REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF DEVICE

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DEVICE TYPE: Lensatic Induction Damped Compass

MODEL: SY-183

MANUFACTURER/DISTRIBUTOR: Stocker & Yale, Inc.
Route 128 and Brimbal Aveue
Beverly, MA 01915

MANUFACTURER/DISTRIBUTOR:

SEALED SOURCE MODEL DESIGNATION: Any licensed company following Stocker & Yale, Inc design specification may manufacturer the luminous capsule.

ISOTOPE: Hydrogen-3 MAXIMUM ACTIVITY: 120 millicuries

LEAK TEST FREQUENCY: Not Required

PRINCIPAL USE: (R) Gas Sources

CUSTOM DEVICE: _____ YES X NO

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DESCRIPTION:

The compass contains seven tritium sealed sources with a total of 120 mCi activity (see drawing, Table VI). Each source is enclosed by glass or plastic or both, and each is incorporated solidly in a heavy duty cast aluminum case; the sealed sources being secured by Dow Corning Silastic 732 RTV adhesive/sealant. The compass case contains a copper damping shell, on the bottom of which is secured a 50 mCi tritium sealed source. Within the damping shell a plastic dial contains a 5 mCi sealed source on the N end of the magnet and two 25 mCi sealed sources; one in the E and one in the W designation of the dial. The capsule is made watertight by sealing with a lexan crystal. A .065 inch thick glass crystal, DD-G-451, Type I, Class 1, Quality q1 secured in an aluminum bezel ring above the capsule crystal, contains a 5 mCi sealed tritium source on the underside. The aluminum compass cover contains two 5 mCi sealed tritium sources secured by 732 RTV and covered by a .020 inch thick plastic window. When not in use, the top is closed and latched to further protect the internal components.

The compass has a weight of 5.2 ounces and can be stored in a cloth pouch, carried in the users pocket or worn around the users neck with a neck cord.

LABELING:

The aluminum cover (or front of the compass) is engraved to read: U.S.. COMPASS, MAGNETIC, contract number or none, if not manufactured under a contract, and the manufacturer and address and date.

The aluminum cases bottom (or back of the compass) is engraved with the isotope and the model number SY-183.

DIAGRAM:

See attachment.

CONDITIONS OF NORMAL USE:

The device is to be used as a direction finder by persons in any possible environmental conditions. The manufacturer predicts the useful life of the device to be 10 years. The expected useful life limit is due primarily to the weakening of the tritium light source brightness.

PROTOTYPE TESTING:

The manufacturer tested the luminous sources to the ANSI Classification of T-2-G-C-A-4-4-2-2-2-2. Note: increase of severity of temperature or thermal shock from the ANSI N542 recommended classification of 1-2-2-2-2-2-2. The manufacturer was granted

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PROTOTYPE TESTING (Cont'd):

a waiver from testing the sources for discoloration in June 1982 by the NRC. Additionally, five complete compasses were subjected to the following tests:

- o 24-hour soak in distilled water
- o Temperature test ranged from -43°C to 71°C
- o Pressure tested to 226 millimeters of mercury
- o Impact tested from a height of 1 meter onto an unyielding surface
- o Vibration tested ranged from 10 to 55 hertz
- o Immersion tested in hot bath of 50°C and in cold bath of 0°C

After completion of the tests, all compasses were 24-hour soak tested again. No failure of attachment or detects of the vials were found at any point in the testing.

EXTERNAL RADIATION LEVELS:

The manufacturer states that there is no measurable external radiation from any external surface of the compass due to the encapsulation of the luminous sources.

QUALITY ASSURANCE AND CONTROL:

Stocker & Yale checks each batch of luminous capsule to ensure that they were manufactured in accordance with contractual arrangements. Stocker & Yale samples lots of 250 complete compasses from every lot of 3200 units. There samples are tested in the same manner as outlined in the prototype testing section. In order for a production lot to be distributed, it must meet an acceptable quality level for testing of 2.5%.

LIMITATIONS AND/OR OTHER CONSIDERATIONS OF USE:

- o The device shall be manufactured, distributed, and tested in accordance with Section 32.22, 10 CFR Part 32 and the reference cited below.
- o The device shall be distributed to persons exempt from the requirements of a license pursuant to 30.19, 10 CFR Part 30.

