Sandvik duplex stainless steels

Superior performance.

Better value.

Greater reliability.

Take the lead

Superior performance. Better value. Greater reliability. When you compare Sandvik's duplex stainless steels with conventional stainless steels, you'll find there's no comparison at all.

Based on the best characteristics of austenite and ferrite, duplex stainless steels combine mechanical strength with extremely high corrosion resistance. In fact, duplex's yield strength is considerably superior to that of conventional stainless steels, allowing for lighter constructions, more compact system designs and less welding.

In tube applications, for example, duplex's higher strength lends itself to thinner walls that withstand the same pressure levels as those of conventional steels.

Equally important, duplex's high corrosion resistance ensures significantly more uptime than carbon steels and conventional stainless steels. Taking into account duplex stainless steels' favorable long-term life-cycle costs, duplex costs less, sometimes much less, than competing materials. That's why duplex stainless steels also make financial sense.

And the future is bright. As the market grows and customers become even more aware of the benefits of duplex, Sandvik is ideally placed to fulfill the growing need for high strength, corrosion-resistant products that can handle a broad range of applications in the most severe environments.

So why not take the lead with Sandvik duplex stainless steels?

Advancing the duplex evolution

Since the launch of the first duplex stainless steel in the 1960s, Sandvik has been at the forefront of duplex development. Today, as a major supplier of duplex stainless steels, Sandvik has enjoyed a steady and growing market share due to its broad range, high quality and product consistency – from delivery to delivery.

Using its metallurgical expertise, Sandvik is continuing to achieve breakthroughs in duplex stainless steels, adding more specialized, higher performance products to its program. These new, more advanced materials, are supplementing Sandvik's core duplex products.

For example, customers who have benefited from the performance of Sandvik SAF 2507, a highly corrosion-resistant super-duplex steel, are likely to upgrade to Sandvik SAF 2707 HD, the latest material in our duplex portfolio. Sandvik SAF 2707 HD is a hyper-duplex steel that is designed to resist corrosion in the most severe chloride containing environments. Sandvik SAF 2707 HD can also serve as an alternative to expensive Ni-based alloys and highly alloyed austenitic stainless steels in a number of applications.

Outperform your competitors

Because high-alloy, duplex stainless steels are complicated to manufacture, specialist knowledge is required for producing a consistently high-performance product. With a long tradition in research and development, coupled with integrated production facilities, Sandvik is uniquely equipped to advance the duplex evolution.

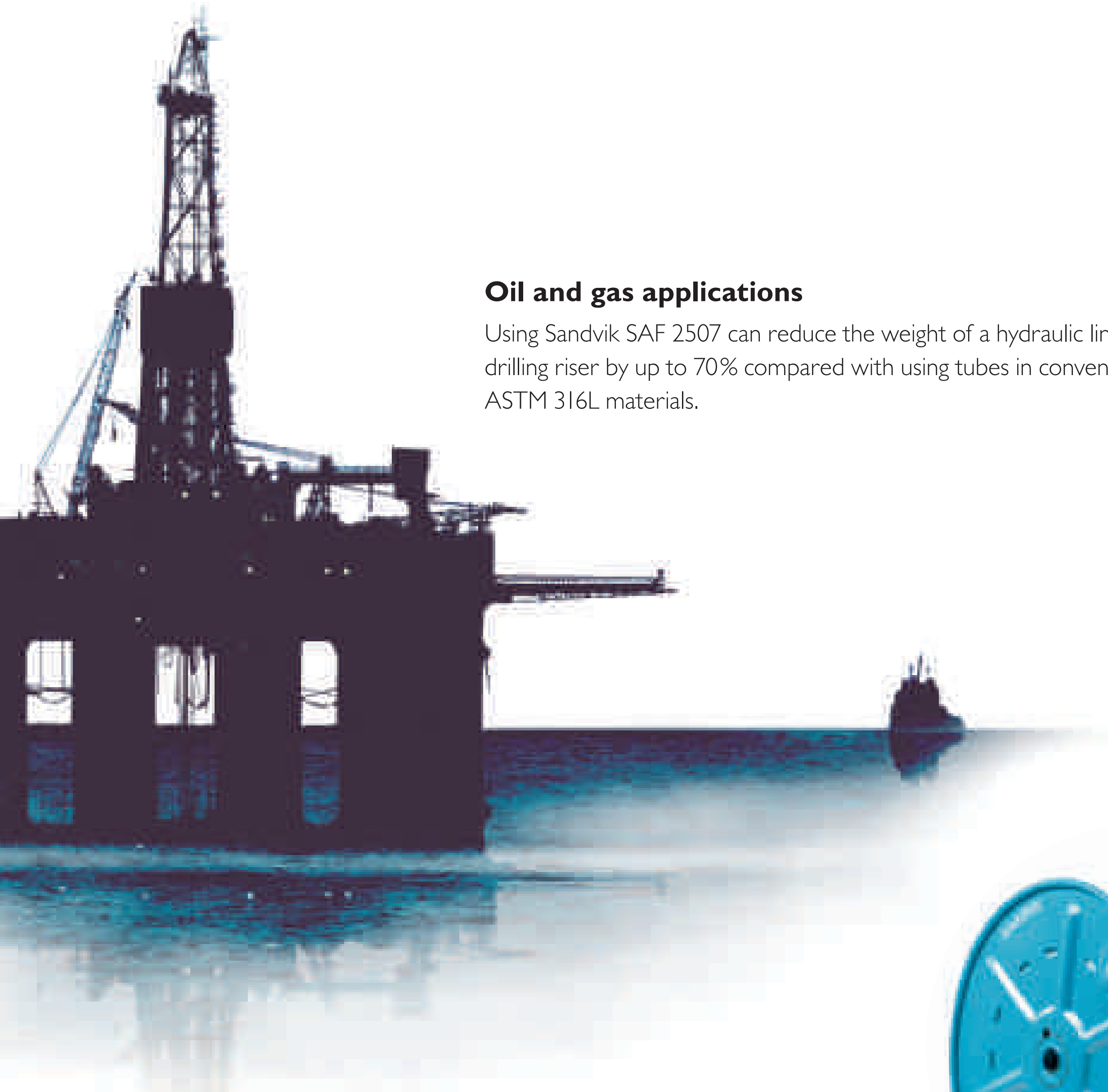
Our integrated production facilities allow us to control the entire process, from melting to the finished product. The end result is a product whose chemical composition is exactly in line with the data we publish. Our commitment to your performance extends beyond the quality of the materials we deliver. With many years experience in developing duplex stainless steels, Sandvik can help you meet your technical challenges. Our metallurgists and engineers, with access to a world-leading database of knowledge, are always available to work closely with you to develop solutions that will help you outperform your competitors.

