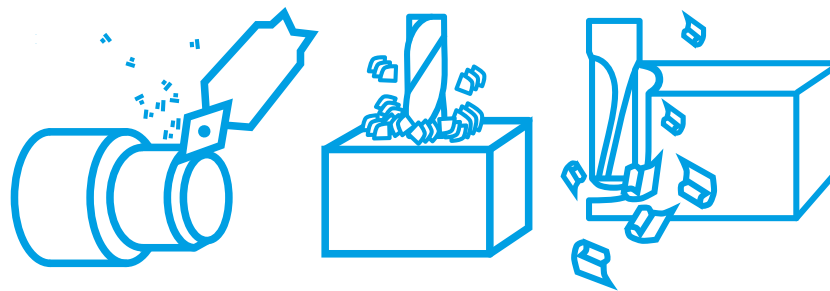


Stainless steel grades optimized for improved machinability

Outokumpu Prodec range datasheet

General characteristics

Stainless steel grades optimized for improved machinability with longer tool life and enhanced quality.



Outokumpu name	Typical applications	Product forms
<p>Prodec 304L/4307 A version of Core 304L/4307 with improved machinability. Improves productivity with faster machining, longer tool life, better dimensional tolerances, superior machined surface quality, and improved yields compared to conventionally produced Core 304L/4307.</p>	<ul style="list-style-type: none"> • Fasteners • Flanges • Valves • Pressure fittings 	Bar, Plate
<p>Prodec 316L/4404 A version of Supra 316L/4404 with improved machinability. Improves productivity with faster machining, longer tool life, better dimensional tolerances, superior machined surface quality, and improved yields compared to conventionally produced Supra 316L/4404.</p>	<ul style="list-style-type: none"> • Fasteners • Flanges • Valves • Pressure fittings 	Bar, Plate
<p>Prodec 303/4305 A version of 303/1.4305 with improved machinability and lower corrosion resistance. This free cutting stainless steel gives you faster machining, longer tool life, better tolerances, superior machined surface quality, and reduced scrap losses compared to conventionally produced 303/1.4305.</p>	<ul style="list-style-type: none"> • Nuts, bolts, and screws • Gears • Shafts • Bearings • Machined parts for process equipment 	Bar, Plate
<p>Prodec 17-4PH A martensitic, precipitation hardening stainless steel for applications that use Dura 17-4PH. It improves productivity with faster machining, longer tool life, better dimensional tolerances, superior machined surface quality, and improved yields compared to conventionally produced 17-4PH.</p>	<ul style="list-style-type: none"> • Fasteners • Flanges • Oil field valve equipment • Pressure fittings • Chemical process equipment • Paper mill equipment • Aircraft parts 	Bar

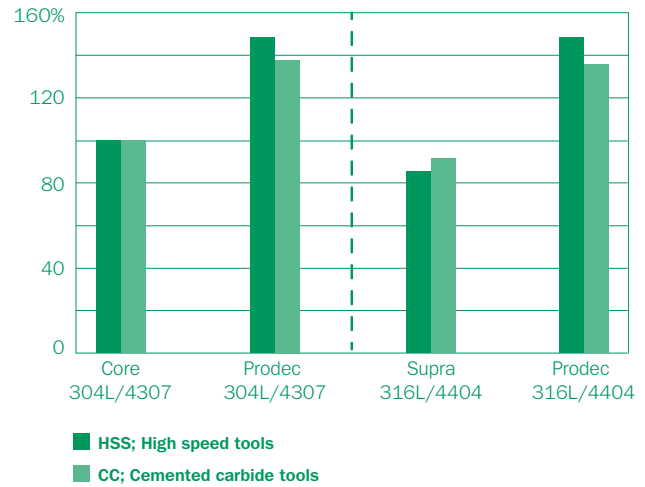
Product performance comparison

Cost saving example – Prodec vs. standard material

	Standard 316L	Prodec 316L/4404	Change +/-
Cutting speed (sfm)	300	450	+67%
RPM	145	215	+67%
Total time/component (mins)	16.93	7.73	-54%
Total machining cost/component	\$26.55	\$12.05	-55%
Productivity increase %			+54%
Savings/component			\$14.50

A cost saving example for machining a part from 6" diameter Prodec 316L/4404 peeled bar.

