WHOI-90-40

Copy 2

Woods Hole Oceanographic Institution

CTD Electromechanical Termination Users Manual

by

H.O. Berteaux, S. Kery, P. O'Malley

August 1990

Funding was provided by the National Science Foundation
through Grant No. OCE 8821977.

WHOI 90-40

CTD Electromechanical Termination Users Manual

by

H.O. Berteaux, S. Kery, P. O'Malley

Woods Hole Oceanographic Institution
Woods Hole, Massachusetts 02543

August 1990

Technical Report

Funding was provided by the National Science Foundation
through Grant No. OCE 8821977.

Approved for Distribution:

Albert J. Williams 3rd

Albert J. Williams 3rd, Chairman

Department of Applied Ocean Physics
and Engineering

Acknowledgments

The electromechanical termination presented in this report has been designed by H.O. Berteaux and S. Kery, Ocean Systems & Moorings Laboratory, Applied Ocean Physics and Engineering Department, Woods Hole Oceanographic Institution, Woods Hole, MA. P. O'Malley greatly contributed to the assembly and maintenance procedure hereafter presented. The CAD drawings were made by R. Arthur.

This work was accomplished as part of the Water Sampler project sponsored by NSF under contract number OCE8821977.

Table of Contents

Abstract

This report describes a new, easy to install, reliable electromechanical cable termination to mechanically attach and electrically, connect cable lowered instrument packages to their lowering cable.

1.0 **INTRODUCTION:**

1.1 Design Objectives: Provide means to mechanically attach and electrically connect oceanographic cable lowered packages, such as the NSF Water Sampler (Figure #1), or a standard CTD rosette (Figure #2), to the .322 inch CTD electromechanical cable (Figure #3), presently used by vessels of the UNOLS fleet.

The electromechanical termination had to be easy to install at sea, without special tools or epoxy. It should be safe, reliable, and allow for rapid mechanical attachment and simple electrical connection. Holding power had to be greater than the cable breaking strength.

1:2 General Description:

The general configuration of the termination is shown in Figure #4. The termination is attached to the package to be lowered by a clevis and pin arrangement. This facilitates the use of the same termination on different types of packages.

The mechanical strength of the electromechanical (E/M) cable is transferred to the termination backshell through dual cones that grip the two armor wire layers. The strength is transferred from the backshell to the clevis through a robust 2 inch 12 thread per inch, threaded connection.

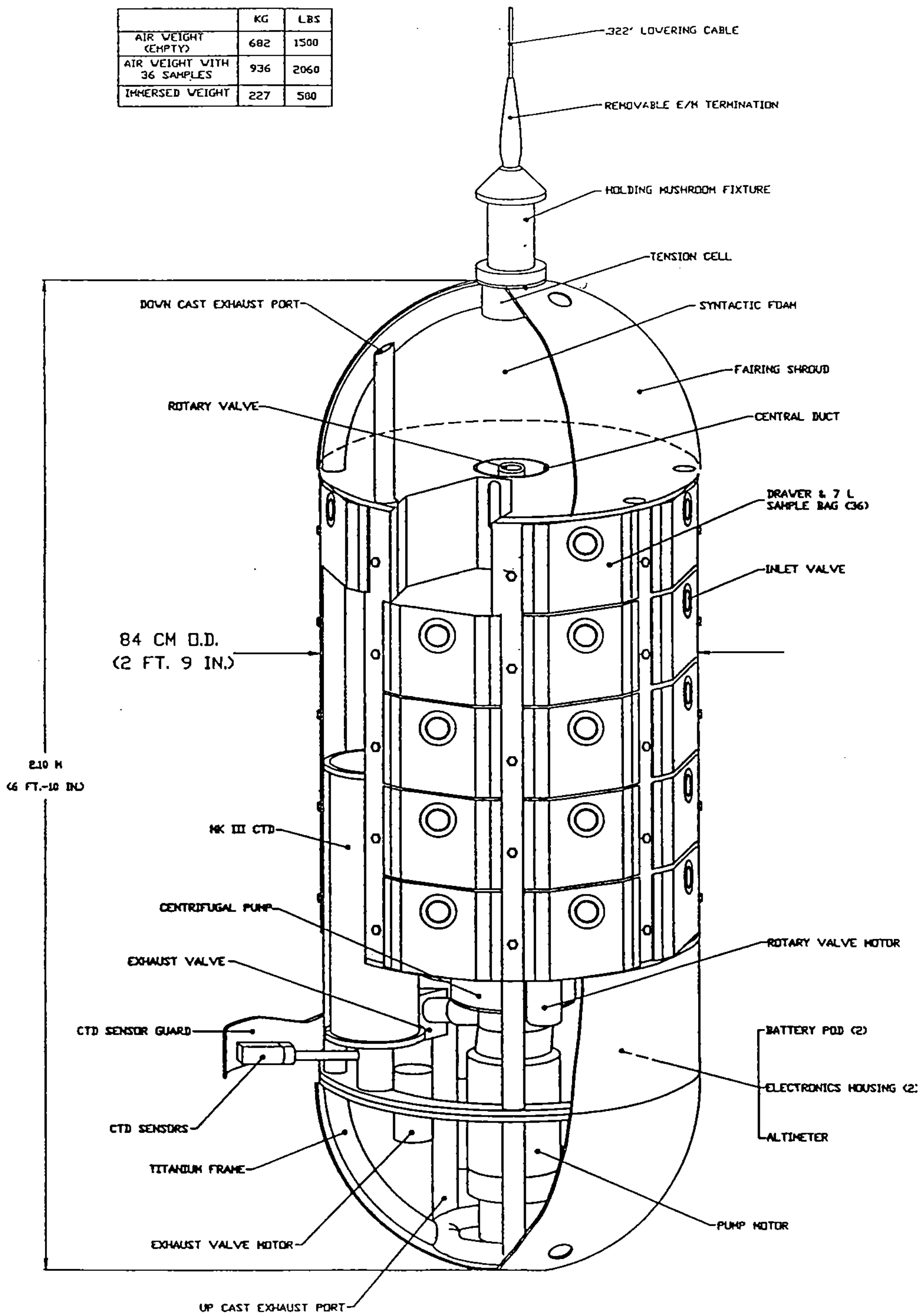
The E/M termination has been designed to meet the following specifications:

Safe working load in tension, 12,000 lbs. which exceeds the rated breaking strength of the cable (11,600 lbs).

Pressure: All electrical parts are rated for a working pressure of 10000 psi (6000 meters).

TABLE OF WEIGHTS

	KG	LBS
AIR WEIGHT (EMPTY)	682	1500
AIR WEIGHT WITH 36 SAMPLES	936	2060
IMMERSED WEIGHT	227	500



WOCE INTEGRATED
SEAWATER SAMPLER
1989-1990

Figure #1: NSF Water Sampler

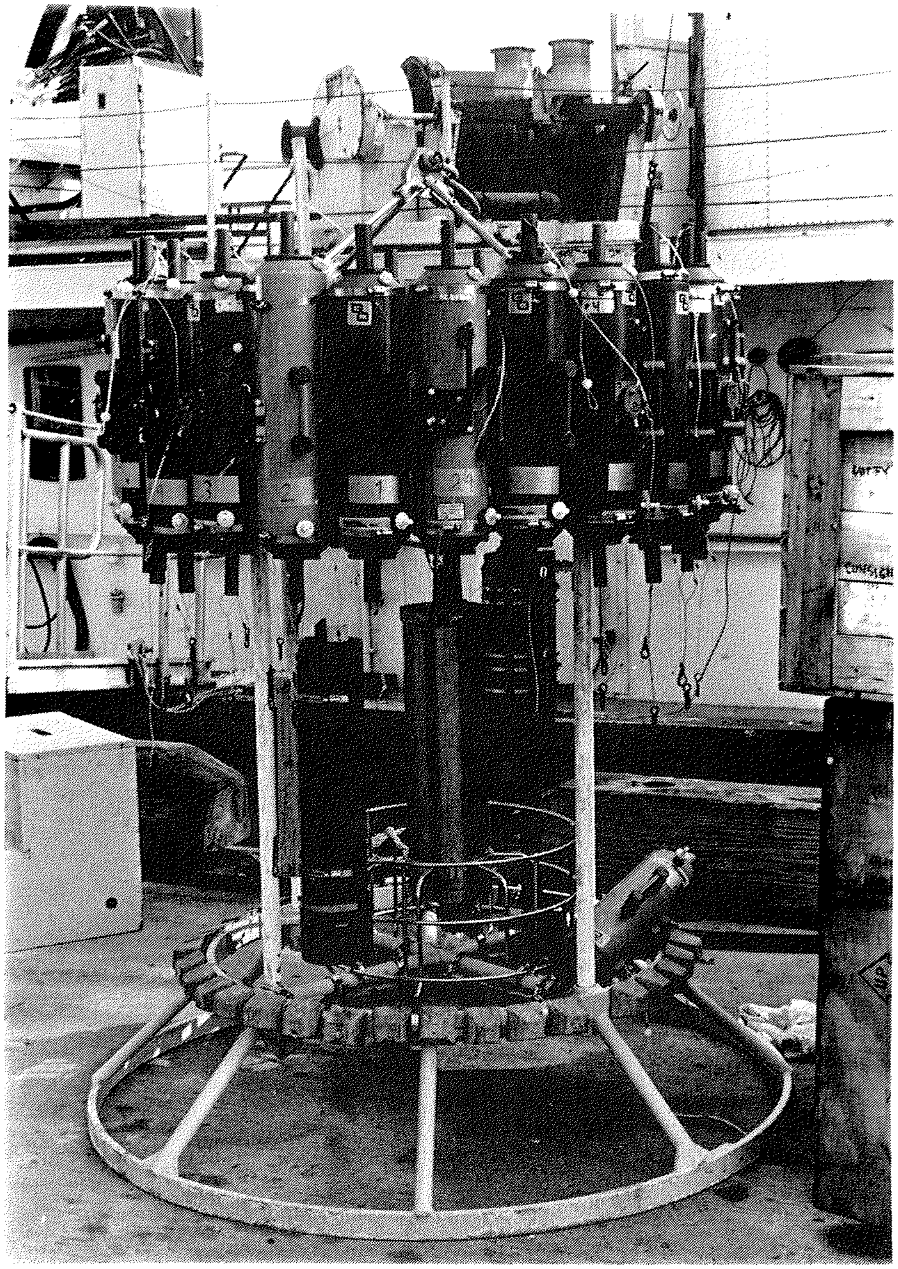


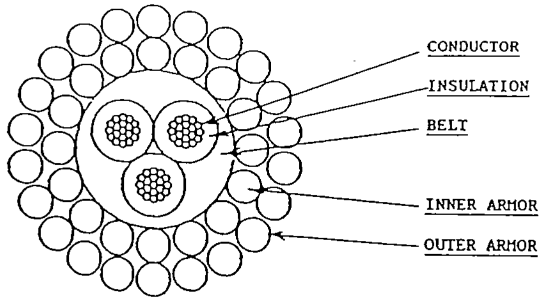
Figure #2: Typical rosette water sampler.

the ROCHESTER corporation

DATALINE

POST OFFICE BOX 312
CULPEPER, VIRGINIA 22701 U.S.A.

TELEPHONE 703/825-2111
TWX 710-839-3439



CONDUCTORS - 3

Ø19 AWG 19/.008" Bare Copper	.039"

INSULATION - 3

.016" Wall Polypropylene Colors: 2 Natural, 1 Black	.071"

CABLED

3 conductors, no fillers	.153"

BELT:

.015" Wall HDPE	.183"

INNER ARMOR

16/.0375" SGXXIPS	.247"

OUTER ARMOR

22/.0375" SGXXIPS	.322"

NOTE: Sequential marker tape in meters included in cable.

CABLE CHARACTERISTICS	**METRIC**	**ENGLISH**
(Nominal Values @ 20°C)		
PHYSICAL		
Wt. in Air		**174 lb/kft**
Wt. in Seawater		**141 lb/kft**
Overall Diameter		**.322" ±.004"**
MECHANICAL		
Breaking Strength		**≥ 11,600 lbf**
Maximum Working Load		**≤ 5,000 lbf**
Recommended Bend Radius		**6 in**
Torque, Rotation, and Elongation (See Attached Printouts and Graphs)		
ELECTRICAL		
Voltage Rating		**600 volts**
Insulation Resistance		**≥ 10,000 MΩ/kft**
dc Resistance		
cdr		**≤ 9.4 Ω/kft**
armor		**2.4 Ω/kft**
Capacitance (cdr-armor)		**35 pF/ft**

the ROCHESTER corporation P.O. BOX 312 CULPEPER, VIRGINIA 22701	TITLE: 3-CONDUCTOR CABLE CODE: I 3 Ø Ø 3 Ø 1 5 2 P 0 Ø Ø		
DATE 05/05/86	SHEET 1	REVISION	NUMBER 01592

TRC 206-3

Figure #3: .322 inch CTD Electromechanical Cable.

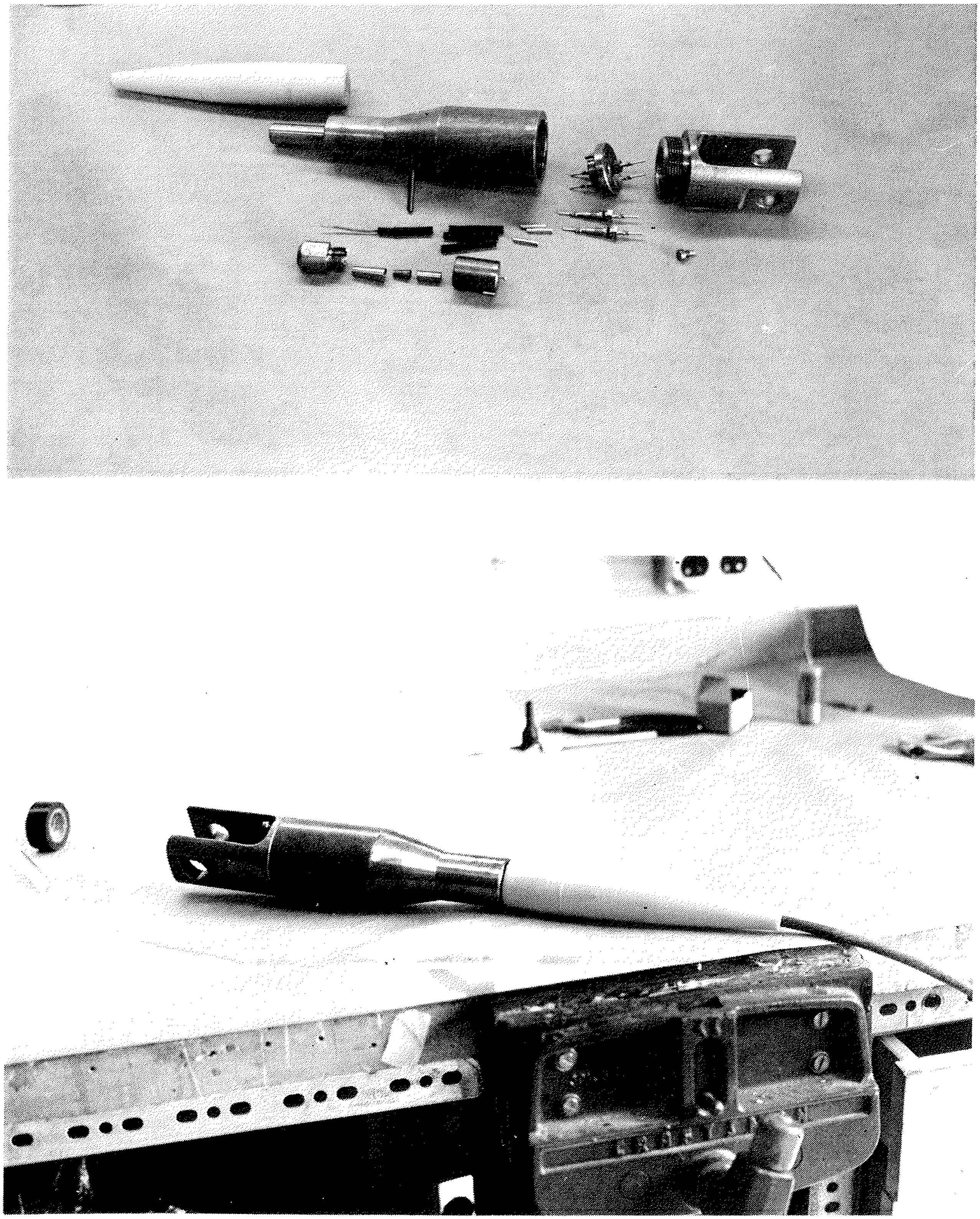


Figure #4: General configuration before and after assembly.

2.0 **MECHANICAL ASSEMBLY: PHASE 1.**

The following describes, step by step, the procedure to mechanically attach the termination to the electromechanical cable.

Step 1. Cut the end of the cable to be terminated cleanly. This is best done with an abrasive blade. Note: It is advisable at this time to check the continuity of the conductor wires through the entire cable, all the way to the ship's lab before the termination procedure is begun. If a broken conductor exists, it will not be necessary to cut the termination off to isolate the problem later.

Step 2. Insert the end of the cable into the end of the bending strain relief boot (Part #1)*, and force about (2) feet of cable through the boot. (Figure #5)

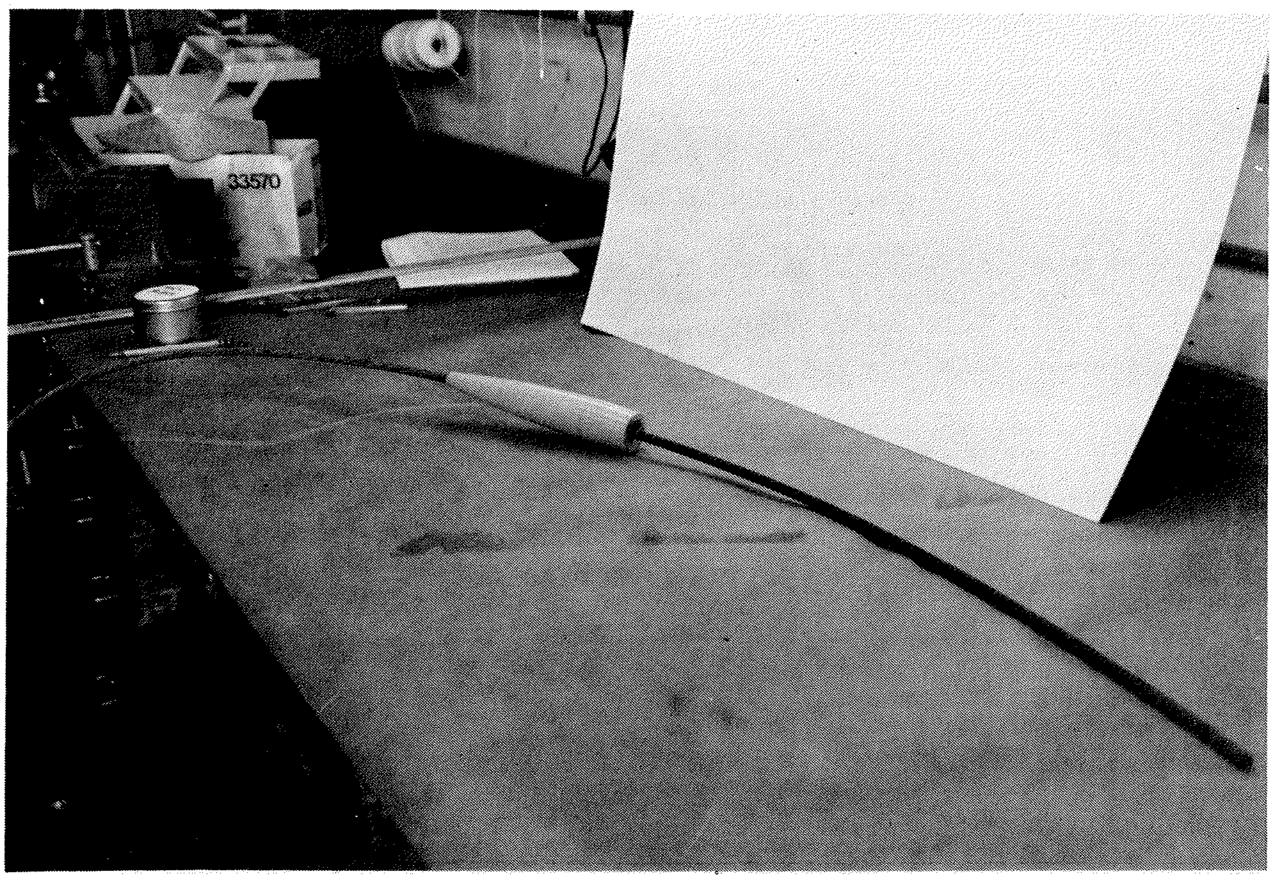


Figure #5: Cable with bending strain relief boot in place.

