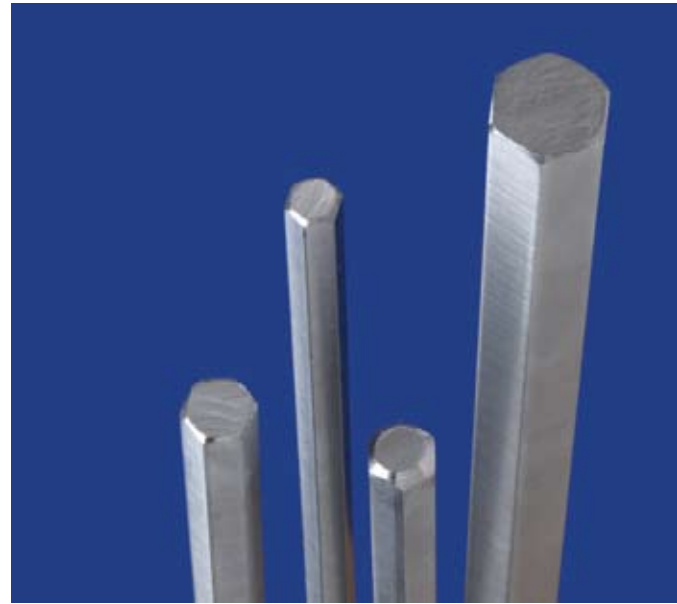




Activating Your Ideas

In Stainless Steel Bar and Long Products

**OUTO
KUMPU**



Applications

Outokumpu produces bar in round, square, hex, rod, billet, and blooms, for applications such as valves, fittings, flanges and other machine components as well as rotors, impellers and shafts in industries including:

- chemical and petrochemical processing
- oil exploration
- biofuels
- pulp and paper
- food and beverage processing
- construction — reinforcement bar
- pharmaceutical
- aerospace

Extreme Performance

The consumption of stainless steel — including bar — is growing faster than that of any other metal in the world. As a global leader in stainless steel, Outokumpu fuels this demand by supplying our customers with even better steels to meet their needs. Our high quality bar/long products are used for applications in the most challenging environments, offering a combination of high strength, corrosion resistance, cost savings, and aesthetic appeal for customers in a wide range of industries.



Outokumpu offers a broad range of austenitic, ferritic, and duplex grades including our proprietary duplex grade LDX 2101® which combines low nickel content with high mechanical strength; and our newest machining bar — 303 HST® — for high-speed steel tooling.

North American Production

We recognize the need to be close to our customers to ensure that the process of purchasing stainless steel is as simple as possible. We meet this need through a responsive supply chain that includes our ISO 9001-2000-certified ALLVAC mill in Richburg, South Carolina. This close cooperation combines specialized product expertise and the most modern manufacturing facilities, resulting in production of a wide range of high quality, domestically produced long products.

Outokumpu quality and cost controls begin at our company-operated chromite mine and ferrochrome smelter in Europe. This quality extends to our state-of-the-art melt shops that ensure superior control of product composition, structure, and inclusion pattern — resulting in very clean steel. Computerized process control of our rolling mills, heat treatment facilities, and finishing lines ensures consistency and superior control of the targeted properties.

Your Complete Stainless Supplier

Outokumpu produces round bar, square bar, hexagonal bar, forged shapes, billet, rod, and blooms in a broad range of sizes in both standard and special grades. With the newest finishing cell technology, we have the capability to produce the highest standard of round bar straightened, peeled, and polished; and also bar that is drawn, annealed, and pickled.

Duplex and Special Grades

Outokumpu has a long tradition of leadership in the introduction of specialized grades of stainless steel, including:

- PRODEC 303, our grade for superior machinability with cemented carbides;
- 303 HST®, our grade for superior machinability with high-speed steel tooling;
- LDX 2101®, our general purpose lean duplex steel with good weldability and excellent machinability;
- 254 SMO®, used for over 20 years to provide longer material life in most corrosive environments;
- 2205 Code Plus Two®, one of our duplex stainless steels for corrosion resistance, toughness, weldability, and high strength; and
- 253 MA®, a micro-alloyed grade for high temperature ranges.

PRODEC® for Enhanced Machinability

Produced exclusively by Outokumpu for over two decades, PRODEC (which stands for PRODUCTION ECONOMY) is a premium quality of stainless steel designed for enhanced machinability and processed to provide uniform consistency of properties from bar to bar and heat to heat. Our PRODEC bar shows the same yield strength, tensile strength, elongation, hardness, and toughness as conventionally produced bar. Yet its corrosion resistance is equal or superior to that of stainless steel of the same grade. PRODEC bar is available in 2205, 303, 304, 304L, 316, and 316L, and meets all requirements of ASTM, ASME, and other specifications.