Relative machinability performance – Prodec vs. standard



The graph shows the machinability of Supra 316L/4404, Prodec 304L/4307 and Prodec 316L/4404 stainless steels in relation (%) to Core 304L/4307. A typical recommendation for Core 304L/4307 is estimated to 160 m/min for Cemented carbide (CC) set at 100% and 25 m/min for High Speed Steel (HSS) tools set at 100%.

Products and dimensions

To find more information about the Prodec range, please visit steelfinder.outokumpu.com

Metric	
Round bar	Offering (mm)
Cold drawn	6–32
Peeled	70–170
Black bar	75–230

Imperial	
Round bar	Offering (in)
Cold Drawn annealed	0.1875–1
Cold Finished Annealed	0.500–3.750
Hot Rolled Annealed Rough Turned	2–7
Hot Rolled Annealed Rough Turned	7–15

Metric	
Hexagon and square bar	Offering (mm)
Hexagon	8–32
Square	8–22

Imperial	
Hexagon and square bar	Offering (in)
Hexagon	0.250–1
Hexagon	1–1.500
Square	0.375–0.875

Chemical composition

The chemical composition is given as % by mass.

Outokumpu name	PRE	C	Ni	Cr	Mo	N	Others	Family
Prodec 304L/4307	20	0.02	8.1	18.1	–	–	–	A
Prodec 316L/4404	24	0.02	10.1	17.2	2.1	–	–	A
Prodec 303/4305	19	0.05	8.1	17.2	–	–	S 0.30	A
Prodec 17-4PH	–	0.02	4.7	16.3	–	–	Nb 3.5Cu	PH

Table uses Outokumpu typical values. The required standard will be fully met as specified in the order.

For the chemical composition list for different standards by product, see steelfinder.outokumpu.com

Pitting Resistance Equivalent is calculated using the following formula: $PRE = \%Cr + 3.3 \times \%Mo + 16 \times \%N$

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.

Corrosion resistance

Although improvements in machinability in the past have been associated with reduced corrosion resistance, the Prodec range has been shown to have corrosion resistance within the range typically expected from comparable stainless steel products.

Prodec 304L/4307 is a versatile, general-purpose stainless steel with good resistance to atmospheric corrosion, many organic and inorganic chemicals, as well as foods and beverages. It has also been used in vacuum-processing equipment and specialized instruments where high integrity is essential.

Prodec 316L/4404 provides improved resistance to pitting and crevice corrosion in environments containing chlorides and other halides.

Prodec 303/4305 is resistant to mildly corrosive environments. In order to achieve the best possible corrosion resistance, all Prodec 303/4305 parts should be chemically treated to remove sulfides from the final surface.

Prodec 17-4PH is a precipitation hardening product with corrosion resistance similar to that of Core 304/4301. It is used in applications where a combination of moderate corrosion performance and high strength is required.

Mechanical properties

Metric						
Outokumpu name	Product form	Min. yield strength R _{p0.2} (MPa)	Yield strength R _{p1.0} (MPa)	Min. Tensile strength R _m (MPa)	Elongation A ₅ (%)	Elongation A (%)
Prodec 304L/4307	P	200	240	500–700	45	45
	B	175	–	500–700	45	–
Prodec 316/4404	P	220	260	520–670	45	45
	B	200	–	500–700	40	–
Prodec 303/4305	P	190	230	500–700	35	–
	B	190	–	500–750	35	–
Prodec 17-4PH	B	520	–	800–950	–	18

Product forms: Quarto plate (P), Bar (B).

Note: Figures according to EN 10088-3 minimum values. 17-4PH in condition +P800. A₈₀ initial length = 80 mm, A initial length = 5.65√S₀. For more information, please see steelfinder.outokumpu.com

Prodec 17-4PH

Note: The mechanical properties of Prodec 17-4PH may be altered by subsequent age hardening treatments. Aging will cause slight dimensional changes.

