DATA SHEET

T 2557 EN

Type 2357-1 Pressure Regulator · Types 2357-2 Excess Pressure Valve

Self-operated Pressure Regulators for special applications

CE

Application

Pressure regulators for cryogenic gases as well as other liquids, gases, and vapors · Operating pressures up to **50 bar** Set point ranges from **0.2** to **40 bar** · Temperatures from **–196** to **+200 °C** · Oxygen clean according to international standards and guidelines

Type 2357-1 · Pressure build-up regulator: valve **opens** when the upstream pressure **drops**
Type 2357-1 · Pressure reducing valve: valve **closes** when the downstream pressure **rises**
Type 2357-2 · Excess pressure valve: valve **opens** when the upstream pressure **rises**

Industrial gases (such as argon, nitrogen and oxygen) are stored in a liquefied condition at extremely low temperatures and at a constant pressure in thermally insulated tanks. Pipes transport the medium to the consumer. The extreme operating conditions (pressures up to 50 bar and temperatures down to –196 °C) require the use of special valves.

The Series 2357 Pressure Regulators are especially designed for the conditions in cryogenic service. These regulators can also be used for gases, liquids and vapors under other operating conditions.

Special features

- Low-maintenance proportional regulators requiring no auxiliary energy
- Wide set point range and convenient set point adjustment
- Rugged design and low overall height
- Cleaned and packed for oxygen service

Versions

The pressure regulators consist of a valve body with two ports (marked A and B), internal operating diaphragm and set point adjuster.

– **Types 2357-1 Pressure Build-up Regulators with safety function** · The upstream pressure is transmitted to the operating diaphragm. The valve opens when the upstream pressure drops. Direction of flow from port B to port A.

  Safety function: the plug in the pressure build-up regulator operates like a safety valve and relieves the pressure chamber. The pressure acts from below against the plug surface. The valve opens to equalize the pressures.

– **Types 2357-1 Pressure Reducing Valve (globe valve):** the valve regulates the downstream pressure to the adjusted set point. The valve closes when the downstream pressure rises. Direction of flow from port A to port B.

Fig. 1: *Type 2357-1 Pressure Regulator (pressure build-up regulator or pressure reducing valve)*

Fig. 2: *Type 2357-2 Pressure Regulator (excess pressure valve)*

– **Types 2357-2 Excess Pressure Valve (angle valve):** the valve regulates the upstream pressure to the set point adjusted at the set point adjuster. The valve opens when the pressure increases until the set point is reached.

  Type 2357-2 can be optionally equipped with a non-return unit. In thermally insulated tanks, the excess pressure is relieved by feeding the gas into the consumer pipeline.

Accessories

– **Types 2357-1/-2:** mounting parts - soldering nipple with ball-type bushing (for connection to 16 or 15 mm pipe diameter); filter with 270 or 50 µm mesh

– **Type 2357-2:** non-return unit

Further accessories in Data Sheet ▶ T 2570.

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Principle of operation

Functioning as a p**ressure build-up regulator** with direction of flow from port B to port A, the pressure upstream of the valve (port B) is transmitted to the operating diaphragm. The valve closes when the upstream pressure increases and opens when the upstream pressure drops.

The pressure build-up regulator operates as a safety valve and relieves the pressure chamber of pressure when the pressure exceeds the set point by 5 bar. After overcoming the spring force of the top springs (16), the valve opens to equalize the pressures.

The process medium flows from port A to port B when the Types 2357-1 Pressure Regulators are used as **pressure reducing valves**.

The valve is open when no pressure is applied. The pressure downstream of the valve (port B) is transmitted to the operating diaphragm (3). The positioning force produced moves the valve plug (2.1) depending on the spring force adjustable at the set point adjuster (10). The valve closes when the pressure downstream of the valve (port B) rises.

The medium always flows through the **Types 2357-2 Excess Pressure Valves** from port A to port B. The valve is closed when no pressure is applied. The pressure at port A is transmitted internally to the operating diaphragm (3). The positioning force produced opposes the adjustable spring force. The valve opens when the pressure increases until the set point is reached.

To discharge small quantities of gas, the Type 2357-2 Excess Pressure Valve can be used with special accessories. The safety valve does not react when just the gas volume must be discharged due to heat leak.

The excess pressure valve can additionally be equipped with a non-return unit, which prevents the medium from flowing back through the valve.

