DUKANE CORPORATION
SEACOM DIVISION

TECHNICAL MANUAL
UNDERWATER ACOUSTIC BEACON
MODEL DK480

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REV 04

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This manual should be read in its entirety prior to any installation, operation, testing or maintenance of the DK480 Underwater Acoustic Beacon.

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SECTION I
GENERAL INFORMATION

1.1. INTRODUCTION.

1.1.1. GENERAL. This manual contains the description, theory, installation and maintenance for the DK480 Underwater Acoustic Beacon manufactured by Dukane Corporation, Seacom Division, 2900 Dukane Drive, St. Charles, Illinois, 60174. These beacons have been tested to, and meet, or exceed, all requirements of SAE AS8045.

1.1.2. SYMBOLS AND ABBREVIATIONS. Symbols and abbreviations used in this manual are in accordance with ANSI Y14.15 and MIL-STD-12, respectively.

1.2. GENERAL DESCRIPTION.

1.2.1. PHYSICAL CHARACTERISTICS. The DK480 beacon consists of a self-contained battery, an electronic module and a transducer. It is housed in a cylindrical watertight aluminum case capable of withstanding high-G impact shock and deep-water immersion. As shown in Table 1, the DK480 beacon operates for 30 days when immersed in water. See Figure 1.

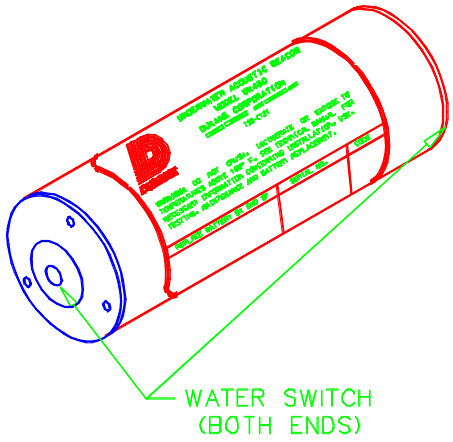


Figure 1. Water Switch Location on Beacon

1.2.2. BEACON MOUNTING. The beacon is mounted to a data recorder by means of a mounting kit (See Section II).

1.2.3. BEACON SIGNAL. The beacon is a battery-powered device, which radiates a pulsed acoustic signal into the surrounding water upon activation by its water-sensitive switch. Search operations in water for beacon equipped vessel, can be conducted by utilizing a portable receiver equipped with a directional hydrophone such as the Dukane Model N30A5 Series Locator. This receiver system is operable from small boats or by free-swimming SCUBA divers. Vessel lost in deep water, i.e., in excess of 6000 feet (1829 meters), require special search gear. Beacon Specifications are listed in Table 1.

Table 1. DK480 BEACON SPECIFICATIONS

Operating Frequency.....	37.5 kHz ± 1 kHz
Operating Depth.....	Surface to 20,000 feet (6096 meters)
Pulse Length.....	10 milliseconds ± 10%
Pulse Repetition Rate.....	Not less than 0.9 Pulse/Sec
Operating Life.....	30 days (minimum)
Battery Life In Beacon.....	6 year
Acoustic Output, Initial.....	1060 dynes/cm^2 rms pressure at 1 meter (160.5dB)
Acoustic Output After 30 Days.....	700 dynes/cm^2 rms pressure at 1 meter (157.0dB)
Operating Temperature Range.....	+28°F (-2.2°C) to +100°F (+37.8°C)
Actuation.....	Fresh or salt water
Radiation Pattern.....	Rated output over 80 percent of sphere
Size.....	1.30 inches (3.30 cm) diameter x 3.25 inches (8.25 cm) long (less mount)
Weight, Beacon.....	5 ounces (140 grams)
Storage Temperature Range.....	-65°F (-54°C) to 160°F (71°C)

1.2.4. ENVIRONMENTAL TEST. The Beacon complies with the preceding operational performance standards after being subjected to environmental tests specified in SAE AS8045.

