NRC FORM 313 (9-88) 10 CFR 30, 32, 33, 34, 35 and 40

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED BY OMB 3150-0120
Expires: 5-31-90

APPLICATION FOR MATERIAL LICENSE

INSTRUCTIONS: SEE THE APPROPRIATE LICENSE APPLICATION GUIDE FOR DETAILED INSTRUCTIONS FOR COMPLETING APPLICATION. SEND TWO COPIES OF THE ENTIRE COMPLETED APPLICATION TO THE NRC OFFICE SPECIFIED BELOW.

APPLICATIONS FOR DISTRIBUTION OF EXEMPT PRODUCTS FILE APPLICATIONS WITH:

U.S. NUCLEAR REGULATORY COMMISSION
DIVISION OF INDUSTRIAL AND MEDICAL NUCLEAR SAFETY, NMSS
WASHINGTON, DC 20555

ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS, IF YOU ARE LOCATED IN:

CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, MAINE, MARYLAND, MASSACHUSETTS, NEW HAMPSHIRE, NEW JERSEY, NEW YORK, PENNSYLVANIA, RHODE ISLAND, OR VERMONT, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION I
NUCLEAR MATERIALS SAFETY SECTION B
475 ALLENDALE ROAD
KING OF PRUSSIA, PA 19406

ALABAMA, FLORIDA, GEORGIA, KENTUCKY, MISSISSIPPI, NORTH CAROLINA, PUERTO RICO, SOUTH CAROLINA, TENNESSEE, VIRGINIA, VIRGIN ISLANDS, OR WEST VIRGINIA, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION II
NUCLEAR MATERIALS SAFETY SECTION
101 MARIETTA STREET, SUITE 2900
ATLANTA, GA 30323

IF YOU ARE LOCATED IN:

ILLINOIS, INDIANA, IOWA, MICHIGAN, MINNESOTA, MISSOURI, OHIO, OR WISCONSIN, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION III
MATERIALS LICENSING SECTION
799 ROOSEVELT ROAD
GLEN ELLYN, IL 60137

ARKANSAS, COLORADO, IDAHO, KANSAS, LOUISIANA, MONTANA, NEBRASKA, NEW MEXICO, NORTH DAKOTA, OKLAHOMA, SOUTH DAKOTA, TEXAS, UTAH, OR WYOMING, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION IV
MATERIAL RADIATION PROTECTION SECTION
611 RYAN PLAZA DRIVE, SUITE 1000
ARLINGTON, TX 76011

ALASKA, ARIZONA, CALIFORNIA, HAWAII, NEVADA, OREGON, WASHINGTON, AND U.S. TERRITORIES AND POSSESSIONS IN THE PACIFIC, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION V
NUCLEAR MATERIALS SAFETY SECTION
1450 MARIA LANE, SUITE 210
WALNUT CREEK, CA 94596

PERSONS LOCATED IN AGREEMENT STATES SEND APPLICATIONS TO THE U.S. NUCLEAR REGULATORY COMMISSION ONLY IF THEY WISH TO POSSESS AND USE LICENSED MATERIAL IN STATES SUBJECT TO U.S. NUCLEAR REGULATORY COMMISSION JURISDICTION.

1. THIS IS AN APPLICATION FOR (Check appropriate item)

- [X] A. NEW LICENSE
- [ ] B. AMENDMENT TO LICENSE NUMBER ______
- [ ] C. RENEWAL OF LICENSE NUMBER ______

2. NAME AND MAILING ADDRESS OF APPLICANT (Include Zip Code)

Marathon Watch Company Ltd.
210 Eighth St.
Lewiston, New York 14092

3. ADDRESS(ES) WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED.

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION: Leon Wein

TELEPHONE NUMBER: (716) 754-7559

SUBMIT ITEMS 5 THROUGH 11 ON 8½ x 11" PAPER. THE TYPE AND SCOPE OF INFORMATION TO BE PROVIDED IS DESCRIBED IN THE LICENSE APPLICATION GUIDE.

5. RADIOACTIVE MATERIAL
a. Element and mass number, b. chemical and/or physical form, and c. maximum amount which will be possessed at any one time.

6. PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED.

7. INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING AND EXPERIENCE.

8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS.

9. FACILITIES AND EQUIPMENT.

10. RADIATION SAFETY PROGRAM.

11. WASTE MANAGEMENT.

12. LICENSEE FEES (See 10 CFR 170 and Section 170.31)
FEE CATEGORY
AMOUNT ENCLOSED $

13. CERTIFICATION. (Must be completed by applicant) THE APPLICANT UNDERSTANDS THAT ALL STATEMENTS AND REPRESENTATIONS MADE IN THIS APPLICATION ARE BINDING UPON THE APPLICANT.

THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATION ON BEHALF OF THE APPLICANT, NAMED IN ITEM 2, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PARTS 30, 32, 33, 34, 35, AND 40 AND THAT ALL INFORMATION CONTAINED HEREIN IS TRUE AND CORRECT TO THE BEST OF THEIR KNOWLEDGE AND BELIEF.

WARNING: 18 U.S.C. SECTION 1001 ACT OF JUNE 25, 1948, 62 STAT. 749 MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION.

SIGNATURE—CERTIFYING OFFICER	TYPED/PRINTED NAME	TITLE	DATE
[signature]	Leon Wein	President	89JUL11

FOR NRC USE ONLY

TYPE OF FEE	FEE LOG	FEE CATEGORY	COMMENTS
APP	Jul. 89 ssm	9A* + 3H	*2nd device eval. (exp.) and Jul. 1 4Q	See addtl fee block on 7/26/89 letter.

AMOUNT RECEIVED	CHECK NUMBER	
$1,600/$580	000001/000034	020843

APPROVED BY	DATE
D. Kimberly	10/2/89

NRC FORM 313 (9-88)

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 7.5 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE OFFICE OF INFORMATION AND REGULATORY AFFAIRS, OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

9002020266 900130
PDR FOIA
BICKMAN90-11 PDR

Application for a License to the Nuclear Regulatory Commission
for the Transfer of Compasses Containing Tritium
by Marathon Watch Company Ltd.

PART 32:answers to sections pertinent to application

32.22
(a)(1) Marathon Watch Company Ltd. is applying for a license to transfer compasses containing tritium.

(2)(i) This product is described as a lensmatic compass to be used for U.S. Army Support Troop Command. The design of this specific compass is 25 years old. Enclosed please find construction specifications of the compass.

(ii) The type of byproduct material in each unit is tritium activated, luminous compound; a high specific tritium labelled polymer coated on zinc sulphide.
Quantity: 0.2 gr. for each unit.

(iii) Chemical form of the byproduct material is tritium. The useful life of product is 3-4 years (half life);
no changes in chemical or physical form will occur during the useful life of the product. Physical form is as in (ii).

(iv) The tritium will be encased in glass vials, therefore there will be no solubility in water and bodily fluids.

(v) Enclosed please find copy of specifications outlining construction of the compass.

(vi) Maximum external radiation levels at 5 and 25 cm are both measured as 0 (none) as measured by geiger counter.

(vii) The degree of access to human beings to the product during normal handling and use is that the compass will be hand held and otherwise in a pouch with belt loop attatchments.

(viii) The total quantity of byproduct material expected to be distributed in the product annually

(ix) The expected useful life of the product (compass) is 3-4 years (half life).

(x) The proposed method of marking each unit with appropriate identification is outlined in the compass specifications. Markings will be engraved on the back of each compass.

(xi) Procedures for prototype testing of the product to demonstrate the effectiveness of the containment, shelilding, and other safety features under both normal and severe conditions of handling, storage, use, and disposal of the product will be under Radiological quality assurance

(xii, xiii, and xiv) Results of prototype testing, estimated radiation doses and dose commitments relevant to safety criteria in 32.23 and a determination that the probabilities with respect to the doses referred to in 32.23(d) meet that criteria are met by Marathon by usage of Radiological Quality Assurance Tests per MIL-C-10436L. This military spec outlines procedures followed for diffusion and contamination testing of each finished compass as well as diffusion testing of vials in groups of 100 prior to their installation for the production quantity of 12,800 compasses per month. This would equate to a minimum analysis rate of 26,500 excluding samples from safety survey. DCAS of Frankfurt, West Germany will be monitoring the production as well as quality and safety procedures. (see appendix A)

(xv) Quality control procedures to be followed in the fabrication of production lots and quality control standards will be set by MIL-Q-9858A.

(xvi) Any additional information, including experimental studies and tests, required by the Commission will be given as required.

32.23

(a) The compass is designed and manufactured in accordance to specifications that contain MIL-C-10436L and therefore will not exceed the dose to the appropriate organ as specified in Column I of the table in 32.24 of this part.

(b) In normal handling and storage of the compass, the completed product will be further military packaged by personnel at a military packing house. The dose will not exceed as per table of organ doses in collumn II of the table in 32.24.

(c) It is unlikely that there will be a signifigant reduction in the effectiveness of the containment, sheilding, or other safety features of the product from wear and abuse likely to occur in normal handling and use of the product during its useful life. Compass will be tested and manufactured as specified under MIL-C-10436L and MIL-Q-9858A.

(d) In use and disposal of a single unit, or in handling and storage of the quantities of exempt units likely to accumulate in one location during marketing, distribution, installation, and servicing of the product, the probability is low that the containment, sheilding, or other safety features of the product would fail under suc cicumstances that a person would receive an external radiation dose or committment in excess of the dose to the appropriate organ as specified in Column III of the table in 32.24, and the probability is negligible that a person would receive an external radiation dose commitment in excess of the dose to the appropriate organ as specified in Column IV, of the table in 32.24.

RADIUM-CHEMIE AG TEUFEN

Postfach, CH-9053 Teufen Telefon 071/33 14 15 Telex 77 231 Telefax 071/33 14 95

Appendix 'A'

CERTIFICATE OF PROTOTYPE TESTING

ZELLER TRITIUM PAINT BATCH 07/89 - REGISTERED US NRC No. PS362

This is to certify that the tritium activated luminous paint of production batch 07/89 has been subjected to the prototype testing required under section 32, 14 (11), 10 CFR 32, of the United States NRC Regulations and in accordance with the ENEA and IAEA Standards.

a) 5 Dials coated with Zeller Paint containing 550 millicuries per gram have been attached to the horizontal vibrating table of our FRAIA vibrating machine type VS operating for one hour at a vibrating of 27 cycles per second and 2 G acceleration.

All components have shown no flaking or chipping of paint

b) The dials and hands subjected to the vibrating and bending tests as described under a) have been totally immersed in distilled water at room temperature for 24 hours. The analysis of test water for its radioactive material content by means of liquid Scintillation System Nuclear Chicago Model 4534 showed the following results:

Set No. dials & hands	millicuries of tritium applied	microcuries of tritium in water	percent of tritium in water
1	1.50	1.23	0.08
2	1.98	1.47	0.07
3	2.63	1.95	0.07
4	3.55	2.31	0.06
5	6.70	4.29	0.06

The Tritium paint batch 07/89 has been manufactured fully in accordance with the information desposited with U.S. Atomic Energy Commission on March 14, 1962 and it meets the test requirements stated in Section 42, 14, title 10, code of Federal Regulations, part 32.

CH-9053 Teufen, 1st July, 1989/ee

RADIUM-CHEMIE LTD.

A. Zeller

Leuchtfarben
Einige kristalline Verbindungen, wie z. B. Zinksulfide, haben die Fähigkeit, Strahlungsenergie aufzunehmen und wieder als sichtbares Licht zu emittieren. Im Gegensatz zu phosphoreszierenden, inaktiven Leuchtpigmenten, die nach Anregung mit Licht einen abnehmenden Nachleuchteffekt besitzen, oder fluoreszierenden Pigmenten, die UV-Licht in sichtbares Licht umwandeln, besitzen radioaktive Leuchtpigmente einen Dauerleuchteffekt.
Die in der Vergangenheit hauptsächlich verwendeten Energieträger waren die Isotopen Radium-226 und später Prometium-147. Leuchtfarben mit ^{147}Pm aktiviert stehen weiterhin in allen Helligkeits- und Farbstufen zur Verfügung.
Mit zunehmenden strahlenhygienischen Anforderungen sind obige Isotopen durch Tritium aktivierte Leuchtpigmente verdrängt worden, deren sehr schwach ionisierende ß-Strahlung durch Bruchteile von Millimeter irgend eines Materials vollständig absorbiert wird.
Kohlenstoff-14 aktivierte Leuchtpigmente gelangen aus preislichen Gründen nur dort zum Einsatz, wo speziell hohe Anforderungen an Helligkeitsstabilität gefordert werden. Sie dienen besonders zur Herstellung von CARBOLUM Standardlichtquellen.

