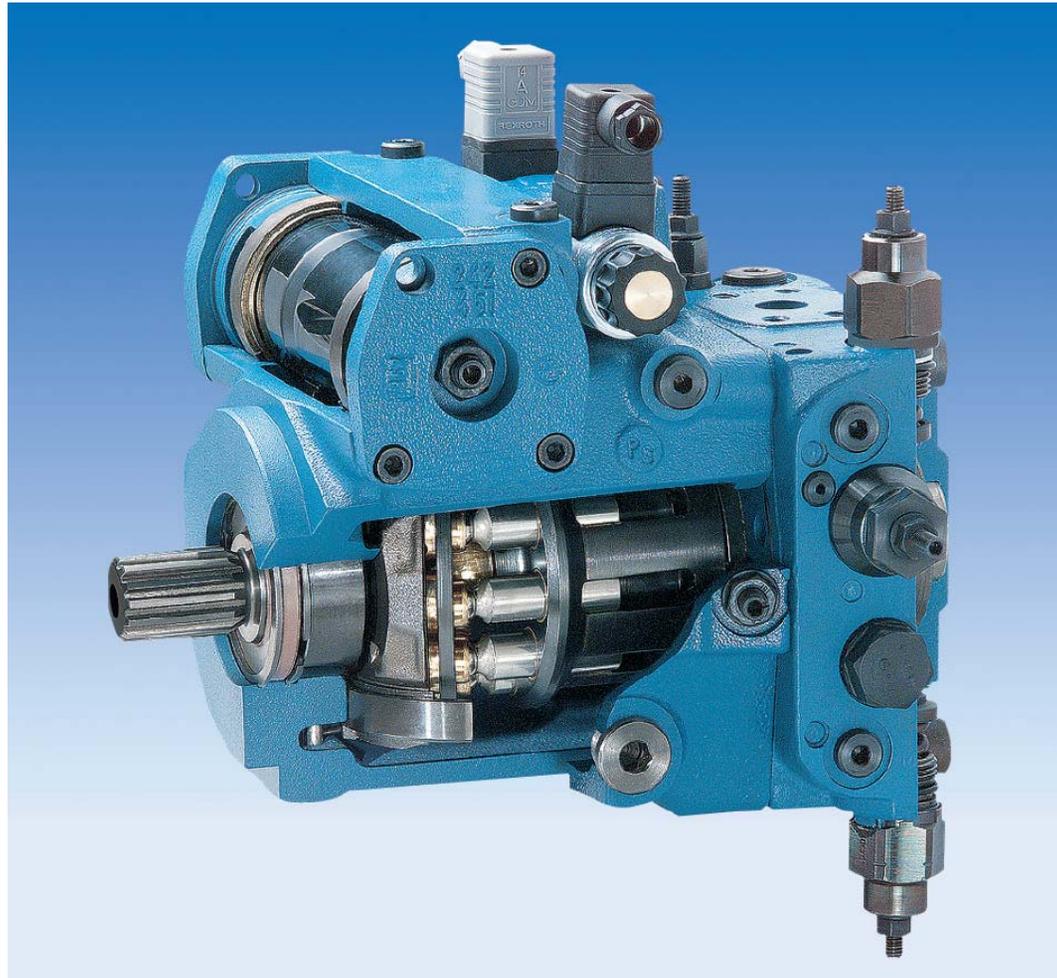
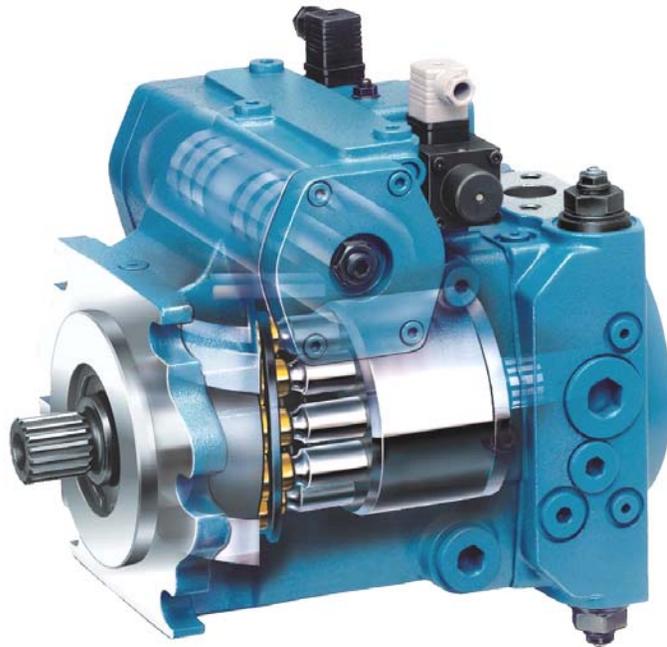


# A4V(T)G Product Training



# A4VG的主要特点和应用



**排量**

28 • 40 • 56 • 71 •  
90 • 125 • 180 • 250

**压力范围**

400 / 450 bar



**变量泵**  
**A4VG**

- 紧凑
- 可逆
- 模块化设计
- 内置补油泵
- 带高压阀，补油阀和压力切断阀-
- 控制方式多样化

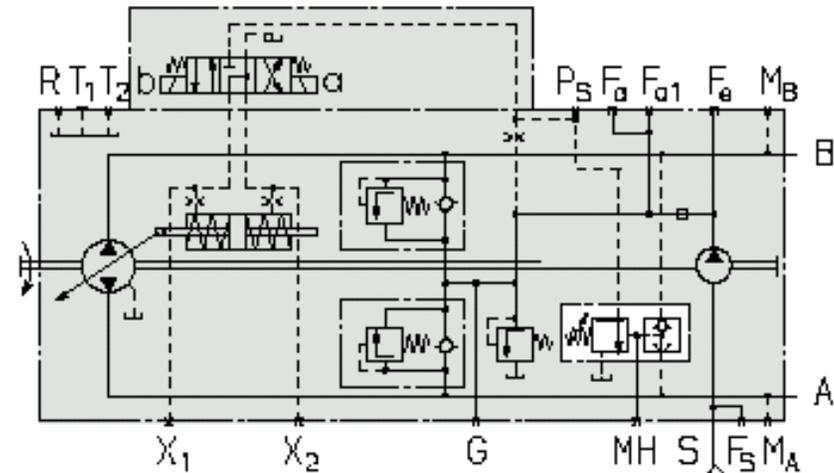
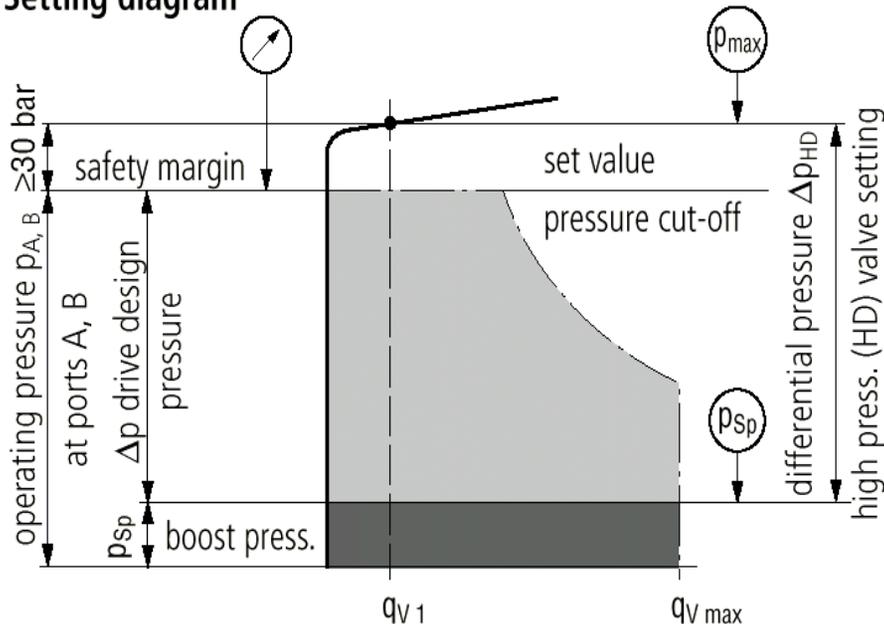
**应用领域**

- 建筑机械
- 农业和林业机械
- 路面机械
- 叉车
- 起重机
- 钻机

# A4VG油泵

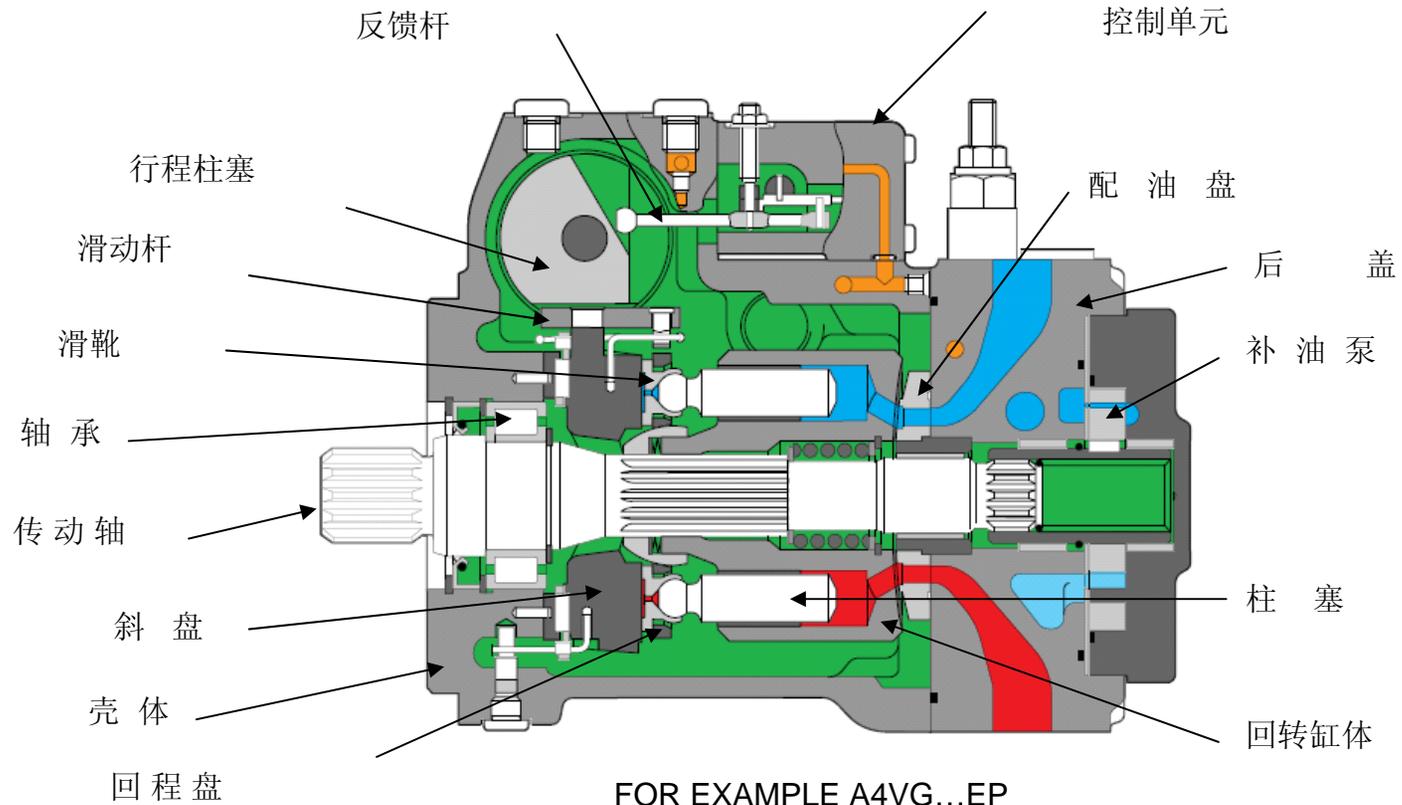
## Cut-off 压力切断阀的设定

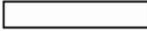
Setting diagram



Note: valve setting is done at  
 **$n = 1000 \text{ min}^{-1}$  and  $V_{g \text{ max}} (q_{V1})$**

