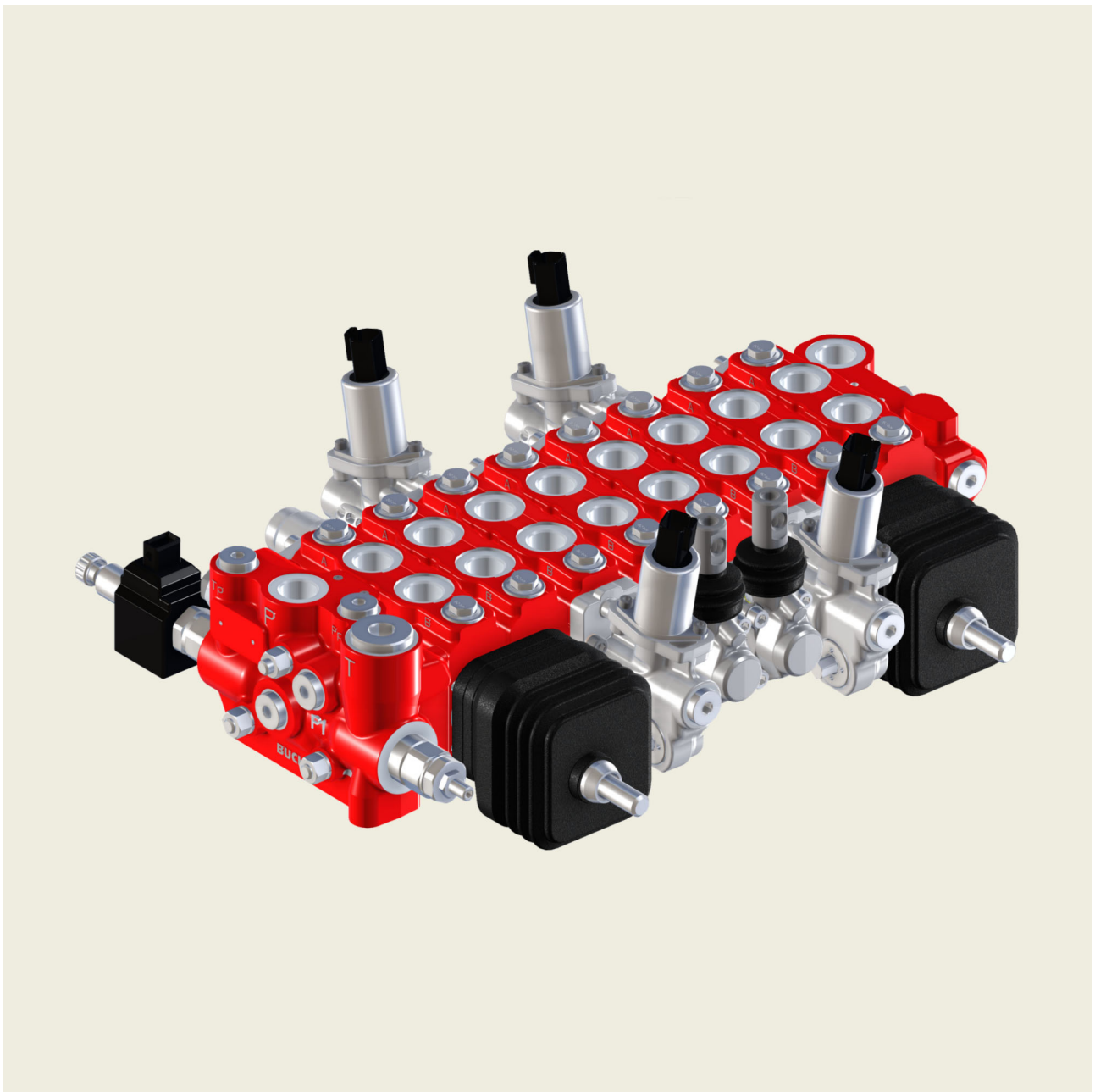


## Directional Control Valve HDS16



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### 1 General information

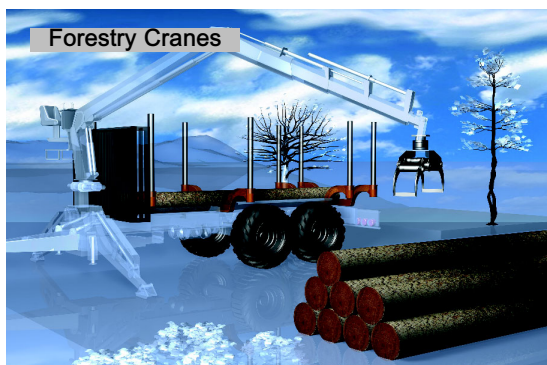
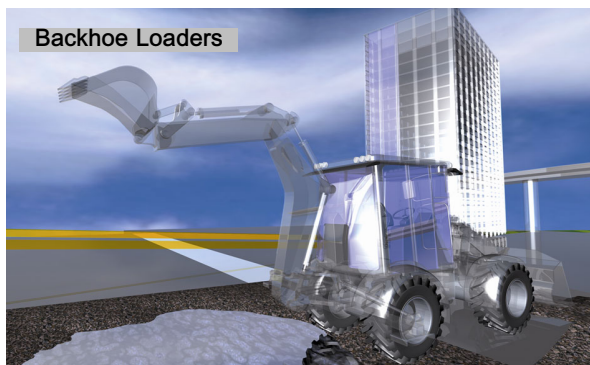
#### 1.1 Introduction

Bucher Hydraulics HDS15 directional valve series has been market leader in a wide range of hydraulic applications for more than 20 years thanks to its extreme flexibility, outstanding control performances and application oriented unique features.

HDS16 is a step forward in this successful experience taking advantage of the gained know-how and following the market trends: lower pressure drops, increased pressure

rating, electro-hydraulic open loop controls internal piloted in combination with emergency lever and direct ON-OFF controls increased performances.

Our customer can still rely on the outstanding features and flexibility they are accustomed to but can also look to the future configuration of the machines hydraulic circuit taking advantage of the innovative options made possible by the new product.



## 1.2 Directional valve installation

For the installation of the directional control valve on the equipment frame it is important to consider the following recommendations:

- the valve can be assembled in any position but, in order to avoid deformations and spool sticking, the surface on which the product is mounted has to be flat;
- before connecting pipelines, make sure that the pipeline hollows as well as fittings and seals are thoroughly clean; check also that the work ports are protected until the connection of the pipelines
- during assembly and servicing operations, it is

necessary to adopt clean procedures and work in an environment free of chips, swarf, dust and other possible source of pollution;

- if the spools are connected to the equipment controls through linkages, make sure that they do not affect their operations;
- before painting the valve, check that the work port plastic plugs are tightly in place;
- do not use high pressure jet washer directly on the valve to prevent water infiltration inside lever and spool caps.

## 1.3 Fittings

In the interest of safety, only fittings with STRAIGHT THREAD ENDS should be used.

Fittings with TAPERED THREAD ENDS should never be used, as they can cause deformation and cracks in the valve body.

Warranty conditions will not be valid in case tapered fittings are used.

The work port adaptors have to be fastened respecting the tightening torque values indicated in the following table (for different port types contact our Sales Dept.):

Cavity	Recommended tightening torque for work port fittings - Nm / lbf				
	M10X1	M14X1.5	M18X1.5	M22X1.5	M27x2
Metric - ISO 261					
With O-Ring seal (ISO 6149-1)	15 / 11.1	30 / 22.1	40 / 29.5	60 / 44.3	90 / 66.4
With copper washer (ISO 9974-1)	15 / 11.1	30 / 22.1	40 / 29.5	60 / 44.3	90 / 66.4
With rubber washer or steel (ISO 9974-1)	15 / 11.1	25 / 18.4	35 / 25.8	60 / 44.3	70 / 51.7
BSP - ISO 228-1	1/8" BSP	1/4" BSP	3/8" BSP	1/2" BSP	3/4" BSP
With copper washer (ISO 1179-1)	15 / 11.1	30 / 22.1	40 / 29.5	60 / 44.3	90 / 66.4
With rubber washer or steel (ISO 1179-1)	15 / 11.1	25 / 18.4	35 / 25.8	60 / 44.3	70 / 51.7
UN-UNF - ISO 263	SAE4 7/16-20 UNF	SAE6 9/16-18 UNF	SAE8 3/4-16 UNF	SAE10 7/8-14UNF	SAE12 1-1/16-12UNF
With O-Ring seal (ISO 11926-1)	10 / 7.4	30 / 22.1	40 / 29.5	60 / 44.3	90 / 66.4



**IMPORTANT!:** Tightening torques depends on several different factors including lubrication, coating and surfaces finish. The fitting manufacturer shall be consulted.

## 1.4 Hydraulic fluid

The main function of the fluid used in hydraulic systems is to transfer energy but it performs also other important functions: protect the components from corrosion, lubricate the directional valve moving parts, remove particles and heat from the system.

In order to ensure proper operation and long life of the system it is important to choose the correct hydraulic fluid with proper additives.

Bucher Hydraulics recommends to use a mineral based oil

according to type HM (ISO 6743/4) or type HLP (DIN 51524) only.

The system should be operated only with hydraulic oil containing anti-foaming and antioxidant additives. Before using other types of fluid, please contact our Sales Dept, since they can cause serious damage to the directional valve components and jeopardize the correct function of the system.

### 1.5 Filtration

In order to ensure proper operation and long life of the directional valve components it is extremely important to provide a proper and effective filtration of the hydraulic fluid. It is advisable to follow filter manufacturers instructions and recommendations.

The fineness of the filter should be selected in order to maintain the fluid contamination level according to the values listed at section 1.7.1 (Technical specification)

### 1.6 Directives and standards

#### - PED (97/23/EC)

The pressure relief valves assembled into the directional control valve cannot be considered and/or confused with the safety valve when the PED Directive is applied to the hydraulic system.

#### - Atex



Attention: The equipment and protective systems of this catalogue ARE NOT intended for use in potentially explosive atmospheres. Ref: Directive 99/92/EC and Directive 2014/34/UE

Particular attention has to be paid to the cleaning of the machine hydraulic circuit and its components before the first run-in, since the presence of foreign materials could cause damages to the directional valve components even if a proper filtration is provided.

#### - ISO 9001:2015 / ISO 14001:2015

Bucher Hydraulics S.p.A. is certified for research, development and production of directional control valves, power units, gear pumps and motors, electro pumps, cartridge valves and integrated manifolds for hydraulic applications.

## 1.7 Hydraulic system

### 1.7.1 Technical specification



**IMPORTANT!:** Parameter values and diagrams shown in this catalogue have been measured with mineral oil having a viscosity of 23 mm<sup>2</sup>/s at 50° C

Features		
Nominal flow range		60 l/min (15 US gpm)
Max inlet pressure (P) <sup>1)</sup>		300 bar (4300PSI)**
Max work port pressure (A/B) <sup>1)</sup>		320 bar (4640 PSI)
Max back pressure (T)	standard	30 bar (430 PSI)
	with ON-OFF control	20 bar (290 PSI)
	with electro-hydraulic positioner (EHO)	10 bar (145PSI)
Max internal leakage A/B→T (at 100 bar/1450 PSI, 23 mm <sup>2</sup> /s) <sup>2)</sup>	standard section without port valves	14 cc/min (*) (0.854 Cu In/min)
	standard section with port valves	19 cc/min (*) (1.139 Cu In/min)
	ON-OFF section without port valves	35 cc/min (2.492 Cu In/min)
	ON-OFF section with port valves	40 cc/min (2.634 Cu In/min)
Fluid		mineral based oil (see 1.4 )
Fluid temperature (with NBR seals)		-20°C / +80°C (-4° to 176° F)
Contamination class		21/19/16 ISO4406:1999 (NAS 1638 class 10)
Contamination class with electro-hydraulic and direct ON-OFF controls		20/18/15 ISO 4406:1999 (NAS 1638 class 9)
Viscosity operating range	recommended	from 15 to 75 mm <sup>2</sup> /s
	admissible	from 12 to 400 mm <sup>2</sup> /s
Max number of elements		10
Ambient temperature in operating conditions:	with mechanical/hydraulic/pneumatic controls	from -30 to +60 °C
	with electric/electrohydraulic devices	from -30 to +50 °C
Tie-rods tightening torque		18 <sup>+2</sup> Nm

For different operating conditions, please contact our Sales Dept.

1) Fatigue tested according to internal procedure at 1.16x rated pressure on 5 samples for 1' 000' 000 cycles.

For work port sizes bigger than ½" BSP and for specific modules (TH) the rated pressure is limited to a lower value (see the correspondent paragraphs)

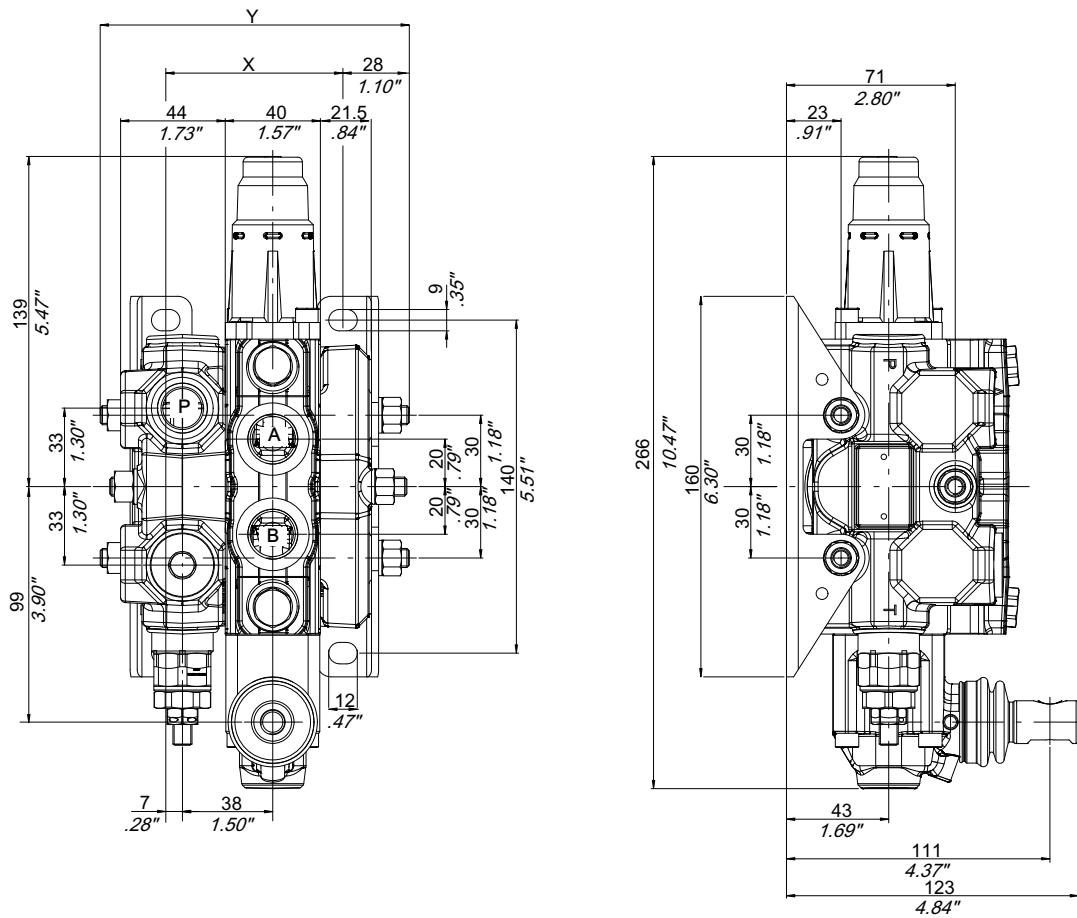
2) Spool leakage values are strongly influenced by fluid viscosity with a linear inversed relationship: 10 cc/min at 100 bar and 23 cSt become roughly 5 cc/min at 100 bar and 46 cSt.

(\*) Lower values can be provided on demand

(\*\*) For direct on-off version see operating limit diagrams at section 4.5

## 1.8 Dimensional data

### 1.8.1 Manual operated

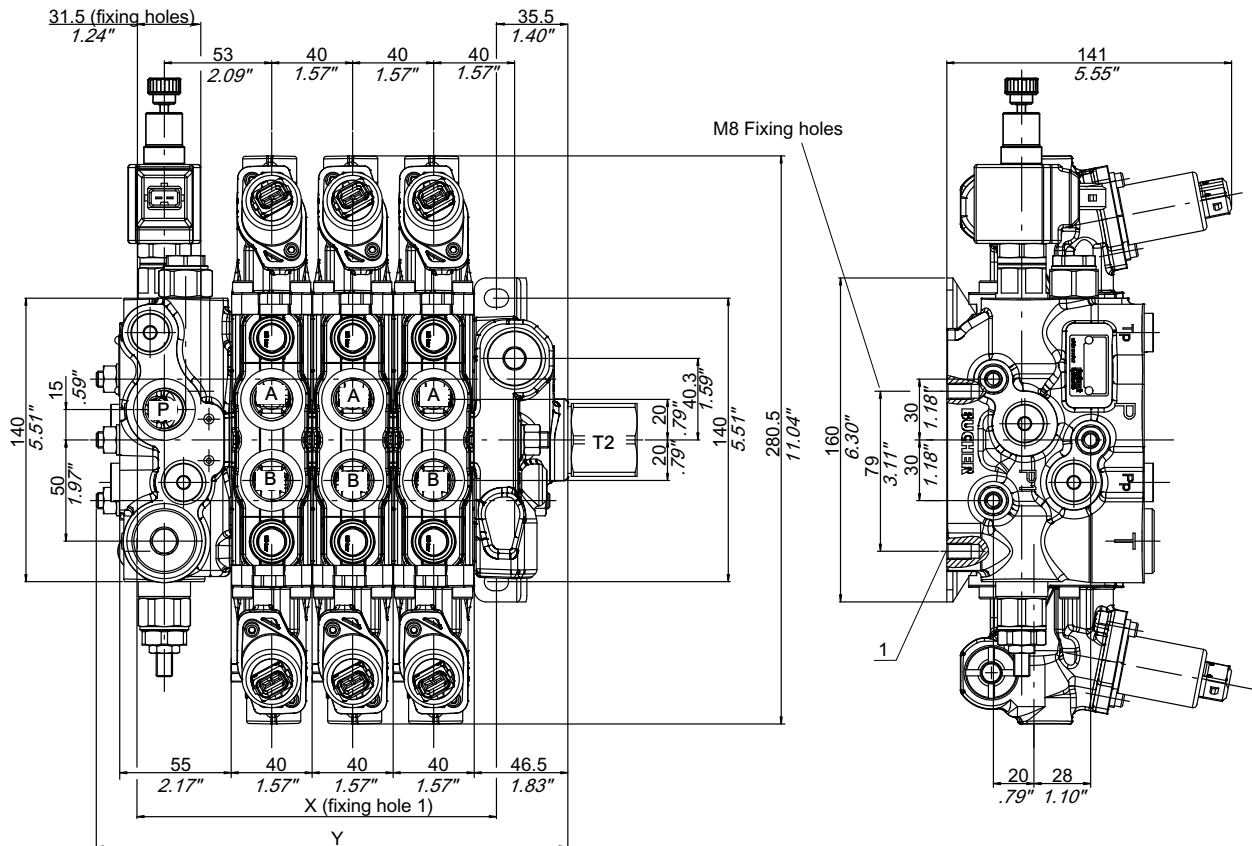


Dimensions with standard inlet and basic outlet

N° of section		/1	/2	/3	/4	/5	/6	/7	/8	/9	/10
X	mm	74.5	114.5	154.5	194.5	234.5	274.5	314.5	354.5	394.5	434.5
	inches	2.93	4.51	6.08	7.66	9.23	10.81	12.38	13.96	15.53	17.11
Y	mm	130	170	210	250	290	330	370	410	450	490
	inches	5.12	6.69	8.27	9.84	11.428	12.99	14.57	16.14	17.72	19.29



1.8.2 Electro-hydraulic operated

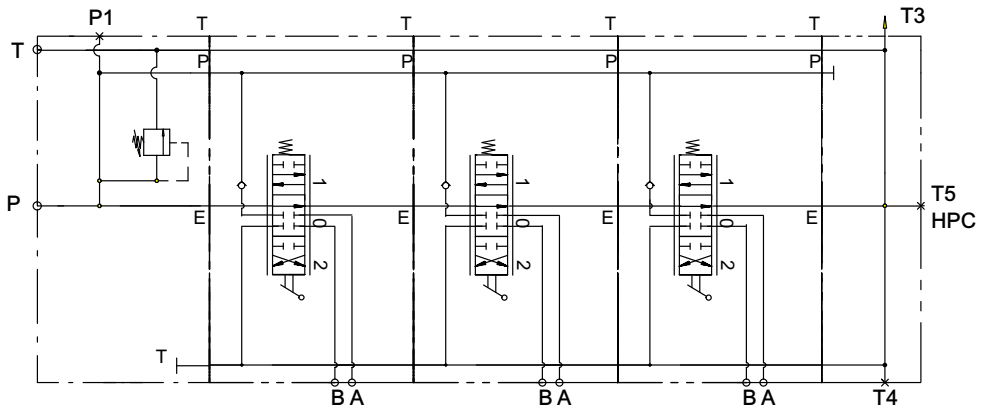


Dimensions with premium inlet and PH outlet

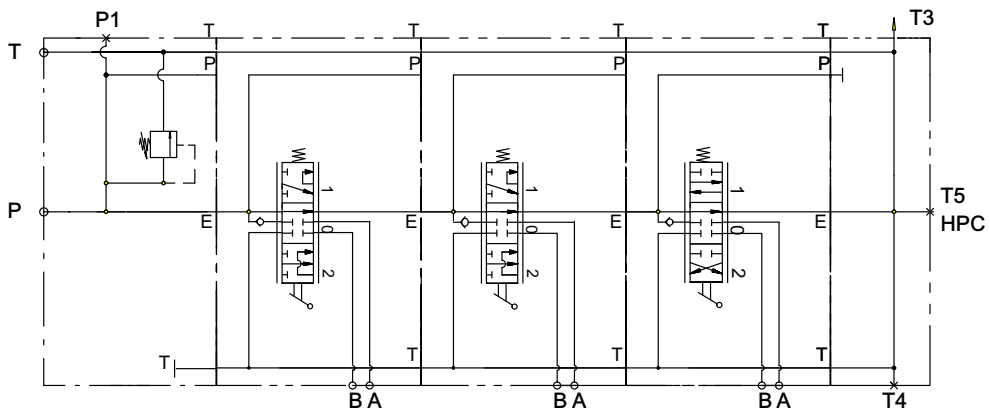
N° of section		/1	/2	/3	/4	/5	/6	/7	/8	/9	/10
X	mm	97.5	137.5	177.5	217.5	257.5	297.5	337.5	377.5	417.5	457.5
	inches	3.84	5.41	6.99	8.56	10.14	11.71	13.29	14.86	16.44	18.01
Y	mm	152.5	192.5	232.5	272.5	312.5	352.5	392.5	432.5	472.5	512.5
	inches	6	7.58	9.15	10.72	12.30	13.88	15.45	17.03	18.60	20.18

## 1.9 Hydraulic circuits combination examples

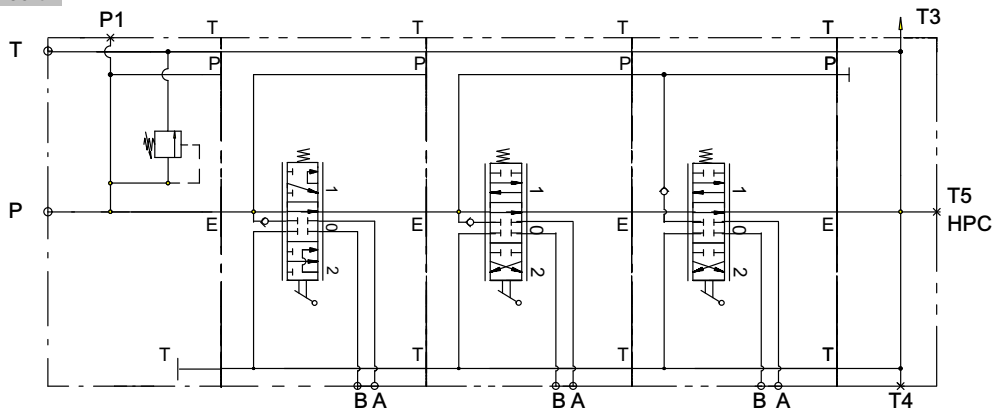
Parallel circuit



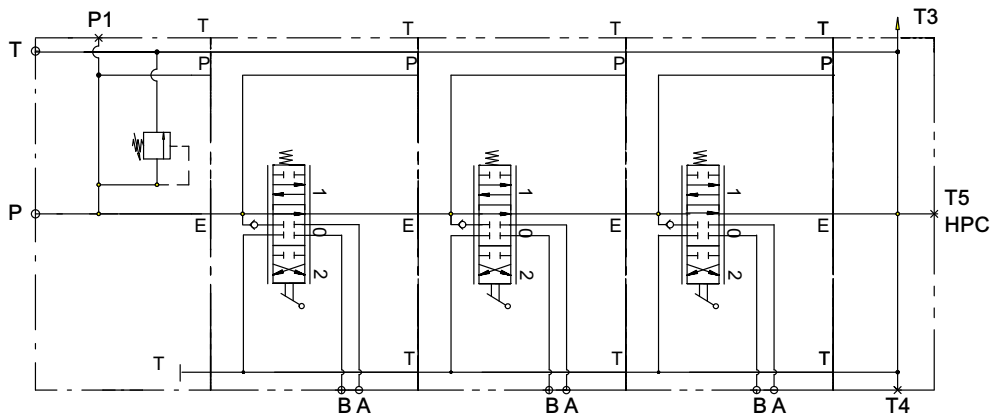
Series circuit



Series/parallel circuit



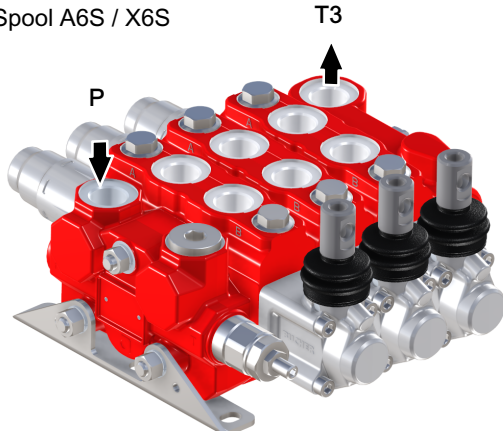
Tandem circuit



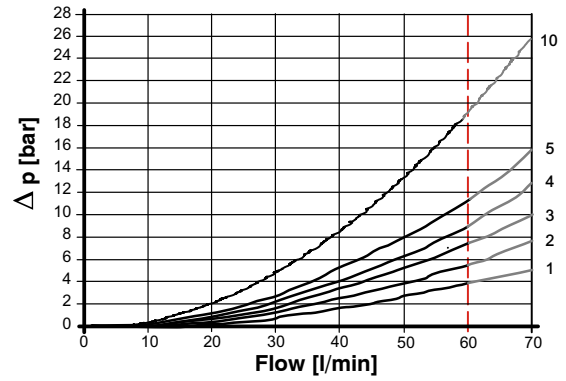
## 1.10 Performance data

### 1.10.1 Open centre P → T3

Parallel and series circuits -  
Spool A6S / X6S

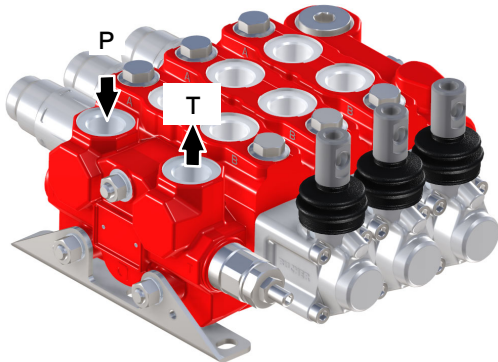


Pressure drop: P → T3

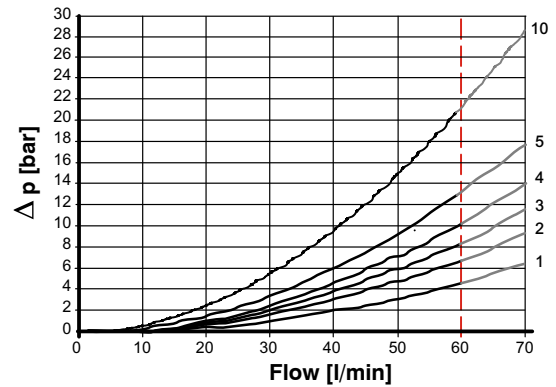


### 1.10.2 Open centre P → T

Parallel and series circuits -  
Spool A6S / X6S

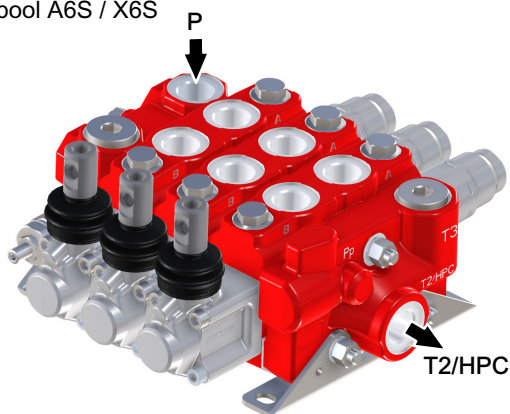


Pressure drop: P → T

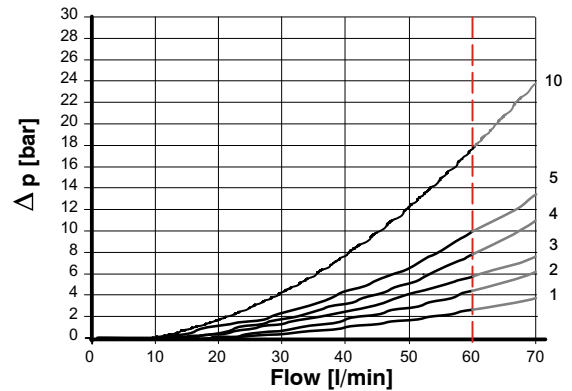


### 1.10.3 Carry over (HPC)

Parallel and series circuits -  
Spool A6S / X6S

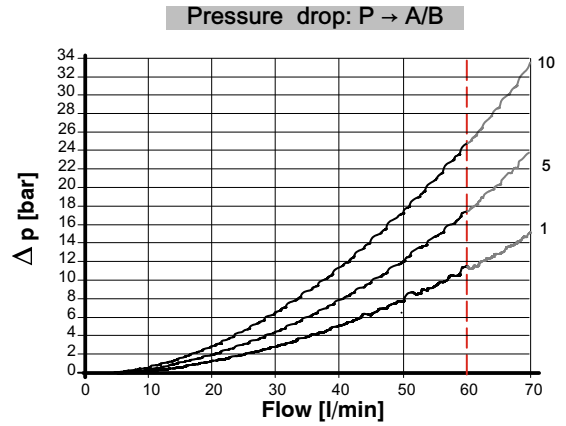
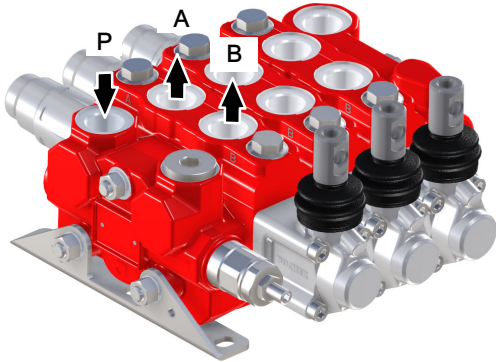


Pressure drop: P → T2/HPC



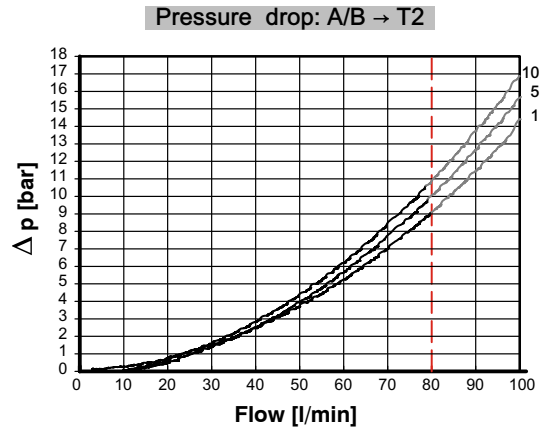
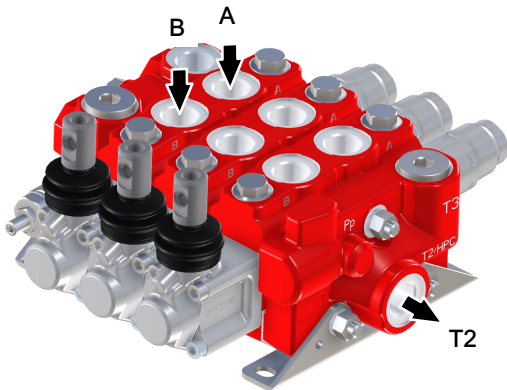
## 1.10.4 Inlet to work port A/B

Parallel and series circuit - Spool A6S/X6S

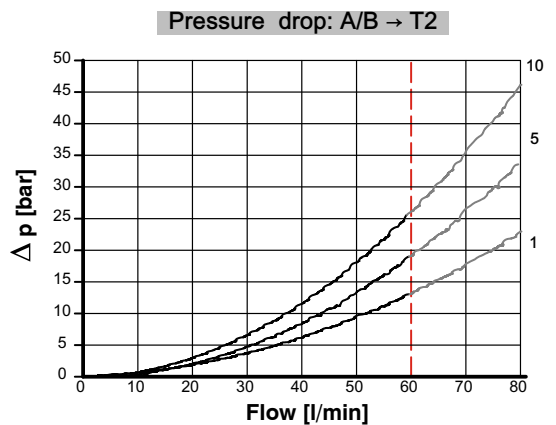
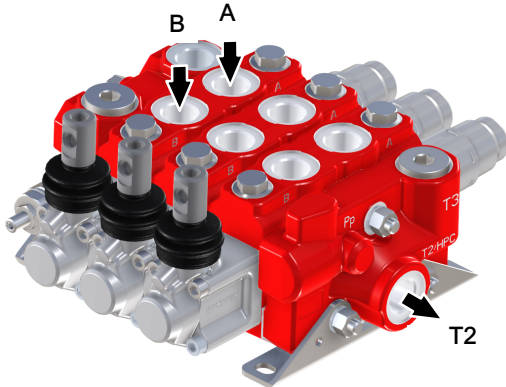


## 1.10.5 A/B work port to outlet "T2"

Parallel circuit - Spool A6S

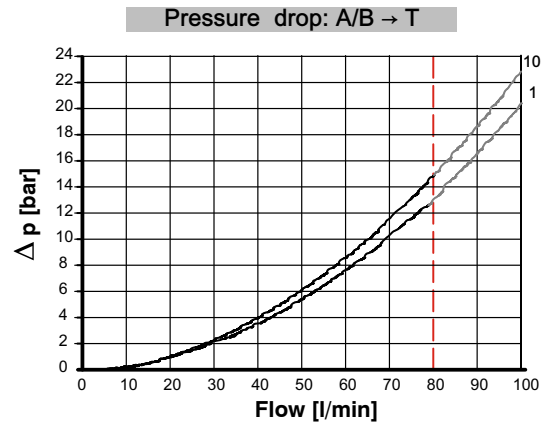
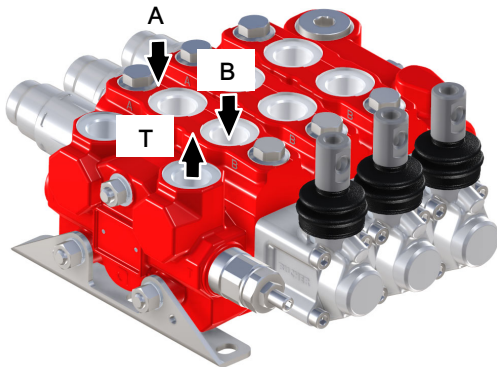