Tritium-Leuchtfarben
sind aktivierte Zinksulfid- oder Zinksilikatpulver mit einer mittleren Kristallgrösse von 20µ. Die Eigenfarben sind gelblich bzw. weiss, mit einem Emissionsmaximum von 520 nm, für welches das menschliche Auge eine maximale Empfindlichkeit besitzt. Zur Daueranregung sind die Leuchtpigmente mit Spuren einer schwerlöslichen, tritiierten Polymerschicht von hoher spezifischer Aktivität überzogen. Die beigefügte Menge Tritium ist ausschlaggebend für die Helligkeit (Tab. 1). Die visuelle Erkennbarkeit einer Leuchtmarkierung ist zudem von der Fläche und Schichtdicke (Abb. 2), sowie der Ablesentfernung abhängig.
Die Helligkeit klingt bei Leuchtfarben in Pulver schneller ab als in aufgetragenem Zustand, d. h. mit Bindemittel vermischt (Abb. 3). Die Pigmente haben im gelblichen Naturfarbton die beste Leuchtkraft; jedes zusätzliche Einfärben hat einen entsprechenden Verlust an Helligkeit zur Folge und erfordert deshalb für glei-

Matières Luminescentes
Quelques composés cristallins, par exemple les sulfures de zinc, ont la capacité d'absorber de l'énergie de rayonnement et de l'émettre ensuite sous forme de lumière visible. Contrairement aux pigments luminescents inactifs qui ont un effet phosphorescent après excitation par la lumière, ou les poudres organiques fluorescentes qui transforment de la lumière ultra-violette en lumière visible, les matières radioluminescentes montrent un effet luminescent permanent.
Les isotopes Radium-226 et plus tard le Prométhium-147 représentaient les porteurs d'énergie utilisés les plus fréquemment dans le passé. Les matières luminescentes au ^{147}Pm sont toujours disponibles dans différents degrés de luminance et couleurs.
Les paramètres de radioprotection étant devenus de plus en plus rigoureux, l'isotope Tritium a été introduit comme nouveau produit pour la fabrication de matières luminescentes. La radiation ionisante bêta très faible du Tritium peut être absorbée facilement par une fraction d'un millimètre d'un matériel quelconque.
Des matières luminescentes activées au carbone-14 sont également à disposition. Celles-ci offrent une excellente stabilité de luminance mais elles sont très coûteuses. Les pigments au ^{14}C sont utilisés couramment pour la production de sources étalons luminescentes CARBOLUM.

Matières Luminescentes activées au Tritium
Ces pigments sont composés de fines poudres de sulfure de zinc ou silicate de zinc d'un grain moyen de 20 µ activés au Tritium. Les couleurs naturelles sont jaunâtres ou blanches d'une émission maximale de 520 nm, dont l'oeil nu possède la meilleure perception. Pour obtenir un effet autoluminescents, on enrobe ces pigments d'une fine pellicule d'un polymère tritié insoluble d'une activité spécifique très élevée. La quantité de tritium employée influence le degré de luminosité (fig. 1). La perception visuelle d'un marquage luminescent dépend également de la surface garnie, de l'épaisseur du dépôt (fig. 2) ainsi que de la distance de lecture.
La luminosité des matières en poudre diminue plus vite que celle des matières posées dont la poudre est mélangée avec la colle (fig. 3). Les pigments de teinte naturelle (jaunâtre) donnent le meilleur rendement lumi-

Luminous Compounds
Some crystalline compounds, such as zinc sulphides, have the ability to take up radiation energy and to emit the same as visible light. Radioactive pigments offer a permanent luminous effect as opposed to phosphorescent inactive luminous pigments, which show a decreasing afterglow after excitation by light, or pure fluorescent pigments which transfer UV light into visible light.
The isotopes Radium-226 and subsequently Promethium-147 were the energy carriers commonly used in the past. Luminous pigments containing Promethium-147 are still available in differing luminous intensities and colours.
With the requirements for protection from radiation becoming more and more rigorous, the isotope Tritium has been introduced as a new raw material for the manufacture of self-luminous pigments. The low energy beta radiation of Tritium can be absorbed completely by fractions of a millimeter of any available material.
Carbon-14 activated luminous pigments are also available. They offer excellent light stability but tend to be costly. C-14 compounds are used mainly for the manufacture of CARBOLUM light standards.

Tritium Luminous Pigments
Tritium compounds are powders consisting of fine-grain tritium activated zinc sulphide or zinc silicate crystals with an average grain size of 20µ. The natural colours are yellowish or white with a dominant wavelength of 520 nm, for which the human eye has the greatest sensitivity. Traces of an almost insoluble tritiated polymer layer of high specific activity produces a continuous excitation of the phosphors. The amount of tritium incorporated determines the brightness of the luminous material (fig. 1). The visual perceptibility of any luminous marking also depends on the size of the painted surface, the paint layer (fig. 2) and the viewing distance.
The brightness of powder compound decreases more rapidly than that of applied paint, i.e. when mixed with suitable binders (fig. 3). All pigments offer the best luminosity in the natural yellowish shade; any additional coloration causes less light emission and more activity is required to achieve equal luminiscence (fig. 4). The dry powder brightness is expressed in millapostilbs (masb) or in

Radium-Chemie

che Lichtstärke eine erhöhte Aktivität (Tab. 4). Die Pulverhelligkeit wird in Millapostilb (masb) oder Mikrolambert (µL) ausgedrückt und die flächenspezifische Lichtstärke für gestrichene Farben in Mikrocandela/cm² (µcd/cm²). Jede Prüfung von Dauerleuchtfarben soll bei vollständiger Dunkelheit und mit an diese adaptiertem Auge erfolgen. Das Leuchtpigment oder bestrichene Objekt ist vorgängig mindestens 20 Minuten vor jedem Lichteinfluss zu schützen.
Durch die ISO-Norm 3157 sind Helligkeitsstufen, Einfärbung und Qualitätsanforderungen festgelegt.
RADIUM CHEMIE AG produziert zudem weitere Farb- und Leuchtstufen, die den Anforderungen dieser Norm entsprechen.

nescent. Plus une matière est teintée, plus l'absorption de la luminosité augmente et une quantité d'activité plus importante est nécessaire pour arriver à la même luminance (fig. 4). On exprime la luminescence de la poudre en millapostilb (masb) ou microlambert (µL) et l'intensité lumineuse spécifique par unité de masse de poudre appliquée est exprimée en microcandela/cm² (µcd/cm²). Tout contrôle de matières et dépôts luminescents doit se faire dans l'obscurité complète. Il est indispensable de soustraire le pigment ou l'objet garni de toute influence lumineuse pendant au moins 20 minutes.
La norme ISO 3157 couvre les définitions se rapportant aux classes de luminance, les couleurs et les caractéristiques de qualité. RADIUM-CHEMIE offre également d'autres degrés de luminosité et couleurs qui correspondent à cette norme.

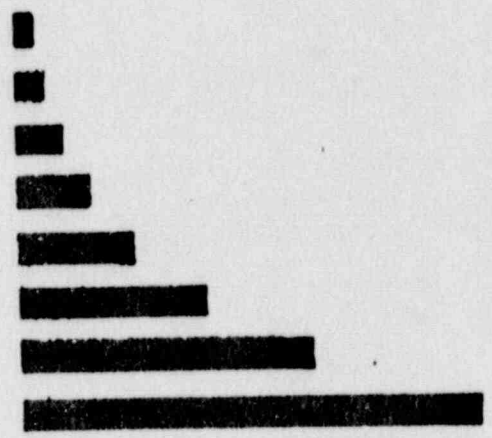
microlamberts (µL) and the surface specific luminous intensity of painted compound is expressed in microcandela/cm² (µcd/cm²). Any accurate visual inspection or comparison must be carried out in complete darkness after the eyes have become dark-adapted. The luminous powder or painted object must previously have been kept in complete darkness for at least 20 minutes to eliminate any effects from light activation.
ISO Standard 3157 determines the luminous intensity classes, the colours and the general quality requirements. RADIUM-CHEMIE also produces other intensity classes and colours which fully meet the ISO Standard requirements.

Fig 1

Leuchtstärkeklassen — Classes d'intensité lumineuse — Classes of luminous intensity
ISO - 3157

Klasse classe class	mCi/gr Farbe 3 couleur 3 colour 3	masb Pulver poudre powder	masb Anstrich 50 mg/cm² dépôt 50 mg/cm² deposit 50 mg/cm²	µcd/cm²	µcd/g
1	16	20	4.0	0.13	2.5
2	25	30	6.5	0.2	4.0
3	40	48	10	0.32	6.3
4	65	70	16	0.5	10
5	100	105	25	0.8	16
6	160	170	40	1.25	25
7	260	275	63	2.0	40
8	400	430	100	3.15	63

(10 masb ≈ 1 µL)



Anmerkung: Im Bedarfsfalle können zusätzliche Klassen 9 und 10 geliefert werden.
Note: On peut introduire, en cas de besoin, des classes supplémentaires 9 et 10.
Note: In case of need, supplementary classes 9 and 10 may be introduced.

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Fig 2

Relative Helligkeitsausbeute- $\left(\frac{\text{Anstrich}}{\text{Pulver}}\right)$ vs. Schichtdicke

Intensité lumineuse relative $\left(\frac{\text{dépôt}}{\text{poudre}}\right)$ vs. épaisseur du dépôt

Relative Luminous Intensity $\left(\frac{\text{deposit}}{\text{powder}}\right)$ vs. thickness of deposit

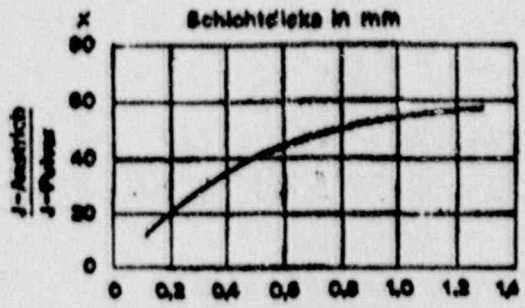

Fig 3

Durchschnittlicher Helligkeitsabfall einer gestrichenen Farbe mittlerer Leuchtstärke

Déclin de l'intensité lumineuse d'une classe moyenne sous forme de posage

Luminous decay of applied medium class compound

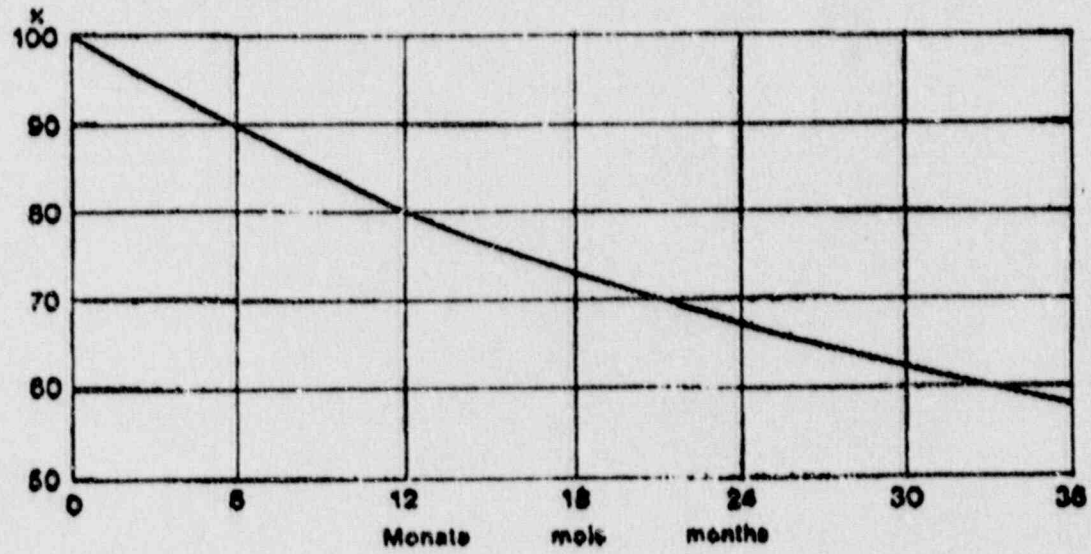

Fig 4

Genormte Farben Couleurs normalisées ISO - 3157 Standardized colours	Relative Lichtausbeute Intensité lumineuse relative Relative luminous intensity	Relativer Aktivitätsgehalt Contenance d'activité relative Relative radioactivity content
1 — weiss, blanc, white	70 %	145 %
3 — gelb, jaune, yellow	100 %	100 %
5 — gelb-grün, jaune-vert, greenish-yellow	97 %	103 %
7 — grün, vert, green	81 %	124 %
9 — grün-blau, vert-bleu, blue-green	76 %	132 %

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Verarbeitung
Die Leuchtpigmente werden normalerweise in Pulverform geliefert, mit entsprechender Menge Bindemittel für die Verarbeitung. Für jede Auftragungsart sind geeignete Bindemittel entwickelt worden, die eine einwandfreie Verarbeitung, sowie vorschriftsgemässe Haftfestigkeit gewährleisten. Zur rationellen Belegung wird ein speziell entwickelter Streichstift oder eine leistungsfähige Siebdruckmaschine empfohlen.
Leuchtfarben sind auf möglichst hellen Grund aufzutragen, um ein Maximum an Helligkeit zu erreichen. Mit einem Gramm Leuchtpigment kann, bei einem Auftrag von 0,25 mm Schichtdicke, eine Fläche von 15 - 20 cm^2 belegt werden. Als Richtwert für eine gut streichfähige Masse sind 2 gr Pigment mit 1 gr Lack zu mischen. Das Vermischen hat in einer künstlich entlufteten Unterdruckzelle zu erfolgen. Desgleichen sind sämtliche Vorräte an radioaktiven Tritiumleuchtfarben in einer solchen aufzubewahren.

Hygienische Massnahmen
Obwohl Tritium wesentlich günstigere strahlenhygienische Parameter aufweist als die andern bis anhin verwendeten Isotopen (reiner β-Strahler, max. Energie 18 keV, biologische Halbwertzeit zirka 10 Tage), sind in Anbetracht der grossen Aktivitätsmengen, im Umgang mit Tritium-Leuchtfarben Sicherheitsvorkehrungen zu treffen.

