AD-A167 614 DIEGO GARCIA FLEET MOORINGS UNDERWATER INSPECTION PROJECT EXECUTION PLAN(U) NAVAL FACILITIES ENGINEERING COMMAND WASHINGTON DC CHESAPEAKE DIV 1980 1/1

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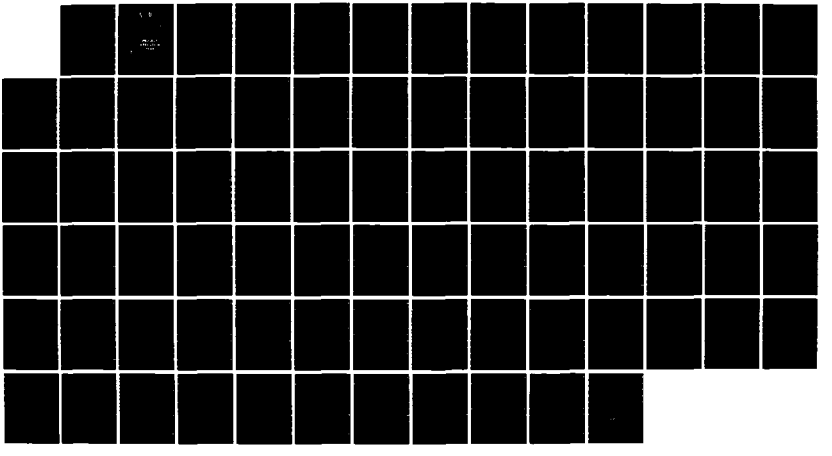

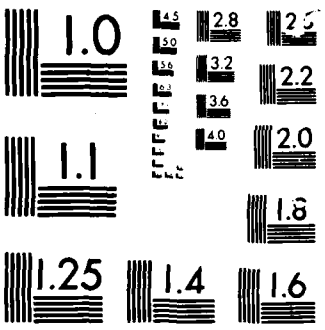

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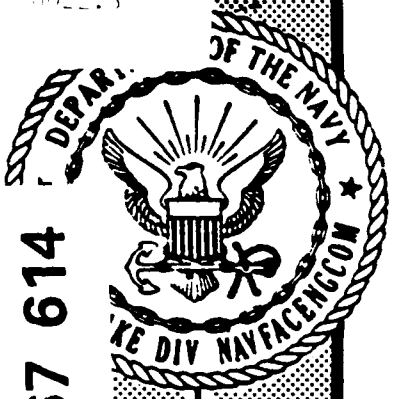

DIEGO GARCIA FLEET MOORINGS UNDERWATER INSPECTION

PROJECT EXECUTION PLAN

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There are 13 Fleet Moorings installed in the lagoon on the island of Diego Garcia. Two are located just north nad south of the POL pier and are classified as mooring dolphins. The remaining 11 Fleet Moorings were recently emplaced for use by ships of the Rapid Deployment Force and other Naval (Con't)

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vessels. Since the procedures for and pupose of the underwater inspection of the two mooring dolphins differ from those of the other Fleet Moorings, the procedures for both types of inspections have been separated. Section B of this plan contains the procedures to be followed during the underwater inspection of the 11 new moorings, while Section C details guidelines for the inspection of the two PLO pier mooring dolphins. UNDERWATER CONSTRUCTION TEAM TWO (UCT2) will provide sufficient qulified divers to perform the underwater inspections, and CHESNAVFACENGCOM (FPO-1) will provide a Project Engineer who will provide technical support to the dive teams and coordinate the data collection process.

DIEGO GARCIA

FLEET MOORINGS

UNDERWATER INSPECTION

PROJECT EXECUTION PLAN

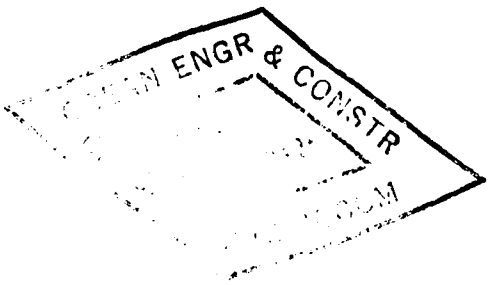


TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

PROJECT EXECUTION PLAN
FLEET MOORING INSPECTIONS
DIEGO GARCIA, BIOT

A. INTRODUCTION

There are 13 Fleet Moorings installed in the lagoon on the island of Diego Garcia. Two are located just north and south of the POL pier and are classified as mooring dolphins. The remaining 11 Fleet Moorings were recently emplaced for use by ships of the Rapid Deployment Force and other Naval vessels. Since the procedures for and purpose of the underwater inspection of the two mooring dolphins differ from those of the other Fleet Moorings, the procedures for both types of inspections have been separated. Section B of this plan contains the procedures to be followed during the underwater inspection of the 11 new moorings, while Section C details guidelines for the inspection of the two POL pier mooring dolphins. UNDERWATER CONSTRUCTION TEAM TWO (UCT2) will provide sufficient qualified divers to perform the underwater inspections, and CHESNAVFACENGCOM (FPO-1) will provide a Project Engineer who will provide technical support to the dive teams and coordinate the data collection process.

B. ELEVEN NEW FLEET MOORINGS

1.0 BACKGROUND: On 17 March 1981, the installation of eleven fleet moorings in the lagoon at Diego Garcia was completed. These moorings were installed in response to new Navy requirements for support of the Indian Ocean Battle Group. The eleven moorings consist of four different classes of moorings which are comprised of seventeen buoy systems. Each of these buoy systems is

cathodically protected with zinc anodes and wire rope continuity cable. Now that these moorings have been in the water for over a year, NAVFACENGCOM desires to conduct an underwater inspection in order to determine the condition of these moorings and the effectiveness of the installed cathodic protection systems, as a part of NAVFACENGCOM's Fleet Mooring Maintenance Program.

2.0 PURPOSE: The purpose of this Project Execution Plan (PEP) is to define the responsibilities of the inspection team and to provide detailed guidelines for the underwater inspection of the eleven moorings which are currently operated and maintained by the Naval Support Office (NSO), Diego Garcia. Figures 1 and 2 depict the geographical positions of the eleven installed fleet moorings while Table 1 contains each moorings anchor positions.

3.0 REFERENCE DATA:

3.1 NAVFAC DM-26, "Design Manual, Harbor and Coastal Facilities", of July 1968

3.2 NAVFAC MO-124, "Mooring Maintenance", of December 1973

3.3 Diego Garcia Fleet Mooring Installation - Project Completion Report (D.G. PCR) of July 1981

3.3.1 D.G. PCR, Annex C, Drawings and As-Built Tables, C-1 through C-7

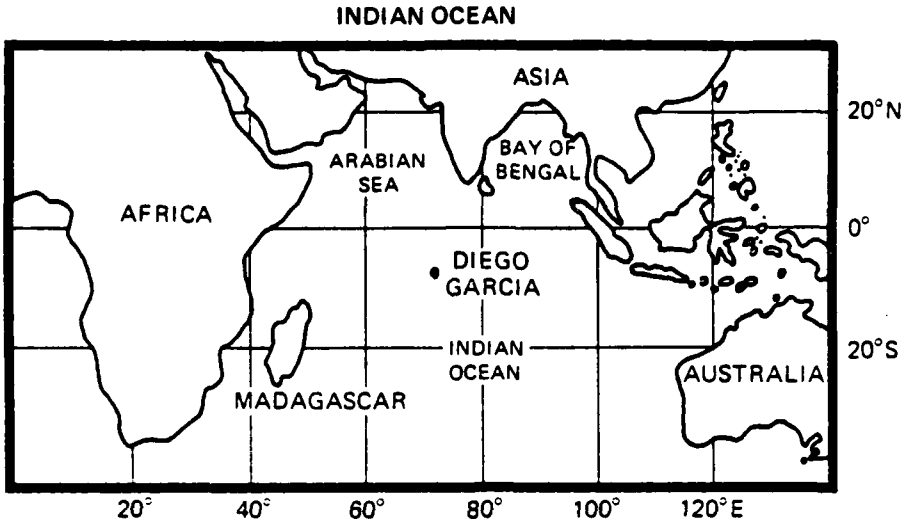


FIGURE 1-1. INDIAN OCEAN

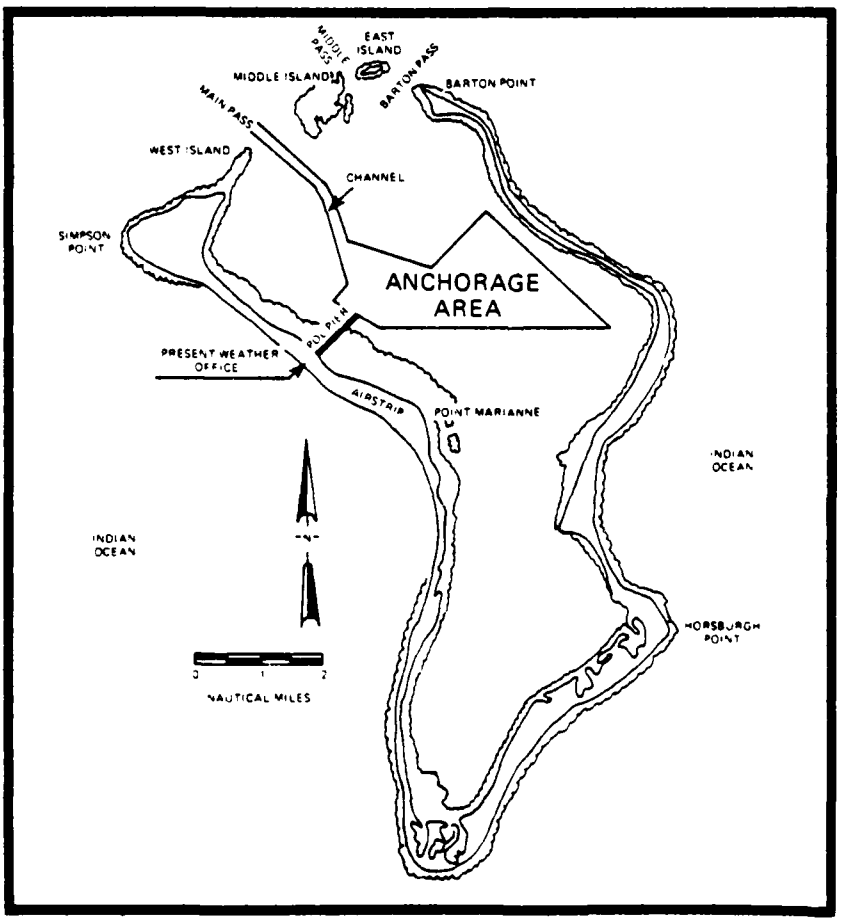


FIGURE 1-2. DIEGO GARCIA

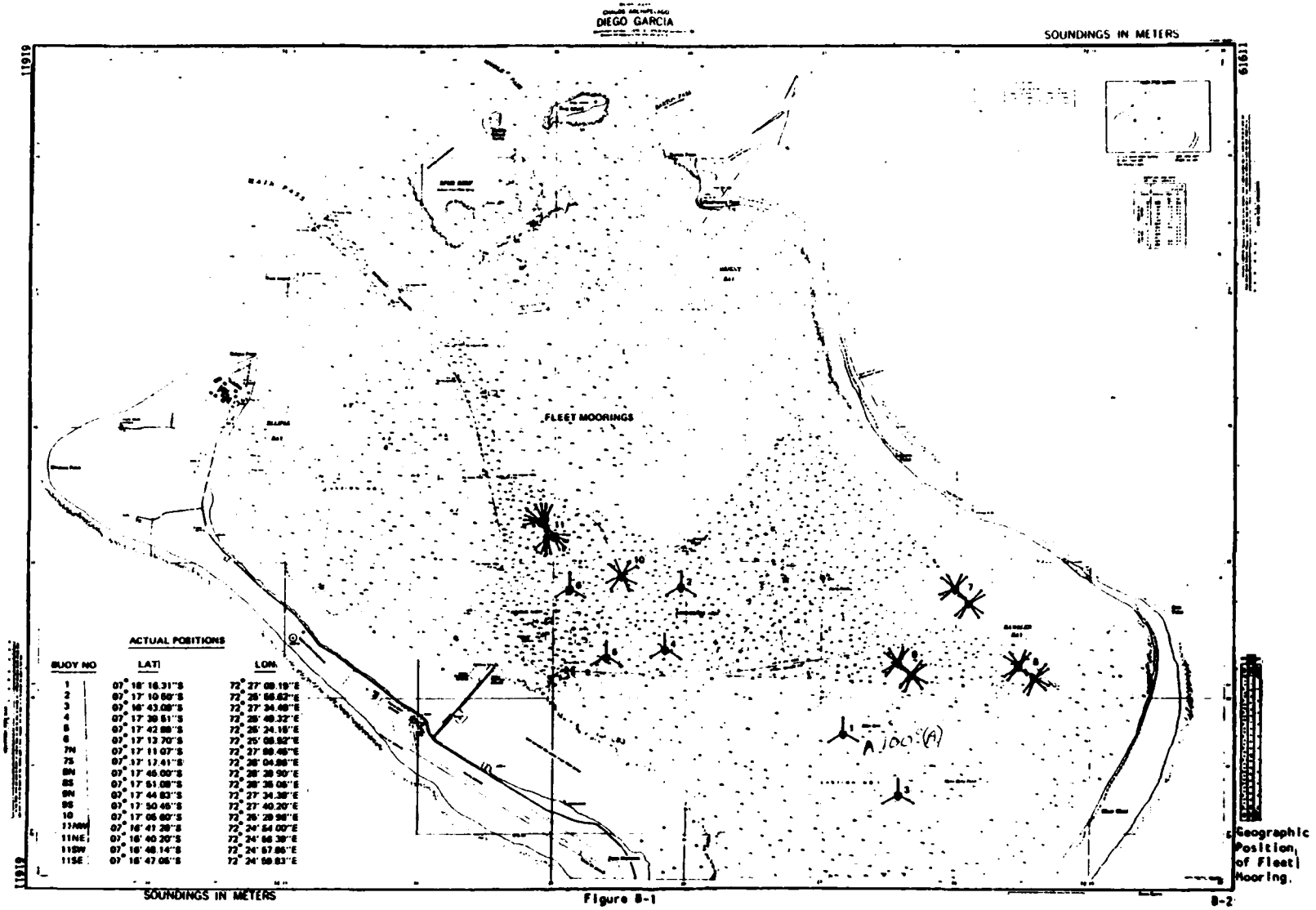


Figure B-1

B-2

FIGURE 2

TABLE 1. DIEGO GARCIA FLEET MOORING ANCHOR POSITIONS

Buoy No.	Anchor No.	Latitude (South)	Longitude (East)
1	A	7°18'01.26"	72°27'19.87"
	B	7°18'10.83"	72°27'14.38"
	C	7°18'10.76"	72°27'25.23"
2	A	7°17'0.86"	72°26'1.82"
	B	7°17'8.56"	72°26'9.99"
	C	7°16'57.54	72°26'12.56"
3	A	7°18'28.22"	72°27'45.07"
	B	7°18'37.55"	72°27'50.65"
	C	7°18'37.42"	72°27'39.74"
4	A	7°17'27.86"	72°26'5.74"
	B	7°17'37.33"	72°26'0.08"
	C	7°17'27.76"	72°25'54.63"
5	A	7°17'27.85"	72°25'35.31"
	B	7°17'37.64"	72°25'40.86"
	C	7°17'37.41"	72°25'29.65"
6	A	7°17'1.33'	72°25'23.08"
	B	7°17'10.90"	72°25'17.72"
	C	7°17'1.23"	72°25'12.33"
7S	A1	7°17'10.87"	72°28'11.96"
	A2	7°17'11.72"	72°28'12.67"
	B1	7°17'12.43"	72°28'17.75"
	B2	7°17'11.88"	72°28'18.63"

TABLE 1. DIEGO GARCIA FLEET MOORING ANCHOR POSITIONS (Continued)

Buoy No.	Anchor No.	Latitude (South)	Longitude (East)
7S	C1	7°17'6.68"	72°28'19.35"
	C2	7°17'5.90"	72°28'18.90"
	D	7°17'3.86"	72°18'11.90"
7N	A1	7°17'0.64"	72°28'14.23"
	A2	7°16'59.92"	72°28'13.65"
	B1	7°16'59.20"	72°28'8.41"
	B2	7°16'59.59"	72°28'7.69"
	C1	7°17'4.86"	72°28'6.94"
	C2	7°17'5.71"	72°28'7.43"
	D	7°17'7.76"	72°28'14.32"
8S	A1	7°17'44.88"	72°28'42.33"
	A2	7°17'45.72"	72°28'42.88"
	B1	7°17'46.15"	72°28'45.22"
	B2	7°17'45.40"	72°28'49.10"
	C1	7°17'40.42"	72°28'49.00"
	C2	7°17'39.76"	72°28'48.26"
	D	7°17'37.78"	72°28'41.59"
8N	A1	7°17'34.63"	72°28'43.63"
	A2	7°17'30.04"	72°28'42.78"
	B1	7°17'33.27"	72°28'27.87"
	B2	7°17'34.08"	72°28'37.06"
	C1	7°17'39.28"	72°28'36.66"
	C2	7°17'39.97"	72°28'37.37"
	D	7°17'41.63"	72°28'44.37"
9S	A1	7°17'44.14"	72°27'47.60"
	A2	7°17'45.00"	72°27'48.28"
	B1	7°17'45.48"	72°27'53.26"
	B2	7°17'44.80"	72°27'54.01"

TABLE 1. DIEGO GARCIA FLEET MOORING ANCHOR POSITIONS (Continued)

Buoy No.	Anchor No.	Latitude (South)	Longitude (East)
9S	C1	7°17'38.91"	72°27'45.03"
	C2	7°17'39.11"	72°27'53.88"
	D	7°17'37.44"	72°27'47.28"
9N	A1	7°17'34.59"	72°27'48.96"
	A2	7°17'33.35"	72°27'48.34"
	B1	7°17'33.00"	72°27'43.36"
	B2	7°17'33.54"	72°27'42.54"
	C1	7°17'38.65"	72°27'42.06"
	C2	7°17'39.37"	72°27'42.74"
	D	7°17'41.16"	72°27'49.37"
10	A1	7°16'53.48"	72°25'38.24"
	A2	7°16'53.19"	72°25'39.32"
	B1	7°16'54.59"	72°25'44.36"
	B2	7°16'55.66"	72°25'44.78"
	C1	7°17'00.53"	72°25'43.25"
	C2	7°17'0.89"	72°25'42.41"
	D1	7°16'59.36"	72°25'37.40"
	D2	7°16'58.32"	72°25'36.78"
11NE	A1	7°16'27.33"	72°25'11.55"
	A2	7°16'26.64"	72°25'10.84"
	B1	7°16'26.09"	72°25'9.99"
	B2	7°16'25.82"	72°25'9.08"
	C	7°16'32.15"	72°25'6.73"
11NW	A1	7°16'30.65"	72°24'59.67"
	A2	7°16'31.46"	72°24'59.50"
	B1	7°16'32.92"	72°24'59.43"
	B2	7°16'33.67"	72°24'59.56"
	C	7°16'32.41"	72°25'6.27"

TABLE 1. DIEGO GARCIA FLEET MOORING ANCHOR POSITIONS (Continued)

Buoy No.	Anchor No.	Latitude (South)	Longitude (East)
11SE	A1	7°16'39.72"	72°25'16.43"
	A2	7°16'38.71"	72°25'16.66"
	B1	7°16'37.77"	72°25'16.67"
	B2	7°16'37.80"	72°25'16.54"
	C	7°16'37.80"	72°25'9.79"
11SW	A1	7°16'43.13"	72°25'4.49"
	A2	7°16'43.76"	72°25'5.30"
	B1	7°16'44.28"	72°25'6.08"
	B2	7°16'44.68"	72°25'6.99"
	C	7°16'36.72"	72°25'9.31"

3.3.2 D.G. PCR, Annex B, Geographic Positions and Tables, B-2 through B-6

4.0 **GENERAL MOORING DESCIPTIONS:** As mentioned previously, the eleven Diego Garcia Fleet Moorings consist of four types:

4.0.1 **Cargo Free Swing Mooring:** There are six (6) of this type mooring, each consisting of a single Peg Top buoy, a riser chain, and three ground legs and anchors. A moored ship's movement, within the desired watch circle about this mooring, is dependent only upon wind, tide, and current.

4.0.2 **Cargo Bow Stern Mooring:** Three (3) of this type mooring exist, each consisting of two telephone buoys with three double ground legs (six anchors) and a single backstay leg attached to each buoy. A moored ship is tied by its bow to one bouy and by its stern to the second. The ship's movement is thereby restricted causing it to be a more stable nesting platform.

4.0.3 **Tender Free Swing Mooring:** Only one of this type mooring is installed at Diego Garcia. This mooring consists of a single Telephone buoy with four double ground legs (eight anchors). This mooring is designed for use by the larger tender type vessels and, again, movements of a moored ship around the buoy is determined only by prevailing wind, tide, and current.

4.0.4 **Tender Bow Stern Mooring:** Only one of this four (4) buoy mooring system exists on the island. A moored ship is tied by its port bow, starboard bow, port quarter, and starboard quarter to each of four Telephone type buoys. Each buoy has two double ground legs (four anchors) and a backstay leg.

Isometric drawings of the above four types of moorings and documentation of the as-built configuration of each buoy system are contained in paragraph 6.0 of this PEP.

5.0 GENERAL INSPECTION OBJECTIVES: The primary purpose of this inspection is to visually check the continuity of the installed cathodic protection systems and, through the use of underwater voltmeters, determine the electrical potential provided by each of these systems to support the protection of its mooring. A secondary mission will be to closely observe selected chain, chain connecting links, and ground rings in order to determine the amount, if any, of wear and/or corrosion suffered by these mooring materials during their one year of fleet usage. Still photographs will be taken of selected portions of each mooring system and of all damaged or abnormal material noted. In addition to the underwater inspection, a random sample of the eleven buoys will be sighted from known ashore reference locations in order to confirm or revise the positional data of these buoys that are detailed in Figure 2 of this PEP and the Diego Garcia Project Completion Report.

6.0 INSPECTION PROCEDURES: The following are the general procedures to be followed during the underwater inspection:

6.1 **Cargo Free Swing Moorings:** There are six of this type mooring installed in the lagoon at Diego Garcia (Fleet Moorings 1 through 6). Each of these moorings is a riser type and includes a MK11 Peg Top Buoy, a half shot of riser chain, a ground ring, three 540 foot ground legs, and three propellant embedment anchors. The buoy, riser, and ground legs of each of these moorings are cathodically protected with zinc anodes and wire rope continuity cable systems. Figure 3 is an isometric drawing of each of these mooring systems, Figure 4 depicts the points to be inspected in each of the risers and ground legs, and Table 2 and Table 3 contain the actual as-built material installed in each of the six mooring systems.

