outokumpu
high performance stainless steel

Supra
Highly corrosive environments

Stainless steels for highly corrosive environments

Outokumpu Supra range datasheet

General characteristics

The Supra range contains stainless steel products designed for highly corrosive environments.

Supra 316/4401 and Supra 316L/4404 are used in the majority of application areas, and are widely available around the world. Some applications require more specific properties, and for this reason a number of other closely related austenitic steels, generally with modified alloying compositions, are also available. These include:

- Stainless steels containing nitrogen for higher strength
- Stainless steels with lower nickel content to promote higher work hardening
- Stainless steels with higher nickel content for specialist cryogenic applications or to increase deep drawability
- Stainless steels with titanium stabilization to improve corrosion resistance at elevated temperatures

A nickel-free ferritic alternative, Supra 444/4521, is also available. Supra 444/4512 has good corrosion resistance and excellent deep drawability.

Chemical composition

Table 1

Supra

Steels with PRE 22–26, for highly corrosive environments.

Outokumpu Classic family

Steel designations				Performance				Typical chemical composition, % by mass					
	EN	ASTM			A [1]	$R_{p0.2}$	Grade						
Outokumpu name		Type	UNS	PRE	%	MPa	family	C	Cr	Ni	Mo	N	Others
Austenitic stainless steels													
Supra 316/4401	1.4401	316	S31600	24	40	240	A	0.04	17.2	10.1	2.1	–	–
Supra 316L/4404	1.4404	316L	S31603	24	40	240	A	0.02	17.2	10.1	2.1	–	–
Supra 316plus	1.4420	–	S31655	26	35 [2]	350 [2]	A	0.02	20.3	8.6	0.7	0.19	–
Supra 316/4436	1.4436	316	S31600	25	40	240	A	0.04	16.9	10.7	2.6	–	–
Supra 316L/4432	1.4432	316L	S31603	25	40	240	A	0.02	16.9	10.7	2.6	–	–
Supra 316L/4435	1.4435	316L	S31603	26	40	240	A	0.02	17.3	12.6	2.6	–	–
Supra 316Ti/4571	1.4571	316Ti	S31635	24	40	240	A	0.04	16.8	10.9	2.1	–	Ti
Ferritic, nickel-free stainless steel													
Supra 444/4521	1.4521	444	S44400	25	20	320	F	0.02	18	–	2	–	Nb Ti

Grade family: A = austenitic, F = ferritic. [1] Elongation reference varies between different standards, information referenced here denotes A_{80} – otherwise see footnote for specific grade or inquire to reference alternative standard. [2] Min. values acc. to EN 10028-7.

