

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES  
SAFETY EVALUATION OF DEVICE

NO: NR-591-D-103-E

DATE: SEP 22 1983

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DEVICE TYPE: Self Luminous Compass

MODEL: KB-77 (suffixes may be used to designate optional graphic scales)

DISTRIBUTOR:

Sea Quest, Inc.  
2151 las Palmas Drive  
Carlsbad, CA 92008

MANUFACTURER:

Suunto Oy  
02920 Espoo 92  
Finland

SEALED SOURCE MODEL DESIGNATION:

Brandhurst Company Limited Light Source  
Model RT/60-25/10

ISOTOPE: Hydrogen-3

MAXIMUM ACTIVITY: 175 millicuries

LEAK TEST FREQUENCY: Not Required

PRINCIPAL USE: (W) Self Luminous Products

CUSTOM DEVICE: \_\_\_\_\_ YES \_\_\_\_\_ X NO

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DESCRIPTION:

The Model KB-77 is a pocket sized liquid filled magnetic compass encased in an inner hermetically sealed capsule of transparent plus black injection molded cellulose acetate. This sealed capsule is then encased in an outer housing of non-corrosive anodized aluminum alloy. The device weighs 110 grams and has dimensions of 75 mm x 55 mm x 25 mm. A single tritium gas light source, consisting of a sealed borosilicate glass, is mounted with nitrocellulose cement onto the base of the inner sealed capsule. The light source illuminates the compass scale thereby permitting use in subdued lighting conditions or in total darkness. The liquid filling the sealed inner capsule is petroleum distillate. Bearing are taken with both eyes open. The user aims the compass so that the index mark on the glass prism cover is in the middle of the glass prism and superimposed on the target. The user then takes the reading as it appears through the optical glass prism. The compass is completely sealed, has no user adjustable parts and cannot be opened by the user without destroying the device.

LABELING:

The manufacturer engraves in the aluminum body the wording "O/Y SUUNTO HELSINKI PATENT," where O/Y SUUNTO indicates the manufacturer and HELSINKI the location of the manufacturer. Two adhesive labels are affixed to the compass. One contains the manufacturer's name and location and the model number of the instrument. The other contains the following wording "The light sources for this product is a sealed capsule containing tritium gas. For service return to Sea Quest, Inc., 2151 Las Palmas Drive, Carlsbad, CA 92008."

DIAGRAM:

See attachments 1, 2, and 3.

CONDITIONS OF NORMAL USE:

The compass is designed for use by professional groups such as geologists, navigators, engineers, surveyors, etc., out of doors in mostly sparsely inhabited areas. It is used for taking bearings relative to the user and a target at a distance. The device can be carried in a small snap closure pouch in the pocket or around the neck of the user with a neck cord. Temperatures and pressures would be those encountered out of doors.

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EXTERNAL RADIATION LEVELS:

The manufacturer reports that there is no detectable radiation at any external surface of the device.

QUALITY ASSURANCE AND CONTROL:

The distributor reports that since the compass is a precision instrument, every product is 100% inspected through a quality control procedure as follows:

- o All components are individually inspected before the assembly into sub-units. All defective parts are rejected.
- o All sub-units are inspected before the final assembly. Defective sub-units are rejected.
- o The liquid filled capsule is tested under an absolute pressure of 3 mm Hg for a period of two hours. If any leakage occurs, the capsule is rejected.
- o The liquid filled capsule is tested at a temperature of -35°C for three hours. If air bubbles appear the unit is rejected.
- o All final assemblies are inspected before final packaging for shipment.

The source manufacturer Brandhurst Company Limited, also has a quality control procedure that calls for redundant 100% inspection.

PROTOTYPE TESTING:

The devices were tested to the following:

- o Temperature tested - -20°C-80°C
- o Vibration tested - 25-500 Hz
- o External pressure tested - 29 lbs. for 15 minutes
- o Impact tested - from one meter for two times onto a concrete floor
- o Immersion tested - 24 hours in water

The manufacturer sends to the distributor a certificate of all testing performed on the compass.