The inspection of each of these moorings will be conducted as follows:

6.1.1 **Buoy:** The above water portion of each buoy will be visually observed in order to determine its general condition. Physical damage such as breaks, dents, or listing (which would indicate internal leaking) will be noted and photographed. The paint will be checked for cracking, chipping, or peeling. Topside jewelry and hatches will be examined and worn or broken material and the extent of rusting recorded and photographed. The upper fender system will be checked for integrity, marine attack, and secure connection to the buoy.

In a similar manner, the lower portion of each buoy shall be inspected by the assigned divers. The thickness of marine growth shall be recorded and a one foot square area cleaned of growth and the condition of the paint observed and photographed. There are two 150 pound anodes (inside impact protective cages) attached to the lower portion of each buoy. Each of these anodes shall be inspected for

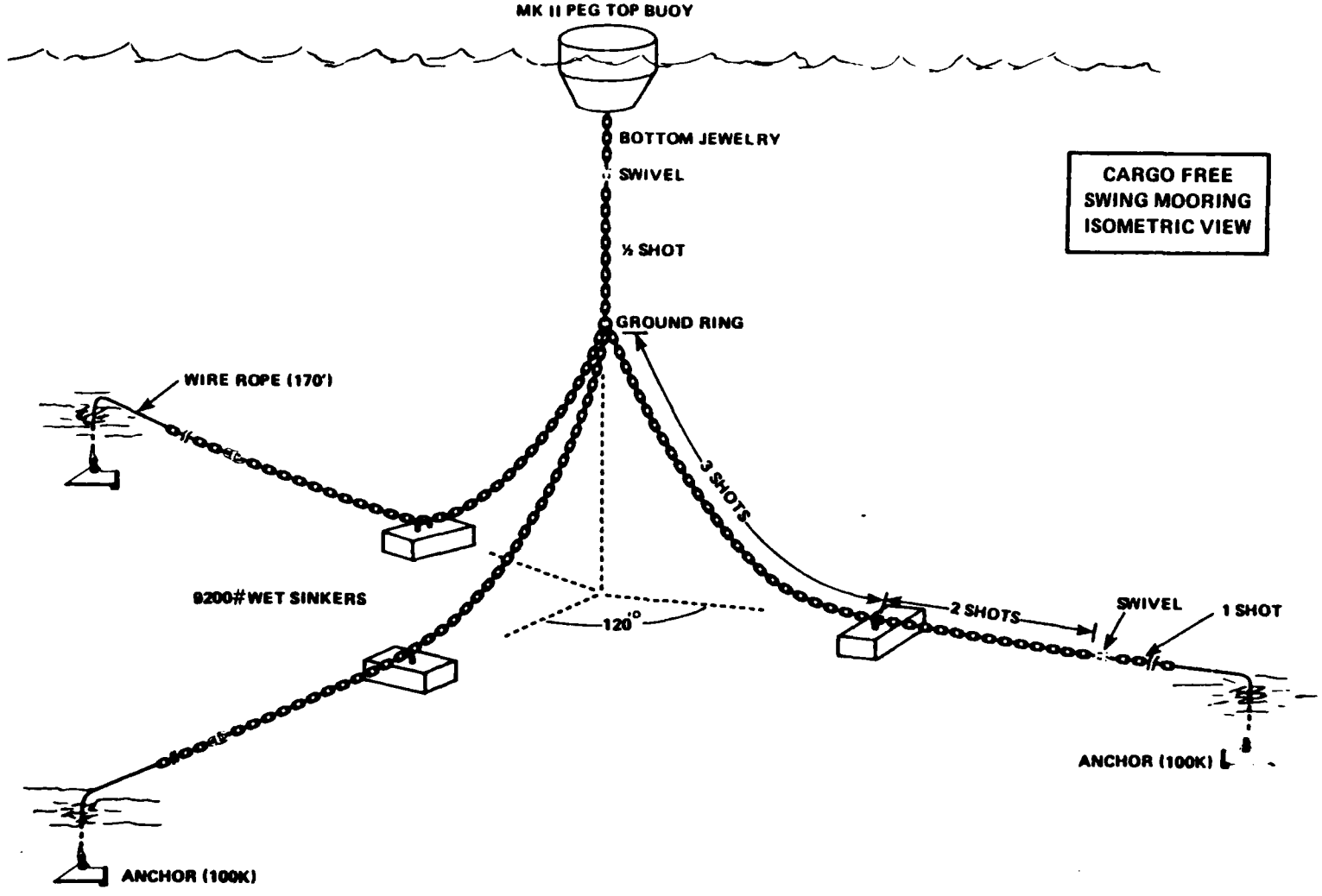

MK II PEG TOP BUOY
BOTTOM JEWELRY
SWIVEL
½ SHOT
GROUND RING
CARGO FREE
SWING MOORING
ISOMETRIC VIEW
WIRE ROPE (170')
3 SHOTS
9200# WET SINKERS
120°
2 SHOTS
SWIVEL
1 SHOT
ANCHOR (100K)
ANCHOR (100K)

FIGURE 3.

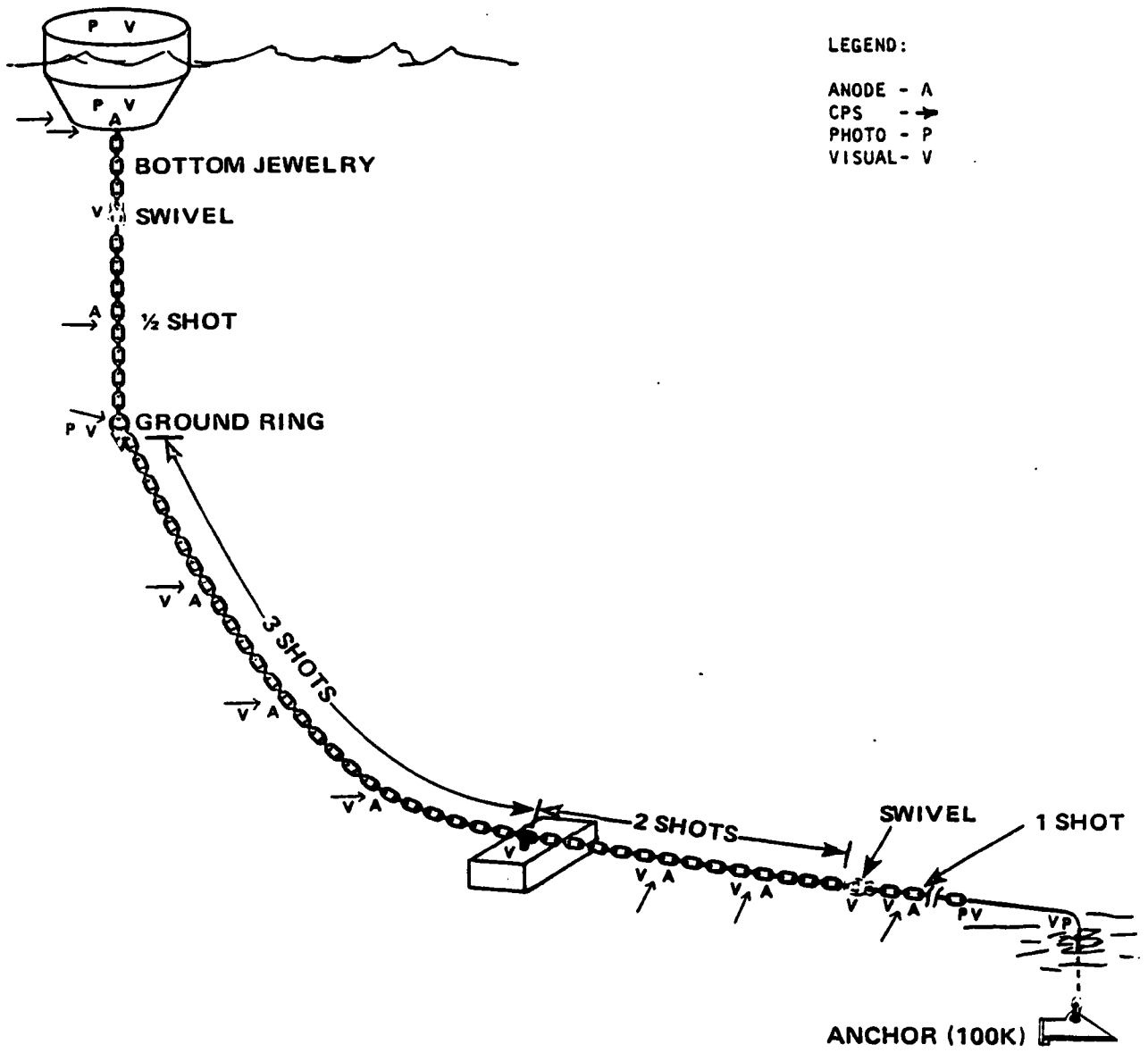


FIGURE 4. GROUND LEG INSPECTION POINTS

TABLE 2. DIEGO GARCIA FLEET MOORINGS AS BUILT
CARGO FREE SWINGING MOORS

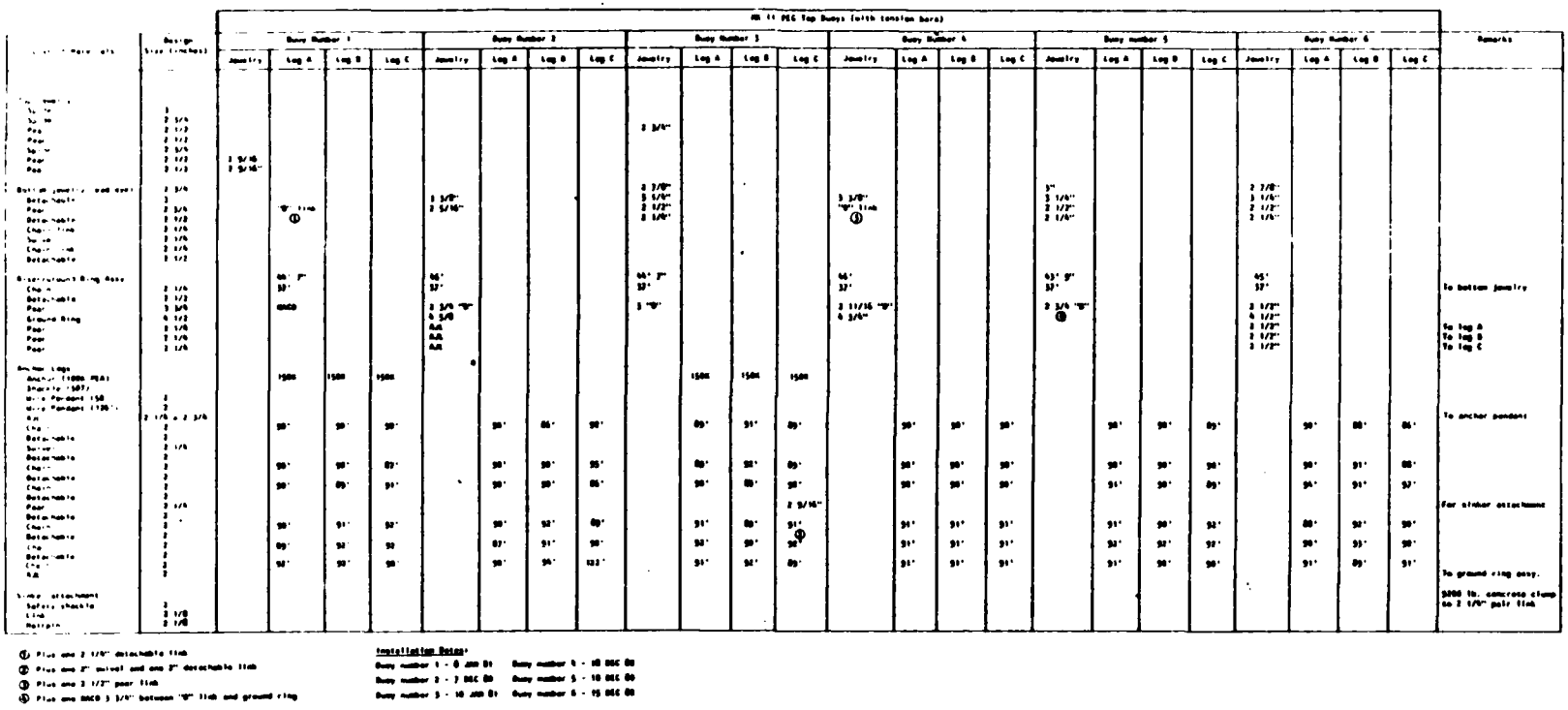
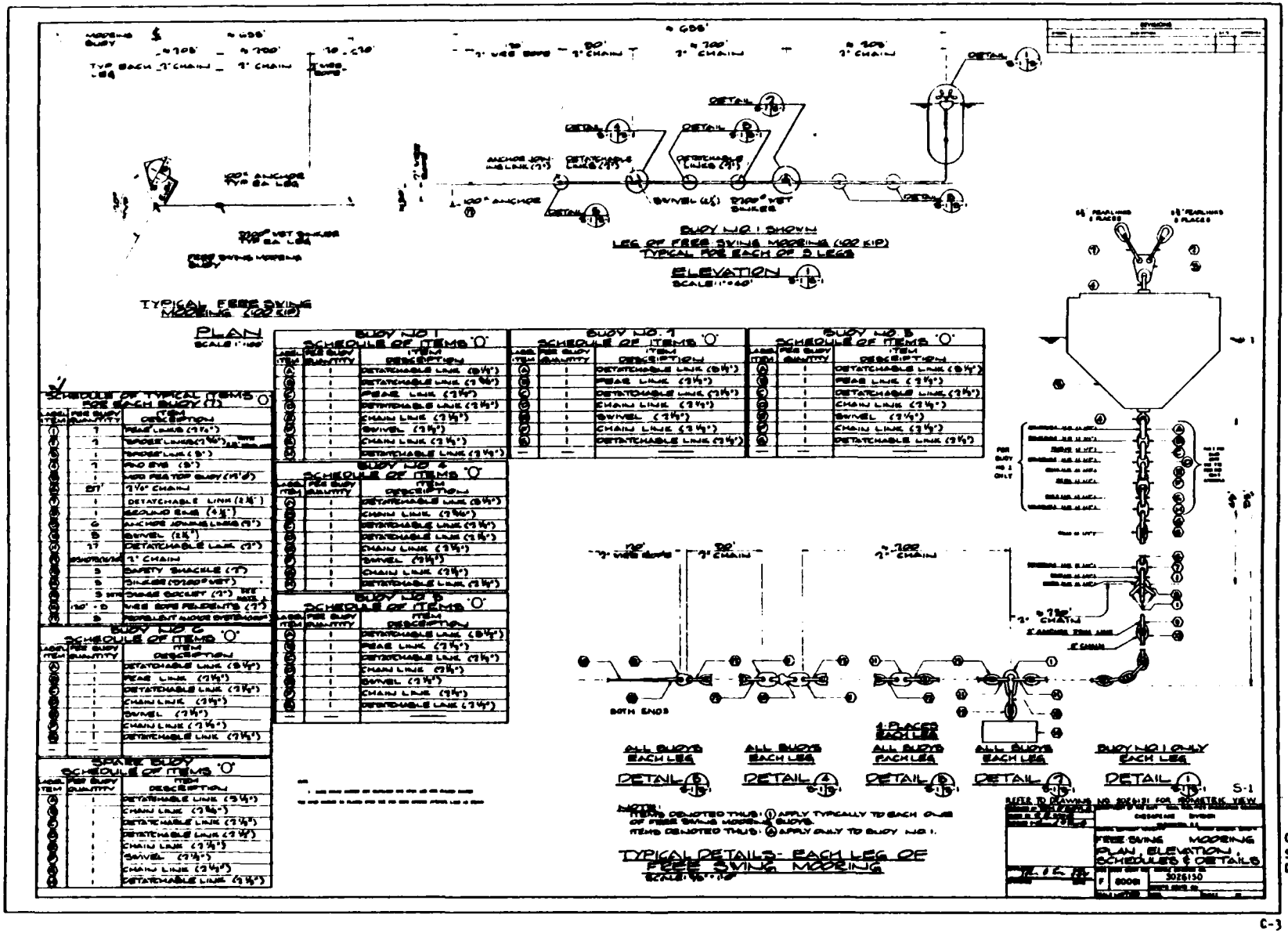


TABLE 3.



Cargo Free Swing Mooring Design

condition, erosion, and proper connection to the buoy brackets. The dimensions of one anode should be recorded, and an underwater voltmeter then used to probe the buoy bottom in three areas, and the resulting electrical potential readings recorded. The divers shall then probe one of the links in the buoy bottom jewelry and record the reading.

6.1.2 Riser: The divers shall swim down the riser chain to the ground ring. Any corrosion noted will be recorded as well as the location along the riser.

The divers shall probe the riser chain with the voltmeter and record the potential reading. In addition, during the swim down the riser, the divers shall visually observe the swivel and attempt to determine if it is working.

6.1.3 Ground Ring: The divers shall closely view the ground ring and check for any signs of abnormal wear or corrosion. The ground ring will be photographed, probed, and the potential recorded.

6.1.4 Ground Legs: Each of the ground legs consists of six shots of chain and was designed to have one 250 pound anode installed per shot. As with the riser chain, divers shall swim down each ground leg and check the integrity and secureness of the continuity cable, the condition of each anode, and take chain potential readings near each anode.

In addition, about 270 feet from the ground ring, a sinker shackle connects a 9,200 pound concrete clump to the ground leg chain. Divers shall check the condition of the shackle and ensure that the clump is still attached to the ground leg. Each ground leg has a swivel located about 180 feet from the clump. This swivel should be viewed for workability. Below the swivel there is one more shot of chain and another anode to check.

Upon reaching the end of the chain, divers shall view and photograph the connection between the chain and the 2 inch wire rope anchor pendant which leads to the anchor. The divers shall then swim this wire rope until the point that it disappears into the bottom checking for kinks or unravelling of the rope. In addition, a photograph should be taken of the rope where it bends into the bottom to determine if any wear has occurred.

6.2 **Cargo Bow/Stern Moorings:** There are three of these moorings installed, each consisting of two buoy systems (Fleet Moorings 7N, 7S, 8N, 8S, 9N, and 9S). Each buoy system consists of a 16 foot diameter Telephone Buoy, three 2 3/4 inch equalizers attached to three of the four buoy pad eyes, three ground leg pairs consisting of seven shots of chain (630') per leg pair, and six 150K propellant embedment anchors. A seven shot back stay leg with its embedment anchor is attached directly to the buoy's fourth pad eye. The buoy, back stay leg, and the ground legs contain cathodic protection systems. Figures 5 and 6 are isometric drawings of each of these six buoy systems, Figures 7 and 8 depict the points to be inspected and Tables 4 and 5 contain lists of the actual as-built material installed in each of the buoy systems. The inspection of each of these six buoy systems will be conducted as follows:

