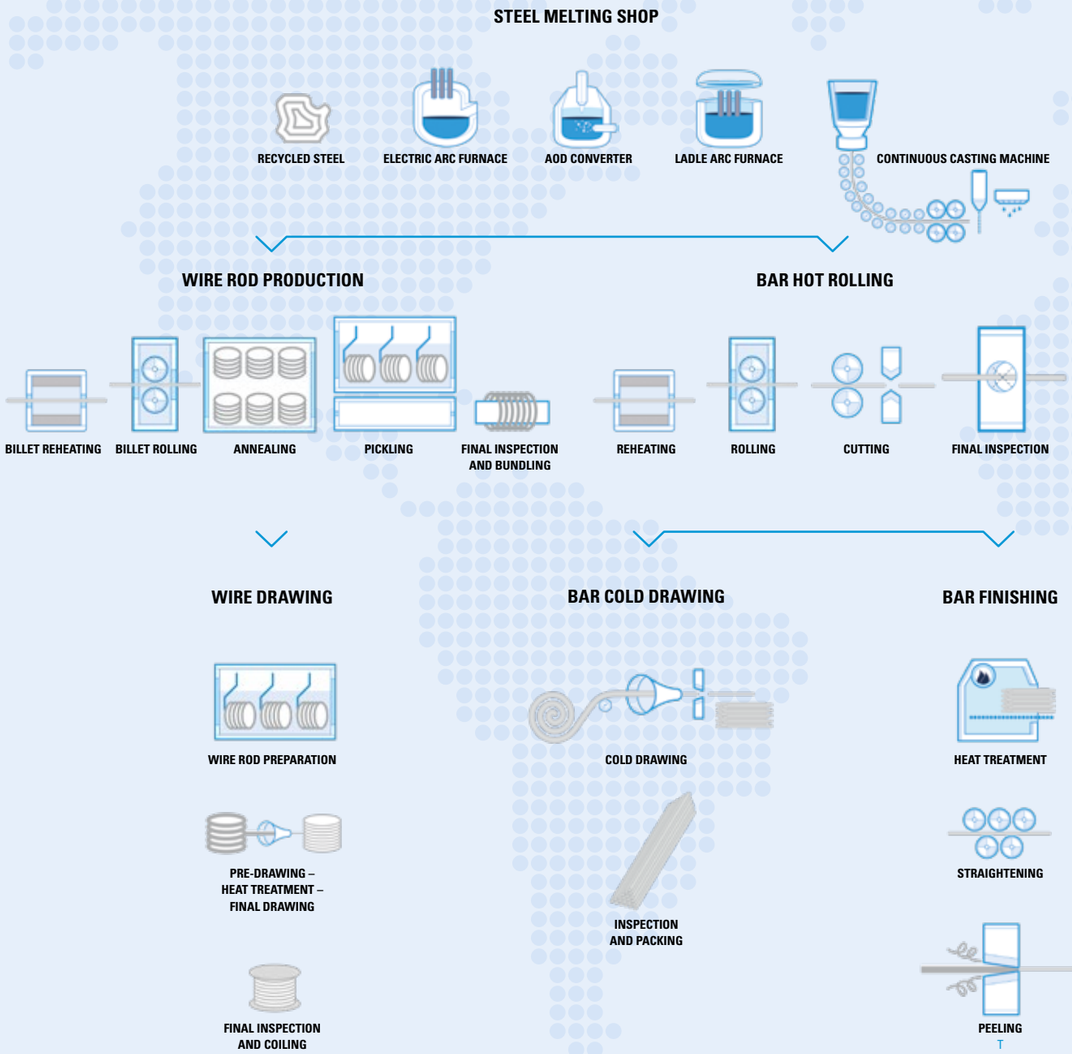
STAINLESS STEEL LONG PRODUCTS

MARCEGAGLIA
SPECIALTIES

STAINLESS STEEL LONG PRODUCTS MANUFACTURING PROCESS



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6.5 **million tonnes** of finished product

7.5 **billion Euros** in turnover

7,800 **employees**

36 **plants** across 4 continents

15,000 **customers**

1st **player** in steel processing sector in the world

1st **producer of stainless steel welded tubes** in the world

1st **producer of carbon steel welded tubes** in Europe

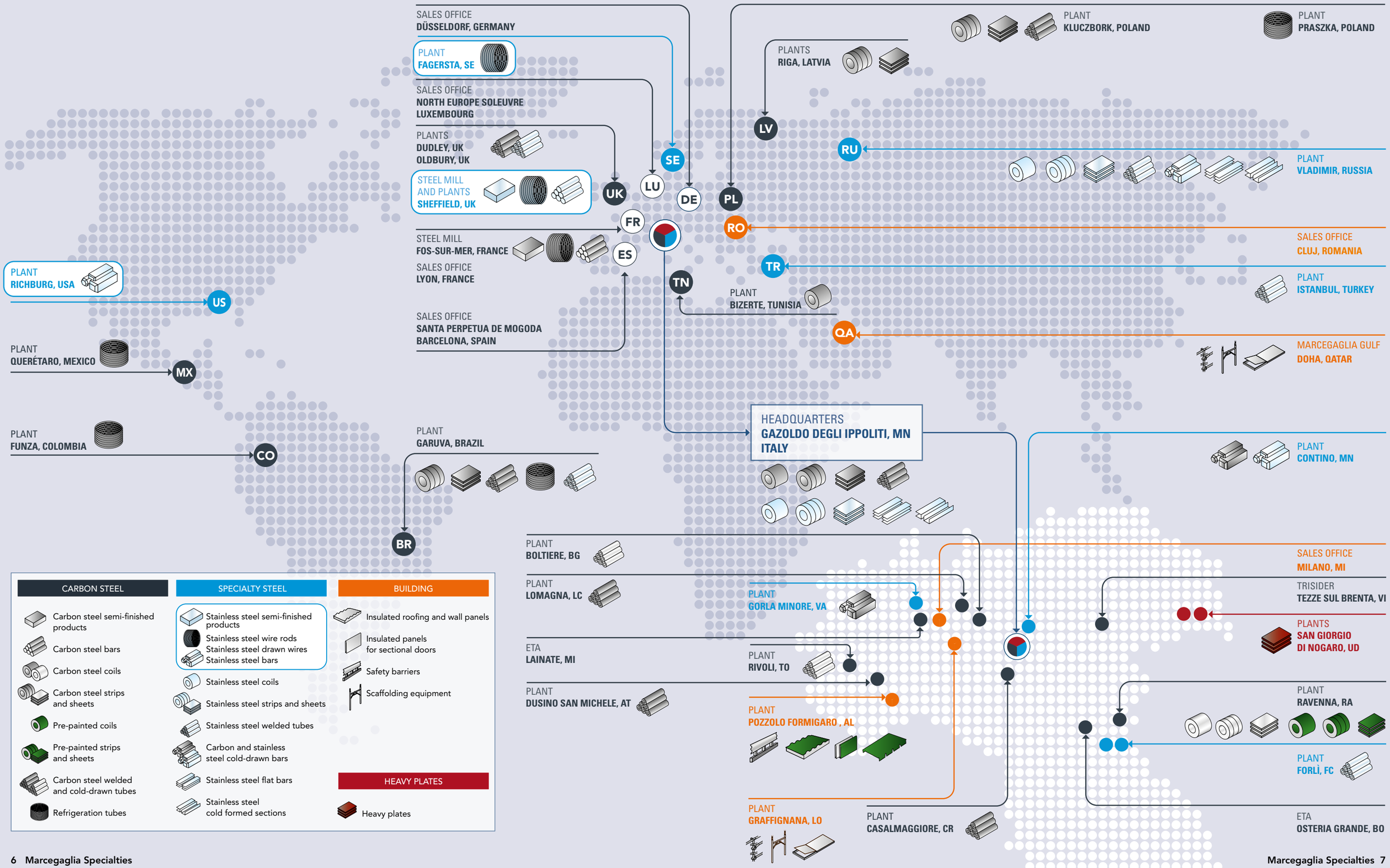
1st **service center** in Italy

INTERNATIONAL PLAYER IN STEEL

Marcegaglia is the italian industrial group leading the European and worldwide steel market.
A unique combination of the dynamic Italian family business model with the great operating capacity and presence in the international markets, typical of the large corporations.

With 6.5 million tons of steel processed every year and 7.5 billion euros of yearly revenues, Marcegaglia is one of the leading players in the world steel scenario.

WORLDWIDE PRESENCE



CARBON STEEL

- Carbon steel semi-finished products
- Carbon steel bars
- Carbon steel coils
- Carbon steel strips and sheets
- Pre-painted coils
- Pre-painted strips and sheets
- Carbon steel welded and cold-drawn tubes
- Refrigeration tubes

SPECIALTY STEEL

- Stainless steel semi-finished products
- Stainless steel wire rods
- Stainless steel drawn wires
- Stainless steel bars
- Stainless steel coils
- Stainless steel strips and sheets
- Stainless steel welded tubes
- Carbon and stainless steel cold-drawn bars
- Stainless steel flat bars
- Stainless steel cold formed sections

BUILDING

- Insulated roofing and wall panels
- Insulated panels for sectional doors
- Safety barriers
- Scaffolding equipment

HEAVY PLATES

- Heavy plates

STRATEGIC RESOURCES AND DISTINCTIVE SKILLS:

SOLID GLOBAL PROCUREMENT NETWORK

DIVERSIFIED RANGE OF PRODUCTS AND SERVICES

WORLDWIDE DISTRIBUTION (CUSTOMER BASE, GEOGRAPHIC MARKETS, AREAS OF USE)

OPERATIONAL EXCELLENCE AND LOGISTICS

FLEXIBILITY / REACTIVITY / SPEEDY DECISION MAKING

SERVICE ORIENTATION

COMPETENCE / MOTIVATION / STABILITY OF MANAGEMENT

FLEXIBLE SOUL

Independence, dynamism, agility, responsiveness, resilience and sustainability are the key elements of Marcegaglia corporate culture: factors that have helped make the company the main point of reference for steel processing both in Italy and abroad. Marcegaglia is able to successfully operate, even given the most difficult markets and geopolitical conditions, thanks to industrial synergies, economies of scale and the diversification of production and supply.

Group culture focuses on the role of people and on sharing specific values, which have become the cornerstones of its business model.

Ready to seize every opportunity for growth whilst paying constant attention to customers needs, Marcegaglia Group has created a network of 36 production plants that guarantee the very best skills, quality, service and know-how, along with a highly efficient logistics and distribution network.

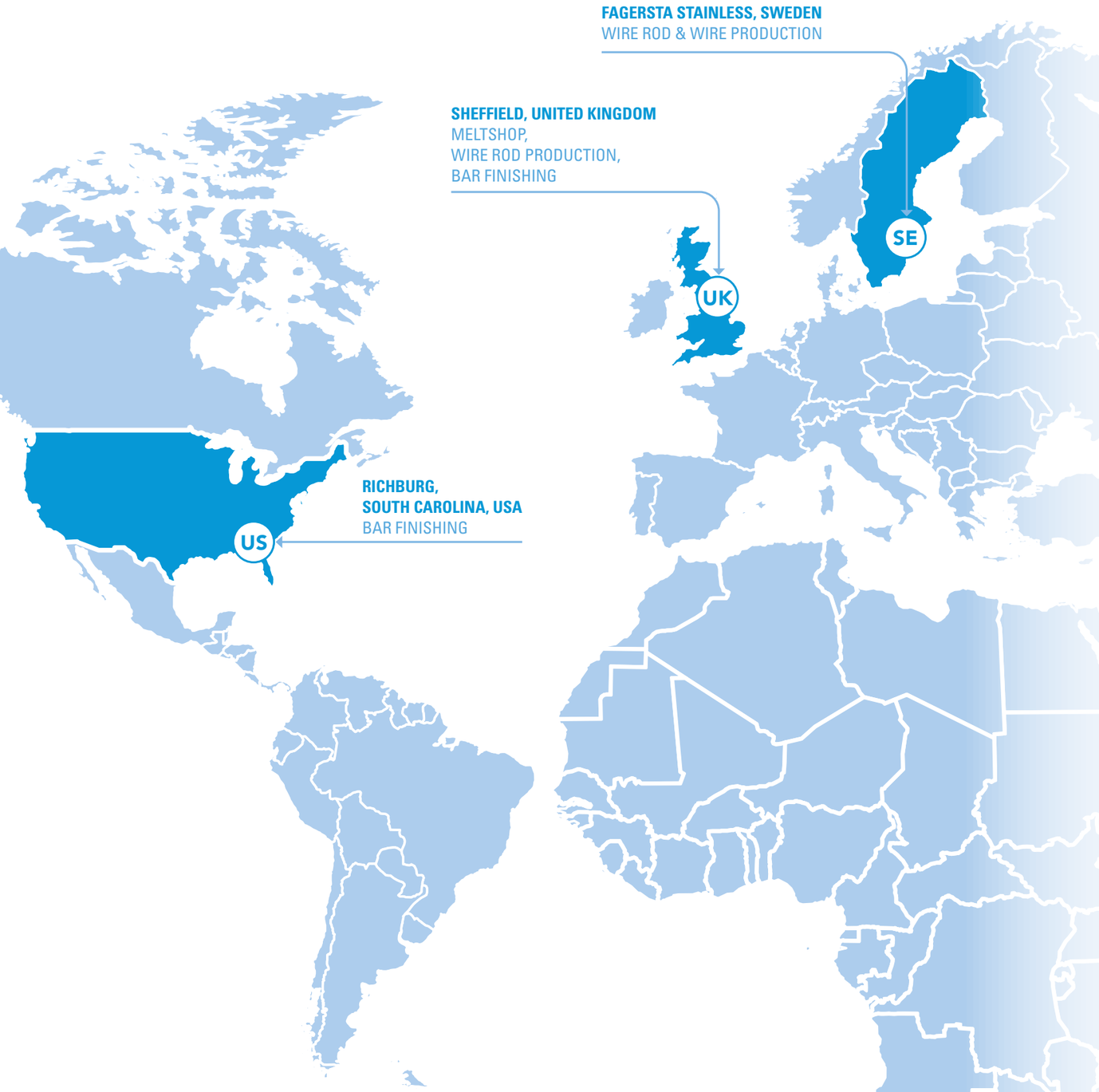
The large number of hubs located in Europe's most strategic manufacturing districts and its privately-owned railway terminals and port facilities in the Mediterranean (Ravenna, San Giorgio di Nogaro and Bizerte) allow the company to meet requests from around the globe and ensuring its international customers prompt, flexible and punctual product delivery..

MOVING THE WORLD

A capillary presence and sophisticated logistic network to get closer to customers all over Europe and in the world

STAINLESS STEEL LONG PRODUCTS
COMPANIES AND PRODUCT RANGE

Stainless steel long products



High performance stainless steel long products

Marcegaglia Long Products is a global producer of high-quality stainless steel long products.
We are known for our ability to offer products in a wide range of grades, shapes and sizes, with high quality and reliability.

Our stainless steel is melted in Europe with over 90% recycled stainless steel scrap content and by using an efficient energy mix we can provide our customers lower than industry average carbon footprint.

Marcegaglia Long Products is the inventor of stainless steel dating back to 1913 in Sheffield, UK when Harry Brearley discovered the martensitic stainless steel.
We are also the first in the world to roll stainless steel wire rod in Fagersta, Sweden.

Our offering includes Prodec® bar that produces highly improved machinable bars. Our long legacy gives a proven track record of our technical expertise that customers benefit when dealing with us.

Our customers use stainless steel in a wide range of industrial end-uses from machined components to welding wire, forging applications, springs, and cold-heading applications to name a few.
Many of our customers produce bars, wire rod as well as drawn wire or act as distributors in the key markets.

Marcegaglia Long Products employs approximately 650 professionals, with production in the UK, Sweden and US.

What makes Marcegaglia Long Products unique?

- Quality, end-to-end process
- Sustainability
- Product portfolio and technical leadership
- Customer tailored products

Production steps for Stainless Steel Long Products

SMACC meltshop

Production starts in the steel meltshop in Sheffield UK, where we produce semi-finished products: slabs as well as continuously cast billets and blooms.
Our own downstream operations in Sheffield, UK use billet feedstock material for producing stainless steel wire rod and cold drawn bars. Our hire-work partners in UK produce peeled bars which are finished at the SSB finishing facility.

Fagersta Stainless in Sweden is specialized in stainless steel wire rod and drawn wire.

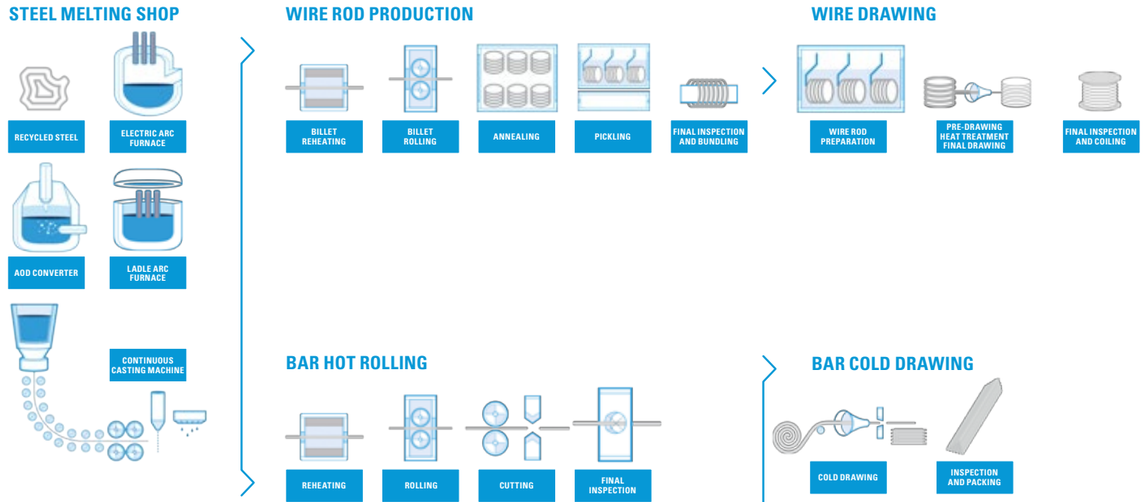
Richburg stainless steel bar operation is located in South Carolina, US. Their feedstock material are mainly originated from UK meltshop.
Billets are rolled at hire-work partner and finished in the Richburg facility.

ASR wire rod mill

Fagersta Stainless wire rod and drawn wire mill

SSB bar finishing mill

Richburg bar finishing mill



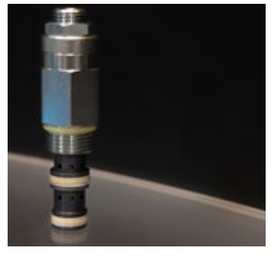
Applications

Typical applications for Marcegaglia stainless long products

- Shafts, valves, fittings, and components
- Seamless tubes, flange
- Wire, springs, bolts, and fasteners
- Forgings

Typical industry sectors that use Marcegaglia stainless long products

- Chemical and petrochemical processing
- Oil and gas
- Pulp and paper
- Automotive and aerospace
- Machinery and electrical
- Food and beverage
- Construction



Our products

Semi-finished products

Continuously cast slabs

Continuously cast billets

Continuously cast blooms

Rebar

Rebar coils

Rebar lengths

Bars

Round

Hexagon

Square

Wire rods

Wire rod coils

Drawn wires

MARCEGAGLIA STAINLESS SHEFFIELD
STAINLESS STEEL SEMI-FINISHED PRODUCTS

Marcegaglia Stainless Sheffield - SMACC Meltshop

Marcegaglia Stainless Sheffield produces consistently high quality billets, blooms and slabs in an industry-leading variety of shapes and grades for use in forging, rolling and further processing.

We also offer billets and blooms in Prodec® enhanced machinability grades for use in downstream applications where high efficiency machining is important.

Marcegaglia Stainless Sheffield has years of experience supplying quality critical industries and understanding customer requirements.

Key benefits

- European melt - in Austenitic, Ferritic, Duplex and Precipitation hardening grades, including Prodec® for improved machinability properties
- Exceptional range of semi-finished products, also in tailored chemical compositions
- Stainless steel production for over a century
- Low Carbon footprint
- Consistent products
- Good overall cost of quality
- Easy to do Business with

Marcegaglia's SMACC operation in Sheffield represents both a proud legacy and a clear vision. Committed to being the leader in stainless steel long products, SMACC produces continuously cast semi-finished stainless steel to the most demanding customer applications.

With a proud tradition of steelmaking – the world's first martensitic stainless steel was invented here more than 100 years ago – Sheffield is home to SMACC (Stainless Melting and Continuous Casting), wire rod mill ASR (Alloy Steel Rods) and bar finishing facility SSB (Sheffield Stainless Bar).

SMACC produces semi-finished products: slabs, blooms and billets in an extremely wide selection of grades and an industry-leading range of shapes and sizes, including our 300 mm slab.
The exceptional flexibility of our meltshop means we can quickly adjust production schedules to provide flexible lead times.

Continuously cast billets and blooms are typically used as feedstock for rolling wire rod or bar and can be used in certain forging applications. Continuously cast slabs are typically hot and cold rolled into coil and sheet plate or used in the forging industry.

Marcegaglia Stainless Sheffield has been producing stainless steel for more than a century. Our legacy of innovation and quality means that we have the right product for every application.

Contact sales at
smacc.sales@marcegaglia.com

Continuously cast billets and blooms

Continuously cast billets and blooms are typically used as feedstock for rolling wire rod or bar and can be used in certain forging applications. We provide a wide range of ferritic, austenitic, duplex, heat resistant, and precipitation hardening stainless steels with consistently high quality and delivery reliability.

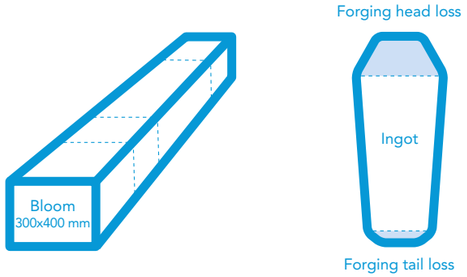
Benefits

- Consistent surface, center line, and cast quality
- Expert technical support for customer processing
- Industry-leading variety of grades (including tailored grades)
- Full product traceability
- Reliable delivery performance

Applications

- Rerolling into billet, bar, and wire rod
- Forging applications

>10% yield benefit by using blooms in forging



Using bloom:

- Cut precise lengths to minimize wastage
- Optimize length of bloom to your needs

Using ingot:

- Removing head and tail results in waste
- Tapered sides require more processing

Continuously cast billet

Billets can be supplied in the ground or unground condition.

Cross-section		Length	
mm	in	m	ft
127 x 127*	5 x 5	3.8–12	12–39
140 x 140	5.5 x 5.5	3.8–12	12–39
150 x 150	5.9 x 5.9	3.8–12	12–39
180 x 180	7 x 7	3.8–12	12–39
200 x 200*	7.9 x 7.9	3.8–12	12–39

* only by confirmation from the mill

Continuously cast bloom

Blooms are delivered in the unground condition. Continuously cast blooms can replace ingots in certain forging applications.

Cross-section		Length	
mm	in	m	ft
300 x 400	12 x 16	2–12	7–39
260 x 462	10.2 x 18.2	2–12	7-39

Continuously cast slabs

Continuously cast slabs are typically hot and cold rolled into coil and sheet plate or used in the forging industry. We provide a wide range of ferritic, austenitic, duplex, heat resistant, and precipitation hardening stainless steels with consistently high quality and delivery reliability.

Benefits

- Consistent surface, center line, and cast quality
- Expert support for processing
- 300 mm slab reduces material wastage and costs while forging
- Reliable delivery performance

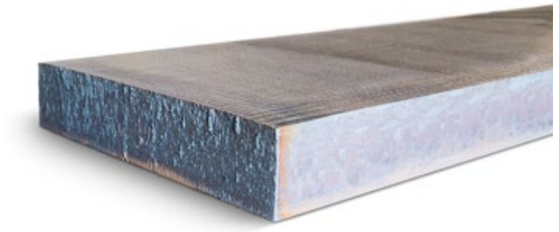
Applications

- Rerolling into plate and coil
- Certain forging applications

Thickness		Width		Length	
mm	in	mm	in	m	ft
170	7	960–1575	38–62	4–12	13–39
200	8	960–1575	38–62	4–12	13–39
300	12	700–1575	28–62	3–6.6	11–22

Continuously cast slab

Slabs can be delivered in the ground or unground condition with a maximum weight of 30 tonnes.



