

MIL-C-38207A(ASG)**8 FEBRUARY 1965**

Superseding
MIL-C-38207(USAF)
16 July 1963

MILITARY SPECIFICATION**CLOCK, AIRCRAFT, MECHANICAL ABU-11/A**

This specification has been approved by the Department of the Air Force and by the Bureau of Naval Weapons.

1. SCOPE

1.1 This specification covers an integrally lighted mechanical aircraft clock with a 1-hour elapsed time capability, designated ABU-11/A.

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 this specification to the extent specified herein.

SPECIFICATIONS**Federal**

DD-G-451	Glass, Flat and Corrugated, for Glazing, Mirrors, and Other Uses
PPP-T-360	Time Measuring Instruments: Packaging of

Military

MIL-G-174	Glass, Optical
MIL-C-675	Coating of Glass Optical Elements (Antireflection)
MIL-R-6855	Rubber; Synthetic, Sheeted Molded, and Extruded
MIL-S-7742	Screw Threads, Standard, Optimum Selected Series: General Specification for
MIL-A-8625	Anodic Coatings, for Aluminum and Aluminum Alloys
MIL-L-25407	Lighting, Integral, Aircraft Instrument, General Specification for
MIL-C-26482	Connectors, Electric, Circular, Miniature, Quick Disconnect
MIL-L-27160	Lighting, Instrument, Integral, White, General Specification for
MIL-B-27497	Bearing, Jewel, Sapphire, Synthetic
MIL-D-70327	Drawings, Engineering and Associated Lists

FSC 0045

411. 101-77A(ASC)

STANDARDS

Federal

FEDERAL STANDARD
NO. 595 Colors

Military

MIL-STD-130	Identification Marking of US Military Property
MIL-STD-143	Specifications and Standards, Order of Precedence for the Selection of
MIL-STD-810	Environmental Test Methods for Aerospace and Ground Equipment
MIL-STD-831	Test Reports, Preparation of
MS3132	Connector, Receptacle, Electric, Solder Type, Box Mounting Flange, No. 4 Holes, Push Pull Coupling
MS3134	Connector, Receptacle, Electric, Solder Type, Single Hole Mounting, Push Pull Coupling
MS3137	Connector, Plug, Electric, Solder Type, Short, Push Pull Coupling
MS33558	Numerals and Letters, Aircraft Instrument Dial, Standard Form of
MS33586	Metals, Definition of Dissimilar
MS51021	Setscrew - Hexagon Socket, Cup Point, Corrosion- Resisting (Chrome-Nickel) Steel, Passivated, UNC-3A

(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 clock furnished under this specification shall be a product which has been subjected to and which has passed the qualification tests specified herein, and which has been listed on or approved for listing on the applicable Qualified Products List.

3.2 Materials.-

3.2.1 Fungus-proof materials.- Materials that are nutrients for fungi shall not be used where it is practical to avoid them. Where used and not sealed, they shall be treated with a fungicidal agent acceptable to the procuring activity.

3.2.2 Antimagnetic materials.- Antimagnetic materials shall be used for all parts of the clock, except where magnetic materials are essential. When the use of magnetic material is necessary, all magnetic material shall be demagnetized.

3.2.3 Metals.- Metals shall be corrosion resistant or suitably treated to resist corrosion due to fuels, salt spray, or other atmospheric conditions likely to occur in storage or normal service. Protective coatings that will crack, chip, or scale with age or extremes of atmospheric conditions shall not be used.

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3.2.3.1 Dissimilar metals.- Unless suitably protected against electrolytic corrosion, dissimilar metals as defined in MS33586 shall not be used in intimate contact with each other.

3.2.3.2 Light metal alloys.- Aluminum, magnesium, and other lightweight alloys shall be used for all metal parts of the clock, except where stressing, fire resistance, or other requirements dictate the use of steel or other heavy metals.

3.3 Selection of specifications and standards.- Specifications and standards for necessary commodities and services not specified herein shall be selected in accordance with MIL-STD-143.

3.4 Design and construction.- The clock shall be designed and sealed to ensure that sand, dust, humidity, salt air, and fungus producing conditions in service life will not interfere with the proper operation of the equipment. The clock shall be so constructed that no parts will work loose in service. The clock shall be built to withstand without failure, the strains, jars, vibrations, and other conditions incident to shipping, storage, installation, and service use.

3.4.1 Clock case.- The clock case shall conform to figure 1.

3.4.1.1 The case shall be constructed from either aluminum alloy or thermo-setting plastic material composed of a suitable filler and phenol condensation binder. The material shall be uniformly and smoothly textured and shall be finished with a durable lusterless black, color No. 37038 in accordance with Federal Standard No. 595.

3.4.1.2 Cover glass.-

3.4.1.2.1 Dimensions.- The diameter of the cover glass shall be 2.052 inches $+0.077$ or -0.010 inch. The thickness shall be $0.062 +0.016$ or -0.000 inch, except as specified in 3.4.1.2.3, when applicable.

3.4.1.2.2 Material.- The case cover glass shall conform to type II, quality AA of DD-G-451, except as specified in 3.4.1.2.3. Any flaws permitted by DD-G-451 shall not interfere with reading of the clock. The edges of the glass shall be ground or otherwise treated to remove roughness, nicks, or sharpness.

3.4.1.2.3 Exception for prism wedge glass.- If a prism wedge glass is used for better light distribution, the material for the cover glass shall be in accordance with MIL-G-174. Any flaws permitted by MIL-G-174 shall not interfere with reading the clock. The thin edge of each prism shall be not less than 0.0468 inch.

3.4.1.2.4 Coverglass and lighting wedge.- All glass surfaces shall be provided with a reflection-reducing coating conforming to MIL-C-675, in addition to withstanding the environmental conditions specified herein, except that the following reflectance tolerances shall apply:

<u>Angle of incidence</u>	<u>Wavelength - millimicrons</u>	<u>Percent reflectance</u>
Zero degree	450 - 675	0.6 max.
Zero degree	425 - 700	0.5 average
30 degrees	450 - 625	1.0 max.
30 degrees	425 - 700	0.5 average