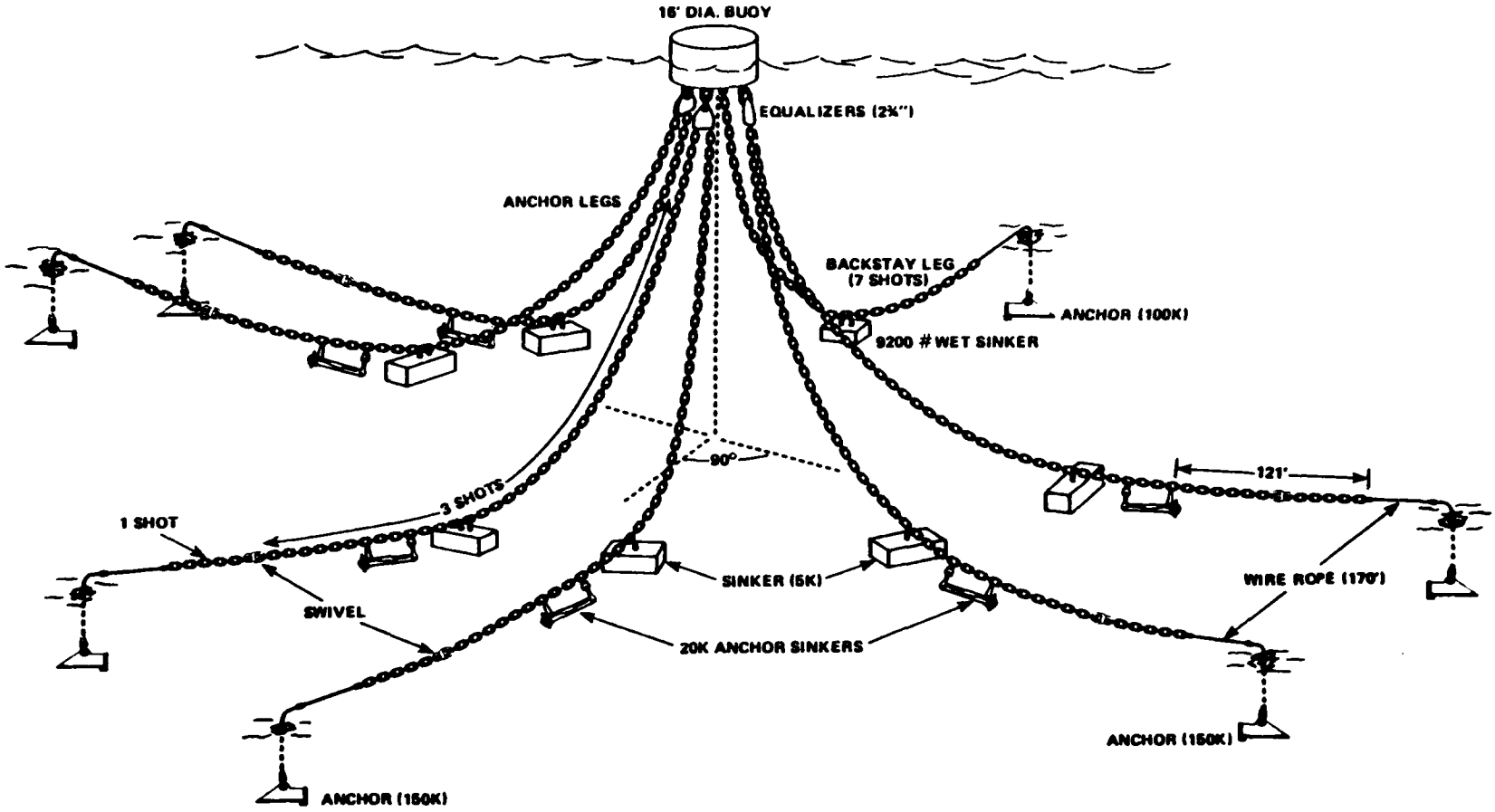


FIGURE 5. CARGO BOW/STERN MOORING

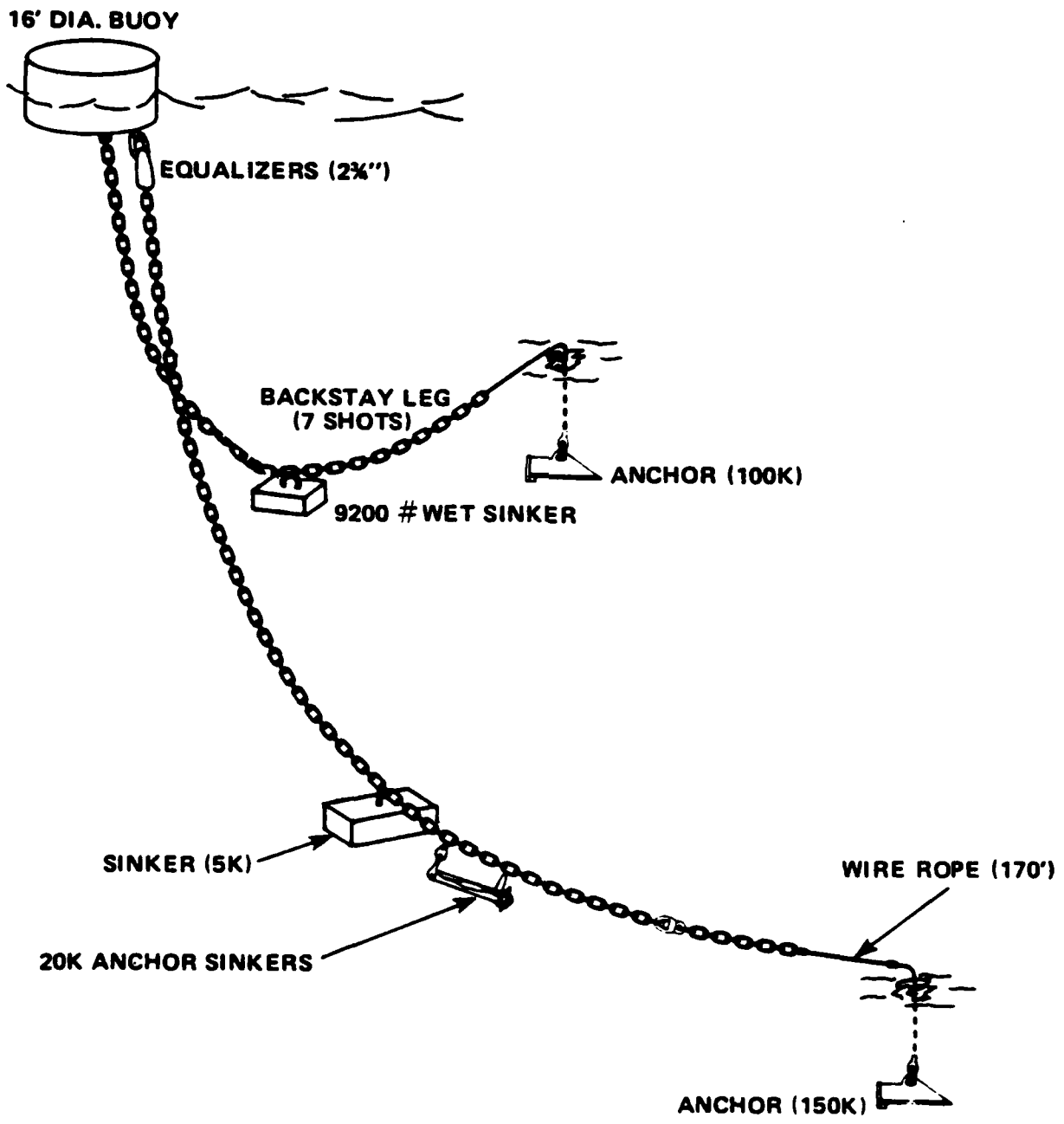


FIGURE 6. CARGO BOW/STERN MOORING

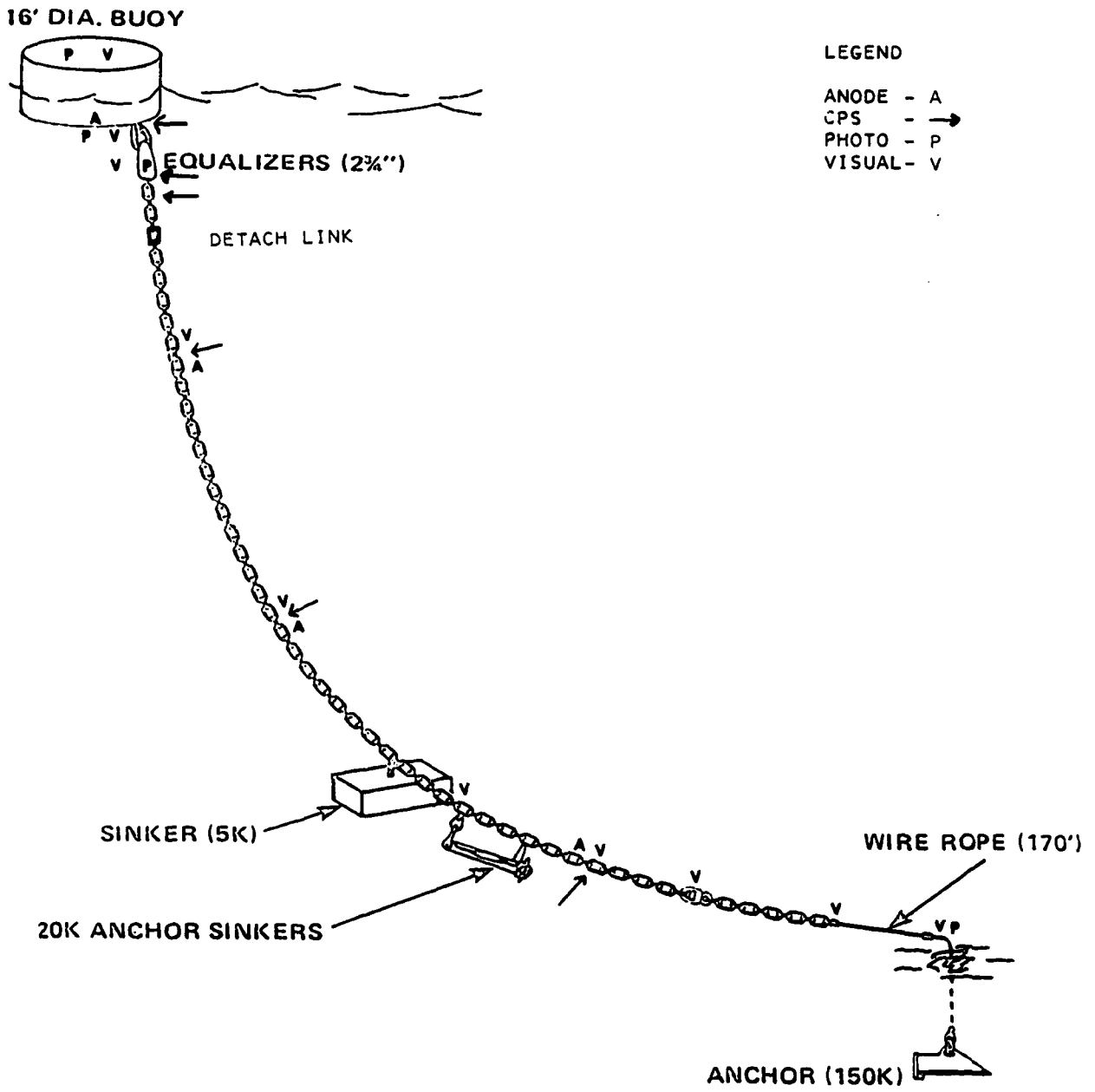


FIGURE 7. CARGO BOW/STERN MOORING GROUNDLEG INSPECTION POINTS

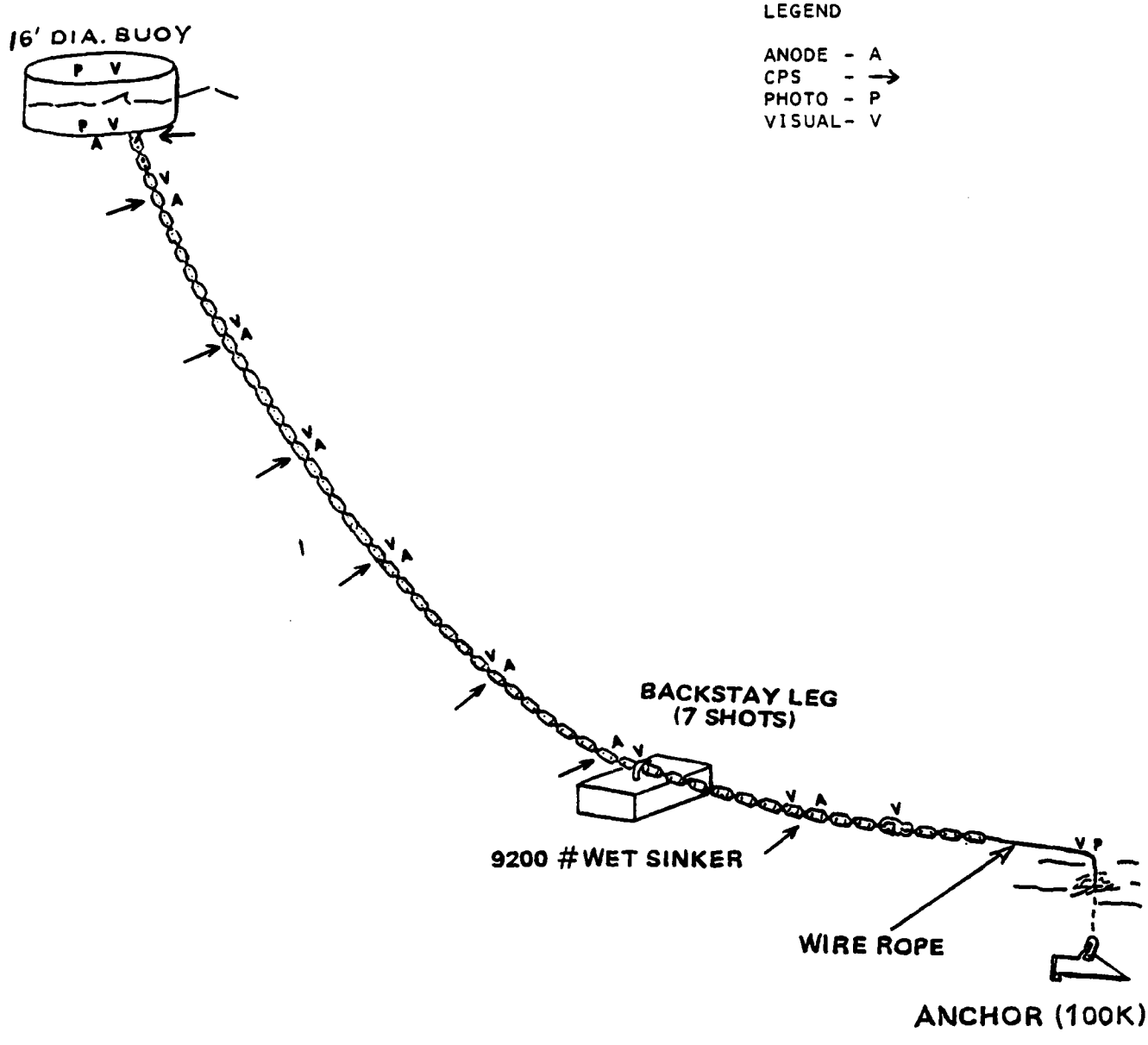


FIGURE 8. CARGO BOW/STERN MOORING BACKSTAY LEG INSPECTION POINTS

TABLE 4. DIEGO GARCIA FLEET MOORINGS AS BUILT
CARGO BOW/STERN MOORS

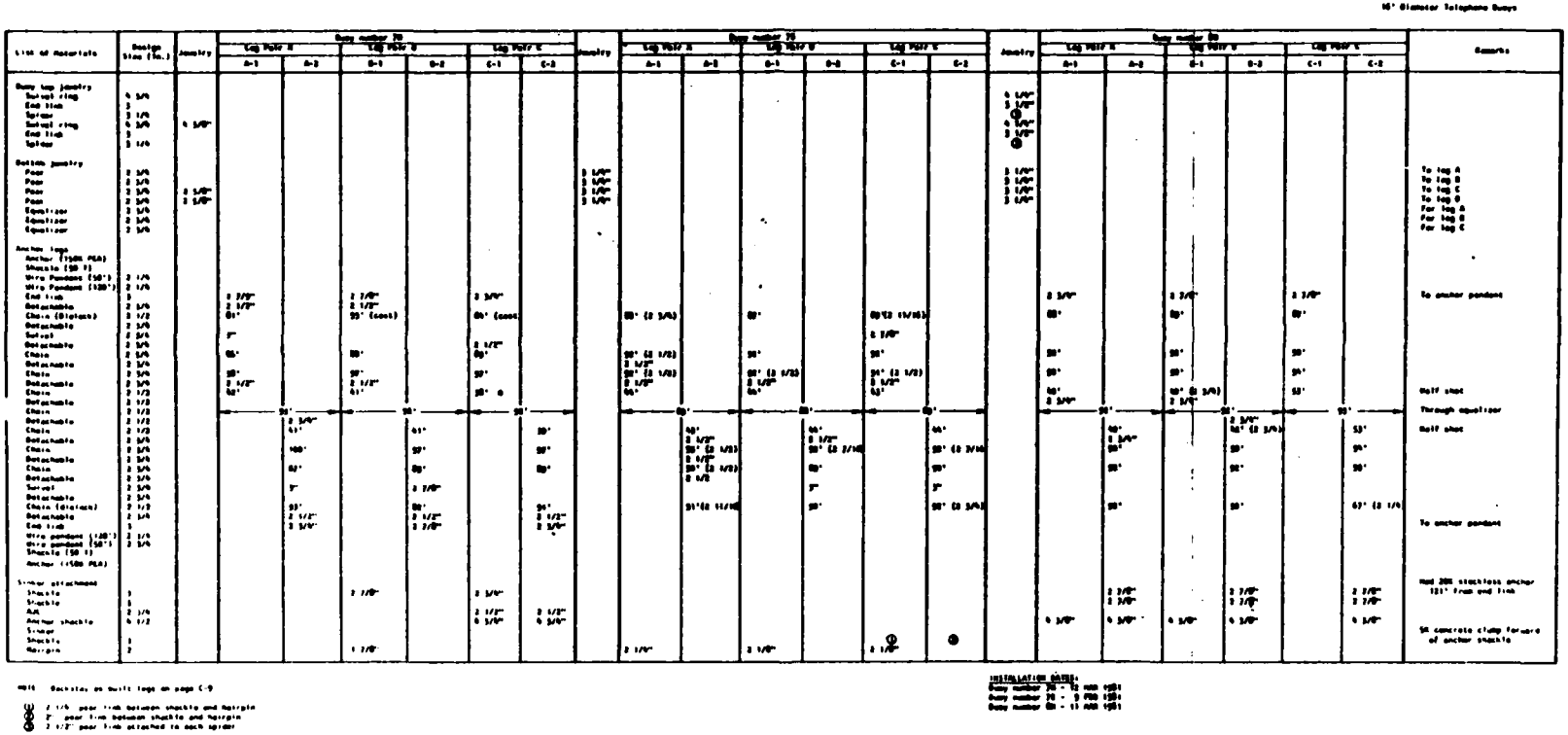


TABLE 4. DIEGO GARCIA FLEET MOORING AS BUILT
CARGO BOW/STERN MOOR BACKSTAY LEGS

(Continued)

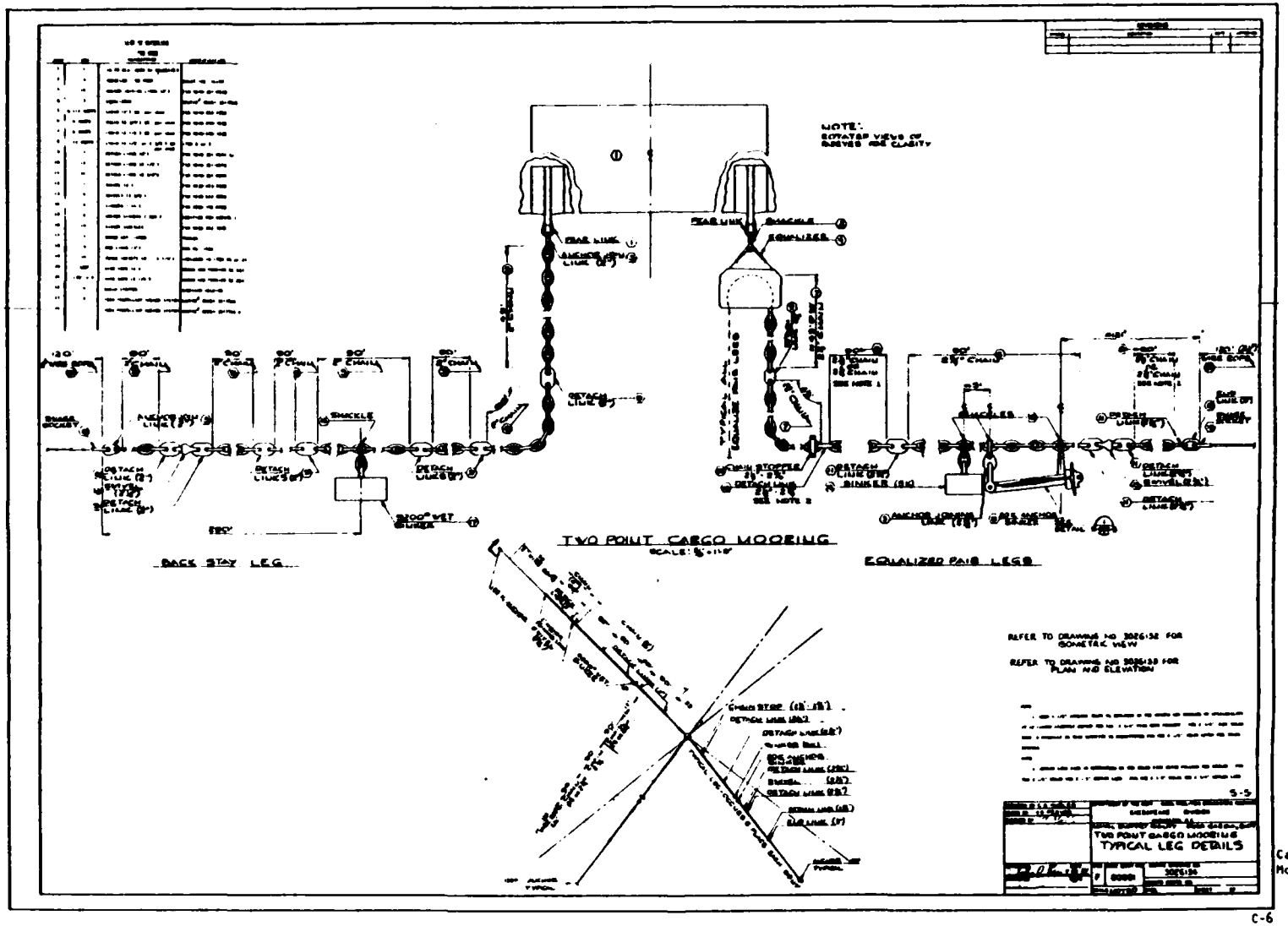
16' Diameter Telephone Buoys

List of Materials	Design Size (in)	Buoy No. 7N Leg D	Buoy 7S Leg D	Buoy 8N Leg D	Buoy 8S Leg D	Buoy 9N Leg D	Buoy 9S Leg D	Remarks
Backstay Leg								
Anchor (100K PEA)								
Shackle (50 T)								
Wire pendant(50')	2							
Wire pendant(120')	2							
AJL	2	2 1/2"	2 1/4"	2 1/2"			2 1/4"	To anchor pendant
Chain	2	90'	90'	90'	90'	90'	90'	
Detachable	2							
Swivel	2 1/4							
Detachable	2							
Chain	2	90'	90'	90'	90'	90'	90'	
Detachable	2							
Chain	2	90'	90'	90'	90'	90'	90' (2 1/4") ②	
Detachable	2							
Chain	2	45'	45'	45'	45'	45'	45'	
Detachable	2							
Chain	2	90'	90'	90'	90'	90'	90'	
Detachable	2							
Chain	2	90'	90'	90'	90'	90'	90'	
Detachable	2							
Chain	2	90'	90'	90'	80'	90'	37'	
AJL	2		2 1/4"					To buoy pear link
Sinker Attachment								9200 lb. concrete clump 290' from anchor pendant
Shackle	3		2 1/4" pear	2 1/8"			2 1/4"	
Chain Link	2 1/8					①		
Hairpin	2 1/8							

① One 2" detachable link between shackle and chain link

② One 2 1/4" swivel between detachable link and 2 1/4" shot of chain

TABLE 5.



Cargo Bow/Stern Mooring Design

C-6

6.2.1 BUOY: The above water portion of each buoy will be visually observed in order to determine its general condition. Physical damage such as breaks, dents, or buoy list will be noted and photographed. The paint will be checked for chipping or peeling. Topside jewelry, rubbing rail, and hatches will be examined and worn or broken material and the extent of any rusting recorded and photographed. The upper fender system will be checked for damage, wear, erosion, marine attack, and proper connection to the fender frame.

The underwater portion of the buoy shall be similarily inspected by UCT divers. The lower fender system shall be inspected, the average thickness of marine growth recorded, and a one foot square area cleaned so that condition of the bottom paint can be observed and photographed. Three 150 pound anodes are attached to brackets welded to the bottom of each buoy. Each of these anodes shall be visually inspected for condition, uniform erosion, and secure connection to their bracket. The dimensions of one anode should be recorded, and an underwater voltmeter then used to probe the buoy bottom in three areas, and the potential readings recorded.

