

hydraulic training for T&T,
M4-12 bankable valve, Sept., 2019

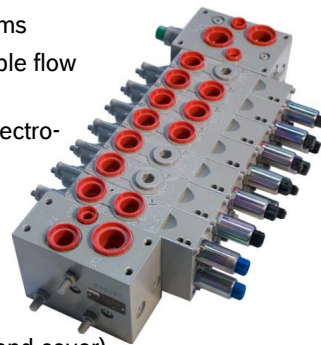
TRUCK & TRAILER
Specialties, Inc.

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Compu-Spread Snow & Ice Control Solutions

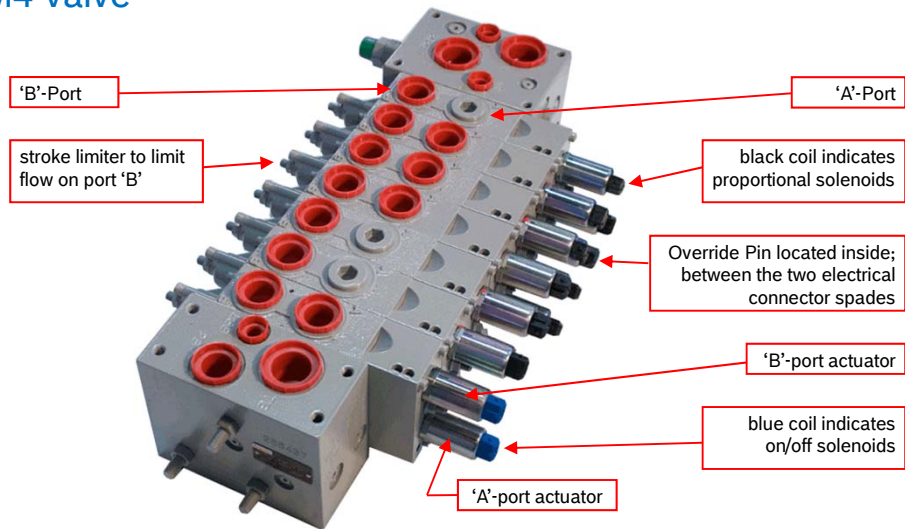
M4-12 load-sense control valves

- closed and open-center systems
- for energy-efficient load-sensed Snow & Ice Control systems
- individual slice compensators ensure precise and repeatable flow metering and individual working port load sense reliefs
- spool actuator types: mechanical, pneumatic, hydraulic, electro-hydraulic
- slice flow rates to 34 USGPM (130 L/min)
- primary system relief integrated: lateral or mid-inlet
- up to 16 slices with a mid-inlet (10 with a lateral inlet)
- very robust design (>5,000 psi rating)
- integral load sense signal bleed-down (on each slice and end cover)
- special inlets and end covers provide single connector surface for enclosure mount



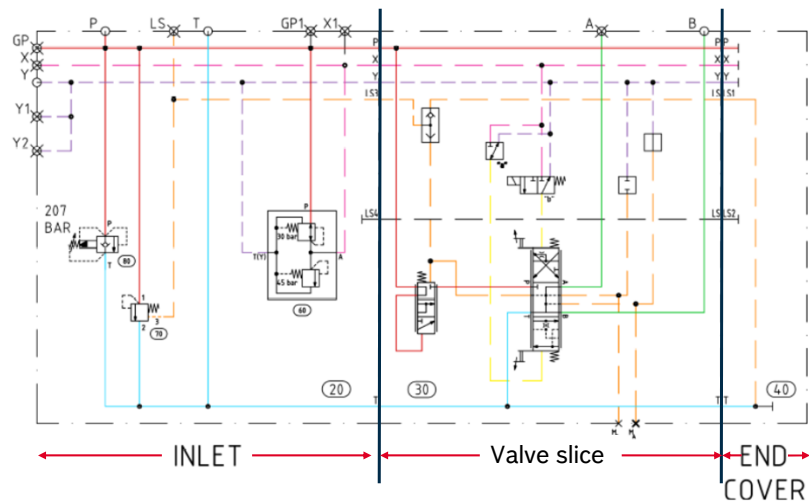
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CS: M4 valve



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Compu-Spread: the anatomy of an M4-12 assembly



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Compu-Spread: M4 lateral inlet

- for closed centre (CC) versions (R987457640)
- for open centre (OC) versions (R987460482)
- for external pilot (PX) versions (R987460258)



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Compu-Spread: M4 lateral inlet – top view

closed centre R987457640

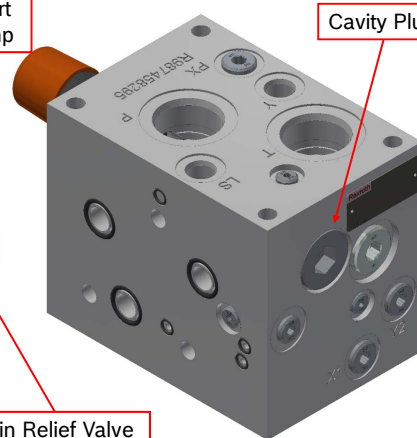
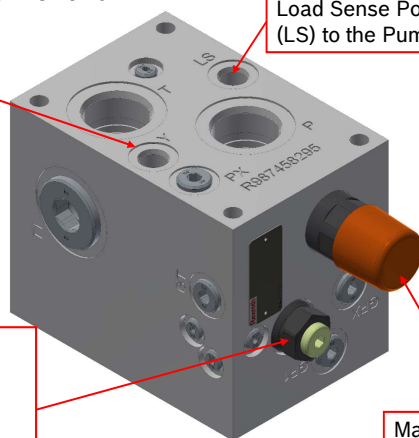
External Drain Port (Y) is to be routed separately to the reservoir

Load Sense Port (LS) to the Pump

Pressure Reducing Valve to supply reduced pressure to Proportional and Directional Pilot Valves (non-adjustable)

Main Relief Valve

Cavity Plug

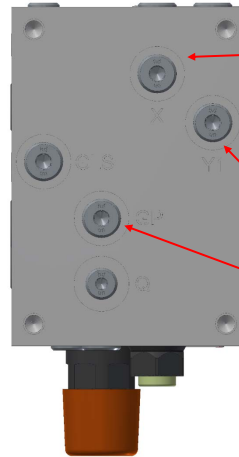
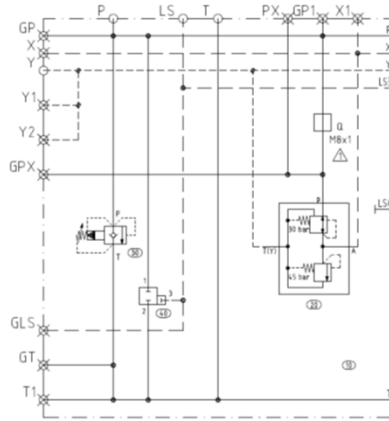


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Compu-Spread: M4 lateral inlet – bottom view

closed centre R987457640

Note: we offer three possible external drain ports, depending on how the valve is mounted. Only one external connection is required, as, internal to the manifold block, Y, Y1, and Y2 are interconnected! Never use an hose smaller than 3/8" in size!



'X'-gauge port to monitor the pilot pressure, handy to assist in troubleshooting

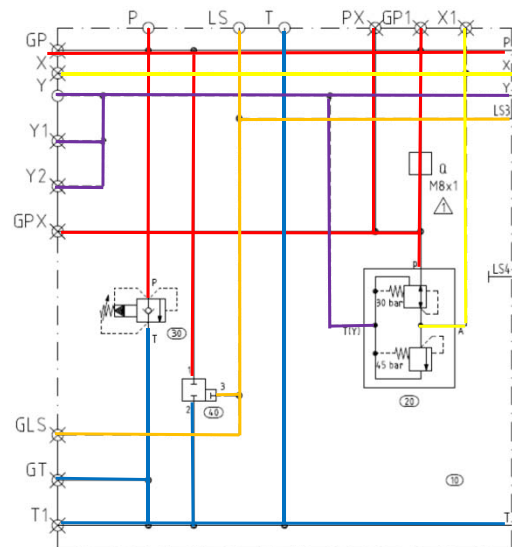
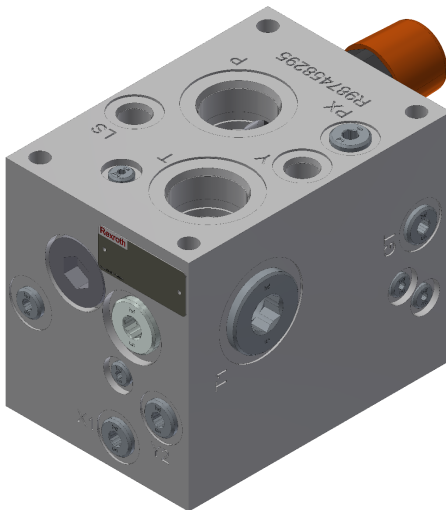
Drain Port (Y1) for use when valves are in certain valve enclosures

Gauge Port (GP) for use when valves are in certain valve enclosures

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Compu-Spread: M4 lateral inlet

