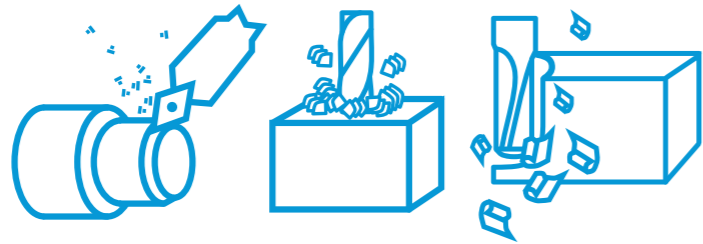


# Prodec® datasheet US - Stainless steel bar optimized for improved machinability

## General characteristics

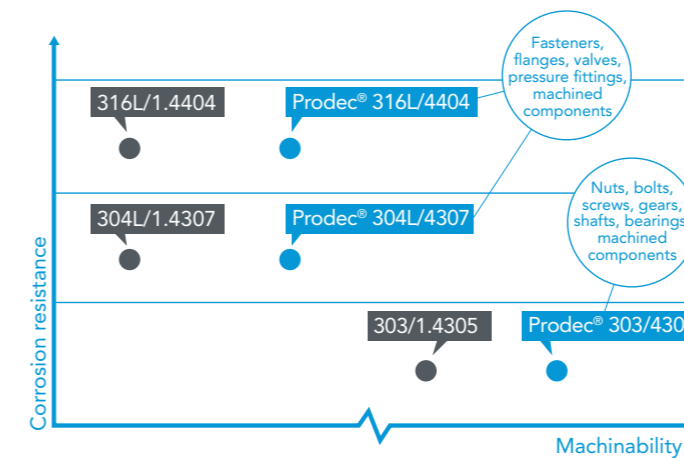
Stainless steel grades optimized for improved machinability with longer tool life and enhanced quality.



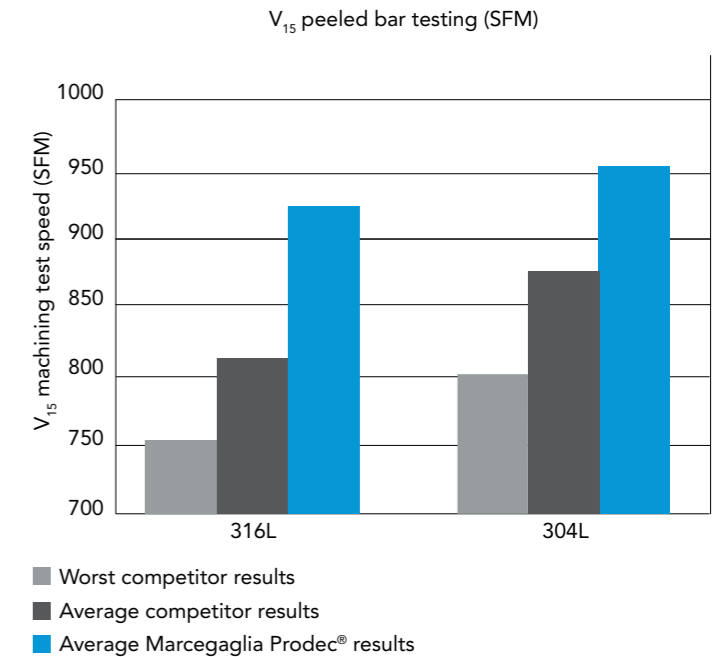
Product name	Typical applications
<b>Prodec® 304L</b> A version of 304L with improved machinability. Improves productivity with faster machining, longer tool life, better dimensional tolerances, superior machined surface quality, and improved yields compared to conventionally produced 304L.	<ul style="list-style-type: none"> <li>• Fasteners</li> <li>• Flanges and valves</li> <li>• Pressure fittings</li> <li>• Machined components</li> </ul>
<b>Prodec® 316L</b> A version of 316L 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 316L.	<ul style="list-style-type: none"> <li>• Fasteners</li> <li>• Flanges and valves</li> <li>• Pressure fittings</li> <li>• Machined components</li> </ul>
<b>Prodec® 303</b> For applications that use 303. This product gives you faster machining, longer tool life, better tolerances, superior machined surface quality, and reduced scrap losses compared to conventionally produced 303.	<ul style="list-style-type: none"> <li>• Nuts, bolts, and screws</li> <li>• Gears</li> <li>• Shafts</li> <li>• Bearings</li> <li>• Machined parts for process equipment</li> </ul>
<b>Prodec® 17-4PH</b> A martensitic, precipitation hardening stainless steel for applications that use 17-4PH. It improves productivity with faster machining, longer tool life, better dimensional tolerances, superior machined surface quality, and improved yields when compared to conventionally produced 17-4PH.	<ul style="list-style-type: none"> <li>• Fasteners</li> <li>• Flanges</li> <li>• Oil field valve equipment</li> <li>• Pressure fittings</li> <li>• Chemical process equipment</li> <li>• Paper mill equipment</li> <li>• Aircraft parts</li> </ul>

## Product performance comparison

### Corrosion resistance vs machinability



### Bar – faster machining with Prodec®



Testing done with Prodec® and 7 European competitors' bars with improved machinability in grades 316L and 304L. The tool used for testing was a cemented carbide insert.

