BUCHER HYDRAULICS

Hydraulics for High - Voltage Circuit - Breakers
Product Overview

motion and progress

Classification: 440.40.50.
Reference: 300-P-9050009-E-02/11.04

Table of contents

Page

1. General informations

Since almost 30 years, BUCHER HYDRAULICS AG develops and produces this special products for High-Voltage circuit-breaker applications.

During this time, some 10.000 valves and some 1000 actuators were installed. They are in operation throughout the world, in all continents and operate often under the hardest environmental conditions.

In all this 30 years we always accomplished to the specific technical requirements.

The Company's continual program of research and development is always set to produce and deliver high quality in all parameters of our products.

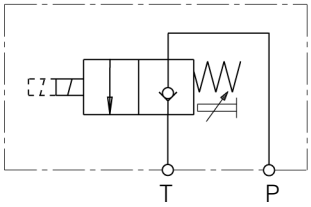
The specific requirements for this products are mostly much higher as for common hydraulic products, for example:

- No external leakage
- Minimum internal leakage
- Lifetime up to 20 years
- Repeatibility of swiching time in the range of milliseconds (ms)
- Safe and proper operation after a rest period of weeks or months under a working pressure up to 500 bar
- Extremely accelaration and decelaration of the actuators up to 1500m/s^2
- Ambiente temperatures from -40°C to +70°C

2. Product-Range

- In the following pages we show a selection of the different products for hydraulic operated circuit-breakers.
- Each product was developed according the specific technical requirements and under consideration of the mounting conditions.
- Detailed brochures on the individual products are availabe on request. Please contact us for joint poject solutions and systems.

2.1 Solenoid directional valve, leakfree, two way, Type VSV...



Multiple Solenoids, on request

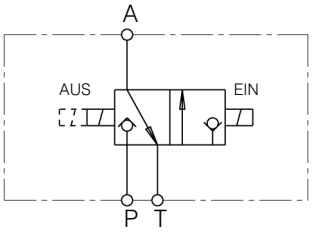
Mounting position, preferable horizontal

2.1.1 Specifications

	Nominal size		Units
Type	VSV 2	VSV 5	
Nominal flow	12	72	l/min
Pressure, max	500	380	bar
Switching time*	3 - 4		ms
Solenoid, power	300 - 500		Watt
Solenoid, voltage	60 - 110 / 125 - 220 / 250		VDC
Duty cycle factor	≤ 5		ED %
Operating temp. range	-40 up to +70		°C

*Dependent of operating- pressure, and el. power of solenoid

2.2 Solenoid directional valve, leakfree, 3/2 way, Type WSV...



Multiple Solenoids, on request

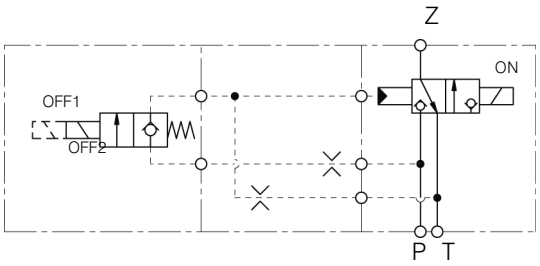
Mounting position, preferable horizontal

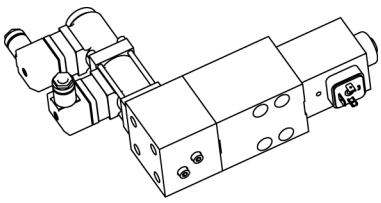
2.2.1

Type	Nominal size WSV 4	Nominal size WSV 12	Units
Nominal flow	30	190	l/min
Pressure, max	500	500	bar
Switching time*	6 - 8	10 - 18	ms
Solenoid, power	300 - 500		Watt
Solenoid, voltage	60 - 110 / 125 - 220 / 250		VDC
Duty cycle factor	≤ 5		ED %
Operating temp.range	-40 up to +70		°C

