

Outokumpu Surface Finishes

outokumpu
high performance stainless steel



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We believe in a world that lasts forever

The world needs and deserves innovations that pass the test of time and are able to be recycled and used again at the end of their lifecycle.

Outokumpu stainless steel is durable in the most challenging of conditions delivering ever longer project lifecycles. The recycled content of Outokumpu advanced materials varies between 70% and 90% depending on the grade and Outokumpu stainless steel is also fully recyclable. The properties of Outokumpu advanced materials, also make them an economically sustainable solution.

Our vision of a world that lasts forever not only reflects these properties but also our ongoing commitment to innovation and the development of lasting customer relationships.

Answers for today's challenges

The use of stainless steel is increasing fast due to the material's durability, corrosion resistance and aesthetics. If the right grades and surface finishes are selected, stainless steel lasts hundreds of years making it the least expensive material, thanks to its low maintenance costs.

Surface finish – appeal, form and function

The variety of surface finishes available for our stainless steel products is wide. From decorative architectural cladding that highlights the architects' aesthetic ideal to the functional and decorative coolness of surfaces in elevators and indoor spaces. From the attractive, hygienic surfaces of domestic and professional kitchens & bathrooms and the easy to clean surfaces of food process tanks and piping - to the textured finishes that provide grip on slippery oil rigs stairways. The applications are almost limitless.

Helping you specify the right surface finish

Specifying the surface appearance of stainless steel can be an intricate process. This is partly because surface finish standards define the production process, rather than the surface finish itself (see table 1).

We can help you choose the surface finish that best meets your needs from the following options and standards.

The options are:

- Standard
- Bright annealed
- Polished or Ground
- Brushed
- Patterned
- Special surfaces including customer specific surfaces.



Standard finishes are:

- 1D: Rough and dull
- 2E: Rough and dull when shot blasting is used for descaling. Smooth and directional finish when brushing is used.
- 2B: Smooth and reflective

The expert's voice

If one is asked to sum up the major characteristics of stainless steel a good answer would be: durability, functionality and beauty. This brochure deals with the "beauty" of the stainless steel by detailing the wide variety of surfaces finishes that Outokumpu can offer.

Due to its durability and corrosion resistance stainless steel has the great advantage of not needing a protective coating. In my view this fact is the most appealing detail about stainless steel. The smoothly reflecting stainless steel look combined with the cool metallic touch make this material fascinating and unique. The pristine metal can unreservedly be experienced. It is not without reason that architects commonly highlight the "honesty" and praise the "purity" of stainless steel as arguments for their material choice.

As the surface is often of major importance in stainless steel applications we offer our customers a wide selection of finishes with different appearances. In addition to our standard finishes like 2B, 2BB or BA we produce an array of different brushed and polished surfaces, which are usually customized upon special request. We offer almost 30 individual surface patterns that give elevators for example a scratch-resistant and esthetically attractive lining or create as a façade material a softly reflecting classy-looking building envelope.

Certainly particular attention should be paid to our special surfaces which excel with exceptional properties regarding their reflectance or roughness. We offer a high gloss surface called 2R² which almost matches the qualities of the mirror polished (No. 8) finish. It is produced inline at our regular mill facilities, making this surface an interesting and cost efficient alternative to No. 8 finish. At the other end of the gloss spectrum we produce a dull finish called "supermatt". This is a shot blasted surface with an extremely homogeneous, high quality appearance and currently our dullest available finish. Our "Deco Matt" finish shows a similar level of dullness. Its highly decorative rough surface is achieved by a combination of deco rolling, pickling and brushing.

As dull surfaces have recently become very much in vogue, Outokumpu drives the development of new low gloss surface finishes with particularly small specular reflectance. Earlier research on dull surfaces has shown that these finishes easily tend to appear somewhat "lifeless".



Dr. Jörn Teipel
Technical Customer Service Architecture

Therefore the challenge in this development is to maintain the liveliness and sparkle that is inherent to stainless steel, but simply toned down.

I am a member of a dedicated team at Outokumpu that is specialized in guiding and consulting our customers in the selection of surface finishes. I encourage you to challenge us when looking for a customized finish for your latest project. It is our pleasure to help you.

Outokumpu standard surface finishes

Table 1.

