

MIL-O-10944B  
 12 October 1965  
~~SUPERSEDED~~  
 MIL-O-10944A  
 16 April 1956

## MILITARY SPECIFICATION

### GAGES, DIMENSIONAL CONTROL

This specification is mandatory for use by all Departments and Agencies of the Department of Defense.

#### 1. SCOPE

1.1 This specification covers dimensional control gages (see 6.1) and is to be used in conjunction with the applicable drawings or documents that depict the type required (see 6.2).

#### 2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids or request for proposal form a part of the specification to the extent specified herein.

#### SPECIFICATIONS

##### Federal

NN-P-515	Plywood, Container Grade
UU-P-268	Paper, Kraft, Wrapping
PPP-B-585	Boxes; Wood, Wirebound
PPP-B-591	Boxes, Fiberboard, Wood-Cleated
PPP-B-601	Boxes, Wood, Cleated Plywood
PPP-B-621	Boxes, Wood, Nailed and Lock-Corner
PPP-B-636	Boxes, Fiber
PPP-T-76	Tape, Pressure-Sensitive Adhesive Paper, Water Resistant.

##### Military

MIL-P-116	Preservation, Methods of
MIL-B-121	Barrier Material, Greaseproofed, Flexible (waterproofed)
MIL-I-6868	Inspection Process, Magnetic Particle
MIL-P-7105	Pipe Threads, Taper, Aeronautical National Form Symbol, ANPT.
MIL-C-45662	Calibration System Requirements

PSC 5220

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**STANDARDS**

**Military**

MIL-STD-109	Quality Assurance Terms and Definitions
MIL-STD-120	Gage Inspection
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-130	Identification Markings of U.S. Military Property

(Copies of specifications, standards and drawings required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2. Other publications.- The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids shall apply.

U. S. DEPARTMENT OF COMMERCE  
Commercial Standard CS8, Gage Blanks  
Handbook H28, Screw-Thread Standards for Federal Services

(Application for copies should be addressed to the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D.C.)

AMERICAN STANDARDS ASSOCIATION (ASA)  
B46.1-1962 Surface Texture (Surface Roughness,  
Waviness and Lay

(Copies may be obtained from the American Society of Mechanical Engineers, United States Engineering Center, 325 East 47th Street, New York 17, New York.)

CONSOLIDATED CLASSIFICATION COMMITTEE  
Uniform Freight Classification Rules

(Application for copies of these freight classification rules should be addressed to the Consolidated Classification Committee, 202 Chicago Union Station, Chicago 6, Ill.)

AMERICAN TRUCKING ASSOCIATION, INC.  
National Motor Freight Classification No. A-3 and No. 13

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(Application for copies of the above publication should be addressed to the American Trucking Associations, Inc., Traffic Department, 1424 Sixteenth Street, N.W., Washington 6, D. C.)

**U. S. POST OFFICE DEPARTMENT**  
**Parcel Post Regulations**

(Application for copies should be obtained from any first class U. S. Post Office.)

**3. REQUIREMENTS**

**3.1 Materials.-** Materials shall be in accordance with the drawings for the required items and the following:

**3.1.1 Steel.-** Steel shall be a high quality, electric furnace alloy steel, alloy tool steel or carbon tool steel having the necessary properties to comply with the hardness, dimensional stability and surface quality requirements.

**3.1.2 Machine steel.-** Machine steel shall be a low carbon, hot rolled steel of high quality having the necessary properties to comply with the hardness, dimensional stability and surface quality requirements. Cold rolled machine steel shall not be used except when the application will not affect the stability and dimensional accuracy of the assembled item (e.g., guard, handles, etc.).

**3.1.3 Cast iron.-** Cast iron shall be a fine grained gray iron of uniform solidity and density, free of all imperfections affecting the serviceability or usefulness of the finished surface. The inclusion of wear and corrosion resistant alloying elements is desirable if machineability is not materially impaired.

**3.1.4 Special wear resistant materials.-** Special wear resistant materials such as tungsten or chromium carbide, boron carbide, ceramics or sapphire shall be of a quality best suited for the particular application. Wear resistant inserts shall be brazed or mechanically fastened in place in accordance with the recognized practice adequately suited for the particular material and application.

**3.1.5 Hardness.-** The actual gage contact and wearing surfaces shall be hardened to the equivalent of the value specified.

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• 3.1.6 Stability.- The material selected and the appropriate artificial seasoning employed shall insure that the distortion or dimensional growth of the critical gage elements is held to a minimum.