Series circuit - Spool X6S

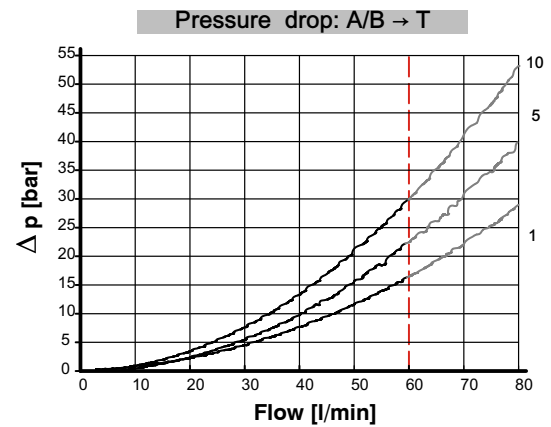
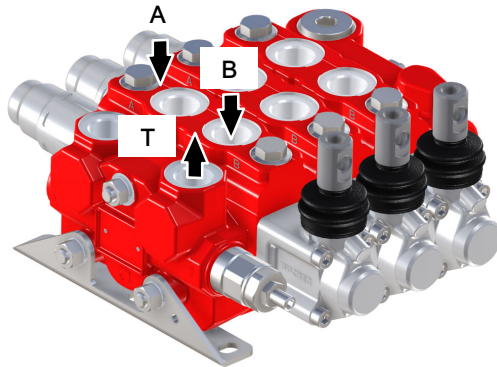


1.10.6 A/B work port to outlet "T"

Parallel circuit - Spool A6S



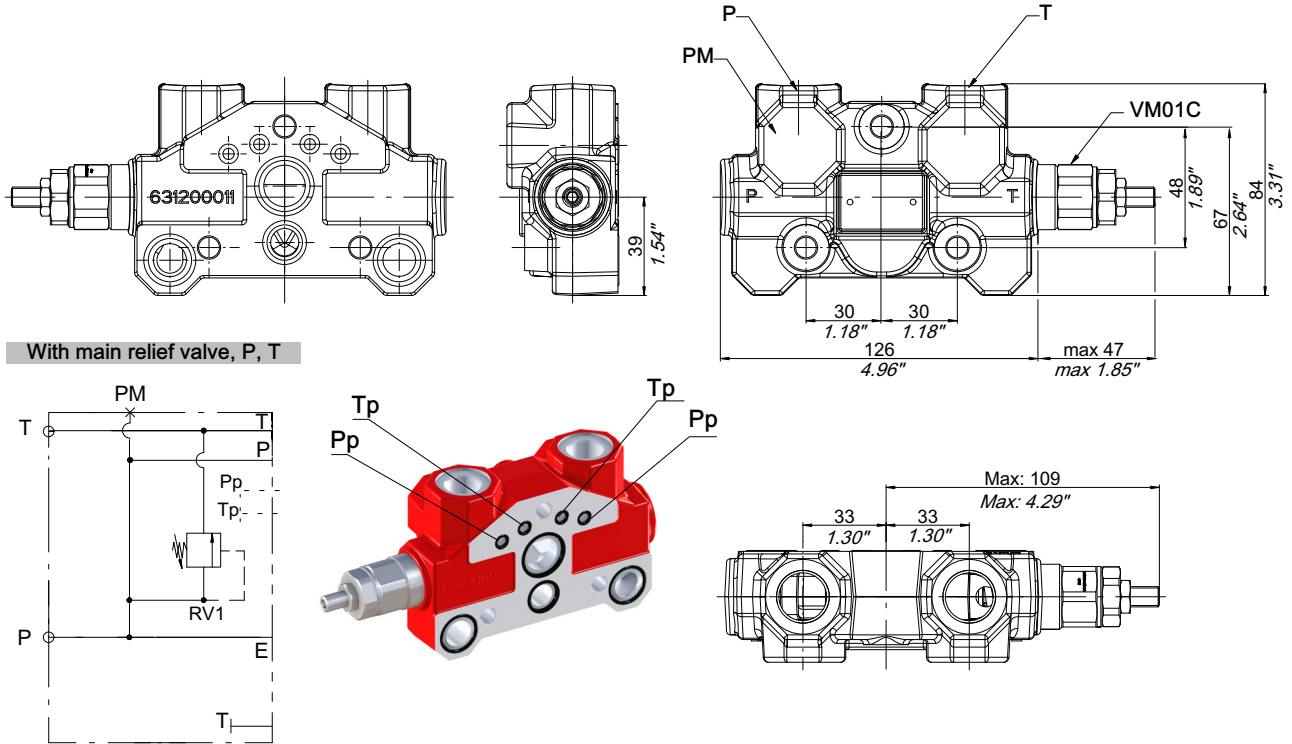
Series circuit - Spool X6S



## 2 Inlet covers

### 2.1 Inlet cover - TH

Basic inlet cover with relief valve



Type	P	T	PM
TH 101	1/2" BSP	1/2" BSP	-
TH 102	1/2" BSP	1/2" BSP	1/4" BSP
TH 701	3/8" BSP	3/8" BSP	-
TH 702	3/8" BSP	3/8" BSP	1/4" BSP
TH 801	M18x1.5	M18x1.5	-
TH 802	M18x1.5	M18x1.5	M14x1.5
TH 901	SAE8	SAE10	-
TH 902	SAE8	SAE10	SAE6

Max inlet pressure (P)<sup>1)</sup>

250 bar (3600 PSI)

Type	P	T	PM
TH 301	SAE10	SAE10	-

Max inlet pressure (P)<sup>1)</sup>

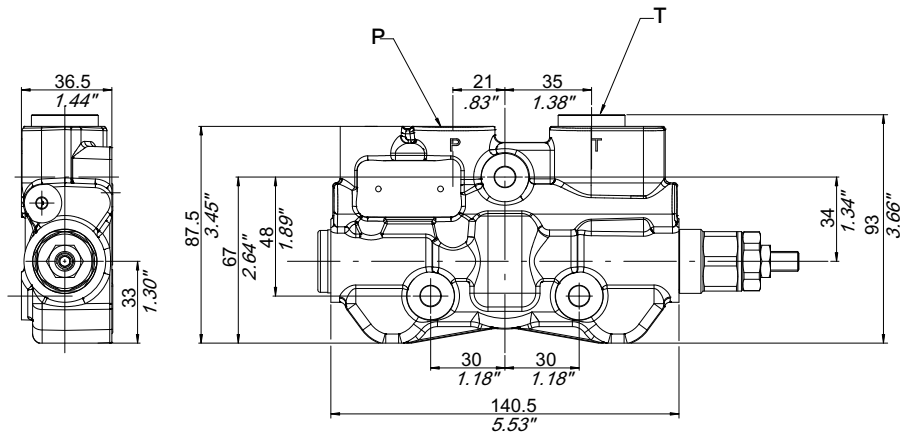
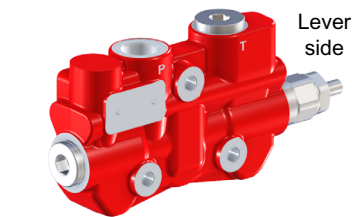
200 bar (2900 PSI)

1) Fatigue tested according to internal procedure at 1.16x rated pressure on 5 samples for 1'000'000 cycles.

## 2.2 Inlet cover - T6H

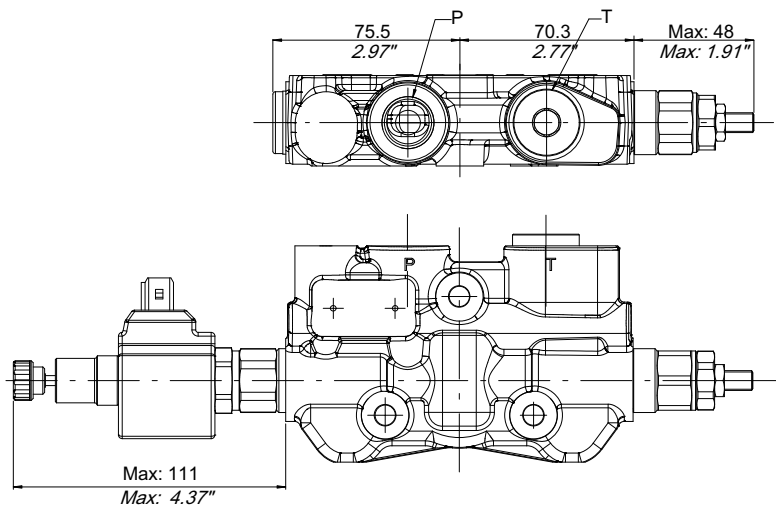
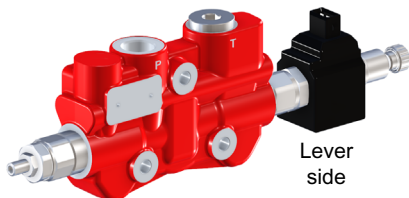
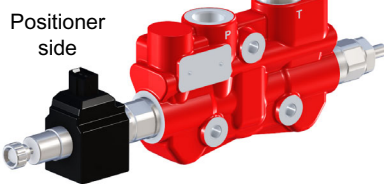
Basic inlet cover with relief valve and unloading valve

With relief valve RV



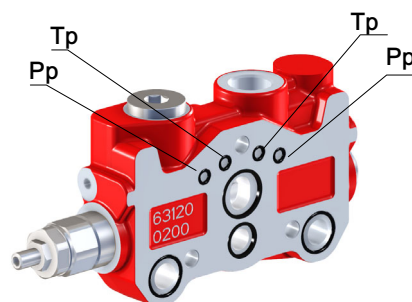
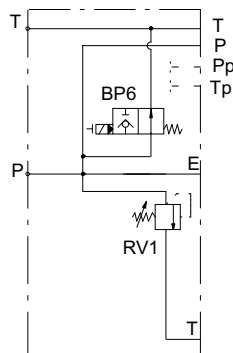
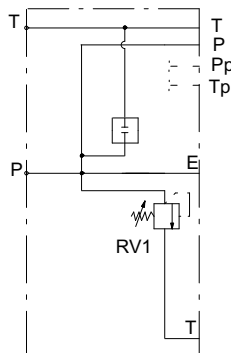
RV = adjustable relief valve

With BP6 valve



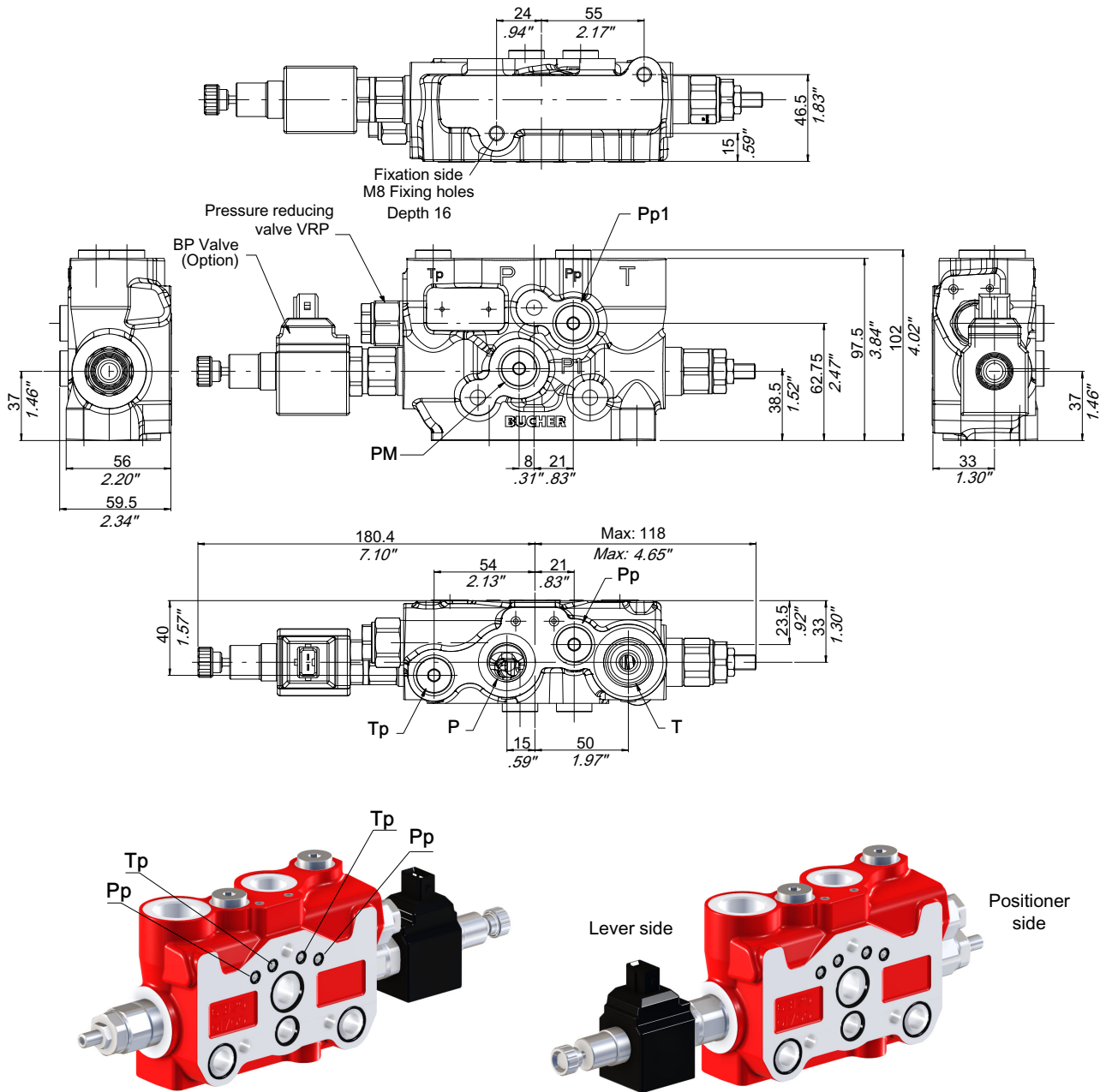
BP = by-pass valve

Type	P	T
T6H 101	1/2" BSP	1/2" BSP
T6H 801	M18x1.5	M22x1.5
T6H 901	SAE8	SAE10



## 2.3 Inlet cover - TP

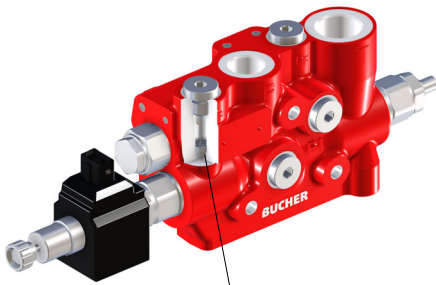
Inlet cover with pilot oil supply pressure reducing valve and unloading valve



RV = adjustable relief valve  
BP = by-pass valve

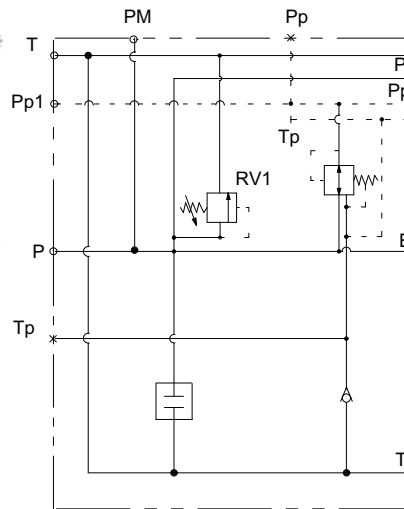
Type	P	T	PM	Pp	Pp1	Tp
TP101	1/2" BSP	3/4" BSP	1/4" BSP	1/4" BSP	1/4" BSP	1/4" BSP
TP301	M22x1.5	M22x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5
TP501	SAE10	SAE10	SAE4	SAE4	SAE4	SAE6



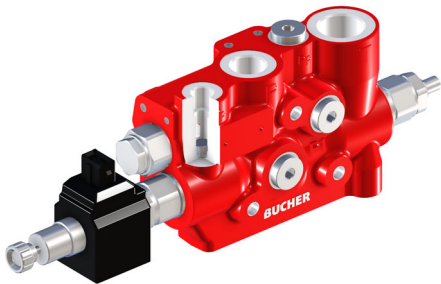
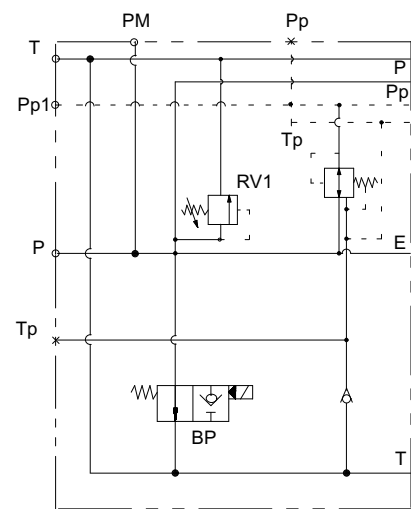


Check valve M10x1  
Code 200787603100

TEST 16 TP\_01 15GR VC  
XX C PM PP1 32 PO TO

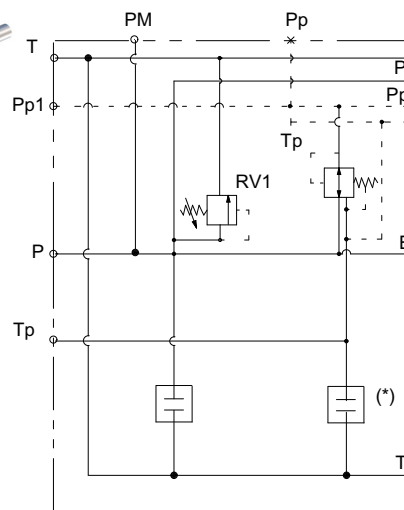


TEST 16 TP\_01 15GR AE 12A-  
XX C PM PP1 32 PO TO

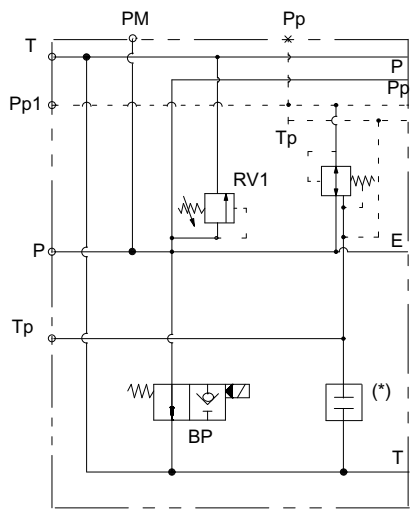


(\*) without external plug

TEST 16 TP\_01 15GR VC  
XX T PM PP1 32 PO TO



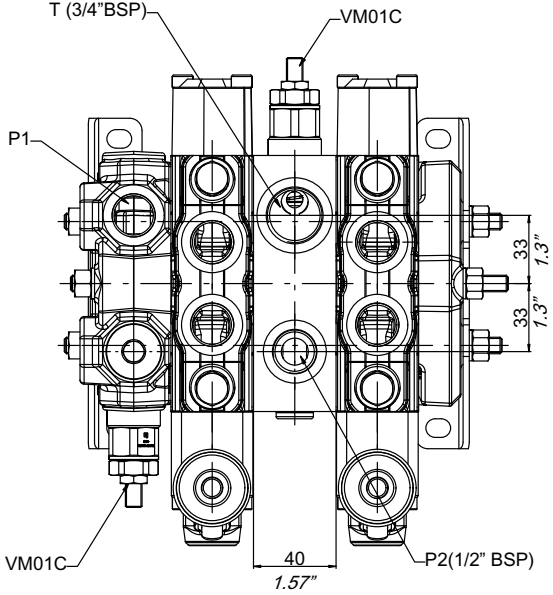
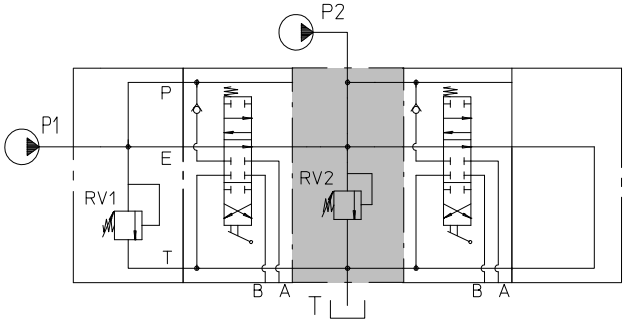
TEST 16 TP\_01 15GR AE  
12A-XX T PM PP1 32 PO TO



2.4 Intermediate inlet section - TI

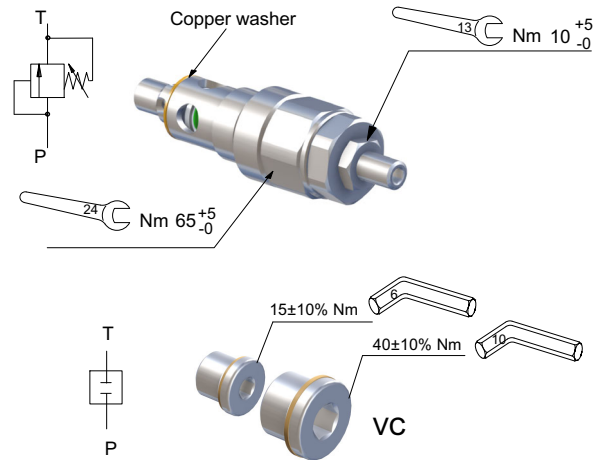
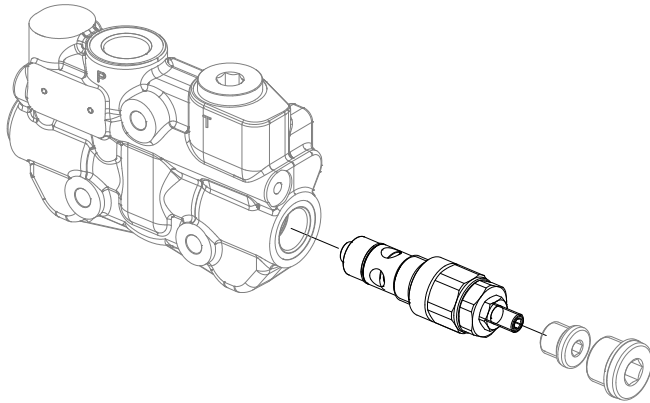
2.4.1 Intermediate inlet section with pressure relief valve

Type
TI**

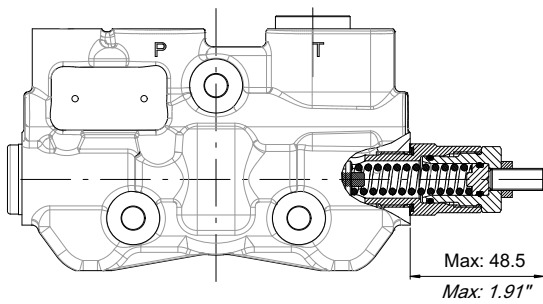


## 2.5 Inlet cover valves

### 2.5.1 Direct acting relief valve - VM01C

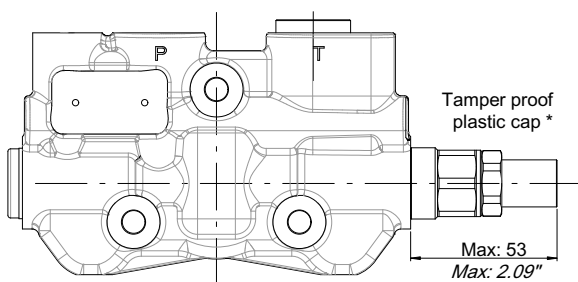


Check the correct position of the front copper washer and tighten with a torque wrench at the indicated value

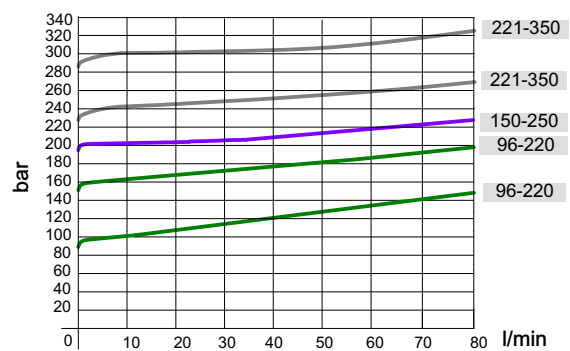


Pressure setting range bar (psi)	Type	Code
96 - 220 (1390 - 3190)	GR	200787403420
150 - 250 (2170 - 3620)	VI	200787403470
221 - 350 (3200 - 5070)	WH	200787403430
Plug	VC	200978400140

Pressure setting referred to 16 l/min

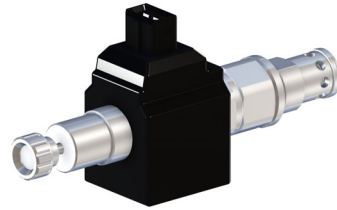
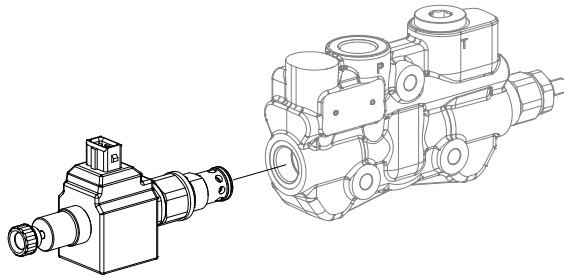


Pressure viscosity characteristic 46 cSt at 40°C

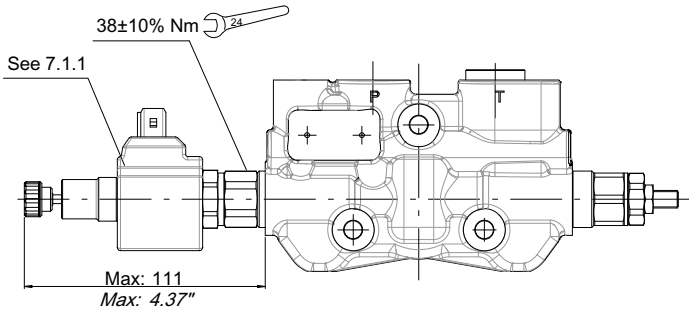


\* Supplied on demand. Code: 200678400562.

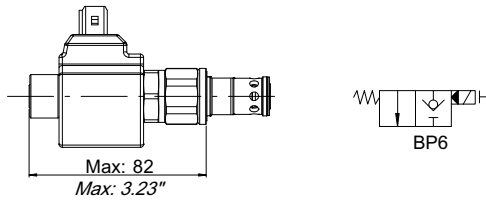
## 2.5.2 Unloading solenoid valve - BP6



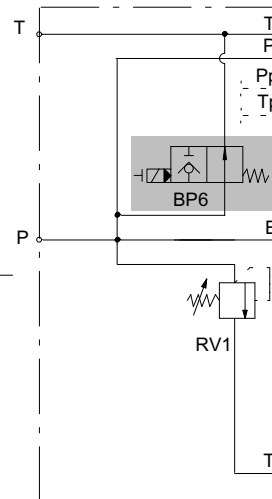
**AE TYPE**



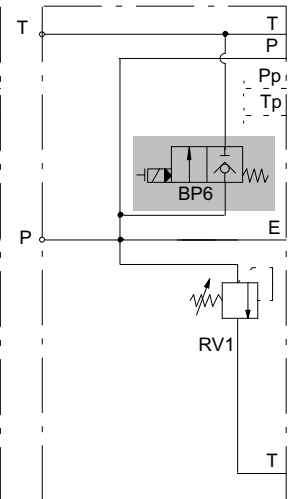
**AEP TYPE**



**Normally open**



**Normally closed**



Circuit	Manual override	Type	Code without coil
Normally open	Push pin	AEP	200542300048
	Screw (*)	AE	200542300049
Normally closed	Push pin	CEP	-
	Screw (*)	CE	-

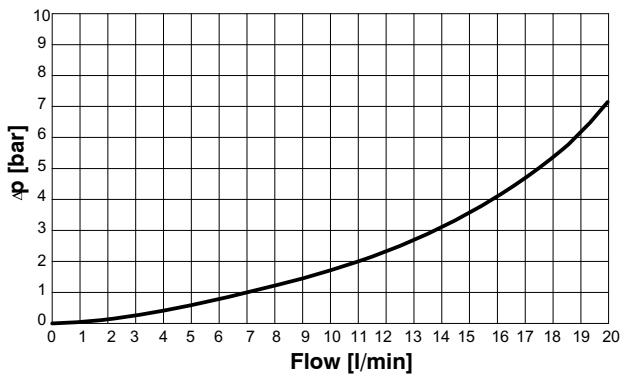
(\*) Screw type override must not be used for continuous operation but in case of emergency only. Should a version without part number be needed, please contact our Sales Dept.

2.5.3 Pressure reducing valve - VRP

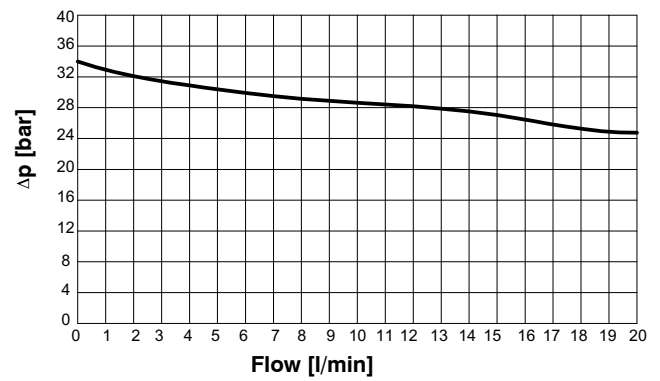


Type	Code	Nominal pressure ( bar)
VRP32	200533930174	32

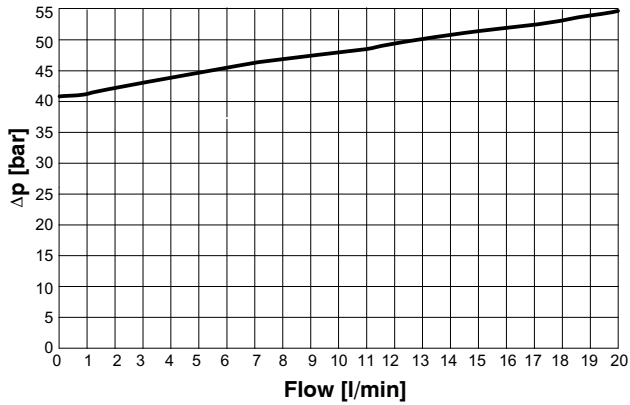
Pressure Vs. Flow Curve P → Pp (Fully open)



Pressure Vs. Flow Curve P → Pp (Reducing)



Pressure Vs. Flow Curve Pp → T (Relieving)

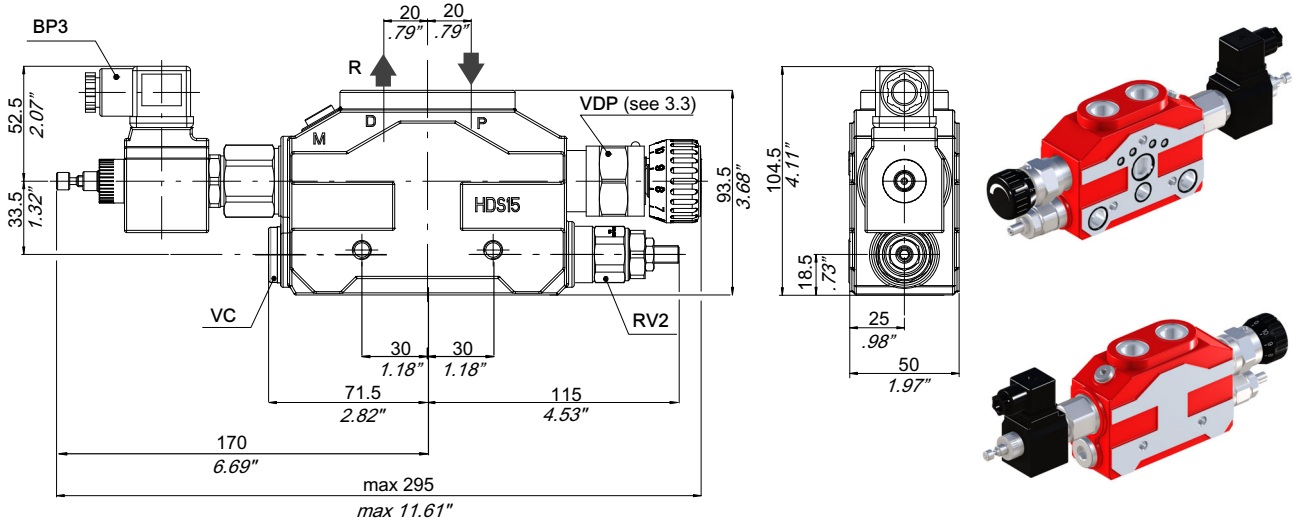


## 3 Pressure compensated flow control elements

### 3.1 Pressure and flow control inlet covers - TQ

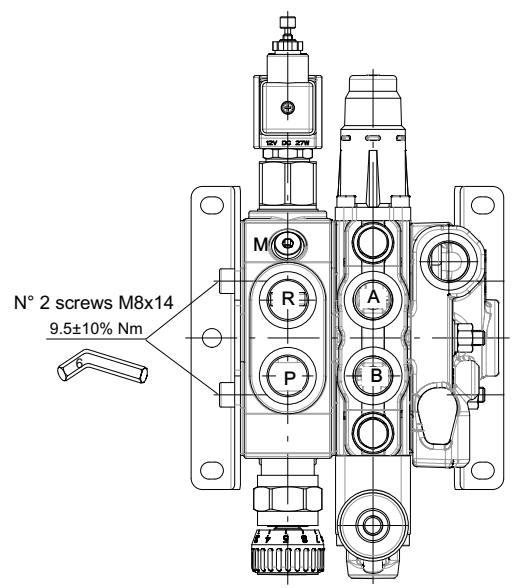
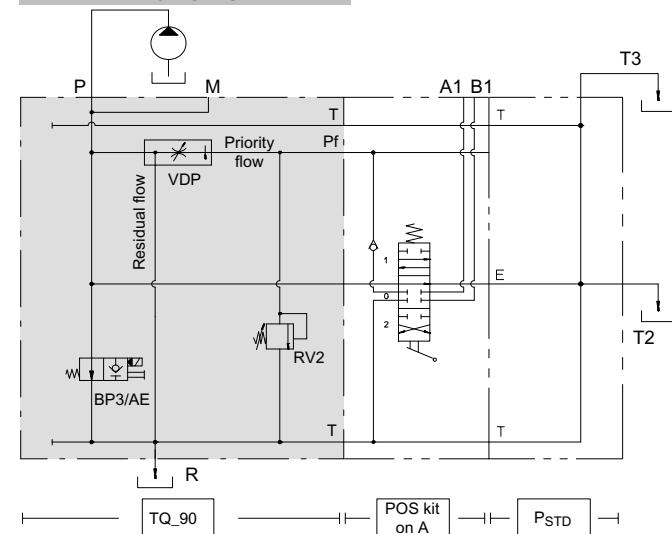
#### 3.1.1 TQ\_90

Flow regulator bypassed with spool in neutral position.  
Residual flow directly to tank (not pressurizable).



