

INCH-POUND

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SUPERSEDING  
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## DETAIL SPECIFICATION

### INDICATOR, ELAPSED TIME, ELECTROCHEMICAL

Inactive for new design after 24 August 1998.

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

#### 1 SCOPE

1.1 Scope. This specification covers the design and performance requirements for lightweight, small and low resolution electrochemical elapsed time indicators.

1.2 Part or Identifying Number. The PIN is as specified on the applicable MS sheet.

#### 2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of the documents cited in sections 3 and 4 of this specification, whether or not they are listed.

Comments, suggestions, or questions on this document should be addressed to Defense Supply Center Richmond, ATTN: DSCR-VEB, 8000 Jefferson Davis Highway, Richmond, VA 23297-5616 or e-mailed to [STDZNMGT@DLA.MIL](mailto:STDZNMGT@DLA.MIL). Since contact information can change, you may want to verify the currency of this address information using the ASSIST database at <http://assist.daps.dla.mil>.

## MIL-DTL-81219C

2.2 Government documents.

2.2.1 Specifications and standards. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract (see 6.2).

## DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-130	- Identification Marking of U S Military Property
MIL-STD-202	- Test Method Standard, Electronic and Electrical Component Parts
MIL-STD-889	- Dissimilar Metals
MS90373	- Indicator, Elapsed Time, Electrochemical (Copper) 115 Volt 50/2400 Hertz or 28 Volt DC
MS90386	- Indicator, Elapsed Time, Electrochemical, (Mercury) 115 Volt AC 50/2400 Hertz, 28 Volt DC or 5 Volt DC

(Copies of these documents are available online at <http://assist.daps.dla.mil/quicksearch/> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related MS sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

## 3. REQUIREMENTS

3.1 Materials. Materials shall conform to applicable specifications and as specified herein. Materials for which there are no applicable specifications, or which are not specifically described herein, shall be of the best quality, of the lightest practicable weight and suitable for the purpose intended.

3.1.1 Fungus-proof materials. Materials that are nutrients for fungi shall not be used where it is practical to avoid them.

3.1.2 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements and promotes economically advantageous life cycle costs.

3.1.3 Metals. Metals shall be of the corrosion resistant type or suitably treated to resist corrosion due to fuels, salt fog, or atmospheric conditions likely to be met in storage or normal service.

3.1.4 Dissimilar metals. Unless suitably protected against electrolytic corrosion, dissimilar metals as defined in MIL-STD-889 shall not be used in intimate contact with each other.

## MIL-DTL-81219C

3.1.5 Nonmagnetic materials. Nonmagnetic materials shall be used for all parts of the transmitter except where magnetic materials are essential.

3.1.6 Non-ferrous materials. Non-ferrous materials shall be used for all parts of the indicator except where ferrous materials are required.

3.1.7 Corrosive fumes. Materials used in the construction of the transmitter shall not produce corrosive or deleterious fumes under the test conditions specified herein.

3.1.8 Protective treatment. When materials are used in the construction of the indicator that are subject to deterioration when exposed to climatic and environmental conditions likely to occur during service usage, they shall be protected against such deterioration in a manner that will in no way prevent compliance with the performance requirements of this specification. Protective coatings that will crack, chip, or scale with age or the extremes of climatic and environmental conditions shall not be used.

3.2 Design and construction.

3.2.1 Design. The indicator shall be in accordance with the applicable MS drawing and the requirements specified herein.

3.2.1.1 Size. The outline dimensions shall be in accordance with the applicable MS drawing.

3.2.1.2 Indication. The type and characteristics of the indication of the elapsed time shall be in accordance with the applicable MS drawing.

3.2.1.3 Sealing. Unless otherwise specified herein, the indicating cell shall be hermetically sealed or fully encapsulated. The hermetic sealing or encapsulation shall be accomplished such that the seal will not be dependent upon materials which will be adversely affected by the action of any atmosphere to which the indicator may be subjected.

