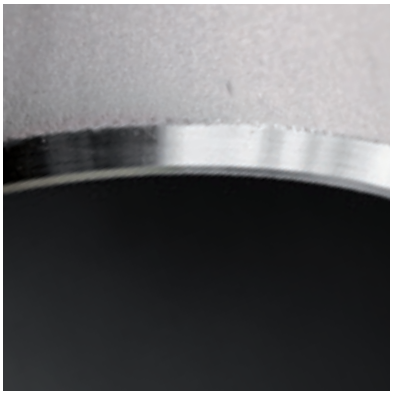
TSS

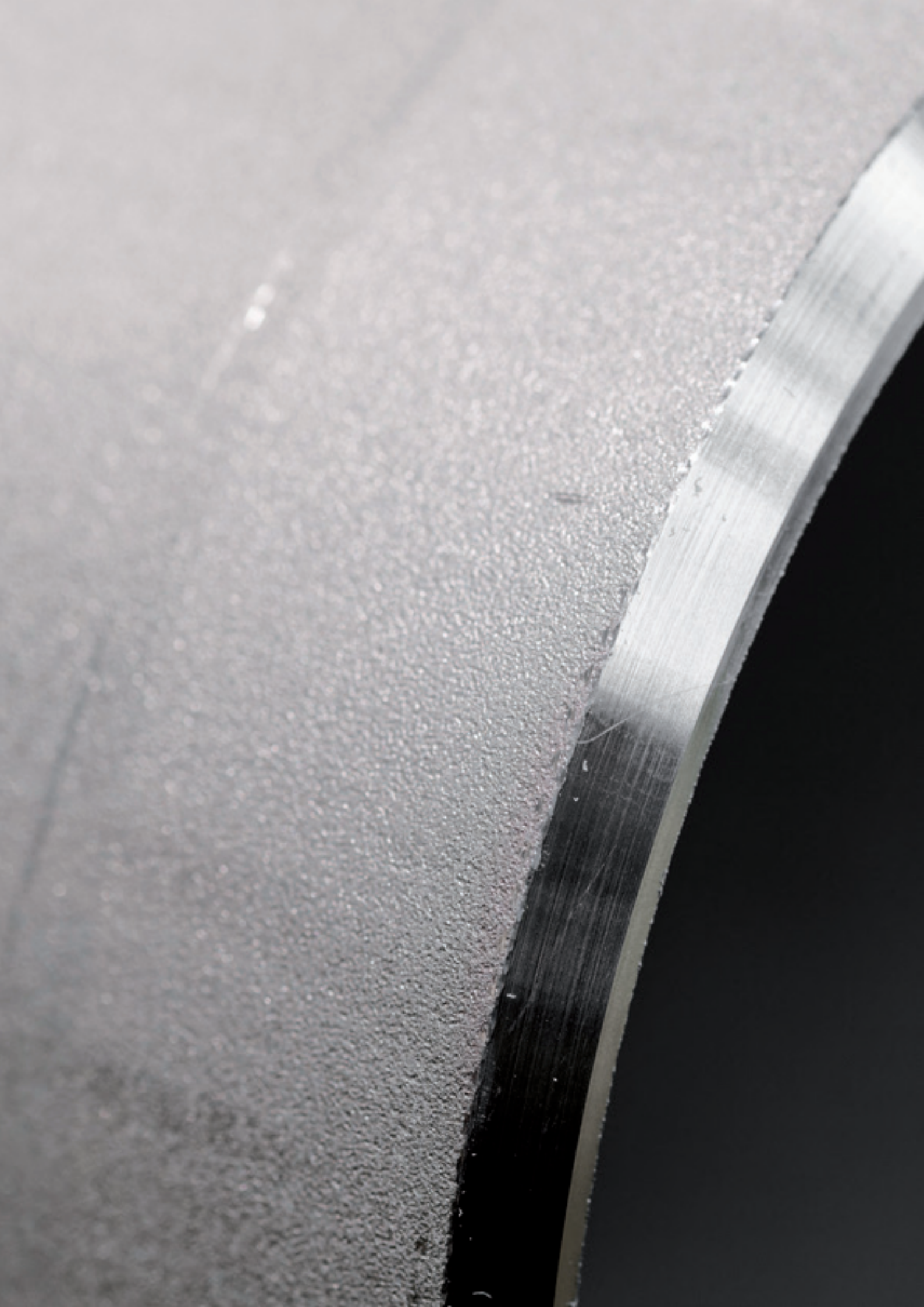
TUBACEX GROUP






CATALOGUE

CONCEPTS, GRADES, STANDARDS, SIZES AND SERVICES



1. INTRODUCTION

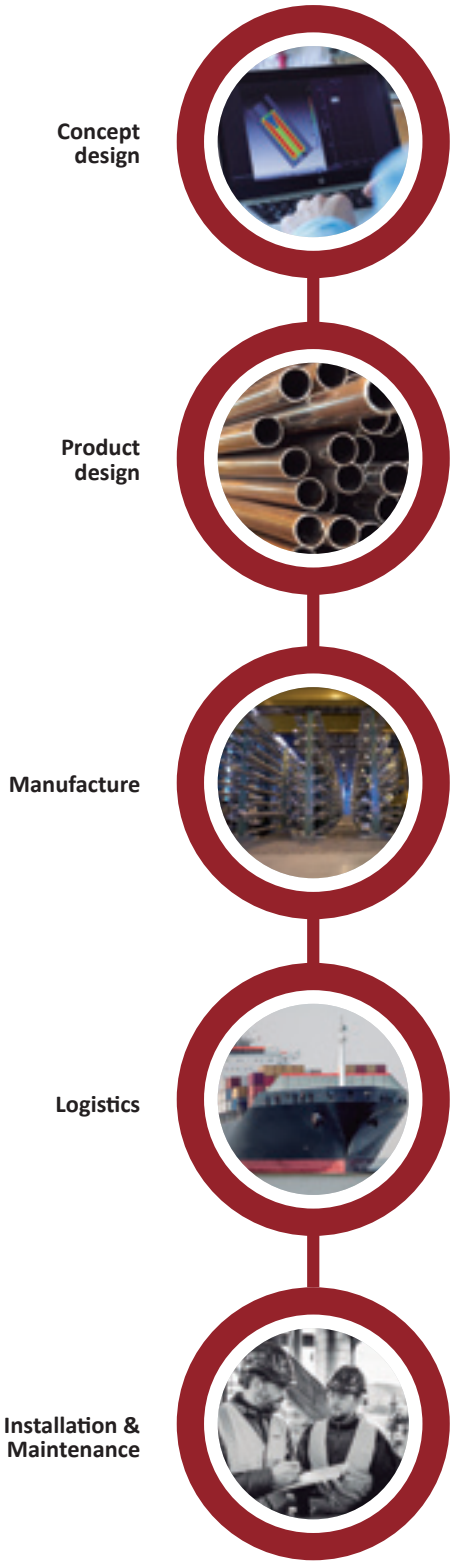
1.1 TUBACEX GROUP, GLOBAL SUPPLIER OF TUBULAR SOLUTIONS

TUBACEX is a **multinational leader in the supply of seamless stainless steel,** high-nickel alloy and nickel superalloy tubular products, headquartered in Llodio, Alava (Spain).
The company has its **own industrial facilities** in Spain, Austria, the USA, Italy, India and Thailand, a global distribution network (TSS) as well as sales offices located around the world.
The main demand segments for the tubes manufactured by TUBACEX are the **Oil & Gas, Powergen and Petrochemical industries.** In addition, part of its production is also supplied to: mechanical industry, aerospace, food, water desalination, electronics, capital goods and new technologies, among other industries.

- **Worldwide Presence:** with production plants in Spain, Austria, Italy, the United States, India and Thailand, a worldwide stock & service network (TSS) and global sales presence.

- **Full Service Supplier:** cooperation with our customers to develop tailor-made solutions. This is possible thanks to a wide range of services offered from design to installation and maintenance operations.

Our innovation strategy has been adapted to offer not only new products resulting from internal R&D activities, but also integral solutions of high technological value.



• **Widest Portfolio on the Market:** in stainless steel and high nickel alloys tubular solutions: pipes, tubes and fittings. More specifically stainless steel and high nickel alloys ingots, bars and billets; seamless pipes and tubes extrusion/cold drawing; large outside diameter seamless pipes and tubes; and fittings and special components.

Stainless Steel and High Nickel alloys bars and billets

ACERALAVA – TUBACEX GROUP

Seamless Pipe to 72”

IBF – TUBACEX GROUP

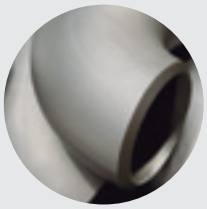
Stock, Service and Trading Value added operations

TSS – TUBACEX GROUP

TUBACEX UPSTREAM TECHNOLOGIES – TUBACEX GROUP








Seamless Pipe and Tubes to 8” (extrusion, piercing, cold finishing)

TTI – TUBACEX GROUP

SCHOELLER BLECKMANN – TUBACEX GROUP

SALEM TUBE – TUBACEX GROUP

TUBACEX INDIA – TUBACEX GROUP

Fittings and special connections from ½” to 72”

