The American Society of Mechanical Engineers

AN AMERICAN NATIONAL STANDARD

MILLING CUTTERS AND END MILLS

ASME B94.19-1997
(Revision of ANSI/ASME B94.19-1985)
REAFFIRMED 2019

Date of Issuance: March 20, 1998

This Standard will be revised when the Society approves the issuance of a new edition. There will be no addenda or written interpretations of the requirements of this Standard issued to this Edition.

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FOREWORD

(This Foreword is not part of ASME B94.19-1997.)

Interest in the standardization of small tools, including milling cutters, dates back as far as 1916. Late in 1918 the American Engineering Standards Committee was organized and by 1920 ASME sponsorship had been sought and obtained for its efforts.

During its early years, the interests of the Sectional Committee on Small Tools and Machine Tool Elements were concentrated on other parts of the standardization program; the manufacturers of milling cutters began the work by inaugurating a program of simplified practice under procedures set up by the U.S. Department of Commerce. A report of this activity was published in 1925.

Technical Committee No. 5, organized in 1927 to further the effort, by 1929 had completed a proposed standard, submitted it to and had it accepted by the Sectional Committee of the ASME and its two cosponsors, the National Machine Tool Builders' Association and the Society of Automotive Engineers. Joint transmission of the proposed standard to the American Standards Association resulted in their grant of approval and recognition as an American Standard on April 8, 1930, with the designation ASA B5c-1930.

Late in 1946, Sectional Committee B5 instructed a reorganized TC5 to revise this standard, bring it into harmony with the American Standard for Machine Tapers (ASA B5.10-1932), and enlarge its scope. On its completion in 1949 and approval by the Sectional Committee and its three cosponsor organizations (The Metal Cutting Tool Institute is the third), the revision was presented to the American Standards Association. Designation as an American Standard was given on April 5, 1950. The document was designated ASA B5.3-1950.

Again in 1956, TC5 was reactivated, this time for the purpose of reviewing both ASA B5.3-1950 and ASA B5c1-1947 (Nomenclature for Milling Cutter Teeth) for possible revision and unification. As a result of the review, the decision was made to revise and unify, which involved such changes as:

(a) deletion of all cutters not considered as standards;

(b) inclusion of a nomenclature section made up of words and terms taken from ASA B5c1-1947 and ASA B5.3-1950 (both the nomenclature section and glossary of terms) but restricted to elements of standard cutters only;

(c) segregation and sectionalizing of tolerances on milling cutter dimensions plus the addition, for the first time, of a table of tolerances on the axial and radial runout of standard cutters.

The resulting American Standard was approved on February 5, 1960; it was designated ASA B5.3-1960.

In 1962, Sectional Committee B5 was divided, and the subject area of "Cutting Tools, Holders, Drivers, and Bushings" was assigned to new Sectional Committee B94, later renamed USA Standards Committee B94. Standardization of Milling Cutters was assigned to TC5 of B94.

Continuing developments in the milling cutter field, particularly a large expansion in the types of standard end mills, led to early reactivation of TC5 for the purpose of reviewing and updating ASA B5.3-1960. The resulting new standard, ANSI B94.19, was approved on May 27, 1968. ANSI B94.19-1968 incorporated several significant changes, such as:

(a) the increasing importance of end mills as a distinct category of cutting tools was recognized in the new title: "Milling Cutters and End Mills";

(b) dimensional standards for end mills were separated from those for conventional milling cutters and were presented in a separate section. Similarly, the tolerance tables for milling cutters and end mills were presented separately;

(c) the nomenclature section was updated and at the same time it was made more compact through deletion of unnecessary photographic illustrations.

The 1977 revision follows the format developed for ANSI B94.19-1968. Dimensional standards for milling cutters are covered by Tables 1–27, while Tables 28–65 cover end mills. These are followed by common milling cutter and end mill elements in Tables 66–69, and by milling cutter and end mill tolerances in Tables 70 and 71, respectively. In the revision, two new tables were added while five were deleted; of the remaining tables, about 25% were revised to some degree.

