

STANDARD CARBON STEELS

ASTM A 576 – 90b (Reapproved 2006)

Steel Grade	Chemical Composition Limits, Percent ^{A,B,C}			
	C	Mn	P max	S max
1008	0.10 max	0.30/0.50	0.040	0.050
1010	0.08/0.13	0.30/0.60	0.040	0.050
1012	0.10/0.15	0.30/0.60	0.040	0.050
1015	0.13/0.18	0.30/0.60	0.040	0.050
1016	0.13/0.18	0.60/0.90	0.040	0.050
1017	0.15/0.20	0.30/0.60	0.040	0.050
1018	0.15/0.20	0.60/0.90	0.040	0.050
1019	0.15/0.20	0.70/1.00	0.040	0.050
1020	0.18/0.23	0.30/0.60	0.040	0.050
1021	0.18/0.23	0.60/0.90	0.040	0.050
1022	0.18/0.23	0.70/1.00	0.040	0.050
1023	0.20/0.25	0.30/0.60	0.040	0.050
1025	0.22/0.28	0.30/0.60	0.040	0.050
1026	0.22/0.28	0.60/0.90	0.040	0.050
1029	0.25/0.31	0.60/0.90	0.040	0.050
1030	0.28/0.34	0.60/0.90	0.040	0.050
1035	0.32/0.38	0.60/0.90	0.040	0.050
1037	0.32/0.38	0.70/1.00	0.040	0.050
1038	0.35/0.42	0.60/0.90	0.040	0.050
1039	0.37/0.44	0.70/1.00	0.040	0.050
1040	0.37/0.44	0.60/0.90	0.040	0.050
1042	0.40/0.47	0.60/0.90	0.040	0.050
1043	0.40/0.47	0.70/1.00	0.040	0.050
1044	0.43/0.50	0.30/0.60	0.040	0.050
1045	0.43/0.50	0.60/0.90	0.040	0.050
1046	0.43/0.50	0.70/1.00	0.040	0.050
1049	0.46/0.53	0.60/0.90	0.040	0.050
1050	0.48/0.55	0.60/0.90	0.040	0.050
1053	0.48/0.55	0.70/1.00	0.040	0.050
1055	0.50/0.60	0.60/0.90	0.040	0.050
1060	0.55/0.65	0.60/0.90	0.040	0.050
1070	0.65/0.75	0.60/0.90	0.040	0.050
1078	0.72/0.85	0.30/0.60	0.040	0.050
1080	0.75/0.88	0.60/0.90	0.040	0.050
1084	0.80/0.93	0.60/0.90	0.040	0.050
1090	0.85/0.98	0.60/0.90	0.040	0.050
1095	0.90/1.03	0.30/0.50	0.040	0.050

^A When Si is required, the following ranges are commonly specified: 0.10% max, 0.10/0.20%, 0.15/0.35%, or 0.20/0.40%. The range of 0.15/0.35% is most common.

^B Copper can be specified when required as 0.20% minimum.

^C The elements Bi, Ca, Se, or Te may be added as agreed between purchaser and supplier.

RESULFURIZED CARBON STEELS

ASTM A 576 – 90b (Reapproved 2006)

Steel Grade	Chemical Composition Limits, Percent ^{A,B}			
	C	Mn	P Max	S
1109	0.08/0.13	0.60/0.90	0.040	0.08/0.13
1110	0.08/0.13	0.30/0.60	0.040	0.08/0.13
1116	0.14/0.20	1.10/1.40	0.040	0.16/0.23
1117	0.14/0.20	1.00/1.30	0.040	0.08/0.13
1118	0.14/0.20	1.30/1.60	0.040	0.08/0.13
1119	0.14/0.20	1.00/1.30	0.040	0.24/0.33
1132	0.27/0.34	1.35/1.65	0.040	0.08/0.13
1137	0.32/0.39	1.35/1.65	0.040	0.08/0.13
1139	0.35/0.43	1.35/1.65	0.040	0.13/0.20
1140	0.37/0.44	0.70/1.00	0.040	0.08/0.13
1141	0.37/0.45	1.35/1.65	0.040	0.08/0.13
1144	0.40/0.48	1.35/1.65	0.040	0.24/0.33
1145	0.42/0.49	0.70/1.00	0.04	0.04/0.07
1146	0.42/0.49	0.70/1.00	0.040	0.08/0.13
1151	0.48/0.55	0.70/1.00	0.040	0.08/0.13

^A When Si is required, the following ranges are commonly specified: 0.10% max, 0.10/0.20%, 0.15/0.35%, or 0.20/0.40%. The range of 0.15/0.35% is most common.

^B The elements Bi, Ca, Se, or Te may be added as agreed between purchaser and supplier.

REPHOSPHORIZED AND RESULFURIZED CARBON STEELS

ASTM A 576 – 90b (Reapproved 2006)

Steel Grade	Chemical Composition Limits, Percent ^{A,B,C}				
	C	Mn	P	S	Pb
1211	0.13 max	0.60/0.90	0.07/0.12	0.10/0.15	...
1212	0.13 max	0.70/1.00	0.07/0.12	0.16/0.23	
1213	0.13 max	0.70/1.00	0.07/0.12	0.24/0.33	...
1215	0.09 max	0.75/1.05	0.04/0.09	0.26/0.35	...
12L14	0.15 max	0.85/1.15	0.04/0.09	0.26/0.35	0.15/0.35

^A When Pb is required as an added element to a standard steel, a range of 0.15/0.35% is specified. Such a steel is identified by inserting the letter "L" between the second and third numerals of the grade designation.

^B The elements Bi, Calcium, Se, or Te may be added as agreed between purchaser and supplier.

^C It is not common practice to produce these steels to specified limits for Si because of the adverse effect on machinability.

Note: SDI does not produce leaded steels. 12L14 is provided for information only.

HIGH MANGANESE CARBON STEELS

ASTM A 576 – 90b (Reapproved 2006)

Steel Grade	Chemical Composition Limits, Percent ^{A,B,C,D}			
	C	Mn	P max	S max
1513	0.10/0.16	1.10/1.40	0.040	0.050
1518	0.15/0.21	1.10/1.40	0.040	0.050
1522	0.18/0.24	1.10/1.40	0.040	0.050
1524	0.19/0.25	1.35/1.65	0.040	0.050
1525	0.23/0.29	0.80/1.10	0.040	0.050
1526	0.22/0.29	1.10/1.40	0.040	0.050
1527	0.22/0.29	1.20/1.50	0.040	0.050
1536	0.30/0.37	1.20/1.50	0.040	0.050
1541	0.36/0.44	1.35/1.65	0.040	0.050
1547	0.43/0.51	1.35/1.65	0.040	0.050
1548	0.44/0.52	1.10/1.40	0.040	0.050
1551	0.45/0.56	0.85/1.15	0.040	0.050
1552	0.47/0.55	1.20/1.50	0.040	0.050
1561	0.55/0.65	0.75/1.05	0.040	0.050
1566	0.60/0.71	0.85/1.15	0.040	0.050
1572	0.65/0.76	1.00/1.30	0.040	0.050

^A When Si is required, the following ranges are commonly specified: 0.10% max, 0.10/0.20%, 0.15/0.35%, or 0.20/0.40%. The range of 0.15/0.35% is most common.

^B Copper can be specified when required as 0.20% minimum.

^C When B is specified, the typical range is 0.0005 to 0.003%.

^D The elements Bi, Ca, Se, or Te may be added as agreed between purchaser and supplier.

CARBON AND CARBON BORON STEELS SUBJECT TO END QUENCH HARDENABILITY REQUIREMENTS

(ASTM A 304 – 05)

Steel Grade	Chemical Composition Limits, Percent				
	C	Mn	P max	S max	Si
1038 H	0.34/0.43	0.50/1.00	0.040	0.050	0.15/0.30
1045 H	0.42/0.51	0.50/1.00	0.040	0.050	0.15/0.30
1522 H	0.17/0.25	1.00/1.50	0.040	0.050	0.15/0.30
1524 H	0.18/0.26	1.25/1.75	0.040	0.050	0.15/0.30
1526 H	0.21/0.30	1.00/1.50	0.040	0.050	0.15/0.30
1541 H	0.35/0.45	1.25/1.75	0.040	0.050	0.15/0.30
15B21 H ^A	0.17/0.24	0.70/1.20	0.040	0.050	0.15/0.30
15B30 H ^A	0.26/0.34	0.70/1.20	0.040	0.050	0.15/0.30
15B35 H ^A	0.31/0.39	0.70/1.20	0.040	0.050	0.15/0.30
15B37 H ^A	0.30/0.39	1.00/1.50	0.040	0.050	0.15/0.30
15B41 H ^A	0.35/0.45	1.25/1.75	0.040	0.050	0.15/0.30
15B48 H ^A	0.43/0.53	1.00/1.50	0.040	0.050	0.15/0.30
15B62 H ^A	0.54/0.67	1.00/1.50	0.040	0.050	0.40/0.60

^A Boron treated, with typical range 0.0005 to 0.0030%.

