716H Safety Relief Valves

716H S a fe t y R e l i e f Va l ve s

INTRODUCTION

The effects of exceeding safe pressure levels in an unprotected pressure vessel or system, can have catastrophic effects on both plant and personnel.
Safety relief valves should be used to protect any pressurised system from the effects of exceeding its design pressure limit.
A safety relief valve is designed to automatically discharge gas, vapour or liquid from any pressure containing system, preventing a predetermined safe pressure being exceeded, and protecting plant and personnel.

Safety Valve
A valve which automatically discharges gases and vapours so as to prevent a predetermined safe pressure being exceeded. It is characterised by a rapid full opening action and is used for steam, gases or vapour service.
Relief Valve
A valve which automatically discharges fluid, usually liquid, when a predetermined upstream pressure is exceeded. The term is commonly used for pressure relieving valves in which the lift is proportional to the increase in pressure above the set pressure.
Safety Relief Valve
A valve which will automatically discharge gases, vapours or liquids, to prevent a predetermined safe pressure being exceeded. It is characterised by a rapid opening action.

DEFINITIONS

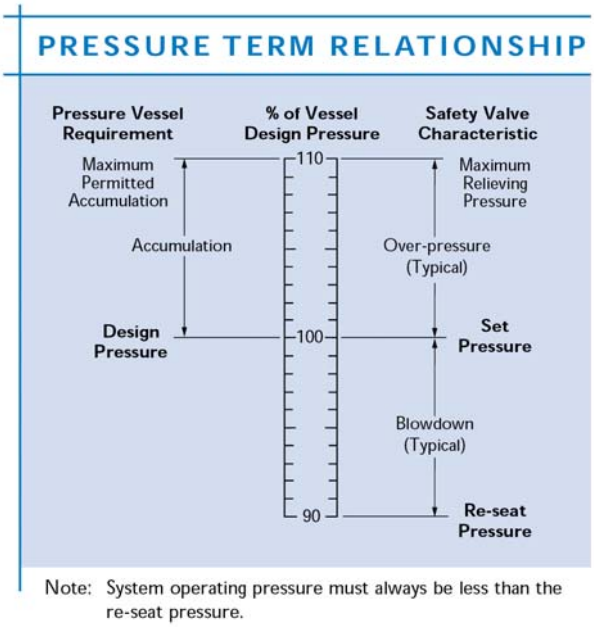
Set Pressure
The pressure measured at the valve inlet at which a safety relief valve should commence to lift under service conditions.
Overpressure
The pressure increase above set pressure at the valve inlet at which the discharge capacity is attained. Usually expressed as a percentage of set pressure.
Accumulation
The pressure increase over a maximum safe working pressure of the vessel or system when the safety relief valve is discharging at its rated capacity is called accumulation. The term refers to the vessel or system to be protected and not to the valve. Accumulation is the same as over-pressure when the valve is set at the design pressure of the vessel.
Re-Seat Pressure
The pressure measured at the valve inlet at which the safety relief valve closes.
Blow-Down
The difference between the set pressure and the re-seating pressure expressed as a percentage of the set pressure or as a pressure difference.
Simmer
The pressure zone between the valve set pressure and the popping pressure. In this pressure zone the valve is only slightly open and therefore discharging a small percentage of its rated capacity.
Popping Pressure
The pressure at which the valve disc rapidly moves from a slightly open (simmer) position to a practically full open position.
Superimposed Back Pressure
Pressure higher than atmosphere in the safety relief valve outlet. This may result from discharge into the common disposal system of other safety relief valves or devices, or as a result of a specific design requirement. Back pressure can be either constant or variable depending on the operating conditions.
Built Up Back Pressure
The pressure existing at the outlet of a safety relief valve caused by flow through the valve into the disposal system.

Differential Set Pressure
This is the difference between the set pressure and the constant superimposed back pressure. It is applicable only when a conventional type safety relief valve is used to discharge against constant superimposed back pressure. (It is the pressure at which the safety valve is set at on the test bench without back pressure.)

