



## DEPARTMENT OF THE NAVY

NAVAL SEA SYSTEMS COMMAND  
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NAVSEAINST 9460.4E  
SER 92C/  
3 Aug 00

### NAVSEA INSTRUCTION 9460.4E

From: Commander, Naval Sea Systems Command

Subj: SONAR TRANSDUCER, HYDROPHONE, AND CABLE REPLACEMENT AND HANDLING CRITERIA

Ref: (a) MIL-E-17555H, Electronic and Electrical Equipment, Accessories, and Provisioned Items (Repair Parts): Packaging of  
(b) NAVSUP Publication 485, Naval Supply Procedures Manual, Volumes I, II and III  
(c) NAVSEAINST 9460.1D, Installation Testing of Naval Sonar Transducers  
(d) NAVSEA T0850-AB-GYD-010, Revision 1, Unsatisfactory Material Reporting Processing Guide

Encl: (1) Selected Sonar Systems with Transducers or Hydrophones Designated for Replacement When Failed  
(2) Sonar Transducer and Hydrophone Replacement Criteria for Selected Elements in Arrays  
(3) Sonar Transducer and Hydrophone Disposition Instructions

1. Purpose. To reissue replacement criteria for selected submarine and surface ship sonar transducers, hydrophones and cables. This instruction is a major revision to the previous version.

2. Cancellation. NAVSEAINST 9460.4D CH-1 of 08 January 1997.

3. Scope

a. This instruction applies to all Naval Sea Systems Command (NAVSEA) SEA 92C and other selected SEA 92 cognizant installed and Ready-for-Issue (RFI) submarine and surface ship sonar transducers, hydrophones and cables.

b. Any disagreements between guidance contained in this instruction and other documentation should be referred to SEA 92C for resolution.

4. Definitions. For the purposes of this instruction, "overhaul" is defined to include Regular Overhaul (ROH),



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Refueling Overhaul (RFOH), Engineered Overhaul (EOH), Depot Maintenance Period (DMP), or Selected Restricted Availability (SRA) as applicable.

5. Responsibilities

a. Type Commanders. Direct and coordinate replacement of failed transducers, hydrophones, or cables as identified by Ship's Commanding Officer.

b. Ship's Commanding Officer. Identify transducers, hydrophones and cables needing replacement. The work list must include enough information to enable the maintenance activity to requisition replacements.

c. Type Commanders, NAVSEA Ships Logistic Managers, or Ship Acquisition Program Managers. Authorize scheduled work covered by this instruction through Planning and Engineering for Repairs and Alterations (PERA) or Submarine Maintenance Engineering, Planning and Procurement (SUBMEPP).

d. Installing activities

(1) Requisition replacement transducers, hydrophones, cables, connectors and overboots.

(2) All transducers and hydrophones identified as repairable items in enclosure (3) shall be handled and packaged in accordance with reference (a). Repairable transducers and hydrophones shall be promptly shipped to the appropriate activity, as indicated in enclosure (3). All uninstalled transducers and hydrophones are to be stored and shipped in individual protective containers. In many cases NAVSEA has provided containers for this purpose. For information concerning the availability of shipping containers, contact the In-Service Engineering Agent (ISEA) at the Naval Undersea Warfare Center (NUWC) Division Newport (Code 2163), Newport, RI 02841, who can refer the caller to the appropriate inventory manager.

(3) Mark the shipping containers with the transducer or hydrophone nomenclature and the condition code from reference (b).

(4) Test replacement transducers, hydrophones and cables

using the Combat System Test Procedures (CSTP) per NAVSEAINST 9460.1D, reference (c). Report all defective transducers, hydrophones and cables in accordance with reference (d).

(5) For replacement transducers and hydrophones, fill out the Transducer/Hydrophone Certification or test data cards and send them to the Transducer ISEA at NUWC Division Newport (Code 2163). If Transducer/Hydrophone Certification or test data cards are not included with replacement transducers and hydrophones, send the following information: hull number, system, installing activity, date installed, transducer or hydrophone model number, transducer or hydrophone serial number, and installation location.

