

NAVSHIPS 92078: Instruction Book for Hydrophone Type CBZT-51038-G

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INSTRUCTION BOOK

for

HYDROPHONE
TYPE CBZT-51038-G

DYNA-LABS, INC.
GARDEN CITY, N. Y.

DEPARTMENT OF THE NAVY
BUREAU OF SHIPS

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Contract: NObsr-57438

Approved by BuShips:
13 November, 1953

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LIST OF EFFECTIVE PAGES

PAGE NUMBERS	CHANGE IN EFFECT	PAGE NUMBERS	CHANGE IN EFFECT
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i to ii	Original	4-2	Original
1-0 to 1-2	Original	4-3	Original
2-1	Original	4-4	Original



DEPARTMENT OF THE NAVY
BUREAU OF SHIPS
WASHINGTON 25, D. C.

IN REPLY REFER TO
Code 993-100
13 November 1953

From: Chief, Bureau of Ships
To: All Activities Concerned with the
Installation, Operation and Main-
tenance of the Subject Equipment

Subj: Instruction Book for Hydrophone Navy
Type CBZT-51038-G NAVSHIPS 92078

1. This is the instruction book for the subject equipment and is in effect upon receipt.
2. When superseded by a later edition, this publication shall be destroyed.
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W. D. LEGGETT, JR.
Chief of Bureau

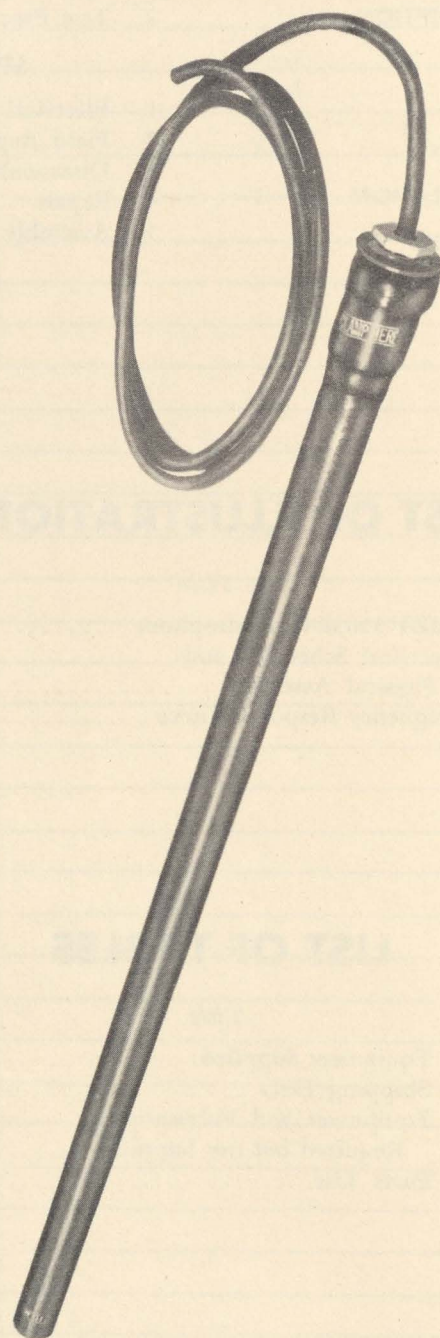


Figure 1. CBZT-51038-G Hydrophone

SECTION 1 GENERAL DESCRIPTION

1. PURPOSE OF HANDBOOK.

This handbook is intended to furnish instructions for the use and maintenance of HYDROPHONE CBZT-51038-G.

2. GENERAL DESCRIPTION AND PURPOSE.

The CBZT-51038-G HYDROPHONE is a piezoelectric device intended for use with equipment such as NAVY MODEL JR-1 Sound Receiving Equipment. The basic function of the Hydrophone is to convert underwater sound-wave energy into electrical-wave energy of the same wave form. This unit is sensitive to underwater vibrations in the frequency range from 200 c.p.s. to 15 KC and shows marked directional response characteristics along the axis of the Hydrophone and non-directional characteristics at right angles to the axis of the Hydrophone.

