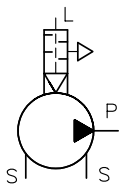
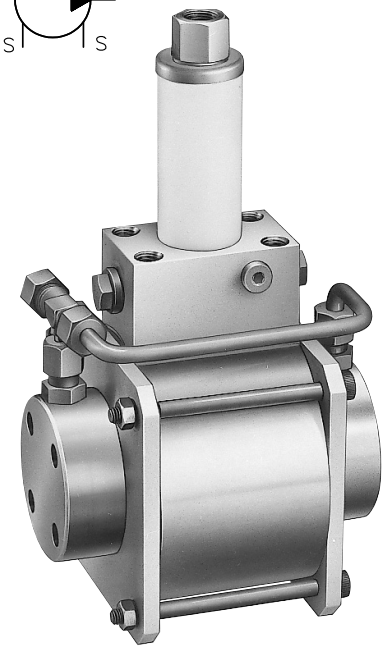
Pneumatically operated hydraulic pump type LP

Working volume	$V_{max\ geom.}$	= 28.3 cm³/double stroke
Promoting flow	$Q_{max\ hydr.}$	= approx. 12 lpm
Operating pressure	$p_{max\ hydr.}$	= 1500 bar
	$p_{max\ pneum.}$	= 10 bar

For hydraulic power packs with different tank sizes as well as possible combinations with directional valves, see D 7280 H !





1. General

1.1 Construction and mode of operation

The LP pumps are valve-controlled, two-way plunger pumps on the principle of a pneumo-hydraulic pressure intensifier. The low-pressure piston with large surface on the drive-side (air-side) pushes the piston with the smaller surface (hydraulic side) against a high fluid pressure in the system. This way up to 630 bar can be achieved with 6 bar air pressure, depending on the transmission ratio (surface ratio of hydraulic piston / air piston). The pumps work with oscillating movements. The stroke reversal is automatic via a directly mounted, self-piloted 4/2-way valve, which receives a reverse impulse always in the end positions of the air piston.
The hydraulic pressure fluid is delivered by the lateral stroke movement. This makes effective use of the power supplied from the compressed-air system, because the return stroke (suction stroke) of the one side coincides with the press, stroke of the opposing side.

The LP pumps behave rather like load-controlled pumps, i.e. the stroke frequency slows down with the delivery flow decreasing while the hydraulic system pressure rises steadily until a balance between the pneumatic and hydraulic forces is achieved where this movement will stall. This point where no more air is consumed depends on the set pressure on the pneumatic side. The pump will restart automatically as soon as the hydraulic pressure drops again in an effort to maintain a constant pressure on the hydraulic side.

The LP pumps are mainly intended for indoor use at stationary plants. They should be protected against ambient influences when used outdoor. A critical point is the permissible air temperature (see sect. 2.1) as this might cause freezing (clogging) of the breather cartridge. This may happen also when the ambient temperature drops below 0°C while the pump is standing still after previous use i.e. a re-start will be impossible. For counter measure see sect. 7 or operating manual B 7280.
The pumps type LP can be used also in vehicles but only under the condition that is completely protected from splash water caused by the moving vehicle or other working mechanisms.

1.2 Application

The LP pumps can be used to supply pressure oil for hydraulic consumers which work primarily on intermittent duty (pressure build-up and pressure keeping). As the energy is supplied by compressed air, it is possible to use the pumps in explosive or hazardous environments (dyestuff industry pyrotechnic factories). The connected system (consumers) may be controlled via directional valves. Directional spool valves should be used when the main purpose of the system is to move consumers after the pump is activated via an on/off pneumatic valve (see sect. 1.1 and 6). Directional seated valves are advantageous for applications where the pump is long-time connected to the air supply to maintain a certain pressure level in the hydraulic system. Otherwise the always apparent internal leakage of directional spool valves would cause unnecessary re-starts of the pump. For suitable directional seated valves, see D 7280H.

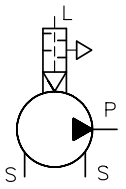
Examples of use:

Hydraulic presses:	One or two stage presses for laboratories, testing, work shops etc. fed via a two pump system where the one for low pessure high volume will stall automatically when its internal pressure balance is achieved.
Jigs and fixtures:	Clamping and gripping devices, production jigs and fixtures for punching, bending, pressing in and out. Portable or transportable jigs and fixtures (e.g. for cutting cables or crimping of cable brackets in the electrical industry, tightening devices for nuts in the construction of motors and boilers). Operating devices for valves, slide valves, butterfly valves, caps. Supply from compressed air cylinders for mounting devices in after-sales service vehicles and workshop vehicles on building sites with no electric terminals, or for emergency operation of doors and other installations in case of failure of the normal compressed air system.
Lubrication systems:	Pressure oil supply for hydrostatic bearings, central oil lubrication, etc.

2. Types available, main data

2.1 Basic model pump

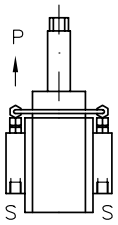
To be set up outside an oil tank. If to be installed in own tank, order complete with suction components as given in sect. 2.2



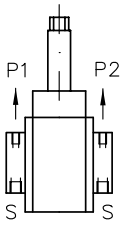
Coding example: **LP 125 -16 ...**

Additional coding for individual pressure outlets P1/ P2 and perm. pressure rating. For curves, see sect. 3.

Standard (without coding): Joined to one outlet port P



E: Individually, for customer furnished piping [3]



Basic type coding: Pneum. side Size and piston- ∅ (mm)	Hydraulic side Piston- ∅ (mm)	Area ratio	Geom. displacement per double stroke: Hydraulic side $V_{hydr.}$ (cm³)	Pneum. side $V_{pneum.}$ (cm³)	Mass (weight) [4] appr. (kg)	Standard (without coding) / Joined to one outlet port P: Standstill pressure (bar)	Corresp. pneum. pressure (bar)	**E** / Individually, for customer furnished piping [3]: Standstill pressure (bar)	Corresp. pneum. pressure (bar)
LP 80 -	**8**	1 : 100	1.5	151-V_{Hy}	5	700	7.1	700 [1]	7.1
	10	1 : 64	2.3			630	10 [2]	630	10 [2]
	12	1 : 44	3.4			430		430	
	16	1 : 25	6			240		240	
LP 125 -	**8**	1 : 244	2	491-V_{Hy}	8.5	700 [1]	2.9	1500 [1]	6.2
	10	1 : 156	3.1				4.5		9.7
	12	1 : 108	4.5				6.5	700 [1]	6.5
	16	1 : 61	8			600	10 [2]	600	10 [2]
	18	1 : 48	10.2			470		470	
	20	1 : 39	12.6			380		380	
	25	1 : 25	19.6			240		240	
	30	1 : 17	28.3			160		160	
LP 160 -	**8**	1 : 400	2	804-V_{Hy}	11.5	700 [1]	1.8	1500 [1]	3.8
	10	1 : 250	3.1				2.8		5.9
	12	1 : 178	4.5				4	700 [1]	4
	16	1 : 100	8				7.1		7.1
	18	1 : 79	10.2				9.2		9.2
	20	1 : 64	12.6			620	10 [2]	620	10 [2]
	25	1 : 41	19.6			390		390	
	30	1 : 28	28.3			265		265	

Port coding: P = Pressure oil outlet, S = Suction oil connection, L = Pneumatic inlet

Pressure medium and pressure

- Driving component (pneum. side): Compressed air prepared with usual commercial maintenance devices; Operating pressure $p_{pneum.}$ = 1.5 ... 10 bar
- Pump component (hydraulic side): Hydraulic oil 10.. .68 mm²/sec (ISO VG 10 to VG 68 as per DIN 51 519) Viscosity range appr. 4.. 1500 mm²/sec, opt. operat. approx. 10...500 mm²/sec For perm. hydraulic pressure $p_{hydr.}$ see above and sect. 3

Maintenance unit: Commercially available maintenance devices, consisting of air filter (filter cartridge approx. 5 µm) with water separator, pressure reducing valve, oiler and pressure gauge are required for perfect preparation of compressed air and safe functioning of the pumps (see sect. 6)

Guide to size of maintenance unit

Type	LP 80	LP 125	LP 160
Normal-rated flow ≧ lpm	800	1600	2500

Temperatures: Compressed air and ambient: +5...40°C; Hydraulic oil : 0 ... 80°C (see also sect. 7)

Installed position: see sect. 5

Air consumption: see sect. 3

[1] Permissible pressure at port P resp. P1 and P2. The corresponding pneumatic pressure has to be limited on the specified figures (dep. on the ratio). This can be done either by means of blocking the air supply e.g. by an electrical signal triggered from a pressure switch etc. or safe guarding via a pressure limiting valve (see also hydraulic power packs type LP acc. to D 7280 H).