An industry-leading range of grades

We produce our semi-finished stainless steel long products in a wide variety of grades.
Contact sales at smacc.sales@marcegaglia.com

Grade family	Marcegaglia name	EN	ASTM			Typical chemical composition, % by mass					
			TYPE	UNS	A182	C	Cr	Ni	Mo	N	Others
F	410S/4000	1.4000	410S	S41008	–	0.03	12.5	–	–	–	–
F	430/4016	1.4016	430	S43000	F 430	0.05	16.2	–	–	–	–
F	430F/4105	1.4105	430F	S43020	F 430	0.08	16.5	–	–	–	S
F	4511	1.4511	430Nb/430Cb	–	–	0.02	16.2	–	–	–	Nb
A	304/4301	1.4301	304	S30400	F 304	0.04	18.1	8.1	–	–	–
A	305/4303	1.4303	305	S30500	–	0.04	17.7	12.5	–	–	–
A	Prodec® 303/4305	1.4305	303	S30300	–	0.05	17.2	8.1	–	–	0.3S
A	304L/4306	1.4306	304L	S30403	–	0.02	18.2	10.1	–	–	–
A	304L/4307	1.4307	304L	S30403	F 304L	0.02	18.1	8.1	–	–	–
A	Prodec® 304L/4307	1.4307	304L	S30403	–	0.02	18.1	8.1	–	–	–
A	301/4310	1.4310	301	S30100	–	0.10	17.0	7.0	–	–	–
A	304LN/4311	1.4311	304LN	S30453	F 304LN	0.02	18.5	9.2	–	0.14	–
A	308L/4316	1.4316	308	S30800	–	0.05	19.5	10.0	–	–	–
A	201/4372	1.4372	201	S20100	–	0.05	17.0	4.0	–	0.02	7Mn
A	316/4401	1.4401	316	S31600	F 316	0.04	17.2	10.1	2.1	–	–
A	316L/4404	1.4404	316L	S31603	F 316L	0.02	17.2	10.1	2.1	–	–
A	Prodec® 316L/4404	1.4404	316L	S31603	–	0.02	17.2	10.1	2.1	–	–
A	316L/4432	1.4432	316L	S31600	F 316L	0.02	16.9	10.7	2.6	–	–
A	316/4435	1.4435	316L	–	–	0.02	17.3	12.6	2.6	–	–
A	316L/4436	1.4436	316	–	F 316	0.04	16.9	10.7	2.6	–	–
A	317L	1.4438	317L	S31703	F 317L	0.02	18.2	13.7	3.1	–	–
A	317LM	–	317LM	S31725	F 47	0.03	19.0	15.0	4.5	–	–
A	904L	1.4539	904L	N08904	F 904L	0.01	19.8	24.2	4.3	–	1.4Cu
A	321/4541	1.4541	321	S32100	–	0.04	17.3	9.1	–	–	Ti
A	4547	1.4547	–	S31254	F 44	0.01	20.0	18.0	6.1	0.2	Cu
A	347/4550	1.4550	347	S34700	F 347	0.05	17.5	9.5	–	–	Nb
A	304Cu/4567	1.4567	(304Cu)	S30430	–	0.01	17.7	9.7	–	–	3Cu
A	316Ti/4571	1.4571	316Ti	S31635	F 316Ti	0.04	16.8	10.9	2.1	–	Ti
A	316Cu/4578	1.4578	(316Cu)	–	–	0.02	16.9	10.7	2.1	–	Cu
A	4828	1.4828	–	–	–	0.04	19.3	11.2	–	–	Si
A	309/4829	1.4829	309	S30900	–	0.03	23.5	13.0	–	–	–
A	309S/4833	1.4833	309S	S30908	–	0.06	22.3	12.3	–	–	–
A	253MA	1.4835	–	S30815	F 45	0.09	21.0	11.0	–	0.17	Si, Ce
A	314/4841	1.4841	314	S31400	–	0.06	24.3	19.2	–	–	Si
A	310S/4845	1.4845	310S	S31008	F 310	0.05	25.5	19.1	–	–	–
A	321H/4878	1.4878	321H	S32109	F 321H	0.05	17.3	9.1	–	–	Ti
A	304H/4948	1.4948	304H	S30409	F 304H	0.05	18.1	8.3	–	–	–
D	4162	1.4162	–	S32101	–	0.03	21.5	1.5	0.3	0.22	5Mn, Cu
D	2209	–	–	S39209	–	0.03	22.0	8.0	3.0	0.15	–
D	2205	1.4462	–	S32205	F 60	0.02	22.4	5.7	3.1	0.17	–
D	2304	1.4362	–	S32304	F 68	0.02	23.0	4.8	0.3	0.1	Cu
D	2507	1.4410	–	S32750	F 53	0.02	25.0	7.0	4.0	0.27	–
D	4460	1.4460	–	S32950	F 52	0.02	25.2	5.6	1.4	0.09	–
D	3RE60		–	S31500	–	0.02	18.5	5.0	2.7	0.08	–
D	SDX 100	1.4501	–	S32760	F 55	0.02	25.4	6.9	3.8	0.27	W, Cu
M	416/4005	1.4005	416	S41600	–	0.1	13.0	–	–	–	S
M	410/4006	1.4006	410	S41000	F 6a	0.12	12.0	–	–	–	–
M	420/4021	1.4021	420	S42000	–	0.2	13.0	–	–	–	–
M	420/4028	1.4028	420	S42000	–	0.3	12.5	–	–	–	–
M	431/4057	1.4057	431	S43100	–	0.2	16.0	1.75	–	–	–
M	4313	1.4313	–	S41500	F 6NM	0.03	12.5	4.1	–	0.6	–
M	248SV/4418	1.4418	–	–	–	0.03	16.0	5.0	1.0	–	–
PH	Prodec® 17-4PH	1.4542	630	S17400	–	0.02	16.3	4.7	–	–	Nb, 3.5Cu
PH	17-4PH	1.4542	630	S17400	–	0.02	15.5	4.8	–	–	Nb, Cu
PH	17-7PH	1.4568	631	S17700	–	0.08	17.0	7.0	–	–	Al
–	F91/4903	1.4903	–	K90901	F 91	0.08	9.0	–	1.0	–	Nb, V
–	F92/4901	1.4901	–	K92460	F 92	0.08	9.0	–	0.45	–	1.75W, Nb, V

F = Ferritic, A = Austenitic, D = Duplex, M = Martensitic, PH = Precipitation Hardening

Chemical compositions given as % by mass. Table uses Marcegaglia typical values.

For full grade offering per product type the required standard will be fully met as specified in the order.

Prodec® grades are only available in the form of long products.

Ensuring quality with end-to-end production

SMACC

Raw materials
Marcegaglia stainless steel contains a very high proportion of recycled materials.

Electric arc furnace
The 130 tonne, 90 MVA furnace melts the stainless scrap into a liquid feedstock.

AOD
In the argon oxygen decarburization vessel the melt is decarburized and chemical composition adjusted.

Ladle arc furnace
In the LAF, final chemical composition and temperature are adjusted and homogenized.

Casting
We use a combination casting machine for slab or bloom, or a six-strand billet casting machine.

Grinding
If required, top and bottom surface grinding is applied to slabs, and full or corner grinding to billets.

Labelling & inspection
Metal tags are attached to each cast item with a unique identity to allow full product traceability.

Packing and shipping
Items may receive additional customer-specific marking before being packed and shipped.

High quality according to international standards

Our manufacturing programs are supported by in-house product inspection and testing, and the extensive experience of our technical team. SMACC is accredited to recognized international standards, including:

- ISO 9001:2015
- ISO 14001:2015
- ISO 45001:2018
- ABS Foundry Approval
- AD 2000 MERKBLATT W0
- DNV rules for classification DNV-CP-0242 Semi-finished steel products
- Lloyd's Register Approved Manufacturer of Steel Plates, Strip, Sections & Bars
- PED 2014/68/EU

MARCEGAGLIA STAINLESS SHEFFIELD

STAINLESS STEEL WIRE RODS

ASR wire rod mill UK

Sheffield Stainless ASR Rod mill started operations in Sheffield in 1965, a short distance from the meltshop SMACC where billet feedstock is produced for our wire rod production.
The manufacturing program consists of a wide range of grades and sizes of which significant proportion are "niche" products.
ASR produces wire rod in a large range of sizes suitable for downstream bar and wire production. Rebar is produced in duplex grades when required in construction projects where high integrity, long life solutions are required. ASR can provide shaped wire rod in hexagon and square forms. Key end-use applications include springs, fasteners, welding wire, machined components and bridge structures with rebar. ASR looks to develop close partnerships with its customers to offer technical solutions to assist them in become the leaders in their field and thus giving them a competitive advantage.

Key benefits

- European melt
- Integrated production
- Low Carbon footprint
- Consistent products
- Good overall cost of quality

The customer is always in focus, so that we can fulfill each customers unique needs. Our goal is to be recognized in the market as the most responsive specialist rod supplier with industry-leading customer service backed by a flexible, high quality manufacturing program.

Contact sales at
sales.asr@marcegaglia.com

Wire rod dimensions

Round
5–27 mm

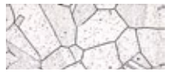
Hexagon
9–27 mm

Square
9–24 mm

To get best possible properties for bar wire rod, following parameters are important:

- Tight chemistry control for consistent properties
- Mechanical properties and deformation hardening
- Corrosion properties
- Surface finish
- Dimension tolerances

Conditions



Batch Annealed
(ASTM 4-6)

Grades

- Austenitic
- Duplex
- PH
- Nickel alloys

Heat sizes

Depending on grade, our heat sizes are:

- Appr. 60 tonnes (132 000 lbs)
- Appr. 120 tonnes (265 000 lbs)

Coil sizes and weights

Dimensions	Inside diameter (min)	Outside diameter (max)	Coil weight
5.0–9.5 mm Round	850 mm	1.250 mm	750–1.000 kg (grade dependent)
10.0–27 mm Round, Hexagon, Square Rebar	980 mm	1.320 mm	750–1.000 kg (grade dependent)

Production platform and certificates

Wire rod production

ASR wire rod are suitable for a variety of applications. These include the likes of flanges, valves, fittings, couplings, seals, shafts, blots and nuts, pumps shafts and hydraulic cylinder parts.

We have a wide range of grades used for bar, but can also make customized chemistries to meet your unique needs. Below you can see a selection of grades within our standard range:

Grade family	Marcegaglia name	ASR Melt Code	EN	ASTM		PRE	Typical chemical composition, % by mass						Application					
				TYPE	UNS		C	Cr	Ni	Mo	N	Others	Cold heading	Springs	Welding	High temper.	Bright bar	Rebar
PH	17-4PH	174XC	1.4542	630	S17400	17	0.01	15.2	4.6	0.2	0.03	3.2 Cu, Nb					X	
PH	17-7PH	177XA	1.4568	631	S17700	18	0.08	16.7	7.6	0.2	0.02	0.9 Al		X				
D	Lean duplex 4162	210XB	1.4162		S32101	26	0.02	21.4	1.5	0.2	0.22	5.0 Mn					X	
D	Duplex 2304	234XB	1.4362		S32304	26	0.02	22.3	4.8	0.3	0.13							X
A	253 MA	253XA	1.4835		S30815	24	0.07	21.0	10.3	0.1	0.17					X		
A	254 SMO	254XA	1.4547		S31254	43	0.01	20.1	18.0	6.1	0.20	3.0 Mn				X		
A	302/4310	302XB	1.4310	302H	S30200	19	0.08	17.5	8.1	0.4	0.04			X				
A	302/4310	302XD	1.4310	302	S30200	19	0.05	17.8	8.1	0.3	0.04			X				
A	Prodec® 303/4305	303PR	1.4305	303	S30300	17	0.05	17.2	8.2	0.5	0.04	0.30 S					X	
A	303/4305	303LS	1.4305	303	S30300	17	0.05	17.2	8.2	0.4	0.05	0.28 S					X	
A	Prodec® 303/4305 (Shapes)	303PS	1.4305	303	S30300	17	0.05	17.2	8.7	0.5	0.03	0.30 S					X	
A	303/4305 (Shapes)	303XI	1.4305	303	S30300	17	0.05	17.2	8.7	0.4	0.03	0.30 S					X	
A	Prodec® 304L/4307	304PR	1.4307	304L	S30403	18	0.02	18.2	8.1	0.4	0.07						X	
A	304L/4307	304UA	1.4307	304L	S30403	18	0.02	18.1	8.1	0.4	0.07						X	
A	304L/4306	304UD	1.4306	304L	S30403	18	0.02	18.5	10.1	0.3	0.03						X	
A	304/4301	304UE	1.4301	304	S30400	20	0.05	18.2	9.1	0.3	0.03						X	
A	304L/4307	304UF	1.4307	304L	S30403	20	0.02	18.2	8.1	0.4	0.06						X	
A	304L/4307	304UN	1.4307	304L	S30403	20	0.02	18.2	8.2	0.4	0.06						X	
A	304L/4307	304XR	1.4307	304L	S30403	20	0.02	18.3	9.1	0.4	0.04						X	
A	304/4310	304XY	1.4310 / 1.4301	304 / 302	S30400 / S30200	20	0.07	18.3	8.3	0.3	0.04						X	
A	304LN	304XZ	1.4311	304LN	S30453	21	0.02	17.9	8.6	0.3	0.14						X	
A	305	305XA	1.4303	305	S30500	20	0.02	18.3	11.3	0.3	0.04						X	
A	307	307XA	1.4370	307		20	0.07	18.0	7.9	0.2	0.05	7 Mn			X			
A	307	307XF	1.4370	307		20	0.05	17.8	8.1	0.2	0.05	7 Mn			X			
A	308LSi/4316	308XJ	1.4316	308L	S30888	21	0.01	19.9	10.6	0.1	0.06	0.8 Si			X			
A	308L/4316	308XL	1.4316	308L	S30883	21	0.01	19.7	10.1	0.3	0.06	0.4 Si			X			
A	309LSi/4332	309XA	1.4332	309L	S30988	25	0.01	23.3	13.8	0.1	0.06	0.8 Si			X			
A	309L/4332	309XC	1.4332	309L	S30983	25	0.01	23.4	13.6	0.1	0.05	0.4 Si			X			
A	309L/4332	309XH	1.4332	309L	S30983	25	0.06	22.4	12.2	0.3	0.07				X			
A	310S/4845	310XC	1.4845	310S	S31008	26	0.05	24.8	19.1	0.2	0.04					X		
A	314/4841	314XC	1.4841	314	S31400	25	0.04	23.2	19.1	0.3	0.04	2.2 Si				X		
A	314/4841	314XF	1.4841			25	0.02	24.2	20.6	0.2	0.04	2.2 Si				X		
A	Prodec® 316L/4404	316PR	1.4404	316L	S31603	24	0.02	16.7	10.1	2.1	0.05						X	
A	316L/4404	316UI	1.4404	316L	S31603	24	0.01	17.1	11.1	2.1	0.03						X	
A	316L/4404	316UK	1.4404	316L	S31603	24	0.02	16.8	11.1	2.1	0.03						X	
A	316L/4404	316UL	1.4404	316L	S31603	25	0.01	17.2	12.1	2.1	0.02						X	
A	316L/4404	316UM	1.4404	316L	S31603	24	0.02	16.7	10.1	2.1	0.03						X	
A	316L/4432	316UN	1.4432	316L	S31683	24	0.01	18.4	11.6	2.2	0.07						X	
A	316L/4432	316XE	1.4432		S31683	26	0.01	18.3	12.2	2.1	0.03	0.4 Si			X			
A	316L/4436	316XL	1.4436	316	S31600	25	0.04	17.3	11.1	2.6	0.03						X	
A	316Cu/4578	316XW	1.4578	316Cu	-	23	0.02	16.8	10.7	2.0	0.02	3.2 Cu	X					
A	Prodec® 316L/4404	316XX	1.4404	316L	S31603	24	0.02	16.8	10.1	2.0	0.05						X	
A	316Ti/4571	320XA	1.4571	316Ti	S31635	24	0.04	16.6	11.3	2.0	0.01	Ti					X	
A	316Ti/4571	320XD	1.4571	316Ti	S31635	24	0.01	16.8	10.8	2.1	0.02	Ti					X	
A	316Ti/4571	320XE	1.4571	316Ti	S31635	24	0.01	16.6	10.6	2.0	0.02	Ti					X	
A	321H	321XB	1.4878	321H		18	0.05	17.2	9.1	0.4	0.01	Ti					X	
A	321	321XG	1.4541	321		18	0.01	17.2	9.1	0.4	0.02	Ti					X	
A	347	347XA	1.4550	347	S34788	19	0.05	17.3	9.1	0.3	0.04	Nb					X	
A	304Cu/4567	399XB	1.4567	304Cu	S30433	19	0.01	17.7	9.5	0.2	0.02	3.1 Cu	X					
A	304Cu/4567	399XE	1.4567	304Cu	S30430	19	0.01	17.7	9.6	0.2	0.02	3.4 Cu	X					
A	304Cu/4567	399XG	1.4567	304Cu	S30430	18	0.01	17.3	8.6	0.2	0.02	3.6 Cu	X					
A-Ni	825	825XA	1.4858			27	0.20	20.0	40.0	2.0	0.01	1.5 Cu				X		
A	904L	904XA	1.4539	904L	N08904	34	0.01	19.9	24.2	4.3	0.05	1.5 Cu				X		

Grade families: F = ferritic, A = austenitic, PH = precipitation hardening

Contact sales at
sales.asr@marcegaglia.com

Ensuring quality with end-to-end production

Melting shop
Consistently produced high quality semis are made at SMACC in 130-tonne melts.

Billet feedstock
The majority of the feedstock comes from our own melting shop.

Reheating furnace
Accurately controlled, two-stage reheating minimizes surface scaling.

Rolling
A highly responsive digital control system tracks the rod through the mill to ensure quality.

Coil forming
Wire rod of up to 10 mm is coiled on a laying head. Rod in larger diameters is coiled in garret coilers.

Annealing
The rotary annealing furnace softens the rod to increase its ductility for further processing.

Pickling
Scale is removed from the hot rolled surface using salt bath and acid treatment.

Testing
Samples from production stages are tested for surface defects, grain size, and tensile strength.

ASR wire rod mill

Quality assurances

Our manufacturing programme is supported by an in-house product inspection and testing programme in addition to a technical team with extensive experience. Our rod and stainless rebar production is accredited to recognized international standards, including:

- ISO 9001
- ISO 14001
- ISO 45001
- AD 2000 MERKBLATT W 0 / TRD 100

Rebar product assurance

Approval is gained by a manufacturer only after demonstrating that their quality systems meet the requirements of ISO 9001, and the additional product-specific CARES requirements. An extensive programme of witness and independent testing also has to be passed, with independent testing being conducted by UKAS accredited laboratories to ensure integrity and competence.

- CARES Product Type Approval to BS 6744
- CARES Product Type Approval to BS 8666
- Certificate of conformity of the factory production control 1608 CPR P222

MARCEGAGLIA STAINLESS SHEFFIELD

STAINLESS STEEL REBAR

Stainless steel rebar

Marcegaglia offers an extensive range of stainless steel rebar with excellent availability and unmatched service.

Our fully integrated capabilities, from melting to testing, enable us to produce stainless rebar with industry-leading consistency and delivery performance.
Stainless steel rebar is produced in a wide range of dimensions and is available in coil, lengths, and bent shapes. Our offering also includes dowel bar and complementary products such as couplers.
We have production site in the UK as well as strategically located stainless steel rebar stock to ensure high availability and short lead times.

Key benefits

- Product quality
- Delivery reliability
- Easy to deal with

Contact sales at sales.rebar@marcegaglia.com

A long lasting and resilient material

Stainless steel rebar is mainly used in construction, for example coastal barrier walls, concrete piers, and bridges where chloride-induced corrosion is a risk. Using stainless steel rebar in these environments reduces the lifetime cost of the structure, as well as maintenance-related downtime.

There are three main cases where stainless steel is the best choice:

- When concrete is subject to the ingress of chlorides from either marine environments or de-icing salts. Stainless steel rebar can resist the initiation of corrosion with chloride concentration levels more than 10 times higher than that which carbon steel can resist.
- When concrete loses the high alkalinity that protects the carbon steel from corrosion due to carbonation. This can take more than 100 years but ultimately is inevitable, making stainless steel the ideal solution for structures requiring a very long lifespan, for example bridges, temples and monuments.

In addition, stainless steel rebar has much better ambient and low temperature energy absorption, fatigue resistance, and toughness than carbon or alloy steels, which is important in applications where there are seismic, security, and other impact resistant considerations. It also has improved stiffness and strength retention in fire compared to carbon steel.

The complete reinforcement package

Marcegaglia stainless steel rebar is available from 6 to 25 mm. We produce rebar in several alloys including the widely used duplex 2304 as well as lean duplex 1.4162 stainless steel, which combines low nickel content with high mechanical strenght, as well as grade 500 produced according to BS 6744.
We also offer a wide variety of bent shapes according to 8666:2020. Our rebar finishing facility uses the latest technology in straightening and cut and bend equipment for diameters up to 25 mm direct from our production site.
We also supply dowel bar and complementary products to offer you a complete stainless steel rebar solution for your project.

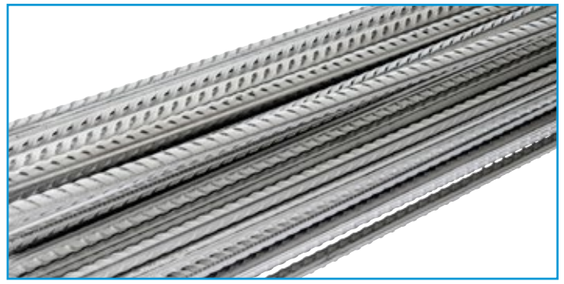
Environmental product declarations

Our environmental product declaration (EPD) for stainless steel rebar helps you understand the exact environmental impacts and energy needs of our products and allows you to calculate how these affect the life cycle of your building or other structure.

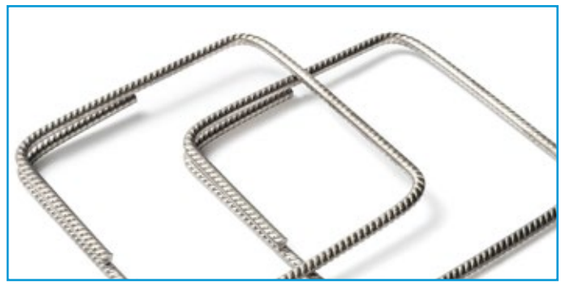
Use our stainless steel for LEED points

Marcegaglia Stainless Sheffield is a pioneer in Leadership in Energy and Environmental Design (LEED), the sustainability oriented building certification scheme that recognizes best-in-class building strategies and practices. LEED certification standards apply to buildings that achieve high energy efficiency and use sustainable materials.
The sustainable characteristics of stainless steel, such as high recycled content and long service life, are rewarded in this scheme.
We offer LEED documentation for our stainless steel rebar, meaning that designers who select our stainless steel can gain LEED points for their building.

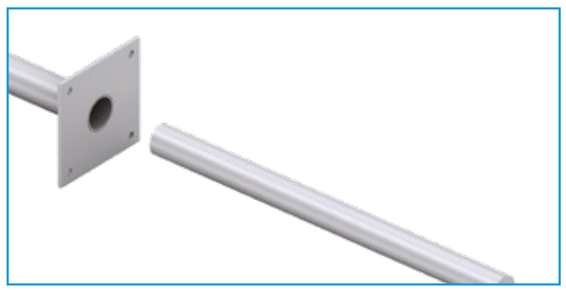
Coil



Lengths



Bent shapes

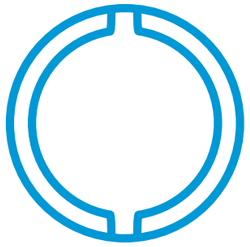


Dowel bar

Coils and lengths

Marcegaglia stainless steel rebar is available from the UK in metric sizes 6–25 mm.
In the UK we produce rebar that has a two-sided pattern (see diagram).

Two-sided pattern



Available alloys

Marcegaglia name	EN	ASTM	UNS	Alloy type
Lean duplex 1.4162	1.4162	–	S32101	D
Lean duplex 4482	1.4482	–	S32001	D
Duplex 2304	1.4362	–	S32304	D
Duplex 2205	1.4462	–	S32205/ S31803	D

D = Duplex

Note: Other alloys, sizes, and specifications may be available upon request.
Please contact the mill for specific requirements.

