

NAVSHIPS 92127(B): TECHNICAL MANUAL
FOR BATHYTHERMOGRAPHS OC-1/S,
OC-2/S, OC-3/S, OC-1A/S, OC-2A/S,
OC-3A/S, OC-1B/S, OC-2B/S, OC-3B/S,
OC-1C/S, OC-2C/S, OC-3C/S

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NAVSHIPS 92127(B)

Non-Registered

★
TECHNICAL MANUAL

for

BATHYTHERMOGRAPHS

OC-1/S, OC-2/S, OC-3/S

OC-1A/S, OC-2A/S, OC-3A/S

OC-1B/S, OC-2B/S, OC-3B/S

OC-1C/S, OC-2C/S, OC-3C/S

RCA SERVICE CO.
SYSTEMS ENGINEERING FACILITY
ALEXANDRIA, VIRGINIA

DEPARTMENT OF THE NAVY
BUREAU OF SHIPS

★
Approved by BuShips: 30 Dec. 1960

18 OCT 1983

INSTRUCTION SHEET

CHANGE 1

Prepared by DITTHORPE-FREEMUTH CORPORA-
TION Milwaukee, Wisconsin, Contract N00011-78-0-0001

CHANGE 1 to Technical Manual for
Bathymographic NAVSHIPS 2127(B)

This Technical Change corrects the manual to
show the addition of the OC-1D's, OC-2D's, and
OC-3D's Bathymographs, Parts I, II, I-A,
and I-B have been replaced and are marked
CHANGE 1.

A supplementary Parts List is supplied and
is to be used for reference in all items in Bath-
ymographic OC-1D's series.

Mark the following per-and-or additions and
delete "Ch 1" wherever it appears.

PAGE NO.	CHANGE IN EFFECT	COLUMN OR FIGURE	LINE OR LOCATION	ACTION
1-1	ORIGINAL	Par 1a	line 5 line 7	add OC-1D's add OC-2D's
8-1	ORIGINAL	Table 8-1	line 8 line 10	add OC-3D's to read "A, C, and D" models
				add the table listed below as part of TABLE 8-1
1	BATHYTHERMGRAPH	100 A	OC-1D's	1462-073-5011
1	BATHYTHERMGRAPH	120 A	OC-2D's	1462-073-5014
1	BATHYTHERMGRAPH	100 B	OC-3D's	1462-073-5011

CHANGE 1**INSTRUCTION SHEET****18 OCT. 1963**

Prepared by DITTMORE-FREIMUTH CORPORATION, Milwaukee 7, Wisconsin, Contract: NObsr 89349.

CHANGE 1 to Technical Manual for
Bathythermographs NAVSHIPS 92127(B)

This Permanent Change revises the manual to show the addition of the OC-1D/S, OC-2D/S, and OC-3D/S Bathythermographs. Pages i, ii, 1-5, and 1-6 have been replaced and are marked CHANGE 1.

A Supplementary Parts List is supplied and is to be used for reference to all items on Bathythermograph OC-()D/S series.

Make the following pen-and-ink additions and mark "Ch 1" adjacent to addition.

PAGE NO.	CHANGE IN EFFECT	COLUMN OR FIGURE	LINE OR LOCATION	ACTION
1-1	ORIGINAL	Par. 1a	line 5 line 7 line 9 line 10	add OC-1D/S add OC-2D/S add OC-3D/S to read "A, C, and D" models
8-1	ORIGINAL	table 8-1		add the table listed below as part of TABLE 8-1

1	BATHYTHERMOGRAPH	200 ft.	OC-1D/S	F6665-073-8933
1	BATHYTHERMOGRAPH	450 ft.	OC-2D/S	F6665-073-8934
1	BATHYTHERMOGRAPH	900 ft.	OC-3D/S	F6665-073-8935



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

IN REPLY REFER TO
Code 240N-100

From: Chief, Bureau of Ships
To: All Activities concerned with the Installation, Operation,
and Maintenance of the Subject Equipment

Subj: Technical Manual for Bathythermographs
OC-1/S, OC-2/S, OC-3/S; OC-1A/S, OC-2A/S, OC-3A/S;
OC-1B/S, OC-2B/S, OC-3B/S (Operation Only)
OC-1C/S, OC-2C/S, OC-3C/S; NAVSHIPS 92127(B)

1. This is the Technical Manual for the subject equipment and is in effect upon receipt. It supersedes NAVSHIPS 92127(A) and NAVSHIPS 93676. In addition to covering the subject equipment this manual shall also be used as a complementary technical manual for NAVSHIPS 91519(A), covering operation only. Refer to NAVSHIPS 91519(A) for information on installation, maintenance and parts. Upon receipt hereof, NAVSHIPS 92127(A) and NAVSHIPS 93676 shall be destroyed.
2. When superseded by a later edition, this publication shall be destroyed.
3. Extracts from this publication may be made to facilitate the preparation of other Department of Defense publications.
4. Errors found in this publication (other than obvious typographical errors), which have not been corrected by means of Temporary Corrections or Permanent Changes should be reported. Such report should include the complete title of the publication and the publication number (short title); identify the page and line or figure and location of the error; and be forwarded to the Electronics Publications Section of the Bureau of Ships.
5. All Navy requests for NAVSHIPS electronics publications listed in the current issue of NAVSANDA Publication 2002 "Requisitioning Guide and Index of Forms and Publications", Cognizance Symbol I, or in a subsequent issue of the Electronics Information Bulletin should be directed to the appropriate Forms and Publications Supply Point.

R. K. JAMES
Chief of Bureau

RECORD OF CORRECTIONS MADE

CHANGE NO.	DATE	FIELD CHANGE NO.	SIGNATURE

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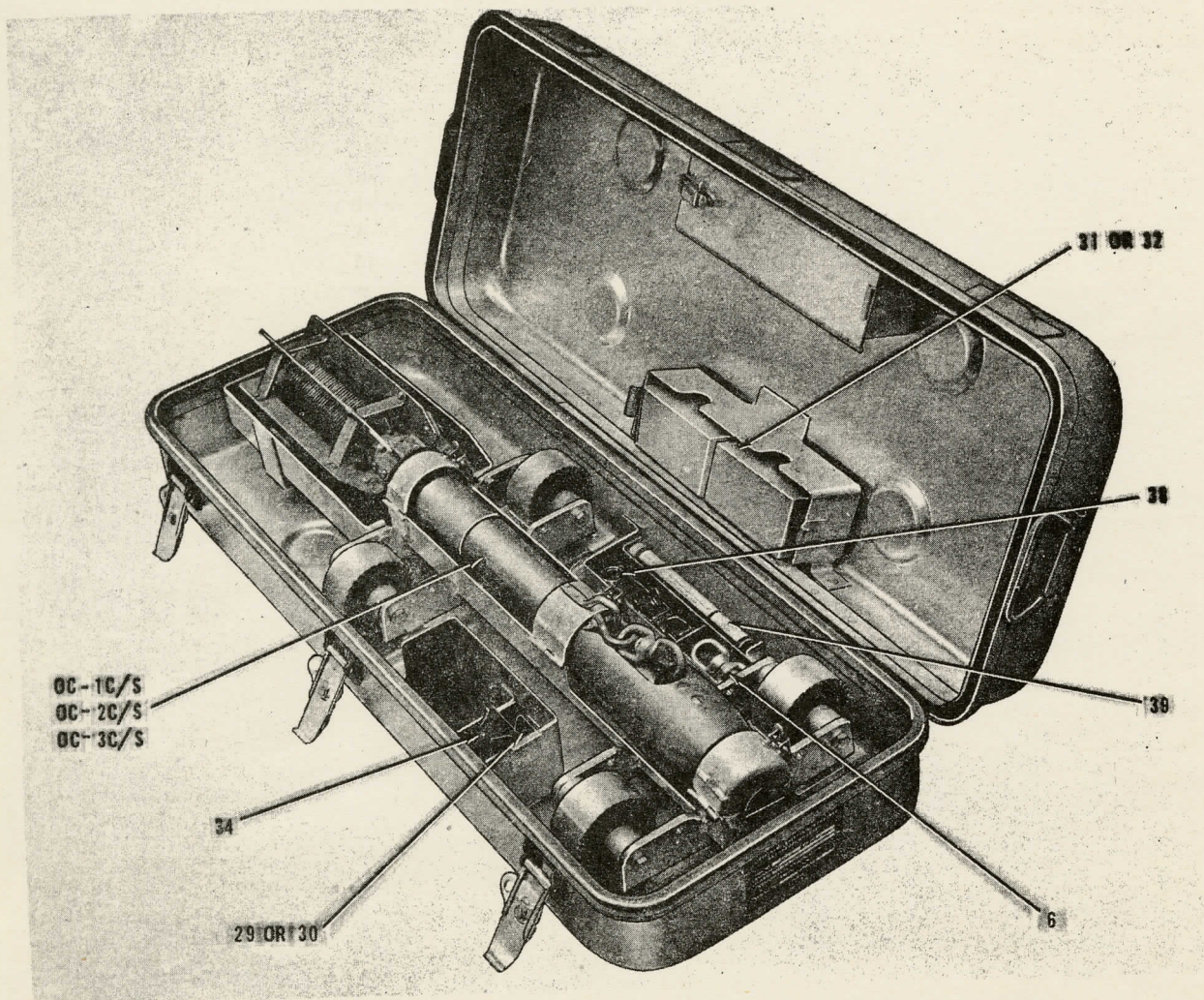


Figure 1-1. Bathythermograph OC-1C/S, OC-2C/S or, OC-3C/S in Carrying Case

SECTION I

GENERAL DESCRIPTION

1. TECHNICAL MANUAL COVERAGE

a. BATHYTHERMOGRAPHS COVERED. The following Bathythermographs are covered in this book:

OC-1/S, OC-1A/S, OC-1C/S	-	Range-Zero to 200 feet	Depth
OC-2/S, OC-2A/S, OC-2C/S	-	Range-Zero to 450 feet	Depth
OC-3/S, OC-3A/S, OC-3C/S	-	Range-Zero to 900 feet	Depth

The A and C models of this equipment are similar to the basic model. For simplicity in explanation, this book will refer to the OC-1C/S, OC-2C/S, and OC-3C/S; and it should be understood that, unless otherwise indicated, the information applies to all models. A numerical system of illustration callouts (reference code) is used to compensate for the lack of consistency in the reference designations that have been assigned the various models. To determine the appropriate reference designation, refer to the parts list for the proper reference code (numerical) and look in the applicable equipment column for the reference designation. The OC-1B/S, OC-2B/S and OC-3B/S vary from the other models in mechanical construction, but all models are handled and used in much the same manner. Mechanical parts are not interchangeable, but the assembled instruments are operationally interchangeable. For illustrations and parts information refer to NAVSHIPS 91519A.

b. THE ABBREVIATION BT. Through usage the abbreviation BT for Bathythermograph has become well known throughout the fleet, in shore establishments that handle the equipment, and in agencies that process and analyze the data. Hereafter in this technical manual, BT will be used for Bathythermograph.

2. PURPOSE AND BASIC PRINCIPLES

a. BT AS AN INSTRUMENT. The BT (figure 1-1) is an instrument for obtaining a permanent, graphical record of water temperature and corre-

sponding depths as the instrument is lowered and raised in the ocean. The BT is lowered into the sea and retrieved by means of a wire cable, boom, and electric hoist (not supplied with this contract). A coated glass slide is inserted before each lowering and removed after each submersion.

b. HOW THE BT WORKS. In general, the BT consists of a thermal element attached to a stylus (figure 1-3) which describes a trace across a coated glass slide. A depth (pressure) element moves the slide perpendicular to the motion of the stylus. Thus, the position of any point on the resulting trace on the slide represents the temperature at a given depth. Using a magnifying grid viewer, the trace or record scribed by the stylus is read by comparing with a grid, (figure 1-4) individually calibrated for each instrument. If a smoked slide (32) is used, the slide must be preserved by dipping in lacquer, properly draining, drying and storing.

3. DESCRIPTION OF UNITS

a. BATHYTHERMOGRAPH. The BT consists of a thermal element assembly (8), (figure 1-3) a depth-element assembly (7), a body tube (28), a nose piece (15), an auxiliary nose sleeve (22), and a tail guard (12) (figure 1-2).

(1) THE THERMAL ELEMENT ASSEMBLY. The thermal element assembly (figure 1-3) consists of a system mounting assembly (14), which has a cast body with six tail fins, and the thermal element. One end of the Bourdon tube of the thermal element is attached to a shaft which is rigidly mounted in the body recess by two clamps (11). A 45 to 50 foot length of capillary tubing is connected to the fixed end of the Bourdon tube and wound around the hexangular tail fins in a way that insures a store of water around the tubing. The free end of the Bourdon tube is connected, through a temperature compensating spring, to a bracket which is soldered to the stylus assembly (27), and the stylus (26). The bourdon tube and capillary tube are filled with liquid xylene that expands and contracts with temperature changes which causes the free end

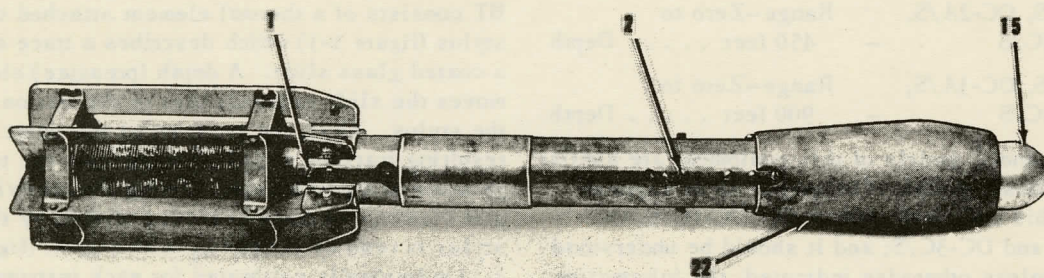
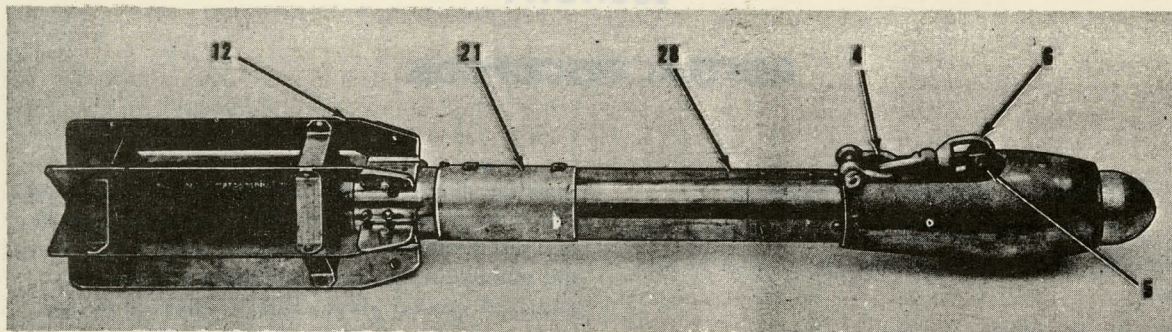


Figure 1-2. Top View and Bottom View, Bathythermograph OC-1C/S, OC-2C/S or OC-3C/S

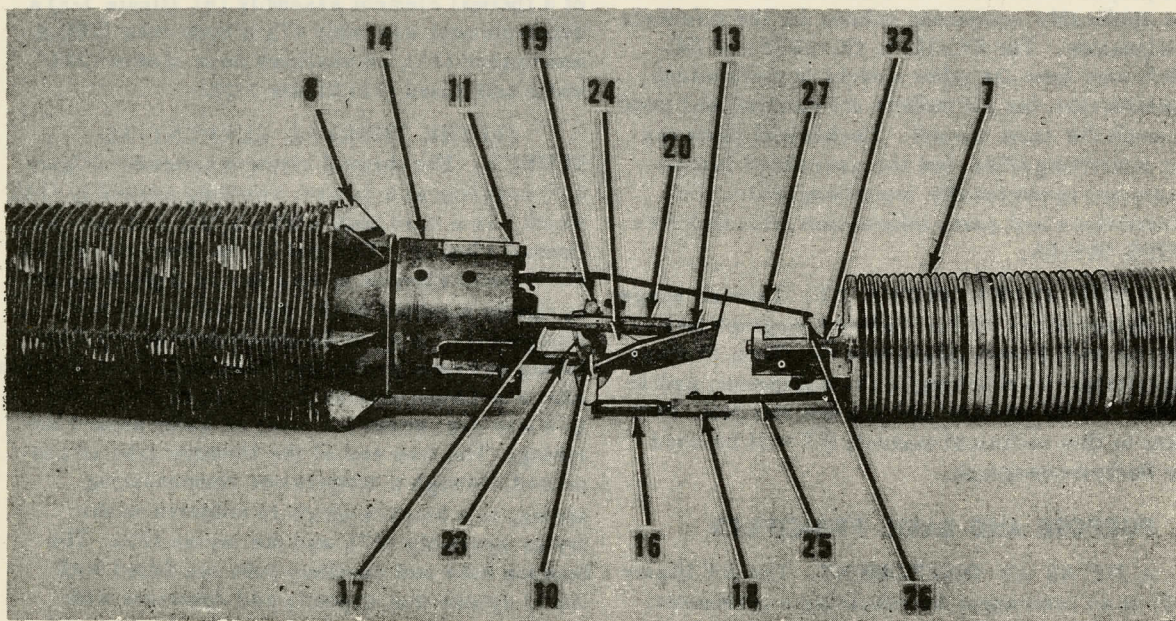


Figure 1-3. Depth Element and Thermal Element, Bathythermograph OC-1C/S and OC-3C/S

of the Bourdon tube to swing and move the stylus across the coated slide. The temperature measured is the average in the capillary tubing. The range is from 28° F. (-2.2° C.) to 90° F. (32.2° C.). The thermal assemblies are similar except for the omission of lifter parts for the stylus in the 900-foot models.

