

CRANE BS&U supporting the Building Services Industry



Andy Lucas

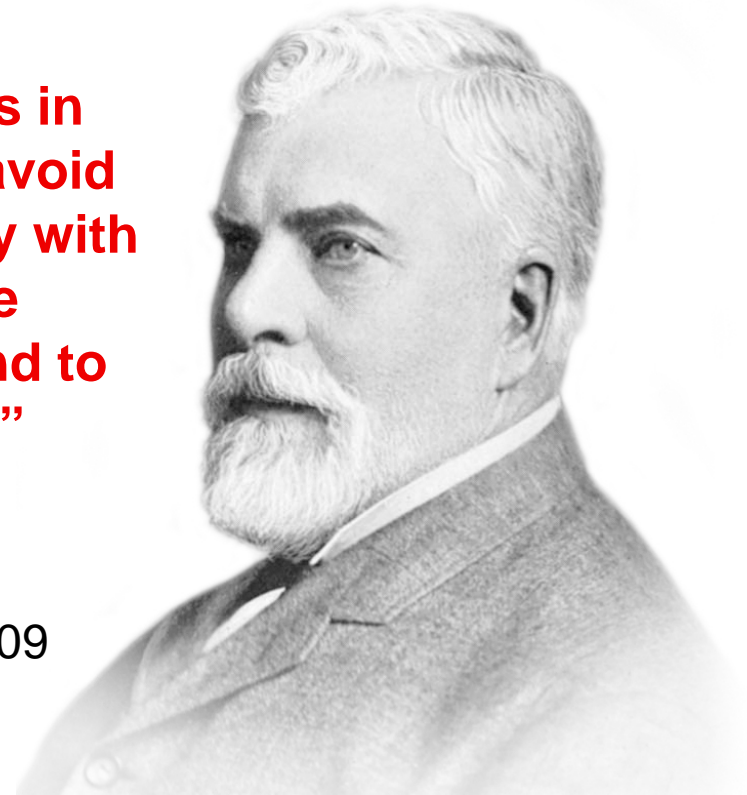
Technical Development Manager CRANE BS&U

Crane Co founded in 1855 by Richard Teller Crane who made the following resolution -

“I am resolved to conduct my business in the strictest honesty and fairness; to avoid all deception and trickery; to deal fairly with both customers and competitors; to be liberal and just towards employees; and to put my whole mind upon the business”

Crane Limited founded in Ipswich in 1919

Crane Building Services & Utilities created 2009



CRANE[®]

BUILDING SERVICES & UTILITIES

Building Services

brownall[™]

RHODES[™]

NABIC[™]

Wade[™]

CRANE

FLUID SYSTEMS

Hattersley[™]

iat[™]
INGOLSTADT
ARMATUREN TECHNOLOGIE

Gas Utilities

WASK[™]
Specialist fittings and equipment for the utilities industry

SPERRYN
GAS CONTROLS **S**[™]

Water Utilities

VIKING JOHNSON[™]
Leaders in pipe joint, repair & flow control products

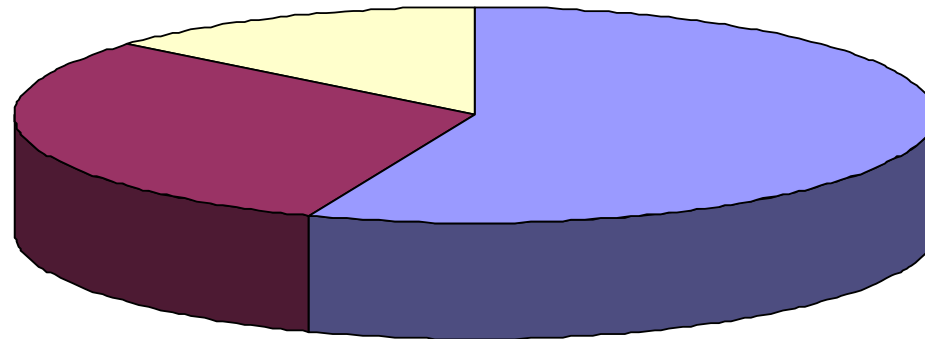
POSIFLEX[™]
Total pipe expansion solutions

Heiden

CRANE BS&U 2010 sales £110m

Gas Utilities

Building Services



Water Utilities

CRANE

BUILDING SERVICES & UTILITIES

industry organisations

- CIBSE
- SoHPE
- BSRIA
- CSA



Commissioning Specialists Association
The HVAC and Building Services Commissioning Engineers Association

Introduction to Safety Valves

CIBSE approved CPD

A magnifying glass with a silver handle is positioned over a globe. The globe is rendered in shades of green and blue, showing continents and latitude/longitude lines. A shadow of a hand is cast onto the globe, suggesting a person is holding the magnifying glass. The background is a solid green color.

