A coverage on safety valve

Purpose of safety valve

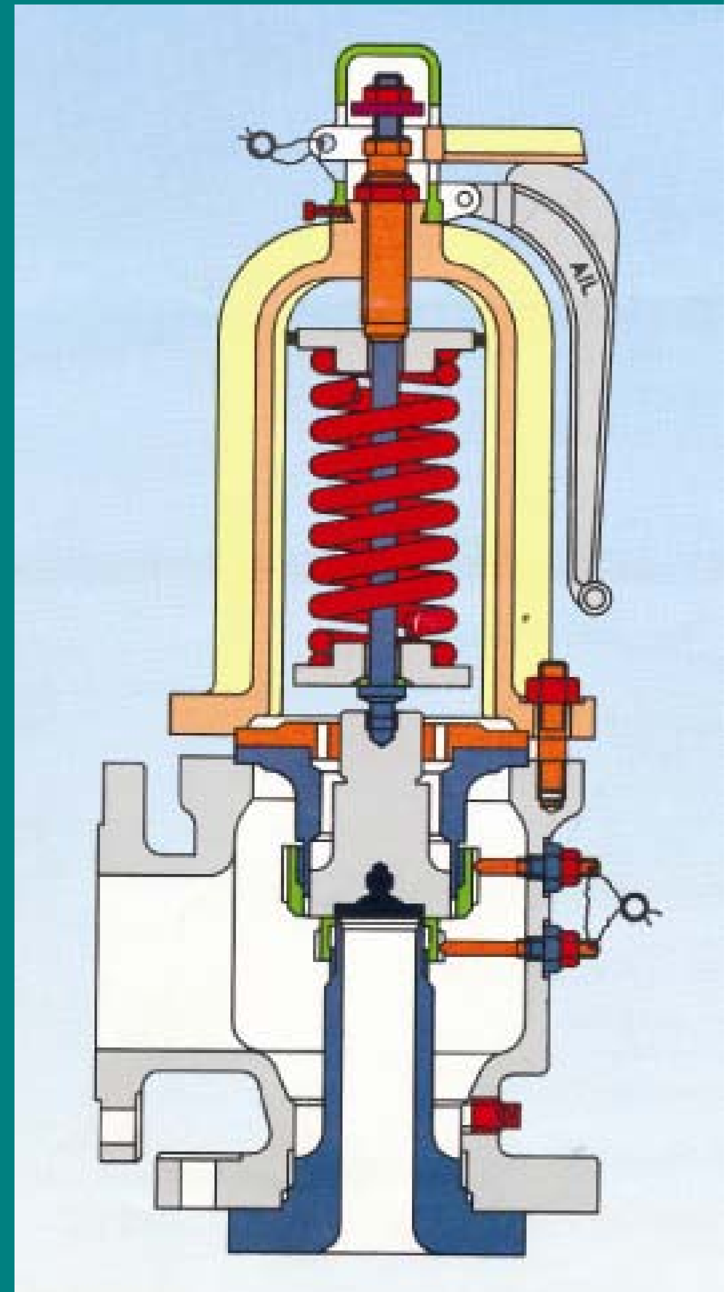
- To safeguard the equipment against exceeding design pressure.
- A boiler without Superheater will have two safety valves in steam drum / Shell.
- A boiler with superheater should have one safety valve on superheater & two safety valves on Steam drum.

A safety valve versus relief valve

- A relief valve is meant for releasing the liquid in a proportional manner in order to maintain some system pressure on a continual basis.
- A safety valve should instantly lift and release the medium by a fixed quantity and bring down the pressure.

Main parameters for safety valve

- Relieving capacity in kg/h
- Steam temperature
- Set pressure
- % accumulation
- % blow down
- Downstream pressure



Relieving capacity of safety valves for a boiler

- All the safety valves put together should relieve the entire steam that is generated by the boiler without casing an increase in pressure by 5%.
- The drum safety valves together should release 75% Boiler steam generation capacity.

Electromatic safety valve

- An electromatic safety valve is a pressure switch initiated safety valve which is set to lift on particular pressure.
- Whereas a regular safety valve can lift only after an accumulation of pressure

Definitions by code regulations

The ASME / ANSI PTC25.3 standards applicable to the USA define the following generic terms:

- **Pressure relief valve** - A spring-loaded pressure relief valve which is designed to open to relieve excess pressure and to reclose and prevent the further flow of fluid after normal conditions have been restored. It is characterised by a rapid-opening 'pop' action or by opening in a manner generally proportional to the increase in pressure over the opening pressure. It may be used for either compressible or incompressible fluids, depending on design, adjustment, or application.

  This is a general term, which includes safety valves, relief valves and safety relief valves.

- **Safety valve** - A pressure relief valve actuated by inlet static pressure and characterised by rapid opening or pop action.

  Safety valves are primarily used with compressible gases and in particular for steam and air services. However, they can also be used for process type applications where they may be needed to protect the plant or to prevent spoilage of the product being processed.

Definitions by code regulations

- **Relief valve** - A pressure relief device actuated by inlet static pressure having a gradual lift generally proportional to the increase in pressure over opening pressure.

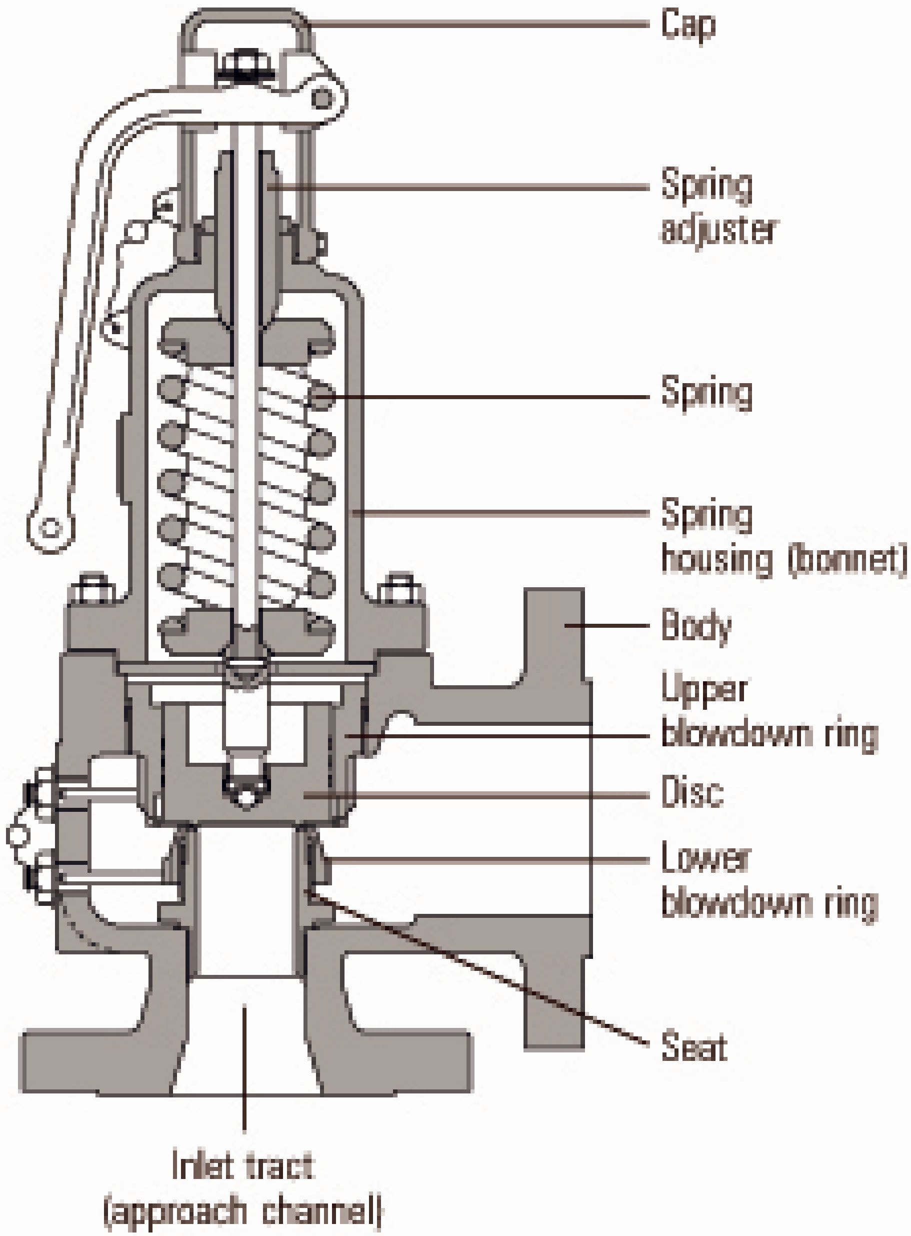
  Relief valves are commonly used in liquid systems, especially for lower capacities and thermal expansion duty. They can also be used on pumped systems as pressure overspill devices.

- **Safety relief valve** - A pressure relief valve characterised by rapid opening or pop action, or by opening in proportion to the increase in pressure over the opening pressure, depending on the application, and which may be used either for liquid or compressible fluid.

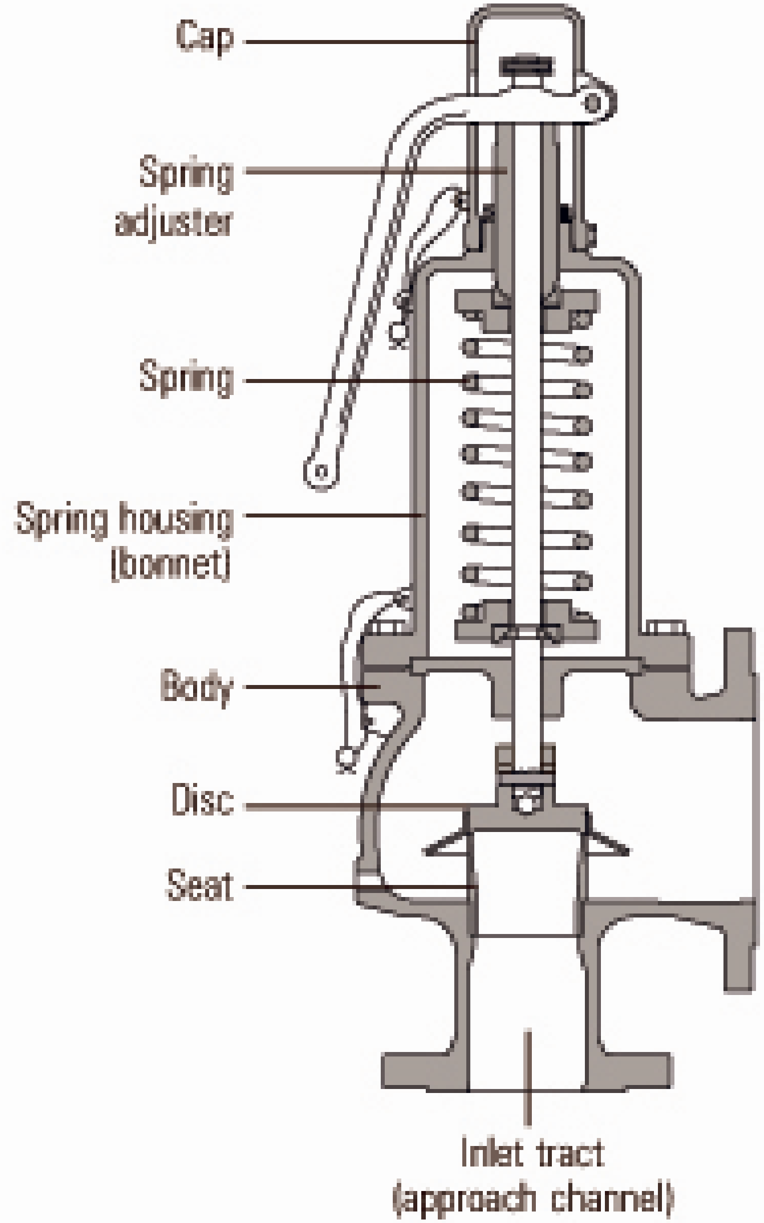
  In general, the safety relief valve will perform as a safety valve when used in a compressible gas system, but it will open in proportion to the overpressure when used in liquid systems, as would a relief valve.

The European standards (BS 6759 and DIN 3320) provide the following definition:

- **Safety valve** - A valve which automatically, without the assistance of any energy other than that of the fluid concerned, discharges a certified amount of the fluid so as to prevent a predetermined safe pressure being exceeded, and which is designed to re-close and prevent the further flow of fluid after normal pressure conditions of service have been restored.



