Ulbrich

We Deliver Precision®

SURGICAL INSTRUMENTS MADE WITH ULBRICH ALLOYS

– CAPABILITY WHITEPAPER –

We Deliver Precision®

ULBRICH.COM

CAPABILITY SHEET

Corrosion-Resistant & High-Strength Alloys for Surgical Instruments

TRUSTED AND RELIED UPON BY OEMS IN THE MEDICAL SPACE, ULBRICH COMBINES ITS EXPERIENCE, EXPERTISE AND MACHINE CAPABILITIES TO CREATE METALS WITH OPTIMAL CHARACTERISTICS

ALLOYS

- 17-4PH® Stainless Steel
- 17-7PH® Stainless Steel
- 301 Stainless Steel
- 304L Stainless Steel
- 305 Stainless Steel
- 410 Stainless Steel
- 420 Stainless Steel
- 420 High Carbon SS
- 420 Low Carbon SS Strip
- 440A Stainless Steel

APPLICATIONS

- Scissors
- Sheers
- Surgical draws
- Needles
- Lances
- Surgical grills & grinders
- Surgical staplers/anvils
- Stapler springs
- Staples
- Cardiovascular clamps
- Tissue grabbers

When it comes to surgical instruments, Ulbrich is able to provide a number of stainless steel alloys that are shaped and designed to perform very specific tasks due to our immense rolling and annealing capabilities. So, whether your medical device requires an alloy to be heat treated to a higher hardness (like PH Grade alloys) or something non-magnetic and highly resistant to corrosion (like Austenitic alloys), we're able to make it happen. From cutting to pricking to stapling, the high-stakes demands of surgical instruments require precision alloys with the exact specifications necessary to perform the job. And at Ulbrich, we have both the alloys and the ability to alter them to the specs your product needs.

DRIVING MEDICAL DEVICE INNOVATION THROUGH PRECISION ALLOYS

With the help of Ulbrich alloys, doctors and workers in the medical field are able to restore and preserve the health of ailing people. We take great pride in the fact that our work plays a part—however big or small. That's why we always hold ourselves, our machines, and our processes to the highest of standards. Because with precision alloys, innovative surgical instruments have the power to transform lives.

17-7PH Stainless Steel

AN INTRODUCTION TO THIS WORKHORSE STAINLESS ALLOY

Ulbrich has supplied 17-7PH in coiled strip and wire forms since the 1980s.

Stainless steel is a widely used group of alloys used across many industries such as medical, automotive, aerospace, energy, oil & gas, food processing, and home appliances. The type of stainless steel you need is dependent on your application and final product goals.

17-7PH is one of the most formable of all the precipitation-hardening stainless steel grades. 17-7PH is known as the "Workhorse Alloy" for good reason as it has high strength and good formability. We hope this will serve as your introductory guide to 17-7PH stainless steel.

WHAT ARE THE OTHER CATEGORIES OF STAINLESS STEEL?

Stainless steel grades fall into five categories:

- Austenitic
- Ferritic
- Martensitic
- Precipitation Hardening
- Duplex Grades

In the 1930s and 40s, a standardized numbering system for the different stainless steel grades was developed by the American Iron and Steel Institute (AISI) and SAE to categorize the various stainless steel types. The AISI/SAE stainless steel numbering system is as follows:

- 200 series - High-manganese austenitic alloys
- 300 series - Chromium-nickel austenitic alloys
- 400 series - High-chromium ferritic and martensitic alloys
- 500 series - 4-6% chromium alloys
- 600 series - Proprietary alloys (many PH alloys fall in here)

This system was later replaced in the 1970s when the ASTM and SAE initiated the Unified Numbering System for Metals & Alloys. This system consists of a prefix letter and five digits to designate a material composition. The letter prefix represents a material type, the first three digits match older three-digit numbering from AISI/SAE system, and the last two digits indicate modern variations. Details are explained in ASTM E527, *"Standard Practice for Numbering Metals and Alloys in the UNS."* UNS is now the accepted numbering system for the steel industry in the US. Other countries have their own numbering systems. In the 1980s, the International Standards Organization (ISO) attempted to develop a uniform numbering system. This effort failed, resulting in many different designations depending on the country of origin, for each alloy. Below is an example of the differences in the numbering systems for grade 17-7PH.

AISI	SAE	UNS	JIS[1]	DIN[2]	EN[3]
17-7PH	631	S17700	SUS631	X7CrNiAl17.7	1.4568

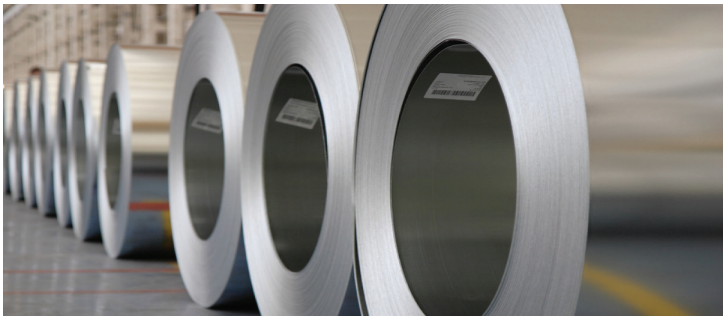
1. Japanese Industrial Standards 2. Deutsches Institut Normung – West German Steel Specification 3. Europaischen Normen – Western Europe

WHAT DOES THE 'PH' INDICATE IN 17-7PH STAINLESS STEEL?

