ASME B1.3-2007
(Revision of ASME B1.3M-1992)

Screw Thread Gaging Systems for Acceptability: Inch and Metric Screw Threads

(UN, UNR, UNJ, M, and MJ)

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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The American Society of Mechanical Engineers
Three Park Avenue • New York, NY 10016

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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.

Periodically certain actions of the ASME B1 Committee will be published as Cases. Cases are published on the ASME Web site under the Committee Pages at http://cstools.asme.org as they are issued.

The American Society of Mechanical Engineers
Three Park Avenue, New York, NY 10016-5990

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FOREWORD

(a) The 1986 edition of this Standard was a combination of ANSI B1.3-1979 and ANSI B1.3M-1981. These earlier versions of this Standard were based upon the following instructions as defined by the B1 Committee at its meeting on October 7, 1976, which charged the B1.3 Subcommittee with the responsibility of preparing these documents.

The Subcommittee was to prepare a catalog of gages and gaging systems so that each gage or gaging system would be defined only in terms of the dimension(s) controlled and so that any material of an editorial nature that could be construed as giving preference to one gage or gaging system over another would be eliminated, as outlined in the following three statements:

(1) All references to referee gaging methods are to be eliminated from all B1 documents.

(2) A catalog of gaging systems is to be prepared by the B1.3 Subcommittee so that any description of the gage relates only to the specific dimension(s) it controls. All material of an editorial nature that could be construed as giving preference will be eliminated.

(3) The level of dimensional acceptability shall be determined by the threaded product application and specified by American National Standards or other product standards, or by procurement drawings or documents.

Subsequently, the Subcommittee decided to combine these previous standards into one document and designate it ANSI/ASME B1.3M-1986, Screw Thread Gaging Systems for Dimensional Acceptability — Inch and Metric Screw Threads (UN, UNR, UNJ, M, and MJ).

(b) The 1992 edition included the following specific changes:

(1) elimination of internal snap gages

(2) addition of best wire size radius contacts to minimum material thread groove measurement gaging

(3) clarification of out-of-round indicating gaging in Tables 1 and 2

(4) addition of a reference to ASME B46.1, Surface Texture, to provide roughness average guidelines to be used for the evaluation of the surface texture of threaded products

(5) addition of linear and coordinate measuring machines to the equipment included for thread evaluation

(6) clarification that System 23 checks are not all mandatory

(7) clarification relating to the measurement of changes in diameter size because of out-of-roundness conditions

(c) The 2007 edition includes the following specific changes:

(1) removal of the words *dimensional* and *control(s)*, and replacement with the wording *inspect/evaluate* (and their related forms), because gages do not control the product dimension.

(2) elimination of references to ASME B1.18M and B1.19M, due to those standards having previously been withdrawn. This also eliminates any reference to System 21A and its gages as previously listed in Tables 1, 2, 3, and 4 (B and C NOT GO segments and rolls, commonly referred to as a double NOT GO).

(3) elimination of the use of cast replica determination of pitch diameter (and related features) for internal product inspection/evaluation.

(4) qualification notes under Tables 1 and 2 with regard to variable gage inspection of functional diameter.

(5) changed the numbering system in Tables 1, 2, 3, and 4 to provide consistency in numbering from table to table.

Suggestions for improvement of this Standard are welcome. They should be sent to Secretary, ASME B1 Standards Committee, Three Park Avenue, New York, NY 10016-5990.

This revision was approved as an American National Standard on March 5, 2007.

ASME B1 COMMITTEE
Screw Threads

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CORRESPONDENCE WITH THE B1 COMMITTEE

General. ASME Standards are developed and maintained with the intent to represent the consensus of concerned interests. As such, users of this Standard may interact with the Committee by proposing revisions and attending Committee meetings. Correspondence should be addressed to:

Secretary, B1 Standards Committee
The American Society of Mechanical Engineers
Three Park Avenue
New York, NY 10016-5990

Proposing Revisions. Revisions are made periodically to the Standard to incorporate changes that appear necessary or desirable, as demonstrated by the experience gained from the application of the Standard. Approved revisions will be published periodically.

The Committee welcomes proposals for revisions to this Standard. Such proposals should be as specific as possible, citing the paragraph number(s), the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent documentation.

Proposing a Case. Cases may be issued for the purpose of providing alternative rules when justified, to permit early implementation of an approved revision when the need is urgent, or to provide rules not covered by existing provisions. Cases are effective immediately upon ASME approval and shall be posted on the ASME Committee Web page.

Requests for Cases shall provide a Statement of Need and Background Information. The request should identify the standard, the paragraph, figure or table number(s), and be written as a Question and Reply in the same format as existing Cases. Requests for Cases should also indicate the applicable edition(s) of the standard to which the proposed Case applies.

Attending Committee Meetings. The B1 Standards Committee regularly holds meetings, which are open to the public. Persons wishing to attend any meeting should contact the Secretary of the B1 Standards Committee.