- Radioaktive Leuchtfarben sind bei der Verarbeitung als offene Strahlenquelle zu handhaben.
- Alle Arbeitsgänge sind so zu organisieren, dass eine Kontamination von Personen und Gegenständen möglichst vermieden wird.
- Jede Person, bei der die Möglichkeit einer Kontamination besteht, hat sich beim Verlassen des Arbeitsraumes einer entsprechenden Kontrolle mit UV-Lampe und, wenn nötig, einer Dekontamination zu unterziehen. Das zum Reinigen und Trocknen kontaminierter Hände, Gegenstände, Arbeitsplätze und dergleichen benützte Material darf nur einmal verwendet werden.
- Kontaminiertes Reinigungsmaterial und Abfälle sind in eigens für radioaktive Abfälle bestimmte Behälter zu deponieren und an die zuständigen Behörden zur Vernichtung zu übergeben.

Préparation et Application
Les matières luminescentes sont normalement fournies sous forme de poudre ainsi qu'une quantité suffisante de colle pour l'application. Il existe des colles appropriées à chaque mode d'application. Celles-ci permettent un passage facile et parfait tout en donnant une adhérence qui correspond aux prescriptions. Un stylo approprié et une machine à sérigraphier sont à disposition pour l'application économique des peintures luminescentes.
Les matières luminescentes sont à appliquer sur un fond clair pour obtenir un bon rendement de luminance. Un gramme de matière est suffisant à couvrir une surface de 15 à 20 cm^2 d'une épaisseur de 0,25 mm. Pour obtenir une masse facile à travailler, on utilisera approximativement 2 grammes de poudre pour 1 gramme de colle. Le mélange de poudre avec colle doit se faire dans une cellule à dépression ventilée où les stocks de pigments radioluminescents sont également conservés.

Mesures Hygiéniques
En dépit des paramètres de radioprotection beaucoup plus favorables du Tritium par rapport aux autres isotopes utilisés jusqu'à présent (émetteur de radiation bêta pure, énergie maximale 18 keV, demi-vie biologique env. 10 jours), des mesures de protection sont à prévoir pour la manipulation de matières luminescentes au Tritium du fait de la concentration importante de radioactivité.

- Les matières radioluminescentes sont à considérer pendant l'application comme source de radiation non-scellée.
- Toutes les opérations sont à organiser de façon à éviter une contamination des personnes et des ustensiles.
- Chaque personne qui pourrait avoir subi une contamination durant le travail doit se soumettre à un contrôle à la lampe ultra-violette en quittant l'atelier et, si c'est nécessaire, à une décontamination. On n'utilisera qu'une fois le matériel destiné à nettoyer et sécher les mains ou objets contaminés (postes de travail ou autres).
- Les objets de nettoyage contaminés sont à conserver dans un récipient prévu pour les déchets radioactifs et sont à remettre à l'autorité compétente en vue de destruction.

Application
Luminous pigments are normally supplied as a powder, together with an adequate quantity of binder and solvent for processing. There are acid-free lacquers available for every individual application method any one of which ensures proper painting characteristics and also excellent adhesion. A specially designed Stylograph pen or an efficient screening machine are recommended for the economical processing of Tritium paints.
Luminous products must be applied to light coloured surfaces in order to obtain maximum brightness. One gram of powder is adequate to cover a surface of 15 to 20 cm^2 at a layer of 0,25 mm. Two grams of powder material with one gram of binder are normally mixed as a guide to get a flowing paint. The initial mixing of dry powder with lacquer should be carried out in a glove-box with assisted ventilation. Stocks of radioactive pigments and paints must also be stored in similar facilities.

Hygienic Precautions
Although the radiological health parameters are more favourable for Tritium than for any other isotope used until now (pure beta emitter, weak energy of 18keV maximum, biological half-life about 10 days), safety measures need to be taken when processing tritium luminous materials, in view of the substantial amounts of activity involved.

- Radioactive luminous products are to be considered as unsealed sources during the processing stage.
- All operations are to be organized in such a manner that contamination of persons and objects is avoided.
- If contamination does occur, the person or persons involved will undergo repetitive inspections on leaving the working zone (with UV lamp), and undertake to carry out a thorough decontamination, if necessary. Every item used for cleaning and drying of contaminated hands, objects and work-table shall not be used more than once.
- Contaminated cleaning material and residues shall be properly disposed of in a closed container designed for radioactive waste only and shall be delivered to the competent authorities.
- While in the work room, hands, equipment and any articles which

5

— Im Arbeitsraum sind Hände, Geräte und Gegenstände, welche der Kontamination ausgesetzt sind, von Mund und Atmungszone fernzuhalten. Nahrungsmittel und Getränke, Rauchwaren, kosmetische Artikel und dergleichen dürfen nicht in die Arbeitsräume gebracht werden.
— Der Arbeitsraum muss ausreichend natürlich oder künstlich belüftet sein. Jeder Arbeitsplatz soll zudem mit einer separaten Absaugung versehen sein.
— Die Ueberwachung des Personals soll durch regelmässige Messung des Tritium-Gehaltes im Urin geschehen.
— Da jeder Umgang mit radioaktiven Stoffen bewilligungspflichtig ist, müssen die gesetzlichen Bestimmungen des jeweiligen Verbraucherlandes beachtet werden.

— Les mains, outils et objets qui risquent d'être contaminés durant le travail doivent être tenus à distance de la bouche et la zone influencée par la respiration. Les aliments, boissons, cigarettes et cosmétiques ne doivent jamais se trouver dans la zone controlée.
— L'atelier doit être aéré fréquemment. Chaque poste de travail doit être équipé d'une aspiration.
— Le contrôle du personnel se fait par des mesures périodiques de concentration de tritium dans l'urine.
— Nous rappelons à ce sujet les prescriptions des différents pays contenues dans l'ordonnance concernant la protection contre les radiations.

might be subjected to contamination must be kept away from the mouth and breathing zone. Articles of food, drinks, cigarettes and cosmetics shall not be permitted in the working area.
— The working room requires natural or assisted ventilation; every work-table shall be equipped with an additional exhaust.
— The operators shall be controlled by regular measurements for the tritium content in urine.
— Since every operation with radioactive substances requires a licence, the prevailing regulations for protection from radiation of any individual country need to be observed.

RADIUM-CHEMIE AG
Schweiz - Suisse - Switzerland
9053 TEUFEN
☎ 071 / 33 14 15 · Telex 77231

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JULY 6, 1989

TO WHOM IT MAY CONCERN:

OUR BUSINESS LOCATED AT THE ABOVE ADDRESS IS IN A SECURE BUILDING ONLY 11 YEARS OLD, MADE OF BRICK AND BLOCK, WITH LOCKS AND DEAD BOLTS ON ALL THE DOORS AND NO WINDOWS IN THE WAREHOUSE. THE PROPERTY IS FENCED IN WITH GATES THAT ARE LOCKED AT NIGHT. WE ARE LOCATED ACROSS THE STREET FROM A BANK SO THE POLICE PATROL FREQUENTLY. ALSO, ALL OF OUR EMPLOYEES HAVE HAD BACKGROUND CHECKS AND THEY ALL HAVE CLEAN RECORDS.

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LOIS WEBER
VICE-PRESIDENT

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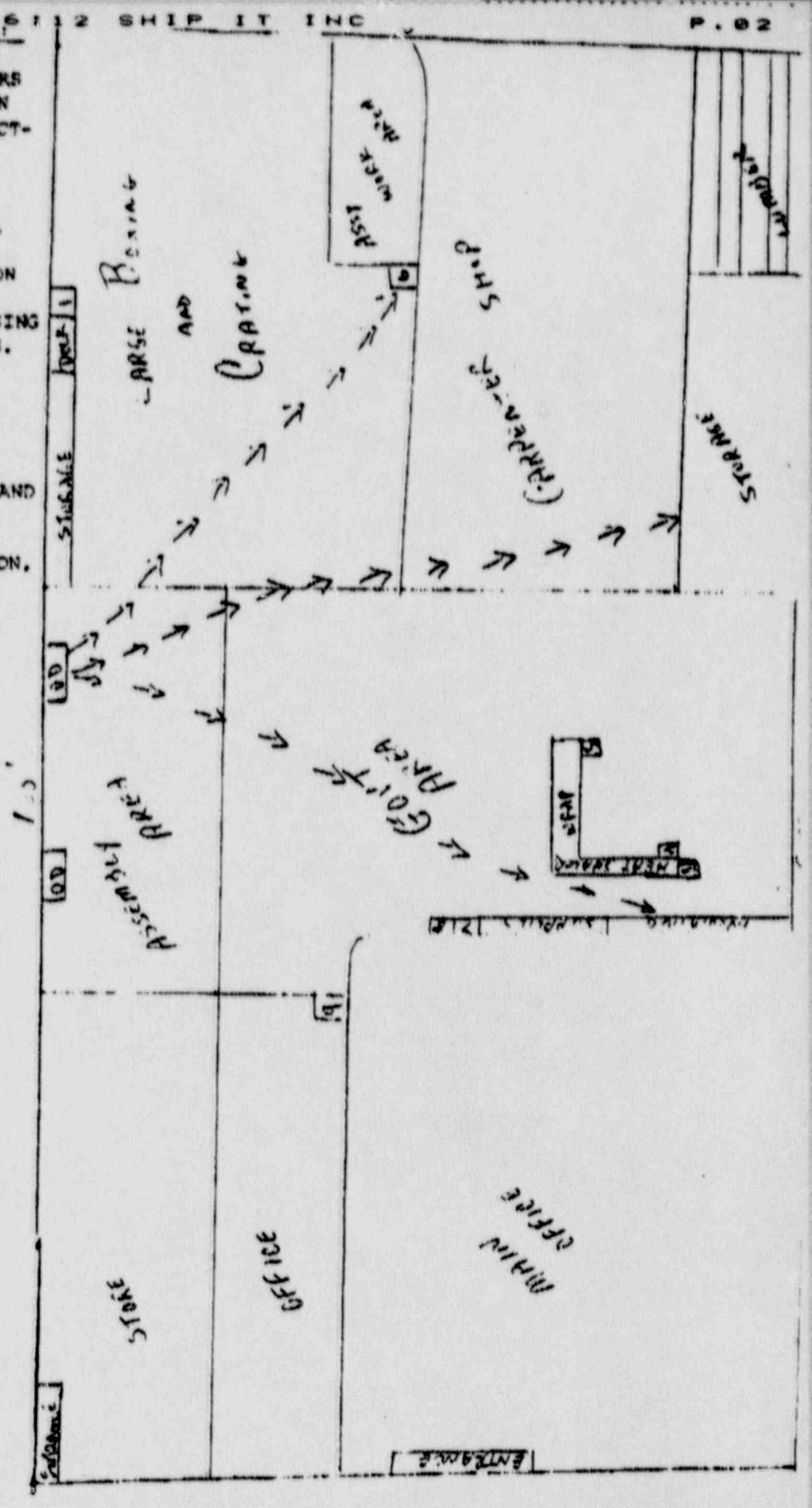
PACKING, CRATING AND INSPECTION.

CALIBRATIONS AND RECORDS.

TESTS AND CONFORMANCE ASSURANCE.

GOVERNMENT OAK DESK



TEL. (416) 475-9420
TELEX: 06-966849
Cable: Morwein-Markham
FAX: (416) 475-2536

MARATHON MANAGEMENT COMPANY
(A SUBSIDIARY OF MARATHON WATCH COMPANY LTD.)
67A STEELCASE RD. WEST, MARKHAM, ONT. L3R 2M4

August 24, 1989

Nuclear Regulatory Commission
1 White Flint North
11555 Rockville Pike
Rockville, MD 20852

Attention: Floyd Deschamps (301) 492-0503
Re: Compasses

Dear Mr. Deschamps,

This letter is in reference to your letter of August 16, 1989, the following are the answers to your questions.

1. It is difficult to be precise in regards to the results to an accident whereby a number of compasses would be destroyed in the same area; because it depends on the size of the room or the stockroom and if the room is equipped with aspiration or not. However, we will try to explain as per the following example:
   1 kuri = 100 millirem
   100 millirem are used for 20 compasses
   20 compasses = 50 millirem
   If the room is small without aspiration, 100 millirem (20 compasses) will send over the room the equivalent of a X-Ray machine used once. It means there is no danger.
2. Model number for compass is CO 190001

Answer to No. 3 will follow.

We hope the above information is to your satisfaction.

Yours truly,

MARATHON MANAGEMENT COMPANY LTD.

Leon Wein

/cw

TEL. (416) 475-9420
TELEX: 06-986649
Cable: Morwein-Markham
FAX: (416) 475-2535

MARATHON MANAGEMENT COMPANY
(A SUBSIDIARY OF MARATHON WATCH COMPANY LTD.)
67A STEELCASE RD. WEST, MARKHAM, ONT. L3R 2M4

July 26, 1989

Nuclear Regulatory Commission
Commercial Secion
Medical Academic & Commercial Use
Safety Branch
N.M.S.S.
1 White Flint North
11555 Rockville Pike
Rockville, MD. 20852

Attention: Floyd Deschamps
Mail Stop 6H3 301-492-0503

Dear Mr. Deschamps,

Enclosed please find a copy of MIL-W-46374E requiring glass vial encapsulated tritium for our mechanical and quartz wrist watches. We need to adjust our license to qualify for this MIL-W-46374 Revision E. If we need to submit any additional fees for the above please advise and we will send you a cheque immediately.

With reference to your question on amount of millicuries per compass, we will reply you after after August 7, 1989.

Thank you very much for your co-operation.

Yours truly,

MARATHON WATCH COMPANY LTD.

Leon Wein

/lz

Encl.