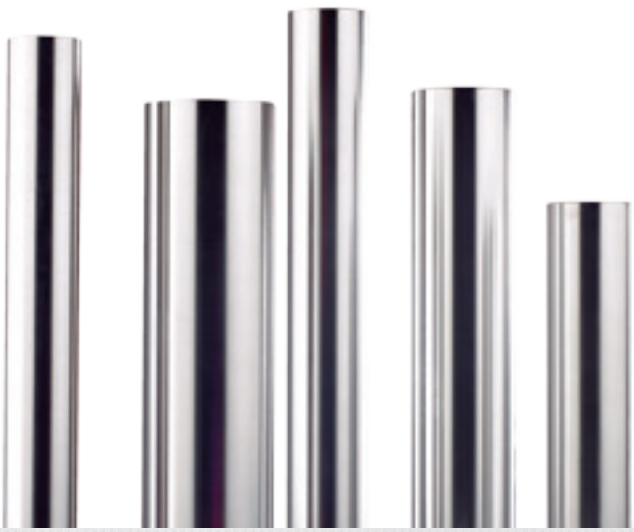
TTA – TUBACEX GROUP

AWAJI STAINLESS – TUBACEX GROUP

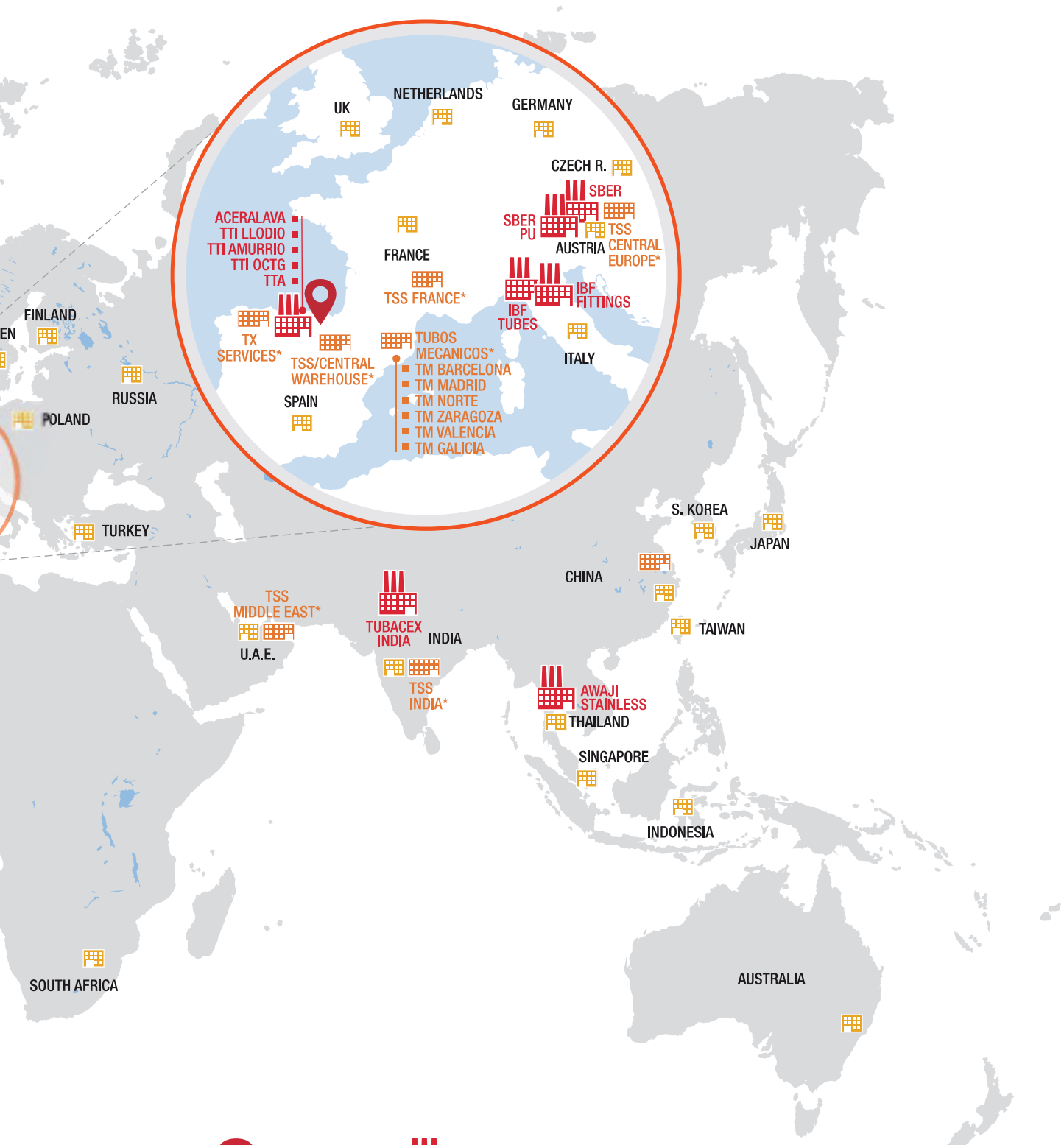
IBF – TUBACEX GROUP

• **Competitiveness:** management excellence with the involvement of the entire workforce. TUBACEX has developed its own operational excellence program (TxPS); a continuous improvement system with significant and sustainable results in all mills in terms of continuous and radical improvements (customer service, productivity, yield evolution, H&S or preventive maintenance, among others).

• **Reliability and Flexibility:** TUBACEX has a **fully integrated production,** with total control of all production stages from steel manufacturing, to production and subsequent distribution and sale. Having its own proprietary steelwork provides the facilities with huge **production flexibility** regarding tubes, both offering the possibility of making special castings as well as reducing delivery times on urgent orders.



WORLDWIDE PRESENCE



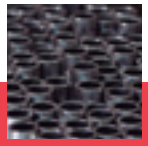
Headquarter (Llodio)
Sede central (Llodio)

12 Production sites
Plantas productivas

16 Service centers
Centros de servicio

32 Sales offices
Oficinas comerciales

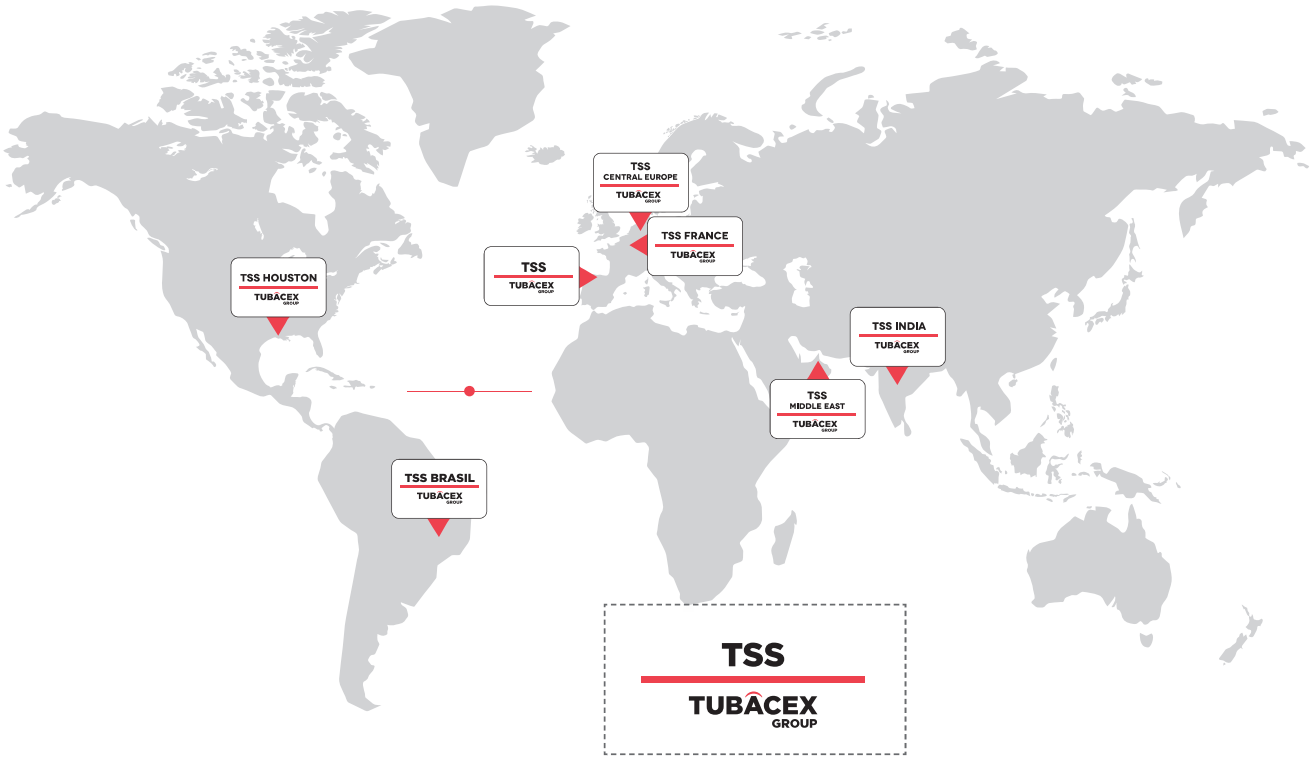
1.2 TSS, THE LARGEST GLOBAL MASTER DISTRIBUTOR OF STAINLESS STEEL TUBULAR PRODUCTS


TUBACEX Group has reinforced its global leadership on the distribution market increasing its value proposal through TUBACEX Service Solutions (TSS), a master distributor capable of offering its distributor clients a wide range of products in stock with full availability anywhere in the world, as well as an array of high value-added services.

Thus, TSS joins a business group with experience in the manufacturing of seamless stainless steel and high alloy tubular products, making the most of the synergies already in place at the Group production plants worldwide to improve customer service. Thanks to this, TSS can guarantee immediate availability, quality and service as well as an array of competitive advantages oriented to reducing its clients' operative costs.

As master distributor, TSS brings TUBACEX's constantly growing product and service portfolio closer to clients, while significantly promoting services offered to them.



TSS is the largest global master distributor of seamless stainless steel and high nickel alloys tubes and fittings. With a worldwide network of own warehouses in Central Europe, France, Spain, Houston (USA), Brazil, Middle East and India, TSS is able to provide immediate product availability and a wide range of services, responding to specific customers' needs. The company offers a series of competitive advantages in terms of production knowledge, commercial support, and administrative savings.

INDUSTRIAL & TECHNICAL STAINLESS STEEL EXPERTISE

TSS is part of an internationally renowned Group with wide experience in the manufacturing of stainless steel tubular solutions & fittings, which shares with its customers its high-value continuous innovation outputs. As part of TUBACEX Group, TSS shares its deep knowledge of materials and their manufacturing processes.

GLOBAL SUPPORT

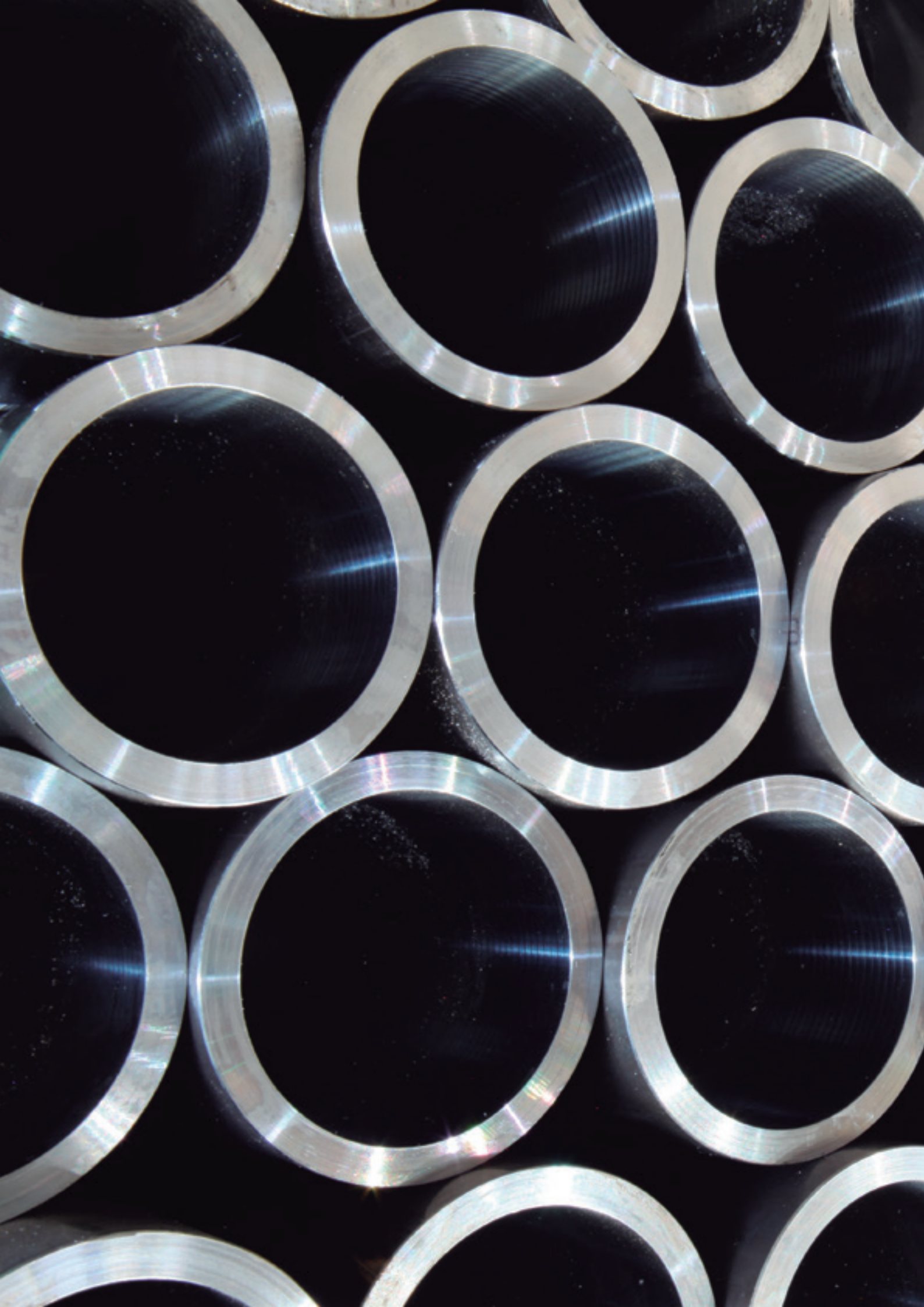
A wide portfolio of Bars & Billets, Pipes & Tubes, and Fittings guaranteed thanks to the global network of industrial plants and warehouses integrated in Tubacex Group worldwide. Global availability and service closer to our customers.