Andy Lucas

Technical Development Manager CRANE BS&U

Title **An introduction to Safety Valves**

Objective **To give an understanding of Safety Valves used in Building Services including**

- **sizing**
- **installation**
- **maintenance**

What are they?

Definition (PED) 'a valve which automatically, without the assistance of any energy other than that of the fluid concerned, discharges a quantity of the fluid so as to prevent a predetermined safe pressure being exceeded, and which is designed to reclose and prevent further flow of fluid after normal pressure conditions of service have been restored'

PED Pressure Equipment Directive 97/23/EC

- the regulation covering safety valves in Europe
- safety valves are classified PED category IV

Standard EN ISO 4126 - joint European & ISO standard

BS6759 – valve manufactured to BS6759 are deemed to comply with EN ISO 4126 if no design changes

What are they?

Safety valves, as the name implies, have a specific function

to protect equipment & personnel

EN ISO 4126 only refers to *safety valves* & covers

- safety valves
- relief valves
- pressure relief valves
- safety relief valves

Why we need one?

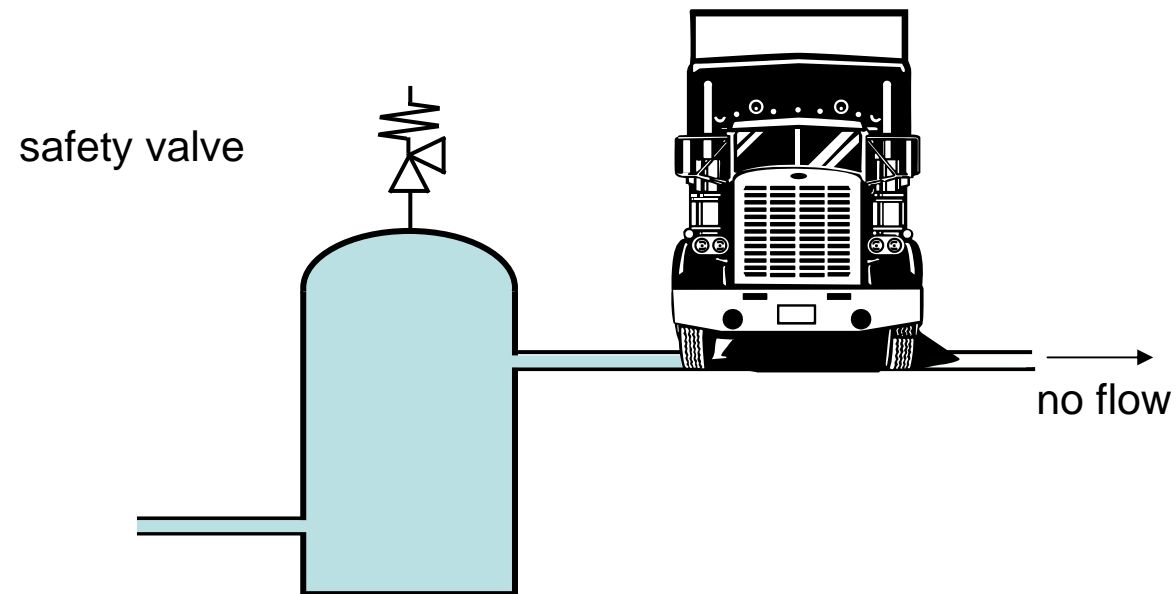
4 main reasons

- blocked discharge
- external heat
- thermal expansion
- failure of pipeline component, ie control valve

Why we need one?

