



# Bailey

## 746 Safety Relief Valves

### 746 Safety Relief Valves

#### 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.

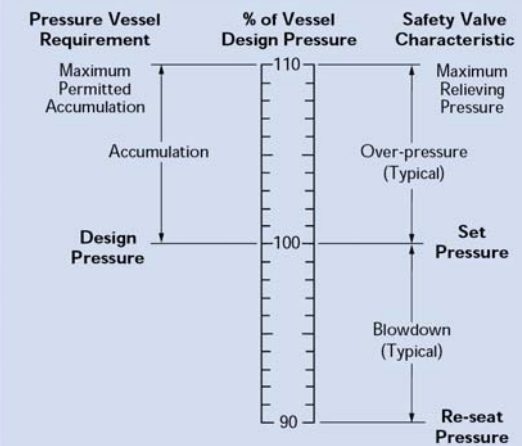
## Discharge Capacity

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.

## PRESSURE TERM RELATIONSHIP



Note: System operating pressure must always be less than the re-seat pressure.

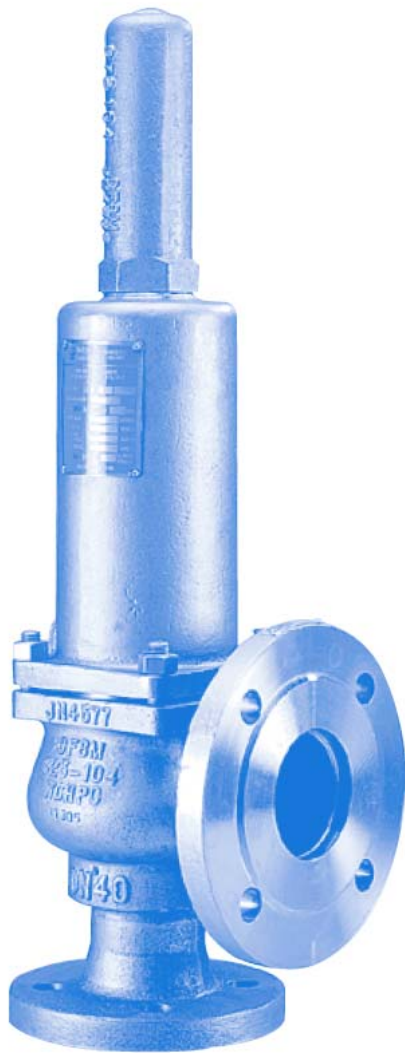
## SAFETY RELIEF VALVE – APPLICATIONS

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.

746

## Safety Relief Valve



### TECHNICAL SPECIFICATION

#### Approvals

BS6759 Pt 1, 2, & 3

ASME VIII

TUV-AD Merkblatt A2

PED certified Category IV

#### Materials

- Body - Carbon St. gr WCB (-29 to 427°C)
- Stainless St. gr CF8M (-46 to 427°C)
- Trim - Stainless Steel
- Viton (-30 to 200°C)
- PTFE (-46 to 220°C)
- EPDM - Hot Water (-46 to 150°C)

#### Performance (ASME)

	Kdr	Over pressure
Steam	0.82	10%
Air / Gas	0.82	10%
Liquids	0.535	10%

#### Maximum Back Pressure

Barg	16
Constant	80%
Built-up	5%
Variable	40% (when bellows fitted)

(Total % must not exceed Barg shown)

#### Connections

Flanged In x Flanged Out

#### Construction

Top Guided / Full Lift

#### Cap Options

- Pressure tight dome
- Packed lever
- Open lever

#### Sizing

Refer to Capacity Charts

Size Range			
Size	Orifice mm <sup>2</sup>	Min (Barg) Pressure**	Max (Barg) Pressure*
DN25 (1")	415	0.35	40
DN32 (1-1/4")	660	0.35	40
DN40 (1-1/2")	1075	0.35	40
DN50 (2")	1662	0.35	40
DN65 (2-1/2")	2827	0.35	35
DN80 (3")	4301	0.35	32
DN100 (4")	6648	0.35	25

\*Maximum pressure stated is reduced over 120°C

\*\* Minimum pressure is greater than stated for bellows valves

Performance (TUV and BS6759)			
	Kdr	Over pressure	Blow down
Steam	0.7	5%	15%*
Hot water	0.7	5%	15%*
Air / Gas	0.7	10%	10%*
Liquid	0.46	10%	20%+