SCREW THREAD GAGING SYSTEMS FOR ACCEPTABILITY: INCH AND METRIC SCREW THREADS (UN, UNR, UNJ, M, AND MJ)

1 GENERAL

(a) This Standard presents screw thread gaging systems suitable for determining the acceptability of UN, UNR, UNJ, M, and MJ screw threads on externally and internally threaded products. It establishes the criteria for screw thread acceptance when a gaging system is used.

(b) A screw thread gaging system comprises a list of screw thread characteristics that must be inspected/evaluated to establish the acceptability of the screw threads on a threaded product and the gage(s) which shall be used when inspecting/evaluating those characteristics.

(c) Federal Government Use. This Standard is approved by the Department of Defense and federal agencies, and is incorporated into FED-STD-H28/20, Screw Thread Standards for Federal Services, Section 20. The use of this Standard by the federal government is subject to all the requirements and limitations of FED-STD-H28/20.

2 REFERENCE DOCUMENTS

The latest issues of the following documents form a part of this Standard to the extent specified herein.

ASME B1.1, Unified Inch Screw Threads (UN and UNR Thread Form)[1]

ANSI/ASME B1.2, Gages and Gaging for Unified Inch Screw Threads[1]

ASME B1.7, Screw Threads: Nomenclature, Definitions, and Letter Symbols[1]

ASME B1.13M, Metric Screw Threads: M Profile[1]

ASME B1.15, Unified Inch Screw Threads (UNJ Thread Form)

ANSI/ASME B1.16M, Gages and Gaging for Metric M Screw Threads[1]

ASME B1.21M, Metric Screw Threads: MJ Profile[1]

ANSI/ASME B1.22M, Gages and Gaging for MJ Series Metric Screw Threads[1]

ASME B46.1, Surface Texture (Surface Roughness, Waviness, and Lay)[1]

ASME/ANSI B47.1, Gage Blanks[1]

Publisher: The American Society of Mechanical Engineers (ASME), Three Park Ave, New York, NY 10016-5990; Order Department: 22 Law Drive, Box 2300, Fairfield, NJ 07007-2300

[1] May also be obtained from American National Standards Institute, 25 West 43rd Street, New York, NY 10036.

3 SCREW THREAD GAGES AND MEASURING EQUIPMENT

(a) Tables 1 and 2, for external and internal screw threads, respectively, are listings of screw thread gages, gaging elements, and measuring equipment.

NOTE: Throughout the remainder of this Standard, the term gage includes any gages, gaging elements, and measuring equipment listed in Tables 1 and 2. See para. 5(d).

For each gage, these tables specify the thread characteristic(s) for which the gages are designated for determining conformance.

(b) The tables are arranged to establish product screw thread acceptance criteria based on recognized gaging concepts used to assess conformance.

(1) Attributes. Fixed limit inspection/evaluation provides a qualitative assessment of a characteristic(s) using gages which determine conformance.

(2) Variables. Indicating control is a quantitative and qualitative assessment on a characteristic(s) which is then compared with limiting values in order to determine if the characteristic(s) is in conformance.

4 GAGING SYSTEMS

(a) Tables 3 and 4 present screw thread gaging systems for inspection/evaluation of externally and internally threaded products, respectively.

(b) Three gaging systems for inspection/evaluation of threads on threaded products are established herein to provide a choice depending on the engineering requirement of the threaded product. These are identified as Systems 21, 22, and 23. The difference between gaging systems is the level of inspection/evaluation deemed necessary to satisfy that conformance has been achieved.

(c) Since most screw thread applications do not require that all of the characteristics described in the

applicable product specifications, standards, and applications documents be inspected/evaluated, selection of the appropriate gaging system will be based on those characteristics important to the end use. Consideration should be given to such factors as form, fit, function, and fabrication of the threaded product. Measurement/gage design capabilities inherent in each inspection/evaluation system should also be considered when comparing the benefits of each system. Guidance for selection of an inspection/evaluation system from the three established gaging systems is as follows:

(1) System 21. Provides for interchangeable assembly with functional size inspection/evaluation at the maximum material limit within the length of standard gaging elements, and also inspection/evaluation of characteristics identified as NOT GO functional diameters or as HI (internal) and LO (external) functional diameters.

(2) System 22. Provides for interchangeable assembly with functional size inspection/evaluation at the maximum material limit within the length of standard gaging elements, and also inspection/evaluation of the minimum material size pitch diameter or thread groove diameter over the length of the full thread. The cumulative effects of all other thread characteristics such as lead, flank angle, taper, and roundness variations are confined within product tolerance limits with no specific inspection/evaluation of their magnitudes.

