

**METALS PREHEATING CHART**

METAL GROUP	METAL DESIGNATION	APPROXIMATE PERCENT CARBON	RECOM-MENDED PREHEAT	METAL GROUP	METAL DESIGNATION	APPROXIMATE PERCENT CARBON	RECOM-MENDED PREHEAT	
PLAIN CARBON STEELS	PLAIN CARBON STEEL	BELOW .20	UP TO 200°F	MEDIUM NICKEL CHROMIUM STEELS	SAE 3115 STEEL	.15	200°F - 400°F	
	PLAIN CARBON STEEL	.20 - .30	200°F - 300°F		SAE 3125 STEEL	.25	300°F - 500°F	
	PLAIN CARBON STEEL	.30 - .45	300°F - 500°F		SAE 3130 STEEL	.30	400°F - 700°F	
	PLAIN CARBON STEEL	.45 - .80	500°F - 800°F		SAE 3140 STEEL	.40	500°F - 800°F	
CARBON MOLY STEELS	CARBON MOLY STEEL	.10 - .20	300°F - 500°F		SAE 3150 STEEL	.50	600°F - 900°F	
	CARBON MOLY STEEL	.20 - .30	400°F - 600°F		SAE 3215 STEEL	.15	300°F - 500°F	
	CARBON MOLY STEEL	.30 - .35	500°F - 800°F		SAE 3230 STEEL	.30	500°F - 700°F	
MANGANESE STEELS	SILICON STRUCTURAL STEEL	.35	300°F - 500°F		SAE 3240 STEEL	.40	700°F - 1000°F	
	MEDIUM MANGANESE STEEL	.20 - .25	300°F - 500°F		SAE 3250 STEEL	.50	900°F - 1100°F	
	SAE T 1330 STEEL	.30	400°F - 600°F		SAE 3315 STEEL	.15	500°F - 700°F	
	SAE T 1340 STEEL	.40	500°F - 800°F		SAE 3325 STEEL	.25	900°F - 1100°F	
	SAE 1350 STEEL	.50	600°F - 900°F		SAE 3435 STEEL	.35	900°F - 1100°F	
	12% MANGANESE STEEL	1.25	USUALLY NOT REQUIRED		SAE 3450 STEEL	.50	900°F - 1100°F	
HIGH TENSILE STEELS (SEE ALSO STEELS BELOW)	MANGANESE MOLY STEEL	.20	300°F - 500°F		MOLY BEARING CHROMIUM AND CHROMIUM NICKEL STEELS	SAE 4140 STEEL	.40	600°F - 800°F
	JAL TEN STEEL	.35 MAX.	400°F - 600°F	SAE 4340 STEEL		.40	700°F - 900°F	
	MANTEN STEEL	.30 MAX.	400°F - 600°F	SAE 4615 STEEL		.15	400°F - 600°F	
	ARMCO HIGH TENSILE STEEL	.12 MAX.	UP TO 200°F	SAE 4630 STEEL		.30	500°F - 700°F	
	DOUBLE STRENGTH #1 STEEL	.12 MAX.	300°F - 600°F	SAE 4640 STEEL	.40	600°F - 1000°F		
	DOUBLE STRENGTH #1A STEEL	.30 MAX.	400°F - 700°F	SAE 4820 STEEL	.20	600°F - 800°F		
	MAYARI R STEEL	.12 MAX.	UP TO 300°F	LOW CHROME MOLY STEELS	2% Cr. - 1/2% Mo. STEEL	UP TO .15	400°F - 600°F	
	OTISCOLOY STEEL	.12 MAX.	200°F - 400°F		2% Cr. - 1/2% Mo. STEEL	.15 - .25	500°F - 800°F	
	NAX HIGH TENSILE STEEL	.15 - .25	UP TO 300°F		2% Cr. - 1% Mo. STEEL	UP TO .15	500°F - 800°F	
	CROMANSIL STEEL	.14 MAX.	300°F - 400°F	2% Cr. - 1% Mo. STEEL	.15 - .25	600°F - 800°F		
	A.W. DYN-EL STEEL	.11 - .14	UP TO 300°F	MEDIUM CHROME MOLY STEELS	5% Cr. - 1/2% Mo. STEEL	UP TO .15	500°F - 800°F	
	CORTEN STEEL	.12 MAX.	200°F - 400°F		5% Cr. - 1/2% Mo. STEEL	.15 - .25	600°F - 900°F	
	CHROME COPPER NICKEL STEEL	.12 MAX.	200°F - 400°F		8% Cr. - 1% Mo. STEEL	.15 MAX.	600°F - 900°F	
	CHROME MANGANESE STEEL	.40	400°F - 600°F	PLAIN HIGH CHROMIUM STEELS	12 - 14% Cr. TYPE 410	.10	300°F - 500°F	
	YOLOY STEEL	.05 - .35	200°F - 600°F		16 - 18% Cr. TYPE 430	.10	300°F - 500°F	
	HI-STEEL	.12 MAX.	200°F - 500°F		23 - 30% Cr. TYPE 446	.10	300°F - 500°F	
	NICKEL STEELS	SAE 2015 STEEL	.10 - .20	UP TO 300°F	HIGH CHROME NICKEL STAINLESS STEELS	18% Cr. 8% Ni. TYPE 304	.07	USUALLY DO NOT REQUIRE PREHEAT BUT IT MAY BE DESIRABLE TO REMOVE CHILL
		SAE 2115 STEEL	.10 - .20	200°F - 300°F		25-12 TYPE 309	.07	
		2 1/2# NICKEL STEEL	.10 - .20	200°F - 400°F		25 - 50 TYPE 310	.10	
		SAE 2315 STEEL	.15	200°F - 500°F		18 - 8 Cb. TYPE 347	.07	
SAE 2320 STEEL		.20	200°F - 500°F	18 - 8 Mo. TYPE 316		.07		
SAE 2330 STEEL		.30	300°F - 600°F	18 - 8 Mo. TYPE 317		.07		
SAE 2340 STEEL		.40	400°F - 700°F					