*Dependent of operating-pressure, and el. power of soleniod

2.3 Pilot operated solenoid valve, leakfree, 3/2 way, Type WSV 12 HE



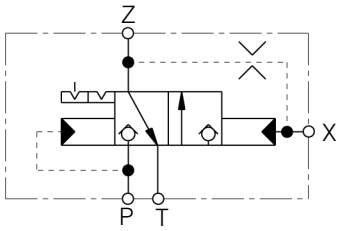


2.3.1 Specifications

Type	Size 12	Units
Nominal flow	190	l/min
Pressure, max	500	bar
Switching time*	6 - 7	ms
Solenoid, power	300 - 500	Watt
Solenoid, voltage	60 - 110 / 125 - 220 / 250	VDC
Duty cycle factor	≤ 5	ED %
Operating temp.range	-40 up to +70	°C

*Dependent of operating-pressure, and el. power of solenoid

2.4 Hydr. operated 3/2 way cartridge valves, leakfree, Type USRP...

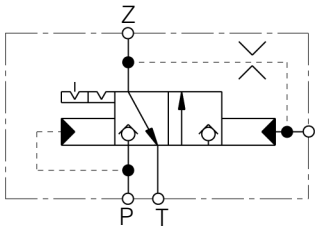


with mechanical detent for both end positions of valve

2.4.1 Specifcations

Type	Nominal size 16	22	32	45	Units
Nominal flow	350	700	1500	3000	l/min
Operating pressure max.	500	400	400	400	bar
Operating temp. range	-40 up to +70				°C

2.5 Hydr. operated 3/2 way valves, leakfree, Type USR... direct flange mounting body design



with mechanical detent for both end positions of valve

2.5.1 Specifications

Type	Nominal size 18	32	Units
Nominal flow	420	1600	l/min
Operating pressure max.	400	400	bar
Operating temp. range	-40 up to +70		°C

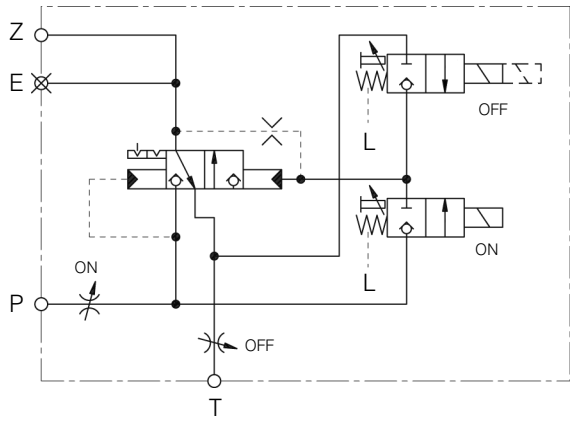
2.6 Control-modul for actuators, Type CM... as a complete, compact pilot-valve

Description: (see also hydr. circuit)

This control-moduls are disigned as a complete control-unit for all different sizes of actuators for hydr. operated high voltage switch gears, and consits of:

- two solenoid operated directional valves (leakfree) as pilot-valves for the operations ON and OFF
- one hydr. operated 3/2 way leakfree cartridge-valve as main control-valve
- two throttle valves for the adjustment of flow (speed) ON and OFF (on request)
- air bleeding port “E”
- The reaction-time of the main-control valve can be individual adjustet at the pilot-valves ON and OFF.

Hydr. circuit



2.6.1 Specifications

Type	Nominal size CM16	CM22	CM32	CM45	Units
Nominal flow	350	700	1500	3000	l/min
Pressure, max	500	400	400	400	bar
Switching time*	10 - 18				ms
Solenoid, power	300 - 500				Watt
Solenoid, voltage	60 - 110 / 125 - 220 / 250				VDC
Duty cycle factor	≤ 5				ED %
Operating temp. range	-40 up to +70				°C

*Dependent of operating-pressure and el. power of solenoid

Design and position of ports P, T, Z according to particular applications.