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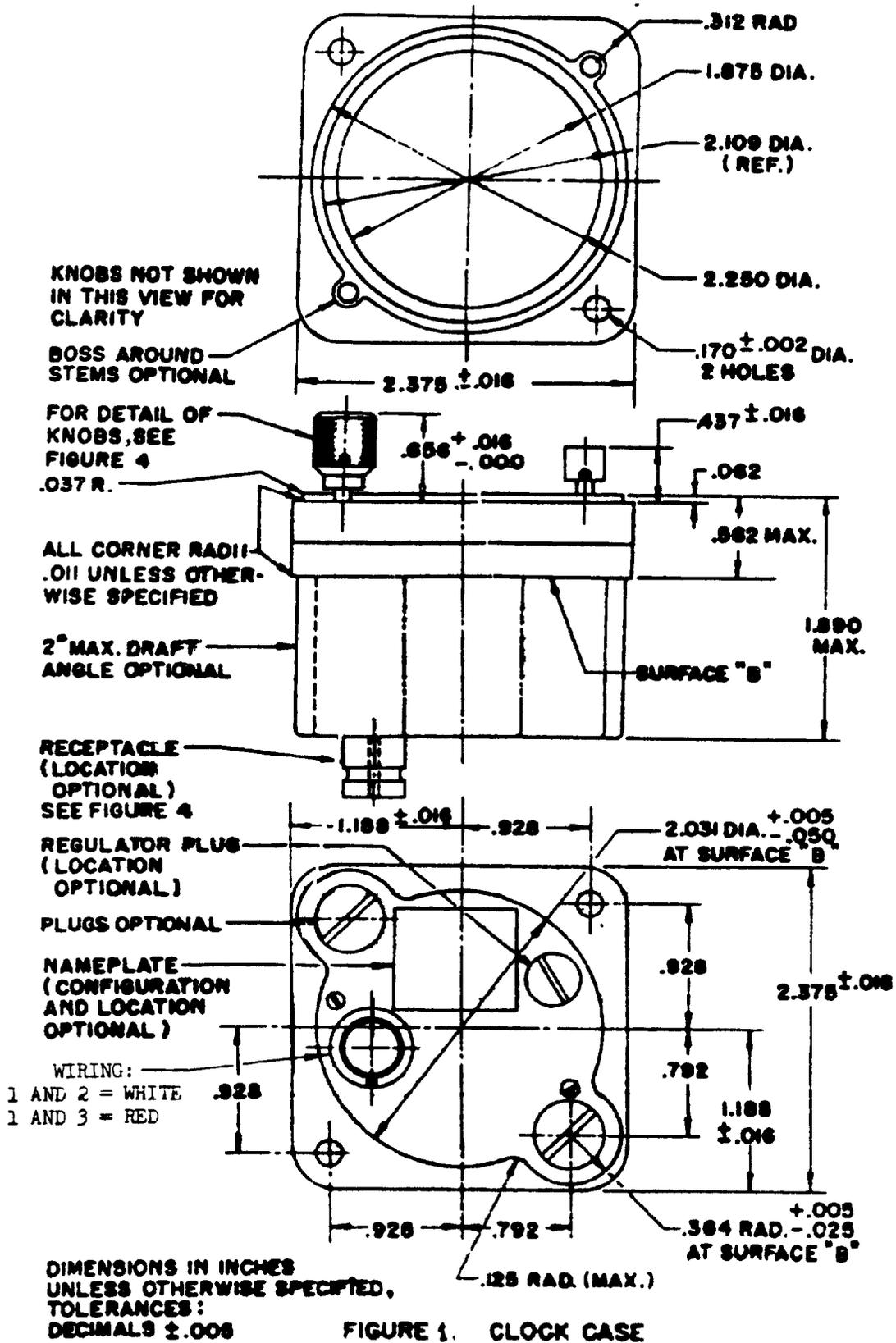


FIGURE 1. CLOCK CASE

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3.4.1.2.5 Cover glass gasket.- The cover glass or bezel gasket shall conform to class 2, grade 60 of MIL-R-6855, or a nonshrinking material acceptable to the procuring activity.

3.4.1.3 Bezel.- If a separate bezel is used, it shall be constructed from nonferrous, low-density metal, or plastic material, finished with a durable lusterless black, color No. 37038, in accordance with Federal Standard No. 595. The bezel shall be held in place by at least four screws.

3.4.1.4 Threaded screw ring.- The threaded screw ring, if used, shall be removable from the case without damaging the case or glass. Steel or magnetic metal shall not be used.

3.4.2 Hands and dial.-

3.4.2.1 Hands.- The clock hands shall conform to the dimensions shown on figure 2, with a thickness equal to accepted commercial requirements. The hands shall be lightweight, sufficiently rigid to prevent oscillation under vibration, firmly attached to the mechanism, yet readily adjustable.

3.4.2.2 Dial.- The clock dial shall be constructed from aluminum or aluminum alloy and shall have a step arrangement as shown on figure 2. The dial dimensions and markings shall conform to figure 3. The dial shall be securely fastened by at least two screws into the case or frame of the mechanism so it will not loosen or turn when the clock is vibrated.

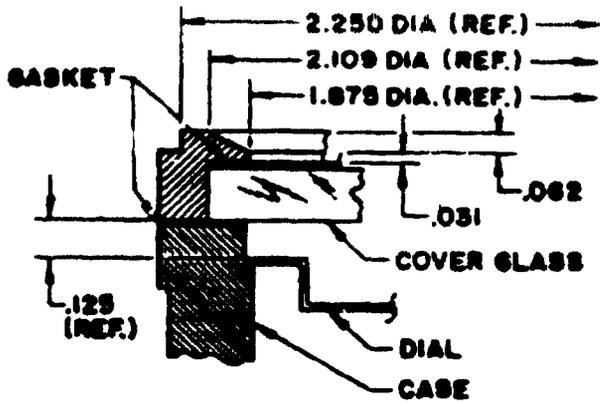
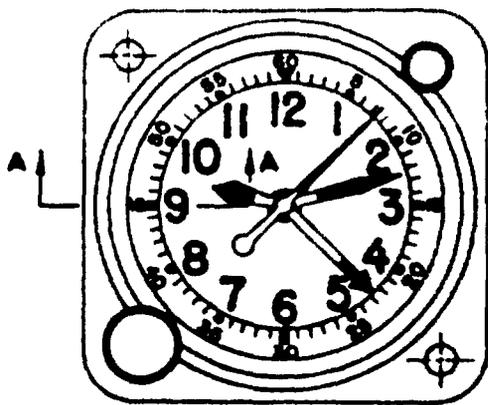
3.4.2.2.1 Dial and cover glass location.- The distance between the inside surface of the cover glass and the cover glass and the main portion of the dial shall not exceed 0.25 inch. The distance between the glass and the stepped up portion of the dial shall not exceed 0.125 inch.

3.4.2.3 Colors for dial and hands.- The dial background and the area of the hands unshaded on figure 2 shall be lusterless black conforming to color No. 37038 of Federal Standard No. 595. The shaded area of the hands and the dial numbers and markings shall be lusterless white conforming to color No. 37875 of Federal Standard No. 595.

