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Engineering Alloys

FIFTH EDITION

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Preface to Fifth Edition

Since publication of the Fourth Edition in 1962 a number of changes have taken place. The major one, as far as this book is concerned, was the death of Norman E. Woldman late in 1969. Dr. Woldman had developed Engineering Alloys through four editions to the high standard that made it a world wide valuable publication. He was at work gathering data for the Fifth Edition at the time of his death. His general knowledge, initiative and organizing ability will be greatly missed.

As an old friend and former co-worker I was asked to finish the revision of the Fifth Edition along the lines he had planned. This involved several procedures to permit the maximum number of alloy entries with a minimum increase in the number of pages.

1. Eliminate the obsolete and discontinued alloys. This has been largely done but a list of the discontinued alloys is given in Section IV along with the code number of the supplier so that if any information on these alloys is required a reference can be made to the source.

2. Eliminate the Alphabetical Index, formerly Section II and put all alloy listings in alphabetical order. This leaves room for many new alloys.

3. Weed out and eliminate a number of duplicate listings.

An additional number of alloys and suppliers is included, and many alloys have been revised and brought up to date. Over 10,000 new or revised alloys are listed.

One trend among suppliers has been noted and that is the tendency to drop certain trade names and go to numbers corresponding to Trade Association standards, particularly Copper Development Association, American Iron and Steel Institute, and the Aluminum Association. This was a major reason for updating many alloy names, and also a reason for many suppliers, particularly foundries, in ceasing to use proprietary names.

Because of this trend an additional section has been added listing some of these association alloys, mainly for composition but also for some mechanical properties. It should be noted that these lists change from year to year.

I wish to express appreciation to The Aluminum Association, American Iron and Steel Institute, American Society for Testing and Materials, Copper Development Association, and Society of Automotive Engineers, Inc. for permission to use some of their charts and tables. I also wish to express appreciation to my wife, Mildred, for aid and assistance in the arduous task of alphabetizing.

Robert C. Gibbons

Preface to Fourth Edition

Since the publication of the Third Edition in 1952 over 15,000 additional proprietary alloys have been accumulated from sources throughout the world, making a grand total of over 35,000 alloys for the newly revised Fourth Edition. Publication rights to the Fourth Edition have been transferred from the American Society for Metals to the Reinhold Publishing Corporation to take advantage of their international sales capabilities.

As in the previous editions, obsolete and discontinued proprietary alloys have been retained not only for historical value but because many of these alloys can still be found on metal fabricators' and consumers' blueprints and specifications. And, although not necessarily a standard or active product with the alloy mill, the alloy or alloys may continue to be made by the respective mills if ordered in mill lots.

The data and information on all the alloys were brought up to date by sending tear sheets from the Third Edition to all the ferrous and non-ferrous alloy manufacturers, with the request that they make the necessary corrections, changes and additions for their own alloys and submit the approved copies to the author. All these corrections and changes have been incorporated in the Fourth Edition.

The format of the Fourth Edition has been changed to enable the author to include more useful information on the alloys. Instead of the previous tabulated organization where space was limited, each alloy is now abstracted in a separate paragraph showing the chemical composition, mechanical properties, uses, and general characteristics.

Preface to Third Edition

During the seven years since the publication of the second edition we have accumulated information on more than 7000 new proprietary alloys which have been incorporated in this third edition.

The methods used in securing information on the new alloys as well as supplementing and correcting data on previously listed alloys followed very closely those outlined in the prefaces to the first and second editions.

Section III, Uses and Applications, as previously published in the first and second editions has been deleted from the present edition. So numerous have become the applications to which specific alloys can be put and so large the number of alloys appropriate to each use, it was felt that Section III on uses and applications has become of little practical value, the more so since some information regarding the primary uses appears in Section II. Consequently, Section IV on Manufacturers and Their Alloys as published in the previous editions is now Section III in the present edition.

The author is grateful for the continued cooperation of the alloy manufacturers in making possible the completeness and accuracy of the text.

Preface to Second Edition

In the eight years since the publication of the first edition, many new alloys have been developed and marketed by the ferrous and non-ferrous manufacturers.

There have been several changes in the composition, properties, and even trade names of many alloys. Some have become obsolete and are no longer being manufactured. It therefore would seem wise to incorporate the new proprietary trade name alloys, and the changes in the alloys already listed, in a second edition.

The manufacturers included in the first edition were requested to supply any changes in composition and properties of their alloys, as originally published. They were also asked to furnish data and information regarding new alloys put out and marketed by them. Many additional manufacturers supplied data on their alloys for incorporation in the revised edition.

Where the proprietary trade names were changed, an attempt was made to record the old name in Section II under the "Remarks" column. Wherever the alloys have become obsolete and their manufacture has been discontinued, it has been so indicated.

All alloys have been credited to the proper manufacturer, except where this information was unobtainable.

Section VI in the original edition, comprising the references in serial order according to their key number (R-number), has been deleted. Since the alloys covered by these references were checked with the manufacturers, it did not seem necessary to show the source of the original information. Section VII, "Useful Data Appendix," of the first edition, will therefore become Section VI.

Professor Albert Dornblatt, co-author of the first edition, died in 1942. Mr. Robert J. Metzler, formerly Assistant Chief Metallurgist of the Eclipse-Pioneer Division of Bendix Aviation Corporation, and now Chief Metallurgist of the Breeze Corporation, has assumed the responsibilities of co-authorship of this second edition.

Preface to First Edition

This book is the result of a growing demand for a practical and technical reference book on engineering alloys.

The authors of the book have made a careful compilation of the available data and information on practically all proprietary commercial and technical alloys manufactured in the United States of America, and on many alloys made in foreign countries, including England, France, Germany and Sweden. The book is devoted to data on the chemical composition, physical and mechanical properties, uses, and manufacturers of proprietary alloys. No attempt has been made to include alloys conforming to standard specification analyses as such; examples of the common engineering alloys produced to customers' specifications will be found among listed proprietary alloys. However, because of their widespread usage, the Society of Automotive Engineers' specification alloys, as well as a few others of general interest, have been included.

The aim has been to present as large an amount of reliable and up-to-date information on commercial alloys as was consistent with convenience in form and breadth of scope of this book. This information has been obtained by direct correspondence with the alloy manufacturers, and supplemented by data obtained from commercial literature and technical publications.

The book is divided into seven sections, as follows: Section I, which gives an alphabetical listing of all alloys and their corresponding index or serial number; Section II, which gives the trade name, composition, properties, uses, general remarks and a key number designating the manufacturer and the reference for each alloy as listed in serial order; Section III, an index of alloys classified according to typical uses or special characteristics such as corrosion-resistance; Section IV, an alphabetical listing of the manufacturers with a summary of the alloys listed that are produced by each; Section V, which lists the manufacturers, with addresses, in serial order according to the key number (M-number); Section VI, comprising the references, in serial order according to their key number (R-number); and Section VII, an appendix containing useful tables and miscellaneous information pertaining to the properties and testing of alloys.

With this arrangement, data on a particular alloy are located by using the alphabetical index (Section I) to ascertain the alloy serial number, and then turning to that number in Section II for the desired information regarding composition, properties, and uses. The manufacturer's name and address can be located by referring to the appropriate M-number in Section V. Similarly, the source of information is ascertained in Section VI under the appropriate R-number. Where an M-number appears in the reference column of Section II, the information was supplied by the manufacturer. Section IV is intended as an index of manufacturers, and while complete so far as the alloys listed in the second section (excepting discontinued alloys) are concerned, it should not be considered as a listing of all the alloys produced by the particular manufacturer.

Some of the alloys listed are either obsolete or are not in commercial production at the present time, but they have been embodied in the text in order to make it as complete a reference as possible. Some of the blank spaces in the text appear because of the manufacturers' feeling that certain information is either confidential or of no practical interest. The latter comment applies particularly

to data on physical properties of tool steels. As it is not feasible to include all the information that could be desired, should more specific data on any particular alloy be wanted by the reader, it is recommended that he refer to the reference or manufacturer cited, or else communicate directly with the authors.

Undoubtedly many important alloys are not listed, despite the authors' best efforts in search of new data. This is especially true in regard to alloys not of American manufacture. The authors will be grateful for any additional information or suggestions for the improvement of this work that may be incorporated at a later time, and they hope that the reader will call to their attention any omissions and errors.