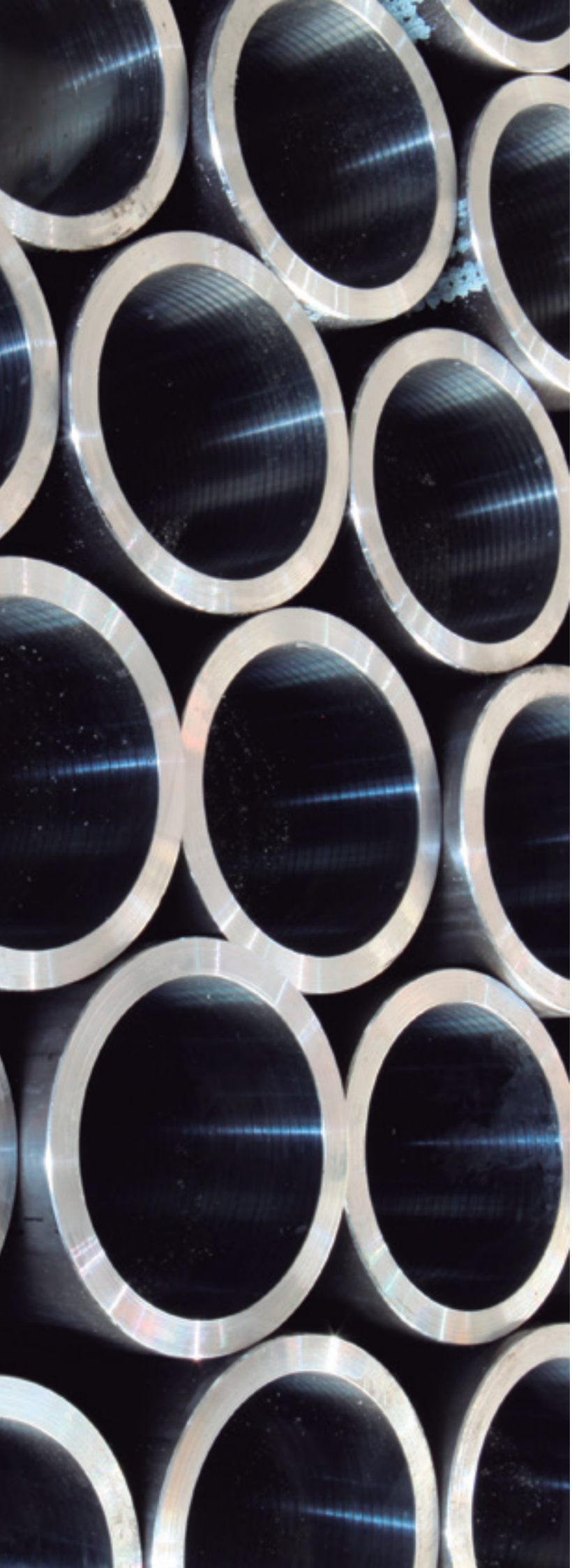
ADVANCED TAILOR-MADE SERVICES

According to its vision and strategy, TUBACEX Group is undergoing a transformation, which allows establishing a close cooperative relationship with our customers, with the goal of developing and providing comprehensive solutions to their specific needs. Tubacex is offering an extensive **portfolio of value-added services upon request:** cutting, color coding, beveling, marking, third-party inspections or NDT, among others.

MAKING YOUR BUSINESS GROW

Our main challenge is to make your business grow, **improving your sales, revenue and cost-saving capacity.** The final aim of TSS is to offer a global service to improve the efficiency, of both projects and customer processes, thus reducing total costs for the customer or "Total cost of ownership". Efficiency can be achieved in very different ways. Therefore, it is necessary to open a dialog and a collaborative interaction with our customers to understand and identify improvement opportunities together.





2. OUR FOCUS: STAINLESS STEEL

2.1 DEFINITION AND MAIN PROPERTIES

Stainless steel is a generic term for a group of corrosion resistant steels with a minimum of 10.5% chromium content. Other alloying elements are added to enhance their structure and properties such as formability, strength and cryogenic toughness. These include metals such as:

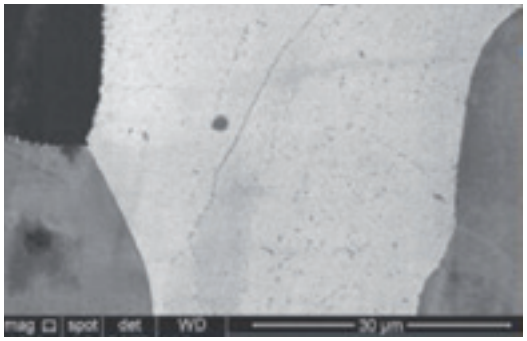
- Nickel
- Molybdenum
- Titanium
- Copper

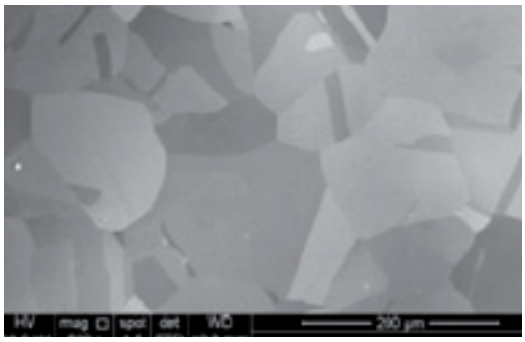
Non-metal additions are also made, and the main ones are:

- Carbon
- Nitrogen

The main requirement for stainless steels is that they should be corrosion resistant for a specified application or environment. The selection of a particular stainless steel "type" and "grade" must initially meet corrosion resistance requirements. Additional mechanical or physical properties may also need to be considered to achieve the overall service performance requirements.

Tubacex R&D laboratory





Corrosion resistance of stainless steels is due to the naturally occurring chromium-rich oxide film present on steel surface. Although extremely thin, this invisible, inert and therefore passive film is tightly adherent to the metal and extremely protective in a wide range of corrosion media. The film is rapidly self-repairing in the presence of oxygen.
Corrosion is the deterioration or destruction of metals and alloys by chemical and/or electrochemical reaction with their environment. In simple terminology, corrosion processes involve reaction of metals with environmental species.

The most important types are:

- Uniform corrosion
- Galvanic corrosion, concentration cell corrosion, water line attack
- Pitting
- Dezincification, dealloying (selective leaching)
- Atmospheric corrosion
- Erosion corrosion
- Fretting
- Crevice corrosion; cavitation
- Stress corrosion, intergranular and transgranular corrosion, hydrogen cracking and embrittlement
- Corrosion fatigue

2.2 CHEMICAL INFLUENCE

Ni

NICKEL promotes an austenitic microstructure, improves corrosion resistance and has no direct influence on the passive layer but exerts a beneficial effect, particularly in sulfuric acid environments.

Cr

CHROMIUM is the most significant alloy providing corrosion resistance. The resistance of the stainless steels to the chemical effects of corrosive agents is determined by their ability to protect themselves by forming a protective film called passive layer. This is a very fine layer on the surface, of the order of 1.0 to 2.0 nm, which reduces the corrosion rate to negligible levels and has a structure similar to chromite. For passivation to occur and remain stable, the Fe-Cr alloy must have a minimum chromium content of about 11% by weight; above this, passivation can occur whereas below that figure it is impossible. The corrosion resistance of Fe-Cr alloys tends to improve as the chromium content is increased, and definite changes happen at about 11% Cr, and again around 17% Cr.

Mo

MOLYBDENUM promotes a ferritic microstructure and is used in stainless steels in amounts up to 8% and most commonly in the range from 2 to 4%. Even such relatively small percentages of molybdenum have a powerful effect in improving the resistance to pitting in chloride environments and to crevice in both Fe-Cr alloys and Fe-Cr-Ni alloys. Molybdenum reduces the intensity of the oxidizing effect required to ensure passivation and decrease the tendency of previously formed passive films to break down.
An increase in the chromium and molybdenum content mainly increases resistance to localized corrosion (pitting and crevice).

Ti

TITANIUM is a highly reactive element which forms a stable TiN precipitate in the liquid phase in the presence of nitrogen (N). In front of both C and N, titanium nitrides TiN (in the liquid phase) and titanium carbides TiC (in the solid phase) are formed, the latter surrounding the former. The most commonly stabilizing element for stainless steel is titanium, used to increase intergranular corrosion resistance, especially in heat-affected zones. Titanium also improves resistance to pitting corrosion since stable Ti_2S has been shown to form instead of manganese sulfides (MnS) which are known to act as pit initiation sites.

Nb

NIOBIUM in stainless steels, is well known as a stabilizing element to prevent the risk of intergranular corrosion in heat-affected zones. To prevent this, niobium is added in sufficient amounts, depending on carbon and nitrogen levels.

C

CARBON is a very strong austenitizer and increases the strength of steel. In austenitic, ferritic and duplex stainless steels, it is kept to low levels (typically 0.005% C to 0.03% C in low carbon grades) to retain the desired properties and mechanical characteristics. In martensitic stainless steels, carbon is deliberately added to obtain both high strength and high hardness.
The principal effect of carbon on corrosion resistance is determined by the way in which it exists in the alloy. If combined with chromium as a separate constituent (chromium carbide), carbon may have a detrimental effect on corrosion resistance by removing some of the chromium from solid solution in the alloy and, therefore, reducing the amount of chromium available to ensure corrosion resistance.

S

SULFUR is added to certain stainless steels to improve machinability, but high amounts of sulfur slightly reduce corrosion resistance, ductility, weldability and formability.

Cu

COPPER enhances corrosion resistance to certain acids such as sulfuric acid and promotes an austenitic microstructure.

N

NITROGEN promotes an austenitic microstructure. In austenitic and duplex stainless steels, nitrogen content increases the resistance to localized corrosion like pitting or intergranular corrosion. This is due to the precipitation of dichromium nitride Cr_2N instead of chromium carbide $Cr_{23}C_6$. Nitrogen in solid solution raises the yield strength too.