(3) System 23. Provides for interchangeable assembly with functional size inspection/evaluation at the maximum material limit within the length of standard gaging elements, and also inspection/evaluation of the minimum material size pitch diameter or thread groove diameter over the length of the full thread. The magnitude of other thread characteristics such as lead, flank angle, taper, and roundness are further inspected/evaluated, as specified within the pitch diameter limits. Only thread characteristics in System 23 for which requirements or limitations are specified must be inspected/evaluated for System 23 compliance. For example, if the product thread has no surface texture requirement nor major-to-pitch runout limitation, then System 23 does not require that these two characteristics be checked.

(d) For special applications, the screw thread on a threaded product may require inspection/evaluation not consistent with any of the standard gaging systems. In such cases, one of the standard gaging systems should be selected and modified by specifying, in accordance with para. 7(b), the addition or the reduction of thread characteristic(s) and gage(s) as selected from Table 1 or 2, as applicable.

(e) Product threads affected by roundness variations may be even-lobed (180 deg contact) or odd-lobed (120 deg contact). Product thread acceptance or rejection can be influenced by thread gages and measuring equipment having the ability to detect one, but not both, because of gage design. Tables 1 and 2 provide a selection of gages which in combination may be needed to assure that diameter size variations caused by out-of-roundness are contained within product tolerance limits.

5 GAGING REQUIREMENTS

(a) Screw threads of threaded products are defined by the applicable thread document. Appropriate standards are listed in section 2.

(b) The gaging system used to inspect/evaluate the screw thread of a threaded product shall be as specified in the product standard, procurement drawing, or purchase inquiry and order. In the absence of a specified gaging system on the purchase order, product drawing, or other applicable documentation, the supplier and customer must agree upon a suitable gaging system. There is no implied default gaging system.

(c) Each of the thread characteristics specified in the gaging system shall be inspected/evaluated using the gage (or one of the gages) specified for that characteristic. Gages shall be in conformance with the applicable gaging documents. Use appropriate standards listed in section 2 unless otherwise specified.

(d) The use of any gage or measuring device is not precluded if the results given by such gage or measuring device correlate with a gage or measuring device listed in this Standard.

(e) All measurement results are not necessarily equal to a characteristic's true size. The environment, the instruments, and the operator are factors influencing measurement results. The sum of these factors may be cumulative, making the measurement results further from the characteristic's true size, or the factors may cancel each other out, making the measurement results closer to the characteristic's true size.

6 ACCEPTABILITY

(a) The screw thread of a threaded product shall be acceptable when each of the thread characteristics specified in the designated gaging system is found to be acceptable.

(b) Within each gaging system, a choice of gages is specified for each characteristic. Acceptance by any one gage in current calibration specified for a characteristic shall be the criterion for acceptance of that characteristic.

(c) All threaded products are subject to visual inspection/evaluation for gross defects. This visual inspection/evaluation shall be made without magnification and is intended to detect such gross defects as missing or incomplete threads, defective thread profile, torn or ruptured surfaces and cracks, etc. Surface texture of threaded products, when required, will be inspected/evaluated by visual or tactile comparison with texture specimens or surface measurement equipment. ASME B46.1 provides roughness average (R_a) guidelines

for various thread manufacturing processes.

(d) Relationship of Gaging Systems to Product Screw Thread Acceptability

(1) Product screw threads acceptable to System 23 are acceptable where Systems 22 and 21 are specified.

(2) Product screw threads acceptable to System 22 are acceptable where System 21 is specified.

7 DESIGNATION

(a) Thread acceptability requirements as described in this Standard must be specified in addition to thread size designation and thread class specified in accordance with the applicable screw thread document.

(1) Thread acceptability requirements may be specified by a general note on the drawing or procurement document, stating a particular system and referencing ASME B1.3.

EXAMPLES:

(1) Acceptability of screw threads shown on this drawing shall be determined based on System 21, ASME B1.3.
(2) Acceptability of screw threads shown on this drawing shall be determined based on System 22, ASME B1.3.
(3) Acceptability of screw threads shown on this drawing shall be determined based on System 23, ASME B1.3.

(2) Thread acceptability requirements may be specified by showing a system number in parentheses following the thread tolerance class designation.

EXAMPLES:

(1) $\frac{1}{4}$-20UNC-2A(21)
(2) M6×1-6g(21)
(3) 0.2500-28UNJF-3A(22)
(4) M6×1-6g(23)

(b) In cases where gaging systems not tabulated in Table 3 or 4 are required, they shall be specified by designating the nearest tabulated gaging system number followed by an "S." The modifications to the designated tabulated gaging system should immediately follow.