The nature of this compilation is such as to make a critical analysis of the data impracticable, and the authors assume no responsibility for the accuracy or reliability of the quoted values and information; in fact, they have attempted to present the data as impartially and faithfully as possible and have abstained from interjecting their personal judgment or opinion in any respect. It should be borne in mind, also, that the mechanical properties of commercial alloys vary between wide limits, and, therefore, the values assigned in a given instance usually represent the most probable values that would be obtained under the given conditions. Some values are quoted from the manufacturers that refer to a test characterizing but a single specimen. In general, however, all these values should be looked upon as being indicative or suggestive rather than definitive. The same is true of the applications cited. Special care must also be exercised in interpreting remarks relative to the corrosion-resistance of any alloy. Furthermore the reader is cautioned against using the data in such manner as would incur liability for infringement of any patents that may now exist or are pending.

Information was obtained from so many sources in the preparation of this book, that a complete acknowledgement, beyond that noted in the citation of sources of information in the reference column of Section II, is difficult to make. Considering the unprecedented nature of this book, the cooperation of the manufacturers listed was most gratifying and their assistance is as deeply appreciated as it was indispensable. The authors wish to make special acknowledgment to the following: the American Society for Metals, the American Society for Testing Materials, the Society of Automotive Engineers, and the National Research Council for permission to use data appearing in their publications; to *Iron Age*, *Chemical and Metallurgical Engineering*, and the *Metal Industry* (London) for use of information that appeared in these magazines; to the Louis Cassier Company (London) and Verlag Chemie for permission to utilize some of the data published in their respective books, *Metals and Alloys* and *Die Werkstoffe Der Chemischen Apparate* (Dr. -Ing. H. Freytag).

The authors wish to acknowledge their appreciation of the services rendered by Professor H. Bluestone of the United States Naval Academy Postgraduate School, who aided in making translations, and by Marie I. Dornblatt, who assisted in checking data and reading proof. In addition the authors are indebted to Dr. F. L. Coonan for his helpful suggestions and criticism during the preparation of the manuscript.

Abbreviations

AA	Aluminum Association
ACI	Alloy Casting Institute
AISI	American Iron and Steel Institute
Ann	Anneal or annealed
A Rock	Hardness Rockwell A scale
ASTM	American Society for Testing and Materials
B	Flux density
Bal	Balance or remainder
BHN	Brinell hardness number
Br	Remanence flux in gausses
Brin	Brinell Hardness Number (10 mm. ball and 3000 kg. load) (# means 500 kg. load)
CD	Cold drawn
CDA	Copper Development Association
CEL	Elastic Limit in Compression in pounds per square inch
CF	Cold finished
Ch	Charpy impact in foot-pounds
cmf	Circular mil feet
Coef Exp	Coefficient of Expansion per °C.
Coef Res	Temperature Coefficient of Resistance per °C
CS	Crushing strength in pounds per square inch
CUS	Ultimate strength in compression in pounds per square inch
CYP	Yield point in compression in pounds per square inch
DPN	Depth penetration hardness (Vickers hardness)
SAE	Society of Automotive Engineers
Sc	Shore Scleroscope hardness number
SC	Sand cast
Sp H	Specific heat in calories per gram per °C
Sp Res	Specific Resistance in microhms per centimeter cube
SS	Shear strength in pounds per square inch
ST	Ultimate strength in Torsion in pounds per square inch
SYP	Shear Yield Point in pounds per square inch
TC	Total carbon content
Th C	Thermal Conductivity in calories per centimeter cube per sec. per °C
Tr D	Transverse Deflection in inches
Tr S	Transverse strength in pounds
TS	Ultimate Tensile Strength in pounds per square inch
t.s.i.	Tons per square inch
VDH	Vickers hardness
YP	Yield point in tension in pounds per square inch
YPC	Yield Point in compression in pounds per square inch
YS	Yield strength in tension in pounds per square inch
YS (comp)	Yield strength in compression

SECTION I

ALLOY DATA

NO. 000 DOUBLE EXTRA CARBON.

M-350; 1.1-1.3 C, bal Fe.
For intricate tools, broaches, drawing and threading dies; water hardening.

000 EXTRA.

M-459; 0.9 C, 19 W, 4 Cr, 2.2 V, bal Fe.
For high speed cutters; high speed steel.

000 SPEZIAL 31.

M-459; 0.8 C, 4 Cr, 0.3 Mo, 2.6 V, 10 W, bal Fe.
For turning, shaping and slotting tools; high speed steel.

1% NEB-BRONZE.

M-1720; 89-93 Cu, 0.7-1.3 Sn, 0.10 max Pb, 0.05 max Fe, bal Zn.
Good hot and cold working properties; good for welding, brazing, soldering.
For jewelry products, flat springs for electrical switchgear.
Copper alloy No. 413.

NO. 1 STANDARD.

M-179; 55-60 Cu, 0.2 max Pb, 1.5 max Al, 3.5 max Mn, 1.5 max Sn, bal Zn.
Extruded: 76,000 TS; 37,000 YS; 28 El; 20 RA; 135 Brin.
Drawn: 86,000 TS; 41,000 YS; 25 El; 18 RA; 140 Brin.
For pump valves, propellers, condenser tubes; Parson's manganese bronze.

"NO. 1 TA" QUALITY.

M-179; 55-60 Cu, 0.2 max Pb, 2-3 Mn, bal Zn.
Rolled: 76,000 TS; 36,000 YS; 25 El; 25 RA; 125 Brin.
For hydraulic tubes; Parson's manganese bronze.

2 AS.

M-1487;
High speed steel; similar to AISI M2.

NO. 2 DIE METAL.

M-1391; 3.5-4.5 Al, 2.5-3.5 Cu, 0.02-1.0 Mg, bal Zn.
Sand cast: 37,000 TS; 3 El.
For stamping and drop hammer dies; subject to intergranular attack.

NO. 2 RELAY.

M-1; 1-1.5 Si, bal Fe.
For armatures, relays, solenoid switches; high permeability.

NO. 2 SS RELAY.

M-1; 1-1.5 Si, bal Fe.
For armatures, relays, solenoid switches; high permeability.

NO. 3 C.

M-69; C, Cr, Co, bal Fe.
For coldwork dies.

NO. 3 MINE TALABOT SPECIAL D.

M-1119; 0.95 C, bal Fe.
For tools, springs, taps, drills; water hardened.

4-6 CHROME.

M-735; 4-6 Cr, Ti = 4 to 6 x C, 0.10 C, bal Fe.
Annealed: 66,000 TS; 39,000 YS; 45 El; 143 Brin.
For oil stills and refinery tubes; corrosion resistant.

NO. 5 RELAY.

M-1; 2.5 Si, bal Fe.
For armatures, switches, solenoid switches; high permeability.

NO. 6 MINE TULIPE SPECIAL D.

M-1119; 0.75 C, bal Fe.
For tools, springs, punches; water hardened.

NO. 7 ALLOY (MATHER & PLATT).

M-454; 3.0 C, 4-5 Cu, 12-14 Ni, 1.0-1.2 Mn, 4-6 Cr, 1.2-1.5 Si, bal Fe.
25,000-30,000 TS; 200-220 Brin.
For valves, centrifugal pumps; austenitic cast iron; abrasion and corrosion resistant.

13 CrMo 44.

M-459; 0.13 C, 0.85 Cr, 0.45 Mo, 0.55 Mn, bal Fe.
For cams, camshafts, bolts, shafts; case hardening, tough.

14 NiCr 74.

M-459; 0.13 C, 0.7 Cr, 3.5 Ni, 0.5 Mn, bal Fe.
Heat treated: 157,000-185,000 TS; 143,000-171,000 YS; 13-10 El.
For gears, cams, camshafts, shafts; case hardening steel, tough.

15 CrNi 6.

M-459; 0.15 C, 1.5 Cr, 1.5 Ni, bal Fe.
For gears, shafts, cams, camshafts; case hardening, tough.

16 MnCr 5.

M-459; 0.16 C, 1.2 Mn, 1 Cr, bal Fe.
For gears, shafts, cams, camshafts; case hardened, tough.

