MIL-W-22176A(SHIPS)
24 March 1961
SUPERSEDING
MIL-W-22176(SHIPS)
1 September 1959

MILITARY SPECIFICATION

WATCH, WRIST, SUBMERSIBLE (400-FOOT), NON-MAGNETIC

1. SCOPE

1.1 Scope.- This specification covers submersible wrist watches with nonmagnetic features, suitable for use by swimmers and divers and having a 30 seconds daily rate accuracy or better.

1.2 Classification.- Wrist watches shall be of the following types, as specified (see 6.1):

Type A - Stem-wind.
Type B - Self-wind.

2. APPLICABLE DOCUMENTS

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

SPECIFICATIONS

FEDERAL

L-P-391 - Plastic, Methacrylate; Sheets, Rods, and Tubes-Cast.
QQ-C-530 - Copper-Beryllium Alloy Bars, Rods, and Wire.
QQ-C-533 - Copper-Beryllium Alloy Strip.
QQ-N-286 - Nickel-Copper-Aluminum Alloy, Wrought (K-Monel).
QQ-S-763 - Steel Bars, Shapes, and Forgings - Corrosion Resisting.

MILITARY

MIL-P-116 - Preservation, Methods of
MIL-L-3918 - Lubricating Oil, Instrument, Jewel Bearing, Nonspreading, Low Temperature.
MIL-P-15137 - Provisioning and Technical Documentation for Repair Parts for Electrical and Mechanical Equipment, Naval Shipboard Use
MIL-M-19590 - Marking of Commodities and Containers to Indicate Radioactive Material.
MIL-M-19595 - Magnetic Effect Limits for Nonmagnetic Equipment and Metals (Special Purpose).
MIL-S-21382 - Strap, Wrist Instrument, Woven Nylon.

STANDARDS

MILITARY

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-129 - Marking for Shipment and Storage.
MS35450 - Bearing, Jewel; Bar Hole.
MS35451 - Bearing, Jewel; Center Bar Hole.
MS35452 - Bearing, Jewel; Olive Hole
MS35453 - Bearing, Jewel; Olive Hole (Cone Cut).
MS35454 - Bearing, Jewel; Endstone.

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications.- The following document forms a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids shall apply.

OFFICIAL CLASSIFICATION COMMITTEE
Uniform Freight Classification Rules.

(Application for copies should be addressed to the Official Classification Committee, 1 Park Avenue at 33rd St., New York 16, N.Y.)

3. REQUIREMENTS

3.1 Qualification.- The watches furnished under this specification shall be a product which has been tested and has passed the qualification tests specified herein, and has been listed on or approved for listing on the applicable qualified products list (see 4.2 and 6.4).

3.2 Material.- Where a definite material specification is not specified, the material shall be of a composition and quality that is normally used in commercial watches of comparable grade, except that all materials used, when assembled in the completed watch, including the strap assembly, shall meet the magnetic effect limits specified in 3.12. All materials shall be of a uniform quality, and shall be free from any defects which might impair the functioning of the watch.

3.2.1 Metals.- Where used, the following metals shall comply with the chemical composition, hardness, permeability, and corrosion resistance requirements of the specifications and classes listed:

Material	Specification	Classes
Corrosion-resisting steel	QQ-S-763	309, 310, 316
K-Monel	QQ-N-286	B
Copper-beryllium alloy bars, rod, wire	QQ-C-530	----------
Copper-beryllium alloy strip	QQ-C-533	----------

3.2.2 Radioactive luminous compound.- The radioactive luminous compound shall consist of a beta-emitting light exciter and a light emitter. The light exciter shall be a radioisotope, except that no form of radium shall be used. The light emitter shall be a green-hued phosphor. The radioisotope shall be encapsulated in ceramic microspheres so as to form a sealed radioactive source which, when applied to the watch, will meet the radiological contamination limitations specified herein. Within 60 days after award of a contract, the supplier shall notify the Government of the nature of the isotope to be used (see 6.3).

3.2.2.1 Brightness values.- The initial brightness of the completely assembled watch measured between 15 and 60 days after assembly shall be not less than 65 microlamberts, and shall not deteriorate to less than 15 microlamberts after 3 years.

3.2.2.2 Radiological contamination.- The radiation level and radiological contamination of the completed watch shall be not greater than the values specified when tested in accordance with 4.4.19.

3.2.3 Plastic.- Plastic shall comply with type I of Specification L-P-391.

3.2.4 Lubricant.- The lubricant used in the watch movement shall comply with Specification MIL-L-3918.

3.3 Design and construction.-

3.3.1 General requirements.- The watch shall be so constructed that no parts will work loose in service, and shall be made to withstand the normal strain of jars and vibrations incident to shipping, storage, and service. Unless otherwise specified herein, all parts of the watch shall be manufactured and assembled in accordance with best commercial practice. Final sealing of the watch shall be done in an environment of 75° ± 3° Fahrenheit (F.), and 15 percent or less relative humidity.

3.3.2 Interchangeability.- All like parts, including repair parts of each watch, shall be interchangeable in all watches of one type furnished by one manufacturer, and shall not adversely affect timekeeping exclusive of minor adjustments. The balance assembly shall be interchangeable as an assembly.

3.4 Movement.-

3.4.1 General requirement.- The movement shall be of standard commercial design consonant with material requirements herein. The size of the movement shall be not less than 8/0 (10.5084 lignes) nor greater than 5/0 (11.6343 lignes). The thickness of the movement through its center shall be 0.300, plus or minus 0.002 inch, when measured from the face of the dial to the outer back surface of the movement ring. The outside diameter of the movement ring shall be 1.139, plus or minus 0.001 inch. The movement shall incorporate an Incabloc feature or equal protection from damage due to mechanical shock. The movement shall have a lever escapement. All plates, bridges, train wheels, and moving parts shall be free from burrs, sharp edges, rough surfaces, and defects.

3.4.2 Mainspring.- When fully wound, the mainspring shall drive the completed movement a minimum of 36 hours without rewinding. The mainspring shall be made of a rustproof, nonbreakable alloy such as Elgiloy, Dynavar, Buloloy, Nivaflex, or equal.

3.4.3 Hairspring and balance wheel unit.- The movement shall have a temperature compensating hairspring and a nonmagnetic, solid, monometallic balance wheel.

3.4.4 Jewels.- The movement shall have not less than 17 jewels located at bearing points most essential to reduce friction of train and escapement parts. Jewels shall be secured in the plate or bridge by means of friction fit. End stone jewels shall be secured in a manner to facilitate cleaning and reoiling. Bar hole, center bar hole, olive hole, olive hole (cone cut), and endstone jewel bearings shall comply with the applicable Military standards listed under 2.1.

