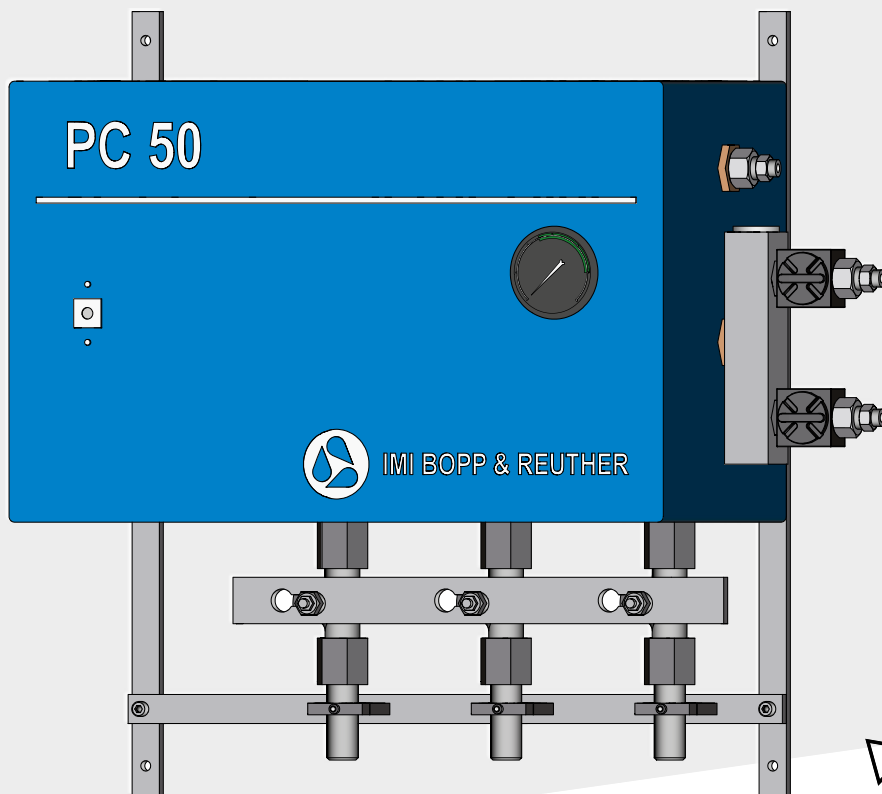


# PC 50



Engineering  
*GREAT* Solutions

**Pneumatic Control Unit  
for safety valve control  
with piston and lifting device**

# PC 50

## Features

The IMI Bopp & Reuther pneumatic control PC 50 is used to control safety valves with modular differential surface double acting piston types AK or safety valve SiZ 2507 with integrated differential surface piston.

- > Quick response times
- > High setting accuracy (low tolerance)
- > Good repeat accuracy
- > Testing of reliability during operation by integrated test valve group with locking bar
- > No air consumption during working condition

## Usage

Control of all IMI Bopp & Reuther safety valves

## Set pressures

0.1 bar g up to 250 bar g

## Modular design

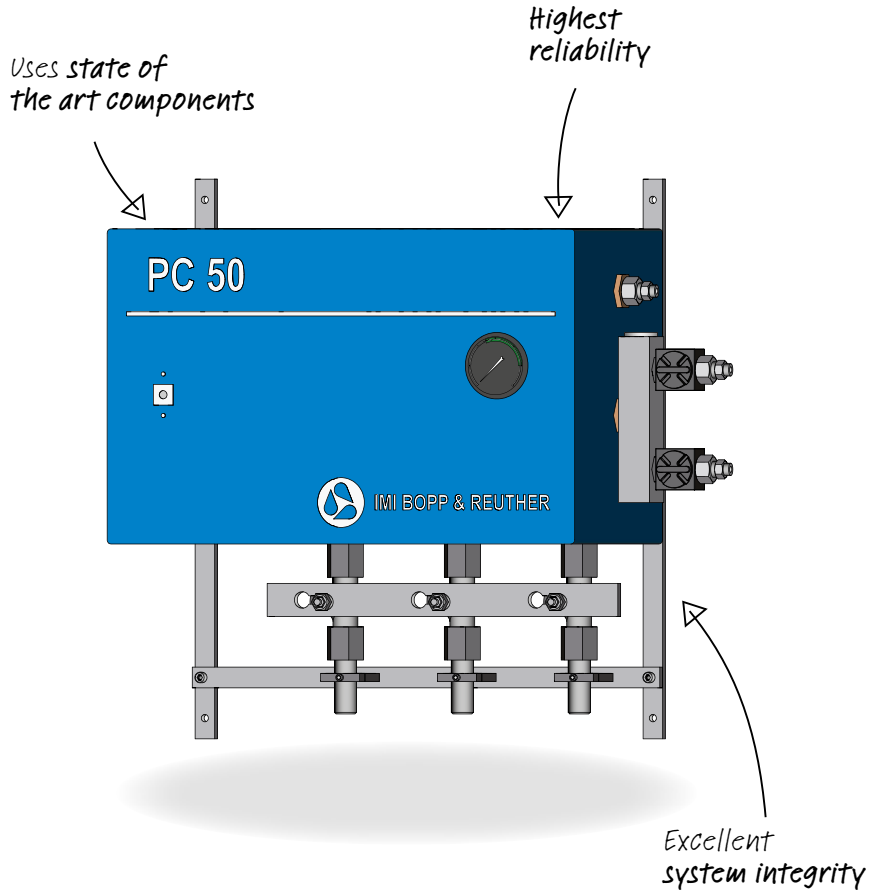
- > Standard device is purely pneumatic
- > Triple redundancy of pressure switches
- > Pressure switches can be checked during operation
- > Only one auxiliary power (pneumatic air) required for operation

## Pressure switch

- > Frictionless force-balance system
- > High setting accuracy of set pressure (<99%)

## Applications

- > In conjunction with assisted safety valves
- > Power Generation
- > Gases, steam or liquids
- > Chemical Industries
- > Process Industries
- > Petrochemicals
- > For nuclear application the Control Unit PC 50 is available in stainless steel body housing with reinforced superstructure. This design is dynamically qualified for 3g/5g including fundamental frequency test in accordance to KTA 2201.4.