18 CrNi 8.

M-459; 0.18 C, 2 Cr, 2 Ni, bal Fe.
For gears, shafts, cams, camshafts; case hardened, tough.

20 MnCr 5.

M-459; 0.2 C, 1.3 Mn, 1.2 Cr, bal Fe.
For gears, shafts, cams, camshafts; case hardened, tough.

24 CrMo 5.

M-459; 0.24 C, 1.15 Cr, 0.25 Mo, 0.55 Mn, bal Fe.
For bolts, hardware, shafts, rams; water hardened.

30 CrNiMo 8.

M-459; 0.3 C, 2 Cr, 0.2 Mo, 2 Ni, bal Fe.
For gears, shafts, machinery parts; shock resistant, oil hardened.

34 Cr 4.

M-459; 0.33 C, 0.65 Mn, 1.0 Cr, 0.25 Si, bal Fe.
For fasteners, gears, shafts; water or oil hardened.

34 CrNiMo 6.

M-459; 0.34 C, 1.5 Cr, 0.15 Mo, 1.5 Ni, bal Fe.
For gears, shafts, machinery parts; shock resistant, oil hardened.

NO. 35 MONEL.

M-68; 31.25 Cu, 65.5 Ni, 1 Fe.
Cold rolled: 78,000-85,000 TS; 45,000-65,000 YS; 40-20 El.
For table tops; corrosion resistant.

36 CrNiMo 4.

M-459; 0.36 C, 1 Cr, 0.15 Mo, 1 Ni, bal Fe.

For gears, shafts, machinery parts; shock resistant, oil hardened.

NO. 37 ALUMINUM SOLDER.

M-1713.

For solder for aluminum; resists pressures up to 1000 lbs.

37 MnSi 5.

M-459; 0.37 C, 1.25 Si, 1.25 Mn, bal Fe.

For punches, upsetters, crimpers; oil hardened, tough.

42 CrMo 4.

M-459; 0.42 C, 1.1 Cr, 0.2 Mo, bal Fe.

For gears, bolts, shafts, axles; oil or water hardened.

47 Cr 4.

M-459; 0.4 C, 1.1 Cr, bal Fe.

For gears, cams, shafts; oil hardened.

50 CrMo 4.

M-459; 0.50 C, 1.0 Cr, 0.2 Mo, 0.65 Mn, bal Fe.

For gears, bolts, shafts, axles; water hardened.

50 CrV 4.

M-459; 0.50 C, 0.85 Mn, 1.0 Cr, 0.1 V, bal Fe.

For bolts, springs, shafts, gears; oil hardened, shock resistant.

NO. 50 SOLDER ALLOY.

M-1136; In-Pb.

For solder; M.P. 600°F.

NO. 55 ALLOY.

England; 27-30 Cr, bal Fe.

For glass-to-metal seals; same coefficient of expansion as glass.

58 CrV 4.

M-459; 0.58 C, 0.95 Mn, 1.0 Cr, 0.09 V, bal Fe.

For springs, punches, forging dies; oil hardened, tough.

NO. 93 CHROME MOLYBDENUM.

M-1; 0.5 C, 0.7 Cr, 0.5 Mo, bal Fe.

For tools; oil hardening, shock resisting; now Atlas 93.

100 Cr 6.

M-459; 1.0 C, 1.5 Cr, bal Fe.

For ball bearings and races, header dies; water hardened, wear resistant.

100 CrMn 6.

M-459; 1.0 C, 1.1 Mn, 1.5 Cr, bal Fe.

For roller bearings; oil or water hardened.

"101" VAN PUNCH.

M-1409; 0.5 C, 5 W, bal Fe.

For punches, piercing dies; head, impact and abrasion resistant.

NO. 122 ALLOY.

M-137; 9.25-10.75 Cu, 0.15-0.35 Mg, 0.9-1.5 Fe, bal Al.

Cast: 17,000 TS; 16,000 YS; 0.5 El; 80 Brin.

Heat treated: 40,000 TS; 0.5 El; 160 Brin.

For pistons; permanent molds.

NO. 155 PREMIUM SILVER BRAZING ROD.

M-1713; 55 Ag, bal Cu.

Cast: 50,000 TS.

For silver brazing; 1155°F working temperature.

"401" COPPER-NICKEL ALLOY.

M-1499; 45.5 Ni, 53.1 Cu, 1.7 Mn, 0.50 Co.

Annealed: 70,000 TS; 30,000 YS; 45 El.

For electronic components.

NO. 444 ALLOY.

M-739; 80-96 Cu, 3.5-5.0 Sn, 3.5-4.5 Pb, 4 Zn.

For bearings, bushings; SAE 791.

NO. 446 ALLOY.

England; 27-30 Cr, bal Fe.

For glass-to-metal seals.

NO. 500 ALLOY.

U.S.; Al alloy.

Cast: 27,000 TS; 20,000 YS; 2 El.

For casting; light weight.

NO. 712 ALLOY.

M-18; 29 Os, 40-50 Ir, bal Pt.

For contact points; corrosion resistant.

NO. 812.

M-57; 1.8 C, 12.5 Cr, bal Fe.

For dies; non-deforming.

NO. 812.

M-357; 1.8 C, 12.25 Cr, bal Fe.

For blanking and coining dies; taps, reamers; non-deforming.

NO. 999.

M-340; 0.7 C, 18 W, 4 Cr, 1 V, 5 Co, bal Fe.

For hogging cuts for fast speeds, cutters; high speed steel.

NO. 1040 ALLOY.

German; 15 Cu, 1 Mn, 3 Mo, 71 Ni, 10 Fe.

For electrical equipment; magnetic alloy.

NO. 3074 HOT WORK.

M-365; 0.40-0.45 C, 8-10 W, 2.5 Cr, 0.10-0.15 V, bal Fe.

For hot work tools and dies, forging mandrels; hot work steel.

NO. 9500-1.

M-216; 95 Bi, 5 Sn. For solder; soft.

"A71NB" QUALITY.

M-179; 61 Cu, 1 min Sn, 0.5 max Pb, bal Zn.

Extruded: 60,000 TS; 25 El; 25 RA; 120 Brin.

Drawn: 66,000 TS; 22 El; 20 RA; 130 Brin.

For condenser tubes; Naval Brass.

A-7W.

M-373; 2.25 C, 5.25 Cr, 4.75 V, 1.0 W, 1.0 Mo, bal Fe.

Air hardening tool steel; AISI A7.

A9V.

M-78; 8.5 Al, 0.5 Zn, 0.3 Mn, bal Mg.

For castings, light metal parts; heat treatable.

A-110.

M-64; 1.2 C, 0.3 Mn, 0.3 Si, bal Fe.

Water hardening tool steel; AISI W1.

"A" ALLOY-1.

M-311; 77 Al, 20 Zn, 3 Cu.

Hot rolled: 60,000 TS; 41,000 YS; 21 El; 36 RA.

For light alloy wrought parts; non-hardenable.

"A" ALLOY-2.

M-311; 4.7 Cu, 1.34 Mg, 1.85 Ni, 1.5 Pb, 0.5 Fe, bal Al.

For light alloy wrought parts; age-hardenable.

A-ALLOY GR. A.

M-59; 0.4-0.8 C, 66-68 Ni, 19-21 Cr, 0.5-1.0 Mn, bal Fe.

Cast: 60,000-80,000 TS; 40,000-50,000 YS; 40 El; 30 RA; 217 Brin.

For heat and corrosion resistant parts; heat and corrosion resistant.

AA NICKEL-COBALT.

M-580; Ni-Co.

For anodes; electroplating.

A.A.A.A.

M-590; Pb, Sb, bal Sn.

For bearings; Babbitt, antifriction metal.

AB2.

M-England; 8.5-10.5 Al, 3.5-5.5 Fe, 4.6-6.5 Ni, 1.5 max Mn, 0.50 max Zn, bal Cu.

For impellers and propellers, gears, pumps, shafts, bushings.

B.S. 1400 equivalent; heat treatable, corrosion resistant.

"AB164" QUALITY.

M-179; Al, Fe, Ni, bal Cu.

Extruded: 82,000 TS; 42,000 YS; 20 El; 12 RA; 170 Brin.

Drawn: 88,000 TS; 46,000 YS; 18 El; 10 RA; 180 Brin.