Our duplex program

- Hyper-duplex: Sandvik SAF 2707 HD®
- Super-duplex: Sandvik SAF 2507®
- Duplex: Sandvik SAF 2205®
- Lean duplex: Sandvik SAF 2304®

A superior solution in a wide range of applications

Sandvik duplex stainless steels are extremely resistant to corrosion and have exceptional mechanical strength. This translates into for example more compact system designs, lighter yet tougher tube installations and more versatile wire products. Here are a few examples of applications where Sandvik duplex stainless steel has proven to be a superior solution.



Oil and gas applications

Using Sandvik SAF 2507 can reduce the weight of a hydraulic line in a drilling riser by up to 70% compared with using tubes in conventional ASTM 316L materials.

A Sandvik SAF 2205SH slickline provides up to 35% higher breaking load than an ASTM 316 line of the same dimension.

Spring applications

Switching from spring wire in ASTM 316Ti material to Sandvik SAF 2205 in an aerosol application reduced the weight in the springs by 30%. Additionally, a productivity increase in spring production of more than 20% was achieved.

Heat exchangers

Sandvik SAF 2707 HD tubes installed in a crude unit overhead system over six years ago are still performing well. The carbon steel tubes they replaced failed after just 9 months.

Hydraulic and instrumentation tubing systems

Sandvik SAF 2304 hydraulic and instrumentation tubing can withstand almost twice the pressure compared with tubes of the same diameter and wall thickess in ASTM 300 materials.

Sandvik duplex stainless steels

Sandvik SAF 2707 HD®
Sandvik SAF 2707 HD is a high alloy, hyper-duplex stainless steel developed to provide high chloride corrosion resistance, combined with improved mechanical properties. It is particularly suitable for use in aggressive, acidic, chloride-containing environments.

Sandvik SAF 2507®
Sandvik SAF 2507 is a high alloy super-duplex steel for service in extremely corrosive conditions. Developed mainly for applications exposed to high stresses in chloride-containing environments like seawater, it contains high amounts of chromium, molybdenum and nitrogen.

Sandvik SAF 2205®
Sandvik SAF 2205 is a medium alloy duplex stainless steel with high corrosion resistance. The most widely used of the current duplex materials, continuous development over many years has led to further improvements in weldability and corrosion resistance through increased nitrogen and molybdenum contents.

Sandvik SAF 2304®
Sandvik SAF 2304 is a lean duplex stainless steel containing no molybdenum and a low nickel content.
It is a high strength, low cost alternative to standard austenitic grades such as ASTM 304L and 316L.

Chemical composition (nominal) %

Sandvik grade	C max	Si max	Mn max	P max	S max	Cr	Ni	Mo	N	Others
SAF 2707 HD	0.030	0.5	1.5	0.035	0.010	27	6.5	4.8	0.4	Co=1.0
SAF 2507	0.030	0.8	1.2	0.035	0.015	25	7	4	0.3	
SAF 2205	0.030	1.0	2.0	0.030	0.015	22	5	3.2	0.18	
SAF 2304	0.030	1.0	2.0	0.035	0.015	22.5	4.5	–	0.10	

Type of steel

Sandvik grade	UNS	EN	W-Nr	DIN	AFNOR	SS
SAF 2707 HD	S32707	–	–	–	–	–
SAF 2507	S32750	1.4410	–	X 2 CrNiMoN 25 7 4	–	2328
SAF 2205	S31803/S32205	1.4462	1.4462	X 2 CrNiMoN 22 5 3	Z 2 CND 22-05-03	2377
SAF 2304	S32304	1.4362	1.4362	X 2 CrNiN 23 4	Z 2 CN 23-04AZ	2327

Product standards

Sandvik grade	Seamless and welded tube and pipe	Flanges	Fittings	Plate, sheet and strip	Bar	Forgings
SAF 2707 HD	ASTM A789; A790	–	–	–	–	–
SAF 2507	ASTM A789; A790	ASTM A182	ASTM A182; A815	ASTM A240; EN 10088-2	ASTM A479; EN 10088-3	ASTM A182
SAF 2205	ASTM A789; A790; NFA 49-217	ASTM A182	ASTM A182; A815	ASTM A240; EN 10088-2	ASTM A276; A479; EN 10088-3	ASTM A182
SAF 2304	ASTM A789; A790; EN 10216-5	–	–	ASTM A240; EN 10088-2	EN 10088-3	EN 10088-3*

* Forged billets.

Products
The duplex stainless steels are available in many product forms. For detailed information, visit www.smt.sandvik.com or contact your local Sandvik sales office.

- Seamless tube and pipe
- Fittings and flanges
- Welding products
- Plate, sheet and wide strip
- Steels for machining
- Forged products
- Cast products
- Powder metallurgy products
- Welded tube and pipe

Approvals
Sandvik duplex stainless steels have pressure purpose approvals, for example from the ASME (American Society of Mechanical Engineers) in US and according to PED (Pressure Equipment Directive) in Europe. For detailed information, please refer to the datasheet for the respective grade on www.smt.sandvik.com or contact your local sales office.

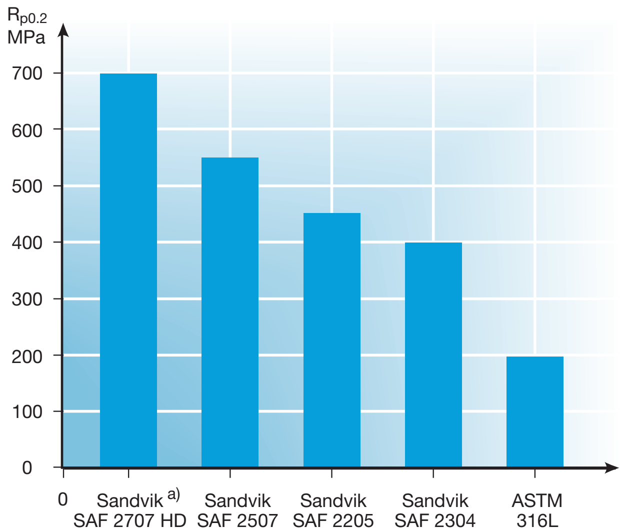
Mechanical properties

General
Since their introduction in the 1960's, duplex stainless steels have found widespread use because of an attractive combination of excellent mechanical properties, high corrosion resistance and relatively low cost compared with other high performance materials.