Austenitic stainless steels

Table 2

Outokumpu name	Typical applications	Product forms
Supra 316/4401 (EN 1.4401/UNS S31600) Supra 316/4401 is a widely used Molybdenum alloyed austenitic stainless steel. It's an all-purpose product with very good corrosion resistance and is suitable for a wide variety of applications that require good formability and weldability. Supra 316/4401 can be delivered with a variety of surface finishes.	• Heat exchangers • Flanges and valves	• Cold rolled coil and sheet • Hot rolled coil and sheet • Quarto plate • Precision strip
Supra 316L/4404 (EN 1.4404/UNS S31603) Supra 316L/4404 is a low-carbon alternative to Supra 316/4401. The lower carbon content minimizes carbide precipitation as a result of heat input, for example during welding, giving improved resistance against intergranular corrosion.Supra 316L/4404 is suitable for a wide variety of applications that require good formability and weldability, and can be delivered with a variety of surface finishes.	• Chemical industry • Petrochemical industry • Pulp and paper industry • Textile industry • Food and beverage industry • Pharmaceutical industry • Medical applications • Flanges and valves	• Cold rolled coil and sheet • Hot rolled coil and sheet • Quarto plate • Precision strip
Supra 316plus (EN 1.4420/UNS S31655) 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.	• Process and transport tanks • Water treatment and pipes • Heat exchangers • Architectural applications	• Cold rolled coil and sheet • Hot rolled coil and sheet
Supra 316/4436 (EN 1.4436/UNS S31600) A product with high resistance to non-oxidizing acids and chloride-containing media due to higher molybdenum content. Supra 316/4436 has good formability and weldability.	• Pulp and paper industry equipment • Pharmaceutical industry equipment • Flanges and valves	• Cold rolled coil and sheet • Hot rolled coil and sheet • Quarto plate
Supra 316L/4432 (EN 1.4432/UNS S31603) Supra 316L/4432 is a low-carbon alternative to Supra 316/4436. The lower carbon content minimizes carbide precipitation as a result of heat input, for example during welding, giving improved resistance against intergranular corrosion.	• Drinking water systems • Cooling systems • Wastewater systems • Flanges and valves	• Cold rolled coil and sheet • Hot rolled coil and sheet • Quarto plate
Supra 316L/4435 (EN 1.4435/UNS S31603) A Supra 316L/4432 alternative with higher chromium and nickel content for enhanced corrosion resistance and formability.	• Urea plants • Pulp and synthetic fiber plants • Flanges and valves	• Cold rolled coil and sheet • Hot rolled coil and sheet • Quarto plate • Precision strip
Supra 316Ti/4571 (EN 1.4571/UNS S31635) A titanium-stabilized alternative to Supra 316L/4404. Due to its titanium-stabilization this product is weldable in all thickness ranges.	• Flue gas applications • Flanges and valves	• Cold rolled coil and sheet • Hot rolled coil and sheet • Quarto plate

Ferritic, nickel-free stainless steel

Table 3

Outokumpu name	Typical applications	Product forms
Supra 444/4521 (EN 1.4521/UNS S44400) 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.	• Hot water tanks • Drinking water pipes	• Cold rolled coil and sheet • Hot rolled coil and sheet • Precision strip

Corrosion resistance

Corrosion resistance of Core range austenitics

Supra range products have excellent corrosion resistance and are suitable for a wide range of applications.

Uniform corrosion

Uniform corrosion is characterized by a uniform attack on the steel surface in contact with a corrosive medium. The corrosion resistance is generally considered good if the corrosion rate is less than 0.1 mm/year (0.004 in/year).

Supra range stainless steels have good resistance to uniform corrosion in many organic and inorganic chemicals. The addition of molybdenum enhances the alloy's corrosion resistance in many acidic environments. Austenitic stainless steels that contain molybdenum are therefore sometimes denoted as 'acid-proof grades'. This does not, however, mean that these materials will not corrode under all circumstances. Strong mineral acids at elevated temperatures are environments where even higher alloyed stainless steels may need to be used. Hydrochloric acid, for example, may cause uniform corrosion, pitting, and crevice corrosion even at quite low concentrations and at moderate temperatures. For more details about highly alloyed products, see the Ultra range.

For further information on corrosion resistance, please refer to the Outokumpu Corrosion Handbook, available from our sales offices.

Pitting and crevice corrosion

Pitting and crevice corrosion typically occur in acidic or neutral chloride solutions. Supra range products provide excellent resistance to pitting and crevice corrosion. Resistance to these types of corrosion is enhanced by increasing the steel's chromium, molybdenum and nitrogen content. Nickel reduces the pitting propagation rate and facilitates repassivation after pitting corrosion has started.

Supra range PRE values

Table 4

Product name	EN	ASTM		PRE
		Type	UNS	
Austenitic stainless steels				
Supra 316/4401	1.4401	316	S31600	24
Supra 316L/4404	1.4404	316L	S31603	24
Supra 316plus	1.4420	–	S31655	26
Supra 316/4436	1.4436	316	S31600	25
Supra 316L/4432	1.4432	316L	S31603	25
Supra 316L/4435	1.4435	316L	S31603	26
Supra 316Ti/4571	1.4571	316Ti	S31635	24
Ferritic, nickel free stainless steels				
Supra 444/4521	1.4521	444	S44400	25

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. Contact us at outokumpu.com/contacts to discuss what product is right for your next project.

