

Tempil[®] PREHEATING CHART

METAL GROUP	METAL DESIGNATION	APPROXIMATE COMPOSITION — PERCENT								RECOM- MENDED PREHEAT	USE TEMPILSTIK [®] TEMPERATURE INDICATING CRAYONS	
		C.	Mn.	Si.	Cr.	Ni.	Mo.	Cu.				
PLAIN CARBON STEELS	PLAIN CARBON STEEL	BELOW .20								UP TO 150°F	150	
	PLAIN CARBON STEEL	.20-.30								150°F-300°F	150-200-250-300	
	PLAIN CARBON STEEL	.30-.45								250°F-450°F	250-300-350-400-450	
	PLAIN CARBON STEEL	.45-.80								450°F-750°F	450-500-600-700-750	
CARBON MOLY STEELS	CARBON MOLY STEEL	.10-.20						.50		150°F-250°F	150-200-250	
	CARBON MOLY STEEL	.20-.30						.50		200°F-400°F	200-250-300-350-400	
MANGANESE STEELS	SILICON STRUCTURAL STEEL	.35	.80	.25						300°F-500°F	300-400-500	
	MEDIUM MANGANESE STEEL	.20-.25	1.0-1.75							300°F-500°F	300-400-500	
	SAE 1330 STEEL	.30	1.75							400°F-600°F	400-500-600	
	SAE 1340 STEEL	.40	1.75							500°F-800°F	500-600-700-800	
	SAE 1045 STEEL	.50	1.75							600°F-900°F	600-700-800-900	
	12% MANGANESE STEEL	1.25	12.0							USUALLY NOT REQUIRED		
HIGH TENSILE STEELS (CONTINUED ON OTHER SIDE)	MANGANESE MOLY STEEL	.20	1.65	.20				.35		300°F-500°F	300-400-500	
	JALTEN STEEL	.35 MAX.	1.50	.30					.40	400°F-600°F	400-500-600	
	MANTEN STEEL	.30 MAX.	1.35	.30					.20	400°F-600°F	400-500-600	
	ARMCO HIGH TENSILE STEEL	.12 MAX.				.50 MIN.	.05 MIN.	.35 MIN.		UP TO 200°F	200	
	DOUBLE STRENGTH #1 STEEL	.12 MAX.	.75			.50-1.25	.10 MIN.	.50-1.50		300°F-600°F	300-400-500-600	
	DOUBLE STRENGTH #1A STEEL	.30 MAX.	.75			.50-1.25	.10 MIN.	.50-1.50		400°F-700°F	400-500-600-700	
	MAYARI R STEEL	.12 MAX.	.75	.35	2-1.0	25-.75			.60	UP TO 300°F	200-300	
	OTISCOLOY STEEL	.12 MAX.	1.25	.10 MAX.	.10 MAX.				.50 MAX.	200°F-400°F	200-300-400	
	NAX HIGH TENSILE STEEL	.15-.25		.75	.60		.17	.15 MAX.	.25 MAX.	Zr .12	UP TO 300°F	200-300
	CROMANSIL STEEL	.14 MAX.	1.25	.75	.50						300°F-400°F	300-400
A.W. DYN-EL STEEL	.11-.14							.40		UP TO 300°F	200-300	
CORTEN STEEL	.12 MAX.		25-1.0	5-1.5	55 MAX.			.40		200°F-400°F	200-300-400	

Preheating prior to welding will;

1. Eliminate the danger of crack formation.
2. Reduce Hard Zones adjacent to weld.
3. Reduce Distortion.
4. Reduce or prevent Shrinkage Stresses.
5. Enhance Diffusion of Hydrogen from steel.

The need for preheating increases as the following factors are changed:

1. The larger the mass being welded.
2. The lower the temperature of the pieces being welded.
3. The lower the atmospheric temperature.
4. The smaller the weld rod in diameter.
5. The greater the speed of welding.
6. The higher the Carbon content of the steel.
7. The higher the Manganese content.
8. The greater Alloy content in air hardening steels.
9. The more the air hardening capacity of the steel.
10. The greater the difference in mass between the two pieces being joined.
11. The more complicated the shape or section of the parts.

