



HENRY
TECHNOLOGIES

High Pressure Safety Devices

Maximum Working Pressure 130 barg

High Pressure Relief Valves

Three-Way Valves



Safety Device Assembly



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DESIGNED FOR PERFORMANCE

PRESSURE RELIEF VALVES

The function of a Pressure Relief Valve is to protect against over-pressure. For safety reasons, excessive over-pressure in any part of a refrigeration system must be avoided.

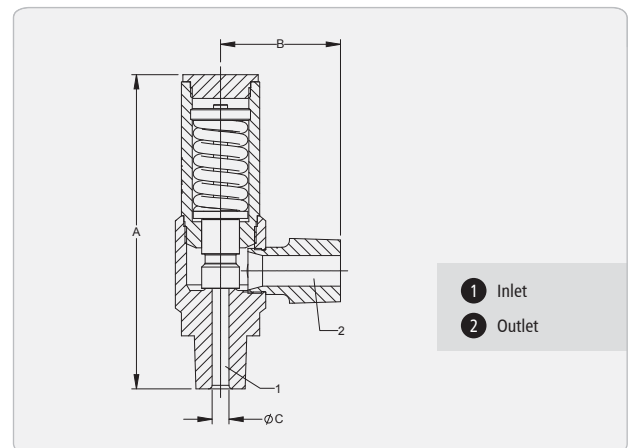
The high pressure relief valve range is specifically designed for high pressure applications up to 130 bar and in particular, transcritical CO₂ systems. The valves are manufactured from Brass.

Main Features

- Maximum pressure setting of 130 bar
- Set pressure tolerance = +/-3%
- Maximum overpressure = 10%
- In accordance with EN ISO 4126-1, the 5701AX valve reseats within 15% of set pressure following a discharge
- TFM second generation PTFE seal
- Allowable operating temperature = -40°C to +150°C
- Suitable for HFC, HCFC, HFO and CO₂ refrigerant gases

Standard pressure settings (barg): 31*,40*,42*,45*,46, 50, 60, 70, 80, 90, 100, 110, 120, 130

* Not available on 5701AX model.



Valve Capacity Ratings (kg Air/min) @ 20°C										
Part No.	Standard Pressure Setting (barg)									
	31.0	40.0	42.0	45.0	46.0	60.0	80.0	100.0	120.0	130.0
5700	3.5	4.5	4.7	5.0	5.1	6.7	8.9	11.0	13.2	14.3
5701AX	N/A*	N/A*	N/A*	N/A*	20.0	25.9	34.4	42.9	51.4	55.7
5702	34.9	44.7	46.9	50.2	51.3	66.5	88.4	110.2	132.1	143.0
5702A										
5702B										
5702C										

* 5701AX minimum pressure setting is 46.0 barg.

High Pressure X-series Relief Valve Range									
Part No.	Conn Size (inch)		Dimensions (mm)			Flow Area (mm ²)	K _{dr}	Weight (kg)	CE Cat
	Inlet	Outlet	A	B	øC				
5700	3/8 NPTF	3/8 NPTF	87.0	30.7	3.5	9.62	0.73	0.27	IV
5701AX	1/2 NPTF	3/4 NPTF	132.5	50.6	7.1	39.59	0.69	0.86	
5702	1/2 NPTF	1 NPTF	179.5	61.4	10.5	86.59	0.81	2.15	
5702A	3/4 NPTF							2.18	
5702B	1 NPTF							2.21	
5702C	1 1/4 NPTF							2.29	

Selection Guidelines

For safety reasons, relief valve selection should only be carried out by suitably qualified engineers.

Henry Technologies pressure relief valves are designed to discharge refrigerant vapour and are not recommended for liquid use.

The European Standards EN378 (reference 1) and EN13136 (reference 2) are recommended for PRV selection.

Example

A liquid receiver is to be protected from over-pressure due to fire.

