

Stainless steels for extremely corrosive environments

Outokumpu Ultra range

outokumpu
high performance stainless steel



outokumpu.com/ultra



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
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The inside view

For usage in highly to extremely corrosive conditions (PRE > 27).

Outokumpu's long history in the stainless steel business and our continuous innovation means we have the right product for any application. By grouping our products into ranges based on performance rather than stainless steel family we want to make it easy to choose the best product for your application.

Ultra range products are designed for applications in extremely corrosive environments with a Pitting Resistance Equivalent (PRE) value of more than 27. This range gives you improved wet-corrosion capabilities and includes our key products Ultra 904L and Ultra 254 SMO as well as several alternatives for specific applications.

The Ultra range is the best choice when you have experienced that grades like Core 304L/4307 or Supra 316L/4404 are not sufficient for the wet-corrosion challenges of your application.

If you are unsure about which product is right for your application, you can rely on our experts to help you. We have long experience creating, producing and supplying stainless steels, combined with data from decades of our own corrosion tests. We invented some of the products in this range and have unrivalled experience in developing and producing wet-corrosion resistant alloys for aggressive conditions characterized by high levels of chlorides, high temperatures and low pH – or a combination of these factors.

When you choose Outokumpu, you also benefit from our dedicated technical and R&D support. We can test specific chemicals or try different products in your process equipment to evaluate the best choice for your application.



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Many of our products have been developed for specific customer needs, and we see innovation as a continuous process. Our Ultra range products are readily available around the globe and are delivered from mills that have long traditions of focusing on the customer and the end user of our products.

Please contact us by outokumpu.com/contacts to find out what product is right for your next project.

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 Ultra range products – and the applications they are best suited for – to get an idea of your options.

Key products

Ultra 904L

A high-nickel and molybdenum austenitic stainless steel with very high corrosion resistance. Ultra 904L was originally developed for handling sulfuric acid at ambient temperatures, and is now used in a broad range of chemical industry applications.

Typical applications

- Chemical and petrochemical industry equipment such as pipes, heat exchangers, tanks, and reactor vessels
- Sulfuric acid handling
- Flanges and valves

Product forms

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

Ultra 254 SMO

A 6% molybdenum and nitrogen-alloyed austenitic stainless steel with extremely high resistance to both uniform and localized corrosion. This product was developed especially for oil and gas offshore platforms and the pulp and paper industry.

Typical applications

- Applications requiring resistance to chlorinated seawater
- Flue gas cleaning
- Maritime exhaust gas cleaning (EGC)
- Bleaching equipment in the pulp and paper industry
- Flanges and valves

Product forms

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

Product forms



C

Cold rolled coil and sheet



H

Hot rolled coil and sheet



P

Quarto plate



B

Bar



R

Wire rod



S

Semifinished
(bloom, billet, ingot & slab)



T

Pipe

Ultra range applications

Outokumpu has extensive experience delivering products for equipment in the following areas:

- Oil and gas industry
- Petrochemical industry
- Bleaching equipment in the pulp and paper industry
- Flue gas cleaning
- Desalination plants
- Seawater processing
- Hydrometallurgy processes
- Food and beverage industry
- Pharmaceutical industry



When you need a stainless steel with excellent corrosion resistance and especially high strength, duplex stainless steels from the Forta range could be considered.



Other Ultra range alloys

We offer several alternatives for applications in specific environments.

