

# Self-operated Pressure Regulators

for special applications



## Type 2357-11 Pressure Regulator

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

**Pressure reducing valve** · Valve closes when the downstream pressure rises

**Type 2357-21 Excess Pressure Valve** · Valve opens when the upstream pressure rises

### Application

Pressure regulators for **cryogenic gases and liquids** as well as other **liquids, gases and vapors** · Operating pressures up to **63 bar** · Set point ranges from **1 to 40 bar** · Temperatures from **-200 to +200 °C** · Oxygen clean according to international standards and guidelines

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) 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 <sup>1)</sup>

### 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 of pressure. The pressure acts on the plug from below. The valve opens to equalize the pressures.

#### 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.

<sup>1)</sup> 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 2357-21 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 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 liquid hydrogen and 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 a **Type 2357-11 Pressure Build-up Regulator** (Fig. 2) 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 decreases.

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 force of the top plug spring (16), the valve opens to equalize the pressures.

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)**

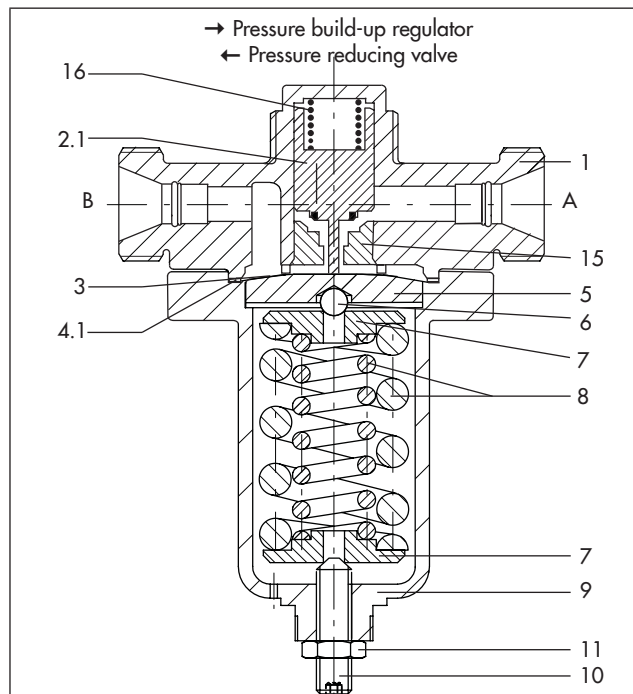
- Standard mounting position with the spring housing suspended downward. Other mounting positions on request.
- **Build-up pressure regulator:** direction of flow from port B to port A
- **Pressure reducing valve:** direction of flow from port A to port B

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

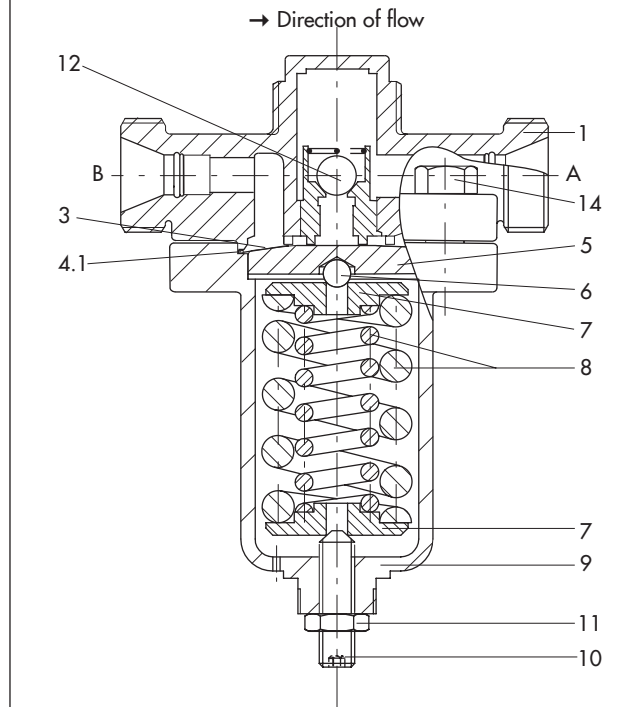
- Installation in horizontal pipelines
- Direction of flow from port B to port A
- Spring housing facing downward

