

Stainless steels for highly corrosive environments

Outokumpu Supra range

outokumpu
high performance stainless steel



outokumpu.com/supra

We believe in a world that lasts forever

Outokumpu is a global leader in the advanced materials business, creating stainless steels that are efficient, long lasting, and recyclable. A strong customer focus, sustainability, and technical excellence are at the heart of everything we do.

As an open and approachable company, our customers rely on our advice to help them select products that will deliver the best long-term performance for their needs.

With over a century of innovation behind us and some of the best minds in the business, we continue to develop pioneering materials to meet the demands of tomorrow.

The durability of stainless steel means that it is not only the best, but also the most economically sustainable choice for a wide range of applications. All of our products are made from an average of 85% recycled material and are fully recyclable at the end of their lifecycles.

Together with our customers and partners, we are building a world that lasts forever.

Stay up to date on our latest innovations, follow market trends, and get inspired by success stories – subscribe to our magazines and newsletters outokumpu.com/newsletter

The inside view

For multi-purpose use and more corrosive environments compared to the Core range (PRE 22 to 27).

At Outokumpu, we've been developing and producing high quality stainless steels for more than a century. This has resulted in an exceptionally wide range of products for every imaginable application. By grouping our products into ranges based on performance, rather than stainless steel type, we aim to make it easy to choose the best product for your application.

Supra range products are designed for applications that demand higher than normal corrosion resistance, and are calculated with a Pitting Resistance Equivalent (PRE) value of 22 to 27. This range contains the popular Supra 316L/4404 and several alternatives. It also features a selection of low-nickel and nickel-free alternatives.

Supra range austenitics are also highly formable and weldable, making them suitable for a wide range of applications from claddings to storage tanks. The magnetic ferritic stainless steels in this range also have good formability, especially in terms of deep drawing, and are ideal for applications with elevated temperatures such as hot water tanks and drinking water pipes.

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All Supra range products are readily available around the globe and are delivered from mills that are well known for their quality and on-time delivery accuracy. You can depend on Outokumpu stainless steels to reliably and consistently meet the specifications that your application demands. Our customers also rely on us to deliver the best material selection advice, and we can often find more cost-effective solutions that help you to avoid over-specifying.



Ville Hakkarainen, Outokumpu

Contact us at outokumpu.com/contacts to find out which of our products is right for your next project.



The Pitting Resistance Equivalent (PRE) number can be used to compare the resistance of different stainless steels to pitting corrosion. It takes into account the effect of the most important alloying elements.

Choosing the right product

Choosing the right stainless steel for the application is key to ensuring both the cost effectiveness and success of your project. Take a look at the individual Supra range products – and the applications they are best suited for – to get an idea of your options.

Key product

Supra 316L/4404

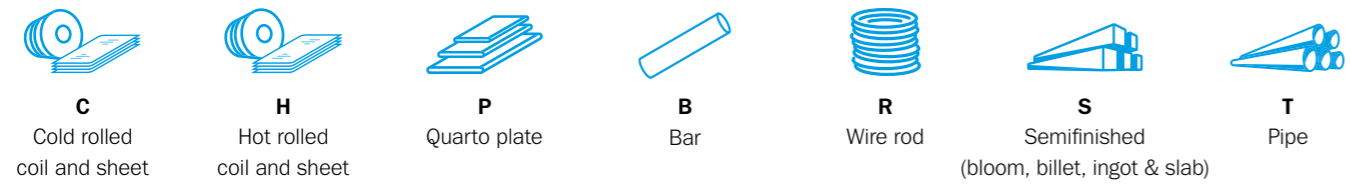
Our most widely used molybdenum-alloyed austenitic stainless steel. Supra 316L/4404 is a low-carbon stainless steel and is used in various process industries and other aggressive environments with higher than average corrosion resistance requirements. Due to its low carbon content, this product is also weldable in thicknesses of more than 5–6 mm/ 0.19–0.23 in without sensitivity to intergranular corrosion.

