MILITARY SPECIFCATION

CHRONOMETER, QUARTZ CRYSTAL, BATTERY-POWERED, METRIC

This specification is approved for use by the Naval Sea Systems Command and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers battery-powered, quartz crystal chronometers having solid state circuitry and intended primarily as master time-measuring instruments.

2. APPLICABLE DOCUMENTS

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

SPECIFICATIONS

FEDERAL
L-P-392 - Plastic Molding Material, Acetal, Injection and Extrusion.
PPP-T-360 - Time Measuring Instruments, Packaging of.

MILITARY
MIL-B-18 - Batteries, Dry.
MIL-B-117 - Bag, Sleeve and Tubing - Interior Packaging.
MIL-S-901 - Shock Tests, H.I. (High Impact); Shipboard Machinery, Equipment and Systems, Requirements for.
MIL-P-15024 - Plates, Tags and Bands for Identification of Equipment.
MIL-E-16400 - Electronic, Interior Communication and Navigation Equipment, Naval Ship and Shore; General Specification for.
MIL-E-17555 - Electronic and Electrical Equipment, Accessories and Repair Parts; Packaging and Packing of.
MIL-I-46058 - Insulating Compound, Electrical (For Coating Printed Circuit Assemblies).

STANDARDS

FEDERAL
FED-STD-595 - Colors.

MILITARY
MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-108 - Definitions of and Basic Requirements for Enclosure for Electric and Electronic Equipment.
MIL-STD-129 - Marking for Shipment and Storage.
MIL-STD-167-1 - Mechanical Vibrations of Shipboard Equipment (Type I - Environmental and Type II - Internally Excited).
MIL-STD-454 - Standard General Requirements for Electronic Equipment.
MIL-STD-781 - Reliability Tests: Exponential Distribution.

DRAWINGS

MILITARY
S2407-475127 - Locker, Chronometer, Type A, B, and C, Aluminum.
805-921996 - Table, Chart, Modular Type.

(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 Sample for first article inspection. Prior to beginning production a sample shall be tested as specified in 4.3 (see 6.4).

3.2 Definitions. For definitions of terms used in this specification, (see 6.3).

3.3 General requirements. The chronometer shall measure and display UTC time (see 6.3.6) using a 24-hour dial as shown on figure 1. The chronometer shall indicate day of the week (see 3.4.8) and hours, minutes and seconds by means of a dial and three concentric hands. The chronometer shall be powered as specified in 3.4.2 and shall be furnished in a 203.20 by 203.20 by 177.80-millimeter (mm) (8 by 8 by 7 inch) deep case (see 6.3.3) suitable for direct installation in shipboard chronometer lockers or modular type chart tables (see 3.4.7) without gimbaling or other special mounting or restraining features. The chronometer shall be designed so that the dial is fully visible through viewing glass in chronometer locker with the chronometer installed in the locker.

3.3.1 Materials and processes. Except as specified herein, materials and processes shall be selected in accordance with MIL-E-16400. Material which is not specified shall enable the chronometer to conform to the requirements of this specification.

3.3.2 Electronic parts. All circuits shall use solid state parts selected in accordance with MIL-E-16400. Parts shall not be potted.

3.3.3 Printed wiring. Printed wiring shall conform to the requirements of MIL-E-16400. Conformal coating conforming to MIL-I-46058 may be used.

3.4 Design and construction.

3.4.1 General. The chronometer shall be so designed and constructed that no parts will work loose in service. Conditions incident to shipping, storage, installation and service shall not affect the serviceability of the chronometer. The chronometer shall be capable of operating at an inclination angle of 60 degrees.

3.4.2 Power. The chronometer shall be powered by self-contained cells conforming to MIL-B-18. The chronometer shall be designed to operate a minimum of one year on a single set of batteries. A built-in battery test meter, operated by means of a push button located as specified in 3.4.7, shall be provided as shown on figure 1. The meter shall indicate the relative strength of the battery and the dial shall be marked to indicate the point at which the battery should be replaced. The test meter circuit shall be so designed that the normal operating battery load is doubled during battery test. Batteries shall be capable of being easily replaced, requiring only simple hand tools. The battery compartment shall be located as shown on figure 1 and shall be isolated so that chronometer movement is not exposed when batteries are changed. Battery compartment, installation marking criteria, and warning label shall be in accordance with requirement 27 of MIL-STD-454. The warning label shall also include marking to prohibit the use of mercury batteries. The chronometer shall continue to operate and keep the correct time for at least 5 minutes while the batteries are being changed. Power consumption shall not exceed 3 milliwatts (mW). Batteries shall not be furnished as a part of this equipment. The chronometer shall be designed to accommodate the gradual voltage drop during the life of the batteries by which it is powered while maintaining the accuracy requirements of 3.7. Chronometer design shall be such that damage will not occur if batteries are installed with polarity reversed, or, alternately, design shall preclude installation of batteries with polarity reversed.

3.4.3 Time generator. The basic element for time generation shall be a quartz crystal oscillator. The quartz crystal shall be temperature compensated, shall require no heating element, shall be hermetically sealed in an evacuated envelope and shall be selected in accordance with 3.3.2. A service adjustment as specified in 3.6 shall be provided for adjustment of long term drift.

3.4.4 Dial. Dial size, markings and layout shall be as shown on figure 2. There shall be no visible eccentricity of the paths formed by the moving tips of the second, minute, and hour hands with the tracks or markings on the dial for the corresponding readings. The minute and hour hands shall be synchronized to eliminate the possibility of error in reading correct time. The hour hand shall point to the hour graduation within plus or minus 3 degrees when the minute hand is centered on the 60-minute position and the hour hand is at any hour, from 01 through 00. There shall be no reading error due to parallax when the dial is read from 30 degrees off the normal. Dial may be stepped or dished if necessary to meet the parallax restriction. The dial shall be void of any marking other than that specified (see 3.15.2).

