Practical Data for Metallurgists

Fourteenth Edition

Since it was first introduced in 1953, The Timken Company's ***Practical Data for Metallurgists*** has grown in popularity such that technical experts, operations managers and engineering personnel consider it as their indispensable guide to the latest metallurgical information. This listing of standard steels, their chemical compositions, hardening abilities and tolerances conforms with information published by the American Iron and Steel Institute and the Society of Automotive Engineers.

Timken has a proud heritage of serving the technical needs of its steel customers across a broad spectrum of industries for 100 years. Our metallurgical expertise, coupled with the finest quality alloy steel bars, tubes and parts, offers value from the boiler room to the board room.

For more information about Timken steel, or to inquire about how to get additional copies of this guide, call 800-223-1954, extension 4023. Outside the U.S. and Canada, call 330-471-4162.

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SAE No.	C	Mn	SAE No.	C	Mn
1005	.06 max	.35 max	**1040**	.37/.44	.60/.90
1006	.08 max	.25/.40	**1042**	.40/.47	.60/.90
1008	.10 max	.30/.50	**1043**	.40/.47	.70/1.00
			1044	.43/.50	.30/.60
1010	.08/.13	.30/.60	**1045**	.43/.50	.60/.90
1011	.09/.14	.60/.90	**1046**	.43/.50	.70/1.00
1012	.10/.15	.30/.60	**1049**	.46/.53	.60/.90
1015	.13/.18	.30/.60			
1016	.13/.18	.60/.90	**1050**	.48/.55	.60/.90
1017	.15/.20	.30/.60	**1053**	.48/.55	.70/1.00
1018	.15/.20	.60/.90	**1055**	.50/.60	.60/.90
			1059	.55/.65	.50/.80
1020	.18/.23	.30/.60			
1021	.18/.23	.60/.90	**1060**	.55/.65	.60/.90
1022	.18/.23	.70/1.00	**1065**	.60/.70	.60/.90
1023	.20/.25	.30/.60			
1025	.22/.28	.30/.60	**1070**	.65/.75	.60/.90
1026	.22/.28	.60/.90	**1074**	.70/.80	.50/.80
1029	.25/.31	.60/.90	**1078**	.72/.85	.30/.60
1030	.28/.34	.60/.90	**1080**	.75/.88	.60/.90
1035	.32/.38	.60/.90	**1086**	.80/.93	.30/.50
1038	.35/.42	.60/.90	**1090**	.85/.98	.60/.90
1039	.37/.44	.70/1.00	**1095**	.90/1.03	.30/.50

P = .040 max S = .050 max

FREE CUTTING RESULPHURIZED STEELS

Chemical Composition Ranges and Limits

SAE No.	C	Mn	P Max	S
1110	.08/.13	.30/.60	.040	.08/.13
1117	.14/.20	1.00/1.30	.040	.08/.13
1118	.14/.20	1.30/1.60	.040	.08/.13
1123	.20/.27	1.20/1.50	.040	.06/.09
1137	.32/.39	1.35/1.65	.040	.08/.13
1140	.37/.44	.70/1.00	.040	.08/.13
1141	.37/.45	1.35/1.65	.040	.08/.13
1144	.40/.48	1.35/1.65	.040	.24/.33
1146	.42/.49	.70/1.00	.040	.08/.13
1152	.48/.55	.70/1.00	.040	.06/.09

FREE CUTTING REPHOSPHORIZED AND RESULPHURIZED STEEL

Chemical Composition Ranges and Limits

SAE No.	C	Mn	P	S
1212	.13 max	.70/1.00	.07/.12	.16/.23
1213	.13 max	.70/1.00	.07/.12	.24/.33
1215	.09 max	.75/1.05	.04/.09	.26/.35

NOTE: 12XX grades are customarily furnished without specified silicon content because of adverse effect on machinability.

HIGH MANGANESE CARBON STEEL

Chemical Composition Ranges and Limits

SAE No.	C	Mn	P Max	S Max
1513	.10/.16	1.10/1.40	.040	.050
1522	.18/.24	1.10/1.40	.040	.050
1524	.19/.25	1.35/1.65	.040	.050
1526	.22/.29	1.10/1.40	.040	.050
1527	.22/.29	1.20/1.50	.040	.050
1533	.30/.37	1.10/1.40	.040	.050
1534	.30/.37	1.20/1.50	.040	.050
1541	.36/.44	1.35/1.65	.040	.050
1544	.40/.47	.80/1.10	.040	.050
1545	.43/.50	.80/1.10	.040	.050
1546	.44/.52	1.00/1.30	.040	.050
1548	.44/.52	1.10/1.40	.040	.050
1552	.47/.55	1.20/1.50	.040	.050
1553	.48/.55	.80/1.10	.040	.050
1566	.60/.71	.85/1.15	.040	.050
1570	.65/.75	.80/1.10	.040	.050
1580	.75/.88	.80/1.10	.040	.050
1590	.85/.98	.80/1.10	.040	.050

STANDARD ALLOY STEELS

Chemical Composition Ranges and Limits

SAE No.	C	Mn	Cr	Ni	Mo	Other
1330	.28/.33	1.60/1.90	.....	.....	.....	.....
1335	.33/.38	1.60/1.90	.....	.....	.....	.....
1340	.38/.43	1.60/1.90	.....	.....	.....	.....
4023	.20/.25	.70/.90	.....	.....	.20/.30	.....
4027	.25/.30	.70/.90	.....	.....	.20/.30	.....
4028*	.25/.30	.70/.90	.....	.....	.20/.30	.....
4037	.35/.40	.70/.90	.....	.....	.20/.30	.....
4047	.45/.50	.70/.90	.....	.....	.20/.30	.....
4118	.18/.23	.70/.90	.40/.60	.....	.08/.15	.....
4120[a]	.18/.23	.90/1.20	.40/.60	.....	.13/.20	.....
4121[b]	.18/.23	.75/1.00	.45/.65	.....	.20/.30	.....
4130	.28/.33	.40/.60	.80/1.10	.....	.15/.25	.....
4131	.28/.33	.50/.70	.90/1.20	.....	.15/.25	.....
4137	.35/.40	.70/.90	.80/1.10	.....	.15/.25	.....
4140	.38/.43	.75/1.00	.80/1.10	.....	.15/.25	.....
4142	.40/.45	.75/1.00	.80/1.10	.....	.15/.25	.....
4145	.43/.48	.75/1.00	.80/1.10	.....	.15/.25	.....
4147	.45/.50	.75/1.00	.80/1.10	.....	.15/.25	.....
4150	.48/.53	.75/1.00	.80/1.10	.....	.15/.25	.....
4320	.17/.22	.45/ .65	.40/.60	1.65/2.00	.20/.30	.....
4340	.38/.43	.60/.80	.70/.90	1.65/2.00	.20/.30	.....
E4340	.38/.43	.65/.85	.70/.90	1.65/2.00	.20/.30	.....
4620	.17/.22	.45/.65	.....	1.65/2.00	.20/.30	.....
4715[c]	.13/.18	.70/.90	.45/.65	.70/1.00	.45/.65	.....
4720	.17/.22	.50/.70	.35/.55	.90/1.20	.15/.25	.....
4815	.13/.18	.40/.60	.....	3.25/3.75	.20/.30	.....
4820	.18/.23	.50/.70	.....	3.25/3.75	.20/.30	.....
50B46§	.44/.49	.75/1.00	.20/.35	.....	.....	.....
5120	.17/.22	.70/.90	.70/.90	.....	.....	.....
5130	.28/.33	.70/.90	.80/1.10	.....	.....	.....
5132	.30/.35	.60/.80	.75/1.00	.....	.....	.....
5140	.38/.43	.70/.90	.70/.90	.....	.....	.....
5150	.48/.53	.70/.90	.70/.90	.....	.....	.....
5160	.56/.64	.75/1.00	.70/.90	.....	.....	.....
51B60§	.56/.64	.75/1.00	.70/.90	.....	.....	.....
51100	.98/1.10	.25/.45	.90/1.15	.....	.....	.....
52100	.98/1.10	.25/.45	1.30/1.60	.....	.....	.....
6150	.48/.53	.70/.90	.80/1.10	.....	.....	.15 min

STANDARD ALLOY STEELS - continued

SAE No.	C	Mn	Cr	Ni	Mo	Other
8615	.13/.18	.70/.90	.40/.60	.40/.70	.15/.25	.....
8617	.15/.20	.70/.90	.40/.60	.40/.70	.15/.25	.....
8620	.18/.23	.70/.90	.40/.60	.40/.70	.15/.25	.....
8622	.20/.25	.70/.90	.40/.60	.40/.70	.15/.25	.....
8630	.28/.33	.70/.90	.40/.60	.40/.70	.15/.25	.....
8637	.35/.40	.75/1.00	.40/.60	.40/.70	.15/.25	.....
8640	.38/.43	.75/1.00	.40/.60	.40/.70	.15/.25	.....
8645	.43/.48	.75/1.00	.40/.60	.40/.70	.15/.25	.....
8720	.18/.23	.70/.90	.40/.60	.40/.70	.20/.30	.....
8822	.20/.25	.75/1.00	.40/.60	.40/.70	.30/.40	.....
						Si
9259	.56/.64	.75/1.00	.45/.65	.....	.....	.70/1.10
9260	.56/.64	.75/1.00	.....	.....	.....	1.80/2.20

* S = .035/.050
§ B = .0005/.003

[a] Formerly PS 15
[b] Formerly PS 24
[c] Formerly PS 30

Unless specified:

Si = .15/.35, P = .030 max (SAE J1268), S = .040 max, Ni = .25 max, Cr = .20 max, Mo = .06 max

These standard grades can have modifications in chemistry when agreed upon by user and supplier.