Receiver dimensions = 2.016m long (L) x 0.841m outside diameter (D)
Refrigerant = R744 (CO₂)
Pressure Setting = 50.0 barg

$$Q_{md} = \frac{3600 \times \phi \times A_{surf}}{h_{vap}}$$

Q_{md} = Minimum required discharge capacity, of refrigerant, of the pressure relief valve (kg/hour)

ϕ = Density of heat flow rate (kW/m²). The standards assume a value to 10 kW/m² but state that a higher value can be used if necessary. This figure relates to an un-lagged vessel.

A_{surf} = External surface area of the vessel (m²)

h_{vap} = Heat of vaporisation calculated at 1.1 times the set pressure, in bar a, of the pressure relief valve (kJ/kg)

Note:

When the relief valve setting is close to the critical pressure of the refrigerant, this sizing method may not be applicable.

$$A_{surf} = (\pi \times D \times L) + \left(2 \times \frac{D^2 \times \pi}{4}\right)$$

$$A_{surf} = (\pi \times 0.841 \times 2.016) + 2 \left(\frac{0.841^2 \times \pi}{4} \right) = 6.44 \text{ m}^2$$

Calculate the heat of vaporisation, h_{vap} , taken at 1.1 times set pressure:

$$P_o = (P_{set} \times 1.1) + P_{atmos} = (50.0 \times 1.1) + 1.013 = 56.01 \text{ bar a}$$

From refrigerant property tables, use saturated vapour and liquid enthalpies at P_o .

Vapour = 410.59 kJ/kg

Liquid = 252.44 kJ/kg

$$h_{vap} = 410.59 - 252.44 = 158.15 \text{ kJ/kg}$$

The minimum required discharge rate of R744 can now be calculated for this vessel and set pressure:

$$Q_{md} = \frac{3600 \times \phi \times A_{surf}}{h_{vap}} = \frac{3600 \times 10 \times 6.44}{158.15} = 1465.95 \text{ kg/hr, R744}$$

For relief valve discharge capacity, Q_m :

$$Q_m = 0.2883 \times C \times A \times K_{dr} \times K_b \times \sqrt{\frac{P_o}{V_o}}$$

Q_m = Discharge capacity, of refrigerant, of the pressure relief valve (kg/hr)

C = Function of the isentropic exponent

A = Flow area of PRV (mm²)

K_{dr} = De-rated coefficient of discharge of PRV

K_b = Theoretical capacity correction factor for sub-critical flow.
A value of 1 is used for critical flow.

P_o = Actual relieving pressure of PRV (bar a)

V_o = Specific volume of saturated vapour at P_o (m³/kg)

Refrigerant data should be referenced for values of C and V_o .

The objective is to select a PRV which results in $Q_m > Q_{md}$. In this way, the relieving capacity of the PRV is greater than required thus avoiding excessive vessel pressure.

For this example, a 5701AX has been selected:

$A = 39.59 \text{ mm}^2$

$K_{dr} = 0.69$

$$Q_m = 0.2883 \times 2.63 \times 39.59 \times 0.69 \times 1 \times \sqrt{\frac{56.01}{0.0054}} = 2,109.5 \text{ kg/hr, R744}$$

$Q_m > Q_{md}$, therefore the 5701AX would be suitable for this system.

Important selection notes:

1. It is important not to grossly over-size a PRV so that Q_m is many times greater than Q_{md} as the performance of the PRV can be affected. Contact Henry Technologies for further guidance.
2. Henry Technologies recommends inlet and outlet piping for all PRVs are sized in accordance with EN13136 (reference 2) to avoid excessive pressure losses which can affect valve performance.
3. If a Henry Technologies rupture disc is used in conjunction with a Henry Technologies PRV, the PRV capacity should be de-rated by 10%. In the above example, the PRV capacity would be de-rated to 1,898.5 kg/hr (2,109.5 x 0.9).

References:

1. BS EN 378-2:2016*
2. BS EN 13136:2013*

*Latest revisions at the time of publication. The user should ensure the latest revisions are referenced.