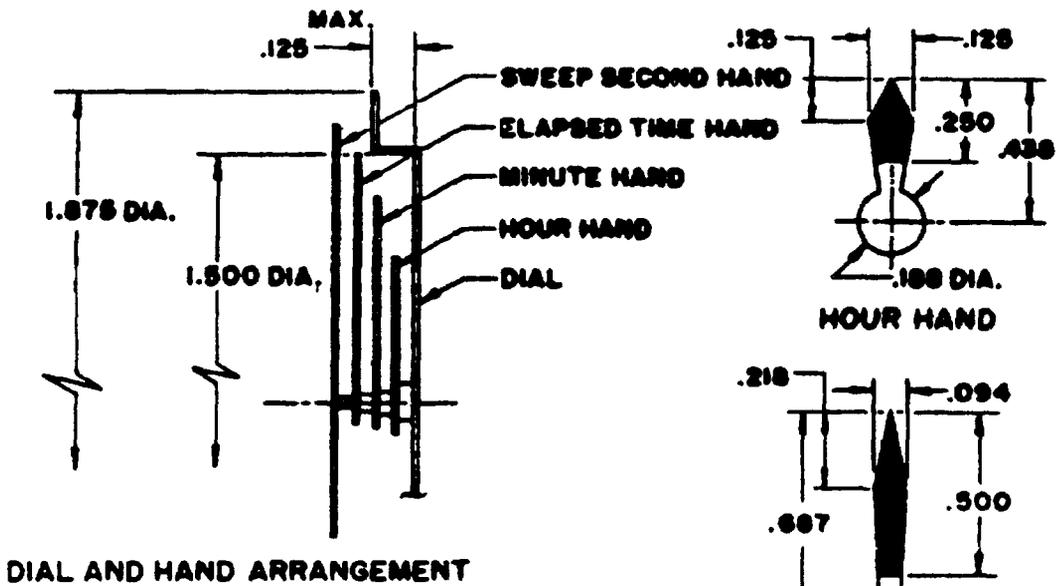
3.4.3 Clock controls.-

3.4.3.1 Winding and setting knob.- A winding and setting knob conforming to the dimensions on figure 4 shall be located in the lower left-hand corner of the clock case. It shall wind the mainspring of the clock when turned in a clockwise direction and shall be free to turn counterclockwise with a ratchet gear. When pulled out, it shall engage the setting gear for the hour and minute hands of the clock into the setting position. The knob shaft shall return to the winding position when released. The knob shall have a diamond knurl surface and shall be attached to the shaft with two socket head setscrews conforming to MS51021-1(2-56).

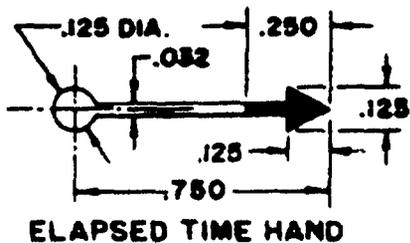
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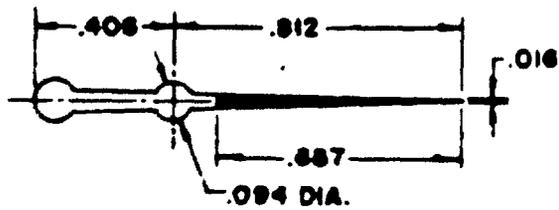
SECTION A-A



DIAL AND HAND ARRANGEMENT



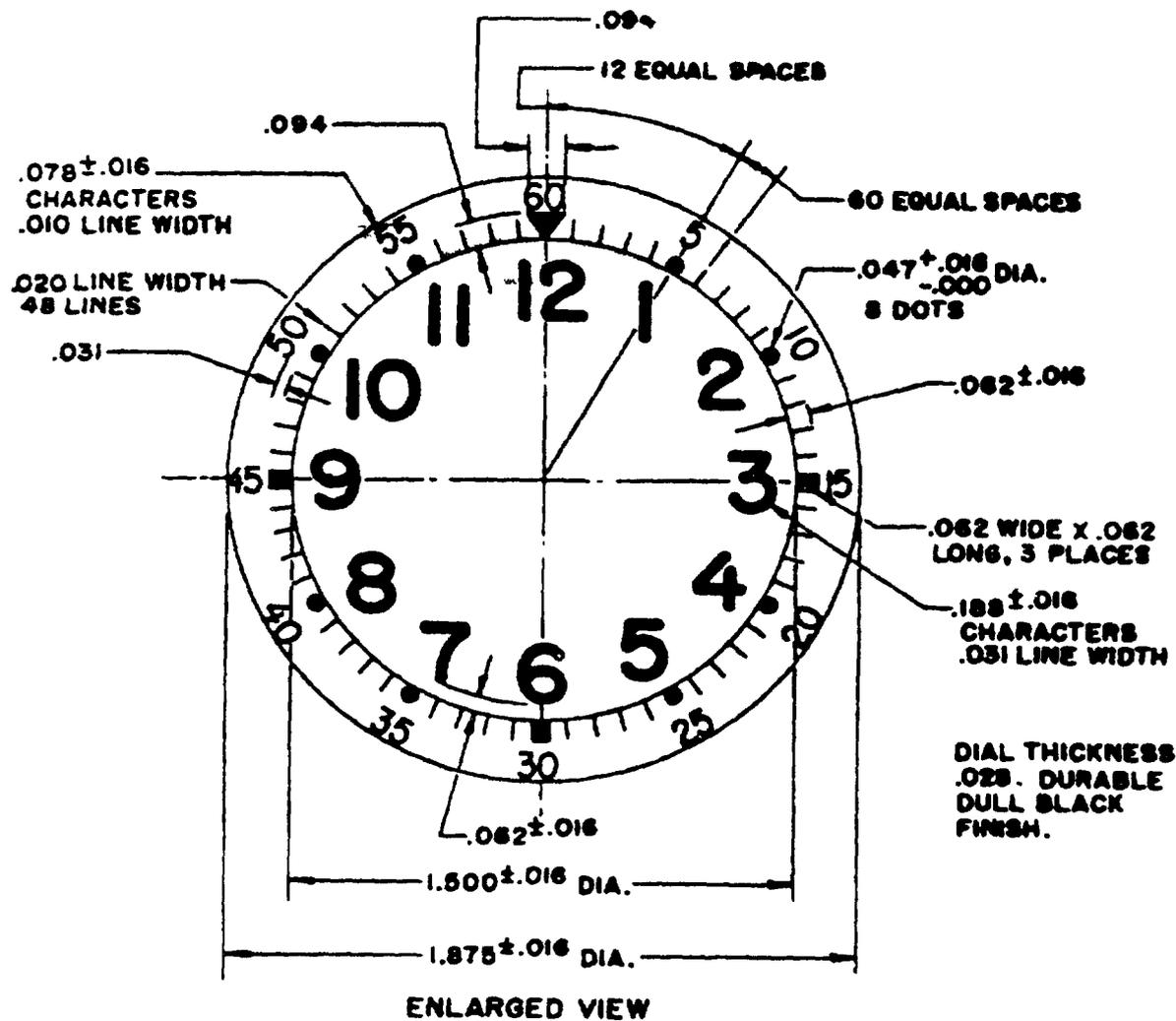
ELAPSED TIME HAND



SWEEP SECOND HAND

DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED, TOLERANCES: DECIMALS $\pm .008$

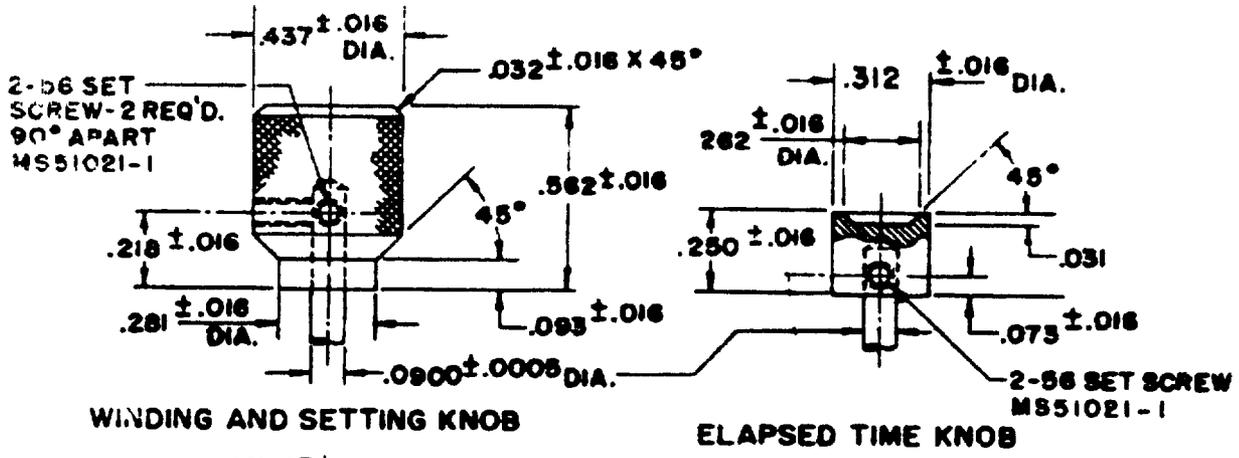
FIGURE 2 CLOCK HANDS



DIMENSIONS IN INCHES UNLESS
OTHERWISE SPECIFIED
TOLERANCES: DECIMALS ± .005

FIGURE 3. CLOCK DIAL

FIG. 2 3237A (ADD)