For engine valve guides; Al bronze, heat resistant.

"AB197" QUALITY.

M-179; Al, Fe, Ni, bal Cu.

Extruded: 110,000 TS; 62,000 YS; 18 El; 10 RA; 190 Brin.

Drawn: 115,000 TS; 68,000 YS; 15 El; 10 RA; 210 Brin.

For hardware; Al bronze, corrosion resistant.

A.B.C.

M-40, M-487; 0.4 C, 0.5 W, 0.25 Cr, 0.3 Si, 0.5 Mn, bal Fe.

For tools, chisels, hammers, drills, gears, shafts; tough and hard.

A.B.C.

M-80; high C, alloy, bal Fe.

For chisels; shock resistant.

ABC-III.

Germany; 0.7 C, 2.5 Mo, 2.5 V, 3 W, bal Fe.

For cutting tools; oil hardened.

ABK METAL.

M-1099; 3-3.75 C, 0.3-0.9 Mn, 0.3-1.2 Si, 3.5-6.5 Ni, 1.5-4 Cr, bal Fe.

Cast: 35,000-80,000 TS; 0.10-0.30 El; 500-650 Brin.
For castings, crushing rolls, liners; wear resistant, cast iron.

ABK Ni-HARD.

M-9; 4.5 Ni, 2.7-3.6 C, 1.5 Cr, 0.5-1.5 Si, 0.3-0.7 Mn, bal Fe.

Cast: 30,000-40,000 TS; 575-750 Brin.

For pump plungers, roller bearing races, chilled rolls; corrosion resistant, tough.

ABRADUR 500.

M-884; 0.40 C, 3.5 Ni, 1.4 Cr, 0.4 Mo, bal Fe.

For gears, shafts, crankshafts; oil hardened, shock resistant.

ABRASALLOY.

M-353; 0.35 C, 1 Cr, 0.25 Mo, 0.75 Mn, 0.35 Si, bal Fe.

For crusher hammers, coal screens, dredge pumps; tough, wear resistant.

ABRASOCRAFT.

M-175; C, alloy, bal Fe.

Welded: 350-500 Brin.

For hard surfacing electrode; abrasion resistant.

ABRASIST.

M-1460; C, alloy, bal Fe.

For machinery castings; abrasion resistant.

ABRASOHARD.

M-811; C, alloy, bal Fe.

For welding rods; abrasion resistant.

ABRASOWELD.

M-578; 2.1 C, 1.1 Mn, 0.75 Si, 0.40 Mo, 6.5 Cr, bal Fe.

Hard surfacing arc welding electrodes for resistance to abrasion and impact.

ABROS.

Eng.; 10 Cr, 88 Ni, 2 Mn.

For electrical resistance, heating elements; stainless and corrosion resistant.

ABSCO METAL 25H.

M-9; high C, Si, Mn, bal Fe.

Cast: 25,000 TS; 150-210 Brin.

For ingot molds, pig molds; cast iron, Class 25.

ABSCO METAL 30.

M-9; high C, Si, Mn, bal Fe.

Cast: 30,000 TS; 20,000 YS; 0.6 El; 170-240 Brin.

For gears, pulleys, general castings; cast iron, Class 30.

ABSCO METAL 30H.

M-9; high C, Si, Mn, alloy, bal Fe.

Cast: 30,000 TS; 220-280 Brin.

For heat and wear resistant castings; cast iron.

ABSCO METAL 35.

M-9; high C, Si, Mn, bal Fe.

Cast: 35,000 TS; 200-260 Brin.

For gears, housings, general castings; cast iron, Class 35.

ABSCO METAL 40.

M-9; high C, Si, Mn, bal Fe.

Cast: 40,000 TS; 210-260 Brin.

For meter bodies, water valves, compressor cylinders; cast iron, Class 40.

ABSCO METAL 40H.

M-9; high C, Si, Mn, alloy, bal Fe.

Cast: 40,000 TS; 230-290 Brin.

For heat and wear resistant castings; cast iron.

ABSCO METAL 50.

M-9; high C, Si, Mn, bal Fe.

Cast: 50,000 TS; 220-280 Brin.

For press parts, cylinder heads, forming dies; cast iron, Class 50.

ABSCO METAL 55.

M-9; high C, Si, Mn, bal Fe.

Cast: 55,000 TS; 45,000 YS; 0.7 El; 230-310 Brin.

For crankshafts, tool shanks, cutter bodies; cast iron, Class 55.

ABSCO METAL 400.

M-9; high C, Si, Mn, alloy, bal Fe.

Cast: 400 Brin.

For ash-sluice pipe chutes, burner nozzles; heat and wear resistant.

ABYSSINIAN GOLD.

Eng.; 88 Cu, 11.5 Zn, 0.5 Au.

For ornaments, jewelry.

ABYSSINIAN GOLD.

Eng.; 90-92 Cu, 8-10 Zn, 1 plated Au.

For ornaments, jewelry; sheets plated with Au.

AC-254.

M-642; 0.24 C, 1.0 Mn, 0.4 Si, 12.0 Cr, 1.0 Ni, 2.5 Mo, 1.0 W, 0.25 V, 0.22 B, bal Fe.

At 1100°F; 85,000 TS; 70,000 YS; 18 El, 55 RA.

For steam turbine blading, jet engine components. Stainless, martensitic, creep resistant.

AC-AMSCO NO. 217.

M-607; 3 C, 8 Cr, 15 W, bal Fe.

600-700 Brin.

For hard facing welding rod; maintains hardness up to 1000°F.

AC-AMSCO NO. 459.

M-607; 3 C, 4 Cr, 4 Mo, bal Fe.

500-600 Brin.

For hard surfacing welding rod; for severe wear and abrasion.

AC-COATED 18-8.

M-607; C, 18 Cr, 8 Ni, bal Fe.

Coated.

For stainless steel welding rod; coated rods.

ACCOLLOY.

M-653; 3.5 Ni, 0.3 C, bal Fe.

For chains.

ACCOLOY CN-1.

M-1005; 0.20 C, 28 Cr, 3 max Ni, bal Fe.

For furnace parts, heat treating equipment; heat resistant, ferritic.

ACCOLOY CN-2.

M-1005; 0.40 C, 28 Cr, 10 Ni, bal Fe.

Cast: 95,000 TS; 45,000 YS; 20 El; 200 Brin.

For furnace parts, heat treating equipment, pots;

Type HE; austenitic, heat resistant.

ACCOLOY CN-3.

M-1005; 0.30 C, 25 Cr, 20 Ni, bal Fe.

Cast: 75,000 TS; 50,000 YS; 17 El; 170 Brin.

For furnace parts, heat treating equipment, pots;

Type HK; austenitic, heat resistant.

ACCOLOY CN-4.

M-1005; 0.35 C, 25 Cr, 12 Ni, bal Fe.

Cast: 80,000 TS; 50,000 YS; 25 El; 185 Brin.

For furnace parts, heat treating equipment, pots;

Type HH; austenitic, heat resistant.

ACCOLOY CNC-4B.

M-1005; 0.10 max C, 24 Cr, 12 Ni, bal Fe.

For furnace parts, heat treating equipment pots; corrosion and heat resistant, austenitic.

ACCOLOY CNC-4D.

M-1005; 0.20 max C, 24 Cr, 12 Ni, bal Fe.

For furnace parts, heat treating equipment, pots; heat and corrosion resistant, austenitic.

ACCOLOY CN-5.

M-1005; 0.25 C, 18 Cr, 8 Ni, bal Fe.

Cast: 75,000 TS; 45,000 YS; 30 El; 175 Brin.

For carburizing boxes; corrosion and heat resistant, austenitic.

ACCOLOY CNC-5A.

M-1005; 0.07 C, 18 Cr, 8 Ni, bal Fe.

Cast: 85,000 TS; 150 Brin.

For castings, baskets, carburizing boxes; Type 304; stainless, austenitic.

ACCOLOY CNC-5B.

M-1005; 0.10 C, 18 Cr, 8 Ni, bal Fe.

Cast: 85,000 TS; 150 Brin.

For heat treating boxes, pots, baskets; Type 302; stainless, austenitic.

ACCOLOY CNC-5C.

M-1005; 0.16 max C, 18 Cr, 8 Ni, bal Fe.

