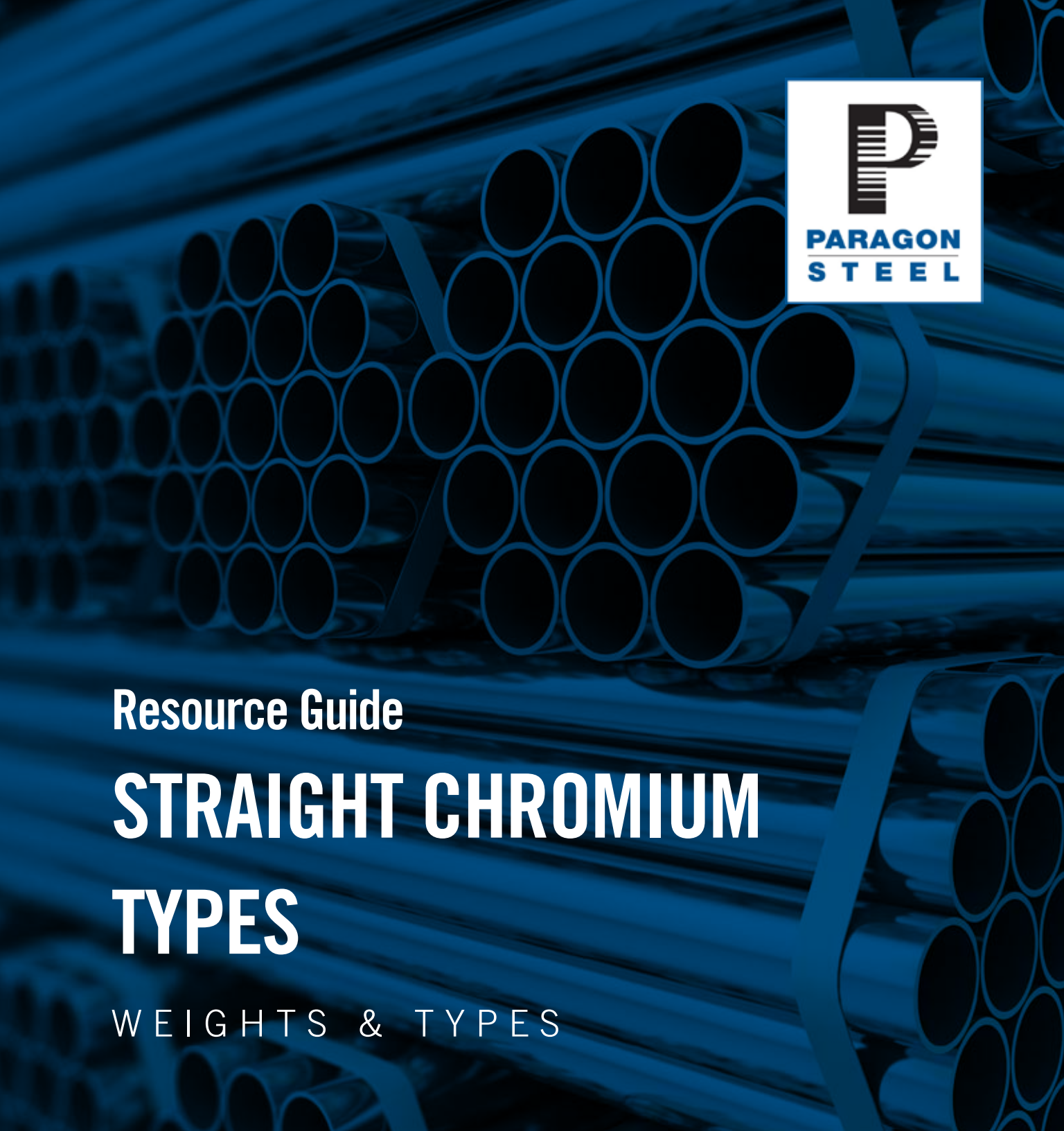


PARAGON STEEL

Resource Guide

STRAIGHT CHROMIUM TYPES

WEIGHTS & TYPES

Type 410 - UNS S41000

Sheets, Plates, Bars, Billets

Color Markings

Heat Treated Bars—Green with Brown Stripe

As Rolled & Annealed Bars & Billets—Green with Black Stripe

Type 410 is the basic chromium grade of stainless steel. It combines excellent corrosion resistance with the ability to develop hardness and mechanical properties by conventional heat treating methods that are similar to those of 4130 alloy steel. It is magnetic in all conditions.

Analysis

C	Mn Max.	P Max.	S Max.	Si Max.	Cr	Ni Max.	Mo Max.	Cu Max.
.10/.15	1.00	.040	.030	1.00	11.50/13.50	.75	.50	.50

Specifications

The following specifications are generally applicable:

Sheets & Plates: AMS-5504. QQ-S-766, ASTM A 176

Bars: AMS-5613, QQ-S-763, MIL-S-861, ASTM A 276

Applications

This grade is used for applications requiring good mechanical properties and involving corrosive conditions that are not too severe, such as valve parts, cutlery, food industry machine parts, screws, bolts, pump rods and pistons, etc. In the annealed condition, it may be drawn or formed. In the aircraft industry, Type 410 is used for parts such as compressor shrouds, where oxidation resistance is required up to 1000°F. Useful at higher temperature only when stresses are low.

