Enclosure 3

CAMMENGA AND ASSOCIATES

100 ANILINE AVE. N.
HOLLAND, MI 49424
Phone 616-392-7999
Fax 616-392-9432

18 MAY 2004

GENERAL DISCUSSION

A. The Wrist Compass, current Phosphorescent model #J582, NSN 6605-00-809-5252 was designed by Stocker Yale in conjunction with the US Military. Stocker Yale manufactured and distributed this Wrist Compass with sealed sources until 1999, when we, Cammenga and Associates, purchased the rights to manufacture and distribute this compass.
B. DOD specifications for this compass include self-luminous requirement. The sealed source vials cannot be removed from the compass unless it is disassembled. Since the tritium (3H) is laser-sealed into glass vials, no radiation is emitted from the vials; also, because tritium is a soft beta emitter, it cannot penetrate the glass of the vials.
C. The application for amendment is made with the provision of maximum vial quantity of 14 and maximum total H-3 activity not to exceed 50 millicuries, per wrist compass.
D. Models for exempt distribution, containing H-3, shall be named as follows:
   J582 (Contains 3 sealed source vials),
   J582-6 (Contains 6 sealed source vials),
   J582-6 (Contains 14 sealed source vials).
   No models exceed a total of 50 mCi ^{3}H
E. Anticipated annual sales of combined models are expected to be less than 5,000 units, each with under 50mCi H-3 activity. This is a relatively small amount of anticipated distribution, which should not require a change of our license regarding the amount of curies distributed annually, which is currently 14,400 curies.
F. The expected useful daytime life of the compass is indefinite. With regards to the sealed sources (H-3 vials), the expected luminous life (night-use) of the compass is directly influenced by the half life of H-3, which is 12.3 years.
G. Each Wrist Compass shall be individually labeled, including "Maximum 50mCi ^{3}H", our exempt distribution license # "21-26460-02E", the model number, and our name, in accordance with 10 CFR 32.25 (b).
H. Quality control procedures remain following MIL-PRF-10436M (within attachment 1), unless self-imposed quality procedures are more restrictive.
I. The Wrist Compass is made of a machined aluminum case and strap holder. The dial is aluminum, with black and phosphorescent material making up the face of the dial. A magnet is installed with jewel mount to dial; tritium filled vials are embedded to the dial using permanent silicone adhesive. Dial assembly receives the pivot mounted to the inside case and allows it to turn freely. The plastic cover (lens) receives 2 tritium filled vials and is then glued (silicone adhesive) to the case to form a water resistant permanent bond. See Attachment 2 for drawings of device and components.

CAMMENGA AND ASSOCIATES

100 Aniline Avenue
Holland, MI 49424
Ph. (616) 392-7999
Fax (616) 392-9432

May 18, 2004

Division of Industrial and Medical Nuclear Safety
Office of Nuclear Materials Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Sealed Source Registration No. NR0210D101E

To Whom It May Concern:

Enclosed is our amendment of Sealed Source Registration No. NR0210D101E. This amendment was prepared in accordance with Regulation Title 10 of the Code of Federal Regulations and NUREG 1556, Vol. 3. Cammenga and Associates proposes to install tritium filled vials into Wrist Compasses for "night viewing".

Any questions you may have can be directed to me at the above phone number. If I am not available, please direct questions to John Andrew Cammenga.

Sincerely,
CAMMENGA AND ASSOCIATES

Michael Pastoor
Vice President/Operations
Radiation Safety Officer

Enclosures:
Amendment application for Sealed Source Registration, NRC Form 313.
Enclosure 1 - Submission of items 5 and 6 of amendment application, NRC Form 313.
Enclosure 2 - with Attachment 1 - Current exempt license and attachments / enclosures.
Enclosure 3 - Discussion
Attachment 2 - Drawings of Wrist Compass

NRC FORM 313 (4-2004)
10 CFR 30, 32, 33, 34, 35, 36, 39, and 40

U.S. NUCLEAR REGULATORY COMMISSION

APPLICATION FOR MATERIAL LICENSE

APPROVED BY OMB: NO. 3150-0120 EXPIRES: 10/31/2005

Estimated burden per response to comply with this mandatory collection request: 7 hours. Submittal of the application is necessary to determine that the applicant is qualified and that adequate procedures exist to protect the public health and safety. Send comments regarding burden estimate to the Records and FOIA/Privacy Services Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by Internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0120), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

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.

APPLICATION FOR DISTRIBUTION OF EXEMPT PRODUCTS FILE APPLICATIONS WITH:

DIVISION OF INDUSTRIAL AND MEDICAL NUCLEAR SAFETY
OFFICE OF NUCLEAR MATERIALS SAFETY AND SAFEGUARDS
U.S. NUCLEAR REGULATORY COMMISSION
WASHINGTON, DC 20555-0001

ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS:

IF YOU ARE LOCATED IN:

ALABAMA, CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, FLORIDA, GEORGIA, KENTUCKY, MAINE, MARYLAND, MASSACHUSETTS, MISSISSIPPI, NEW HAMPSHIRE, NEW JERSEY, NEW YORK, NORTH CAROLINA, PENNSYLVANIA, PUERTO RICO, RHODE ISLAND, SOUTH CAROLINA, TENNESSEE, VERMONT, VIRGINIA, VIRGIN ISLANDS, OR WEST VIRGINIA, SEND APPLICATIONS TO:

LICENSING ASSISTANCE TEAM
DIVISION OF NUCLEAR MATERIALS SAFETY
U.S. NUCLEAR REGULATORY COMMISSION, REGION I
475 ALLENDALE ROAD
KING OF PRUSSIA, PA 19406-1415

IF YOU ARE LOCATED IN:

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

MATERIALS LICENSING BRANCH
U.S. NUCLEAR REGULATORY COMMISSION, REGION III
2443 WARRENVILLE ROAD, SUITE 210
LISLE, IL 60532-4352

ALASKA, ARIZONA, ARKANSAS, CALIFORNIA, COLORADO, HAWAII, IDAHO, KANSAS, LOUISIANA, MONTANA, NEBRASKA, NEVADA, NEW MEXICO, NORTH DAKOTA, OKLAHOMA, OREGON, PACIFIC TRUST TERRITORIES, SOUTH DAKOTA, TEXAS, UTAH, WASHINGTON, OR WYOMING, SEND APPLICATIONS TO:

NUCLEAR MATERIALS LICENSING BRANCH
U.S. NUCLEAR REGULATORY COMMISSION, REGION IV
611 RYAN PLAZA DRIVE, SUITE 400
ARLINGTON, TX 76011-4005

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 JURISDICTIONS.

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

- [ ] A. NEW LICENSE
- [X] B. AMENDMENT TO LICENSE NUMBER NR0210D101E
- [ ] C. RENEWAL OF LICENSE NUMBER

2. NAME AND MAILING ADDRESS OF APPLICANT *(Include ZIP code)*

Cammenga & Associates, Inc.
100 Aniline Ave
Holland, MI 49424

3. ADDRESS WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED

100 Aniline Ave.
Holland, MI 49424

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION

Mike Pastoor

TELEPHONE NUMBER

616-392-7999

SUBMIT ITEMS 5 THROUGH 11 ON 8-1/2 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 EXPERIENCE.

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

9. FACILITIES AND EQUIPMENT.

10. RADIATION SAFETY PROGRAM.

11. WASTE MANAGEMENT.

12. LICENSE FEES *(See 10 CFR 170 and Section 170.31)*

FEE CATEGORY Amendment | AMOUNT ENCLOSED $ N/A

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, 36, 39, 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.

CERTIFYING OFFICER – TYPED/PRINTED NAME AND TITLE	SIGNATURE	DATE
R.S.O. MIKE PASTOOR		18 MAY 2004

FOR NRC USE ONLY

TYPE OF FEE	FEE LOG	FEE CATEGORY	AMOUNT RECEIVED	CHECK NUMBER	COMMENTS
			$		
APPROVED BY				DATE	

Enclosure 1

CAMMENGA AND ASSOCIATES

100 ANILINE AVE. N.
HOLLAND, MI 49424
Phone 616-392-7999
Fax 616-392-9432

18 May 2004

#5. RADIOACTIVE MATERIAL

Radioactive Material: Tritium
Mass: 3
Physical Form Sealed Sources, Gas

1. Specifications

A. H-3 Compass Vials
The H-3 is contained in small glass-sealed vials coated with phosphorescent material. The H-3 vials function as radio-luminescent lights within the compass. These vials are attached to the compass with silicone (or like) adhesive. Specifications for the vials are as follows; each compass would contain a maximum of 14 vials:

- 3 each - vial #13219E0783, model # T4902-1 (each vial contains 5 millicuries H-3). Identical vial currently installed into our Lensatic Compass, NSN 6605-01-196-6971 and registered under this registration number NR0210D101E.
- Maximum - 11each, vial model #T5608-1, Length = 2.5mm, OD =0.90mm, (each vial contains maximum activity per light of 3.15 millicuries (0.117 GBq), while the standard for this light is 0.89mCi (0.033GBq).

Maximum total H-3 activity per new Wrist Compass not to exceed 50 millicuries. New vials will be purchased using same procedures and vendor as current - mb microtec, A.G., Bern, Switzerland or other suitable supplier.

B. Maximum H-3 possession limit for this license would remain 14,400 curies.

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

The licensed material (H-3) will be incorporated into a Wrist Compass for distribution to person(s) exempt from licensing. The H-3 vials will be received, handled, and used within the manufacturing process, in accordance with the guidelines found in the Manufacturing and Distribution NRC license Number 21-2640-01 for Cammenga and Associates, 100 Aniline Ave. N., Holland, MI 49424. The finished product (Wrist Compass) will be checked for quality, checked for safety, handled, and stored per our current safety guidelines found in MIL-PRF-10436M (Attachment 1).

Enclosure 2 (containing Attachment 1)

CAMMENGA AND ASSOCIATES
100 ANILINE AVE. N.
HOLLAND, MI 49424
Phone 616-392-7999
Fax 616-392-9432

18 May 2004

Our exemption license, number 21-26460-02E, is attached - including all enclosures and attachments from License renewal, 20 January 2003.

U.S. NUCLEAR REGULATORY COMMISSION

Attachment 1

Amendment No. 02

MATERIALS LICENSE

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter I, Parts 30, 31, 32, 33, 34, 35, 36, 39, 40, and 70, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special nuclear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations, and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

Licensee	In accordance with application dated January 29, 2003,
1. Cammenga & Associates	3. License number 21-26460-02E is renewed in its entirety to read as follows:
2. 100 Aniline Avenue Holland, MI 49424	4. Expiration date July 31, 2013
	5. Docket No. 030-33020 Reference No.-

6. Byproduct, source, and/or special nuclear material	7. Chemical and/or physical form	8. Maximum amount that licensee may possess at any one time under this license
A. Hydrogen-3	A. Glass Sealed Vials (MB Microtec Models 400/6, 400/3, and 400/1)	A. Not applicable (see Condition 11)

9. Authorized use:

Pursuant to Section 32.22, 10 CFR Part 32, "Specific Domestic Licenses to Manufacture or Transfer Certain Items Containing Byproduct Material," the licensee is authorized to distribute the self-luminous compass models described by manufacturing print number 13208E4680 containing sealed sources as specified in Condition 10 of this license to persons exempt from the requirements for a license pursuant to Section 30.19, 10 CFR Part 30, or equivalent provisions of the regulations of any Agreement State.

CONDITIONS

10. The following self-luminous products may be distributed pursuant to this license provided the amount of hydrogen-3 contained in each device does not exceed the amount specified:

Device Model	Maximum Activity per Device
3H, 3HCS, 3HSD, 3HGVT, GB3H, B3H, B3HCS, 3HRF, RF3H, SY183, SandY183	120 mCi (4.44 GBq)

11. This license does not authorize possession or use of licensed material.

MATERIALS LICENSE
SUPPLEMENTARY SHEET

License Number
21-26460-02E

Docket or Reference Number
030-33020

Amendment No. 02

CONDITIONS

(Continued)

12. The licensee may distribute only from its facility located at 100 Anlline Avenue N., Holland, Michigan.

13. The licensee shall file periodic reports as specified in Section 32.25(c), 10 CFR Part 32.

14. Except as specifically provided otherwise by this license, the licensee shall conduct its program in accordance with the statements, representations, and procedures contained in the documents, including any enclosures, listed below. The U.S. Nuclear Regulatory Commission's regulations shall govern unless the statements, representations, and procedures in the licensee's application and correspondence are more restrictive than the regulations.

    A. Letter dated January 28, 2003 and application dated January 29, 2003;
    B. Registration Certificate No. NR-0210-D-101-E;
    C. Facsimile dated April 03, 2003;
    D. Facsimile dated April 08, 2003;
    E. Facsimile dated June 23, 2003;
    F. Facsimile dated July 14, 2003, sent 10:16am; and
    G. Facsimile addendum dated July 14, 2003, sent 10:28am.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Date: July 21, 2003

By: Anthony S. Kirkwood

Anthony S. Kirkwood
Materials Safety and Inspection Branch
Division of Industrial and
Medical Nuclear Safety
Office of Nuclear Material Safety
and Safeguards
Washington, DC 20555

Attachment 1

FROM RENEWAL APPLICATION DATED JANUARY 2003

METRIC

MIL-PRF-10436M
15 SEPTEMBER 1998
SUPERSEDING
MIL-C-10436L
15 MAY 1987

PERFORMANCE SPECIFICATION

COMPASS, MAGNETIC, UNMOUNTED:

LENSATIC, LUMINOUS, 5 DEGREE AND 20 MIL

GRADUATIONS, WITH CARRYING CASE

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

1. SCOPE

1.1 Scope. This specification covers an induction-damped, lensatic, unmounted, magnetic compass, with 5 degree and 20 mil graduations, for individual use during day and nighttime.