WINDING AND SETTING KNOB

ELAPSED TIME KNOB

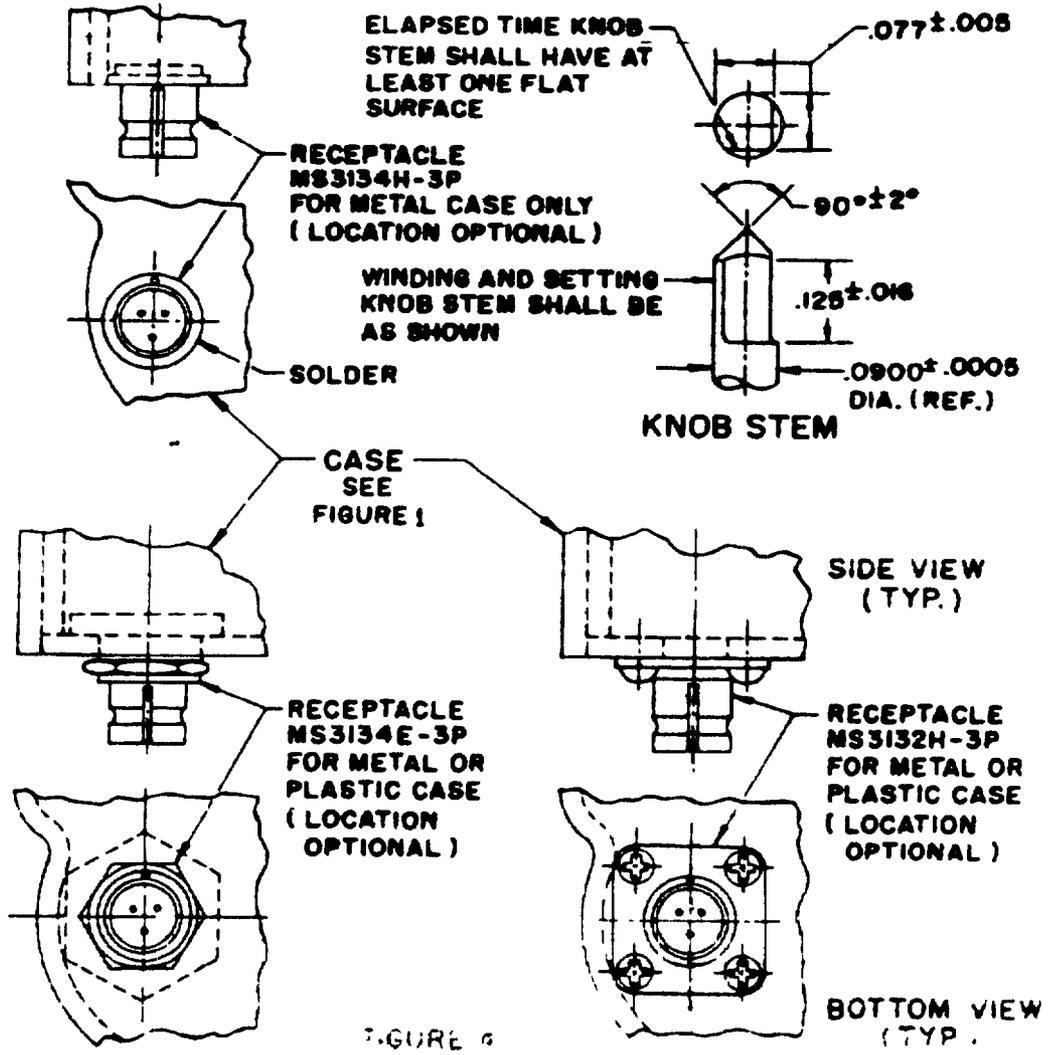


FIGURE 2

CLOCK KNOBS AND ELECTRICAL RECEPTACLES

DIMENSIONS IN INCHES.
UNLESS OTHERWISE SPECIFIED,
TOLERANCES: DECIMALS ± .005

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3.4.3.2 Elapsed time knob.— An elapsed time knob conforming to the dimensions on figure 4 shall be located in the upper right-hand corner of the clock case to control the elapsed time function of the clock. Pushing the knob shall operate the three phases of this function as follows: When the elapsed time and sweep second hands are at rest at "60" on the dial, pushing the knob shall cause them to start; if the hands are moving, pushing the knob shall cause them to stop; if the hands are stopped elsewhere on the dial than at "60", pushing the knob shall cause them to fly back to "60". The elapsed time function shall not interfere with the hour and minute time hands. The knob shall be attached to the shaft with one socket head setscrew conforming to MS51021-1(2-56).

3.4.3.3 Stems.— The winding stem and the elapsed time stem shall be made of steel with a minimum carbon content of 0.75 percent and with a minimum degree of hardness equal to Rockwell C45. Each stem shall be milled to conform to dimensions shown on figure 4 to provide for "seating" the setscrews.

3.4.4 Balance wheel and hairspring unit.— The balance wheel and hairspring unit shall be temperature compensated.

3.4.4.1 Balance staff.— The balance staff shall be readily removable and replaceable without disturbing the poise of the balance wheel.

3.4.4.2 Hairspring.— The hairspring shall be constructed from corrosion-resistant metal.

3.4.4.3 Escapement.— A fully jeweled lever escapement, including a roller jewel and two pallet stones, shall be provided.

3.4.4.4 Pallet, lever, and escape wheel.— The pallet, lever, and escape wheel shall be made of steel with a minimum carbon content of 0.75 percent and with a minimum degree of hardness equal to Rockwell C45.

3.4.5 Lever regulator.— A lever regulator to adjust the clock time rate shall be accessible from the regulator opening on the case and shall be centered on the regulator scale. within 10 percent of either the "fast" or "slow" scale range.

3.4.6 Movement.— The clock shall have an 8-day movement with not less than 15 jewels. End stone jewels shall be securely mounted in removable caps to facilitate cleaning and oiling. All jeweled bearings shall be in accordance with MIL-B-27497. Location of the jewels shall be as follows:

<u>Location</u>	<u>Number of jewels</u>
Lever pallet	2
Roller	1
Balance (upper and lower pivot)	2 each
Pallet (upper and lower pivot)	1 each
Escape wheel (upper and lower pivot)	1 each
4th wheel (upper and lower pivot)	1 each
3rd wheel (upper and lower pivot)	1 each

3.4.6.1 Mainspring.— The material for the mainspring shall be a corrosion-resistant, high-strength, unbreakable alloy.

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3.4.7 Screw threads.- Screw threads shall conform to MIL-S-7742.

