

GENERAL INSTRUCTION MANUAL

ISSUING ORG. TERMINAL DEPARTMENT

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SUBJECT HANDLING, STORAGE, INSPECTION AND TESTING OF SPM HOSES
IN THE FIELD

APPROVAL

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CONTENT:

This General Instruction describes the handling, storage, inspection and testing of Single Point Mooring (SPM) loading hoses in the field. It contains the following:

1. Scope
2. References
3. General
4. Hose Handling
5. Storage
6. Inspection and Testing
7. Inspection Frequency And Replacement Policy
8. Hoses on Hold Status

APPENDIX I "Hose Data Sheet"

1.0 SCOPE:

This Instruction provides a guide for proper handling, storage, inspection and testing of SPM hoses in the field.

2.0 REFERENCES:

This Instruction takes into account the following:

- 2.1 22-SAMSS-004.
- 2.2 OCIMF, 4th Edition, 1991. Guide to Purchasing, Manufacturing, and Testing of Loading and Discharge Hoses for Offshore Moorings.
- 2.3 OCIMF, BMF, 2nd Edition, 1974. Guide for the Handling, Storage, Inspection and Testing of Hoses in the Field.
- 2.4 Mobil Engineering Guide, EGE, 05-B-2-1980. SPM/MBM Hose Care and Handling.
- 2.5 Social Recommended Practice #6, "Use, Handling, Storage and Inspection of Cargo and Submarine Hoses".
- 2.6 Hose manufacturers' Installation and Maintenance Manuals.
- 2.7 Saudi Aramco SPM Maintenance Manual.
- 2.8 OCIMF, final draft, 1994. SPM Operation and Maintenance Guide.
- 2.9 Re-evaluation program of used/on hold SPM hoses. Reference TTSD/JTEU-112/94, 301/94, 307/94 and 046/96.

3.0 GENERAL:

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The SPM hose strings are a critical link between the Tanker and the Terminal. To ensure the optimum life of these hoses and reduction of hazards to the environment through pollution, it is essential that they are handled and stored correctly, and also inspected and tested regularly.

4.0 HOSE HANDLING:

- 4.1 Hoses shall be lifted using a load spreader bar. This should provide a minimum three-point lift with one central sling and another at each end, all equally spaced (see Fig. 1). Under no circumstances shall a fork lift be used for lifting hoses.
- 4.2 Lifting straps should be Safe Working Load (SWL) 5.4 metric tons (6 Sh. ton) 30.5 cm (12") wide to prevent kinking or chaffing of the hose. Wire rope shall not be used to lift hoses.
- 4.3 A hose shall never be lifted by a single sling at its mid-point or by two slings positioned one at each end of the hose.

