Oil & Gas Products

—MADE POSSIBLE BY—

Ulbrich Shaped Wire

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CAPABILITY WHITEPAPER

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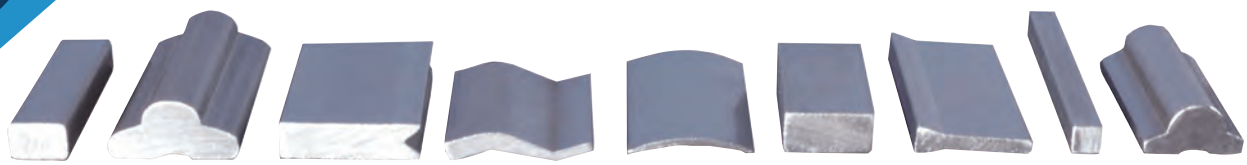
CAPABILITY SHEET

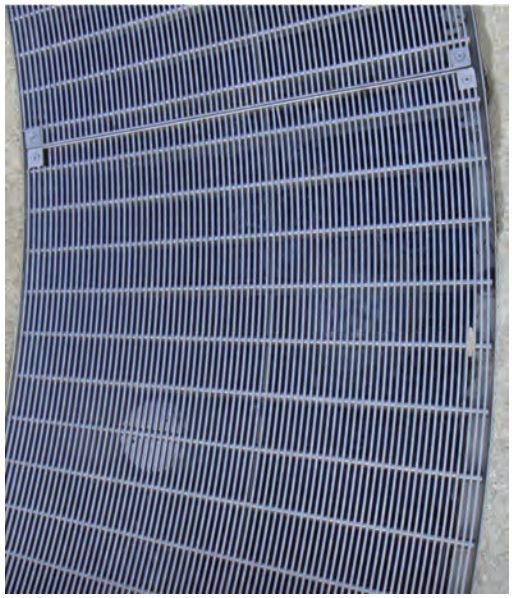
Shaped Wire for Oil & Gas Applications



PROUDLY SUPPLYING STAINLESS & SPECIALTY METAL FOR VITAL COMPONENTS OF THE OIL & GAS EXTRACTION INDUSTRY, ULBRICH DELIVERS PRECISION AND STRENGTH WHILE MAINTAINING A COMMITMENT TO CORROSION PROTECTION.

UNRIVALED RESISTANCE TO THE HARSHEST ELEMENTS

Products used in the Oil & Gas industry are subject to some of the harshest environmental conditions in the world. It's a necessity that Ulbrich materials perform in these extreme environments.

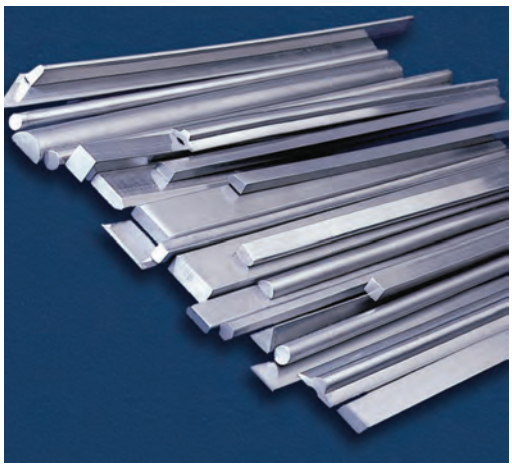


OIL & GAS DRILLING MATERIALS HAVE TO BE BUILT TO LAST USING ONLY THE HIGHEST QUALITY MATERIALS

Acid-bearing fluids used during drilling operations can eat into the tubing they flow through. Temperatures in excess of 1,100 degrees Fahrenheit tend to occur in oil processing plants and can make steel brittle. That is why the metals Ulbrich supplies are manufactured to withstand these corrosive conditions.

YOUR OIL & GAS INDUSTRY LEADING METAL SUPPLIER

Metals are present in nearly every step of the value chain. Ulbrich provides a number of different materials used in many demanding applications throughout the Oil & Gas market.



APPLICATIONS:

