Indirect Heat: heated gases are isolated in high purity 316 seamless stainless steel flow-tube, never contacting the heating elements or any other heater components.

**CLEAN & PURE FLOW-TUBE**
- Particle Test: Meets Semi F-70 “Ultra-High Purity” spec
- Roughness (Ra): Meets Semi F-19 “Ultra-High Purity” spec
  - Average Ra: 2.53 μin (0.064262 μm)
  - Maximum Ra: 3.19 μin (0.081026 μm)
- Bend Radius: Complies with Semi E49 Guidelines for Inert and Reactive Gases (5 x Radius)
- Passivated to ASTM-967 specs

**POWERFUL & ACCURATE HEAT**
- Max Operating Temperature to 300°C (572°F)
- Standard Power: 208 Volt single phase, 400 Watts
- Replaceable Heating Element
- Dual Sensor Thermocouple: for accurate control of operating temps and secure over-temp protection

**EASILY INTEGRATED**
- Industry-Standard Gasline Flow-Tube Size:
  - 1/4” (6.3 mm) OD, .035 Wall (.89 mm)
- Industry-Standard VCR Fittings (certified Ultra-High Purity) on Tube Inlet & Outlet

**COMPACT & SAFE**
- Body Dimensions: 3.50” (89 mm) x 3.75” (95 mm)
- Optional Insulating Jacket (Semi-S2 Compliant)

**APLICATIONS:**
- Carrier Gas Heating
- Process Gas Heating
- Air & Nitrogen Heating for Wafer Drying

**PUR-Therm gas delivery heaters from CAS are designed to heat critical carrier gases and process gases. Manufactured to meet the industry’s stringent purity standards, PUR-Therm gives OEMs and fabricators a more efficient, more accurate method of heating chamber gases, without sacrificing purity.**
**PUR-Therm™ Gas Delivery Heater: High-Purity**

*Small Footprint for Easy Integration*

Heater body height & diameter less than 4” [100 mm]

**Side View**

- 4.0 [101] mm
- ∅ 3.75 [95] mm

**Bottom View**

- 3.1 [79] mm
- (2x) 1/4”-20 or M6 x 1.00 TAPPED HOLES
- 1.75 [44] mm
- TUBE, ∅ .25” [6.3] WALL, .035” [89]

**Front View**

- 2.75 [70] mm
- 1.97 [50] mm

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**PUR-Therm Heating Profile: Delta T using Nitrogen**

Process Fluid = Nitrogen @ 30 psi (206 kPa) (2.06 Bar), Average Inlet Temp = 20.91°C (69°F), Single Pass*

![Graph showing heating profile](image)

- 50 W
- 75 W
- 100 W
- 125 W
- 150 W
- 175 W
- 200 W

---

*Outlet Pressure Drop for PUR-Therm is Minimal: <2 PSI for All Above Tests*

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**More Than Enough Power**

PUR-Therm is configured specifically for heating process & carrier gases.

Given These Typical Specs for Carrier/Process Gas Heating...

- Test Media: Nitrogen
- Flowrate: 20 SLM Max.
- Inlet Temp: 20°C
- Outlet Temp: 140°C
- Delta-T: 120°C

...Approximate Required Watts Would Be: 100 W

*PUR-Therm is equipped with a 400 Watt element.*

So if your process has higher flowrates or temperature requirements, PUR-Therm has more than enough power.

**Semi S2 Touch-Safe Insulating Jacket**

PUR-Therm is available with a custom-fit insulation jacket made from high-temp materials.
Semi F70 Particle Testing
Graph shows data gathered after 20 minute purge process.
No particles were found, monitoring for >=0.3um and >=0.1um size particles.
These results classify PUR-Therm in the F70 test’s Ultra-High Purity category.

Flow-Tube Purity: Tested and Proven
CAS understands the importance of testing and verifying cleanliness.
Tests have been performed on completed PUR-Therm Heaters as well as individual flow-tube assemblies.

