SAE The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
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AEROSPACE STANDARD

SAE AS23479

Issued 1999-05

Indicator, Pressure, 1 1/2-Inch, Integrally Lighted

FSC 6620

NOTICE

This document has been taken directly from U.S. Military Specification MIL-I-23479B, Amendment 1, Notice 2 and contains only minor editorial and format changes required to bring it into conformance with the publishing requirements of SAE technical standards. The initial release of this document is intended to replace MIL-I-23479B, Amendment 1, Notice 2. Any part numbers established by the original specification remain unchanged.

The original Military Specification was adopted as an SAE standard under the provisions of the SAE Technical Standards Board (TSB) Rules and Regulations (TSB 001) pertaining to accelerated adoption of government specifications and standards. TSB rules provide for (a) the publication of portions of unrevised government specifications and standards without consensus voting at the SAE Committee level, and (b) the use of the existing government specification or standard format.

Under Department of Defense policies and procedures, any qualification requirements and associated qualified products lists are mandatory for DOD contracts. Any requirement relating to qualified products lists (QPL's) has not been adopted by SAE and is not part of this SAE technical document.

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1. SCOPE:

1.1 Scope:

This specification covers design requirements and all performance requirements for the procurement of single and dual hermetically sealed, integrally lighted, remote indicating, pressure indicators.

1.2 Classification:

The indicators shall be furnished in the following ranges as specified in MS17996.

Range	Single Indicator 1 1/2 inch size	Dual Indicator 1 1/2 inch size
0-5000 Hyd	MS17996-1	MS17996-5
0-100 Oil	MS17996-2	MS17996-6
0-2500 Hyd	MS17996-3	MS17996-7
0-300 Oil	MS17996-4	MS17996-8
0-50 Boost	MS17996-9	MS17996-10
0-150 Oil	MS17996-11	MS17996-14
0-200 Oil	MS17996-12	MS17996-15
0-250 Oil	MS17996-13	MS17996-16

2. APPLICABLE DOCUMENTS:

2.1 The following documents, of the issue in effect on date of invitation for bids, form a part of this specification to the extent specified herein:

SPECIFICATIONS

Federal

DD-G-451	Glass, Flat and Corrugated, for Glazing, Mirrors, and other uses
PPP-B-601	Boxes, Wood, Cleated-Plywood
PPP-B-636	Boxes, Fiberboard

2.1 (Continued):

Military

MIL-P-116	Preservation, Methods of
MIL-C-5015	Connectors, Electric, “AN” Type
MIL-I-7057	Indicators, Synchro, Aircraft, General Specification for
MIL-T-7748	Transmitters, Pressure, Synchro, Aircraft, 320 - Degree Movement, High Temperature, General Purpose
MIL-L-25467	Lighting, Integral, Aircraft Instrument, General Specification for
MIL-C-26482	Connectors, Electric, Circular, Miniature Quick Disconnect

STANDARDS

Federal

FED STD NO. 595	Colors

Military

MIL-STD-130	Identification Marking of U S Military Property
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-1186	Cushioning, Anchoring, Bracing, Blocking, and Waterproofing; With Appropriate Test Methods
MIL-STD-781	Reliability Test Exponential Distribution
MS 17996	Indicator, Pressure, 1 1/2 inch, Integrally Lighted

(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.)

3. REQUIREMENTS:

3.1 Qualification:

The indicator furnished under this specification shall be a product which has been tested and meets the qualification inspections specified herein, and has been listed on or approved for listing on the applicable qualified products list.

3.2 Order of precedence:

The requirements of MIL-I-7057 are applicable as requirements of this specification. Additional requirements shall be as specified herein.

3.2.1 Where the general specification and this specification conflict, this specification shall govern.

3.3 Design and construction:

The indicator shall be designed to provide remote indication of pressure in pounds per square inch when connected to a transmitter conforming to MIL-T-7748. The calibration of pressure versus angular degrees shall be linear within ±0° 15' of arc. The indicator shall be integrally lighted as specified in MIL-I-7057 and MIL-L-25467.

3.4 Dial:

The dial shall be marked as shown on figure 1. Unless otherwise specified all visible portions of the dial shall be lusterless black Color No. 37038 of FED. STD. NO. 595 and all markings on the dial shall be lusterless white Color No. 37875 of FED. STD. NO. 595.

3.5 Pointer(s):

The pointer shall be as specified on MS17996. The pointer shall be suitable for integral lighting. The shaded portion of the pointer shall be finished in a lusterless white conforming to Color No. 37875 of FED. STD. NO. 595.

3.6 Performance:

The indicator shall perform satisfactory when subjected to the tests specified in Section 4.