**EC type examination**

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



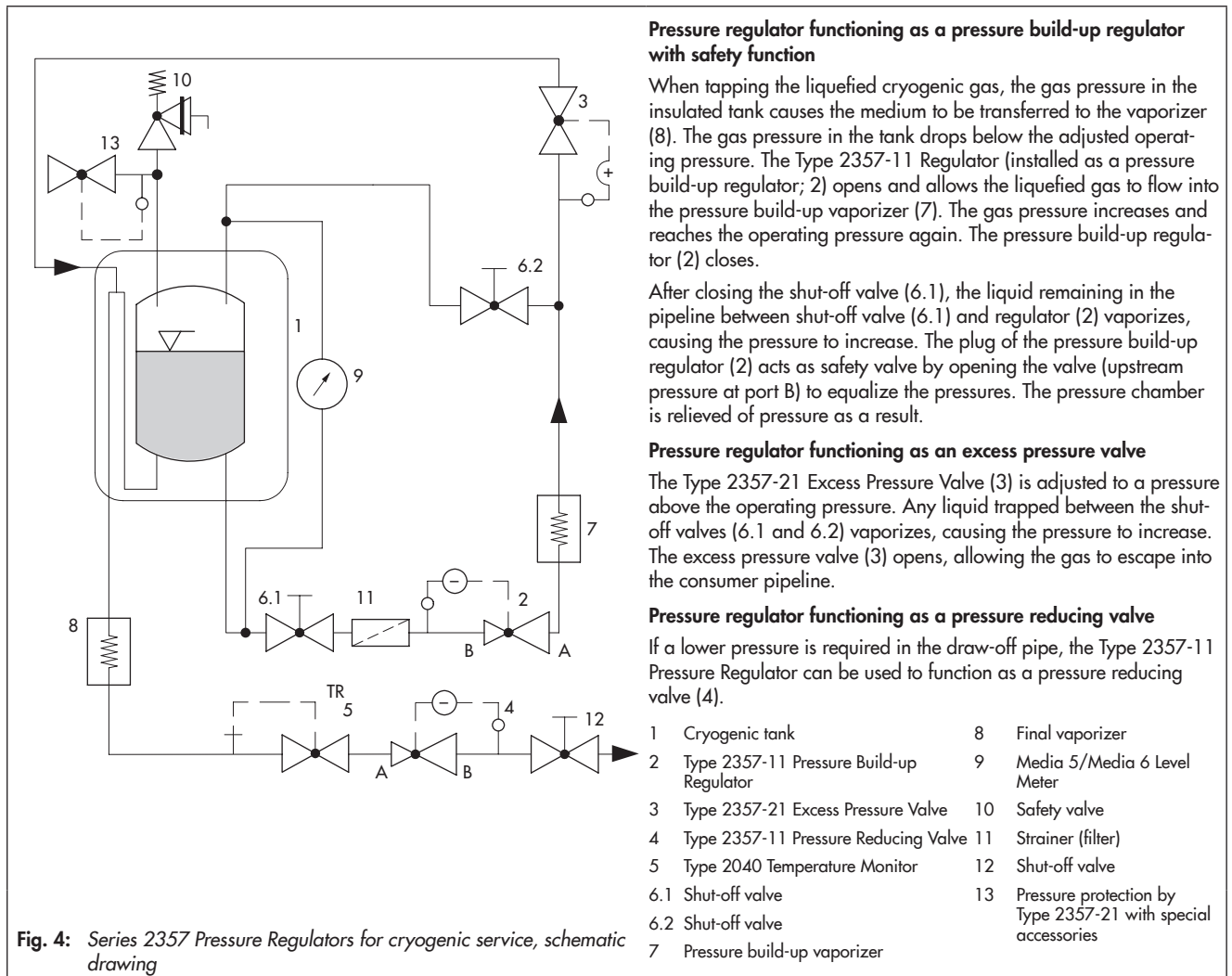
**Fig. 2:** Type 2357-11 Pressure Build-up Regulator or Pressure Reducing Valve