Cold Differential Set Pressure
The pressure at which a safety relief valve, intended for high temperature service, is set on a test rig using a test fluid at ambient temperature. The cold differential test pressure will be higher than the set pressure, in order to compensate for the effect of elevated temperature on the valve.

Valve Lift
The actual travel of the valve disc away from the seat when the valve is relieving.

Discharge Capacity
Actual rate of discharge of service media, which can be expressed in mass flow or volumetric terms.



Equivalent Capacity
Calculated mass or volumetric flow rate of the valve of a given test fluid. The fluids commonly used for test purposes are steam, air and water.

SAFETY RELIEF VALV E – APPLICATIONS

Application	Medium	Safety Relief Valve Type
Vented boilers Un-vented boilers	Hot Water	706 716 746/766 Pop 716T
Boiler, pipeline and vessel protection	Steam	706/716 746 756/766 Pop 1640B 300
Compressor pipeline and receiver protection	Air	706 716 746 POP 1640B 300
Pipeline and vessel protection	Cold Water	706 716 746 1640B 300
Pump Protection	Liquids	480/485
Process pipeline, pump and vessel protection	Process/Corrosive Liquids	716 Stainless steel 746 Stainless steel 490 Stainless steel
Clean steam and hygienic environments	Steam and Gases	716 Stainless steel 746 Stainless steel
Pipework, tank and equipment protection	Cryogenic Gases	776
Pipework, tank and equipment protection	Cold & Fine Gases	716 776
Blowers, bulk transfer, tank duty, road/rail transfers	Air	616D

The selection of figure number for each application depends on:
Pressure - capacity - material - temperature - fluid - connection required.

716H
Safety Relief Valve

TECHNICAL SPECIFICATION

Approvals
ASME VIII
PED certified Category IV

Materials

Body	- Carbon Steel gr WCB (-29 to 260°C)
	- Stainless Steel gr CF8M (-46 to 260°C)
Trim	- Aflas to 205°C
	- EPDM to 150°C
	- St.St. to 260°C

Maximum Back Pressure

Barg	19.65
Constant	80%
Built-up	10%
Variable	0%

(Total % must not exceed Barg shown)

Connections
Screwed In x Screwed Out
Flanged In x Flanged Out (except DN15)

Construction
Top Guided / Full Lift

Cap Options
Open lever
Pressure tight dome
Packed lever

Sizing
Refer to Capacity Charts

DESIGN

The figure 716H safety relief valve is a high pressure version of the popular 716 valve.
Pressures up to 102 Barg (orifice dependent) can now be accommodated in two high grade materials, Carbon Steel A216-WCB and Stainless Steel A351-CF8M.
The 716H is certified to the ASME VIII code for the full range of flowing media.

Size Range

Size	Orifice mm^2	Min (Barg) Pressure	Max (Barg) Pressure
DN15 (1/2")	109 (No.7)	0.35	51
DN20 (3/4")	109 (No.7)	0.35	51
DN25 (1")	109 (No.7)	0.35	51
DN15 (1/2")	45 (No.6)	51	102
DN20 (3/4")	45 (No.6)	51	102

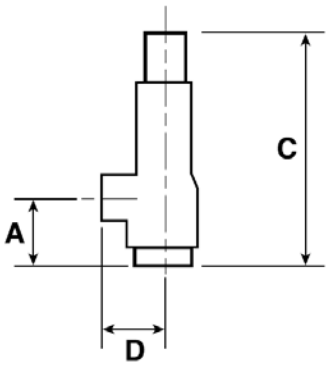
Performance

	6-Kdr	7-Kdr	Over pressure	Blow down
Steam	0.811	0.824	10%*	15%
Hot water	0.811	0.824	10%*	15%
Air / Gas	0.811	0.824	10%*	15%
Liquid	0.670	0.505	10%*	15%