3.2.1.4 Scale. The indicator scale shall be in accordance with the applicable MS drawing and 3.2.1.4.1 and 3.2.1.4.2.

3.2.1.4.1 Scale visibility. The scale shall be so designed that the full scale of the indicator can be easily read at a distance of 18 inches. There shall be no objectionable shadow on the graduated scale with general illumination and the indication cell shall be free from defects that would prevent the indicator from being easily read. Such defects include but are not limited to scratches, cracks and chips. This requirement applies both before and after the tests specified herein.

## MIL-DTL-81219C

3.2.1.4.2 Divisions. The timer scale shall be divided as below:

- a. MS90373 – at least 10 scale divisions, each corresponding to 1/10th of the full scale length.
- b. MS90386 – as specified on the MS sheet.

3.2.1.5 Terminals. The terminals shall be solder type and shall be capable of carrying the applicable current and voltage.

3.2.1.6 Polarity. On all DC indicators and regulators, the symbol “+” shall be marked or stamped in a permanent, legible manner on or as close to the positive terminal as is practicable.

3.2.1.7 Finish. The indicator shall be finished in a durable black color. The finish shall not melt, crack, blister or scale as a result of the tests specified herein

3.2.1.8 Identification of product. Meters, assemblies and parts thereof shall be marked for identification in accordance with MIL-STD-130. The indicator shall be identified in accordance with the applicable MS sheet.

3.2.1.9 Interchangeability. All parts having the same manufacturer's part number shall be directly and completely interchangeable with each other in respect to installation and performance.

3.2.1.10 Holder. A mounting holder, when required, shall be in accordance with the applicable MS sheet.

3.2.1.11 Input power. The indicator shall supply the range of voltage, and if applicable frequency, specified on the applicable MS sheet. It shall be controllable over these ranges.

3.2.1.12 Weight. The total weight of the indicator or indicator assembly (indicator, holder and regulator) shall not exceed that specified on the applicable MS sheet.

3.2.2 Construction. The indicator shall be constructed so that no parts will work loose in service. It shall be built to withstand strains, jars, vibrations, and other conditions incident to shipment, storage, installation, and service.

3.3 Performance. The indicator shall give the specified performance when subjected to any of the tests or combinations of tests specified in section 4.

3.4.1 Low temperature storage. The indicator shall withstand a temperature of -80°C (-112°F) as specified in 4.6.12 and meet the operational requirements of 3.4.8.

3.3.2 Dielectric strength. The indicator shall be capable of withstanding an application of 1500 Vac, 60 Hz between terminals and case at sea level barometric pressure without damage, arcing or current leakage in excess of 1 milliampere (see 4.6.3).

3.3.3 Thermal shock. Unless otherwise specified in the applicable MS sheet, the indicator shall operate without degradation through a range of -55°C to 85°C (-67°F to 185°F)

## MIL-DTL-81219C

ambient (see 4.6.4). There shall be no warping, cracking or discoloration which would adversely affect the performance of the indicator. The indicator shall maintain its specified accuracy during and after the thermal shock.

3.3.4 Altitude. The indicator shall operate with barometric pressure ranging from 30 inches of mercury (sea level) to 0.82 inch of mercury (80,000 feet elevation) and with pressure varying at a maximum rate of 0.5 inch of mercury per second (see 4.6.6).

3.3.5 Salt atmosphere. The indicator shall meet the operational check requirements of 3.4.8 after being subjected to the tests specified in 4.6.7. There shall be no signs of corrosion of the metal parts after the test.

3.3.6 Vibration. The indicator shall show no evidence of breakage, separation of electrolyte, permanent deformation or loosening of parts and shall be operative during and after subjection to the vibration test specified in 4.6.8. Application of the vibration shall be in each of the three principal planes.

3.3.7 Shock. The indicator shall show no evidence of breakage, separation of electrolyte, permanent deformation or loosening of parts and shall be operative during and after subjection to the vibration test specified in 4.6.9.

3.3.8 Operational check. Each indicator shall meet the requirements specified in the applicable MS sheet (see 4.6.2).

3.3.9 Hermetic seal. The indicator shall show no evidence of leakage when tested as specified in 4.6.5.

3.3.10 Power consumption. Power consumption at rated voltage shall be in accordance with the applicable MS sheet (see 4.6.11).

