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# **SPECIALISTS OF HIGH PERFORMANCE NICKLE ALLOYS**

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# INTRODUCTION

## PROVIDE UNMATCHED SERVICE TO OUR CUSTOMERS

**KANAKRATNA STEELAGE** has been recognised as one of the leading importers , stockiest and suppliers of ferrous & non - ferrous metals in Mumbai. Our reputation for quality & excellence in service is reflected in our client portfolio & spans many different industries including chemical & petrochemical , re fineries , oil & gas , water treatment plants , offshore , shipbuilding , power plants , & Other Engineering services. We provide unmatched service to our customers while maintaining a competitive price point for our products . We work closely with all of our clients, big and small , to ensure that their unique requirements are met . Our experience enables us to contribute to each client's success . Al though Collaborating with our clients , we impart additional technical knowledge and experience that sets us apart from the competition .

- We rigorously test our products before shipment .
- World Class Service Environment .
- Excellent quality products at a competitive price .
- Well Professional Team .



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## OUR PRODUCTS

Ance alloys in stock , including special alloys , nickel alloys , super alloys , titanium alloys , duplex alloys , nitronic alloys , stainless steel alloys , and other high - performance alloys . But that's not all : in addition to superior materials , we provide a wide range of world - class services , practical technical advice , and worldwide , on - time delivery.

Find out more!



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# Nickel Alloys

Nickel alloys are metals created by combining nickel with another material as the primary element . It combines two materials to produce more desirable properties like increased strength and corrosion resistance . It's used in a wide range of equipment across multiple industries due to its distinct properties. KanakRatna is a leading supplier and stockiest of nickel in all grades.



## **MONEL K 500**

Monel K500 is a nickel-copper alloy which combines the excellent corrosion resistance of Alloy 400 with higher strength and hardness obtained through the addition of aluminum and titanium to the nickel-copper base. It has excellent low temperature properties with tensile and yield strengths increasing with decrease in temperature, while ductility and toughness are virtually unimpaired. There is no ductile-to-brittle transformation even at temperatures as low as liquid hydrogen, making it suitable for cryogenic applications. The corrosion resistance of Monel K500 is equivalent to that of Alloy 400 except that in the aged condition, it has a greater tendency towards stress-corrosion cracking in some environments. It is resistant to a sour gas environment and has very low corrosion rates in high velocity seawater, making it ideal for marine applications.

## **MONEL- 400**

MONEL- 400 has a wide range of mechanical properties, depending on the supply condition, with excellent properties at sub-zero temperatures. It does not undergo a ductile-to-brittle transition even when cooled to the temperature in liquid hydrogen. It also has useful short-time high temperature properties in the hot rolled and annealed condition and toughness is maintained over a wide range of temperatures. Due to MONEL400's resistance to corrosion by many reducing media, it makes it suitable for service in a variety of environments and is widely used in marine applications due to its very low corrosion rates in flowing sea water. It is also resistant to stress corrosion cracking and pitting in most fresh and industrial waters.

## **HASTELLOY C 276**

HASTELLOY C 276 is a Nickel - chromium - molybdenum wrought alloy that is considered the most versatile corrosion resistant alloy available . This alloy is resistant to the formation of grain boundary precipitates in the weld heat - affected zone , thus making it suitable for most chemical process applications in an as welded condition . Alloy C - 276 also has excellent resistance to pitting , stress - corrosion cracking and oxidizing atmospheres up to 1900 ° F . Alloy C - 276 has exceptional resistance to a wide variety of chemical environments .

## **HASTELLOY C 22**

HASTELLOY C 22 is a nickel - chromium - molybdenum alloy with enhanced resistance to pitting , crevice corrosion and stress corrosion cracking . It resists the formation of grain boundary precipitates in the weld - heat affected zone making it suitable for use in the as - welded condition . C - 22 has outstanding resistance to both reducing and oxidizing media and because of its resistibility can be used where " upset " conditions are likely to occur . It is proven to possess excellent weldability and high corrosion resistance as consumable filler wires and electrodes . The alloy has proven results as a filler wire in many applications . As filler wire use when other corrosion resistant wires have failed . C - 22 can easily be cold - worked because of its ductility and cold - forming is the preferred method of forming . More energy is required because the alloy is generally stiffer than austenitic stainless steels . 0.28 " thick sheet in the heat - treated at 2050 ° F , rapid quenched condition , has an average Olsen cup depth of 0.49 " . -