Outokumpu name	Typical applications	Product forms
<p>Ultra 317L A molybdenum-alloyed austenitic stainless steel with higher corrosion resistance than Supra 316L/4404 – mainly used in the USA and Asia.</p>	<ul style="list-style-type: none"> • Chemical processing industry 	<p>C, P, B, R, S, T</p>
<p>Ultra 4439 A molybdenum and nitrogen-alloyed austenitic stainless steel with significantly higher corrosion resistance than Supra 316L/4404. Also known as 317LMN.</p>	<ul style="list-style-type: none"> • Chemical processing industry • Flue gas cleaning • Flanges and valves 	<p>C, H, P, S, T</p>
<p>Ultra 725LN Ultra 725LN is a type 310 material (high chrome and high nickel) that has been developed and optimized for urea production, which demand extremely high corrosion resistance. It has similar general pitting resistance as Ultra 904L.</p>	<ul style="list-style-type: none"> • Urea production 	<p>P</p>
<p>Ultra 6XN A 6% molybdenum, high-nickel and nitrogen-alloyed austenitic product with extremely high resistance to both uniform and localized corrosion.</p>	<ul style="list-style-type: none"> • Applications requiring resistance to chlorinated seawater • Flue gas cleaning 	<p>C, H, P, S</p>
<p>Ultra 4565 A 4.5% molybdenum, very high nitrogen alloyed austenitic stainless steel with excellent corrosion resistance and high mechanical strength.</p>	<ul style="list-style-type: none"> • Flue gas cleaning 	<p>C, H, P, S, T</p>
<p>Ultra 654 SMO The most corrosion-resistant stainless steel in the world. A 7% molybdenum, very high nitrogen alloyed austenitic product with high mechanical strength. A potentially lean alternative to traditional wet-corrosion resistant nickel-based alloys.</p>	<ul style="list-style-type: none"> • Pressurized and erosive systems handling chlorinated seawater at higher temperatures • Plate heat exchangers • Flue gas cleaning 	<p>C, P, S, T</p>

