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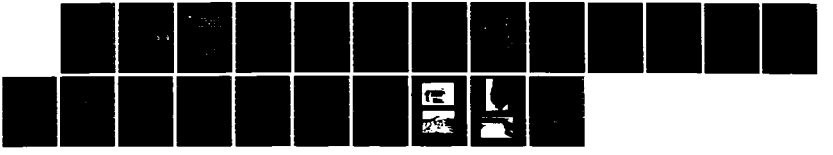

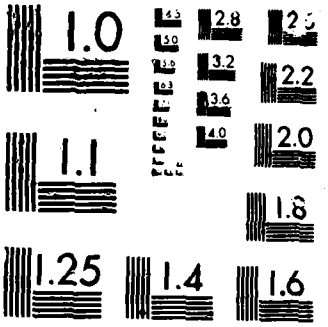

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NAVAL STATION LONG BEACH FLEET MOORING INSPECTION REPORT

FPO-1-82 (24)

OCEAN ENGINEERING
PROJECT OFFICE
CHESAPEAKE DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
WASHINGTON, D.C. 20374

20 DECEMBER 1982

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Under the COMNAVFACENGCOM Fleet Mooring Maintenance Program, CHESNAVFACENGCOM has been tasked to conduct the underwater inspections of fleet moorings worldwide. In July 1982, CHESNAVFACENGCOM developed an inspection plan and designated an Engineer-In-Charge (EIC) to provide on-site engineering (Con't)

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support during the inspection of the fleet mooring operated and maintained by the Naval Statio at Long Beach, CA. The underwater inspection of this reported "A" Class mooring was conducted by divers of Underwater Construction Team Two (UCT-2). CHESNAVFACENGCOM has reviewed the inspection data gathered by the UCT-2 divers and other data collectd on site by the EIC during the inspection. This data and its subsequent evaluatin served as the basis for this inspection report.

TABLE OF CONTENTS

LONG BEACH FLEET MOORING
UNDERWATER INSPECTION REPORT

1.0 INTRODUCTION

1.1 Background. Under the COMNAVFACENGCOM Fleet Mooring Maintenance Program, CHESNAVFACENGCOM has been tasked to conduct the underwater inspections of fleet moorings worldwide. In July 1982, CHESNAVFACENGCOM developed an inspection plan and designated an Engineer-in-Charge (EIC) to provide on-site engineering support during the inspection of the fleet mooring operated and maintained by the Naval Station at Long Beach, CA. The underwater inspection of this reported "A" Class mooring was conducted by divers of Underwater Construction Team Two (UCT-2). CHESNAVFACENGCOM has reviewed the inspection data gathered by the UCT-2 divers and other data collected on site by the EIC during the inspection. This data and its subsequent evaluation served as the basis for this inspection report.

1.2 Mooring Historical Data. The riser-type mooring maintained by NAVSTA Long Beach is located in the west basin of the Los Angeles middle harbor (Figure 1). This mooring was initially installed in 1956 but was removed for overhaul during the Spring of 1981. The currently configured mooring was installed on 5 May 1981 and is reported to be an "A" class. However, Class A moorings consist of 2 3/4 inch ground leg chain while this mooring has 2 1/2 inch ground leg chain, which more adequately meets the size requirements of a Class B mooring assembly. In addition, the length of each of the four ground legs is less than the length specified in DM-26 for the 55-foot water depth used as design criteria. DM-26 calls for 4 shots of chain per leg, while as-built documentation shows that each leg actually contains only 2-1/2 shots of chain. There is no cathodic protection system installed in the mooring.

2.0 INSPECTION PROCEDURES

2.1 Inspection Objectives. The purpose of mooring inspections is to determine the general physical condition of the buoys and chain assemblies and, when possible, to verify or update existing as-built and maintenance records. Underwater inspections performed by divers sample only a portion of the submerged buoy hull and chain assemblies in order to compile a general description of the mooring's condition. The existence of fairly consistent measurements during this "selective sampling" inspection provides a good indication of the installation's overall condition. It should be kept in mind that periodic underwater inspections are intended as an expeditious and relatively inexpensive supplement to accurate maintenance records. As such, they cannot fully substitute for a complete inspection involving recovery of the mooring and the measurement and evaluation of each component.

