



**DEPARTMENT OF PETROLEUM RESOURCES  
7, KOFO ABAYOMI STREET VICTORIA ISLAND  
LAGOS**

Applicable to all Operators  
Upstream and Downstream

**Guidelines: Maintenance and Inspection Standard for  
Flexible Pipes, SCR and FPSO Mooring Chain Systems**

**ORIG DEPT: Technical  
Services**

# **Requirements for the Maintenance and Inspection of Flexible Pipes, SCR and Mooring Chain Systems in the Nigerian Oil and Gas Industry**

*ISSUED BY*

**THE DEPARTMENT OF PETROLEUM RESOURCES**

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## 1. Objective

To ensure the integrity of hose assemblies and associated fittings installed on critical services , mooring chains and associated fittings installed on all offshore floating and storage facilities (FPSO, FSO, and FSU) employed in Oil and Gas production

## 2. Responsibilities

The responsibilities for implementing the requirements of this guidelines are detailed below:

It is the responsibility of the Mangerto ensure that:

- i. Hose lines are classified “critical” or “non critical” as applicable.
- ii. The inspection frequencies for flexible hoses/pipes and mooring “critical” systems are in place and reviewed periodically in conjunction with the Inspection unit of the operator.
- iii. The maintenance strategy for “non critical” systems is reviewed periodically.
- iv. Only authorised, competent personnel are permitted to install, inspect and maintain flexible hose lines.
- v. Ensure that accurate informative records are kept.
- vi. Only authorised, competent personnel are permitted to install, inspect and maintain mooring chains.
- vii. Ensure that accurate informative records are kept.

## 3. Summary

Flexible hoses are used extensively in a wide range of processes and systems, failure of which can cause safety hazards and/or operational defects such as hydrocarbon leakage, or compromise the operation of safety and control systems. The integrity of flexible hose lines is dependent on the appropriate selection of hose product and adherence to the installation procedures. Personnel competency is therefore a key issue. These guidelines for maintenance and inspection highlight the personnel competency,

inspection and general management requirements necessary to ensure the integrity of flexible hose installations.

The mooring system will be examined by looking at the chain entering the chain table or hawser pipe to see if there are any loose or missing chain studs or any excessive wear in the links. If any irregularities are suspected the chain sections shall be cleaned with water jets and investigated further by application of advance inspection techniques. This maintenance and inspection guidelines highlights the personnel competency, inspection and general management requirements necessary to ensure the integrity of the mooring system.

#### **4. Maintenance and Inspection Strategies**

The following strategies shall be adopted to ensure the integrity of flexible hose and Mooring systems installations:

(a) Flexible Hoses:-

- i. All personnel required to install, inspect and maintain flexible hose lines shall be formally authorised and registered to do so and be fully conversant with the appropriate installation and maintenance procedures (Ref Appendix A).
- ii. All personnel required to test flexible hose lines shall be formally authorised and registered to do so and be fully conversant with the relevant test procedure (Ref Appendix B).
- iii. Historical inspection and failure data shall be formally recorded to facilitate data retrieval.

*- Systems shall be classified as "critical" or "non critical" as defined in Section 5.2.*

(b) Mooring Systems:-

To ensure the integrity of mooring systems installations, the following shall be applicable:

- iv. All personnel required to install, inspect and maintain mooring

lines shall be formally authorised and registered to do so and be fully conversant with the appropriate installation and maintenance procedures.

- v. Historical inspection and failure data shall be formally recorded to facilitate data retrieval.

## **5. Practice**

### **5.1 Authorised Personnel**

All personnel whose duties involve installation, maintenance or inspection of flexible hose lines, mooring chain systems shall be competent in accordance with the MOSR and registered as “authorised” to carry out such duties.

### **5.2 Inspection**

#### **5.2.1 Classification of Systems**

- a. Critical systems shall be identified taking into account; historical failure data, known problems and environmental factors. As a minimum the following shall be considered 'critical systems':
  - All systems with hydrocarbon service;
  - All water systems in excess of 20 bar;
  - All chemical service systems;
  - All high pressure fluid power systems;
  - All hydraulic systems required for emergency action / actuation;
  - All mooring systems on FPSO and FSO shall be considered 'critical systems';
  - Any other systems where leakage would present a significant hazard.
- b. All other installations shall be considered 'non critical'.

#### **5.2.2 Periodic Inspection**

Periodic inspection shall be carried out as laid down in Company Procedures in addition to the requirements of these guidelines.

### **5.2.3 Inspection Criteria & Frequency**

#### **(i) Flexible Hose System**

Flexible hose systems to be considered for identification, registration and inspection are those that are known or suspected to suffer degradation in service or their content leakage could lead to significant impact on personnel, production, assets and environment without prejudice to their default frequency of inspection. The critical system classification in Section 5.2.1 shall be referred to for guidance.

The frequency and type of inspection of registered systems shall be governed by the expected rate of degradation and the nature of the contents. This implies local judgement and in this regard, note shall also be taken of the generally accepted satisfactory record to date and of the associated scale of activities. The factors to be considered include:

- i. Deterioration rates based on knowledge and experience with the actual hose, or with the process or materials of construction on similar systems;
- ii. Materials, method of construction and sophistication of design generally, including novel or unusual features;
- iii. Support, expansion, contraction characteristics;
- iv. Line content at a temperature in excess of the atmospheric boiling point (note also cryogenic materials);
- v. Line content in excess of its auto ignition temperature;
- vi. Line content that includes toxic or corrosive material.