Example: boost pressure 20 bar; operating pressure 410 bar  
operating pres.  $p_{A, B}$  - boost pres.  $p_{Sp}$  + safety margin = differential pres.  $\Delta p_{HD}$   
410 bar - 20 bar + 30 bar = **420 bar**

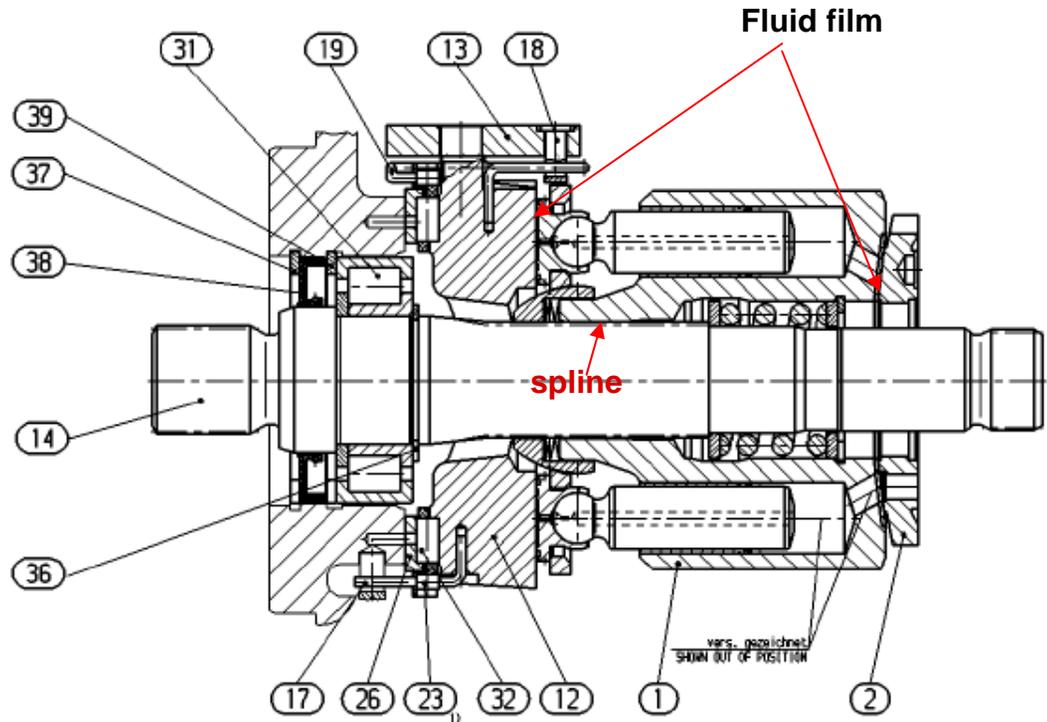


					
Hochdruck High pressure Haute pression Alta pressione Alta presión	Niederdruck Return line pressure Basse pression Bassa pressione Baja presión	Saugdruck Suction pressure Pression d'aspiration Pressione d'aspirazione Presión de aspiración	Lecköldruck Case drain pressure Pression de drainage Pressione di trafilemento Presión de drenaje	Steuerdruck Pilot pressure Pression de pilotage Pressione di pilotaggio Presión de pilotaje	Stelldruck Control pressure Pression de commande Pressione di posizionamento Presión de taraje

## Spare parts list

- 1, rotary group, hydraulic section
- 2, distributor plate
- 12, cradle
- 13, slide ring
- 14, **drive shaft (KEY)**
- 17, wire
- 18, joint pin
- 19, wire
- 26, bearing liner
- 31, **plain roller bearing (KEY)**
- 32, cradle bearing assembly(set)
- 36, retaining ring
- 37, retaining ring
- 38, shaft seal ring
- 39, retaining ring

Only mount roller(item 23) if it is not contained in item 32

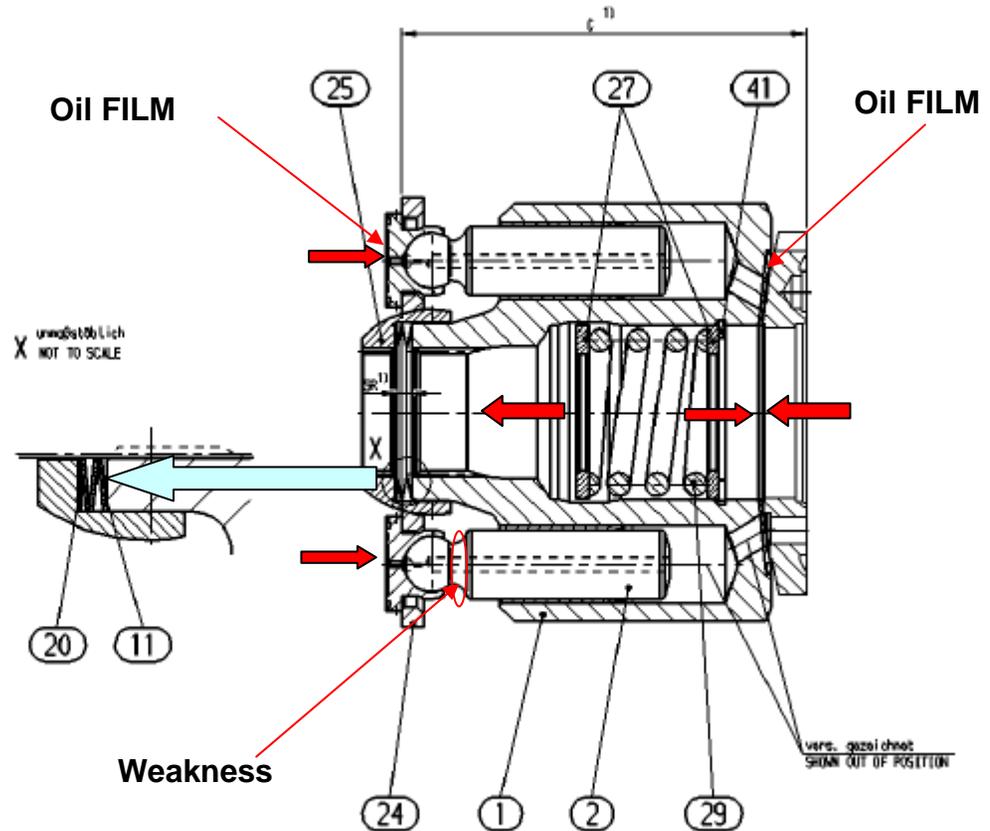


The operating life is calculated according to bearing. If bearing is broken down, the pump stop working.

The pump convert mechanical energy to hydraulic energy via drive shaft ( **with spline** ), for sure shaft broken, pump broken.

## Spare parts list

- 1, cylinder with bush
- 2, **piston-slipper pad (key)**
- 11, cup spring stack
- 20, shim
- 24, **retaining plate (key) : to avoid shoes loose**
- 25, retaining ball
- 27, washer
- 29, **pressure spring (key)**
- 41, retaining ring

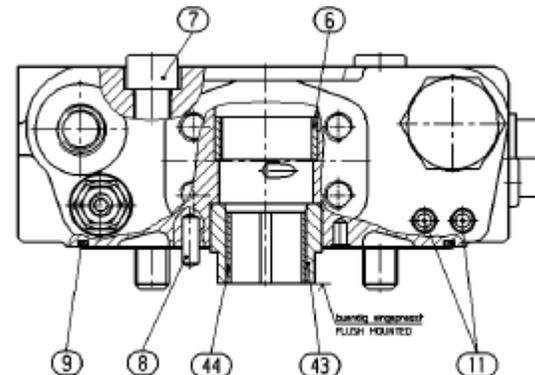
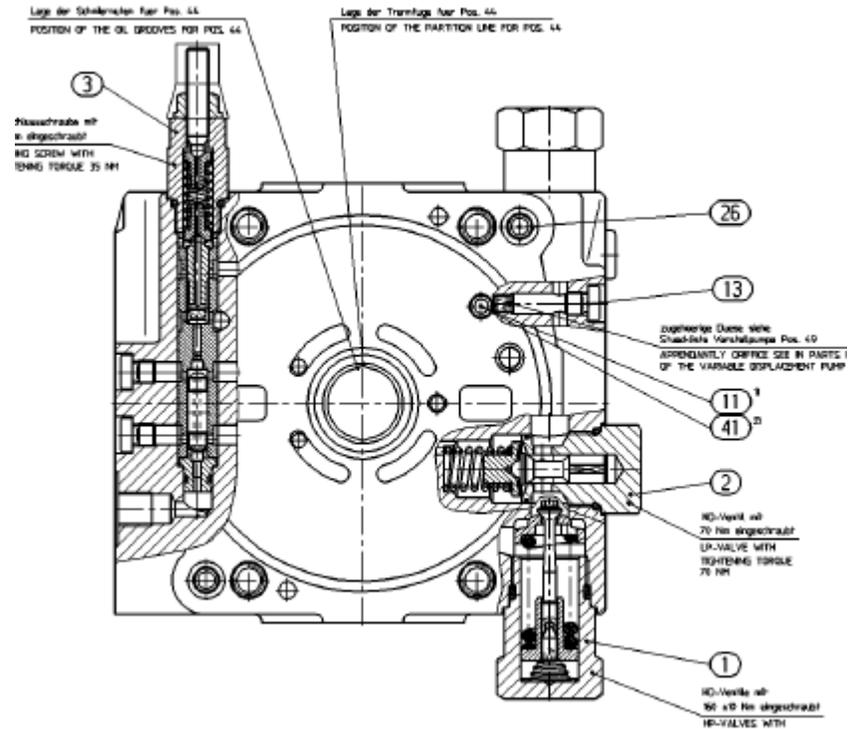


if piston was broken, the pump can't finish normal charge and discharge oil. Sometimes the swashplate keep big swivel angle, it is dangerous for mobile machine. (F.g. crane)

- The role of pressure spring include:
- 1, result in force which make cylinder push towards distributor and swashplate.
  - 2, keep balance between cylinder and distributor, also swashplate and shoes. Form suitable oil diaphragm.
  - 3, result in torque against overturning moment, keep balance of cylinder.

# PORT PLATE WITH VALVES

- 1, **Pressure relief valve** 2 sets
- 2, boost pressure relief valve 1 set
- 3, **pressure override valve(cut-off)**
- 11, double break-off pin
- 13, locking screw
- 26, O ring
- 41, double break-off pin
- 6, bearing bushing
- 7, socket-head screw
- 8, cylinder pin
- 9, O ring
- 43, bush
- 44, bearing bushing

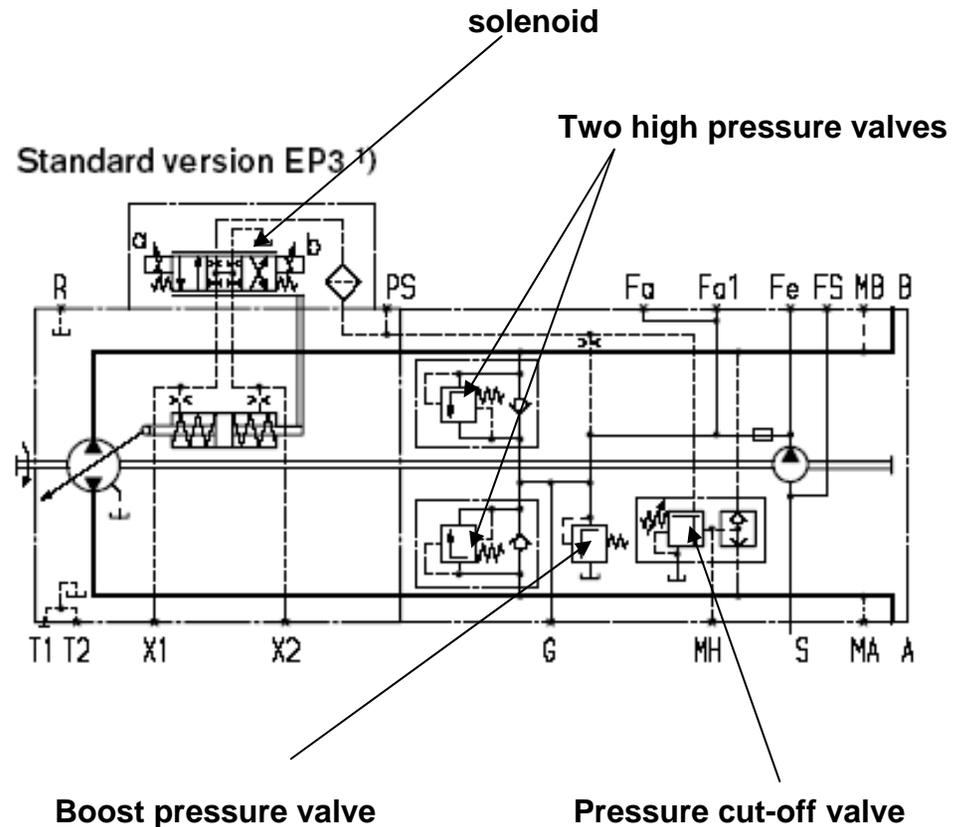


High pressure valve is to protect hydrostatic transmission from override.