Atmospheric corrosion

Supra range austenitic stainless steels offer good resistance to atmospheric corrosion in applications where superficial surface staining from incipient pitting or crevice corrosion is usually undesirable. These products can normally be used in moderately aggressive industrial and coastal areas.

When high amounts of chlorides or pollutants are present, as is the case in certain industrial areas or in aggressive marine atmospheres or marine splashing zones, higher-alloyed stainless steels from the Ultra range may need to be considered, especially if the atmosphere is also hot or humid.

In coastal, industrial, or heavily polluted areas, regular washing can prevent the build up of deposits that can lead to corrosion. A smooth surface finish supports natural rinsing by rain water and can prolong the service interval.

Supra range stainless steels are not suitable for load-bearing structures in swimming pool halls, such as hangers for roof constructions. To address the risk of stress corrosion cracking (SCC) in pool environments, only the steel grades given in Eurocode 3, EN 1993-1-4 should be used for load bearing parts exposed to environments above indoor swimming pools.

Stress corrosion cracking (SCC)

Supra range austenitics are susceptible to chloride-induced stress corrosion cracking (SCC). Critical service conditions – i.e. applications subjected to combinations of tensile stresses, temperatures above about 50 °C/120 °F, and solutions containing chlorides – should be avoided. Stress corrosion cracking may also occur in hot, strong alkaline solutions (above 110 °C/230 °F). Depending on the specific application, ferritic or duplex stainless steels are usually more suitable for applications demanding high resistance to SCC.

Intergranular corrosion

A low carbon content extends the time required for significant sensitization. Modern steel making methods enable much lower carbon contents to be achieved.

Still, operations that increase the risk of intergranular corrosion are welding of thick sections, heat treatment operations within the critical temperature interval 550–850 °C/1020–1560 °F, and slow cooling after heat treatment or hot forming. Steels with low carbon content (< 0.03%) or with a titanium addition have better resistance to intergranular corrosion after such operations.

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Corrosion resistance of Core range ferritic stainless steels

Outokumpu produces Supra 444/4521 with a typical chromium content of 18% and molybdenum content of 2% by mass. The resistance to localized corrosion is close to the Supra 316/4401 “acid-proof” austenitic. Supra 444/4521 is not susceptible to chloride-induced SCC. In solutions containing chlorides, pitting and crevice corrosion is possible depending on various parameters such as chloride concentration, temperature, pH value, redox potential, and crevice geometry. The best material performance is usually reached with the help of adequate design, correct postweld treatment, and regular cleaning during service (if applicable).

For further information on corrosion resistance, please refer to the corrosion tables in the Outokumpu Corrosion Handbook, available from our sales offices.