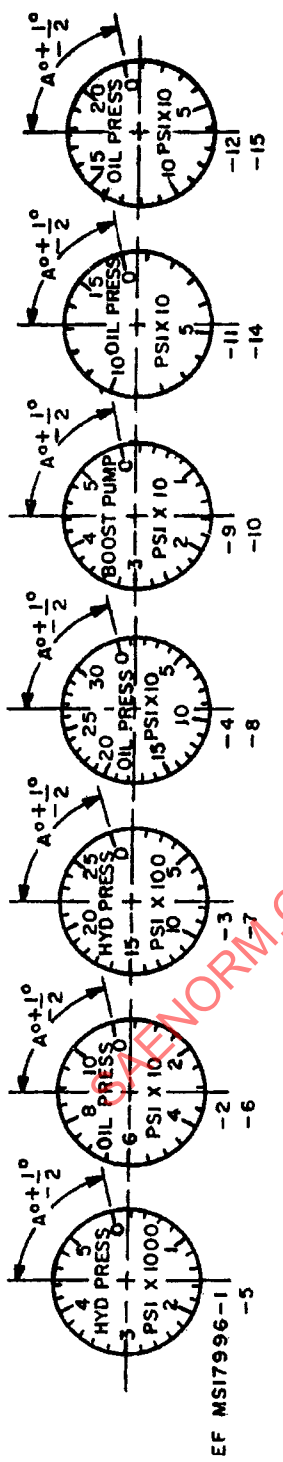
3.6.1 Reliability in mean-time-between-failures (MTBF): The indicator shall have 1000 hours of mean (operating) time between failures when tested and accepted as outlined under the requirements of 4.4.3.

3.7 Case:

The outline dimensions of the indicator case shall conform to MS17996. The case shall be hermetically sealed and the design shall be such that the mechanism may be removed from the case, replaced, and the case resealed without the use of special tools and fixtures.

3.7.1 Cover glass: The qualty of the cover glass shall be in accordance with DD-G-451, Type II, Quality AA. Any flaws permitted by DD-G-451 shall not interfere with reading of the dial.

3.7.1.1 Cover glass mounting: The distance from the inner surface of the cover glass to the surface of the dial on which the marking is applied shall not exceed 0.188 inch for single indicators or 0.250 inch for dual indicators.



Angle A From Vertical Center Line	Ranges (PSI) 0 – 5	0–10	0–25
78°	0	0	0
142°	1	2	5
206°	2	4	10
270°	3	6	15
334°	4	8	20
38°	5	10	25

Ranges PSI 0–15	0–30	Angle A From Vertical Center Line
0	0	78°.0°
5	5	131.3°
10	10	184.7°
15	15	238.0°
20	20	291.3°
25	25	344.6°
30	30	38.0°

Ranges PSI 0–20	Angle A From Vertical Center Line
0	78°
5	158°
10	238°
15	318°
20	38°

E-Z Mark at 238° All Indicators. All Dial Scales to be Linear Within ± 1/2°

Marking	Height or Length inch ± 0.016	Width of Line or Graduation inch ± 0.005	Finish
Numerals	.12	0.020	Lusterless White
Major Graduations	.12	0.020	
Minor Graduations	.06	0.015	
Lettering "PSI"	.09	0.015	
Lettering Nomenclature	.12	0.020	
Background of Dial			Lusterless Black

Figure 1 - Dial

3.8 Wiring:

The electrical wiring system shall be insulated from the indicator case, except that "J" pin of the indicator shall be grounded to the case. The wiring, shall be as shown in Figure 2. (Pin "J" of the dual indicator is case ground and is intended to be connected to the airframe ground in service. Pins "A" and "K" may be externally jumped to pin "J" if it should become desirable to ground these circuits at the indicator. The mating connector should be used for this purpose).

3.8.1 Electrical connector: The electrical connector used shall conform to MIL-C-26482 or MIL-C-5015 and shall be of the type specified in MS17996. The connector shall be mounted on the rear surface of the case with the axis of the connector within 1/16 inch of the axis of the case. The largest polarizing keyway of the connector shall be at the top center of the indicator.

3.9 Identification of product:

The indicator shall be marked for identification in accordance with MIL-STD-130 and shall include the following information:

Indicator, Pressure, 1 1/2 - Inch, Integrally Lighted
MS part No.
Stock No.
Manufacturer's part No.
Manufacturer's serial No.
Contract or order No.
Manufacturer's name or trade-mark
US Property

3.10 Weight:

The weight of the indicator shall not exceed 0.7 pound for the single indicator or 1.2 pounds for the dual.