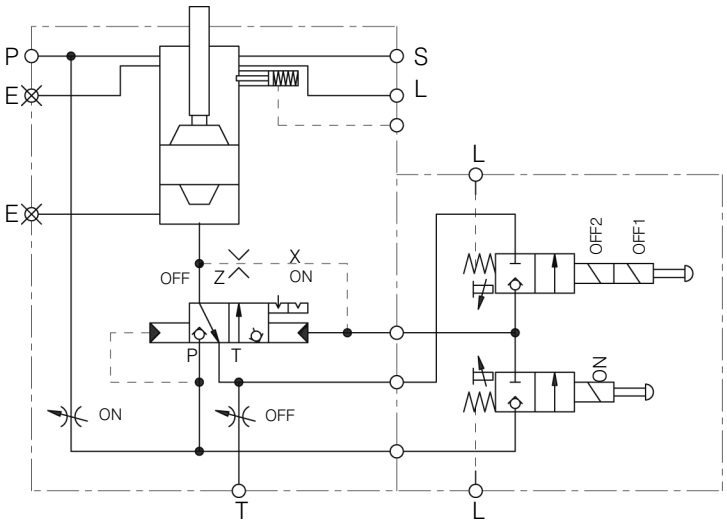
2.7 Hydraulic Actuators Type AT... for High-voltage switch gears

Description:

Each actuator is developped, designed manufactured and tested to:

- the specific requirements of: power-demand, stroke, speed ON and OFF, end cushioning of stroke, and mounting specifications.

Hydr.circuit (example)



2.7.1 Specifications

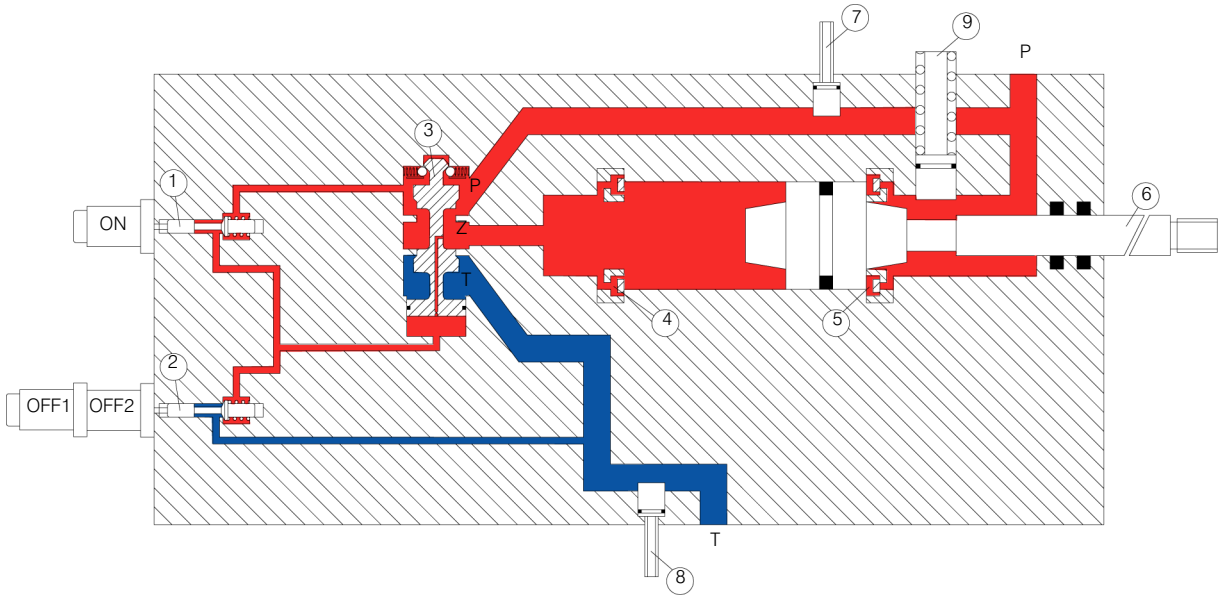
	Size designation (mm)						Units
Type	32	47	55	63	75	85	
Piston ø	32	47	55	63	75	85	mm
Rod ø	18	25	28	32	36	40	mm
Stroke	120 - 250						mm
Operating pressure max.	400						bar
Speed of actuator (cylinder)							
ON max.	8						m/s
OFF max.	12						m/s
Solenoid-voltage	60 - 110 / 125 - 220 / 250						VDC
Solenoid-power	300 - 500						Watt
Duty cycle factor of solenoid	≤ 5						ED %
Reaction time	ON 8-18 / OFF 7-16						ms
Operating temp. range	-40 up to +70						°C