4 main reasons

- blocked discharge

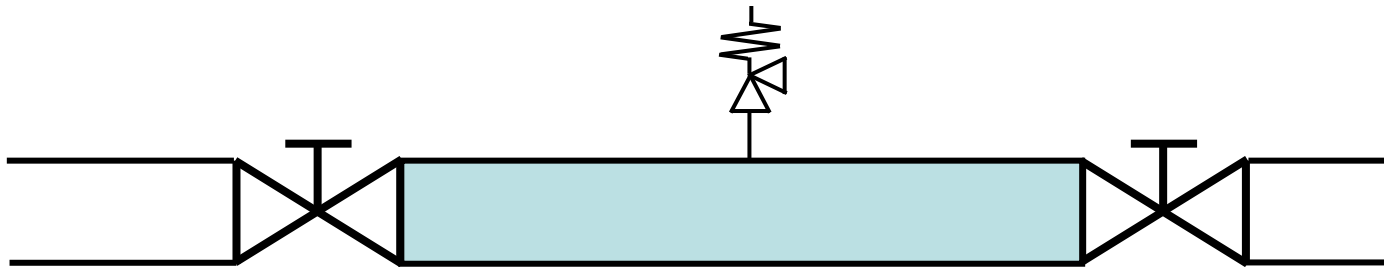
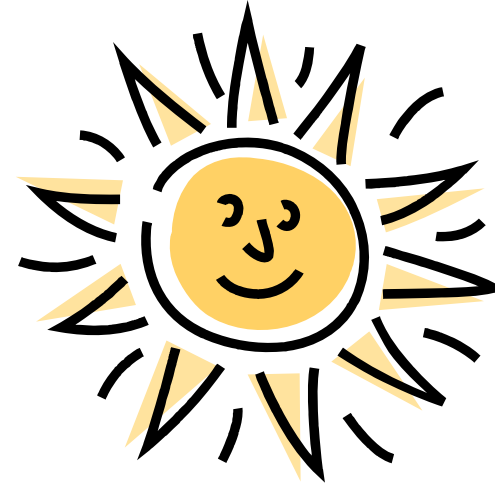


Safety Valves

Why we need one?

4 main reasons

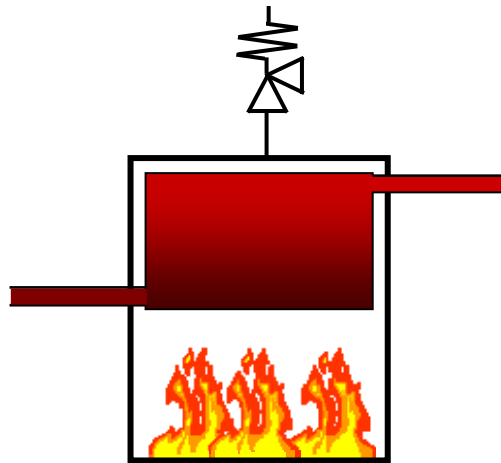
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Why we need one?

4 main reasons

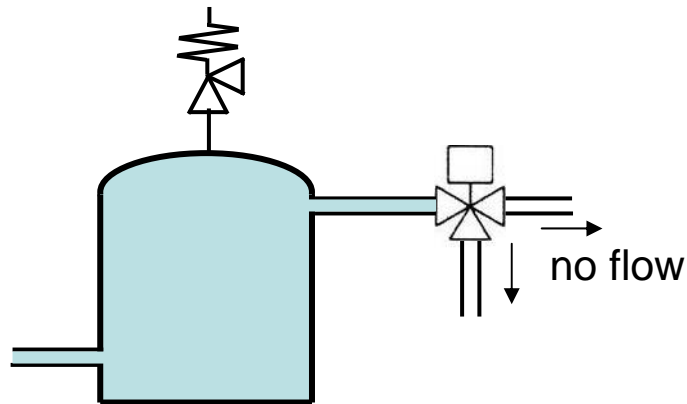
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- external heat
- thermal expansion



Why we need one?

4 main reasons

- blocked discharge
- external heat
- thermal expansion
- failure of pipeline component, ie control valve



Terminology

Set pressure	the pressure at which the valves starts to open measured at valve inlet normally 1.1 x working pressure or working pressure + 0.7 bar for water whichever is the greater
Overpressure	pressure at which valve has to achieve its full discharge capacity normally set pressure +10%
Accumulation	pressure increase over the maximum working pressure of the system during discharge through the safety valve

Operating states

there are 3 operating states for safety valves

1. Equilibrium
2. Fully open
3. Fully closed

Terminology

Blowdown	the pressure difference between set pressure and pressure at which the valve reseats expressed as a % of the set pressure
Reseat Pressure	pressure at which valve is fully closed
Working Pressure	pressure at which the system being protected normally operates
Discharge Capacity	the amount of water / gas/ vapour the valve will pass at a given pressure