PS GRADES (Formerly EX Grades)

Chemical Composition Ranges and Limits

PS No.	C	Mn	Cr	Ni	Mo	Other
10	.19/.24	.95/1.25	.25/.40	.20/.40	.05/.10	.....
16	.20/.25	.90/1.20	.40/.60	.....	.13/.20	.....
17	.23/.28	.90/1.20	.40/.60	.....	.13/.20	.....
18	.25/.30	.90/1.20	.40/.60	.....	.13/.20	**B**
19	.18/.23	.90/1.20	.40/.60	.....	.08/.15	.0005-.003
20	.13/.18	.90/1.20	.40/.60	.....	.13/.20	.....
21	.15/.20	.90/1.20	.40/.60	.....	.13/.20	.....
31	.15/.20	.70/.90	.45/.65	.70/1.00	.45/.60	.....
32	.18/.23	.70/.90	.45/.65	.70/1.00	.45/.60	.....
33	.17/.24	.85/1.25	.20 min	.20 min	.05 min	.....
34	.28/.33	.90/1.20	.40/.60	.....	.13/.20	.....
36	.38/.43	.90/1.20	.45/.65	.....	.13/.20	.....
38	.43/.48	.90/1.20	.45/.65	.....	.13/.20	.....
39	.48/.53	.90/1.20	.45/.65	.....	.13/.20	.....
40	.51/.59	.90/1.20	.45/.65	.....	.13/.20	.....
54	.19/.25	.70/1.05	.40/.70	.....	.05 min	.....
55	.15/.20	.70/1.00	.45/.65	1.65/2.00	.65/.80	.....
56	.08/.13	.70/1.00	.45/.65	1.65/2.00	.65/.80	.....
57†	.08 max	1.25 max	17.00/19.00	.....	1.75/2.25	.....
58	.16/.21	1.00/1.30	.45/.65	.....	.....	.....
59	.18/.23	1.00/1.30	.70/.90	.....	.....	.....
61	.23/.28	1.00/1.30	.70/.90	.....	.....	**B**
63	.31/.38	.75/1.10	.45/.65	.....	.....	.0005-.003
64	.16/.21	1.00/1.30	.70/.90	.....	.....	.....
65	.21/.26	1.00/1.30	.70/.90	.....	.....	**V**
66	.16/.21	.40/.70	.45/.75	1.65/2.00	.08/.15	.10/.15
67	.42/.49	.80/1.20	.85/ 1.20	.....	.25/.35	.....

Unless Specified:
Si = .15/.35, P = .035 max, S = .040 max

†P = .040 max, S = .15/.35, Si = 1.00 max

Note : PS Nos. 15, 24 and 30 are now standard grades.
(See SAE Nos. 4120, 4121 and 4715)

STANDARD H STEELS

Chemical Composition Ranges

SAE No.	C	Mn	Cr	Ni	Mo	Other
1330 H	.27/.33	1.45/2.05	.....	.....	.....	.....
1335 H	.32/.38	1.45/2.05	.....	.....	.....	.....
1340 H	.37/.44	1.45/2.05	.....	.....	.....	.....
1345 H	.42/.49	1.45/2.05	.....	.....	.....	.....
4027 H	.24/.30	.60/1.00	.....	.....	.20/.30	.....
4028 H[a]	.24/.30	.60/1.00	.....	.....	.20/.30	.....
4032 H	.29/.35	.60/1.00	.....	.....	.20/.30	.....
4037 H	.34/.41	.60/1.00	.....	.....	.20/.30	.....
4042 H	.39/.46	.60/1.00	.....	.....	.20/.30	.....
4047 H	.44/.51	.60/1.00	.....	.....	.20/.30	.....
4118 H	.17/.23	.60/1.00	.30/.70	.....	.08/.15	.....
4130 H	.27/.33	.30/.70	.75/1.20	.....	.15/.25	.....
4135 H	.32/.38	.60/1.00	.75/1.20	.....	.15/.25	.....
4137 H	.34/.41	.60/1.00	.75/1.20	.....	.15/.25	.....
4140 H	.37/.44	.65/1.10	.75/1.20	.....	.15/.25	.....
4142 H	.39/.46	.65/1.10	.75/1.20	.....	.15/.25	.....
4145 H	.42/.49	.65/1.10	.75/1.20	.....	.15/.25	.....
4147 H	.44/.51	.65/1.10	.75/1.20	.....	.15/.25	.....
4150 H	.47/.54	.65/1.10	.75/1.20	.....	.15/.25	.....
4161 H	.55/.65	.65/1.10	.65/.95	.....	.25/.35	.....
4320 H	.17/.23	.40/.70	.35/.65	1.55/2.00	.20/.30	.....
4340 H	.37/.44	.55/.90	.65/.95	1.55/2.00	.20/.30	.....
E4340 H	.37/.44	.60/.95	.65/.95	1.55/2.00	.20/.30	.....
4620 H	.17/.23	.35/.75	.....	1.55/2.00	.20/.30	.....
4718 H	.15/.21	.60/.95	.30/.60	.85/1.25	.30/.40	.....
4720 H	.17/.23	.45/.75	.30/.60	.85/1.25	.15/.25	.....
4815 H	.12/.18	.30/.70	.....	3.20/3.80	.20/.30	.....
4817 H	.14/.20	.30/.70	.....	3.20/3.80	.20/.30	.....
4820 H	.17/.23	.40/.80	.....	3.20/3.80	.20/.30	.....
50B40 H[b]	.37/.44	.65/1.10	.30/.70	.....	.....	.....
50B44 H[b]	.42/.49	.65/1.10	.30/.70	.....	.....	.....
5046 H	.43/.50	.65/1.10	.13/.43	.....	.....	.....
50B46 H[b]	.43/.50	.65/1.10	.13/.43	.....	.....	.....
50B50 H[b]	.47/.54	.65/1.10	.30/.70	.....	.....	.....
50B60 H[b]	.55/.65	.65/1.10	.30/.70	.....	.....	.....

[a] S = .035/.050
[b] B = .0005/.003

STANDARD H STEELS - continued

SAE No.	C	Mn	Cr	Ni	Mo	Other
5120 H	.17/.23	.60/1.00	.60/1.00	.....	.....	.....
5130 H	.27/.33	.60/1.10	.75/1.20	.....	.....	.....
5132 H	.29/.35	.50/.90	.65/1.10	.....	.....	.....
5135 H	.32/.38	.50/.90	.70/1.15	.....	.....	.....
5140 H	.37/.44	.60/1.00	.60/1.00	.....	.....	.....
5147 H	.45/.52	.60/1.05	.80/1.25	.....	.....	.....
5150 H	.47/.54	.60/1.00	.60/1.00	.....	.....	.....
5155 H	.50/.60	.60/1.00	.60/1.00	.....	.....	.....
5160 H	.55/.65	.65/1.10	.60/1.00	.....	.....	.....
51B60H[b]	.55/.65	.65/1.10	.60/1.00	.....	.....	.....
						V
6118 H	.15/.21	.40/.80	.40/.80	.....	.....	.10/.15
6150 H	.47/.54	.60/1.00	.75/1.20	.....	.....	.15
81B45 H[b]	.42/.49	.70/1.05	.30/.60	.15/.45	.08/.15	.....
8617 H	.14/.20	.60/.95	.35/.65	.35/.75	.15/.25	.....
8620 H	.17/.23	.60/.95	.35/.65	.35/.75	.15/.25	.....
8622 H	.19/.25	.60/.95	.35/.65	.35/.75	.15/.25	.....
8625 H	.22/.28	.60/.95	.35/.65	.35/.75	.15/.25	.....
8627 H	.24/.30	.60/.95	.35/.65	.35/.75	.15/.25	.....
8630 H	.27/.33	.60/.95	.35/.65	.35/.75	.15/.25	.....
86B30 H[b]	.27/.33	.60/.95	.35/.65	.35/.75	.15/.25	.....
8637 H	.34/.41	.70/1.05	.35/.65	.35/.75	.15/.25	.....
8640 H	.37/.44	.70/1.05	.35/.65	.35/.75	.15/.25	.....
8642 H	.39/.46	.70/1.05	.35/.65	.35/.75	.15/.25	.....
8645 H	.42/.49	.70/1.05	.35/.65	.35/.75	.15/.25	.....
86B45 H[b]	.42/.49	.70/1.05	.35/.65	.35/.75	.15/.25	.....
8650 H	.47/.54	.70/1.05	.35/.65	.35/.75	.15/.25	.....
8655 H	.50/.60	.70/1.05	.35/.65	.35/.75	.15/.25	.....
8660 H	.55/.65	.70/1.05	.35/.65	.35/.75	.15/.25	.....
8720 H	.17/.23	.60/.95	.35/.65	.35/.75	.20/.30	.....
8740 H	.37/.44	.70/1.05	.35/.65	.35/.75	.20/.30	.....
8822 H	.19/.25	.70/1.05	.35/.65	.35/.75	.30/.40	.....
						Si
9260 H	.55/.65	.65/1.10	.....	.....	.....	1.70/2.20
9310 H	.07/.13	.40/.70	1.00/1.45	2.95/3.55	.08/.15	.....
94B15 H[b]	.12/.18	.70/1.05	.25/.55	.25/.65	.08/.15	.....
94B17 H[b]	.14/.20	.70/1.05	.25/.55	.25/.65	.08/.15	.....
94B30 H[b]	.27/.33	.70/1.05	.25/.55	.25/.65	.08/.15	.....