Performance

Strength vs. Corrosion resistance

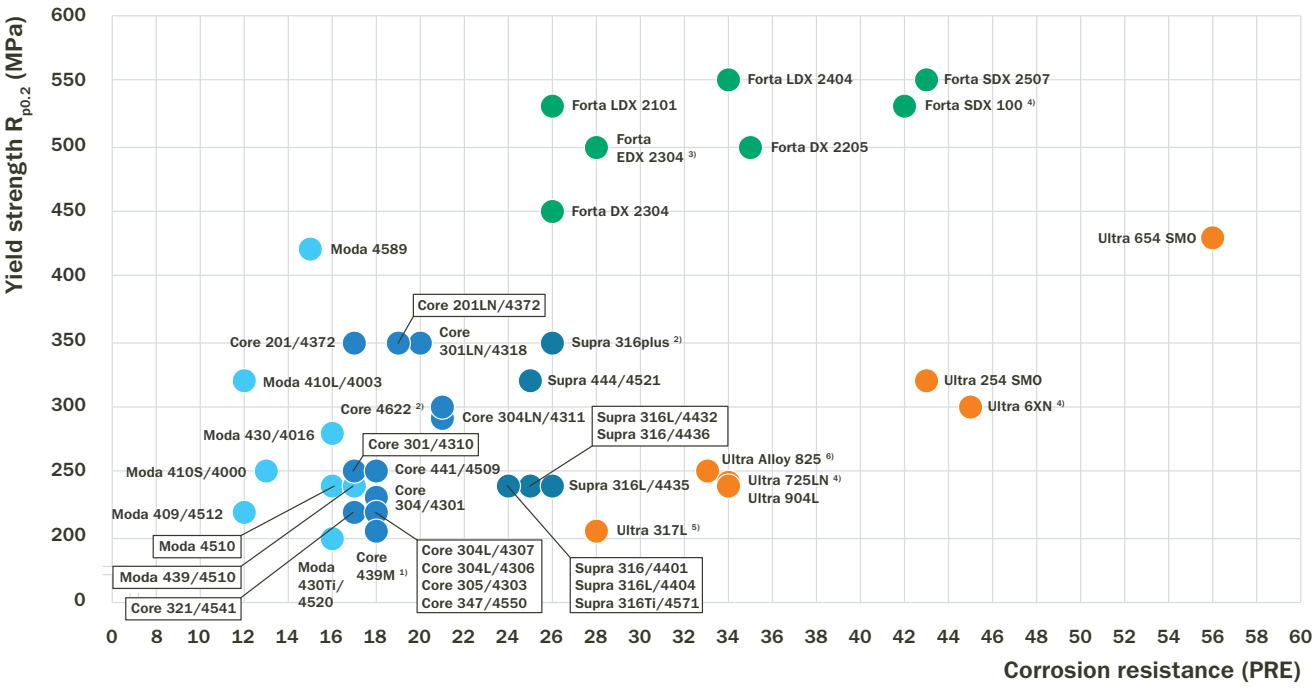

Fig. 1. Strength vs. Corrosion resistance.

Elongation vs. Corrosion resistance

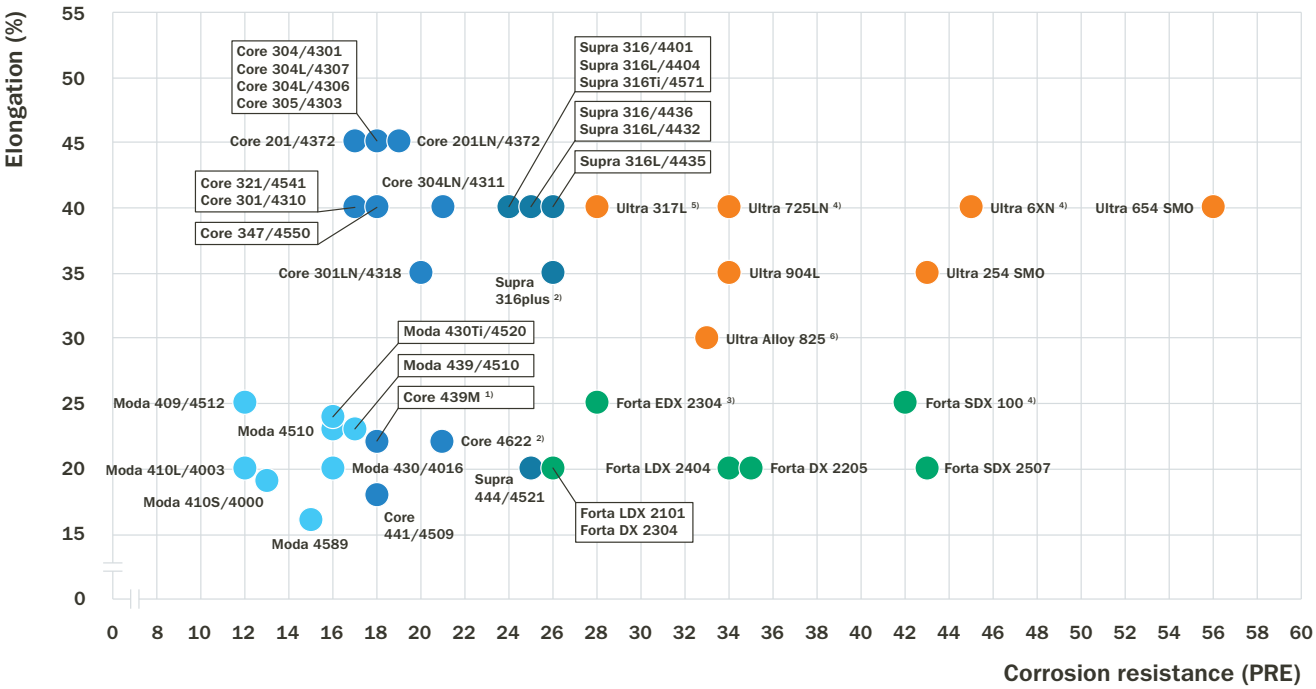

Fig. 2. Elongation vs. corrosion resistance.