4. QUALITY ASSURANCE PROVISION:

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, 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.

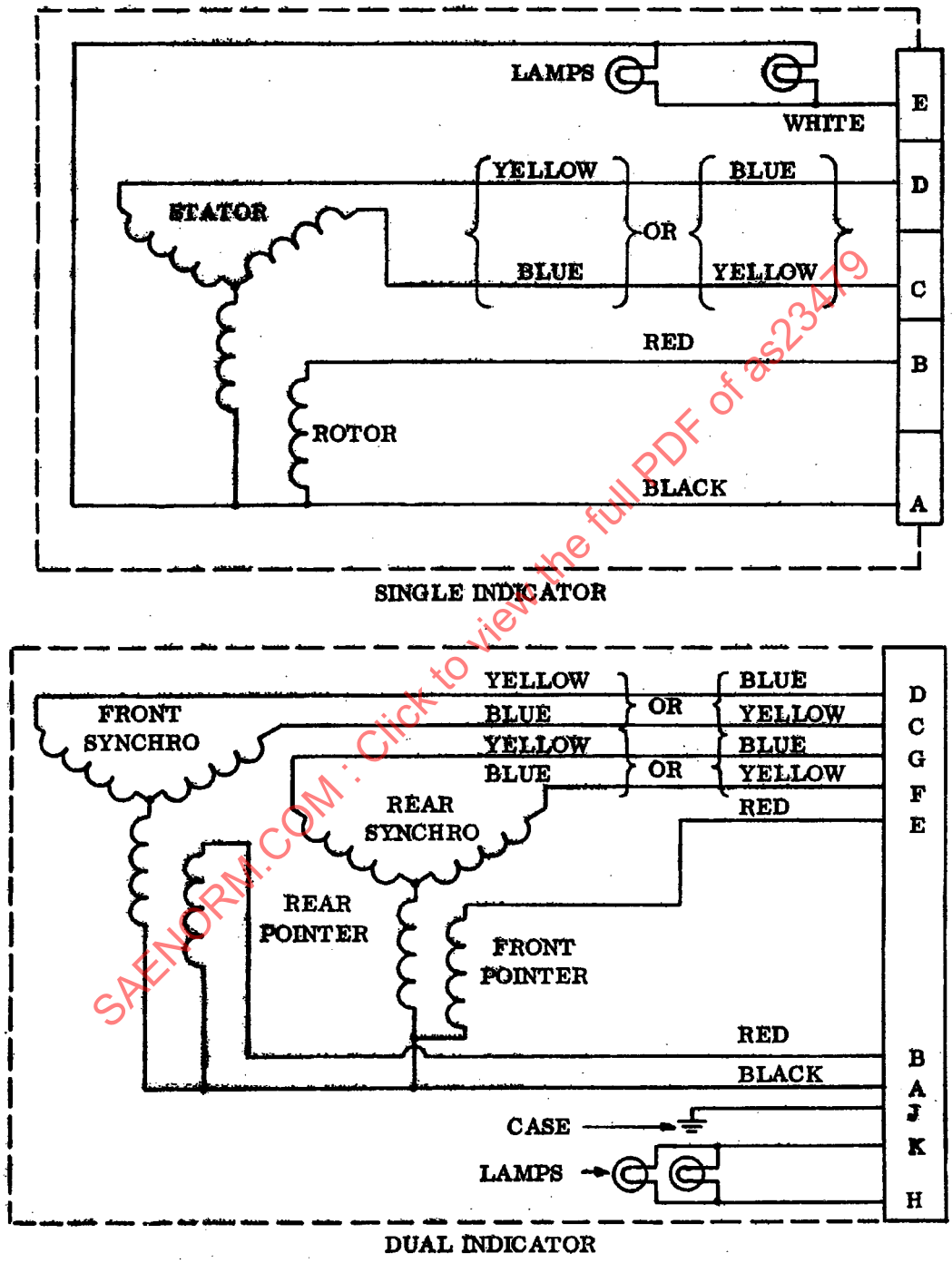


FIGURE 2 - INTERNAL WIRING

4.2 Classification of inspection:

Inspection of the Indicator shall be classified as follows:

(a) Qualification inspection: Qualification inspection consists of examinations and tests performed on sample indicators submitted for approval as a qualified product.

(b) Quality conformance inspection: Quality conformance inspection consists of examinations and tests performed on indicators manufactured and submitted for acceptance under contract.

