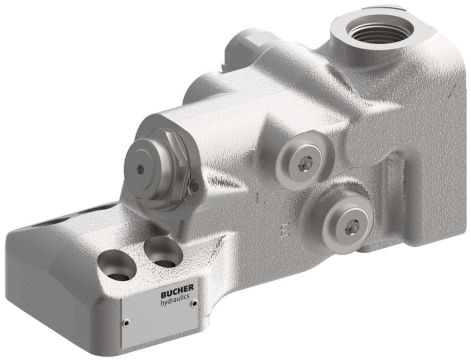
Excavator Pipe-Rupture Valve

Q_{max} = 250 l/min [66 gpm], p_{max} = 420 bar [6000 psi]
Hydraulic-proportional pilot operated seat valve, flat design
Series CFS 16-A-EF...



- Fulfils safety requirements in accordance with ISO 8643, EN 474 and DIN 24093
- Leak-free load holding
- Flat design → valve with nose, no sandwich plate necessary
- Satisfies exacting demands on corrosion protection
- Guaranteed closing force for the load-control assembly → reliable shut-off even with a broken spring
- No impact, or only very low impact on the existing hydraulic system → easy to retrofit
- Pressure relief independent of return-line pressure
- Thermal expansion pressure relief is integrated in pressure relief valve
- Long service life

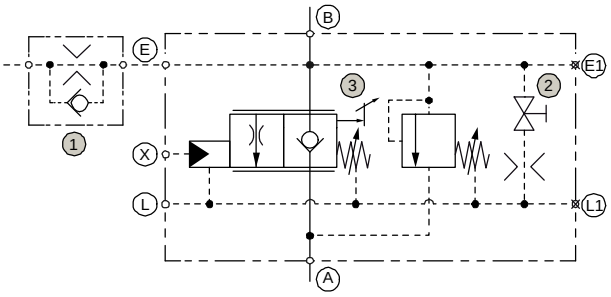
1 Description

The excavator pipe-rupture valve is used wherever so required by the standards ISO 8643, EN 474 and DIN 24093 for excavators with a lifting device (e.g. a load hook on the bucket). The actuators concemed are the lift cylinder, the stick cylinder and the adjusting cylinder.

The valve should also be used on machines in which a pipe-rupture on the actuators could produce dangerous situations (e.g. machines for materials handling and demolition). The excavator pipe-rupture valve, series CFS (Compact Flow Control and Safety Valve), prevents uncontrolled lowering of the actuator in the event of a pipe- or hose-rupture. In addition, the CFS valve holds the actuator in its position when the main valve is centred. The valve also includes a secondary pressure-relief function, which protects the actuator against overload. The inlet and actuator ports on the CFS are standard SAE flanged ports, and the valve can therefore be retrofitted to existing equipment without any difficulty. Thanks to its load-independent, two-stage opening principle, variations in load pressure – even right up to the maximum – have no effect on the fine-control characteristics and the hydraulic performance of the valve. The design of the valve means that it can be operated by very small lowering pressures. The valve is set at the machine in a way that ensures that the excavator pipe-rupture function has no effect on the hydraulic values that have already been set in the machine (pre-opening principle).

This means that excavators with and without a materials handling function can be equipped with the same basic hydraulic system (the machine's work cycles remain the same). When the main spool valve is a closed-centre model and a secondary valve is connected in parallel, no pressure summing occurs. There is no need for a large-bore, external tank return line.