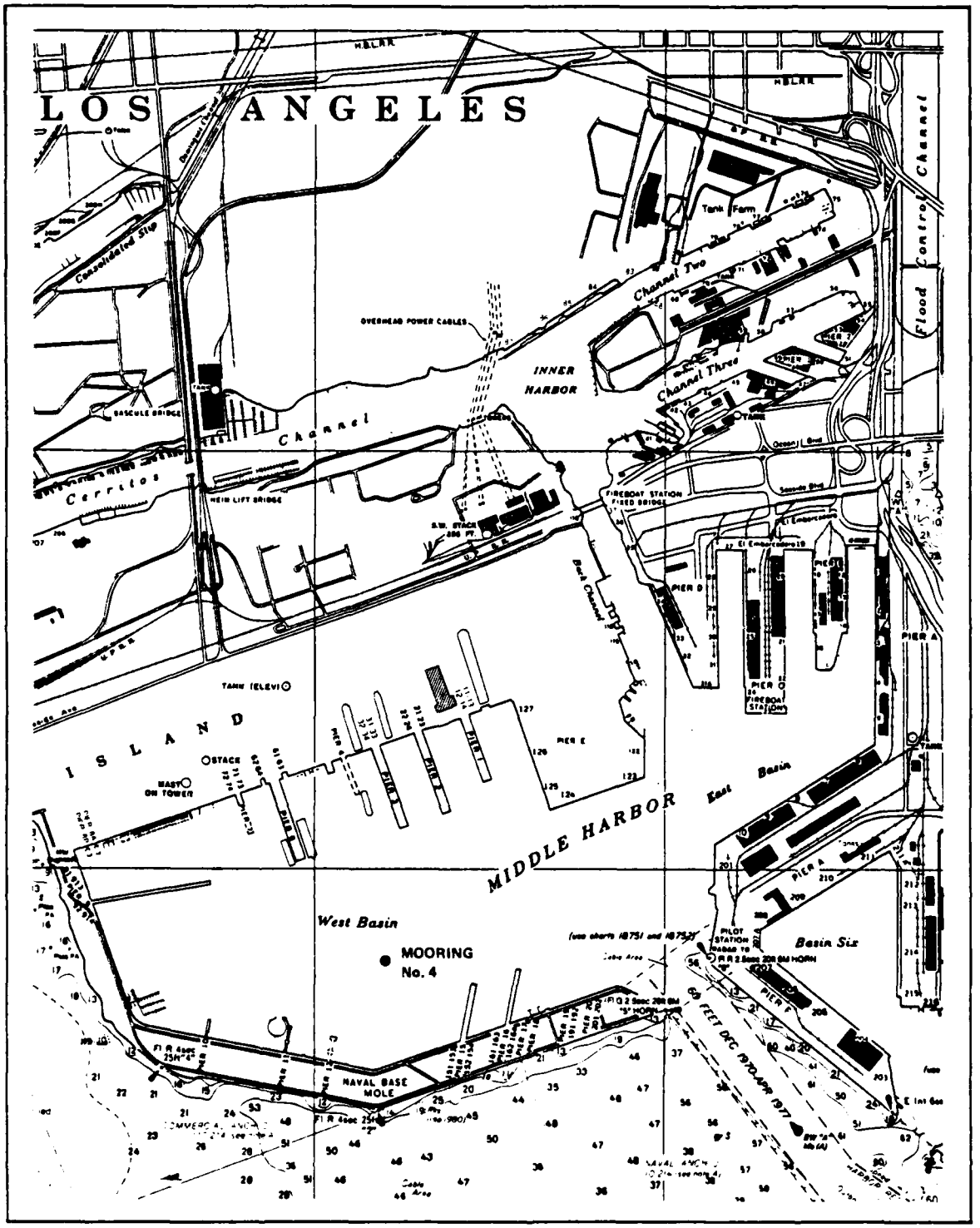


Figure 1. Geographic Position of Long Beach Mooring

One of the more important parameters used to evaluate the condition of a mooring is chain wire diameter. After cleaning to bare metal, a selective sampling of the wire diameter of chain links and connecting hardware is taken in order to determine the amount of deterioration due to corrosion and wear. "Single Link" measurements are taken where chain is slack, and detect only corrosion loss. "Double Link" measurements, taken where two links connect under tension, detect the combined effects of corrosion and wear. Chain links and other components which measure 90% or greater of original wire diameter are considered "good" condition; measurement between 80% and 90% of original diameter is considered "fair" condition and is cause for the mooring to be downgraded in classification; any measurement less than 80% is considered "poor" and is cause for the mooring to be declared unsatisfactory for fleet use. Figure 2 shows the proper method of taking single and double link measurements.