2. APPLICABLE DOCUMENTS

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

2.2 Government documents.

2.2.1 Other Government documents and publications. The following other Government documents and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: U.S. ARMY TOPOGRAPHIC ENGINEERING CENTER, ATTN: CETEC-TD-T, 7701 TELEGRAPH ROAD, ALEXANDRIA, VA 22315-3864, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 6605

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

OTHER GOVERNMENT DOCUMENTS

DEPARTMENT OF INTERIOR, U.S. GEOLOGICAL SURVEY

ISOGONIC CHARTS

Epoch 1995 Map No. GP1002-D	Magnetic Declination of the U.S.
Epoch 1995 Map No. GP1002-F	Magnetic Total Intensity of the U.S.
Epoch 1995 Map No. GP986-V	Magnetic Vertical Intensity of the U.S.
Epoch 1995 Map No. GP986-H	Magnetic Horizontal Intensity of the U.S.

(Application for copies should be addressed to Map Distribution, U.S. Geological Survey, Box 25286, Federal Center, Denver, CO 80225.)

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

3. REQUIREMENTS

3.1 Description. The compass (see Figure 1A and 1B) shall be an induction-damped, hand-held, north-seeking instrument with internal, self-exciting light source.

3.2 First article. Unless otherwise specified (see 6.2), a sample shall be subjected to first article inspection.

3.3 Design, materials, and manufacturing processes. Unless otherwise specified, the design, materials, and manufacturing processes are the prerogative of the contractor as long as all articles submitted to the government meet the operating, environmental, and support requirements specified.

3.3.1 Material deterioration prevention and control. The compass shall be fabricated from compatible materials, inherently corrosion resistant or treated to provide protection against the various forms of corrosion and deterioration to which they are susceptible.

3.4 Operating requirements.

3.4.1 Graduations. The compass shall be graduated in degrees and mils. The degree graduations shall be red and identified at 5 degree intervals. They shall be numbered every 20 degrees, with north being 0 degrees. The north arrow may be used in lieu of the "0" degree marking. The mil graduations shall be black and identified at 20 mil intervals. They shall be numbered every 200 mils, using only hundreds and thousands digits (i.e., 2, 4, 6, ...64 represent 200, 400, 600, ...6400 mils). North shall be identified as 6400 mils. All graduations shall be distinguishable in day and night conditions (see 4.4.1.1).

3.4.2 Scale. The compass shall have a scale of 1:50000 with graduations of 100 meters, 0 to 6000 minimum, along the length of the compass, in the opened configuration (if applicable) (see 4.4.1.2)

3.4.3 Sighting device. The compass shall have a sighting mechanism, capable of aiming the compass in day and night conditions (see 4.4.1.3).

3.4.4 Bezel. The compass shall have an attached bezel (ring with luminous line), capable of rotation through 360 degrees in either direction. Rotation shall be limited to 3 degree increments with tactile (non-audible) feedback. There shall also be means to prevent accidental movement or removal of the bezel (see 4.4.1.4).

3.4.5 Free floating assembly. When a free floating assembly is employed, the compass shall incorporate a mechanism that restricts all movement of the dial assembly when the compass is not in use, and automatically releases the dial assembly for use (see 4.4.1.5).

3.4.6 Lanyard. A neck lanyard 2.5 ±0.5 millimeters (mm) thick with the ends permanently joined to form a loop, 150 ±5 centimeters (cm) in circumference, shall be attached to each compass. The lanyard shall be Army green and made from a suitable, pliable, durable material (see 4.4.1.6).

3.4.6.1 Lanyard attachment. The lanyard and compass attachment point shall withstand a force of 34 kg without damage, breakage or separation from the compass (see 4.4.1.6.1).

3.4.7 Carrying case. A carrying case shall be furnished with each compass. The case shall be a pouch made from a suitable, pliable, durable material, with a single heavy duty fastening system on the fold over flap closure. The carrying case material shall be Army green and the fasteners shall be lusterless black. It shall be provided with a means for drainage and for attachment to belts 7 cm wide. The case shall be constructed for repeated use and to facilitate storage and retrieval of the compass and instruction card (see 4.4.1.7 and 4.4.3.4).

3.4.7.1 Instruction card. Instructions in white lettering shall be printed on a dark green card, 6 x 10 cm nominal size, that shall not be damaged by water or moisture. One card, without being folded, shall be inserted into each compass carrying case (see 4.4.1.7.1). Additional instruction cards shall be provided as specified (see 6.2). Data, printed legibly on cards, shall be as follows:

INSTRUCTIONS:

(1) Align luminous line on compass ring with sight lines.

(2) Turn ring counterclockwise by desired number of clicks. Note: Number of clicks = degrees azimuth divided by 3. Example: 51 degrees azimuth / 3 = 17 clicks counterclockwise.

(3) Turn compass until north arrow lines up with luminous line on ring.

(4) Sight line now points to azimuth.

3.4.8 Magnetic performance. The compass shall provide magnetic performance as specified in 3.4.8.1. when operated in accordance with the instructions in 3.4.7.1. It shall be capable of being read to an accuracy that ensures an error not greater than 40 mils, in any ambient light, under adverse field conditions (see 4.4.1.8).

3.4.8.1 Magnetic standard. The compass shall operate in a magnetic field with a horizontal component equal to the local standard ±.01 oersted and vertical component of the local standard ±.03 oersted (Continental United States). The local standard shall be established using the U.S. Geological Survey (Department of the Interior) Epoch 1995 Map No. GP1002-D, Magnetic Declination of the U.S.; Epoch 1995 Map No. G1002-F, Magnetic Total Intensity of the U.S.; Epoch 1995 Map No. GP986-V, Magnetic Vertical Intensity of the U.S.; and Epoch 1995 Map No. GP986-H, Magnetic Horizontal Intensity of the U.S.

3.4.9 Mechanical performance. The compass shall meet the subordinate requirements with the compass in the operational configuration and away from all magnetic effects external to the compass caused by buildings, vehicles, electrical devices, etc.

3.4.9.1 Damping. The magnetic assembly, shall come to rest within 6 seconds of time after being deflected 540 ±20 mils from a position of equilibrium (see 4.4.1.9.1).

3.4.9.2 Freedom of rotation when tilted. The operation of the compass shall not be adversely affected when it is tilted 8.0 ±.1 degree from the horizontal and rotated 360 degrees in a plane normal to the longitudinal axis of the pivot (see 4.4.1.9.2).

3.4.9.3 Compass error. The error in magnetic azimuth, including that caused by pivot friction, shall not be greater than 40 mils (see 4.4.1.8).

3.4.9.4 Friction error. The error caused by friction between the pivot supporting the dial and its bearing shall not be greater than 20 mils (see 4.4.1.9.3).

3.4.10 Illumination. The compass shall have internal, self-exciting light sources of constant luminosity for sighting and reading. In addition, the dial assembly shall have a light source on the permanent magnet to indicate north and the bezel crystal shall have a light source to aid in setting readings and sighting. The "E" (east) and "W" (west) markings shall also be illuminated. All sources shall be mounted flush with or recessed in their mounting surfaces and encapsulated to inhibit damage (see 4.4.1.9.4).

3.4.10.1 Luminosity. Luminous material, in the final form, shall have a peak spectral output of 530 ±30 nanometers. The brightness of the luminous sources installed in the completed compass shall be sufficient to allow the performance of compass functions in any ambient light and under any of the environmental conditions specified herein (see 4.4.1.9.4.1). Self-exciting luminous sources shall have a minimum service life of 12 years (see 6.2).

3.5 Environmental requirements.

3.5.1 Water leakage. The complete compass shall be capable of being submerged into water without leakage into the interior of the compass, where it will adversely affect performance directly or indirectly (see 4.4.2.1).

3.5.2 Shock. The compass shall not be damaged or suffer performance degradation when dropped from a height of 90 cm (see 4.4.2.2).

3.5.3 Low and high temperatures. When exposed to temperature extremes of -44°C and 68°C, the compass shall function properly and shall not be damaged (see 4.4.2.3).

3.5.4 Thermal shock (vials only). Self-excited luminous sources shall not be damaged by thermal shock caused by sudden temperature changes of -52°C to 68°C (see 4.4.2.4).

3.6 Support requirements.

3.6.1 Dimensions and weight. The compass shall not be greater than 9 cm long, 8 cm wide and 4 cm high, in its closed or stored configuration. Its weight shall not be greater than 170 grams (see 4.4.3.1)

3.6.2 Radiological containment. If radioactive luminous light sources are used (see 3.4.10), these subordinate requirements are mandatory.

3.6.2.1 Contamination. Removable contamination activity of the completed compass shall be less than 900 disintegration rate per minute (dpm) at the time of production (see 4.4.3.2.1).

3.6.2.2 Diffusion. A completed compass with all the luminous vials installed shall not leak radioactive material in excess of 0.05 microcuries in 24 hours (see 4.4.3.2.2).

3.6.3 Impact durability of vials. If radioactive self-luminous source vials are used, the vials shall show no evidence of leakage, breaking, checking, shattering or spalling when the compass is dropped onto a hard surface (see 4.4.3.3).

3.6.4 Durability. The case, compass body, crystal, and moving parts shall meet all of the requirements that are described, herein, for a minimum service life of 12 years (see 4.4.3.4).

3.6.5 Finishes.

3.6.5.1 Wear surfaces. Any exterior surfaces subject to wear from repeated use shall be finished in a manner that produces a wear resistant black finish (see 4.4.3.5.1)(see 6.2).

3.6.5.2 Non-wear surfaces. All other external surfaces shall be treated and painted for corrosion protection, as necessary. The finish coat shall be a semi-gloss Army green enamel (see 4.4.3.5.2).

3.6.5.3 Damping shell. The inside (visible) surfaces of the damping shell shall be treated and painted for corrosion protection. The finish coat shall be a white enamel (see 4.4.3.5.3).

3.6.6 Markings.

3.6.6.1 Identification. Lot identification shall be permanently marked on the compass, inside the cover (if applicable) to include year and month of manufacture and lot number. The top of the compass shall be marked with the identification and part number of the manufacturer, and National Stock Number (NSN) (see 4.4.3.6.1).

3.6.6.2 Radiation marking. If radioactive materials are used in the production of the compass, one of these subordinate requirements is mandatory (see 6.2).

3.6.6.2.1 Specific license marking. The bottom of the compass shall be permanently marked as required by applicable Nuclear Regulatory Commission Byproduct Materials License. It shall include the radiation caution symbol (not in color), quantity of isotope, the byproduct-materials

license number, and appropriate control instructions of the using service. A warning against disassembly shall also be included (see 4.4.3.6.2.1).

3.6.6.2.2 Marking of a license exempt item. The bottom of the compass shall be permanently marked to include the Nuclear Regulatory Commission manufacturer's identification number, XXXmCi 3H and "CONTROLLED DISPOSAL REQUIRED" (see 4.4.3.6.2.2 and 6.4).

4. VERIFICATION

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

a. First article inspection (see 4.2).

b. Conformance inspection (see 4.3).

c. Comparison inspection (see 6.8).

4.2 First article inspection. First article compasses shall consist of 10 completely assembled units.

4.2.1 Tests. Unless otherwise specified (see 6.2), the first article compasses shall be tested as specified in table I in the sequence presented. Failure of any test shall be cause for rejection of the first article compasses.

TABLE I. Test schedule.

Test	Verification	Requirement
Luminosity	4.4.1.9.4.1	3.4.10.1
Contamination	4.4.3.2.1	3.6.2.1
Shock	4.4.2.2	3.5.2
Low and High temperature	4.4.2.3	3.5.3
Damping	4.4.1.9.1	3.4.9.1
Freedom of rotation when tilted	4.4.1.9.2	3.4.9.2
Magnetic performance and compass error	4.4.1.8	3.4.8, 3.4.9.3
Friction error	4.4.1.9.3	3.4.9.4
Lanyard attachment	4.4.1.6.1	3.4.6.1
Durability *	4.4.3.4	3.6.4
Impact durability of vials*	4.4.3.3	3.6.3
Diffusion	4.4.3.2.2	3.6.2.2
Water leakage	4.4.2.1	3.5.1
Luminosity	4.4.1.9.4.1	3.4.10.1

* To be performed during first article testing only.

4.2.2 Examination. The first article compasses shall be examined and shall meet the requirements as specified in Table II. Presence of one or more defects shall be cause for rejection of the first article compasses.

Table II. Examination schedule for First Article and Quality Conformance

Examination	Verification	Requirements
Graduations	4.4.1.1	3.4.1
Scale	4.4.1.2	3.4.2
Sighting device	4.4.1.3	3.4.3
Bezel	4.4.1.4.	3.4.4
Free floating assembly	4.4.1.5	3.4.5
Lanyard	4.4.1.6	3.4.6
Carrying case	4.4.1.7	3.4.7
Instruction card	4.4.1.7.1	3.4.7.1
Illumination	4.4.1.9.4	3.4.10
Dimensions and weight	4.4.3.1	3.6.1
Wear surfaces	4.4.3.5.1	3.6.5.1
Non-wear surfaces	4.4.3.5.2	3.6.5.2
Damping shell	4.4.3.5.3	3.6.5.3
Identification	4.4.3.6.1	3.6.6.1
Radiation marking	4.4.3.6.2	3.6.6.2
Specific license marking	4.4.3.6.2.1	3.6.6.2.1
Marking licenses exempt item	4.4.3.6.2.2	3.6.6.2.2, 6.4

4.3 Conformance inspection.

4.3.1 Sampling. The compass sample size (see 6.9) for examination and testing shall be in accordance with the contract. A lot shall be accepted when zero defects are found and rejected when one or more defects are found. The production lot size shall be 3200 compasses, unless otherwise specified (see 6.2).

4.3.2 Tests.

4.3.2.1 Samples. Samples selected in accordance with 4.3.1 shall be tested and meet the requirements as specified in Table I. Any sample failing to pass any test shall be considered defective.

4.3.3 Examination.

4.3.3.1 Samples. Samples selected in accordance with 4.3.1 shall be examined and meet the requirements as specified in Table II.

4.3.3.2 Individual examination. Each production compass product shall be compared to an approved first article model (see 3.2) by examination in a darkroom for uniformity of light emission, proper source alignment and adhesive bonding, after the compasses have been dark

adapted for a period of not less than 1 hour. The absence of light uniformity, as compared to an approved first article model, improper source alignment or bonding shall constitute failure of that compass only. In cases of question, the luminosity of the source shall be determined as specified in 4.4.1.9.4.1. Failure of one or more sources to perform all compass functions in any ambient light and under any of the environmental conditions specified herein shall constitute failure of that compass only.

