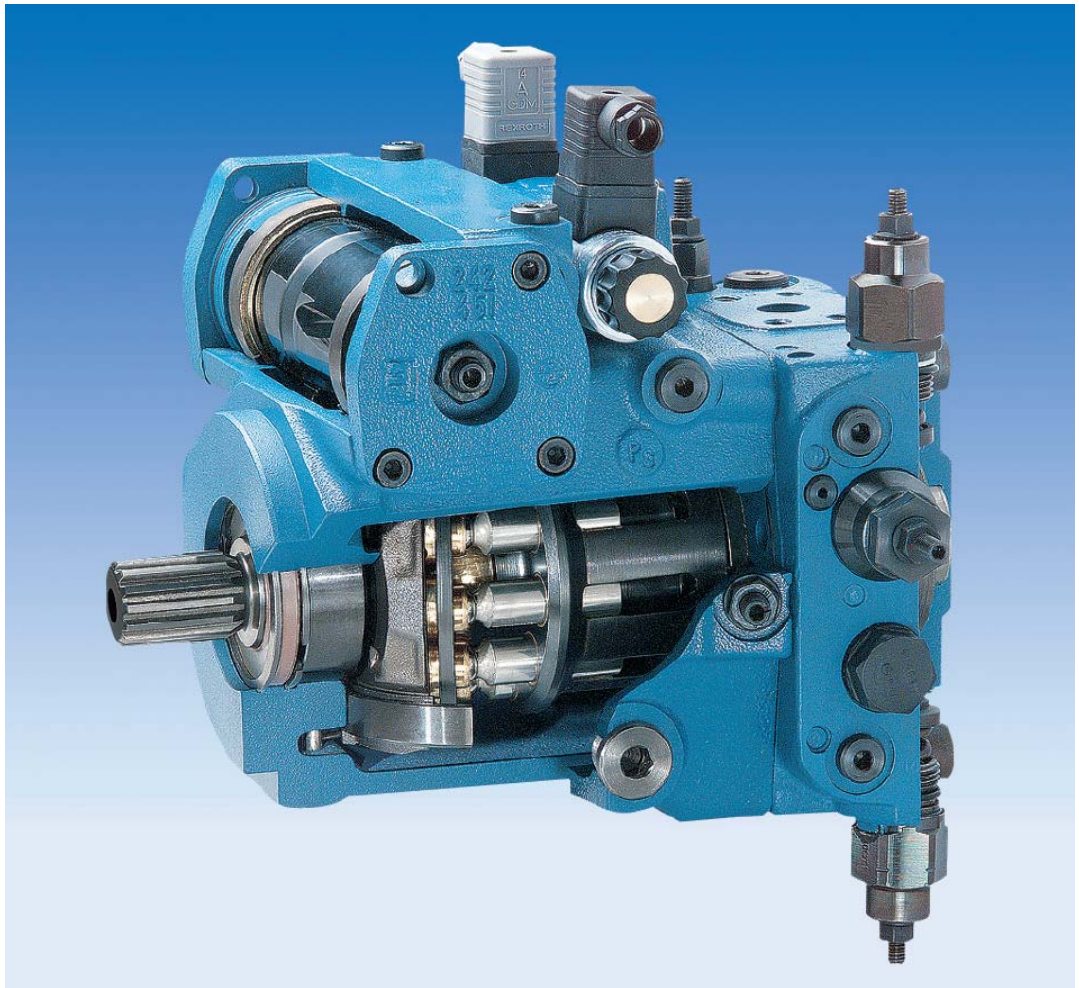
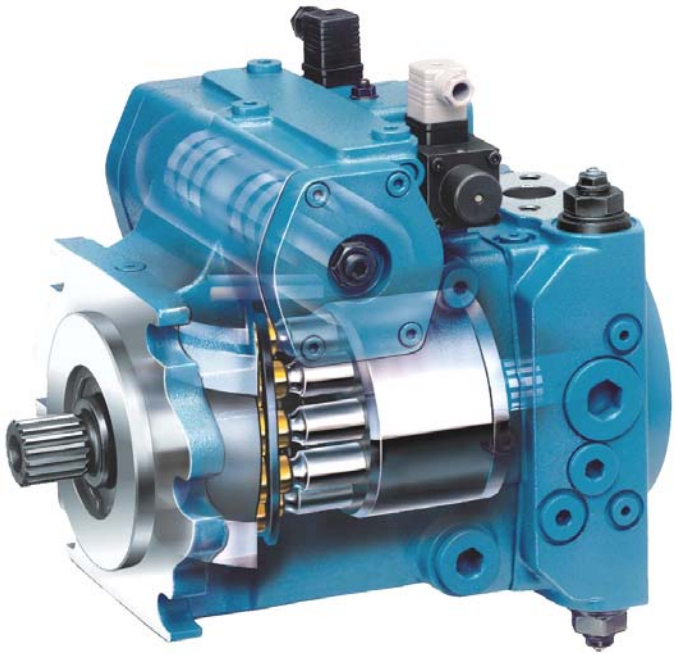
A4V(T)G Product Training



A4VG的主要特点和应用



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

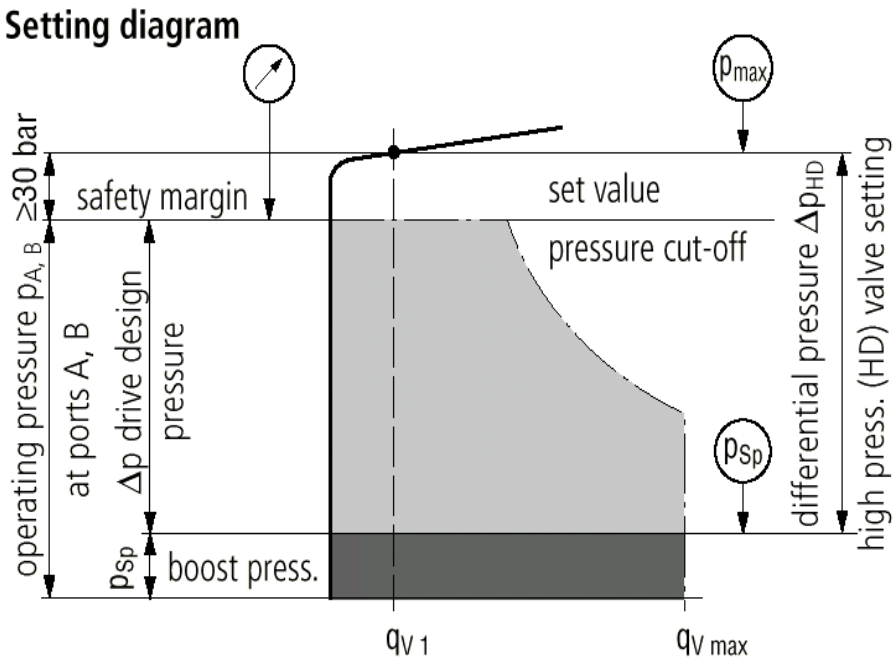
- 建筑机械
- 农业和林业机械
- 路面机械
- 叉车
- 起重机
- 钻机

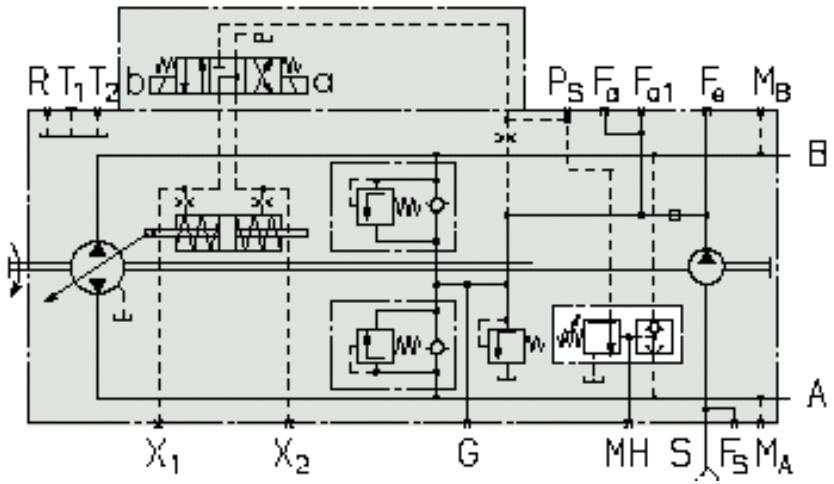
排量 **28 • 40 • 56 • 71 • 90 • 125 • 180 • 250**