[2] Maximum permissible operating pneumatic pressure

[3] Observe the pressure rating of pipes and fittings for customer furnished piping ! Special high pressure fittings are required for the versions up to 1500 bar !

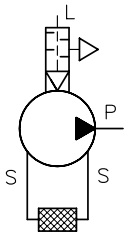
[4] For accesory, see sect. 2.2

2.2 Pump with suction components

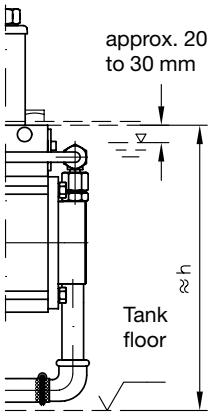
(to be installed in customer furnished oil tanks)

Order example: **LP 125-25 /S 81**

Basic pump section 2.1



For suction components assembled by the customer, double nipples conf. DIN 2982 or pipes conf. DIN 2440 or DIN 2448 where a pipe thread conf. DIN 2999 can be cut, are appropriate for use. The components must be carefully sealed, see also sect. 5.3.
Precision pipes conf. DIN 2391 can be used together with pipe fittings, e.g. conf. DIN 2353/ISO 8434-1, respectively stud fittings shape B conf. DIN 3852 sheet 2.
Plastic piping can also be used for long suction distances, if this is advantageous for routing.

Suitable for type	Suction component coding	Suitable for appr. inside height of tank h (mm)	Mass (weight) approx. (kg)	Diagramm see also sect. 4.1 to 4.3; for installation by customer see 5.3
LP 80	**S 70**	180	0.20	
	S 72	250	0.30	
	S 73	350	0.40	
LP 125	**S 80**	220	0.25	
	S 81	240	0.30	
	S 82	320	0.50	
	S 83	410	0.70	
LP 160	**S 90** [2]	260	0.30	
	S 91	320	0.45	
	S 92	410	0.60	

Pump type as in sect. 2.1		Suction pipes supplied by customer: For pipe fittings necessary $d_{i\ min}$	For pipe fittings suitable d_a x s	Screw joint DIN 2353 series	Directly screwed in [1]
LP 80-	16	10	12x1	L and S	DIN 2440-DN 10 or 17.2x1.8 DIN 2448
	12 8	10 ... 8	12x1		
LP 125- and LP 160-	30	13	15x1	L	DIN 2440-DN 15 or 21.3x2 DIN 2448
	25 and 20	12...11	15x1	L and S greatest accross flats a/f 27	
	18 8	10	16x1.5		

[1] Pipe ends with pipe thread DIN 2999
[2] only type LP 160-25 and LP 160-30

2.3 Optional leakage drain with type LP 125 and LP 160

A drain line is necessary, when the pump is installed outside the tank and any leakage (drops only) are not permissible or unwanted, e.g. due to clean room conditions etc.

Order example 1:
(Pump complete with leakage drain) **LP 125-20 - 420**

Basic pump acc. to sect. 2.1

Drain hose to the tank

220
260
310
420
600
1500

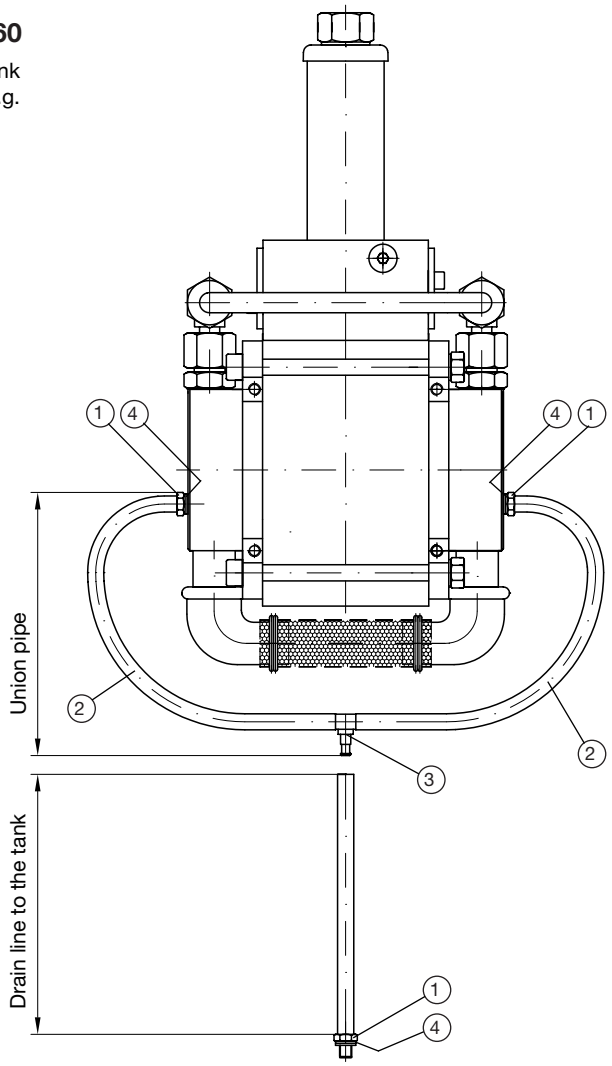
Standard length (mm)

Order example 2:
(Leakage drain line as individual part) **LP - 420**

The line consists of:

(1)	3	Hose nipple	6020 070
(2)	2	Hose	6020 077 a
(3)	1	Hose clamp	T-PK-4 (FESTO)
(4)	3	Seal ring A 6x10x1 DIN 7603-Cu	

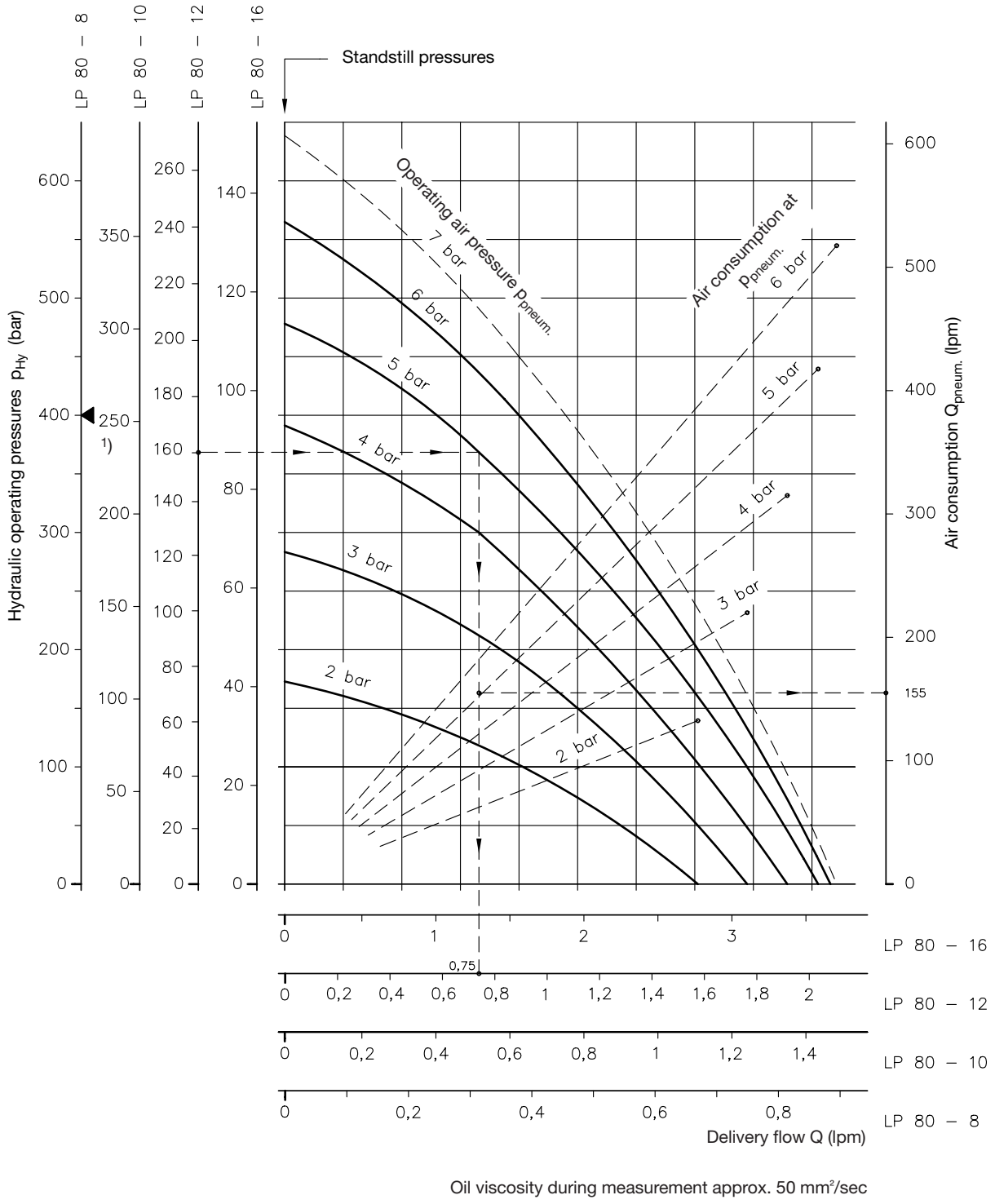
Desired length of the drain line to the tank, see example 1



3. Characteristic curve

Guideline figures for the pump delivery and pressure in dependance on the pneumatic pressure.
The guidelline figures for the air consumption is based on standard conditions.