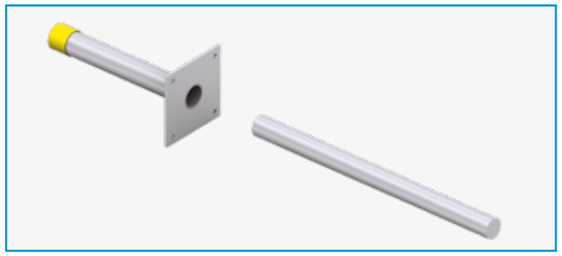
Bent shapes and dowel bar

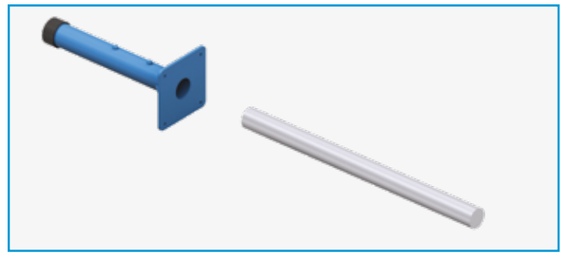
Bent shapes

CARES-certified BS 6744 rebar is available in bent shapes according to BS 8666:2020.
Grade 500 BS 6744:2016 stainless steel rebar can be supplied in straight lengths up to 12 m as well as cut and bent shapes in accordance with BS 8666:2020.

Dowel bar

Dowel bars are used to transfer shear loads across construction and movement joints in concrete.
The standard Marcegaglia dowel system is available in a wide range of diameters and lengths.
Stainless steel and durable plastic de-bonding sleeves are available with integral nail plates for easy fixing to the shuttering.
Our sales can also assist you in finding local suppliers.





Stainless steel rebar in action

Gateway Bridge, Brisbane, Australia

Marcegaglia Stainless Sheffield delivered 200 tonnes of lean duplex 1.4162 stainless steel rebar for use in the most critical structures of the bridge.
To ensure a 300 year lifespan, stainless rebar was specified for the pile caps located in the splash zones of the two main river pylons of the Brisbane River. Instead of using 316L/1.4404, we recommended low-nickel lean duplex 1.4162, which offers superb price stability and is a cost-effective alternative for durable reinforced concrete structures.

Allt Chonoglais Bridge, Scotland

Marcegaglia delivered over 7,000 pieces of rebar in duplex 2304, a total of 67 tonnes, for refurbishing the bridge. Stainless steel rebar was specified for the areas which are at greater risk from chloride-induced reinforcement corrosion due to the application of de-icing salts during the winter months. This included the bridge deck, abutments, wing walls, and bearing plinths. The customer selected duplex 2304 rebar due to its competitive cost and exceptional chloride resistance which helps to give the bridge a 120-year lifespan.

Buddhist temple, Chounbri province, Thailand

The temple committee in Thailand in charge of the development wished to create a sacred place that would last more than 1,000 years. Marcegaglia supplied over 23,200 rebar pieces in 90 different sizes and lengths in lean duplex 1.4162 stainless steel. Marcegaglia's Rebar Finishing team managed the extremely complex delivery and was able to meet the customer's request for a very tight length tolerance. In addition, the team managed a tight schedule, achieving 100% on-time delivery.

La Sagrada Família basilica, Barcelona, Spain

Marcegaglia has supplied stainless steel for La Sagrada Família basilica since 2013 in stainless steel rebar, bar, machined components, and plasma-cut plate products. The building has exceptional lifecycle expectations and a unique design. When completed, 18 towers of La Sagrada Família will reach heights from 94 to 182 meters above ground level. Stainless steel rebar was the first choce for the tower structures due to its high strength, exceptional corrosion resistance, and reduced lifecycle costs. Marcegaglia is the single-supplier for the project, delivering products in Marcegaglia duplex 2304 and duplex 2205 grades in easy-to-assemble sizes and shapes.

Junction Värtan, Stockholm, Sweden

Marcegaglia delivered 300 tonnes of lean duplex 1.4162 stainless steel rebar for use in a major junction in a new motorway around northern Stockholm, Sweden. Roads in northern climates face particularly corrosive environments due to chlorides from de-icing salts. As the junction is meant to be largely maintenance free, stainless steel rebar in 316L/1.4404 was originally specified. Lean duplex 1.4162 stainless steel was ultimately chosen as the very low nickel content results in good price stability.

Coast protection scheme, Cromer, UK

Marcegaglia delivered 335 tonnes of duplex 2304 stainless steel rebar for the Cromer coast protection scheme. Cromer sea defenses have protected the area against the North Sea for over 150 years. The project includes refacing sea walls with concrete and replacing the timber groynes which protect the beach.
The goal of the project is not to just maintain current defenses, but also withstand predicted sea level rises over the next 50 years.

Sheikh Jaber al-Ahmad Al-Sabah Bridge, Kuwait

Stainless steel is the ideal material for infrastructure projects in maritime environments due to its high corrosion resistance and low life-cycle costs. Marcegaglia provided 1,600 metric tons of duplex 2304 stainless steel rebar for the Sheikh Jaber al-Ahmad Al-Sabah project in Kuwait. The 36 km long causeway project is one of the largest infrastructure projects to be constructed in the region.

Mega Reservoir project, Qatar

The Qatar mega reservoirs projects include five primary reservoir and pumping station packages with a capacity of 100 million gallons each, making them the largest reinforced concrete reservoirs in the world. Marcegaglia provided 350 metric tonnes of smooth round stainless steel dowel bar for the project. Marcegaglia 316L/4404 stainless steel dowel bars are used in expansion joints for the movement of lateral loads and to manage stress within the joint. They were selected for their high corrosion resistance.

Ensuring quality with end-to-end production

From melting to bar finishing

Melting shop
Consistently produced high quality semis are made at SMACC in 130-tonne melts.

Billet casting
We use a combination casting machine for slab, bloom or six-strand billet casting machine.

Preheating
Billets are reheated before rolling into wire rod.

Rolling
A highly responsive digital control system tracks the rod through the mill to ensure quality.

Wire rod coiling
Wire rod of up to 10 mm is coiled on a laying a head. Rod in larger diameters is coiled in garrett coilers.

Straightening
Rebar coils are straightened before cutting to lengths to remove tension in the material.

Shape bending
Rebar can be bent to a number of shapes according to customer specifications.

Packing
Rebar shapes and lengths are carefully packed before delivery to their final destination.

High quality according to international standards

We offer rebar according to BS 6744 and BS 8666. Marcegaglia supplies mill test certificates with every bundle delivered and our mills are accredited to recognized international standards, including:

- ISO 9001 - TÜV Nord
- CARES Certificate of Approval for production of rebar
- IGQ - compliance with Regulation 305/2011/EU product type approval

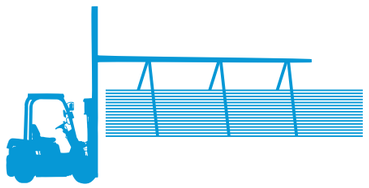
Handling stainless steel rebar

To get the best results when using stainless steel rebar, we suggest the following handling, storage, and transport guidelines:

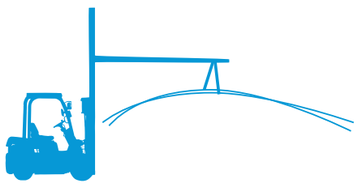
- In general, always avoid carbon steel contamination
- Do not place stainless steel rebar directly on the ground
- Ensure that stainless steel is packed in proper packing material if transported together with carbon steel
- Do not expose stainless steel rebar to marine environments and de-icing salt prior to casting in concrete
- Pack stainless steel rebar in appropriate packing material if stored in aggressive environments
- Slings and bundling wire should be made of nylon or other materials that do not contain, or have not been in contact with, carbon steel
- Movement of long lengths of stainless steel rebar must be performed with even and sufficient support along the length of the reinforcement
- If stainless steel rebar is heated above 400 °C/750 °F, a heat tint or oxide scale may be formed that requires pickling

If contamination occurs:

- Clean the surface with water
- Staining can be removed by using a passivating cleaner such as Avesta Cleaner 401, available from Avesta Finishing Chemicals



Correct method for moving rebar



Incorrect method for moving rebar

Services

Marcegaglia has over 100 years of technical expertise in both production and use of stainless steel.
We can offer support during materials selection, processing, and end use to help you get the most out of our materials.
We offer full-service rebar packages and work closely with you to ensure the optimal schedule for producing, finishing, and delivering rebar.
We have production site in the UK, and hold strategically located rebar stock for fast delivery and materials testing needs.

Marcegaglia services can include:

- Materials selection advice
- Rebar cut to length and cut and bend
- Rebar project management
- Delivery flexibility with short lead times
- Technical support
- Training
- Long-term pricing for larger contracts

Contact sales at
sales.rebar@marcegaglia.com

MARCEGAGLIA STAINLESS SHEFFIELD

STAINLESS STEEL BARS

Marcegaglia Stainless Sheffield high-performance bar

Marcegaglia Long Products is a global producer of high quality stainless steel long products. We are known for our ability to offer products in wide range of grades, shapes and sizes, high quality and reliability. Our stainless steel is sustainable material with over 90% of recycled content. Products are melted in Europe with energy sources and raw materials that provide our customers a lower than industry average carbon footprint.

Our offering includes Prodec® bar that stands for highly improved machinable bars. Our long legacy gives a proven track record of our technical expertise that customers benefit when dealing with us.

Sheffield Stainless Bar operations was established in Sheffield in 2010 by Outokumpu, now part of the Marcegaglia Group manufacturing stainless steel bars and rebar.

Sheffield Stainless Bar is located in Sheffield on the same site as the SMACC Meltshop with a short distance from the ASR Wire Rod Mill where wire rod feedstock is supplied for our bar and rebar production.

Key benefits

- European melt, integrated production
- Low carbon footprint
- Consistent products
- Good overall cost of quality
- Prodec® – for improved machining applications
- Easy to do business with

Contact sales at barfinishingsales@marcegaglia.com

High performance stainless steel bars

Marcegaglia Sheffield, UK offers services for distributors providing high quality, competitive prices and short lead times.

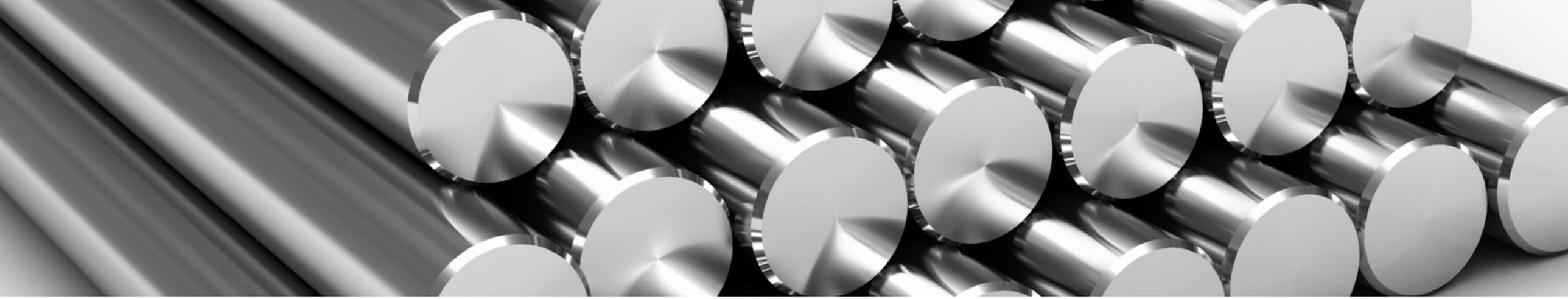
Our industry-leading, over a century long expertise in stainless steel production and our unique processes allow us to deliver bars with exceptional consistency and machinability. Our end-to-end approach, from melting and rolling to finishing and testing, ensures the highest quality according to customer specifications. Delivery reliability, competitive lead times and technical support are the cornerstones of our customer promise.

Max one week delivery time to Europe

New supplier in the market offering stock services

High quality bars in both standard and improved machinable bars

Wide range of bars in round, square and hexagon shapes



Cold finished bar

The cold drawing process is improving the mechanical strength and dimensional tolerances. It is achieved by cold deforming a hot rolled product using a die, resulting in a slight area reduction. Marcegaglia Sheffield Bar Stock offers cold drawn products in round, square and hexagonal shape in 3 - 6 meters lenghts with a bundle weight of around half a tonne.

Peeled bar

Hot rolled bars have generally small surface imperfections after hot rolling, that are formed during the cooling process. Metal oxide layers can also build up over time. Peeling process is removing imperfections as well as produces smooth surface and glossy visual appearance for the bars.
These properties are required in the end-customer's further processing.

Grade	ISO 286 h9	ISO 286 h9	ISO 286 h11	ISO 286 h11
	Cold Drawn ●	Peeled ●	Cold Drawn ⬢	Cold Drawn ■
304L/304/4307/4301	6–32	28-90	8–100	8–100
316L/316/4404/4401	6–32	28-90	8–100	8–100
303/4305	6–32	28-90	8–100	8–100

Standards	Comment
EN 10088-3	–
EN 10088-5	–
EN 10272	–
AD 2000 merkblatt W0, W2, W10	–
NACE MR0103, MR0175	–
PED 2014/68/EU	–

All material is certified according to EN 10204/3.1.

Hot rolled bar

The hot rolled product has a slightly higher elongation compared to a cold drawn product.
Marcegaglia Sheffield Bar Stock offers two different surface conditions; peeled or hot rolled in round bars from stock to meet your requirements. Length are approximately 3 - 6 m round bars from stock and bundle weight is depending on size, varying between 0.5 to 2.2 tonnes.

Grade	ISO 286, k11, EN 10060	EN 10059
	●	■
304L/304/4307/4301	28-90	10–100
316L/316/4404/4401	28-90	10–100
303/4305	28-90	10–100

Standards	Comment
EN 10088-3	–
EN 10088-5	–
EN 10272	–
AD 2000 merkblatt W0, W2, W10	–
ASTM A276, A479	for larger dimensions
NACE MR0103, MR0175	–
PED 2014/68/EU	–

All material is certified according to EN 10204/3.1.

Hexagon bar

Marcegaglia and Böllinghaus Steel offer stainless steel hexagon bars from 8–100 mm / 5/16" to 4".
We produce our hexagon bar in a wide range of ferritic, austenitic, duplex, heat resistant, and precipitation hardening stainless steels as well as the Prodec® range for superior machinability.
Our products have consistently high quality, including their surface, straightness, and chemical composition.
Our experts can also guide you through the whole process from material selection to end use, helping you to get the best possible results from our materials.

Benefits

- High surface quality means bar can be used without further surface treatment
- High machinability with Prodec® range grades
- High tolerance conformance

Dimensions		Condition	Tolerance
mm	in		
8 - 100	5/16" to 4"	Cold drawn	h11

Dimensions
8–100 mm / 5/16" to 4"

BÖLLINGHAUS® STEEL

Marcegaglia's representative for hexagon, square, and flat bars in Europe, Asia, and Latin America is Böllinghaus Steel.

Square bar

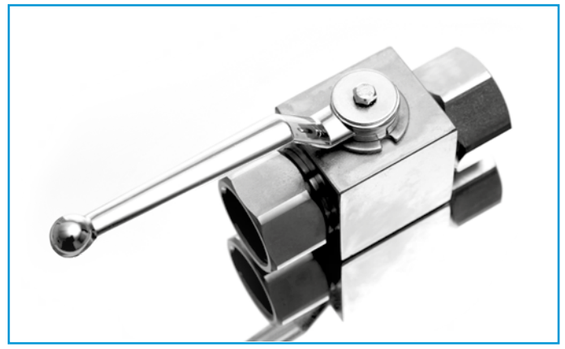
Marcegaglia and Böllinghaus Steel offer stainless steel square bars from 8-100 mm / 5/16" to 4" and 10-100 mm / 1/2'' to 4''. We produce our square bar in a wide range of ferritic, austenitic, duplex, heat resistant, and precipitation hardening stainless steels as well as the Prodec range for superior machinability.
Our products have consistently high quality, including their surface, straightness, and chemical composition.
Our experts can also guide you through the whole process from material selection to end use, helping you to get the best possible results from our materials.

Benefits

- High surface quality means bar can be used without further surface treatment
- High machinability with Prodec® range grades
- High tolerance conformance

Dimensions		Condition	Tolerance
mm	in		
8 - 100	5/16" to 4"	Cold drawn	h11
10 - 100	½ to 4"	Hot rolled	-

Dimensions
8-100 mm / 5/16" to 4"
and 10-100 mm / 1/2'' to 4''



BÖLLINGHAUS® STEEL

Marcegaglia's representative for hexagon, square, and flat bars in Europe, Asia, and Latin America is Böllinghaus Steel.

Chemical composition

General purpose standard bars

Steel designation					Typical chemical composition, % by wt.				
Marcegaglia	EN	ASTM	UNS	ISO	C	Cr	Ni	Mo	Products
304/4301	1.4301	304	S30400	4301-304-00-I	0.04	18.1	8.1	–	
304L/4307	1.4307	304L	S30403	4307-304-03-I	0.02	18.1	8.1	–	
316/4401	1.4401	316	S31600	4401-316-00-I	0.04	17.2	10.1	2.1	
316L/4404	1.4404	316L	S31603	4404-316-03-I	0.02	17.2	10.1	2.1	
303/4305	1.4305	303	S30300	4305-303-00-I	0.05	17.2	8.1	–	

Marcegaglia grades 304/4301 and 304L/4307 are dual certified.

Mechanical properties

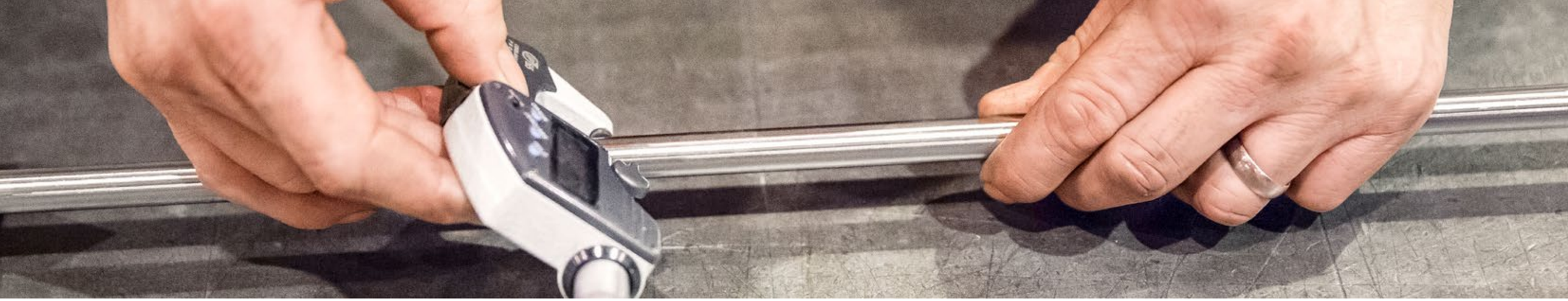
General purpose standard bars

Steel designation Marcegaglia	Product form	Yield strength $R_{p0.2}$ (MPa)	Tensile strength R_m (MPa)	Elongation A_5	Hardness (HBW) max.
304/4301	Hot rolled bar	175	500–700	45/35 [2]	215
	Cold drawn bar	400/380/175 [1]	600–930/600–930/500–830	25/25/30	–
304L/4307	Hot rolled bar	175	500–700	45/35 [2]	215
	Cold drawn bar	400/380/175 [1]	600–930/600–930/500–830	25/25/30	–
316/4401	Hot rolled bar	200	500–700	40/30 [2]	215
	Cold drawn bar	400/380/200	600–930/580–930/500–830	25/25/30	–
316L/4404	Hot rolled bar	200	500–700	40/30 [2]	215
	Cold drawn bar	400/380/200	600–930/580–930/500–830	25/25/30	–
303/4305	Hot rolled bar	190	500–700	35	230
	Cold drawn bar	400/400/190	600–950/600–950/500–850	15/15/20	–

[1] d<=10mm/10<d<=16/16<d<=40
[2] d<=160 long/160<d<=250 trans

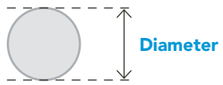
Marcegaglia grades 304/4301 and 304L/4307 are dual certified.

We offer competitive prices, short lead times and high quality.
The lead times are between mill direct and distributor services.



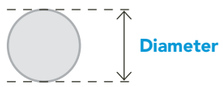
Tolerances

Round peeled bars, ISO 286-2 k13	
Diameter, mm	Tolerance
18– <30	-0/+0.33
30– <50	-0/+0.39
50– <80	-0/+0.46
80– <120	-0/+0.54
120– <180	-0/+0.63
180– <250	-0/+0.72

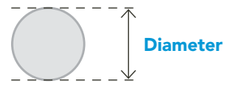


Cold drawn square and hexagon bars, ISO 286-2 h11	
Dimension, mm	Tolerance
>6–10	-0.09/+0
>10–18	-0.11/+0
>18–30	-0.13/0
>30–50	-0.16/0

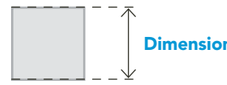
Cold drawn round bars, ISO 286-2 h9	
Diameter, mm	Tolerance
>6–10	-0.036/+0
>10–18	-0.043/+0
>18–30	-0.052/+0
>30–50	-0.062/0



Hot rolled round bars, EN 10060	
Diameter, mm	Tolerance
10–15	±0.4
16–25	±0.5
26–35	±0.6
36–50	±0.8
52–80	±1.0
85–100	±1.3
105–120	±1.5
125–160	±2
165–200	±2.5

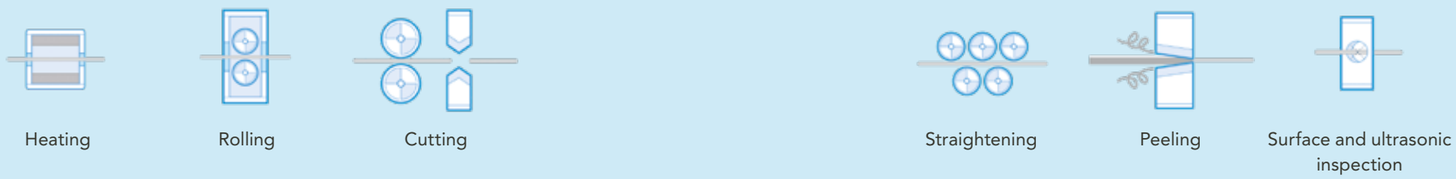


Hot rolled square bars, EN 10059	
Dimension, mm	Tolerance
8–14	±0.4
15–25	±0.5
26–35	±0.6
40–50	±0.8
55–90	±1.0



End-to-end production platform

Hot rolled & peeled

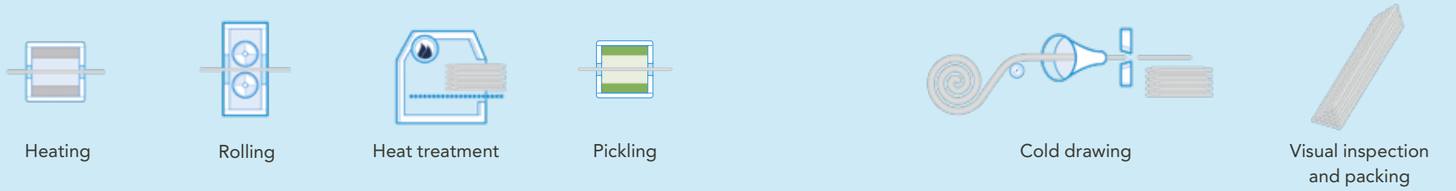


Marcegaglia Stainless Sheffield's melting shop (SMACC) produces as cast billets, which are processed in the UK to be hot rolled, peeled and non-destructive testing. Produced bars can either be sold in the as-rolled condition (black bar), peeled condition or as ground bar.

Hot rolled, pickled

Böllinghaus Steel is located in Hilden, Germany and has its own production facilities in Portugal. The portfolio comprises of hot rolled and pickled as well as cold drawn bars in various forms and lengths manufactured of stainless steel in various grades.

Cold drawn



Sheffield Stainless Bar in Sheffield, UK is a leading producer of hexagon and square cold drawn bars and Prodec superior machinability bars in small diameters.

Ensuring quality with end-to-end production

Sheffield Stainless Bar

Melting shop
Consistently produced high quality semis are made at the SMACC melting shop.

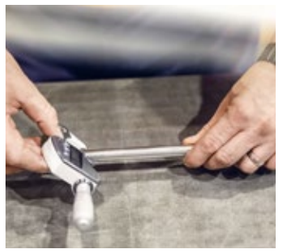
Billet feedstock
Our rolling mill uses billet feedstock produced at the SMACC melting shop.

Hot rolling into wire rod
Rod coil feedstock is used for bar production at Sheffield Stainless Bar.