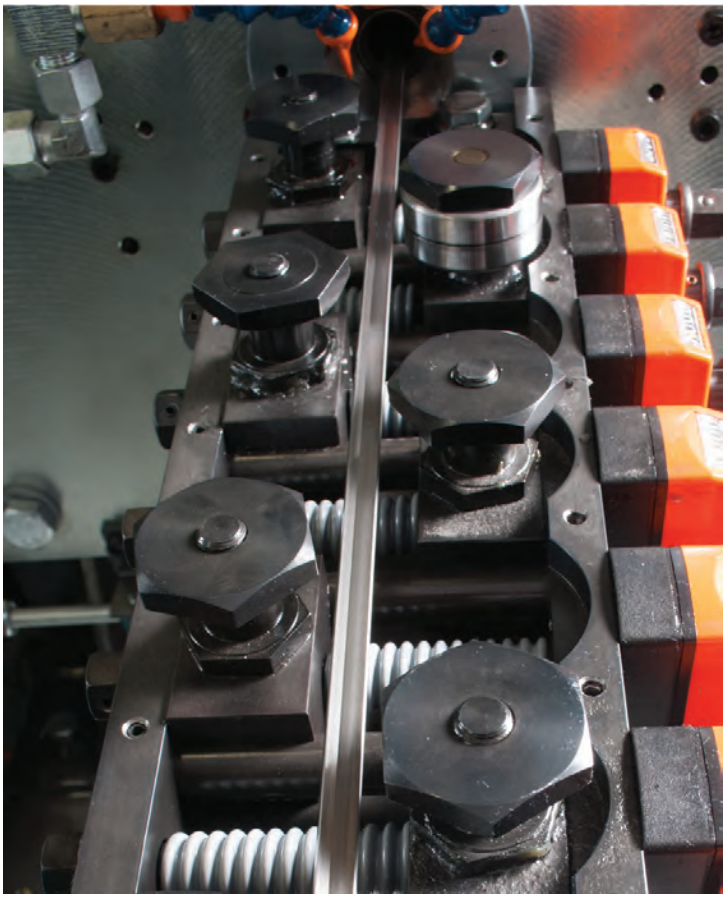
- Wedge Wire
- Well Screens
- Filter Screens
- Seals

ULBRICH ALLOYS AND METALS USED:

- 300 Series Stainless
- 400 Series Stainless
- 2205 Duplex Grade
- Nitronic 32
- Nickel Alloys
- Titanium
- Aluminum
- Carbon Steel

Wedge Wire, Filter and Well Screens Produced to Exacting Specifications

At Ulbrich Shaped Wire, we produce a huge variety of shapes, but our primary focus is on wedge wire and profile wire. These precision wires play a vital role in sand control methods of oil & gas companies. Because we're able to process such a diverse set of alloys and custom shapes, we're capable of producing wire to exacting cross-sectional dimensions for your filter screen products and well screen needs.



ULBRICH MAINTAINS UNIFORM TOLERANCES WITH THE LATEST SHAPING TECHNOLOGY

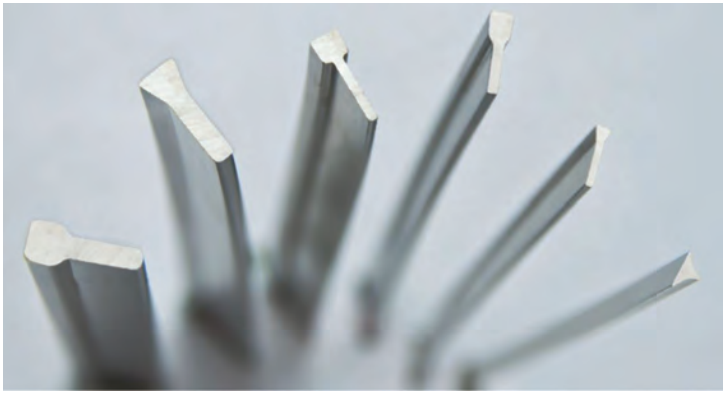
By offering statistical process control (SPC) data, we can easily show any variations within a spool, helping us optimize our manufacturing process and enabling us to produce highly functional wire for any application. And in every operation, our employees verify shape and properties to ensure you're getting exactly what your spec and print requires. With an unmatched ability to control radiuses and geometry, Ulbrich can provide you with the precision shaped wires you need to meet the demands of your customers. This, combined with Ulbrich's spooling process, delivers a tight package that effectively reduces the likelihood that you'll run into snags and coil breaks while winding your oil & gas applications.

INDUSTRY-LEADING PRODUCTS COMBINED WITH INDUSTRY-BEST CUSTOMER SUPPORT

At Ulbrich, we take pride in forming legitimate and reliable partnerships with our customers. To us, that means working closely with you in order to deliver exactly what you need across all of our services. Our dedicated team of metallurgists, engineers, product specialists and project sales managers are able to assist you in developing new and innovative wire products, while also addressing current performance issues you might have with your existing shapes or flats.

Ulbrich We Deliver Precision®

Wedge Wire: The Ultimate Guide



Wedge wire, or as it's sometimes referred to, profile bar, is primarily used in the manufacture of screens. It is categorized as a type of screen wire because it belongs to a family of shapes that are used to manufacture screens, which are used in a wide variety of applications. The product has a triangular shape that varies in height, width and radius on both the nose and corners. Alloys, temper and surface requirements differ based on the what application the screen will be used in. There will be deeper explanation on this later.

Screens themselves are used in a wide variety of industries. Some common end uses are water filtration, mineral and food processing, pulp and paper manufacturing, oil extraction, as well as in architectural applications. Screen forms may vary as well, coming in flats, cylinders and basket forms depending on functionality of the end use.

For someone just looking at a wedge wire, they might assume the product itself is very simple and straight forward. This couldn't be further from the truth. Very careful consideration must be taken when developing a specification for wedge wire. End users need to think carefully when making the appropriate selections in order to develop the appropriate screen. The screens then rest on a support which can be provided in round or screen wire, or roll formed strip, among other options. This forms a type of screen panel; think of a complex strainer like one used at home for making pasta.