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Location</th>
<th>R\textsubscript{a} (μm)</th>
<th>R\textsubscript{a} (μm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electro-polished Stainless Steel Tube for PUR-Therm Gas Heater</td>
<td>1</td>
<td>2.17</td>
<td>0.055118</td>
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<tr>
<td></td>
<td>2</td>
<td>2.72</td>
<td>0.069088</td>
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<tr>
<td></td>
<td>3</td>
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<td>0.081026</td>
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<tr>
<td></td>
<td>4</td>
<td>2.28</td>
<td>0.057912</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>2.27</td>
<td>0.057658</td>
</tr>
<tr>
<td>Average</td>
<td>2.53</td>
<td>0.064262</td>
<td></td>
</tr>
<tr>
<td>Semi F19 Standard for UHP</td>
<td>≤ 5 μin</td>
<td>≤ 0.13 μm</td>
<td></td>
</tr>
</tbody>
</table>

Surface Roughness Testing
Graph shows Ra data across 5 locations.
According to the Semi F19 Ra specification for High Purity and Ultra-High Purity, PUR-Therm’s tube meets the Ultra-High Purity standard.
Profilometry analysis determined by ANSI/ASME B46.1 Test provided by independent lab with multiple certifications.
With PUR-Therm Heaters, Purity Starts with the Tube
CAS purchases industry leading High Purity and Ultra-High Purity tubing for use in PUR-Therm. These are a few of the critical quality and purity-related tests performed by the tube manufacturer.

PRECISE METALLURGIC COMPOSITION & INITIAL MANUFACTURING
- Tubing is produced from TP 316L stainless steel raw material, conforming with ASTM A632. Tubing is seamless.
- Tubing has a sulfur range of 0.005 to 0.012%
- Tubing is bright annealed in dry hydrogen atmosphere (dew point <=40°C), or vacuum annealed (10 micron Hg)

LOW RA ELECTROPOLISHING
- Tubing is electropolished using automated equipment to uniformly monitor & control all major variables.
- Tube’s finished ID must have an average Ra of 5 µin (0.1270000 µm) maximum.

EXTREMELY-THOROUGH PASSIVATING
- Tubes are passivated for 30 minutes minimum, then rinsed with filtered DI water.
- Final rinse is in ISO Class 4 cleanroom; tubes are rinsed with 0.1 micron filtered, 18 megohm-cm DI water, heated to 60°C. Rinsing continues until effluent resistivity measures a minimum of 17.5 megohm-cm.
- After final DI rinsing, tubes are dried using UHP nitrogen filtered to 0.005 micron.

MULTIPLE DEEP-ANALYSIS TESTS
- Particle Testing
  Must show less than 10 particles ≥ 0.1 micron per cubic foot, and no particles ≥ 0.3 per cubic foot
- SEM (Scanning Electron Microscopy) Analysis
  is performed in compliance with SEMATECH 90120401B
  Must show no more than 40 distinguishable pits, inclusions, or other raw material defects at 3500 X magnification.
- XPS Analysis (X-Ray Photoelectron Spectroscopy)
  is performed in compliance with SEMATECH 90120403B
  Must verify a minimum chromium to iron ratio of 1.5:1 and a minimum chromium-oxide to iron-oxide ratio of 3:1
- AES Analysis (Auger Electron Spectroscopy)
  is performed in compliance with SEMATECH 91060573B
  The level of acceptability is a mean oxide layer thickness of 20 Angstroms

Cas Aluminum Solutions designs and manufactures precision-engineered thermal components for semiconductor machine OEMs and fabricators worldwide. CAS is a leader in 200 & 300 mm Pedestal Heaters, and we offer an array of Circulation Heaters for liquids & gases, including CAST-X Circulation Heaters, PUR-X PFA Tube Heaters, and our new PUR-Therm Gas Delivery Heaters.

Customers view CAS as “an extension of their engineering team” due to the relationships we build in developing, testing and manufacturing key components. Our list of innovations includes platens with both heating and cooling capabilities, several innovative 450 mm chucks, and our CAST-X High-Temp Circulation Heaters, capable of heating liquids & gases to 600°C.

In addition to 3-D structural modeling and FEA (finite element analysis) thermal modeling, our in-house test lab includes infrared thermal imaging, X-Ray & ultrasound technology, vacuum chamber testing, lifecycle testing and more. The CAS manufacturing facility features the latest pressure-casting technology, advanced CNC machining & finishing, and cleanroom assembly facilities.

Contact CAS to get started on your precision-engineered project: CAS has engineers throughout the Americas, Europe and Asia.

For questions concerning PUR-Therm, please contact:
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