## Extension options

- > Safety valve testing option
- > Remote lifting
- > Electrical heating (with response)
- > Ex-design (explosion proof)
- > Brass and bronze free
- > Pressure transmitter for critical medium

## Approvals and standards

### EC type examination

- Pressure Equipment Directive 97/23/EG

### VdTÜV type approval according to

TÜV.SV.1053

IMI Bopp & Reuther will not renew the existing VdTÜV type approvals. The requirements by VdTÜV and applicable standards are completely covered by the EC type examination.

# PC 50

## Type code

Type code			Order example
<b>1</b>	<b>Product type</b>	PC 50	PC 50
<b>2</b>	<b>Pressure ranges</b>	06	> 0,1 to 0,25 bar (2,5 bar <sup>1)</sup> )
		07	> 0,25 to 0,4 bar (2,5 bar <sup>1)</sup> )
		08	> 0,4 to 0,6 bar (2,5 bar <sup>1)</sup> )
		09	> 0,6 to 1 bar (2,5 bar <sup>1)</sup> )
		10	> 1 to 2,5 bar
		10.1	> 2,5 to 4 bar
		11	> 4 to 6 bar
		12	> 6 to 10 bar
		13	> 10 to 16 bar
		14	> 16 to 25 bar
		15	> 25 to 40 bar
		16	> 40 to 60 bar
		17	> 60 to 100 bar
<b>3</b>	<b>Connection modes</b>	N1	safety valve with existent lifting air
		T1	safety valve without existent lifting air
		N2	two safety valves with existent lifting air
		T2	two safety valves without existent lifting air
		TN	two safety valves one valve with existent lifting air one valve without existent lifting air
		SA	safety shut-off valve
<b>4</b>	<b>Testing of set pressure</b>	0	without
		1	with
<b>5</b>	<b>Remote lifting</b>	0	without
		1	with
		2	explosion-proof
<b>6</b>	<b>Electrical heating</b>	0	without
		4	explosion-proof and with additional temperature switch for monitoring
<b>7</b>	<b>Special design</b>	0	without
		1	with
<b>8</b>	<b>Pressure tapping line</b>	0	without test valve group <sup>3)</sup>
		1	Feed pipe <sup>2)</sup>
		2	flange DIN/EN
		3	flange ASME
		4	special connection
<b>9</b>	<b>Design</b>	0	Standard
		1	brass and bronze-free
		2	non-magnetic
		3	nuclear

<sup>1)</sup> For the calculation of the pressure switch reset value instead of the scale final value

<sup>2)</sup> OD Ø 21,3 x 3,2 1.7335 weld preparation regarding to DIN 2559-Form 22 design, shut off valves regarding to DIN 16271

<sup>3)</sup> Control units build into TÜV monitored plants must be equipped with the shut-off valve assembly according to type test approval.