2.3 STAINLESS STEEL: FAMILIES AND GRADES

The categorization of stainless steels is unusual amongst metals in that it is based upon the nature of their metallurgical structure - the terms used denote the arrangement of the atoms which make up the grains in the steel, and which can be observed when a polished section through a piece of the material is viewed at high magnification through a microscope. Depending upon the exact chemical composition of the steel the microstructure may be made up of the stable phases austenite or ferrite, a "duplex" mix of these two, the martensite phase created when some steels are rapidly quenched from a high temperature, or a structure hardened by precipitated micro-constituents.

Austenitic	Additional elements can be added for critical applications Suitable for cryogenic applications Avoids brittlenest at low temperatures	304, 310, 314, 316, 316L, 317, 317L, 321, 347
Ferritics	Additional elements can be added for critical applications Suitable for cryogenic applications Avoids brittlenest at low temperatures	405, 409, 430, 434, 446
Martensitics	Possibility of hardening by heat treatment to very high tensile strenght Adequate for midly corrosive environments	403, 410, 416, 420, 422, 431, 440
Precipitation hardening	Moderate corrosion resistance to aggresive environments	
Duplex	Resistent to stress corrosion cratching Toughness superior than ferritics, but inferior than austenitic To be used between -50ºC - 300ºC	UNS S31803, UNS S32760, UNS S32750
High Ni Alloys	To be used in extremelly corrosive conditions Hight temperature resistance: • Alloy 20: resistance to sulfuric acid and chloride stress corrosion • Alloy 28: phosporic and sulfuric acid resisntance + integranual corrosion • Alloy 800: good resistance in oxidizing, nitriding and carburizing conditions • Alloy 825: resistant to chloride stress corrosion and to integranular attack.	Alloy 20, Alloy 28, Alloy 800, Alloy 825

2.3.1 AUSTENITICS

This group contains at least 16% chromium and 6% nickel (the basic grade 304 is referred to as 18/8) and range through to the high alloy or "super austenitics" such as 904L and 6% molybdenum grades.
Additional elements can be added such as molybdenum, titanium or copper, to modify or improve their properties, making them suitable for many critical applications involving high temperature as well as corrosion resistance. This group of steels is also suitable for cryogenic applications because the effect of the nickel content in making the steel austenitic avoids the problems of brittleness at low temperatures, which is a characteristic of other types of steel.

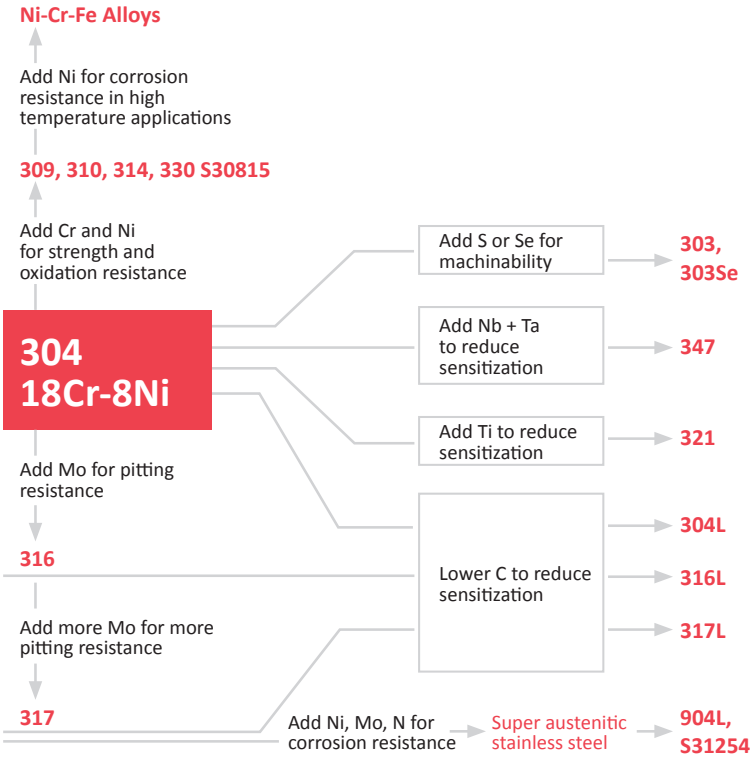


Figure 4.
The relationship between the various 300 series austenitic grades (Courtesy Kappa Associates International [2]).

2.3.2 FERRITICS

Ferritic stainless steels are plain chromium stainless steels (10.5 to 18%).
They have good ductility, are magnetic and have good resistance to high temperature oxidation and moderately corrosive environments.

2.3.3 MARTENSITICS

Martensitic stainless steels are also plain chromium stainless steels but, because of a high carbon (C) content, they can be hardened by heat treatment to very high tensile strength and hardness, although ductility and toughness diminish with increasing strength. The martensitic stainless steels are magnetic and have adequate corrosion resistance in mildly corrosive environments.

2.3.4 PRECIPITATION HARDENING STAINLESS STEELS

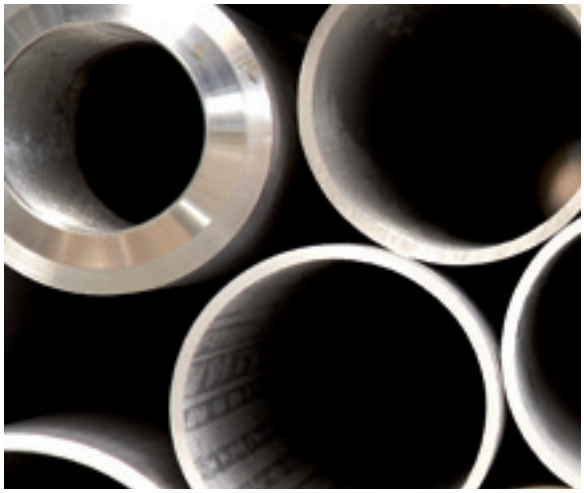
Precipitation - hardening stainless steels are chromium/nickel stainless steels containing other elements such as aluminum (Al) or copper (Cu).
Hardening is achieved by a solution treating the steel, quenching (rapid cooling) and then aging. The precipitation-hardening grades have moderate corrosion resistance to aggressive environments.

2.3.5 FERRITIC-AUSTENITIC

Duplex stainless steels such as 1.4462 (UNS S31803) and superduplex 1.4501 (UNS S32760) or 1.4410 (UNS S32750) have microstructures comprising a mixture of austenite and ferrite, usually 50/50. They contain high chromium (Cr), but insufficient nickel (Ni) to produce a microstructure that is fully austenitic. Duplex ferritic-austenitic steels combine some of the features of each class: they are resistant to stress corrosion cracking, albeit not quite as resistant as the ferritic steels; their toughness is superior to that of the ferritic steels but inferior to that of the austenitic steels, and their strength is greater than that of the (annealed) austenitic steels, by a factor of two or more. In addition the duplex steels have general corrosion resistances equal to or better than 304 and 316, and pitting corrosion resistances are superior to 316. They suffer reduced toughness below about –50 °C and after exposure above 300 °C, so are only used between these temperatures.

2.3.6 HIGH NI ALLOYS

This group of alloys is used for their outstanding corrosion and high temperature resistance. Many are metallurgically related to the austenitic stainless steels but are much more highly alloyed, particularly with nickel, chromium and molybdenum in order to enhance their corrosion resistance. These alloys are used to resist extremely corrosive conditions in the energy, power, chemical and petrochemical industries.



Alloy20 N08020
Its nickel, chromium, molybdenum, copper and niobium levels all provide excellent general corrosion resistance. Resistance to sulfuric acid is particularly exceptional but the alloy shows useful resistance in phosphoric acid, nitric acid as well as in chloride environments. Alloy20 is an excellent option when chloride stress corrosion cracking is an issue and resists pitting and crevice corrosion.

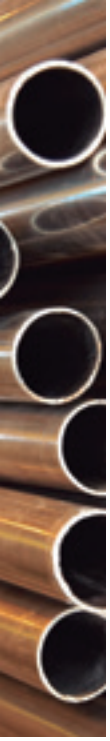
Alloy28 N08028
It is an austenitic nickel-iron-chromium alloy with molybdenum and copper. It has excellent corrosion resistance in strong acids, especially phosphoric and sulfuric acid, high resistance to localized corrosion as pitting or crevice as well as stress corrosion cracking (SCC) and intergranular corrosion in various environments.

Alloy800 N08800
It is heat resistant nickel-iron-chromium alloy with controlled levels of carbon, aluminum and titanium. It has good creep rupture strength at high temperatures and good resistance in oxidizing, nitriding and carburizing conditions.

Alloy825 N08825
It is a nickel-iron-chromium alloy with additions of molybdenum, copper and titanium. It was developed to provide exceptional corrosion resistance in both oxidizing and reducing environments. The alloy is resistant to chloride stress-corrosion cracking and pitting. The addition of titanium stabilizes Alloy825 against sensitization in the as-welded condition making the alloy resistant to intergranular attack.

Alloy 625 N06625
It is an austenitic nickel base alloy known for its high strength at elevated temperatures, outstanding fabricability and excellent resistance to oxidation and corrosion over an extensive range of corrosive conditions. These properties allow Alloy 625 tubing to be used in a wide spectrum of applications. It is widely used in seawater applications such as offshore oil equipment or sheathing for undersea cables, due to its high corrosion-fatigue strength, high tensile strength and resistance to chloride-ion stress-corrosion cracking. The aerospace industry also uses Alloy 625 tubing for its high tensile, creep, and rupture fatigue strength and excellent weldability, making it a useful material for engine exhaust systems, fuel and hydraulic line tubing, and heat exchanger tubing. The chemical processing industry also uses this material in a wide range of applications.

3. OUR STOCK PRODUCT PORTFOLIO



3.0 INTRODUCTION: STAINLESS STEEL LONG PRODUCTS & APPLICATIONS

Stainless steel products can be divided into: flat and long products. Tubacex Group focuses on long products. These products meet the needs of countless sectors and in particular, of those associated with energy, in addition to other industrial activities such as:

OIL AND GAS EXPLORATION AND PRODUCTION

New challenging corrosive environments and applications are driving Tubacex product portfolio of corrosion resistant alloys in both on-shore and off-shore E&P, with a particular focus in:

• Oil Country Tubular Goods (OCTG) • Umbilical tubes along with a wide range of seamless stainless and high nickel alloys for subsea application (risers, flowlines, manifolds…).

• Tubes for platforms (piping systems, separators…).

REFINING, PETROCHEMICAL AND CHEMICAL

Tubacex offers an extensive grade and size portfolio to achieve designers expectations regarding several areas and equipments in the Petrochemical and Chemical industry, particularly:

• Regas Facilities • Refineries • Heat exchangers • Reactors • Furnaces, Heaters and Re-Heaters • Other process industries.

FERTILIZER PRODUCTION

Fertilizer production materials need to bear severe corrosion conditions. Tubacex provides pipes & tubes for the equipment involved in the production of Urea, Ammonia, Nitric acid, Sulphuric acid, Phosphoric acid and Melamine.

• Strippers • Condensers • Scrubbers • Reactors • Piping.

POWER GENERATION

Tubacex's manufacturing range covers the main stainless steel heat resistant grades used in boiler equipment, in both:

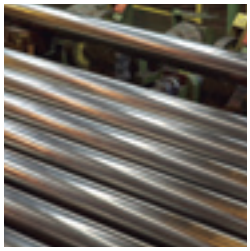
• Critical equipment • Ultra Super Critical (USC) equipment • Industrial power plants.

• Nuclear power plants.