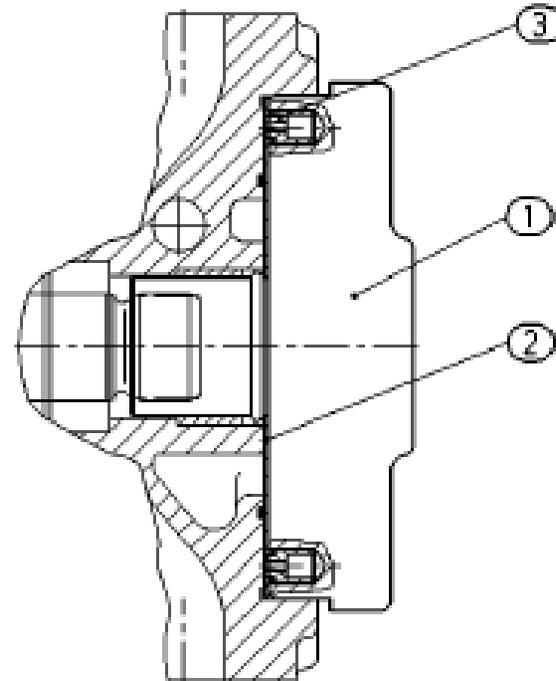
Pressure cut-off valve prevents the operation of high pressure valve because operation of hi-valve will cause energy wasting.

Take EP3 as example, explain how to operate for high pressure valve and pressure cut-off valve.

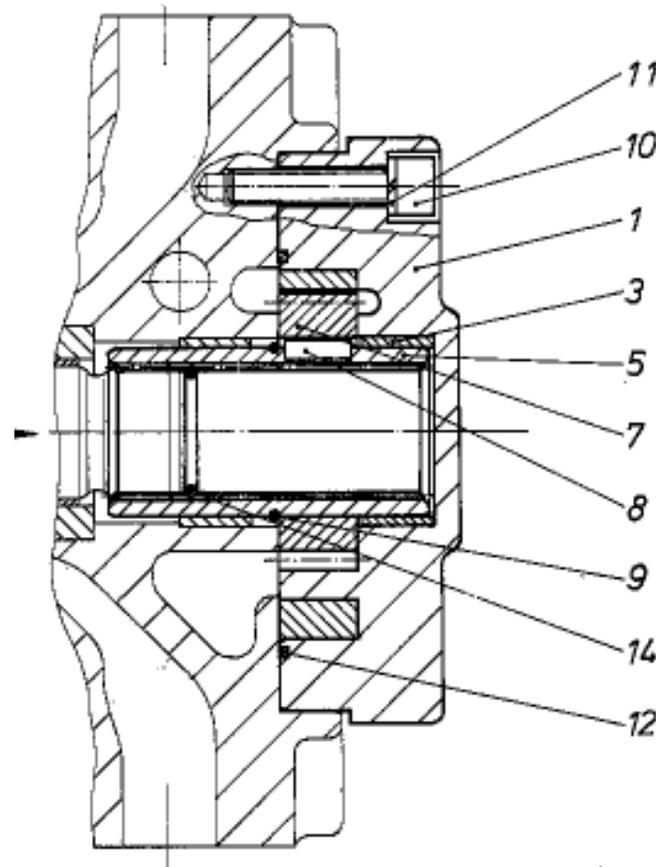
Boost pump function: replenish leakage; cool pump; supply control oil.

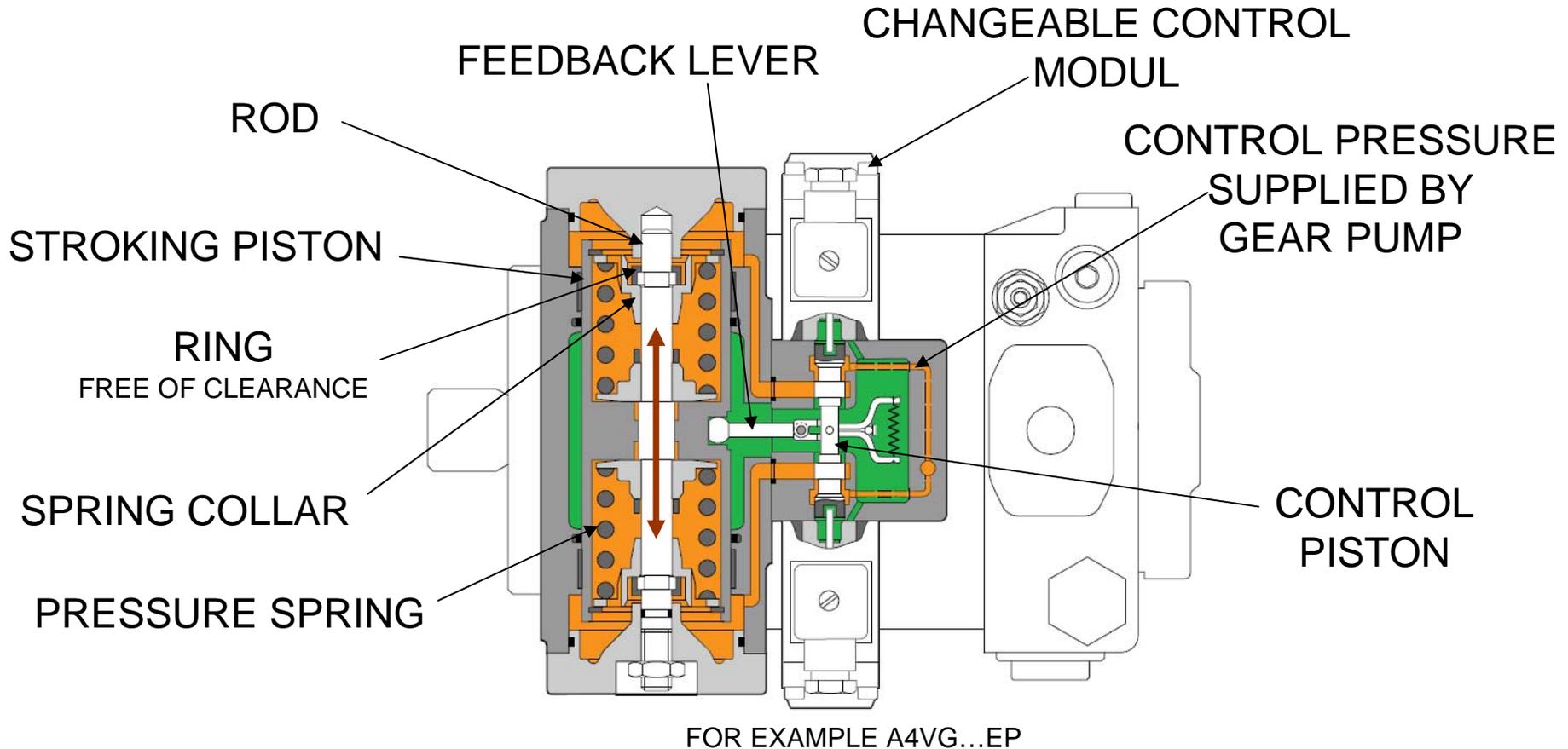


- 1, internal gear pump
- 2, wear plate complete
- 3, locking plug



- 1, pump cover
- 3, bearing bushing
- 5, through-drive shaft
- 7, wheel set
- 8, shaft key
- 9, snap ring
- 10, socket-head screw
- 11, locking washer
- 12, kantseal ring
- 14, snap ring





					
Hochdruck High pressure Haute pression Alta pressione Alta presión	Niederdruck Return line pressure Basse pression Bassa pressione Baja presión	Saugdruck Suction pressure Pression d'aspiration Pressione d'aspirazione Presión de aspiración	Lecköldruck Case drain pressure Pression de drainage Pressione di trafilamento Presión de drenaje	Steuerdruck Pilot pressure Pression de pilotage Pressione di pilotaggio Presión de pilotaje	Stelldruck Control pressure Pression de commande Pressione di posizionamento Presión de taraje