## **HASTELLOY B3**

HASTELLOY B3 Round Bars are available in standard and customized option. We ensure that our range of HASTELLOY B3 Bars meets the international quality standard. Our HASTELLOY B3 Rods are extremely appreciated by our clients with great and excellent features. Also known as UNS N10675 Round Bars, Our HASTELLOY Alloy B3 Bars are accessible to our valuable customers in different range of diameters, wall thicknesses and sizes in customized form and also at quite affordable rates. We offer different types of these bars such as HASTELLOY 83 Bright Bars, HASTELLOY 83 Hex Bars, HASTELLOY B3 Black Bars, HASTELLOY 83 Flat Bars, HASTELLOY B3 Billets Bars, and HASTELLOY 83 Forged Bars.

## **HASTELLOY C4**

HASTELLOY Alloy C4 Round Bars in India. Owing to the proficiency of our experts, we have been able to bring forth HASTELLOY C4 Bars (HASTELLOY C4 Rods) for our clients. HASTELLOY C4 Round Bars has excellent features like High strength, Corrosion resistance, Perfect hardness, Durability, Low maintenance, Application specific design, Dimensional precise, and more. We offer different types of these bars such as HASTELLOY ca Bright Bars, HASTELLOY ca Hex Bars, HASTELLOY ca Black Bars, HASTELLOY C4 Flat Bars, HASTELLOY C4 Billets Bars, and HASTELLOY C4 Forged Bars. Also known as UNS N106455 Round Bars, our HASTELLOY Alloy C4 Bars are accessible to our valuable customers in different range of diameters, wall thicknesses and sizes in customized form and also at quite affordable rates.

## **INCONEL-625**

Alloy 625 is a nickel-chromium alloy which gains its stiffening effect through molybdenum and niobium additions, therefore eliminating the need for this alloy to be aged. It has superior resistance to a wide range of corrosive environments as well as the high temperature effects of oxidation and carburisation. Alloy 625 is excellent for sea-water applications, having freedom from pitting and crevice corrosion, high corrosion fatigue strength and resistance to chloride-ion stress corrosion cracking. This alloy also has high tensile, creep and rupture strength, fatigue and thermal fatigue strength and oxidation resistance, making it suitable for aircraft engine exhaust systems, housing engine controls and aircraft ducting systems. It is also used in the nuclear field for reactor cores, control rod components in nuclear water reactors.

## **INCONEL-600**

In strong oxidizing solutions like hot, concentrated nitric acid, 600 has poor resistance. Alloy 600 is relatively un-attacked by the majority of neutral and alkaline salt solutions and is used in some caustic environments. The alloy resists steam and mixtures of steam, air and carbon dioxide. Alloy 600 is non-magnetic, has excellent mechanical properties and a combination of high strength and good workability and is readily weldable. Inconel 600 exhibits cold forming characteristics normally associated with chromium-nickel stainless steels. Typical corrosion applications include titanium dioxide production (chloride route), perchlorethylene syntheses, vinyl chloride monomer (VCM), and magnesium chloride. Alloy 600 is used in chemical and food processing, heat treating, phenol condensers, soap manufacture, vegetable and fatty acid vessels and many more.

## INCONEL 718

Inconel 718 is a high strength , corrosion resistant nickel chromium alloy , initially developed for the aerospace industry and still considered the material of choice for the majority of aircraft engine components . Its excellent strength and corrosion resistance have been recognised by the oil industry and it is now widely used in this field .

## INCONEL-690

Super alloys have good creep and oxidation resistance. They are also known as high performance alloys, and can be formed in different shapes. Work hardening, precipitation hardening, and solid-solution hardening are performed for strengthening the super alloys. These alloys have the capacity to function at very high temperatures and severe mechanical stress, and also where high surface stability is required. Inconel 69 TM is a nickel-chromium alloy. It has high resistance to hot gases or oxidizing chemicals due to the presence of high chromium content. The following datasheet gives an overview of Inconel 690 TM

## INCONEL-601

Inconel 601 nickel-chromium-iron alloy is a general-purpose engineering material for applications that require resistance to heat and corrosion. The outstanding characteristic of Inconel 601 is its resistance to high-temperature oxidation. The alloy also has good resistance to aqueous corrosion, has high mechanical strength, and is readily formed, machined, and welded. The limiting chemical composition of Inconel 601 is listed in Table I. The composition is a face-centered-cubic solid solution with a high degree of metallurgical stability. The alloy's nickel base, in conjunction with a substantial chromium content, provides resistance to many corrosive media and high-temperature environments. Oxidation resistance is further enhanced by the aluminum content.