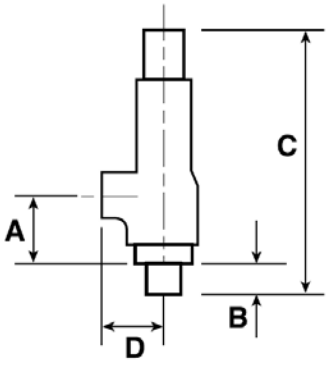
*or 0.2 Barg min

DIMENSIONS

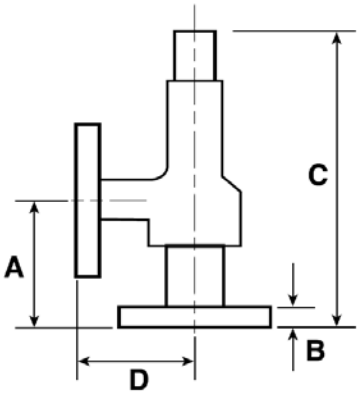
Female screwed



Male screwed



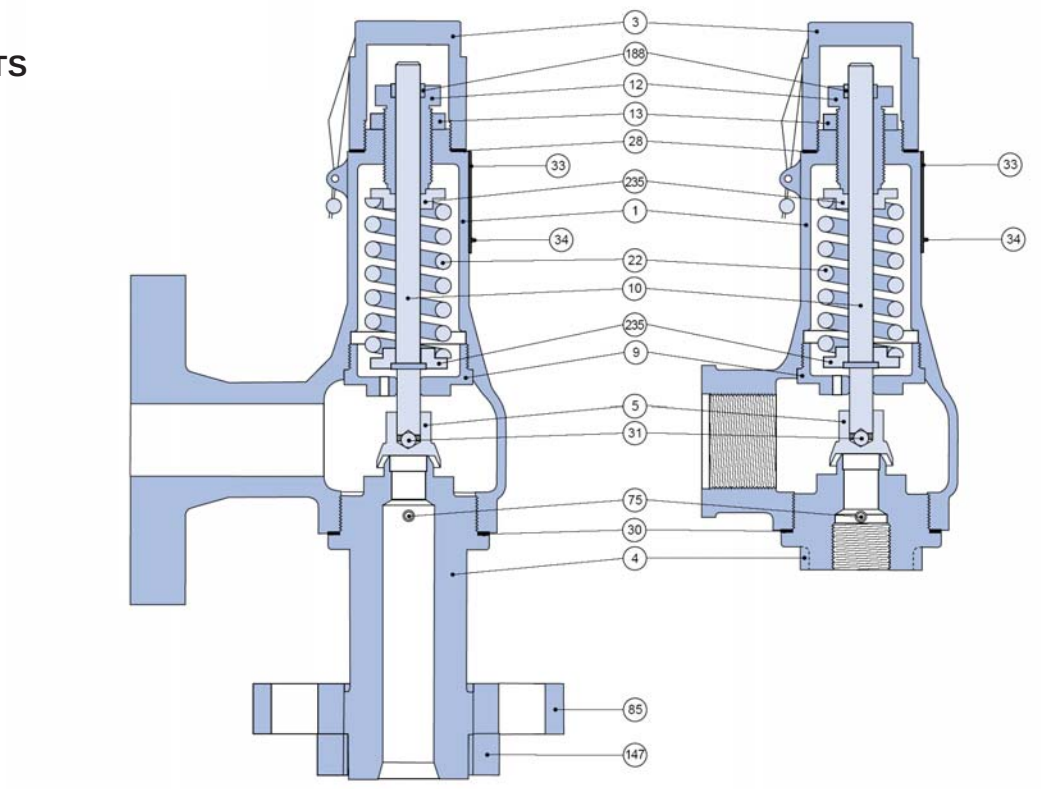
Flanged



Sizes (ins)	inlet & outlet	Orifice					Max pressure up to100°F (Psig)		Weight (kg)
Inlet & Outlet	connection	No.	A	B	C+	D	Inlet	Outlet	
1/2" x 3/4"	Screwed	6	64	21	257	55	1480	285	4
3/4" x 3/4"	Male x Female								
1/2" x 1"	Screwed	7	44	-	189	55	740	285	4
3/4" x 1"	Female x Female								
1" x 1"	Screwed	7	43	19	209	55	740	285	4
	Male x Female								
3/4" x 1"	ANSI 150# x 150#	7	117	31	262	95	740	285	6.5
3/4" x 1"	ANSI 300# x 150#			41					
1" x 1"	ANSI 150# x 150#	7	117	33	262	95	740	285	6.5
1" x 1"	ANSI 300# x 150#			45					

+When a Lever or Test Gag is fitted dimension C will increase. All dimensions in mm.