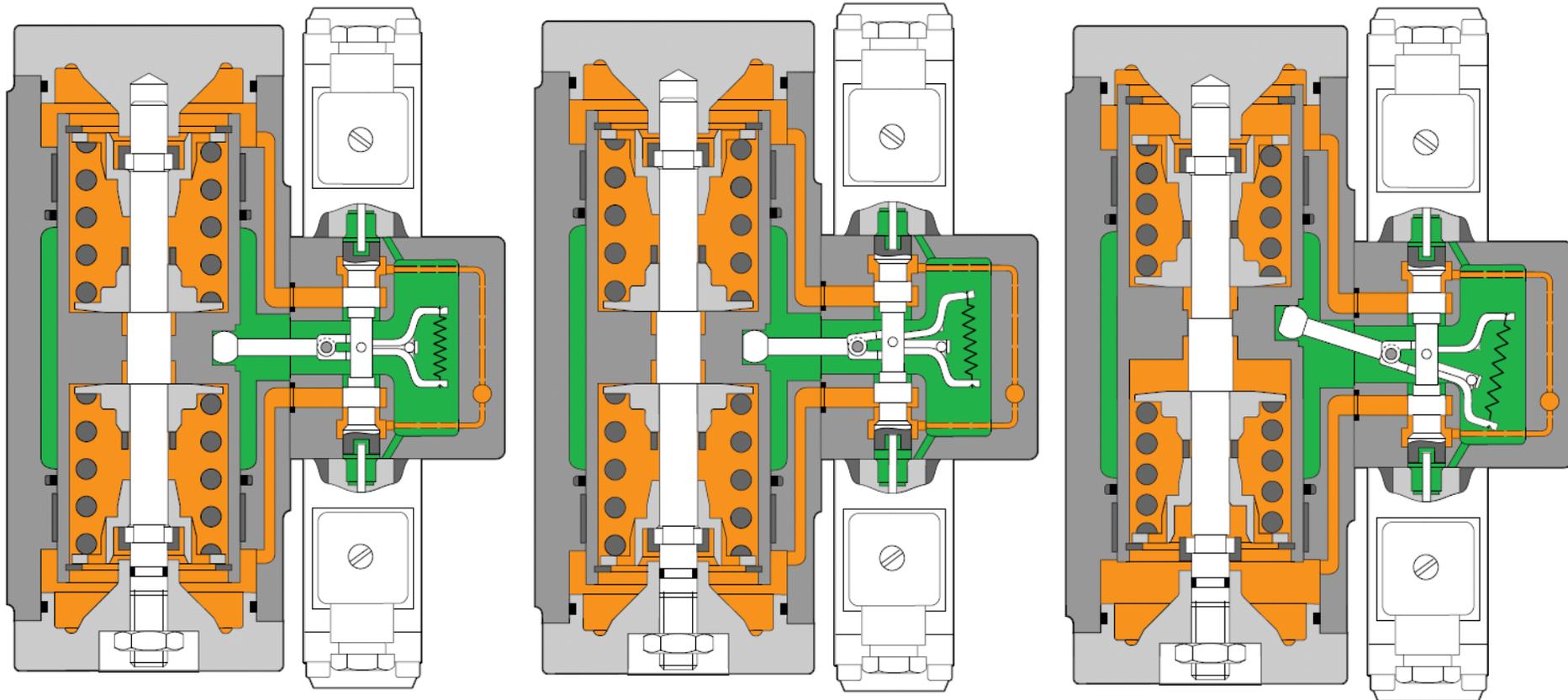
# FUNCTION - FEEDBACK LEVER

Or example A4VG...EP

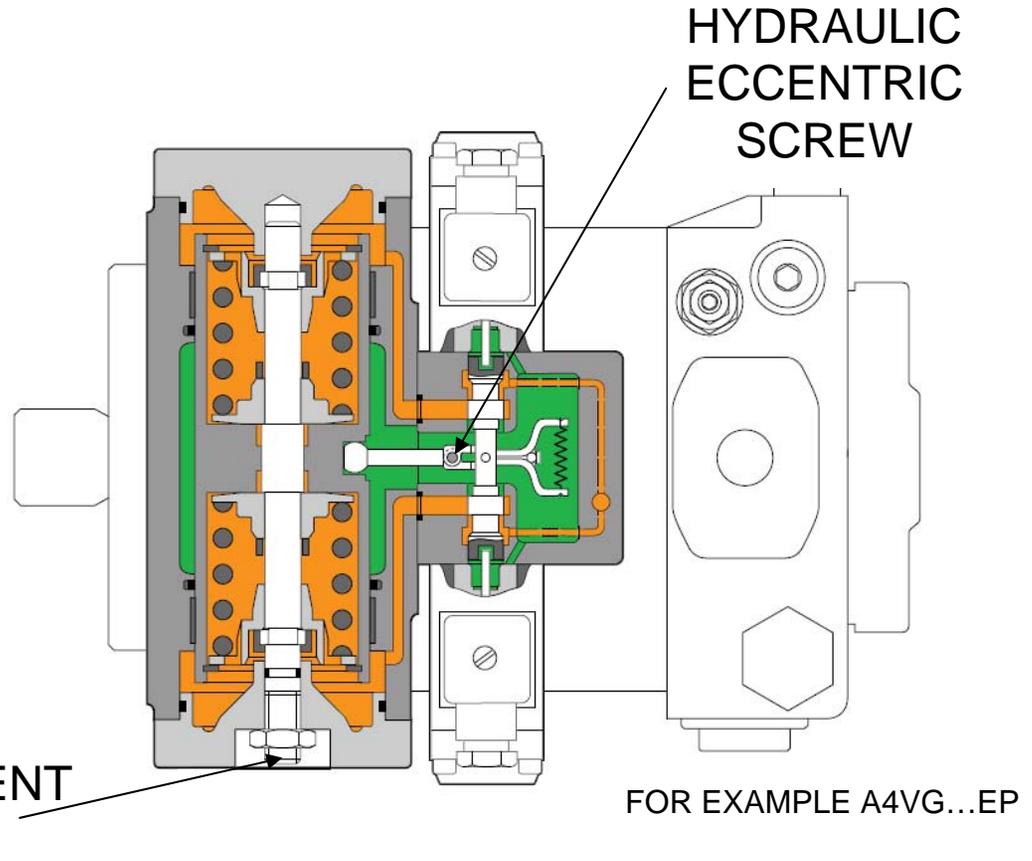
I

II

III

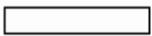


Both screws have to be adjusted, so that the pump does not produce any flow if the controller is not activated

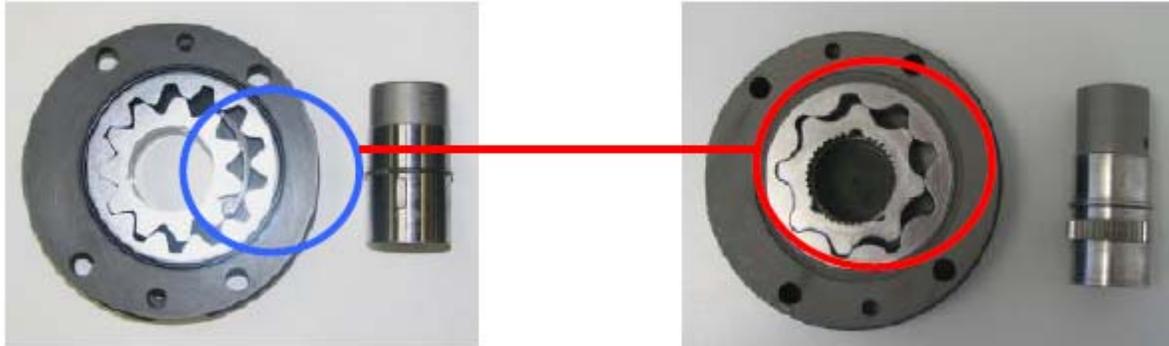


**MECHANICAL ADJUSTMENT SCREW**

FOR EXAMPLE A4VG...EP

					
Hochdruck High pressure Haute pression Alta pressione Alta presión	Niederdruck Return line pressure Basse pression Bassa pressione Baja presión	Saugdruck Suction pressure Pression d'aspiration Pressione d'aspirazione Presión de aspiración	Lecköldruck Case drain pressure Pression de drainage Pressione di trafilamento Presión de drenaje	Steuerdruck Pilot pressure Pression de pilotage Pressione di pilotaggio Presión de pilotaje	Stelldruck Control pressure Pression de commande Pressione di posizionamento Presión de taraje

# The difference of Boost pump between A4VG & A4VTG



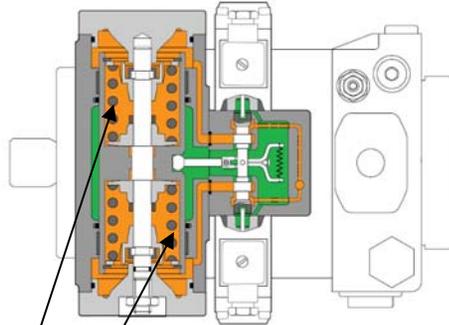
## **A4VG with internal gear pump as boost pump:**

- Less noise
- Less pulsation
- Less contact stress
- Less abrasion
- Long operating life
- Better self-priming
- Higher manufacturing cost

## **A4VTG with Gerotor pump as boost pump:**

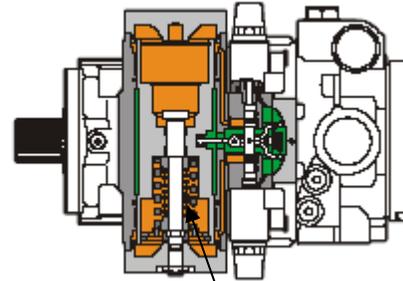
- Relative bigger pulsation
- Less tooth, bigger volume
- Better self-priming
- Reduction of machining without crescent
- Spline drive for increase strength
- Less manufacturing cost

## A4VG\*/32



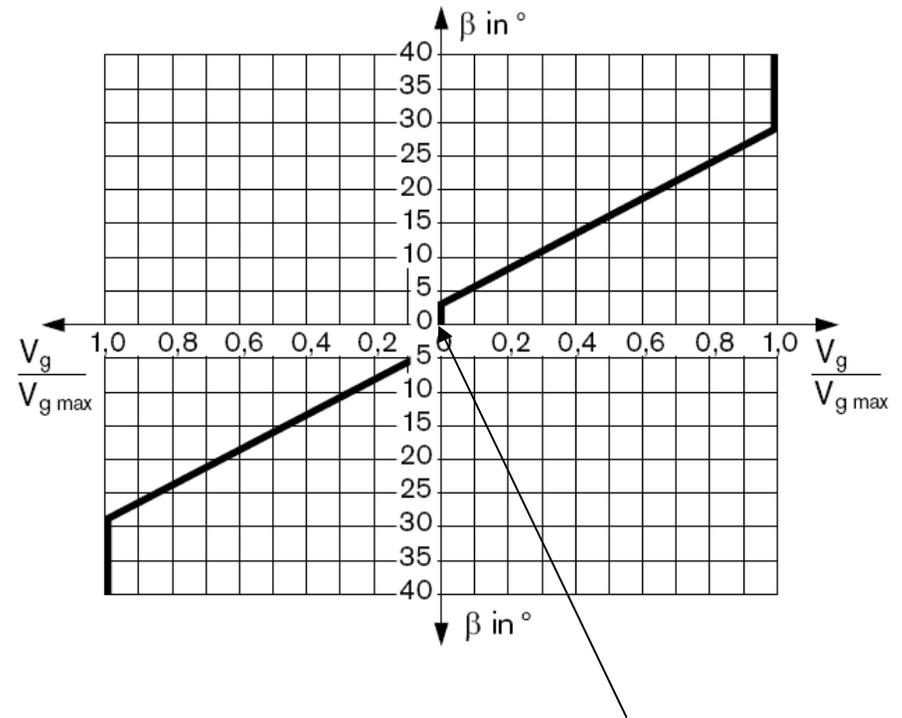
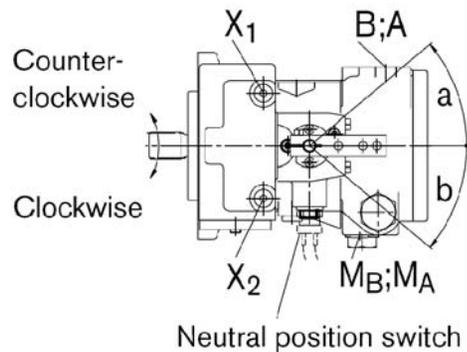
**Two stroking spring package**

## A4VTG\*/33

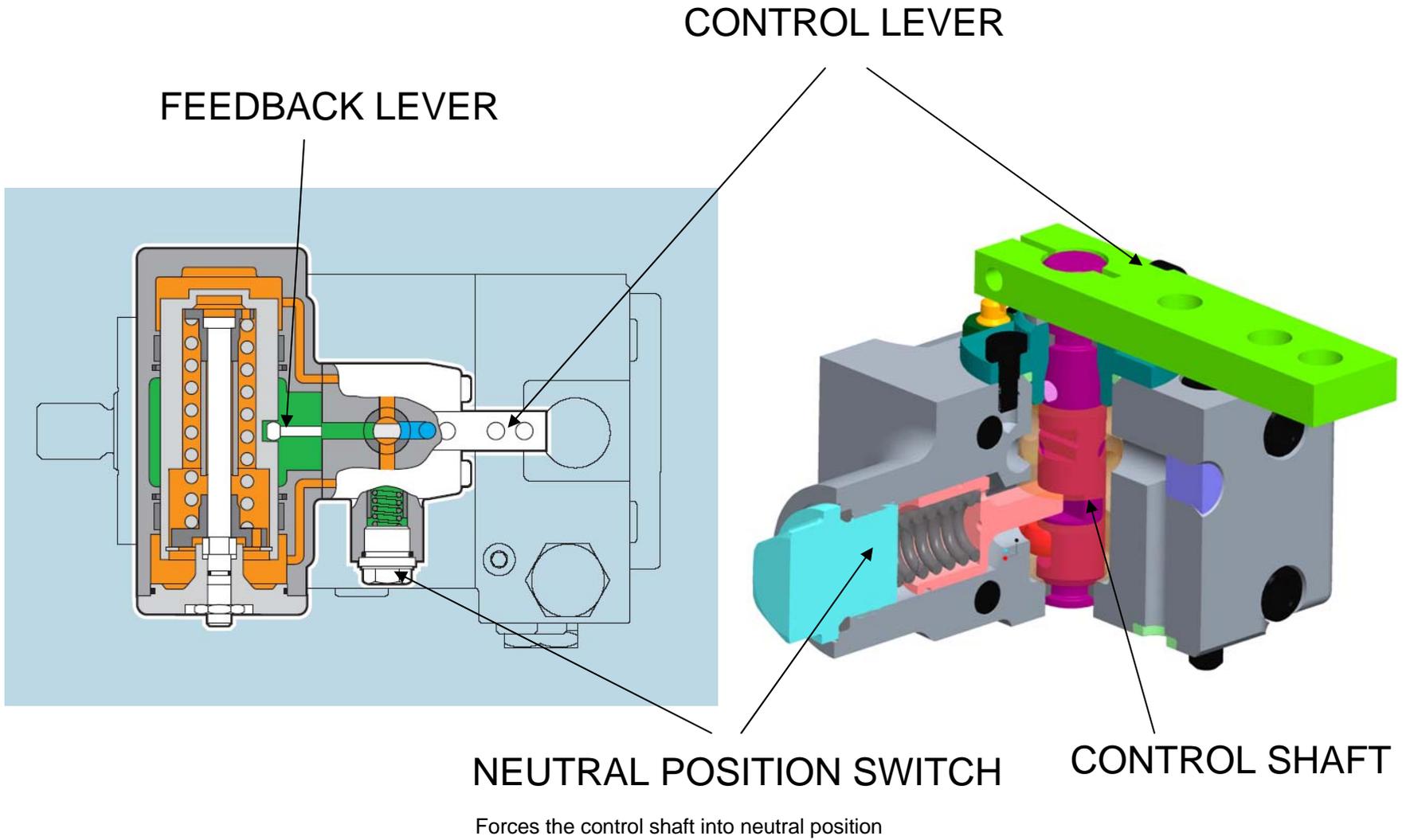


**Single stroking spring package, less cost**

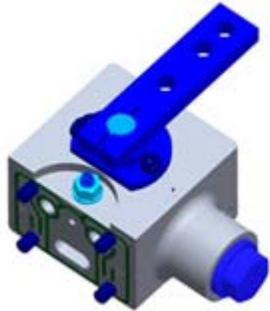
- The flow output changes proportional of the rotation of the control lever
- Spring centered to zero position
- Application with feedback lever



“After a certain swivel angle of the control lever the pump begins to swivel”



## Standard version with cylindrical or hexagonal control shaft



Cylindrical control shaft,  
without zero position  
switch

Material description:  
e.g.. STEUERGERAET  
HW, ZYL. OHNE SCH.