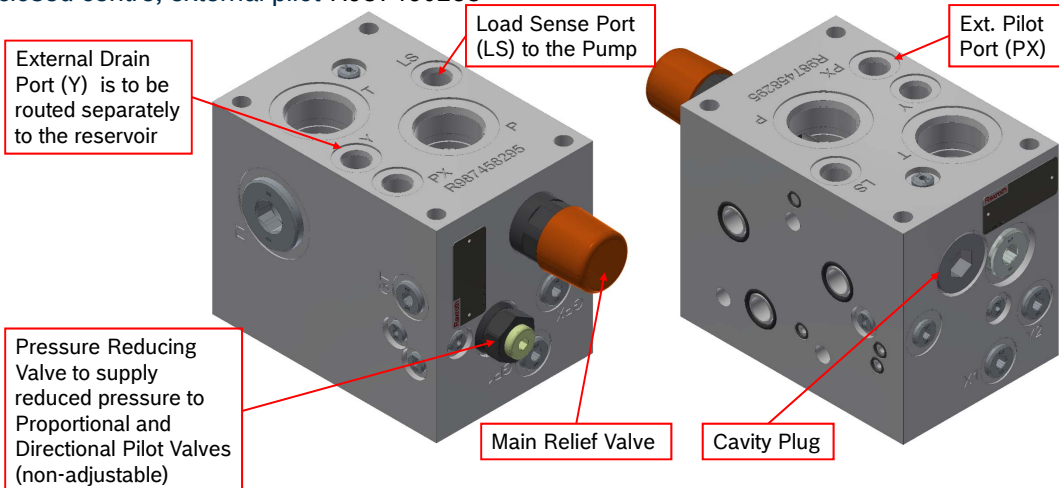
closed centre R987457640



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Compu-Spread: M4 lateral inlet – top view

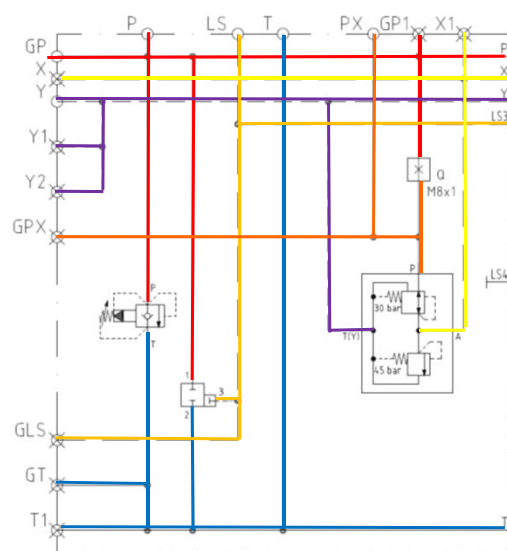
closed centre, external pilot R987460258



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Compu-Spread: M4 lateral inlet

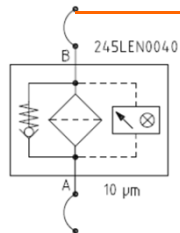
closed centre, external pilot R987460258



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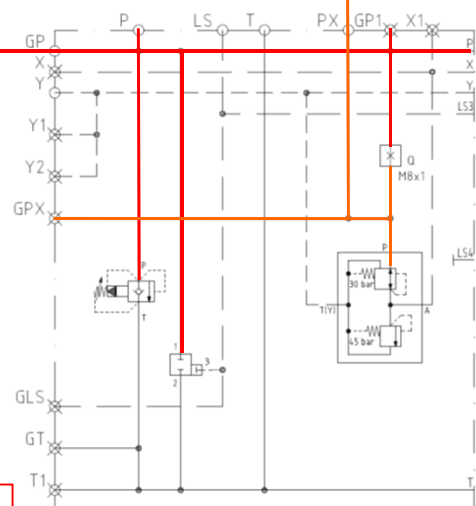
Compu-Spread: M4 lateral inlet:

PX version; external pilot filtration option
below 3500 psi (245 bar)



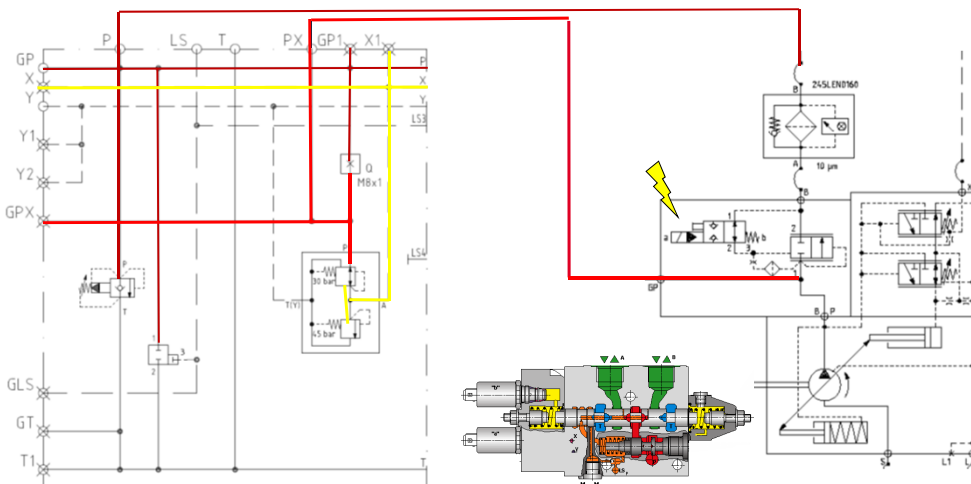
In-line pressure filter
R928030728

to be used in conjunction with an in-line pressure filter
in the main pressure port (245LEN0160 or 250)



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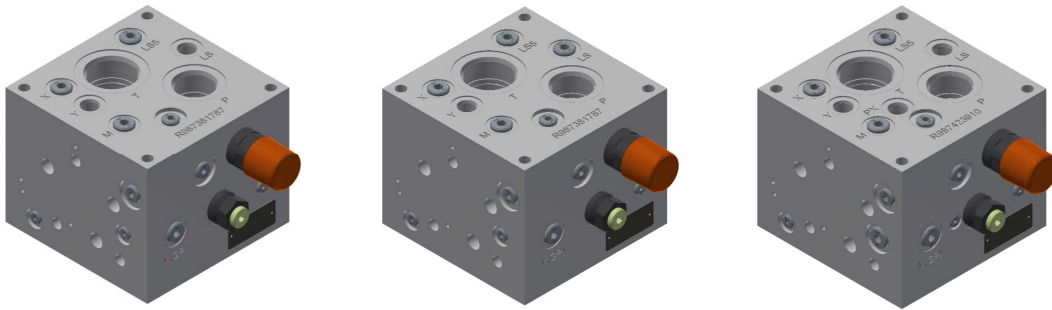
Compu-Spread: M4 lateral inlet: PX version; depressurisation option



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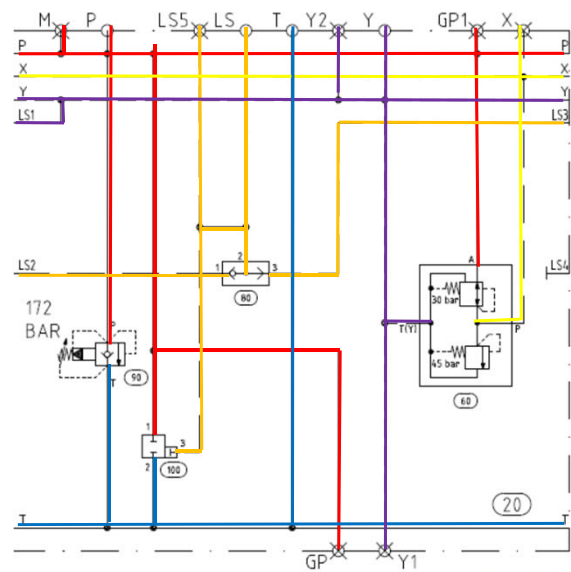
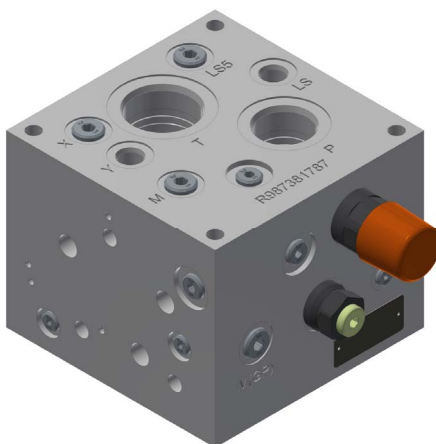
Compu-Spread M4 mid-inlets

- for closed center (CC) versions (R987379566)
- for open center (OC) versions (R987379575)
- for external pilot (PX) versions (R987423909)