June 20, 1989

Department of the Army
Headquarters, U.S. Army Armament
Munitions and Chemical Command
Picatinny Arsenal, New Jersey 07806-5000

Attention: Mr. Paul Tremblay/SMCAR-BAC-S

Dear Mr. Tremblay,

With reference to your letter of June 8, 1989 regarding MIL-W-46374 Revision E.

We wish to qualify for this Military Specification MIL-W-46374 revision E. We would like to submit our mechanical and our quartz watches with the new (glass vial encapsulated tritium). Please advise how many watches we need to submit to the government to be tested.

Thank you very much for your co-operation.

Yours truly,

MARATHON WATCH COMPANY LTD.

Leon Wein

/lz

DEPARTMENT OF THE ARMY
HEADQUARTERS, U.S. ARMY ARMAMENT, MUNITIONS AND CHEMICAL COMMAND
PICATINNY ARSENAL, NEW JERSEY 07806-5000

June 8, 1989

REPLY TO
ATTENTION OF

SMCAR-BAC-S

Marathon Watch Company
67A Steelcase Road, West
Markham, Ontario
Canada L3R 2M4

Dear Sir:

The enclosed is an advance copy of Revision E to MIL-W-46374. As you probably recall, watches with tritium painted features were discovered to have very high disintegrations per minute counts after even limited (days) packaged condition periods.

The proposed solution, glass vial encapsulated tritium, was the draft Revision E as forwarded to your company and the user DoD community for comment. The result of this coordination is the enclosed MIL-L-W-46374E, effective May 31, 1986. The associated Qualified Products List, QPL-46374, has also been revised to indicate zero sources of supply.

The new specification will shortly be advertised in the Commerce Business Daily. However, as a once qualified source to the Revision D to MIL-W-46374, should you elect to qualify to the Revision E and with the same movement as qualified under Revision D, an abbreviated test program will be arranged. This is simply in recognition of the fact that if a qualified movement is used in a watch with tritiated vials, tests such as magnetism, isochronism and accuracy (including long term) need not be performed.

The point of contact for the above is Mr. Paul Tremblay, telephone number (AC 201) 724-6671.

Sincerely,

T. Chleboski
Chief, Specifications and
Standardization Office

Enclosure

INCH - POUND

MIL-W-46374E
31 May 1989
SUPERSEDING
MIL-W-46374D
10 OCTOBER 1986

MILITARY SPECIFICATION

WATCH, WRIST: GENERAL PURPOSE

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

1. SCOPE.

1.1 Scope. This specification covers mechanical and mechanical/quartz wrist watches intended for general use.

1.2 Classification. Watches shall be of the following types and colors, as specified (see 6.1 and 6.2).

Types

1 - Mechanical analog, fifteen jewel, maintainable
2 - Mechanical analog
3 - Quartz analog with battery installed
4 - Quartz analog; battery out of watch but packed with watch
5 - Quartz analog; battery not included with watch

Colors

M - Silvery metallic
B - Black
O - Olive drab

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document, should be addressed to: Commander U.S. Army ARDEC, ATTN: SMCAR-BAC-S, Picatinny Arsenal, New Jersey 07806-5000 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A
FSC 6645
DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

2. APPLICABLE DOCUMENTS.

2.1 Government documents.

2.1.1 Specifications, standards and handbooks. The following specifications, standards and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

Federal

L-P-392	Plastic Molding Material, Acetal, Injection and Extrusion
PPP-T-360	Time Measuring Instruments, Packaging Of
PPP-B-566	Boxes, Folding, Paperboard
PPP-B-636	Box, Fiberboard
PPP-B-676	Boxes, Set-up Paperboard

Military

MIL-I-45607	Inspection Equipment, Supply and Maintenance Of
MIL-S-46383	Strap, Wrist: Instrument

STANDARDS

Federal

FED-STD-313	Material Safety Data Sheets, Preparation and Submission Of
FED-STD-595	Colors

Military

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-109	Quality Assurance Terms and Definitions
MIL-STD-129	Marking for Shipment and Storage

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

2.1.2 Other Government documents and publications.

CODE OF FEDERAL REGULATIONS
Nuclear Regulatory Commission, Rules and Regulations
Title 10 - Chapter I, Parts 30 and 32

(Applications for copies should be addressed to Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS.

3.1 Qualification. The watches furnished under this specification shall be products which are authorized by the qualifying activity for listing on the applicable Qualified Products List at the time set for opening of bids (see 4.3 and 6.7).

3.2 Design and construction. Watches shall have a plastic or corrosion resistant steel case and a strap. A stem set movement shall drive luminous concentrically mounted hour and minute hands around a 12 hour dial having luminous vials. The watch design shall be such that parts will not loosen in service. Figures forming a part of this specification are intended for guidance in physical and dimensional detail. Alternative designs and dimensional deviations are permissible but subject to prior Government approval (see 6.7).

3.2.1 Materials. All materials shall be of a uniform quality and free from any defects which might impair the function, accuracy, wear resistance or safety. Material which is not specified by a definite material specification shall be of a composition and quality that will enable the watch to meet all applicable requirements of this specification.

3.2.1.1 Self-luminous features. Self-luminous features shall be luminous vials consisting of glass encapsulated phosphor with the hydrogen isotope tritium, in gaseous form, as an exciter: Vials shall contain not more than one percent of tritium oxide and not more than six percent total impurities. Any watch shall contain no more than 25 millicuries of tritium.

3.2.1.2 Nuclear Regulatory Commission license. At the time of contract award, contractor must possess a valid U.S. Nuclear Regulatory Commission (NRC) or Agreement State Byproduct Material License which authorizes possession of sufficient elemental tritium to fulfill contract requirements and which authorizes manufacture of radioactive instruments and articles (i.e., watches). The contractor must also possess an NRC license issued pursuant to 10 CFR 32 which authorizes manufacture and distribution to the general public of the contracted watches as license exempt items. A copy of these licenses, with license application package, will be provided to the contracting officer.

3.2.1.3 Toxicity. The finished product covered by this specification shall have no adverse effect on the health of personnel when used for its intended purpose. Questions pertinent to this effect shall be referred by the contracting activity to the appropriate departmental medical service who will act as an advisor to the contracting agency.

3.2.2 Protective finish. All metal parts, which are susceptible to corrosion and not protected by a lubricant, shall be protected by a protective finish or preservation except those parts whose proper functioning would be detrimentally affected.

3.2.3 Movements.

3.2.3.1 Movement and manufacturer identification. Preferably at the time of "application for qualification testing" but no later than the date of initiation of such testing, the watch manufacturing or distributing source of supply shall submit to the Government activity identified in 6.7 the name and plant address of the manufacturer of the actual movement employed in the finished watch and the caliber and similarly descriptive movement identification. Any change in movement manufacturer or plant address of the manufacturer or choice of movement employed in the watch design without first alerting the qualifying activity identified in 6.7 accordingly, shall be cause for immediate removal from the Qualified Products List.

3.2.3.2 Type 1 and 2 mechanical watches.

3.2.3.2.1 Mechanical watch movement. The movement shall be stem wound and stem set, with the stem located at the 3 o'clock position of the dial. The maximum diametric measurement of the movement of type 1 mechanical jeweled watch shall be not less than 0.933 inch or greater than 1.025 inches.

3.2.3.2.2 Mainspring. When fully wound, the mainspring shall drive the complete movement a minimum of 36 hours without rewinding. The material for the mainspring shall be a corrosion resistant "nonbreakable" or cobalt base alloy.

3.2.3.2.3 Hairspring and balance wheel assembly. The movement shall have a temperature compensated hairspring and a solid monometallic non-magnetic balance wheel. The hairspring and balance wheel shall be material that in combination will not be affected functionally in the presence of the magnetic field specified in 3.3.8.

3.2.3.2.4 Movement design approval. At the initiation of qualification testing and at the time of each contract award, movement design of Types I and II watches shall be reviewed by and subject to the approval of the Government. Manufacturer drawings, specifications and supporting data, as applicable, shall be submitted for Government approval in accordance with 4.9. Data submitted shall be of sufficient detail to allow complete review of movement design, including all dimensions, jewel bearing locations and functional components.

3.2.3.3 Type 1, mechanical jeweled watch.

3.2.3.3.1 Second hand stop mechanism. Pulling the stem to the setting position shall result in stopping of the movement. Rotation of the stem shall permit the minute and hour hand to be advanced without any movement of the second hand. The depressing of the stem shall result in complete operation of the movement and hands.

3.2.3.3.2 Escapement. The pallet and escape wheel shall be steel. The pallet shall contain jewels.

3.2.3.3.3 Jewel bearings. The movement shall have a minimum of fifteen functional jewel bearings located at bearing points most essential to reduce friction and wear of the train and escapement parts. Jewels shall be solidly secured in the plate or bridge by friction fit. The jewel bearing material shall be of synthetic sapphire or equal.

3.2.3.3.4 Regulator. The movement shall be provided with a regulator. The regulator shall be at the midpoint of adjustment (within ±20% of its total range of adjustment), when the watch is subjected to the accuracy tests specified in 4.7.19.

3.2.3.3.5 Female stem. The female stem shall be fabricated of corrosion resistant steel and when joined with the male stem, shall result in the complete stem functioning as an assembly. It shall be dimensioned so that the face of the female section will be outside of the case sleeve when the stem is in the winding position, and locked within the male stem inside of the case sleeve (for the full length of motion from winding to setting), when in the setting position. The female stem shall be so dimensioned as to locate the joint between the male and female stems inside of the sleeve when the stem is in the setting position. It shall also enable the movement to drop out of the watchcase when the female stem is in the winding position.

3.2.3.4 Type 3 thru 5, quartz watch.

3.2.3.4.1 Quartz watch movement. The movement shall be battery powered quartz.

3.2.3.4.2 Power. The watch shall be powered by a self contained power cell which is commercially available from a minimum of two manufacturers. The watch shall be designed to operate a minimum of 2-1/2 years. The power cell shall contain orientation marks which identify the positive (+) side.

3.2.3.4.3 Internal. The spring used for power cell contacts shall be phosphor bronze or equivalent. The negative contact for the power cell shall be plated 0.1 micron thickness of bright gold. The positive power cell contact shall be either nickel plated stainless steel or plated bright gold 0.1 micron in thickness.

3.2.4 Watch crown. The crown shall have a straight knurl, and conform to the dimensions of Figure 3.

3.2.5 Design of dials and hands.

3.2.5.1 Dimensions, dial and hands. Figures 1 and 2 indicate dimensions preferred for dial and hands. Alternative designs shall be permissible but subject to the approval of the Qualifying Activity.

3.2.5.2 Application of self-luminous sources. Areas designated in Figures 1 and 2 as "luminiscent green" indicate required position of glass vial encapsulated tritium.

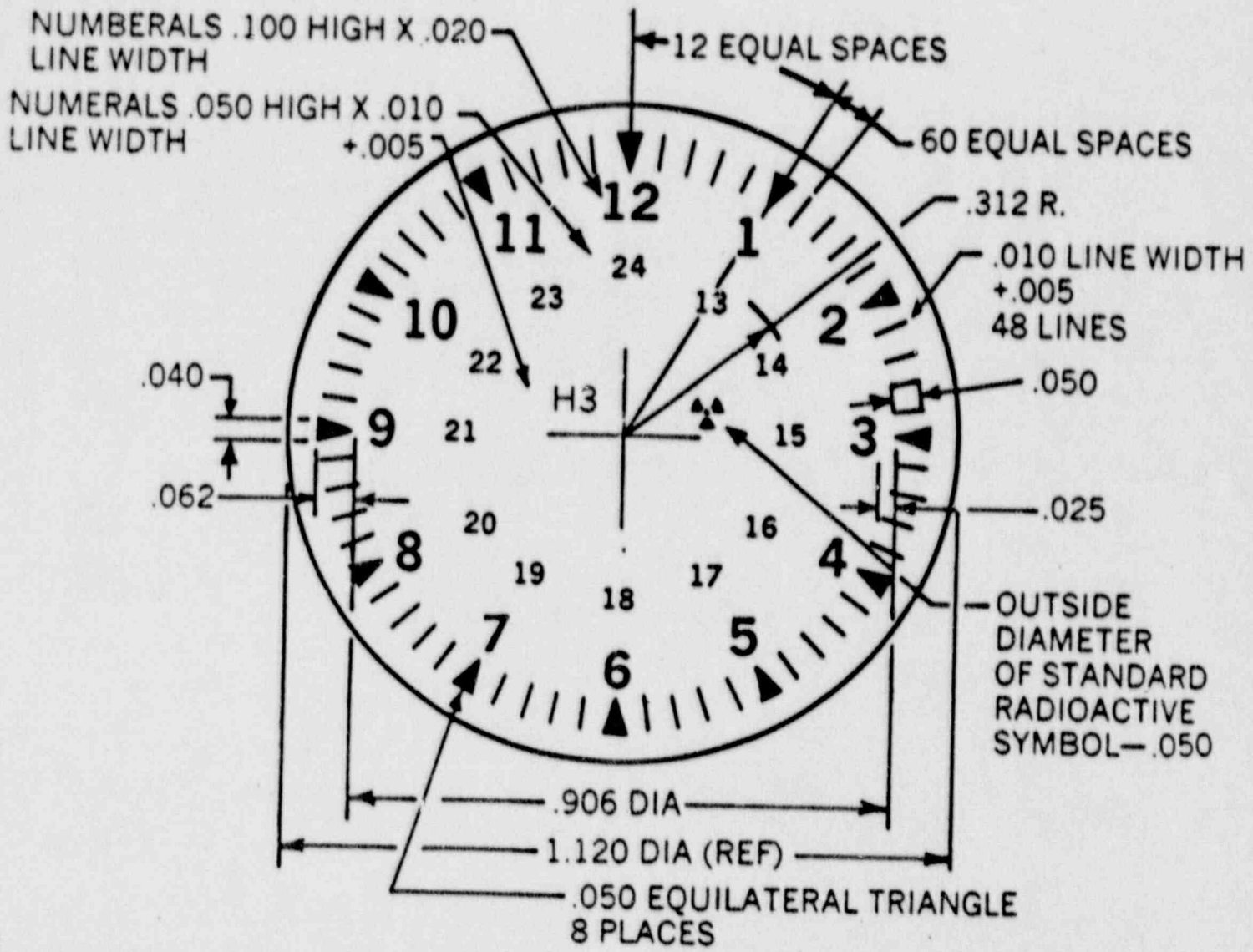
3.2.5.3 Dial markings. Markings on dials shall be in accordance with Figure 1. Manufacturer symbols or identification shall not appear on the dial.