## INCONEL X - 750

INCONEL X - 750 AB Steel is one of the largest exporter , manufacturer and supplier of Inconel Alloy 750 Round Bars in India . Inconel Alloy 750 Bars has excellent resistance to chloride - ion stress - corrosion cracking , and as well shows appropriate resistance to a number of oxidizing environments ' . Inconel 750 Round Bars ( also known as UNS N07750 Round Bars and Rods ) is very much resistant to chemical corrosion and oxidation , and has some high stress - rupture effectiveness and low creep rates under high stresses at temperatures after suitable heat treatment . Our Inconel 718 Bars are accessible to valuable customers in different range of diameters , wall thicknesses and sizes in customized form and also at quite affordable rates . Meanwhile , we offer different types of these bars such as Inconel 750 Bright Bars , Inconel 750 Hex Bars , Inconel Black Bars , Inconel 750 Flat Bars , Inconel 750 Billets Bars , and Inconel 750 Forged Bars

## **INCONEL 925**

Inconel 925 is an age hardenable nickel-iron-chromium alloy with the additions of molybdenum, copper, titanium and aluminium. The alloy's chemical composition is designed to provide a combination of high strength and excellent corrosion resistance. The nickel content provides protection against chloride-iron stress corrosion cracking and in combination with molybdenum and copper, gives outstanding resistance to reducing chemicals. Molybdenum aids resistance to pitting and crevice corrosion, while chromium provides resistance to oxidising environments.

## **INCOLOY-800**

UNS N08810 / UNS N08811 - Incoloy 800 H is an iron-nickel-chromium alloy having the same basic composition as Incoloy 800, with significantly higher creep rupture strength. The higher strength results from close control of carbon, aluminum and titanium contents in conjunction with a high temp anneal. The 800H modification was to control carbon (0.05 to 0.10%) and grain size to (>ASTM 5) to optimize stress rupture properties. Incoloy 800 H has further modifications to the combined titanium and aluminum levels (0.85 to 1.2%) to ensure optimum high temperature properties. The alloy is dual certified and combines the properties of both forms. The chemical balance allows the alloy to exhibit excellent resistance to carburization, oxidation and nitriding atmospheres. 800HT will not become embrittled even after long periods of usage in the 1200-1600 deg F range where many stainless steels become brittle.

## **INCONEL-800H - 800HT**

Excellent cold forming characteristics typically associated with the nickel-chromium alloys are exhibited with 800HT. When cold formed extensively the grain size produces a visibly undulated surface called "orange peel". 800HT can be welded by the common techniques used on stainless steels. Typical applications for the alloy include ethylene pyrolysis, hydrocarbon cracking, cracking furnaces for vinyl chloride, diphenol and acetic acid. The alloy is also used for valves, fittings and other components exposed to corrosive attack from 1100 to 1800 deg F. Round bar ranging from 3/4" to 6" diameter, and light gauge sheet and plate. Incoloy 800 H material can be supplied in random lengths, cut to order or machined to customer requirements. Machining includes drilling, threading, milling, CNC shapes, turning, tapping, flanges and others.



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## Special Alloys

Special alloys are referred to as "special" because they were developed for specific applications and are classified according to their intended use. Super Alloys are typically extremely strong and resistant to corrosion, and they retain these properties even at elevated temperatures.



## ALLOY 20

Nickel alloy 20 is a low-carbon, niobium-stabilized austenitic nickel/iron/chromium alloy with additions of molybdenum and copper. It exhibits exceptional corrosion resistance in chemical environments containing phosphoric acid, nitric acid, chlorides and sulphuric acid. It also has good mechanical properties at both ambient and elevated temperatures.

## ALLOY - 926

Alloy 926 is a super-austenitic molybdenum stainless steel that exhibits excellent resistance to a variety of highly corrosive environments. The combination of molybdenum and nitrogen in its composition resists pitting and crevice corrosion, while copper improves sulfuric acid resistance, and nitrogen improves yield and tensile strengths.