4.4 Test and examination.

4.4.1 Operating requirements validation.

4.4.1.1 Graduations. The compass graduations shall be visually examined to verify that the degrees are in red with 5 degree intervals, the mil graduations are in black with 20 mil intervals, and graduations are distinguishable in day and night conditions. Any deviation constitutes failure of this requirement.

4.4.1.2 Scale. The compass scale shall be visually examined to verify that it has a 1:50000 scale with 100 meters graduations, 0 to 6000 minimum, along the length of the compass, in the opened configuration (if applicable). Any deviation constitutes failure of this requirement.

4.4.1.3 Sighting device. The compass shall be aimed at a target. Inability to aim the compass at the target utilizing sighting mechanism shall constitute failure of this requirement.

4.4.1.4 Bezel. The bezel shall be rotated 360 degrees in both directions. Failure of the bezel to rotate in either directions in three-degree increments with tactile (non-audible) feedback or to restrict accidental movement or to remain attached shall constitute failure of this requirement.

4.4.1.5 Free floating assembly. The compass shall be examined in an open and closed configuration. The restraining mechanism shall be tested by hand shaking the closed compass; rattling of the floating dial assembly shall constitute failure of this requirement. Then, the compass shall be opened to a reading position; failure of the restraining mechanism to release the dial assembly shall constitute failure of this requirement.

4.4.1.6 Lanyard. The neck lanyard shall be examined to verify that the thickness is 2.5 ±0.5 mm and the ends are permanently joined to form a loop of 150 ±5 centimeters (cm) in circumference, and that the material is a suitable, pliable, durable material of Army green. Failure of this examination constitutes failure of this requirement.

4.4.1.6.1 Lanyard attachment. The assembled compass shall be fixed in an apparatus able to withstand the forces to be applied that will not hinder or support the attachment of the lanyard. A minimum tensile force of 34 kilograms shall be applied to the attached lanyard, at a point where the force is exerted on both the joint forming the loop and the point of attachment to the compass. Any damage or breakage of the lanyard or compass shall constitute failure of this test.

4.4.1.7 Carrying case. The carrying case shall be examined to verify that the material is pliable and durable and the color is Army green. In addition, verify that the case has a heavy duty, lusterless black fastening system on the flap enclosure, a means for drainage, and a 7 mm belt attachment. The compass shall be placed in the case and the case flap fastened and unfastened. Then the compass shall be removed from the case to verify ease of storage and removal. There

shall be no snags or tightness within the case which prevents the compass from slipping in and out easily. Failure of this examination constitutes failure of this requirement.

4.4.1.7.1 Instruction card. The instruction card shall be examined to verify that the instructions are correct; the lettering is white; the card is dark green and 6 x 10 cm, nominal size; the card is water or moisture resistant; and that one unfolded card fits in the compass carrying case. Failure of this examination constitutes failure of this requirement.

4.4.1.8 Magnetic performance and compass error. The compass shall be placed in a horizontal position on a fixed point and by means of the sighting mechanism, the compass shall be sighted on three targets of known magnetic azimuths approximately 120 degrees apart. With no remedial action by the operator, before, at, or after, a reading shall be taken at each target. The difference between the known azimuths and readings taken is the compass error. An error greater than 40 mils or failure of the compass to function correctly shall constitute failure of this test.

4.4.1.9 Mechanical performance. The following tests shall be with the compass in the operational configuration and away from all magnetic effects external to the compass.

4.4.1.9.1 Damping. The compass magnet shall be deflected 540± 20 mils from a position of equilibrium and released. If the magnetic assembly requires more than 6 seconds to come to rest, it shall constitute failure of this test.

4.4.1.9.2 Freedom of rotation when tilted. The compass shall be tilted 8.0 ± 0.1 degree from the horizontal and uniformly rotated 360 degrees at approximately 10 seconds of time per revolution, in a plane normal to the longitudinal axis of the pivot. The compass shall be rotated one complete revolution in the clockwise direction and one complete revolution counterclockwise. Inability of the dial or magnetic assembly to remain free while being rotated shall constitute failure of this test.

4.4.1.9.3 Friction error. The compass dial assembly shall be magnetically deflected 40 ±5 mils by an external force acting in the horizontal plane of the compass. The mechanism shall be permitted to come to rest. The external force shall then be removed in a radial direction in the same horizontal plane. The compass dial shall then be read. The procedure shall be repeated by deflecting the magnet 40 ±5 mils in the opposite direction. One-half of the difference between the two readings is the friction error. An error greater than 20 mils shall constitute failure of this test.

4.4.1.9.4 Illumination. The compass shall be examined to verify that the unit has light sources for reading and sighting; the permanent magnet on the dial assembly and the bezel crystal have light sources to aid in setting readings and sighting; and, the "E" (east) and "W" (west) markings are illuminated. Also, verify that the light sources are self-exciting and that all sources are recessed or flush mounted and encapsulated. Failure of this examination constitutes failure of this requirement.

4.4.1.9.4.1 Luminosity. The assembled compass shall be examined visually for dead or dim luminous sources, after it has been dark adapted for not less than 1 hour. The spectral and luminescent output shall be visually compared to a compass used to establish the working standards (see 6.2.1). Sources of questionable luminosity shall be retested. All subsequent brightness tests shall be determined by a photoelectric photometry method, corrected for photopic

vision, using a photometer calibrated to the working standards. If the brightness of the luminous sources of the assembled compass is not sufficient to perform all compass functions in any ambient light and under any of the environmental conditions specified; herein, it shall constitute failure of this test.

4.4.2 Environmental requirements verification.

4.4.2.1 Water leakage. When radiological tests are performed, this test may be accomplished in conjunction with diffusion tests. The complete compass shall be submerged in 300 ml of distilled or deionized water for 24 hours at 23°±5°C. The compass shall be removed from the water and examined for water leakage. If there is evidence of water in the compass bowl at the completion of the test, it shall constitute failure of this test.

4.4.2.2 Shock. The compass, in the open configuration (if applicable), shall be dropped twice from a height of 90 cm onto a solid surface covered with 10 cm of 40 grit kiln dried sand. The sand may be covered with a sheet of plastic not greater than 2 mils thick. The compass shall hit the sand or plastic face up on one drop and edgewise on the second. Any evidence of damage (other than cosmetic) to the compass or failure to operate as specified herein shall constitute failure of this test.

4.4.2.3 Low and high temperature. The completed compass shall be subjected to one complete cycle each of low and high temperature operation. The compass in its closed configuration (if applicable) shall be subjected to a temperature of -44° ±2°C for a period of 30 minutes without the benefit of solar radiation. After this period and at this temperature, the compass shall be opened (if applicable) and examined. The compass shall then be closed (if applicable) and after stabilizing at room temperature, be subjected to a temperature of 68° ±3°C for a period of 30 minutes. After this period and at this temperature, the compass shall be opened (if applicable) and examined. During either examination, any evidence of damage or failure of the compass dial to seek north and rotate smoothly and freely shall constitute failure of this test.

4.4.2.4 Thermal shock (vials only). Unless certification of conformance is obtained from the luminous source supplier, all radioactive self-luminous source vials to be installed in the compass, shall be subjected to two successive cycles of thermal shock. Begin the cycle by immediately placing the vials in a temperature of -52° ±2°C for 15 minutes. Remove the vials from the cold environment immediately to a temperature of 68° ±3°C for another 15 minutes. This constitutes one cycle. After the final cycle, the vials shall be returned to room temperature and the sources examined. Any damage or degradation to the vials shall constitute failure of this test.

4.4.3 Support requirements verification.

4.4.3.1 Dimension and weight. The compass shall be measured and weighed. Dimensions greater than 9 cm long, 8 cm wide and 4 cm high, in its closed or stored configuration or weight greater than 170 grams shall constitute failure of this requirement.

4.4.3.2 Radiological containment. If radioactive material is used in the production of compass components, these subordinate tests are mandatory.

4.4.3.2.1 Contamination. A piece of Whatman-50 filter paper, or equivalent, moistened with deionized or distilled water shall be used to wipe the compass. All exterior surfaces of the

compass, opened (if applicable), shall be thoroughly wiped with the filter paper. The amount of radioactive contamination on the filter paper shall be determined using a liquid scintillation counting system capable of measuring 100 picocuries or less of radioactivity. The paper shall be placed in the liquid scintillation solution within one minute of wiping the compass. A removable contamination activity of more than 900 dpm per compass shall constitute failure of this test.

4.4.3.2.2 Diffusion. The completed compass with all the self-luminous sources installed shall be submerged in 300 ml of distilled or deionized water for 24 hours at 23° ±5°C. The compass shall be removed from the water and the water shall be analyzed. If the radioactive content of the water exceeds .05 microcuries, it shall constitute failure of the test.

4.4.3.3 Impact durability of vials. Unless otherwise specified (see 6.2), the first article compasses only shall be subjected to this testing procedure. Each compass, in the open configuration (if applicable), shall be subjected to a free fall from a height of 100 cm onto an unyielding, rigid steel surface. The compass shall be dropped twice, without effort to orient the compass or shield the self-luminous sources. Unaided, visual evidence of leakage, breaking, checking, shattering, spalling of the vials shall constitute failure of this test. Damage to the compass, other than the vials, does not constitute failure of this test.

4.4.3.4 Durability. Unless otherwise specified (see 6.2), the first article compasses only shall be subjected to this testing procedure. The compass shall demonstrate a 99% probability of success with a 95% low confidence level with zero failures, each compass shall be tested as follows (recommended minimum number of cycles is 473):

a. Remove from its case and open the compass completely (if applicable).
b. The compass in the open configuration, if applicable, shall be dropped from a height of 90 cm, alternately on its face, side and bottom, onto a solid surface covered with 10 cm of 40 grit kiln dried sand. The sand may be covered with a sheet of plastic not greater than 2 mils thick.
c. After each drop examine the compass for damage.
d. After each drop rotate the bezel 360°, clockwise on even numbered drops and counter-clockwise on odd numbered drops, to ensure proper operation.
e. After each drop, alternating targets, sight the compass on one of three targets of known magnetic azimuths approximately 120° apart and record each reading.
f. After every tenth drop test the compass for friction error as defined in 4.4.1.9.3.
g. Close the compass (if applicable) and return it to the case.

Any evidence of damage (other than cosmetic) to the compass (or its case) or inability to operate as specified herein shall constitute failure of this test.

4.4.3.5 Finishes.

4.4.3.5.1 Wear surfaces. The compass shall be examined to verify that all exterior surfaces subject to wear are finished in a wear resistant black finish (e.g. black oxide or anodizing). Failure of this examination constitutes failure of this requirement

4.4.3.5.2 Non-wear surfaces. The compass shall be examined to verify that all external non-wear surfaces have been treated and painted with semi-gloss Army green enamel. Failure of this examination constitutes failure of this requirement

4.4.3.5.3 Damping shell. The compass shall be examination to verify that inside (visible) surfaces of the damping shell have been treated and painted with white enamel. Failure of this examination constitutes failure of this requirement

4.4.3.6 Markings.

4.4.3.6.1 Identification. The compass shall be examined to verify that the lot identification is permanently marked on the compass, inside the cover (if applicable) and the marking includes year and month of manufacture and lot number, for example 90-7-002. The top of the compass shall be marked with the identification and part number of the manufacturer, and National Stock Number (NSN). Incomplete or illegible marking shall constitute failure of this requirement.

4.4.3.6.2 Radiation marking. If radioactive luminous light sources are used, verify which marking is required (see 6.2).

4.4.3.6.2.1 Specific license marking. The compass shall be examined to verify that the bottom of the compass is permanently marked as required by applicable Nuclear Regulatory Commission Byproduct Materials License; that it includes the radiation caution symbol (not in color), quantity of isotope, the byproduct-materials license number, appropriate control instructions of the using service, and a warning against disassembly. Incomplete or illegible marking shall constitute failure of this requirement.

4.4.3.6.2.2 Marking of a license exempt item. The compass shall be examined to verify that the bottom of the compass is permanently marked to include the Nuclear Regulatory Commission manufacturer's identification number, XXXmCi 3H (where XXX shall be replaced by the actual nominal activity) and "CONTROLLED DISPOSAL REQUIRED" (see 6.4). Incomplete or illegible marking shall constitute failure of this requirement.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DOD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

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

6.1 Intended use. The compass, with self-luminous light sources to facilitate use during periods of darkness, is for obtaining magnetic azimuths for ground navigation, reconnaissance. and fire control purposes.

6.1.1 Military Unique Rationale. The Lensatic Compass is military unique because it must operate satisfactorily and not be damaged during the rigors of world-wide battlefield deployment. The compass is required to survive and perform in extreme cold and heat, not be damaged when dropped onto hard surfaces, or leak when submerged in water. In addition, the self-excited luminous sources (which have in the past utilized radioactive material) must not be damaged by thermal shock caused by sudden temperature changes of -52°C to 68°C and have a "luminous life" of 12 years, minimum.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specification.
b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2).
c. When first article inspection is not required (see 3.2).
d. When compasses for standards are required (see 6.2.1)
e. Number of additional instruction cards required (see 3.4.7.1).
f. Whether marking of compasses is to be for specific licenses or for general licenses (see 3.6.6.2.).
g. When the production lot size is less than 3,200 compasses (see 4.3.1).
h. When the impact test is not required (see 4.4.3.3).
i. When the durability test is not required (see 4.4.3.4).
j. When a manufacturer's certification of service life of luminous sources is required (see 3.4.10.1).
k. Packaging requirements (see 5.1).
l. When license to manufacture and distribute radioactive luminous sources is required (see 6.2.2).

6.2.1 Compass standards. When specified (see 6.2), two assembled compasses, of known luminosity, are furnished to the U.S. Army TMDE Activity, ATTN: AMSMI-TMDE-DR, 10115 Duporttail Road, Suite 136, Fort Belvoir, VA 22060-5847. The Government measures the luminosity of the sources; then, the compasses and readings are returned to the contracting officer. The readings are used as standards in the testing specified in 4.4.1 and 4.4.2. If self-excited luminous sources are used in the production of the compass, the sources will be aged a period of not less than 30 days prior to being assembled into the compass.

6.2.2 Nuclear Regulatory Commission license. If radioactive luminous sources are used, the contractor will obtain a specific license to manufacture and distribute these sources in accordance

with the requirements of Title 10 (Nuclear Regulatory Commission) of the Code of Federal Regulations.