压力范围 **400 / 450 bar**

A4VG油泵

Cut-off
压力切断阀的设定





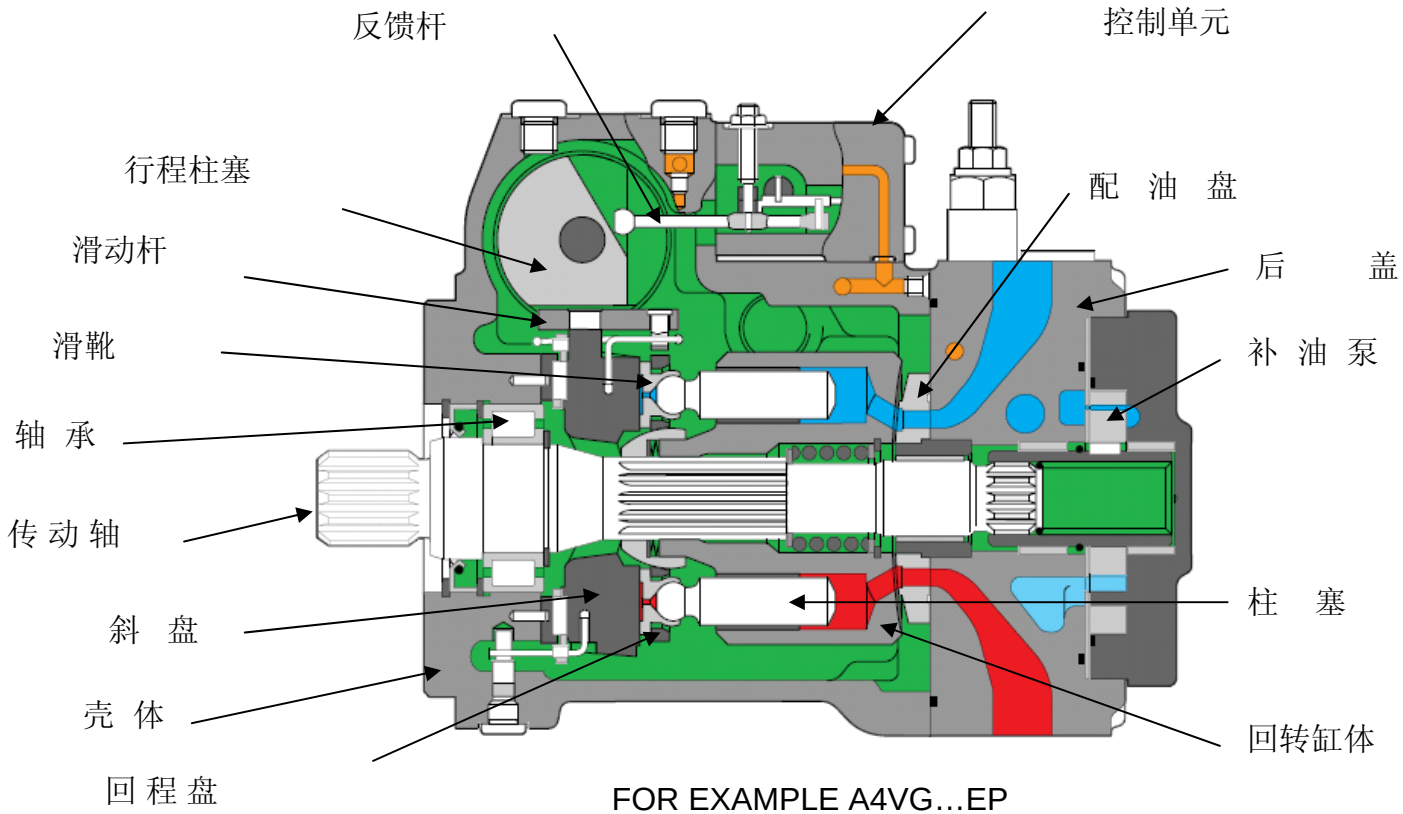
Note: valve setting is done at

n = 1000 min^{-1} and $V_{g\,max}$ ($q_{V\,1}$)

Example: boost pressure 20 bar; operating pressure 410 bar

operating pres. $p_{A,B}$	−	boost pres. p_{Sp}	+	safety margin	=	differential pres. Δp_{HD}
410 bar	−	20 bar	+	30 bar	=	**420 bar**

Components of A4V(T)G



FOR EXAMPLE A4VG…EP

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

ROTARY GROUP

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)

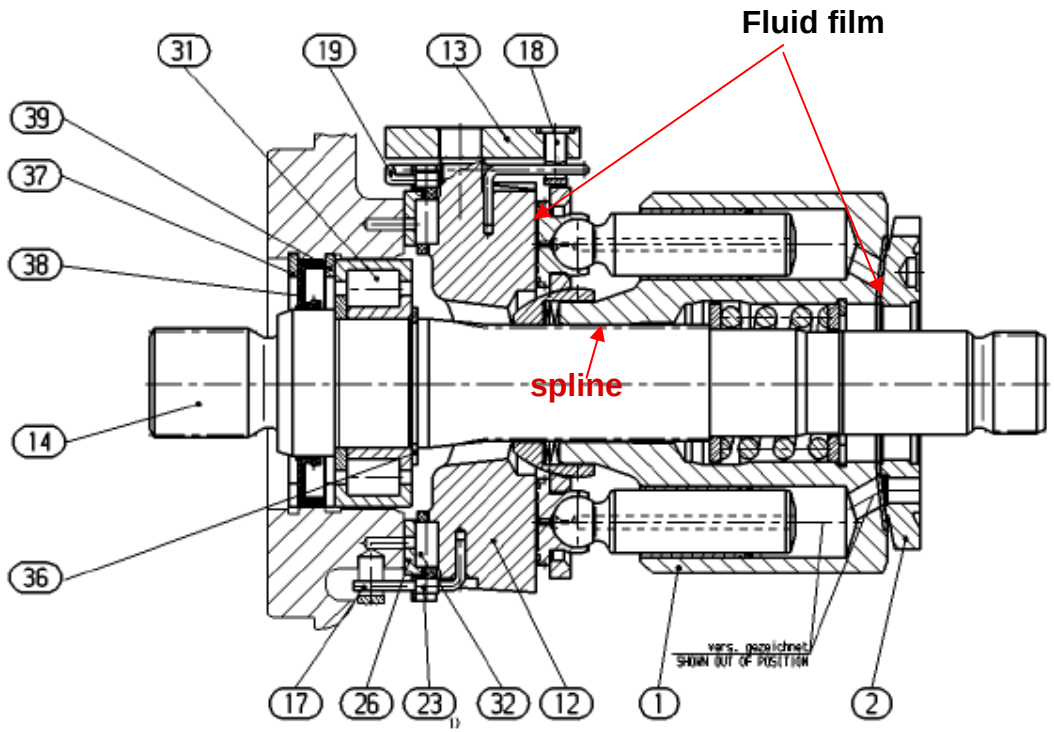
36, retaining ring

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.

ROTARY GROUP, Hydraulic Section

Rexroth
Bosch Group

Spare parts list

1, cylinder with bush

2, piston-slipper pad (key)

11, cup spring stack

20, shim

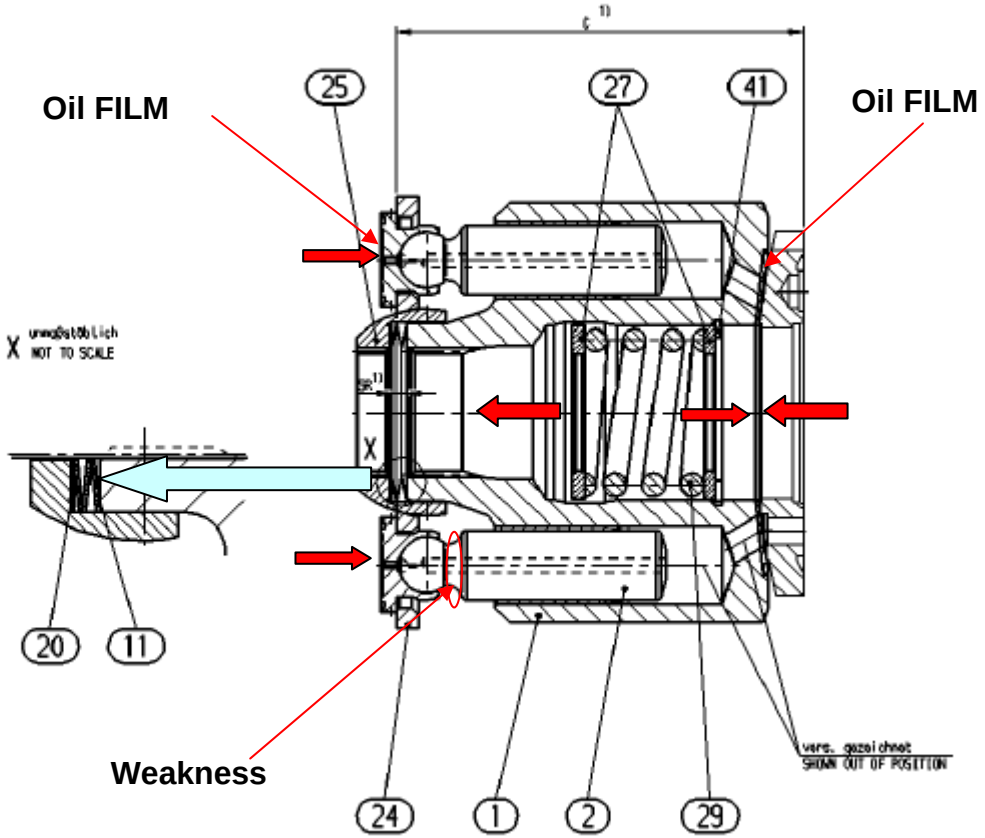
24, retaining plate (key) : to avoid shoes loose

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 diaphregm.