3.2.6 Case assembly and design.

3.2.6.1 Case dimensions. Figure 3 indicates preferred case dimensions. Alternate designs shall be permissible but will be subject to the approval of the Qualifying Activity.

3.2.6.1.1 Case, type 2. Case design shall prevent access to the movement.

3.2.6.1.2 Case, types 3 thru 5. Case design shall allow access for battery servicing.



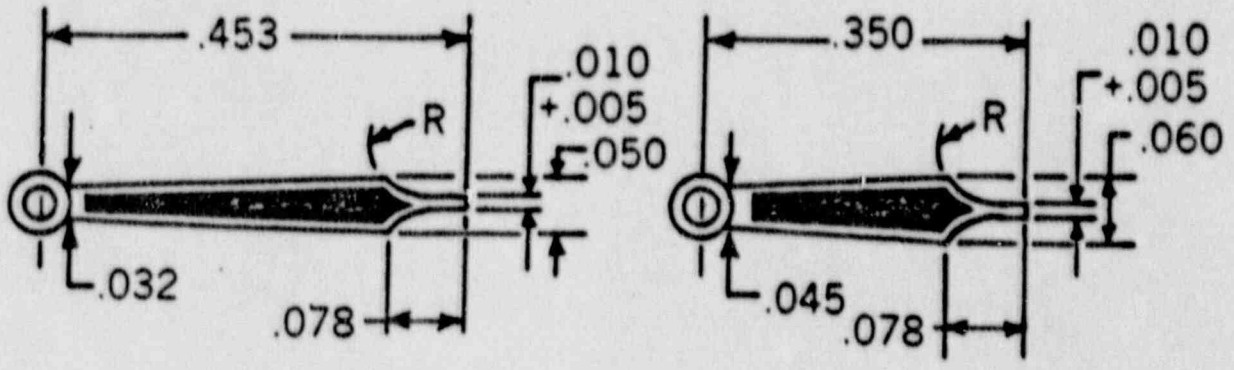
NOTES:

1. Dial face background in accordance with FED-STD-595 Color Black No. 37038.
2. Numbers and graduations in accordance with FED-STD-595 Color White No. 37875.
3. All triangles indicate positions for luminous vials.
4. H3 and ☢ shall be centrally located and clearly visible.

Dimensions in inches
unless otherwise
specified
Tolerances
Decimals ± .010

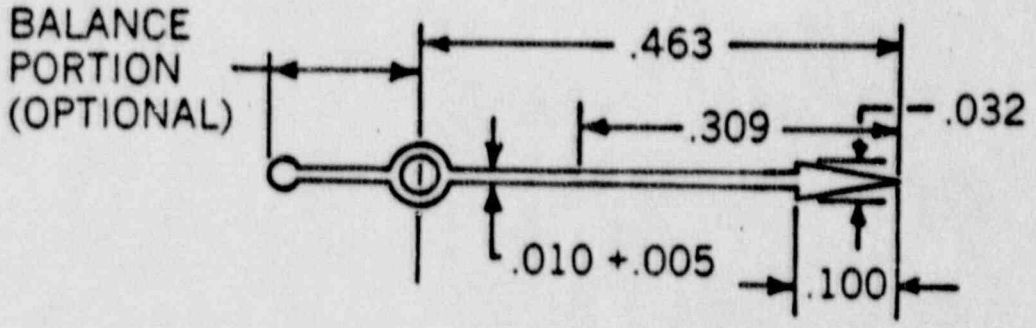
INCHES	MM
.005	.127
.010	.254
.020	.508
.025	.635
.040	1.016
.050	1.270
.062	1.575
.100	2.540
.312	7.9248
.906	23.012
1.120	28.575

FIGURE 1



MINUTE HAND

HOUR HAND



SWEEP SECOND HAND

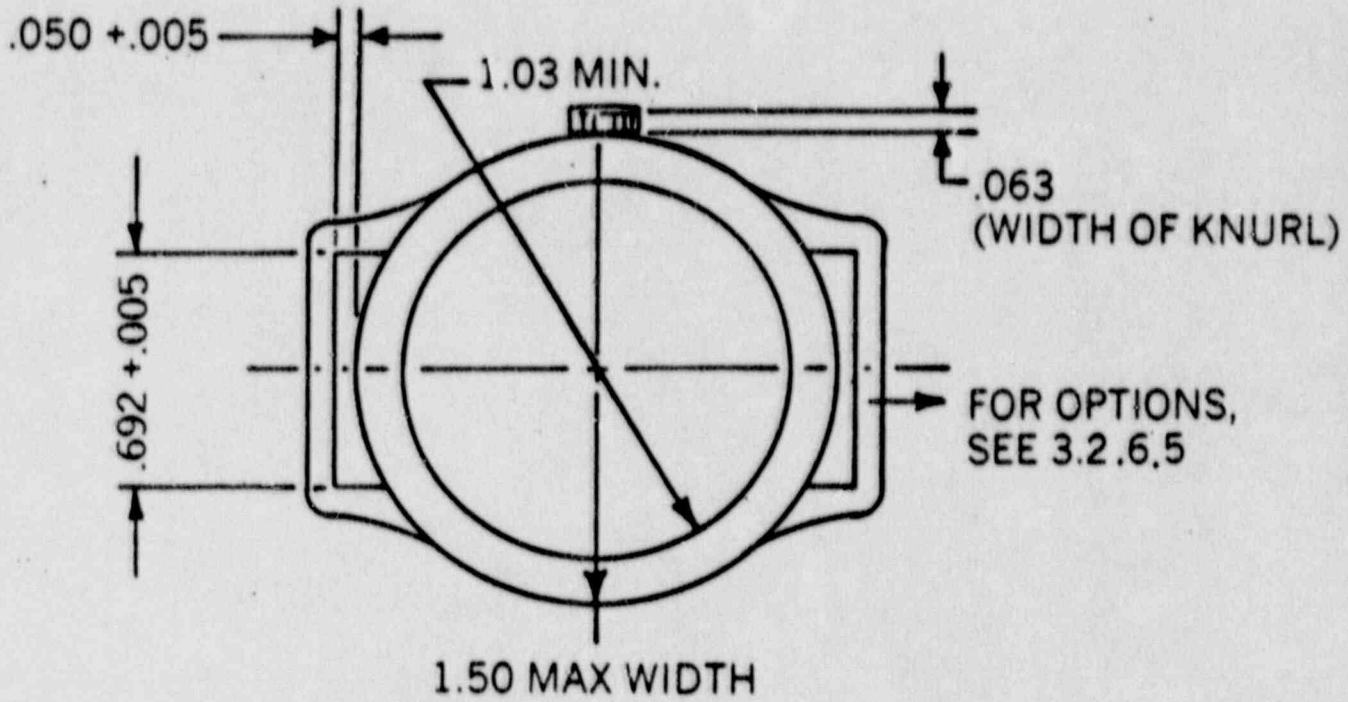
NOTES:

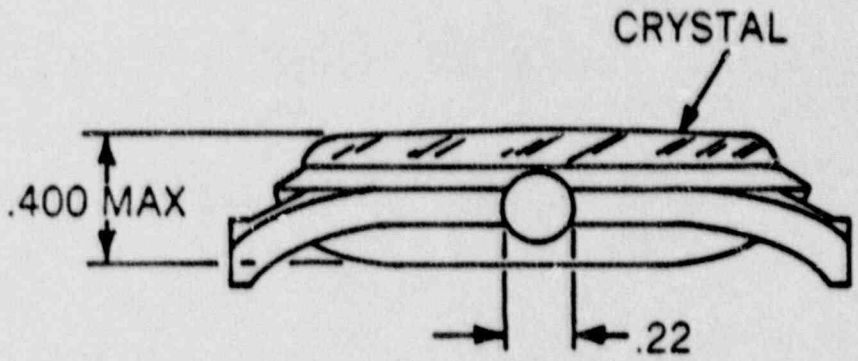
1. Shaded areas of hands to be luminescent green.
2. Hour and minute hand skeletons to be in accordance with FED-STD-595, Color White No. 37875.
3. Thickness of skeletons .008
4. Unshaded areas to be in accordance with FED-STD-595, Color White No. 37875
5. Variations will be considered. See 3.2.6

Dimensions in inches
unless otherwise
specified
Tolerances
Decimals ± .010

INCHES	MM
.005	.127
.008	.2032
.010	.254
.032	.813
.045	1.143
.050	1.270
.078	1.981
.100	2.540
.309	7.849
.350	8.800
.453	11.506
.463	11.760

FIGURE 2



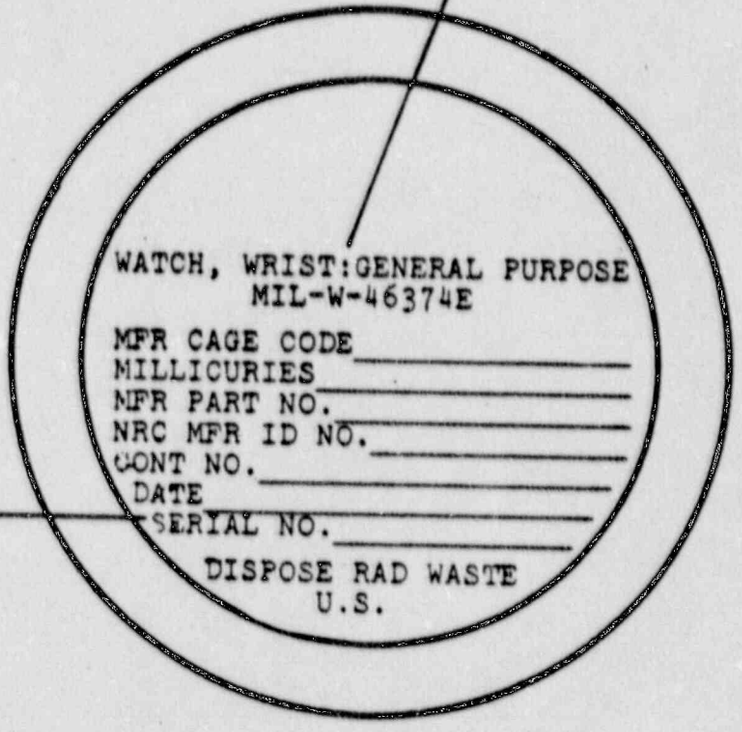


INCHES	MM
.005	.127
.010	.254
.050	1.27
.063	1.600
.22	5.588
.40	10.16
.692	17.577
1.03	26.162
1.50	38.100

DIMENSIONS IN INCHES
TOLERANCES ± .010 (UNLESS OTHERWISE SPECIFIED)

FIGURE 3

LETTERS AND NUMERALS TO BE .05 (1.270MM) HIGH
X .010 (.254MM) DEEP CENTRALLY LOCATED OR
MAY BE POSITIONED AROUND THE
BEVELED PORTION.
THE MFR NAME, NATL STOCK NO.,
CONT NO., AND DATE MAY BE APPLIED
WITHOUT THE DESCRIPTIVE TITLES.



INCLUDE ON
TYPE 1 ONLY

BACK OF CASE

DIMENSIONS IN INCHES
TOLERANCES ± .01

FIGURE 4

3.2.6.2 Case markings. The back of each case shall be marked with the data required by Figure 4. The marking of the month shall be the first three letters of the month and the marking of the year shall be the year in full, e.g., December 1986 would be "DEC 1986". Preferred dimensions of markings are indicated. Variations shall be permissible but subject to the approval of the Qualifying Activity.

3.2.6.2.1 Type 1. The date (month and year) to be included in the identification shall be the date of acceptance of the watch by the Government. The serial numbers will be assigned by the contracting officer (see 6.2.). Serial numbers of rejected watches shall not be repeated. The manufacturer's name and model or grade number shall be marked on the movement (barrel bridge, train bridge or both).

3.2.6.2.2 Type 2 thru 5. The date (month and year) to be included in the identification shall be the date of manufacture.

3.2.6.3 Case material. The case shall be fabricated of Type I, Class 3 acetal plastic material in accordance with L-P-392, or of corrosion resistant steel.

3.2.6.4 Case finish and color. All visible exterior metal or plastic surfaces of the case assembly, excluding control switches and spring type case bars shall have a dull nonspecular/nonreflective finish. The color shall be silvery metallic, black (color number 37038) or olive drab (color number 24087) of FED-STD-595 as specified in the ordering data (6.2).

3.2.6.5 Case bars. Watch cases shall include either integral bars or stainless steel removable spring bars for the watch strap. The case/spring bars shall be designed to accommodate a MIL-S-46383 strap and shall be capable of withstanding a static pull on the strap of up to 15$\pm$1/2 pounds on each bar without damage as specified in 4.7.6.5.