Type	HDS15 equivalent	P	R	M
TQ890	T90/1	M18x1.5	M18x1.5	1/8" BSP
TQ190	T90/3	1/2" BSP	1/2" BSP	1/8" BSP
TQ590	T909	M22x1.5	M22x1.5	1/8" BSP
TQ390	T90/5	SAE10	SAE10	1/8" BSP
Max inlet pressure (P)			250 bar	

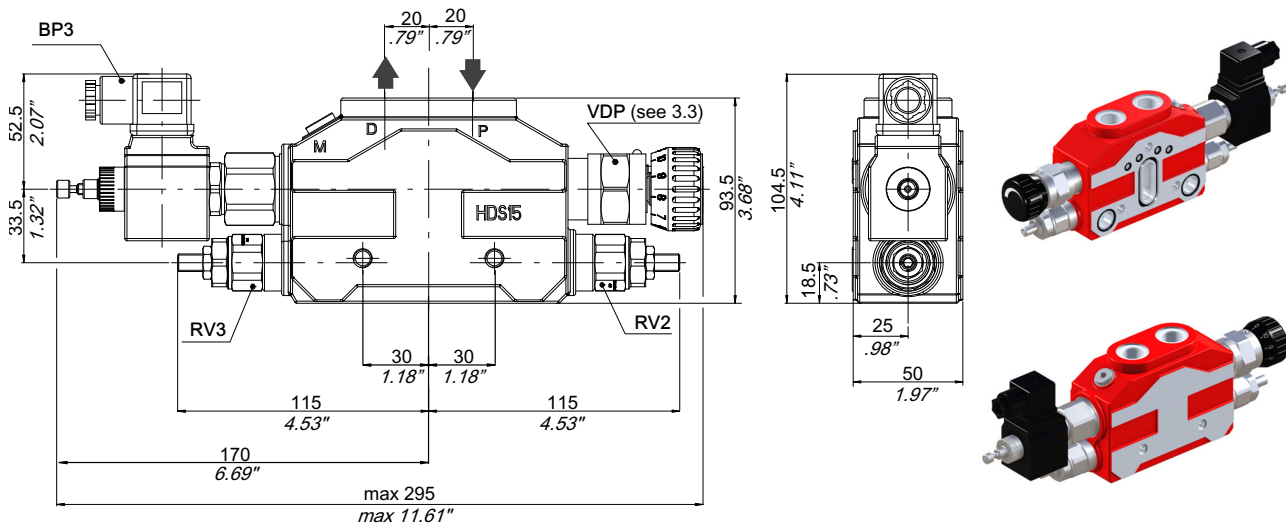
TEST 16 TQ\_90 15 VC AE 24D-V25 PO RO



R port cannot be pressurized  
Sections: positioner kit on A port to have the lever on flow regulator side

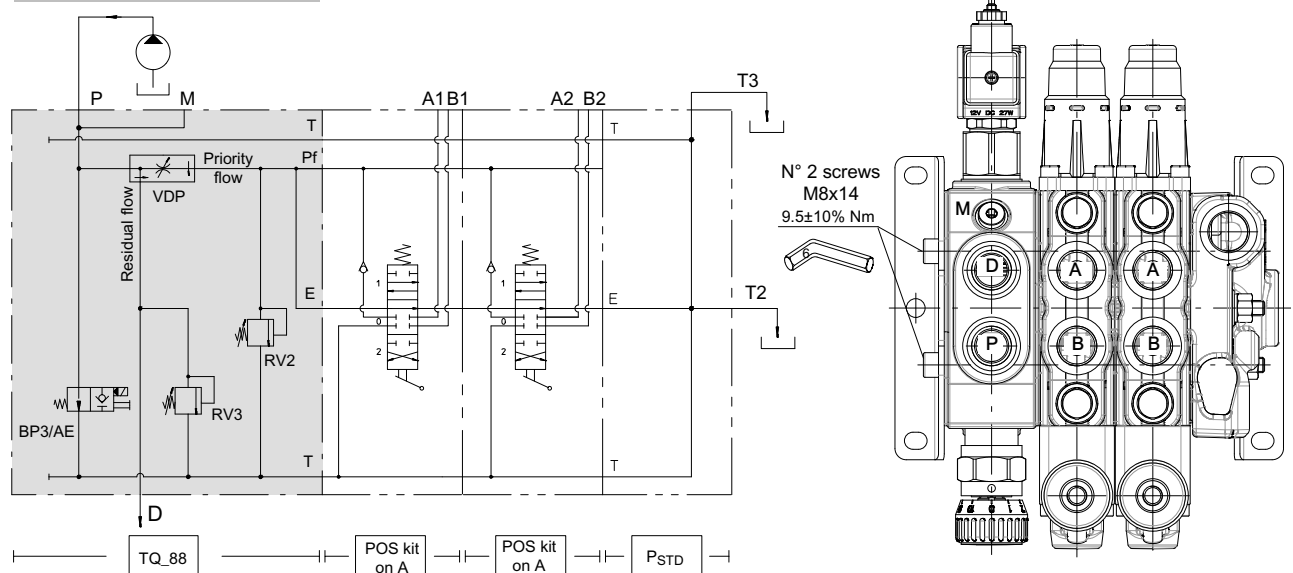
## 3.1.2 TQ\_88

Flow regulator continuously crossed.  
Residual flow can be pressurized.



Type	HDS15 equivalent	P	D	M
TQ888	T88/1	M18x1.5	M18x1.5	1/8" BSP
TQ188	T88/3	1/2" BSP	1/2" BSP	1/8" BSP
Max inlet pressure (P)			250 bar	

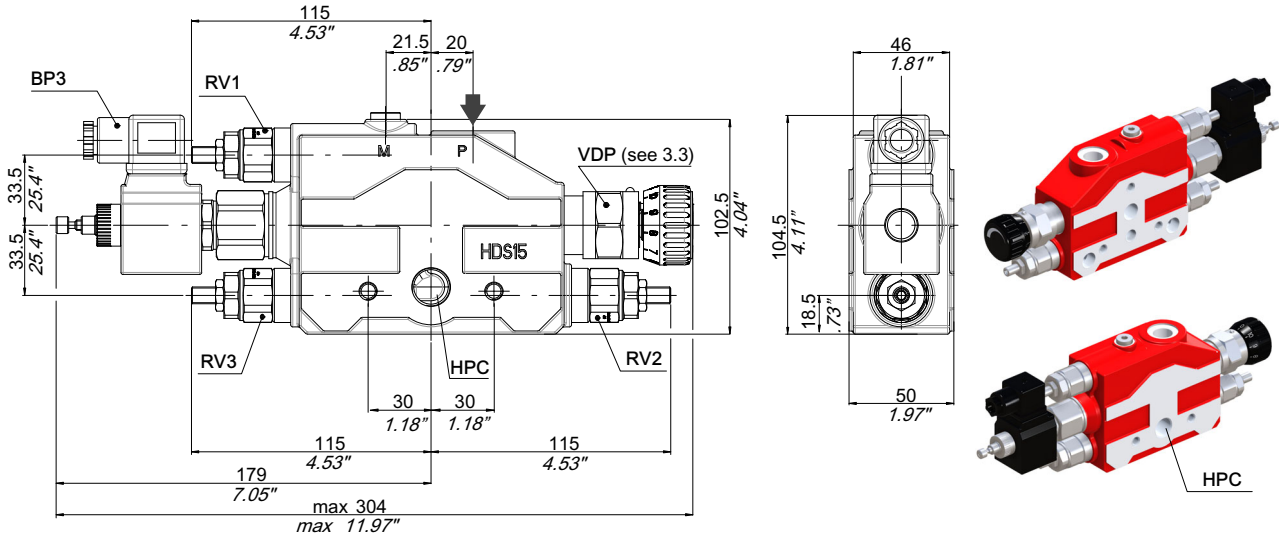
TEST 16 TQ\_88 15 20 AE  
24D- V25 PO DO



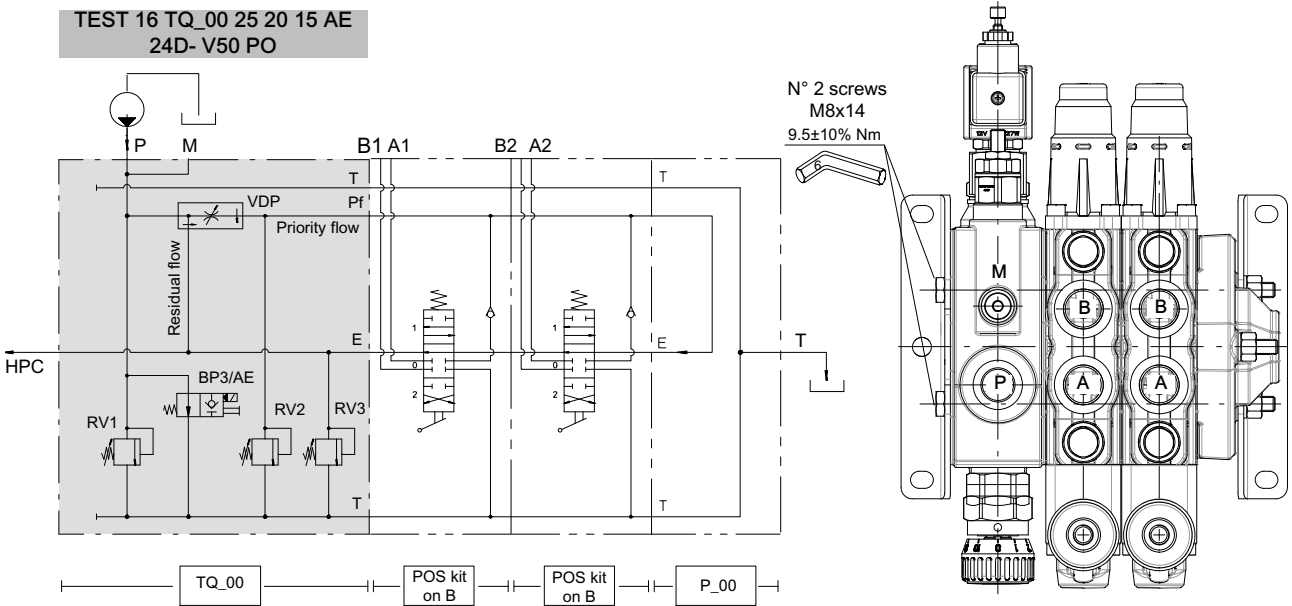
D port can be pressurized  
Sections: positioner kit on A port to have the lever on flow regulator side

## 3.1.3 TQ\_00

Flow regulator continuously crossed.  
 Priority flow added to the residual one with spool in neutral position  
 Full flow supplied to HPC port



Type	HDS15 equivalent	P	M	HPC
TQ800	T100/1	M18x1.5	1/8" BSP	M18x1.5
TQ100	T100/3	1/2" BSP	1/8" BSP	1/2" BSP
TQ500	T100/9	M22x1.5	1/8" BSP	M22x1.5
TQ300	T100/5	SAE10	1/8" BSP	SAE10
Max inlet pressure (P)			250 bar	

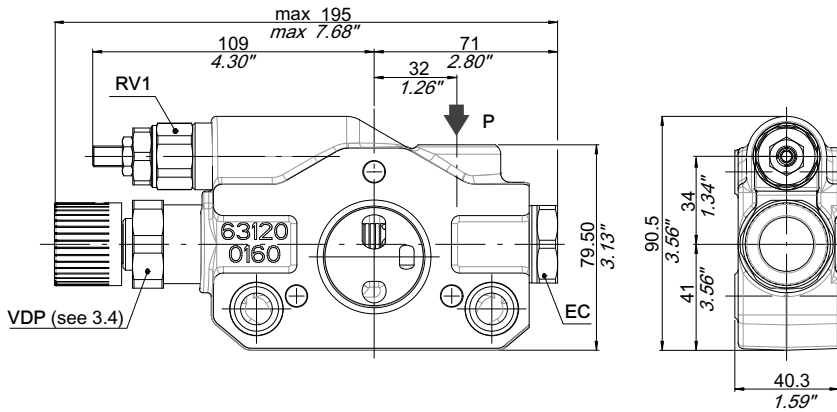


HPC port pressurized  
 Sections: positioner kit on B port to have the lever on flow regulator side  
 In the ordering description write "I" (Inverted) in Positioner kit side indication (see 4.2.2)



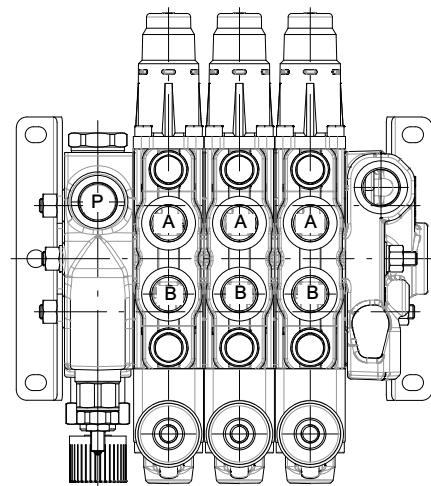
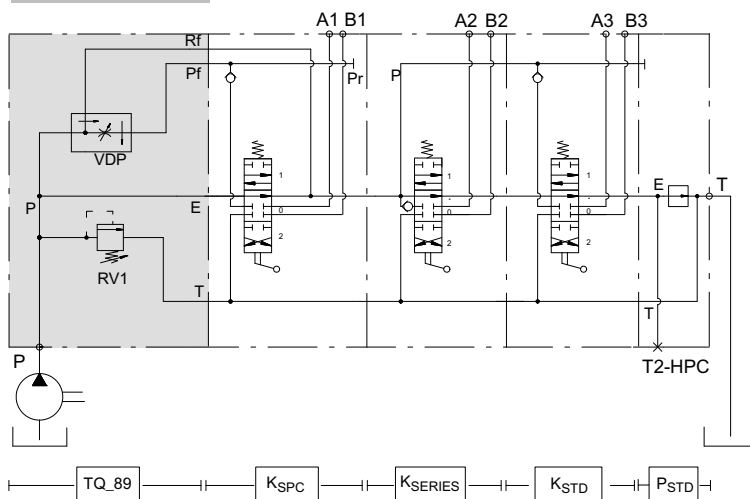
## 3.1.4 TQ\_89

Flow regulator bypassed with spool in neutral position.  
 Priority flow to the first section and residual flow to downstream sections  
 Priority flow added to the residual one with first spool in neutral position



Type	HDS15 equivalent	P
TQ589	T89/9	M22x1.5
Max inlet pressure (P)		250 bar

TEST 16 TQ\_89  
15 EC V50 PO

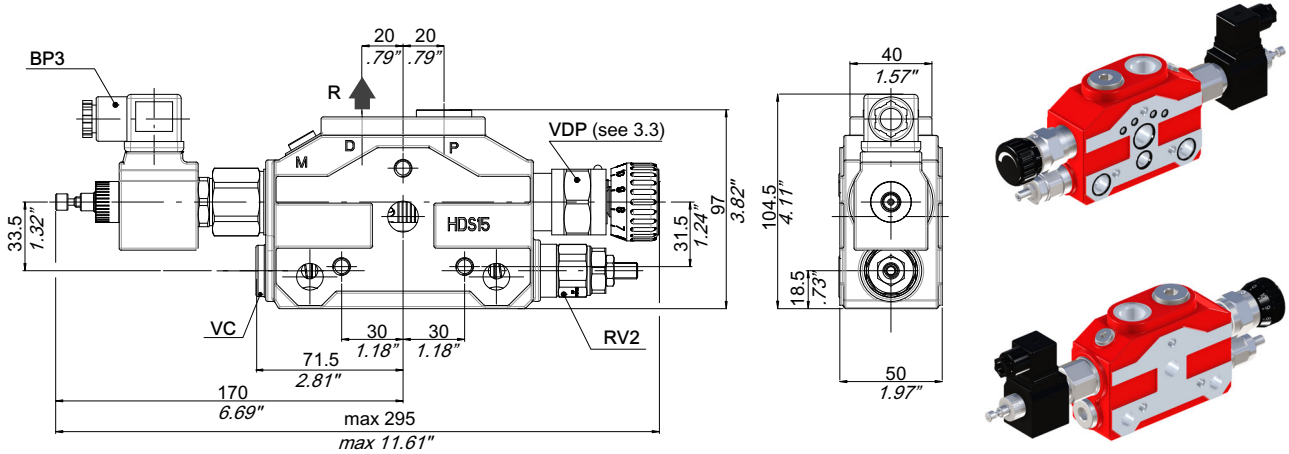


Sections: positioner kit on A port to have the lever on flow regulator side

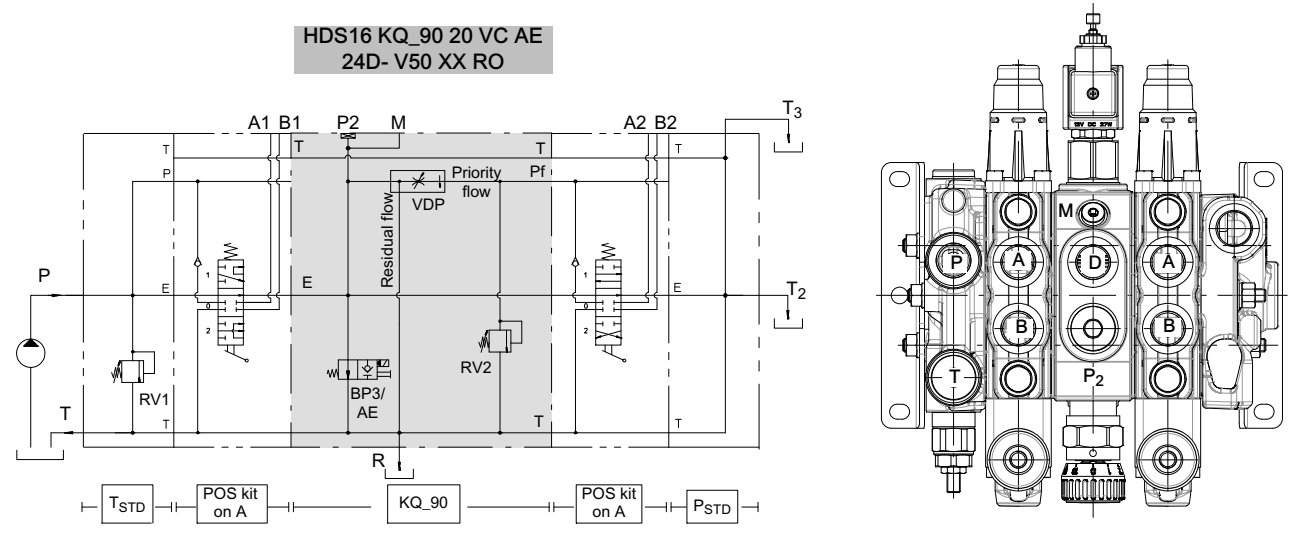
## 3.2 Pressure and flow controls elements KQ

### 3.2.1 KQ\_90

Flow regulator bypassed with downstream spool in neutral position  
Residual flow directly to tank (not pressurizable)



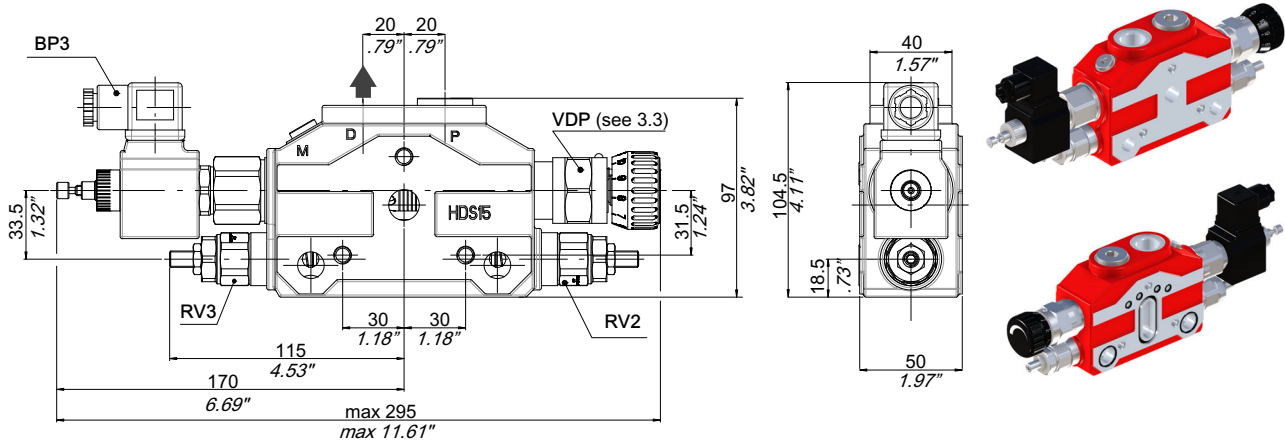
Type	HDS15 equivalent	P	D	M
KQ190	K90/3	1/2" BSP	1/2" BSP	1/8" BSP
KQ390	T90/5	SAE10	SAE10	1/8" BSP
Max inlet pressure (P)			250 bar	



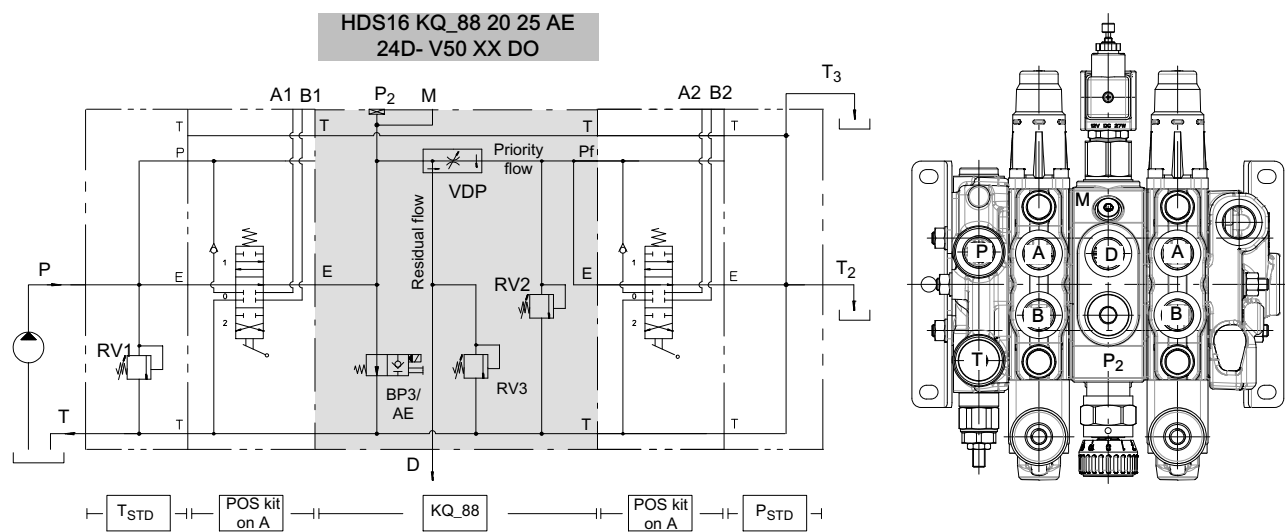
R port cannot be pressurized  
Sections: positioner kit on A port to have the lever on flow regulator side

## 3.2.2 KQ\_88

Flow regulator continuously crossed.  
Residual flow can be pressurized



Type	HDS15 equivalent	P	D	M
KQ188	K88/3	1/2" BSP	1/2" BSP	1/8" BSP
Max inlet pressure (P)			250 bar	



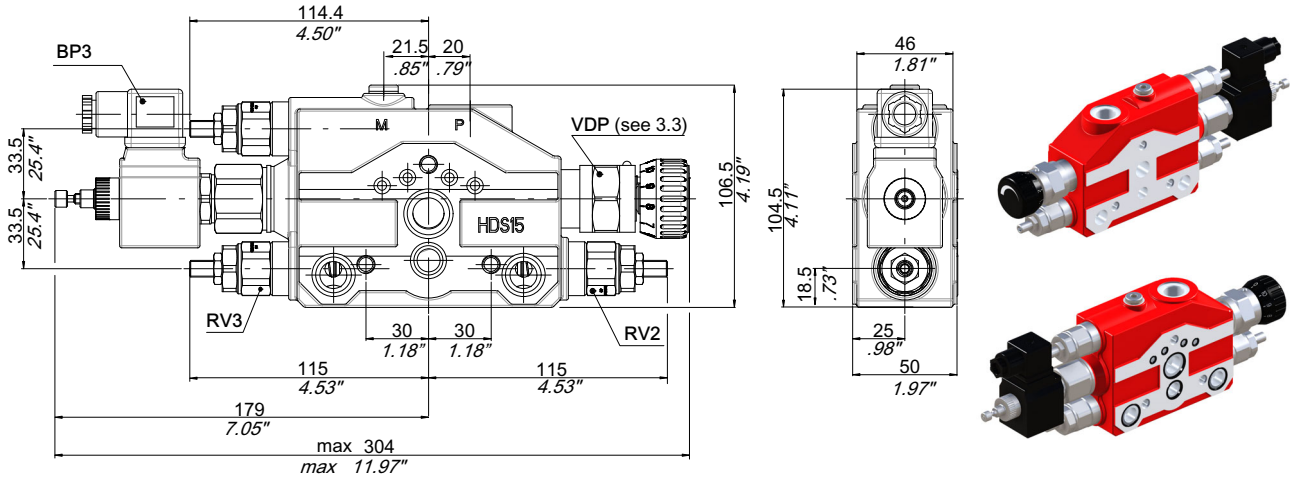
D port can be pressurized  
Sections: positioner kit on A port to have the lever on flow regulator side

## 3.2.3 KQ\_00

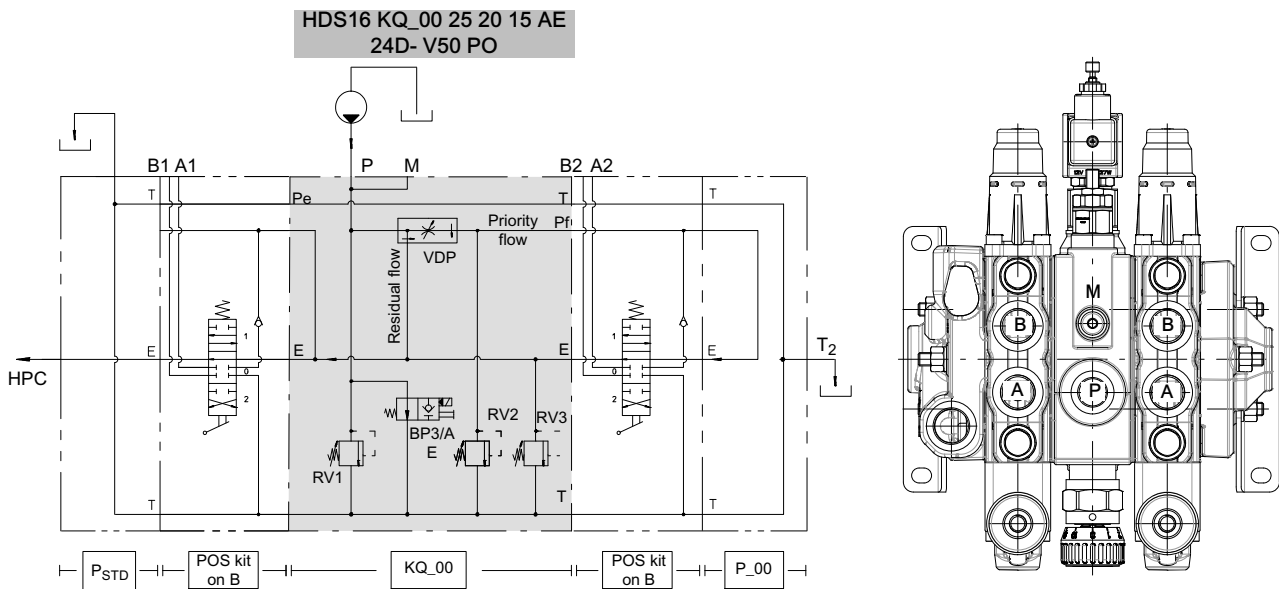
Flow regulator continuously crossed.

Priority flow added to the residual one with previous spool in neutral position.

Full flow supplied to following sections and HPC port



Type	HDS15 equivalent	P	M
KQ800	K100/1	M18x1.5	1/8" BSP
KQ100	K100/3	1/2" BSP	1/8" BSP
KQ500	K100/9	M22x1.5	1/8" BSP
Max inlet pressure (P)			250 bar



HPC port pressurized

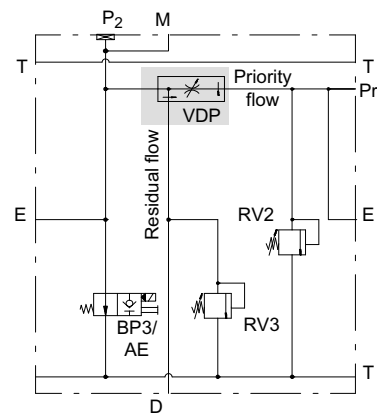
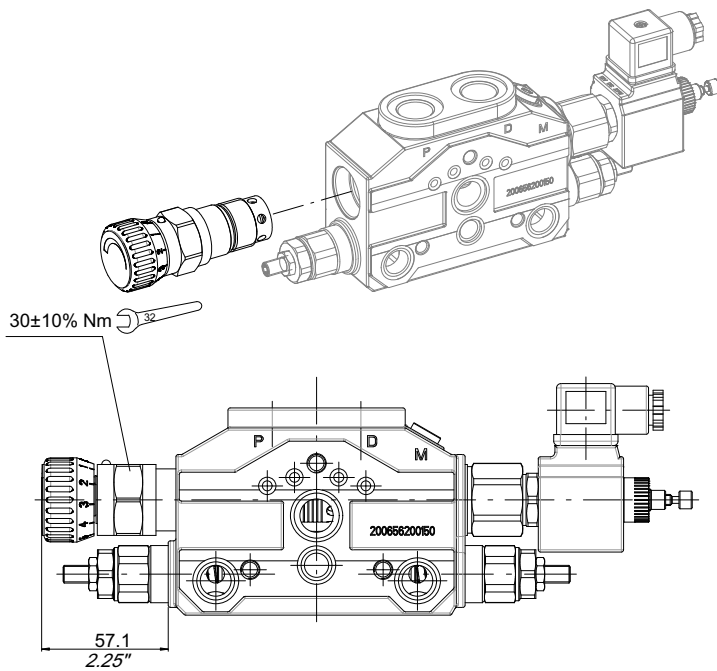
Sections: positioner kit on B port to have the lever on flow regulator side

In the ordering description write "I" (Inverted) in Positioner kit side indication (see 4.2.2)

### 3.3 Flow regulators

#### 3.3.1 Flow regulator with knob - VDP

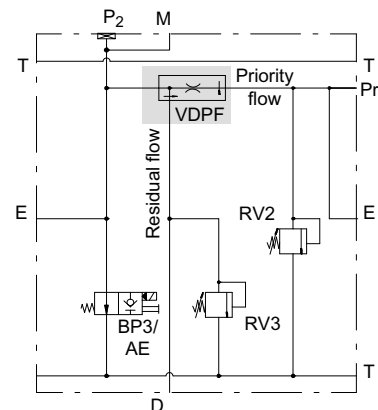
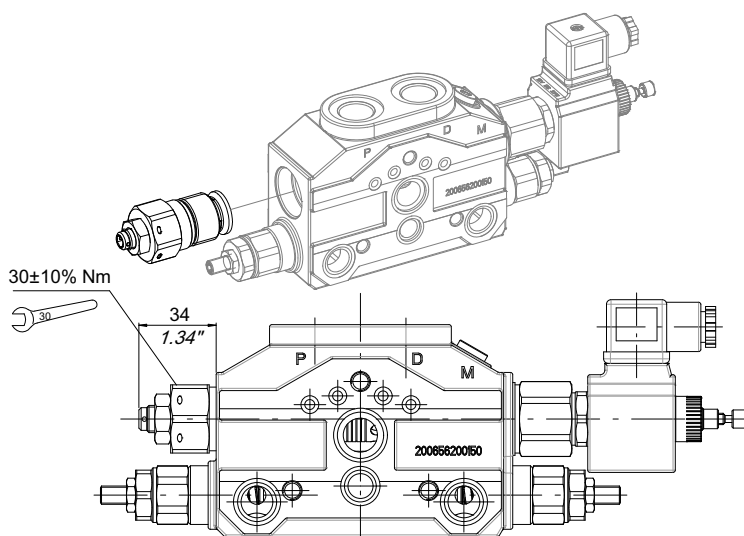
Not suitable for TQ\_89



Type	Flow setting range (l/min)	Code
V06	0,5 ÷ 6	200787201430
V12	0,5 ÷ 12	200787201420
V25	0,5 ÷ 25	200787201410
V50	0,5 ÷ 50	200787201400

#### 3.3.2 Flow regulator with fixed range - VDPF

Not suitable for TQ\_89

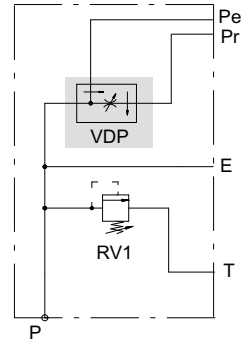
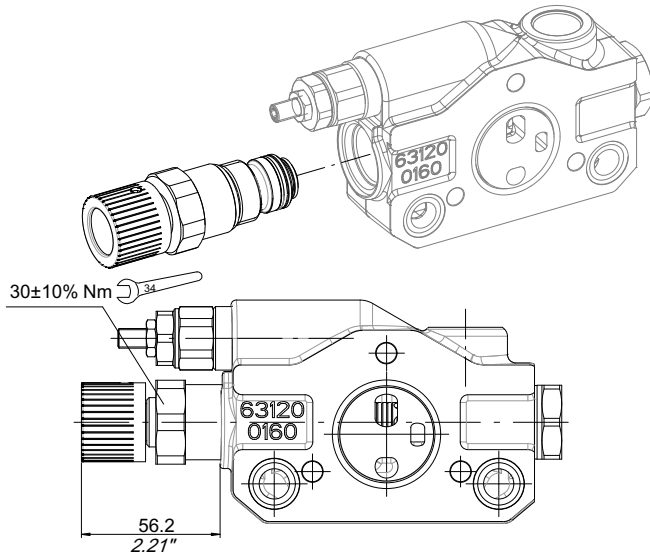


Type	Flow setting range (l/min)	Code
F--	5 ÷ 50	200787200860

Ex: F05= set at 5 l/min

## 3.4 Special flow regulator with knob - VDP

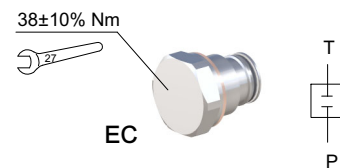
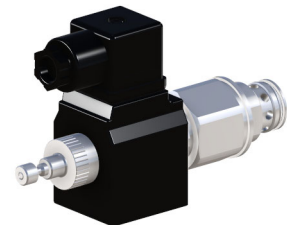
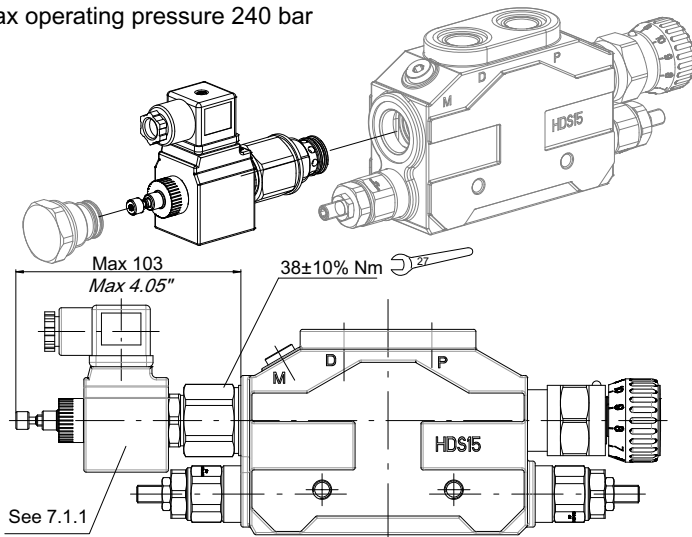
For TQ\_89, only