- Moda – Stainless steels for mildly corrosive environments (PRE ≤17)
- Core – Stainless steels for corrosive environments (PRE 17–22)
- Supra – Stainless steels for highly corrosive environments (PRE 22–26)
- Forta – Duplex stainless steels (PRE 26–43)
- Ultra – Stainless steels and nickel base alloys for extremely corrosive environments (PRE > 27)

PRE = %Cr + 3.3 x %Mo + 16 x %N.
Values for $R_{p0.2}$ yield strength and for A_{80} elongation are according to EN 10088-2 min. values for cold rolled strip. Chemical compositions and PRE calculations are based on Outokumpu typical values.

[1] Elongation reference varies between different standards, for coil the standard typically uses A_{80} – otherwise see footnote for specific grade.
[2] Min. values acc. to EN 10028-7.
[3] Outokumpu MDS-D35 for EDX 2304.
[4] Min. values for plate acc. to EN 10088-2.
[5] Min values acc. to ASTM A240.
[6] Min. values hot-rolled and cold-rolled acc. to ASTM B424.

Please see values for other product forms at **steelfinder.outokumpu.com**

Mechanical properties

Mechanical properties at 20 °C, values according to EN 10088-2

Table 5

Metric						
Outokumpu name	**Product form**	**Yield strength $R_{p0.2}$ (MPa)**	**Yield strength $R_{p1.0}$ (MPa)**	**Tensile strength R_m (MPa)**	**Elongation A (%)**	**Elongation A_{80} (%)**
Austenitic stainless steels						
Supra 316/4401	C	240	270	530–680	40	40
	H	220	260	530–680	40	40
	P	220	260	520–670	45	45
Supra 316L/4404	C	240	270	530–680	40	40
	H	220	260	530–680	40	40
	P	220	260	520–670	45	45
Supra 316plus	C*	350	380	650–850	35	35
	H*	350	380	650–850	35	35
Supra 316/4436	C	240	270	550–700	40	40
	H	240	270	550–700	40	40
	P	220	260	530–730	40	40
Supra 316L/4432	C	240	270	550–700	40	40
	H	220	260	550–700	40	40
	P	220	260	520–670	45	45
Supra 316L/4435	C	240	270	550–700	40	40
	P	220	260	520–670	45	45
Supra 316Ti/4571	C	240	270	540–690	40	40
	H	220	260	540–690	40	40
	P	220	260	520–670	40	40
Ferritic, nickel-free stainless steels						
Supra 444/4521	C	320	–	420–640	20	20
	H	300	–	400–600	20	20
	P	300	–	420–620	20	20

*) Min. values acc. to EN 10028-7.

A_{80} initial length = 80 mm, A initial length = $5.65\sqrt{S_0}$ (A_5)
Product forms: cold rolled coil and sheet (C), hot rolled coil and sheet (H), quarto plate (P). More product forms may be available than shown in the table.

For more information, please see **steelfinder.outokumpu.com**

Mechanical properties, values according to ASTM A240

Table 6

Outokumpu name	EN	ASTM		Product form	Yield strength $R_{p0.2}$ (MPa)	Yield strength $R_{p2.0}$ (ksi)	Tensile strength R_m (MPa)	Tensile strength R_m (ksi)	Elongation A_{50} (%)
		Type	UNS						
Austenitic stainless steels									
Supra 316/4401	1.4401	316	S31600	C, H, P	205	30	515	75	40
Supra 316L/4404	1.4404	316L	S31603	C, H, P	170	25	485	70	40
Supra 316plus	1.4420	–	S31655	C, H	310	45	635	92	35
Supra 316/4436	1.4436	316	S31600	C, H, P	205	30	515	75	40
Supra 316L/4432	1.4432	316L	S31603	C, H, P	170	25	485	70	40
Supra 316L/4435	1.4435	316L	S31603	C, H, P	170	25	485	70	40
Supra 316Ti/4571	1.4571	316Ti	S31635	C, H, P	205	30	515	75	40
Ferritic, nickel-free stainless steels									
Supra 444/4521	1.4521	444	S44400	C, H	275	40	415	60	20