Corrosion Resistance

Excellent resistance to corrosion from the atmosphere, fresh water, iron-bearing mine waters, food acids, neutral and basic salts, mild acids and alkalis. This grade has excellent corrosion resistance in all conditions of heat treatment, but maximum resistance is obtained by hardening and polishing.

Resistance to Scaling

Resists scaling at temperatures up to approximately 1200°-1300°F in continuous service. Over 1300°F it has relatively low strength, and resistance to oxidation is reduced.

Mechanical Properties

Specifications AMS-5504 requires the following properties of sheets and plates in the annealed condition:

Tensile Strength (psi)	Elongation in 2"	
95,000 Max.	.030" thick and under	Over .030" thick
	15% Min.	20% Min.

Hardenability

Specification AMS-5504 requires that material 3/8" thick and under, and 3/8" specimens form heavier material, shall be capable of attaining hardness of Rockwell “C” 35-45 after being heated to 1750°F, held at heat for 15-30 minutes, and cooled in still air.

Machinability

Type 410 has better machining characteristics than the chromium-nickel grades. It has a machinability rating of 54%, with 1212 rated 100%. Surface cutting speed on automatic screw machines is approximately 90 feet per minute.

Weldability

May be welded by all the commercial processes except forge or hammer welding. Large sections should be preheated prior to welding. Because of its air-hardening properties, annealing after welding is recommended to obtain maximum ductility and toughness.

Forging

Forge between 2000° and 2200°F. Do not forge below 1650°F. Cool slowly.

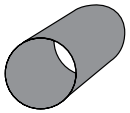
Annealing

Full annealing range is between 1550° and 1650°F. Cool slowly in furnace. Low annealing range is between 1200° and 1400°F. Cool in air.

Hardening

Hardening range is between 1750° and 1850°F. Quench large sections in oil. Small sections may be quenched in air. Temper to required hardness.

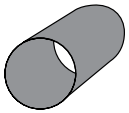
Type 410 Rounds ~ Annealed



Size in Inches	Est. Wt. Lbs. Per Sq. Foot	Est. Wt. Lbs. 12-Ft. Bar	Size in Inches	Est. Wt. Lbs. Per Sq. Foot	Est. Wt. Lbs. 12-Ft. Bar	Size in Inches	Est. Wt. Lbs. Per Sq. Foot	Est. Wt. Lbs. 12-Ft. Bar
Annealed & Cold Drawn Max. Brinell 241			Annealed & Ground Max. Brinell 241			Annealed & Ground Max. Brinell 241		
1/4	.1671	2.005	5/8	1.044	12.53	1/2	6.014	72.17
5/16	.2610	3.132	11/16	1.263	15.16	5/8	7.058	84.70
3/8	.3759	4.510	3/4	1.504	18.04	11/16	7.612	91.34
7/16	.5116	6.139	13/16	1.765	21.17	3/4	8.186	98.23
1/2	.6682	8.019	7/8	2.046	24.56	7/8	9.397	112.8
			15/16	2.349	29.19	**2**	10.69	128.3
			1	2.673	32.07	1/8	12.07	144.8
			1/16	3.017	36.21	1/4	13.53	162.4
			1/8	3.383	40.59	3/8	15.08	180.9
			3/16	3.769	45.23	1/2	16.71	200.5
			1/4	4.176	50.12	**3**	24.06	288.7
			3/8	5.053	60.64	1/2	32.74	392.9

Note: Stock Lengths 10' to 12' and 20' to 22'

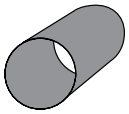
Type 410 Rounds (Continued)



Size in Inches	Est. Wt. Lbs. Per Sq. Foot	Est. Wt. Lbs. 12-Ft. Bar
H.R. Ann. & Pickled Max. Brinell 235		
2 1/4	13.53	162.4
1/2	16.71	200.5
3/4	20.21	242.6
3	24.06	288.7
1/4	28.23	338.8
1/2	32.74	392.9
3/4	37.59	451.0
4	42.77	513.2
1/4	48.28	579.3
1/2	54.13	649.5
3/4	60.31	723.7
5	66.82	801.9
1/4	73.67	884.0
1/2	80.86	970.2
6	96.22	1155
1/4	104.4	1253
1/2	112.9	1355
7	131.0	1572
1/2	150.4	1804
8	171.1	2053
1/2	193.1	2317
9	216.5	2598
1/2	241.2	2895
10	267.0	3207
11	323.4	3881
12	384.9	4619

Note: Stock Lengths 10' to 12' and 20' to 22'

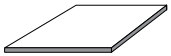
Type 410 Rounds ~ Hot Rolled Heat Treated - Brinell 248-302