3.4.8 Mounting screws and nuts.-

3.4.8.1 Mounting screws for installing the clock shall be type 6-32UNC-2A roundhead, brass machine screws, having lusterless black oxidized or black nickel finish conforming to color No. 37038 of Federal Standard No. 595. The screw length shall be sufficient to mount the clock on a 3/16-inch-thick panel.

3.4.8.2 Removable spring nuts, type 6-32UNC-2B, shall be furnished to fit each mounting lug.

3.4.8.3 A sufficient number of these screws and nuts shall be furnished in a marked envelope, size 2-1/4 by 4 inches, and packaged with each clock. The envelope shall be marked as follows:

IMPORTANT

This envelope contains mounting screws and nuts

3.4.9 Lighting.- Provision shall be made for dual integral lighting. White lighting shall be in accordance with MIL-L-27160, and red lighting shall be in accordance with MIL-L-25467, as applicable.

3.4.9.1 Lamps.- A minimum of 4 each, 5-volt, 10,000-hour bulbs shall be mounted in the enclosure around the dial. The lamps and wiring shall be securely attached to the case or bezel.

3.4.9.2 Receptacle.- The clock shall be provided with a 3-pin receptacle complying, as applicable, with one of the configurations shown on figure 4. This receptacle shall be in accordance with MIL-C-26482 and shall mate with a connector conforming to MS3137-3S.

3.4.9.2.1 Pin 1 designation.- Pin 1 shall be used for ground return and shall be grounded to the metal case or, if the case is plastic, shall be connected to the frame of the receptacle and to a terminal lug or clamp that can be grounded to the instrument panel with the mounting screw.

3.4.9.2.2 Pin 2 designation (white lighting).- When 5 volts are applied to pins 1 and 2, the clock shall conform to the lighting requirements of MIL-L-27160.

3.4.9.2.3 Pin 3 designation (red lighting).- When 5 volts are applied to pins 1 and 3, the clock shall conform to the lighting requirements of MIL-L-25467.

3.4.10 Reliability.- The clock shall be designed and constructed to provide maximum practical periods of time between failures of the clock. The clock shall have a mean-time-between-failure (MTBF) of at least 2,500 hours.

3.4.11 Maintenance provisions.- The design of the clock shall permit ease and speed of maintainability for both preventive and corrective maintenance.

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3.4.12 Lubrication.- The clock shall be sufficiently lubricated for at least 2 years' operation. The lubricant shall be of such quality that satisfactory lubrication will be provided when the clock is run at temperatures of +55° to -35° C (+131° to 31° F).

3.5 Performance.- The performance of the clock shall be as specified herein and shall show no deterioration as a result of the tests specified in section 4.

3.5.1 Elapsed time function operation.- When the elapsed time knob is pushed either easy or hard, it shall operate one of the three phases of the elapsed time functions specified in 3.4.3.2. The triangle under the number "60" shall be the zero position. On the fly-back or zero push, both the sweep-second and the elapsed time hands shall return to the zero triangle and shall remain at this position until the knob is pushed for the starting function.

3.5.2 Rundown time.- After being fully wound, the clock shall operate for a minimum of 8 days (192 hours) before stopping.

3.5.3 Rate (see 6.3) and accuracy.-

3.5.3.1 Room temperature rate.-

3.5.3.1.1 Daily rate (DR) (see 6.3).- The average of the daily rates for 4 consecutive days shall not exceed 30 seconds.

3.5.3.1.2 Accuracy criterion.- Any daily rate noted in the 4-day period shall not differ from the average daily rate (ADR) (see 6.3) by more than 15 seconds.

3.5.3.2 Temperature compensation rates -

3.5.3.2.1 Zero° C compensation.- The rate of the clock when operated in an environment of 0° C for 6 hours shall not vary from the starting error (see 6.3) by more than 10 seconds.

3.5.3.2.2 Minus 35° C compensation.- The rate of the clock when operated in an environment of -35° C for 6 hours shall not vary from the starting error by more than 75 seconds.

3.5.3.2.3 Plus 55° C compensation.- The rate of the clock when operated in an environment of +55° C for 6 hours shall not vary from the starting error by more than 15 seconds.

3.5.3.3 Vibration error rate.- The rate of the clock when subjected to vibration as specified in 4.8.7 shall not vary from the starting error by more than 15 seconds during 4-1/2 hours. During vibration, the oscillation at the tip of the minute and second hands shall not exceed 0.0625 inch. No screws or parts shall be loosened nor any parts damaged as a result of the vibration error test.

3.5.3.4 Rates after environmental exposure.- The rate of the clock for 6 hours, starting no later than 1 hour after exposure to each of the following environmental conditions, shall not vary from the starting error by more than the number of seconds specified below

(1) temperature ranging from 0° to 55° C, operating, and +55° to -35° C, operating 15 seconds.

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- (b) Relative humidity up to 100 percent. 20 seconds
- (c) Shock of 15g to be attained within 11 milliseconds
±10 percent: 20 seconds.
- (d) Vibration up to 2g within the range of 5 to 500
cycles per second (cps). 20 seconds.
- (e) Magnetic field intensity of 5.0 oersteds maximum:
15 seconds or 5 seconds, as applicable.

3.6 Part numbering of interchangeable parts.- All parts having the same manufacturer's part number shall be functionally and dimensionally interchangeable. The identification and part numbering requirements of MIL-D-70327 shall govern the manufacturer's part numbers and changes thereto.

3.7 Weight.- The weight of the clock shall not exceed 16 ounces.

3.8 Finishes.- Aluminum-alloy parts shall be covered with an anodic film conforming to MIL-A-8625. Aluminum-alloy dials and small holes and parts on which anodic film would interfere with proper performance need not be anodized.

3.9 Operation markings.-

3.9.1 Dial scale.- The dial scale numerals shall distinctly indicate the graduation to which each applies.

3.9.2 Dial markings.- The dial shall be marked in accordance with figure 3. The form of letters and numerals on the dial shall conform to MS33558. All markings shall be durable to withstand usage encountered in service.

3.9.3 Clock case marking.- The clock case shall be clearly marked adjacent to the lighting receptacle as follows:

Wiring. 1 and 2 = White
1 and 3 = Red

3.10 Identification of product.- Equipment, assemblies, and parts shall be marked for identification in accordance with MIL-STD-130.

3.10.1 The clock movement shall be permanently stamped, engraved, or etched with the following information.

Manufacturer's name
Manufacturer's trademark or code
Manufacturer's movement serial number
Number of jewels
Compensated or uncompensated, as applicable

3.10.2 The clock case shall have a nameplate with the following information:

Clock, Aircraft, Mechanical ABU-11/A
 MIL-C-38207
 Manufacturer's part No.
 Manufacturer's serial No. (year)
 Contract or order No.
 Stock No. FSN 6645-
 Manufacturer's name:
 US property

3.11 Workmanship.- The aircraft clock, including all parts and accessories, shall be finished in a thoroughly workmanlike manner. Particular attention shall be given to neatness and marking of assemblies, and to ensuring that they are free from burrs and sharp edges.