3.4.5 Regulator.- The movement shall be provided with a lever index regulator. The completed watch shall meet the accuracy requirements specified in 3.10 with the regulator set at the midpoint of adjustment within plus or minus 20 percent of its total range.

3.4.6 Winding and setting.-

3.4.6.1 Type A watches.- The movement shall be stem-wound and stem-set with the winding and setting mechanism incorporated as part of the movement and operating independently of the case. Entrance for the stem shall be located at the 3 o'clock

position of the dial. The stem and crown assembly shall be of pressuretight construction. O-rings shall be utilized to maintain a rotary pressuretight seal between the stem and crown assembly and the case pipe. Winding and setting operations shall not impair the timekeeping and pressuretight properties of the watch. Means shall be provided to prevent overwinding due to the lack of winding sensitivity inherent in the design of submersible watches.

3.4.6.2 Type B watches.- The movement shall be self-wound and stem-set, with the winding and setting mechanism incorporated as part of the movement and operating independently of the case. Entrance for the stem shall be located at the 3 o'clock position of the dial. The stem and crown assembly shall be of pressuretight construction. O-rings shall be utilized to maintain a rotary pressuretight seal between the stem and crown and the case pipe. The self-wind mechanism shall consist of a pendulous weight pivoted at the center of the movement between the top plate and the movement ring, and engaged to the barrel arbor in such a manner as to impart a winding motion to the mainspring with any swing of the weight through 360 degrees. Means shall be provided to enable manual winding of the watch by turning the winding and setting stem. Winding and setting operations shall not impair the timekeeping and pressuretight properties of the watch. Means shall be provided to prevent overwinding, due either to lack of winding sensitivity in the stem or to continual movement of the pendulous weight.

3.4.6.3 Second setting mechanism.- In both type A and type B watches, a second setting mechanism shall be incorporated into the movement to stop the second hand when the winding stem is pulled into the setting position. The second setting mechanism shall be so constructed that it will not impair the timekeeping properties of the watch despite frequent and random use.

3.4.7 Movement ring.- A movement ring shall be provided to enclose the watch movement except for the winding and setting stem. The movement ring shall serve as a spacer for adapting the size of the movement to the case (see 3.8.1). The complete movement, when encased in the movement ring, shall fit into the case snugly and without interference.

3.5 Dial.- The dial shall be of metal, flat, and shall be in accordance with figure 1. The diameter shall be 1.120, plus or minus 0.005 inch with a minimum thickness of 0.015 inch. The dial, when secured to the movement, shall be such that the distance from the face of the dial to the centerline of the winding stem is 0.106 ± 0.002 inch. The background finish of the dial shall be a durable dull black. The minute track shall be of an open design with each minute marked with a glossy white, nonilluminous, straight radial line segment. The mark at each hour position shall be larger than and distinguishable from the other minute marks. Luminous compound (see 3.2.2) shall be used on the geometrically-shaped hour markings. The name of the manufacturer and the letters "U.S." shall be marked on the face of the dial in glossy white, nonilluminous paint. A moisture indicator (see 3.7) shall be securely fastened to the dial with a nonaqueous and nonhydroscopic adhesive, and shall be located as shown on figure 1.

3.6 Hands.- There shall be three luminous hands, one each to indicate the hour, minute, and second. The hands shall be of metal and shall be as shown on figure 2. The tips of both the minute and second hands shall extend over the mark on the minute scale. The hour hand shall be shorter, and shall not overlap the hour marks. The top surfaces of the three hands shall be painted a glossy white, except where filled with luminous compound as shown on figure 2. Luminous compound shall be in accordance with 3.2.2.

3.6.1 In the finished watch, the hands shall be essentially parallel to the dial and to each other, with sufficient clearance between each hand to prevent rubbing or binding. All hands shall rotate concentrically with respect to the minute track on the dial. The tips of the minute and second hands shall be curved downward so that, after assembly, parallax is reduced to a minimum.

3.7 Moisture indicator.- The moisture indicator shall consist of a moisture-sensitive chemical such as cobalt chloride and a pink oil-base ink as a reference color. The color of the pink reference ink shall correspond to Munsell color number 5RP7/6 on Munsell Chart Number 95. The moisture-sensitive chemical and reference ink shall be applied to a 25-percent rag, 32-weight, uncoated, white bond paper stock. The indicators shall be 7/32 inch in diameter, and shall be located as shown on figure 1. Prior to assembly of the moisture indicators to the dial, a test sample from each sheet from which the indicators will be cut shall be subjected to the test specified in 4.4.8.

3.8 Case assembly.-

3.8.1 General requirements.- The case assembly, including case, back, strap pins, and elapsed time

ring, shall be fabricated of corrosion-resisting steel, class 310. The case shall be of pressure-tight construction having a rotatable elapsed time ring and a screw back. External dimensions of the case shall be as shown on figure 3. Internal dimensions of the case shall be as required to form a good fit for the assembled movement and movement ring (see 3.4.1 and 3.4.7). The location of the pipe on the case shall be compatible with the location of the winding stem as specified in 3.4.6 and 3.5. The strap pins shall be permanently attached to the case. The pins shall be of one-piece construction.

3.8.2 Crystal.- The crystal shall be made of tempered glass. The crystal periphery shall be metallized and soldered securely into the case. The glass shall be clear, uncolored, and free from bubbles, striae, scratches, chips, or other imperfections which may interfere with the reading of the watch. The crystal, when assembled to the case, shall meet the crystal strength test specified in 4.4.9.1.

3.8.2.1 Upon specific written approval from the bureau or agency concerned, a crystal made of nonhygroscopic, thermosetting plastic may be used in lieu of the glass crystal. Plastic crystals shall be cemented in place using a clear, nonhygroscopic adhesive which is nonsoluble in water, and which is compatible with the plastic crystal. Requests for approval to use a plastic crystal shall be accompanied by a full technical description of the plastic to be used and the method to be used in cementing the crystal to the case.

3.8.3 Case back.- Access to the movement shall be by means of a two-piece screw type back. The seal between the case back and case shall be obtained by means of an O-ring. The two-piece construction of the case back shall permit compression of the O-ring, but shall not subject the O-ring to rotary motion when the back is screwed down. The case back shall be readily removable with a watchmaker's wrench.

3.8.4 Elapsed time ring.- The watch shall be equipped with a rotatable elapsed time ring of the same outer diameter as the case. The ring shall be fitted with a graduated scale. The ring shall be capable of being rotated and set by hand. Means shall be provided for securing the ring in any set position to prevent unintentional movement caused by abrasion, shock, or vibration. The securing device shall be contained within the dimensions shown on figure 3. The design of the elapsed time ring shall preclude unintentional detachment from the case due to shock or vibration. The outer edge of the ring shall be knurled.

