



**M****VING AHEAD**

力士乐工程机械控制阀-M4/M7  
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June 23<sup>th</sup>,2011

## 内容

- 力士乐工程机械控制阀概况
- 负载敏感和流量共享原理
- 负载敏感阀系列 - M4结构与选型
- 流量共享阀系列 - M7结构与选型
- 辅助信息与典型应用

# 力士乐工程机械控制阀-M4/M7

## 力士乐工程机械控制阀概况

### Control blocks



Open Center OC  
SM12, MO, M1, M8, M9

### Power brake valves



Modular design  
LT 05, 06, 07, 08, 09,31

### Steering units



LAGC

### Pilot control devices



Foot pedal  
2TH6R, 4TH6NR

### Valve modules



Stabilizing module  
RSM



Load Sensing LS  
M4, SP, SB, EHR



Compact design  
LT 13, 17



LAGU



Arm-rest installation  
4TH5/6, TH87



Flow divider  
MH2, RTM



Flow sharing LUDV  
SX, M6, M7



Trailer brake



LAGZ

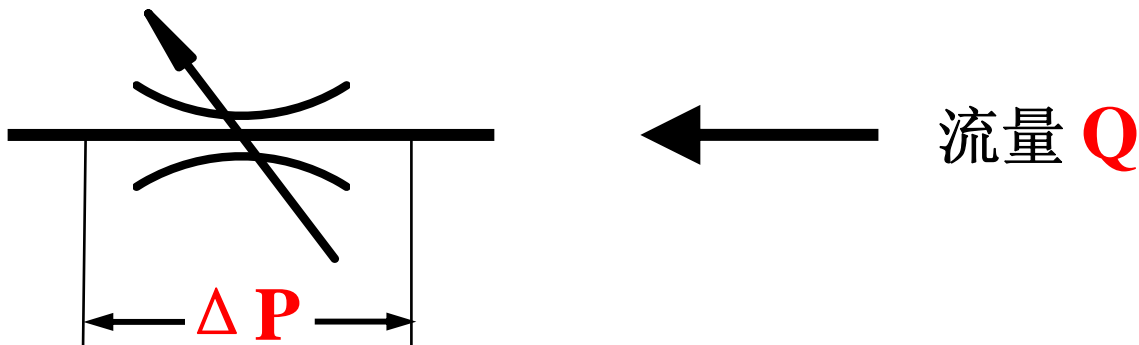


Loader joystick  
THF5/6



Safety valves  
MHB, MHRB, FD

# 节流小孔流量方程



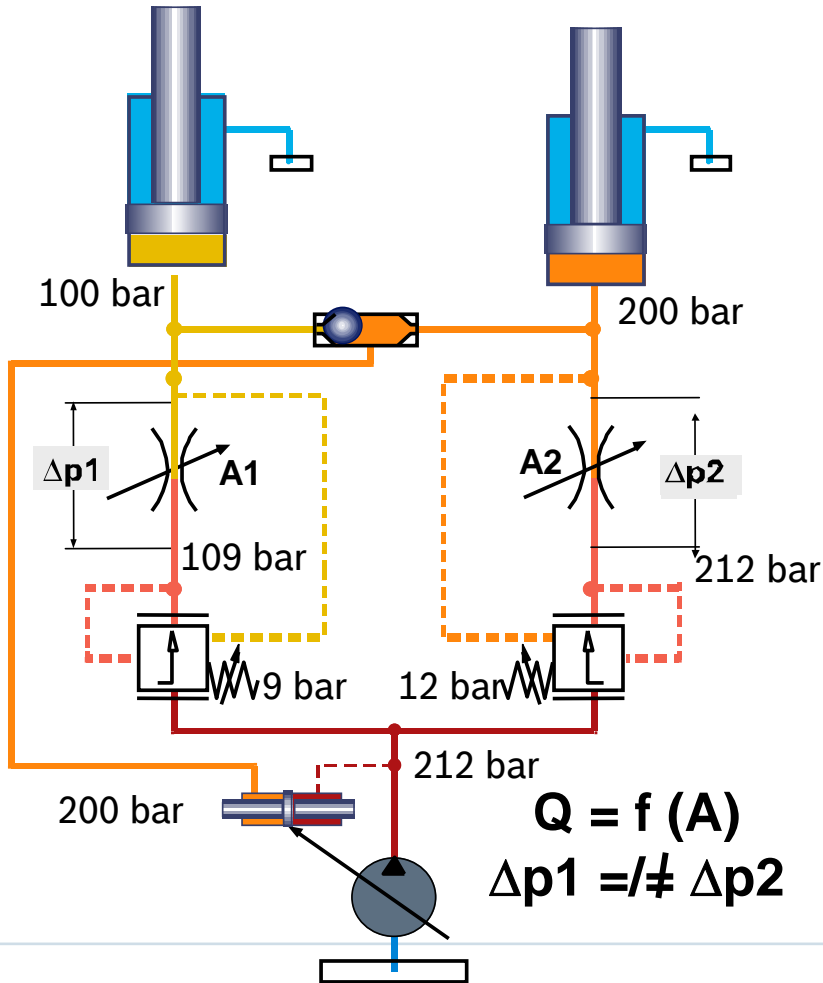
$$Q = \alpha * A * \sqrt{\frac{2}{\zeta} \Delta P}$$

$$K = \alpha * \sqrt{\frac{2}{\zeta}}$$

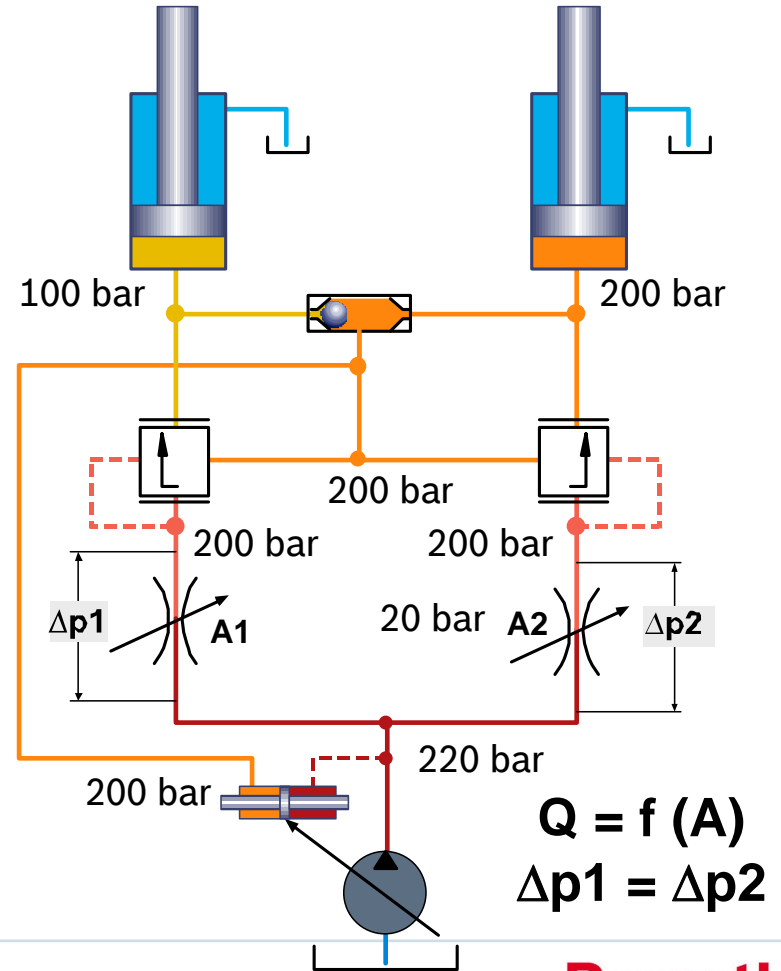
$Q = K * A \sqrt{\Delta P}$        $\Delta P = \text{恒定值}$        $Q = f(A)$