STOCK FOR DISTRIBUTION AND OTHER INDUSTRIES

Tubacex's manufacturing range covers the main seamless stainless steel portfolio for distributors worlwide:

• Pipes and Tubes according to all relevant standards • Hollow Bars for metal-mechanic industry through Tubacex Service Solutions • Instrumentation and hydraulic tubing for a wide range of high added value industries, including automotive and aerospace • Round Bars.



STAINLESS STEEL AND HIGH NICKEL ALLOYS INGOTS, BARS AND BILLETS

Stainless steel and high nickel alloy long products are produced by the group's subsidiary Aceralava, either rolled or forged up to 20":

- Round bar
- Round billet
- Square billet
- Ingot

SEAMLESS PIPES AND TUBES EXTRUSION/COLD DRAWING

Seamless pipes up to 8" are the bulk of Tubacex portfolio, with focus in Stainless steel and high nickel alloy materials. This includes:

- Pipes and tubes for several applications
  - Straight / U-bended tubes
  - Welded and coiled seamless tubes (for umbilical application)
- Mechanical tubing

BIG OUTSIDE DIAMETER SEAMLESS PIPES AND TUBES

The Tubacex Group completes its seamless portfolio with trepaning/ boring technology that expands manufacturing range to 72" OD, in all materials from carbon steel to titanium – with main focus in Stainless Steel and High Nickel alloys.

FITTINGS AND SPECIAL COMPONENTS

The Tubacex Group's range includes the design and manufacturing of butt welding fittings, tube bends, elbows, tees, reducers and caps (both seamless and welded), complementing the wide offer of tubular solutions, in a complete manufacturing range that goes up to 72" in any thickness.

TSS product portfolio covers the following products:

1. **Pipes and tubes from 6 mm up to 219 mm (8") in stock (up to 72" on request):**
   - **Instrumentation tubing**
   - **Hydraulic tubing**
   - **Heat exchanger tubing**
   - **Isometric tubing**
   - **Piping**
2. **Mechanical tubing up to 250 mm (10") in stock (up to 72" on request) for machined components.**
3. **Forged steel bars up to 500 mm (20") for engineering and machine industry applications.**
4. **Fittings: a complete manufacturing range.**

3.1

INSTRUMENTATION TUBING

Instrumentation tubes play an important role as precision system components to protect and partner with other components, devices or instruments ensuring the safe and trouble-free operations of power generation, shipbuilding, railway, automotive, chemical, petrochemical and Oil & Gas applications.

Consequently, these tubes have to meet very high quality requirements, such as extremely clean surfaces and corrosion resistance with the most accurate tolerances for perfect fitting with couplings.

Tubacex Group's Instrumentation Tubes product portfolio comprises manufacturing units at these 3 strategic locations: Ternitz, Austria, Greenville, Pennsylvania (USA) and Umbergaon, (India).

Our stock products have the following features – additional specifications, grades and sizes are available on request:

GRADES AVAILABLE:

304/L – 1.4301/1.4306
316/L – 1.4401/1.4404
1.4571 (TP316Ti)
TP321/H – 1.4541 -1.4878
UNS S31803/UNS S2205 -1.4462
UNS S32750 – 1.4410
TX 316/L Min Mo2.5
TP310/S/H -1.4845
6Mo – 1.4547
904L – 1.4539
OTHER HIGH NICKEL ALLOYS AVAILABLE UPON REQUEST

SPECIFICATION:

DELIVERY STANDARDS
EN 10216-5 TC1 EN 10297-2
ASTM ASME A213
ASTM A269
AD2000-MERKBLATT W2/W10/EINBAUROHRE

TOLERANCE STANDARD
EN 10305-1 &/OR EN10216-5 and ASTM A269

ADDITIONAL TESTS
Cold finished and Bright Annealed
NACE MR0175 – NACE MR0103 - EN ISO 15156
ISO 3651-2 PRACT A – ASTM A262 PRACTICE E
TRD100 – TRB100
100% PMI tested
Material hydraulically tested according to A999 par22.2
Eddy current tested

LENGTHS
Fixed lengths: 6,000 mm (20 Feet)
Random lengths 5,000 mm – 7,000 mm

ENDS
Plain ends

SIZES

Instrumentation tubing in TSS stock covers the full standard range from 6mm to 18 mm outside diameter. Sizes below 3mm OD are available on request.

Instrumentation (sizes in millimeters)

mm OD	WT	Weight Kg/m	mm OD	WT	Weight Kg/m	mm OD	WT	Weight Kg/m
6.00	1.00	0.125	10.00	2.00	0.401	15.00	1.50	0.507
6.00	1.50	0.169	12.00	1.00	0.275	15.00	2.00	0.651
6.00	2.00	0.200	12.00	1.50	0.394	16.00	1.00	0.375
8.00	1.00	0.175	12.00	2.00	0.501	16.00	1.50	0.544
8.00	1.50	0.244	14.00	1.00	0.325	16.00	2.00	0.701
8.00	2.00	0.300	14.00	1.50	0.469	18.00	1.00	0.426
10.00	1.00	0.225	14.00	2.00	0.601	18.00	1.50	0.620
10.00	1.50	0.319	15.00	1.00	0.350	18.00	2.00	0.801

Instrumentation (imperial sizes)

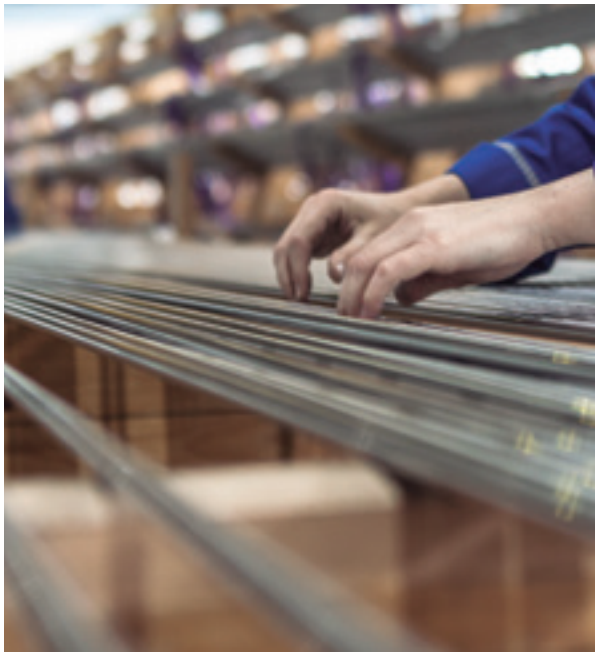
Inches OD	WT	BWG WT	Mm OD	WT	Weight Kg/m
1/4	0.035	21	6.35	0.89	0.122
1/4	0.049	18	6.35	1.24	0.159
1/4	0.065	16	6.35	1.65	0.194
3/8	0.035	21	9.53	0.89	0.192
3/8	0.049	18	9.53	1.24	0.258
3/8	0.065	16	9.53	1.65	0.325
1/2	0.035	21	12.70	0.89	0.263
1/2	0.049	18	12.70	1.24	0.357
1/2	0.065	16	12.70	1.65	0.457

3.2 HYDRAULIC TUBING

This is an essential product for any type of hydraulic system. The main features of TSS hydraulic tubes are: surface cleanliness and high pressure resistance to guarantee no leakages when connecting.

Power generation, shipbuilding, chemical, petrochemical and oil & gas applications are the main uses of this type of tubes.

Our stock products have the following features – additional specifications, grades and sizes are available on request:



GRADES AVAILABLE:

304/L – 1.4301/1.4306
316/L – 1.4401/1.4404
1.4571 (TP316Ti)
TP321/H – 1.4541 -1.4878
OTHER HIGH NICKEL ALLOYS AVAILABLE UPON REQUEST

SPECIFICATION:

DELIVERY STANDARDS
EN 10216-5 TC2 EN 10297-2
ASTM ASME A213
ASTM A269
AD2000-MERKBLATT W2/W10/EINBAUROHRE

TOLERANCE STANDARD
EN 10305-1 and ASTM A269

ADDITIONAL TESTS
Cold finished and Bright Annealed
NACE MR0175 – NACE MR 0103 - EN ISO 15156
ISO 3651-2 METHOD A – ASTM A262 PRACTICE E
100% PMI tested
Material hydraulically tested according to A999 par22.2
Eddy current tested

LENGTHS
Random lengths: 5,000 to 7,000 mm
Fixed lengths: 6,000 mm (upon request)

ENDS
Plain ends

SIZES

Hydraulic tubing in TSS stock covers the full standard range from 20 mm to 42 mm outside diameter. Other sizes are available on request.

Hydraulic tubing

mm OD	WT	Weight Kg/m	mm OD	WT	Weight Kg/m	mm OD	WT	Weight Kg/m
20.00	1.00	0.476	25.00	4.00	2.103	35.00	2.50	2.034
20.00	1.50	0.695	25.00	5.00	2.503	35.00	3.00	2.403
20.00	2.00	0.901	28.00	1.00	0.676	35.00	4.00	3.104
20.00	2.50	1.095	28.00	1.50	0.995	35.00	5.00	3.755
20.00	3.00	1.277	28.00	2.00	1.302	38.00	1.00	0.926
20.00	4.00	1.602	28.00	2.50	1.596	38.00	1.50	1.371
20.00	5.00	1.877	28.00	3.00	1.877	38.00	2.00	1.802
22.00	1.00	0.526	28.00	4.00	2.403	38.00	2.50	2.222
22.00	1.50	0.770	28.00	5.00	2.879	38.00	3.00	2.628
22.00	2.00	1.001	30.00	1.00	0.726	38.00	4.00	3.404
22.00	2.50	1.220	30.00	1.50	1.070	38.00	5.00	4.130
22.00	3.00	1.427	30.00	2.00	1.402	42.00	1.00	1.026
22.00	4.00	1.802	30.00	2.50	1.721	42.00	1.50	1.521
22.00	5.00	2.128	30.00	3.00	2.028	42.00	2.00	2.003
25.00	1.00	0.601	30.00	4.00	2.603	42.00	2.50	2.472
25.00	1.50	0.882	30.00	5.00	3.129	42.00	3.00	2.929
25.00	2.00	1.151	35.00	1.00	0.851	42.00	4.00	3.805
25.00	2.50	1.408	35.00	1.50	1.258	42.00	5.00	4.631
25.00	3.00	1.652	35.00	2.00	1.652			

3.3 HEAT EXCHANGER TUBING

Heat exchangers are important components in the oil & gas, refinery, chemical, petrochemical and power generation industries.

The need of higher efficiency in heat transfer processes and improved corrosion properties has increased the quality requirements of the seamless stainless steel tubes used in these applications.

Our stock products have the following features – additional specifications, grades and sizes are available on request:

GRADES AVAILABLE:

304/L – 1.4301/1.4306

316/L – 1.4401/1.4404

SPECIFICATION:

DELIVERY STANDARDS

ASTM ASME A213 MW

TOLERANCE STANDARD

ASTM A1016

ADDITIONAL TESTS

ASTM A262 PRACTICE E

100% PMI tested

Cold finished material hydraulically tested according to A999 part 22.2 and eddy current tested according to E426

LENGTHS

Taylor-made to client's requirement (5 working days maximum service from stock)

ENDS

Plain ends

SIZES

Heat exchanger tubes in TSS stock covers the full standard range from 6 mm to 18 mm outside diameter. Smaller OD and other wall thickness are available on request.