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

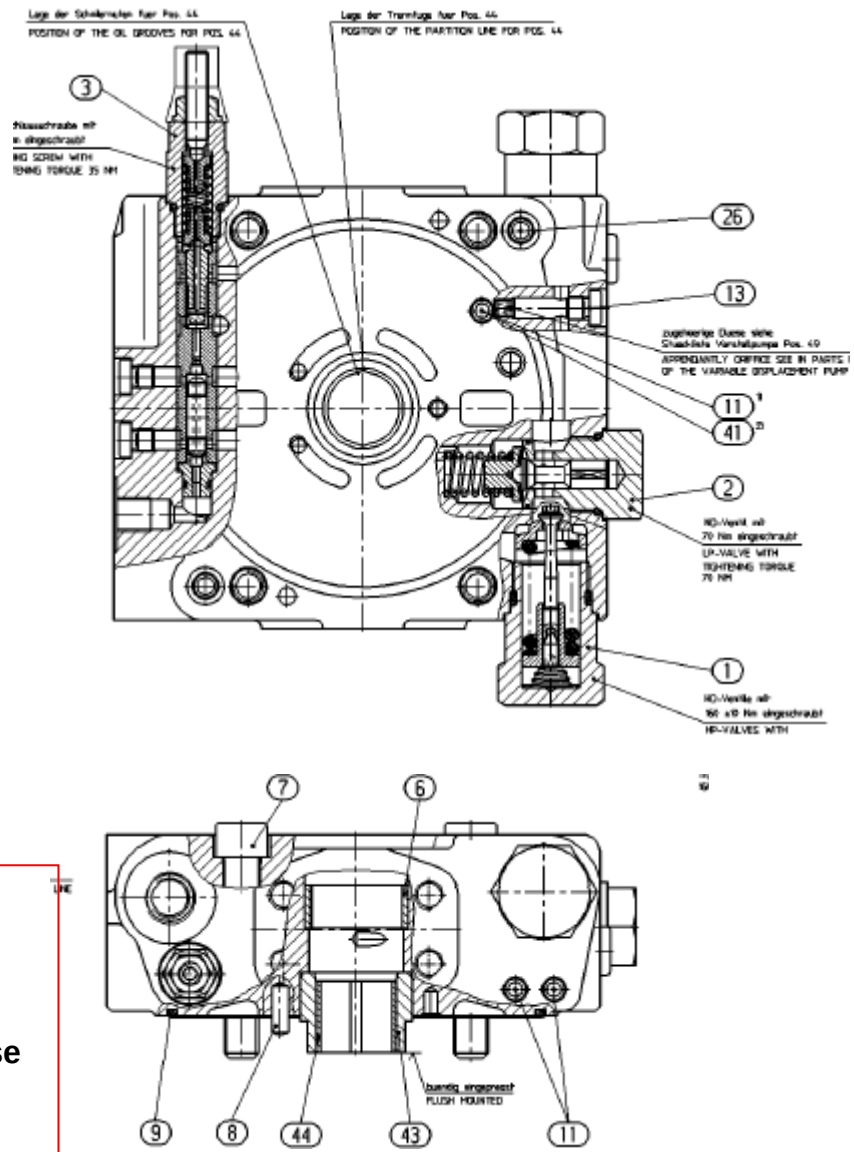
7, socket-head screw

8, cylinder pin

9, O ring

43, bush

44, bearing bushing



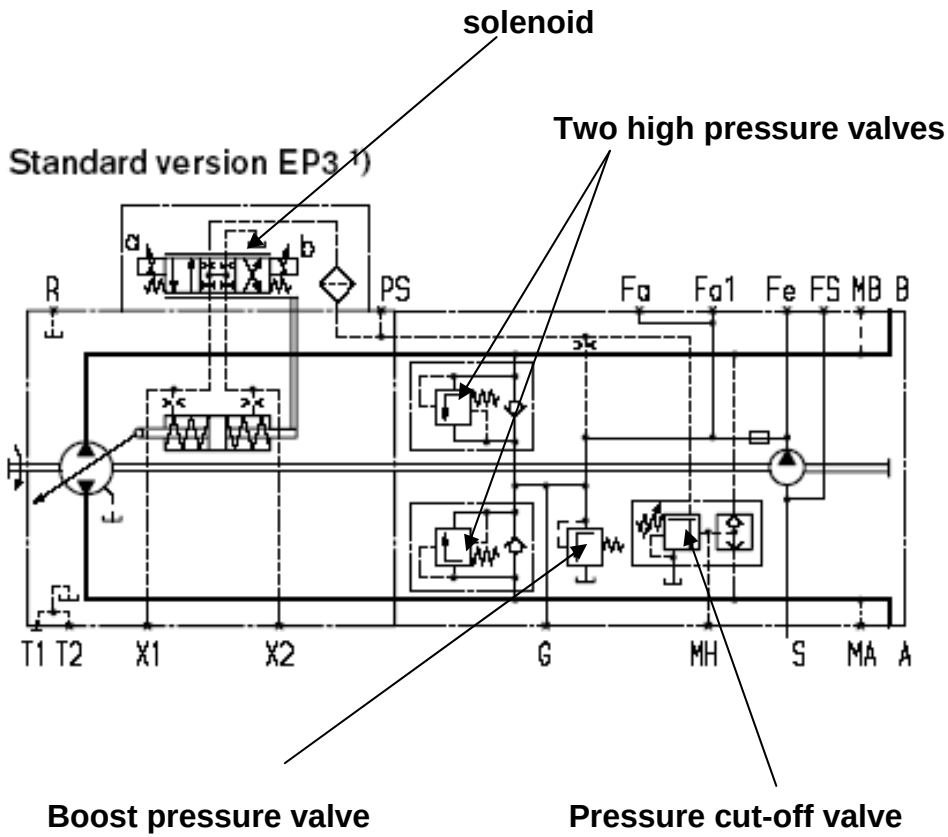
High pressure valve is to protect hydrostatic transmission from override.

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

Working principle

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

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

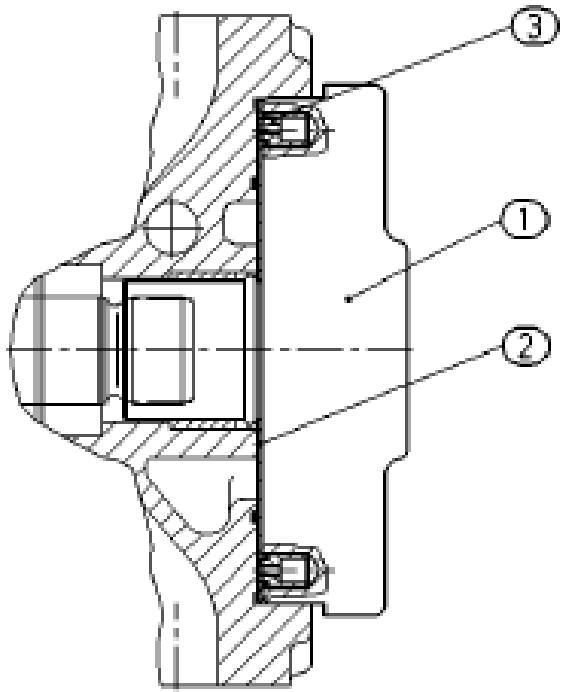


Internal gear pump assembly

1, internal gear pump

2, wear plate complete

3, locking plug



Internal gear pump

1, pump cover

3, bearing bushing

5, through-drive shaft

7, wheel set

8, shaft key

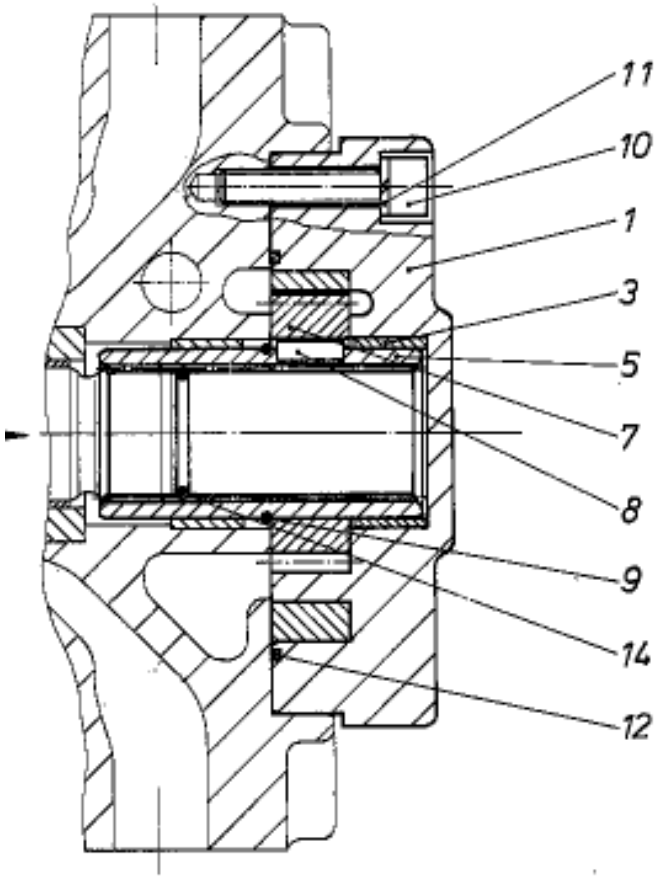
9, snap ring

10, socket-head screw

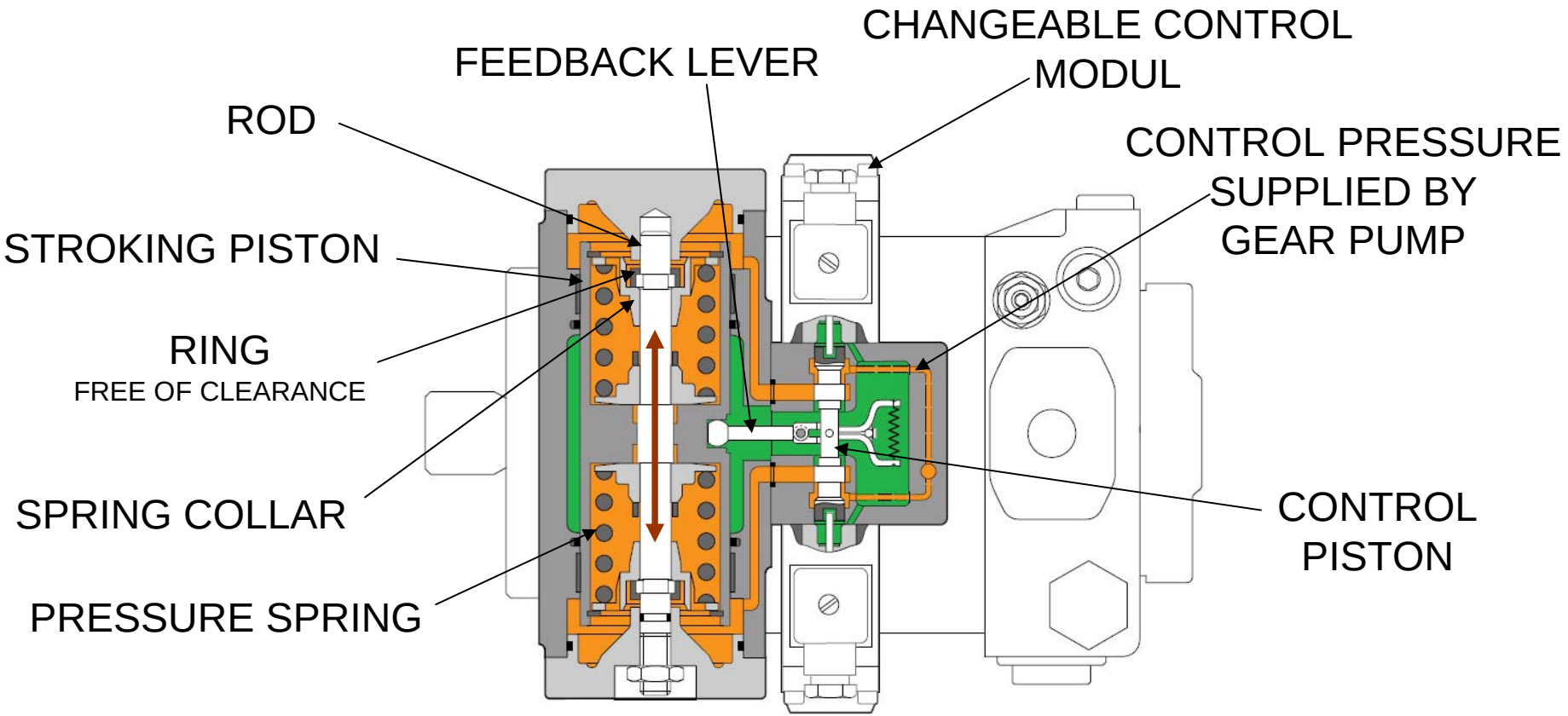
11, locking washer

12, kantseal ring

14, snap ring



COMPONENTS / FUNCTION OF A DISPLACEMENT CONTROL



FOR EXAMPLE A4VG…EP

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Alta presión	Baja presión	Presión de aspiratión	Presión de drenaje	Presión de pilotaje	Presion de taraje