WHAT MATERIALS AND ALLOYS ARE USED?

Wedge Wire is very effective for filtering and separating solid materials from fluids. This can be important in multiple settings, but depending on the specific application, the alloy and materials needed can vary. For instance, filtering fluid for an application in the food and beverage market, such as a microbrewery beer tank, may require a different type of alloy than something in the oil and gas market, like a well screen. Alloy selection may also depend on your manufacturing process and what else needs to be added to the wire before it is ready for use. In some cases, welded wedge wire is needed, while in others the profile provided just needs to be put on the support rod.

Alloy selection is critical to the success of the end product. Is the screen being used in a caustic or high temperature environment? Is weight a concern? Is there a need for a softer alloy that is more formable or is the desire for something that is capable of high mechanical properties? As a result, screens are made out of many different alloys depending on the end use. You'll find wedge wires manufactured out of stainless steel, titanium, aluminum, carbon steel, duplex grades, red metals, and a variety of other high-performance nickel alloys including Hastelloy, Inconel and Monel 400.

Stainless steel wedge wire is often a popular selection given the vast variety of grades and, of course, price considerations. After you've selected your alloy, determining the appropriate size for your application is the next step in the process. Ulbrich can offer this material from roughly .032 inches thick to almost any wire thickness above that. Wedge wire can also be offered in any temper from annealed to full hard. Choosing thickness and temper will also depend on the application. The end use of this unique wire shape can vary, and because of the different industries that may require filtration, it can be very useful.

Wedge Wire: The Ultimate Guide

WHERE AND HOW IS WEDGE WIRE USED?

After the wedge wire itself is produced, it will have to rest on a support, which, as we mentioned earlier, can include round or screen wire, or even strip/sheet. Screen wire and wedge wire screen is often produced in two, sometimes three, types of screens: Flat screen and Cylindrical screen are the main types but within cylindrical, there can be round and basket screens. Flat screen consists of screen wire cut to specific lengths and is welded or dry fit to the screen's structure. On the other hand, cylindrical screen contains a spool of screen wire paid off onto a machine that winds the wire into a cylinder and welds the wire to the supports as the screen rotates and grows. Flat screens can also be roll formed into cylindrical screens and cylindrical screens can be cut and rolled flat into a flat screen configuration if necessary. These scenarios depend on the end use.

SPECIFIC APPLICATIONS INCLUDE:

- Food Processing
- Pulp and Paper Manufacturing
- Water Reservoir Intakes
- Oil and Gas - Well Screens
- Filter Screens
- Mineral Processing
- Microbrewery Beer Tanks
- Architectural Applications

Wedge wire could be used for all of the above as well as more applications across different industries. Wherever filtration is needed, wedge wire should be considered because of both its effectiveness and the fact that it can be provided as a final product. The selection in alloy and thickness will obviously depend on what market and segment the screen is used in. A metallurgist or technical expert could help further if there are any specific questions on this.

PHYSICAL FACTORS WITH WEDGE WIRE

It is essential to consider physical factors like surface finish, uniformity and consistency within a wire when considering wedge wire for your application. Continuity of finish is an important factor for screens, particularly with architectural applications. In general, scratches and other visual defects will stand out in most screens quite easily. With architectural products, the amount of reflectivity can have a big impact and so can the consistency within the surface of the wedge wire. Visually, looking from panel to panel that can have an effect if one run doesn't look identical to the other.

When it comes to the wire itself, consistency within a spool of wedge wire is critical for making a successful screen. If the wedge wire manufacturer doesn't have the proper equipment or procedures in place for verifying uniformity within a spool, the screen wire manufacturer runs several risks. Variations in the spool means variations within the slots of that screen. The best-case scenario is a potential rework of a screen, but then there's also the worst case scenario, where the entire screen ends up as scrap. Then all of the labor and time that went into manufacturing that screen is lost. Add to that a potential missed deadline to a customer.

Wedge Wire: The Ultimate Guide

MEETING SPECIFICATIONS AND TESTING

Although many wedge wires have tight tolerances, that doesn't mean that all wedge wire customers have the ability to verify their final shape in order to confirm that it meets both mechanical properties and corner/nose measurements. Some screen manufacturers do have vision systems to verify the screen slot widths between wedge wires and may be able to look at cross sections of the wedge. Many can only trust that the producer of the wedge wire is meeting the specification. That is why it's critical for screen manufactures to align themselves with a vendor who adheres strictly to the requirements laid out by them and the screen designers.

It's not an unheard-of occurrence to run into the situation where Ulbrich has reviewed a customer print and we've had to request revisions only to have the customer come back to us saying, "My current supplier makes it to print." As a follow up we always request a sample to verify the measurements and in the vast, vast majority of cases the wedge wire isn't to print, and the customer has never been aware of that fact.