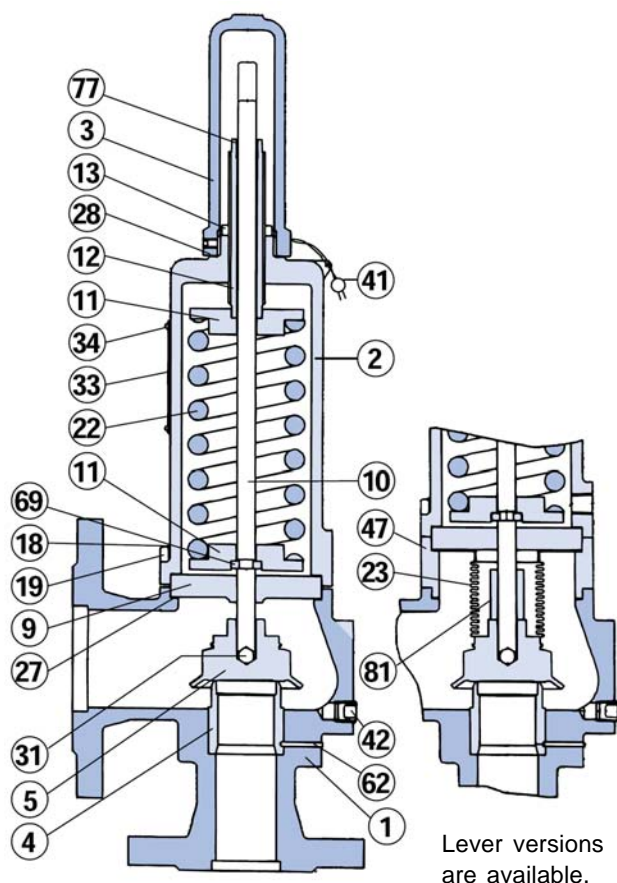
\*or 0.3 Barg min

+or 0.6 Barg min

### DESIGN

The 746 Safety Relief Valve incorporates a freely pivoting disc, which ensures correct alignment with the nozzle. The combination of top guiding, unobstructed seat bore and full lift capability ensures the highest possible discharge rate thus maximum plant protection. Due to the large flows available the inlet pipework must be sized to give a maximum inlet pressure drop of 3%. The 746 safety relief valve is available in both conventional and balanced bellows types, and features a special disc style for liquid application, which enhances valve performance.

The 'conventional' arrangement is suitable for applications where the built up pressure will not exceed 5%. The conventional valve can also be used in systems where the superimposed backpressure is at a constant level (up to 80%). The 'balanced bellows' arrangement is for applications where several safety relief valves discharge into a common discharge manifold, or in any circumstances where a variable back pressure can occur, up to a maximum of 40%.



ITEM	PART	MATERIALS	
		Carbon Steel	St.St
1	Body	Carbon	St St.St
2	Bonnet	Carbon St.	St.St
3	Cap	Carbon St.	St.St
4	Seat	St.St	St.St
5*	Disc#	St.St	St.St
9	Guide Plate	St.St	St.St
10 (H)	Spindle	St.St	St.St
11	Spring Plate	St.St	St.St
12	Adjusting Screw	St.St	St.St
13	Locknut	St.St	St.St
18 (H)	Body Stud	Carbon St	St.St
19	Body Nut	Carbon St	St.St
22 (H)	Spring**	C.V	St.St
23 (B)*	Bellows Unit	St.St	St.St
27*	Body/Bonnet Gasket	Garlock	Garlock
28*	Cap Gasket	Garlock	Garlock
31*	Ball	St.St	St.St
33	Nameplate	St.St	St.St
34	Nameplate Pin	Carbon St	St.St
41	Warranty Seal	Lead/wire	Lead/wire
42	Drain Plug	Carbon St	St.St
47 (BH)	Spacing Piece	St.St	St.St
62	Seat Pin	St.St	St.St
69	Split Collar	St.St	St.St
77	Adjusting Screw Bush	PTFE	PTFE
81 (B)	Lift Stop	St.St	St.St

Note:

B - Denotes used on Bellows type valves.

H - High Pressure type valves; and spacer and larger studs, spring and spindle.