Size in Inches	Est. Wt. Lbs. Per Sq. Foot	Est. Wt. Lbs. 24-Ft. Bar
1 1/4	4.176	100.2
3/8	5.053	121.3
1/2	6.014	144.3
3/4	8.186	196.5
7/8	9.397	225.5
2	10.69	256.6
1/4	13.53	324.7
1/2	16.71	401.0
3/4	20.21	485.0
3	24.06	577.4
1/4	28.23	677.5
1/2	32.74	785.8
3/4	37.59	902.2
4	42.77	1027
1/4	48.28	1159
1/2	54.13	1299
3/4	60.31	1447
5	66.82	1604
1/4	73.67	1768
1/2	80.86	1941
6	96.22	2309
1/2	112.9	2710
7	131.0	3144
1/4	140.5	3372
1/2	150.4	3610
9	216.5	5196

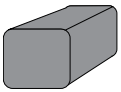
Note: Stock Length 22’ to 24’

Type 410 Plates ~ Hot Rolled, Annealed, & Pickled



Thickness & Width (For Weights, see Page 6)							
3/16 x	36	5/16 x	36	1/2 x	36	3/4 x	36
	48		48		48		48
	60		60		60		60
	72		72		72		72
	84		84		84		84
	96		96		96		96
1/4 x	36	3/8 x	36	5/8 x	36	1 x	48
	48		48		48	1 1/4 x	48
	60		60		60	1 1/2 x	48
	72		72		72	1 3/4 x	48
	84		84		84		
	96		96		96		

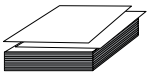
Note: Stock Lengths up to 20'



Type 410 BILLETS

Refer to Page 99

Type 410 SHEETS ~ Annealed & Pickled
No. 2D Finish (Dull Cold Rolled)



Thickness		Width & Length	Est. Wt. Lbs. Per Sq. Ft.	Est. Wt. Lbs. Per Sheet	Thickness		Width & Length	Est. Wt. Lbs. Per Sq. Ft.	Est. Wt. Lbs. Per Sheet
.032"	(22 Ga.)	36x120	1.318	39.5	**.080"**	(14 Ga.)	36x120	3.296	98.9
.036"	(20 Ga.)	36x120	1.483	44.5	**.090"**	(13 Ga.)	36x120	3.708	111.2
.040"	(20 Ga.)	36x120	1.648	49.4	**.109"**	(12 Ga.)	36x120	4.491	134.7
.050"	(18 Ga.)	36x120	2.060	61.8	**.125"**	(11 Ga.)	36x120	5.150	154.5
.063"	(16 Ga.)	36x120	2.596	77.9	**.140"**	(10 Ga.)	36x120	5.768	173.0

Type 416 Free Machining - UNS S41600

Stainless Bars and Billets

Color Markings

Annealed Bars, Pump Shafting and Unannealed Billets—Ends painted Green

Heat Treated Bars—Green with Blue Stripe

Type 416 is a chromium grade of stainless steel modified by the addition of phosphorus and sulphur to produce a free-machining steel. It is the most readily machinable of all stainless steels. A wide range of mechanical properties may be obtained by conventional heat treating methods. It is magnetic in all conditions. Manufactured by the electric-furnace process, it is a quality steel, free from all injurious defects.

Analysis

C Max.	Mn Max.	P Max.	S	Si Max	Cr	Ni Max.	Mo Max.	Cu Max.
.15	1.25	.060	.15/.40	1.00	12.00/13.50	.75	.60	.50

Specifications

The following specifications are generally applicable:
AMS-5610, ASTM A 314, ASTM A 581, ASTM A 582.

Applications

Type 416 is used for applications demanding the mechanical properties and corrosion resistance of Type 410 combined with free machining properties. It can be turned, threaded, formed or drilled at speeds approaching those of screw stock.

Corrosion Resistance

Excellent resistance to corrosion from atmosphere, fresh water, food acids and neutral and basic salts. This grade has excellent corrosion resistance in all conditions of heat treatment, but maximum resistance is obtained by hardening and polishing.

Resistance to Scaling

Resists scaling at temperatures up to approximately 1200°-1300°F in continuous service.

Mechanical Properties

Applicable specifications require the following properties:

	Tensile Strength (psi)	Yield Strength (psi)	Elongation in 2"	Reduction of Area
H.R. Annealed	70,000 Min	40,000 Min.	15% Min.	50% Min.
Annealed & C.F.	70,000 Min	40,000 Min.	15% Min.	45% Min.

Hardenability

A 3/8" section quenched in oil from 1825°F will harden to a minimum of Rockwell “C” 35.

Machinability

Type 416 has very good machining characteristics. It has a machinability rating of approximately 97%, with 1212 rated 100%. Surface cutting speed on automatic screw machines is approximately 160 feet per minute.

Weldability

This grade has poor weldability properties. Welds are brittle, with tendency to crack.

Forging

Forge between 2100° and 2300°F. Do not forge below 1700°F. Cool slowly.

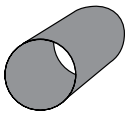
Annealing

Full annealing range is between 1550° and 1650°F. Cool slowly in furnace. Low annealing range is between 1200° and 1400°F. Cool in air.