• 3.1.7 Surface quality.- The value specified shall be the maximum acceptable roughness of the surface expressed in micro-inches. These values correspond to the meter indications of surface roughness measuring instruments which from their method of operation show readings in accordance with the standard values prescribed in (ASA) B46.1.

3.1.7.1 All gaging surfaces specifying an  $\frac{8}{\text{B}}$  finish or finer shall be lapped free of amorphous or smear metal.

3.2 Dimensional requirements.- All parts and complete items shall comply with the dimensional requirements specified in accordance with the drawings for the required items.

3.2.1 General tolerances.- When either specific or general tolerances are not specified the following tolerances shall apply, except for unfinished surfaces of castings:

Linear fractional dimensions  $\pm 1/64$   
 Linear decimal dimensions  $\pm 0.010$   
 Angular dimensions  $\pm 0^\circ 30'$

• 3.2.1.1 Sharp edges.- Edges which are not specifically required to be sharp shall be removed to approximately  $1/32$  inch radius or chamfer.

3.2.1.3 Reference dimensions.- A dimension labeled "Ref" or "Calc" is a nonmandatory dimension without tolerance, entered on the drawing for informational purposes only and does not directly govern machining or acceptance inspection.

3.2.2 Geometric requirements.- All surfaces shall be true to geometric form within the limits specified and shall be free of all objectionable or detrimental irregularities.

3.2.2.1 Parallelism.- The parallelism of gaging and precision functioning surfaces shall be such that all points on the surfaces fall within the range of the gage tolerance specified for the dimension between the surfaces. The error in parallelism shall in no case exceed 0.0002 inch in the first inch plus 0.0001 inch for each additional inch of surface governed.

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**3.2.2.2 Perpendicularity.-** The perpendicularity of gaging and precision functioning surfaces shall be such that all points on the surface fall within the range of the gage tolerances specified on the dimensions which either directly or indirectly govern the position of the surface. The error in perpendicularity shall in no case exceed 0.0002 inch in the first inch plus 0.0001 inch for each additional inch of surface governed.

**3.2.2.3 Centrality, alinement or concentricity.-** The centrality, alinement or concentricity of gaging or precision functioning surfaces or forms shall be such that the displacement of the actual centerlines is limited to one half of the total of the gage tolerances on the two surfaces or forms governed.

**3.2.2.4 Flatness.-** The flatness of gaging and precision functioning surfaces shall be such that all points on the surface fall within the range of the gage tolerance specified on dimensions located from the surface. The error in flatness shall in no case exceed 0.0002 inch in the first inch plus 0.0001 inch for each additional inch of surface governed.

### **3.2.3 Mechanical fits.**

**3.2.3.1 Slide or slip fit.-** A slide or slip fit shall be a fit that will function freely without shake or side play when both members are lubricated with a very light oil. A slide fit feel created by use of heavy oil or grease shall not be acceptable. All abrasive material shall be removed from the sliding contact surfaces.

**3.2.3.2 Push, snug, or wring fit.-** A push, snug or wring fit shall be the tightest fit which can be assembled and disassembled by hand. Mating members shall have at least 75 percent contact area and shall assemble within the locational tolerance specified.

**3.2.3.3 Drive or press fit.-** A drive or press fit shall be an interference fit which will require heavy pressure or impact for assembly.

**3.2.3.3.1 Drive fit for dowels.-** Dowel fits shall be a light drive fit and shall be such that no relative movement can be obtained between the doweled members in the plane of resistance when fastening screws are loosened. The workmanship, surface finish, and allowance shall be such that the doweled members can be removed and reassembled within the locational tolerances specified. Where stock size and location will permit, soft plugs may be used in hardened pieces to facilitate reaming or grinding dowel holes in line.

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3.3 Design and construction.- Unless otherwise specified, the following requirements shall apply.

3.3.1 American Gage Design (AGD standard type gages).- The blanks from which standard gages are finished shall be in accordance with CS-8. When carbide or other special wear resistant blanks are used they may conform to manufacturer's standards.

3.3.1.1 Plain ring gages.- The internal gaging surfaces of plain ring and similar gages shall be free of bell mouth condition to the extent that all points on the gaging surface shall be within the specified tolerance.

3.3.1.2 Thread plug and thread setting plug gages.- All thread plug gages shall be in accordance with Handbook H28.

3.3.1.3 Thread ring and thread snap gages.- All thread ring and thread snap gages shall be in accordance with Handbook H28.