EXAMPLES:

(1) Acceptability of screw threads shown on this drawing shall be determined based on System 21S, ASME B1.3, with the addition of inspection/evaluation of the thread root radius.
(2) M6×1-6g(21S): Root radius inspection/evaluation required
(3) Acceptability of screw threads shown on this drawing shall be determined based on System 22S, ASME B1.3, with the addition of inspection/evaluation of the thread root radius.
(4) $\frac{1}{4}$-20UNRC-2A(22S): Root radius inspection/evaluation required
(5) $\frac{1}{4}$-20UNC-2A(22S): Size measurement values required
(6) M6×1-6g(23S): Functional limit per gage 1.1 solid ring required
(7) M6×1-6g(23S): Surface texture inspection/evaluation not required

Table 1 Screw Thread Gages and Measuring Equipment for External Product Thread Characteristics

Thread Gages and Measuring Equipment	Maximum Material GO		NOT GO Functional Diameter		Minimum Material			
					Pitch Diameter		Thread Groove Diameter	
	Func. Limit, A_1	Func. Size, A_2	Func. Limit, B_1	Func. Size, B_2	Limit, C_1	Size, C_2	Limit, D_1	Size, D_2
1 Threaded Ring Gages, Split or Solid (ASME/ANSI B47.1) 1.1 GO	•							
1.2 NOT GO			•					
2 Thread Snap Gages 2.1 GO segments	•							
2.2 NOT GO segments			•					
2.3 GO rolls	•							
2.4 NOT GO rolls			•					
2.5 Minimum material — pitch diameter type — cone and vee					•			
2.6 Minimum material — thread groove diameter type — cone only							•	
3 Plain Diameter Gages 3.1(a) Maximum (GO) plain cylindrical ring for major diameter								
(b) Minimum (NOT GO) plain cylindrical ring for major diameter								
3.2 Major diameter snap type								
3.3 Minor diameter snap type								
3.4 Maximum and minimum major diameter snap type								
3.5 Maximum and minimum minor diameter snap type								
4 Indicating Thread Gages Having either two contacts at 180 deg or three contacts at 120 deg 4.1 GO segments 4.1.1 GO segments at 120 deg contact	•	•	• [Note (1)]	• [Note (1)]				
4.1.2 GO segments at 180 deg contact	•	•	• [Note (1)]	• [Note (1)]				
4.3 GO rolls 4.3.1 GO rolls at 120 deg contact	•	•	• [Note (1)]	• [Note (1)]				
4.3.2 GO rolls at 180 deg contact	•	•	• [Note (1)]	• [Note (1)]				
4.5 Minimum material — pitch diameter type — cone and vee 4.5.1 Gage elements at 120 deg contact					•	•		
4.5.2 Gage elements at 180 deg contact					•	•		
4.6 Minimum material — thread groove diameter type — cone or best wire size radius profile 4.6.1 Gage elements at 120 deg contact							•	•
4.6.2 Gage elements at 180 deg contact							•	•
4.7 Major diameter and pitch diameter runout gage								
4.8 Differential segments or rolls (GO profile for one pitch in length) used in combination with GO/minimum material indicating gages to yield a diameter equivalent for variations in lead (including uniformity of helix) and flank angle								

Table 1 Screw Thread Gages and Measuring Equipment for External Product Thread Characteristics

	Roundness of Pitch Cylinder				Taper of Pitch Cylinder		Lead Incl. Helix Variation, *H*	Flank Angle Variation, *I*	Major Diameter		Minor Diameter		Root Rad., *L*	Diam. Runout Major to Pitch, *M*	Surface Texture, *N*
	Oval 180 deg		Multilobe 120 deg												
	Limit, E_1	Size, E_2	Limit, F_1	Size, F_2	Limit, G_1	Size, G_2			Limit, J_1	Size, J_2	Limit, K_1	Size, K_2			
1.1 ›											[Note (2)]				
1.2 ›															
2.1 ›	•										[Note (2)]				
2.2 ›	•				•										
2.3 ›	•										[Note (2)]				
2.4 ›	•				•										
2.5 ›	•				•										
2.6 ›	•				•										
3.1(a) ›									•						
3.1(b) ›									•						
3.2 ›									•						
3.3 ›											•				
3.4 ›									•						
3.5 ›											•				
4.1.1 ›			•	•							[Note (2)]				
4.1.2 ›	•	•									[Note (2)]				
4.3.1 ›			•	•							[Note (2)]				
4.3.2 ›	•	•									[Note (2)]				
4.5.1 ›			•	•	•	•									
4.5.2 ›	•	•			•	•									
4.6.1 ›			•	•	•	•									
4.6.2 ›	•	•			•	•									
4.7 ›														•	
4.8 ›	•	•	•	•	•	•	•	•							

Table 1 Screw Thread Gages and Measuring Equipment for External Product Thread Characteristics (Cont'd)