Coil pre-dipping
The surface of the bar is coated with a drawing lubricant to aid cold drawing.

Preparation for cold drawing
Rod coils are moved from the pre-dipping station to the cold drawing line.

Cold drawing
Wire rod is drawn through a die, reducing the cross-sectional area of the bar, and cut to lengths.



Testing
Final process steps include testing and inspection of the material.

Packing
Packing and shipping is done according to customer-specific requirements.

High quality according to international standards

Our manufacturing programs are supported by in-house product inspection and testing, and the extensive experience of our technical team. SSB is accredited to recognized international standards, including:

- ISO 9001 - TÜV Nord
- ISO 14001 - TÜV Nord
- AD 2000 Merkblatt WO - TÜV Nord
- CARES - Certificate of Conformity of the Factory Production Control
- CARES - CE Declaration of Conformity

PRODEC®

improved machinability bar

Marcegaglia Stainless Sheffield has developed highly improved machinability bars which carry the name Prodec®.
Prodec® grades have been specifically designed for consistent, superior machinability enabling faster machining speed, longer tool life and enhanced quality. Prodec® is melted, rolled and finished within the UK giving 100% European origin for the produced bars.

- Faster machining
- Longer tool life
- Superior quality - finished tolerance and surface
- European origin

Extensive technical knowledge and our end-to-end production chain enables us to optimize the material's machinability properties through all steps of the process. Unlike typical grades optimized for machinability, Prodec® products have similar corrosion resistance to conventionally produced stainless steel grades.

Round bar

Product	Dimension	Length	Tolerance
Cold drawn	6–25.4 mm	2.2–6 m	h9 & A484*
Cold drawn & Centerless ground	6–25.4 mm	2.2–6 m	h8*
Cold finished	28–90 mm	3 m or 6 m	h9 & A484 (ground polished)
Hot rolled & Peeled	28–90 mm	3 m or 6 m	k11 & A484

*Other tolerances available on request

Hexagon bar

Product	Dimension	Length	Condition
Cold drawn bar	8–25.4 mm	2.2–6 m	h11 & A484

Square bar

Product	Dimension	Length	Condition
Cold drawn bar	8–22.23 mm	2.2–6 m	h11 & A484

Prodec® grades - stock availability:

303 (1.4305), 304/304L (1.4301/1.4307), 316/316L (1.4401/1.4404)

Non-Prodec® grades - mill quantities:

17-4, 17-7, A240, 1.4547, 305, 310, 314, 347, 320, 321, 304Cu, 316Cu, 2101, 2304, welding grades

Manufacturing standard

Product	Dimension	Testing method	Standard
Round bar	All dimensions	Eddy current	EN 10277 Table 3 Class 3
Round bar	28–90 mm	Ultrasonic testing	EN 10308 Class 3*
Round bar	28–90 mm	Eddy current	EN 10277 Table 3 Class 2
Hexagon bar	17, 19, 22, 24 mm	Eddy current	EN 10277 Table 3 Class 2

*Excluding 1.4305/303 grades

Product designation

Stainless steel for general purposes

Supply conditions

- Dimensional tolerances according to EN 10278 or ASTM A484
- Corrosion testing to ASTM A262 Method E & EN ISO 3651-2 Method A on Prodec® 304, 316
- Upon request: certification according to AD 2000 W2/W10

Optional processing

- Centerless grinding
- Polishing (grit 240)
- Chamfering

Standard chamfering edges

Dimension	Depth at 45°
8–10 mm	1 mm
10–20 mm	1.2 mm
30–90 mm	1-3 mm

Round bar stock profile

Cold drawn bar h9	Stock Profile		
Prodec® L=3000 mm	Ø 1.4305	Ø 1.4307	Ø 1.4404
6	x	x	x
6.35	x	x	x
7			
8	x	x	x
9			
9.53	x	x	x
10	x	x	x
11			
12	x	x	x
12.7	x	x	x
13	x	x	
14	x	x	x
15	x	x	x
15.88	x	x	x
16	x	x	x
17			
18	x	x	x
19			
19.05	x	x	x
20	x	x	x
21	x	x	x
22	x	x	x
22.23	x	x	x
23			
24	x	x	x
25	x	x	x
25.4	x	x	x

Peeled k11	Stock Profile		
Prodec® L=6000 mm	Ø 1.4305	Ø 1.4307	Ø 1.4404
28	x	x	x
30	x	x	x
32	x	x	x
34			
35	x	x	x
36	x	x	x
38	x	x	x
40	x	x	x
42	x	x	
45	x	x	x
50	x	x	x
52	x	x	x
55	x	x	x
60	x	x	x
65	x	x	x
70	x	x	x
75	x	x	x
80	x	x	x
85	x	x	x
90	x	x	x

Cold finished h9	Stock Profile		
Prodec® L=3000 mm	Ø 1.4305	Ø 1.4307	Ø 1.4404
28	x	x	x
30	x	x	x
32	x	x	x
34	x		
35	x	x	x
36	x	x	x
38	x	x	x
40	x	x	x
42	x	x	x
45	x	x	x
50	x	x	x
52	x	x	x
55	x	x	x
60	x	x	x
65	x	x	x
70	x	x	x
75	x	x	x
80	x	x	x

Peeled, a484	Stock Profile		
Prodec® L=3000 mm	Ø 1.4305	Ø 1.4307	Ø 1.4404
38.1	x	x	x
41.28	x	x	x
44.45	x	x	x
50.8	x	x	x
57.15	x	x	x
60.33	x	x	x
63.5	x	x	x
69.85	x	x	x
76.2	x	x	x
82.55	x	x	x
88.9	x	x	x

Contact sales at barfinishingsales@marcegaglia.com

Ensuring quality with end-to-end production

Sheffield Stainless Bar

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Final process steps include testing and inspection of the material.

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- AD 2000 Merkblatt WO - TÜV Nord
- CARES - Certificate of Conformity of the Factory Production Control
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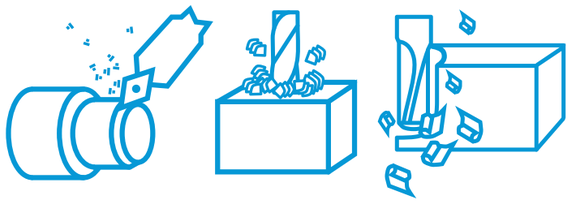
Prodec® datasheet - Stainless steel bar optimized for improved machinability

General characteristics

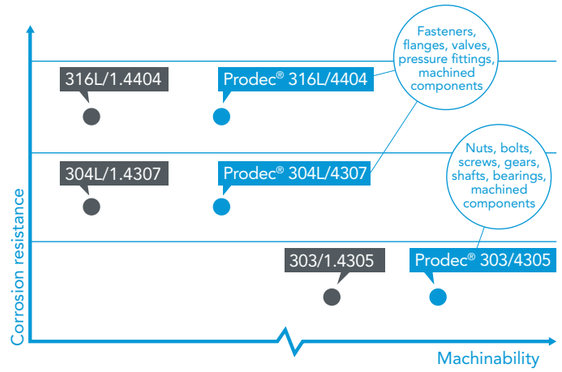
Stainless steel grades optimized for improved machinability with longer tool life and enhanced quality.



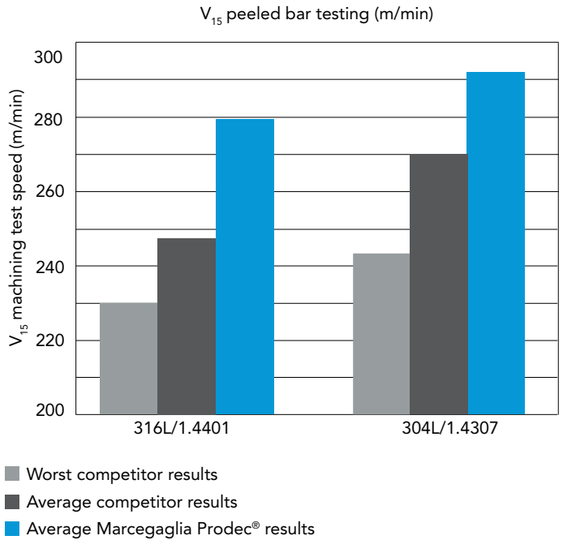
Product name	Typical applications	Product forms
Prodec® 304L/4307 A version of 304L/4307 with improved machinability. Improves productivity with faster machining, longer tool life, better dimensional tolerances, superior machined surface quality, and improved yields compared to conventionally produced 304L/4307.	• Fasteners • Flanges and valves • Pressure fittings • Machined components	Bar Wire rod Billet
Prodec® 316L/4404 A version of 316L/4404 with improved machinability. Improves productivity with faster machining, longer tool life, better dimensional tolerances, superior machined surface quality, and improved yields compared to conventionally produced 316L/4404.	• Fasteners • Flanges and valves • Pressure fittings • Machined components	Bar Wire rod Billet
Prodec® 303/4305 For applications that use 303/1.4305. This product gives you faster machining, longer tool life, better tolerances, superior machined surface quality, and reduced scrap losses compared to conventionally produced 303/1.4305.	• Nuts, bolts, and screws • Gears • Shafts • Bearings • Machined parts for process equipment	Bar Wire rod Billet

Product performance comparison

Corrosion resistance vs machinability



Bar – faster machining with Prodec®



Testing done with Marcegaglia Prodec® and 7 European competitors' bars with improved machinability in grades 316L/4404 and 304L/4307. The tool used for testing was a CNMG 2015 cemented carbide insert.

Bar – cost savings with Prodec®

		Standard 316L/4404	Prodec® 316L/4404	Improvement	
Cutting speed	m/min	92	137	45	
Processing time/component	min	16.9	7.7		54%
Total machining cost/component	€	23.1	10.6	12.6	55%
Productivity increase	%				54%
Savings/component	€			12.6	

A cost saving example for rough turning a 6» diameter Prodec® 316L/4404 peeled bar with a cemented ca

Products and dimensions

Metric	
Round bar	**Offering (mm)**
Cold drawn	6–25.4
Centerless ground	6–25.4
Peeled	28–90
Black bar	28–90

Metric	
Hexagon and square bar	**Offering (mm)**
Hexagon	8–25.4
Square	8–22.23

Chemical composition

The chemical composition is given as % by mass.

Grade family	Marcegaglia name	EN	ASTM		PRE	Typical chemical composition, % by mass					
			TYPE	UNS		C	Cr	Ni	Mo	N	Others
A	Prodec® 304L/4307	1.4307	304L	S30403	18	0.02	18.1	8.1	–	–	–
A	Prodec® 316L/4404	1.4404	316L	S31603	24	0.02	17.2	10.1	2.1	–	–
A	Prodec® 303/4305	1.4305	303	S30300	17	0.05	17.2	8.1	–	–	0.3S

Chemical compositions and PRE calculations are based on Marcegaglia typical values.

Pitting Resistance Equivalent is calculated using the following formula: PRE = %Cr + 3.3 x %Mo + 16 x %N

Surface finish and other factors determine the actual corrosion resistance of a particular product.

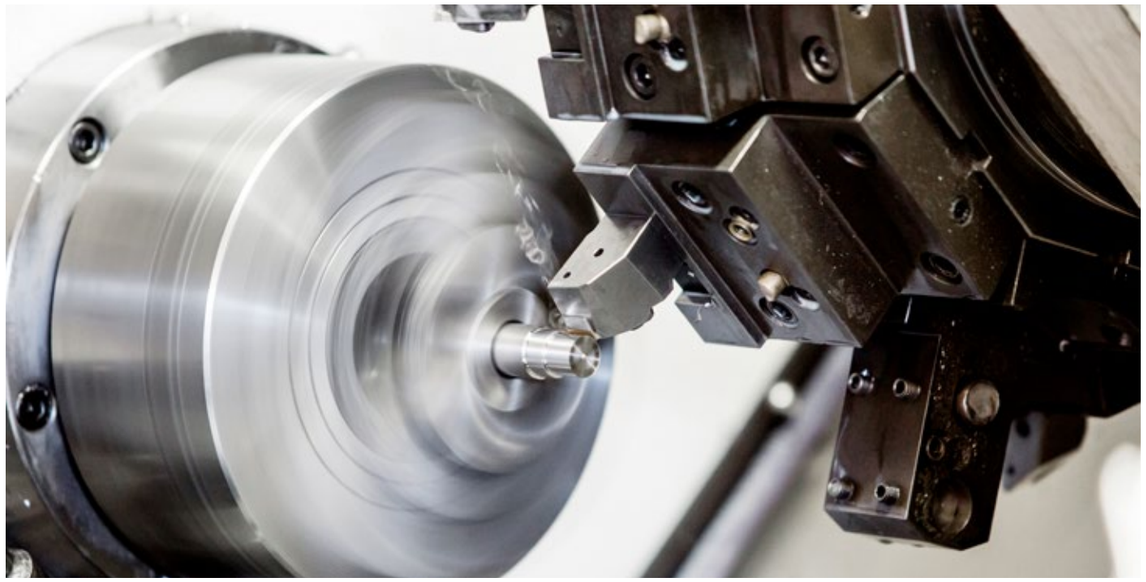
Corrosion resistance

Although improvements in machinability have been associated with reduced corrosion resistance in the past, the Prodec® treated products have shown corrosion resistance within the range typically expected from comparable stainless steel products.

Prodec® 304L/4307 is a versatile, general-purpose stainless steel with good resistance to atmospheric corrosion, many organic and inorganic chemicals, as well as foods and beverages. It has also been used in vacuum-processing equipment and specialized instruments where high integrity is essential.

Prodec® 316L/4404 provides improved resistance to pitting and crevice corrosion in environments containing chlorides and other halides.

Prodec® 303/4305 is resistant to mildly corrosive environments. In order to achieve the best possible corrosion resistance, all Prodec® 303/4305 parts should be chemically treated to remove sulfides from the final surface.



Mechanical properties

Metric					
Marcegaglia name	Product form	Min. yield strength $R_{p0.2}$ (MPa)	Tensile strength R_m (MPa)	Elongation A_5 (%)	Hardness (HBW) max.
Prodec® 304L/4307	Hot rolled bar	175	500–700	45/35	215
	Cold drawn bar	400/380/175	600-930/600-930/500-830	25/25/30	–
Prodec® 316L/4404	Hot rolled bar	200	500–700	40/30	215
	Cold drawn bar	400/380/200	600-930/580-930/500-830	25/25/30	–
Prodec® 303/4305	Hot rolled bar	190	500–750	35	230
	Cold drawn bar	400/400/190	600-950/600-950/500-850	15/15/20	–

Minimum values for Hot rolled bars and Cold drawn bars according to EN 10088-3.5) HB max

Physical properties

Metric						
Marcegaglia name	Density [kg/dm³]	Modulus of elasticity at 20 °C [GPa]	Coefficient of thermal expansion 20–100 °C [10⁻⁶/K]	Thermal conductivity at 20 °C [W/(m*K)]	Thermal capacity at 20 °C [J/(kg*K)]	Electrical resistivity at 20 °C [Ω*mm²/m]
Prodec® 304L/4307	7.9	200	16.0	15	500	0.73
Prodec® 316L/4404	8.0	200	16.0	15	500	0.75
Prodec® 303/4305	7.9	200	16.0	15	500	0.73

Values according to EN 10088-1.

Imperial						
Marcegaglia name	Density [lbm/in³]	Modulus of elasticity [psi]	Coefficient of thermal expansion 68-212 °F [µin/(in* °F)]	Thermal conductivity [Btu/(hr*ft* °F)]	Thermal capacity [Btu/(lbm* °F)]	Electrical resistivity [µΩ*in]
Prodec® 304L/4307	0.285	29 * 10⁶	8.89	8.7	0.119	28.74
Prodec® 316L/4404	0.289	29 * 10⁶	8.89	8.7	0.119	29.53
Prodec® 303/4305	0.285	29 * 10⁶	8.89	8.7	0.119	28.74

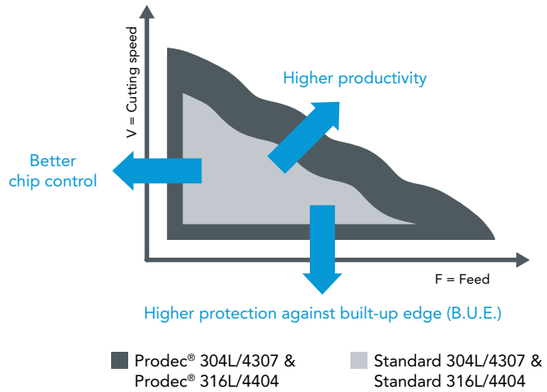
Values according to EN 10088-1.

Fabrication

Machining

Prodec® products enable higher machining speeds, longer tool life, and superior part quality with reduced total cost for finished parts.

Prodec® 304L/4307 and Prodec® 316L/4404 are special variants of standard Types 304 (UNS S30400) / 304L (UNS S30403) and 316 (UNS S31600) / 316L (UNS S31603) respectively with enhanced metallurgy for better machinability. The general rules for machining stainless steel also apply to the Prodec® grades.
The difference is that Prodec® grades enable a longer tool life and/or tougher machining conditions.
The machining window illustrated on the right gives a demonstration of this.



Machining guidelines

The cutting parameters in this guideline will work under normal cutting conditions. It is suggested to begin with cutting parameters in the ranges indicated in the tables and then to improve parameters by moving to higher or lower speed, feed or depth of cut until best performance is reached. It is possible to end up in a range somewhat outside the values indicated in the tables depending on the actual machine set-up.

Turning

- The machine and setup must be rigid
- Use shortest possible tool length
- Use coolant
- Use smallest possible nose radius to avoid vibrations

	Carbide Tooling				HSS Tooling		
Turning	**Depth of cut or width (mm)**	**Speed (m/min)**	**Feed (mm/rev)**	**Tool Grade**	**Speed (m/min)**	**Feed (mm/rev)**	**Tool Grade**
Finishing	-2	260–280	0.10	M10–15	50 [1]	0.10	T15
Medium	2–5	200–260	0.25	M10–25	35	0.25	T15
Roughing	5–10	50–220	0.40	M25–35	20	0.40	T15

[1] Coated tools

Milling

- Avoid cutting through holes/cavities
- Ensure good chip evacuation, recutting of chips may cause tool damage

	Carbide Tooling			HSS Tooling		
Milling	**Speed (m/min)**	**Feed (mm/rev)**	**Tool Grade**	**Speed (m/min)**	**Feed (mm/rev)**	**Tool Grade**
Face milling	150–250	0.08–0.30	M10–30	24–40	0.08–0.20	T15
Side milling	180–240	0.08–0.30	M10–30	24–40	0.08–0.20	T15
End milling	150–220	0.05–0.20	M10–30	24–40	0.025–0.15	T15
End milling [2]	50–100	0.05–0.20	M35	–	–	–

[2] Solid cemented carbide

Drilling – high speed steel twist drills

- Use coolant
- If possible use internal coolant through drill
- Use of cobalt high alloyed drills is preferred
- With PVD-coated HSS drills the cutting speed can be increased by 10%
- Use as short drill as possible

	HSS Tooling			
Drilling [3]	**Diameter (mm)**	**Speed (m/min)**	**Feed (mm/rev)**	**Rpm (rev/min)**
	1	10–12	0.05	3200–3800
	3	15–17	0.10	1600–1800
	5	17–20	0.12	1080–1270
	10	17–20	0.15	540–640
	15	17–20	0.20	360–430
	20	17–20	0.30	270–320
	30	17–20	0.30	180–220

[3] HSS-5%Co

Forming

Cold forming

Prodec® products can be readily formed and fabricated with the full range of cold forming operations.
They can be used in heading, drawing, bending, and upsetting. Cold forming operations will increase the strength and hardness of the material, and may leave it slightly magnetic.

Hot forming

Prodec® 303/4305, Prodec® 304L/4307, and Prodec® 316L/4404 can be forged in the 925–1200 °C/1700–2200 °F range. For maximum corrosion resistance, forgings should be annealed at a minimum temperature of 1030°C/1900 °F and then water quenched or rapidly cooled by other means after hot forming operations.

Welding

Prodec® 304L/4307 is readily weldable with the full range of conventional welding methods with the exception of oxyacetylene. AWS E308/ER308 or E308L/ER308L filler metals should be used, but molybdenum-containing austenitic stainless steel filler metals may also be considered. After welding, it may be necessary to fully anneal to restore the corrosion resistance lost by sensitization to intergranular corrosion when chromium carbides were precipitated in the grain boundaries in the weld heat-affected zone (HAZ).

Prodec® 316L/4404 is readily welded with the full range of conventional welding methods with the exception of oxyacetylene. AWS E316L/ER316L and other low-carbon filler metals with a molybdenum content higher than that of the base metal should be used.

Prodec® 303/4305 stainless steel is not recommended for applications requiring welding. When welding is necessary, AWS E312 filler metal may be considered. An alternative product for parts requiring welding is Prodec® 304L/4307.

Standards and approvals

The most commonly used international product standards are given in the table below.

Standards

- EN 10088-3
- EN 10088-5
- EN 10272
- ASME SA479
- ASTM A479/479M
- ASTM A276
- ASTM A555
- ASTM A493

Certificates and approvals

Marcegaglia Stainless Sheffield meets the most common certifications and approvals:

- AD 2000 Merkblatt
- Approval of Material Manufacturers
- Factory Production Control Certificate
- ISO 9001
- ISO 14001
- ISO 50001
- ISO 45001
- Pressure Equipment Directive (PED)

Contact sales at barfinishingsales@marcegaglia.com

Machining guideline for Prodec® 304L/4307 and Prodec® 316L/4404

Prodec® 304L/4307 and Prodec® 316L/4404 are special variants of standard Types 304 (UNS S30400) / 304L (UNS S30403) and 316 (UNS S31600) / 316L (UNS S31603) respectively with enhanced metallurgy for better machinability. The general rules for machining stainless steel also apply to the Prodec® grades.
The difference is that Prodec® grades enable a longer tool life and/or tougher machining conditions.
The machining window illustrated on the right gives a demonstration of this.

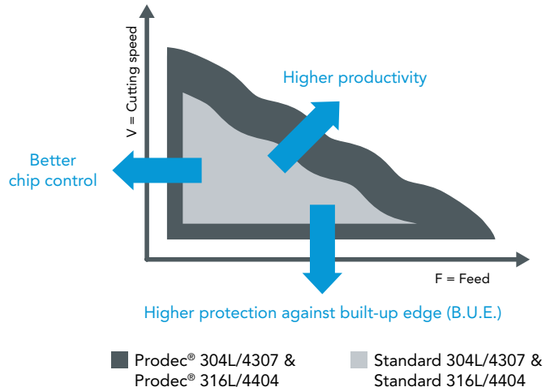
Other fabrication operations such as welding, hot working and cold working can be performed in the same way as for standard 304L/4307 and 316L/4404.

Product forms

Prodec® 304L/4307 and Prodec® 316L/4404 are available as round, hexagon and square bars, as well as wire rod and concast billets.

Machining guidelines

The cutting parameters in this guideline will work under normal cutting conditions. It is suggested to begin with cutting parameters in the ranges indicated in the tables and then to improve parameters by moving to higher or lower speed, feed or depth of cut until best performance is reached.
It is possible to end up in a range somewhat outside the values indicated in the tables depending on the actual machine set-up.
A guide for further optimization of cutting parameters can be found under the "Troubleshooting" section on the next page.



