



Ministry  
of Defence

## Inspection, Maintenance & Testing of Equipment Installed at Petroleum Installations on MOD Property

# Practitioner Guide 05/12

### Estate Management



#### **Document Aim:**

This Practitioner Guide sets the Ministry of Defence (MOD) Standard for the inspection, maintenance and testing of fixed mechanical and electrical equipment at petroleum installations.

#### **Document Synopsis:**

This document provides procedural guidance on the maintenance, inspection and testing of fixed mechanical and electrical equipment installed at petroleum installations on MOD estate. It is not a technical guide on the practical aspects of maintenance, inspection and testing of such installations, which is left to the professional skills and judgement of Competent Person(s) undertaking the work.

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<p><b>Who should read this:</b> Property Managers, Establishment Works Consultants, Works Services Managers, Private Finance Initiative Contractors, Regional Prime Contractors, Stand Alone Prime Contractors, Specialist Principal Support Providers, DIO Specialist Term Consultants and Site Estate Authority Teams</p>	
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## **Foreword**

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This Practitioner Guide here after known as the guide is published by Defence Infrastructure Organisation (DIO) for application across all areas of the MOD and replaces Defence Works Functional Standard 07. The Guide is mandated for all contracts let after publication of this document. For existing contracts, no work involving expenditure on any MOD account is to be entered into without prior authority from the appropriate MOD officer for that location or facility.

# Contents

Paragraph

Foreword  
Acknowledgements  
Abbreviations

## SECTION 1

**Introduction** 1.0  
Aim 1.1  
Scope 1.2  
Safety 1.3

**Application of the Guide Elsewhere** 2.0  
USVF Bases 2.1  
Overseas Estates 2.2  
Deployed Operating Bases 2.3

**Maintenance Schedules and Frequencies** 3.0

**Standards** 4.0

**Hazardous Area Classification (Petroleum)** 5.0

**Electrical** 6.0

**Technical Authority** 7.0

## SECTION 2

**Inspection, Maintenance and Testing Index** 1.0  
Mechanical Works 1.1  
Electrical Works 1.2

**Maintenance, Inspection and Testing Schedule** 2.0  
Mechanical Works 2.1  
Electrical Works 2.2

**APPENDIX A** - Quick reference frequency schedule

# SECTION 1

## 1.0 INTRODUCTION

### 1.1 Aim

1.1.1 The aim of the Guide is to afford guidance and direction on the maintenance and inspection frequencies applicable to petroleum installation fixed equipment located within petroleum hazardous area and any associated distribution equipment that forms part of that petroleum installation.. The information presented in this document is the basis for preparation of schedules for the maintenance of such equipment installed on Bulk Petroleum Installations.

1.1.2 Maintenance frequencies outlined in this Practitioner Guide are designed to help ensure that fuel installations are maintained in accordance with statutory and client requirements for:

- Equipment reliability
- Safety of operation
- Environmental protection

1.1.3 The aim of this Guide is to consolidate and present inspection, maintenance and testing policy requirements in one easy to read document which:

- Are required by Ministry of Defence (MOD)/North Atlantic Treaty Organization (NATO) for application to Bulk Petroleum Installations.
- Comply with the requirements of the relevant British Standards (BS) and other Approved Codes of Practice (ACOP).
- Form the basis for, and therefore facilitate the development of, an inspection and test programme for installations
- Help ensure that installed mechanical and electrical equipment continues to function in a safe and satisfactory manner.
- Minimise the risk of ignition, in hazardous areas, caused by inadequately maintained apparatus
- Form the basis for the audit of maintenance activities.

1.1.4 This Guide does not include details of procedures or method statements for undertaking the inspection, maintenance or testing since these shall be specific to each site and item of equipment.

1.1.5 This is not a technical guide on the practical aspects of maintenance, inspection and testing and certification of such installations, which is left to the professional skills and judgement of the Competent Person<sup>1</sup> undertaking the work.

### 1.2 Scope

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<sup>1</sup> A person who possesses sufficient technical knowledge and experience for the nature of the mechanical and electrical work undertaken, and is able at all times to prevent danger, and where appropriate injury, to themselves and others.

1.2.1 This Guide is applicable to all bulk fuel storage installations including:

- Aviation Fuelling and Distribution Installations
- Marine Ship to Shore Fuelling
- Petroleum Supply Depots

1.2.2 This Practitioner Guide does not apply to Mechanical Transport Fuelling Installations or mobile fuelling equipment or installations installed with non-European equipment.