CHEMICAL RANGES & LIMITS OF HOT ROLLED CARBON STEELS

ASTM A 576 – 90b (Reapproved 2006)

Element ^A	When Maximum of Specified Element is:	Chemical Range	Conventional Lowest Maximum
Carbon – (When Mn does NOT exceed 1.10%)	...	...	0.06
	Thru 0.12	...	...
	Over 0.12 thru 0.25	0.05	...
	Over 0.25 thru 0.40	0.06	...
	Over 0.40 thru 0.55	0.07	...
	Over 0.55 thru 0.80	0.10	...
	Over 0.80	0.13	...
Carbon – (When Mn DOES exceed 1.10%)	Over 0.12 thru 0.25	0.06	...
	Over 0.25 thru 0.40	0.07	...
	Over 0.40 thru 0.55	0.08	...
	Over 0.55 thru 0.80	0.11	...
	Over 0.80	0.14	...
Manganese	...	...	0.35
	Thru 0.40	0.15	...
	Over 0.40 thru 0.50	0.20	...
	Over 0.50 thru 1.65	0.30	...
Phosphorus	...	...	0.03
	Thru 0.04	...	...
	Over 0.04 thru 0.08	0.03	...
	Over 0.08 thru 0.13	0.05	...
Sulfur	Thru 0.05	...	0.05
	Over 0.05 thru 0.09	0.03	...
	Over 0.09 thru 0.15	0.05	...
	Over 0.15 thru 0.23	0.07	...
	Over 0.23 thru 0.50	0.09	...
Silicon^B	Thru 0.10	...	0.10
	Over 0.10 thru 0.15	0.08	...
	Over 0.15 thru 0.20	0.10	...
	Over 0.20 thru 0.30	0.15	...
	Over 0.30 thru 0.60	0.20	...
Copper	When Cu is required as an added element, 0.20% minimum is generally specified		
Lead^C	Lead is reported only as a range of 0.15 to 0.35% since it is usually added to the mould or ladle stream as the steel is poured		
Boron	Boron treated steels are typically produced to a range of 0.0005 to 0.003%		

^A The specification for the elements Bi, Ca, Se, and Te will be agreed upon between purchaser and supplier.

^B It is not common practice to produce a Rephosphorized and Resulfurized carbon steel to specified limits for Si because of its adverse effect on machinability.

^C A heat analysis for Pb is not determinable, since Pb is added to the ladle stream.

PERMISSIBLE VARIATIONS FOR PRODUCT ANALYSIS OF CARBON STEEL

ASTM A 29/A 29M – 05

Element	Limit, or Maximum of Specified Range (%)	Variance Over the Maximum Limit or Under the Minimum Limit (%)
Carbon ^A	Thru 0.25	0.02
	Over 0.25 thru 0.55	0.03
	Over 0.55	0.04
Manganese	Thru 0.90	0.03
	Over 0.90 thru 1.65	0.06
Phosphorus ^{A,B}	Basic steels	0.008 over
	Acid Bessemer steel	0.01
Sulfur ^{A,B}		0.008
Silicon	Thru 0.35	0.02
	Over 0.35 thru 0.60	0.05
Copper	Under minimum only for Cu bearing steels	0.02
Lead ^C	0.15 thru 0.35	0.03

^A Rimmed and capped steels are not subject to rejection on product analysis unless misapplication is clearly indicated.

^B Resulfurized or Rephosphorized steels are not subject to rejection on product analysis for these elements unless misapplication is clearly indicated.

^C Product analysis tolerance for lead applies both over and under to a specified range of 0.15/0.35 %.

STANDARD ALLOY STEELS

(ASTM A 322 – 07)

Steel Grade ^C	Chemical Composition Ranges and Limits, Percent ^{A,B}					
	C	Mn	Ni	Cr	Mo	Other
1330	0.28/0.33	1.60/1.90	--	--	--	
1335	0.33/0.38	1.60/1.90	--	--	--	
1340	0.38/0.43	1.60/1.90	--	--	--	
1345	0.43/0.48	1.60/1.90	--	--	--	
4023	0.20/0.25	0.70/0.90	--	--	0.20/0.30	
4024	0.20/0.25	0.70/0.90	--	--	0.20/0.30	S 0.035/0.050
4027	0.25/0.30	0.70/0.90	--	--	0.20/0.30	
4028	0.25/0.30	0.70/0.90	--	--	0.20/0.30	S 0.035/0.050
4037	0.35/0.40	0.70/0.90	--	--	0.20/0.30	
4047	0.45/0.50	0.70/0.90	--	--	0.20/0.30	
4118	0.18/0.23	0.70/0.90	--	0.40/0.60	0.08/0.15	
4120	0.18/0.23	0.90/1.20	--	0.40/0.60	0.13/0.20	
4121	0.18/0.23	0.75/1.00	--	0.45/0.65	0.20/0.30	
4130	0.28/0.33	0.40/0.60	--	0.80/1.10	0.15/0.25	
4137	0.35/0.40	0.70/0.90	--	0.80/1.10	0.15/0.25	
4140	0.38/0.43	0.75/1.00	--	0.80/1.10	0.15/0.25	
4142	0.40/0.45	0.75/1.00	--	0.80/1.10	0.15/0.25	
4145	0.43/0.48	0.75/1.00	--	0.80/1.10	0.15/0.25	
4147	0.45/0.50	0.75/1.00	--	0.80/1.10	0.15/0.25	

STANDARD ALLOY STEELS

(ASTM A 322 – 07)

Steel Grade ^C	Chemical Composition Ranges and Limits, Percent ^{A,B}					
	C	Mn	Ni	Cr	Mo	Other
4150	0.48/0.53	0.75/1.00	--	0.80/1.10	0.15/0.25	
4161	0.56/0.64	0.75/1.00	--	0.70/0.90	0.25/0.35	
4320	0.17/0.22	0.45/0.65	1.65/2.00	0.40/0.60	0.20/0.30	
4340	0.38/0.43	0.60/0.80	1.65/2.00	0.70/0.90	0.20/0.30	
E4340^D	0.38/0.43	0.65/0.85	1.65/2.00	0.70/0.90	0.20/0.30	
4615	0.13/0.18	0.45/0.65	1.65/2.00	--	0.20/0.30	
4620	0.17/0.22	0.45/0.65	1.65/2.00	--	0.20/0.30	
4621	0.18/0.23	0.70/0.90	1.65/2.00	--	0.20/0.30	
4626	0.24/0.29	0.45/0.65	0.70/1.00	--	0.15/0.25	
4715	0.13/0.18	0.70/0.90	0.70/1.00	0.45/0.65	0.45/0.60	
4720	0.17/0.22	0.50/0.70	0.90/1.20	0.35/0.55	0.15/0.25	
4815	0.13/0.18	0.40/0.60	3.25/3.75	...	0.20/0.30	
4817	0.13/0.20	0.40/0.60	3.25/3.75	...	0.20/0.30	
4820	0.18/0.23	0.50/0.70	3.25/3.75	...	0.20/0.30	
5117	0.15/0.20	0.70/0.90	...	0.70/0.90	...	
5120	0.17/0.22	0.70/0.90	...	0.70/0.90	...	
5130	0.28/0.33	0.70/0.90	...	0.80/1.10	...	
5132	0.30/0.35	0.60/0.80	...	0.75/1.00	...	
5135	0.33/0.38	0.60/0.80	...	0.80/1.05	...	

STANDARD ALLOY STEELS

(ASTM A 322 – 07)

Steel Grade ^C	Chemical Composition Ranges and Limits, Percent ^{A,B}					
	C	Mn	Ni	Cr	Mo	Other
5140	0.38/0.43	0.70/0.90	...	0.70/0.90	...	
5150	0.48/0.53	0.70/0.90	...	0.70/0.90	...	
5155	0.51/0.59	0.70/0.90		0.70/0.90	...	
5160	0.56/0.64	0.75/1.00	...	0.70/0.90	...	
E51100^D	0.98/1.10	0.25/0.45	...	0.90/1.15	...	
E52100^D	0.98/1.10	0.25/0.45	...	1.30/1.60	...	
6118	0.16/0.21	0.50/0.70	...	0.50/0.70	...	V 0.10/0.15
6150	0.48/0.53	0.70/0.90	...	0.80/1.10	...	V 0.15 min
8615	0.13/0.18	0.70/0.90	0.40/0.70	0.40/0.60	0.15/0.25	
8617	0.15/0.20	0.70/0.90	0.40/0.70	0.40/0.60	0.15/0.25	
8620	0.18/0.23	0.70/0.90	0.40/0.70	0.40/0.60	0.15/0.25	
8622	0.20/0.25	0.70/0.90	0.40/0.70	0.40/0.60	0.15/0.25	
8625	0.23/0.28	0.70/0.90	0.40/0.70	0.40/0.60	0.15/0.25	
8627	0.25/0.30	0.70/0.90	0.40/0.70	0.40/0.60	0.15/0.25	
8630	0.28/0.33	0.70/0.90	0.40/0.70	0.40/0.60	0.15/0.25	
8637	0.35/0.40	0.75/1.00	0.40/0.70	0.40/0.60	0.15/0.25	
8640	0.38/0.43	0.75/1.00	0.40/0.70	0.40/0.60	0.15/0.25	
8642	0.40/0.45	0.75/1.00	0.40/0.70	0.40/0.60	0.15/0.25	
8645	0.43/0.48	0.75/1.00	0.40/0.70	0.40/0.60	0.15/0.25	

STANDARD ALLOY STEELS

(ASTM A 322 – 07)

Steel Grade ^C	Chemical Composition Ranges and Limits, Percent ^{A,B}					
	C	Mn	Ni	Cr	Mo	Other
8655	0.51/0.59	0.75/1.00	0.40/0.70	0.40/0.60	0.15/0.25	
8720	0.18/0.23	0.70/0.90	0.40/0.70	0.40/0.60	0.20/0.30	
8822	0.20/0.25	0.75/1.00	0.40/0.70	0.40/0.60	0.30/0.40	
9259	0.56/0.64	0.75/1.00	...	0.45/0.65	...	Si 0.70/1.10
9260	0.56/0.64	0.75/1.00	...	...	...	Si 1.80/2.20
Standard Boron Steels^E						
50B44	0.43/0.48	0.75/1.00	...	0.20/0.60	...	
50B46	0.44/0.49	0.75/1.00	...	0.20/0.35	...	
50B50	0.48/0.53	0.75/1.00	...	0.40/0.60	...	
50B60	0.56/0.64	0.75/1.00	...	0.40/0.60	...	
51B60	0.56/0.64	0.75/1.00	...	0.70/0.90	...	
81B45	0.43/0.48	0.75/1.00	0.20/0.40	0.35/0.55	0.08/0.15	
94B17	0.15/0.20	0.75/1.00	0.30/0.60	0.30/0.50	0.08/0.15	
94B30	0.28/0.33	0.75/1.00	0.30/0.60	0.30/0.50	0.08/0.15	

^A Unless noted, all grades have a Si range of 0.15 to 0.35%. Silicon may be specified to 0.10% maximum, which generally relates to severely cold-formed parts.