Safety Valves

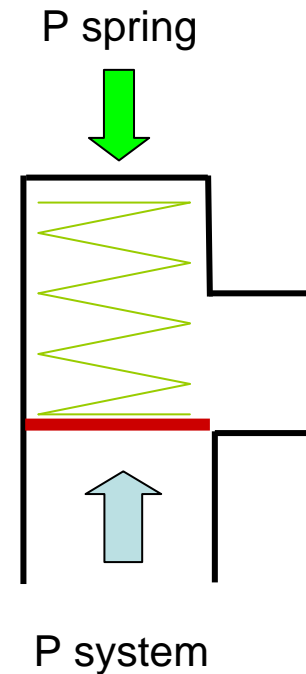
Equilibrium

forces acting to close are in **equilibrium** (balance) with the forces acting to open and the seat & disc are just in contact

defined in EN ISO 4126 as the **Set Pressure**

this is the point when flow is **about** to start

in practice flow **commences** as the equilibrium point is reached



$$P \text{ system} = P \text{ spring}$$

Safety Valves

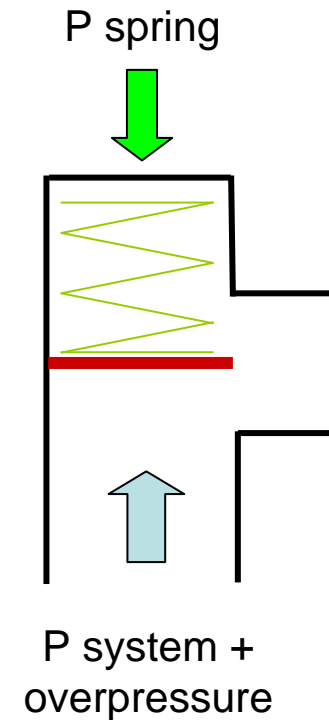
Fully open

the position the valve must achieve to pass its **rated capacity** at its specified overpressure

note - this is not the **Set Pressure**

different designs of valve have different relationship between flow & pressure

some designs have a rapid increase in flow for a small increase in pressure - others offer a gradual increase



$$P \text{ system} + \text{overpressure} = P \text{ spring}$$

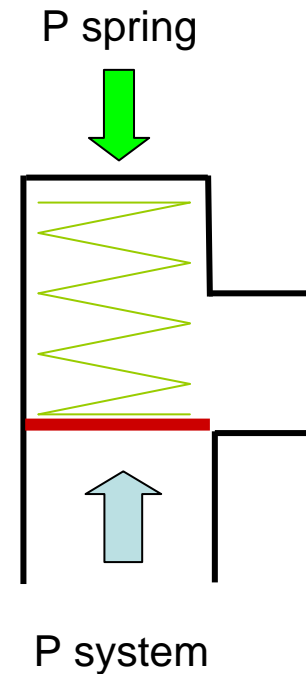
Safety Valves

Fully closed

the position when the valve has re-seated
ie fully closed - ***nil leakage***

the difference between the re-seat
pressure & set pressure is often referred to
as the ***Blowdown Pressure***

the blowdown pressure will depend on
valve design, the faster the flow increases
on opening the lower the blowdown
pressure is



$$P \text{ re-seat} = P \text{ system} - \text{blowdown}$$

Direct Spring Safety Valve

within Building Services the Direct Spring Safety valve is generally used

the spring is pre-compressed to apply force downwards on the disc holding it onto the seat to maintain a pressure seal