# Resilient trims are available.

\* Recommended spares.

\*\* Other spring material options are available dependent on duty.

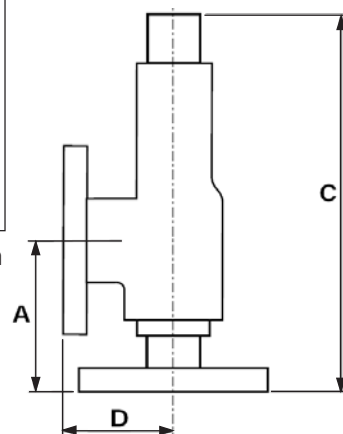
## DIMENSIONS

Valve Type	Valve Size	Inlet	Outlet	A	'C' Dome	'C' Lever	'C' Bellows	D	Weight (kg)
Flanged	DN25	1"	1-1/2"	105	410	410	445	100	8.5
	DN32	1-1/4"	2"	115	455	455	490	110	14.0
	DN40	1-1/2"	2-1/2"	140	570	570	605	115	20.0
	DN50	2"	3"	150	615	615	665	120	30.0
	DN65	2-1/2"	4"	170	725	725	785	140	42.5
	DN80	3"	5"	195	825/ 925H 925/ H	825/ 925H 925/ H	865/ 965H 955/ 1060	160	64.5
	DN100	4"	6"	220	1030 H	1030 H	1060	180	86.0

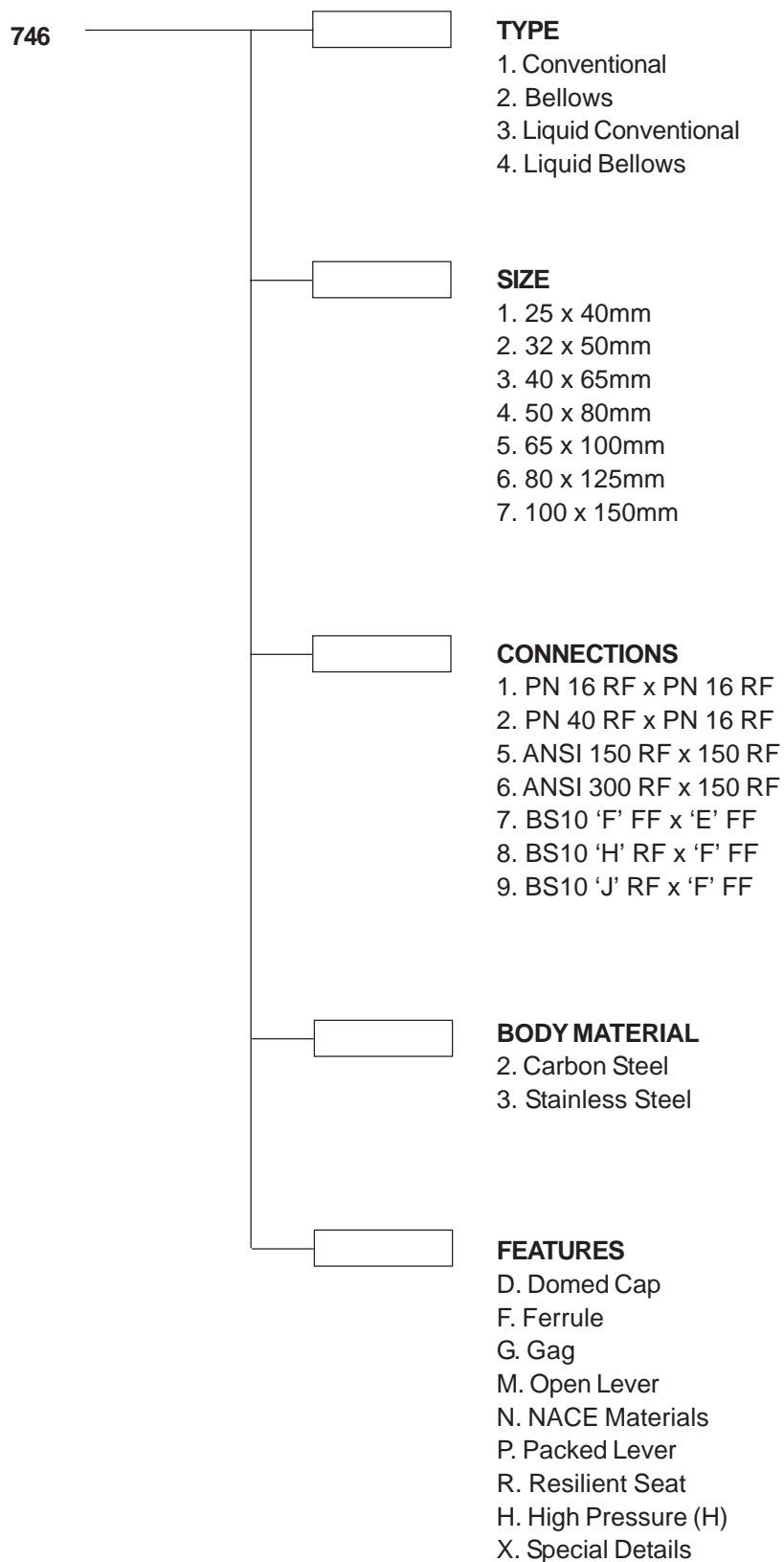
Flange sizes listed are for :  
Cast Steel Flanges PN 40x16  
Others available on request.