Outokumpu product	Standard ASTM/EN*	Process route	Notes	Surface appearance
Hot Rolled				
1D	1/1D	Hot rolled, heat treated, (shot blasted) and pickled.	Standard for most steel types to ensure good corrosion resistance; also common finish for further processing.	Rough and dull.
Semi-cold Rolled				
RAP® 2E	1/2E	Cold rolled, heat treated, mechanically descaled followed by pickling.	A relatively rough shotblasted finish with cold band tolerances and less roughness than a 1D finish.	Rough and dull.
Cold Rolled				
2E	1/2E	Cold rolled, heat treated, mechanically descaled followed by pickling.	Descaling through brushing gives a finish that is directional and significantly smoother than 1D.	Rough and dull when shot blasting is used for descaling. Smooth and directional finish when brushing is used (Nyby mill).
2D	2D	Cold rolled, heat treated, pickled.	Surface not as smooth as 2B or 2R.	Smooth.
2B	2B	Cold rolled, heat treated, pickled, skin passed. (Skin passing may be by tension leveling.)	Smooth surface with low gloss.	Smoother than 2D.
2BB	2B	Cold rolled, heat treated, bright pickled, skin passed.	Smoother and brighter than 2B, higher image clarity. Available on some ferritic grades, only.	Smooth and reflective.
2R	BA/2R	Cold rolled, skin passed, bright annealed.	Smooth, mirror-like surface with high image clarity.	Smooth, bright, reflective.
2H	TR/2H	Work hardened (temper rolled).	Cold worked by rolling to obtain higher strength level.	Higher gloss than 2B and 2D.

* Note: surface roughness value, or surface sample, is required to verify exact specification.

Standard Finishes



RAP® 2E A relatively rough shotblasted finish with cold band tolerances and less roughness than a 1D finish.



2E A brushed 2E slightly directional finish. It is much smoother than shot-blasted finishes and can replace the standard cold rolled finish 2B in many applications where good cleanability is an advantage.



2B Smooth surface with low gloss.



2R / BA A bright and mirror-like finish for applications where either high gloss or an exceptionally hygienic surface is required. The 2R finish is used in applications requiring high image clarity or an ultra-smooth surface that is easy to clean.

Typical applications

Table 2.

Surface	Typical applications
1D	Machines / instruments, buses, railway vehicles, profiles, electrical cabinets, laboratory cabinets, tubes, cut ware, press plates, stamping parts, tank construction, commercial kitchens, building industry, automotive, boiler
2E/RAP 2E	Tubes, tanks, busses, railway, structural parts, conveyers
2D	Tubes, stamping parts, building industry, automotive, beer kegs
2B	Machines / instruments, buses, railway vehicles, profiles, electrical cabinets, laboratory cabinets, tubes, cutlery, cut ware, press plates, stamping parts, tank construction, commercial kitchens, building industry, automotive, boiler, clever clamps, surgical instruments, pumps manufacturer, beer kegs, chimney pipes, heat exchangers, sinks, elevators
2BB	Washing machine drums, dishwashers, dryiers, commercial kitchens
2R	Sinks, dishwashers, dryer, washing machines, cookers, microwave, cookware, profiles, electrical cabinets, laboratory cabinets, tubes, cutlery, stamping parts, commercial kitchens, automotive, boiler, clever clamps, pumps manufacturer, chimney pipes, heat exchangers, bicycle rims
2H	Automotive, chains, machines / instruments, tank construction, press plates, building industry, boiler, cut ware, surgical instruments, implants, railway vehicles, profiles, stamping parts

More information steelfinder.outokumpu.com



Outokumpu special finishes

When you seek surface qualities beyond those found in our standard finishes, our global network of service centres offer wide range of finishes to suit every need: From the aesthetic finishes used in architectural applications and the hygienic surfaces required in restaurant kitchen equipment to patterned surfaces used in decorative and industrial applications.