6.2.2 BUOY BOTTOM JEWELRY: None of the three equalizers on each buoy, nor the first chain shot of each leg pair passing through an equalizer are cathodically protected. Photographs of the equalizers and any wear points on the chain passing through it shall be taken. Divers shall probe the equalizer and at least one link on either side of the first shot and record the results. This data should determine whether electric potential is flowing through the chain and equalizer.

6.2.3 **Ground Legs:** Below the detachable link between the initial shot of chain through the equalizer and the remainder of the ground leg, each half of a leg pair contains three shots of chain cathodically protected with continuity wire and a 250 pound anode per shot. Divers shall swim down each side of each leg pair closely checking the integrity of the wire rope continuity cable. Any breaks in or looseness of the cable and the location of these deficiencies shall be recorded. Each of the anodes shall be examined for uniform erosion. Any uneven anode erosion shall be reported and photographed. If an anode is damaged, hanging loose from the continuity cable, or missing, this fact shall also be recorded and photographs taken. In addition, the divers shall probe the chain near each anode and record the potential reading.

About 200 feet below the equalizer, sinker shackles connect both a 5,000 pound concrete clump and a 20,000 pound stockless anchor clump to each ground leg. Divers shall check the condition of the three shackles attaching these two clumps to the chain. Broken or damaged shackles shall be recorded and photographed. In addition, each ground leg has a swivel located about 30 feet below the two clumps. This swivel should be observed to determine if it is still working. Below the swivel, there is one more shot (90 feet) of chain to be probed and another anode to be inspected.

Upon reaching the end of the chain in each ground leg pair, divers should view and photograph the swage fittings, pins, and retainers connecting the chain and the 2¼ inch wire rope anchor pendant which leads to the anchor. The divers should then swim the wire rope until it disappears into the bottom checking for kinks, breaks, wear, or

unravelling of the rope. A photograph shall be taken of the rope where it bends into the bottom.

6.2.4 **Backstay Leg:** A similar inspection will be conducted of each single backstay leg. Each of these legs is cathodically protected with wire rope continuity cable and seven 250 pound anodes (one per shot of chain). These legs have attached to them, about 350 feet from the buoy, a single 9,200 pound clump, and a swivel located about 225 feet below the clump. The integrity of the continuity cable and the conditions of the anodes, sinker shackle, swivel, and anchor pendant will be inspected in the same manner as those in the ground legs. Again, an underwater voltmeter will be used to probe each backstay leg in positions near its anodes.

6.3 **TENDER FREE SWING MOORING:** Fleet Mooring 10 is the only mooring of this type installed at Diego Garcia. This mooring consists of a single 16 foot Telephone Buoy, four 2 3/4 inch equalizers attached to the buoy pad eyes, four ground leg pairs consisting of seven shots of chain each, and eight 150K, PEAs. The design of this mooring is identical to that of each of the Cargo Bow/Stern buoy systems with the exception that this mooring has a fourth leg pair instead of a backstay leg. Figure 9 is an isometric drawing of FM 10 while Figure 10 depicts the points to be inspected on each leg of the mooring. Tables 6 and 7 contain the as-built material installed in these moorings.

Since the buoy and composition of each leg pair of this mooring are similar to those of the Cargo Bow/Stern Moorings, the inspection procedures detailed in paragraphs 6.2.1 through 6.2.3 will be also followed during the inspection of this mooring.

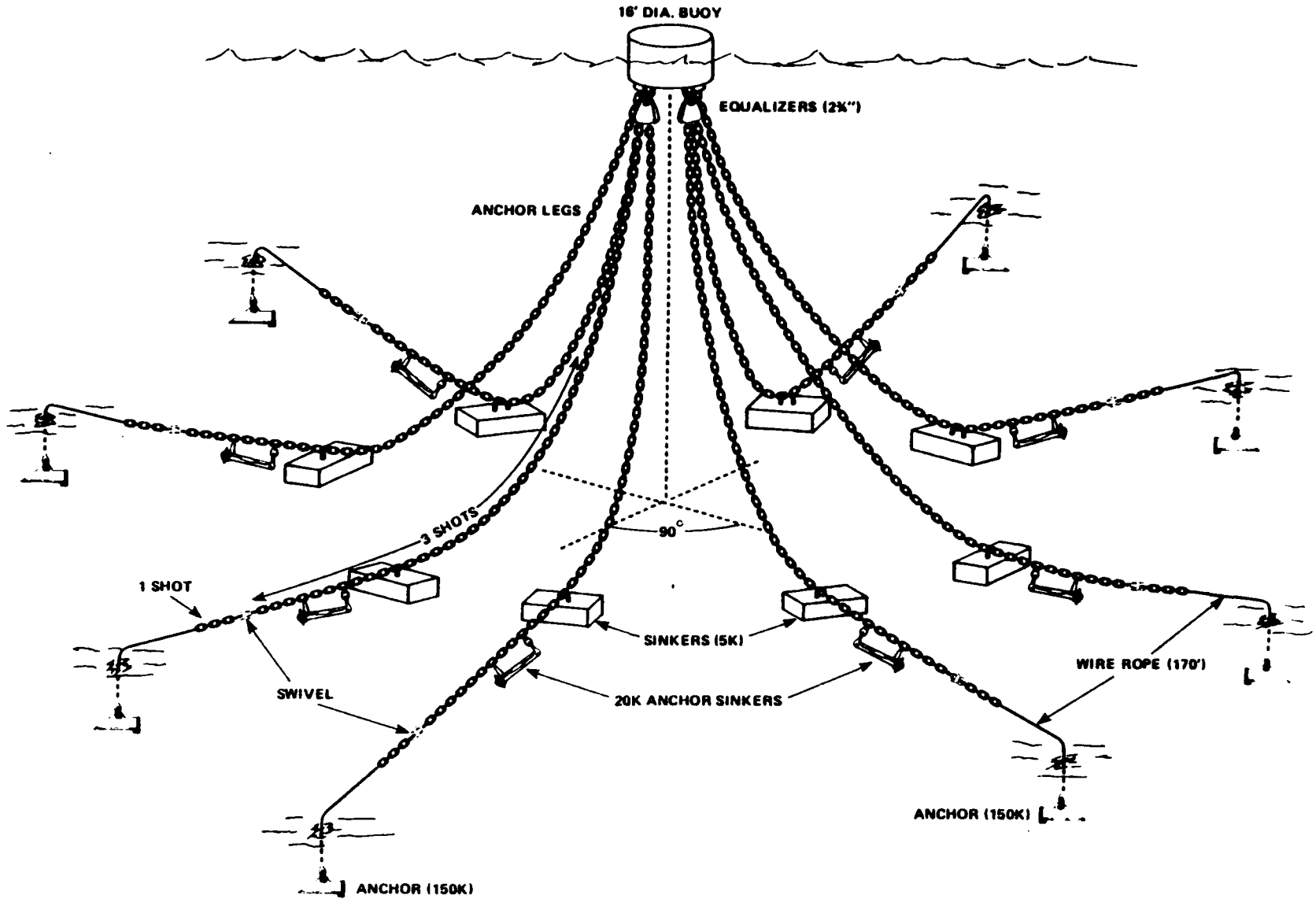


FIGURE 9. TENDER FREE SWINGING MOORING

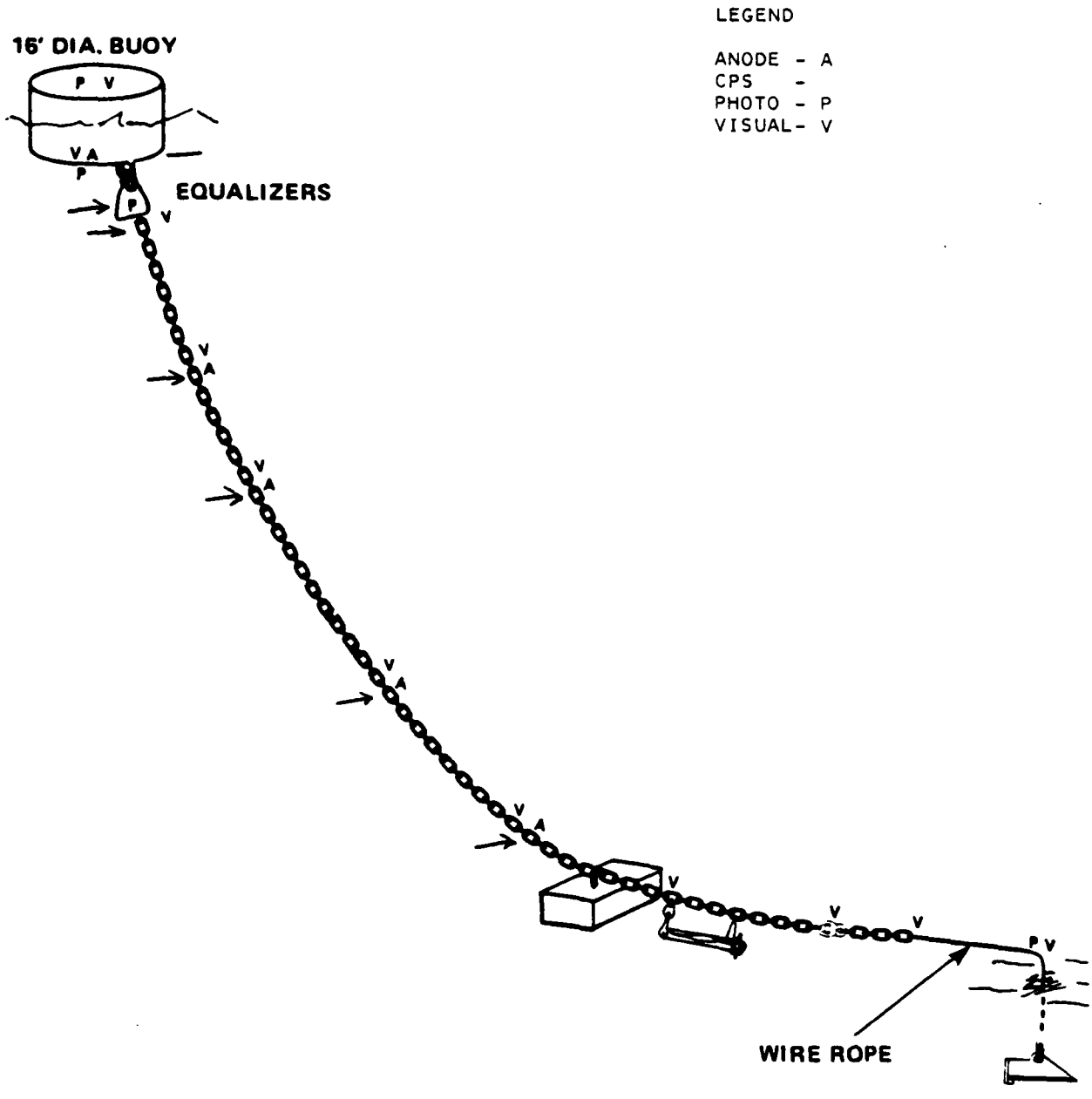


FIGURE 10. TENDER FREE SWINGING MOORING GROUND LEG INSPECTION POINT

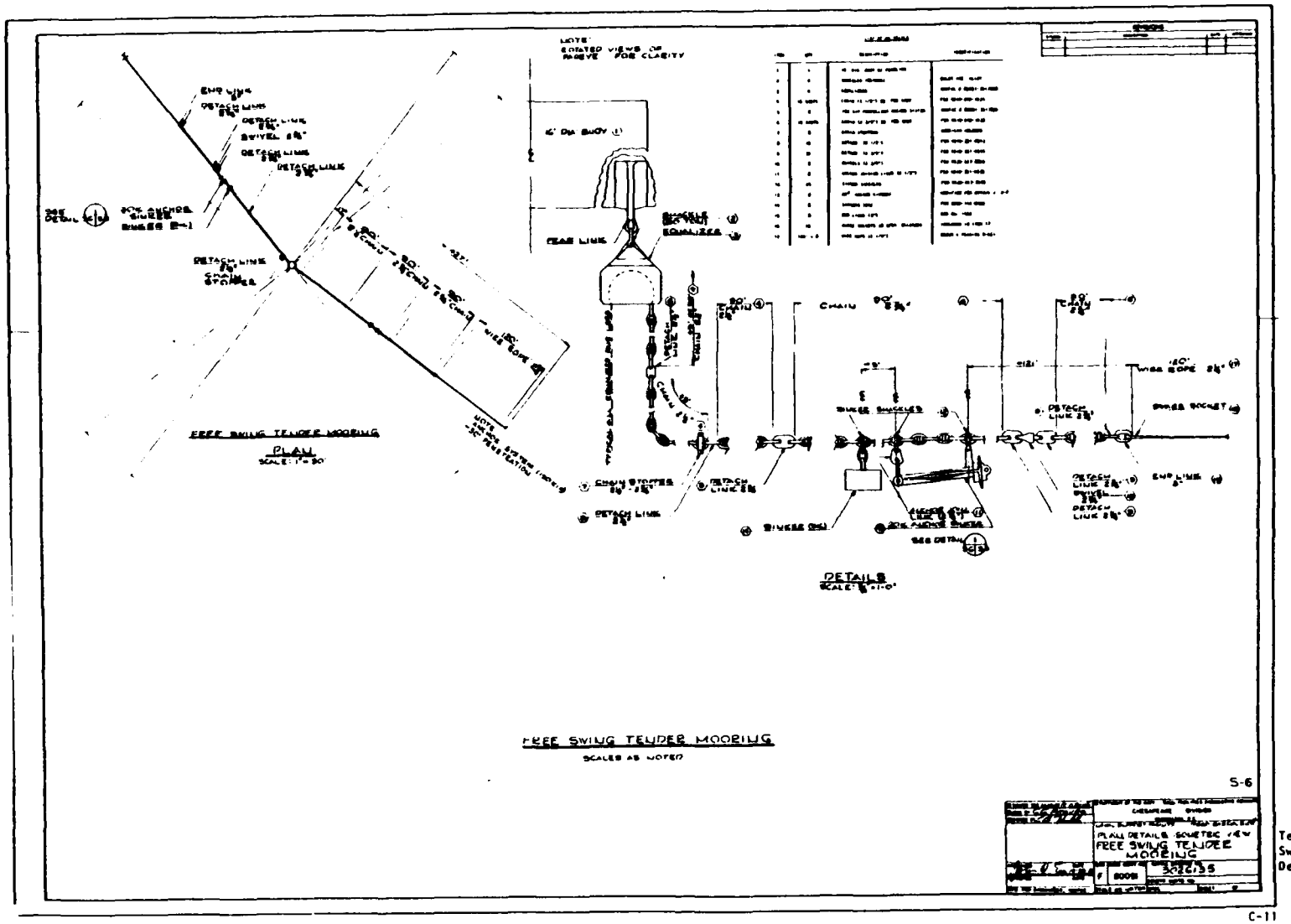
TABLE 6. DIEGO GARCIA FLEET MOORING AS BUILT
TENDER FREE SWINGING MOOR

16' Diameter Telephone Buoys

List of Materials	Design Size (inches)	Buoy number 18								Remarks
		Leg Pair A		Leg Pair B		Leg Pair C		Leg Pair D		
		A-1	A-2	B-1	B-2	C-1	C-2	D-1	D-2	
Buoy top jewelry										
Swivel ring	4 1/4									
Kenter shackle	3 1/2									
Pear	2 9/16									
Swivel ring	4 1/4									
Kenter shackle	3 1/2									
Pear	2 9/16									
Buoy bottom jewelry										
Pear	3 3/8									To leg pair A
Pear	3 3/8									To leg pair B
Pear	3 3/8									To leg pair C
Pear	3 3/8									To leg pair D
Equalizer	2 3/4									For leg pair A
Equalizer	2 3/4									For leg pair B
Equalizer	2 3/4									For leg pair C
Equalizer	2 3/4									For leg pair D
Anchor legs										
Anchor (15BK PEA)										
Shackle (50 T)										
Wire pendant (50')	2 1/4									
Wire pendant (120')	2 1/4									
End link	3					2 9/16" Pear				To anchor pendant
Detachable	2 3/4									
Chain	2 3/4	93'		93'		89' (2 1/2")		88'(2 11/16)		
Detachable	2 3/4					A.R.				
Swivel	2 3/4					3"				
Detachable	2 3/4					A.R.				
Chain	2 3/4	94'		94'		89' (2 1/2")		90'		
Detachable	2 3/4									
Chain	2 1/2	70'		93'		90' (2 3/8")		90'		
Detachable	2 1/2									
Chain	2 1/2	51'		42'		45'		45'		Half shot
Detachable	2 1/2									
Chain	2 1/2	← 94' →		← 85' →		← 89' →		← 89' →		Through equalizer
Detachable	2 1/2									
Chain	2 1/2		54'		42'		36'		45'	Half shot
Detachable	2 1/2									
Chain	2 1/2		83'		94'		90'		87'	
Detachable	2 3/4									
Chain	2 3/4		94'		83'		90' (2 3/8")		90'	
Detachable	2 3/4									
Swivel	2 3/4									
Detachable	2 3/4									
Chain	2 3/4		84'		93'		89' (2 7/16)		90'	
Detachable	2 3/4									
End link	3						2 9/16"			To anchor pendant
Wire pendant (120')	2 1/4									
Wire pendant (50')	2 1/4									
Shackle (50 T)										
Anchor (15BK PEA)										
Sinker attachment										Mod 28K stockless anchor 27' from swivel toward buoy
Shackle	3									
Shackle	3									
Pear	2 3/4			3"	2 1/2"		3"		3"	
Sinker										5K concrete clump forward of anchor shackle attachment
Shackle	3									
Pear	2 1/2	2 1/4"	2"	2"	1 3/4"	1 3/4"	2"	2 1/4"	2"	
Hairpin	2 1/4							2"	2"	

INSTALLATION DATE: 24 JAN 1981

TABLE 7.



Tender Free Swing Mooring Design

6.4. **Tender Bow/Stern Mooring:** This mooring consists of four buoy systems (Buoy 11NE, 11SE, 11SW, and 11NW). Each buoy system consists of a Telephone Buoy and a large (3¼") equalizer attached to one of the buoy's pad eyes. A shot of 3¼ inch chain passes through this equalizer, and attached to each end of this chain is a 2 3/4 inch equalizer. A ground leg pair passes through each of these equalizers. Thus, each buoy has two ground leg pairs consisting of seven shots of chain and two 150K PEAs. In addition, each buoy has a 180 foot backstay leg attached to the pad eye opposite the one connected to the large equalizer. The three equalizers, the 3 ¼ inch shot of chain through the large equalizer, and the initial shot through each of the small equalizers are not cathodically protected. Only the lower three shots of each half a leg pair and the backstay leg are cathodically protected with zinc anodes and wire rope continuity cable. Figure 11 is an isometric view of one of the four buoy systems comprising this mooring, Figure 12 depicts the points to be inspected on each half a ground leg pair, Figure 13 shows the inspection points for the backstay legs, and Figures 14 and 15 and Table 8 depict the installed as-builts.

The inspection of each of the four buoy systems comprising Fleet Mooring 11 will be conducted as follows:

6.4.1 **Buoy:** Each of these four standard 16 foot Telephone Buoys was modified to include a tension bar swivel plate to which the topside jewelry is attached. Check each of these swivel plates for freedom of motion and photograph these plates. With this exception, each of these buoys is similar to those in the Cargo Bow/Stern Moorings, and