Unless specified:
Si = .15/.35, P = .030 max (SAE J1268), S = .040 max, Cu = .35 max, Ni = .25 max, Cr = .20 max, Mo = .06 max

[b] B = .0005/.003

STANDARD CARBON and CARBON BORON H STEELS

Chemical Composition Ranges and Limits

SAE No.	C	Mn	P Max	S Max	Si
1038 H	.34/.43	.50/1.00	.040	.050	.15/.35
1045 H	.42/.51	.50/1.00	.040	.050	.15/.35
1522 H	.17/.25	1.00/1.50	.040	.050	.15/.35
1524 H	.18/.26	1.25/1.75	.040	.050	.15/.35
1526 H	.21/.30	1.00/1.50	.040	.050	.15/.35
1541 H	.35/.45	1.25/1.75	.040	.050	.15/.35
15B21*	.17/.24	.70/1.20	.040	.050	.15/.35
15B28H	.25/.34	1.0/1.50	.040	.050	.15/.35
15B30H	.27/.35	.70/1.20	.040	.050	.15/.35
15B35H*	.31/.39	.70/1.20	.040	.050	.15/.35
15B37H*	.30/.39	1.00/1.50	.040	.050	.15/.35
15B41H*	.35/.45	1.25/1.75	.040	.050	.15/.35
15B48H*	.43/.53	1.00/1.50	.040	.050	.15/.35
15B62H*	.54/.67	1.00/1.50	.040	.050	.40/.60

For electric furnace steels P & S = .025 max and the prefix E is added.
* B = .0005/.003

RESTRICTED HARDENABILITY STEELS

Chemical Composition Ranges

SAE No.	C	Mn	Si	Ni	Cr	Mo
15B21RH*	.17/.22	.80/1.10	.15/.35	.....	.....	.....
15B35RH*	.33/.38	.80/1.10	.15/.35	.....	.....	.....
3310RH	.08/.13	.40/.60	.15/.35	3.25/3.75	1.40/1.75	.....
4027RH	.25/.30	.70/.90	.15/.35	.....	.....	.20/.30
4118RH	.18/.23	.70/.90	.15/.35	.....	.40/.60	.08/.15
4120RH	.18/.23	.90/1.20	.15/.35	.....	.40/.60	.13/.20
4130RH	.28/.33	.40/.60	.15/.35	.....	.80/1.10	.15/.25
4140RH	.38/.43	.75/1.00	.15/.35	.....	.80/1.10	.15/.25
4145RH	.43/.48	.75/1.00	.15/.35	.....	.80/1.10	.15/.25
4161RH	.56/.64	.75/1.00	.15/.35	.....	.70/.90	.25/.35
4320RH	.17/.22	.45/.65	.15/.35	1.65/2.00	.40/.60	.20/.30
4620RH	.17/.22	.45/.65	.15/.35	1.65/2.00	.....	.20/.30
4820RH	.18/.23	.50/.70	.15/.35	3.25/3.75	.....	.20/.30
50B40RH*	.38/.43	.75/1.00	.15/.35	.....	.40/.60	.....
5130RH	.28/.33	.70/.90	.15/.35	.....	.80/1.10	.....
5140RH	.38/.43	.70/.90	.15/.35	.....	.70/.90	.....
5160RH	.56/.64	.75/1.00	.15/.35	.....	.70/.90	.....
8620RH	.18/.23	.70/.90	.15/.35	.40/.70	.40/.60	.15/.25
8622RH	.20/.25	.70/.90	.15/.35	.40/.70	.40/.60	.15/.25
8720RH	.18/.23	.70/.90	.15/.35	.40/.70	.40/.60	.20/.30
8822RH	.20/.25	.75/1.00	.15/.35	.40/.70	.40/.60	.30/.40
9310RH	.08/.13	.45/.65	.15/.35	3.00/3.50	1.00/1.40	.08/.15

Unless specified: Cu = .35 max, Ni = .25 max, Cr = .20 max, Mo = .06 max
* B = .0005 /.003

FORMERLY STANDARD STEELS

Chemical Composition Ranges and Limits

SAE No.	C	Mn	P Max	S Max
1009	.15 max	.60 max	.040	.050
1013	.11/.16	.50/.80	.040	.050
1033	.30/.36	.70/1.00	.040	.050
1034	.32/.38	.50/.80	.040	.050
1037	.32/.38	.70/1.00	.040	.050
1059	.55/.65	.50/.80	.040	.050
1062	.54/.65	.85/1.15	.040	.050
1064	.60/.70	.50/.80	.040	.050
1069	.65/.75	.40/.70	.040	.050
1075	.70/.80	.40/.70	.040	.050
1084	.80/.93	.60/.90	.040	.050
1085	.80/.93	.70/1.00	.040	.050
1086	.80/.94	.30/.50	.040	.050
1108	.08/.13	.50/.80	.040	.08/.13
1109	.08/.13	.60/.90	.040	.08/.13
1111	.13 max	.60/.90	.07/0.12	.10/.15
1112	.13 max	.70/1.00	.07/0.12	.16/.23
1113	.13 max	.70/1.00	.07/0.12	.24/.33
1114	.10/.16	1.00/1.30	.040	.08/.13
1115	.13/.18	.60/.90	.040	.08/.13
1116	.14/.20	1.10/1.40	.040	.16/.23
1119	.14/.20	1.00/1.30	.040	.24/.33
1120	.18/.23	.70/1.00	.040	.08/.13
1126	.23/.29	.70/1.00	.040	.08/.13
1132	.27/.34	1.35/1.65	.040	.08/.13
1138	.34/.40	.70/1.00	.040	.08/.13
1139	.35/.43	1.35/1.65	.040	.13/.20
1145	.42/.49	.70/1.00	.040	.04/.07
1151	.48/.55	.70/1.00	.040	.08/.13
1211	.13 max	.60/.90	.07/.12	.10/.15
1320	.18/.23	1.60/1.90	.040	.040
1345	.43/.48	1.60/1.90	.035	.040
1518	.15/.21	1.10/1.40	.040	.050
1525	.23/.29	.80/1.10	.040	.050
1536	.30/.37	1.20/1.50	.040	.050
1547	.43/.51	1.35/1.65	.040	.050
1551	.45/.56	.85/1.15	.040	.050
1561	.55/.65	.75/1.05	.040	.050
1572	.65/.76	1.00/1.30	.040	.050

FORMERLY STANDARD STEELS - continued
Chemical Composition Ranges and Limits

SAE No.	C	Mn	Cr	Ni	Mo	Other
2317	.15/.20	.40/.60	.....	3.25/3.75	.....	.....
2330	.28/.33	.60/.80	.....	3.25/3.75	.....	.....
2340	.38/.43	.70/.90	.....	3.25/3.75	.....	.....
2345	.43/.48	.70/.90	.....	3.25/3.75	.....	.....
2512	.09/.14	.45/.60	.....	4.75/5.25	.....	.....
2515	.12/.17	.40/.60	.....	4.75/5.25	.....	.....
2517	.15/.20	.45/.60	.....	4.75/5.25	.....	.....
3115	.13/.18	.40/.60	.55/.75	1.10/1.40	.....	.....
3120	.17/.22	.60/.80	.55/.75	1.10/1.40	.....	.....
3130	.28/.33	.60/.80	.55/.75	1.10/1.40	.....	.....
3135	.33/.38	.60/.80	.55/.75	1.10/1.40	.....	.....
3140	.38/.43	.70/.90	.70/.90	1.10/1.40	.....	.....
3140	.38/.43	.70/.90	.55/.75	1.10/1.40	.....	.....
3145	.43/.48	.70/.90	.70/.90	1.10/1.40	.....	.....
3150	.48/.53	.70/.90	.70/.90	1.10/1.40	.....	.....
3215	.10/.20	.30/.60	.90/1.25	1.50/2.00	.....	.....
3220	.15/.25	.30/.60	.90/1.25	1.50/2.00	.....	.....
3230	.25/.35	.30/.60	.90/1.25	1.50/2.00	.....	.....
3240	.35/.45	.30/.60	.90/1.25	1.50/2.00	.....	.....
3245	.40/.50	.30/.60	.90/1.25	1.50/2.00	.....	.....
3250	.45/.55	.30/.60	.90/1.25	1.50/2.00	.....	.....
3310	.08/.13	.45/.60	1.40/1.75	3.25/3.75	.....	.....
3311	.10/.16	.30/.50	1.30/1.60	3.25/3.75	.15 max	.....
3312	.08/.13	.45/.60	1.40/1.75	3.25/3.75	.....	.....
3316	.14/.19	.45/.60	1.40/1.75	3.25/3.75	.....	.....
3325	.20/.30	.30/.60	1.25/1.75	3.25/3.75	.....	.....
3335	.30/.40	.30/.60	1.25/1.75	3.25/3.75	.....	.....
3340	.35/.45	.30/.60	1.25/1.75	3.25/3.75	.....	.....
3415	.10/.20	.30/.60	.60/.95	2.75/3.25	.....	.....
3435	.30/.40	.30/.60	.60/.95	2.75/3.25	.....	.....
3450	.45/.55	.30/.60	.60/.95	2.75/3.25	.....	.....
4012	.09/.14	.75/1.00	.....	.....	.....	.....
4024†	.20/.25	.70/.90	.....	.....	.20/.30	.....
4032	.30/.35	.70/.90	.....	.....	.20/.30	.....
4042	.40/.45	.70/.90	.....	.....	.20/.30	.....
4053	.50/.56	.75/1.00	.....	.....	.20/.30	.....
4063	.60/.67	.75/1.00	.....	.....	.20/.30	.....
4068	.63/.70	.75/1.00	.....	.....	.20/.30	.....
4119	.17/.22	.70/.90	.40/.60	.....	.20/.30	.....
4125	.23/.28	.70/.90	.40/.60	.....	.20/.30	.....
4135	.33/.38	.70/.90	.80/1.10	.....	.15/.25	.....
4161	.56/.64	.75/1.00	.70/.90	.....	.25/.35	.....
4317	.15/.20	.45/.65	.40/.60	1.65/2.00	.20/.30	.....
4337	.35/.40	.60/.80	.70/.90	1.65/2.00	.20/.30	.....