4.3 Qualification inspection:

The qualification inspection of the indicator shall consist of all the examinations and tests of this specification performed in the order specified under the paragraph headed Inspection methods and samples submitted for Qualification shall be accompanied by the suppliers report showing that the reliability test for the Reliability Qualification Phase (4.4.3) has been satisfactorily met on other samples of the same equipment.

4.3.1 Qualification inspection sample: Qualification inspection samples shall consist of three indicators manufactured in accordance with this specification. The indicators submitted for qualification inspection shall have been previously subjected only to the individual inspections. The samples shall be forwarded to the laboratory designated in the Letter of Authorization.

4.3.1.1 Qualification inspection sample identification: The qualification inspection samples shall be plainly identified by durable tags, securely attached, and marked with the following information:

Sample for Qualification Inspection
Indicator, Pressure, 1 1/2-Inch, Integrally Lighted
Submitted by (Manufacturer's name, date)
for Qualification Inspection in accordance with
Specification MIL-I-23479 under authorization
(reference letter authorizing tests).

4.4 Quality conformance inspection:

The Quality conformance inspection shall consist of the Individual inspection, the Sampling plans, and the Reliability assurance tests of this specification. The contractor shall furnish all samples and shall be responsible for accomplishing all the inspections. Sampling plan B inspections shall be conducted at a Government laboratory designated by the procuring activity. Quality conformance inspection, except for Sampling plan B, shall be under the supervision of the Government quality control representative. The contractor shall furnish test reports showing quantitative results for all tests required by this specification, signed by an authorized representative of the contractor or laboratory as applicable. Acceptance or approval of material during the course of manufacture shall in no case be construed as a guarantee of the acceptance of the finished product.

4.4.1 Individual inspection: Each indicator submitted for acceptance shall be subjected to the Individual inspection. This inspection shall determine compliance with the requirements of material, workmanship, operational adequacy, and reliability. As a minimum, each indicator accepted shall have passed the Individual tests of MIL-I-7057.

4.4.2 Sampling plans: The Sampling plans shall consist of Sampling plan A and Sampling plan B inspections. The inspection samples selected for sampling tests shall first have passed the Individual inspections. The inspection samples which have been subjected to Sampling plan A inspection shall not be delivered on contract until they have been refurbished and resubmitted and passed all the Individual inspections. Inspection samples which have been subjected to the Sampling plan B inspection shall not be delivered on contract.

4.4.2.1 Sampling plan A sample selection: Sampling plan A samples shall be selected at random in accordance with the following schedule:

Quantity Offered for Acceptance	Quantity to be Selected for Inspection
First 15	(See Note)
Next 50	1
Next 75	1
Next 100	1
Each additional 200 or fraction thereof	1

NOTE: When Sampling plan B is invoked, the quantity shall be zero. When Sampling plan B is to be omitted, the quantity shall be one.

When a defective indicator occurs, no items from those still on hand or later produced shall be accepted until the extent and cause of failure have been determined and appropriately corrected. In addition, when a failure occurs, shift to one sample out of fifteen (when Sampling plan B is omitted) and proceed as indicated.

4.4.2.1.1 Sampling plan A inspection: Each sample selected for Sampling plan A inspection shall be subjected to the Sampling plan A tests of MIL-I-7057.

4.4.2.2 Sampling plan B Instructions: Three indicators shall be selected at random from the first fifteen (15) produced on contract and submitted within 10 days after manufacture. These indicators shall be forwarded, at the contractor's expense, to a Government Laboratory designated by the procuring activity. Each sample shall be plainly identified by a securely attached durable tag marked with the following information:

Indicator, Pressure, 1-1/2-Inch Integrally Lighted
Submitted by (Manufacturer's name, date)
for production acceptance Sampling Plan B inspection,
in accordance with Contract or Order No.
Manufacturer's Part Number

4.4.2.2.1 Sampling Plan B inspection: Each sample selected for Sampling Plan B inspection shall be subjected to the Sampling plan B tests of MIL-I-7057.

4.4.3 Reliability assurance tests: Reliability Assurance Tests shall be conducted in accordance with MIL-STD-781. Qualification Phase and Production Acceptance (Sampling) Phase Tests shall be conducted. Equipments selected for Reliability Assurance Tests shall first have passed the Individual Tests.

4.4.3.1 Reliability qualification phase: Prior to Qualification Product Listing (QPL), a minimum of three equipments shall be tested as outlined in MIL-STD-781, under the section entitled "Qualification Phase of Production Reliability Tests". The maximum number of test samples to be used shall be those listed in Table 5 of MIL-STD-781. For the Qualification Phase, Test Level F shall be used. The Accept-Reject Criteria for Test Plan I shall be used.