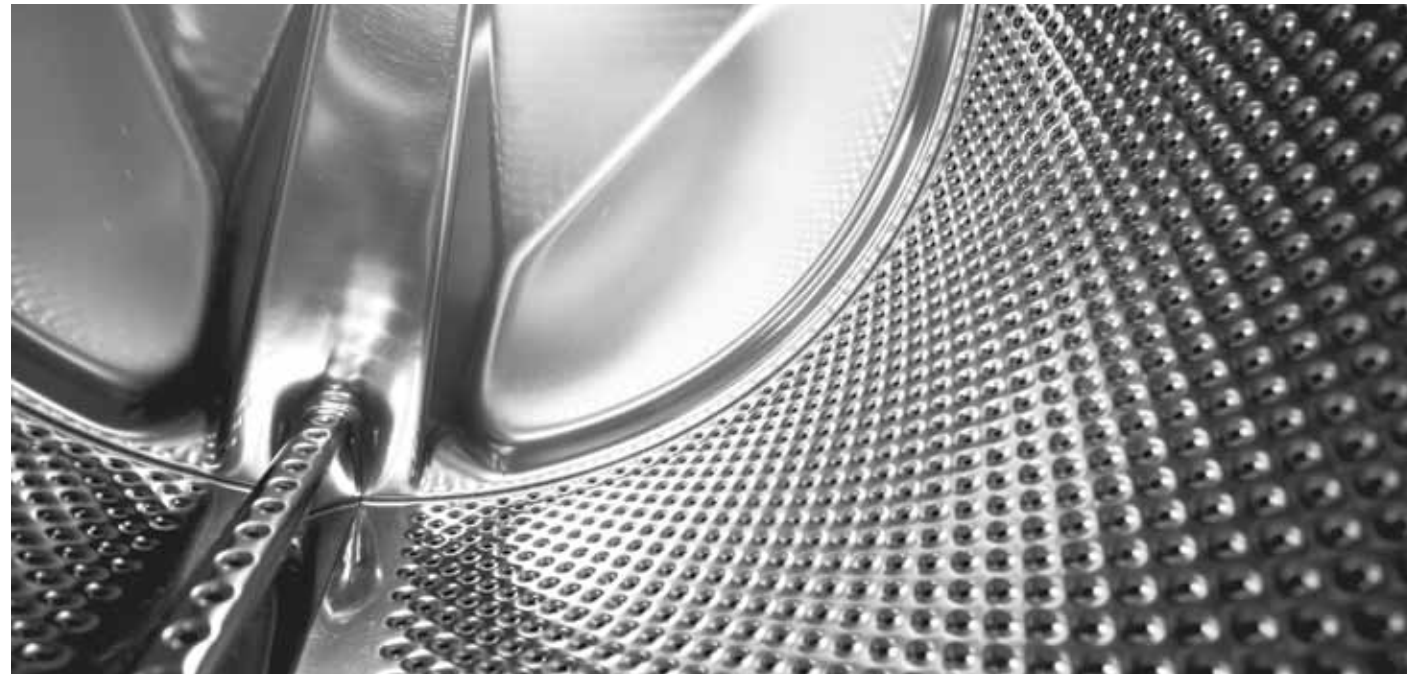
Polished surfaces

By polishing the cold rolled steel sheet with an abrasive belt of a certain grain size (grit), a surface is obtained which has a silver-like metallic shine, which improves the decorative effect.

By optimizing the grain of the belt the surface finish can be fine-tuned to meet your specific application requirements. The finer the grain of the abrasive belt, the higher gloss and more even the finish. Polishing

with a coarse grinding belt of grit P180 may for example give an Ra value of 0.6-0.9 μm . The roughness of the surface in this case is suitable for applications that require low visual appearance. Using successively finer grit belts, an almost mirror-like surface can be produced.

Surface roughness and structure can also be affected by different polishing techniques, even if no differences are detectable with the naked eye. Wet polishing, for example, produces a finer surface than



dry polishing. The grain size (grit) of the abrasive belt and the resultant surface roughness of the sheet do therefore necessarily not have a fixed relation. Wet polishing also produces a cleaner surface with less microscopic defects than dry polishing, this means that dirt, bacteria and corrosive substances generally do not attach as easily to wet polished surfaces. However, the dry polished surface has a more matte gloss that is often sought after in aesthetic applications. The ground or polished surface has more or less clearly visible scoring, which also makes scratches from daily wear and tear less visible. A polished surface is also easy to re-create, for example after repairs or welding work, compared with a 2B or 2R surface.

Polished sheet is used for purposes where quality of appearance and hygiene are very important, such as:

- Commercial kitchens (work surfaces, cooking utensils, dishwashers, freezers)
- Households (cooking vessels)
- Public places (sanitary facilities, hospital equipment, kick-plates)

Brushed surfaces

The use of brushing (with Scotch Brite®, for example), usually on a 2B surface, provides a silky-matt finish without clear grinding scores. A brushed surface also has the advantage that it can easily be re-created. The Ra value for brushed sheet can be around 0.1-0.4 μm . Brushed stainless steel sheet is used in situations where appearance is an important factor, such as:

- Buildings (sheet metal cladding and lift interiors)
- Vehicles (car hub caps, wall panels for express trains)
- Households (sink units)

EN and ASTM standards are different

The codes for stainless steel surface finishes given in the EN and ASTM standards are different from each other. Tables 3 and 4 overleaf describe how the EN and ASTM standards define some of the surfaces typically offered.

