

T 2560 EN

Type 2357-11 Pressure Regulator · Type 2357-21 Excess Pressure Valve Self-operated Pressure Regulators



Application

Pressure regulators for **cryogenic gases** and **liquids** as well as other **liquids, gases and vapors** · Operating pressures up to **63 bar** · Set points from **0.2 to 40 bar** · Temperatures from **-200 to +200 °C** · Oxygen clean according to international standards and guidelines

Pressure build-up regulator · Valve opens when the upstream pressure drops

Pressure reducing valve · Valve closes when the downstream pressure rises

Excess pressure valve · The 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 -200 °C) make it necessary to use 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 ¹⁾

Versions

The pressure regulators consist of a valve body, operating diaphragm and set point adjuster.

Type 2357-11 Pressure Build-up Regulator with safety function

The upstream pressure is transmitted to the operating diaphragm. The valve opens when the upstream pressure falls below the adjusted set point. 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.

¹⁾ The regulators are not approved for oxygen service according to EIGA 13/02/E due to the use of thin-walled components made of CrNi steel



Fig. 1: Type 2357-11 Pressure Regulator/Type 2357-21 Excess Pressure Valve

Type 2357-11 Pressure Reducing 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.

Type 2357-21 Excess Pressure 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. Direction of flow from port B to port A.

The valve opens when the pressure increases until the set point is reached. The regulator is additionally equipped with an integrated non-return unit that prevents the medium from flowing back.

Special versions (details on request)

Type 2357-11 and Type 2357-21 Pressure Regulators

- Version for flammable gases

Accessories

Coupling nut and ball-type bushing with welding nipple for 21.3x1.6 mm pipe diameter · Coupling nut and ball-type bushing with flanges · Other accessories in Data Sheet

▶ T 2570.

Principle of operation

Ports A and B are marked on the valve body.

Functioning as **Type 2357-11 Pressure Build-up Regulator** (Fig. 2)

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. The resulting downstream pressure is 5 bar below the upstream pressure.

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 valve (port B) increases.

The medium flows through the **Type 2357-21 Excess Pressure Valve** (Fig. 3) from port B to port A. The valve is closed when no pressure is applied. The pressure at port B 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. The integrated non-return unit prevents the medium from flowing back.

Installation

Type 2357-11 Pressure Build-up Regulator (pressure reducing valve)

- Standard mounting position with the spring housing suspended downward. Other mounting positions on request.
- **Build-up pressure regulator:** direction of flow from port B to port A
- **Pressure reducing valve:** direction of flow from port A to port B

Type 2357-21 Excess Pressure Valve with non-return unit

- Installation in horizontal pipelines
- Direction of flow from port B to port A
- Spring housing points downward

EC type examination

An EC type examination according to the Pressure Equipment Directive 2014/68/EU, Module B has been performed on the Type 2357-11 Regulator.

