

MIL-I-26860B
17 May 1972
SUPERSEDING
MIL-I-26860A
24 July 1958

MILITARY SPECIFICATION

INDICATOR, HUMIDITY, PLUG, COLOR CHANGE

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

1. SCOPE

1.1 This specification establishes requirements for externally mounted color change humidity indicators for determining relative humidity within rigid containers and flexible moisture-vapor-proof envelopes or bags.

1.2 Classification. Indicator plugs shall be of the following type, as specified (see 6.2).

Type I - For mounting in threaded boss.

Type II - For mounting with self-containing locking device or in threaded boss.

2. APPLICABLE DOCUMENT

* 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

QQ-A-225/5	Aluminum Alloy Bar, Rod, And Wires; Rolled, Drawn, Or Cold Finished, 2017
QQ-A-225/6	Aluminum Alloy Bar, Rod, And Wire; Rolled, Drawn, Or Cold Finished, 2024
UU-P-63	Paper, Blotting
PPP-B-601	Boxes, Wood, Cleated-Plywood
PPP-B-636	Boxes, Shipping, Fiberboard
PPP-P-420	Plugs And Flanges (For Drum Closures)

Military

MIL-P-116	Preservation Methods Of
MIL-B-131	Barrier Material, Water Vaporproof Flexible, Heat Sealable
MIL-P-5425	Plastic, Sheet Acrylic, Heat Resistant
MIL-S-6855	Synthetic Rubber Sheet, Strips, Molded Or Extruded Shapes

MIL-I-26860B

STANDARDS

Military

MIL-STD-105	Sampling Procedures And Tables For Inspection By Attributes
MIL-STD-129	Marking For Shipment And Storage
MIL-STD-130	Identification Marking Of US Military Property
MIL-STD-171	Finishing Of Metal And Wood Surfaces
MS18013	Indicator, Humidity, Plug, Color Change
MS27215	Plug, Dehydrator, Humidity Indicating, Engine Cylinder, 18MM Thread

DRAWINGS

Ordnance Corps

9129386	Plug, Humidity Indicator
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(Copies of specifications, standards, drawings, and publications 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 document forms a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

UNIFORM CLASSIFICATION COMMITTEE

Uniform Freight Classification Rules

(Application for copies should be addressed to the Uniform Classification Committee, Room 202, Union Station, 516 W. Jackson Blvd., Chicago IL 60606.)

3. REQUIREMENTS

- * 3.1 Preproduction testing. This specification makes provisions for preproduction testing.
- * 3.2 Preproduction sample. Unless otherwise specified (see 6.2), the contractor shall furnish as soon as practical after the award of contract or order six (6) preproduction samples for inspection. This inspection shall consist of the examination and tests specified in 4.3.1.2 and 4.5 and shall be conducted prior to the submission for acceptance of the remainder of the gages furnished under contract. The preproduction samples shall be identical to the units the contractor proposes to furnish in fulfillment of the contract. These samples will be expended in testing. Approval of preproduction samples shall not relieve the contractor of his obligation to meet the requirements of the specification for the remaining units to be delivered under the contract.
- * 3.3 Materials. Material used in the manufacture of humidity indicators shall conform to the applicable Government specifications or where Government specification are not involved shall be of higher quality to insure that the indicator plugs meet all the performance requirements specified herein.

- * 3.3.1 Metal. Metal components of the humidity plug shall be manufactured from brass or an aluminum alloy conforming to QQ-A-225/5 or QQ-A-225/6. Unless otherwise specified, all metal surfaces not exposed to the contained atmosphere shall be finished with a suitable protection in accordance with MIL-STD-171 such as zinc plating for brass and anodizing for aluminum.
- * 3.3.2 Gaskets - O rings. Sealing gaskets shall be manufactured from material conforming to MIL-S-6855, Class II, Grade 60.
- * 3.3.3 Spacer - separating washer. The separating washer shall be manufactured from asbestos rubber or any other nonmetallic material which will not affect the environmental requirements of the humidity indicator.
- * 3.3.4 Transparent viewer. Material used in the manufacture of the viewing window shall be clear transparent plastic conforming to MIL-P-5425.
- * 3.3.5 Indicating element. The relative humidity indicating element shall be manufactured from blotting paper conforming to UU-P-63, Grade B, except the paper shall be white in color, halftone and smooth on both sides. The thickness shall be 0.0185 ± 0.0035 inches. The blotting paper shall be impregnated with a chemically pure cobaltous chloride solution. No chemical additives shall be used except for spots manufactured to change color above 50 percent and under 20 percent relative humidity.

