CHANGE NOTICES ARE NOT CUMULATIVE AND SHALL BE RETAINED UNTIL SUCH TIME AS THE STANDARD IS REVISED.

FED-STD-H28/22A
CHANGE NOTICE 1
27 August 1991

FEDERAL STANDARD

SCREW-THREAD STANDARDS FOR FEDERAL SERVICES

SECTION 22

GAGES AND GAGING FOR METRIC SCREW THREADS

-M AND MJ THREAD FORMS

The following changes, which form a part of FED-STD-H28/22A dated 5 November 1987, are approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal Agencies.

REMOVE: Pages 13, 14 of 5 November 1987
ADD: Pages 13, 13a and 14 of Change Notice 1

Page 3: Paragraph 4.1.1.2.2 - Change "Thus, without further checking" to "Together with maximum material gages".

Page 18: Paragraph 70.3 - In heading, change "thread" to "thermal".

RETAIN THIS CHANGE NOTICE AND PLACE IT BEFORE THE FIRST PAGE OF THE STANDARD

MILITARY INTERESTS:

Custodians:

Army - AR
Navy - AS
Air Force - 99

Review Activities:

Army - AT, AV, ME
Navy - OS
Air Force - 82

User Activities:

Army - CR, ER
Navy - SH

CIVIL AGENCY COORDINATING ACTIVITIES:

Commerce - NIST
DOT - ACO
GSA - 7FXE

PREPARING ACTIVITY:

DLA - IS

(DoD Project THDS-0081)

AMSC N/A

THDS

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

40.4 Deleted.

50. Differential gaging and thread element measurement.

NOTES:
(1) Differential gaging cannot be used on internal threads smaller than 5 mm.
(2) Differential gaging should not be performed until GO functional size and pitch diameter size have been verified to be within tolerance.
(3) Differential gaging measures diameter equivalents of variations in lead and flank angle.

50.1 Cumulative thread form differential gaging. Cumulative thread form variation is the combined effect on GO functional size of individual thread form variations in lead (pitch) including helix, flank angles, taper, straightness and roundness. It is the maximum difference between GO functional diameter and pitch diameter along and around the full length of engagement. When this Cumulative Differential Reading is not greater than the smallest tolerance, specified as percent of the pitch diameter tolerance, for lead, angle, taper, straightness and roundness, the product thread is verified as within the specification for these characteristics. Otherwise, the product thread must be gaged or directly measured to assure that diameter equivalents of the variations in lead, flank angle, straightness and roundness are within their respective tolerances. Cumulative Differential Reading must not exceed the cumulative form tolerance when this is specified.

50.2 Roundness and taper.

50.2.1 Roundness or circularity differential gaging. The roundness of pitch cylinder is checked by use of segments or rolls, as illustrated in ANSI/ASME B1.16M-1984, Figure 30 for external threads and Figure 16 for internal threads or ANSI/ASME B1.22M-1985, Figure 31A for external threads and Figure 17A for internal threads. Rotate the product thread for maximum difference in readings.

(a) When two gage contacts spaced 180 degrees apart are used, roundness on even lobed parts is 1/2 (max - min) but roundness on odd lobed parts cannot be determined.

(b) When three gage contacts spaced 120 degrees apart are used, roundness on three lobed parts is 1/2 (max - min) but roundness on even lobed parts cannot be determined.

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50.2.2 Taper differential gaging. Check the product thread along the thread axis over the usable length without rotation for readings at each end using pitch diameter segments or rolls, as illustrated in ANSI/ASME B1.16M-1984, Figure 30 (c) and (d) for external threads and Figure 16 (c) and (d) for internal threads or ANSI/ASME B1.22M-1985, Figures 28 and 29 for external threads and Figures 14 and 15 for internal threads. Taper differential is the difference in readings, disregarding sign, between the end positions of the thread.

50.3 Lead (including helix) differential gaging. Variation in lead is especially important since it affects GO functional size in the ratio of 1 on lead to 1.732 on the GO functional size in a 60 degree thread. Due to the fact that taper can compensate for lead variation on GO functional size, the following gaging procedure is given. After inspecting cumulative form, roundness and taper as specified in 50.1 and 50.2 above, determine the GO functional size, Z, and single lead, full form cone and vee reading, Yc, at the center-length position of the selected Z measurement on the thread axis as shown in details (a) and (b) in ANSI/ASME B1.16M-1984, Figure 30 for external threads and Figure 16 for internal threads or ANSI/ASME B1.22M-1985, Figure 31A for external threads and Figure 17A for internal threads. Reading Yc is made without rotation of the thread from the angular position of the Z reading. For parallel threads with taper within pitch diameter tolerance, lead differential is equal to the numerical difference between Z and Yc.

Lead differential, external thread is (Z - Yc)
Lead differential, internal thread is (Yc - Z)

50.3.1 Determining allowances on pitch diameter to compensate for lead variation in product threads with long length of engagement.

50.3.1.1 Follow procedure in 50.3 above to determine Lead Differential Reading for the product thread over a length equal to the length of the functional diameter gaging elements.

50.3.1.2 Divide the length of engagement of the product thread by the length of the functional diameter gaging elements. This result is the Length Factor.

50.3.1.3 Multiply the differential reading (para. 50.3.1.1) by the Length Factor (para. 50.3.1.2). This result is the amount by which the specified maximum-material functional diameter of that external product thread must be below the specified maximum-material limit. This will compensate for the lead variation in that product thread and will assure acceptance over full length engagement with a mating product thread made to its specified maximum-material size.

50.4 Flank angle differential gaging. There are two methods of expressing flank angle variations: (1) by differential means and (2) by angular notation. There is no practical correlation between measured half-angle variations and their effects on functional size. Differential gaging provides a diameter equivalent resulting from variations in the flank angles. The flank angle differential is equal to the numerical difference between X and Y readings, disregarding sign, as shown in ANSI/ASME B1.16M-1984, Figure 30 for external threads and Figure 16 for internal threads or ANSI/ASME B1.22M-1985, Figure 31A for external threads and Figure 17A for internal threads. Reading Y is made at the same location as X.

Flank angle differential, external thread is (Y - X)
Flank angle differential, internal thread is (X - Y)

50.4 Direct measurements.

50.5.1 Where a relatively few parts with threads are involved, when neither limit nor indicating gages are available and it is economically impracticable to procure them, it may be necessary to use direct measurements. Such situations may occur in model shops, experimental and research departments, tool rooms and job shops. A discussion of some commonly used practices follows.

50.5.2 Adequate means for determining accuracy of thread angle, thread form, and lead (both linear and helical) are essential. Optical projection or mechanical gages of a general nature are used frequently for such checking.

50.5.3 Numerical values for pitch diameter/thread groove diameter may be determined by use of the three-wire method or for NOT GO minimum-material limit by the use of thread micrometers. The accuracy of these values is affected by the factors delineated in 50.5.4 through 50.5.7 below.

50.5.4 Values obtained from measuring systems, including three-wire measurement, are influenced by:

Variation in geometry and pitch of product thread.
Product thread characteristics (cleanliness, surface texture, hardness, etc.)
Measuring force.
Operating skill.
Shape of the threaded part.
Uncertainty in thread wires and gage blocks.

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