303 HST®

303 HST® stainless steel bar is engineered to optimize machine performance in high volume screw machines. It also delivers superior surface finish and product consistency. 303 HST is also PRODEC-treated, making it

PRODEC Bar vs. Conventional Bar

Compared with conventionally produced stainless steel, PRODEC machinable stainless steel offers significant benefits including:

- **faster machining — allowing higher speeds and feeds with either carbide or high speed steel tooling longer tool life**
- **better dimensional tolerances in machined parts**
- **superior machined surface quality and integrity**
- **reduced scrap losses**
- **consistent performance for on schedule production**

the most versatile premium machining product available. 303 HST is available in cold-drawn round bar and hex bar from 3/16" through 1" in diameter. It is chamfered and boxed. Round bar is centerless ground to 1/2 standard tolerance.

Superior Performance with Duplex

Outokumpu is one of the world's largest producers of duplex stainless steels — which combine the best properties of austenitic and ferritic grades. The result is a product that — when compared to standard austenitic grades — offers almost twice the strength level; equal or superior pitting and crevice resistance; and greatly enhanced resistance to stress corrosion cracking. Outokumpu pioneered the development of duplex stainless steel with 2205 Code Plus Two®, followed by our super duplex Outokumpu 2507, which combines high tensile and impact strength with low thermal expansion and high conductivity.

LDX 2101® — Making Stainless Stronger

Outokumpu continues our pioneering developments with the introduction of a new duplex, LDX 2101®. This low alloy, general purpose duplex features, in most applications, twice

the mechanical strength of 304 or 316L with only one-fifth the nickel content for better price stability. The corrosion resistance of LDX 2101 in general is at least as good as that of Cr-Ni grades such as 304 and in most cases is as good as Cr-Ni-Mo grades such as 316L. LDX 2101 offers good stress-corrosion cracking and has pitting resistance similar to 316L in most environments. The higher strength of LDX 2101 — equivalent to that of 2205 — makes it a practical and economical choice for concrete reinforcing bar and other civil engineering and construction applications.

Technical Support

Choosing the right grade can offer substantial rewards. In this regard, our technical team assists users and fabricators in the selection, installation, operation, and maintenance of our stainless steel applications. We also offer end-users the opportunity to test materials on their own premises. This testing is supported by extensive testing in our state-of-the-art laboratory where our personnel can draw upon years of field experience with stainless steel to help customers make technically and economically correct materials decisions. Outokumpu is prepared to discuss individual applications and to provide data and experience as a basis for specific material selection and application. For assistance with technical questions, please call Outokumpu bar operations at 1.888.458.4600.

Specifications

Table 1

Grade	UNS	ASTM	ASME	Federal	AMS
303	S30300	A 582	NA	NA	5640
304 / 304L	S30400 / S30403	A 276, A 479	SA-479, SA-276	QQS 763F	5639, 5647, QQS 763
316 / 316L	S31600 / S31603	A 276, A 479	SA-479, SA-276	QQS 763F	5648, 5653, QQS 763
317 / 317L	S31700 / S31703	A 276, A 479	SA-479, SA-276	QQS 763F	QQS 763
LDX2101	S32101	A 276, A 479	SA-479, SA-276		
410	S41000	A 276, A 479	SA-479, SA-276	QQS 763F	5612, 5613, QQS 763
416	S41600	A 582			5610
430	S43000	A 276, A 479	SA-479, SA-276		5627
430F	S43020	A 582			
15-5 ESR	S15500	A 564	SA-564		5659
Alloy 218	S21800	A 276, A 479			5848
17-4	S17400	A 564	SA-564		5643
2205 Code Plus Two	S31803 / S32205	A 276, A 479	SA-479, SA-276		
253 MA	S30815	A 276, A 479	SA-479, SA-276		
254 SMO	S31254	A 276, A 479	SA-479, SA-276		
321 / 321H	S32100 / S32109	A 276, A 479	SA-479, SA-276		5645
347 / 347H	S34700 / S34709	A 276, A 479	SA-479, SA-276		5646
309, 309H, 309S	S30900 / S30909 / S30908	A 276, A 479	SA-479, SA-276		5650
310, 310H, 310S	S31000 / S31009 / S31008	A 276, A 479	SA-479, SA-276		5651
304HN	S30452				
XM-19	S20910	A 276, A 479	SA-479, SA-276		

Programs

Round Bar (in inches)

Table 2

	303	304L	304H	316L	316H	317L	410	416	430	430F	15-5 ESR	Alloy 218
3/16-1 CDA	x	x	x	x	x	x	x	x	x	x		x ^A
1/2-1 CFA	x	x	x	x	x	x	x	x	x	x	x	
>1-3 3/4 CFA	x	x	x	x	x	x	x	x	x	x	x	x
2-3 1/2 HRART	x	x	x	x	x	x	x	x	x	x	x	x
>3 1/2-7 HRART	x	x	x	x	x	x	x	x				
>7-10 HRART	x	x	x	x	x	x						