Cast: 90,000 TS; 160 Brin.

For heat treating boxes, chemical plant equipment; Type 302; stainless, austenitic.

ACCOLOY NC-1.

M-1005; 0.2 C, 68 Ni, 18 Cr, bal Fe.

Cast: 65,000 TS; 36,000 YS; 9 El; 176 Brin.

For autoclaves, furnace parts; Type HX; austenitic, heat resistant.

ACCOLOY NC-2.

M-1005; C, 60 Ni, 18 Cr, bal Fe.

For castings; heat resistant.

ACCOLOY NC-3.

M-1005; 0.40 C, 18 Cr, 38 Ni, bal Fe.

For furnace parts, cylinder liners, conveyors, fixtures; Type HU; austenitic, heat resistant.

ACCOLOY NC-4.

M-1005; 0.25-0.70 C, 35 Ni, 15 Cr, bal Fe.

Cast: 70,000 TS; 40,000 YS; 10 El; 180 Brin.

For cyanide pots, furnace equipment; Type HT; austenitic, heat resistant.

ACCOLOY NC-5.

M-1005; C, 30 Ni, 10 Cr, bal Fe.

For castings; heat resistant.

ACCULOY 280 C.

M-1538; Au, bal Sn.

Uses: Brazing alloy for electronic parts.

High corrosion and etch resistance. High electrical conductivity.

ACCUMULATOR METAL.

U.S.; 90 Pb, 9.2 Sn, 0.8 Sb.

Bearings, battery plates, antifriction.

ACCURATE METAL.

M-1676; 29-32 Ni, 68 min Cu, 0.4-0.7 Fe.

Annealed: 57,000 TS; 21,000 YS; 43 El; B 44 Rock.

Hard: 82,000 TS; 75,000 YS; 5 El; B 86 Rock.

Soft: 54,000 TS; 16,000 YS; 35 El; B 40 Rock.

For electronic components, marine hardware, ferules, pump valves.

Corrosion resistant, non-magnetic.

ACCURLOY.

M-1510; 0.51 C, 1.05 Cr, 0.25 Mo, 0.53 Ni, 0.21 V, 0.97 Mn, bal Fe.

Heat treated: 165,000 TS; 150,000 YS; 20 El; 59 RA; 280-300 Brin.

For shafts, pins, boring bars, piston rods; heat treated and stress-relieved bars, shock resistant.

ACEROID.

M-592; Zn, bal Cu.

For castings.

ACEROLD.

M-592; C, alloy, bal Fe.

For machinery castings.

ACHORN 6-6-4-2.

M-608; 0.85 C, 4 Cr, 2 V, 6.5 W, 5 Mo, bal Fe.

For tools, cutters; high speed steel.

ACHORN 9W HOT WORK.

M-608; 0.30 C, 3.0 Cr, 0.5 V, 9.5 W, bal Fe.

Hot work tool steel; oil hardening; for forging dies, hot forming dies; AISI H21.

ACHORN 11W HOT WORK.

M-608; 0.40 C, 3.0 Cr, 0.45 V, 12.0 W, bal Fe.

Oil hardening hot work tool steel, tungsten type; for forging and hot working dies.

AISI H22.

ACHORN 15W HOT WORK.

M-608; 0.45 C, 3.5 Cr, 0.7 V, 14 W, bal Fe.

Air or oil hardening hot working tool and die steel; AISI H24.

ACHORN 18-4-1.

M-608; 0.65 C, 3.75 Cr, 18.5 W, 1.2 V, bal Fe.

For tools, cutters; high speed steel.

ACHORN 33 HOT WORK.

M-608; 0.33 C, 0.85 Si, 5.0 Cr, 0.2 V, 1.25 W, 1.45 Mo, bal Fe.

Hot work tool steel, chromium type; AISI H12.

ACHORN 33A HOT WORK.

M-608; 0.40 C, 0.3 Mn, 0.9 Si, 5.0 Cr, 0.5 V, 1.3 Mo, bal Fe.

Oil or air hardening tool and die steel; for forging dies and hot forming dies.

AISI H11.

ACHORN 33M HOT WORK.

MD-608; 0.40 C, 1.0 Si, 5.0 Cr, 1.0 V, 1.0 Mo, bal Fe.

Air or oil hardening hot work tool steel; AISI H13.

ACHORN AF-33 HOT WORK.

M-608; 0.30-0.35 C, 0.8-1.0 Si, 5 Cr, 1.1 W, 1.5 Mo, bal Fe.

For hot work dies; hot work steel.

ACHORN 100 CHROMIUM.

M-608; 1.0 C, 1.5 Cr, bal Fe.

Low alloy tool steel, oil hardening.

AISI L1.

ACHORN 225 C HIGH PRODUCTION DIE.

M-608; 2.1 C, 12.0 Cr, 0.75 W, bal Fe.

Oil or air hardening cold work tool steel; chromium type; for punch and trim dies, thread rolling tools, gages.

AISI D3.

ACHORN "350" FINISHING.

M-608; 1.3 C, 3.5 W, bal Fe.

For tools, dies; fast finishing steel.

ACHORN 512.

M-608; 0.10 C, 0.48 Mn, 1.5 Cr, 3.5 Ni, bal Fe.

Low carbon steel for cold hubbing and then case hardening for molds.

ACHORN ALLOY PIVOT.

M-608; 1.10 C, 0.40 Mn, 0.25 Si, 1.35 Cr, 0.40 Mo, bal Fe.

Oil hardening steel for shafts, pivots, lathe centers.

AISI L7.

ACHORN BEST CARBON.

M-608; 0.8-1.2 C, 0.25 Si, 0.25 Mn, bal Fe.

Water hardened: 166,000-216,000 TS; 110,000-150,000 YS; 11-15 EI; 32-37 RA; 330-600 Brin.

For taps, reamers, drills, punches, stamps, knurls, mandrels, cutters.

Type W1 water hardening.

ACHORN CARBON DRILL ROD.

M-608; 1.0 C, 0.25 Mn, 0.28 Si, bal Fe.

Water hardening tool steel; AISI W1.

ACHORN CM AIR HARDENING.

M-608; 0.70 C, 2.0 Mn, 0.3 Si, 1.0 Cr, 1.35 Mo, bal Fe.

Medium alloy, air hardening cold work tool steel; AISI A6.

ACHORN COLD DRAWN TOOL STEEL.

M-608; 1.05 C, 0.25 Mn, 0.28 Si, bal Fe.

Water hardening tool steel, for drills, arbors, lathe centers, bushings. AISI W1.

ACHORN COLD HEADING.

M-608; 0.8-1.2 C, 0.25 Si, 0.25 Mn, bal Fe.

Water hardened: 166,000-216,000 TS; 110,000-150,000 YS; 11-15 EI; 32-37 RA; 330-600 Brin.

For taps, drills, reamers, punches, stamps, knurls, mandrels, cold heading tools.

Type W1 water hardening.

ACHORN COMPOSITE STEEL.

M-608; 1.0 C, 0.40 Cr, 0.40 V, 1.25 W, bal Fe.

Water or oil hardening steel for shafts, arbors, lathe centers, drill bushings.

AISI F1.

ACHORN CRM-50.

M-608; 0.5-0.55 C, 0.6 Mn, 1.0 Cr, 0.20 Mo, bal Fe.

For hot work dies; hot work steel.

ACHORN CVM.

M-1421; 0.95 C, 0.7 Mn, 5 Cr, 0.25 V, 1.2 Mo, bal Fe.

For punches, blanking and forming dies; air hardened, non-deforming.

ACHORN EXTRA BLADE.

M-608; 1.1 C, 0.25 Mn, bal Fe.

For tools, cutters; oil hardened.

ACHORN EXTRA CARBON.

M-608; 1.05 C, 0.25 Mn, 0.28 Si, bal Fe.

Water hardening tool steel; AISI W1.

ACHORN EXTRA CHISEL.

M-608; 0.8-1.1 C, 0.25 Si, 0.25 Mn, bal Fe.

Water hardened: 166,000-216,000 TS; 110,000-150,000 YS; 11-15 EI; 32-37 RA; 330-600 Brin.

For taps, drills, reamers, punches, stamps, knurls, mandrels.

Type W1 water hardening.