Options:

All actuators can be obtained with a large number of integrated optional-components such as:

- multiple pilot-valves or solenoids ON/ OFF
- locking mechanism of cylinder-rod in position ON
- positional sensors for cylinder-rod, positon ON and OFF.
- special SF6-gas seals, when actuator is directly mounted to circuit-breaker
- specific guiding-bush and piston, for taking-over lateral forces from transmission-lever of circuit breaker
- throttle valves for adjustment of speed ON and OFF
- fine adjustment of reaction-time at the pilot-valves

2.7.2 Functional diagram (in position ON)



1) Pilot-valve ON

2) Pilot-valve OFF

3) Main control valve USR

4) End cushioning OFF

5) End cushioning ON

6) Piston-rod

7) Throttle valve ON

8) Throttle valve OFF

9) Locking mechanism for position ON

2.7.3 Functional description:

Closing ON:

By energising the solenoids ON with an el. power of min. 250 Watts, the pilot-valve (1) opens, and the main control-valve (3) switches to the upper position (as shown in functional diagram). The cylinder-rod (6) now starts to move to end-position ON.

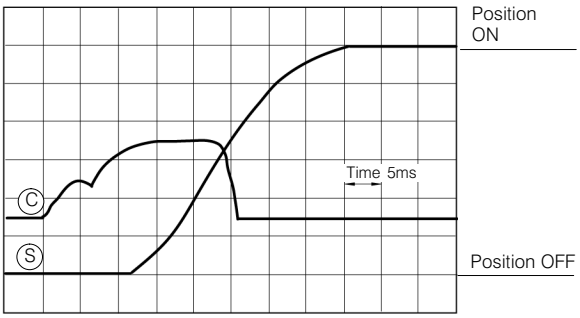
Opening (tripping) OFF:

By energising one of the solenoids OFF with an el. power of min. 250 Watts, the pilot-valve (2) opens and the main control-valve(3) switches to lower position. The cylinder-rod (6) now starts to move to end-position OFF.

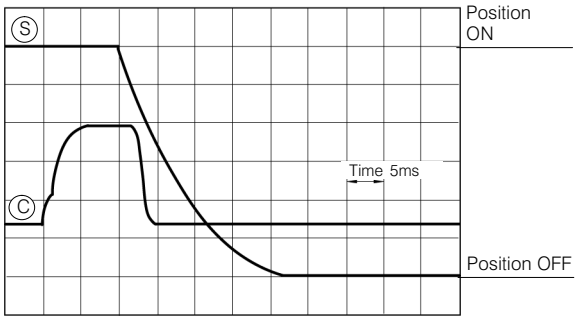
End cushioning:

The specific end-cushioning for ON and OFF function starts 25 - 50mm before end-position of cylinder rod, and gives a continuous deceleration to the end position.