负荷传感控制原理

## 负载敏感

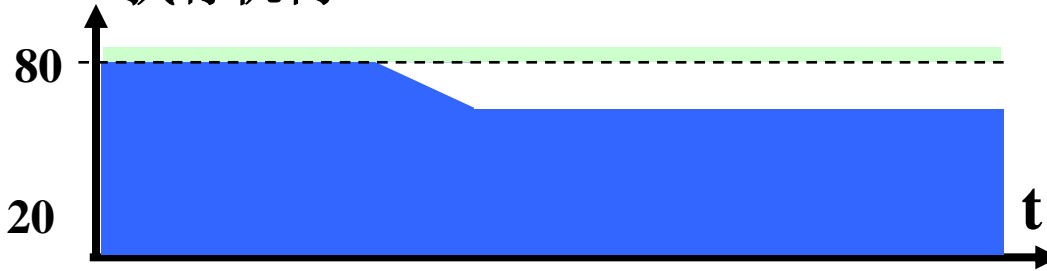


## 流量共享



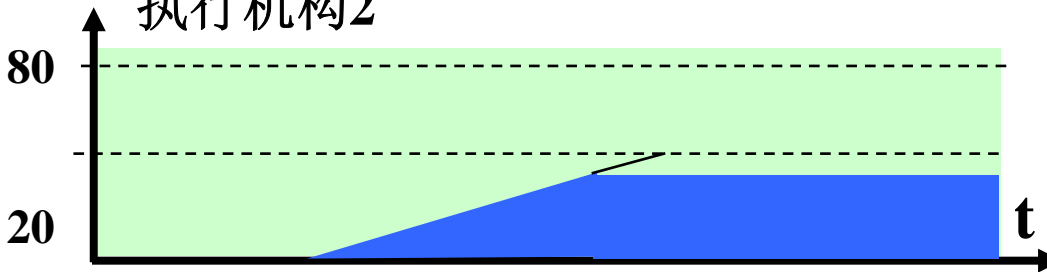
# 力士乐工程机械控制阀-M4/M7

## 执行机构1



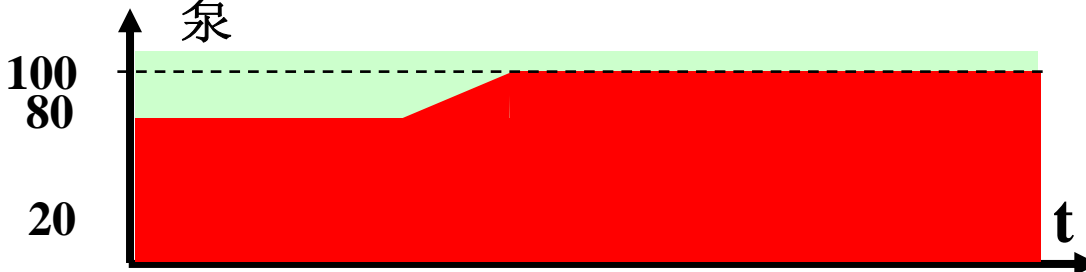
比率: 0.77

## 执行机构2



比率: 0.77

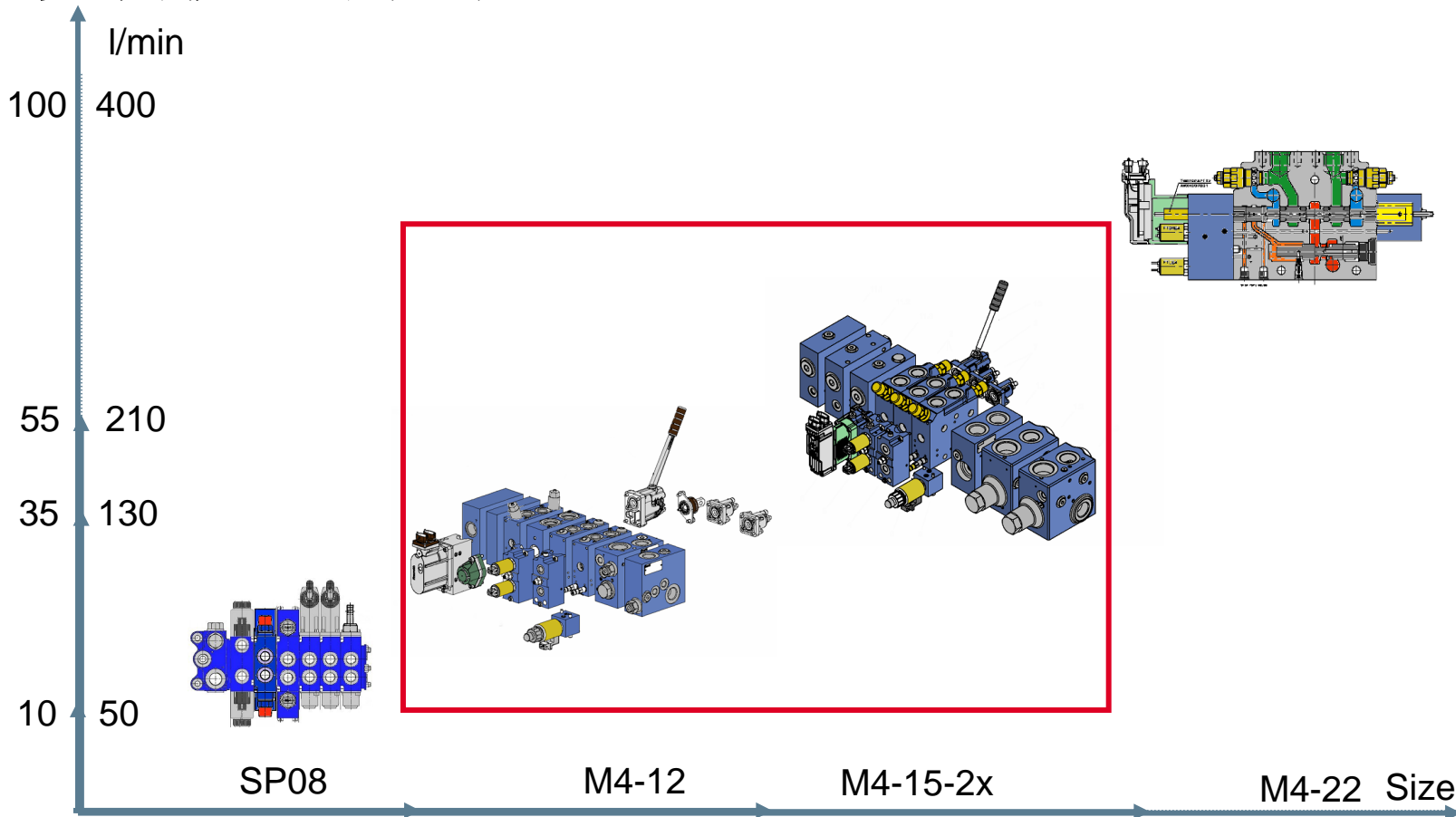
## 泵



$100 / (80 + 50) = 0.77$

负载敏感阀在泵流量不足的情况下，大负载会停止运动，小负载会快速运动。  