Typical applications

- Equipment in the chemical and petrochemical industry
- Pulp and paper industry equipment
- Textile industry equipment
- Food and beverage industry equipment
- Pharmaceutical industry equipment
- Medical applications
- Flanges and valves

Product forms
C, H, P, B, R, S, T

Product forms



Supra range applications

- Pulp and paper industry stack liners
- Heat exchangers
- Equipment in coastal environments (when not in direct contact with seawater)
- Storage tanks
- Process equipment
- Pipes
- Swimming pools
- Food and beverage industry equipment
- Pharmaceutical industry equipment
- Chemical industry equipment
- Textile finishing
- Roofs and façade cladding
- Outdoor furniture, art and monuments



Alternatives

Outokumpu name	Typical applications	Product forms
Supra 316/4401 A normal-carbon alternative to Supra 316/4404 that is widely used for various applications.	<ul style="list-style-type: none"> Heat exchangers Flanges and valves 	C, H, P, B, R, S, T
Supra 316plus The highest strength stainless steel in the Supra range. Supra 316plus is a cost-efficient, 21Cr, lower-nickel/molybdenum alternative to traditional molybdenum austenitics like Supra 316L. This product has good formability, excellent weldability, and is usable in cryogenic applications.	<ul style="list-style-type: none"> Process and transport tanks Water treatment and pipes Heat exchangers Architectural applications 	C, H, P
Supra 316L/SANS4402 A high-strength, high-formability product often used in container transports and where there is an elevated temperature requirement.	<ul style="list-style-type: none"> Container tanks 	C, H, P
Supra 316L/4432 A product with high resistance to non-oxidizing acids and chloride-containing media due to its higher molybdenum content. Supra 316L/4432 has good formability and weldability.	<ul style="list-style-type: none"> Drinking water systems Cooling systems Wastewater systems Flanges and valves 	C, H, P, B, R, S, T
Supra 316/4436 A Supra 316L/4432 alternative with higher carbon content and similar corrosion resistance.	<ul style="list-style-type: none"> Pulp and paper industry equipment Pharmaceutical industry equipment Flanges and valves 	C, H, P, B, R, S, T
Supra 316L/4435 A Supra 316L/4432 alternative with higher chromium and nickel content for enhanced corrosion resistance and formability.	<ul style="list-style-type: none"> Urea plants Pulp and synthetic fiber plants Flanges and valves 	C, H, P, B, R, S, T
Supra 316Ti/4571 A titanium-stabilized, molybdenum-alloyed austenitic alternative to Supra 316L/4404 – mainly used for elevated temperature applications. Due to its titanium-stabilization this product is weldable in all thickness ranges.	<ul style="list-style-type: none"> Flue gas applications Flanges and valves 	C, H, P, B, R, S, T

Nickel-free stainless steel

Nickel-free stainless steels offer good price stability along with good corrosion resistance and formability.

Outokumpu name	Typical applications	Product forms
Supra 444/4521 A nickel-free, molybdenum alloyed ferritic stainless steel with very good corrosion resistance, good cold formability, and high strength. Supra 444/4521 allows for thinner walls in tanks and is not prone to stress-corrosion cracking.	<ul style="list-style-type: none"> Hot water tanks Drinking water pipes 	C, H, P, S