The 'PH' behind the '17-7' in the alloy name means that this is a precipitation hardening alloy. The principle of precipitation hardening is that a supercooled solid solution changes its metallurgical structure on aging. Precipitation hardening stainless steel offers a means of obtaining very high strength for a stainless material through a low-temperature treatment applied after fabrication with minimal dimensional distortion. The PH alloys of stainless steel fall into three categories: austenitic, semi-austenitic, and martensitic. Each type has unique chemistries, heat treatments, properties, and applications associated with it.

It is essential to understand that 17-7PH is a semi-austenitic PH alloy. In a semi-austenitic PH alloy, quenching to room temperature after soaking produces an austenitic structure. Martensite is formed by one of two processes. The first is cooling the steel to sub-zero temperature; the second involves conditioning heat treatments that remove carbon from the solution in the form of chromium carbides.

Like austenitic stainless steels, semi-austenitic PH Alloys such as 17-7PH have good corrosion and oxidation resistance and do this without losing toughness & ductility typically associated with high-strength materials. 17-7PH is known for its ability to gain higher strength through heat treatment, similar to martensitic grades.



WHAT DOES '17-7' IN 17-7PH STAND FOR?

The numbers "17" & "7" making up the name of this alloy refers to its chromium content (~17%) and the amount of nickel (~7%) present in the alloy. This numbering is a common way to refer to stainless steel grades. For example, 304 stainless steel is sometimes referred to as 18-8 due to the composition being approximately 18% chromium and 8% minimum nickel. In addition to the chromium and nickel, other vital elements in 17-7PH are manganese and aluminum. This chemistry of this stainless alloy grants 17-7PH good corrosion resistance, high strength and hardness, formability, and excellent fatigue properties, which make it a very desirable alloy for many applications.

The manganese reduces the critical cooling rate during hardening, meaning it increases the hardenability of this grade. While the aluminum is added for deoxidizing and grain refining, however because of the aluminum content, working with 17-7PH can present challenges.

Aluminum serves as the hardening mechanism and has a strong affinity for Oxygen. Aluminum oxide is extremely abrasive and will wear down tooling if it is present in excessive amounts on the surface 17-7PH. It's important to note that when annealing 17-7, the adequate atmosphere, including ensuring minimal amounts of trace oxide in the furnace, is required to minimize the tendency for the material to form Aluminum oxide. The complexity and precision needed to produce this material to the highest quality standards are why manufacturers working 17-7 should seek highly capable precision manufacturers who can control this process. Quality can only be achieved through constant measurements of temperature, anneal speed, dewpoint, trace Oxygen, and quench rate, which is carefully monitored in real-time and examined for effectiveness.

HOW IS 17-7PH STAINLESS STEEL MANUFACTURED? The same way as other stainless steels.

STEPS OF THE STAINLESS STEEL MAKING PROCESS

1) Melting & Refining

Stainless steel scrap and raw materials get added to an Electric Arc Furnace (EAF). Various refining stations, such as Argon Oxygen Decarburization (AOD), Ladle Metallurgy Station (LMS), Wire Feed Station (WFS), and the Argon Stir Station, are used to get the steel to the desired chemistry and temperature.

2) Continuous Casting

The molten metal is transferred to a ladle then to a tundish and continuously cast into ~ 10" thick slabs. The width of the slabs can vary, as can the length.

3) Hot Rolling

In hot rolling, the slabs of metal pass through a furnace, which heats them to the desired temperature depending on the grade of stainless steel that is being processed. When the desired temperature is achieved, the slabs run through a series of rolls, reducing the thickness of the material from approximately 10" thick slabs to 1/8" thick strip. Afterward, the strip is coiled for further processing.

4) Anneal & Pickling

Annealing is the process of heating the material to the desired temperature to soften and set properties, which allows the material to be further processed by cold rolling or fabricated into parts. Pickling is the process that removes the scale formed on the surface through hot rolling or annealing in the atmosphere through the immersion of the strip in an acid solution. These two processes can be combined into one single process known as a continuous anneal and pickle line.

5) Cold Rolling

The process in which the steel is passed through one or more pairs of rolls at a temperature below the recrystallization temperature to reduce the thickness to the desired gauge.

6) Slitting

The process of cutting large, wide coils of steel into narrower widths.

WHAT ARE THE DIFFERENCES BETWEEN 17-7PH AND OTHER TYPES OF STAINLESS STEEL?

Different types of stainless steel possess different properties and are suitable for varying applications based on these characteristics. Let's take a look at the differences between all the stainless steel types.

17-7PH STAINLESS STEEL

17-7PH stainless steel is chromium-nickel-aluminum, semi-austenitic PH Alloy. Desirable properties that engineers and purchasers seek out this alloy for their applications include:

- High strength
- Good corrosion resistance
- Excellent fatigue properties
- Good formability
- High-temperature properties

This type of stainless steel is less magnetic than other PH grades but provides high strength and hardness, good formability, and offers minimal distortion following heat treatment. This combination makes it suitable for many aerospace applications.