3.3.11 Life accuracy. Unless otherwise specified in the applicable MS sheet, accuracy shall be within five percent (5%) of actual elapsed time when tested in accordance with 4.6.10.

3.4 Workmanship. The indicator, including all parts and accessories, shall be so constructed and finished that it shall be free from all defects which would affect proper functioning in service. Particular attention shall be given to freedom from blemishes, defects, burrs and sharp edges, accuracy of dimensions, radii of fillets and marking of parts and assemblies (see 4.6.1).

## MIL-DTL-81219C

## 4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. First article inspection (see 4.3).
- b. Conformance inspection (see 4.5).

4.2 Inspection condition. Unless otherwise specified, all inspections shall be performed in accordance with test conditions specified in the applicable test method document or applicable paragraph(s) in this specification.

4.2.1 Standard atmospheric conditions. Whenever the pressure and temperature existing at the time of the test are not specified, the test shall be conducted at an atmospheric pressure of 29.92 inches of mercury (Hg) and at an ambient temperature  $25\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$  ( $77\text{ }^{\circ}\text{F} \pm 9\text{ }^{\circ}\text{F}$ ).

4.3 First article inspection. First article tests shall be performed when specified by the procuring document (see 6.2).

4.3.1 First article sample. The first article sample shall consist of three indicators for each voltage and hour rating combination. The indicators submitted for testing shall have been previously subjected only to the individual tests of 4.5.1. Samples shall have been manufactured by the manufacturer's normal production process.

4.3.2 First article tests. The first article inspection shall consist of the examinations and tests specified below and in the MS sheet. Tests shall be performed in the order shown. Failure of any indicator to pass all the tests shall be considered a failure of the sample lot.

	<u>Requirement</u>	<u>Method</u>
a. Examination of product	3.2, 3.4	4.6.1
b. Operational check	3.3.8	4.6.2
c. Power consumption	3.3.10	4.6.11
d. Dielectric strength	3.3.2	4.6.3
e. Thermal shock	3.3.3	4.6.4
f. Vibration	3.3.6	4.6.8
g. Shock	3.3.7	4.6.9
h. Salt Atmosphere	3.3.5	4.6.7
i. Altitude	3.3.4	4.6.6
j. Hermetic seal	3.3.9	4.6.5
k. Life accuracy	3.3.11	4.6.10
l. Low temperature storage	3.3.1	4.6.12

4.4 Conformance inspection. Conformance inspection shall consist of the individual tests of 4.4.1 for each unit produced, as well as the sampling plan of 4.4.2.

## MIL-DTL-81219C

4.4.1. Individual tests. Each transmitter shall be subjected to the following tests as described in 4.6.

- a. Examination of product (see 4.6.1).
- b. Operational check (see 4.6.2)

4.4.2 Sampling plan.

4.4.2.1 Sample plan quantity. The quantity of indicators tested for conformance inspection shall be as follows:

<u>Quantity offered</u>	<u>Quantity to test</u>
First 15	1
Next 50	1
Next 75	1
Next 100	1
Each additional 200 or fraction thereof	1

When a defective indicator is detected, no indicators from those still in stock or later produced shall be accepted until the extent and cause of failure have been determined and appropriately corrected. In addition, the sample frequency shall be restarted at the 1 out of 15 level.

4.4.2.2 Sample plan tests. Sampling plan tests are in addition to the individual tests.

- a. Thermal Shock (see 4.6.4).
- b. Hermetic seal (see 4.6.5).
- c. Dielectric strength (see 4.6.3).

4.5 Disposition of tested indicators. Indicators which have been subjected to either first article inspection testing or conformance inspection sample plan testing may not be delivered on a contract specifying the military part number.

4.6 Methods.

4.6.1 Examination of product. Each indicator shall be inspected to determine compliance with the requirements specified herein with respect to materials, workmanship, marking, dimensions, and weight.