3.4 Design and construction.

- 3.4.1 General. The humidity indicators shall be so designed that the indicating element is freely exposed to the contained atmosphere and only common hand tools are required to install and remove the plugs from rigid or flexible containers. The design shall be such that the exterior gaskets seat in a rectangular groove in the plug. The depth of the groove shall be not less than 60 percent nor more than 70 percent of the original gasket thickness.
- * 3.4.2 Type I. The type I indicators shall be suitable for installation in threaded plug openings of engine cylinders. Thread length, diameter and the number of threads shall be as specified in MS27215.
- * 3.4.3 Type II. The type II indicators shall be suitable for attachment in barrier material conforming to MIL-B-131, Class 1 or 2, or in metal containers. The corners of the indicator plug and locknut which will be adjacent to the barrier material shall be so rounded as to preclude puncturing of the barrier material during installation. (Reference Ordnance Drawing 9129286 and MS18013).
 - * 3.4.3.1 Size. Unless otherwise specified, the type II indicators shall be externally threaded with a 3/4-inch modified National Standard straight pipe thread as specified in the Table titled "Plug Thread Sizes" of PPP-P-420.

3.5 Performance.

- * 3.5.1 Leakage. There shall be no leakage of the indicator plug when tested in accordance with 4.5.2.

- * 3.5.2 Color and sensitivity of the indicating element. The indicating element when impregnated with the chemical solution shall be a lavender or lavender-pink when at equilibrium with the specified relative humidity measured at 73.5° Fahrenheit (F) $\pm 3.5^\circ\text{F}$, blue at a relative humidity atmosphere 5 ± 2.5 percent higher than the stated relative humidity. Equilibrium shall be reached within 24 hours when tested under static conditions as specified in 4.5.1.
- * 3.5.3 Moisture vapor transmission rate of type II indicator plugs. When tested in accordance with 4.5.3 and calculated as specified in 4.5.3.1, the moisture vapor transmission rate (MVTR) of the test pouch in which the type II indicator plug has been installed shall not exceed 0.07 gram of water per 100 square inches for a period of 24 hours.
- * 3.5.4 Viewing area. The indicating element shall be covered by an optically clear plastic window with no point on thyperiphery of the viewing area being less than 5/16 inch from the center of the viewing area.
- * 3.5.5 Markings. Unless otherwise specified in the contract or purchase order, single-spot element with a 40 percent specified relative humidity shall have printed in black on the center of the card "Represerve When Pink." Multiple-spot indicating elements shall be identified with black numbers stating the specified relative humidity of each spot. All letters and numbers shall be visible through the viewing cover.
- * 3.6 Identification of products. Indicators shall be marked in accordance with MIL-STD-130.
- * 3.7 Workmanship. The completed humidity indicator shall have no mold marks, cracks, splits nor other visible defects which may impair the physical properties and performance of the indicator in any way.

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 as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by 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 Inspection of components and materials. In accordance with 4.1, the supplier is responsible for insuring that material and components used were manufactured, tested, and inspected in accordance with the requirements of referenced subsidiary specifications and standards to the extent specified, or in accordance with this specification. In the event of conflict, this specification shall govern.