(2) THE DEPTH ELEMENT ASSEMBLY. The depth-element assembly (7) (figure 1-3) is located inside the body tube assembly, and it consists of a spring loaded piston enclosed in a flexible envelope made of three brass bellows soldered together. The tail end of the bellows is soldered to one side of the piston head; the other side of the piston head is the slide holder. The nose end of the bellows is soldered to a base that is fastened to the body tube by six screws.

As the instrument is lowered into the sea, increasing water pressure tends to collapse the bellows and compress the spring, thus moving the slide holder toward the nose. The springs in each of the BT models are designed so that a pressure corresponding to their respective depth ratings will move the slide 0.7 inch. The assemblies are similar except for the omission of stylus lifter parts from the 900-foot models and differences in the springs.

(3) THE BODY TUBE ASSEMBLY. The body-tube assembly (28) (figure 1-2) serves as a main support for the unit, and protects the internal mechanism. A moveable brass sleeve (21) on the body tube covers four access ports. The sleeve can be pushed easily towards the nose to uncover these ports. The circular port is for inserting a finger to eject the coated slide. The square port adjacent to the circular port is for access to the depth-element stop adjustment screw, while the rectangular port (opposite the circular port) gives access to the slide holder and slide. The slanting, oval port gives access to the stylus lifter (13) (figure 1-3). The sleeve is split and the split terminates in a notch. This notch must engage the head of a stop screw in the body tube in order for the sleeve to slide all the way back against the tail piece and set the automatic stylus lifter.

(4) THE AUTOMATIC STYLUS LIFTER. The automatic stylus lifter is provided on Bathy-

thermographs OC-1C/S and OC-2C/S, but not on OC-3C/S. When retrieved by a fast ship, a BT will tow along the surface where vibration is likely to be set up in the stylus, thus obscuring the descending trace on the coated slide. To prevent this, an automatic device operated by the depth element lifts the stylus off the slide as the BT approaches within 70 to 50 feet of the surface. The automatic lifter (figure 1-3) consists of a pushrod assembly mounted underneath the slide holder of the depth element assembly and a stylus lifter assembly and catch mounted on the thermal element assembly. The pushrod assembly consists of a release plunger (16), installed on the threaded end of a release rod (18) that is fastened to a flat release spring (25). The stylus lifter assembly consists of a stylus lifter (13) and stylus lifter shaft (20) supported by two stylus lifter posts (17). The catch (10) mounted on the catch shaft (19) is held against the edge of the stylus lifter by the catch spring (23), and when set, holds the stylus lifter away from contact with the stylus assembly. The release plunger works against the flat arm of the catch. The stylus lifter has a projection or ear which projects through the oval port of the body tube. When the sleeve (21) (figure 1-2) is moved all the way toward the tailguard, the ear is pushed in and the catch engages the stylus lifter to hold it from contact with the stylus assembly.

(5) THE BRASS NOSE PIECE ASSEMBLY. The brass nose piece assembly (15) that is attached to the forward end of the body tube acts as a weight which causes the BT to dive nose first when lowered. The towing cable is attached to a screw pin shackle (4) and swivel (6) which are secured to the instrument by a threaded towing stud (5). The model and serial number of the BT is stamped on the nose piece. This number is covered when the auxiliary nose sleeve (22) is in place.

(6) THE AUXILIARY NOSE SLEEVE. The cast bronze auxiliary nose sleeve (22) (figure 1-2) is attached to the nose when increased diving speed is desired. Table 1-1 shows approximate ships speed in knots at which full depth should be reached with and without the auxiliary nose sleeve when using 1000 feet of cable. The nose sleeve is needed on 900-foot models for all lowerings except when the ship is lying to.

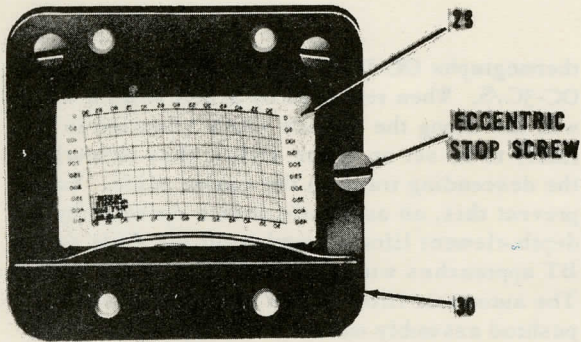


Figure 1-4. Grid and Slide Holder

or curve. Looking at the coated surface, the upper, left-hand corner has a large bevel and the lower, left-hand corner has a small bevel. These bevels are used to identify position of the slide and to facilitate insertion in the slide holder. Slides are packed 50 to a box; four boxes are supplied with each instrument.

d. THE GRID AND SLIDE HOLDER. A grid (29) (figure 1-4), is calibrated and furnished for each Bathythermograph. The serial number of the grid and the BT must correspond. The grid is cemented in a slide holder (30) and a locating

TABLE 1-1. DIVING SPEED WITH
AUXILIARY NOSE SLEEVE

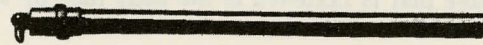
BT	DEPTH FEET	MAX. SPEED WITH NOSE SLEEVE	MAX. SPEED WITH NOSE SLEEVE
OC-1C/S	200	15	22
OC-2C/S	450	10	13
OC-3C/S	900	3	6

(7) THE TAIL GUARD ASSEMBLY. The tail-guard assembly (12) (figure 1-2) has six fins strengthened by riveted braces. This assembly serves to protect the capillary tubing of the thermal element assembly as well as to stabilize the BT during lowering, raising, and towing.

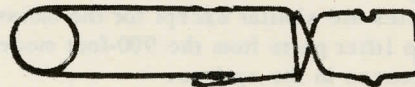
b. COMPONENTS OF BT OC-3C/S. Model OC-3C/S differs from the OC-1C/S and OC-2C/S models in the following respects:

The automatic stylus lifter is not provided, so the parts required for it are omitted from the thermal element assembly and the depth element assembly. In the depth element assembly (7) (figure 1-3), the spring is placed outside the bellows. This design is used because a small diameter bellows is required to withstand the greater pressure at a depth of 900 feet.

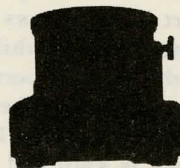
c. THE COATED GLASS SLIDE. The purpose of the coated glass slide (32) (smoked) or (31) (metallic) is to show a continuous record of depth against temperature in the form of a graph



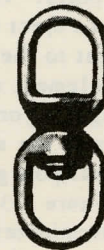
M-300



H-303



N-302



H-106

Figure 1-5. Accessories

stop is set to position the slide properly. A slide viewer (34) (figure 1-5), is provided to receive the slide holder and magnify the image of the trace and grid. Temperature and depth values are read from the slide by inserting it in the slide holder with the coated surface against the grid, and reading values from the temperature and depth scales on the grid.

4. ACCESSORIES.

The following accessories are furnished with each BT: (figure 1-5) One slide viewer (34), one swivel (6), one pair of tongs (38), and one bucket thermometer (39).

5. EQUIPMENT REQUIRED BUT NOT SUPPLIED

a. HOIST. A hoist designed for the job such as the E6/S, E-14/S, E-15/S, E-16/S Hoist, or equivalent is essential. The hoist has a drum which holds 3000 feet of cable, an electric motor with controls and reduction gears, a control level for operating the brake and clutch, and a drum revolution counter. See NAVSHIPS 91874, Technical Manual for Hoist.

b. BOOM. A boom, which extends at least eight feet and not more than ten feet from the side of the ship is necessary. The boom and rigging should be strong enough to withstand a force of 1500 pounds. A gate boom, as shown in BuShips Drawing No. 56800-668234, is a type often used. (See Section 2.)

c. TOWING BLOCK. A special counter-balanced BT towing block is required. One is supplied as original equipment with the hoist. At least two spare blocks should be carried.

d. TOWING CABLE. The cable requirement is 3000-foot reels of 7 x 7 strand, 3/32 inch diameter, stainless steel, aircraft cable. This cable is normally tough but it is very expensive, so great care must be taken to guard against kinking the cable or running it over a sharp edge. It is very difficult to splice.

e. DECK RACK. A covered deck rack is needed to store the BT near the hoist. Thus,

when frequent lowerings are being made, it is not necessary to remove the BT from the cable after every lowering. The rack should protect the thermal element from excessive heat.

f. RUST PREVENTATIVE COMPOUND. Grade III Rust Preventative compound is used to clean the BT periodically (see Section 6-3).

6. REFERENCE DATA

a. Nomenclature: Bathythermograph OC-1/S, OC-2/S, and OC-3/S, OC-1A/S, OC-2A/S, and OC-3A/S, OC-1C/S, OC-2C/S, and OC-3C/S.

b. Contractor: Wallace & Tiernan Incorporated, Belleville 9, New Jersey. Belfort Instrument Company, Baltimore, Maryland.

c. Cognizant Naval Inspector: Inspector of Naval Materiel, Newark 2, New Jersey. Inspector of Naval Material, Baltimore, Maryland.

d. Number of packages per complete shipment of equipment: one. No equipment spares are furnished.

e. Total cubical contents: 2.36 cu ft.

f. Total weight: 68 lbs.

g. Depth Range: BT OC-1C/S, 0 to 200 feet depth
BT OC-2C/S, 0 to 450 feet depth
BT OC-3C/S, 0 to 900 feet depth

b. Temperature Range: -2.2° C. (28° F.) to 32.2° C. (90° F.). Maximum exposure 40.8° C. (105° F.). Minimum exposure -6.7° C. (20° F.).

7. EQUIPMENT LISTS

a. Equipment Supplied: Table 1-2 lists this equipment.

b. Equipment Required But Not Supplied: Table 1-3 lists this equipment.

c. Shipping Data: The equipment listed in Table 1-2 is shipped in a box 35-1/4 by 14-1/2 by 8 inches; 2.36 cubic feet in volume; and 68 pounds in weight.

TABLE 1-2. EQUIPMENT SUPPLIED

QUANTITY PER EQUIPMENT	NAME OF UNIT	DESIG- NATION	OVER-ALL DIMENSIONS			VOLUME	WEIGHT
			HEIGHT	WIDTH	DEPTH		
1	Bathythermograph	OC-1C/S OC-2C/S or OC-3C/S	31-3/8	5	4-1/2	0.41	26.5
2	Slide Holder with Grid		3-1/16	1-1/16	3-7/16	0.0063	0.36
2	Instruction Books						
1	Bathythermograph Observers Log Pad PRNC-NHO- 1189						
1	Dipping Tongs		5-11/16	3-3/16	3/4	0.0028	0.04
1	Slide Viewer		1-3/4	2-1/4	2	0.0043	0.31
4	Boxes of 50 Slides		2-1/8	4-5/8	2-5/8	0.015	0.75
1	Thermometer in case		6-1/4	5/16	5/16	0.0003	0.14
1	Swivel		3-3/8	1-1/4	3/4	0.0016	0.18

Dimensions are inches, volume cubic feet, weight pounds.

8. BASIC SIMILARITIES IN MODELS OC-1C/S, OC-2C/S, OC-3C/S

These Bathythermographs vary from Navy types CTB-40080A, CTB-40120A and CTB-40180 in mechanical construction, but are handled and used in much the same manner. Mechanical parts are not interchangeable but the instruments as a whole are operationally interchangeable.

The Navy type CTB-40120A has the depth range of 180 feet whereas the depth range of the BT-1C/S is 200 feet.

The BT OC-1C/S and OC-2C/S are equipped with automatic stylus lifters; the CTB-40120A and the CTB-40080A are not.

The OC-1C/S, OC-2C/S, and OC-3C/S are the same as OC-1A/S, OC-2A/S, and OC-3A/S except that the body tubes, depth element assemblies, and the thermal element assemblies are not interchangeable between the OC-()A/S, OC()B/S, and the OC()C/S types, due to a design change effecting the method of locating the depth element assembly and the thermal element assembly.

TABLE 1-3. EQUIPMENT REQUIRED BUT NOT SUPPLIED

QUANTITY PER EQUIP.	NAME OF UNIT	NAVY TYPE DESIGNATION	STANDARD STOCK NO.
1	Bathythermograph Hoist	E6/S, or equivalent	
1	Bathythermograph Boom	BuShips Dwg Number 56800-668324	
3	Special BT Towing Block	E6/S, or equivalent	N16-800 821-101
3	Cable, 3/32" diam. 7 x 7 strand, stainless steel aircraft, in 3,000 foot reels		
1	Deck Rack		
1	Rust Preventive Compound-gallon	Grade III	

TABLE 1-1. EQUIPMENT REQUIRED BUT NOT SUPPLIED

STANDARD STOCK NO.	NAVY TYPE DESIGNATION	NAME OF UNIT	QUANTITY PER EQUIP.
	ES-2, or equivalent	Hydrographic Boat	1
	ES-2, or equivalent	Hydrographic Boat	1
NIG-800 82-101	ES-2, or equivalent	Special PT Towing Boat	1
		Cable, 3/32" diam. 7 x 7 strand, stainless steel armor, in 1,000 foot coils	1
		Deck box	1
	Grade III	Fast Transceiver (Proposed-Reflex)	1

SECTION II**INSTALLATION****1. HANDLING AND STORAGE.**

a. THE BT CASE. The BT case should be secured in a readily accessible location, so that all equipment may be kept permanently in it when not in use.

b. PROTECT THE BT. The BT should always be secured to protect it from severe jolts in rough seas. It should be stored where it is not subjected to excessive vibrations and temperatures (see Section 6).

c. SECURE DIPPING JARS. It is advisable to secure the rinsing and dipping jars, so the top of each can be removed with one hand. Other accessories should be made as handy as possible.

2. INSTALLATION

a. THE HOIST. The deck space available, and characteristics of the ship, will determine the actual rig used. In general, the hoist is located on the main deck, always aft of the midships section, and preferably not more than 20 to 50 feet forward of the stern. If the hoist is located any further forward, the BT cannot clear the slipstream, and even a moderate roll or yaw will allow the BT to be drawn into the propellers. Furthermore, the instrument would tend to hit

against the ship's side while being hauled in. This difficulty will be minimized, and the loss of instruments avoided, if the hoist and boom are placed on the main deck, as far aft as possible.

b. THE BOOM. The BT boom may be of either the topping lift type, or the gate type. It should extend outboard not less than 8 feet, nor more than 10 feet, except where an unusual hull conformation may require a longer boom. The boom must withstand a force of 1500 pounds. The BT is towed from a special counterbalanced towing block rigged to the end of the boom so that it is at least 8 feet from the side of the ship. Design the rig for one man, but make it convenient for a two man operation.

c. HOIST AND BOOM ALIGNMENT. Secure the hoist firmly to the deck with the drum slightly aft of the boom. Rig the boom so the cable will wind onto the forward end of the drum when the block is vertical. When the BT is being hauled in from far astern and the block is almost horizontal, the cable should wind onto the middle of the drum. During lowering and retrieving, exact centering of the wire on the drum, will reduce wear on the towing block. Whatever the position of the towing block, the cable must not bend over or chafe against either flange of the drum.

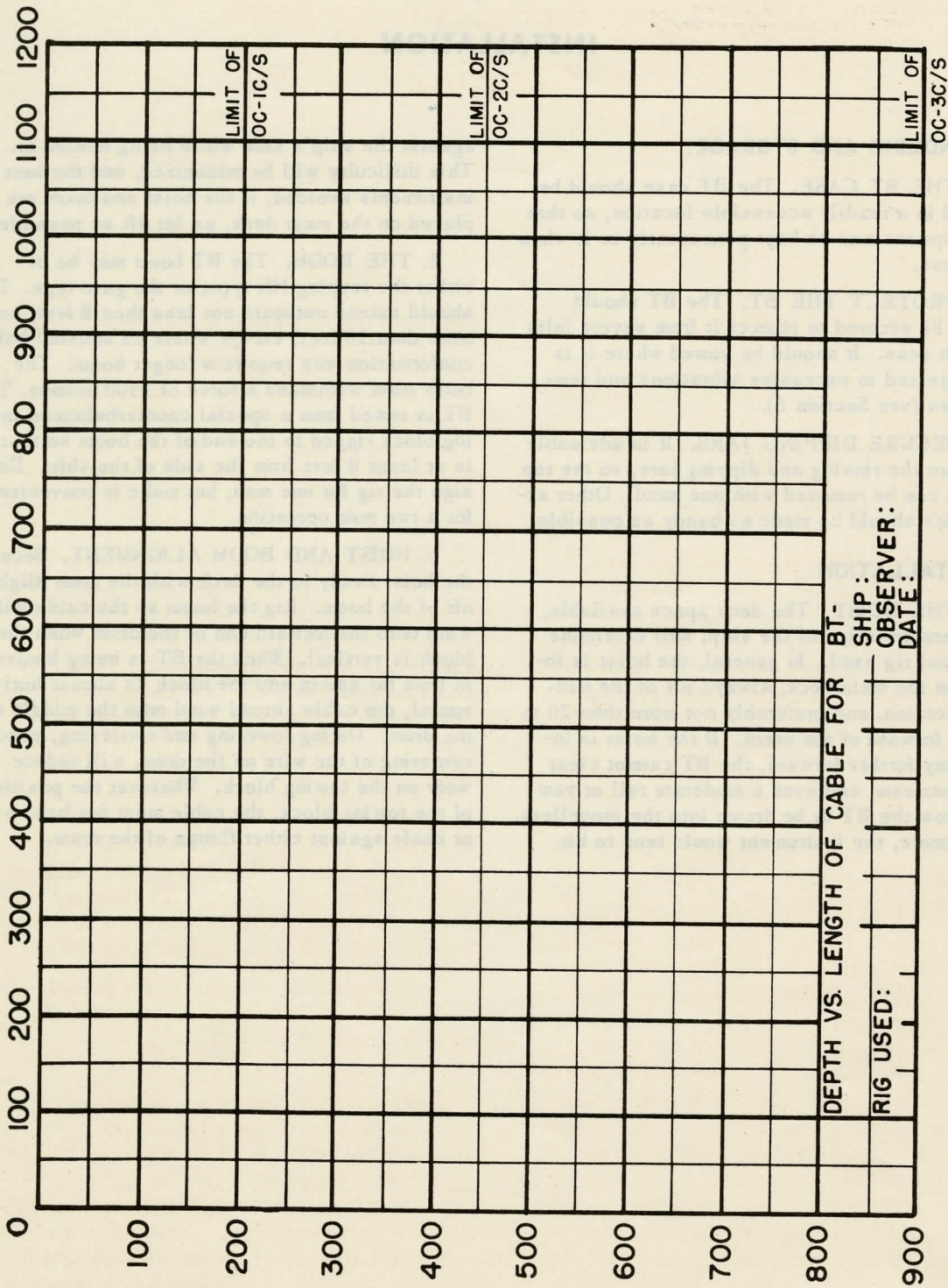


Figure 3-2. Chart, Depth vs. Length of Cable

SECTION III**OPERATION****1. LOWERING THE BT**

a. **MAKE PRACTICE LOWERINGS.** The BT is designed to be lowered from a ship underway at speeds up to 18 knots. The best results, however are obtained when the speed is not more than 12 knots. At higher speeds, unless the sea is very smooth, only an experienced operator should attempt to operate the hoist. Inexperienced operators should practice lowering and recovering a dummy BT or sounding lead before undertaking the operations with an actual instrument.

b. **KEEP SHIP ON STEADY COURSE.** Successful use of the BT during tactical operation demands complete understanding between the bridge and the operator of the hoist as to probable movements of the vessel while the instrument is over board. While the BT is in the water the ship should be kept on as steady a course as possible. However, if an unexpected turn is made, especially away from the lowering side, apply the brake immediately and leave it on until the ship is on the new course, and the cable is again clear of the stern.