AUSTENITIC STAINLESS

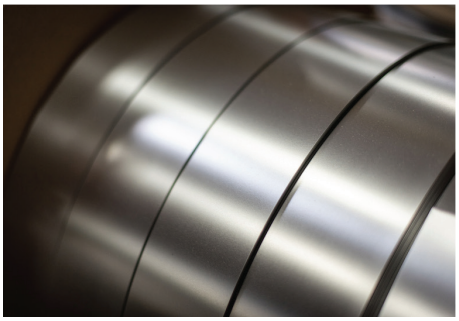
These stainless are either chromium-nickel (300 series) or manganese- nitrogen (200 series) alloys. They contain a minimum of 16% chromium, and the nickel can range from 3% - 30%. Molybdenum can be added for increased pitting corrosion resistance.

Austenitic stainless steels are non-magnetic in the annealed condition, but become partially magnetic through work hardening.

This largest category of stainless steel has excellent formability, corrosion resistance, and a wide range of strengths available, making them excellent choices for almost every application.

FERRITIC STAINLESS STEEL

Ferritic stainless are straight chromium grades with the Cr level varying from 10.5 – 30%. They make up the 400 series of alloys, which have very good elevated temperature oxidation resistance, good ductility, and are magnetic. These properties and their relative price stability due to low nickel and other alloying elements make them an excellent fit for many automotive applications.



MARTENSITIC STAINLESS

Often referred to as 400 series alloys, these stainless steels are comprised primarily of chromium and carbon. Martensitic stainless steels are magnetic and capable of being heat-treated to very high hardnesses and strength levels.

PRECIPITATION HARDENING

Precipitation hardening (PH) stainless steels are made of chromium-nickel with added key elements depending on the grade. They can attain very high strength as a result of the precipitation-hardening process while maintaining toughness.

DUPLEX STAINLESS GRADES

Duplex are a combination of austenitic & ferritic stainless, developed for applications in which high strength and excellent corrosion resistance are essential. They are used extensively in the pulp & paper industry, oil & gas industry, and chemical refineries.

17-7 PH Stainless Steel UNS S17700

STRIP, COIL, FOIL, WIRE, AMS 5528 (CONDA), AMS 5529 (COND C), ASTM A693, MIL-S25043

We Deliver Precision®

17-7 PH STAINLESS STEEL DESCRIPTION

17-7 Precipitation Hardening Alloy is a semi-austenitic stainless steel which is austenitic in the annealed condition, but martensitic in the hardened condition. Type 17-7PH provides high strength and hardness, excellent fatigue properties, good corrosion resistance and minimum distortion upon heat treatment. Easily formed in the annealed condition then hardened to high strength levels by simple heat treatments to Conditions RH 950 and TH 1050. The exceptionally high strength of Condition CH 900 offers many advantages where limited ductility and workability are permissible. In its heat treated condition, it provides exceptional mechanical properties at temperatures up to 900 °F (482 °C).

APPLICATIONS

- Numerous Aerospace Applications
- Chemical Processing Equipment
- Food Processing Equipment
- Oil & Petroleum Refining Equipment
- Heat Exchangers
- Bellville Washers
- Honeycomb
- Surgical Parts
- Clips
- Springs
- Blades
- Bellows

17-4 PH SS UNS S17400

STRIP, COIL, FOIL, WIRE, AMS 5523, ASTM A167

17-4 PH STAINLESS STEEL DESCRIPTION

Type 17-4PH is a martensitic precipitation-hardening stainless steel that provides an outstanding combination of high strength, good corrosion resistance, good mechanical properties at temperatures up to 600 °F (316 °C), good toughness in both base metal and welds, and short time, low-temperature heat treatments that minimize warpage and scaling.

APPLICATIONS

- Surgical Parts
- Aerospace
- Petrochemical / Chemical
- Food Processing

ULBRICH.COM

301 Stainless Steel UNS S30100

STRIP, COIL, FOIL & WIRE

ASTM A666, AMS 5901 (ANN), AMS 5902 (3/4H), AMS 5517 (1/4H), AMS 5518 (1/2H), AMS 5519 (FH)

301 STAINLESS STEEL DESCRIPTION

Type 301 is a chromium nickel austenitic stainless steel capable of attaining high strengths and ductility by cold working. It is not hardenable by heat treatment. 301 is non-magnetic in the annealed condition and becomes increasingly magnetic with cold working. This chromium nickel stainless steel alloy provides high strength and good ductility when cold worked. 301 is a modification of stainless steel grade 304 with lower chromium and nickel to increase the work hardening range. Type 301 exhibits corrosion resistance comparable to type 302 and 304. In the cold worked and annealed condition, 301 achieves its most optimal resistance to corrosion. It is preferable over types 302 and 304 in the tempered condition because the higher elongations (which are attainable at a given strength level) facilitate fabrication.

APPLICATIONS

- Surgical Parts
- Springs
- Fasteners
- Washers
- Zippers
- Clips
- Clamps
- Computer Parts
- Contacts
- Stamping Parts
- Pins

304L Stainless Steel UNS S30403

STRIP, COIL, FOIL, WIRE, AMS 5511, ASTM A240, ASTM A666

304L STAINLESS STEEL DESCRIPTION

304L has oxidation resistance to a maximum temperature of 1650° F (899° C) continuously without appreciable scaling. The maximum temperature for intermittent exposure is 1500° F (816° C). Since 304L is an extra low-carbon variation of 304, it can often be used in the "as-welded" condition (without annealing), even in severe corrosive conditions, except for applications specifying stress relief. 304L has good welding characteristics and can be welded by all standard methods, but attention needs to be paid to avoid weld "hot cracking". Welding may be followed by annealing to relieve stresses during severe forming or spinning.