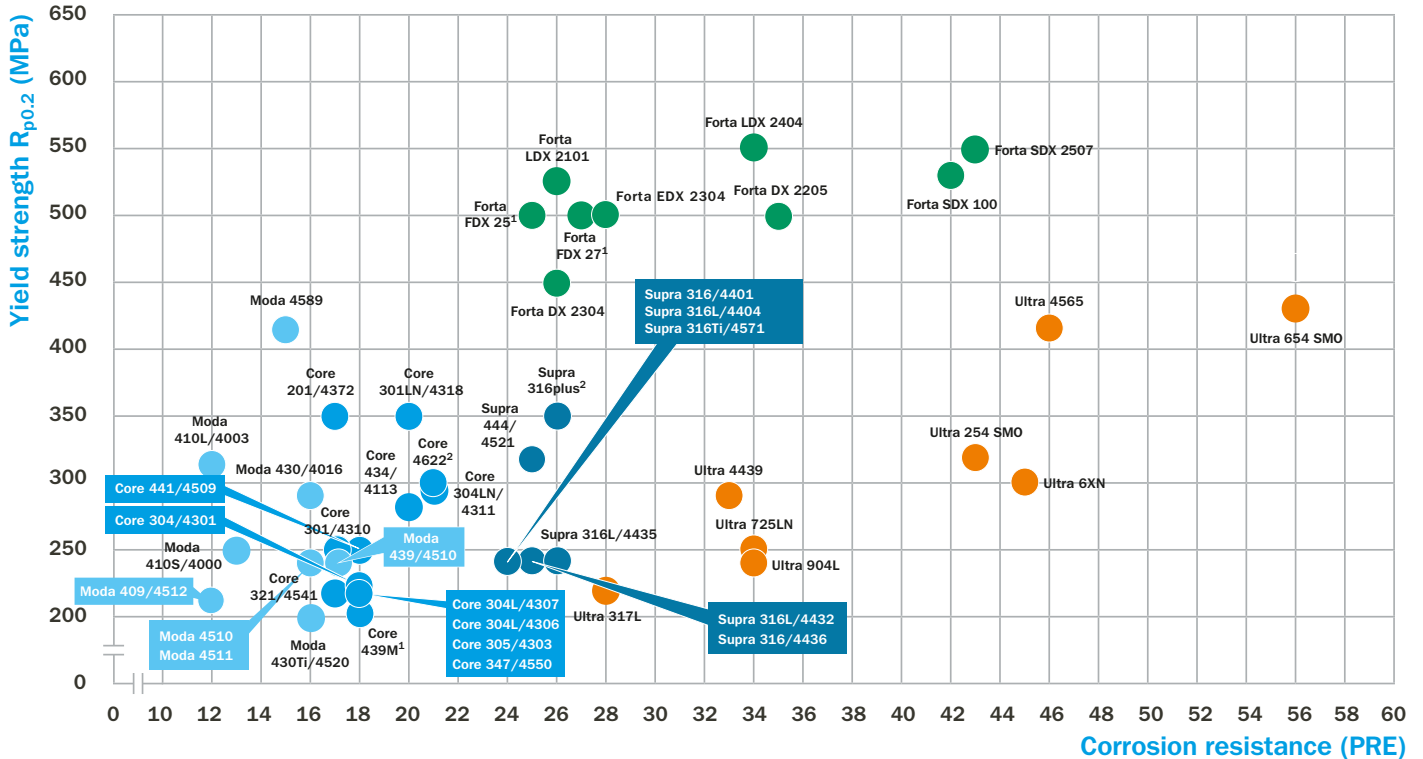


For some aggressive environments you can still consider cost-effective options from the Core range. For example, molybdenum is generally not good for a high alkalinity or high temperature process, so Core 304L/4307 could be a better solution.

Please contact us by outokumpu.com/contacts to find out which product is right for your next project.

Product performance comparison

Strength vs. corrosion resistance



- Moda – Mildly corrosive environments
- Core – Corrosive environments
- Supra – Highly corrosive environments
- Forta – Duplex and other high strength (PRE 16 to 43)
- Ultra – Extremely corrosive environments (PRE > 27)

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

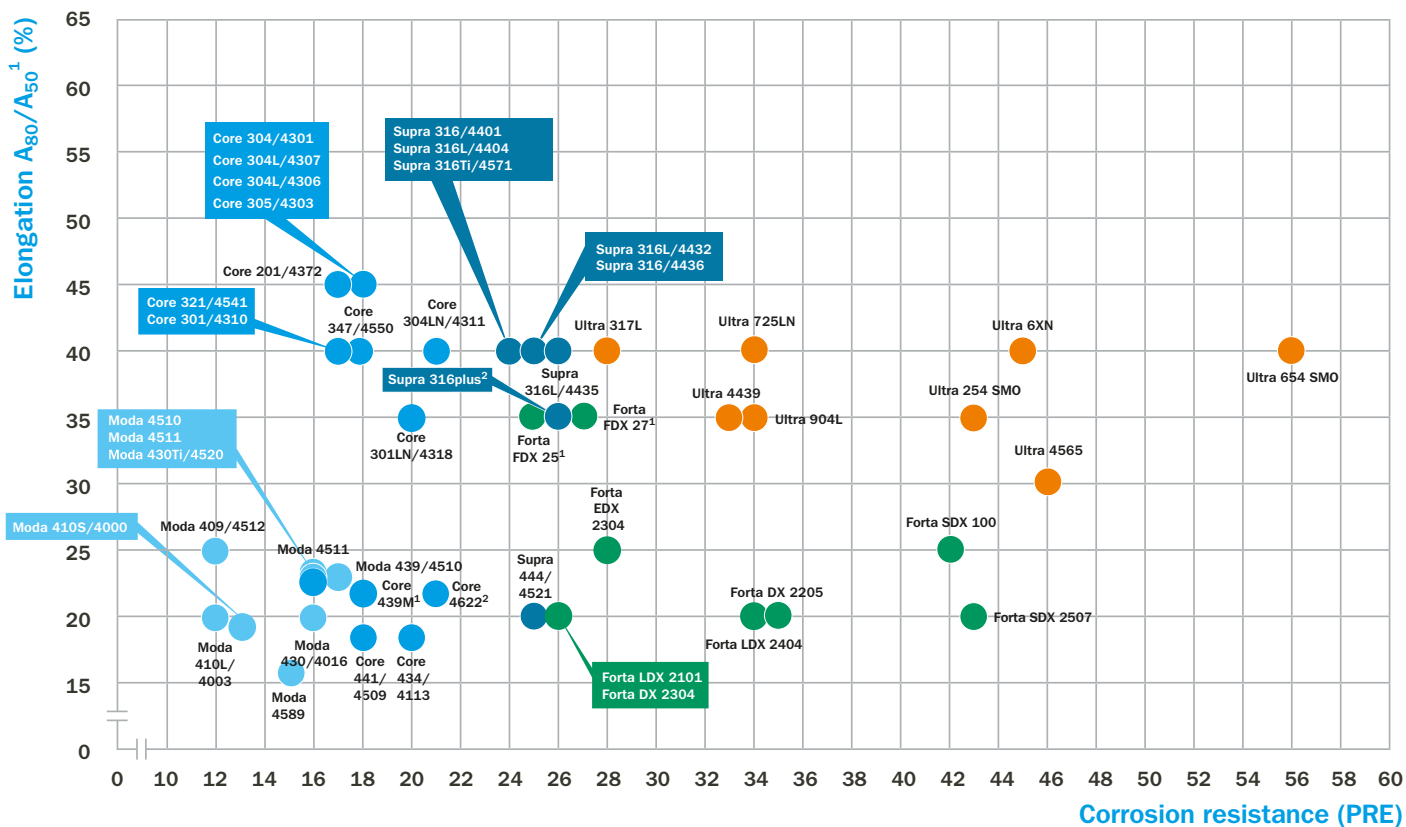
Note: PRE values shown are Outokumpu typical values. Yield strength ($R_{p0.2}$) according to EN 10088-2 minimum values for cold rolled strip. Yield strength for temper rolled products ranges from 500-2000 MPa.