Installation – Main issues

1. Connect the relief valve at a location above the liquid refrigerant level, in the vapour space. Stop valves should not be located between the vessel and the relief valve except the three-way type.
2. Do not discharge the relief valve prior to installation or when pressure testing the system.
3. Pressure relief valves should be mounted vertically.
4. Relief valves should be changed out after discharge. Most systems are subject to accumulations of debris and particles of metal and dirt are generally blown onto relief valve seats during discharge. This can inhibit the relief valve from re-sealing at the original set pressure. A valve can also relieve at a lower pressure than the stamped setting due to the force of the re-closing action.
5. The pipe-work must not impose loads on the relief valve. Loads can occur due to misalignment, thermal expansion, discharge gas thrust, etc.
6. Transcritical CO₂ systems should generally be sized with the shortest length and largest bore outlet pipe work practical to avoid solids forming downstream of the PRV during a discharge.

THREE-WAY DUAL SHUT-OFF VALVES

The function of a three-way valve is to permit replacement of one of the pressure relief devices, while the other is protecting the pressure vessel. In this way, a vessel is protected from over-pressure during servicing. It also allows a pressure relief device to be replaced in-situ, without removing the system refrigerant charge.

Applications

All three-way valves are suitable for HCFC, HFC, HFO and CO₂ refrigerants gases along with their associated oils. The 802 series is also suitable for ammonia.

Refrigeration standard, EN378, specifies that a three-way valve is required on vessels of CE Category II, III and IV. EN378 or an equivalent National Standard should be consulted for further guidance. It should be recognised however that a three-way valve can be fitted to a vessel of any size, to enable safe, easy and economical replacement of pressure relief devices.

Main features

- Proven robust design
- Compact

Technical Specification

Allowable operating pressure = 0 to 130 barg

Allowable operating temperature = -29°C to +149°C

Materials of Construction

The 92 and 802 series valve bodies are made from brass and carbon steel respectively. The stem is made from plated steel. The stem seal packing is made from either PTFE or graphite based material.

The 92 series seal cap is made from moulded plastic.

The 802 series seal cap is made from stainless steel.

Installation – Main issues

1. Assemble the three-way valve to a vessel using a high strength pipe nipple, suitable for the maximum operating pressure.
2. The pipework must not impose loads on the valve. Loads can occur due to misalignment, thermal expansion, discharge gas thrust, etc.
3. The three-way valve should be front or back seated, not left with both pressure relief devices exposed.