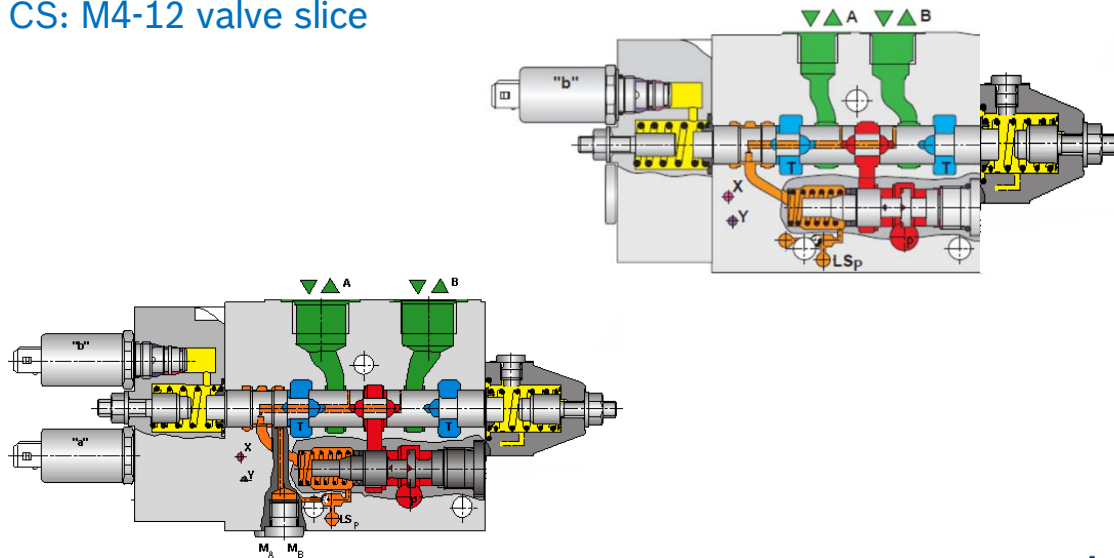
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Compu-Spread M4 mid-inlets closed center R987379566



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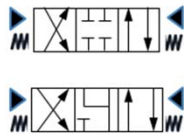
CS: M4-12 valve slice



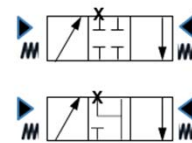
Compu-Spread: M4 valve overview of flow paths

Basically, we have four possibilities with the M4 valve which we focus on in C-S:

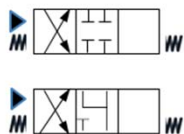
4/3 way valve:



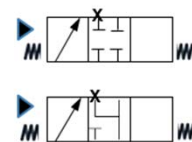
3/3 way valve:



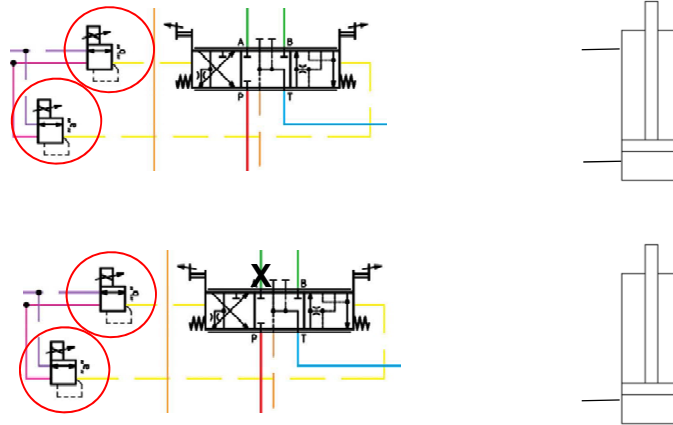
4/2 way valve:



3/2 way valve:

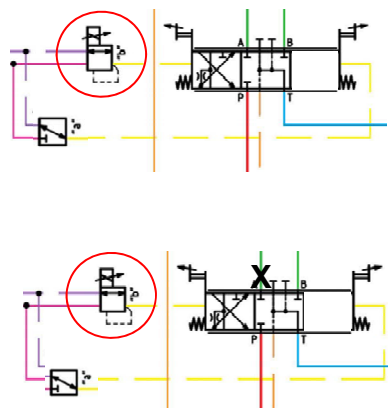


M4 valve highlights: 4/3 & 3/3 cylinder ('E') spool slices

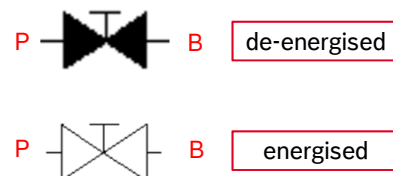


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M4 valve highlights: 4/2 & 3/2 cylinder ('E') spool slices

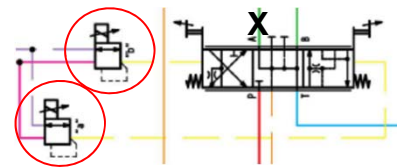
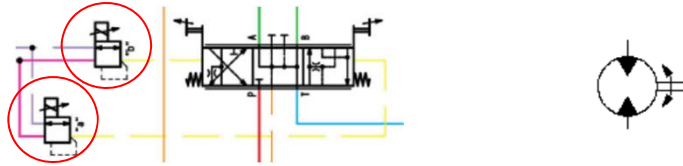


this configuration is currently
not used in Compu-Spread!



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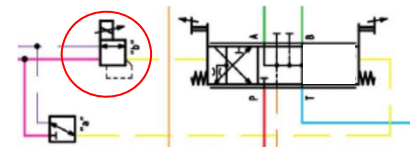
M4 valve highlights: 4/3 & 3/3 motor ('J') spool slices



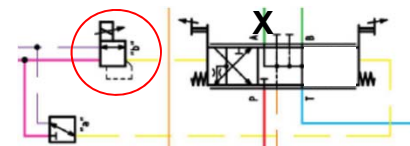
this configuration is currently not used in Compu-Spread!

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M4 valve highlights: 4/2 & 3/2 motor ('J') spool slices



this configuration is currently not used in Compu-Spread!



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M4-12-2X model code ... as it relates to the housings and the LS reliefs

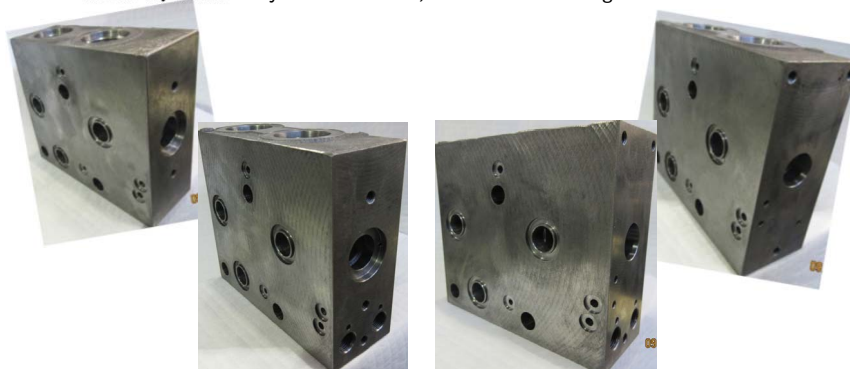
Pressure compensator		
with pressure compensator, with load holding function	= S	
without pressure compensator, with load holding function (not in combination with PM)	= C	
without pressure compensator, without load holding function	= Q	
LS valve		
with LS pressure relief valve (pressure information in bar, 3-digit) (no Z possible)	=
with LS-DB (pressure relief function) plug screw (no Z possible)	= Q	Q
with LS unloading plug	= B	B
without LS pressure relief valve (LS-DB cannot be retrofitted) (no M possible)	= Z	Z
Housing with measuring ports	= M	
Housing without measuring ports	= Z	
Housing for change over axis ¹⁾ (possible in combination with ZUZ only)	= U	
Housing for electroproportional or switchable pressure relief function ²⁾	= K	
210 bar, decreasing characteristic curve ²⁾	= L	
210 bar, rising characteristic curve ²⁾	= J	
350 bar, decreasing characteristic curve ²⁾	= R	
350 bar, rising characteristic curve ²⁾	= N	

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M4-12-2X series housing types as used in C-S

Four different types of housings are used by Compu-Spread, depending on the function and the requirement:

- Mechanical or Pneumatic actuation, without Load Sensing Reliefs
- Mechanical or Pneumatic actuation, with Load Sensing Reliefs
- Electro-Hydraulic or Hydraulic actuation, with Load Sensing Reliefs
- Electro-Hydraulic or Hydraulic actuation, without Load Sensing Reliefs



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M4-12-2X series housing types as used in C-S



Pneumatic or Mechanical Housing

Hydraulic or Electro-hydraulic Housing

No LS reliefs

With LS reliefs

With LS reliefs

No LS reliefs

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CS: M4 valve

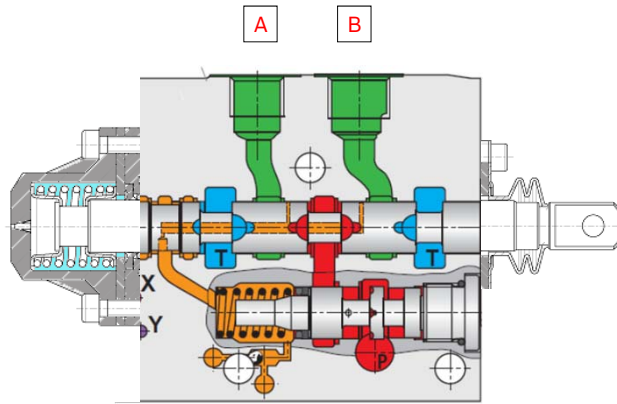
In C-S, we actuate our valves:

- Mechanically
- Pneumatically
- Electro-Hydraulically
- Hydraulically

Further information in the clear text									
Secondary valves									
Flange surface [®]									
Shock/Feed valve, adjustable									
Shock/Feed valve, non-adjustable									
Plug screw (secondary valves can be retrofitted)									
SAE – 12 without secondary valve (cannot be retrofitted)									
Operation B side cover									
Standard cover									
Encapsulated operation									
Position of handle-operated lever				without Handle-operated lever					
60°		0°		-60°		R			
K		L		M		R			
N		O		P		X			
see notes on page 42									
further versions									
purely mechanical operation									
Tongue [®]									
Tongue with lever [®]									
Supply voltage 24 V				Supply voltage 12 V			Supply voltage and plug-in connector [®]		
1				3			Junior Timer 2-pin (AMP)		
8				9			DT04-2P (Deutsch)		
Operation A side cover									
Purely mechanical [®]									
Encapsulated, spring centered		Spring centered		Detent in		A and B			
M		A		B1		B2		B4	
Mechanical									
Hydraulic									
H =									
Standard									
with damping orifice, both sides			with measuring ports, both sides			with damping orifice, with measuring ports, both sides			Orifice + check valve for hydraulic superposition [®]
W2		W5		W8		W7		G2	
W4		W6		W7		G4		Electrohydraulically proportional	
W5		W6		W7		G4		Electrohydraulically switchable	

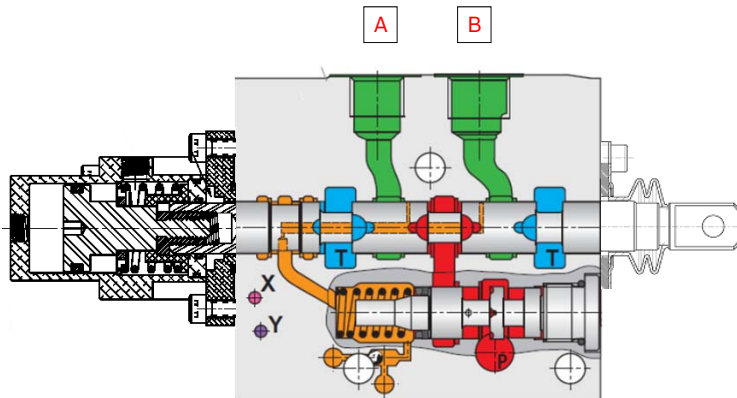
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CS: M4 valve spool actuation - mechanically



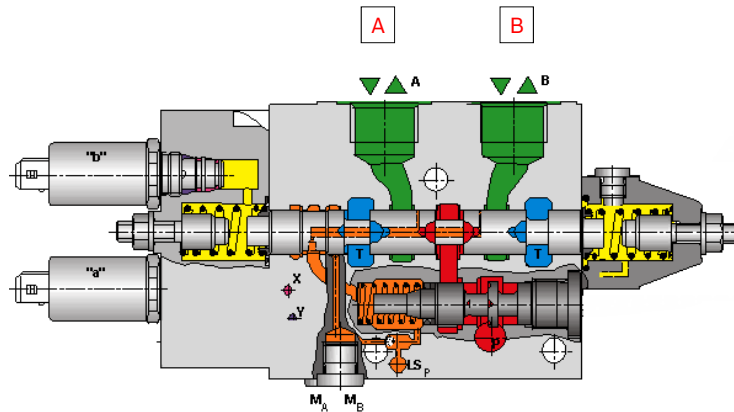
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CS: M4 valve spool actuation - pneumatically



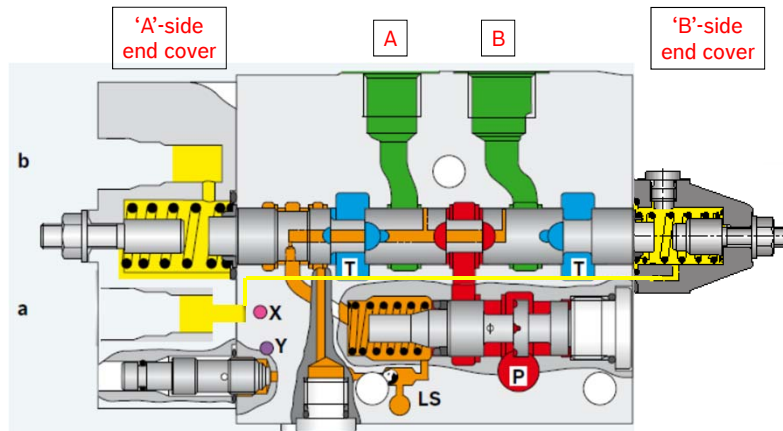
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CS: M4 valve spool actuation – electro-hydraulically



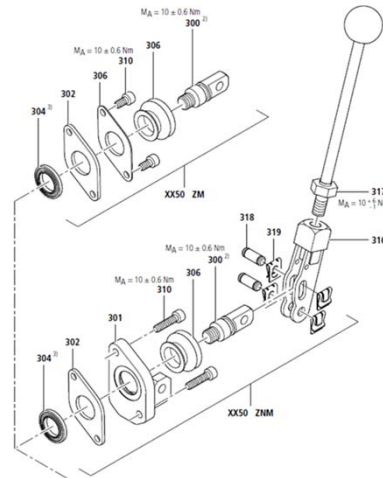
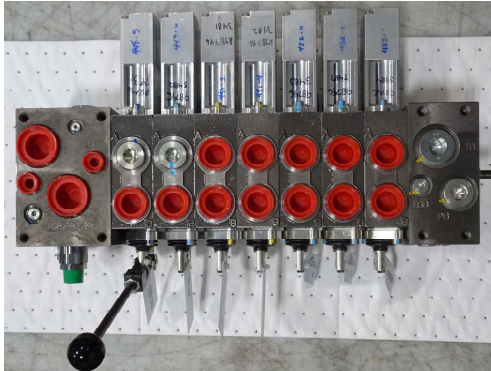
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CS: M4 valve spool actuation – hydraulically



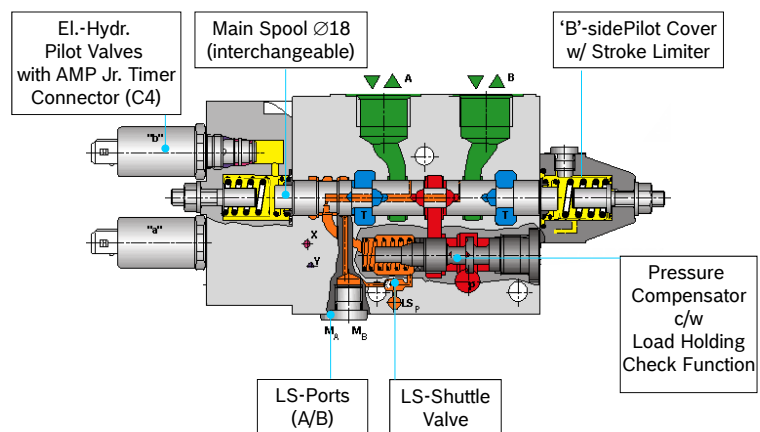
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Compu-Spread: pneumatically actuated slice with optional manual override handle



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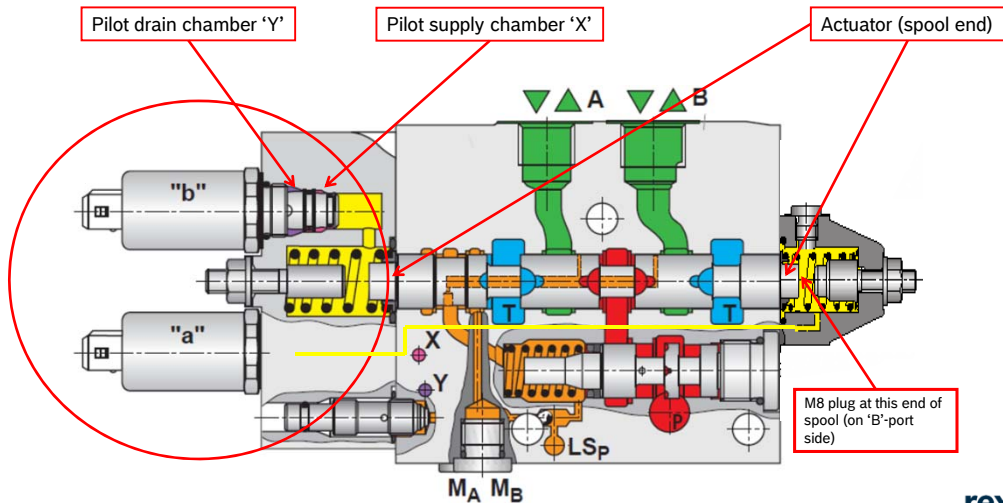
M4-12: Electro-hydraulic Actuation