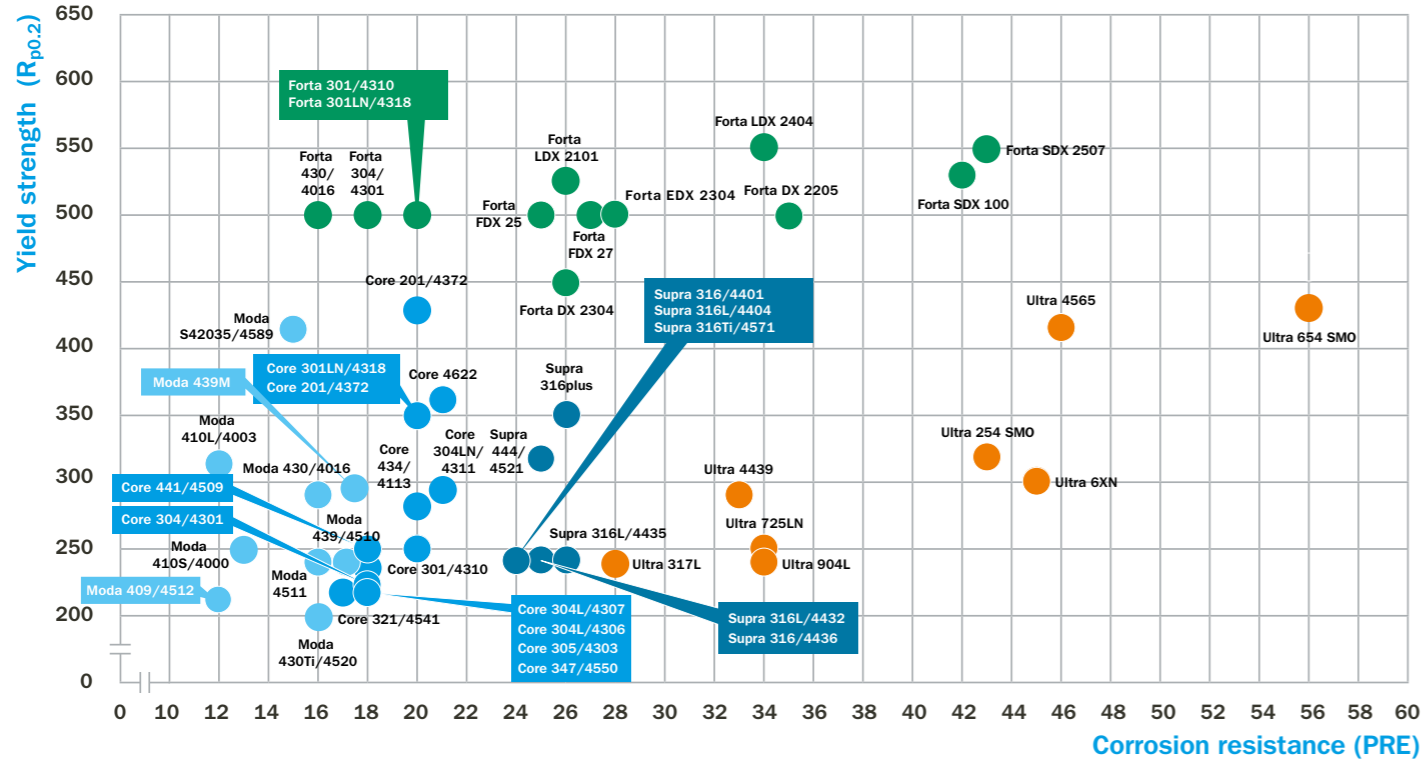


If you need steels for extremely corrosive environments (PRE > 27), check the Ultra range.

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Product performance comparison