Operating characterics ON



Operating characteristics OFF



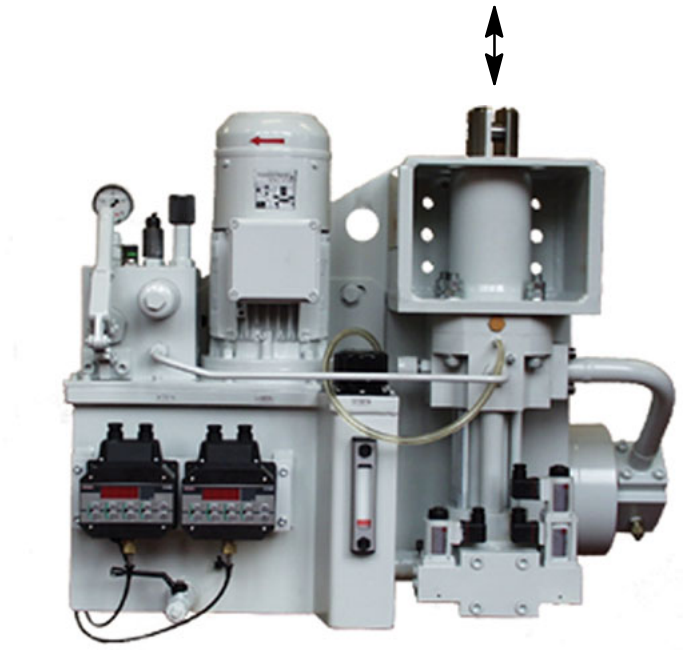
C current (A) at solenoid

S Stroke

2.8 Hydr. drive-systems for high-voltage switch gears (52 KV - 800 KV)

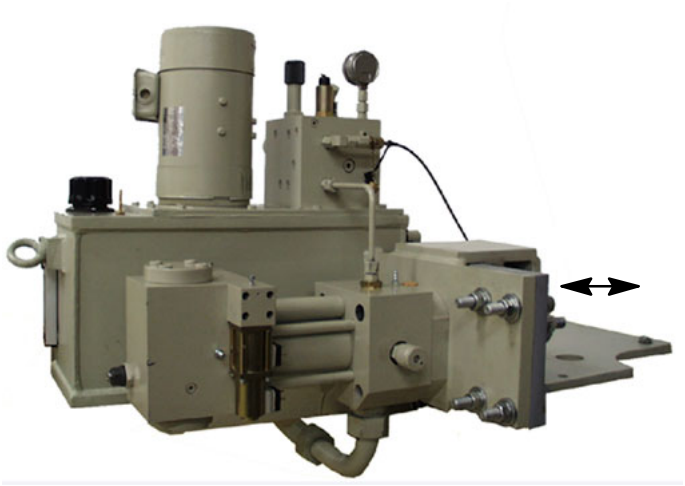
Also, all complete hydr. drive-systems are developped, designed, manufactured and tested according to the specific requirement of the high-voltage switch gear. All complete drive systems are individually tested at our factory and set to the specific settings of the customer.

2.8.1 Examples



Hydr. drive-system with vertical arrangement of actuator

- power unit in compact design
- actuator with locking mechanism
- piston accumulator
- pressure switches
- hand pump
- high pressure filter
- pressure relief valve
- pressure release valve
- completely mounted on a supporting structure according to the particular requirements