*Note: In practice, hose assemblies are subjected to a wide variety of conditions depending on the equipment and environment. Consequently it is recommended that records be kept for each hose application with a view to establishing its working life. For guidance the following Table shall be utilized to*

determine Inspection frequency.

### **Flexible Hose Inspection Frequency Prescriptions**

<b>Cat</b>	<b>Service Application</b>	<b>Interval Between Visual Inspections</b>
<b>I</b>	<ul style="list-style-type: none"> <li>- BOP Hoses - Drilling</li> <li>- Choke &amp; Kill - Drilling</li> <li>- Rotary/Kelly - Drilling</li> <li>- Firewater Transfer - Platform</li> <li>- Wellhead and ESD, Function Control</li> <li>- Process Hoses, Production Gas or Fluids</li> <li>- Boatloading, Bulk Suction Discharge Hoses</li> </ul>	3 Months (Service Test before Operational Use)
<b>II</b>	<ul style="list-style-type: none"> <li>- High Pressure Utility, over 20 Bar (Gases, Water, Oil &amp; Greases)</li> <li>- Hydraulic Service Non-Static Service</li> <li>- Chemical Hose including Cement, Pumping and Mud Processing</li> <li>- Platform to Rig Substructure Catenary Hose</li> </ul>	12 Months
<b>III</b>	- Locally Classified Hoses, for Periodic Inspection, Low Pressure Utility, High Usage	24 Months
<b>IV</b>	<ul style="list-style-type: none"> <li>- Static Hydraulic Systems</li> <li>- Skidded Prime Mover System e.g., Fire Pumps, Mud Pumps, Other Systems</li> </ul>	48 Months

Non critical systems need not be inspected frequently unless abnormal failure rates are observed and recorded which would economically justify the inclusion of the system in the higher inspection programme. Local Judgement must be made and applied here to ensure long term integrity of systems.

#### **(ii) Mooring System**

Mooring systems to be considered for identification, registration and inspection are those that are known or suspected to suffer degradation in service and of which failure could lead to a hazardous situation, have a significant impact on production or affect personnel or environment without prejudice to their default frequency of inspection.

The frequency and type of inspection of registered systems shall be governed by the expected rate of degradation and the configuration of the system. This implies local judgement and in this regard, note shall also be taken of the generally accepted satisfactory record to date and of the associated scale of activities. The factors to be considered include:

- a. Deterioration rates based on knowledge and experience with the actual mooring or with the process or materials of construction on similar systems;
- b. Materials, method of construction and sophistication of design generally, including novel or unusual features;
- c. Marine growth type and characteristics on the support of the mooring chains.

***Mooring Chain System Frequency Prescriptions***

<b>Cat</b>	<b>Type Of Inspection</b>	<b>Interval and Type of Inspection</b>
I	Visual and use of ROV for fly-by on entire length	Annually
II	Wear measurements using caliper mounted on ROV	30 Monthly
III	Ultrasonic measurements and or ACFM to check for defects, kinks etc	30 Monthly

***(iii) Mooring Chains***



Local Judgement must be made and applied here to ensure long term integrity of systems. In-water-survey in lieu of dry docking is compulsory and shall include mooring chain inspection for all moored offshore facilities. It is mandatory to install or retrofit all existing Mooring Chains with the following:

- a. In-line tension monitoring to assure integrity of chains during service;
- b. A free moving swivel to reduce stress and wear due to twisting.

- **Periodic Inspection** (Every 12 Months)

There shall be visual inspection of the mooring chains system using ROV to check cuts, kinks, bulges, signs of abrasion, etc. Particular attention shall be focused close to the end fittings. A competent person shall carry out this inspection and observations logged. Inspection intervals shall be dependent on history and condition factors.

There shall be pressure testing of frequently used and critical hoses. In-situ pressure testing shall be performed to verify the integrity of the complete assembly of the hose. The test pressure shall be 1.1 x design working pressure.

- **In-Water-Survey** (30 Monthly Interval)

In-water-Survey (IWS) or Major Survey shall be conducted to collect empirical data and provide information for assessment of integrity.

**Notice of these activities must be given to Department of Petroleum Resources and shall include all planned scope, DPR certified third party inspection service provider and other relevant information as may be required by the Department. Participation by DPR during the execution of scope shall be at the discretion of the Director of Petroleum Resources**

#### **(iv) High Pressure Hose Inspection Standards**

All high pressure hoses shall be inspected on a regular basis. The frequency and extent of the inspection shall be in-line with the following:

- **Periodical Visual Inspection** (Every 3 to 6 Months)

There shall be visual inspection of the hose body for cuts, kinks, bulges, signs of abrasion, etc. Particular attention shall be focused close to the end fittings for signs of over-bending. A competent person shall carry out this inspection and observations logged. Inspections interval shall be dependent on history and condition factors.

- **Pressure Testing of Hose Assemblies** (Annually)

There shall be pressure testing of frequently used and critical hoses under high pressure. In-situ pressure testing shall be performed to verify the integrity of the complete assembly of the hose. The test pressure shall be 1.1 x design working pressure.

- **Major Survey** (5 Yearly Interval)

There shall be a major inspection survey of the hose assemblies. The hose shall be decommissioned and subjected to internal and external examination the result of which shall be documented and submitted to the Department of Petroleum Resources.

*(These guidelines are derived from the consideration of the failure modes of the hoses)*

**Note: All inspection reports shall be submitted to the Department of Petroleum Resources within 4 weeks from inspection completion dates.**