3.1 Size LP 80

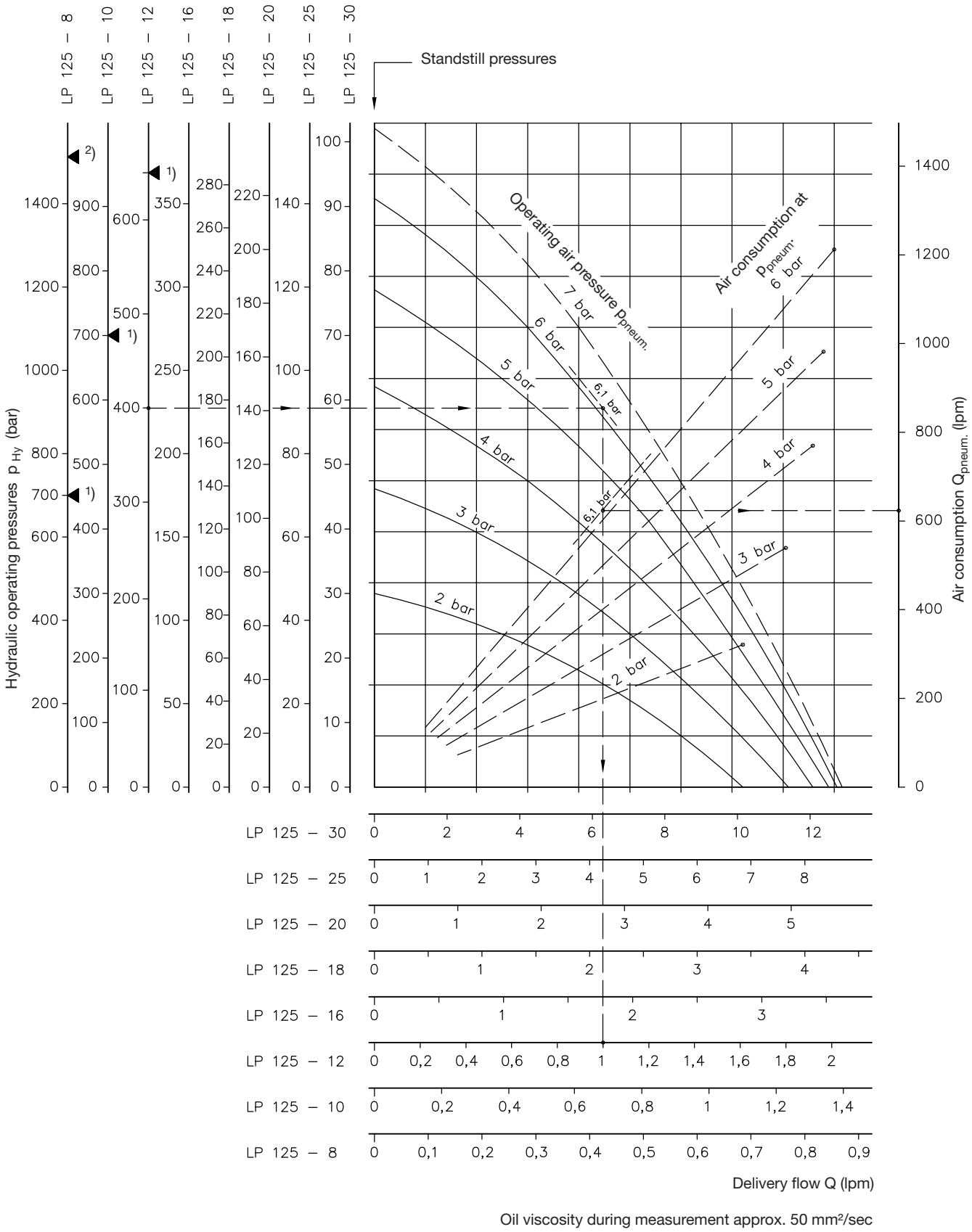


Oil viscosity during measurement approx. 50 mm²/sec

Example: A pump type LP 80-12 delivers a flow of approx. 0.75 lpm at a pneum. pressure of 5 bar and a hydr. pressure of 160 bar. Air consumption will be approx. 155 lpm.
The standstill air pressure is approx. 3.8 bar (pneumatic pressure, where the pump starts up against a hydraulic pressure of 160 bar).

1) The max. permissible pressure for the standard version is caused by the common pressure outlet port P. This also applies to hydraulic power packs acc. to D 7280 H

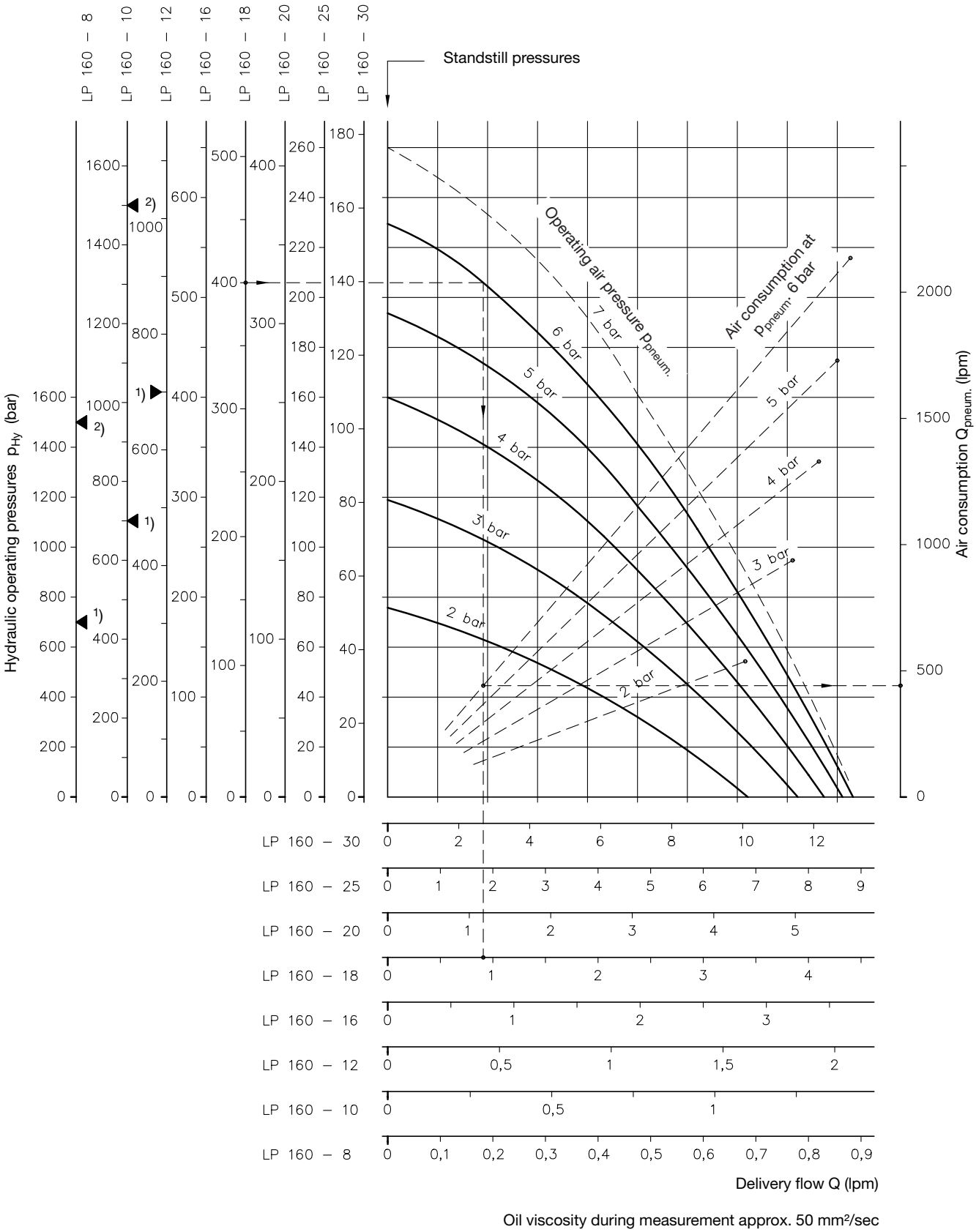
3.2 Size LP 125



Example: A pump type LP 125-12 delivers a flow of approx. 1 lpm at a pneum. pressure of 6.1 bar and a hydr. pressure of 400 bar. Air consumption will be approx. 620 lpm.
The standstill air pressure is approx. 3.8 bar (pneumatic pressure, where the pump starts up against a hydraulic pressure of 400 bar).