Typical ASME valve



Typical DIN valve

Terminologies used in safety valve

- LIFT OR POP - REFERS TO THE OPENING OF THE SAFETY VALVE
- BLOWDOWN - THE PRESSURE DROP BETWEEN LIFT AND RESEATING OF THE SAFETY VALVE
- RESEAT - CLOSING OF THE SAFETY VALVE WITHOUT CHATTERING

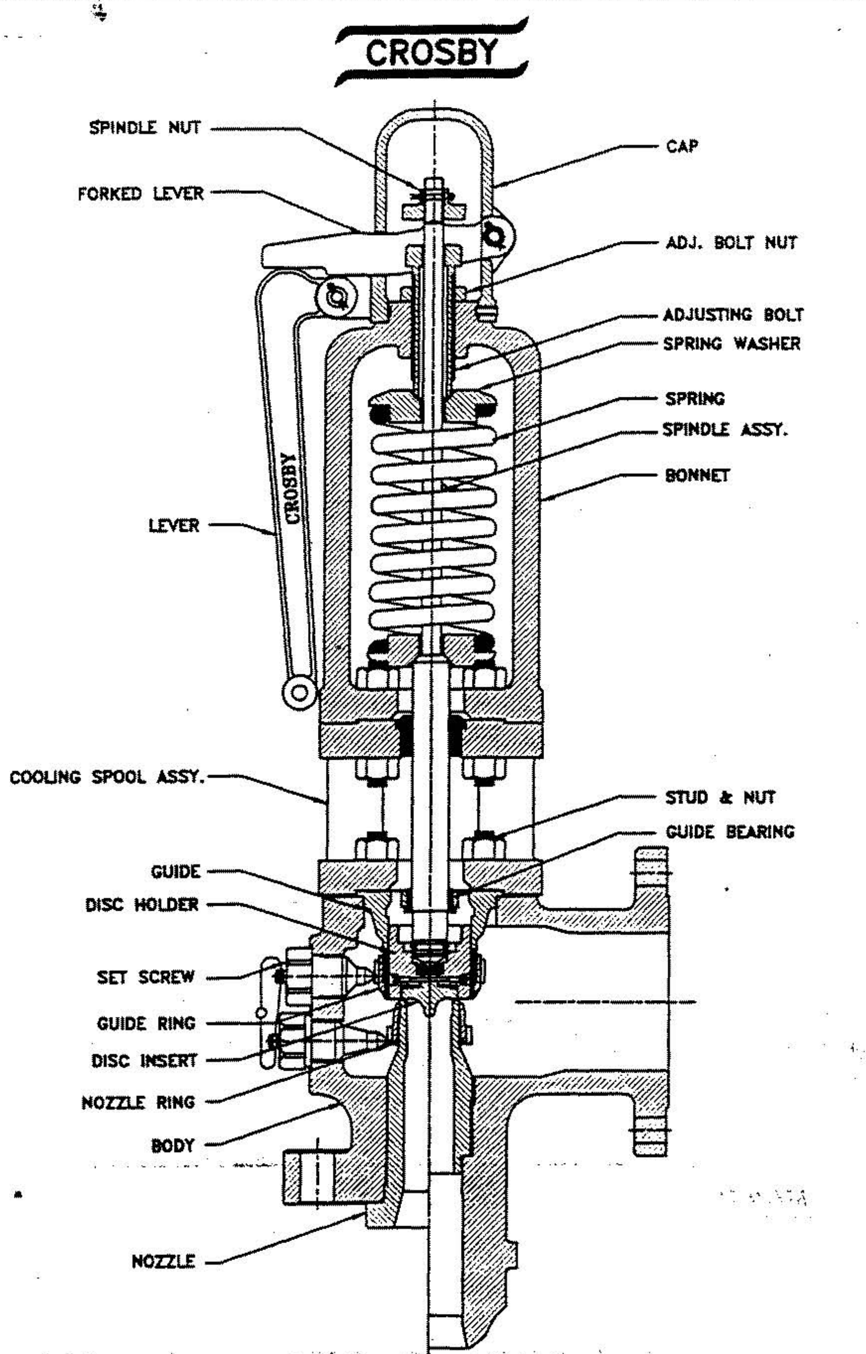


ILLUSTRATION OF HSA/HCA VALVE ASSEMBLY

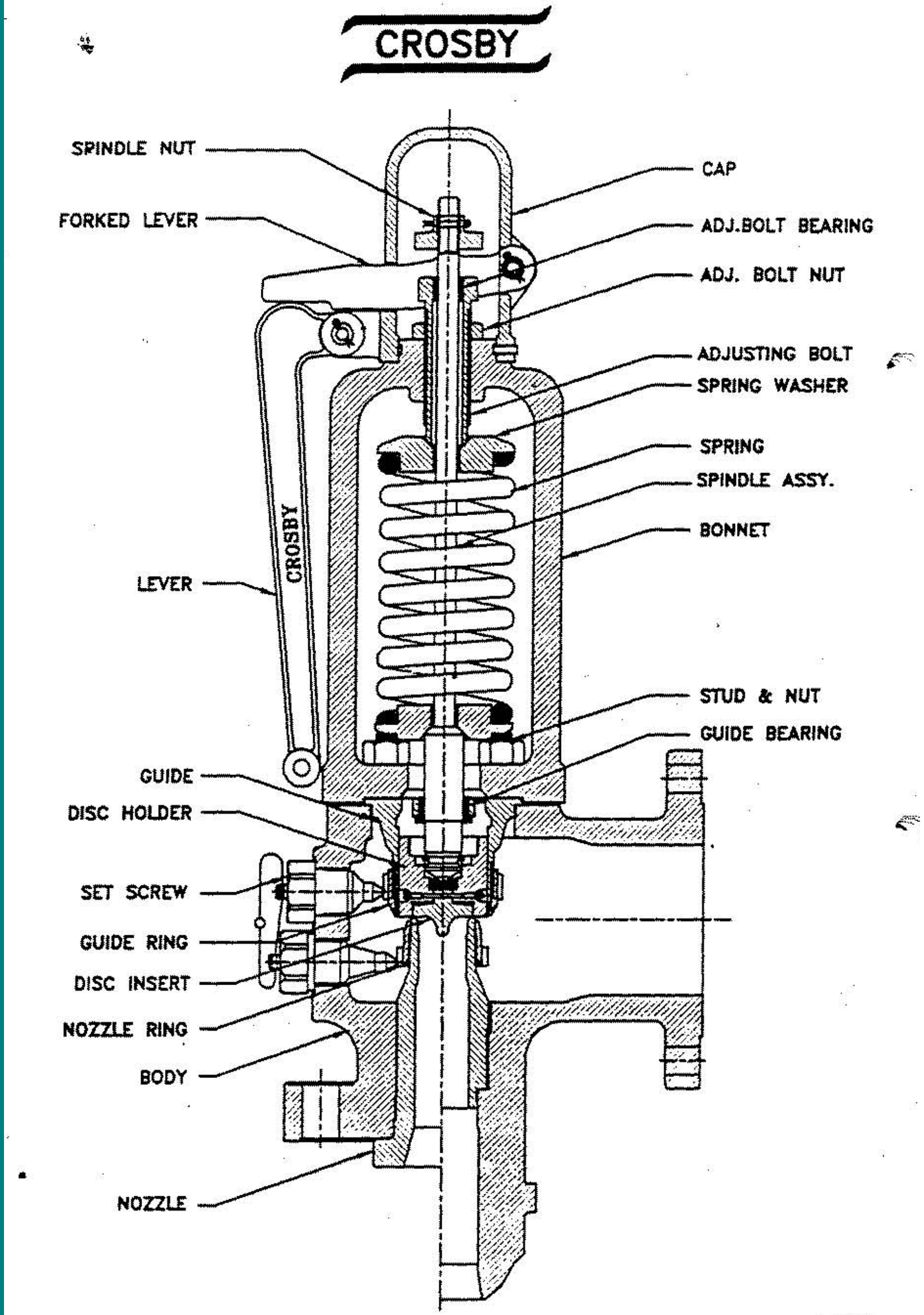


ILLUSTRATION OF HS/HC VALVE ASSEMBLY

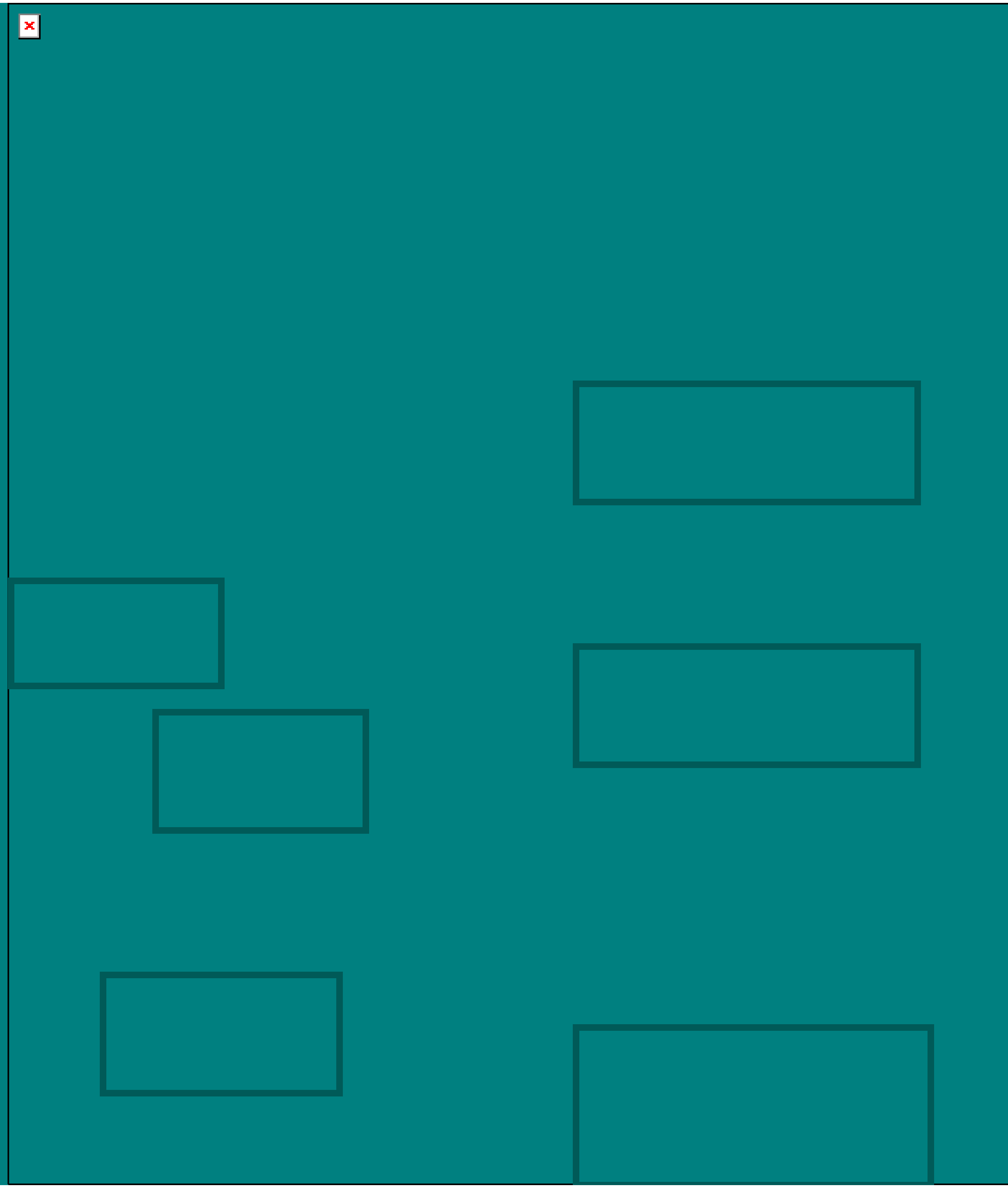
Terminologies used in safety valve

- SIMMERING - STEAM THAT LEAKS BY THE SEAT AND DISK PRIOR TO THE LIFTING OF THE SAFETY VALVE. ACCEPTABLE CONDITION WITHIN 1% OF LIFTING PRESSURE.
- CHATTERING - THE RAPID POPPING AND RESEATING OF THE SAFETY VALVE

Terminologies used in safety valve

- GAG - A MECHANICAL DEVICE PLACED ON THE SAFETY TO PREVENT THE SAFETY FROM LIFTING DURING TESTING AND BOILER HYDROSTATIC TESTS

- MAWP
- Design pressure
- Operating pressure
- Set pressure
- Overpressure
- Accumulation
- Blowdown



Flow area of safety valve

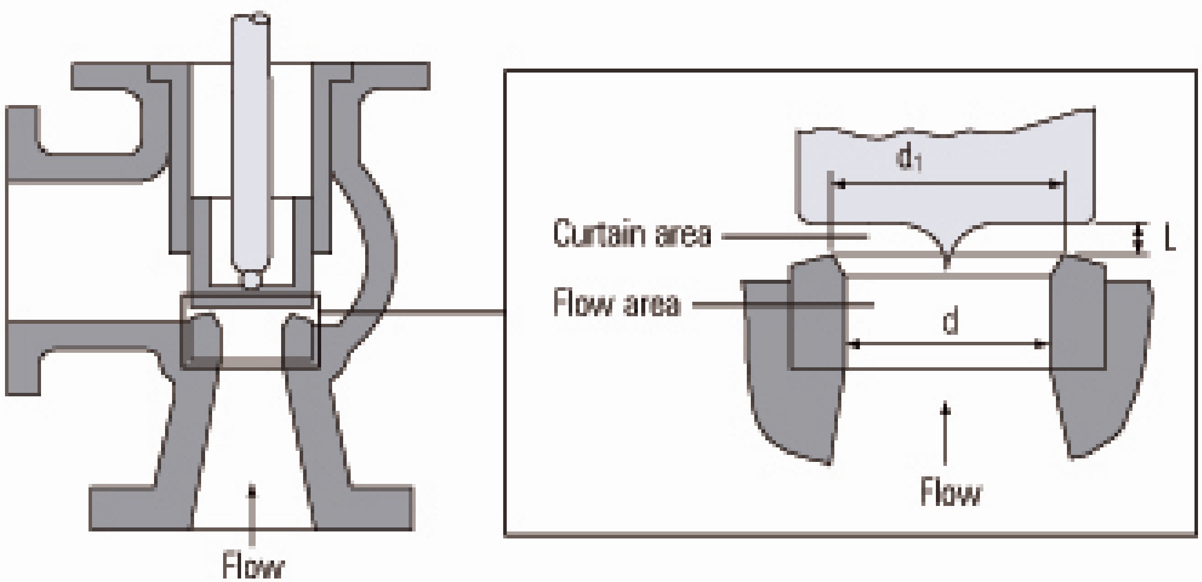
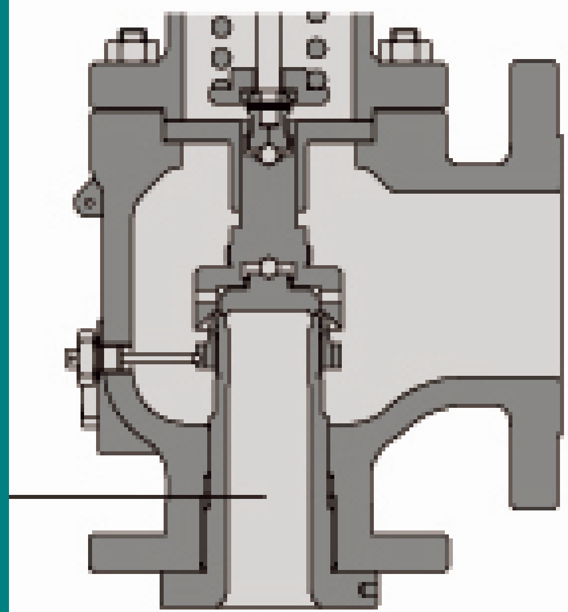