3.8.4.1 Elapsed time ring scale.- The elapsed time ring scale shall be made of plastic (see 3.2.3), and shall be as shown on figure 4. The graduations and numerals shall be engraved or molded into the underneath side of the scale such that, when viewed from the top, the scale will appear as shown on figure 4. All markings shall be filled with luminous compound conforming to 3.2.2. The underneath side of the scale shall be given at least four uniform coats of black lusterless paint, in order to seal in the luminous compound, and to provide background contrast for the markings. The completed scale shall be recessed in, and shall be securely mounted to the elapsed time ring in such a manner as to preclude detachment or damage of the plastic scale due to changes in temperatures encountered in use or storage.

3.8.5 Finish.- All visible, exterior metal surfaces of the case assembly, including crown, shall have a dull gray, nonreflecting finish.

3.9 Strap.- Each watch supplied under this specification shall be equipped with a one-piece nylon strap conforming to Specification MIL-S-21382, and which has met the magnetic test requirement of that specification.

3.10 Accuracy.- All watches shall be Military grade II having a 30 seconds daily rate accuracy or better. Watches, in a demagnetized state, shall meet the accuracy requirements in the dial-up position and the crown-down position. When tested in accordance with 4.4.12, the mean daily rate shall not exceed plus or minus 30 seconds when tested at 75° ± 3°F., and shall not exceed plus or minus 60 seconds when tested at 20° ± 2°F., and at 130° ± 2°F.

3.11 Isochronism.- Watches shall pass the test for isochronism specified in 4.4.13 in the dial-up position at 75° ± 3°F. The variation in rate shall be recorded every 6 hours for a period of 48 hours, and shall not exceed 3 seconds from the rate recorded in the previous 6-hour period.

3.12 Magnetic characteristics.- The watch shall have less than 0.1 millioersted magnetic effect when tested in accordance with 4.4.21.

3.13 Vibration.- The watch shall be vibrated at an amplitude of 0.015 inch (total excursion 0.030 inch) and a frequency increasing from 5 to 25 cycles per second (c.p.s.). At each integral frequency, vibration shall be maintained for one minute. The watch shall show no evidence of damage affecting serviceability as a result of vibration when tested in accordance with 4.4.15. The watch shall subsequently meet the final accuracy requirements of 3.17.

3.14 Shock.- The watch shall show no evidence of damage affecting serviceability after a controlled drop from a height of 1 foot (equivalent to approximately a 4-foot free fall) at room temperature, once with the watch in the crown-up position, and once with the watch in the dial-up position when tested in accordance with 4.4.16. The watch shall subsequently meet the final accuracy requirements of 3.17.

3.15 Hydrostatic pressure.- The watch shall be capable of withstanding a hydrostatic pressure of 178 ± 5 pounds per square inch (gage) when tested in accordance with 4.4.18. The completed watch shall show no evidence of leakage or other damage affecting serviceability, and shall meet the final accuracy requirements of 3.17.

3.16 Storage.- The watch shall show no evidence of damage affecting serviceability, when subjected to the ambient storage temperature of minus 80°F. and plus 160°F. in accordance with storage tests specified in 4.4.17. The watch shall subsequently meet the final accuracy requirements of 3.17.

3.17 Final accuracy.- Watches shall meet the accuracy requirements of 3.10 at 75°F., when subjected to the environmental tests of Section 4.

3.18 Identification.- Each watch shall show on the movement (barrel bridge, train bridge, or pendulous weight) the manufacturer's name and model or grade number. Each case shall be legibly marked on the exterior of the case back with the number of this Specification ("MIL-W-22176"), serial number (e.g., "Serial 1234"), the word "NONMAGNETIC" with the nonmagnetic symbol "μ", and the radiation symbol (see 5.4.1). The serial numbers will be assigned consecutively by the bureau or agency concerned (see 6.1). Serial numbers of rejected watches may or may not be repeated, at the option of the supplier. The supplier shall furnish the contracting agency with a list of all the serial numbers of watches accepted by the Government.

3.19 Operating instructions.- An instruction sheet or sheets, as necessary, describing the detailed procedures for the operation of the watch shall be furnished with each watch (see 5.1.3). The instructions shall include diagrams, figures, or photographs that are necessary to illustrate procedures for winding and setting of the watch and for operating and setting the elapsed time ring. In addition to the above, the following instructions shall be included:

"WARNING - This watch contains radioactive material. Personnel handling and using this watch should be cautioned against opening the watch or in any way exposing the compound the elapsed time ring, dial, or hands. If the watch becomes damaged or unserviceable, it should be returned to designated supply points for disposal or repair in accordance with existing instructions. Packaging and marking of damaged watches to be returned shall be at least equal to that specified for new watches. If radioactive material is exposed, carefully wrap the watch and seal all joints in wrapping and packaging, or seal the watch in a plastic bag to assure no leakage of radioactive material to the exterior of the package."

3.20 Repair parts.- Repair parts for watches ordered under this specification shall have less than 0.1 millioersted magnetic effect when tested in accordance with 4.4.22.1. Repair parts containing radioactive material shall not have a radiation level greater than that specified when tested in accordance with 4.4.22.2. When specified (see 6.1), repair parts shall be supplied in accordance with Specification MIL-P-15137. Onboard repair parts will not be supplied.

4. QUALITY ASSURANCE PROVISIONS

4.1 The supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own or any other inspection facilities and services acceptable to the Government. Inspection records of the examination and tests shall be kept complete and available to the Government as specified in the contract or order. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 The magnetic effect test shall be conducted at the U. S. Naval Weapons Plant, Washington 25, D. C. (see 6.2).

4.2 Qualification inspection.[1]- Qualification inspection shall be conducted at a laboratory satisfactory to the Bureau of Ships. Four watches of each type for which qualification is requested shall be examined and tested to determine compliance with all requirements of this specification. The following specific examinations and tests shall be performed in the order listed. Watches shall not be opened until final accuracy has been tested.

[1] Application for Qualification tests shall be made in accordance with "Provisions Governing Qualification" (see 6.4 and 6.5).

Examination and test	Requirement paragraph	Test paragraph
Winding and setting	3.4.6	4.4.4
Second setting	3.4.6.3	4.4.5
Accuracy	3.10	4.4.12
Isochronism	3.11	4.4.13
Magnetic field	3.17	4.4.14
Vibration	3.13	4.4.15
Shock	3.14	4.4.16
Hydrostatic pressure	3.15	4.4.18
Brightness value	3.2.2.1	4.4.1
Radiological contamination	3.2.2.2	4.4.19
Storage	3.16	4.4.17
Final accuracy	3.17	4.4.20
Elapsed time ring	3.8.4	4.4.9.2
Case assembly	3.8	4.4.9
Crystal strength	3.8.2	4.4.9.1
Interchangeability	3.3.2	4.4.2
Dial	3.5	4.4.6
Hands	3.6	4.4.7
Movement	3.4	4.4.3
Magnetic effect	3.12	4.4.21

4.3 Acceptance inspection.- Acceptance inspection shall be conducted upon sample number of watches selected in accordance with 4.3.1. These watches shall be subjected to the following examinations and tests. Group B examinations and tests on any one watch shall be conducted before Group A.