Installation

- Standard mounting position with the spring housing suspended downward. Other mounting positions on request.
- Build-up pressure regulator with safety function: direction of flow from port B to port A
- Pressure reducing valve: direction of flow from port A to port B
- Type 2357-2 Excess Pressure Valve with non-return unit: the center axis of the regulator must be vertical and port B must point upward.

EC type examination

An EC type examination according to the Pressure Equipment Directive 97/23/EC, Module B has been performed on the regulators (PN 50 version).

Serial number

The devices are marked with a serial number on the nameplate. Details on the nameplate are listed in ▶ EB 2557.

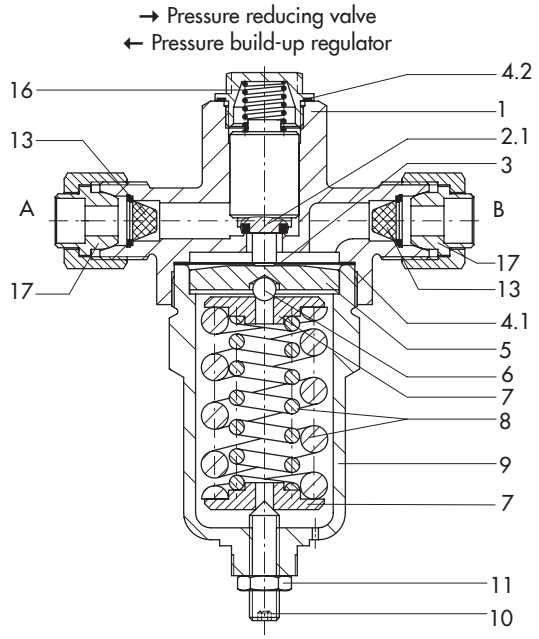


Fig. 3: *Type 2357-1 Pressure Build-up Regulator or Pressure Reducing Valve (PN 50)*

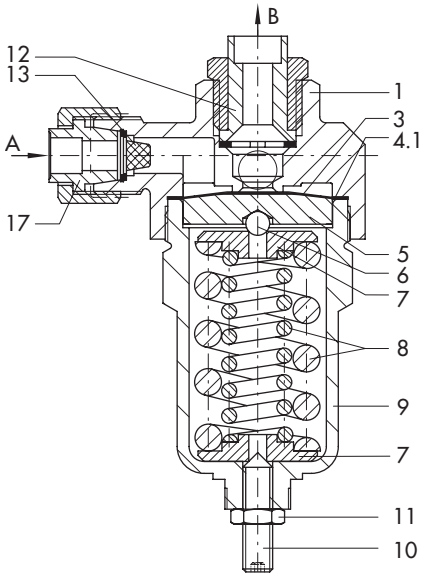


Fig. 4: *Type 2357-2 Excess Pressure Valve (PN 50)*

1 Valve body
2.1 Plug
3 Operating diaphragm
4.1 Gasket (bottom section of the body)
4.2 Seal (top section of body)
5 Diaphragm plate
6 Ball
7 Spring plate
8 Set point springs
9 Bottom section of the body (spring housing)
10 Set point adjuster (hexagon socket, SW 5)
11 Lock nut (SW 17)
12 Non-return unit (accessories)
13 Filter
16 Plug spring
17 Soldering nipple with ball-type bushing (accessories)

Sample application (schematic drawing)

Pressure regulator functioning as a pressure build-up regulator with safety function

When tapping the liquefied cryogenic gas, the gas pressure in the insulated tank causes the medium to be transferred to the vaporizer (8). The gas pressure in the tank drops below the adjusted operating pressure. The Type 2357-1 Regulator (installed as a pressure build-up regulator; 2) opens and allows the liquefied gas to flow into the pressure build-up vaporizer (7). The gas pressure increases and reaches the operating pressure again. The pressure build-up regulator (2) closes.