3.2.7 Crystal. The crystal shall be made of tempered glass, mineral crystal or nonhygroscopic, thermosetting plastic. The crystal shall be transparent, uncolored, and free from bubbles, striae, scratches, chips, or other imperfections which may interfere with reading the watch. The crystal shall be fabricated in such a manner as to be similar in design to Figure 3 and shall properly fit the case.

3.2.7.1 Crystal strength. The crystal, when assembled to the case, shall show no evidence of cracking or chipping when tested as specified in 4.7.7.1.

3.2.8 Strap. The strap shall be in accordance with MIL-S-46383, Type II. The color number shall be 34087 of FED-STD-595 or as specified (see 6.2).

3.3 Performance.

3.3.1 Vibration. While running, the watch shall not be damaged and shall pass the radiological requirements after 60 minutes of composite vibrations at amplitudes of (0.3 - 0.7 - 0.3 mm). The frequencies shall be varied uniformly between 30 Hz to 60 Hz and 30 Hz for 20 minutes each of the directions stated in 4.7.22.

3.3.2 Shock. The watch shall show no evidence of damage affecting serviceability and shall pass the radiological requirements after the shock test specified in 4.7.23.

3.3.3 Storage. The watch shall show no evidence of damage affecting serviceability and shall pass the radiological requirements after being subjected to storage temperature test specified in 4.7.24. This criteria pertains to mechanical and radiological performance; therefore the battery should be removed from the quartz watch during the test. Batteries used for powering a quartz watch degrade considerably if stored at the temperature extremes.

3.3.4 Water resistance. The watch shall show no evidence of leakage after being subjected to the test specified in 4.7.25.

3.3.5 Synchronization. The hands shall be synchronized to eliminate the possibility of error in reading correct time. The hour hand shall indicate the correct time within ± 1 dial graduation when the minute hand is at 12.

3.3.6 Setting. The crown shall be capable, while being moved from the running to set position, of withstanding a pull of 5 pounds ± 0.25 lb (see 4.7.13).

3.3.6.1 Mechanical watch. The minute hand shall not rotate (jump), at its tip, more than one tip width when the crown is moved from the setting position to the winding position after setting the hands.

3.3.6.2 Quartz watch. When the crown is pulled in the setting position the mechanism is mechanically stopped. When the stem is pushed in the watch shall start immediately.

3.3.7 Winding torque, type 1 and 2. When fully wound, the mechanical watch shall not be damaged when a torque of 6 ± 0.5 inch-ounces is applied to the crown (see 4.7.12).

3.3.8 Magnetism. While running, the watch shall not be adversely affected when subjected to a 14.5 to 15.5 gauss magnetic field, as specified in 4.7.21, and shall subsequently meet the requirements of 3.3.11.

3.3.9 Dark viewing. The luminous features shall be of sufficient brightness so as to be readable in darkness while holding the watch no closer to 12 inches from the eyes of a dark-adapted observer having normal or corrected 20/20 vision. Luminosity shall be uniform for visible dials. There shall be no indication of dead or dim vials.

3.3.10 Isochronism. Watches shall pass the test for isochronism specified in 4.7.20, in a dial-up position at 75 degrees ±3 degrees fahrenheit (23.9 degrees ±1 degrees celsius).

3.3.10.1 Type 1. The variation in rate (see 6.5.4), shall be recorded every 6 hours for a period of 24 hours and shall not exceed 5 seconds from the rate recorded in the previous 6 hour period. The watches shall be fully wound prior to testing and shall not be wound during the test.

3.3.10.2 Type 2. In the dial up position, at 75 degrees ±3degrees fahrenheit (23.9 degrees ±1 degrees celsius) the variation in rate shall not exceed ten seconds in a 24 hour period, between the first four hours and the last four hours.

3.3.11 Accuracy. After meeting the requirements of 3.3.1 to 3.3.10 inclusive (as applicable to the type watch), the mean daily rates (see 6.5.6) of the watch in each of the two positions of (1) dial-up and (2) crown-down shall not exceed the following values at the temperatures specified.

Temperature (In Degrees)		Mean Daily Rate (Seconds Per Day)		
Fahrenheit	Celsius	Type 1	Type 2	Type 3
40±2	(4.4±1.1)	±60	±120	±3
75±2	(23.9±1.1)	±30	±60	±0.7
125±2	(51.7±1.1)	±60	±120	±3

3.3.12 Radiological.

3.3.12.1 Contamination. Complete watches, after having been subjected to 3.3.1, 3.3.2 and 3.3.3, wiped as specified in 4.7.2.3.1, shall indicate disintegrations per minute (dpm) of not more than 100.

3.3.12.2 Contamination, long term. Qualification and surveillance testing, see 4.8). Complete watches, when packaged in accordance with 5.1.2 for a period of not less than ninety days and wiped in accordance with 4.7.2.3.1, shall indicate not more than 100 dpm.

3.3.12.3 Diffusion. Completed watches, with all luminous vials installed, shall be submerged in a measured volume of distilled or deionized water, equal to approximately 10 times the volume of the watch, for 24 hours at 73±3 degrees fahrenheit (23±1 degrees celsius). The diffusion of contamination into the water shall not exceed 50 nanocuries per day, when tested as specified in 4.7.2.3.2.

3.3.13 Long term accuracy, (qualification only). Accuracy will be determined during a 90 day period as specified in 4.7.26. During the 90 day period of operation, watches shall be subjected to shock and vibration after 30 days and 60 days of operation in accordance with 3.3.1. and 3.3.2., except that duration of vibration shall be for only five (5) minutes in each direction. Watches shall meet the following criteria:

	Average Mean Daily Rate (Seconds Per Day)	Mean Daily Rate (Seconds Per Day)
Type 1	36	60
Type 2	72	120
Type 3 thru 5	2.4	4

3.4 Workmanship. All parts shall be finished so the case and the crown shall have no sharp edges or corners which could cause skin cuts or abrasions. All lugs from tip of lug to body of bezel shall have sharp edges and corners rounded to avoid skin abrasion. Rounded edges and corners shall be reasonably uniform in appearance.

3.4.1 Assembled vials. All luminous vials, after final assembly of the watch, shall be free from extraneous paint, adhesive or other foreign materials which could reduce luminosity.

3.5 Interchangeability, type 1. All like parts shall be interchangeable in all watches of one model furnished by one manufacturer, and shall not adversely affect timekeeping exclusive of minor adjustments. The hairspring and balance wheel assembly shall be interchangeable as a unit.

3.6 Operating instructions. An operating instruction shall be furnished with each watch. This instruction shall describe all the functions of the watch, the durability (i.e., shock and water resistance features) life expectancy, and accuracy that can be expected from the watch, type battery, and any precautions that should be observed during the life of the watch. (See 5.3).

3.7 Safety data sheet. Since this specification describes a product which contains a hazardous (radioactive) material, material safety data sheets shall be prepared in accordance with FED-STD-313 (see 6.2.1).

4. QUALITY ASSURANCE PROVISIONS.

4.1 Responsibility for inpsection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor 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.

4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection as part of manufacturing operations is an acceptable practice to ascertain performance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

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

a. Qualification Inspection

b. Quality Conformance Inspection

4.3 Qualification inspection. Qualification inspection consist of testing, and material certifications as applicable, for all the requirements specified in Sections 3 and 5.

4.3.1 Qualification sample. A quantity of 20 watches shall be submitted for qualification testing as directed by the activity identifyed in 6.7. Testing shall be performed at a laboratory facility acceptable to the Government. Sample watches submitted for testing shall be derived from normal production and be indicative of normal production equipment and procedures. Ten of the watches shall be packaged in accordance with 5.1.2. The twenty watch sample shall be identifyed by an attached tag containing the following information:

a. Sample for Qualification Tests.

b. Submitted by (name) (date) for qualification tests in accordance with requirements of MIL-W-46374 under authorization (reference letter authorizing test).

c. Manufacturer's model, grade number or part number.

d. Name of manufacturer.

4.3.2 Retention of qualification. To retain qualification, the contractor shall forward a report at 6-month intervals to the qualifying activity. The qualifying activity shall establish the initial reporting date. The report shall consist of:

a. A summary of the results of the tests performed for inspection of product for delivery (Table IV), indicating as a minimum the number of lots that have passed, the number that have failed, and the group which they failed. The results of tests of all reworked lots shall be identified and accounted for.

b. A summary of the results of tests performed for periodic inspection (Table II), including the number and mode of failures. The summary shall include results of all periodic inspection tests performed and completed during the 6-month period. If the summary of the test results indicates nonconformance with specification requirements, and corrective action acceptable to the qualifying activity has not been taken, action may be taken to remove the failing product from the qualified products list.

Failure to submit the report within 30 days after the end of each 6-month period may result in loss of qualification for the product. In addition to the periodic submission of inspection data, the contractor shall immediately notify the qualifying activity at any time during the 6-month period that the inspection data indicates failure of the qualified product to meet the requirements of this specification.

In the event that no production occurred during the reporting period, a report shall be submitted certifying that the company still has the capabilities and facilities necessary to produce the item. If during two consecutive reporting periods there has been no production, the manufacturer may be required, at the discretion of the qualifying activity, to submit his qualified products to testing in accordance with the qualification inspection requirements and the reason for no production.

4.4 Quality conformance inspection. Inspections shall be performed in accordance with inspection provisions set forth herein. The characteristics shown in Tables I, II, III and IV, and requirements for packaging and marking set forth in 4.5.3.7 shall constitute minimum inspections to be performed by supplier prior to Government acceptance or rejection by item or lot.

4.5 Inspection provisions.

4.5.1 General provisions. The quality assurance provisions of this specification and of other documents referenced herein form the basis for inspection to be performed by the supplier. Quality assurance terms and definitions shall apply as defined in MIL-STD-109.

4.5.2 Submission of product. Unless otherwise specified herein or by the contracting officer, inspection lot size, lot formation, and presentation of lots shall be in accordance with "Submission of Product" provisions of MIL-STD-105.

4.5.3 Examination and tests. Examination and tests related to section 3 herein, shall be performed on an individual characteristics basis in accordance with MIL-STD-105, and the inspection level and sampling plans specified in each table. Acceptance or rejection of a lot shall be based on cumulative defects on characteristics of each table. Examination and tests for packaging, packing and marking shall be in accordance with PPP-T-360. The Government reserves the right to inspect for any applicable requirement and to reject individual nonconforming items.

4.5.3.1 Certifications. Certifications for characteristics specified in Table I below shall include test data and results specified. Certification shall be provided prior to performing inspections in accordance with Tables and shall suffice for Government acceptance throughout contract, providing the materials, finishes, manufacturing processes, and techniques used to produce the items for which certification was issued have not been changed or revised. Any and all changes will require a new certification from the contractor. Certification does not relieve contractor of the responsibility for inspection of characteristics, and recording data and results therefrom. Recorded data results shall be made available to the Government upon request. When defects or inferior quality is detected, and the Government deems a material or finish analysis necessary, the contractor will be required to submit data, samples, or specimens to the contracting officer for analysis and approval.

TABLE I. Conformance Inspection, Certifications.

CHARACTERISTIC	REQUIREMENT
Materials	3.2.1
Glass vials	3.2.1.1
Protective finishes, (metal parts)	3.2.2
Case (Material)	3.2.6.3
Crystal	3.2.7
Strap	3.2.8

4.5.3.2 Quality conformance inspection, radiological shall be in accordance with Table II.

TABLE II. Conformance Inspection, Radiological.

USE LEVEL S-4 OF TABLE I WITH SAMPLING PLAN TABLE II-A, MIL-STD-105

Watch Lot sizes for inspection of installed gaseous tritium filled glass vials of completed watches, hour hands, minute hands, or second hands shall be not less than 500. The acceptance number for glass vials shall be "0", regardless of lot size.

CHARACTERISTICS	REQUIREMENT	TEST
MAJOR: AQL (see 6.3)		
101. Contamination	3.3.12.1	4.7.2.3.1
102. Diffusion	3.3.12.3	4.7.2.3.2

4.5.3.3 Quality conformance inspection, materials and design. Quality conformance inspection, materials and design shall be in accordance with Table III.

TABLE III. Conformance Inspection, Materials and Design.

USE LEVEL II OF TABLE I WITH SAMPLING PLAN TABLE II-A, MIL-STD-105

CHARACTERISTICS	REQUIREMENT	TEST
MAJOR: AQL (see 6.3)	Type 1-5	Type 1-5
107. Case	3.2.6	4.7.6
108. Crystal	3.2.7	4.7.7
109. Dark viewing	3.3.9	4.7.10
110. Movement design	3.2.3.2.4	4.9
MINOR: AQL (see 6.3)		
201. Dial	3.2.5	4.7.4
202. Hands	3.2.5	4.7.5
203. Case bars	3.2.6.5	4.7.6.5
204. Case finish	3.2.6.4	4.7.6.2
205. Crown	3.2.4	4.7.8
206. Identification marking	3.2.6.2	4.7.17
207. Workmanship	3.4	4.7.18
208. Operating Instructions	3.6	5.3

4.5.3.4 Qualification conformance inspection, performance. Quality conformance inspection, performance testing shall be in accordance with Table IV.

TABLE IV. Conformance Inspection, Performance.