SECTION II
INSTALLATION

2.1. GENERAL.

This section describes the installation of the DK480 beacon in the mounting kit.

2.2. INSTALLATION CRITERIA OF THE BEACON.

NOTE

All installations to data recorders should be in accordance with the recorder manufacturer's approved procedures and hardware.

2.3. SURVIVABILITY.

2.3.1. The beacon location should minimize the probability of physical damage to the device in the event of a disaster.

2.3.2. The area selected for the beacon mounting should be free of the possibility of heavy equipment tearing loose and striking the device.

2.3.3. Installation should be made to a substantial structural member, but kept as simple as possible and must not weaken the structural member.

2.4. ENVIRONMENTAL.

2.4.1. The DK480 beacon must not be disassembled, crushed, penetrated, incinerated or exposed to temperatures above 160°F (71°C).

2.4.2. The beacon is a battery-powered device and installed shelf life is affected by higher than normal temperatures. Maximum temperature must not exceed 160°F (71°C).

2.4.3. Inadvertent actuation of the water switch by any source of water, such as rain, salt spray, melting ice or snow, head or washroom overflow, foods and beverages, must be avoided as this will lead to exhaustion of the beacon power source.

2.4.4. In order to avoid accumulation of moisture on the water-switch, the device should be mounted with the long axis of the beacon horizontal. A clean switch will allow moisture to collect into droplets and run off the switch, without activating the beacon.

2.4.5. Honeycomb structure, tarpaulin fabrics, clothing, cargo, etc., are sound-absorbing materials. Do not surround the device with these materials and if necessary, remove small areas of such materials from the immediate vicinity.

2.4.6. Any compartment that may not be expected to flood should not be used. Direct contact between the beacon case and water is necessary for actuation and acoustic radiation.

2.5. MAINTENANCE.

In addition to observance of the preceding mandatory considerations, where possible the selection of a mounting location should provide for convenient beacon access during inspection intervals. The proper mounting location should also provide for clearance for removing the beacon from its mounting cradle.

SECTION III
OPERATION

3.1. THEORY OF OPERATION.

3.1.1. The DK480 beacon is a battery-operated underwater acoustic pulse generator that is activated when the water switch is immersed in either fresh or salt water.

3.1.2. The water switch is part of a triggering circuit, which when actuated will initiate normal pulsing of the beacon circuit. The signal is coupled to a piezo-ceramic transducer ring. This results in mechanical motion that is transmitted to the metal case of the beacon, which in turn, radiates acoustic energy into the surrounding water at 37.5 kHz.

3.1.3. The pulses generated are approximately 10 milliseconds in duration, and occur about once per second in water. See Figure 2. The beacon will operate for a minimum of 30 days after being immersed in the water. The beacon will withstand depths to 20,000 feet (6096 meters). It can be detected at a range of 2000 to 4000 yards (1800 to 3600 meters). The sea state, nearby boats, marine animals, gas or oil lines, and other factors contributing to the ambient noise level which will affect the range at which the beacon can be detected.

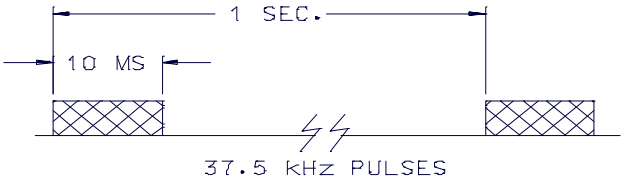


Figure 2. Nominal Pulse Train

SECTION IV
TESTING

4.1. GENERAL.

The DK480 beacon should be tested before and after installation in the mounting kit and at recommended maintenance intervals. See Section V.

4.2. OPERATIONAL TESTING.

The 42A12 Ultrasonic Test Set or the TS300 Portable Test Set can be used to perform operational tests on the beacon.

NOTE

The procedure for use of the 42A12 Ultrasonic Test Set is contained in the 42A12 Manual. The beacon is turned on by providing an electrical contact from switch pin to switch pin.