3.11.1 Screw assemblies.- Assembly screws and bolts shall be tight. The word "tight" means that the screw or bolt cannot be appreciably tightened further without damage to the screws, bolts, or threads.

3.11.2 Cleaning.- The aircraft clock shall be thoroughly cleaned of metal chips and other foreign material at final assembly.

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, 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.

4.2 Classification of inspections.- The examining and testing of the clock shall be classified as follows:

- (a) Qualification inspections (4.3)
- (b) Certification inspections (4.4)
- (c) Quality conformance inspections (4.5)

4.3 Qualification inspections.-

4.3.1 Qualification samples.- The samples shall consist of 10 clocks representative of the production clock. Samples shall be identified with the manufacturer's part number and shall be accompanied by such other information as required. They shall be tested under the conditions specified herein and at the location designated by the activity responsible for qualification (see 6.4).

4.3.1.1 Data to accompany samples.- The samples shall be accompanied by the following data:

- (a) Brief operating data to enable test personnel to correctly operate the clock.

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- (b) Engineering data in the form of assembly drawings (two sets) and calibration record charts of test chambers, meter gages, and stands used to conduct qualification tests.
- (c) Certification that wiring conforms to 3.4.9.2 and subparagraphs thereto.

4.3.1.2 Testing schedule.- The sample clocks shall be subjected to the tests as specified in table I.

TABLE I. Qualification test schedule

Type of test	Sample number										Acceptable paragraph
	1	2	3	4	5	6	7	8	9	10	
Examination of product	X	X	X	X	X	X	X	X	X	X	4.7.1
Operation of elapsed time function	X	X	X	X	X	X	X	X	X	X	4.8.1
Rundown	X	X	X	X	X	X	X	X	X	X	4.8.2
Room temperature rate	X	X	X	X	X	X	X	X	X	X	4.8.3
Zero° C compensation	X	X	X	X	X	X	X	X	X	X	4.8.4
Minus 35° C compensation	X	X	X	X	X	X	X	X	X	X	4.8.5
Plus 55° C compensation	X	X	X	X	X	X	X	X	X	X	4.8.6
Vibration error	X	X	X	X	X	X	X	X	X	X	4.8.7
High temperature	X	X									4.8.8.1
Low temperature			X	X							4.8.8.2
Humidity					X	X					4.8.8.3
Shock								X	X	X	4.8.8.4
Vibration									X	X	4.8.8.5
Operation in a magnetic field	X	X	X	X	X	X	X	X	X	X	4.8.8.6
Lighting	X	X	X	X	X	X	X	X	X	X	4.8.9

4.3.1.3 Qualification for reliability.- For conformance to the reliability requirement of 3.4.10, the 10 samples shall pass the following tests when conducted as part of the qualification tests specified in table I.

<u>Test</u>	<u>Applicable paragraph</u>
Operation of elapsed time function	4.8.1
Rundown	4.8.2
Room temperature rate	4.8.3
Zero° C compensation	4.8.4
Minus 35° C compensation	4.8.5
Plus 55° C compensation	4.8.6
Vibration error	4.8.7
Lighting	4.8.9

4.3.2 Test report, test samples, and data.- The contractor shall furnish the activity responsible for qualification a report of the qualification tests, including the following:

- (a) Test report: Three certified copies of the test report in accordance with MIL-STD-831.
- (b) Test samples: Two tested samples of the clocks and two clocks which have passed individual tests (4.5.1).
- (c) Data: The data required under 4.3.1.1.

4.3.3 Tests.- Qualification tests shall consist of the examinations and tests specified under 4.7 and 4.8, subject to the test conditions (4.6) specified herein.

4.4 Certification inspection for primary standard.- This procedure shall be a certification inspection procedure to establish a "lighting prime standard clock" to be used on production line testing only. Prior to acceptance testing, a production clock conforming to all requirements of the lighting specifications specified herein, along with certified lighting data on the clock shall be submitted for approval to the procuring activity. The clock shall be sealed prior to submission and should contain a mating connector with approximately 1 foot of low-impedance lead wire. A minimum of 12 average areas covering all representative areas on the dial of the clock will be measured for brightness and color as required in applicable specifications. If approved, the clock will be certified and identified as a "lighting prime standard" for a 90-day period

4.4.1 Effective life of prime standard.- The certified "prime standard clock" will be used for visual comparison of production clocks for 100 operating hours or for 90 days, whichever comes first. If, during this period, a change of ± 20 percent in brightness or ± 5 percent in color takes place in two or more of the measured areas using the initially submitted data as a reference, the certification of the "prime standard clock" will be voided. (See 4.8.10.)

4.5 Quality conformance inspections.- Quality conformance inspections shall consist of the examinations, individual tests, and sampling plans A and B tests.

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4.5.1 Individual tests.- Each clock shall be subjected to the following tests.

<u>Tests</u>	<u>Applicable paragraph</u>
Examination of product	4.7.1
Operation of elapsed time function	4.8.1
Room temperature rate	4.8.3
Visual lighting comparison	4.8.10
Reliability acceptance	4.8.11

4.5.2 Sampling plans A and B tests.-

4.5.2.1 Sampling plan A.- Unless otherwise specified by the procuring activity, 4 clocks shall be selected at random from the first 20 clocks of the initial production run and, having passed the individual tests (4.5.1), shall be subjected to the following tests:

<u>Tests</u>	<u>Sample No. 1 (2 clocks)</u>	<u>Sample No. 2 (2 clocks)</u>	<u>Applicable paragraph</u>
High temperature	---	X	4.8.8.1
Low temperature	---	X	4.8.8.2
Humidity	X	---	4.8.8.3
Vibration	X	---	4.8.8.5
Operation in a magnetic field	X	---	4.8.8.6

4.5.2.2 Sampling plan B.- Four clocks shall be selected at random from every 50, or fraction thereof, manufactured on the production run and shall be subjected to the following tests:

<u>Tests</u>	<u>Applicable paragraph</u>
Rundown	4.8.2
Zero° C compensation	4.8.4
Minus 35° C compensation	4.8.5
Plus 55° C compensation	4.8.6
Vibration error	4.8.7
Shock	4.8.8.4
Lighting	4.8.9

4.5.3 Rejection and retest.- When one clock selected from the production run fails to meet the specification, no items still on hand or later produced shall be accepted until the extent and cause of failure have been determined and appropriately corrected. The contractor shall explain to the Government representative the cause of failure and the action taken to preclude recurrence. After correction, all of the tests shall be repeated.

4.5.3.1 Individual tests may continue.- For production reasons, individual tests may be continued pending the investigation of a sampling test failure. Final acceptance of the clocks on hand or later produced shall not be made until it is determined that all clocks meet all the requirements of this specification.

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4.5.3.2 Defects in clocks already accepted.- The investigation of a test failure could indicate that defects may exist in clocks already accepted. If so, the contractor shall fully advise the procuring activity of all defects likely to be found and methods of correcting them.