2 Symbol



Optional available functions

1	Balance valve (parallel applications)
2	Mechanical emergency lowering
3	Adjustable stroke limiter

3 Technical data

General characteristics			Description, value, unit	
Designation			excavator pipe-rupture valve	
Design			hydraulic-proportional pilot operated seat valve, flat design	
Size			nominal size 16, SAE ¾“, 6000 psi	
Mounting method			flange-mounting	
Port				
Supply port	A		SAE ¾“, 6000 psi	ISO 6162-2 DN 19 M10 (SAE J518 Code 62-12, M10x1.5)
Supply port	A1	(optionally)	G ¾“ 1-1/16-12 UN-2B	ISO 1179-1 or ISO 11926-1 (SAE-12, SAE J1926-1)
Actuator port	B		SAE ¾“, 6000 psi	ISO 6162-2 DN 19 M10 (SAE J518 Code 62-12, M10x1.5)
Pilot port	X		G ¼“ 9/16-18 UNF-2B	ISO 1179-1 or ISO 11926-1 (SAE-6, SAE J1926-1)
Drain port	L / L1		G ¼“ 9/16-18 UNF-2B	ISO 1179-1 or ISO 11926-1 (SAE-6, SAE J1926-1)
Balance-line port	E / E1		G ¼“ 9/16-18 UNF-2B	ISO 1179-1 or ISO 11926-1 (SAE-6, SAE J1926-1)
Weight			4.6 … 5.1 kg	(10.1 … 11.2 lbs)
Mounting attitude			unrestricted	
Ambient temperature range			-20 °C … +80 °C (others on application)	(-4 °F … +176 °F)
Surface Protection			valve is zinc plated (Cr VI-free) mounting screws zinc-flake coated (e.g. with Geomet® finish)	

Hydraulic characteristics	Description, value, unit	
Maximum operating pressure	420 bar	(6000 psi)
Maximum pressure at the flow- or return port A / A1	420 bar (see sect. 7.2.4 Releasing pressure at port A)	
Maximum pressure at the actuator- / load port B	420 bar	(6000 psi)
Maximum pressure at the balance-line port E / E1	420 bar	(6000 psi)
Maximum pressure at the pilot port X	100 bar	(1400 psi)
Maximum pressure at the drain port L	see sect. 7.2.3 Leakage-oil drain	
Maximum flow rate	250 l/min	(66 gpm)
Leakage rates (HLP 46 at 40°C)	max. leakage A → L: max. leakage X → L:	0.3 l/min (0.079 gpm) 0.1 l/min (0.026 gpm)
Secondary pressure relief	320 ... 420 bar → secure setting (others on application)	(4600 … 6000 psi)
Flow direction	A → B, free flow through check valve B → A, controlled flow	

Hydraulic characteristics	Description, value, unit
Operator type	hydraulic proportional
Opening pressure range	4.4 … 10 bar (63.8 … 140 psi) (others on application)
Pressure setting (in factory)	setting is done at 20 l/min (B → A) and 33 bar load pressure. the pilot pressure can therefore be set in a range from 11 … 16.6 bar (others on application)
Full opening	The set opening pressure + pilot-pressure range 18 bar + drain-oil back pressure (see sect. 7.2.3 Leakage-oil drain)
Opening pilot ratio	1:480
Hydraulic fluid	HL and HLP mineral oil to DIN 51 524; for other fluids, please contact BUCHER
Hydraulic fluid temperature range	-25 °C … +100 °C (-13 °F … +212 °F)
Viscosity range	2.8 … 1500 mm^2/s (cSt), recommended 15 … 250 mm^2/s (cSt)
Minimum fluid cleanliness Cleanliness class to ISO 4406 : 1999	class 20/18/15

4 Construction and function

4.1 The different types of function/application

4.1.1 Function monitoring

The pipe rupture valve only acts as a monitoring element, so that in the case of a pipe rupture the ISO 8643 standard is complied with. The lowering movement is controlled by the main spool. Load acts on the main spool.

IMPORTANT!:
Bucher Hydraulics recommends the spool types
A… and R…

4.1.2 Function load-bearing

The lowering movement of the load bearing function is controlled (monitored) by the pipe rupture valve. Load acts on pipe rupture valve.

ATTENTION!:
This function is only available on request at Bucher Hydraulics!

IMPORTANT!:
Bucher Hydraulics recommends the spool type B… and D…

4.1.3 Function float position

The floating position is an intelligent floating function of the boom that gives short cycle times, saves fuel, protects attachments and significantly simplifies handling of the excavator.