APPLICATIONS

- Medical Parts Manufacturing
- Manufacture of Surgical Parts
- Tubing
- Flexible Metal Hose
- Bellows

305 Stainless Steel UNS 30500

STRIP, COIL, FOIL & WIRE, AMS 5514, ASTM A240, QQ-S-766

305 STAINLESS STEEL DESCRIPTION

305 is an austenitic chromium nickel stainless steel with a low rate of work hardening. This low rate of work hardening makes it suitable for many deep drawing applications. In order to minimize earring during drawing, the directionality introduced during cold rolling must be kept to a minimum amount. Deep drawing quality should be noted when ordering 305. Ordering annealed or dead soft does not guarantee deep drawing quality. 305 is non magnetic and becomes magnetic (at a slow rate) with increasing cold work.

APPLICATIONS

- Deep Drawn Parts
- Cups / Pans
- Mixing Bowls
- Rivets
- Eyelets
- Tubes
- Pens

410 Stainless Steel UNS S41000

STRIP, FOIL, WIRE, AMS 5504, AMS 5505, ASTM A-240

410 STAINLESS STEEL DESCRIPTION

Type 410 is a martensitic stainless steel that provides good corrosion resistance plus high strength and hardness. It is magnetic in both the annealed and hardened conditions. A wide range of properties can be achieved with different heat treatments. Applications requiring moderate corrosion resistance and high mechanical properties are ideal for type 410.

APPLICATIONS

- Cutlery
- Hardware
- Micrometer Parts
- Oil Valve Parts
- Clips
- Springs
- Fasteners
- Compressor Parts
- Gauge Parts
- Pins

420 Stainless Steel UNS S42000

STRIP, COIL, FOIL, WIRE, AMS 5506, ASTM A240

420 STAINLESS STEEL DESCRIPTION

Type 420 is a martensitic stainless steel that provides good corrosion resistance similar to 410 plus increased strength and hardness. It is magnetic in both the annealed and hardened conditions. Maximum corrosion resistance is attained only in the fully hardened condition. It is never used in the annealed condition.

APPLICATIONS

- Surgical Instruments
- Cutlery
- Staight Edges
- Fasteners
- Dental Instruments
- Tapes
- Scissors
- Firearms

440A Stainless Steel UNS S44002

STRIP, COIL, FOIL, WIRE, ASTM A 276

440A STAINLESS STEEL DESCRIPTION

Type 440A is a straight chromium martensitic stainless steel which combine the superior wear resistance of high carbon alloys with the excellent corrosion resistance of chromium stainless steels. It is magnetic in both the annealed and hardened conditions. Maximum corrosion resistance is attained only in the fully hardened condition.

APPLICATIONS

- Surgical Parts
- Cutlery
- Scissors

We Deliver Precision®

420 High Carbon and 420 Low Carbon Stainless Steel UNS S42000

TEMPERED 420HC STEEL STRIP, AS ROLLED, AMS 5506, ASTM A240

420LC STAINLESS STEEL STRIP, COIL, FOIL, AND WIRE
THIS ALLOY IS UNIQUE TO ULBRICH: NO APPLICABLE INDUSTRY SPECIFICATION

420HC AND 420LC STAINLESS STEEL DESCRIPTIONS

Types 420 High Carbon and 420 Low Carbon are martensitic stainless steels that provide full corrosion resistance only when hardened or hardened and tempered. In these conditions, the corrosion resistance is similar to type 410 plus increased strength and hardness. 420HC and 420LC stainless steels are magnetic in both the annealed and hardened conditions. Maximum corrosion resistance is attained for both alloys only in the fully hardened condition. They are never used in the annealed condition.

420HC Steel also offers good ductility when annealed and excellent corrosion resistance properties when the metal is polished, surface ground or hardened.

Type 420LC can be hardened by cold working and heat treating, and can be moderately drawn and formed in the annealed condition. 420LC Steel has better formability than its high carbon counterpart.

420HC AND 420LC STAINLESS STEEL APPLICATIONS

- Surgical Instruments
- Dental Instruments
- Cutlery
- Tapes
- Staight Edges
- Scissors
- Fasteners
- Firearms