4.6 Test conditions.-

4.6.1 Standard atmospheric conditions.- Unless otherwise specified, all tests shall be made at standard atmospheric pressure (approximately 29.92 inches of mercury) and at room temperature (approximately 25° C (77° F)). When tests are made with atmospheric pressure or room temperature differing materially from the above values, proper allowance shall be made for the change in instrument reading.

4.6.2 Attitude.- Unless otherwise specified, the clock shall be tested in its normal operating position with the face vertical.

4.6.3 Lighting.- All tests except the 0° C compensation test (4.8.4), the -35° C compensation test (4.8.5), and the low-temperature test (4.8.8.2) shall be performed with the lighting circuit activated and the bulbs lit. Half of the clocks in the test group shall be connected to produce red lighting and half to produce white lighting.

4.6.4 Temperature test precaution.- To prevent condensation of moisture on the mechanism following exposure to the specified temperatures in the 0° C compensation test (4.8.4) and the -35° C compensation test (4.8.5) the clock shall remain in the closed test chamber until the temperature has returned to normal.

4.6.5 Vibration stand.- A vibration stand shall be used that will vibrate at any desired frequency between 500 and 3,000 cycles per minute (cpm) and will so subject the instrument to vibration that a point on the instrument case will describe, in a plane inclined 45 degrees to the horizontal, a circle as specified in 4.8.7.

4.7 Examinations.-

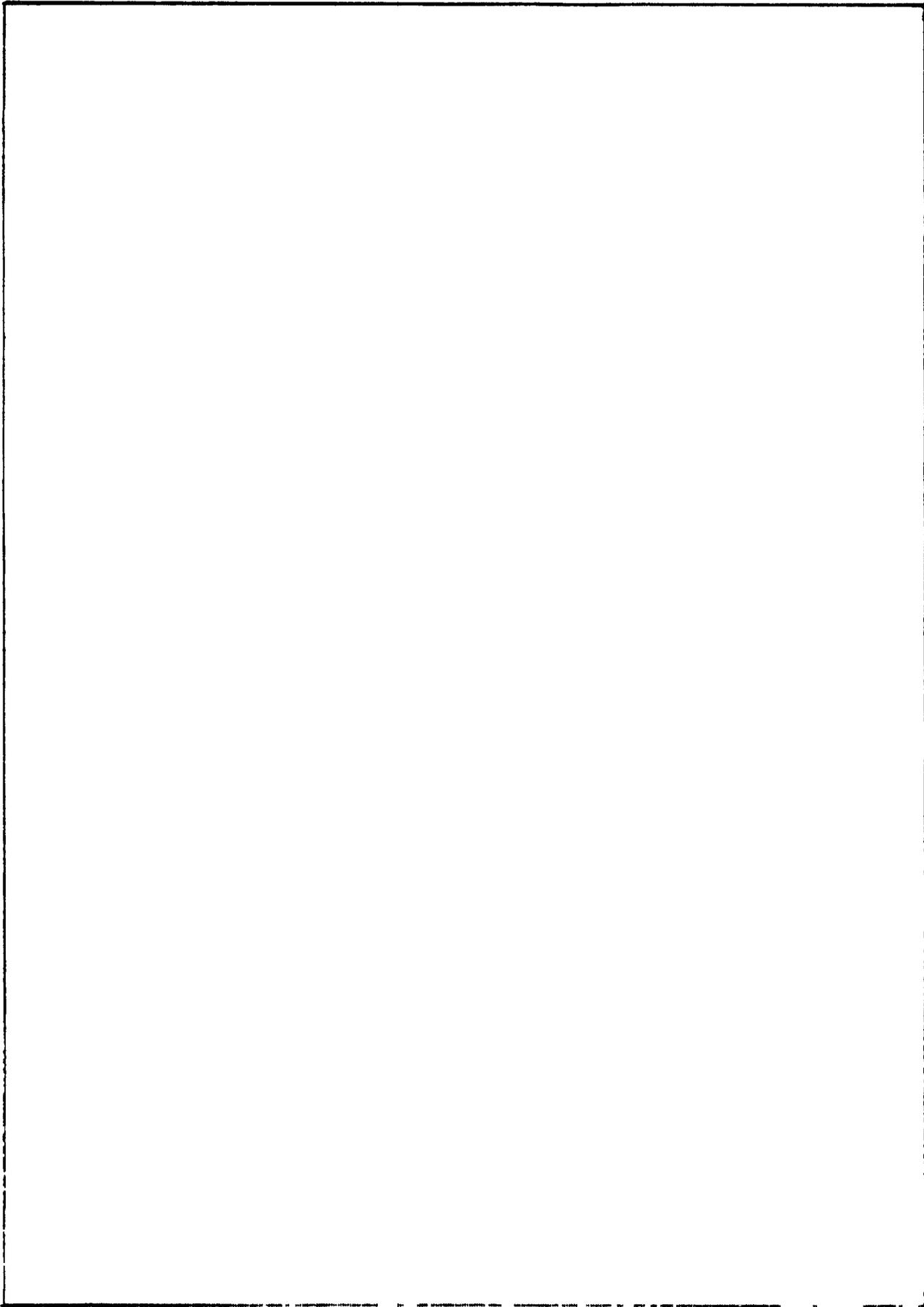
4.7.1 Examination of product.- The clock shall be inspected to verify that the materials, design and construction, necessary mechanical measurements, marking, and workmanship comply with this specification.

4.7.2 Examination of preparation for delivery.- Preparation for delivery shall be examined for conformance to section 5.

4.8 Test methods.-

4.8.1 Operation of elapsed time function.- The clock shall be fully wound and tested for action of the sweep second and elapsed time hands on start, stop, and flyback operation.

4.8.1.1 Elapsed time flyback (15-minute interval).- The clock shall be tested for 4 successive operations of the sweep second and elapsed time hands over intervals of approximately 15 minutes, starting from zero (60) index. Upon operation of the flyback mechanism, the hands shall return to the exact index position.



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mental tests in order to collect comparison data for the "pretest performance record" as specified in MIL-STD-810. The required data may be collected in conjunction with the room temperature rate test (4.8.3) and used for comparison in checking clock performance after exposure to environmental limits.

4.8.8.1 High temperature.-- The clock shall be subjected to a high-temperature test in accordance with Method 501, Procedure I, except that exposure to a temperature of 71° C shall be for 24 hours and the test specified in 4.8.1.1 shall be substituted for the phase of the test calling for operation at highest operating temperature.

4.8.1.1 Rate check.-- After completion (within 1 hour) of the 24-hour high-temperature exposure test, the clock shall be fully wound and operated for 6 consecutive hours at room temperature. The clock shall not gain nor lose more than 15 seconds during this 6-hour period.

4.8.8.2 Low temperature.-- The clock shall be subjected to a low-temperature test in accordance with Method 502, Procedure I, except that exposure to a temperature of -62° C shall be for 24 hours and the test specified in 4.8.8.2.1 shall be substituted for the phase of the test calling for operation at lowest operating temperature.

4.8.8.2.1 Rate check.-- After completion (within 1 hour) of the low-temperature exposure test, the clock shall be fully wound and operated for 6 consecutive hours at room temperature. The clock shall not gain nor lose more than 15 seconds during this 6-hour period.

4.8.8.3 Humidity.-- The clock shall be subjected to a humidity test in accordance with Method 507, Procedure I, except that the total time shall be 120 hours (5 cycles).