Type	Flow setting range (l/min)	Code
V50	5 ÷ 50	200787202240

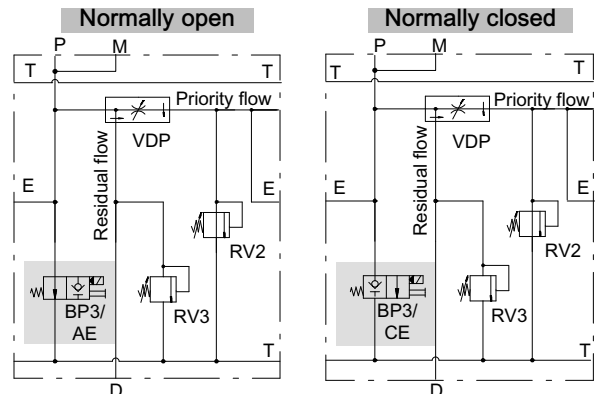
## 3.5 Unloading solenoid valve - BP3

Max operating pressure 240 bar



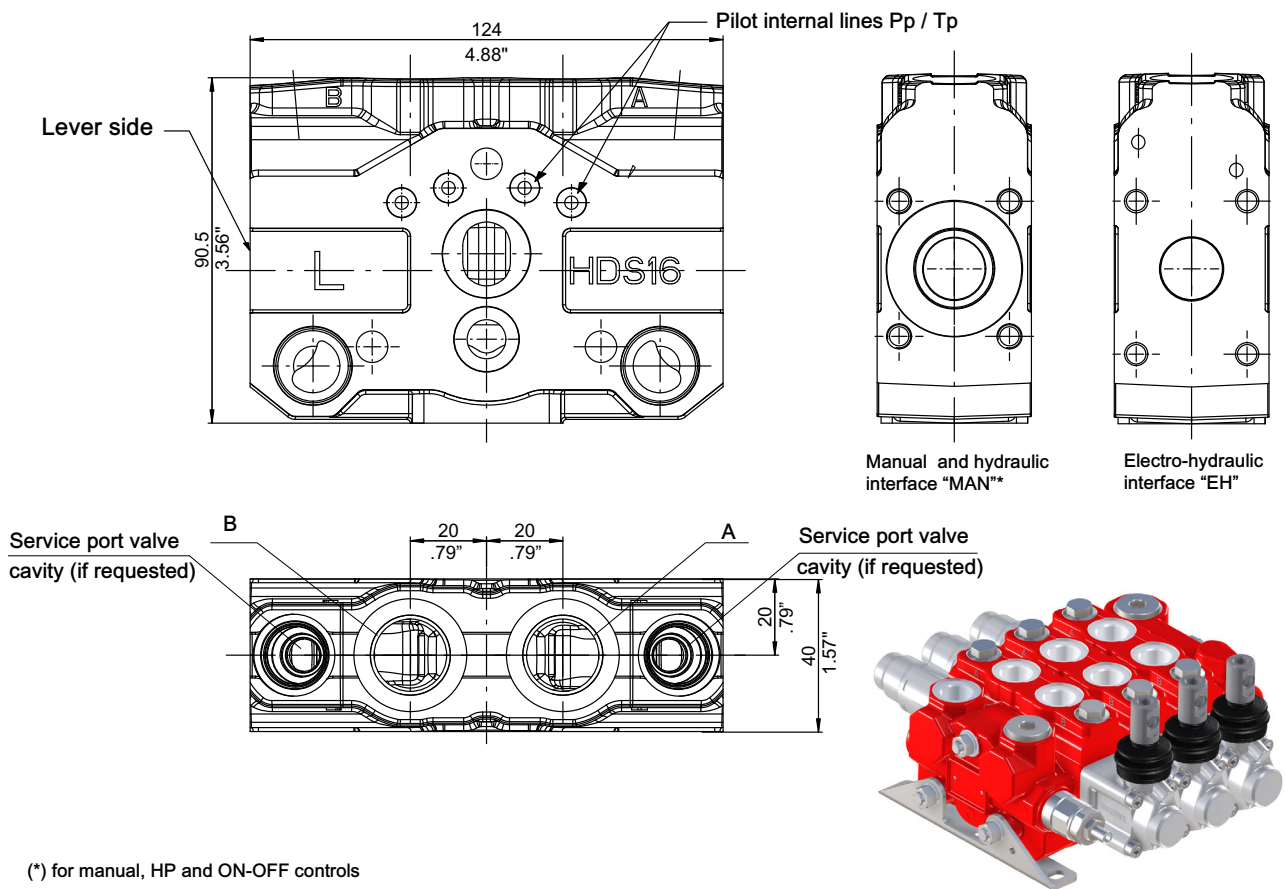
Circuit	Manual override	Type	Code without coil
Normally open	With (*)	AE	200757200490
	Without	A	200757200470
Normally closed	With (*)	CE	200757200480
	Without	C	200757200460
Plug		EC	200778300021

(\*) Screw type override must not be used for continuous operation but for emergency only.

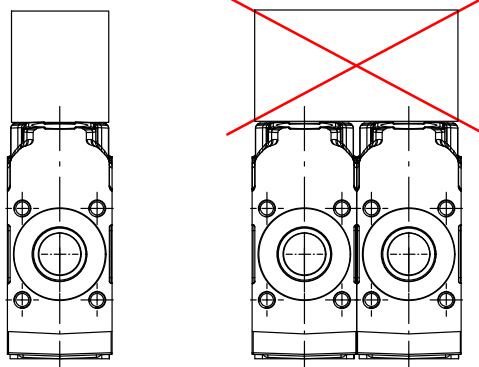


## 4 Sections

### 4.1 Characteristics and dimensions



**Attention:**  
flanging manifolds on the top work port surface of a valve section is not allowed without previous approval by our Technical Department. Larger flanging manifolds that connect together two or more valve sections are forbidden.



### 4.1.1 Parallel valve bodies with pilot lines (Pp / Tp)

Thread	Interface	Type	
		Without A/B service port valve cavities	With A/B service port valve cavities
1/2" BSP	MAN	K102	K101
1/2" BSP	EH	K106	K105
3/8" BSP	MAN	K702	K701
3/8" BSP	EH	K706	K705
M18x1.5	MAN	K802	K801
M18x1.5	EH	K806	K805
SAE8	MAN	K902	K901
SAE8	EH	K906	K905
SAE10 (*)	MAN	K302	K301
SAE10 (*)	EH	K306	K305

(\*) For this port sizes the maximum operated pressure must be reduced.

For floating spools a dedicated valve body is needed. To specify that the body has to be used with a floating spool it is necessary to add a letter (Z or W) to the body identification number.

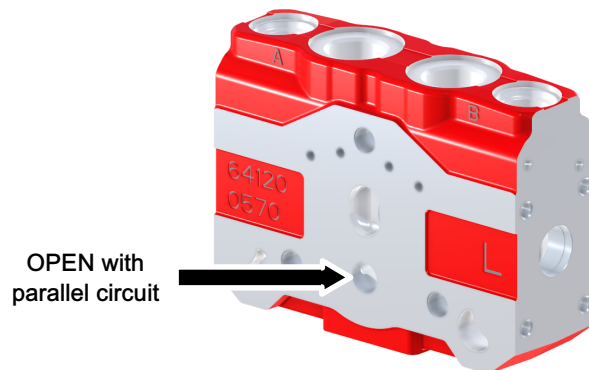
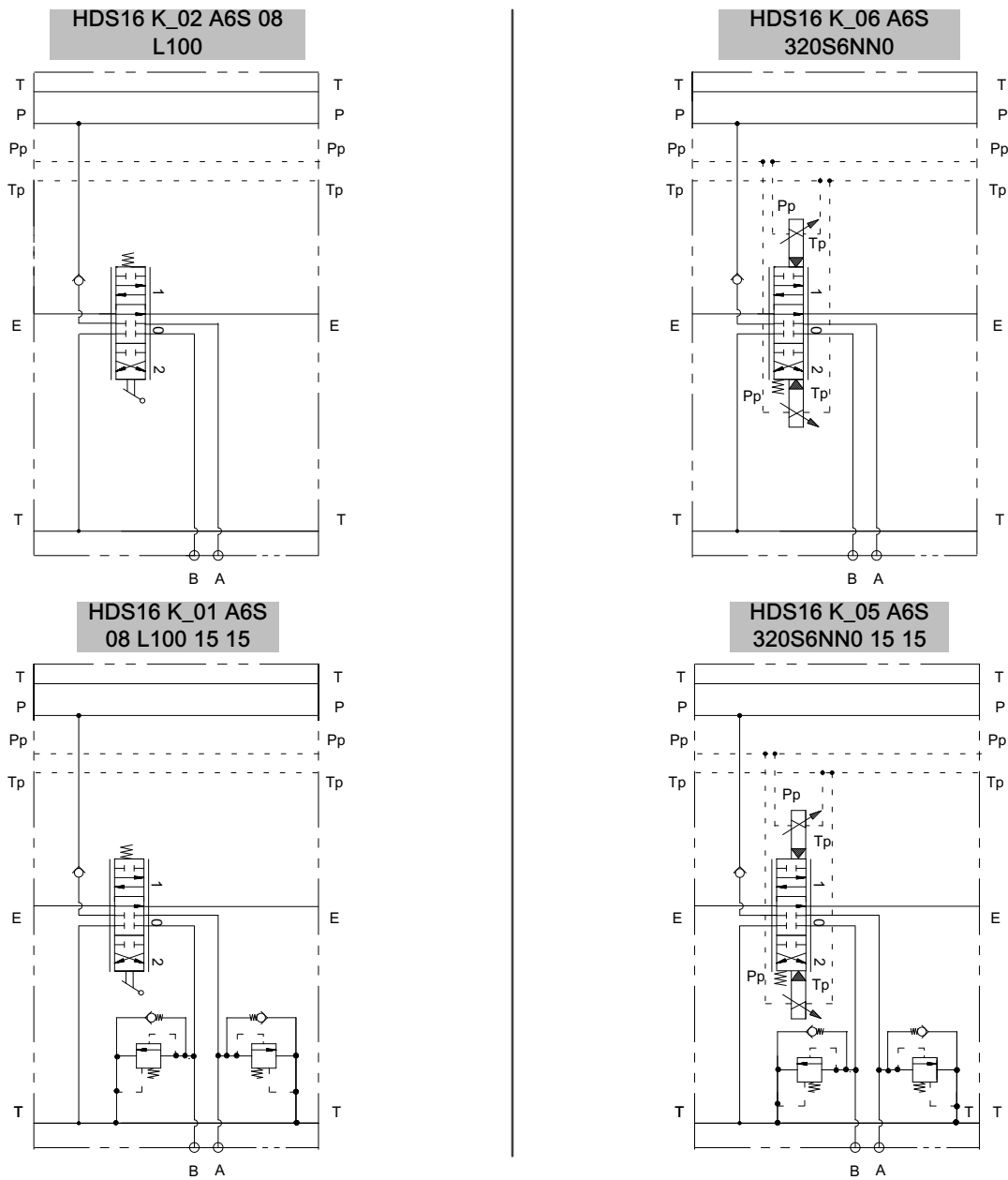
For example a manual interface body with 1 /2" BSP thread and service port valves to be used with Z6S spool can be identified as KZ101.

K	Z	1	0	1
---	---	---	---	---

Specific circuit  
 Z = for Z spool  
 W = for W spool  
 R = for R spool  
 Omitted for other spools



## 4.1.2 Parallel circuit



### 4.1.3 Series and tandem bodies

Thread	Interface	Type	
		Without A/B service port valve cavities	With A/B service port valve cavities
1/2" BSP	MAN	K152	K151
1/2" BSP	EH	K156	K155
3/8" BSP	MAN	K752	K751
3/8" BSP	EH	K756	K755
M18x1.5	MAN	K852	K851
M18x1.5	EH	K856	K855
SAE8	MAN	K952	K951
SAE8	EH	K956	K955
SAE10 (*)	MAN	K352	K351
SAE10 (*)	EH	K356	K355

(\*) For this port sizes the maximum operated pressure must be reduced.

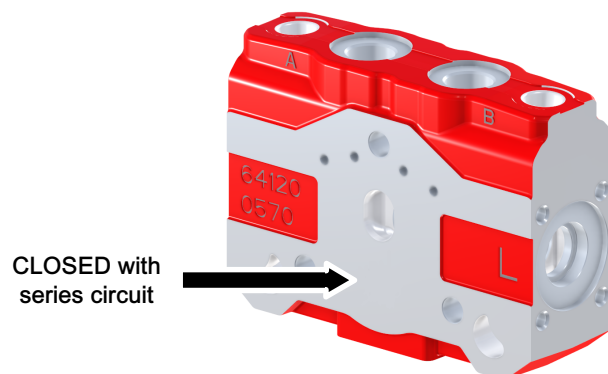
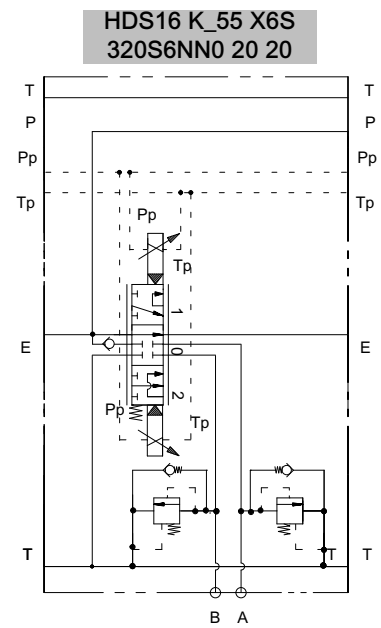
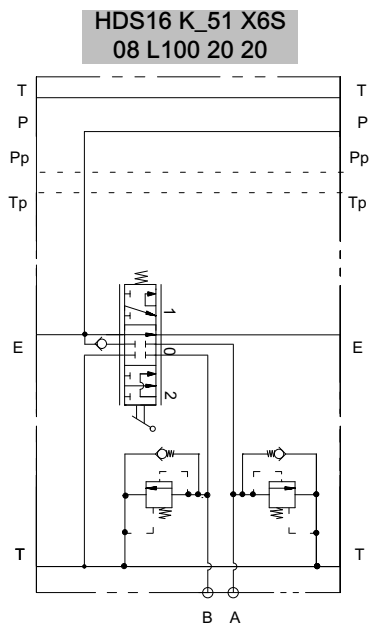
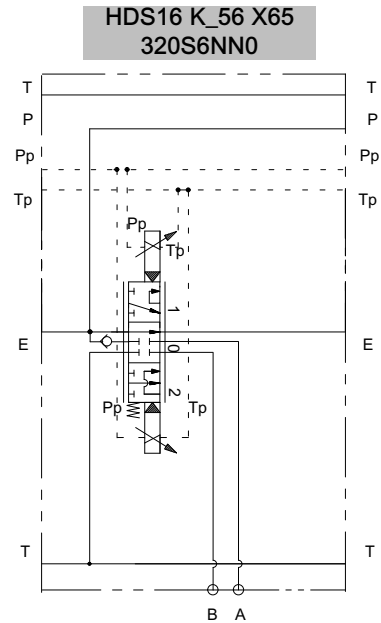
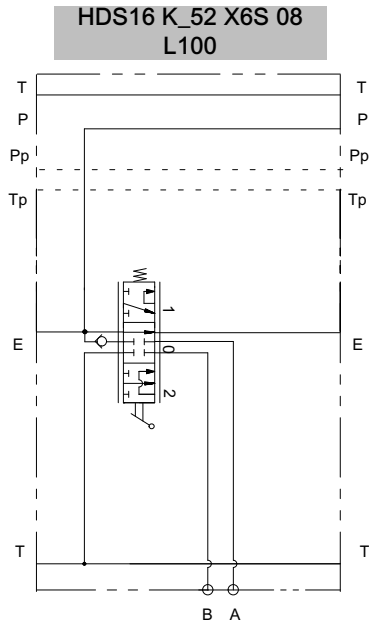
For floating spools a dedicated valve body is needed. To specify that the body has to be used with a floating spool it is necessary to add a letter (Z or W) to the body identification number.

For example a manual interface body with 1 /2" BSP thread and service port valves to be used with Z6S spool can be identified as KZ151.

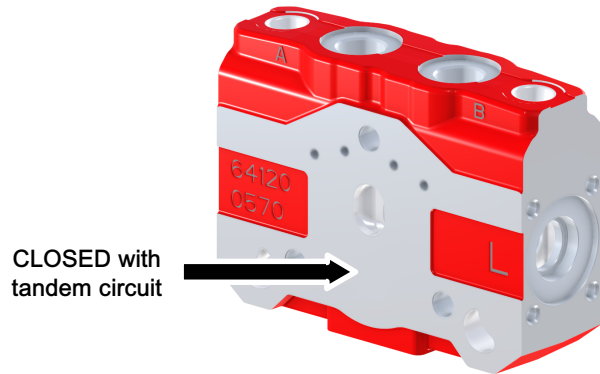
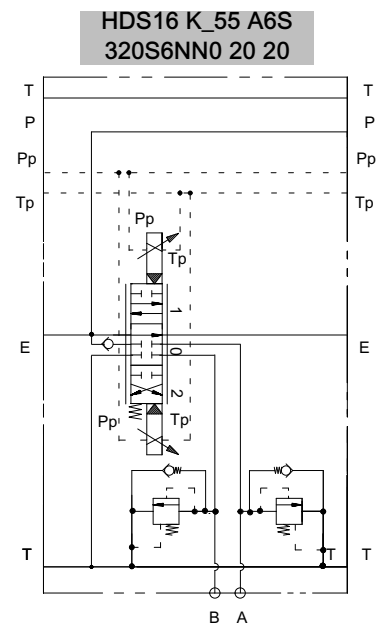
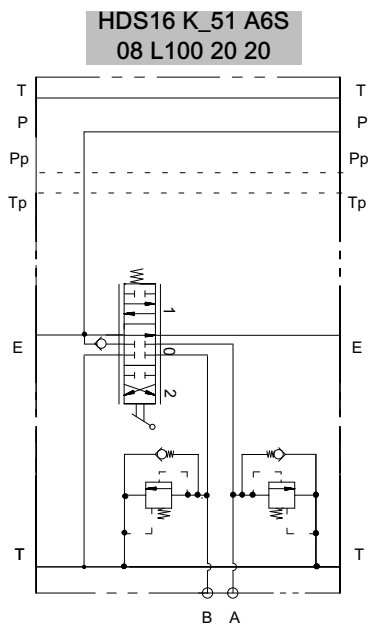
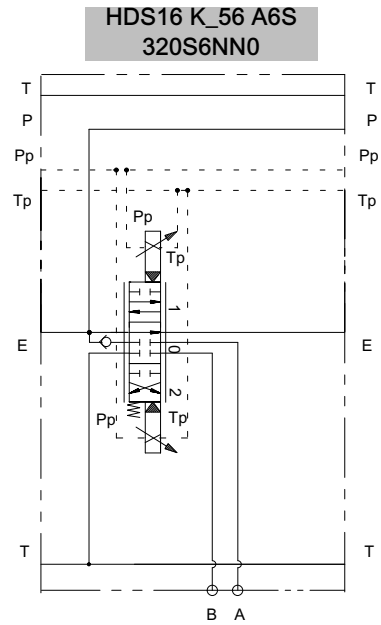
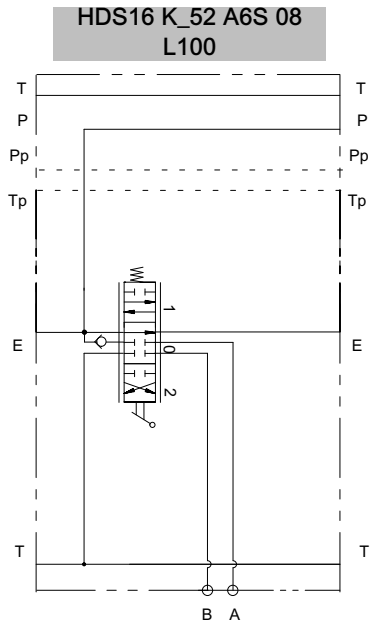
K	Z	1	5	1
---	---	---	---	---

Specific circuit  
 Z = for Z spool  
 W = for W spool  
 R = for R spool  
 Omitted for other spools

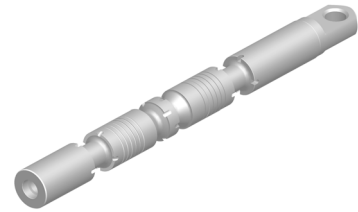
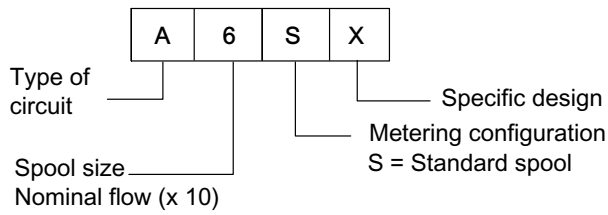
## 4.1.4 Series circuit



## 4.1.5 Tandem circuit



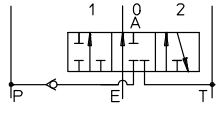
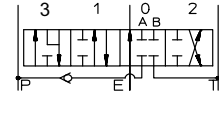
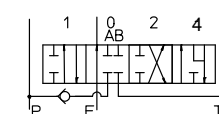
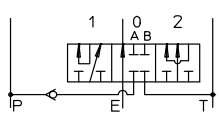
## 4.2 Spools



### 4.2.1 Standard spools

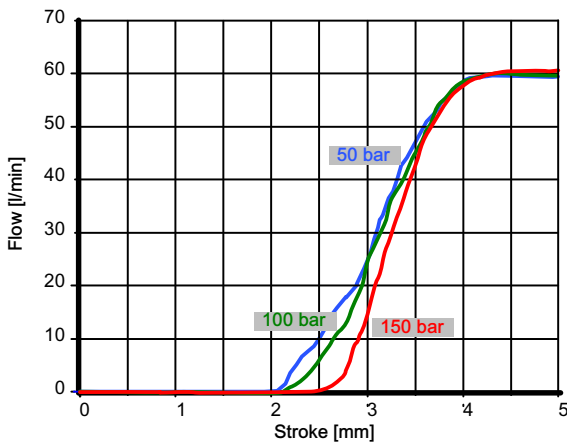
For manual, hydraulic and electro-hydraulic controls

Spool Type	HDS15 equivalent	Hydraulic schematic	Circuit	Features	Application examples
A6S	A		Double acting A/B closed	Symmetric	
A5B	AXB		Double acting A/B closed	High metering to tank on B side	LOADERS BOOM and BUCKET FUNCTION
(A5A)	AXA		Double acting A/B closed	High metering to tank on A side	LOADERS BOOM and BUCKET FUNCTION
(A4S)	-		Double acting A/B closed	Symmetric	
A4R	-		Double acting A/B closed	Symmetric High metering to tank on A/B	SWING FUNCTION / ROTATION
A4A	-		Double acting A/B closed	High metering to tank on A side	LOADERS BOOM and BUCKET FUNCTION
A4B	-		Double acting A/B closed	High metering to tank on B side	LOADERS BOOM and BUCKET FUNCTION
(A2S)	AXS		Double acting A/B closed	Symmetric	
(B6S)	B			Double acting A/B closed E closed	
C6S	C		Double acting A/B to tank	Motor Spool	
(D6S)	D		Double acting A closed B to tank in neutral		
(G6S)	G		Single acting B closed		FORK LIFT LIFTING FUNCTION
(L6S)	L		Double acting B closed A to tank in neutral		

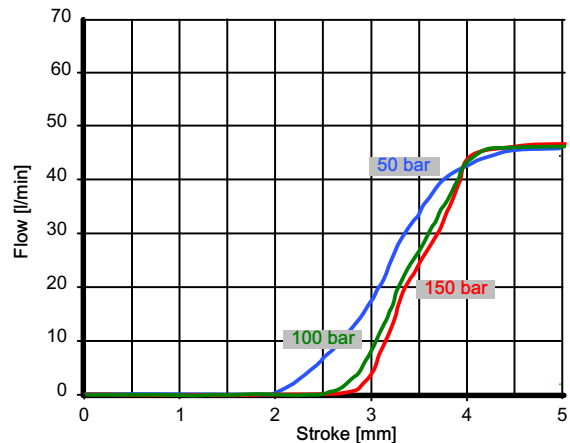
Spool Type	HDS15 equivalent	Hydraulic schematic	Circuit	Features	Application examples
S6S	S		Single acting A closed		FORK LIFT LIFTING FUNCTION
Z5S	ZSS		Double acting A/B closed	Pull to float (Manual controls only)	LOADERS BOOM FUNCTION
(Z6S)	ZS		Double acting A/B closed	Pull to float (Manual controls only)	LOADERS BOOM FUNCTION
W4A	-		Double acting A/B closed	Push to float High metering to tank on A side	LOADERS BOOM FUNCTION
W5S	WSS		Double acting A/B closed	Push to float	LOADERS BOOM FUNCTION
X6S	X		Double acting A/B closed	Series spool	

( ) : should this specific spool be needed, please contact our Sales Dept.

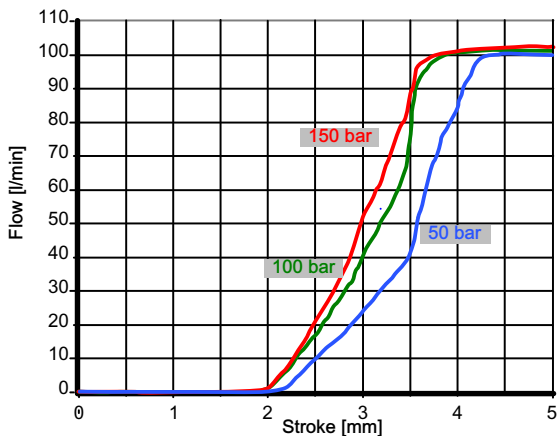
Spool size 6 metering: P → A/B (inlet flow 60 l/min)



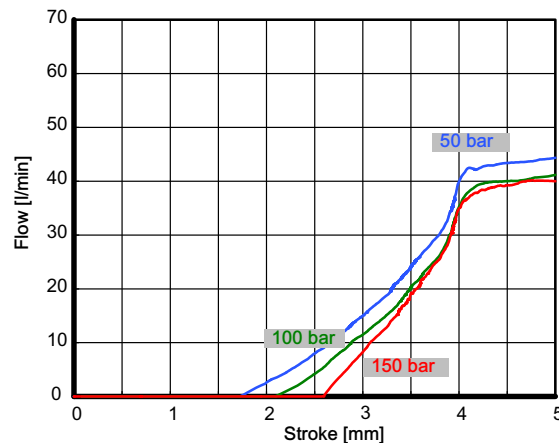
Spool size 6 metering: P → A/B (inlet flow 45 l/min)



Spool size 6 metering: A/B → T (port flow 100 l/min) metering configuration S

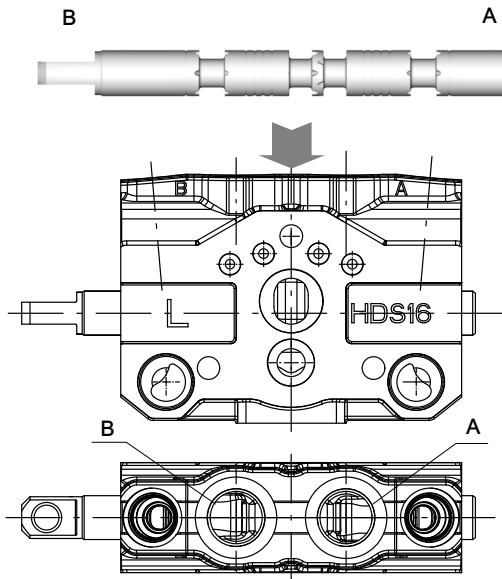


Spool size 4 metering: P → A/B (port flow 40 l/min) metering configuration A4R



4.2.2 Spool assembly direction

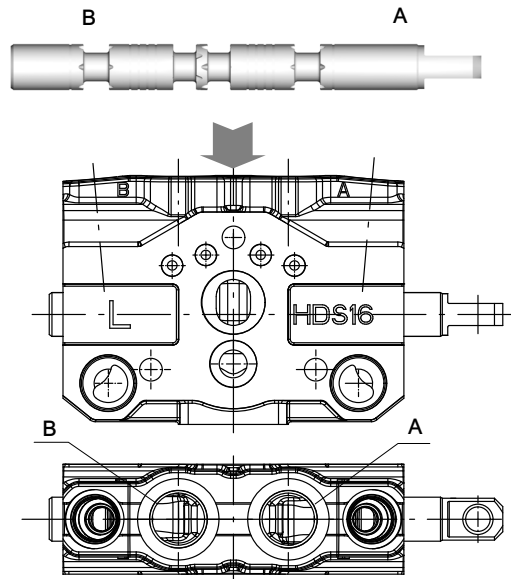
Positioner kit on A port - standard position



standard position

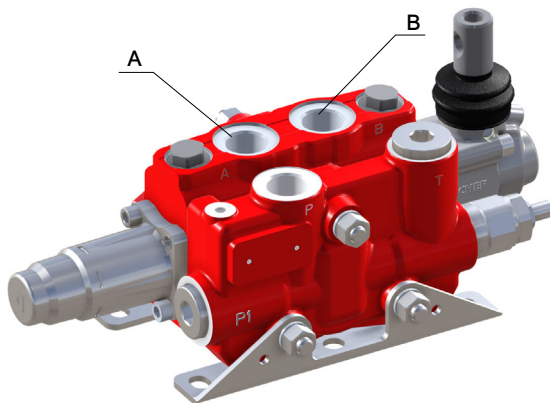
HDS16 KZ101 Z6S 33 L100 0000

Positioner kit on B port - inverted spool



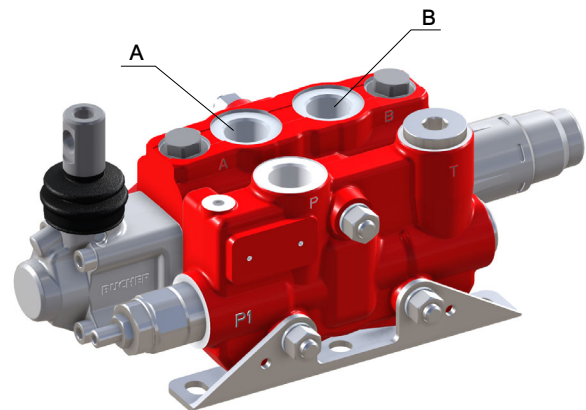
inverted spool

HDS16 KZ101 Z6S 33 L100 0000 I



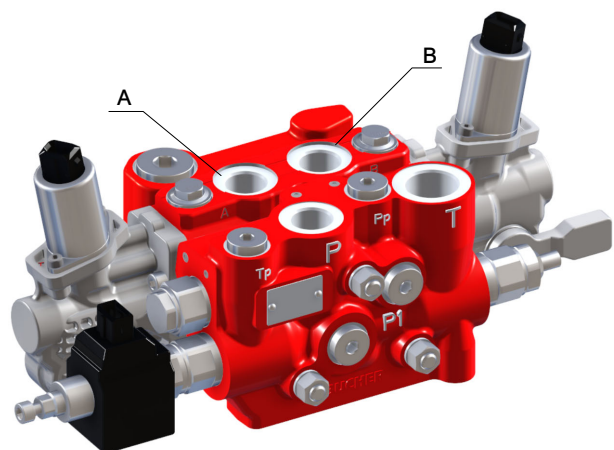
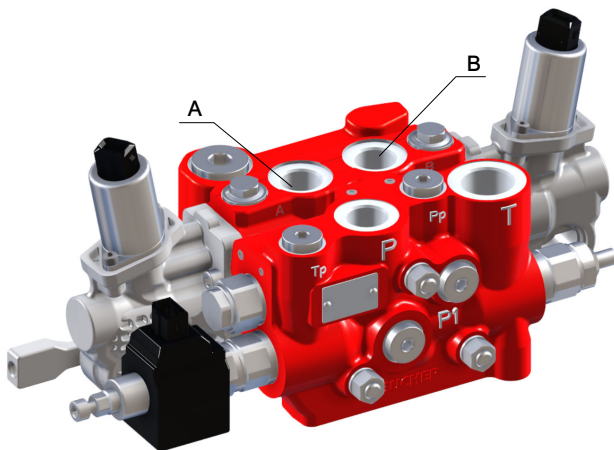
standard position

HDS16 K105 A6S 320S6NNKH 0000



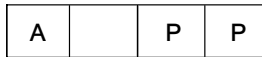
inverted spool

HDS16 K105 A6S 320S6NNKH 0000 I



A and B are marked on casting.

## 4.2.3 For EMC push-pull ON/OFF controls



Type of circuit

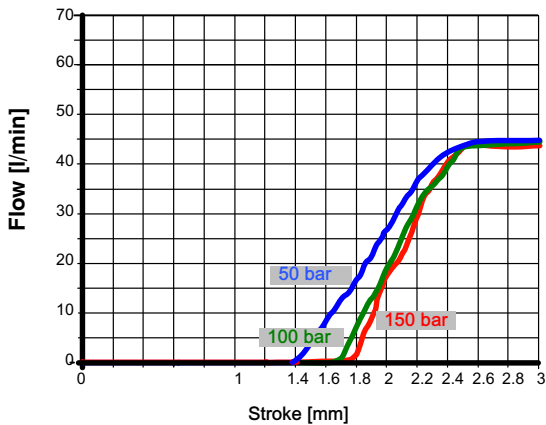
Special feature or blank

Spool Type	HDS15 equivalent	Hydraulic schematic	Circuit	Features
APP	APD		Double acting A/B closed	Symmetric
CPP	CPD		Double acting A/B to tank in neutral	Motor spool
(GPP)	GPD		Single acting B closed	

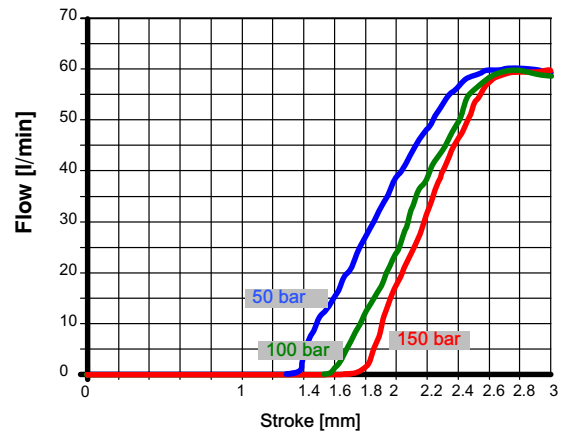
( ) : should this specific spool be needed, please contact our Sales Dept.

## 4.2.4 Spool metering curves

Spool metering: P→A→B→T (inlet flow 45 l/min)

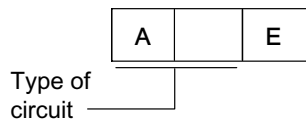


Spool metering: P→A→B→T (inlet flow 60 l/min)





## 4.2.5 Direct acting ON/OFF spools



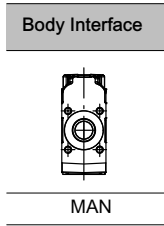
Spool Type	Hydraulic schematic	Circuit	Features
AE		Double acting A/B closed	
CE		Double acting A/B to tank in neutral	
(GE)		Single acting B closed	
(SE)		Single acting A closed	
RE		Double acting A/B closed	Regenerative in A or B port Special body required
XE *		Double acting A/B closed	Series spool
(XCE) *		Double acting A/B to tank in neutral	Series spool

\* : must be used T port on outlet cover.