Turning

- The machine and setup must be rigid
- Use shortest possible tool length
- Use coolant
- Use smallest possible nose radius to avoid vibrations

Milling

- Avoid cutting through holes/cavities
- Ensure good chip evacuation, recutting of chips may cause tool damage

	Carbide Tooling				HSS Tooling		
Turning	**Depth of cut or width (mm)**	**Speed (m/min)**	**Feed (mm/rev)**	**Tool Grade**	**Speed (m/min)**	**Feed (mm/rev)**	**Tool Grade**
Finishing	-2	260–280	0.10	M10–15	50 [1]	0.10	T15
Medium	2–5	200–260	0.25	M10–25	35	0.25	T15
Roughing	5–10	50–220	0.40	M25–35	20	0.40	T15

[1] Coated tools

	Carbide Tooling			HSS Tooling		
Milling	**Speed (m/min)**	**Feed (mm/rev)**	**Tool Grade**	**Speed (m/min)**	**Feed (mm/rev)**	**Tool Grade**
Face milling	150–250	0.08–0.30	M10–30	24–40	0.08–0.20	T15
Side milling	180–240	0.08–0.30	M10–30	24–40	0.08–0.20	T15
End milling	150–220	0.05–0.20	M10–30	24–40	0.025–0.15	T15
End milling [2]	50–100	0.05–0.20	M35	–	–	–

[2] Solid cemented carbide

Drilling – high speed steel twist drills

- Use coolant
- If possible use internal coolant through drill
- Use of cobalt high alloyed drills is preferred
- With PVD-coated HSS drills the cutting speed can be increased by 10%
- Use as short a drill as possible

	HSS Tooling			
Drilling [3]	**Diameter (mm)**	**Speed (m/min)**	**Feed (mm/rev)**	**Rpm (rev/min)**
	1	10–12	0.05	3200–3800
	3	15–17	0.10	1600–1800
	5	17–20	0.12	1080–1270
	10	17–20	0.15	540–640
	15	17–20	0.20	360–430
	20	17–20	0.30	270–320
	30	17–20	0.30	180–220

[3] HSS-5%Co

Other machining operations

Cut-off

- Reduce feed by 50% approximately 6mm from the center

Reaming

- Type of coolant: emulsion or cutting oil

Tapping

- For blind holes use spiral flute grinding for good chip evacuation
- For through holes use spiral point grinding with gun nose to push the hips forward

Threading single insert

- Full profile insert for high quality thread forms
- V-profile insert – threading with minimum tool inventory
- Multipoint insert for economic threading in mass production

Drilling indexable insert

- Cutting data is very dependent on the drill design. Hence, the manufacturers recommendations must be considered

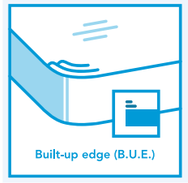
	Carbide Tooling			HSS Tooling		
Other machining operations	**Speed (m/min)**	**Feed (mm/rev)**	**Tool Grade**	**Speed (m/min)**	**Feed (mm/rev)**	**Tool Grade**
Cut-off	100–150	0.05–0.15	M30	24	0.05	T15
Reaming	50	0.10–0.40	M10–M30	10–15	0.10–0.40	T15
Tapping	–	–	–	5–13	–	–
Threading singel insert	90–130	–	M10–M30	15–20	–	T15
Drillling indexable insert	200–250	0.06–0.12	Center M30 Periferi M10	–	–	–

Contact sales at
barfinishingsales@marcegaglia.com

Troubleshooting

Flank wear
For longer tool life – reduce cutting speed or use a harder insert.

Notch wear
Notch wear is a common wear mechanism when machining stainless steel. Increased cutting speed will reduce notch but increase flank wear. If possible, use an insert with smaller entering angle 60-80 degrees or variable cutting depth or softer insert grade.



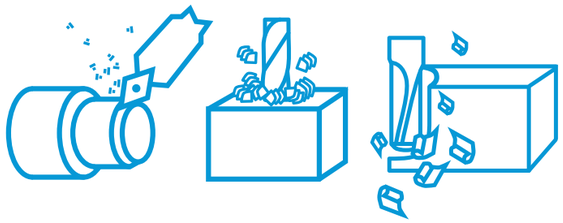
Built-up edge (B.U.E.)
Built-up edge occurs when the cutting speed is too low and the stainless steel tends to stick to the tool (in milling the chips stick to the tool). To avoid – increase cutting speed or use another coating.

Plastic deformation
To avoid – reduce either cutting speed, feed or use a harder insert.

Long chips
To avoid – increase feed or use an insert with smaller chip breaker.

Machining guideline for Prodec® 303/4305

Prodec® 303/4305 is a fully resulfurized free-machining austenitic stainless steel. The Prodec® brand name means this steel has been specially melted and treated by Marcegaglia's proprietary ladle metallurgy techniques to maximize machinability while retaining good mechanical properties, corrosion resistance, and forming characteristics. This free cutting stainless steel gives you faster machining, longer tool life, better tolerances, superior machined surface quality, and reduced scrap losses compared to conventionally produced EN 1.4305.



Product forms

Prodec® 303/4305 is available as round, hexagon and square bars as well as wire rod and concast billets.

Machining guidelines

The cutting parameters in this guideline will work under normal cutting conditions. It is suggested to begin with cutting parameters in the ranges indicated in the tables and then to improve parameters by moving to higher or lower speed, feed or depth of cut until best performance is reached.
It is possible to end up in a range somewhat outside the values indicated in the tables depending on the actual machine set-up.
A guide for further optimization of cutting parameters can be found under the "Troubleshooting" section on the next page.

Turning

- The machine and setup must be rigid
- Use shortest possible tool length
- Use coolant
- Use smallest possible nose radius to avoid vibrations

Milling (only end milling)

- The machine and setup must be rigid
- Use shortest possible tool length
- Use coolant
- Use smallest possible nose radius to avoid vibrations

	Carbide Tooling				HSS Tooling		
Turning	**Depth of cut or width (mm)**	**Speed (m/min)**	**Feed (mm/rev)**	**Tool Grade**	**Speed (m/min)**	**Feed (mm/rev)**	**Tool Grade**
Finishing	0.050–0.10	180–375	0.10–0.25	M10–15	40–55	0.12–0.25	T15
Roughing	0.12–5.0	90–220	0.25–0.60	M25–35	30–40	0.38–0.50	T15

	Carbide Tooling				HSS Tooling		
Milling	**Depth of cut or width (mm)**	**Speed (m/min)**	**Feed ex. (mm/rev)**	**Tool Grade**	**Speed (m/min)**	**Feed (mm/rev)**	**Tool Grade**
End milling[1]	1.0–15.0	50–250	0.050–0.20	M35	10–50	0.075–0.15	T15

1) Solid cemented carbide

Drilling – high speed steel twist drills

- Use coolant
- If possible use internal coolant through drill
- Use of cobalt high alloyed drills is preferred
- With PVD-coated HSS drills the cutting speed can be increased by 10%
- Use as short drill as possible

Other machining operations

Cut-off

- Reduce feed by 50% approximately 6mm from the center

Tapping

- For blind holes use spiral flute grinding for good chip evacuation
- For through holes use spiral point grinding with gun nose to push the chips forward

Threading single insert

- Full profile insert for high quality thread forms
- V-profile insert – threading with minimum tool inventory
- Multipoint insert for economic threading in mass production

Forming

- Use coolant
- The machine and setup must be rigid
- Use shortest possible tool length

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	HSS Tooling			
Drilling[2]	**Diameter (mm)**	**Speed (m/min)**	**Feed ex. (mm/rev)**	**Rpm (rev/min)**
Steel Twist Drills	1	13–16	0.065	4100–4900
	3	19–22	0.13	2000–2300
	5	22–26	0.16	1400–1650
	10	22–26	0.20	700–830
	15	22–26	0.25	470–560
	20	22–26	0.40	350–420
	30	22–26	0.40	230–290

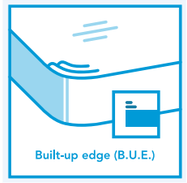
2) HSS-5%Co

	Carbide Tooling				HSS Tooling		
Other machining operations	**Depth of cut or width (mm)**	**Speed (m/min)**	**Feed ex. (mm/rev)**	**Tool Grade**	**Speed (m/min)**	**Feed (mm/rev)**	**Tool Grade**
Cut–off	1.5–7.0	80–200	0.040–0.15	M30	20–40	0.030–0.080	T15
Tapping	–	–	–	–	3–35	–	–
Threading singel insert	–	90–130	–	M10–M30	3–35	–	T15
Forming	7–50	40–130	0.040–0.12	M10–M30	20–40	0.040–0.40	T15

Troubleshooting

Flank wear
For longer tool life – reduce cutting speed or use a harder insert.

Notch wear
Notch wear is a common wear mechanism when machining stainless steel. Increased cutting speed will reduce notch but increase flank wear. If possible, use an insert with smaller entering angle 60-80 degrees or variable cutting depth or softer insert grade.



Built-up edge (B.U.E.)
Built-up edge occurs when the cutting speed is too low and the stainless steel tends to stick to the tool (in milling the chips stick to the tool). To avoid – increase cutting speed or use another coating.

Plastic deformation
To avoid – reduce either cutting speed, feed or use a harder insert.

Long chips
To avoid – increase feed or use an insert with smaller chip breaker.

MARCEGAGLIA FAGERSTA STAINLESS

STAINLESS STEEL WIRE RODS AND WIRES

Fagersta Stainless Wire Rod and Drawn Wire

Fagersta Stainless, located in Sweden, is focused in producing stainless steel wire rod and wire.

Fagersta Stainless has a history that started in the 16th century, and was established in current form in 1984. Wire rod production started 1884, and it was probably the first mill in the world to roll stainless wire rod in 1921. Fagersta Stainless is specialised in thinner dimensions of wire rod and drawn wire. Key customers are producing welding wire, spring wire, cold-heading products and wheel spokes.

Fagersta has become successful in some niche areas where the properties of the wire and wire rod are developed exclusively for certain applications. With long-term customer relationships, together with some of the leading actors, we develop our products with high quality according to customer requirements.

We have high capacity and highly trained commercial and technical staff to support the market. Our products are sold worldwide directly from Sweden or via a network of representatives.

Our goal is to be recognized in the market as the most responsive specialist rod supplier with industry-leading customer service backed by a flexible, high quality manufacturing program.

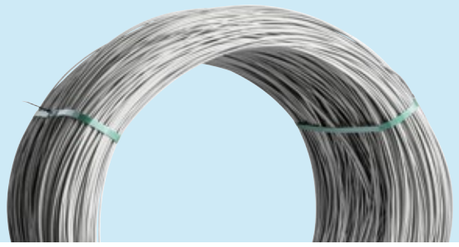
Key benefits

- Product quality
- Delivery reliability
- Expert technical advice
- Easy to deal with

Wire rod and drawn wire dimensions

Wire rod

5 – 18 mm (0.197”– 0.709”) in increments of 0.5 mm (0.020”).
MOQ for standard steel grades is 3 ton
Coil weight is 1 000 kg



Drawn wire

1.50 – 16.00 mm (0.059” – 0.630”)
h9 according to EN 10278
Min MOQ is 1 ton
Coil weight 250 – 1 000 kg

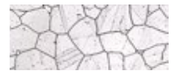
To get best possible properties, following parameters are important:

- Tight chemistry control
- Mechanical properties and deformation hardening
- Corrosion properties
- Surface finish
- Dimension tolerances

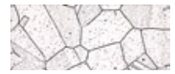
Wire rod conditions and packaging

Conditions

Direct cooling (DK)
ASTM 10-13



“In line”-annealing (DST)
ASTM 5-8



Batch Annealed (SG)
ASTM 3-6

Packaging options

Wire rod steel grades

- Ferritic Grades
- Austenitic Grades
- Duplex
- PH

Drawn wire conditions and packaging

Conditions

- Stearate
- Oil / Grease
- Metal

Packaging

- Coils on pallet
- Compact coil on pallet
- Coil with bobbin
- Coil with tube carrier
- Spool

Oil / Grease

- FAGERSTA XFO-coating (Oil)
- FAGERSTA XFH-coating (Grease)

Metal

- FAGERSTA Cu-coating (Copper)
- FAGERSTA Ni-coating (Nickel)

Drawn wire steel grades

- Ferritic Grades
- Austenitic Grades
- Duplex
- PH

Wire rod and drawn wire heat sizes

Depending on grade, our heat sizes are:

- Appr. 8 tonnes (17 000 lbs)
- Appr. 60 tonnes (132 000 lbs)
- Appr. 120 tonnes (265 000 lbs)

Ensuring quality with end-to-end production

Melting shop
Consistently produced high quality semis are made at SMACC in 130-tonne melts.

Billet feedstock
The majority of the feedstock comes from our own melting shop.

Reheating furnace
Accurately controlled, two-stage reheating minimizes surface scaling.

Rolling
A highly responsive digital control system tracks the rod through the mill to ensure quality.

Coil forming
Wire rod of up to 18 mm is coiled on a laying head.

Annealing
The annealing furnace softens the rod to increase its ductility for further processing.

Pickling
Scale is removed from the hot rolled surface using salt bath and acid treatment.

Testing
Samples from production stages are tested for surface defects, grain size, and tensile strength.

Fagersta Stainless wire rod and drawn wire mill

Quality assurances

Our manufacturing programme is supported by an in-house product inspection and testing programme in addition to a technical team with extensive experience. Our rod and drawn wire production is accredited to recognized international standards, including:

- ISO 9001
- ISO 14001
- ISO 50001 (Energy Management System)

WIRE ROD FOR WELDING

Thanks to a company history starting already 1873, Fagersta Stainless belongs to one of the world leading producers of stainless wire rod and wire. With customized chemistries the products fulfill everything from simple to high demanding applications.

STANDARD STEEL GRADES FOR WELDING

Our grades have tight chemistries and therefore equal properties from delivery to delivery.
We recommend following of our standard grades:

OPTIMUM WIRE ROD FOR WELDING

To get best possible properties for welding wire rod, these parameters are important:

- Tight chemistry for identical properties
- Mechanical properties and deformation hardening
- Corrosion properties
- Surfaces
- Dimension tolerances

Grade family	Marcegaglia name	Fagersta	EN	ASTM		PRE	CWH	Typical chemical composition, % by mass					
				TYPE	UNS			C	Cr	Ni	Mo	N	Others
F	409/4512	R108.10	-	409CB	-	11	-	0.03	11.3	0.35	-	-	Nb
F	409Ti/4512	R109.11	1.4512	409TI	-	11	-	0.025	11.3	-	-	-	-
F	430Nb/4511	R258.10	1.4511	430Nb	-	19	-	0.01	18.2	-	-	-	-
F	430NbTi/4016	R258.13	18 LNbTi	-	-	18	-	0.015	18.2	-	-	-	Ti, Nb
A	4551	R358.16	1.4551 / 19 9 NbSi	347Si	S34788	21	-	0.035	19.4	9.8	-	0.04	Nb
A	4551	R358.22	19 9 Nb	347	-	20	-	0.05	19.6	9.2	-	0.03	Nb
A	347H/4550	R358.22	-	347H	-	20	-	0.05	19.6	9.2	-	0.03	Nb
A	308L/4316	R366.10	1.4316 / 19 9 L	308L	S30883	21	-	0.01	19.7	10.2	-	0.05	S
A	308LSi/4316	R366.72	1.4316 / 19 9 Lsi	308L	S30888	21	-	0.015	19.85	10.35	-	0.065	S
A	318/4576	R448.11	1.4576 / 19 12 3 Nb	318	-	29	-	0.04	19.3	11.6	2.6	0.04	S
A	318Si/4576	R448.12	19 12 3 NbSi	-	-	28	-	0.035	18.9	11.8	2.7	0.05	S
A	316L/4430	R466.10	19 12 3 L	316L	-	28	-	0.01	18.3	12.2	2.6	0.04	S
A	316LSi/4430	R466.20	1.4430 / 19 12 3 LSi	316LSi	S31688	28	-	0.01	18.3	11.8	2.6	0.04	-
A	317L	R476.25	18 15 3 L	317L	-	31	-	0.01	18.8	13.7	3.6	0.05	S
A	16–8–2	R516.30	42584	-	-	20	-	0.05	15.5	8.5	1.2	0.04	-
A	307L	R526.10	18 8 Mn	307	-	17	-	0.035	17.3	7.8	-	-	-
A	307Si	R526.70	18 8 SiMn	307	-	18	-	0.08	18.2	8	-	-	S
D	2209	R647.31	22 9 3 N L	2209	S39209	35	-	0.01	23	8.75	3	0.16	Al
D	2594	R647.73	25 9 4 NL	2594	-	42	-	0.01	25.1	9.5	4	0.25	Al
D	2507	R647.77	1.4410	-	-	42	-	0.02	25	6.6	4	0.28	-
D	2307	R656.20	23 7 NL	2307	-	27	-	0.01	24	8	-	0.14	-
D	2504	R656.30	25 4	-	-	26	-	0.07	25.3	4.5	-	-	-
D	312	R656.70	29 9	312	-	32	-	0.1	30.35	9.2	-	0.055	Al
A	309L/4332	R806.20	1.4332 / 23 12 L	309L	S30983	25	-	0.01	23.5	13.7	-	0.08	S
A	309LSi/4332	R806.24	1.4332 / 23 12 L Si	309L	S30988	25	-	0.02	23.3	13.8	-	0.12	S
A	309LSi/4332	R806.42	1.4332 / 23 12 L Si	309L	S30988	25	-	0.015	23.5	13.6	-	0.08	-
A	309LNb4332	R806.45	23 12 L Nb	309LNb	-	25	-	0.01	23.9	12.6	-	0.04	Al, Nb
A	309Si/4332	R806.72	22 12 H	-	-	23	-	0.09	23.3	12.75	-	0.055	-
A	309LMo/4459	R816.10	23 12 2 L	-	-	31	-	0.01	21.45	15	2.7	0.06	-
A	ER310/4845	R826.70	25 20	310	-	26	-	0.12	26	20.8	-	-	-
A	904L	R840.21	20 25 5 C L	385	N08904	36	-	0.01	20	25	4.5	0.05	Cu
A	Alloy 825	R906.10	-	Alloy 825	-	33	-	0.01	22.3	43	3.2	-	Cu, Ti
A	Alloy 625	R906.25	2.4856	A-625	N06625	-	-	0.02	22.2	65	8.7	-	Nb
A	Alloy 601	R920.61	2.4851	A-601	N06601	-	-	0.05	23	59	-	-	Al
A	Alloy 600	R930.60	2.4816	A-600	N06600	-	-	0.05	16.2	74	-	-	-

Grade families: F = ferritic, A = austenitic, D = duplex

MECHANICAL PROPERTIES AND DEFORMATION HARDENING

Depending on end-product's shape and required tensile strength, the wire rod should have specific ductility (formability) for the cold heading process and specific level of deformation hardening. Following methods of measurement are used regarding deformation hardening:

- **CWH-factor** "Cold Work Hardening Factor", a matrix consisting of C, Cr and Ni contents. The factor varies between 80 – 150 and increases with increasing deformation hardening in the steel.

- **Md30**: the temperature (°C) at which 30% true elongation (about 25% area reduction) makes 50% of the austenitic phase transform to deformation martensite. A higher temperature means higher deformation hardening in the steel.

CORROSION

PRE (Pitting Resistance Equivalent = Cr + 3.1 x Mo + 25 x N) is a factor comparing properties of different chemistries with regards to pitting and crevice corrosion in corrosive environments. A higher value means better resistance. In the table above, PRE is shown for the grades we recommend for welding.

SURFACES

- Direct cooling (DK) ASTM 10-13
- "In line"-annealing (DST) ASTM 5-8
- Pit furnace (SG) ASTM 3-6

Our standard procedure is to supply the wire rod in pickled condition.

DIMENSIONS

Standard: 5 – 18 mm (.197" - .709") in increments of 0.5 mm (.020")
(MOQ:s for some dimensions)

Tolerance: 5.0 – 10.0 +/-0.15
>10.0 – 18.0 +/-0.20

Ovality: max 60% of the total tolerance span

Surface classes: Class 3 is the standard class which has a max defect depth of 0.10 mm for dimensions ≤ 10 mm and 1% of the diameter for dimensions > 10 mm. Welding rod has class 2 (max 0.20).

PACKAGING METHODS

Coil weight: appr. 1000 kg - **Outer diameter**: max 1250 mm - **Inner diameter**: max 950 mm

WIRE ROD FOR COLD HEADING

Thanks to a company history starting already 1873, Fagersta Stainless belongs to one of the world leading producers of stainless wire rod and wire. With customized chemistries the products fulfill everything from simple to high demanding applications.

STANDARD STEEL GRADES FOR COLD HEADING

Our grades have tight chemistries and therefore equal properties from delivery to delivery.
We recommend following of our standard grades:

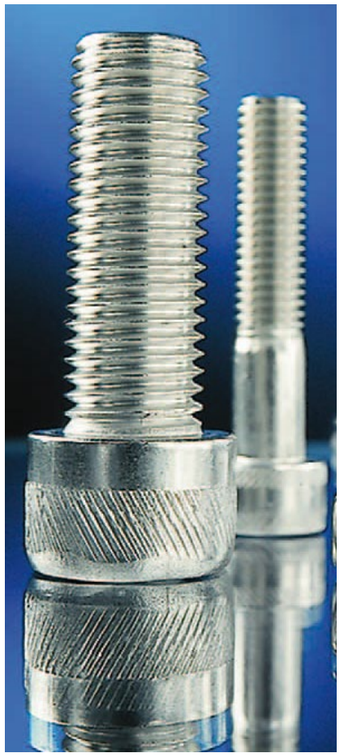
OPTIMUM

To get best possible properties for cold heading wire rod, these parameters are important:

- Tight chemistry for identical properties
- Mechanical properties and deformation hardening
- Corrosion properties
- Surfaces
- Dimension tolerances

Grade family	Marcegaglia name	Fagersta	EN	ASTM		PRE	CWH	Typical chemical composition, % by mass					
				TYPE	UNS			C	Cr	Ni	Mo	N	Others
F	409/4512	R108.10	-	409CB	-	11	-	0.03	11.3	-	-	-	Nb
F	409Ti/4512	R109.11	1.4512	409TI	-	11	-	0.015	11.3	-	-	-	-
F	430/4016	R250.11	1.4016	430	S43000	16	-	0.015	16.4	-	-	-	-
F	430L/4016	R258.10	18 LNB	-	-	18	-	0.01	18.2	-	-	-	Cu
A	304L/4306	R350.11	1.4306	304L	S30403	18	-	0.02	18.3	10.3	-	-	-
A	304/4301	R350.19	1.4301	304	S30400	18	-	0.03	18.2	8.2	-	-	-
A	304L/4307	R350.43	1.4307	304L	S30403	20	-	0.015	18.3	8.6	-	-	-
A	305/4303	R390.21	1.4303	305	S30500	20	-	0.01	17.7	11.2	-	-	-
A	316L/4404	R425.10	1.4404	316L	S31603	24	-	0.015	16.8	11.2	2.1	-	-
A	316L/4436	R440.10	1.4436	316	S31600	25	-	0.02	16.8	11.6	2.6	-	-
A	316Cu/4578	R545.11	1.4578	316Cu	-	24	-	0.02	17	10.8	2.2	-	Cu
PH	Alloy 286/4980	R569.10	1.4980	A–286	S66286	18	-	0.05	14.6	24.7	1.2	-	Al, Ti
PH	Alloy 286/4980	R569.60	1.4980	A–286	S66286	18	-	0.05	14.6	24.7	1.2	-	Al, Ti
PH	Alloy 286/4980 ESR	R569.63	1.4980	A-286	S6686	18	-	0.05	14.6	24.7	1.2	-	Al, Ti
PH	Alloy X750	R969.75	2.4669	A-X750	N07750	-	-	0.05	14.4	74.5	-	-	Al,Ti, Nb
A	304Cu/4567	R575.21	1.4567	304Cu	S30430	19	-	0.01	17.9	9.7	-	-	Cu

Grade families: F = ferritic, A = austenitic, PH = precipitation hardening



MECHANICAL PROPERTIES AND DEFORMATION HARDENING

Depending on end-product's shape and required tensile strength, the wire rod should have specific ductility (formability) for the cold heading process and specific level of deformation hardening. Following methods of measurement are used regarding deformation hardening:

- **CWH-Factor** "Cold Work Hardening Factor", a matrix consisting of C, Cr and Ni contents. The factor varies between 80 – 150 and increases with increasing deformation hardening in the steel.
- **Md30**: the temperature (°C) at which 30% true elongation (about 25% area reduction) makes 50% of the austenitic phase transform to deformation martensite. A higher temperature means higher deformation hardening in the steel.

CORROSION

PRE (Pitting Resistance Equivalent = Cr + 3.1 x Mo + 25 x N) is a factor comparing properties of different chemistries with regards to pitting and crevice corrosion in corrosive environments. A higher value means better resistance. In the table above, PRE is shown for the grades we recommend for cold heading.

SURFACES

- Direct cooling (DK) ASTM 10-13
- "In line"-annealing (DST) ASTM 5-8
- Pit furnace (SG) ASTM 3-6

Our standard procedure is to supply the wire rod in pickled condition.

DIMENSIONS

Standard: 5 – 18 mm (.197" - .709") in increments of 0.5 mm (.020") (MOQ:s for some dimensions)
Tolerance: 5.0 – 10.0 +/-0.15
>10.0 – 18.0 +/-0.20
Ovality: max 60% of the total tolerance span
Surface classes: Class 3 is the standard class which has a max defect depth of 0.10 mm for dimensions ≤ 10 mm and 1% of the diameter for dimensions > 10 mm. Welding rod has class 2 (max 0.20).