### **1.3 Safety**

1.3.1 All work is to be undertaken in accordance with the MOD Safety Rules and Procedures for Work on Petroleum Installations JSP 375 Volume 3, Chapter 5

1.3.2 The Authorised Person Petroleum, AP (Pet) who is responsible for the application of the MOD Safety Rules and Procedures, controls all works on fuel installations under the delegation of the Operating Authority. No inspection, maintenance or testing which could affect the petroleum installation shall be undertaken without first having been authorised to do so by the issue of either a permit to work or standing instruction by the AP (Pet).

1.3.3 Design or procedural changes, or equipment changes must not be initiated on any fuel facility without a recorded Hazards of Operation (HAZOP) review being undertaken. This will consider the risks to operability, maintainability, loss of containment, accessibility, plant reliability and life expectancy, standard operating and emergency procedures that may be introduced by the change or the new procedure. Records of the change should be maintained for the life of the facility.

## **2.0 Application of the Guide Elsewhere**

### **2.1 USVF Bases**

2.1.1 The guidelines given in this Practitioner Guide (PG) are applicable to the full range of mechanical and electrical European standard equipment found on fuel installations on MOD Establishments occupied by the United States Visiting Forces (USVF).

2.1.2 Both in terms of quality and safety the standard of work undertaken on United States Visiting Forces (USVF) sites must not be inferior to those executed on the UK MOD sites.

### **2.2 Overseas Estates**

2.2.1 On the Defence Infrastructure Organisation (DIO) managed overseas estates design and maintenance of mechanical and electrical equipment on fuel installations, selection of contractors and the appointment of Competent Persons must comply with UK regulations unless host nation regulations are at least as stringent. Hence on remote overseas estates UK regulations are the norm whilst in British Forces (Germany) (BF(G)), Canada and USA, for example, local regulations may be applicable. Further guidance can be obtained from the Technical Authority.

- 2.2.2 The estates occupied by BF(G) apply their own local (German) regulations. The competency of the contractor is established prior to contract let and local procedures apply to the selection and appointment of the Competent Person. For this reason, while the general principles mentioned in this PG may be applicable, the document will be of limited use to BF(G) staff.

### **2.3 Deployed Operating Bases**

Where operational conditions permit the application of peacetime regulations and contractors are engaged on works services under CONDO<sup>2</sup> the guidance given in this guide should be followed on permanent/semi-permanent deployed operating bases where practicable. The guide is not applicable for installations designed, executed and maintained by the Royal Engineers in an operational theatre designated as a Military Works Area<sup>3</sup>.

### **3.0 Maintenance Schedules/Frequencies**

- 3.1 This Guide summarises the maintenance requirements on bulk fuel installations in line with statutory legislation and industry standards/guidelines. Where particular guidance exists for the inspection, maintenance and testing activities, these are detailed. The inspection, maintenance and testing frequencies given in section 2.0 Maintenance, Inspection and Testing Schedule are the expected minimum, but should not be considered prescriptive. More frequent and/or more detailed inspections will be necessary where there is a corrosive or other adverse atmospheric condition, a high risk of mechanical damage or vibration and where there are other onerous circumstances. The need for more frequent maintenance inspections may be determined by the manufacturer, equipment condition, process and site/environmental conditions – this is a site-specific responsibility.
- 3.2 It is recognised that there may be sound engineering reasons to alter the maintenance scope or reduce frequency of maintenance activities on specific plant. The overriding condition for such changes is that there will be no deterioration in safety, performance, reliability or life expectancy of either the individual piece of equipment or its contribution to an overall system.
- 3.3 Such changes must be supported by a formal engineering review, based upon plant maintenance records and inspection reports. Changes must be fully documented and auditable, and supported by the plant owner and the Authorising Engineer Petroleum.
- 3.4 Planned Maintenance schedule and maintenance records shall be kept up to date to demonstrate due diligence.
- 3.5 All inspection, maintenance and testing tasks shall be recorded on appropriate forms detailing the work completed and shall be kept for the life time of the equipment.
- 3.6 In the event of a change of maintenance organisation, the complete maintenance, inspection and testing records must be handed over in their entirety to the new organisation.

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<sup>2</sup> Contractors on Deployed Operations.

<sup>3</sup> Infrastructure Management on Joint Operations: Joint Warfare Publication 4-05.