2. EXAMINE THE CABLE AND CONNECTION TO THE BT

a. **THE CABLE HITCH.** Be sure that the cable is secured to the drum in such a manner that it cannot pull loose if all the cable should pay off the drum. As an additional precaution, never pay out the last layer of cable on the drum when lowering the BT. The cable should be wound on the drum so that it pays out and reels in at the top of the drum. Run the free end of the cable through the counterbalanced towing block, and fasten to the shackle using the cable hitch shown in figure 3-1. Be sure that the hitch is as neat and streamlined as possible. Serve the hitch. Attach the shackle to the swivel on the BT. Make sure that the swivel works freely.

b. **AUXILIARY NOSE SLEEVE.** Attach the auxiliary nose sleeve described in sec. 1 par. 3(6), when it is required to reach maximum range. Make sure the two set screws are securely tightened and remain so.

3. CHECK THE HOIST

a. **HOIST INSTRUCTIONS.** Complete instructions for operation and maintenance of the BT hoist are given in NAVSHIPS 91874. Technical Manual for Hoist, or any superseding Technical Manual. Brief instructions are given below for the E6/S, E14/S, E/15S and E16/S hoists.

b. **THE HAND LEVER.** The hand lever on the hoist serves as both brake and clutch. It has three positions: (1) When it is vertical, the hoist is in neutral and the drum can be turned freely in either direction; (2) When it is pushed outboard, or away from the operator, to the engaged or hoist position, the motor turns the drum and reels in the cable; (3) When the lever is pulled inboard, or towards the operator, to the brake position, the drum is locked and cannot be turned.

On some earlier models the hand lever operation is just the reverse, i.e., the brake is away and the clutch is toward the operator. Check the operation of the hoist to be sure of the proper sequence of hand lever positions.

c. **THE HOIST MOTOR.** With the hoist lever in neutral, turn on the motor to make sure the power is available.

Note

Never put a BT over the side without having the hoist motor turned on.

Leave the motor on at all times while making a lowering.

d. **LUBRICATE THE HOIST.** Lubricating instructions and diagrams are provided in the hoist manual. Shaft bearings should be kept well lubricated. The drum should turn freely in neutral.

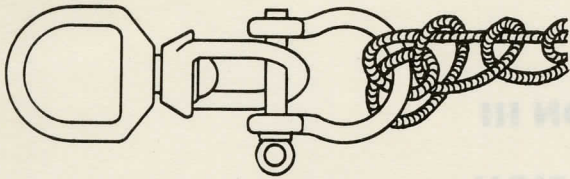


Figure 3-1. BT Cable Hitch

If the revolution counter is not provided with a pressure grease fitting, one should be installed to prevent the shaft from freezing. Check the condition of the revolution counter daily and lubricate as needed.

4. PUT THE SLIDE IN THE BT.

a. INSPECT NEW SLIDES. Remove the waterproof cover from the box of coated glass slides to be used. Inspect the slides before using. If the slides are the metallic coated (gold color) type, check for evenness of coating. If the slides are the smoke coated (black color) type, check for evenness of coating and for spots and streaks in the smoke.

Test a few smoked slides for wash effect by holding them under a moderate stream of water. Dispose of slides on which the smoked surface appears spotted or flaked. Always hold a slide by the edge to avoid scratching or marking the coating.

b. BRASS SLEEVE. To open the BT push the brass sleeve forward towards the nose exposing the slide ports.

c. CHECK THE SLIDE HOLDER. Check the grooves of the slide holder to make sure they are clean and free of glass chips. The curved spring should hold the slide firmly against the opposite groove.

d. INSPECT THE STYLUS. Inspect the stylus to insure that it is clean to get a clear sharp trace. This should be done before every lowering. A dirty or dull stylus produces a wide trace that is very difficult to read as well as inaccurate. The stylus can be cleaned by gently scraping it with the soft end of a paper match. Be very careful not to bend the stylus.

e. INSERT THE SLIDE. Insert the slide into the grooves of the slide holder, as shown in figure 3-3, so the edge with the beveled corners enters first, with the longer bevel toward the nose of the BT. This positions the coated surface under the stylus.

f. SEAT THE SLIDE. Make sure the slide is pushed firmly all the way against the stop pin and is seated flat in the holder. If this is not done large errors in the record will result.

5. PUT THE BT OVER THE SIDE

a. OBTAIN PERMISSION TO LOWER. Obtain permission from the Officer of the Deck to make a lowering.

b. GET A DEPTH SOUNDING. Obtain a sonic depth sounding from the Bridge to insure that the BT does not hit the bottom, and for record on the BT log sheet.

c. CLOSE THE SLEEVE. Pull the sleeve of the BT down over the slide holder to bring the stylus against the coated surface of the slide. To reduce excessive scratching of the slide do not move the sleeve back until the BT is ready to be put over the side.

When using BTs OC-1C/S (200 feet range) or OC-2C/S (450 feet range) pull the sleeve back toward the tail guard as far as it will go to engage the catch of the automatic stylus lifter. Then push the sleeve forward toward the nose at least one inch in order to leave the catch port

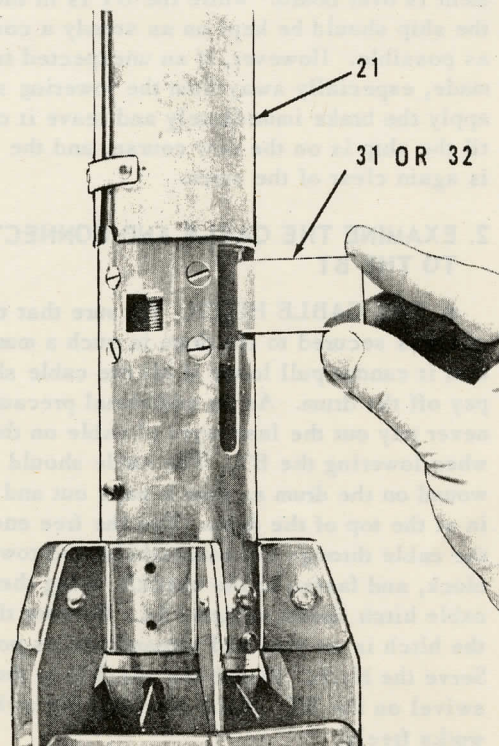


Figure 3-3. Inserting Slide

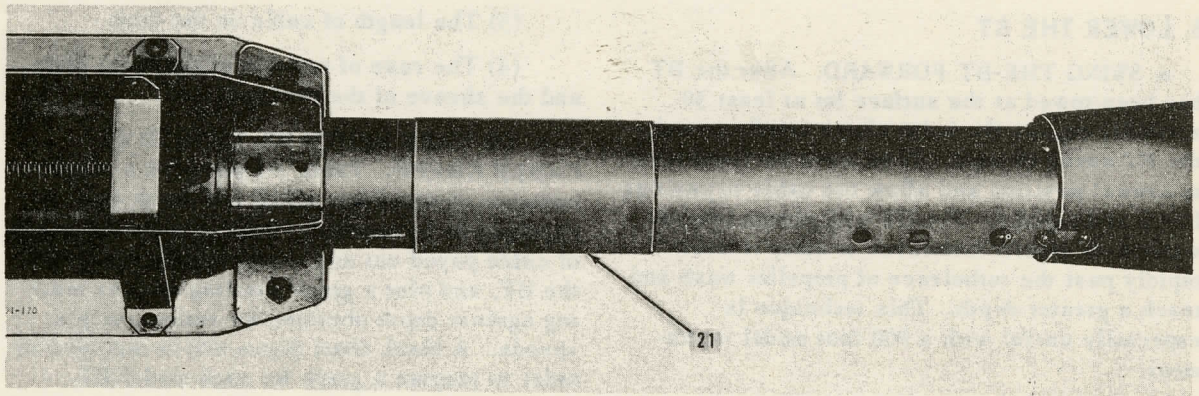


Figure 3-4. BT OC-1C/S or OC-2C/S with Sleeve Positioned for Lowering.

about two thirds open and the catch free to release (see figure 3-4). When using BT OC-3C/S (900 feet range), which does not have the automatic lifter, leave the sleeve all the way back toward the tail guard. The stylus is always in contact with the coated slide; therefore the BT should be handled with care to avoid unnecessary scratching of the slide.

d. TAKE IN SLACK CABLE. With one hand hold the BT at the rail, and with the other turn the hoist drum to take up the slack cable. When all slack is retrieved set the hoist brake.

6. DROP THE BT INTO THE WATER

a. TURN ON MOTOR. Turn on the hoist motor so that power is instantly available for the rest of the operation.

b. SWING THE BT OUTBOARD. Swing the BT outboard well clear of the water.

c. LOWER INTO THE WATER. Lower the BT into the water until it is being towed just under the surface without porpoising or skipping. Set the brake, and tow in this position for at least 30 seconds to enable the BT to come to the temperature of the surface water.

d. CHECK THE CABLE. When towing, check the cable to see that it is leading properly to the towing block.

e. SET THE COUNTER. Set the revolution counter on the hoist to zero.

7. TAKE THE SEA SURFACE (BUCKET) TEMPERATURE

a. TAKE TEMPERATURE. While the BT is being towed at the surface, obtain the tempera-

ture of the surface water and record it on Oceanographic Log Sheet - B (PRNC-NHO-1189). Record also the consecutive slide number, Greenwich Mean Time, day of the month, sonic depth sounding, and ship's speed (see Section 4).

b. THE BUCKET TEMPERATURE. Obtain a half-gallon or gallon can from the galley and attach a line to it. Lower the can, and let it fill and empty several times before hauling a surface sample on board. Immediately insert the stem thermometer into the water so that at least 3 inches of the bulb end is immersed. Stir the thermometer with a circular motion for 20 to 30 seconds, and immediately read the thermometer (with the stem still immersed in the water) to the nearest tenth of a degree (0.1°F.). Stir once or twice more and check the reading. Never remove the thermometer from the bucket to take the reading, as this will produce erroneous readings.

c. TAKE THE TEMPERATURE AT THE TIME OF LOWERING. It is important that the surface (bucket) sample be taken at the time the BT is being towed, and that the temperature reading be made as soon as possible. If the sample is allowed to stand for as much as one minute, the temperature reading will no longer be valid.

Note

Only in the event that it is impossible to obtain bucket temperatures due to loss or breakage of the thermometer should engine room injection temperatures be used. In such cases the BT lowerings should coincide with the time of injection readings. Record the injection depth to the nearest foot on each log sheet, and indicate those lowerings using injection temperatures in lieu of bucket temperature.

8. LOWER THE BT

a. **SWING THE BT FORWARD.** After the BT has been towed at the surface for at least 30 seconds, engage the hoist clutch briefly to make the BT swing forward. Then move the hand lever to neutral position and allow the cable to pay out freely and rapidly. The BT will plunge into the water with greater momentum to carry it more rapidly past the turbulence of propeller wash and reach a greater depth. This technique is especially useful with a 900 foot model instrument.

b. **AVOID CABLE BACKLASH.** When the ship is making more than 12 knots there usually is enough drag on the cable, while the BT is diving, to insure that the cable will not suddenly slack and backlash. At lower speeds, and during times when the ship is rolling heavily or yawing the cable may suddenly become slack between the towing block and the hoist. If the drum is permitted to continue paying out rapidly this will cause backlash on the hoist drum, or a kink in the cable at the towing block. To prevent this, the operator should provide himself with a round stick about a foot and a half long, to gently slow the drum when excessive slack appears. The end of an old swab handle will do. Do not apply too much pressure to the drum with the stick, because once the diving motion of the BT is arrested, the drag of the cable in the water will not permit it to dive farther, regardless of the amount of cable payed out. Finer braking control can be made with the stick than by using the hoist brake, for only slight pressure of the brake will usually stop the dive of the BT.

WARNING

Do not touch the cable with your hands when the drum is in motion, as serious injury may result.

c. **WHEN THE SHIP IS LYING TO.** When the ship is at zero speed, or lying to, the cable should not be allowed to pay out freely, but should be braked slightly to prevent backlash.

9. STOP AT THE PROPER DEPTH

a. **TO REACH DEPTH.** To reach a given depth the amount of cable to be payed out will depend on:

- (1) The speed of the Ship
- (2) The type of BT and whether or not the auxiliary nose sleeve is attached.

(3) The length of cable on the drum

(4) The ease of rotation of the hoist drum and the sheave of the towing block.

b. **TO MAKE DEPTH VS. LENGTH OF CABLE GRAPH.** Table 1-1 provides a rough estimate of speeds at which full depth may be expected to be reached. Take data on the length of cable payed out and actual depths reached by the BT, and plot a graph showing counter reading against depth obtained for various ship's speeds. A blank chart (figure 3-2) is included in order to prepare a graph for each model BT.

CAUTION

Care must be exercised to insure that the BT is not lowered to a depth greater than that for which it was designed.

c. **APPLY THE BRAKE.** When the counter indicates that the proper length of cable has been payed out, or when the last layer of cable on the drum has been reached, the brake should be applied smoothly, allowing the drum to stop without a sudden jerk. An excessive jerk will part the cable. With the brake on, the BT will return rapidly to near the surface far astern of the ship.

d. **CHECK THE CABLE LEAD.** Check to see that the cable leads properly for reeling in. If it does not lead from the towing block to the center of the drum, adjust the boom guys until it does.

10. HAUL IN THE BT

a. **ENGAGE THE CLUTCH.** Move the hand lever smartly from brake position to hoist position. Do not pause while going through neutral or more cable will pay out. Guide the cable back and forth in even layers on the drum using the wooden stick. Do not use a metal guide unless it is attached to the hoist and is equipped with rollers.

b. **WATCH THE CABLE.** Watch the cable and be alert to stop the hoist if the cable becomes fouled by kelp, seaweed, etc. If fouled, apply the brake and clear the cable with a boat-hook. Keep watching the cable, only glancing at the revolution counter from time to time to check the amount of cable out.

c. **CHECK COUNTER AND CABLE ANGLE.** Continue hoisting until it is indicated by the counter, and by rapid decrease in cable angle,

that the BT is close astern but still a safe distance from the ship's screws.

11. BRING THE BT ABOARD

a. BRING THE BT UNDER THE BOOM.

When about 100 feet of cable remains out, the BT should be visible at the surface. As the cable is reeled in, the BT will reach a position below the boom where it will begin to porpoise, breaking clear of the surface and swinging forward as the ship rolls or as wave crests pass.

b. USE CARE. To bring the BT alongside and raise it so that it does not swing too much requires practice. It is the most critical part of the operation. If the BT is brought in too fast, it may skip or swing forward of the boom, perhaps hitting the side of the ship, or even swinging completely over the boom. Should the brake be applied too suddenly as the BT swings forward, its upward motion is accelerated by the whip action of the boom, and it may swing over the boom or hit the side of the ship violently. If the BT skips or swings forward, it is advisable to shift at once into neutral and allow the BT to sink freely until it has passed clear astern and is safe to try again. Safe retrieval of the BT requires carefully applied use of brake and hoist, synchronized with the roll of the ship and the passing wave crests. Wait until the boom dips towards the water as a wave crest passes under the boom. At that time, hoist the BT until it is about 3 or 4 feet from the towing block. The opposite roll of the ship will carry the BT clear of the water, with short enough scope of cable to prevent the BT from hitting the ship. As soon as it is well clear of the water, apply the brake and turn off the hoist motor to prevent possible jamming of the BT against the towing block.

c. RETRIEVING THE BT FROM A GATE BOOM. To retrieve the BT when a gate boom is used, the use of a retrieving line and ring is recommended. This consists of a metal ring, an inch to an inch and a half in diameter, through which the cable is passed between the towing block and the BT. Attach one end of a retrieving line to the ring, and secure the other end to the lifeline or rail. With the proper amount of slack, the ring will ride freely when the BT is being lowered and hoisted. To bring the BT in with the retrieving line haul in on the line. Carefully ease the brake as needed to provide slack. The BT can be easily brought to hand.

If a retrieving line is not used, it will be necessary to rig in the gate boom by casting off

the after guy, and swinging the boom in with the forward guy. Another way is to have one man catch the cable with a boathook, and the operator slack the cable as the boathook is hauled in.

d. RETRIEVING THE BT FROM A TOPPING LIFT BOOM. To retrieve the BT when a topping lift boom is used, the BT can be brought aboard by the operator hauling in on the topping lift. As the boom tops up the BT swings to within reach of the operator.