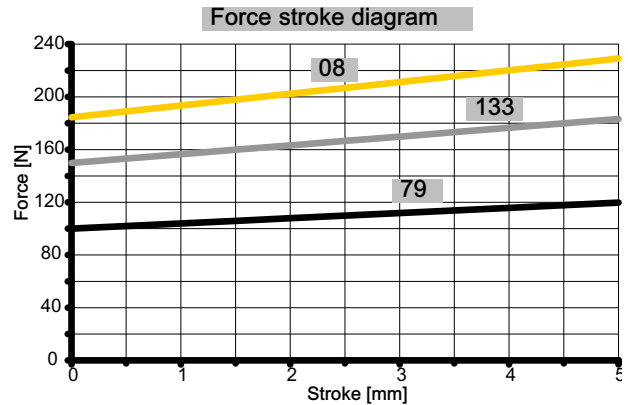
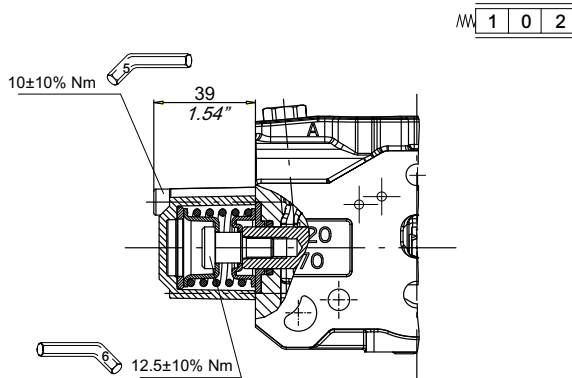
( ) : should this specific spool be needed, please contact our Sales Dept.

## 4.3 Manual positioners

The standard position of the spring kit is always located on A port side.

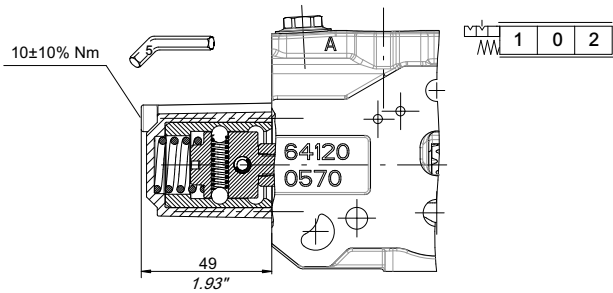


### 4.3.1 Spring return to neutral position

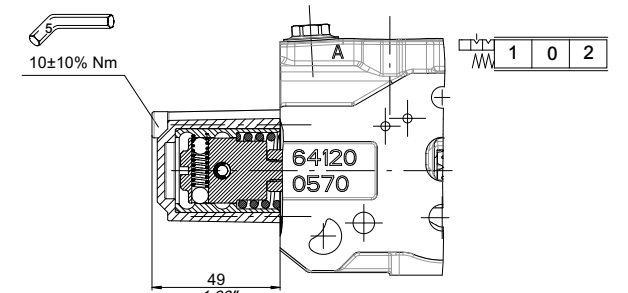


Type	Code	Spring colour
08	200768610081	YELLOW
79	200768610911	BLACK
133	200768610311	WHITE

### 4.3.2 Spring return to neutral position and detent position in 1 or 2

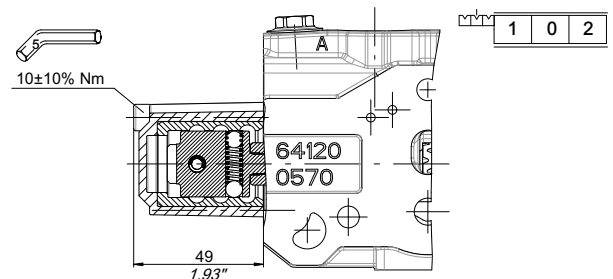


Type	Code
10	200768630040

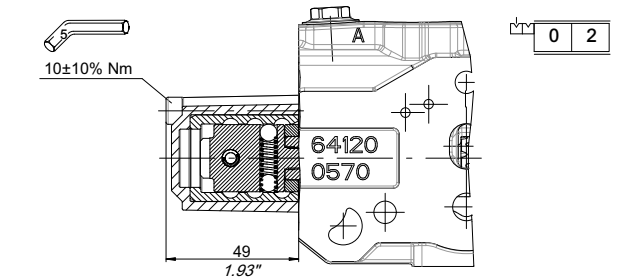


Type	Code
20	200768630090

### 4.3.3 Detent in all positions

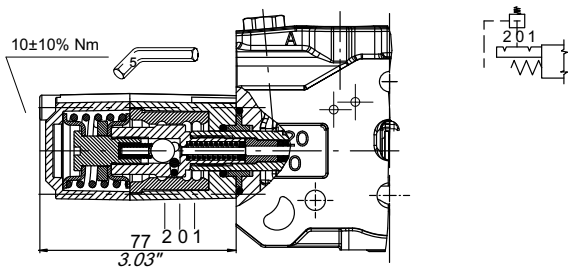


Type	Code
17	200768620140



Type	Code
25	200768620150

### 4.3.4 Kick-out in position 1 and 2

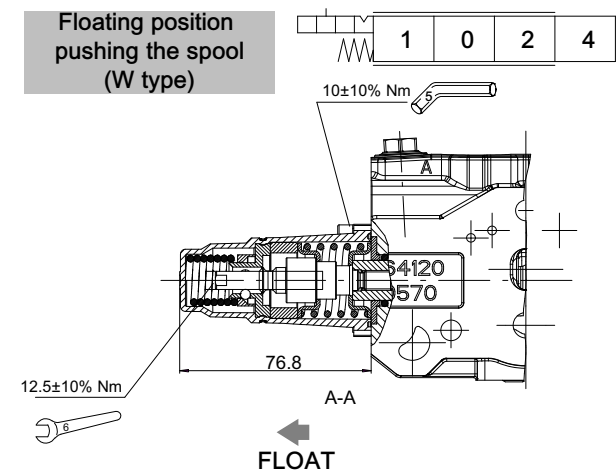
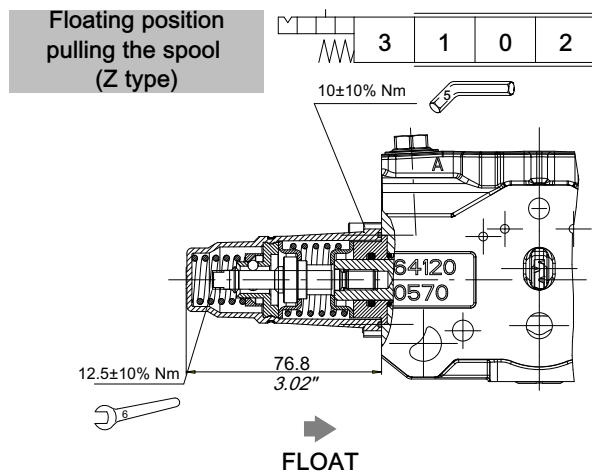


Type	Code	Spring colour
358	200768630471	YELLOW

Standard kick-out setting: 150 bar

A special spool is requested

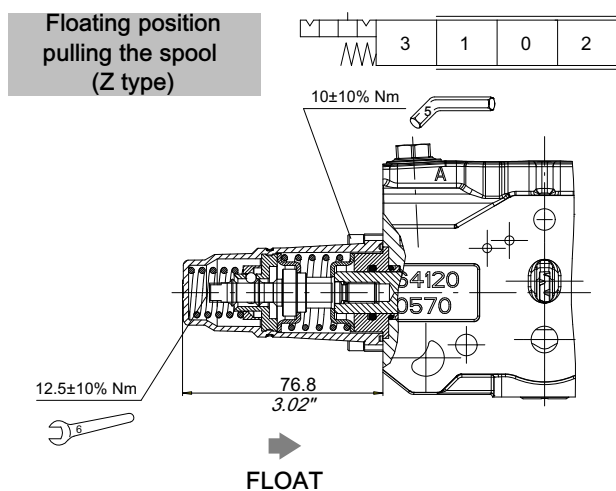
### 4.3.5 Detent in floating position and spring return to neutral from position 1 and 2



Type	Code	Main spring	Detent spring
33	200768641110	BLACK	BLACK
31	200768641180	BLACK	WHITE

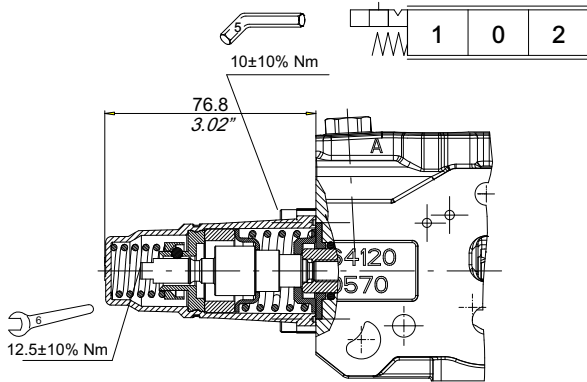
Type	Code	Main spring	Detent spring
32	200768641150	BLACK	BLACK
30	200768641160	BLACK	WHITE

### 4.3.6 Detent in position 2 and 3 and spring return to neutral in both directions



Type	Code	Main spring	Detent spring
39	200768640760	BLACK	WHITE

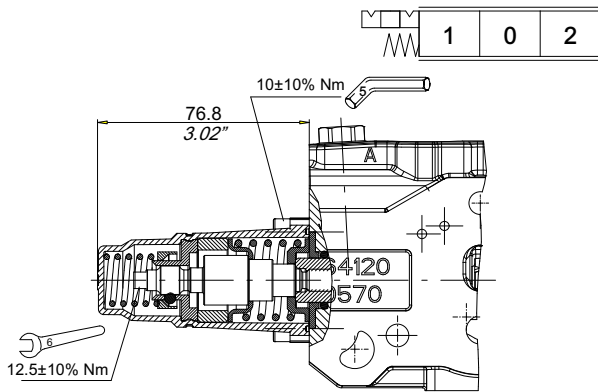
## 4.3.7 Detent in position 2 and spring centred



Type	Code	Main spring	Detent spring
-	-	WHITE	WHITE

Should this positioner be needed, please contact our Sales Dept.

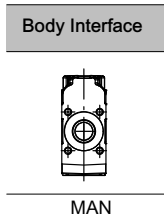
## 4.3.8 Detent in position 1 and 2 and spring centred



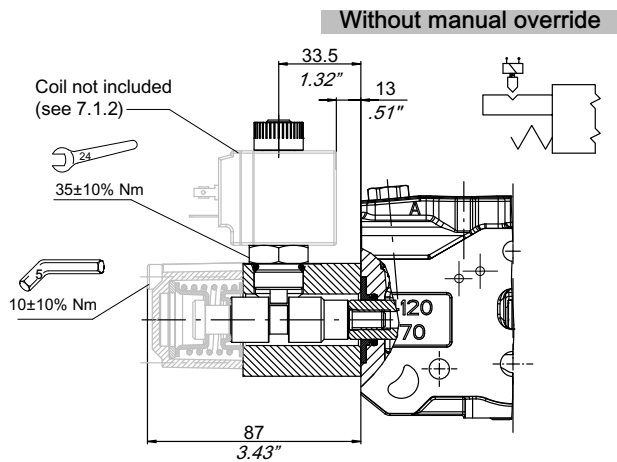
Type	Code	Main spring	Detent spring
-	-	WHITE	BLACK

Should this positioner be needed, please contact our Sales Dept.

## 4.4 Intermediate kits

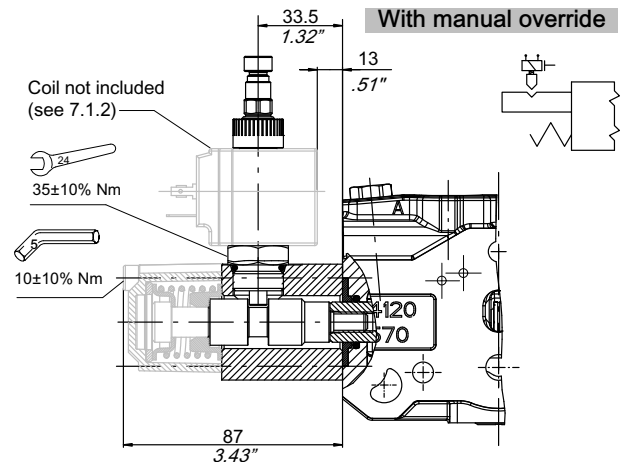


### 4.4.1 Electro-mechanical locking (normally locked)



Type	Code
EM	-

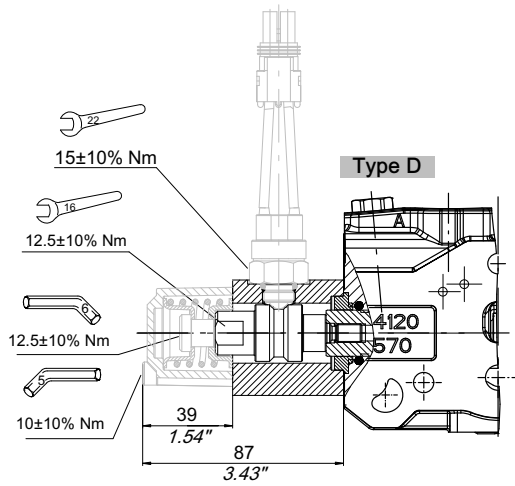
Should this positioner be needed, please contact our Sales Dept.

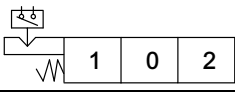
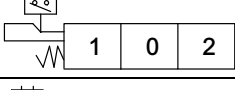
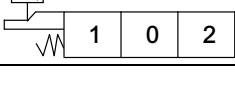


Type	Code
EME	-

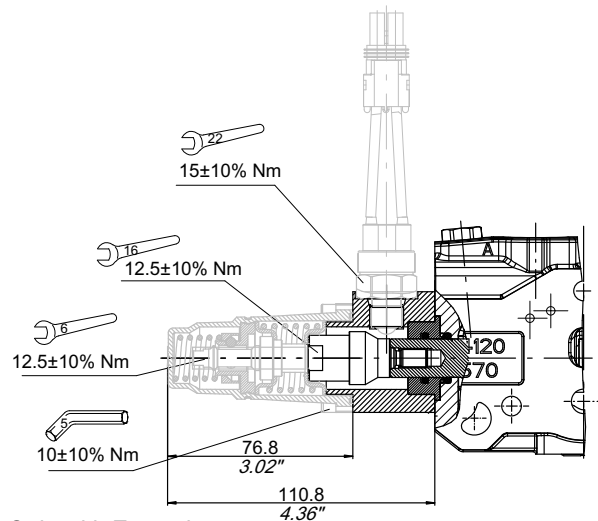
## 4.4.2 Microswitch kits

### 4.4.2.1 Spool movement detection

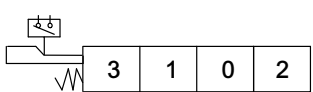


Type	Code	Scheme
D	200768310010	
S1	200768310020	
S2	200768310030	

### 4.4.2.2 Floating position detection

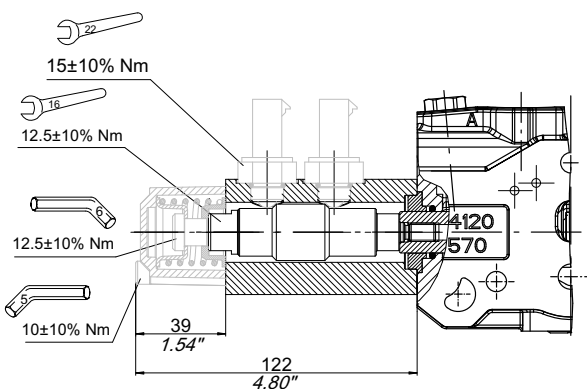


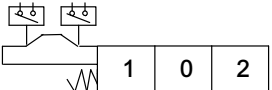
Only with Z spool

Type	Code	Scheme
S3	-	

Should this positioner be needed, please contact our Sales Dept.

### 4.4.3 Spool direction detection



Type	Code	Scheme
D2	-	

Should this positioner be needed, please contact our Sales Dept.

D: microswitch operated in both directions

S1: microswitch operated in POS.1

S2: microswitch operated in POS. 2

S3: microswitch operated in POS. 3 (only with Z spool)

D2: two microswitches, one for each direction.

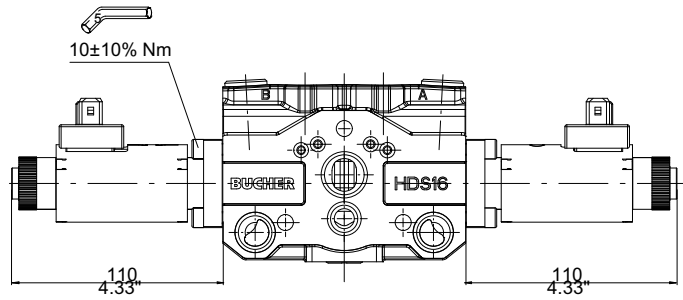
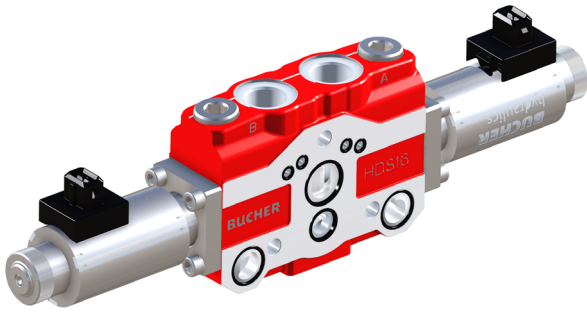
For microswitches see 7.2

## 4.5 Direct acting ON-OFF control

Body Interface

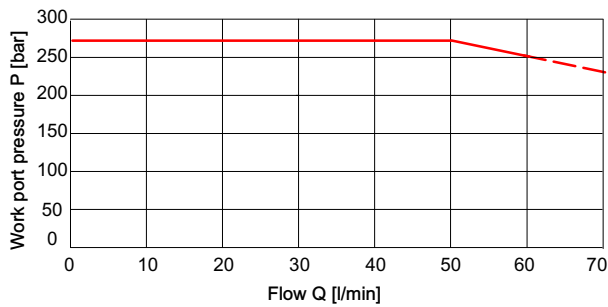


MAN



### Solenoid tube mechanical characteristics

Max peak pressure	100 bar (1450 PSI)
Max static pressure	250 bar (3630 PSI)



Operating performance with coil under stabilization temperature conditions at nominal voltage.

Valid for single actuation of parallel, series and independent sections with T or HPC back pressure < 20 bar.

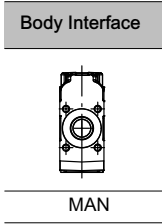
For other operating conditions please contact our Sales Department.

Type	Double acting	Type	Single acting port "B"	Type	Single acting port "A"
01E		02E		03E	

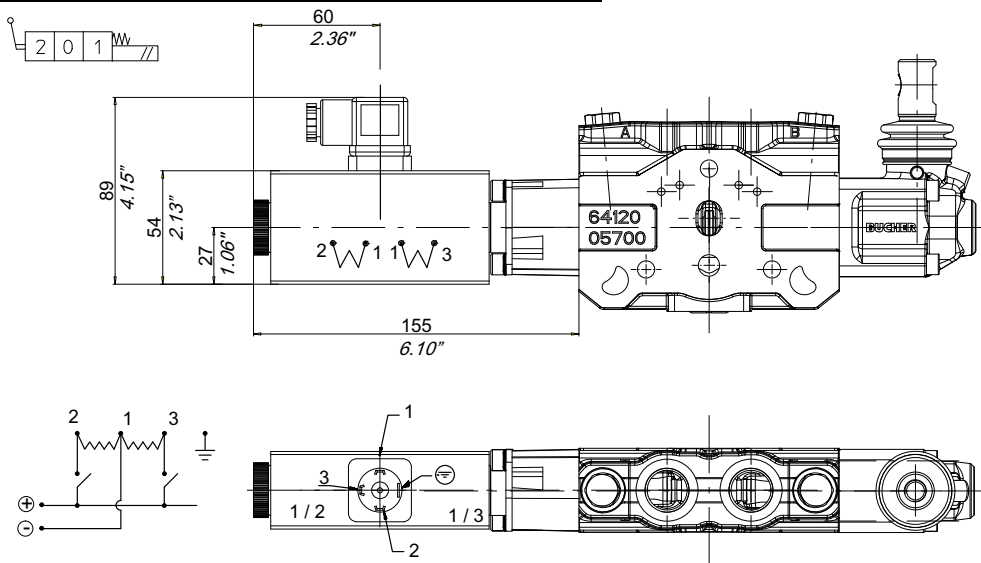
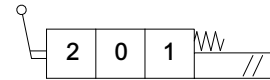
For coils see 7.1.3.

## 4.6 Electromagnetic ON-OFF control - Push/Pull type - PP

The standard position of the spring kit is always located on A port side.



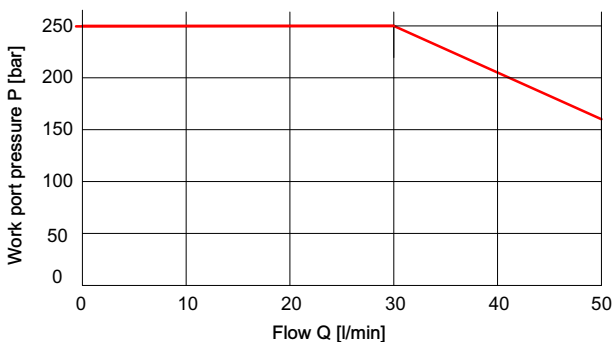
Type	Code	Voltage
344*	200768611790	12 V DC
343*	200768611800	24 V DC



\* To be used with special spools only: the spool definition is different from the standard one because of the extension "PP". For example A spool become APP.

Ex.: (A spool + 24 VDC positioner)= APP343

Mechanical and hydraulic features	
Max flow vs pressure	see diagram
Max back pressure	5 bar (70 PSI)
Operating oil temperature	80° C (180° F)

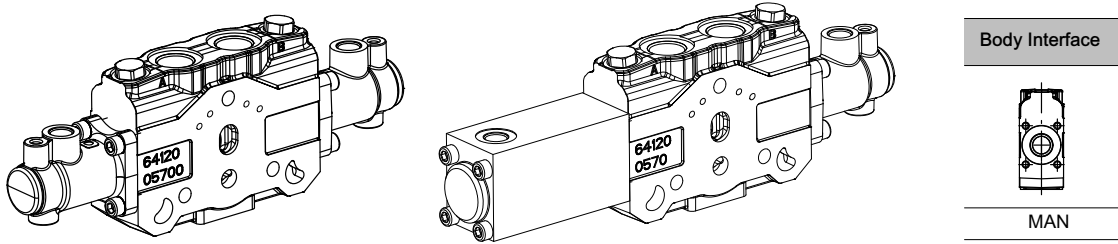


Electromagnetic specification	
Input voltage	12 V DC [24 V DC] + 10%
Power consumption	60 W
ED	100%
Ohms resistance (cold T°)	2.4 Ω [9.6 Ω]
Ohms resistance (stabilized T°)	3.1 Ω [12.5 Ω]
Current consumption (cold T°)	5 A (2.5 A)
Current consumption (stabilized T°)	3.8 A (1.9 A)
Ambient operating temperature range	-25° C/+50° C

Insulation class:  
According to VDE 0580 standard: H  
Electrical connection: DIN 43650: IP 65

## 4.7 Hydraulic controls - HP

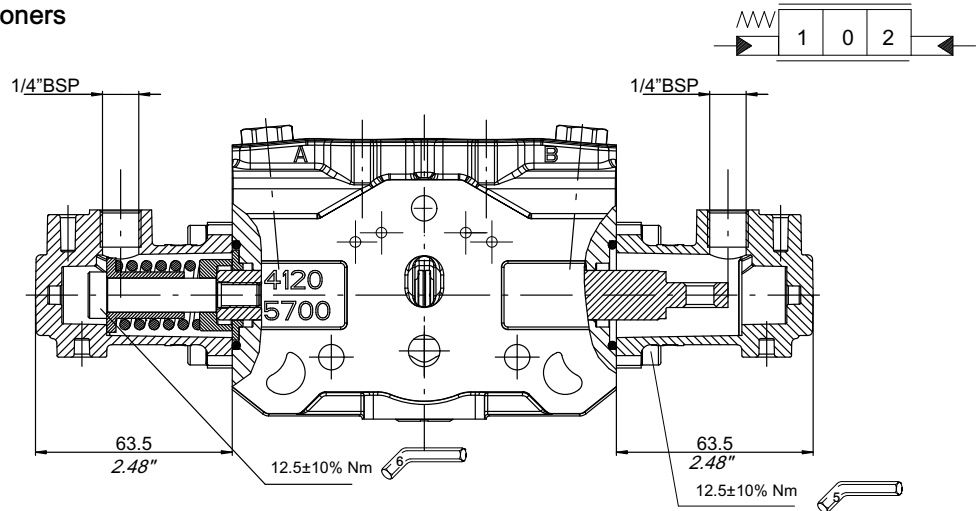
The standard position for positioner kits is on A port side



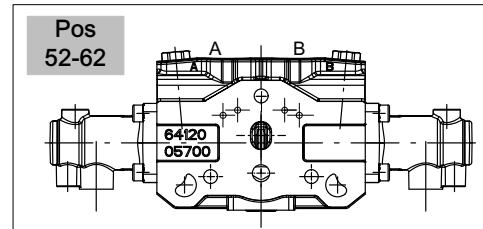
### 4.7.1 Standard positioners

P<sub>max</sub> = 40 bar (580 PSI)

Pos  
50-60



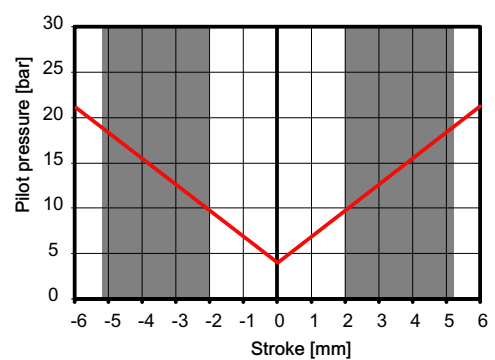
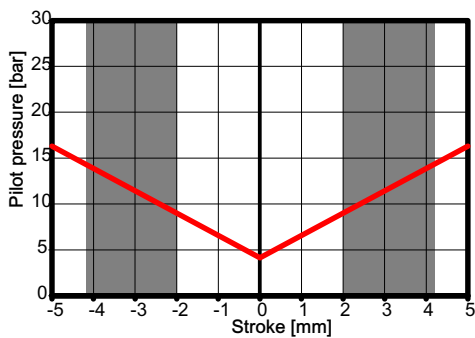
Type		D	Spring	Code
50	52	1/4" BSP	5	200768650632
-	-	SAE6	-	-
60	62	1/4" BSP	6	-
-	-	SAE6	-	-



Pos 50-52

Spring types

Pos 60-62



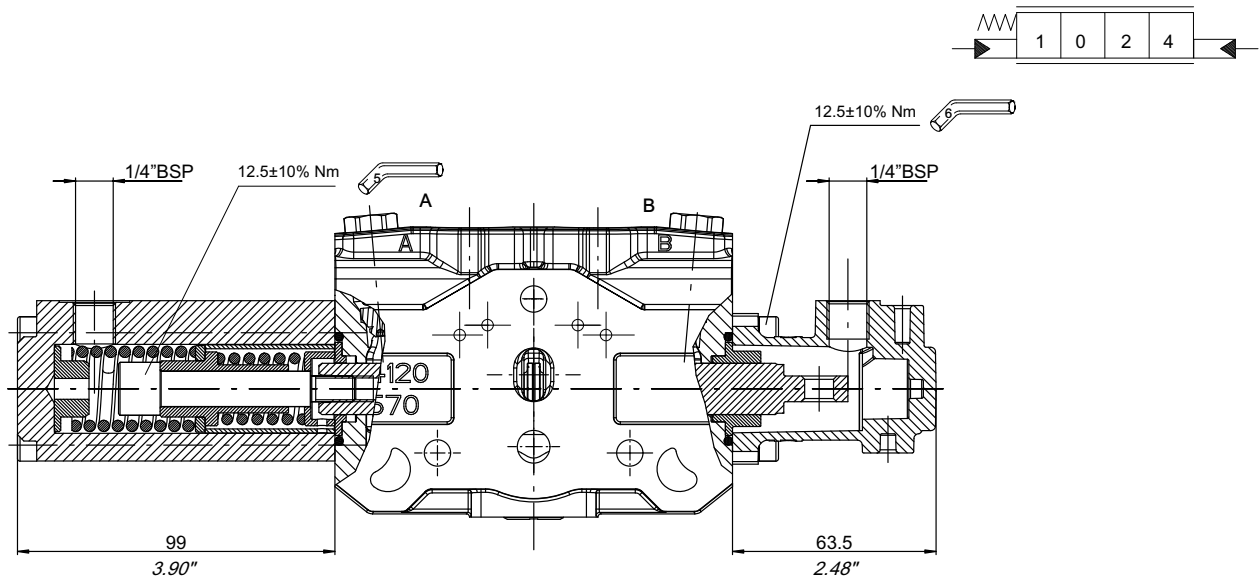
Standard metering stroke

Spools for specific applications/functions could have different metering strokes.  
Should a version without part number be needed, please contact our Sales Dept.

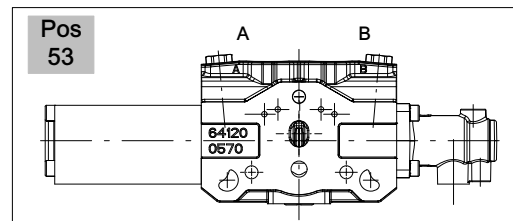


## 4.7.2 Floating positioners

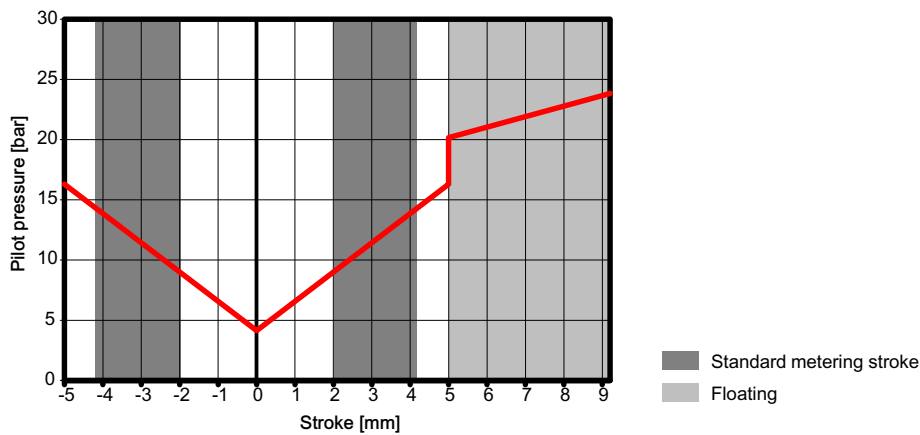
P max = 40 bar



Type		D	Spring	Code
51	53	1/4" BSP	5	200768650681
-	-	SAE6	-	-



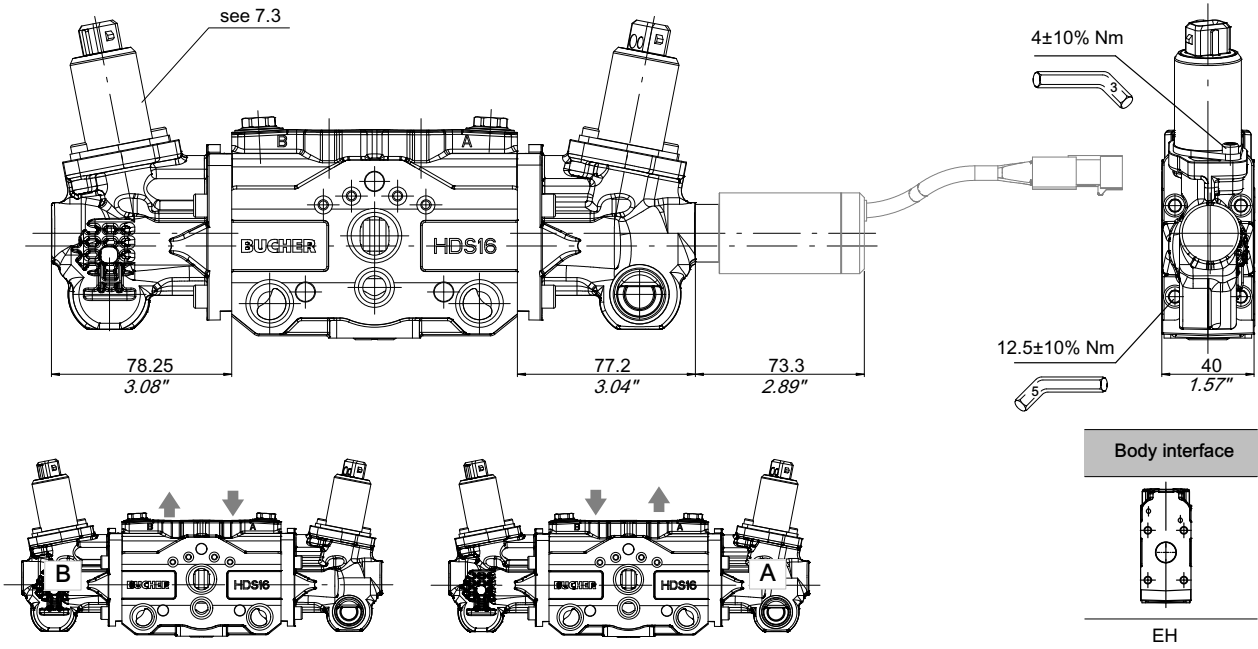
Spring characteristic curves



Should a version without part number be needed, please contact our Sales Dept.