4.3. BATTERY TESTING.

Use the TS300 Ultrasonic Test Set to perform the following procedure:

Measure the battery voltage. The beacon battery voltage is acceptable if it has a range of 2.97 Volts or greater. The beacon is operable at the given minimum acceptable voltage. For DK480 beacon if the battery voltage is below the minimum acceptable voltage the battery should be replaced.

SECTION V
MAINTENANCE DK480

5.1. GENERAL.

This section contains DK480 beacon cleaning, beacon testing, battery replacement and testing, disposal and storage procedures. Initially beacons must be tested at every installation or battery change. The recommended schedule for beacon cleaning and testing is every 12 months, when the beacon is installed on a recorder and the recorder is installed in accordance with manufacturers specifications. Otherwise, the recommended schedule is every six months. The required schedule for Battery Replacement and Off-Current Testing is every 6 years.

5.2. BEACON CLEANING.

Clean both switches on the beacon with a soft cloth and mild detergent, then dry thoroughly with a clean cloth. Clean the end insulators to prevent leakage currents from occurring across the switch. This will affect battery life. The water switches should be cleaned at any time if dirt or dust becomes apparent.

5.3. BEACON TESTING.

5.3.1. Make sure that the beacon case is clean and dry prior to testing.

5.3.2. See Sections 4.2. and 4.3. for testing procedures.

5.4. PRECAUTIONS.

5.4.1. The DK480 Beacon must not be exposed to temperatures in excess of 160°F (71°C).

5.4.2. Any situation that could possibly crush or penetrate the case of the beacon should be avoided.

5.5. BEACON DISASSEMBLY.

Disassembly of the beacon is limited to battery replacement, as outlined in Section 5.6.

5.6. BATTERY REPLACEMENT AND TESTING.

WARNING

INCORRECT INSTALLATION OF BATTERY WILL CAUSE PERMANENT DAMAGE TO BEACON.

5.6.1. GENERAL. Battery replacement should be done in a maintenance shop under clean conditions to prevent dust from contaminating O-ring and lubricant. Because the old O-ring may have developed a set with age, O-ring replacement is mandatory at the time of battery change. O-ring lubrication should be applied to new O-ring and threads before installation.

NOTE

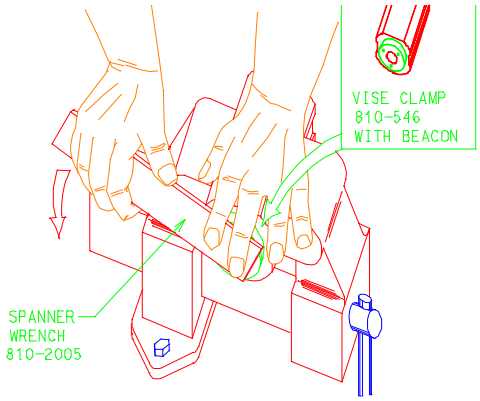
Replacement of the battery in the DK480 beacon *must* be done by a qualified technician.

CAUTION

TO AVOID INTERNAL DAMAGE, DO NOT CLAMP THE BEACON IN A VISE, UNLESS A VISE-CLAMP (P/N 810-546) IS USED.

Figure 3. Battery End Cover Removal With Vise Clamp and Spanner Wrench

5.6.2. BATTERY REPLACEMENT.



A. Secure the beacon with Vise-Clamp (P/N 810-546) as shown in Figure 3.

B. Use Spanner Wrench (P/N 810-2005) to remove end cover containing 3 wrench holes by unscrewing counterclockwise. The breakaway torque is usually high so spanner wrench should be held firmly in contact with battery end cover in order to prevent damage to wrench holes.

C. Remove the old O-ring from the cover. Do not use a steel screwdriver or sharp tool because of danger of damaging O-ring groove.