Fig. 9.1.4 Illustration of the standard defined areas



(a)

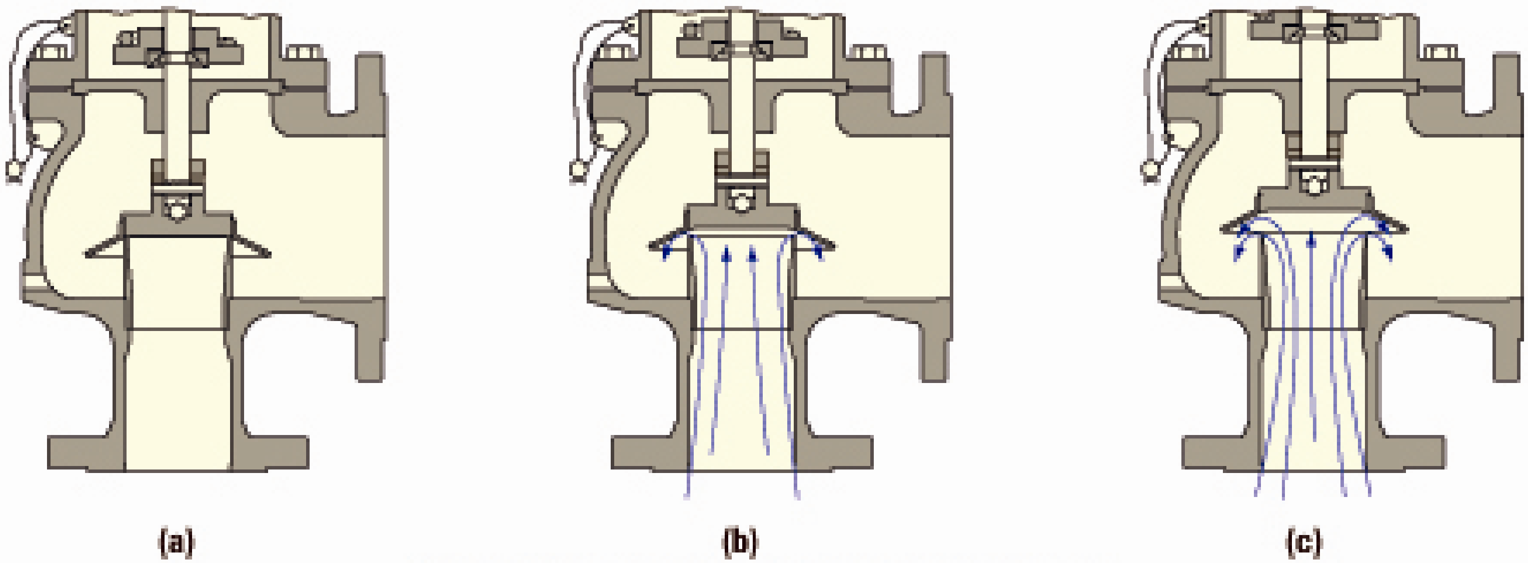


Fig. 9.1.6 Operation of a conventional safety valve

Accumulation & blow down

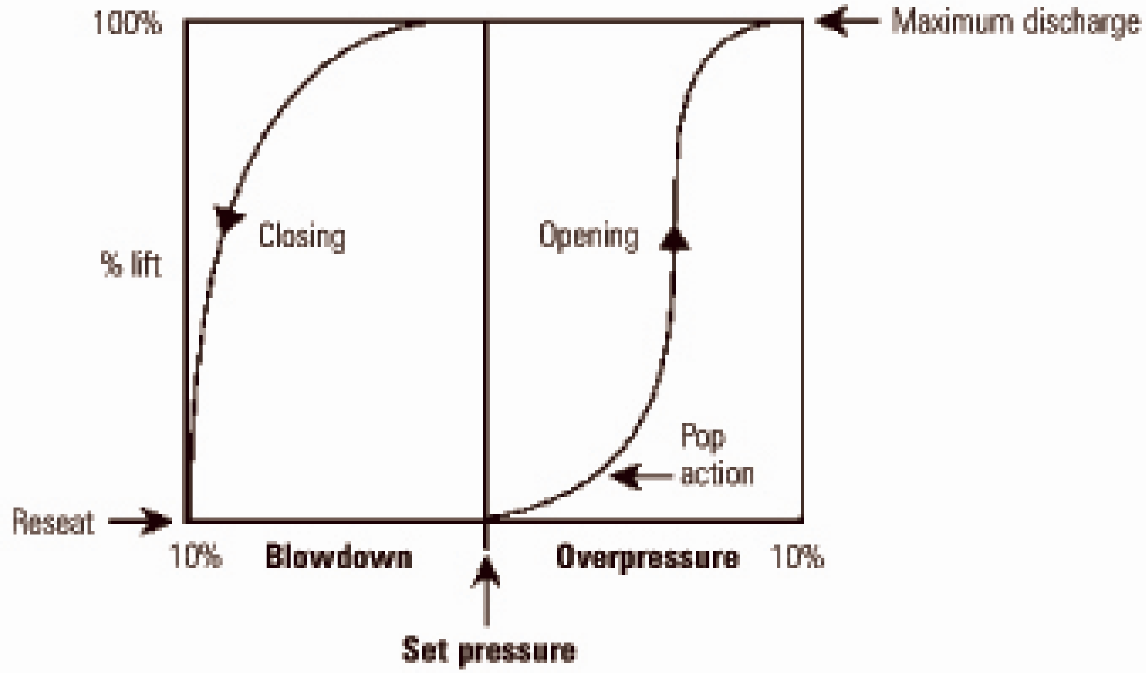


Fig. 9.1.7 Relationship between pressure and lift for a typical safety valve

The blowdown rings found on most ASME type safety valves are used to make fine adjustments to the overpressure and blowdown values of the valves (see Figure 9.1.8). The lower blowdown (nozzle) ring is a common feature on many valves where the tighter overpressure and blowdown requirements require a more sophisticated designed solution. The upper blowdown ring is usually factory set and essentially takes out the manufacturing tolerances which affect the geometry of the huddling chamber.

The lower blowdown ring is also factory set to achieve the appropriate code performance requirements but under certain circumstances can be altered. When the lower blowdown ring is adjusted to its top position the huddling chamber volume is such that the valve will pop rapidly, minimising the overpressure value but correspondingly requiring a greater blowdown before the valve re-seats. When the lower blowdown ring is adjusted to its lower position there is minimal restriction in the huddling chamber and a greater overpressure will be required before the valve is fully open but the blowdown value will be reduced.

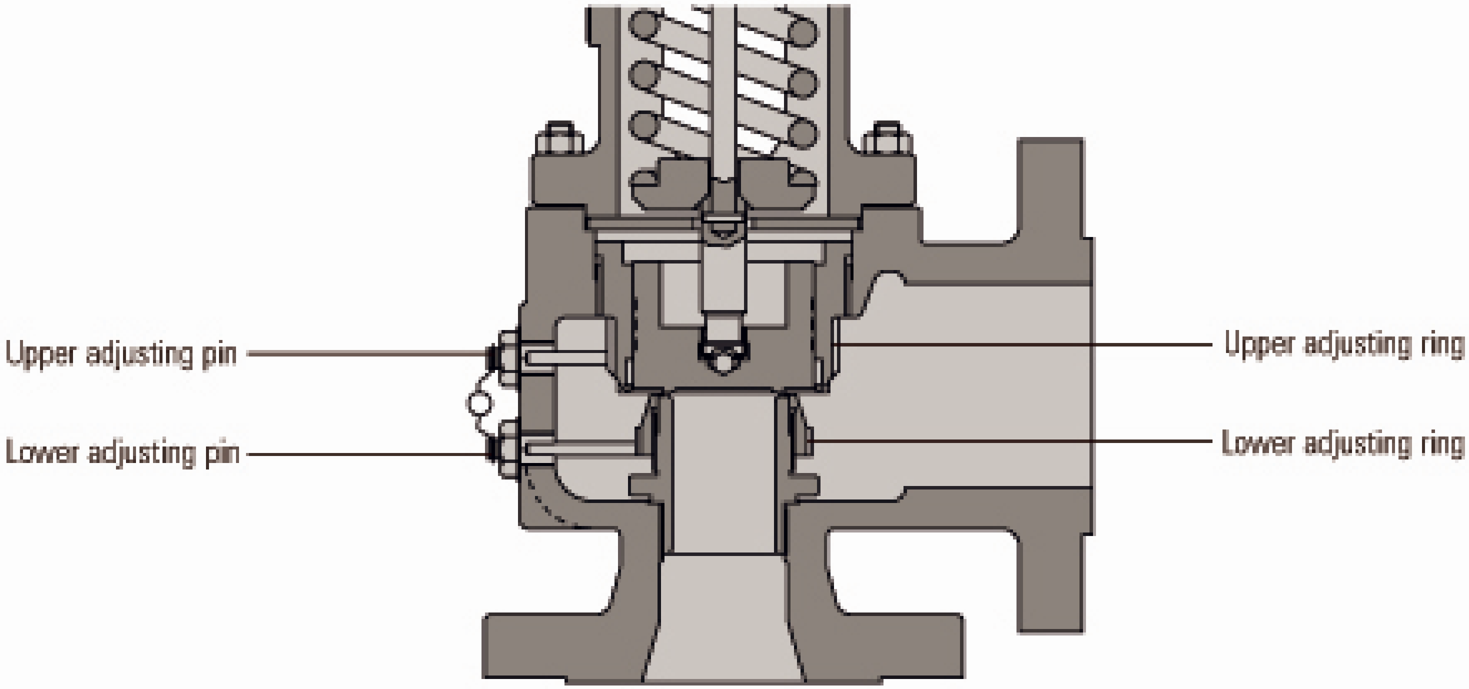
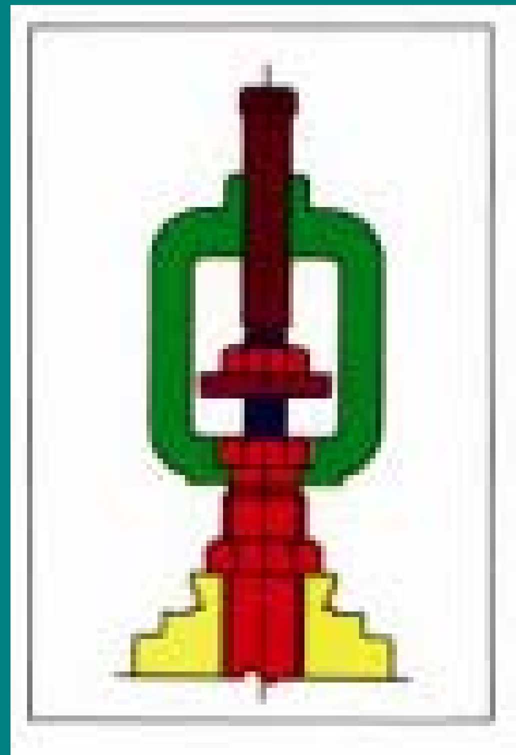


Fig. 9.1.8 The blowdown rings on an ASME type safety valve



Weather hood provides complete protection for yoke, spring and valve steam for outdoor installations

Test gag is used for preventing the valve from lift during hydro test / safety valve testing. Test gad should be turned down only finger tight. It must be removed after testing is completed

Safety valve sizing as per IBR-293

Saturated steam – kg/h

$$A \approx \frac{E}{C * P}$$

Superheated steam – kg/h

$$A \approx \frac{E_s \sqrt{1 + (2.7 * T_s / 1000)}}{C * P}$$

Where,

A = reqd nozzle orifice / bore area, in mm2.

E = reqd sat steam relieving capacity, kg/h

C = IBR constant for the manufacturer

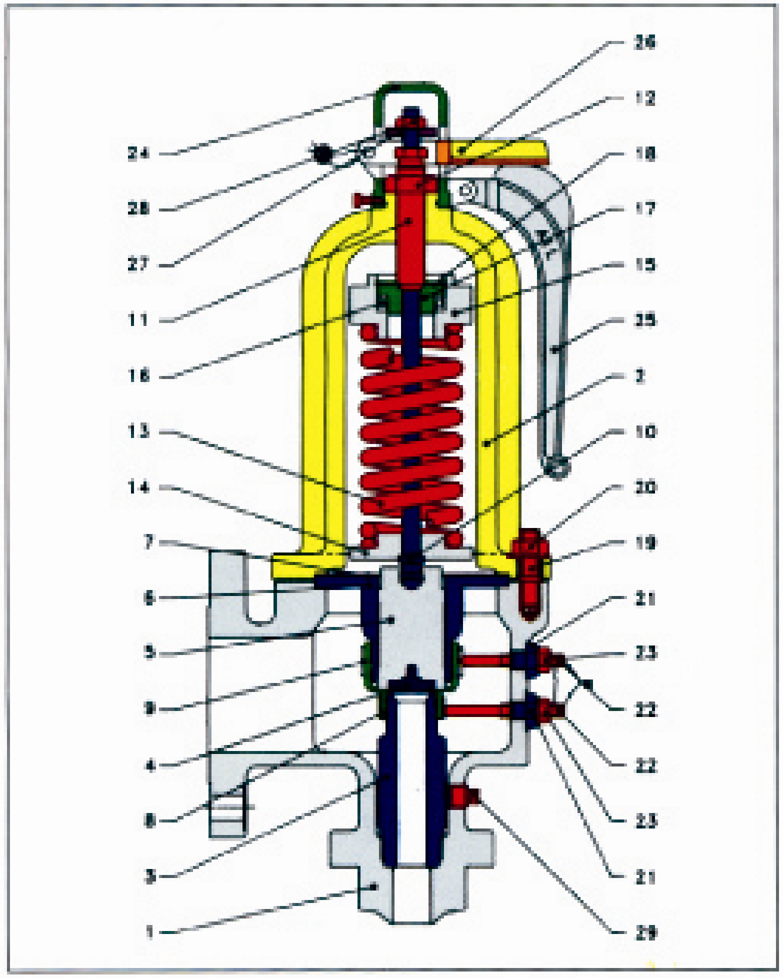
P = set pressure, bar (a)

Es = reqd relieving capacity of SH steam, kg/h

Ts = deg of superheat (deg C)