Strength vs. corrosion resistance



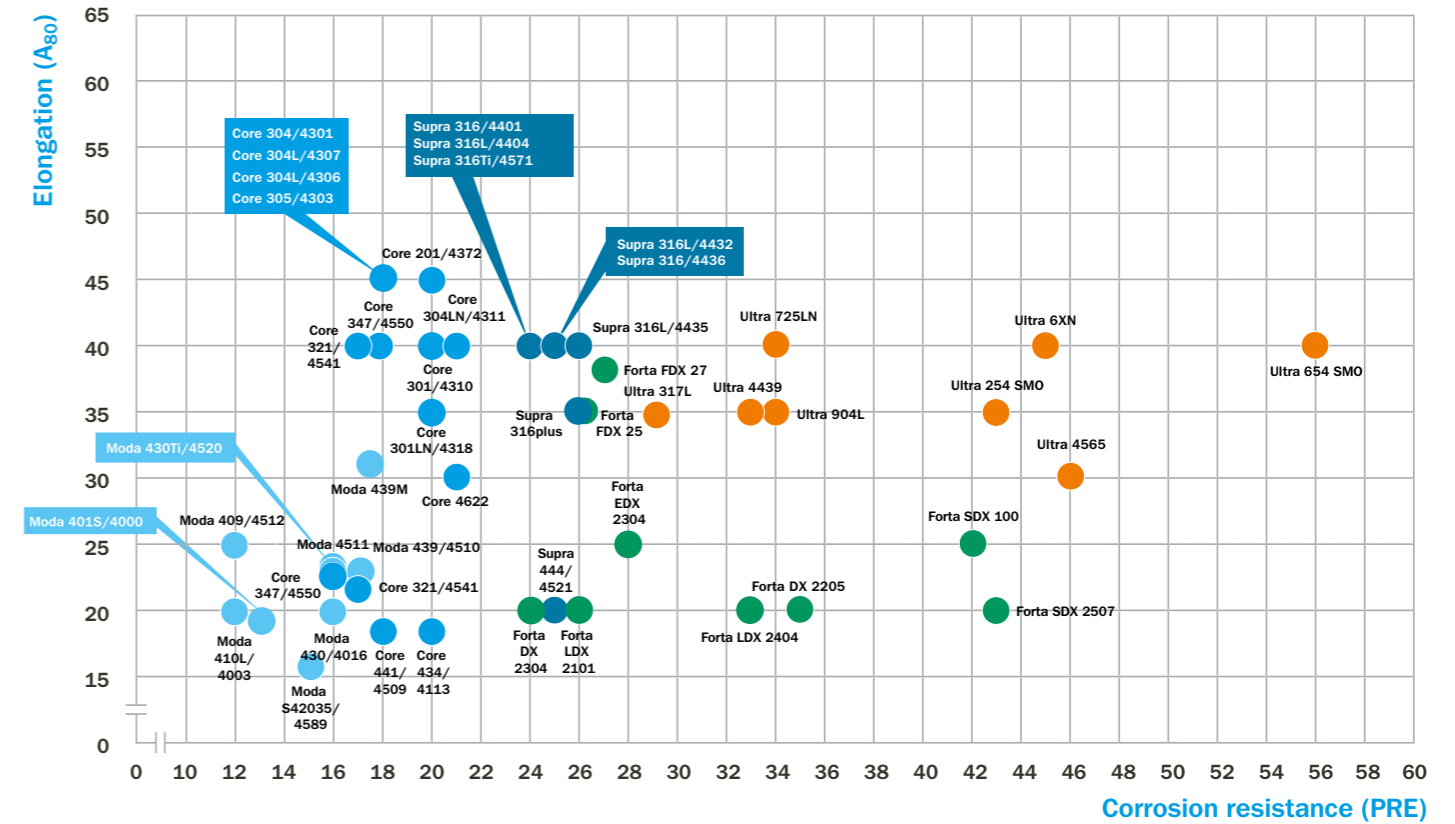
- Moda – Mildly corrosive environments (PRE up to 17)
- Core – Corrosive environments (PRE 17 to 22)
- Supra – Highly corrosive environments (PRE 22 to 27)
- Forta – Duplex and other high strength (PRE 18 to 43)
- Ultra – Extremely corrosive environments (PRE > 27)

PRE calculation = $\%Cr + 3.3 \times \%Mo + 16 \times \%N$

Note: PRE values shown are Outokumpu typical values. Yield strength ($R_{p0.2}$) according to EN 10088-2 minimum values for cold rolled strip. Yield strength for temper rolled products ranges from 500-2000 MPa.

For more values by product, please see steelfinder.outokumpu.com

Elongation vs. corrosion resistance



- Moda – Mildly corrosive environments (PRE up to 17)
- Core – Corrosive environments (PRE 17 to 22)
- Supra – Highly corrosive environments (PRE 22 to 27)
- Forta – Duplex and other high strength (PRE 18 to 43)
- Ultra – Extremely corrosive environments (PRE > 27)

PRE calculation = $\%Cr + 3.3 \times \%Mo + 16 \times \%N$

Note: PRE values shown are Outokumpu typical values. Elongation (A_{80}) according to EN 10088-2 minimum values for cold rolled strip.