PACKAGING METHODS

Coil weight: appr. 1000 kg - **Outer diameter**: max 1250 mm - **Inner diameter**: max 950 mm

WIRE ROD FOR HIGH TEMPERATURE

Thanks to a company history starting already 1873, Fagersta Stainless belongs to one of the world leading producers of stainless wire rod and wire. With customized chemistries the products fulfill everything from simple to high demanding applications.

STANDARD STEEL GRADES FOR HIGH TEMPERATURE

Our grades have tight chemistries and therefore equal properties from delivery to delivery.
We recommend following of our standard grades:

OPTIMUM WIRE ROD FOR HIGH TEMPERATURE

To get best possible properties for high temperatures, these parameters are important:

- Tight chemistry for identical properties
- Mechanical properties and deformation hardening
- Corrosion properties
- Surfaces
- Dimension tolerances

Grade family	Marcegaglia name	Fagersta	EN	ASTM		Typical chemical composition, % by mass					
				TYPE	UNS	C	Cr	Ni	Mo	N	Others
F	409/4512	R108.10	-	409CB	-	0.03	11.3	-	-	-	Nb
F	409Ti/4512	R109.11	1.4512	409TI	-	0.015	11.3	-	-	-	Ti
A	4828	R323.10	1.4828	-	-	0.045	19.3	11.7	-	0.03	-
A	4835	R327.10	1.4835	-	S30815	0.075	21	10.2	-	0.16	REM
PH	Alloy 286 / 4980	R569.60	1.4980	A–286	S66286	0.05	14.6	24.7	1.2	-	Al, Ti, V
A	310S/4845	R820.10	1.4845	310S	S31008	0.045	24.7	19.4	-	-	-
A	314/4841	R823.11	-	314	S31400	0.03	23.5	19.4	-	-	-
A	314/4841	R823.13	1.4841	314	S31400	0.01	24.3	20.7	-	-	-
A	310S/4845	R826.70	25 20 310	-	-	0.12	25.9	20.8	-	-	-
A	904L	R840.70	1.4539	904L	N08904	0.01	20	25	4.5	0.05	Cu
A	330/4886	R860.13	1.4886	330	N08330	0.01	18.5	34.5	-	-	-
A	330Nb/4886Nb	R868.11	-	-	-	0.015	19.5	34.5	-	-	Nb

Grade families: F = ferritic, A = austenitic, PH = precipitation hardening

MECHANICAL PROPERTIES AND DEFORMATION HARDENING

Depending on end-product's shape and required tensile strength, the wire rod should have specific ductility (formability) for the cold heading process and specific level of deformation hardening. Following methods of measurement are used regarding deformation hardening:

- **CWH-Factor** "Cold Work Hardening Factor", a matrix consisting of C, Cr and Ni contents. The factor varies between 80 – 150 and increases with increasing deformation hardening in the steel.
- **Md30**: the temperature (°C) at which 30% true elongation (about 25% area reduction) makes 50% of the austenitic phase transform to deformation martensite. A higher temperature means higher deformation hardening in the steel.

CORROSION

PRE (Pitting Resistance Equivalent = Cr + 3.1 x Mo + 25 x N) is a factor comparing properties of different chemistries with regards to pitting and crevice corrosion in corrosive environments. A higher value means better resistance. In the table above, PRE is shown for the grades we recommend for high temperatures.

SURFACES

- Direct cooling (DK) ASTM 10-13
- "In line"-annealing (DST) ASTM 5-8
- Pit furnace (SG) ASTM 3-6

Our standard procedure is to supply the wire rod in pickled condition.

DIMENSIONS

Standard: 5 – 18 mm (.197" - .709") in increments of 0.5 mm (.020")
(MOQ:s for some dimensions)
Tolerance: 5.0 – 10.0 +/-0.15
>10.0 – 18.0 +/-0.20
Ovality: max 60% of the total tolerance span
Surface classes: Class 3 is the standard class which has a max defect depth of 0.10 mm for dimensions ≤ 10 mm and 1% of the diameter for dimensions > 10 mm. Welding rod has class 2 (max 0.20).

PACKAGING METHODS

Coil weight: appr. 1000 kg - **Outer diameter**: max 1250 mm - **Inner diameter**: max 950 mm

WIRE ROD FOR SPRINGS

Thanks to a company history starting already 1873, Fagersta Stainless belongs to one of the world leading producers of stainless wire rod and wire. With customized chemistries the products fulfill everything from simple to high demanding applications.

STANDARD STEEL GRADES FOR SPRINGS

Our grades have tight chemistries and therefore equal properties from delivery to delivery.
We recommend following of our standard grades:

OPTIMUM WIRE ROD FOR SPRINGS

To get best possible properties for spring wire rod, these parameters are important:

- Tight chemistry for identical properties
- Mechanical properties and deformation hardening
- Corrosion properties
- Surfaces
- Dimension tolerances

Grade family	Marcegaglia name	Fagersta	EN	ASTM		PRE	CWH	Typical chemical composition, % by mass					
				TYPE	UNS			C	Cr	Ni	Mo	N	Others
A	321/4541	R359.10	1.4541	321	S32100	19	103	0.03	17.8	9.2	-	-	Ti
A	302/4310	R320.17	1.4310	302H	S30200	20	130	0.07	18.35	8.1	-	0.04	-
A	316/4401	R420.18	1.4401	316	S31600	24	102	0.05	16.8	10.7	2.1	-	-
PH	17–7PH	R560.21	1.4568	631	S17700	18	150	0.08	16.5	7.65	-	-	Al

Grade families: A = austenitic, PH = precipitation hardening

MECHANICAL PROPERTIES AND DEFORMATION HARDENING

Depending on end-product's shape and required tensile strength, the wire rod should have specific ductility (formability) for the cold heading process and specific level of deformation hardening. Following methods of measurement are used regarding deformation hardening:

- **CWH-factor** "Cold Work Hardening Factor", a matrix consisting of C, Cr and Ni contents. The factor varies between 80 – 150 and increases with increasing deformation hardening in the steel.
- **Md30**: the temperature (°C) at which 30% true elongation (about 25% area reduction) makes 50% of the austenitic phase transform to deformation martensite. A higher temperature means higher deformation hardening in the steel.

CORROSION

PRE (Pitting Resistance Equivalent = Cr + 3.1 x Mo + 25 x N) is a factor comparing properties of different chemistries with regards to pitting and crevice corrosion in corrosive environments. A higher value means better resistance. In the table above, PRE is shown for the grades we recommend for springs.

SURFACES

- Direct cooling (DK) ASTM 10-13
- "In line"-annealing (DST) ASTM 5-8
- Pit furnace (SG) ASTM 3-6

Our standard procedure is to supply the wire rod in pickled condition.

DIMENSIONS

Standard: 5 – 18 mm (.197" - .709") in increments of 0.5 mm (.020")
(MOQ:s for some dimensions)
Tolerance: 5.0 – 10.0 +/-0.15
>10.0 – 18.0 +/-0.20
Ovality: max 60% of the total tolerance span
Surface classes: Class 3 is the standard class which has a max defect depth of 0.10 mm for dimensions ≤ 10 mm and 1% of the diameter for dimensions > 10 mm. Welding rod has class 2 (max 0.20).

PACKAGING METHODS

Coil weight: appr. 1000 kg - **Outer diameter**: max 1250 mm - **Inner diameter**: max 950 mm

WIRE ROD IN DUPLEX

Thanks to a company history starting already 1873, Fagersta Stainless belongs to one of the world leading producers of stainless wire rod and wire. With customized chemistries the products fulfill everything from simple to high demanding applications.

OUR DUPLEX STEEL GRADES

We offer a wide range of Duplex grades for many different applications i.e. cold heading, welding and bright wire for general applications. Our grades have tight chemistries and therefore equal properties from delivery to delivery.

CHARACTERISTIC PROPERTIES FOR DUPLEX STEEL

Duplex steel is often characterized by:

- Good corrosion properties
- Good mechanical properties
- Good fatigue properties
- High resistance against abrasion
- Good welding properties

Grade family	Marcegaglia name	Fagersta	EN	ASTM		PRE	Typical chemical composition, % by mass					
				TYPE / AWS	UNS		C	Cr	Ni	Mo	N	Others
D	2101/4162	R 617.10	1.4162	2101	-	28	0.030	21.50	1.50	0.30	0.220	0.7 Si 5.0Mn
D	2304/4362	R 630.21	1.4362	2304	-	26	0.015	22.50	4.70	0.25	0.110	0.45Si 0.95 Mn
D	2209/4662	R 646.21	1.4662	2209	-	37	0.01	23.00	8.75	3.15	0.160	Al
D	2205/4462	R 647.70	1.4462	2205	-	37	0.017	22.20	5.20	3.20	0.180	Al
D	312	R 656.70	-	312 / 29-9	-	32	0.100	30.35	9.20	-	0.055	Al

MECHANICAL PROPERTIES AND DEFORMATION HARDENING

Depending on end-product's shape and required tensile strength, the wire rod should have specific ductility (formability) for the cold heading process and specific level of deformation hardening.
Following methods of measurement are used regarding deformation hardening:

- **CWH-Factor** "Cold Work Hardening Factor", a matrix consisting of C, Cr and Ni contents. The factor varies between 80 – 150 and increases with increasing deformation hardening in the steel.
- **Md30**: the temperature (°C) at which 30% true elongation (about 25% area reduction) makes 50% of the austenitic phase transform to deformation martensite. A higher temperature means higher deformation hardening in the steel.

CORROSION

PRE (Pitting Resistance Equivalent = Cr + 3.1 x Mo + 25 x N) is a factor comparing properties of different chemistries with regards to pitting and crevice corrosion in corrosive environments. A higher value means better resistance. In the table above, PRE is shown for the grades we recommend for our Duplex grades.

SURFACES

- Direct cooling (DK) ASTM 10-13
- "In line"-annealing (DST) ASTM 5-8
- Pit furnace (SG) ASTM 3-6

Our standard procedure is to supply the wire rod in pickled condition.

DIMENSIONS

Standard: 5 – 18 mm (.197" - .709") in increments of 0.5 mm (.020").
(MOQ:s for some dimensions)
Tolerance: 5.0 – 10.0 +/-0.15
>10.0 – 18.0 +/-0.20
Ovality: max 60% of the total tolerance span
Surface classes: Class 3 is the standard class which has a max defect depth of 0.10 mm for dimensions ≤ 10 mm and 1% of the diameter for dimensions > 10 mm. Welding rod has class 2 (max 0.20).

PACKAGING METHODS

Coil weight: appr. 1000 kg - **Outer diameter**: max 1250 mm - **Inner diameter**: max 950 mm

BRIGHT FORMING WIRE

Thanks to a company history starting already in 1873, Fagersta Stainless is one of the world leading producers of stainless steel wire rod and wire. With customized chemistries, the products fulfill everything from simple to high demanding applications.

WHAT CAN WE OFFER?

Services:
- Material directly from stock
- Optimal packaging solutions to secure the wire quality and safe handling

Product properties:
- Tight chemistry to ensure product consistency
- Bright surfaces with high end surface smoothness
- High performance corrosion resistance
- Consistent and narrow mechanical properties and deformation hardening
- Optimal straightening and bending propertie

Grade	Fagersta article	Dimension	Tolerance	Tensile Strength range	Packing Methods
304	DF100178	2.50	+0/-0.03	800-1000	Coil 250 kg
304	DF100174	3.00	+0/-0.03	750-950	Coil 500 kg
304	DF100184	3.50	+0/-0.03	750-950	Bobbin 500 kg
304	DF100175	4.00	+0/-0.03	800-1000	Bobbin 500 kg
304	DF013319	4.00	+0/-0.03	800-1000	Compact Coil 1000 kg
304	DF100197	5.00	+0/-0.03	750-950	Compact Coil 1000 kg
304	DF011876	6.00	+0/-0.03	850-1100	Compact Coil 1000 kg
304	DF100189	7.00	+0/-0.03	850-1100	Compact Coil 1000 kg
304	DF100185	8.00	+0/-0.03	700-900	Compact Coil 500 kg
304	DF013046	10.00	+0/-0.03	750-900	Coil 1000 kg
304	DF014118	12.00	+0/-0.04	700-900	Coil 1000 kg
316L	DF100168	2.00	+0/-0.03	800-1000	Coil 250 kg
316L	DF100186	2.50	+0/-0.03	800-1000	Coil 250 kg
316L	DF100147	3.00	+0/-0.03	800-1000	Coil 250 kg
316L	DF100195	3.50	+0/-0.03	800-1000	Coil 1000 kg
316L	DF014531	4.00	+0/-0.03	750-950	Bobbin 500 kg
316L	DF013363	4.00	+0/-0.03	750-950	Compact Coil 1000 kg
316L	DF011602	5.00	+0/-0.03	750-950	Compact Coil 1000 kg
316L	DF100151	6.00	+0/-0.03	750-950	Compact Coil 1000 kg
316L	DF100193	7.00	+0/-0.03	750-950	Compact Coil 500 kg

STOCK

Due to a close cooperation with our meltshop, we have the possibility to offer customized chemistries on top of the grades we have in our standard range.
Fagersta Stainless produces bright forming wire in a large number of austenitic, ferritic and Duplex stainless steel grades, which makes it possible for us to supply material for applications in various environments.
We stock bright forming wire with dimensions of 1.50-12.00 mm.

MECHANICAL PROPERTIES

Our standard is to supply bright forming wire with a tensile strength of 750-1,100 N/mm^2.
By choosing a specific grade and how we process it in production, we can adjust the mechanical properties according to the customers wishes and therefore offer other intervals of tensile strength.
Tensile strength:
Customized levels
Max 40 N/mm^2 variation within a coil
Max 100 N/mm^2 variation from delivery to delivery
Yield strength: With customized chemistries we can control yield strength in relation to tensile strength.

CORROSION

PRE (Pitting Resistance Equivalent = Cr + 3.1 x Mo + 25 x N) is a factor comparing properties of different chemistries with regards to pitting and crevice corrosion in corrosive environments. A higher value means better resistance. In the table above, PRE is shown for the grades we recommend for bright forming wire. Surface smoothness is also an important factor to prevent corrosion.

BRIGHT SURFACES

Products made from bright forming wire are often used in environments where there are high demands with regards to hygiene and aesthetical properties. It is therefore important that the surfaces are bright and free from defects, which also gives an optimum result at the electro-polishing process. We have developed our own various bright drawing methods which makes it possible for us to offer everything from standard to high demanding surfaces:

- FAGERSTA Bright forming wire from stock
- FAGERSTA Royal, at request with higher tensile properties

DIMENSIONS

Standard: 1.50-12.00 mm (.059" - .472")
Tolerance: h9 according to EN 10278 1.50 - 3.00 + 0 / - 0.025
3.01 - 6.00 + 0 / - 0.030
6.01 - 12.00 + 0 / - 0.036
Ovality: max 50% of the total tolerance span

MAIN BRIGHT FORMING WIRE GRADES

Grade family	Marcegaglia name	Fagersta	EN	ASTM TYPE	PRE	CWH	Typical chemical composition, % by mass					
							C	Cr	Ni	Mo	N	Others
Austenitic	304/4301	R350.19	1.4301	304	18	108	0.04	18.1	8.1	-	-	-
Austenitic	316L/4404	R425.10	1.4404	316L	24	92	0.02	17	10.1	2.1	-	-

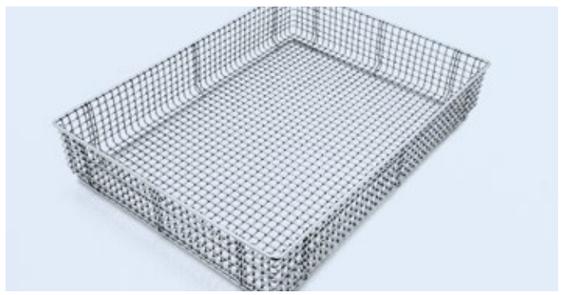
Other grades available on request, read more from leaflet on Fagersta standard steel grades.

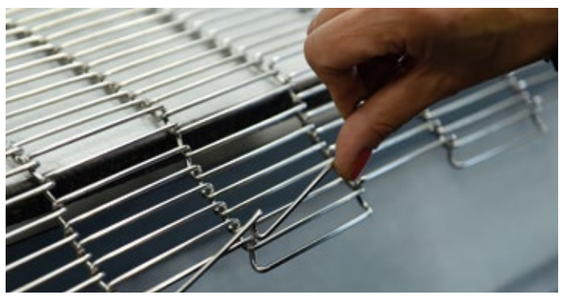
BRIGHT FORMING APPLICATIONS

Products made from stainless steel bright forming wire are often used in environments where there are high demands with regards to hygiene and aesthetical properties. It is therefore important that the surfaces are bright and free from defects.

Industries with bright forming applications indlue automotive, aerospace, medical devices, electronics and electrical components, construction, jewelry, marine, food and beverage.

Fagersta Stainless has developed its own bright drawing methods which makes it possible to offer customers everything from standard to high demanding surfaces.





COLD HEADING WIRE

Thanks to a company history starting already 1873, Fagersta Stainless belongs to one of the world leading producers of stainless wire rod and wire. With customized chemistries the products fulfill everything from simple to high demanding applications.

IMPORTANT PROPERTIES FOR COLD HEADING

To get best possible properties for cold heading, these parameters are important:

- Tight chemistry for identical properties
- Mechanical properties and deformation hardening
- Corrosion properties
- Surfaces and lubricants
- Dimension tolerances

STANDARD STEEL GRADES FOR COLD HEADING

Due to a close cooperation with our meltshop, we have the possibility to offer customized chemistries on top of the grades we have in our standard range. Our grades have tight chemistries and low slag concentrations and therefore equal properties from delivery to delivery. We recommend following standard grades:

Grade family	Marcegaglia name	Fagersta	EN	ASTM		PRE	CWH	Typical chemical composition, % by mass					
				TYPE	UNS			C	Cr	Ni	Mo	N	Others
F	409/4512	R108.10	-	409CB	-	11	-	0.03	11.3	-	-	-	Nb
F	409Ti/4512	R109.11	1.4512	409TI	-	11	-	0.015	11.3	-	-	-	-
F	430/4016	R250.11	1.4016	430	S43000	16	-	0.015	16.4	-	-	-	-
F	430L/4016	R258.10	18 LNB	-	–	18	-	0.01	18.2	-	-	-	Cu
A	304L/4306	R350.11	1.4306	304L	S30403	18	-	0.02	18.3	10.3	-	-	-
A	304/4301	R350.19	1.4301	304	S30400	18	-	0.03	18.2	8.2	-	-	-
A	304L/4307	R350.43	1.4307	304L	S30403	20	-	0.015	18.3	8.6	-	-	-
A	305/4303	R390.21	1.4303	305	S30500	20	-	0.01	17.7	11.2	-	-	-
A	316L/4404	R425.10	1.4404	316L	S31603	24	-	0.015	16.8	11.2	2.1	-	-
A	316L/4436	R440.10	1.4436	316	S31600	25	-	0.02	16.8	11.6	2.6	-	-
A	316Cu/4578	R545.11	1.4578	316Cu	-	24	-	0.02	17	10.8	2.2	-	Cu
PH	Alloy 286/4980	R569.10	1.4980	A–286	S66286	18	-	0.05	14.6	24.7	1.2	-	Al, Ti
PH	Alloy 286/4980	R569.60	1.4980	A–286	S66286	18	-	0.05	14.6	24.7	1.2	-	Al, Ti
A	304Cu/4567	R575.21	1.4567	304Cu	S30430	19	-	0.01	17.9	9.7	-	-	Cu

Grade families: F = ferritic, A = austenitic, PH = precipitation hardening

MECHANICAL PROPERTIES

We can control mechanical properties by choosing a specific grade and how we process it in production:
Tensile strength: Customized levels
Max 40 N/mm² variation within a coil - Max 100 N/mm² variation from delivery to delivery
Elongation: With customized chemistries we can control elongation in relation to tensile strength.

CORROSION

PRE (Pitting Resistance Equivalent = Cr + 3.1 x Mo + 25 x N) is a factor comparing properties of different chemistries with regards to pitting and crevice corrosion in corrosive environments. A higher value means better resistance. In the table above, PRE is shown for the grades we recommend for cold heading.

SURFACES AND LUBRICANTS

Different end treatments of wire rod combined with various processes during the drawing operations, we can reach the surface smoothness needed for different applications. With our collection of lubricants we can adjust the wire to the customers requirements regarding tool wear, product geometries etc:

Stearate:	• FAGERSTA XFK-coating	Na and K based
	• FAGERSTA XFT-coating	Synthetic
	• FAGERSTA XFN-coating	Na based
	• FAGERSTA XF-coating	Synthetic and Ca based
Oil / Grease:	• FAGERSTA XFO-coating	Oil
	• FAGERSTA XFH-coating	Grease
Metal:	• FAGERSTA Cu-coating	Copper
	• FAGERSTA Ni-coating	Nickel

DIMENSIONS

Standard: 1.50-16.00 mm (.059" - .630")
Tolerance: h9 according to EN 10278
1.50 - 3.00 + 0 / - 0.025
3.01 - 6.00 + 0 / - 0.030
6.01 - 10.00 + 0 / - 0.036
10.01 – 16.00 + 0 / - 0.043
Ovality: max 50% of the total tolerance span

PACKAGING METHODS

The wire is supplied in various packagings depending on the needs of the customer.
See separate leaflet.

VECTOR® SPOKE WIRE

Thanks to a company history starting already 1873, Fagersta Stainless belongs to one of the world leading producers of stainless wire rod and wire. With customized chemistries the products fulfill everything from simple to high demanding applications.

IMPORTANT PROPERTIES FOR SPOKE WIRE

After decades of close cooperation with our customers, we have developed spoke wire that fulfills the high requirements on the products properties:

- Tight chemistry which will ensure an excellent product consistency
- Consistent mechanical properties and well-defined deformation hardening
- Corrosion properties
- Surface conditions
- Dimension and tolerance

STANDARD STEEL GRADES FOR SPOKE WIRE

We recommend following standard grades:

EN	TYPE / AWS	Fagersta	C %	Si %	Mn %	Cr %	Ni %	Mo %	N %	TS N/mm² (ksi)	CWH	Md30 Nohara	PRE
1.4301	304	R 350.19	0.030	0.40	1.50	18.20	8.20	0.60	0.050	900-1200	108	9	20
1.4310	302	R 300.20	0.052	0.45	1.20	17.40	8.25	0.60	0.050	900-1200	128	4	19

Other grades can be offered on demand

VECTOR® SPOKE WIRE

Our high-end spoke wire for racing and downhill bicycles. Vector® is our austenitic spoke wire collection. It is often used for top bike racing, triathlons, downhill racing and e-bikes. The reason for this is the unique forming properties which make it possible to reduce the center section of the spoke and therefore lower the weight, increase the strength, and fatigue resistance as well as flexibility. After reduction, the center section can also be pressed in a mold to form shapes that will improve aerodynamics. It is within this collection you can find one of the world's best spoke wires.
Our research has proven that a better adjusted chemistry will improve fatigue properties. Our A1 and A2 therefore have up to 25% better fatigue properties compared to standard 304 material.

	EN	TYPE	Fagersta	C %	Si %	Mn %	Cr %	Ni %	Mo %	N %	TS N/mm² (ksi)	CWH	Md30 Nohara	PRE
VECTOR® A1	1.4310	302	R 300.20	0.052	0.45	1.20	17.40	8.25	0.60	0.050	850-1300 (123-189)	128	4	19
VECTOR® A2	1.4310	302Mo	R 300.38	0.1	1.4	1.6	17.2	8.2	0.7	0.03	1300-1500 (189-218)	139	-31	20

PRE = Cr + 3.1 * Mo + 25 * N

MECHANICAL PROPERTIES

We can control mechanical properties and surface conditions by choosing a specific grade and how we process it in production:

- **Tensile strength**: high tensile strength is needed. We supply in customized levels from 850-1500 N/mm2 (123-218 ksi).
- **Forming properties**: this is important in order to be able to reduce the spoke diameter in the middle section which will save weight, increase strength,flexibility and fatigue resistance. Straightening, bending and threading properties are also important basic requirements in order to make any type of spoke wire.
- **Elongation**: By testing and calculating Md30 we can control elongation in relation to tensile strengt.

CORROSION

PRE (= Pitting Resistance Equivalent = Cr + 3.1 x Mo + 25 x N) is a factor comparing properties of different chemistries with regards to pitting and crevice corrosion in corrosive environments. A higher value means better resistance. In the table above, PRE is shown for the grades we recommend for spoke wire. Surface smoothness is also an important factor to prevent corrosion.