- * 4.2 Inspection classification and requirements. Inspection shall be classified as follows:
 - a. Preproduction inspection (see 4.2.1).
 - b. Quality conformance inspection (see 4.3).
- * 4.2.1 Preproduction inspection. The preproduction inspection shall be performed on six units submitted in accordance with 3.2 unless otherwise specified (see 6.2). This inspection shall include the examination of 4.3.1.2 and tests of 4.5.1.
- * 4.3 Quality conformance inspection. Quality conformance inspection shall consist of all the tests specified in 4.3.1.2 and 4.3.1.3 and performance tests 4.5.1, 4.5.2 and 4.5.3.
- * 4.3.1 Sampling for inspection. Sampling for inspection shall be performed in accordance with the provisions set forth in MIL-STD-105 except where otherwise indicated. For purposes of sampling, an inspection lot shall consist of all plugs produced under essentially the same conditions and presented for inspection at one time. The level of inspection and the acceptable quality (AQL) shall be as specified herein.
- * 4.3.1.1 Rejected lots. If an inspection lot is rejected, the supplier may withdraw the lot, rework it to correct the defects, or screen out the defective units and reinspect. Rejected lots shall be reinspected using tightened inspection levels.
- * 4.3.1.2 Examination of the end item for defects in material, construction, identification and workmanship. The sample unit for this examination shall be one plug visually inspected.

<u>Examine</u>	<u>Defects</u>
Material	Gaskets or sealing material adjacent to indicating element. Separating washer not rubber asbestos or equal. Rubber gaskets and O rings not MIL-S-6855, Class II. Viewer not clear transparent or plastic MIL-P-5425. Metal not brass or aluminum alloy QQ-P-225/5 or /6. Indicating element not blotting paper UU-P-63.
Construction	Indicating element not freely exposed to interior area of container. Exterior gaskets not properly seated in plug groove. Blotting paper not white in color. half tone and smooth on both sides. Indicating element wrong side up or missing. Metal surfaces exposed to outside atmosphere not finished.
Identification	Illegible, incorrect or incomplete markings.
Workmanship	Surface defects, burrs, splits, tears, cracks.

- * 4.3.1.3 Examination of the end item for defects of dimensions. The sample unit for this inspection shall be one indicator.

<u>Examine</u>	<u>Defects</u>
Blotting Paper Gage	Blotting paper not proper thickness.
Plastic Window Gage	Viewing area less than 5/8-inch diameter.
External Screw Gage Thread	Thread size not 3/4-inch straight pipe thread for type II plugs.

- * 4.3.1.4 Inspection levels and accepted quality levels (AQL) for examination and tests of production lots.

<u>Examination or Test Paragraph</u>	<u>Inspection Level</u>	<u>AQL</u>
4.3.1.2	II	2.5
4.3.1.3	S-3	2.5
4.5.1	S-4	1.0
4.5.2	S-4	1.0
4.5.3	S-1	2.5

- * 4.4 Performance. Performance tests are those tests performed on humidity indicator plugs in accordance with the requirements of the specification and are required to be submitted for acceptance under a contract of purchase order. The level of inspection and the acceptable quality level shall be as specified herein.

4.5 Test methods.

- * 4.5.1 Color and sensitivity of indicating element. The samples under test whether single or multiple spot elements shall be placed in a static relative humidity atmosphere of $5 \pm 2-1/2$ percent below and $5 \pm 2-1/3$ percent above the relative humidity critical for the indicating spot being tested and at a temperature of $72.5^{\circ}\text{F} \pm 3-1/2^{\circ}\text{F}$. The samples shall remain in the static atmosphere for 24 hours. At the end of this period the spot shall blue at the relative humidity less than the specified humidity, and pink at the relative humidity more than the specified humidity. Evidence of any mottling or color defects shall be cause for rejection of the lot represented.
- * 4.5.2 Leak tests (type I and II). The sample indicator plug shall be fitted into an appropriate boss by either screwing into a threaded fitting or by means of a pressure clamp gripping the base of the plug. A minimum pressure of ten (10) pounds per square inch shall be applied to the humidity plug and the assembly examined for leakage by noting any pressure drop. The pressure drop may be checked by any suitable gage or by immersion under approximately 1 inch of water. Evidence of leakage shall be cause for rejection of the lot represented.

- * 4.5.3 Moisture vapor transmission rate (type II). Pouches approximately 4 inches by 6 inches shall be constructed of barrier material conforming to MIL-B-131, Class I. One pouch shall be required for each sample plug to be tested. An indicator plug shall be properly installed in each pouch. A 50 gram bag of anhydrous calcium chloride shall be placed in each pouch and the pouches sealed. The pouches shall then be conditioned for 24 hours at 100°F ±3°F at 95 ±5 percent relative humidity. After conditioning each pouch shall be opened and the anhydrous calcium chloride bag removed and a fresh calcium chloride bag shall be weighed and inserted into the pouch. The pouches shall then be resealed and exposed for a period of 64 to 68 hours at the above conditions, after which they shall be opened and the calcium chloride bags reweighed.