3. REFERENCE DATA.

- a. Nomenclature.—Hydrophone CBZT-51038-G.
- b. Contract Number and Date.—Contract NObsr-57438 dated May 28, 1952.
- c. Contractor—DYNA-LABS, INC., Garden City, New York.
- d. Cognizant Naval Inspector—Inspector of Naval Materiel, Great Neck, New York.
- e. Equipment Shipped—One package per complete shipment.
- f. Cubic Contents.—.46 cubic feet crated, .08 cubic uncrated.
- g. Total Weight.—16 pounds crated, 15 pounds uncrated.
- h. Frequency Range.—200 c.p.s. to 15 KC.
- i. Open-Circuit Receiving Response—The open-circuit receiving response for plane underwater sound-waves incident at right angles to the line is not less than -110

db referred to one volt per microbar at any frequency range between 200 c.p.s. and 15 KC.

j. Response—Frequency Characteristics.—The open-circuit response frequency characteristic of this unit is essentially flat and substantially free of valleys and peaks. The slope of the characteristic at any frequency between 200 c.p.s. and 15 KC does not exceed ± 2 db per octave.

k. Directional Response Characteristics.—In the plane normal to the longitudinal axis of the Hydrophone and bisecting its length, the directional response pattern in a polar presentation is approximately a circle. The departure of the pattern from a circle does not exceed ± 1.5 db at any frequency range between 200 c.p.s. and 15 KC. In a plane including the longitudinal axis of the Hydrophone, the directional response pattern is that characteristic of a three foot line source. For any octave band above 1-1/2 KC, the response for the sound incident along the line is down at least 15 db from the maximum response.

l. Impedance.—The Hydrophone is suitable for feeding into a resistive load of 100 to 150 ohms.

m. Hydrostatic Pressure.—The Hydrophone may be safely used at depths up to 1000 feet.

n. Temperature Information.—Operating temperature range -1° to $+35^{\circ}$ C. Storage temperature range -54° to $+85^{\circ}$ C.

o. Cable.—The Hydrophone is supplied with an 11 foot length of Navy Type DCOP-6 cable sealed to it.

4. EQUIPMENT SUPPLIED AND REQUIRED.

- a. Equipment Supplied—Table 1-1 lists equipment supplied with Hydrophone CBZT-51038-G.
- b. Shipping Data—Table 2-1 lists shipping data for Hydrophone CBZT-51038-G.
- c. Equipment Required But Not Supplied Table 1-3 lists equipment required but not supplied.

TABLE 1-1. EQUIPMENT SUPPLIED

Quantity per Equipment	NAME OF UNIT	Navy Type	Overall Dimensions		Volume	Weight
		Designation	Length	Dia.		
1	Hydrophone	CBZT-51038-G	46	2-1/2	.13	15

TABLE 1-2. SHIPPING DATA

Shipping Box No.	CONTENTS		Overall Dimensions			Volume	Weight
	NAME	DESIGNATION	Height	Width	Depth		
1	Hydrophone	CBZT-51038-G	3-3/8	48	4-3/4	.46	16.

TABLE 1-3. EQUIPMENT AND PUBLICATIONS REQUIRED BUT NOT SUPPLIED

Quantity per Equipment	NAME OF UNIT	Navy Type Designation	Required Use	Required Characteristics
1	Hydrophone Tripod	10159A	To mount Hydrophone	
1	Sound Receiving Equipment	JR-1 or equiv.		

SECTION 2 THEORY OF OPERATION

The CBZT-51038-G is a line hydrophone for broad band audio frequency underwater signal detection.