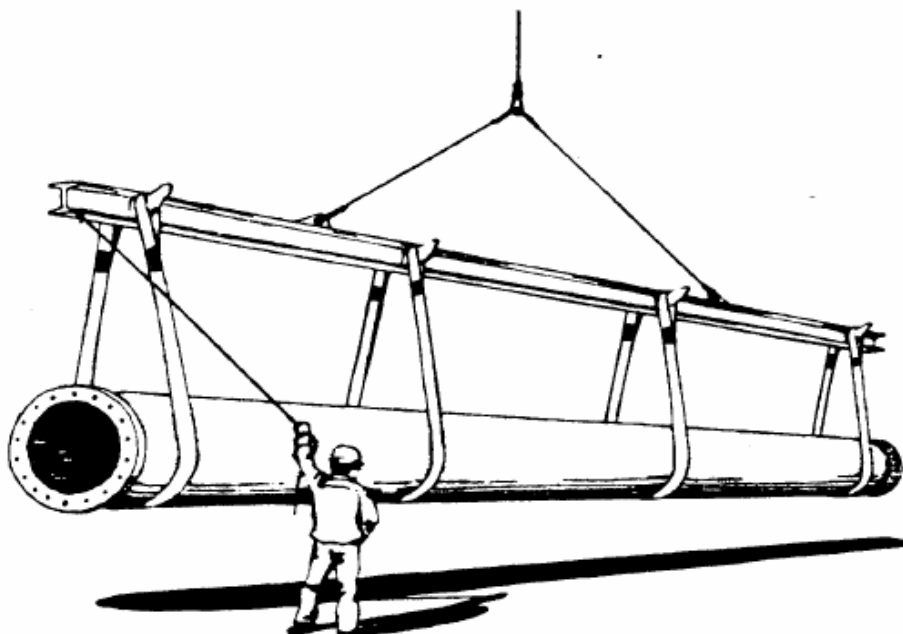


Figure 1 Correct Lifting of Hoses

- 4.4 Hoses shall not be dragged across the ground.
- 4.5 A hose shall not be bent below its minimum bend radius as follows:

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(Measured to Inside Surface of Hose)

Nominal Hose Bore		Hose with Float Location Collars		Hose with Integrally Built-in Floatation Media	
Inches	(mm)	Feet	(cm)	Feet	(m)
12	(300)	06	(1.85)	08	(2.50)
16	(400)	08	(2.50)	10	(3.10)
20	(500)	10	(3.10)	12	(3.70)
24	(600)	12	(3.70)	15	(4.50)

- 4.6 When hoses are being towed, all necessary precautions shall be taken to ensure buoyancy. The towing speed for floating hose strings shall not exceed 5 knots, and for assembled sub-sea hose systems shall not exceed 3 knots.
- 4.7 When connecting and disconnecting hoses, they should never be lifted near the middle with a single sling; however, one sling may be placed around the nipple section so that the hose flanges can be aligned during assembly.
- 4.8 If hoses are to be transported on flatbed trailers they shall not be stacked more than two high. The trailer must take the full hose length with both flanges supported. The hoses must be restrained from movement by being securely chocked or tied down with wide straps.

5.0 STORAGE:

- 5.1 Whenever possible, the hoses shall be stored on the pallets which are used for delivery from the vendor. Pallets shall only be stacked on firm level ground (e.g., asphalted areas) as follows:
- | | |
|------------------------------------|--------------------------------|
| 400 mm/500 mm/600 mm (16"/20"/24") | hoses - stack 4 high (maximum) |
| 300 mm (12") | hoses - stack 5 high (maximum) |
- 5.2 If hoses cannot be stored on pallets, they should be laid out straight and level on firm ground such as asphalted areas. The hoses shall not be stacked more than two high under these circumstances.
- 5.3 Hoses shall be stored in a sun-sheltered area or covered to protect them from direct sunlight.
- 5.4 All hoses, when in storage, shall have plywood blank flanges installed to protect the internals of the hose from dust, sand and moisture. These flanges shall have four (4), one (1) inch holes drilled to allow the free circulation of air through the hose bore.
- 5.5 Before storing new hoses, the Inspector must inspect them and initiate a Hose Data Card (see Section 6.5). The Inspector must then sign the warehouse stock tally sheet to show the disposition of these hoses. This sheet is held by the warehouse stock controlman.
- 5.6 Accurate records of hoses deliveries should be kept by Juaymah Terminal Maintenance Division/SPM Unit and those received earliest shall be put into service first.

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PAGE NO. 4 OF 11**6.0 INSPECTION AND TESTING:**

- 6.1 Visual Inspection: Before inspecting the hose, the Inspector must examine the flanges to determine the hose serial number and date of manufacture. This information should be recorded, in addition to the following:

6.1.1 External

- a. Large losses of floatation (in excess of 20%).
- b. Abrasions or cuts to the helix wires or reinforcing plies.
- c. Kinks (helix wire reinforced hose only).
- d. Damaged flanges.

NOTE: Regular undulation along the bore of a helix wire reinforced hose may be the result of frequent bending in service and should not be given as an immediate cause for rejection. The same applies to a regular rippling which might be an impression of displaced helix wires. A note should be made of such observations so that they can be referred to when the hose is under vacuum. If bulges appear at the location where rippling was observed or any other place in the hose when it is under vacuum, then the lining can be assumed to be delaminated and the hose shall be rejected.