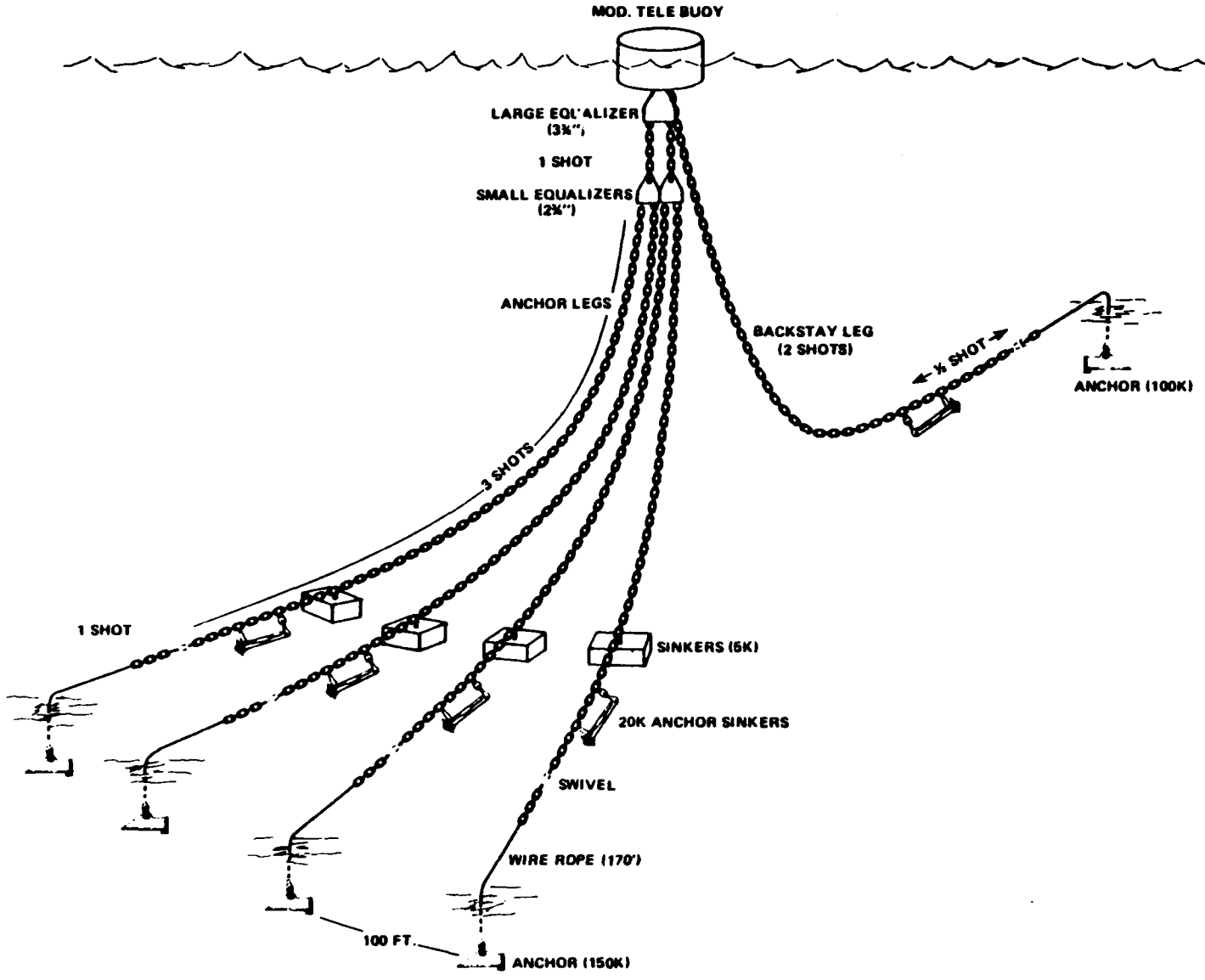


FIGURE 11. TENDER BOW/STERN MOORING

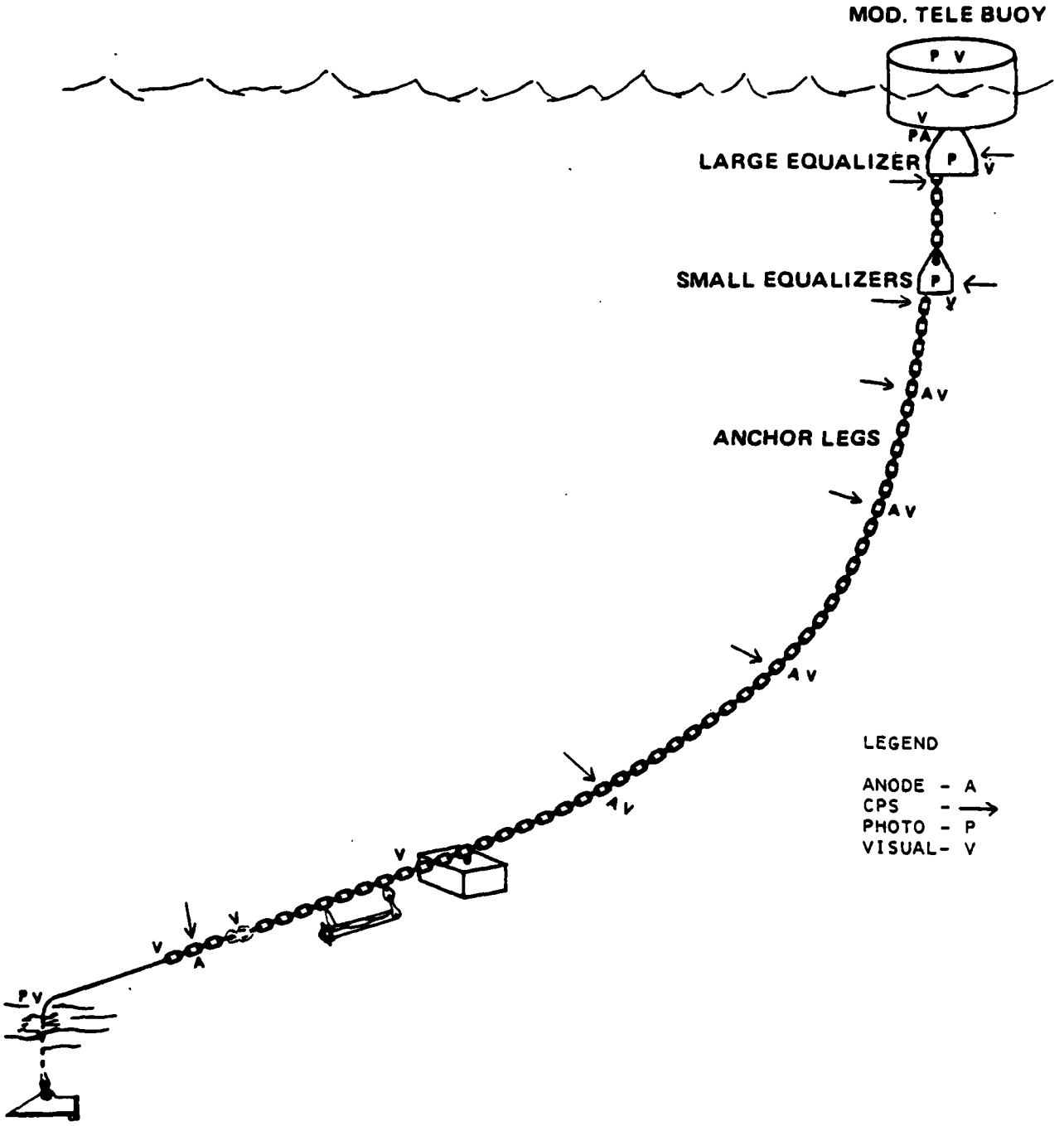


FIGURE 12. TENDER BOW/STERN MOORING GROUND LEG INSPECTION POINTS

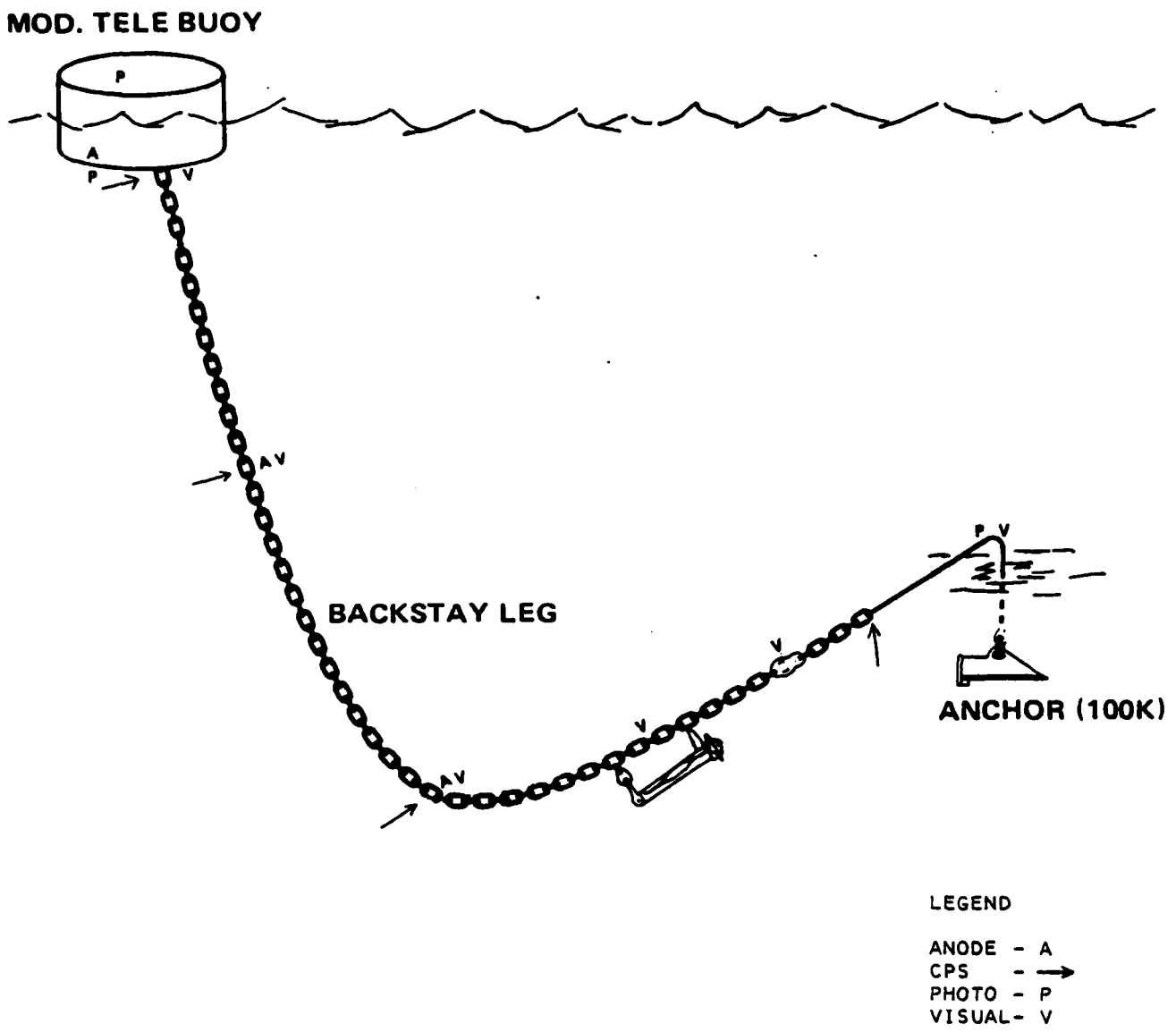
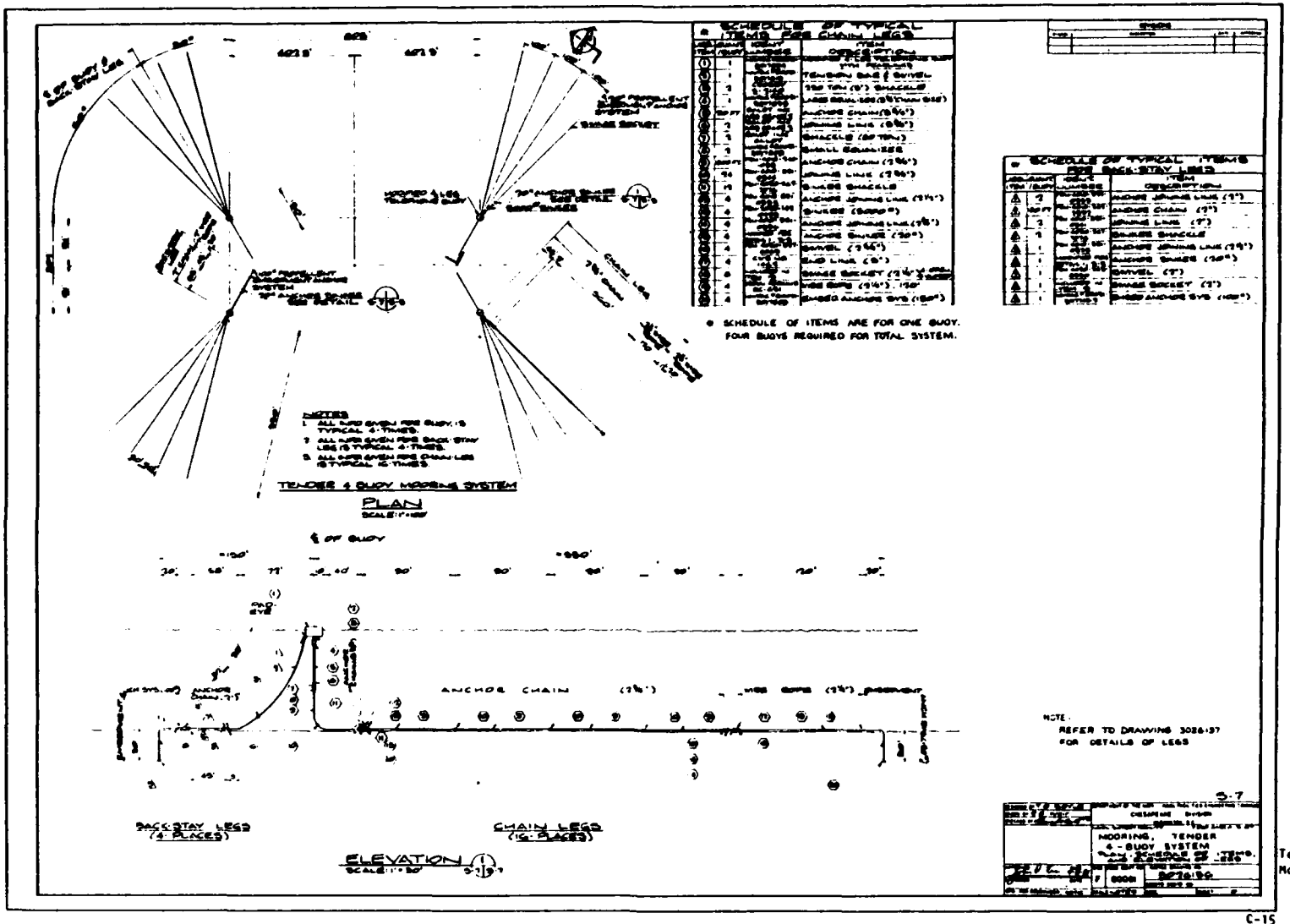


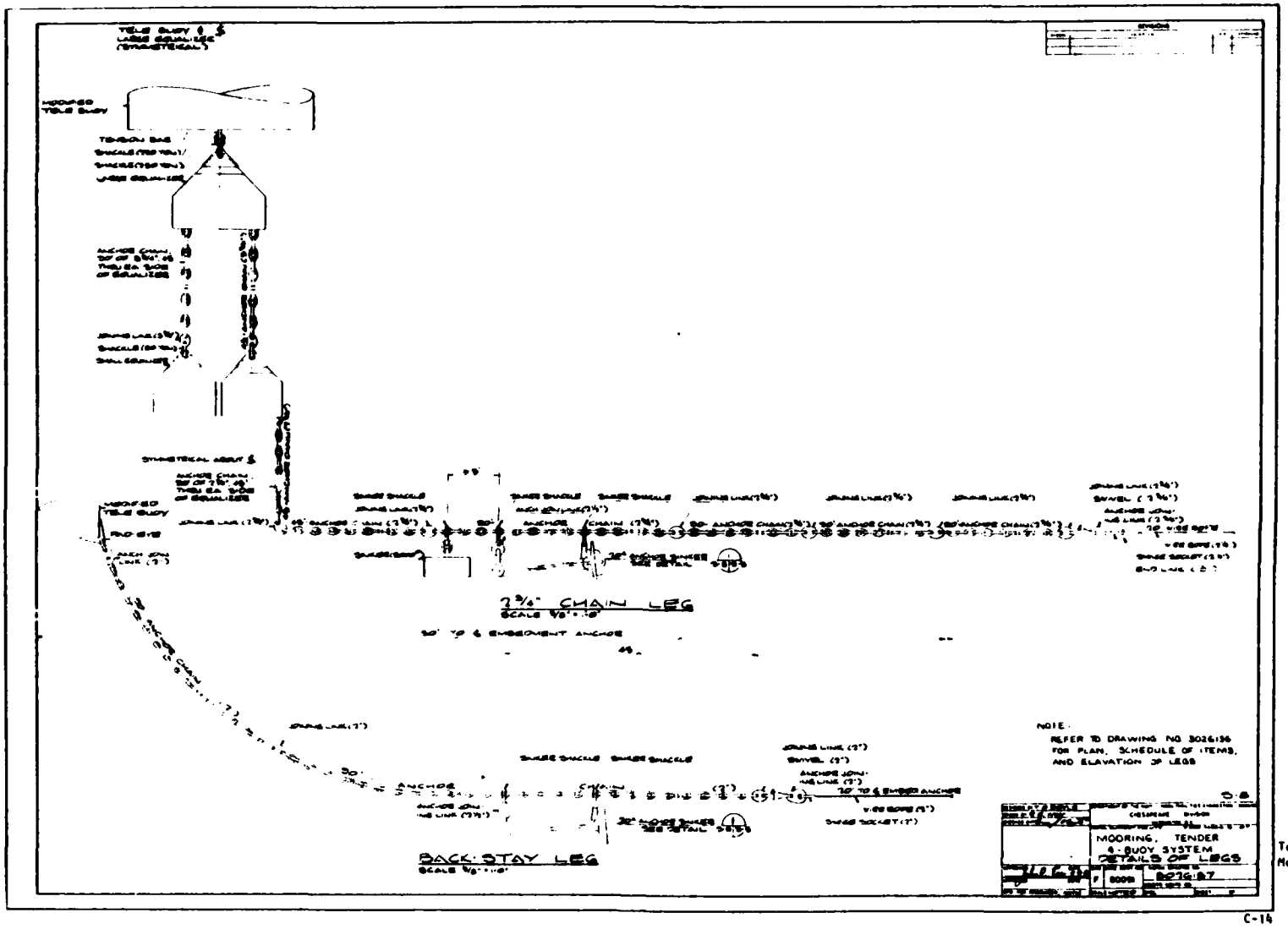
FIGURE 13. TENDER BOW/STERN MOORING BACKSTAY LEG INSPECTION POINTS



C-15

Tender Bow/Stern Mooring Design

FIGURE 14. TENDER BOW/STERN MOORING DESIGN



Tender Bow/Stern Mooring Design

FIGURE 15. TENDER BOW/STERN MOORING DESIGN

TABLE 8. DIEGO GARCIA FLEET MOORING AS BUILT
TENDER FOUR POINT MOOR

Modified 16' Diameter Telephone Buoys

List of Materials	Design Size (In.)	Buoy number 1118				Buoy number 1119				Buoy number 1116				Buoy number 1150				Remarks
		Leg Pair A		Leg Pair B		Leg Pair A		Leg Pair B		Leg Pair A		Leg Pair B		Leg Pair A		Leg Pair B		
		A-1	A-2	B-1	B-2	A-1	A-2	B-1	B-2	A-1	A-2	B-1	B-2	A-1	A-2	B-1	B-2	
Leg pair equalizer ass'y																		
Equalizer shackle	5																	Attached to buoy
Equalizer shackle	5																	Attached to 3 3/4" equalizer
Large equalizer	3 3/4																	
Chain	3 3/4	← 50' →				← 50' →				← 50' →				← 50' →				Through 3 3/4" equalizer
Detachable	3 3/4																	Between chain and 2 1/2" shackle
Detachable	3 3/4																	Between chain and 2 1/2" shackle
Equalizer shackle	2 1/2																	To small equalizer
Equalizer shackle	2 1/2																	To small equalizer
Small equalizer	2 3/4																	
Small equalizer	2 3/4																	
Anchor legs																		
Anchor (15Mk PEA)																		
Shackle (90 T)																		
Wire pendant (50')	2 1/4																	
Wire pendant (120')	2 1/4																	
End link	3	2 7/8"				2 7/8"		2 7/8"		2 7/8"				2 7/8"		2 7/8"		To anchor pendant
Detachable	2 3/4																	
Chain	2 3/4	90' (2 5/16)		90' (2 5/16)		90' (2 1/2")		90'		90'(Dielock)		90'(Dielock)		90'		90'(Dielock)		
Detachable	2 3/4																	
Swivel	2 3/4																	
Detachable	2 3/4																	
Chain	2 3/4	90'		90'		90'		90'		90' (2 1/2)		90' (2 1/2)		90'		45'(Dielock)		
Detachable	2 3/4																	
Chain	2 3/4	90'		90'		90'		90'		90' (2 1/2)		90' (2 1/2)				90' (2 1/2)		
Detachable	2 3/4															2 1/2"		
Chain	2 3/4	45'		45'		45'		45'		45' (2 1/2)		45' (2 1/2)		45'		45' (2 1/2)		Half shot
Detachable	2 3/4															2 1/2"		
Chain	2 3/4	← 50' →		← 50' →		← 50' →		← 50' →		← 50' →		← 50' →		← 50' →		← 50' →		Through equalizer
Detachable	2 3/4																2 1/2"	
Chain	2 3/4		45'		45'		45'		45'		45' (2 1/2)		45' (2 1/2)		45'		45' (2 1/2)	Half shot
Detachable	2 3/4																2 1/2"	
Chain	2 3/4		90'		90'		90'		90'		90' (2 1/2)		90' (2 1/2)		90'		90' (2 1/2)	
Detachable	2 3/4																2 1/2"	
Chain	2 3/4		90'		90'		90'		90'		90' (2 1/2)		90' (2 1/2)		90'		90' (2 1/2)	
Detachable	2 3/4																2 1/2"	
Swivel	2 3/4																2 1/2"	
Detachable	2 3/4																2 1/2"	
Chain	2 3/4		90'		90'		90' (2 1/2)		90'		90'(Dielock)		90' (Dielock)		90'		90' (Dielock	
Detachable	2 3/4																2 1/2"	
End link	3		2 7/8"		2 3/4"		2 7/8"		2 7/8"								2 7/8"	To anchor pendant
Wire pendant (120')	2 3/4																	
Wire pendant (50')	2 3/4																	
Shackle (90 T)																		
Anchor (15Mk PEA)										3"								
Sinker attachment																		
Shackle	3	2 7/8"	2 7/8"	2 7/8"	2 7/8"	2 7/8"	2 7/8"	2 7/8"				2 7/8"	2 7/8"	2 7/8"	2 7/8"	2 7/8"	2 7/8"	5K concrete clump 250' from swivel toward buoy
Hairpin	2																	
Sinker attachment																		
Shackle	3	2 7/8"	2 7/8"	2 7/8"	2 7/8"	2 7/8"	2 7/8"	2 7/8"	2 7/8"			2 7/8	2 7/8"	2 7/8"	2 7/8"	2 7/8"	2 7/8"	Mod 30K stockless anchor joined behind concrete clump
Adj	2 1/2					2 3/4"	2 3/4"											
Shackle	3	2 7/8"	2 7/8"	2 7/8"	2 7/8"	2 7/8"	2 7/8"	2 7/8"	2 7/8"			2 7/8"	2 7/8"	2 7/8"	2 7/8"	2 7/8"	2 7/8"	To anchor crown padeye

NOTE: Backstay leg as built is on page C-15.

Tender bow/stern mooring installation completed 17 MAR 81

Modified 16' Diameter Telephone Buoys

List of Materials	Design Size (in)	Buoy 11 NE Leg C	Buoy 11 NW Leg C	Buoy 11 SE Leg C	Buoy 11 SW Leg C	Remarks
Backstay Leg						
Anchor (100K PEA)						
Shackle (50 T)						
Wire pendant (50')	2					
Wire pendant (120')	2					
AJL	2					To anchor pendant
Swivel	2 1/4	2 1/2	2 3/8	2 3/8	2 3/8	
Detachable	2					
Chain	2 1/8	90' (2 1/16)	90' (2 1/16)	90' (2 1/16)	90' (2 1/16)	
Detachable	2					
Chain	2 1/8	43' ①	62' (2 1/16) ②	58' (2 1/16) ③	90' (2 1/16)	
AJL	2					
Pear	3-3 3/4			3 3/4		Attached to buoy padeye
Sinker Attachment						Mod 20K stockless anchor 45' from swivel towards buoy
Shackle	3	2 7/8	2 7/8	2 7/8	2 7/8	
Shackle	3	2 7/8	2 7/8		2 7/8	
AJL	2 1/2					

① 47' was removed after installation
② 28' was removed after installation
③ 32' was removed after installation

TABLE 8. DIEGO GARCIA FLEET MOORINGS TENDER FOUR POINT MOOR BACKSTAY LEGS (Continued)

the inspection procedures contained in paragraph 6.2.1 will be followed during the inspection of each buoy.