^B The maximum limits for P and S are 0.035% and 0.040% respectively, unless otherwise agreed upon between purchaser and supplier.

^C Grade designations correspond to the respective AISI and SAE designations. Grade compositions correspond to the respective AISI compositions.

^D The max S and P for Electric Furnace Quality Steels (grades preceded by an 'E') is 0.025 max.

^E These steels can be expected to contain 0.0005 to 0.003% B. If the usual Ti additive is not permitted, these steels can be expected to contain up to 0.005% B.

ALLOY STEEL GRADES SUBJECT TO END QUENCH HARDENABILITY REQUIREMENTS

(ASTM A 304 – 05)

Steel Grade	Chemical Composition Ranges and Limits, Percent ^A					
	C	Mn	Si	Ni	Cr	Mo
1330 H	0.27/0.33	1.45/2.05	0.15/0.35	...	...	...
1335 H	0.32/0.38	1.45/2.05	0.15/0.35	...	...	...
1340 H	0.37/0.44	1.45/2.05	0.15/0.35	...	...	...
1345 H	0.42/0.49	1.45/2.05	0.15/0.35	...	...	...
4027 H	0.24/0.30	0.60/1.00	0.15/0.35	...	...	0.20/0.30
4028 H ^B	0.24/0.30	0.60/1.00	0.15/0.35	...	...	0.20/0.30
4032 H	0.29/0.35	0.60/1.00	0.15/0.35	...	...	0.20/0.30
4037 H	0.34/0.41	0.60/1.00	0.15/0.35	...	...	0.20/0.30
4042 H	0.39/0.46	0.60/1.00	0.15/0.35	...	...	0.20/0.30
4047 H	0.44/0.51	0.60/1.00	0.15/0.35	...	...	0.20/0.30
4118 H	0.17/0.23	0.60/1.00	0.15/0.35	...	0.30/0.70	0.08/0.15
4130 H	0.27/0.33	0.30/0.70	0.15/0.35	...	0.75/1.20	0.15/0.25
4135 H	0.32/0.38	0.60/1.00	0.15/0.35	...	0.75/1.20	0.15/0.25
4137 H	0.34/0.41	0.60/1.00	0.15/0.35	...	0.75/1.20	0.15/0.25
4140 H	0.37/0.44	0.65/1.10	0.15/0.35	...	0.75/1.20	0.15/0.25
4142 H	0.39/0.46	0.65/1.10	0.15/0.35	...	0.75/1.20	0.15/0.25
4145 H	0.42/0.49	0.65/1.10	0.15/0.35	...	0.75/1.20	0.15/0.25

ALLOY STEEL GRADES SUBJECT TO END QUENCH HARDENABILITY REQUIREMENTS

(ASTM A 304 – 05)

Steel Grade	Chemical Composition Ranges and Limits, Percent ^A					
	C	Mn	Si	Ni	Cr	Mo
4147 H	0.44/0.51	0.65/1.10	0.15/0.35	...	0.75/1.20	0.15/0.25
4150 H	0.47/0.54	0.65/1.10	0.15/0.35	...	0.75/1.20	0.15/0.25
4161 H	0.55/0.65	0.65/1.10	0.15/0.35	...	0.65/0.95	0.25/0.35
4320 H	0.17/0.23	0.40/0.70	0.15/0.35	1.55/2.00	0.35/0.65	0.20/0.30
4340 H	0.37/0.44	0.55/0.90	0.15/0.35	1.55/2.00	0.65/0.95	0.20/0.30
E4340 H	0.37/0.44	0.60/0.95	0.15/0.35	1.55/2.00	0.65/0.95	0.20/0.30
4419 H	0.17/0.23	0.35/0.75	0.15/0.35	...	...	0.45/0.60
4620 H	0.17/0.23	0.35/0.75	0.15/0.35	1.55/2.00	...	0.20/0.30
4621 H	0.17/0.23	0.60/1.00	0.15/0.35	1.55/2.00	...	0.20/0.30
4626 H	0.23/0.29	0.40/0.70	0.15/0.35	0.65/1.05	...	0.15/0.25
4718 H	0.15/0.21	0.60/0.95	0.15/0.35	0.85/1.25	0.30/0.60	0.30/0.40
4720 H	0.17/0.23	0.45/0.75	0.15/0.35	0.85/1.25	0.30/0.60	0.15/0.25
4815 H	0.12/0.18	0.30/0.70	0.15/0.35	3.20/3.80	...	0.20/0.30
4817 H	0.14/0.20	0.30/0.70	0.15/0.35	3.20/3.80	...	0.20/0.30
4820 H	0.17/0.23	0.40/0.80	0.15/0.35	3.20/3.80	...	0.20/0.30
50B40 H ^C	0.37/0.44	0.65/1.10	0.15/0.35	...	0.30/0.70	...
50B44 H ^C	0.42/0.49	0.65/1.10	0.15/0.35	...	0.30/0.70	...

ALLOY STEEL GRADES SUBJECT TO END QUENCH HARDENABILITY REQUIREMENTS

(ASTM A 304 – 05)

Steel Grade	Chemical Composition Ranges and Limits, Percent ^A					
	C	Mn	Si	Ni	Cr	Mo
5046 H	0.43/0.50	0.65/1.10	0.15/0.35	...	0.13/0.43	...
50B46 H ^C	0.43/0.50	0.65/1.10	0.15/0.35	...	0.13/0.43	...
50B50 H ^C	0.47/0.54	0.65/1.10	0.15/0.35	...	0.30/0.70	...
50B60 H ^C	0.55/0.65	0.65/1.10	0.15/0.35	...	0.30/0.70	...
5120 H	0.17/0.23	0.60/1.00	0.15/0.35	...	0.60/1.00	...
5130 H	0.27/0.33	0.60/1.00	0.15/0.35	...	0.75/1.20	...
5132 H	0.29/0.35	0.50/0.90	0.15/0.35	...	0.65/1.10	...
5135 H	0.32/0.38	0.50/0.90	0.15/0.35	...	0.70/1.15	...
5140 H	0.37/0.44	0.60/1.00	0.15/0.35	...	0.60/1.00	...
5145 H	0.42/0.49	0.60/1.00	0.15/0.35	...	0.60/1.00	...
5147 H	0.45/0.52	0.60/1.05	0.15/0.35	...	0.80/1.25	...
5150 H	0.47/0.54	0.60/1.00	0.15/0.35	...	0.60/1.00	...
5155 H	0.50/0.60	0.60/1.00	0.15/0.35	...	0.60/1.00	...
5160 H	0.55/0.65	0.65/1.10	0.15/0.35	...	0.60/1.00	...
51B60 H ^C	0.55/0.65	0.65/1.10	0.15/0.35	...	0.60/1.00	...
6118 H ^D	0.15/0.21	0.40/0.80	0.15/0.35	...	0.40/0.80	...
6150 H ^E	0.47/0.54	0.60/1.00	0.15/0.35	...	0.75/1.20	...

ALLOY STEEL GRADES SUBJECT TO END QUENCH HARDENABILITY REQUIREMENTS

(ASTM A 304 – 05)

Steel Grade	Chemical Composition Ranges and Limits, Percent ^A					
	C	Mn	Si	Ni	Cr	Mo
81B45 H ^C	0.42/0.49	0.70/1.05	0.15/0.35	0.15/0.45	0.30/0.60	0.08/0.15
8617 H	0.14/0.20	0.60/0.95	0.15/0.35	0.35/0.75	0.35/0.65	0.15/0.25
8620 H	0.17/0.23	0.60/0.95	0.15/0.35	0.35/0.75	0.35/0.65	0.15/0.25
8622 H	0.19/0.25	0.60/0.95	0.15/0.35	0.35/0.75	0.35/0.65	0.15/0.25
8625 H	0.22/0.28	0.60/0.95	0.15/0.35	0.35/0.75	0.35/0.65	0.15/0.25
8627 H	0.24/0.30	0.60/0.95	0.15/0.35	0.35/0.75	0.35/0.65	0.15/0.25
8630 H	0.27/0.33	0.60/0.95	0.15/0.35	0.35/0.75	0.35/0.65	0.15/0.25
86B30 H ^C	0.27/0.33	0.60/0.95	0.15/0.35	0.35/0.75	0.35/0.65	0.15/0.25
8637 H	0.34/0.41	0.70/1.05	0.15/0.35	0.35/0.75	0.35/0.65	0.15/0.25
8640 H	0.37/0.44	0.70/1.05	0.15/0.35	0.35/0.75	0.35/0.65	0.15/0.25
8642 H	0.39/0.46	0.70/1.05	0.15/0.35	0.35/0.75	0.35/0.65	0.15/0.25
8645 H	0.42/0.49	0.70/1.05	0.15/0.35	0.35/0.75	0.35/0.65	0.15/0.25
86B45 H ^C	0.42/0.49	0.70/1.05	0.15/0.35	0.35/0.75	0.35/0.65	0.15/0.25
8650 H	0.47/0.54	0.70/1.05	0.15/0.35	0.35/0.75	0.35/0.65	0.15/0.25
8655 H	0.50/0.60	0.70/1.05	0.15/0.35	0.35/0.75	0.35/0.65	0.15/0.25
8660 H	0.55/0.65	0.70/1.05	0.15/0.35	0.35/0.75	0.35/0.65	0.15/0.25
8720 H	0.17/0.23	0.60/0.95	0.15/0.35	0.35/0.75	0.35/0.65	0.20/0.30

ALLOY STEEL GRADES SUBJECT TO END QUENCH HARDENABILITY REQUIREMENTS

(ASTM A 304 – 05)

Steel Grade	Chemical Composition Ranges and Limits, Percent ^A					
	C	Mn	Si	Ni	Cr	Mo
8740 H	0.37/0.44	0.70/1.05	0.15/0.35	0.35/0.75	0.35/0.65	0.20/0.30
8822 H	0.19/0.25	0.70/1.05	0.15/0.35	0.35/0.75	0.35/0.65	0.30/0.40
9260 H	0.55/0.65	0.65/1.10	1.70/2.20	...	...	...
9310 H	0.07/0.13	0.40/0.70	0.15/0.35	2.95/3.55	1.00/1.45	0.08/0.15
94B15 H^C	0.12/0.18	0.70/1.05	0.15/0.35	0.25/0.65	0.25/0.55	0.08/0.15
94B17 H^C	0.14/0.20	0.70/1.05	0.15/0.35	0.25/0.65	0.25/0.55	0.08/0.15
94B30 H^C	0.27/0.33	0.70/1.05	0.15/0.35	0.25/0.65	0.25/0.55	0.08/0.15

^A P and S in open-hearth steel is 0.035% and 0.040% respectively, while the P and S in electric furnace steel is 0.025% max (Grade preceded by an 'E').