## 4.8 Electro-hydraulic open loop proportional / ON-OFF control - EHO

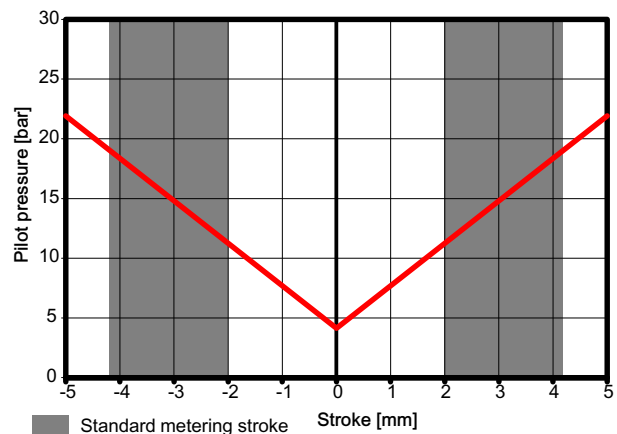
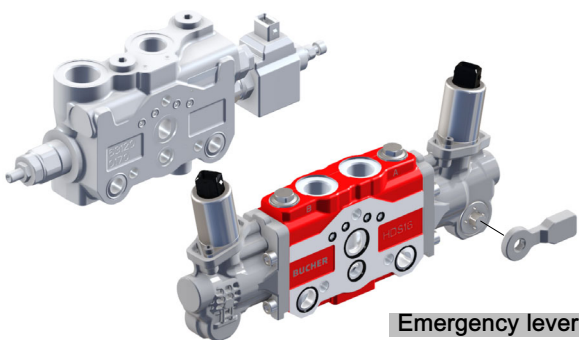
The standard position of positioner kits/emergency lever is on A port side  
 Max piloted pressure= 35 bar



3	2	2	S	6	N	N	0	S	U
---	---	---	---	---	---	---	---	---	---

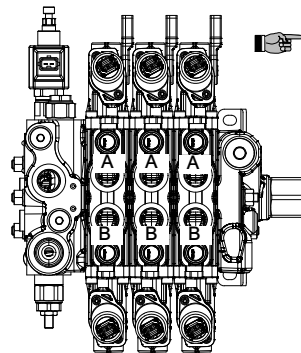
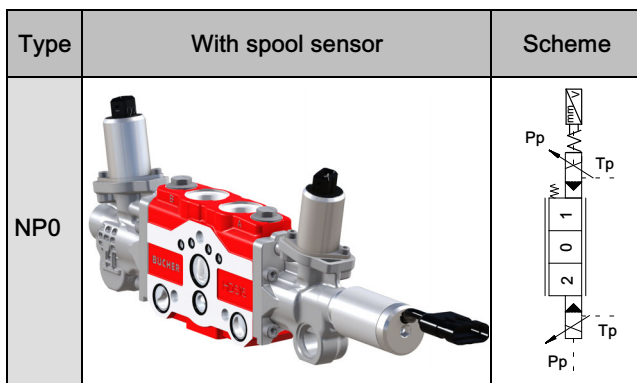
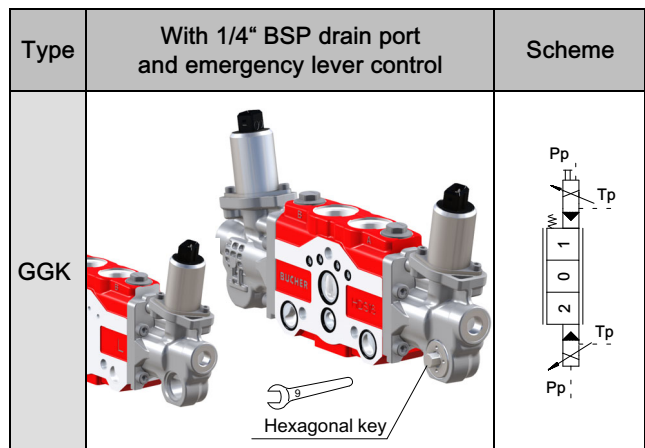
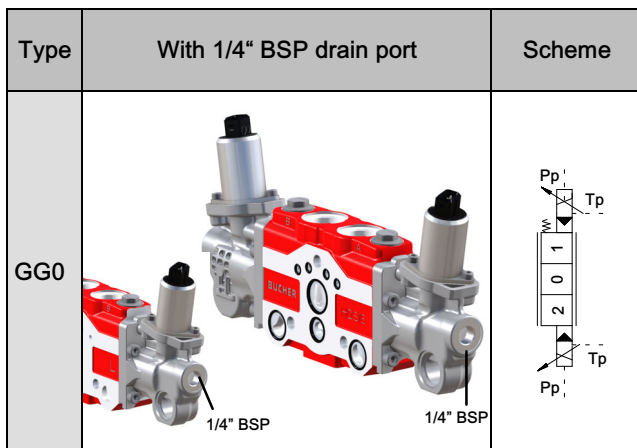
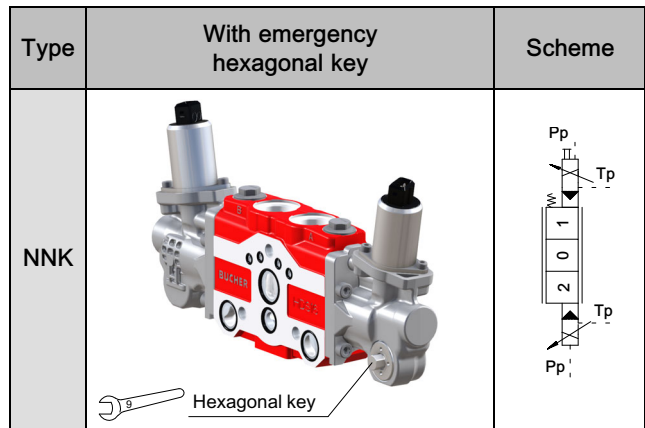
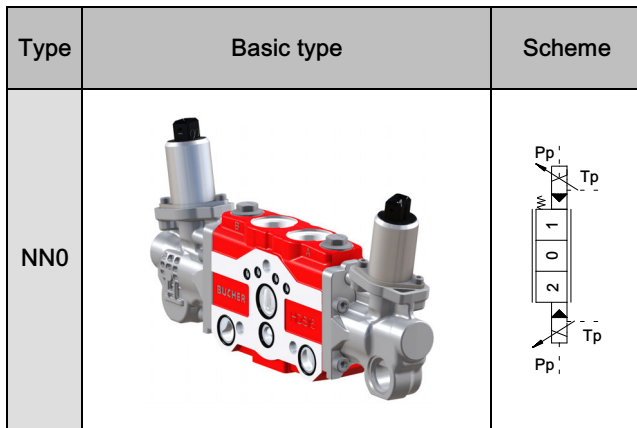
Proportional pressure reducing valve type (see 7.3)	
Orifice type (fixed)	
Spring type (fixed)	
Combination type (see next page)	
Emergency lever type (fixed)	
Emergency lever position (see next page)	

EHO positioner spring curve



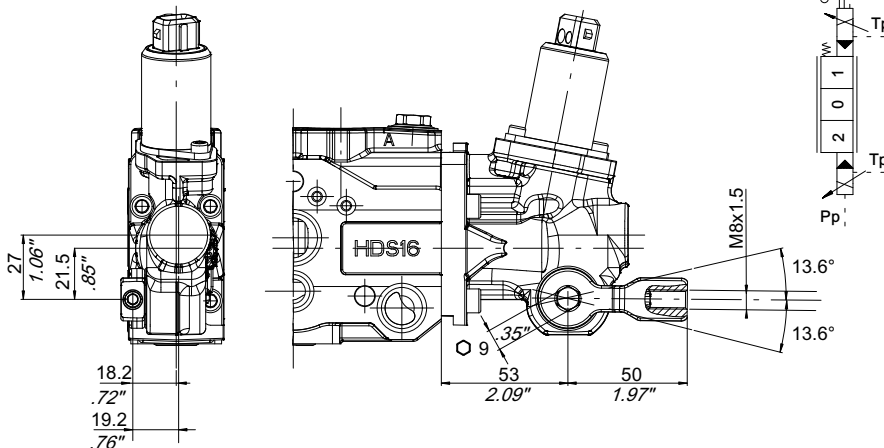
The pressure differential between pilot lines Pp and Tp should be > 25 bar in order to be sure to switch the spool to full stroke in all operating conditions

## Combination types

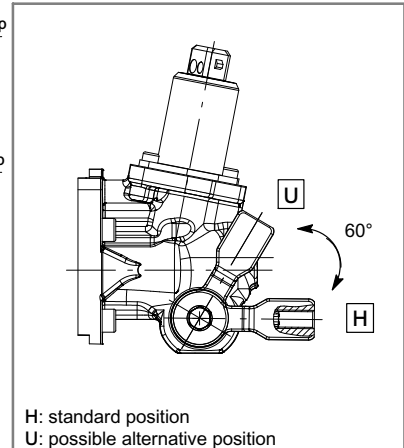


**IMPORTANT:**  
The standard position of positioner kits/emergency lever is on A port side (see 4.2.2)

## Emergency lever

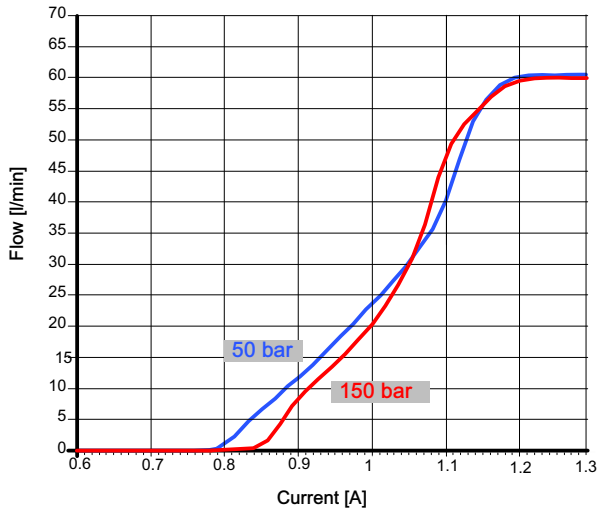


## Emergency lever positions

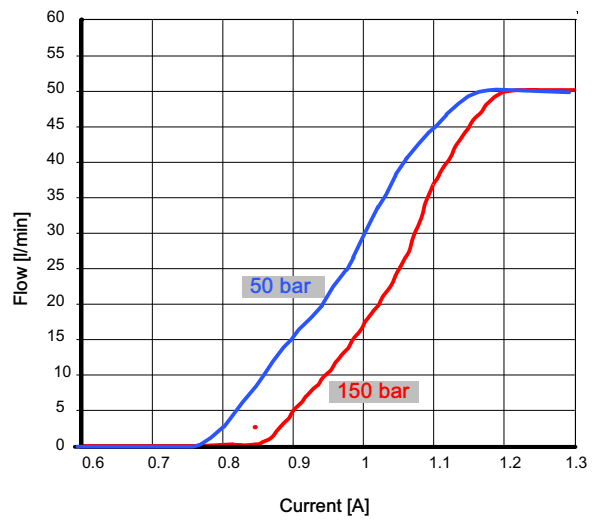


## 4.8.1 Spool metering curves 12 V

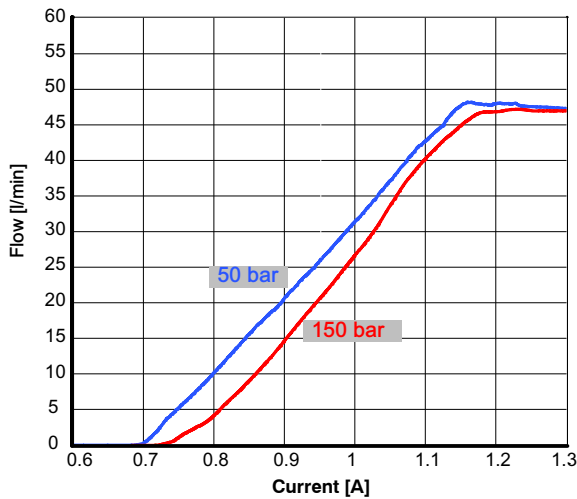
Spool size 6 metering : P→A→B→T (inlet flow 60 l/min)



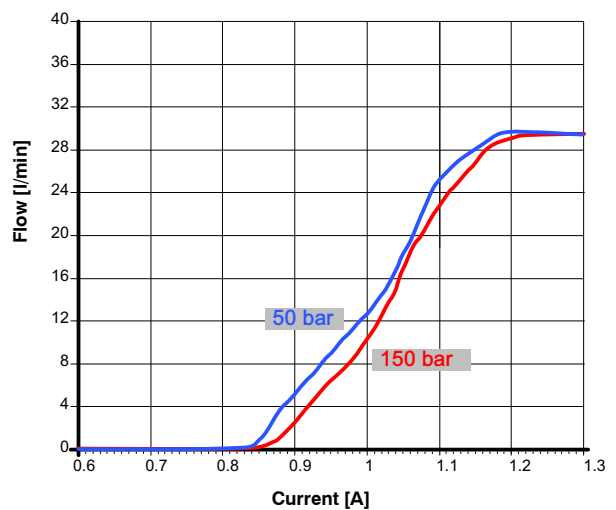
Spool size 5 metering: P→A→B→T (inlet flow 50 l/min)



Spool size 4 metering: P→A→B→T (inlet flow 45 l/min)

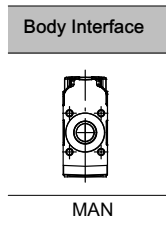
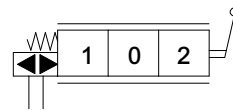
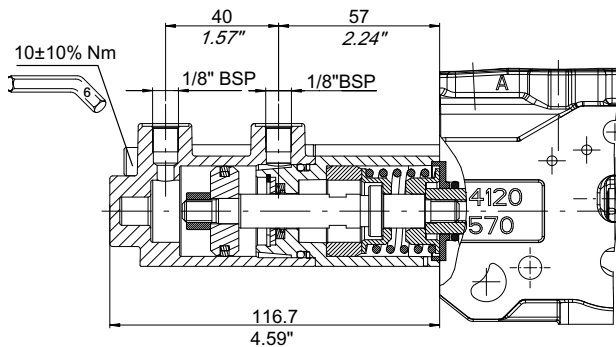


Spool size 2 metering: P→A→B→T (inlet flow 30 l/min)



## 4.9 Pneumatic control

The standard position of positioner kits is on A port side



Type	Code
24	200768650111

### Operating conditions

Hydraulic control:

Pressure range: min. 6 bar (87 psi) - max. 15 bar (217 psi)

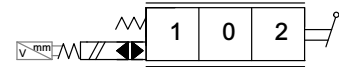
Pneumatic control:

Pressure range: min. 6 bar (87 psi) - max. 10 bar (145 psi)

### 4.10 Electro-hydraulic ON-OFF control with lever option - EHI

The standard position for positioner kits is on A port side

Type	Code	Voltage
720	2007686617500	12/24 V DC



Lever side

Positioner side

Body interface

Body interface

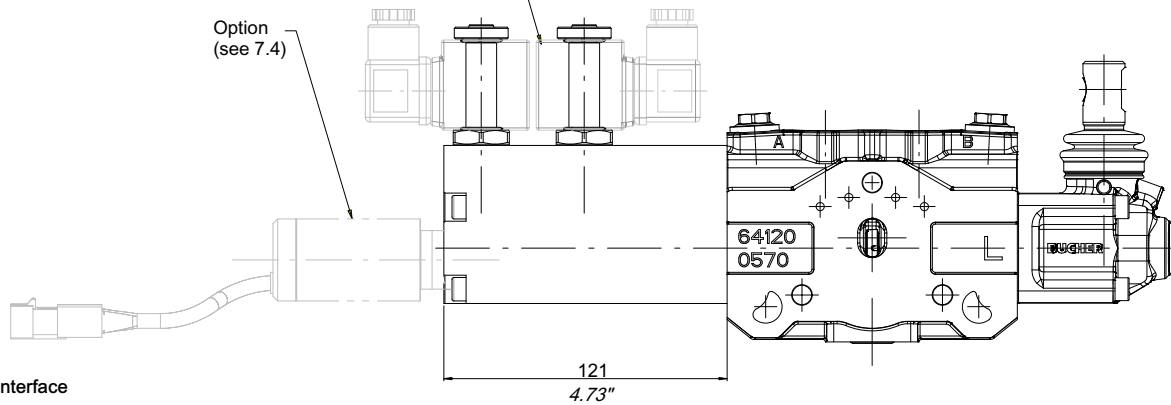


MAN

EHM\*

Coils not included  
(see 7.1.2)

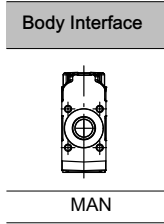
Option  
(see 7.4)



\*Special interface

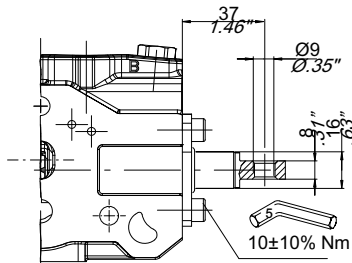
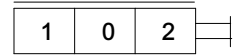
## 4.11 Levers

The standard position of the lever kit is always on B port side.



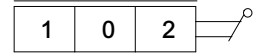
### 4.11.1 Free end spool with dust proof seal

Type	Code
L55	200707190040

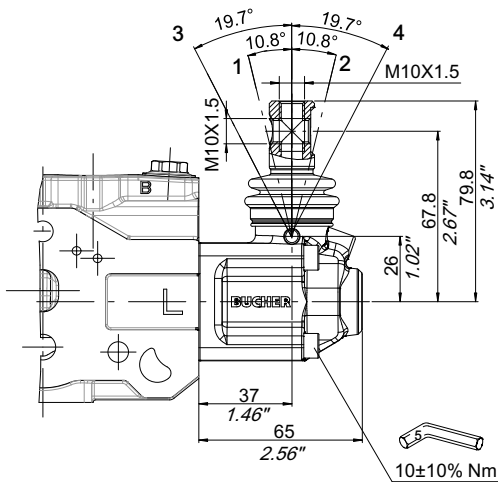


### 4.11.2 Standard lever group

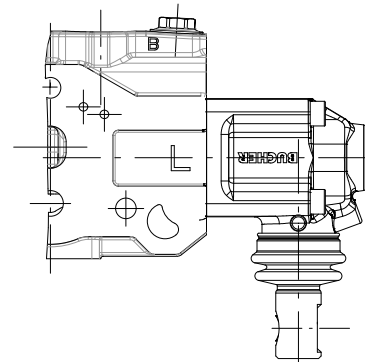
Type	Code
L100    L300	200707120670



L100

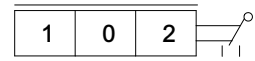


L300

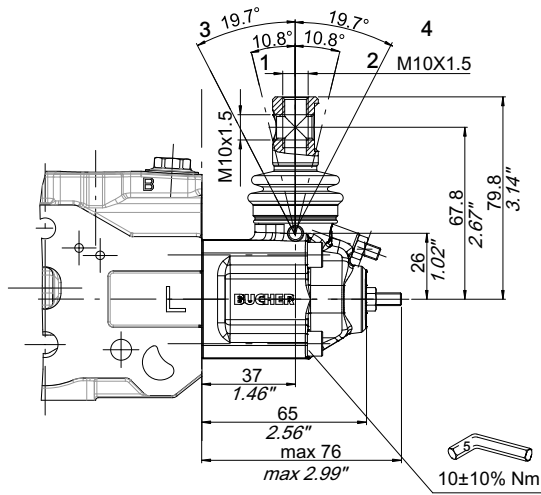


### 4.11.3 Lever group with stroke limitation

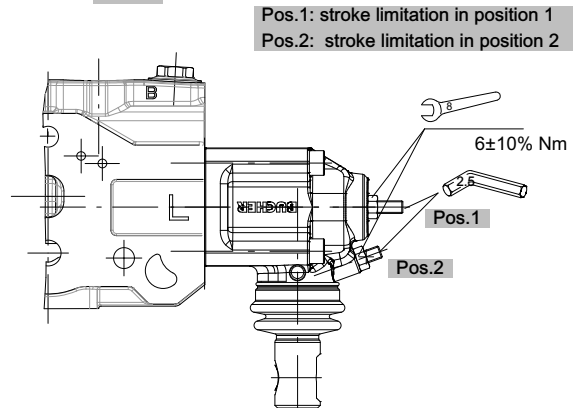
Type		Code
L102	L302	200707120690



**L102**

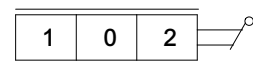


**L302**

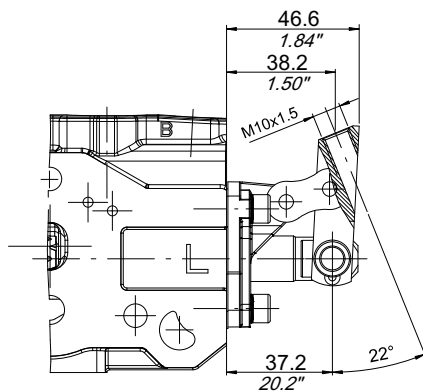


### 4.11.4 Special steel lever group

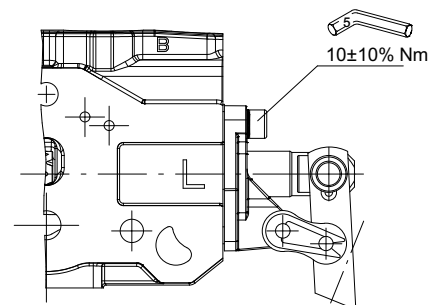
Type		Code
L240	L440	200707120660



**L240**

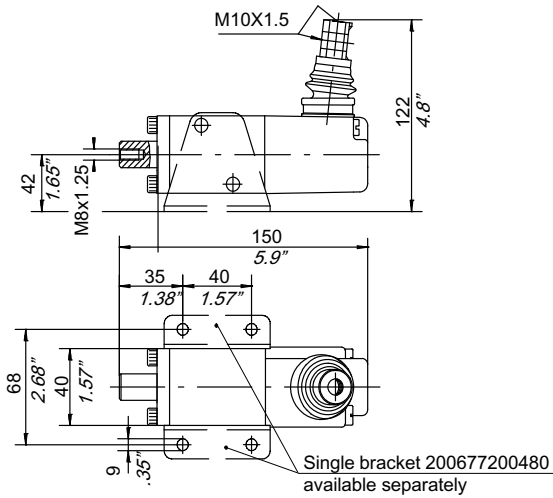


**L440**

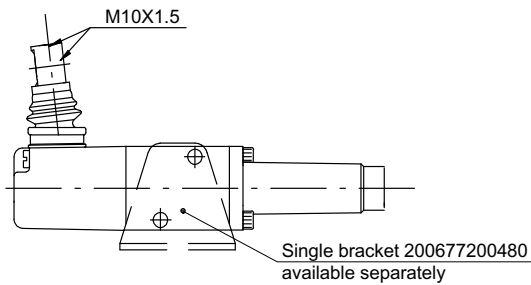


## 4.11.5 Remote cable control

### L142 Only for rod remote control



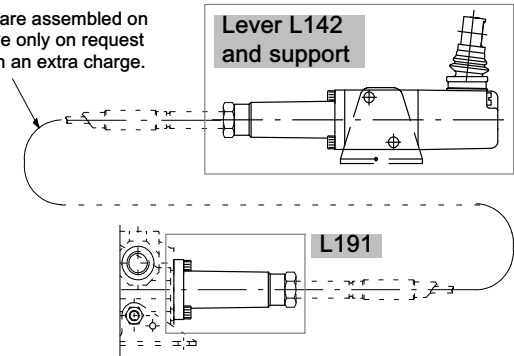
### Lever L142 and support



Type	Code
L142	200707120120
L142 and support	200760900130
L191	200760900010

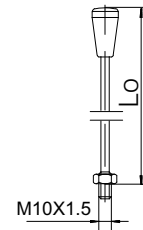
### Cable

Cables are assembled on the valve only on request and with an extra charge.



Cable length	Code	Cable length	Code
1000 mm	200544104002	2500 mm	200544104007
1500 mm	200544104005	3000 mm	200544104008
2000 mm	200544104006	4000 mm	200544104009

### Lever stick AL00\*

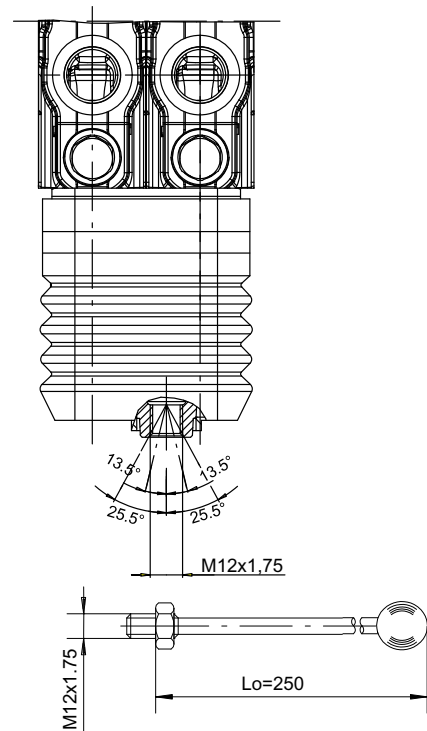
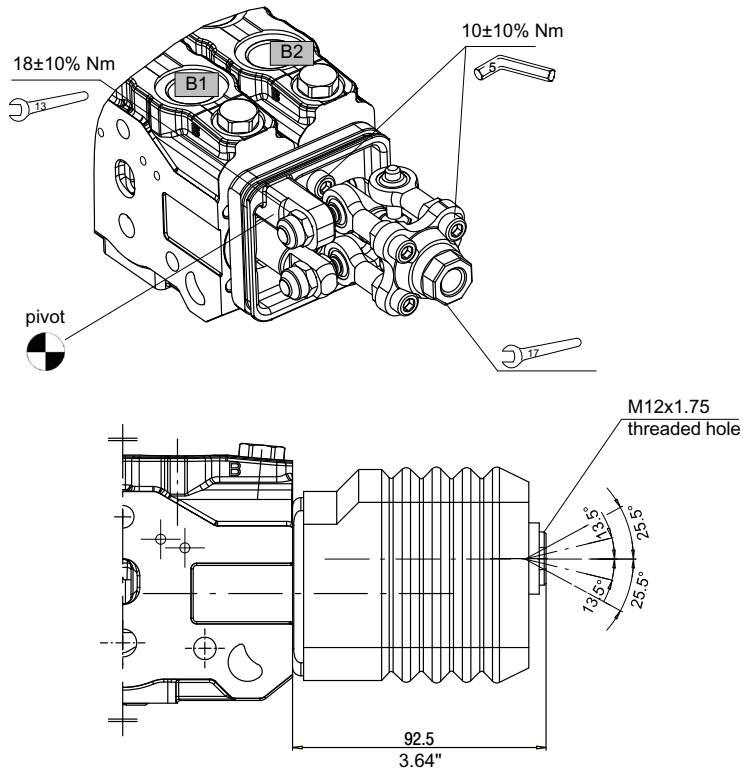
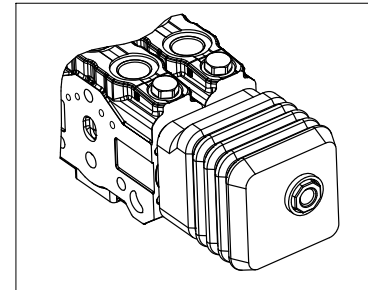
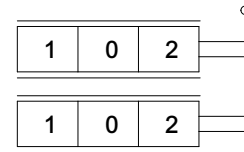


Lo		Type	Code
mm	inches		
190	7.48	AL001	200702220010
255	10.04	AL002	200702220030
300	11.81	AL003	200702220040
350	13.78	AL004	200702220050



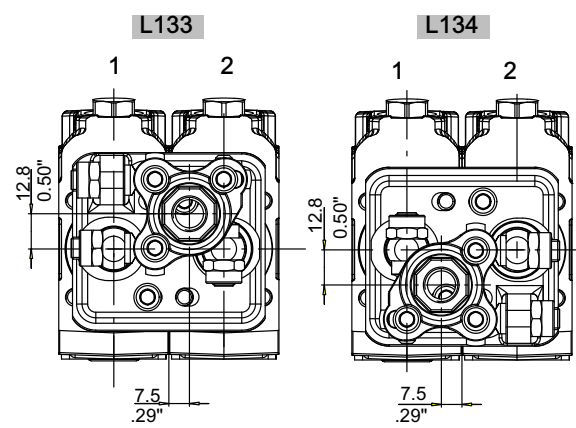
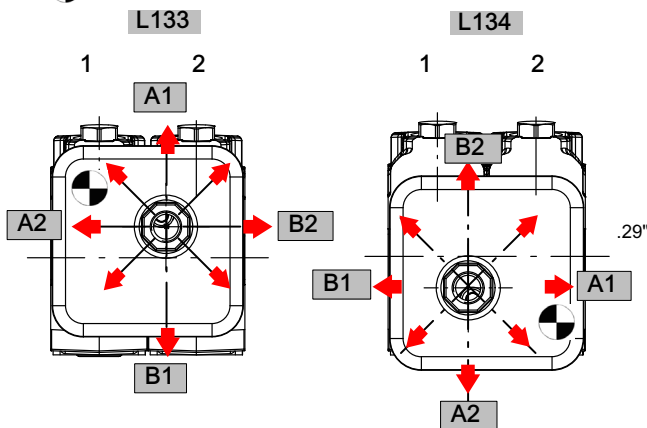
## 4.11.6 Manual joystick control L133 - 134

Type		Code
L133	L134	200775930470



Type	Code
AL010	200702230040

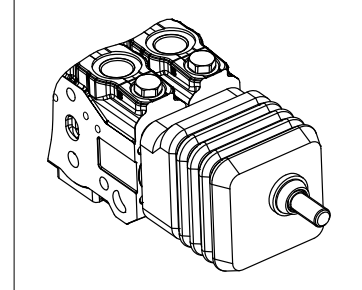
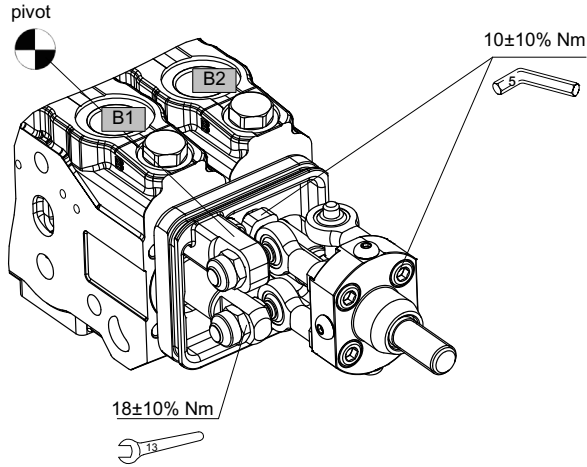
Pivot



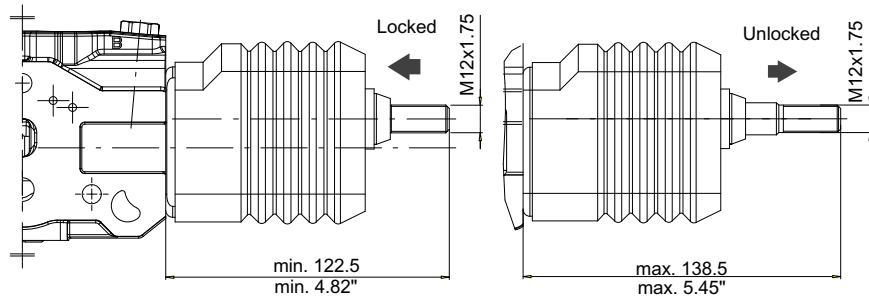
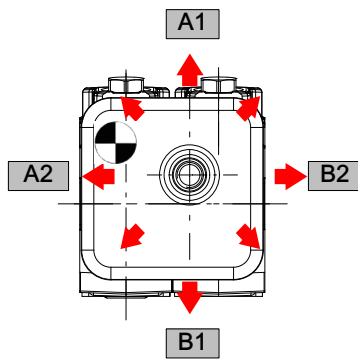
With two floating spools the combinations Z-Z and W-W are permitted, only.