BRIGHT SURFACES

Spoke wire is often used in environments where there are high demands with regards to aesthetical properties. It is therefore important that the surfaces are bright and free from defects. We have developed our own various bright drawing methods which makes it possible for us to offer everything from standard to high demanding surfaces:

- FAGERSTA Vector®
- FAGERSTA Royal at request with higher mechanical properties

DIMENSIONS

Standard: 1.50-5.00 mm (.059" - .197")
Tolerance: h9 according to EN 10278
1.50 - 3.00 + 0 / - 0.025
3.01 - 5.00 + 0 / - 0.030
Ovality: max 50% of the total tolerance span

PACKAGING METHODS

The wire is supplied in various packaging depending on the needs of the customer.
See separate leaflet.

Fagersta Stainless standard range of grades

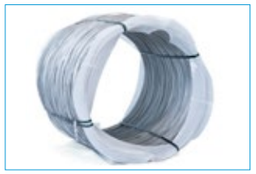
GRADE FAMILY	MARCEGAGLIA NAME	FAS	EN	ASTM TYPE	ASTM UNS	PRE	CWH	C	CR	NI	MO	N	OTHERS	COLD HEADING	SPRINGS	WELDING	HIGH TEMPER.	BRIGHT FORMING	SPOKES
FERRITIC	409/4512	R10810	-	409CB	-	11	-	0.03	11.30	0.35	-	-	Nb	x		x	x		
	409Ti/4512	R10911	1.4512	409TI	-	11	-	0.02	11.30	-	-	-	-	x		x	x		
	430/4016	R25011	1.4016	430	S43000	16	-	0.02	16.40	-	-	-	-	x				x	
	430LNb	R25810	18 LNB	430Nb	-	18	-	0.01	18.20	-	-	-	Nb	x		x			
	430NbTi/4016	R25813	18 LNbTi	-	-	18	-	0.015	18.20	-	-	-	Ti, Nb			x			
	446	R27070	-	446	-	26	-	0.05	23.90	-	-	0.08	-					x	
AUSTENITIC	302/4310	R30020	1.4310	302	-	19	128	0.052	17.40	8.25	0.60*	0.05	0.45Si 1.2Mn					x	x
	302/4310	R30031	1.4310	302	-	19	139	0.10	17.30	8.20	0.60*	0.03	0.9Si 1.25Mn					x	
	302/4310/304H/4948	R32017	1.4310 / 1.4948	302 / 304H	S30200	20	130	0.07	18.35	8.10	-	0.04	-		x			x	
	4828	R32310	1.4828	-	-	-	-	0.045	19.30	11.70	-	0.03	Si				x	x	
	4835	R32710	1.4835	-	S30815	26	-	0.08	21.00	10.20	-	0.16	REM				x	x	
	304L/4306	R35011	1.4306	304L	S30403	18	-	0.02	18.30	10.30	-	-	-	x					
	304/4301	R35019	1.4301	304	S30400	18	108	0.03	18.20	8.20	-	-	-	x				x	x
	304L/4307	R35020	1.4307	304L		20	90	0.02	18.50	9.75	0.60*	0.03*	0.45Si 1.2Mn					x	
	304L/4307	R35043	1.4307	304L	S30403	20	93	0.02	18.30	8.60	-	-	-	x				x	
	4551	R35816	1.4551/19 9 NbSi	347Si	S34788	21	-	0.04	19.40	9.80	-	0.04	Nb			x			
	347H/4550/4551	R35822	19 9 Nb	347 / 347H	-	20	-	0.05	19.60	9.20	-	0.03	Nb			x			
	321/4541	R35910	1.4541	321	S32100	19	-	0.03	17.80	9.20	-	-	Ti		x				
	308L/4316	R36610	1.4316/19 9 L	308L	S30883	21	-	0.01	19.70	10.20	-	0.05	S			x			
	308LSi/4316	R36672	1.4316/19 9 Lsi	308L	S30888	21	-	0.02	19.85	10.35	-	0.07	S			x			
	303/4305	R38030	1.4305	303	-	19	132	0.06	17.20	8.10	-	0.04	S					x	
	305/4303	R39021	1.4303	305	S30500	20	91	0.01	17.70	11.20	-	0.03*	-	x				x	
	316/4401	R42018	1.4401	316	S31600	24	-	0.05	16.80	10.70	2.10	-	-		x				
	316L/4404	R42510	1.4404	316L	S31603	24	-	0.02	16.80	11.20	2.10	-	-	x				x	
	316L/4404	R42520	1.4404	316L	-	24	95	0.02	16.70	10.10	2.07	-	-					x	
	316Ti/4571	R42915	1.4571	316Ti	-	24	94	0.01	16.60	10.60	2.10	0.03*	Ti					x	
	316L/4436	R44010	1.4436	316	S31600	26	-	0.02	16.80	11.60	2.60	0.05*	0.5Si 1.55Mn	x				x	
	318/4576	R44811	1.4576/19 12 3 Nb	318	-	29	-	0.04	19.30	11.60	2.60	0.04	S			x			
	318Si/4576	R44812	19 12 3 NbSi	-	-	28	-	0.04	18.90	11.80	2.70	0.05	S			x			
	316L/4430	R46610	19 12 3 L	316L	-	28	-	0.01	18.30	12.20	2.60	0.04	S			x			
	316LSi/4430	R46620	1.4430/19 12 3 LSi	316LSi	S31688	28	-	0.01	18.30	11.80	2.60	0.04	-			x			
	317L	R47625	18 15 3 L	317L	-	31	-	0.01	18.80	13.70	3.60	0.05	S			x			
	16–8–2	R51630	16 8 2	-	-	20	-	0.05	15.50	8.50	1.20	0.04	-			x			
	204Cu/4597	R52510	1.4597	204Cu	-	22	-	0.05	16.30	1.80	0.30*	0.20	Mn					x	
	307L	R52610	18 8 Mn	307	-	17	-	0.04	17.30	7.80	-	-	-			x			
	307Si	R52670	18 8 SiMn	307	-	18	-	0.08	18.20	8.00	-	-	S			x			
	316Cu/4578	R54511	1.4578	316Cu	-	24	-	0.02	17.00	10.80	2.20	-	Cu	x					
	304Cu/4567	R57521	1.4567	304Cu	S30430	19	-	0.01	17.90	9.70	-	-	Cu	x					
	304Cu/4567	R57531	1.4567	304Cu	S30430	19	-	0.01	17.50	9.10	-	-	Si, Mn, Cu	x					
	304Cu/4567	R57541	1.4567	304Cu	S30430	19	-	0.01	17.20	8.70	-	-	Si, Mn, Cu	x					
	309L/4332	R80620	1.4332/23 12 L	309L	S30983	25	-	0.01	23.50	13.70	-	0.08	S			x			
	309LSi/4332	R80624	1.4332/23 12 L Si	309L	S30988	25	-	0.02	23.30	13.80	-	0.12	S			x			
	309LSi/4332	R80642	1.4332/23 12 L Si	309L	S30988	25	-	0.02	23.50	13.60	-	0.08	-			x			
	309LNb4332	R80645	23 12 L Nb	309LNb	-	25	-	0.01	23.90	12.60	-	0.04	Al, Nb			x			
	309Si/4332	R80672	22 12 H	-	-	23	-	0.09	23.30	12.75	-	0.06	-			x			
	309LMo/4459	R81610	23 12 2 L	-	-	31	-	0.01	21.45	15.00	2.70	0.06	-			x			
	310S/4845	R82010	1.4845	310S	S31008	26	-	0.05	24.70	19.40	-	-	-				x	x	
	314/4841	R82311	-	314	S31400		-	0.03	23.50	19.40	0.60	0.06*	2.7Si 1.75 Mn				x	x	
	314/4841	R82313	1.4841	314	S31400	26	-	0.01	24.30	20.70	-	-	Si				x	x	
	310S/4845	R82670	25 20	310	-	26	-	0.12	25.90	20.80	-	-	-			x	x		
	904L	R84070	20 25 5 C L / 1.4539	904L	N08904	36	-	0.01	20.00	25.00	4.50	0.05	Cu			x	x		
	330/4886	R86013	1.4886	330	N08330	-	-	0.01	18.50	34.50	-	-	-				x	x	
	330Nb	R86811	1.4864	Type 330Cb	N08330	-	-	0.02	19.50	34.50	-	-	Nb				x	x	
	Alloy 825	R90610	-	Alloy 825	-	33	-	0.01	22.30	42.90	3.20	-	Cu, Ti			x			
DUPLEX	2101/4162	R61710	1.4162	2101	-	28	-	0.03	21.50	1.50	0.30	0.22	0.7 Si 5.0Mn Cu					x	
	2304/4362	R63021	1.4362	2304	-	26	-	0.015	22.50	4.70	0.25	0.11	0.45Si 0.95 Mn					x	
	2209	R64621	22 9 3 N L	2209	S39209	35	-	0.01	23.00	8.75	3.15	0.16	Al			x			
	2507	R64777	1.4410	-	-	42	-	0.02*	25.00	6.60	3.80	0.28	-					x	
	2205	R64721	1.4462	-	-	35	-	0.02	22.30	5.20	3.20	0.18	-					x	
	2594	R64773	25 9 4 NL	2594	-	42	-	0.01	25.10	9.50	4.00	0.25	Al			x			
	2307	R65620	23 7 NL	2307	-	27	-	0.01	23.50	7.70	-	0.14	-			x			
	2504	R65630	25 4	-	-	26	-	0.07	25.30	4.50	-	-	-			x			
	312	R65670	29 9	312 / 29-9	-	32	-	0.10	30.35	9.20	-	0.055	Al			x			
PRECIPIT. HARDE-NING	17–7PH	R56021	1.4568	631	S17700	17	-	0.08	16.50	7.65	-	-	Al		x			x	
	Alloy 286/4980 air melted	R56910	1.4980	A–286	S66286	18	-	0.05	14.60	24.70	1.20	-	Al, Ti, V	x					
	Alloy 286/4980 VAR	R56960	1.4980	A–286	S66286	18	-	0.05	14.60	24.70	1.20	-	Al, Ti, V	x			x		

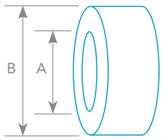
Customized chemistries on demand. (*Max)

PACKAGING METHODS

Thanks to a company history starting already 1873, Fagersta Stainless belongs to one of the world leading producers of stainless wire rod and wire. With customized chemistries the products fulfill everything from simple to high demanding applications.
For more information see our product leaflets or visit our web site.

COIL

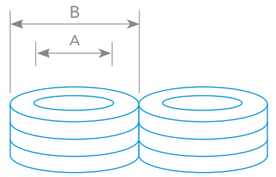




WIRE ROD	
A (mm)	950
B (mm)	1250
Weight (kg)	1000

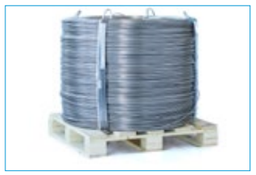
Transportation bag as an extra option.

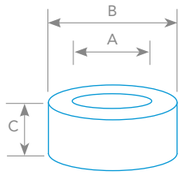
COIL ON A PALLET



WIRE		
A (mm)	450	900
B (mm)	600 - 750	1300
Weight (kg)	250 x 2 coils	1000
Pallet (mm)	800 x 800 x 100 OR 1200 x 800 x100	1150x1150x100

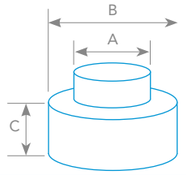
COMPACT COIL ON A PALLET





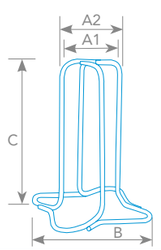
WIRE				
A (mm)	540	600	475	800
B (mm)	750 / 800	800 / 850	780	1000
C (mm)	400 / 600	400 / 610	300 / 600	500
Weight (kg)	500 / 1000	500 / 1000	500 / 1000	1000
Pallet (mm)	800 x 800 x 100			1150x1150x100

COIL WITH BOBBIN



WIRE	
A (mm)	450
B (mm)	800
C (mm)	500 / 1000
Weight (kg)	500 / 1000
Pallet (mm)	800 x 800 x 100

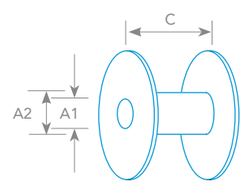
COIL WITH TUBE CARRIER



WIRE							
	S 800	S 1500	M 800	M 1200	L 800	XL 650	XL 1200
A1 (mm)	380	380	540	530	620	770	760
A2 (mm)	450	450	610	600	690	850	830
B (mm)	920	920	1040	1040	1120	1460	1460
C (mm)	800	1520	770	1200	820	710	1200
Weight (kg)	1000	1000	1000	1000	1000	1000	1000
Pallet (mm)	800 x 800 x 100		1150 x 1150 x 100				

Tube carriers available at special request.

SPOOL



WIRE			
	Spool 17	Spool 800	Spool 67
A1 (mm)	32	80	42
A2 (mm)	406	406	406
B (mm)	750	800	760
C (mm)	285	500	360
Weight (kg)	300	800	500
Tare (kg)	38	130	47

Spools available at special request.

MARCEGAGLIA STAINLESS RICHBURG

STAINLESS STEEL BARS

Marcegaglia Stainless Richburg Stainless Steel Bars

Marcegaglia produces high-performance stainless steel bars in an industry-leading variety of grades and shapes.

Our end-to-end approach, from melting to testing, means that we can offer a full range of long products with industry-leading consistency, delivery performance, and technical support.

Marcegaglia high-performance stainless steel bars are produced in an extremely wide selection of grades, including our Prodec range for superior machinability. We have long-term partnerships with service centers that operate in several end-use segments: chemical, oil & gas, automotive, aerospace to name a few.

We are proud to serve you with superior communication and technical expertise. We're here to support you all the way from materials selection to end use, helping you to get the best result possible from our stainless steels.

Key benefits

- Product quality and broad offering
- Delivery reliability
- Technical expertise
- Easy to deal with

Our mill

Richburg Stainless Bar is well known for its high quality Prodec bars and technical expertise. The unit was established in 1994 and produces bars in premium commodity and special grades. Bars are produced from billets made in the Marcegaglia meltshop in the UK and hot rolled at several facilities. Marcegaglia Richburg produces quality cold finished bars from ¼ inch to 15 inches.

Contact sales at
sales.richburg@marcegaglia.com
www.richburg.marcegaglia.com

BAR PROGRAM

Items shown are produced regularly for quick delivery from stock or within competitive industry lead-times.
Please call a Marcegaglia representative for availability.

ROUND BARS										
	303	304 L	304 H	316 L	317 L	310	321	347	253 MA	416
1/4-1 CDA	P	P	P	P	P		x	x		
9/16-1 CFA	P	P	P	P	P	x	x	x	x	x
>1-3 3/4 CFA	P	P	P	P	P	x	x	x	x	x
2-3 1/2 HRART	P	P	P	P	P	x	x	x	x	x
>3 1/2-7 HRART	P	P	P	P	P	x	x	x		x
>7-10 HRART	P	P		P						
>10-15 HRART	P	P		P						

	440 C	17-4	15-5ESR	15-5VAR	LDX 2101®	2205 +2	2507	304 HN	N60	XM-19	XM-25
1/4-1 CDA											
9/16-1 CFA		P	x	x	x				x[A]		x[A]
>1-3 3/4 CFA	x	P	x	x	x	x	x	x[B]	x[B]	x[B]	x
2-3 1/2 HRART	x	P	x	x	x	x	x	x[B]	x	x[B]	x
>3 1/2-7 HRART		P				x	x				x
>7-10 HRART											
>10-15 HRART											

P: PRODEC® Improved Machinability
A: Alloy only available down to 1/4"
CDA: Cold Drawn Annealed
B: HS available from 1 3/8" to 3 1/2"
CFA: Cold Finished Annealed
HRART: Hot Rolled Annealed Rough Turned

HEXAGONAL					
	303	304 L	316 L	321	347
1/4"-1"	x	x	x	x	x
1"-1 1/2"	x	x	x		
2 1/2"	x	x	x		

LENGTH CAPABILITIES		
1/4"-1	CDA	12' STD, 16' Max
1/2"-3 3/4"	CFA	12' STD, 24' Max
2"-3 1/2"	HRART	12' STD, 24' Max
>3 1/2"-7"	HRART	12' STD, 30' Max
>7"-15"	HRART	Inquire

OTHER VALUE FEATURES OF OUR BAR PROGRAM:

PRODEC®: For improved machinability 303, 304L, 316L and 17-4 P come standard as Prodec® Quality Material.
Complete program: Standard and special grades, in sizes from 1/4" to 15" round and 3/8" to 2 1/2" hexagonal.
Quality: Marcegaglia Bar is ISO 9001/AS9100/PED approved. Each bundle is "XRF" grade assured.
Conditions: 17-4 & 15-5 aged conditions, strain hardened austenitics, and Q&T martensitics available upon inquiry.
DFARS Compliant: All material produced is 225.7002-3B1 & 252.225.7014 compliant.
Polished surface: CD and CF products 9/16" to 3" (including hexagonal to 1").
Centerless Grinding: 1/4 - to 1/2 -standard tolerance available in 1/4" to 4" diameters.
Eddy Current testing: Standard for 303 and 416 grades. Available upon request in other grades.
Chamfering: Both ends in drawn products and one end for CF products through 1 1/16".
Defense: Offering various grades to support the firearms industry.

SPECIFICATIONS

Grade	UNS	ASTM	ASME	Federal	AMS
303	S30300	A 582	NA	NA	5640
304 / 304L	S30400 / S30403	A 276, A 479	SA-479, SA-276	QQS 763F	5639, 5647, QQS 763
316 / 316L	S31600 / S31603	A 276, A 479	SA-479, SA-276	QQS 763F	5648, 5653, QQS 763
317 / 317L	S31700 / S31703	A 276, A 479	SA-479, SA-276	QQS 763F	QQS 763
309, 309S	S30900 / S30909 / S30908	A 276, A 479	SA-479, SA-276		5650
310, 310S	S31000 / S31009 / S31008	A 276, A 479	SA-479, SA-276		5651
321 / 321H	S32100 / S32109	A 276, A 479	SA-479, SA-276		5645
347 / 347H	S34700 / S34709	A 276, A 479	SA-479, SA-276		5646
253 MA	S30815	A 276, A 479	SA-479, SA-276		
410	S41000	A 276, A 479	SA-479, SA-276	QQS 763F	5612, 5613, QQS 763
416	S41600	A 582			5610
440C	S44004	A 276		QQS 763F	QQS 763, 5630, 5880
17-4	S17400	A 564	SA-564		5643
15-5 ESR/VAR	S15500	A 564	SA-564		5659
EN lean duplex 1.4162	S32101	A 276, A 479	SA-479, SA-276		
2205	S31803 / S32205	A 276, A 479	SA-479, SA-276		
2507	S32750	A 276, A 479	SA-479, SA-276		
304HN	S30452				
N60	S21800	A 276, A 479			5848
XM-19	S20910	A 276, A 479	SA-479, SA-276		

TOLERANCES - STAINLESS STEEL BAR

Conforms to ASTM A 484						
Round Bar/Cold Finished		Round Bar/Hot Rolled and Rough Turned			Square Bar and Hexagons/Cold Finished	
Size	Tolerances	Size	Tolerances	Out of Round	Size	Tolerances
Under 5/16"	±0.001	Over 2" to 2 1/2"	+1/32-0	0.023	Under 5/16"	+.000-0.002
5/16" up to but excluding 1/2"	±0.0015	Over 2 1/2" to 3 1/2"	+3/64-0	0.035	Over 5/16" to under 1/2"	+.000-0.003
1/2" up to but excluding 1"	±0.002	Over 3 1/2" to 4 1/2"	+1/16-0	0.046	1/2" up to and including 1"	+.000-0.004
1" up to but excluding 1 1/2"	±0.0025	Over 4 1/2" to 5 1/2"	+5/64-0	0.058	Over 1" up to and including 2"	+.000-0.006
1 1/2" up to and including 3 1/4"	±0.003	Over 5 1/2" to 6 1/2"	+1/8-0	0.070	Over 2" up to and including 3"	+.000-0.008
Over 3 1/4" up to and including 4 1/2"	±0.005	Over 6 1/2" to 8"	+5/32-0	0.085	Over 3"	+.000-0.010
Over 4 1/2" up to and including 6"	±0.008	Over 8" to 12"	+3/16-0	0.094		

STRAIGHTNESS TOLERANCES FOR MACHINE-STRAIGHTENED BAR

Rough Turned	Cold Finished
1/8" in any 5'	1/16" in any 5'
but may not exceed 1/8" x $\frac{\text{length in feet}}{5}$	but may not exceed 1/16" x $\frac{\text{length in feet}}{5}$

WEIGHT FORMULAS FOR STEEL

Weight estimates per linear foot
Rounds= D^2 x 2.6729
Hexagonals= D^2 x 2.9473

Ensuring quality with end-to-end production

Marcegaglia Stainless Richburg

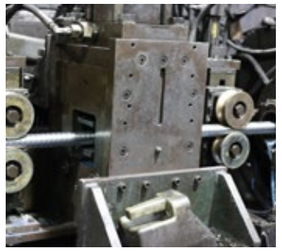
Melting shop
Consistently produced high quality semis are made at the SMACC melting shop.

Billet feedstock
Our rolling mill uses billet feedstock produced at the SMACC melting shop.

Hot rolling
Rod coil feedstock is produced at several facilities.

Bar heat treatment
Various heat treatments performed on bar to achieve the optimal material properties.

Cold drawing operation
Coil is drawn through a die, reducing the cross-sectional area of the bar.



Finishing
Peeling of bars enhances surface quality and tolerances.

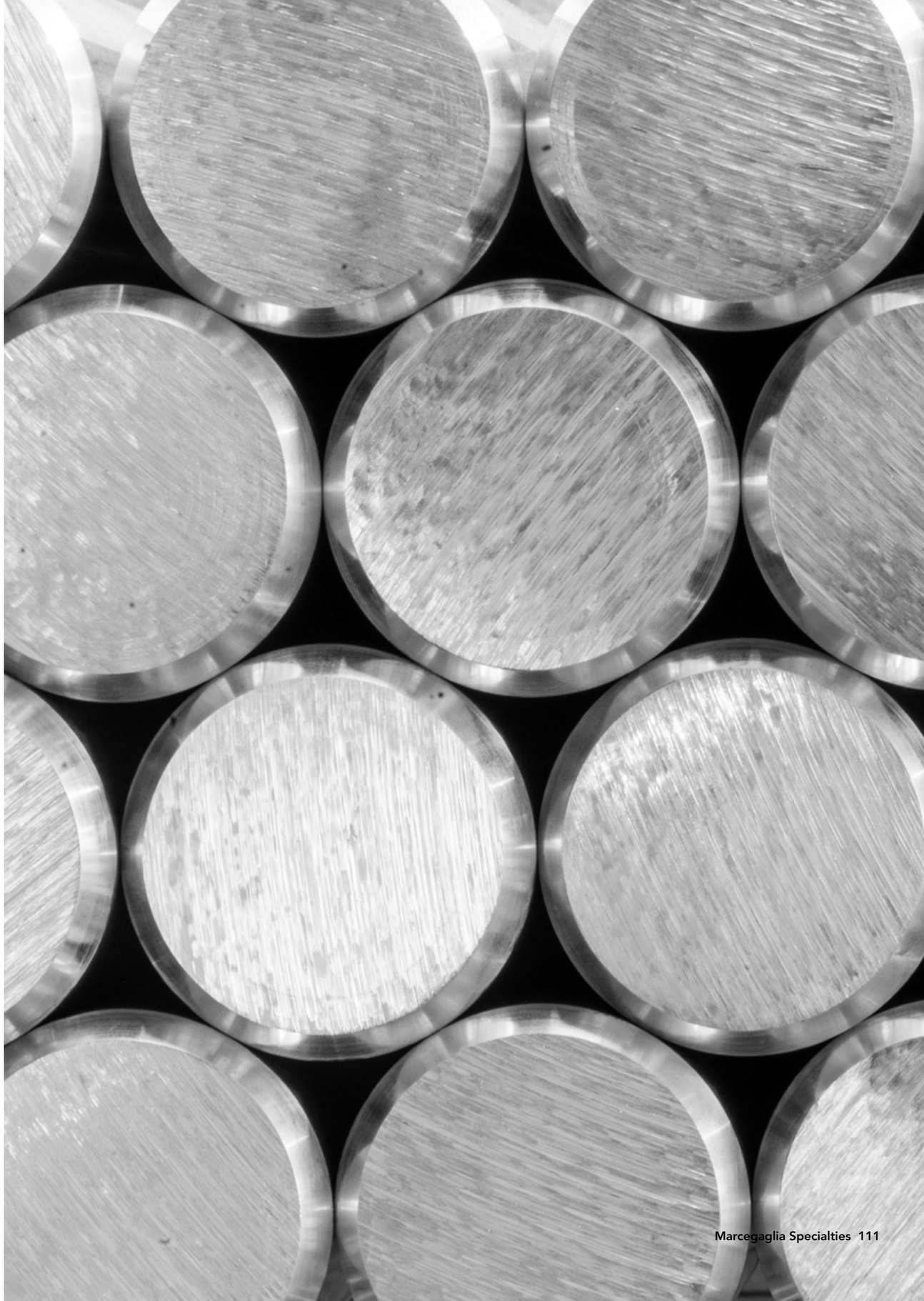
Testing
Dimensional and Eddy-Current inspection are standard.