Hardening

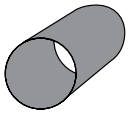
Hardening range is between 1750° and 1850°F. Quench large sections in oil. Small sections may be quenched in air. Temper to required hardness.

Type 416 Rounds ~ Ann. & C.F. (Brinell 241 Max.) or H.T. & C.F.(Rockwell "C" 25-32)



Size in Inches	Est. Wt. Lbs.		Size in Inches	Est. Wt. Lbs.		Size in Inches	Est. Wt. Lbs.	
	Per Sq. Foot	12-Ft. Bar		Per Sq. Foot	20-Ft. Bar		Per Sq. Foot	12-Ft. Bar
Cold Drawn			1/2	.6682	8.019	15/16	2.349	46.98
1/16	.0104	.1253	**Ground**			31/32	2.508	50.17
3/32	.0235	.2819	17/32	.7544	15.09	**1**	2.673	53.46
1/8	.0418	.5012	9/16	.8457	16.91	1/16	3.017	60.35
5/32	.0653	.7831	19/32	.9423	18.85	1/8	3.383	67.66
3/16	.0940	1.128	5/8	1.044	20.88	3/16	3.769	75.38
7/32	.1279	1.535	21/32	1.151	23.02	1/4	4.176	83.53
1/4	.1671	2.005	11/16	1.263	25.27	5/16	4.604	92.09
9/32	.2114	2.537	23/32	1.381	27.62	3/8	5.053	101.1
5/16	.2610	3.132	3/4	1.504	30.07	7/16	5.523	110.5
11/32	.3158	2.790	25/32	1.631	32.63	1/2	6.014	120.3
3/8	.3759	4.510	13/16	1.765	35.29	9/16	6.526	130.5
13/32	.4411	5.293	27/32	1.903	38.06	5/8	7.058	141.2
7/16	.5116	6.139	7/8	2.046	40.93	11/16	7.612	152.2
15/32	.5873	7.048	29/32	2.195	43.90	3/4	8.186	163.7

Type 416 Rounds (Continued)



Size in Inches	Est. Wt. Lbs. Per Sq. Foot	Est. Wt. Lbs. 20-Ft. Bar
Ground (Contd)		
13/16	8.781	175.6
7/8	9.397	187.9
15/16	10.03	200.7
2	10.69	213.8
1/8	12.07	241.4
3/16	12.79	255.8
1/4	13.53	270.6
5/16	14.29	285.9
3/8	15.08	301.5
7/16	15.88	317.6
1/2	16.71	334.1
5/8	18.42	368.4
3/4	20.21	404.3
7/8	22.09	441.9
3	24.06	481.1
1/4	28.23	564.6
1/2	32.74	654.8

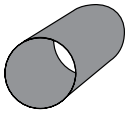
Size in Inches	Est. Wt. Lbs. Per Sq. Foot	Est. Wt. Lbs. 12-Ft. Bar
3/4	37.59	751.7
4	42.77	855.3
1/4	48.28	965.6
1/2	54.13	1083
3/4	60.31	1206
5	66.82	1336
1/2	80.86	1617
H.R., Ann. & Pickled Brinell 241 Max.		
3	24.06	288.7
1/8	26.10	313.2
1/4	28.23	338.8
3/8	30.45	365.3
1/2	32.74	392.9
5/8	35.12	421.5
3/4	37.59	451.0
4	42.77	513.2
1/4	48.28	579.3

Size in Inches	Est. Wt. Lbs. Per Sq. Foot	Est. Wt. Lbs. 12-Ft. Bar
1/2	54.13	649.5
3/4	60.31	723.7
5	66.82	801.9
1/4	73.67	884.0
1/2	80.86	970.2
6	96.22	1115
1/4	104.4	1253
1/2	112.9	1355
3/4	121.8	1461
7	131.0	1572
1/2	150.4	1804
3/4	160.5	1926
8	171.1	2053
9	216.5	2598
3/4	254.1	3049
10	267.3	3207

Note: Stock Lengths Cold Drawn & Hot Rolled - 10' to 12' and 20' to 22'. Ground & Pump Shafting - 20' to 22'

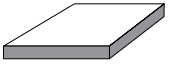
Type 416 Rounds (Continued)

Precision Pump Shafting
Tolerances: 1/2 Standard
Straightness: .005" in 10'
Finish: 40 micro finish max.
Tensile: 100,000/120,000 psi
Brinell: 207-245



Size in Inches	Est. Wt. Lbs.		Size in Inches	Est. Wt. Lbs.	
	Per Sq. Foot	20-Ft. Bar		Per Sq. Foot	20-Ft. Bar
5/8	1.044	20.88	7/16	15.88	317.6
3/4	1.504	30.07	1/2	16.71	334.1
13/16	1.765	35.29	11/16	19.31	386.1
7/8	2.046	40.93	3/4	20.21	404.3
1	2.673	53.46	15/16	23.06	461.3
1/8	3.383	67.66	**3**	24.06	481.1
3/16	3.769	75.38	3/16	27.16	543.1
1/4	4.176	83.53	1/4	28.23	564.6
3/8	5.053	101.1	7/16	31.58	631.7
7/16	5.523	110.5	1/2	32.74	654.8
1/2	6.014	120.3	11/16	36.35	726.9
11/16	7.612	152.2	15/16	41.44	828.8
3/4	8.186	163.7	**4**	42.77	855.3
15/16	10.03	200.7	1/4	48.28	965.6
2	10.69	213.8	1/2	54.13	1083
3/16	12.79	255.8	**5**	66.82	1336
1/4	13.53	270.6	1/2	80.86	1617

