

## Cold Gas Thruster (CGT)

Two Cold Gas Thruster (CGT) designs are available at AST to serve for pressure regulated and unregulated systems onboard spacecrafts. In regulated systems, a low-pressure Cold Gas Thruster (LP-CGT) can be operated at constant pressure conditions and therefore provide predictable and repeatable thrust performance. The fast-switching thruster allows very small impulse bits of 110  $\mu$ Ns. The miniature valve produces very small shocks during actuation which makes it well useable for shock-noise sensitive applications. Combined with its exceptional lifetime this thruster design allows for a highly accurate satellite attitude control.



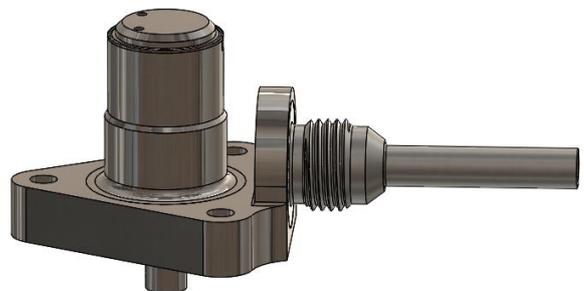
The high-pressure configuration of AST's Cold Gas Thruster (HP-CGT) accepts operation in blow-down mode when directly connected to the propellant storage tank. Especially at begin of mission life this allows for high thrust (up to 4 N) which can be used for spacecraft fast detumbling or even orbit control.

Both CGT configurations are composed of inlet interface, inlet filter, miniature valve, a mounting body and thruster nozzle. Depending on the

operational needs, the CGT design can be mounted on heated brackets or equipped with dedicated heating elements to maintain known operational conditions. Only stainless steel and FKM materials are in contact with the gas which provide good gas compatibility and allow a very wide range of applications.

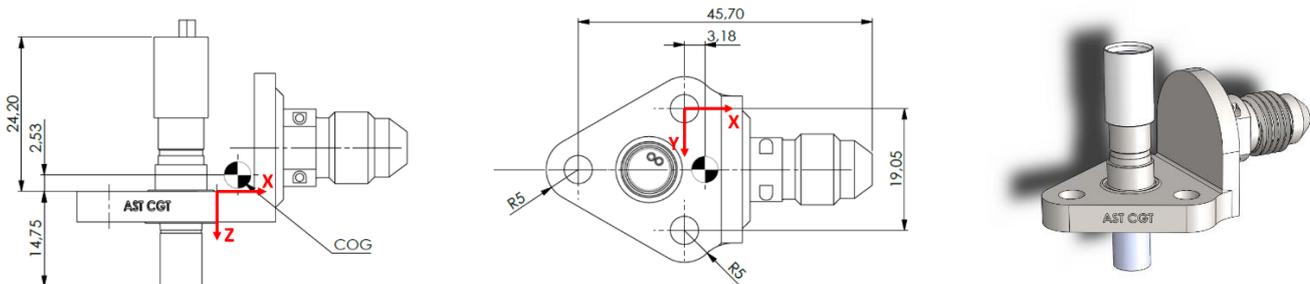
The CGT design is an all-welded design which provides robustness against rupture and propellant loss. All high-pressure joints are made by electron-beam welding and each unit is proof-pressure and leakage tested before shipment. Inlet filters and nozzle dust-caps protect the unit during handling and integration.

The designs are based on AST's flight heritage components and manufacturing processes. Flight heritage exists with the heritage LP-CGT design for use with Nitrogen. An upgraded design of the LP-CGT is qualified for operation with Xenon and the HP-CGT is in development.