† S = .035/.50

FORMERLY STANDARD STEELS - continued
Chemical Composition Ranges and Limits

SAE No.	C	Mn	Cr	Ni	Mo	Other
4419	.18/.23	.45/.65	.....	.....	.45/.60	.....
4419H	.17/.23	.35/.75	.....	.....	.45/.60	.....
4422	.20/.25	.70/.90	.....	.....	.35/.45	.....
4427	.24/.29	.70/.90	.....	.....	.35/.45	.....
4608	.06/.11	.25/.45	.....	1.40/1.75	.15/.25	.....
46B12*	.10/.15	.45/.65	.....	1.65/2.00	.20/.30	.....
4615	.13/.18	.45/.65	.....	1.65/2.00	.20/.30	.....
4617	.15/.20	.45/.65	.....	1.65/2.00	.20/.30	.....
4620	.18/.23	.50/.70	.....	1.65/2.00	.20/.30	.....
4621	.18/.23	.70/.90	.....	1.65/2.00	.20/.30	.....
4621H	.17/.23	.60/1.00	.....	1.55/2.00	.20/.30	.....
4626	.24/.29	.45/.65	.....	.70/1.00	.15/.25	.....
4640	.38/.43	.60/.80	.....	1.65/2.00	.20/.30	.....
4718	.16/.21	.70/.90	.35/.55	.90/1.20	.30/.40	.....
4812	.10/.15	.40/.60	.....	3.25/3.75	.20/.30	.....
4817	.15/.20	.40/.60	.....	3.25/3.75	.20/.30	.....
5015	.12/.17	.30/.50	.30/.50	.....	.....	.....
50B40*	.38/.43	.75/1.00	.40/.60	.....	.....	.....
50B44*	.43/.48	.75/1.00	.40/.60	.....	.....	.....
5045	.43/.48	.70/.90	.55/.75	.....	.....	.....
5046	.43/.48	.75/1.00	.20/.35	.....	.....	.....
50B50*	.48/.53	.75/1.00	.40/.60	.....	.....	.....
5060	.56/.64	.75/1.00	.40/.60	.....	.....	.....
50B60*	.56/.64	.75/1.00	.40/.60	.....	.....	.....
5115	.13/.18	.70/.90	.70/.90	.....	.....	.....
5117	.15/.20	.70/.90	.70/.90	.....	.....	.....
5135	.33/.38	.60/.80	.80/1.05	.....	.....	.....
5145	.43/.48	.70/.90	.70/.90	.....	.....	.....
5145H	.42/.49	.60/1.00	.60/1.00	.....	.....	.....
5147	.46/.51	.70/.95	.85/1.15	.....	.....	.....
5152	.48/.55	.70/.90	.90/1.20	.....	.....	.....
5155	.51/.59	.70/.90	.70/.90	.....	.....	.....
50100	.98/1.10	.25/.45	.40/.60	.....	.....	.....
						V
6115	.10/.20	.30/.60	.80/1.10	.....	.....	.15 min
6117	.15/.20	.70/.90	.70/.90	.....	.....	.10 min
6118	.16/.21	.50/.70	.50/.70	.....	.....	.10/.15
6120	.17/.22	.70/.90	.70/.90	.....	.....	.10 min
6125	.20/.30	.60/.90	.80/1.10	.....	.....	.15 min
6130	.25/.35	.60/.90	.80/1.10	.....	.....	.15 min
6135	.30/.40	.60/.90	.80/1.10	.....	.....	.15 min
6140	.35/.45	.60/.90	.80/1.10	.....	.....	.15 min
6145	.43/.48	.70/.90	.80/1.10	.....	.....	.15 min
6195	.90/1.05	.20/.45	.80/1.10	.....	.....	.15 min
						w
71360	.50/.70	.30 max	3.00/4.00	.....	.....	12.00/15.00
71660	.50/.70	.30 max	3.00/4.00	.....	.....	15.00/18.00
7260	.50/.70	.30 max	.50/1.00	.....	.....	1.50/2.00

* B = .0005/.003

FORMERLY STANDARD STEELS - continued
Chemical Composition Ranges and Limits

SAE No.	C	Mn	Cr	Ni	Mo	Other
8115	.13/.18	.70/.90	.30/.50	.20/.40	.08/.15	.....
81B45*	.43/.48	.75/1.00	.35/.55	.20/.40	.08/.15	.....
8625	.23/.28	.70/.90	.40/.60	.40/.70	.15/.25	.....
8627	.25/.30	.70/.90	.40/.60	.40/.70	.15/.25	.....
8632	.30/.35	.70/.90	.40/.60	.40/.70	.15/.25	.....
8635	.33/.38	.75/1.00	.40/.60	.40/.70	.15/.25	.....
8641†	.38/.43	.75/1.00	.40/.60	.40/.70	.15/.25	.....
8642	.40/.45	.75/1.00	.40/.60	.40/.70	.15/.25	.....
86B45*	.43/.48	.75/1.00	.40/.60	.40/.70	.15/.25	.....
8647	.45/.50	.75/1.00	.40/.60	.40/.70	.15/.25	.....
8650	.48/.53	.75/1.00	.40/.60	.40/.70	.15/.25	.....
8653	.50/.56	.75/1.00	.50/.80	.40/.70	.15/.25	.....
8655	.51/.59	.75/1.00	.40/.60	.40/.70	.15/.25	.....
8660	.56/.64	.75/1.00	.40/.60	.40/.70	.15/.25	.....
8715	.13/.18	.70/.90	.40/.60	.40/.70	.20/.30	.....
8717	.15/.20	.70/.90	.40/.60	.40/.70	.20/.30	.....
8719	.18/.23	.60/.80	.40/.60	.40/.70	.20/.30	.....
8735	.33/.38	.75/1.00	.40/.60	.40/.70	.20/.30	.....
8740	.38/.43	.75/1.00	.40/.60	.40/.70	.20/.30	.....
8742	.40/.45	.75/1.00	.40/.60	.40/.70	.20/.30	.....
8745	.43/.48	.75/1.00	.40/.60	.40/.70	.20/.30	.....
8750	.48/.53	.75/1.00	.40/.60	.40/.70	.20/.30	.....
9250[1]	.45/.55	.60/.90	.....	.....	.....	.....
9254[2]	.51/.59	.60/.80	.60/.80	.....	.....	.....
9255[1]	.51/.59	.70/.95	.....	.....	.....	.....
9261[1]	.55/.65	.75/1.00	.10/.25	.....	.....	.....
9262[1]	.55/.65	.75/1.00	.25/.40	.....	.....	.....
9310	.08/.13	.45/.65	1.00/1.40	3.00/3.50	.08/.15	.....
9315	.13/.18	.45/.65	1.00/1.40	3.00/3.50	.08/.15	.....
9317	.15/.20	.45/.65	1.00/1.40	3.00/3.50	.08/.15	.....
94B15	.13/.18	.75/1.00	.30/.50	.30/.60	.08/.15	.....
94B17	.15/.20	.75/1.00	.30/.50	.30/.60	.08/.15	.....
94B30*	.28/.33	.75/1.00	.30/.50	.30/.60	.08/.15	.....
9437	.35/.40	.90/1.20	.30/.50	.30/.60	.08/.15	.....
9440	.38/.43	.90/1.20	.30/.50	.30/.60	.08/.15	.....
94B40*	.38/.43	.75/1.00	.30/.60	.30/.60	.08/.15	.....
9442	.40/.45	.90/1.20	.30/.50	.30/.60	.08/.15	.....
9445	.43/.48	.90/1.20	.30/.50	.30/.60	.08/.15	.....
9447	.45/.50	.90/1.20	.30/.50	.30/.60	.08/.15	.....
9747	.45/.50	.50/.80	.10/.25	.40/.70	.15/.25	.....
9763	.60/.67	.50/.80	.10/.25	.40/.70	.15/.25	.....
9840	.38/.43	.70/.90	.70/.90	.85/1.15	.20/.30	.....
9845	.43/.48	.70/.90	.70/.90	.85/1.15	.20/.30	.....
9850	.48/.53	.70/.90	.70/.90	.85/1.15	.20/.30	**V**
438V12*	.08/.13	.75/1.00	.40/.60	1.65/2.00	.20/.30	.03 min
438V14*	.10/.15	.45/.65	.40/.60	1.65/2.00	.08/.15	.03 min