^B S range is 0.035 to 0.050%.

^C These steels can be expected to have a 0.0005% minimum B content.

^D V range is 0.10 to 0.15%.

^E Minimum V content is 0.15%.

STEEL GRADES SUBJECT TO RESTRICTED END QUENCH HARDENABILITY REQUIREMENTS

(ASTM A 914/A 914M – 92; Reapproved 2005)

Steel Grade	Chemical Composition Ranges and Limits, Percent ^A					
	C	Mn	Si	Ni	Cr	Mo
15B21 RH ^B	0.17/0.22	0.80/1.10	0.15/0.35	...	...	...
15B35 RH ^B	0.33/0.38	0.80/1.10	0.15/0.35	...	...	...
3310 RH	0.08/0.13	0.40/0.60	0.15/0.35	3.25/3.75	1.40/1.75	...
4027 RH	0.25/0.30	0.70/0.90	0.15/0.35	...	...	0.20/0.30
4118 RH	0.18/0.23	0.70/0.90	0.15/0.35	...	0.40/0.60	0.08/0.15
4120 RH	0.18/0.23	0.90/1.20	0.15/0.35	...	0.40/0.60	0.13/0.20
4130 RH	0.28/0.33	0.40/0.60	0.15/0.35	...	0.80/1.10	0.15/0.25
4140 RH	0.38/0.43	0.75/1.00	0.15/0.35	...	0.80/1.10	0.15/0.25
4145 RH	0.43/0.48	0.75/1.00	0.15/0.35	...	0.80/1.10	0.15/0.25
4161 RH	0.56/0.64	0.75/1.00	0.15/0.35	...	0.70/0.90	0.25/0.35
4320 RH	0.17/0.22	0.45/0.65	0.15/0.35	1.65/2.00	0.40/0.60	0.20/0.30
4620 RH	0.17/0.22	0.45/0.65	0.15/0.35	1.65/2.00	...	0.20/0.30
4820 RH	0.18/0.23	0.50/0.70	0.15/0.35	3.25/3.75	...	0.20/0.30
50B40 RH ^B	0.38/0.43	0.75/1.00	0.15/0.35	...	0.40/0.60	...
5130 RH	0.28/0.33	0.70/0.90	0.15/0.35	...	0.80/1.10	...
5140 RH	0.38/0.43	0.70/0.90	0.15/0.35	...	0.70/0.90	...
5160 RH	0.56/0.64	0.75/1.00	0.15/0.35	...	0.70/0.90	...

STEEL GRADES SUBJECT TO RESTRICTED END QUENCH HARDENABILITY REQUIREMENTS

(ASTM A 914/A 914M – 92; Reapproved 2005)

Steel Grade	Chemical Composition Ranges and Limits, Percent ^A					
	C	Mn	Si	Ni	Cr	Mo
8620 RH	0.18/0.23	0.70/0.90	0.15/0.35	0.40/0.70	0.40/0.60	0.15/0.25
8622 RH	0.20/0.25	0.70/0.90	0.15/0.35	0.40/0.70	0.40/0.60	0.15/0.25
8720 RH	0.18/0.23	0.70/0.90	0.15/0.35	0.40/0.70	0.40/0.60	0.20/0.30
8822 RH	0.20/0.25	0.75/1.00	0.15/0.35	0.40/0.70	0.40/0.60	0.30/0.40
9310 RH	0.08/0.13	0.45/0.65	0.15/0.35	3.00/3.50	1.00/1.40	0.08/0.15

^A P and S in open-hearth steel is 0.035% and 0.040% max respectively, while P and S in electric furnace steel is 0.025% max.

^B These steels can be expected to have 0.0005 to 0.003% B.

SAE POTENTIAL STANDARD STEELS

(SAE J1081 – NOV 2000)

PS No. ^A	Chemical Composition Ranges and Limits, Percent ^B					
	C	Mn	Ni	Cr	Mo	Other
PS 10	0.19/0.24	0.95/1.25	0.20/0.40	0.25/0.40	0.05/0.10	
PS 16	0.20/0.25	0.90/1.20	...	0.40/0.60	0.13/0.20	
PS 17	0.23/0.28	0.90/1.20	...	0.40/0.60	0.13/0.20	
PS 18	0.25/0.30	0.90/1.20	...	0.40/0.60	0.13/0.20	
PS 19	0.18/0.23	0.90/1.20	...	0.40/0.60	0.08/0.15	B 0.0005/0.003
PS 20	0.13/0.18	0.90/1.20	...	0.40/0.60	0.13/0.20	
PS 21	0.15/0.20	0.90/1.20	...	0.40/0.60	0.13/0.20	
PS 31	0.15/0.20	0.70/0.90	0.70/1.00	0.45/0.65	0.45/0.60	
PS 32	0.18/0.23	0.70/0.90	0.70/1.00	0.45/0.65	0.45/0.60	
PS 33 ^C	0.17/0.24	0.85/1.25	0.20 min	0.20 min	0.05 min	
PS 34	0.28/0.33	0.90/1.20	...	0.40/0.60	0.13/0.20	
PS 36	0.38/0.43	0.90/1.20	...	0.45/0.65	0.13/0.20	
PS 38	0.43/0.48	0.90/1.20	...	0.45/0.65	0.13/0.20	
PS 39	0.48/0.53	0.90/1.20	...	0.45/0.65	0.13/0.20	
PS 40	0.51/0.59	0.90/1.20	...	0.45/0.65	0.13/0.20	
PS 54	0.19/0.25	0.70/1.05	...	0.40/0.70	0.05 min	

SAE POTENTIAL STANDARD STEELS

(SAE J1081 – NOV 2000)

PS No. ^A	Chemical Composition Ranges and Limits, Percent ^B					
	C	Mn	Ni	Cr	Mo	Other
PS 55	0.15/0.20	0.70/1.00	1.65/2.00	0.45/0.65	0.65/0.80	
PS 56	0.08/0.13	0.70/1.00	1.65/2.00	0.45/0.65	0.65/0.80	
PS 57	0.08 max	1.25 max	...	17.00/19.00	1.75/2.25	S 0.15/0.35, P 0.040 max
PS 58	0.16/0.21	1.00/1.30	...	0.45/0.65	...	
PS 59	0.18/0.23	1.00/1.30	...	0.70/0.90	...	
PS 61	0.23/0.28	1.00/1.30	...	0.70/0.90	...	
PS 63	0.31/0.38	0.75/1.10	...	0.45/0.65	...	B 0.0005/0.003
PS 64	0.16/0.21	1.00/1.30	...	0.70/0.90	...	
PS 65	0.21/0.26	1.00/1.30	...	0.70/0.90	...	
PS 66	0.16/0.21	0.40/0.70	1.65/2.00	0.45/0.75	0.08/0.15	V 0.10/0.15
PS 67	0.42/0.49	0.80/1.20	...	0.85/1.20	0.25/0.35	
PS 68 ^D	0.15 max	0.85/1.15	...	...	...	P 0.04/0.09, S 0.26/0.35

^A Some PS steels may be supplied to a hardenability requirement.

^B Unless specified, Si = 0.15/0.35, P = 0.025 max, and S = 0.025 max.

^C Supplied to a hardenability requirement of 15 HRC points within the range of HRC 23/43 at J4, subject to agreement between producer and user.

^D PS 68 has Sn content of 0.04/0.08.