(6) For technical and/or logistical advice on SEA 92 transducers and hydrophones addressed in this instruction, contact the ISEA at NUWC (Code 2163). The ISEA Hotline can be reached 24 hours a day at, commercial (401) 832-4931 or DSN 920-4931. The ISEA will refer a caller requiring logistical advice to the appropriate inventory manager.

6. Action

a. Specific sonar systems

(1) Transducers, hydrophones and cables for systems listed in enclosure (1) are designated as replace when failed. When determined to be defective by test requirements in the applicable Maintenance Requirement Cards (MRCs), these elements shall be replaced during overhaul or at the discretion of the Ship's Commanding Officer during non-overhaul periods.

(2) For elements that form part of an array, replace as directed in enclosure (2).

b. General

(1) During the overhaul pre-arrival period, determine defective transducers, hydrophones and cables by the tests required in applicable MRCs. Replace defective elements in accordance with the guidance of enclosures (1) and (2).

(2) Test all replacement transducers, hydrophones and cables in accordance with NAVSEAINST 9460.1D, reference (c).

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(3) Transducers and hydrophones not scheduled for replacement during overhaul, but removed for other reasons, shall be reinstalled upon successful completion of testing using the Maintenance Requirement Cards (MRC), in accordance with reference (c).



G. P. NANOS, JR.

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SELECTED SONAR SYSTEMS WITH TRANSDUCERS OR HYDROPHONES DESIGNATED  
FOR REPLACEMENT WHEN FAILED

- NOTE: (1) Transducers and hydrophones for the systems listed below shall be replaced during overhaul (regular overhaul, refueling overhaul, engineered overhaul, selected restricted availability, depot maintenance period) or emergent drydockings, if they do not meet the test requirements of Maintenance Requirement Cards/Procedures (MRCs/ MRPs) or if transducers or cables are physically damaged during overhaul. Failed transducers and hydrophones for the systems listed below may also be replaced during other than drydocking periods, at the discretion of the Ship's Commanding Officer.
- (2) If a transducer or hydrophone is identified as defective by MRC/MRP testing, isolate the problem to either the transducer, hydrophone, cable or plugs. Repair or replacement should be limited to defective components.
- (3) Removed elements are to be returned for restoration, or disposal, as indicated in enclosure (3).

SONAR SYSTEMS

Failed transducers and hydrophones for the following systems shall be replaced during drydocking periods, or at the discretion of the Ship's Commanding Officer, as noted above:

1. AN/UQN-1/4/4A
2. AN/BQH-1C
3. AN/WQC-2/2A
4. AN/BQN-13/13A
5. AN/BQS-4
6. AN/BQS-14. Between overhauls, replace staves 11 through 50 if defective. Do not mix DT-605 and DT-605A hydrophones in an array.

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7. AN/BQS-15. Note: AN/BQS-15 with EC-17/18 see enclosure (2) para. 13
8. OD-161
9. AN/BQA-8A/B/C (DT-513B)
10. AN/BQC-1
11. AN/BQH-5, (AN/BSY-1 Units 1837/1838) (AN/BSY-2 Units 4695X/4695Z)
12. AN/BQN-17
13. AN/WLR-9A/9B(V)1,2,3,4, and AN/WLR-12
14. AN/BQQ-6, and AN/BQQ-5E. Units 4/5 (DT-593) or 4/5/6 (DT-511, DT-592), and Units 46/47 (TR-233 Series), 48 (TR-232 Series), 52/53 (TR-321 Series), 55/56/57 (TR-122C), 64/65/66 (TR-341), and 70 (TR-297A, TR-331, TR-355)
15. AN/BSY-1. Units 1807-1810 (TR-321 Series), 1811 (TR-232 Series), 1812-1814 (TR-233 Series), 1815 (DT-511B), 1816/1817 (DT-592), 1819/1820/1821/1822 (TR-338) 1823/1824 (TR-302A), and Units 1827-1834 (DT-513B)
16. AN/BSY-2. Units 46951 (DT-511B), 46953/46955 (DT-592), 46957xx (DT-513B), 4697H/4697J (TR-302A), 46971-46974 (TR-321 Series), 46975 (TR-232 Series) and Units 46978, 46979 and 4697A (TR-233 Series)