Hydr. drive-system with horizontal arrangement of actuator

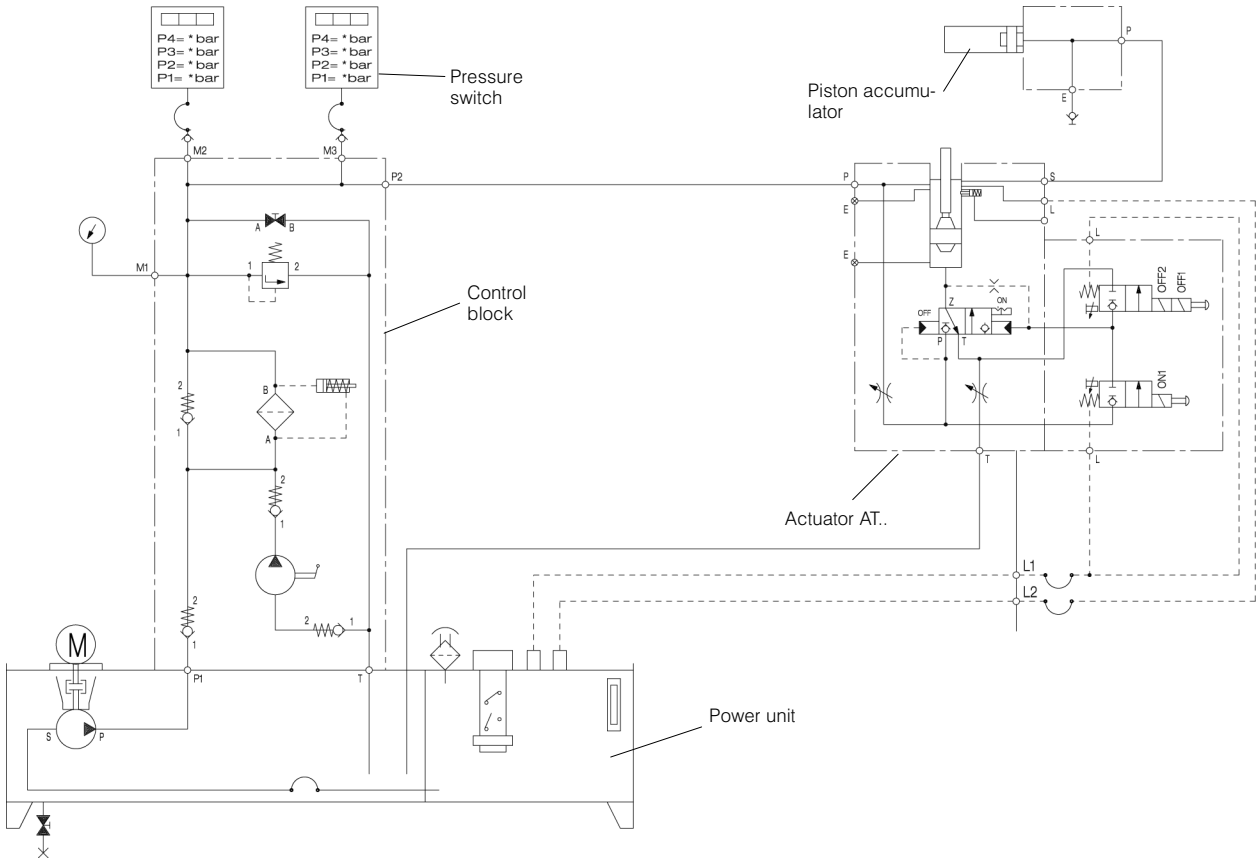
- power unit in compact design
- actuaor with locking-mechanism
- piston accumulator
- pressure switches
- handpump
- high pressure filter
- pressure relief valve
- pressure release valve
- completely mounted on a supporting structure according to the particular requirements

2.8.2 Functional description

The complete drive-system for high voltage switch-gears consists of the following main components:

- Power unit with pump/ motor and directly mounted control-block
- Piston accumulator
- Actuator, complete with pilot valves
- Pipe work installation
- Supporting structure for direct mounting at the circuit-breacker

Hydraulic circuit (Example)



The piston-pump driven by the electric-motor delivers the hydr. fluid through the pressure-filter to the piston accumulator. The gas-side of this accumulator is preloaded with nitrogen (N2) to a pressure of 220 to 280 bar.

When the hydr. pressure at the fluid-side of the accumulator exceeds the preloading gas pressure, the accumulator is filled with pressure fluid, as the gas is compressed to max. working pressure of 280 to 360 bar.

With this pressurised fluid the actuator now can be operated ON or OFF. The accumulator normally can store pressurised fluid for an operating sequence O-C-O (OFF-ON-OFF).

After a defined pressure drop (setting of the pressure-switches), the pump/ motor-unit starts to pressurise the accumulator again.