A smaller grain size and a two phase austenitic ferritic microstructure that prevents grain growth, gives Sandvik duplex stainless steels increased toughness and strength (in particular, very high proof strength).

Figures in the table below apply to material in the solution annealed condition at 20°C, with the following considerations:

- Proof strength can be further increased by approximately 400 MPa, if material is cold worked by pilgering.
- Tube and pipe with wall thicknesses >20 mm may have slightly lower values.
- Seamless tubes with <4mm wall thickness have guaranteed proof strength (Rp0.2) values which are 50 MPa higher than those listed.
- In accordance with ASTM A789, Sandvik SAF 2304 tubes with a maximum outside diameter of 25.4 mm have a guaranteed minimum proof strength of 450 MPa and a minimum tensile strength of 690 MPa.



Comparison of minimum proof strength, Rp0.2, of the duplex stainless steels and the austenitic stainless steel ASTM TP 316L.
a) Valid for wall thickness less than or equal to 4 mm/0.157 inch.

Minimum values for wall thicknesses <20 mm/0.787 inch

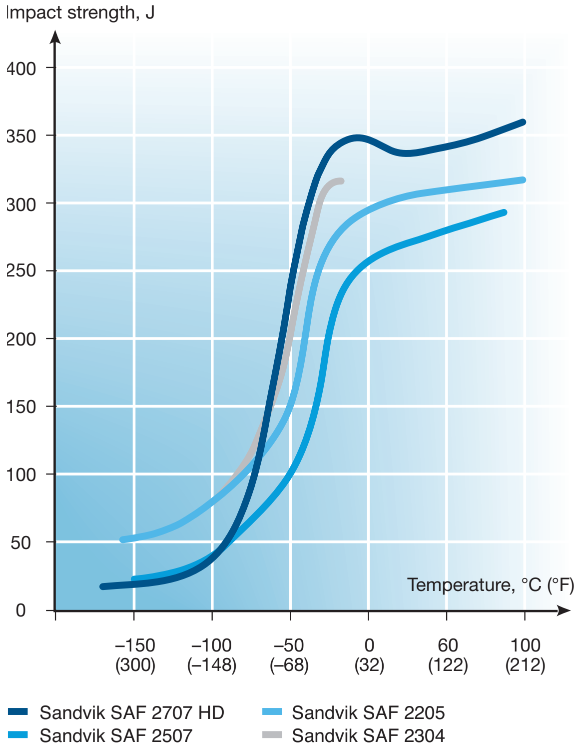
Sandvik grade	Proof strength $R_{p0.2}$ a) MPa/ksi min	Tensile strength R_m MPa/ksi	Elongation A % min	Hardness HRC max
SAF 2707 HD	700 b)/	920–1 100 b)/	25	34 b)
	101 b)	133–160 b)	25	34 b)
SAF 2507	550/	800–1 000/	25	32
	80	116–145	25	32
SAF 2205	485/	680–880/	25	28
	70	99–128	25	28
SAF 2304	400/	630–820/	25	30.5
	58	87–119	25	30.5

1 MPa = 1 N/mm^2
a) $R_{p0.2}$ corresponds to 0.2% offset yield strength.
b) Valid for wall thickness less than or equal to 4 mm/0.157 inch.

Recommendations are for guidance only, and the suitability of a material for a specific application can be confirmed only when we know the actual service conditions. Continuous development may necessitate changes in technical data without notice.

Impact strength

All four duplex stainless steels have good impact strength because of their optimised microstructure. The ductile-to-brittle transition temperature is approximately –50°C.



Impact strength values (10x10 mm Charpy V-notch specimens).

Fatigue strength

Owing to their high proof strength the duplex stainless steels also have very good fatigue strength. During cyclic tensile stress testing the fatigue limit is found approximately when the maximum load in a cycle reaches the proof strength of the material.

At high temperature

If a duplex stainless steel is exposed to high temperatures for prolonged periods, the microstructure changes, which results in a reduction in impact strength. This does not necessarily affect the behavior of the material at the operating temperature. For example, heat exchanger tubes can in most cases be used at higher temperatures without any problems. Please contact Sandvik for more information.

The maximum temperatures allowed according to the German VdTÜV data sheets and ASME BPVC

Grade	VdTÜV	ASME BPVC
Sandvik SAF 2707 HD	250°C/482°F a)	Pending
Sandvik SAF 2507	250°C/482°F	316°C/600°F b)
Sandvik SAF 2205	280°C/536°F	316°C/600°F b)
Sandvik SAF 2304	280°C/536°F	316°C/600°F b)

a) The maximum temperature for Sandvik SAF 2707 HD is 250°C according to European pressure equipment approval PMA (Particular Material Appraisal).

b) Comment according to ASME: This steel may be expected to develop embrittlement after service at moderately elevated temperatures.

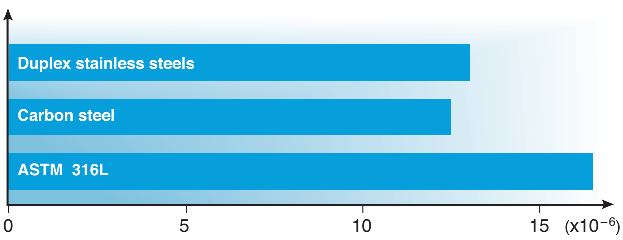
Physical properties

The density of the duplex stainless steels is approximately 7.8 g/cm³. The thermal conductivity (listed below) is compared with the austenitic grade ASTM 316L.