PARTS



ITEM	PART	CARBON STEEL	STAINLESS STEEL
1	Body	SA 216-WCB CARB ST	SA 351-CF8M ST ST
3	Cap	SA 216-WCB CARB ST	SA 351-CF8M ST ST
4*	Nozzle	ASTM A479-316L	ASTM A479-316L
5*	Disc assy.	VARIOUS	VARIOUS
9	Guide	NITRONIC 60	NITRONIC 60
10	Spindle	ASTM A479-431	ASTM A479-431
12	Adjusting screw	ASTM A479-410	ASTM A479-410
13	Locking nut	ASTM A479-316L	ASTM A479-316L
22*	Spring	C.S. ALUMINIUM COATED	ASTM A313-316
28*	Cap gasket	ST-706 6	ST-706
30	Body gasket	ST-706	ST-706
31*	Ball	AISI 440C ST ST	AISI 440C ST ST
33	Data plate	321 ST ST	321 ST ST
34	Hammer drive screw	ELECTRO BRASSED CS.	ASTM A479-316L
75	Grub screw	ASTM A479-316L	ASTM A479-316L
85	Inlet flange	SA 105 CARB ST	SA 182-F316 ST ST
147	Flange nut	SA564 17/4 (33HRC)	SA564 17/4 (33HRC)
188	Adjusting screw bush	VIRGIN PTFE	VIRGIN PTFE
235	Spring end plate	ASTM A479-431	ASTM A479-431

FIGURE NUMBERING (sizeing - Refer to Cap)

716H [ ] [ ] [ ] [ ] [ ]

ORIFICE

6. 45mm^2 (0.07ins^2)
7. 109mm^2 (0.169ins^2)

SIZE Inlet x Outlet

1. DN 15 x 25 (0.5" x 1")
2. DN 20 x 25 (0.75" x 1")
3. DN 25 x 25 (1" x 1")
4. DN 15 x 20 (0.5" x 0.75")
5. DN 20 x 20 (0.75" x 0.75")

DN 15 x 25
is not available flanged.

CONNECTIONS
Inlet x Outlet

1	=	BSP Male x Female
2	=	BSP Female x Female
3	=	PN 16/40 x PN 16 RF
4	=	PN 64 x PN 16 RF
5	=	ANSI 150 x 150 RF
6	=	ANSI 300 x 150 RF
0	=	Non-standard

MATERIALS Body / Trim

1	=	Carbon Steel WCB / 316L
3	=	Carbon Steel WCB / Aflas
4	=	Stainless Steel CF8M / 316L
6	=	Stainless Steel CF8M / Aflas

Note:
1/ Carbon Steel valves are only available down to -29°C.
2/ All valves are fitted with Stainless Steel springs.

ACCESSORIES

D	=	Dome Cap
M	=	Open Lever
P	=	Packed Lever
F	=	Government Ring
G	=	Test Gag

AIR CAPACITY CHART (l/s) @ 0.3 Barg or 10% overpressure* and 15°C

716H (ASME VIII)
Air Capacity @ 10% Overpressure & 15°C

Set Pressure	No.6 Orifice	No.7 Orifice
Barg	l/s	l/s
1	–	37
10	–	210
20	–	403
30	–	595
40	–	787
50	–	980
51	407	999
60	478	–
80	635	–
100	791	–
102	807	–

SATURATED STEAM CAPACITY CHART (kg/h)

