

PART I

**DATA FOR THE WROUGHT CORROSION-RESISTING AND
HEAT-RESISTING CHROMIUM STEELS**

TABLE I.—CHEMICAL COMPOSITIONS OF WROUGHT CORROSION-RESISTING CHROMIUM STEELS.

A.S.T.M. Designation	A.S.T.M. Grade	A.I.S.I. Type Number	Carbon, per cent	Manganese, max., per cent	Phosphorus, max., per cent	Sulfur, per cent	Silicon, max., per cent	Chromium, per cent	Nickel, max., per cent	Molybdenum, per cent
8 to 10 per cent chromium		502	0.15 max. ^a	0.50	0.030	0.030 max.	0.50	4.00 to 6.00	.....	0.45 to 0.65 ^a
A 176-42	1		0.15 max.	1.50	0.030	0.030 max.	0.50	8.00 to 10.00	.....	0.75 to 1.50
A 176-42	2	410	0.15 max.	0.60	0.030	0.030 max.	0.75	10.00 to 14.00	0.60	.....
		420	0.15 min.	0.60	0.030	0.030 max.	0.60	12.00 to 14.00	.....	.....
		420F	0.15 min.	0.60	0.030	0.070 min. ^c	0.60	12.00 to 14.00	.....	0.60 max.
		416	0.15 max.	0.60	0.030	0.070 min. ^c	0.75	12.00 to 14.00	.....	0.60 max.
		440	0.12 min.	1.00	0.030	0.030 max.	0.60	14.00 to 18.00	.....	.....
A 176-42	4	430	0.12 max.	1.00	0.030	0.030 max.	1.00	14.00 to 18.00	0.60	.....
A 240-42	A	430F	0.12 max.	1.00	0.030	0.070 min. ^d	1.00	14.00 to 18.00	.....	0.60 max.
A 176-42	5									
A 176-42	6									
A 240-42	B	446 ^e	0.35 max.	1.00	0.030	0.030 max.	1.00	23.00 to 30.00	0.60	.....

^a A.I.S.I. type 502 has a carbon content of 0.10 max., per cent; molybdenum optional.^b A.I.S.I. type 403 is similar to A.S.T.M. grade 1.^c Or selenium 0.07 min., per cent.^d A.I.S.I. type 442 is similar to A.S.T.M. grade 5.^e A nitrogen content of 0.10 min., per cent, insures grain refinement.

TABLE II.—PHYSICAL PROPERTIES AND WORKING CHARACTERISTICS OF WROUGHT CORROSION-RESISTING CHROMIUM STEELS IN THE ANNEALED CONDITION.

A.S.T.M. Designation	.....	8 to 10 per cent Chromium	A 176 - 42 2	.....	.....	A 176 A 240 4 A	A 176 A 240 6 B
A.S.T.M. Grade	502		410	420	440	430 430	446 446
A.I.S.I. Type No.							
Modulus of elasticity in tension, psi.....	29 000 000	.....	29 000 000	29 000 000	29 000 000	29 000 000	29 000 000
Modulus of elasticity in torsion, psi.....	.....	.....	.....	11 700 000	.....	.....	.....
Density (lb. per cu. in.).....	0.28	.....	0.28	0.28	0.28	0.28	0.27
Density (g. per cu. cm.).....	7.8	.....	7.7	7.7	7.7	7.7	7.6
Specific electrical resistance at room temperature, microhms per cm. per sq. cm.....	40	.....	57	55	60	60	67
Magnetic permeability.....	ferromagnetic	ferromagnetic	ferromagnetic	ferromagnetic	ferromagnetic	ferromagnetic	ferromagnetic
Specific heat, Btu. per lb. per deg. Fahr. (32 to 212 F.).....	0.11	.....	0.11	0.11	0.11	0.11	0.12
..... (212 F.).....	21.2	.....	14.4	14.4	14.0	15.1	12.1
..... (392 F.).....	20.8	.....	15.0	.....	.....	15.2	12.7
..... (572 F.).....	20.4	.....	15.5	.....	.....	15.2	13.3
..... (752 F.).....	19.8	.....	16.1	.....	.....	15.2	13.8
..... (932 F.).....	19.5	.....	.....	.....	.....	15.2	14.1
..... (32 to 212 F.).....	0.000062	0.000062	0.000061	0.000057	0.000056	0.000058	0.000059
..... (32 to 600 F.).....	0.000068	0.000067	.....	.....	.....	0.000061	.....
..... (32 to 1000 F.).....	0.000072	0.000068	0.000072	.....	.....	0.000063	0.000063
..... (32 to 1200 F.).....	0.000073	0.000072	.....	0.000068	.....	.....	.....
..... (32 to 1832 F.).....	.....	0.000076	0.000076	.....	0.000073	0.000076	.....
Maximum temperature without excessive scaling, deg. Fahr.....	1150	1200	1250	1200	1400	1550	2000
Melting point range, deg. Fahr.....	2700 to 2800	.....	2700 to 2790	.....	.....	2700 to 2750	2700 to 2750
..... (Initial temperature, deg. Fahr.).....	2100 to 2200	2000 to 2150	2000 to 2150	2000 to 2150	1900 to 2050	1900 to 2050	1900 to 2000
..... (Final temperature, deg. Fahr.).....	1500 to 1600	1850 to 1900	1400 to 1500	1700 to 1750	1750 to 1800	1300 to 1500	1300 to 1450
Forging practice..... (Method of cooling.).....	slow cool	slow cool	slow cool	slow cool	slow cool	air cool	air cool
..... (Low anneal.).....	1325-1375	1325-1375	1200-1350	.....	.....	.....	.....
..... (Full anneal.).....	slow cool from	slow cool from	slow cool from	slow cool from	slow cool from	air cool or rapid	rapid cool from
.....	1525-1600	1575-1675	1500-1600	1550-1650	1550-1650	cool from 1400-1450	1450-1550
Hardening temperature, deg. Fahr.....	rapid cool from	rapid cool from	rapid cool from	rapid cool from	rapid cool from	nonhardening	nonhardening
.....	1600-1700	1675	1750-1800	1850-1900	1850-1950	.....	.....
Maximum cold reduction of wire before anneal, per cent.....	75	.....	75	.....	.....	75	75
Riveting and hot forming temperatures, deg. Fahr.....	below 1450	1250 to 1400	below 1450	.....	.....	below 1450	below 1650