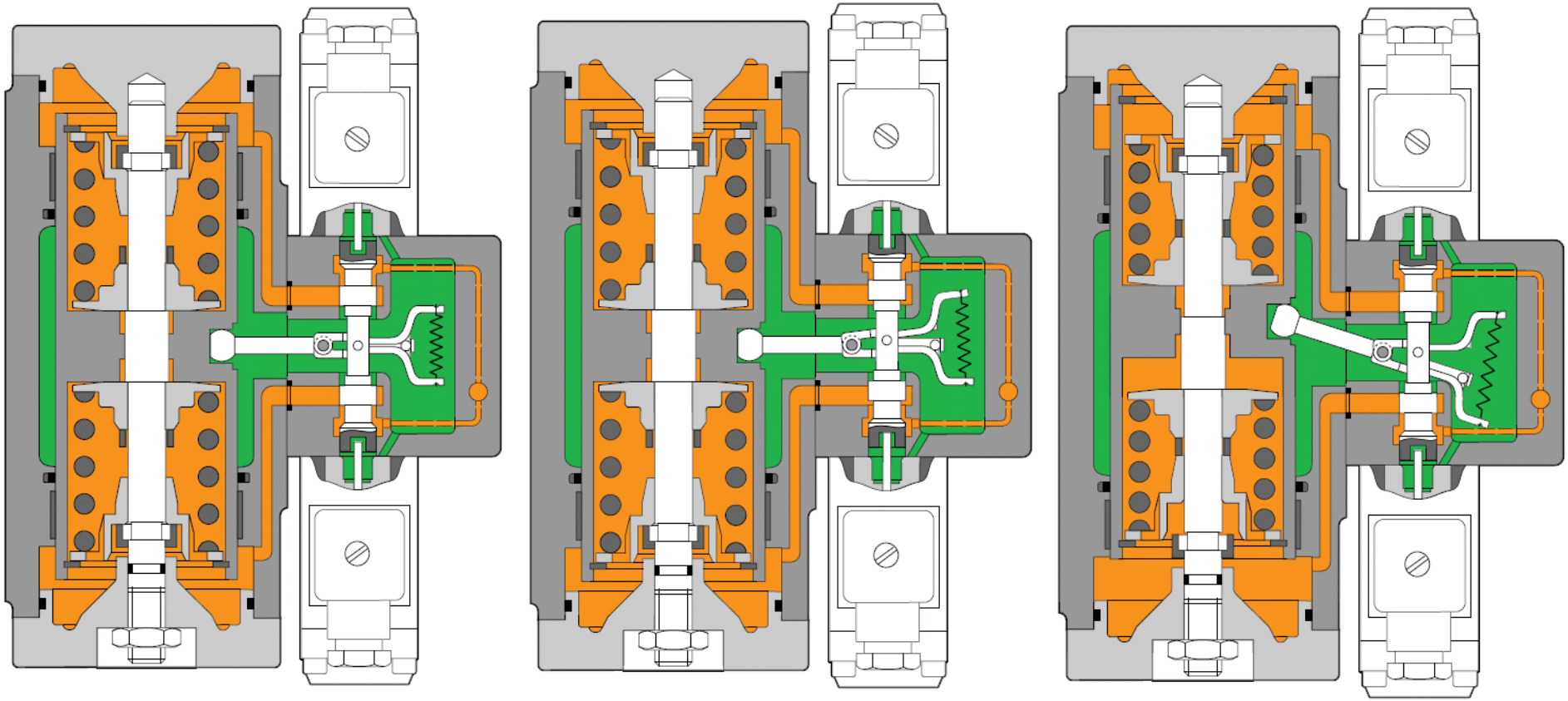
FUNCTION - FEEDBACK LEVER

Or example A4VG…EP

I

II

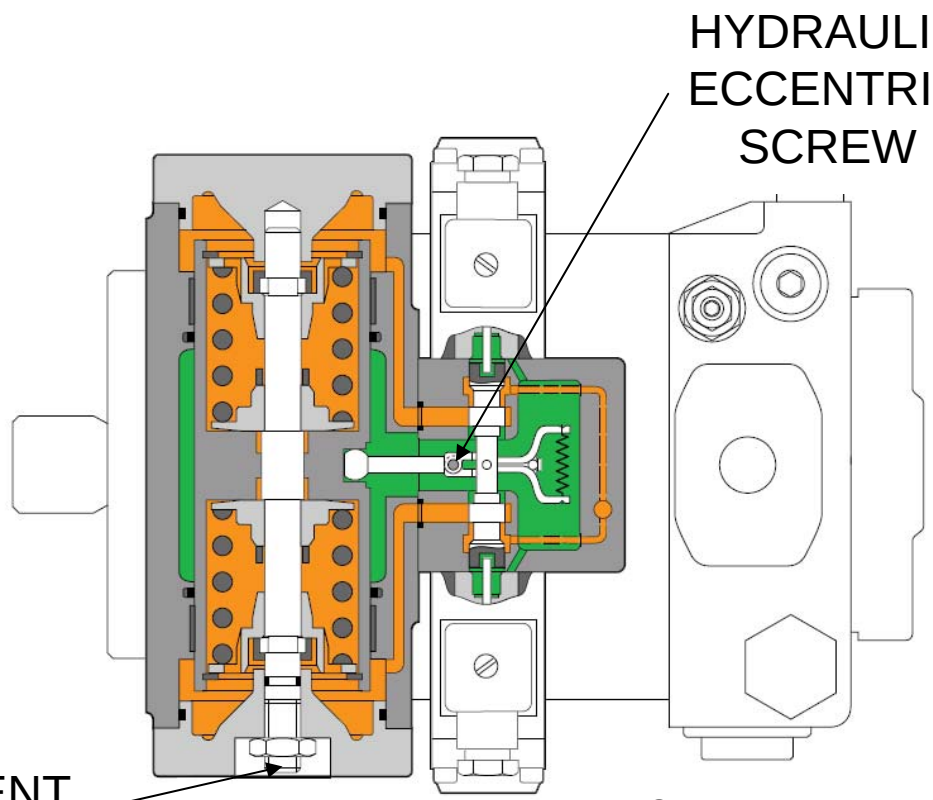
III



MECHANICAL CENTERING / NEUTRAL ADJUSTMENT

Rexroth
Bosch Group

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



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Alta presión	Baja presión	Presión de aspiratión	Presión de drenaje	Presión de pilotaje	Presion 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