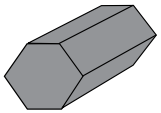
Type 416 Cold Drawn Flats



Size in Inches		Est. Wt. Lbs.		Size in Inches		Est. Wt. Lbs.	
		Per Sq. Foot	12-Ft. Bar			Per Sq. Foot	12-Ft. Bar
3/16 x	1	.6381	7.657	1/2 x	3/4	1.276	15.31
	1 1/2	.9572	11.49		1	1.702	20.42
	2	1.276	15.31		1 1/2	2.552	30.63
1/4 x	1/2	.4254	5.105		2	3.403	40.84
	3/4	.6381	7.657	3/4 x	1	2.552	30.63
	1	.8508	10.21		1 1/2	3.829	45.94
	1 1/2	1.276	15.31		2	5.105	61.26
	2	1.702	20.42	1 x	1 1/2	5.105	61.26
3/8 x	1	1.276	15.31		2	6.806	81.68
	1 1/2	1.914	22.97	1 1/4 x	1 1/2	6.381	76.57
	2	2.552	30.63		2	8.508	102.1
				1 1/2 x	2	10.21	122.5
					3	15.31	183.8

Note: Stock Lengths 10' to 12'

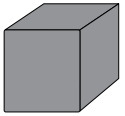
Type 416 Hexagons ~ Annealed & Cold Drawn (Brinell 241 Max.) or Heat Treated & Cold Drawn (Rockwell "C" 25-32)



Size in Inches	Est. Wt. Lbs.		Size in Inches	Est. Wt. Lbs.		Size in Inches	Est. Wt. Lbs.	
	Per Sq. Foot	12-Ft. Bar		Per Sq. Foot	12-Ft. Bar		Per Sq. Foot	12-Ft. Bar
1/4	.1842	2.210	3/4	1.658	19.89	3/8	5.572	66.87
5/16	.2878	3.454	13/16	1.946	23.35	1/2	6.631	79.56
3/8	.4145	4.973	7/8	2.257	27.08	5/8	7.783	93.39
7/16	.5641	6.769	15/16	2.590	31.08	3/4	9.026	108.3
1/2	.7368	8.842	**1**	2.947	35.37	7/8	10.36	124.3
9/16	.9325	11.19	1/16	3.327	39.93	**2**	11.79	141.5
5/8	1.151	13.82	1/8	3.730	44.76			
11/16	1.393	16.72	1/4	4.605	55.26			

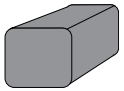
Note: Stock Lengths 10' to 12'

Type 416 Squares ~ Annealed & Cold Drawn (Brinell 241 Max.)



Size in Inches	Est. Wt. Lbs.		Size in Inches	Est. Wt. Lbs.	
	Per Sq. Foot	12-Ft. Bar		Per Sq. Foot	12-Ft. Bar
3/16	.1196	1.436	7/8	2.606	31.27
1/4	.2127	2.552	15/16	2.991	35.89
5/16	.3323	3.988	**1**	3.403	40.84
3/8	.4786	5.743	1/4	5.318	63.81
7/16	.6514	7.817	3/8	6.434	77.21
1/2	.8508	10.21	1/2	7.657	91.89
5/8	1.329	15.95	**2**	13.61	163.4
3/4	1.914	22.97	1/2	21.27	255.2

Note: Stock Lengths 10' to 12'



Type 416 Billets

Refer to Page 99

Type 430 - UNS S43000

Stainless Bars

Color Markings

Ends painted Black and Green

Type 430 is a 16% straight chromium grade. Due to higher chromium content, its corrosion and heat resisting properties are superior to those of Type 410. This is a tough, ductile, non-hardening grade with good mechanical properties. It is magnetic in all conditions.

Analysis

	C Max.	Mn Max	P Max.	S	Si Max.	Cr	Ni Max.
Type 430	.12	1.00	.040	.030 Max.	1.00	16.00/18.00	.50

Specifications

Specification ASTM A 276 is generally applicable.

Applications

The heat resisting properties of these grades make them suitable for such applications as oil refinery equipment, oil burner components and fasteners.

Corrosion Resistance

Type 430 possesses better general corrosion resistance than the lower chromium grades, though not the high corrosion resistance of the 18-8 grades. It has high resistance to nitric acid as well as sulphur-bearing gases up to its maximum service temperature.

Resistance to Scaling

Resists scaling in continuous service at temperatures up to approximately 1500° F.