4.6.2 Operational check. (see 3.3.8)

4.6.2.1 MS90373 (copper type).

4.6.2.1.1 Indicator cell only. The indicating cell without the regulator shall be measured for resistance by means of an AC Wheatstone Bridge circuit (caution – do not use a volt/ohm meter) at room ambient conditions. The measured resistance shall not exceed 5000 ohms.

## MIL-DTL-81219C

4.6.2.1.2 Complete indicator assembly (holder, indicating cell and regulator). The indicators shall have a current flow of  $70 \pm 2$  microamperes at room ambient conditions when connected a voltage source supplying the voltage specified by the applicable MS sheet. A microammeter placed in series between the indicating cell anode and the regulator shall be used to measure the current. After any or all tests specified in 4.6.4 through 4.6.9 the current flow must be  $70 \pm 3$  microamperes.

4.6.2.1.3 Test readings. Unless otherwise specified herein, before a test reading is taken on MS90373 indicators, the indicator may be tapped lightly or vibrated at 30, 60 or 120 Hz with a maximum amplitude of 0.002 inch

4.6.2.2 (MS90386) Mercury types. The indicators shall be check in accordance with the operational check test as specified on the MS sheet

4.6.3 Dielectric strength. The indicator shall be tested in accordance with MIL-STD-202, Method 301. The indicator shall be tested at 1500 Vac, 60 Hz for one minute (see 3.3.2).

4.6.4 Thermal shock. The indicators shall be tested as specified below. At the completion of the test, the indicator shall meet the operational requirements of 4.6.2. (see 3.3.3)

4.6.4.1 MS90386 (mercury type). The indicator shall be tested in accordance with MIL-STD-202, Method 107, Condition A. The indicator shall be operated during the test at its rated voltage and 60 HZ if is an AC indicator.

4.6.4.2 MS90373 (copper type). The indicator shall be tested in accordance with MIL-STD-202, Method 107, Condition A except for the number of cycles specified in the MS sheet. The indicator shall be operated during the test at its rated voltage and 60 HZ if is an AC indicator.

4.6.5 Hermetic seal. (see 3.3.9).

4.6.5.1 MS90373 (copper type). The liquid filled indicating cell of the indicator shall be tested for hermetic seal as follows:

- The cell shall be placed on white absorbent paper.
- The paper with cell(s) shall be placed in an oven at  $85^{\circ}\text{C} \pm 3^{\circ}\text{C}$  ( $185^{\circ}\text{F} \pm 5^{\circ}\text{F}$ ).
- There shall be no evidence of staining of the paper (blue coloration) or the presence of blue salts around the end caps upon completion of this test.

4.6.5.2 MS90386 (mercury type). After 1/2 hour exposure at  $85^{\circ}\text{C} \pm 3^{\circ}\text{C}$  ( $185^{\circ}\text{F} \pm 5^{\circ}\text{F}$ ) there shall be no microscopic evidence of mercury leakage expulsion within the encapsulation.

4.6.6 Altitude. The indicator shall be tested in accordance with MIL-STD-202, Method 105 except the absolute pressure shall be 0.82 inches of mercury. The indicator shall be operated for 10 minutes under the reduced pressure at the following voltage:

- 128 Vac, 60 Hz for 115 Vac indicators
- 29 Vdc for 28 Vdc indicators



## MIL-DTL-81219C

- 5.5 Vdc for 5 Vdc indicators

At the completion of the test, the indicator shall meet the operational requirements of 4.6.2 (see 3.3.4)

4.6.7 Salt atmosphere. The indicator shall be tested in accordance with MIL-STD-202, Method 101, Condition B. No voltage shall be applied during the test. At the completion of the test, the indicator shall meet the operational requirements of 4.6.2 (see 3.3.5).

4.6.8 Vibration. The indicator shall be tested in accordance with MIL-STD-202, Method 204, Condition D. Application of the vibration shall be in each of the three principal planes. The indicator shall be rigidly mounted in the horizontal position. The indicators shall be energized during the test at their rated voltage. The AC indicators shall be energized at 60 Hz. At the completion of the test, the indicator shall meet the operational requirements of 4.6.2 (see 3.3.6).