Representative samples of the light sources are subjected to the following:

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PROTOTYPE TESTING (Cont'd):

- o Immersion
- o Thermal stability
- o Thermal shock
- o High and low temperature vibration tests

LIMITATIONS AND/OR OTHER CONSIDERATIONS OF USE:

- o The device shall be distributed to persons who are exempt from the requirements for a license as defined in Section 30.19, 10 CFR Part 30.
- o The device shall be manufactured and initially transferred in accordance with the requirements of Section 32.22, 10 CFR Part 32.
- o This registration sheet and the information contained within the references shall not be changed or transferred without the written consent of the NRC.

SAFETY ANALYSIS SUMMARY:

Based on our review of the device design, the information and test data cited below and that equivalent devices were previously deemed acceptable for licensing by the NRC, we conclude that the Sea Quest, Inc. has supplied sufficient information to demonstrate that:

- o In normal use and disposal of a single exempt unit, it is unlikely that the external radiation dose in any one year, or the dose commitment resulting from the intake of radioactive material in any one year, to a suitable sample of the group of individuals expected to be most highly exposed to radiation or radioactive material from the product will exceed the dose to the appropriate organ as specified in Column I of the following table.
- o In normal handling and storage of the quantities of exempt units likely to accumulate in one location during marketing, distribution, installation, and servicing of the product, it is unlikely that the external radiation dose in any one year, or the dose commitment resulting from the intake of radioactive material in any one year, to a suitable sample of the group of individuals expected to be most highly exposed to radiation or radioactive material from the product will exceed the dose to the appropriate organ as specified in Column II of the following table.
- o It is unlikely that there will be a significant reduction in the effectiveness of the containment, shielding, 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.



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SAFETY ANALYSIS SUMMARY (Cont'd):

- o In use and disposal of a single exempt 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, shielding, or other safety features of the product would fail under such circumstances that a person would receive an external radiation dose or dose commitment in excess of the dose to the appropriate organ as specified in Column III of the following table and the probability is negligible that a persons would receive an external radiation dose or dose commitment in excess of the dose to the appropriate organ as specified in Column IV of the following table.

Table of Organ Doses

<u>Part of Body</u>	<u>Column I</u>	<u>Column II</u>	<u>Column III</u>	<u>Column IV</u>
Whole body; head and trunk; active blood-forming organs; gonads; or lens of eye	0.001	0.01	0.5	15
Hands and forearms; feet and ankles; localized areas of skin averaged over areas no larger than 1 square centimeter	0.015	0.15	7.5	200
Other organs	0.003	0.03	1.5	50

Therefore, we find the devices acceptable for licensing purposes. Furthermore, we conclude that the device would be expected to maintain their containment integrity for normal condition of use specified in this certificate.

REFERENCES:

The following supporting documents for the Model KB-77 compass are hereby incorporated by reference and are made a part of this registry document:

- o Sea Quest, Inc. letters dated August 24, 1983, July 11, 1983, December 15, 1982, with enclosures thereto.

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ISSUING AGENCY:

U.S. Nuclear Regulatory Commission

SEP 22 1983  
Date: \_\_\_\_\_

Reviewer: \_\_\_\_\_

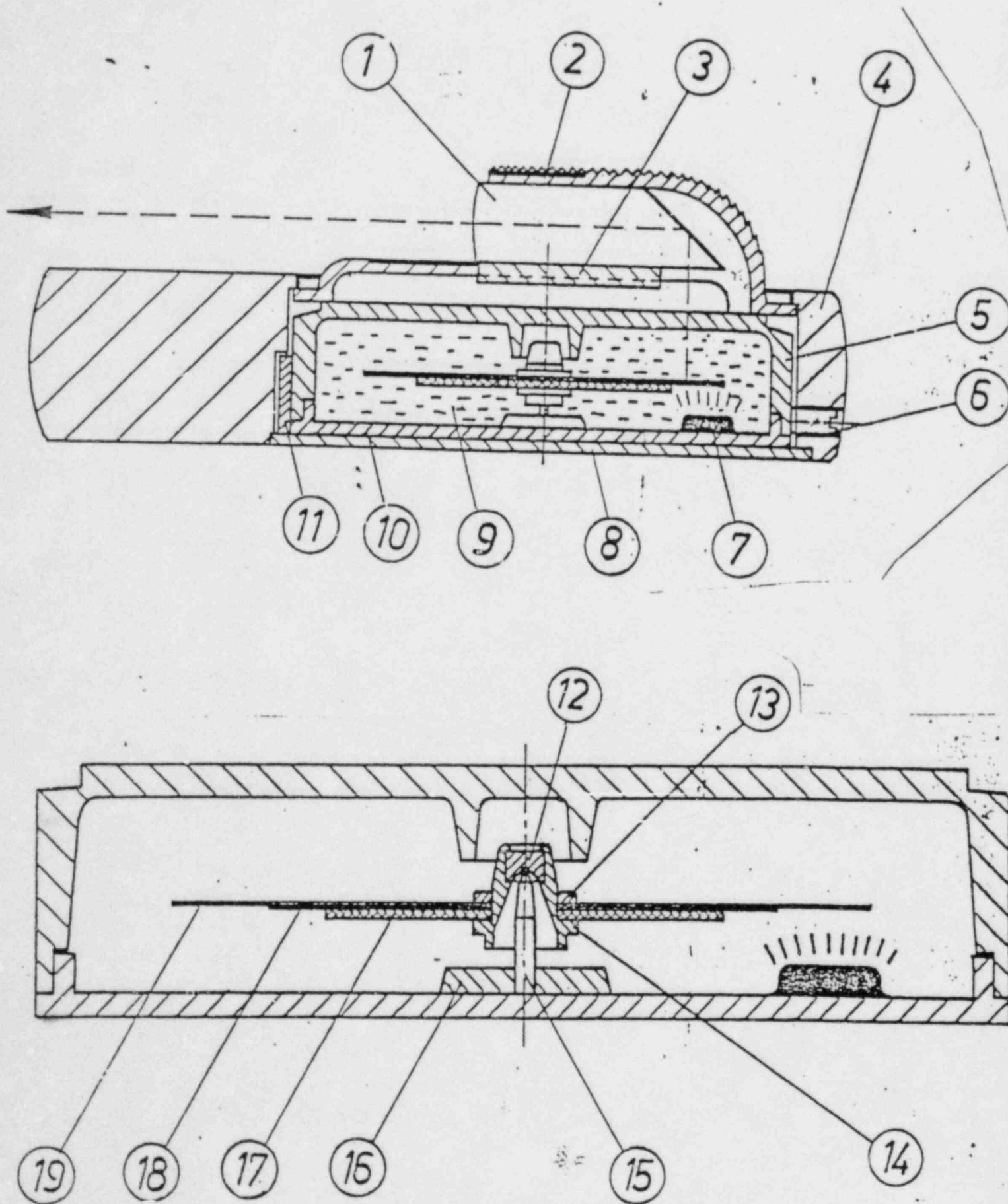
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Date: \_\_\_\_\_