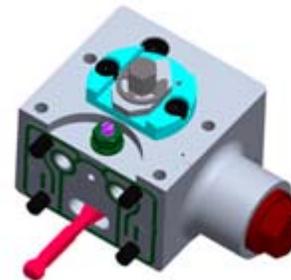
Teethed control shaft,  
without zero position  
switch

Material description:  
e.g.. STEUERGERAET  
HW, VERZ. OHNE  
SCH.



Hexagonal control shaft,  
with zero position  
switch

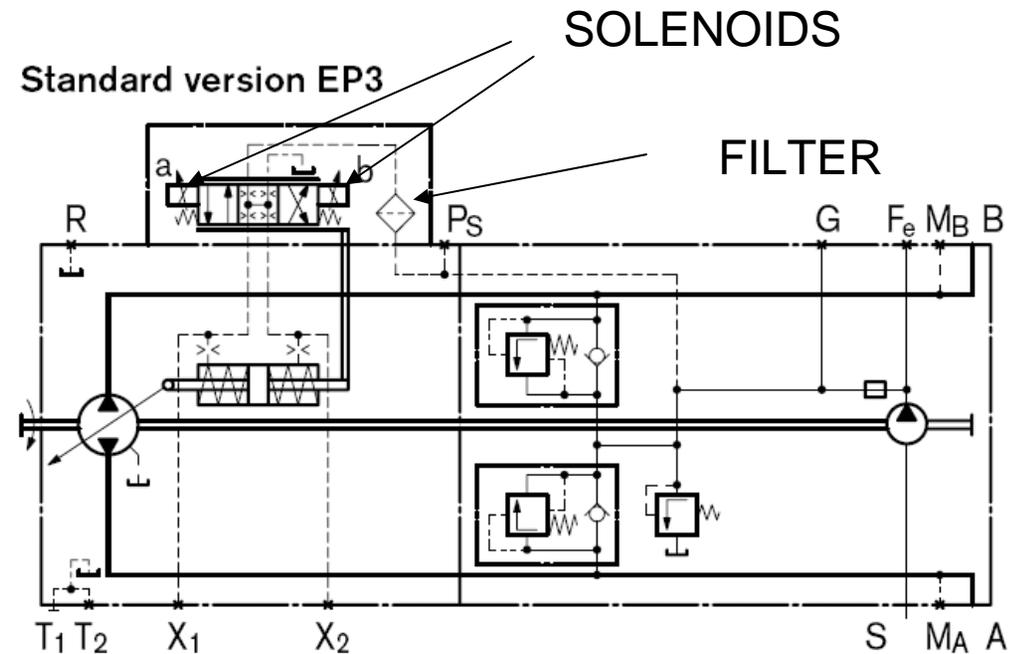
Material description:  
e.g. STEUERGERAET  
HW, ZYL, MIT SCH.



Hexagonal control shaft,  
without zero position  
switch

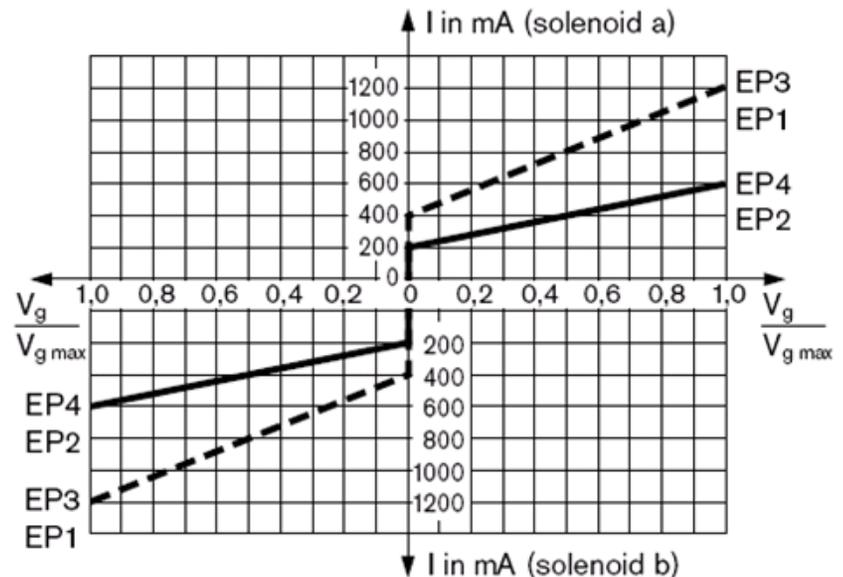
Material description: E.G.  
STEUERGERAET HW,  
6KT, OHNE SCH.

- Activation of the control piston by applying current on the proportional solenoids. The more current is applied to one of the solenoids the more the control piston opens the connection to the control pressure on one side and to the tank on the other side.
- Feedback lever allows to maintain a certain displacement independent to operating pressure, timing and input speed



Solenoid technical data	EP3/EP1	EP4/EP2
Voltage	12 V DC ( $\pm 20\%$ )	24 V DC ( $\pm 20\%$ )
Control current		
Start of control at $V_{g0}$	400 mA	200 mA
End of control at $V_{g\max}$	1200 mA	600 mA
Limiting current	1.54 A	0.77 A
Nominal resistance (at 68 °F / 20 °C)	5.5 $\Omega$	22.7 $\Omega$
Dither frequency	100 Hz	100 Hz
Actuated time	100 %	100 %
Type of protection	see range of connectors on page 60	

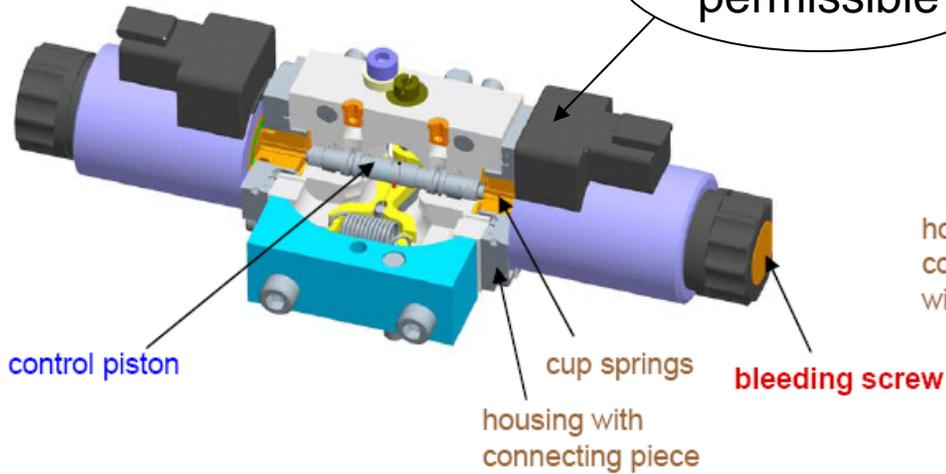
EP3/4: with supply filtration (standard)  
EP1/2: without supply filtration (not permissible for new projects!)



# CONTROL DEVICE – EP COMPARISON

**Previous:** EP1, EP2

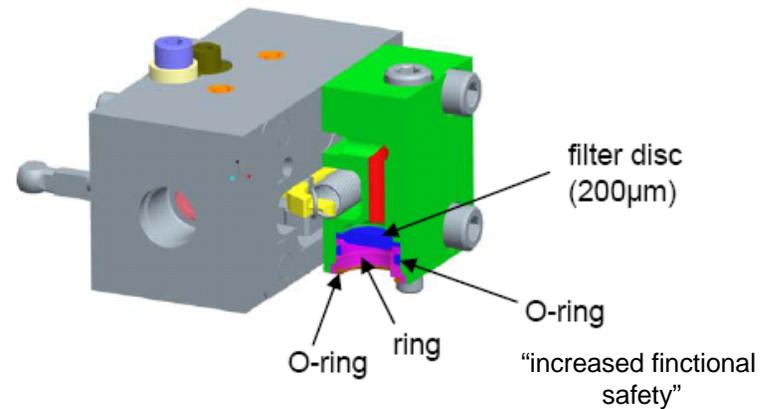
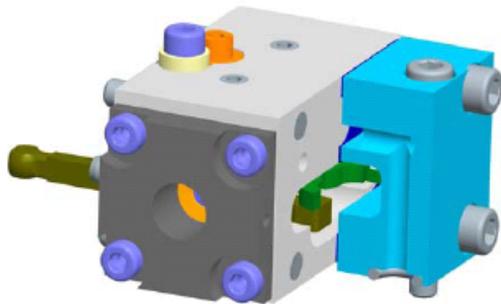
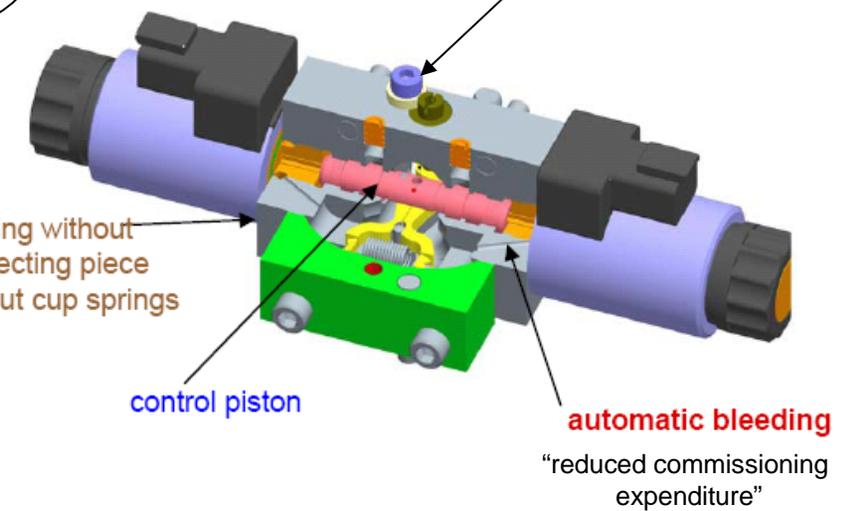
no longer permissible