Thread Gages and Measuring Equipment	Maximum Material GO		NOT GO Functional Diameter		Minimum Material			
					Pitch Diameter		Thread Groove Diameter	
	Func. Limit, A_1	Func. Size, A_2	Func. Limit, B_1	Func. Size, B_2	Limit, C_1	Size, C_2	Limit, D_1	Size, D_2
4.10 Cumulative form gaging — maximum-material and minimum-material dimensions collectively establish cumulative form within limits defined by the applicable thread documents								
5 Indicating Plain Diameter Gages 5.1 Major diameter type								
5.2 Minor diameter type								
6 Pitch Micrometer With Standard Contacts (Approximately NOT GO Profile) Cone and Vee			•	•				
7 Pitch Micrometer With Modified Contacts (Approximately Pitch Diameter Contact) Cone and Vee					•	•		
8 Thread Measuring Wires With Suitable Measuring Means							•	•
9 Optical Comparator and Toolmaker's Microscope With Suitable Fixturing					•	•		
10 Profile Tracing Equipment With Suitable Fixturing								
11 Lead Measuring Machine With Suitable Fixturing								
12 Helical Path Attachment Used With GO Type Indicating Gage								
13 Helical Path Analyzer								
14 Plain Micrometer and Calipers — Modified as Required								
15 Surface Measuring Equipment or Texture Comparison Specimen								
16 Roundness Equipment								
17 Linear Measuring Machine With Required Accessories						•		
18 Coordinate Measuring Machine With Required Accessories						•		•

Table 1 Screw Thread Gages and Measuring Equipment for External Product Thread Characteristics (Cont'd)

	Roundness of Pitch Cylinder				Taper of Pitch Cylinder		Lead Incl. Helix Variation, *H*	Flank Angle Variation, *I*	Major Diameter		Minor Diameter		Root Rad., *L*	Diam. Runout Major to Pitch, *M*	Surface Texture, *N*
	Oval 180 deg		Multilobe 120 deg												
	Limit, E_1	Size, E_2	Limit, F_1	Size, F_2	Limit, G_1	Size, G_2			Limit, J_1	Size, J_2	Limit, K_1	Size, K_2			
4.10 ›	Cumulative Form														
5.1 ›									•	•					
5.2 ›											•	•			
6 ›	•	•			•	•									
7 ›	•	•			•	•									
8 ›	•	•			•	•									
9 ›	•	•	•	•			•	•	•	•	•	•	•	•	
10 ›								•					•		
11 ›							•								
12 ›							•								
13 ›							•								
14 ›									•	•					
15 ›															•
16 ›	•	•	•	•											
17 ›		•				•	•			•		•			
18 ›		•		•		•	•	•		•		•	•	•	

GENERAL NOTES:

(a) The notation NOT GO is used to indicate LO, Mn/Mt, and NOT GO gages as described by the respective gage standard.

(b) Some thread gage and measuring equipment is no longer recognized for technical reasons. Therefore, these gage numbers have been removed.

(c) A GO thread ring gage and GO functional diameter elements used to inspect/evaluate the UN, UNR, and M external product thread series cannot be used to inspect/evaluate the functional diameter of the counterpart "J" series external product thread UNJ and MJ thread series, due to interference at the minor diameter of the product. When inspecting/evaluating UNJ and MJ products, UNJ and MJ GO gages must be used.

NOTES:

(1) Additional inspection/evaluation methods are necessary in order to determine that the measured value obtained reflects functional diameter limit and/or size, rather than a value influenced by gage contact at the external product thread minor diameter.

(2) Maximum minor diameter limit is acceptable when product passes GO gage on UN, UNR, UNJ, M, and MJ threads.

Table 2 Screw Thread Gages and Measuring Equipment for Internal Product Thread Characteristics

Thread Gages and Measuring Equipment	Maximum Material GO		NOT GO Functional Diameter		Minimum Material			
					Pitch Diameter		Thread Groove Diameter	
	Func. Limit, A_1	Func. Size, A_2	Func. Limit, B_1	Func. Size, B_2	Limit, C_1	Size, C_2	Limit, D_1	Size, D_2
1 Threaded Plug Gage (ASME/ANSI B47.1) 1.1 GO	•							
1.2 NOT GO			•					
1.3 Full form gage GO plug (MJ only)	•							
3 Plain Diameter Gages 3.1(a) Minimum (GO) plain cylindrical plug for minor diameter								
(b) Maximum (NOT GO) plain cylindrical plug for minor diameter								
4 Indicating Thread Gages Having either two contacts at 180 deg or three contacts at 120 deg 4.1 GO segments 4.1.1 GO segments at 120 deg contact	•	•	• [Note (1)]	• [Note (1)]				
4.1.2 GO segments at 180 deg contact	•	•	• [Note (1)]	• [Note (1)]				
4.3 GO rolls 4.3.1 GO rolls at 120 deg contact	•	•	• [Note (1)]	• [Note (1)]				
4.3.2 GO rolls at 180 deg contact	•	•	• [Note (1)]	• [Note (1)]				
4.5 Minimum material — pitch diameter type — cone and vee 4.5.1 Gage elements at 120 deg contact					•	•		
4.5.2 Gage elements at 180 deg contact					•	•		
4.6 Minimum material — thread groove diameter type — cone or best wire size radius profile 4.6.1 Gage elements at 120 deg contact							•	•
4.6.2 Gage elements at 180 deg contact							•	•
4.7 Minor diameter and pitch diameter runout gage								
4.8 Differential segments or rolls (GO profile for one pitch in length) used in combination with GO/minimum material indicating gages to yield a diameter equivalent for variations in lead (including uniformity of helix) and flank angle								
4.10 Cumulative form gaging — maximum-material and minimum-material dimensions collectively establish cumulative form within limits defined by the applicable thread documents								
5 Indicating Plain Diameter Gages 5.1 Major diameter type								
5.2 Minor diameter type								
6 Pitch Micrometer With Standard Contacts (Approximately NOT GO Profile) Cone and Vee			•	•				
7 Pitch Micrometer With Modified Contacts (Approximately Pitch Diameter Contact) Cone and Vee					•	•		
8 Thread Measuring Balls With Suitable Measuring Means							•	•