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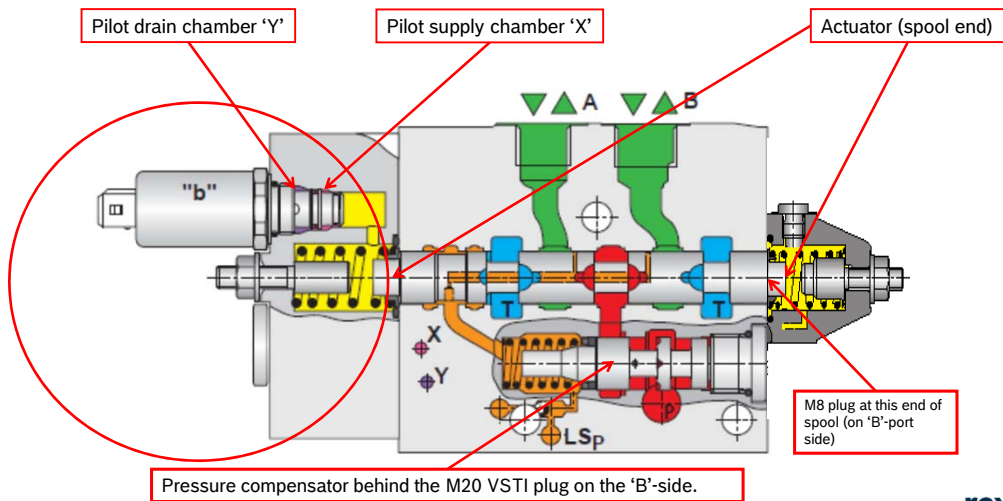
M4-12 230106

M4-12: Electro-Hydraulic Actuation Pilot Valves



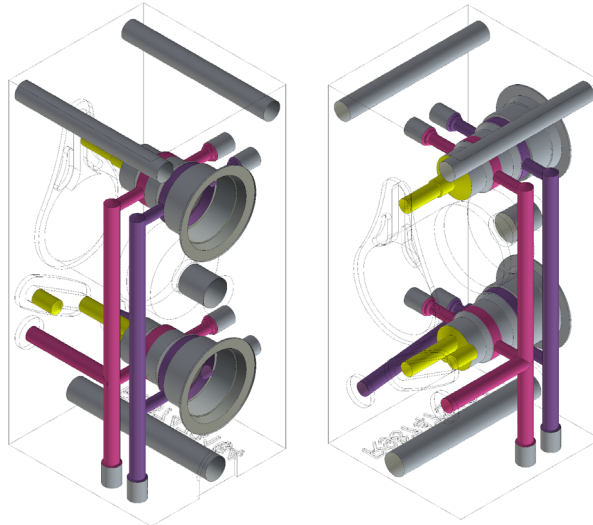
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M4-12: Electro-Hydraulic Actuation Pilot Valve, single coil (011)



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C-S: M4-12-2X 'A'-side electro-hydraulic end cover: CS-M4-12-31/WV

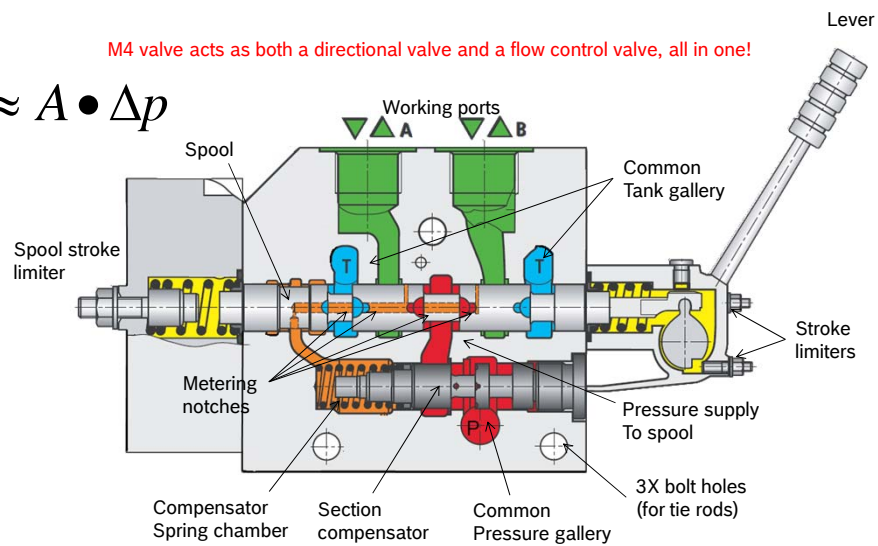


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M4 load sensing valve Typical valve section

M4 valve acts as both a directional valve and a flow control valve, all in one!

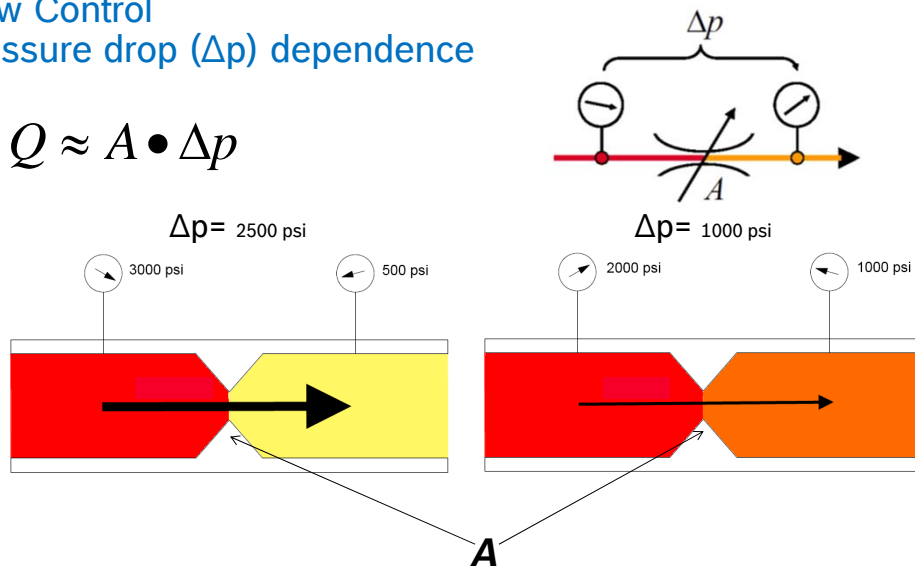
$$Q \approx A \bullet \Delta p$$



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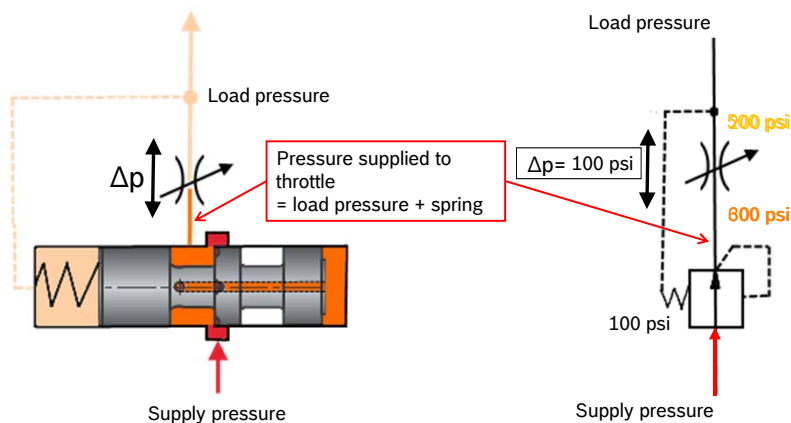
Flow Control Pressure drop (Δp) dependence

$$Q \approx A \cdot \Delta p$$



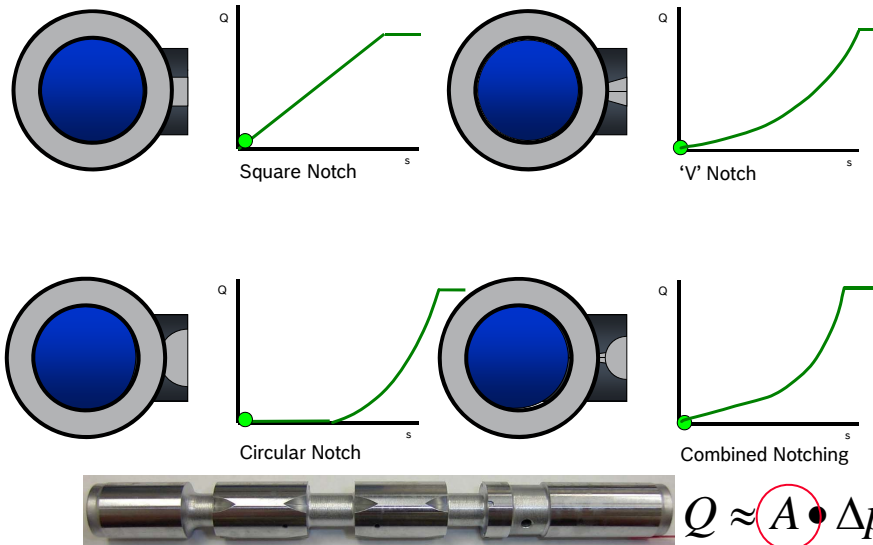
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Flow Control Pressure compensation