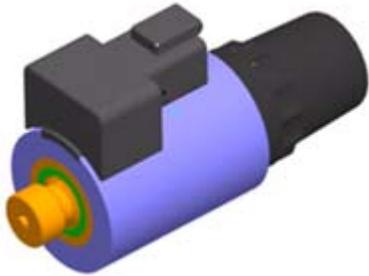
**New:** EP3, EP4

standard

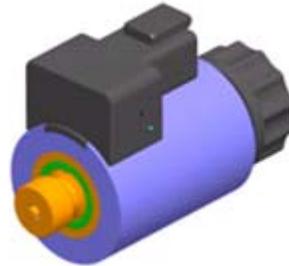
housing without connecting piece  
without cup springs



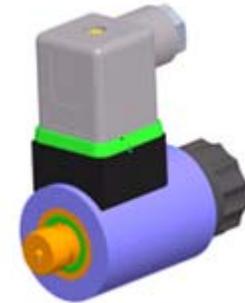
# CONTROL DEVICE – EP DIFFERENT TYPES



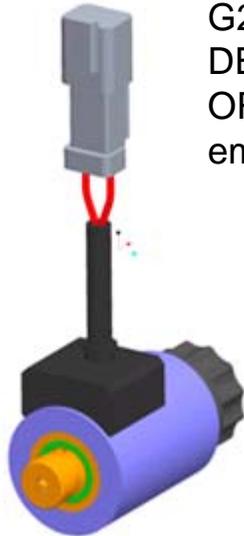
G2DS – molded connector  
DEUTSCH-SWITCH, 12V  
OR 24V, with  
emergency activation



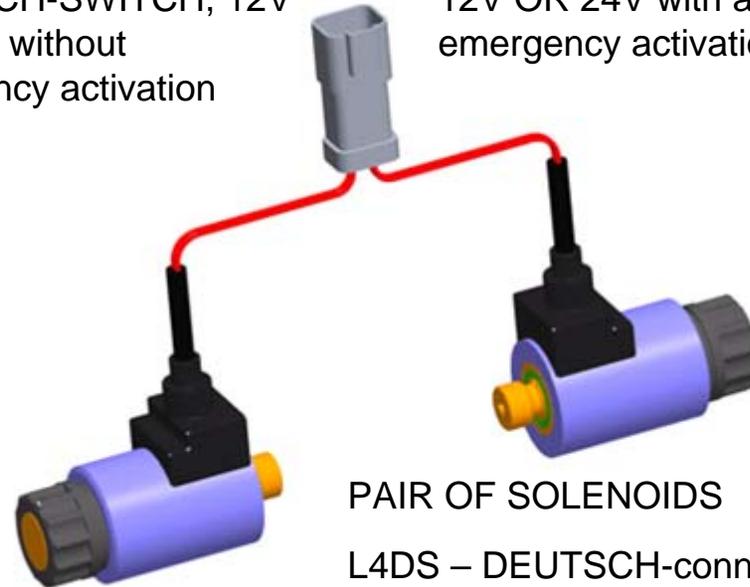
G2DS – molded connector  
DEUTSCH-SWITCH, 12V  
OR 24V without  
emergency activation



Z4HM – HIRSCHMANN-connector,  
12V OR 24V with and without  
emergency activation



L2DS – DEUTSCH-connector  
with strand,  
12V OR 24V with and without  
emergency activation



PAIR OF SOLENOIDS

L4DS – DEUTSCH-connector with  
strand,  
12V OR 24V with and without  
emergency activation

## 安装注意事项!

- 安装前，必须把泵内的液压油泄干净，防止跟系统中的液压油混合。
- 安装前，必须保证系统没有压力，电器元件没有电。
- 安装时，必须防止焊珠或金属碎屑进入。
- 调试前，必须保证所有连接件和密封处紧固。
- 在清洗元件表面时，必须把所有开口堵死。
- 在清洗时，不能用带有溶解和腐蚀性的清洁剂，最好用水
- 不用压力高的清洗器清洗密封处和电器元件
- 柱塞泵的寿命很大程度上依赖于液压介质的质量。正因为如此，请在柱塞泵工作一年或2000小时后，更换油液。或者请液压介质供应商或相关检测机构，检测是否适合继续使用。
- 在液体介质干净，柱塞泵的寿命取决于轴承的寿命。
- 如需对泵进行维修，必须由经过专门培训的并且得到授权的熟练人员来做。
- 请订购力士乐的备件，如果从其他公司订购备件，不符合技术要求会造成危险的。

## 定期检查液压泵和液压系统！

液压系统	检查油箱液面	每天
	检查工作温度	每周
	检查液体介质质量	每年或2000小时
柱塞泵	检查柱塞泵是否泄露，如能早发现，有助于检查故障，所以力士乐建议保持液压系统工作环境清洁干净。	每天
	检查柱塞泵的噪音情况	每天
	当系统停止工作，泄压冷却后，检查紧固处是否松动	每月

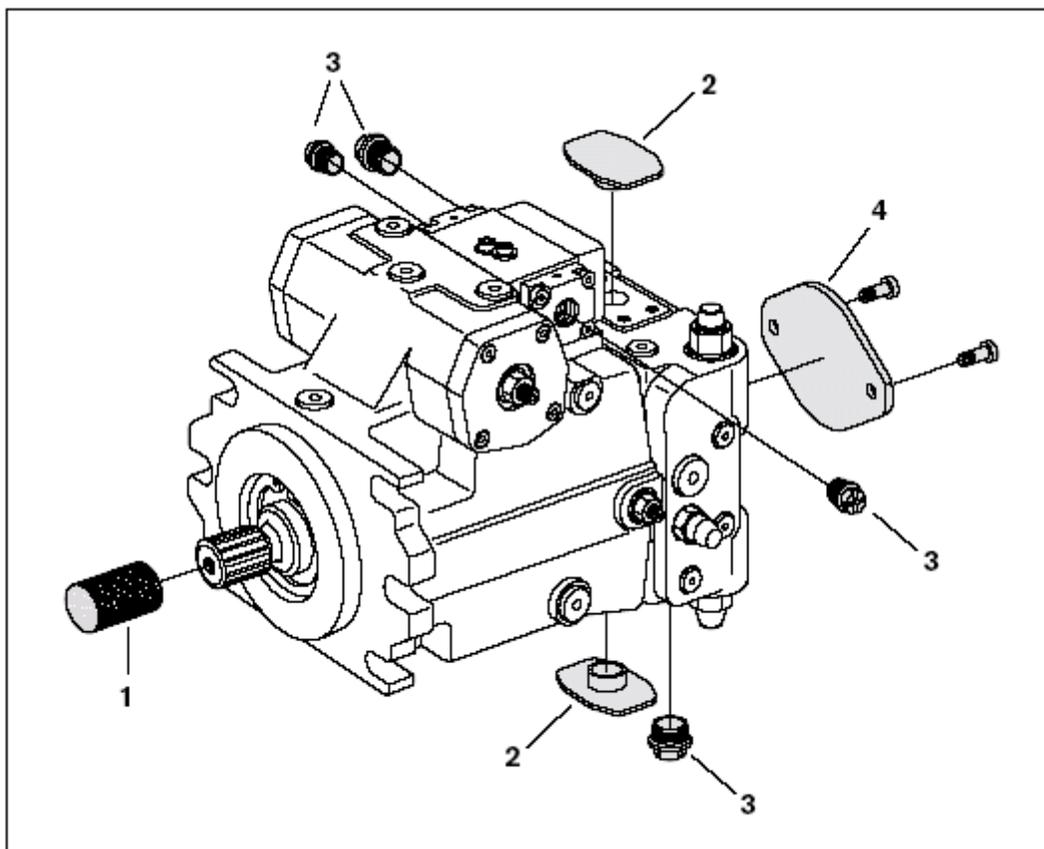
发货时带的附件包括:

1, 保护套为了在运输中保护轴头

2, 工作油口的保护盖

3, 塑料堵或螺堵

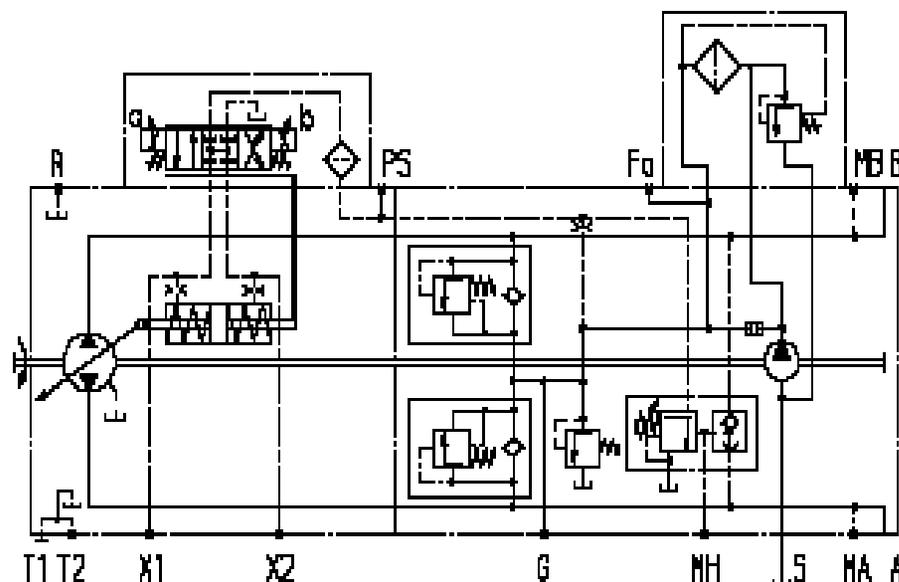
4, 后盖法兰和紧固螺钉



## 带冷启动阀的过滤器

- 1, 直接安装在泵上, 不用单独订货。
- 2, 过滤等级20微米
- 3, 过滤器材料glass fiber
- 4, 最大压力 100bar
- 5, 过滤器连接在泵上, 不用单独订货
- 6, 泵的后盖上装有冷启动阀, 防止在气温低时, 泵遭到破坏。  
当压差达到 $\Delta P=14\text{bar}$ , 冷启动阀开启

Circuit diagram variation F (with mountable filter)

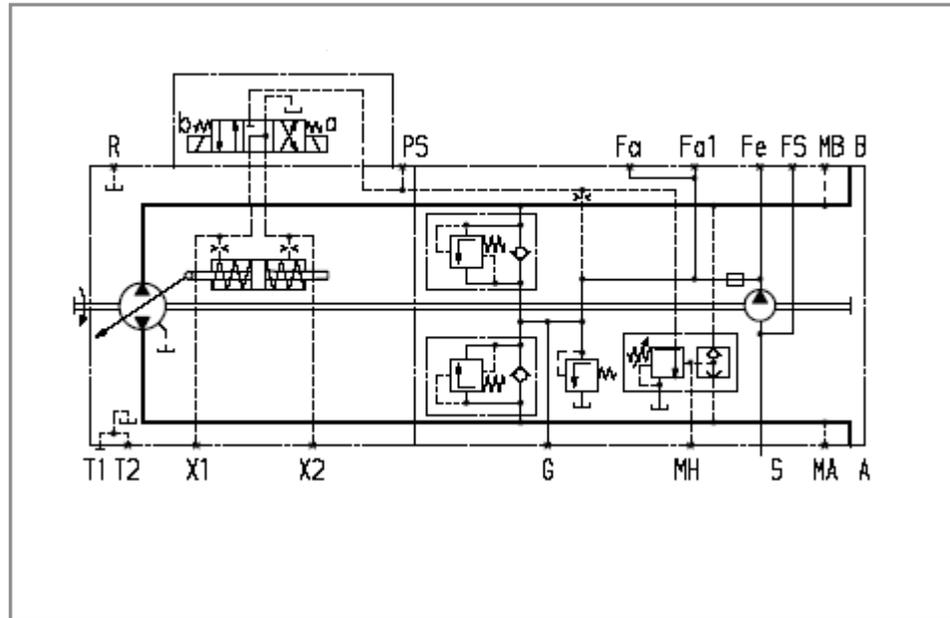


当电磁铁通电时，泵的斜盘摆角在最大，  
当电磁铁失电时，泵的斜盘摆角在最小。  
每侧的电磁铁对应泵的不同工作方向。

**EZ1——12V**

**EZ2——24V**

标准的开关电磁阀上不带手动弹簧复位功能



## 高压阀带旁通功能 (5, 6)

1, 关了内燃机或发动机

2, 用六角扳子 (WAF13)

