

Custom Casting Design Guide

Design-for-manufacturing reference for custom nickel and cobalt alloy castings produced by investment casting or sand casting.

Casting Type	Custom nickel alloy and cobalt alloy castings for OEM and replacement projects
Methods	Precision investment casting (lost wax) and sand casting
Alloys	C-276, Inconel 625, Monel 400, Hastelloy X, ASTM A494 grades and related high-performance alloys
Weight Range	From small precision parts around 0.1 kg up to heavy castings around 1,500 kg by design review
Design Support	3D modeling, pattern making, reverse engineering, DFM review and machining support

1. Product Overview

Custom castings are used when off-the-shelf components cannot meet a project's geometry, corrosion environment, weight target or assembly requirements. Near-net-shape casting can create integral passages, curved vanes and complex contours while reducing welding, machining time and material waste.

Casting Method	Best For	Typical Advantage
Investment Casting	Complex small-to-medium parts, impellers, valves and precision components	Higher precision and smoother surface finish
Sand Casting	Large pump casings, volutes, pipe fittings and heavy industrial parts	Lower tooling cost and practical size flexibility
Reverse Engineering	Broken or obsolete parts without complete drawings	3D scanning and pattern creation from an existing sample

2. Key Design Principles

- Use casting to combine complex geometry into one integral part and reduce welded joints.
- Select the alloy around corrosion media, temperature, strength, wear and inspection requirements.
- Define critical machined surfaces separately from as-cast surfaces to control cost and tolerance.
- Provide CAD files, drawings and service conditions early so DFM feedback can improve manufacturability.

Further information under:	https://www.nickelcasting.com/nickel-alloys/nickel-casting/custom/
Home page:	www.nickelcasting.com
Email:	ni@Nickelcasting.com

Casting Design Guide

The following design guide helps engineering and purchasing teams prepare a clear RFQ for custom nickel alloy castings. Final recommendations should be confirmed after drawing review, alloy selection and casting method selection.

3. Casting Method Comparison

Feature	Investment Casting (Lost Wax)	Sand Casting
Precision	+/-0.1 mm typical for suitable geometry	+/-1.5 mm typical for suitable geometry
Surface Finish	Smooth, around 125 RMS typical	Rougher, around 250-500 RMS typical
Part Size	Small to medium parts, commonly below 100 kg	Medium to massive castings, over 1000 kg possible by review
Tooling Cost	Higher tooling for repeated precision production	Lower tooling using wood, resin or plastic patterns
Best For	Complex valves, impellers, precision industrial parts	Large pump casings, volutes and heavy pipe fittings

4. Design Inputs Checklist

Input	Recommended Detail
Drawing / CAD	PDF drawing plus STEP, IGES or native CAD model; mark critical dimensions and datums
Alloy / Service	Required alloy or corrosion media, temperature, pressure, wear and regulatory requirements
Casting Method	Investment casting for precision; sand casting for larger parts or lower-cost tooling
Tolerance Plan	Separate as-cast tolerances from finish-machined surfaces and threaded / sealing areas
Inspection Plan	RT, PT, PMI, tensile testing, chemical analysis, dimensional report or customer standard

5. Typical Production Flow

Step	Engineering / Production Activity
DFM Review	Analyze CAD file, casting orientation, gating concept, machining allowance and inspection needs
Pattern / Tooling	Create 3D printed prototype tooling or machined production tooling depending on quantity
Molding & Pouring	Build ceramic shell or sand mold; pour controlled nickel alloy heat
Finishing	Remove gates and risers, heat treat, blast, inspect and machine to final tolerance

Applications and Ordering Information

Use this section to define custom casting requirements and accelerate engineering review for OEM nickel alloy casting projects.

6. Typical Applications

Industry / Area	Typical Components
Chemical Processing	Complex valve bodies, acid-resistant impellers, housings and corrosion-resistant flow parts
Marine & Offshore	Seawater components, pump parts, elbows and heavy-duty corrosion-resistant castings
Aerospace / High Temperature	Nickel alloy and cobalt alloy components requiring heat strength and oxidation resistance
Legacy Equipment	Reverse-engineered replacement parts reproduced from samples, scans or incomplete drawings

7. Information to Include When Requesting a Quote

- Files: PDF drawing plus STEP / IGES / native CAD if available; photos or samples for reverse engineering.
- Material: target alloy, ASTM A494 grade, wrought equivalent or service environment for alloy selection.
- Dimensions and weight: overall size, wall thickness, critical tolerances and machined features.
- Quantity and schedule: prototype, trial lot, production quantity and required delivery date.
- Quality requirements: RT, PT, PMI, tensile test, chemical analysis, dimensional report and certificates.

Company Information	
Address	Shanghai, China
Email	ni@Nickelcasting.com
Home Page	www.nickelcasting.com
Product Page	https://www.nickelcasting.com/nickel-alloys/nickel-casting/custom/

Disclaimer

This document is provided for general reference only. Actual casting dimensions, tolerances, alloy availability and inspection requirements may vary by pattern, drawing, product form, heat treatment and applicable specification. Please contact us for confirmed specifications, test reports and material certificates before ordering.