6.1.2 Internal

- a. Any damage to the lining.
- b. Bent nipples.
- c. Kinks (helix wire reinforced hose only).
- d. Displaced helix wires or heavy ribbing.
- e. Lining separation from the nipple end.

If any of the above is noted, then the hose must be scrapped and no other tests are required. Under these circumstances the hose is marked "X". Any borderline cases must be referred to the Juaymah Terminal Engineering Unit (JTEU), SPM Engineer for further investigation.

If none of the above is noted, then the hose is marked "O" as visually acceptable, and testing continues.

6.2 Hydrostatic Testing:

- 6.2.1 Lay the hose out straight and level on rollers so that it is free to elongate under pressure.
- 6.2.2 Wire brush the flange faces if necessary to remove old gasket material or rust.
- 6.2.3 New compressed synthetic fiber, inside bolt circle gaskets, and blind flanges should then be fitted to each end of the hose. The hose is pressurized to 0.7 bar (10 PSIG) and held at this pressure for ten minutes; the length between the flanges is then measured and recorded. Compare this length to the factory final length at 0.7 bar. Whichever length is the smaller should be used as length "LB" when computing the field temporary elongation.

NOTE: Some new hoses, especially helix wire-free types, which are tested before being placed in service, can have a smaller length at 0.7 bar when tested in the field. The use of the smaller original length is a more stringent test for the hose.

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6.2.4 Pressurize the hose to half its original test pressure. This pressure must be maintained for ten minutes, and then released over a five-minute period.

6.2.5 Pressurize the hose to its original test pressure over five minutes. After ten minutes at that pressure, the hose length, "LA", must be measured and recorded. During this period the Inspector must visually inspect the outside of the hose ensuring there are no leaks, bulges or other defects.

6.2.6 The field temporary elongation of the hose is then calculated using the following formula:

$$TE = (LA - LB) / LB \times 100\%$$

TE - Field Temporary Elongation

LA - Field final length at test pressure.

LB - Factory final length at 10 PSIG. (can be obtained on the Factory Test Data Sheet supplied by the Vendor)

6.2.7 The Inspector must then compare the field temporary elongation to the factory elongation (Saudi Aramco Temporary Elongation in 08-SAMSS-004); and if the following criteria are satisfied, then the hose has passed the hydrostatic test.

HELIX WIRE: For helix wire reinforced hoses, the field TE shall be below two (2) times the factory TE, or 2%, whichever is greater.

HELIX FREE: For helix wire free hoses, the allowable field TE shall be maximum 2%, more than the factory TE.

6.2.8 If the hose passes hydrostatic testing and is not an Specially Reinforced for SALM Service (SRSS) type, then it is marked "OK" together with the date of the test. If the hose fails the hydrostatic test, it must be marked "X" and scrapped.

6.3 Vacuum Testing:

6.3.1 Lay the hose out straight and level, ensuring that there are no foreign objects in the bore.

6.3.2 Wire brush the flange faces if necessary to remove old gasket material or rust.

6.3.3 Lightly grease the flange faces and place a neoprene gasket 3.2 mm (1/8" thick) on the flange faces at opposite ends.

6.3.4 Clean two Plexiglas's blanks 2.54 cm (1") minimum thickness and connect one to the vacuum pump inlet. Position these blanks on the hose flange faces while simultaneously starting the vacuum pump. Run the pump until a vacuum of -0.85 bar (25 in. of Hg) is produced in the hose bore.

6.3.5 This vacuum should be maintained for ten minutes while the Inspector once again visually inspects the hose.

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NOTE: A powerful light source should be used at the opposite end of the hose while the Inspector checks the hose bore (refer to Para. 6.1). He must then inspect from the other end of the hose.

Providing the hose passes this test, the hose is marked "VT" and the testing continues; otherwise the hose is marked "X" and scrapped.