All dimensions in mm

Flanged x Flanged



## FIGURE NUMBERING



### Notes:

A. Any special requirements will be indicated by the letter X which will be agreed with the sales office. For example, paint specification or spring material.

B. Any combination of features can be called up eg. DG, PR, DFRN etc.

C. (H) for '746' 80 and 100mm valves only. Lever versions are available.



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

Set Pressure (Barg)	Valve Type 746# (BS6759 Pt2)						
	DN25	DN32	DN40	DN50	DN65	DN80	DN100
0.35	69.6	109	178	275	467	711	1098
1.0	115	182	297	459	781	1188	1836
2.0	181	287	468	723	1231	1872	2894
3.0	242	384	626	968	1646	2505	3872
4.0	303	482	786	1215	2066	3144	4859
5.0	365	580	945	1462	2486	3782	5846
6.0	427	678	1105	1708	2906	4421	6834
7.0	488	776	1265	1955	3326	5060	7821
8.0	550	874	1424	2202	3746	5699	8808
9.0	611	972	1584	2449	4165	6337	9795
10.0	673	1070	1744	2696	4585	6976	10783
12.0	796	1267	2063	3189	5425	8253	12757
12.5	827	1316	2143	3313	5635	8573	13251
14.0	920	1463	2382	3683	6265	9531	14732
16.0	1043	1659	2701	4177	7104	10808	16706
18.0	1166	1855	3021	4670	7944	12086	18681
20.0	1289	2051	3340	5164	8784	13363	20655
22.0	1413	2247	3659	5658	9623	14641	22630
24.0	1536	2443	3979	6151	10463	15918	24605
26.0	1659	2639	4298	6645	11303	17196	
28.0	1782	2835	4617	7138	12142	18473	
30.0	1906	3031	4936	7632	12982	19751	
32.0	2029	3227	5256	8126	13822	21028	
34.0	2152	3423	5575	8619	14661		
36.0	2276	3619	5894	9113			
38.0	2399	3815	6214	9607			
40.0	2522	4011	6533	10100			

\* Minimum overpressure = 0.07 Barg at set pressure less than 1.0 Barg.