	17-4	2205+2	253 MA	254 SMO	321	347	309	310	904L	LDX 2101	304 HN	XM-19
3/16-1 CDA				x	x				x			
1/2-1 CFA	x		x		x	x	x	x	x	x		
>1-3 3/4 CFA	x	x	x	x	x	x	x	x	x	x	x ^C	x ^D
2-3 1/2 HRART	x	x	x	x	x	x	x	x	x	x	x ^C	x ^E
>3 1/2-7 HRART	x ^B	x		x	x	x	x	x	x	x		
>7-10 HRART					x	x						

A: Alloy 218 only available down to 3/4" C: 304 HN only available from 1 3/8" to 3 1/2" HS E: XM-19 only available from 1 3/8" to 3 1/2" HS
 B: 17-4 only available up to 5 1/4" D: XM-19 annealed only available from 1" to 3 1/2"

NOTE: 303, 304L, 316L and 317L come standard as PRODEC

Rounds

Table 3

12 ft Bar								
Size in inches	Weight per foot, lbs	Weight per bar, lbs	Size in inches	Weight per foot, lbs	Weight per bar, lbs	Size in inches	Weight per foot, lbs	Weight per bar, lbs
1/8	0.042	0.50	1 9/16	6.520	78.24	4 3/4	60.250	723.00
.130	0.045	0.54	1 5/8	7.051	84.61	5	68.750	801.10
3/16	0.094	1.13	1 11/16	7.604	91.25	5 1/4	73.600	883.20
7/32	0.128	1.54	1 3/4	8.178	98.14	5 1/2	80.770	969.20
1/4	0.167	2.00	1 13/16	8.773	105.30	5 3/4	88.290	1059.00
.255	0.174	2.08	1 7/8	9.388	112.70	6	96.120	1153.50
5/16	0.261	3.13	1 15/16	10.020	120.20	6 1/4	104.300	1252.00
.3175	0.269	3.23	2	10.680	128.20	6 1/2	112.800	1353.80
1 1/32	0.316	3.79	2 1/16	11.360	136.30	6 3/4	121.700	1460.00
3/8	0.376	4.51	2 1/8	12.060	144.70	7	130.800	1570.80
.380	0.386	4.62	2 3/16	12.780	153.40	7 1/4	140.400	1684.10
7/16	0.511	6.13	2 1/4	13.520	162.20	7 1/2	150.200	1802.20
1/2	0.668	8.02	2 5/16	14.280	171.40	7 3/4	160.400	1924.40
.505	0.680	8.16	2 3/8	15.060	180.70	8	170.900	2050.60
9/16	0.845	10.14	2 7/16	15.870	190.40	8 1/4	181.700	2180.70
5/8	1.043	12.52	2 1/2	16.690	200.30	8 1/2	192.900	2315.00
.630	1.061	12.72	2 9/16	17.530	210.40	8 3/4	204.500	2453.10
1 1/16	1.262	15.14	2 5/8	18.400	220.80	9	216.300	2595.20
3/4	1.502	18.02	2 11/16	19.290	231.50	9 1/4	228.500	2741.40
.755	1.522	18.26	2 3/4	20.200	242.40	9 1/2	241.000	2891.60
13/16	1.763	21.16	2 13/16	21.120	253.40	9 3/4	253.800	3045.80
7/8	2.044	24.53	2 7/8	22.070	264.80	10	267.000	3204.00
15/16	2.347	28.16	2 15/16	23.040	276.50	10 1/2	294.400	3532.40
1	2.670	32.04	3	24.030	288.40	11	324.000	3876.80
1.005	2.696	32.38	3 1/8	26.080	312.90	11 1/2	354.000	4237.30
1 1/16	3.014	36.17	3 1/4	28.210	338.50	12	384.500	4613.76
1 1/8	3.379	40.55	3 3/8	30.420	365.00	12 1/2	417.200	5006.20
1 3/16	3.766	45.19	3 1/2	32.710	392.50	13	451.200	5414.70
1 1/4	4.173	50.08	3 5/8	35.090	421.10	13 1/2	487.000	5839.30
1 5/16	4.600	55.20	3 3/4	37.550	450.60	14	523.300	6279.84
1 3/8	5.049	60.59	4	42.730	512.60	15	601.000	7209.00
1 7/16	5.518	66.22	4 1/4	48.230	578.70			
1 1/2	6.008	72.10	4 1/2	54.070	648.90			

Pounds/Ft = 2.9473 x S²

Round, Hex, Square and Wire Rod Table 4

Program: 5mm to 25mm in most stainless steel grades.