A_{50} initial length = 50 mm
Product forms: cold rolled coil and sheet (C), hot rolled coil and sheet (H), quarto plate (P). More product forms may be available than are shown in table.

For more information, please see **steelfinder.outokumpu.com**

The strength of the Supra range austenitic steels increases with increasing levels of carbon, nitrogen and, to a certain extent, molybdenum and manganese. Austenitic steels exhibit very high ductility; they have a high elongation to fracture. The steels are very tough, a property that extends to cryogenic temperatures.

Ferritic stainless steels typically have higher yield strengths than austenitic stainless steels. Elongation and forming properties are equivalent to those of standard carbon steels.

Outokumpu uses the European Standard EN 10088 where applicable. The permitted design values may vary between product forms; see the relevant specification for the correct value.

Mechanical properties at elevated temperatures

An elevated temperature is usually defined as being up to 500–600 °C/930–1100 °F, with high temperature being in excess of this. Outokumpu Supra range austenitic stainless steels possess useful elevated and high temperature strength and oxidation resistance. The highest elevated temperature strength among these steels is exhibited by the nitrogen-alloyed steels and those containing titanium or niobium. Most of these products are approved for pressure vessel applications, with pressure vessel codes giving design values for temperatures up to 400 °C/750 °F. For applications such as heaters, catalytic converters, and furnaces – where pressure is not a factor – austenitic corrosion-resistant stainless steels can be used up to approximately 800 °C/1470 °F, depending on specific circumstances.

Structural fire resistance

The performance requirements of a stainless steel structure that may be subjected to accidental fire loading are similar to those of carbon steel. Supra range austenitic stainless steels generally retain a higher proportion of their room temperature strength than carbon steels above temperatures of about 550 °C/1000 °F, and a higher proportion of their stiffness at all temperatures.

The behavior of stainless steel differs from that of most other metals at fire temperatures in that its mechanical properties (mainly modulus of elasticity and yield strength) are maintained comparatively well up to temperatures corresponding to a 30-minute standard fire. The temperature of unprotected stainless steel after a 30-minute standard fire is 800–830 °C/1470–1520 °F depending on the thickness of the material. There are significant differences in the values of the effective yield strengths used in structural design between stainless steel grades. For example, the titanium-stabilized Supra 316Ti/4571 has higher strength values at elevated temperatures than other stainless steel products. Therefore, the selection of steel involves balancing the need for elevated temperature strength.

Where mechanical resistance in the case of fire is required, the structure should be designed and constructed in such a way that it maintains its load-bearing function during the relevant fire exposure. EN 1993-1-2 “Eurocode 3 – Design of steel structures – Part 1-2: General rules – Structural fire design”, 2010 AISC Specification for Structural Steel Buildings (AISC, 2010c) and Euro Inox “Design Manual for Structural Stainless Steel” (2006) give further guidance on fire design for stainless steels.

Mechanical properties at cryogenic temperatures

Supra range austenitic stainless steels are not susceptible to brittle fracture in the solution-annealed condition. Due to their high impact toughness at very low temperatures, they are suitable for cryogenic applications.

The lowest minimum metal temperatures for austenitic stainless steels are listed in EN 13445-2 Annex B.