FORMER SAE EX AND PS STEELS

(SAE J1249 JUN 2000)

Former Number	Aprox SAE Grade	Chemical Composition Ranges and Limits, Percent						Deletion Date
		C	Mn	Ni	Cr	Mo	Other	
PS 10	...	0.19/0.24	0.95/1.25	0.20/0.40	0.25/0.40	0.05/0.10		1993
PS 19	...	0.18/0.23	0.90/1.20	...	0.40/0.60	0.08/0.15	B 0.0005/0.003	1993
PS 21	...	0.15/0.20	0.90/1.20	...	0.40/0.60	0.13/0.20		1993
PS 31	...	0.15/0.20	0.70/0.90	0.70/1.00	0.45/0.65	0.45/0.60		1993
PS 32	...	0.18/0.23	0.70/0.90	0.70/1.00	0.45/0.65	0.45/0.60		1993
PS 34	...	0.28/0.33	0.90/1.20	...	0.40/0.60	0.13/0.20		1993
PS 36	...	0.38/0.43	0.90/1.20	...	0.45/0.65	0.13/0.20		1993
PS 38	...	0.43/0.48	0.90/1.20	...	0.45/0.65	0.13/0.20		1993
PS 39	...	0.48/0.53	0.90/1.20	...	0.45/0.65	0.13/0.20		1993
PS 40	...	0.51/0.59	0.90/1.20	...	0.45/0.60	0.13/0.20		1993
PS 56	...	0.08/0.13	0.70/1.00	1.65/2.00	0.45/0.65	0.65/0.80		1993
PS 57	...	0.08 max	1.25 max	...	17.00/19.00	1.75/2.25	S 0.15/0.35, Si 1.00 max	1993
PS 58	...	0.16/0.21	1.00/1.30	...	0.45/0.65	...		1993
PS 59	...	0.18/0.23	1.00/1.30	...	0.70/0.90	...		1993
PS 61	...	0.23/0.28	1.00/1.30	...	0.70/0.90	...		1993
PS 63	...	0.31/0.38	0.75/1.10	...	0.70/0.90	...	B 0.0005/0.003	1993

FORMER SAE EX AND PS STEELS

(SAE J1249 JUN 2000)

Former Number	Aprox. SAE Grade	Chemical Composition Ranges and Limits, Percent						Deletion Date
		C	Mn	Ni	Cr	Mo	Other	
PS 64	...	0.16/0.21	1.00/1.30	...	0.70/0.90	...		1993
PS 65	...	0.21/0.26	1.00/1.30	...	0.70/0.90	...		1993
PS 66	...	0.16/0.21	0.40/0.70	1.65/2.00	0.45/0.75	0.08/0.15	V 0.10/0.15	1993
PS 67	...	0.42/0.49	0.85/1.20	...	0.85/1.20	0.25/0.35		1993
EX 1	9310	0.15/0.21	0.35/0.60	4.80/5.30	...	0.20/0.30	P 0.040 max	1976
EX 2	...	0.64/0.75	0.25/0.45	0.70/1.00	0.15/0.30	0.08/0.15	P & S 0.025 max each	1971
EX 3	5060	0.56/0.64	0.75/1.00	...	0.40/0.60	...		standard
EX 4	4118	0.18/0.23	0.75/1.00	...	0.45/0.65	0.05/0.10		1973
EX 5	8620	0.18/0.23	0.75/1.00	0.40/0.70	0.45/0.65	0.08/0.15		1971
EX 6	8622	0.20/0.25	0.75/1.00	0.40/0.70	0.45/0.65	0.08/0.15		1971
EX 7	8625	0.23/0.28	0.75/1.00	0.40/0.70	0.45/0.65	0.08/0.15		1971
EX 8	8627	0.25/0.30	0.75/1.00	0.40/0.70	0.45/0.65	0.08/0.15		1971
EX 9	8620	0.19/0.24	0.95/1.25	0.20/0.40	0.25/0.40	0.05/0.10	Si 0.050 max	1976
EX 11	8640	0.38/0.43	0.75/1.00	0.20/0.40	0.25/0.40	0.05/0.10	B 0.0005/0.003, Si 0.050 max	1976
EX 12	8640	0.38/0.43	0.75/1.00	0.20/0.40	0.25/0.40	0.05/0.10	B 0.0005/0.003	1976

FORMER SAE EX AND PS STEELS

(SAE J1249 JUN 2000)

Former Number	Aprox. SAE Grade	Chemical Composition Ranges and Limits, Percent						Deletion Date
		C	Mn	Ni	Cr	Mo	Other	
EX 13	...	0.66/0.75	0.80/1.05	0.20/0.40	0.25/0.40	0.05/0.10	P & S both 0.025 max, Si 0.050 max	1976
EX 14	...	0.66/0.75	0.80/1.05	0.20/0.40	0.25/0.40	0.05/0.10	P & S both 0.025 max	1976
EX 15	4120	0.18/0.23	0.90/1.20	...	0.40/0.60	0.13/0.20		
EX 22	8615	0.13/0.18	0.75/1.00	...	0.45/0.65	0.20/0.30		1973
EX 23	8617	0.15/0.20	0.75/1.00	...	0.45/0.65	0.20/0.30		1973
EX 24	...	0.18/0.23	0.75/1.00	...	0.45/0.65	0.20/0.30		1973
EX 25	8622	0.20/0.25	0.75/1.00	...	0.45/0.65	0.20/0.30		1973
EX 26	8625	0.23/0.28	0.75/1.00	...	0.45/0.65	0.20/0.30		1973
EX 27	8627	0.25/0.30	0.75/1.00	...	0.45/0.65	0.20/0.30		1976
EX 28	4718	0.16/0.21	0.75/1.00	0.40/0.70	0.45/0.65	0.30/0.40		1973
EX 29	4320	0.18/0.23	0.75/1.00	0.40/0.70	0.45/0.65	0.30/0.40		1976
EX 30	...	0.13/0.18	0.70/0.90	0.70/1.00	0.45/0.65	0.45/0.60		
EX 35	8637	0.35/0.40	0.90/1.20	...	0.45/0.65	0.13/0.20		1976
EX 37	8642	0.40/0.45	0.90/1.20	...	0.45/0.65	0.13/0.20		1976
EX 41	8660	0.56/0.64	0.90/1.20	...	0.45/0.65	0.13/0.20		1976

FORMER SAE EX AND PS STEELS

(SAE J1249 JUN 2000)

Former Number	Aprox. SAE Grade	Chemical Composition Ranges and Limits, Percent						Deletion Date
		C	Mn	Ni	Cr	Mo	Other	
EX 42	8615	0.13/0.18	0.95/1.25	0.20/0.40	0.25/0.40	0.05/0.10		1976
EX 43	...	0.13/0.18	0.95/1.25	0.20/0.40	0.25/0.40	0.05/0.10	B 0.0005/0.003	1976
EX 44	8617	0.15/0.20	0.95/1.25	0.20/0.40	0.25/0.40	0.05/0.10		1976
EX 45	...	0.15/0.20	0.95/1.25	0.20/0.40	0.25/0.40	0.05/0.10	B 0.0005/0.003	1976
EX 46	8622	0.20/0.25	0.95/1.25	0.20/0.40	0.25/0.40	0.05/0.10		1976
EX 47	8625	0.23/0.28	0.95/1.25	0.20/0.40	0.25/0.40	0.05/0.10		1976
EX 48	8627	0.25/0.30	0.95/1.25	0.20/0.40	0.25/0.40	0.05/0.10		1976
EX 49	8630	0.28/0.33	0.95/1.25	0.20/0.40	0.25/0.40	0.05/0.10		1976
EX 50	8635	0.33/0.38	0.95/1.25	0.20/0.40	0.25/0.40	0.05/0.10		1976
EX 51	8637	0.35/0.40	0.95/1.25	0.20/0.40	0.25/0.40	0.05/0.10		1976
EX 52	8640	0.38/0.43	0.95/1.25	0.20/0.40	0.25/0.40	0.05/0.10		1976
EX 53	8642	0.40/0.45	0.95/1.25	0.20/0.40	0.25/0.40	0.05/0.10		1976
EX 60	...	0.20/0.25	1.00/1.30	...	0.70/0.90	...		1983
EX 62	...	0.25/0.30	1.00/1.30	...	0.70/0.90	...		1983

Note 1: All steels contain 0.035% max P and 0.040% max S, except as noted.

Note 2: All steels contain 0.15/0.35% Si, except as noted.

FORMER STANDARD SAE STEELS

(SAE J1249 JUN 2000)

Steel Grade	Chemical Composition Ranges and Limits, Percent ^A				
	C	Mn	P max	S max	Last Date
1009	0.15 max	0.60 max	0.04	0.05	1965
1011	0.09/0.14	0.60/0.90	0.04	0.05	1993
1019	0.15/0.20	0.70/1.00	0.04	0.05	
1033	0.30/0.36	0.70/1.00	0.04	0.05	1965
1034	0.32/0.38	0.50/0.80	0.04	0.05	1968
1037	0.32/0.38	0.70/1.00	0.04	0.05	
1059	0.55/0.65	0.50/0.80	0.04	0.05	1968
1062	0.54/0.65	0.85/1.15	0.04	0.05	1993
1064	0.60/0.70	0.50/0.80	0.04	0.05	1953
1069	0.65/0.75	0.40/0.70	0.04	0.05	
1074	0.70/0.80	0.50/0.80	0.04	0.05	1993
1075	0.70/0.80	0.40/0.70	0.04	0.05	
1084	0.80/0.93	0.60/0.90	0.04	0.05	
1085	0.80/0.93	0.70/1.00	0.04	0.05	
1086	0.80/0.94	0.30/0.50	0.04	0.05	1977

FORMER STANDARD SAE STEELS

(SAE J1249 JUN 2000)

Steel Grade	Chemical Composition Ranges and Limits, Percent ^A				Last Date
	C	Mn	P max	S max	
1108	0.08/0.13	0.50/0.80	0.04	0.08/0.13	
1109	0.08/0.13	0.60/0.90	0.04	0.08/0.13	1977
1110	0.08/0.13	0.30/0.60	0.04	0.08/0.13	1993
1111	0.13 max	0.60/0.90	0.07/0.12	0.10/0.15	1969
1112	0.13 max	0.70/1.00	0.07/0.12	0.16/0.23	1969
1113	0.13 max	0.70/1.00	0.07/0.12	0.24/0.33	1969
1114	0.10/0.16	1.00/1.30	0.04	0.08/0.13	1952
1115	0.13/0.18	0.60/0.90	0.04	0.08/0.13	1965
1116	0.14/0.20	1.10/1.40	0.04	0.16/0.23	1952
1119	0.14/0.20	1.00/1.30	0.04	0.24/0.33	1977
1120	0.18/0.23	0.70/1.00	0.04	0.08/0.13	1965
1123	0.20/0.27	1.20/1.50	0.04	0.06/0.09	1993
1139	0.35/0.43	1.35/1.65	0.04	0.13/0.20	
1145	0.42/0.49	0.70/1.00	0.04	0.04/0.07	1977
1152	0.48/0.55	0.70/1.00	0.04	0.06/0.09	1993
1211	0.13 max	0.60/0.90	0.07/0.12	0.10/0.15	

FORMER STANDARD SAE STEELS

(SAE J1249 JUN 2000)