- 3.7 Ownership of inspection maintenance and test records remains with the MOD.
- 3.8 Where operational deficiencies are identified through the inspection, maintenance and testing activities, these shall be relayed in writing to the Operating Authority.
- 3.9 Where defective equipment is identified as part of the inspection, maintenance and testing programme, suitable remedial action should be undertaken, and where the equipment is in a critical service it shall be isolated until a repair is affected
- 3.10 Register, records and corrective action
- 3.10.1 A register of equipment that requires, inspection, maintenance and testing shall be compiled by each establishment, complete with details of required frequencies. The register shall be compiled with due cognisance of this Practitioner Guide and:
- Manufacturers' recommendations
  - Systems designers' recommendations
  - Equipment maintenance manuals
  - National and International standards and codes of practice
  - Known equipment failure modes
  - Criticality of duty
  - Environmental and process conditions
- 3.10.2 The register should detail equipment identification number, description of item, location and required inspection interval.
- 3.10.3 Fixed equipment which is in the hazardous area or (safety, environmental or reliability) critical service shall be highlighted on the equipment register as shall activities which are specifically required by the Major Accident Control Regulations (MACR) site assessment.
- 3.10.4 The register should be used as the basis for a Pre-Planned Maintenance (PPM) schedule and for maintenance records that shall be kept up to date to demonstrate due diligence.



#### 4.0 Standards

The inspection, maintenance and testing of mechanical and electrical equipment installed at fuel storage installations shall be undertaken in accordance with this Practitioner Guide with consideration of the following:

Reference	Title
<b>General</b>	
SI 2954*	SI 2001 No 2954 Control of Pollution (Oil Storage) (England) Regulations 2001
SSI 133	SSI 2006 No 133 The Water Environment (Oil Storage)(Scotland) Regulations 2006
	Petroleum (Consolidation) Act and Regulations made there under
EEMUA 159	Inspection, Maintenance and Repair of Above Ground Vertical Cylindrical Storage Tanks
DWFS 05	Specification for Specialist Works on Petroleum Installations – Mechanical
DWFS 031	Internal Cleaning of Fuel Tanks
<b>Safety</b>	
HSW	Health and Safety at Works Act 1974
JSP 375 Vol 3	Chapter 3.MoD Safety Rules and Procedures - Electricity
JSP 375 Vol 3	Chapter 5.MOD Safety Rules and Procedures - Petroleum
DSEAR	Dangerous Substances and Explosive Atmosphere Regulations (2002)
<b>Electrical</b>	
BS 7671	Requirements for Electrical Installations, IEE Wiring Regulations and IEE Guidance Note No 3 Inspection and Testing
BSEN 60079	Electrical Apparatus for Explosive Gas Atmospheres – Part 17, Inspection and Maintenance of Electrical Installations in Hazardous Areas
BSEN 60079	Electrical Apparatus for Explosive Gas Atmospheres – Part 19 Repairs & overhaul for apparatus used in explosive atmosphere
BSEN 60079	Electrical Apparatus for Explosive Gas Atmospheres – Part 14 Electrical installation design selection and erection
BSEN 62305	Protection against Lightning
EEMUA 186	Practitioner handbook, Electrical Installation, Inspection & Maintenance in Potentially Explosive Atmospheres
IP	Institute of Petroleum Model Code of Practice – Part 1 Electrical Safety Code
EI	Guidelines for managing inspection of Ex electrical equipment ignition risk in support of IEC 60079 Part 17
BS 7430	Code of Practice for Earthing
EAW	The Electricity @ Works Regulations 1989
<u>ESQCR 2002</u>	The Electricity Safety Quality and Continuity Regulations 2002 (Amendment) 2006
JSP 317	The Storage & Handling of Fuels & Lubricants

- Where 'host country' regulations are more stringent, they shall apply
- Note: BS EN 60079 is the same document as IEC 60079

## **5.0 Hazardous Area Classification (Petroleum)**

- 5.1 The classification of the petroleum hazardous area is based upon the concept of dealing with the risk of fire and explosion by area classification. The area classification criteria are given in BS EN 60079 - 10.
- 5.2 The petroleum hazardous area classifications are:
- Zone 0 Zone in which the explosive atmosphere is continuously present or present for long periods.
  - Zone 1 Zone in which an explosive atmosphere is likely to occur in normal operation.
  - Zone 2 Zone in which an explosive atmosphere is not likely to occur in normal operation, and if it occurs will exist only for a short time.
- 5.2 Hazardous area classification drawings, specific to each installation, should be held by the Operating Authority and the Maintenance Management Organisation (MMO).
- 5.3 The hazardous area classification drawings must comply with DSEAR and the requirements of Joint Services Safety Regulations for the Storage and Handling of Fuels and Lubricants (JSP 317).
- 5.4 The hazardous area classification drawings shall be used in conjunction with this Guide to determine the inspection and maintenance frequencies of mechanical and electrical equipment and installations.