6.4 Burst Testing:

6.4.1 Required Equipment:

- a. Two blind flanges with o ring groove
- b. Two o rings
- c. 1 inch nominal size high pressure hose (Min. Rated Pressure = 1,750 psig)
- d. High pressure pump (Min. Rated Pressure = 1,750 psig)
- e. Pressure gauge (Range = 2,000 psig)
- f. Pressure recorder
- g. Valve (Min. Rated Pressure = 1,750 psig)
- h. Crane (Min. Capacity = 5 tons)
- i. Nylon sling (S.W.L = 5 tons)
- j. Connections, Wrench, etc.

6.4.2 Test Layout:

- a. Lay the hose that is to be burst tested out straight and level on the ground.
- b. Clean both flange faces using a wire brush if necessary to remove old gasket material and/or corrosion.
- c. Arrange the hose and associated testing equipment as shown in the attached sketch.
- d. Open valve "B" and pump water into the hose from pump "A" until water comes out from valve "B".
- e. Lift up the hose end "C" to a height of about one (1) meter to remove any trapped air. This is important for safety reasons since pressurized trapped air can be dangerous when the hose ruptures.
- f. Continue pumping water into the hose until water comes out again from valve "B".
- g. Stop water pumping and then shut off the valve "B".
- h. Make sure that the pressurization hose is untangled and laid down on the ground as straight as possible.

6.4.3 Burst Testing Procedure:

- a. With all personnel well away from the test hose for safety reasons, start pressurizing it to the anticipated bursting pressure, i.e. 3 times the hose rated pressure or 5 times the system working pressure whichever is higher, over a period of 15 minutes.
- b. If the hose does not burst at this pressure, maintain the pressure for a further period of 15 minutes.
- c. Raise the pressure until the hose bursts.

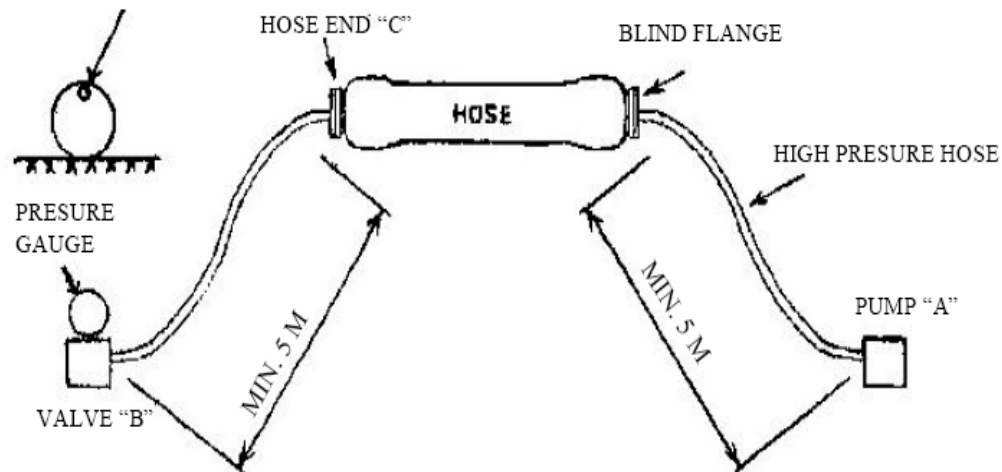
6.4.4 Burst Test Result:

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- a. Record the pressure at which the hose burst, the failure mode and the exact place of failure.
- b. Issue a burst test report which includes the burst hose serial number, the achieved service life, failed reason and previous comments and observations noted in the burst hose inspection card.
- c. Retain the burst test report for analysis purposes.