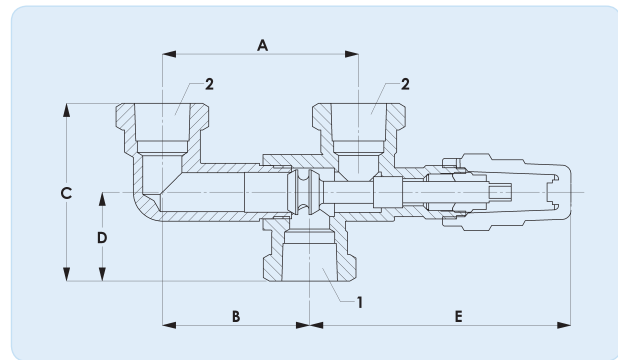


Fig. 1

- 1 Inlet
- 2 Outlet

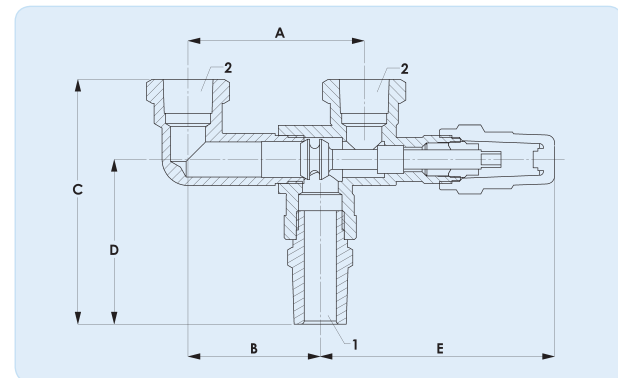


Fig. 2

Type	Part No	Inlet Conn Size (inch)	Outlet Conn Size (inch)	Dimensions (mm)					Drawing reference	Weight (kg)	Kv (m ³ /hr)	CE Cat
				A	B	C	D	E				
92	923MTH	3/8 MPT	3/8 FPT	70	52	90	57	93	fig.2	0.57	2.80	SEP
802	8021TH	1/2 FPT	1/2 FPT	92	59	86	44	146	fig.1	1.47	4.78	SEP
802	8022TH	3/4 FPT	3/4 FPT	92	59	86	44	146	fig.1	1.33	7.60	SEP
802	8024TH	1 FPT	1 FPT	148	94	99	51	191	fig.1	3.70	10.07	SEP
802	8025TH	1 1/4 FPT	1 1/4 FPT	148	94	99	51	191	fig.1	3.25	14.36	Cat I

RUPTURE DISCS

The function of a Rupture Disc is to protect against over-pressure. For safety reasons, excessive over-pressure in any part of the refrigeration system must be avoided. A rupture disc is generally used in combination with a Henry Technologies pressure relief valve.

Applications

A rupture disc protects against any leakage or weeping of refrigerant through a relief valve. A rupture disc can also be used in combination with a pressure gauge and/or pressure switch to detect if a relief valve has discharged.

Henry Technologies rupture discs are designed to operate with gases and should not be used to prevent liquid over-pressure.

The brass 55 series models are suitable for use with HCFC, HFC, HFO and CO₂ refrigerant gases. The stainless steel 56 series models are also suitable for ammonia.

In line with the Institute of Refrigeration Guidelines (UK), it is recommended that at least every 5 years all low and high side bursting discs should be replaced. This interval may have to be reduced if other regulations apply.

How it works

A foil disc is clamped in a holder. The disc is designed to burst at a pre-determined pressure - the set pressure. A reverse acting disc is used. This means that the disc is domed against the direction of the fluid pressure and designed to buckle due to compression forces, prior to bursting. Advantages of a reverse acting disc include being less sensitive to temperature, high operating pressures and improved fatigue life. Each disc is manufactured with a precision score mark. This score mark in combination with the buckling action causes the disc to burst. At burst, the disc is designed to hinge resulting in a large available flow area. The disc is designed to be non-fragmenting after rupturing.

Materials of Construction

For 55 and 56 series, the main bodies are made from brass and stainless steel respectively.

The foil disc is made from Nickel alloy.

Main features

- Proven safe design
- CE marked
- High flow capacity
- Compact
- Reverse acting, non-fragmenting disc
- 2 x 1/8 NPT pressure ports
- Helium leak tested
- Pressure settings up to 130 barg available on request
- EN ISO 4126-2 Compliant

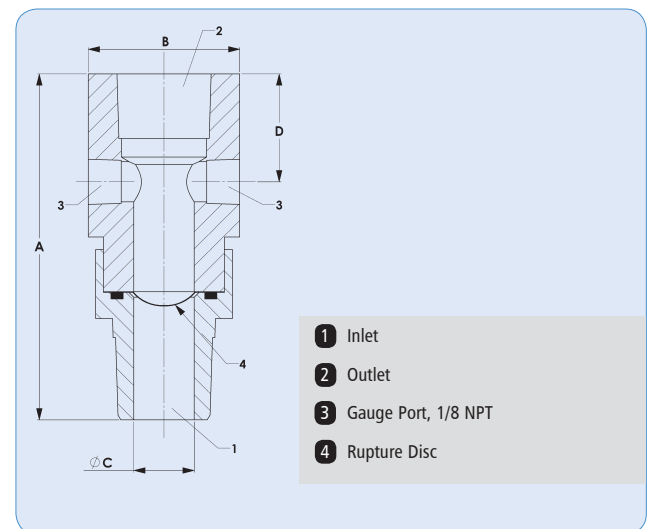


Technical Specification

Set pressure range = 10.3 to 60 barg (55 series)

Set pressure range = 10.3 to 130 barg (56 series)