* B = .0005/.003
† S = .04/.60
[1] Si = 1.80/2.20
[2] Si = 1.20/1.60

SELECTED MILITARY SPECIFICATIONS

Chemical Composition Ranges and Limits

MIL	Solid or Tube	C	Mn	P Max	S Max	Si	Cr	Ni	Mo	Nearest Equivalent	
										AMS	SAE No.
S-5000	S	.38/.43	.65/.85	.025	.025	.15/.35	.70/.90	1.65/2.00	.20/.30	6415	E4340
S-50783[1]	S	1.00/1.15	1.60/1.90	.035	.040	.70/1.00	.20 max	.25 max	.06 max		
S-5626	S	.38/.43	.75/1.00	.025	.025	.20/.35	.80/1.10	.25 max	.15/.25	6382	4140
S-6049	S	.38/.43	.75/1.00	.025	.025	.20/.35	.40/.60	.40/.70	.20/.30	638740	
S-6050	S	.28/.33	.70/.90	.025	.025	.20/.35	.40/.60	.40/.70	.15/.25	6280	8630
S-6709[2]	S	.38/.43	.50/.70	.025	.025	.20/.40	1.40/1.80	.....	.30/.40	6470	.....
S-6758	S	.28/.33	.40/.60	.025	.025	.20/.35	.80/1.10	.25 max	.15/.25	637	4130
S-7108[3]	S	.23/.28	1.20/1.50	.040	.040	1.30/1.70	.40 max.	1.65/2.00	.35/.45	6418	4625M4*
S-7393	S	.08/.13	.45/.60	.015	.015	.20/.35	1.25/1.75	3.25/3.75	.....	6250	3310
	S	.14/.19	.45/.60	.025	.025	.20/.35	1.25/1.75	3.25/4.00	.....	.....	3316
	S	.07/.13	.40/.70	.025	.025	.20/.35	1.00/1.40	3.00/3.50	.08/.15	.....	9310
S-7420	S	.95/1.10	.25/.45	.025	.025	.20/.35	1.30/1.60	.....	.....	6440	52100
S-8503[4]	S	.48/.53	.70/.90	.025	.025	.20/.35	.75/1.20	.....	.....	6448	6150

Aircraft Quality Steels Except Where Indicated
Cu = .35 max unless specified

* Timken Company mill type

[1] Al = .020 max
[2] Al = .95/1.35
[3] P & S = .025 max if Basic Electric Furnace Steel is specified
[4] V = .15 min

SELECTED MILITARY SPECIFICATIONS - continued
Chemical Composition Ranges and Limits

MIL	Solid or Tube	C	Mn	P Max	S Max	Si	Cr	Ni	Mo	Nearest Equivalent AMS	Nearest Equivalent SAE No.
S-8690[5]	S	18/.23	.70/1.00	.025	.025	.20/.35	.40/.60	.40/.70	.15/.25	6274	8620
S-8695[3]	S	.34/.41	.60/1.00	.040	.040	.20/.35	.....	.....	.20/.30	6300	4037
S-8699[3,6]	S	.28/.33	.80/1.00	.040	.040	.20/.35	.75/.95	1.65/2.00	.35/.50	6427	4330M4V1*
S-8707	S	.38/.43	.70/.90	.040	.040	.20/.35	.70/.90	.85/1.15	.20/.30	6342	9840
S-8844-1	S or T	.38/.43	.65/.90	.010	.010	.15/.35	.70/.90	1.65/2.00	.20/.30	.....	4340
S-8844-3[6]	S or T	.40/.45	.65/.90	.010	.010	1.45/1.80	.70/.95	1.65/2.00	.35/.45	.....	300M
T-5066	T	.22/.28	.30/.60	.025	.025	.30 max	.....	.....	.....	.....	1025
S-11595[7]	S	.48/.55	.75/1.00	.040	.040	.20/.35	.80/1.10	.....	.15/.25	.....	4150
S-11595[7]	S	.47/.55	.70/1.00	.040	.05/.09	.20/.35	.80/1.15	.....	.15/.25	.....	41R50
S-11595[7,8]	S	.41/.49	.60/.90	.040	.040	.20/.35	.80/1.15	.....	.30/.40	.....	4142M3V2*
S-46047[8]	S	.38/.45	.75/1.00	.025	.020	.20/.35	.95/1.25	.....	.55/.70	.....	.....

Aircraft Quality Steels Except Where Indicated
Cu = .35 max unless specified

* Timken Company mill type

[5] P & S = .015 max if consumable vacuum melted steel is specified
[6] V = .05/.10
[7] Al = .040 max
[8] V = .20/.30

SELECTED AMS ALLOY STEEL SPECIFICATIONS

Chemical Composition Ranges and Limits

AMS Number	C	Mn	Si	Cr	Ni	Mo	V	Other Designations
6250	.07/.13	.40/.70	.15/.35	1.25/1.75	3.25/3.75	.06 max	.....	3310
6260[1]	.07/.13	.40/.70	.15/.35	1.00/1.40	3.00/3.50	.08/.15	.....	9310
6263	.11/.17	.40/.70	.15/.35	1.00/1.40	3.00/3.50	.08/.15	.....	9315
6264	.14/.20	.40/.70	.15/.35	1.00/1.40	3.00/3.50	.08/.15	.....	9317
6265[2]	.07/.13	.40/.70	.15/.35	1.00/1.40	3.00/3.50	.08/.15	.....	9310
6266[3]	.08/.13	.75/1.00	.20/.40	.40/.60	1.65/2.00	.20/.30	.03/.08	43BV12
6270	.11/.17	.70/1.00	.15/.35	.40/.60	.40/.70	.15/.25	.....	8615
6272	.15/.20	.70/1.00	.15/.35	.40/.60	.40/.70	.15/.25	.....	8617
6274	.17/.23	.75/1.00	.15/.35	.35/.65	.35/.75	.15/.25	.....	8620
6275[3]	.15/.20	.60/.95	.15/.35	.30/.50	.30/.60	.08/.15	.....	94B17
6280	.28/.33	.70/.90	.15/.35	.40/.60	.40/.70	.15/.25	.....	8630
6281	.28/.33	.70/.90	.15/.35	.40/.60	.40/.70	.15/.25	.....	8630
6282	.33/.38	.75/1.00	.15/.35	.40/.60	.40/.70	.20/.30	.....	8735
6290	.11/.17	.45/.65	.15/.35	.20 max	1.65/2.00	.20/.30	.....	4615
6292	.15/.20	.45/.65	.15/.35	.20 max	1.65/2.00	.20/.30	.....	4617
6294	.17/.22	.45/.65	.15/.35	.20 max	1.65/2.00	.20/.30	.....	4620
6299	.17/.23	.40/.70	.15/.35	.35/.65	1.55/2.00	.20/.30	.....	4320
6300[4]	.35/.40	.70/.90	.15/.35	.20 max	.25 max	.20/.30	.....	4037

P & S = .025 max, Cu = .35 max unless specified

[1] B = .001 max
[2] P & S = .015 max
[3] B = .0005/.005
[3] P & S = .040 max

SELECTED AMS ALLOY STEEL SPECIFICATIONS - continued
Chemical Composition Ranges and Limits

AMS Number	C	Mn	Si	Cr	Ni	Mo	V	Other Designations
6302	.28/.33	.45/.65	.55/.75	1.00/1.50	.25 max.	.40/.60	.20/.30	17-22-AS®
6303[5]	.25/.30	.60/.90	.55/.75	1.00/1.50	.50 max.	.40/.60	.75/.95	17-22-AV®
6304	.40/.50	.40/.70	.15/.35	.80/1.10	.25 max.	.45/.65	.25/.35	
6312	.38/.43	.60/.80	.15/.35	.20 max	1.65/2.00	.20/.30	.....	4640
6320	.33/.38	.75/1.00	.15/.35	.40/.60	.40/.70	.20/.30	.....	8735
6321[6]	.38/.43	.75/1.00	.15/.35	.30/.55	.20/.40	.08/.15	.....	81B40
6322	.38/.43	.75/1.00	.15/.35	.40/.60	.40/.70	.20/.30	.....	8740
6323	.38/.43	.75/1.00	.15/.35	.40/.60	.40/.70	.20/.30	.....	8740
6324	.38/.43	.75/1.00	.15/.35	.55/.75	.55/.85	.20/.30	.....	8740 Mod
6328	.48/.53	.75/1.00	.15/.35	.40/.60	.40/.70	.20/.30	.....	8750
6342	.38/.43	.70/.90	.15/.35	.70/.90	.85/1.15	.20/.30	.....	9840
6371	.28/.33	.40/.60	.15/.35	.80/1.10	.25 max	.15/.25	.....	4130
6372	.33/.38	.70/.90	.15/.35	.80/1.10	.25 max	.15/.25	.....	4135
6381	.38/.43	.75/1.00	.15/.35	.80/1.10	.25 max	.15/.25	.....	4140
6382	.38/.43	.75/1.00	.15/.35	.80/1.10	.25 max	.15/.25	.....	4140
6407	.27/.33	.60/.80	.40/.70	1.00/1.35	1.85/2.25	.35/.55	.....	HS220-07
6409[7]	.38/.43	.65/.85	.15/.35	.70/.90	1.65/2.00	.20/.30		4340*

P & S = .025 max, Cu = .35 max unless specified

* Special Aircraft Quality

[5]Cu = .50 max
[6]B = .0005/.005
[7]P = .015 max, S = .008 max

SELECTED AMS ALLOY STEEL SPECIFICATIONS - continued
Chemical Composition Ranges and Limits

AMS Number	C	Mn	Si	Cr	Ni	Mo	V	Other Designations
6412	.35/.40	.65/.85	.15/.35	.70/.90	1.65/2.00	.20/.30	.....	4337
6414[8]	.38/.43	.60/.90	.15/.35	.70/.90	1.65/2.00	.20/.30	.....	CV4340
6415	.38/.43	.65/.85	.15/.35	.70/.90	1.65/2.00	.20/.30	.....	4340
6418	.23/.28	1.20/1.50	1.30/1.70	.20/.40	1.65/2.00	.35/.45	.....	4625M4
6419[9]	.40/.45	.60/.90	1.45/1.80	.70/.95	1.65/2.00	.30/.50	.05/.10	300M
6421[10]	.35/.40	.65/.85	.15/.35	.70/.90	.70/1.00	.15/.25	.....	98B37 Mod
6422[10]	.38/.43	.65/.85	.15/.35	.70/.90	.70/1.00	.15/.25	.01/.06	98B40 Mod
6427	.28/.33	.75/1.00	.15/.35	.75/1.00	1.65/2.00	.35/.50	.05/.10	4330M4V1
6428	.32/.38	.60/.80	.15/.35	.65/.90	1.65/2.00	.30/.40	.17/.23	
6430[8]	.32/.38	.60/.90	.40/.60	.65/.90	1.65/2.00	.30/.40	.17/.23	4335M4V2
6431[9]	.45/.50	.60/.90	.15/.30	.90/1.20	.40/.70	.90/1.10	.08/.15	D6-AC
6440	.98/1.10	.25/.45	.15/.35	1.30/1.60	.25 max	.10 max	.....	52100
6444[8]	.98/1.10	.25/.45	.15/.35	1.30/1.60	.25 max	.08 max	.....	CV52100
6445[8]	.92/1.02	.95/1.25	.50/.70	.90/1.15	.25 max	.08 max	.....	51100
6448	.48/.53	.70/.90	.15/.35	.80/1.10	.25 max	.06 max	.15/.30	6150