Straightness Tolerances for Machine-Straightened Bar Table 5

Rough Turned	Cold Finished
1/8" in any 5' but may not exceed 1/8" x length in feet	1/16" in any 5' but may not exceed 1/16" x length in feet
5	5

Hex

Table 6

	303	304L	316L	321	347	LDX 2101	416
3/16" - 1"	X	X	X	X	X	X	
1" - 1 3/4" *	X	X	X	X	X	X	X

*Full sizes available mid 2009. Call to inquire.

Hex

Table 7

12 ft Bar								
Size in inches	Weight per foot, lbs	Weight per bar, lbs	Size in inches	Weight per foot, lbs	Weight per bar, lbs	Size in inches	Weight per foot, lbs	Weight per bar, lbs
1/4	0.184	2.21	13/16	1.944	23.33	13/8	5.567	66.80
5/16	0.288	3.46	7/8	2.254	27.05	17/16	6.085	73.02
3/8	0.414	4.97	15/16	2.588	31.06	11/2	6.625	79.50
7/16	0.564	6.77	1	2.945	35.34	15/8	7.775	93.30
1/2	0.736	8.83	11/16	3.324	39.89	111/16	8.385	100.60
9/16	0.932	11.18	11/8	3.727	44.72	13/4	9.019	108.23
5/8	1.150	13.80	13/16	4.152	49.82	113/16	9.673	116.10
11/16	1.392	16.70	11/4	4.601	55.21	17/8	10.362	124.20
3/4	1.656	19.87	15/16	5.072	60.86	2	11.789	141.40

Pounds/Ft = 2.9473 x S2

Squares

Table 8

12 ft Bar								
Size in inches	Weight per foot, lbs	Weight per bar, lbs	Size in inches	Weight per foot, lbs	Weight per bar, lbs	Size in inches	Weight per foot, lbs	Weight per bar, lbs
1/4	0.213	2.55	3/4	1.913	22.96	11/4	5.313	63.76
5/16	0.332	3.98	13/16	2.245	26.94	15/16	5.857	70.29
3/8	0.478	5.74	7/8	2.603	31.24	13/8	6.428	77.14
7/16	0.651	7.81	15/16	2.988	35.86	11/2	7.650	91.80
1/2	0.850	10.20	1	3.400	40.80	15/8	8.980	107.74
9/16	1.076	12.91	11/16	3.840	46.06	13/4	10.410	124.95
5/8	1.328	15.94	11/8	4.303	51.64	17/8	11.950	143.44
11/16	1.607	19.29	13/16	4.795	57.54	2	13.600	163.20

Pounds/Ft = 2.9473 x S2

Billet

Table 9

Program:	303	304L	316L	317L	410	416	430	17-4	2205+2®	253	254	321	347	309	310	904L
										MA®	SMO®					

* Rolled billet in 3" to 7" RCS or rounds.
 * CC bloom in 12" x 16"
 * CC billet in 5," 5 1/2" or 6"

Conforms to ASTM A 484						
Round Bar/Cold Finished		Round Bar/Hot Rolled and Rough Turned			Square Bar and Hexagons/Cold Finished	
Size	Tolerances	Size	Tolerances	Out of Round	Size	Tolerances
Under 5/16"	+/-0.001	Over 2" to 2 1/2"	+1/32 -0	0.023	Under 5/16"	+0.000 -0.002
5/16" up to but excluding 1/2"	+/-0.0015	Over 2 1/2" to 3 1/2"	+3/64 -0	0.035	Over 5/16" to under 1/2"	+0.000 -0.003
1/2" up to but excluding 1"	+/-0.002	Over 3 1/2" to 4 1/2"	+1/16 -0	0.046	1/2" up to and including 1"	+0.000 -0.004
1" up to but excluding 1 1/2"	+/-0.0025	Over 4 1/2" to 5 1/2"	+5/64 -0	0.058	Over 1" up to and including 2"	+0.000 -0.006
1 1/2" up to and including 3 1/4"	+/-0.003	Over 5 1/2" to 6 1/2"	+1/8 -0	0.070	Over 2" up to and including 3"	+0.000 -0.008
Over 3 1/4" up to and including 4 1/2"	+/-0.005	Over 6 1/2" to 8"	+5/32 -0	0.085	Over 3"	+0.000 -0.010
Over 4 1/2" up to and including 6"	+/-0.008	Over 8" to 12"	+3/16 -0	0.094		

10571EN, Schaumburg, USA, August 2008.

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Outokumpu is a global leader in stainless steel. Our vision is to be the undisputed number one in stainless, with success based on operational excellence. Customers in a wide range of industries use our stainless steel and services worldwide. Being fully recyclable, maintenance-free, as well as very strong and durable material, stainless steel is one of the key building blocks for sustainable future.

What makes Outokumpu special is total customer focus – all the way, from R&D to delivery. You have the idea. We offer world-class stainless steel, technical know-how and support. We activate your ideas.



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