Mechanical Properties

The following values are average and may be considered as representative of this grade in the annealed condition:

Tensile Strength (psi)	Yield Strength (psi)	Elongation in 2"	Reduction of Area	Hardness
75,000	45,000	30%	65%	Brinell 155

Machinability

Type 430 has a machinability rating of approximately 55% with 1212 rated 100%. Surface cutting speed on automatic screw machines is approximately 90 feet per minute.

Weldability

Fair welding characteristics, with welds tending to be brittle. Type 430 has low heat conductivity (1/3 that of carbon steel) and a low coefficient of expansion (10% less than carbon steel).

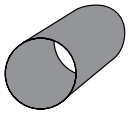
Forging

Forge between 1850° and 1950°F. Do not forge below 1400°F.

Annealing

Heat to between 1400° and 1500°F and air cool.

Type 430 Rounds



Size in Inches	Est. Wt. Lbs.		Size in Inches	Est. Wt. Lbs.	
	Per Sq. Foot	12-Ft. Bar		Per Sq. Foot	12-Ft. Bar
Annealed & Cold Drawn			Annealed & Ground		
1/4	.1671	2.005	**1**	2.673	32.07
3/8	.3759	4.510	1/8	3.383	40.59
1/2	.6682	8.019	3/8	5.053	60.64
5/8	1.044	12.53	1/2	6.014	72.17
3/4	1.504	18.04	5/8	7.058	84.70
			3/4	8.186	98.23

Note: Stock Lengths 10' to 12' and 20' to 22'

Type 431 - UNS S43100

Stainless Bars, Billets and Wire

Color Markings

Bars & Billets—Ends Green and Yellow

Type 431 is a “16 chromium” stainless steel modified by the addition of nickel. It is designed to develop high mechanical properties by conventional heat treating methods. Its corrosion resistance is superior to such straight chromium grades as Types 410 and 416. It is magnetic in all conditions. Manufactured by the electric-furnace process, it meets rigid industry requirements.

Analysis

C	Mn	P Max.	S Max.	Si	Cr	Ni
.13/.17	.30/.80	.040	.030	.20/.60	15.50/16.50	2.00/3.00

Specifications

The following specifications are generally applicable: MIL-S-18732, ASTM A 276

Applications

Type 431 is used in applications requiring higher mechanical properties than can be obtained from Type 410 and where corrosive conditions are not too severe, such as valve parts, centrifuge bowls, chemical equipment, bolts and screws.

Corrosion Resistance

The corrosions resistance of Type 431 is superior to that of Type 410. This grade has excellent resistance to corrosion in all conditions of heat treatment, from mild acids and alkalis, neutral and basic salts, food acids and atmosphere. Maximum resistance is obtained by hardening and polishing.

Resistance to Scaling

Resists scaling at temperatures up to approximately 1400°F in continuous service.

Mechanical Properties

As required by Specification MIL-S-18732, this grade can be heat treated to meet the following minimum properties:

	Tensile Strength (psi)	Yield Strength (psi)	Elongation in 2"	Reduction of Area
HT-200—Quenched in oil from 1875°F, cool to -100°F and double temper at 550°F	200,000 Min.	150,000 Min.	10% Min.	40% Min.

Machinability

Type 431 has better machining characteristics than the chromium-nickel grades. It has a machinability rating of 45%, with 1212 rated 100%. Surface cutting speed on automatic screw machines is approximately 75 feet per minute.

Weldability

May be welded by all the commercial processes except forge or hammer welding. Large sections should be preheaed prior to welding. Becuase of air-hardening properties, this grade should be annealed after welding.

Forging

Forge between 2100° and 2250°F. Cool slowly. Do not forge below 1700°F.

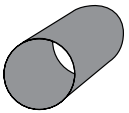
Annealing

Full annealing is impractical. The low annealing range is between 1150° and 1225°F.

Hardening

Hardening range is between 1850° and 1950°F. Quench large sections in oil. Small sections may be quenched in air. Temper to required hardness.

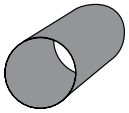
Type 431 Rounds ~ Brinell 228-285



Size in Inches	Est. Wt. Lbs.		Size in Inches	Est. Wt. Lbs.	
	Per Sq. Foot	12-Ft. Bar		Per Sq. Foot	12-Ft. Bar
Annealed & Cold Drawn			13/16	1.765	21.17
3/16	.0940	1.128	7/8	2.046	24.56
1/4	.1671	2.005	15/16	2.349	28.19
5/16	.2610	3.132	**1**	2.673	32.07
3/8	.3759	4.510	1/8	3.383	40.59
7/16	.5116	6.139	3/16	3.769	45.23
1/2	.6682	8.019	1/4	4.176	50.12
Annealed & Ground			3/8	5.053	60.64
9/16	.8457	10.15	1/2	6.014	72.17
5/8	1.044	12.53	5/8	7.058	84.70
11/16	1.263	15.16	3/4	8.186	98.23
3/4	1.504	18.04	7/8	9.397	112.8

Note: Stock Lengths 10' to 12' and 20' to 22'

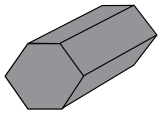
Type 431 Rounds (Continued)