3.3.1.4 Adjustable snap, length and plug gages.- The pins or buttons shall be precision fitted so that parallelism of gaging surfaces can be obtained and maintained after locking. When locked within the specified size range for each gage frame, the opposing gaging surfaces shall be parallel within the following tolerances:

<u>Size Range (inches)</u>		<u>Parallelism (inches)</u>
<u>Above</u>	<u>To &amp; incl.</u>	<u>Tolerance</u>
.000	2.5000	.00010
.250	5.6875	.00015
5.6875	11.6250	.00020
11.6250	--	.00030

3.3.2 Pipe thread gages.- All pipe thread gages (except ANPT series) shall be in accordance with Handbook H28.

3.3.2.1 ANPT pipe thread gages.- Gages for the ANPT series shall be in accordance with MIL-P-7105.

3.3.3 Flat plate or flat sheet gages.- Working or construction holes to facilitate multiple grinding are permitted where such holes will not affect the functioning or stability of the gage.

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**3.3.4 Built up snap and similar spacer type gages.-** Holding screws shall be of the fit specified. The counterbore for the head shall be deeper than the screw head so that the sealing wax will be retained when applied. The entering ends of the threads of all tapped holes shall be countersunk at an angle of  $90^\circ$  to a diameter of 0.010 inch greater than the maximum major diameter of the tapped holes.

**3.3.5 Sectional chamber or receiving type gages.-** The allowance between mating surfaces and the outside housing of chamber type gages shall be such that the parts will assemble snugly and disassemble with a push fit (see 3.2.3.2).

**3.3.6 Flush pin gages.-** The feeler edges on both the pin and body of flush pin gages shall be sharp. All other edges shall be removed in accordance with 3.2.1.1. The pin shall be flush with the steps at the maximum and minimum positions specified and shall function with a slide or slip fit (3.2.3.1) throughout the required travel. The travel of the pin shall be such that it will exceed the established limits by 0.03 inch minimum. The central  $1/3$  of the slide fit bearing length may be undercut on either the pin or the body. The pin shall always be in contact at both ends of the bearing length when the pin is extended to the limits of travel.

**3.4 Inspection aids.-** When specified, all special devices such as pins, buttons, templates, etc. used by the contractor for inspection of a particular gage or group of gages shall become the property of the Government and shall be furnished with the gages.

**3.5 Protective finish, permanent.**

**3.5.1** Unless otherwise specified, small gages such as plugs, rings, built-up snaps and length gages, and the precision gaging, locating, and functioning surfaces of fixture gages will not require a protective finish. When specified, the requirements as to size, hardness, and surface quality shall apply after the application of the protective finish.

**3.5.2** Large fixture gages shall require that a protective finish be applied to the nonfunctioning, nongaging, and nonlocating surfaces to prevent corrosion of large areas or surfaces. Normally, this includes cast iron or steel bases, stands and legs of fixture gages, which shall be protected with a suitable enamel, lacquer or commercial finish. Gray and black are the preferred colors. Red and green colors shall not be used except as specified in 3.6.1. Materials which are inherently corrosion resistant need not have an additional protective finish or coating.

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3.6 Marking identification data.- All identification data shall be in accordance with the drawings for the required items and shall conform with MIL-STD-130. Marking shall include the manufacturer's name or identification symbol where size and shape of the gage is such as to make this marking practical. Marking shall be produced by impression stamping, engraving, etching or other approved means. The marking shall be permanent, legible and logically grouped.

3.6.1 Gages may be further identified by color applied in a durable fashion. "Go gages" shall be identified by green while "not go gages" shall be identified by red.

3.7 Condition.- Gages shall be free of seams, scratches, cracks, nicks, rust spots and other imperfections which will be detrimental to their use or durability.

3.8 Workmanship.- The workmanship shall be of the highest quality consistent with the tolerances and finishes specified.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection.- Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Quality assurance terms and definitions.- Reference shall be made to MIL-STD-109 to define quality assurance terms used.

4.1.2 Inspection.- Inspection shall be in accordance with referenced documents and as specified herein.

#### 4.2 Inspection provisions.

4.2.1 Submission of product.- Gages shall be submitted for acceptance, either at destination or the contractor's facility as required. When possible a lot of gages shall consist of units of a single type or an identifiable group of product designated for shipment and acceptance.



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• 4.2.2 Examination.- Each gage shall be inspected 100% for all requirements of drawings and specifications in accordance with methods and procedures outlined in MIL-STD-120 and as stated herein. All nonconforming material shall be rejected. A statement of findings shall be submitted for each lot of gages presented to the Government for acceptance. Each statement shall include the following data:

- a. Purchase order or contract number.
- b. Item nomenclature and part number.
- c. Applicable drawings and specifications used for inspection.
- d. Method of inspection.
- e. Authorized deviations, if any.
- f. A statement of findings shall cover each gage presented for acceptance.
- g. Statement that inspection has been conducted in accordance with above criteria and that items have been found to conform with all requirements.
- h. Signature of a responsible officer of the contractor.