12. REMOVE THE SLIDE AND SECURE THE EQUIPMENT

a. MOVE THE SLEEVE FORWARD. As soon as the BT is in hand, move the sleeve forward toward the nose to insure that the stylus is lifted clear of the slide.

b. PLACE IN DECK RACK. Slack off the cable and place the BT in the deck rack. Set the brake. Turn off the motor.

c. NOTIFY O. O. D. Notify the Officer of the Deck that the BT is on deck and the hoist secured.

d. REMOVE THE SLIDE. Partially eject the slide by pushing against its edge with the forefinger or a pencil through the slide ejecting port. Grip the edges of the slide carefully by the thumb, and forefinger, and withdraw it from the BT.

e. LEAVE BT IN DECK RACK. If another lowering of the BT is to be made soon and there is no danger of overheating or freezing, it may be left in the deck rack connected to the cable; otherwise unshackle it and stow it in a cool place.

CAUTION

Never let the temperature of the BT exceed 105°F. (40.8°C.), or fall below 20°F. (-6.7°C.). If these temperatures are exceeded the calibration of the instrument will be impaired. Never leave the BT on deck without protection from the hot sun. Keep the thermal element covered with wet cloths.

13. GENERAL PRECAUTIONS

a. Do not lower the BT when the ship is expected to turn or when other ships are close astern.

b. Do not bump, drop, or jar the BT.

c. Do not use cable that is badly kinked.

Cut off the kinked portion and rebitch the shackle.

d. Do not lower the BT without first determining the depth of the water.

e. Do not leave the BT where the temperature may go above 105°F. (40.8°C.). or below 20°F. (-6.7°C.).

f. Do not turn the hoist motor off while taking a lowering or when the hoist has any load on it.

g. Do not use a bad slide. If it is coated on the wrong side, or is badly spotted, streaked, or flaked, dispose of it and select a good one.

BT should be visible at the surface. As the cable is reeled in, the BT will reach a position below the boom where it will begin to protrude. Working clear of the surface and waiting for word as the ship rolls or as wave crest pass. USE CARE. To bring the BT alongside and make it so that it does not swing too much requires practice. It is the most critical part of the operation. If the BT is brought in too fast, it may slip or swing forward of the boom, thus exposing the side of the ship, or even swinging completely over the boom. Should the brake be applied too suddenly as the BT swings forward, its forward motion is restrained by the whip action of the boom, and it may swing over the boom or hit the side of the ship violently. If the BT slips or swings forward, it is advisable to stop at once (see manual) and allow the BT to swing back to its normal position. This is done by applying the brake and holding it until the BT is in position. Then with the boom down, the water in a wave crest passes under the boom. At this time, lower the BT until it is about 1 or 2 feet from the water level. The opposite end of the ship will carry the BT clear of the water, with about enough scope of cable to prevent the BT from fouling the ship. As soon as it is well clear of the water, apply the brake and run off the boom water to prevent possible fouling of the BT against the water level. RETRIEVING THE BT FROM A GATE. To retrieve the BT when a low boom is used, the use of a retrieving line and pig is recommended. This consists of a steel cable, 1/2 inch to 3/4 inch and a fall is inserted through which the cable is passed between the water block and the BT. Attach one end of a retrieving line to the rig, and secure the other end to the lifeline of the BT. With the proper amount of slack, the rig will rise freely when the BT is being lowered and hoisted. In using the BT in with the retrieving line, it is on the line. Carefully ease the brake as needed to provide slack. The BT can be easily brought to land. If a retrieving line is not used, it will be necessary to rig in the gate boom by casting off

CAUTION

Never let the temperature of the BT exceed 105°F. (40.8°C.), or fall below 20°F. (-6.7°C.). If these temperatures are exceeded the following action of the instrument will be indicated. Never lower the BT in deck without protection from the hot sun. Keep the thermal element covered with wet cloths.

GENERAL PRECAUTIONS

1. Do not lower the BT when the ship is heeled to starboard or when other ships are close astern. 2. Do not pump, dump, or let the BT. 3. Do not use cable that is badly stained.

SECTION IV

PREPARING SLIDES AND LOG SHEETS

1. INSPECT THE SLIDE

As soon as the slide is removed from the BT, examine it to make sure that a suitable trace has been obtained. Sometimes, with smoked slides, the smoke coating washes away on contact with sea water. If this has occurred, lower the BT again with a fresh slide.

2. LABEL THE SLIDE

a. WRITE THE PROPER INFORMATION. With a sharp instrument or hard pencil, write the following information on the slide, being very careful not to obscure or touch the temperature-depth trace. Do not write too close to the edges of the slide.

(1) CONSECUTIVE SLIDE NUMBER AND TIME GROUP. Number slides consecutively for each cruise. If a ship uses forty slides on a cruise they should be numbered from 1 to 40. Use Greenwich Mean Time (0000 to 2359), giving the minute at which the BT entered the water. Enter a dash between slide number and time.

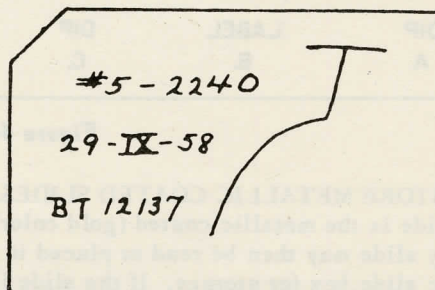
(2) DATE. Record the day, month and year. Use Roman numerals for the month. Thus 29 September 1958 is written 29-IX-58.

(3) BT INSTRUMENT NUMBER. The serial number of the BT is stamped on the nose of the instrument. This is often hidden under the auxiliary nose sleeve. If the number is followed by a letter be sure to always include the letter. Check the reading grid for agreement of serial number. This number is very important, as the laboratory that will process the slide has thousands of grids, only one of which is a duplicate of the one for this BT. Without the proper grid, the data on the slide is worthless.

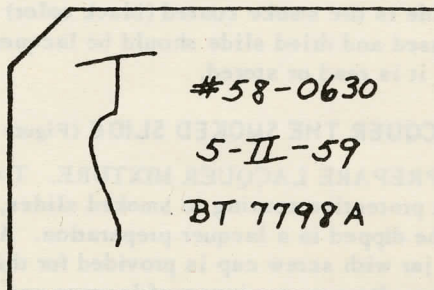
3. RINSE THE SLIDE

a. DIP THE SLIDE. Hold the slide by means of the dipping tongs provided (see figure 1-5), and rinse the slide by dipping in a jar of fresh water. Let the slide dry.

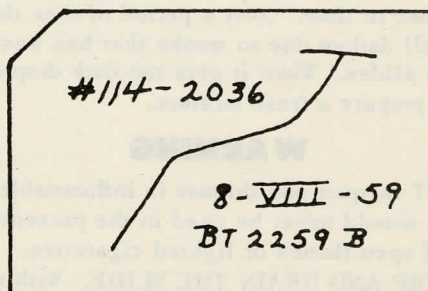
b. Examples of slide labeling.



Slide No. 5, taken at 2240 GMT on 29 November 1958 with BT number 12,137



Slide No. 58, taken at 0630 GMT on 5 February 1959 with BT number 7798 A



Slide No. 114, taken at 2036 GMT on 8 July 1959 with BT number 2259 B

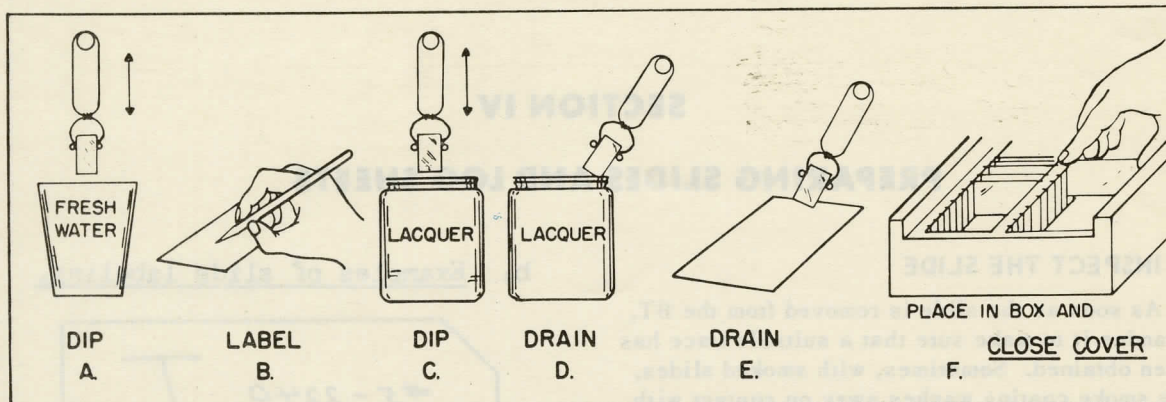


Figure 4-1. Lacquering the Slide

b. STORE METALLIC COATED SLIDES. If the slide is the metallic coated (gold color) type, the dry slide may then be read or placed in the plastic slide box for storage. If the slide is handled carefully it is not necessary to lacquer it. Rough handling will smudge and scratch it however.

c. LACQUER SMOKE COATED SLIDES. If the slide is the smoke coated (black color) type, the rinsed and dried slide should be lacquered before it is read or stored.

4. LACQUER THE SMOKED SLIDE (Figure 4-1)

a. PREPARE LACQUER MIXTURE. To provide a protective coating to smoked slides, they must be dipped in a lacquer preparation. A glass jar with screw cap is provided for this purpose. Prepare a mixture of lacquer and thinner that is only a little thicker than water. Fill the jar about $\frac{2}{3}$ to $\frac{3}{4}$ full. As the mixture will tend to thicken with use due to evaporation, it is necessary to add both thinner and lacquer from time to time. Over a period of time the mixture will darken due to smoke that has washed off the slides. When it gets too dark dispose of it and prepare a fresh mixture.

WARNING

BT lacquer and thinner is inflammable. It should never be used in the presence of open flames or lighted cigarettes.

b. DIP AND DRAIN THE SLIDE. With the dipping tongs, gently dip the slide until it is completely immersed in the lacquer mixture. Remove the slide, and let the excess lacquer drain by holding the edge of the slide against the lip of the jar. Close the jar, and hold the edge of

the slide against an absorbent paper towel for about half a minute to drain the remaining excess lacquer.

c. DRY THE SLIDE. The slide may be dried by holding it near a light bulb or some other source of dry heat. A covered drying box containing a light bulb can be easily made from plywood. The slide is left in the dipping tongs and the tongs are suspended from a hook near the bulb until thoroughly dry (about 10 to 15 minutes).

If the slide is left to dry in damp, moving air, the lacquer often fogs, or turns white, and the slide becomes difficult or impossible to read. A fogged slide may be cleared, however, by re-dipping it in lacquer after it has dried.

If the source of drying described above is not available it is best to place the slide in the storage box immediately after draining the lacquer. Close the lid. To prevent slides from sticking to the older type wooden boxes place a length of string, wire, or piece of broom straw lengthwise in the box to keep the slides clear of the bottom until dry. It is very important that the box be reopened within an hour and the slide removed from the grooves and replaced. This will prevent the slide from becoming stuck to the box when the lacquer becomes thoroughly dry. If slides are permitted to become stuck solidly in the box, they are more susceptible to breakage both in shipment and when they are to be removed from the box for processing ashore.

After drying, the lacquer on the slide should be perfectly transparent, hard, smooth, and just thick enough to protect the smoked surface from being scratched or smudged during handling. If the lacquer coating is thick and uneven, thinner must be added to the mixture. If the coating is

OCEANOGRAPHIC LOG SHEET-B
PRNC-NHO-1189 (Rev. 10-58)

U.S. NAVY HYDROGRAPHIC OFFICE
WASHINGTON 25, D.C.

BATHYTHERMOGRAPH OBSERVATIONS
FOR USE WITH H O PUB NO. 606 C

VESSEL USS BROUGH (DE-148) MONTH MARCH YEAR 1959 TIME ZONE +8, +7 CRUISE OPERATION DEEP FREEZE IV SHEET NO. 26

CONSEC. SLIDE NUMBER	GREENWICH MEAN TIME		LATITUDE	LONGITUDE	DEPTH (Fathoms)	SHIP'S SPEED (Knots)	SEA SURFACE TEMP. (Bucket)	WIND		AIR TEMP.		BAROM. (MBS) (Tab. 2)	WEA. THER. (Tab. 3)	CLOUDS		VIS. (Tab. 6)	SEA (Tab. 7)	SWELL		BT INSTR. NO.	OBS. INIT.	
	HOUR	DATE						DIR. (Tab. 1)	SPEED (Knots)	DRY BULB	WET BULB			TYPE (Tab. 4)	AMT. (Tab. 5)			DIR. (Tab. 1)	AMT. (Tab. 8)			
373	0720	09	34°50'	126°40'	3050	16	68.5	29	15	68.0	62.1	14	02	8	6	7	3	3	2	3	11375	WJD
374	1115	09	34°25'	125°25'	2500	16	68.2	29	18	68.5	63.0	14	02	8	6	7	3	3	2	3	11375	BBP
375	1930	09	32°44'	123°43'	2500	16	72.2	25	12	74.1	67.7	14	01	4	2	7	3	0	2	3	11375	gB
376	2320	09	32°20'	122°41'	2400	16	72.9	23	14	76.9	72.1	14	02	4	2	7	3	0	2	3	11375	WJD
377	0330	10	31°56'	121°41'	2100	14	72.2	18	16	73.5	68.0	15	02	1	2	7	3	2	2	3	11375	BBP
378	0735	10	31°06'	121°17'	2150	14	72.6	23	18	72.2	67.2	17	02	3	2	7	3	2	2	3	11375	gB
379	1430	10	30°21'	119°45'	2000	14	73.8	16	12	72.7	67.0	17	03	2	4	7	3	2	2	3	11375	WJD
380	1833	10	29°36'	119°00'	2700	14	73.6	14	14	76.0	68.9	18	03	5	8	7	3	2	2	3	11375	BBP
381	2235	10	29°10'	118°06'	1800	14	76.1	14	10	76.0	69.0	15	03	5	8	7	3	2	2	3	10221A	gB
382	0220	11	28°46'	117°17'	2200	14	76.4	16	07	74.0	70.0	16	02	5	8	7	2	2	2	3	10221A	WJD
383	0620	11	28°20'	116°25'	2700	14	75.1	16	07	76.3	71.4	16	02	5	8	7	2	2	2	3	10221A	BBP
384	1035	11	27°53'	115°31'	1800	14	75.3	02	06	74.0	70.1	15	02	5	8	7	2	2	2	3	10221A	gB
385	1433	11	27°28'	114°41'	1875	14	76.4	02	05	76.1	70.9	16	01	8	2	7	2	2	2	3	10221A	WJD

NOTE: IF NECESSARY TO USE INJECTION TEMPS. IN LIEU OF BUCKET TEMPS. GIVE INJECTION DEPTH.

NAVY-DPPO PRNC WASH., D.C.

Figure 4-2. Oceanographic Log Sheet

thin and dull and the smoke can still be smudged, the mixture is too thin and lacquer should be added.

5. FILL OUT THE LOG SHEET

a. **BT OBSERVER'S LOG.** The log sheet should be filled in as soon as possible after an observation is made. The Bathythermograph Observer's Log contains Oceanographic Log Sheet B (PRNC-NHO-1189), a sample of which is shown in figure 4-2. All information required is important in the analysis of the BT trace. It should be furnished with great care. Use the codes and tables provided. Complete all entries. Do not use ditto marks.

b. **THE LOG SHEET HEADINGS.** Fill in the ship's name and number, and the month and year at the top of the sheet. Use Greenwich Mean Time for all BT observations. In the space marked time zone indicate the local time zone in which the ship is operating. Number the log sheets consecutively.

c. **THE LOG SHEET COLUMNS.** Fill in all of the log sheet columns as instructed below.

(1) **CONSECUTIVE SLIDE NUMBER.** Number slides consecutively, starting with number 1 for the first BT taken on each cruise.

(2) **HOUR.** The Greenwich Mean Time, Hour and minute (0000 to 2359) at which the BT enters the water.

(3) **DATE.** The day of the month only by Greenwich Mean Time. The date changes after 2359.

(4) **LATITUDE AND LONGITUDE.** Enter the ship's position in degrees and minutes at the time the BT enters the water. Be sure to indicate whether North or South Latitude and East or West Longitude in the blue line boxes at the top of the columns. Start a new log sheet when changing from North to South or East to West. Close coordination is required with the navigator. Approximate dead-reckoning positions are NOT accurate enough for the BT log sheets. Astronomical, geographical, or electronic fixes should be plotted, and the exact positions at the time of BT lowerings derived by interpolation.

(5) **DEPTH.** Record the sonic sounding in fathoms.

(6) **SHIP'S SPEED.** Give the speed of the ship in knots for each observation. If the ship is lying to when an observation is made show

the speed as zero.

(7) **SEA SURFACE TEMPERATURE.** The sea surface temperature is obtained by a bucket thermometer as described in Section 3, Part 7. Record the temperature to the nearest 0.1°F.

(8) **WIND DIRECTION.** Code the wind direction as given in Table I, (WMO Code 23).

(9) **WIND SPEED.** Record wind speed in knots whenever possible. If it is necessary to use Beaufort's scale, so indicate on the log sheet.

(10) **AIR TEMPERATURE - DRY BULB AND WET BULB.** Record the dry bulb and wet bulb temperatures in degrees and tenths to the nearest 0.1°F.

(11) **BAROMETER.** Record the barometric pressure in millibars using two digits, neglecting 900 or 1000 milibars. Use Table 2 to convert inches of mercury to millibars.

(12) **WEATHER.** Record the weather present at the time of observation using the code given in Table 3, (WMO Code 92).