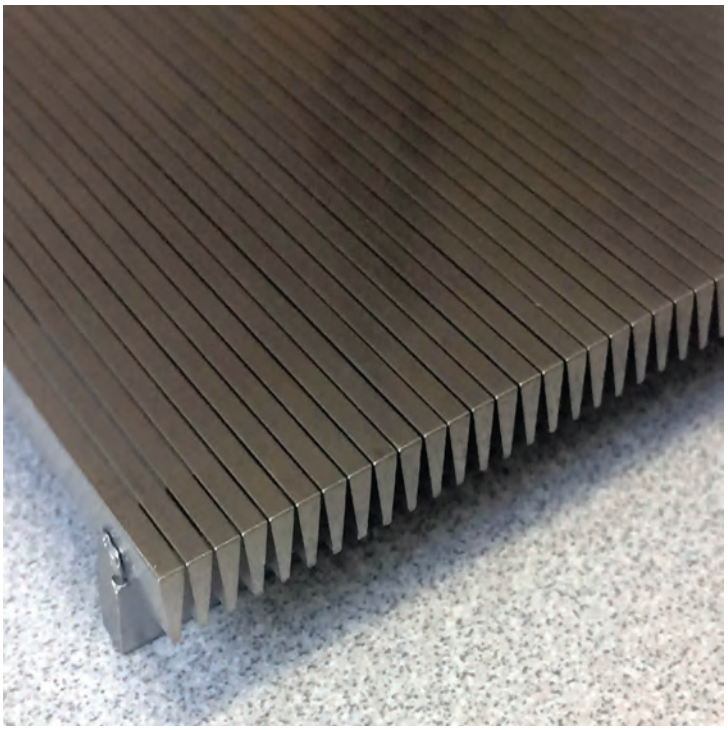
Just like with many other industries, screen wire specifications continually get tighter and tighter. As a result, it's critical to select a wedge wire vendor who not only invests in the latest technology to manufacture that wire but also invests in the appropriate testing equipment and vision systems to guarantee you're getting what you're ordering.

Having a long term understanding of all the factors that go into making a successful wedge wire/profile bar is an important factor too. Due to Ulbrich being so diverse in the products we manufacture, our quality systems from other industries flow through our entire business. The same care and quality standards that have gone into successfully manufacturing our aerospace and medical applications for decades also apply to our wedge wire as well as all other products that we produce.

WEDGE WIRE PRODUCED BY ULBRICH

This material can be offered at Ulbrich to your exact specifications. Through our annealing, flat wire rolling, wire drawing, and wire shaping processes, the final product can be sent to the customer in a final shape that meets the print exactly. Important factors to consider include controlling the radius of both the nose of the shape and the corner. These are instrumental control points in the manufacturing process because they will determine how well the screen can filter out unwanted material and directly impact flow rates (how fast fluids pass through the screen). Slot width and corner radiuses are very dependent on application and are essential dimensions to consider when deciding on your wire because this will determine the size of materials allowed through the filter.

Ulbrich's industry leading tight tolerances and metallurgical support can help with deciding on what dimensions to go with and other factors that need to be considered such as inconsistent finish, fluctuations in hardness, or other quality issues. Please contact us today to learn more.



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Titanium Shaped Wire

ULBRICH'S INDUSTRY-LEADING EXPERTISE IN METAL PROCESSING HELPS SHAPE TITANIUM PRODUCTS WITH INCREDIBLY PRECISE TOLERANCES, PROVIDING ACCESS TO ALLOY STRENGTHS THAT WOULD BE OTHERWISE INACCESSIBLE

PROFILE CAPABILITIES

Ulbrich custom engineers precision titanium shaped wire products in many common profiles, but our bread and butter is our ability to produce custom profiles for your specific application and manufacturing processes. Titanium Shaped Wire is produced to exacting cross-sectional dimensions in our dedicated shaped wire facility. Our capabilities range from square, flat or round wire to custom profiles to meet a specific net shape, allowing production of parts at a much lower cost than alternative manufacturing methods. Our Titanium profile wire minimizes or eliminates costly machining by being net, or near net, in shape. We have a state of the art, in-house, tooling facility and some of the most talented toolmakers in New England!

ULBRICH ADVANTAGES

- Continuous Coils & Traverse/Oscilate Spools
- Cut to Length Available as well as Pancakes
- Close Dimensional Tolerances
- No Burr
- Net or Near Net Shape
- State-of-the-Art, In-House Tooling Facility
- In-Process Gauge and Measurement
- Achieve Specific Tensile/Yield/Temper Range Requirements

YOUR PREMIER TITANIUM SUPPLIER

Our custom shaped wire profiles are produced to exact cross-sectional dimensions, minimizing yield loss. The mechanical properties of titanium alloys make Ulbrich's Shaped Wire suitable for extremely corrosive environments as well as demanding high temperature applications.

Grade 5 (Ti-6Al-4V) UNS R56400 ASTM B265, AMS 4911, AMS 4928

Stronger than CP Titanium alloys, containing 6% Aluminum and 4% Vanadium, Grade 5 Ti has many advantages: excellent formability, corrosion resistance, weldability, strength, and it is heat treatable.

