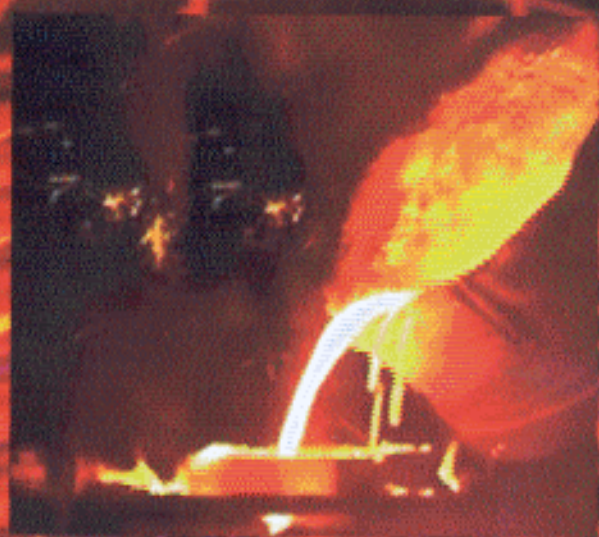


A comprehensive, up-to-date and user-friendly compendium



THE STEEL HANDBOOK



Alok Nayar

Contents

<i>Preface</i>		vii
<i>Acknowledgements</i>		viii
<i>How to Use the Modified CCT Diagram</i>		xvii
<i>Abbreviations and Symbols</i>		xix
CHAPTER 1	Classification of Steels	1
CHAPTER 2	Designation System for Wrought Steels Based on Steel Names	5
CHAPTER 3	Phase Transformations and Microstructures in Steels	10
CHAPTER 4	Heat Treatment of Steels	24
CHAPTER 5	Types of Steels	33
CHAPTER 6	Properties of Steels	41
	■ Engineering Steels 43	
	Unalloyed Steels 43	
	Plain carbon steels 43	
	• CC4 43	
	• CC8 48	
	• C10 53	
	• CC11 61	
	• C15 66	
	• C16 74	
	• C20 80	
	• CC21 89	
	• C25 94	
	• C28 102	

- C30 108
- C35 117
- C40 127
- C45 138
- C50 150
- C55 160
- C60 170
- C65 180
- C70 186
- C75 192
- C85 197
- C95 204

High manganese carbon steels 211

- 22Mn6 211
- 28Mn6 217
- 36Mn6 225
- 42Mn6 232

Free cutting steels 238

- 9S20 238
- 10S20, 10SPb20 242
- 11SMn28, 11SMnPb28 248
- 12SMn35, 12SMnPb35 252
- 17SMn20 256
- 35S20 260
- 44SMn28 264
- 46S20 270

Low Alloy Steels 275

Silicon and silicon-chromium steels 275

- 59Si7 275
- 55SiCr6-3 283
- 56SiCr7 291
- 61SiCr7 297

Manganese-vanadium steels 303

- 19MnVS6 303
- 30MnVS6 306
- 38MnVS6 309
- 46MnVS6 312
- 46MnVS3 315

Chromium steels 318

- 37Cr2 318
- 46Cr2 326
- 20Cr4 334
- 34Cr4 341
- 37Cr4 350
- 41Cr4 359

- 55Cr3 368
- 100Cr6 376
- 16MnCr5 382
- 20MnCr5 389

Chromium-manganese-silicon steels 395

- 100CrMnSi4-4 395
- 100CrMnSi6-4 399

Chromium-molybdenum steels 403

- 18CrMo4 403
- 25CrMo4 409
- 34CrMo4 418
- 42CrMo4 427
- 50CrMo4 437
- 60CrMo3-1 445
- 60CrMo3-3 451
- 100CrMo7 459
- 100CrMo7-3 463
- 31CrMo12 467