Allowable operating temperature = -40°C to +107°C



Part No	Conn Size (inch)		Dimensions (mm)					Maximum Setting pressure (barg)	Weight (kg)	CE Cat
	Inlet	Outlet	A	B	ØC	D	MNFA, mm ² (note 1)			
5525	3/8 NPT	3/8 FPT	65	31.8 A/F	9.7	20	64.5	60	0.28	Cat IV
5526	1/2 NPT	1/2 FPT	73	31.8 A/F	12.7	23	109.7	60	0.30	Cat IV
5625	3/8 NPT	3/8 FPT	65	Ø28.6	9.7	20	64.5	130	0.20	Cat IV
5626	1/2 NPT	1/2 FPT	73	Ø28.6	12.7	23	109.7	130	0.20	Cat IV
5627	3/4 NPT	3/4 FPT	81	Ø38.1	19	29	187.1	130	0.34	Cat IV
5628	1 NPT	1 FPT	93	Ø44.5	25.5	32	335.5	130	0.56	Cat IV
5629	1 1/4 NPT	1 1/4 FPT	95	50.8 A/F	33.3	33	683.9	130	0.76	Cat IV

Note 1: MNFA = Minimum net flow area. The MNFA is the net area after a complete disc burst, taking into account any structural members which reduce the nominal flow area. MNFA should be used as the flow area, A, in flow capacity calculations

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PRESSURE INDICATOR

The function of the Pressure Indicator is to provide visual indication in the event of a rupture disc burst. If the disc has ruptured, the pressure relief valve will have discharged and must be replaced. (refer to Sentry safety device information).

Applications

The G16 and G20 Pressure Indicators are intended to be used as part of the Henry Sentry safety device assembly.

The units are suitable for use with HCFC, HFC, HFO, CO₂ and ammonia refrigerants, along with their associated oils.

Main features

- Easy to read large indicator dial
- Stainless steel movement

Technical Specification

Allowable operating pressure = 0 to 200 barg

Allowable operating temperature = -40°C to + 65°C

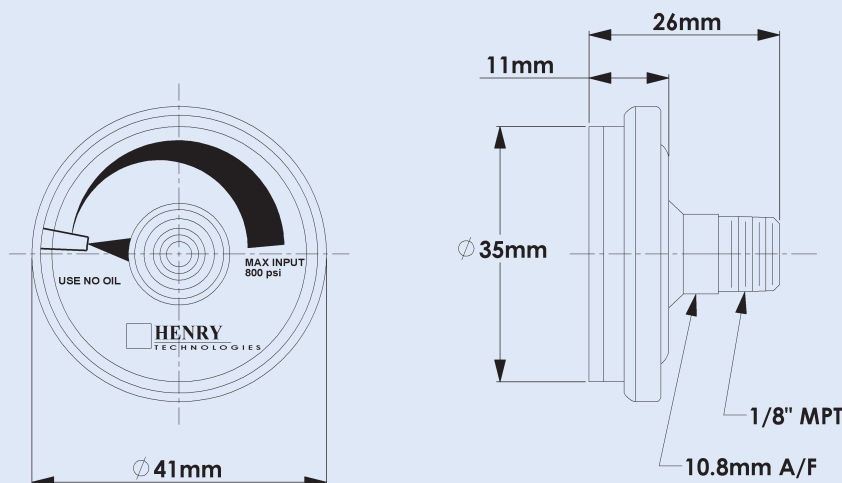
Materials of Construction

Stainless steel case and movement.

Plexiglas dial window.



Part No	MWP (barg)	Weight (g)	CE Cat
G16	55	27	SEP
G20	200	27	SEP



The information contained in this brochure is correct at the time of publication.

Henry Technologies has a policy of continuous product development; we therefore reserve the right to change technical specifications without prior notice.

Extensive changes within our industry have seen products of Henry Technologies being used in a variety of new applications. We have a policy, where possible, to offer research and development assistance to our clients. We readily submit our products for assessment at the development stage, to enable our clients to ascertain product suitability for a given design application.

It remains the responsibility of the system designer to ensure all products used in the system are suitable for the application. For details of our warranty cover, please refer to our standard terms and conditions of sale. Copies are available on request.

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