1) The max. permissible pressure for the standard version is caused by the common pressure outlet port P. This also applies to hydraulic power packs acc. to D 7280 H
2) For the max. permissible pressure for version ..-8E see sect. 2.1.

3.3 Size LP 160



Example: A pump type LP 160-18 delivers a flow of approx. 0.9 lpm at a pneum. pressure of 6 bar and a hydr. pressure of 400 bar. Air consumption will be approx. 500 lpm.
The standstill air pressure is approx. 5.3 bar (pneumatic pressure, where the pump starts up against a hydraulic pressure of 400 bar).

[1]) The max. permissible pressure for the standard version is caused by the common pressure outlet port P. This also applies to hydraulic power packs acc. to D 7280 H

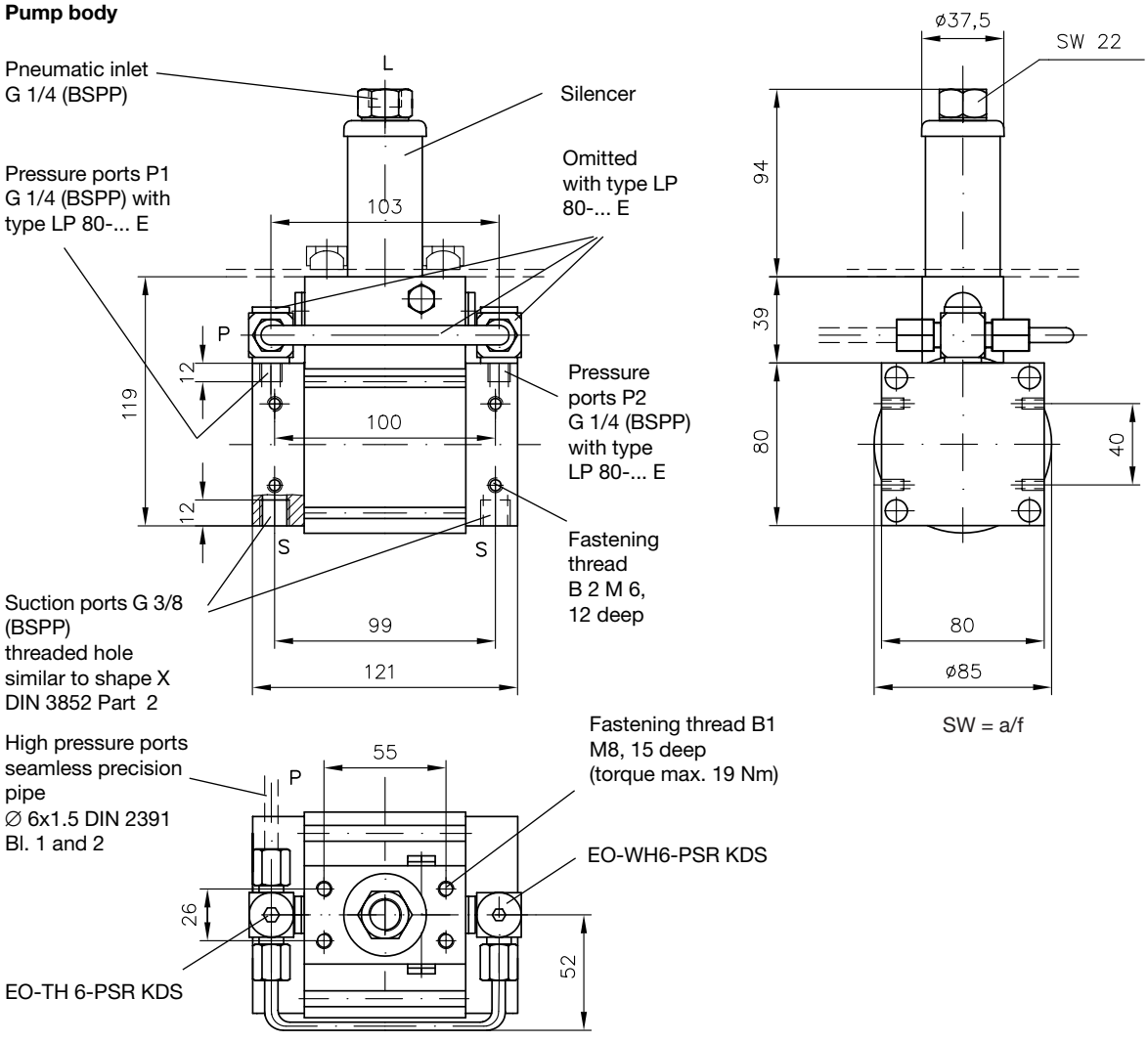
[2]) For the max. permissible pressure for version ..-8E and ...-10E see sect. 2.1.

4. Dimensions for units

All Dimensions are in mm, subject to change without notice !

4.1 Basic pump LP 80

Pump body

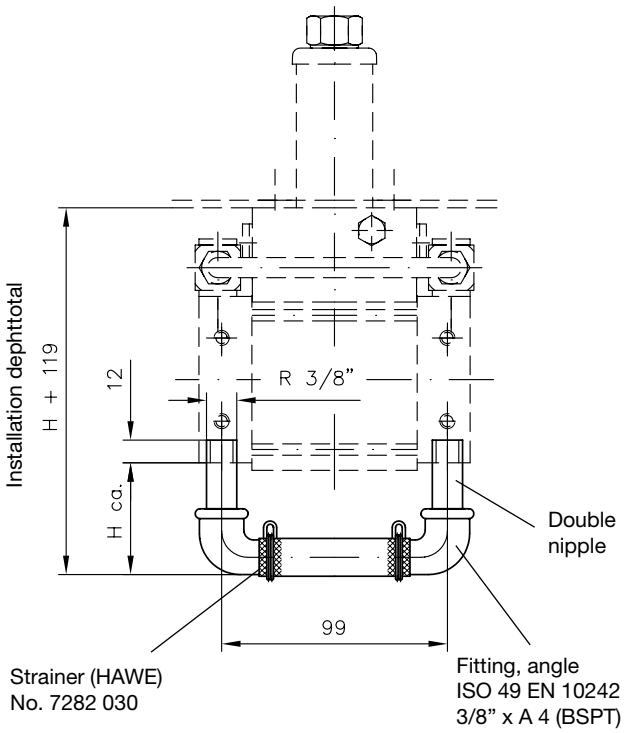


Suction components for LP 80

If the complete hydraulic power unit (D 7280H) is not required, but simply the pump to be mounted in customer-furnished tanks, then it should be ordered ready for installation with suction components (order example in sect. 2.2)

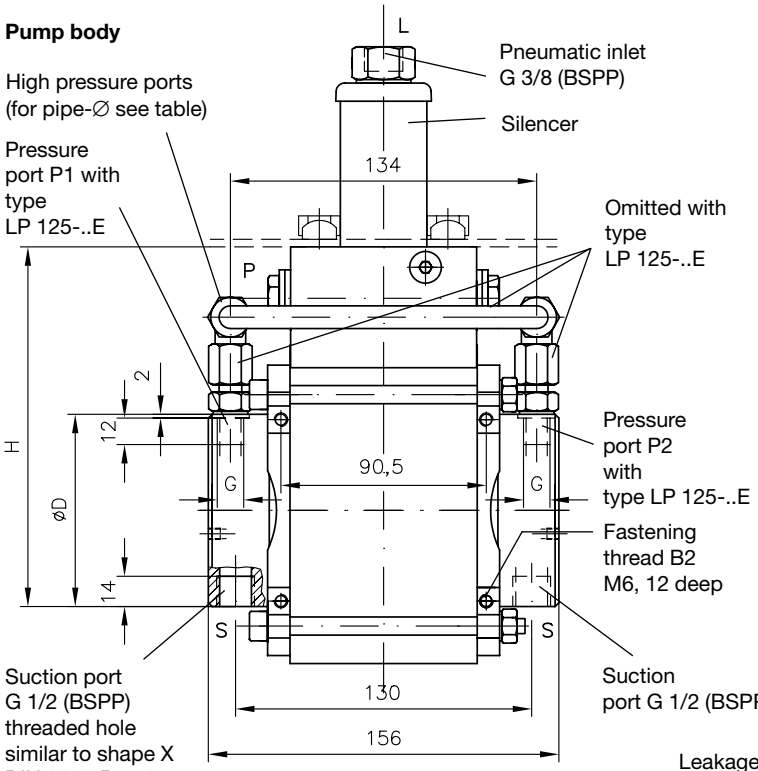
Coding	Double nipple DIN 2982 (BSPT)	Installation depth H approx. (mm)	to be used in tank
S 70	3/8" x 40	55	---
S 72	3/8" x 80	95	B 4
S 73	3/8" x 180	205	---