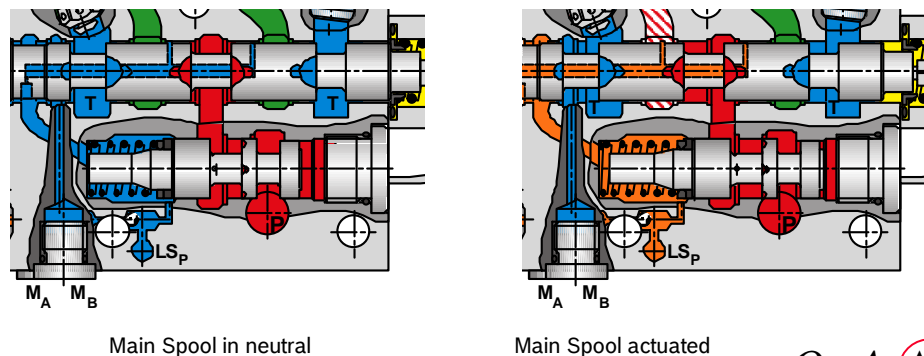


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Characteristics of Different Metering Notches on the M4 spools



Function of pressure compensator

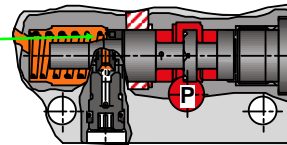


Spool Flow Rates & adjustments of Flow using the Pressure Compensator Shims

Symmetrical spools

Flow in L/min (set deviating flows via the stroke limiters)						
100-100	073-073	052-052	034-034	023-023	014-014	
085-085	065-065	045-045	030-030	020-020	012-012	
070-070	057-057	038-038	026-026	017-017	010-010	
0 shim:				130 psi	9 bar	
1 shim:				152 psi	10,5 bar	
2 shims:				174 psi	12 bar	

Shims

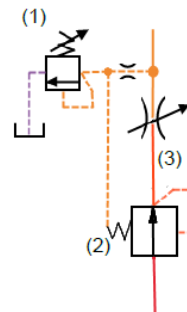
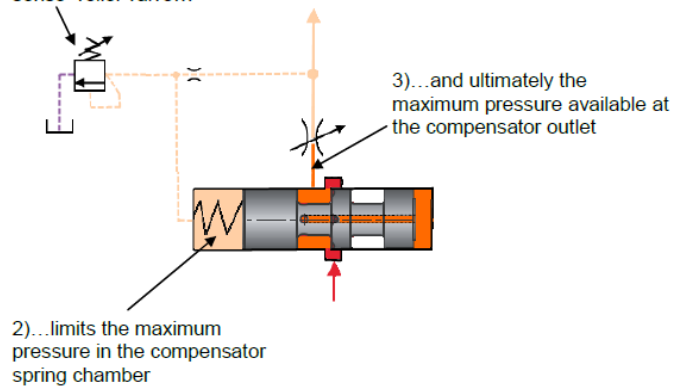


$$Q \approx A \cdot \Delta p$$

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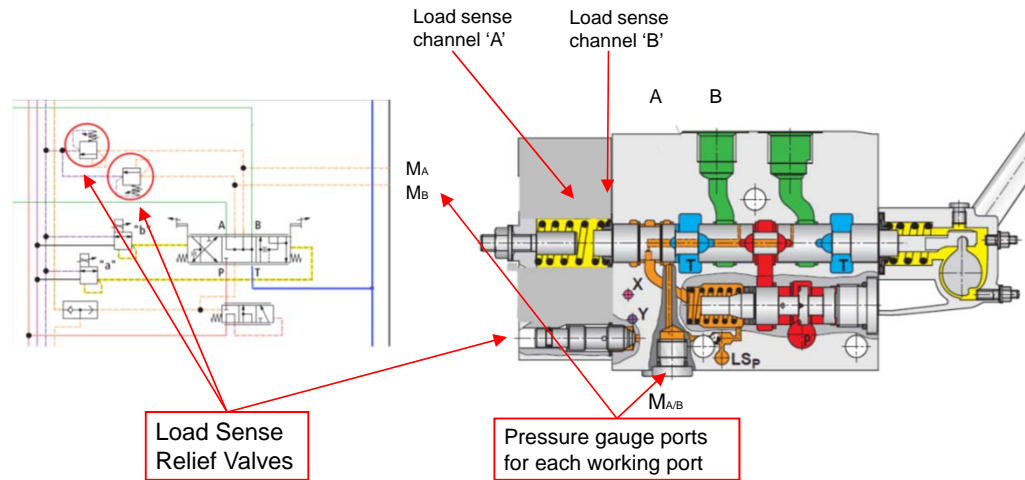
Pressure control Load sense reliefs

1) The small "load sense" relief valve...

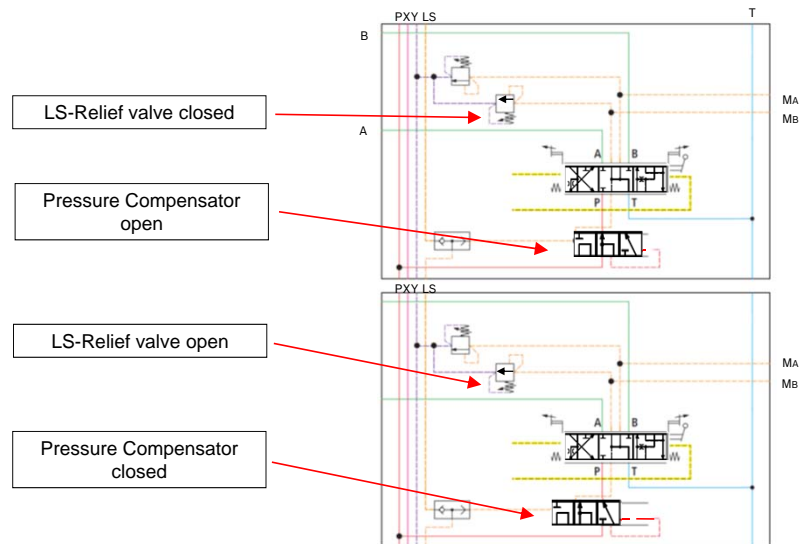


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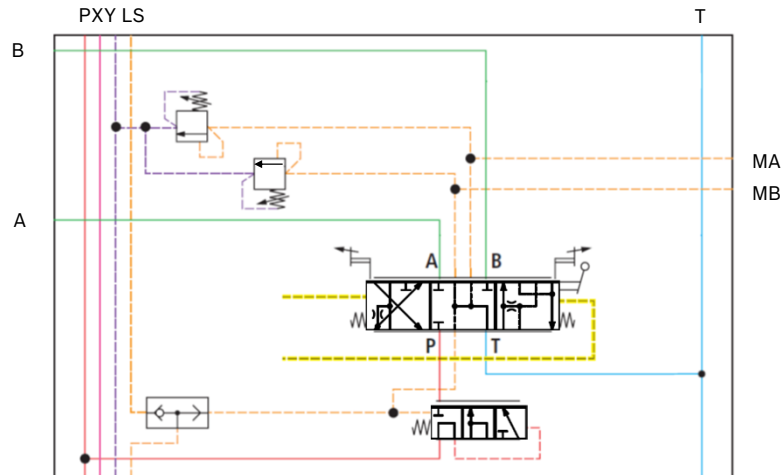
Pressure Control Load Sense Reliefs



Two Stages of Pressure Control of the LS Reliefs: closed and open

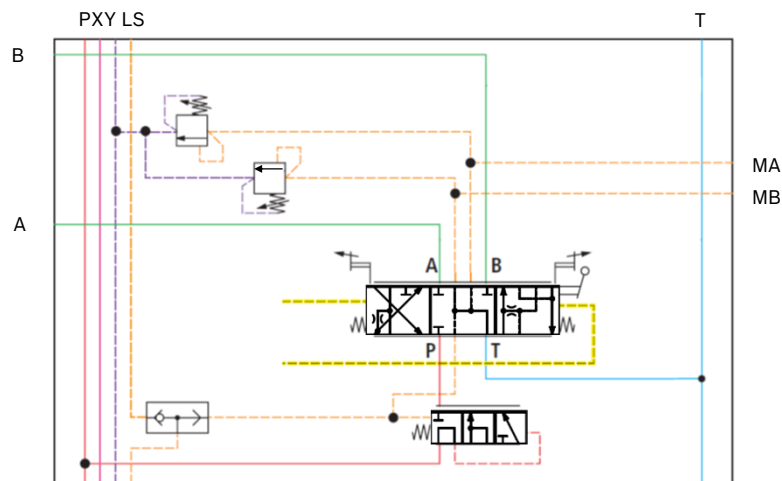


Load Sensing Reliefs with load induced pressure lower than LS relief setting (LS Relief closed)



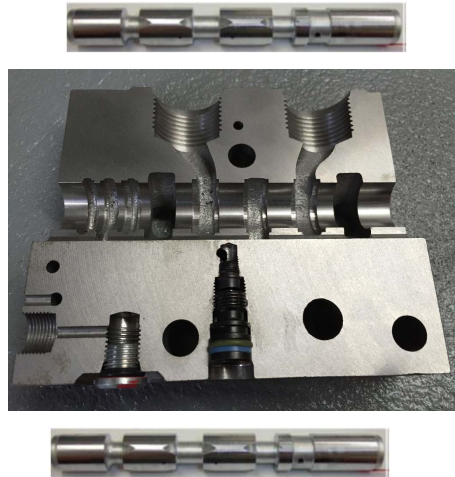
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Load Sensing Reliefs with load induced pressure opening the 'B'-port LS relief (LS Relief open)