BWG		inch		mm		Weight	
OD	WT	OD	WT	OD	WT	Kg/m	lb/ft
3/4”	16	0.750	0.065	19.05	1.65	0.72	0.48
3/4”	14	0.750	0.083	19.05	2.11	0.89	0.60
3/4”	12	0.750	0.109	19.05	2.77	1.13	0.76
1”	16	1.000	0.065	25.40	1.65	0.98	0.66
1”	14	1.000	0.083	25.40	2.11	1.23	0.83
1”	12	1.000	0.109	25.40	2.77	1.57	1.05
1 1/4”	16	1.250	0.065	31.75	1.65	1.24	0.84
2 1/4”	14	1.250	0.083	31.75	2.11	1.56	1.05
3 1/4”	12	1.250	0.109	31.75	2.77	2.01	1.35
1 1/2”	16	1.500	0.065	38.10	1.65	1.51	1.01
2 1/2”	14	1.500	0.083	38.10	2.11	1.90	1.28
3 1/2”	12	1.500	0.109	38.10	2.77	2.45	1.65

3.4 ISOMETRIC TUBING

Chemical, petrochemical, water industry, power generation, Oil & Gas applications are the main users of these tubes.

Our stock products have the following features – additional specifications, grades and sizes are available on request:

GRADES AVAILABLE:

304/L – 1.4301/1.4306
316/L – 1.4401/1.4404
1.4571 (TP316Ti)
TP321/H – 1.4541 -1.4878

SPECIFICATION:

DELIVERY STANDARDS
EN 10216-5 TC1 or TC2 EN 10297-2
ASTM ASME A312
ASTM ASME A213
ASTM A269
All items AD2000-MERKBLATT W2/W10/TRD100 KEINE or EINBAUROHRE (upon request)

TOLERANCE STANDARD
ASTM A999 and EN ISO1127

ADDITIONAL TESTS
NACE MR0175 – NACE MR 0103 - EN ISO 15156
ISO 3651-2 METHOD A – ASTM A262 PRACTICE E
100% PMI tested
TRD100 TRB100
Material hydraulically tested according to A999 part 22.2
Cold finished material eddy current tested according to E426
Check analysis

LENGTHS
Random lengths: 5,000 to 7,000 mm

ENDS
Plain ends

SIZES

Isometric tubing in TSS stock covers the full standard range from 21.3 mm to 139.7 mm outside diameter. Special sizes are available on request.

Pipes

Isometric tubing

mm OD	WT	Weight Kg/m
21.30	2.00	0.966
21.30	2.30	1.094
21.30	2.60	1.217
21.30	2.90	1.336
21.30	3.20	1.450
26.90	2.00	1.247
26.90	2.30	1.416
26.90	2.60	1.582
26.90	2.90	1.742
26.90	3.20	1.898
33.70	2.00	1.587
33.70	2.30	1.808
33.70	2.60	2.024
33.70	2.90	2.236
33.70	3.20	2.443
42.40	2.00	2.023
42.40	2.30	2.309
42.40	2.60	2.590
42.40	2.90	2.867
42.40	3.20	3.140
48.30	2.00	2.318
48.30	2.30	2.648
48.30	2.60	2.974
48.30	2.90	3.296
48.30	3.20	3.613
60.30	2.00	2.919
60.30	2.30	3.339
60.30	2.60	3.755
60.30	2.90	4.167
60.30	3.20	4.574
76.10	2.30	4.249
76.10	2.90	5.314
76.10	3.60	6.534
76.10	5.00	8.899
76.10	6.30	11.008
139.70	4.00	13.588
139.70	5.00	16.859
139.70	6.30	21.038

3.5 PIPING

Chemical, petrochemical, water industry, power generation, Oil & gas applications are the main users of this product.

Our seamless stainless steel pipes are installed worldwide with outstanding continuous success.

Our stock products have the following features – additional specifications, grades and sizes are available on request:

GRADES AVAILABLE:
304/L – 1.4301/1.4306
316/L – 1.4401/1.4404
1.4571 (TP316Ti)
TP321/H – 1.4541 -1.4878
TP347/H – 1.4550
TP310/S/H -1.4845
TP314 – 1.4841
253 MA – UNS S30815 – 1.4835
UNS S31803/UNS S2205 -1.4462
UNS S32750 – 1.4410
UNS32760 – 1.4501
6Mo – 1.4547 – UNS S31254
904L – 1.4539
ALLOY 825 – 2.4858
ALLOY 20 – 2.4660
OTHER GRADES AVAILABLE UPON REQUEST

SPECIFICATION:

DELIVERY STANDARDS
ASTM ASME A312
ASTM ASME A376
EN 10216-5 TC1 EN 10297-2
All items AD2000-MERKBLATT W2/W10/TRD100 EINBAUROHRE

TOLERANCE STANDARD
ASTM A999 and EN ISO1127 D2/T2-D3/T3

ADDITIONAL TESTS:
NACE MR0175 – NACE MR 0103 - EN ISO 15156
ISO 3651-2 METHOD A – ASTM A262 PRACTICE E – MIL P24691/3
100% PMI tested
Material hydraulically tested according to A999 par22.2
Cold finished material eddy current tested according to E426
Check analysis

CHEMISTRY:
PREN number to be calculated and reported
Certify values Mo, Cu, V, Ti, Nb, W, Co, N
C<0.03% for “L” grades

LENGTHS:
Random lengths: 6,096 to 7,315 mm

ENDS:
Plain ends

SIZES

Pipes in TSS stock cover the full standard range from ¼” to 8” outside diameter. Sizes over 8” are available on request.

NPS Sch OD	WT	Inches OD	WT	Mm OD	WT	Weight Kg/m
1/4´´	10S	0.540	0.065	13.72	1.65	0.499
1/4´´	40S	0.540	0.088	13.72	2.24	0.644
1/4´´	80S	0.540	0.119	13.72	3.02	0.809
3/8´´	10S	0.675	0.065	17.14	1.65	0.640
3/8´´	40S	0.675	0.091	17.14	2.31	0.858
3/8´´	80S	0.675	0.126	17.14	3.20	1.117
1/2´´	10S	0.840	0.083	21.34	2.11	1.016
1/2´´	40S	0.840	0.109	21.34	2.77	1.288
1/2´´	80S	0.840	0.147	21.34	3.73	1.644
1/2´´	160S	0.840	0.188	21.34	4.78	1.982
3/4”	10S	1.050	0.083	26.67	2.11	1.297
3/4”	40S	1.050	0.113	26.67	2.87	1.710
3/4”	80S	1.050	0.154	26.67	3.91	2.228
3/4”	160S	1.050	0.219	26.67	5.56	2.938
1´´	10S	1.315	0.109	33.40	2.77	2.124
1´´	40S	1.315	0.133	33.40	3.38	2.540
1´´	80S	1.315	0.179	33.40	4.55	3.286
1´´	160S	1.315	0.250	33.40	6.35	4.300
1´´	XXS	1.315	0.358	33.40	9.09	5.532
1 1/4´´	10S	1.660	0.109	42.16	2.77	2.731
1 1/4´´	40S	1.660	0.140	42.16	3.56	3.440
1 1/4´´	80S	1.660	0.191	42.16	4.85	4.530
1 1/4´´	160S	1.660	0.250	42.16	6.35	5.692
1 1/2´´	10S	1.900	0.109	48.26	2.77	3.154
1 1/2´´	40S	1.900	0.145	48.26	3.68	4.107
1 1/2´´	80S	1.900	0.200	48.26	5.08	5.491
1 1/2´´	160S	1.900	0.281	48.26	7.14	7.349
1 1/2´´	XXS	1.900	0.400	48.26	10.16	9.690
2´´	10S	2.375	0.109	60.32	2.77	3.991
2´´	40S	2.375	0.154	60.32	3.91	5.521
2´´	80S	2.375	0.218	60.32	5.54	7.597
2´´	160S	2.375	0.343	60.32	8.71	11.253
2´´	XXS	2.375	0.436	60.32	11.07	13.648
2 1/2´´	10S	2.875	0.120	73.02	3.05	5.342

NPS Sch OD	WT	Inches OD	WT	Mm OD	WT	Weight Kg/m
2 1/2´´	40S	2.875	0.203	73.02	5.16	8.765
2 1/2´´	80S	2.875	0.276	73.02	7.01	11.583
2 1/2´´	160S	2.875	0.552	73.02	14.02	20.706
3´´	10S	3.500	0.120	88.90	3.05	6.555
3´´	40S	3.500	0.216	88.90	5.49	11.463
3´´	80S	3.500	0.300	88.90	7.62	15.504
3´´	160S	3.500	0.438	88.90	11.13	21.668
3´´	XXS	3.500	0.600	88.90	15.24	28.101
3 1/2´´	10S	4.000	0.120	101.60	3.05	7.524
3 1/2´´	40S	4.000	0.226	101.60	5.74	13.774
3 1/2´´	80S	4.000	0.318	101.60	8.08	18.916
4´´	10S	4.500	0.120	114.30	3.05	8.494
4´´	40S	4.500	0.237	114.30	6.02	16.317
4´´	80S	4.500	0.337	114.30	8.56	22.658
4´´	120S	4.500	0.438	114.30	11.13	28.744
4´´	160S	4.500	0.531	114.30	13.49	34.043
4´´	XXS	4.500	0.674	114.30	17.12	41.647
5´´	10S	5.563	0.134	141.30	3.40	11.737
5´´	40S	5.563	0.258	141.30	6.55	22.094
5´´	80S	5.563	0.375	141.30	9.52	31.405
5´´	160S	5.563	0.625	141.30	15.88	49.857
6´´	10S	6.625	0.134	168.28	3.40	14.033
6´´	40S	6.625	0.280	168.28	7.11	28.685
6´´	80S	6.625	0.432	168.28	10.97	43.199
6´´	120S	6.625	0.562	168.28	14.27	55.015
6´´	160S	6.625	0.719	168.28	18.26	68.573
6´´	XXS	6.625	0.864	168.28	21.95	80.403
8”	10S	8.625	0.148	219.08	3.75	20.214
8”	40S	8.625	0.322	219.08	8.18	43.185
8”	60S	8.625	0.406	219.08	10.31	53.881
8”	80S	8.625	0.500	219.08	12.70	65.611
8”	120S	8.625	0.719	219.08	18.26	91.794
8”	160S	8.625	0.906	219.08	23.01	112.936
8”	XXS	8.625	0.875	219.08	22.23	109.542

3.6 MECHANICAL TUBING / HOLLOW BARS

Engineering and machine industrial applications, such as fittings, cutting rings, control valves and machining components for Oil & Gas applications are the main uses of this product.

TSS boasts the largest stainless steel mechanical tubing stock in the world. Our MECATEX grade in 304/L & 316/L improves machinability, while guaranteeing weldability, mechanical properties and corrosion resistance at same time.

Our stock products have the following features – additional specifications, grades and sizes are available on request:

GRADES AVAILABLE:

MECATEX 304/L
MECATEX 316/L
1.4571 (TP316Ti)
TP321/H/1.4541
UNS S31803/UNS S32205
HIGH NICKEL ALLOYS UPON REQUEST.