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		C.	Mn.	Si.	Cr.	Ni.	Mo.	Cu.			
HIGH TENSILE STEELS (CONT.)	CHROME COPPER NICKEL STEEL	.12 MAX.	.75		.75	.75		.55		200°F-400°F	200-300-400
	CHROME MANGANESE STEEL	.40	.90		.40					400°F-600°F	400-500-600
	YOLOY STEEL	.05-.35	3-1.0			1.75		1.0		200°F-600°F	200-300-400-500-600
	HI-STEEL	.12 MAX.	.6	.3 MAX.		.55		.9-1.25		200°F-500°F	200-300-400-500
NICKEL STEELS	2½% NICKEL STEEL	.25				2.25				200°F-400°F	200-300-400
	3½% NICKEL STEEL	.23				3.50				200°F-400°F	200-250-300-350-400
MOLY BEARING CHROMIUM AND NICKEL STEELS	SAE 4140 STEEL	.40			.90			.20		600°F-800°F	600-700-800
	SAE 4340 STEEL	.40			.80	1.85	.25			700°F-900°F	700-800-900
	SAE 4615 STEEL	.15				1.80	.25			400°F-600°F	400-500-600
	SAE 4820 STEEL	.20				3.50	.25			600°F-800°F	600-700-800
LOW CHROME MOLY STEELS	1¼% Cr. — ½% Mo. STEEL	.17 MAX.			1.25		.50			250°F-400°F	250-300-350-400
	2¼% Cr. — 1% Mo. STEEL	.15 MAX.			2.25		1.0			300°F-500°F	300-400-500
MEDIUM CHROME MOLY STEELS	5% Cr. — ½% Mo. STEEL	.15 MAX.			5.0		.5			400°F-600°F	400-500-600
	7% Cr. — ½% Mo. STEEL	.15 MAX.			7.0		.5			400°F-600°F	400-500-600
	9% Cr. — 1% Mo. STEEL	.15 MAX.			9.0		1.0			400°F-600°F	400-500-600
PLAIN HIGH CHROMIUM STEELS	11½-13% Cr. TYPE 410	.15 MAX.			12.0					400°F-600°F	400-500-600
	16-18% Cr. TYPE 430	.12 MAX.			17.0					300°F-500°F	300-400-500
	23-27% Cr. TYPE 446	.20 MAX.			25.0					300°F-500°F	300-400-500
CHROME NICKEL STAINLESS STEELS	18% Cr. 8% Ni. TYPE 304	.07			18.0	8.0				USUALLY DO NOT REQUIRE PREHEAT BUT IT MAY BE DESIRABLE TO REMOVE CHILL	200
	25-12 TYPE 309	.07			25.0	12.0					
	25-20 TYPE 310	.10			25.0	20.0					
	18-8 Cb. TYPE 347	.07			18.0	8.0		Cb. 10XC			
	18-8 Mo. TYPE 316	.07			18.0	8.0	2.5				
	18-8 Mo. TYPE 317	.07			18.0	8.0	3.5				
IRONS	CAST IRON									700°F-900°F	700-800-900
	NI RESIST									500°F-1000°F	500-700-900-1000
NON FERROUS	NICKEL, MONEL, INCONEL										
	ALUMINUM-COPPER										

Tempilstik[®] Temperature Indicating Crayons are also recommended for indicating temperatures in —

- SURFACE WELDING
- HARD FACING
- OVERLAYING FOR CORROSION RESISTANCE
- TORCH OR FLAME CUTTING
- FLAME CONDITIONING OF SEMI-FINISHED STEEL
- HEAT TREATMENT
- LOCAL HEATING AND COOLING
- PIPE BENDING
- SHEARING OF BAR STEEL
- STRAIGHTENING HARDENED PARTS
- SHRINKING ONE PART ON ANOTHER
- RECONDITIONING
- REFINERY STILL TUBES
- REPAIR WELDING COSTLY DIES
- TARRING CAST IRON MOLDS
- TARRING CAST IRON PIPE
- STACK TEMPERATURES
- BRAZING
- SOLDERING
- FABRICATION OF NON-FERROUS METALS

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