Imperial						
Outokumpu name	Product form	Min. Yield strength R _{p0.2} (ksi)	Min. Yield strength R _{p1.0} (ksi)	Min. Tensile strength R _m (ksi)	Elongation A ₅₀ (%)	
Prodec 304L/4307	P	–	–	–	–	
	B	25	–	70	40	
Prodec 316/4404	P	–	–	–	–	
	B	25	–	70	40	
Prodec 303/4305	B	–	–	–	–	
Prodec 17-4PH	B	105	–	135	16	

Product forms: Quarto plate (P), Bar (B).

Note: Figures according to ASTM A276 minimum values (17-4PH to ASTM A564 and condition H1150, 303 supplied to ASTM A582). A₅₀ initial length = 50 mm. For more information, please see steelfinder.outokumpu.com

Prodec 17-4PH

Note: The mechanical properties of Prodec 17-4PH may be altered by subsequent age hardening treatments. Aging will cause slight dimensional changes.

Physical properties

Metric						
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*K)]	Thermal capacity at 20 °C [J/(kg*K)]	Electrical resistivity at 20 °C [Ω*mm ² /m]
Prodec 304L/4307	7.9	200	16	15	500	0.73
Prodec 316/4404	8	200	16	15	500	0.75
Prodec 303/4305	7.9	200	16	15	500	0.73
Prodec 17-4PH	7.8	200	10.9	16	500	0.71

Imperial						
Outokumpu name	Density [lbm/in ³]	Modulus of elasticity [psi]	Coefficient of thermal expansion 68-212 °F [μin/(in* °F)]	Thermal conductivity [Btu/(hr*ft* °F)]	Thermal capacity [Btu/(lbm* °F)]	Electrical resistivity [μΩ*in]
Prodec 304L/4307	0.285	29 * 10 ⁶	8.89	8.7	0.119	28.74
Prodec 316/4404	0.289	29 * 10 ⁶	8.89	8.7	0.119	29.53
Prodec 303/4305	0.285	29 * 10 ⁶	8.89	8.7	0.119	28.74
Prodec 17-4PH	0.282	29 * 10 ⁶	6.06	9.2	0.119	27.95

Fabrication

Machining

Prodec range products enable higher machining speeds, longer tool life, and superior part quality with reduced total cost for finished parts.

Operation	Depth of cut or width (in)	HSS Tooling			Carbide Tooling		
		Cutting Speed (SFM)	Feed (IPR)	Tool Grade	Cutting Speed (SFM)	Feed (IPR)	Tool Grade
Turning	0.002–0.200	70–180	0.005–0.020	T15	150–900	0.003–0.200	P15–M25
Forming	0.2–0.7	100–180	0.001–0.004	T15	150+	0.003–0.012	P15–M25
Cut-Off or Grooving	0.04–0.20	Up to 130	0.001–0.005	T15	120–450	0.001–0.008	M25
Drilling	All	Up to 120	0.003–0.025	M35	80–870	0.0025–0.012	P15–M25
Reaming	All	40–120	0.003–0.025	M35	80–870	0.0025–0.012	P15–M25
Taping	All	Up to 120	N/A	M35	–	–	–
Single Point Threading	–	–	–	–	200–490	Thread Size: 3/4"–10" Passes: 9–11	M20

Operation	Depth of cut or width (in)	HSS Tooling			Carbide Tooling		
		Cutting Speed (SFM)	Feed (IPR)	Tool Grade	Cutting Speed (SFM)	Feed (IPR)	Tool Grade
Turning	0.040-0.200	60-130	0.005-0.015	T15	150-850	0.003-0.030	P15-M25
Forming	0.2–0.7	100–180	0.001–0.004	T15	150–850	0.003–0.012	P15–M25
Cut-Off or Grooving	0.04–0.20	Up to 120	0.002–0.005	T15	300–500	0.003–0.008	M25
Drilling	All	Up to 110	0.003–0.018	M35	80–820	0.003–0.010	P15–M25
Reaming	All	40–120	0.003–0.025	M35	80–810	0.0025–0.012	P15–M25
Taping	All	Up to 120	N/A	M35	–	–	–
Single Point Threading	–	–	–	–	200–490	Thread Size: 3/4"–10" Passes: 9–11	M20