*"Part" refers to spare part, see list page 36.

Step 3. Slide the connector backshell (Part #2), down the cable until it rests against the boot. Figure #6.

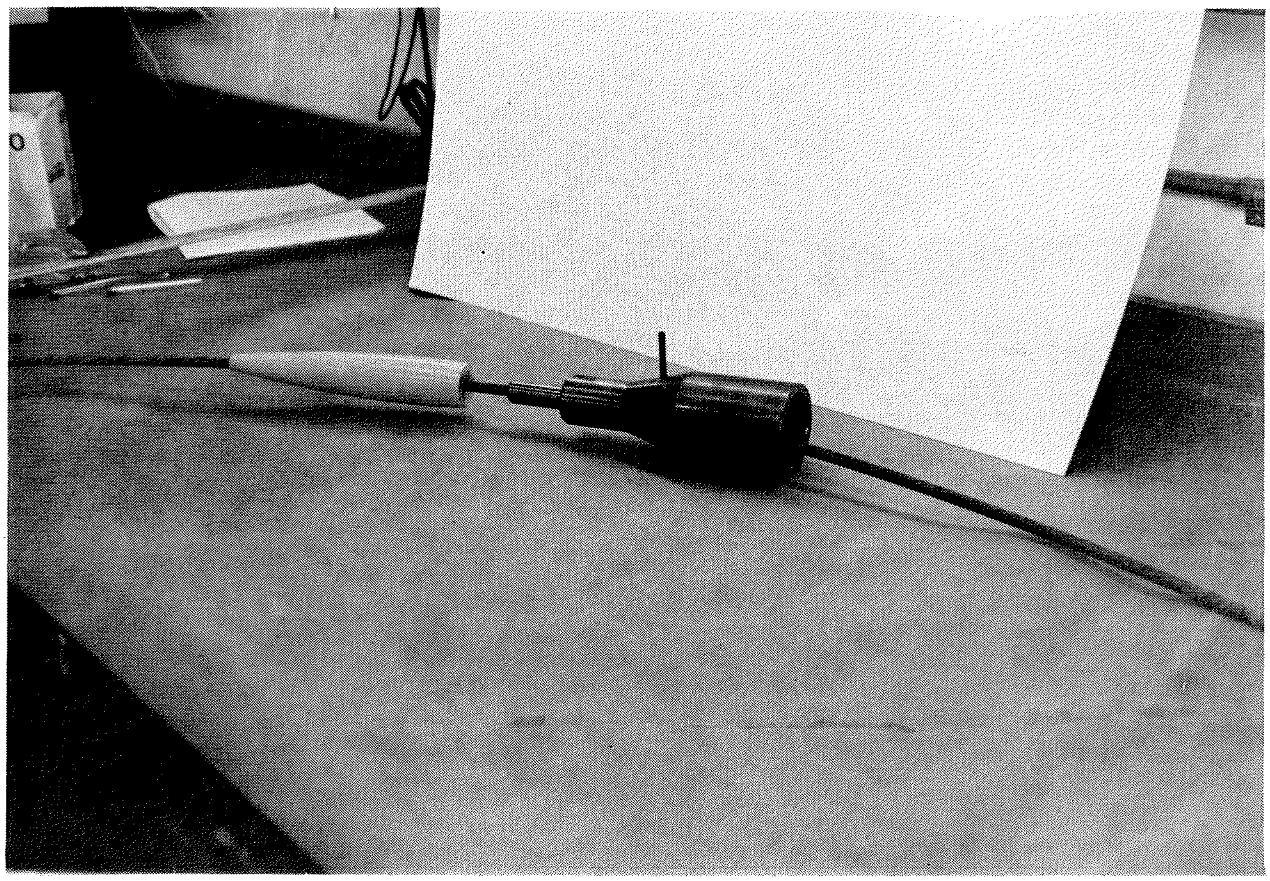


Figure #6: Connector backshell and boot on cable.

Step 4. Clamp the cable in a vise using the assembly blocks (Part #3), (10) inches from the end of the cable. The backshell and boot can rest on the floor.

Step 5. Slip the lower half of the cone retainer (Part #4) over the cable until it rests on the assembly blocks. Figure #7.

Figure #7: Assembly blocks clamp cable in vise. Cone retainer in place.

Step 6. Wrap 1-1/2 turns of 3/4" Scotch 88 tape about 1 inch above the cone retainer. Figure #8.

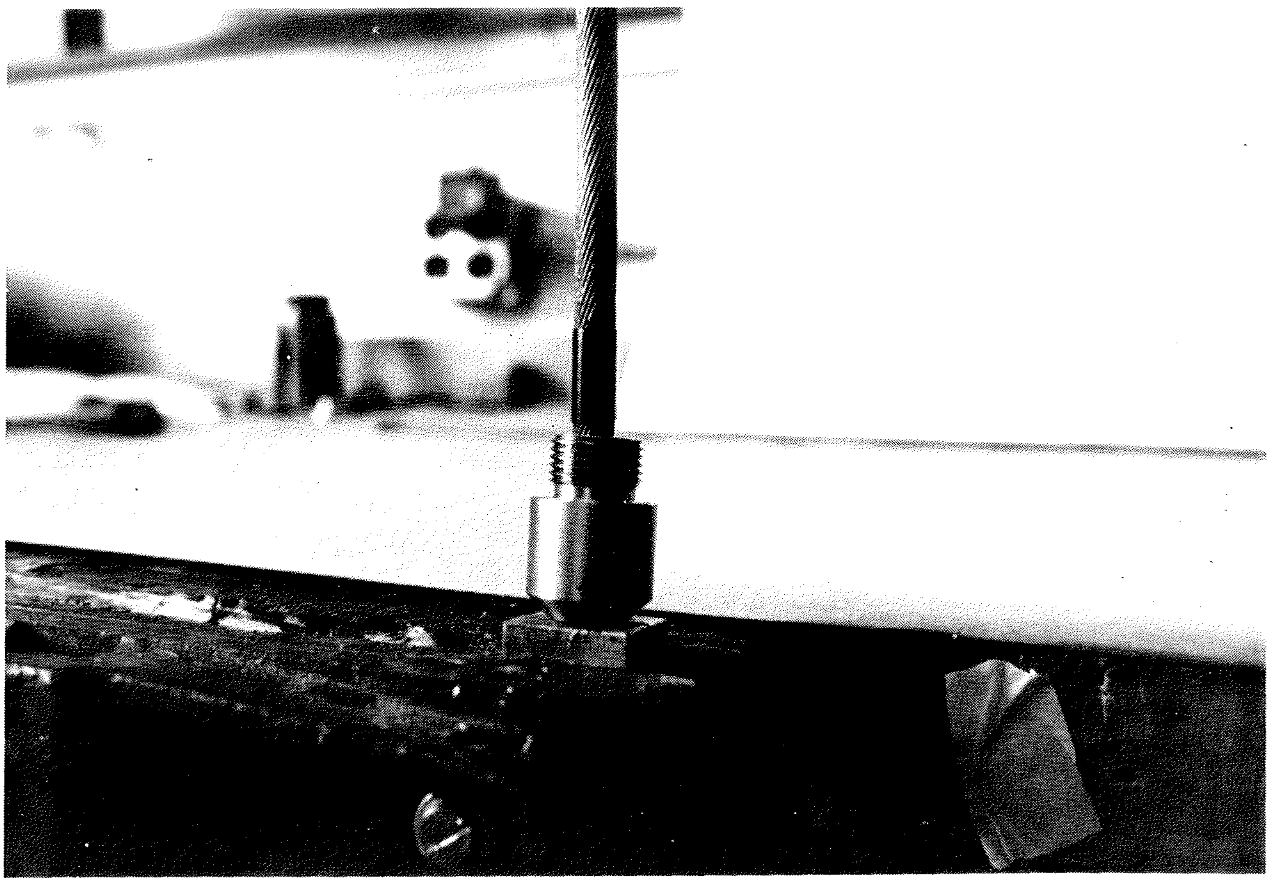


Figure #8: Tape on cable.

Step 7. Carefully unlay the outer armor wires down to the tape. Figure #9.

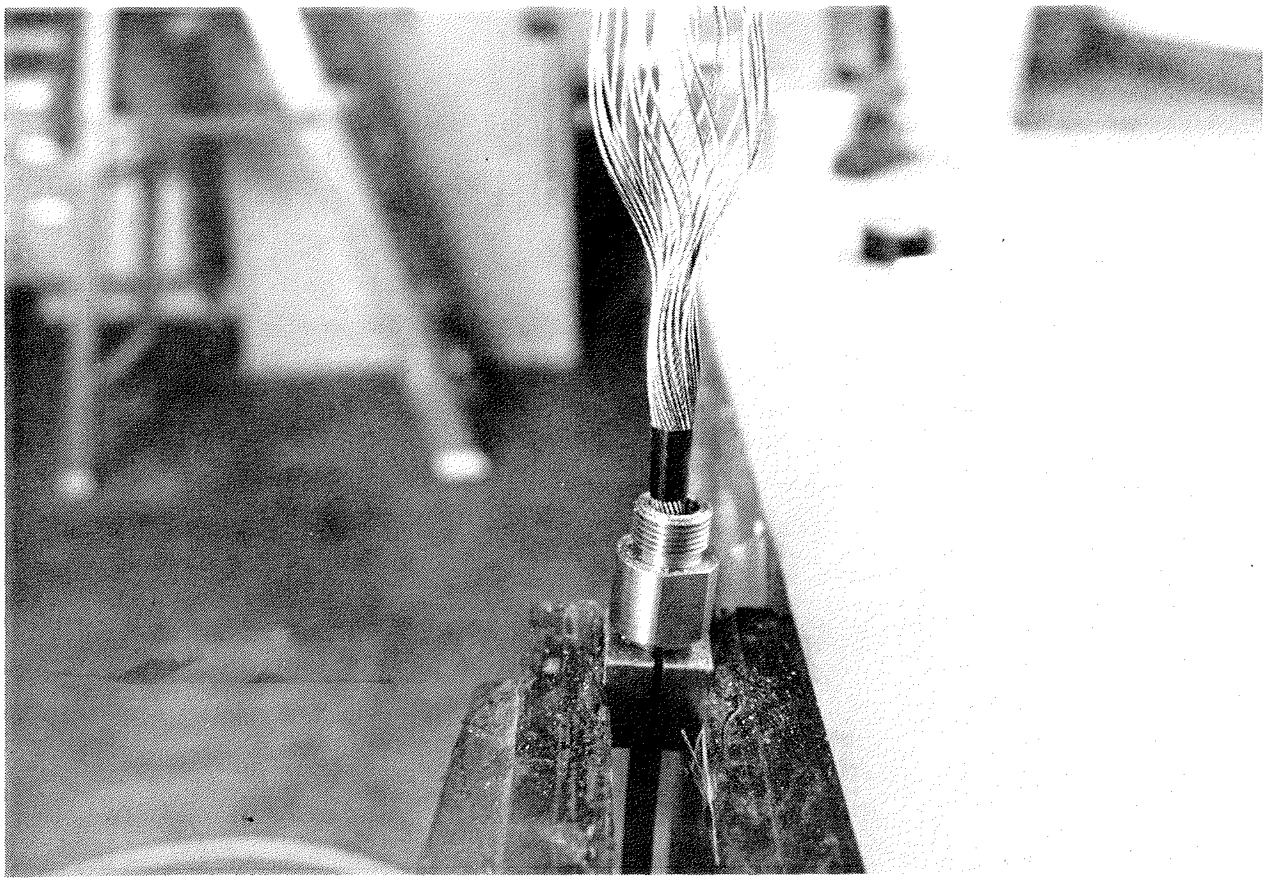
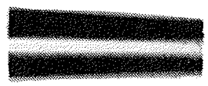
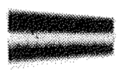


Figure #9: Outer armor wires unlayed down to tape.

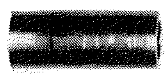
Step 8. Slide the larger of the two cones. (Figure #10, Part #5), over the inner armor, down to the tape (Figure #11).



part #5
Large Cone



part #6
Small Cone



part #7
Straight Tube

Figure #10

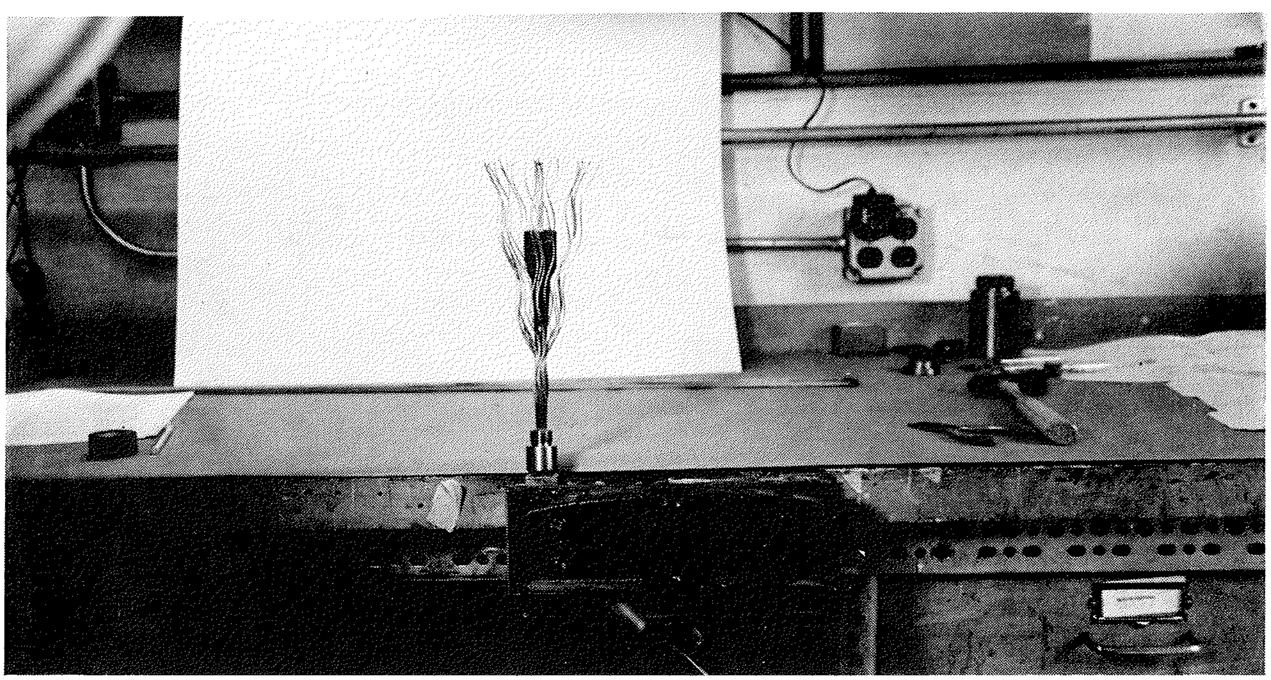


Figure #11

Step 9. Slide the large plug driver, (Figure #12, Part #8), over the inner armor and drive the cone down until it seats firmly by striking the plug driver with a hammer.
When the plug is properly seated, it will protrude, (1/16th) of an inch above the top of the lower cone retainer (Figure #13).