Standard underwater inspection procedures do not call for the inspection of any part of the mooring which has been buried. Ground legs and risers are observed only to the point at which they become buried; no attempt is made to locate and inspect anchors or other mooring materials which are not readily visible.

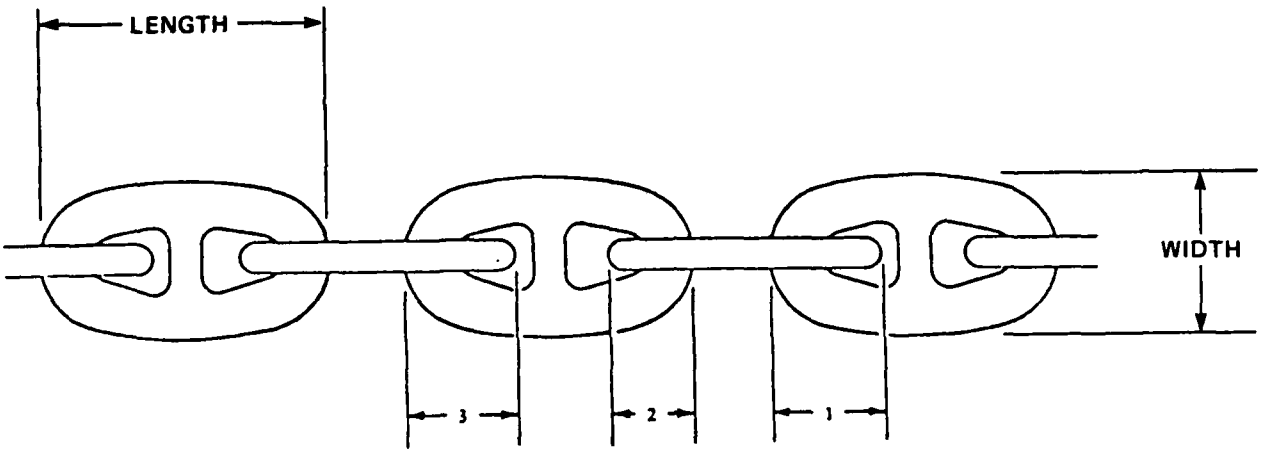
2.2 Buoy. The buoy was inspected and its general condition determined. The buoy markings were noted and checked for conformance with those noted in applicable charts. The buoy diameter was measured and recorded along with the freeboard dimensions. Physical damage, such as holes and dents, was reported. The paint was checked for cracking, chipping, and peeling. Hatches, openings, and penetrations were examined and broken parts and rust were reported.

The buoy fenders and chafing rail were checked for integrity and secure connection to the buoy.

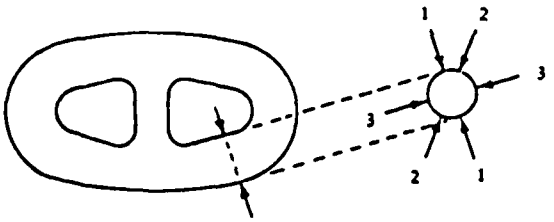
The buoy top chain jewelry was inspected and measured with calipers.

Divers inspected the buoy below the waterline. The thickness of marine growth was recorded, three one-foot-square areas were selected and cleared of growth, and the condition of the paint was noted.

The bottom chain jewelry connecting the buoy to the riser was identified and measured with calipers.



Double Link Measurement



Single Link Measurement

FIGURE 2. LOCATIONS FOR TAKING CHAIN LINK MEASUREMENTS

2.3 Riser. To determine chain wear, the riser chain was inspected by taking three (3) consecutive double link measurements, using precut gauges and/or calipers, at both ends and at the center of the riser. To determine original chain size, divers measured the length of a chain link and took single link caliper measurements of its wire diameter. Divers also documented the type of hardware connecting the riser chain to the ground ring.