(13) **CLOUDS - TYPE AND AMOUNT.** Record the cloud type using the codes given in Table 4. Report only the most significant cloud type. Give the amount of sky covered by clouds using the code given in Table 5 (WMO Code 60).

(14) **VISIBILITY.** Report the condition of visibility at the time of BT observation using the code given in Table 6.

(15) **SEA.** Report the state of the sea (wind waves) by using the code given in Table 7 (WMO Code 75).

(16) **SWELL - DIRECTION AND AMOUNT.** Code the direction of the predominant swell train present at the time of BT observation using the code given in Table 1. Record the code best describing the swell condition given in Table 8 in the amount column.

(17) **BT INSTRUMENT NUMBER.** Record the number stamped on the nose of the instrument. Always record any letter shown after the number, such as A or B, as this indicates a recalibrated instrument and therefore would have a different grid than the original. Check the number stamped on the nose with that given on the grid. They must always agree.

(18) **OBSERVER'S INITIALS.** The person taking the observations should always initial the last column. If further remarks concerning

the observation are required that is, condition initials and record the remarks on the back of
of the BT, etc., place an asterisk (*) beside the the sheet.

TABLE 1

COMPASS DIRECTION CODE

True direction from which surface wind is blowing or
from which wave system is approaching is 10s of degrees
(WMO Code 23)

Code			
00	.....	Calm	
01	.....	5°	to 14°
02	.....	15°	to 24° NNE
03	.....	25°	to 34°
04	.....	35°	to 44°
05	.....	45°	to 54° NE
06	.....	55°	to 64°
07	.....	65°	to 74° ENE
08	.....	75°	to 84°
09	.....	85°	to 94° EE
10	.....	95°	to 104°
11	.....	105°	to 114° ESE
12	.....	115°	to 124°
13	.....	125°	to 134°
14	.....	135°	to 144° SE
15	.....	145°	to 154°
16	.....	155°	to 164° SSE
17	.....	165°	to 174°
18	.....	175°	to 184° S
19	.....	185°	to 194°
20	.....	195°	to 204° SSW
21	.....	205°	to 214°
22	.....	215°	to 224°
23	.....	225°	to 234° SW
24	.....	235°	to 244°
25	.....	245°	to 254° WSW
26	.....	255°	to 264°
27	.....	265°	to 274° W
28	.....	275°	to 284°
29	.....	285°	to 294° WNW
30	.....	295°	to 304°
31	.....	305°	to 314°
32	.....	315°	to 324° NW
33	.....	325°	to 334°
34	.....	335°	to 344° NNW
35	.....	345°	to 354°
36	.....	355°	to 4° N
99	.....	Direction variable or unknown	

TABLE 2

BAROMETRIC PRESSURE CONVERSION - INCHES TO MILLIBARS
(Neglecting 900 and 1,000 millibars)
(For example: 45-945, and 03-1003)

Inches	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
27.9	45	45	46	46	46	46	47	47	48	48
28.0	48	48	49	49	50	50	50	51	51	51
28.1	52	52	52	53	53	53	54	54	54	55
28.2	55	55	56	56	56	57	57	57	58	58
28.3	58	59	59	59	60	60	60	61	61	61
28.4	62	62	62	63	63	63	64	64	64	65
28.5	65	66	66	66	66	67	67	68	68	68
28.6	68	68	69	70	70	70	70	71	72	72
28.7	72	72	73	73	73	74	74	74	75	75
28.8	75	76	76	76	77	77	77	78	78	78
28.9	79	79	79	80	80	80	81	81	81	82
29.0	82	82	83	83	83	84	84	84	85	85
29.1	85	86	86	86	87	87	88	88	88	88
29.2	89	89	90	90	90	90	91	91	92	92
29.3	92	93	93	93	94	94	94	95	95	95
29.4	96	96	96	97	97	97	98	98	98	99
29.5	99	99	00	00	00	01	01	01	02	02
29.6	02	03	03	03	04	04	04	05	05	05
29.7	06	06	06	07	07	08	08	08	08	09
29.8	09	10	10	10	10	11	11	12	12	12
29.9	12	13	13	14	14	14	15	15	15	16
30.0	16	16	17	17	17	18	18	18	19	19
30.1	19	20	20	20	21	21	21	22	22	22
30.2	23	23	23	24	24	24	25	25	25	26
30.3	26	26	27	27	27	28	28	28	29	29
30.4	30	30	30	30	31	31	32	32	32	32
30.5	33	33	34	34	34	34	35	35	36	36
30.6	36	37	37	37	38	38	38	39	39	39
30.7	40	40	40	41	41	41	42	42	42	43
30.8	43	43	44	44	44	—	—	—	—	—

TABLE 3

PRESENT WEATHER (WMO CODE 92)																																							
00 - 49 NO PRECIPITATION AT THE STATION AT THE TIME OF OBSERVATION																																							
00 - 19 No precipitation, fog, duststorm, sandstorm or drifting snow at the station*) at the time of observation or during the preceding hour, except for 09																																							
Code Figure																																							
No hydrometers except clouds	<table border="0"> <tr> <td>00</td> <td>Cloud development not observed or not observable</td> <td rowspan="3">} Characteristic change of the state of sky during the past hour</td> </tr> <tr> <td>01</td> <td>Clouds generally dissolving or becoming less developed</td> </tr> <tr> <td>02</td> <td>State of sky on the whole unchanged</td> </tr> </table>	00	Cloud development not observed or not observable	} Characteristic change of the state of sky during the past hour	01	Clouds generally dissolving or becoming less developed	02	State of sky on the whole unchanged																															
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02	State of sky on the whole unchanged																																						
Haze, dust, sand or smoke	<table border="0"> <tr> <td>03</td> <td>Clouds generally forming or developing</td> <td rowspan="16">}</td> </tr> <tr> <td>04</td> <td>Visibility reduced by smoke, e. g. veldt or forest fires, industrial smoke or volcanic ashes</td> </tr> <tr> <td>05</td> <td>Haze</td> </tr> <tr> <td>06</td> <td>Widespread dust in suspension in the air, not raised by wind at or near the station at the time of observation</td> </tr> <tr> <td>07</td> <td>Dust or sand raised by wind at or near the station at the time of observation, but no well developed dust devil(s), and no duststorm or sandstorm seen</td> </tr> <tr> <td>08</td> <td>Well developed dust devil(s) seen at or near the station within last hour, but no duststorm or sandstorm</td> </tr> <tr> <td>09</td> <td>Duststorm or sandstorm within sight of the station or at the station during the last hour</td> </tr> <tr> <td>10</td> <td>Mist</td> <td rowspan="3">} Shallow fog at the station, whether on land or sea, not deeper than about 2 meters on land or 10 meters at sea</td> </tr> <tr> <td>11</td> <td>Patches of</td> </tr> <tr> <td>12</td> <td>More or less continuous</td> </tr> <tr> <td>13</td> <td>Lightning visible, no thunder heard</td> <td rowspan="16">}</td> </tr> <tr> <td>14</td> <td>Precipitation within sight, not reaching the ground or the surface of the sea</td> </tr> <tr> <td>15</td> <td>Precipitation within sight, reaching the ground or the surface of the sea, but distant (i.e., estimated to be more than 5 km.) from the station</td> </tr> <tr> <td>16</td> <td>Precipitation within sight, reaching the ground or the surface of the sea, near to, but not at the station</td> </tr> <tr> <td>17</td> <td>Thunder heard, but no precipitation at the station</td> </tr> <tr> <td>18</td> <td>Squalls</td> <td rowspan="2">} within sight during the past hour</td> </tr> <tr> <td>19</td> <td>Funnel cloud(s)**)</td> </tr> </table>	03	Clouds generally forming or developing	}	04	Visibility reduced by smoke, e. g. veldt or forest fires, industrial smoke or volcanic ashes	05	Haze	06	Widespread dust in suspension in the air, not raised by wind at or near the station at the time of observation	07	Dust or sand raised by wind at or near the station at the time of observation, but no well developed dust devil(s), and no duststorm or sandstorm seen	08	Well developed dust devil(s) seen at or near the station within last hour, but no duststorm or sandstorm	09	Duststorm or sandstorm within sight of the station or at the station during the last hour	10	Mist	} Shallow fog at the station, whether on land or sea, not deeper than about 2 meters on land or 10 meters at sea	11	Patches of	12	More or less continuous	13	Lightning visible, no thunder heard	}	14	Precipitation within sight, not reaching the ground or the surface of the sea	15	Precipitation within sight, reaching the ground or the surface of the sea, but distant (i.e., estimated to be more than 5 km.) from the station	16	Precipitation within sight, reaching the ground or the surface of the sea, near to, but not at the station	17	Thunder heard, but no precipitation at the station	18	Squalls	} within sight during the past hour	19	Funnel cloud(s)**)
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19	Funnel cloud(s)**)																																						
*) The expression "at the station" refers to a land station or a ship.																																							
**) Tornado cloud or waterspout																																							

TABLE 3 (Continued)

20 - 29 Precipitation, fog or thunderstorm at the station during the preceding hour but not at the time of observation	
20 Drizzle (not freezing)	} not falling as shower(s)
21 Rain (not freezing)	
22 Snow	
23 Rain and snow	
24 Freezing drizzle or freezing rain	
25 Shower(s) or rain	
26 Shower(s) of snow, or of rain and snow	
27 Shower(s) of hail*), or of rain and hail*)	*) hail, small hail,
28 Fog	soft hail
29 Thunderstorm (with or without precipitation)	
30 - 39 Duststorm, sandstorm or drifting snow	
30	- has decreased during the preceding hour
31 } Slight or moderate dust storm or sandstorm	- no appreciable change during the preceding hour
32	- has increased during the preceding hour
33	- has decreased during the preceding hour
34 } Severe duststorm or sandstorm	- no appreciable change during the preceding hour
35	- has increased during the preceding hour
36 Slight or moderate drifting snow	} generally low (below eye level)
37 Heavy drifting snow	
38 Slight or moderate drifting snow	} generally high (above eye level)
39 Heavy drifting snow	
40 - 49 Fog at the time of observation	
40 Fog at a distance at the time of observation, but not at the station during the last hour, the fog extending to a level above that of the observer	
41 Fog in patches	
42 Fog, sky visible	} has become thinner during the preceding hour
43 Fog, sky invisible	
44 Fog, sky visible	} no appreciable change during the preceding hour
45 Fog, sky invisible	
46 Fog, sky visible	} has begun or has become thicker during the preceding hour
47 Fog, sky invisible	
48 Fog, depositing rime, sky visible	
49 Fog, depositing rime, sky invisible	

TABLE 3 (Continued)

50 - 59 PRECIPITATION AT THE STATION AT THE TIME OF OBSERVATION	
50 - 59 Drizzle	
50 Drizzle, not freezing, intermittent	slight at time of observation
51 Drizzle, not freezing, continuous	
52 Drizzle, not freezing, intermittent	moderate at time of
53 Drizzle, not freezing, continuous	observation
54 Drizzle, not freezing, intermittent	thick at time of
55 Drizzle, not freezing, continuous	observation
56 Drizzle, freezing, slight	
57 Drizzle, freezing, moderate or thick	
58 Drizzle and rain, slight	
59 Drizzle and rain, moderate or heavy	
60 - 69 Rain	
60 Rain, not freezing, intermittent	slight at time of
61 Rain, not freezing, continuous	observation
62 Rain, not freezing, intermittent	moderate at time of
63 Rain, not freezing, continuous	observation
64 Rain, not freezing, intermittent	heavy at time of
65 Rain, not freezing, continuous	observation
66 Rain, freezing, slight	
67 Rain, freezing, moderate or heavy	
68 Rain or drizzle and snow, slight	
69 Rain or drizzle and snow, moderate or heavy	
70 - 79 Solid precipitation not in showers	
70 Intermittent fall of snow flakes	slight at time of
71 Continuous fall of snow flakes	observation
72 Intermittent fall of snow flakes	moderate at time of
73 Continuous fall of snow flakes	observation
74 Intermittent fall of snow flakes	heavy at time of
75 Continuous fall of snow flakes	observation
76 Ice needles (with or without fog)	
77 Granular snow (with or without fog)	
78 Isolated starlike snow crystals (with or without fog)	
79 Ice pellets	

TABLE 3 (Continued)

80 - 99 Showery precipitation, or precipitation with current or recent thunderstorm

- | | | |
|----|--|---|
| 80 | Rain shower(s), slight | |
| 81 | Rain shower(s), moderate or heavy | |
| 82 | Rain shower(s), violent | |
| 83 | Shower(s) of rain and snow mixed, slight | |
| 84 | Shower(s) of rain and snow mixed, moderate or heavy | |
| 85 | Snow shower(s), slight | |
| 86 | Snow shower(s), moderate or heavy | |
| 87 | Shower(s) of soft or small hail, with or without rain or rain and snow mixed | - slight |
| 88 | Shower(s) of hail), with or without rain or rain and snow mixed, not associated with thunder | - moderate or heavy |
| 89 | Shower(s) of hail), with or without rain or rain and snow mixed, not associated with thunder | - slight |
| 90 | thunder | - moderate or heavy |
| 91 | Slight rain at time of observation | |
| 92 | Moderate or heavy rain at time of observation | - thunderstorm during the preceding hour but not at time of observation |
| 93 | Slight snow, or rain and snow mixed or hail*) at time of observation | |
| 94 | Moderate or heavy snow, or rain and snow mixed or hail*) at time of observation | |
| 95 | Thunderstorm, slight or moderate, without hail*), but with rain and/or snow at time of observation | |
| 96 | Thunderstorm, slight or moderate, with hail*), at time of observation | |
| 97 | Thunderstorm, heavy, without hail*), but with rain and/or snow at time of observation | - thunderstorm at time of observation |
| 98 | Thunderstorm combined with dust-storm or sandstorm at time of observation | |
| 99 | Thunderstorm, heavy, with hail*) at time of observation | |

TABLE 4		TABLE 5	
SIGNIFICANT CLOUD TYPE		SIGNIFICANT CLOUD COVER (WMO CODE 60)	
0	Stratus (St) or Fractostratus (Fs)	0	No clouds
1	Cirrus (Ci)	1	Less than 1/10, or 1/10
2	Cirrostratus (Cs)	2	2/10 and 3/10
3	Cirrocumulus (Cc)	3	4/10
4	Altostratus (As)	4	5/10
5	Altostratus (As)	5	6/10
6	Stratocumulus (Sc)	6	7/10 and 8/10
7	Nimbostratus (Ns)	7	9/10 and 9/10 plus
8	Cumulus (Cu) or Fractocumulus (Fc)	8	10/10
9	Cumulonimbus (Cb)	9	Sky obscured
X	Cloud not visible owing to darkness, fog, duststorm, sandstorm or other analogous phenomena.		

TABLE 6		
VISIBILITY		
CODE	DESCRIPTION	OBJECTS NOT VISIBLE AT:
0	Dense fog.....	50 yards
1	Thick fog.....	200 yards
2	Fog.....	400 yards
3	Moderate fog.....	1000 yards
4	Thin fog or mist.....	1 mile
5	Visibility poor.....	2 miles
6	Visibility moderate.....	5 miles
7	Visibility good.....	10 miles
8	Visibility very good.....	30 miles
9	Visibility excellent.....	over 30 miles

TABLE 7		
STATE OF SEA - WIND WAVES (WMO CODE 75)		
CODE	DESCRIPTION	HEIGHT (Feet)
0	Calm (Glassy).....	0
1	Calm (Rippled).....	0 - 1/3
2	Smooth (Wavelets).....	1/3 - 1 2/3
3	Slight.....	1 2/3 - 4
4	Moderate.....	4 - 8
5	Rough.....	8 - 13
6	Very Rough.....	13 - 20
7	High.....	20 - 30
8	Very High.....	30 - 45
9	Phenomenal.....	over 45

NOTE: The bounding height is to be assigned to the lower code, that is a height of 4 feet is coded as 3.

TABLE 8
SWELL CONDITIONS

CODE	APPROX. HEIGHT IN FEET	DESCRIPTION		APPROX. LENGTH IN FEET
0	0	No swell		0
1 2	1-6	Low swell	Short or average Long	0 - 600 Above 600
3 4 5	6 - 12	Moderate	Short Average Long	0 - 300 300 - 600 Above 600
6 7 8	Greater than 12	High	Short Average Long	0 - 300 300 - 600 Above 600
9	• • •	Confused		

7. SHIPPING SLIDES AND LOG SHEETS

a. PACK THE SLIDES AND LOG SHEETS TOGETHER. Whenever a full box of slides is accumulated or a cruise is completed, it should be carefully packed to avoid breakage. Include all completed log sheets with the slides. Do not pack any material between the slides in the box. Pad the slide box well and pack with the log sheets in a cardboard box. Wrap the package securely and label BREAKABLE - HANDLE WITH CARE.

b. Ship the package to:

Hydrographer
U. S. Navy Hydrographic Office
Washington 25, D. C.

8. TO OBTAIN ADDITIONAL BT LOG SHEETS

Additional log sheets are obtained upon request from the Hydrographic Office.

9. TO OBTAIN ADDITIONAL SLIDES AND OTHER PARTS

a. SLIDES. New slides are a standard stock item in the Electronic supply system and are obtained through any normal supply support channel. See Table 8, Table of Replaceable Parts, for description for ordering.

b. TOWING BLOCKS AND CABLE. Stock numbers and designations for ordering additional Towing Blocks and reels of cable are given in Table 1-4, Equipment Required but not Supplied.

c. BT PARTS. Descriptions of other components are given in Table 8-2, Replaceable Parts.

SECTION V

READING THE BT SLIDE

1. THE SLIDE AND GRID VIEWER

To read the slide, it must be placed in the grid and slide holder attached to the magnifying slide viewer. The coated side of the grid in the holder is next to the coated side of the slide to provide proper focus and reduce parallax. Like the slide, the coated side of the grid can be easily scratched, or damaged by water. Never place a wet slide in the viewer.