流量共享阀在此情况下，各执行机构会同比降速，不会有执行机构停止运动。

## 负载敏感阀系列



备注：除此之外还有应用于叉车和拖拉机的SB和HER阀。

## M4 零部件

### End Cover

(P,T, on request)

standard

int. pilot oil  
supply

ext. pilot oil  
supply

### Pilot Cover (A)

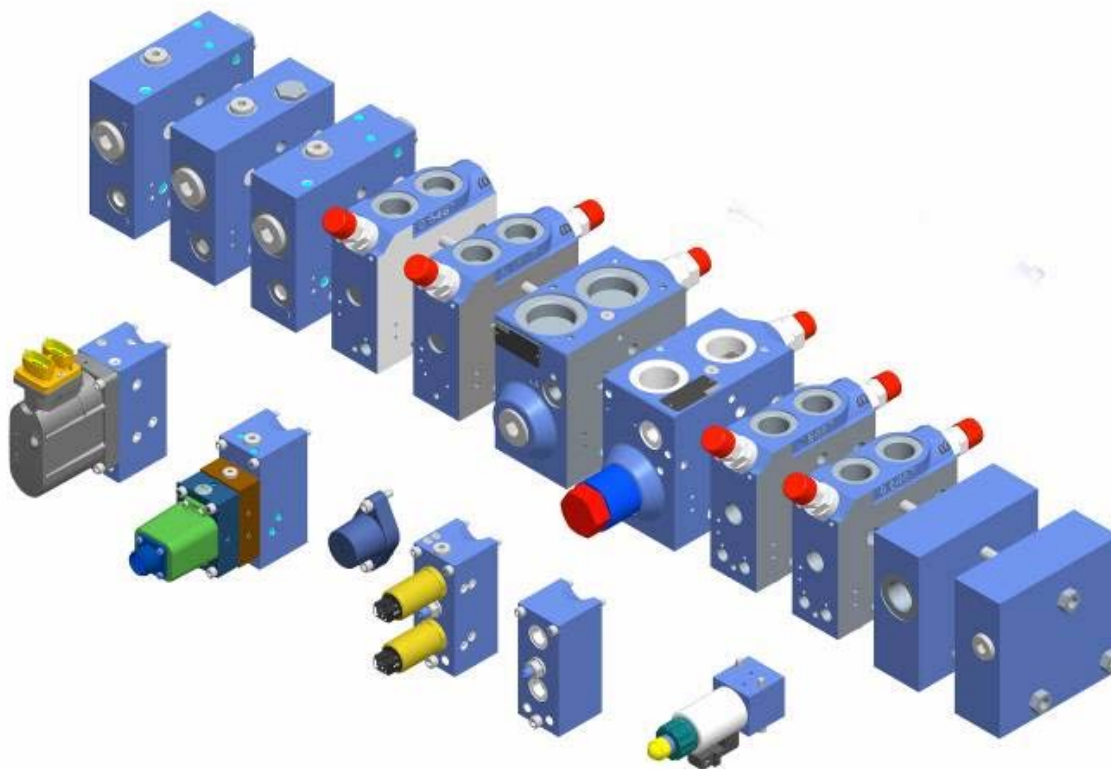
servohydraulic

electrohydraulic  
w/ integr. electr.