The control-block normally consists of the following:

- Pressure relief-valve (set to max. operation pressure)
- Pressure filter (on request)
- Pressure release valve (for service)
- Hand-pump, for emergency operation
- Check-Valves
- Pressure-gauge
- Pressure switches

The power unit is equiped with:

- tank breather filter
- fluid level gauge
- fluid level switch (option)
- drain screw

3. Determination/dimensioning of actuators and drive systems

The in-house developped computer simulation program enables us to obtain a rapid and exact calculation and dimensioning of an actuator, based on the technical datas of the circuit-breacker.

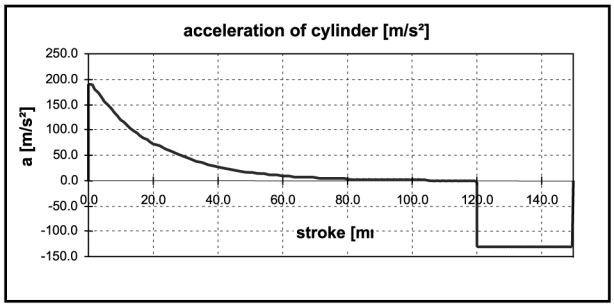
The graphically diagrams are presenting the progression of the different charachteristic valves, e.g: (see also Graph No. 1-2-3)

- Acceleration versus stroke
- Operation time versus stroke
- Speed versus stroke
- Acceleration and deceleration
- pressure progression versus stroke
- compression force versus stroke (only OFF)

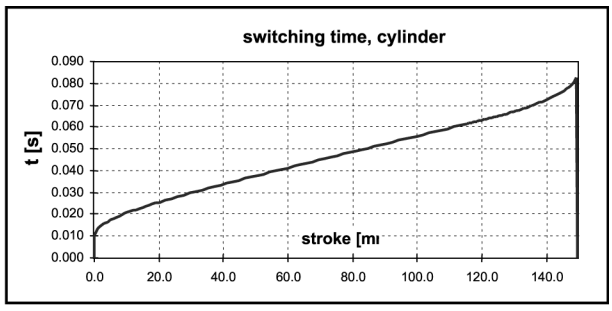
3.1 Example: computer calculation/simulation “operation ON”

Description	reference	Units	Value
Acuator (cylinder)	piston diameter	mm	47
	rod-diameter	mm	25
	stroke (cylinder)	mm	150
	mass of piston	kg	5.7
	cross section, throttle	cm^2	3.8
Operation ON	friction of actuator	daN	10
Piston accumulator	operating pressure	bar	282
	pressure drop per cm^3	bar	0.022
Pilot valve ON	switching time ON	s	0.01
Mechanics (c.b.)	ext. friction	daN	224.5
Ext. mass (circuit breaker)	mass	kg	53.5

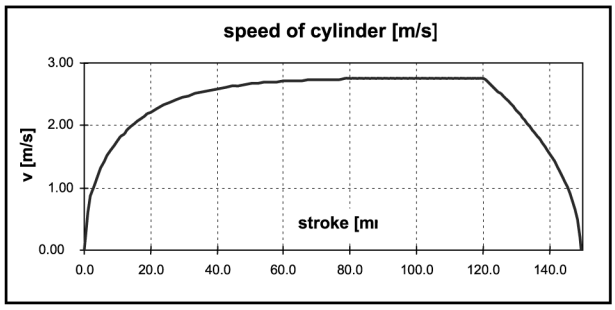
Acceleration versus stroke



Operation time versus stroke



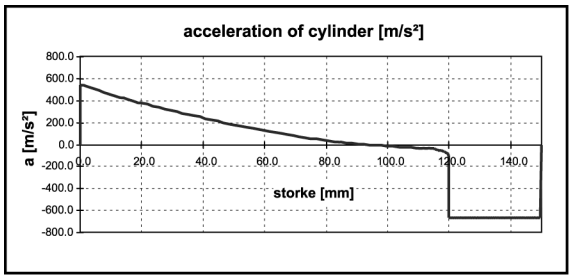
Speed versus stroke



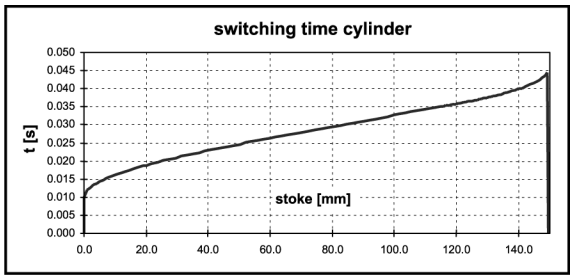
3.2 Example: computer calculation/simulation “operation OFF”