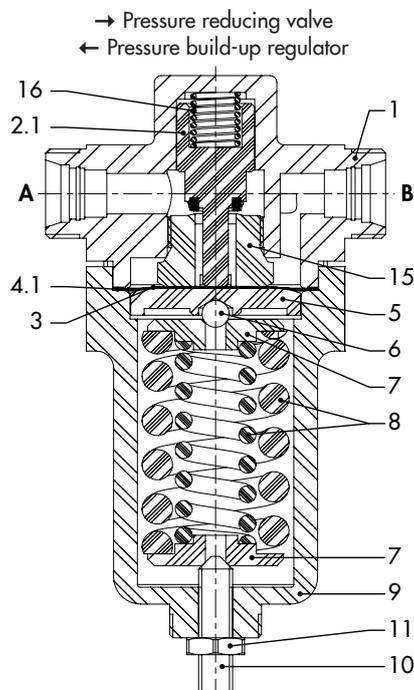


Fig. 2: Type 2357-11 Pressure Build-up Regulator or Pressure Reducing Valve

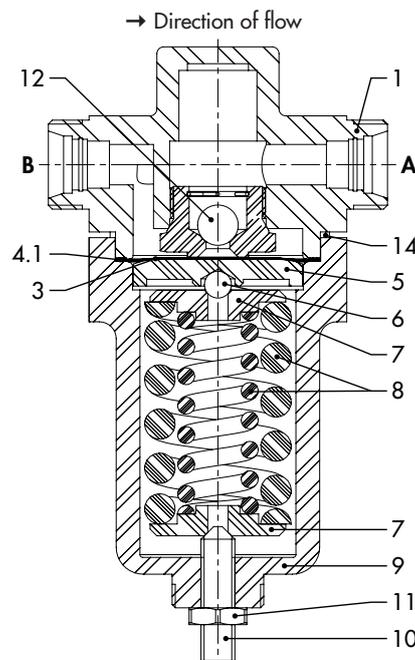


Fig. 3: Type 2357-21 Excess Pressure Valve

1	Valve body	9	Bottom section of the body
2.1	Plug	10	Set point adjuster
3	Operating diaphragm	11	Lock nut
4.1	Seal	12	Integrated non-return unit
5	Diaphragm plate	14	Housing screws
6	Ball	15	Seat
7	Spring plate	16	Plug spring
8	Set point springs		

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 2357-11 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

The Type 2357-21 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 2357-11 Pressure Regulator can be used to function as a pressure reducing valve (4).