Examinations and tests	Requirement paragraph	Test paragraph
Group A		
Winding and setting	3.4.6	4.4.4
Second setting	3.4.6.3	4.4.5
Hydrostatic pressure	3.15	4.4.18
Final accuracy	3.17	4.4.20
Magnetic effect	3.12	4.4.21
Group B		
Accuracy	3.10	4.4.12
Magnetic field	3.17	4.4.14
Brightness values	3.2.2.1	4.4.1
Radiological contamination	3.2.2.2	4.4.19
Strap	3.9	4.4.10
Elapsed time ring	3.8.4	4.4.9.2
Identification	3.18	4.4.11
Case Assembly	3.8	4.4.9
Crystal strength	3.8.2	4.4.9.1
Dial	3.5	4.4.6
Hands	3.6	4.4.7
Movement	3.4	4.4.3

4.3.1 Sampling for acceptance inspection.-

4.3.1.1 Inspection lot.- All watches of one type presented for delivery at one time shall be considered a lot. The lot may include the entire contract quanitity or it may be the production quantity of any convenient time period.

4.3.1.2 Sampling for group A inspection.- All watches offered for delivery shall be subjected to the group A examination and tests. The results of each test shall be compared with the requirements of this specification. In the event of failure to conform to this specification for any test or examination, the supplier shall correct the cause of failure on future production units and repair the deficiency in all watches produced on the contract or order.

4.3.1.3 Sampling for group B inspection.- A sample number of watches shall be selected from each inspection lot by the inspector in accordance with inspection level L8 of the table for small sample inspection of Standard MIL-STD-105. All watches in the sample shall be subjected to the group B examinations and tests specified in 4.3 with lot acceptance based on an AQL of 2.5 percent in accordance with the single sampling plan of Standard MIL-STD-105.

4.4 Examination and test procedures.-

4.4.1 Brightness value.- Brightness shall be determined photoelectrically. The photoelectric device shall have been calibrated, not more than 6 months prior to this test, by a brightness standard that has been certified for brightness by a laboratory satisfactory to the Government. The watch being tested shall have been kept in total darkness for at least 8 hours prior to and during the test. Watches that fail to meet the requirements of 3.2.2.1 shall be declared defective.

4.4.2 Interchangeability.- Several identical parts from each of the sample watches shall be interchanged among the watches to determine compliance with 3.3.2.

4.4.3 Movement.- A visual and dimensional examination shall be made to determine that the size, quality of workmanship, number and type of jewels, pressuretight construction, and fit of

movement ring are in compliance with 3.4.1, 3.4.4, 3.4.6, and 3.4.7.

4.4.4 Winding and setting. - The operation of the winding and setting mechanism shall be checked to determine compliance with 3.4.6.1 or 3.4.6.2 as applicable.

4.4.5 Second setting mechanism. - At least 5 settings of the second setting mechanism shall be made on each watch to determine compliance with 3.4.6.3.

4.4.6 Dial. - The dial shall be inspected for size, markings, legibility, and finish to determine conformance with 3.5.

4.4.7 Hands. - The hour, minute, and second hands shall be inspected for length, shape, and finish to determine compliance with 3.6.

4.4.8 Moisture indicator. - The moisture indicator test shall be conducted as follows: Place the selected test samples in an enviorment of 75°F. ± 3°F., and 15 percent or less relative humidity for 24 hours. With the temperature constant, increase the relative humidity to 90 ± 5 percent for 24 hours, then lower the relative humidity to 15 percent for 24 hours. During this cycling, the cobalt chloride section of the test strip should change from blue to pink to blue with each respective change in relative humidity. After returning the test samples to an enviorment of 75°F. and 15 percent relative humidity for 24 hours, increase the relative humidity to 40 percent. The cobalt chloride section of the test sample should change from blue to pink in 15 minutes ± 2 minutes. Any test sample failing to show a change in color in the required time limit shall be cause for rejection of the entire sheet from which the test sample was taken. This test shall be conducted by the supplier prior to assembly of watches submitted for QPL approval or final acceptance.

4.4.9 Case assembly. - A visual and dimensional examination of the case assembly shall be made to determine compliance with 3.8.

4.4.9.1 Crystal strength test. - After assembly to the case, the case assembly, including crystal, shall be placed flat, crystal up, on a horizontal, rigid, nonresilient, metal surface. A solid steel sphere weighing 0.56 ounce ± 0.05 ounce (approximately 5/8 inch diameter) shall then be freely dropped so as to fall 40 inches ± 1 inch, before striking the crystal. The ball shall be dropped twice on each crystal; once so as to strike within 1/8 inch of the center, and once so as to strike within 1/8 inch of the periphery. Any visible damage to the crystal shall be cause for rejection. This test shall be conducted with the movement removed from the case.

4.4.9.2 Elapsed time ring. - With the watch handheld by both strap ends, the elapsed time ring shall be subjected to a minimum of 5 sharp blows around the periphery of the ring, using a nonmarking hard rubber or plastic hammer, in such a direction as might dislodge the elapsed time ring from the case. In addition, an attempt shall be made to rotate the elapsed time ring by means of a torque wrench. Any movement of the elapsed time ring, without release of the securing device, before a torque of three inch-pounds is applied, shall be cause for rejection.

4.4.10 Strap. - Certification shall be obtained as to conformance with 3.9.

4.4.11 Indentification. - A visual examination shall be made to determine compliance with 3.18.

4.4.12 Accuracy. - Prior to the accuracy tests, the watch shall be conditioned by being fully wound and shall have run a minimum of 36 hours without rewinding to determine compliance with 3.4.2. The setting of the regulator shall be checked for compliance with 3.4.5. The watch shall be wound at the beginning of each test and each 24 hours thereafter for the duration of the tests. Daily rates of each watch shall be recorded for a period of three days in each position, and at each temperature specified in 3.10, and the mean daily rate for each test determined therefrom. Any watch, whose mean daily rate exceeds the requirement of 3.10, shall be rejected. This test shall be performed before the watch is subjected to the magnetic field test specified in 4.4.14.

4.4.13 Isochronism. - The watch shall be run for 24 hours to allow settling out and rewound for the beginning of the test and each 24 hours thereafter for a duration of 48 hours. Any watch whose variation in rate exceeds the requirement of 3.11 shall be rejected. The rate shall be determined by reading the dial of the watch.