Table 3.

Polished and brushed finishes given in EN 10088-2:2005.¹

Designation	Description
2G	Ground Grade of grit or surface roughness can be specified. Unidirectional texture, not very reflective.
2J	Brushed or dull polished Grade of brush or polishing belt or surface roughness can be specified. Unidirectional texture, not very reflective.
2K	Satin polish Additional specific requirements to a “J” type finish, in order to achieve adequate corrosion resistance for marine and external architectural applications. Transverse Ra < 0.5 µm with clean cut surface finish.
2P	Bright polished This finish is achieved by mechanical polishing. The process or surface roughness can be specified. It is a non-directional finish, reflective with high degree of image clarity.

¹ EN 10088-2:2005, Stainless steels. Part 2: Technical delivery conditions for sheet/plate and strip for general purposes.

² ASTM A 480/A 480M – 09, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.

More information steelfinder.outokumpu.com

Table 4.

Polished and brushed finishes given in ASTM A 480/A 480M – 09.²

Designation	Description
No. 3	Intermediate polished finish This is a linearly textured finish that may be produced by either mechanical polishing or rolling. Average surface roughness (Ra) may generally be up to 40 micro-inches. A skilled operator can generally blend this finish.
No. 4	General purpose polished finish This is a linearly textured finish that may be produced by either mechanical polishing or rolling. Average surface roughness (Ra) may generally be up to 25 micro-inches. A skilled operator can generally blend this finish. There may also be overlap in measurements of surface roughness for both No. 3 and No. 4 finishes.
No. 6	Dull satin finish This finish has a soft, satin appearance and has a reflectivity that is lower than a No. 4 finish. It is used for architectural applications and ornamentation where high luster is undesirable; it is also used effectively to contrast with brighter finishes.

Aesthetic and functional



DB Dry brushed finishes are not only pleasing to the eye but also easy to clean, which has made them especially popular for household appliances and many applications seeking a decorative effect.



4N Wet ground finishes are smooth with a satin-like look, which provides for easy cleaning. Typical uses include interior surfaces and household appliances.



Outokumpu patterned & special finishes

With patterning we are able to achieve an enhanced combination of design and function. We offer you a large variety of patterned surfaces each with different gloss and reflection effects. As standard we emboss on 2R and by special request on 2B. The most popular designs are Microchecker, Haze, Laser, Microlinen, Diamonds, Square, Linen and Leather Grain. Individual patterns can also be developed according to your needs. After embossing we apply a recovery annealing for improved formability and due to tension leveling we achieve an extremely high flatness.

Typical applications include:

- Lifts, doors, escalators
- Stairs and walkways
- Wall panels and cladding for buildings
- Sinks and counter tops
- Protective shields
- Cisterns and tanks

Standard steel grades for these decorative finishes are EN 1.4307 (ASTM 304L), EN 1.4404 (ASTM 316L), EN 1.4301 (ASTM 304) and EN 1.4509 (ASTM 441). Other grades for more corrosive environments are available on request.

Double sided pattern

Patterned sheet is produced by means of extra rolling of cold-rolled coils between special imprinted rolls. In this way, a waffle-type pattern can be obtained on both sides of the sheet. At the same time, the rigidity and strength of the material is increased by almost 50%. This means that it is possible to use a thinner sheet, and thus obtain a lower weight.

Special finishes

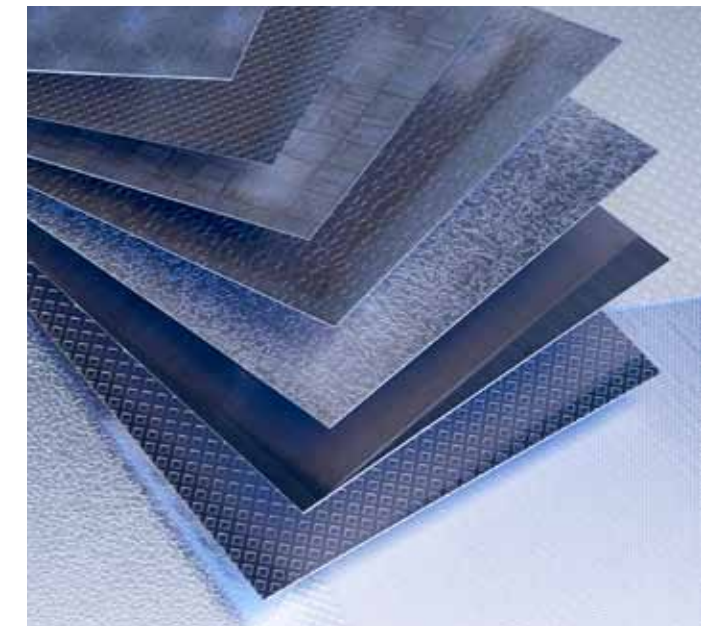
Deco finishes are rolled with an imprinted roll on one side producing a decorative surface with high resistance to wear and scratching. Deco material is highly formable.