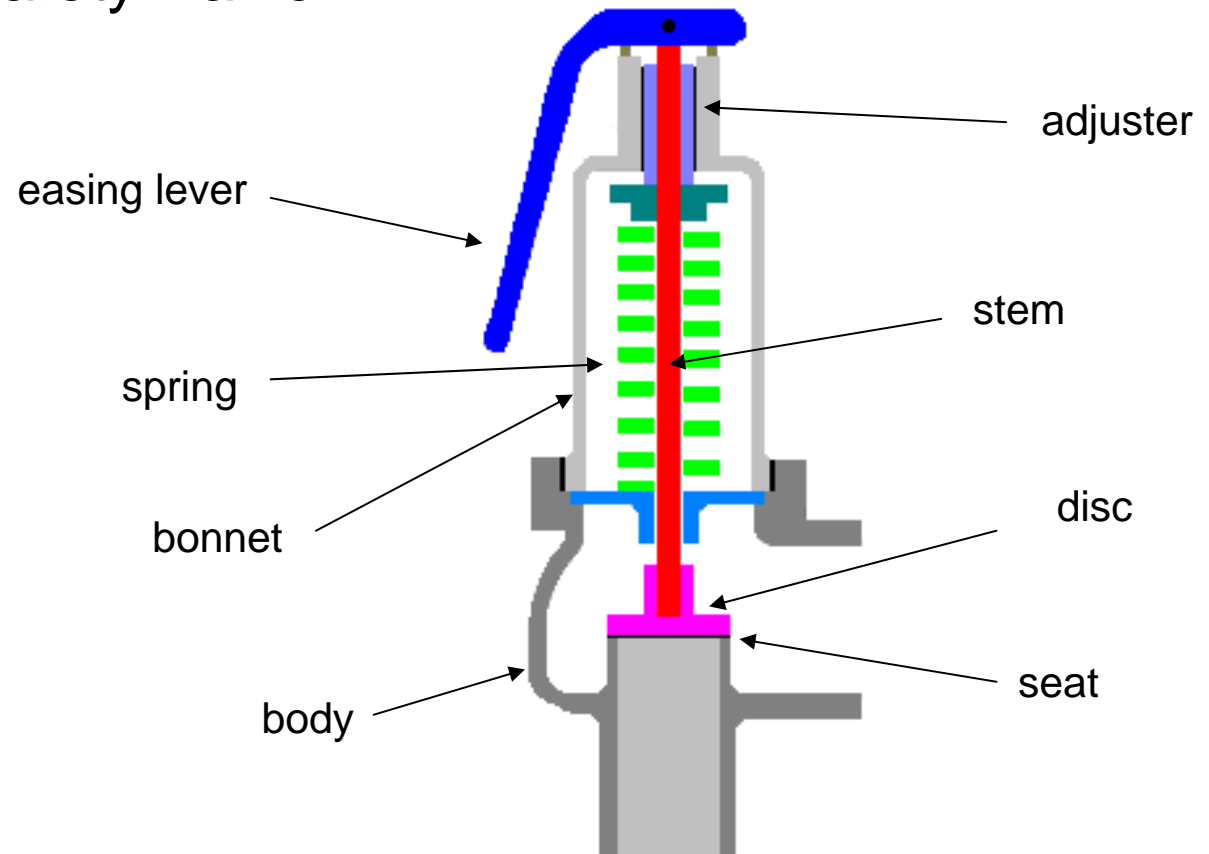
if the system pressure increases the spring force is exceeded & flow commences