CHARACTERISTIC	REQUIREMENTS		TEST	
MAJOR: AQL (see 6.3)	Type 1-2	Type 3-5	Type 1-2	Type 3-5
GROUP A				
110. Mainspring	3.2.3.2.2		4.7.15	
111. Winding torque	3.3.7		4.7.12	
112. Magnetism	3.3.8		4.7.21	
113. Hairspring Magnetism	3.2.3.2.3		4.7.16	
114. Setting	3.3.6.1	3.3.6.2	4.7.13	4.7.13
115. Synchronization	3.3.5	3.3.5	4.7.14	4.7.14
116. Isochronism	3.3.10		4.7.20	
GROUP B				
117. Vibration	3.3.1		4.7.22	
118. Shock	3.3.2		4.7.23	
119. Storage	3.3.3		4.7.24	
120. Water resistance	3.3.4		4.7.25	
121. Accuracy	3.3.11		4.7.19	
122. Power	3.2.3.4.2		4.7.3.3	

USE Level II of Table I with sampling plan Table IIA, MIL-STD-105.

Examinations 110 through 115 inclusive shall be completed prior to conducting 117 through 122. Examination 117 through 120 shall be performed prior to 121.

4.5.3.5 Qualification testing. Qualification testing shall be in accordance with Table V.

TABLE V. Qualification.

CHARACTERISTIC	REQUIREMENTS	TEST
123. Long term accuracy	3.3.13	4.7.26
124. Contamination, long term	3.3.12.2	4.7.27
125. Movement design	3.2.3.2.4	4.9

4.5.3.6 Noncompliance. If a sample fails to pass Table II inspection, the manufacturer shall notify the qualifying activity and the cognizant inspection activity of such failure and take corrective action on the materials or processes, or both, and on all units of product which can be corrected and which are considered subject to the same failure. Acceptance and shipment of the product shall be discontinued until corrective action, acceptable to the qualifying activity has been taken. After the corrective action has been taken, Table II inspection shall be repeated on additional sample units (all tests and examinations, or the test which the original sample failed, at the option of the qualifying activity). Table IV, Groups A and B inspections may be reinstituted; however, final acceptance and shipment shall be withheld until the Table II inspection has shown that the corrective action was successful. In the event of failure after reinspection, information concerning the failure shall be furnished to the cognizant inspection activity and the qualifying activity.

4.5.3.7 Packaging and marking inspection. Examination and tests for packaging, packing, and marking shall be in accordance with Section 5 and PPP-T-360.

4.5.3.8 Disposition of nonconforming product. Rejected lots shall be screened for all defective characteristics. Removal or correction of defective units and resubmittance of rejected lots shall be in accordance with "Acceptance and Rejection" as specified in MIL-STD-105.

4.6 Inspection equipment and facilities. The contractor shall insure that test and inspection facilities of sufficient accuracy, quality and quantity are established and maintained in accordance with MIL-I-45607 to permit performance of required inspections. The Government reserves the right to use the test equipment for its own independent inspections to the extent that such use will not unduly interfere with the contractor's delivery schedule.

4.6.1 Accuracy. Accuracy of the watch shall be determined by a mechanical, electric, or electronic time measuring instrument having an accuracy of ± 2 seconds per day for testing the mechanical watch and $\pm .025$ seconds per day for testing the quartz watch as determined by a primary time standard.

4.6.2 Contractor provided inspection equipment. The contractor shall provide inspection equipment compatible with the "Test Methods and Procedures" specified in 4.7 of this specification.

4.6.3 Diffusion test - accuracy and procedures. The manufacturer analysis of tritium content in the diffusion test shall be made with a liquid scintillation counter. The system calibration shall be established using quenched standards. Total system plus standards errors in the standardization shall not be in excess of ±5 percent. Efficiencies of the unknown samples shall be established by the channels-ratio method, the external channels-ration method, or the "H" number method of quench compensation. Counting time shall be established as such that at the test limits, the error (1 standard deviation) shall not be greater than 15 percent. The scintillation solution shall be an acceptable water soluble liquid scintillation cocktail. The counting bottles shall be a low potassium liquid scintillation borosilicate glass bottle or polyethylene liquid scintillation vial. When polyethylene scintillation vials are used, a set of quench standards traceable to the NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY shall be made up in the polyethylene vials to determine efficiency. If the quench standards are in glass bottles, a correction factor shall be determined so that the correct results will be obtained from samples in polyethylene scintillation vials.

4.7 Test methods and procedures. Unless otherwise specified herein, the tests shall be performed at 60 F (15.6 C) to 90 F (32.2 C), at barometric pressure of 28 to 31 inches of mercury and maximum relative humidity of 80 percent.

4.7.1 Materials and protective finishes. Compliance of materials and protective finishes to the requirements of 3.2.6, 3.2.7 and 3.2.8 shall be certified as set forth in 4.5.3.1. In addition, a visual inspection of component parts and assemblies shall be made to determine compliance with 3.2. Where defects or inferior quality is evident and the Government deems a material analysis necessary, the contractor will be requested to submit samples or specimens to the contracting officer for analysis and approval.

4.7.2 Luminous components.

4.7.2.1 Certification. Glass vials shall be certified to meet the requirements of 3.2.1.1.

4.7.2.2 Visual. Assembled vials shall be inspected for compliance with 3.4.1.

4.7.2.3 Radiological.

4.7.2.3.1 Contamination. A piece of Whatman-50 filter paper, or equivalent, moistened with deionized or distilled water shall be used to wipe the watches. All exterior surfaces of the completed watch shall be thoroughly wiped with the filter paper. The amount of tritium contamination on the filter paper shall be determined by using a liquid scintillation counting technique. The paper shall be placed in the liquid scintillation solution within one minute after wiping the watch. The liquid scintillation counting system shall have sufficient sensitivity to detect a lower limit of detection of 10 picocuries or less of tritium with a 95 percent confidence limit. This test shall be performed by the contractor. The contractor shall furnish filter paper, solution, and bottles. The scintillation solution shall be as specified in 4.6.3. The bottles shall be as specified in 4.6.3. The test solution in the bottle with the used filter paper inside shall be identified with the sample watch it represents by the use of a waterproof marking system on the bottle. The five watches (see 4.8), and their corresponding contamination wipes shall be forwarded to the Government (see 6.7), for liquid scintillation counting. Disintegration rate of more than 250 dpm per watch shall constitute failure of this test.

4.7.2.3.2 Diffusion and water leakage. Completed watches with all the luminous sources installed shall be submerged in, a measured volume of distilled or deionized water, equal to approximately 10 times the volume of the watch, for 24 hours at 73±3 degrees fahrenheit (23±5 degrees celsius). Watches shall be removed from the water. This is the test procedure for tritium diffusion, and if the radioactive content of the water exceeds 50 nanocuries/day, it shall constitute failure of the test. The watches also shall be examined for water leakage, and if there is water in the crystal bowl at the completion of the test, it shall constitute failure of the water resistance test. Failure of watches of either of these tests shall be cause for refusal by the Government to continue acceptance of the production watches until evidence has been provided by the contractor that corrective action has been taken to eliminate the deficiencies. Diffusion testing shall not be conducted until at least 30 days after vial manufacture.

4.7.3 Design and construction - movement. Movement identity and design and construction, (stem mound and stem set) shall be determined prior to qualification testing for compliance with 3.2.3.

4.7.3.1 Type 1 Jewel bearings. One percent of the watches under contract, but not less than three watches, shall be examined to insure the watch contains the appropriate number of jewels placed at the most critical friction points, and are in compliance with 3.2.3.3.3.

4.7.3.2 Type 1 and 2 Regulator. The regulator setting shall be checked after meeting the accuracy requirement of 3.3.11, to determine compliance with 3.2.3.3.4.

4.7.3.3 Type 3 thru 5 Module power drain tests. The module shall be tested to insure that the current drain allows an operating life as specified in 3.2.3.4.2. The module shall be measured with a current meter to determine the timekeeping current drain. To allow sufficient latitude in available power, the capacity of the power cell as measured in milliamp-hours (ma hours), shall be derated by 20 percent to obtain the net power capacity of the power cell. The comparison of power drain from the module to the power capacity of the derated power cell shall be made to insure that a minimum life of 30 months can be obtained from the power cell.

4.7.4 Dial. The dial shall be visually and dimensionally inspected for size of markings, legibility and finish in accordance with the respective requirements of 3.2.5 and Figure 1.

4.7.5 Hands. The hour, minute and second hands shall be inspected for style, length, shape and finish in compliance with 3.2.5 and Figure 2.

4.7.6 Case.

4.7.6.1 Case material. The material (plastic or corrosion resistant steel) shall be certified as specified in 4.5.3.1 to determine compliance with 3.2.6.3.

4.7.6.2 Case finish. The plastic case shall be visually color matched to determine compliance with the color chip number per FED-STD-595 as specified in 3.2.6.4. Stainless steel cases shall be visually examined for a dull nonreflecting finish as specified in 3.2.6.4.

4.7.6.3 Type 2 Case. The case shall be inspected visually and dimensionally to determine conformance to Figure 3 or acceptability to the Qualifying Activity. A physical test shall be applied where case parts are not capable of being removed to determine conformance to 3.2.6.1.1. The physical test shall consist of applying a force, or prying under normal pressure (equivalent of 8 to 10 pounds direct force) in such a manner that no marking or scarring of the case and case finish shall result.

4.7.6.4 Type 3 thru 5 Case. The case shall be inspected visually and dimensionally to determine conformance to 3.2.6.1.2 and 3.2.6.4. The plastic case shall be visually color matched to determine compliance with the color chip number and Federal Standard specified in 3.2.6.4. Stainless steel cases shall be visually examined for a dull nonreflecting finish as specified in 3.2.6.4.

4.7.6.5 Case bar test. With the watch in a secured position and the strap held in a position that will not exert pressure on the buckle or the keeper of the strap, a pulling force of 15±1/2 pounds shall be applied to each case/spring bar via the strap without the case/spring bar permanently bending, loosening or causing damage to the case/spring bar or case assembly.

4.7.7 Crystal. Crystals shall be examined before and after assembly to the case and after the storage temperature test of 4.7.24, to determine compliance with 3.2.7. Certification of the material shall be in conformance with 4.5.3.1.

4.7.7.1 Mineral glass crystal strength test. After assembly to the case, the case assembly including crystal shall be placed flat, crystal up, on a rubber sheet (0.5 mm or 0.02 inch thickness) placed on a horizontal, rigid nonresilient, metal surface. A solid steel sphere weighing 0.56 + 0.05 ounces (15.7±1.4 grams) approximately 5/8 inch or 1.59 cm diameter) shall then be freely dropped so as to fall 12 inches (30.48 cm) before striking the crystal. Any visible damage to the crystal shall be cause for rejection.

4.7.8. Crown. The crown shall be visibly examined and dimensionally checked for conformance with Figure 3 or acceptability by the Qualifying activity.

4.7.9. Strap. The strap shall be accepted by certification (see 4.5.3.1) to insure compliance with 3.2.8.

4.7.10 Dark viewing. A dark room shall be utilized to represent total darkness when conducting the visual examination under the conditions and distance specified in 3.3.9 to determine compliance therewith. Watches shall be in the dark room for at least eight hours prior to conducting examinations. Individual(s) performing test shall be acclimated to the dark room a minimum of 20 minutes prior to conduct of test. This test shall be performed no sooner than sixty days after vial installation.

4.7.11 Winding test, Type 1 and 2. The winding operation shall be smooth without excessive torque. Continuous winding shall not adversely affect the timekeeping qualities of the watch.

4.7.12. Winding torque, Type 1 and 2. The winding torque will be applied and measured with a torque gauge. When the watch is fully wound, the maximum torque specified in 3.3.7 shall be applied without any damaging effect to the watch.

4.7.13. Setting. A standard type pull gauge with appropriate adapter shall be utilized to apply the direct force (pull) specified in 3.3.6. The crown shall not be damaged or separated from the movement when the direct force (pull) is applied.

4.7.13.1 Hour-minute setting. Six settings shall be made in 2-hour increments to insure compliance with 3.3.6.1 and 3.3.6.2.

4.7.13.2 Second hand stop mechanism. The second setting mechanism shall be activated for at least five different settings, to insure that a precise stop and start action can be obtained without adverse effect on the hands or movement, in accordance with 3.2.3.3.

4.7.14 Hand synchronization. The watch shall be examined to determine conformance with 3.3.5. The setting mechanism shall be activated and readings taken when the minute hand is at "12" and the hour hand is at the 3, 6, 9 and 12 hour respectively, to determine compliance with 3.3.5.

4.7.15 Mainspring, Type 1 and 2. With the watch fully wound, it shall be examined for continuous running, without rewinding, for the minimum time specified in 3.2.3.2.2.

4.7.16 Hairspring and balance wheel assembly, Type 1 and 2. The hairspring and balance wheel unit shall be considered acceptable for compliance with 3.2.3.2.3 if the watch is capable of meeting the requirements of 3.3.11.

4.7.17 Identification marking. All numbers and lettering shall be visually inspected for correctness, legibility, and application in accordance with 3.2.6.2. Inspection for permanent marking shall insure that acceptable processes have been applied such as: castings, moldings, steel stamp, acid, etching, or engraving.

4.7.18 Workmanship. Quality of workmanship in conjunction with best industry practices shall be inspected by visual and tactile means at the discretion of the Government during in-process and on the complete watch to insure that watches are continually produced in accordance with 3.4.

4.7.19 Accuracy. During the conditioning period, the running watches shall be subjected to the test temperature for at least 4 hours prior to the test. Daily rates (see 6.5.5), shall be recorded for a period of three days in each position and the mean daily rate (see 6.5.6), determined therefrom. The watches shall be rejected if the mean daily rate (see 6.5.6), exceeds the requirements of 3.3.11. The Type 1 and 2 watches shall be wound at the beginning of each test and each 24 hours thereafter for the duration of the tests. The mean daily rate shall be determined by means of a master time source as specified in 4.6.1.