SONAR TRANSDUCER AND HYDROPHONE REPLACEMENT  
CRITERIA FOR SELECTED ELEMENTS IN ARRAYS

- NOTE: (1) Elements are exempt from mandatory replacement if they meet test requirements of Maintenance Requirement Cards/Procedures (MRCs/MRPs).
- (2) If a transducer or hydrophone is identified as defective by MRC/MRP testing, isolate the problem to either the transducer, hydrophone, cable or plugs. Repair or replacement should be limited to defective components.
- (3) Removed elements are to be returned for restoration, or disposal, as indicated in enclosure (3).

SONAR SYSTEMS

1. AN/BQQ-5, AN/BSY-1, AN/BSY-2, and AN/BQR-7 hydrophones (DT-276 or DT-276A):

Note: Defective DT-276 or DT-276A hydrophones will always be replaced with DT-276A hydrophones. Terminate DT-276A hydrophone cables with Non-Conductive Coating (NCC) connectors, M24231 MOD

- a. At overhaul. Replace all defective hydrophones.
- b. Between overhauls. Replace all defective hydrophones and repair molded plugs and cables during maintenance periods when 10 percent of the individual hydrophones in the array or 10 percent of the hydrophones in a given aperture have failed.
- c. During sonar testing after replacement. Replace defective hydrophones and repair molded plugs and cables using the following guidelines:
- (1) Three hydrophones per stave conformal array: Replace all defective hydrophones if more than six hydrophones in the array or three hydrophones in an aperture are defective. As to AN/BSY-2, replace all defective hydrophones if more than four hydrophones in the array are defective.
- (2) One hydrophone per stave line array: Replace all defective hydrophones in a side aperture if more than one hydrophone in that aperture is defective. Replace all defective hydrophones in the forward aperture.

d. During sonar testing after new construction. Replace all defective hydrophones if more than two hydrophones in the array are defective.

2. AN/BQR-21:

a. At overhaul, ships with AN/BLR-14. Replace all defective hydrophones and return the AN/BQR-21 interface with the AN/BLR-14 to its normal configuration if the alterations in paragraph 3.b. have been made.

b. Between overhaul, ships with AN/BLR-14. Replace all defective hydrophones if either 12 hydrophones in the array or four adjacent hydrophones have failed. Note: The AN/BLR-14 is interfaced with preamplifier outputs from hydrophones 2, 4, 6, 8, 16, 18, 32, 34, 36, 38, 40, 42, 44, 46, and 48. Failure of any of these hydrophones will degrade AN/BLR-14 system performance. Correct this by substituting the signal from an adjacent hydrophone if one is available. See AN/BLR-14 MRCs for test requirements and interface transfer guidelines. Special procedures are required for substituting preamplifier outputs for hydrophones 2, 16, 18, 32, 34, and 48. Log alterations of the interface with the AN/BLR-14 so it can be restored to its normal configuration when defective hydrophones are replaced. Advise the ISEA, NUWC Division Newport, Code 2163, of all AN/BLR-14 interface alterations. If hydrophone failures occur where no adjacent hydrophone is available, replace defective hydrophones and return the interface to its normal configuration.

c. During sonar testing after overhaul, ships with AN/BLR-14. Replace all defective hydrophones if more than two hydrophones in the array have failed. In addition, replace defective hydrophones connected in the normal AN/BLR-14 configuration.

3. AN/BQQ-5 Spherical Array (TR-317):

a. At overhaul. Replace all defective elements.

b. Between overhauls. For hull numbers below SSN 721, replace all defective elements if more than 124 elements in the array or more than 19 elements in a single 192 element aperture have failed. For hull numbers SSN 721 and above (Sonar Active Detection System (SADS) arrays), replace all defective elements if more than 110 elements in the array, or more than 19 elements in a 192 element aperture, or more than 17 elements in a 176 element aperture have failed.

c. During sonar testing after overhaul. For hull numbers below SSN 721, replace all defective elements if more than 50 elements in the array or more than 10 elements in a 192 element aperture have failed. For hull numbers SSN 721 and above, replace all defective elements if more than 44 elements in the array or more than 10 elements in any aperture have failed.