part #8
Large Cone Driver

part #9
Small Cone Driver

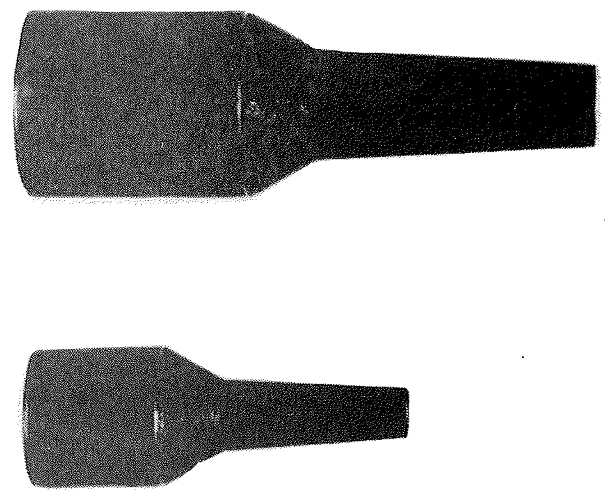


Figure #12

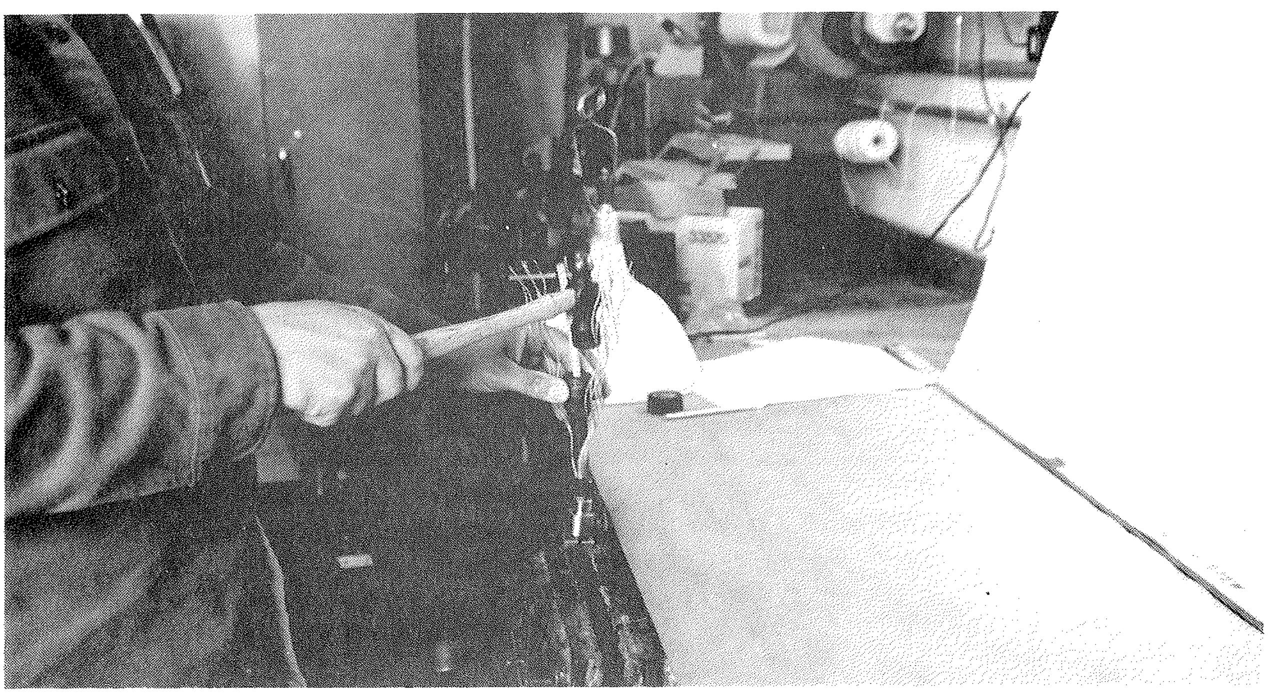
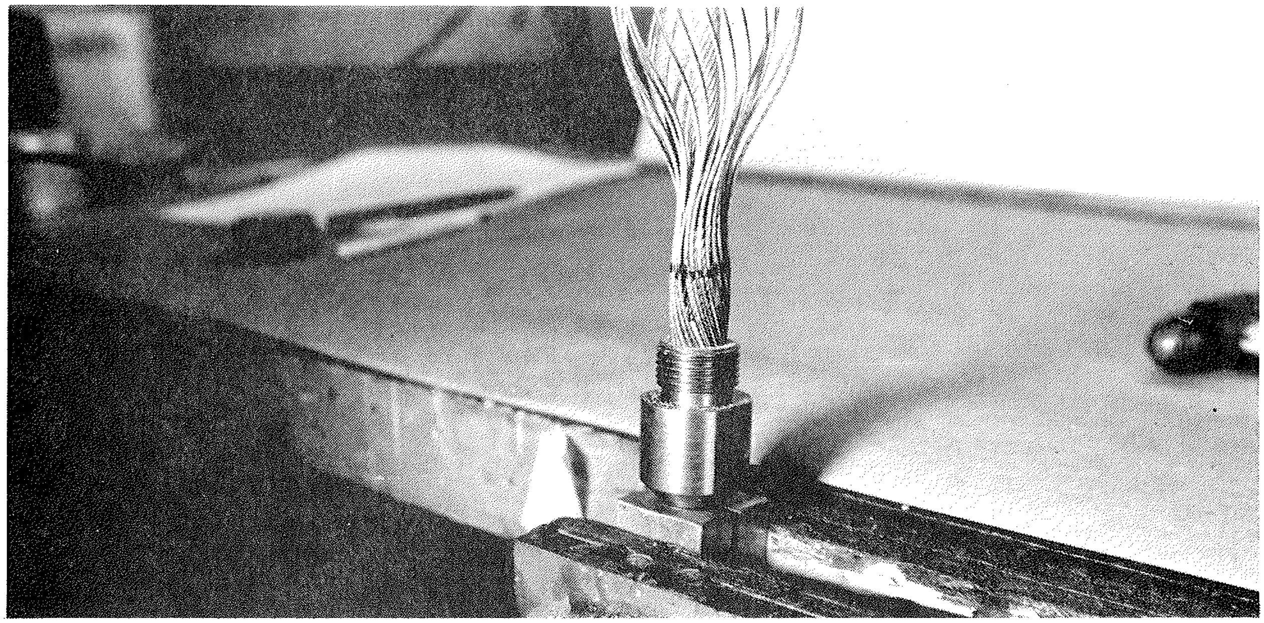


Figure #13

Step 10. Carefully mark the outer armor wires at 5/8ths of an inch from the top of the cone retainer. Now clip the wires off at this mark. This length will allow the wires to pull down and seat properly when under tension. Figures #14 and #15.



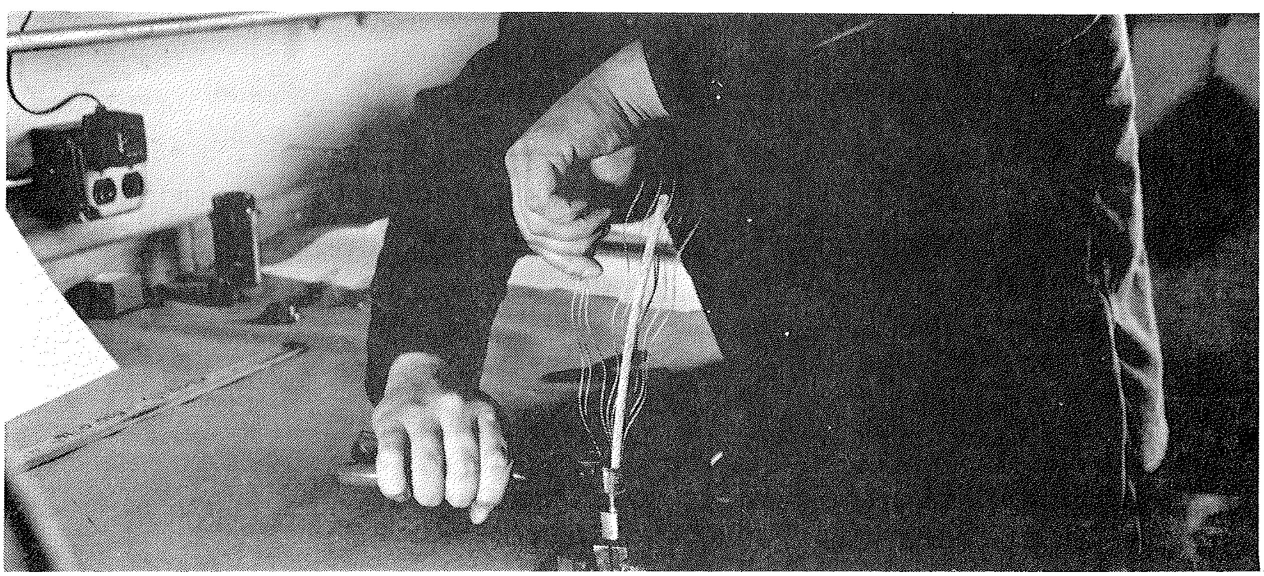


Figure #14 and Figure #15: Clip wires with Felco C-7 wire cutters or equivalent.

Step 11. Wrap tape around inner armor as before and unlay down to the tape. Figure #16.

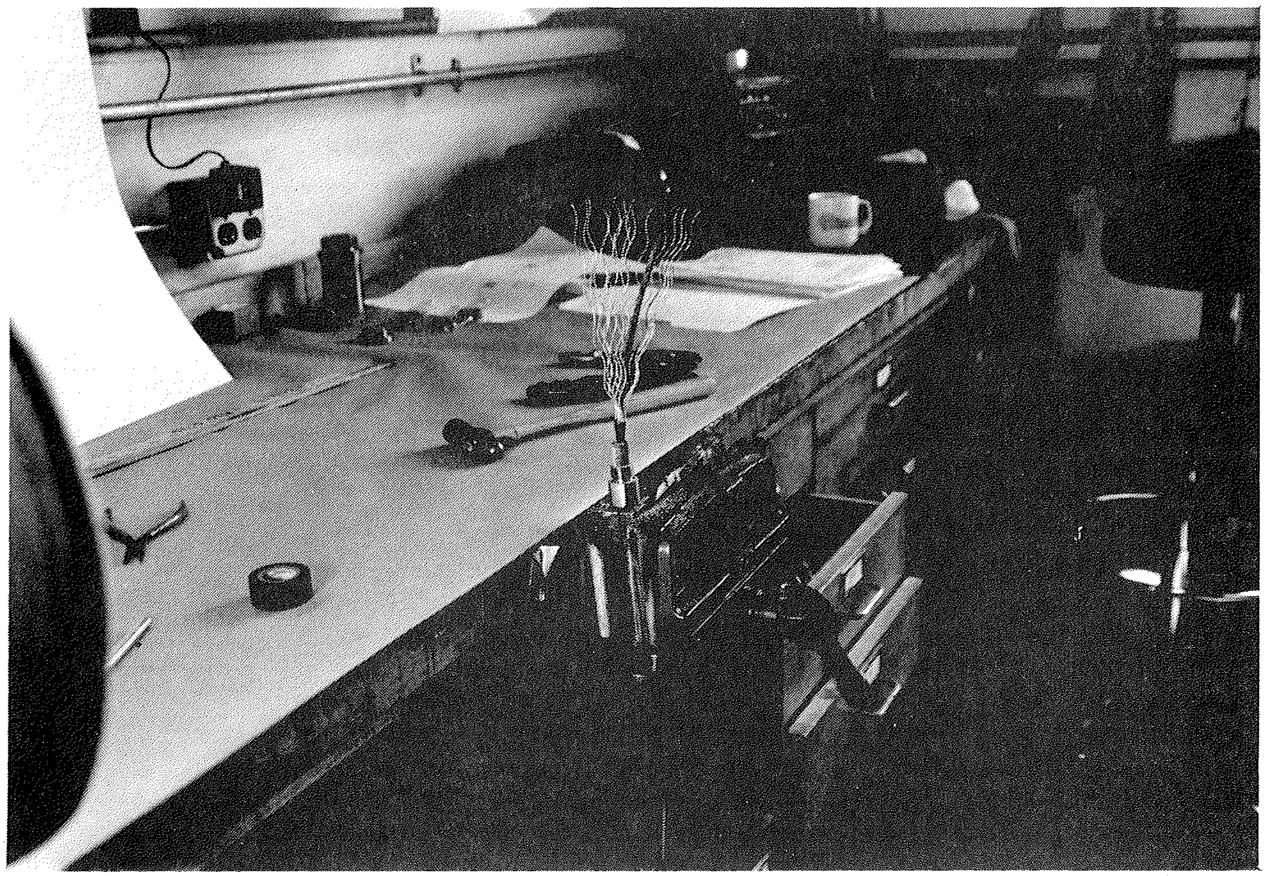


Figure #16

Step 12. Slide the smaller cone (Figure #10, Part #6), down over the conductor core and drive to a firm seat with the smaller plug driver, (Figure #12, Part #9). NOTE: Be careful to keep the plug driver straight at all times or the cone or plug driver may damage the plastic core jacket. Figure #17.

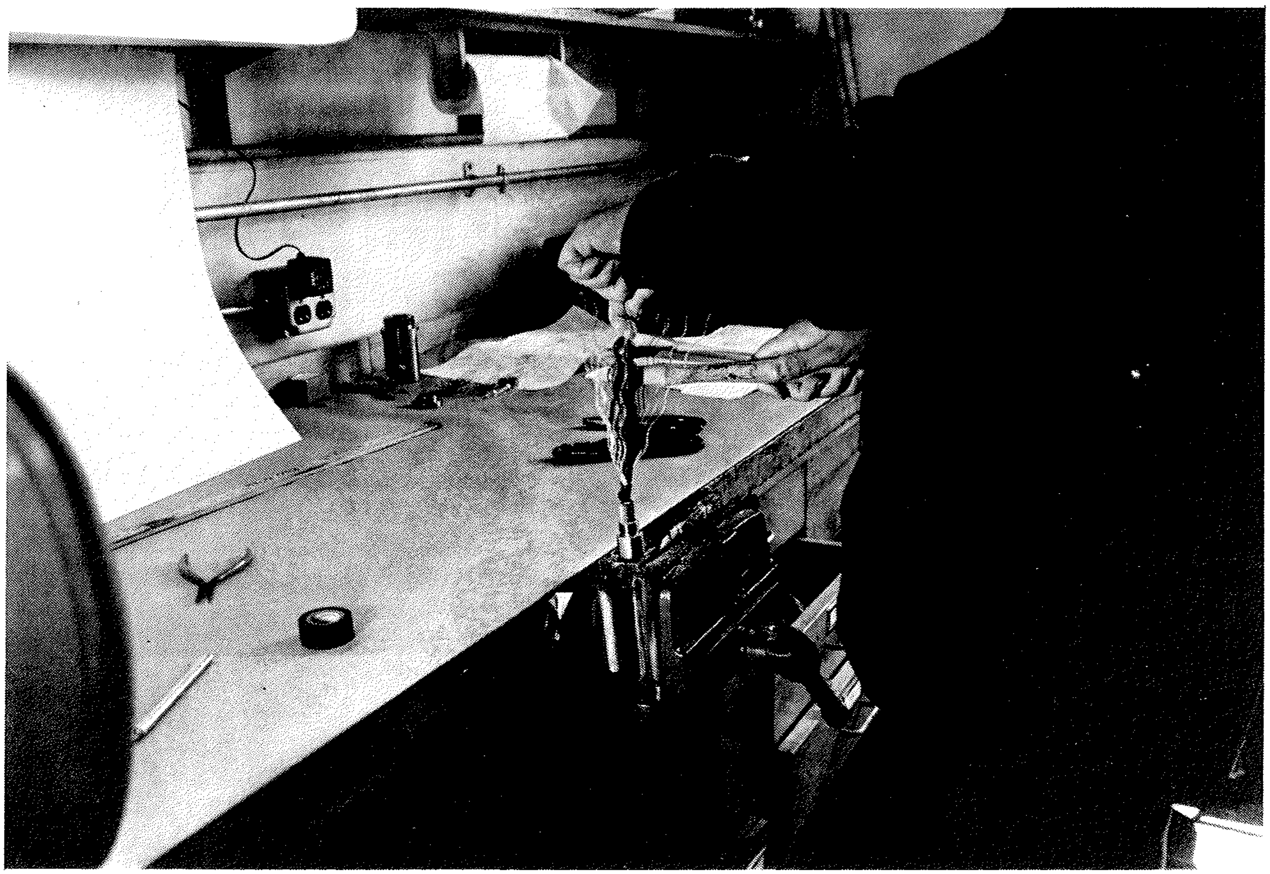


Figure #17: Drive small cone until it seats.

Step 13. Carefully clip the inner armor wires, even with the ends of the outer armor wires. Figure #18.

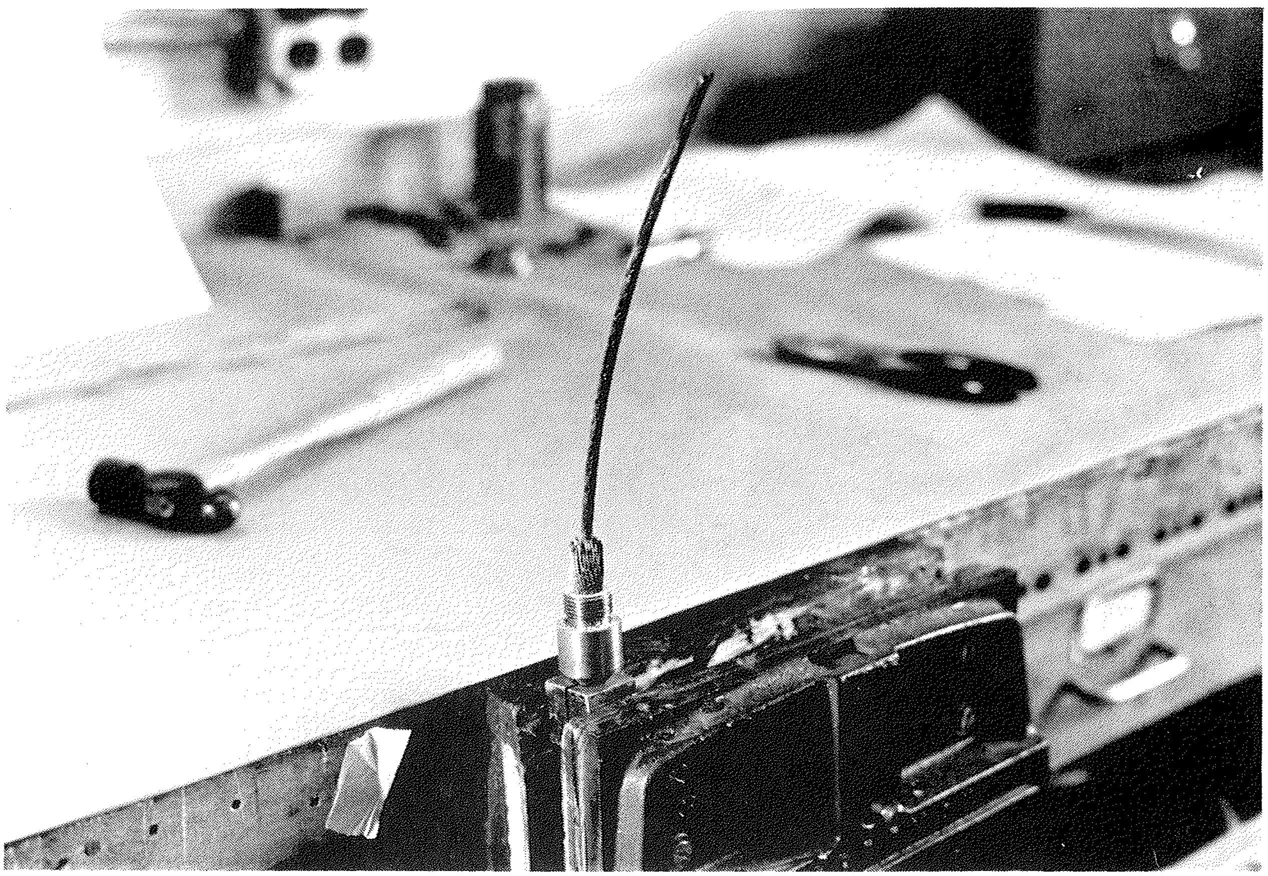


Figure #18: Armor wires clipped to proper length.

Step 14. Inspect the conductor core for damage. If the core is cut such that the insulation of the conductor wires is visible, it will be necessary to start over at step 1. Slide the straight steel tube (Figure #10, Part #7) over the conductor core down to the top of the inner cone. This tube is to protect the conductors from being cut by the armor wires when the upper half of the cone fitting is screwed on. Figure #19.