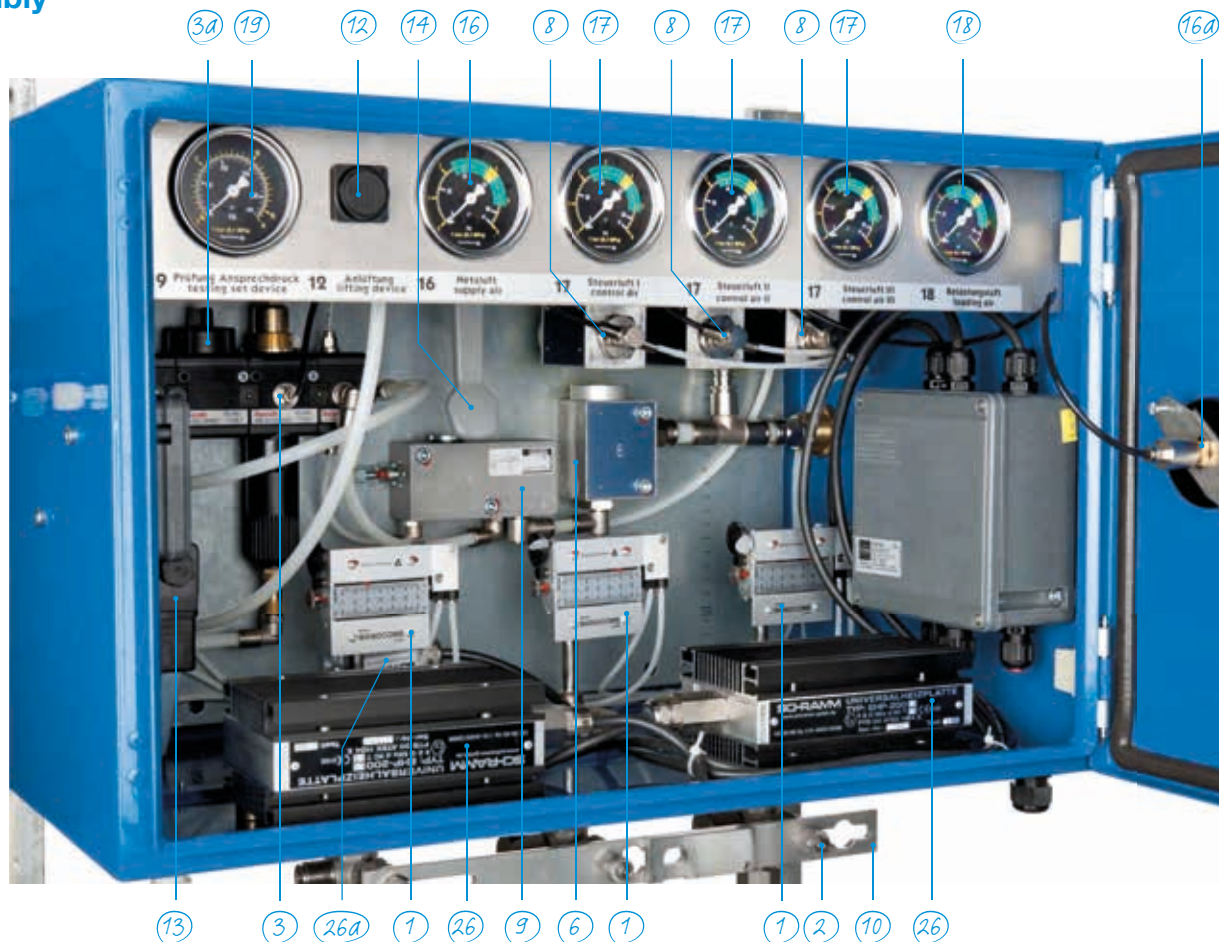
Type ►  
Please state ►

**PC 5016.T1.014.011**

Setting for pressure switches:  
50 / 45 / 45 bar g

# PC 50

## Assembly



**List of components PC 50**  
(see also Flow diagram, page 9)

Part	Description
1	Pressure switch
2	Shut off valve with test connection
3	Pressure reducer with fine filter
3a	Ball valve
6	Quick vent valve (lifting air)
8	Quick vent valve (loading air)
9	Pneumatic time element
10	Locking bar
12	Push-button valve (on-place lifting)
13	Solenoid valve (remote lifting)
14	Push-button valve (testing of set pressure)
16	Pressure gauge for reduced supply air
16a	Indication of function (reduced supply air)
17	Pressure gauge for control air
18	Pressure gauge for loading air
19	Pressure gauge (testing of set pressure)
26	Heating
26a	Temperatur switch for monitoring

### Optional equipment PC 50

#### Description

Brass and bronze free unit

Push-button valve (14) and test gauge (19) for testing of the safety valve

Electrical heating (explosion-proof) (26)

Second external temperature switch for remote monitoring (explosion proof) (26a)

Solenoid valve for remote lifting, 24V DC (optional explosion proof) (13)

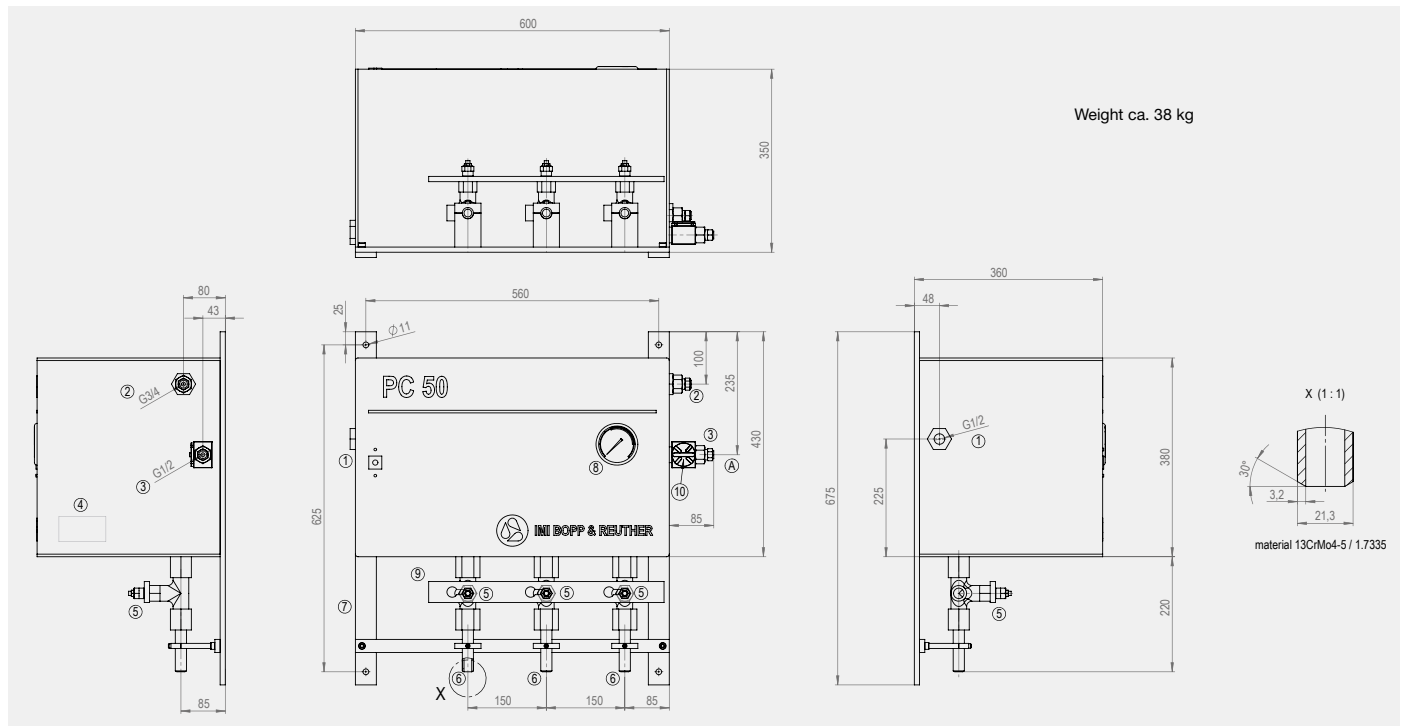
Pressure transmitter for protection of the pressure switch (protection against corrosive or viscous medium)