## INCONEL 286

Incoloy® alloy A-286 (UNS S66286) is an iron-nickel-chromium alloy with additions of molybdenum and titanium. It is age hardenable for high mechanical properties. The alloy maintains good strength and oxidation resistance at temperatures up to about 1300°F (700°C).

The alloy is austenitic in all metallurgical conditions. The high strength and excellent fabrication characteristics of Incoloy alloy A-286 make the alloy useful for various components of aircraft and industrial gas turbines. It is also used for fastener applications in automotive engine and manifold components subject to high levels of heat and stress and in the offshore oil and gas industry.



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## Duplex & Super Duplex

Duplex & Super Duplex stainless steels get their name from their two phase microstructure , which is composed of grains of stainless steel that are 50 % austenitic and 50 % ferritic . This type of steel offers a number of advantages and is frequently preferred over standard ferritic or austenitic stainless steels due to its increased strength - it is approximately twice as strong as these metals . Due to the increased yield strength of duplex stainless steels , thinner sections can be created , resulting in significant weight savings .



## **DUPLEX 2205**

Duplex stainless steels are extremely corrosion resistant, work hardenable alloys. Duplex stainless steel plate contains relatively high levels of chromium (between 18% and 28%) and low to moderate amounts of nickel (between 1.5% and 8%). The high corrosion resistance and excellent mechanical properties of duplex stainless steels can be attributed to their chemical composition and balanced (duplex) microstructure of approximately equal volume percentages of ferrite and austenite. Because of this duplex nature, it will display properties characteristic of both austenitic and ferritic stainless steels. Duplex stainless steels are in most cases, tougher than ferritic stainless steels. Strengths of duplex stainless steels can in some cases be double that for austenitic stainless steels.

## **UNS S32750 F-53**

Super Duplex UNS S32750 is the most common super duplex grade in the market. UNS S32750 is a duplex stainless steel especially designed for service in aggressive chloride-containing environments. It has very good resistance to localized corrosion and stress corrosion cracking in combination with high mechanical strength. It is widely used in oil & gas, hydropower, pressure vessels, pulp & paper, structural components and chemical tankers.

## **UNS S32760 F-55**

Super Duplex UNS S32760 is among the most common super duplex grade in the market. UNS S32760 is a duplex stainless steel especially designed for service in aggressive chloride-containing environments and has additions of W and Cu compared to UNS S32750. It has very good resistance to localized corrosion and stress corrosion cracking in combination with high mechanical strength.

## **UNS S32550 - FERRALIUM 255 -F61**

FERRALIUM 255 is finding many cost effective applications in the chemical, marine, metallurgical, municipal sanitation, plastics, oil and gas, petrochemical, pollution control, wet phosphoric acid, paper making and metalworking industries. Called "super" because it is more alloyed than ordinary stainless steels and has superior corrosion resistance, FERRALIUM 255 is being used in areas where conventional stainless' are inadequate or, at best marginal. One good example is in the paper industry which was hit with an epidemic of corrosion problems when environmental laws forced recycling of process liquids. In closed systems, chemicals such as chlorides can build up to highly corrosive concentrations over time. Paper makers have found that ordinary stainless equipment, which had previously given good service, was no longer adequate for many applications.

## **UNS S31254 - SMO 254 -F44**

The 6Mo super austenitic steel combines moderate tensile strength and high ductility with excellent corrosion resistance in seawater and variety of industrial environment. Typically the alloy has PREN of 42 — 44, which ensure that the resistance to pitting corrosion is high and it also has a high resistance to crevice corrosion.

## **UNS S31803 - F51 UNS S32205 -F60**

Duplex UNS S31803/ S32205 are the most common duplex grades in the market. They have very good resistance to localized corrosion and stress corrosion cracking in combination with high mechanical strength. They are widely used in oil & gas, hydro power, pressure vessels, pulp & paper, structural components and chemical tankers. The alloy are not intended to be used at temperatures above 300 °C due to embrittlement.

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## PH Grades

PH alloys are similar to other stainless steel and nickel-based alloys except for the presence of trace amounts of copper, aluminium, phosphorus, or titanium. After forming a part from a PH alloy, it is subjected to an age-hardening process during which these elements precipitate as hard intermetallic compounds, significantly increasing the part's hardness and strength.