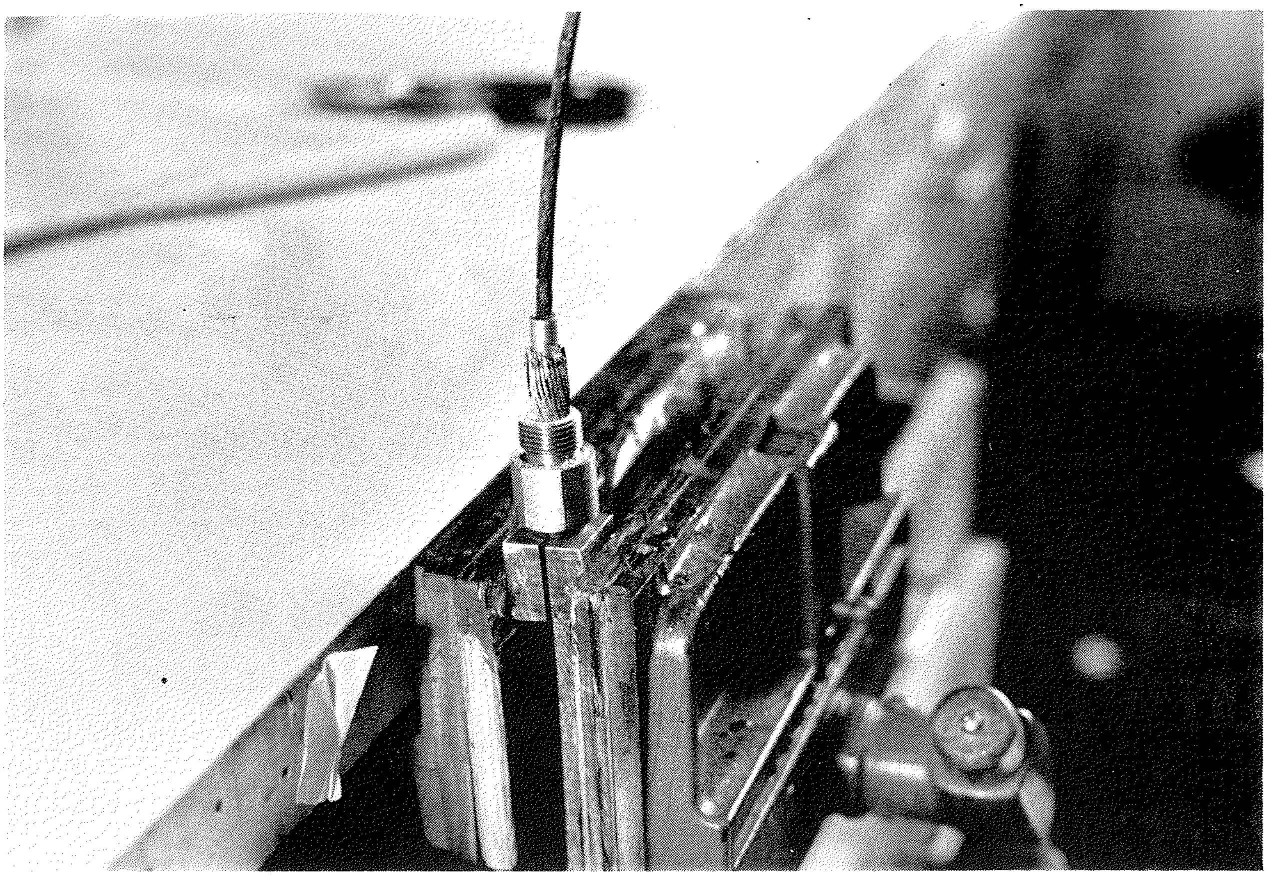


Figure #19: Steel tube in place.

Step 15. Remove the cable from the assembly blocks and hold the lower cone retainer firmly in vise.

Step 16. Screw the upper half of the cone of the cone retainer, (Part #10), firmly down on the lower half.
NOTE: The upper and lower halves of the retainer must be screwed down until no gap is left between them. The wrench flats on the two halves may not line up. Figure #20.

The first phase of the mechanical assembly is now complete. The electrical assembly follows. The second phase of the mechanical assembly completes the termination procedure.

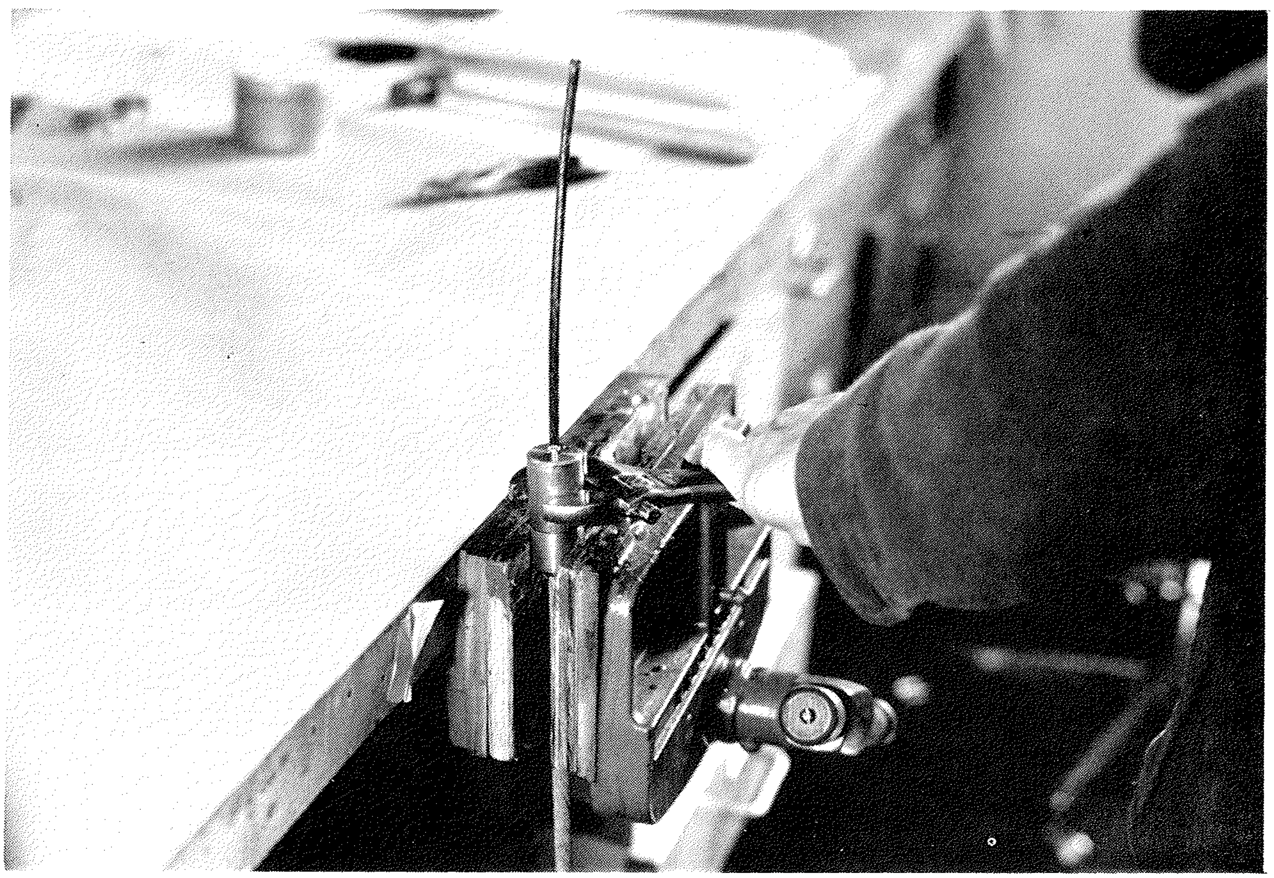


Figure #20: Tighten upper retainer half part #10 firmly onto lower half.

3.0 **ELECTRICAL ASSEMBLY: Phase II**

This section describes how the electrical conductors of the cable are connected to the pins of the E/M termination.

Step 17. The HDPE core jacket must now be stripped off down to within 1/4" of the cone retainer. Heat the jacket with a heat gun to soften it, then very carefully peel off the core jacket using pliers as shown in Figure #21. Be careful not to heat or damage the jackets of the individual conductor wires.

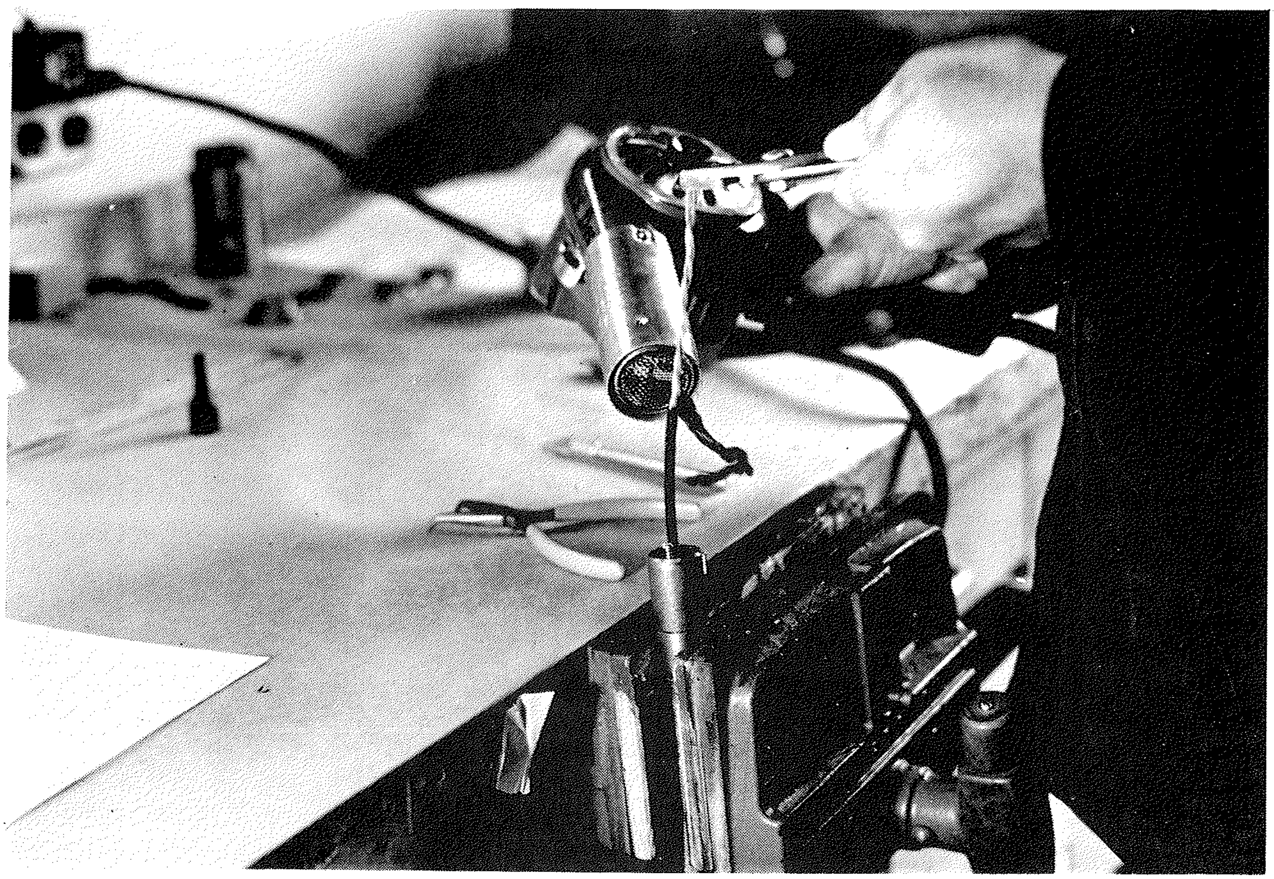


Figure #21

Step 18. To facilitate the installation of the Kemlon boots (Part #11), strip the insulation from 2-1/2 inches from the end of each of the conductor wires. Figure #22.

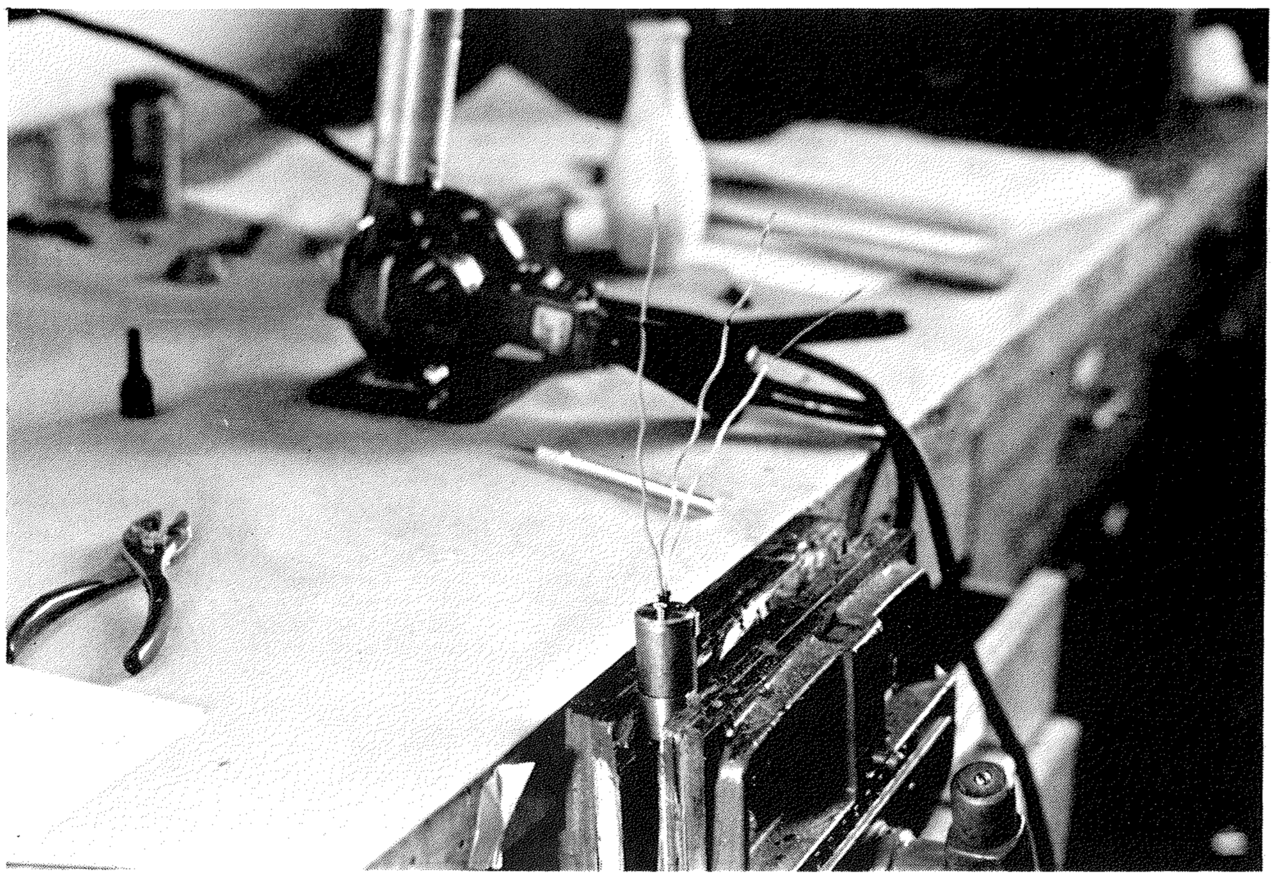


Figure #22

Step 19. Slip one Kemlon boot, (Part #11), small end first, over each of the three conductor wires. The stripped portion should protrude from the large end of the boot. Lightly lubricate the conductor insulation jackets with alcohol. Hold the stripped end of the conductor, where it protrudes from the boot with pliers. Grip the boot with the other hand and slide it down over the insulation jacket until it is within a half inch of the cone retainer. Figure #23.

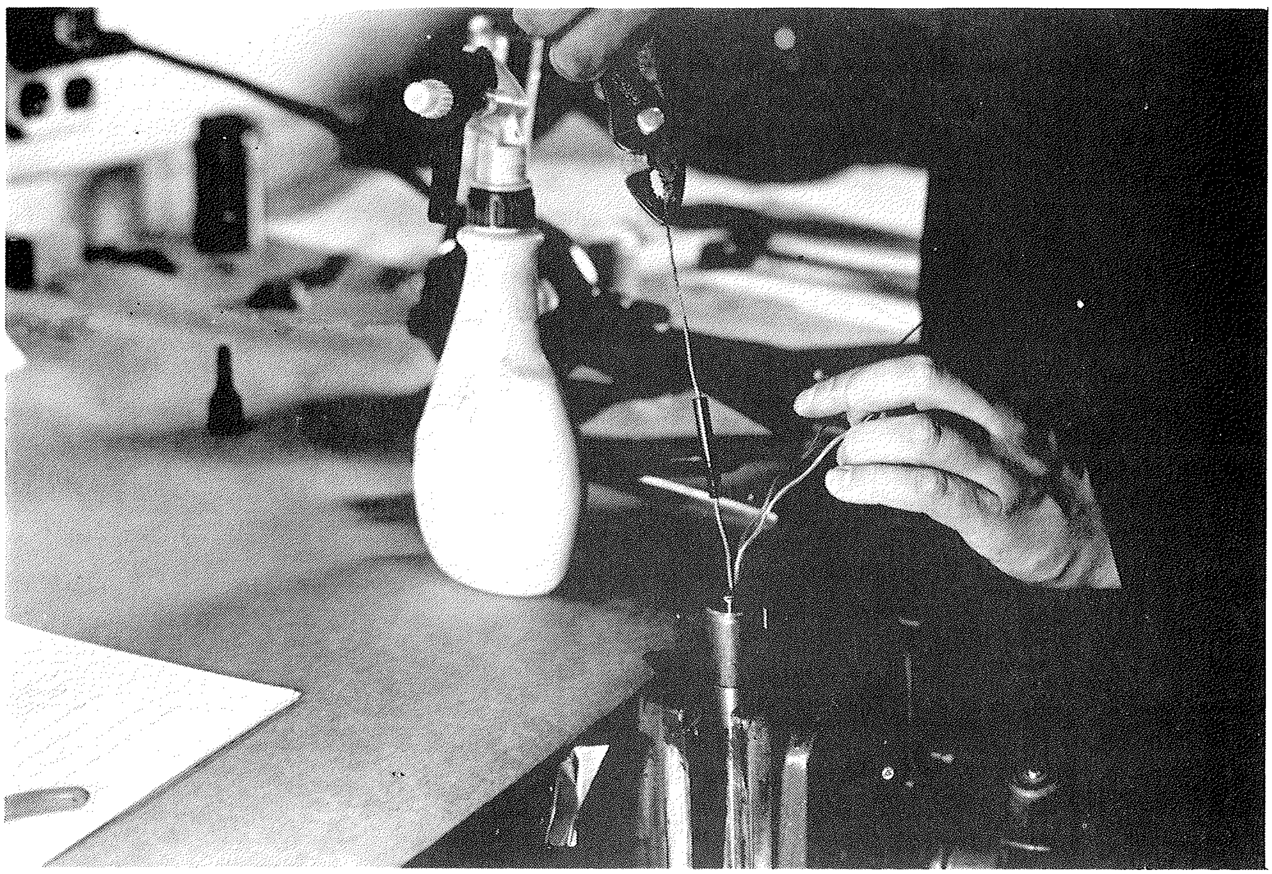


Figure #23

Step 20. Cut the three conductors off 6 inches from the top of the cone retainer.

Step 21. Strip the end of each of the conductors for 1/4 of an inch from the end.

Step 22. Now solder a Kemlon pin, (Part #12), to the end of each conductor. Figure #24.