6.2.3 Test vials. Prior to production, the source vial provider furnishes the Government with two sets of loose vials (a set of loose vials constitutes the number and specific types of vials installed in a single compass). The Government reserves the right to perform diffusion, contamination, other nondestructive testing and destructive testing, if necessary, on the loose vials. Forward these vials to the U.S. Army TMDE Activity, ATTN: AMSMI-TMDE-DR, 10115 Duporttail Road, Suite 136, Fort Belvoir, VA 22060-5847.

6.3 First article. When a first article inspection is required, the item(s) should be a pre-production model(s). The first article should consist of ten units. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examinations, approval of the first article test results and disposition of the first articles. Invitation for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product that has been previously acquired or tested to this specification by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is appropriate for the pending contract. Bidders should not submit alternative bids unless specifically requested to do so in the solicitation.

6.4 Marking of license exempt item. The contracting officer should take the necessary action to ensure proper marking when a license exempt item is being furnished (see 3.6.6.2.2).

6.5 Definitions. The following definitions apply for this specification.

6.5.1 Compass durability. The compass shall have a 99% probability of success with a 95% low confidence level during a 12-year life.

6.5.2 Historical samples. Five compasses are randomly selected from the first two hundred production compasses from the first lot and forwarded to the U.S. Army TMDE Activity, ATTN: AMSMI-TMDE-DR, 10115 Duporttail Road, Suite 136, Fort Belvoir, VA 22060-5847. These compasses are retained by the Government for comparative purposes and to establish a historical audit trail.

6.6 Subject term (key word) listing.

Magnetic
Lensatic
Graduated
Induction damped
Self-luminous

6.7 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

6.8 Comparison inspection.

6.8.1 Government verification testing. The Government performs verification testing of production compasses as follows:

Five compasses will be randomly selected from each production lot of 3,200 compasses for removable contamination, water leakage, and luminosity testing. These five compasses can not be from previously selected samples, but are chosen from the remaining compasses of the lot. There are no substitutions. The contractor performs a contamination wipe test on these five compasses. These compasses are not washed or cleaned, in any way, following the test. The compasses and wipes are forwarded to the U.S. Army TMDE Activity, ATTN: AMSMI-TMDE-DR, 10115 Duporttail Road, Suite 136, Fort Belvoir, VA 22060-5847 for liquid scintillation counting. Upon completion of tests, the U.S. Army TMDE Activity will notify the contracting officer of the results within 7 working days. Failure of any of the five compasses constitutes failure of this test.

6.8.1.1 Random testing. The Government may select compasses at any time during the contract production period and subject these compasses to verification of the requirements in section 3, the examination specified in section 4 as specified in table II (see 4.2.2), to determine conformance to the requirements of this specification. The inspection will be performed by the Government, at a site selected by the Government, on units selected at random from those that have been accepted by the Government and will not include the previously inspected first article model compasses. In addition to any test specified as part of the inspection comparison, the Government reserves the right to conduct any and all other tests contained in this specification as part of the inspection comparison, and failure of such additional tests shall have the same effect as failure of these tests specified as conformance inspection.

6.9 Sample size. The contracting officer should include specific instructions in acquisition documents regarding the sample size. In the past, a sample size of 125 compasses for a lot size of 3,200 compasses was required.

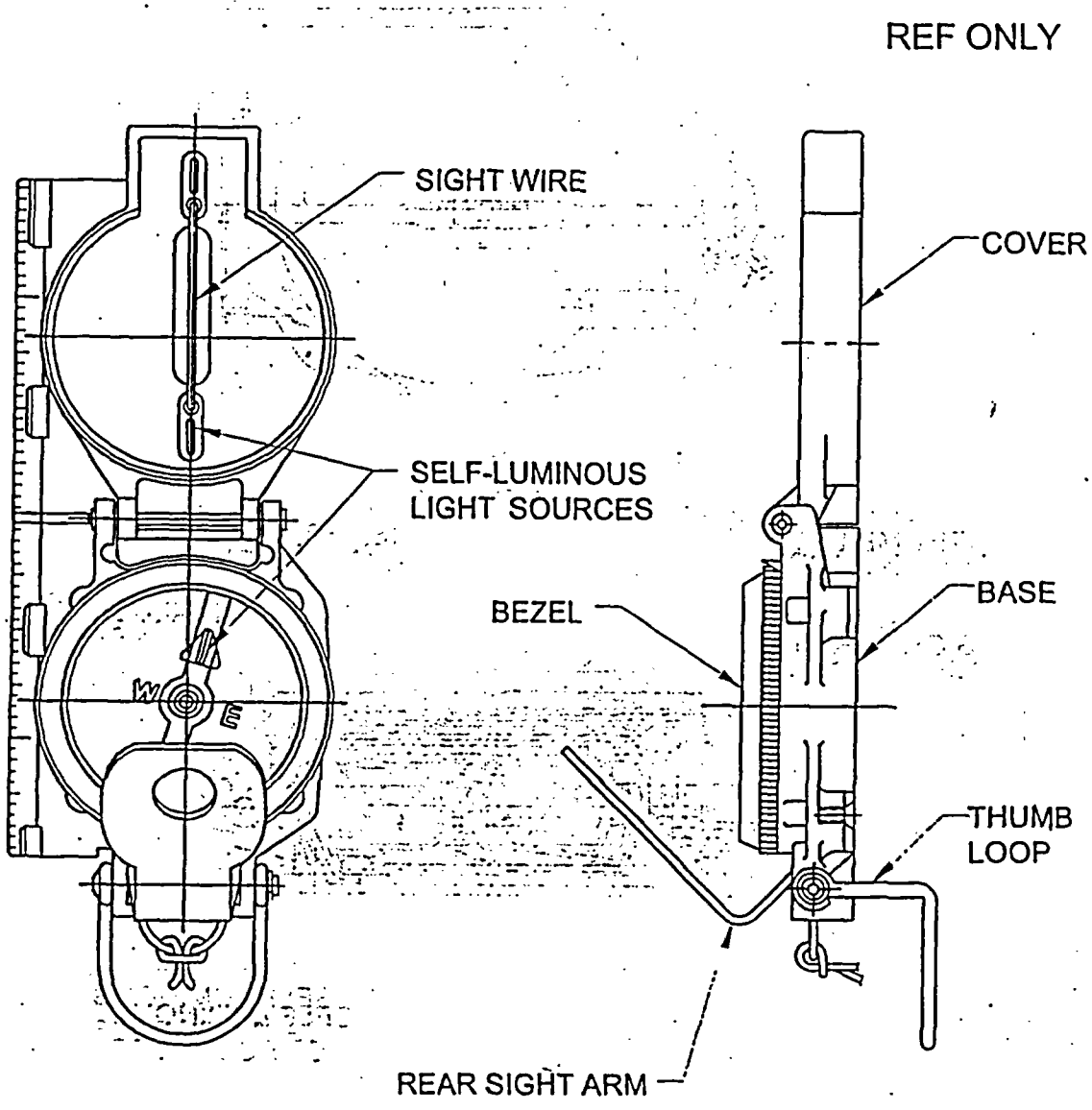
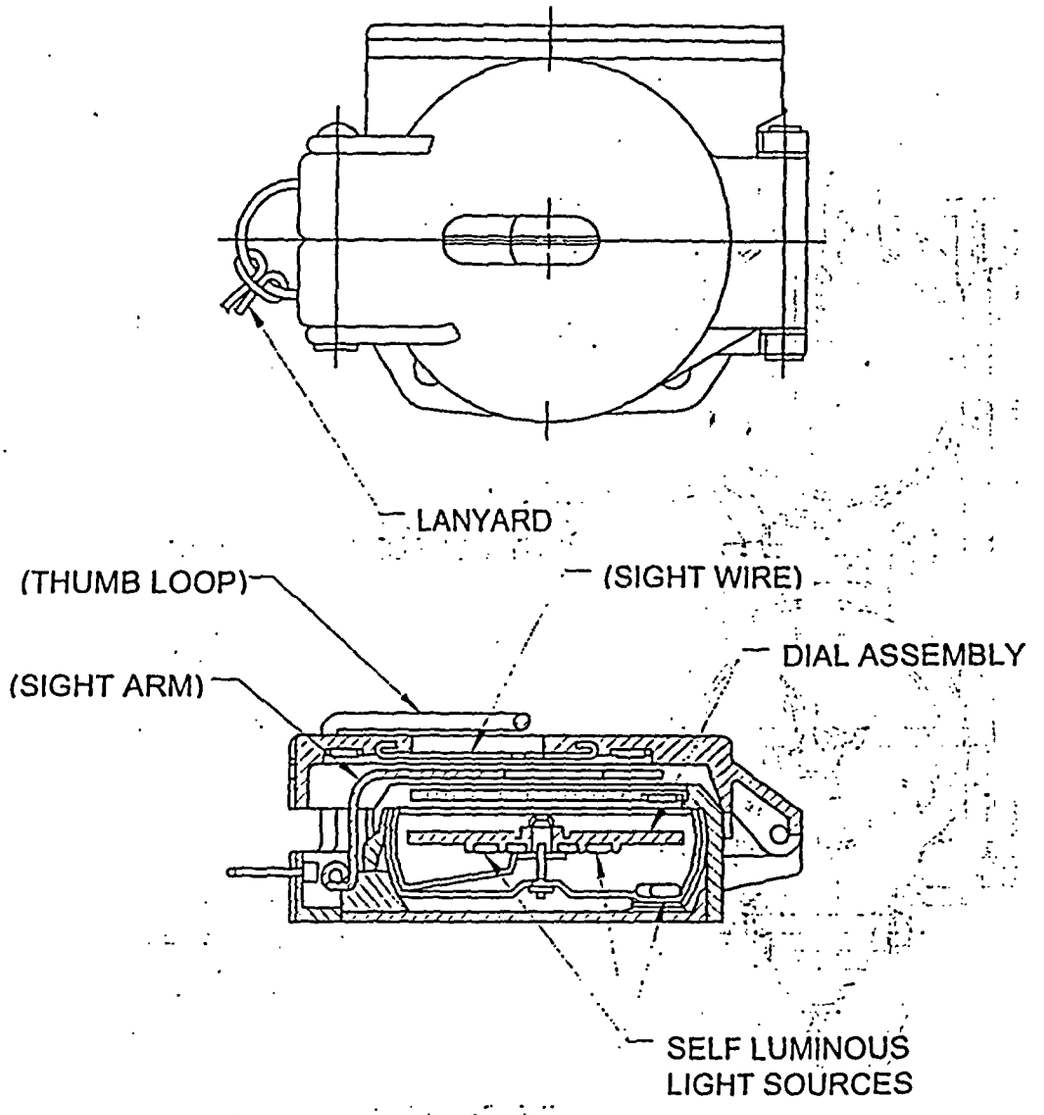


FIGURE 1A. Lensatic compass.

REF ONLY



COMPASS - CLOSED

FIGURE 1B. Lensatic compass.

Custodians:
Army - CE3
Air Force - 99
Navy - MC

Preparing activity:
Army - CE3

Project 6605-0508

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter must be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-PRF-10436M	2. DOCUMENT DATE (YYMMDD) 15 September 1998

3. DOCUMENT TITLE
Compass, Magnetic, Unmounted Lensatic, Luminous , 5 Degree and 20 MIL Graduations, With Carrying Case

4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed)*

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)	b. ORGANIZATION	
C. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY

a. NAME TOPOGRAPHIC ENGINEERING CENTER	b. TELEPHONE (Including Area Code) (1) Commercial (703)428-6862 (2) AUTOVON DSN 328-6862
C. ADDRESS (Include Zip Code) TOPOGRAPHIC ENGINEERING CENTER ATTN: CETEC-TD-TE 7701 TELEGRAPH ROAD ALEXANDRIA, VA 22315-3864	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340

DD Form 1426, Oct 89 *Previous editions obsolete*

Enclosure 1
January 2003

FROM RENEWAL APPLICATION DATED

CAMMENGA AND ASSOCIATES
100 ANILINE AVE. N.
HOLLAND, MI 49424
H 616-392-7999
F 616-392-9432

#5. RADIOACTIVE MATERIAL January 30, 2003

Radioactive Material:	Tritium
Mass:	3
Physical Form:	Sealed Sources, Gas

1. Specifications

   A. H-3 Compass Vials

   The H-3 is contained in small glass-sealed vials coated with phosphorescent material. The H-3 vials function as radio-luminescent lights on the compass used by U.S. Military personnel. These vials are attached to the compass with silicone (or like) adhesive. Specifications for the vials and compass are specified by MIL-PRF-10436M (Attachment 1). Each compass contains the following vials:

   4 – 13219E0783 vials (each vial contains 5 millicuries H-3)
   2 – 13219E0785 vials (each vial contains 25 millicuries H-3)
   1 – 13219E0784 vial (each vial contains 50 millicuries H-3)

   Maximum total H-3 activity per new compass = 120 millicuries. Used compass total H-3 activities may vary but not to exceed 1 curie each. New vials will be purchased from mb Microtec, A.G., Bern, Switzerland or other suitable supplier.

   B. Maximum H-3 Possession Limit For This License – 14,400 Curies

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

The licensed material (H-3) will be incorporated into a US Military Lensatic Compass for distribution to person(s) exempt from licensing. The H-3 vials will be received, handled, and used within the manufacturing process, in accordance with the guidelines found in the Manufacturing and Distribution NRC License Number 21-26460-01 for Cammenga and Associates, 100 Aniline Ave. N., Holland, MI 49424. The finished product (compass) will be checked for quality, checked for safety, handled and stored in accordance with MIL-PRF-10436M (Attachment 1).