P & S = .025 max, Cu = .35 max unless specified
[8] P & S = .015 max
[9] P & S = .010 max
[10] B = .0005/.005

NITRIDING STEELS

Chemical Composition Ranges and Limits

AMS Number	C	Mn	Si	Cr	Ni	Mo	Al	Other Designations
6470	.38/.43	.50/.80	.20/.40	1.40/1.80	.....	.30/.40	.95/1.30	135M or #3
6471	.38/.43	.50/.80	.15/.40	1.40/1.80	.25 max	.30/.40	.95/1.30	Nit #3
6472*	.38/.43	.50/.70	.20/.40	1.40/1.80	.....	.30/.40	.95/1.30	
6475	.21/.26	.50/.70	.20/.40	1.00/1.25	3.25/3.75	.20/.30	1.10/1.40	N

* P = .035 max, S = .040 max

AUSTENITIC STAINLESS STEELS

Chemical Composition Ranges and Limits

Type Number	C Max	Mn Max	Si Max	P Max	S Max	Cr	Ni	Others
201	.15 max	5.5/7.5	1.00	.060	.030	16.00/18.00	3.50/5.50	N = 0.25 max
202	.15 max	7.5/10.0	1.00	.060	.030	17.00/19.00	4.00/6.00	N = 0.25 max
301	.15 max	2.00	1.00	.045	.030	16.00/18.00	6.00/8.00	.....
302	.15 max	2.00	1.00	.045	.030	17.00/19.00	8.00/10.00	.....
302B	.15 max	2.00	2.00/3.00	.045	.030	17.00/19.00	8.00/10.00	.....
303	.15 max	2.00	1.00	.200	.15 min	17.00/19.00	8.00/10.00	Zr, Mo = .60 max*
304	.08 max	2.00	1.00	.045	.030	18.00/20.00	8.00/10.50	.....
TP304	.08	2.00	.75	.040	.030	18.00/20.00	8.00/11.00	.....
304L	.03	2.00	1.00	.045	.030	18.00/20.00	8.00/12.00	.....
TP304L	.035	2.00	.75	.040	.030	18.00/20.00	8.00/13.00	.....
TP304H	.04/.10	2.00	.75	.040	.030	18.00/20.00	8.00/11.00	.....
305	.12	2.00	1.00	.045	.030	17.00/19.00	10.50/13.00	.....
308	.08	2.00	1.00	.045	.030	19.00/21.00	10.00/12.00	.....
309	.20	2.00	1.00	.045	.030	22.00/24.00	12.00/15.00	.....
310	.25	2.00	1.50	.045	.030	24.00/26.00	19.00/22.00	.....
TP310	.15	2.00	.75	.040	.030	24.00/26.00	19.00/22.00	.....
314	.25	2.00	1.50/3.00	.045	.030	23.00/26.00	19.00/22.00	.....
316	.08	2.00	1.00	.045	.030	16.00/18.00	10.00/14.00	Mo=2.00/3.00
TP316	.08	2.00	.75	.040	.030	16.00/18.00	11.00/14.00	Mo=2.00/3.00
316L	.03	2.00	1.00	.045	.030	16.00/18.00	10.00/14.00	Mo=2.00/3.00
TP316L	.035	2.00	.75	.040	.030	16.00/18.00	10.00/15.00	Mo=2.00/3.00
TP316H	.04/.10	2.00	.75	.040	.030	.....	11.00/14.00	Mo=2.00/3.00

* At producers option, reported only when intentionally added.

AUSTENITIC STAINLESS STEELS - continued
Chemical Composition Ranges and Limits

Type Number	C Max	Mn Max	Si Max	P Max	S Max	Cr	Ni	Others
TP317	.08	2.00	.75	.040	.030	18.00/20.00	11.00/14.00	Mo=3.00/4.00
321	.08	2.00	1.00	.045	.030	17.00/19.00	9.00/12.00	Ti = 5 x C min, .60 max
TP321	.08	2.00	.75	.040	.030	17.00/20.00	9.00/13.00	Ti = 5 x C min, .60 max
TP321H	.04/.10	2.00	.75	.040	.030	17.00/20.00	9.00/13.00	Ti = 4 x C min, .60 max
347	.08	2.00	1.00	.045	.030	17.00/19.00	9.00/13.00	Cb +Ta=10 x C min
TP347	.08	2.00	.75	.040	.030	17.00/20.00	9.00/13.00	Cb + Ta=10 x C min =1.00 max
TP347H	.04/.10	2.00	.75	.040	.030	17.00/20.00	9.00/13.00	Cb + Ta=8 x C min =1.00 max
348	.08	2.00	1.00	.045	.030	17.00/19.00	9.00/13.00	Cb + Ta=10 x C min Ta=.10 max
TP348	.08	2.00	.75	.040	.030	17.00/20.00	9.00/13.00	Cb + Ta=10 x C min Cb + Ta= 1.00 max
TP348H	.04/.10	2.00	.75	.040	.030	17.00/20.00	9.00/13.00	Cb + Ta= 8 x C min Ta=.10 max Cb + Ta=1.00 max
384	.08	2.00	1.00	.045	.030	15.00/17.00	17.00/19.00	.....
385	.08	2.00	1.00	.045	.030	11.50/13.50	14.00/16.00	.....

H = Grades for high temperature service.
TP = Tubular Products

CHROMIUM STAINLESS STEELS

Chemical Composition Ranges and Limits

Type Number	C Max	Mn Max	Si Max	P Max	S Max	Cr	Ni	Others
403	.15	1.00	.50	.040	.030	11.50/13.00	.....	Turbine Quality
405	.08	1.00	1.00	.040	.030	11.50/14.50	.....	Al=.10/.30
TP405	.08	1.00	.75	.040	.030	11.50/13.50	.50 max	Al=.10/.30
410	.15	1.00	1.00	.040	.030	11.50/13.50	.....	.....
TP410	.15	1.00	.75	.040	.030	11.50/13.50	.50 max	.....
414	.15	1.00	1.00	.040	.030	11.50/13.50	1.25/2.50	.....
416	.15	1.25	1.00	.060	.150 min	12.00/14.00	.....	Zr, Mo= .60 max*
420	Over .15	1.00	1.00	.040	.030	12.00/14.00	.....	.....
TP420	Over .15	1.00	.75	.030	.030	12.00/14.00	.50 max	.....
430	.12	1.00	1.00	.040	.030	16.00/18.00	.....	.....
430F	.12	1.25	1.00	.060	.150 min	.....	.....	Mo= .60 max*
431	.20	1.00	1.00	.040	.030	15.00/17.00	1.25/2.50	.....
440A	.60/.75	1.00	1.00	.040	.030	16.00/18.00	.....	Mo=.75 max
440B	.75/.95	1.00	1.00	.040	.030	16.00/18.00	.....	Mo=.75 max
440C	.95/1.20	1.00	1.00	.040	.030	16.00/18.00	.....	Mo=.75 max
TP443	.20	1.00	.75	.040	.030	18.00/23.00	.50 max	Cu =.90/1.25
501	Over .10	1.00	1.00	.040	.030	4.00/ 6.00	.....	Mo=.40/.65
502	.10	1.00	1.00	.040	.030	4.00/ 6.00	.....	Mo=.40/.65

Prefix TP denotes tubular products.

Suffixes A, B and C denote differing carbon ranges for the same grade. F denotes a free machining grade.

*At producer's option, reported only when intentionally added.