The 1985 revision followed the 1977 format. Due to the addition of new Tables 66–71, which gave dimensions and standard sizes for premium high speed steel end mills, the 1977 tables with these numbers were redesignated as Tables 72–77.

The 1997 revision of this Standard follows the same format as the 1985 version with a few changes that were made to bring it into conformance with standard industry practice. Three tables were removed and dimensions for overall length were changed in eight of the tables. Tolerances were added to Table 74 for premium high speed steel end mills and adjustments were made to the tables to remove specifications for tools that are no longer being manufactured.

ASME B94.19-1997 was approved by the American National Standards Institute (ANSI) on September 25, 1997.

ASME STANDARDS COMMITTEE B94
Cutting Tools, Holders, Drivers, and Bushings

(The following is the roster of the Committee at the time of approval of this Standard.)

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MILLING CUTTERS AND END MILLS

1 SCOPE

This Standard covers high speed steel milling cutters and end mills of one piece construction as listed in Tables 1 through 62. It also includes general definitions, sizes, and tolerances.

2 NOMENCLATURE

2.1 Definitions

milling cutter: a rotary cutting tool provided with one or more cutting elements called teeth, which intermittently engage the workpiece and remove material by relative movement of the workpiece and cutter (see Fig. 1).

end mill: a milling cutter that is shank mounted to the machine tool and has cutting teeth on the end in addition to those on the periphery. It may be of single or double end construction (see Fig. 2).

2.2 General Classifications

2.2.1 Classification Based on Type of Relief on Cutting Edges

profile sharpened cutter: a cutter on which the relief is obtained, and that is resharpened by grinding a narrow land back of the cutting edges. Profile sharpened cutters may produce flat, curved, or irregular surfaces.

form relieved cutter: a cutter which is so relieved that, by grinding only the faces of the teeth, the original form is maintained throughout the life of the cutter. Form relieved cutters may produce flat, curved, or irregular surfaces.

2.2.2 Classification Based on Method of Mounting

arbor-type cutter: a cutter with a hold for mounting on an arbor and that usually has a keyway to receive a driving key. Sometimes called a shell-type cutter.

shank-type cutter: a cutter with a straight or tapered shank to fit the machine tool spindle or adapter.

2.3 Explanation of "Hand" of Milling Cutters

The terms *right hand* and *left hand* are used to describe hand of rotation, hand of cutter, and hand of flute helix.

2.3.1 Hand of Rotation (or Hand of Cut)

right-hand rotation (or right-hand cut): the counterclockwise rotation of a cutter revolving so as to make a cut when viewed from a position in front of a horizontal milling machine and facing the spindle.

left-hand rotation (or left-hand cut): the clockwise rotation of a cutter revolving so as to make a cut when viewed from a position in front of a horizontal milling machine and facing the spindle.

2.3.2 Hand of Cutter. Some types of cutters require special consideration when referring to their hand. These are principally cutters with unsymmetrical forms, face type cutters, or cutters with threaded holes.

symmetrical cutter: may be reversed on the arbor in the same axial position and rotated in the cutting direction without altering the contour produced on the workpiece, and may be considered as either right or left hand.

unsymmetrical cutter: reverses the contour produced on the workpiece when reversed on the arbor in the same axial position and rotated in the cutting direction.

single angle milling cutter: when the larger diameter side faces the viewer, a single angle milling cutter is right hand if it must be rotated counterclockwise to make a cut. When the larger diameter side faces the viewer, a single angle milling cutter is left hand if it must be rotated clockwise to make a cut.

single corner rounding cutter: . when the smaller diameter side faces the viewer, the cutter is right hand if rotated counterclockwise to make a cut, and is left hand if rotated clockwise to make a cut.

2.3.3 Hand of Flute Helix

straight flute: a milling cutter with its cutting edges in planes parallel to the cutter axis.

Milling cutters with flute helix in one direction only are described as having right- or left-hand helixes.