NOTE: TR-317 and TR-317A/B/C elements may be intermixed if cabling is made compatible.

4. AN/BSY-1 Spherical Array (Unit 1801) (TR-317/A/B/C):

a. At overhaul. Replace all defective elements.

b. Between overhauls. Replace all defective elements if more than 110 elements in the Spherical Array have failed or more than the following have failed in any aperture:

FUNCTION

APERTURE CRITERIA

Receive:

DIMUS and Active Sector Search:

26 inputs, in a 264 channel aperture (322 elements in aperture with pairing), failed

Omni 16 Degrees:

16 inputs, in a 160 channel aperture (202 elements in aperture with pairing), failed

Omni 32 Degrees:

8 inputs, in an 80 channel aperture (104 elements in aperture with pairing), failed

c. During sonar testing after overhaul. Replace all defective elements if more than 44 elements in the Spherical Array have failed or 10 percent of the input channels to any active or receive aperture have failed.

5. AN/BSY-1 and AN/BSY-2 High Frequency Array (HFA) (DT-633, TR-339/340):

a. At overhaul. Replace all defective transducers and hydrophones.

b. Between overhauls and during sonar testing after replacement. Replace all defective TR-339/340 transducer or DT-633 hydrophone under the following conditions:

(1) Replace a TR-339/340 if two or more elements out of the 22 elements in the transmit/receive section have failed or if the stave in the receive only section has failed.

(2) Replace failed DT-633 hydrophone if both staves in a hydrophone have failed, two adjacent hydrophones have adjacent stave failures, or more than two randomly positioned DT-633 hydrophone staves fail.

6. AN/BSY-1 (TR-338) and AN/BSY-2 (TR-338A) top sounders: Removed elements are to be returned to the ISEA at NUWC Division Newport, Code 2163.

a. At and between overhauls. Replace all defective transducers.

b. Replacement outboard cables for TR-338/A transducers shall be maintained at 90 feet.

7. AN/SQS-53A/B with TR-313 transducer elements, and AN/SQS-53C with TR-343 transducer elements:

a. At overhaul. Replace all defective elements.

b. Between overhauls. Replace all defective elements if more than 57 elements in the array or more than 15 elements in a 192 element aperture have failed.

c. During sonar testing after overhaul. Replace all defective elements if more than 12 elements in the array or more than three elements in a 192 element aperture have failed.

8. AN/SQS-56 with TR-330/A transducers:

a. Prior to drydocking. Three months prior to drydocking, send AN/WQM-8 and MRC test data to the ISEA, NUWC Division, Newport Code 2163 for analysis. NUWC Division, Newport will review the test results and, within 10 working days of receiving the test data, recommend replacement or retention of transducer to the Type Commander.

b. At SRA drydocking. Replace all defective elements.

c. Between SRAs. Replace all defective elements if more than 39 elements in the array or more than 13 elements in a 96 element aperture have failed.

d. During sonar testing after new construction and SRA. Replace all defective elements if more than eight elements in the array or more than three elements in a 96 element aperture have failed.

9. AN/BQQ-6 or AN/BQQ-5E Unit 1 (SSBN 726 Class) (DT-574):

a. At overhaul between overhauls and during sonar testing after overhaul. Replace all defective elements if more than 26 elements in a 264 element aperture have failed.

10. AN/BQQ-6 or AN/BQQ-5E Unit 8 (SSBN 726 Class) (DT-574A):

a. At overhaul. Replace all defective hydrophones.

b. Between overhauls and during sonar testing after overhaul. Replace all defective hydrophones if more than four hydrophones in either side section or more than two hydrophones in the forward section of the array have failed.

11. AN/BSY-2 Unit 46911, Passive Spherical Array (DT-574 Hydrophones):

a. At overhaul. Replace all defective hydrophones

b. Between overhauls. Replace all defective hydrophones if more than 230 elements in the array have failed or more than the following have failed in any aperture:

70 hydrophones in any 32 column by 26 row aperture.