SELECTED ASTM SPECIFICATIONS

Chemical Composition Ranges and Limits

ASTM Number	Grade	C	Mn	Si	Cr	Ni	Mo	V
A106*	A	.25 max	.27/.93	.10 min	.40 max	.40 max	.15 max	.08 max
	B	.30 max	.29/1.06	.10 min	.40 max	.40 max	.15 max	.08 max
	C	.35 max	.29/1.06	.10 min	.40 max	.40 max	.15 max	.08 max
A182	F11	.10/.20	.30/.80	.50/1.00	1.00/1.50	.....	.44/.65	
	F12	.10/.20	.30/.80	.10/.60	.80/ 1.25	.....	.44/.65	
A192	A	.06/.18	.27/.63	.25 max	.....	.....	.....	
A200	T4	.05/.15	.30/.60	.50/1.00	2.15/2.85	.....	.44/.65	
	T5†	.15 max	.30/.60	.50 max	4.00/6.00	.....	.45/.65	
	T7†	.15 max	.30/.60	.50/1.00	6.00/8.00	.....	.45/.65	
	T9†	.15 max	.30/.60	.25/1.00	8.00/10.00	.....	.90/1.10	
	T11†	.05/.15	.30/.60	.50/1.00	1.00/1.50	.....	.44/.65	
	T21†	.05/.15	.30/.60	.50 max	2.65/3.35	.....	.80/1.06	
	T22†	.05/.15	.30/.60	.50 max	1.90/2.60	.....	.87/1.13	
	T91**	.08/.12	.30/.60	.20/.50	8.00/9.00	.40 max	.85/1.05	.18/.25
A209	T1	.10/.20	.30/.80	.10/.50	.....	.....	.44/.65	
	T1b	.14 max	.30/.80	.10/.50	.....	.....	.44/.65	

See current ASTM specifications for P & S limitations.
† These grades also included in ASTM Specifications A213 and A335.
* The combined elements of Cr, Ni, Mo, V and Cu must not exceed 1%
** Cb = .06/.10, N = .03/.07, Al = .04 max

SELECTED ASTM SPECIFICATIONS - continued
Chemical Composition Ranges and Limits

ASTM Number	Grade	C	Mn	Si	Cr	Ni	Mo	Others
A210	A1	.27 max	.93 max	.10 min	.....	.....	.....	
	C	.35 max	.29/1.06	.10 min	.....	.....	.....	
A213	T5b	.15 max	.30/.60	1.00/2.00	4.00/6.00	.....	.45/.65	
	T5c	.12 max	.30/.60	.50 max	4.00/6.00	.....	.45/.65	Ti = 4 x C min, .70 max
	T12	.05/.15.	30/.61	.50 max	.80/1.25	.....	.44/.65	
	TP304H‡	04/.10	2.00 max	.75 max	18.00/20.00	8.00/11.00	.....	
	TP310H‡	.04/.10	2.00 max	.75 max	24.00/26.00	19.00/22.00	.....	
	TP316H‡	.04/.10	2.00 max	.75 max	16.00/18.00	11.00/14.00	2.00/3.00	
	TP321H‡	.04/.10	2.00 max	.75 max	17.00/20.00	9.00/13.00	.....	Ti = 4 x C min, .60 max
	TP347H‡	.04/.10	2.00 max	.75 max	17.00/20.00	9.00/13.00	.....	Cb + Ta=8 x C min,1.00 max
	TP348	.08 max	2.00 max	.75 max	17.00/20.00	9.00/13.00	.....	Cb + Ta=10 x C min, Ta=.10 max Cb + Ta=1.00 max

See current ASTM specifications for P & S limitations

‡ These grades also included in ASTM Specifications A312 and A376.

TIMKEN® TUBULAR HOLLOW DRILL STEELS

Chemical Composition Ranges and Limits

Type	C	Mn	Si	Cr	Ni	Mo
TDS-10®	.72/.85	.30/ .60	.....	.....	.....	.....
TDS-30®	.17/.22	.45/ .65	.15/.30	.40/ .60	1.65/2.00	.20/.30
TDS-50®	.27/.33	.60/ .80	.40/.70	1.00/1.35	1.85/2.25	.35/.55
TDS-70®	.25/.31	.80/1.20	.50/.80	1.90/2.40	.25 max.	.25/.35
TDS-90®	.23/.28	.40/ .60	.15/.30	3.00/3.50	.....	.45/.60

TIMKEN® OIL COUNTRY STEELS

Chemical Composition Ranges and Limits

Type	C	Mn	Si	Cr	Ni	Mo	Cb	Other
4130M-5	.25/.33	.40/.70	.....	.90/1.20	.....	.60/.75	.02/.05	
4130M-6	.25/.33	.70/.90	.20/.35	1.00/1.50	.25 Max	.30/.40		
4130M-7	.25/.33	.60/.90	.....	I.20/1.50	.....	.65/.75	.02/.05	
4130M-8	.25/.33	.90/1.10	.20/.40	1.00/1.50	.15 Max	.75/.85	.02/.05	
4130M-9	.25/.33	.40/.70	.....	.90/1.20	.....	.60/.75	.02/.05	V = .04/.08

P = .015 max, S = .005 max

TIMKEN® WELDABLE HIGH STRENGTH STEELS

Chemical Composition Ranges and Limits

Type	C	Mn	Si	Cr	Ni	Mo	V	B
WHS 100™	.13/.21	1.00/1.30	.15/.30	.65/.90	.40/.70	.15/.25	.03/.08	.003 added
WHS 130™	.20/.27	.60/ .80	.15/.30	.70/.90	1.55/2.00	.20/.30	.....	.....

TM = Trademark of The Timken Company

TIMKEN® HIGH STRENGTH STEELS

Chemical Composition Ranges and Limits

Type	C	Mn	Si	Cr	Ni	Mo	V
HS-220-07	.27/.33	.60/.80	.40/.70	1.00/1.35	1.85/2.25	.35/.55	.....
HS-220-18	.23/.30	1.20/1.50	1.30/1.70	.20/.40	1.65/2.00	.35/.45	.....
HS-220-27	.28/.33	.75/1.00	.15/.30	.75/1.00	1.65/2.00	.35/.50	.05/.10
HS-220-28	.32/.38	.60/.80	.15/.30	.65/.90	1.65/2.00	.30/.40	.17/.23
HS-220-30	.33/.38	.60/.90	.40/.60	.65/.90	1.65/2.00	.30/.40	.17/.23
HS-250	.37/.44	.65/.90	.40/.60	.80/1.10	.70/1.00	.30/.40	.....
HS-260	.38/.43	.60/.80	.50/.70	1.00/1.35	1.85/2.25	.35/.50	.....

TIMKEN® MICROALLOY STEELS

Chemical Composition Ranges and Limits

Type	C	Mn	V	Other
MicroTec 2W65	.16/.20	1.20/1.40	.06/.10	
MicroTec 2W70	.16/.20	1.40/1.60	.07/.11	
MicroTec 2W75	.16/.22	1.30/1.70	.10/.20	
MicroTec 3W75	.26/.30	1.00/1.30	.13/.23	
MicroTec 3M80A	.28/.33	1.30/1.50	.08/.18	S=.025/.050
MicroTec 3M85	.31/.35	1.30/1.50	.10/.14	S=.030/.050
MicroTec4M85	.36/.40	1.20/1.40	.04/.10	S = .030/.050, Si=.30/.50
MicroTec 4M90A	.36/.41	1.10/1.30	.10/.18	S = .030/.050
MicroTec 4M95	.36/.40	1.30/1.50	.08/.12	S=.045 Max., Si = .50/.70, N = .012/.018
MicroTec 5H90	.52/.57	.70/1.00	.05/.20	S=.025/.035

Unless specified: P= 0.030 max., S=0.040 max., Si=0.15/0.35., Cr=0.20 max., Ni=0.25 max., Mo=0.06 max. and Cu=0.35 max.

TIMKEN® ALLOY STEELS FOR HIGH TEMPERATURE SERVICE

Chemical Composition Range and Limits

Type	C	Mn	P Max	S Max	Si	Cr	Mo	ASTM No
.50Mo*	.10/.20	.30/.80	.045	.045	.10/.50	.....	.44/.65	1
DM®	.15 max	.30/.60	.030	.030	.50/1.00	1.00/1.50	.44/.65	11
DM-2	.15 max	.30/.60	.....	.....	.50 max	.80/1.25	.44/.65	.....
2 1/4 Cr 1 Mo	.15 max	.30/.60	.030	.030	.50 max	1.90/2.60	.87/1.13	22
5 Cr 1/2 Mo	.15 max	.30/.60	.030	.030	.50 max	4.00/6.00	.45/.65	5
5 Cr 1/2 Mo+Ti**	.12 max	.30/.60	.030	.030	.50 max	4.00/6.00	.45/.65	5c
5 Cr 1/2 Mo+Si	.15 max	.30/.60	.030	.030	1.00/2.00	4.00/6.00	.45/.65	5b
5 Cr 1 Mo+Si	.15 max	.30/.60	.030	.030	1.00/1.50	4.00/6.00	.09/1.10	.....
7 Cr 1/2 Mo	.15 max	.30/.60	.030	.030	.50/1.00	6.00/8.00	.45/.65	7
9 Cr 1 Mo	.15 max	.30/.60	.030	.030	.25/1.00	8.00/10.00	.90/1.10	9
T9***	.08/.12	.30/.60	.020	.010	.20/.50	8.00/9.50	.85/1.05	91

*.50 Mo steel also available with .08/.14 C. ** Ti =4 x C min, .70 max *** Ni =.40 max, V =.18/.25, Cb =.06/.10, N =.03/.07, Al =.04 max

TIMKEN® HIGH TEMPERATURE ENGINEERING STEELS

Chemical Composition Ranges

Type	C	Mn	P Max	S Max	Si	Cr	Mo	V	AMS No
17-22-A®	.41/.48	.45/.65	.030	.030	.55/.75	1.00/1.50	.40/.60	.20/.30	.....
17-22-AS®	.28/.33	.45/.65	.030	.030	.55/.75	1.00/1.50	.40/.60	.20/.30	6302
17-22-AV®	.25/.30	.60/.90	.030	.030	.55/.75	1.00/1.50	.40/.60	.75/.95	6303

TIMKEN® TUBING FOR POLYETHYLENE PRODUCTION

Chemical Composition Ranges

Type	C	Mn	Cr	Ni	Mo
4333M4	.30/.38	.70/1.00	.70/.90	1.65/2.00	.35/.45
4333M6	.30/.38	.70/1.00	.80/1.20	2.00/2.50	.50/.65

TIMKEN® SPECIAL BEARING STEELS

Chemical Composition Ranges and Limits

Type	C	Mn	Si	Cr	Ni	Mo	V
52100*	.98/1.10	.25/.45	.15/.35	1.30/1.60	.....	.....	.....
ASTM-A485-1(#1 Mod.)[a]	.90/1.05	.95/1.25	.45/.75	.90/1.20	.....	.....	.....
ASTM-A485-2(#2 Mod.)	.85/1.00	1.40/1.70	.50/.80	1.40/1.80	.....	.....	.....
ASTM-A485-3(T-1)[a]	.95/1.10	.65/.90	.15/.35	1.10/1.50	.....	.20/.30	.....
ASTM-A485-4(T-2)[a]	.95/1.10	1.05/1.35	.15/.35	1.10/1.50	.....	.45/.60	.....
TBS-600™[b]	.95/1.10	.60/.80	.85/1.20	1.25/1.65	.....	.25/.35	.....
CBS-600™[c]	.16/.22	.40/.70	.90/1.25	1.25/1.65	.....	.90/1.10	.....
CBS1000M™[d]	.10/.16	.40/.60	.40/.60	.90/1.20	2.75/3.25	4.00/5.00	.25/.50
CBS-50NiL**	.11/.15	.15/.35	.10/.25	4.00/4.25	3.20/3.60	4.00/4.50	1.13/1.33
TBA-2[e]	.70/.80	1.05/1.35	.15/.35	.90/1.20	1.30/1.65	1.20/1.40	.....
M-50	.77/.85	.35 max.	.25 max.	3.75/4.25	.10 max.	4.00/4.50	.90/1.10
440C	.95/1.20	1.00 max.	1.00 max.	16.00/18.00	.....	.75 max.	.....
TBS-9®	.89/1.01	.50/.80	.15/.35	.40/.60	.25 max.	.08/.15	.....