IMPORTANT!:
Bucher Hydraulics recommends the spool type C… and Q…

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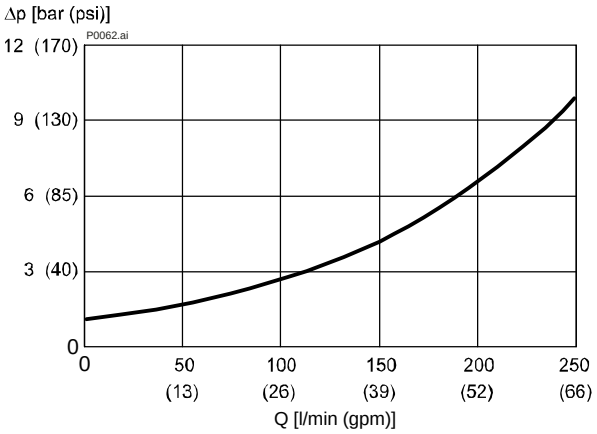
5 Performance graphs

measured with oil viscosity 33 mm^2/s (cSt)

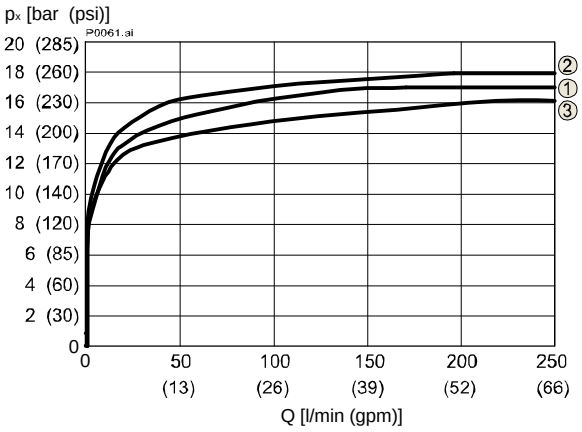
The different types of spool differ mainly in the characteristics of the start of opening. All types are designed for a maximum flow rate of 250 l/min (66 gpm).

IMPORTANT!:
Other spool types with their characteristic curves are available on request.

Δp = f (Q) Pressure drop - Flow rate characteristic
Lifting (A → B), applies to all spool variants