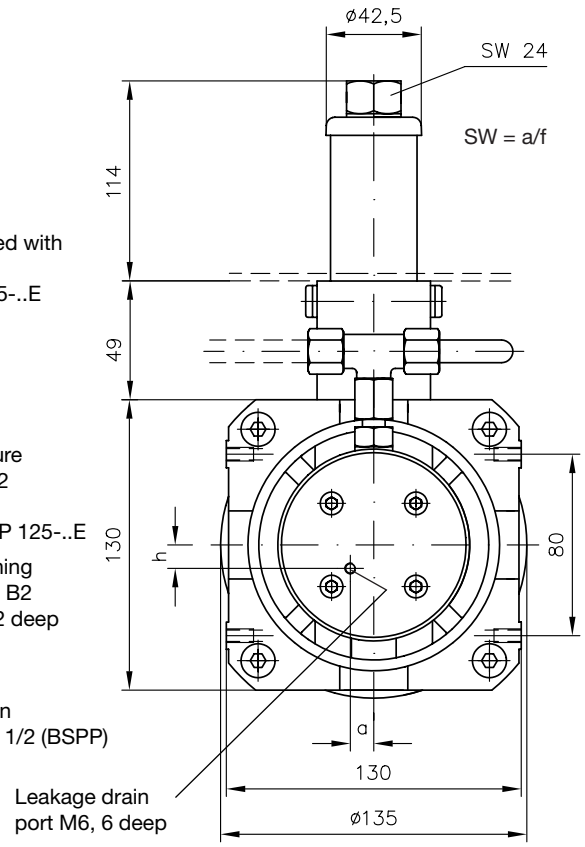
For the suction components, it is also possible to use precision pipes and usual commercial pipe screw joints; see remarks in sect. 2.2
For customer-furnished suction pipes, the thread should be cut to DIN 2999, so that the useful thread length l_1 (DIN 2999) is not exceeded.

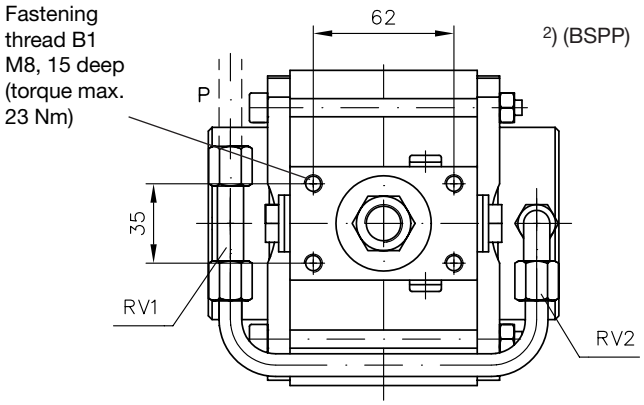


4.2 Basic pumps LP 125

Pump body







Type	G 2)	D	H	a	h	Recommend-ed pipe 1)
LP 125-30	G 3/8	90	159	14.5	14.5	10x1.5
LP 125-25	G 3/8	85	156.5	13.5	13.5	
LP 125-20	G 3/8	80	154	11.5	11.5	
LP 125-18	G 3/8	80	154	11	11	
LP 125-16	G 1/4	80	154	10	9	8x1.5
LP 125-12	G 1/4	75	151.5	9	7.5	8x2 (min.)
LP 125-10	G 1/4	75	151.5	8.5	5	
LP 125-8	G 1/4	75	151.5	9	0	

Pipe screw joint	RV 1	RV 2
LP 125-30(25, 20, 18)	EO-EVT 10-PSR	EO-EVW 10-PSR
LP 125-16(12, 10, 8)	EO-EVT 8-PSR	EO-GE 8-PSR

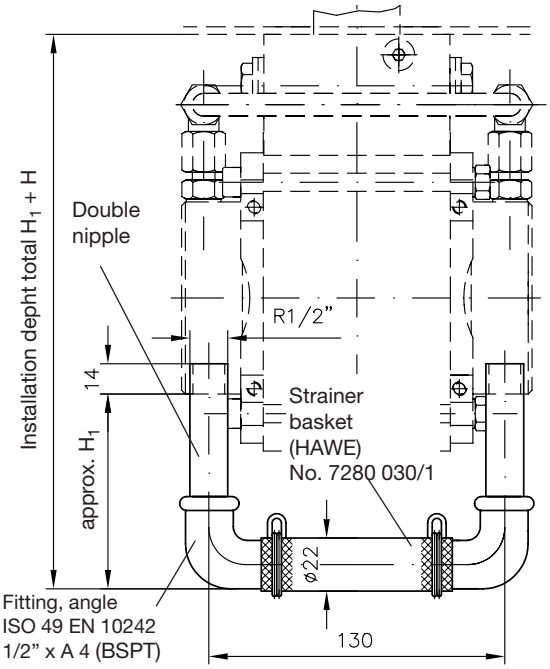
Suction components LP 125

If the complete hydraulic power unit is not required, but simply the pump to be mounted in customer-furnished tanks, then it should be ordered ready for installation with suction components (coding example in sect. 2.2).

Coding	Double nipple DIN 2982 (BSPT)	Installation depth H1 approx. (mm)	to be used in tank
S 80	1/2" x 45	57	---
S 81	1/2" x 55	72	B 4
S 82	1/2" x 145	162	B 10
S 83	1/2" x 230	242	B 25

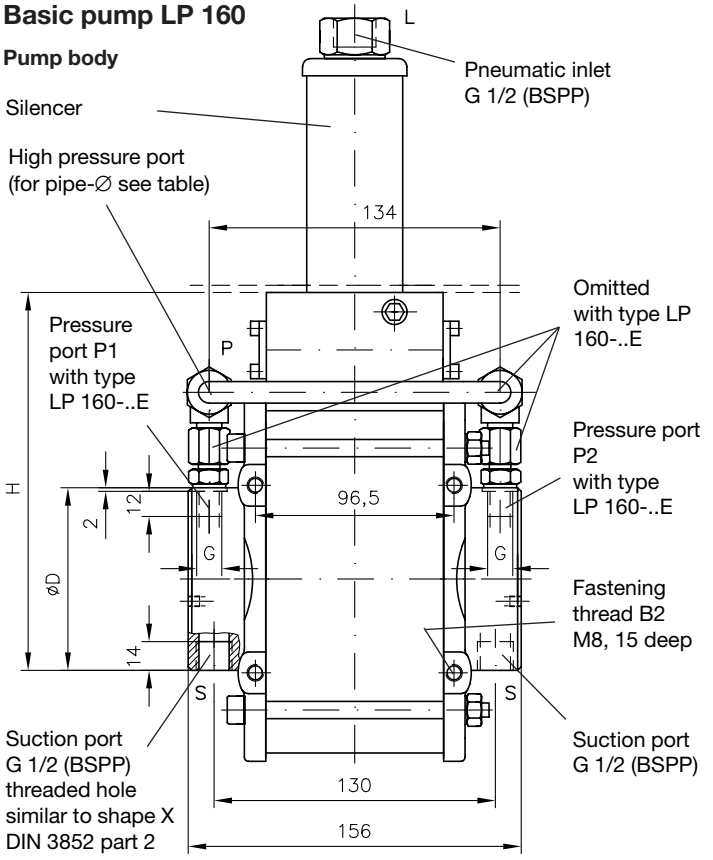
For the suction components, it is also possible to use precision pipes and usual commercial pipe screw joints; see remarks in sect. 2.2.
For customer-furnished suction pipes, the thread should be cut to DIN 2999, so that the useful thread length l_1 (DIN 2999) is not exceeded.