Pressure tapping line with flange or threaded connection

Electric signal for control unit operation at set pressure

# PC 50

## Control Unit PC 50 – Dimensions



### Connections

Item	Description	Dimensions of Connections, Explanations
1	Supply air connection	G 1/2" female; supply air pressure range: 2.5 to 10 bar g
2	Loading air connection	G 3/4" female; loading air pressure range: 2.5 to 5 bar g
3	Lifting air connection	G 1/2" female
4	Nameplate	
5	System pressure shut-off valve with testing connection	M20 x 1.5 (According to DIN 16271)
6	Pressure tapping line	Weld end according to DIN 2559 pipe size $\varnothing$ 21.3 x 3.2 material 13CrMo4-5 (1.7335)
7	Mounting frame	For installation of the control unit
8	Indication of function	Shows the operation status of the control unit
9	Locking bar	Allows the closing of only one shut-off valve
10	Lifting air valve	Position of three-way valve according to connection mode/arrangement

### Technical Data

Time-lag	less than 0.15 sec.
Switch reset value	up to 3% of the end of scale value of the pressure switch (see type code page 3)
Repeat accuracy	> 99.50%
Setting accuracy	> 99%

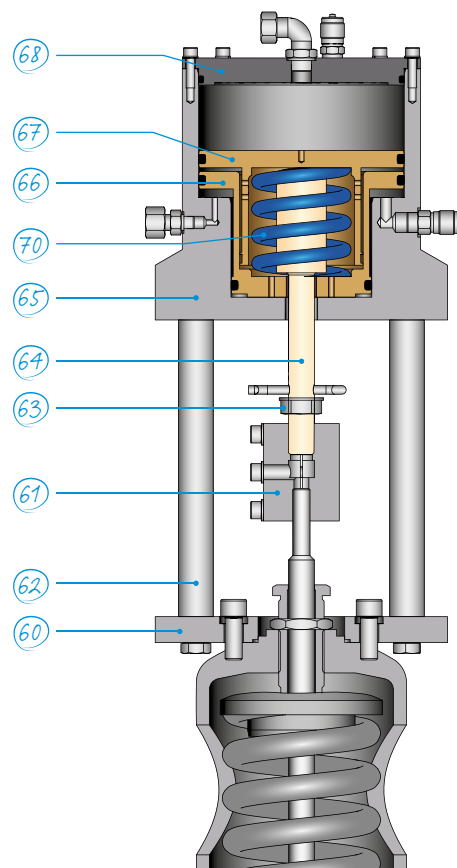
# Pneumatic piston AK

## Pneumatic piston AK

The pneumatic actuator AK follows the relief principle and uses differential surface pistons of a "flying piston" design. This ensures frictionless opening as a spring safety valve if the air supply fails.

The safety valve will no longer be gastight at the upper end of the bonnet once the actuator is set up. If a gastight design is required (typically for all applications except steam), a bellows design will need to be selected.

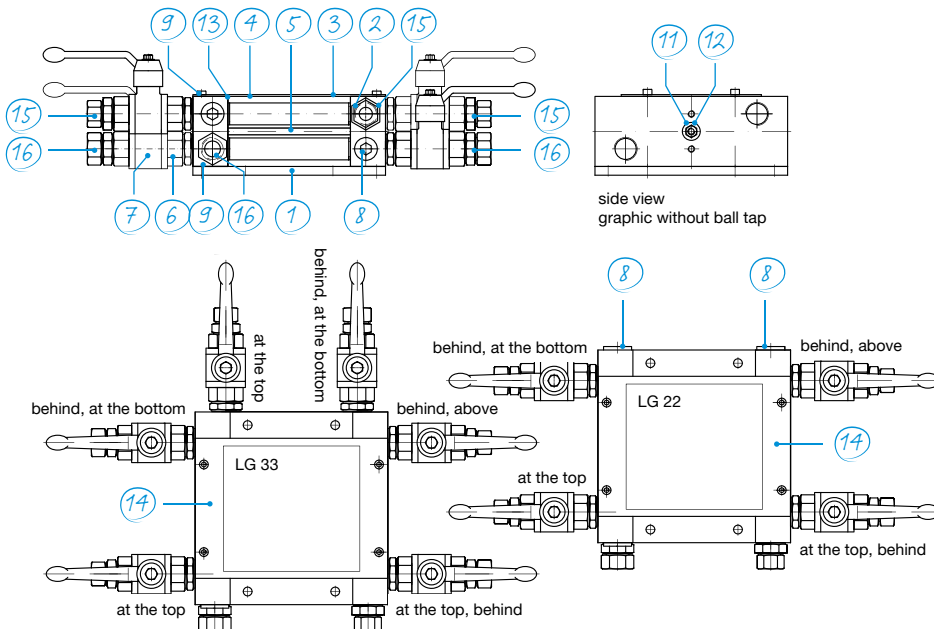
Part	Name	Material
60	Bonnet plate	P250GH / 1.0460
61	Coupling	1.0038
62	Column	GX35CrMo / 1.4122
63	Locking nut (Test Gag)	1.0109
64	Spindle	GX35CrMo / 1.4122
65	Piston housing	P250GH / 1.0460 (hard chrome-plated)
66	Lifting piston	GX35CrMo / 1.4122 size 1+2 GP240GH / 1.0619 size 3-5 (coated with zinc dust paint)
67	Loading piston	GX35CrMo / 1.4122 size 1+2 GP240GH / 1.0619 size 3-5 (coated with zinc dust paint)
68	Cover	P250GH / 1.0460
70	Spring	1.8159



- > Differential surface double acting piston for accurate performance (area of loading piston larger than area of lifting piston).
- > On failure of supply air the control air is vented off the pneumatic system, the piston spring is forcing apart the piston halves and the piston stem is free (flying piston). The valve operates as a spring-loaded safety valve.
- > Five piston sizes cover all valve dimensions and pressure ranges.
- > The piston integrated locking nut allows for safety valve gagging for e.g. pressure system hydro test.
- > A post installation modification of existing spring loaded safety valves is possible to optimize the functional performance, e.g. in case of increasing operating pressures.
- > The piston assembly AK is an approved optional design for IMI Bopp & Reuther safety valves with TÜV-type test and CE marking.