ACHORN EXTRA SOLID DRILL.

M-608; 1.15 C, 0.30 Mn, bal Fe.

For tools, drills; water hardened.

ACHORN FAGERSTA BEST.

M-608; 1.05-1.15 C, 0.20-0.25 Mn, 0.25 Si, bal Fe.

For drills, cutters, reamers, taps, broaches; Type W1; water hardened.

ACHORN FAGERSTA CHISEL.

M-608; 0.8-0.9 C, 0.3 Mn, 0.25 Si, bal Fe.

For chisels, screw drivers; water hardened; Type W1.

ACHORN FAGERSTA COLD HEADING.

M-608; 0.95 C, 0.3 Mn, 0.25 Si, bal Fe.

For cold heading dies, form tools; Type W1; water hardened.

ACHORN FAGERSTA ENVELOPE DIE.

M-608; 1.05-1.15 C, 0.3 Mn, 0.25 Si, bal Fe.

For envelope dies, cutters, drills, form tools; Type W1; water hardened.

ACHORN FAGERSTA EXTRA.

M-608; 1.0-1.1 C, 0.3 Mn, 0.25 Si, bal Fe.

For tools, cutters, drills, taps, reamers; Type W1; water hardened.

ACHORN FAGERSTA EXTRA CUTLERY.

M-608; 1.07-1.12 C, 0.25 Mn, 0.3 Si, bal Fe.

For cutlery tools, drills, taps; Type W1; water hardened.

ACHORN FAGERSTA FINISHING.

M-608; 1.15 C, 0.4 Mn, 0.4 Cr, 2.5 W, bal Fe.

For finishing cutters; water hardened, keen cutting edge.

ACHORN FAGERSTA HIGH PRODUCTION.

M-608, M-385; 1.6 C, 0.8 Mn, 12 Cr, 0.2 V, bal Fe.

For blanking and forming dies; air hardened, non-deforming.

ACHORN FAGERSTA HOT DIE.

M-608; 0.55 C, 0.45 Mn, 5.0 W, 3.0 Ni, bal Fe.

For upsetting and forging dies, extrusion rams and liners; hot work steel, oil hardened.

ACHORN FAGERSTA SHOE DIE.

M-608, M-385; 0.55 C, 0.65 Cr, 0.35 Mo, bal Fe.

For shoe dies, cutting dies for leather and rubber; oil hardening.

ACHORN FAGERSTA SILVER DIE.

M-608; 1.0 C, 0.25 Mn, 0.25 Si, bal Fe.

For silver dies; Type W1; water hardened.

ACHORN FAGERSTA SMOOTH BOR HOLLOW.

M-608; 0.80 C, 0.25 Mn, 0.25 Si, bal Fe.

For rock drills; Type W1; water hardened.

ACHORN FAGERSTA SOLID DRILL.

M-608; 0.8-0.9 C, 0.35 Mn, 0.25 Si, bal Fe.

For solid drills; Type W1; water hardened.

ACHORN FAGERSTA SPECIAL ALLOY DIE.

M-608; 0.45-0.55 C, 0.9 Cr, 1.2 W, 0.2 Mo, bal Fe.

For dies, tools; oil hardened.

ACHORN FAGERSTA STANDARD.

M-608; 0.9-1.0 C, 0.3 Mn, 0.25 Si, bal Fe.

For tools, drills, taps, hobs, reamers; Type W1; water hardened.

ACHORN FAGERSTA STANDARD CUTLERY.

M-608; 0.85-0.95 C, 0.35 Mn, 0.25 Si, bal Fe.
For cutlery tools, drills; reamers; Type W1; water hardened.

ACHORN FAGERSTA SUPERIOR OIL.

M-608; 1.0 C, 1.0 Mn, 0.4 Cr, 0.4 W, bal Fe.
For tools, dies, cold headers; water or oil hardened.

ACHORN FAGERSTA UNBREAKABLE CHISEL.

M-608; 0.45 C, 0.9 Cr, 1.2 W, 0.2 Mo, bal Fe.
For chisels, upsetters; oil hardened, tough.

ACHORN FAGERSTA WHITE GOLD.

M-608; 1.15 C, 0.4 Mn, 0.4 Cr, 1.2 W, bal Fe.
For tools, cutters; oil or water hardened.

ACHORN GRAPHITIC OIL.

M-608; 1.45 C, 0.8 Mn, 1.15 Si, 0.20 Cr, 0.25 Mo, bal Fe.
Oil hardening cold work tool steel; AISI O6.

ACHORN HEAT TREATED MOLD STEEL.

M-608; 0.30 C, 0.80 Mn, 0.50 Si, 1.7 Cr, 0.40 Mo, bal Fe.
Hardened, machinable, for molds; AISI P20.

ACHORN HIGH PRODUCTION.

M-608; 1.6 C, 12 Cr, 0.8 Mo, 0.8 V, bal Fe.
For punches, drawing dies, form tools; air hardened, non-deforming.

ACHORN HOLLOW DRILL.

M-608; 0.75 C, 0.3 Mn, bal Fe.
Heat treated: 180,000 TS; 130,000 YS; 12 El; 36 RA; 360 Brin.
For hollow drills, die blocks; water hardened; Type W1.

ACHORN KLOSTER BRILLIANT AX.

M-608; 0.7 C, 4 Cr, 18 W, 1.75 V, bal Fe.
For tools, cutters, reamers, hobs, lathe and planer tools; high speed steel; Type T1.

ACHORN KLOSTER BRILLIANT WKE.

M-608; 0.7 C, 4.5 Cr, 18 W, 1.5 V, 5 Co, bal Fe.
For lathe and planer tools, hobs, reamers, taps, drills; high speed steel; Type T4.

ACHORN KLOSTER PRIOR EXTRA.

M-608; 0.6-0.7 C, 4-5 Cr, 18-19 W, 1.2 V, 1 Co, bal Fe.
For lathe and planer tools, hobs, reamers, taps, drills; high speed steel, oil hardened.

ACHORN KLOSTER REMA.

M-608; 0.02-0.05 C, 0.02-0.07 Mn, bal Fe.
For molding dies for plastics; hobbing steel.

ACHORN M1 HIGH SPEED.

M-608; 0.80 C, 4.0 Cr, 1.0 V, 1.5 W, 8.0 Mo, bal Fe.
High speed steel, molybdenum type; for drills, lathe tools, milling cutters. AISI M1.

ACHORN M-2.

M-608; 0.8 C, 5 Mo, 6.5 W, 2 V, 4 Cr, bal Fe.
For lathe and planer tools, drills, reamers; high speed steel.

ACHORN M2½ (CLASS 1) HIGH SPEED.

M-608; 1.0 C, 4.0 Cr, 2.5 V, 6.25 W, 6.25 Mo, bal Fe.
High speed tool steel, molybdenum-tungsten type; AISI M3 Class 1.

ACHORN M3 (CLASS 2) HIGH SPEED

M-608; 1.15 C, 4.0 Cr, 3.0 V, 6.0 W, 5.5 Mo, bal Fe.
High speed steel, tungsten-molybdenum-vanadium-chromium. AISI M3 Class 2.

ACHORN M4 HIGH SPEED.

M-608; 1.28 C, 4.5 Cr, 4.0 V, 5.5 W, 4.5 Mo, bal Fe.
High speed steel, tungsten-molybdenum-vanadium-chromium; AISI M4.

ACHORN M10 HIGH SPEED.

M-608; 0.85 C, 4.0 Cr, 2.0 V, 8.0 Mo, bal Fe.
Molybdenum type high speed steel; AISI M10.

ACHORN M34 HIGH SPEED.

M-608; 0.90 C, 4.0 Cr, 2.0 V, 1.75 W, 8.5 Mo, 8 Co, bal Fe.
High speed steel, molybdenum-cobalt type, AISI M34.

ACHORN MANGANESE OIL HARDENING.

M-608; 0.90 C, 1.50 Mn, 0.25 Si, 0.30 Mo, bal Fe.
Oil hardening in small sections; AISI O2.

ACHORN MOLDALOY.

M-608; 0.10 C, 0.5 Mn, 0.5 Cr, 1.2 Ni, bal Fe.
For dies, molds; carburizing grade.

ACHORN Ni-Cro-Mo.