Chromium-molybdenum-vanadium steels 473

- 52CrMoV4 473

Chromium-vanadium steel 479

- 51CrV4 479

Chromium-aluminium-molybdenum steels 491

- 33CrAlMo5-4 491
- 41CrAlMo7-4 496

Molybdenum steel 501

- 36Mo3 501

Nickel-chromium steels 508

- 15NiCr13 508
- 20NiCrMo2 515
- 41CrNiMo2 524
- 36CrNiMo4 533
- 17NiCrMo6 540
- 18CrNiMo7 547
- 20NiCrMo7 554
- 31CrNiMo8 560
- 36CrNiMo6 567
- 41NiCrMo7 574
- 18NiCrMo14-6 583

Boron steels 587

- CE20BG1 587
- CE20BG2 591
- CE28B 595
- CE35B 599

- 35MnB5E 603
- 37CrB1E 607
- 60CrB3 611

■ **Tool Steels 618**

Cold Work Tool Steels 618

Unalloyed cold work tool steels 618

- C70U 618
- C80U 623
- C90U 628
- C105U 633
- C120U 638

Alloy cold work tool steels 643

- 90MnCrV8 643
- 105V 648
- 50WCrV8 653
- 60WCrV8 658
- 95MnWCr5 663
- X100CrMoV5 668
- X153CrMoV12 673
- X210Cr12 679
- X210CrW12 684

Hot Work Tool Steels 689

- 55NiCrMoV7 689
- X37CrMoV5-1 694
- X40CrMoV5-1 700
- X30WCrV9-3 706

High Speed Tool Steels 711

- HS18-0-1 711
- HS1-8-1 716
- HS2-9-2 721
- HS6-5-2 726
- HS6-5-3 731
- HS6-5-2-5 736
- HS10-4-3-10 740
- HS 2-9-1-8 745

■ **Valve Steels for Internal Combustion Engines 750**

Martensitic Valve Steels 750

- X45CrSi9-3 750
- X50CrSi8-2 756
- X85CrMoV18-2 761

Austenitic Valve Steels 766

- X55CrMnNiN-20-8 766
- X53CrMnNiN21-9 771

- X50CrMnNiNbN21-9 776
- X53CrMnNiNbN21-9 781
- X33CrNiMnN23-8 786

Stainless Steels 791

Austenitic Stainless Steels 791

- X2CrNi18-9 791
- X5CrNi18-9 796
- X10CrNiS18-9 801
- X6CrNiNb18-10 805
- X6CrNiTi18-10 810
- X2CrNiMo17-12-2 815
- X2CrNiMo19-14-4 819
- X5CrNiMo17-12-2 823
- X12CrMnNi17-7-5 829

Austenitic-Ferritic (Duplex) Stainless Steels 833

- X2CrNiMoN22-5-3 833
- X2CrNiMoCuN25-6-3 837

Ferritic Stainless Steels 841

- X6CrTi12 841
- X6Cr13 846
- X6CrAl13 851
- X6Cr17 855
- X6CrMo17-1 860
- X15CrN26 865

Martensitic Stainless Steels 869

- X12Cr13 869
- X20Cr13 875
- X30Cr13 882
- X17CrNi16-2 889

Precipitation Hardening Stainless Steels 895

- X5CrNiCuNb16-4 895
- X7CrNiAl17-7 900
- X8CrNiMoAl15-7-2 906

Annexure A	Types of Steel Based on Deoxidation Practice	910
Annexure B	Permissible Deviations Between Specified Cast Analysis and Product Analysis of Steels	912
Annexure C	Ruling Sections for the Mechanical Properties	919
Annexure D	Preheat and Interpass Temperatures, and Postweld Heat Treatment for Unalloyed Steels	922
Annexure E	Machinability Rating of Unalloyed and Low Alloy Steels	925
Annexure F	Corrosion Resistance of Stainless Steels	929

<i>Annexure G</i>	Equivalent International and National Standards on Testing of Steels	932
<i>Annexure H</i>	Conversion Table for Vickers Hardness, Brinell Hardness, Rockwell Hardness and Tensile Strength	942
<i>Annexure I</i>	Dimensions, Sectional Areas and Masses per Unit Length of Steel Bars	946
<i>Annexure J</i>	Areas of Plane Figures	951
<i>Annexure K</i>	Conversion Factors	956
<i>Annexure L</i>	Directory	965
<i>Subject Index</i>		973
<i>Designation Index</i>		976