## 17 - 4 PH

17-4 PH Stainless Steel is martensitic precipitation-hardening steel that provides an outstanding combination of high strength, corrosion resistance, good mechanical properties at temperatures up to 6000F(3160C), toughness in both base metal and welds, and short-time, low-temperature heat treatments that minimize warpage and scaling,

## 13-8 MO(UNS S13800)

Stainless steels are known as high-alloy steels. These steels contain good corrosion resistance in comparison with other steels because they contain larger amounts of chromium. Stainless steels are available in three different groups based on their crystalline structure. These groups include martensitic, austenitic and ferritic. The combination of martensitic and ferritic steels forms a fourth group of stainless steels known as precipitation-hardened steels. Stainless steel-grade 13-8 is an age hardenable, precipitation stainless steel. This steel has good resistance to stress and general corrosion cracking, high transverse toughness and high strength obtained by a single low temperature heat treatment. The following datasheet provides an overview of stainless steel-grade 13-8



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## Titanium Alloys

The ore minerals rutile ( titanium dioxide ) and ilmenite are used to extract titanium metal , which is abundant in the earth's crust ( iron - titanium oxide ) . Titanium has high strength , stiffness , and toughness , as well as a low density and good corrosion resistance . A wide range of titanium alloys , ranging from applications at very low to very high temperatures , enable these properties . Weight savings are possible in a variety of aero space applications as well as other high - performance applications in the medical , chemical , and automobile industries .



## TITANIUM GRADE 2

Titanium Grade 2 is a pure alpha titanium. With moderate strength and excellent corrosion resistance and formability, Grade 2 titanium represents the most widely used form of titanium. Compared to the other grades of commercially pure titanium, Grade 2 titanium is slightly weaker than Grade 3, but stronger than Grade 1 and equally resistant to corrosion. Titanium grade 2 is non-magnetic. These properties account for Grade 2 titanium's versatility in regard to its applications.

## TITANIUM GRADE 5

This alpha-beta alloy is the workhorse alloy of the titanium industry. Titanium grade 5 has good tensile properties at ambient temperature and a useful creep resistance up to 3000C. Resistance to fatigue and crack propagation is excellent. Like most titanium alloys, Grade 5 has outstanding resistance to corrosion in most natural and many industrial process environments. The ability to age harden this alloy makes it a good choice for such applications as springs and fasteners.





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## Stainless Steel Alloys

While regular steel contains a small amount of chromium to improve its strength and hardness, stainless steel alloys exhibit superior corrosion resistance due to their ability to form a passivation layer of chromium oxide on their outer surface, effectively coating the steel and protecting it from harmful oxidation that occurs between exposed iron and oxygen molecules in the atmosphere. KanakRatna Steelage is a leading supplier and stockiest of Stainless Steel in all grades



## **ALLOY 440C**

Stainless steels are high-alloy steels which have high corrosion resistance compared to other steels due to the presence of large amounts of chromium. Based on their crystal structure, they are divided into three types such as ferritic, austenitic, and martensitic steels. Another group of stainless steels are precipitation-hardened steels. They are a combination of martensitic and austenitic steels.

Grade 440C stainless steel is a high carbon martensitic stainless steel. It has high strength, moderate corrosion resistance, and good hardness and wear resistance. Grade 440C is capable of attaining, after heat treatment, the highest strength, hardness and wear resistance of all the stainless alloys. Its very high carbon content is responsible for these characteristics, which make 440C particularly suited to such applications as ball bearings and valve parts,

## **904L**

AISI 904L is a high nickel — molybdenum austenitic stainless steel with a very high corrosion resistance specifically for handling medium concentrated sulfuric acid solutions. Good weldability and excellent formability.

## **1.1488**

In our standard condition the steel matrix consists of approx. 80 % martensite, 10 % austenite and 10 % ferrite. This composition allows a low carbon martensitic structure after quenching and tempering. Martensite, some remaining austenite, chrome and molybdenum together contribute to the following characteristic properties:

**High tensile strength.**

**High toughness — also in welds.**

**Better corrosion properties than for most of the existing stainless martensitic steels. Very good fatigue resistance.**

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## Nitronic Alloys

NITRONIC Alloys are classified into the 200 and 300 series and contain between 16 % and 30 % chromium and 2 % and 20 % nickel for improved surface quality , formability , corrosion and wear resistance . Heat treatment cannot be used to harden austenitic alloys . Due to their superior formability and corrosion resistance , these steels are the most widely used grades of stain less steel . In their annealed condition , all austenitic steels are nonmagnetic . Certain austenitics are slightly magnetic when cold worked , depending on their composition .