M-608; 0.68 C, 0.6 Mn, 0.25 Si, 0.65 Cr, 1.4 Ni, 0.20 Mo, bal Fe.
Oil hardening, low alloy tool steel for shafts, arbors, lathe centers, tool holders. AISI L6.

ACHORN OIL HARDENING DRILL ROD.

M-608; 0.90 C, 1.1 Mn, 0.5 Cr, 0.15 V, 0.5 W, bal Fe.
Oil hardenable in small sections; AISI O1.

ACHORN OILWEAR.

M-608; 1.25 C, 0.3 Mn, 0.35 Si, 0.4 Cr, 0.2 V, 1.4 W, bal Fe.
Oil hardening cold work tool steel, wear resistant type; AISI O7.

ACHORN REMA IRON.

M-608; 0.06 C, 0.21 Mn, bal Fe.
For plastic mold dies; water hardened.

ACHORN SOLID DRILL.

M-608; 0.85 C, 0.35 Mn, bal Fe.
Heat treated: 190,000 TS; 145,000 YS; 10 El, 30 RA; 400 Brin.
For drills, punches, taps, reamers, cutters; water hardened; Type W1.

ACHORN SPRING STEEL SHEET.

M-608; 1.0 C, 0.25 Mn, 0.28 Si, bal Fe.
Water hardened sheet steel, spring temper; AISI W1.

ACHORN STANDARD CARBON.

M-608; 1.0-1.1 C, 0.30 Mn, bal Fe.
For cutters, drills, reamers, punches; water hardened; Type W1.

ACHORN SUPERIOR OIL HARDENING.

M-608; C, alloy, bal Fe.
For tools, dies, punches; oil hardened.

ACHORN T2 HIGH SPEED.

M-608; 0.80 C, 4.0 Cr, 2.0 V, 18.5 W, 0.75 Mo, bal Fe.
Tungsten type high speed steel; AISI T2.

ACHORN T4 HIGH SPEED.

M-608; 0.75 C, 4.0 Cr, 1.05 V, 18.5 W, 5.0 Co, bal Fe.
Tungsten-cobalt type high speed steel; AISI T4.

ACHORN T5 HIGH SPEED.

M-608; 0.80 C, 4.25 Cr, 2.0 V, 19.0 W, 1.0 Mo, 8.0 Co, bal Fe.
Tungsten-cobalt type high speed steel; AISI T5.

ACHORN T15 HIGH SPEED.

M-608; 1.5 C, 4.75 Cr, 5.0 V, 12.5 W, 5.0 Co, bal Fe.
High speed steel, tungsten, cobalt, vanadium type; AISI T15.

ACHORN TOOL STEEL SHEET.

M-608; 1.05 C, 0.25 Mn, 0.28 Si, bal Fe.
Water hardenable sheet steel; AISI W1.

ACHORN UBC.

M-608; 0.48 C, 0.9 Cr, 1.1 W, 0.2 Mo, bal Fe.
For hot work dies; hot work steel.

ACHORN USI STEEL.

M-608; 0.60, 0.85 Mn, 2.0 Si, 0.25 Cr, 0.2 V,
0.25 Mo, bal Fe.
Water or oil hardening tool steel, shock resisting
type; AISI S5.

ACHORN V85 STEEL.

M-608; 0.90 C, 0.3 Mn, 0.25 Si, 0.25 V, bal Fe.
Water hardening tool steel; AISI W2.

ACHORN VAMO.

M-608; 0.50 C, 0.45 Mn, 1.0 Si, 5.2 Cr, 1.5 Ni,
1.0 V, 1.4 Mo, bal Fe.
Medium alloy, air hardening cold work tool steel;
AISI A9.

ACHORN VBC.

M-608; 0.5 C, 0.90 Cr, 1.25 W, 2 Mo, 0.25 Mn,
bal Fe.
For punches, rivet sets, upsetters; oil hardened, hot
work steel.

ACIBAL.

Al alloy.
For light alloy parts.

ACIBEL.

M-280; 0.07-0.13 C, 0.15-0.25 Pb, 0.85-1.15 Mn,
0.23-0.33 S, bal Fe.
Rolled: 70,000 TS.
For shafts, gears, machine tool parts; free-cutting,
case hardened.

ACIBRADE.

M-280; 0.55-0.70 C, 1.25-1.55 Mn, 0.1-0.35 Si,
bal Fe.
Rolled: 137,000 TS; 275 Brin.
For rods for coke crushing rod mills; wear resistant,
tough.

ACICUI AR.

M-494; 2.9 C, 2 Si, 2.5 Ni, 0.9 Mo, bal Fe.
Cast: 280-350 Brin.
For castings, gears, housings; alloy cast iron.

ACID BRONZE-1.

Eng.; 88 Cu, 10 Sn, 2 Pb.
For bearings, chemical equipment; corrosion
resistant.

ACID BRONZE-2.

Eng.; 82 Cu, 8 Sn, 8 Pb, 2 Zn.
For chemical equipment; corrosion resistant.

ACID BRONZE-3.

Eng.; 84 Cu, 9.5 Sn, 6.3 Pb, 0.2 P.
For chemical equipment; corrosion resistant.

ACID BRONZE-4.

Eng.; 74 Cu, 8 Sn, 17 Pb, 1.5 Zn.
For chemical equipment; corrosion resistant.

ACID METAL.

U.S.; 88 Cu, 10 Sn, 2 Pb.
For chemical equipment; corrosion resisting.

ACID RESISTING-1.

Eng.; 10 Cr, 30 Ni, 40.8 Fe, 6.2 W, 1.55 Mn,
0.45 Si.
For chemical apparatus, acid resisting vessels and
tanks; stainless and corrosion resistant.

ACID RESISTING-2.

Eng.; 14.5 Cr, 20 Ni, 56 Fe, 5 Co, 4.5 Cu.
For chemical apparatus; resists attack of HNO₃.

ACID RESISTING-3.

Eng.; 15 Cr, 53 Ni, 23 Fe, 4 W, 1.25 Mn, 3.75 Si.
For chemical apparatus;
heat and corrosion resistant.

ACIDUR.

M-323; 16-17 Si, bal Fe.
Cast.
For chemical apparatus; corrosion resistant.

ACIER A₁

M-1043; 0.50 C, bal Fe.
Annealed: 96,000 TS; 52,000 YS; 16 El; 23 RA;
170 Brin.
For axles, gears, bolts, bushings, crankshafts;
water hardened.

ACIER ACM.

M-1043; 0.55 C, 1.4 Ni, 0.6 Cr, 0.35 Mo, bal Fe.
For gears, bolts, forging dies; oil hardened, tough.

ACIER ACMA.

M-1043; 0.55 C, 1.4 Ni, 0.6 Cr, 0.35 Mo, bal Fe.
For gears, forging dies; oil hardened, tough.

ACIER AF NO. 1.

M-1043; 0.85 C, bal Fe.
Heat treated: 200,000 TS; 150,000 YS; 10 El;
30 RA; 400 Brin.
For drills, taps, reamers, hobs, springs; Type W1;
water hardened.

ACIER AFS.

M-1043; 0.80 C, bal Fe.
Heat treated: 188,000 TS; 143,000 YS; 12 El;
35 RA; 388 Brin.
For drills, punches, reamers, taps, springs, hobs;
Type W1; water hardened.

ACIERAL-1.

M-281; 6 Cu, 0.4 Zn, 0.9 Ni, 0.1 Fe, 0.4 Si, bal Al.
Cast: 20,000 TS.
For automotive engine parts; castings.

ACIERAL-2.

M-281; 2.3-3.8 Cu, 0.7-1.4 Fe, 1.0-1.5 Mn, bal Al.
Rolled: 22,000 TS; 2 El.
For automotive engine parts; high strength.

ACIER AM3.

M-1043; 0.35 C, 1.1 Mn, bal Fe.
For punches, axles, gears, shafts; water hardened.

ACIER AS.

M-1043; 0.50, bal Fe.
Annealed: 96,000 TS; 52,000 YS; 16 El; 23 RA;
170 Brin.
For axles, gears, bolts, tie rods; water hardened.

ACIER BLN.

M-1043; 0.28 C, 10 W, 3 Cr, 0.3 Mo, 0.3 V, bal Fe.
For extrusion rams and dies, punches; hot work
steel, oil hardened.