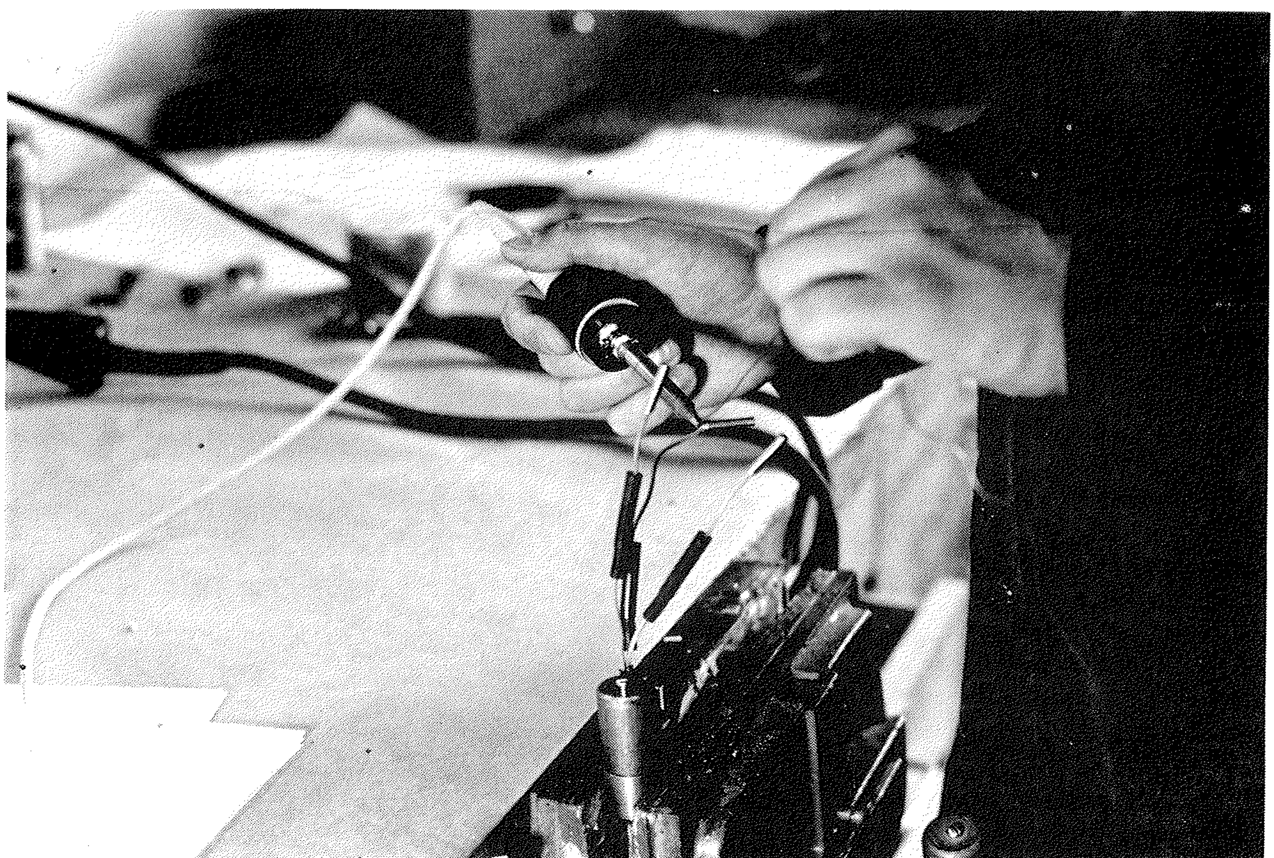


Figure #24

Step 23. Slip the boot back up over each pin until you feel it click into place. Figure #25.

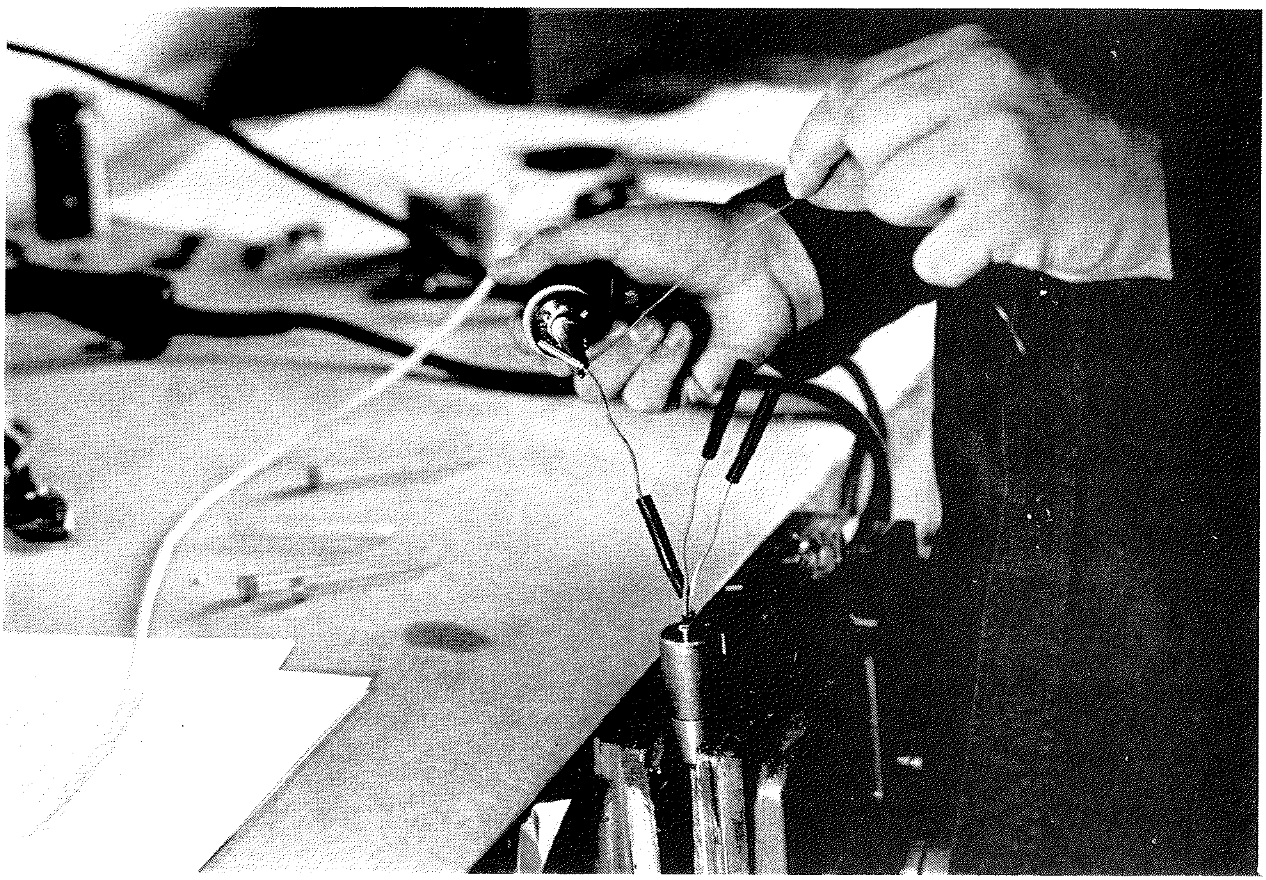


Figure #25

In cases where sea water grounding is desired, proceed with steps 24 and 25 as follows:

Step 24. Cut an additional 6 inches of identical conductor. Following steps 18, 19, 20 & 21 put a Kemlon connector assembly on one end. Strip the jacket on the other end back for 1/2 inch and crimp on a fork style terminal, (Part #13).

Step 25. Attach the grounding wire by inserting the fork terminal under the small screw, (Part #14), located at the top of the cone retainer, tighten securely. Figure #26.

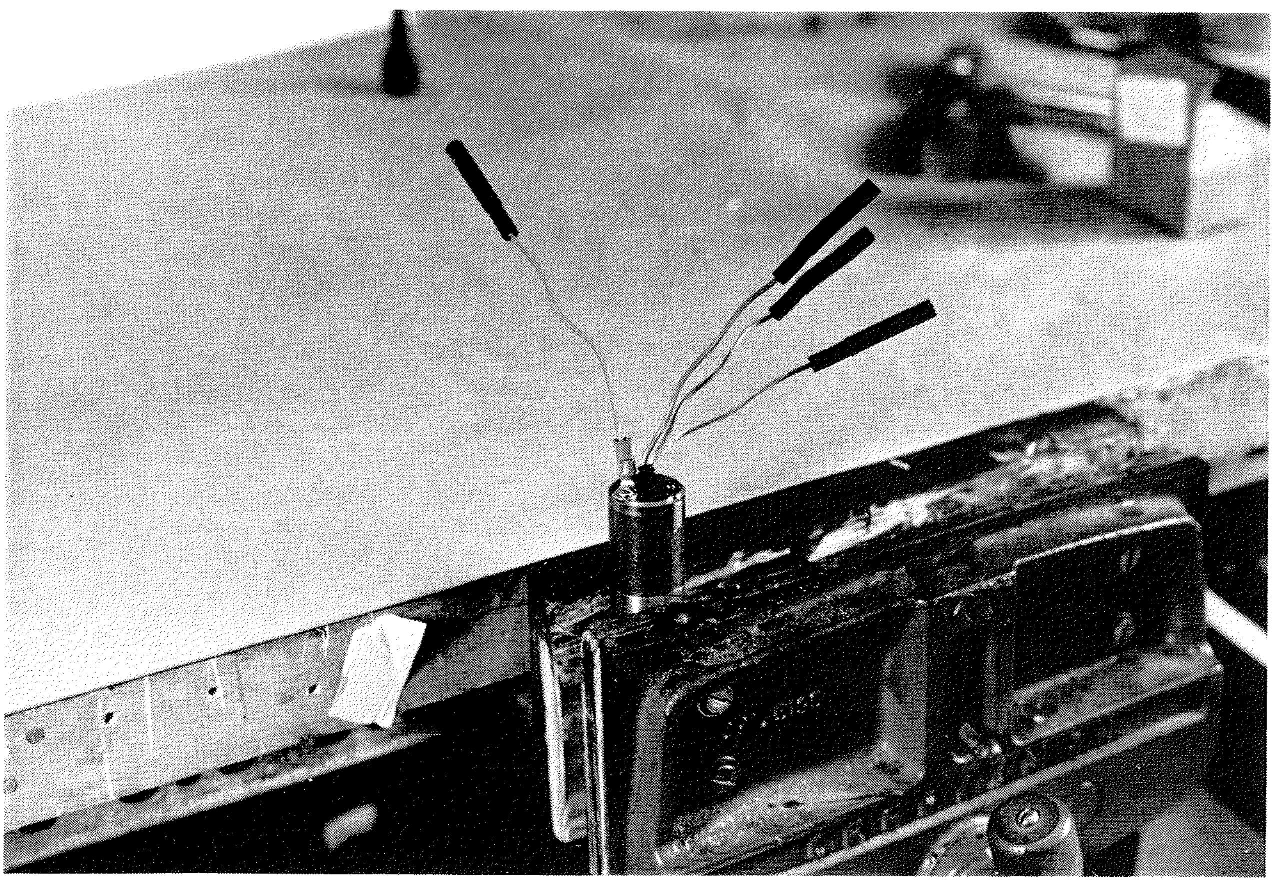


Figure 26.

4.0 **FINAL ASSEMBLY: Phase III**

Step 26. Screw the four double ended Kemlon bulkhead penetrators, (Part #15), into the connector bulkhead, (Figure #27, Part #16).

Step 27. Plug the four boots from the electromechanical cable conductors into the Kemlon penetrators located on the stepped down end of the bulkhead. Figure #27.

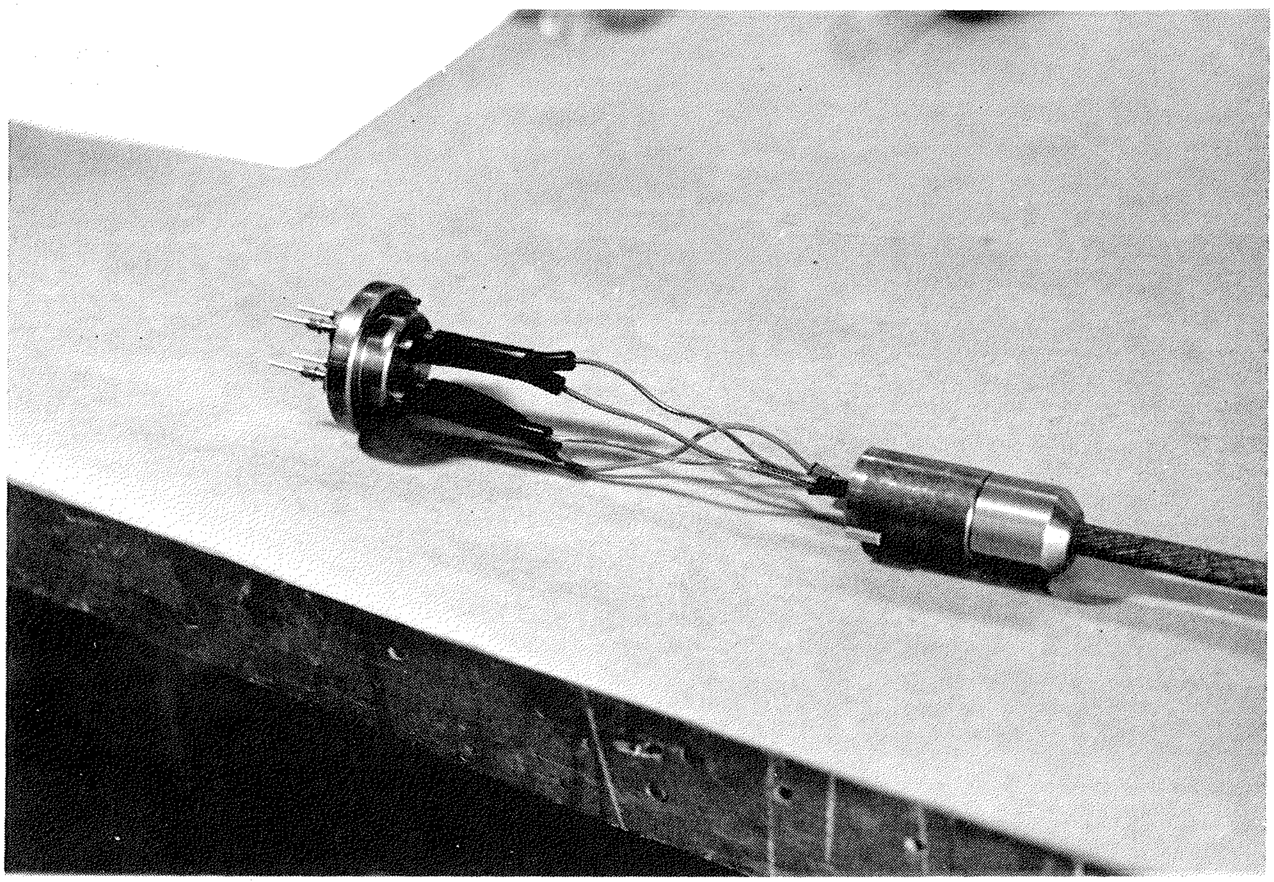


Figure #27

Step 28. Remove the termination from the vise. Slide the connector backshell up the cable over the cone retainer. Make sure that the key seats properly in the keyway.

Step 29. Carefully tap the roll pin (Part #17), into the hole in the side of the connector backshell. Observe that the pin crosses over the top of the cone fitting and does not contact the conductor core.

Step 30. Insert the connector bulkhead into the top of the connector backshell such that the antirotating roll pin, (Part #18), slides into the corresponding hole in the backshell. Figure #28.

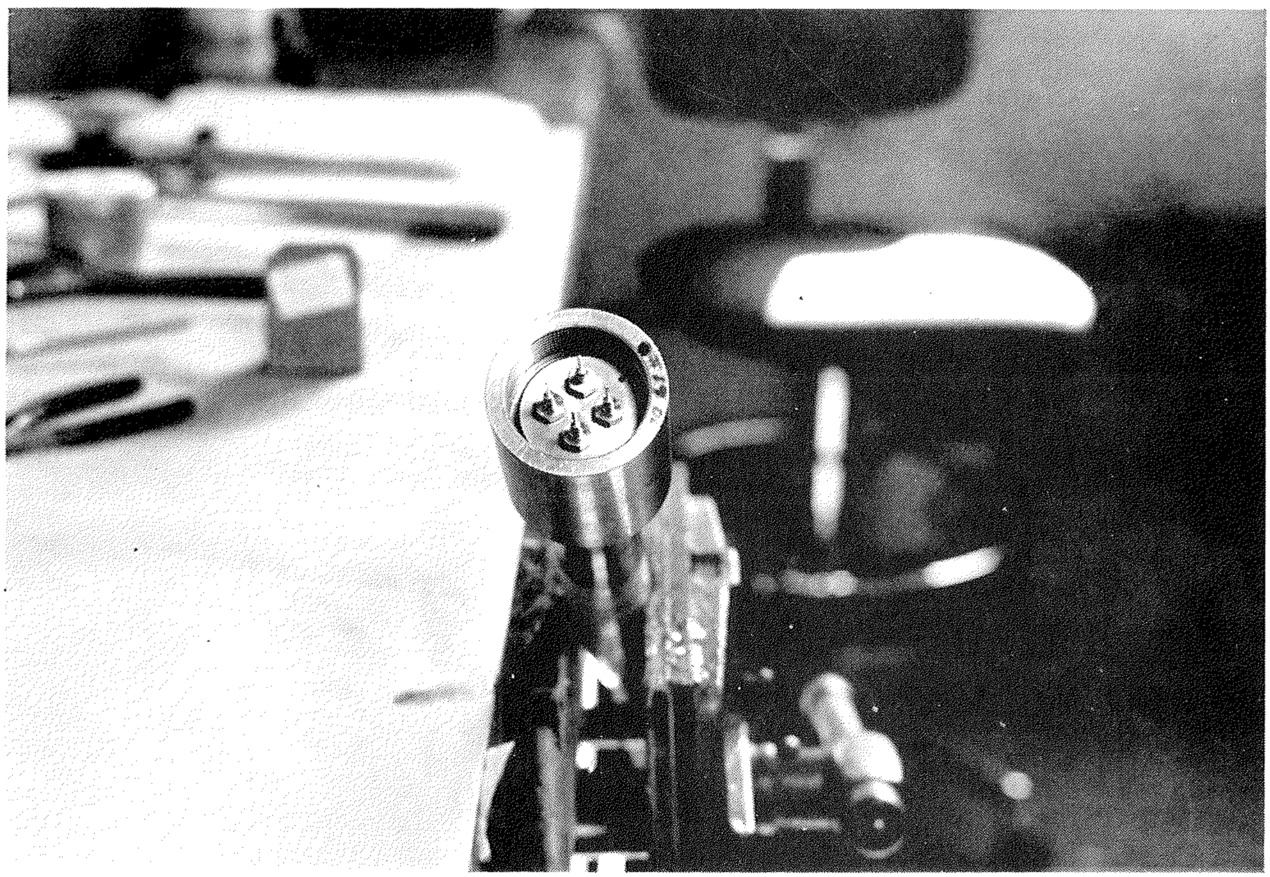


Figure #28

Step 31. Screw the connector clevis (Part #19), down into the connector backshell and tighten the locking screw (Part #20). Figure #29.