## **6.0 Electrical**

- 6.1 Electrical work and testing in petroleum hazardous areas are to be controlled in accordance with JSP 375 Volume 3 Chapter 3 Electricity. Electrical work and testing in hazardous areas is to be under the overall control of the AP Petroleum.
- 6.2 The electrical installations in petroleum sites are within two well defined areas and they are:
- Within the hazardous area as defined by the DSEAR zonal classification. The electrical installations within these areas shall be inspected, tested and maintained in accordance with the requirements of BS EN 60079 part 17. For the purpose of this Guide the whole of the circuit shall be considered from point of origin to final point of termination, whether this is fully within the zonal classification area or partly within the zonal classified area.
  - Outside the hazardous area as defined by the DSEAR zonal classification, but still within the fenced area which defines the clients declared hazardous area. These installations shall be inspected, tested and maintained in accordance with the requirements of BS7671 and the guidance given within Guidance Note 3.

6.3 Inspections, maintenance and testing in petroleum hazardous areas should only be undertaken by competent personnel who are:

- Electrically qualified and experienced personnel, who shall only be deemed competent to work on hazardous area equipment on completion of suitable training, followed by assessment, and supervised experience in the:
- Selection, use, inspection and maintenance of electrical apparatus designed and manufactured for use in hazardous areas. Refresher training for this should be undertaken at no less than 4 yearly intervals.
- Familiar with JSP 375, Volume 3, Chapter 5 Petroleum and Chapter 3 Electricity.
- Experience and knowledgeable of the installation to be worked on or under direct supervision of an experience and knowledgeable person.

6.4 Records of Inspection, Maintenance and Test shall be kept for the life of the apparatus/installation, and shall be compared against the current values to identify any deterioration which is taking place.

6.5 As part of the requirements of 6.4 above and for Safety Management Systems (SMS) it is necessary for the MMO to have a suitable database to record details of equipment which has been installed and to record any defects found during inspection. To enable the defects to be grouped and to enable the database to be interrogated by defect types, it is necessary to have standard defect codes. This will also enable the database to be shared between the authority and service providers.

Defect Code	Code Description
1	Ex electrical equipment not appropriate for hazardous area
2	Circuit identification not appropriate
3	Enclosure defective
4	Gaskets, seals defective
5	Unauthorised modification
6	Cable gland defect
7	Ex d flame path defective (this might also cover enclosure, glands, sealing etc.)
8	Lamp defect
9	Electrical connection defect
10	Cable, trunking, conduit
11	Earthing defect
12	Cable insulation defect
13	Equipment insulation defect
14	Overload, temperature protection device defective
15	Corrosion, weather, vibration defect
16	Dust or dirt defect
17	Ex p pressurisation or pre-start purge defect
18	Intrinsically safe earthing defect
19	Intrinsically safe printed circuit board defect
20	Intrinsically safe circuit defect, e.g. invasion of power circuit, point to point screen defect

6.5.1 The severity of the defects should be coded in accordance with the current edition of BS 7671 and which is detailed below:-

- **Code C1** Danger present, risk of injury. This would include defects with safety implication, e.g. uncertified equipment, bolts missing, Supplied from labels missing, damage to flame path, loose connection.
- **Code C2** Potentially dangerous. This would include installation integrity, e.g. flame path impeded, unconnected cores, cable glands/stop ends, earthing (visual inspection) certification inadequate.
- **Code C3** Improvement recommended. This would include house keeping, e.g. ingress, mounting, corrosion, redundant equipment, duty/tag numbers, defects to coatings and paint finish

6.5.2 In all cases an initial detailed inspection of the apparatus shall be completed before it is put into service. In the case of electric motors the initial inspection applies to the termination boxes and inspection covers only as it is unreasonable, due to the potential damage that may be done, to strip and inspect the stator housings etc. Certificates of Conformity to the manufacturing standard shall be obtained and copies shall be stored with maintenance records. Subsequent inspections shall be carried out periodically and be of the appropriate grade:

**Visual**, an inspection that identifies defects without the use of access equipment or tools, those defects, such as missing bolts, which will be apparent to the eye. Binoculars and remote heat detecting equipment may be useful in some situations.

or

**Close**, an inspection which encompasses those aspects covered by visual inspection and in addition, identifies those defects (e.g. loose bolts), which will be apparent only by use of access equipment (e.g. ladders), and tools. Close inspections do not normally require the enclosure to be opened or equipment to be de-energised.

or

**Detailed**, an inspection which encompasses those aspects covered by close inspection and in addition, identifies those defects (e.g. loose terminations and ingress of water) which will only be apparent by opening the enclosure and using tools and test equipment.