SPECIFICATION:

DELIVERY STANDARDS
EN 10216-5 TC1
ASTM A511-ASTM A312
EN 10297-2

TOLERANCE STANDARD
OD -0/+2% with min -0/+1mm
ID +0/-2% with min +0/-1mm
MIN WALL: 95% of nominal wall

ADDITIONAL TESTS
NACE MR0175 – EN ISO 15156
ISO 3651-2 METHOD A - ASTM A262 PRACTICE E
100% PMI tested
Hydraulically tested ASTM A999 par22.2

LENGTHS
Finished 2 to 6.5 meters

SIZES

TSS mechanical tubing stock covers the full standard range from 32 mm to 250 mm outside diameter. Special sizes are available on request.

Hollow bar sizes defined by outside diameter and inside diameter in millimeters:

mm OD	WT	ID	Weight Kg/m
32.00	8.00	16	5.107
32.00	6.00	20	4.149
36.00	10.00	16	6.916
36.00	8.00	20	5.958
36.00	5.50	25	4.462
40.00	10.00	20	7.980
40.00	7.50	25	6.484
40.00	6.00	28	5.426
45.00	12.50	20	10.806
45.00	10.00	25	9.310
45.00	8.50	28	8.252
45.00	6.50	32	6.656
50.00	12.50	25	12.468
50.00	11.00	28	11.411
50.00	9.00	32	9.815
50.00	7.00	36	8.006
50.00	5.00	40	5.985
56.00	14.00	28	15.640
56.00	10.00	36	12.236
56.00	8.00	40	10.214
60.00	10.00	40	13.300
63.00	15.50	32	19.584
63.00	13.50	36	17.775
63.00	11.50	40	15.753
63.00	9.00	45	12.927
63.00	6.50	50	9.769
70.00	10.00	50	15.959
71.00	17.50	36	24.903
71.00	15.50	40	22.882
71.00	13.00	45	20.056
71.00	7.50	56	12.668
75.00	17.50	40	26.765
75.00	12.50	50	20.781
75.00	7.50	60	13.466
76.00	9.00	58	16.039
80.00	20.00	40	31.919
80.00	17.50	45	29.093
80.00	15.00	50	25.934
80.00	8.50	63	16.166
85.00	20.00	45	34.579
85.00	15.00	55	27.929

mm OD	WT	ID	Weight Kg/m
85.00	9.00	67	18.194
90.00	20.00	50	37.239
90.00	17.00	56	33.010
90.00	13.50	63	27.470
90.00	9.50	71	20.342
95.00	22.50	50	43.390
95.00	14.00	67	30.163
95.00	10.00	75	22.609
100.00	22.00	56	45.644
100.00	18.50	63	40.105
100.00	14.50	71	32.976
100.00	10.00	80	23.939
106.00	25.00	56	53.863
106.00	21.50	63	48.324
106.00	17.50	71	41.195
106.00	13.00	80	32.158
106.00	8.00	90	20.854
112.00	24.50	63	57.022
112.00	20.50	71	49.893
112.00	16.00	80	40.856
112.00	11.00	90	29.552
118.00	27.50	63	66.199
118.00	23.50	71	59.070
118.00	19.00	80	50.033
118.00	14.00	90	38.728
125.00	27.00	71	70.381
125.00	22.50	80	61.344
125.00	17.50	90	50.040
125.00	12.50	100	37.405
132.00	30.50	71	82.344
132.00	26.00	80	73.307
132.00	21.00	90	62.003
132.00	13.00	106	41.149
140.00	30.00	80	87.777
140.00	25.00	90	76.473
140.00	20.00	100	63.838
140.00	17.00	106	55.619
140.00	14.00	112	46.921
150.00	35.00	80	107.062
150.00	27.50	95	89.606
150.00	22.00	106	74.903

mm OD	WT	ID	Weight Kg/m
150.00	19.00	112	66.205
150.00	12.50	125	45.717
160.00	35.00	90	116.371
160.00	24.00	112	86.820
160.00	20.00	120	74.478
160.00	19.00	122	71.259
160.00	14.00	132	54.369
170.00	35.00	100	125.681
170.00	32.00	106	117.462
170.00	26.00	118	99.587
170.00	20.00	130	79.797
170.00	15.00	140	61.843
180.00	40.00	100	148.955
180.00	27.50	125	111.550
180.00	25.00	130	103.072
180.00	20.00	140	85.117
180.00	15.00	150	65.833
190.00	42.00	106	165.340
190.00	33.50	123	139.453
190.00	29.00	132	124.191
190.00	25.00	140	109.721
190.00	20.00	150	90.437
190.00	15.00	160	69.823
200.00	44.00	112	182.576
200.00	30.00	140	135.656
200.00	25.00	150	116.371
200.00	20.00	160	95.757
200.00	15.00	170	73.813
212.00	41.00	130	186.487
212.00	31.00	150	149.248
212.00	21.00	170	106.689
212.00	16.00	180	83.415
224.00	42.00	140	203.324
224.00	32.00	160	163.425
224.00	27.00	170	141.481
224.00	22.00	180	118.207
236.00	43.00	150	220.746
236.00	23.00	190	130.309
240.00	35.00	170	190.849
250.00	25.00	200	149.620

For further information visit our website www.tubacex.com

3.7 ROUND BARS

Stainless steel round bars wrap up our hollow bar portfolio for machining. In both products tailor-made cutting service is available.

The Tubacex Group's steel melting shop Aceralava is our main supplier, which allows us to guarantee constant availability and flexibility in case of special requirements.

Our stock products have the following features – additional specifications, grades and sizes are available on request:

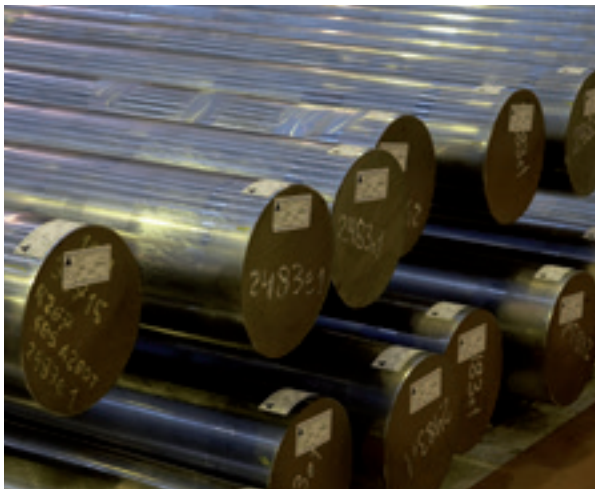
GRADES AVAILABLE:

304/L – 1.4301/1.4306
316/L – 1.4401/1.4404
UNS31803/UNS32205

SPECIFICATION:

DELIVERY STANDARDS
ASTM A182
EN10088-3
EN10250-4
EN10222-5
EN10272

ADDITIONAL TESTS
ISO 3651-2
NACE MR-0175



SIZES

TSS round bar stock includes a wide range from 165 mm to 500 mm outside diameter. Special sizes are available on request.

mm OD	Inch OD	Weight Kg/m	Weight LB/FT
R165	6.50	168	112.9
R175	6.89	189	127.00
R180	7.09	200	134.4
R190	7.48	223	149.8
R200	7.88	247	166.0
R210	8.27	272	182.8
R220	8.67	298	200.2
R230	9.06	326	219.1
R240	9.45	355	238.5
R250	9.85	385	258.7
R260	10.24	417	280.2
R270	10.64	450	302.4
R280	11.03	483	324.6
R290	11.42	519	348.8
R300	11.82	555	372.9
R310	12.21	593	398.5
R320	12.61	631	424.0
R330	13.00	672	451.6
R340	13.39	713	479.1
R350	13.79	755	507.3
R360	14.18	799	536.8
R370	14.58	844	567.0
R375	14.77	867	582.6
R380	14.97	890	598.0
R400	15.76	987	663.2
R440	17.33	1081	726.3
R450	17.73	1249	839.3
R500	19.70	1522	1022.7

3.8 FITTINGS

Butt Welding Fittings are used in a wide range of sectors and applications such as Oil & Gas, nuclear, power generation, chemical, petrochemical and fertilizer production industries.

GRADES AVAILABLE:

304/L – 1.4301/1.4306

316/L – 1.4401/1.4404

SPECIFICATION:

DELIVERY STANDARDS

ASTM ASME A403

DIMENSION STANDARD

ASME B16.9

SIZES

2'' (60,33 mm) up to 8'' (219,08 mm)

Wall thickness: sch10-40-80

MORE ABOUT OUR FITTINGS:

90º & 45º ELBOWS

Elbows are most commonly used fittings.

• For 90º elbows, their size designations are either long radius or short radius:
For long radius elbows, the center to end dimension is always 1-1/2 times the nominal size of the elbow.
Short radius elbows have a center to end dimension equal to pipe diameter.

For a particular job, the type of elbow selected is usually a compromise based on three considerations: fluid flow rate, space available and initial cost.
For service where the flow rate is critical and space is available, the user may select the long radius fitting, which gives him the least reduction in flow and pressure drop from internal frictional resistance and stream turbulence.
On the other hand, where space is limited and flow rate is non-critical, a short radius elbow is often selected.
When fluids are moved long distance or must encounter many directional changes, short radius elbows are not recommended because of their greater friction loss.

A long radius elbow costs less than a short radius one.
Long radius account more than 90% of all elbows in use.

• As for 45º long radius elbow (there is no 45º short radius), it has all the flow advantages of 90º long radius. It is generally used when a partial or gradual change in direction is desired.

TEES

A tee is a branched, reinforced outlet fitting that permits flow at 90º to the main flow. The main flow passes through the 'run' of the tee, while the 90º outlet is called the 'branch' of the tee.
A straight (equal) tee is manufactured with all three outlets at same size, while reducing tee is made with the branch outlet smaller than the run to accommodate the design flow rate.

REDUCERS

All reducers, either eccentric or concentric, decrease the effective size of the pipe. With smaller cross sectional area there is increased frictional resistance to the flowing fluid and an increase of system pressure.
The eccentric reducer has the reducing outlet end off center. It will line up straight with one side of the inlet but not with the other outlet. This reducer is harder to manufacture than the concentric reducer so costs more.
An advantage over the concentric reducer is that can be hung or suspended flush against a flat ceiling or wall. This lends greater support to the piping system and many times reduces the required space. When used in horizontal piping systems with the straight side up, it acts as a trap for foreign material; when installed straight side down, it prevents trapping of foreign material.
The concentric reducer is made with both inlet and outlet on a common center line. This reducer is less costly to manufacture than the eccentric type and it is adaptable to most piping installations.

CAPS

The function of a cap is to block off the end of a line. The cap is placed over the open end and welded around the joint.