4.4.14 Magnetic field. - The watch shall be idealized in a 100 ± 10 oersted magnetic field by turning the field on for 3 seconds and off for 3 seconds, repeated 10 times. The watch shall be oriented so that its stem is parallel to the direction of the field. The watch shall subsequently meet the requirements of 3.17.

4.4.15 Vibration. - The watch shall be vibrated in accordance with 3.13 in each of three mutually perpendicular axes, one of which is perpendicular to the plane of the dial.

4.4.16 Shock. - For the crown-up position, the watch without strap shall be positioned and secured to a steel block in such a manner that the area of the rim of the case, between "8 and 10" o'clock, shall be

in full contact with the locating surface of the steel block with pressure applied to a protion of the rim on each side of the stem to prevent shifting at the moment of impact. For the dial-up position, the watch without strap shall be positioned and secured to a steel block in such a manner that the case back will rest on the locating surface of the steel block with pressure applied on the elapsed time ring to prevent shifting at the moment of impact. When the watch is properly positioned and secured, the steel block shall be dropped one foot onto a steel plate at least 1/2 inch in thickness. The weight of the steel mounting block, including securing device, shall be 1.75 pounds ± 1 ounce, and the area of contact at the instant of impact shall be approximately 1.25 square inches. During the drop, care should be exercised to guide the block (with watch) to prevent any gyration.

4.4.17 Storage. - In compliance with 3.16, the unpackaged watch shall be subjected to ambient temperatures as follows:

Store at room temperature (75° ± 3°F.) for 6 hours.
Store at plus 160°F. (± 2°F.) with at least 50 percent relative humidity for 24 hours.
Store at minus 80°F. (± 2°F.) for 24 hours.
Store at room temperature for 24 hours.

The watch shall not be run during the storage test. Temperature changes may be gradual to avoid thermal shock.

4.4.18 Hydrostatic pressure. - Prior to this test, each watch shall be sealed as required by 3.3.1 and inspected to determine that there is a distinct differentiation between the pink and blue portions of the moisture indicator. The ambient temperature during this test shall be 75° ± 10°F. The watch shall be wound and placed in a pressure vessel in any position with the watch running. The watch shall be surrounded with distilled water and subjected to a gradually increasing pressure. The pressure shall be held at 178 ± 5 pounds per square inch gage for 1 hour. The watch shall be removed form the pressure vessel and allowed to sit in the open air for 2 hours. It shall then be visually examined for any evidence of water penetration. Fading of the blue portion of the moisture indicator shall be cause for rejection.

4.4.19 Radiological contamination. - The radiation level and radiological contamination of the completed watch shall be determined in accordance with the following tests:

4.4.19.1 Radiation level. - The radiation level at all surfaces of the watch, using a type AN/PDR -27( ) radiacmeter or approved equivalent, shall not cause an indication greater than 1.5 milliroentgens per hour using the probe with beta shield removed, and with the probe placed against the surface of the watch.

4.4.19.2 Wipe test. - All exposed external surfaces of the watch shall be wiped (one wipe) thoroughly with a piece of filter paper of high wet strength and absorption capacity, which has been previously moistened with a suitable wetting agent. The paper shall then be allowed to dry. The radioactivity of the paper shall be measured. Combined beta-gamma radiation shall not exceed 5 disintegrations per minute per square centimeter. There shall be no detectable alpha contamination.

4.4.20 Final accuracy. - Each watch shall be retested for accuracy to determine compliance with 3.17.

4.4.21 Magnetic effect. - After completion of all other tests, the magnetic effect limit of each watch shall be determined in accordance with Specification MIL-M-19595 (see 6.2), except that the watch shall be idealized, by turning the 100 oersted magnetic field on for 3 seconds and off for 3 seconds, repeated 10 times. Any watch failing to meet the magnetic effect limit of 3.12 shall be rejected.

4.4.22 Repair parts tests. -

4.4.22.1 Magnetic effect. - The magnetic effect of repair parts shall be determined in accordance with Specification MIL-M-19595 (see 6.2), except that the parts shall be idealized by turning the 100 oersted magnetic field on for 3 seconds and off for 3 seconds, repeated 10 times. The distance between the center of a face of the magnetometer head to the surface of the repair part shall be 2 inches.

4.4.22.2 Radiation level. - The radiation level of repair parts shall not exceed 1.5 milliroentgens per hour when measured with a type AN/PDR-27( ) radiacmeter or approved equivalent, using the probe with the beta shield removed. Dials and hands, ordered as repair parts, shall be measured by placing a 1/16-inch sheet of clear plastic or glass between the repair part and the probe to simulate the crystal of an assembled watch.

4.5 Inspection of preparation for delivery. - Sample articles, packages, and packs shall be selected in accordance with the sampling plans of Specification MIL-P-116. They shall be examined and tested in accordance with Specification MIL-P-116 to verify conformance with Section 5 herein. Surfaces of packing boxes shall be measured for radiation level as specified in 5.2.1.3.3.

5. PREPARATION FOR DELIVERY

5.1 Domestic shipment and early equipment use. -

5.1.1 Packaging of nonmagnetic submersible wrist watches. - Packaging shall be sufficient to

afford adequate protection against physical damage during shipment from the supply source to the using activity and until early use.

5.1.1.1 Magnetic effect. - The unit container shall be nonmagnetic and the magnetic effect of container and contents shall be measured in accordance with Specification MIL-M-19595, except that measurement shall be taken at a distance of 2 inches.

5.1.2 Packing. - Packing shall be accomplished in a manner which will insure acceptance by common carrier and will afford protection against physical and mechanical damage during direct shipment from the supply source to the using activity for early use. The shipping containers or method of packing shall conform to the Uniform Freight Classification Rules and Regulations or other carrier regulations as applicable to the mode of transportation.

5.1.2.1 Radiation level. - The radiation level at any surface of the packing container shall not exceed 50 milliroentgens per hour.

5.1.3 Marking. - In addition to any special marking required by the contract or order or herein, interior packages and exterior shipping containers shall be marked in accordance with Standard MIL-STD-129 and Specification MIL-M-19590.

5.1.3.1 Marking materials. - Marking ink, paint, or other marking material containing ferrous oxide or other magnetic dyes shall not be used for marking of interior packages.

5.1.3.2 Special marking. - Interior packages and exterior shipping containers shall be marked with the following information:

"Radioactive material fogs film. DO NOT STORE WITHIN 25 FEET OF UNDEVELOPED FILM."