3.4.4.1 Setting. A two-position setting mechanism shall be provided to set the three hands. One position of the mechanism shall allow the minutes and hours to be set without any movement of the second hand. Return of the mechanism to the other (normal) position shall result in resumption of the measurement of time. The stem shall be capable, while being moved from the normal to the setting position, of withstanding a pull of 44.5 newtons (10 pounds) ± 1.1 newtons (0.25 pounds) (see 3.4.7). The stem shall not be damaged or separated when the force is applied (see 4.5.15).

3.4.4.2 Synchronization. Two electrical pushbuttons shall be provided for making small corrections in time by electrical means. Depression of one button shall stop the chronometer movement and depression of the other button shall speed up the movement. Operation of the pushbuttons shall not upset the synchronization of the minute and second hands (see 3.4.7).

3.4.5 Reliability. The chronometer shall be designed to have a minimum specified operating life of 5 years without maintenance, other than battery replacement, and without degradation in performance.

3.4.6 Dial cover. The dial cover shall be non-yellowing and made of clear methyl methacrylate or glass. The dial cover shall be free of bubbles, scratches, and other imperfections which may interfere with reading of the chronometer. Cover design shall ensure distortion-free dial viewing.

3.4.7 Case (see 6.3.3). The case shall be of a rigid thermosetting black acetal plastic material conforming to type I, class 2 of L-P-392. The case shall be suitable for storage in chronometer lockers and chart tables as shown on Drawings 805-921996 and S2407-475127, without the use of external pads or blocks. Rubber or expanded polyurethane foam pads may be used in the case interior to fill voids and increase shock resistance of the chronometer. A recessed controls compartment at the bottom of the case (see figure 1) shall contain the battery test pushbutton (see 3.4.2), the setting stem (see 3.4.4.1), the synchronization buttons (see 3.4.4.2), the day-of-week indicator change stem (see 3.4.8) and the long term drift adjustment (see 3.6). The case shall have a finger recess, and may have a carrying handle in accordance with figure 1 to facilitate carrying the chronometer and shall be watertight in accordance with MIL-STD-108. There shall be no evidence of water penetration, deterioration, or damage to any part of the chronometer or case, including controls and battery compartments, as a result of the watertightness test of 4.5.2.

3.4.8 Day indicator. A day-of-the week indicator shall be located on the dial panel and shall be designed to be readable with normal unaided vision from a distance of not less than 1 meter (3 feet). Means shall be provided to manually change the indicator. The indicator shall automatically advance at 00 hours ±2 minutes (see 3.4.7).

3.4.9 Color and gloss. Color and gloss of all areas of the dial and hands for which a color requirement is specified (see figures 1, 2, and 3) shall match the specified FED-STD-595 color and show no signs of change or substrate deterioration after completion of tests specified herein.

3.4.10 Hands. Hands shall be in accordance with figure 3.

3.5 Capacitive coupling. The daily rate (see 6.3.4) shall vary by not more than 10 percent when the chronometer is contained in a grounded metal storage locker (see 4.5.3).

3.6 Long term drift. A calibrated adjustment capability shall be provided to adjust for aging of the crystal. This adjustment shall be located as specified in 3.4.7. Crystals shall be aged prior to use. Changes of rate due to temperature cycling (see 4.5.11) shall be less than 10 percent of the daily rate (see 6.3.4) at constant temperature.

3.7 Accuracy. The daily rate (see 6.3.4) shall not exceed that shown on figure 4. The deviation of daily rate (see 6.3.5) at any temperature shall be 0.02 second, or less.

3.8 Shock. The chronometer shall be capable of withstanding the grade A, class II, type A, lightweight shock test of MIL-S-901. The change in daily rate (see 6.3.4) after shock test shall not exceed plus or minus 0.1 second from the rate prior to shock, the daily rate shall be not more than plus or minus 0.1 second, and there shall be no change in the day indicator (see 3.4.8), in operation of the battery test meter (see 3.4.2), or in position of stem setting (see 3.4.4.1).

3.9 Vibration. The chronometer shall be capable of withstanding the vibration test, type I of MIL-STD-167-1. Following the test, the chronometer shall conform to the accuracy requirements of 3.7 and there shall be no change in the day indicator (see 3.4.8) or in operation of the battery test meter (see 3.4.2).

3.10 Temperature. The chronometer shall conform to temperature range 4 requirement of MIL-E-16400.

3.11 Magnetism. While running, the accuracy of chronometer shall not be affected when subjected to the magnetic test of 4.5.8.

3.12 Humidity. The chronometer shall conform to the humidity requirement of MIL-E-16400.

3.13 Salt fog. The chronometer shall conform to the salt fog requirement of MIL-E-16400.

3.14 Fungus. The chronometer shall conform to the fungus requirement of MIL-E-16400.

3.15 Marking for identification.

3.15.1 Case. The back exterior of the case of the chronometer shall be legibly and permanently marked as shown on figure 5. Serial numbers will be assigned by the contracting officer.

3.15.2 Dial. The inscription "U.S." shall be engraved on the dial as shown on figure 2. Size, location, and shape of letters shall be in general accordance with figure 2.

3.16 Technical data.

3.16.1 Provisioning technical documentation. Provisioning technical documentation shall be prepared in accordance with the data ordering document specified (see 6.1.2).