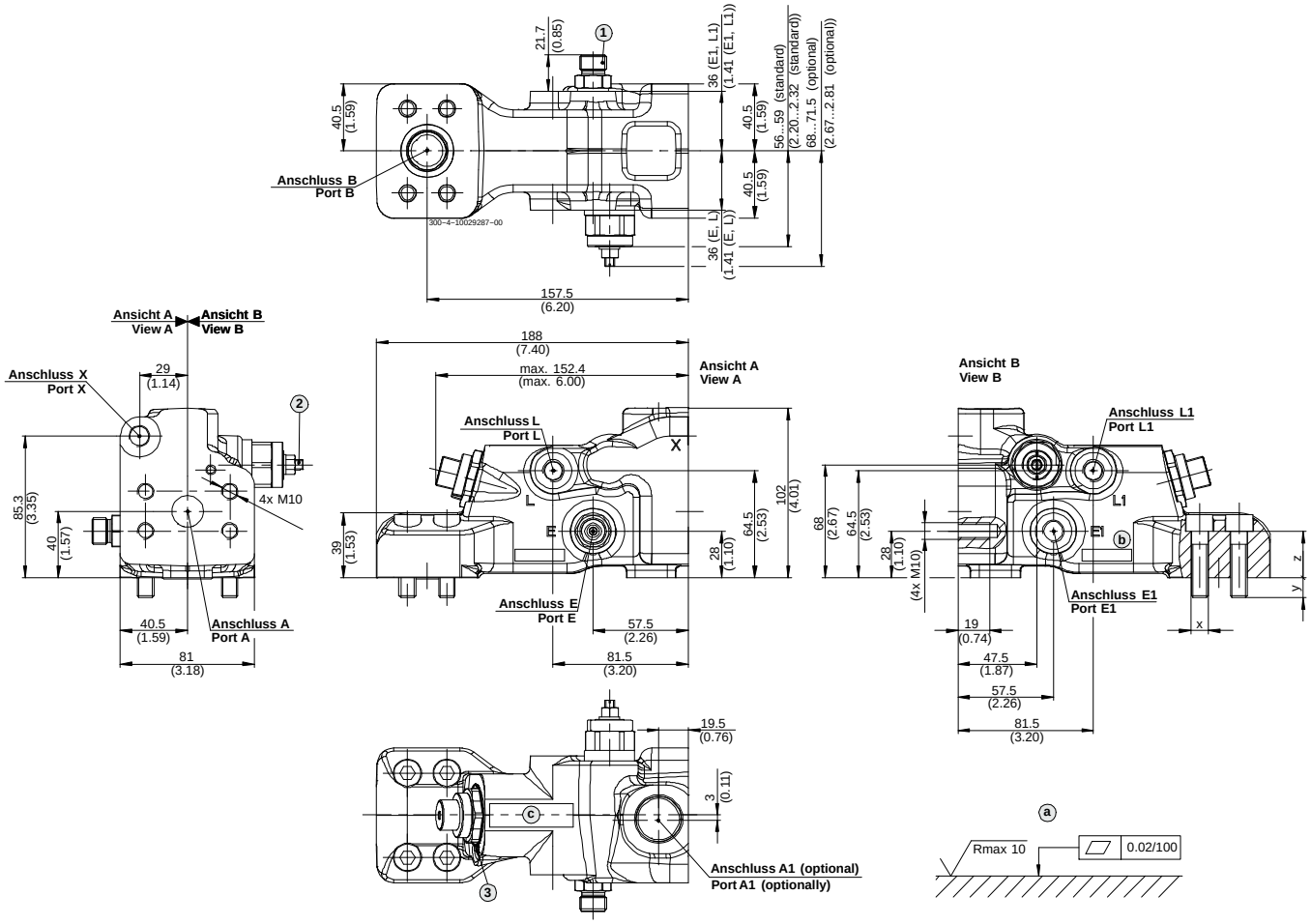


p = f (Q) Pressure - Flow rate characteristic
Lowering (B → A), spool fully open



1	Spool type R100
2	Spool type R251
3	Spool type R291

6 Dimensions & sectional view



IMPORTANT!:
Connection / Port A1 is available as an option. It is only manufactured if this option is specified in the ordering code.

Ports				Screw data (see sect. 6.1)			
A	A1 (optionally)	B	X, L, L1, E, E1	x	y	z	M_A
SAE 3/4“ 6000 psi	G ¾“ or 1-1/16-12 UN-2B	SAE 3/4“ 6000 psi	G 1/4“ or 9/16-18 UNF-2B	M10	12	28	55 [Nm] ± 8%

a	Required quality of the mating surface	1	Option with balance valve (08S - DIN 3861)
b	Serial- / test number	2	Option with stroke limiter (adjustable)
c	Type designation / code	3	Option with emergency lowering

7 Installation and commissioning

IMPORTANT!:
Designing excavator pipe rupture valves requires specialst technical knowledge and product knowledge.
Safety applications must be verified by adequate tests to ensure safety in actual use.

IMPORTANT!:
In order for Bucher Hydraulics to be able to design the the excavator pipe rupture valve correctly, please refer to the technical design data sheet 300-D-9050103.
(LOGinternal area; registration required).

7.1 Assembly / Disassembly

ATTENTION!:
Only qualified personnel with mechanical skills may carry out any maintenance work. Generally, the only work that should ever be undertaken is to check, and possibly replace, the seals. When changing seals, oil or grease the new seals thoroughly before fitting them.

IMPORTANT!:
During commissioning, it is essential that all air is bled from the hydraulic system.
Port threads are formed in accordance with DIN 3852 T1.
Fixing screws to DIN 912, strength class 12.9, must be used to mount the valve.
Pay attention to the specified tightening torques!
Before fitting the valve, remove all plastic protectors and plastic residues.