2.4 Ground Legs. To determine chain wear, three (3) consecutive double link measurements were made at both ends and at the center of each leg until the chain was buried in the seafloor. Where a segment of chain was resting on the bottom and was not in tension, single link measurements were taken instead of double link measurements. To determine original chain size, divers measured the length of a chain link and took single link caliper measurements of its wire diameter. The hardware connecting the ground legs to the ground ring was documented. The length of chain from the ground ring to the point where the chain was buried in the mud was recorded.

2.5 Ground Ring. The ground ring was examined for general and localized wear. The depth of water at the ground ring was recorded by the divers.

2.6 Anchors. All four anchors were buried in the mud bottom and not visible to the divers.

2.7 Photography. Photographs were taken both on and under the surface when required to support observed material conditions.

3.0 INSPECTION SUMMARY

3.1 Findings. As a result of a review and evaluation of the data obtained by UCT-2 divers during the inspection, the following comments are pertinent:

- Although reported as an "A" Class, this mooring only has 2 1/2" ground leg chain which more adequately meets the size requirements of a Class B mooring assembly.
- The material condition of this mooring, numbered FM-4, is good. However, due to its relatively short ground legs, this mooring does not meet the established criteria for inclusion into any class of fleet mooring as specified in DM-26.
- The buoy, a 12-foot diameter Mark II Peg-Top, has some light rust spots on its sides. Otherwise, the buoy and its top and bottom jewelry are in satisfactory condition.
- A five foot section of the lower buoy fender system (at the waterline) is loose.

- Measurements taken of chain links and fittings were all greater than ninety percent of the original wire diameters.

- The Harbor Operations Officer advised that, due to more than adequate pier space, this mooring is never used by ships. Instead, it is primarily used for securing spare camels and/or roller logs.

Annex A contains more detailed information concerning the status of this mooring.

4.0 RECOMMENDED ACTION

NAVSTA Long Beach personnel should review their mooring requirements, based on the sizes of ships and environmental conditions expected to be encountered and determine the capacities or classes of moorings that are required. The existing mooring does not meet the design requirements for any class of mooring and should not be used by ships. However, it is satisfactory for the current use of securing camels and/or roller logs.

ANNEX A

FLEET MOORING INSPECTION RESULTS

FLEET MOORING FOUR
(FM-4)
INSPECTION RESULTS

Buoy

This buoy is a painted Mark II 12'0" diameter Peg Top (S/N 181) with a 4'1" freeboard. The buoy has a wooden chafing rail and three wooden fenders, two parallel fenders near the top of the buoy and one at the waterline. Figure A-1 is an isometric view of the mooring. A five foot section of the lower fender is loose, and there are some light rust spots on the buoy's side. All top and bottom chain jewelry on the buoy are in satisfactory condition.

Riser

Three double link measurements were taken. All readings were greater than 90 percent of the original wire diameter (2 3/4"). The ground ring is at a depth of 50 feet below the surface.

Ground Legs A, B, C, and D

All four legs are buried about 20 feet down from the ground ring. Double-link measurements of available portions of the legs were greater than 90 percent of the original wire diameter.

Overall Mooring

Although this mooring is reported to be a Class A mooring, it does not meet the DM-26 criteria for this class of mooring. A Class A mooring consists of 2-3/4 inch chain in both its riser and ground legs. According to diver measurements, this mooring has a 2-3/4 inch riser but only 2-1/2 inch ground legs which more appropriately meet the size requirements of a Class B mooring assembly. However, each leg of this FM-4 mooring contains only 2-1/2 shots of chain, and this does not meet the minimum requirement of 4 shots of chain per leg for a Class B mooring installed in 50-60 feet of water. In fact, 2-1/2 shots of chain per ground leg do not meet minimum requirements for any class of fleet mooring assembly installed in 50-60 feet of water.

Recommended Action

NAVSTA Long Beach personnel should review their mooring requirements, based on the sizes of ships and environmental conditions expected to be encountered and determine the capacities or classes of moorings that are required. The existing mooring does not meet the design requirements for any class of mooring and should not be used by ships. However, it is satisfactory for the current use of securing camels and/or roller logs.