4.6.9 Shock. The indicator shall be tested in accordance with MIL-STD-202, Method 213, Condition A, or as specified on the applicable MS sheet. At the completion of the test, the indicator shall meet the operational requirements of 4.6.2 (see 3.3.7).

4.6.10 Life accuracy. Each indicator type shall be tested for life accuracy for  $1000 \pm 40$  hours. The test shall be performed at the following conditions:

<u>Temperature</u>	<u>Voltage</u>	<u>Elapsed Time</u>
85°C (185°F)	Maximum Rated	200 ± 8 hours
85°C (185°F)	Minimum Rated	200 ± 8 hours
-20°C (-4°F)	Maximum Rated	200 ± 8 hours
-20°C (-4°F)	Minimum Rated	200 ± 8 hours
25°C (77°F)	Nominal Rated	200 ± 8 hours

The Maximum, minimum and nominal voltage ratings are shown on the applicable MS sheet. At the end of the 1000 hours, the indicator shall be for accuracy in accordance with the requirements of the applicable MS sheet. Accuracy is calculated as follows:

$$\text{Accuracy (\%)} = \frac{(\text{Measured Elapsed Time} - \text{Actual Elapsed Time})}{\text{Actual Elapsed Time}} \times 100$$

Failure of one or more indicators is considered failure of the entire sample. AC indicators shall be energized at 60 Hz.

4.6.11 Power consumption. Indicators shall be checked for power consumption at the rated voltage in accordance with the applicable MS sheet, using suitable measuring equipment (see 3.3.10).

4.6.12 Low temperature Storage. The indicator shall be placed in a chamber maintained at -80°C (-112°F) for  $30 \pm 2$  minutes. The temperature shall then be raised to -20°C +5°C/-0°C (-4°F +9°F/-0°F). This cycle shall be repeated for a total of 3 cycles. It shall then be brought to room

## MIL-DTL-81219C

ambient temperature. At room temperature, the indicator shall meet the operational requirements of 4.6.2 (see 3.3.1).

## 5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD or in-house contract personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the inventory control point's packaging activities within the military service or defense agency, or within the military service's system commands. Packaging data retrieval is available from the managing military service's or defense agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

## 6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The indicators covered by this specification are intended to accurately record the number of hours that the equipment has operated in the environment described herein. These devices are suitable for use in aircraft.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. MS number and quantity
- c. Issue of individual documents referenced (see 2.2.1).
- d. Special test conditions, if any (see 4.2).
- e. First article requirement (see 4.3).
- f. Packaging requirements (see 5.1).

6.3 Definitions.

6.3.1 Voltage. All AC voltages as used in this specification should be considered to be root mean square (rms) values.

6.3.2 Hermetic seal. A perfectly closed and airtight seal made between vitric surfaces, metallic surfaces or vitric to metallic surfaces. It is not intended to include seals accomplished by gaskets, but vitric epoxy resin seals with epoxy resin encapsulation are acceptable.

6.3.3 Indicator. The indicator is a complete elapsed time indicator assembly. The assembly may be packaged with an indicating cell and regulator in a single inseparable package, or it may be separable and consist of a holder, regulator and indicating cell.

6.3.4 Holder. The part of a separable indicator assembly into which the indication cell is inserted, and its associated cap.

## MIL-DTL-81219C

6.3.5 Regulator. The part of the indicator assembly, or the separable component thereof, which controls the current to the indicating cell.

6.3.6 Indicating cell. The part of the indicating assembly from which the elapsed time is read.

6.3.7 Accuracy. A number which indicates the limit of error expressed as a percentage of the total reading.

6.4 Subject term (key word) listing.

Aircraft

Hermetic seal

Indicating cell

6.5 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes. The changes are the result of the cancellation of the Qualified Products List (QPL) requirement and resulting change to a first article requirement, the cancellation of referenced specifications and formatting updates.

Custodian:

Navy – AS

Air Force – 71

Preparing Activity:

DLA - GS1

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NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST database at <http://assist.daps.dla.mil>.