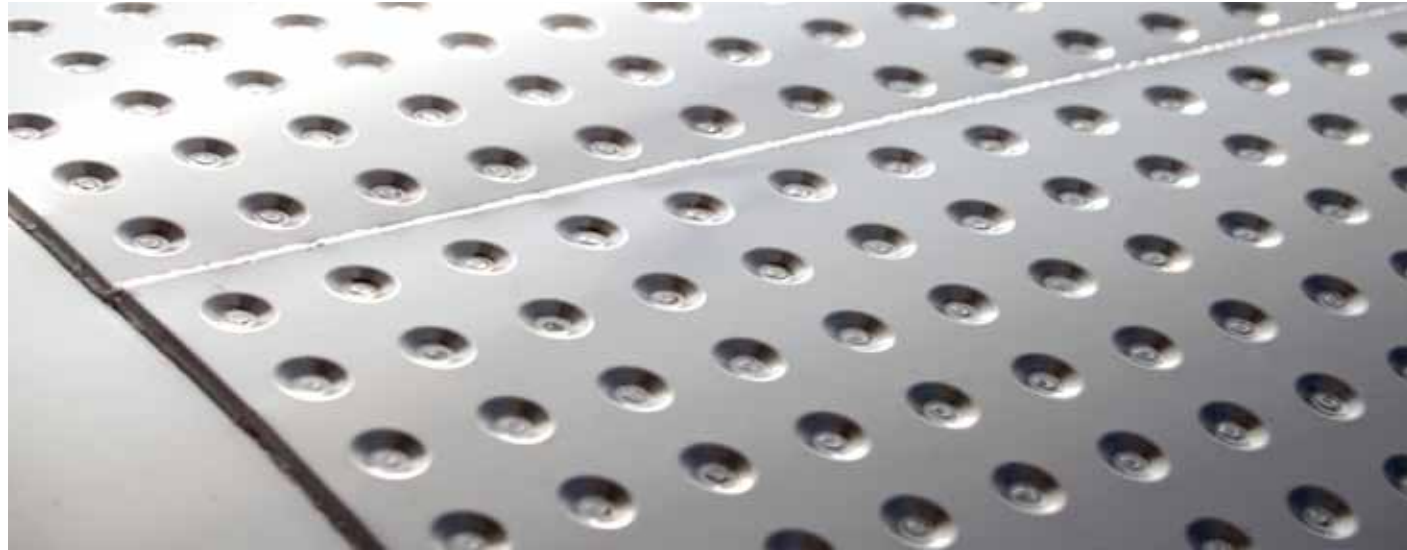
Outokumpu produces also other special finishes such as 2R² – A smooth surface with high reflectivity. Gritline – A finish with similar properties to polished 240 grit but with improved corrosion resistance. Supermatt - A shot blasted surface delivering a low gloss, extremely homogeneous and high quality appearance.

Typical applications include:

- Lifts, doors, escalators
- Counter and bar tops
- Refrigerators and freezers
- Any surfaces that are susceptible to fingerprints

DecoMatt and DecoLinen is also available on EN 1.4462 (ASTM 2205).





Beyond simply material supply

From order to pre fabrication and delivery

At Outokumpu we can help you with every stage of the process from initial grade selection advice through to the delivery of world-class stainless steel and a surface finish that meets your particular requirements. Our service centres, which are located in the key markets, can perform a wide range of surface finishing activities – from polishing and grinding through to innovative decorative finishes. Our local service centres also offer a range of prefabrication services such as bending, laser, plasma and waterjet cutting.