42 hydrophones in any 16 column by 26 row half aperture.

42 hydrophones in any half aperture consisting of any top or bottom 13 rows and 32 columns of hydrophones

c. During sonar testing after replacement. Replace all defective hydrophones if more than 92 hydrophones in the array have failed or more than the following have failed in any aperture:

30 hydrophones in any 32 column by 26 row aperture.

15 hydrophones in any 16 column by 26 row half aperture.

15 hydrophones in any half aperture consisting of any top or bottom 13 rows and 32 columns of hydrophones

d. During sonar testing after new construction. Replace all defective hydrophones if more than 46 hydrophones in the array have failed or more than the following have failed in any aperture:

15 hydrophones in any 32 column by 26 row aperture.

8 hydrophones in any 16 column by 26 row half aperture.

8 hydrophones in any half aperture consisting of any top or bottom 13 rows and 32 columns of hydrophones.

12. AN/BSY-2 Unit 46933, Active Hemispherical Array (TR-353A):

a. At overhaul. Replace all defective elements.

b. Between Overhauls. Replace all defective elements if more than 56 elements in the array or more than 19 elements in a single 192 element aperture have failed.

c. During sonar testing after replacement. Replace all defective elements if more than 22 elements in the array or more than 8 elements in an aperture have failed.

d. During sonar testing after new construction. Replace all defective elements if more than 11 elements in the array or more than 4 elements in an aperture have failed.

13. AN/BSY-2 and AN/BQG-5 Wide Aperture Array (WAA):

a. Newly installed or refurbished (in drydock). Replace all defective hydrophones if more than 6 hydrophone channels have failed in an array.

b. Newly installed or refurbished (waterborne/after deep dive-prior to departure from refurbishment facility). Replace all defective hydrophones if more than 16 hydrophone channels have failed in an array.

c. At overhaul. Replace all defective hydrophones.

d. In service. Replace defective hydrophones if more than 40 hydrophone channels have failed in an array. Replace staves with highest number of failed hydrophones to achieve not greater than 35 failed hydrophones in the array.

NOTE: An array is defined as one of the six WAA panels on the submarine, three on the port side and three on the starboard side. There are 44 hydrophone channels in each array (11 in each corner) that are not used by the beamformer. If any of the failures occur on these channels, do not include them when totaling the failure channel count for each array. Contact the Transducer ISEA, NUWC Division Newport, Code 2163, for the location of the 44 hydrophones in each array that are not utilized by the beamformer. The WAA hydrophones are connected directly to Outboard Electronic Bottles (OBE). The hydrophones must be disconnected from the OBE prior to megger tests to prevent damage to the OBE and properly isolate the failure.

14. AN/BQS-15 with EC-17/18:

a. At overhaul. Replace all defective transducers and hydrophones.

b. Between overhauls and during sonar testing after replacement. Replace defective hydrophone or projector array under the following conditions:

(1) Replace the hydrophone array if 5 or more random stave failures, or if 4 or more adjacent stave failures are present in either the upper or lower array.

(2) Replace the projector array if the resistance of 3 or more projector staves and their associated cabling exceeds 2 ohms, as measured from the inboard at the output side of the dummy load to the array. This measurement should be performed after calibration testing indicates low source level and fault isolation indicates that the cables and transmitter are operating within acceptable limits.