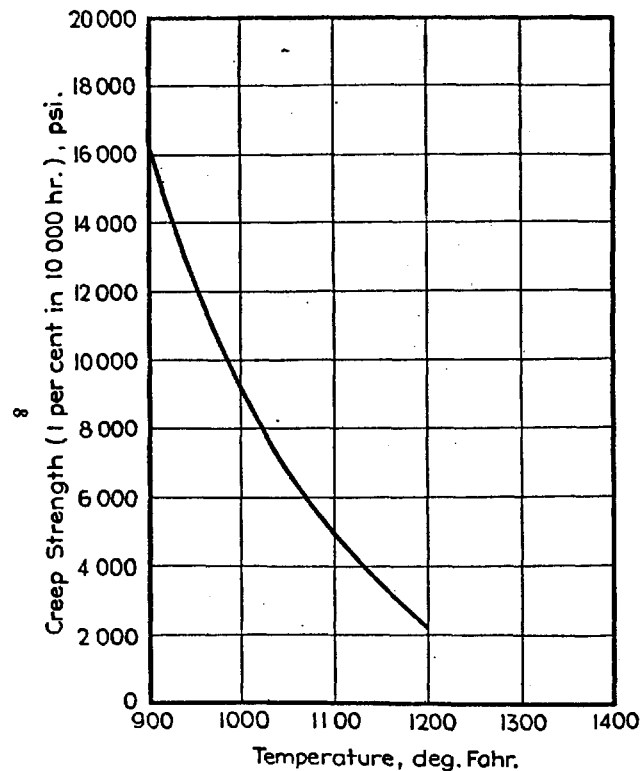


FIG. 1.—Creep Strength at Various Temperatures of 4 to 6 per cent Chromium Steel (A.I.S.I. Type No. 502).

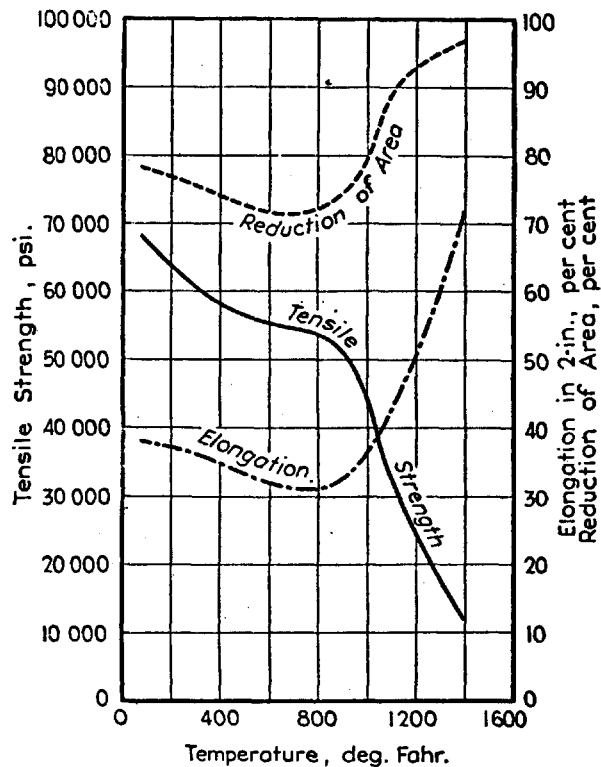


FIG. 2.—Short-Time High-Temperature Tensile Properties of 4 to 6 per cent Chromium Steel (A.I.S.I. Type No. 502).

TABLE III.—MECHANICAL PROPERTIES OF 4 TO 6 PER CENT CHROMIUM STEEL.

CHEMICAL COMPOSITION, PER CENT										A.S.T.M. Designation.....													
Carbon.....	0.15 max.	Silicon.....	0.50 max.	A.S.T.M. Grade.....						.....													
Manganese.....	0.50 max.	Chromium.....	4 to 6	A.I.S.I. Type No.....						502													
Phosphorus.....	0.03 max.	Molybdenum.....	0.15 to 0.65	Structure.....						Martensitic													
Sulfur.....	0.03 max.																						
MECHANICAL PROPERTIES																							
Form and Treatment	Tensile Strength, psi.	Yield Strength (offset = 0.2 per cent), psi.	Yield Point, ^a psi.	Proportional Limit, psi.	Elongation in 2 in., per cent	Reduction of Area, per cent	Impact Resistance, ft.-lb.		Hardness Number		Endurance Limit (Fatigue), psi.	Cold Bend, deg.	Ductility										
							Charpy	Izod	Brinell (3000-kg. load, 10-mm. ball)	Rockwell			Erichsen Value mm.	Olsen Value, ^c in.									
Sheet:																							
Annealed.....	65 000	...	35 000	...	28	...	...	...	...	B70	...	180	...	0.250 to 0.450									
Strip:																							
Cold-rolled.....	...	...	...	...	...	...	...	...	...	...	...	...	...	...									
Annealed.....	75 000	...	35 000	...	28	...	...	...	...	B75	...	180	...	...									
Wire:																							
Cold-drawn, 50 per cent.....	100 000	92 500	...	...	8	...	...	...	...	B97	...	180	...	...									
Annealed.....	73 000	30 000	...	...	28	...	...	...	...	B72	...	180	...	...									
Plate:																							
Annealed.....	70 000	...	40 000	...	28	...	...	85	155	...	...	180	...	...									
Tubing:																							
Annealed.....	70 000	...	39 000	...	35	...	45	...	145	...	...	...	...	...									
Bars:																							
Cold-drawn.....	...	...	...	...	...	...	...	...	...	...	...	...	...	...									
Annealed.....	70 000	...	37 000	26 000	35	70	45	85	145	...	...	180	...	...									
Hardened and Tempered ^b	176 000	...	144 000	...	18	60	...	30	350	...	...	...	...	...									
Forgings:																							
Annealed.....	...	...	...	...	...	...	...	...	...	...	...	...	...	...									