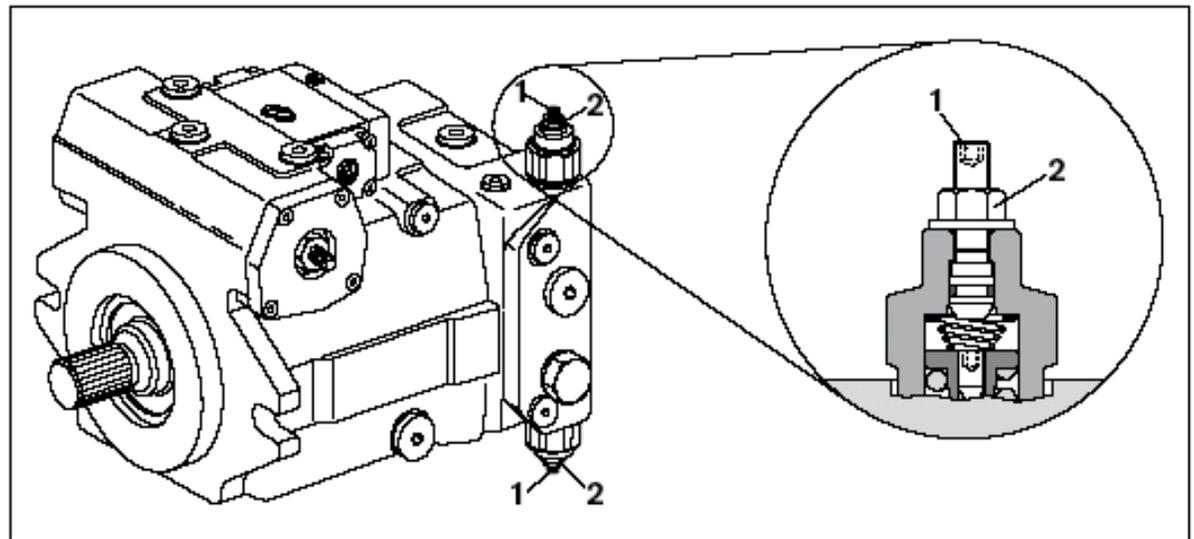
逆时针转一圈半, 松开2锁紧螺母

3, 用内六角扳子 (WAF4) 旋转

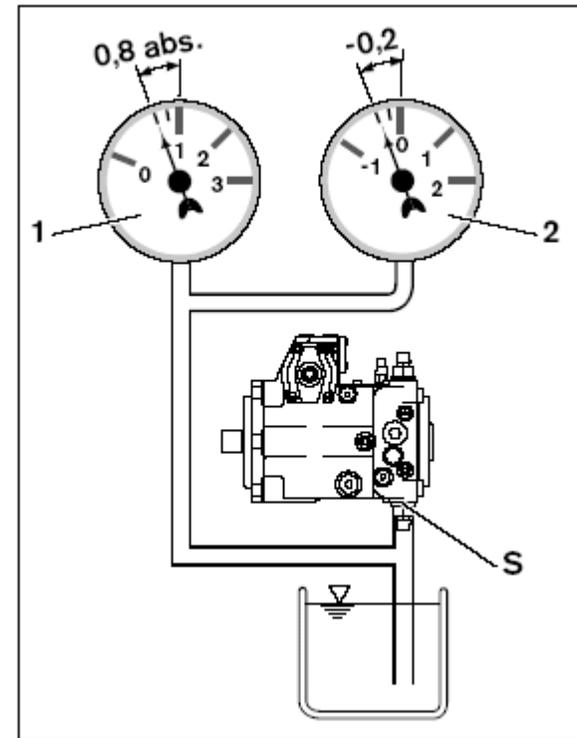
螺钉1, 直到转进簧座一圈半

4, 用22Nm的扭矩, 拧紧螺母2

当拖车完毕后, 请立即恢复高压功能, 操作跟上面相反



吸油压力必须大于等于0.8bar;  
冷启动时 (t小于3分钟) 大于等于0.5bar



为了保证柱塞泵的使用寿命，我们推荐油液清洁度等级至少为：  
20/18/15符合ISO4406

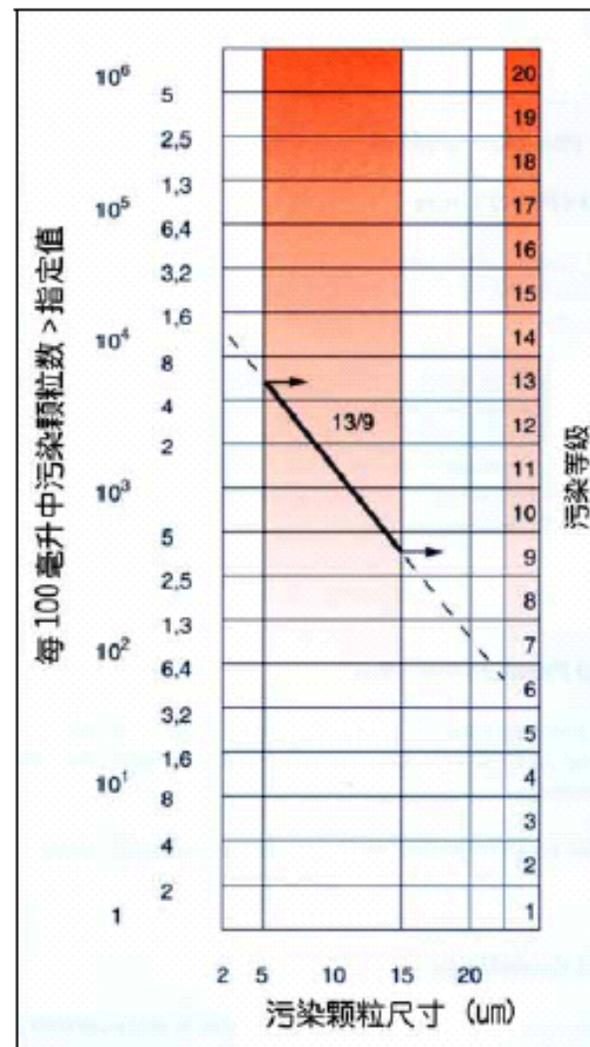
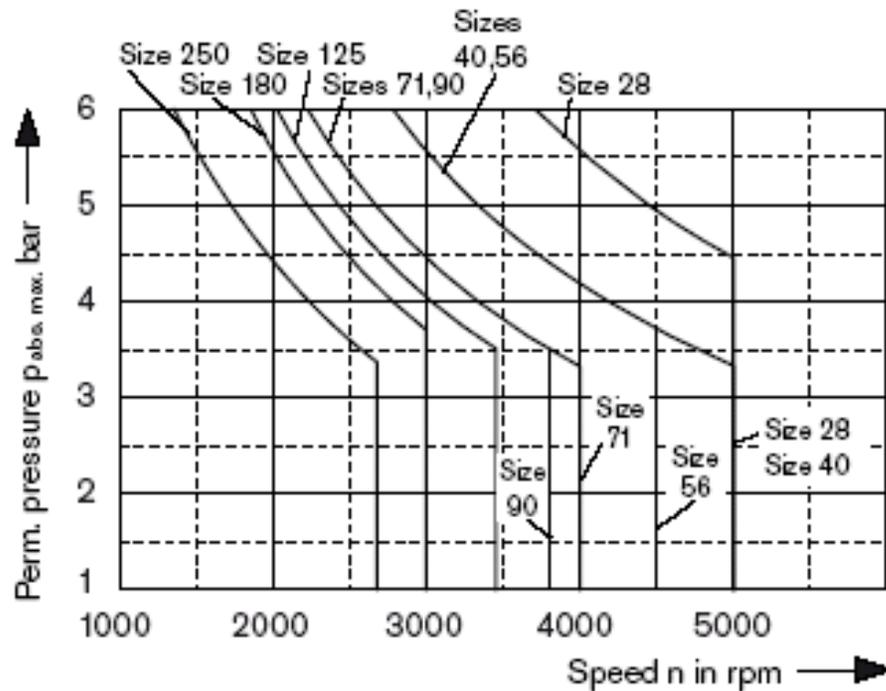
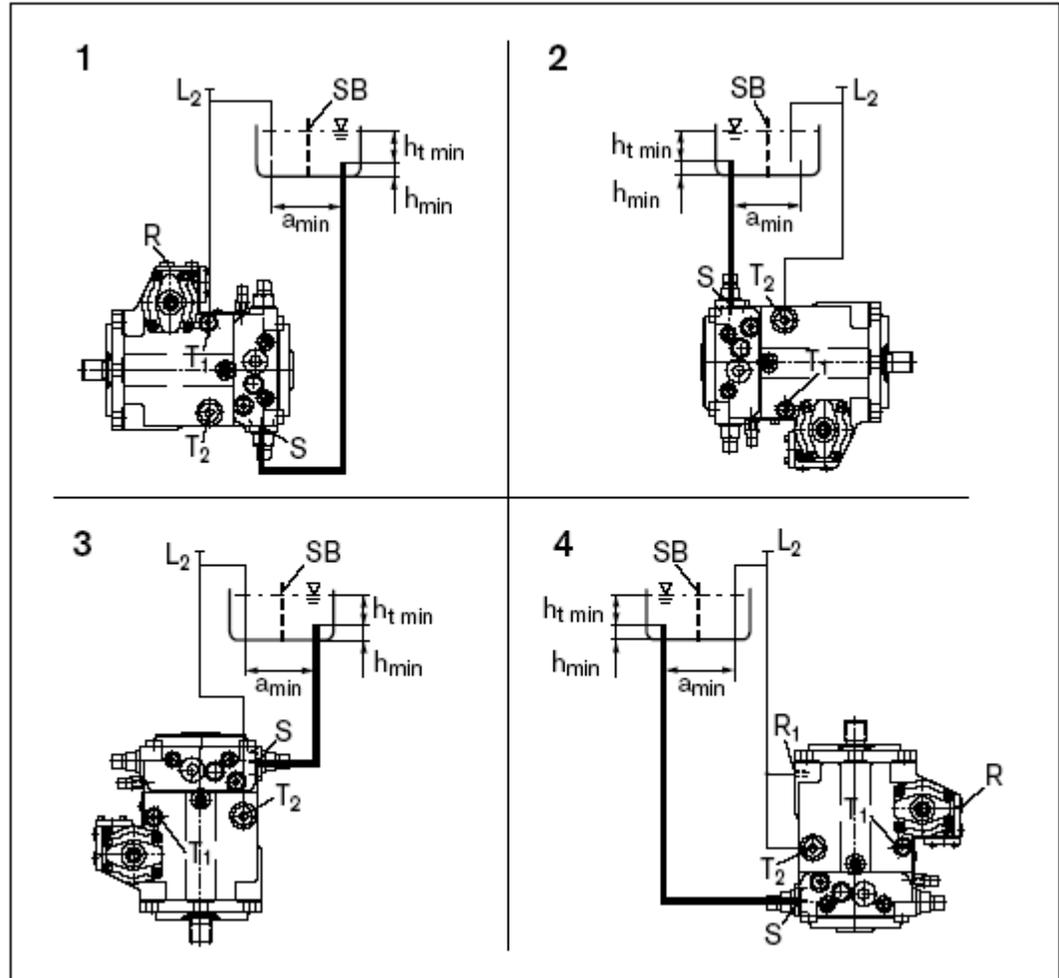