Steel Grade	Chemical Composition Ranges and Limits, Percent ^A				
	C	Mn	P max	S max	Last Date
1513	0.10/0.16	1.10/1.40	0.04	0.05	1993
1518	0.15/0.21	1.10/1.40	0.04	0.05	1977
1525	0.23/0.29	0.80/1.10	0.04	0.05	1977
1533	0.30/0.37	1.10/1.40	0.04	0.05	1993
1534	0.30/0.37	1.20/1.50	0.04	0.05	1993
1536	0.30/0.37	1.20/1.50	0.04	0.05	
1544	0.40/0.47	0.80/1.10	0.04	0.05	1993
1545	0.43/0.50	0.80/1.10	0.04	0.05	1993
1546	0.44/0.52	1.00/1.30	0.04	0.05	1993
1551	0.45/0.56	0.85/1.15	0.04	0.05	
1553	0.48/0.55	0.80/1.10	0.04	0.05	1993
1561	0.55/0.65	0.75/1.05	0.04	0.05	
1570	0.65/0.75	0.80/1.10	0.04	0.05	1993
1572	0.65/0.76	1.00/1.30	0.04	0.05	1977
1580	0.75/0.88	0.80/1.10	0.04	0.05	1993
1590	0.85/0.98	0.80/1.10	0.04	0.05	1993

FORMER STANDARD SAE STEELS

(SAE J1249 JUN 2000)

Steel Grade	Chemical Composition Ranges and Limits, Percent						Last Date
	C	Mn	Ni	Cr	Mo	Other	
1320	0.18/0.23	1.60/1.90	...	...	...	Si 0.20/0.35	1956
1330	0.28/0.33	1.60/1.90	...	...	...		1993
1345	0.43/0.48	1.60/1.90	...	...	0.15/0.25		
2317	0.15/0.20	0.40/0.60	3.25/3.75	...	...	Si 0.20/0.35	1956
2330	0.28/0.33	0.60/0.80	3.25/3.76	...	...	Si 0.20/0.35	1953
2340	0.38/0.43	0.70/0.90	3.25/3.77	...	...	Si 0.20/0.35	1953
2345	0.43/0.48	0.70/0.90	3.25/3.78	...	...	Si 0.20/0.35	1952
2512	0.09/0.14	0.45/0.60	4.75/5.25	...	...	Si 0.20/0.35, P&S 0.025 max	1953
2515	0.12/0.17	0.40/0.60	4.75/5.25	...	...	Si 0.20/0.35	1956
2517	0.15/0.20	0.45/0.60	4.75/5.25	...	...	Si 0.20/0.35, P&S 0.025 max	1959
3115	0.13/0.18	0.40/0.60	3.25/3.75	...	...	Si 0.20/0.35	1956
3120	0.17/0.22	0.60/0.80	1.10/1.40	0.55/0.75	...	Si 0.20/0.35	1956
3130	0.28/0.33	0.60/0.80	1.10/1.40	0.55/0.75	...	Si 0.20/0.35	1956
3135	0.33/0.38	0.60/0.80	1.10/1.40	0.55/0.75	...	Si 0.20/0.35	1960
X3140	0.38/0.43	0.70/0.90	1.10/1.40	0.70/0.90	...	Si 0.20/0.35	1947

FORMER STANDARD SAE STEELS

(SAE J1249 JUN 2000)

Steel Grade	Chemical Composition Ranges and Limits, Percent						Last Date
	C	Mn	Ni	Cr	Mo	Other	
3140	0.38/0.43	0.70/0.90	1.10/1.40	0.55/0.75	...	Si 0.20/0.35	1964
3145	0.43/0.48	0.70/0.90	1.10/1.40	0.70/0.90	...	Si 0.20/0.35	1952
3150	0.48/0.53	0.70/0.90	1.10/1.40	0.70/0.90	...	Si 0.20/0.35	1952
3215	0.10/0.20	0.30/0.60	1.50/2.00	0.90/1.25	...	Si 0.15/0.30	1941
3220	0.15/0.25	0.30/0.60	1.50/2.00	0.90/1.25	...	Si 0.15/0.30	1941
3230	0.25/0.35	0.30/0.60	1.50/2.00	0.90/1.25	...	Si 0.15/0.30	1941
3240	0.35/0.45	0.30/0.60	1.50/2.00	0.90/1.25	...	Si 0.15/0.30	1941
3245	0.40/0.50	0.30/0.60	1.50/2.00	0.90/1.25	...	Si 0.15/0.30	1941
3250	0.45/0.55	0.30/0.60	1.50/2.00	0.90/1.25	...	Si 0.15/0.30	1941
3310	0.08/0.13	0.45/0.60	3.25/3.75	1.40/1.75	...	Si 0.20/0.35, P&S 0.025 max	1964
3312	0.08/0.13	0.45/0.60	3.25/3.75	1.40/1.75	...	Si 0.20/0.35, P&S 0.025 max	1948
3316	0.14/0.19	0.45/0.60	3.25/3.75	1.40/1.75	...	Si 0.20/0.35, P&S 0.025 max	1956
3325	0.20/0.30	0.30/0.60	3.25/3.75	1.25/1.75	...	Si 0.15/0.30	1936
3335	0.30/0.40	0.30/0.60	3.25/3.75	1.25/1.75	...	Si 0.15/0.30	1936
3340	0.35/0.45	0.30/0.60	3.25/3.75	1.25/1.75	...	Si 0.15/0.30	1936

FORMER STANDARD SAE STEELS

(SAE J1249 JUN 2000)

Steel Grade	Chemical Composition Ranges and Limits, Percent ^A						Last Date
	C	Mn	Ni	Cr	Mo	Other	
3415	0.10/0.20	0.30/0.60	2.75/3.25	0.60/0.95	...	Si 0.15/0.30	1941
3435	0.30/0.40	0.30/0.60	2.75/3.25	0.60/0.95	...	Si 0.15/0.30	1936
3450	0.45/0.55	0.30/0.60	2.75/3.25	0.60/0.95	...	Si 0.15/0.30	1936
4012	0.09/0.14	0.75/1.00	...	...	0.20/0.30	Si 0.15/0.30	1977
4024	0.20/0.25	0.70/0.90	...	...	0.20/0.30	S 0.035/0.050	
4028	0.25/0.30	0.70/0.90	...	...	0.20/0.30	S 0.035/0.050	1993
4032	0.30/0.35	0.70/0.90	...	...	0.20/0.30		
4042	0.40/0.45	0.70/0.90	...	...	0.20/0.30		
4053	0.50/0.56	0.75/1.00	...	...	0.20/0.30	Si 0.20/0.35	1956
4063	0.60/0.67	0.75/1.00	...	...	0.20/0.30	Si 0.20/0.35	1964
4068	0.63/0.70	0.75/1.00	...	...	0.20/0.30	Si 0.20/0.35	1957
4119	0.17/0.22	0.70/0.90	...	0.40/0.60	0.20/0.30	Si 0.20/0.35	1956
4121	0.18/0.23	0.75/1.00	...	0.45/0.65	0.20/0.30		1993
4125	0.23/0.28	0.70/0.90	...	0.40/0.60	0.20/0.30	Si 0.20/0.35	1950

FORMER STANDARD SAE STEELS

(SAE J1249 JUN 2000)

Steel Grade	Chemical Composition Ranges and Limits, Percent ^A						Last Date
	C	Mn	Ni	Cr	Mo	Other	
4131	0.28/0.23	0.50/0.70	...	0.90/1.20	0.15/0.25		1993
4135	0.33/0.38	0.70/0.90	...	0.80/1.10	0.15/0.25		
4147	0.45/0.50	0.75/1.00	...	0.80/1.10	0.15/0.25		1993
4161	0.56/0.64	0.75/1.00	...	0.70/0.90	0.25/0.35		
4317	0.15/0.20	0.45/0.60	1.65/2.00	0.40/0.60	0.20/0.30	Si 0.20/0.35	1953
4337	0.35/0.40	0.60/0.80	1.65/2.00	0.70/0.90	0.20/0.30	Si 0.20/0.35	1964
4419	0.18/0.23	0.45/0.65	...	...	0.45/0.60	Si 0.15/0.30	1977
4419 H	0.17/0.23	0.35/0.75	...	...	0.45/0.60	Si 0.15/0.30	1977
4422	0.20/0.25	0.70/0.90	...	...	0.35/0.45		
4427	0.24/0.29	0.70/0.90	...	...	0.35/0.45		
4608	0.06/0.11	0.25/0.45	1.40/1.75	...	0.15/0.25	Si 0.25 max	1956
46B12^B	0.10/0.15	0.45/0.65	1.65/2.00	...	0.20/0.30		1957
4615	0.13/0.18	0.45/0.65	1.65/2.00	...	0.20/0.30		
4617	0.15/0.20	0.45/0.65	1.65/2.00	...	0.20/0.30		
X4620	0.18/0.23	0.50/0.70	1.65/2.00	...	0.20/0.30	Si 0.20/0.35	1956

FORMER STANDARD SAE STEELS

(SAE J1249 JUN 2000)

Steel Grade	Chemical Composition Ranges and Limits, Percent ^A						Last Date
	C	Mn	Ni	Cr	Mo	Other	
4621	0.18/0.23	0.70/0.90	1.65/2.00	...	0.20/0.30	Si 0.15/0.30	1977
4621 H	0.17/0.23	0.60/1.00	1.55/2.00	...	0.20/0.30	Si 0.15/0.30	1977
4626	0.24/0.29	0.45/0.65	0.70/1.00	...	0.15/0.25		
4640	0.38/0.43	0.60/0.80	1.65/2.00	...	0.20/0.30	Si 0.20/0.35	1952
4715	0.13/0.18	0.70/0.90	0.70/1.00	0.45/0.65	0.45/0.60		1993
4718	0.16/0.21	0.70/0.90	0.90/1.20	0.35/0.55	0.30/0.40		
4720	0.17/0.22	0.50/0.70	0.90/1.20	0.35/0.55	0.15/0.25		1993
4812	0.10/0.15	0.50/0.70	3.25/3.75	...	0.20/0.30	Si 0.20/0.35	1956
4815	0.13/0.18	0.40/0.60	3.25/3.75	...	0.20/0.30		1993
4817	0.15/0.20	0.40/0.60	3.25/3.75	...	0.20/0.30		
5015	0.12/0.17	0.40/0.60	...	0.30/0.50	...	Si 0.15/0.30	1977
50B40 ^B	0.38/0.43	0.75/1.00	...	0.40/0.60	...		
50B44 ^B	0.43/0.48	0.75/1.00	...	0.40/0.60	...		
5045	0.43/0.48	0.70/0.90	...	0.55/0.75	...	Si 0.20/0.35	1953
5046	0.43/0.48	0.75/1.00	...	0.20/0.35	...		