Operation	Depth of cut or width (in)	HSS Tooling			Carbide Tooling		
		Cutting Speed (SFM)	Feed (IPR)	Tool Grade	Cutting Speed (SFM)	Feed (IPR)	Tool Grade
Turning	0.040-0.200	50-100	0.005-0.014	T15	150-790	0.004-0.030	P15-M25
Forming	0.2–0.7	90–160	0.001–0.004	T15	250–500	0.0003–0.010	P15–M25
Cut-Off or Grooving	0.04–0.20	Up to 120	0.002–0.005	T15	250–500	0.003–0.008	M25
Drilling	All	Up to 110	0.003–0.018	M35	80–770	0.003–0.010	P15–M25
Reaming	All	40–120	0.003–0.020	M35	80–300	0.0025–0.015	P15–M25
Taping	All	Up to 120	N/A	M35	–	–	–
Single Point Threading	–	–	–	–	250–440	Thread Size: 3/4"–10" Passes: 9–11	M20

Note:

- Small differences in cutting speed will affect tool life
- Higher feed rate tends to give better surface and chip formation
- TiAlN coated high speed steel tools provide much longer tool life than un-coated
- Results can vary depending upon tooling and machine set-up.

For more information concerning machining, please contact our sales offices.

outokumpu.com/contacts

Forming

Cold forming

Prodec range products can be readily formed and fabricated with the full range of cold forming operations. They can be used in heading, drawing, bending, and upsetting. Cold forming operations will increase the strength and hardness of the material, and may leave it slightly magnetic.

For Prodec 17-4PH, cold forming or fabrication should be done prior to the final solution annealing and age hardening treatments.

Hot forming

Prodec 303/4305, Prodec 304L/4307, and Prodec 316L/4404 can be forged in the 925–1200 °C/1700–2200 °F range. For maximum corrosion resistance, forgings should be annealed at a minimum temperature of 1030°C/1900 °F and then water quenched or rapidly cooled by other means after hot forming operations.

Prodec 17-4PH should be uniformly heated to 1175–1200 °C /2150–2200 °F for a minimum of one hour. It should not be forged below about 1000 °C/1850 °F. Forgings must be solution annealed before the final aging treatment.

Welding

Prodec 304L/4307 is readily weldable with the full range of conventional welding methods with the exception of oxyacetylene. AWS E308/ER308 or E308L/ER308L filler metals should be used, but molybdenum-containing austenitic stainless steel filler metals may also be considered. After welding, it may be necessary to fully anneal to restore the corrosion resistance lost by sensitization to intergranular corrosion when chromium carbides were precipitated in the grain boundaries in the weld heat-affected zone (HAZ).

Prodec 316L/4404 is readily welded with the full range of conventional welding methods with the exception of oxyacetylene. AWS E316L/ER316L and other low-carbon filler metals with a molybdenum content higher than that of the base metal should be used.

Prodec 303/4305 stainless steel is not recommended for applications requiring welding. When welding is necessary, AWS E312 filler metal may be considered. An alternative product for parts requiring welding is Prodec 304L/4307.

Prodec 17-4PH can be satisfactorily welded with either 630 or AWS E308L/ER308L welding consumables. However, the 308L filler metal cannot be heat treated to the same mechanical properties as the base metal. The thermal cycle associated with welding can substantially alter the condition of Prodec 17-4PH. To obtain the properties considered characteristic of Prodec 17-4PH, the material should be solution annealed and aged after welding.

For more information, see the Outokumpu Welding Handbook, available from our sales offices.

outokumpu.com/contacts

Standards and approvals

The most commonly used international product standards are given in the table below. For a list of standards by product, see steelfinder.outokumpu.com

Standards

EN10088-2
EN 10088-3
EN 10088-4
EN 10088-5
EN 10272
ASME SA479
ASTM A479/479M
ASTM A276
ASTM A555
ASTM A493

Certificates and approvals

Outokumpu meets the most common certifications and approvals, including:

- AD 2000 Merkblatt
- Approval of Material Manufacturers
- Factory Production Control Certificate
- ISO 9001
- ISO 14001
- ISO 50001
- ISO/TS 16949
- NORSOK
- OHSAS 18001
- Pressure Equipment Directive (PED)

For the 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

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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