## SONAR TRANSDUCER AND HYDROPHONE DISPOSITION INSTRUCTIONS

<u>TRANSDUCER</u>	<u>SYSTEM</u>	<u>DISPOSITION (Notes)</u>
AT-200 Series	AN/UQN-1/4	PNSY, TRF (1)
DT-276 Series	AN/BQR-7/BQQ-5/BSY-1/BSY-2	Dispose (2)
DT-365	AN/BQS-15	PNSY, TRF (1)
DT-369	AN/BQH-5/BSY-1/BSY-2	NSWCCD (3)
DT-511 Series	AN/WLR-9/BQQ-6/BSY-1/BSY-2	NUWC NPT, ISEA (4)
DT-513 Series	AN/BQA-8/BSY-1/BSY-2	Dispose (2)
DT-574 Series	AN/BQQ-6/BSY-2	Dispose (2)
DT-592 Series	AN/WLR-9/BQQ-6/BSY-1/BSY-2	NUWC NPT, ISEA (4)
DT-593	AN/WLR-12	NUWC NPT, ISEA (4)
DT-605 Series	AN/BQS-14	PNSY, TRF (1)
DT-611 Series	AN/BQR-21	PNSY, TRF (1)
DT-633	HFA, BSY-1/BSY-2	NUWC NPT, ISEA (4)
HS058D0300	AN/BQN-13	Dispose (2)
TR-122 Series	AN/BQC-1/BQQ-6	PNSY, TRF (1)
TR-141	AN/BQS-4	PNSY, TRF (1)
TR-155 Series	AN/BQQ-5	PNSY, TRF (1)
TR-192 Series	AN/UQN-1/4	PNSY, TRF (1)
TR-216	OD-161	NUWC NPT, ISEA (4)
TR-217	AN/BQS-14	NUWC NPT, ISEA (4)
TR-232 Series	AN/WQC-2/BQQ-6/BSY-1/BSY-2	NUWC NPT, ISEA (4)
TR-233 Series	AN/WQC-2/BQQ-6/BSY-1/BSY-2	NUWC NPT, ISEA (4)
TR-242 Series	AN/BQS-15	PNSY, TRF (1)
TR-281 Series	AN/BQS-15	NUWC NPT, ISEA (4)
TR-282 Series	AN/BQS-15	NUWC NPT, ISEA (4)
TR-297 Series	AN/BQQ-6	PNSY, TRF (1)
TR-302 Series	AN/BQN-17/BSY-1/BSY-2	NUWC NPT, ISEA (4)
TR-313 Series	AN/SQS-53A/B	PNSY, TRF (1)
TR-316	AN/BQS-14	PNSY, TRF (1)
TR-317 Series	AN/BQQ-5/BSY-1	PNSY, TRF (1)
TR-321 Series	AN/BQH-1/BQQ-6/BSY-1/BSY-2	NUWC NPT, ISEA (4)
TR-330 Series	AN/SQS-56	PNSY, TRF (1)
TR-331 Series	AN/UQN-1/4	NUWC NPT, ISEA (4)
TR-338 Series	Top Sounder, AN/BSY-1/BSY-2	NUWC NPT, ISEA (4)

<u>TRANSDUCER</u>	<u>SYSTEM</u>	<u>DISPOSITION (Notes)</u>
TR-339	HFA, AN/BSY-1/BSY-2	NUWC NPT, ISEA (4)
TR-340	HFA, AN/BSY-1/BSY-2	NUWC NPT, ISEA (4)
TR-341	AN/BQN-13/BQQ-6	MRIL (5)
TR-343 Series	AN/SQS-53C	PNSY, TRF (1)
TR-353A	AN/BSY-2 Array	PNSY, TRF (1)
TR-355	AN/UQN-1/4	NUWC NPT, ISEA (4)
AN/BQS-15 EC-17/18	AN/BQS-15 EC-17/18	PNSY, TRF (1)
Wide Aperture Array	AN/BQG-5/BSY-2	PNSY, TRF (1)

Notes:

- (1) Return to Receiving Officer, Portsmouth Naval Shipyard, Portsmouth, NH 03804-5000 ATTN: D. L'Italien (Code 5114).
- (2) Use local disposal procedures consistent with lead/zirconate/titanate (PZT) ceramic disposal.
- (3) Return to Commander, Naval Surface Warfare Center, 9500 McArthur Blvd., West Bethesda, MD 20817 (Code 732POSTEK).
- (4) Return to Naval Undersea Warfare Center, Division Newport, 1176 Howell St., Newport, RI 02841-1708 ATTN: ISEA (Code 2163).
- (5) Return in accordance with guidance contained in NAVSUP Publication 4107-N, "Master Repairable Item List" (MRIL).