4.8.8.3.1 Rate check.-- Within 1 hour after completion of the humidity test, the clock shall be fully wound and operated for 6 consecutive hours. The clock shall not gain nor lose more than 20 seconds during this 6-hour period.

4.8.8.4 Shock.-- The clock shall be subjected to a shock test in accordance with Method 516, Procedure I. An acceleration of 15g shall be attained with the clock operating and being oriented in each of the following positions:

- (a) Face up
- (b) Face down
- (c) The numeral "15" up
- (d) The numeral "30" up
- (e) The numeral "45" up
- (f) The numeral "60" up

4.8.8.4.1 Rate check - Within 1 hour after completion of the shock test, the clock shall be fully wound and operated for 6 consecutive hours. The clock shall not gain nor lose more than 20 seconds during this 6-hour period.

4.8.8.5 Vibration.-- The clock shall be subjected to a vibration test in accordance with Method 514, table 514-I titled "Vibration Test Selection Chart", test data: 1CIA. The tests shall be performed in accordance with Procedure I of Method 514, except that no random vibration testing shall be required. All clock hands shall be operating during the test.

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4.8.8.5.1 Rate check.- Within 1 hour after completion of the vibration test, the clock shall be fully wound and operated for 6 consecutive hours. The clock shall not gain nor lose more than 10 seconds during this 6-hour period.

4.8.8.6 Operation in a magnetic field.- The clock shall be subjected to the following field strengths for at least 10 seconds in the order given; and the rates shall be noted:

- (a) In a magnetic field with a horizontal strength of 0.15 to 0.22 oersted.
- (b) In a magnetic field with a horizontal strength of approximately 5.0 oersteds.
- (c) In a magnetic field with a horizontal strength of 0.15 to 0.22 oersted.

4.8.8.6.1 Rate check.- Within 1 hour after each field strength subjection, the clock shall be fully wound and operated for 6 successive hours and the rates noted. The rates noted from (b) and (c) of 4.8.8.6 shall not differ by more than 15 seconds, and the rates noted from (a) and (c) shall not differ by more than 5 seconds.

4.8.9 Lighting.- The clock lighting circuit shall be properly connected and tested in accordance with MIL-L-25467 for red lighting and MIL-L-27160 for white lighting, except that the life test shall not be required.

4.8.10 Visual lighting comparisons.- The clock shall be tested by comparing it with the "lighting prime standard clock" (see 4.4). Critical areas on the clock dial shall be compared for brightness and color with corresponding areas on the "prime standard clock" and shall conform to the "prime standard clock". The "prime standard clock" shall be energized with 2.7 ±0.05 volts at the pin connection for either red or white light, as applicable. The voltage at the appropriate pins of the clock being subjected to test shall be varied until the brightness appears comparable to the "prime standard clock". The measured voltage to the clock under test shall be between 2.55 and 2.85 volts.

4.8.10.1 If there is no approved "lighting prime standard clock", the clock shall be subjected to testing as specified in 4.8.9 in lieu of the visual lighting comparison test.

4.8.11 Reliability acceptance test.- The reliability acceptance criterion specified in this paragraph shall be applied to each production run. This criterion shall be that no clocks shall fail to pass the room temperature rate test specified in 4.8.3.

5. PREPARATION FOR DELIVERY

5.1 Packaging, packing, and marking.- Packaging, packing, and marking shall be in accordance with PPP-T-360, group 3. Levels of packaging and packing shall be as specified in the contract or order, and shall be

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5.1.1 Precautionary marking.-- The following precautionary marking shall appear on two opposite sides of each interior package, whenever practicable, depending on the size of the carton, and shall also appear on the exterior shipping container.

FRAGILE
DELICATE INSTRUMENT
HANDLE WITH CARE

6. NOTES

6.1 Intended use.-- The clocks are intended for use as the primary timepiece with an elapsed time capability in aircraft requiring an integrally lighted clock.

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

- (a) Title, number, and date of this specification.
- (b) Stock No.
- (c) Levels of packaging and packing desired (see 5.1).

6.3 Definitions.-- For the purpose of this specification, the following definitions apply.

6.3.1 Error.-- Error is the algebraic time difference in seconds between the test clock and National Bureau of Standards broadcast time. (Station WWV,)

6.3.1.1 Starting error.-- Starting error is the error at start of test period.

6.3.2 Rate.-- Rate is the difference between the error at the start and the error at the end of a given time interval.

6.3.2.1 Daily rate.-- Daily rate is the rate in a 24-hour interval.

6.3.3 The following is an example of rate and accuracy computation (measurements in seconds):

	<u>Daily reading</u>	<u>Daily rate</u>	<u>Difference between each DR and the ADR</u>
Starting error	0		
1st day	+30	+30	30 variation from 20 = 10
2nd day	+50	+20	20: no variation
3rd day	+60	+10	10: variation from 20 = 10
4th day	+80	+20	20: no variation
		80 $80 \div 4 = 20$ 20 = ADR	Therefore, no DR differs from the ADR by more than 15 seconds

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6.4 Qualification.- With respect to products requiring qualification, awards will be made only for such products as have, prior to the time set for opening of bids, been tested and approved for inclusion in the applicable Qualified Products List, whether or not such products have actually been so listed by that date. The attention of the suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the Qualified Products List is the Systems Engineering Group (SEG), Wright-Patterson Air Force Base, Ohio 45433, and information pertaining to qualification of products may be obtained from that activity.

6.5 International standardization agreement.- Certain provisions of 3.4.1, 3.4.2, and 3.9.2 of this specification are the subject of international standardization agreements STANAG 3405 and ABC AIR STD 10/32. When amendment, revision, or cancellation of this specification is proposed, the departmental custodians will inform their respective Departmental Standardization Offices so that appropriate action may be taken respecting the international agreement concerned.

6.6 Marginal indicia.- The margins of this specification are marked to indicate where changes, deletions, or additions to the previous issue have been made. This is done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Figures are not so marked. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content as written, irrespective of the marginal notations and relationship to the last previous issue

Custodians:
Navy - WP
Air Force - (11)

Preparing activity:
Air Force - (11)

Reviewer activities:
Navy - WP
Air Force - (11), (67)
International interest (see section 6)

Review/user information is current as of the date of this document. For future coordination of changes to this document, draft circulation should be based on the information in the current Federal Supply Classification Listing of DoD Standardization Documents.

SPECIFICATION ANALYSIS SHEET

Use Applicable Budget
Bureau No. 114-P004

INSTRUCTIONS

This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity.

SPECIFICATION

MIL-C-38207A(ASC) Clock, Aircraft, Mechanical ASU-11/A

ORGANIZATION

CITY AND STATE

ITEM NO.

QUANTITY OF ITEM PROCURED

DOLLAR AMOUNT

\$

MATERIAL PROCURED UNDER A

 Direct Government Contract Subcontract

1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?

A. GIVE PARAGRAPH NUMBER AND WORDING

B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES

2. COMMENT ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID

3. IS THIS SPECIFICATION RESTRICTIVE?

 YES NO

IF "YES" IN WHAT WAY?

4. REVISIONS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity.)

PREPARED BY (Printed or typed name and activity)

DATE

DL Form 1111

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