6.4.2 **Buoy Bottom Jewelry:** Divers shall photograph the large equalizer and check the chain passing through it for excessive wear. In addition, they shall visually check for wear and photograph the two back to back shackles between the buoy and the large equalizer. The underwater voltmeter shall be used to probe this equalizer and at least one link either side of the large (3¼") chain passing through it and record the results. In a similar manner, the two smaller equalizers and the chain passing through each shall be photographed and electric potential readings taken and recorded.

6.4.3 **Ground Legs:** Use the inspection procedures detailed in paragraph 6.2.3.

6.4.4 **Backstay Leg:** Each backstay leg was designed to be two shots (180') in length and is cathodically protected by continuity wire and two 250 pound anodes. A 20K stockless anchor clump is attached to each leg by two shackles about 135 feet below the buoy and a swivel is installed between the end of the ground leg chain and the anchor joining link connecting it to the 2 inch wire rope anchor pendant. The integrity of the continuity cable and the conditions of the anodes, sinker shackles, swivel, and anchor pendant shall be inspected using the same guidelines as provided for the ground leg inspection outlined in paragraph 6.2.3.

C. TWO POL BUOY DOLPHINS

8.0 **BACKGROUND:** During April and May of 1980, two Buoy Dolphin systems were installed in Diego Garcia as part of the POL Pier Project. The POL pier is a 40 feet wide platform by 550 feet long and is connected by a trestle to the shore at its southeasterly end (see Figure 16). The two Buoy Dolphins serve the purpose of securing bow and stern lines of large classes of ships and are located at the two ends of the pier approximately 175 feet from the edge of the pier and set back 60 feet (inshore) from the pier face as shown in Figure 17. Each of the Buoy Dolphin systems consists of a modified MARK II Peg Top Buoy, five chain legs, sinkers, and propellant embedment anchors.

9.0 **MOORING BUOY DOLPHIN SYSTEM DESCRIPTION:** These two Buoy Dolphin systems could not accommodate the relatively large horizontal length of ground legs as designed in standard Fleet Moorings (as outlined in DM-26) because of the water depth constraints and close proximity to the POL pier and shore. The mooring design, however, did attempt to maintain most of the criteria and characteristics of standard Fleet Moorings.

9.0.1 Each Buoy Dolphin system contains a standard Peg Tap buoy modified, with the addition of a skirt, to a cylindrical shape to provide greater buoyancy. In view of the fact that repairs at such a remote site would be difficult, each buoy was filled with foam to deter damage that could be caused by user ships.

9.0.2 Each of the two systems contains a riser assembly, ground ring, and five legs ... a single ground leg, a ground leg pair through an equalizer, and two backstay legs attached to a spider plate. The lower end of

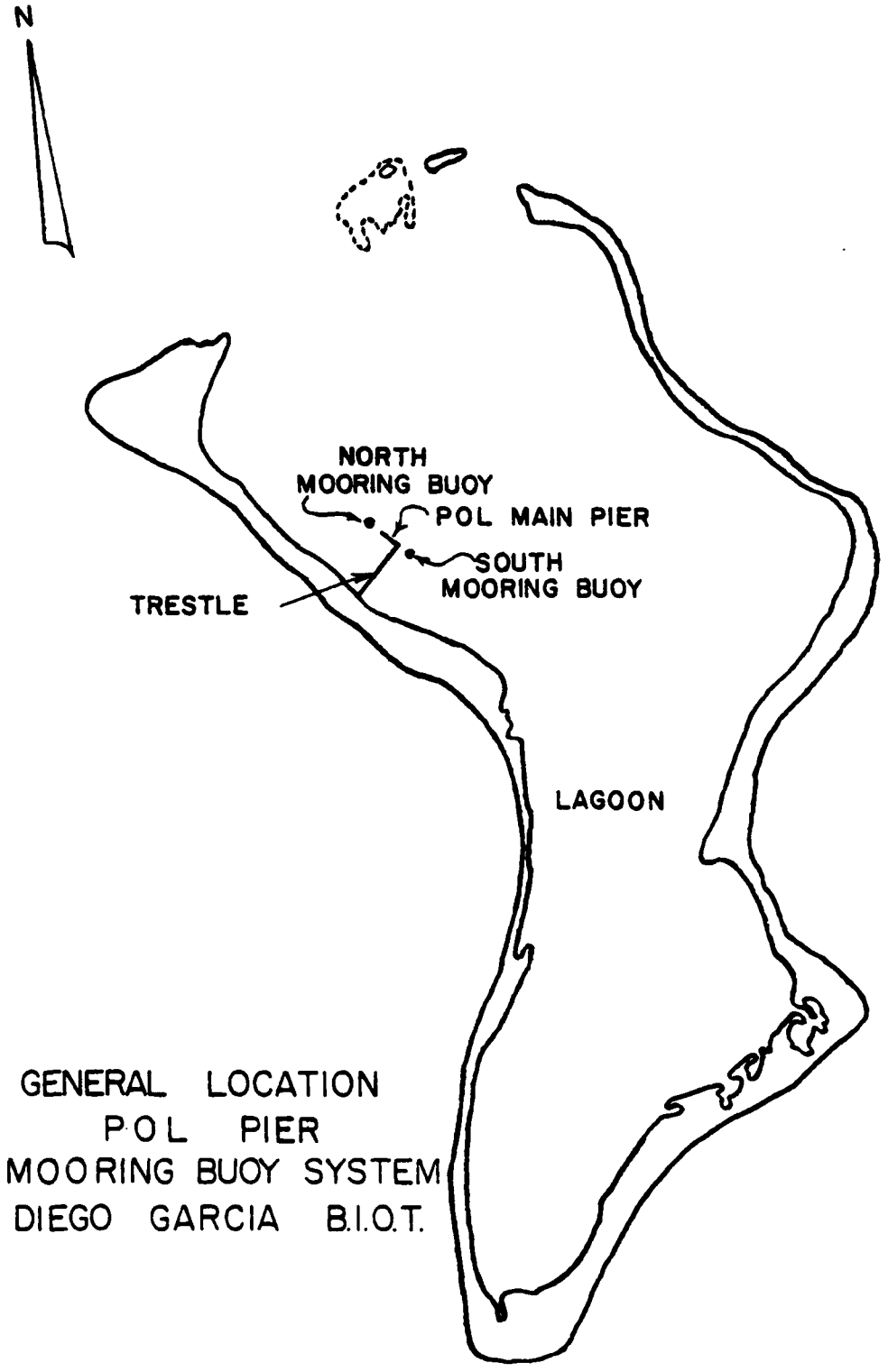
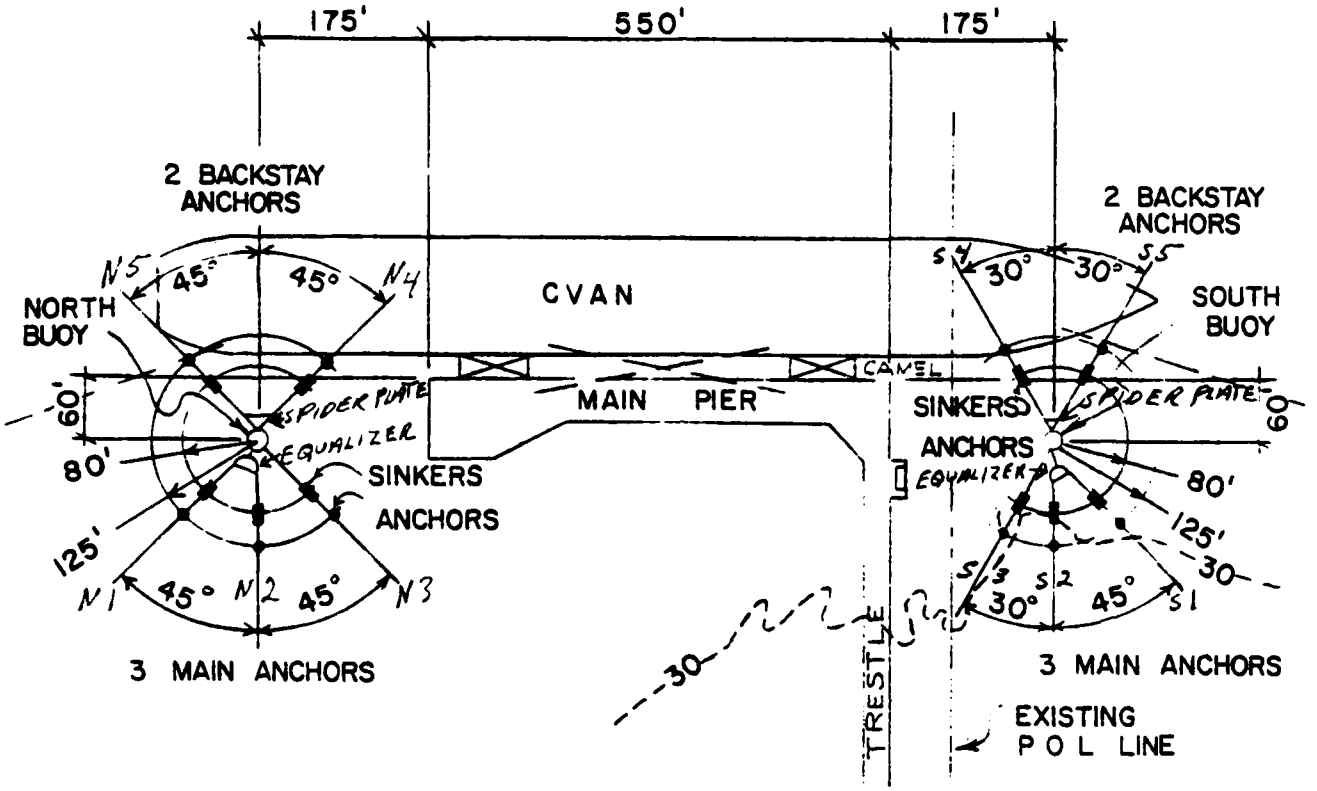

N
NORTH
MOORING BUOY
POL MAIN PIER
SOUTH
MOORING BUOY
TRESTLE
LAGOON
GENERAL LOCATION
POL PIER
MOORING BUOY SYSTEM
DIEGO GARCIA B.I.O.T.

FIGURE 16.



SITE LAYOUT
POL PIER - MOORING BUOY SYSTEM
DIEGO GARCIA B.I.O.T.

Note: ---30--- Indicates Contour Line, Waterdepth in Feet

FIGURE 17.

each of the five legs is attached to a 2" wire rope anchor pendant leading to a 100 KIP Propellant Embedment Anchor. A list of each POL pier mooring as-builts is contained in Table 10.

9.0.3 Both Buoy Dolphin systems are cathodically protected. There are two anodes attached by brackets to the bottom of each buoy and two attached to the 20K anchor clump shackled to each chain leg. Wire rope continuity cable (3/4") is weaved through each of the five legs and clamped to the chain and to the anodes on the anchor clumps. Figure 18 is a diagram of the cathodic protection system attached to each of the Buoy Dolphin systems.

10.0 **INSPECTION PROCEDURES:** The following guidelines are to be followed during the underwater inspection:

10.1 **Buoy:** The above water portion of each buoy will be visually observed in order to determine its general condition. Physical damage such as breaks, dents, or listing (which would indicate internal leaking) will be noted and photographed. The paint will be checked for cracking, chipping, or peeling. Topside jewelry and hatches will be examined and worn or broken material and the extent of rusting recorded and photographed. The upper fender system will be checked for integrity, marine attack, and secure connection to the buoy. Buoy top jewelry will be measured with calipers and their overall dimensions logged.

TABLE 10

POL PIER MOORINGS

AS-BUILTS

TOP JEWELRY: "F" Shackle
4" AJL (NORTH BUOY ONLY)
3½" AJL

BUOY: Modified MKII Peg Top Buoy

BOTTOM JEWELRY: 10 Links 3½" Chain
3½" AJL
Ground Ring

Ground Legs 1 & 2	Ground Leg 3	Back Stay Legs 4 & 5
3½" AJL	3½" AJL	3½" AJL
2½" AJL	2¼" AJL	3½" Detachable
2½" Shackle	1 Shot 2¼" Chain*	2½" Shackle
Equalizer	2¼" Detachable	Spider Plate
1 Shot 2¼" Chain	2¼" Swivel	2½" Shackle
2¼" Detachable	2½" Detachable	2¼" Swivel
2¼" Swivel	½ Shot 2½" Chain	2¼" Detachable
2¼" Detachable	2½" AJL	1 Shot 2¼" Chain*
½ Shot 2¼" Chain*	1 Link 3½" Chain	2¼" Detachable
2¼" Detachable	Swage Fitting	2¼" Swivel
2¼" Swivel	2" Anchor Pendant	2½" Detachable
2½" Detachable	100K PEA	½ Shot 2½" Chain

Continued

TABLE 10

POL PIER MOORINGS

AS-BUILTS

Ground Legs 1 & 2	Ground Leg 3	Back Stay Legs 4 & 5
½ Shot 2¼" Chain		2½" AJL
2½" AJL		1 Link 3½" Chain
1 Link 3½" Chain		Swage Fitting
Swage Fitting		2" Anchor Pendant
2" Anchor Pendant		100K PEA
100K PEA		

* 20K Pound anchor clump attached by two sinker shackles

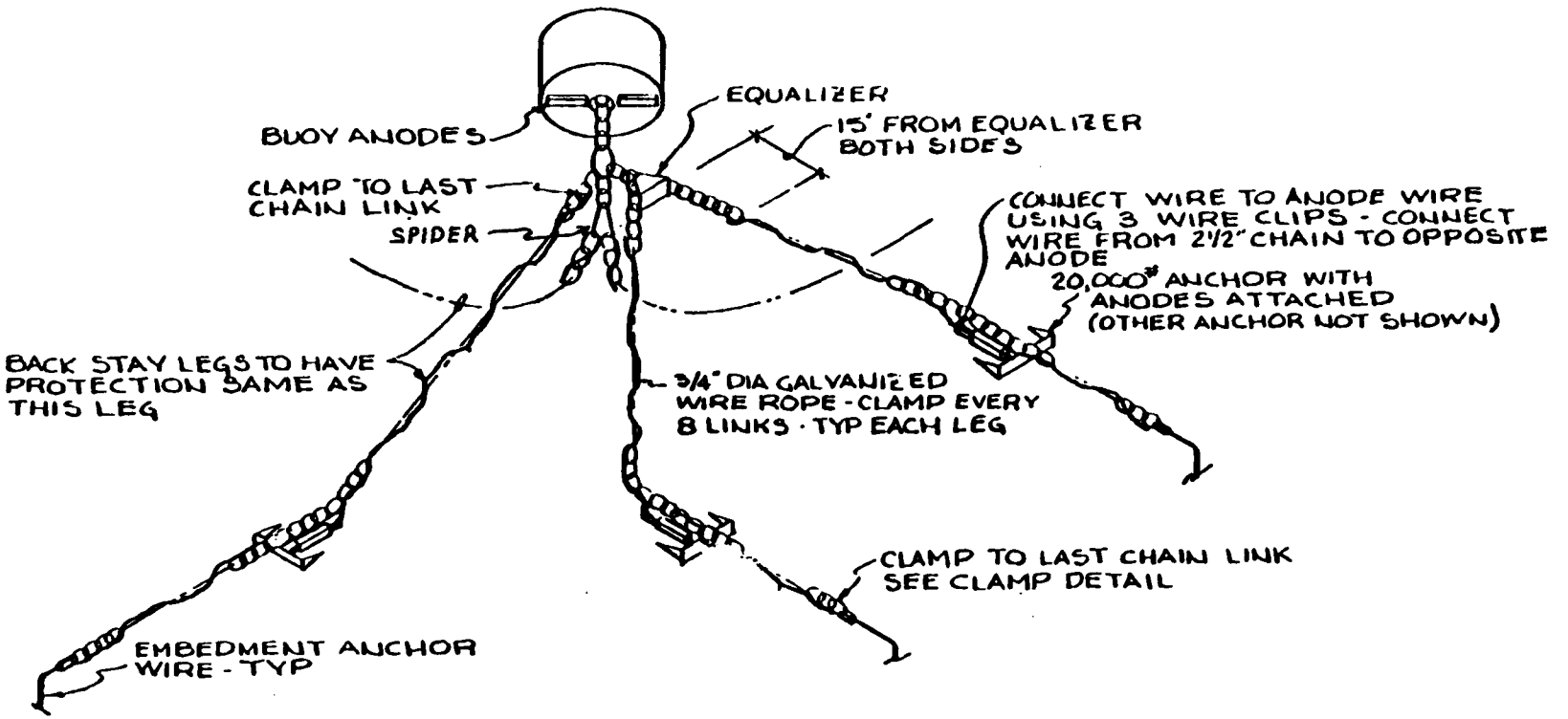


FIGURE 18. CATHODIC PROTECTION SYSTEM DIAGRAM

In a similar manner, the lower portion of each buoy shall be inspected by the assigned divers. The thickness of marine growth shall be recorded and a one foot square area cleaned of growth and the condition of the paint observed and photographed. Since both of these buoys are of the hawse pipe type, the condition of the rubbing casting shall be noted and recorded. There are two anodes attached to the lower portion of each buoy. Each of these anodes shall be inspected for condition, erosion, and proper connection to the buoy brackets. The dimensions of one anode should be recorded, and an underwater voltmeter then used to probe the buoy bottom in three areas, and the resulting electrical potential readings recorded. The divers shall then probe one of the links in the buoy bottom jewelry and record the reading.

10.2 **BOTTOM JEWELRY:** The bottom links of riser chain that protrude from the hause pipe and the anchor joining link connecting the riser to the ground ring shall be viewed, measured with calipers, and their wire diameters recorded. The voltmeter will be used to probe one of these links and the anchor joining link and the results recorded.

10.3 **GROUND RING:** The ground ring shall be examined for general and localized wear. Caliper measurements will be taken in the area of most severe wear and the wire diameter recorded. The inner diameter of this ring will also be measured and the ground ring photographed. The joining links and/or shackles connecting the ground ring to the equalizer, spider plate, and leg 3 shall be viewed for wear and measured.

10.4 EQUALIZER/SPIDER PLATE: Photographs of the equalizer and any wear points on the chain passing through it shall be taken. The spider plate will also be viewed for wear and photographed. Divers shall probe the equalizer and at least one link on either side of the shot of chain passing through it, and the readings recorded. The spider plate should also be probed and electric potential recorded.

10.5 GROUND/BACKSTAY LEGS: Each of the three ground legs and two backstay legs consist of a shot of 2¼" chain and two half shots each separated by a swivel. The lower end of the last half shot is attached to the wire rope anchor pendant. Three consecutive double link measurements using the pre-cut go-no-go gauges at both ends and near the center of each shot and half shot of chain in each leg. In the event that a section of chain is resting on the bottom and not in tension, single link measurements will be taken instead of double link. All connecting links (detachable links, anchor joining links, and swivels) shall be identified and measured with calipers. In addition as the divers swim down each leg they shall closely check the integrity of the wire rope continuity cable, probe the chain every 25 feet, and record the results.

About 130 feet from the top of each leg, a 20,000 pound stockless anchor clump is attached to the chain by two sinker shackles. These shackles and the two anodes attached to each anchor clump shall be measured and photographed.

D. PROJECT ENGINEER RESPONSIBILITIES

11.0 DOCUMENTATION: The CHESDIV assigned Project Engineer is responsible for documentation of the inspection. He will maintain both a time phased log of events occurring during the inspection and the master inspection form. Since no underwater communications equipment will be available during the Diego Garcia inspection, the Project Engineer must be prepared to debrief each diver, upon his return to the surface, in order to gain immediate knowledge of what the diver saw, felt, or perceived. The information obtained from the divers will be recorded, and this data will subsequently be the basis of the Project Completion Report.

Upon completion of the inspection and prior to departing the area, the Project Engineer will brief the ROICC and NSO personnel on the preliminary results of the inspection. This briefing will include the general condition of each mooring and its cathodic protection system as well as any specific problem areas uncovered. A similar briefing will be given to PACNAVFACENGCOM personnel during the return trip and to CHESDIV (FPO-1) personnel upon the Project Engineer's return to CONUS.

The Project Engineer will be responsible for the preparation of the Project Completion Report which will contain the results of the inspection and any recommendations for corrective maintenance actions. This report, when approved by CHESNAVFACENGCOM, will be forwarded to all interested commands.

12.0 STATUS REPORTS: Summary status reports will be prepared on-island by the Project Engineer and reported via a UCT-2 DET message on a weekly basis to CHESDIV and UCT-2s home port.