## 4.11.7 Manual joystick control L260-460 with integrated locking system

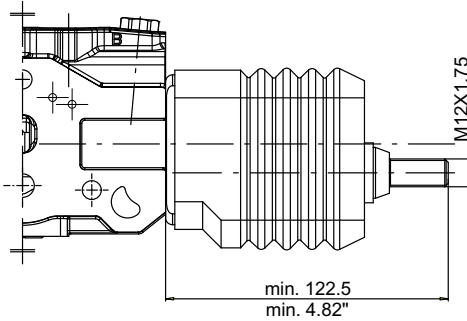
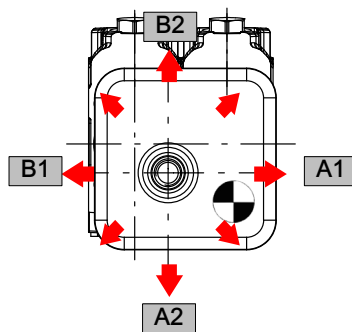
Type		Code
L260	L460	200775930480



**L260**



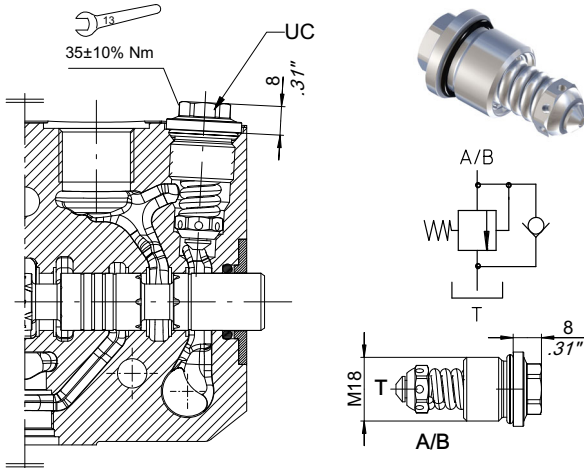
**L460**



## 5 Section valves

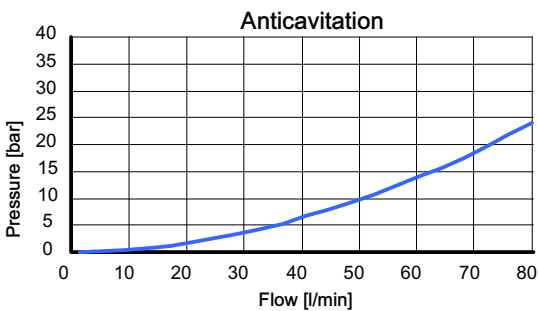
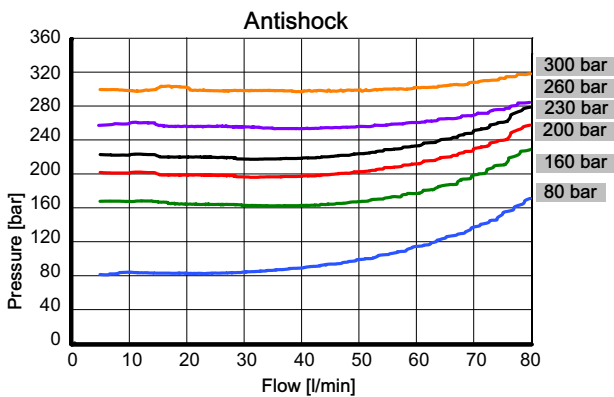
### 5.1 Anti-shock and anti-cavitation valves - UC

#### 5.1.1 Fixed setting



The dedicated cavity is machined on request only

Setting/ 10	Pressure setting at 10 l/min (*) bar (psi)	Code
05	50 (720)	200533930240
08	80 (1160)	200533930370
10	100 (1450)	200533930250
12	120 (1740)	200533930260
14	140 (2030)	200533930175
15	150 (2170)	200533930270
16	160 (2320)	200533930380
17	170 (2460)	200533930280
18	180 (2610)	200533930460
19	190 (2750)	200533930290
20	200 (2900)	200533930300
21	210 (3040)	200533930310
23	230 (3330)	200533930320
24	240 (3480)	200533930390
25	250 (3620)	200533930330
26	260 (3770)	200533930400
27	270 (3910)	200533930410
28	280 (4060)	200533930340
30	300 (4350)	200533930173
32	320 (4640)	200533930350
35	350 (5070)	200533930360
00	00 (plug)	200778400410

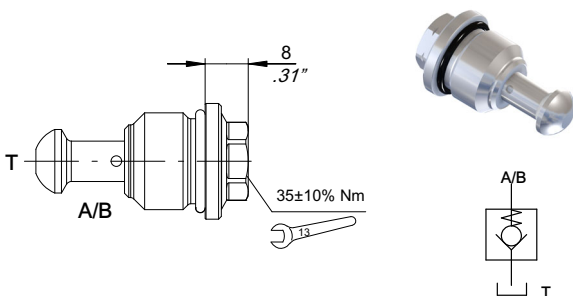


(\*) For different pressure settings please contact our Sales Department

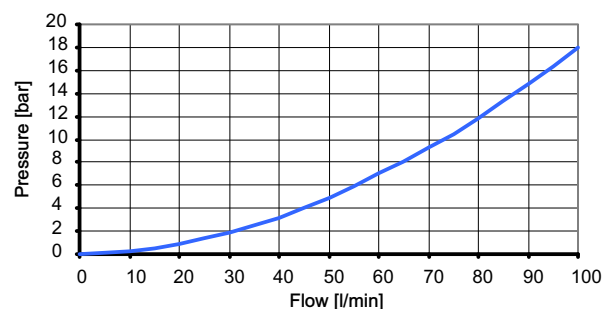


**IMPORTANT!** The UC anti-shock valve is designed to absorb shock effects. Therefore, it should not be used as pressure relief valve

### 5.2 Anti-cavitation valves - C

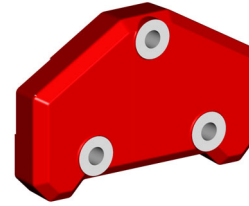
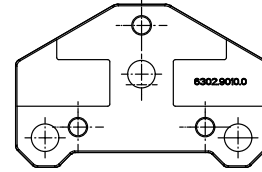
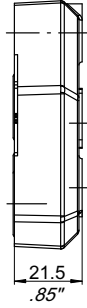
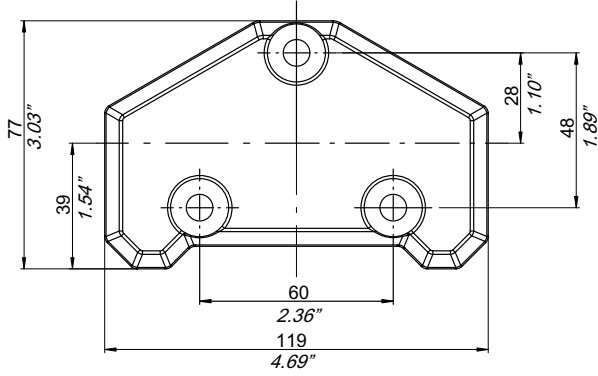


Type	Code
C	200533940088

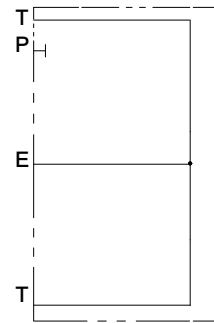


## 6 End covers

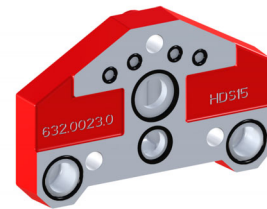
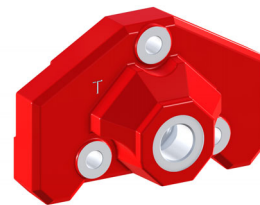
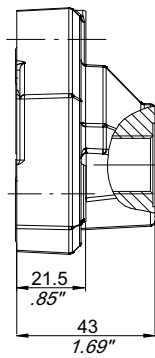
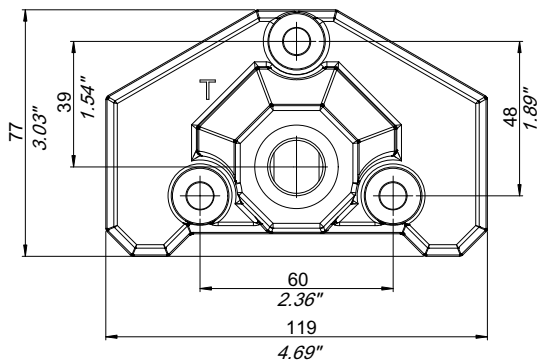
### 6.1 Basic end cover - P31



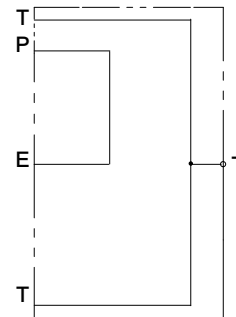
Type
P31



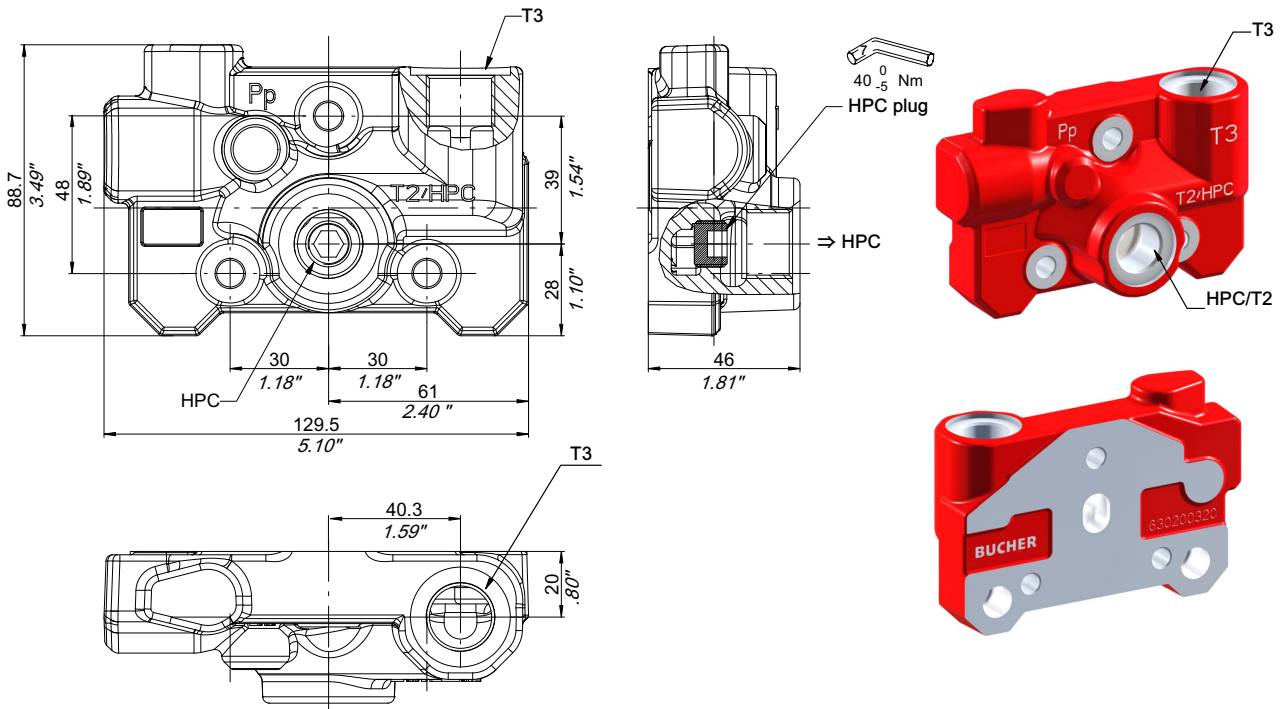
### 6.2 Outlet cover - P\_00



Type	T
P100	1/2" BSP
P800	M18x1.5

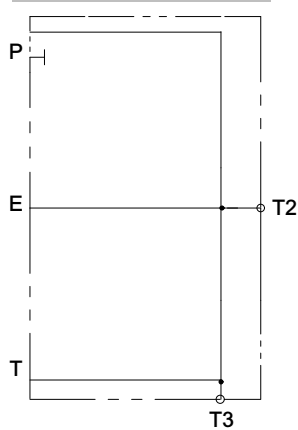


6.3 Outlet cover - PM

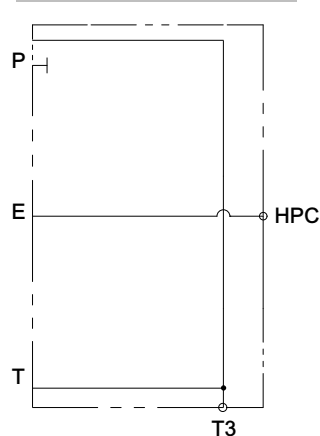


Type		T2/HPC	T3
Standard	With HPC		
PM 101	PM 111	1/2" BSP	1/2" BSP
PM 201	PM 211	3/4" BSP	3/4" BSP
PM 301	PM 311	SAE10	SAE10
PM 501	PM 511	M22x1.5	M22x1.5

COP16 PM\_01 T2 T3

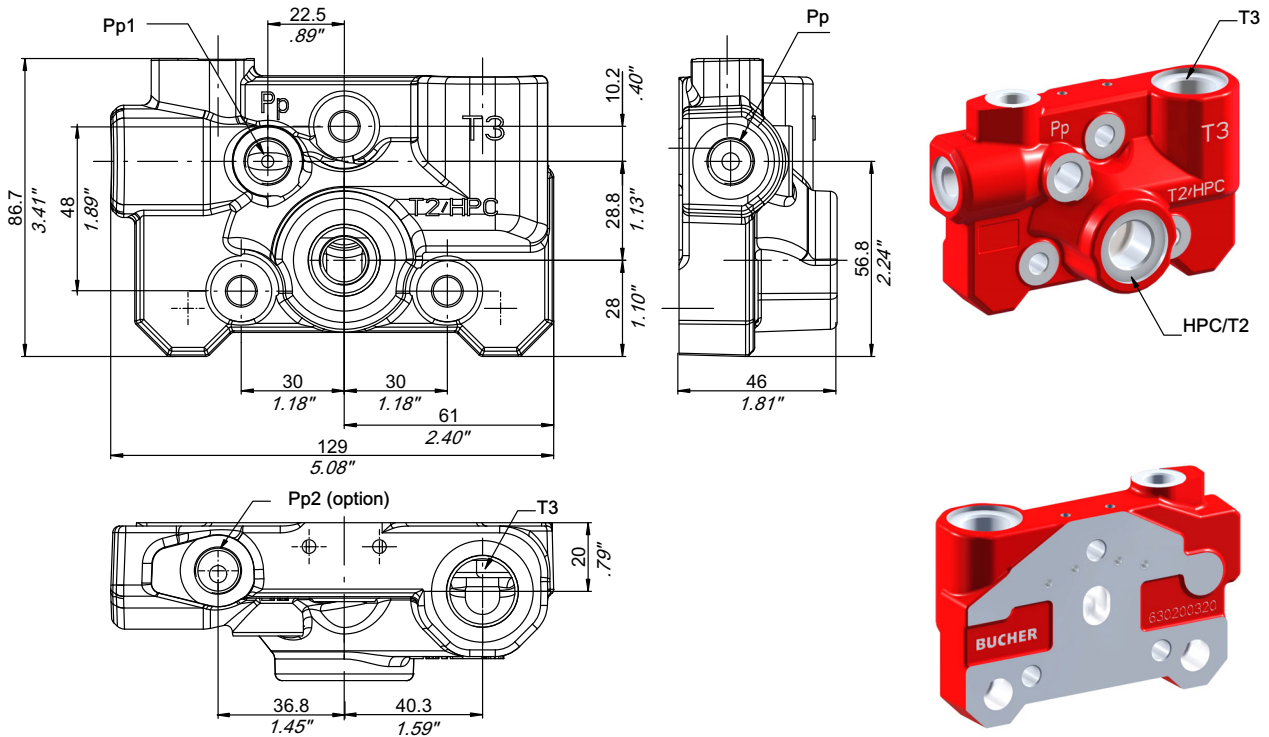


COP16 PM\_11 HPC T3



## 6.4 Outlet cover - PH

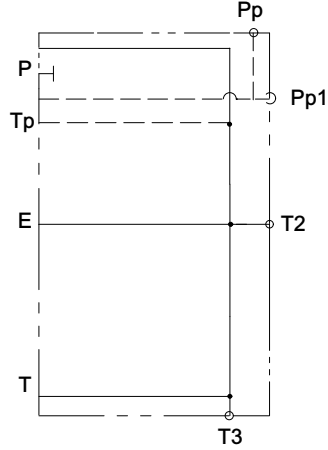
### 6.4.1 With pilot pressure port Pp



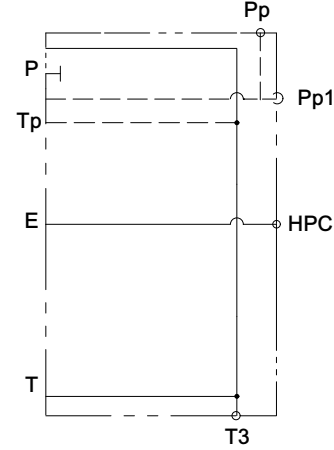
Pp ports max supply pressure: 35 bar

Type		T2/HPC	T3	Pp	Pp1	Pp2
Standard	With HPC					
PH 101	PH 111	1/2" BSP	1/2" BSP	1/4" BSP	1/4" BSP	-
PH 102	PH 112	1/2" BSP	1/2" BSP	1/4" BSP	1/4" BSP	1/4" BSP
PH 201	PH 211	3/4" BSP	3/4" BSP	1/4" BSP	1/4" BSP	-
PH 202	PH 212	3/4" BSP	3/4" BSP	1/4" BSP	1/4" BSP	1/4" BSP
PH 301	PH 311	SAE10	SAE10	SAE6	SAE6	-
PH 302	PH 312	SAE10	SAE10	SAE6	SAE6	SAE6
PH 501	PH 511	M22x1.5	M22x1.5	M14x1.5	M14x1.5	-
PH 502	PH 512	M22x1.5	M22x1.5	M14x1.5	M14x1.5	M14x1.5

COP16 PH\_01 T2 T3 PP PP1 00



COP16 PH\_11 HPC T3 PP PP1 00

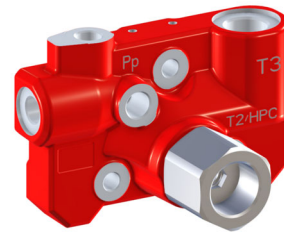
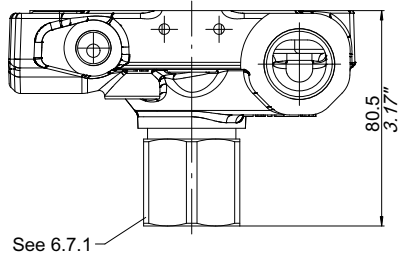


## 6.4.2 With back pressure valve

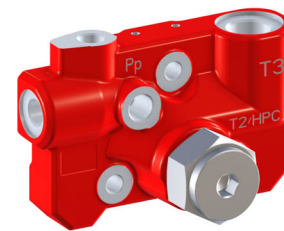
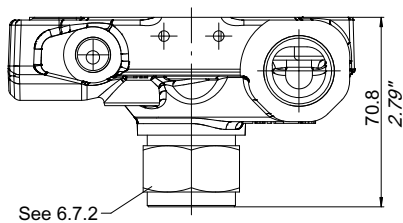
Return back pressure valve (T2 = 3/4" BSP)

The valve is fixed set and create an additional back pressure to the neutral gallery free flow according to the diagrams. (see 6.7.1 and 6.7.2)

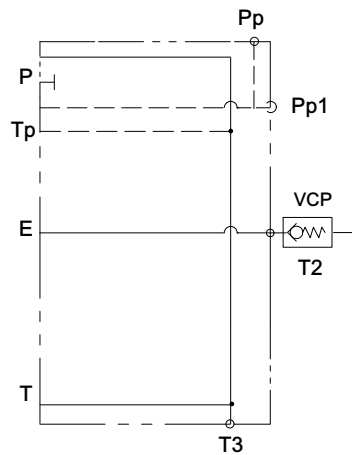
### VCP



### VIN

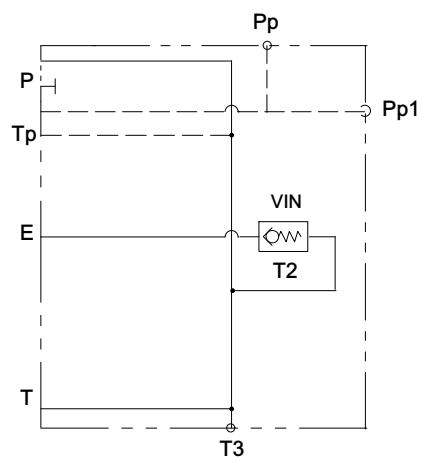


COP16 PH211 VCP12 PP PP1 00



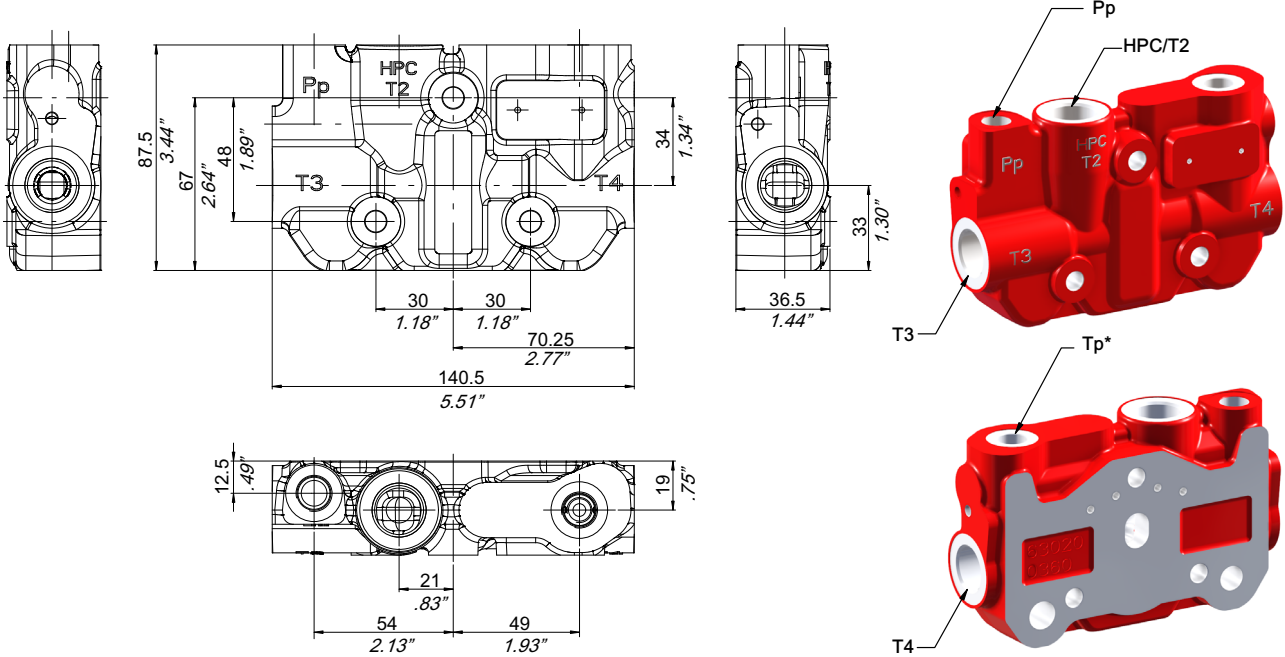
T2 and T3 port must be connected to tank

COP16 PH211 VIN08 PP PP1 00



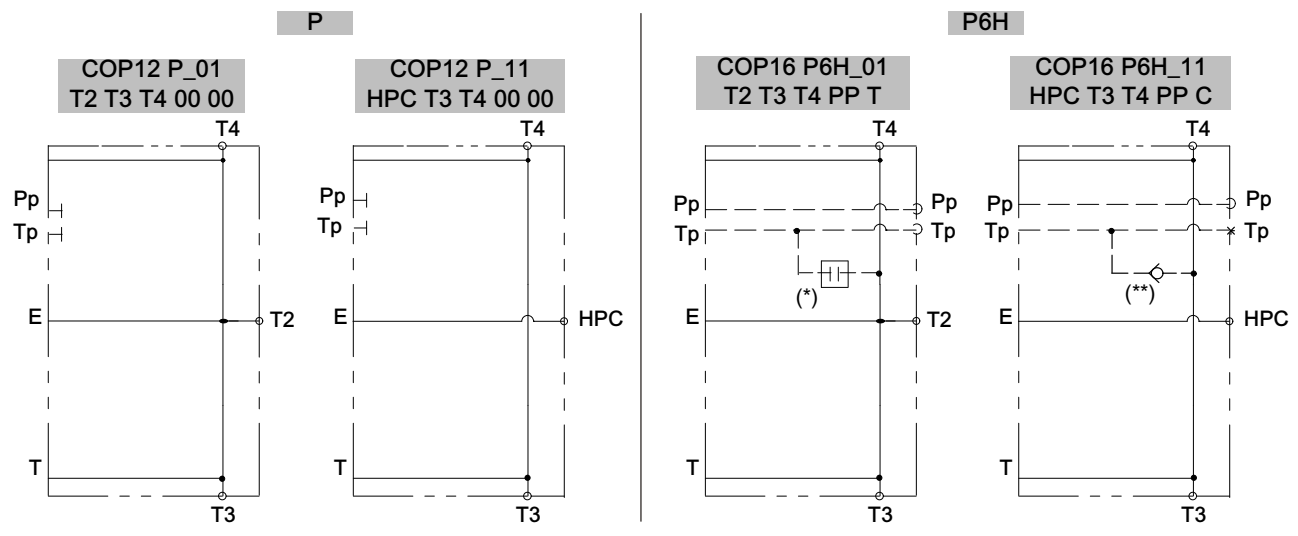
## 6.5 Outlet cover - P and P6H

With upper T2/HPC port and/or Tp port



Type		T2/HPC	T3	T4	Pp	Tp
Standard	With HPC					
P 101	P 111	1/2" BSP	1/2" BSP	1/2" BSP	-	-
P6H 101	P6H 111	1/2" BSP	1/2" BSP	1/2" BSP	1/4" BSP	1/4" BSP
P 401	P 411	SAE8	SAE8	SAE8	-	-
P6H 901	P6H 911	SAE8	SAE8	SAE8	SAE6	SAE6
P 501	P 511	M22x1.5	M22x1.5	M22x1.5	-	-
P6H 501	P6H 511	M22x1.5	M22x1.5	M22x1.5	M14x1.5	M14x1.5

P6H outlet cover to be used only with T6H Inlet cover (see 2.2)



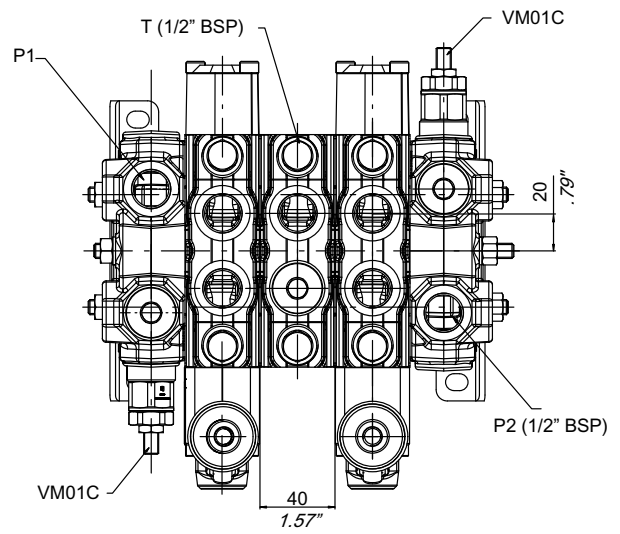
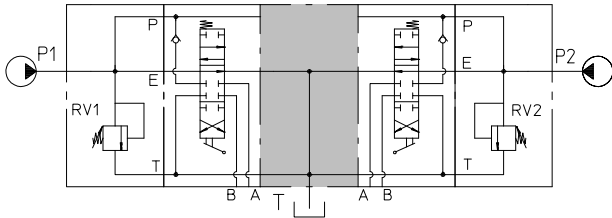
(\*) with external drain - T  
Plug M10x1 200527104401

(\*\*) with internal drain - C  
Check valve M10x1 200787603100



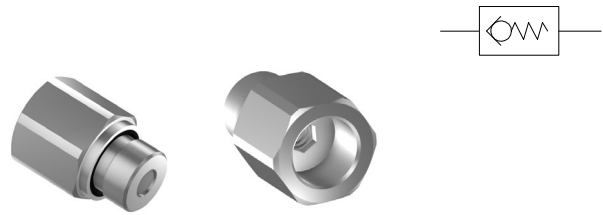
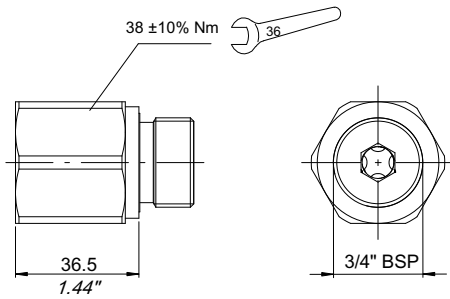
6.6 Intermediate outlet section - PI

Type	Ports
PI 101	1/2 BSP
PI 301	SAE10
PI 501	M22x1.5



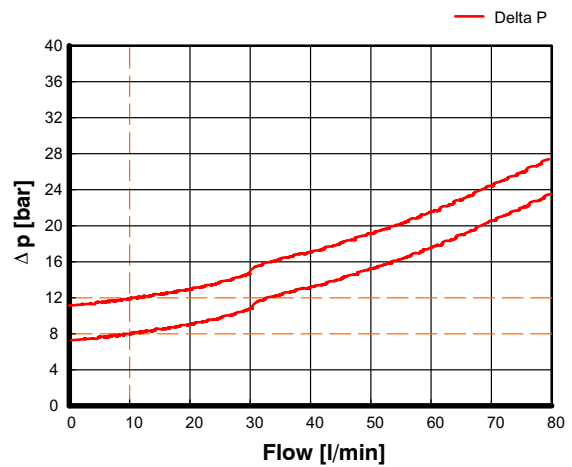
## 6.7 End cover valves

### 6.7.1 Back pressure valve - VCP

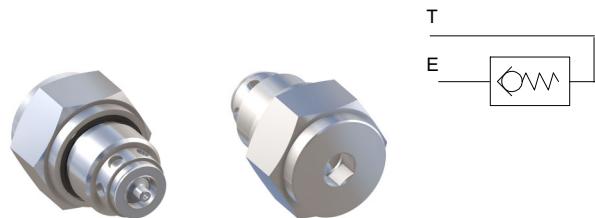
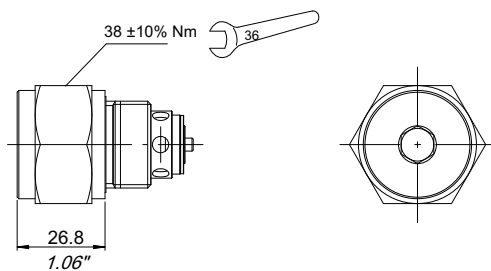


Type	Code	Nominal pressure ( bar)
VCP08	200787404320	08
VCP12	200787404340	12

VCP characteristic curve (recorded on HDS16/1)  
Valve set at 12 bar with 10 l/min.

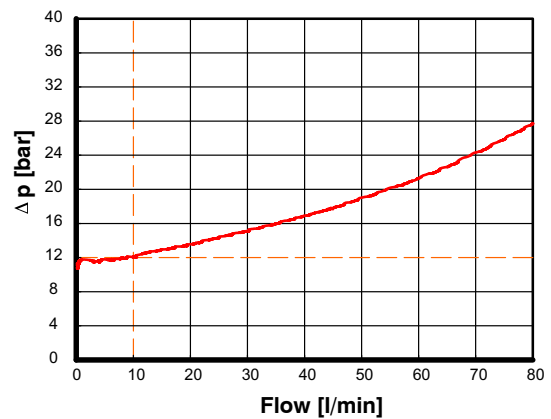


### 6.7.2 Back pressure valve with internal drain - VIN



Type	Code	Nominal pressure ( bar)
VIN08	200787404310	08
VIN12	-	12

VIN characteristic curve (recorded on HDS16/1)  
Valve set at 12 bar with 10 l/min.



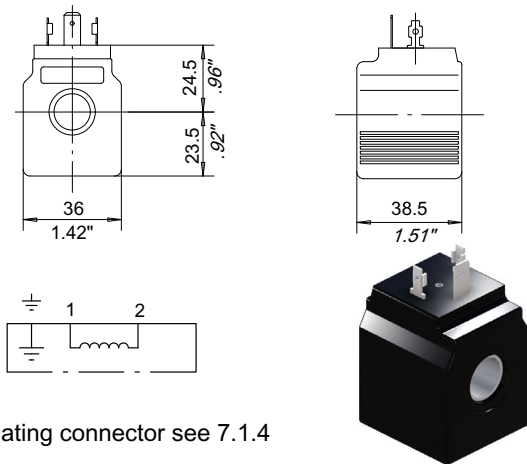
Should a version without part number be needed, please contact our Sales Dept.

## 7 Additional electric and electronic devices

### 7.1 Coils and connectors

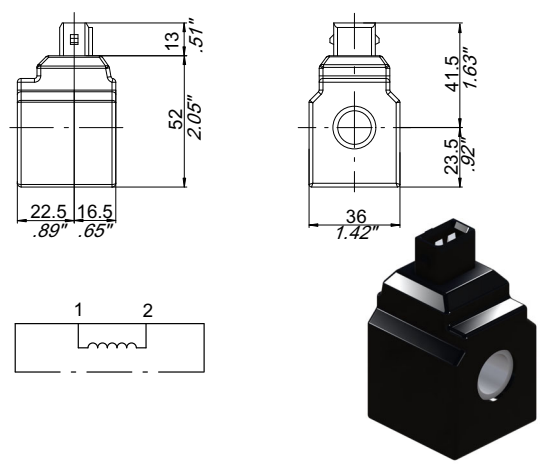
#### 7.1.1 Solenoid valve coils (Ø13 L36)

DIN 43650-A/ISO4400 connector

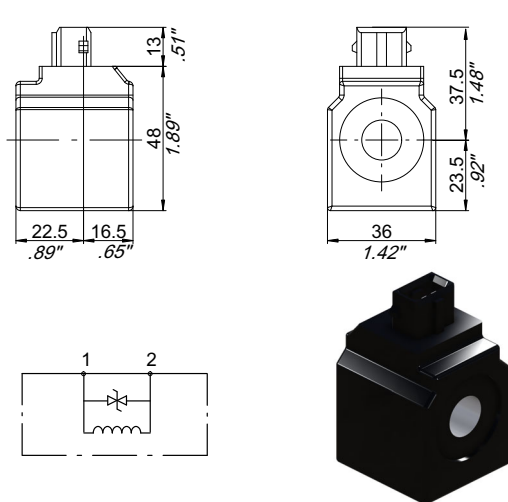


For mating connector see 7.1.4

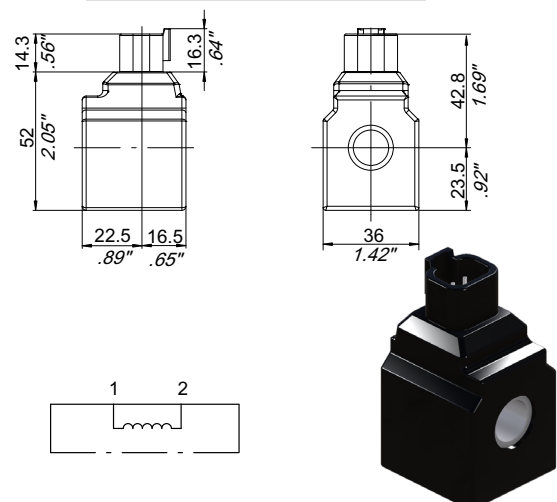
AMP JT 84-9414 connector



AMP JT 84-9419 connector



Deutsch DT04-2P connector



#### Coil features

Wire class	H (VDE0580)
Duty cycle	ED 100%
Voltage tolerance	± 10%

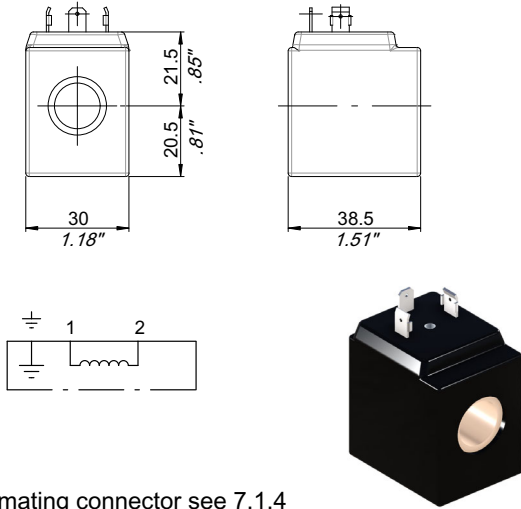
Connector style	Type	IP	Diode	Code	Nominal coil voltage (VDC)	Power (W)	Current consumption at 20°C (A)	Resistance at 20°C (Ω)
DIN	12 H -	65	-	200674910100	12	27.2	2.2	5.3
	24 H -		-	200674920080	24	27	1.12	21.3
AMP	12 A -	65	-	200674910250	12	27.2	2.2	5.3
	24 A -		-	200674920200	24	27	1.12	21.3
AMP + DIODE	12 A D	65	Transil	200541210032	12	21	1.75	6.85
	(24 A D)		Transil	200541220033	24	21	0.78	27
DT	12 D -	67	-	200674910370	12	27	2.2	5.3
	(24 D -)		-	200674920290	24	27.2	1.12	21.3

IP value is not referred to the coil itself and is reached using the proper mating connector and seals in the final assembly.

( ) : should this specific coil be needed, please contact our Sales Dept.

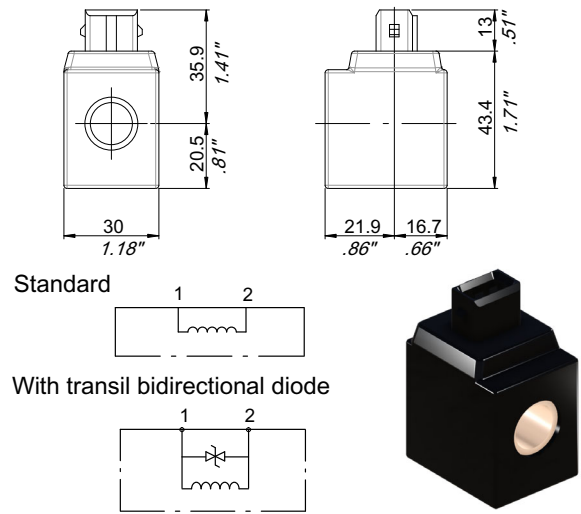
## 7.1.2 Solenoid valve coils (Ø13 L30 - 18 W)

DIN 43650-A/ISO4400 connector

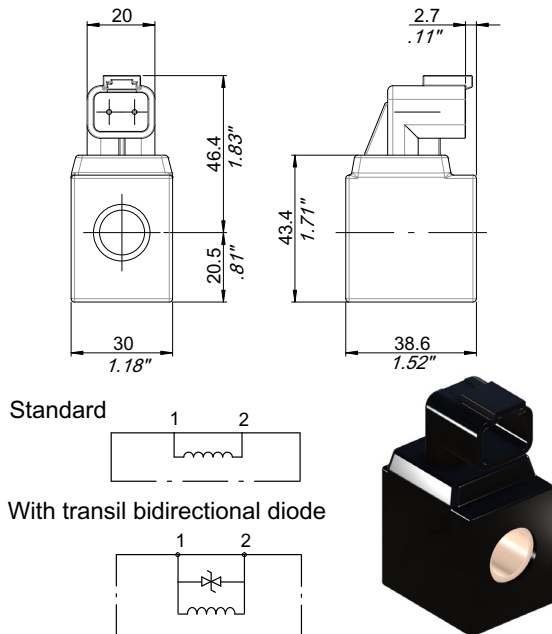


For mating connector see 7.1.4

AMP JT 84-9414 connector



Deutsch DT04-2P connector



Coil features

Wire class	H (VDE0580)
Duty cycle	ED 100%
Voltage tolerance	± 10%

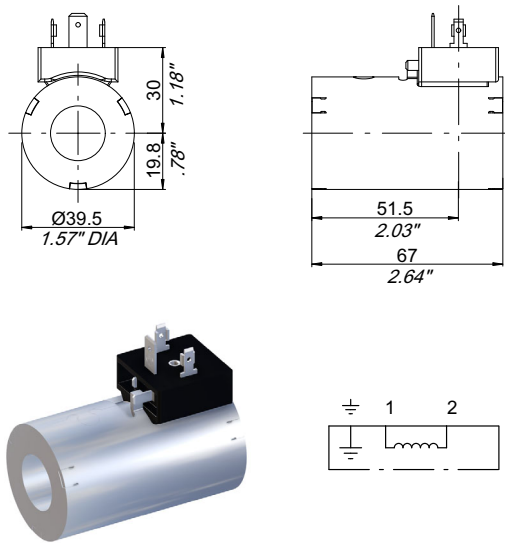
Connector style	Type	IP	Diode	Code	Nominal coil voltage (VDC)	Power (W)	Current consumption at 20°C (A)	Resistance at 20°C (Ω)
DIN	(12 H -)	65	-	200674910490	12	18	1.5	8
	(24 H -)		-	200674920390	24	18	0.75	32
AMP	(12 A -)	65	-	200674910480	12	18	1.5	8
	(12 A D)		Transil	200674910540	12	18	1.5	8
	(24 A -)		-	200674920400	24	18	0.75	32
	(24 A D)		Transil	200674920370	24	18	0.75	32
DT	12 D -	67	-	200674910470	12	18	1.5	8
	(12 D D)		Transil	200674910530	12	18	1.5	8
	(24 D -)		-	200674920410	24	18	0.75	32
	(24 D D)		Transil	200674920380	24	18	0.75	32

IP value is not referred to the coil itself and is reached using the proper mating connector and seals in the final assembly.