^a Yield point as determined with dividers must not be confused with a defined yield strength, such as, at 0.2 per cent offset.^b Oil quenched from a temperature between 1600 and 1700 F.; tempered at 700 F.^c Depending on thickness with maximum value in thinner thicknesses.

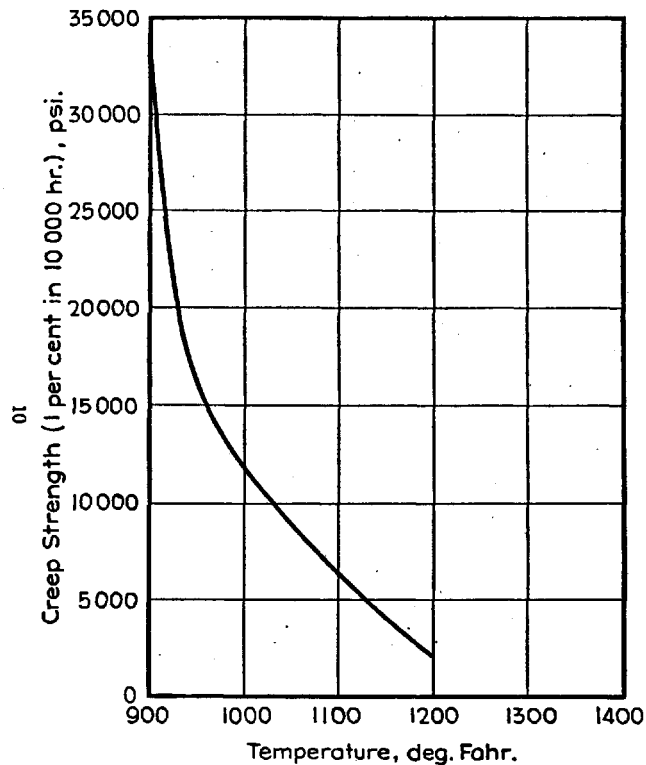


FIG. 3.—Creep Strength at Various Temperatures of 8 to 10 per cent Chromium Steel.

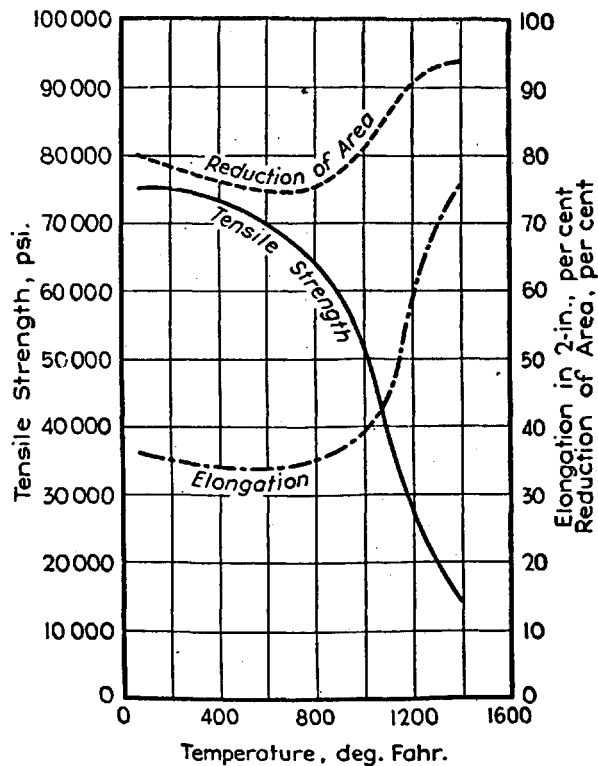


FIG. 4.—Short-Time High-Temperature Tensile Properties of 8 to 10 per cent Chromium Steel.

TABLE IV.—MECHANICAL PROPERTIES OF 8 TO 10 PER CENT CHROMIUM STEEL.

CHEMICAL COMPOSITION, PER CENT							A.S.T.M. Designation.....					
Carbon.....	0.15 max.	Silicon.....	0.50 max.				A.S.T.M. Grade.....					
Manganese.....	1.50 max.	Chromium.....	8 to 10				A.I.S.I. Type No.....					
Phosphorus.....	0.03 max.	Molybdenum.....	0.75 to 1.50				Structure..... Martensitic					
Sulfur.....	0.03 max.											
MECHANICAL PROPERTIES												
Form and Treatment	Tensile Strength, psi.	Yield Strength (offset = 0.2 per cent), psi.	Yield Point,* psi.	Proportional Limit, psi.	Elongation in 2 in., per cent	Reduction of Area, per cent	Impact Resistance ft.-lb.		Hardness Number		Endurance Limit (Fatigue), psi.	Cold Bend, deg.
							Charpy	Izod	Brinell (3000-kg load, 10-mm. ball)	Rockwell		
Sheet:												
Annealed.....	85 000	...	53 000	...	27	...	...	...	...	...	...	180
Strip:												
Cold-rolled.....	...	...	...	...	...	...	...	...	...	...	...	...
Annealed.....	...	...	...	...	...	...	...	...	...	...	...	...
Wire:												
Cold-drawn.....	...	...	...	...	...	...	...	...	...	...	...	...
Annealed.....	...	...	...	...	...	...	...	...	...	...	...	...
Plate:												
Annealed.....	...	...	...	...	...	...	...	...	...	...	...	...
Tubing:												
Annealed.....	70 000	...	43 000	...	35	70	45	...	145	...	...	180
Bars:												
Cold-Drawn.....	...	...	...	...	...	...	...	...	...	...	...	...
Annealed.....	70 000	...	45 000	...	30	70	45	90	145	...	...	180
Hardened and Tempered.....	...	...	...	...	...	...	...	...	...	...	...	...
Forgings:												
Annealed.....	...	...	...	...	...	...	...	...	...	...	...	...