Safety Valves

Direct Spring Safety Valve

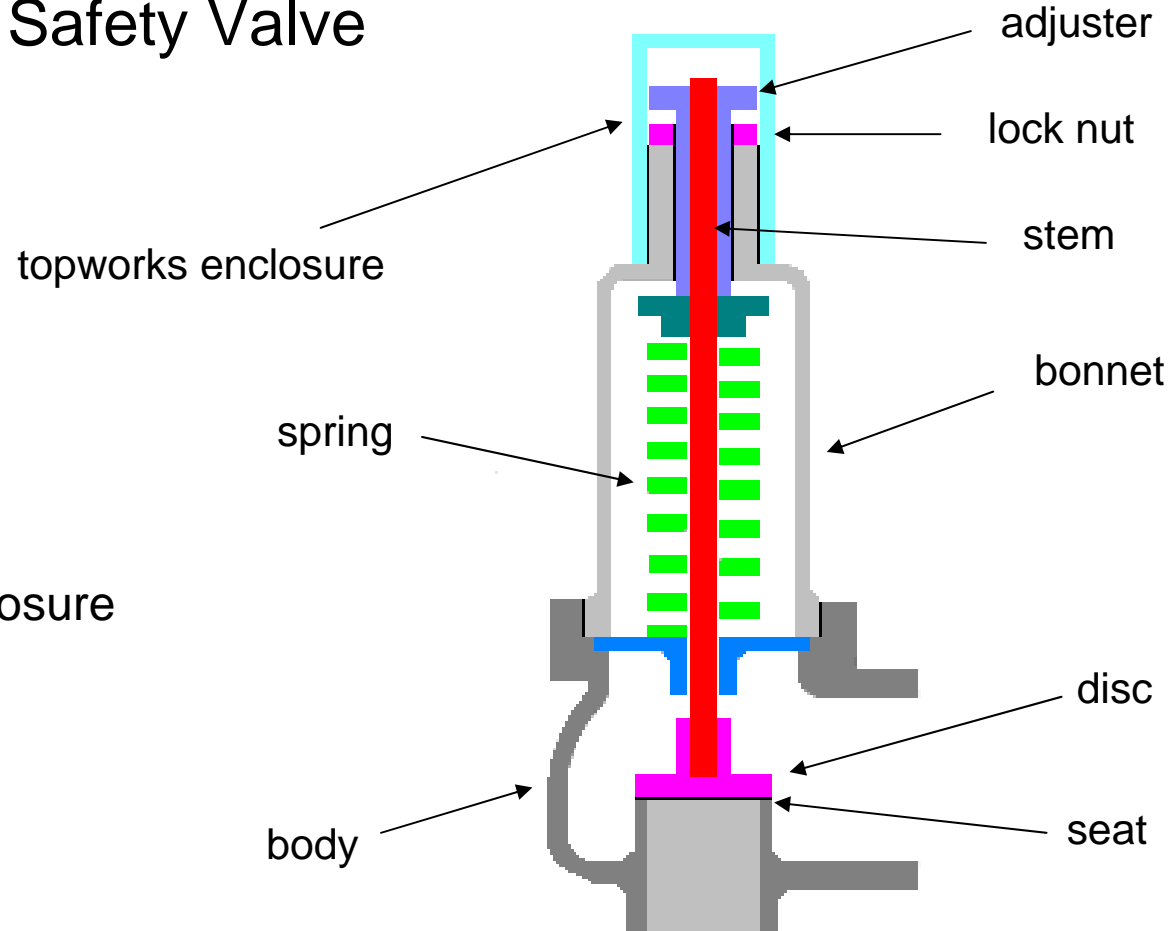
Direct Spring
with easing lever



Safety Valves

Direct Spring Safety Valve

Direct Spring
with topworks enclosure



Combined Pressure & Temperature

Direct Spring Safety Valve with temperature function

the spring is pre-compressed to apply force downwards on the disc holding it onto the seat to maintain a pressure seal

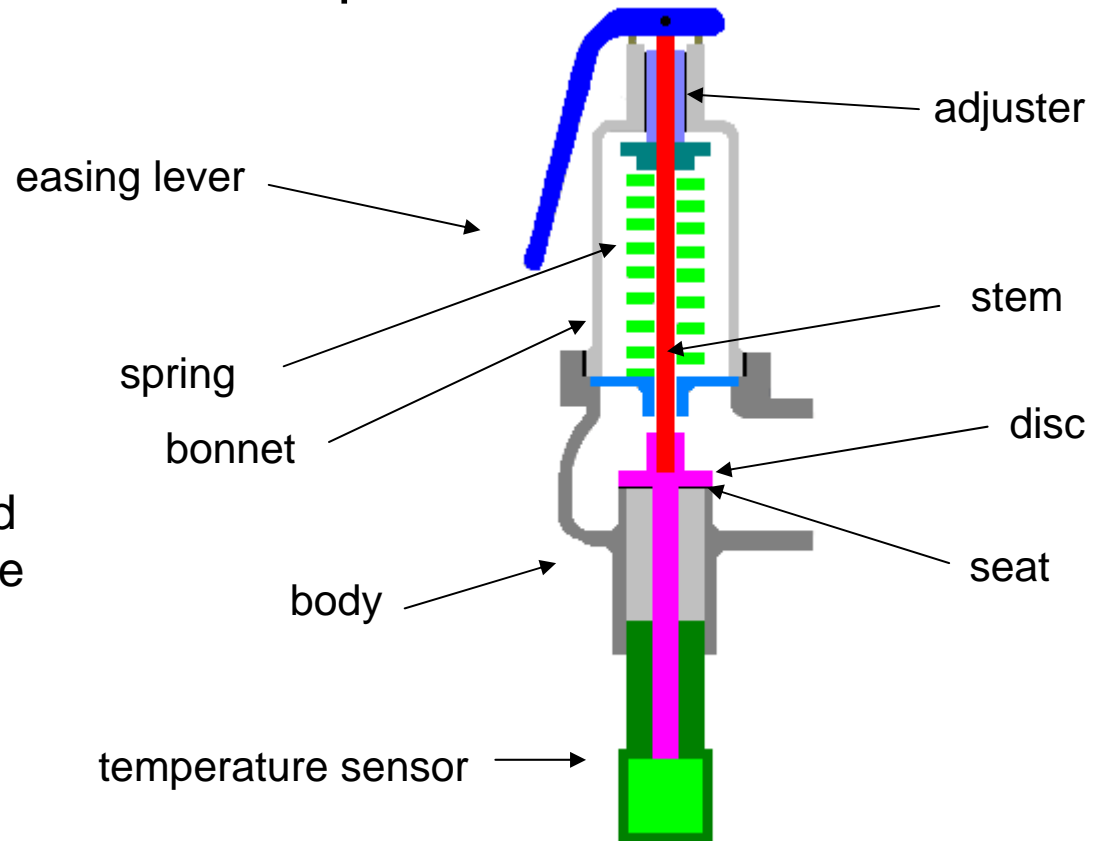
if the system *pressure* or *temperature* increases the spring force is exceeded & flow commences

temperature sensor



Combined Pressure & Temperature

Direct Spring Combined
Pressure & Temperature
with easing lever



Sizing

correct sizing of Safety Valves is important

- undersize valves may not relieve sufficient quantity of system media to prevent pressure build-up
- oversized valves will partially lift at set pressure & then re-seat so could cause 'chattering' of the disc damaging the seat / disc surfaces

sizing affects how a Safety Valve performs

Sizing

requirements for sizing Safety Valves are

What is the application

What is the set pressure

What is the discharge capacity required

Sizing

requirements for sizing Safety Valves are

What is the application

- system media, ie water / steam etc
- operating temperature
- operating pressure

