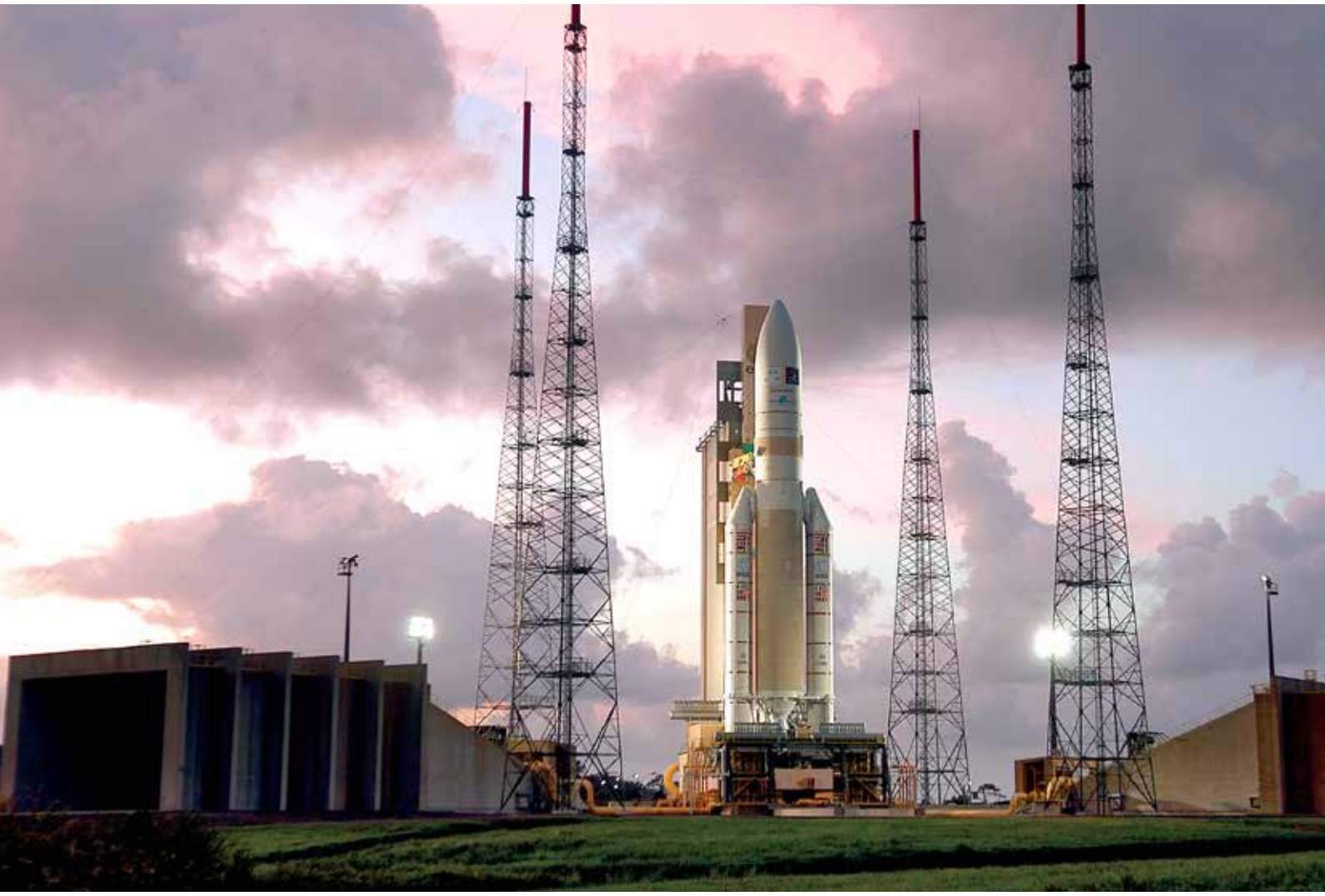
Flow rate pressure regulators



Capitalizing on its cryogenic engineering capabilities and extensive experience on space specific requirements, Air Liquide has developed a full range of mechanical flow rate pressure regulators.

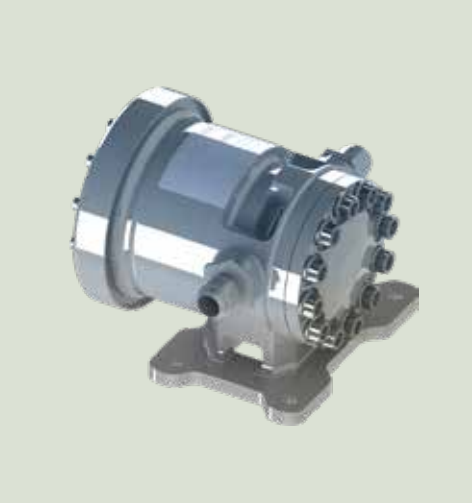
Air Liquide offers both standard and customized turnkey solutions to meet your specific needs and supports you throughout the different phases of your project: from preliminary studies to system qualification.