Size in Inches	Est. Wt. Lbs. Per Sq. Foot	Est. Wt. Lbs. 12-Ft. Bar
Annealed & Ground		
2	10.69	128.3
1/8	12.07	144.8
1/4	13.53	162.4
3/8	15.08	180.9
1/2	16.71	200.5
5/8	18.42	221.0
3/4	20.21	242.6
3	24.06	288.7
1/4	28.23	338.8
1/2	32.74	392.9
3/4	37.49	451.0
4	42.77	513.2
Hot Rolled, Annealed & Pickled		
4 1/2	54.13	649.5
5	66.82	801.9
1/2	80.86	970.2
6	96.22	1155

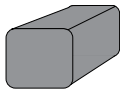
Note: Stock Lengths 10' to 12' and 20' to 22'

Type 431 Hexagons ~ Brinell 228-285



Size in Inches	Est. Wt. Lbs. Per Sq. Foot	Est. Wt. Lbs. 12-Ft. Bar
Annealed & Cold Drawn		
3/8	.4145	4.973
7/16	.5641	6.769
1/2	.7368	8.842
9/16	.9325	11.19
5/8	1.151	13.82
11/16	1.393	16.72
3/4	1.658	19.89
13/16	1.946	23.35
7/8	2.257	27.08
15/16	2.590	31.08
1	2.947	35.37
1/16	3.327	39.93
1/8	3.730	44.76
1/4	4.605	55.26
3/8	5.572	66.87
7/16	6.090	73.08
1/2	6.631	79.56

Note: Stock Lengths 10' to 12'



Type 431 Billets

Refer to Page 99

Type 440-C - UNS S44004

(Air Melt and Consumable Electrode Vacuum Arc Remelt) Stainless Bars

Color Markings

Air Melt—Ends painted Blue

Vacuum Arc Remelt—Gold with Brown Stripe

This is a high carbon chromium stainless steel, capable of developing high hardness and mechanical properties by conventional heat treating methods. It exhibits best corrosion resistance in the hardened condition. It has excellent resistance to wear and abrasion and is magnetic in all conditions. It develops the highest hardness of the stainless steels. This grade is available as an air melt electric furnace product, and for the ultimate in quality, as a consumable electrode vacuum arc remelt product.

Analysis

C	Mn Max.	P Max.	S Max.	Si Max.	Cr	Mo Max.	Ni Max.	Cu Max.
.95/1.20	1.00	.040	.030	1.00	16.00/18.00	.65	.75	.50

Specifications

The following specifications are generally applicable:

AMS-5630, QQ-S-763, ASTM A 276, ASTM A 580

Applications

Used for severe abrasive service such as in needle valves, balls and seats for check valves and ball bearings. Well adapted for pump parts, which must resist corrosion encountered in the oil industry.

Corrosion Resistance

Type 440-C resists corrosion from fresh water, steam, crude oil, gasoline, etc., and resists staining from fruit and food acids. Maximum resistance is obtained by hardening and polishing.

Resistance to Scaling

Resists scaling up to 1200° F in continuous service.

Machinability

Type 440-C has fair machining characteristics, with a machinability rating of 39%, with 1212 rated as 100%. Surface cutting speed on automatic screw machines is approximately 65 feet per minute.

Weldability

Poor welding properties, due to high carbon content.

Forming

This grade has poor forming and stamping properties.

Forging

Forge between 1900° and 2100°F, not below 1650°F. Cool slowly.

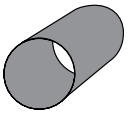
Annealing

Full annealing range is 1550° - 1650°F. Cool slowly in furnace.

Hardening

Hardening range is between 1850° and 1950°F. Quench large sections in oil. Small sections may be quenched in air. Temper as required.

Type 440-C Rounds ~ Annealed & Cold Drawn - Brinell 285 Max. Hot Polled Annealed Rough Turned - Brinell 255 Max.