3.16.2 Instruction sheet. An instruction sheet as shown on figure 5 shall be permanently affixed to the back of each chronometer. The sheet shall not become detached, damaged, or discolored as a result of any test required by 4.3 or 4.4.

3.16.3 Technical manuals. Technical manuals shall be prepared in accordance with the data ordering document specified (see 6.1.2).

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.

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

(a) First article inspection (see 4.3)
(b) Quality conformance inspection (see 4.4)

4.2.1 Examination and test plan. An examination and test plan in accordance with MIL-E-16400 shall be furnished as specified (see 6.1.2 and 6.1.2.1).

4.3 First article inspection. First article inspection shall be conducted on four chronometers and shall consist of the tests shown in table I. Shock, vibration, and inclination tests shall be conducted after completion of all other tests except watertightness (see 4.5.2), reliability (see 4.5.11.3) and fungus (see 4.5.13).

Table I - First article inspection

Test	Requirement paragraph	Test paragraph
Surface Examination		4.5.16
Power consumption	3.4.2	4.5.1
Watertightness	3.4.7	4.5.2
Capacitive coupling	3.5	4.5.3
Accuracy	3.7	4.5.4
Shock	3.8	4.5.5
Vibration	3.9	4.5.6
Temperature	3.10	4.5.7
Magnetism	3.11	4.5.8
Battery test meter	3.4.2	4.5.9
Reliability	3.4.5	4.5.11
Humidity	3.12	4.5.10
Salt Fog	3.13	4.5.12
Fungus	3.14	4.5.13
Inclination	3.4.1	4.5.14
Setting	3.4.4.1	4.5.15

4.3.1 First article inspection report. A first article inspection report shall be furnished when specified (see 6.1.2 and 6.1.2.1).

4.4 Quality conformance inspection. Quality conformance inspection shall consist of the group A, B, and C tests of 4.4.2, 4.4.3 and 4.4.4.

4.4.1 Sampling for quality conformance inspection.

4.4.1.1 Lot. A lot shall consist of all chronometers offered for delivery at one time and produced on the same facilities using identical materials and manufacturing and assembly procedures.

4.4.1.2 Sampling for group B tests. A random sample of chronometers shall be selected from each lot in accordance with inspection level S-1 of MIL-STD-105, and shall be subjected to the group B tests of 4.4.3.

4.4.1.3 Sample for group C tests. When required by the Government one chronometer shall be subjected to the group C tests of 4.4.4.

4.4.2 Group A. All chronometers offered for delivery shall be subjected to the group A tests shown in table II. Any chronometer failing any group A test shall be rejected.

4.4.3 Group B. Each sample chronometer selected in accordance with 4.4.1.2 shall be subjected to each group B test shown in table II. If any sample chronometer fails any group B test, the lot represented by the sample shall be rejected.

Table II - Quality conformance inspection

Test	Requirement paragraph	Test paragraph
Group A:		
Surface Examination		4.5.16
Accuracy	3.7	4.5.4.1
Group B:		
Power consumption	3.4.2	4.5.1
Watertightness	3.4.7	4.5.2
Battery test meter	3.4.2	4.5.9
Inclination	3.4.1	4.5.14
Setting	3.4.4.1	4.5.15
Group C:		
Capacitive coupling	3.5	4.5.3
Shock	3.8	4.5.5
Vibration	3.9	4.5.6
Temperature (high and low)	3.10	4.5.7
Magnetism	3.11	4.5.8
Humidity	3.12	4.5.10
Salt fog	3.13	4.5.12
Fungus	3.14	4.5.13

4.4.4 Group C. The sample chronometer selected in accordance with 4.4.1.3 shall be subjected to each group C test shown in table II.

4.4.5 Quality conformance inspection report. When specified (see 6.1.2 and 6.1.2.1) quality conformance inspection (group A,B or C) reports shall be furnished.

4.5 Test procedures.

4.5.1 Power consumption. The chronometer shall be tested to determine conformance with the power consumption requirement of 3.4.2.

4.5.2 Watertightness. The chronometer shall be subjected to a submergance test for watertight enclosures in accordance with MIL-STD-108. The chronometer shall be running during the test. When this test is conducted as part of first article inspection (see 4.3), test shall be conducted after completion of vibration, inclination and shock tests.

4.5.3 Capacitive coupling. The chronometer shall be tested to determine conformance with the capacitive coupling requirement of 3.5. The accuracy test of 4.5.4 shall be conducted first in a non-metallic area and then with the chronometer enclosed in a grounded metal locker conforming to the drawing referenced in 3.4.7.

4.5.4 Accuracy. The chronometer shall be tested to determine conformance with the accuracy requirements of 3.7. Accuracy of test apparatus shall be in accordance with the requirements of MIL-E-16400. No adjustments to the frequency determining circuits will be permitted after the beginning of the test. Rate shall be determined by measuring the dividing circuitry output frequency at temperatures of 13°C, 22°C, and 32°C, corresponding to points C, D, and E, respectively, on figure 4, and calculating the resultant daily rates (see 6.3.4) from the measured frequencies.

4.5.4.1 Group A quality conformance tests for accuracy (see 4.4.2) shall be conducted in accordance with 4.5.4 except tests at 13°C and 32°C may be omitted.

4.5.5 Shock test. Prior to the shock test, the chronometer shall be subjected to the accuracy test of 4.5.4. The chronometer shall then be subjected to a grade A, class II, type A, lightweight shock test in accordance with MIL-S-901. Shock mounts shall not be blocked or removed during test. Chronometer shall be equipped with batteries with timekeeping mechanism in operation at time of test. During the test, the chronometer shall be installed in a test bracket designed to secure the chronometer in a manner consistent with mounting provisions of the chronometer lockers (see 3.4.7). The chronometer shall then be subjected to the accuracy test of 4.5.4 to determine conformance with 3.8. Chronometers which have been subjected to the shock test shall not be delivered as a part of the contract quantity.