### Bar – cost savings with Prodec®

		Standard 316L	Prodec® 316L	Improvement
Cutting speed	sfm	300	450	150
Processing time/component	min	16.9	7.7	54%
Total machining cost/component	\$	26.6	12.1	55%
Productivity increase	%			54%
Savings/component	\$			14.5

A cost saving example for rough turning a 6" diameter Prodec® 316L peeled bar with a cemented carbide tool.

## Products and dimensions

Imperial	
Round bar	Offering (in)
Cold drawn	0.25–1.00
Peeled	0.50–15

Imperial	
Hexagon and square bar	Offering (in)
Hexagon	0.25–2.5



# Typical chemical compositions

The chemical composition is given as % by mass.

Grade family	Marcegaglia name	ASTM		PRE	Typical chemical composition, % by mass					
		TYPE	UNS		C	Cr	Ni	Mo	N	Others
A	Prodec® 304L	304L	S30403	18	0.02	18.1	8.1	–	–	–
A	Prodec® 316L	316L	S31603	24	0.02	16.8	10.1	2.1	–	–
A	Prodec® 303	303	S30300	17	0.05	17.2	8.1	–	–	0.3S
PH	Prodec® 17-4PH	630	S17400	16	0.02	15.5	4.8	–	–	3.4Cu Nb

Chemical compositions and PRE calculations are based on Marcegaglia typical values.

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.

# Corrosion resistance

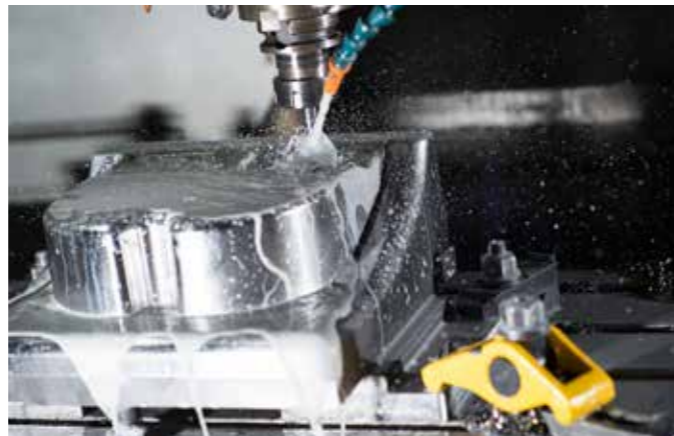
Although improvements in machinability have been associated with reduced corrosion resistance in the past, the Prodec® treated products have shown corrosion resistance within the range typically expected from comparable stainless steel products.

Prodec® 304L 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 provides improved resistance to pitting and crevice corrosion in environments containing chlorides and other halides.

Prodec® 303 is resistant to mildly corrosive environments. In order to achieve the best possible corrosion resistance, all Prodec® 303 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 standard 304. It is used in applications where a combination of moderate corrosion performance and high strength is required.



# Mechanical properties

Grade	Diameter / Round or hex size	Requirements			
		UTS (ksi)	YS (ksi)	% El (4D)	% RA
Prodec® 304L	½" and smaller	90 – 115	45 min	30 min	50 min
	Larger than ½"	75 – 115	30 min	40 min	50 min
Prodec® 316L	½" and smaller	90 – 115	45 min	30 min	50 min
	Larger than ½"	75 – 115	30 min	30 min	50 min
Prodec® 303	½" and smaller	125 max	NONE	NONE	NONE
	Larger than ½"	NONE	NONE	NONE	NONE

## 304L and 316L Hardness Requirement

Diameter / Round or hex size	Requirement
2" and smaller	140 – 255 HB (76-100 HRB, 22 max HRC)
Greater than 2"	0 – 255 HB (0-100 HRB, 22 max HRC)

## 303 Hardness Requirement

255 HB or 25 HRC max

## 17-4PH (Annealed Condition)

363 HB or 38 HRC max

## 17-4PH

Can be heat treated at several temperatures between 900F and 1150F to achieve a variety of hardness and tensile values. The grade is often machined in the annealed condition then heat treated to achieve the final properties.