**Dimensions of Standard Pipe Sizes**

Nominal Pipe Size In.	Outside Diameter, In.	Nominal Wall Thickness For				
		Schedule 5	Schedule 10	Schedule 40	Schedule 80	Schedule 160
1/8	0.405	-	0.049	0.068	0.095	-
1/4	0.540	-	0.065	0.088	0.119	-
3/8	0.675	-	0.065	0.091	0.126	-
1/2	0.840	0.065	0.083	0.109	0.147	0.187
3/4	1.050	0.065	0.083	0.113	0.154	0.218
1	1.315	0.065	0.109	0.133	0.179	0.250
1-1/4	1.660	0.065	0.109	0.140	0.191	0.250
1-1/2	1.900	0.065	0.109	0.145	0.200	0.281
2	2.375	0.065	0.109	0.154	0.218	0.343
2-1/2	2.875	0.083	0.120	0.203	0.276	0.375
3	3.500	0.083	0.120	0.216	0.300	0.438
3-1/2	4.000	0.083	0.120	0.226	0.318	-
4	4.500	0.083	0.120	0.237	0.337	0.531
5	5.563	0.109	0.134	0.258	0.375	0.625
6	6.625	0.109	0.134	0.280	0.432	0.718
8	8.625	0.109	0.148	0.322	0.500	0.906
10	10.750	0.134	0.165	0.365	0.593	-
12	12.750	0.165	0.180	0.406	0.687	-

**MELTING POINTS OF METALS**

Metal or Alloy	Melting Point, °F
Aluminum, pure.....	1220
Brass and Bronze.....	1600 - 1660
Copper.....	1981
Iron, Cast & Malleable.....	2300
Lead, Pure.....	621
Magnesium.....	1202
Nickel.....	2647
Silver, Pure.....	1761
Steel, Hi-Carbon (0.40% to 0.70% Carbon).....	2500
Steel, Medium Carbon (0.15% to 0.40% Carbon).....	2600
Steel, Low Carbon (less than 0.15%).....	2700
Stainless Steel, 18% Chromium, 8% Nickel.....	2590
Titanium.....	3035
Tungsten.....	6170
Zinc, Cast or Rolled.....	787

**SYMBOLS OF THE ELEMENTS**

Element	Symbol	Element	Symbol	Element	Symbol	Element	Symbol
Actinium.....	Ac	Einsteinium.....	Es	Mercury.....	Hg	Samarium.....	Sm
Aluminum.....	Al	Europium.....	Eu	Molybdenum.....	Mo	Scandium.....	Sc
Americium.....	Am	Fermium.....	Fm	Neodymium.....	Nd	Selenium.....	Se
Antimony.....	Sb	Fluorine.....	F	Neon.....	Ne	Silicon.....	Si
Argon.....	A	Francium.....	Fa	Nickel.....	Ni	Silver.....	Ag
Arsenic.....	As	Gadolinium.....	Gd	Niobium.....	Nb	Sodium.....	Na
Astatine.....	At	Gallium.....	Ga	Nitrogen.....	N	Strontium.....	Sr
Barium.....	Ba	Germanium.....	Ge	Nobelium.....	No	Sulfur.....	S
Berkelium.....	Bk	Gold.....	Au	Osmium.....	Os	Tantalum.....	Ta
Beryllium.....	Be	Hafnium.....	Hf	Oxygen.....	O	Technetium.....	Tc
Bismuth.....	Bi	Helium.....	He	Palladium.....	Pd	Tellurium.....	Te
Boron.....	B	Holmium.....	Ho	Phosphorus.....	P	Terbium.....	Tb
Bromine.....	Br	Hydrogen.....	H	Platinum.....	Pt	Thallium.....	Tl
Cadmium.....	Cd	Illium.....	Il	Plutonium.....	Pu	Thorium.....	Th
Calcium.....	Ca	Indium.....	In	Polonium.....	Po	Thulium.....	Tm
Californium.....	Cf	Iodine.....	I	Potassium.....	K	Tin.....	Sn
Carbon.....	C	Iridium.....	Ir	Praseodymium.....	Pr	Titanium.....	Ti
Cerium.....	Ce	Iron.....	Fe	Promethium.....	Pm	Uranium.....	U
Cesium.....	Cs	Krypton.....	Kr	Protoactinium.....	Pa	Vanadium.....	V
Chlorine.....	Cl	Lanthanum.....	La	Radium.....	Ra	Wolfgram.....	W
Chromium.....	Cr	Lead.....	Pb	Radon.....	Rn	Xenon.....	Xe
Cobalt.....	Co	Lithium.....	Li	Rhenium.....	Re	Ytterbium.....	Yb
Copper.....	Cu	Lutecium.....	Lu	Rhodium.....	Rh	Yttrium.....	Y
Curium.....	Cm	Magnesium.....	Mg	Rubidium.....	Rb	Zinc.....	Zn
Dysprosium.....	Dy	Manganese.....	Mn	Ruthenium.....	Ru	Zirconium.....	Zr
Erbium.....	Er	Mendelevium.....	Md				