4.5.3.1 Calculations. The water vapor transmission rate shall be reported in grams of moisture transmitted per 100 square inches of sample area for 24 hours and shall be calculated as shown below. The results of the individual pouches shall be reported.

$$\text{TRANSMISSION RATE (MVTR)} = \frac{(W_2 - W_1) \times 2400}{T \times A}$$

WHERE - W_1 = Weight (in grams) at the beginning of the exposure period

W_2 = Weight (in grams) at the end of the exposure period

T = Exposure period in hours (64 to 68) hours

A = Area exposed in square inches.

When tested in accordance with 4.5.3, the MVTR of the test pouch in which the type II indicator plug has been installed exceeds 0.07 grams of water plus 100 square inches for 24 hours shall be cause for rejection of the sample lot it represents.

- 4.6 Examination of preparation for delivery requirements. An examination shall be made to determine that the preservation, packaging, packing and marking complies with the Section 5 requirements. Defects shall be scored in accordance with the list below. The sample unit shall be one shipping container fully prepared for delivery with the exception that it need not be closed. Defects of closure listed shall be examined on shipping containers fully prepared for delivery. The lot size shall be the number of shipping containers in the end item inspection lot. The inspection level shall be S-2 and the AQL shall be 2.5 defects per hundred units.

<u>Examine</u>	<u>Defect</u>
Marking (exterior and interior)	Omitted, incorrect, illegible, of improper size, location, sequence or method of application.
Preservation and packaging	Not in accordance with specified method.
Materials	Any component missing, damaged or not as specified.
Workmanship	Inadequate application of components, such as: incomplete closure of container flaps, improper taping, loose strapping, inadequate stapling. Bulged or distorted containers.
Content	Number of unit packages per intermediate box is more or less than required.

5. PREPARATION FOR DELIVERY

- * 5.1 Preservation and packaging. Preservation and packaging shall be Level A or C, as specified (see 6.2).
- * 5.1.1 Level A. Each indicator shall be preserved and packaged in accordance with MIL-P-116, Method ICl (No preservative).
- * 5.1.1.1 Intermediate packaging. Fifty indicators preserved and packaged as described in 5.1 shall be placed in a close-fitting intermediate container conforming to Grade W6C, PPP-B-636.
- * 5.1.2 Level C. Each indicator shall be preserved and packaged in a manner which will afford adequate protection against corrosion, deterioration and physical damage during shipment from supply source to the first receiving activity. The supplier may use his commercial practice providing it meets this requirement.
- * 5.2 Packing. Packing shall be Level A, B or C, as specified (see 6.2).
- * 5.2.1 Level A. Each indicator preserved and packaged as specified in 5.1.1 shall be packed in weather resistant shipping containers conforming to PPP-B-636 or overseas type PPP-B-601. The grade of each PPP-B-636 shipping container, determined by the gross weight and size, shall comply to the applicable special requirements table of the specification. Waterproofing, closure and strapping of the shipping container shall be in accordance with the appendix of the applicable container specification. Containers shall be of uniform shape and size and of minimum cube and tare.
- * 5.2.2 Level B. Same as Level A, except that waterproofing is not required and domestic shipping containers may be used.

- * 5.2.3 Level C. Packages that require overpacking for acceptance by the carrier shall be placed in exterior type shipping containers in a manner that will insure safe transportation at lowest rate to the point of delivery. Containers shall comply with Uniform Freight Classification Rules, or regulations of other carriers applicable to the mode of transportation.
- * 5.3 Marking. In addition to any other markings required by contract or order, interior packages and shipping containers shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. The indicator plugs covered by this specification are intended for insertion in the barriers of method II of MIL-P-116 packages in which it is necessary to determine that the desiccant within a package is sufficiently active to maintain a relative humidity below that at which corrosion might occur.

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

- a. Title, number, and date of this specification.
- b. Type of indicator (see 1.2).
- c. When preproduction samples are not required (see 3.2).
- d. Relative humidity of indicator element required (see 3.5.5).
- e. Locknuts as required (see 3.4.3).
- f. Selection of applicable levels of preservation, packaging, and packing (see Section 5).