SAFETY ANALYSIS SUMMARY:

Based on our review of the data provided by Stocker & Yale, Inc. for registration of the compass to allow the unit to be distributed to persons exempt. We concur with the conclusions as submitted in Stocker & Yale, Inc, safety analysis that:

DEVICE TYPE: Lensatic Induction Damped Compass

SAFETY ANALYSIS SUMMARY (Cont'd):

1. In normal use and disposal of a single exempt unit, it is unlikely that the external radiation dose 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 (compass) will exceed the dose to the appropriate organ as specified in Column 1 of the Table in §32.24, 10 CFR Part 32.

   With normal use and disposal it is virtually impossible for an individual's body burden of tritium to meet or exceed the 0.001 rem of Column 1 of the table in § 32.24. The basis for this conclusion is predicted upon:

   a) The measured external radiation, found in each prototype (5 pieces) during testing, was not detectable above natural background.

   b) Based on the accumulative dose measured over a period of a year, of radiation workers who have been handling compasses with higher radioactive level (180 mCi/compass) than the prototype compass (120 mCi/compass), it is unlikely that the external radiation dose, in any one year, to the general public would exceed the 0.001 rem allowed in Column 1 of the Table in § 32.24.

2. 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 (compass), it is unlikely that the external radiation 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 (compass) will exceed the dose to the appropriate organ as specified in Column II of the Table in § 32.24.

   The tritium sources are sealed in glass vials, which in turn are firmly secured by Dow Corning 732 RTV adhesive/sealant within the designated areas of the metal compass. Each compass is folded and packed in individual field cases, these are put into an intermediate cardboard carton holding 20 compasses, finally five intermediate boxes are put into a larger exterior cardboard carton holding 100 compasses in the case of military shipments. For civilian users who buy in limited quantities, compasses shall be sealed in individual boxes or nylon carrying cases and usually not more than 20 compasses to a carton. Due to the low beta radiation energy of tritium (0.0186 MeV) the product (compass) would produce no external radiation. There could be radiation release only on rupture of the sealed source. In such an instance, the gaseous state of the tritium would cause it to quickly dissipate into a very large volume of air, so as to be immeasurable for all practical purposes.

   Testing of the prototype compasses (5 pieces) and previous test experience on over 500,000 production pieces indicate rupture of the sealed sources will not occur under normal or rough handling, short of complete destruction of the compass.

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SAFETY ANALYSIS SUMMARY (Cont'd):

Normal storage will pose no danger to the security of the sources. Because of the gaseous form of the tritium it is unlikely even destruction of large quantities of compasses during wartime conditions would present unreasonable exposure danger to individuals.

3. It is unlikely that there will be significant reduction in the effectiveness of the containment, shielding or other safety features of the product (compass) from wear and abuse likely to occur in normal handling and use of the compass during its useful life. The compass through prototype testing (see Prototype Testing) and previously manufactured compasses (over 500,000) have been subjected to very severe physical shock, high and low temperatures, contamination, diffusion and water leakage tests. It is extremely unlikely the many safety features would be sufficiently overcome so as to allow leakage of measurable amounts of radiation. Compasses returned to Stocker & Yale, Inc. 4 to 12 years after manufacture display intact tritium sources.

4. 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 (compass), the probability is low that the containment, shielding, or other safety features of the product (compass) 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 Table in §32.24, and the probability is negligible 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 IV of the Table in § 32.24.

The use and disposal of a single unit or the handling and storage of quantities of the product (compass) would not result in any external dose absorption due to the low energy beta emission (0.0186 MeV) of tritium. The probability of a dose commitment being received by a user or handler is negligible as indicated by the intensive and severe testing done to measure the containment and shielding ability of the product (compass). During all of the severe use and abuse this product (compass) has been subjected to, no tritium source has ruptured or dislodged. These results have been accomplished with production of compasses containing larger and more vulnerable sources than those proposed in the new design of the prototypes under test and consideration for exempt status.

We find the compass acceptable for licensing purposes for distribution to persons who are exempt from the requirements for a license pursuant to Section 30.19, 10 CFR Part 30.