D. Remove the old battery.

E. Clean the threads, O-ring groove in the body and the threads on the cover by wiping them thoroughly with solvent.

CAUTION

FOREIGN SUBSTANCES IN LUBRICANT ON SEALING SURFACES MAY DAMAGE THREADS AND/OR ALLOW WATER LEAKAGE THROUGH THE O-RING SEAL. SCRATCHES OR GOUGES ON SEALING SURFACES WILL ALSO CAUSE WATER LEAKAGE.

F. Carefully install a new O-ring on the battery cover. Apply a thin coating of O-ring lubricant (P/N 810-346, 810-500 or 810-1168) to O-ring, O-ring groove and threads. Note: O-ring, lubricant and battery are provided in battery replacement kit 810-2009/K.

G. Install new battery. Be sure the end marked "INSERT THIS END FIRST " goes in first. See Figure 4. Contact Dukane Corporation, Seacom Division at (630) 584-2300, Ext. 860 for replacement 810-2009/K battery kits.

WARNING

REPLACE BATTERY WITH 810-2008 BATTERY *ONLY*. USE OF AN UNAUTHORIZED BATTERY WILL VOID THE WARRANTY AND MAY CAUSE AN INOPERATIVE OR DANGEROUS CONDITION. USE OF ANOTHER BATTERY MAY PRESENT A RISK OF FIRE OR EXPLOSION.

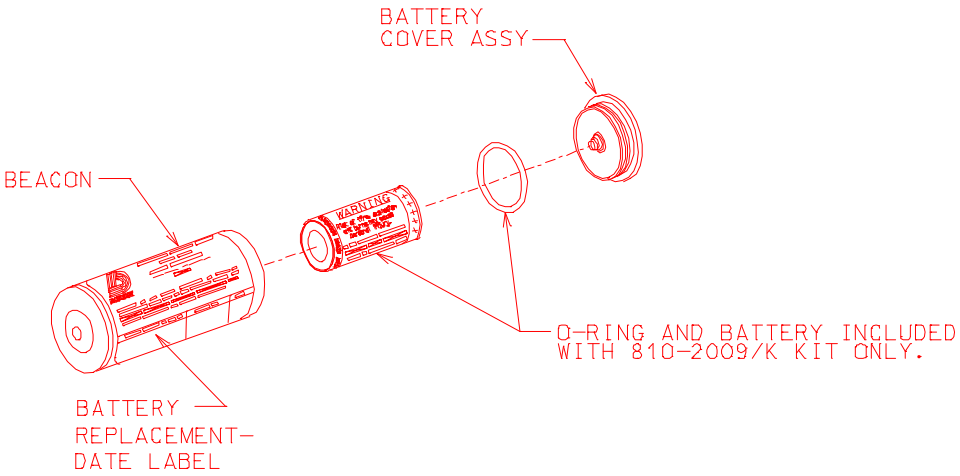


Figure 4. Beacon Exploded View Showing Relative Location of Battery and Related Parts

CAUTION

DO NOT RECHARGE, DISASSEMBLE, HEAT ABOVE 160°F (71°C) OR INCINERATE. DISPOSE OF THE BATTERIES PROMPTLY, KEEP AWAY FROM CHILDREN. THERE IS A RISK OF BATTERY FIRE, EXPLOSION, AND BURNS.

H. Perform OFF-CURRENT TEST as outlined in Section 5.7.

I. Replace the cover and tighten it until the cover flange contacts the body or leaves less than a 0.003 inch gap. Use hand force only on the wrench. Hold the beacon in a vise clamp as shown in Figure 3. Clean the beacon exterior of excess O-ring grease.

J. Perform operational test of beacon as outlined in Section IV.

K. Replace the battery replacement date label on the outside of the beacon case with the new label supplied with the battery. Locate the label on the beacon body in the space provided. Never put label on either water switch end of the beacon. Place the new label on the beacon after the beacon is installed in the mount.