Enclosure 2
(FROM RENEWAL APPLICATION DATED JANUARY 2003)

CAMMENGA AND ASSOCIATES
100 ANILINE AVE. N.
HOLLAND, MI 49424
H 616-392-7999
F 616-392-9432

January 30, 2003

Notice of Significant Changes:

1. Current Radiation Safety Officer, Anna Cammenga, to become Radiation Safety Consultant.

2. Appointment of new Radiation Safety Officer, Michael T. Pastoor.

Enclosure 3
(FROM RENEWAL APPLICATION DATED JANUARY 2003)

CAMMENGA AND ASSOCIATES
100 ANILINE AVE. N.
HOLLAND, MI 49424
H 616-392-7999
F 616-392-9432

GENERAL DISCUSSION

January 28, 2003

A. Finished Product, US Military Lensatic Compass, NSN 6605-01-196-6971. This compass was designed in 1966 and has been used by the military ever since. Several million have been produced for the military and commercial markets. The sealed source vials cannot be removed from the compass unless it is disassembled. Since the tritium (3H) is laser-sealed into the glass vials, no radiation is emitted from the vials; also, because tritium is a soft beta emitter it cannot penetrate the glass of the vials. The compass is constructed essentially the same as it was originally designed, with MIL-PRF-10436M (Attachment 1) governing the safety and performance standards.

B. Models for exempt distribution, containing H-3, are sold in two series only and always incorporate the following numbers/letters: "3H" and "183". Current models include: Model 3H, Model 3HCS, Model 3HSD, Model 3HGVT, Model GB3H, Model B3H, Model B3HCS, Model 3HRF , Model RF3H, Model SY183, and Model SandY183. There are no structural differences in models or series. Model number variances are for marketing purposes only.

C. Safety Criteria and examples concerning health and safety of any person in contact with a compass are contained within Attachment 2.

D. Total quantity of BPM expected to be distributed annually averages up to 120,000 finished compasses, which is an average up to 14,400 curies annually.

E. The expected useful daytime life of the compass is indefinite. With regards to the sealed sources (H-3 vials), the expected night-time life of the compass is directly influenced by the half life of H-3, which is 12.3 years

F. Each compass shall be individually labeled and always include "120mCi 3_H" and "21-26460-02E" (Manufacturer exempt distribution license number) in accordance with 10 CFR 32.25 (b).

G. Quality control procedures will follow MIL-PRF-10436M (Attachment 1), unless self-imposed quality procedures are more restrictive.

H. Pursuant to conversation/e-mail with Anthony Kirkwood of the NRC - Washington, DC, we have requested a copy of the letter attached to our existing license dated January 21, 1993 and the Registration Certificate NR-210-D-101-E. Upon receiving these documents, we will evaluate them and return necessary correspondence to the NRC as soon as possible. The letter dated November 14, 1992 is no longer applicable as the enclosures and attachments of the renewal application supercede that letter.

ATTACHMENT 2
(From renewal application dated January 2003)

CAMMENGA AND ASSOCIATES
100 ANILINE AVE. N.
HOLLAND, MI 49424
H 616-392-7999
F 616-392-9432

10CFR 32.23 SAFETY CRITERIA

January 28, 2003

1. **General Discussion**

Tritium does not present an external radiation hazard because it emits no x-rays or gamma rays and the beta particle emitted has a very low energy. The major hazard is from internal uptake. Inhalation and percutaneous absorption (absorption through the skin) are by far the most important intake mechanisms for the user of RL devices (vials). The intake rate of absorption through the skin is between 50% and 100% of the intake rate of inhalation. We will use equal rates for inhalation and absorption.

2. **Basic Equation**

The basic equation to calculate dose in rem due to inhalation is shown below. (Reference: Tritium Radioluminescent Devices Health and Safety Manual, Pacific Northwest Laboratory, Richland, WA.)

$$H = (Q)\ (1.26E\text{-}4)\ (C)\ (T)$$

Where: H= the committed dose equivalent (rem)
Q= the quality factor (no dimension)
C= the activity conc of H-3 in air (uCi/ml)
T= the exposure time (min)

The values for the quality factor (Q) range from 1 to 2. We will use the value of 2 which simplifies the equation to that shown below. We will use this equation in each of our examples.

$$H = (5.04E\text{-}4)\ (C)\ (T)$$

3. EXAMPLES

A. Normal Use Of A Single Unit (10CFR 32.23 (a))

For this example, a single unit is defined as one compass containing seven H-3 vials, 120 mCi total activity. The worker assembles one compass at a time at an individual workstation, eight hours/day, 250 days/year, 1.2 E5 minutes/year. The maximum H-3 diffusion rate for each compass is 1.2E-2 uCi/hour. A diagram of the clean room and individual workstations is included within Attachment 4. The volume of each workstation is approximately 100 cu. ft. and is equipped with exhaust ventilation such that the estimated dilution air volume per workstation is estimated at 1000 cu. ft./hour.

Estimated H-3 Activity Conc In Workstation = $\frac{1.2E\text{-}2 \text{ uCi/hour}}{1000 \text{ cu. ft./hour}} \times \frac{1 \text{ cu. ft.}}{2.83E4 \text{ ml}} = 4.2E\text{-}10 \text{ uCi/ml}$

Estimated Dose To Worker/Year From Assembling Compasses

H= 504E-6 C T

H= (504E-6) (4.2E-10 uCi/ml) (1.2E5 mins/yr)

H= 2.5E-8 rem

This value is far below the .001 rem limit of 10CFR 32.24, Column I.

B. Normal Handling/Storage Of Quantities Of Tritium Vials Likely To Accumulate In One Location (10CFR 32.23 (b)

For the purposes of this example, we will assume that the maximum allowable number of compasses that will be in storage is 120,000 compasses (840,000 H-3 vials), or 14,400 Ci total activity. The worker occupies the storage room a maximum of two hours/day, 250 days/year, 30,000 minutes/year. The maximum H-3 diffusion rate in the storage room is 1400 uCi/hour. A diagram of the storage room is included as Attachment 4. The volume of the storage room is approximately 1400 cu. ft. and is exhausted by an area exhaust fan such that the dilution air in the storage room is estimated at 150 cu. ft./hour.

Estimated H-3 Activity Conc In Storage Room = $\frac{1400 \text{ uCi/hour}}{150 \text{ cu. ft./hour}} \times \frac{1 \text{ cu. ft.}}{2.83E4 \text{ ml}} = 3.3E\text{-}4 \text{ uCi/ml}$

Estimated Dose To Worker/Year From Working In The Storage Room

H= 504E-6 C T
H= (504E-6) (3.3E-4 uCi/ml) (3.0E4 mins/yr)
H= 5.0E-3 rem

This value is far below the .01 rem limit of 10CFR 32.24, Column II.

NOTE: The shipping room is also used for storage of finished compasses. The exhaust fan to the atmosphere in this room far exceeds the cfm calculations referenced in the above example.

C. Use/Disposal Of Quantities Of H-3 Vials Likely To Accumulate In One Location 10CFR 32.23 (d)

For the purposes of this example, we will assume that 100 compasses in storage are severely damaged such that all 700 of the H-3 vials (12 Ci) contained are broken and the H-3 released into the storage room. We will also assume that the area exhaust ventilation is not working. A reasonable assumption is that the H-3 will be contained within a volume of 100 cu. ft. and the worker is able to vacate the area within one minute.

Estimated H-3 Activity Conc In Storage Room = $\frac{12 \text{ Ci}}{100 \text{ cu. ft.}} \times \frac{1 \text{ cu. ft.}}{2.83E4 \text{ ml}} = 4.2 \text{ uCi/ml}$

Estimated Dose To Worker From This Event

H= 504E-6 C T
H= (504E-6) (4.2 uCi/ml) (1 min)
H= 2.1E-3 rem

This value is below the 0.5 rem limit of 10CFR 32.24, Column III.

D. Use/Disposal Of Quantities Of H-3 Vials Likely To Accumulate In One Location 10CFR 32.23 (d)

For the purposes of this example, we will assume that a transportation accident occurs in which 25% of a 10,000 vial shipment breaks. A reasonable assumption is that the H-3 will be concentrated within a volume of 200 cu. ft. and the worker is able to vacate the area within one minute. We will also assume that the accident involves the 50 mCi vials (the highest activity vials in the compass).

Estimated H-3 Activity Conc In Affected Area $= \frac{125 \text{ Ci}}{200 \text{ cu. ft.}} \times \frac{1 \text{ cu. ft.}}{2.83E4 \text{ ml}} = 22.1 \text{ uCi/ml}$

Estimated Dose To Worker From This Event

$H = 504E\text{-}6\ C\ T$

$H = (504E\text{-}6)\ (22.1 \text{ uCi/ml})\ (1 \text{ min})$

$H = 1.1E\text{-}2 \text{ rem}$

This value is below the 0.5 rem limit of 10CFR 32.24, Column III.

From renewal application dated January 2003

ATTACHMENT 3

January 31, 2003

CAMMENGA AND ASSOCIATES
100 ANILINE AVE. N.
HOLLAND, MI 49424
H 616-392-7999
F 616-392-9432

PERIODIC REPORT OF TRANSFER

From January 31, 1998 through January 31, 2003

According to 10 CFR 32.35 (c), we are including this report concerning products transferred to other persons for use under 10 CFR 30.19. The following information will meet that requirement:

1. We manufacture the Lensatic Military Compass (NSN 6605-01-196-6971) containing self-luminous, H-3 sealed source vials.

2. Each compass contains a set of seven of the above-mentioned sealed source vials as follows:
   a. 4 Each Of Vials Containing 5 Millicuries Of Tritium
   b. 2 Each Of Vials Containing 25 Millicuries Of Tritium
   c. 1 Each Of Vials Containing 50 Millicuries Of Tritium
   Total Tritium Activity Per Compass: 120 Millicuries

3. Since the closing date of the last Report of Transfer, we have transferred:

   230,018 Compasses

   each Containing 120 Millicuries Of Tritium.

We trust that this fulfills the reporting requirement specified in 10 CFR 32.25 (c). Please contact me if any other information is needed.

With Best Regards,

Mike Pastoor
VP Operations
Radiation Test Technician (Authorized User)

cc: US NRC Region III

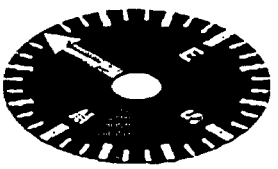
Attachment 2

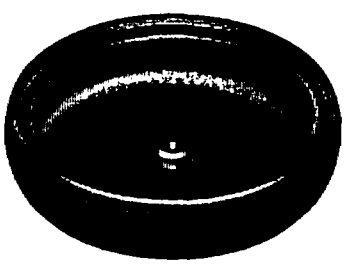
CAMMENGA AND ASSOCIATES

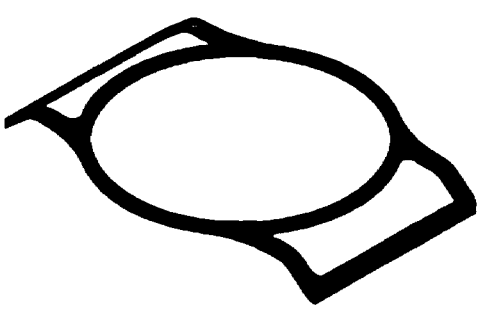
100 ANILINE AVE. N.
HOLLAND, MI 49424
Phone 616-392-7999
Fax 616-392-9432

18 May 2004

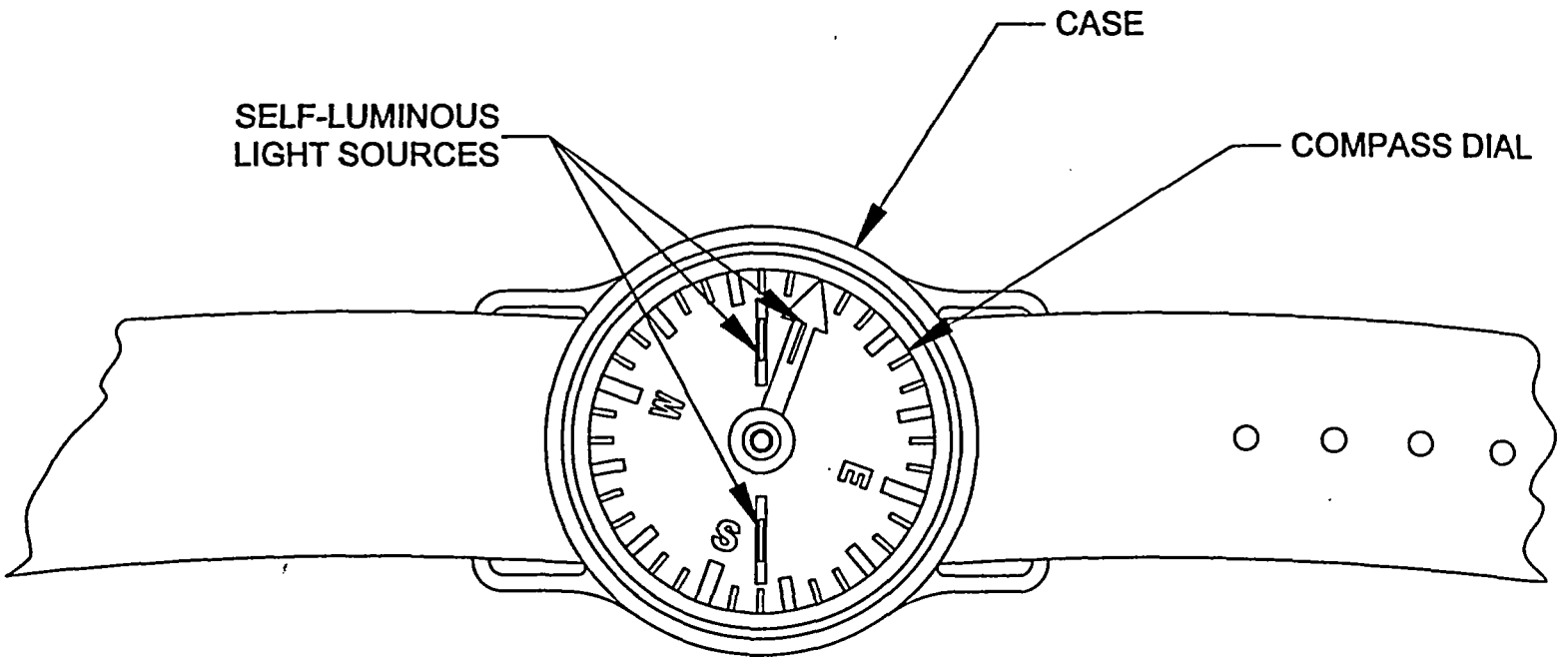
Wrist compass drawings, prints, and material list.