4.5.6 Vibration test. The vibration test shall be conducted in accordance with type I of MIL-STD-167-1. The chronometer shall be in operation during the test. The chronometer shall then be subjected to the accuracy test of 4.5.4.

4.5.7 Temperature test.

4.5.7.1 Low temperature. The low temperature test shall be conducted in accordance with MIL-E-16400, except batteries shall not be installed while chronometer is subjected to storage temperature. The rate of the chronometer shall be checked in accordance with 4.5.4 before lowering the temperature. After being subjected to the storage temperature of MIL-E-16400, the chronometer shall be held at temperatures of 0°C and 7°C, corresponding to points A and B, respectively, on figure 4 for at least 2 hours at each temperature and rate checks per the frequency measurement method specified in 4.5.4 shall be conducted. Daily rates (see 6.3.4) shall not exceed those permitted in figure 4.

4.5.7.2 High temperature. The high temperature test shall be conducted as specified in MIL-E-16400, except batteries shall not be installed while chronometer is subjected to storage temperatures. After being subjected to the storage temperature of MIL-E-16400, the chronometer shall be held at temperatures of 41°C and 50°C, corresponding to points F and G, respectively, on figure 4 for at least 6 hours at each temperature and rate checks per the frequency measurement method described in 4.5.4 shall be conducted. Daily rates (see 6.3.4) shall not exceed those shown on figure 4.

4.5.8 Magnetism. While running, the chronometer shall be subjected to a magnetic field environment test in accordance with MIL-E-16400. The chronometer shall then be subjected to the accuracy test of 4.5.4.

4.5.9 Battery strength meter. Battery voltage shall be gradually dropped until the chronometer accuracy at point "D" shown on figure 4 can no longer be maintained by the compensatory feature of 3.4.2. The replacement point marked on the battery test meter shall be 8 ± 2 percent above the voltage at which required accuracy can no longer be maintained.

4.5.10 Humidity. Humidity tests shall be conducted as specified in MIL-E-16400. Accuracy before, during and after the humidity test shall be in accordance with applicable test points shown on figure 4.

4.5.11 Reliability test. The chronometers shall be subjected to a test of 5,000 chronometer-hours duration allowing zero failures. A failure is defined as not meeting the performance criteria of this specification. The procedures of MIL-STD-781 shall apply with environmental conditions as specified in 4.5.11.1 and 4.5.11.2.

4.5.11.1 A vibration level of 1G ± 10 percent shall be applied in the vertical plane with the chronometer horizontally mounted for at least 10 minutes of each hour.

4.5.11.2 Temperature cycling from 13°C to 22°C to 32°C with dwell periods of 6 hours at each temperature after stabilization shall be conducted on a continual basis. The daily accuracy test shall be conducted alternately at each dwell temperature. Daily rates (see 6.3.4) shall conform to the requirements of 3.6 and 3.7.

4.5.11.3 After completion of testing required by 4.5.11, and all other tests required by this specification, sample chronometer(s) shall be subjected to a long-term performance test for a duration of 210 calendar days. The test shall be conducted under standard test conditions in accordance with MIL-E-16400. Daily rate (see 6.3.4) may be determined by weekly rating checks. Chronometer(s) shall meet performance criteria of this specification. Three of the four sample chronometers shall be subjected to this test after completion of all other tests except the fungus test (see 4.5.13).

4.5.12 Salt fog test. A salt fog test shall be conducted in accordance with MIL-E-16400.

4.5.13 Fungus. A fungus test shall be conducted in accordance with MIL-E-16400, after all other applicable tests have been completed. Chronometer shall be running during the test. Accuracy of chronometer at conclusion of the test shall be in accordance with figure 4 for the temperature at which the rate check is performed. When this test is performed as part of first article inspection (see 4.3), only 1 of the 4 chronometers submitted shall be tested. The remaining 3 chronometers shall be subjected to the long-term performance test of 4.5.11.3.

4.5.14 Inclination. An inclination test shall be performed in accordance with MIL-E-16400, using the maximum inclination of 60 degrees. The mounted positions of the chronometer for the inclination test shall be as follows:

(a) Perpendicular to dial.
(b) Through numerals 00 and 12.

Accuracy of chronometer at conclusion of the test shall be in accordance with figure 4 for the temperature at which the rate check is performed.

4.5.15 Setting. A standard type pull gage with appropriate adapter shall be used to apply to the stem, the direct force (pull) specified in 3.4.4.1.

4.5.16 Surface examination. Each chronometer shall be visually and dimensionally examined to verify conformance with the requirements of this specification. Any chronometer containing one or more of the following defects shall be rejected:

(a) Case not as specified. (See 3.3, 3.4.7 and figure 1.)
(b) Manual setting mechanism missing, inoperative, or not located as specified. (See 3.4.4.1 and 3.4.7.)
(c) Electrical synchronization buttons missing, inoperative, or not located as specified. (See 3.4.4.2 and 3.4.7).
(d) Dial cover broken, poor quality, does not permit clear viewing, not free of bubbles, scratches, distortions or other imperfections, or of wrong material.
(e) Dial not as specified, incorrect size, wrong color, scratched or damaged; dial markings of incorrect size or layout, not legible. (See 3.4.4 and 3.15.2.
(f) Hands bent; not of proper size or shape; hands will not move, or rub against dial; wrong color. (See 3.4.10.)
(g) Battery replacement requires more than simple tools, battery compartment not isolated from chronometer movement or not located as specified, battery quantity or size not as specified, battery marking criteria and storage warning label missing or not as specified. (See 3.4.2.)
(h) Instruction sheet missing; information not complete. (See 3.16.2.)
(i) Day-of-the-week indicator missing or not as specified. Change stem not located as specified. (See 3.4.7 and 3.4.8.)
(j) Mercury battery warning label not included. (See 3.4.2..)
(k) Battery test meter missing or not as specified. (See 3.4.2.)
(l) Service adjustment missing or not as specified. (See 3.6.)
(m) Parallax reading errors at 30 degrees, or less. (See 3.4.4.)
(n) Movement of hands not concentric with dial markings. (See 3.4.4.)

