



# CryoGas International

*Reporting on the business and technologies driving today's industrial gas industry*

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# Circulation Heating and Air Separation

## Cast Aluminum Solutions Highlights the CAST-X 4000

“There are many different types of ‘circulation heaters,’” begins Jeff Awe, Product Manager and Marketing Director for Cast Aluminum Solutions, giving background for the discussion of his company’s latest offering, the CAST-X 4000 circulation heater. “The CAST-X 4000 is known as a ‘cast-in’ heater, and there are only a few companies that make these. The most distinct characteristic of a cast-in heater is that the heating elements do not ever come in contact with the media being heated, and our cast-in heaters can be used to heat both liquids and gases, usually not at the same time, although it is possible with our ‘dual flow-path tube’ units, which includes the CAST-X 4000, 3000, and 2500.”

Launched in August 2015, the CAST-X 4000 is Cast Aluminum’s latest offering for the cast-in circulation heating market, emphasizing the no-contact approach and the heater’s ability to withstand pressures up to 2,500 psi. Two spiral-wound flow-path tubes each have a one-inch outside diameter and .083 inch wall. “The standard flow-path tube is 316L stainless steel, but Inconel and other alloys are also available,” informs Awe.

“Inconel is used for high-pressure and high-heat applications. Passivated and electro-polished tubing is also available; these are primarily used in cases where absolute cleanliness and sterility are critical (think pharmaceutical applications and blood/plasma heating processes).

“These tubes are quite long, over 210 inches each. So after they are spiraled, they are placed into a mold, with very precise specifications regarding how close to the outer wall the tubes can be, how close to the heating elements they can be, and so on. Also inserted into the mold are the heating elements. These are typically long ‘I’ or ‘U’ shaped components, and they must be configured within the mold to equally precise specifications. Thermocouple sensor positions are also carefully configured, and there are several options to choose from. There are several options for heating elements as well, as our heaters are available



CAST-X 4000 Circulation Heater from Cast Aluminum Solutions

in an array of volt, watt, and circuitry configurations.

“After the aluminum is poured into the mold, you’ll see the control terminals for the heating elements sticking out the top. Proprietary processes are employed to cast fittings that will marry the electrical housing (containing all the wiring) to the main heater unit. All casting, wiring, and assembly processes are completed in-house at our plant in Batavia, Illinois, just outside Chicago.”

### Use in Air Separation

“The air separation industry is one of the most common sectors for the CAST-X 4000, where they see use as ‘regeneration heaters,’ ‘air condensate heaters’ and in ‘freeze protection’ applications,” he continues. “Cryogenic air separation units (ASU) utilize the varying condensing/boiling points to enable separation by distillation at cryogenic temperatures. Liquefying and distilling air provides a process to successfully separate the

nitrogen and oxygen.

“Modern ASUs utilize a Pre-Purifier Unit (PPU), which removes moisture, CO<sub>2</sub> and most hydrocarbons from the air to prevent ice and dry ice forming later in the process. A PPU is typically made up of a chiller (to cool the air to 40–55°F), a condensate separator to remove free water, and two vessels filled with desiccant and mole sieve material, which adsorbs the contaminants while allowing the air to pass through. The desiccant and molecular sieve bed is regenerated by passing heated waste nitrogen to remove accumulated contaminants. The CAST-X 4000 is used to heat the waste nitrogen, and this is the ‘regeneration heater.’

“Anti-Condensate heaters are typically strip heaters, flexible heaters, or circulation heaters similar to the CAST-X line. They are installed in motor enclosures and other types of electrical enclosures.

The CAST-X 4000 heaters would likely be used in the smaller ASUs or remote

ASUs...anywhere that space is a premium or 'smaller is better.' Don't forget that one of the key benefits/features/reasons that engineers buy the CAST-X line is that these heaters are quite compact, given their heating capability and power.

"In cold conditions, thaw heaters are used to heat up a small portion of the gas stream, and that stream is then used to keep things from freezing up. These are used extensively in northern climates or during winter months. This will be a common application for the CAST-X 4000."

Awe also sees potential for the CAST-X 4000 in research and development applications around industrial gases and process chemicals. "Natural gas plants also use circulation heaters to heat natural gas during the cold months," he adds. "This is sometimes called a 'trim heater' and it helps to eliminate the condensation that tends to build up in the gas under colder conditions. Gases are heated to around 150°F (66°C). This area of the plant/process is called the 'trim cage.'"

### The Touch-Free Approach

"The advantage of the no-contact design is that — if you are dealing with potentially

explosive materials or working in explosive environments — the CAST-X can deliver the heat you need to a liquid or gas without the risk of having that media explode or flame up. The flammable media is relegated to the flow-path tube, never interacting with the open air, or points where there might be sparks or flash/ignition points. Also, with the CAST-X configuration, the fluid or gas never touches the heating element (which could potentially be an ignition generator)."

To further the safety aspect of the CAST-X 4000, its electrical housing is available in a version that's "completely explosion-proof." "This is called the ATEX enclosure," says Awe. "With the ATEX-Certified enclosure, even if there were to be a spark inside the housing, the air inside that housing is completely sealed off from the rest of the outside world, so whatever spark or flame up there might possibly be — rare, but let's pretend it might happen — it would be locked/sealed inside that six-inch square heavy metal ATEX housing," and thus pose no threat to the ambient air surrounding or the rest of the facility.

"Another important advantage of the CAST-X 4000 is its relatively small size to

power ratio. One simple way of thinking about it is that you're getting up to 60 kW of power in a heater that's only about 25 inches tall, and about 12 inches in diameter."

### Taking the Pressure

Just how does the CAST-X 4000 manage to stand up to that 2,500 psi pressure? Awe has the answer: "The CAST-X 4000 is built with a very strong stainless steel tube (316L grade). This tube is tested by our tube supplier and verified to withstand the pressures we advertise. The design of the CAST-X also helps ensure tube stability and rigidity.

"Because the tube is cast into the aluminum mass, it is protected from bending or denting — forces that could potentially decrease the tube's ability to handle high pressures. The only portion of the flow-path tubes that are exposed are the input and output connection points (2.8 inches long). Threaded or compression-fit fittings can then be attached to the flow-path tube nubs." ■

**For more** specs on the CAST-X 4000 and all of Cast Aluminum Solutions' offerings, check out [castaluminumsolutions.com](http://castaluminumsolutions.com).

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For more information on the CAST-X line of Circulation Heaters, please contact Cast Aluminum Solutions:

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Cast Aluminum Solutions serves OEMs and end-users with precision-engineered heat-transfer solutions.

The CAST-X line is available in several sizes, with a variety of circuitry, tubing and enclosure options.

Located near Chicago in Batavia, IL, Cast Aluminum Solutions serves customers worldwide through our network of application engineers, representatives and distributors. CAS Engineers work directly with customers to develop practical, reliable solutions to critical heating applications.

CAS is an ISO 9001 Certified company.



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