716H (ASME VIII)
Steam Capacity @ 10% Overpressure

Set Pressure	No.6 Orifice	No.7 Orifice
Barg	kg/h	kg/h
1	–	100
10	–	567
20	–	1086
30	–	1605
40	–	2124
50	–	2643
51	1098	2695
60	1289	–
80	1712	–
100	2135	–
102	2177	–

WATER CAPACITY CHART (l/min) @ 10% overpressure* @ 20 C

716H (ASME VIII)
Water Capacity @ 10% Overpressure & 20 C

Set Pressure	No.6 Orifice	No.7 Orifice
Barg	l/m	l/m
1	–	49
10	–	155
20	–	219
30	–	269
40	–	310
50	–	347
51	193	350
60	209	–
80	241	–
100	270	–
102	272	–

INSTALLATION

Safety Relief Valves should always be installed in an upright position with their spring chamber vertical.
All packing materials should be removed from the valve connections prior to installation.

Pressure Vessels

When fitting a Safety Relief Valve onto pressure vessels, the inlet connection pipe should be as short as possible and the bore should be at least equivalent to the nominal bore size of the valve.
The pressure drop between the vessel and the valve should be no more than 3% at rated capacity.
A pressure-tight dome should be specified when:
1) A back pressure must be contained within the relieving system.
2) A head of liquid is built up within the valve body and consequently needs to be contained.
3) The relieving medium is toxic, corrosive or environmentally unfriendly.

Pipelines

When fitting a Safety Relief Valve into a pipeline, the inlet connecting pipe leading from the main pipeline to the Safety Relief Valve should be as short as possible, so that the inlet pressure drop is no more than 3% of rated capacity. In addition, it is advised that the Safety Relief Valve is placed a sufficient distance downstream of the pressure source. This will protect the valve from the adverse effects of pressure pulsations.

Discharge Pipelines

These should be equal to or larger than the valve outlet, with adequate supports, minimum number of bends and overall length. Unless balanced bellows valves are installed, the maximum built up backpressure should not exceed 10% of the set pressure, although the 746, 756 and the 766 can handle higher back pressure if required. Steam service valves should be adequately drained.
Alignment of the discharge or drain should present no risk to persons or property. Protection from the collection of rainwater or condensation in the discharge pipe is advisable.

System Cleansing

It is essential that new installations are fully flushed and all debris removed prior to installing the valve as serious damage can be caused to valve seats, resulting in subsequent leakage.

Pressure Adjustment

Every valve is fitted with a suitable spring and tested before leaving the factory. Valves can be preset on request but to alter the set pressure, the adjusting screw, when viewed from the top, should be screwed downwards in a clockwise direction to increase the set pressure and upwards in an anti-clockwise direction to decrease it. Set pressure adjustment must be carried out by experienced and approved personnel. Any change in set pressure must be within the range of the existing spring, if it exceeds the range, a new spring will be required. The cap lead seal must be re-made after any adjustment to the set pressure.

Blow-down Adjustment (POP, 756 & 766 valves only)

The blow-down ring (part no. 8) is set before the valve leaves the factory and normally no further adjustment will be necessary. However, if the reseating pressure has to be altered in service, the blow-down ring should be screwed (downwards) clockwise to raise the re-seat, popping and simmer pressures. If the blowdown ring is screwed (upwards) anti-clockwise the re-seat, popping and simmer pressures will lower. When re-inserting the setting screw (part no 9.) it should always be placed to engage a slot in the blow-down ring. The standard blowdown is 5% for 756, 10% for 766 and 10% for a POP type valve (minimum 0.3 Barg for all three valve types).
For recommended settings, please contact our technical sales office who will be pleased to help.

COLD DIFFERENTIAL TEST PRESSURE

When setting a valve intended for use at high temperature on a test rig using a test fluid at ambient temperatures, it is necessary to set the valve at a slightly higher pressure, so that it will open at the correct set pressure under operating conditions. The necessary allowance is shown in the following table.

Operating temperature	Increase in set pressure at ambient temperature
Up to 121°C	None
122°C to 316°C	1%
317°C to 427°C	2%