(o) Hour hand not within ±3 degrees of hour graduation when minute hand is centered on the 60-minute position. (See 3.4.4.)
(p) Material not as specified. (See 3.3.1.)
(q) Identification plate missing or not as specified. (See 3.15.1.)

4.6 Inspection of preparation for delivery. Sample packages and packs and the inspection of preservation, packaging, packing, and marking for shipment and storage shall be in accordance with the requirements of section 5 and the documents specified therein.

5. PREPARATION FOR DELIVERY

(The preparation for delivery requirements specified herein apply only for direct Government procurements. For the extent of applicability of the preparation for delivery requirements of referenced documents listed in section 2, see 6.2.)

5.1 Preservation-packaging, packing and marking.

5.1.1 Chronometer(s). Each chronometer shall be preserved-packaged level A or C, packed level A, B, or C as specified (see 6.1.1) in accordance with group 4 packaging and packing of PPP-T-360. Packages and packs shall be marked in accordance with PPP-T-360 and shall also include warranty markings in accordance with of MIL-STD-129 as applicable.

5.1.2 Repair parts. Repair parts shall be preserved-packaged level A or C, packed level A, B, or C as specified (see 6.1.1) and marked in accordance with MIL-E-17555. Repair parts consisting of semi-conductors or solid state devices shall be preserved-packaged level A in accordance with 5.1.2.1.

5.1.2.1 Semi-conductors or solid state devices. Semi-conductors such as diodes, transistors, integrated circuits as well as circuit boards or chassis in which they are incorporated, shall be individually packaged in a carrier bag conforming to class E, types I or II, style 1 or class F, type I, style 1 of MIL-B-117. MIL-B-117 bag material shall employ aluminum foil as a laminate of the bag barrier material. Leads and terminals shall be protected from damage by means of the container (carrier) design, die cut inserts, or by the use of non-corrosive cushioning material. Leads and other projecting parts may be used for positioning, but shall not be subjected to loads or other stresses such as bending or twisting that can damage the entry seals.

6. NOTES

6.1 Ordering data.

6.1.1 Procurement requirements. Procurement documents should specify the following:

(a) Title, number, and date of this specification.
(b) Serial numbers assigned (see 3.15.1).
(c) Level of preservation-packaging and packing required (see 5.1).

6.1.2 Contract data requirements. When this specification is used in a procurement invoking the provisions of Armed Services Procurement Regulations (ASPR), paragraph 7-104.9(n) and which incorporates a DD Form 1423 Contract Data Requirements List (CDRL) the data requirements identified below will be developed as specified in the cited Data Item Description (DID) and delivered in accordance with such CDRL. When the ASPR provisions are not invoked, the data specified below shall be delivered in accordance with the contract requirements.

Spec. paragraph	Data requirement	Service	Applicable DID	Options
3.16.1	Certificate or prior submission	SH	DI-V-2075	Option 1 (MIL-STD-1375)
3.16.1	Provisioning parts list	SH	DI-V-2078	Option 2 (MIL-STD-1375)
3.16.1	Design change notice	SH	DI-V-2077	Option 2 (MIL-STD-1375)
3.16.3	Technical manual outline/book plan	SH	DI-M-2041	Type II of MIL-M-15071
3.16.3	Technical manual standard basic issue	SH	DI-M-2044	Type II of MIL-M-15071

Spec. paragraph	Data requirement	Service	Applicable DID	Options
4.2.1	List of tests, test equipment and test procedures	SH	UDI-T-23732	
4.3.1	First article inspection report	SH	UDI-T-23473	
4.4.5	Quality conformance inspection report	SH	UDI-T-23473	
4.5.5	Shock test procedures	SH	UDI-T-23757	
	Shock test report	SH	UDI-T-23753	
	Procedures, post shock test functional testing	SH	UDI-T-23755	
4.5.6	Vibration test report	SH	UDI-T-23762	
4.5.11	Reliability:			
	Test and demonstration plan	SH	UDI-R-23562	
	Test procedures		UDI-T-23710	
	Test and demonstration report		UDI-R-23563	

(Copies of data item descriptions (DIDS) required by the supplier in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.)

6.1.2.1 Data submission. The CDRL should specify that the test plans and procedures should be submitted to the Naval Ship Engineering Center, Mechanicsburg Division, Mechanicsburg, PA 17055 for approval at least 60 days prior to the scheduled start of the applicable test(s) and that test reports should be submitted not later than 30 days after the applicable test(s) (see 6.1.2).

6.2 Sub-contracted material and parts. The preparation for delivery requirements of referenced documents listed in Section 2 do not apply when material and parts are procured by the supplier for incorporation into the equipment and lose their separate identify when the equipment is shipped.

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

6.3.1 Accuracy error notation. Where algebraic signs are used to denote the direction of timekeeping accuracy error, the plus (+) sign represents "fast" and the minus (-) sign "slow".