## NITRONIC - 50

NITRONIC 50 / UNS S20910 / XM-19 is manganese alloyed austenitic stainless steel with improved corrosion resistance compared to 316L and 317L due to increased chromium content plus about twice the yield strength of the same at room temperature. Unlike many austenitic alloys, NITRONIC 50 does not become magnetic when cold formed. NITRONIC 50 Stainless has very good mechanical properties at both elevated and sub-zero temperatures.

## NITRONIC - 60

NITRONIC 60 is silicon/manganese alloyed austenitic stainless steel with double yield strength of AISI 304 material. The increased silicon and manganese level inhibit wear, galling and fretting and makes the alloy fit for temperatures up to 1000°C. General corrosion resistance is between AISI 304 and 316. It offers better chloride pitting resistance, stress corrosion cracking resistance and crevice corrosion resistance than AISI 316L in laboratory conditions.



## **NICKEL WELDING MATERIAL**

Nickel alloys can be joined reliably by all types of welding processes or methods, with the exception of forge welding and oxyacetylene welding. The wrought nickel alloys can be welded under conditions similar to those used to weld austenitic stainless steels. Cast nickel alloys, particularly those with a high silicon content, present difficulties in welding.

The most widely employed processes for welding the non-age-hardenable (solid-solution-strengthened) wrought nickel alloys are gas-tungsten arc welding (GTAW), gas-metal arc welding (GMAW), and shielded metal arc welding (SMAW). Submerged arc welding (SAW) and electroslag welding (ESW) have limited applicability, as does arc plasma welding (PAW). Although the GTAW process is preferred for welding the precipitation-hardenable alloys, both the GMAW and SMAW processes are also used.

## **PHOSPHOROUS- ALUMINIUM BRONZE**

Kanakratna Steelage is a well established business firm which is engaged in manufacturing, supplying and exporting of a wide range of Aluminum bronze. The products offered by our company are extensively applied not only in commercial sectors but also for household purposes. Aluminum bronze offered by our organization is a type of bronze in which aluminum is the main alloying metal that has been added to copper.

Our Aluminum Bronze Products are made available to the clients in different specifications which is divided into single-phase which contains less than 8% aluminum and two-phase which contains 8% to 11% aluminum. We even examine our products on numerous set quality parameters to ensure their flawless composition and functionality.

The Phosphorus Bronze offered by us are from the bronze family Phosphor Bronze, Being of type C 510 Phosphor Bronze (Grade A), these standard alloy finds usage in electrical applications. Further, these are also used in : Meeting equivalent specifications of ASTM B139/ B139M, these also match reference specifications of SAE J461; SAE J463 and AMS 4625.

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## Our Quality

### **WE PROVIDE BEST QUALITY PRODUCT.**

Product quality is a top priority and an essential objectives , one of the factors at the basis of competitiveness and the fame that the Kanakratna Steelage has obtained over the years among other companies . Strict checks are carried out systematically using state - of - the -art machinery that guarantee high product quality standards. Kanakratna steelage in fact has been ISO 9001 certified .



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## Our Capabilities

- We keep small to high range of size stocks to meet on time delivery.
- In house Cutting Facility up to 16" Size.
- We Supply Cut to Length as per Customer Request
- We provide colour code & Bar coding.
- We keep special inventory on behalf of Customer.
- We provide Central Excise & High seas sales for duty benefit.



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## Power & Energy

Kanakratna steelage stocks a variety of special alloys from stainless steels, nickel alloys, and titanium alloys for turbine hardware, turbine blades, and vanes. Whether it's photovoltaic, wind, or geothermal energy, the advancement of emerging energy technology has accelerated significantly in recent years. Renewable energy supplies now account for a sizable portion of annual power production in a number of developed nations. Nonetheless, global electricity production from fossil fuels (coal and natural gas) and nuclear energy will continue to rise in the coming years.





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## Chemical & Fertilizer

The chemical and fertilizer industries have developed a vast array of novel processes in recent years. Demands on process parameters have steadily increased as raw materials and energy sources become scarcer and more expensive, but also as a result of increasingly stringent environmental regulations. This has resulted in elevated operating temperatures and pressures that can be safely maintained only with the use of high-alloy materials. Apex's comprehensive range of corrosion- and high-temperature-resistant high-performance materials enables the development of optimal solutions for the demanding tasks associated with these new technologies.