ULBRICH.COM

Alloys for Medical Manufacturing

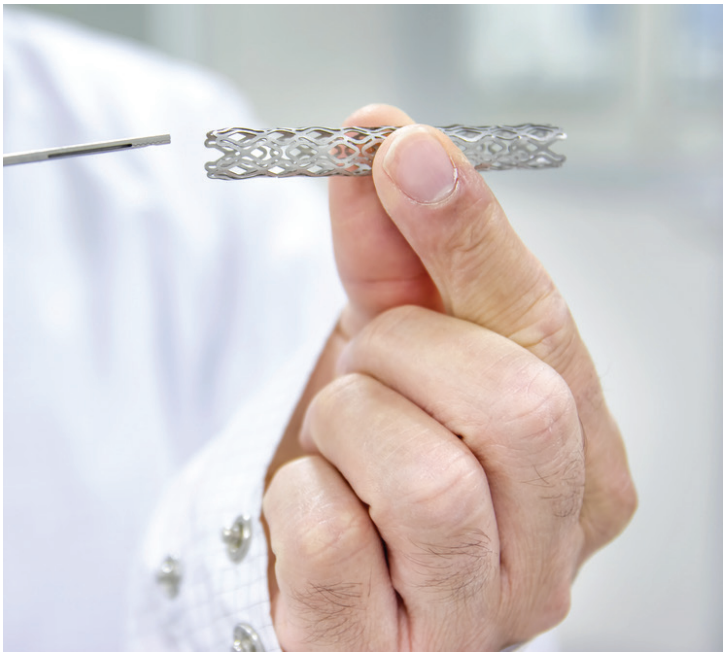
THINGS TO CONSIDER WHEN EVALUATING WIRE ALLOYS FOR YOUR MEDICAL APPLICATION

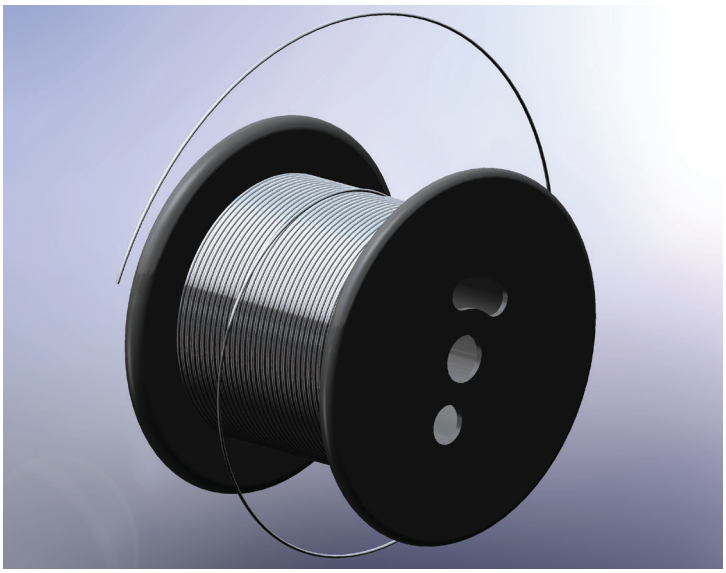
WHAT ARE THE PROPERTIES TO CONSIDER?

Here is the short answer: any decision on chemical, mechanical and physical properties of metal alloys is highly dependent on what task the medical device will perform and the environment in which it will operate.

End-use applications dictate every single decision that goes into selecting an alloy, determining its shape and size and quantifying the amount of material needed. Other properties medical manufacturers and buyers should consider might be: atomic, electrical, environmental, magnetic, radiological, manufacturing properties such as castability or machinability, and even perhaps thermal properties of the material.

When specifying an alloy for your medical application, correct and uniform chemical properties should be decided upon early in the metal selection process. Taking careful steps to select the right chemical makeup of an alloy allows precision re-rollers or other metal suppliers to source accurate, high quality raw material—that has been smelted or manufactured long before arriving at our loading bays. At Ulbrich, Engineers, Product Managers and seasoned Sales professionals work together to communicate the best route to take in terms of material selection.



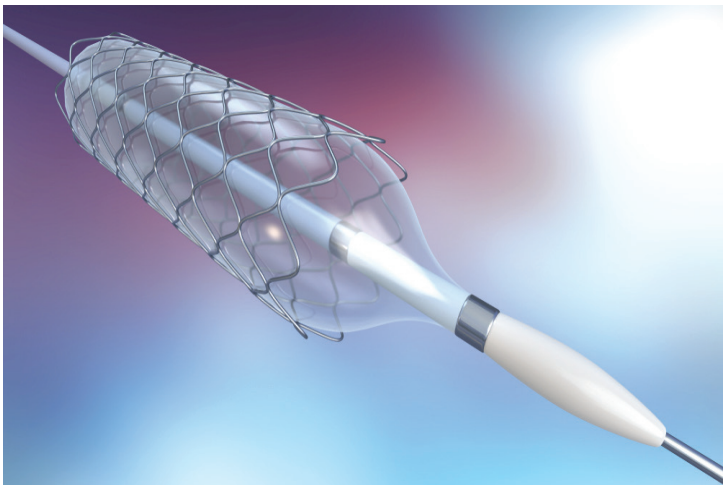


At Ulbrich Specialty Wire Products in Westminster, SC, where most of our medical device customers procure precision round and flat wire, we have medical manufacturing and metallurgical experts who help our customers select and procure the right material with the right properties based on their specific application demands. The most common mechanical properties are high strength and dimensional control for medical braid wire applications. Dimensional control, surface smoothness and elongation have also become of high importance for Mandrel applications.

Mechanical properties and oxide layers related to the specialty metal Nitinol, which is a shape-memory alloy, are known to be critical factors in the medical device industry these days.

Biocompatibility, or the capacity of the human body to adapt to contact with metal such as Titanium, is also a factor that medical manufacturers must often consider. For example, Titanium rods applied in oral surgeries bind to human flesh. The Titanium rods are permanently and effectively set in place making their biocompatibility extremely important to prevent rejection, corrosion, or infection. Titanium is highly biocompatible so it is often used in medical manufacturing such as dental implants, allowing patients to heal quickly and to use their jaw/teeth as if nothing happened.