5.7. BEACON OFF-CURRENT TEST.

Connect test leads as shown in Figure 5 and check for current leakage between battery and pin. The battery OFF current must be less than 3 microamperes. Beacons with greater than 3
microamperes OFF current should be taken out of service immediately.

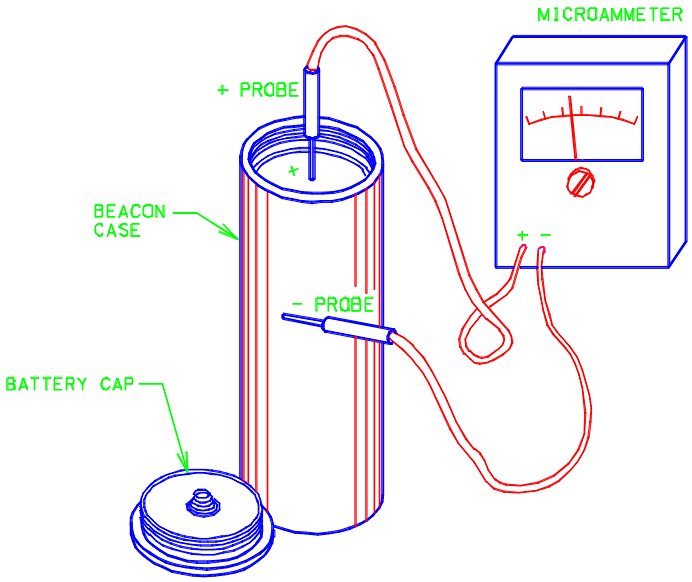


Figure 5. Beacon Off-Current Test Set-Up

WARNING

DO NOT RECHARGE, DISASSEMBLE, HEAT ABOVE 160°F (71°C) OR INCINERATE. THERE IS A RISK OF BATTERY FIRE, EXPLOSION, AND BURNS.

5.8. BATTERY DISPOSAL.

Dispose of battery in accordance with all local, state and federal regulations or contact Dukane for battery disposal service. Dispose of batteries promptly, keep away from children.

5.9. BEACON STORAGE.

When long term storage of a beacon is required, the beacon should be stored in the original shipping container (or equivalent). Make sure it is stored in a cool dry environment. The beacon should be stored without battery.

5.10. BEACON OVERHAUL.

The acoustic characteristics of the beacon shall be checked after 18 years of service to insure that the beacon is still in compliance with IMO regulations. The beacon should be returned to Dukane Corporation/Seacom Division to be checked. Please see section VIII for procedure to returning the beacon to factory.

SECTION VI
WARRANTY DK480

The Dukane Corporation warrants that the electronics and case of the Model DK480 Underwater Acoustic Beacon (hereafter referred to as the "unit") will be free from defects in materials and workmanship for six years from the date of shipment from Dukane Corporation. Dukane Corporation will remanufacture or replace any unit or battery found not to be in conformity with this warranty.

In accordance with the Technical Manual published by Dukane Corporation the customer is responsible for the following items: (1) periodic testing of the units in service; (2) removing and shipping, prepaid, any inoperative units back to Dukane Corporation; (3) installing any replacement units.

This warranty does not cover: (i) defects caused by the customer's failure to use, test or maintain any unit in accordance with Dukane Corporation's Technical Manual; (ii) product failures caused by abuse, misuse or neglect; (iii) corrosion, oxidation, abrasion, rust, surface damage, weather conditions, variations in environment that affect the appearance or operation of products; or (iv) any product where the customer has attempted any repair or service of the internal components.

Dukane Corporation's sole/exclusive liability under this warranty is limited to repair or replacement of a unit or battery that is defective.

DUKANE CORPORATION SHALL NOT BE LIABLE FOR ANY INCIDENTAL, SPECIAL CONSEQUENTIAL OR EXEMPLARY DAMAGES ARISING OUT OF THE INSTALLATION, USE, TESTING, SERVICING OR MAINTENANCE OF ANY UNIT.