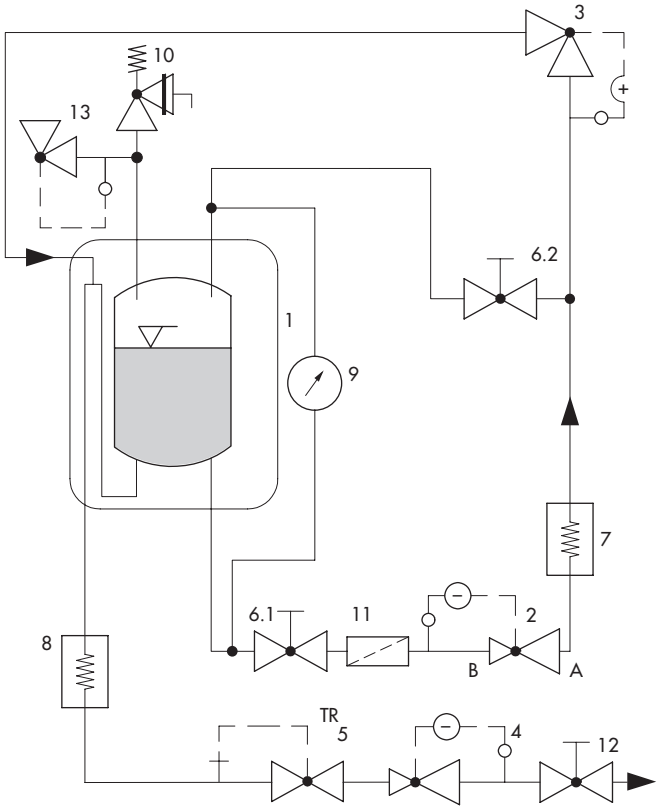
After closing the shut-off valve (6.1), the liquid remaining in the pipeline between shut-off valve (6.1) and regulator (2) vaporizes, causing the pressure to increase. The plug of the pressure build-up regulator (2) acts as safety valve by opening the valve (upstream pressure at port B) to equalize the pressures. The pressure chamber is relieved of pressure as a result.

Pressure regulator functioning as an excess pressure valve (economizer)

The Type 2357-2 Excess Pressure Valve (3) is adjusted to a pressure above the operating pressure. Any liquid trapped between the shut-off valves (6.1 and 6.2) vaporizes, causing the pressure to increase. The excess pressure valve (3) opens, allowing the gas to escape into the consumer pipeline.

Pressure regulator functioning as a pressure reducing valve

If a lower pressure is required in the draw-off pipe, the Type 2357-1 Pressure Regulator can be used to function as a pressure reducing valve (4).



1 Cryogenic tank
2 Type 2357-1 Pressure Build-up Regulator
3 Type 2357-2 Excess Pressure Valve (economizer)
4 Types 2357-1 Pressure Reducing Valve
5 Type 2040 Temperature Monitor
6.1 Shut-off valve
6.2 Shut-off valve
7 Pressure build-up vaporizer
8 Final vaporizer
9 Media 5/Media 6 Level Meter
10 Safety valve
11 Strainer (filter)
12 Shut-off valve
13 Pressure protection by Type 2357-2 with special accessories

Fig. 5: *Series 2357 Pressure Regulator for cryogenic service, schematic drawing*

Table 1: *Type 2357-... · Valve versions and end connections*

Type	Design	Version	Connections	
			Input	Output
2357-1	Pressure build-up regulator/pressure reducing valve	Globe valve	G ¾ A Conical joint	
2357-2	Excess pressure valve	Angle valve	G ¾ A Conical joint	G ¾ Female thread

Table 2: *Technical data · All pressures in bar (gauge)*

Type	2357-1		2357-2	
K_{VS} coefficient	0.25	0.8	1.25	0.4
Set point ranges [1] in bar	1 to 25 10 to 36	1 to 8 5 to 25 8 to 40		1 to 25 10 to 36
Nominal pressure	PN 40	PN 50		PN 40
Safety function for Types 2357-1	5 bar above the set point			
Max. perm. differential pressure Δp	Types 2357-1 Pressure Reducing Valves: Gases 30 bar · Liquids 6 bar Types 2357-2 Excess Pressure Valve: 3 bar (> 3 bar only with special accessories)			
Temperature range	–196 to +200 °C			

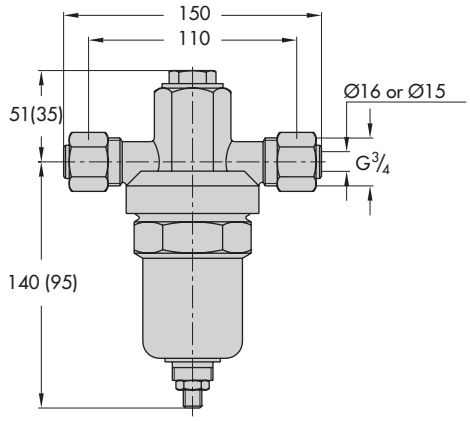
[1] Further set point ranges on request

Table 3: *Materials · Material numbers according to DIN EN*

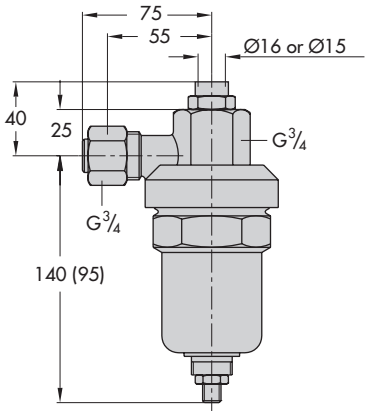
Type	2357-1	2357-2
Building	CC754S-GM (brass) [1]	
Cover	CC754S-GM (brass) [1]	
Plug	CW602N (brass) with PTFE soft seal	–
Operating diaphragm	CuBe	
Set point springs	Stainless steel (1.4310)	
Body gasket	PTFE	