Many medical manufacturers use a spring temper flat, round or custom shaped wire for their application. Different required characteristics that might be desirable based on manufacturing process or end use might warrant annealed, full-hard, half-hard, and quarter-hard wire which can be provided upon request from wire manufacturers.



The harder the temper, the more rigid the structure will be. This gives a good torque response to the device, which is also known as “torquability”. For example, in the production of catheters, special maneuverability is the key to success, making torquability of the material used in their production a very important requirement.

Catheters are medical devices that can be inserted in the body to treat diseases or perform surgical procedures. Mechanical properties play a huge role in the selection of metal for making catheters, since they are extruded over specialty metals like Nitinol to create catheters. Medical device customers must also decide whether to go with coiled-enforced or braid-enforced catheters for their application. In the production of catheters, many customers are now using Nitinol for coiled catheters used in especially sensitive surgeries where precision is paramount, like neural or cardiovascular surgeries.

WHAT ARE THE DIFFERENT METHODS FOR ENSURING MATERIAL QUALITY FOR MEDICAL WIRE AND WHAT DO THEY ACCOMPLISH?

Methods for ensuring quality stainless steels and special metals for medical wire should be a big focus, not only for the quality assurance team at your organization, but it should be an expectation of yours that it is the utmost priority of your medical rolling mill.

Continuous dimensional data collection (SPC data) should be collected as the metal runs through the mill because it will improve consistency in the performance for your manufacturing process as well as the medical device. Working closely with metal manufacturers who have trained metallurgists on staff who have knowledge of how metal is shaped and sized at the miniscule, mathematical level is extraordinarily advantageous for medical device manufacturers. This type of quality control ensures that defects are less likely and therefore, time and energy savings are benefitting your medical device or component business and streamlining your production while reducing scrap, waste and failure. Most of all, dimensional data collection assures that materials are within your specifications and meet all regulatory and manufacturing requirements.

Surface cleanliness is another major factor that has an impact on improving or degrading material performance in demanding medical applications. The methods to ensure cleanliness can never be stringent enough, because people’s lives are literally on the line. Precision strip, flat wire and round wire must be as particulate-free as possible to ensure peak results, because anything else could be catastrophic.

Quality Control Coordinators, Machine Operators and Helpers at Ulbrich are continuously inspecting each work order with vigorous attention to detail. Team communication and collaboration are paramount to ensuring quality throughout the supply chain. When selecting a materials partner, you should work to understand if they have the same level of commitment to quality up and down the organizational chart as you would expect. Compliance with the latest ISO certifications are well and good, however, to meet the material needs of medical device customers, special precautions and utmost care should not only be standardized in the process, but engrained in the culture.

Personal Protective Equipment (PPE) is only step one to keeping material free and clear of contaminants. Custom barriers, guards, and other means of contaminant prevention should be installed on the machinery at every stage of material production to protect metal in progress (as well as the Machine Operators) from being compromised. This ensures that the material you receive is ready for, and has been manufactured to, the same level of cleanliness and attention to quality and performance that you set for yourself as a medical manufacturer.

A method on the front end of the manufacturing process starts with purchasing. Buying material from qualified sources and reputable vendors is essential. The chemistry makeup of the material must be carefully inspected while at the same time, inclusion rates should be as low as possible (non-existent in a perfect world).

In choosing a supplier and an alloy, medical device customers must seek those sources who sell materials with consistent and undeviating mechanical properties which are paramount to processing medical wire. Manufacturing sources as well as production methods are equally vital in the supply chain to attaining success in the world of high-tech medical devices.

Lastly, tedious spooling methods to avoid tangles during production are also of high importance. When medical device customers go to use bulk, Steeger or Wardwell bobbins, they do not want any breakages due to tangling wires. With round wire as thin as 0.00075" for nitinol and stainless steel alloys, tangling can cause massive strain on medical device production. Ulbrich cautiously wraps wire on spools with the next operation in mind, and we then ask for feedback on the performance of the spooling.

WHAT ENVIRONMENTAL OR CONTEXTUAL FACTORS ARE DEVICES SUBJECTED TO THAT CAN AFFECT MATERIAL SELECTION?

Will the device be implanted in the body, or how long will the device be in there? Biocompatibility and response to blood is an essential factor here. MRI Compatibility may also be required depending on your application.

HOW IMPORTANT ARE THE CORROSION RESISTANT PROPERTIES OF STAINLESS STEEL OR OTHER SPECIAL METAL WIRE FOR MEDICAL DEVICE MANUFACTURING?

Very Important. For example, 304V stainless steel wire has been vacuum arc remelted so that it has a more uniform chemistry with minimal voids and contaminants. 304V SS is a flexible, robust material that can easily be soldered or welded. 304V wire is used in many medical applications because of its low cost compared to other materials that meet the minimum standards for corrosion resistance.

WHAT ARE COMMON MATERIALS WE SEE MEDICAL MANUFACTURERS TURNING TO?

Bi-metals are becoming more widely used and popularized. Special alloys and various metals like MP35N, a developmental project-based alloy, offer new, high performance capabilities for surgeons. Other bi-metals like Nitinol with a Platinum core (cladded) and a Nitinol with a Tantalum core have received greater exposure in the medical device marketplace as of late. Heavy metals like Platinum, Tantalum and Tungsten show up extremely well under a fluoroscope during cardiovascular surgery, for example, and allows surgeons to see where they are going within the human body.