# The 746 can be sized/certified to ASME VIII and AD Merkblatt A2 - contact factory for details.

## SATURATED STEAM CAPACITY CHART (kg/h)

Set Pressure (Barg)	Valve Type 746 <sup>#</sup> (BS6759 Pt1 @ 5% Overpressure)†						
	DN25	DN32	DN40	DN50	DN65	DN80	DN100
0.35	124	198	322	498	847	1289	1992
1.0	269	429	698	1079	1836	2793	4317
2.0	457	727	1183	1830	3112	4735	7318
3.0	635	1010	1645	2543	4326	6581	10173
4.0	795	1265	2060	3185	5417	8241	12738
5.0	955	1519	2475	3826	6508	9901	15303
6.0	1115	1774	2889	4467	7598	11560	17869
7.0	1276	2029	3304	5108	8689	13220	20433
8.0	1436	2283	3719	5750	9780	14880	22999
9.0	1596	2538	4134	6391	10871	16539	25565
10.0	1756	2793	4549	7032	11962	18199	28130
12.0	2076	3302	5378	8315	14143	21518	33260
12.5	2156	3429	5586	8636	14689	22348	34543
14.0	2397	3811	6208	9598	16325	24838	38391
16.0	2717	4321	7038	10880	18587	28157	43522
18.0	3037	4830	7867	12163	20689	31476	48652
20.0	3357	5339	8697	13446	22871	34795	53783
22.0	3678	5849	9526	14728	25052	38115	58913
24.0	3998	6358	10356	16011	27234	41434	64044
26.0	4318	6868	11186	17293	29416	44753	
28.0	4638	7377	12015	18576	31598	48073	
30.0	4959	7886	12845	19859	33779	51392	
32.0	5279	8396	13675	21142	35961	54711	
34.0	5599	8905	14504	22424	38143		
36.0	5919	9414	15334	23707			
38.0	6240	9924	16164	24990			
40.0	6560	10433	16993	26272			

\* Minimum overpressure = 0.07 Barg at set pressure less than 0.7 Barg.

Minimum overpressure = 0.07 Barg at set pressure less than 1.0 Barg.

# The 746 can be sized/certified to ASME VIII and AD Merkblatt A2 - contact factory for details.

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

Set Pressure (Barg)	Valve Type 746 <sup>#</sup> (BS6759 Pt3)						
	DN25	DN32	DN40	DN50	DN65	DN80	DN100
0.35	105	167	272	420	715	1088	
1.0	170	270	440	680	1157	1761	2722
2.0	240	382	622	962	1637	2490	3849
3.0	294	468	762	1178	2005	3050	4714
4.0	340	540	880	1361	2315	3522	5443
5.0	380	604	984	1521	2588	3937	6086
6.0	416	662	1078	1667	2835	4313	6666
7.0	449	715	1164	1800	3062	4659	7210
8.0	481	764	1245	1924	3273	4980	7698
9.0	510	811	1320	2041	3472	5282	8165
10.0	537	854	1392	2152	3660	5568	8606
12.0	589	936	1525	2357	4009	6099	9428
12.5	601	955	1556	2406	4092	6225	9622
14.0	636	1011	1647	2546	4330	6588	10183
16.0	680	1081	1760	2722	4629	7043	10886
18.0	721	1146	1867	2887	4910	7470	11547
20.0	760	1208	1968	3043	5176	7874	12171
22.0	797	1267	2064	3191	5428	8259	12765
24.0	832	1324	2156	3333	5670	8626	13332
26.0	866	1378	2244	3469	5901	8978	
28.0	899	1430	2329	3600	6124	9317	
30.0	931	1480	2410	3727	6339	9644	
32.0	961	1528	2490	3849	6547	9960	
34.0	991	1575	2566	3967	6748		
36.0	1019	1621	2641	4082			
38.0	1047	1666	2713	4194			
40.0	1074	1709	2783	4303			

\* Minimum overpressure = 0.07 Barg at set pressure less than 0.7 Barg.

# The 746 can be sized/certified to ASME VIII and AD Merkblatt A2 - contact factory for details.



## HOT WATER CAPACITY CHART (kW) FOR A PRESSURISED (un-vented) SYSTEM

Set Pressure (Barg)	Valve Type 746 (BS6759 Pt1 @ 5% Overpressure)†						
	DN25	DN32	DN40	DN50	DN65	DN80	DN100
0.35	227	360	587	907	1543	2547	3628
1.0	235	374	608	941	1600	2434	3762
2.0	309	492	801	1239	2107	3206	4956
3.0	398	633	1031	1594	2711	4124	6375
4.0	498	792	1291	1996	3394	5164	7983
5.0	599	952	1551	2398	4078	6204	9590
6.0	699	1112	1811	2799	4762	7244	11198
7.0	799	1271	2071	3201	5445	8285	12805
8.0	900	1431	2331	3603	6129	9721	14413
9.0	1000	1590	2591	4005	6813	10365	16020
10.0	1100	1750	2851	4407	7496	11405	17628
12.0	1301	2069	3370	5211	8863	13485	20843
12.5	1351	2149	3500	5412	9205	14005	21647
14.0	1501	2388	3890	6015	10231	15565	24058
16.0	1703	2708	4410	6818	11598	17645	27274
18.0	1903	3027	4930	7622	12965	19725	30489
20.0	2104	3346	5450	8426	14332	21805	33704
22.0	2304	3665	5970	9230	15699	23885	36919
24.0	2505	3984	6490	10034	17067	25965	40134
26.0	2706	4304	7010	10837	18434	28045	
28.0	2907	4623	7530	11641	19801	30125	
30.0	3107	4942	8050	12445	21168	32206	
32.0	3308	5261	8569	13249	22536	34286	
34.0	3509	5580	9089	14053	23903		
36.0	3710	5900	9609	14856			
38.0	3910	6219	10129	15660			
40.0	4111	6538	10649	16464			