# Physical properties

Imperial						
Marcegaglia name	Density [lbm/in³]	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	0.285	29 * 10 <sup>6</sup>	8.89	8.7	0.119	28.74
Prodec® 316	0.289	29 * 10 <sup>6</sup>	8.89	8.7	0.119	29.53
Prodec® 303	0.285	29 * 10 <sup>6</sup>	8.89	8.7	0.119	28.74
Prodec® 17-4PH	0.282	29 * 10 <sup>6</sup>	6.06	9.2	0.119	27.95

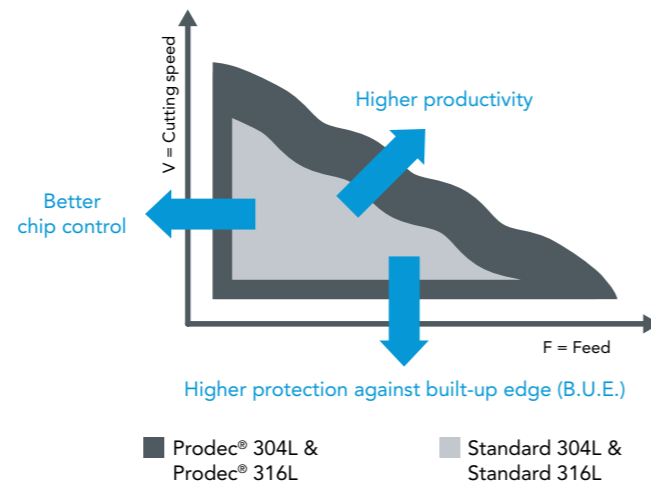
Values according to EN 10088-1.

# Fabrication

## Machining

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

Prodec® 304L and Prodec® 316L are special variants of standard Types 304 (UNS S30400) / 304L (UNS S30403) and 316 (UNS S31600) / 316L (UNS S31603) respectively with enhanced metallurgy for better machinability. The general rules for machining stainless steel also apply to the Prodec® grades. The difference is that Prodec® grades enable a longer tool life and/or tougher machining conditions. The machining window illustrated on the right gives a demonstration of this.



## Machining guidelines

The cutting parameters in this guideline will work under normal cutting conditions. It is suggested to begin with cutting parameters in the ranges indicated in the tables and then to improve parameters by moving to higher or lower speed, feed or depth of cut until best performance is reached. It is possible to end up in a range somewhat outside the values indicated in the tables depending on the actual machine set-up.

### Turning

- The machine and setup must be rigid
- Use shortest possible tool length
- Use coolant
- Use smallest possible nose radius to avoid vibrations

### Milling

- Avoid cutting through holes/cavities
- Ensure good chip evacuation, recutting of chips may cause tool damage

### Drilling – high speed steel twist drills

- Use coolant
- If possible use internal coolant through drill
- Use of cobalt high alloyed drills is preferred
- With PVD-coated HSS drills the cutting speed can be increased by 10%
- Use as short drill as possible

## Machining parameters for Prodec® 304L and 316L

Turning	Carbide Tooling			
	Grade	Feed (in/rev)	SFM	DoC (in)
Finishing	M10-20	0.004	840-930	< 0.08
Medium	M10-25	0.010	650-850	0.08 - 0.2
Roughing	M20-35	0.015	150-750	0.2-0.4

Milling	Carbide Tooling		
	Grade	Feed	SFM
Face Milling	M10-25	0.004	485-825
Side Milling	M10-30	0.010	580-800
End Milling	M10-30	0.015	480-725

Drilling (HSS Cobalt Alloy)	HSS Tooling			
	Diameter (in)	RPM	Feed	SFM
	0.04	2850-3800	0.002	30-40
	0.12	1600-1750	0.004	50-55
	0.2	955-1050	0.005	55-65
	0.4	470-625	0.006	55-65
	0.6	350-415	0.008	55-65
	0.8	265-310	0.012	55-65
	1.2	175-210	0.012	55-65

## Forming

### Cold forming

Prodec® 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 completed prior to the final solution annealing and age hardening treatments.

### Hot forming

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

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

### Welding

Prodec® 304L 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 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 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.

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.

## Standards and approvals

The most commonly used international product standards are given in the table below.

### Standards

- ASME SA 479
- ASTM A479
- ASTM A276
- ASTM A564
- ASTM A582
- SAE AMS for various grades

### Certificates and approvals

Marcegaglia Stainless Richburg meets the most common certifications and approvals:

- AD 2000 Merkblatt
- Approval of Material Manufacturers
- Factory Production Control Certificate
- ISO 9001
- ISO 14001
- Pressure Equipment Regulation (PER)
- Pressure Equipment Directive (PED)
- AS9100

# Contacts and enquiries

### Contact us

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