Though these other special metal alloys have proven to be great alternatives for the medical industry, 304V stainless steel wire is still most often used in the majority of medical applications because the alloy meets the minimum standards for corrosion resistance while still being a safe and productive material.

WHAT IS CRITICAL TO THE PRODUCTION AND PERFORMANCE OF SURGICAL INSTRUMENTS?

When it comes to surgical instruments, stainless steel alloys—like Austenitics, Martensitics, and PH Grades—that are shaped and designed to perform very specific tasks are critical and common. Alloys used to produce medical instruments should be manufactured to withstand the demands of daily use in healthcare environments, with rigorous attention to detail and quality. From cutting to pricking to stapling, the high-stakes demands of medical devices and surgical instruments require precision manufactured alloys with the exact specifications necessary to perform the job.

ULBRICH IS DRIVING MEDICAL INSTRUMENT INNOVATION THROUGH PRECISION ALLOYS.

With the help of precision special metals, doctors and workers in the medical field can restore and preserve the health of ailing people. At Ulbrich, we take great pride in the fact that our work plays a part—however big or small—in the health of millions. And that's why we're always holding ourselves, our machines, and our processes to the highest of standards. Because with precision alloys, innovative surgical (increasingly robotic) instruments have the power to transform lives.

Different surgical instruments and incision tools require a diverse range of alloys and alloy characteristics. Choosing the best materials and having them produced to exacting mechanical, chemical, and physical specifications ensures that the resulting product, or component delivers more consistency, less waste, and lower failure rates. Ulbrich has a long history of providing alloys and bi-metals to the medical industry due to our strategic sourcing methods, our huge inventory of alloys, and immense rolling and annealing capabilities. It gives us a competitive advantage that we are able to pass on to our customers. So, whether your medical device requires an alloy to be heat-treated to a higher hardness (such as Precipitation Hardening Grades) or something non-magnetic and highly resistant to corrosion (like Austenitic alloys), we're able to make it happen.

SURGICAL INSTRUMENTS MADE WITH PRECISION ALLOYS INCLUDE BUT ARE NOT LIMITED TO:

- Scissors
- Sheers
- Surgical Draws
- Catheters
- Needles
- Lances
- Surgical Grills and Grinders
- Surgical Staplers/Anvils
- Stapler Springs, Staples
- Cardiovascular Clamps
- Tissue Grabbers
- Strip Square
- Surgical Robotic Instruments
- and more...

STAINLESS STEEL:

- 304 Stainless Steel
- 304V Stainless Steel
- 304LV Stainless Steel
- 304LVM Stainless Steel
- 316 Stainless Steel
- 316L Stainless Steel
- 17-4PH Stainless Steel
- 17-7PH Stainless Steel
- 305 Stainless Steel
- 410 Stainless Steel
- 420 Stainless Steel
- 420 High and Low Carbon
- 440A Stainless Steel

SPECIAL METALS:

- Nitinol
- Titanium
- MP35N
- Copper
- Aluminum
- Tungsten
- Beryllium Copper
- Molybdenum
- Phosphor Bronze
- L605
- and many other "bi-metals"

(combinations of cladded wire that may include Silver or Platinum)

We Deliver Precision®

ULBRICH.COM

SHAPED WIRE CAPABILITIES

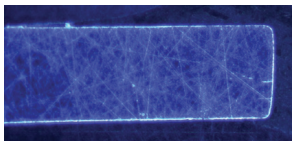
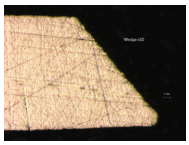
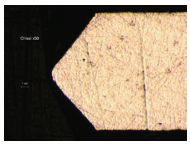
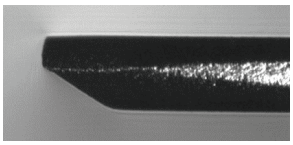
Precision Rolled, Coated & Shaped Wires for Medical

Ulbrich Specialty Wire Products is expanding shaping capabilities to include ultra-fine cross sections and additional alloys to complement Ulbrich Shaped Wire's already extensive offering.

SPECIALTY EDGING:

Exact dimensions achieved with specialized tooling to create accurate edges.

TYPES OF EDGES

Square	Chisel	Wedge	Tapered
			

SPECIALTY SHAPES:

MATERIALS

- Stainless Steel
- Titanium Alloys
- Nickel Alloys
- Cobalt Alloys
- Nitinol
- Copper
- Special Metals

COATING

In-House Capacity:

- Gold
- Silver
- Nickel

SIZING

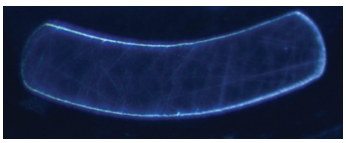
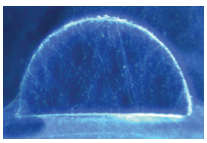
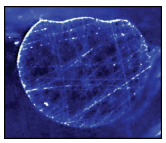
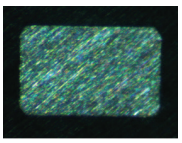
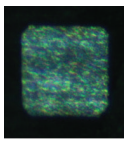
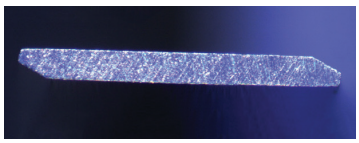
Various radii and angles are achieved consistently and replicated over multiple batches and thousands of feet by using specific shaping rolls and edging tools.