**Figure 2 Burst Testing Hoses**

- 6.5 Documentation: The hose Inspector must complete the Hose Data Card, see Appendix I, whenever he inspects a hose:
- 6.5.1 The original hose data is available from the manufacturer's testing certificates.
 - 6.5.2 The SPM Maintenance Unit must supply hose string "into" and "out-of-service" information as well as hose string movement details as soon as they are available. They must also supply, as required, any individual hose histories which the Inspector requires to issue his hose failure reports.
 - 6.5.3 It is most important that the correct failure code is allocated to failed hoses. If a hose has failed for more than one reason then the primary reason should be written first. The following failure codes are to be used:
 - F1 Lining blister.
 - F2 Rupture in service.
 - F3 Nipple leak in service.
 - F4 Severely Kinked or have more than one (1) slight kinks.
 - F5 Rough handling offshore.
 - F6 Excessive elongation during pressure test.
 - F7 Carcass leak during pressure test.
 - F8 Vacuum test failure.
 - F9 Miscellaneous.
 - F10 Achieved service life.
 - F11 Nipple leak during pressure test.

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- F12 Lining cuts.
- F13 Rough handling onshore.
- F14 Heavily damaged floatation material.
- F15 Abrasion to helix wires or steel reinforcing plies.

A hose inspection and testing report must be issued by the TTSD/Terminal Inspection Unit, to summarize the results of hose testing. This must include copies of the Hose Data Cards and must show the number of hoses tested, the number failed, and the number on "hold" status (see Section 8).

7.0 INSPECTION FREQUENCY AND REPLACEMENT POLICY:

Hoses shall be inspected and tested as follows:

7.1 Mainline Floating Hoses, 24" Diameter Cargo:

- a. New Hoses - Three (3) years initial installation, then remove for inspection and testing.
- b. Used Hoses - Yearly inspection and testing. After six (6) years in service these hoses must be retired. If they are visually acceptable, they must be tested. If they pass the tests, they shall be retired with the failure code F10, "Achieved service life".

Note: Bridgestone hoses shall be retired after seven (7) years.

- c. Experimental and new manufacturer's hoses - Install for one (1) year, then inspect and test. If the hoses show no problems after the first year then re-install for a further one (1) year and re-evaluate after that year's service.

7.2 Mainline Floating Hoses, 12" Diameter Bunker:

- a. New Hoses - Three (3) years after initial installation, then remove for inspection and testing.
- b. Used Hoses - Yearly inspection and testing. After six (6) years in service these hoses must be retired. If they are visually acceptable they must be tested. If they pass the test they can be retired with the code F10, "achieved service life".
- c. Experimental and new manufacturer's hoses - Install for one (1) year, then inspect and test. If the hoses show no problems after the first year then re-install for a further one (1) year and re-evaluate after that year's service.

7.3 First Off Buoy Hoses, 24" Diameter Crude and 12" Diameter Bunker:

- a. New Hoses: One (1) year initial installation, then removed for inspection and testing.
- b. Used Hoses: Used for one (1) more year after which they shall be inspected and tested. Hoses which pass this test shall be marked F10, "achieved service life".

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- c. Experimental and new manufacturer's hoses - Install for one (1) year then evaluate the hose after inspection and testing. Carefully monitor the hoses' performance while in service.

7.4 Rail/Tail Hoses, 20" Diameter, 16" Diameter and 12" Diameter:

- a. Rail Hose - Replace every year with a new hose. If the used hose passes inspection and testing, re-use as a tail hose (20" diameter and 16" diameter). If a 12" diameter rail hose passes the test use it as a mainline hose and treat it as specified in Para. 7.2b. However the years of service will include the period of service in the rail hose position.
- b. Tail Hose - Service life for tail hoses, and rail hoses which pass the tests after one (1) year service, is two (2) years. After two years service the hose must be inspected and tested. If they pass the tests they shall be retired with the failure code F10, "achieved service life".
- c. Experimental and new manufacturer's hoses - Install for one (1) year, then evaluate the hose after inspection and testing, carefully monitor the hoses' performance while in service. If the hoses show no problems after the first year, then re-install for a further one (1) year and re-evaluate after that year's service.