Packing & shipping
Final process steps include inspection, packing, and shipping.

High quality according to international standards

Our manufacturing programs are supported by in-house product inspection and testing, and the extensive experience of our technical team. Richburg is accredited to recognized international standards, including:

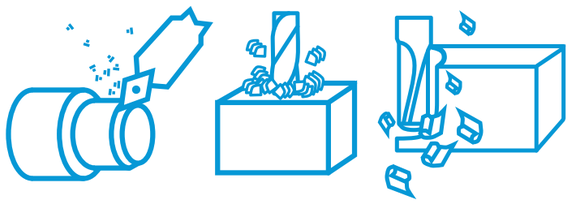
- ISO 9001
- AS9100
- PED/PER
- Each bundle is “XRF” grade assured
- DFARS compliant



Prodec® datasheet US - Stainless steel bar optimized for improved machinability

General characteristics

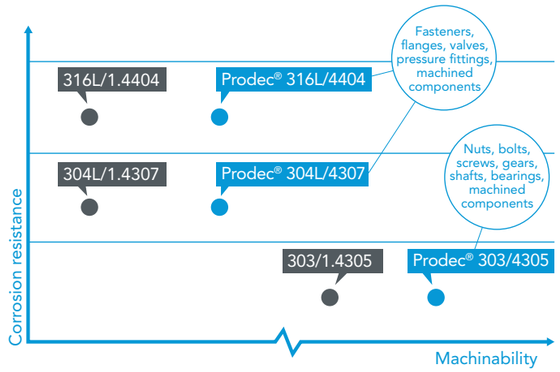
Stainless steel grades optimized for improved machinability with longer tool life and enhanced quality.



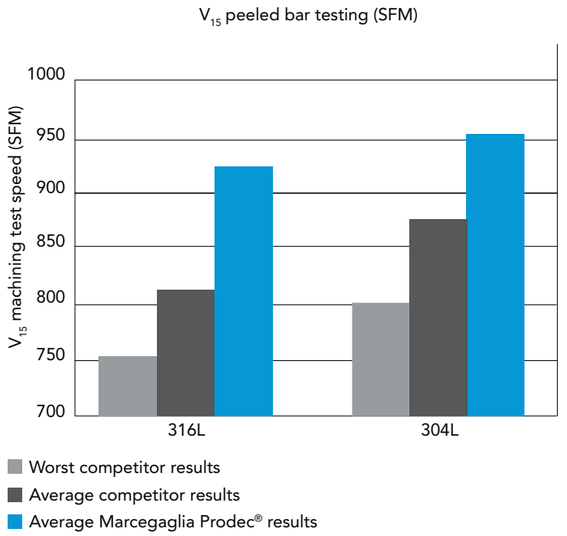
Product name	Typical applications
Prodec® 304L A version of 304L with improved machinability. Improves productivity with faster machining, longer tool life, better dimensional tolerances, superior machined surface quality, and improved yields compared to conventionally produced 304L.	• Fasteners • Flanges and valves • Pressure fittings • Machined components
Prodec® 316L A version of 316L with improved machinability. Improves productivity with faster machining, longer tool life, better dimensional tolerances, superior machined surface quality, and improved yields compared to conventionally produced 316L.	• Fasteners • Flanges and valves • Pressure fittings • Machined components
Prodec® 303 For applications that use 303. This product gives you faster machining, longer tool life, better tolerances, superior machined surface quality, and reduced scrap losses compared to conventionally produced 303.	• Nuts, bolts, and screws • Gears • Shafts • Bearings • Machined parts for process equipment
Prodec® 17-4PH A martensitic, precipitation hardening stainless steel for applications that use 17-4PH. It improves productivity with faster machining, longer tool life, better dimensional tolerances, superior machined surface quality, and improved yields when compared to conventionally produced 17-4PH.	• Fasteners • Flanges • Oil field valve equipment • Pressure fittings • Chemical process equipment • Paper mill equipment • Aircraft parts

Product performance comparison

Corrosion resistance vs machinability



Bar – faster machining with Prodec®



Testing done with Prodec® and 7 European competitors' bars with improved machinability in grades 316L and 304L. The tool used for testing was a cemented carbide insert.

Bar – cost savings with Prodec®

		Standard 316L	Prodec® 316L	Improvement	
Cutting speed	sfm	300	450	150	
Processing time/component	min	16.9	7.7		54%
Total machining cost/component	$	26.6	12.1	14.5	55%
Productivity increase	%				54%
Savings/component	$			14.5	

A cost saving example for rough turning a 6» diameter Prodec® 316L peeled bar with a cemented carbide tool.

Products and dimensions

Imperial	
Round bar	**Offering (in)**
Cold drawn	0.25–1.00
Peeled	0.50–15

Imperial	
Hexagon and square bar	**Offering (in)**
Hexagon	0.25-2.5

Typical chemical compositions

The chemical composition is given as % by mass.

Grade family	Marcegaglia name	ASTM		PRE	Typical chemical composition, % by mass					
		TYPE	UNS		C	Cr	Ni	Mo	N	Others
A	Prodec® 304L	304L	S30403	18	0.02	18.1	8.1	–	–	–
A	Prodec® 316L	316L	S31603	24	0.02	16.8	10.1	2.1	–	–
A	Prodec® 303	303	S30300	17	0.05	17.2	8.1	–	–	0.3S
PH	Prodec® 17-4PH	630	S17400	16	0.02	15.5	4.8	–	–	3.4Cu Nb

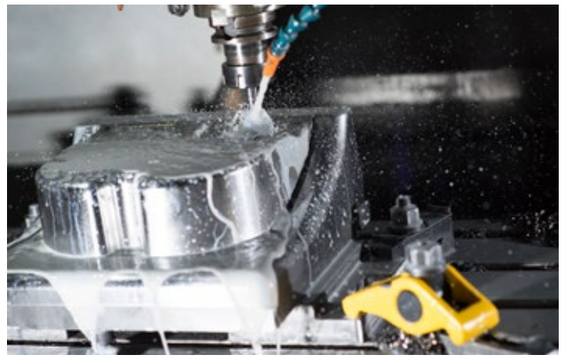
Chemical compositions and PRE calculations are based on Marcegaglia typical values.

Pitting Resistance Equivalent is calculated using the following formula:
PRE = %Cr + 3.3 x %Mo + 16 x %N

Surface finish and other factors determine the actual corrosion resistance of a particular product.

Corrosion resistance

Although improvements in machinability have been associated with reduced corrosion resistance in the past, the Prodec® treated products have shown corrosion resistance within the range typically expected from comparable stainless steel products.



Prodec® 304L is a versatile, general-purpose stainless steel with good resistance to atmospheric corrosion, many organic and inorganic chemicals, as well as foods and beverages. It has also been used in vacuum-processing equipment and specialized instruments where high integrity is essential.

Prodec® 316L provides improved resistance to pitting and crevice corrosion in environments containing chlorides and other halides.

Prodec® 303 is resistant to mildly corrosive environments. In order to achieve the best possible corrosion resistance, all Prodec® 303 parts should be chemically treated to remove sulfides from the final surface.

Prodec® 17-4PH is a precipitation hardening product with corrosion resistance similar to that of standard 304. It is used in applications where a combination of moderate corrosion performance and high strength is required.

Mechanical properties

Grade	Diameter / Round or hex size	Requirements			
		UTS (ksi)	YS (ksi)	% El (4D)	% RA
Prodec® 304L	½" and smaller	90 – 115	45 min	30 min	50 min
	Larger than ½"	75 – 115	30 min	40 min	50 min
Prodec® 316L	½" and smaller	90 – 115	45 min	30 min	50 min
	Larger than ½"	75 – 115	30 min	30 min	50 min
Prodec® 303	½" and smaller	125 max	NONE	NONE	NONE
	Larger than ½"	NONE	NONE	NONE	NONE

304L and 316L Hardness Requirement

Diameter / Round or hex size	Requirement
2" and smaller	140 – 255 HB (76-100 HRB, 22 max HRC)
Greater than 2"	0 – 255 HB (0-100 HRB, 22 max HRC)

303 Hardness Requirement

255 HB or 25 HRC max

17-4PH (Annealed Condition)

363 HB or 38 HRC max

17-4PH

Can be heat treated at several temperatures between 900F and 1150F to achieve a variety of hardness and tensile values. The grade is often machined in the annealed condition then heat treated to achieve the final properties.

Physical properties

Imperial						
Marcegaglia name	Density [lbm/in³]	Modulus of elasticity [psi]	Coefficient of thermal expansion 68-212 °F [µin/(in* °F)]	Thermal conductivity [Btu/(hr*ft* °F)]	Thermal capacity [Btu/(lbm* °F)]	Electrical resistivity [µΩ*in]
Prodec® 304L	0.285	$29 * 10^6$	8.89	8.7	0.119	28.74
Prodec® 316	0.289	$29 * 10^6$	8.89	8.7	0.119	29.53
Prodec® 303	0.285	$29 * 10^6$	8.89	8.7	0.119	28.74
Prodec® 17-4PH	0.282	$29 * 10^6$	6.06	9.2	0.119	27.95

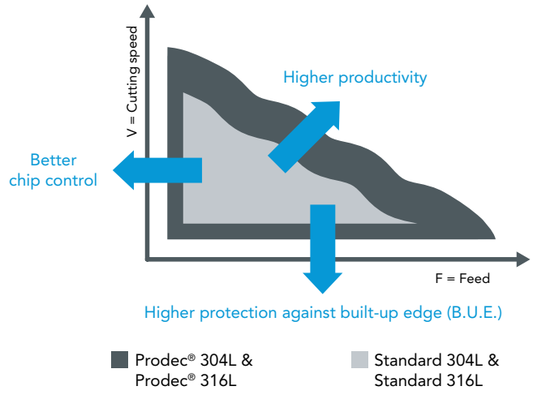
Values according to EN 10088-1.

Fabrication

Machining

Prodec® products enable higher machining speeds, longer tool life, and superior part quality with reduced total cost for finished parts.

Prodec® 304L and Prodec® 316L are special variants of standard Types 304 (UNS S30400) / 304L (UNS S30403) and 316 (UNS S31600) / 316L (UNS S31603) respectively with enhanced metallurgy for better machinability. The general rules for machining stainless steel also apply to the Prodec® grades.
The difference is that Prodec® grades enable a longer tool life and/or tougher machining conditions.
The machining window illustrated on the right gives a demonstration of this.



Machining guidelines

The cutting parameters in this guideline will work under normal cutting conditions. It is suggested to begin with cutting parameters in the ranges indicated in the tables and then to improve parameters by moving to higher or lower speed, feed or depth of cut until best performance is reached. It is possible to end up in a range somewhat outside the values indicated in the tables depending on the actual machine set-up.

Turning

- The machine and setup must be rigid
- Use shortest possible tool length
- Use coolant
- Use smallest possible nose radius to avoid vibrations

Milling

- Avoid cutting through holes/cavities
- Ensure good chip evacuation, recutting of chips may cause tool damage

Drilling – high speed steel twist drills

- Use coolant
- If possible use internal coolant through drill
- Use of cobalt high alloyed drills is preferred
- With PVD-coated HSS drills the cutting speed can be increased by 10%
- Use as short drill as possible

Machining parameters for Prodec® 304L and 316L

	Carbide Tooling			
Turning	**Grade**	**Feed (in/rev)**	**SFM**	**DoC (in)**
Finishing	M10-20	0.004	840-930	< 0.08
Medium	M10-25	0.010	650-850	0.08 - 0.2
Roughing	M20-35	0.015	150-750	0.2-0.4

	Carbide Tooling		
Milling	**Grade**	**Feed**	**SFM**
Face Milling	M10-25	0.004	485-825
Side Milling	M10-30	0.010	580-800
End Milling	M10-30	0.015	480-725

	HSS Tooling			
Drilling (HSS Cobalt Alloy)	**Diameter (in)**	**RPM**	**Feed**	**SFM**
	0.04	2850-3800	0.002	30-40
	0.12	1600-1750	0.004	50-55
	0.2	955-1050	0.005	55-65
	0.4	470-625	0.006	55-65
	0.6	350-415	0.008	55-65
	0.8	265-310	0.012	55-65
	1.2	175-210	0.012	55-65

Forming

Cold forming

Prodec® products can be readily formed and fabricated with the full range of cold forming operations. They can be used in heading, drawing, bending, and upsetting. Cold forming operations will increase the strength and hardness of the material, and may leave it slightly magnetic.

For Prodec® 17-4PH, cold forming or fabrication should be completed prior to the final solution annealing and age hardening treatments.

Hot forming

Prodec® 303, Prodec® 304L, and Prodec® 316L can be forged in the 1700–2200 °F range. For maximum corrosion resistance, forgings should be annealed at a minimum temperature of 1900 °F and then water quenched or rapidly cooled by other means after hot forming operations.

Prodec® 17-4PH should be uniformly heated to 2150–2200 °F for a minimum of one hour. It should not be forged below about 1850 °F. Forgings must be solution annealed before the final aging treatment.

Welding

Prodec® 304L is readily weldable with the full range of conventional welding methods with the exception of oxyacetylene. AWS E308/ER308 or E308L/ER308L filler metals should be used, but molybdenum-containing austenitic stainless steel filler metals may also be considered. After welding, it may be necessary to fully anneal to restore the corrosion resistance lost by sensitization to intergranular corrosion when chromium carbides were precipitated in the grain boundaries in the weld heat-affected zone (HAZ).

Prodec® 316L is readily welded with the full range of conventional welding methods with the exception of oxyacetylene. AWS E316L/ER316L and other low-carbon filler metals with a molybdenum content higher than that of the base metal should be used.

Prodec® 303 stainless steel is not recommended for applications requiring welding. When welding is necessary, AWS E312 filler metal may be considered. An alternative product for parts requiring welding is Prodec® 304L.

Prodec® 17-4PH can be satisfactorily welded with either 630 or AWS E308L/ER308L welding consumables. However, the 308L filler metal cannot be heat treated to the same mechanical properties as the base metal. The thermal cycle associated with welding can substantially alter the condition of Prodec® 17-4PH. To obtain the properties considered characteristic of Prodec® 17-4PH, the material should be solution annealed and aged after welding.

Standards and approvals

The most commonly used international product standards are given in the table below.

Standards

- ASME SA 479
- ASTM A479
- ASTM A276
- ASTM A564
- ASTM A582
- SAE AMS for various grades

Certificates and approvals

Marcegaglia Stainless Richburg meets the most common certifications and approvals:

- AD 2000 Merkblatt
- Approval of Material Manufacturers
- Factory Production Control Certificate
- ISO 9001
- ISO 14001
- Pressure Equipment Regulation (PER)
- Pressure Equipment Directive (PED)
- AS9100

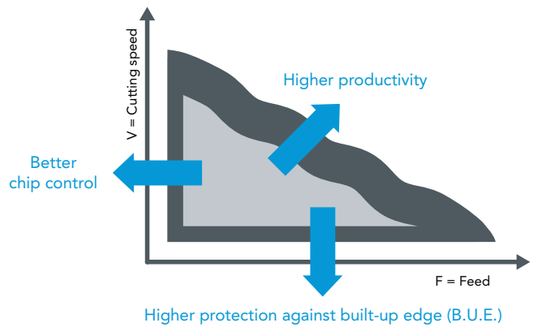
Contacts and enquiries

Contact us

Our experts are ready to help you choose the best stainless steel product for your next project.

Machining guideline for Prodec® 304L and Prodec® 316L

Prodec® 304L and Prodec® 316L are special variants of standard Types 304 (UNS S30400) / 304L (UNS S30403) and 316 (UNS S31600) / 316L (UNS S31603) respectively with enhanced metallurgy for better machinability. The general rules for machining stainless steel also apply to the Prodec® grades.
The difference is that Prodec® grades enable a longer tool life and/or tougher machining conditions.
The machining window illustrated on the right gives a demonstration of this.



Other fabrication operations such as welding, hot working and cold working can be performed in the same way as for standard 304L and 316L.

Product forms

Prodec® 304L and Prodec® 316L are available as round and hexagon bars.

Machining guidelines

The cutting parameters in this guideline will work under normal cutting conditions. It is suggested to begin with cutting parameters in the ranges indicated in the tables and then to improve parameters by moving to higher or lower speed, feed or depth of cut until best performance is reached.
It is possible to end up in a range somewhat outside the values indicated in the tables depending on the actual machine set-up.
A guide for further optimization of cutting parameters can be found under the "Troubleshooting" section on the next page.

Turning

- The machine and setup must be rigid
- Use shortest possible tool length
- Use coolant
- Use smallest possible nose radius to avoid vibrations

Milling

- Avoid cutting through holes/cavities
- Ensure good chip evacuation, recutting of chips may cause tool damage

	Carbide Tooling			
Turning	**Grade**	**Feed (in/rev)**	**SFM**	**DoC (in)**
Finishing	M10-20	0.004	840-930	< 0.08
Medium	M10-25	0.010	650-850	0.08 - 0.2
Roughing	M20-35	0.015	150-750	0.2-0.4

	Carbide Tooling		
Milling	**Grade**	**Feed**	**SFM**
Face Milling	M10-25	0.004	485-825
Side Milling	M10-30	0.010	580-800
End Milling	M10-30	0.015	480-725

Drilling – high speed steel twist drills

- Use coolant
- If possible use internal coolant through drill
- Use of cobalt high alloyed drills is preferred
- With PVD-coated HSS drills the cutting speed can be increased by 10%
- Use as short a drill as possible

	HSS Tooling			
Drilling (HSS Cobalt Alloy)	**Diameter (in)**	**RPM**	**Feed**	**SFM**
	0.04	2850-3800	0.002	30-40
	0.12	1600-1750	0.004	50-55
	0.2	955-1050	0.005	55-65
	0.4	470-625	0.006	55-65
	0.6	350-415	0.008	55-65
	0.8	265-310	0.012	55-65
	1.2	175-210	0.012	55-65

Other machining operations

Cut-off

- Reduce feed by 50% approximately 6mm from the center

Reaming

- Type of coolant: emulsion or cutting oil

Tapping

- For blind holes use spiral flute grinding for good chip evacuation
- For through holes use spiral point grinding with gun nose to push the hips forward

Threading single insert

- Full profile insert for high quality thread forms
- V-profile insert – threading with minimum tool inventory
- Multipoint insert for economic threading in mass production

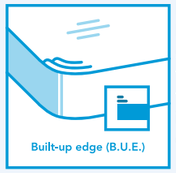
Drilling indexable insert

- Cutting data is very dependent on the drill design. Hence, the manufacturers recommendations must be considered

Troubleshooting

Flank wear
For longer tool life – reduce cutting speed or use a harder insert.

Notch wear
Notch wear is a common wear mechanism when machining stainless steel. Increased cutting speed will reduce notch but increase flank wear. If possible, use an insert with smaller entering angle 60-80 degrees or variable cutting depth or softer insert grade.



Built-up edge (B.U.E.)
Built-up edge occurs when the cutting speed is too low and the stainless steel tends to stick to the tool (in milling the chips stick to the tool). To avoid – increase cutting speed or use another coating.

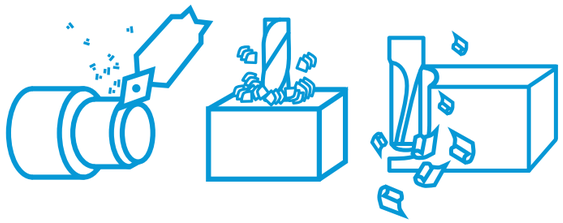
Plastic deformation
To avoid – reduce either cutting speed, feed or use a harder insert.

Long chips
To avoid – increase feed or use an insert with smaller chip breaker.

	Carbide Tooling		
Other Machining Operations	**Grade**	**Feed**	**SFM**
Cut-off	M25	0.002-0.006	325-500
Reaming	M10-M30	0.004-0.016	170
Tapping	-	-	-
Threading single insert	M10-M30	-	300-450
Drilling w/indeaxable insert	Center M30 Periphery M10	0.002-0.005	650-825

Machining guideline for Prodec® 303

Prodec® 303 is a fully resulfurized free-machining austenitic stainless steel. The Prodec® brand name means this steel has been specially melted and treated by Marcegaglia's proprietary ladle metallurgy techniques to maximize machinability while retaining good mechanical properties, corrosion resistance, and forming characteristics. This free cutting stainless steel gives you faster machining, longer tool life, better tolerances, superior machined surface quality, and reduced scrap losses compared to conventionally produced 303.



Product forms

Prodec® 303 is available as round and hexagon bars.

Machining guidelines

The cutting parameters in this guideline will work under normal cutting conditions. It is suggested to begin with cutting parameters in the ranges indicated in the tables and then to improve parameters by moving to higher or lower speed, feed or depth of cut until best performance is reached. It is possible to end up in a range somewhat outside the values indicated in the tables depending on the actual machine set-up. A guide for further optimization of cutting parameters can be found under the "Troubleshooting" section on the next page.

Turning

- The machine and setup must be rigid
- Use shortest possible tool length
- Use coolant
- Use smallest possible nose radius to avoid vibrations

Milling (only end milling)

- The machine and setup must be rigid
- Use shortest possible tool length
- Use coolant
- Use smallest possible nose radius to avoid vibrations

	Carbide Tooling			
Turning	**Grade**	**Feed (in/rev)**	**SFM**	**DoC (in)**
Finishing	M10-15	<0.010	590-1230	< 0.004
Roughing	M25-35	0.010-0.025	300-720	0.005-0.2

	Carbide Tooling		
Milling	**Grade**	**Feed**	**SFM**
End Milling	M35	0.002-0.008	160-820

Drilling – high speed steel twist drills

- Use coolant
- If possible use internal coolant through drill
- Use of cobalt high alloyed drills is preferred
- With PVD-coated HSS drills the cutting speed can be increased by 10%
- Use as short drill as possible

	HSS Tooling			
Drilling (HSS Cobalt Alloy)	**Diameter (in)**	**RPM**	**Feed**	**SFM**
	0.04	4100-4900	0.0025	42-52
	0.12	2000-2300	0.005	62-72
	0.2	1400-1650	0.006	72-85
	0.4	700-830	0.008	72-85
	0.6	470-560	0.010	72-85
	0.8	350-420	0.016	72-85
	1.2	230-290	0.016	72-85

Other machining operations

Cut-off

- Reduce feed by 50% approximately 6mm from the center

Tapping

- For blind holes use spiral flute grinding for good chip evacuation
- For through holes use spiral point grinding with gun nose to push the chips forward

Threading single insert

- Full profile insert for high quality thread forms
- V-profile insert – threading with minimum tool inventory
- Multipoint insert for economic threading in mass production

Forming

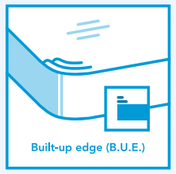
- Use coolant
- The machine and setup must be rigid
- Use shortest possible tool length

	Carbide Tooling		
Other Machining Operations	**Grade**	**Feed**	**SFM**
Cut-off	M30	0.002-0.006	260-660
Tapping	-	-	-
Threading single insert	M10-M30	-	300-450

Troubleshooting

Flank wear
For longer tool life – reduce cutting speed or use a harder insert.

Notch wear
Notch wear is a common wear mechanism when machining stainless steel. Increased cutting speed will reduce notch but increase flank wear. If possible, use an insert with smaller entering angle 60-80 degrees or variable cutting depth or softer insert grade.



Built-up edge (B.U.E.)
Built-up edge occurs when the cutting speed is too low and the stainless steel tends to stick to the tool (in milling the chips stick to the tool). To avoid – increase cutting speed or use another coating.

Plastic deformation
To avoid – reduce either cutting speed, feed or use a harder insert.

Long chips
To avoid – increase feed or use an insert with smaller chip breaker.

Technical norms are referred to in the latest release valid
at the publication date of the present catalogue.

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