Physical properties

Metric values according to EN 10088-1

Table 7

Outokumpu name	Density [kg/dm^3]	Modulus of elasticity at 20 °C [GPa]	Coefficient of thermal expansion 20–100 °C [10^{-6}/K]	Thermal conductivity at 20 °C [W/(m x K)]	Thermal capacity at 20 °C [J/(kg x K)]	Electrical resistivity at 20 °C [Ω x mm²/m]	Magnetizable
Austenitic stainless steels							
Supra 316/4401	8.0	200	16.0	15	500	0.75	No
Supra 316L/4404	8.0	200	16.0	15	500	0.75	No
Supra 316plus*	7.9	200	16.0	15	500	0.73	No
Supra 316/4436	8.0	200	16.0	15	500	0.75	No
Supra 316L/4432	8.0	200	16.0	15	500	0.75	No
Supra 316L/4435	8.0	200	16.0	15	500	0.75	No
Supra 316Ti/4571	8.0	200	16.5	15	500	0.75	No
Ferritic, nickel-free stainless steels							
Supra 444/4521	7.7	220	10.4	23	430	0.80	Yes

*) Outokumpu values.

Imperial values converted from Table 7

Table 8

Outokumpu name	Density [lbm/in^3]	Modulus of elasticity [psi]	Coefficient of thermal expansion 68-212 °F [µin / (in x °F)]	Thermal conductivity [Btu/(hr x ft x °F)]	Thermal capacity [Btu/(lbm x °F)]	Electrical resistivity [µΩ x in]	Magnetizable
Austenitic stainless steels							
Supra 316/4401	0.289	29 x 10^6	8.9	8.7	0.120	29.53	No
Supra 316L/4404	0.289	29 x 10^6	8.9	8.7	0.120	29.53	No
Supra 316plus	0.285	29 x 10^6	8.9	8.7	0.120	28.74	No
Supra 316/4436	0.289	29 x 10^6	8.9	8.7	0.120	29.53	No
Supra 316L/4432	0.289	29 x 10^6	8.9	8.7	0.120	29.53	No
Supra 316L/4435	0.289	29 x 10^6	8.9	8.7	0.120	29.53	No
Supra 316Ti/4571	0.289	29 x 10^6	9.2	8.7	0.120	29.53	No
Ferritic, nickel-free stainless steels							
Supra 444/4521	0.278	32 x 10^6	5.8	13.3	0.103	31.50	Yes

Fabrication

Supra range austenitics

Formability

Supra range austenitics can be readily formed by all cold forming methods. All grades share common forming properties:

- Excellent stretch formability
- High work-hardening rate
- Average strain ratio r of approximately 1

The stability of the austenite decreases with lower alloying element content; more martensite is formed during cold working. In addition to the chemical composition, the martensite transformation depends on the forming temperature. At about 150 °C/300 °F no martensite is formed even for the most unstable grades. It follows that the formability of metastable austenitic stainless steels can be modified by selective heating of the piece being worked. For very demanding deep drawing applications and for multiple-step forming operations, stable grades with higher nickel content are preferable. These stable grades are designed to minimize martensite formation, but do retain their work-hardening capacity in the subsequent forming steps. Stable grades can also result in slightly reduced tool wear, lower elastic springback, and better dimensional tolerances.

Hot forming

Hot forming can be carried out in the 850–1150 °C/1550–2100 °F range. For maximum corrosion resistance, forgings should be annealed at 1070 °C/1950 °F and rapidly cooled in air or water after hot forming operations. Slow cooling may have adverse effects on the ductility and corrosion properties of the product.

Heat treatment

Solution annealing should be performed at 1000–1100 °C/1830–2010 °F and followed by rapid cooling in water or air. For titanium-stabilized grades, annealing temperatures above 1070 °C/1950 °F may impair the resistance to intergranular corrosion. Titanium-stabilized grades may also be given a stabilizing treatment at lower temperatures. However, temperatures below 980 °C/1790 °F should only be used after due consideration of the intended service environment. In applications where high residual stresses cannot be accepted, stress relief treatment may be necessary. This can be performed by annealing as outlined above.

Supra range austenitic stainless steels cannot be hardened by heat treatment, but they can be readily hardened by cold working.