# Lifting valve assembly

## Lifting valve assembly LG 22 and LG 33

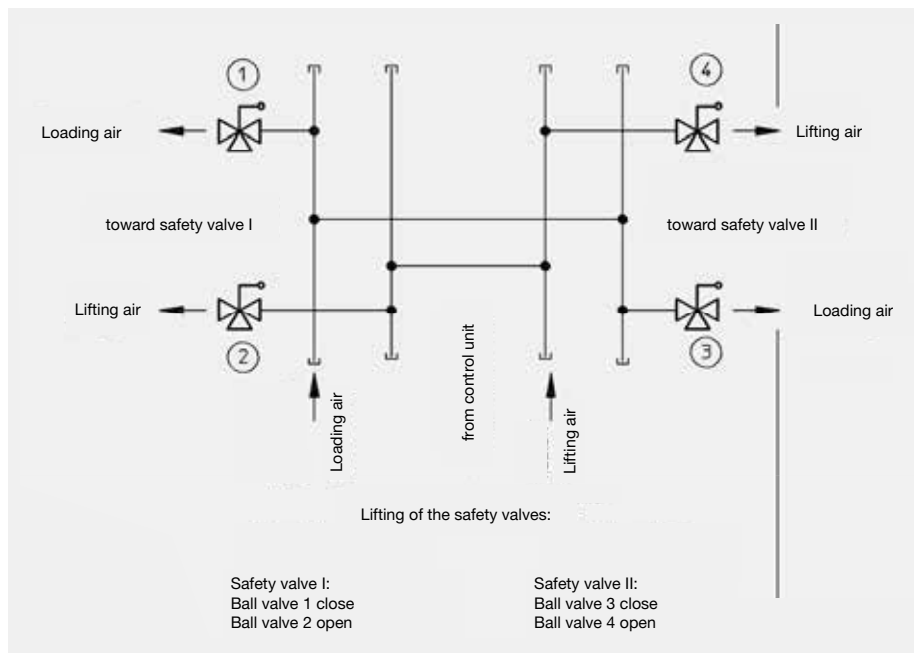


### Materialcode

#### LG 22 / LG 33

Part	Name	Material
1	Plate for lifting lever	3.3535
2	Allocator for lifting lever	3.1645
3	Top plate for lifting lever	3.3535
4	Connection for lifting lever	3.3206
5	Tension rod for lifting lever	1.0308 (ZN)
6	Threaded steel pipe fitting	
7	Ball tap with vent G $\frac{3}{4}$ i	
8	Lock screw G $\frac{3}{4}$	
9	Cylinder bolt M6 x 14	A2
11	Hexagon nut M8	A2
12	Serrated lock washer 8,4	A2
13	Seal, fluted	PA (white)
14	Distribution device	A2
15	Mechanical joint GE 15LR $\frac{3}{4}$ ED"	1.4571
16	Mechanical joint GE 18LR $\frac{3}{4}$ ED"	1.4571

## Lifting valve assembly LG 22 and LG 33



- > The lifting valve assembly LG 22 has one loading air inlet and one lifting air inlet, with outlets for two valves' loading and lifting air. The LG 33 has outlets for three valves' loading and lifting air.
- > The LG 33 is required for the connection of three safety valves to one PC 50 control unit with easy operation. The LG 22 may be used for two safety valves.
- > The 3/2-way valves built in the lifting valve assembly enable selection of all pneumatic system connection mode, i. e. for each valve separate lifting air on/off.
- > Lifting of a single safety valve is possible without change of production function of the 2nd or 3rd valve.
- > In case of long pipe runs between the control unit and multiple valves the piping effect may be reduced with a lifting and loading air manifold within short distance of the safety valves.