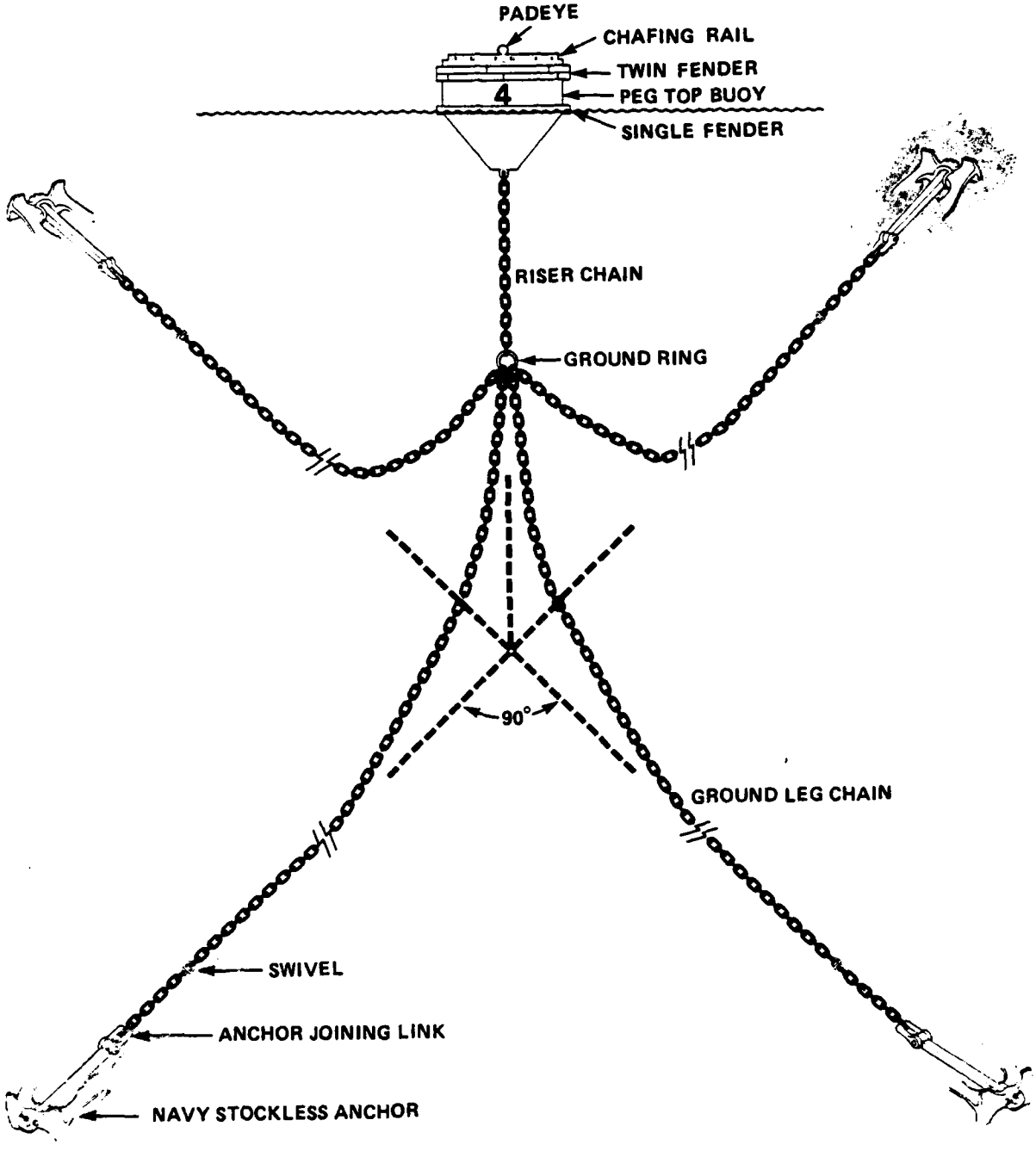


FIGURE A-1: SCHEMATIC DRAWING OF FM 4

MOORING NO.: FM 4 CLASS: A LOCATION: NAVSTA LONG BEACH LAT: _____ LONG: _____

WATER DEPTH: 55' TYPE MOORING: ☒ RISER ☐ TELEPHONE ANCHOR SIZE/TYPE: NI BUOY TYPE: Pet Top (12') S/N 181

DATE: 1 SEPT 82 ENGINEER-IN-CHARGE H. WALTER DIVER: J. MESERVE / M. RICHARDSON

COMPONENTS		NI	CONDITION NEW	SINGLE LINK % 90+	SINGLE LINK % 80+	SINGLE LINK % 80-	DOUBLE LINK % 90+	DOUBLE LINK % 80+	DOUBLE LINK % 80-	D	U/W VOLT READING	COMMENT
BUOY-TOP HARDWARE												NC ANODES
RISER	NEAR BUOY		2 3/4"				5 1/2"					LENGTH OF LINK 16"
	MIDDLE		↓				5 1/2"					
	NEAR GRD RG		↓				5 1/2"					
GROUND RING			5"	4 5/8"								AT 50' DEPTH
GROUND LEG NO. A	UPPER END		2 1/2"				4 1/2"					BRNG 090°/LINK LENGTH 15"
	WEARPOINT		↓				4 1/2"					BURIED 20' BELOW G.R.
GROUND LEG NO. B	UPPER END		↓				4 3/4"					BRNG 180°/LINK LENGTH 15"
	WEARPOINT		↓				4 3/4"					BURIED 30' BELOW G.R.
GROUND LEG NO. C	UPPER END		↓				4 1/2"					BRNG 235°/LINK LENGTH 15"
	WEARPOINT		↓				4 1/2"					BURIED 20' BELOW G.R.

BOTTOM TYPE: ☐ SAND ☒ MUD ☐ CLAY ☐ CORAL ☐ ROCK

Visibility 8' D = depth NI = not inspected, inaccessible

*Measured Depth/Depth to Mean Low Water Springs

CHESNAVFACENGCOM REPORT FPO-1-82(24), "NAVSTA LONG BEACH FLEET MOORING INSPECTION REPORT," DECEMBER 1982

MOORING NO.: FM 4 CLASS: A LOCATION: NAVSTA LONG BEACH LAT: _____ LONG: _____

WATER DEPTH: 55' TYPE MOORING: ☒ RISER ☐ TELEPHONE ANCHOR SIZE/TYPE: 1'I BUOY TYPE: Pig Top (12')