FEATURES

- Conforms to IBR regulations for steam service
- Over pressure : 3% to 5%, Blowdown : 3% to 5%
- Butt weld body design provides choice of inlet sizes
- Simple and rugged construction
- Thrust Bearing facilitates precise set point adjustments and low friction torque



MATERIAL SPECIFICATION

ITEM	PART NAME			MATERIAL
1	Body	Material Class	A&B	ASTM A216 Gr. WCB
			C	ASTM A217 Gr. WC6
2	Yoke	Material Class	A&B	ASTM A216 Gr. WCB
			C	ASTM A217 Gr. WC6
3	Nozzle			ASTM A351 Gr. CF8M
4	Disc			Prec. Hardened St.Steel
5	Disc Holder			Prec. Hardened St.Steel
6	Sleeve Guide			ASTM A351 Gr. CF8M
7	Guide or Lift Stop[1]			Stainless Steel
8	Blow Down Ring, Lower			ASTM A351 Gr. CF8M
9	Blow Down Ring, Upper			ASTM A351 Gr. CF8M
10	Stem			Stainless Steel
11	Spring Adjusting Screw			Stainless Steel
12	Jam Nut (Spr. Adj. Scr)			Stainless Steel
13	Spring	Material Class	A	Carbon Steel[2]
			B&C	High Temp. Alloy[2]
14	Spring Button			Carbon Steel, plated
15	Housing			Carbon Steel, plated
16	Thrust Bearing			Steel
17	Collar			Carbon Steel
18	Circlip			Steel
19	Body Stud			ASTM A193 Gr. B7
20	Hex. Nut Body			ASTM A194 Gr. 2H
21	Lock Screw (BDR)			Stainless Steel
22	Lock Screw Stud (BDR)			Stainless Steel
23	Hex. Nut (BDRLS)			Stainless Steel
24	Cap			Steel/Iron
25	Lever			Steel/Iron
26	Lever Fork			Steel/Iron
27	Stem Test Nut			Stainless Steel
28	Stem Jam Nut			Stainless Steel
29	Pipe Plug, Body			Steel

ENMAS	WO Nr / Prop.Nr	WB029M			Document no	
	Customer	GRASIM INDUSTRIES-120TPH			WB029M-DCS-003-00	
	SAFETY VALVE SIZING FOR INTEGRAL SUPERHEATER					
	Prepared By		Approved By			Date
	Name	S Balachandar	Name			
	Sign		Sign			

Rev Nr.	Revision Details	Rev by	Checked by	Date

INPUTS

Steam generation rate Nett =	120000	kg/h
Peakgeneration to be considered, if any =	0	%
Saturated steam flow, if used for auxiliaries =	0	kg/h
Main steam pressure before MSSV =	66	kg/cm2 g
Calculated pressure drop in SH ckt =	9.8	kg/cm2

RELIEVING CAPACITY CALCULATIONS

Maximum steam generation capacity of boiler = 120000 kg/h

Peak generation capacity = 1 x 120000 kg/h

= 120000 kg/h

As per code 75 % shall be the releving capacity of the Drum Safety Valves

Therefore SH steam SV relieving capacity = 0.25 x 120000 kg/h

= 30000 kg/h

Total steam to be relieved by drum Safety Valves = (0.75 x 120000) + (0) kg/h

= 90000 kg/h

Drum SV 1 relieving capacity =(0.5 x 90000) = 45000 kg/h

Drum SV 2 relieving capacity = 45000 kg/h

SET PRESSURE CALCULATIONS

Main steam pressure	= 66 kg/cm2 g		
MSSV set pressure	= 66 *1.05 kg/cm2 g		
	= 69.3 kg/cm2 g		
	Say,	69.5	kg/cm2 g
MSSV set pressure	= 69.5 kg/cm2 g		
Actual press drop in steam ckt MSSV relieves steam	= 9.8 kg / cm2		
Drum pressure when MSSV floats	= 69.5 + 9.8 = 79.3 kg/cm2 g		
With safety Margin	Say,	0.5	kg/cm2 g
Drum I SV set pressure	= 79.3+0.5=79.8 kg/cm2 g		
Drum I safety valve set pressure	Say,	80.00	kg/cm2 g
Difference between drum I & II SV set pressures	=	1.00	kg/cm2 g
Drum II SV set pressure	= 80+1 = 81 kg/cm2 g		
Drum operating pressure at MCR conditon	= 66+9.8 = 75.8 kg/cm2 g		
Margin considered for drum design pressure	=	8.00	%
Therefore ,Drum design pressure	=(75.8x (100+8)/100))=81.86 kg/cm2 g		

Summary

SH safety valve set pressure	=	**69.5 kg/cm2g**
Drum safety valve set pressure 1	=	**81 kg/cm2g**
Drum safety valve set pressure 2	=	**82 kg/cm2g**
Max relieving capacity of SH safety valve	=	**30000 kg/h**
Min relieving capacity of Drum 1 / 2 safety valve	=	**45000 kg/h**

ENMAS	WO Nr / Prop.Nr	WB029M			Document no
	Customer	GRASIM INDUSTRIES-120TPH			WB029M-DCS-004-00
	SAFETY VALVE SIZING FOR INTEGRAL SUPERHEATER-MBEIL Method				
	Prepared By		Approved By		Date
	Name	S Balachandar	Name		29/01/07
	Sign		Sign		

Rev Nr.	Revision Details	Rev by	Checked by	Date

INPUTS

Steam generation rate Nett = 120000 kg/h

Peakgeneration to be considered, if any = 0 %

Saturated steam flow, if used for auxiliaries = 0 kg/h

Main steam pressure before MSSV,p2 = 66 kg/cm2 g

Calculated pressure drop in SH ckt = 9.8 kg/cm2

RELIEVING CAPACITY CALCULATIONS

Maximum steam generation capacity of boiler = 120000 kg/h

Peak generation capacity = 1 x 120000 kg/h = 120000 kg/h

As per code 75 % shall be the releving capacity of the Drum Safety Valves

Therefore SH steam SV relieving capacity = 0.25 x 120000 kg/h = 30000 kg/h

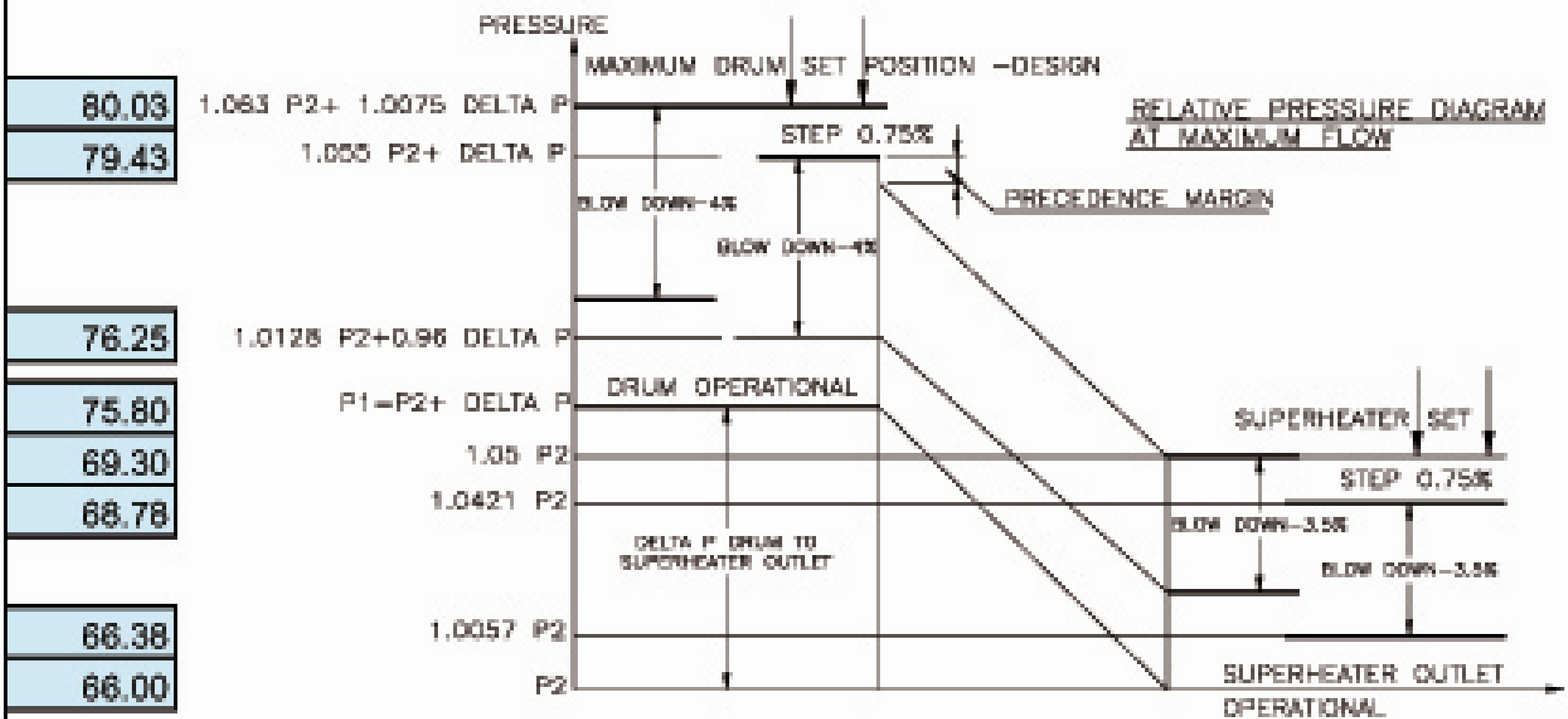
Total steam to be relieved by drum Safety Valves = (0.75 x 120000) + (0) kg/h

= 90000 kg/h

Drum SV 1 relieving capacity =(0.5 x 90000) = 45000 kg/h

Drum SV 2 relieving capacity = 45000 kg/h

SET PRESSURE CALCULATIONS



Summary

SH safety valve set pressure	**=**	**69.3 kg/cm2g**
Drum safety valve set pressure 1	**=**	**79.43 kg/cm2g**
Drum safety valve set pressure 2	**=**	**80.03 kg/cm2g**
Max relieving capacity of SH safety valve	**=**	**30000 kg/h**
Min relieving capacity of Drum 1 / 2 safety valve	**=**	**45000 kg/h**

ASME sec I –clause – PG-67

- Safety valves must discharge all the steam generated without allowing the boiler pressure to increase beyond 6% of design pressure.
- Any economiser that may be shut off from boiler shall have one or more safety relief valve with relieving capacity based on its heat duty.
- One or more safety valve shall be set at or below MAWP of boiler.

ASME sec I –clause – PG-67

- The highest safety valve set pressure shall not be more than 3% of MAWP.
- The complete range of all saturated steam safety valve shall not exceed 10% of highest pressure to which any valve is set.

ASME sec I –clause – PG-67 on safety valve construction

- Safety valve shall be so constructed that any failure of a part of safety valve should not obstruct the free & full discharge of steam.
- Safety valve shall be direct spring loaded pop type, with seat inclined at 45 -90 deg to spindle axis.
- The saturated steam safety valve should have a total relieving capacity of at least 75%.

ASME sec I –clause – PG-67 on safety valve construction

- When two different size valves are used at drum, the smaller safety valve shall at least equal to 50% of relieving capacity of bigger valve.
- Safety valve shall be designed to vent the steam without chattering with a minimum blow down of 2 psi or 2% of set pressure whichever is greater.
- Safety valves shall lift fully at a pressure not exceeding 3% of set pressure.

ASME sec I –clause – PG-71 on safety valve mounting

- Safety valve shall be erected with its spindle upright.
- There shall not be intervening valve or obstruction between valve & the boiler.
- The safety valve stub should not be longer than a corresponding Tee fitting.
- The stub inner flow area should not be less than the safety valve inlet flow area.
- There should not be any obstruction to steam flow path in the vicinity of safety valve.

ASME sec I –clause – PG-71 on safety valve mounting

- When a discharge pipe is used, the flow area should not be less than that of the safety valve discharge nozzle flow area.
- The discharge pipe should be short and straight and shall be so arranged to avoid undue stresses.
- Each valve shall have the body drain below the seat and shall be given a open drain pipe connection.

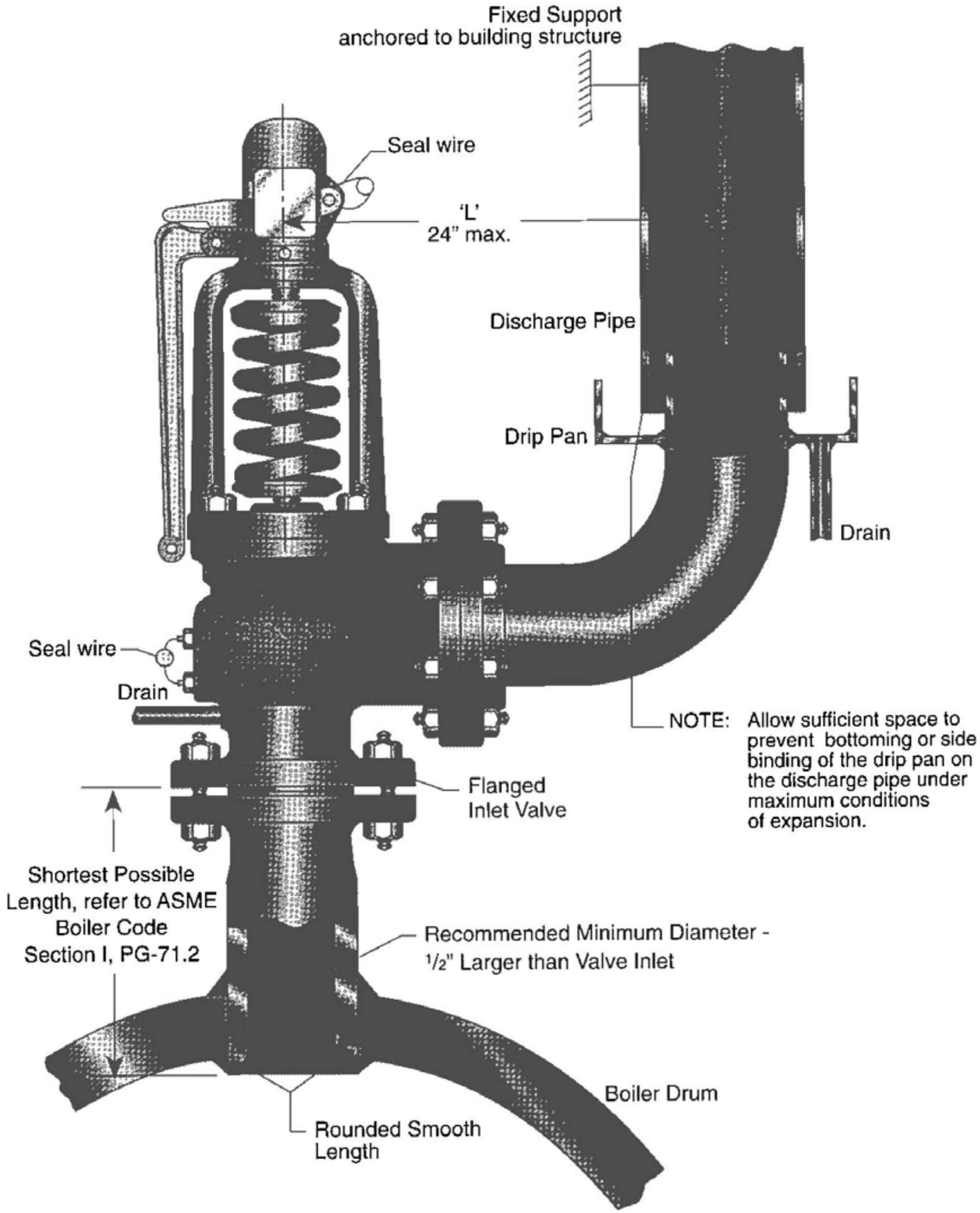
ASME sec I –clause – PG-71 on safety valve mounting

- If a muffler is used, it shall have sufficient outlet area to prevent back pressure.
- The tolerance on set pressure is as per the table.