图 14.4 按 ISO 4406 标准的污染等级

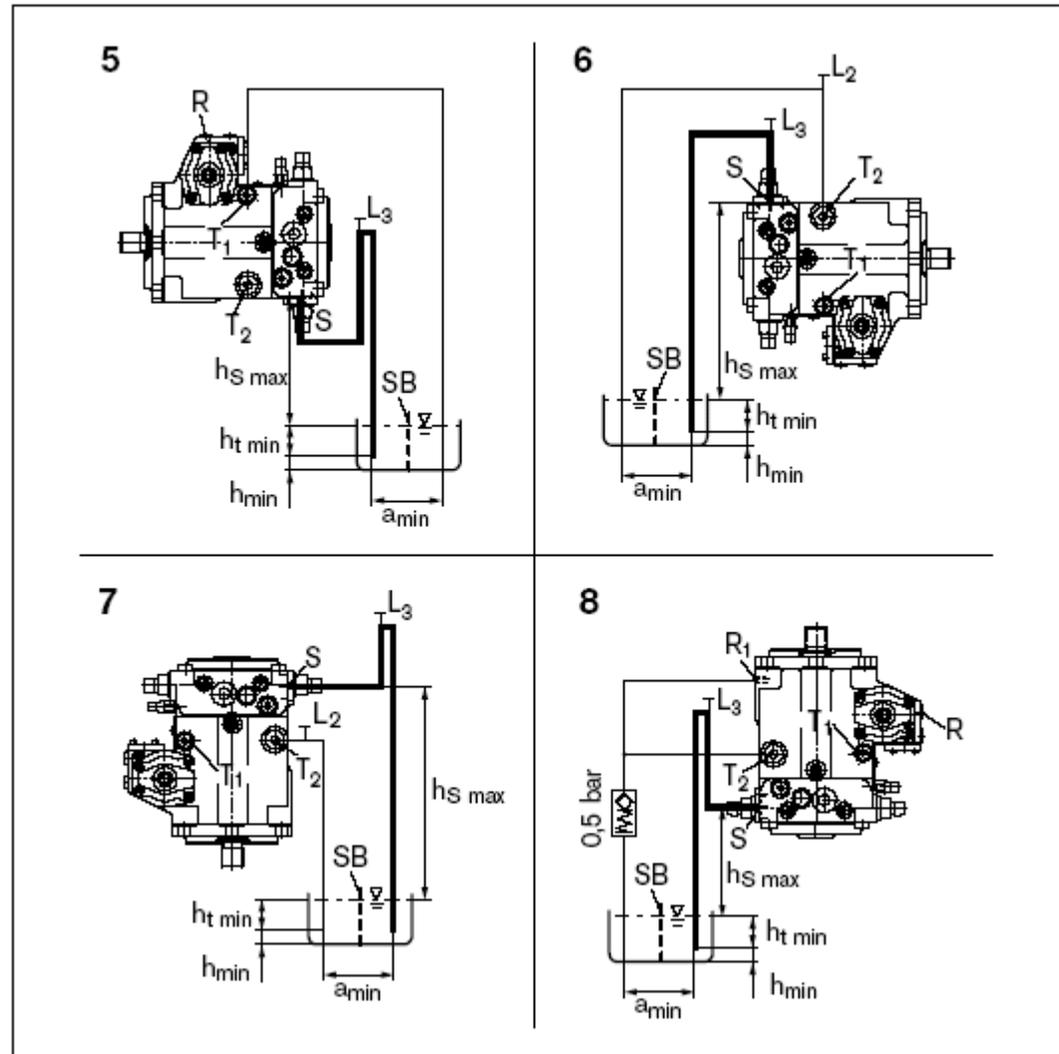
轴封的寿命受泵的转速和泄油压力的影响，我们推荐在正常工作下，不能超过3bar，在速度降低时，不超过6bar. 瞬时（小于0.1秒），可达10bar.

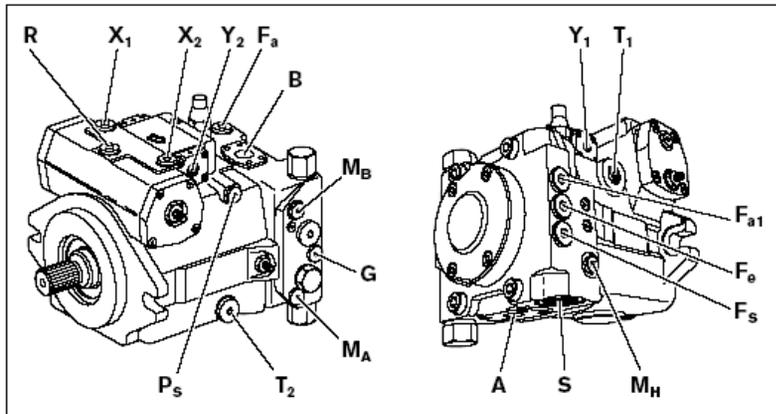


当柱塞泵在油箱外安装时，低于油箱安装是标准的安装方式。我们推荐1，2两种安装方式。



当柱塞泵轴朝上安装方式。我们推荐8两种安装方式。泄油路上的单向阀能防止产生气蚀，对轴承造成破坏。遵循最大吸油高度  $h_{Smax}=800mm$





Designation	Port for	Standard	Peak pressure (bar) <sup>1)</sup>	State
<b>A, B</b>	Service line Fixing threads	SAE J518 <sup>2)</sup> DIN 13	450	O
<b>S</b>	Suction	DIN 3852	5	O <sup>3)</sup>
<b>T<sub>1</sub></b>	Tank	DIN 3852	3	O <sup>4)</sup>
<b>T<sub>2</sub></b>	Tank	DIN 3852	3	X <sup>4)</sup>
<b>R</b>	Air bleed	DIN 3852	3	X
<b>X<sub>1</sub>, X<sub>2</sub></b>	Control pressure (upstream the throttle)	DIN 3852	40	X
<b>G</b>	Boost pressure	DIN 3852	40	X
<b>P<sub>S</sub></b>	Pilot pressure inlet	DIN 3852	40	X
<b>M<sub>A</sub>, M<sub>B</sub></b>	Measuring pressure A, B	DIN 3852	450	X
<b>M<sub>H</sub></b>	Measuring high pressure	DIN 3852	450	X
<b>F<sub>a</sub></b>	Boost pressure inlet	DIN 3852	40	X <sup>6)</sup>
<b>F<sub>a1</sub></b>	Boost pressure, inlet (mountable filter)	DIN 3852	40	X
<b>F<sub>e</sub> <sup>5)</sup></b>	Boost pressure outlet	DIN 3852	40	X <sup>6)</sup>
<b>F<sub>S</sub></b>	Connection of filter to suction line (cold start)	DIN 3852	5	X
<b>Y<sub>1</sub>, Y<sub>2</sub></b>	Control signal (HD only)	DIN 3852	18	O
<b>Z</b>	Inching signal (DA4/8 only)	DIN 3852	70	O
<b>Y</b>	Pilot pressure port (DA7 only)	DIN 3852	40	O

1)瞬时的压力峰值的发生与不同的应用领域有关。

2)仅尺寸符合SAE J518

3)堵住,

4)根据安装位置确定T1,T2哪个连接

5)可选

6)压油过滤必须连接

O表示 必须连接(发货时, 用塑料堵堵上)

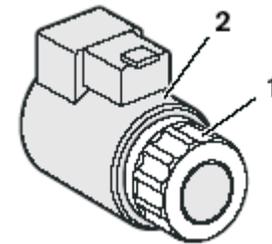
X 正常工作时, 堵上。

**Table 8: Tightening torques of the threaded holes and locking screws**

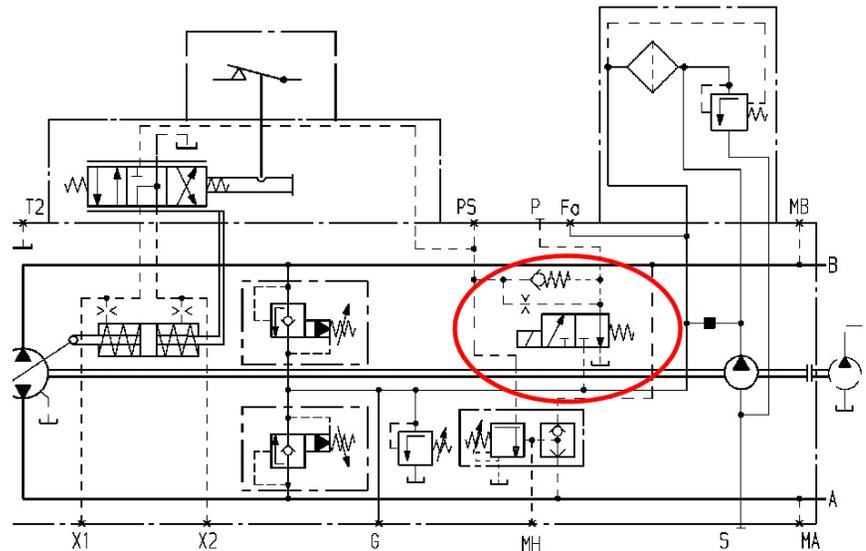
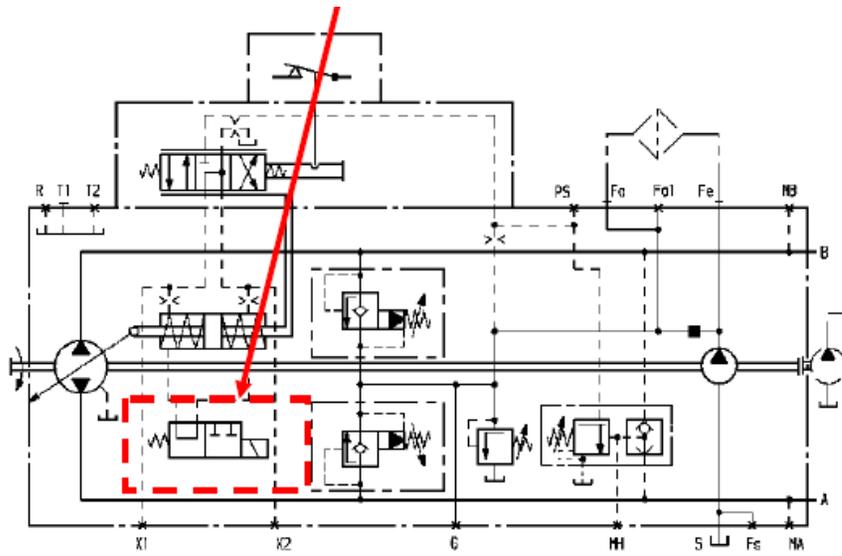
Threaded size of the ports		Max. permissible tightening torque of the threaded holes $M_{Gmax}$	Required tightening torque of the locking screws $M_y$	WAF hexagon socket
M10x1	DIN 3852	30 Nm	12 Nm	5 mm
M12x1.5	DIN 3852	50 Nm	25 Nm	6 mm
M14x1.5	DIN 3852	80 Nm	35 Nm	6 mm
M16x1.5	DIN 3852	100 Nm	50 Nm	8 mm
M18x1.5	DIN 3852	140 Nm	60 Nm	8 mm
M22x1.5	DIN 3852	210 Nm	80 Nm	10 mm
M26x1.5	DIN 3852	230 Nm	120 Nm	12 mm
M27x2	DIN 3852	330 Nm	135 Nm	12 mm
M33x2	DIN 3852	540 Nm	225 Nm	17 mm
M42x2	DIN 3852	720 Nm	360 Nm	22 mm
M48x2	DIN 3852	900 Nm	400 Nm	24 mm
5/16-24 UNF-2B	ISO 11926	10 Nm	7 Nm	1/8 in
3/8-24 UNF-2B	ISO 11926	20 Nm	7 Nm	5/32 in
7/16-20 UNF-2B	ISO 11926	40 Nm	15 Nm	3/16 in
9/16-18 UNF-2B	ISO 11926	80 Nm	25 Nm	1/4 in
3/4-16 UNF-2B	ISO 11926	160 Nm	62 Nm	5/16 in
7/8-14 UNF-2B	ISO 11926	240 Nm	127 Nm	3/8 in
1 1/16-12 UN-2B	ISO 11926	360 Nm	147 Nm	9/16 in
1 5/16-12 UN-2B	ISO 11926	540 Nm	198 Nm	5/8 in
1 5/8-12 UN-2B	ISO 11926	960 Nm	320 Nm	3/4 in
1 7/8-12 UN-2B	ISO 11926	1200 Nm	390 Nm	3/4 in

- 1, 逆时针旋转螺母1一圈, 就松开了紧固螺母
- 2, 转动阀体2到指定位置
- 3, 紧固螺母1, 用5+1Nm.

改变电磁铁插头的位置



紧急制动开关的工作原理图，左边的制动迅速，右边的能选择控制时间



**your questions are welcomed**