It consists of twenty prepolarized electrostrictive barium titanate cylinders operating below their resonant frequency. This mode of operation establishes a flat frequency response over the audio range (.200—15 KC). The sensitivity, a function of the cylinder's diameter and thickness, is designed to produce a signal level of -105 db/micro bar relative to 1 volt/micro bar.

Due to its inherent symmetry, its response at right angles to its axis (broadside response) is uniform ± 1 db over an azimuth of 360°. However, due to its length it acts as a directional 3 ft. line around the vertical plane.

The terminal impedance is a function of electrically

paralleling the transducer elements. Individual cylinder capacity (average) is .0125 MFD.

This CBZT-51038-G hydrophone is based upon the concept of a center member, which is strong enough to withstand the hydrostatic loads, supporting the rim-mounted barium titanate cylinders, which are pressure-released by air and isolated from the support and each other by means of soft compliant spacing washers. Consequently they receive energy as individual elements and permit their self resonance rather than coupled resonances to determine the hydrophone's directional characteristics and resonant frequency.

The cylinder wall thickness, the castor-oil film and RHO-C rubber boot are designed for optimum acoustic matching between water and the hydrophone transducer elements.

SECTION 3 INSTALLATION

1. MOUNTING.

The CBZT-51038-G is intended for use with Navy Type 10159A Hydrophone Tripod.

a. CAUTION must be observed in tightening the "U" bolt clamps so that the rubber covering of the Hydrophone is not cut or damaged. Clamping pressure should be no more than the amount required to prevent the hydrophone from moving in its mounting.

b. Clamp the Hydrophone in an up-right position to the two horizontal angle members of the tripod by means of the "U" bolts with nuts, flatwashers and lockwashers supplied with the tripod. The cable end of the Hydrophone goes upward or toward the apex of the tripod. It is extremely important that the Hydrophone be clamped to the tripod only at the points marked "CLAMP HERE". These mounting points are stenciled on the body of the Hydrophone in white paint.

c. The Hydrophone cable should be made fast to the tripod at a point above and as nearly in a line with the Hydrophone as possible. This is necessary in order to avoid flexing of the cable with underwater currents.

d. Using marlin, secure the Hydrophone cable to the tripod leg and horizontal member on which the junction box is located. The marlin servings should be no more than 12 inches apart, and closer where necessary, to prevent flexing of the cable with underwater currents.

e. Before the whole assembly is submerged, the outside of the Hydrophone should be very carefully scrubbed with soap and water to remove all dirt and grease, which, if present on the rubber cover will impair the efficiency of the unit.

2. TEST PROCEDURE.

After Hydrophone has been mounted it should be tested as outlined in Section 4, Paragraph 1.

SECTION 4 MAINTENANCE

1. ELECTRICAL TESTS.

If abnormal operation is suspected, the following tests may be conducted:

1.1. D.C. Resistance of Hydrophone and Cable.

1.1.1. Should be 200 megohms.

1.1.1.1. Values under 5 megohms indicate excessive leakage between cable wires or across cylinders. (Due to moisture).

1.1.1.2. Disconnecting the cable and hydrophone proper and remeasuring resistance will isolate the defect.

1.2. Capacity of Hydrophone.

1.2.1. Should be .25 MFD.

1.2.1.1. Values lower than .24 MFD. indicate that a lead has broken, within the hydrophone, and removed one or more cylinders from the line circuit.

1.2.1.2. Each cylinder lost from the circuit will reduce the hydrophone capacity by .0125 MFD.

2. FIELD REPAIRS.

If tests show conclusively that the Hydrophone is not functioning properly it will be necessary to replace it. Field repairs are impracticable since a vacuum chamber is necessary to remove and assemble the rubber boot. Further difficulty would be encountered because it is necessary to replace the castor oil drained from the Hydrophone with a pure U.S.P. Grade AA castor oil which has been subjected to a vacuum for several hours to reduce the moisture content of the oil.