[1] PN 40: CW617N (brass)

Dimensions



Type 2357-1 Pressure Regulator with soldering nipple (accessories)
Weight 2.0 (0.9) kg



Type 2357-2 Pressure Regulator with soldering nipple and non-return unit (accessories) · Weight 1.7 (0.6) kg

Specifications in parentheses () apply for regulators in PN 40

Flow capacity of the regulator dependent on the liquid column in the cryogenic tank

The value table and the mass flow diagram show the flow capacity for the media nitrogen (N_2), oxygen (O_2), argon (Ar), carbon dioxide (CO_2) and natural gas (LNG).

The specifications apply to the Type 2357-1 Pressure Build-up Regulator installed in the liquid phase of the pressure build-up control loop; as shown in Fig. 5 (sample application).

The maximum flow capacity [kg/h] of the regulator arises from the liquid level of the medium in the tank and can be determined from the graph.

The data in the graph are based on theoretical calculations which do not take factors, such as pressure losses in the pipeline, into account. Therefore, the real flow capacity may deviate from the calculated value.

Table 4: *Mass flow dependent on the liquid column in the cryogenic tank*

Filling level [m]	Mass flow rate [kg/h]				
	N_2	O_2	Ar	CO_2	LNG
1	248	351	427	359	130
3	379	537	653	550	199
5	475	673	819	689	249
7	555	785	956	805	291
9	624	884	1,076	906	328
11	687	973	1,184	996	361
14	771	1,093	1,329	1,119	405
17	848	1,201	1,460	1,230	445
20	918	1,300	1,580	1,331	482

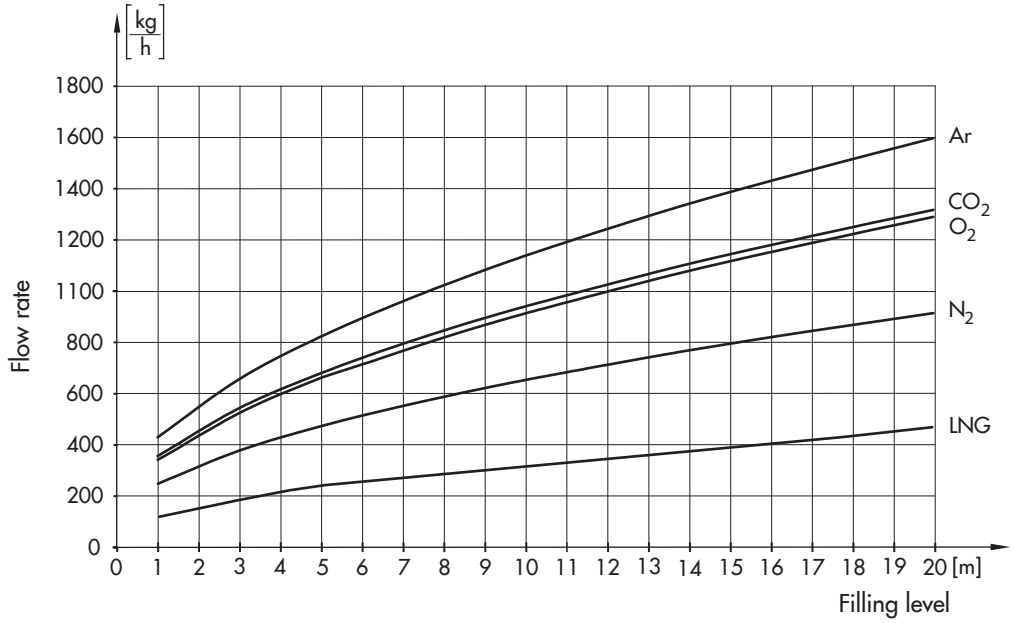


Fig. 6: *Mass flow dependent on the liquid column in the cryogenic tank*

Ordering text

Types 2357-1/-2 Pressure Regulators

Set point range ... bar

Optionally, accessories ...

Special version ...