2. INSERT THE SLIDE IN THE VIEWER

To insert the slide in the holder place the long edge of the slide having the smaller bevel against the spring at the bottom of the grid, with the coated surface toward the grid. The short edge with the beveled corners should be just clear of the stop pin. Care must be taken to always keep the top of the slide against the groove opposite the spring, and the side tight against the stop pin, otherwise incorrect temperature and depth readings will result.

3. REMOVE THE SLIDE FROM THE VIEWER

To remove the slide from the viewer depress the spring with the fingernail. This will release the slide and let it fall into the hand: Do not push the slide out of the viewer lengthwise along the face of the grid as this will cause excessive scratching of both grid and slide.

4. READ THE BT TRACE

a. GRID CONSTRUCTION. The trace scratched by the stylus of the BT is a continuous record of temperature against depth. Each point on the trace represents a value of temperature and depth which can be read off the appropriate line of the grid. The horizontal depth lines on the grid are slightly curved because the stylus assembly swings through an arc as the temperature changes at any fixed depth. The temperature lines on the grid are not quite vertical because the Bourdon tube is slightly affected by pressure changes as

well as temperature changes. The lines on the grid are established by actual test and calibration of each instrument. Therefore each BT has its own grid which cannot be used with any other BT.

b. TEMPERATURE AND DEPTH SCALES AND TOLERANCES. Temperatures on the grid are given in increments of whole degrees, with heavy lines on every 5°. Most BTs have a temperature scale range from 28° F. to 90°F. The curved horizontal depth lines are in feet with the increments as follows:

Model	Depth Range	Grid Depth Scale Increments
OC-1C/S	200 ft.	5 ft.
OC-2C/S	450 ft.	10 ft.
OC-3C/S	900 ft.	20 ft.

Temperatures are read by interpolation to the nearest tenth of a degree (0.1°). Depths are read to within 2 feet or better for a 200 foot type, 5 feet or better for a 450 foot type and 10 feet or better for a 900 foot type.

c. TO READ THE TRACE. The center of the trace is read. For a very wide trace an eye estimate of the center must be made. Where two well defined, separate traces appear, the center or mean of the two traces is read. The surface temperature (BT) is read at the point where the trace starts downward from the surface.

5. CHECK FOR INSTRUMENT MALFUNCTION

a. HYSTERESIS. The stylus scratches its trace both while the BT is diving and as it rises to the surface. The water conditions where it dives may be slightly different from where it rises. These conditions are usually negligible. However the instrument may have hysteresis, that is, there might be a lag in the movement of one of the elements which produces two separate traces. If the up and down traces are essentially similar throughout their entire length a slight divergence is usually immaterial. *If the traces*

consistently diverge by $\frac{1}{2}^{\circ}$ or more change to another BT.

b. SURFACE TRACE SHOWS DEPTH ERROR. The BT, when on deck, usually has a different temperature than when in the water. The thermal element assembly will move the stylus along the zero depth line to the surface water temperature position during the 30 seconds or more the BT is being towed at the surface. Thus the top of most traces is an almost horizontal line. This surface trace should fall on the zero depth line of the grid when the slide is viewed. If the surface trace appears above or below the zero depth line of the grid, all depth readings on the trace must be corrected by the amount of this error for accurate results.

c. COMPARE BT AND BUCKET SURFACE TEMPERATURES. It is advisable to make frequent comparison between the surface temperature as read from the BT slide, and the bucket surface temperature obtained for the lowering. For a series of slides taken with the same BT, the slide and bucket surface temperature reading should be approximately the same. If they differ slightly, the difference should remain relatively

constant over a long period of time. If this difference changes and if the amount of the difference continues for later lowerings, it is an indication that the calibration of the instrument has changed. A shift in calibration, sometimes called a "shift in zero points," should not affect the shape of any given trace. However the operator should note on the BT log sheet the slide number at which the shift in calibration was detected. Tests for determining the amount of shift are described in Section 6.

NOTE

If the surface temperature of the BT differs from the bucket temperature by 4° or more, or if it shifts from reading to reading, the BT needs adjustment and should be turned in for repair and recalibration. (See Section 7-3)

d. IF BT HITS BOTTOM. If the BT strikes bottom or an underwater object, the depth at which it struck can usually be determined by reading the depth of the horizontal lines across the trace, made when the stylus arm vibrated with the shock.

SECTION VI

STORAGE AND PREVENTIVE MAINTENANCE

1. CAREFUL TREATMENT ESSENTIAL

The BT is an accurate measuring instrument. While the construction is reasonably rugged, the internal mechanism is delicate, so that careful handling at all times is essential for maintaining the accuracy of the equipment.

2. STORING THE BT

a. AVOID VIBRATION. When not in actual use the BT should always be stored in a location that is as free from vibration as possible. Excessive vibration may cause calibration shifts and possible damage to the thermal or depth elements. Periodically check the BT and tighten all screws, as vibration often causes them to loosen and fall out.

b. AVOID EXTREME TEMPERATURES. It is important that the BT be stored in a location where the temperatures will not exceed 105°F. (40.8°C.) or go below 20°F. (-6.7°C.). Never leave the BT on deck without adequate protection to keep the temperature within this range. Always protect the thermal element from the hot sun. If placing the BT in the shade is inadequate to keep the temperature below 105° the thermal element must be kept covered with wet cloths. During cold weather prevent ice from forming on the depth bellows and thermal element. Ice formations will seriously impair the operation of these units

during a lowering and may cause permanent damage.

3. CLEANING THE BT

a. FRESH WATER RINSE. After each period of use, the BT should be rinsed with fresh water, inspected for damage or fouling, and returned to its proper place in the rack. Whenever a BT is being replaced or stored it should be thoroughly rinsed and cleaned before boxing it.

b. CLEANING. Once a week rinse the interior of the BT with a half cupful of Grade III Rust Preventive Compound - Navy Departments Specification 52-C-18 (Federal Standard Stock Catalog No. 52-C-3257-60) for a one gallon can). Place the BT in a clean bucket with the tail fins down. Slide the sleeve toward the nose, pour a half cup of the compound and close the sleeve. Then, holding the hands over the four ports or openings in the body tube, shake the BT and turn it over on its nose and back several times so that every part is thoroughly covered. Let the compound drain out. The compound can be re-used several times without harm. Do not oil the BT. Fresh water or rust preventative compound is all the lubrication necessary. Do not use brightwork or metal polish on the BT as the powder residue from the polish may get into and clog the thermal and depth elements.

FAILURE REPORT

"Report each failure of the equipment, whether caused by a defective part, wear, improper operation, or an external cause. Use ELECTRONIC FAILURE REPORT form DD787. Each pad of the forms includes full instructions for filling out the forms and forwarding them to the Bureau of Ships. However, the importance of providing complete information cannot be emphasized too much. Be sure that you include the model designation and serial number of the equipment (from the equipment identification plate), the type number and serial number of the major unit (from the major unit identification plate), and the type number and reference designation of the particular defective part (from the technical manual). Describe the cause of the failure completely, continuing on the back of the form if necessary. Do not substitute brevity for clarity. And remember-there are two sides to the failure report-

"Your Side"

"Bureau Side"

"Every FAILURE REPORT is a boost for you:

- 1. It shows that you are doing your job.
- 2. It helps make your job easier.
- 3. It insures available replacements.
- 4. It gives you a chance to pass your Knowledge to every man on the team.

"The Bureau of Ships uses the information to:

- 1. Evaluate present equipment.
- 2. Improve future equipment.
- 3. Order replacements for stock.
- 4. Prepare field changes.
- 5. Publish maintenance data.

Always keep a supply of failure report forms on board. You can get them from the nearest Forms and Publications Supply Distribution Point."

SECTION VII

CORRECTIVE MAINTENANCE AND REPLACEMENT

1. DISASSEMBLY OF THE BT

Do not disassemble the BT. It is a precision instrument with delicate internal mechanisms. Even with the greatest care possible it is difficult to avoid damage if disassembly is attempted aboard ship.

2. EMERGENCY DETERMINATION OF ZERO SHIFT

a. CALIBRATION. The BT trace can be read to 0.1°F. on the temperature scale and to 10 feet or better on the depth scale depending on the range of the model. Shocks may occur to the instrument during handling, lowering, storing, or shipping which may cause hysteresis, temperature or depth error. Nothing can be done aboard ship for hysteresis. In order to determine the amount of correction to apply to temperature or depth readings for accurate work the following procedures can be used in an emergency.

b. TEMPERATURE ERROR. Load the BT with a coated slide and leave the brass sleeve up so that the stylus does not rest on the slide. Immerse the tailfins in a bucket of cold water (about 40°F.) deep enough to cover the thermal element and sleeve. Insert the bucket thermometer into the water. Stir the water for about 30 seconds. Push the sleeve down to bring the stylus in contact with the slide and read the temperature of the bucket thermometer. Then raise the sleeve and trip the stylus lifter without taking the BT out of the water. Add hot water to raise the temperature to about 60°F. Stir the water for about 30 seconds and make another mark on the slide as before. Read the thermometer. Again add hot water to raise the temperature to about 80°F. Stir and take the temperature as before. The temperature values may be plotted on a graph against the temperatures obtained from the bucket thermometer. A small shift in zero temperature-values may be corrected by adjusting the eccentric stop screw (figure 1-4) on the grid holder to line up the grid values cor-

rectly with the recorded values. If the error is too great to eliminate by means of the eccentric screw, or the holder has a fixed stop pin, subtract the BT surface temperature from the bucket temperature (Bucket minus BT = difference) to obtain the difference. Average all differences and apply the sign algebraically.

Example:

$$\begin{array}{r} \text{Bucket Temp.} = + 40.2^{\circ} + 59.7^{\circ} + 81.2^{\circ} \\ \text{BT Temp.} \quad \quad - 43.5^{\circ} \quad - 63.3^{\circ} \quad - 84.2^{\circ} \\ \text{Diff.} \quad \quad \quad = -3.3^{\circ} \quad -3.6^{\circ} \quad -3.0^{\circ} \end{array}$$

$$\text{Average difference} = -3.3^{\circ}\text{F}$$

Apply the average difference, according to the sign, to each temperature reading to obtain a correct temperature.

c. DEPTH ERROR. With the sleeve all the way back, immerse the thermal element in a bucket of cold water (about 35° - 40°F.) and then in a bucket of warm water (about 80° - 85°F.). This will cause a long zero depth line to be drawn across the slide. The slide is placed in the viewer and the difference, in feet, of the trace above or below the zero depth line is read. This depth error must be applied to temperature readings at each depth to obtain a correct depth. Some grid holders are provided with an adjustable set edge at the top. The depth error can be corrected on this type of holder by aligning the zero trace of the slide with the zero line of the grid and retightening the screws. This must be done with great care, however, as a very slight error in surface alignment will cause skewing of the BT trace and result in increasingly large temperature errors towards the bottom of the grid.

3. TURNING THE BT IN FOR REPLACEMENT

a. DETERMINE THE NEED. The results from the above methods of calibration are at best approximate and suggested only as a makeshift in the absence of better equipment. Any instrument found seriously in error should be turned in

for repair and recalibration and a replacement obtained. However a small shift in calibration does not destroy the usefulness of the instrument. The relative change of temperature with depth, or the way the temperature changes with depth is the most important thing. A shift in the zero points does not usually change the relative values unless the instrument has been seriously injured. A comparison of the temperature changes between depths as shown on the slide from a suspected BT, with the changes shown on the slide of another BT lowered in the same water, will usually indicate if the suspected instrument is no longer useful without adjustment or recalibration. The following limits of error are given to aid in determining need for repair and recalibration.

(1) TURN THE BT IN if the temperature of the BT differs from the bucket temperature consistently by 4°F., or more.

(2) TURN THE BT IN if the temperature of the BT shifts erratically from reading to reading, as compared to the bucket or another BT.

(3) TURN THE BT IN if the BT shows double traces over the entire length of the trace, i.e., the up and down traces differ widely, as it has developed hysteresis. Closely spaced traces (less than 1/2 degree) and double traces in strong gradients (layers of rapid change of temperature) are not considered as hysteresis.

(4) TURN THE BT IN if the BT shows a depth error of more than 10 feet for a 200-foot instrument, 20 feet for a 450-foot instrument or 40 feet for a 900-foot instrument.

(5) TURN THE BT IN if the stylus is dull and consistently produces wide traces regardless of cleaning, or type of slide used.

(6) TURN THE BT IN if the date of the last calibration of the BT is more than 18 months past.

b. WHERE TO TURN IN THE BT. If the BT fails to operate satisfactorily or exceeds any of the limits given above it should be turned into the nearest Bathythermograph Repair Facility, along with all of its accessories including grids

and grid mount assembly. The mailing addresses for the existing Bathythermograph Repair Facilities are as follows:

1. Bathythermograph Repair Facility
Boston Naval Shipyard
Boston 29, Mass.
2. Bathythermograph Repair Facility
Mare Island Naval Shipyard
Vallejo, Calif.
3. Bathythermograph Repair Facility
Pearl Harbor Naval Shipyard
Navy # 128
c/o Fleet Post Office
San Francisco, Calif.

Note

To avoid needless expense of purchase, the following items must be returned with the BT when unit is returned for repairs or recalibration.

- (a) 2 Slide Holders (N6655-171-9446)
- (b) 1 Slide Viewer (N6655-335-9573)
- (c) 1 Thermometer (N6685-171-9674)
- (d) 1 Tongs (N5120-699-3331)

c. TO GET REPLACEMENT. A request for replacement should be submitted to the Bureau of Ships (Code 623C3) in accordance with Bu-Ships instructions 9674.9A. Disposition of the previous BT should be noted in the request for replacement. Submit along with the request an Electronic Failure Report form DD787.

d. TO REPLACE LOST BTs. When a BT is lost at sea, a Survey Report, Form NAVSANDA Form 154, shall be prepared and forwarded with a request for replacement to Bureau of Ships (Code 623C3). An authorization for replacement will then be issued by the Bureau. In the event immediate replacement is required, advise the Bureau by message and forward the survey report under separate cover. The remaining accessories and shipping boxes should be forwarded to the nearest Bathythermograph Repair Facility.

SECTION VIII

PARTS LIST

1. INTRODUCTION.

A reference code as well as a reference designation has been assigned to each part to compensate for the lack of consistency in the reference designations previously assigned the various models.

2. LIST OF MAJOR UNITS.

For ordering purposes Table 8-1 lists major units with their Navy type designation and stock numbers.

3. MAINTENANCE PARTS LIST.

Table 8-2 is a table of replaceable parts.

Column 1 lists the reference code; columns 2, 3 and 4 list the reference designation; column 5 gives the name and description of the part and the manufacturers symbol; column 6 indicates how the part is used and gives its functional location in the equipment.

Stock numbers of parts used in this equipment may be obtained by referring to the Stock Number Identification Table (SNIT) published by E.S.O.

4. LIST OF MANUFACTURERS.

Table 8-3 lists manufacturers of parts used in the equipment. The first column indicates the manufacturers code used in Table 8-2 to identify the manufacturers.

TABLE 8-1. LIST OF MAJOR UNITS

QUANTITY	NAME OF MAJOR UNIT	DEPTH	NAVY TYPE DESIGNATION	STOCK NUMBER
1	Bathythermograph	200 ft.	OC-1/S, 1A/S, 1B/S, 1C/S	F6655-640-9354
1	Bathythermograph	450 ft.	OC-2/S, 2A/S, 2B/S, 2C/S	F6655-171-8575
1	Bathythermograph	900 ft.	OC-3/S, 3A/S, 3B/S, 3C/S	F6655-171-9667

TABLE 8-2. TABLE OF REPLACEABLE PARTS

REF. CODE	REF. DESIGNATION			NAME AND DESCRIPTION	LOCATING FUNCTION
	OC-1/S OC-2/S OC-3/S	OC-1A/S OC-2A/S OC-3A/S	OC-1C/S OC-2C/S OC-3C/S		
1	0-112	0-112	Not Used	SCREW, MACHINE: Natural brass; thermal element locating screw; #10-32 x 17/32" o/a. CWT Part/dwg. No. FP-6151	Positions thermal element in body tube.
1	Not Used	Not Used	H-101	SCREW, MACHINE: Natural brass; finished; 7" tapered head, .320" max. diam., 11/32" lg.; 1/4"-32 NEFT, class 2 fit, 7/32" lg. undercut to 7/32" diam. at head; 5/8" nominal length; CWT Part/dwg. No. FP-7108.	Positions thermal element in body tube.
2	0-125	0-125	Not Used	SCREW, MACHINE: Natural brass; thermal element locating screw, #10-32 x 17/32" o/a. CWT Part/dwg. No. FP-6151.	Positions pressure element in body tube.
2	Not Used	Not Used	H-100	SCREW, MACHINE: Natural brass; finished; 7" tapered head, .320" max. diam., 11/32" lg.; 1/4"-32 NEFT, class 2 fit, 7/32" lg. undercut to 7/32" diam. at head; 5/8" nominal length; CWT Part/dwg. No. FP-7108.	Positions pressure element in body tube.
3	Not Used	Not Used	H-102	SCREW, PRESSURE ELEMENT STOP: Natural brass; no head; screw driver slot one end; 1/4"-20 NCT for entire length, class 2 fit; 1-3/4" nominal length; CWT Part/dwg. No. FP-7162; listed for reference only.	In pressure element stop to prevent excess movement of that element.
4	H-100	H-100	H-104	SHACKLE, SCREW PIN: Forged steel; galvanized; Wilcox Crittenden & Co. Inc. Type 290; 1/4" diam. stock; 1-1/8" overall length, 3/4" between jaws; 5/16" diam. pin with eye one end; CWT Part dwg. No. FU-3241.	Connection between cable and shackle.
5	0-121	0-121	H-105	STUD, TOWING: Brass rod, 1/4" diam.; one end threaded 1/4" 20 NCT, class 2 fit, 1/4" lg.; other end slotted for screw driver; 13/16" lg; part of 0-105; CWT Part/Dwg. No. FP-5907.	Connection between swivel and BT.
6	H-101	H-101	H-106	SWIVEL, EYE AND EYE: Forged steel, galvanized, Wilcox Crittenden & Co. Inc. type 676; 1/4" diam. stock; 3-3/8" over-all length; 3/4" inside diam. of eye; CWT Part/Dwg. No. FU-3240	Connection between shackle and towing stud.
7	M-101	M-101	Not Used	ELEMENT, PRESSURE: C/o brass base and slide carrier w/3 brass bellows soldered together, evacuated and sealed; contains calibration spring and piston; depth range 0-200 ft, accuracy ± 2 ft; 2" OD x 9" lg. approx. o/a; Part of OC-1/S, OC-1A/S, CWT Part/Dwg. No. FU-2632.	Measure Depth.
7	M-102	M-102	Not Used	ELEMENT, PRESSURE: C/o brass base and slide carrier w/3 brass bellows soldered together, evacuated and sealed; contains calibration spring and piston; depth range 0-450 ft, accuracy ± 4.5 ft; 2" OD x 9" lg. approx. o/a; Part of OC-2/S, OC-2A/S, CWT Part/Dwg. No. FU-2633.	Measure depth.