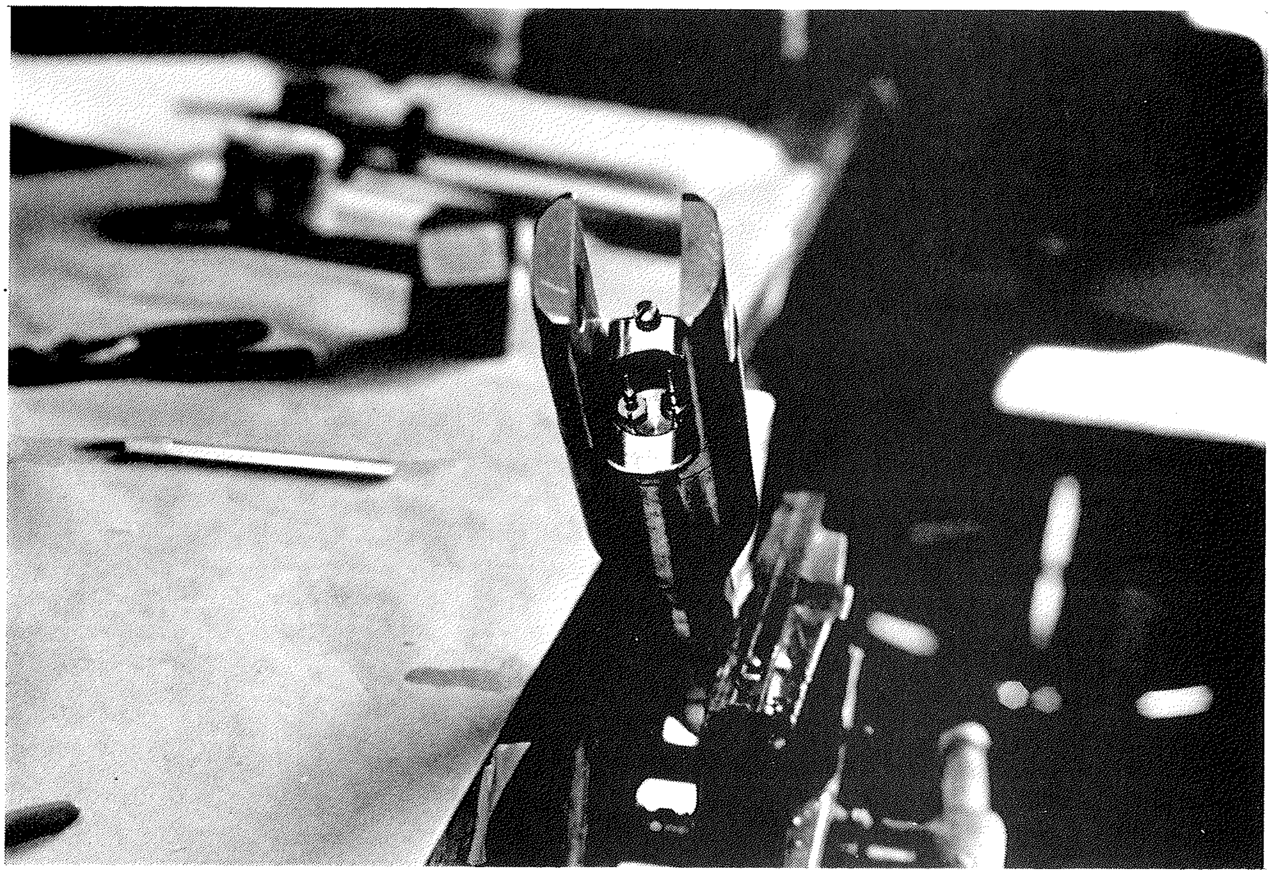


Figure #29

Step 32. Now fill the connector assembly with Aqualube or a good grade of water resistant grease thru the optional grease fitting on the connector backshell.

Step 33. Slip the boot back up the cable and over the boot seat on the back of the connector backshell. The completed cable termination is shown in Figure #30.

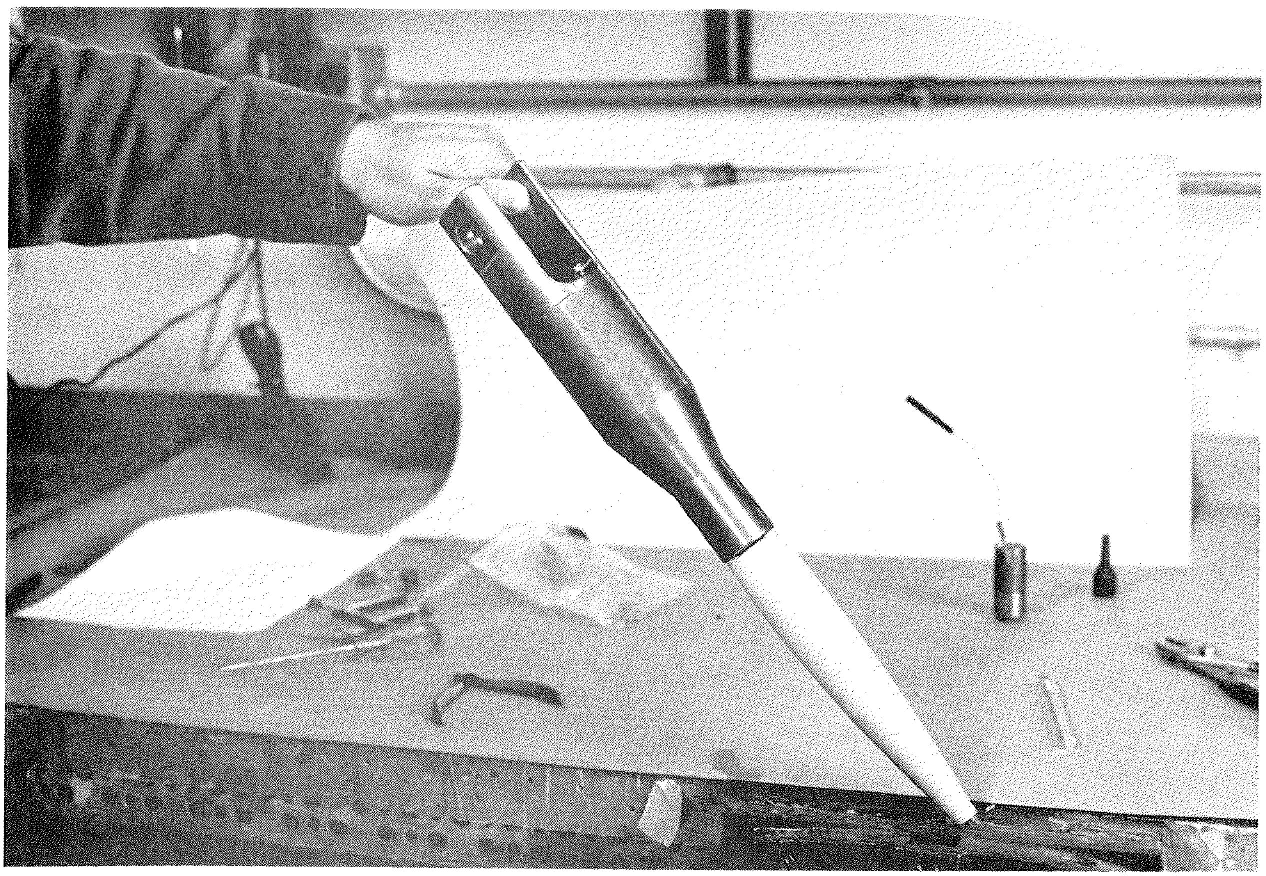


Figure #30

5.0 ATTACHMENT AND CONNECTION TO THE CABLE LOWERED INSTRUMENT PACKAGE.

The package to be attached and connected must be equipped with a lug of such dimensions and hole diameter to fit the jaw and the pin of the E/M termination. Furthermore the package must have an electrical pigtail terminated by three (or four) individual right angle KEMLON connectors (Part #24).

Step 34. Plug the four right angle connectors from the package onto the four pins from the connector bulkhead that protrude into the center of the clevis.

Step 35. Slide the clevis over the attachment eye at the apex of the package and insert the retaining pin (Part #21).

Step 36. Slide the washers (Part #22) over the ends of the retainer pin and pin each end with a 1/8" by 1-1/2" cotter pin (Part #23).

6.0 PROOF TESTING AND TROUBLESHOOTING.

6.1 Proof Testing.

It is advisable to always proof test the termination before using it. A bad termination could result in the loss of the instrument package. The following tests are suggested:

1. Lift a 4000 to 5000 lb dead weight (100% of the cable safe working load) and hold for 5 minutes. Note: It is normal for the cable to pull out of the fitting by as much as 1/8 of an inch as the cones pull tight and seat themselves during the first loading.

2. Check electrical continuity thru each conductor from the termination pins, through the entire cable, sliprings and cable to the read out in the ships lab. If the cable was checked before it was terminated and connectors are found to be open, then something in the termination is likely to be at fault.

3. Check for shorts between each of the conductors and the armor wires or connector backshell. The seawater ground pin should be shorted to the armor wires and the connector shell.

4. Check for shorts between the conductors. To do this disconnect both ends of the cable. Measure for continuity between each pin and each of the other 3. Continuity indicates a short between the pins at some point in the cable.

6.2 Troubleshooting

Items to check if a loss of continuity occurs:

A. Remove the locking screw and unscrew the clevis from the connector backshell. Check each of the double ended bulkhead connectors for continuity. Replace any connector that exhibits a loss of continuity.

B. Spray out each of the boots with a water displacing solvent like Electromotive cleaner and recheck continuity.

C. Check continuity from sliprings to lab.

D. Check continuity of each conductor from the slipring assembly through the termination.

If A and B do not correct the problem and the continuity is good from the sliprings to the lab, but not thru the cable, then it may be necessary to cut the termination off and reterminate.

Items to check if a short occurs:

D. Check for continuity between each conductor and the armor wires or the connector backshell.

E. Check the cable for any visible kinks or other damage.

7.0 SPARE PARTS LIST AND MANUFACTURERS INFORMATION

7.1 List of Spare Parts

Part #	Description	# Spares Required
1.	Bending strain relief boot	1
2.	Connector backshell	1
3.	Assembly blocks	1 pair
4.	Cone retainer lower half	6
5.	Large cone	6
6.	Small cone	6
7.	Straight tube	6
8.	Driver for large cones	1
9.	Driver for small cones	1
10.	Cone retainer upper half	6
11.	Kemlon boots	24
12.	Kemlon pins	24
13.	Fork terminal	12
14.	Terminal retainer screw, 4-40 x 1/4"	12
15.	Kemlon double ended penetrators	12
16.	Connector bulkhead	1
17.	Roll pin, 3/16 x 1 1/2 inches	12
18.	Roll pin, 5/64 x 1/2 inch	6
19.	Connector clevis	1
20.	Locking screw, 10-32 x 1/2 w/dog point	6
21.	Clevis pin, 3/4 x 2 3/4 inches	2
22.	Clevis pin washers	6
23.	Cotter pins, 1/8 x 1 1/2 stainless steel	12
24.	Kemlon right angle pigtails	6

7.2 **List of Required Tools**

Mechanical

Pliers
Felco C7 cable cutters or equivalent
Straight screwdriver
5/32 inch roll pin punch
Bench vise
Channel lock pliers or a small pipe wrench
Cut off saw with a steel cutting abrasive blade

Electrical

Heat gun
Soldering iron
Continuity meter
Megaohm meter

Miscellaneous

Spray bottle filled with boat stove alcohol (Isopropyl)
Solder
Grease gun with Aqualube or equivalent grease (optional)
Scotch 88 electrical tape

7.3 **Parts Suppliers & Sources**

1. Bending strain relief boot. Globe Rubber Company, 254 Beach Street, Rockland, MA 02730 617-871-3700.
   Ordering information: WHOI standard 3/16 inch wire rope boot, one inch is band sawed off of the larger end when used with this termination, as per Drawing #052-008.
2. Connector backshell. Machine as per Drawing #052-022, stock required: 2 1/2 inch round bar, 9 1/4 inches long. Leaded cold rolled steel.
3. Assembly blocks: machine as per Drawing #052-013.
4. Cone retainer lower half. Machine as per Drawing #052-009. Stock required: 1 inch round bar, 2 inches long, leaded cold rolled steel.
5. Large cone. Esmet Inc., Canton, Ohio, order thur local distributor, C.G. Edwards Co., P.O. Box 358, South Boston, MA 02127, 617-268-4111, ordering information: Electroline ME-231 dual cone plugs for conductor core E/M cable. Conductor bundle OD 0.183 inches. This includes parts 5, 6 and 7.
6. Small cone. See 5.
7. Straight tube. See 5.
8. Large cone driver. Esmet, Inc. Ordering information: SP 307-5A plug driver.
9. Small cone driver. See 8.
10. Cone retainer upper half. Machine as per drawing #052-010. Stock required: 1 inch round bar, 1 1/2 inches long, leaded cold rolled steel.
11. Kemlon boots. Kemlon products and development, 6310 Sidney, P.O. Box 14666, Houston, TX 77021. 713-747-5020. Ordering information: K-16-sf female solder connectors, part #16-A-240 and 16-A-242 for #19 AWG conductor with polypropylene insulation to .071 inch OD.
12. Kemlon pins. Included in 11.

13. Fork terminal. Electroline, Inc., 90 Memorial Drive, Springfield, MA 01104, 800-442-1032. Or any automotive parts store. Ordering information: spade tongue terminals such as MV18-405 or equivalent.
14. Small screw. All Stainless, Inc., 75 Research Rd., Hingham, MA 02043, 617-749-7100. Ordering information: 4-40 by 1/4 pan head screws, type 316 or type 18-8 stainless .
15. Double ended Kemlon penetrators. Kemlon products and development. Ordering information: K-16-2p double ended single pin feed thru connectors, part #16-B-1931.
16. Connector bulkhead. Machine as per drawing #052-023. Stock required: 1.75" Dia. x .75 thick cold rolled steel.
17. Roll pin, 3/16" x 1 1/2 inches long. Industrial Distributors Supply, Inc., P.O. Box 5007, 468 Alden St., Fall River, MA 800-932-5880.
18. Roll pin, 5/64" x 1/2 inch long. Source, as 17.
19. Connector clevis. Machine as per Drawing # 052-026. Stock required: 2 1/2" round bar x 4.25 inches long, leaded cold rolled steel.
20. Locking screw, 10-32 x 1/2 inch binder head with .125" long dog point, .125 diameter. Industrial Distributor Supply. Dog point must be machined after purchase.
21. Clevis pin. 3/4 inch diameter x 2 3/4 inches long. Cold rolled steel round bar with a 5/32 hole thru 1/8" from each end.
22. Clevis pin washers.
23. Cotter pins, 1/8 x 1 1/2 inches long, stainless steel. All Stainless, Inc. (see 14)
24. Kemlon right angle pigtails Part #K-16-FFR, 16-A-318 with type R105 F54 cable.

8.0 INSPECTION AND MAINTENANCE PROCEDURE

The termination and the cable should be visually inspected before each lowering. Retermination or replacement of damaged parts should be made at the discretion of the operator. The following check list should be used as a guide line:

1. Inspect the cable from the winch drum to the termination for any sign of kinking or excessive corrosion.
2. Slide the bending strain relief boot off of the termination and inspect the cable where it enters the termination for any sign of a bulge, kink or unlaying of the armor wires.
3. Grab the termination and gently try to twist the cable in the end. If the cable turns freely, remove the locking screw, the clevis, the connector bulkhead and visually inspect the key and keyway on the cone retainer. Check the Kemlon boots and pins for any sign of damage due to twisting. Repair, replace or reterminate as necessary .
4. Visually check the Kemlon bulkhead pins for damage or deformation. If any of them are bent, disassemble the locking screw, clevis and connector bulkhead and measure for continuity thru each of the pins. Replace any that are damaged.
5. Make sure that the roll pin is in the connector backshell.
6. Check the locking screw in the clevis for tightness.
7. Check that the bending strain relief boot is properly seated on the connector backshell.
8. Make sure all cotter pins are in place and properly bent before lowering begins.

Service Life and Scheduled Retermination:

The termination should be carefully inspected for corrosion and proof tested after any period of prolonged storage. A likely cause of failure is the progressive deterioration of the armor wires due to corrosion within the cones and of the cones within the cone retainer. Inspecting the wires or the cones after assembly becomes difficult. The termination should be disassembled, and signs of corrosion should be observed. Indications of heavy corrosion at the face of the wires or the cones should prompt a complete retermination. If not badly corroded, the termination should be tensile proof tested to 5000 lbs. for five minutes.

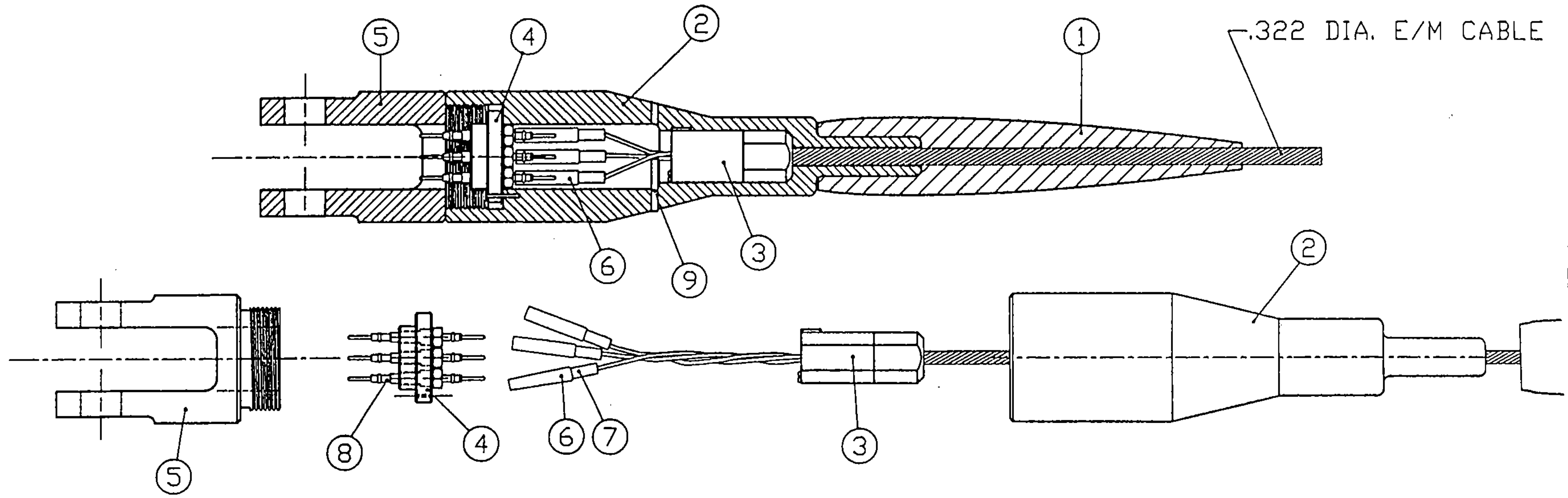
Without knowledge of the exact duty cycles during the service life of the termination it is difficult to schedule regular reterminations. The termination should be cut off and reassembled when deemed necessary, and certainly after any cast which sees unusually high loads.