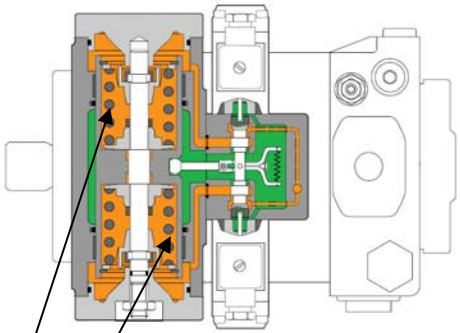
-Reduction of maching without crescent

-Spline drive for increase strength

-Less manufacturing cost

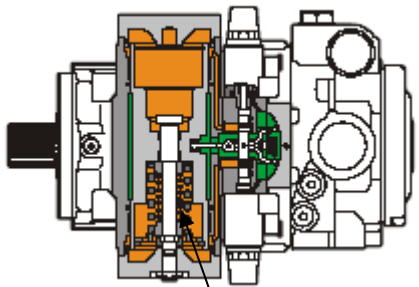
CONTROL MODULE

A4VG*/32



Two stroking spring package

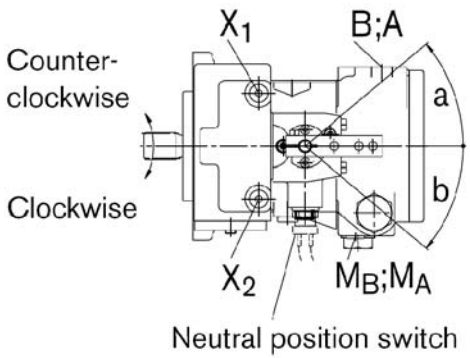
A4VTG*/33

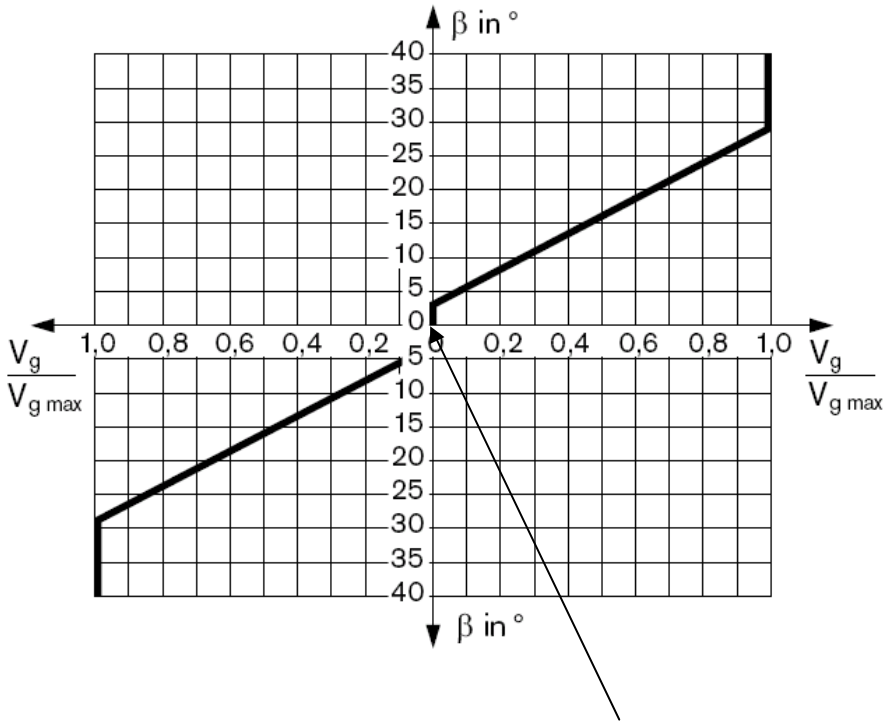


Single stroking spring package, less cost

CONTROL DEVICE – HW

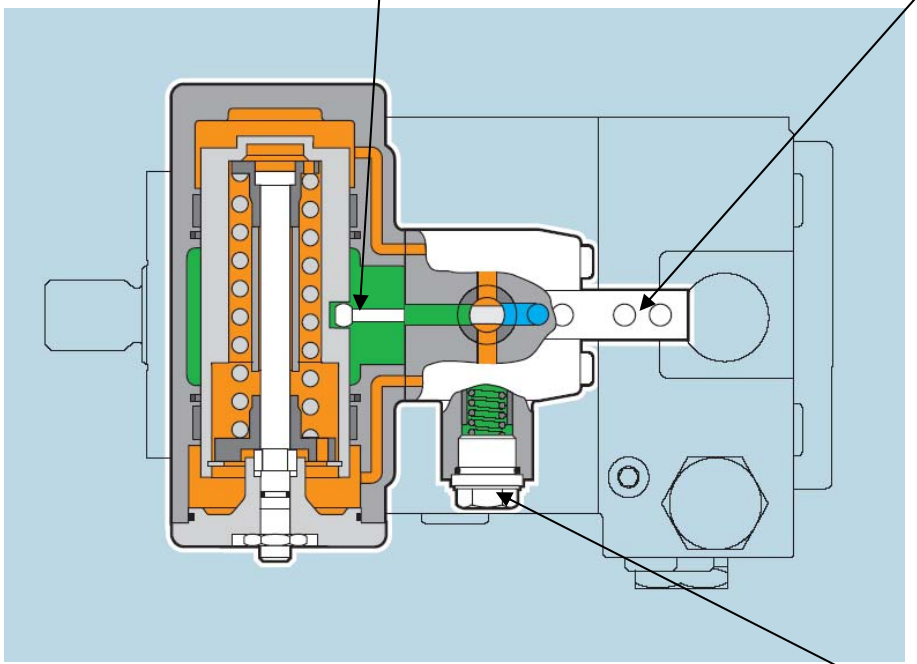
- The flow output changes proportional of the rotation of the control lever
- Spring centered to zero position
- Application with feedback lever





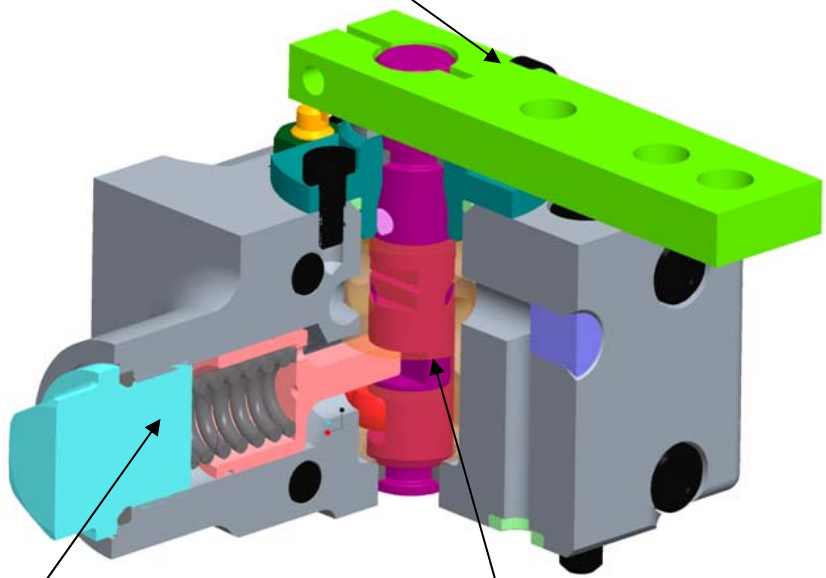
"After a certain swivel angle of the control lever the pump begins to swivel"

CONTROL DEVICE – HW



CONTROL LEVER

FEEDBACK LEVER



NEUTRAL POSITION SWITCH

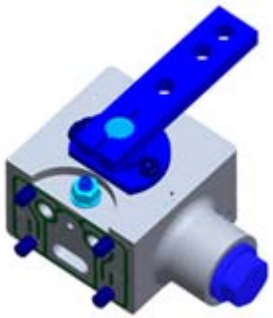
CONTROL SHAFT

Forces the control shaft into neutral position

CONTROL DEVICE – HW OVERVIEW

Rexroth
Bosch Group

Standard version with cylindrical or hexagonal control shaft



Cylindrical control shaft, without zero position switch

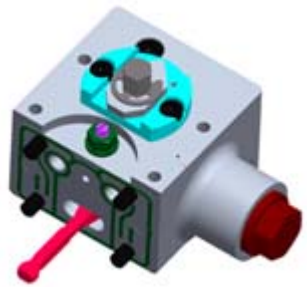
Material description:
e.g.. STEUERGERAET HW, ZYL. OHNE SCH.

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.



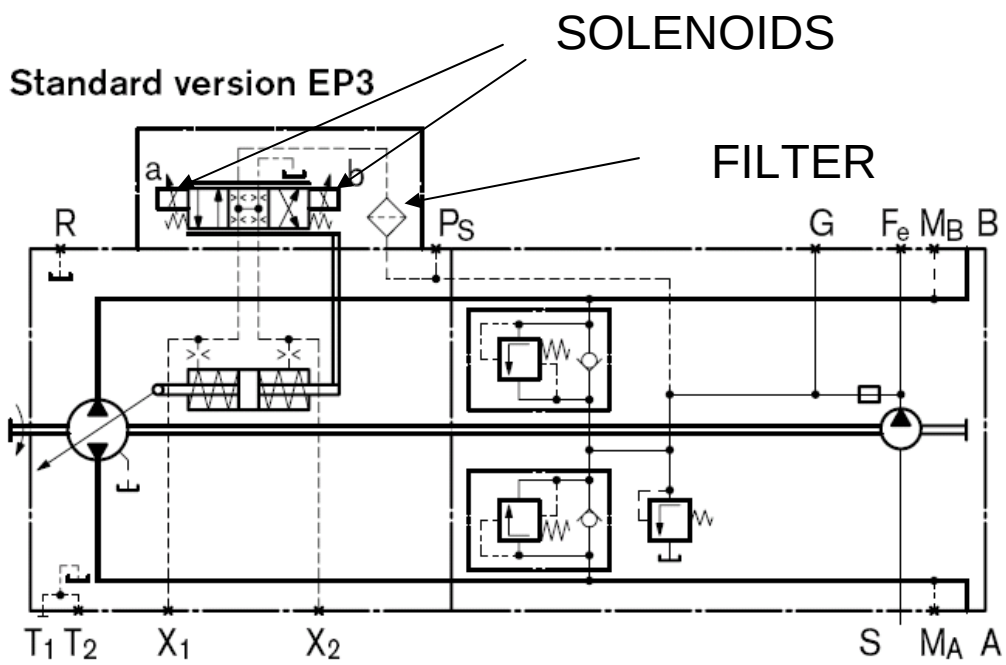
Hexagonal control shaft, without zero position switch

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

CONTROL DEVICE – EP

- 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.

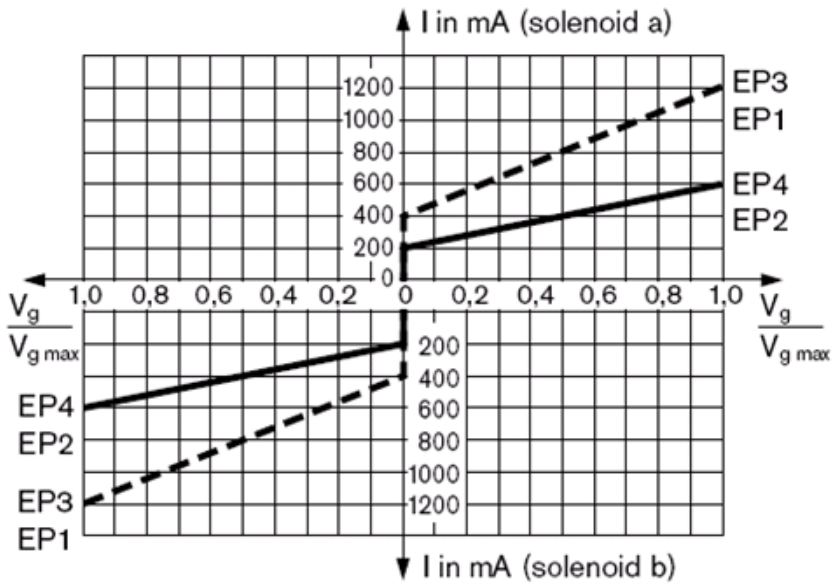
- Feedback lever allows to maintain a certain displacement independent to operating pressure, timing and input speed



CONTROL DEVICE – EP

Solenoid technical data	EP3/EP1	EP4/EP2
Voltage	12 V DC (±20 %)	24 V DC (±20 %)
Control current		
Start of control at $V_{g\,0}$	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 Ω	22.7 Ω
Dither frequency	100 Hz	100 Hz
Actuated time	100 %	100 %
Type of protection	see range of connectors on page 60	

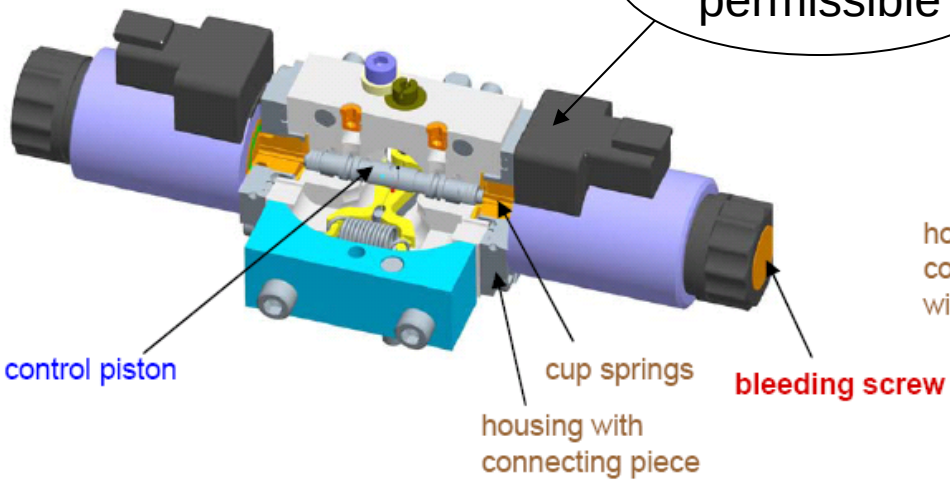
EP3/4: with supply filtration (standard)
EP1/2: without supply filtration (not permissible for new projects!)