• 4.2.3 Government inspection and acceptance.- Items will be accepted based on an acceptable statement of findings. The Government, however, may conduct independent inspection to verify contractor findings. Such inspections shall be made at destination and non-conforming items shall be rejected and returned to the contractor. Such items may be reworked or replaced and re-submitted for acceptance.

• 4.3 Measuring and test equipment.- The contractor shall provide and maintain measuring and test devices necessary to assure that items conform to technical requirements. In order to assure continued accuracy, these devices shall be calibrated at established intervals against certified standards which have known valid relationships to national standards. Calibration of inspection equipment shall be in accordance with MIL-C-45662. When required, the contractor's measuring and test equipment shall be made available for use by the Government to determine conformance of product with contract requirements. In addition, if conditions warrant, contractor's personnel shall be available for operation of such devices and for verification of their accuracy and condition.

4.4 Test methods and procedures.

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4.4.1 Hardness test.-- Hardness tests shall be made on standard type hardness testers and shall be made as near to the actual gage wear surface as practicable. Thread gages shall be tested on the end of the gage adjacent to the threads. The actual threads shall have an equivalent hardness.

4.4.2 Stability test.-- Stability tests shall be made where deemed necessary to determine whether the gage units have been sufficiently stabilized. Gages shall remain within tolerance after this treatment. This test will not be applied to gage units which would be permanently damaged by the test.

4.4.3 Surface quality test.-- The actual surface roughness shall be determined by measurement or by comparison of the gage surface to an acceptable standard reference surface.

4.4.4 Magnetic inspection.-- When specified, magnetic particle inspection shall be performed in accordance with the requirements of MIL-I-6868 to insure satisfactory detection of harmful discontinuities having axis in any direction.

#### 4.5 Dimensional.

4.5.1 Critical dimensions.-- All measured sizes shall be completely within the limits specified. The last significant figure shall be one place beyond that indicated. For example, the measured size for a .5000 - .0001 dimension shall be within the limits of .5000 and .49990 to be acceptable.

4.5.1.1 Standard temperature.-- Gage dimensions shall be within the specified tolerance limits at a temperature of  $68^{\circ}\text{F} \pm 1^{\circ}\text{F}$ .

#### 4.6 Mechanical fits.

4.6.1 Slide or slip fits.-- The slide or slip fits shall be inspected for free action and shake or sideplay at all points within the working range of the fit. The members will be disassembled and cleaned before inspection when deemed necessary.

4.6.2 Dowel fits.-- The dowel fits shall be inspected with all fastening screws loosened. One of the doweled members shall be tapped lightly to determine relative movement. The members will be disassembled, cleaned, and reassembled before inspection, when deemed necessary.

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#### 4.6.3 Design and construction.

4.6.3.1 American Gage Design (AGD standard type gages).- Unless otherwise specified standard type gages shall be inspected for conformance to CS-8.

4.6.3.1.1 Taper lock handles and gaging members.- The taper shanks and handles of gages of taper lock design shall be inspected to insure correct taper and size.

4.6.3.2 Thread gages.- Unless otherwise specified, thread gages shall be inspected in accordance with Handbook H28.

4.6.3.2.1 Thread plug gages.- The pitch diameter of thread plug gages shall be measured by the use of wire methods as prescribed in Handbook H28. The thread form and flank angle shall be determined by means of an optical measuring device of suitable accuracy. The lead shall be determined by means of an instrument of suitable accuracy.

4.6.3.2.2 Thread ring and thread snap gages.- The pitch diameter of thread ring and thread segment snap gages, i.e., the size adjustment, shall be determined by the fit of the ring or segment snap on a thread setting plug. The determination of thread form and flank angle may be made by examination of a suitable case of the ring gage threads by means of an optical measuring device of suitable accuracy. Thread roll snap gages shall be set to a thread setting plug. The thread form and flank angle of snap gage thread rolls shall be determined by an optical measuring device of suitable accuracy.

4.6.3.3 Workmanship and condition.- Gaging surfaces shall be inspected for seams, cracks, nicks, scratches, rust spots, and other defects which may materially affect the wear life or stability of the gage.

4.6.4 Inspection of preparation of delivery.- Preservation, packaging, packing and marking shall be inspected for compliance with the applicable requirements of Section 5.