Titanium 6-2-4-2 UNS R54620 UNS R54621 AMS 4919, AMS 4952, AMS 4975, AMS 4976, AMS 4981

A near-alpha Ti alloy, Timetal 6242 contains good tensile strength, creep strength and toughness. It is intended for high temperature use environments up to 1000°F (538°C).

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300 and 400 Series Stainless Steel Wire

ULBRICH SPECIALIZES IN TAILORING STAINLESS STEEL SHAPED, FINE, FLAT, ROUND, SQUARE, PLATED AND UNPLATED WIRE FOR CORROSION-RESISTANT PRODUCTS USED IN VARIOUS INNOVATIVE MANUFACTURING APPLICATIONS

AUSTENITIC

With its exceptional resistance to heat and corrosion, Austenitic grades have many positive characteristics driving demand across various industries. This category of stainless steel is known for its unsurpassed strength and formability

- Type 301 UNS S30100
- Type 301Si UNS S30116
- Type 302 UNS S30200
- Type 302HQ UNS S30430
- Type 303 UNS S30300
- Type 303Se UNS S30323
- Type 304(V/LV) UNS S30400
- Type 304L UNS S30403
- Type 304Cu UNS S30430
- Type 305 UNS S30500
- Type 309 UNS S30908
- Type 310 UNS S31000
- Type 310S UNS S31008
- Type 316 UNS S31600
- Type 316L UNS S31603
- Type 316LS UNS S31673
- Type 316LVM UNS S31673
- Type 316Ti UNS S31635
- Type 317 UNS S31700
- Type 317L UNS S31703
- AL-6XN UNS N08367
- Carpenter 20 CB-3 UNS N08020
- Type 321 UNS S32100
- Type 330 UNS N08330
- Type 347 UNS S34700
- Nitronic 30 UNS S20400
- Nitronic 32 UNS S24100
- Nitronic 33 UNS S24000
- Nitronic 40 UNS S21900
- Nitronic 50 UNS S20910
- High Carbon Steel Wire

MARTENSITIC

Martensitic steel is a type of stainless that, because of its chemical composition, can be hardened and strengthened through heat and aging treatments. These methods make Martensitic steel stronger than other stainless types. The Martensitic grades cover a wide range of applications, from combating comparatively mild corrosive conditions to creating maximum strength and stiffness for cold formed parts.

- Type 420 UNS S42000
- Type 420LC UNS S42000
- Type 420HC UNS S42000
- Type 440A UNS S44002
- Custom 450 UNS S45000
- Custom 455 UNS S45500
- Type 410 UNS S41000
- Type 416 UNS S41600

FERRITIC

Ferritic stainless steel is really defined as a straight chromium non-hardenable class of stainless alloys which have chromium ranging from 10.5% to 30% and a carbon level under .20%. Ferritic grades differ from other stainless types in two crucial regards: its chemical composition and its molecular grain structure. These steels are non-hardenable by heat treatment and only slightly hardenable by cold rolling.

- Type 430 UNS S43000
- Type 430Li UNS S43000
- Type 434 UNS S43400
- Type 436 UNS S43600
- Type 444 UNS S44400

2205 Duplex Grade Stainless Steel Wire UNS S31803, UNS S32205

We Deliver Precision®

SHAPED, FLAT, SQUARE, ROUND, FINE, PLATED AND UN-PLATED
SPECIFICATIONS: ASTM A240, ASTM A 276, ASTM A 479, ASTM A 790

DUPLEX 2205 ALLOY WIRE DESCRIPTION

Duplex 2205 is a two-phase ferritic/austenitic with 22% chromium, 5-6% nickel and 3% molybdenum. It is the most widely used duplex stainless steel grade and is characterized by high yield strength, double that of the standard austenitic stainless steel grades. It demonstrates good fatigue strength, as well as outstanding resistance to stress-corrosion cracking, crevice, pitting, erosion and general corrosion in severe environments.

APPLICATIONS

- Screens and other components for the pulp and paper industry
- Well screens for oil and gas industry
- Marine applications
- Components for the chemical processing industry

Nitronic 32® UNS S24100

WIRE, ASTM A276 (XM-28), ASTM A313 (XM-28), ASTM A580 (XM-28)

NITRONIC 32® DESCRIPTION

Nitronic 32® (XM-28) is an austenitic stainless steel that has almost twice the yield strength of 304 and comparable corrosion resistance. The alloy has high work hardenability which leads cold working to high strengths while maintaining good ductility.

APPLICATIONS

- Abrasion and corrosion resistant screens
- Clamps for pole line hardware
- Concrete reinforcing accessories
- High strength non-magnetic springs
- Wire forms, racks and cages

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316L Stainless Steel UNS S31603

STRIP, COIL, FOIL & WIRE SPECIFICATIONS: AMS 5507, ASTM A666

316L STAINLESS STEEL DESCRIPTION

Type 316L is a low carbon austenitic chromium-nickel stainless steel with corrosion resistance similar to type 316 but with resistance to intergranular corrosion following welding. 316L stainless steel is one of the most commonly used alloys in the production of sand control well screens.