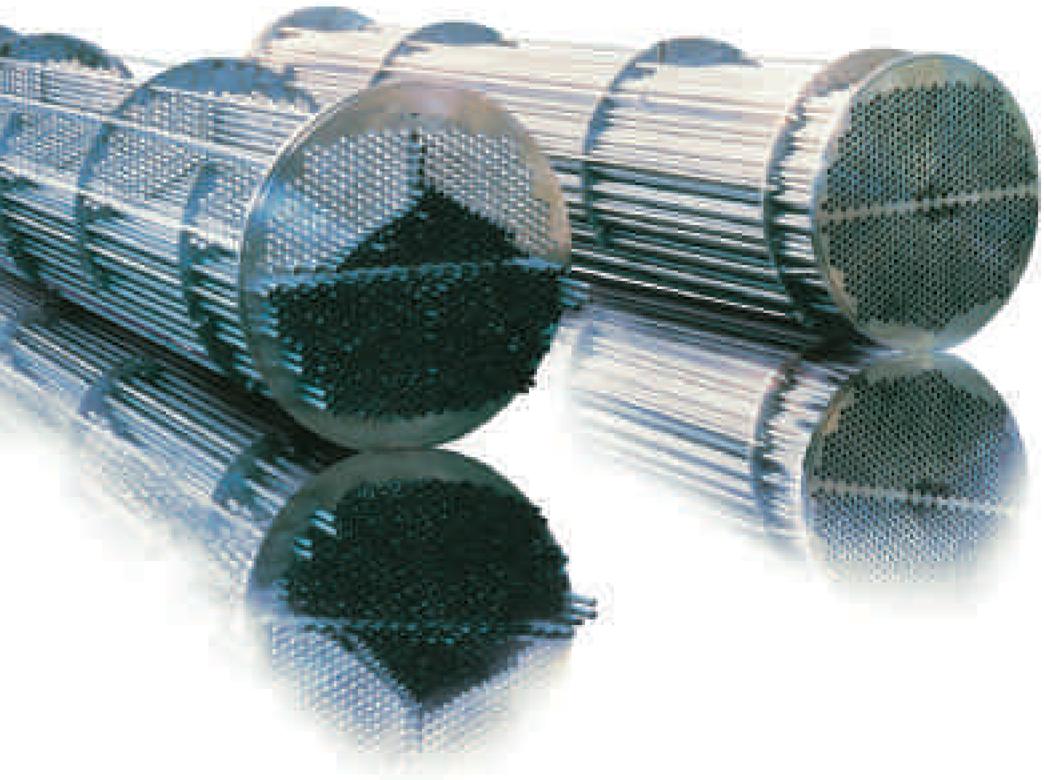
The duplex stainless steels have a thermal expansion close to that of carbon steel. This gives them definite design advantages over the austenitic stainless steels.

Thermal conductivity, W/m °C/°F

Grade	Temperature 20°C/ 68°F	100°C/ 212°F	200°C/ 392°F	300°C/ 572°F
Sandvik SAF 2707 HD	12	14	17	19
Sandvik SAF 2507	14	15	16	18
Sandvik SAF 2205	14	16	17	19
Sandvik SAF 2304	16	17	18	19
ASTM 316L	14	15	17	18



Thermal expansion per temperature 30–100°C (86–212°F).



Corrosion resistance

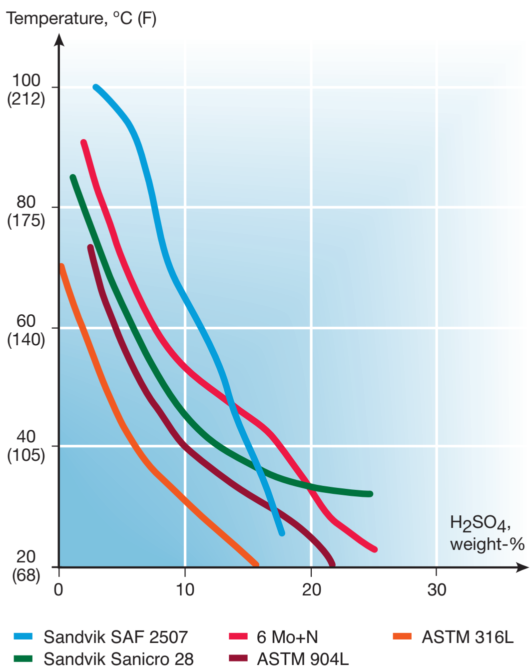
General corrosion

Each of the Sandvik duplex stainless steel grades brings particular benefits to the wide range of conditions, environments and media found in the process industries.

The duplex stainless steels' resistance to general corrosion is an important factor in prolonging the service life of process equipment. This makes them a superior alternative to standard austenitic grades such as ASTM 304L and 316L. The hyper-duplex grade Sandvik SAF 2707 HD and super-duplex Sandvik SAF 2507 can also serve as alternatives to expensive Ni-based alloys and highly alloyed austenitic stainless steels in some applications.

The graphs on pages 12–16 show the corrosion resistance of Sandvik duplex stainless steels compared with other materials such as standard austenitic grades.

The curves in the isocorrosion diagrams represent a corrosion rate of 0.1 mm/year. This means that above the curve the corrosion rate is higher and below it is lower than 0.1 mm/year.



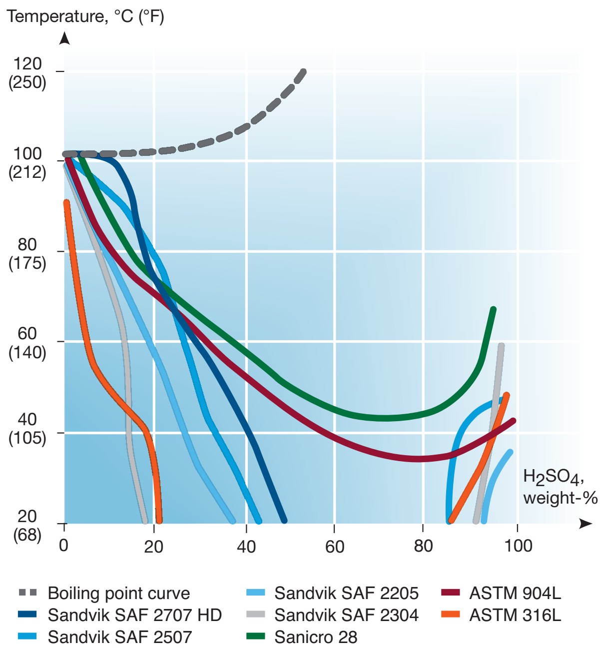
Isocorrosion diagram for Sandvik SAF 2507 in naturally aerated sulphuric acid in stagnant condition with 2000 ppm chloride ions (0.1 mm/year, 4 mpy).