* Yield point as determined with dividers must not be confused with a defined yield strength, such as, at 0.2 per cent offset.

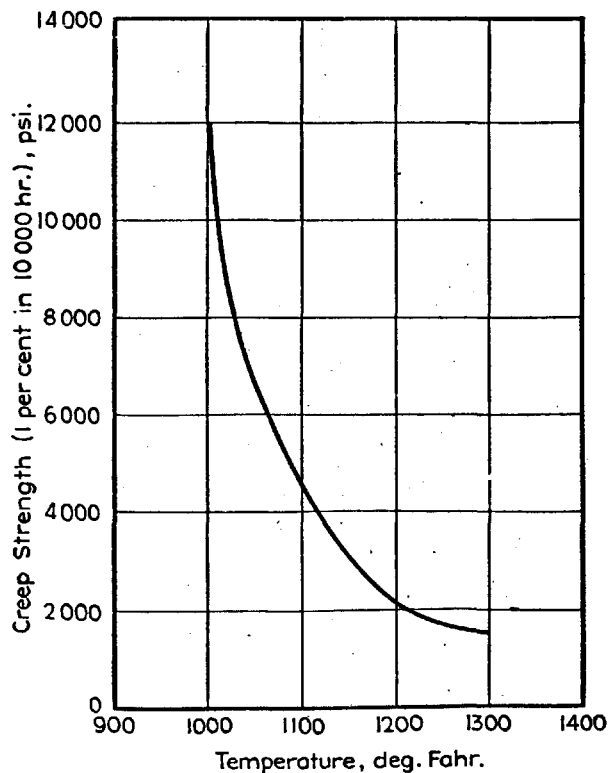


FIG. 5.—Creep Strength at Various Temperatures of Low-Carbon, 10 to 14 per cent Chromium Steel (A.S.T.M. Designation: A 176 - 42, Grade 2; A.I.S.I. Type No. 410).

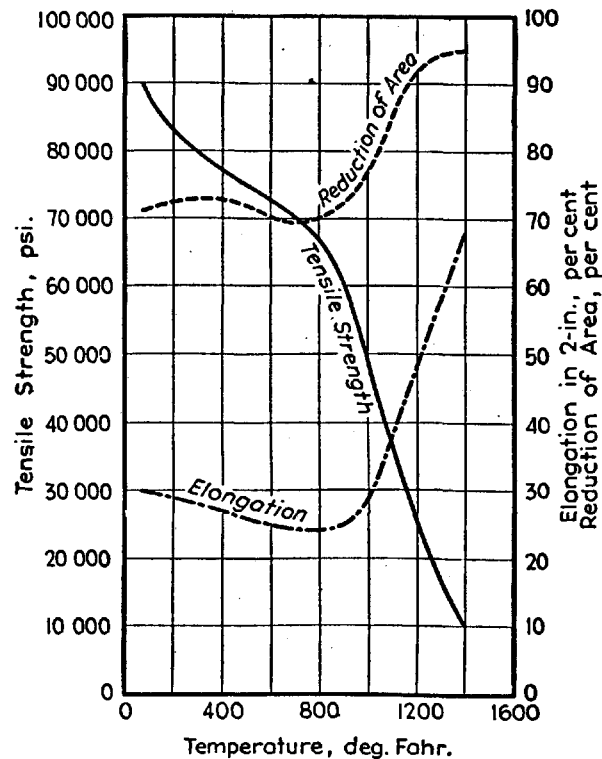


FIG. 6.—Short-Time High-Temperature Tensile Properties of Low-Carbon, 10 to 14 per cent Chromium Steel (A.S.T.M. Designation: A 176 - 42, Grade 2; A.I.S.I. Type No. 410).

TABLE V.—MECHANICAL PROPERTIES OF LOW-CARBON, 10 TO 14 PER CENT CHROMIUM STEEL.

CHEMICAL COMPOSITION, PER CENT										A.S.T.M. Designation ¹ A 176-42												
Carbon.....	0.15 max.	Silicon.....	0.75 max.	A.S.T.M. Grade..... 2		A.I.S.I. Type No..... 410		Structure..... Martensitic														
Manganese.....	0.60 max.	Chromium.....	10 to 14																			
Phosphorus.....	0.03 max.	Nickel.....	0.60 max.																			
Sulfur.....	0.03 max.																					
MECHANICAL PROPERTIES																						
Form and Treatment	Tensile Strength, psi.	Yield Strength (offset = 0.2 per cent), psi.	Yield Point, ^a psi.	Proportional Limit, psi.	Elongation in 2 in., per cent	Reduction of Area, per cent	Impact Resistance, ft.-lb.		Hardness Number		Endurance Limit (Fatigue), psi.	Cold Bend, deg.	Ductility									
							Charpy	Izod	Brinell (3000-kg. load, 10-mm. ball)	Rockwell			Erichsen Value, mm.	Olsen Value, in.								
Sheet:																						
Annealed.....	70 000	...	40 000	...	26	...	...	...	...	B75	...	180	7 to 8	0.3 to 0.4								
Strip:																						
Cold-rolled, 40 per cent.....	125 000	...	110 000	...	3	...	...	...	...	C23	...	...	8	...								
Annealed.....	78 000	...	40 000	...	28	...	...	...	...	B80	...	...	...	...								
Wire:																						
Cold-drawn, 20 per cent.....	88 000	75 000	...	35 000	12	...	...	...	...	B90	...	...	...	...								
Cold-drawn, 40 per cent.....	102 000	95 000	...	55 000	10	...	...	...	...	B95	...	...	...	...								
Cold-drawn, 60 per cent.....	110 000	105 000	...	75 000	6	...	...	...	...	B100	...	...	...	...								
Annealed.....	72 000	37 000	...	24 000	25	...	...	...	...	B75	...	180	...	...								
Plate:																						
Annealed.....	75 000	...	42 000	...	30	60	...	...	135	...	...	180	...	...								
Tubing:																						
Annealed.....	72 000	...	40 000	...	30	...	...	...	150	B80	...	...	...	...								
Bars:																						
Cold-drawn, 20 per cent.....	90 000	70 000	...	56 000	20	50	...	...	185	...	...	...	...	...								
Annealed.....	73 000	40 000	52 000	34 000	30	68	...	90	155	...	40 000	180	...	...								
Hardened and Tempered ^b	187 000	134 000	166 000	100 000	15	55	...	30	385	...	90 000	...	...	...								
Tempered ^b	95 000	65 000	75 000	53 000	25	55	...	85	195	...	55 000	...	...	...								
Forgings:																						
Annealed.....	85 000	...	55 000	...	25	60	...	85	155	...	...	...	...	...								