6.3.2 Average daily rate. The average of individual daily rates (see 6.3.4) with each individual daily rate being considered as algebraically positive (+) in the computation (see 6.3.1).

6.3.3 Case. The external housing or shell of the chronometer. This does not include a separate carrying case for the chronometer.

6.3.4 Daily rate. The error in seconds (or portions thereof) between two readings of the chronometer 24 hours apart.

6.3.5 Deviation of daily rate. The amount of time by which individual daily rates (see 6.3.4) can vary from the average daily rate (see 6.3.2) on the same chronometer.

6.3.6 UTC time. Universal time coordinated. A smoothed approximation of mean solar time corrected for seasonal variations in the rate of rotation of the earth. This is the time distributed for most broadcast time signals.

6.4 First article inspection. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection as to those bidders offering a product which has been previously procured or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending procurement.

Preparing activity:
Navy - SH
(Project 6645-N286)

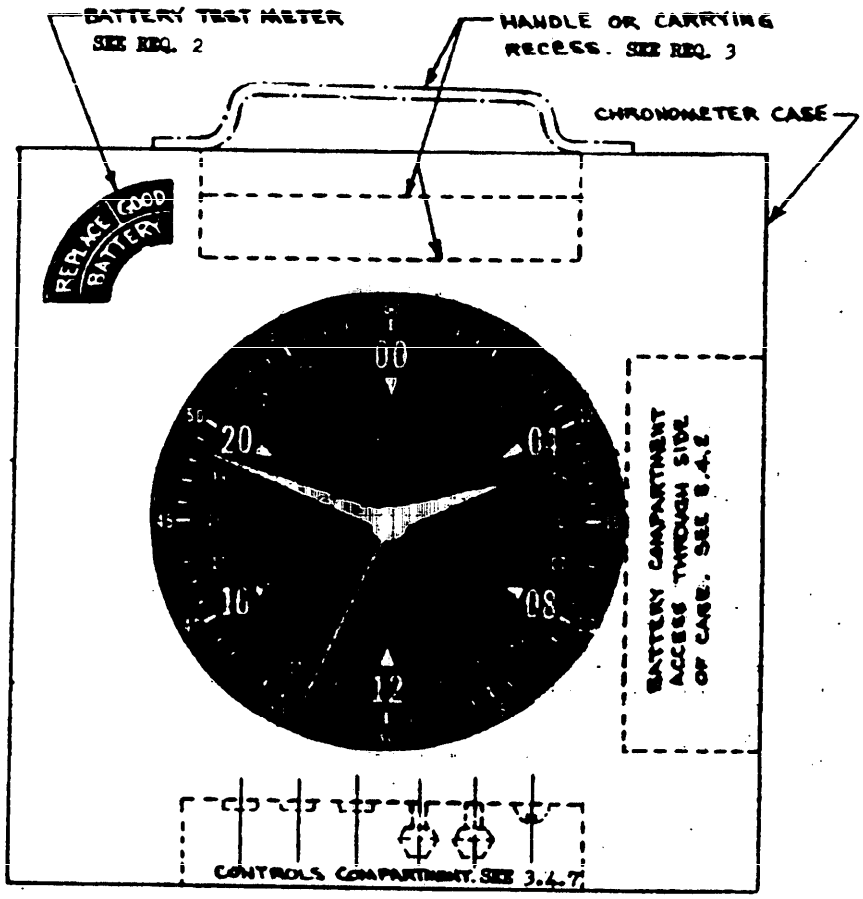
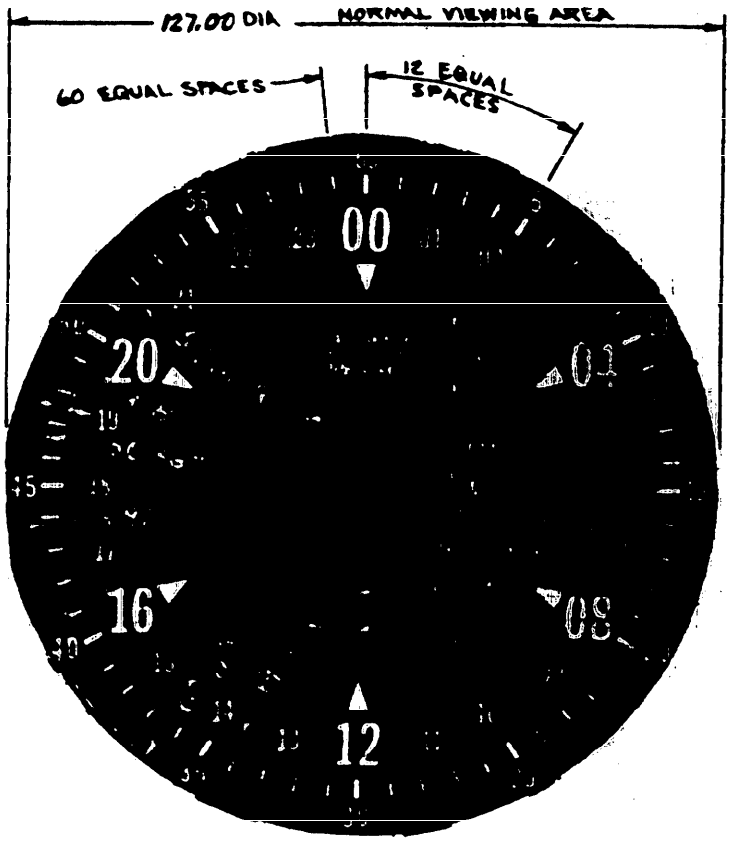


FIGURE 1 - CHRONOMETER ARRANGEMENT

REQUIREMENTS:

1. Chronometer dial shall be centered in case shown.
2. Battery test meter shall be located approximately as shown and shall be mounted flush with chronometer case. Lettering and dial colors shall be as specified in figure 2 for the main dial. (see 3.4.2).
3. Handle or carrying recess shall be provided and located so at to be accessible when chronometer is installed in chronometer locker or chart table (See 3.4.7).
4. Day indicator lettering shall be at least 6.35 mm (o.250 inch) high with a 0.8 mm (0.030 inch) stroke weight and shall be white on a black background as specified in Figure 2 for the main dial. (see 3.4.8).