Concurrence: \_\_\_\_\_

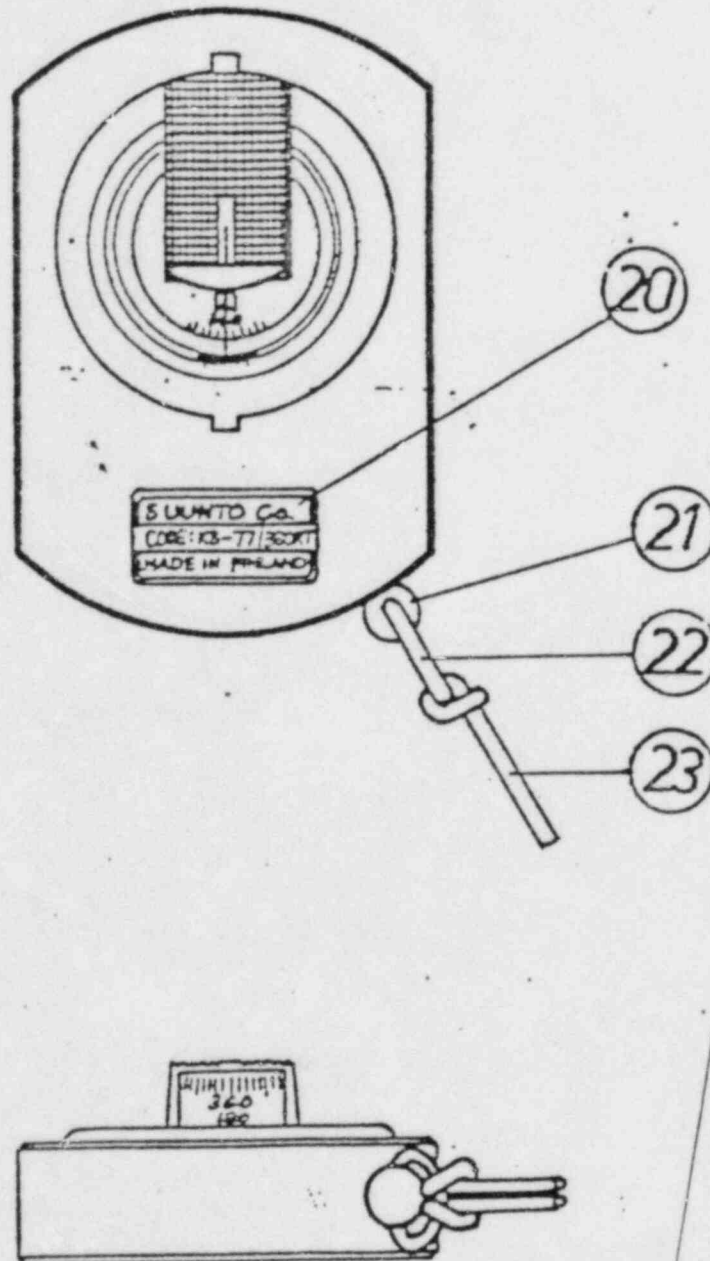
*[Signature]*

*Joseph W. Brown Jr.*

KB-77 Luminous compass



KB-77 self luminous compass





PARTS LIST

1. High quality optical glass prism.
2. Prism cover, made of cellulose acetate.
3. Locking plate.
4. Compass body, manufactured of aluminum, machine-worked with common metal shop methods.
5. Upper part of hermetically sealed capsule, injection molded of transparent cellulose acetate.
6. Brass screw of preliminary locking of the capsule into the body.
7. Tritium light source.
8. Aluminum disc, rolled into its place from the underside of the instrument. This disc protects the capsule from below.
9. Filling fluid.
10. Bottom of capsule, injection molded on black cellulose acetate. Parts 5 and 8 are cemented together and the capsule hereby formed is filled with petroleum distillate, the boiling point of which is approximately 155°C. The diameter of filling bore is 0.7 mm and after filling the hole is closed with Pandetikon nitrocellulose cement.
11. Four small cellulose acetate pieces, cemented into the capsule to keep it in optical alignment.
12. Sapphire bearing.
13. Brass ring for fastening of parts 14 and 19.
14. Brass socket for sapphire bearing.
15. Pivot.
16. Fastening plate, cemented into part 10 for mounting of pivot.
17. Magnet.
18. Aluminum disc.
19. Transparent compass card with scales.
20. Type sticker.
21. Brass screw,
22. Brass ring for neck cord,
23. Neck cord of polyamide.