Sizing

requirements for sizing Safety Valves are

What is the application

What is the set pressure

- the pressure at which the valves starts to open measured at valve inlet

normally $1.1 \times$ working pressure

or

working pressure + 0.7 bar for water whichever is the greater

Sizing

requirements for sizing Safety Valves are

What is the application

What is the set pressure

What is the discharge capacity required

- the amount of water / gas / vapour required to discharge at a given pressure

Installation

installed position of the Safety Valve affects how the Safety Valve performs

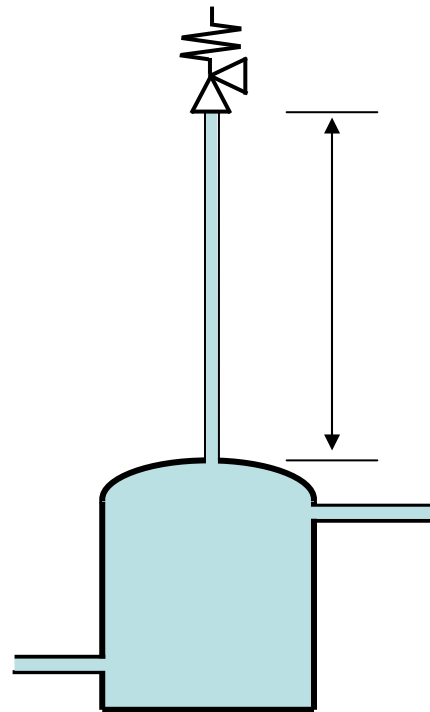
mount vertically

avoiding

- long pipework runs to Safety Valves
- valves between system & Safety Valve
- fittings / bend between Safety Valve and system
- installation near to pipework lateral connections
- inverted outlet

Installation

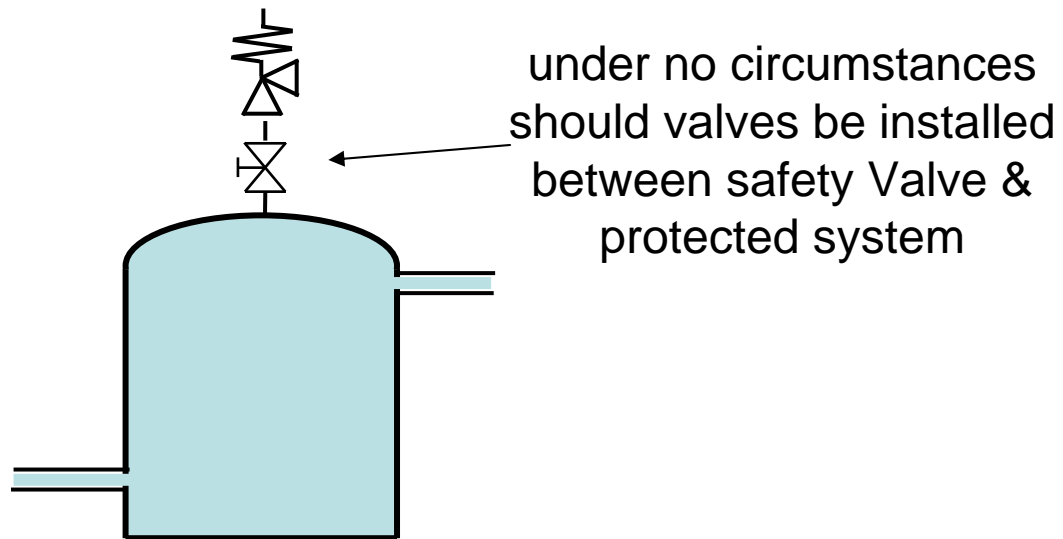
- long pipework runs to Safety Valves



pipework losses between protected system & Safety Valve should not be greater than **3%** of maximum discharged capacity pressure