¹) According to ASTM A240.

²) According to EN 10028-7.

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

Elongation vs. corrosion resistance



- Moda – Mildly corrosive environments
- Core – Corrosive environments
- Supra – Highly corrosive environments
- Forta – Duplex and other high strength (PRE 16 to 43)
- Ultra – Extremely corrosive environments (PRE > 27)

PRE calculation = %Cr + 3.3 x % Mo + 16 x %N

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

¹⁾ According to ASTM A240.

²⁾ According to EN 10028-7.

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



Learn more by outokumpu.com/ultra

Product properties

Ultra range

Extremely corrosive environments (PRE > 27)

Steel designations				Performance				Typical chemical composition, % by mass					
Outokumpu name	EN	ASTM		PRE	A ₈₀ %	R _{p0.2} MPa	Grade family	C	Cr	Ni	Mo	N	Others
		Type	UNS										
Ultra 904L	1.4539	904L	N08904	34	35	240	A	0.01	19.8	24.2	4.3	–	1.4Cu
Ultra 254 SMO	1.4547	–	S31254	43	35	320	A	0.01	20.0	18.0	6.1	0.20	Cu
Alternatives													
Ultra 317L ¹⁾	1.4438	317L	S31703	28	40 ²⁾	220 ²⁾	A	0.02	18.2	13.7	3.1	–	–
Ultra 4439	1.4439	317LMN	S31726	33	35	290	A	0.02	17.3	13.7	4.1	0.14	–
Ultra 725LN	1.4466	–	S31050	34	40 ²⁾	250 ²⁾	A	0.01	25.0	22.3	2.1	0.12	–
Ultra 6XN	1.4529	–	N08926/ N08367	45	40 ²⁾	300 ²⁾	A	0.01	20.5	24.8	6.5	0.20	Cu
Ultra 4565	1.4565	–	S34565	46	30	420	A	0.02	24.0	17.0	4.5	0.45	5.5Mn
Ultra 654 SMO	1.4652	–	S32654	56	40	430	A	0.01	24.0	22.0	7.3	0.50	3.5Mn Cu

¹⁾ Also available with 11.7% Ni which is not consistent with 1.4438. ²⁾ Min. values for plate acc. to EN 10088-2.

Note: PRE values and chemical composition figures shown are Outokumpu typical values. Yield strength (R_{p0.2}) and elongation (A₈₀) are based on EN 10088-2 minimum values for cold rolled strip.

For more information, please see steelfinder.outokumpu.com

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.

Ultra 254 SMO used on an offshore platform

Due to the aggressiveness of crude oil, offshore platform pipes must have exceptionally high corrosion resistance.

BSL Tube & Raccords chose Ultra 254 SMO for the manufacture of pipes for sensitive sections in the topside equipment on the Al Shaheen platforms in Qatar.

This high-alloyed super-austenitic grade was developed and patented by Outokumpu to withstand the most corrosive environments, including those presented by crude oil. Outokumpu has also supplied large volumes of this product for pipes designed for 70-year life spans on offshore platforms in the North Sea.

“ This high-alloyed super-austenitic grade was developed and patented by Outokumpu to withstand the most corrosive environments.



Looking for expert help to choose the best product for your next project? Please contact us by [outokumpu.com/contacts](https://www.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
environments

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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