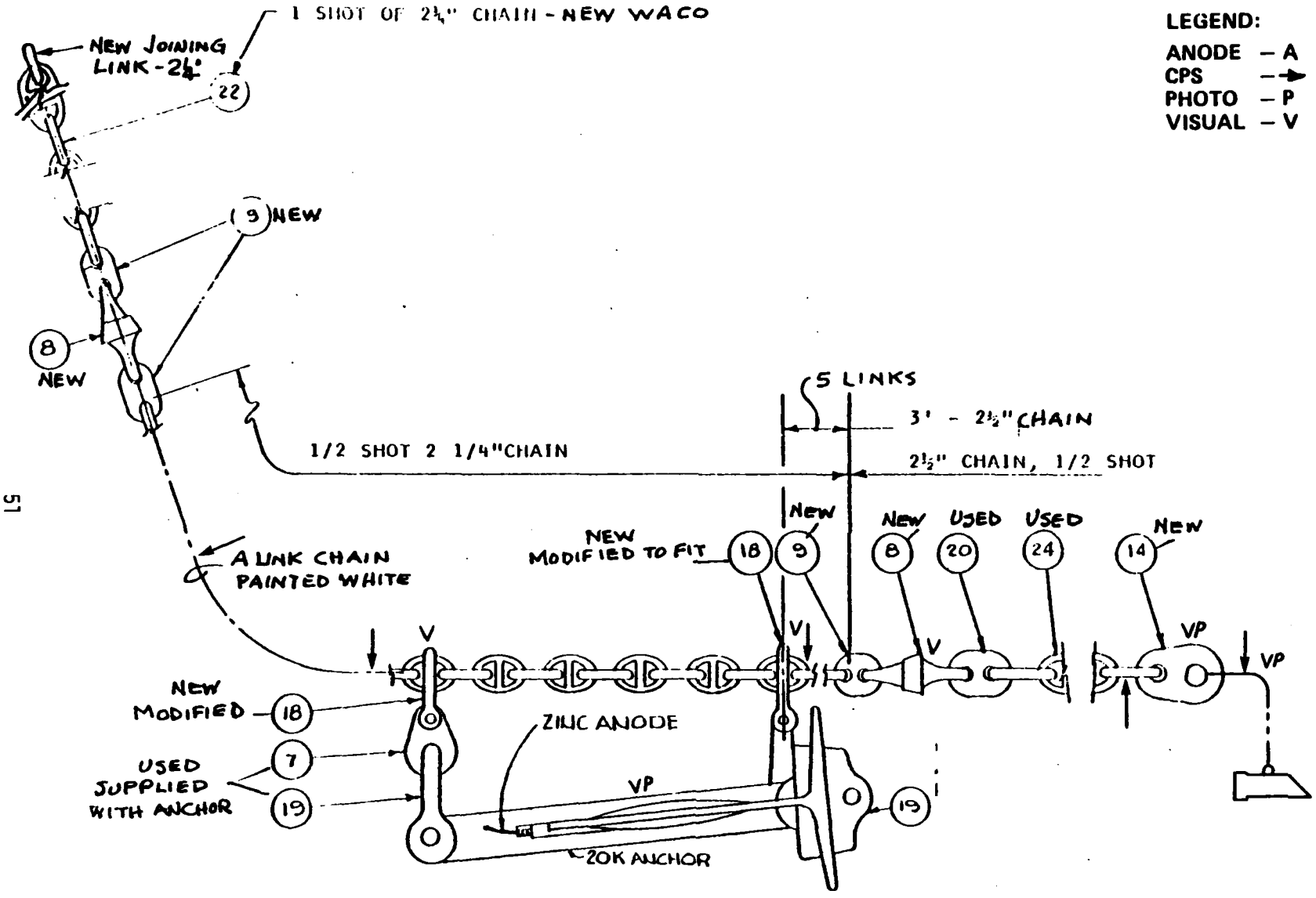


FIGURE 19. LEG – NORTH 1

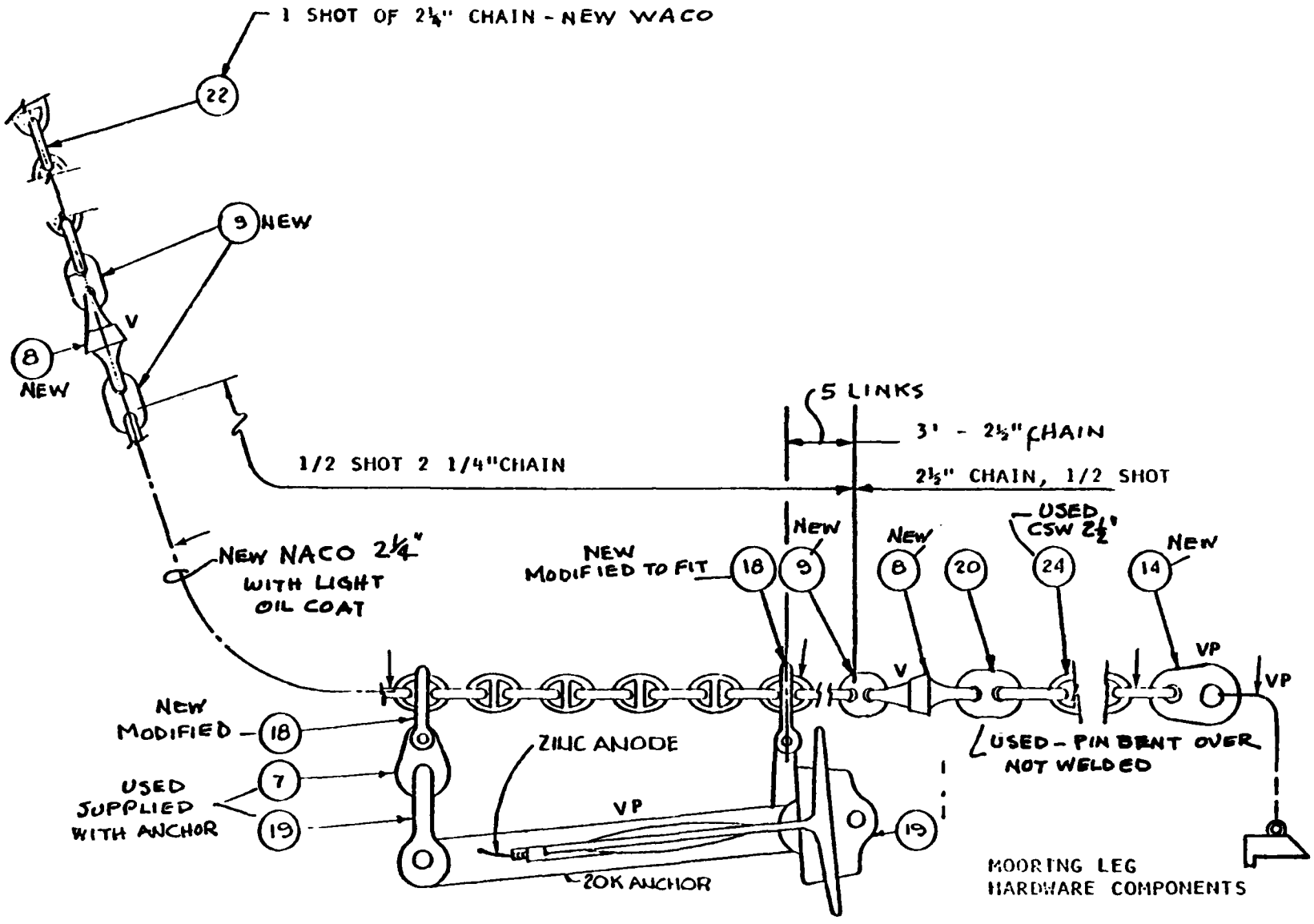
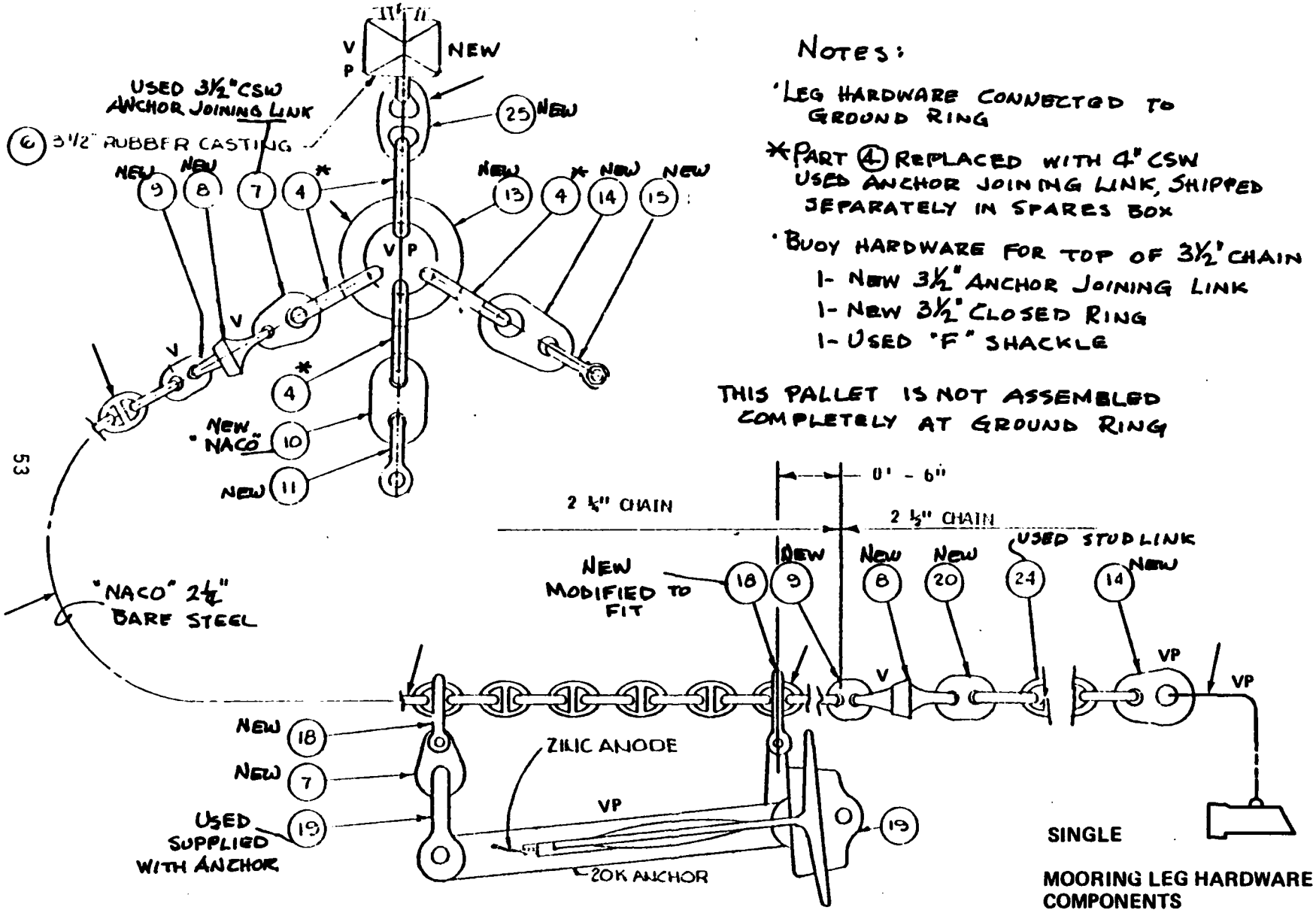


FIGURE 20. LEG – NORTH 2



NOTES:

*LEG HARDWARE CONNECTED TO GROUND RING

*PART (4) REPLACED WITH 4" CSW USED ANCHOR JOINING LINK, SHIPPED SEPARATELY IN SPARES BOX

*BUOY HARDWARE FOR TOP OF 3½" CHAIN IS
1- NEW 3½" ANCHOR JOINING LINK
1- NEW 3½" CLOSED RING
1- USED "F" SHACKLE

THIS PALLET IS NOT ASSEMBLED COMPLETELY AT GROUND RING

SINGLE

MOORING LEG HARDWARE COMPONENTS

FIGURE 21. LEG – NORTH 3

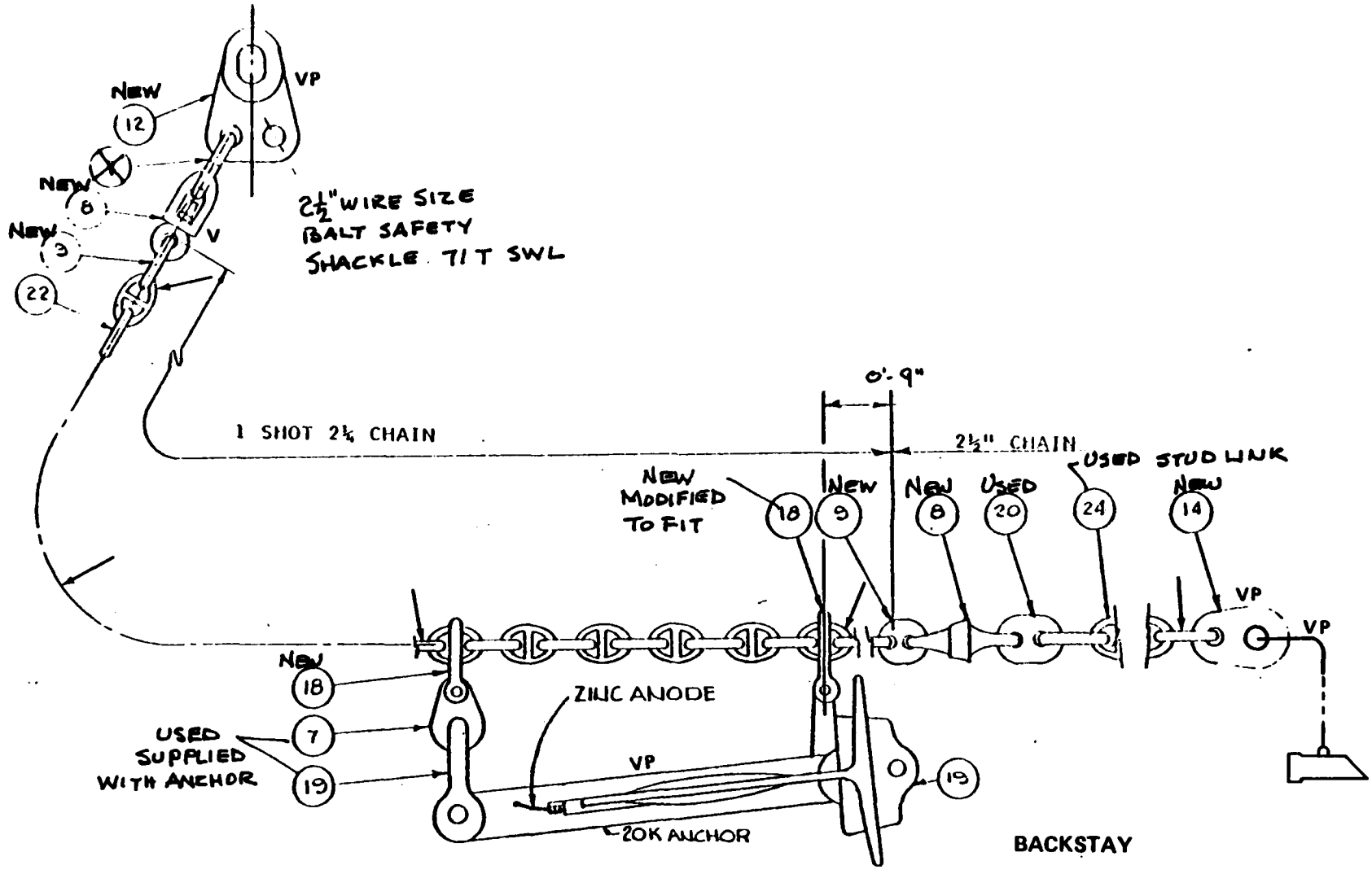


FIGURE 22. LEG – NORTH 4

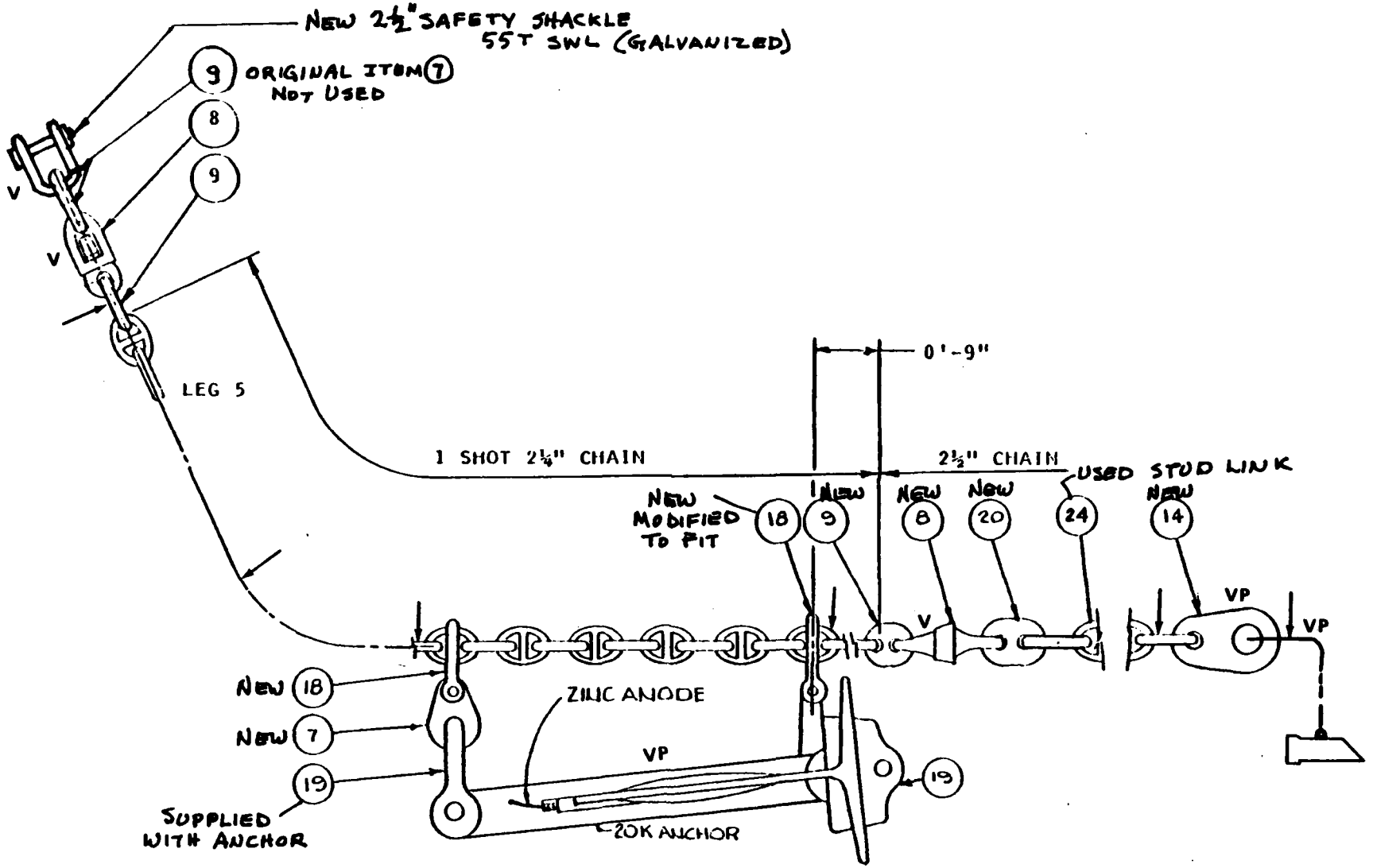


FIGURE 23. LEG – NORTH 5

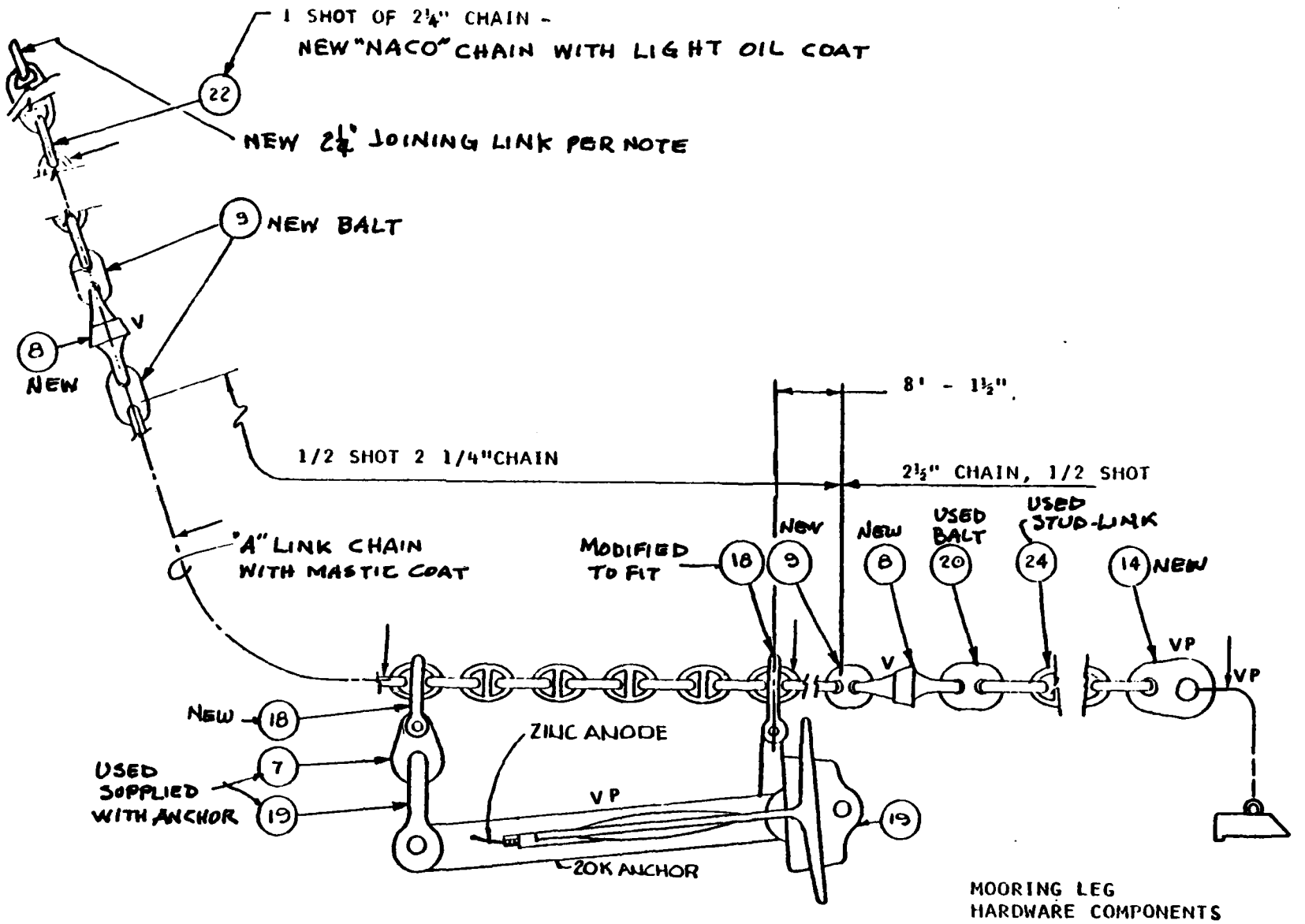


FIGURE 24. LEG – SOUTH 1

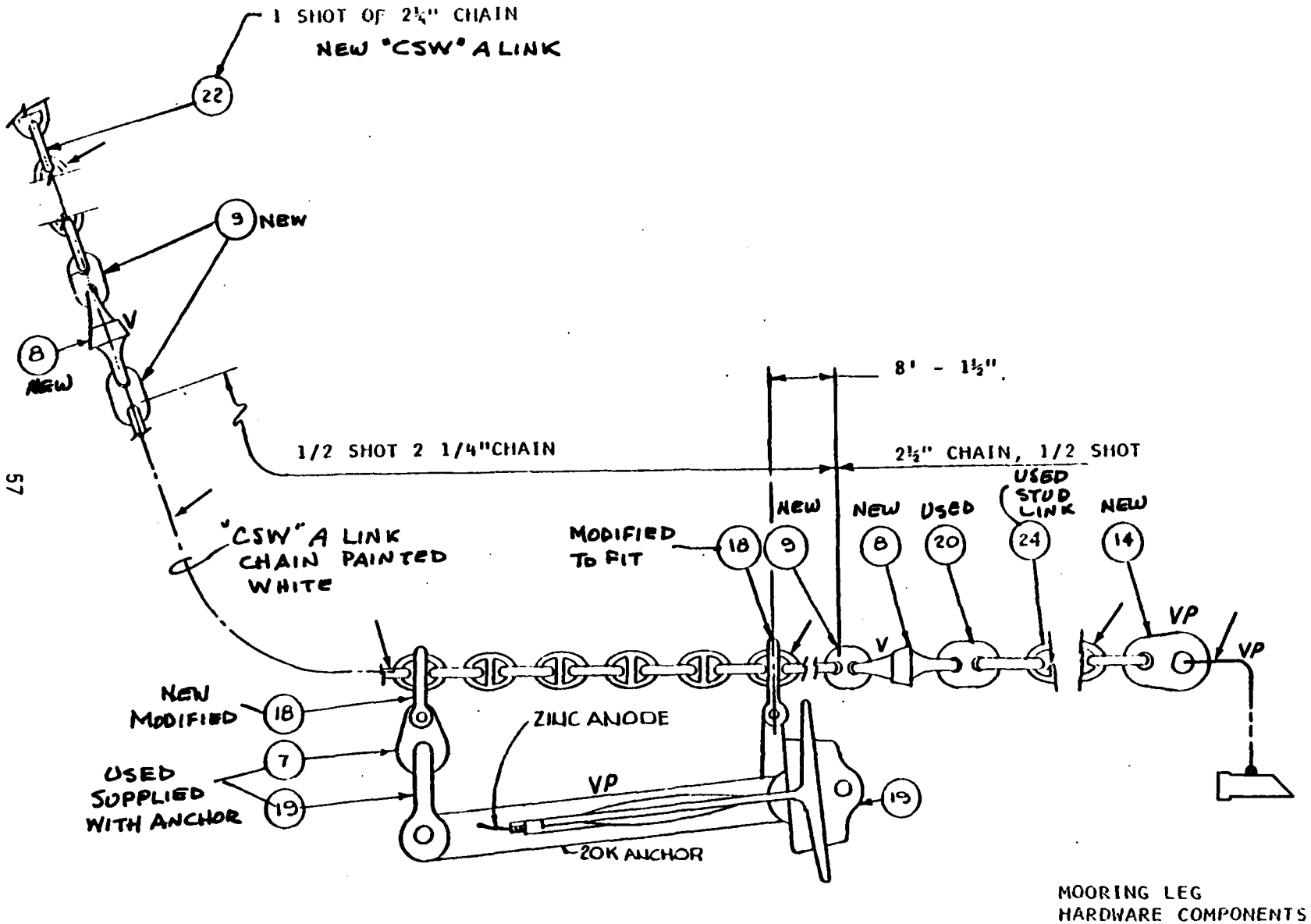
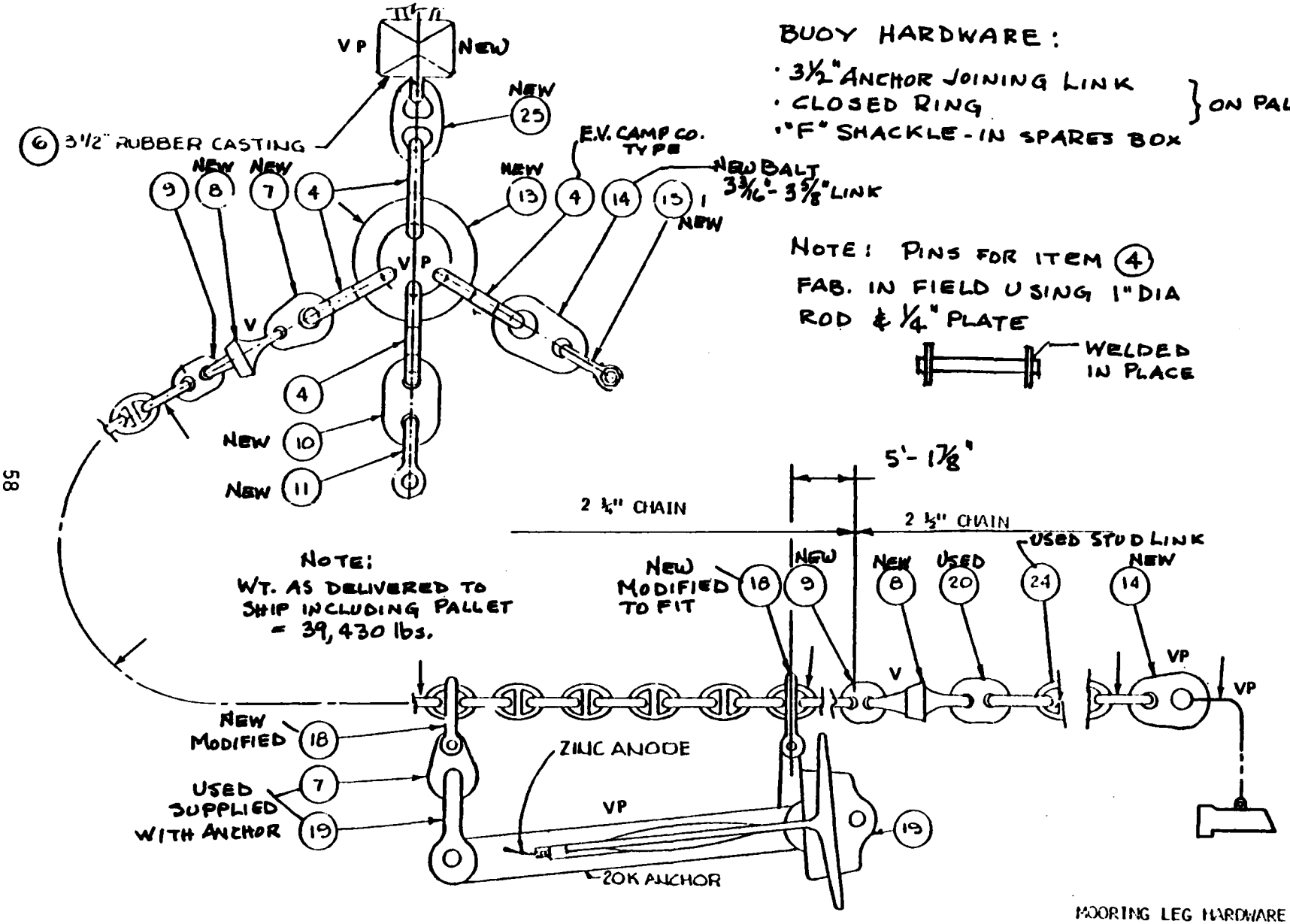


FIGURE 25. LEG – SOUTH 2



MOORING LEG HARDWARE COMPONENTS

FIGURE 26. LEG – SOUTH 3

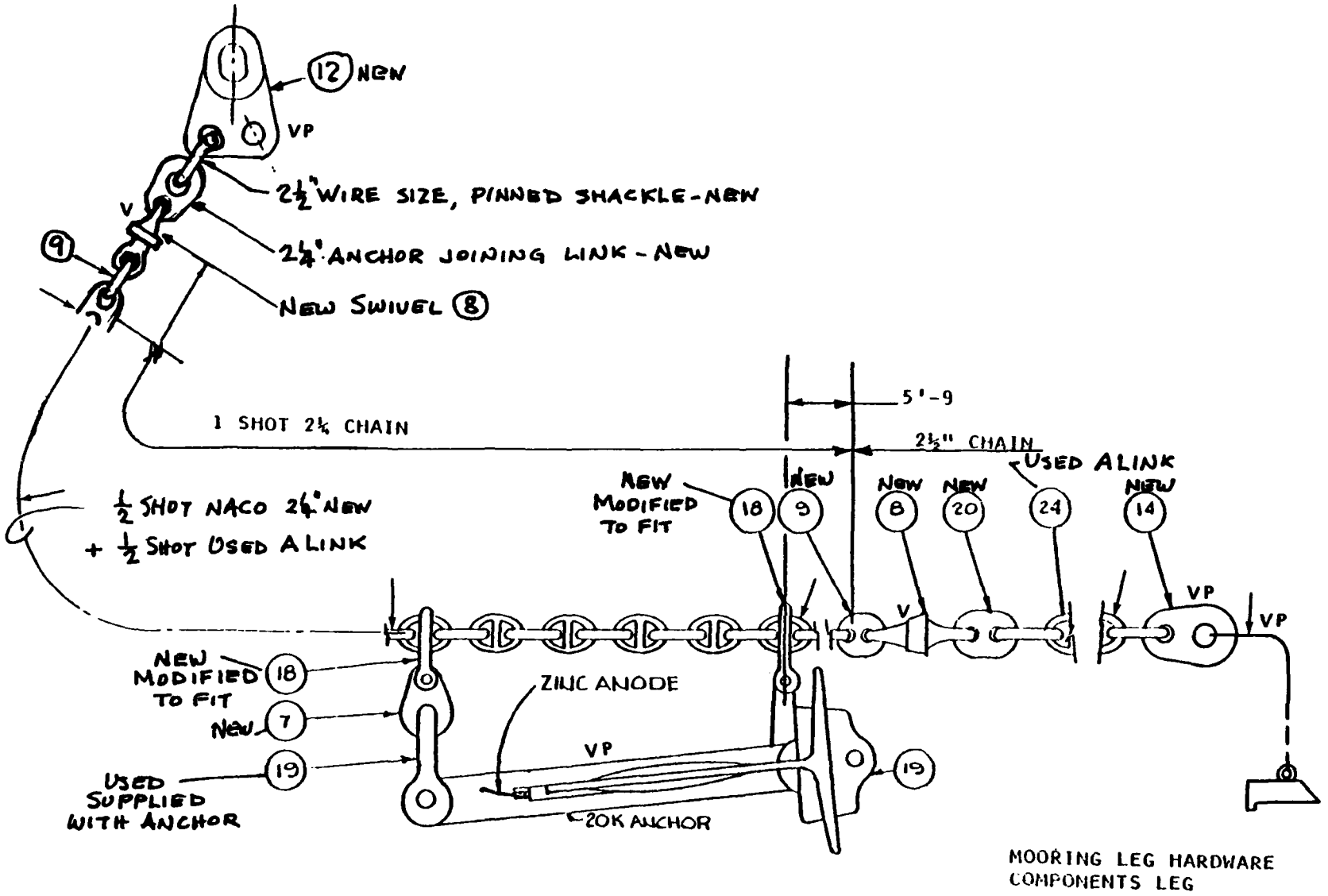


FIGURE 27. LEG – SOUTH 4

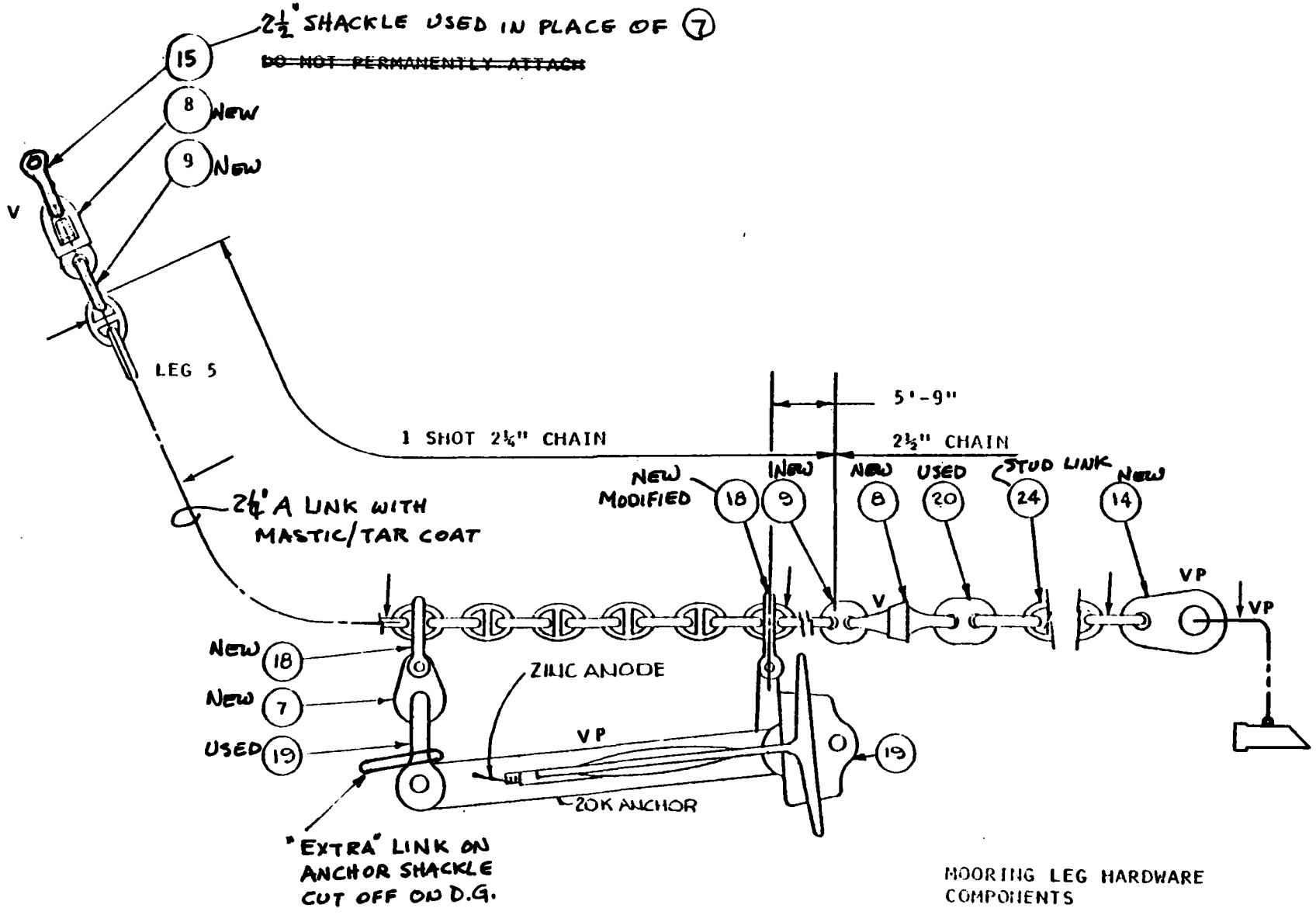


FIGURE 28. LEG – SOUTH 5

13.0 PROJECT SCHEDULE: Although the actual inspection schedule is dependent upon many changing factors and is thus uncertain, the following project schedule is planned:

1 May	-	UCT-2 Divers on island.
10 May	-	Project Engineer departs Washington D.C. for Diego Garcia via a stop at PWC Subic.
15 May	-	Project Engineer on island. Underwater inspection of Fleet Moorings commences.
15 June	-	Inspection completed. Project Engineer departs for CONUS via stops at PWC Subic and Pearl Harbor.
	-	Project Engineer returns to Washington D.C.

ANNEX A

ADDITIONAL INFORMATION

1.0 As previously mentioned, there are thirteen fleet moorings installed in the lagoon at Diego Garcia. Table A-1 depicts the types of these moorings by buoy number, the designed watch circles, and the classes of ships that were expected to use each mooring.

TABLE A-1

Number and Types of Moorings

Buoy Number	Type Mooring	Swing Radius (Ft)	Type Ship
1	Cargo Free Swinging	1,000	Ammunition
2	Cargo Free Swinging	1,000	General
3	Cargo Free Swinging	1,000	Ammunition
4	Cargo Free Swinging	1,500	General
5	Cargo Free Swinging	1,000	General
6	Cargo Free Swinging	1,000	General
7	Two Point Cargo Bow/Stern	Fixed	Ammunition
8	Two Point Cargo Bow/Stern	Fixed	Ammunition
9	Two Point Cargo Bow/Stern	Fixed	Ammunition
10	Tender Free Swinging	1,500	Alt. Tender
11	Four Point Tender Bow/Stern	Fixed	Tender
N	POL Buoy Dolphin	Fixed	CV/AO
S	POL Buoy Dolphin	Fixed	CV/AO

2.0 Table A-2 contains information concerning standing water depths and bottom conditions as reported by divers who participated in the installation of these moorings.

TABLE A-2

Diego Garcia Fleet Moorings

Buoy Number	Standing Water Depth (Feet)	Type Bottom
1	88 - 93	Sand
2	81 - 90	Hard Coral
3	86 - 92	Soft Silt
4	81 - 90	Hard Coral
5	70 - 80	Sand & Silt
6	90 - 101	Coral & Sand
7N	81 - 89	Sand
7S	79 - 87	Sand
8N	77 - 83	*
8S	83 - 95	Sand & Coral
9N	84 - 101	Sand
9S	92 - 101	Sand
10	79 - 89	*
11	86 - 92	*
POL N	30 - 60	*
POL S	30 - 60	*

* Not Reported

3.0 As currently envisioned, four weeks of diving are planned consisting of six day work weeks and 12 hours per day. UCT-2 will have available 10 sets of divers (2 men per set) and these divers will use SCUBA diving equipment. With this number of divers, it is anticipated that the inspection of all 19 buoys, 98 ground legs, and other mooring material can be completed within the desired time frame. Due to the fact that most of the divers will have to make two dives during each 12 hour period, the standing water depths involved, and the limitations of SCUBA equipment, the following diving procedures are proposed for each diver set:

3.01 On Fleet Moorings 1 through 6, the first dive of the day will be deep and the divers will inspect a ground leg from below the ground ring to the point that the wire rope anchor pendent enters the bottom. The second dive of the day will be shallow with the divers inspecting the mooring from the buoy bottom to and including the ground ring.

3.02 Since there are no ground rings in Fleet Mooring 7 through 11, the first drive of the day should start at the connecting link at the end of the shot of chain passing through the lowest equalizer and again inspect the ground len and anchor pendant. On their second dive of the day, divers inspect the mooring material above this connecting link.

3.03 The two Buoy Dolphins are in shallower water depths which removes many diving restrictions.

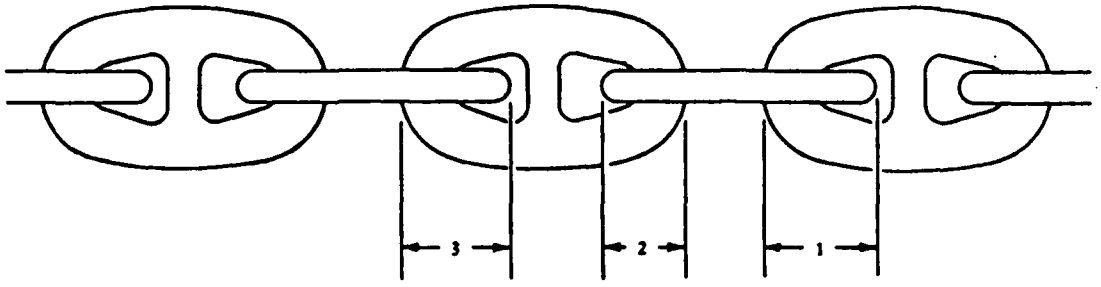
The above procedures are merely suggested. The final responsibility for the efficient and safe utilization of divers still rests with the dive team leader.

4.0 A selective sampling approach shall be used in measuring the POL mooring chain. This consists of measuring the wire diameter of the chain and connecting hardware to determine the amount of corrosion and wear. Chain which is less than 90% of original diameter should be downgraded in classification; chain which is less than 80% of original diameter should be surveyed. Single link measurements on the wire diameter of a single A-link detect corrosion loss; double link measurements made where two A-links contact detect corrosion and wear. Single link measurements are made on three different diameters on the same approximate cross section while double link measurements are used on three adjoining links. Figure A-1 shows the correct ways of taking both single and double link measurements.

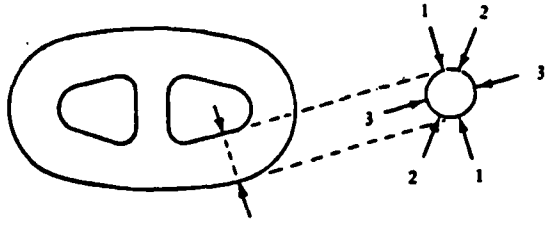
5.0 When a properly functioning cathodic protection system is probed with an underwater voltmeter, the meter reading should be between -.800mV and -.900mV. A reading below this range indicates a problem area and should be investigated as follows:

5.01 Return to the last checkpoint that was within the desired range. From this point probe the chain every five feet until the corrosion cell or faulty area is located. Record the position of this area by determining its position relative to a known point such as a swivel, anode or connecting link. If time permits, record the position of the faulty area in relation to two known points, one higher and one lower along the chain from the corrosion cell.

5.1 It should be noted that to insure getting good readings the metal contacted should be cleaned of fouling or corrosion products and paint. Lack of good contact is detected by noting the stability of the potential readings indicated on the



Double Link Measurement



Single Link Measurement

FIGURE A-1. LOCATIONS FOR TAKING CHAIN LINK MEASUREMENTS

voltmeter. If the indicated potential drifts more than 0.010 volts over a short period, particularly if it shifts rapidly between a high and low value, then good contact between the probe and the metal is probably not being maintained.

6.0 In addition to accomplishing the primary purpose of the inspection, checking the physical condition of each mooring and its cathodic protection system, divers are expected to be alert for possible mechanical failures of mooring material. These types of failures, such as a broken shackle or connecting link, should be obvious. The position of the failure in relation to a known position must be recorded. If time permits, after the inspection of all moorings has been completed, urgents repairs may be attempted.

7.0 UCT-2 will coordinate the transportation of their personnel and equipment to the island and the CHESDIV Project Engineer will proceed independently to the site.

The following equipment will be provided on-island by UCT-2 in support of the inspection:

- All diving support equipment

- <u>Measuring Aids</u>
  - Outside calipers (24 inch minimum)
  - 100 foot tape measure
  - GO-NO-GO gauges suitable for checking 2¼", 2½", and 3½" chain
  - One, two, and three foot scales with large numbers suitable for photographic documentation

- Survey Equipment
  - One underwater voltmeter and three sets of spare batteries
  - Accurate diver depth guages
  - Magnetic diver compasses

- Two underwater cameras (35mm) with sufficient color film, flash bulbs, and spare batteries

- Cleaning Equipment
  - Wire brushes
  - Chipping hammers
  - Chisels
  - Brushing tools
  - Water blaster

- Two 2,000 pound lift bags

- 100 Cable clamps (2¾")

- Marker tags (to mark and relocate links)

- Maintenance hand tools

The Project Engineer will provide:

- Project Execution Plans

- Mooring drawings and photographs
- Graphic supplies
- Data recording forms
- Copy of DM-26
- Surface camera (35mm) and film
- Four underwater voltmeters and four spare batteries
- Pre-dive briefing material

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