FORMER STANDARD SAE STEELS

(SAE J1249 JUN 2000)

Steel Grade	Chemical Composition Ranges and Limits, Percent ^A						Last Date
	C	Mn	Ni	Cr	Mo	Other	
50B50 ^B	0.48/0.53	0.75/1.00	...	0.40/0.60	...		
5060	0.56/0.64	0.75/1.00	...	0.40/0.60	...		
50B60 ^B	0.56/0.64	0.75/1.00	...	0.40/0.60	...		
5115	0.13/0.18	0.70/0.90	...	0.40/0.60	...		
5117	0.15/0.20	0.70/0.90	...	0.70/0.90	...		
5135	0.33/0.38	0.60/0.80	...	0.80/1.05	...		
5145	0.43/0.48	0.70/0.90	...	0.70/0.90	...	Si 0.15/0.30	1977
5145H	0.42/0.49	0.60/1.00	...	0.60/1.00	...	Si 0.15/0.30	1977
5147	0.46/0.51	0.70/0.95	...	0.85/1.15	...		
5152	0.48/0.55	0.70/0.90	...	0.90/1.20	...	Si 0.20/0.35	1956
5155	0.51/0.59	0.70/0.90	...	0.70/0.90	...		
50100	0.98/1.10	0.25/0.45	...	0.40/0.60	...		
E51100 ^C	0.98/1.10	0.25/0.45	...	0.90/1.15	...		1993
6115	0.10/0.20	0.30/0.60	...	0.80/1.10	...	V 0.15 min	1936
6117	0.15/0.20	0.70/0.90	...	0.70/0.90	...	V 0.10 min	1956

FORMER STANDARD SAE STEELS

(SAE J1249 JUN 2000)

Steel Grade	Chemical Composition Ranges and Limits, Percent ^A						Last Date
	C	Mn	Ni	Cr	Mo	Other	
6118	0.16/0.21	0.50/0.70	...	0.50/0.70	...	V 0.10/0.15	
6120	0.17/0.22	0.70/0.90	...	0.70/0.90	...	V 0.10 min	1961
6125	0.20/0.30	0.60/0.90	...	0.80/1.10	...	V 0.15 min	1936
6130	0.25/0.35	0.60/0.90	...	0.80/1.10	...	V 0.15 min	1936
6135	0.30/0.40	0.60/0.90	...	0.80/1.10	...	V 0.15 min	1941
6140	0.35/0.45	0.60/0.90	...	0.80/1.10	...	V 0.15 min	1936
6145	0.43/0.48	0.70/0.90	...	0.80/1.10	...	V 0.15 min	1956
6195	0.90/1.05	0.20/0.45	...	0.80/1.10	...	V 0.15 min	1936
8115	0.13/0.18	0.70/0.90	0.20/0.40	0.30/0.50	0.08/0.15		
81B45^B	0.43/0.48	0.75/1.00	0.20/0.40	0.35/0.55	0.08/0.15		
8625	0.23/0.28	0.70/0.90	0.40/0.70	0.40/0.60	0.15/0.25		
8627	0.25/0.30	0.70/0.90	0.40/0.70	0.40/0.60	0.15/0.25		
8632	0.30/0.35	0.70/0.90	0.40/0.70	0.40/0.60	0.15/0.25	Si 0.20/0.35	1951
8635	0.33/0.38	0.75/1.00	0.40/0.70	0.40/0.60	0.15/0.25	Si 0.20/0.35	1956
8637	0.35/0.40	0.75/1.00	0.40/0.70	0.40/0.60	0.15/0.25		1993

FORMER STANDARD SAE STEELS

(SAE J1249 JUN 2000)

Steel Grade	Chemical Composition Ranges and Limits, Percent ^A						Last Date
	C	Mn	Ni	Cr	Mo	Other	
8641	0.38/0.43	0.75/1.00	0.40/0.70	0.40/0.60	0.15/0.25	S 0.04/0.06	1956
8642	0.40/0.45	0.75/1.00	0.40/0.70	0.40/0.60	0.15/0.25		
86B45^B	0.43/0.48	0.75/1.00	0.40/0.70	0.40/0.60	0.15/0.25		
8647	0.45/0.50	0.75/1.00	0.40/0.70	0.40/0.60	0.15/0.25	Si 0.20/0.35	1948
8650	0.48/0.53	0.75/1.00	0.40/0.70	0.40/0.60	0.15/0.25		
8653	0.50/0.56	0.75/1.00	0.40/0.70	0.50/0.80	0.15/0.25	Si 0.20/0.35	1956
8655	0.51/0.59	0.75/1.00	0.40/0.70	0.40/0.60	0.15/0.25		
8660	0.56/0.64	0.75/1.00	0.40/0.70	0.40/0.60	0.15/0.25		
8715	0.13/0.18	0.70/0.90	0.40/0.70	0.40/0.60	0.20/0.30	Si 0.20/0.35	1956
8717	0.15/0.20	0.70/0.90	0.40/0.70	0.40/0.60	0.20/0.30	Si 0.20/0.35	1956
8719	0.18/0.23	0.60/0.80	0.40/0.70	0.40/0.60	0.20/0.30	Si 0.20/0.35	1952
8735	0.33/0.38	0.75/1.00	0.40/0.70	0.40/0.60	0.20/0.30	Si 0.20/0.35	1952
8740	0.38/0.43	0.75/1.00	0.40/0.70	0.40/0.60	0.20/0.30		
8742	0.40/0.45	0.75/1.00	0.40/0.70	0.40/0.60	0.20/0.30	Si 0.20/0.35	1964
8745	0.43/0.48	0.75/1.00	0.40/0.70	0.40/0.60	0.20/0.30	Si 0.20/0.35	1953

FORMER STANDARD SAE STEELS

(SAE J1249 JUN 2000)

Steel Grade	Chemical Composition Ranges and Limits, Percent ^A						Last Date
	C	Mn	Ni	Cr	Mo	Other	
8750	0.48/0.53	0.75/1.00	0.40/0.70	0.40/0.60	0.20/0.30	Si 0.20/0.35	1956
9250	0.45/0.55	0.60/0.90	...	...	...	Si 1.80/2.20	1941
9254	0.51/0.59	0.60/0.80	...	0.60/0.80	...	Si 1.20/1.60	
9255	0.51/0.59	0.70/0.95	...	...	...	Si 1.80/2.20	1977
9261	0.55/0.65	0.75/1.00	...	0.10/0.25	...	Si 1.80/2.20	1956
9262	0.55/0.65	0.75/1.00	...	0.25/0.40	...	Si 1.80/2.20	1961
9310	0.08/0.13	0.45/0.65	3.00/3.50	1.00/1.40	0.08/0.15		
9315	0.13/0.18	0.45/0.65	3.00/3.50	1.00/1.40	0.08/0.15	Si 0.20/0.35	1959
9317	0.15/0.20	0.45/0.65	3.00/3.50	1.00/1.40	0.08/0.15	Si 0.20/0.35	1959
94B15 ^B	0.13/0.18	0.75/1.00	0.30/0.60	0.30/0.50	0.08/0.15		
94B17 ^B	0.15/0.20	0.75/1.00	0.30/0.60	0.30/0.50	0.08/0.15		
94B30 ^B	0.28/0.33	0.75/1.00	0.30/0.60	0.30/0.50	0.08/0.15		
9437	0.35/0.40	0.90/1.20	0.30/0.60	0.30/0.50	0.08/0.15	Si 0.20/0.35	1950
9440	0.38/0.43	0.90/1.20	0.30/0.60	0.30/0.50	0.08/0.15	Si 0.20/0.35	1950
94B40 ^B	0.38/0.43	0.75/1.00	0.30/0.60	0.30/0.50	0.08/0.15		1964

FORMER STANDARD SAE STEELS

(SAE J1249 JUN 2000)

Steel Grade	Chemical Composition Ranges and Limits, Percent ^A						Last Date
	C	Mn	Ni	Cr	Mo	Other	
9442	0.40/0.45	0.90/1.20	0.30/0.60	0.30/0.50	0.08/0.15	Si 0.20/0.35	1950
9445	0.43/0.48	0.90/1.20	0.30/0.60	0.30/0.50	0.08/0.15	Si 0.20/0.35	1950
9447	0.45/0.50	0.90/1.20	0.30/0.60	0.30/0.50	0.08/0.15	Si 0.20/0.35	1950
9747	0.45/0.50	0.50/0.80	0.40/0.70	0.10/0.25	0.15/0.25	Si 0.20/0.35	1950
9763	0.60/0.67	0.50/0.80	0.40/0.70	0.10/0.25	0.15/0.25	Si 0.20/0.35	1950
9840	0.38/0.43	0.70/0.90	0.85/1.15	0.70/0.90	0.20/0.30	Si 0.20/0.35	1964
9845	0.43/0.48	0.70/0.90	0.85/1.15	0.70/0.90	0.20/0.30	Si 0.20/0.35	1950
9850	0.48/0.53	0.70/0.90	0.85/1.15	0.70/0.90	0.20/0.30	Si 0.20/0.35	1961
43BV12^D	0.08/0.13	0.75/1.00	1.65/2.00	0.40/0.60	0.20/0.30	Si 0.20/0.35	
43BV14^D	0.10/0.15	0.45/0.65	1.65/2.00	0.40/0.60	0.08/0.15	Si 0.20/0.35	

^A Standard alloy steels usually contain 0.035% maximum P and 0.040% S, unless noted otherwise. Standard alloy steels usually contain 0.15/0.35% Si, unless noted otherwise.