mechanic

electrohydraulic

hydraulic



LS-Pressure Relief Valves  
Fixed / el.prop

### Inlet Elements

Closed Center

Open Center

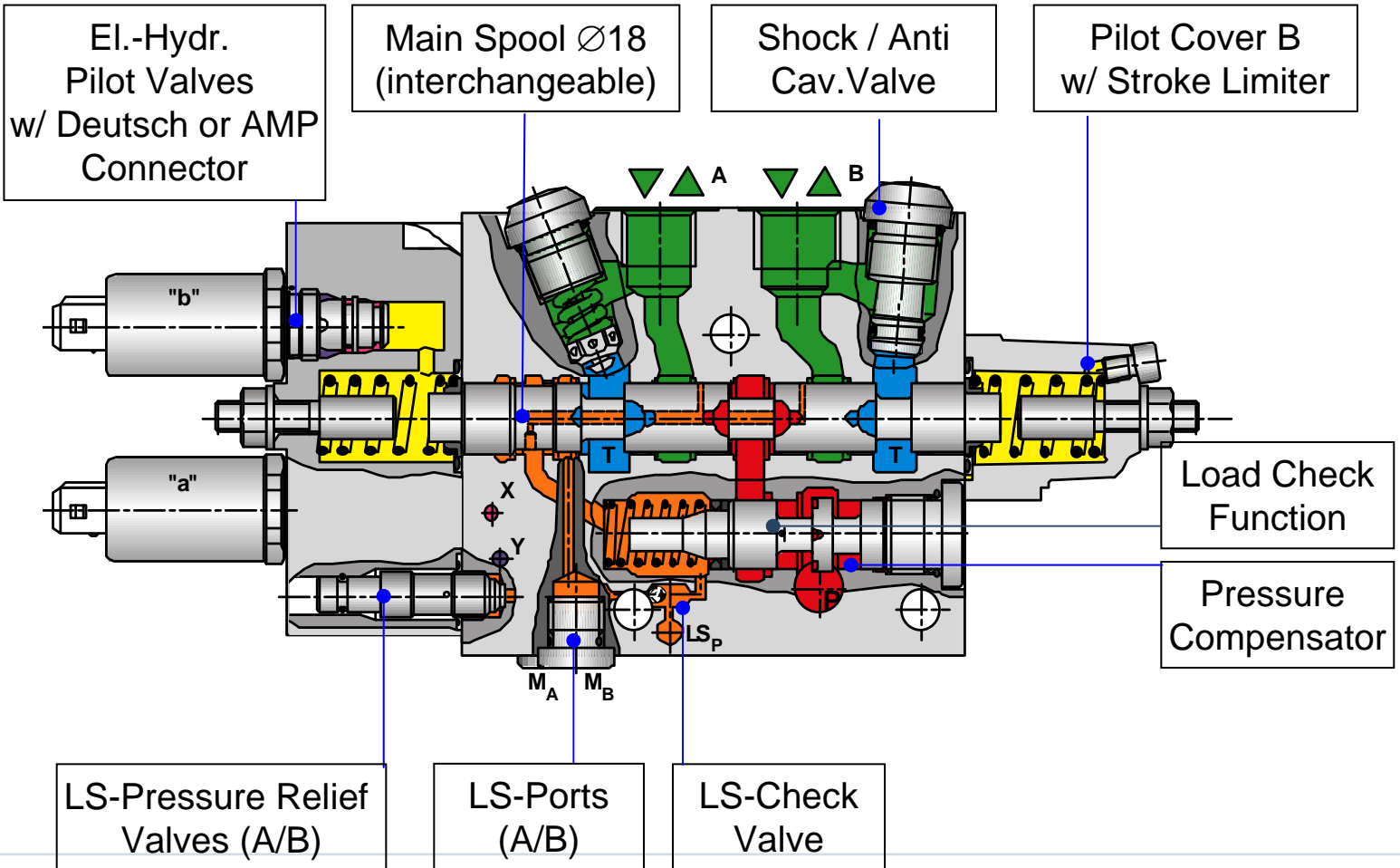
Closed Center  
with Priority

Closed Center  
mid-inlet

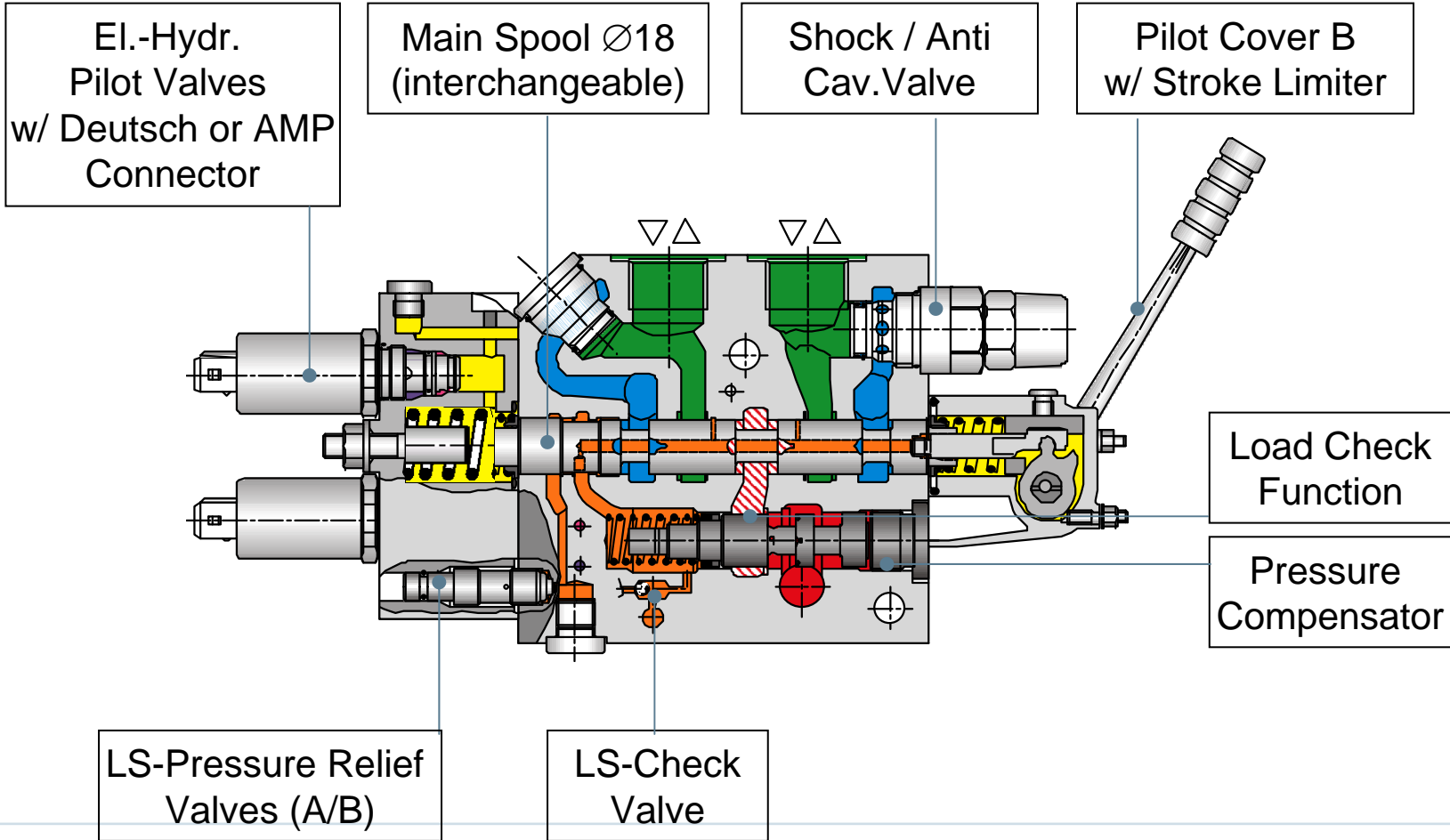
Closed Center  
mid-inlet  
with Priority