Sample application

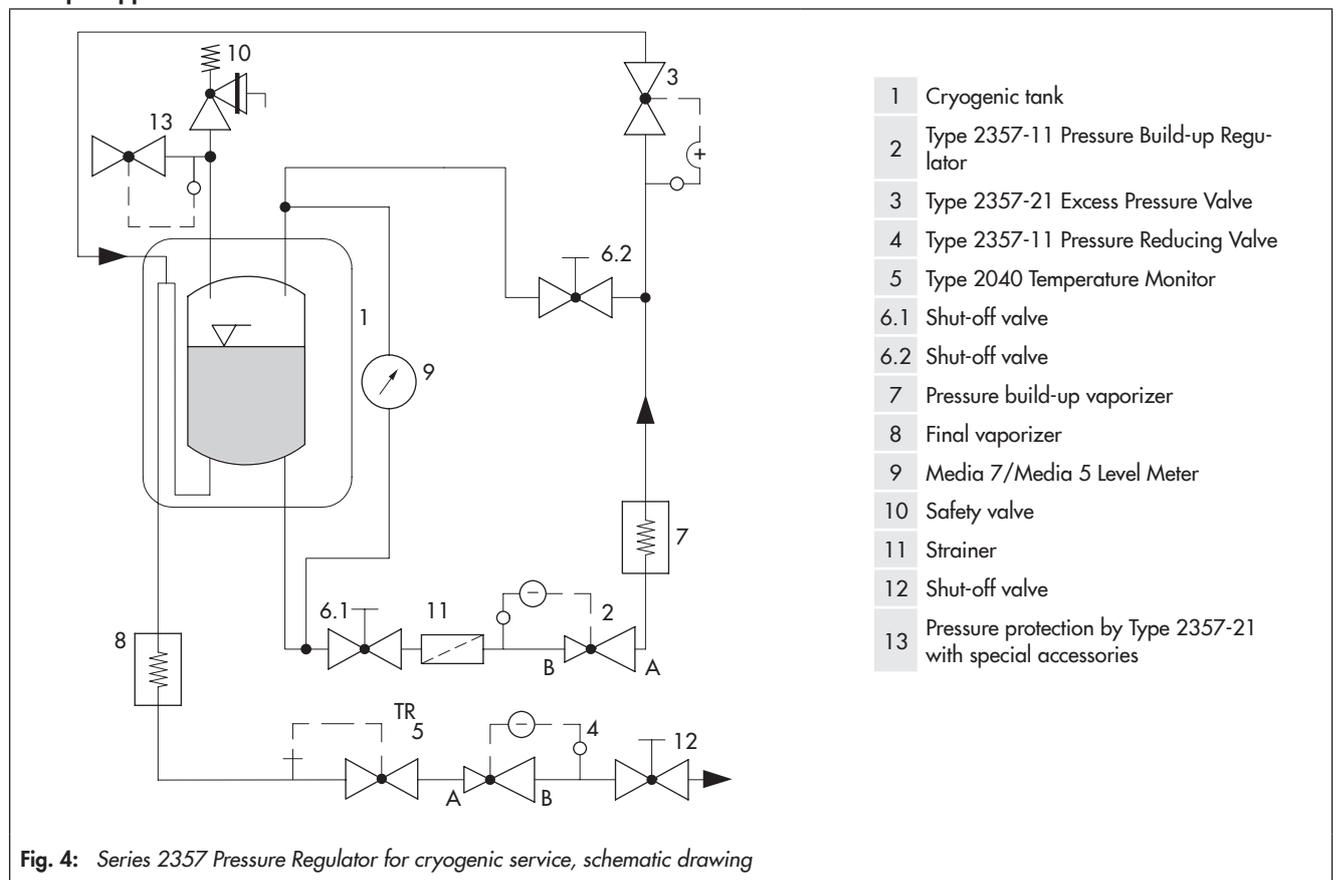


Table 1: Technical data · All pressures in bar (gauge)

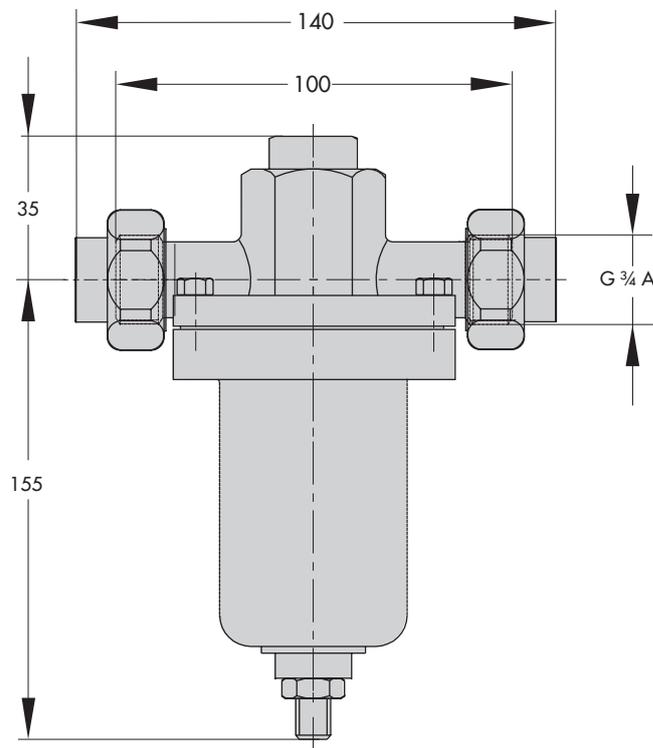
Type	2357-11	2357-21
K_{VS} coefficient	0.8	1.25
Set point ranges ¹⁾ in bar	0.2 to 2.5 · 1 to 8 · 5 to 25 · 8 to 40	
Permissible operating pressure	63 bar ²⁾	
Conformity	CE · UK CA	
Safety function for Type 2357-11	5 bar above the set point	
Max. perm. differential pressure Δp	Type 2357-11 Pressure Reducing Valve: Gases 30 bar · Liquids 6 bar Type 2357-21 Excess Pressure Valve: 3 bar (> 3 bar only with special accessories; K_{VS} reduced to 0.02)	
Temperature range	-200 to +200 °C	

1) Further set point ranges on request

2) For oxygen $p_{max} = 40$ bar

Table 2: Materials · Material numbers according to DIN EN

Type	2357-11	2357-21
Body	1.4404	
Spring housing	1.4404	
Plug	1.4404	
Operating diaphragm	CuBe with composite diaphragms made of 1.4310	
Set point springs	Stainless steel (1.4310)	
Body gasket	PTFE	

Dimensions in mm and weights

Type 2357-11 Pressure Regulator/Type 2357-21 Excess Pressure Valve with welding ends (accessories) · Weight approx. 4 kg

Fig. 5: Dimensions and weights

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 (N₂), oxygen (O₂), argon (Ar), carbon dioxide (CO₂) and natural gas (LNG).