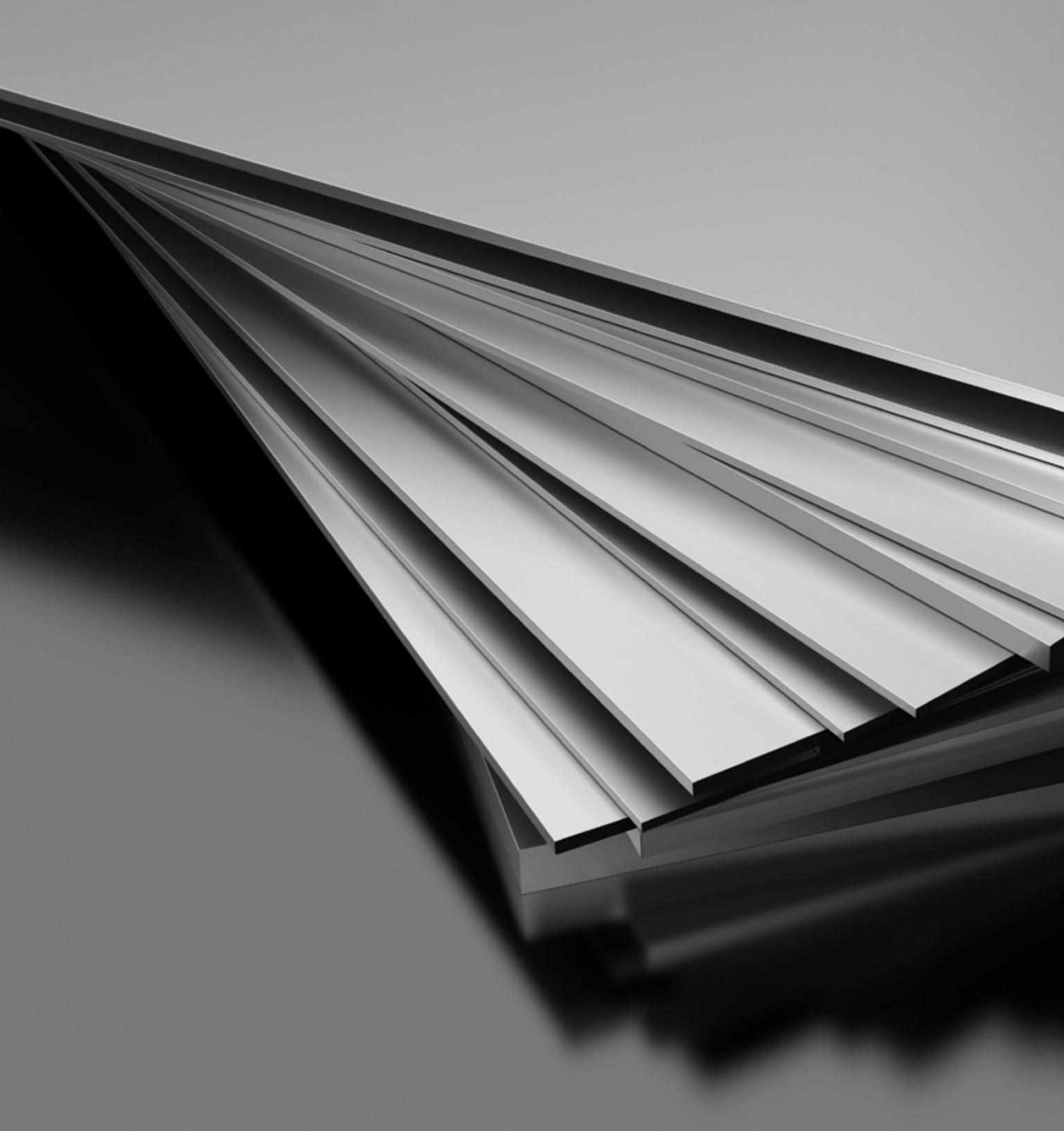


Size in Inches	Est. Wt. Lbs. Per Sq. Foot	Est. Wt. Lbs. 12-Ft. Bar
Annealed & Cold Drawn		
1/8	.0418	.5012
7/32	.1279	1.535
1/4	.1671	2.005
9/32	.2114	2.537
5/16	.2610	3.132
3/8	.3757	4.510
7/16	.5116	6.139
1/2	.6682	8.019
Annealed & Ground		
17/32	.7544	9.052
9/16	.8457	10.15
5/8	1.044	12.53
11/16	1.263	15.16
3/4	1.504	18.04
13/16	1.765	21.17
7/8	2.046	24.56
15/16	2.349	28.19
1	2.673	32.07
1/16	3.017	36.21
1/8	3.383	40.59

Size in Inches	Est. Wt. Lbs. Per Sq. Foot	Est. Wt. Lbs. 12-Ft. Bar
Annealed & Ground (Contd.)		
1 3/16	3.769	45.23
1/4	4.176	50.12
5/16	4.604	55.25
3/8	5.053	60.64
7/16	5.523	66.28
1/2	6.014	72.17
5/8	7.058	84.70
3/4	8.186	98.23
2	10.69	128.3
1/4	13.53	162.4
1/2	16.71	200.5
3	24.06	288.7
Hot Rolled, Ann. Rough Turned		
1 7/8	9.397	112.8
2	10.69	128.3
1/8	12.07	144.8
1/4	13.53	162.4
3/8	15.08	180.9
1/2	16.71	200.5
5/8	18.42	221.0

Size in Inches	Est. Wt. Lbs. Per Sq. Foot	Est. Wt. Lbs. 12-Ft. Bar
Hot Rolled, Ann. Rough Turned (Contd.)		
3/4	20.21	242.6
3	24.06	288.7
1/8	26.10	313.2
1/4	28.23	338.8
1/2	32.74	392.9
3/4	37.59	451.0
4	42.77	513.2
1/2	54.13	649.5
5	66.82	801.9
1/2	80.86	970.2
6	96.22	1155
1/4	104.4	1253
1/2	112.9	1355
7	131.0	1572
8	171.1	2053
1/2	193.1	2317
9	216.5	2598
1/2	241.2	2895
10	267.3	3207

Note: Stock Lengths 10' to 12' and 20' to 22'



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