# M4-12 剖面图



# M4-15 剖面图

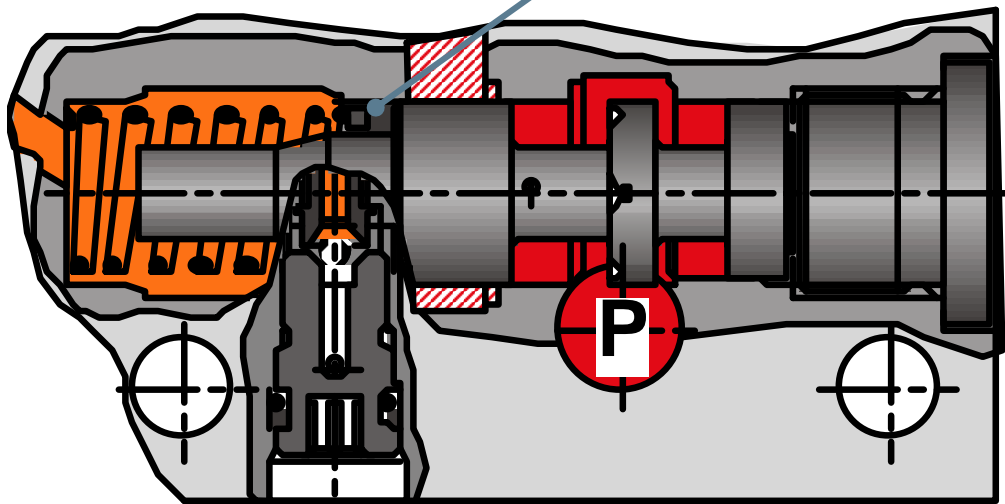


# M4 压力补偿器

压力补偿阀  $\Delta p$  的设置

- 0 垫片: 6 to 9 bar
  - 1 垫片: 7,5 to 10,5 bar (Standard)
  - 2 垫片: 9 to 12 bar
- (垫片零件号-No. 889 721 12,5x17,0x2,25)

按阀芯型  
号选



# M4 阀芯、流量与压力补偿器的关系

## a. 对称阀芯

Spool type	Pressure comp.	Flow in L/min (set deviating flows via the stroke limiter)					
		100-100	073-073	052-052	034-034	023-023	014-014
E, J, Q	S	085-085	065-065	045-045	030-030	020-020	012-012
		070-070	057-057	038-038	026-026	017-017	010-010

DW  $\Delta p = 6$  bis 9 bar

DW  $\Delta p = 7,5$  bis 10,5 bar

DW  $\Delta p = 9$  bis 12 bar)

## b. 非对称阀芯

Spool type	Pressure comp.	Flow in L/min (set deviating flows via the stroke limiter)				
		100-073	100-052	052-034	034-023	023-014
E, J	S	085-065	085-045	045-030	030-020	020-012
		070-057	070-038	038-026	026-017	017-010

### Example:

requested  $Q_{\text{Verbraucher}} = 90$  L/min : 85L spool + 2 washers = 100 L/min  
+ flow limited with stroke limiter to 90L

 Nennauslegung

## M4 型号与选型



**R901223370**

**M4-4574-20/6M4-15JHW21OSYV01**

Eingang inlet	type	DB relief valve [bar]								
	J	350								
Sektionen Anschluss port	Druckwaage compensator type	LS-DB relief valve [bar]		Relief spool type	Volumenstrom Flow [l/min]		Bedrftigung operation		DB relief valve [bar]	
		A	B		A	B	A	B	A	B
Sektion 1	S	130	M 260	E	100-100		H		H320	H320
Sektion 2	S	300	M 200	J	025-016		W21		Q	Q
Sektion 3	S	300	M 200	J	025-016		W21		Q	Q
Sektion 4	S	300	M 200	J	080-080		H		Q	Q
Sektion 5	S	300	M 200	J	080-080		W21		H320	H320
Sektion 6	S	300	M 200	J	080-080		W21		H320	H320
Endelement cover	type									
	LAY	V01								

**R901242852**

**M4-7654-20/5M4-12JW2RV01**

Eingang inlet	type	DB relief valve [bar]								
	J	280		Y						
Sektionen Anschluss port	Druckwaage compensator type	LS-DB relief valve [bar]		Relief spool type	Volumenstrom Flow [l/min]		Bedrftigung operation		DB relief valve [bar]	
		A	B		A	B	A	B	A	B
Sektion 1	S	120	M 220	E	034-023		W21R		H320	H320
Sektion 2	S	120	M 220	E	034-023		W21R		H320	H320
Sektion 3	S	120	M 220	E	034-023		W21R		H320	H320
Sektion 4	S	120	M 220	E	034-023		W21R		H320	H320
Sektion 5	S	=	M 250	J	057-057		W21R		Q	Q
Endelement cover	type									
	LA	V01								

注意比较M4-12与M4-15的同异处:

- 1、二次溢流阀
- 2、内部先导供油模块的位置

利用**M4-configurator**进行选型，并可得到相应的图纸。

## 流量共享阀系列



**SX 10, 12, 14**

300 bar

70-120 L/min

Mini excavators < 6 to  
Excavators < 10 to  
Backhoe loaders  
Skid steer loaders