DATE: 1 SEPT 82 ENGINEER-IN-CHARGE M. WALTER DIVER: J. HESERVE H. RICHARDSON

COMPONENTS		NI	CONDITION								U/W VOLT READING	COMMENT
			NEW	SINGLE LINK %			DOUBLE LINK %			D		
				90+	80+	80-	90+	80+	80-			
BUOY-TOP HARDWARE												
RISER	NEAR BUOY											
	MIDDLE											
	NEAR GRD RG											
GROUND RING												
GROUND LEG NO. D	UPPER END		2½"				4 3/4"					BRNG 330°/LINK LENGTH 15"
	WEARPOINT		↓				4 3/4"					BURIED 20' BELOW THE 6 8.
GROUND LEG NO. ___	UPPER END											
	WEARPOINT											
GROUND LEG NO. ___	UPPER END											
	WEARPOINT											

BOTTOM TYPE: ☐ SAND ☒ MUD ☐ CLAY ☐ CORAL ☐ ROCK

Visibility 8' D = depth NI = not inspected, inaccessible

*Measured Depth/Depth to Mean Low Water Springs

CHESNAVFACENGCOM REPORT FPO-1-82(24), "NAVSTA LONG BEACH FLEET MOORING INSPECTION REPORT," DECEMBER 1982

FM-4 AS-BUILT
5 MAY 1981

Bottom Hardware

- Pad Eye
- 3-1/2" Detachable Link
- 2-9/16" Pear Link
- 2-1/2" Detachable Link

Riser Chain

- 17'-2-3/4" Dilok Chain
- 2-1/2" Detachable Link
- 15'-2-3/4" Dilok Chain
- 2-1/2" Detachable Link
- 2-1/2" B.C. Link
- 3-5/8" NACCO
- 5" X 15" ID Ground Ring

Ground Legs "A" and "D"

- 3-5/8" NACCO
- 2-9/16" Pear Link
- 2-1/4" Detachable Link
- 90'-2-1/2" Cast Chain
- 2-1/4" Detachable Link
- 45'-2-1/2" Cast Chain
- 2-1/4" Detachable Link
- 90'-2-1/2" Cast Chain
- 2-1/2" Detachable Link
- 2-3/4" X 3" Anchor Joining Link
- 20K Stockless Anchor with 4' Stabilizer Bar