# Pneumatic assisted safety valve

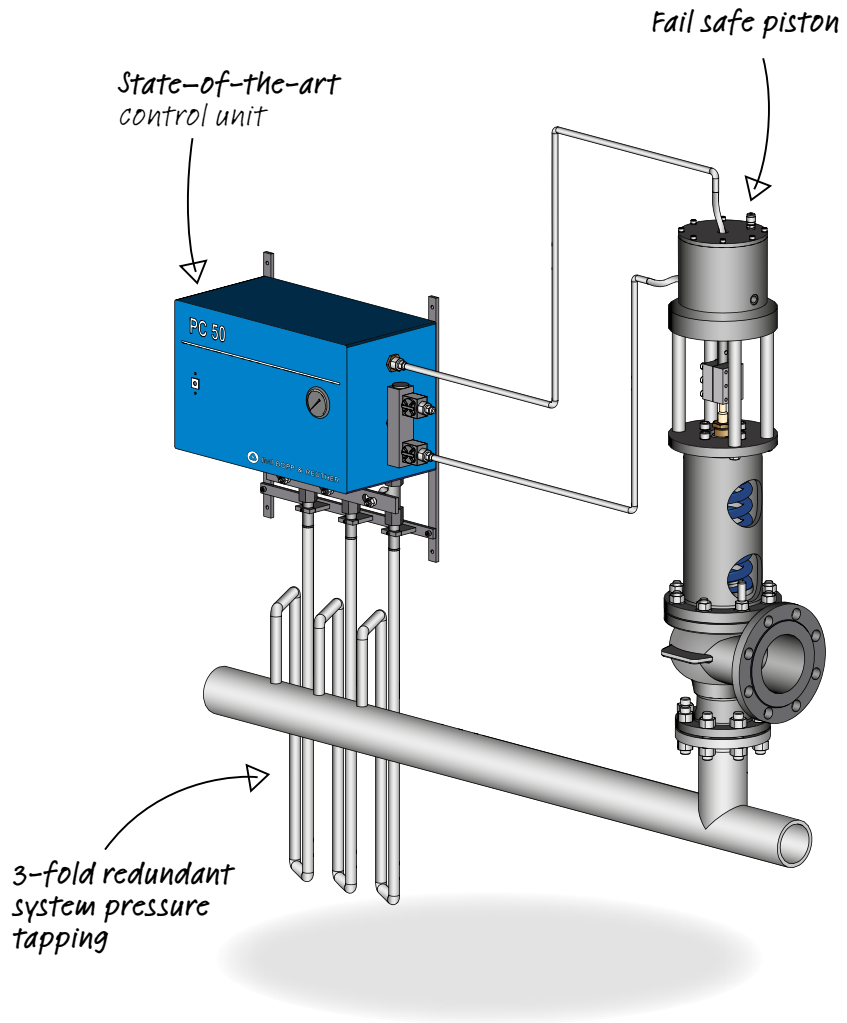
## Features

Controlled safety valves are used primarily where standard spring-loaded safety valves cannot meet stringent operating conditions. Typical applications are systems with high operating pressures, increased tightness requirements, limited opening and reseating parameters, critical applications.

### Operation of controlled safety valves

In addition to the safety valve spring the controlled safety valve is equipped with an air pressure cylinder piston. After start-up of the control unit the loading air is built up above the piston. The space below the piston can be operated either with continuously present lifting air or without lifting air. The control unit PC 50 operates in accordance with the closed circuit principle, i. e. the loading air discharges by reaching the engage pressure (usually set pressure). The pressure switches work as redundant multiple monitoring (e. g. 3 control lines in a 1 out of 3 principle).

Once triggered, the loading air is released thus removing the additional closing force and the safety valve opens supported by the lifting air present below the piston or without lifting air and as a spring loaded safety valve with its own opening characteristics. In case of air supply failure controlled safety valves operate exactly like direct spring loaded safety valves. The control unit PC 50 and the controlled safety valves fully meet the requirements according to DIN EN ISO 4126-5, AD 2000-A2 and TRD 421.



## Benefits of controlled safety valves

- > Improvement of the static performance, e.g. increased tightness up to valve opening, high setting accuracy, and precise repetition of the set pressure thus improving operating efficiency.
- > Improvement of the dynamic performance, e.g. reduction of the opening and reseating hysteresis, stabilisation of the valve blow-off, controlled safety valve opening below the set pressure, controlled overflow with pressure maintenance improving operating efficiency and reducing down time.
- > Stabilized function of the safety valve
- > Requirements in high operating pressure or the size of the safety valve, may require the use of controlled safety valves while still guaranteeing operational safety.
- > With the use of the control unit, the operating pressures can be staggered in multiple valve applications increasing the level of control on the system and avoiding unnecessary loss of medium.