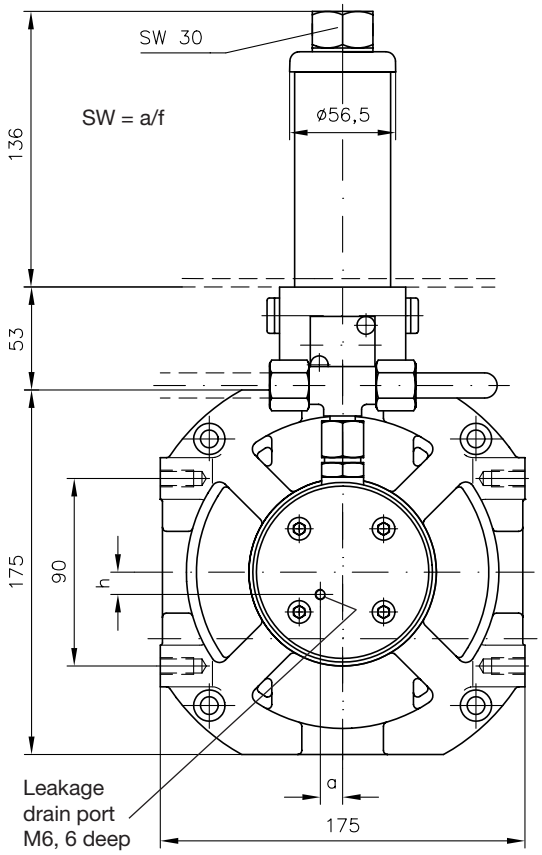
1) Seamless precision pipe DIN 2391 page 1 and 2

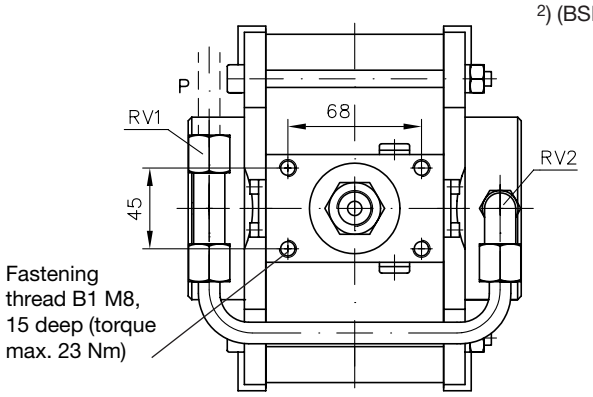


4.3 Basic pump LP 160

Pump body







Type	G [2]	D	H	a	h	Recommended pipe [1]
LP 160-30	G 3/8	90	184	14.5	14.5	10x1.5
LP 160-25	G 3/8	85	181.5	13.5	13.5	
LP 160-20	G 3/8	80	179	11.5	11.5	
LP 160-18	G 3/8	80	179	11	11	
LP 160-16	G 1/4	80	179	10	9	8x2 (min.)
LP 160-12	G 1/4	75	176.5	9	7.5	
LP 160-10	G 1/4	75	176.5	8.5	5	
LP 160-8	G 1/4	75	176.5	9	0	

[2] (BSPP)

Pipe screw joint	RV 1	RV 2
LP 160-30(25, 20, 18)	EO-EVT 10-PSR	EO-EVW 10-PSR
LP 160-16(12, 10, 8)	EO-EVT 8-PSR	EO-GE 8-PSR

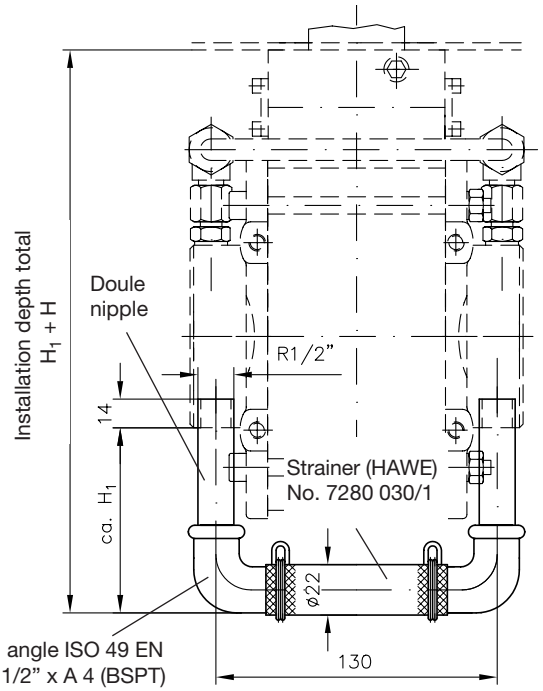
Suction components for LP 160

If the complete hydraulic power unit is not required, but simply the pump to be mounted in customer-furnished tanks, then it should be ordered ready for installation with suction components (coding example in sect. 2.2).

Coding	Double nipple DIN 2982 (BSPT)	Installation depht H_1 approx. (mm)	to be used in tank
S 90	1/2" x 60	72	---
S 91	1/2" x 120	132	B 10
S 92	1/2" x 200	212	B 25

For the suction components, it is also possible to use precision pipes and usual commercial pipe screw joints; see remarks in sect. 2.2.
For customer-furnished suction pipes, the thread should be cut to DIN 2999, so that the useful thread length l_1 (DIN 2999) is not exceeded.

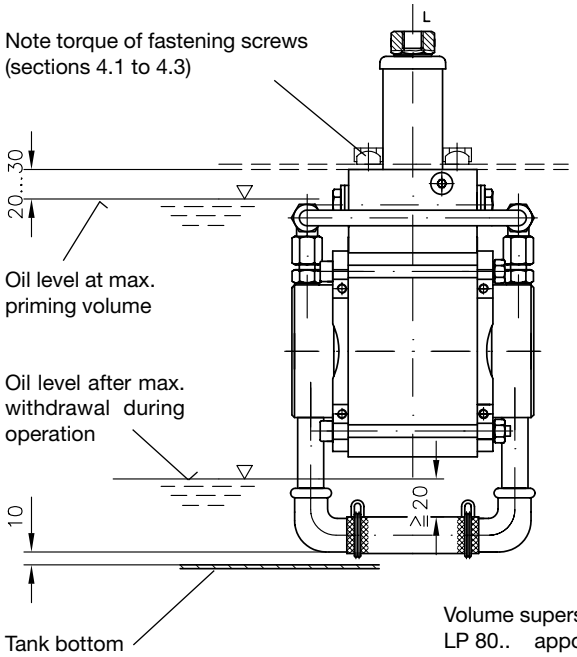
[1] Seamless precision pipe DIN 2391 page 1 and 2

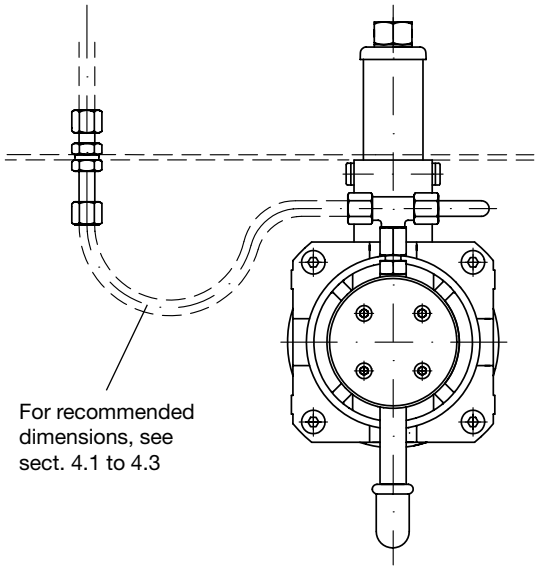


5. Mounting instruction

Installation position like illustrated in the dimensional drawings (i.e. suction ports down, pressure ports and muffler up) as this eases automatic bleeding of the hydraulic pump elements. A lateral or downward orientation is also possible, see sect. 5.2.2.