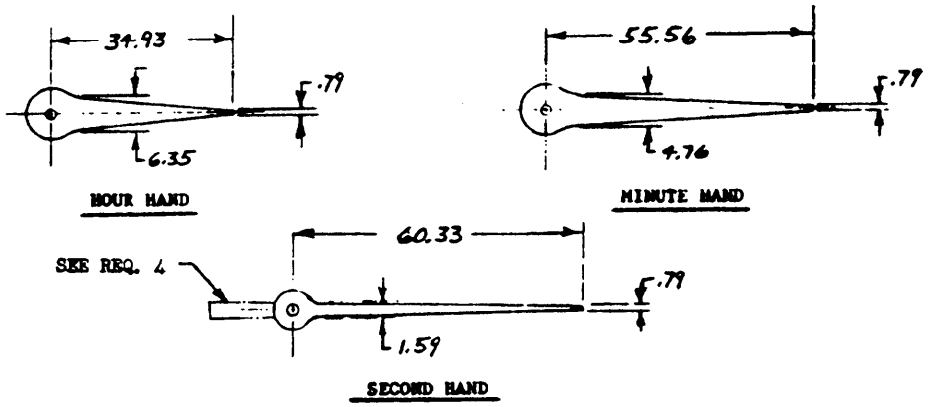


Fractional equivalents	
mm	Inches
127.00	5
62.71	2-15/32
56.36	2-7/32
50.80	2
49.21	1-15/16
33.34	1-5/16
20.64	13/16
19.05	3/4
9.53	3/8
6.35	1/4
4.76	3/16
3.97	5/32
3.18	1/8

FIGURE 2 - DIAL REQUIREMENTS

REQUIREMENTS:

1. Numerals shall measure not less than 3.97 by 8.74 mm (5/32 by 11/32 inch) per numeral for the nautical hour readings and 2.39 by 3.97 mm (3/32 by 5/32 inch) per numeral for remaining readings. Stroke weight for nautical hour numerals and major minute graduations shall be 1.02 mm (0.040 inch) for other numerals and minute graduations, 0.51 mm (0.020 inch); and for intermediate hour graduations 0.25 mm (0.010 inch).
2. Dial background shall be lusterless black per FED-STD-595, color 37038. Numerals and markings shall be white per FED-STD-595, color 37875.(see 3.4.9).
3. All dimensions are in millimeters. Decimal or fractional equivalents are given for information only and are based on 25.4 mm = 1 inch.
4. Tolerances shall be as follows:
   All dimensions, except stroke weight: plus or minus 0.40 mm (plus or minus 1/64 inch).
   Stroke weight: Minus 0, plus 0.13 mm (minus 0, plus 0.005 inch).
   Angles: Plus or minus 1 degree.



Fractional equivalents	
mm	Inches
60.33	2-3/8
55.56	2-3/16
34.93	1-3/8
6.35	1/4
4.76	3/16
1.59	1/16
.79	1/32
.40	1/64

FIGURE 3 - HAND REQUIREMENTS

REQUIREMENTS:

1. Hands shall be white per FED-STD-595, color 37875 (see 3.4.9).
2. Hands may be curved or bent to reduce parallax; however, effective length shall be not less than shown.
3. Counter balance as shown may be added to second hand at the option of the manufacturer.
4. All dimensions are in millimeters. Fractional equivalents are given for information only and are based on 25.4 mm = 1 inch.
5. Tolerances shall be plus or minus 0.40 mm (plus or minus 1/64 inch).