Key benefits

- ✓ Qualified for flight
- ✓ High level of accuracy
- ✓ Robustness
- ✓ Tightness
- ✓ Very compact size

Low flow rate pressure regulator

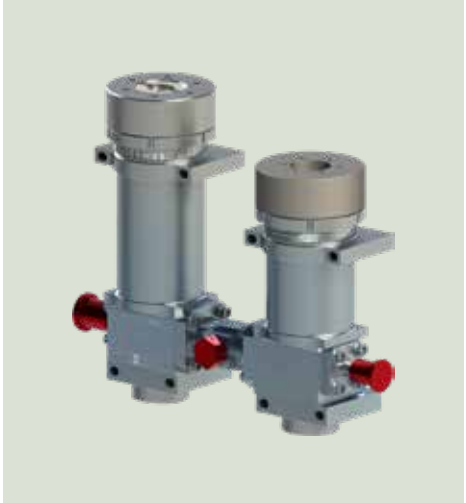
Single stage regulator (with integrated filter)



Application	Small launchers
Media (operational)	Gaseous helium
Media (compatibility)	Inert gas
Upstream Pressure	328 – 40 bar
Regulated pressure	31.4 ± 0.6 bar
Proof factor	1.5
Burst factor	2.5
Mass flow rate	4 g/s (nominal)
Response time	< 100 ms
External leak rate	10-4 scc/s (GHe)
Internal leak rate	10-3 scc/s (GHe)
Lifetime (ground storage)	8 years
Reliability	0.99997 (with a minimum level of confidence of 60%)
Thermal environment	-60°C / +43°C
Inlet gas temperature	-50°C / +33°C
Mass	< 1.7 kg
Dimension	• Length: 114 mm • Width: 113 mm • Height: 87 mm
Technology Readiness Level (TRL) according to ESA standards	Development in progress: TRL 6

Medium flow rate pressure regulator

Two stages regulator



Application	Upper stage heavy launchers
Media (operational)	Gaseous helium
Media (compatibility)	Inert gas
Upstream pressure	400 – 44 bar
Regulated pressure	20.75 ± 0.65 bar
Proof factor	1.5
Burst factor	2.5
Mass flow rate	22.5 g/s nominal (6.5 to 29 g/s)
Response time	< 100 ms
External leak rate	< 10-2 scc/s (GHe)
Internal leak rate	< 1 scc/s (GHe)
Lifetime (ground storage)	6 years
Reliability	0.99975 (with a minimum level of confidence of 60%)
Thermal environment	-20°C / + 70°C
Inlet gas temperature	-70°C / + 40°C
Mass	< 5 kg
Dimension	• Length: 216 mm • Width: 235 mm • Height: 75 mm
Technology Readiness Level (TRL) according to ESA standards	TRL 9