The connector backshell and clevis were designed such that at the cables working load of 5000 pounds the assembled termination body would be stressed well below the theoretical endurance limit of the steel. The extent of corrosion damage should be determined by regular inspection and the effected parts removed from service when sufficient damage has occurred. Corrosion can be significantly reduced if the termination is galvanized or if zinc anodes are placed in metallic contact with the surface.

9.0 MECHANICAL DRAWINGS

Shown in order as they are referred to by part number in the text.

ITEM	DESCRIPTION	QTY	PART NO.	DRAWING NO.
1	BENDING STRAIN RELIEF BOOT	1	1	052-008
2	CONNECTOR BACKSHELL	1	2	052-022
3	CONE RETAINER ASSEMBLY	1	—	052-011
4	CONNECTOR BULKHEAD	1	16	052-023
5	CONNECTOR CLEVIS	1	19	052-021
6	KEMLON BOOT	4	11	
7	KEMLON PIN	4		
8	KEMLON DOUBLE ENDED PENETRATOR	4		
9	3/16" DIA. X 1 1/2" ROLL PIN	1		



MAT'L

FINISH

UNLESS OTHERWISE NOTED DIMENSIONS ARE IN INCHES INCLUDE CHEM. OR PLATED FIN.

TOLERANCES

APPROVALS	SIGNATURE & DATE
DRAWN	RIA 8/17/90
CHECKED	
MECH	
ELECT	
SYSTEM	

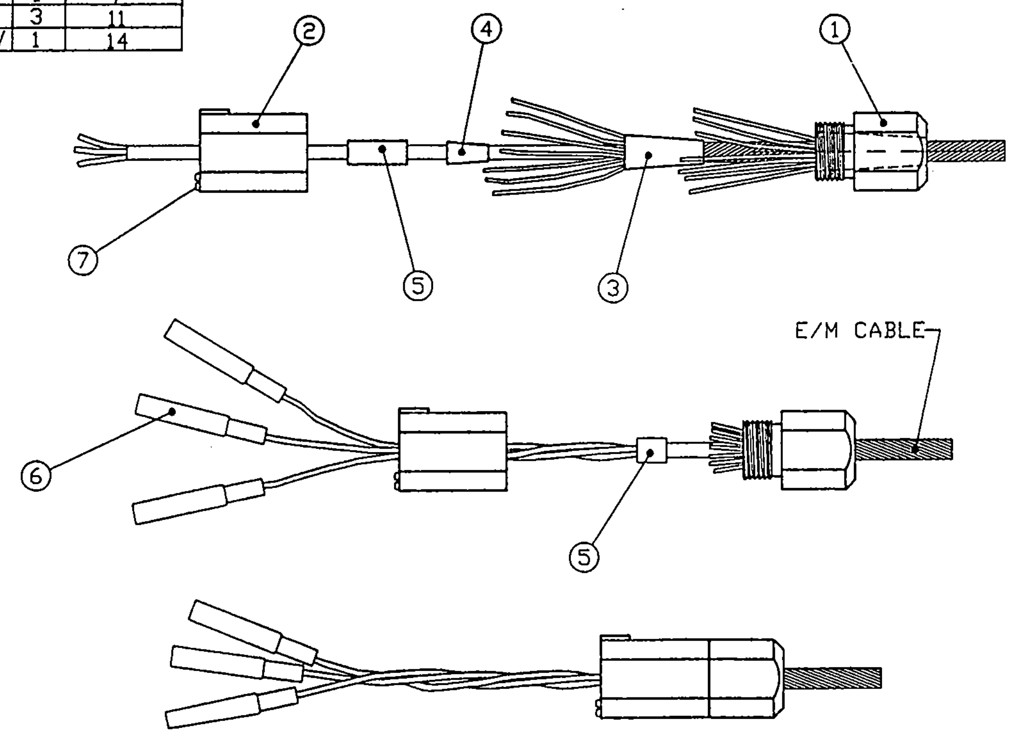
REMOVE BURRS, BREAK SHARP EDGES

WOODS HOLE OCEANOGRAPHIC INSTITUTION
OCEAN SYSTEMS & MOORINGS LAB
Ocean Engineering Department

TITLE
CTD CABLE TERMINATION
GENERAL ASSEMBLY

SCALE	SIZE	DRAWING NO.	REV
PROJ. NO. 20/21977.00	D	052-012	

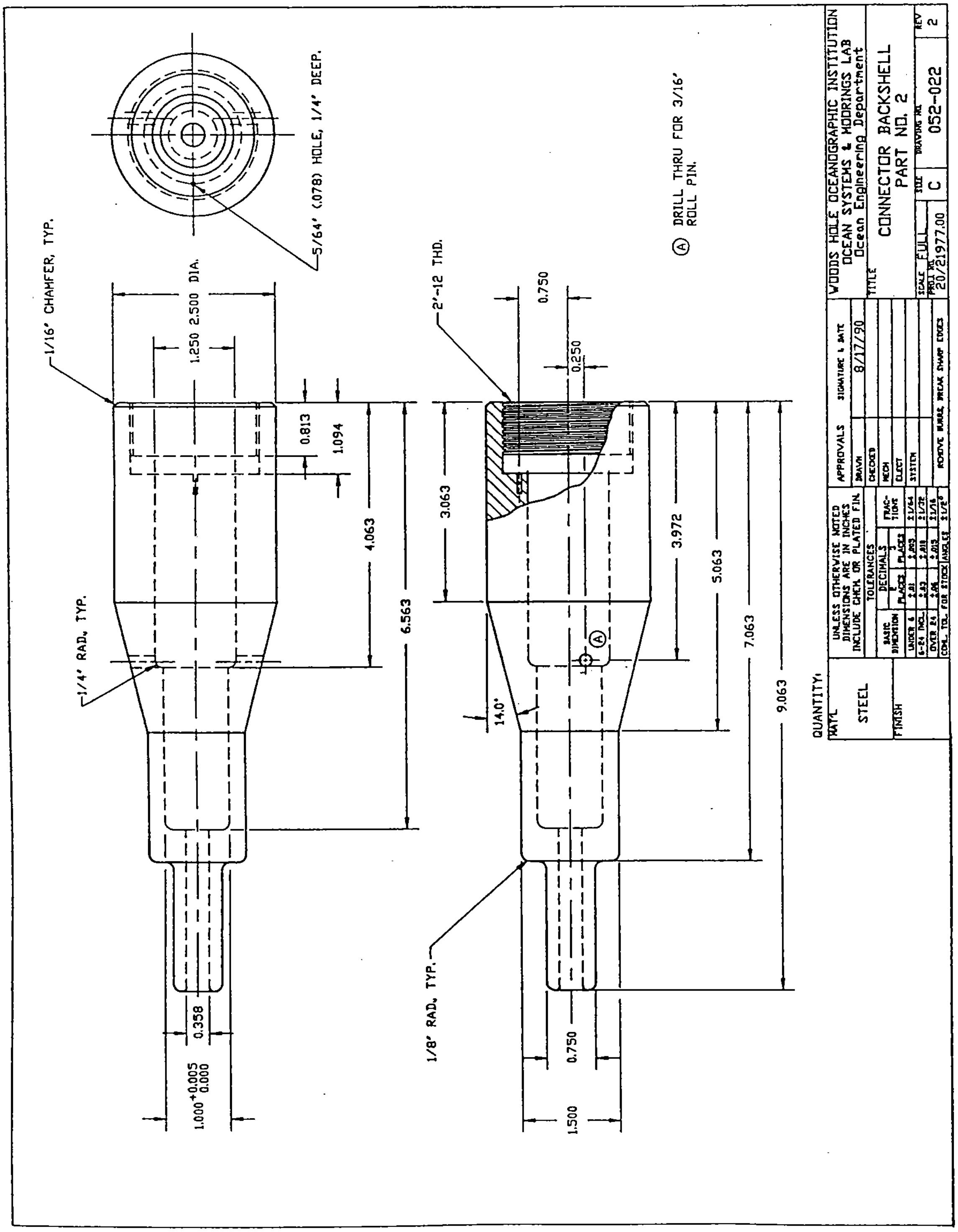
ITEM	DESCRIPTION	QTY	PART NO.
1	CONE RETAINER, LOWER HALF	1	4
2	CONE RETAINER, UPPER HALF	1	10
3	LARGE CONE	1	5
4	SMALL CONE	1	6
5	STRAIGHT TUBE	1	7
6	KEMLON BOOTS AND PINS	3	11
7	4-40 X 1/4"PAN HEAD SCREW	1	14

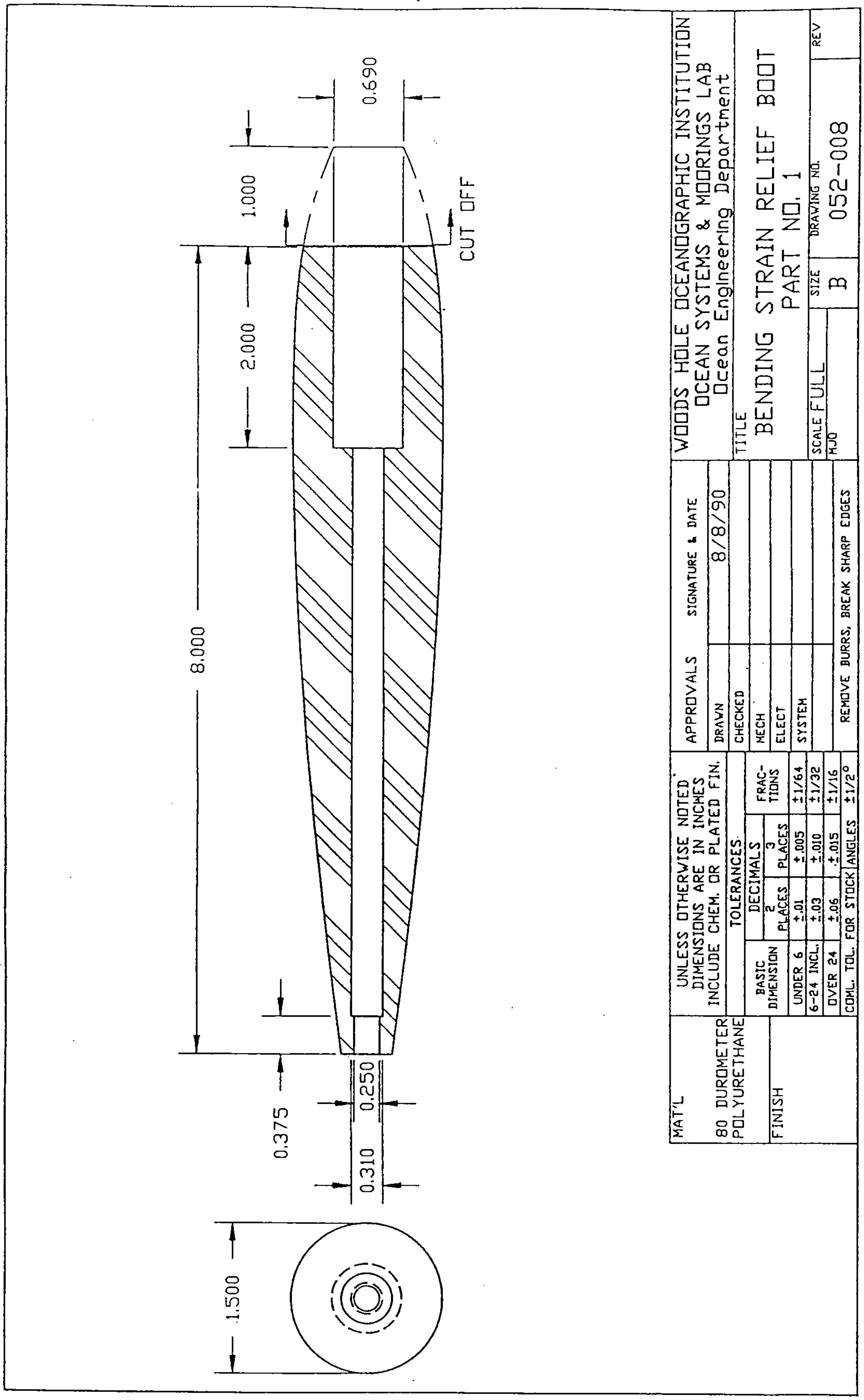


KEMLON PIN PART NO. 16-A-242
KEMLON BOOT PART NO. 16-A-240

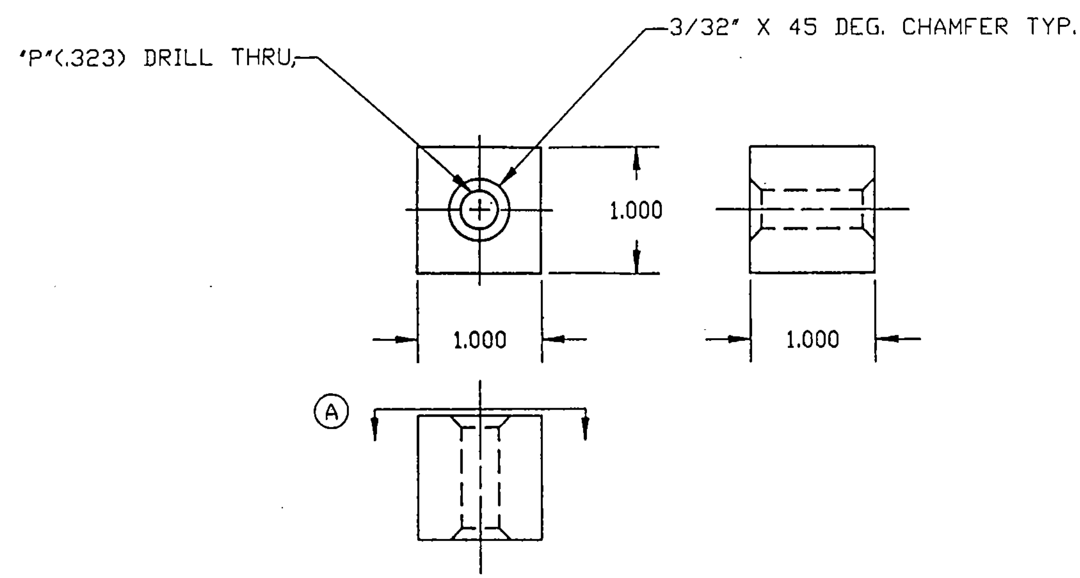
QUANTITY:

MAT'L / FINISH	UNLESS OTHERWISE NOTED DIMENSIONS ARE IN INCHES INCLUDE CHEM. OR PLATED FIN. TOLERANCES DECIMALS	APPROVALS — SIGNATURE & DATE: DRAWN RIA 8/17/90; CHECKED; MECH; ELECT; SYSTEM; REMOVE BURRS, BREAK SHARP EDGES	WOODS HOLE OCEANOGRAPHIC INSTITUTION OCEAN SYSTEMS & MOORINGS LAB Ocean Engineering Department — TITLE: CONE RETAINER ASSEMBLY — SCALE; PROJ NO. 20/21977.00; SIZE C; DRAWING NO. 052-011; REV


1/16" CHAMFER, TYP.
5/64" (.078) HOLE, 1/4" DEEP.
Ⓐ DRILL THRU FOR 3/16" ROLL PIN.
1.250
2.500 DIA.
2"-12 THD.
0.750
0.250
0.813
1.094
4.063
6.563
3.063
3.972
5.063
7.063
9.063
14.0°
1/4" RAD. TYP.
1/8" RAD. TYP.
0.358
1.000 +0.005 0.000
0.750
1.500
QUANTITY:
MAT'L STEEL
FINISH
UNLESS OTHERWISE NOTED DIMENSIONS ARE IN INCHES INCLUDE CHEM. OR PLATED FIN.
TOLERANCES
REMOVE BURRS, BREAK SHARP EDGES
APPROVALS
SIGNATURE & DATE
DRAWN 8/17/90
CHECKED
MECH
ELECT
SYSTEM
WOODS HOLE OCEANOGRAPHIC INSTITUTION
OCEAN SYSTEMS & MOORINGS LAB
Ocean Engineering Department
TITLE
CONNECTOR BACKSHELL
PART NO. 2
SCALE FULL
PROJ NO. 20/21977.00
SIZE C
DRAWING NO. 052-022
REV 2



0.690
1.000
CUT OFF
2.000
8.000
0.375
0.250
0.310
1.500
WOODS HOLE OCEANOGRAPHIC INSTITUTION
OCEAN SYSTEMS & MOORINGS LAB
Ocean Engineering Department
TITLE
BENDING STRAIN RELIEF BOOT
PART NO. 1
SCALE FULL
MJO
SIZE
B
DRAWING NO.
052-008
REV
APPROVALS
SIGNATURE & DATE
DRAWN
8/8/90
CHECKED
MECH
ELECT
SYSTEM
REMOVE BURRS, BREAK SHARP EDGES
UNLESS OTHERWISE NOTED
DIMENSIONS ARE IN INCHES
INCLUDE CHEM. OR PLATED FIN.
TOLERANCES
BASIC DIMENSION
DECIMALS
2 PLACES
3 PLACES
FRAC-TIONS
UNDER 6
±.01
±.005
±1/64
6-24 INCL.
±.03
±.010
±1/32
OVER 24
±.06
±.015
±1/16
COML. TOL. FOR STOCK
ANGLES
±1/2°
MAT'L
80 DUROMETER
POLYURETHANE
FINISH



NOTE:

(A) CUT THE BLOCK IN HALF PARALLEL TO THE THRU HOLE AFTER MACHINING.

MAT'L	
STEEL	
FINISH	

UNLESS OTHERWISE NOTED DIMENSIONS ARE IN INCHES INCLUDE CHEM. OR PLATED FIN.