Machinability

Due to their high toughness and work hardening behavior, austenitic steels are more difficult to machine than carbon steels but are still comparatively easy to machine compared to more highly alloyed stainless steel grades. They require higher cutting forces than carbon steels, show resistance to chip breaking, and have a high tendency to built-up edge formation. The best machining results are obtained by using high-power equipment, sharp tooling, and a rigid set-up. See also the Outokumpu Machining Guidelines.

Better machinability performance is given by Prodec range variants, which have been modified for improved machinability. For more information please see the Prodec range datasheet.

Welding

Supra range austenitic stainless steels have excellent weldability and are suitable for the full range of conventional welding methods except oxyacetylene.

In thin sections, autogenous welding may be used. In thicker sections, products with lower carbon content are preferred. To ensure that the weld metal properties (e.g. strength and corrosion resistance) are equivalent to those of the parent metal, matching or slightly over-alloyed fillers are preferable. In some cases, however, a differing composition may improve weldability or structural stability.

Austenitic steels have about 50% higher thermal expansion and lower heat conductivity compared to ferritic and duplex steels. This means that larger deformation and higher shrinkage stresses may result from welding.

Generally, post-weld heat treatment is not required. In special cases where there is a high risk of stress corrosion cracking or fatigue, stress relief treatment may be considered. In order to fully restore the corrosion resistance of the weld, the weld oxides should be removed by pickling.

More detailed information about welding procedures can be obtained from the Outokumpu Welding Handbook, available from our sales offices.

outokumpu.com/contacts

Supra range ferritics

Formability

Supra 444/4521 can be formed using typical forming processes such as folding, bending, and drawing. It has higher minimum yield strength than a standard austenitic stainless steel like Core 304/4301 in combination with lower work-hardening behavior. Due to the stabilization, the r value is higher compared to nonstabilized ferritic stainless steels such as Moda 430/4016. These characteristics mean excellent deep drawability.

Welding

Conventional welding methods and filler materials 316L/309LMO can be used for Supra 4521. Heat input in welding should be kept to a minimum. Shielding gases should be based on argon or helium, and should not contain hydrogen, nitrogen, or carbon dioxide. Generally, welded structures show lower ductility compared to that of the base material.

More detailed information about welding procedures can be obtained from the Outokumpu Welding Handbook, available from our sales offices.

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Surface finishes

A wide variety of surface finishes are available for Supra range products. Many are produced at the mill, and other surface finishes can be applied later during processing either at a service center or after fabrication.

The classic mill finishes offered on our Supra range include 1D, 2E, 2B and 2R/BA. In case a more demanding finish is required, polishing (2G, 2K / ASTM No. 3 and 4) or brushing (2J) is an efficient technique to upgrade the surface which can also be applied directly on the coil. Within our Deco range, Outokumpu offers a selection of high-class surface finishes with very distinguished properties on our popular Supra 316L/4404. Temper rolled 2H finishes are available in the Forta range. The surface finish also plays an important role in influencing the corrosion resistance of the stainless steel, especially in the case of atmospheric corrosion or where splashing is common. A smooth surface finish increases the resistance to corrosion initiation. In general, the roughness of the hot rolled 1D surface is higher than cold rolled surfaces. The bright annealed surface (2R/BA) is highly reflective and very smooth compared to the cold rolled, annealed, pickled, and skin-passed (2B) surface.

More information about surface finishes can be found in the Deco range brochure or on our website.

outokumpu.com/deco

Products and dimensions

To find the minimum and maximum thickness and width by surface finish for a specific product in the Supra range, please contact Outokumpu.

Standards, specifications and approvals

For a list of international standards by product, see **steelfinder.outokumpu.com**

For a list of certificates and approvals by mill, see **outokumpu.com/certificates**

Contacts and enquiries

Contact us

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

outokumpu.com/contacts

Own notes

1561EN-4. November, 2022.

Working towards a world that lasts 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	Core	Supra	Forta	Ultra	Dura	Therma	Prodec	Deco
Mildly corrosive environments	Corrosive environments	Highly corrosive environments	Duplex & other high strength	Extremely corrosive environments	High hardness	High service temperatures	Improved machinability	Special surfaces

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high performance stainless steel

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