

Worldwide Guide to Equivalent Irons and Steels

Fifth Edition

ASM Materials Data Series

Fran Cverna, Coordinating Editor
Patricia Conti, Associate Editor

Contributors:
Taehyung Kim
Nikolai Kobasko
Yongchang Liu
Alok Nayar
Soyoung Park

Prepared under the direction of the
ASM International Materials Properties Database Committee



**The Materials
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Preface

The First Edition of the *Worldwide Guide to Equivalent Irons and Steels* was published in 1979. This Fifth Edition carries on the tradition of continually expanding the listings of specifications and designations used by standards organizations around the world to indicate the name or grade of an alloy. More than 30,000 listings are presented in this edition with increased coverage from major steel producing countries such as China, India, and Japan.

The use of the word “equivalent” in the title may be a misnomer if the reader expects to immediately determine functional equivalents. In this edition, as in the previous, similar alloys from around the world are grouped on the basis of chemical composition. This provides the reader with a starting point for the further investigation of equivalency. Equivalency could be judged by any or all of the methods of classifying irons and steels: composition, manufacturing method, finishing method, product shape, deoxidization method, hardenability, mechanical equivalence, corrosion and heat resistance, quality, and cost. It is important to recognize that a definitive judgment on the equivalency of two irons or steels requires the study of the specifications by a qualified individual. Most specifications are complex documents that cannot be condensed into a single line of text. A listing of Standards Organizations with contact information is provided in the back of this book to assist the reader.

Because specifications are dynamic documents that change with time, obsolete or inactive specifications and former alloy designations are sometimes included to aid those who need to locate alloys cited in older documents. The purpose of this book is to provide the reader with a comprehensive list of iron and steel designations along with chemical composition and some basic mechanical properties, if specified. The *Worldwide Guide to Equivalent Irons and Steels* should be the first place to go when an unfamiliar iron and steel is encountered. From this book, the reader will find chemically similar materials, references to their complete specifications, and references to standards that designate similar materials.

Each entry in the book contains the following information as applicable and available.

The Specification column lists standards, specifications, norms, schedules, recommended practices, registry numbers, and other publications that provide the designation, name, or grade of a specific alloy. The publication is usually presented as an acronym of the issuing standards organization with a specific document number and date. The format of the document number in the book may differ slightly from that on the document itself; spaces and revision letters have sometimes been eliminated. Arabic numerals are used consistently; although, some Organizations use Roman numerals. The full title of the publication is provided in the Appendix. The date provided gives the most recent year in which the standard was reaffirmed as an active standard, or the date of publication. Specifications are indexed at the back of the book.

The Designation column lists the grade name or a numeric or alphanumeric symbol for a particular alloy, strength, or form of the metal. The designation is how the material is identified in the publication. In some cases, a standard itself defines one unique alloy, in which case the specification number is the designation.

Chemical composition is given as listed in the publication in conventional weight percent. The elements common to a material family are listed in columnar fashion. Others are listed in a group under the heading “Other.” A maximum, minimum, range, or nominal value is given. Incidental elements are not given. Because of space limitations, not all specified functional relationships between chemicals are presented. Inequality expressions have been used to define the chemical limits: $10xC \leq Nb + Ta \leq 1.10$, means the sum of niobium and tantalum is greater than or equal to 10 times the weight percent of carbon and less than or equal to 1.10%. Note that Nb is used for niobium (columbium) everywhere except where Cb is a part of the alloy designation such as TP309Cb. It is beyond the scope of this book to differentiate between mandatory compositions and those offered in a specification as typical “for information only.” The latter is true in the case of specifications based upon mechanical properties rather than composition. Specifications often allow compositions as agreed upon contractually between the buyer and seller.

Properties, such as ultimate tensile strength (UTS) and yield strength (YS), are given in SI units (MPa). Elongation is expressed in % of gage length. The hardness units are listed in the individual records. These mechanical values are often functions of product thickness or diameter. A representative size is often listed under “Notes.” This size is in no way a limit on the size available for the products defined by the specification. Room temperature values are given unless noted otherwise. Since these values may be typical, they may not be usable for design purposes.

This guide is arranged with alloys of similar chemical composition grouped together, headed by the common United States name. These similar alloys are grouped into Material Families based on common alloying elements being in a proscribed range. Collections of Material Families comprise Material Groups, which make up the five sections of the book. While the underlying structure is chemical equivalency, historically steels have been classified by application as well. For this reason, Tool Steels are in their own Material Group.

Various organizations have struggled with the equivalency of designations. Reaching a consensus on the definition of terms such as similarity, equivalency, and interchangeability is in itself difficult. The disclaimer of all previous editions of this book must be repeated. The groupings of designations serve as a useful guide to materials having similar compositions. The grouping is therefore not intended to be used for design interchangeability, nor is functional equivalency implied. Substitution of one material for another is solely the responsibility of the reader.

Fran Cverna

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