Hyper-duplex: Sandvik SAF 2707 HD

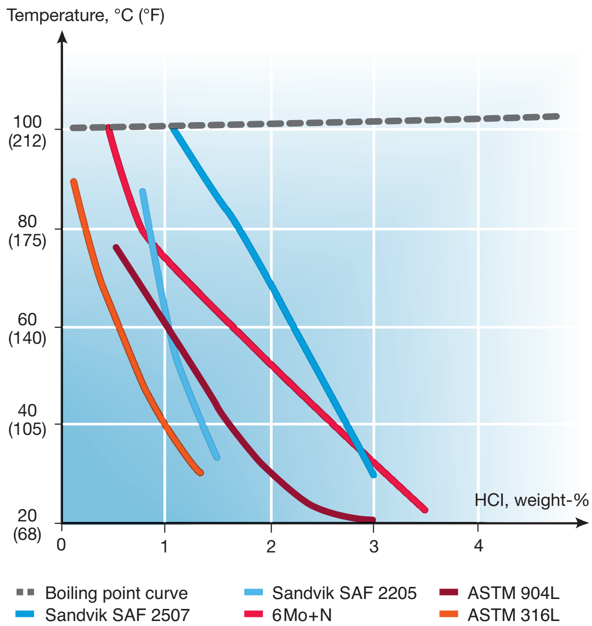
is a further development of the super-duplex Sandvik SAF 2507, improving the performance in aggressive, acidic, chloride-containing environments. Sandvik SAF 2707 HD is a very competitive alternative to highly alloyed austenitic stainless steels and Ni-based alloys in the most demanding applications, such as hot tropical seawater.

Super-duplex: Sandvik SAF 2507

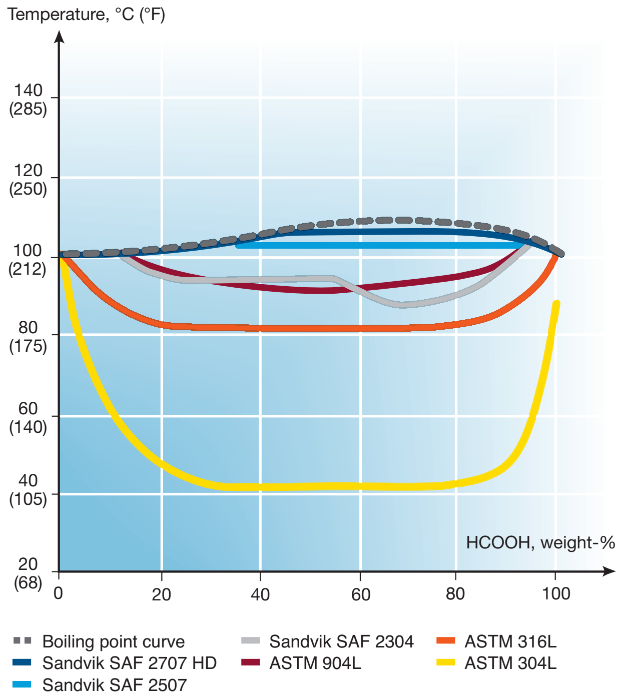
is higher alloyed than the medium alloyed and lean duplex grades, and has a very high corrosion resistance in chloride containing media, including seawater. Sandvik SAF 2507 is also well suited for use in organic acids and other environments where the general corrosion resistance for lower alloyed grades is insufficient.



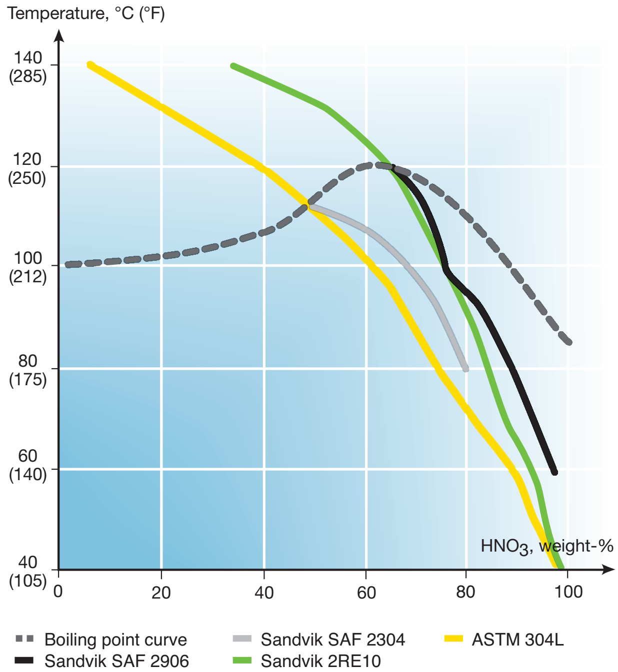
Isocorrosion diagram for Sandvik SAF 2707 HD, SAF 2507, SAF 2205 and SAF 2304 in naturally aerated sulphuric acid (0.1 mm/year, 4 mpy) in stagnant condition.



Isocorrosion diagram for Sandvik SAF 2507 and SAF 2205 in naturally aerated hydrochloric acid (0.1 mm/year, 4 mpy) in stagnant condition.



Isocorrosion diagram for Sandvik SAF 2707 HD, SAF 2507 and SAF 2304 in naturally aerated formic acid (0.1 mm/year, 4 mpy) in stagnant condition.



Isocorrosion diagram for Sandvik SAF 2304 and SAF 2906 in nitric acid (0.1 mm/year, 4 mpy) in stagnant condition. For further information about Sandvik SAF 2906, please see datasheet.

Duplex: Sandvik SAF 2205
has better resistance to general corrosion than the standard austenitic stainless steel ASTM 316L in most media. It is suitable for use in many different industrial environments.

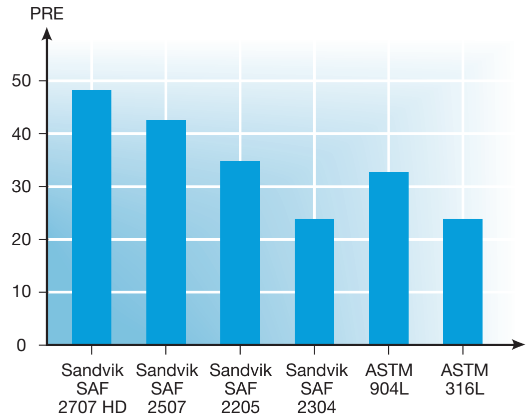
Lean duplex: Sandvik SAF 2304
offers in general a similar corrosion resistance as ASTM 316L, but has advantages in oxidising media such as nitric acid solutions due to its low molybdenum content.