4.4.3.2 Reliability production acceptance (sampling) phase tests: Samples of the equipment shall be tested as outlined in MIL-STD-781, under the Section entitled "Production Acceptance (Sampling) Phase of Production Reliability Tests". For the Sampling Phase Test Level F shall be used. The Accept-Reject Criteria for Test Plan II shall be used to determine the length of the tests (until an accept or reject decision is reached).

4.4.3.2.1 Procedure for production acceptance (sampling) phase: The Reliability Production Acceptance (Sampling) Phase tests shall be conducted at least once for each lot. The number of equipments shall be in accordance with Table 5 of MIL-STD-781. The test program shall start with first month's production. Equipments shall be selected and placed on test in the same manner as though one month's production was a lot. The equipments shall be tested until an accept or reject decision is reached. The test results shall be summarized monthly for the procuring activity. The procuring activity reserves the right to stop the acceptance of equipment at any time after one or more reject decisions have been reached pending a review of the contractor's efforts to improve the equipment, the equipment quality control, etc.

4.4.3.3 Procedures report and test details: The test details such as the length of the test cycle, the length of the heat portion of the cycle, the performance characteristics to be measured, special failure criteria, etc. shall be part of the test procedures to be submitted to and approved by the procuring activity prior to the beginning of the Qualification Test Phase of the Reliability Assurance Tests. The following paragraphs shall be considered as minimum requirements and apply to both phases.

4.4.3.3.1 Duty cycle: The duty cycle shall be continuous during the heating portion of the temperature cycle. The duty cycle shall consist of cycling the indicator between approximately 10 and 80 percent of full scale and return at a rate of 12 ± 1 cycles per hour. The power shall be "off" three to five minutes after each hour of "on" time. The indicator lighting shall be energized when the indicator is operating.

4.4.3.3.2 Performance characteristics to be measured: The Scale error and friction test, described under inspection methods, shall be conducted at least once each week. The indicator shall be observed daily, on regular working days, for any obvious failure such as rough pointer movement or lighting failures.

4.4.3.3.3 Failure criteria: Whenever performance characteristics fall below the acceptance requirements (4.4.3.3.2), at least one failure has occurred. If subsequent analysis reveals that several parts have deteriorated, each shall be counted a failure, unless one part caused the other parts to fail.

4.4.3.3.4 Preventive maintenance: No preventive maintenance may be accomplished on the equipments while they are on test.

4.4.3.3.5 Operational stability: No adjustment of any controls inaccessible to the operator shall be made during the Reliability Test.

4.4.3.3.6 Disposition of samples upon completion of tests: Any equipment tested may be delivered on contract provided it meets all the following requirements:

a. It is representative of production units currently being accepted.
b. It is in "good as new" condition or has been refurbished (see 6.5.1 and 6.5.2).
c. It is otherwise satisfactory.

4.4.4 Inspection conditions: The Inspection conditions (Test conditions) of MIL-I-7057 shall apply.

4.4.5 Inspection methods: All Inspection methods (Test methods) of MIL-I-7057 shall apply. Tolerances not given in MIL-I-7057 are given in Table I. The following are exceptions from the tests of MIL-I-7057.

Dielectric strength - Pin "J" of dual indicators shall be excluded in the procedure.

Magnetic effect - The tolerance shall be one degree in lieu of 3 degrees.

TABLE I
Pressure Indicator Tolerance PSI

Dial Scale	0-5	0-10	0-15	0-20	0-25	0-30
Scale error						
Room temperature	0.025	0.050	0.075	0.10	0.125	0.150
Low temperature High temperature	0.050	0.100	0.150	0.20	0.250	0.300
Friction						
Room temperature	0.025	0.050	0.075	0.10	0.125	0.150
Low temperature High temperature	0.050	0.100	0.150	0.20	0.250	0.300
Vibration						
Pointer oscillation	0.025	0.050	0.075	0.10	0.125	0.150
Pointer variation	0.025	0.050	0.075	0.10	0.125	0.150
Position Error at Mid-scale (EZ)	0.025	0.050	0.075	0.10	0.125	0.150

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: Unless otherwise specified in the contract or order, Indicators, Pressure, 1 1/2 Inch, Integrally Lighted shall be individually preserved and packaged in accordance with MIL-P-116, Method III, in a unit container conforming to Type CF, Class Domestic, Variety SW, Grade 125, PPP-B-636.

5.1.2 Level C: Indicators, Pressure, 1 1/2 Inch, Integrally Lighted shall be individually 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. This level may conform to the supplier's standard practice provided the latter meets the requirements of this level.

5.2 Packing:

Packing shall be Level A, B or C, as specified (see 6.2).