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## Naval & Marine

Superalloys, or high-performance alloys, are alloys that exhibit excellent mechanical strength and good surface stability, and corrosion and oxidation resistance. Alloys in the INCONEL series are often encountered in extreme environments. These super alloys are oxidation and corrosion resistant and well-suited for service in extreme environments.

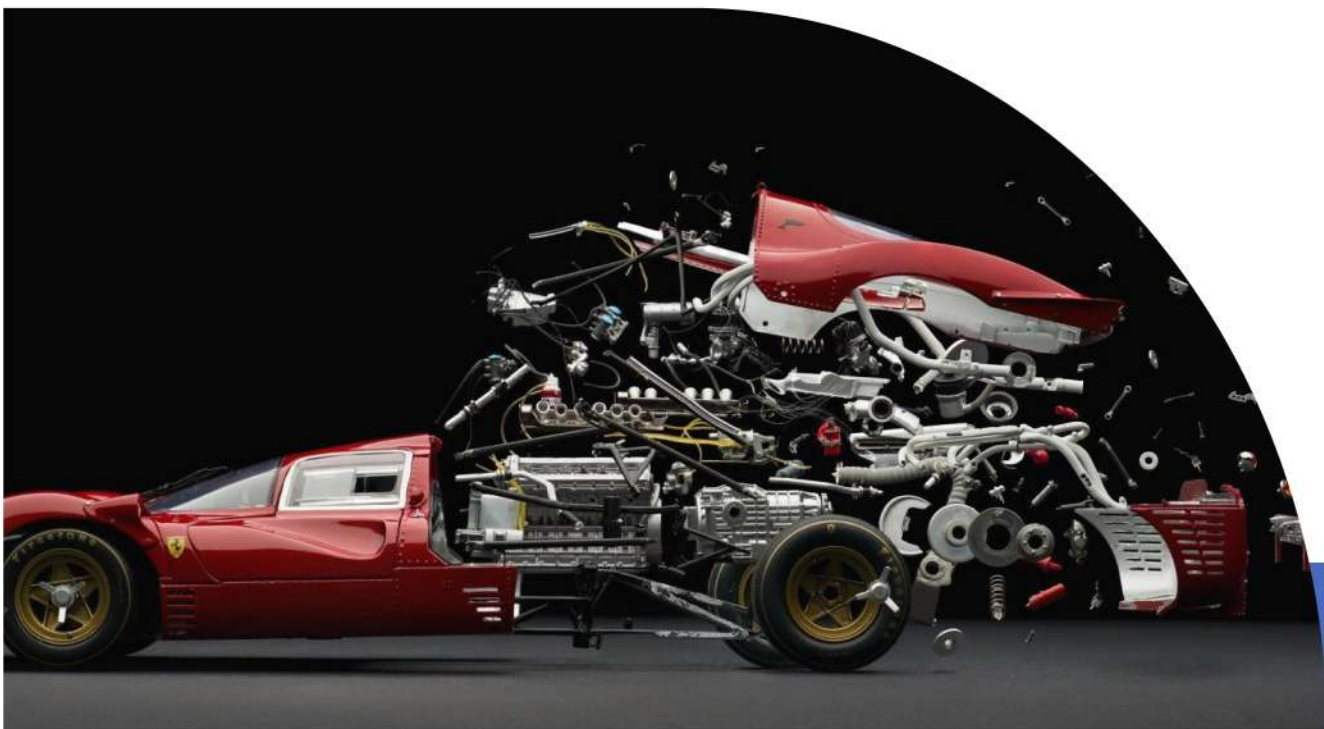


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## Automotive & Engineering

The automotive industry's current trend is toward increasingly powerful engines with smaller displacements. The stated objective of downsizing is to reduce fuel consumption while also lowering pollution emissions. Due to the design of these typically turbocharged engines, higher exhaust temperatures are generated, necessitating stricter requirements for component and material design. As a result, the engine's service life is determined by both the design and the materials used.

KanakRatna Steelage provides many types of materials to meet the diverse requirements of the automobile's various sections. These include resistance to high temperatures, creep, load reversal, corrosion, and wear. KanakRatna Steelage India's strip, sheet, wire, and bars are critical components in a wide variety of automotive components.





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