Set press	tolerance
≤ 70 psi	2 psi
> 70 ≤ 300 psi	3% of set press
> 300 ≤ 1000 psi	10 psi
>1000 psi	1% set press

ASME sec I –clause – PG-71 on safety valve mounting

- The spring in a safety valve shall bot be reset for any pressure more than 5% above or below that for which it marked.



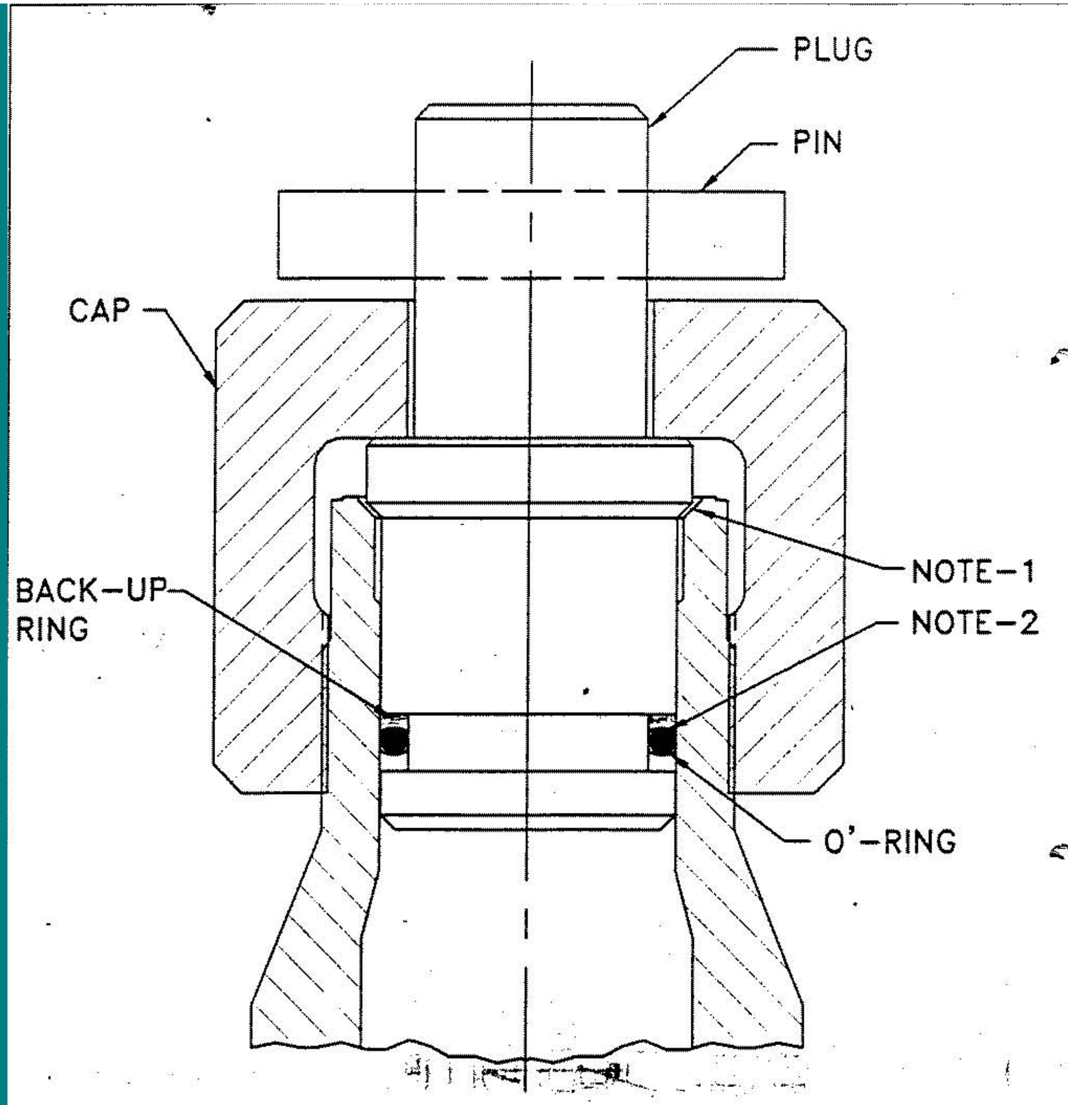
The points related to installation

- Minimum length stub
- Rounded inlet nozzle
- Higher tube inlet area
- Body drain
- Drip pan arrangement
- Drip pan drain.
- No load on safety by escape piping.
- Anchoring of escape piping
- Minimum bend length for escape piping.

Boiler Hydro test after erection of safety valve

<u>Hydrotest at higher pressure than operating pressure</u>

- In case of flanged connection, the safety valve shall be removed. Blind flange shall be used.
- In case of welded safety valve hydrostatic plug to be used.



HYDRO PLUG ASSEMBLY

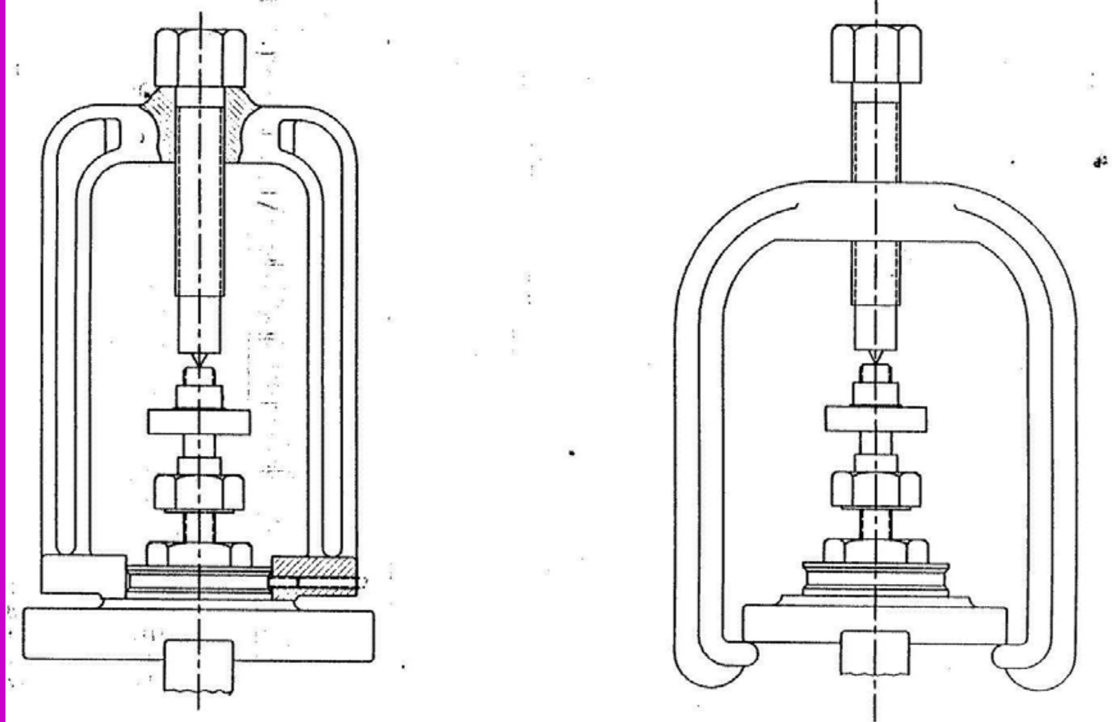
NOTE

1. PLUG MUST BE SEATED ON THIS SURFACE PRIOR TO INSTALLING CAP.
2. "O" RING & BACK-UP RING TO BE INSTALLED AFTER WELDING OF BODY TO INSTALLATION.

Boiler Hydro test after erection of safety valve

<u>Hydro test at operating pressure</u>

- In case of flanged / welded safety valve, the safety valve shall be in place and gag can be used for hydro test at rated pressure.



TEST CLAMPS

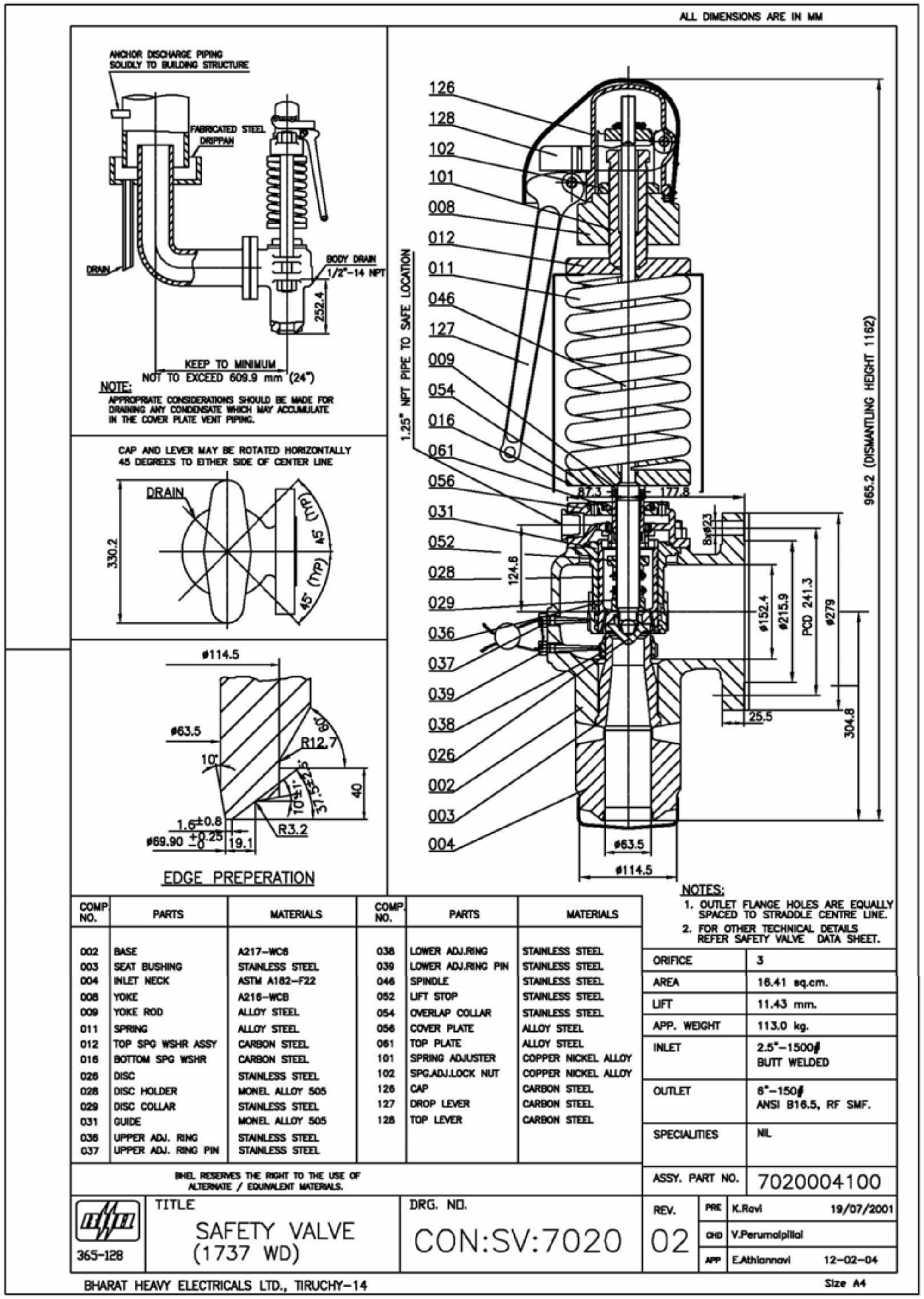
Typical safety valve data sheet from a vendor