**Fig. 3:** Type 2357-21 Excess Pressure Valve

1 Valve body	10 Set point adjuster (hex socket, SW 5)
2.1 Plug	11 Lock nut (SW 17)
3 Operating diaphragm	12 Integrated non-return unit
4.1 Seal (bottom section of body)	14 Body screws
5 Diaphragm plate	15 Seat
6 Ball	16 Plug spring
7 Spring plate	
8 Set point springs	
9 Bottom section of body (spring housing)	

## Typical application (schematic drawing)



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

Type	2357-11	2357-2
$K_{VS}$ coefficient	0.8	1.25
Set point ranges <sup>1)</sup> in bar	1 to 8 5 to 25 8 to 40	
Permissible operating pressure	63 bar <sup>2)</sup>	
Safety function for Type 2357-11	5 bar above the set point	
Max. permissible differential pressure $\Delta p$	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)	
Temperature range	-200 to +200 °C	

<sup>1)</sup> Other set point ranges on request · <sup>2)</sup> For oxygen:  $p_{max} = 40$  bar

**Table 2: Materials** · Material numbers according to DIN EN

Type	2357-11	2357-21
Body	1.4408	
Spring housing	1.4408	
Plug	1.4404	
Operating diaphragm	CuBe with cover diaphragms made of 1.4404	
Set point springs	Stainless steel (1.4310)	
Body gasket	PTFE	

### 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 of the media nitrogen (N<sub>2</sub>), oxygen (O<sub>2</sub>), argon (Ar), carbon dioxide (CO<sub>2</sub>) and natural gas (LNG).

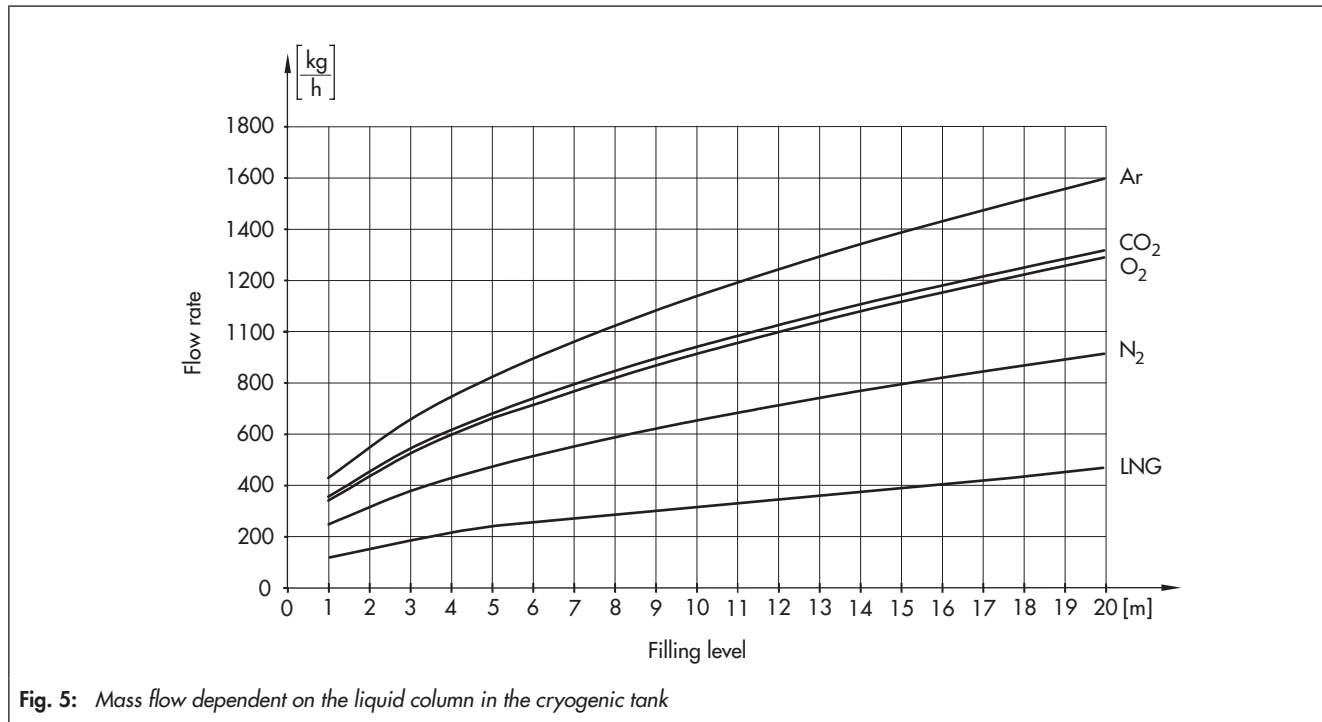
The specifications apply to the **Type 2357-11** Pressure Build-up Regulator installed in the liquid phase of the pressure build-up control loop; as shown in Fig. 4 (typical application).