^B Boron content 0.0005/0.003%

^C Letter "E" preceding the grade indicates electric arc furnace steel. P and S are each 0.025% maximum.

^D Boron content 0.0005/0.003% and V content is 0.03% min.

CARBURIZING BEARING QUALITY STEELS

(ASTM A 534 – 04)

Steel Grade	Chemical Composition Ranges and Limits, Percent ^{A,B,C,D}							
	C	Mn	P (max)	S (max)	Si	Cr	Ni	Mo
4118H	0.17/0.23	0.60/1.00	0.025	0.015	0.15/0.35	0.30/0.70	...	0.08/0.15
4320H	0.17/0.23	0.40/0.70	0.025	0.015	0.15/0.35	0.35/0.65	1.55/2.00	0.20/0.30
4620H	0.17/0.23	0.35/0.75	0.025	0.015	0.15/0.35	...	1.55/2.00	0.20/0.30
4720H	0.17/0.23	0.45/0.75	0.025	0.015	0.15/0.35	0.30/0.60	0.85/1.25	0.15/0.25
4817H	0.14/0.20	0.30/0.70	0.025	0.015	0.15/0.35	...	3.20/3.80	0.20/0.30
4820H	0.17/0.23	0.40/0.80	0.025	0.015	0.15/0.35	...	3.20/3.80	0.20/0.30
5120H	0.17/0.23	0.60/1.00	0.025	0.015	0.15/0.35	0.60/1.00	...	...
8617H	0.14/0.20	0.60/0.95	0.025	0.015	0.15/0.35	0.35/0.65	0.35/0.75	0.15/0.25
8620H	0.17/0.23	0.60/0.95	0.025	0.015	0.15/0.35	0.35/0.65	0.35/0.75	0.15/0.25
9310H	0.07/0.13	0.40/0.70	0.025	0.015	0.15/0.35	1.00/1.45	2.95/3.55	0.08/0.15
20Cr3	0.17/0.23	0.60/1.00	0.025	0.015	0.40 max	0.60/1.00	...	...
20Cr4	0.17/0.23	0.60/0.90	0.025	0.015	0.40 max	0.90/1.20	...	...
20MnCr4-2	0.17/0.23	0.65/1.10	0.025	0.015	0.40 max	0.40/0.75	...	...
17MnCr5	0.14/0.19	1.00/1.30	0.025	0.015	0.40 max	0.80/1.10	...	...
19MnCr5	0.17/0.22	1.10/1.40	0.025	0.015	0.40 max	1.00/1.30	...	...
15CrMo4	0.12/0.18	0.60/0.90	0.025	0.015	0.40 max	0.90/1.20	...	0.15/0.25

CARBURIZING BEARING QUALITY STEELS

(ASTM A 534 – 04)

Steel Grade	Chemical Composition Ranges and Limits, Percent ^{A,B,C,D}							
	C	Mn	P (max)	S (max)	Si	Cr	Ni	Mo
20CrMo4	0.17/0.23	0.60/0.90	0.025	0.015	0.40 max	0.90/1.20	...	0.15/0.25
20MnCrMo4-2	0.17/0.23	0.65/1.10	0.025	0.015	0.40 max	0.40/0.75	...	0.10/0.20
20NiCrMo2	0.17/0.23	0.60/0.95	0.025	0.015	0.40 max	0.35/0.65	0.40/0.70	0.15/0.25
20NiCrMo7	0.17/0.23	0.40/0.70	0.025	0.015	0.40 max	0.35/0.65	1.60/2.00	0.20/0.30
18CrNiMo7-6	0.15/0.21	0.50/0.90	0.025	0.015	0.40 max	1.50/1.80	1.40/1.70	0.25/0.35
18NiCrMo14-6	0.15/0.20	0.40/0.70	0.025	0.015	0.40 max	1.30/1.60	3.25/3.75	0.15/0.25
16NiCrMo16-5	0.14/0.18	0.25/0.55	0.025	0.015	0.40 max	1.00/1.40	3.80/4.30	0.20/0.30

^A Elements not quoted shall not be intentionally added to the steel without the agreement of the purchaser.

^B Intentional additions of Ca or Ca alloys for deoxidation or inclusion shape control are not permitted unless specifically approved by the purchaser.

^C All grades have the following maximum limits: 0.30% max Cu, 0.0020% max O, and 0.050% max Al.

^D For machinability purposes, S may be specified as 0.015-0.030%.

Microcleanliness Requirements (ASTM E45)			
Thin		Heavy	
A	2.5	A	1.5
B	2	B	1
C	0.5	C	0.5
D	1	D	1
Macrostructure Requirements (ASTM E381): S2 R2 C2			

MEDIUM CARBON BEARING QUALITY STEELS

(ASTM A 866 – 01)

Steel Grade	Chemical Composition Ranges and Limits, Percent ^{A,B}									
	C	Mn	P ^C	S ^C	Si	Cr	Mo	Cu (max)	O (max) ^D	Al (max)
1030	0.28/0.34	0.60/0.90	0.025	0.025	0.15/0.35	...	...	0.30	0.0020	0.050
1040	0.37/0.44	0.60/0.90	0.025	0.025	0.15/0.35	...	...	0.30	0.0020	0.050
1050	0.48/0.55	0.60/0.90	0.025	0.025	0.15/0.35	...	...	0.30	0.0020	0.050
1541	0.36/0.44	1.35/1.65	0.025	0.025	0.15/0.35	...	...	0.30	0.0020	0.050
1552	0.47/0.55	1.20/1.50	0.025	0.025	0.15/0.35	...	...	0.30	0.0020	0.050
4130	0.28/0.33	0.40/0.60	0.025	0.025	0.15/0.35	0.80/1.10	0.15/0.25	0.30	0.0020	0.050
4140	0.38/0.43	0.75/1.00	0.025	0.025	0.15/0.35	0.80/1.10	0.15/0.25	0.30	0.0020	0.050
4150	0.48/0.53	0.75/1.00	0.025	0.025	0.15/0.35	0.80/1.10	0.15/0.25	0.30	0.0020	0.050
5140	0.38/0.43	0.70/0.95	0.025	0.025	0.15/0.35	0.70/0.90	...	0.30	0.0020	0.050
5150	0.48/0.53	0.70/0.90	0.025	0.025	0.15/0.35	0.70/0.90	...	0.30	0.0020	0.050
6150^E	0.48/0.53	0.70/0.90	0.025	0.025	0.15/0.35	0.80/1.10	...	0.30	0.0020	0.050

MEDIUM CARBON BEARING QUALITY STEELS

(ASTM A 866 – 01)

Steel Grade	Chemical Composition Ranges and Limits, Percent ^{A,B}									
	C	Mn	P ^C	S ^C	Si	Cr	Mo	Cu (max)	O (max) ^D	Al (max)
C56E2^F	0.52/0.60	0.60/0.90	0.025	0.015	0.40 max	...	...	0.30	0.0020	0.050
56Mn4^F	0.52/0.60	0.90/1.20	0.025	0.015	0.40 max	...	...	0.30	0.0020	0.050
43CrMo4^F	0.40/0.46	0.60/0.90	0.025	0.015	0.40 max	0.90/1.20	0.15/0.30	0.30	0.0020	0.050

^A Elements not quoted shall not be intentionally added to the steel without the agreement of the purchaser.

^B Intentional additions of Ca or Ca alloys for deoxidation or inclusion shape control are not permitted unless specifically approved by the purchaser.

^C P and S are maximum limits.

^D Oxygen content applies to product analysis and shall be determined in accordance with Test Method ASTM E 1019.

^E Requires 0.15 min V.

^F Specified element ranges meet the requirements of ISO 683, Part 17, Table 3, NO. B1, 100CR6.

Note: The same inclusion and macrostructure requirements apply as are specified in ASTM A 534 – 04.

HIGH CARBON BEARING QUALITY STEELS

(ASTM A 295/A 295M – 05)

Steel Grade	Chemical Composition Ranges and Limits, Percent ^{A,B,C}									
	C	Mn	P ^D	S ^D	Cr	Ni (max)	Mo	Cu (max)	O (max) ^E	Al (max) ^F
52100^G	0.93/1.05	0.25/0.45	0.025	0.015	1.35/1.60	0.25	0.10 max	0.30	0.0015	0.050
5195	0.90/1.03	0.75/1.00	0.025	0.015	0.70/0.90	0.25	0.10 max	0.30	0.0015	0.050
5090M	0.89/1.01	0.50/0.80	0.025	0.015	0.40/0.60	0.25	0.08/0.15	0.30	0.0015	0.050
1070M	0.65/0.75	0.80/1.10	0.025	0.015	0.20 max	0.25	0.10 max	0.30	0.0015	0.050
5160	0.56/0.64	0.75/1.00	0.025	0.015	0.70/0.90	0.25	0.10 max	0.30	0.0015	0.050

^A Elements not quoted shall not be intentionally added to the steel without the agreement of the purchaser.

^B Intentional additions of Ca or Ca alloys for deoxidation or inclusion shape control are not permitted unless specifically approved by the purchaser.

^C The Si range for all grades is 0.15/0.35%.

^D P and S are maximum limits.

^E Oxygen content applies to product analysis and shall be determined in accordance with Test Method ASTM E 1019.

^F Total Al content.

^G Specified element ranges meet the requirements of ISO 683, Part 17, Table 3, NO. B1, 100CR6.

Note: The same inclusion and macrostructure requirements apply as are specified in ASTM A 534 – 04.