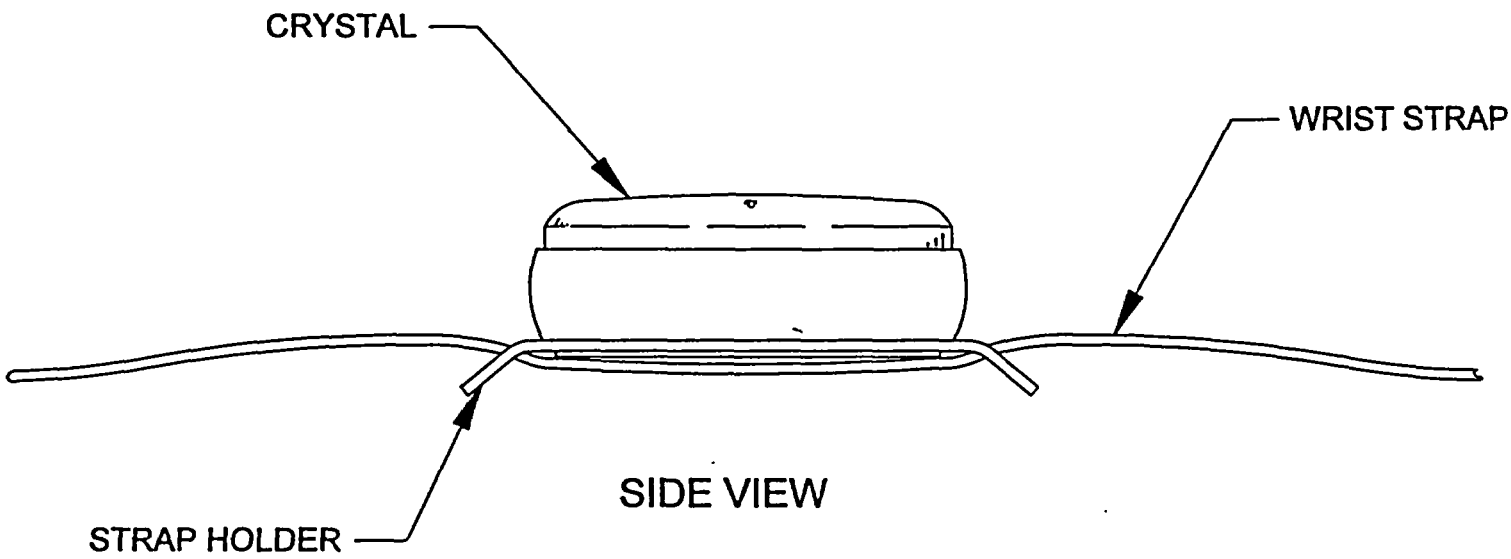




DESCRIPTION: LUMINOUS SOURCE LOCATION AND SEALED CASE COMPONENT ASSEMBLY DIAGRAM	CAMMENGA & ASSOC. 100 ANILINE AVE. HOLLAND, MI 49424
EXPLODED VIEW	TITLE: WRIST COMPASS CASE ASSEMBLY
DRAWING: JAC DATE: 21 APR. 04	



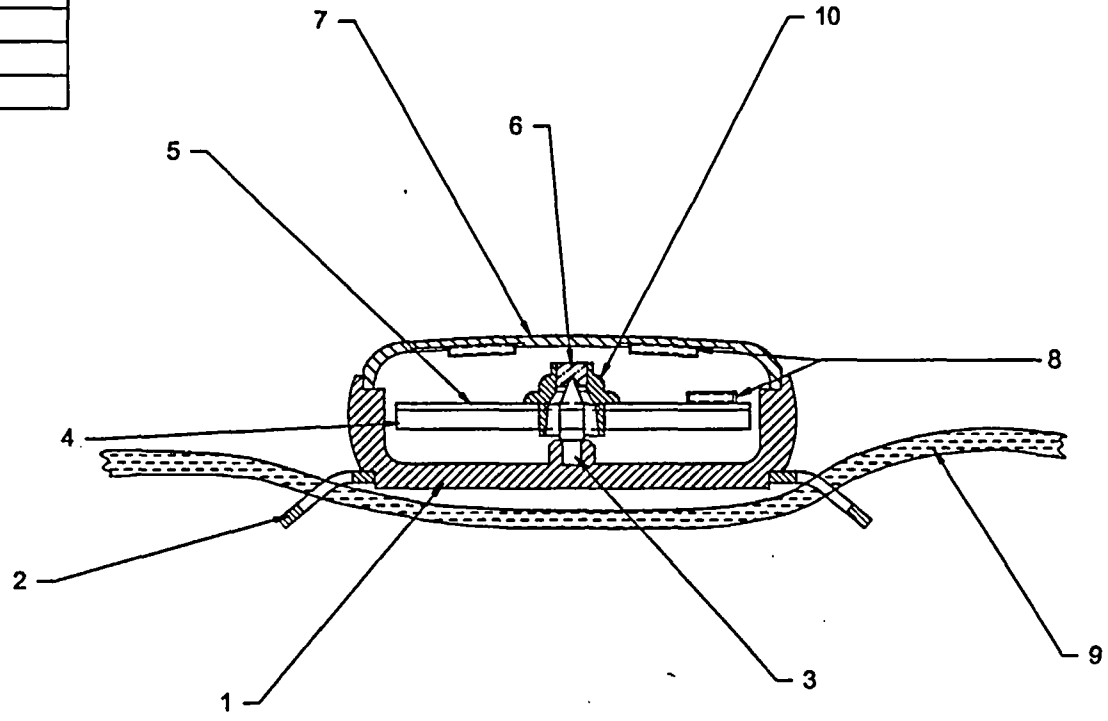
PLAIN VIEW



SIDE VIEW

DESCRIPTION: COMPASS MAGNETIC, WRIST (SURVIVAL, RECONNAISSANCE EVASION, RESISTANCE, ESCAPE)	CAMMENGA & ASSOC. 100 ANILINE AVE. HOLLAND, MI 49424
PLAIN AND SIDE VIEWS	TITLE: WRIST COMPASS EXTERIOR FEATURES
DRAWING: JAC / DATE: 22 APR. 04	
DRAWING # 1232	SHEET / FIG. A-2

PART	NAME
1.	CASE
2.	STRAP HOLDER
3.	PIVOT
4.	MAGNET
5.	COMPASS DIAL
6.	VEE GLASS JEWEL BEARING
7.	CRYSTAL
8.	VIAL
9.	WRIST STRAP
10.	JEWEL MOUNT



UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS ±1/64
DECIMALS ±.010
±.005
ANGLES ±0° 5'

MATERIAL:
SEE MATERIAL LIST

DRAWN:	A. KARD	DATE 11-11-81
CHECKED:		DATE
APPROVED:		DATE
REVISED DRAWING	J A C	DATE 12 APR. 04

CAMMENGA & ASSOC.

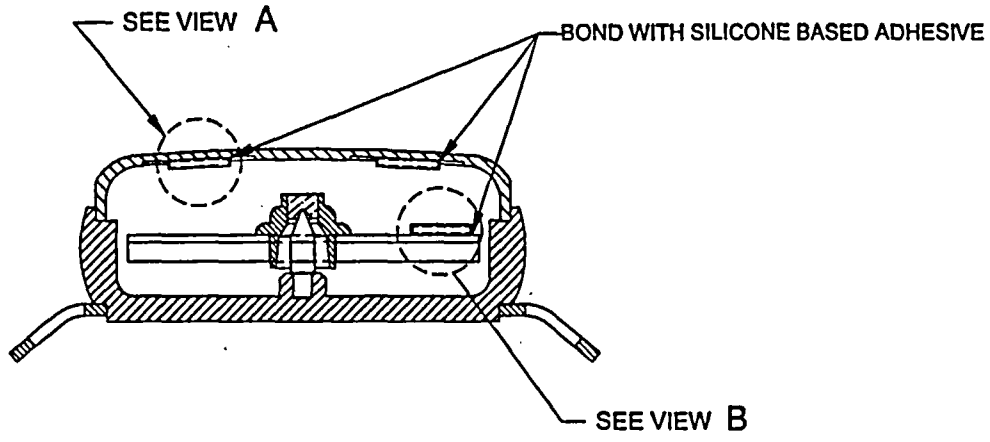
100 ANILINE AVE. HOLLAND, MI 49424

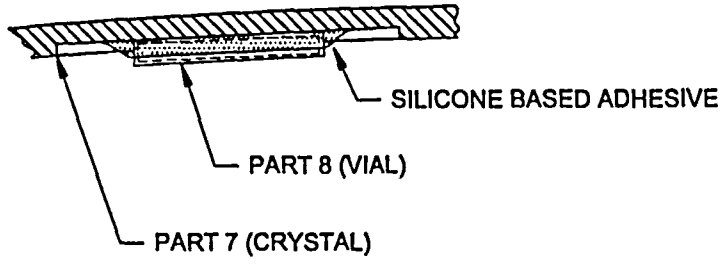
TITLE

WRIST COMPASS (CROSS SECTION)

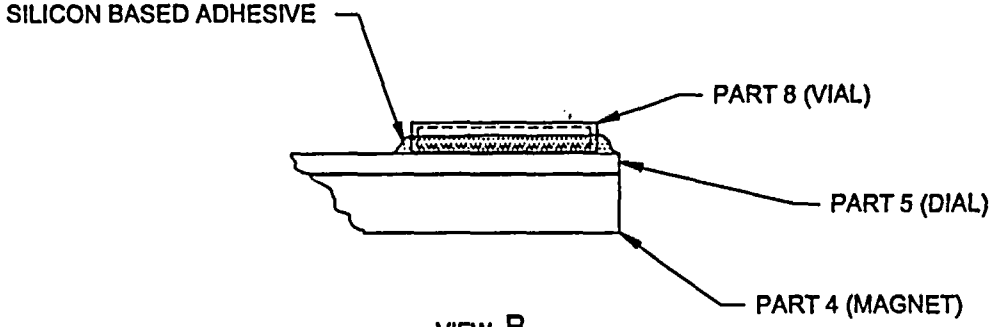
SIZE	CAGE CODE	DWG NO	REV
A4		1232	

SCALE | SHEET





VIEW A

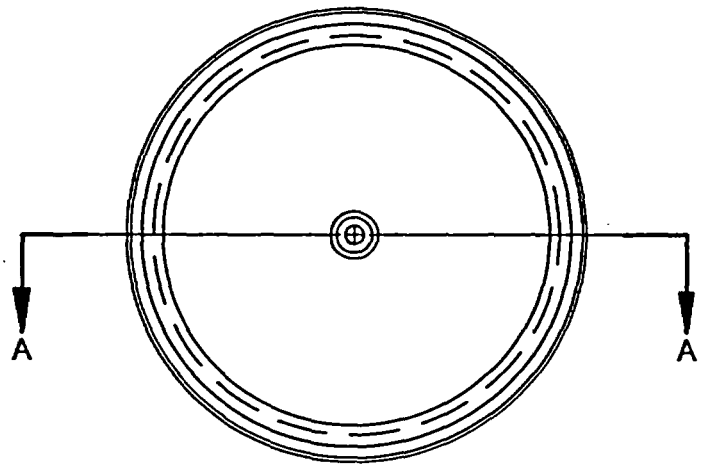


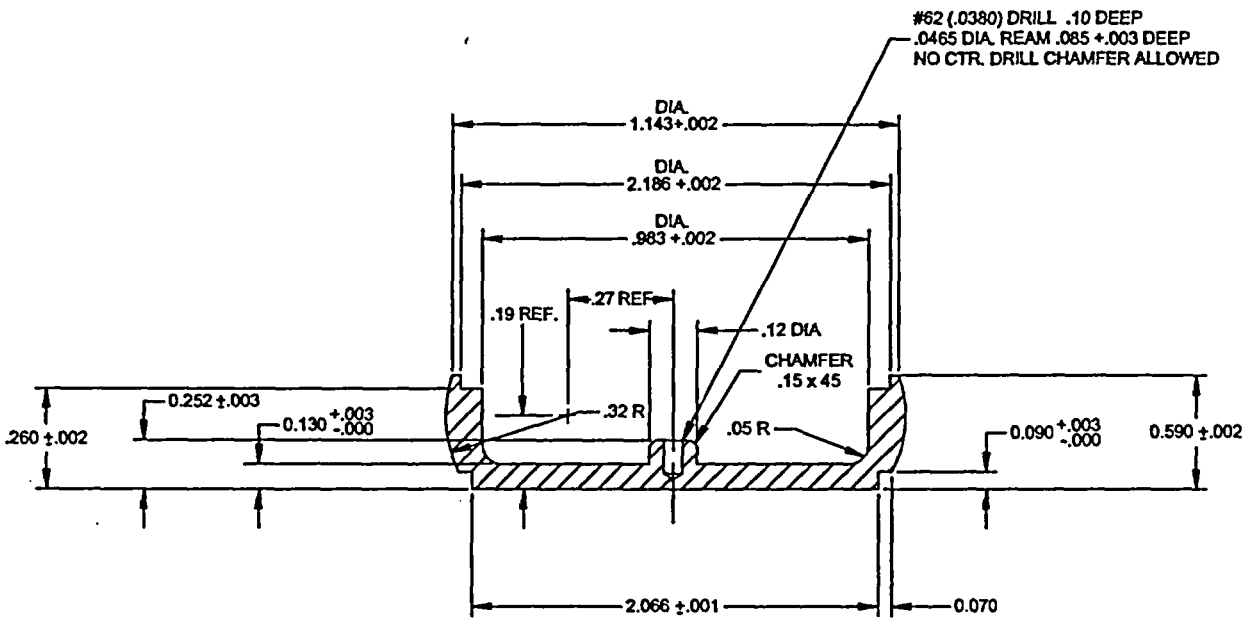
VIEW B

NOTES:

1. USING RTV 732 SILICONE SEALANT FOR MOUNTING SELF-LUMINOUS LIGHT SOURCES.
   A. BOND PART 8 TO PART 7
   B. BOND PART 8 TO PART 5
2. HANDLING AND ATTACHMENT PROCEDURES ARE TO BE IN ACCORDANCE WITH U.S. NUCLEAR REGULATORY COMMISSION LICENSE NO. 21-26460-02