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REFERENCES:

The following supporting documents for the Stocker & Yale, Inc. Lensatic Compass are hereby incorporated by reference and are made a part of this registry document:

o Stocker & Yale, Inc. letter dated November 2, 1982, with enclosures thereto.

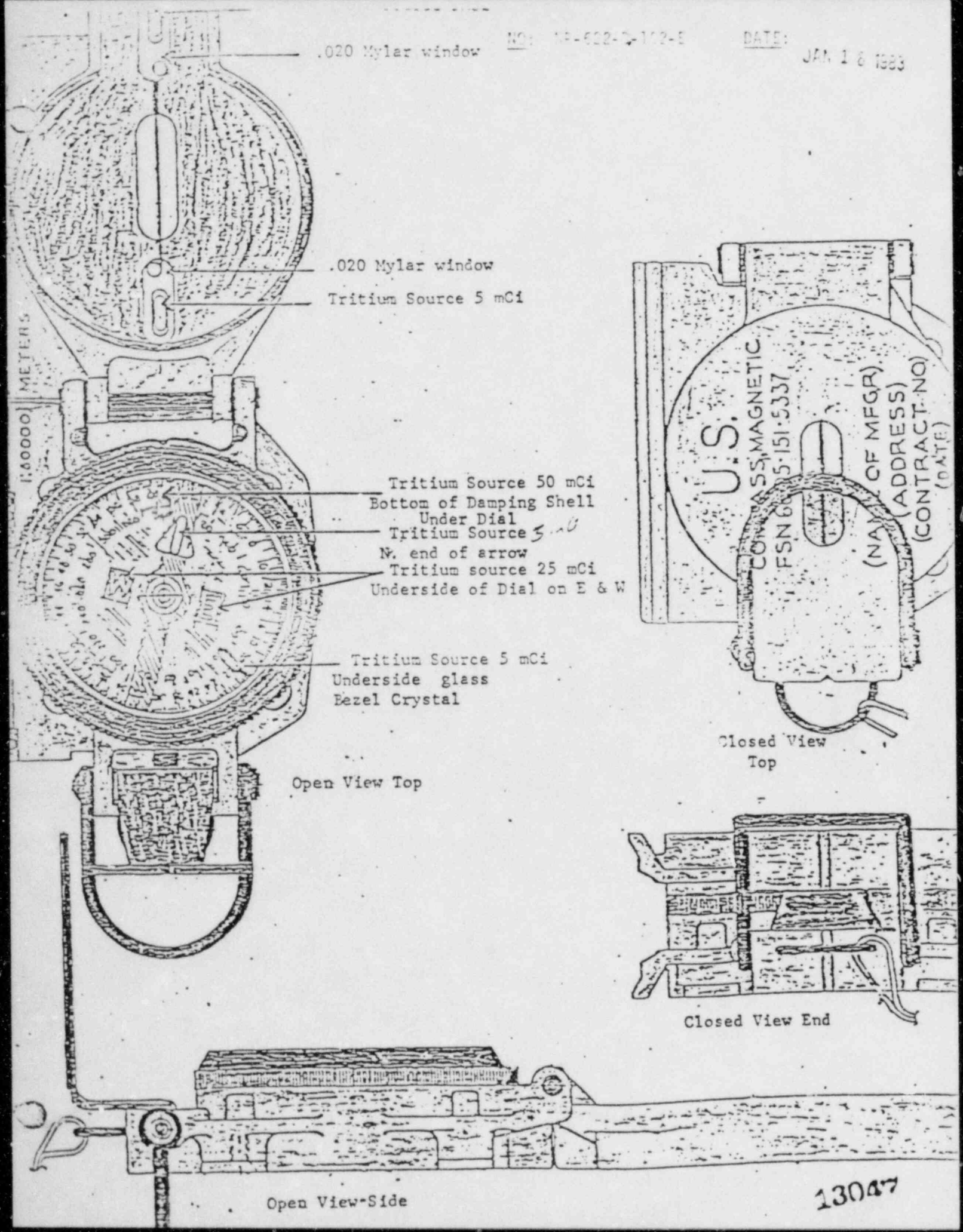
ISSUING AGENCY:

U.S. Nuclear Regulatory Commission

Date: _____ Reviewer: _____

Date: _____ Concurrence: _____

NO: 18-602-0-102-E DATE: JAN 1 6 1983



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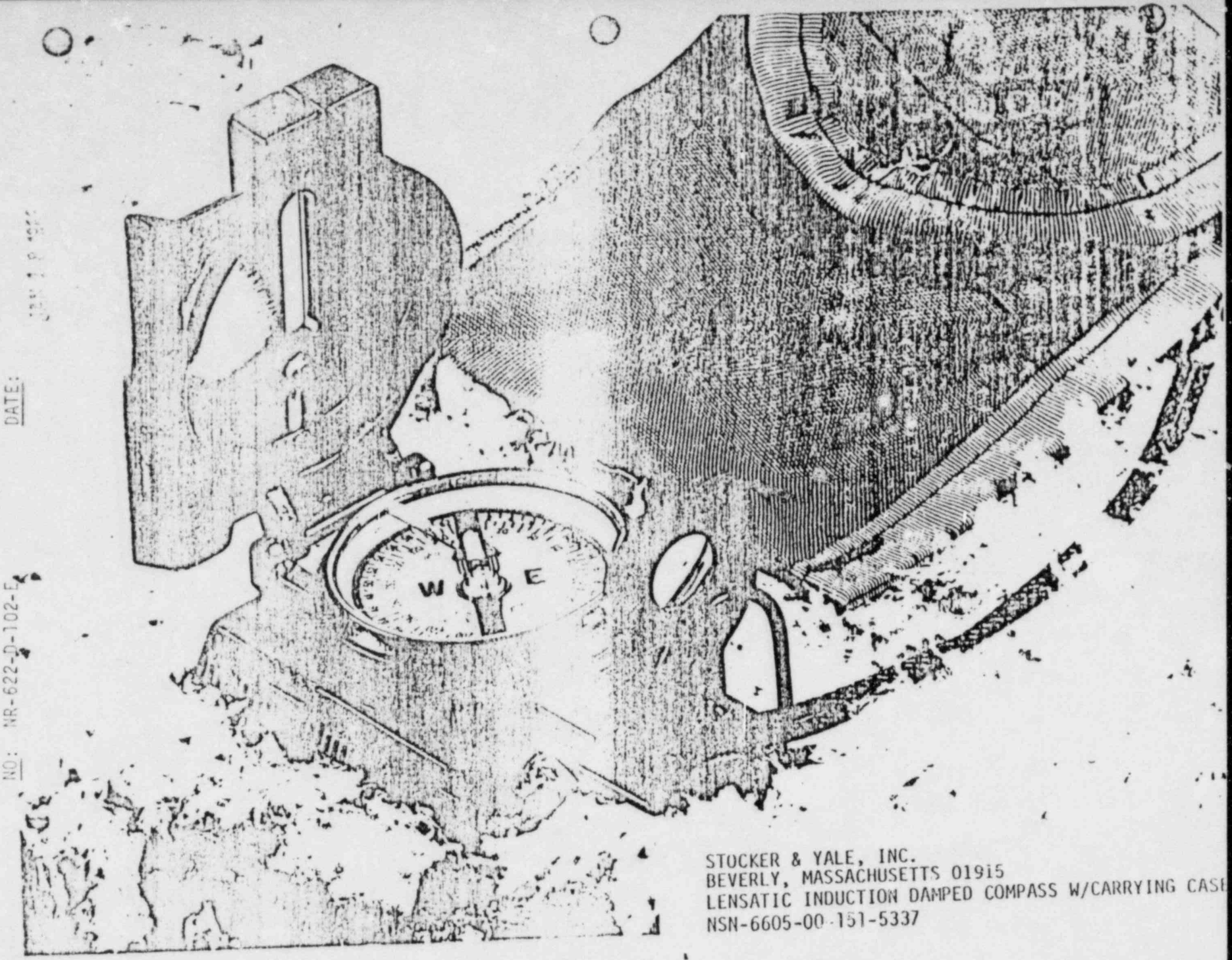

STOCKER & YALE, INC.
BEVERLY, MASSACHUSETTS 01915
LENSATIC INDUCTION DAMPED COMPASS W/CARRYING CASE
NSN-6605-00-151-5337