Pitting and crevice corrosion

The pitting and crevice corrosion resistance of a steel is primarily determined by the content of chromium, molybdenum and nitrogen. An index used to compare this resistance is the PRE (Pitting Resistance Equivalent).

For duplex stainless steels the pitting corrosion resistance is dependent on the PRE value in both the ferrite phase and the austenite phase. This means that the phase with the lowest PRE value will set the limit for localised corrosion resistance of the steel.

Minimum PRE values for the duplex stainless steels and some other alloys:



The PRE is defined as, in weight-%

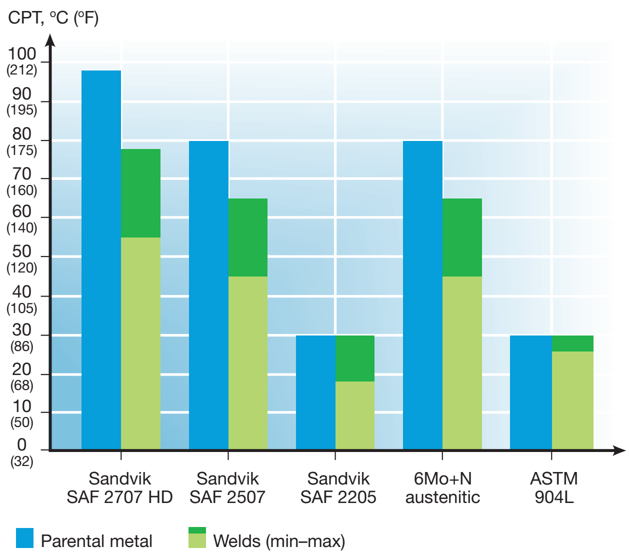
PRE = % Cr + 3.3 x % Mo + 16 x % N

Critical Pitting Temperatures (CPT) in different environments

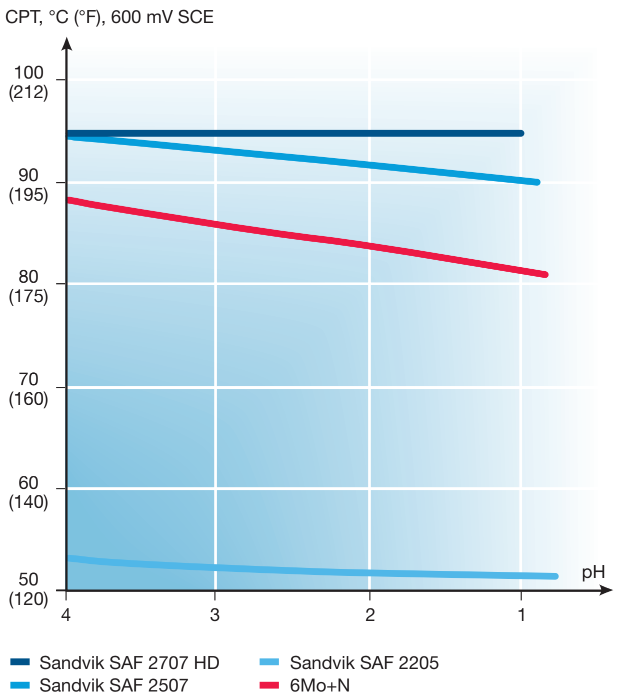
The ranking given by the PRE value can generally be used to predict the performance of an alloy in chloride environments, as shown by the results of corrosion testing presented in the graphs on this spread.

The critical pitting temperature can also be determined by electrochemical methods as the temperature at which a current increase occurs is associated with the breakdown of the passive layer at a certain potential. In the two upper graphs on page 15 these temperatures have been determined in sodium chloride solutions with the potential fixed at 600 mV relative to the saturated calomel electrode (SCE). The surfaces are ground with 600 grit paper.

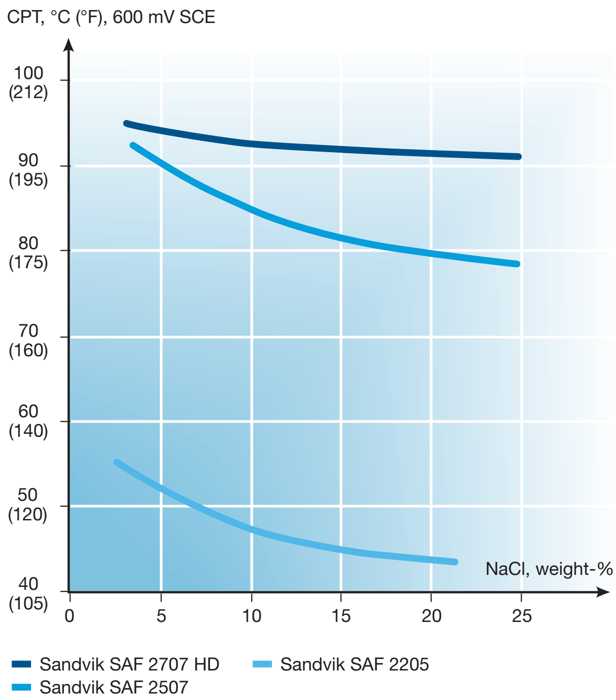
The applied potential of +600 mV vs SCE is a very high value comparable to that encountered in chlorinated sea water. It is important also to bear in mind that in an actual application there may be other factors playing a vital part in the corrosion behaviour, thus increasing or decreasing the critical pitting and crevice corrosion temperatures.