^a Yield point as determined with dividers must not be confused with a defined yield strength, such as, at 0.2 per cent offset.^b Oil quenched from a temperature between 1750 and 1800 F.; tempered at 800, and 1300 F.

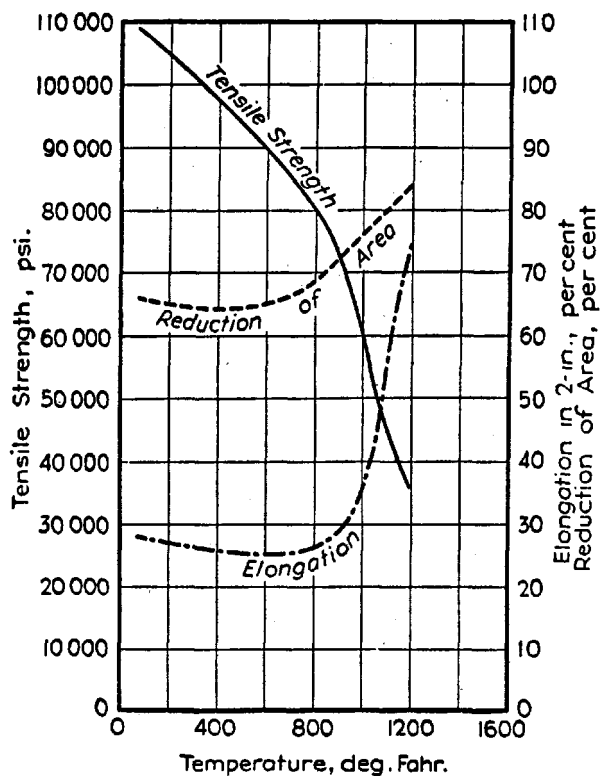


FIG. 7.—Short-Time High-Temperature Tensile Properties of High-Carbon, 12 to 14 per cent Chromium Steel (A.I.S.I. Type No. 420).

TABLE VI.—MECHANICAL PROPERTIES OF HIGH-CARBON, 12 TO 14 PER CENT CHROMIUM STEEL.

CHEMICAL COMPOSITION, PER CENT						A.S.T.M. Designation.....						
Carbon.....	0.15 min. ^c	Sulfur.....	0.03 max.	A.S.T.M. Grade.....								
Manganese.....	0.60 max.	Silicon.....	0.60 max.	A.I.S.I. Type No.....	420							
Phosphorus.....	0.03 max.	Chromium.....	12 to 14	Structure.....	Martensitic							
MECHANICAL PROPERTIES												
Form and Treatment	Tensile Strength, psi.	Yield Strength (offset = 0.2 per cent), psi.	Yield Point, ^a psi.	Proportional Limit, psi.	Elongation in 2 in., per cent	Reduction of Area, per cent	Impact Resistance ft.-lb.		Hardness Number		Endurance Limit (Fatigue), psi.	Cold Bend, deg.
							Charpy	Izod	Brinell (3000-kg. load, 10-mm. ball)	Rockwell		
Sheet:												
Annealed.....	...	...	...	...	...	...	...	...	...	...	...	...
Strip:												
Cold-rolled.....	...	...	...	...	...	...	...	...	...	...	...	...
Annealed.....	...	...	...	...	...	...	...	...	...	...	...	...
Wire:												
Cold-drawn, 30 per cent.....	135 000	120 000	...	77 000	7	30	...	...	...	C25	...	...
Annealed.....	95 000	47 000	...	51 000	23	65	...	...	...	B93	...	180
Plate:												
Annealed.....	...	...	...	...	...	...	...	...	...	...	...	...
Tubing:												
Annealed.....	...	...	...	...	...	...	...	...	...	...	...	...
Bars:												
Cold-drawn.....	...	...	...	...	...	...	...	...	...	...	...	...
Annealed.....	90 000	...	57 000	38 000	28	65	...	30	190	B92	50 000	180
Hardened and tempered ^b 500 F.	240 000	191 000	220 000	161 000	5	7	...	...	490	C51	...	...
Hardened and tempered ^b 1400 F.	180 000	70 000	80 000	56 000	27	65	...	70	200	...	...	...
Forgings:												
Annealed.....	...	...	...	...	...	...	...	...	...	...	...	...

^a Yield point as determined with dividers must not be confused with a defined yield strength, such as, at 0.2 per cent offset.^b Oil quenched from a temperature of 1850 F.; tempered at 500 and 1400 F.^c Data obtained on steels which contained 0.30 to 0.40 per cent carbon.

TABLE VII.—MECHANICAL PROPERTIES OF 12 TO 14 PER CENT CHROMIUM STEEL (FREE MACHINING).