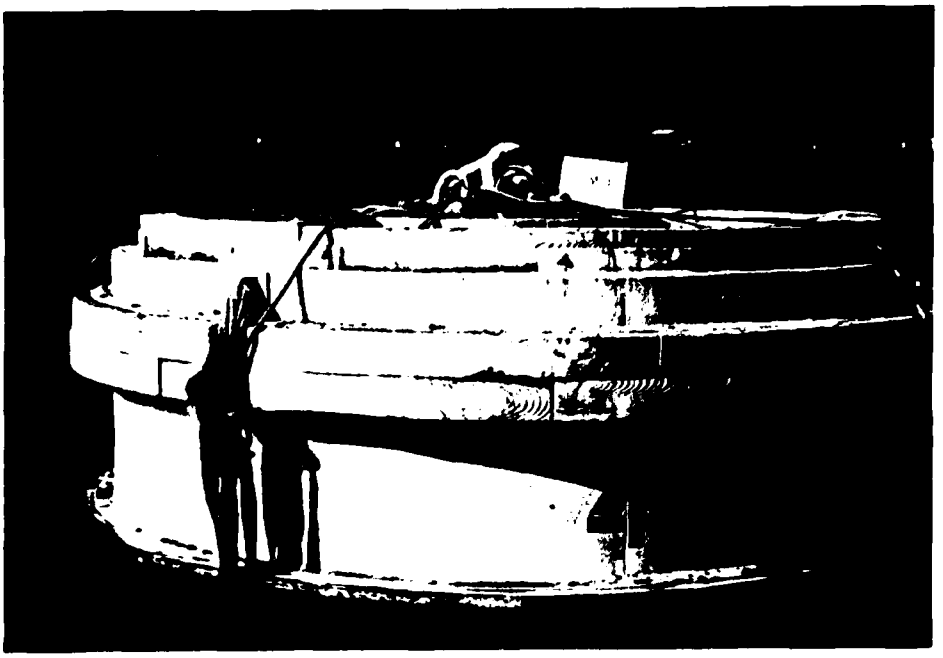
Ground Legs "B" and "C"

- Same as Legs "A" and "D" except for a 3-1/4" Pear Link and a 2-1/2" Detachable Link between the Anchor Joining Link and the Anchor.

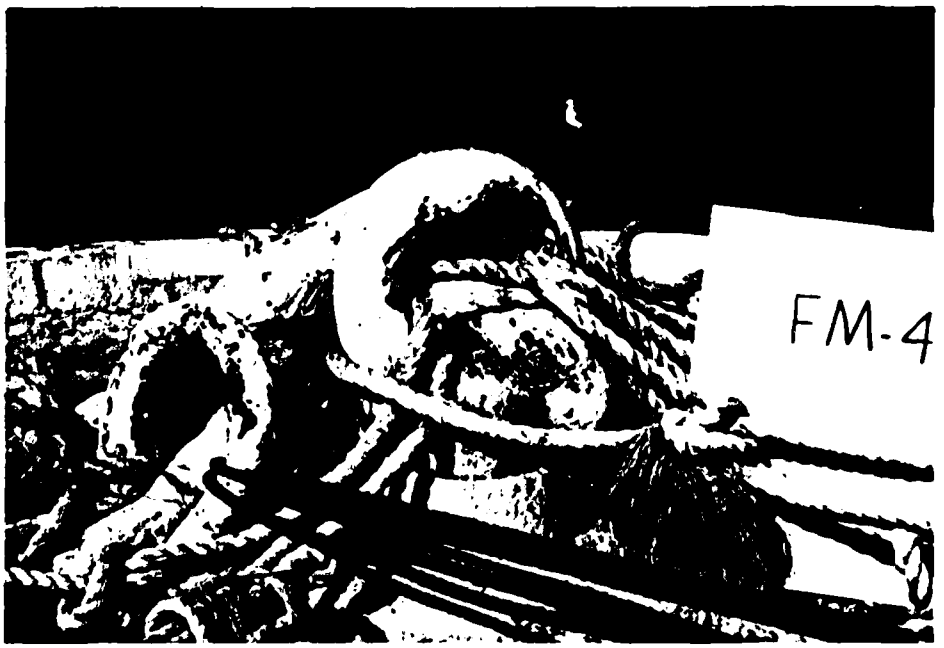
NOTE: Above data provided by NAVSTA Long Beach.

ANNEX B

SAMPLE PHOTOGRAPHS



FM-4, Naval Station Long Beach



FM-4 top jewelry

Links in riser chain. Note relatively light marine growth

Roller logs lashed together and tied to the mooring

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