3. DISASSEMBLY.

If the necessary vacuum equipment is available the Hydrophone may be serviced in the following manner:

3.1. Cut the rubber sealer from the strap (O-103) and the seal (O-104). Remove the strap and seal from the boot (O-102). Care must be taken not to damage the boot.

3.2. Place the Hydrophone in a vacuum chamber so that only the 1/8 inch wide flange on the cable end of the boot is exposed. Evacuate the chamber until the boot is sufficiently dilated to allow the crystal array to be slid out of the boot.

3.3. Untie and unwrap the cable braid and unsolder the two conductors of the cable (W-101) from the terminal block (E-101). Remove the gland nut (A-103), washer (A-104) and cable (W-101) from the hub and support tube assembly (A-101).

3.4. Remove the end cap (A-105), nut (A-107) and washer (A-106).

4. REPAIR.

4.1. Inspect the cable, packing and the boot for defects which would cause water to leak into the hydrophone. Replace defective parts.

4.2. Slide the cylinders (Y-101) apart to expose the solder connections. Check each cylinder and its connections for damage. Replace any damaged cylinders and resolder any broken connections.

4.3. If failure was due to water leaking into the Hydrophone wipe all parts dry.

5. ASSEMBLY.

5.1. Assemble the cable (W-101) in the hub (A-101) snaking the two conductors thru the grommets holes in the tube. Snake the cable braid thru the remaining hole. Replace the washer (A-104) and the gland nut (A-103) tightening the nut securely. Thread the bare ends of the conductors thru the holes in the terminal block (E-101) and solder. Solder the leads from the first cylinder to the conductors. Wrap the cable braid around the terminal block and tie securely. This acts as a strain relief for the cable.

5.2. Assemble the washer (A-106) and the nut (A-107) on the support tube. Draw the cylinders up tight. Replace the end cap (A-105).

5.3. Place approximately one pint of U.S.P. Grade AA castor oil in a vacuum for several hours until bubbles no longer appear in the oil.

5.4. Place the boot (O-102) in the vacuum chamber. Pour the castor oil into the boot. Evacuate the chamber until the boot is sufficiently dilated to permit the crystal array to be slid into the boot. Release the vacuum and remove the Hydrophone from the vacuum chamber. Pour the castor oil into the boot. Evacuate the chamber until the boot is sufficiently dilated to permit the crystal array to be slid into the boot. Release the vacuum and remove the Hydrophone from the vacuum chamber.

5.5. Loop two layers of strapping (O-103) around the boot and thru the seal (O-104). Bind securely as this forms the water tight seal between the hub and boot.

5.6. Coat the strap and seal with Minnesota Mining & Mfg., Co. primer EC 776. Allow the primer to dry and coat the seal and strap with sealer EC 801.