**M6-15, 20, 22**

350/420 bar

160-350 L/min

Loaders  
Dozer



**M7-20, 22, 25**

350/420 bar

220, 400, 600 L/min

Excavators > 10 to  
Forestry machines  
Drilling rigs  
Cranes

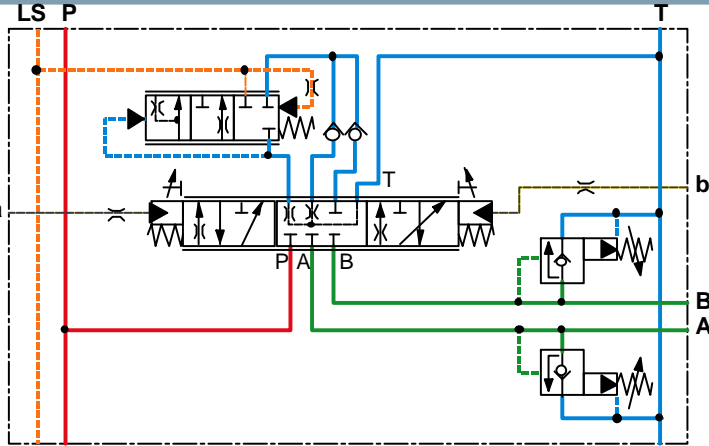


## M7 剖面图

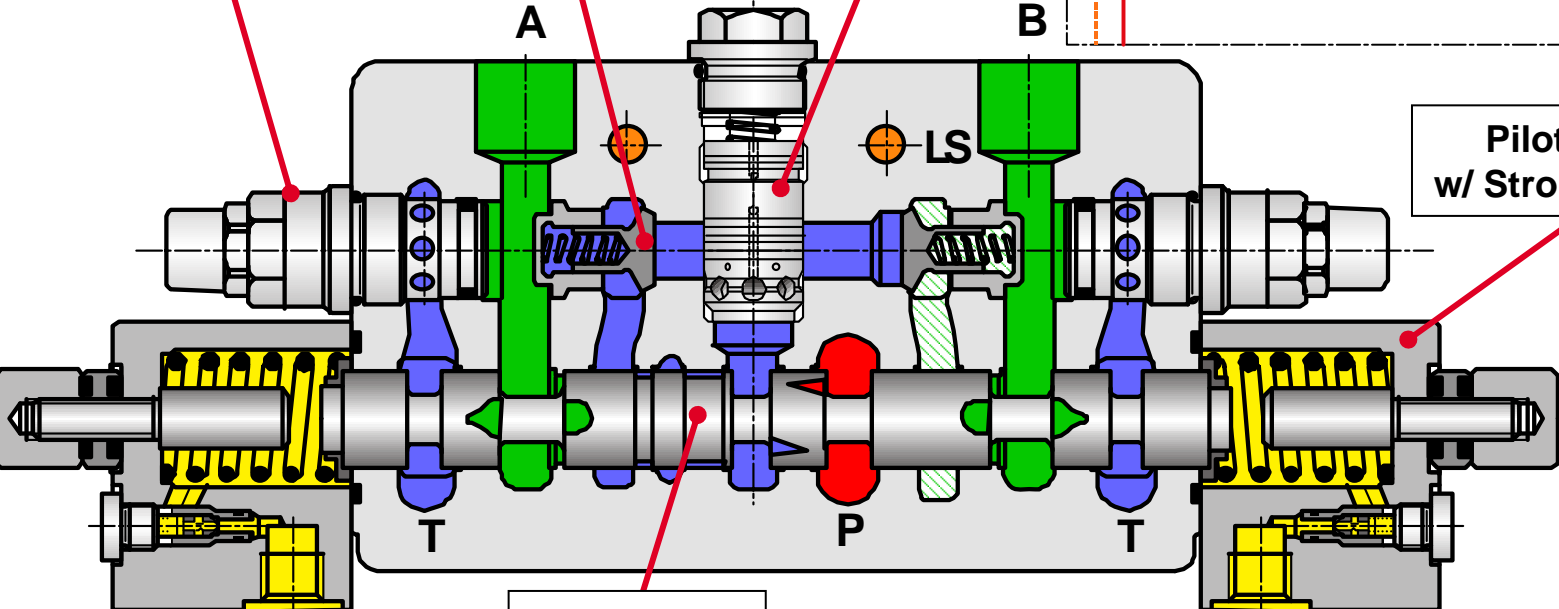
Secondary Pressure Relief Valve

Load Holding Valve

Pressure Compensator



Pilot Cover w/ Stroke Limiter

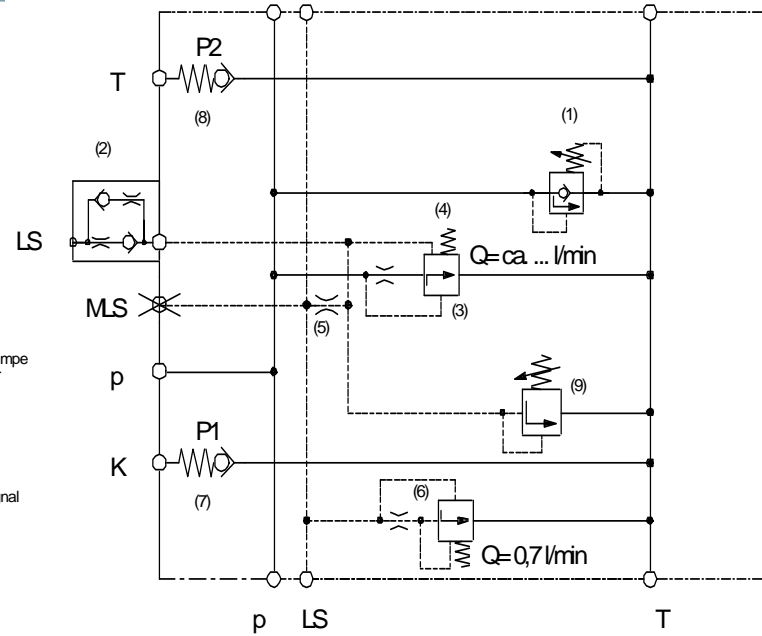
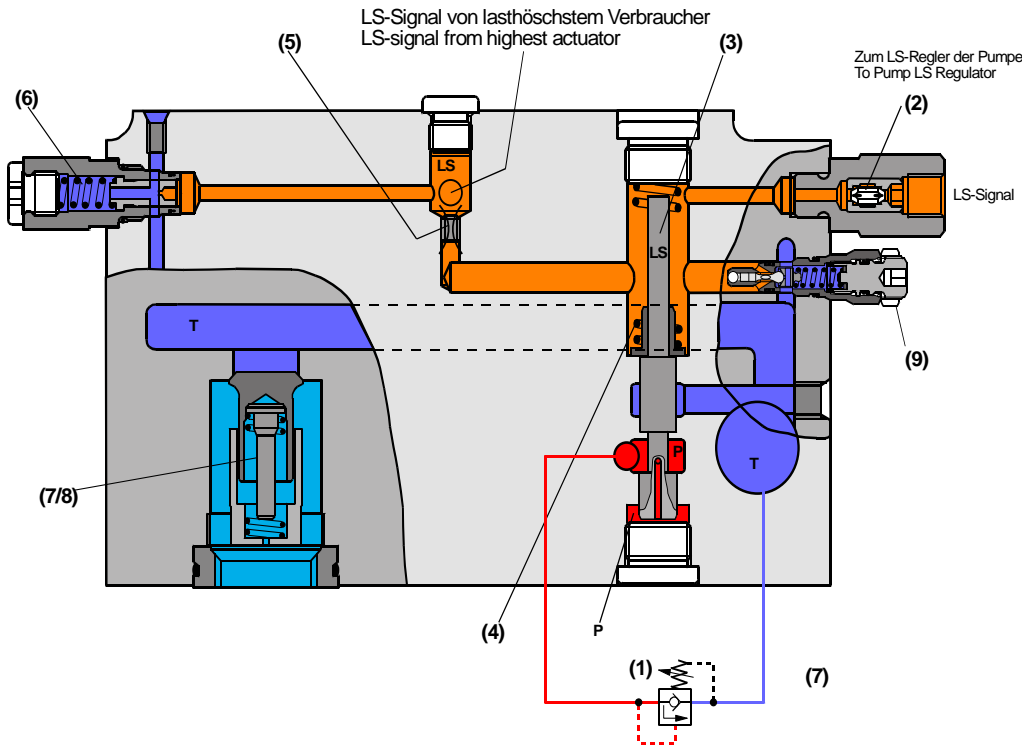