## LP-CGT - Characteristics

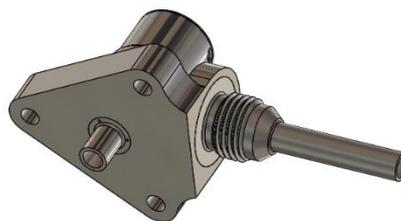
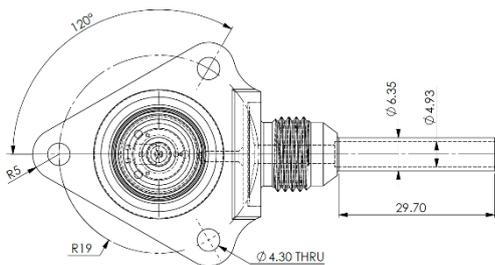
<i>Parameter</i>	<i>Value</i>	<i>Remark</i>
<i>Operating Media</i>	<i>He, N2, Xe, Kr</i>	<i>N2 with flight heritage</i>
<i>Inlet Pressure MEOP</i>	<i>1 to 6 bar</i>	<i>typical 1 to 2 bar regulated</i>
<i>Proof Pressure</i>	<i>1.5 x MEOP</i>	<i>verified during acceptance tests</i>
<i>Burst Pressure</i>	<i>4 x MEOP</i>	<i>design value &gt; 24 bar</i>
<i>Thrust</i>	<i>up to 34 mN / bar</i>	<i>Thrust proportional to inlet pressure Wide range of thrust levels available</i>
<i>Minimum Impulse Bit</i>	<i>110 μNs</i>	<i>heritage @ 1bar, N2</i>
<i>Specific Impulse</i>	<i>&gt;69 s &gt;25s</i>	<i>Heritage with N2 qualified with Xe</i>
<i>Internal Leakage</i>	<i>&lt; 1*10-5 sccs GHe</i>	<i>verified during acceptance tests</i>
<i>External Leakage</i>	<i>&lt; 1*10-8 sccs GHe</i>	<i>verified during acceptance tests</i>
<i>Thermal Range non-op</i>	<i>-35°C to +95°C</i>	<i>incl. qualification margin</i>
<i>Thermal Range op</i>	<i>-10°C to +80°C</i>	<i>full performance, depending on gas</i>
<i>Thermal Range op (cold start)</i>	<i>-20°C to +80°C</i>	<i>limited performance (heater recommended)</i>
<i>Fluid Filtration Rate</i>	<i>11μm</i>	<i>5μm mesh at inlet</i>
<i>Mass</i>	<i>&lt; 60g</i>	<i>w/o harness or pipework</i>
<i>Average Power Consumption</i>	<i>&lt;1 W</i>	<i>at hold-voltage; depending on valve actuation frequency</i>
<i>Valve Operating Voltage</i>	<i>22V to 32V</i>	<i>min pull-in voltage required for motorization margin; 50% hold-voltage</i>
<i>Vibration Qualification Levels</i>	<i>&gt;30 gRMS</i>	<i>all 3 axis</i>
<i>Radiation Tolerance</i>	<i>&gt;480 krad</i>	<i>Total Ionizing Dose (TID)</i>



The LP-CGT characteristics are subject to changes. Please contact AST for details and requests on further options.

## HP-CGT - Characteristics

<i>Parameter</i>	<i>Value</i>	<i>Remark</i>
<i>Operating Media</i>	<i>N2, Ar, Kr, Xe,</i>	<i>Characterization Tests performed</i>
<i>Inlet Pressure MEOP</i>	<i>186 bar</i>	<i>For use with Xenon</i>
	<i>300 bar</i>	<i>For Use with Krypton, Argon</i>
<i>Proof Pressure</i>	<i>1.5 x MEOP</i>	<i>verified during acceptance tests</i>
<i>Burst Pressure</i>	<i>2.5 x MEOP</i>	<i>design value &gt; 465 bar</i>
<i>Thrust</i>	<i>up to 4 N</i>	<i>Thrust proportional to inlet pressure</i> <i>Wide range of thrust levels available</i>
<i>Minimum Valve Actuation Time</i>	<i>10ms</i>	<i>Typical min valve actuation</i>
<i>Specific Impulse</i>	<i>&gt;65 s (N2), &gt;50s (Ar)</i> <i>&gt;35s (Kr), &gt;25 s (Xe)</i>	<i>Depending on inlet pressure and gas temperature</i>
<i>Internal Leakage</i>	<i>&lt; 1*10-5 sccs GHe</i>	<i>verified during acceptance tests</i>
<i>External Leakage</i>	<i>&lt; 1*10-8 sccs GHe</i>	<i>verified during acceptance tests</i>
<i>Thermal Range non-op</i>	<i>-10°C to +80°C</i>	<i>incl. qualification margin</i>
<i>Thermal Range op</i>	<i>+25°C to +65°C</i>	<i>full performance for use with Xe</i>
<i>Thermal Range op (cold start)</i>	<i>-10°C to +65°C</i>	<i>limited performance (heater recommended)</i>
<i>Fluid Filtration Rate</i>	<i>11µm</i>	<i>5µm mesh at inlet</i>
<i>Mass</i>	<i>&lt; 150 g</i>	<i>w/o harness</i>
<i>Average Power Consumption</i>	<i>&lt;3 W</i>	<i>at hold-voltage; depending on valve actuation frequency</i>
<i>Valve Operating Voltage</i>	<i>24V to 32V</i>	<i>min pull-in voltage required for motorization margin; 50% hold-voltage</i>
<i>Vibration Qualification Levels</i>	<i>&gt;30 gRMS</i>	<i>all 3 axis</i>
<i>Radiation Tolerance</i>	<i>30 Mrad</i>	<i>Total Ionizing Dose (TID)</i>



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