Description	reference	Units	Value
Actuator (cylinder)	piston-diameter	mm	47
	rod-diameter	mm	25
	stroke (cylinder)	mm	150
	mass of piston	kg	5.7
	cross section throttle	cm^2	3.8
Operation OFF	cushioning-length	mm	30
Piston accumulator	operating pressure	bar	282
	pressure drop per cm^3	bar	0.022
Pilot valve ON	switching time ON	s	0.01
Mechanics (c.b.)	ext. friction	daN	224.5
Ext. mass (circuit breaker)	mass	kg	53.5
Compression force of c.b.	compression force at stroke 0 mm	daN	0
	compression force at stroke 35.5 mm	daN	475
	compression force at stroke 82.9 mm	daN	1372
	compression force at stroke 118.4 mm	daN	1794.6
	compression force at stroke 150 mm	daN	0

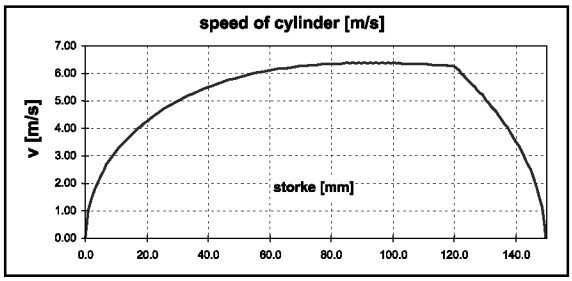
Acceleration versus stroke



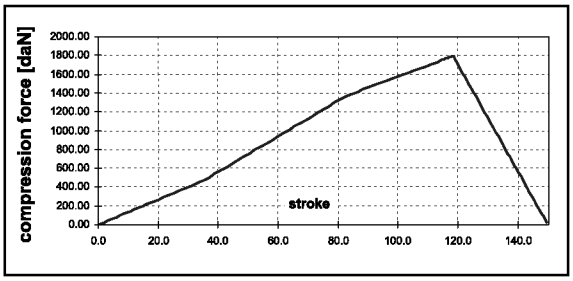
Operation time versus stroke



Speed versus stroke



Compression force versus stroke



BUCHER HYDRAULICS **www.bucherhydraulics.com**

Switzerland (Head Office)
High **V**oltage **S**witch **G**ears
Phone +41 41 757 03 33
Fax +41 41 757 16 49
info.nh@bucherhydraulics.com

France
Phone +33 389 64 22 44
Fax +33 389 65 28 78
info.fr@bucherhydraulics.com

Netherlands
Phone +31 79 34 26 24 4
Fax +31 79 34 26 28 8
info.nl@bucherhydraulics.com

UK
Phone +44 24 76 35 35 61
Fax +44 24 76 35 35 72
info.uk@bucherhydraulics.com

USA
Phone +1 262 605 82 80
Fax +1 262 605 82 78
info.wi@bucherhydraulics.com

Switzerland
Phone +41 33 67 26 11 1
Fax +41 33 67 26 10 3
info.ch@bucherhydraulics.com

Germany
Phone +49 7742 85 20
Fax +49 7742 71 16
info.de@bucherhydraulics.com

Italy
Phone +39 0522 92 84 11
Fax +39 0522 51 32 11
info.it@bucherhydraulics.com

Austria
Phone +43 6216 44 97
Fax +43 6216 44 97 4
info.at@bucherhydraulics.com

China
Phone +86 10 64 44 32 38
Fax +86 10 64 44 32 35
info.bj@bucherhydraulics.com