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ± 1/64 DECIMALS ± .010 ± .005 ANGLES ± 0° 5'	DRAWN: J A C DATE 23 APR. 04	CAMMENGA & ASSOC. 100 ANILINE AVE. HOLLAND, MI 49424
	CHECKED: DATE	
	APPROVED: DATE	TITLE: METHOD OF ATTACHMENT
PARTS: SEE MATERIAL LIST		SIZE A | CAGE CODE | DWG NO | REV
		SCALE | SHEET



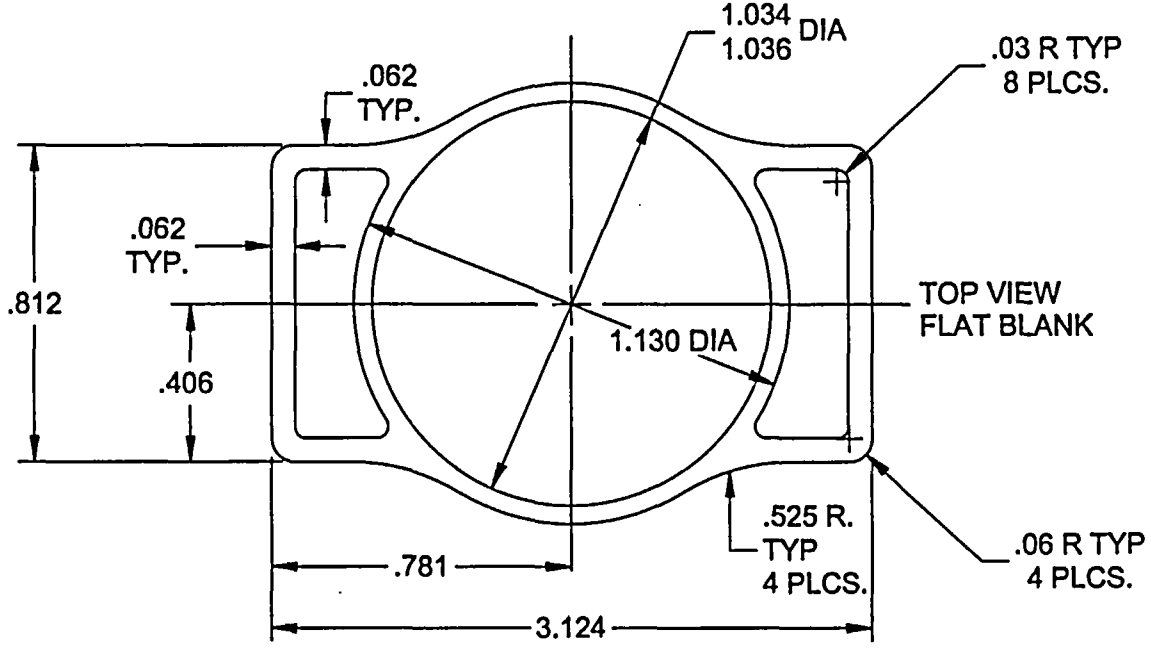


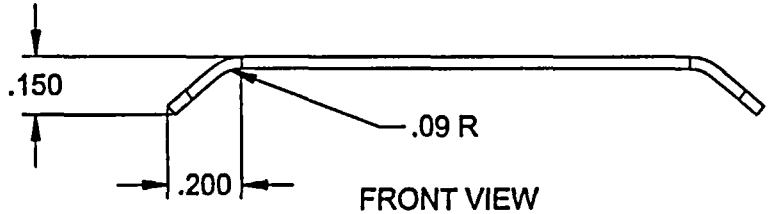
SECTION A-A

NOTES:

REMOVE CUTOFF BURR WITH CTR DRILL IF NECESSARY

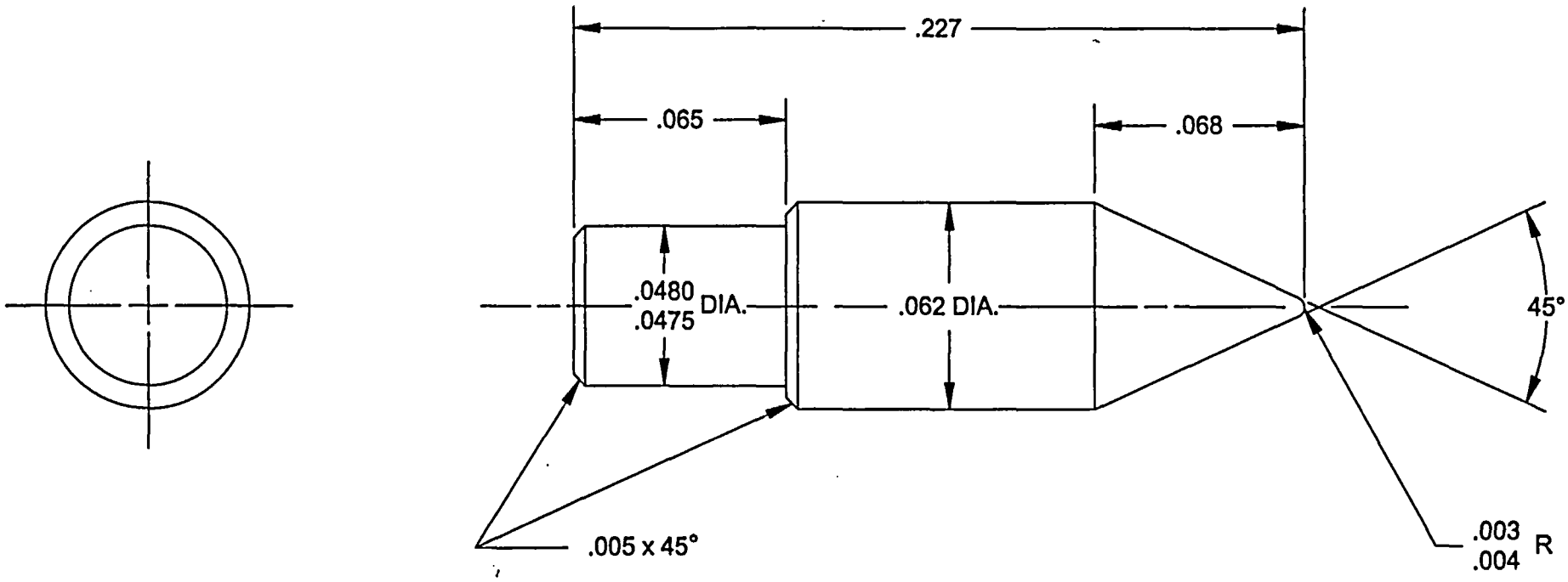
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ± 1/64 DECIMALS ± .010 ± .005 ANGLES ± 0° 5'	DRAWN: A KAROL DATE 12 NOV. 81 CHECKED: DATE APPROVED: DATE REVISED DRAWING DATE J A C 22 APR. 04	CAMMENGA & ASSOC. 100 ANILINE AVE. HOLLAND, MI 49424 TITLE CASE	
MATERIAL: LEADED BRASS OR ALUMINUM 6262-T6		SIZE A4 / CAGE CODE W 01 / DWG NO 1231 / REV	
		SCALE 2 : 1 / SHEET	





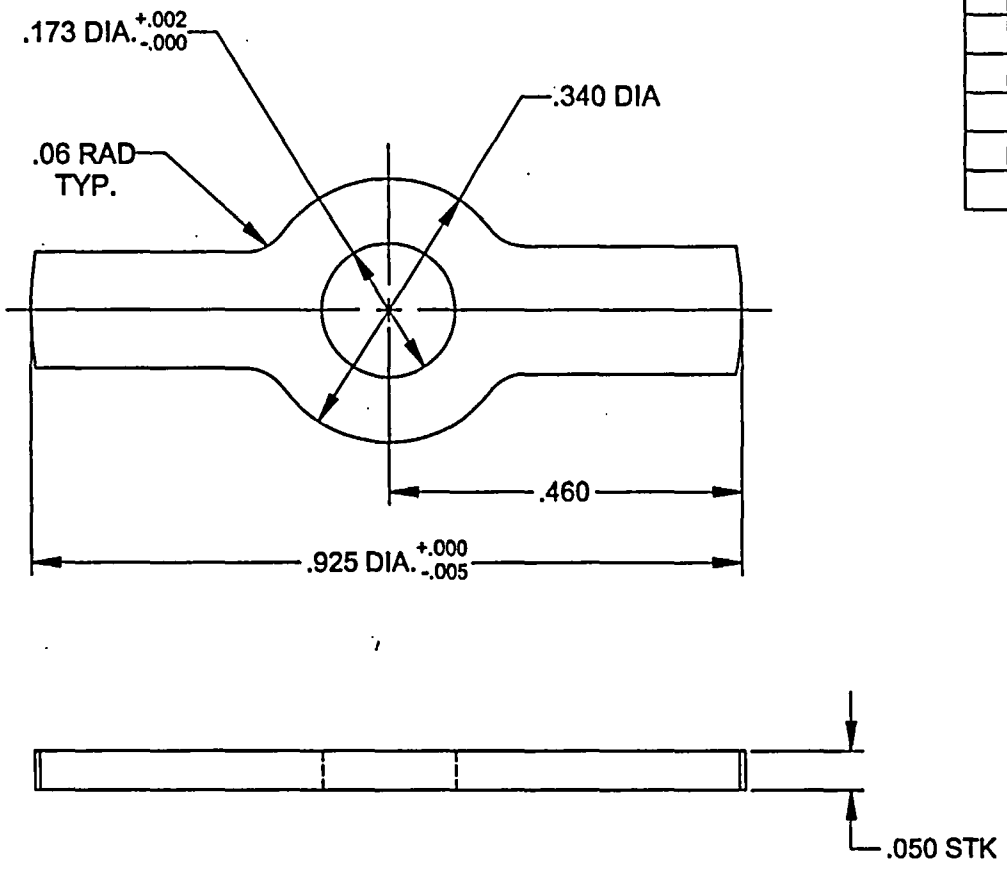
FRONT VIEW
AFTER FORMING

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ±1/64 DECIMALS ±.01 ±.005 ANGLES ±0° 5'	DRAWN: S&Y DATE 11-1981 CHECKED: DATE APPROVED: DATE REVISED DRAWING J A C DATE 28 APR. 04	CAMMENGA & ASSOC. 100 ANILINE AVE. HOLLAND, MI 49424 TITLE: STRAP HOLDER
MATERIAL: ALUM. - OR - HALF HARD BRASS .03 THK		SIZE A4 · CAGE CODE W 02 · DWG NO 1233 · REV SCALE 2 : 1 · SHEET



UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ±1/64 DECIMALS ±.01 ±.005 ANGLES ±0° 5'	DRAWN: RAE DATE 4-6-76 CHECKED: DATE APPROVED: DATE	CAMMENGA & ASSOC. 100 ANILINE AVE. HOLLAND, MI 49424
MATERIAL: NON-MAGNETIC HIGH CARBON DRILL ROD	REVISED DRAWING J A C DATE 28 APR. 04	TITLE PIVOT
		SIZE A4 / CAGE CODE W 03 / DWG NO 1234 / REV
		SCALE 20 : 1 / SHEET

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED



NOTES:

PIECE MUST BE FLAT WITHIN .010

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON FRACTIONS ——
DECIMALS ±.01
±.005
ANGLES ±0° 5 '

MATERIAL:

ALNICO V

DRAWN: LWC	DATE 4-81	
CHECKED:	DATE	
APPROVED:	DATE	
REVISED DRAWING J A C	DATE 26 APR, 04	

CAMMENGA & ASSOC.

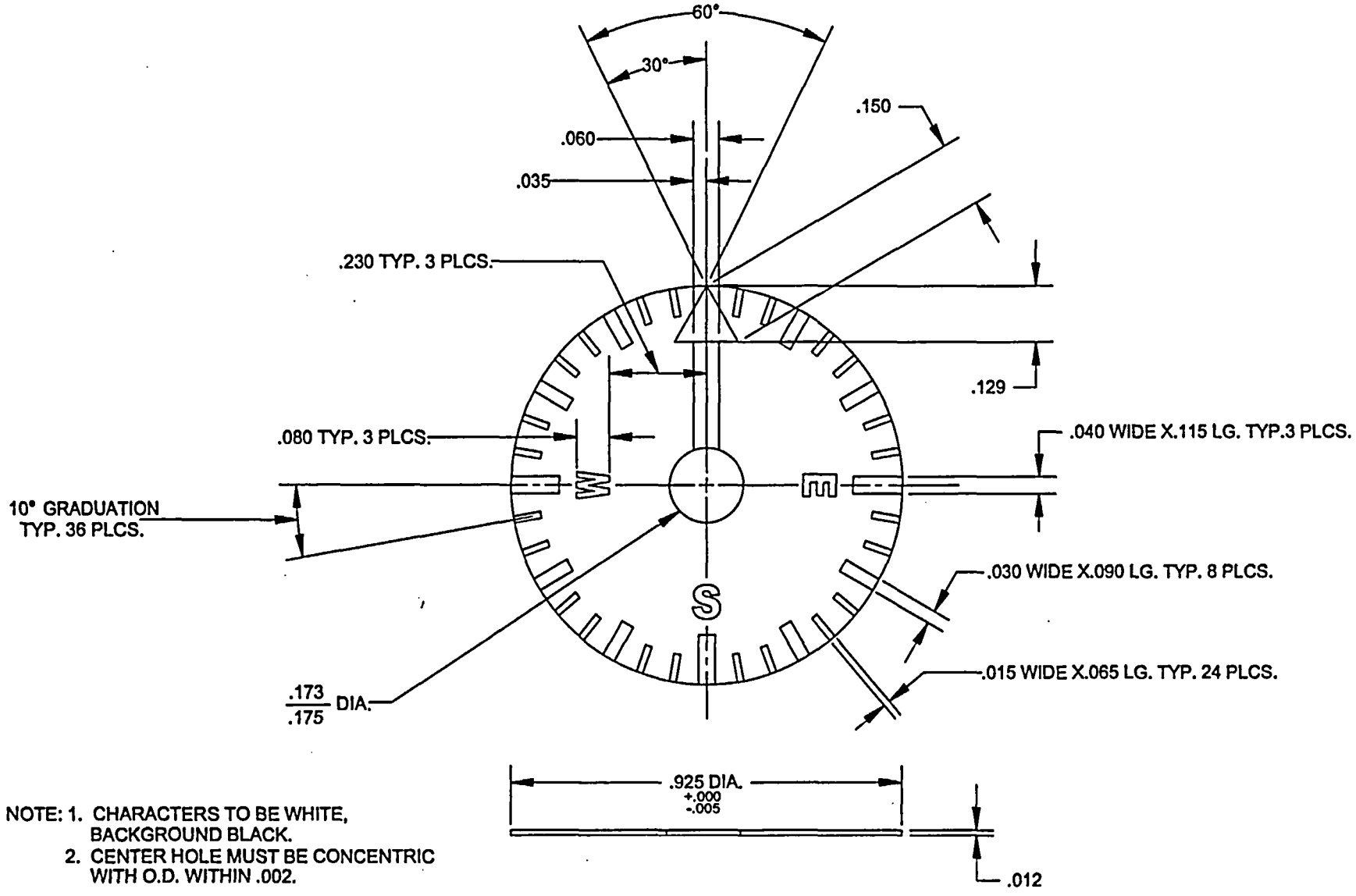
100 ANILINE AVE. HOLLAND, MI 49424

TITLE

MAGNET

SIZE	CAGE CODE	DWG NO	REV
A4	W 04	1237	

SCALE 4 : 1 SHEET



NOTE: 1. CHARACTERS TO BE WHITE, BACKGROUND BLACK.
2. CENTER HOLE MUST BE CONCENTRIC WITH O.D. WITHIN .002.