4.7.20. Isochronism. This test shall be conducted concurrently with 4.7.19.

4.7.20.1 Type 1. This test shall vary from that in 4.7.19 in that the error shall be determined at 6-hour intervals. The difference of error recorded between each 6-hour period shall not exceed 5 seconds.

4.7.20.2 Type 2. In the position and at the temperature specified in 3.3.10, the watch shall be fully wound and operated for four hours. The watch shall again be fully wound and the rate recorded while fully wound and after four hours of operation. The rates shall again be recorded at the 20 and 24th hour. The difference in uniformity of rate between the four-hour periods shall not exceed 10 seconds.

4.7.21 Magnetism. A magnetic field shall be generated electrically utilizing standard test equipment capable of developing the magnetic intensity (in Gauss) within the limits specified in 3.3.8. With the watch running, it shall be placed into the energized field with the stem parallel to the direction of the field. The field shall be on for three seconds and off for three seconds. This cycle shall be repeated ten times. Upon completion and removal from the field, the watch shall be rated by a precision type rate recorder having an accuracy as specified in 4.6.1 to determine compliance with 3.3.8.

4.7.22 Vibration. The watch shall be vibrated in accordance with 3.3.1 as follows:

20 minutes with vibration perpendicular to dial.
20 minutes with vibration in plane of dial and in direction from 12 to 6.
20 minutes with vibration in plane of dial and in direction from 9 to 3.

4.7.23 Shock. While running, the watch shall be dropped from the height of 50 centimeters (19.7 inches), uncontrolled, onto vinyl tile (3 mm or 1/8 inch thickness) affixed to a concrete block. At the conclusion of this test the watch shall be running and be subjected to a visual and tactile examination in compliance with 3.3.2 for any crystal damage or other loose, missing, and damaged parts. After passing this examination the watch shall then be subjected to the test in 4.7.24.

4.7.24 Storage. In compliance with 3.3.3, subject the watches to ambient temperatures and time in the following order:

Store at -50 degrees ±2 degrees F (-45 degrees + 1.1 degrees C) for 24 hours.
Store at room temperature (60 degrees to 90 degrees F (15.5 to 32.2 degrees C) for 24 hours.
Store at 140 degrees ±2(60 degrees ±1.1 degree C) with at least 50 percent relative humidity for 24 hours.
Store at room temperature for 24 hours.

After exposure to each extreme temperature, the watch shall be examined for physical defects or damage. There shall be no evidence of physical defects, damage of watch, or imperfections of crystal. After passing this test the watch shall be subjected to and shall meet the requirements of 3.3.11.

NOTE: Type 1 and 2 watches shall not be run during storage tests. Temperature changes in the watch may be gradual to avoid thermal shock. Type 3 to 5 watches shall have the battery in the watch.

4.7.25 Water resistance. In compliance with 3.3.4 the watch shall be tested for waterproofness by immersing it completely for at least five minutes in distilled water containing a wetting agent of approximately 1% by weight at room temperature and atmospheric pressure of 15 pounds per square inch (1 atmosphere) for five minutes. For an additional five minutes the watch shall be immersed under a pressure of 44 pounds per square inch (3 atmospheres).

The watch interior shall then be inspected for moisture by placing on a heating element at 105 F (40.6 C) for five minutes, then placing several drops of 70 F (21 C) water on the center of the crystal. Any visible condensated water (fogging) on the inside of the crystal constitutes failure of this test.

4.7.26 Long term accuracy (qualification only). The test shall only be conducted on watches submitted in conformance with 4.3 to determine compliance with 3.3.13. Each watch shall have met all other qualification requirements and tests herein prior to being subjected to the long term accuracy test. The test shall be conducted at 75 degrees F $\pm$3 degrees F (23.9 degrees C + 1.7 degrees C) for a total running time of 90 days, half of which time shall have been in a dial-up and half in a crown-down position, alternated at seven (7)day intervals. In consideration of the normal work week of testing personnel, testing need not be continuous. The watches shall be wound daily an shall be alternated and tested as specified in 3.3.13 to obtain approximately half the operating time (45 days) in each position. Compliance with long term accuracy specified in 3.3.13 shall be determined by using a master time source accurate to within $\pm$.025 seconds a day, to record the average mean daily rate (see 6.5.6) for compliance with 3.3.13. The mean daily rate (see 6.5.6) for any "individual" watch tested shall meet the accuracy specified in 3.3.13 for mean daily rate.

4.7.27 Contamination, long term (qualification only). Ten watches, packaged in accordance with 5.1.2 and held in storage for a period of not less than 90 days, shall be subjected to the test in 4.7.2.3.1, shall pass the requirement stated in 3.3.12.2.

4.8 Surveillance testing. Five watches randomly selected from production lot quantities not to exceed 1000 units, shall be forwarded to the Qualifying activity (see 6.7) for testing in accordance with 4.7.2.3.1 and 4.7.2.3.2. These five watches shall not have been previously selected from any sample nor shall they be washed or cleaned. Failure of any of the five watches shall be cause for refusal of the Government to continue acceptance of production watches until evidence has been provided by the manufacturer that corrective action has been taken to eliminate the deficiences. Failure to notify the Government of corrective action within 30 days of having been notified of failure of a surveillance sample shall be cause for removal from the Qualified Products List. Watches submitted for surveillance testing shall not be returned to the manufacturer, but shall be retained by the Qualifying activity (6.7) for historical audit and record keeping purposes.

4.9 Movement design inspection. Manufacturer data on movement design shall be forwarded to the Government activity identified in 6.8.

5. PACKAGING.

5.1 Packaging. Packaging shall be level A or C, as specified (6.2).

5.1.1 Level A.

5.1.1.1 Unit packaging. Each wrist watch shall be wrapped in neutral tissue paper. The wrist strap shall be wrapped around the watch and cushioned to prevent damage to the instrument. Type 3 watch shall have the stem maintained in the setting position (battery disconnected) by a removable spacer or shim while in the package. Each watch, wrapped and cushioned shall be packaged in a paperboard box conforming to PPP-B-676 or PPP-B-566. The box shall be closed as specified in the appendix to the applicable box specification.

5.1.1.2 Intermediate packaging. Ten unit packages of wrist watches shall be intermediately packaged in a fiberboard box conforming to PPP-B-636, class domestic.

5.1.2 Level C. Wrist watches shall be packaged to afford adequate protection against damage during shipment from the supply source to the first receiving activity.

5.2 Packing. Packing shall be level A, B, or C, as specified (6.2).

5.2.1 Level A. The packing shall be in accordance with group 1, Level A of PPP-T-360.

5.2.2 Level B. Six intermediate packages (60 watches) shall be packed in a close fitting fiberboard box conforming to PPP-B-636, class weather-resistant. Closure of the fiberboard box shall be in accordance with the appendix of PPP-B-636.

5.2.3 Level C. Wrist watches in quantities as specified (6.2), packaged as specified in 5.1.2, shall be packed in containers to assure carrier acceptance and safe arrival at destination in compliance with Uniform Freight Classification Rules or National Motor Freight Classification Rules.

5.3 Operating Instructions. Operating instructions shall be included in each unit package as specified in 3.6.

5.3.1 Disposal instructions Type 2 thru 5. Disposal instructions shall be included in each unit package, printed on 20 pound white sulphite paper, four inches by 1-1/2 inches. This may be included as part of the operating instructions. The instruction shall be as follows:

DO NOT ATTEMPT TO REPAIR UNSERVICEABLE WATCHES

5.4 Marking. In addition to the marking requirements specified in PPP-T-360, the unit package, intermediate package, and shipping container shall be marked with the date of acceptance by the Government.

5.4.1 Radioactive marking. Radioactive marking and labeling shall be as specified in MIL-STD-129, except as follows:

a. Marking for unit and intermediate packages shall include the lot number.

b. The unit and intermediate packages shall be marked with radioactive symbol, the isotope, and activity present in millicuries. Abbreviations may be used for the isotope, H^3, and millicuries, mCi.

6. NOTES.

(THIS SECTION CONTAINS INFORMATION OF A GENERAL OR EXPLANATORY NATURE THAT MAY BE HELPFUL BUT IS NOT MANDATORY.)

6.1 Intended use. The intended use, available maintenance and storage of the watch will determine which type watch is required. The following criteria is a guide for watch type selection to match user requirements:

Type 1: Long life (5-10 years), maintainable, nonmagnetic, synchronizable, water resistant, accuracy $\pm$90 seconds per month (18 minutes per year).

Type 2. Short life (2 years), nonmaintainable, anti-magnetic, water resistant, accuracy $\pm$90 seconds per month (18 minutes per year).

Type 3-5: Short life (2 years), nonmaintainable, battery powered, anti-magnetic, water resistant, accuracy $\pm$21 seconds per month (4 minutes per year).

6.2 Ordering data. Procurement documents should specify the following:

a. Title, number, and date of this specification

b. Selection of applicable levels of packaging and packing

c. Applicable Part Identifying Number

d. List of serial numbers to be assigned, Type 1 only (see 3.5).

e. Quantities required in level C packing (5.2.3).

f. Warranty: Notwithstanding inspection and acceptance by the Government of supplies furnished under this contract, or any condition of this contract concerning the conclusiveness thereof, the contractor warrants that for two years all watches furnished under this contract will be free of defects in design material or workmanship and will conform with all requirements of this contract (in conformance with FAR clause 52.246-17).

g. Applicable AQLs (see 6.3).

6.2.1 Material safety data sheet. Since the specification describes a product which contains a hazardous (radioactive) material, a Material Safety Data Sheet shall be prepared in accordance with FED-STD-313. One copy shall be submitted to the contracting officer, address as specified (6.2). In addition, a copy shall be provided to the Military Service or Federal department/agency address in 20.5 of FED-STD-313, of each service or agency that purchased the item.

6.2.2 Disposal of radioactive waste. Contractor generated radioactive waste must be disposed of in accordance with federal and state regulations. The provisions of AR 700-64 apply.

6.3 Acceptable quality level (AQL). The AQL applicable to Tables II through IV is 1.0 (percent defective).

6.4 Acquisition strategy, recommended for quartz analog watches. Establish a multiyear contract with delivery of small quantities of 100 units or less within 30 days and large quantities of 100 to 1,000 units within 45 to 60 days. This will reduce high temperature storage time and stocking cost for a noncritical item.

NOTE: A typical 30 month battery used in a quartz analog watch stored at 120 degrees Fahrenheit would affect a loss of approximately 10% of its capacity in 30 days reducing the battery runable life to six months.

6.5 Definitions of terms used.

6.5.1 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."

6.5.2 Error. Algebraic time difference in seconds between the watch being tested and the master timepiece.

6.5.3 Starting error. Error at start of test period.

6.5.4 Rate. Difference between the starting error and error at the end of a given time interval.

6.5.5 Daily rate. Rate in a 24 hour period. The term "daily rate" is used synonymously with the term "daily error" and "daily accuracy."

6.5.6 Mean daily rate. Mean daily rate is the arithmetic average of individual daily rates (daily errors) with proper regard to algebraic signs in the summation. Unless otherwise specified, the mean daily rate shall be for three consecutive days operation.

6.5.7 Average mean daily rate. This term is used to denote the average of the mean daily rates of two or more timepieces with each individual rate being considered as algebraically positive (+) in the computation.

6.6 Part or Identifying Number (PIN). The military part number shall consist of the designator "M", the basic specification number, the dash number assigned to the type of number of the watch (see 1.2), case color symbol (see 1.2 and 3.2.6.4) and strap color symbol (see 1.2 and 3.2.8).

M	46374	1	M	B
Military Designator	General Specification Number	Type Number (See 1.2)	Case Color (See 1.2 and 3.2.6.4)	Strap Color (See 1.2 and 3.2.8)

6.7 Qualification. With respect to products requiring qualifications, 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 on 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 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 U.S. Army Armament, Research, Development and Engineering Center, ATTN: SMCAR-BAC-S, Picatinny Arsenal, New Jersey 07806-5000. Information pertaining to qualification of products may be obtained from that activity.

6.8 Movement design review. Drawings, specifications and associated data, in conformance to 3.2.3.2.4, must be forwarded to the following:

William Langer Plant
Rolla, North Dakota 58367

6.8.1 Jewel bearings. Jewel bearings for Type I and II watches are subject to the provisions of FAR Clauses 52.208-1 and 52.208-2.

6.9 Subject term (key word) listing.

Analog Watch
Aviation Watch, Wrist
Chronograph, Wrist
Chronometer, Wrist
Electronic Watch, Wrist
Jewel Bearings
Luminous Vials
Quartz Movement
Scintillation counter
Tritium

Custodian:
Army - AR
Navy - SH
Air Force -99

Preparing activity:
Army - AR

Project No. 6645-0397

Review activities:
Air Force - 82
DLA - GS

User activity:
Navy - MC

Civil Agencies Coordinating Activities:
GSA - FSS

(TO DETACH THIS FORM, CUT ALONG THIS LINE.)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-W-46374E	WATCH, WRIST: GENERAL PURPOSE

3a. NAME OF SUBMITTING ORGANIZATION

b. ADDRESS *(Street, City, State, ZIP Code)*

4. TYPE OF ORGANIZATION *(Mark one)*

- ☐ VENDOR
- ☐ USER
- ☐ MANUFACTURER
- ☐ OTHER *(Specify)*: _____

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*