5.1 Installation in customer-furnished oil tanks





Volume superseding:
LP 80.. appox. 0.9 l with fluid level distance h ≈ 15 - 20 mm to the mounting area
LP 125.. appox. 2.2 l with fluid level distance h ≈ 20 - 25 mm to the mounting area
LP 160.. appox. 3.1 l with fluid level distance h ≈ 25 - 30 mm to the mounting area

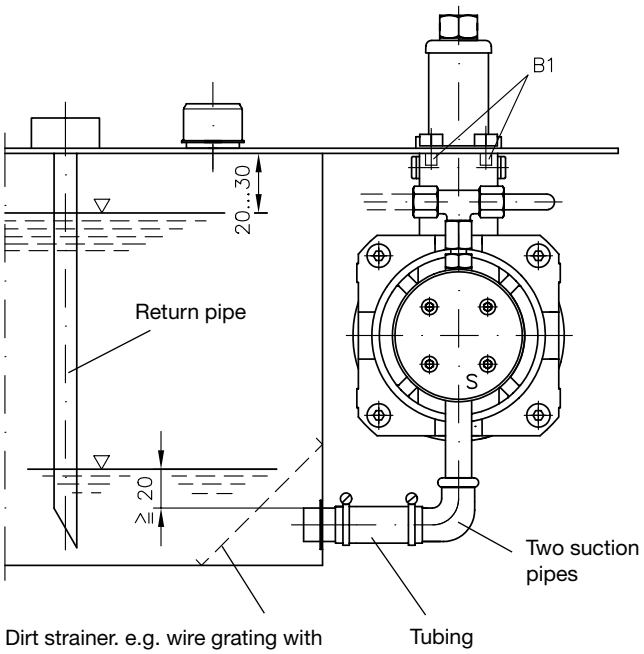
5.2 Installation outside an oil tank

It is best to install the pump in a position where the fluid level does not drop below the centerline of the pump. Foot valves preventing that the suction line runs empty during prolonged stand-still periods of the pump have to be provided when the pump is positioned above the fluid level. The end of the return pipe should be positioned below the lowest expected oil level. The joints of the suction pipes must be properly sealed (see also section 5.3).

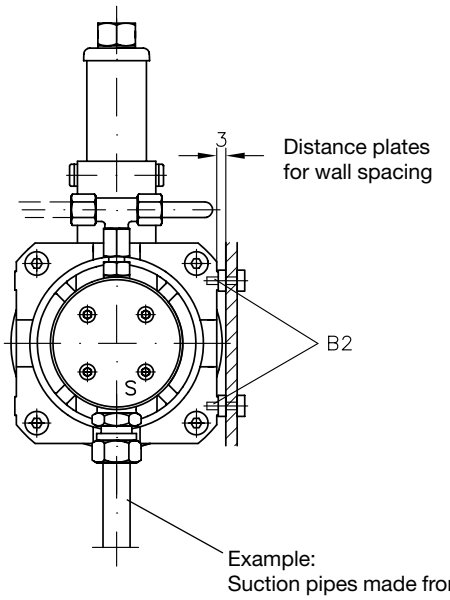
5.2.1 Usual arrangement, with pump in delivery state

Two possible fastening methods (for fastening thread, see sections 4.1 to 4.3)

Hanging position, using fastening thread B1;
note tightening torque (sect. 4.1 to 4.3)



Side position, using fastening thread B2

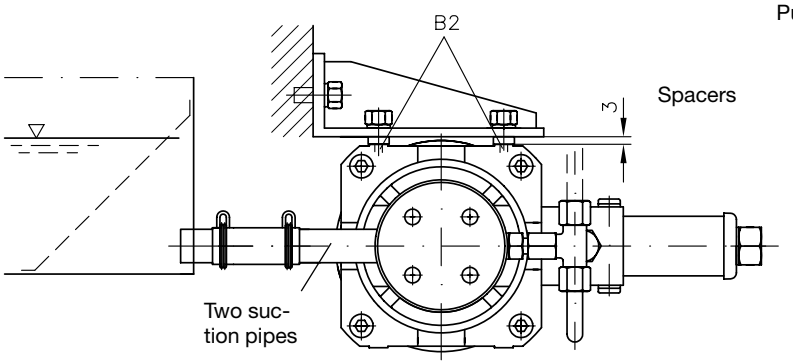


5.2.2 Horizontal or hanging position

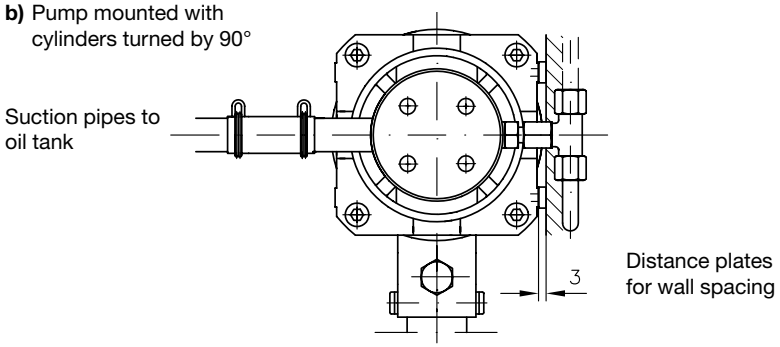
While taking into consideration the best position for the suction pipes, as given in sect. 5 "Installation position", or in special operating circumstances as in sect. 7, the pump cylinders can be installed off-set by 90° after loosening the screws (b) sect. 5.3. Restriction for LP 80: The pump can only be installed laterally like in illustration **a)** as a complete unit (state of delivery). It is not possible to rotate the hydraulic cylinders in relation to the pneumatic cylinder. The other installations like illustration **b)** or below are not possible due to design reasons.

Pump positions with suction connection lying horizontally

a) Pump in original factory adjusted mounting condition

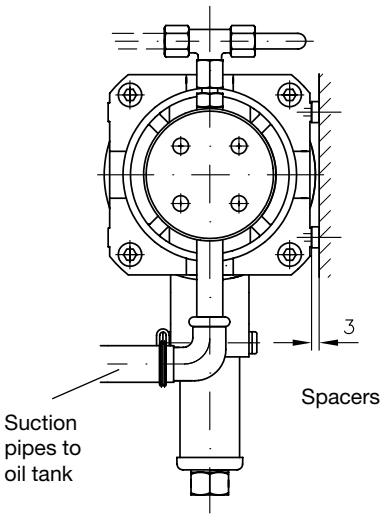


b) Pump mounted with cylinders turned by 90°



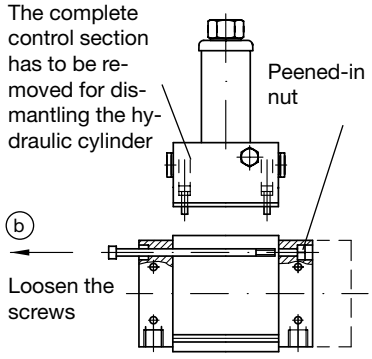
Pump position with suction connection entering vertically from bottom to top

Pump mounted with cylinders turned by 180°



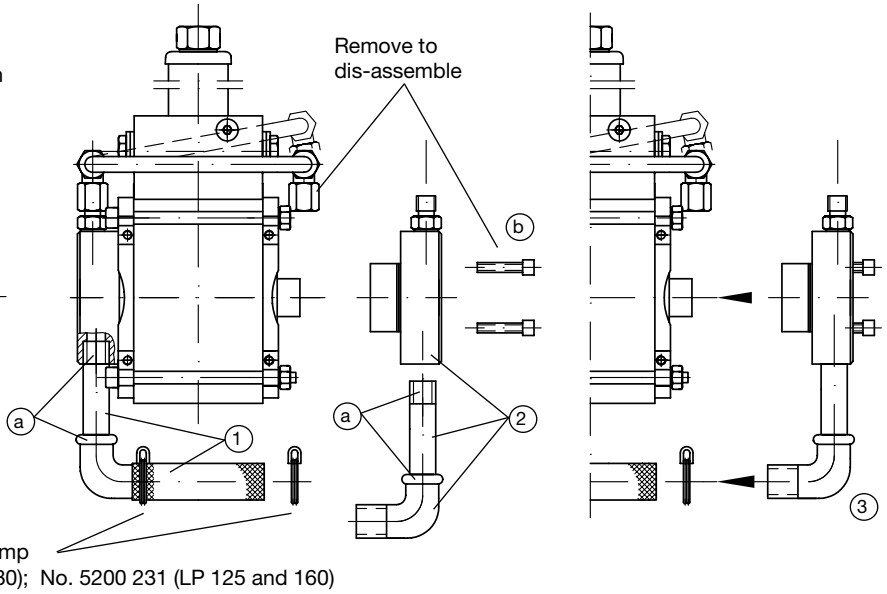
5.3 Subsequent assembly of the suction components from sections 4.1 to 4.3

Type LP 80



(a) Like LP 125 and 160

Type LP 125 and LP 160



(1) Screw the pre-mounted half of the suction components (double nipple, angle, strainer basket) into the cyl. head