( ) : should this specific coil be needed, please contact our Sales Dept.

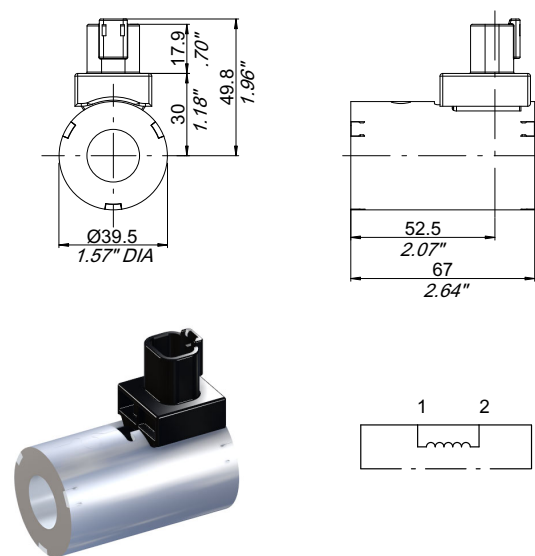
## 7.1.3 ON-OFF positioner coils (Ø19)

DIN 43650-A/ISO4400 connector

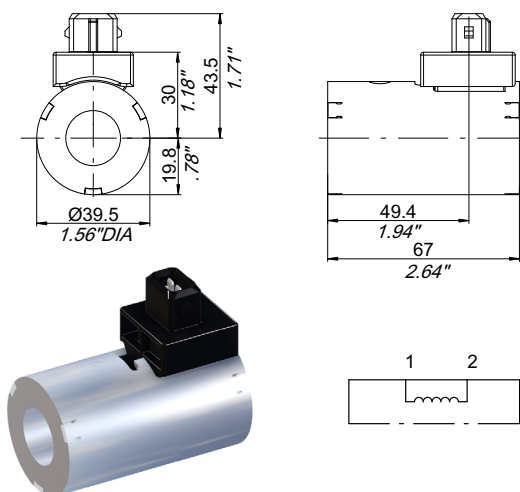


For mating connector see 7.1.4

Deutsch DT04-2P connector



AMP JT-84-9419 connector



Coil features

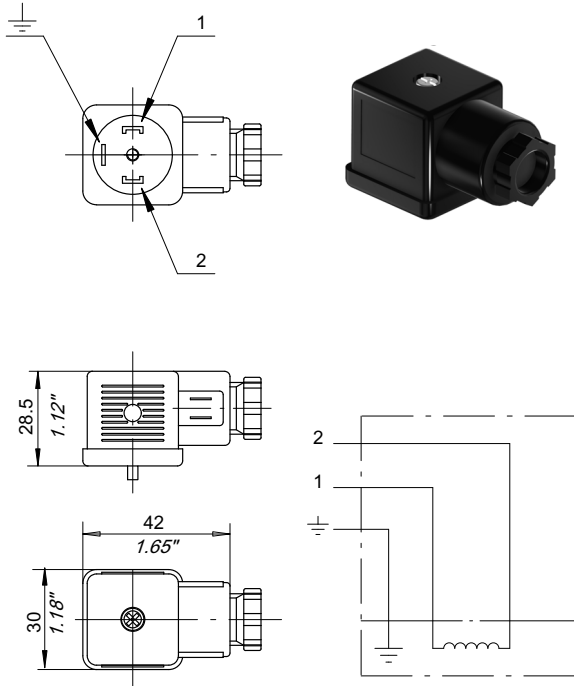
Wire class	H (VDE0580)
Duty cycle	ED 100%
Voltage tolerance	± 10%
Magnetic frame protection	Fe/ZnNi5/Cn/T0 (DIN 50979)

Connector style	Type	IP	Code	Nominal coil voltage (VDC)	Power (W)	Current consumption at 20°C (A)	Resistance at 20°C (Ω)
DIN	12 H -	65	200674910430	12	29	2.35	5.1
	24 H -		200674920320	24	25	1.12	21.5
AMP	12 A -	65	200674910450	12	29	2.35	5.1
	24 A -		200674920340	24	25	1.12	21.5
DT	12 D -	67	200674910440	12	29	2.35	5.1
	24 D -		200674920330	24	25	1.12	21.5

IP value is not referred to the coil itself and is reached using the proper mating connector and seals in the final assembly.

## 7.1.4 DIN43650-A/ISO4400 connector

Type	Code
DIN43650-A/ISO4400	200544110009



For power input	D.C.
Number of poles	2 + $\perp$
Nom. capacity at contacts	10 A.
Max capacity at contacts	16 A.
Resistance at contacts	$\geq 4$ mOhm
Max section of cable	1.5 mm <sup>2</sup>
Outer material	Glass fibre reinforced Nylon
Contact mount material	
Color	Black
Armour clamp	Pg 9
Ø cable	6-8 mm.
Protection factor	IP65 (DIN40050)
Insulation class	C (VDE0110)
Temperature range	-40 / +90 °C

To be ordered separately, not included in the coil.

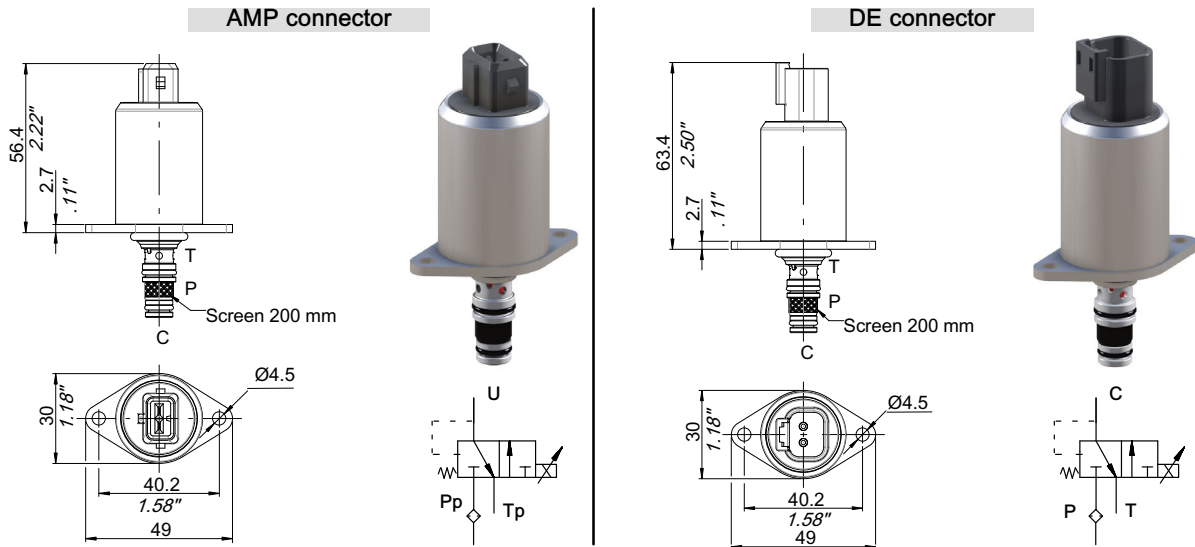
## 7.2 Microswitches

Type	Type	Code	Hydraulic scheme	Description	Connector type
SAE6 C21-478	C W -	200544124021		Normally Closed, Encapsulated with Wire Leads	Packard Weather Pack
SAE6 O21-477	O W -	200544124022		Normally Open, Encapsulated with Wire Leads	Packard Weather Pack
SAE6 O21-467	O M -	200544124023		Normally Open, Encapsulated with Wire Leads, Convoluted nylon wire shield	Packard Metri-pack
SAE6 C21-462	C V I	200544124027		Normally Closed, Sealed Terminals	Packard Weather Pack

### Microswitch features

Current rating	.01 - 5.0 DC Amp
Voltage rating	5.0 - 24.0 VD C
Mechanical life	500.000 cycles
Temperature range	-30 to 120° C

### 7.3 Proportional pressure reducing valves



Electro-hydraulic specifications	12 V	24 V
Nominal flow rate	3.5 l/min (0.93 US gpm)	
Max pressure (P, T)	P: 50 bar (725 PSI), T: 40 bar (580 psi)	
Rated supply voltage	12 VDC	24 VDC
Current supply characteristic	PWM (Pulse width modul.)	
Rated current range	100 - 1400 mA	50 - 720 mA
Superimposed dither frequency	100 ÷ 180 Hz	
Degree of protection	AMP IP65 / Deutsch IP67 and IP69K	
Pp filter screen	200 µm	
Coil resistance	4.7 Ohm ±5%	20.8 Ohm ±5%
Response time	< 40 ms	
Leakage from Pp to Tp	< 15 cc/min. at 35 bar (< 0.9 cu.in./min. at 500 psi)	
Duty cycle	ED100% @ 14,4 VDC and 80°C assembled on the valve housing	ED 100% @ 28.8 VDC and 80°C assembled on the valve housing
Connector Type	AMP Junior timer / DEUTSCH DT04-2P	

Type	Code	Voltage	Connector
320	200533960033	12 VDC	AMP
321	200533960034	24 VDC	AMP
322	200533960035	12 VDC	Deutsch
323	200533960036	24 VDC	Deutsch

(\*) nr. 2 screws M4x12 are not included

## 7.4 Spool position hall effect sensor

### 7.4.1 Proportional

Connector style	Type	Codes
AMP	PS A	200544124029
Deutsch	PS D	200544124033

Mechanical specifications	
Maximum mechanical stroke	$\geq \pm 8.5$ mm
External diameter	35 mm
Body length	$91 \pm 8.5$ mm
Cable length (including connector)	350 mm
Maximum operating pressure	5 MPa (50bar)
Operating temperature range	$-25^{\circ}\text{C} / +105^{\circ}\text{C}$
Protection class	IP 67

Electric specifications - Linear, Hall-effect sensor	
Power Supply Voltage	$7 \div 32$ Vdc
Current Consumption	$< 20$ mA
Output signal in Neutral	2.5 V
Output signal range	$1 \text{ V} \div 4 \text{ V}$
Tolerance on output signal	$\pm 0.1$ V
Maximum linearity error ( $-25 \div 105^{\circ}\text{C}$ )	$\pm 2\%$
Max. Electrical stroke linearity range	$\pm 7.5$ mm (adjustable)
Insulation resistance	$>500 \text{ M}\Omega$ @ 500 V

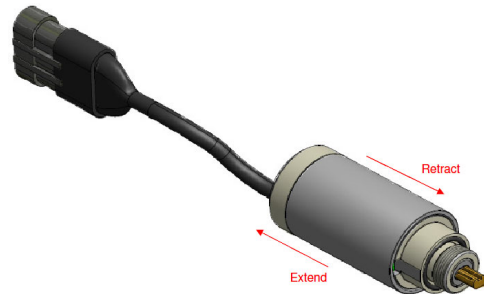
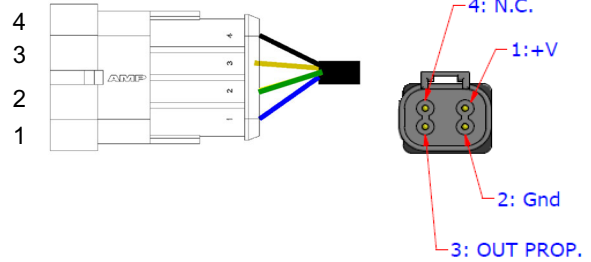
Statistical data (reliability)	
MTTFd	127 y
DC	low

### Electrical Connections

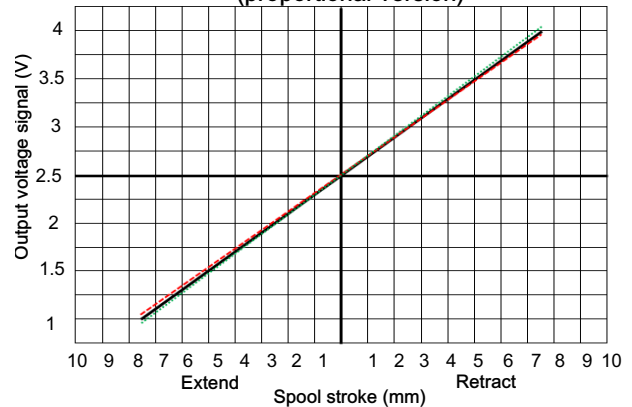
1. Vcc - Blue
2. Gnd - Green/Yellow
3. Proportional Output - Brown
4. n.u. - Black

Amp seal, 4 male pins

Deutsch DT04-4P

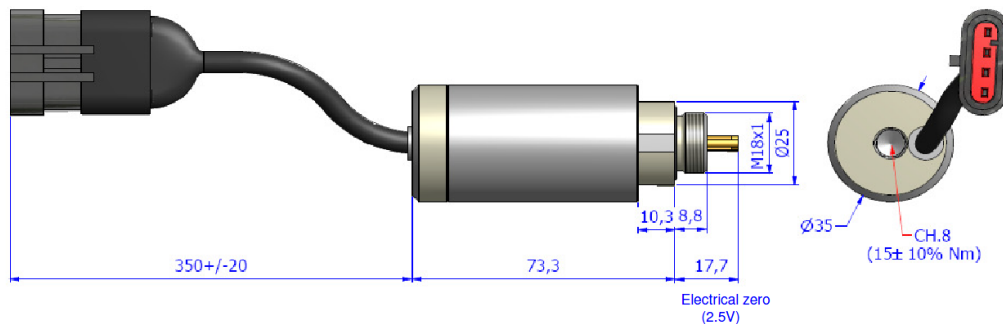


Output signal control characteristic (proportional version)



Red lines:  $-25 / +85^{\circ}\text{C}$

Green lines:  $85 / 105^{\circ}\text{C}$





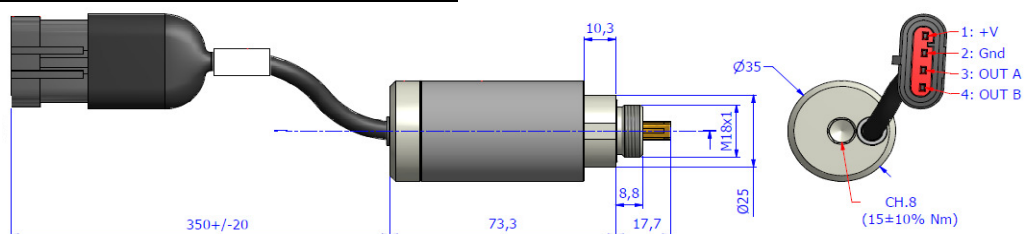
## 7.4.2 ON-OFF

Connector style	Type	Codes
AMP	OS A	200544124032

Mechanical specifications	
Maximum mechanical stroke	$\geq \pm 8.5$ mm
External diameter	35 mm
Body length	$91 \pm 8.5$ mm
Cable length (including connector)	350 mm
Maximum operating pressure	5 MPa (50bar)
Operating temperature range	$-25^{\circ}\text{C} / +105^{\circ}\text{C}$
Protection class	IP 67
Connector	Amp seal, 4 male pins
Mechanical life	5 Million cycles

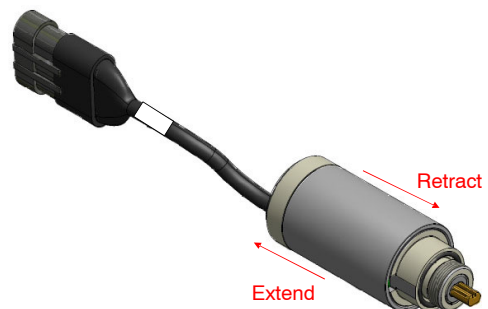
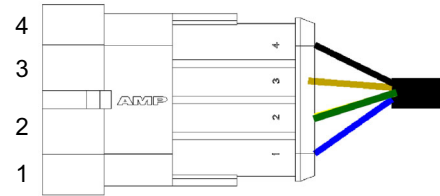
Electric specifications - Linear, Hall-effect sensor	
Power Supply Voltage	$7 \div 32$ Vdc
Current Consumption	$< 20$ mA
Output signal (inactive)	$> \text{VBATT} - 1$ V
Output signal (active, external pull-down)	$< 1$ V
Switching threshold	1 mm
Hysteresis on switching threshold	0.3 mm
Insulation resistance	$> 500$ M $\Omega$ @ 500 V

Statistical data (reliability)	
MTTFd	127 y
DC	low

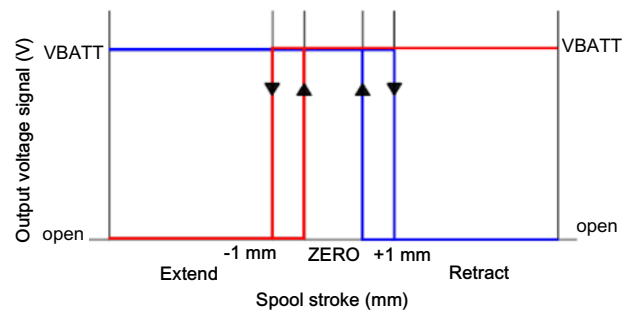


## Electrical Connections (proportional version)

1. Vcc - **Blue**
2. Gnd - **Green/Yellow**
3. OUT A (Retract) - **Brown**
4. OUT B (Extend) - **Black**



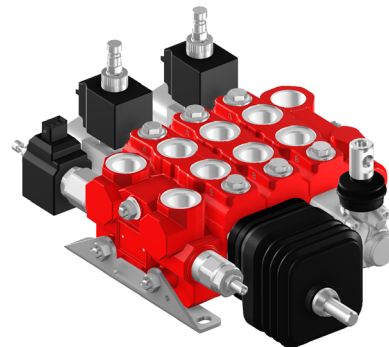
## Output signal control characteristic (proportional version)



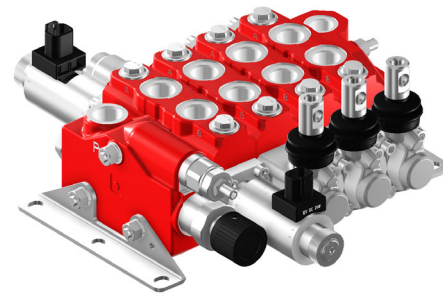
- NEUTRAL POSITION: Out A, Out B to VBATT,
- EXTEND (stem entering in the sensor): Out A (blue) to VBATT, Out B (red) goes open.
- RETRACT (stem exiting from the sensor): Out B (red) to VBATT, Out A (blue) goes open.
- The hysteresis keeps the switching threshold more stable

## 8 Suitable applications (Examples)

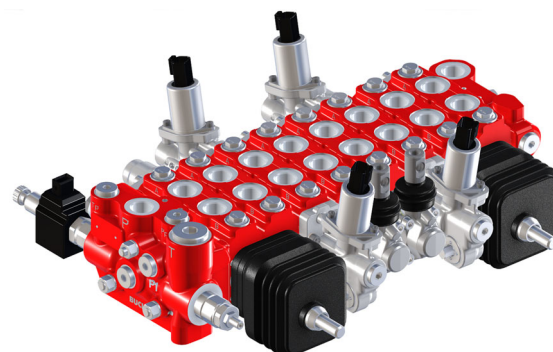
### 8.1 Wheel loaders



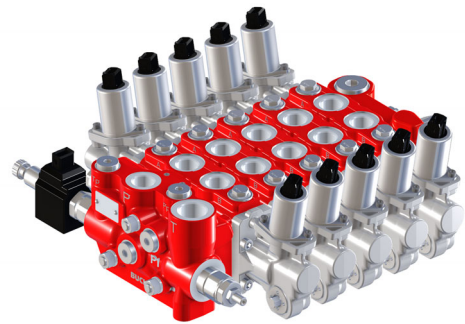
### 8.2 Tractors



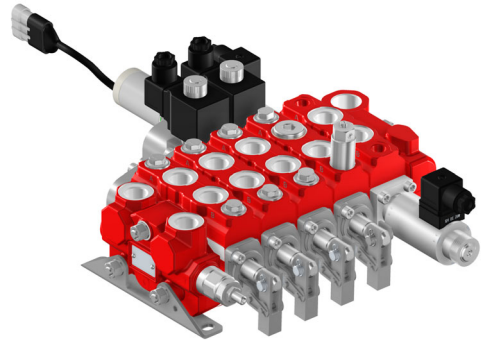
### 8.3 Forestry cranes



## 8.4 Telehandlers



## 8.5 Fork lifts



### 9 Ordering code composition

#### 9.1 Inlet cover

##### 9.1.1 Inlet cover - TH

T	E	S	T	1	6	T	H	1	0	1	3	0	W	H	0	0	P	O	X	X
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Inlet cover type (see 2.1)

RV valve adjustment pressure

-- = not set

15 = setting/10

RV valve

GR - VI - WH = RV setting range (see 2.5.1)

Gauge port (optional)

00 = not present

PM = present, open

XX = plugged

P port

XX = plugged

PO = open

T port

XX = plugged

TO = open

#### Examples

TEST 16 TH102 15GR XX PO XX

TEST 16 TH801 20VI 00 PO TO

## 9.1.2 Inlet cover - T6H

T	E	S	T	1	6	T	6	H	1	0	1	2	0	V	I			C	E	1	2	A	-	P	O	X	X
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	--	--	---	---	---	---	---	---	---	---	---	---

Inlet cover type (see 2.2)

RV valve adjustment pressure

-- = not set  
15 = setting/10

Lever side: RV or BP valves

GR - VI - WH = RV setting range (see 2.5.1)  
CEP - AEP - CE - AE = BP valve (see 2.5.2)  
VC = plug

RV valve adjustment pressure

-- = not set  
15 = setting/10

Positioner side: RV or BP valves

GR - VI - WH = RV setting range (see 2.5.1)  
CEP - AEP - CE - AE = BP valve (see 2.5.2)  
VC = plug

Solenoid type and voltage (see 7.1.1)

P port

XX = plugged  
PO = open

T port

XX = plugged  
TO = open

### Examples

TEST 16 T6H101 15GR VC PO XX

TEST 16 T6H102 15GR AE 24D- PO TO

TEST 16 T6H102 CE 18GR 12AD PO XX

### 9.1.3 Inlet cover - TP

T	E	S	T	1	6	T	P	1	0	1	1	5	G	R			A	E	1	2	A	-	P	P	C	P	M	P	P	1	3	2	P	O	X	X
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	--	--	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

<p><b>Inlet cover type</b> (see 2.3)</p>	
<p><b>RV valve adjustment pressure</b> -- = not set 15 = setting/10</p>	
<p><b>Lever side: RV or BP valves</b> GR - VI - WH = RV setting range (see 2.5.1) CEP - AEP - CE - AE = BP valve (see 2.5.2) VC = plug</p>	
<p><b>RV valve adjustment pressure</b> -- = not set 15 = setting/10</p>	
<p><b>Positioner side: RV or BP valves</b> GR - VI - WH = RV setting range (see 2.5.1) CEP - AEP - CE - AE = BP valve (see 2.5.2) VC = plug</p>	
<p><b>Solenoid type and voltage</b> (see 7.1.1)</p>	
<p><b>Pp port</b> PP = present, open XX = plugged</p>	
<p><b>TP port</b> T = external drain (open, internal M10x1 plug) C = internal drain (externally plugged + check valve)</p>	
<p><b>PM port</b> 00 = not present PM = present, open XX = plugged</p>	
<p><b>Pp1 port</b> PP1 = present, open XX = plugged</p>	
<p><b>Pilot supply pressure reducing valve VRP</b> 32 = pressure reducing valve adjustment in bar (see 2.5.3) XX = plugged</p>	
<p><b>P port</b> XX = plugged PO = open</p>	
<p><b>T port</b> XX = plugged TO = open</p>	

#### Examples

TEST 16 TP301 CE 20VI 24D- XX T PP1 32 PO TO

TEST 16 TP101 30WH AE 12A- PP C XX XX 32 PO XX

## 9.2 Pressure compensated flow control elements -TQ and KQ

H D S 1 6    K Q 1 0 0    1 2    1 5    V C    A E    2 4 D -    V 2 5    P 0    0 0

T E S T 1 6    T Q 1 0 0

Element type  
(see 3.1 and 3.2)

RV1 valve (see 2.5.1)

15 = valve adjustment pressure (setting/10)  
omitted for TQ and KQ\_88, \_90  
VC = plug

RV2 valve (see 2.5.1)

15 = valve adjustment pressure (setting/10)  
VC = plug

RV3 valve (see 2.5.1)

15 = valve adjustment pressure (setting/10)  
VC = plug

BP valve (see 3.5)

CE - AE - C - A = BP valve  
EC = plug

Solenoid type and voltage (see 7.1.1)

Flow regulator type (see 3.3)

P port

XX = plugged  
PO = open

D/R port

XX = plugged  
DO - RO = open  
omitted if not present

### Examples

HDS16 KQ188 15 VC AE 12H- V50 XX DO

TEST 16 TQ190 20 VC AE 24D- F10 PO RO

TEST 16 TQ800 15 VC VC EC V50 PO

### 9.3 Sections

For versions with Electro Mechanical Locking System/Microswitch see 9.3.1  
 For versions with EHO control see 9.3.2

H	D	S	1	6	K	*	1	0	1	A	6	S	7	9	L	1	0	0	2	5	2	5	I				
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	--	--	--	--

<p><b>Body type</b>          * = specific circuit          (see 4.1.1 or 4.1.3)</p>	
<p><b>Spool type</b> (see 4.2)</p>	
<p><b>Positioner type</b> (see 4.3, 4.5, 4.6, 4.7, 4.9 and 4.10)</p>	
<p><b>Lever type</b> (see 4.11)</p>	
<p><b>Valve A port</b> (see 5)          25 = UC valve adjustment pressure (setting/10)          00 = plug          C = anticavitation</p>	
<p><b>Valve B port</b> (see 5)          25 = UC valve adjustment pressure (setting/10)          00 = plug          C = anticavitation</p>	
<p><b>Positioner kit side indication</b> (see 4.2.2)          Omitted with positioner kit on A port - standard position          I = positioner kit on B port - inverted spool</p>	
<p><b>Additional information</b>          ON-OFF controls solenoid (see 7.1.3)          Positioners with sensor (see 7.4)          EHI control solenoid (see 7.1.2)</p>	

**Examples**  
 HDS16 KW101 W5P 51 25 C  
 HDS16 K801 AE 01E 20 20 24D-



## 9.3.1 Sections with electro-mechanical locking system / microswitch

H	D	S	1	6	K	*	1	0	1	A	6	S	1	3	3	E	M	L	1	0	0	2	5	2	5		1	2	D	-
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	--	---	---	---	---

**Body type**

\* = specific circuit  
(see 4.1.1 or 4.1.3)

**Spool type (see 4.2)**

**Positioner type (see 4.3)**

**Intermediate kit**

EM - EME = electro-mechanical locking system (see 4.4.1)  
D-S1-S2-S3-D2 = microswitch positioner type (see 4.4.2)

**Lever type (see 4.11)**

**Valve A port (see 5)**

25 = UC valve adjustment pressure (setting/10)  
00 = plug  
C = anticavitation

**Valve B port (see 5)**

25 = UC valve adjustment pressure (setting/10)  
00 = plug  
C = anticavitation

**Positioner kit side indication (see 4.2.2)**

Omitted with positioner kit on A port - standard position  
I = positioner kit on B port - inverted spool

**Additional information**

Electro-mechanical locking solenoid (see 7.1.2)  
Microswitch positioners (see 7.2)

**Examples**

HDS16 K101 A5A 01 EME L100 30 20 12A-

HDS16 K101 A6S 133 D L100 15 15 OW-

### 9.3.2 Sections with EHO control

H	D	S	1	6	K	*	1	0	1	A	6	S			3	2	0	S	6	N	N	K	S			2	5	2	5	I
---	---	---	---	---	---	---	---	---	---	---	---	---	--	--	---	---	---	---	---	---	---	---	---	--	--	---	---	---	---	---

**Body type**

\* = specific circuit  
(see 4.1.1 or 4.1.3)

Spool type (see 4.2)

EHO Configuration (see 4.8)

**Valve A port (see 5)**

25 = UC valve adjustment pressure (setting/10)  
00 = plug  
C = anticavitation

**Valve B port (see 5)**

25 = UC valve adjustment pressure (setting/10)  
00 = plug  
C = anticavitation

**Positioner kit/emergency lever side indication (see 4.2.2)**

Omitted with positioner kit/emergency lever on A port - standard position  
I = positioner kit/emergency lever on B port - inverted spool

#### Examples

HDS16 K105 A6S 322S6NNKSH 15 15

HDS16 K106 A4B 320S6GG0

## 9.4 End covers

### 9.4.1 Outlet cover - P\_00

C	O	P	1	6	P	1	0	0	T	O
---	---	---	---	---	---	---	---	---	---	---

Outlet cover type (see 6.2)

T port

TO = open

XX = plugged

#### Examples

COP 16 P800 XX

---

### 9.4.2 Outlet cover - PM

C	O	P	1	6	P	M	2	0	1	T	2				T	3
---	---	---	---	---	---	---	---	---	---	---	---	--	--	--	---	---

Outlet cover type (see 6.3)

Standard

HPC

T2/HPC port

Standard type

T2 = open

XX = plugged

HPC type

HPC = purely HPC (open)

CC = closed centre

T3 port

T3 = open

XX = plugged

#### Examples

COP 16 PH212HPC XX

---

### 9.4.3 Outlet cover - PH

C	O	P	1	6	P	H	2	0	1	T	2				T	3	P	P	P	P	1	0	0	
---	---	---	---	---	---	---	---	---	---	---	---	--	--	--	---	---	---	---	---	---	---	---	---	--

Outlet cover type (see 6.4)

Standard  
HPC

T2/HPC port

Standard type

T2 = open

XX = plugged

HPC type

HPC = purely HPC (open)

CC = closed centre

VCP12 = with VCP (12: spring setting in bar, see 6.7.1)

VIN08 = with VIN08 (08= spring setting in bar, see 6.7.2)

T3 port

T3 = open

XX = plugged

Pp port

PP = present, open

XX = plugged

Pp1 port

PP1 = present, open

XX = plugged

Pp2 port (optional)

00 = not present

PP2 = present, open

XX = plugged

#### Examples

COP 16 PH212HPC XX PP PP1 00

9.4.4 Outlet cover - P and P6H

C	O	P	1	2	P	1	0	1	T	2			T	3	T	4	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	--	--	---	---	---	---	---	---	---	---

C	O	P	1	6	P	6	H	1	0	1
---	---	---	---	---	---	---	---	---	---	---

Outlet cover type (see 6.5)  
Standard  
HPC

T2/HPC port  
Standard type  
T2 = open  
XX = plugged  
HPC type  
HPC = purely HPC (open)  
CC = closed centre

T3 port  
T3 = open  
XX = plugged

T4 port  
T4 = open  
XX = plugged

Pp port  
00 = not present  
PP = open  
XX = plugged

Tp port  
00 = not present  
T = external drain (internally plugged)  
C = internal drain (externally plugged)

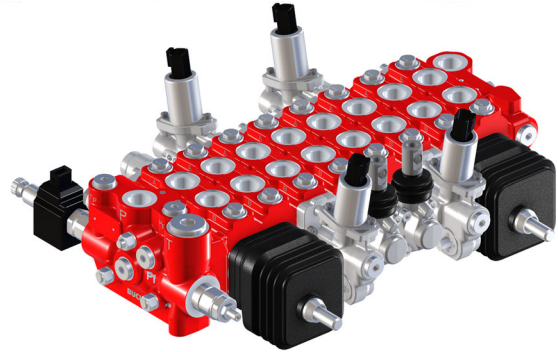
Examples

COP 12 P101 T2 T3 XX

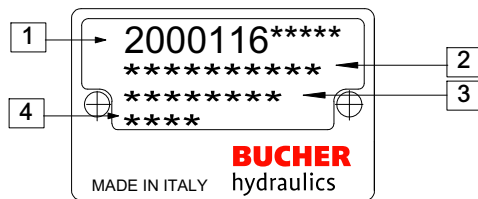
COP 16 P6H101 HPC XX T4 PP C

## 9.5 Examples of ordering code

TEST16 TP\_01 15GR AE 12A- XX T XX XX 32 PO XX  
 HDS16 K\_01 A\_\_ 79 L460 20 20  
 HDS16 KZ\_01 W\_\_ 33 L46 22 10  
 HDS16 K\_06 A\_\_ 322S6GGK 12 25 I  
 HDS16 K\_01 A\_\_ 79 L100 00 00  
 HDS16 K\_01 A\_\_ 79 L100 00 00  
 HDS16 K 06 A\_\_ 322S6GGK 20 20 I  
 HDS16 KZ\_01 Z\_\_ 33 L460 22 10  
 HDS16 K\_01 A\_\_ 79 L460 20 20  
 COP16 PH\_01 XX T3 PP PP1 00



## 10 Product identification plate



- 1 : BHRE Product Order Code
- 2 : Customer Code (on demand, only - if not requested manufacturing year and month are printed)
- 3 : WO : Production Work Order
- 4 : WO progressive number

Manufacturing month	Manufacturing year						
	2017	2018	2019	2020	2021	2022	2023
January	7A	8M	9M	0M	1M	2M	3M
February	7B	8N	9N	0N	1N	2N	3N
March	7C	8P	9P	0P	1P	2P	3P
April	7D	8Q	9Q	0Q	1Q	2Q	3Q
May	7E	8R	9R	0R	1R	2R	3R
June	7F	8S	9S	0S	1S	2S	3S
July	7G	8T	9T	0T	1T	2T	3T
August	7H	8U	9U	0U	1U	2U	3U
September	7I	8V	9V	0V	1V	2V	3V
October	7J	8Z	9Z	0Z	1Z	2Z	3Z
November	7K	8X	9X	0X	1X	2X	3X
December	7L	8Y	9Y	0Y	1Y	2Y	3Y



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