Table 2 Screw Thread Gages and Measuring Equipment for Internal Product Thread Characteristics

	Roundness of Pitch Cylinder				Taper of Pitch Cylinder		Lead Incl. Helix Variation, *H*	Flank Angle Variation, *I*	Major Diameter		Minor Diameter		Root Rad., *L*	Diam. Runout Minor to Pitch, *M*	Surface Texture, *N*
	Oval 180 deg		Multilobe 120 deg												
	Limit, E_1	Size, E_2	Limit, F_1	Size, F_2	Limit, G_1	Size, G_2			Limit, J_1	Size, J_2	Limit, K_1	Size, K_2			
1.1 ›									[Note (2)]						
1.2 ›															
1.3 ›									[Note (2)]		•				
3.1(a) ›											•				
3.1(b) ›											•				
4.1.1 ›			•	•					[Note (2)]						
4.1.2 ›	•	•							[Note (2)]						
4.3.1 ›			•	•					[Note (2)]						
4.3.2 ›	•	•							[Note (2)]						
4.5.1 ›			•	•	•	•									
4.5.2 ›	•	•			•	•									
4.6.1 ›			•	•	•	•									
4.6.2 ›	•	•			•	•									
4.7 ›														•	
4.8 ›	•	•	•	•	•	•	•	•							
4.10 ›	Cumulative Form														
5.1 ›									•	•					
5.2 ›											•	•			
6 ›	•	•			•	•									
7 ›	•	•			•	•									
8 ›	•	•			•	•									

Table 2 Screw Thread Gages and Measuring Equipment for Internal Product Thread Characteristics (Cont'd)

	Thread Gages and Measuring Equipment	Maximum Material GO		NOT GO Functional Diameter		Minimum Material			
						Pitch Diameter		Thread Groove Diameter	
		Func. Limit, A_1	Func. Size, A_2	Func. Limit, B_1	Func. Size, B_2	Limit, C_1	Size, C_2	Limit, D_1	Size, D_2
9	Optical Comparator and Toolmaker's Microscope With Suitable Fixturing and Cast Replica								
10	Profile Tracing Equipment With Suitable Fixturing								
14	Surface Measuring Equipment or Texture Comparison Specimen								
15	Roundness Equipment								
16	Linear Measuring Machine With Required Accessories						•		•
17	Coordinate Measuring Machine With Required Accessories						•		•

Table 2 Screw Thread Gages and Measuring Equipment for Internal Product Thread Characteristics (Cont'd)

	Roundness of Pitch Cylinder				Taper of Pitch Cylinder		Lead Incl. Helix Variation, *H*	Flank Angle Variation, *I*	Major Diameter		Minor Diameter		Root Rad., *L*	Diam. Runout Minor to Pitch, *M*	Surface Texture, *N*
	Oval 180 deg		Multilobe 120 deg												
	Limit, E_1	Size, E_2	Limit, F_1	Size, F_2	Limit, G_1	Size, G_2			Limit, J_1	Size, J_2	Limit, K_1	Size, K_2			
9 ›							•	•	•	•		•	•		
10 ›								•					•		
14 ›															•
15 ›	•	•	•	•											
16 ›		•				•				•		•			
17 ›		•		•		•	•	•		•		•	•	•	

GENERAL NOTES:

(a) The notation NOT GO is used to indicate HI, Mn/Mt, and NOT GO gages as described by the respective gage standard.

(b) Some thread gage and measuring equipment is no longer recognized for technical reasons. Therefore, these gage numbers have been removed.

(c) UN-2B and UNJ-2B NOT GO thread plug gages are the same except for the identification; therefore, a UN-2B NOT GO gage can be used to inspect/evaluate either a UN-2B or a UNJ-2B product, and a UNJ-2B NOT GO gage can be used to inspect/evaluate either a UN-2B or a UNJ-2B product as well. UN-3B and UNJ-3B NOT GO thread plug gages are the same except for the identification; therefore, a UN-3B NOT GO gage can be used to inspect/evaluate either a UN-3B or a UNJ-3B product, and a UNJ-3B NOT GO gage can be used to inspect/evaluate either a UN-3B or a UNJ-3B product as well.