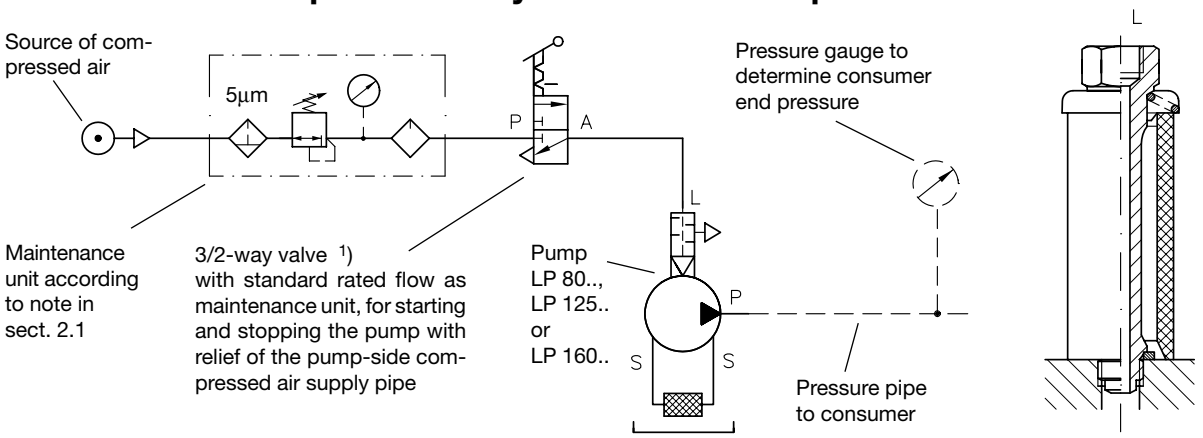
(2) Screw the other pre-mounted half of the suction components into the unscrewed head of the other side of the pump

(3) When screwing together, place the end of the angle in the strainer basket opening, holding the tube clip open

(a) Apply liquid seal (Loctite 245) or sealing tape to the pipe ends. Leave the first two or three threads free, to prevent any sheared off sealing tape or liquid seal from getting into the suction valve.

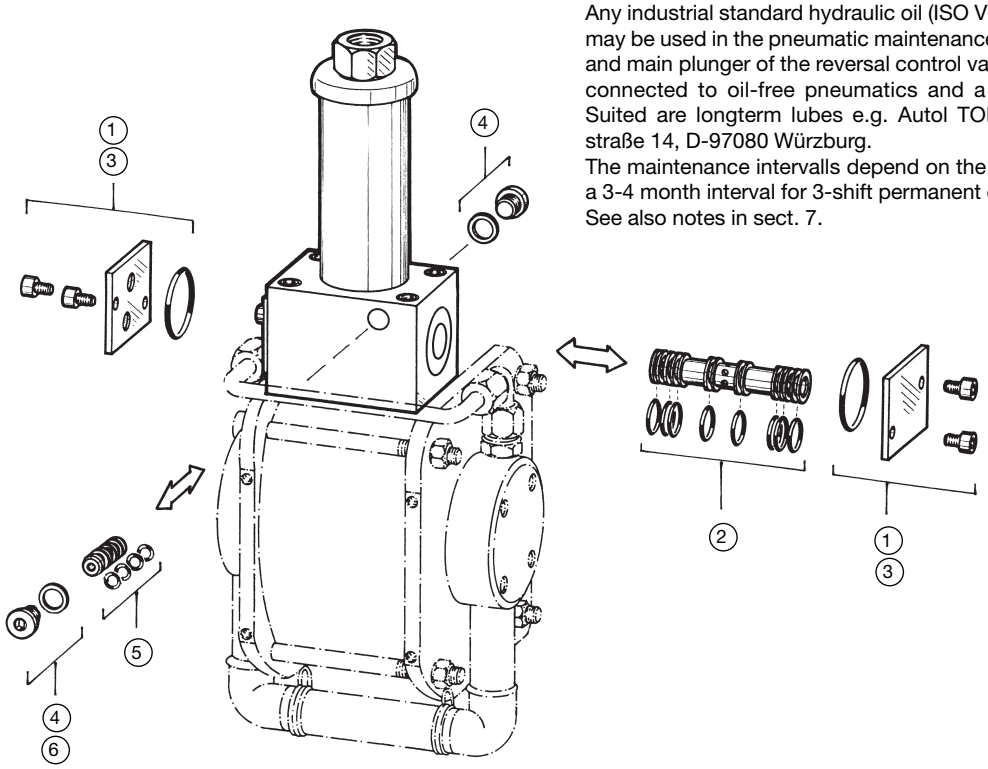
(b) LP 80: Screws without Loctite, torque 10 Nm
LP 125 and 160: The screws are secured with Loctite 241. They should be cleaned (kept free of oil and grease), and when mounting the threads should be given a new coat of Loctite over a length of about 12 mm. Torque 10 Nm.

6. Connection to the pneumatic system and initial operation



1. Set the pressure reducing valve on the maintenance unit down to the lowest supply air pressure (approx. 1.5 bar). The air start valve should be on stop.
2. Loosen the pressure pipe at the consumer sufficiently so that trapped air can escape. Open the air start valve and wait for the oil to come.
3. Air start valve on stop. Tighten the pressure pipe, and after starting the pump again, pressurize the unloaded consumer several times and move it forward and backward. Then turn the pressure reducing valve up as in 1 to required supply air pressure (step by step if necessary), untill the desired end pressure, e.g. standstill pressure, is shown on the pressue gauge of the pressure pipe to the hydraulic consumer.

A maintenance unit in the compressed air supply line is mandatory, since it ensures flawless operation by filtering, moisture separation and oiling (= conditioning of compressed air). It has a pressure reducing valve to limit the air pressure, which is necessary on the hydraulic side to set the standstill pressure.
Attention: Observe the max. pressure rating in sect. 2.1 for pumps with standard piping (state of delivery)!
If the pump is connected to compressed air cylinders, care should be taken that the pressure reducing valve is connected in the prescribed way. The pumps type LP feature neither a pressure limiting nor a pressure reducing valve.



Any industrial standard hydraulic oil (ISO VG 10) or spindle oil (ISO VG 5 to 10) may be used in the pneumatic maintenance unit. The dynamic seals of piloting and main plunger of the reversal control valve should be lubed regularily when connected to oil-free pneumatics and a frequent all-day use is intended. Suited are longterm lubes e.g. Autol TOP 2000 from Co. Autol, Paradiesstraße 14, D-97080 Würzburg.
The maintenance intervalls depend on the indivdual operation conditions e.g. a 3-4 month interval for 3-shift permanent operation.
See also notes in sect. 7.

① Remove cover plate including O-rings.

② Push out the main plunger (any side) the sleeve remains in the housing.
Lube the visible sections of the O-rings.
Reinstall the plunger in the housing (sleeve).

③ Reinstall the cover plate including O-rings.

④ Remove the tapped plugs including the copper seal rings.

⑤ Push the piloting plunger (any side) out of the housing.
Lube the visible sections of the O-rings.
Reinstall the plunger in the housing.

⑥ Reinstall the tapped plugs including the copper seal rings.

1) Industrial standard pneumatic reducers can be installed at port L, if the thread of port A at the pneumatic directional valve and port L at the air driven pump type LP are differing. The largest possible diameter for the air line should be used always.

7. Note for prolonged operation periods

Any pressurized gas (or gas mixture) will cool down due to the thermodynamic regularity, when decompressed suddenly (adiabatic). This will cause also cool down of the surrounding material where the decompression happens and where the gas is routed through. The stand still periods during normal usual working cycles are usually sufficient that these components come to ambient temperature again.

But white frost or internal icing may occur (dep. on the moisture in the compressed air), when the pump is running for prolonged periods. This effect is also visible at other pneumatic tools where the working speed is cut down and even stand-still is caused by iced control elements. Pumps type LP are prone to such malfunction when permanently operated for more than 20 minutes and air pressure is higher than 4 bar. A good preventive measure is adding anti-freeze-lubricant (like for truck brakes) in the service unit of the compressed air. This will cut down the freezing point and will additionally lube the dynamic (moving) seals on the pneumatic side of the pump. It is advantageous to install the pump with the silencer directing sideward or downwards as any excess antifreeze condensing at the silencer will drop down and not drip into the movement reversal valve again. Evidently this is not possible with complete hydraulic power packs from HAWE (see sect. 5.2.2) as the silencer is always vertically upwards.

A recommended anti-freeze-lubricant is e.g. "Klüberbio LR 6-15" from Co. Klüber Lubication,
D-81379 München, Geisenhausenerstr. 7.

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8. Noise generation

This depends mainly on the operating air pressure and is optimally limited in relation to the total degree of effectiveness of the pump by the exhaust air silencer

Measuring conditions:	Workroom, noise level approx. 42 dB(A) measuring point 1m above the ground; 1m distance from the objekt Pump standing on sound deadening felt 50 mm
Measuring instrument:	Precision sound level measuring instrument DIN IEC 651 cl. 1
Oil viscosity	approx. 50 mm²/sec