CAST ALUMINUM Solutions

SENSEMASTER LTD
Sensing, Heating & Anti-static Solutions

Sensemaster Ltd.
Unit 1 Severn Bridge Ind Est.
Caldicot, Monmouthshire. NP26 5PW

Electropolished ID Tubing, and Passivation, are both standard offerings across the entire CAST-X line.

Standard EP tubing typically used for CAST-X is a basic 15-25 Ra (microinches) roughness average.
This is the usual standard from any worldwide mill that CAS source from.

Heaters can also be manufactured for ultra-high purity markets (semi, pharma, medical etc.) so elevation to a higher-purity / lower-Ra tube can be achieved.

Typically, these will have an Ra in the 5-15 Ra range, and usually sourced within the USA.

Additionally, these Companies are well known reputable facilities with excellent high standards of service & Certification.

Examples of Suppliers of High Purity tubing:

Cardinal Tech 50.

https://sensemaster.co.uk/wp-content/uploads/2025/08/Cardinal-Tech-50-Specification.pdf

https://www.cardinaluhp.com/

Valex high purity or BPE certified tubing

https://sensemaster.co.uk/wp-content/uploads/2025/08/VALEX-BPE-CERTIFIED-TUBING-DATA.pdf

https://www.valex.com/products-stainless-steel-asme-bpe.aspx

Dockweir high purity or BPE certified tubing

https://sensemaster.co.uk/wp-content/uploads/2025/08/DOCKWEILER-ASME_BPE-TUBING-.pdf

https://www.dockweiler.com/products/surfaces/asme-bpe

RathGibson high purity or BPE certified tubing

https://www.pccenergy.com/companies/rathgibson/

The Passivation procedure CAS products comply with is the ASTM 967 standard for passivating stainless steel.

A diluted nitric acid solution is pumped through the heater’s flow-tube followed by tube rinsing using high purity water.

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To complete the process the tube is dried using warm nitrogen gas.

https://sensemaster.co.uk/wp-content/uploads/2025/08/PASSIVATION-ASTM-967-SPEC-DETAILS.pdf

All Passivation work is performed by a company namely Electro-Max in Hampshire Illinois.

https://www.electromax-inc.com/passivation/passivation-metals-and-metal-alloys/passivating-stainless-steel/

https://sensemaster.co.uk/wp-content/uploads/2025/08/Electro-Max-Nadcap-Certificate-2020-2022.pdf

https://sensemaster.co.uk/wp-content/uploads/2025/08/Electro-Max-Nadcap-Aerospace-Quality-System-2020-2022-certificate.pdf

https://sensemaster.co.uk/wp-content/uploads/2025/08/Electro-Max-ISO-14001-9-7-2021.pdf

https://sensemaster.co.uk/wp-content/uploads/2025/08/Electro-Max-ISO-9001-2015-9-7-2021.pdf

https://sensemaster.co.uk/wp-content/uploads/2025/08/Electro-Max-ISO13485-2016-9-19-2021.pdf

Typical ASTM A967 process:

The process instigates precleaning the ID of the tubing with an alkaline degreaser after which fresh water is pumped through to rinse and remove all residuals from the alkaline cleaner.
Once the part is cleaned, passivate solution is pumped through the tube in a continuous loop to get the recommended treatment time on the surface to be cleaned.
After the passivation process, fresh water is pumped through again to remove any residuals from the acid treatment and finally rinsed for an extended time with a Type IV reagent grade DI water.
All processing at EMI is based on quality.
Many years ago, EMI catered to the automotive and appliance industries but changed their focus about 10 years ago to improve on quality accreditations which would allow them to process high value parts for critical applications.
Maintaining a strong process-based quality system allows them to operate to over 500 different specs on a daily basis.
Their tried and tested rugged system has allowed them to become an industry leader in lead times and expedite options; while maintaining the high standard of quality they have secured over the last 10 years.
Gaining a merit audit on their Nadcap accreditation is an award issued to only a select number of individuals & businesses.
Striving for excellence they continually explore additional critical processes in order to support all of their customers finishing needs.
Optimum customer focus has maintained that small company feel throughout their continued growth.
Every aspect of business at EMI is based on quality.

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There is an additional "Argon filling & purging technique." Offered on some CAS products.
However currently this is only available on the CAST-X 4000 series & PUR-Therm series of heaters.
The Argon Fill / Purge during the casting process is something that adds a "next level up" in terms of purity.
The tube is filled with argon & a cap is placed on one end of the tube with a valve on the other end.
While the argon is in the tube, under pressure, the valve is closed, entrapping the pressurized argon.
The purpose of the argon is to displace the air, which contains oxygen, and can potentially be a source or fuel for oxidation.
By filling and capping with argon, it reduces the risk of oxidation within the tube ID.

PUR-Therm is a small heater designed to heat semiconductor gases (carrier gases and process gases) that are destined for the wafer processing vacuum chamber, where the silicon wafer is heated and hot gases are over sprayed (vapor deposition process).
Information for PUR-Therm can be found https://sensemaster.co.uk/pur-solvent/
This heater is around 1300-1500 watts maximum.
The PUR-Therm comes standard with VCR fittings.

When the product was developed, it went through a number of PPM particle tests, successfully passing all.
Therefore, it was proven to be a high purity heater for the semi market
Increasingly, over the past 2 years, CAS ramped up dealings with the pharma processing market.
Several high purity CAST-X 4000 heaters were successfully incorporated into equipment suppliers' systems ultimately destined for Moderna and Genentech.
These were CIP (clean in place) systems and WFI (water for injection) systems for both companies.
These CAST-X 4000 Heaters (16 in total) all had the super high purity electropolished tubes with an Ra of around 8 microinches.
The Passivation procedure "post tube bending, but pre casting" was carried out to make 100% sure the tubes were clean before the casting process, removing any micro-debris from tube ID preventing it from being "cooked" onto the tube ID as a result of the high temps seen in casting process."
Then the Argon Cap & Purge technique was employed during casting.
Then another Passivation was carried out again, after all manufacturing and assembly processes were complete.
The one metric that CAS measured themselves against was Ra (tube ID roughness average).
It was quoted that the tube ID "would not be any more than 10 microinches above the original tube Ra from the mill".
This meant if the original straight tube was 8 Ra, the final heater would not be any more than 18 Ra, when measuring tube ID.
A thorough measurement procedure was carried out, with a profilometer, to track the tube ID Ra throughout the manufacturing process.
It transpired that ultimately it was more like 2-3 microinches on average (mostly the number was 0 to 1 Ra) was added to the ID roughness.
This was a very positive test result.
One concern was that on occasion a slight discoloration of the tube ID occurred.
However as this did not affect the high purity clean finish the heater was approved and integrated into the system.