TOLERANCES			
BASIC DIMENSION	DECIMALS 2 PLACES	DECIMALS 3 PLACES	FRAC-TIONS
UNDER 6	±.01	±.005	±1/64
6-24 INCL.	±.03	±.010	±1/32
OVER 24	±.06	±.015	±1/16
COML. TOL. FOR STOCK		ANGLES	±1/2°

APPROVALS	SIGNATURE & DATE
DRAWN	8/8/90
CHECKED	
MECH	
ELECT	
SYSTEM	

REMOVE BURRS, BREAK SHARP EDGES

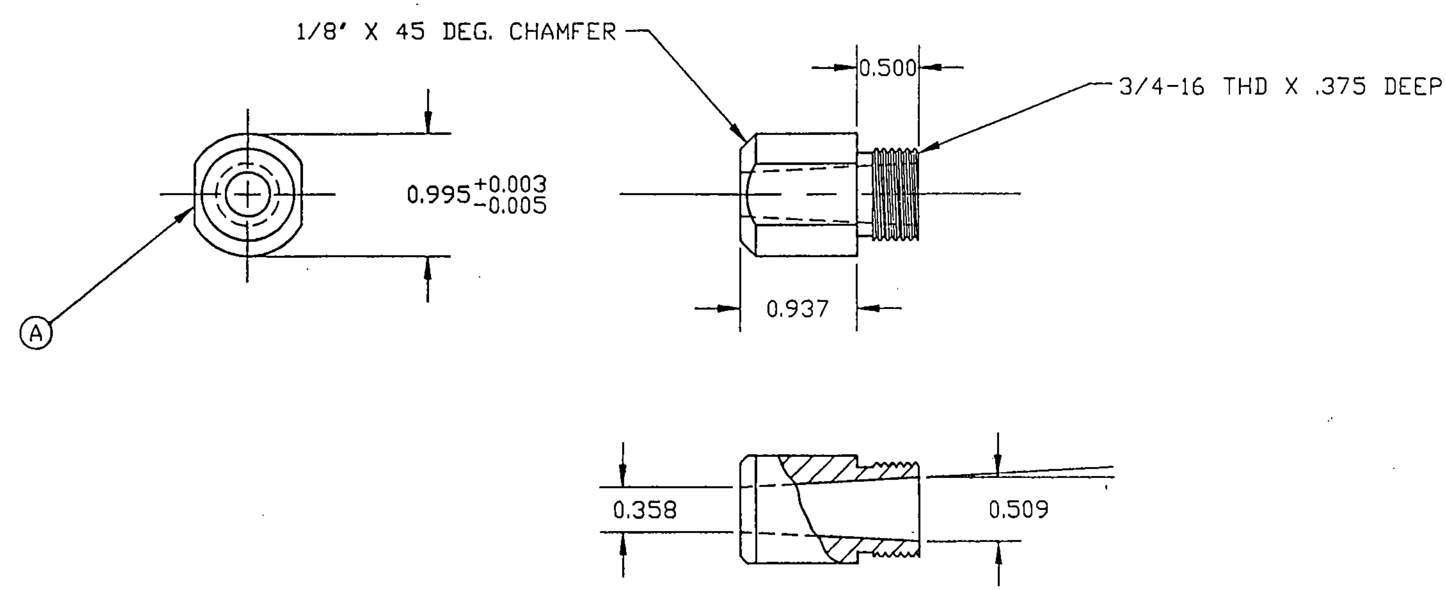
WOODS HOLE OCEANOGRAPHIC INSTITUTION
OCEAN SYSTEMS & MOORINGS LAB
Ocean Engineering Department

TITLE

ASSEMBLY BLOCK

SCALE	SIZE	DRAWING NO.	REV
FULL	B	052-013	

MJD



NOTE:
(A) MILL FLATS AFTER ASSEMBLY WITH UPPER HALF OF THE CONE RETAINER, PART NO. 10.

QUANTITY:

MAT'L: STEEL

FINISH:

UNLESS OTHERWISE NOTED' DIMENSIONS ARE IN INCHES INCLUDE CHEM. OR PLATED FIN.

TOLERANCES

BASIC DIMENSION	DECIMALS 2 PLACES	DECIMALS 3 PLACES	FRACTIONS
UNDER 6	±.01	±.005	±1/64
6-24 INCL.	±.03	±.010	±1/32
OVER 24	±.06	±.015	±1/16
COML. TOL. FOR STOCK	ANGLES		±1/2°

APPROVALS	SIGNATURE & DATE
DRAWN	8/8/90
CHECKED	
MECH	
ELECT	
SYSTEM	

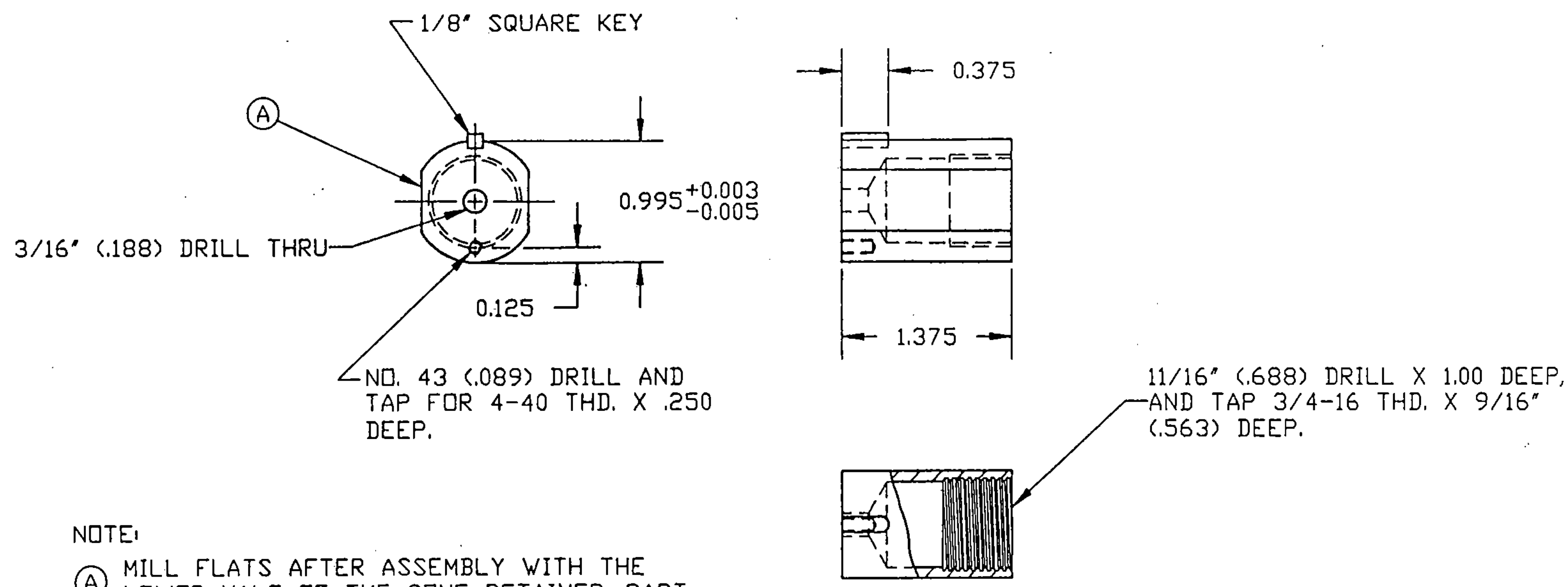
REMOVE BURRS, BREAK SHARP EDGES

WOODS HOLE OCEANOGRAPHIC INSTITUTION
OCEAN SYSTEMS & MOORINGS LAB
Ocean Engineering Department

TITLE: CONE RETAINER, LOWER HALF PART NO. 4

SCALE: FULL | SIZE: B | DRAWING NO.: 052-009 | REV:

PROJ. NO. 20/21977.00

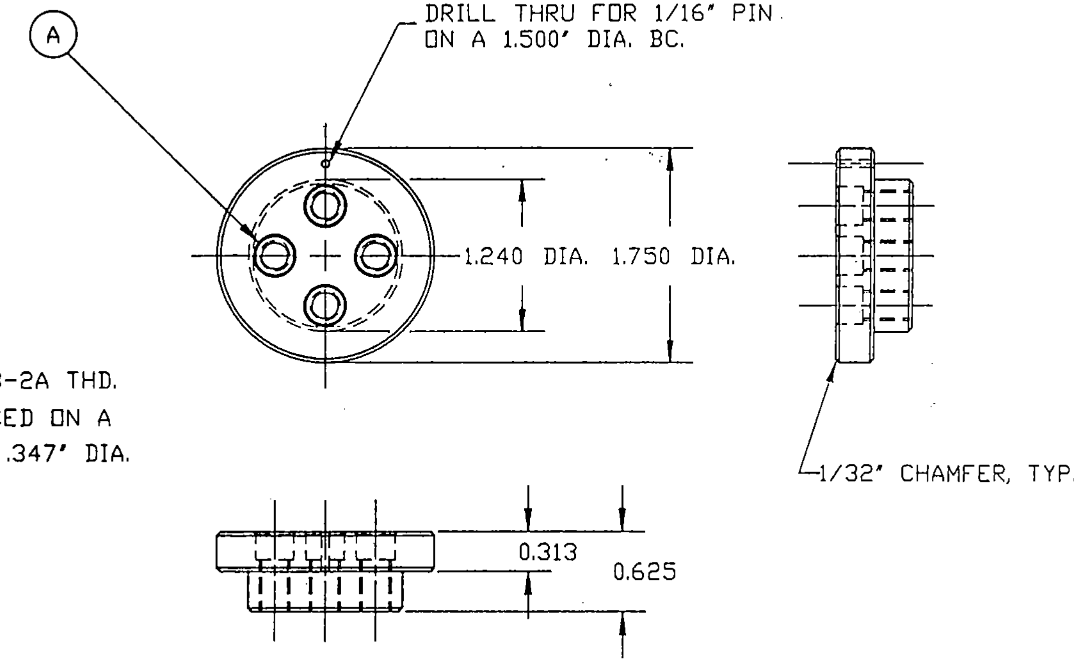


NOTE:

Ⓐ MILL FLATS AFTER ASSEMBLY WITH THE LOWER HALF OF THE CONE RETAINER, PART NO. 4.

QUANTITY:

MAT'L	UNLESS OTHERWISE NOTED DIMENSIONS ARE IN INCHES INCLUDE CHEM. OR PLATED FIN.				APPROVALS	SIGNATURE & DATE	WOODS HOLE OCEANOGRAPHIC INSTITUTION OCEAN SYSTEMS & MOORINGS LAB Ocean Engineering Department
STEEL	TOLERANCES				DRAWN	8/8/90	TITLE
	BASIC DIMENSION	DECIMALS 2 PLACES	DECIMALS 3 PLACES	FRACTIONS	CHECKED		CONE RETAINER, UPPER HALF PART NO. 10
FINISH	UNDER 6	±.01	±.005	±1/64	MECH		
	6-24 INCL.	±.03	±.010	±1/32	ELECT		SCALE FULL
	OVER 24	±.06	±.015	±1/16	SYSTEM		PROJ. NO. 20/21977.00 · SIZE B · DRAWING NO. 052-010 · REV
	COML. TOL. FOR STOCK		ANGLES	±1/2°	REMOVE BURRS, BREAK SHARP EDGES		



(A) NO. 3 (.213) DRILL THRU AND TAP 1/4'-28-2A THD. CBORE .312'/.313' X .220 DEEP, EQUALLY SPACED ON A .813' DIA. BC.; CHAMFER EDGES 82 DEG. X .347' DIA. 4 PLACES.

QUANTITY:

MAT'L

FINISH

UNLESS OTHERWISE NOTED: DIMENSIONS ARE IN INCHES INCLUDE CHEM. OR PLATED FIN.

TOLERANCES			
BASIC DIMENSION	DECIMALS 2 PLACES	DECIMALS 3 PLACES	FRACTIONS
UNDER 6	±.01	±.005	±1/64
6-24 INCL.	±.03	±.010	±1/32
OVER 24	±.06	±.015	±1/16
COML. TOL. FOR STOCK	ANGLES		±1/2°

APPROVALS	SIGNATURE & DATE
DRAWN	RIA 11/21/89
CHECKED	
MECH.	
ELECT	
SYSTEM	

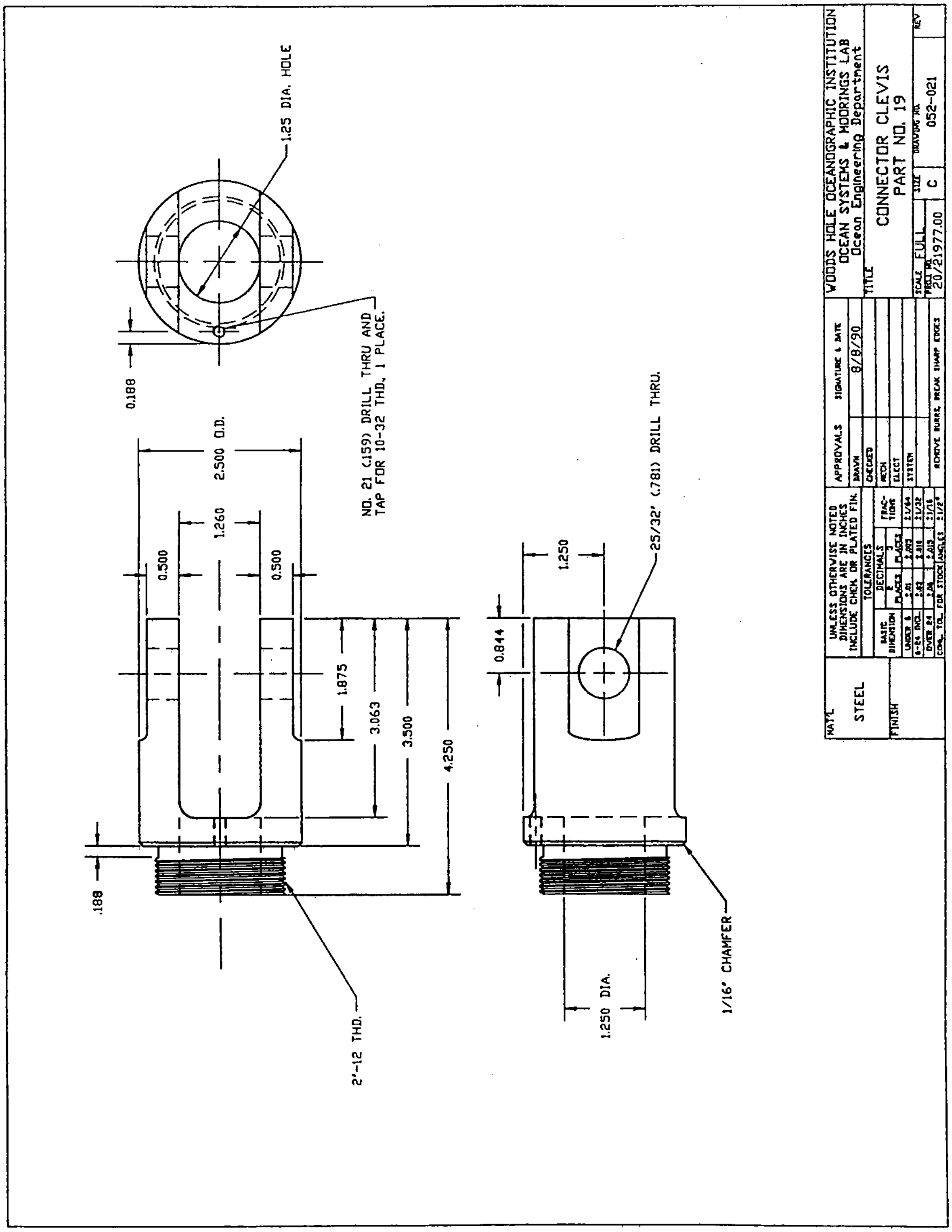
REMOVE BURRS, BREAK SHARP EDGES

WOODS HOLE OCEANOGRAPHIC INSTITUTION
OCEAN SYSTEMS & MOORINGS LAB
Ocean Engineering Department

TITLE
CONNECTOR BULKHEAD
PART NO. 16

SCALE	SIZE	DRAWING NO.	REV
FULL	B	052-023	

MJO


1.25 DIA. HOLE
0.188
NO. 21 (.159) DRILL THRU AND TAP FOR 10-32 THD., 1 PLACE.
2.500 O.D.
1.260
0.500
0.500
1.875
3.063
3.500
4.250
.188
2"-12 THD.
1.250
25/32" (.781) DRILL THRU.
0.844
1.250 DIA.
1/16" CHAMFER
WOODS HOLE OCEANOGRAPHIC INSTITUTION
OCEAN SYSTEMS & MOORINGS LAB
Ocean Engineering Department
TITLE
CONNECTOR CLEVIS
PART NO. 19
SCALE FULL
SIZE C
DRAWING NO. 052-021
PART NO. 20/21977.00
REV
APPROVALS
SIGNATURE & DATE
DRAWN 8/8/90
CHECKED
MECH
ELECT
SYSTEM
UNLESS OTHERWISE NOTED DIMENSIONS ARE IN INCHES INCLUDE CHECK OR PLATED FIN.
TOLERANCES
REMOVE BURRS, BREAK SHARP EDGES
MAT'L
STEEL
FINISH

DOCUMENT LIBRARY

January 17, 1990

Distribution List for Technical Report Exchange

Attn: Stella Sanchez-Wade
Documents Section
Scripps Institution of Oceanography
Library, Mail Code C-075C
La Jolla, CA 92093

Hancock Library of Biology &
Oceanography
Alan Hancock Laboratory
University of Southern California
University Park
Los Angeles, CA 90089-0371

Gifts & Exchanges
Library
Bedford Institute of Oceanography
P.O. Box 1006
Dartmouth, NS, B2Y 4A2, CANADA

Office of the International
Ice Patrol
c/o Coast Guard R & D Center
Avery Point
Groton, CT 06340

NOAA/EDIS Miami Library Center
4301 Rickenbacker Causeway
Miami, FL 33149

Library
Skidaway Institute of Oceanography
P.O. Box 13687
Savannah, GA 31416

Institute of Geophysics
University of Hawaii
Library Room 252
2525 Correa Road
Honolulu, HI 96822

Marine Resources Information Center
Building E38-320
MIT
Cambridge, MA 02139

Library
Lamont-Doherty Geological
Observatory
Colombia University
Palisades, NY 10964

Library
Serials Department
Oregon State University
Corvallis, OR 97331

Pell Marine Science Library
University of Rhode Island
Narragansett Bay Campus
Narragansett, RI 02882

Working Collection
Texas A&M University
Dept. of Oceanography
College Station, TX 77843

Library
Virginia Institute of Marine Science
Gloucester Point, VA 23062

Fisheries-Oceanography Library
151 Oceanography Teaching Bldg.
University of Washington
Seattle, WA 98195

Library
R.S.M.A.S.
University of Miami
4600 Rickenbacker Causeway
Miami, FL 33149

Maury Oceanographic Library
Naval Oceanographic Office
Bay St. Louis
NSTL, MS 39522-5001

Marine Sciences Collection
Mayaguez Campus Library
University of Puerto Rico
Mayagues, Puerto Rico 00708

Library
Institute of Oceanographic Sciences
Deacon Laboratory
Wormley, Godalming
Surrey GU8 5UB
UNITED KINGDOM

The Librarian
CSIRO Marine Laboratories
G.P.O. Box 1538
Hobart, Tasmania
AUSTRALIA 7001

Library
Proudman Oceanographic Laboratory
Bidston Observatory
Birkenhead
Merseyside L43 7 RA
UNITED KINGDOM

50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO. WHOI 90-40	2.	3. Recipient's Accession No.

4. Title and Subtitle CTD Electromechanical Termination Users Manual	5. Report Date August 1990
	6.
7. Author(s) H.O. Berteaux, S. Kery, P. O'Malley	8. Performing Organization Rept. No. WHOI 90-40
9. Performing Organization Name and Address Woods Hole Oceanographic Institution Woods Hole, Massachusetts 02543	10. Project/Task/Work Unit No.
	11. Contract(C) or Grant(G) No. (C) OCE 8821977 (G)
12. Sponsoring Organization Name and Address National Science Foundation	13. Type of Report & Period Covered Technical Report
	14.

15. Supplementary Notes

This report should be cited as: Woods Hole Oceanographic Inst. Tech. Rept., WHOI 90-40.

16. Abstract (Limit: 200 words)

This report describes a new, easy to install, reliable electromechanical cable termination to mechanically attach and electrically connect cable lowered instrument packages to their lowering cable.

17. Document Analysis a. Descriptors

CTD electromechanical termination
field installable
WOCE

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report)	21. No. of Pages
Approved for public release; distribution unlimited.		54
	20. Security Class (This Page)	22. Price

(See ANSI-Z39.18) *See Instructions on Reverse* OPTIONAL FORM 272 (4-77)
(Formerly NTIS-35)
Department of Commerce