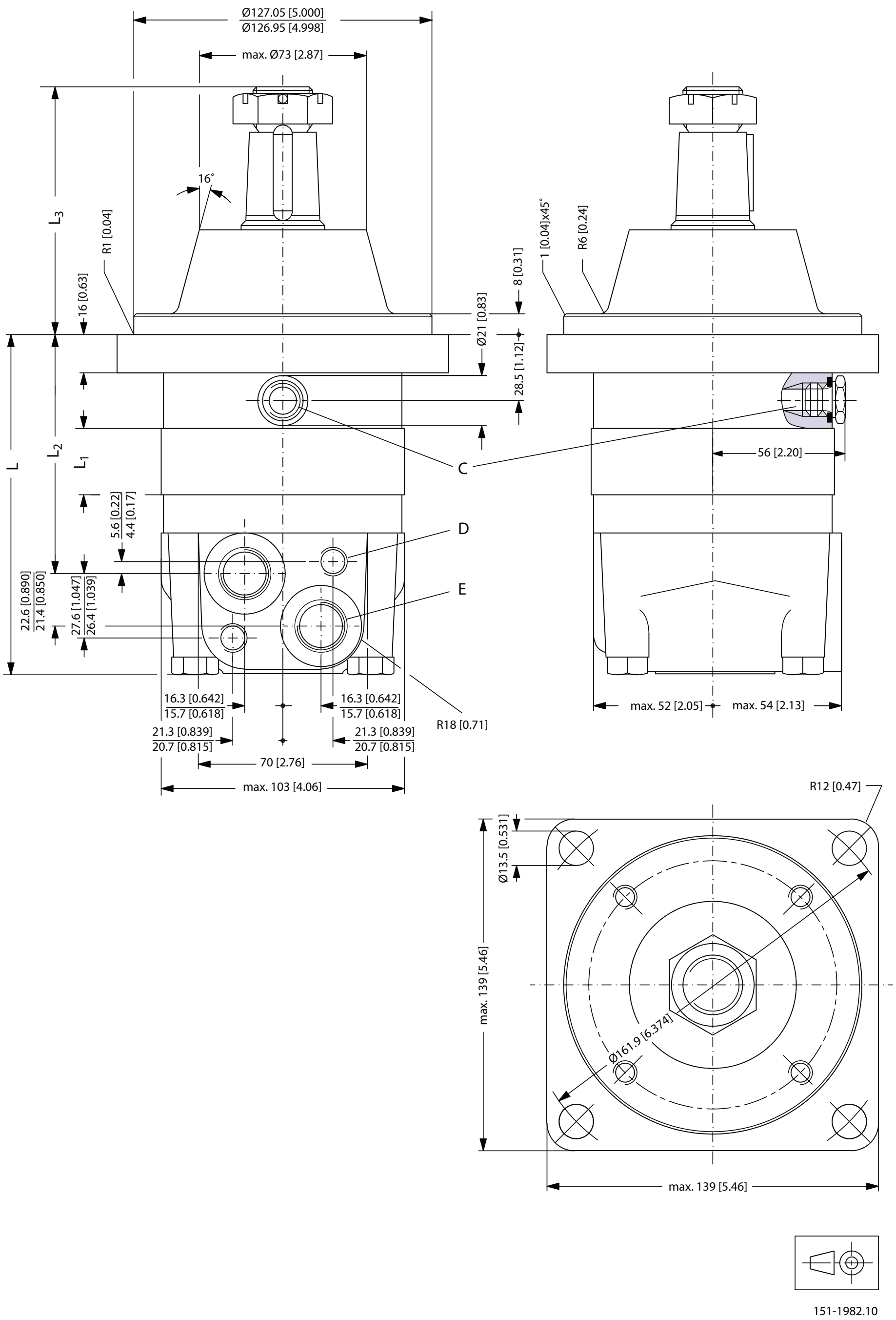
D: M10; 13 mm [0.51 in] deep

OMS

Type	L_{max} mm [in]	L_1 mm [in]	L_2 mm [in]
OMSW 80	129 [5.08]	14.0 [0.551]	87 [3.43]
OMSW 100	132 [5.20]	17.4 [0.685]	90 [3.54]
OMSW 125	137 [5.39]	21.8 [0.858]	95 [3.74]
OMSW 160	143 [5.63]	27.8 [1.094]	101 [3.98]
OMSW 200	150 [5.91]	34.8 [1.370]	108 [4.25]
OMSW 250	158 [6.22]	43.5 [1.713]	116 [4.57]
OMSW 315	170 [6.69]	54.8 [2.157]	128 [5.04]
OMSW 400	183 [7.20]	68.4 [2.693]	142 [5.59]

OMS

Wheel—US version



C: Drain connection
7⁄16 - 20 UNF;
12 mm [0.47 in] deep
O-ring boss port

D: M10; 13 mm [0.51 in] deep

E: 7⁄8 - 14 UNF;
16.7 mm [0.657 in] deep
O-ring boss port

Type	L_{max} mm [in]	L_1 mm [in]	L_2 mm [in]
OMSW 80	130 [5.12]	14.0 [0.551]	88 [3.46]
OMSW 100	133 [5.24]	17.4 [0.685]	91 [3.58]