USA STANDARD

Preferred Limits and Fits for Cylindrical Parts

USAS B4.1-1967 (R1974)

Note

For soft conversion of nominal dimensions and limits given in this standard, 1 inch = 25.4 mm.

For explanation of conversion techniques see American National Standard Z210.1-1972, Metric Practice Guide.

REAFFIRMED 2020

Sponsor

The American Society of Mechanical Engineers

Published by

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

United Engineering Center 345 East 47th Street New York, N. Y. 10017

ACCEPTANCE NOTICE

The above Industry Standardization Document was adopted on 4 January 1972 and is approved for use by the DoD. The indicated industry groups have furnished the clearances required by existing regulations. Copies of the document are stocked by DoD Single Stock Point, U.S. Naval Publications and Forms Center, Philadelphia, Pennsylvania 19120, for issue to DoD activities only.

Title of Document: Preferred Limits and Fits for Cylindrical Parts

Date of Specific Issue Adopted: 18 September 1967 – Plus Errata

Releasing Industry Group: The American Society of Mechanical Engineers

Custodians:
Army – MU
Navy – SH
Air Force – 70

Military Coordinating Activity:
Air Force – 70

Project No. MISC-0596

Foreword

THIS standard represents the latest result of vork which began with the organization of Sectional Committee B4 in June 1920 under the name "Sectional Committee on the Standardization of Plain Limit Gages for General Engineering Work." This original committee produced American Standard ASA B4a-1925, "Tolerances, Allowances and Gages for Metal Fits," which was used in varying degree for many years.

In December 1930, Sectional Committee B4 was reorganized and the name changed to the present form, "Sectional Committee on the Standardization of Allowances and Tolerances for Cylindrical Parts and Limit Gages." The change in name indicated a significant shift to a more definite and somewhat more restricted mission for the committee.

During the years of World War II an ASA War Committee formed in 1943 worked on the project but produced no completed results, and the activity was turned back to Sectional Committee B4. After the war the subject was discussed at the Canadian Conference on the Unification of Engineering Standards held in Ottawa in 1945, attended by delegates from Great Britain, Canada, and the United States, and again at another joint meeting in New York later in the same year. These meetings are significant because since 1945 work in this project has been strongly influenced by these and similar ABC conferences. Proper evaluation of the present standard will depend upon an appreciation of the important effects of progress towards agreement on unification of standards between the ABC countries.

The result of the activities immediately following World War II was American Standard "Limits and Fits for Engineering and Manufacturing (Part I), ASA B4.1-1947." In the preface to that document it was stated that the ABC meetings resulted in agreement on five basic principles, and since the first four of these principles, with certain minor and obvious variations, apply to this present standard, it is considered worth while to repeat them here. First, there must be a common language (definitions) through which analyses may be recorded and conveyed. Second, a table of preferred basic sizes helps in reducing the number of different diameters commonly used in a given size range. Third, preferred tolerances and allowances are a logical complement to preferred sizes and should aid the designer in selecting standard tolerances. Fourth, uniformity of method of applying tolerances is essential.

Additional ABC conferences were held in New York in June 1952 and February 1953. Delegations from Sectional Committee B4 were active in these conferences, which resulted in a draft proposal for an ABC system of Limits and Fits, published as ASA B4/30. The Sectional Committee B4 delegates to these conferences voted to recommend approval of the ABC proposals as the basis for an American standard if and when such a standard were developed.

Since the publication of this standard there has been additional discussions at ABC conferences held in Ottawa in June 1960 and at Arden House, New York, in September 1962. There has been an expansion of definitions under ASA B1.7, and they are reflected in the revision.

The revised proposal was submitted to the sponsor organization and to the USA Standards Institute (formerly American Standards Association) for final approval as a USA Standard. This approval was granted on August 3, 1966.

This revision, however, was never published as it was noted that other changes, agreed to at the Arden House ABC Conference, had not been incorporated in the standard.

A new revision was issued, and following approval by the USA Standards Committee B4, it was approved by the sponsor and on September 18, 1967 by the USA Standards Institute.

USA STANDARD

This USA Standard is one of nearly 3000 standards approved as American Standards by the American Standards Association. On August 24, 1966, the ASA was reconstituted as the United States of America Standards Institute. Standards approved as American Standards are now designated USA Standards. There is no change in their index identification or technical content.

UDC 621.753.1.3

USA Standards Committee B4, Standardization of Allowances and Tolerances for Cylindrical Parts and Limit Gages

OFFICERS

G. H. Stimson, *Chairman*

COMMITTEE MEMBERS

AMERICAN SOCIETY FOR QUALITY CONTROL
R. J. Morris, International Harvester Co., Chicago, Ill

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, THE
Z. R. Bliss, Brown University, Providence, R. I.
R. T. Woythal, Kearney & Trecker Corp., Milwaukee, Wisconsin

AMERICAN SOCIETY OF TOOL AND MANUFACTURING ENGINEERS
G. H. Stimson, Greenfield Tap and Die, Division of United-Greenfield Corp., Greenfield, Mass.

ANTI-FRICTION BEARING MANUFACTURERS ASSOCIATION, INC.
H. L. Potter, The Fafnir Bearing Co., New Britain, Conn.