365-003/A	Bharat Heavy Electricals Ltd., Trichy-14, Valves Engineering		**Safety Valve Data Sheet** **VSS:SV:2002 / 00**		**Sheet: 1 of 1** **Date: 23-01-2007** **Ref: 1107860**
		Customer:	**M/s ENMAS ANDRITZ PRIVATE LTD.** **A/c BIRLA CELLULOSIC**		**Pre: A.Paramasivam** **Appd: E.Athiannavi**
1	*Item no.*		1	2	3
2	*Tag no.*		NA	NA	NA
3	*Location*		DRUM	DRUM	SH
4	*No.of Valves*		1 NO.	1 NO.	1 NO.
5	*Fluid*		SAT.STEAM	SAT.STEAM	SH STEAM
6	*Required Capacity*	kg/h	<-------------------------------	90000 kg/h----------------->	30000 kg/h
7	***Set Pressure***	kg/cm²(g)	81.2	82.0	70.3
8	***Relieving Temperature***	°C	295.5	296.2	485.0
9	*Valve Type*		Open Yoke, Spring Loaded, Semi Nozzle & Full Lift	Open Yoke, Spring Loaded, Semi Nozzle & Full Lift	Open Yoke, Spring Loaded, Semi Nozzle & Full Lift
10	*Orifice Designation*		2	3	3
11	*Orifice Area*	mm²	922	1641	1641
12	***Valve Capacity***	kg/h	35679.0	64121.0	44399.0
13	*System Design Temperature*	°C	--	--	--
14	*System Operating Pressure*	kg/cm²(g)	76.3	76.3	66
15	*System Design Pressure*	kg/cm²(g)	82	82	82
16	*Imposed Back Pr.*		Atmosphere	Atmosphere	Atmosphere
17	*Allowable Over Pr.*		5%	5%	5%

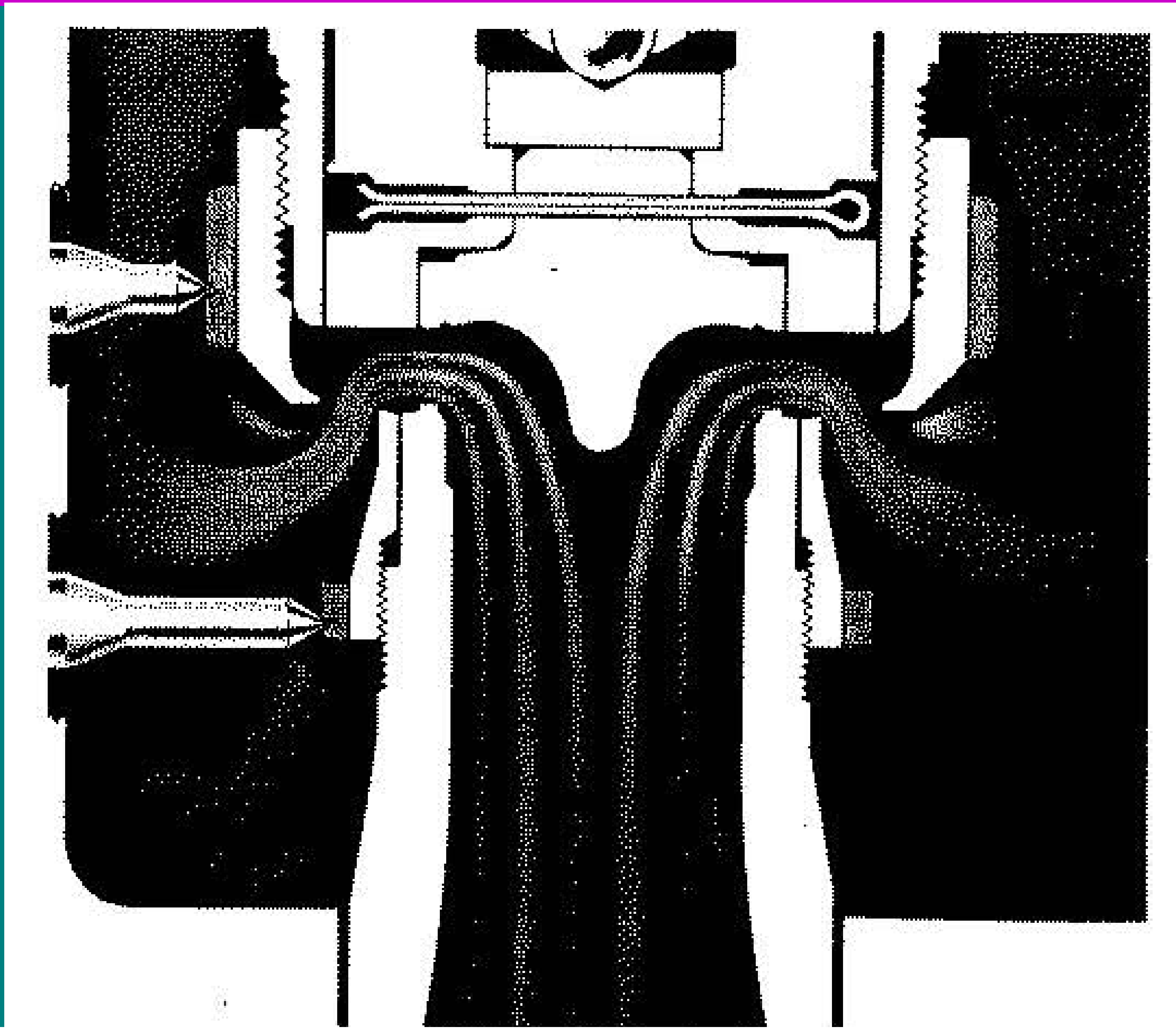
Typical safety valve data sheet from a vendor

16	*Imposed Back Pr.*		Atmosphere	Atmosphere	Atmosphere
17	*Allowable Over Pr.*		5%	5%	5%
18	*Blowdown*	%	2.5 to 5%	2.5 to 5%	2.5 to 5%
19	*Applicable Code*		IBR	IBR	IBR
20	***Valve Model***		1727 WB	1737 WB	1737 WD
21	*Valve Partno.*		7080004100	7019004100	7020004100
22	*Spring no.(for BHEL use)*		0104200CR	0104350CR	0104340CR
23	*Inlet Size & Rating*		2.0"-1500#	2.5"-1500#	2.5"-1500#
24	*Inlet Standard*		As per GA drawing.	As per GA drawing.	As per GA drawing.
25	*Inlet Flange Facing*		Butt Weld	Butt Weld	Butt Weld
26	*Outlet Size & Rating*		3.0"-150#	6.0"-150#	6.0"-150#
27	*Outlet Standard*		ASME B16.5	ASME B16.5	ASME B16.5
28	*Outlet Flange Facing*		RF.SMF	RF.SMF	RF.SMF
29	*Base Material*		A216-WCB	A216-WCB	A217-WC6
30	*Disk Material*		13%Cr. SS.	13%Cr. SS.	13%Cr. SS.
31	*Seatbushing Material*		316 SS.	316 SS.	316 SS.
32	*Spindle Material*		316 SS.	316 SS.	316 SS.
33	*Spring Material*		ALLOY ST.	ALLOY ST.	ALLOY ST.
34	*Lift*	mm	8.57	11.43	11.43
35	*Weight*	kg	64.0	113.0	113.0
36	*Reaction Force*	kgf	917	1763	1512
37	*Noise Level at 10 m distance*	dBA	111	113	114
38	*Inspection*		IBR	IBR	IBR
39	*Speciallities if any*		NIL	NIL	NIL
40	*Accessories*		Plain Lever,Test Gag, Spring Cover & Hydrostatic Test Plug	Plain Lever,Test Gag, Spring Cover & Hydrostatic Test Plug	Plain Lever,Test Gag, Spring Cover & Hydrostatic Test Plug

Safety valve- a vendor drawing



Safety valve under floated condition.



Headers

On superheaters and reheater headers, inlet nozzle connections for safety valves should be as short as possible. It is desirable to use piping nozzles having a rounded entrance and larger ID than the valve nominal size. This is often necessary to keep the inlet pressure drop within limits. Such connections should be away from turns or branches which can cause turbulence.

When safety valves are installed on a header or vertical riser, the connection should be as close and as short as possible. The exit from the header or riser should be larger than the valve inlet, have a well rounded approach and a uniform reduction of diameter with no abrupt changes, preferably with a smooth gradual taper (similar to a seamless reducing or Y fitting). The design should also result in minimum pressure drop from the header or riser to the safety valve.

Pipe lines

Where safety valves are installed to protect a piping system, as on the low pressure side of a reducing valve or on a turbine by-pass, the pipe or header must be of sufficient size to maintain flow under the safety valve while it is discharging. On a pressure reducing valve installation, the safety valves should be located at least eight pipe diameters downstream from the PRV. Where nozzles are used, they must be as short as possible and preferably one pipe size larger than the valve inlet. Nozzles must be braced to counterbalance the reaction when the valve discharges. Several smaller valves are better than one large valve, and the set pressure of each valve should be stepped within code limitations.

Outlet reaction forces

The discharge of a safety valve will impose a reactive load on the inlet of the valve and the mounting nozzle and adjacent supporting vessel shell as a result of the reaction force of the flowing stream. The precise nature of the loading and the resulting stresses will depend on the configuration of the valve and the discharge piping. This must be taken into consideration by those responsible for the installation of the safety valve and associated vessel or piping.

Determination of Outlet Reaction Forces is the responsibility of the designer of the vessel and/or piping.

Inlet piping

Safety Valves should always be mounted in a vertical position directly on nozzles having a well-rounded approach that provides smooth, unobstructed flow from the vessel or line to the valve. A Safety Valve should NEVER be installed on a nozzle having an inside diameter smaller than the inlet connection to the valve, or on excessively long nozzles.

The pressure drop occurring in the inlet piping between the valve and pressure source should be computed at actual flow of the valve. It is well to remember that the ASME Boiler Code (Section I) rating for Safety Valves is only 90% of the actual flow. The safety valve or safety relief valve(s) shall be connected to the boiler independent of any other connection, and attached as close as possible to the boiler or the normal steam flow path, without any unnecessary intervening pipe or fitting. Such intervening pipe or fitting shall not be longer than the face-to-face dimension of the corresponding tee fitting of the same diameter and pressure under the applicable American National Standard. The wall thickness of the inlet piping must be heavy enough to resist bending moments due to reaction when the valve discharges.

require careful and accurate design both as to inlet and discharge piping. The higher the operating pressure and the greater the valve capacity, the more critical becomes the need for proper design of the installation. (ASME Power Piping Code B 31-1)

Inlet piping

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Ask for paper by J.R. Zahorsky entitled, "Degradation of Pressure Relief Valve Performance Caused by Inlet Piping Configuration."

Outlet reaction forces

The discharge of a safety valve will impose a reactive load on the inlet of the valve and the mounting nozzle and adjacent supporting vessel shell as a result of the reaction force of the flowing stream. The precise nature of the loading and the resulting stresses will depend on the configuration of the valve and the discharge piping. This must be taken into consideration by those responsible for the installation of the safety valve and associated vessel or piping.

Determination of Outlet Reaction Forces is the responsibility of the designer of the vessel and/or piping.

Boilers

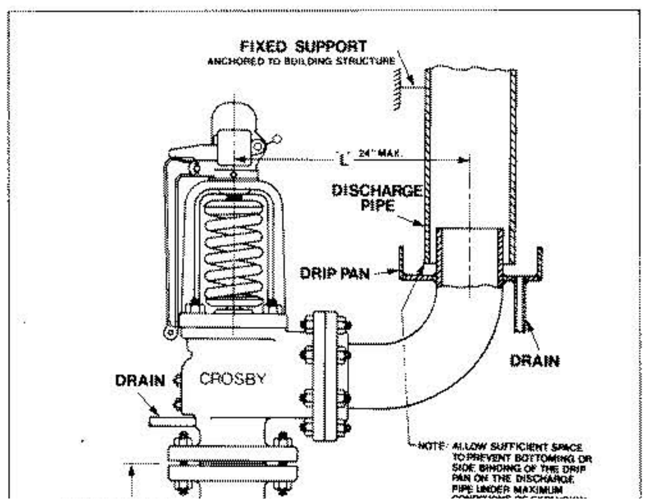
Crosby recommends that the absolute minimum differential pressure, i.e. the pressure between the valve set pressure and operating pressure be not less than

nections for safety valves should be as short as possible. It is desirable to use piping nozzles having a rounded entrance and larger ID than the valve nominal size. This is often necessary to keep the inlet pressure drop within limits. Such connections should be away from turns or branches which can cause turbulence.

When safety valves are installed on a header or vertical riser, the connection should be as close and as short as possible. The exit from the header or riser should be larger than the valve inlet, have a well rounded approach and a uniform reduction of diameter with no abrupt changes, preferably with a smooth gradual taper (similar to a seamless reducing or Y fitting). The design should also result in minimum pressure drop from the header or riser to the safety valve.

Pipe lines

Where safety valves are installed to protect a piping system, as on the low pressure side of a reducing valve or on a turbine by-pass, the pipe or header must be of sufficient size to maintain flow under the safety valve while it is discharging. On a pressure reducing valve installation, the safety valves should be located at least eight pipe diameters downstream from the PRV. Where nozzles are used, they must be as short as possible and preferably one pipe size larger than the valve inlet. Nozzles must be braced to counterbalance the reaction when the valve discharges. Several smaller valves are better than one large valve, and the set pressure of each valve should be stepped within code limitations.