* 52100 shown for reference purposes only
** Max Cu .10, Co .25, W .25, P .015, S .010

[a] Deep hardening steels.

[b] Through hardening steel for service up to 600 F.
[c] Carburizing steel for service up to 600 F.

[d] Carburizing steel for service up to 1000 F.

[e] Through hardening steel can be air quenched.
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TIMKEN® GRAPHITIC TOOL STEELS

Chemical Composition Nominal

Type	C	Mn	P	S	Si	Cr	Ni	Mo	W	Al	AISI
Graph-Mo®	1.40	.85	.025	.025	.90	.....	.....	.25	.....	.....	O-6
Graph-Air®	1.35	1.80	.025	.025	1.20	.....	1.85	1.50	.....	.....	A-10

Note: See Latrobe Section for other tool and die steels.

TIMKEN LATROBE HIGH SPEED STEELS

Nominal Chemical Analyses

AISI Type	Latrobe Grade	C	Si	Mn	W	Cr	V	Mo	Co	Other
M1	Tatmo™	.83	.30	.30	1.75	3.75	1.15	8.50	.....	.....
M2	Double Six™	.85	.30	.30	6.15	4.15	1.85	5.00	.....	.....
M2 H.C.	HS29 XL®	.98	.30	.30	6.25	4.15	1.85	5.00	.....	Alloy Sulfides
$M3_1$	Corsair™	1.02	.25	.25	6.00	4.00	2.40	5.00	.....	.....
$M3_2$	Crusader™	1.20	.25	.25	6.00	4.10	3.00	5.00	.....	.....
M4	Stark™	1.32	.25	.25	5.35	4.50	3.85	4.40	.....	.....
M7	Tatmo-V™	1.00	.35	.25	1.60	3.75	2.00	8.55	.....	.....
M7	Tatmo-VN™	1.02	.40	.30	1.75	3.75	1.90	8.50	.....	Nitrogen
M10	TNW™	.87	.25	.25	.75	4.00	1.90	8.00	.....	.....
M33	Kelvan™	.88	.30	.25	1.75	3.75	1.15	9.55	8.25	.....
M34	Tatmo Cobalt™	.90	.30	.25	1.50	3.75	2.05	8.00	8.25	.....
M36	CO-6™	.88	.30	.30	5.75	4.10	1.85	4.90	7.60	.....
M42	Dynamax™	1.08	.50	.25	1.50	3.85	1.20	9.50	8.00	.....
M50	CM - 50™	.84	.50	.30	.....	4.10	1.00	4.25	.....	.....
M52	CM - 52™	.89	.45	.25	1.10	4.00	1.85	4.50	.....	.....
T1	E. No. 1™	.75	.30	.25	18.00	4.10	1.10	.....	.....	.....
T5	Super Cobalt™	.85	.30	.30	18.75	4.10	1.90	.....	8.25	.....
T15	Dynavan™	1.57	.25	.25	12.25	4.00	5.00	.....	5.00	.....

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TIMKEN LATROBE COLD WORK DIE STEELS

Nominal Chemical Composition

AISI Type	Latrobe Grade	C	Si	Mn	W	Cr	V	Mo	Ni	Other
D2	Olympic™	1.50	.30	.30	.....	12.00	.90	.75	.....	.....
D3	GSN®	2.15	.40	.40	.....	12.25	.25	.....	.....	.....
D5	RipTide™	1.50	.50	.35	.....	11.65	.....	.80	.....	Co = 2.80
D7	BR-4®	2.30	.40	.40	.....	12.50	4.00	1.10	.....	.....
A2	Select B™	1.00	.30	.75	.....	5.00	.25	1.00	.....	.....
A6	Lesco® A-6	.70	.30	2.00	.....	1.00	.....	1.25	.....	.....
A7	BR-3®	2.80	.30	.70	.....	5.25	4.50	1.10	.....	.....
A8	MGR™	.55	.95	.30	1.25	5.00	.....	1.25	.....	.....
A10	Graph-Air®	1.35	1.20	1.80	.....	.....	.....	1.50	1.85	.....
O1	Badger™	.94	.30	1.20	.50	.50	.....	.....	.....	.....
O6	Graph-Mo®	1.40	.90	.85	.....	.....	.....	.25	.....	.....
L6	Montana™	.70	.25	.60	.....	.70	.....	.....	1.40	.....
S1	XL Chisel™	.53	.25	.25	2.00	1.35	.25	.....	.....	.....
S5	Lanark™	.61	1.90	.90	.....	.18	.28	1.25	.....	.....
S7	Bearcat®	.50	.25	.75	.....	3.25	.....	1.40	.....	.....
.....	Staminal®	.55	1.00	.90	.....	.40	.13	.45	2.70	.....
.....	Chipper Knife	.50	.95	.45	.....	8.00	.45	1.30	.....	.....
4142	Brake Die*	.42	.30	.90	.....	1.00	.....	.20	.....	.....

*Prehardened

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TIMKEN LATROBE HOT WORK DIE STEELS

Nominal Chemical Composition

AISI Type	Latrobe Grade	C	Si	Mn	W	Cr	V	Mo	Ni	Other
H10	Dart™	.42	1.00	.55	.....	3.15	.35	2.15	.....	.....
H11	Dycast No.1™	.40	1.00	.30	.....	5.00	.50	1.30	.....	.....
H12	LPD®	.35	1.00	.30	1.30	5.00	.30	1.40	.....	.....
H13	VDC®, VDC®-RF	.40	1.00	.40	.....	5.25	1.00	1.35	.....	.....
H13	Viscount*	.40	1.00	.80	.....	5.25	1.00	1.35	.....	Alloy Sulfides
H14	Lumdie®	.40	1.00	.25	4.75	5.25	.....	.....	.....	.....
H21	CLW™	.33	.45	.25	9.15	3.30	.45	.....	.....	.....
.....	Koncor™	1.10	1.00	.35	.....	5.25	4.00	1.10	.....	.....
.....	HW108™	.35	1.00	.30	.....	3.50	.75	2.50	.....	Co = 3.00
P21	Cascade™	.20	.30	.30	.....	.25	.20	.....	4.10	Al = 1.20

* The Viscount grade series is VDC containing alloy sulfides for improved machinability. Viscount 20 is supplied annealed and Viscount 44 is supplied prehardened.

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COMPARATIVE PROPERTIES FOR THE SELECTION AND USE OF HIGH SPEED STEELS

AISI Type	Latrobe Grade	Relative Wear Resistance	Relative Toughness	Relative Grindability	Relative Red Hardness
M1	Tatmo™				
M2	Double Six™				
$M3_1$	Corsair™				
$M3_2$	Crusader™				
M4	Stark™				
M7	Tatmo-VN				
M10	TNW™				
M36	CO-6™				
M42	Dynamax™				
T1	E. No. 1™				
T5	Super Cobalt™				
T15	Dynavan™				

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COMPARATIVE PROPERTIES FOR THE SELECTION AND USE OF HOT WORK DIE STEELS

AISI Type	Latrobe Grade Name	Relative Heat Resistance	Relative Toughness	Relative Wear Resistance
H10	Dart™			
H11	Dycast No.1™			
H12	LPD®			
H13	VDC®, VDC®- RF			
H13*	Viscount 20® and Viscount 44®			
H14	Lumdie®			
-	Koncor™			
H21	CLW™			
P21	Cascade™			

* with alloy sulfides

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COMPARATIVE PROPERTIES FOR THE SELECTION AND USE OF COLD WORK DIE STEELS

AISI Type	Latrobe Grade	Relative Wear Resistance	Relative Toughness	Relative Machinability	Ability To Hold Size During Heat Treat.
D2	Olympic™				
D3	GSN®				
D7	BR-4®				
A2	Select B™				
O6	Graph-Mo®				
O1	Badger™				
A10	Graph-Air®				
A8	MGR™				
A6	Lesco® A-6				
-	Staminal®				
S7	Bearcat®				

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COMPARATIVE PROPERTIES FOR THE SELECTION AND USE OF SHOCK STEELS

AISI Type	Latrobe Grade	Relative Toughness	Relative Wear Resistance	Size Stability During Heat Treat.
-	Staminal®			
A8	MGR™			
S1	-			
S5	Lanark™			
S7	Bearcat®			
L6	Montana™			
H13	VDC®			

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