REVISIONS:

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCE ON MACHINED DIMENSIONS:

FRACTIONAL	1/64
2 DECIMAL PLACES	.010
3 DECIMAL PLACES	.005
ANGLES	1/2°

MATERIAL
2S ALUMINUM HALF HARD OR EQUAL

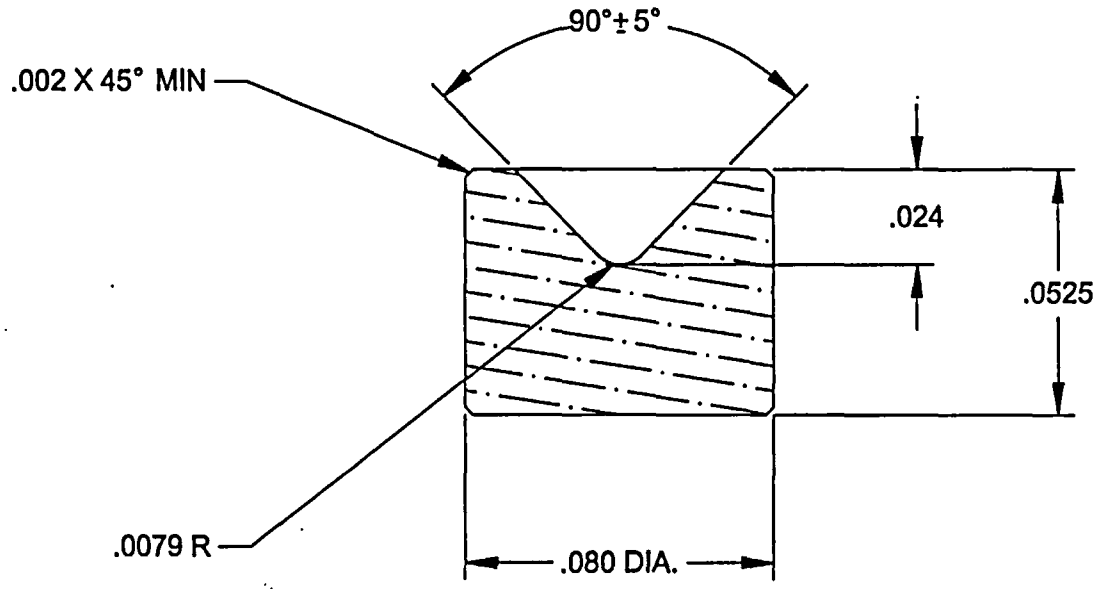
DRW. BY. A. KAROL DATE 11-10-81
CHK. BY. DATE
APPROVAL
REVISED DRAWING J A C DATE 19 JAN. 04

CAMMENGA & ASSOC.
100 ANILINE AVE. HOLLAND, MI 49424

TITLE
WRIST COMPASS DIAL

SIZE	CAGE CODE	DWG NO	REV
A4		1230	

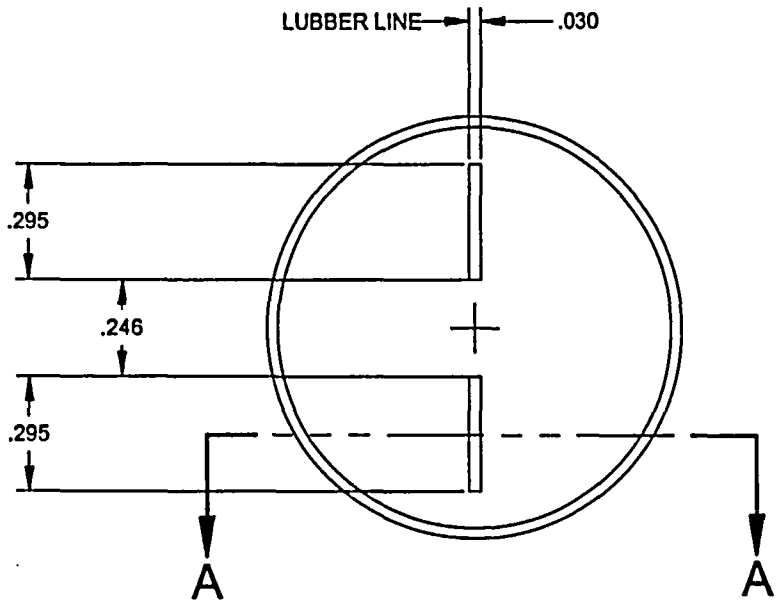
SCALE 3 : 1 SHEET 1 OF 1

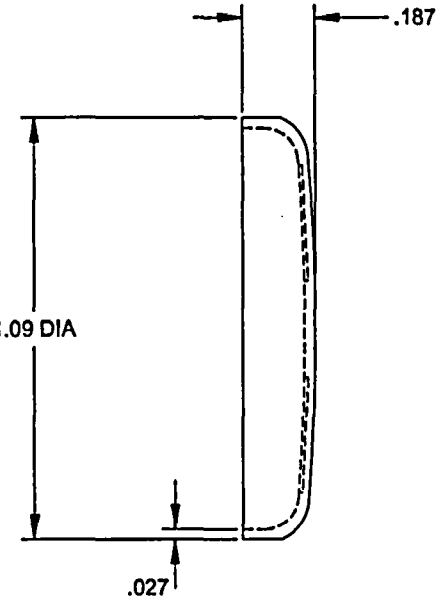


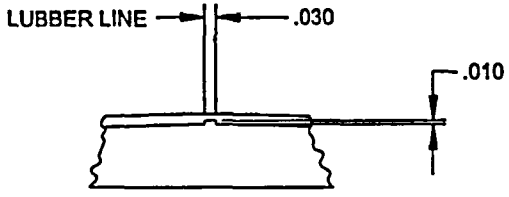
NOTE:

FROM MIL STD. MS 27045-14

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ±1/64 DECIMALS ±.01 ±.005 ANGLES ±0° 5'	DRAWN: BOUCHARD DATE 11-12-81 CHECKED: DATE APPROVED: DATE	CAMMENGA & ASSOC. 100 ANILINE AVE. HOLLAND, MI 49424 TITLE
MATERIAL: FIRST QUALITY GLASS	REVISED DRAWING DATE J A C 28 APR. 04	VEE GLASS JEWEL BEARING
		SIZE A4 | CAGE CODE W 06 | DWG NO 1239 | REV
		SCALE 20 : 1 | SHEET

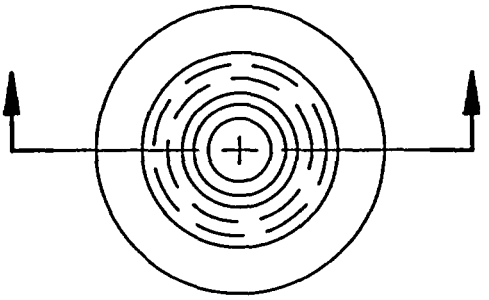


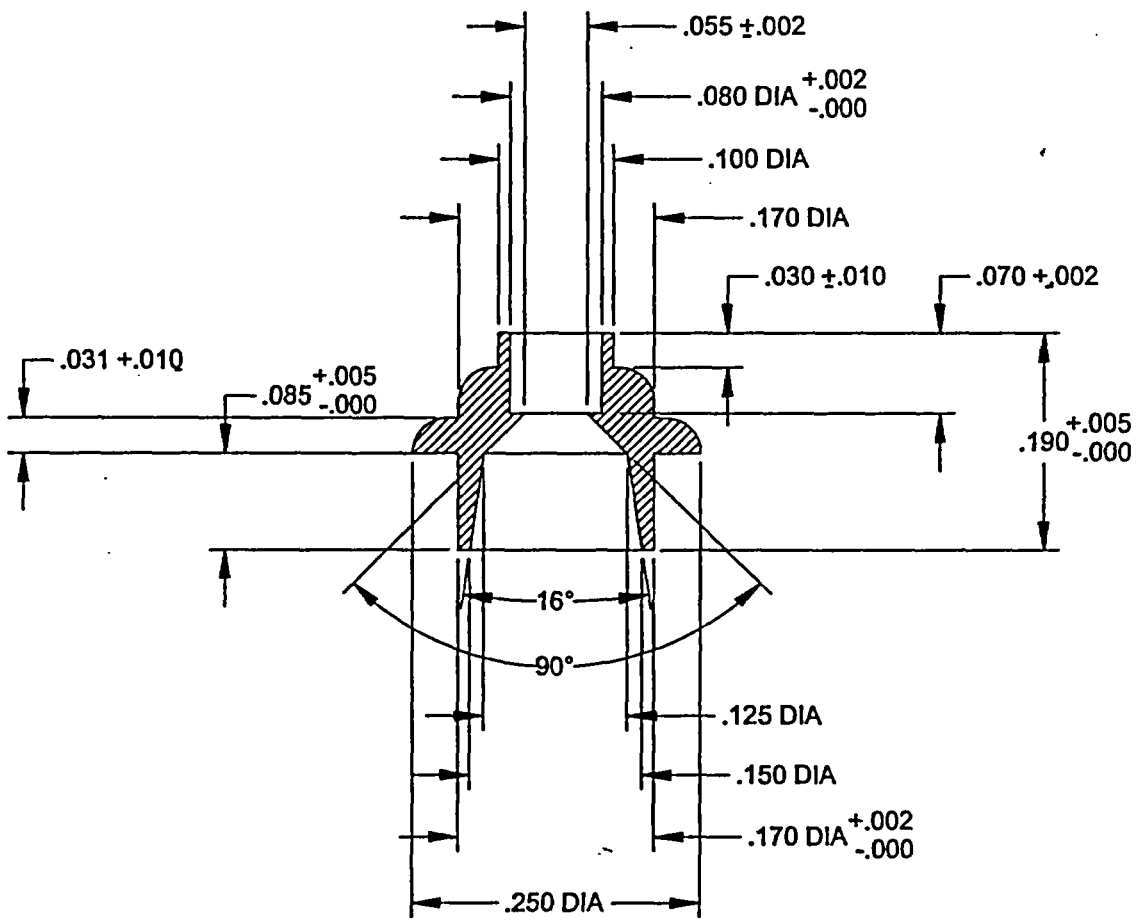




SECTION A-A

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS — DECIMALS ± .005 ± .01 ANGLES ± 0.5°	DRAWN: S & Y DATE 1981 CHECKED: DATE APPROVED: DATE	CAMMENGA & ASSOC. 100 ANILINE AVE. HOLLAND, MI 49424 TITLE
MATERIAL: UNBREAKABLE WATCH CRYSTAL	REVISED DRAWING J A C DATE 12 APR. 04	CRYSTAL, WRIST COMPASS
		SIZE A4 / CAGE CODE W 07 / DWG NO 1238 / REV
		SCALE 2 : 1 / SHEET





UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS —— DECIMALS ±.01 ±.005 ANGLES ±0° 5'	DRAWN: DEW	DATE 1-88	CAMMENGA & ASSOC. 100 ANILINE AVE. HOLLAND, MI 49424
	CHECKED:	DATE	
	APPROVED:	DATE	TITLE: JEWEL MOUNT
MATERIAL: ALUM 2011-T3	REDRAWN: J A C	DATE 26 APR. 04	SIZE A4 | CAGE CODE W 10 | DWG NO 1243 | REV
			SCALE 6 : 1 | SHEET

MATERIAL LIST NO. 1232

DESCRIPTION: COMPASS MAGNETIC, WRIST
(SURVIVAL, RECONNAISSANCE,
EVASION, RESISTANCE, ESCAPE)
MODEL 1232

DATE: 22 APR. 200 4

CAMMENGA & ASSOC.
100 Aniline Ave. Holland MI, 49424

Phone: 800-468-9553
Fax: (616) 392-9432
Email: cammenga@cammenga.com

PART	SIZE	DRAWING NO.	NAME	MATERIAL		
1	A4	1231	CASE	ALUMINUM 6262-T9 OR 6061-T6		
2	A4	1233	STRAP HOLDER	HALF HARD BRASS OR EQUAL ALUMINUM.		
3	A4	1234	PIVOT	NON MAGNETIC HIGH CARBON DRILL ROD		
4	A4	1237	MAGNET	ALNICO V		
5	A4	1230	COMPASS DIAL	25 ALUMINUM HALF HARD OR EQUAL		
6	A4	1239	VEE GLASS JEWEL BEARING	FIRST QUALITY GLASS		
7	A4	1238	CRYSTAL	UNBREAKABLE WATCH CRYSTAL		
8	A4	1240	VIAL	MB MICRO TECH. GLASS VIAL, FILLED WITH TRITIUM		
9			WRIST STRAP	TYPE II MIL-S-46383B		
10	A4	1243	JEWEL MOUNT	ALUMINUM 2011-T3		