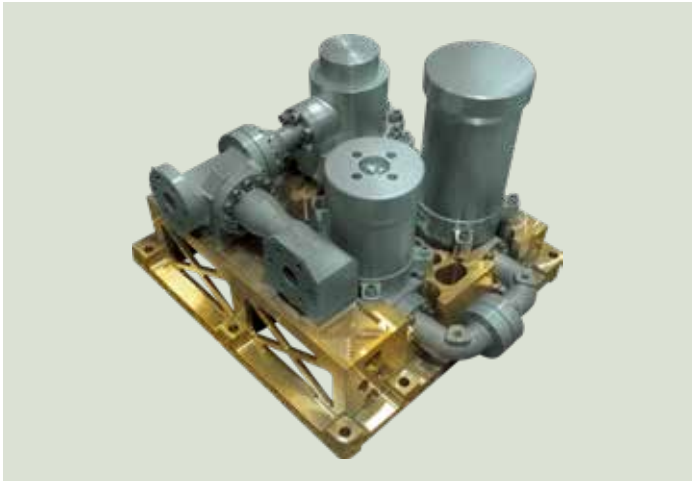
High flow rate pressure regulator

Two stages regulator
with regulation plate in option

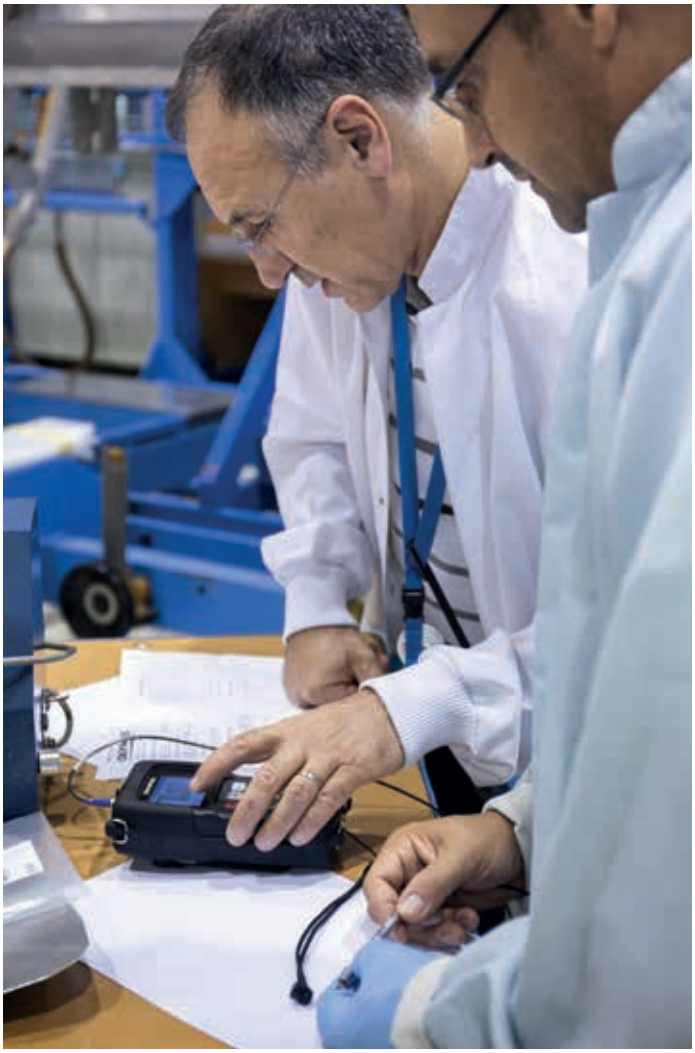
Much more than a high-flow rate pressure regulator, we propose a regulation plate, which is an integrated high performances and high quality solution allowing to:

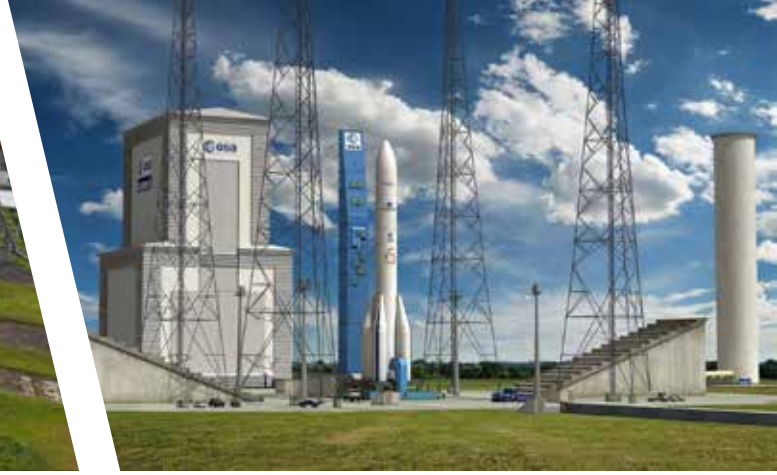
- Protect downstream circuits from any regulator failure (relief valve)
- Assess regulator behavior (pressure transducer)
- Protect system from a reverse flow (check valves)

Integrated components	• Filter • Two stages pressure regulator • Pressure transducer • Relief valve • Check valves
Application	Upper stage heavy and super-heavy launchers
Media (operational)	Gaseous helium
Media (compatibility)	Inert gas
Upstream Pressure	400 – 58 bar
Regulated pressure	41 to 49 bara according to mass flow rate
Proof factor	1.5
Burst factor	2.5
Mass flow rate	0.5 g/s to 170 g/s
Response time	< 2 s (oscillations induced by a perturbations last less than)
External leak rate	1 scc/s (GHe)
Internal leak rate	N/A
Lifetime (ground storage)	5 years
Reliability	0.99944 (with a minimum level of confidence of 60%)
Thermal environment	-120°C / 50°C
Inlet gas temperature	-120°C / 60 °C
Mass	< 19 kg (pressure regulator only: 9 kg)
Dimension	• Length: 374 mm • Width: 289 mm • Height: 254 mm
Technology Readiness Level (TRL) according to ESA standards	TRL 8



The high-flow rate pressure regulator can be sold separately.





Our strengths

- Recognized experience in the space adventure for 60 years
- Solid expertise in space cryogenics for ground facilities, launchers and satellites
- End-to-end solutions for your cryogenic propellants: from production to engine feeding onboard the launcher
- Dedicated teams providing support
- Unique cryogenic test center simulating space environment in order to qualify your flight equipment
- Resources of an international group

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A world leader in gases, technologies and services for Industry and Health, Air Liquide is present in 75 countries with approximately 66,400 employees and serves more than 3.8 million customers and patients.