5.2 Domestic shipment and storage or overseas shipment. - The requirements and levels of packaging, packing, and marking for shipment shall be specified by the procuring activity (see 6.1)

(5.2.1 The following provides various levels of protection during domestic shipment and storage or overseas shipment which may be required when procurement is made (see 6.1):

5.2.1.1 Packaging of watches.

5.2.1.1.1 Level A. - Each watch shall be thoroughly dried, individually protected and packaged in accordance with method III of Specification MIL-P-116. Contact preservative is not required. The unit container shall conform to Specification PPP-B-566 or PPP-B-676, at the option of the contractor. Box closure shall be in accordance with the appendix to the applicable box specification.

5.2.1.1.2 Level C. - Packaging shall be sufficient to afford adequate protection against physical damage during shipment from the supply source to the using activity and until early use. In addition, the unit container shall be nonmagnetic.

5.2.1.1.3 Magnetic effect. - The unit container shall be nonmagnetic and the magnetic effect of the container with contents shall be measured in accordance with Specification MIL-M-19595, except that measurement shall be taken at a distance of 2 inches.

5.2.1.2 Repair parts. -

5.2.1.2.1 Level A. - Repair parts shall be cleaned, preserved, and packaged in accordance with Specification MIL-P-17207. In addition, for all radioactive repair parts, a sheet containing the following information shall be placed inside each repair part unit container:

"WARNING. - This part and the part which it replaces contains radioactive material. Outside of their protective packaging, these parts should be handled only by personnel authorized to repair the watch, using established radiological safety instructions. Damaged or unserviceable parts shall be disposed of through an AEC licensed commercial outlet."

5.2.1.2.1.1 Magnetic effect. - Unit packages of repair parts shall be nonmagnetic when checked for magnetic effect as specified in 5.2.1.1.3.

5.2.1.2.2 Level C. - Not applicable.

5.2.1.3 Packing of watches and repair parts. -

5.2.1.3.1 Level A. - Watches and repair parts shall be packed in fiberboard boxes conforming to class 2, v3c or v3s of Specification PPP-B-636. The style of the box shall be at the option of the contractor. All center and edge seams and manufacturer's joint of the boxes shall be sealed with minimum 3-inch wide tape conforming to Specification PPP-T-60 or PPP-T-76. Steel strapping on boxes shall not be used; boxes shall be banded with tape conforming with Specification PPP-T-97 and applied in accordance with the appendix to the box specification.

5.2.1.3.2 Level B. - Watches and repair parts shall be packed in fiberboard boxes conforming to class 1 of Specification PPP-B-636. The style of the box shall be at the option of the contractor.

5.2.1.3.3 Radiation level. - The radiation level at any surface of shipping boxes containing watches

or repair parts for watches shall not exceed 50 milliroentgens per hour.

5.2.1.4 Marking. - In addition to any special marking required by the contract or order, or herein, interior packages and exterior shipping containers shall be marked in accordance with Standard MIL-STD-129..

5.2.1.4.1 Radioactive materials. - When radioactive material is intentionally added to an item, each unit package and exterior shipping container shall be marked in accordance with Specification MIL-M-19590.

5.2.1.4.2 Marking materials. - Marking ink, paint, or other marking material containing ferrous oxide or other magnetic dyes shall not be used for marking of unit packages.

5.2.1.4.3 Special marking. - Interior unit packages and exterior shipping containers shall be marked with the following information:

"Radioactive material fogs film. DO NOT STORE WITHIN 25 FEET OF UNDEVELOPED FILM."

6. NOTES

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

(a) Title, number, and date of this specification.
(b) Type required (see 1.2).
(c) List of serial numbers to be assigned (see 3.18).
(d) Repair parts requirements (see 3.20).
(e) Preservation and packaging, packing, or marking requirements if other than those required by 5.1 (see 5.2).

6.2 Magnetic effect. -

6.2.1 Applications for submitting equipment for magnetic effect tests should be made to: Superintendent, U. S. Naval Weapons Plant, Washington 25, D. C. The application should be made as far in advance of the anticipated submission date as is practicable, and should contain the following information:

(a) Type of equipment.
(b) Size and type of unit containers to be forwarded.
(c) Quantity submitted.
(d) Date of delivery.
(e) Date completion is desired.
(f) Reports required.
(g) Disposition instructions.

6.2.2 Shipments of equipment submitted for magnetic effect test are to be addressed:

Receiving Officer
U. S. Naval Weapons Plant
Washington 25, D. C.

6.2.2.1 The exterior containers of the shipments should be marked:

FOR INSPECTION ONLY
Attention: Code 980
Contract identification
(Agency and contract number)

6.3 License for radioactive material. - Radioactive isotopes are controlled and licensed by the U. S. Atomic Energy Commission. In order to obtain material containing a radioactive isotope from any domestic source, the supplier of watches under this specification will be required to have a current AEC Byproduct Material License for the particular isotope used (see 3.2.2). In addition, the laboratory or testing facility and the Government activity or activities to which the watches or radioactive repair parts are initially delivered will be required to have current AEC Licenses. Application for an AEC Byproduct Material License may be made to:

U. S. Atomic Energy Commission
Isotopes Branch
Division of Licensing and Regulations
Washington 25, D. C.

6.4 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 Qualified Products List QPL 22176, 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 Bureau of Ships, Department of the Navy, Washington 25, D. C., and information pertaining to qualification of products may be obtained from that activity. Application for Qualification tests shall be made in accordance with "Provisions Governing Qualification" (see 6.5).