TABLE 8-2. TABLE OF REPLACEABLE PARTS (Continued)

REF. CODE	REF. DESIGNATION			NAME AND DESCRIPTION	LOCATING FUNCTION
	OC-1/S OC-2/S OC-3/S	OC-1A/S OC-2A/S OC-3A/S	OC-1C/S OC-2C/S OC-3C/S		
7	M-103	M-103	Not Used	ELEMENT, PRESSURE: C/o brass base and slide carrier w/3 brass bellows soldered together, evacuated and sealed; contains piston and a calibration spring exterior to bellows; depth range 0-900 ft. accuracy ± 9 ft.; 2" OD x 9" lg. approx. o/a. Part of OC-3/S. OC-3A/S. CWT Part/Dwg. No. FU-2747.	Measures depth.
7	Not Used	Not Used	M-100	ELEMENT, PRESSURE: Consists of brass base, slide carrier, 3 brass bellows soldered together evacuated and sealed; contains spring and piston; depth range 0 to 200 ft.; accuracy ± 2 ft.; 2" diam., 9" long; part of OC-1C/S; CWT Part/Dwg. No. FU-3246.	Measures depth.
7	Not Used	Not Used	M-101	ELEMENT, PRESSURE: Consists of brass base, slide carrier, 3 brass bellows soldered together evacuated and sealed; contains calibration spring and piston; depth range 0 to 450 ft.; accuracy ± 4.5 ft., 2" diam., 9" long; part of OC-2C/S; CWT Part/Dwg. No. FU-3250.	Measures depth.
7	Not Used	Not Used	M-102	ELEMENT, PRESSURE: Consists of brass base, slide carrier, spacer, 3 brass bellows soldered together evacuated and sealed; contains piston; calibration spring is exterior to bellows; depth range 0 to 900 ft.; accuracy ± 9 ft.; 2" diam., 9" long; part of OC-3C/S; CWT Part/Dwg. No. FU-3252.	Measures depth.
8	M-100	M-100	Not Used	ELEMENT, THERMAL: Cast brass cylinder w/6 sheet brass fins soldered in equiangular position; includes thermal element assembled at one end w/attached stylus and automatic stylus lifter; 3" OD x 12-41/64" max. approx. o/a; Part of OC-1/S, OC-1A/S, OC-2/S, OC-2A/S; CWT Part Dwg. No. FU-2678.	Measures temperature.
8	M-104	M-104	Not Used	ELEMENT, THERMAL: Cast brass cylinder w/6 sheet brass fins soldered in equiangular position; includes thermal element assembled at one end w/attached stylus and manual stylus lifter; 3" OD x 12-41/64" max. approx. o/a; Part of OC-3/S, OC-3A/S; CWT Part/Dwg. No. FU-2626.	Measures temperature.
8	Not Used	Not Used	M-103	ELEMENT, THERMAL: Consists of cast brass cylinder with 6 sheet brass fins soldered in equiangular position; M-105 assemblies at one end with attached stylus and automatic stylus lifter; 3" diam., 12-41/64" long; Part of OC-1C/S, OC-2C/S; CWT Part/Dwg. No. FU-3248.	Measures temperature.
8	Not Used	Not Used	M-104	ELEMENT, THERMAL: Consists of cast brass cylinder with 6 sheet brass fins soldered in equiangular position; M-105 assemblies at one end with attached stylus and manual stylus lifter; 3" diam., 12-41/64" long; Part of OC-3C/S; CWT Part/Dwg. No. FU-3251.	Measures temperature.

TABLE 8-2. TABLE OF REPLACEABLE PARTS (Continued)

REF. CODE	REF. DESIGNATION			NAME AND DESCRIPTION	LOCATING FUNCTION
	OC-1/S OC-2/S OC-3/S	OC-1A/S OC-2A/S OC-3A/S	OC-1C/S OC-2C/S OC-3C/S		
9	M-105	M-105	M-105	ELEMENT, UNMOUNTED THERMAL: Consists of beryllium copper Bourdon tube with 40 to 50 ft. xylene filled capillary tubing attached one end and bi-metal strip attached other end; 1-15/16" long, 1-1/4" diam.; capillary tubing .050" O.D., .015" LD.; temperature range 28° F. to 90° F., accuracy $\pm 0.1^\circ$ F.; Part of thermal element; CWT Part/Dwg. No. FU-2604.	Measures temperature.
10	0-118	0-118	0-100	CATCH: High brass sheet, 1/32" thick, #2 hard, formed to special shape; 1-1/8" long, 5/8" wide, 3/8" high; Part of thermal element; CWT Part/Dwg. No. FP-5960.	Engages stylus lifter in automatic stylus lifter assembly.
11	0-106	0-106	0-101	CLAMP, THERMAL ELEMENT: Brass rod 23/32" long, 3/16" wide, 3/16" high; two #31 clearance holes 7/64" and 1/2" from one end; part of thermal element; CWT Part/Dwg. No. FP-5902.	Secures Bourdon tube in System mounting.
12	0-103	0-103	0-102	GUARD, TAIL: Consists of 6 sheet brass guards 1/32" thick; spaced equilaterally, the rear end locked in a slotted brass hub, positioned and strengthened by 12 supports riveted to the guards thereby forming two bands around guard; #18 drill clearance hole in each guard; 10-3/8" long, 5" diam.; CWT Part/Dwg. No. FU-2835.	Protects thermal element.
13	0-111	0-111	0-103	LEVER: High brass sheet, 1/32" thick, #2 hard, formed to special shape; 2-3/16" long, 1-7/16" wide; part of thermal element; CWT Part/Dwg. No. FP-7114.	Lifts stylus from slide.
14	0-105	0-105	Not Used	FRAME: Cast brass conical cylinder w/6 sheet brass fins soldered in equilateral position, 2-7/8" O.D. x 8-13/16" lg. Part of thermal element; CWT Part/Dwg. No. FU-2622.	Mounting for Bourdon Tube and support for windings of capillary tubing.
14	Not Used	Not Used	0-104	FRAME: Consists of cast brass cylinder with conical end and internal boss, tubing support fin, anchor rod, 6 sheet brass tubing support fins soldered in equilateral position; 2-7/8" diam., 8-13/16" long; part of thermal element; CWT Part/Dwg. No. FU-3249.	Mounting for Bourdon tube and support for windings of capillary tubing.
15	Not Used	0-101	Not Used	PIECE, NOSE: Cast bronze 2-1/8" O.D. x 9-3/4" o/a; has integrally cast towing boss with tow point 5-1/4" aft of nose and 1-19/32" above center line, also 6 #10-32 tapped holes for mounting body tube; CWT Part/Dwg. No. FP-6325.	Diving weight.
15	0-101	Not Used	Not Used	PIECE, NOSE: Same as nose piece used on OC-1A/S, OC-2A/S and OC-3A/S with exception of external machining. CWT Part/Dwg. No. FU-2625.	Diving weight.

TABLE 8-2. TABLE OF REPLACEABLE PARTS (Continued)

REF. CODE	REF. DESIGNATION			NAME AND DESCRIPTION	LOCATING FUNCTION
	OC-1/S OC-2/S OC-3/S	OC-1A/S OC-2A/S OC-3A/S	OC-1C/S OC-2C/S OC-3C/S		
15	Not Used	Not Used	0-105	PIECE, NOSE: Cast bronze, separate force fit towing pin; has 6 # 10-32 tapped holes for assembly in equipment; 2-1/8" diam., 9-3/8" long; one end turned to 2" diam. for assembly in body tube. CWT Part/Dwg. FU-2998.	Diving weight.
16	0-115	0-115	0-106	PLUNGER, RELEASE: Brass, dull nickle plated; one end tapped # 6-32 1/2" deep; 11/16" long, 3/16" wide, 3/16" high; part of depth element for OC-1/S, OC-2/S, OC-1A/S, OC-2A/S, OC-1C/S, OC-2C/S. CWT Part/Dwg. No. FP-6075.	Contacts and releases catch on automatic stylus lifter mechanism.
17	0-110	0-110	0-107	POST, STYLUS LIFTER: Brass; 3/16" diam., 2-5/8" long; one end turned to .125" max. diam. 5/8" long, knurl 1/4" long 3/8" from .125" diam. end; # 41 drill hole 1/4" from 3/16" diam. end. # 2-56 tapped hole 1" from same end; part of thermal element; CWT Part/Dwg. No. FP-5899.	Mounting for stylus lifter.
18	0-114	0-114	0-108	ROD, RELEASE: Brass, 3/16" square 1-3/8" long; one end turned and threaded #6-32 NOT, class 2 fit, 9/16" long; # 2-56 tapped holes 1/8" and 7/16" from end; part of depth element; CWT Part/Dwg. No. FP-5957.	Positions release plunger.
19	0-119	0-119	0-109	SHAFT, CATCH: Brass 1-7/8" long, 3/16" diam.; # 42 clearance holes 3/32" from each end; part of thermal element; CWT Part/Dwg. No. FP-5958.	Mount for catch.
20	0-116	0-116	0-110	SHAFT, STYLUS LIFTER: Brass; 1-7/8" long, 3/32" diam.; one end knurled 5/32" long; part of depth element for OC-1/S, OC-2/S, OC-1A/S, OC-2A/S, OC-1C/S, OC-2C/S; CWT Part/Dwg. No. FP-5904 included for reference only.	Mounting for stylus lifter.
21	0-109	0-109	Not Used	SLEEVE: Brass tubing 2-1/8" I.D. x 1/32" wall x 4-3/4" lg. Slotted to engage locating shoulder screw and held together by 2 brass lost motion straps; part of OC-1/S, OC-2/S, OC-1A/S, OC-2A/S; CWT Part/Dwg. No. FU-2833.	Covers ports in body tube.
21	0-123	0-123	Not Used	SLEEVE: Brass tubing 2-1/8" I.D. x 1/32" wall x 4-3/4" lg. Slotted to engage locating shoulder screw and held together by 2 brass lost motion straps; part of OC-3/S, OC-3A/S; CWT Part/Dwg. No. FP-5874.	Covers ports in body tube.
21	Not Used	Not Used	0-111	SLEEVE: Brass tubing; 4" long, 2-1/8" inside diam., 1/32" wall; slit lengthwise and one end of slit notched, two lost motion straps riveted to hold diam.; CWT Part/Dwg. No. FU-2833.	Covers ports in body tube.

TABLE 8-2. TABLE OF REPLACEABLE PARTS (Continued)

REF. CODE	REF. DESIGNATION			NAME AND DESCRIPTION	LOCATING FUNCTION
	OC-1/S OC-2/S OC-3/S	OC-1A/S OC-2A/S OC-3A/S	OC-1C/S OC-2C/S OC-3C/S		
22	0-102	0-102	0-102	SLEEVE, NOSE: Cast bronze, slotted with 1" slot to fit over nose piece; two 1/4" 20 tapped holes 1-5/8" and 2-3/8" from one end with two 3/8" long 1/4" 20 FHMS; 3" O.D., 2-5/32" I.D., 7-1/4" long; CWT Part/Dwg. No. FP-5897.	Auxiliary diving weight.
23	0-120	0-120	0-113	SPRING, CATCH: Phosphor bronze 1/32" diam. torsion type, 6 spaced coils 9/32" diam.; hook terminals at right angles on opposite sides of coil on 7/8" mounting centers; part of thermal element; CWT Part/Dwg. No. FP-5961.	Energizes, catch.
24	0-117	0-117	0-115	SPRING, STYLUS LIFTER: Phosphor bronze, .032" diam.; torsion type, 6 coils close wound 3/16" diam.; hook terminal parallel on opposite sides of coil on 1-3/8" mounting centers; part of thermal element; CWT Part/Dwg. No. FP-5900.	Actuates stylus lifter.
25	0-113	0-113	0-114	SPRING, RELEASE: Beryllium copper, flat type; 2-1/8" long, 7/16" wide, 1/64" thick; four #43 clearance holes, two each end; part of depth element for OC-1/S, OC-2/S, OC-1A/S, OC-2A/S, OC-1C/S, OC-2C/S; CWT Part/Dwg. No. FP-5959.	Resilient mounting for release plunger.
26	0-108	0-108	0-116	STYLUS: "Transcript tone" phonograph needle; jewel point; 1/8" long; part of stylus assembly; CWT Part/Dwg. No. P-23143. Listed for reference only.	Marks trace on smoked slide.
27	0-107	0-107	0-117	STYLUS ASSEMBLY: Consists of beryllium copper arm with stylus 0-116 soldered at one end; 3-5/8" long, 7/64" max. width, .010" thick; part of thermal element; CWT Part/Dwg. No. FU-2634.	Records trace on smoked slide.
28	0-100	0-100	Not Used	ASSEMBLY, BODY TUBE: c/o 90-10 Commercial bronze tubing 14-11/16" lg. x 2-1/8" O.D. x 1/16" wall (4 ports for access to slide and stylus lifter, and clearance holes for mounting nose piece and thermal element are provided), 3 high brass bi-winged brackets .094" thick silver soldered to one end so that 6 wings are spaced equiangularly. Each wing has #8-32 brass elastic stop nut with nylon insert staked thereto for mounting tail guard; part of OC-1/S, OC-2/S, OC-1A/S, OC-2A/S, CWT Part/Dwg. No. FU-2635.	Main support of equipment.
28	0-124	0-124	Not Used	ASSEMBLY, BODY TUBE: c/o 90-10 Commercial bronze tubing 14-11/16" lg. x 2-1/8" O.D. x 1/16" wall (4 ports for access to slide and stylus lifter, and clearance holes for mounting nose piece and thermal element are provided), six #6-32 tapped holes provided for mtg. diving attachment, 3 high brass bi-winged brackets .094" thick silver soldered to one end so that 6 wings are spaced equiangularly. Each wing has #8-32 brass elastic stop nut with nylon insert staked thereto for mounting tail guard; part of OC-3/S, OC-3A/S; CWT Part/Dwg. No. FU-2749.	Main support of equipment.

TABLE 8-2. TABLE OF REPLACEABLE PARTS (Continued)

REF. CODE	REF. DESIGNATION			NAME AND DESCRIPTION	LOCATING FUNCTION
	OC-1/S OC-2/S OC-3/S	OC-1A/S OC-2A/S OC-3A/S	OC-1C/S OC-2C/S OC-3C/S		
28	Not Used	Not Used	0-118	ASSEMBLY, BODY TUBE: Commercial bronze tubing, 4 ports for access to slide and stylus lifter provided, holes provided for mounting thermal element, depth element; 3 high brass bi-winged brackets .094" thick silver soldered to one end so 6 wings are spaced equiangularly; each wing has # 8-32 brass elastic stop nut with nylon insert staked thereto for mounting tail guard; 14-11/16" long, 2-1/8" diam., 1/16" thick wall; CWT Part/Dwg. No. FU-3243.	Main support of equipment.
29	N-101	N-101	N-200	GRID: Photosensitive slide N-201 exposed, developed and fixed; horizontal lines units of depth; vertical lines temperature units; CWT Part/Dwg. No. FP-6069.	Scale for reading slide trace.
30	0-104	0-104	0-200	HOLDER, SLIDE: Die cast aluminum anodized, dyed black; eccentric stop screw one end; moveable edge; flat beryllium copper spring to position and hold slide; 4 clearance holes for mounting on slide viewer, 2-1/8" long, 2-1/4" wide, 5/16" thick; opening in center 1-1/2" long, 7/8" wide, CWT Part Dwg. No. FU-2789.	Mounting for grid and holds slide for reading.
31				SLIDE, STABALLOY: Glass metallic coated, 1-3/4 lg., 1" wide, .045" thick, corners of one end beveled; Hytech Corporation.	Receives graph.
32	N-100	N-100	N-300	SLIDE: Glass, clear selected; 1-3/4" lg., 1" wide, 0.045" thick, corners of one end beveled 45° x 7/64" and 45° x 3/64"; one side coated with skunk oil and smoked; CWT Part/Dwg. No. FP-6072.	Receives graph.
33			N-301	SLIDE SET, SMOKED: Consists of molded plastic box, 50 slides, and telescoping cardboard set-up box for shipping. CWT Part/Dwg. No. FU-2832.	Receives graph.
34	H-102	N-102	N-302	VIEWER, SLIDE: Consists of metal housing, telescoping lens holder with set screw, lens; 2-3/32" long, 2" wide, 1-25/32" high; lens holder extendable to 1-7/8" high; four # 4-36 tapped holes on 1" x 1-11/16" mounting centers for mounting slide holder; CFD Catalog No. 680-1; CWT Part/Dwg. No. FU-2663.	Magnifies grid and slide for viewing.
35	H-104	H-104	H-300	JAR, CLEAR GLASS: One pint jar 2-7/8" diam. 3-9/16" high, 70 mm thread; metal screw cap with cardboard liner; CWT Part/Dwg. No. FU-2667.	Serves as mixing jar for dipping slides.
36	H-102	H-102	H-301	LACQUER: One half pint clear lacquer, #NL-28591, in can 4-3/4" high, 2-3/4" wide, 1-1/4" deep with sealed cover; CWT Part/Dwg. No. U-12457.	Preserves slides.