CONTROL DEVICE – EP COMPARISON

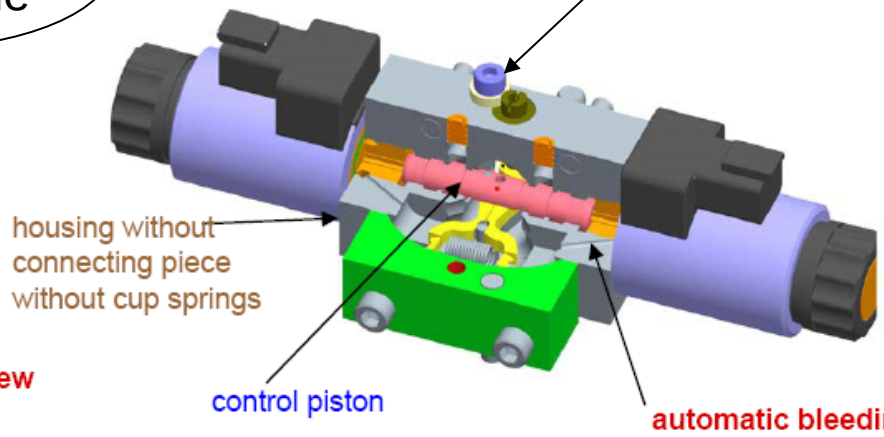
Previous: EP1, EP2

no longer permissible

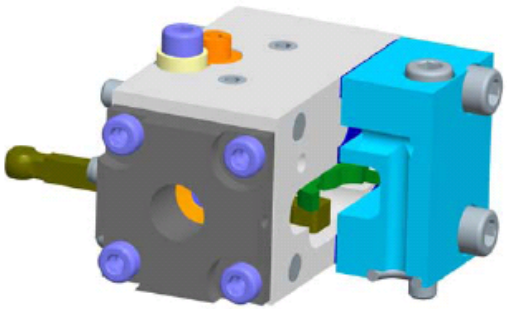


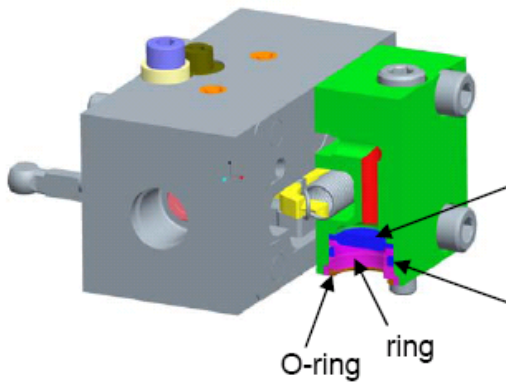
New: EP3, EP4

standard



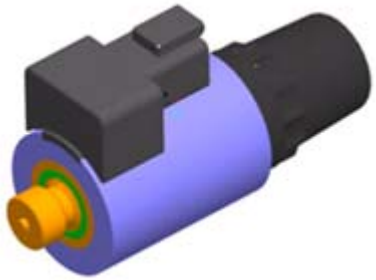
"reduced commissioning expenditure"



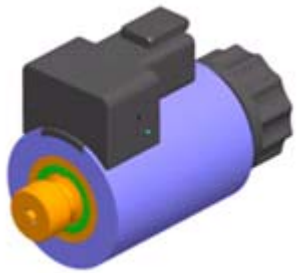


"increased finctional safety"