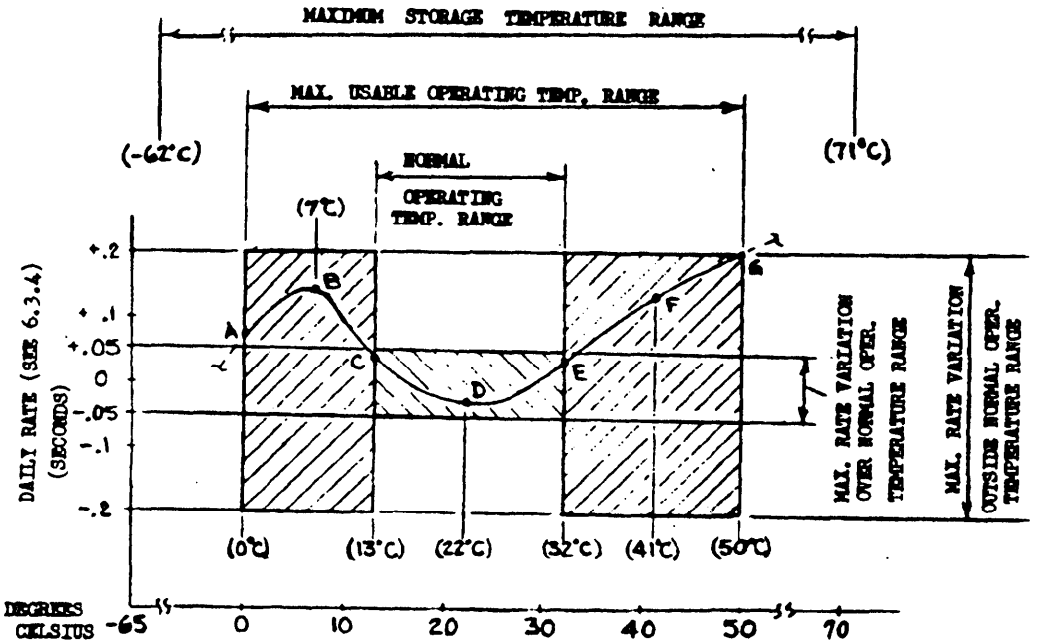


FIGURE 4 - PERFORMANCE REQUIREMENTS

NOTES

1. Curve shown is typical crystal frequency response over the temperature range indicated.

2. Points identified are check points at the temperatures indicated and will not necessarily result in rate variations of either the magnitude or sign shown. Daily rates at the temperature points indicated shall however, fall within the shaded area for the temperature range under consideration.

3. Refer to paragraph 4.3 for tests to be conducted at each temperature point identified on the response curve. Temperatures at these points shall be maintained during tests within ± 1.4°C of those shown.

4. The storage temperature range is shown for reference only.

5. Equivalent Farenheit degrees for significant temperature points are -62°C, -79.6°F; 0°C, 32°F; 7°C, 44.6°F; 13°C, 55.4°F; 22°C, 71.6°F; 32°C, 89.6°F; 41°C, 105.8°F; 50°C, 122°F; and 71°C, 159.8°F.

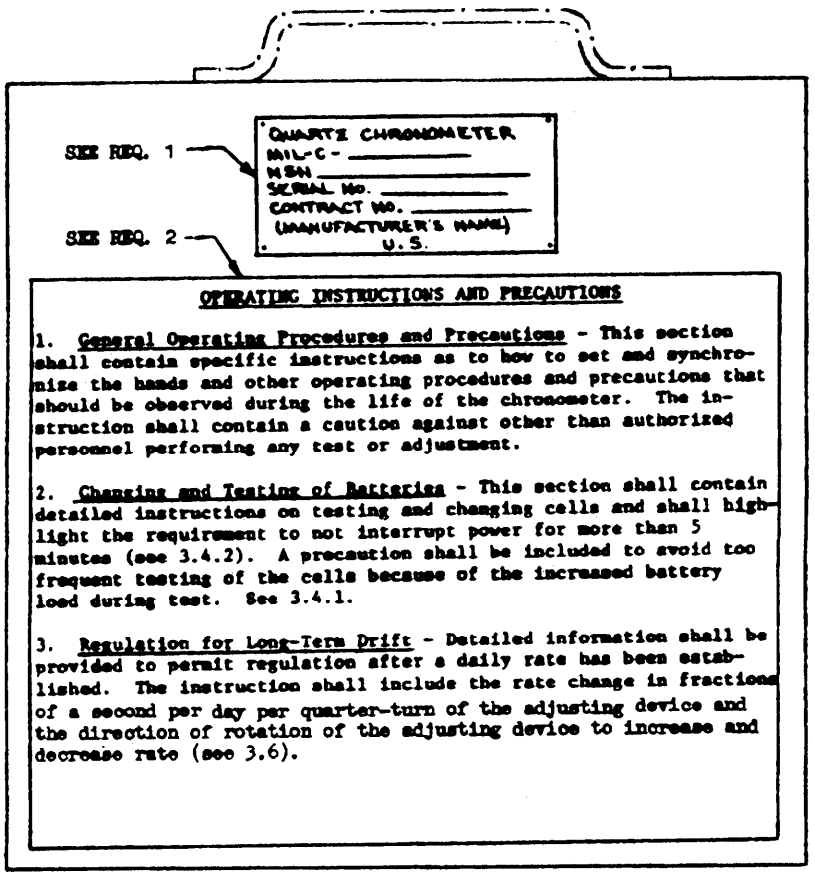


FIGURE 5 - BACK OF CHRONOMETER CASE

REQUIREMENTS:

1. Identification plate shall contain information indicated and be in accordance with MIL-P-15024 except adhesive backed plates per type G of MIL-P-15024 shall not be used. Plastic cases may, at the manufacturer's option, have the information indicated permanently engraved in the case material in lieu of providing a separate label plate (See 3.15.1).
2. An instruction sheet containing the information shown shall be located on the back of the chronometer case as shown (See 3.16.2).
3. Battery compartment warning labels per 3.4.2 are required, in addition to the instruction sheet shown above.

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

OMB Approval
No. 22-R255

INSTRUCTIONS: The purpose of this form is to solicit beneficial comments which will help achieve procurement of suitable products at reasonable cost and minimum delay, or will otherwise enhance use of the document. DoD contractors, government activities, or manufacturers/vendors who are prospective suppliers of the product are invited to submit comments to the government. Fold on lines on reverse side, staple in corner, and send to preparing activity. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements. Attach any pertinent data which may be of use in improving this document. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity.

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NAME OF ORGANIZATION AND ADDRESS

CONTRACT NUMBER

MATERIAL PROCURED UNDER A

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1. HAS ANY PART OF THE DOCUMENT CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?
   A. GIVE PARAGRAPH NUMBER AND WORDING.

   B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES

2. COMMENTS ON ANY DOCUMENT REQUIREMENT CONSIDERED TOO RIGID

3. IS THE DOCUMENT RESTRICTIVE?

   ☐ YES ☐ NO *(If "Yes", in what way?)*

4. REMARKS

SUBMITTED BY *(Printed or typed name and address - Optional)*

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