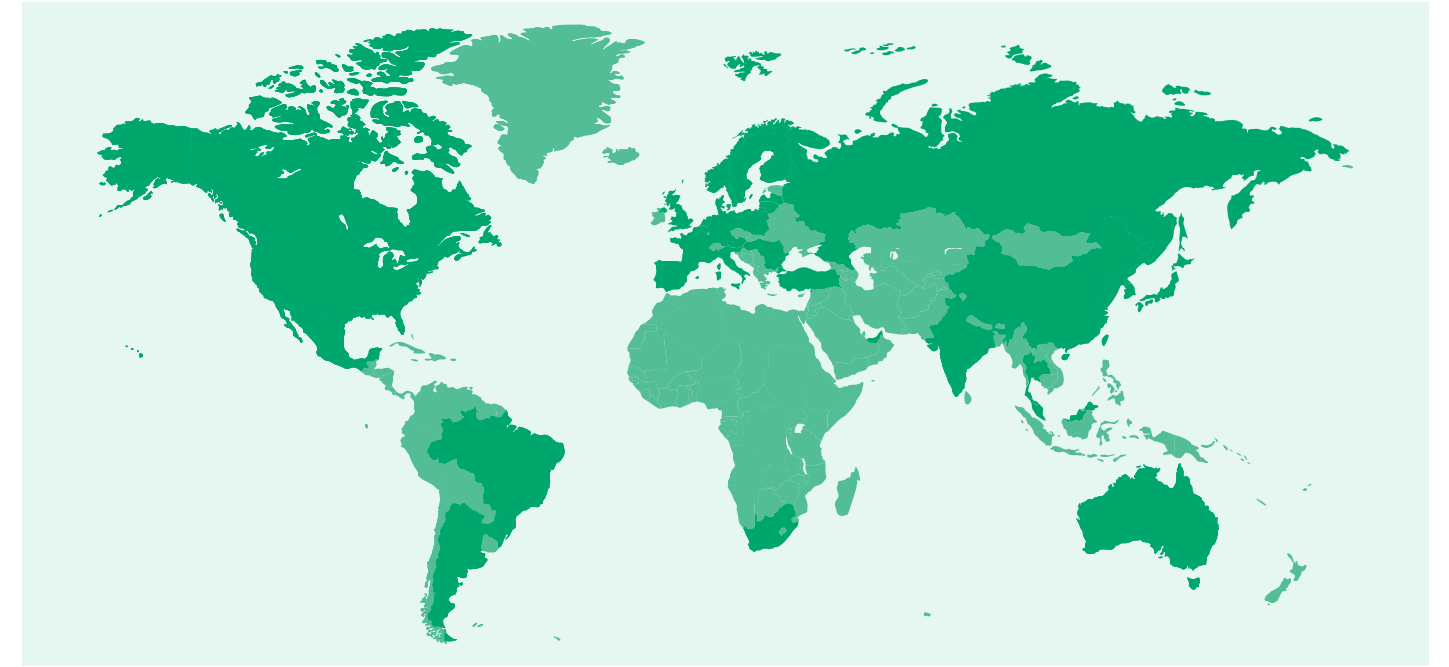
Materials testing for optimal grade selection

We have extensive experience in testing stainless steels in many food & drink environments. The results of several of these tests, covering the most common foodstuffs from starch and syrup to acetic acids

and ethyl alcohol, are available to you in the Outokumpu Corrosion Handbook.

In specific cases, we can also offer testing of different stainless steel grades in your own processes at your premises, supported by testing and evaluation by our specialists in our own corrosion laboratory. These tests, together with our long experience ensures that the grade you finally choose is the optimal solution.

We study your needs on the spot, delivering professional help not only in material selection but also in planning, logistics advice and adapted service for optimal products, cost-efficient operations, and well-planned deliveries.



We are where you are

All our operations are geared to maintain close contact with our customers and make the process of purchasing stainless steel as simple as possible.

We are the world's leading producer of stainless steel and also in technical support, research and development. We serve our customers from our main production facilities in Finland, Sweden, UK, Mexico and USA, supported by operations in some 30 countries around the world. Wherever in the world you may be, we are just around the corner.

Outokumpu online – useful tools and links

Select the right materials at steelfinder.outokumpu.com

- Mechanical properties
- Chemical composition
- Physical properties
- Corrosion rates/values
- Fabrication indexes/values

Contact our sales at outokumpu.com/contact-us

- Dimensions for flat and long products
- Thickness and width ranges in mm and inches
- Available surface finishes and decoration patterns for flat products
- Calculation tools to optimize material selection

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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.

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