CONTROL DEVICE – EP DIFFERENT TYPES

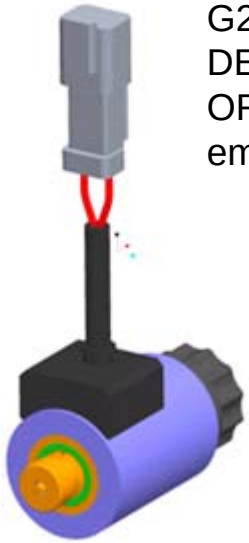


G2DS – molded connector DEUTSCH-SWITCH, 12V OR 24V, with emergency activation

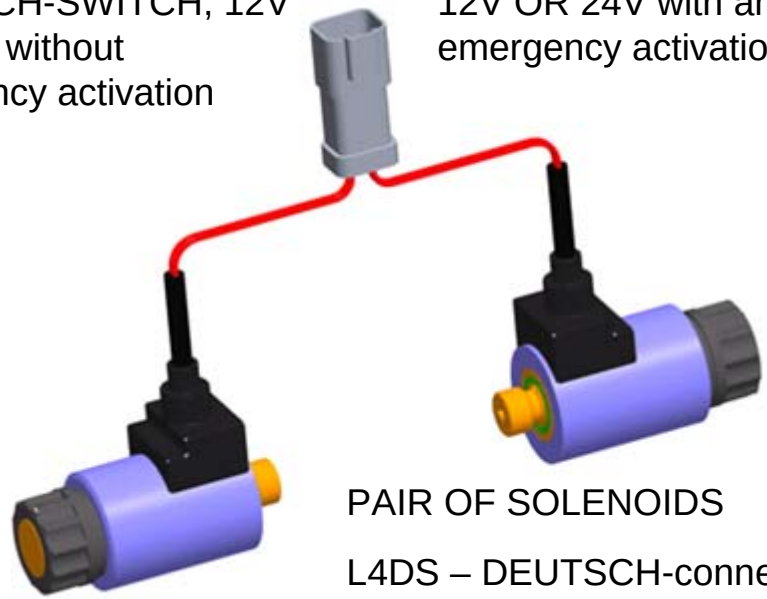


G2DS – molded connector DEUTSCH-SWITCH, 12V OR 24V without emergency activation

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

A4VG 注意事项

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。

A4VG 注意事项

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

A4VG 的附件

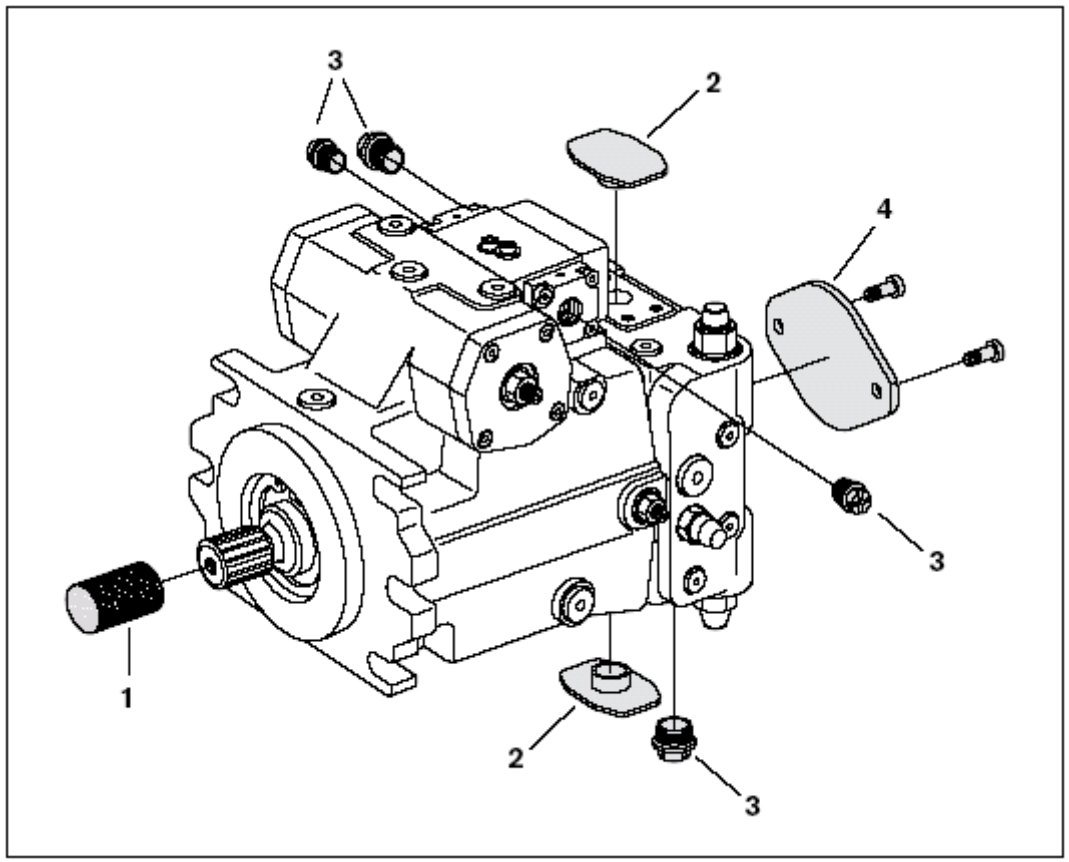
发货时带的附件包括：

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



A4VG——过滤器

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

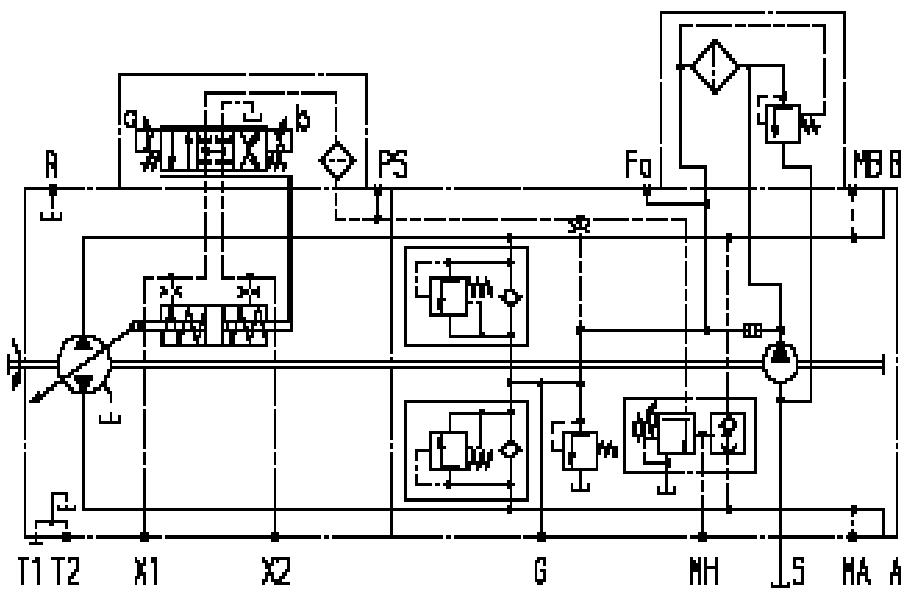
4，最大压力 100bar

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△P=14bar，冷启动阀开启



A4VG——开关电磁铁控制

当电磁铁通电时，泵的斜盘摆角在最大，

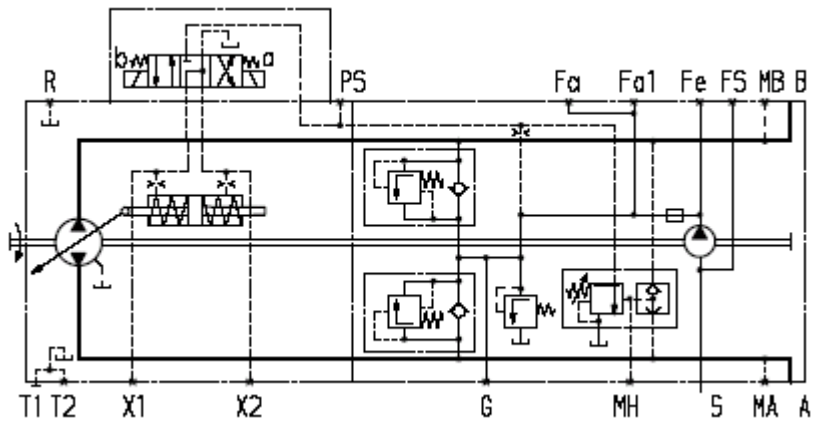
当电磁铁失电时，泵的斜盘摆角在最小。

每侧的电磁铁对应泵的不同工作方向。

EZ1——12V

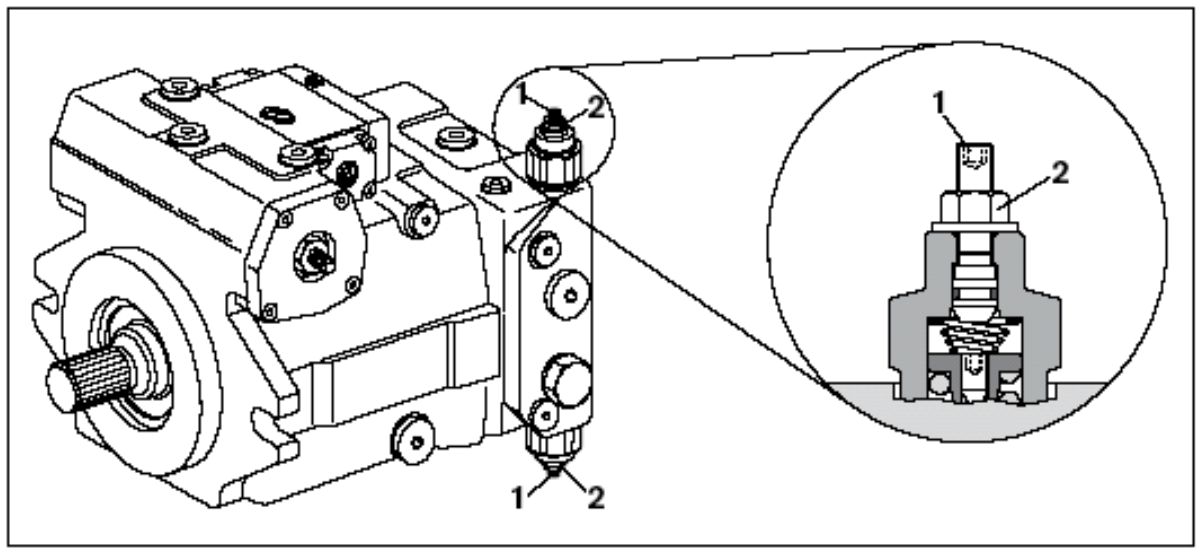
EZ2——24V

标准的开关电磁阀上不带手动弹簧复位功能



A4VG的高压旁通功能

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

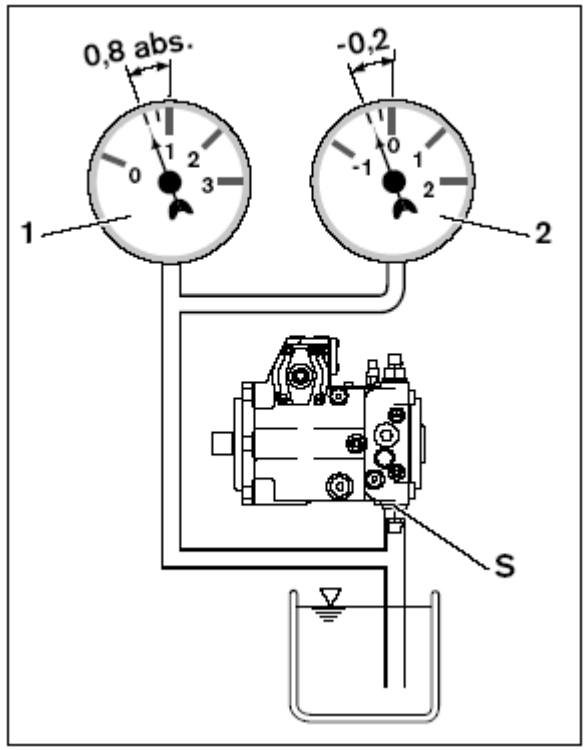


A4VG的吸油要求

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



A4VG的油液清洁度

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

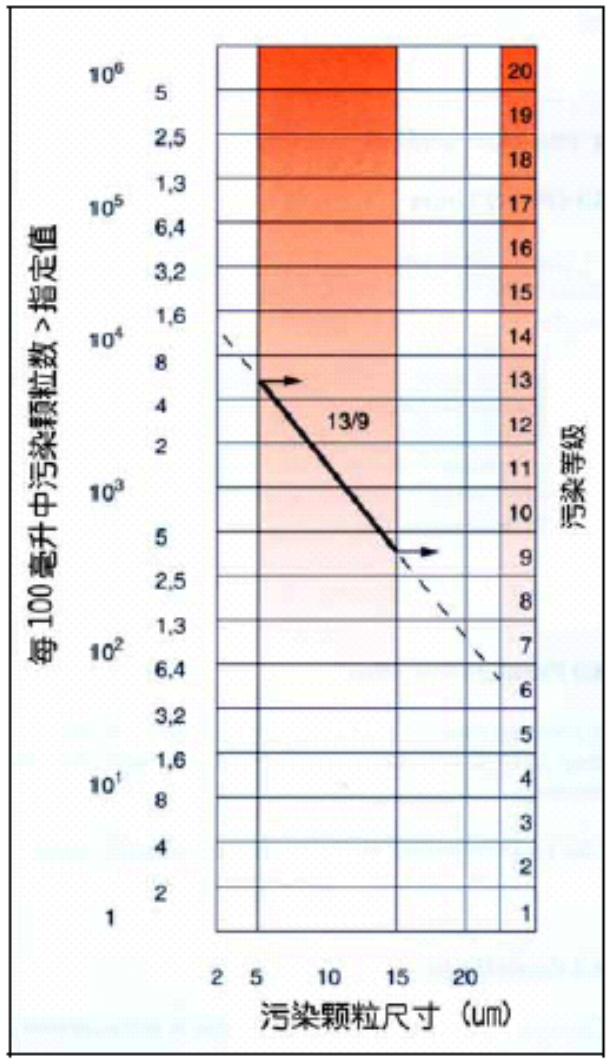
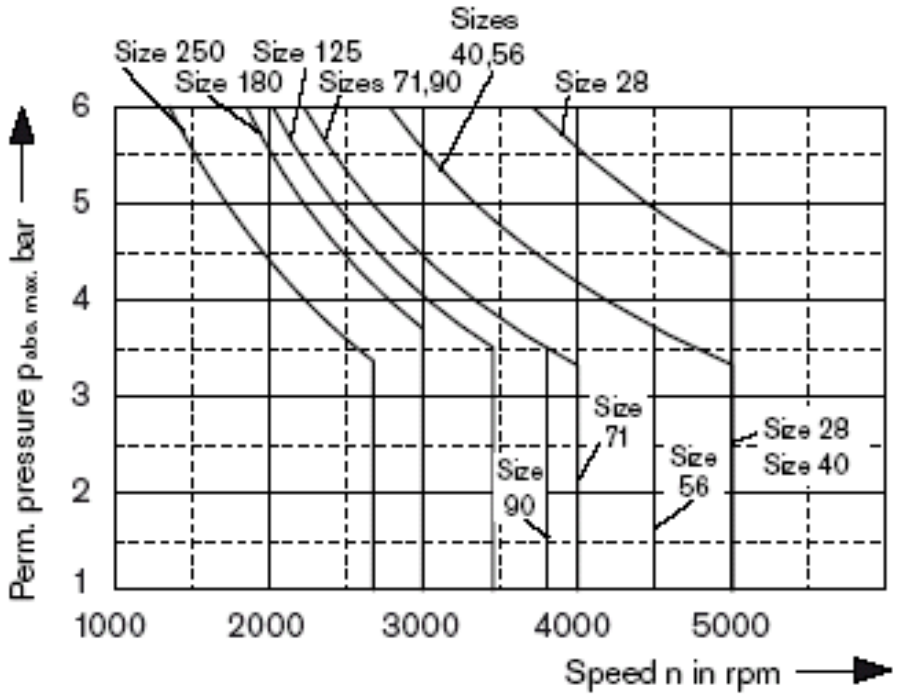