#### 5. PREPARATION FOR DELIVERY

5.1 Preservation and packaging.- Preservation and packaging shall be Level A or C as specified (see 6.2).

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5.1.1 Level A.

5.1.1.1 Cleaning.- The gages shall be cleaned in accordance with process C-1 of MIL-P-116.

5.1.1.2 Drying.- The gages shall be dried in accordance with any applicable drying procedure specified in MIL-P-116.

5.1.1.3 Preservative application.- The gages shall be preserved with type P-10 preservative as specified in MIL-P-116.

5.1.1.4 Unit packaging.- Each gage shall be packaged by method IA-15 as specified in MIL-P-116 and herein. The gage shall be wrapped with type II, grade A, class 2, barrier material conforming to MIL-B-121 and secured with tape conforming to PPP-T-76. The MIL-B-121 barrier material shall be overwrapped with Kraft paper conforming to UU-P-268.

5.1.2 Level C.- The gages shall be preserved and packaged in accordance with the manufacturer's commercial practice.

5.2 Packing.- Packing shall be level A, B, or C as specified (see 6.2).

5.2.1 Level A.- The gages (gages of the same federal stock number) shall be packed in a close-fitting wirebound wood box, wood cleated fiberboard box, wood cleated-plywood box, nail wood box, or a fiberboard box conforming to PPP-B-585, class 3, PPP-B-591 (overseas type), PPP-B-601, style A or B using plywood conforming to NN-P-515, type II or III, class 2, PPP-B-621, class 2, and PPP-B-636, class 2 or 3, respectively. Closure and strapping requirements shall be in accordance with the applicable box specification or appendix thereto. The gross weight for wood or wood-cleated boxes shall be approximately 200 pounds. The gross weight of fiberboard boxes shall not exceed the weight limitations of the applicable box specifications.

5.2.2 Level B.- The gages (gages of the same federal stock number) shall be packed in close-fitting wirebound wood box, wood-cleated fiberboard box, wood cleated-plywood box, nail wood box or a fiberboard box conforming to PPP-B-585, class 1, PPP-B-591 (domestic type), PPP-B-601 (domestic type), PPP-B-621, class 1, and PPP-B-636, class 1, respectively. Closure shall be as specified in the applicable box specification or appendix thereto. The gross weight of wood or wood-cleated boxes shall be approximately 200 pounds. The gross weight of fiberboard boxes shall not exceed the weight limitations of the applicable box specification.

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5.2.3 Level C.- The gages shall be packed to afford protection against damage during direct shipment from the supply source to the first receiving activity for immediate use. Containers shall comply with Uniform Freight Classifications, Motor Freight Regulations or Parcel Post Regulations, whichever is applicable.

5.3 Marking.- Unit packages and shipping containers shall be marked in accordance with the requirements of MIL-STD-129.

## 6. NOTES

6.1 Intended use.- This specification is intended to be used for the procurement of inspection gages and precision layout tools not specified in the following military specifications:

- (a) MIL-G-45653 Gages, Cylindrical Plug and Ring, Plain
- (b) MIL-G-45654 Gages, Plug and Ring, Thread
- (c) MIL-G-46382 Gages, Snap, Thread Roll

6.2 Ordering data.- Procurement documents should specify the following:

- (a) Title, number and date of this specification.
- (b) Title, number and date of applicable drawings, documents or data.
- (c) Level of preservation, packaging and packing.

6.3 Identification of changes.- The margins of this specification are marked with an asterisk to indicate where changes (additions, modifications, corrections, deletions) from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the previous issue.

### Custodians:

Army - MU  
Navy - WP  
Air Force - 67

### Preparing activity:

Army - MU

Project No. 5220-0085

### Review activities:

Army - GL, MO, MU, WC  
Navy - WP  
Air Force - 67

### User activities:

Army - None  
Navy - MC  
Air Force - None

## STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER		2. DOCUMENT TITLE	
3a. NAME OF SUBMITTING ORGANIZATION		4. TYPE OF ORGANIZATION (Mark one)	
b. ADDRESS (Street, City, State, ZIP Code)		<input type="checkbox"/> VENDOR	
		<input type="checkbox"/> USER	
		<input type="checkbox"/> MANUFACTURER	
		<input type="checkbox"/> OTHER (Specify):	
5. PROBLEM AREAS			
a. Paragraph Number and Wording:			
b. Recommended Wording:			
c. Reason/Rationale for Recommendation:			
6. REMARKS			
7a. NAME OF SUBMITTER (Last, First, MI) - Optional		b. WORK TELEPHONE NUMBER (Include Code) - Optional	
c. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional		8. DATE OF SUBMISSION (YYMMDD)	