

1. Introduction to Nickel Alloys

Nickel alloys are advanced metallic materials primarily composed of nickel (Ni >50%), combined with elements such as chromium (Cr), molybdenum (Mo), iron (Fe), and copper (Cu).

These alloys are specifically engineered for **extreme environments**, including:

- High temperature (up to 1100°C)
- Strong corrosive media (acid, seawater, chemicals)
- High-pressure industrial systems

Nickel alloys are widely used in industries where **material failure is not acceptable**, such as aerospace, chemical processing, offshore engineering, and power generation.

2. Main Types of Nickel Alloys

2.1 Inconel Alloys (High Temperature Superalloy)

Composition: Nickel-Chromium based

Key Grades: 600 / 625 / 718

Key Features:

- Excellent high-temperature resistance (up to 1100°C)
- Strong oxidation and scaling resistance
- High tensile and creep strength

Typical Applications:

- Gas turbines
- Jet engines
- Heat exchangers
- Nuclear reactors

2.2 Monel Alloys (Marine Corrosion Resistant Alloy)

Composition: Nickel-Copper based

Key Grades: 400 / K500

Key Features:

- Outstanding resistance to seawater corrosion
- High toughness in marine environments
- Good mechanical strength

Typical Applications:

- Offshore platforms
- Marine piping systems
- Seawater heat exchangers
- Pumps and valves

2.3 Hastelloy Alloys (Chemical Resistant Alloy)

Composition: Nickel-Molybdenum-Chromium based

Key Grades: C276 / C22

Key Features:

- Exceptional resistance to strong acids
- Excellent resistance to pitting and crevice corrosion
- Stable performance in chemical environments

Typical Applications:

- Chemical reactors
- Acid processing systems
- Flue gas desulfurization units

- Pharmaceutical equipment

3. Engineering Performance Data

3.1 Mechanical Properties (Typical Values)

Property	Inconel 625	Monel 400	Hastelloy C276
Tensile Strength	690 – 930 MPa	480 – 620 MPa	690 – 790 MPa
Yield Strength	310 – 550 MPa	170 – 345 MPa	283 – 355 MPa
Elongation	≥30%	≥35%	≥40%

3.2 Temperature Resistance

Material	Max Service Temperature
Stainless Steel (316L)	~600° C
Inconel Alloys	1000 – 1100° C
Monel Alloys	~600° C
Hastelloy Alloys	~900° C

3.3 Corrosion Resistance Comparison

Environment	Stainless Steel	Nickel Alloy
Seawater	Moderate corrosion	Excellent resistance
Sulfuric Acid	Poor	Excellent
Hydrochloric Acid	Very poor	Outstanding (Hastelloy)
High Temperature Oxidation	Moderate	Excellent

4. ASTM / ASME Material Mapping

4.1 Inconel Standards

- ASTM B166 – Rod, bar, wire
- ASTM B167 – Pipe & tube
- ASME SB-166 / SB-167

4.2 Monel Standards

- ASTM B127 – Plate & sheet
- ASTM B164 – Rod & bar
- ASTM B165 – Seamless pipe

4.3 Hastelloy Standards

- ASTM B575 – Plate, sheet, strip
- ASTM B622 – Seamless pipe
- ASTM B619 – Welded pipe

5. Corrosion Resistance Chart (Engineering Reference)

Corrosion Rate (Typical)

Material	Corrosion Rate
Carbon Steel	1.0 – 2.0 mm/year
Stainless Steel 316L	0.5 – 1.2 mm/year
Nickel Alloys	<0.05 mm/year

Nickel alloys significantly reduce corrosion-related failure and maintenance cost.

6. Selection Guide (Engineering Decision)

6.1 Selection Based on Environment

Condition	Recommended Alloy
High Temperature (>800° C)	Inconel
Seawater / Marine	Monel
Strong Acid	Hastelloy

6.2 Key Selection Factors

- Operating temperature
 - Corrosive media type
 - Mechanical load requirements
 - Service life expectation
 - Cost vs lifecycle performance
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7. Product Forms & Supply Range

Nickel alloys are available in multiple forms:

- Pipes & Tubes
 - Sheets & Plates
 - Bars & Rods
 - Fittings & Flanges
 - Custom machined components
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8. Industrial Applications

Nickel alloys are widely used in:

- Aerospace engines
 - Oil & gas pipelines
 - Chemical processing plants
 - Power generation systems
 - Marine engineering
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9. Advantages of Nickel Alloys

- Long service life
 - Reduced maintenance cost
 - High reliability in critical systems
 - Excellent performance in extreme environments
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10. Conclusion

Nickel alloys are essential materials for modern industry, especially where high temperature, corrosion resistance, and mechanical strength are required.

Choosing the right alloy—Inconel, Monel, or Hastelloy—can significantly improve system performance and reduce operational risk.

Contact for Supply

We provide:

- Full range nickel alloys (Inconel / Monel / Hastelloy)
- Pipes, tubes, sheets, bars
- ASTM / ASME certified materials
- Custom processing & global delivery

Contact us for:

- Technical datasheets
- Latest price
- Stock availability

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