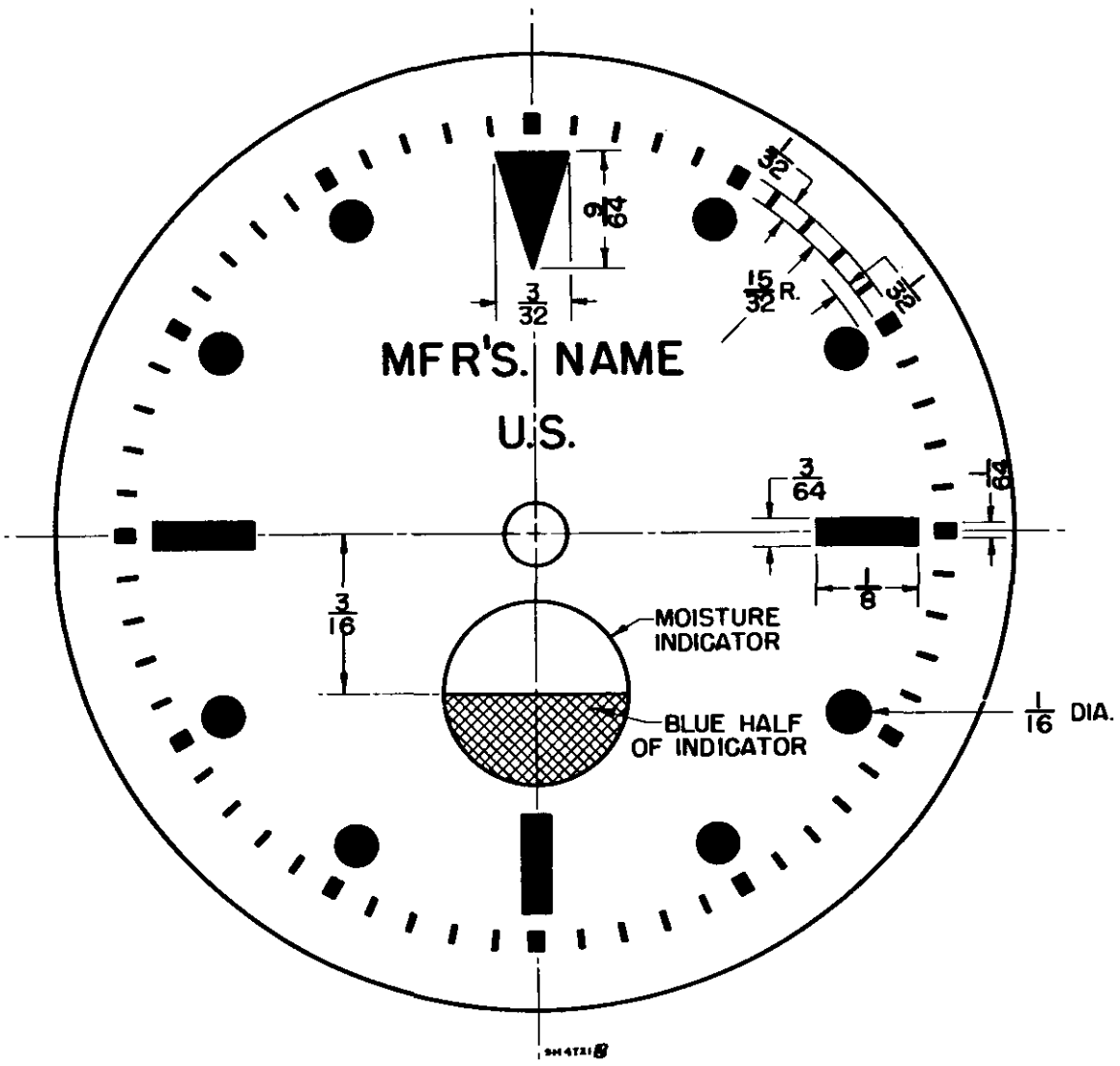
6.5 Copies of "Provisions Governing Qualification" may be obtained upon application to Commanding Officer, Naval Supply Depot, 5801 Tabor Avenue, Philadelphia 20, Pa.

6.6 Crystal strength. - Experience has indicated that a glass crystal must be tempered to obtain an

average stress of 4.7 Kg./mm. 2 to pass the crystal strength test.

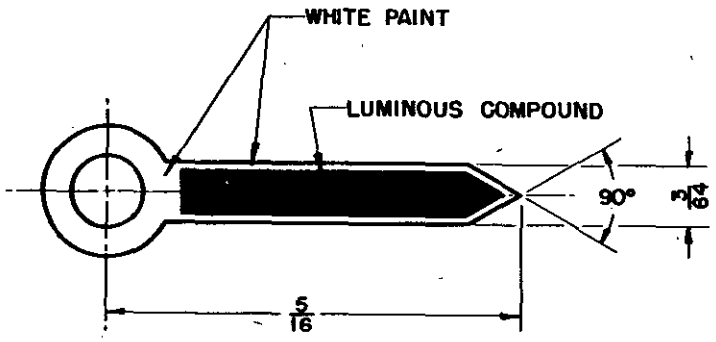
Notice. - When Government drawings, specifications or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation or conveying any rights or permission to manufacture, use or sell any patented invention that may in any way be related thereto.

Preparing activity:
Navy - Ships
(Project 6645-N006Sh)