NOTES:

(1) Additional inspection/evaluation methods are necessary in order to determine that the measured value obtained reflects functional diameter limit and/or size, rather than a value influenced by gage contact at the external product thread major diameter.

(2) Minimum major diameter limit is acceptable when product passes GO gage.

Table 3 Gaging Systems for External Threads

Characteristics Inspected/Evaluated [Note (1)]	Applicable Thread Gages and Measuring Equipment			
	Attributes/Fixed Limit	Column	Variables/Indicating	Column
System 21				
GO maximum material	1.1, 2.1, 2.3, 4.1.1, 4.1.2, 4.3.1, 4.3.2	A_1	4.1.1, 4.1.2, 4.3.1, 4.3.2	A_2
NOT GO functional diameter	1.2, 2.2, 2.4, 4.1.1, 4.1.2, 4.3.1, 4.3.2, 6	B_1	4.1.1, 4.1.2, 4.3.1, 4.3.2, 6	B_2
Major diameter	3.1(a), 3.1(b), 3.2, 3.4, 5.1, 9, 14	J_1	5.1, 9, 14, 17, 18	J_2
Minor diameter (rounded root — UNJ, MJ only)	3.3, 3.5, 5.2, 9	K_1	5.2, 9, 17, 18	K_2
System 22				
GO maximum material	1.1, 2.1, 2.3, 4.1.1, 4.1.2, 4.3.1, 4.3.2	A_1	4.1.1, 4.1.2, 4.3.1, 4.3.2	A_2
Minimum material				
Pitch diameter	2.5, 4.5.1, 4.5.2, 7, 9	C_1	4.5.1, 4.5.2, 7, 9, 17, 18	C_2
or				
Thread groove diameter	2.6, 4.6.1, 4.6.2, 8	D_1	4.6.1, 4.6.2, 8, 18	D_2
or [Note (2)]				
NOT GO functional diameter combined with control of:	1.2, 2.2, 2.4, 4.1.1, 4.1.2, 4.3.1, 4.3.2, 6	B_1	4.1.1, 4.1.2, 4.3.1, 4.3.2, 6	B_2
lead (including helix)	. . .	. . .	4.8, 9, 11, 12, 13, 17, 18	H
and				
flank angle (over the length of full thread)	. . .	. . .	4.8, 9, 10, 18	I
Major diameter	3.1(a), 3.1(b), 3.2, 3.4, 5.1, 9, 14	J_1	5.1, 9, 14, 17, 18	J_2
Minor diameter (rounded root — UNJ, MJ only)	3.3, 3.5, 5.2, 9	K_1	5.2, 9, 17, 18	K_2
Root profile (UNJ, MJ only)	. . .	. . .	9, 10, 18	L
System 23				
GO maximum material	1.1, 2.1, 2.3, 4.1.1, 4.1.2, 4.3.1, 4.3.2	A_1	4.1.1, 4.1.2, 4.3.1, 4.3.2	A_2
Minimum material				
Pitch diameter	2.5, 4.5.1, 4.5.2, 7, 9	C_1	4.5.1, 4.5.2, 7, 9, 17, 18	C_2
or				
Thread groove diameter	2.6, 4.6.1, 4.6.2, 8	D_1	4.6.1, 4.6.2, 8, 18	D_2
Major diameter	3.1(a), 3.1(b), 3.2, 3.4, 5.1, 9, 14	J_1	5.1, 9, 14, 17, 18	J_2
Minor diameter (rounded root — UNJ, MJ only)	3.3, 3.5, 5.2, 9	K_1	5.2, 9, 17, 18	K_2
Root profile (UNJ, MJ only)	. . .	. . .	9, 10, 18	L
Roundness of pitch cylinder:				
Oval 180 deg	2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 4.1.2, 4.3.2, 4.5.2, 4.6.2, 4.8, 6, 7, 8, 9, 16	E_1	4.1.2, 4.3.2, 4.5.2, 4.6.2, 4.8, 6, 7, 8, 9, 16, 17, 18	E_2
Multilobe 120 deg	4.1.1, 4.3.1, 4.5.1, 4.6.1, 4.8, 9, 16	F_1	4.1.1, 4.3.1, 4.5.1, 4.6.1, 4.8, 9, 16, 18	F_2
Taper of pitch cylinder	2.2, 2.4, 2.5, 2.6, 4.5.1, 4.5.2, 4.6.1, 4.6.2, 4.8, 6, 7, 8	G_1	4.5.1, 4.5.2, 4.6.1, 4.6.2, 4.8, 6, 7, 8, 17, 18	G_2
Cumulative form variation	. . .	. . .	4.10	E_1 through I
Lead including helix variation	. . .	. . .	4.8, 9, 11, 12, 13, 17, 18	H
Flank angle variation	. . .	. . .	4.8, 9, 10, 18	I
Runout major diameter to pitch diameter	. . .	. . .	4.7, 9, 18	M
Surface texture	. . .	. . .	15	N

GENERAL NOTES:

(a) A variable/indicating gage may be used for an attribute/fixed limit gage inspection/evaluation when gage elements and mechanisms are set to prevent movement.