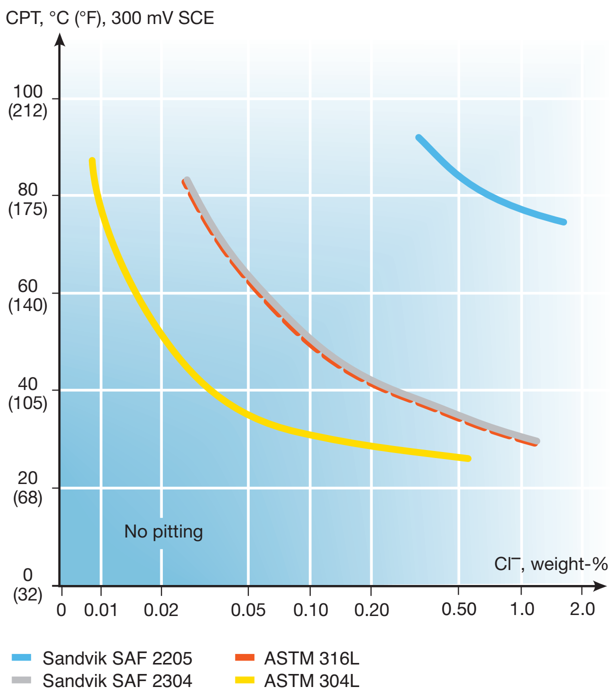
Critical pitting temperatures (CPT) for Sandvik SAF 2707 HD, SAF 2507 and SAF 2205 in 6% $FeCl_3$ determined in the ASTM G48A test where the samples are exposed to 6% $FeCl_3$ solution for 24h and the temperature when pitting starts to develop is determined.



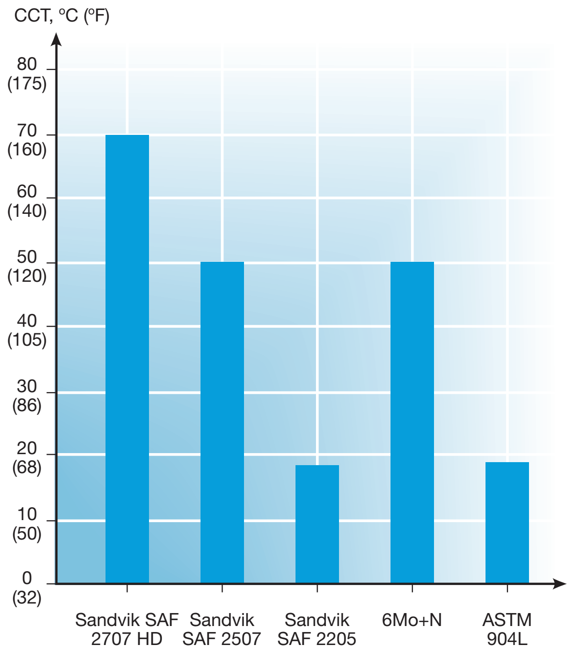
Critical pitting temperatures (CPT) for Sandvik SAF 2707 HD, SAF 2507 and SAF 2205 in 3% NaCl solution with varying pH at +600 mV SCE.



Critical pitting temperatures (CPT) for Sandvik SAF 2707 HD, SAF 2507 and SAF 2205 in various concentrations of sodium chloride at +600 mV vs SCE, neutral pH.



Critical pitting temperatures for Sandvik SAF 2205 and SAF 2304 in various concentrations of sodium chloride at +300 mV vs SCE, neutral pH.



Approximate values for the critical crevice corrosion temperature (CCT) after exposure in 6% $FeCl_3$ solution for 24h according to ASTM TP G48B. In practice the values may differ somewhat from these owing to variations in crevice gap and surface condition.

Stress corrosion cracking

The standard austenitic steels of the ASTM 304L and 316L types are prone to stress corrosion cracking (SCC) in chloride-bearing solutions at temperatures above 60°C (140°F).

Duplex stainless steels are far less prone to this type of corrosion. Practical experience and laboratory tests have shown their good resistance to stress corrosion cracking.

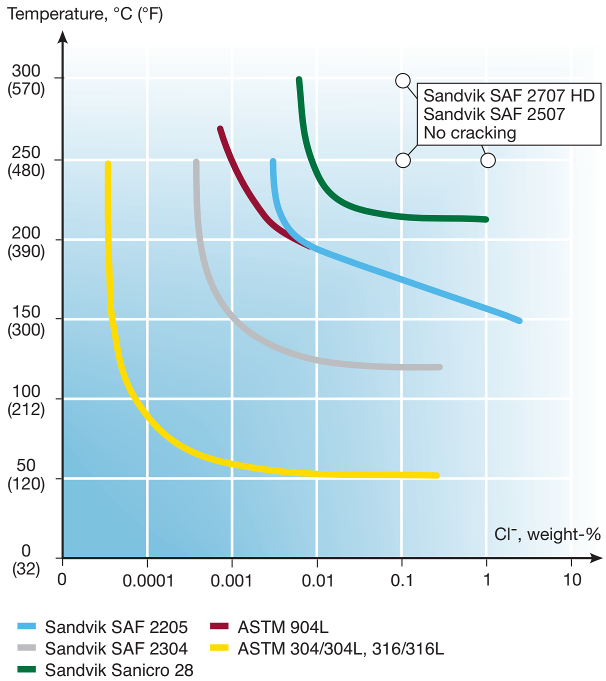
Intergranular corrosion

In modern duplex stainless steels the chemical composition is balanced in such a manner that the reformation of austenite in the heat-affected zone of the weld takes place quickly. This results in a microstructure that gives corrosion properties and toughness roughly equal to that of the parent metal. Welded joints in duplex stainless steels easily pass the intergranular corrosion test according to ASTM A262 Practice E (Strauss' test).

Erosion corrosion

Steels of the ASTM 316L type often suffer erosion-corrosion if exposed to flowing media containing highly abrasive solid particles, such as sand, or to media with very high flow velocities. Owing to their combination of high hardness and good corrosion resistance, duplex stainless steels display very good resistance under such conditions.

Testing in sand-containing media has shown that Sandvik duplex stainless steels have erosion-corrosion resistance better than corresponding austenitic stainless steels.



Stress Corrosion Cracking (SCC) resistance for Sandvik SAF 2707 HD, SAF 2507, SAF 2205 and SAF 2304 in oxygen-bearing neutral chloride solutions. The high-pressure autoclave tests have been performed for 1,000 h with an applied stress equal to the proof strength at the testing temperature. The curves represent the border line for SCC. Below the curve cracking does not occur. The line for ASTM 304L/316L steels is a compilation of practical experience and laboratory results. (Some cases where SCC has occurred below the curve have been reported in the literature).

Corrosion fatigue

Duplex stainless steels have a high resistance to fatigue and corrosion fatigue because of their good mechanical properties and high corrosion resistance.