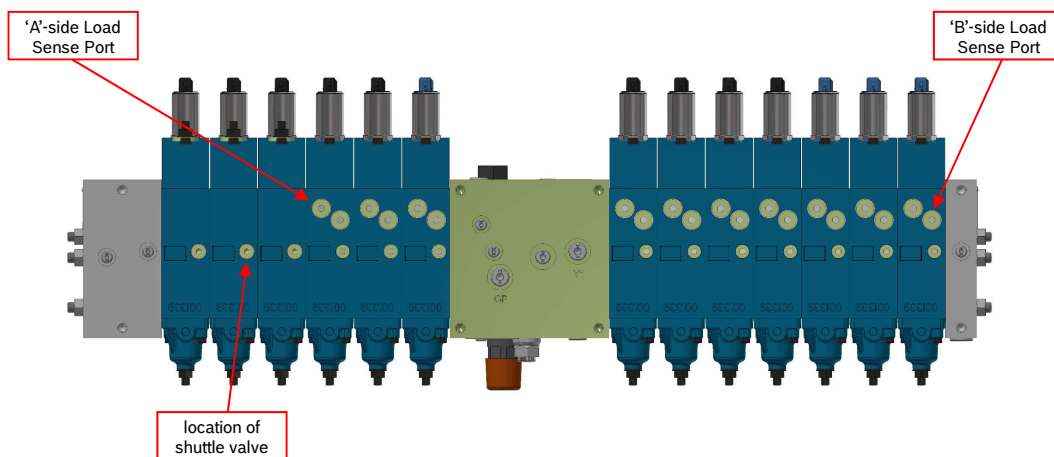
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Compu-Spread: M4 spool overlap (using cut-away slice)



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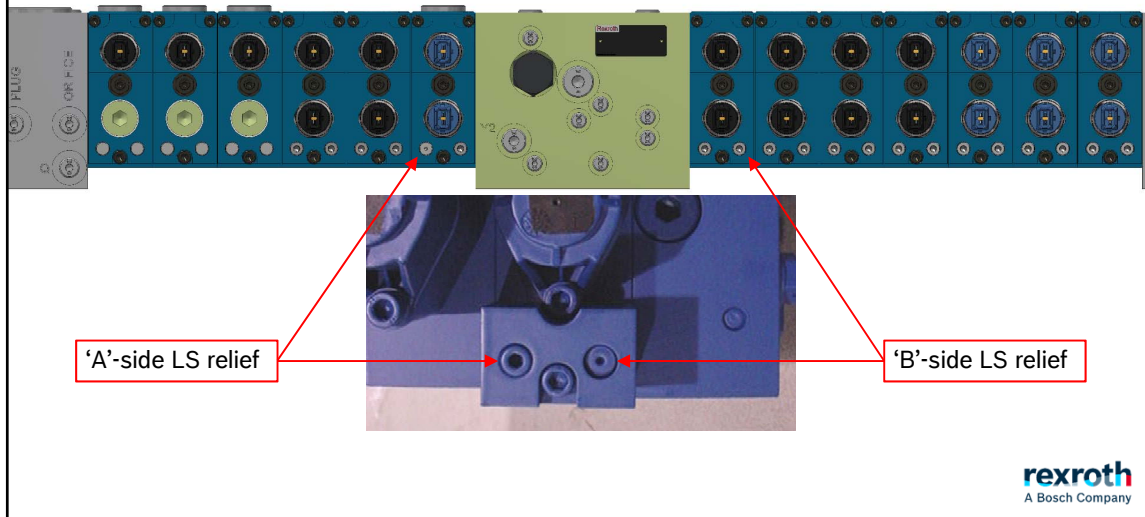
C-S: M4-12: LS relief valve options (opposite face of working ports)








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M4-12 230106

M4-12 LS Reliefs for a mechanical or pneumatic section (mechanical shown below, photo), electro-hydraulic above



C-S: M4-12 LS relief valve options

- | | | |
|---|---|--|
| A |  | LS relief valve (50-150 bar) with LS drilled housing, R900890249 |
| B |  | LS relief valve (150-350 bar) with LS drilled housing, R900890248 |
| C |  | LS Unloading Plug (drain or bleed). Used when we want to bleed the LS signal such that pump stays on standby with LS, R900729941 |
| D |  | Plug for LS function with LS drilled housing, R900724246 |
| E |  | Plug for LS function without LS drilled housing, R901005193 (only for electro-hydraulic non LS housing) |

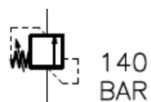
Viton 'O'-ring for all of the above: R900007038 (1x each)

C-S: M4 valve: LS relief type A&B

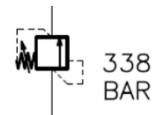
- LS relief valves – two types: 50-150 bar & 150-350 bar, identified by stamping on valve
- Minimum possible setting on low pressure version 15 - 20 bar.



150 bar version



350 bar version



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C-S: M4 valve: LS reliefs type C&D

- LS Unloading Plug (drain or bleed). Used when we want to bleed the LS signal such that pump stays on standby with LS, R900729941 (C)
- Plug for LS function with LS drilled housing, R900724246 (D)



Bleed version (C)



Small dimple on
the visual surface



Plugged version
(D)



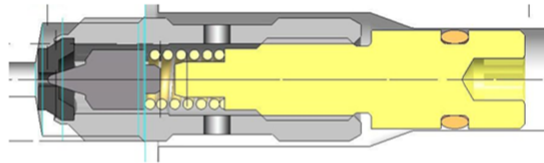
More of an hole
than a dimple,
though still no
allen key



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M4 valve pressure limits

LS pressure relief valve



- Adjustable versions are available
- Adjustable versions are for:
 - 0 – 150 bar
 - 150 – 350 bar

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M4-12 LS Reliefs, E

It is not officially a plug, for it does not thread into a housing, but when we use an Electro-hydraulic actuator without LS reliefs, we need to ensure the 'Y'-port hydraulic fluid makes its way back to the 'Y'-port and then to tank. Without these plugs, it would drain to atmosphere, an unwanted condition.



Stud version (E)



No dimple on the visual surface



102 DCCA/SLM | 04/03/2019
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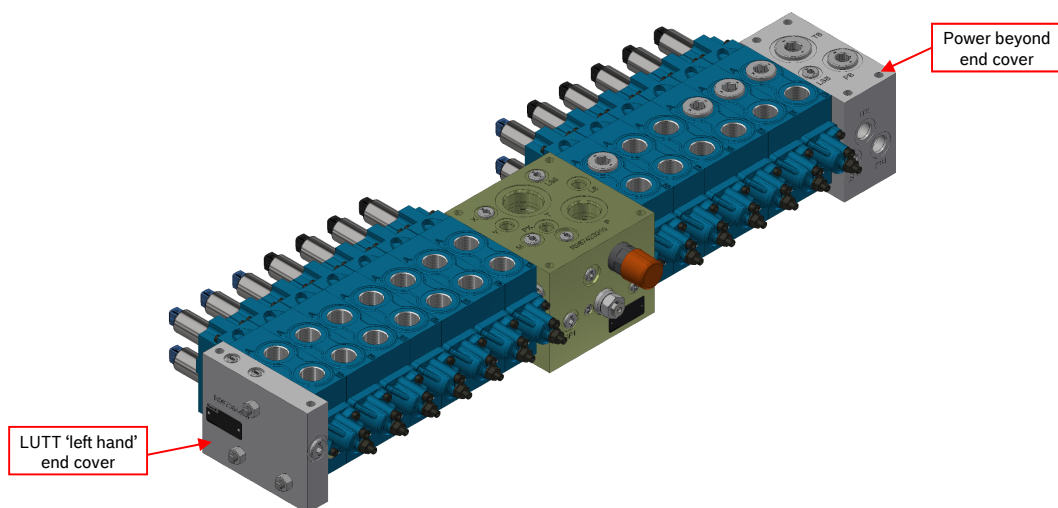
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Compu-Spread M4 valve end covers

- LATT
- LUTT
- ~~LATT LSP (special and newly designed)~~
- LZPT(TP)S1 power beyond end cover
- LZPT(TP)S2 power beyond end cover