Minimum overpressure = 0.07 Barg at set pressure less than 1.0 Barg.

## 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%

## 700 SERIES TECHNICAL SPECIFICATION

Fig. No	706	716	746	756	766	776
<b>Body Material</b>	Bronze	Bronze Cast Iron Stainless Steel	Cast Steel Stainless Steel	Cast Iron	Cast Steel Cast Steel	Bronze
Code		<b>BS6759</b>				<b>ADMERKBLATT A2</b>
<b>Approvals Part</b>	1, 2, & 3	1, 2, & 3	1, 2, & 3#	1	1	
<b>Top Guided</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Lift</b>	High Lift	Full Lift	Full Lift	Full Lift	High Lift	Full Lift
<b>Size Range</b>	DN15-50 1/2" – 2"	DN15-50 1/2" – 2"	DN25-100 1" – 4"	DN25-80 1" – 3"	DN40-80 1-1/2" – 3"	DN15-50 1/2" – 2"
<b>Orifice Areas</b> (mm <sup>2</sup> )						Sizing data to TUV available on request.
DN15	126	109	—	—	—	
DN20	364	314	—	—	—	
DN25	481	415	415	415	—	
DN32	791	660	660	660	—	
DN40	1240	1075	1075	1075	2280	
DN50	1943	1662	1662	1662	4054	
DN65	—	—	2827	2827	6334	
DN80	—	—	4301	4301	9121	
DN100	—	—	6648	—	—	
<b>Pressure Range†</b> (Barg)	0.35 to 12.5	0.35 to 32	0.35 to 40	0.35 to 24	0.35 to 24	1 to 41.3
<b>Temp Range (°C)</b> (with suitable material)	–59 to +220	–90 to +260	–40 to +427	–29 to +300	–29 to +230	–196 to +60
<b>Connection</b>	Screwed Flanged	Screwed Flanged	Flanged	Flanged	Flanged	Screwed
<b>Trim Options</b>	Brass EPDM (WRC) Viton	Stainless Aflas EPDM	Stainless Aflas EPDM	Stainless EPDM	Stainless EPDM	KEL F (PCTFE)
<b>Cap Options</b>	Dome Open lever	Dome Open lever	Dome Open lever Packed lever	Open lever	Open lever	Dome
<b>Kdr. Cert. Coeff.</b> Steam/Hot Water/Gases	0.173	0.7	0.7	0.716	0.4	—
<b>Kdr. Cert. Coeff.</b> Liquids	0.149	0.46	0.46	—	—	—
<b>Pressure Maximum</b> Constant	Brz 5.5 Barg	SS 5.5 Barg	SS 16 Barg	CS 12 Barg	CS 12 Barg	SS 5.5 Barg
<b>Back</b> Built-up	80%	80%	80%	—	—	80%
<b>Pressure*</b> Variable	10%	10%	10%	50%	50%	10%
	—	—	40%	—	—	—

\*For higher back pressures consult factory. \*\*Resilient 766 is limited to 10%.

†For maximum pressure per size and material refer to capacity and spring charts, pages 14 to 23.

††716 EPDM Seat, max pressure of 12.5 Barg on DN 15, 20, 25 and 18 Barg on DN 32, 40, 50.

#746 is also available ASME VIII and AD Merkblatt A2 certified, details available on request.

Material	Seat	Body	
Temperature	EPDM (WRC)	Bronze BSI 400 - LG2	–196 c to 232 °C
Limitations	EPDM	Cast Iron BSI 452-260	–10 C to 300 °C
	Aflas	Carbon Steel SA216-WCB	–29 C to 427 °C
	Brass	Stainless Steel 316/CF8M	–90 C to 427 °C
	Stainless Steel		