Main Spool

a

b

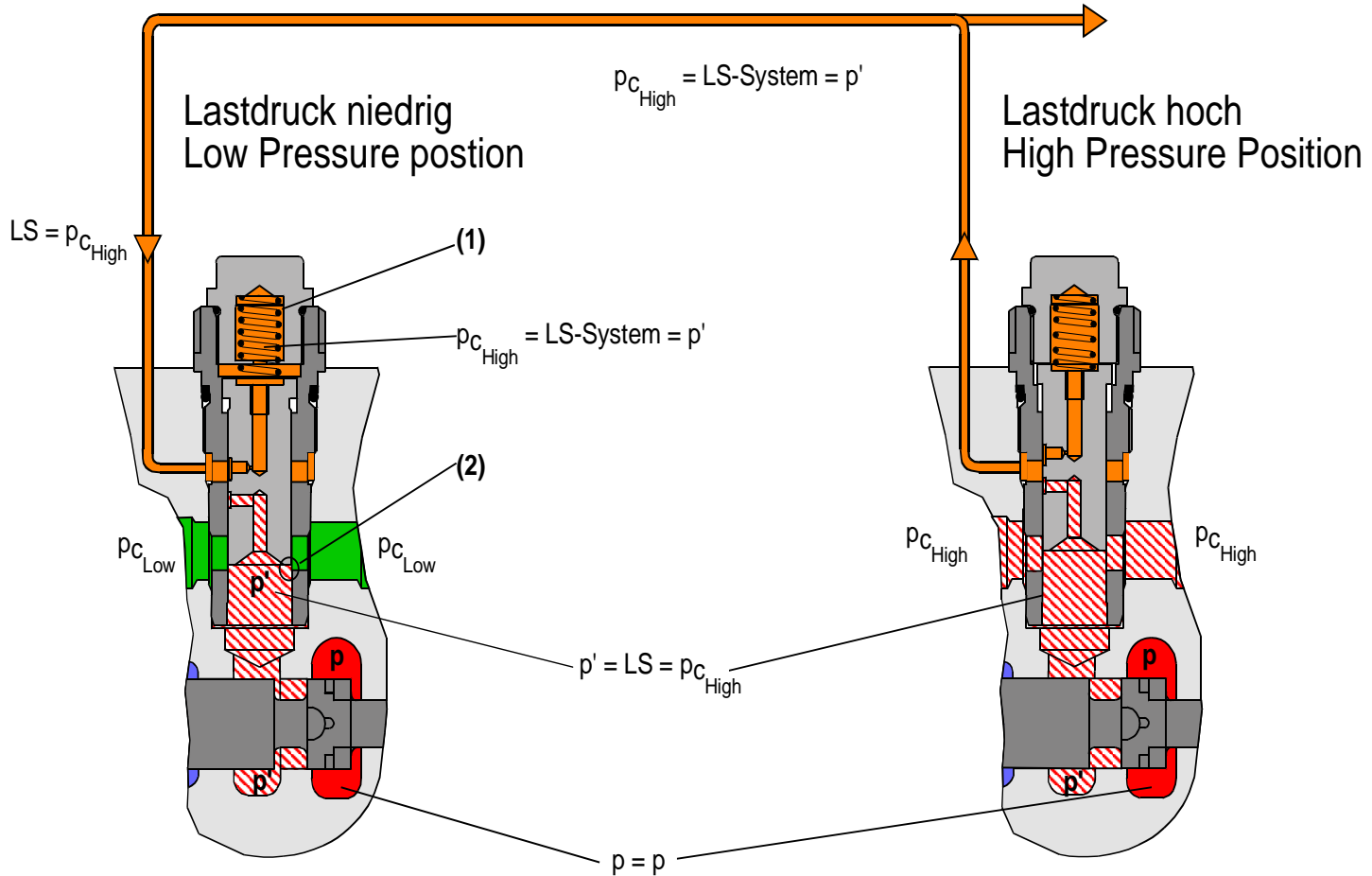
## M7 进油联



- (1) primary pressure relief valve (schematic only)
- (2) LS shuttle
- (3) unloading valve piston
- (4) unloading valve spring
- (5) LS central orifice
- (6) LS drain valve
- (7/8) tank and cooler line pre-charging valve  
( $p_1 < p_2$ )
- (9) LS pressure cut- off valve with / without  
pressure sequencing stage



# M7 压力补偿器



## M7 型号与选型

### Main control valve

Electronic-Hydraulic operation  
Pressure of primary valve  
With internal flow summation  
With transmission compensation valve  
Check valve of port T  
Without Check valve of port K

M7-XXXX-3X / 7-22 / 3 -0 Z 3 -0-22  
3 (P1=A370A340J3N0A) +P2=A370A340J3N0A)  
(Unloading A1=20L/min; Unloading A2=20L/min) V11  
1M7-22-3X/ 0Q 450-450 W21C4 -00 H100 H320  
2M7-22-3X/ 0Q 450-450 W21C4-00 H100 H320  
3M7-22-3X/ 0Q 300-300 W21C4 -00 E E  
Summation DC24V (Orifice 2,5mm / Compensation Travel)  
4M7-22-3X/ 0Q 300-300 W21C4-00 E E  
5M7-22-3X/ 0Q 450-450 W21C4 -00 H150 H320  
6M7-22-3X/ 0Q 300-300 W21C4-00 H150 H320  
7M7-22-3X/OM320-320 W21 C4-00 H150 H320

主控制阀: M7-1827-30/7M7-22 (R9011)

电液比例先导操作的LUDV系统

主安全阀设定: 2 x 370 bar

内合流功能

行走机构带负载平衡功能

T油口单向阀3.5bar

无K油口单向阀.

main hoist主卷扬

aux.hoist 副卷扬

travel right 右行走

travel left 左行走

luffing 变幅

arm luffing 桅杆变幅

hoist 5

在进行M7选型时需要了解:

整机性能参数, 发动机功率转速参数, 泵型号, 执行器参数 (马达或油缸)。

## 辅助信息

### 1、网上工具 - M4 Configurator

快速选型与出图

<http://www.boschrexroth.com/ics/>

### 2、产品样本

**M4-12**      **RE64276**

**M4-15**      **RE64283**

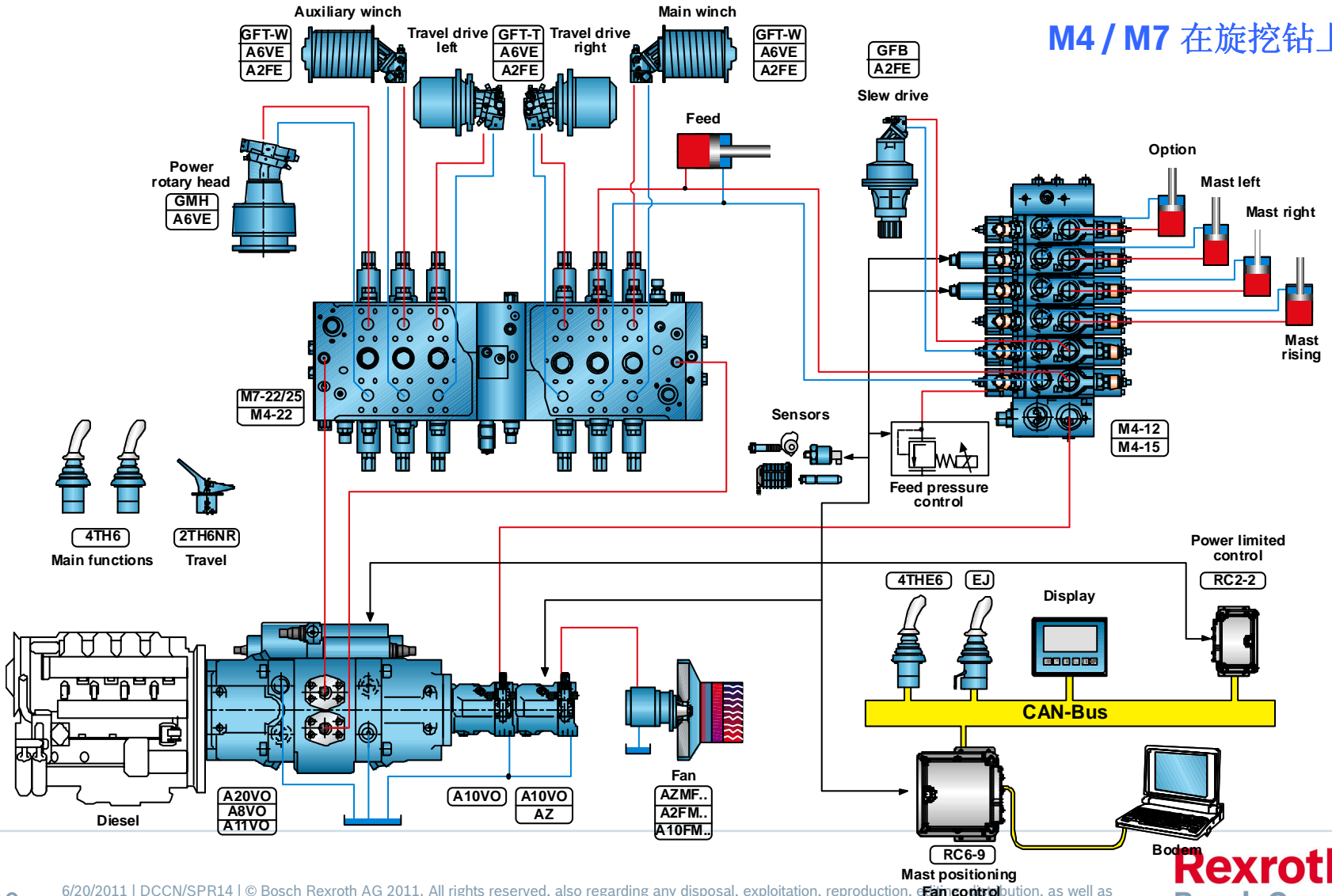
**M7-22**      **RE64295**

<http://www.boschrexroth.com/various/utilities/mediadirectory/>

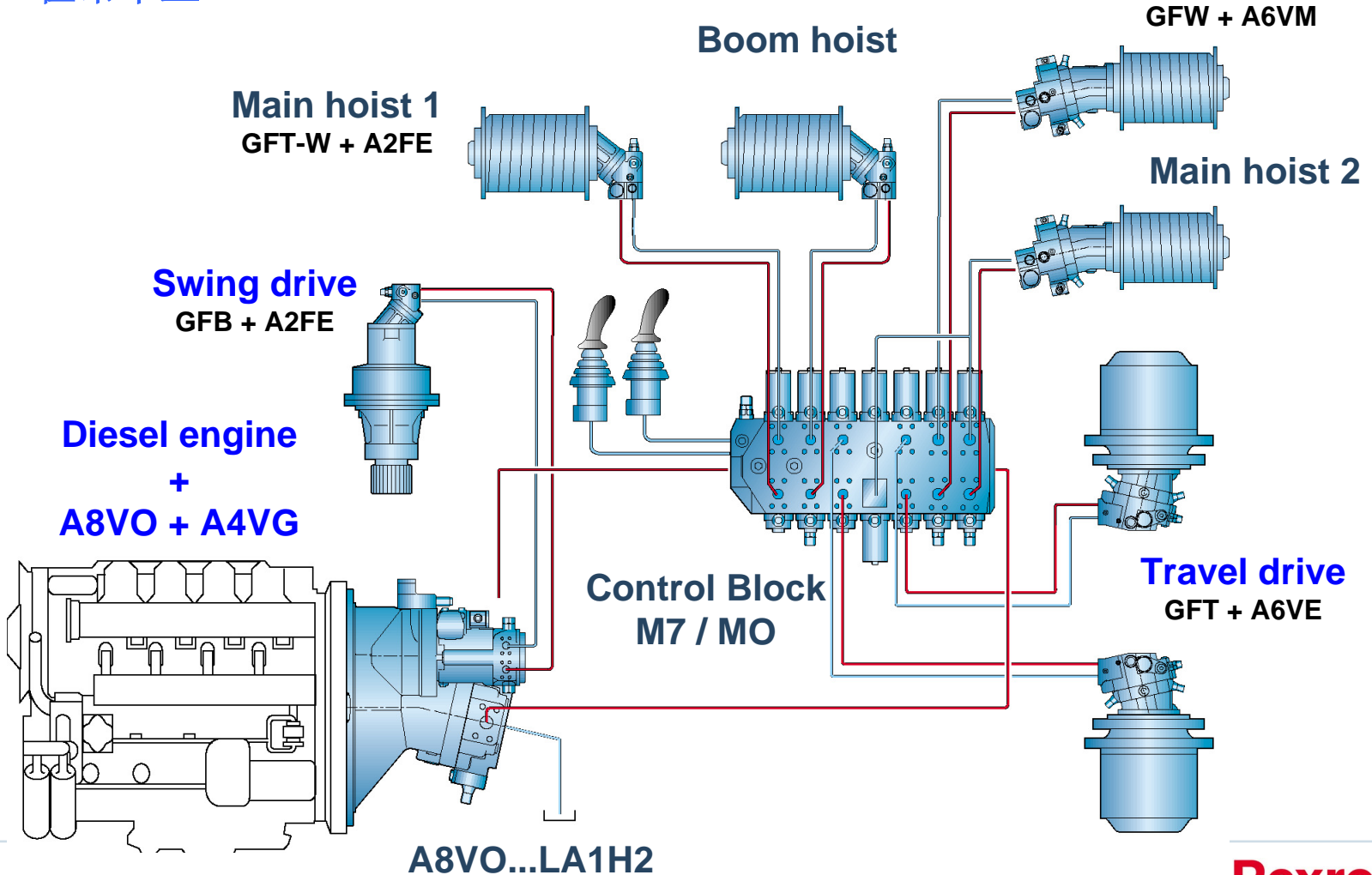
### 3、直接联系我们！

# 力士乐工程机械控制阀-M4/M7

## M4 / M7 在旋挖钻上



## M7 在吊车上



Thank you for your attention!!