BUSINESS EQUIPMENT MANUFACTURERS ASSOCIATION
A. E. Mall, International Business Machines Corp., Endicott, N. Y.

METAL CUTTING TOOL INSTITUTE
A. F. Miller, Jr., Wells Tool Co., Greenfield, Mass.

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
F. V. Kupchak, Westinghouse Electric Corp., Pittsburgh, Pa.
L. D. Price, Alternate, National Electrical Mfgrs. Association, New York, N. Y.

NATIONAL MACHINE TOOL BUILDERS' ASSOCIATION
F. S. Blackall, III, The Taft-Peirce Mfg. Co., Woonsocket, R. I.

SOCIETY OF AUTOMOTIVE ENGINEERS, INC.
R. F. Holmes, General Motors Technical Center, Warren, Michigan

SPORTING ARMS & AMMUNITIONS MANUFACTURERS ASSOCIATION
J. F. Walsh, Olin Mathieson Chemical Co., New Haven, Conn.

U. S. DEPT. OF THE ARMY
C. B. Keane, Frankford Arsenal, Philadelphia, Pa.

U. S. DEPT. OF COMMERCE
I. H. Fullmer, National Bureau of Standards, Washington, D. C.

U. S. DEPT. OF THE NAVY
Code 609.3C, Bureau of Ships, Navy Dept., Washington, D. C.
J. C. Reid, Alternate, Bureau of Ships, Navy Dept., Washington, D. C.

U. S. MACHINE, CAP, WOOD AND TAPPING SCREW BUREAUS
H. G. Muenchinger, Holo-Krome Screw Corp., Hartford, Conn.

INDIVIDUAL MEMBERS
W. S. Brown, Roanoke, Virginia
H. W. Fahrlander, Sr., St. Petersburg, Fla.
W. H. Gourlie, West Hartford, Conn.
R. E. W. Harrison, Harrison Engineering Services, Inc., Washington, D. C.
Ronald Jones, Westinghouse Electric Corp., Philadelphia, Pa.
A. O. Schmidt, The Pennsylvania State University, University Park, Pa.
L. F. Spector, Hitchcock Publishing Co., Wheaton, Ill.
H. D. Stover, Timken Roller Bearing Co., Canton, Ohio

USA Standard

Preferred Limits and Fits for Cylindrical Parts

1. Scope and Application

1.1 This standard presents definitions of terms applying to fits between plain (non-threaded) cylindrical parts and makes recommendations on preferred sizes, allowances, tolerances, and fits for use wherever they are applicable. The standard through 20 in. diameter is in accord with the recommendations of American-British-Canadian Conferences. Experimental work is being carried on and when results are available, agreement in the range above 20 in. will be sought. It represents the combined thinking and experience of groups who have been interested in standards in this field, and it should have application for a wide range of products. The recommendations, therefore, are presented for guidance and for use where they might serve to improve and simplify products, practices, and facilities.

Many factors, such as length of engagement, bearing load, speed, lubrication, temperature, humidity, surface texture, and materials, must be taken into consideration in the selection of fits for a particular application, and modifications in these recommendations might be required to satisfy extreme conditions. Subsequent adjustments might also be desired as the result of experience in a particular application to suit critical functional requirements or to permit optimum manufacturing economy. Selection of departure from these recommendations will depend upon consideration of the engineering and economic factors that might be involved.

2. Definitions

2.1 Terms relating to the size and fit of parts which are generally applicable to mechanical parts, are defined as follows:

2.2 **Dimension.** A dimension is a geometrical characteristic such as diameter, length, angle, or center distance. The term "dimension" is also used for convenience to indicate the size or numerical value of a dimension as specified on the drawing.

2.3 **Size.** Size is a designation of magnitude. When a value is assigned to a dimension it is referred to hereinafter as the size of that dimension.

NOTE: It is recognized that the words "dimension" and "size" are both used at times to convey the meaning of magnitude.

2.4 **Nominal Size.** The nominal size is the designation which is used for the purpose of general identification.

2.5 **Basic Size.** The basic size is that size from which the limits of size are derived by the application of allowances and tolerances.

2.6 **Reference Size.** A reference size is a size without tolerance used only for information purposes and does not govern machining or inspection operations.

2.7 **Design Size.** The design size is the basic size with allowance applied, from which the limits of size are derived by the application of tolerances. If there is no allowance the design size is the same as the basic size.

2.8 **Actual Size.** An actual size is a measured size.

2.9 **Limits of Size.** The limits of size are the applicable maximum and minimum sizes. (See 2.14, Tolerance Limit)

2.10 **Maximum Material Limit.** A maximum material limit is that limit of size that provides the maximum amount of material for the part. Normally it is the maximum limit of size of an external dimension or the minimum limit of size of an internal dimension.

2.11 **Minimum Material Limit.** A minimum material limit is that limit of size that provides the minimum amount of material for the part. Normally it is the minimum limit of size of an external dimension or the maximum limit of size of an internal dimension.

NOTE: An example of exceptions: an exterior corner radius where the maximum radius is the minimum material limit and the minimum radius is the maximum material limit.