5.7. After the sealer has hardened wash the Hydrophone thoroughly.

5.8. Test the Hydrophone as outlined in paragraph 1.

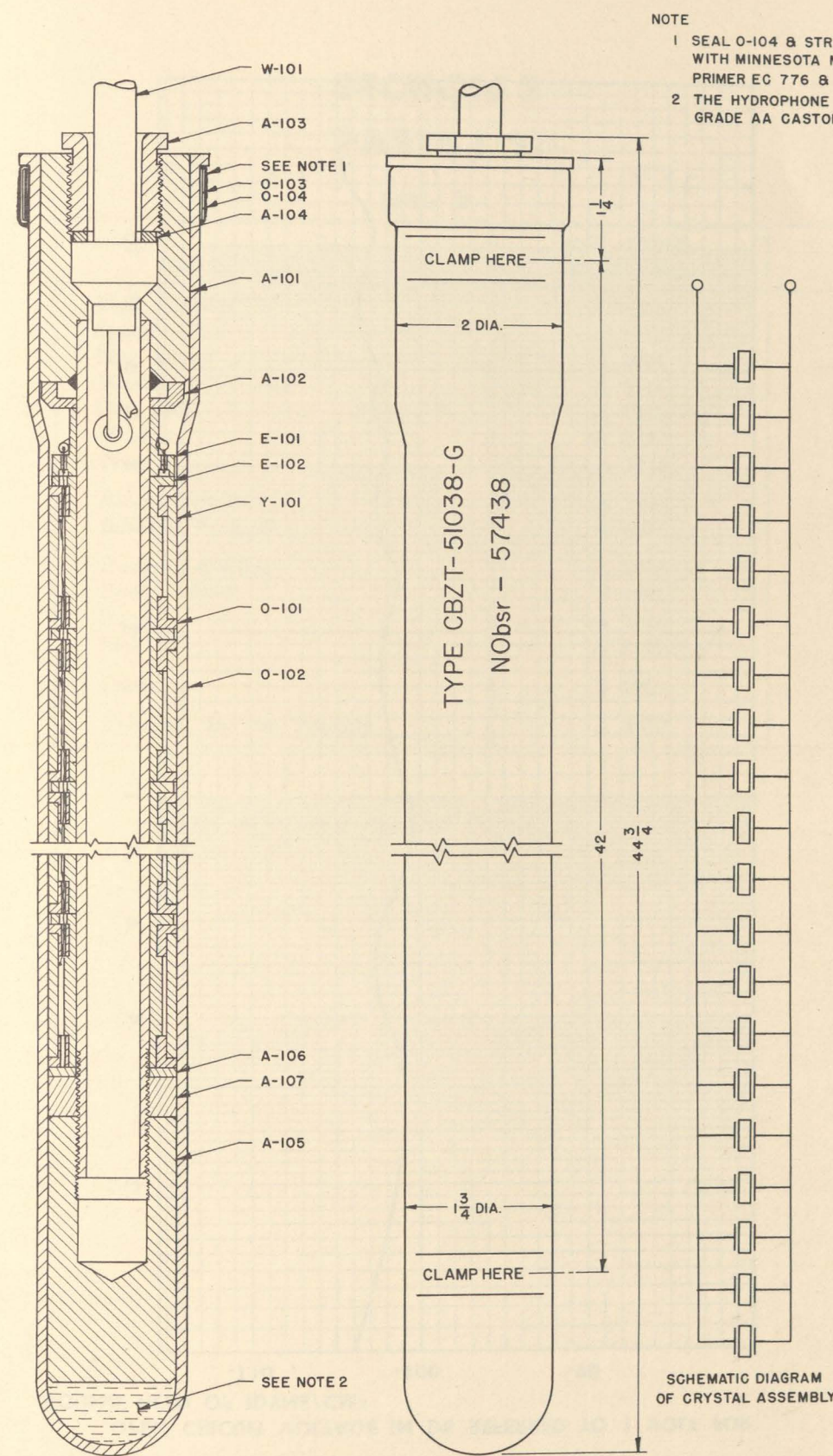


Figure 2. Electrical Schematic and Physical Assembly

RECEIVING FREQUENCY RESPONSE
LINE HYDROPHONE TYPE CBZT-51038-G

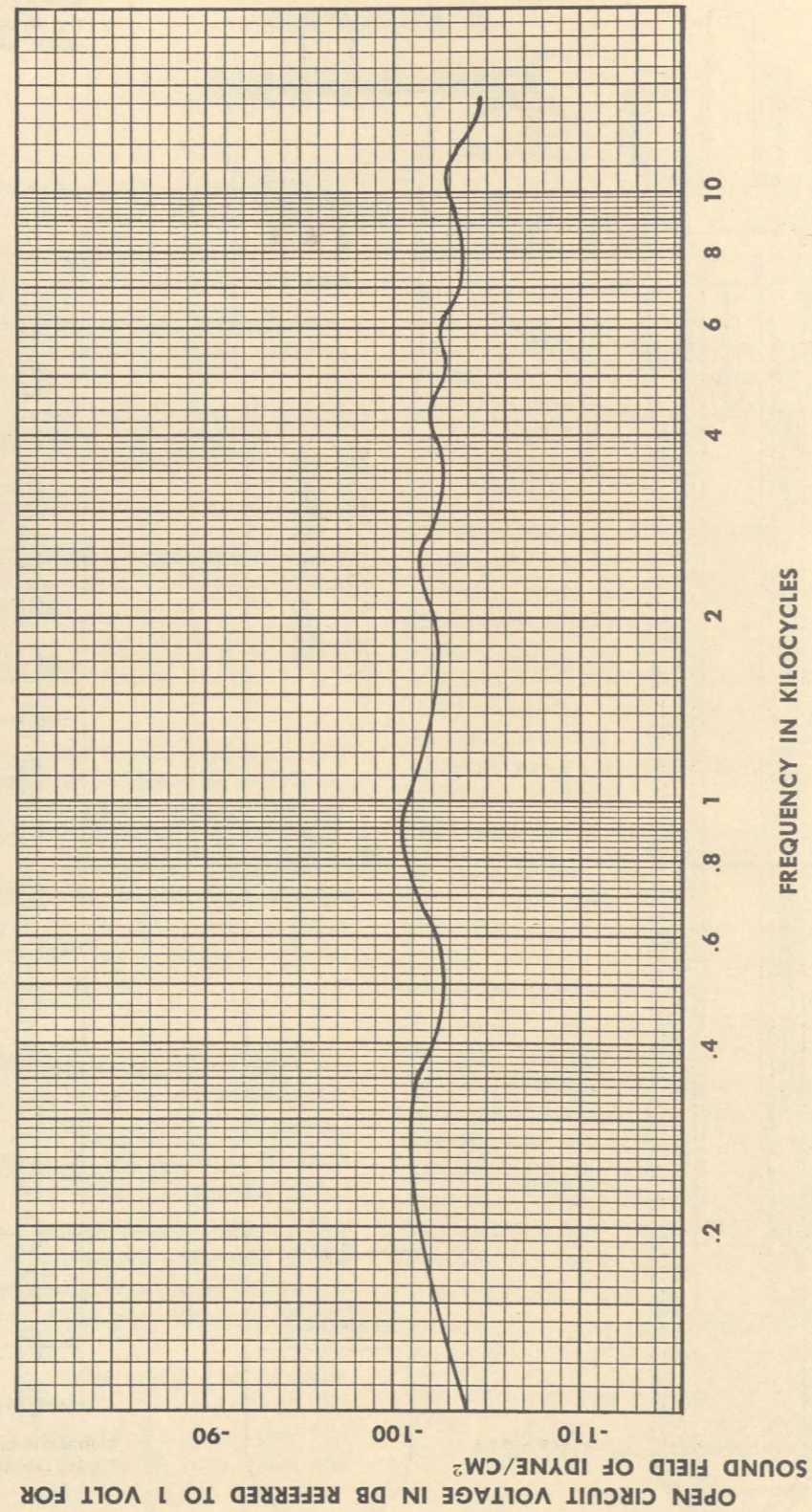


Figure 3. Frequency Response Curve

SECTION 5
PARTS LIST

TABLE 5-1

REF. DESIG.	NAME OF ITEM	MFR. DRWG. & PRT. NO.	QUANT.
A 101	Hub, Support Tube	A 1966	1
A 102	Spacer	A 1972	1
A 103	Nut, Gland	A 1971	1
A 104	Washer	A 2116	1
A 105	Cap, End	A 1978	1
A 106	Washer	A 2117	1
A 107	Nut	A 2014	1
E 101	Block, Terminal	A 1974	1
E 102	Bushing, Insulating	A 1976	20
O 101	Bushing, Rubber	A 1975	40
O 102	Boot, Rubber	B 1982	1
O 103	Strap	A 2118	1
O 104	Seal	A 2119	1
W 101	Cable	B 1969	1
Y 101	Cylinder, Barium Titanate	A 1977	20