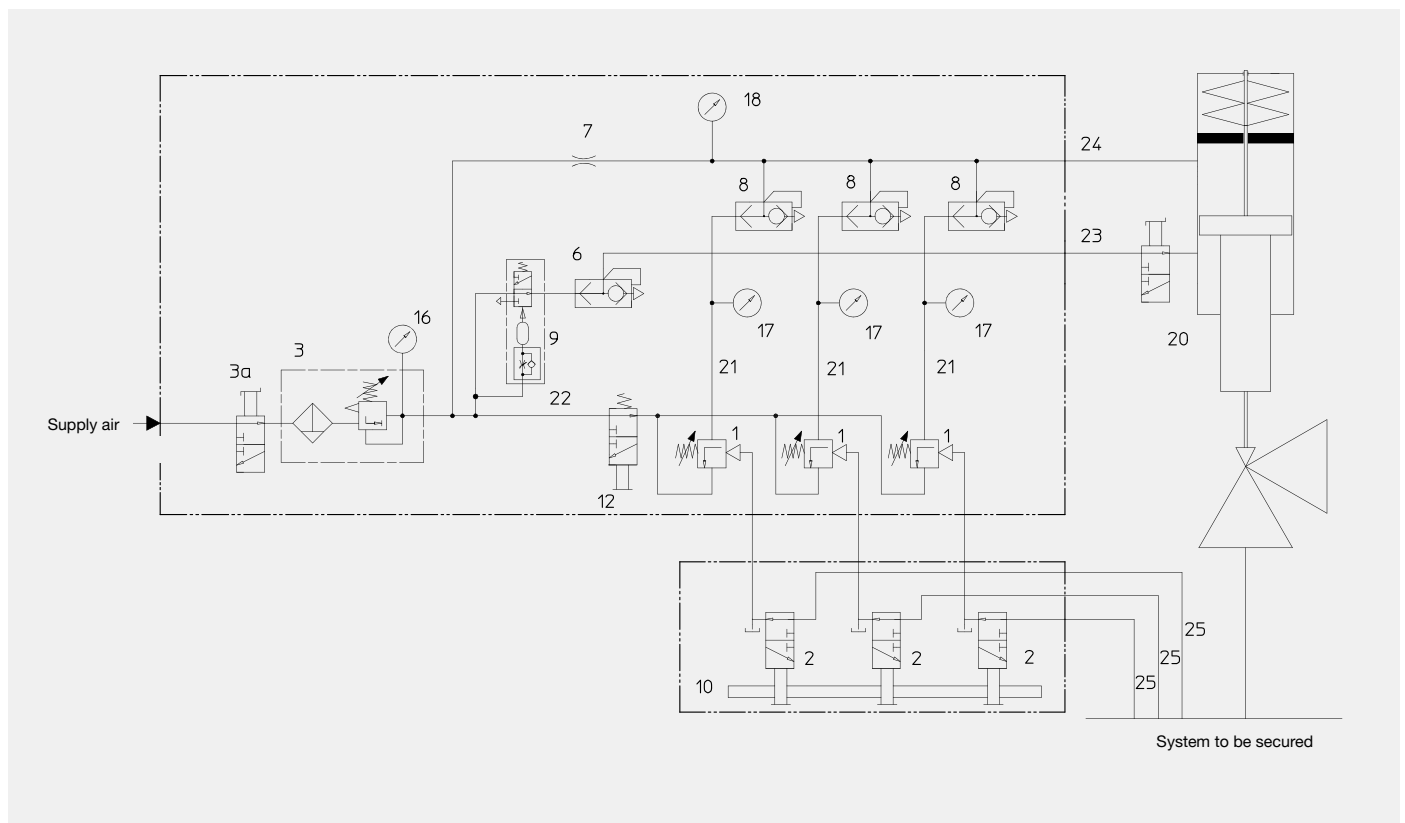


# Pneumatic assisted safety valve

## Applications

- > In conjunction with assisted safety valves
  - > Power Generation
  - > Gases, steam or liquids
- > Chemical Industries
  - > Process Industries
  - > Petrochemicals
- > For nuclear application the Control Unit PC 50 is available in stainless steel body housing with reinforced superstructure.

## Pneumatic diagram PC 50 in operating position with one safety valve

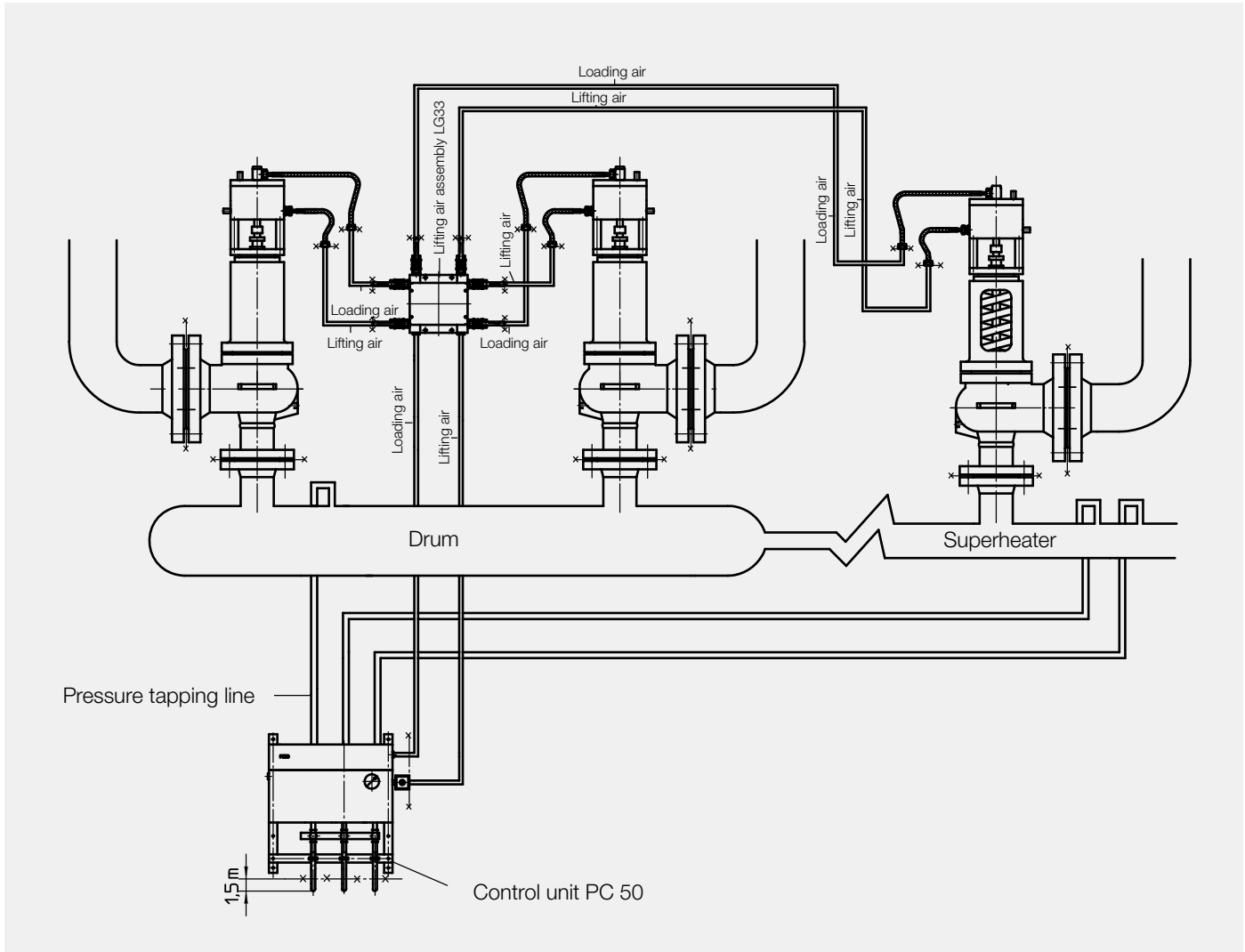


### List of components PC 50 (see pneumatic diagram above)

Part	Description	Part	Description
1	Pressure switch	16	Pressure gauge for reduced supply air
2	Shut off valve with test connection	17	Pressure gauge for control air
3	Pressure reducer with fine filter	18	Pressure gauge for loading air
3a	Ball valve	20	3-way ball valve
6	Quick vent valve (lifting air)	21	Control air line
7	Throttle	22	Control air line
8	Quick vent valve (loading air)	23	Lifting air connection
9	Pneumatic time element	24	Loading air connection
10	Locking bar	25	Pressure tapping line
12	Push-button valve (on-place lifting)		

# Steam generator application

## Example of a steam generator application



In the above application two controlled safety valves are installed on the drum and one controlled safety valve on the superheater. The set pressure of the superheater safety valve is lower compared to the drum safety valve and is in operation with lifting air on (connection mode N, see type code page 3).