The maximum flow capacity [kg/h] of the regulator arises from the liquid level [m] 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.

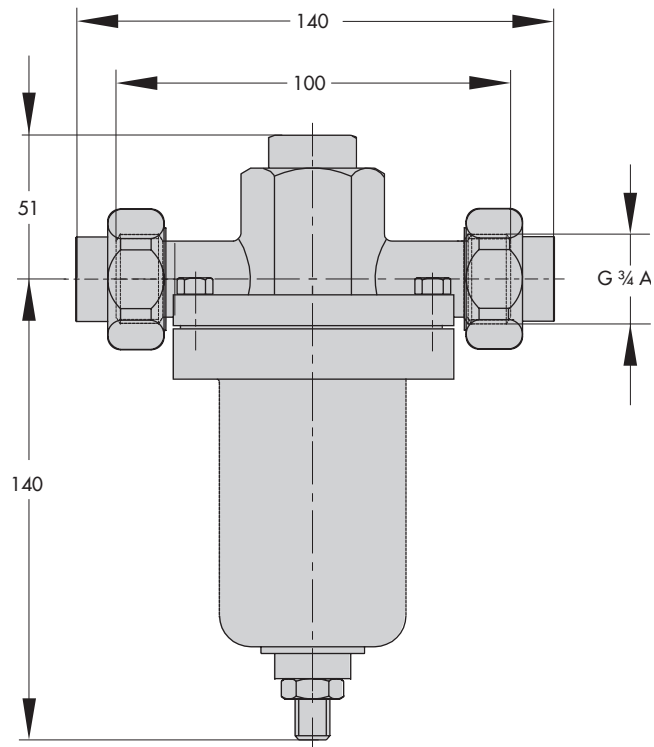
**Table 3:** Mass flow dependent on the liquid column in the cryogenic tank

Filling level [m]	Mass flow rate [kg/h]				
	N <sub>2</sub>	O <sub>2</sub>	Ar	CO <sub>2</sub>	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	1076	906	328
11	687	973	1184	996	361
14	771	1093	1329	1119	405
17	848	1201	1460	1230	445
20	918	1300	1580	1331	482



**Fig. 5:** Mass flow dependent on the liquid column in the cryogenic tank

## Dimensions and weights



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

All dimensions in mm

**Fig. 6:** *Dimensions and weights*

### Ordering text

Type 2357-11/Type 2357-21 Pressure Regulator

Set point range ... bar

Optionally, accessories ...

Special version ...

Specifications subject to change without notice



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