IMPORTANT!:
Protect seals and flange faces from damage.
The mating flange face must be of the quality specified in the catalogue sheet!
Pay attention to the port designations.

IMPORTANT!:
Release all hydraulic pressure from the system before any disassembly work.

7.2 Adjustment information

7.2.1 Pilot valve

During testing, the pilot valve for the lowering function is factory-set to the opening pressure stipulated by the customer and then locked.
The change in pressure is 5.8 bar per turn.
- clockwise → increases the pressure
- anticlockwise → decreases the pressure

ATTENTION!:
The pilot valve adjusting screw has no end stop - it can be completly unscrewed!

IMPORTANT!:
The warranty will be voided if the valve is worked on or tampered with!

7.2.2 Secondary pressure relief valve (SV)

During testing, the secondary pressure-relief valve (SV) is factory-set to the pressure setting / operating pressure stipulated by the customer and then locked. The pressure is set with flow Q = 0.75 l/min.

The change in pressure is 94 bar per turn.
- clockwise → increases the pressure
- anticlockwise → decreases the pressure

7.2.3 Leakage-oil drain

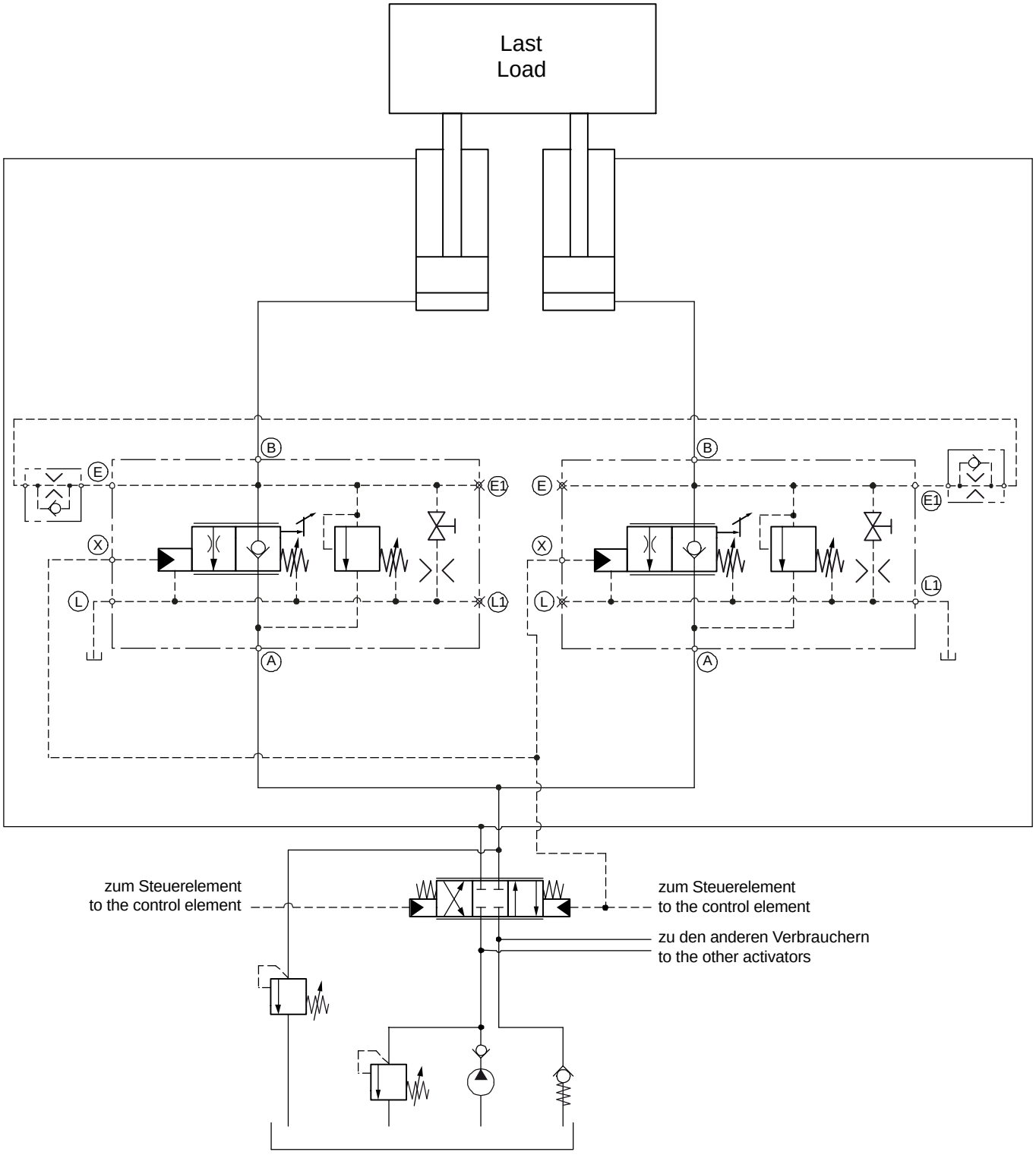
The leakage oil from both pilot cartridges as well as their spring chambers is drained to port L. This port should be drained to tank with the least possible back-pressure. Any tank preload- or back-pressure in the drain line has a 1:1 effect on the opening values of the pilot valve and the pressure relief valve.