CHEMICAL COMPOSITION, PER CENT							A.S.T.M. Designation.....					
Carbon.....	0.15 max.	Silicon.....	0.75 max.				A.S.T.M. Grade.....					
Manganese.....	0.60 max.	Chromium.....	12 to 14				A.I.S.I. Type No.....	416				
Phosphorus.....	0.03 max.	Molybdenum.....	0.60 max.				Structure.....	Martensitic				
Sulfur or Selenium.....	0.07 min.											
MECHANICAL PROPERTIES												
Form and Treatment	Tensile Strength, psi.	Yield Strength (offset = 0.2 per cent), psi.	Yield Point, ^a psi.	Proportional Limit, psi.	Elongation in 2 in., per cent	Reduction of Area, per cent	Impact Resistance ft.-lb.		Hardness Number		Endurance Limit (Fatigue), psi.	Cold Bend, deg.
							Charpy	Izod	Brinell (3000-kg. load, 13-mm. ball)	Rockwell		
Sheet:												
Annealed.....	...	...	...	...	...	...	...	...	...	...	...	...
Strip:												
Cold-rolled.....	...	...	...	...	...	...	...	...	...	...	...	...
Annealed.....	...	...	...	...	...	...	...	...	...	...	...	...
Wire:												
Cold-drawn.....	...	...	...	...	...	...	...	...	...	...	...	...
Annealed.....	75 000	...	...	40 000	25	...	...	...	...	B82	...	180
Plates:												
Annealed.....	...	...	...	...	...	...	...	...	...	...	...	...
Tubing:												
Annealed.....	...	...	...	...	...	...	...	...	...	...	...	...
Bars:												
Cold-drawn.....	104 000	...	...	55 000	15	45	...	...	217	...	57 000	...
Annealed.....	80 000	...	45 000	36 000	25	60	...	35	180	...	43 000	180
Hardened and tempered ^b 700 F.	160 000	...	145 000	...	12	40	...	...	300	...	...	...
Hardened and tempered 1400 F.	86 000	...	48 000	42 000	25	60	...	35	180	...	...	...
Forgings:												
Annealed.....	89 000	...	50 000	...	23	55	...	30	193	...	...	...

^a Yield point as determined with dividers must not be confused with a defined yield strength, such as, at 0.2 per cent offset.^b Oil quenched from a temperature of 1800 F.; tempered at 700, and 1400 F.

TABLE VIII.—MECHANICAL PROPERTIES OF HIGH-CARBON, 14 TO 18 PER CENT CHROMIUM STEEL.

CHEMICAL COMPOSITION, PER CENT							A.S.T.M. Designation.....					
Carbon.....	0.12 min. ^a	Sulfur.....	0.03 max.				A.S.T.M. Grade.....					
Manganese.....	1.00 max.	Silicon.....	0.60 max.				A.I.S.I. Type No.....	440	Martensitic			
Phosphorus.....	0.03 max.	Chromium.....	14 to 18				Structure.....					
MECHANICAL PROPERTIES												
Form and Treatment	Tensile Strength, psi.	Yield Strength (offset = 0.2 per cent), psi.	Yield Point, ^a psi.	Proportional Limit, psi.	Elongation in 2 in., per cent	Reduction of Area, per cent	Impact Resistance ft.-lb.		Hardness Number		Endurance Limit (Fatigue), psi.	Cold Bend, deg.
							Charpy	Izod	Brinell (3000-kg. load, 10-mm. ball)	Rockwell		
Sheet:												
Annealed.....	...	...	...	...	...	...	...	...	...	...	...	...
Strip:												
Cold-rolled.....	...	...	...	...	...	...	...	...	...	...	...	...
Annealed.....	...	...	...	...	...	...	...	...	...	...	...	...
Wire:												
Cold-drawn.....	...	...	...	...	...	...	...	...	...	...	...	...
Annealed.....	105 000	...	65 000	35 000	18	...	...	...	...	B95	...	...
Plate:												
Annealed.....	...	...	...	...	...	...	...	...	...	...	...	...
Tubing:												
Annealed.....	...	...	...	...	...	...	...	...	...	...	...	...
Bars:												
Cold-drawn.....	...	...	...	...	...	...	...	...	...	...	...	...
Annealed.....	106 000	...	65 000	32 000	20	50	...	30	217	...	50 000	...
Hardened and tempered ^b 600 F.	259 000	...	228 000	...	2	7	...	9	530	...	110 000	...
Hardened and tempered ^b 1300 F.	125 000	...	92 000	...	20	40	...	14	260	...	70 000	...
Forgings:												
Annealed.....	110 000	...	65 000	...	20	40	...	7	223	...	...	...

^a Yield point as determined with dividers must not be confused with a defined yield strength, such as, at 0.2 per cent offset.^b Oil quenched from a temperature of 1850 F.; tempered at 600 and 1300 F.^c Data obtained on steels which contained 0.60 to 0.80 per cent carbon.