APPLICATIONS

- Chemical Screens and Tubing
- Storage and Transportation Tanks
- Photographic Handling
- Paper Mill Processing
- Watch Manufacturing
- Food Processing
- Marine Applications
- Pharmaceutical
- Gas Scrubbers
- Oil Refineries
- Textile Industry Parts
- Flexible Metal Hose

Incoloy® 825 UNS N08825

SHAPED, FLAT, SQUARE, ROUND, FINE, PLATED AND UN-PLATED
AMS 5542, ASTM B424, ASTM B425, ASTM B564, ASTM B906

INCOLOY® 825 WIRE DESCRIPTION

Alloy 825 is a nickel-iron-chromium-molybdenum-copper alloy containing high levels of chromium, nickel, copper and molybdenum to provide high levels of corrosion resistance to both moderately oxidizing and moderately reducing environments. Far superior when compared to the standard stainless steels. As an austenitic, nickel-base alloy, the material is ductile over a wide range of temperatures from cryogenic to well in excess of 1000°F (538°C). Fabrication of Alloy 825 is typical of nickel-base alloys, with the material readily formable and weldable by a variety of techniques.

APPLICATIONS

- Components for chemical processing pollution control
- Components for processing nuclear fuel
- Sand control well screens
- Oil and gas recovery
- Pickling tank parts

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Nickel Alloys

EXHIBITING HIGH STRENGTH AND EXCELLENT CORROSION RESISTANCE, NICKEL ALLOYS MAKE A GREAT MATERIAL FOR A VARIETY OF APPLICATIONS.

Named for the significant amount of nickel used as it is the unifying or principal ingredient, nickel alloys were developed for use in both highly corrosive or high-temperature environments. The addition of other alloys such as Molybdenum, Chromium, and Iron modify these alloys for uses.

CORROSION RESISTANT ALLOYS

Nickel is a great base for corrosion resistant alloys. In addition to them being inherently resistant to some chemicals, these alloys can be highly alloyed with elements that will improve their corrosion resistant properties.

- Hastelloy® B-2 UNS N10665
- Hastelloy® B-3 UNS N10675
- Hastelloy® G-30 UNS N06030
- Hastelloy® G-3 UNS N06985
- Hastelloy® C-22 UNS N06022
- Hastelloy® C-4 UNS N06455
- Hastelloy® C-276 UNS N10276

HIGH TEMPERATURE GRADES

Nickel-based alloys, especially those in the High Temperature Nickel grade category, offer superior performance at temperatures above 1832°F which makes them suitable in extremely harsh environments. High Temperature Nickel alloys offer many characteristics including excellent weldability, workability, and ductility.

- Hastelloy® X UNS N06002
- Haynes® 242 UNS N10242
- Inconel® 617 UNS N06617
- Haynes® 188 UNS R30188
- Haynes® 263 UNS N07263
- Inconel® 625 UNS N06625
- Haynes® 214 UNS N07214
- Haynes® 282 UNS N07208
- Inconel® 718 UNS N07718
- Haynes® 230 UNS N06230
- Haynes® HR-120 UNS N08120
- Inconel® X750 UNS N07750

OTHER HIGH PERFORMANCE NICKEL

High Performance Nickel Alloys are designed with good strength and to resist oxidation and carburization at elevated temperatures. Alloys such as Monel are in this category due to their good ductility and use under a wide variety of corrosive conditions.

- Monel® 400 UNS N04400
- Monel® 401 UNS N04401
- Monel® 404 UNS N04404
- Monel® K500 UNS N05500
- Inconel® 600 UNS N06600
- Inconel® 601 UNS N06601
- Inconel® 702 UNS N07702
- NiSPAN-C® 902 UNS N09902
- Nickel 200 UNS N02200
- Nickel 201 UNS N02201
- Nickel 270 UNS N02270
- Permanickel 300® UNS N03300
- Incoloy® 800 UNS N08800
- Incoloy® 825 UNS N08825
- Alloy 80/20 Ni Cr UNS N06003

Monel® 400
UNS N04400

We Deliver Precision®

AMS 4730, AMS 4544, QQN 2810D, ASTM B127, ASTM B164

SHAPED, FLAT, SQUARE, ROUND, FINE, PLATED & BARE WIRE

MONEL® 400 OR ALLOY 400 WIRE DESCRIPTION

Monel 400 is a nickel copper alloy which has high strength over a wide temperature range up to 1000°F. It is regarded as being a ductile Nickel-Copper alloy with resistance to a wide variety of corrosive conditions. This alloy is most frequently applied in a range of environments going from mildly oxidizing through neutral and to moderately reducing conditions. Additional application area of this material is in marine environments and other non-oxidizing chloride solutions. Like with commercially pure Nickel, Monel® 400 is low in strength in the annealed condition, for this reason a variety of tempers are used to achieve higher strength levels. Monel 400 is one of the few alloys that maintains its strength in sub-zero or cryogenic temperatures, so it is often used in those applications.