THIS WARRANTY IS GIVEN IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING THE WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

SECTION VII
SERVICE PROGRAM DK480

7.1. BEACON RETURN – DEFECTIVE.

7.1.1. In the case of a failure which is determined to be within the Warranty terms (Section VI), the beacon, will be replaced by Dukane Corporation at no cost to the customer.

7.1.2. When a beacon is returned to the customer after warranty service, the remainder of the original warranty will be applied to the returned beacon.

7.2. BEACON RETURN - NO DEFECT.

If the beacon is returned to Dukane Corporation and is found to be operational, the beacon will be returned to the customer shipping collect. In addition, the customer will be notified that an analysis fee applies.

7.3. BEACON RETURN - OUT OF WARRANTY.

If the beacon is returned to Dukane Corporation and is found to be out of Warranty, the cost of an overhauled beacon will be determined and the customer will be notified for the appropriate approvals.

7.4. BATTERY CHANGE/OVERHAUL FOR THE DK480.

7.4.1. At or near the expiration date listed on the case, the beacon can be returned to Dukane Corporation for battery change and overhaul to appropriate standards. (See Section 8.2.)

7.4.2. The Overhaul Program consists of: 1) a comprehensive series of operational tests to verify the performance of the beacon to its published specifications; 2) a replacement battery; and 3) an additional warranty for another six years. Each shipment of overhauled beacons will include the necessary documentation to indicate that the product being returned meets its published specifications and that the product could be new or overhauled, at the discretion of Dukane Corporation. Dukane Corporation's standard procedure is to not return the original serial number when a beacon is overhauled. A different unit with a different serial number will be supplied from Dukane Corporation's common stock.

Notes:

1. See Section VIII for information about how to return the beacon to Dukane Corporation for service.

2. Call Dukane Corporation, Seacom Division at (630) 584-2300, Ext. 860 for appropriate service charges or further information about the Service Program.

SECTION VIII
PROCEDURE FOR RETURNING DK480 BEACON TO FACTORY

8.1. BEACON SERVICE.

8.1.1. PACKAGING. Insure that proper protection for the beacon is provided i.e. protection from inadvertent shorting of the water switch and protection from surface scratches or abrasions.

8.1.2. INFORMATION TO BE INCLUDED WITH THE BEACON.

A. Reason for the return.
B. Serial Number of the beacon(s).
C. Return Authorization Number (See 8.1.3.).
D. Purchase Order (if required) for Beacon Replacement.

8.1.3. RETURN AUTHORIZATION. Prior to shipping the beacon to Dukane Corporation, a Return Authorization Number may be required and can be obtained from Dukane Corporation, Seacom Division's Service Department by calling (630)584-2300 Ext. 860, or via Fax (630)584-5154, or via e-mail at seacom@dukane.com.

8.1.4. SHIPPING INSTRUCTIONS. When the beacon is returned under warranty, ship to:

Dukane Corporation
Attn: Seacom Division Code 860
2900 Dukane Drive
St. Charles, IL 60174

8.2. BATTERY CHANGE/OVERHAUL.

8.2.1. PACKAGING. Insure that proper protection for the beacon is provided i.e. protection from inadvertent shorting of the water switch and protection from surface scratches or abrasions.

8.2.2. PROCEDURE-CUSTOMER.

A. Contact Dukane Corporation, Seacom Division's Service Department, (630)584-2300, Ext. 860, or via Fax (630)584-5154, or via e-mail at seacom@dukane.com. Provide the following information:

1. Quantity of beacons that are being returned.
2. Purchase Order, for beacon replacement.
3. Shipping and billing addresses.
4. Shipping carrier.
5. Collect account number for shipping carrier, if applicable.
6. Contact name and phone number.

B. Ship beacons to Dukane Corporation per 8.1.4. along with a copy of the Purchase Order.

8.2.3. PROCEDURE-DUKANE. Upon receipt of the beacons and a Purchase Order, the appropriate quantity of overhauled beacons will be shipped FOB St Charles, IL.

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