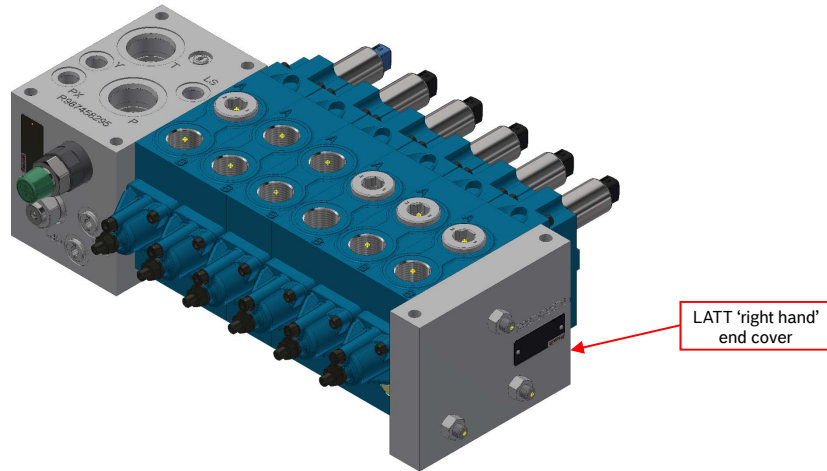
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Compu-Spread M4 valve end covers



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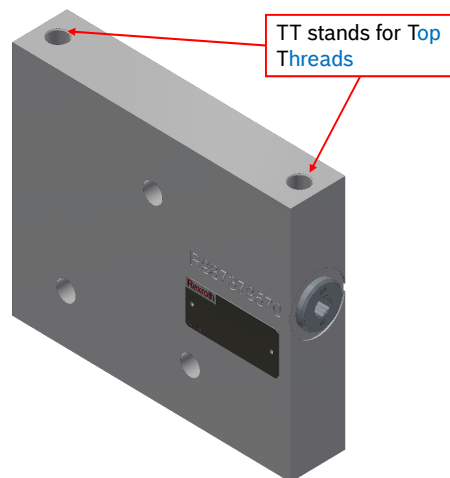
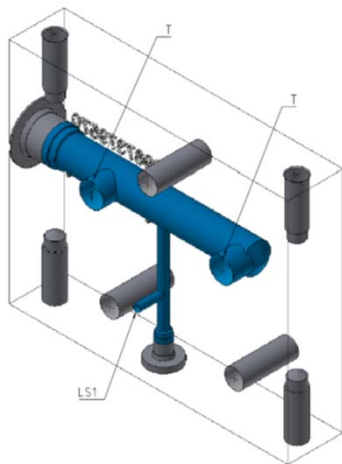
Compu-Spread M4 valve end covers



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Compu-Spread M4 valve end covers

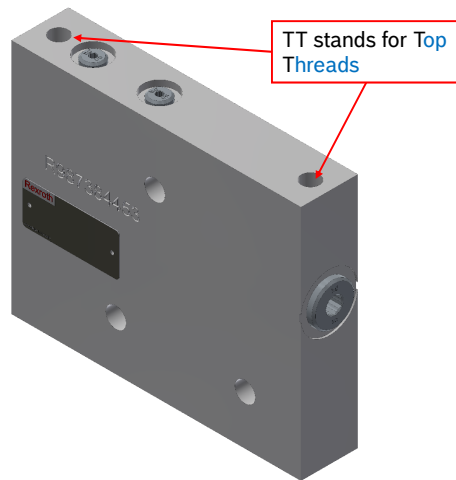
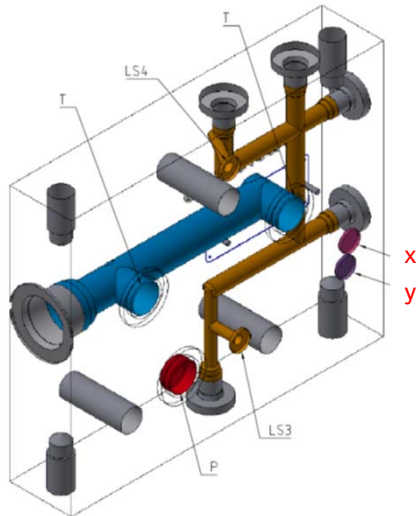
Standard LATT end cover (right side)



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Compu-Spread M4 valve end covers

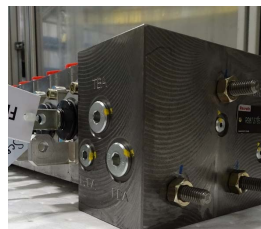
Standard LUTT end cover (left side)



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Compu-Spread M4 valve end covers

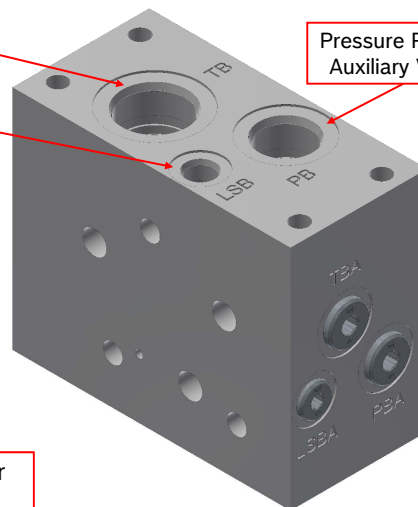
power beyond



Tank Port For
Auxiliary Valves

Load Sense Port
For Auxiliary Valves

Pressure Port For
Auxiliary Valves



Note: steel plugs are now always installed in our power beyond (instead of plastic plugs)!

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C-S: M4 valve with power beyond

- CS-M4-12-2X/LZPT(TP) S1 B19; LS signal bleed open (R987379572)
- CS-M4-12-2X/LZPT(TP) S2 B19; LS signal bleed plugged (R987379573)



older version

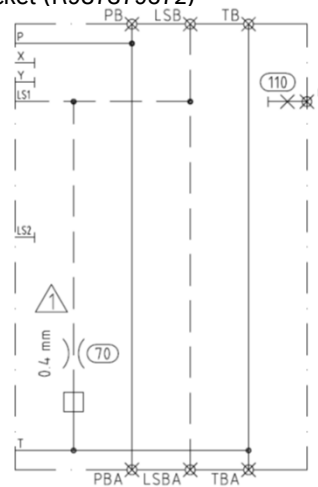


newer version with 'Q' pocket

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Compu-Spread: M4 valve with power beyond

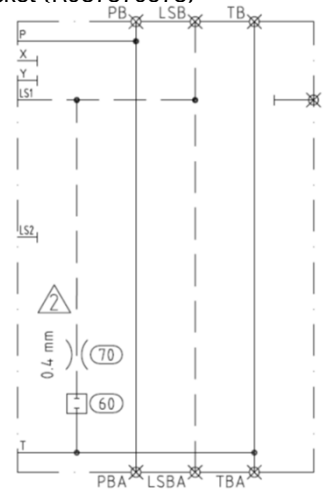
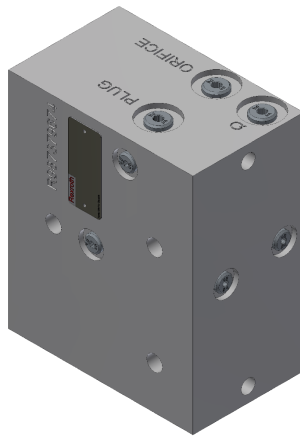
- the "NEW" S1 version with the 'Q'-pocket (R987379572)



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Compu-Spread: M4 valve with power beyond

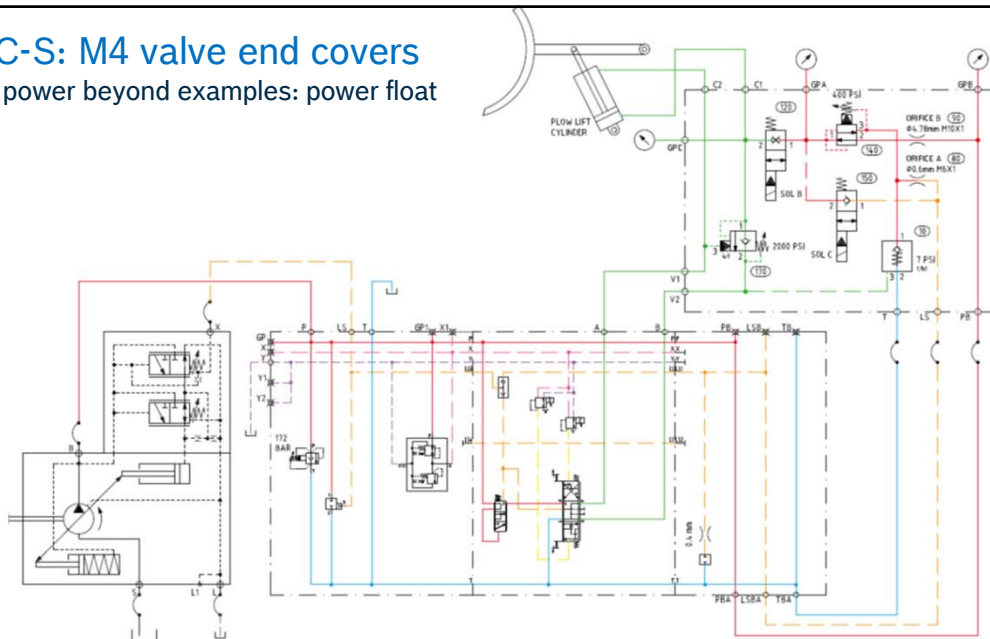
- the “NEW” S2 version with the ‘Q’-pocket (R987379573)



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C-S: M4 valve end covers

power beyond examples: power float



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Compu-Spread: M4 painting



Paint RAL 9004 black