ACIER BTR.

M-1043; 0.35 C, 4.6 Ni, 0.3 Cr, 1.1 Mo, bal Fe.
For gears, dies, crankshafts; oil hardened, tough.

ACIER CMYO.

M-1043; 1 C, 1 Cr, 0.2 Mo, bal Fe.
For bearings, liners, sleeves; water or oil hardened.

ACIER CNW.

M-1043; 0.38 C, 3 W, 2.5 Cr, 0.7 Mo, 0.3 V, bal Fe.
For hot work dies and tools; hot work steel.

ACIER CTN2.

M-1043; 0.10 C, 2 Ni, bal Fe.
For spindles, gears, cams, camshafts; case hardening
steel, tough.

ACIER CTN6.

M-1043; 0.10 C, 6 Ni, bal Fe.
For spindles, gears, cams, shafts; case hardening
steel, tough.

ACIER DIABOLIQUE SATAN NO. 2.

M-1043; 1.15 C, 1.9 W, 0.5 Cr, bal Fe.
For header dies, fast finishing cutters; water
hardened, wear resistant.

ACIER FAM.

M-1043; 0.42 C, 2 Si, 0.6 Mn, bal Fe.
For heat resistant parts; heat resistant.

ACIER FFV NO. 3.

M-1043; 0.85 C, 0.30 Mn, bal Fe.
Heat treated: 200,000 TS; 150,000 YS; 10 El;
30 RA; 400 Brin.
For drills, taps, reamers, springs, hobs; Type W1;
water hardened.

ACIER M13AFY.

M-1043; 1.1 C, 13 Mn, bal Fe.
For wear resistant parts; wear and abrasion resistant.

ACIER NC2.

M-1043; 0.3 C, 2.8 Ni, 0.5 Cr, bal Fe.
For gears, bolts, machine tool parts; oil hardened,
tough.

ACIER TRIPLE SATAN.

M-1043; 0.32 C, 9 W, 3.2 Cr, bal Fe.
For extrusion rams and dies, punches; hot work
steel, oil hardened.

ACIER VDLD.

M-1043; 0.35 C, 3.8 Ni, 1.5 Cr, bal Fe.
For gears, bolts, dies, crankshafts; oil hardened,
tough.

ACIER VDLDM.

M-1043; 0.35 C, 4 Ni, 1.5 Cr, 0.5 Mo, bal Fe.
For gears, shafts, crankshafts; oil hardened, tough.

ACIMET C-1.

M-480; 90 Cu, 10 Al, 0.06 max C.
Heat treated: 70,000 TS; 28,000 YS; 20 El; 20 RA;
100 Brin.
For acetic acid equipment castings, pumps, impeller
shafts for rubber pumps; corrosion resistant.

ACIMET C-2.

M-480; 85 Cu, 5 Sn, 5 Pb, 5 Zn.
30,000-33,000 TS; 18,000-20,000 YS; 20 El; 20 RA;
50-60 Brin.
For fittings and pumps for brewery, distilleries,
alcohol plants, etc.; pressure tight.

ACIMET C-3.

M-480; 60 Cu, 2 Pb, 38 Zn.
50,000-75,000 TS; 18,000 YS; 40 El.
For close grained forged oil fittings; free-cutting.

ACIMET C-4.

M-480; 58 Cu, 0.5 Al, 0.5 Sn, 39 Zn, 0.75 max Fe,
0.75 max Mn.
70,000-75,000 TS; 35,000 YS; 20 El; 20 RA;
100-110 Brin.
For impeller shaft and gland fittings for rubber and
plastic pumps for handling HCl; corrosion
resistant.

ACIMET HARD LEAD ALLOY.

M-480; 94.5-95 Pb, 4.5-5.5 Sb.
2,800 TS; 1,600 YS; 75 El; 90 RA.
For valves, pumps, fittings, castings, handling cor-
rosive chemicals; M.P. 495°F.

ACIPCO 1005.

M-285; 0.08 max C, 0.3-0.6 Mn, bal Fe.
Cast, normalize and temper: 48,000 TS; 25,000 YS;
35 El; 110 Brin.
For high magnetic permeability parts. AISI 1005.

ACIPCO 1015.

M-285; 0.10-0.20 C, 0.3-0.6 Mn, bal Fe.
Cast, normalize and temper: 55,000 TS; 30,000 YS;
30 El; 130 Brin.
Standard mild steel, high ductility.
AISI 1015.

ACIPCO 1025.

M-285; 0.20-0.30 C, 0.3-0.6 Mn, bal Fe.
Cast, normalize and temper: 65,000 TS; 35,000 YS;
25 El; 150 Brin.
Standard structural steel, good weldability.
AISI 1025.

ACIPCO 1045.

M-285; 0.40-0.50 C, 0.5-0.9 Mn, bal Fe.
Cast, normalize and temper: 85,000 TS; 45,000 YS;
15 El; 180 Brin.
For machine parts, and for flame hardening.
AISI 1045.

ACIPCO 1070.

M-285; 0.65-0.75 C, 0.5-0.9 Mn, bal Fe.
Cast, normalize and temper: 105,000 TS; 50,000 YS;
5 El; 220 Brin.
Particularly for parts requiring flame or induction
hardened areas. AISI 1070.

ACIPCO 4130.

M-285; 0.25-0.35 C, 0.4-0.7 Mn, 0.8-1.1 Cr, 0.15-0.25
Mo, bal Fe.
Cast, normalize and temper: 80,000 TS; 45,000 YS;
17 El; 185 Brin.
Cast, water quench and temper: 100,000-160,000 TS;
65,000-145,000 YS; 16-5 El; 250-450 Brin.
Preferred water quenching grade. AISI 4130.

ACIPCO 4140.

M-285; 0.35-0.45 C, 0.6-1.0 Mn, 0.8-1.1 Cr, 0.15-0.25
Mo, bal Fe.
Cast, normalize and temper: 100,000 TS; 50,000 YS;
16 El; 200 Brin.
Cast, oil quench and temper: 120,000-180,000 TS;
85,000-165,000 YS; 16-5 El; 250-450 Brin.
Oil hardening alloy steel.
AISI 4140.

ACIPCO 4330.

M-285; 0.25-0.35 C, 0.4-0.7 Mn, 1.65-2.0 Ni, 0.7-0.9
Cr, 0.2-0.3 Mo, bal Fe.
Cast, normalize and temper: 100,000 TS; 60,000 YS;
16 El; 200 Brin.
Cast, quench and temper: 120,000-180,000 TS;
85,000-165,000 YS; 16-5 El; 250-450 Brin.
Hardenable in heavy sections. AISI 4330.

ACIPCO 8620.

M-285; 0.15-0.25 C, 0.6-1.0 Mn, 0.4-0.7 Ni, 0.4-0.6
Cr, 0.15-0.25 Mo, bal Fe.
Cast, normalize and temper: 70,000 TS; 40,000 YS;
20 El; 150 Brin.
Low alloy carburizing grade.
AISI 8620.

ACIPCO ACICULAR IRONS.

M-285; 2.5-3.0 C, 0.5-1.5 Mn, 0.25 max P, 0.12 max
S, 1.7-2.3 Ni, 0.8-1.2 Mo, bal Fe.
Cast: 60,000 TS; 300 Brin.
For highly stressed rolls and cylinders; heat treatable.

ACIPCO CA-15.

M-285; 0.15 max C, 1.0 max Mn, 1.5 max Si,
11.5-14.0 Cr, 1.0 max Ni, bal Fe.
Cast, normalize and temper: 100,000 TS; 65,000 YS;
18 El; 228 Brin.
Heat treatable chromium stainless.
ACI CA 15; AISI 410.

ACIPCO CF-8.

M-285; 0.08 max C, 1.5 max Mn, 2.0 max Si, 18-21
Cr, 8-11 Ni, bal Fe.
Cast: 70,000 TS; 30,000 YS; 30 El; 150 Brin.
Austenitic stainless castings. ACI CF-8; AISI 304.

ACIPCO CF-8M.

M-285; 0.08 max C, 1.50 max Mn, 1.50 max Si,
18-21 Cr, 9-12 Ni, 2-3 Mo, bal Fe.