7.5 Sub-Sea CALM Hoses:

- a. The service life for Standard Submarine (SS) and Variably Reinforced SPM Service (VRSS) hoses, both 24" diameter and 12" diameter, is four (4) years. Once the new hoses are made up into the sub-sea system they must be left in service for their service lives, then removed and inspected and tested. Those that pass the test must be retired F10, "achieved service life".
- b. No experimental or new manufacturer's SS or VRSS hoses shall be allowed in CALM sub-sea systems until the basic design has been evaluated as a mainline floating hose.

7.6 Sub-Sea SALM Hoses:

- a. The service life for the mainline submarine hose system used on a SALM is four (4) years. This hose system consists of 24" diameter or 12" VRSS hoses; hoses 24" diameter x 30' long SRSS and 12" diameter x 30' long SS hoses. Once the new hoses are made up into the sub-sea system they must be left in service for their lives, then removed and inspected and tested. Those that pass the test must be retired F10, "achieved service life".
- b. The service life for the 24" diameter and 12" diameter VRSS jumper hoses, and hose-arm bunker hose, is six (6) years. After six (6) years continuous service they must be removed and evaluated.
- c. Experimental and new manufacturer's hoses. VRSS hoses are the same as used on a CALM, see 7.5b.

12" diameter SRSS hoses are in fact 30' long SS hoses and are not specially reinforced, see Para. 7.5b. The hose-arm 12" diameter x 23' - 9" hose-arm bunker hose is also of standard construction, see Para. 7.5b.

7.7 Notes:

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- a. All hoses retired under F10 must be placed on hold for further evaluation or for use in an emergency. Hoses that have reached 12 years from the day they were manufactured, should be scrapped or used as a fender.
- b. Hoses which fail inspection and testing may be used as fenders or sent to reclamation.
- ** c. Consult with a third party and obtain their concurrence before extending the service life of any type of hoses.

8.0 HOSES ON HOLD STATUS:

Tested hoses must be placed on a "hold" status if their original test data is unavailable. As soon as the original test data is available, the disposition of the hose must be made available by the Hose Inspector. If the hoses are urgently required for use, they may only be used if their temporary elongation is below 2% and only in an emergency where no other hoses are available.

To compute the temporary elongation under these circumstances, the hose should be tested recording its length at 10 PSIG (LB) and at its rated pressure (LA). The temporary elongation is then:

$$(LA - LB)/LB \times 100\%$$

A 'Request for Waiver of Saudi Aramco Engineering Standard' (Form 6409), must be completed before any such hoses are returned to service.

Approved By:

Manager, Terminal Department

Date: _____

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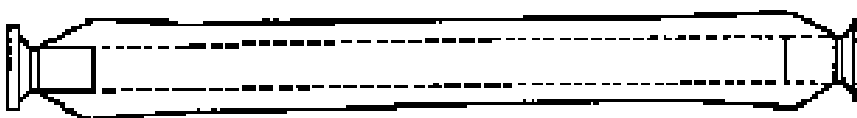
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APPENDIX I**HOSE DATA SHEET**

MFG DATA	MFG	MFG DATA		LENGTH	TYPE	SERIAL NO.	
	EXACT LENGHT	FACTORY TEMP.ELONGATION (TE)	TEST PRESSURE	VACUUM TEST	ELECTRICAL CONTINUITY	STIFFNESS TEST	KERSENE TEST
STORAGE	DATA OF STORAGE	WHERE STORED	STORAGE TIME PRIOR TO INST.	TESTED BEF. USE			
HISTORY	SPM	POSITION	DATE IN	DATE OUT	SERVICE TIME		
	1						
	2						
	3						
	4						
	5						
FIELD TESTS	TEST PRESSURE	LB	LA	TE	VACUUM TEST	STIFFNESS (CABLE FORCE)	
	1						
	2						
	3						
	4						



	INSP.DATE	INSPECTOR	SIGNATURE	HOSE DISP.	FAILURE COD.	REMARKS
1						
2						
3						
4						
5						

* CHANGE

** ADDITION

NEW INSTRUCTION ☐COMPLETE REVISION ☐