APPLICATIONS

- Cable wrap for oil and gas production
- Chemical and hydrocarbon processing
- Marine engineering components
- Fasteners, Valves, Pumps, Fittings
- Well Screens / Filter Screens
- Heat exchangers
- Flexible metal hose

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Guide to Monel 400: Insights & Advantages

When manufacturing end use applications that will be used in extreme environments such as those which need to withstand extreme temperatures, high pressure or incredibly corrosive environments, selecting an alloy that is up to that task is critical. Monel 400 is a Nickel-Copper alloy that is generally characterized as having good corrosion resistance, good weldability, and moderate to high strength. It is resistant to sea water and steam at high temperatures as well as caustic solutions and salt. It is ideal for applications used in oil refineries throughout the world and it is widely used in the chemical and marine industries as well.

In the past, the oil and the gas industry relied on what are typically considered low end corrosion resistant alloys. Over the last decade or so, this industry has adopted more advanced materials to reduce failure experienced over time in their equipment and parts. The cost impact of overcoming the downtime inducing effects of corrosion, pressure and extreme temperature, as well as failure-rate and safety, prompted this industry to look for materials like Monel 400 which offered increased reliability in harsh conditions.

Monel alloy's good corrosion resistance and high strength properties also make it a great option in marine engineering, cabling, chemical processing, piping, as well as a variety of other applications depending upon what form it is used in. Being a resistant alloy, Monel 400 stands up to high temperature steam atmospheres and rapidly flowing brackish/sea water, while also maintaining excellent resistance to stress corrosion cracking in most freshwaters. It is useful in temperatures up to 1000°F (538°C) so with its anti-corrosive properties and toughness, can be an ideal choice of alloy for very unique needs and applications.

WHAT IS MONEL 400? THE HISTORY AND FULL CHEMICAL COMPOSITION OF MONEL 400

As a Nickel-Copper alloy, Monel 400 is a binary alloy, also known as a "puritan alloy". What this means is that the proportions of nickel and copper are equal to that of the natural ore extracted from the Sudbury mines in Ontario, Canada. The alloy was created by the International Nickel Company in 1901 and it was named after their company president Ambrose Monell, but because trademarks are not allowed to carry a family name, they created their own loophole by simply removing the "L" at the end. Now, the Monel 400 trademark is owned by Special Metals Corporation and it is primarily composed of 52 – 67% nickel (Ni) and copper (Cu), with small amounts of iron, manganese, carbon, and silicon. In comparison to steels, it is extremely difficult to machine as it work hardens quickly.

Element	Min	Max
Nickel	63%	
Manganese		2.0%
Silicon		.50%
Iron		2.5%
Sulfur		.024%
Carbon		.30%
Copper	28%	34%

MONEL 400 VS COMPARABLE STAINLESS

Stainless Steels and this Monel alloy can both be cold worked, but other than that many of their properties differ. Let's look at an austenitic stainless steel with high corrosion resistance, 316 Stainless Steel. While their thermal expansion and specific heat capacity numbers are similar, Monel 400 has a maximum temperature of 1000 degrees Celsius, almost double that of 316 stainless (590 degrees Celsius). Also, this stainless alloy has very high corrosion resistance among the austenitic stainless, but the nickel alloy greatly surpasses it in this category as well. The combination of excellent resistance at high temperatures and excellent corrosion resistance make the Monel alloy a great selection for a variety of applications.

TYPICAL APPLICATIONS FOR MONEL 400

Monel 400, being known for its high strength and corrosion resistant properties, works in a wide range of temperatures and is available for use in a variety of products. Various Grades of Monel are used in a wide range of industries, from aerospace to marine applications. It is used extensively for piping as it is resistant to both steam and seawater atmospheres. More specifically, it's toughness and anti-corrosive properties make it ideal for heavy duty applications like piping in the oil industry.

Other possible applications for this alloy include heat exchangers, sea water scrubbers in gas systems, cladding, pumps and shafts in the chemical business, and more. Due to good mechanical properties from sub zero temperatures to nearly 1000°F, it can be used in a variety of atmospheres. Given that fact, Monel 400 is typically a more expensive alloy than stainless steel.

WHAT ARE OTHER BEST USES FOR MONEL 400?

- marine engineering
- chemical equipment
- flexible metal hose
- heat exchangers
- hydrocarbon processing
- fasteners
- pumps
- valves
- fittings

MONEL 400 PRODUCT FORMS AVAILABLE

This alloy comes in a variety of forms and product lines such as rod and bar (sometimes known as 400 bar), but Ulbrich primarily supplies this alloy in strip and wire form. Due to its high strength, this Monel alloy can be used at lighter gauges and thicknesses for certain applications as compared to other nickel alloys or stainless steels. It can be produced in a wide variety of strip finishes and tempers; Monel 400 is also available in multiple shapes of wire including flat and round Monel wire.