(b) Some thread gage and measuring equipment is no longer recognized for technical reasons. Therefore, these gage numbers have been removed.

NOTES:

(1) For gages and measuring equipment to be used, refer to Table 1.

(2) Only by agreement between purchaser and supplier on limits and/or methods.

Table 4 Gaging Systems for Internal Threads

Characteristics Inspected/Evaluated [Note (1)]	Applicable Thread Gages and Measuring Equipment			
	Attributes/Fixed Limit	Column	Variables/Indicating	Column
System 21				
GO maximum material	1.1, 1.3, 4.1.1, 4.1.2, 4.3.1, 4.3.2	A_1	4.1.1, 4.1.2, 4.3.1, 4.3.2	A_2
NOT GO functional diameter	1.2, 4.1.1, 4.1.2, 4.3.1, 4.3.2, 6	B_1	4.1.1, 4.1.2, 4.3.1, 4.3.2, 6	B_2
Minor diameter	1.3, 3.1(a), 3.1(b), 5.2	K_1	5.2, 9, 16, 17	K_2
System 22				
GO maximum material	1.1, 1.3, 4.1.1, 4.1.2, 4.3.1, 4.3.2	A_1	4.1.1, 4.1.2, 4.3.1, 4.3.2	A_2
Minimum material				
Pitch diameter	4.5.1, 4.5.2, 7	C_1	4.5.1, 4.5.2, 7, 16, 17	C_2
or				
Thread groove diameter	4.6.1, 4.6.2, 8	D_1	4.6.1, 4.6.2, 8, 16, 17	D_2
or [Note (2)]				
NOT GO functional diameter combined with control of:	1.2, 4.1.1, 4.1.2, 4.3.1, 4.3.2, 6	B_1	4.1.1, 4.1.2, 4.3.1, 4.3.2, 6	B_2
lead (including helix)	. . .	. . .	4.8, 9, 17	H
and				
flank angle (over the length of full thread)	. . .	. . .	4.8, 9, 10, 17	I
Minor diameter	1.3, 3.1(a), 3.1(b), 5.2	K_1	5.2, 9, 16, 17	K_2
System 23				
GO maximum material	1.1, 1.3, 4.1.1, 4.1.2, 4.3.1, 4.3.2	A_1	4.1.1, 4.1.2, 4.3.1, 4.3.2	A_2
Minimum material				
Pitch diameter	4.5.1, 4.5.2, 7	C_1	4.5.1, 4.5.2, 7, 16, 17	C_2
or				
Thread groove diameter	4.6.1, 4.6.2, 8	D_1	4.6.1, 4.6.2, 8, 16, 17	D_2
Minor diameter	1.3, 3.1(a), 3.1(b), 5.2	K_1	5.2, 9, 16, 17	K_2
Roundness of pitch cylinder:				
Oval 180 deg	4.1.2, 4.3.2, 4.5.2, 4.6.2, 4.8, 6, 7, 8, 15	E_1	4.1.2, 4.3.2, 4.5.2, 4.6.2, 4.8, 6, 7, 8, 15, 16, 17	E_2
Multilobe 120 deg	4.1.1, 4.3.1, 4.5.1, 4.6.1, 4.8, 15	F_1	4.1.1, 4.3.1, 4.5.1, 4.6.1, 4.8, 15, 17	F_2
Taper of pitch cylinder	4.5.1, 4.5.2, 4.6.1, 4.6.2, 4.8, 6, 7, 8	G_1	4.5.1, 4.5.2, 4.6.1, 4.6.2, 4.8, 6, 7, 8, 16, 17	G_2
Cumulative form variation	. . .	. . .	4.10	E_1 through I
Lead including helix variation	. . .	. . .	4.8, 9, 17	H
Flank angle variation	. . .	. . .	4.8, 9, 10, 17	I
Runout minor diameter to pitch diameter	. . .	. . .	4.7, 17	M
Surface texture	. . .	. . .	14	N

GENERAL NOTES:

(a) A variable/indicating gage may be used for an attribute/fixed limit gage inspection/evaluation when gage elements and mechanisms are set to prevent movement.

(b) Some thread gage and measuring equipment is no longer recognized for technical reasons. Therefore, these gage numbers have been removed.

NOTES:

(1) For gages and measuring equipment to be used, see Table 2.

(2) Only by agreement between purchaser and supplier on limits and/or methods.

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