- * 6.3 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 the last previous issue.

Custodians:

Navy - AS
Air Force - 82

Preparing Activity:
Air Force - 82

Review Activities:

Navy - AS, OS
Air Force - 11

Project No. 6685-0426

User Activities:

Navy - SH, YD
Army - ME, GL, AV, MU, MI, EL, SL

MILITARY SPECIFICATION

INDICATOR, HUMIDITY, PLUG, COLOR CHANGE

This amendment forms a part of Military Specification MIL-I-26860B, dated 17 May 1972, and is mandatory for use by all Departments and Agencies of the Department of Defense.

Page 5

3.4.3, line 5: Delete "9129286" and substitute "9129386."

Custodians:
Navy - AS
Air Force - 82

Preparing Activity:
Air Force - 82

Review Activities:
Navy - AS, OS
Air Force - 11

Project No. 6685-0489

User Activities:
Navy - SH, YD
Army - ME, GL, AV, MU, MI, EL, SL

MIL-I-26860B
AMENDMENT 2
25 April 1974

SUPERSEDING
AMENDMENT 1
26 October 1972

MILITARY SPECIFICATION

INDICATOR, HUMIDITY, PLUG, COLOR CHANGE

This amendment forms a part of Military Specification MIL-I-26860B,
dated 17 May 1972, and is approved for use by all Departments
and Agencies of the Department of Defense.

Page 3

3.4.3, line 5: Delete "9129286" and substitute "9129386."

Page 4

3.5.2, line 5: Delete "higher" and substitute "lower."

3.5.3, title: Delete and substitute:

"Moisture vapor transmission rate of type II indicator plugs (aluminum)."

Custodians:

Navy - AS
Air Force - 82

Preparing Activity:
Air Force - 82

Project No. 6685-0512

Review Activities:

Navy - OS
Air Force - 11

User Activities:

Navy - SH, YD
Army - ME, GL, AV, MU, MI, EL, SG

MILITARY SPECIFICATION SHEET

INSULATING AND JACKETING COMPOUNDS,
ELECTRICAL (FOR CABLES, CORDS, AND WIRES),
INSULATING COMPOUND, TYPE IH-LOW TEMPERATURE,
HEAT AND OZONE RESISTANT, ETHYLENE-PROPYLENE RUBBER (EPM)
OR ETHYLENE-PROPYLENE-DIENE RUBBER (EPDM)

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

The complete requirements for acquiring the Insulating Compound
described herein shall consist of this specification and the latest
issue of MIL-I-3930.

PHYSICAL PROPERTY REQUIREMENTS

UNAGED:

Tensile strength, minimum psi	=	800
Elongation, minimum percent	=	250
Set, maximum, inch	=	.375
Tensile stress at 200 percent elongation, minimum psi	=	200

AFTER 168 ± 1 HOUR OXYGEN BOMB AGING AT 80°C:

Tensile strength, minimum percent of original	=	90
Elongation, minimum percent of original	=	75

AFTER 20 ± 1/2 HOUR AIR PRESSURE AGING AT 127°C:

Tensile strength, minimum percent of original	=	90
Elongation, minimum percent of original	=	75

OVEN AGING AT 121°C:

Tensile strength, minimum percent of original	=	85
Elongation, minimum percent of original	=	75

OZONE RESISTANCE (AFTER AIR OVEN CONDITIONING
AND 168 ± 1 HOUR IN OZONE):

120°F	=	No visible cracks
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FSC 5970

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

BRITTLENESS TEMPERATURE, MAXIMUM °C:

Unaged = -55
Oven aged = -55

TORSIONAL STIFFNESS RATIO, MAXIMUM:

AT -55°C = 5

TORSIONAL MODULUS, MAXIMUM PSI:

AT -55°C = 900

COLD TENSION RECOVERY, MINIMUM PERCENT:

AT -55°C = 10

Custodians:
Army - CR
Air Force - 85

Preparing activity:
Army - CR
(Project 5970-0560-09)

Review Activities:
Army - AR, ME, MI

Agent
DLA-IS