MONEL 400 SHAPED WIRE FROM ULBRICH

There is great demand within the markets and applications we've talked about thus far for a corrosion resistant Nickel-Copper alloy in a variety of shapes and wire profiles. Cold-Rolled shaped wire is advantageous compared to other shaping methods because complex near net shapes, granular dimensional control, and exacting cross-sectional dimensions are achievable with almost no yield loss. These shapes are produced using a combination of rolling and drawing in order to produce near net shapes that can reduce costly machining further down the manufacturing process.

Monel 400 from Ulbrich can still be supplied in not only shaped wire, but also strip and round wire in continuous coil form with close dimensional tolerances and no burr allowing manufacturers to run more coil, at faster speeds without worry. Many manufacturers working with Monel 400 shaped wire benefit from the fact that it can be easily joined and fabricated using conventional processes and procedures. Producing Monel in shaped wire profiles to specific physical properties is also very doable with Ulbrich's metallurgy staff available to advise on your specific applications.

Whether you have specific questions about Monel 400 or any other alloy, feel free to contact an Ulbrich specialist anytime. Hopefully this article was able to increase your knowledge about when to choose Monel 400 for your applications and show all the advantages of the Nickel-Copper alloy. Monel wire & strip are both options and can be offered in a wide variety of surface finishes, thicknesses and widths.

We Deliver Precision®

ULBRICH.COM

Precision Shaped Wire

DESIGNED WITH YOUR SUCCESS IN MIND

WIDTH RANGE
.020″ – 1.50″
(0.508mm – 38.1mm)

THICKNESS RANGE
.005″ – .335″
(0.127mm – 8.509mm)

COMMON SHAPES AND CUSTOM WIRE PROFILES PRODUCED TO CROSS-SECTIONAL PERFECTION

Our cutting edge shaped wire rolling mills allow us to meet the demanding dimensional tolerances your business requires as tight as +/- .0025mm (.0001”). With features such as automatic on-line gauge control and data acquisition technology allowing us to roll wire faster with extreme precision and consistency, Ulbrich has near limitless wire capabilities for any application.

IN-HOUSE TOOLING CAPABILITIES SUPPORT SPEED TO MARKET

Our in-house toolmakers allow us to remain nimble and to react quickly to customer demands and ensure the highest quality and consistency, particularly with new shapes. What would typically take days or weeks with an outside toolmaking company, Ulbrich can prototype things very quickly, iterating rapidly and pushing product out usually within a couple hours.

OUR SHAPED WIRE MANUFACTURING COMBINED WITH OUR UNMATCHED MATERIAL EXPERTISE

Ulbrich was built on a foundation of material knowledge and a dedication to investing in critical equipment, enabling us to rise to the challenges of modern industrial production. Combining a focus factory approach with a robust supply line, Ulbrich Shaped Wire has become synonymous with metallurgical expertise. This allows us to leverage a wide selection of alloys in our wire rolling mills, which furthers our rapid prototyping and custom shaped wire capabilities to develop superior wire for customers whether they require a standard or custom cross section for any market.

Knowledgeable Leadership in Oil & Gas Materials

ALWAYS LOOKING FOR WAYS TO INNOVATE AND IMPROVE UPON OIL & GAS APPLICATIONS

In addition to our state-of-the-art capabilities in rolling, slitting, and annealing, Ulbrich is continuously testing, researching, and analyzing alloys and their chemical and mechanical properties to maximize performance potential. What does this mean for you? It means when you partner with Ulbrich, you not only get the best of the best in personnel, process, and product—you also get a promise of a team that truly cares about making your oil & gas parts as consistently successful and effective as possible.

GLOBAL REPRESENTATION WITH SERVICE & DISTRIBUTION CENTERS LOCATED WORLDWIDE

Ulbrich Stainless Steels & Special Metals, Inc., is a family owned company in its fourth generation of leadership. Established in 1924, Ulbrich has become a critical supplier of stainless steels and special metals to the Oil & Gas Extraction Industry. During this time, we have participated in the development and manufacturing of hundreds of innovative applications. With industry leading Dimensional Control, real time gauging and Statistical Process Control (SPC), a large variety of specialty alloys, and the best customer service available, we strive to produce and distribute the highest quality materials to you. Ulbrich is comprised of a series of manufacturing divisions that supply specialty strip and foil, as well as precision flat, fine, round, and shaped wire, all with local management and all designed to provide custom metals products that can withstand the harshest environmental conditions around the world.

YOU HAVE IDEAS. WE HAVE RESOURCES. PARTNER WITH LEADING EXPERTS.

With Ulbrich's world-class Development Innovation Team, you can gain access to product specialists and quality metallurgists, each with expertise that is best-suited for your unique raw material needs. Our team can deliver custom material solutions to maximize the performance of your application. Talk to a specialist today to learn about what finishes, edge capabilities, mechanical properties, packaging and lengths we can offer for your application! Learn more about our Development Partnership online at **www.ulbrich.com/company/development-partnership**

Contact Ulbrich For Your Oil & Gas Shaped Wire Needs!

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Ulbrich

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