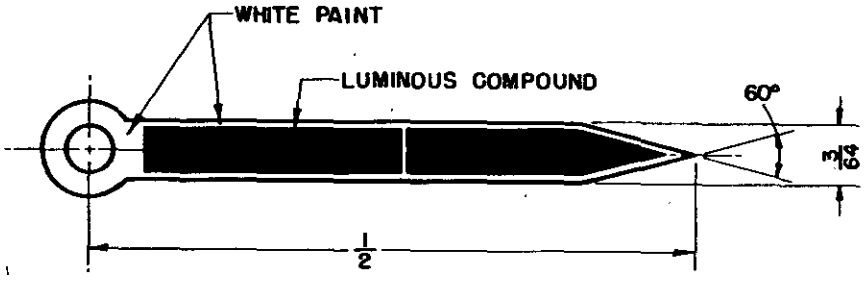


NOTE: ALL DIMENSIONS ARE IN INCHES

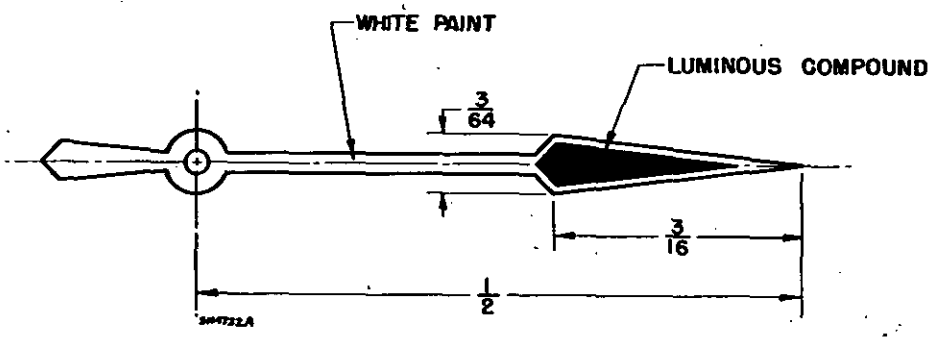
FIGURE 1.-DIAL



HOUR HAND



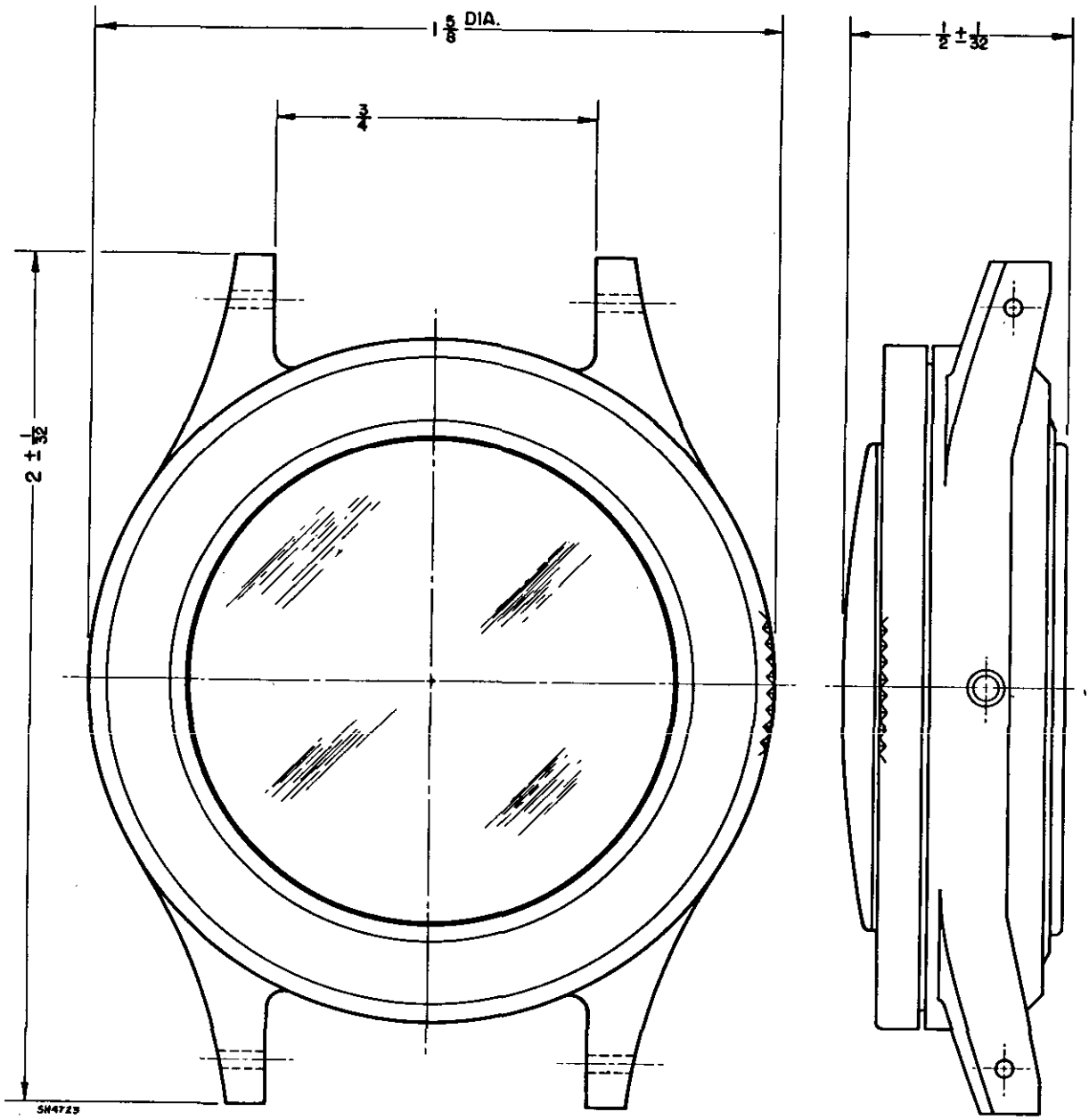
MINUTE HAND



SWEEP-SECOND HAND

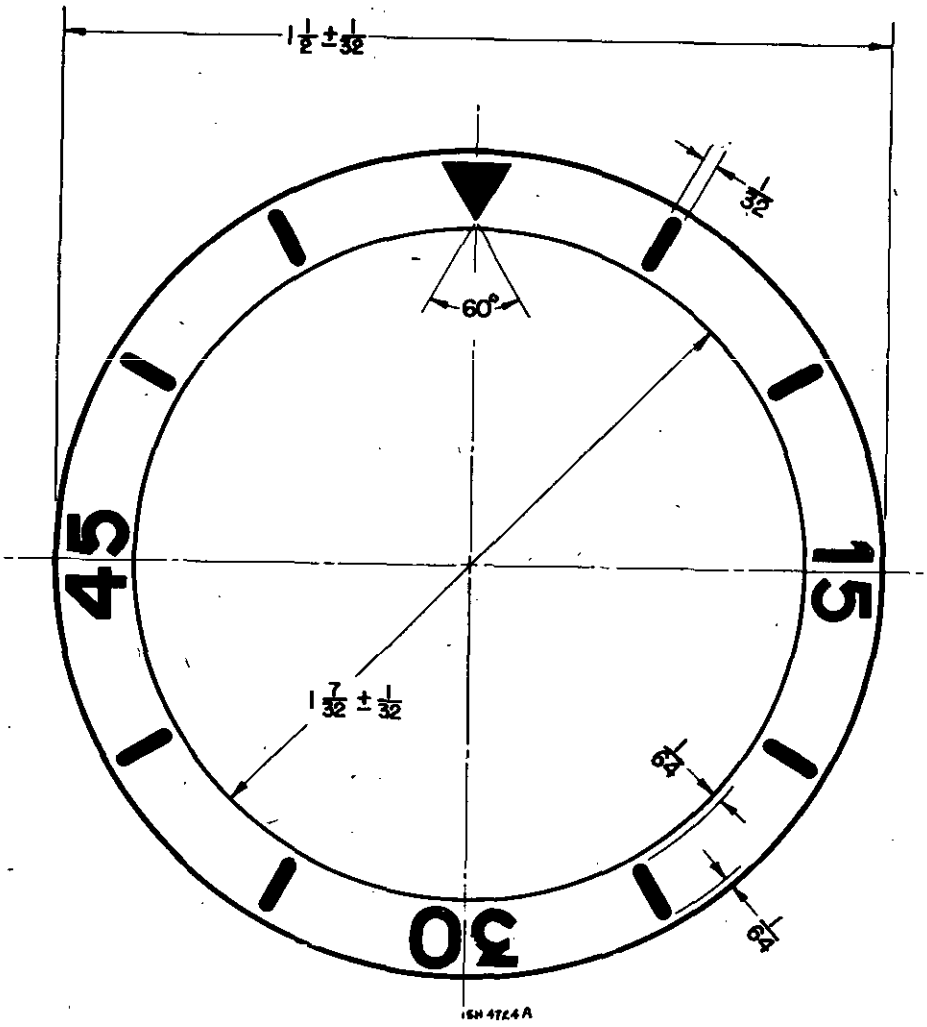
NOTE: ALL DIMENSIONS ARE IN INCHES.

FIGURE 2.-HANDS



NOTE: ALL DIMENSIONS ARE IN INCHES
TOLERANCE: FRACTIONS ± 1/64 UNLESS OTHERWISE SPECIFIED

FIGURE 3. – CASE ASSEMBLY



NOTE: ALL DIMENSIONS ARE IN INCHES

FIGURE 4.- ELAPSED TIME RING SCALE