APPLICATION NOTE

PRECISION INVESTMENT CASTING (PIC)

edwardsvacuum.com

WHERE IS VACUUM USED?

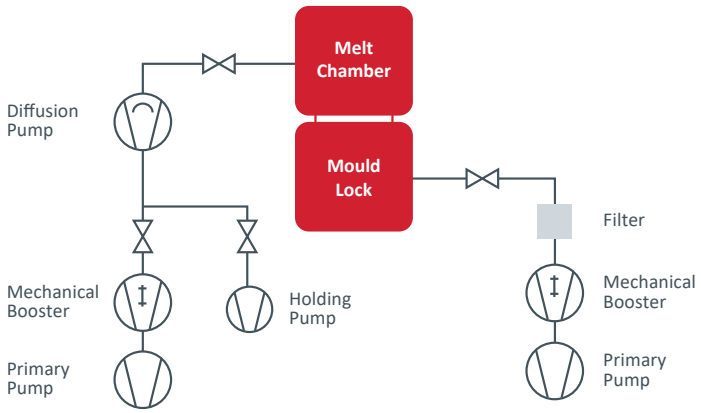
Precision investment casting (PIC) is a process carried out to produce complex mechanical components with high precision, such as turbine blades. The ceramic mould is created by dipping the shaped wax into a ceramic slurry. The mould is then dewaxed using a high-pressure steam autoclave, which rapidly flushes out the wax. The shell is then fired at a high temperature to sinter the ceramic particles together. The metal is melted by induction and then poured into a ceramic mould with the component's shape. These final two steps are processed under vacuum to ensure cleanliness of material and temperature control.

TYPICAL PRECISION INVESTMENT CASTING SYSTEMS

PIC furnaces usually have two chambers with two independent vacuum systems:

- A melting chamber, where the alloy is melted/poured/ allowed to solidify, equipped with a high vacuum pump system with a diffusion pump
- A mould/load lock chamber for mould introduction equipped with a medium vacuum pump/booster combination to pump down to typically less than 0.1 mbar in a maximum of 60 seconds to avoid any temperature drop in the mould

Both the melting and mould chambers collect large quantities of dust and particulate material that can reach vacuum systems especially during a fast pump down.



Typical layout for PIC operation

SOLUTIONS

Dry pumping systems - Recommended technology	
GXS dry screw pumps and GXS combinations	MAXX vacuum systems (GXS pump range is systemised with pXH mechanical boosters)

Oil Sealed pumping systems - Conventional technology	
Stokes Microvac rotary piston pumps with EH and 6" Stokes booster combination	nHT series diffusion pumps

EDWARDS' BENEFITS

GXS DRY SCREW PUMPS

160–750 m³/h primary pumps offer pumping speeds up to 3,450 m³/h with vacuum boosters. Equipped with an intelligent on-board controller with extensive communication and automated control capabilities. These dry pump systems substantially reduce maintenance and operating costs.

Benefits:

- Increased tolerance to particles created by the melt
- Clean residual vacuum
- Elimination of oil back streaming, which is a source of contamination and degassing in the furnace
- Large water vapour pumping capacity aids the drying of the new chamber lining
- Elimination of oil mist at the exhaust and external oil leaks

Highly reliable
Ability to handle harsh processes

Low maintenance cost
No unplanned down time

Increased productivity
Longer intervals between services

Safe operation, consistent output
Automated control of your process

MAXX VACUUM SYSTEMS

The GXS pump range is complemented by the new generation of pXH large mechanical boosters for an integrated flexible modular skid design.

Variety of pump combinations ensure optimised configurations
Delivers the performance required by your processes

Easy to upgrade
Allows a smooth upgrade whenever you need more capacity

STOKES MICROVAC ROTARY PISTON PUMPS

Packaged with the EH range or 6" series of mechanical boosters

Value for investment
Low rotational speed that enables the longest pump life cycle

Easy maintenance on site
Robust, simple mechanism for high reliability and ease of rebuild

Proven and tested
Time-tested, proven performance of over 80 years

nHT SERIES DIFFUSION PUMPS

The nHT series diffusion pumps have been designed for optimum heat transfer to the oil, resulting in faster heat up times and a significant reduction in energy consumption.

Increased productivity
High-throughput pumping

Stable performance
High backing line pressure

Better end product quality
Low oil back streaming

Publication Number: 3602 566 0 01
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