Installation recommendations

A safety valve should not be installed on on s stub with smaller inlet area that that of safety valve

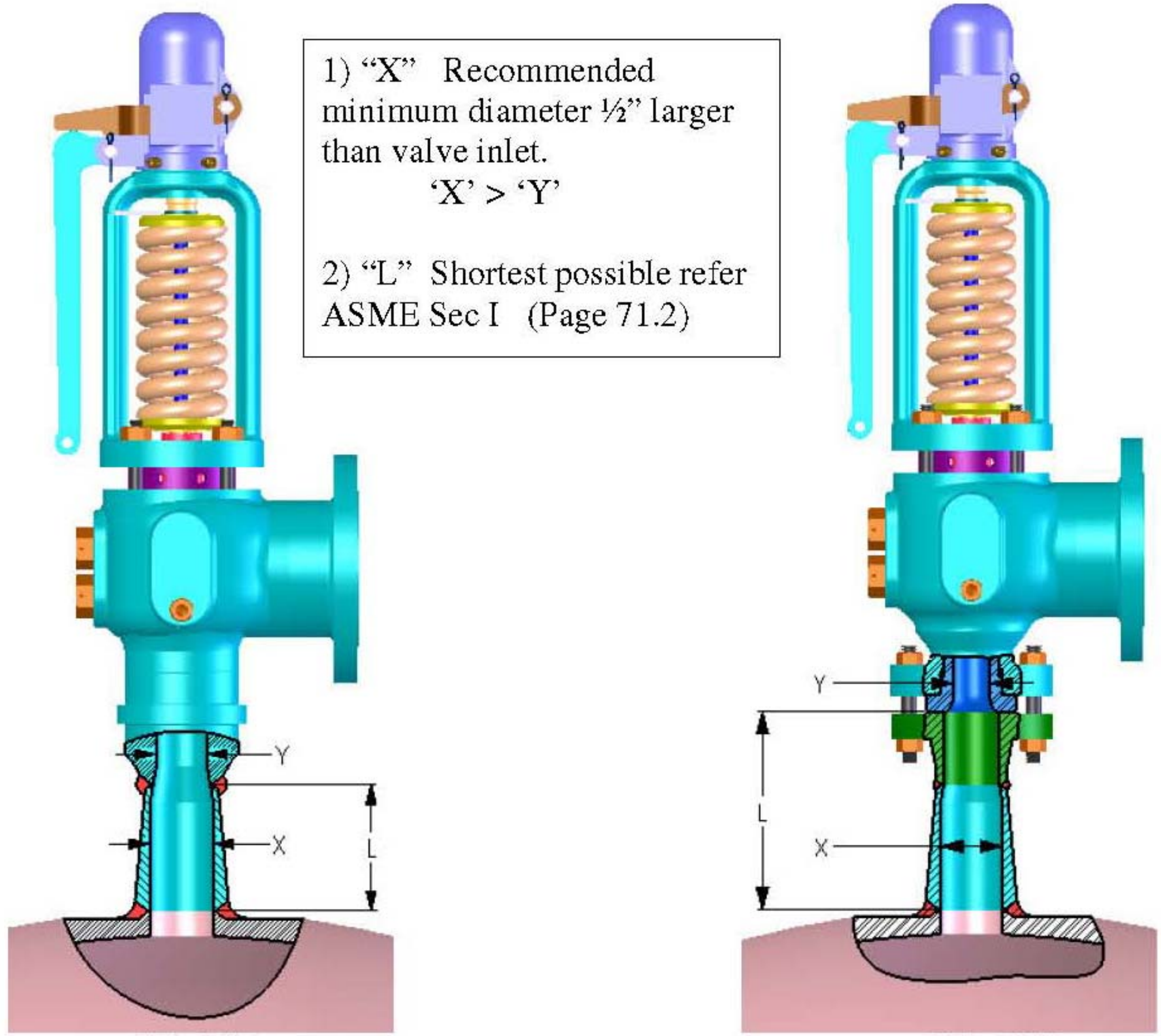
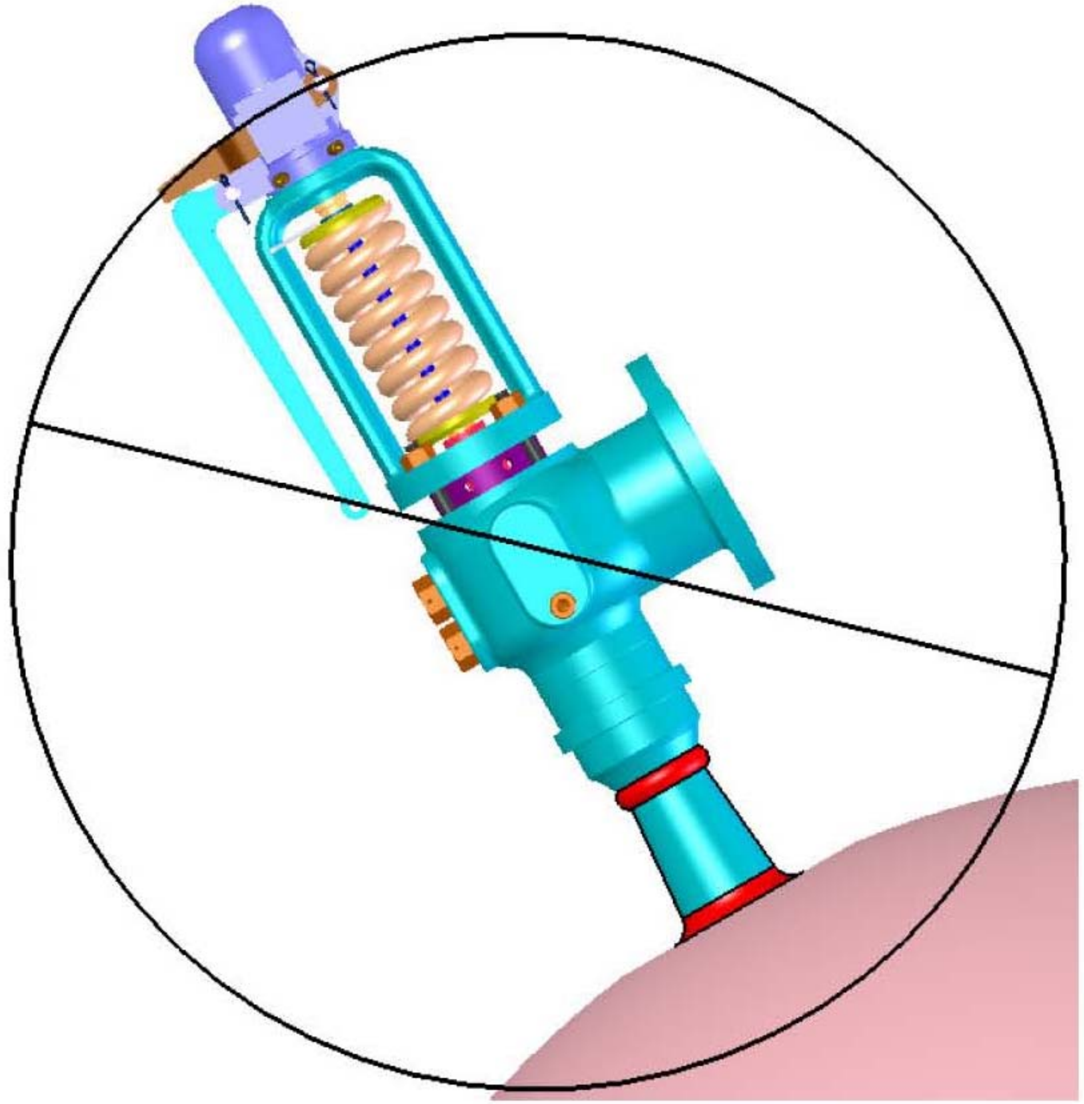


FIG: 1(A)

FIG: 2(B)

Installation recommendations

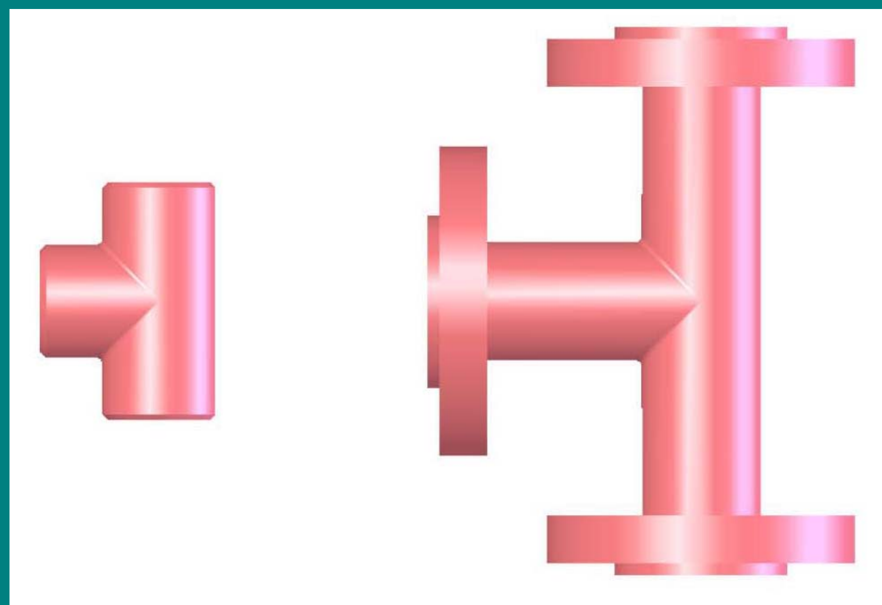
A safety valve should be erected with the spindle upright



Installation recommendations

A safety valve should be mounted directly on the nozzle independent of any other connection and attached as close as possible having a well rounded approach that provides smooth, unobstructed flow from the vessel or line.

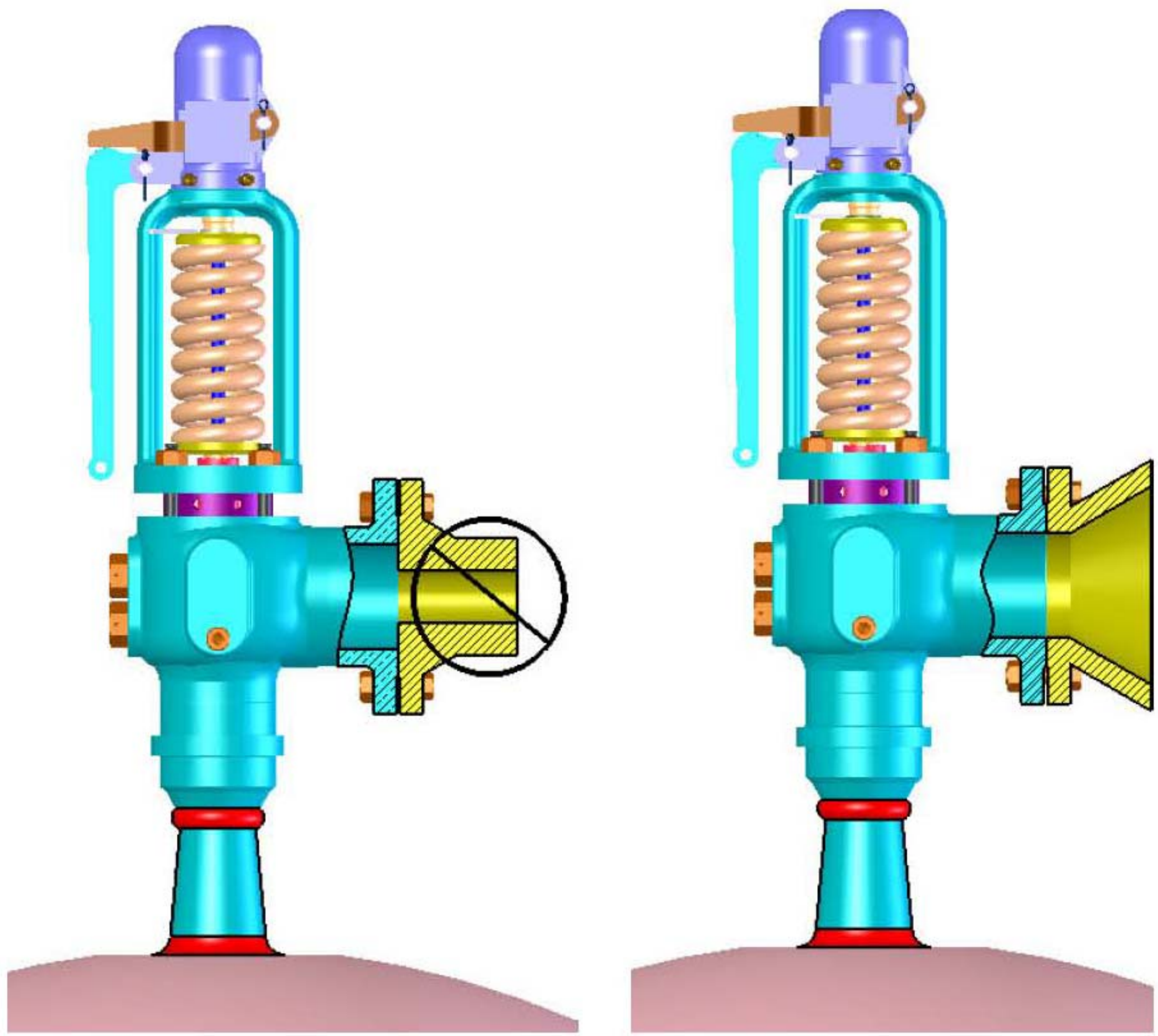
Installation recommendations



Safety valves should always be mounted without any unnecessary intervening pipe or fitting. Such intervening pipe or fitting shall not be longer than face-to-face dimension of the corresponding Tee fitting of the same diameter and pressure class under the applicable ASME Standard. (ASME Sec-I : PG-71.2)