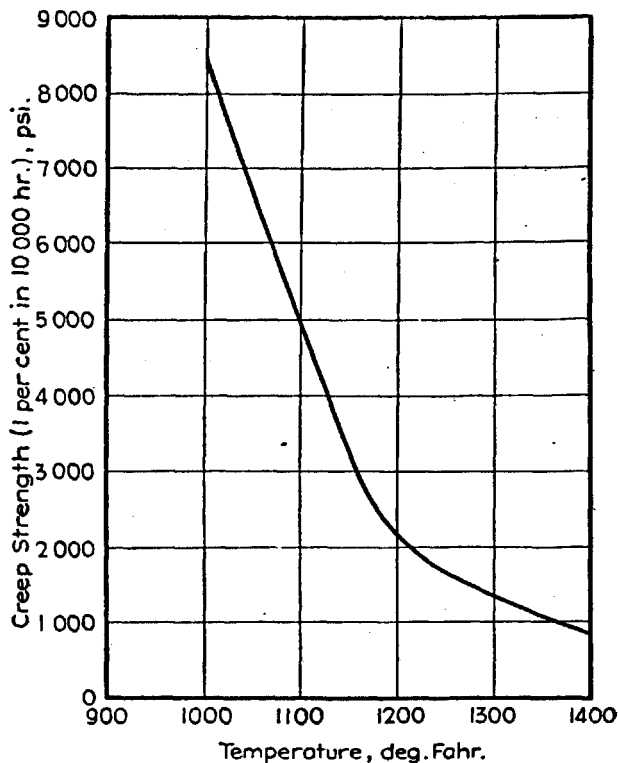


FIG. 8.—Creep Strength at Various Temperatures of Low-Carbon, 14 to 18 per cent Chromium Steel (A.S.T.M. Designations: A 176-42, Grade 4, and A 240-42, Grade A; A.I.S.I. Type No. 430).

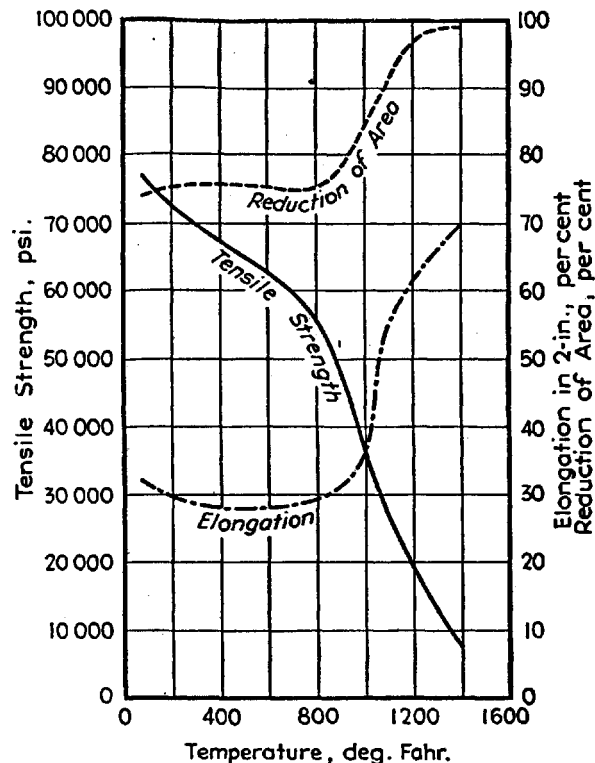


FIG. 9.—Short-Time High-Temperature Tensile Properties of Low-Carbon, 14 to 18 per cent Chromium Steel (A.S.T.M. Designations: A 176-42, Grade 4, and A 240-42, Grade A; A.I.S.I. Type No. 430).

TABLE IX.—MECHANICAL PROPERTIES OF LOW-CARBON, 14 TO 18 PER CENT CHROMIUM STEEL.

CHEMICAL COMPOSITION, PER CENT							A.S.T.M. Designation.....		A 176 - 42		A 240 - 42			
Carbon.....	0.12 max.	Silicon.....	1.00 max.	14 to 18		A.S.T.M. Grade.....		4		A				
Manganese.....	0.03 max.	Chromium.....	0.60 max.	14 to 18		A.I.S.I. Type No.....		430		430				
Phosphorus.....	0.03 max.	Nickel.....	0.60 max.	14 to 18		Structure.....		Ferritic		Ferritic				
Sulfur.....	0.03 max.													
MECHANICAL PROPERTIES														
Form and Treatment	Tensile Strength, psi.	Yield Strength (offset = 0.2 per cent), psi.	Yield Point, ^a psi.	Proportional Limit, psi.	Elongation in 2 in., per cent	Reduction of Area, per cent	Impact Resistance, ft.-lb.		Hardness Number		Endurance Limit (Fatigue), psi.	Cold Bend, deg.	Ductility	
							Charpy	Izod	Brinell (3000-kg. load, 10-mm. ball)	Rockwell			Erichsen Value, mm.	Olsen Value, in.
Sheet:														
Annealed.....	80 000	...	50 000	...	25	...	...	...	...	B80	...	180	7 to 9	0.275 to 0.375
Strip:														
Cold-rolled.....	100 000	...	88 000	...	8	...	...	...	...	B98	...	...	...	...
Annealed.....	80 000	...	50 000	...	25	...	...	...	...	B80	...	180	7 to 9	0.3 to 0.4
Wire:														
Cold-drawn, 20 per cent.....	90 000	...	80 000	35 000	13	...	...	...	...	B93	...	...	...	...
Cold-drawn, 40 per cent.....	100 000	...	95 000	55 000	10	...	...	...	...	B98	...	...	...	...
Cold-drawn, 60 per cent.....	110 000	...	105 000	75 000	8	...	...	...	...	C23	...	...	...	...
Annealed.....	80 000	...	50 000	20 000	25	...	...	...	...	B82	...	180	...	...
Plate:														
Annealed.....	80 000	...	50 000	...	25	50	...	...	170	B80	...	180	...	...
Tubing:														
Annealed.....	80 000	...	50 000	...	25	50	...	...	...	B80	...	...	...	...
Bars:														
Cold-drawn, 20 per cent.....	92 000	...	85 000	45 000	15	45	...	...	190	...	46 000	...	...	...
Annealed.....	80 000	...	50 000	33 000	25	50	...	...	170	...	40 000	...	...	...
Hardened and Tempered.....	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Forgings:														
Annealed.....	80 000	...	50 000	...	25	50	...	...	170	...	...	...	...	...

^a Yield point as determined with dividers must not be confused with a defined yield strength, such as, at 0.2 per cent offset.