Fabrication

Welding
Modern duplex stainless steels have generally good weldability. The most common arc welding methods for stainless steels can be used with good results:

- Gas tungsten-arc welding (GTAW or TIG)
- Gas metal-arc welding (GMAW or MIG/MAG)
- Shielded metal-arc welding (SMAW or MMA)
- Submerged-arc welding (SAW)
- Flux-cored arc welding (FCAW)

Due to a balanced composition, where nitrogen plays an important role, austenite formation in the heat-affected zone (HAZ) and weld metal is rapid. Under normal welding conditions a sufficient amount of austenite is formed to maintain good resistance to localised corrosion. The metallurgical characteristics differ somewhat between the duplex grades, but the basic features are the same. Too rapid cooling may result in excessive amounts of ferrite, reducing the toughness. Therefore, welding with low heat input in thick walled materials should be avoided. Welding methods, such as resistance welding, laser welding and electron beam welding, which cause extremely rapid cooling should also be avoided or used with extreme caution. Too slow cooling can in the higher alloyed duplex grades cause formation of intermetallic phases detrimental to corrosion resistance and toughness. Optimum weld properties can be obtained by closely following the directions below and on page 18:

- The weld must be allowed to cool before next pass.
- Heat input should be kept within specific limits to secure a good microstructure in the weldment and hence optimum material properties. It is important that the heat input is adapted to the thickness of the material.
- Pre-heating is not necessary unless welding is carried out at temperatures far below room temperature, or if moisture is condensing on the material. Pre-heating with open flame should be avoided.

Sandvik base material	Type of consumable	Sandvik filler material designation	Cmax (%)	Cr (%)	Ni (%)	Mo (%)	N (%)
SAF 2304	Wire (GTAW, GMAW, SAW)	23.7.L	0.020	23	7.0	–	0.14
SAF 2205 and SAF 2304	Wire (GTAW, GMAW, SAW)	22.8.3.L	0.020	23	9.0	3.2	0.16
	Covered electrodes (SMAW)	22.9.3.LR	0.03	22	9.0	3.0	0.12
		22.9.3.LB	0.04	22	9.0	3.0	0.15
	Flux cored wire (FCAW)	22.9.3.LT	0.03	23	9.5	3.1	0.16
SAF 2507 and SAF 2205	Wire (GTAW, GMAW, SAW)	25.10.4.L	0.020	25	9.5	4.0	0.25
	Covered electrodes (SMAW)	25.10.4.LR	0.03	25	9.5	4.0	0.25
		25.10.4.LB	0.04	25	9.5	4.0	0.25
SAF 2507 and SAF 2707 HD	Wire (GTAW, SAW)	27.9.5.L	0.020	27	9	4.6	0.30

- For welding methods like GTAW nitrogen mixed into the shielding gas and the root purging gas provides improved resistance to localized corrosion.
- Post weld heat treatment (PWHT) is not normally required. If PWHT is required annealing should be carried out in accordance with the recommendations in the "Heat treatment" section below.
- Use filler material whenever possible. Suitable filler materials are listed in the table on page 17. If filler material cannot be used in GTAW, for practical reasons, the shielding gas must contain nitrogen. Further information about our welding consumables is found in the catalogue "Stainless welding products" ref. no. S-236.

In very aggressive environments Sandvik SAF 2205 can be welded with the super-duplex filler materials Sandvik 25.10.4.L or 25.10.4.LR to obtain the highest corrosion resistance possible in the weld. Sandvik SAF 2507 can also be welded with Sandvik 27.9.5.L in order to improve the corrosion resistance in aggressive environments.

When Sandvik SAF 2304 is used in oxidising nitrate environments the filler material Sandvik 23.7.L should be used. In this case, please contact Sandvik for advice.

Detailed recommendations regarding welding parameters, gas shielding, maximum interpass temperatures, post-weld treatment, etc. are available in the folder "Welding guide for Sandvik duplex stainless steels" ref. no. S-1252. For welding recommendations for Sandvik SAF 2707 HD, please contact Sandvik. By following the guidelines, welding of duplex stainless steels is just as easy as welding austenitic materials.

Bending

The initial force required for bending duplex stainless steels is higher than for steels of the ASTM 304L and 316L types. However, when the proof strength is exceeded, the plastic deformation takes place just as easily in the duplex as in the austenitic stainless steels. Duplex stainless steels can be cold-bent to approximately 20% deformation without subsequent heat treatment. Under service conditions where the risk of stress corrosion cracking starts to increase, heat treatment is recommended even after lower degree of cold bending.

Heat treatment is carried out in the form of solution annealing or resistance annealing (see "Heat treatment" section below).

Expanding

Duplex stainless steels have high proof and tensile strength. Test results and practical experience have shown that expansion of tubes can be successfully carried out into tube-sheets of considerably lower strength. Normal expanding methods can be used, but the expansion requires higher initial force and should be undertaken in a one-step operation. As a general rule, tube to tube-sheet joints should be welded if the service conditions include a high chloride concentration, thus limiting the risk for crevice corrosion.

Machining

Being a two-phase material (austenitic-ferritic) a duplex stainless steel will present a different wear picture from that of single-phase austenitic steel of the ASTM 304/304L and 316/316L types. The cutting speed must be slightly lower than that recommended for ASTM 304/304L and TP 316/316L. It is recommended that a tougher insert grade is used for machining duplex stainless steels than that used for machining austenitic stainless steels. Built-up edges and chipping are to be expected in the whole cutting data area.

Heat treatment

Solution annealing

If it is necessary to restore the duplex structure after a fabrication operation, this should be done at the following solution annealing temperatures followed by rapid cooling in air or water (some product forms may require a higher temperature).

Grade	Temperature
Sandvik SAF 2707 HD	1080-1120°C/1976–2048°F
Sandvik SAF 2507	1050–1125°C/1922–2057°F
Sandvik SAF 2205	1020–1100°C/1868–2012°F
Sandvik SAF 2304	930–1050°C/1706–1922°F

Sandvik Materials Technology
SE-811 81 Sandviken, Sweden, Phone +46 26 26 30 00 , Fax +46 26 26 02 20
www.smt.sandvik.com

S-120-ENG. 01.2009. Printed by Sandvikens Tryckeri AB, Sweden.