For more values by product, please see steelfinder.outokumpu.com

Learn more at outokumpu.com/supra

Product properties

Supra range

Highly corrosive environments (PRE 22 to 27)

Steel designations		Performance						Typical chemical composition, % by mass						
Outokumpu name	EN	ASTM		PRE	A ₈₀ %	R _{p0.2} MPa	R _m MPa	Grade family	C	Cr	Ni	Mo	N	Others
		Type	UNS											
Supra 316/4401	1.4401	316	S31600	24	40	240	530	A	0.04	17.2	10.1	2.1	-	-
Supra 316L/4404	1.4404	316L	S31603	24	40	240	530	A	0.02	17.2	10.1	2.1	-	-
Alternatives														
Supra 316plus	1.4420	-	S31655	26	35	350	700	A	0.02	20.3	8.6	0.7	0.19	-
Supra 316L/SANS4402	SANS4402	-	-	24	50 ¹⁾	290 ¹⁾	600	A	0.02	17.2	10.1	2.1	-	-
Supra 316L/4432	1.4432	316L	S31603	25	40	240	550	A	0.02	16.9	10.7	2.6	-	-
Supra 316/4436	1.4436	316	S31600	25	40	240	550	A	0.04	16.9	10.7	2.6	-	-
Supra 316L/4435	1.4435	316L	-	26	40	240	550	A	0.02	17.3	12.6	2.6	-	-
Supra 316Ti/4571	1.4571	316Ti	S31635	24	40	240	540	A	0.04	16.8	10.9	2.1	-	Ti
Ni-free alternative														
Supra 444/4521	1.4521	444	S44400	25	20	320	420	F	0.02	18.0	-	2.0	-	Nb Ti

¹⁾ Mechanical values acc. to SANS 50028-7.

Note: Yield strength (R_{p0.2}), tensile strength (R_m), and elongation (A₈₀) according to EN 10088-2 minimum values for cold rolled strip. Chemical compositions are Outokumpu typical values.

For specific values by product, please see steelfinder.outokumpu.com

Supra range products are available with the following surface finishes: 1, 2B, 2D, 2E, and our Deco range of special surfaces, including Deco BA/2R.

Stainless steel types

Austenitic stainless steels have good to excellent corrosion resistance combined with very good weldability and formability. The austenitic structure has good creep resistance and good oxidation resistance that makes these steels useful at elevated temperatures. They can also be used in cryogenic applications and are, in the annealed condition, the only non-magnetic steel group.

Ferritic stainless steels have good resistance to corrosion, especially stress-corrosion cracking. Their lower carbon and nitrogen content, together with niobium and/or titanium stabilization, improve both weldability and toughness. Ferritic stainless steels are magnetic.

Supra 316plus in liquid transport containers

The Langh Group needed a corrosion-resistant steel for liquid transport containers.

The properties of Supra 316plus allow for thinner wall thickness – meaning a lower overall container weight – while excellent corrosion resistance enables transportation of aggressive liquids.

Developed by Outokumpu, Supra 316plus is a unique product that provides a competitive alternative to 316L. Supra 316plus contains less nickel and molybdenum and has higher strength than 316L, even in the annealed condition, due to higher nitrogen alloying.



Looking for expert help to choose the best product for your next project? Contact us at outokumpu.com/contacts

Working towards forever.

We work with our customers and partners to create long lasting solutions for the tools of modern life and the world's most critical problems: clean energy, clean water, and efficient infrastructure. Because we believe in a world that lasts forever.

outokumpu
classic

outokumpu
pro

Moda

Mildly
corrosive
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Core

Corrosive
environments

Supra

Highly
corrosive
environments

Forta

Duplex
& other
high strength

Ultra

Extremely
corrosive
environments

Dura

High
hardness

Therma

High
service
temperatures

Prodec

Improved
machinability

Deco

Special
surfaces

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