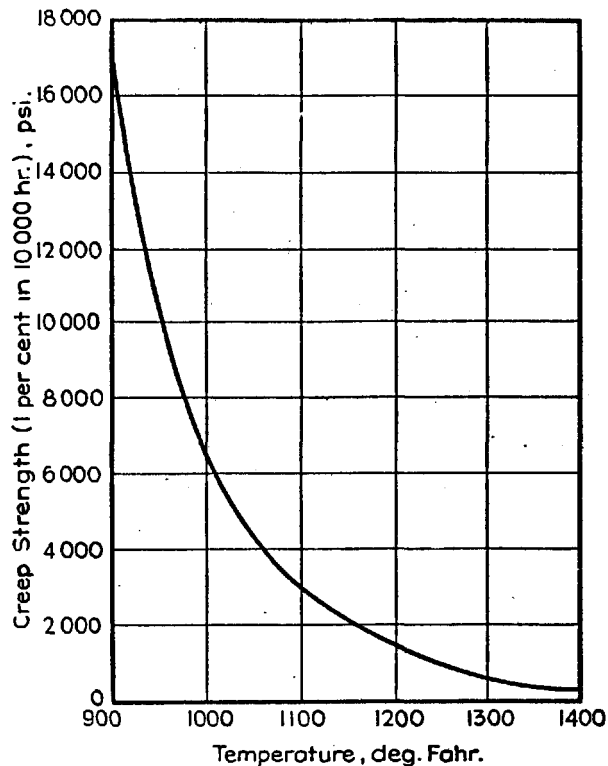


FIG. 10.—Creep Strength at Various Temperatures of 23 to 30 per cent Chromium Steel (A.S.T.M. Designations: A 176-42, Grade 6, and A 240-42, Grade B; A.I.S.I. Type No. 446).

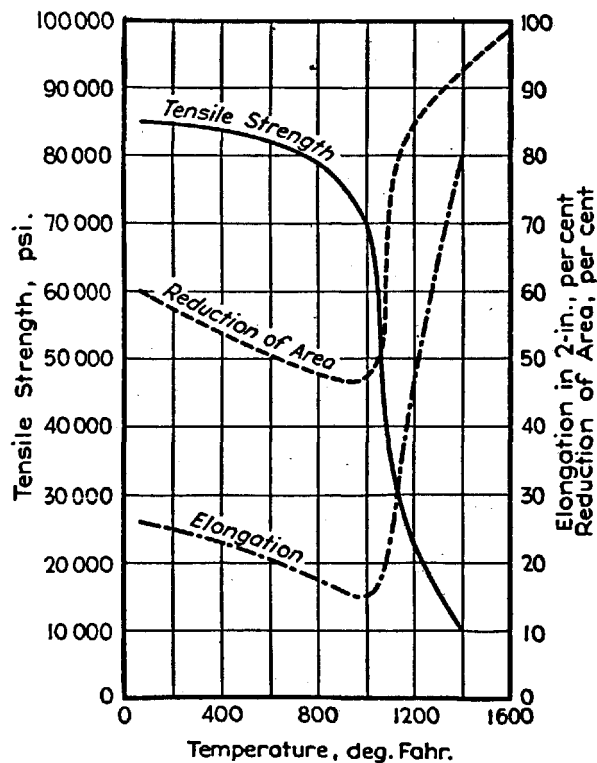


FIG. 11.—Short-Time High-Temperature Tensile Properties of 23 to 30 per cent Chromium Steel (A.S.T.M. Designations: A 176-42, Grade 6, and A 240-42, Grade B; A.I.S.I. Type No. 446).

TABLE X.—MECHANICAL PROPERTIES OF 23 TO 30 PER CENT CHROMIUM STEEL.

CHEMICAL COMPOSITION, PER CENT							A.S.T.M. Designation..... A 176-42 A 240-42							
Carbon.....	0.35 max.	Silicon.....	1.00 max.	23 to 30	0.60 max.	A.S.T.M. Grade.....	6	B						
Manganese.....	1.00 max.	Chromium.....	23 to 30	0.60 max.		A.I.S.I. Type No.....	446	446						
Phosphorus.....	0.03 max.	Nickel.....	0.60 max.			Structure.....	Ferritic	Ferritic						
Sulphur.....	0.03 max.													
MECHANICAL PROPERTIES														
Form and Treatment	Tensile Strength, psi.	Yield Strength (offset = 0.2 per cent), psi.	Yield Point,* psi.	Proportional Limit, psi.	Elongation in 2 in., per cent	Reduction of Area, per cent	Impact Resistance, ft.-lb.		Hardness Number		Endurance Limit (Fatigue), psi.	Cold Bend, deg.	Ductility	
							Charpy	Izod	Brinell (3000-kg. load, 10-mm. ball)	Rockwell			Erichsen Value, mm.	Olsen Value, in.
Sheet:														
Annealed.....	85 000	...	55 000	...	25	...	...	...	...	B83	...	180	7 to 8	0.275 to 0.375
Strip:														
Cold-rolled.....	87 000	...	55 000	...	25	...	...	...	...	B84	...	180	7 to 8	0.3 to 0.4
Wire:														
Cold-drawn, 65 per cent.....	135 000	...	115 000	...	...	...	...	...	...	B84	...	...	...	...
Annealed.....	90 000	...	50 000	...	25	...	...	...	...	B84	...	...	...	...
Plate:														
Annealed.....	85 000	...	55 000	...	25	...	...	2	...	B83	...	180	...	...
Tubing:														
Annealed.....	83 000	...	55 000	...	25	50	...	...	175	B85	...	...	...	...
Bar:														
Cold-drawn.....	85 000	...	55 000	37 000	25	45	...	2	...	B84	48 000	180	...	...
Annealed.....	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Hardened and Tempered.....	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Forgings:														
Annealed.....	...	...	...	...	...	...	...	...	...	...	...	...	...	...

^a Yield point as determined with dividers must not be confused with a defined yield strength, such as, at 0.2 per cent offset.^b Nitrogen usually 0.10 min. per cent, to insure grain refinement and workability.