The specifications apply to the **Type 2357-11** Pressure Build-up Regulator installed in the liquid phase of the pressure build-up control loop; as shown in Fig. 4 (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 3: 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

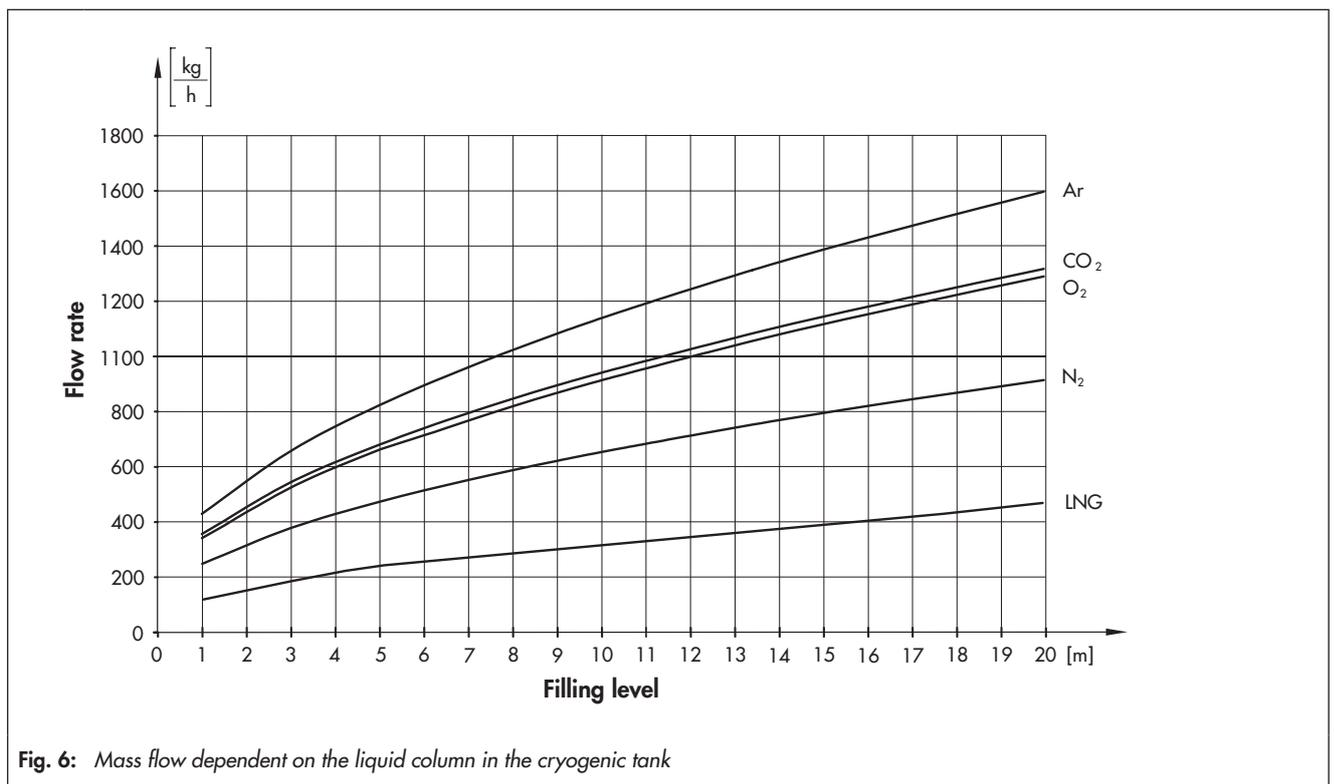


Fig. 6: Mass flow dependent on the liquid column in the cryogenic tank

Ordering text

Type 2357-11 and Type 2357-21 Pressure Regulators

Set point range ... bar

Optionally, accessories ...

Special version ...