GENERAL SIZE RANGES

• Thickness:	.001" – .080"	(0,025 – 2 mm)
• Width:	.010" – .200"	(0,25 – 5 mm)
• Diameter:	.010" up to .080"	(0,25 up to 2 mm)

TYPES OF SHAPES

Existing shapes shown below. Custom Shapes developed on request.

U-Shaped	D-Shaped	Wave	Rectangle	Square	Rhombus
					

Actual examples of possible shapes that can be manufactured. Images obtained using a scanning electron microscope.

Ulbrich Wires are precision rolled or drawn to size. Products have a clean superior finish and are free of burrs. Ulbrich offers custom shapes made of a wide variety of alloys and coatings. Ulbrich produces complex shape profiles while maintaining exacting dimensional standards. The physical properties can be closely controlled, making Ulbrich's precision wire products the ideal choice for any application.

We Deliver Precision®

ULBRICH.COM

STRIP COIL CAPABILITIES

Metals for Medical

STRIP APPLICATIONS:

- Implantable Housings:
  Pacemakers, Hearing Aids, Defibrillators
- Surgical Instruments
- Hypodermic Needles and Shields
- Staple Guns
- Endoscopic Products

SLITTING CAPABILITIES:

GAUGES	.0004 — .125 inch (0.010 — 3.175mm)
RIBBON WOUND WIDTH	.020 in — 48 inch (0.508 — 1220mm)
OSC WOUND WIDTH	.125 in — 1.5 inch (3.175 — 38.1mm)

The full range of widths can be produced on all thicknesses.

PACKAGING:

- Oscillate Wound
- Ribbon Wound
- Cut to Length

#1 ROUND EDGE

#3 SLIT EDGE

#5 SQUARE EDGE

MEDICAL GRADE ALLOYS:

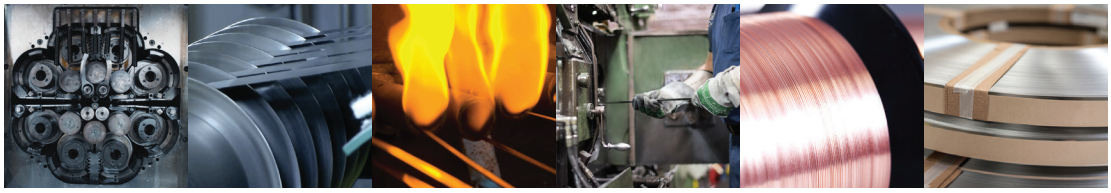
STAINLESS STEELS	• 301 • 304 • 305 • 316 • 410 • 420 • 440A • 17-7PH • 17-4PH
SPECIALTY METALS	• Niobium Type 1 • Nickel 201 • Inconel® 625 • Haynes® 25 L-605
TITANIUM	• Ti Gr 1 • Ti Gr 2 • Ti Gr 3 • Ti Gr 4 • Ti Gr 9 (3-2.5) • Ti 15-3-3-3

We Deliver Precision®

ULBRICH.COM

Our Industry Leading Capabilities

DESIGNED WITH YOUR SUCCESS IN MIND



OVERVIEW OF MANUFACTURING

Our state-of-the-art equipment, technology, and staff make us the go-to stainless steel and special metals producer for numerous manufacturing markets, including the medical, aerospace and automotive industries.

ROLLING TOLERANCES

Our largest H-mill can handle incoming strip material up to .125” thick, while our smallest Z-mill can roll foil as light as .00039″: an order of magnitude thinner than a human hair.

SLITTING & EDGING

From Round to Square edge, our slitters have the ability to separate a wide strip into “mults” or narrower strips to achieve your desired width with as much minimized burr as possible.

ANNEALING

Utilizing hydrogen, nitrogen, and argon controlled atmospheres, we properly anneal all the alloys we offer to satisfy the most demanding specifications of the aerospace, medical, and nuclear industries.

MATERIAL PROPERTIES

From Bright to Dull or Quarter Hard to Extra Full Hard, Ulbrich has the ability to control your desired surface finish and mechanical properties of your Precision Strip & Wire products.

COATING & PLATING

Based on your exact requirements, we expertly apply protective coatings with various thicknesses, adhesion properties, colors, and opacity to ensure your product is successfully brought to completion. Additionally, our multiple plating lines, first-rate production capabilities, and expert metallurgists can handle any plating needs you have.

PACKAGING

With production and shipping capabilities spanning the entire globe, we are able to accommodate steel and metal product packaging and transit to almost any international destination.

Precision Products & Alloys for Medical

WE'RE ALWAYS LOOKING FOR WAYS TO INNOVATE AND IMPROVE UPON MEDICAL DEVICES

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 medical device 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 Medical Device Industry. During this time, we have participated in the development and manufacturing of hundreds of innovative medical applications. With industry leading Dimensional Control, real time gauging and Statistical Process Control (SPC), a large variety of medical 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 to satisfy the needs of the medical devices original equipment manufacturers.

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 Medical Needs!

info@ulbrich.com | **800-243-1676**

Ulbrich

We Deliver Precision®

ULBRICH.COM