TABLE 8-2. TABLE OF REPLACEABLE PARTS (Continued)

REF. CODE	REF. DESIGNATION			NAME AND DESCRIPTION	LOCATING FUNCTION
	OC-1/S OC-2/S OC-3/S	OC-1A/S OC-2A/S OC-3A/S	OC-1C/S OC-2C/S OC-3C/S		
37	H-103	H-103	H-302	THINNER, LACQUER: One half pint lacquer thinner, #NV-791A for thinning lacquer #NL-28591; in can 4-3/4" high, 2-3/4" wide, 1-1/2" deep, with sealed cover; CWT Part/Dwg. No. U-12456.	Thin lacquer.
38	H-105	H-105	H-303	TONGS: Brass wire, nickle plated, 3/32" diam.; wound and bent to form spring and slide holder; CWT Part/Dwg. No. 5996; included for reference only.	Hold slides when lacquering.
39	M-106	M-106	M-300	THERMOMETER: General observation type, mercury filled, magnifying lens type stem; 5-1/2" long; range 20° F. to 100° F. in 1° graduations; accuracy ± 0.5° F.; in nickle plated brass protecting tube 6" lg. 5/16" diam. nickle plated brass outer carrying case, 3/8" diam., 6-3/8" long; CTI; CWT Part/Dwg. No. FU-3242.	Mounting for grid and holds slide for reading.

TABLE 8-3. LIST OF MANUFACTURERS

DESIGNATING SYMBOLS	NAME	ADDRESS
CWT	Wallace & Tiernan Inc. Wilcox, Crittenden Company	Belleville 9, New Jersey Middletown, Connecticut
CFD	Federal Mfg. & Engineering	199 Steuben Street Brooklyn, New York
CTI	Taylor Instrument Co.	Rochester, New York

TABLE 23. LIST OF MANUFACTURERS

ADDRESS	NAME	DESIGNATING SYMBOLS
Bellerose, N. Y. (New Jersey) Middlesex, Connecticut	Ballou & Tamm Inc. Vibcor, Crumwell Company	CVT CFD
100 Hudson Street Brooklyn, New York	Federal Mfg. & Engineering	CFD
Rochester, New York	Taylor Instrument Co.	CFI

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NOTE

This parts list has been corrected by means of the following supplementary tables. For any given item, always refer first to the appropriate supplementary table, since it completely supersedes any corresponding listing in the basic table. If no information is shown for a given item, refer to the basic table for the required information.

TABLE 8-2A. BATHYTHERMOGRAPHS OC-1D/S, OC-2D/S, OC-3D/S,
SUPPLEMENTARY PARTS LIST

REF. CODE	REF. DESIG.	NAME AND DESCRIPTION	LOCATING FUNCTION
		BATHYTHERMOGRAPH OC-1D/S: C/o a thermal element, pressure element, housing, automatic stylus lifter, nose piece, nose sleeve, and tail guard; used for obtaining a permanent graphical record of water temp against d as it is raised and lowered in the ocean; d range of 0 to 200 ft; 97188 part/dwg no. 2356-AY1-C.	
		BATHYTHERMOGRAPH OC-2D/S: C/o a thermal element, pressure element, housing, automatic stylus lifter, nose piece, nose sleeve, and tail guard; used for obtaining a permanent graphical record of water temp against d as it is raised and lowered in the ocean; d range of 0 to 450 ft; 97188 part/dwg no. 2356-AY2-C.	
		BATHYTHERMOGRAPH OC-3D/S: C/o a thermal element, pressure element, housing, manual stylus lifter, nose piece, nose sleeve, and tail guard; used for obtaining a permanent graphical record of water temp against d as it is raised and lowered in the ocean; d range of 0 to 900 ft; 97188 part/dwg no. 2356-AY3-C.	
2	H100	SCREW, MACHINE: Natural brass; finished; fillister hd; 0.374 in. max. dia, 1/4 in.-20 NCT, class 2 fit, 1/4 in. lg; 97188 part/dwg no. 2356-84-A.	Positions pressure element in body tube.
2	H101	Same as H100.	Positions thermal element in body tube.
3	H102	SCREW, ADJUSTMENT: Natural brass; no hd; screwdriver slot one end; 1/4 in.-20 NCT for entire lg, class 2 fit; 1-3/4 in. nom lg; 97188 part/dwg no. 2356-50-A (ref only).	In pressure element stop to prevent excess movement of that element.
4	H103	SHACKLE, SCREW PIN: Forged steel; galvanized; 1/4 in. dia stock; 1-1/8 in. o/a lg; 3/4 in. between jaws; 5/16 in. dia pin with eye one end; 79577 type 290; 97188 dwg no. 2356-BM1-A, part no. 137.	Connection between cable and shackle.
5	H104	STUD, TOWING: Brass rod, 1/4 in. dia; one end thd 1/4 in.-20 NCT, class 2 fit, 1/4 in. lg; other end slotted for screw driver; 13/16 in. lg; 97188 part/dwg no. 2356-48-A.	Connection between swivel and BT.
6	H105	SWIVEL, EYE AND EYE: (Link) forged steel; galvanized; 1/4 in. dia stock; 3-3/8 in. o/a lg; 3/4 in. inside dia of eye; 79577 type 676; 97188 dwg no. 2356-BM1-A, part no. 136.	Connection between shackle and towing stud.
7	M100	PRESSURE ELEMENT, BATHYTHERMOGRAPH: Consists of brass base, slide carrier, 3 brass bellows soldered together evacuated and sealed; contains calibration spring and piston; d range 0 to 200 ft; accuracy ± 2 ft; 2 in. dia, 9 in. lg; incl O106, O108, O114; 97188 part/dwg no. 2356-AY11-3 (part of OC-1D/S).	Measures depth.

TABLE 8-2A. BATHYTHERMOGRAPHS OC-1D/S, OC-2D/S, OC-3D/S,
 SUPPLEMENTARY PARTS LIST (Continued)

REF. CODE	REF. DESIG.	NAME AND DESCRIPTION	LOCATING FUNCTION
7	M101	PRESSURE ELEMENT, BATHYTHERMOGRAPH: Consists of brass base, slide carrier, 3 brass bellows soldered together evacuated and sealed; contains calibration spring and piston; d range 0 to 450 ft; accuracy ± 4.5 ft; 2 in. dia, 9 in. lg; incl O106, O108, O114; 97188 part/dwg. no. 2356-AY12-B (part of OC-2D/S).	Measures depth.
7	M102	PRESSURE ELEMENT, BATHYTHERMOGRAPH: Consists of brass base, slide carrier, spacer, 3 brass bellows soldered together evacuated and sealed; contains piston; calibration spring is exterior to bellows; d range 0 to 900 ft; accuracy 9 ft; 2 in. dia, 9 in. lg; 97188 part/dwg. no. 2356-AY13-B (part of OC-3D/S).	Measures depth.
8	M103	THERMAL UNIT ASSEMBLY: Consists of cast brass cylinder with 6 sheet brass fins soldered in equiangular position; M105 assemblies at one end with attached stylus and automatic stylus lifter; 3 in. dia, 12-41/64 in. lg; incl M105, O100, O101, O103, O104, O107, O109, O110, O113, O115, O117; 97188 part/dwg. no. 2356-AY20-C (part of OC-2D/S, OC-1D/B).	Measures temp.
8	M104	THERMAL UNIT ASSEMBLY: Consists of cast brass cylinder with 6 sheet brass fins soldered in equiangular position; M105 assemblies at one end with attached stylus and manual stylus lifter; 3 in. dia, 12-41/64 in. lg; incl M105, O101, O103, O104, O107, O110, O115, O117; 97188 part/dwg. no. 2356-AY19-C (part of OC-3D/S).	Measures temp.
9	M105	THERMAL ELEMENT, BATHYTHERMOGRAPH: Consists of beryllium copper bourdon tube with 40 to 50 ft xylene filled capillary tubing attached one end and bi-metal strip attached other end; 1-15/16 in. lg, 1-1/4 in. dia; capillary tubing 0.05 in. od, 0.015 in. id; temp range 28 deg F to 90 deg F; accuracy ± 0.1 deg F; 97188 part/dwg. no. 2356-65-B (part of M103, M104).	Measures temp.
10	O100	CATCH: High brass sheet, formed to special shape; 1-1/8 in. lg, 3/5 in. w, 3/8 in. h; 97188 part/dwg. no. 2356-25-A (part of M103).	Engages stylus lifter in automatic stylus lifter assy.
11	O101	CLAMP, THERMAL ELEMENT: Brass rod 23/32 in. lg, 3/16 in. w, 3/16 in. h; two no. 31 clearance holes 7/64 in. and 1/2 in. from one end; 97188 part/dwg. no. 2356-32-A (part of M103, M104).	Secures bourdon tube in system mounting.
12	O102	TAIL FIN ASSEMBLY: Housing consisting of 6 sheet brass guards spaced equiangularly, the rear end locked in a slotted brass hub, positioned and strengthened by 12 supports riveted to the guards thereby forming two bands around guard; no. 18 drill clearance hole in each guard; 5 in. dia, 10-3/8 in. lg; 97188 part/dwg. no. 2356-43-A.	Protects thermal element.
13	O103	STYLUS LIFTER: High brass sheet, formed to special shape; 2-3/16 in. lg, 1-7/16 in. w; 97188 part/dwg. no. 2356-22-A (part of M103, M104).	Lifts stylus from slide.
14	O104	SYSTEM AND TUBE SUPPORT ASSEMBLY: Consists of cast brass cylinder with conical end and internal boss, tubing support fin anchor rod, 6 sheet brass tubing support fins soldered in equiangular position; 2-7/8 in. dia, 8-13/16 in. lg; 97188 dwg. no. 2356-AY19 and 20-C, parts 29, 30 & 31 (part of M103, M104).	Mounting for bourdon tube and support for windings of capillary tubing.
15	O105	NOSE ASSEMBLY: Cast bronze, separate force fit towing pin; has 6 no. 18-32 tapped holes for assembly in equipment; 2-1/8 in. dia, 9-3/8 in. lg; one end turned to 2 in. dia for assembly in O118; 97188 part/dwg. no. 2356-46-A.	Diving weight.
16	O106	PLUNGER, RELEASE: Brass, dull nickle plated; one end tapped no. 6-32 1/2 in. deep; 11/16 in. lg, 3/16 in. w, 3/16 in. h; 97188 part/dwg. no. 2356-15-A (part of M100, M101).	Contacts and releases catch on automatic stylus lifter mechanism.
17	O107	POST, PEN LIFTER: Brass, 3/16 in. dia, 2-9/16 in. lg; one end turned to 0.124 in. max dia, 5/8 in. lg, knurl 1/4 in. lg, 3/8 in. from 0.124 in. dia end; no. 41 drill hole 1/4 in. from 3/16 in. dia end, no. 2-56 tapped hole 1 in. from same end; 97188 part/dwg. no. 2356-23-A (part of M103).	Mounting for stylus lifter.

TABLE 8-2A. BATHYTHERMOGRAPHS OC-1D/S, OC-2D/S, OC-3D/S,
SUPPLEMENTARY PARTS LIST (Continued)

REF. CODE	REF. DESIG.	NAME AND DESCRIPTION	LOCATING FUNCTION
17	O119	POST, PEN LIFTER: Brass, 3/16 in. sq, 2-9/16 in. lg, one end turned to 0.124 in. max dia, 5/8 in. lg, knurl 1/4 in. lg, 3/8 in. from 0.124 in. dia end; no. 41 drill hole 1/4 in. from 3/16 in. dia end, 97188 part/dwg no. 2356-75-A (part of M104).	Mounting for stylus lifter.
18	O108	RELEASE ROD: Brass, 3/16 in. sq, 1-3/8 in. lg; one end turned and thd no. 6-32 NCT, class 2 fit, 9/16 in. lg; no. 2-56 tapped holes 1/8 in. and 7/16 in. from end; 97188 part/dwg no. 2356-16-A.	Positions release plunger.
19	O109	SHAFT, CATCH: Brass, 1-7/8 in. lg, 3/16 in. dia; no. 42 clearance holes 3/32 in. from each end; 97188 part/dwg no. 2356-26-A (part of M103).	Mounting for catch.
20	O110	SHAFT, PEN LIFTER: Brass, 1-7/8 in. lg, 3/32 in. dia; one end knurled 5/32 in. lg; 97188 part/dwg no. 2356-27-A (part of M100, M101).	Mounting for stylus lifter.
21	O111	WINDOW COVER ASSEMBLY: Brass tubing; 4 in. lg; 2-1/8 in. inside dia, 1/32 in. wall; slit lengthwise and one end of slit notched; two lost motion straps riveted on to hold dia; 97188 part/dwg no. 2356-39-A.	Covers ports in body tube.
22	O112	NOSE WEIGHT: Cast bronze, slotted with 1 in. slot to fit over O105; two 1/4 in.-20 tapped holes 1-5/8 in. and 2-3/8 in. from one end with two 3/8 in. lg, 1/4 in.-20 FHBMS; 3-1/8 in. od, 2-5/32 in. id, 7-3/16 in. lg; 97188 part/dwg no. 2356-47-A.	Auxiliary diving weight.
23	O113	SPRING, CATCH: Phosphor bronze 1/32 in. dia; torsion type, 6 spaced coils 9/32 in. dia; hook terminals at right angles on opposite sides of coil on 7/8 in. mtg centers; 97188 part/dwg no. 2356-24-A (part of M103).	Energizes catch.
24	O115	SPRING, PEN LIFTER: Phosphor bronze, 0.032 in. dia; torsion type, 6 coils close wound 3/16 in. dia; hook terminal parallel on opposite sides of coil on 1-3/8 in. mtg centers; 97188 part/dwg no. 2356-28-A (part of M103, M104).	Actuates stylus lifter.
25	O114	SPRING, RELEASE: Beryllium copper, flat type; 2-1/8 in. lg, 7/16 in. w, 1/64 in. thk; four no. 43 clearance holes, two each end; 97188 part/dwg no. 2356-14-A (part of M100, M101).	Resilient mounting for release plunger.
26	O116	POINT: Transcript tone phonograph needle; jewel point; 1/8 in. lg; 97188 part/dwg no. 2356-34-A (part of O117).	Marks trace on slide.
27	O117	PEN AND POINT ASSEMBLY: Consists of beryllium copper arm with stylus O116 soldered at one end; 3-5/8 in. lg, 7/16 in. max w, 0.010 thk; 97188 part/dwg no. 2356-35-A (part of M103, M104).	Records trace on slide.
28	O118	HOUSING ASSEMBLY: Bronze tubing, 4 ports for access to slide and stylus lifter provided, holes provided for mtg M103 or M104, M100, M101 or M102; 3 high brass bi-winged brackets, 0.094 in. thk; silver soldered to one end; 6 wings are spaced equiangularly; each wing has no. 8-32 brass elastic stop nut with nylon insert staked thereto for mtg O102; 14-11/16 in. lg, 2-1/8 in. dia, 1/16 in. thk wall; 97288 part/dwg no. 2356-21-A.	Main support of equipment.
SLIDE HOLDER AND GRID			
29	N200	GRID, SLIDE: Photosensitive slide N201 exposed, developed and fixed; horizontal lines of d; vertical lines temp units; 97188 part/dwg no. 2356-BM1-A, part no. 133, 134, and 135.	Scale for reading slide trace.
30	O200	ADJUSTABLE GRID HOLDER: Die cast al anodized, dyed black; eccentric stop screw one end; movable edge; flat beryllium copper spring to position and hold slide; 4 clearance holes for mtg on N302; 2-1/8 in. lg, 2-1/4 in. w, 5/16 in. thk; opening in center 1-1/2 in. lg, 7/8 in. w; 97188 part/dwg no. 2356-55-B.	Mounting for grid and holds slide for reading.

TABLE 8-2A. BATHYTHERMOGRAPHS OC-1D/S, OC-2D/S, OC-3D/S,
 SUPPLEMENTARY PARTS LIST (Continued)

REF. CODE	REF. DESIG.	NAME AND DESCRIPTION	LOCATING FUNCTION
ACCESSORIES			
32	N300	SLIDE: Coated; (GFE)	Receives graph.
33	N301	SLIDE SET: Coated; (GFE) (for reference only).	
34	N302	VIEWER, GRID: Consists of Phenolic housing, telescoping lens holder with set screw, lens; 2-3/32 in. lg, 2 in. w. 1-25/32 in. h; lens holder extendable to 1-7/8 in. h; four no. 4-36 tapped holes on 1 in. x 1-11/16 in. mtg centers for mtg O200; 97188 part/dwg no. 2356-141-B.	Magnifies grid and slide for viewing.
38	H303	TONGS: Brass wire, nickle plated, 3/32 in. dia; wound and bent to form spring and slide holder; 97188 dwg no. 2356-BM1-A, part no. 143 (for ref only).	Hold slides when lacquering.
39	M300	THERMOMETER: General observation type, mercury filled, magnifying lens type stem; 5-1/2 in. lg; range 20 deg F to 100 deg F in 1 deg graduations; accuracy ± 0.5 deg F; in nickle plated brass protecting tube 6 in. lg, 5/16 in. dia; nickle plated brass outer carrying case, 3/8 in. dia, 6-3/8 in. lg; 64467 part no. 488-8; 97188 dwg no. 2356-BM1-A, part no. 142.	For taking temp of bucket sample.

TABLE 8-3A. BATHYTHERMOGRAPHS OC-1D/S, OC-2D/S, OC-3D/S,
 LIST OF MANUFACTURERS

CODE NO.	NAME	ADDRESS
97188	Dittmore-Freimuth Corp.	Milwaukee, Wis.
64467	Weksler Thermometer Corp.	New York, N.Y.
79577	Wilcox-Crittenden & Co., Inc.	Middletown, Conn.