7.2.4 Releasing pressure at port A

In the case of a closed volume at the supply or return port A, pressure must be released from it. Maximum allowable static pressure in the closed position is 10 bar.

8 Application examples

8.1 Parallel application



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9 Ordering code

e.g. CFS | 16 | – A – E F N O – R ___ – ... – SV ... – Z – _ _ – _ – _ ...

CFS	=	series
16	=	size – SAE 3/4“
A	=	model / version
E	=	EN 474, ISO 8643 and DIN 24093
F	=	flat design
N	=	NBR (Nitril) seals **(standard)**
V	=	FKM (Viton) seals
T	=	MIL (Low temperature) seals
O	=	without fixing screws **(standard)**
D	=	with Geomet fixing screws. (ZL) 12.9 DIN912
R	=	spool type R
Q	=	spool type Q
A	=	spool type A
B	=	spool type B
C	=	spool type C
D	=	spool type D (other spool types on application)
___	=	flow rate during lowering (defined by Bucher Hydraulics)
...	=	factory-set setting range for opening pressure (final value will be entered after commissioning)
SV	=	secondary pressure relief
...	=	setting for secondary pressure relief
Z	=	ports X, L, E: BSP threads according to DIN 1179-1 **(standard)**
U	=	ports X, L, E: UNF threads according to ISO 11926-1
V	=	ports X, L: fittings package with pipe thread
(blank)	=	single operation, E and E1 plugged, L open **(standard)**
R	=	parallel operation, balance valve in E, E1 & L1 plugged
L	=	parallel operation, balance valve in E1, E & L plugged
E	=	parallel operation, without balance valve, E & L open, E1 & L1 plugged
E1	=	parallel operation, without balance valve E1 & L1 open, E & L plugged (other versions on application)
(blank)	=	without emergency lowering **(standard)**
N	=	with mechanical emergency lowering
(blank)	=	without port A1 **(standard)**
A1	=	with port A1
(blank)	=	without stroke limiter **(standard)**
H	=	with adjustable stroke limiter
...	=	setting for stroke limiter (final value will be entered after commissioning)

IMPORTANT!:
After acceptance (according to ISO 8643), the definitive setting values are hydraulically measured and recorded by Bucher Hydraulics.

10 Related data sheets

Reference	Description
300-D-9050103	Technical design sheet for excavator pipe rupture valves

IMPORTANT!:
Additional documentation and 3D models (.stp or .igs format) can be downloaded from *www.bucherhydraulics.com*
(LOGintern area; registration is necessary)

We also offer customised solutions.
Please talk to our sales team.

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