3.9 GENERAL FEATURES

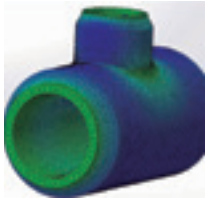
3.9.1 TOLERANCES

Main tolerance description:

EN 10305-1	Size		Tolerances		
	OD mm		OD mm		WT
	From 4 to 30		+/- 0.08		+/- 10%
	From 32 to 40		+/- 0.15		+/- 10%
	From 42 to 50		+/- 0.20		+/- 10%
ASTM A269	Size		Tolerances		
	Inches	mm	OD inches	OD mm	WT
	Less than 1/2	Less than 12	+/- 0.005	0,127	+/- 15%
	Over 1/2 to 1-1/2	12,6 - 38	+/- 0.005	0,127	+/- 10%
	Over 1-1/2 to 3-1/2	38,1 to 88,8	+/- 0.010	0,254	+/- 10%
	Over 3-1/2 to 5-1/2	88,9 to 139,6	+/- 0.015	0,381	+/- 10%
	Over 5-1/2 to 8	139,7 to 203	+/- 0.030	0,762	+/- 10%
ASTM A99	Size		Tolerances		
	OD mm		OD mm		WT
	From 10,29 to 48,26		+/- 0.40	-0.79	5% + Tol by weight
	From 48,27 to 114,30		+/- 0.79	-0.79	5% + Tol by weight
	From 114,31 to 219,08		+/- 1.59	-0.79	5% + Tol by weight
	From 219,09 to 457,20		+/- 2.38	-0.79	5% + Tol by weight
	From 457, 21 to 609,60		+/- 3.18	-0.79	5% + Tol by weight
EN10216-5 (ISO 1127)					
	OD spec	Tolerances		WT spec	Tolerances
	D1	+/- 1.50% with min +/- 0.75 mm		T1	+/- 15% with min +/- 0.60 mm
	D2	+/- 1.00% with min +/- 0.50 mm		T2	+/- 12.5% with min +/- 0.40 mm
	D3	+/- 0.75% with min +/- 0.30 mm		T3	+/- 10% with min +/- 0.20 mm
	D4	+/- 0.50% with min +/- 0.10 mm		T4	+/- 7.5% with min +/- 0.15 mm

3.9.2 HEAT TREATMENT

Heat treatment ensures the correct microstructure and, therefore, promotes mechanical and corrosion resistant properties.
Solution annealing is the most commonly used heat treatment process. Stresses and work-hardening induced by forming, welding and any subsequent cold work are removed. Any sensitization which may have occurred is dissolved and carbides are put back into the solution.



3.9.3 CHEMICAL TREATMENTS

PICKLING
Pickling, generally in a bath of mixed nitric and hydrofluoric acids, removes any high temperature oxidation or scale from the surface of the material.

PASSIVATION
Passivation promotes the formation and improves the integrity of the passive layer on any freshly created surface and dissolves any free iron/steel contamination which may have occurred.

3.9.4 MECHANICAL TREATMENTS

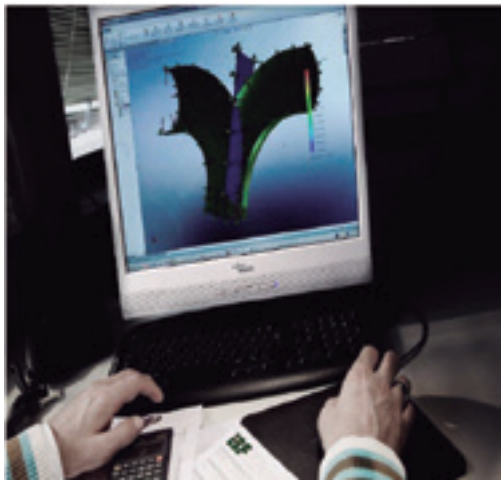
GRINDING, BRUSHING, POLISHING

Both grinding and polishing involve metal removal.
Generally speaking, those operations which serve mainly to remove metal rapidly are considered as grinding, while those in which the emphasis is centered on attaining smoothness are classified as polishing.

Although brushing normally involves the use of a fine abrasive action on the surface of the metal, in contrast to grinding and polishing there is no deliberate attempt to remove a surface layer. Rather it is modified by the action of bristles or a nylon fabric medium that may have some fine abrasive or lubricant included.
Any mechanical treatment of stainless steel affects the surface roughness and thereby the corrosion resistance of the steel. In general, the corrosion resistance decreases if surface roughness increases.

BLASTING

In blasting the impacting medium cuts the steel surface, removing small amounts of metal from the surface. The resulting surface finish and hence surface corrosion resistance of the treated stainless steel is partly dependent on the blasting medium. Very hard media, such as aluminum oxide can leave a jagged or torn faces to metal peaks on the surface, whereas the softer media, such as silicon carbide give a smoother finish.



3.9.5 CERTIFICATES

According to EN10204 several types of certificates can be issued.

TYPE 2.1, WORK DECLARATION

Document in which the manufacturer declares that the products supplied are in compliance with the requirements of the order, without inclusion of test results.

TYPE 2.2, WORK CERTIFICATE WITH RESULTS

Document in which the manufacturer declares that the products supplied are in compliance with the requirements of the order and in which he supplies test results based on non-specific inspection.

TYPE 3.1, INSPECTION CERTIFICATE WITH RESULTS ACCORDING TO INSPECTOR

Document issued by the manufacturer in which he declares that the products supplied are in compliance with the requirements of the order and in which he supplies test results.
The test unit and the tests to be carried out are defined by the product specification, the official regulation and corresponding rules and/or the order.
The document is validated by the manufacturer's authorized inspection representative, independent of the manufacturing department.

TYPE 3.2, INSPECTION CERTIFICATE WITH RESULTS ACCORDING TO BUYER/INSPECTOR

Document prepared by both the manufacturer's authorized inspection representative, independent of the manufacturing department and either the purchaser's authorized inspection representative or the inspector designated by the official regulations and in which they declare that the products supplied are in compliance with the requirements of the order and in which test results are supplied.

4. OUR SERVICE PORTFOLIO IN TUBACEX SERVICES

Historically Tubacex has been a pioneer in serving the market. We think that increasing our service when our clients demand it will strengthen our leadership.
During our experience working with our clients, some of them have shared their needs with us. In general, these are regular exchanges where our client has a competitive advantage if they have a material with specific conditions and minimum availability.
In addition, being part of a strong industrial group with technicians, plants and laboratories in 3 continents gives our project a unique advantage and flexibility. The operations listed below are just some of the most demanded; nevertheless we have the widest service offer in our sector thanks to the support of Tubacex Group.
We offer a vast number of activities to support our clients and make their life easier:

4.1 MTC 3.2 AND IRC

We provide the following third-party inspection services:
ITP (Inspection test plan)
Material witnessing. Visual and dimensional inspections.
Supplier surveillance.
Mechanical testing witnessing at our approved labs.
Non Destructive Test witnessing at our plants.
Monitoring the manufacturing process from raw material to final step at Tubacex Group plants.

4.2 UPGRADES

Ultrasonic tests at our works according to Euronorm and ASTM standards.
Dye penetrant testing at our works according to Euronorm and ASTM standards.
Additional corrosion testing, customized impact tests, grain sizes…

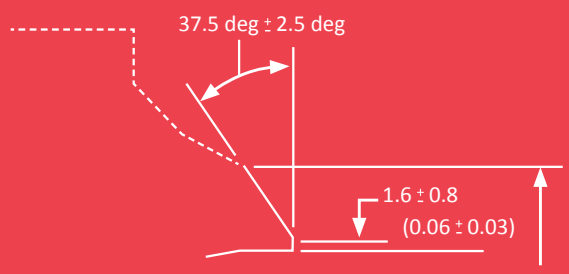
4.3 SPECIAL MARKING, VIBRO-ETCHING AND COLOR CODING

We provide these services for projects where such requirements are specified.

4.4 MACHINING / BEVELING

High Green technology machining and beveling CNC machine.
Beveling, operation at both ends of the tube is required for welding of tubular solution components to be joined. The following are the main references to shape internal and external walls:

ANSI B16.25 FIG 2A
ANSI B16.25 FIG 3A
ANSI B16.25 FIG 4 (most demanded one)
ANSI B16.25 FIG 5A
ANSI B16.25 FIG 5B
ISO 9692-1 KZ 1.3
ISO 9692-1 KZ 1.5
DIN 2559 KZ-22
EN 9692-1
SPECIAL 99.9º HEEL: 9.9 MM



4.5 BENDING

Bending range: 3/4” (25 mm) through 8” (219,08 mm).
Bending radius: depending on material and thickness.
Thermal treatment.
Hydraulic test.
Penetrant test.

4.6 GROOVING & MECHANICAL CONNECTIONS

- Tool system for grooving, internal and external machining.
- Perfect surface finish.
- A tool for every task (parting off, external grooving, internal grooving, face grooving, profiling).
- Proven joint reliability.
- Each joint is a union.
- Installed cost savings.

4.7 POLISHING

Polishing, according to client´s roughness specification.

4.8 FINNING

Solid and serrated, spiral wound and continuously welded to the tubes by high frequency electric resistance welding process.

4.9 CUTTING

Tailor - made for all our products.


E103

5. WHY TSS: MAKING YOUR BUSINESS GROW

TSS was born for the purpose of making our clients' business grow through our service. Thanks to our business model we can guarantee the widest product portfolio with immediate availability, thanks to TUBACEX Group network of integrated production plants. On the other hand, TSS offers an array of competitive advantages oriented to reducing our clients' administrative and operating costs, both via specific commercial agreements as well as undertaking volatility risk.
As a result of wide experience in the fields of manufacturing and distribution, TUBACEX is an integrated partner capable of immediately addressing the most demanding needs of clients and with the reliability and flexibility needed by the most challenging markets.

THE WIDEST RANGE IN THE INDUSTRY

TSS offers the largest Seamless Stainless Steel stock in the world. In addition, through Tubacex Group's manufacturing capabilities, the widest range in Seamless Stainless Steel pipes and fittings (from 1/8" mm to 72") is available on request.

QUALITY

Tubacex Group is widely recognized for its quality. The group guarantees trusted production processes and product quality in its manufacturing units and service centers in Europe, Asia and America.

AVAILABILITY

The biggest stock worldwide for a taylor made delivery service.

SERVICES

Taking advantage of our own experience and capabilities installed in the rest of Tubacex Group, we have an array of products and particularities exceeding mere product sale and marketing.

RAW MATERIAL MANAGEMENT

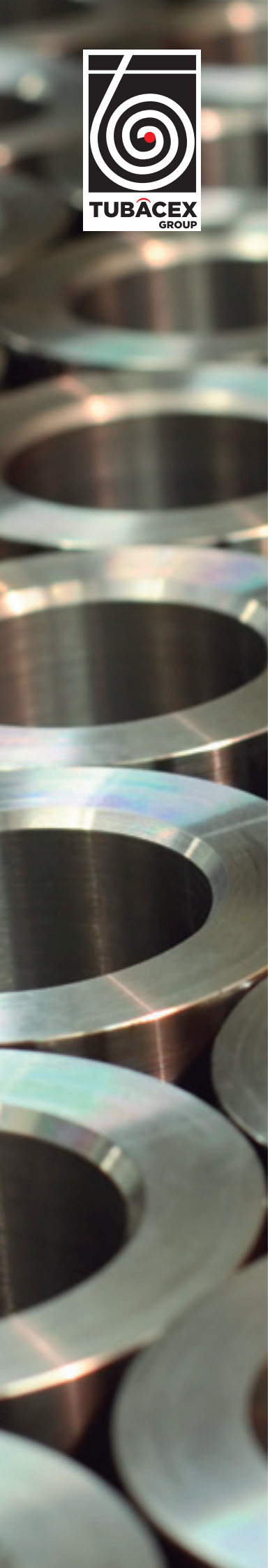
Leaders in protecting our clients from raw materials fluctuations and volatility.

WORLWIDE PRESENCE

Our aim is to serve in an excellent way our clients as close as possible wherever they are.

FLEXIBILITY TO ADAPT TO EACH CUSTOMER'S NEEDS

TSS offers flexibility to specifically adapt to each customer's requirements.



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