In order to ensure that no condensate will flow back to the main pressure system line the control unit must be placed at a lower elevation than the main steam pipe.

Pressure tapping lines are typically located on the higher elevation of the pressure system, offset to each other and water seals are to be used when utilizing hot mediums. The pressure tapping lines shall be instal-

led in horizontal direction or downwards to the steam pipe. The vertical upward tapping line part is always hot and has condensate return which drips in the steam pipe. These hot segments of the pressure tapping lines have to be insulated.

For detailed installation instructions please see operating and maintenance manual.

The connection mode of the drum valves is arrangement T (see type code page 3), i.e. loading air only. The pressure tapping lines are connected to the drum and the superheater. In case the steam system pressure triggers the set pressure of any pressure switch (1 out of 3), the loading air is vented from safety valve cylinders. The superheater safety valve opens first

supported by the lifting air, while the drum safety valves are still closed due to higher spring setting.

The sole opening of the superheater safety valve covers many relief cases with short pressure increase and cooling of the steam generation system is further ensured, because steam is relieved at the system end.

Should the pressure in the steam generator increase further, the drum safety valves open against spring setting and the total generated steam capacity is discharged to retain safe pressure levels.

# Mobile Testing

## Test of the Set Pressure of the Safety Valve during Operation

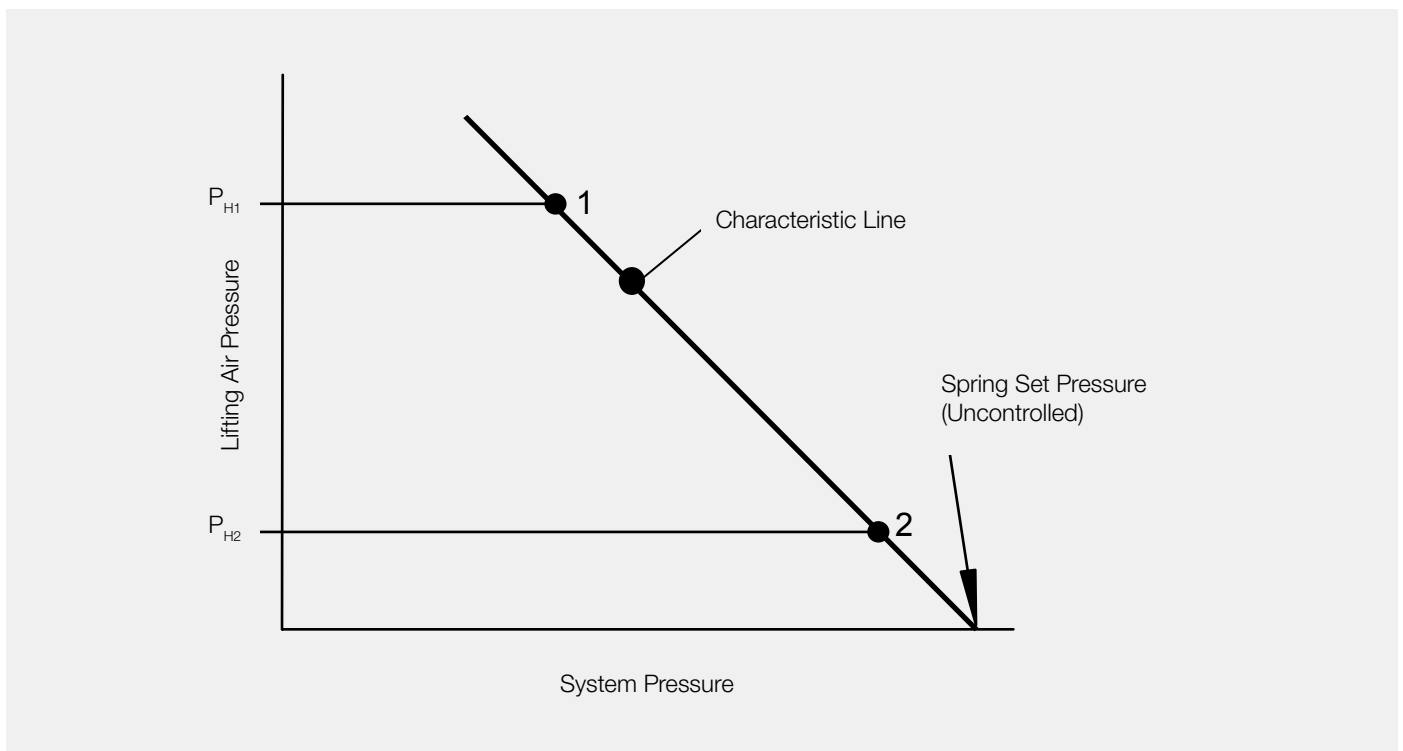
One of most important benefits of the mobile testing is that the set pressure of a safety valve can be tested during operation.

The registered lifting air pressure  $P_{H1}$  and  $P_{H2}$  at the pressure gauge and the pressure of the system are entered into a diagram.

The test procedure is carried out at first (zero point method) with two system pressures at least- in the diagram the points 1 and 2.

The connecting straight line through the measured points meets the x-Axis of the diagram at the set pressure.

If, during a repeated test, the measured values are on the characteristic line of the zero point measurement, this is considered as a proof of the set pressure.



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