图 14.4 按 ISO 4406 标准的污染等级

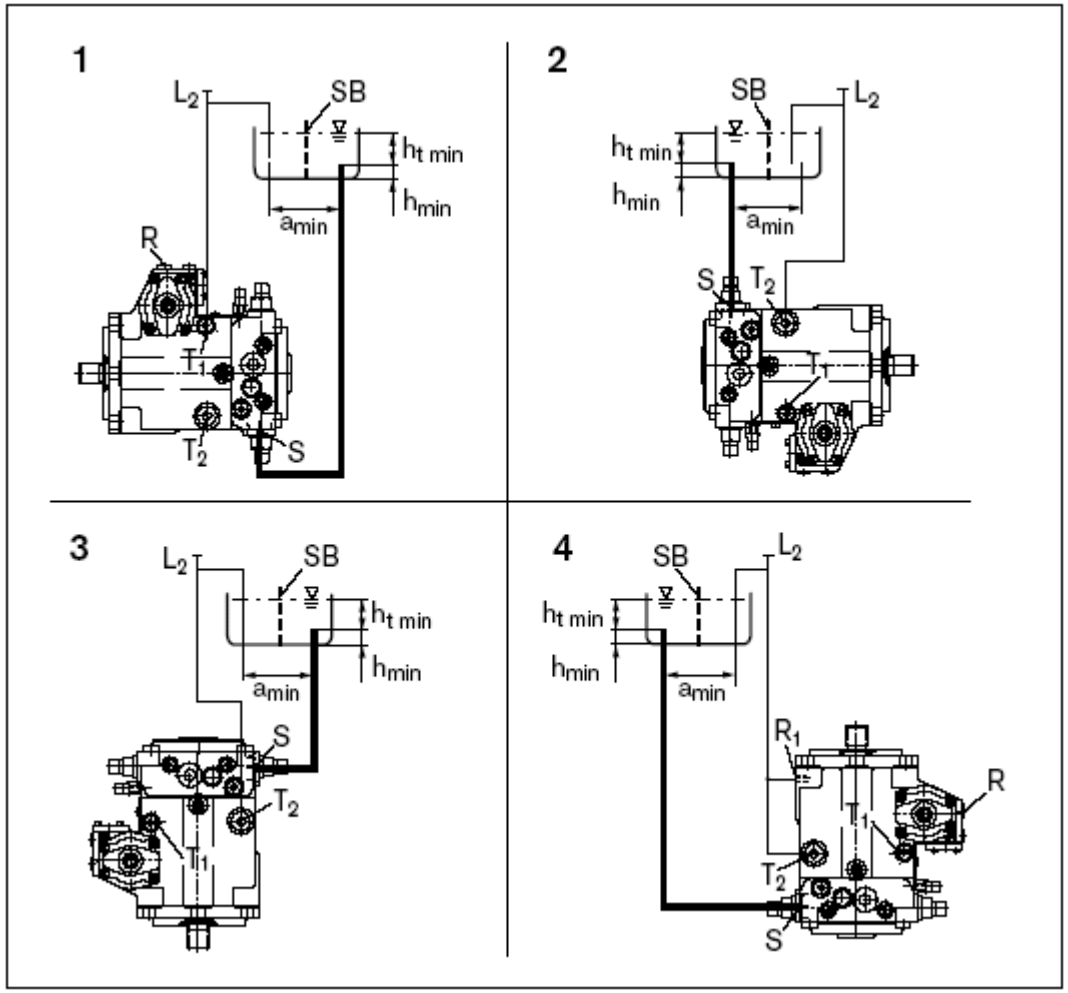
A4VG泄油与转速的关系

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.



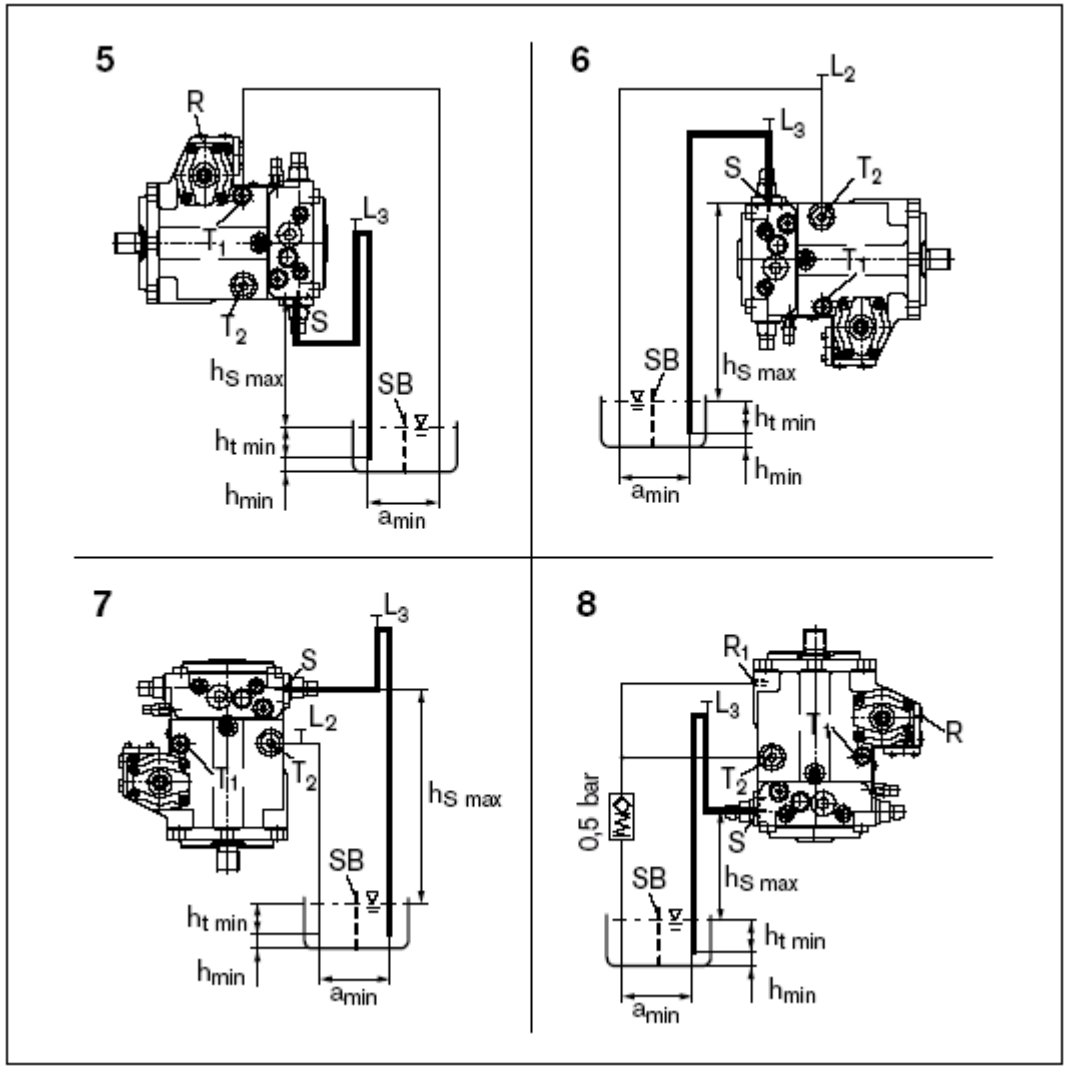
A4VG的安装方式

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。

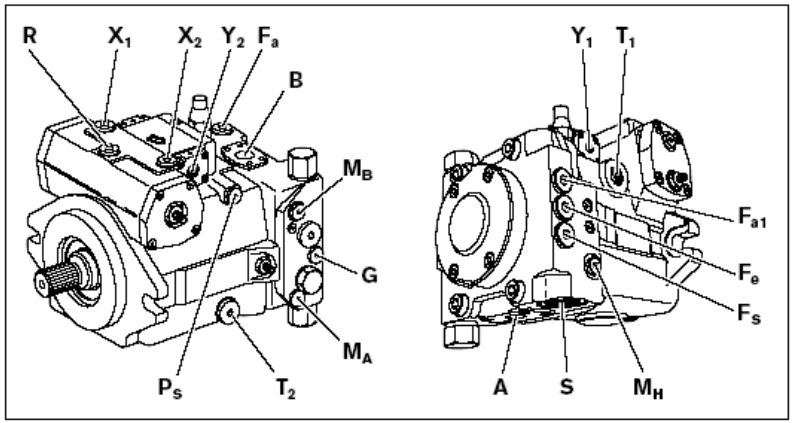


A4VG的安装方式

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
hsmax=800mm



A4VG的油口



Designation	Port for	Standard	Peak pressure (bar) [1]	State
A, B	Service line Fixing threads	SAE J518 [2] DIN 13	450	O
S	Suction	DIN 3852	5	O [3]
T_1	Tank	DIN 3852	3	O [4]
T_2	Tank	DIN 3852	3	X [4]
R	Air bleed	DIN 3852	3	X
X_1, X_2	Control pressure (upstream the throttle)	DIN 3852	40	X
G	Boost pressure	DIN 3852	40	X
P_S	Pilot pressure inlet	DIN 3852	40	X
M_A, M_B	Measuring pressure A, B	DIN 3852	450	X
M_H	Measuring high pressure	DIN 3852	450	X
F_a	Boost pressure inlet	DIN 3852	40	X [6]
F_{a1}	Boost pressure, inlet (mountable filter)	DIN 3852	40	X
F_e [5]	Boost pressure outlet	DIN 3852	40	X [6]
F_S	Connection of filter to suction line (cold start)	DIN 3852	5	X
Y_1, Y_2	Control signal (HD only)	DIN 3852	18	O
Z	Inching signal (DA4/8 only)	DIN 3852	70	O
Y	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。

A4VG——拧紧力矩

Rexroth
Bosch Group

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_V	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

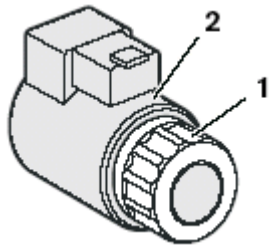
A4VG——电磁铁的调整

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



A4VG——制动

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