Installation

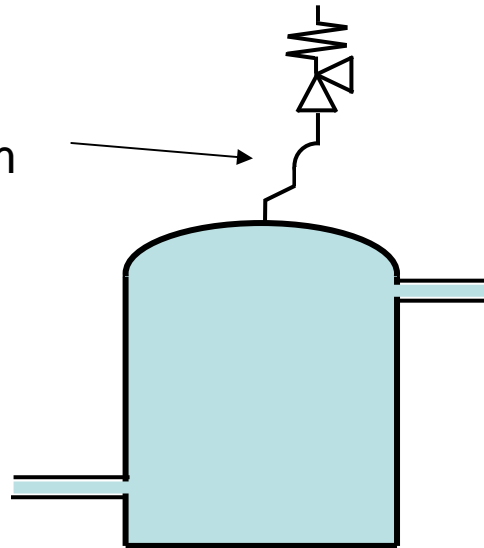
- long pipework runs
- valves between system & Safety Valve



Installation

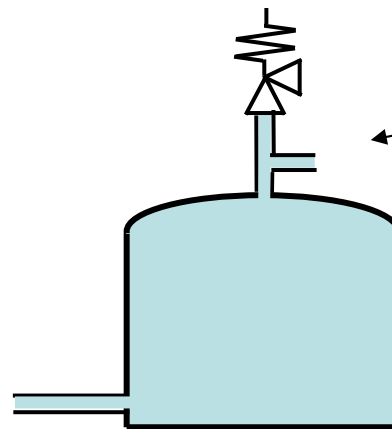
- long pipework runs
- valves between system & Safety Valve
- fittings / bend between Safety Valve and system

fitting etc between
Safety Valve & system
affect discharge
capacity & should be
avoided



Installation

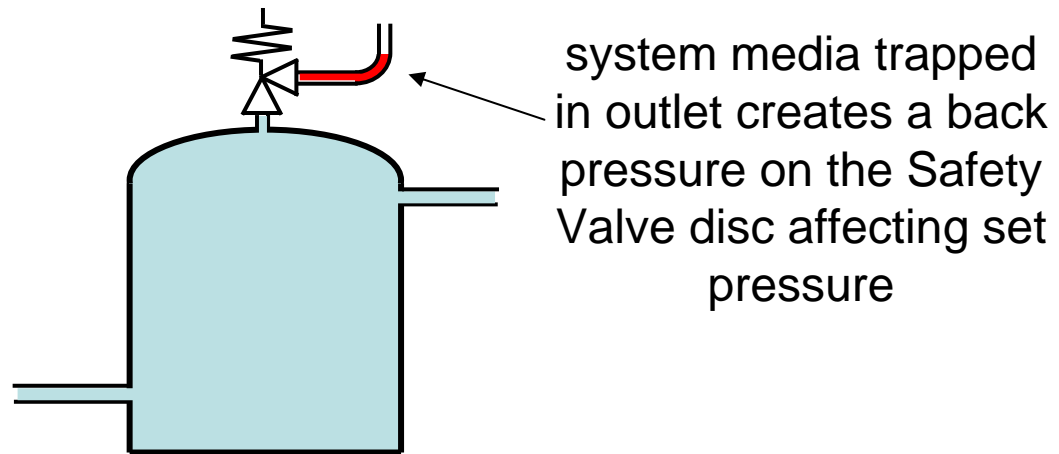
- long pipework runs
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- installation near to pipework lateral connections



flow into lateral
pipework affects system
pressure at Safety
Valve inlet

Installation

- long pipework runs
- valves between system & Safety Valve
- fittings / bend between Safety Valve and system
- installation near to pipework lateral connections
- inverted outlet



Maintenance

regular maintenance ensures

- Safety Valve will work when required
- life of valve
- system is correctly protected from over pressure
- compliance with insurance company requirements

Maintenance

maintenance regime should include

- the mechanical operation should be checked at **three monthly intervals** by manually operating the easing lever
see installation instructions supplied with valve
- to avoid unnecessary strain on the easing gear, the valve should be under a pressure of not less than 75% of its set pressure
- where arduous conditions of service exist, more frequent testing may be required

It is the responsibility of the user to establish the frequency of manual testing

Maintenance

the set pressure of Safety Valves should be checked every *twelve months*

- this can be carried out in situ
 - usually difficult on site as gauges need to be calibrated and system pressure needs to be varied to check set pressure
- by removal of the Safety Valve to a test facility

before removing the valve, steps should be taken to ensure that the system has been de-pressured

Introduction to Safety Valves

CIBSE approved

A magnifying glass with a silver handle and frame is positioned over a globe. The globe is rendered in shades of green and blue, showing continents and latitude/longitude lines. A large, semi-transparent blue handprint is overlaid on the globe, with its fingers spread. The text 'CIBSE approved' is written in a bold, orange, sans-serif font across the center of the handprint and globe.

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Technical Development Manager CRANE BS&U