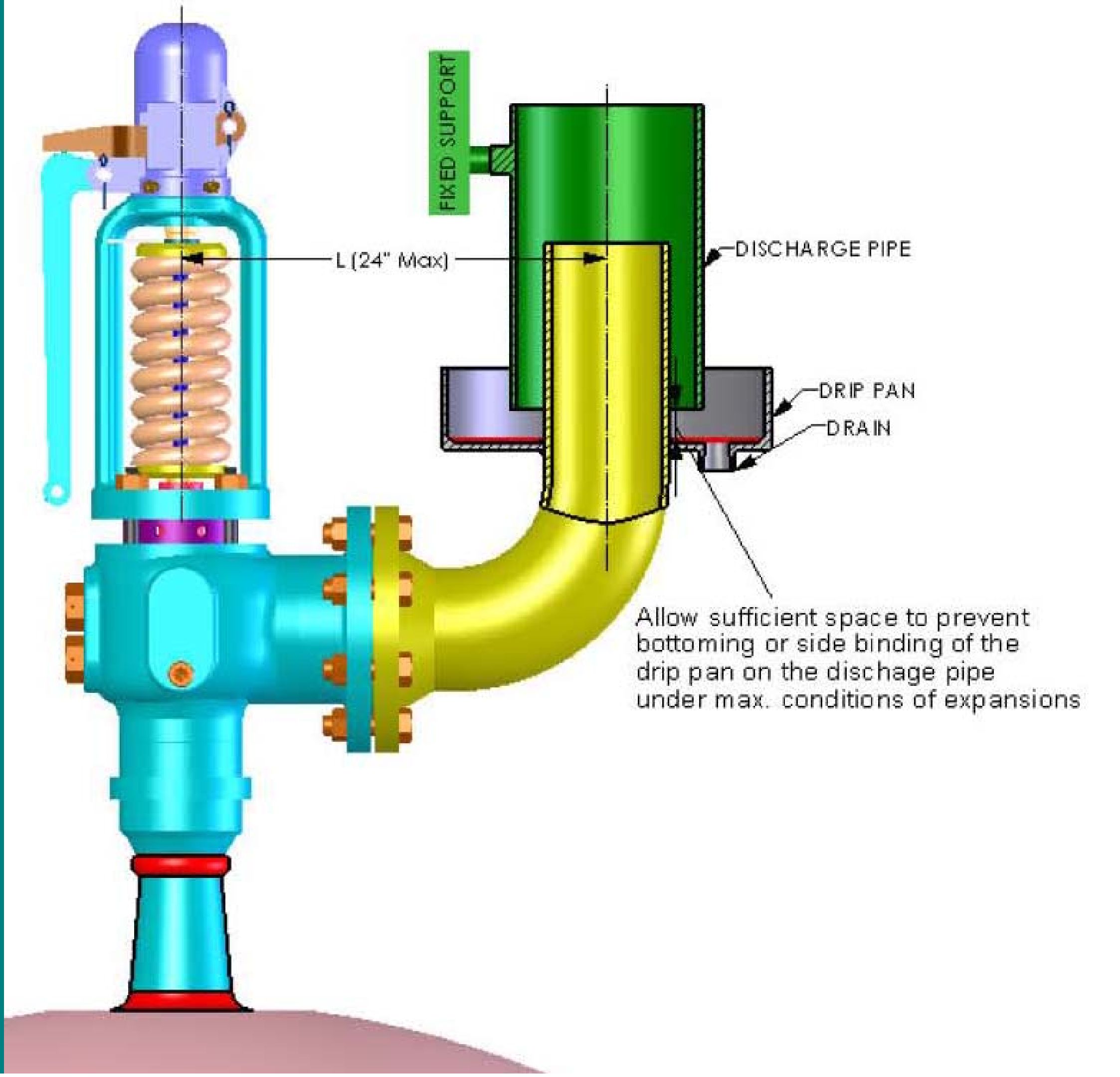
Installation recommendations

The cross sectional area of the discharge pipe shall not be less than the full area of the valve outlet.



Installation recommendations

Discharge pipe should be small and straight & arranged to avoid undue stresses on the valve.
Discharge pipe diameter above drip pan should be adequately to avoid blow back of steam.
The distance between the centre line of valve & discharge line should not exceed 24 inches.



Installation recommendations

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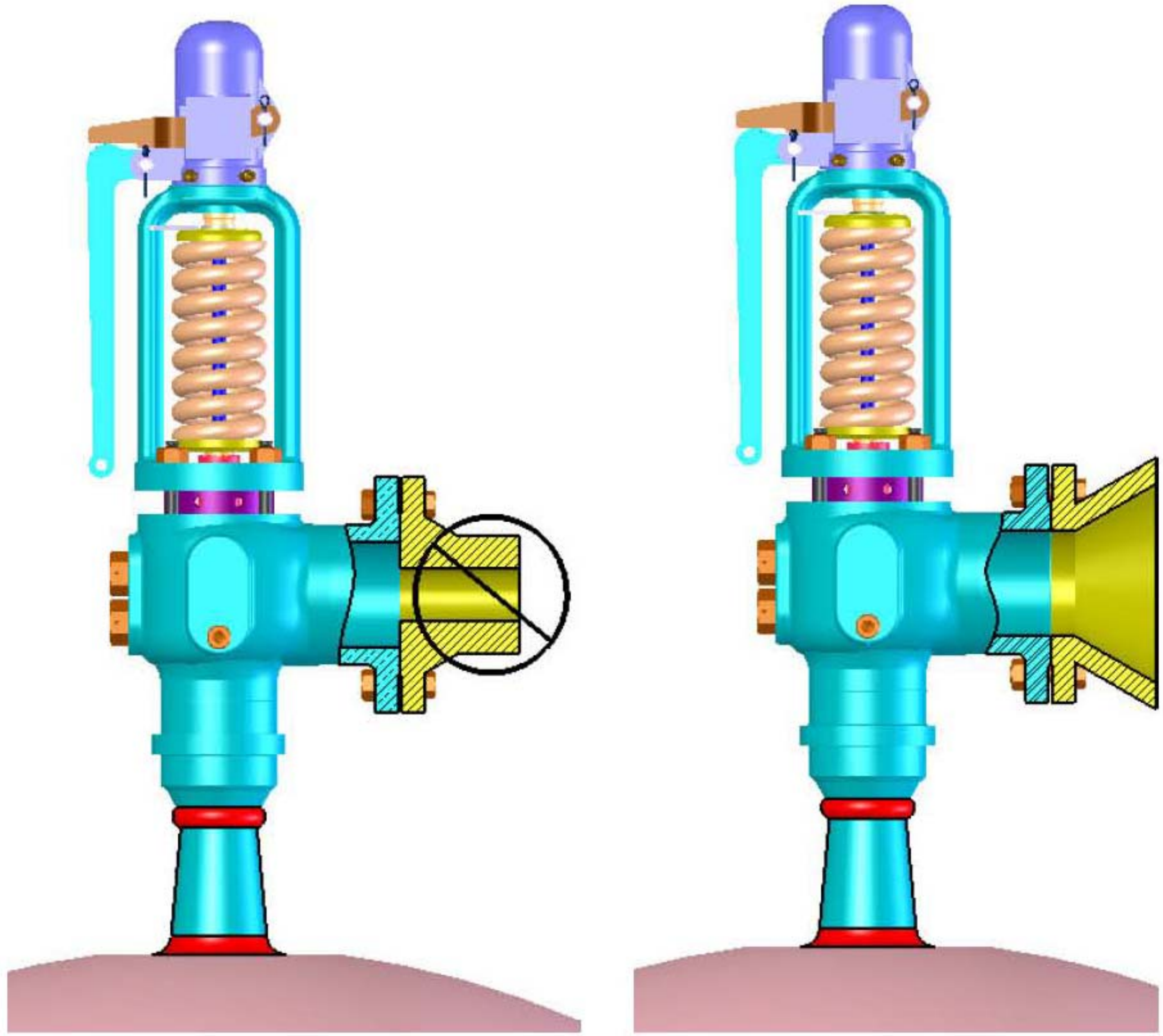
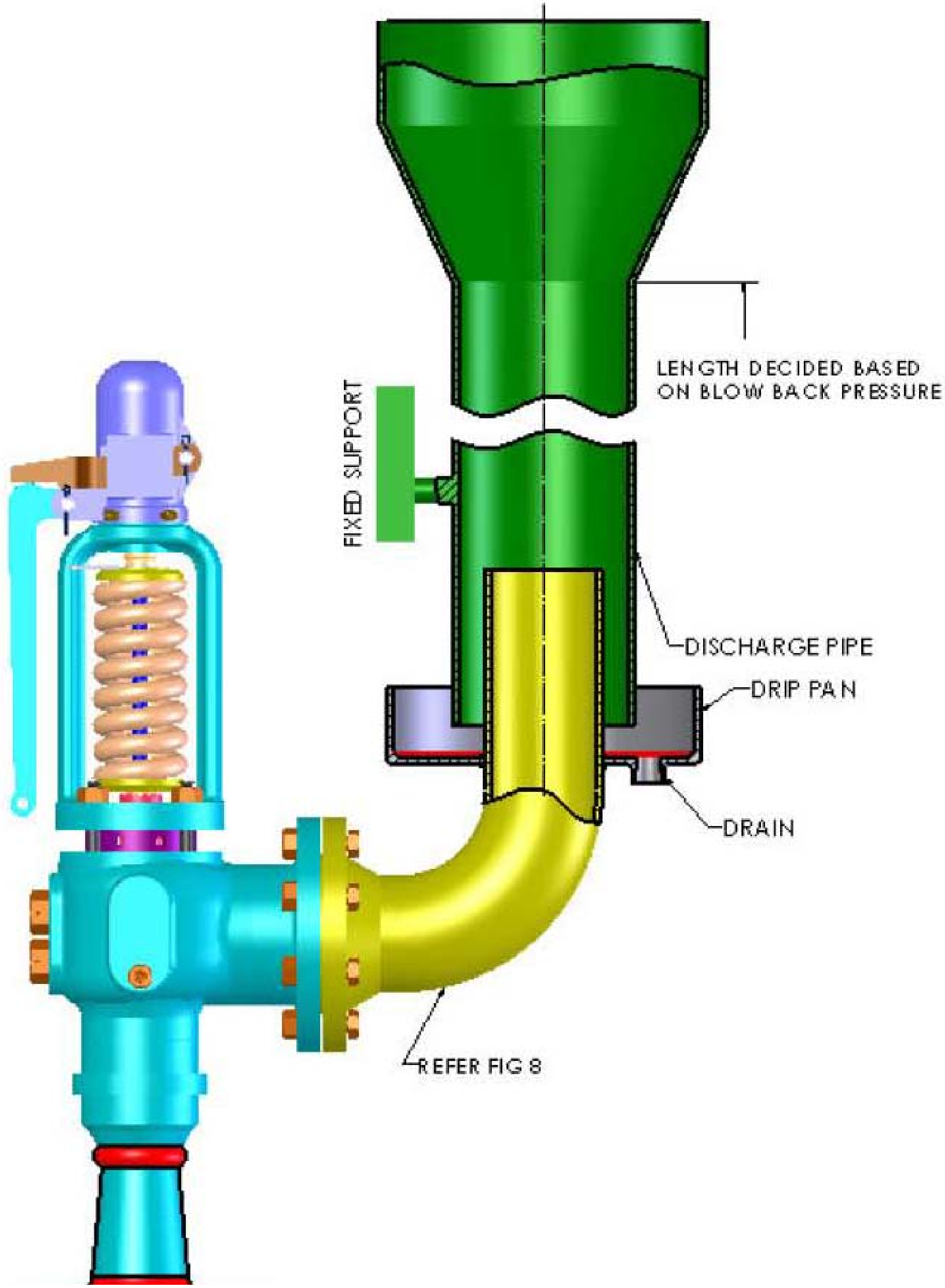


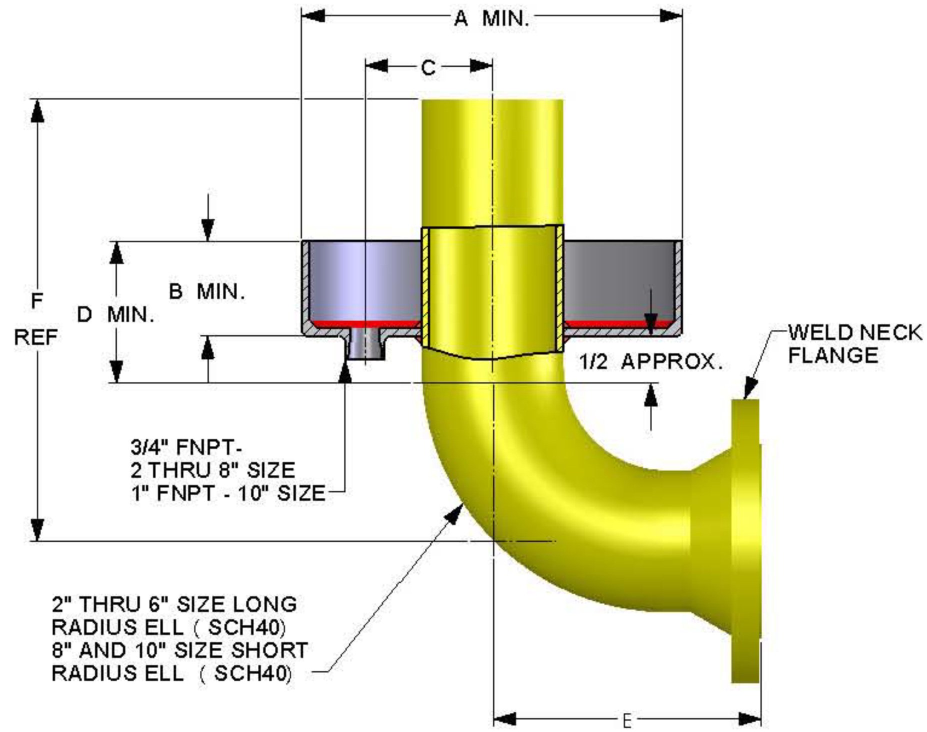
Installation recommendations

When the length of discharge pipe is long, it may be necessary to increase the diameter in the upper part of the stack.



Installation recommendations

Recommendations on drip pan sizing



DRIP PAN ELBOW

DIMENSIONS — Inches

Valve Outlet Size (in)	A	B	C	D	E			F
					150 ANSI Class	300 ANSI Class	600 ANSI Class	
2	9	2-1/2	3	6	5-1/2	X	X	9
2-1/2	9	2-1/2	3	7	6-1/2	X	X	10-3/4
3	9	3	3	8	7-1/4	7-5/8	8	12-1/2
4	12	3	4	8	9	9-3/8	X	14
6	14	4	5	8	12-1/2	12-7/8	X	17
8	16	4	6-1/2	8	12	X	X	16
10	20	5	8	10	14	X	X	20

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❖ Safety valve should be installed between the superheater and the first stop valve. The pressure drop upstream of each safety valve shall be considered in the determination of the set pressure and relieving capacity of that valve. If the Superheater outlet header has a full, free steam passage from end to end and is so constructed that steam is supplied to it at practically equal intervals throughout its length so that there is a uniform flow of steam through the superheater tubes and the header, the safety valve or valve may be located anywhere in the length of the header.
(ASME Sec-I : PG-68.1)

❖ The superheater safety valve should be located at least 8 pipe diameters downstream from any bend in a high velocity steam line to help prevent sonic vibrations. This distance should be increased (preferably 10 times) if the direction of steam flow changes from vertical upwards to horizontal in such a manner as to increase density of the flow in the area directly beneath the safety valve. (ASME B31.1 App. II: 5.2)

❖ Safety valve installation should not be located closer than 8 pipe diameters (based on ID) either upstream or downstream from fittings.

❖ Orientation of the valve outlet should preferably parallel to the longitudinal axis to the run-pipe or header
(ASME B31.1 App. II: 5.3)

ASME Section 1 Valves- pressure relations