6.5.3 Inspection times:

GRADE	PROPORTION	FREQUENCY
Visual	100% of Apparatus	12 Monthly
Close	100% of Apparatus	12 Monthly
Detailed	100% of Apparatus	12 Monthly

6.5.4 In accordance with BS EN 60079 part 17, the results of the inspections and comments of the inspector should be reviewed to determine if a more frequent inspection regime is required.

- 6.5.5 Detailed Inspections require electrical testing to take place. Conducting these tests may introduce a spark and an electric shock hazard into the work place which shall to be controlled in accordance with the requirements of JSP 375 Volume 3 Chapters 3 and 5.
- 6.5.6 To determining the safe working practice the following shall be considered when conducting these tests:
1. Isolation of the circuit (for cathodic protection circuits this shall be 24 hours prior to work).
  2. The location, including that of any interconnected cables or apparatus, atmosphere and any con-current works
  3. Tests should be carried out after inspection of terminations and establishing that all relevant earth connections are in good order (earth connections made onto rusty surfaces may flash due to the presence of the oxide).
  4. As long as existing Intrinsically Safe instruments, certified to current standards are within calibration they can be used (Intrinsically Safe instruments certified to BS 1259 are no longer available in part due Dangerous Substances and Explosive Areas Regulations (DSEAR))
  5. These tests may result in energy being stored in the circuit under test which shall be discharged in a safe manner, normally through the test instrument
  6. Tests of circuits within EEx'd' or FLP enclosures should be conducted with the enclosures closed and all securing screws correctly in place.
  7. Earth fault loop impedance measurements, high current continuity tests and prospective short circuit current measurements should only be undertaken in hazardous areas in gas free atmospheres and is to be controlled in accordance with the requirements of JSP 375 Volume 3 Chapters 3 & 5 It is imperative that since these tests can introduce current and/or voltages in parts of the installation where they might not be expected, due to bonding of extraneous conductive parts and lightning protection systems that the whole installation be taken into account in the risk assessment as these tests could result in incendive sparking in areas or parts of the installation not covered by the Permit to Work.
  8. Electronic equipment can be damaged by certain electrical tests therefore such equipment must be identified and isolated where required by the manufactures.
  9. Manufacturers recommended isolation procedures are to be followed prior to testing being undertaken.
- 6.5.7 Where inspection, maintenance or testing discloses deterioration that may affect the ability of the equipment or installation to perform safely in a hazardous area, appropriate remedial measures should be taken.
- 6.5.8 Replacement equipment shall comply with BS EN 60079 and shall be ATEX certified in accordance with the requirements DSEAR. For Non-EU countries IEC Ex. certified equipment shall be used. No alterations should be made to any apparatus or installation without the prior approval of the Authorising Engineer.
- 6.5.9 Alarm and Shutdown testing

6.5.9.1 Control and instrumentation apparatus installed in bulk fuel installations and on associated pipelines should be periodically tested to prove that they will effectively prevent risk of danger to:

- People
- Plant
- The Environment

All protective devices should be tested so that the complete shutdown loop is proven e.g. when a high pressure switch exceeds its set point; the pump set/valve is stopped/closed to prevent risk of danger/damage. This shall be achieved by use of calibrated, traceable to national standards, test equipment i.e. standard test gauges, hydraulic pressure pump and Multimeter for pressure switches and transmitters.

6.5.10 The frequency of these tests would normally be determined at the design stage and/or set by a Regulatory Authority. These should be considered as the minimum requirement and if due to experience through to changed circumstances more frequent or extensive tests are required to prevent the risk of danger they should be considered.

6.5.11 Where the electrical installation is outside the hazardous area as defined by the DSEAR zonal classification and provided the circuit under test does not supply equipment with the hazardous area as defined by the DSEAR zonal classification, then the electrical installation shall be in accordance with the current edition of BS 7671 Guidance Note 3, the results of the inspections and comments of the inspector should be reviewed to determine if a more frequent inspection regime is required.

6.5.12 The following tests shall be carried out, (guidance on carrying out these tests is given in BS 7671 Guidance Note 3):

- Continuity Testing of Protective Conductors, Main and Supplementary Bonding
- Continuity of Ring Final Circuit Conductors
- Insulation Resistance Tests
- Site Applied Insulation
- Separation of Circuits
- Barriers and Enclosures
- Correct Polarity
- Earth Electrode Resistance(s) Testing excluding Lightning Protection.
- Earth Loop Impedance Measurements
- Residual current Devices (RCDs)
- Circuit Breakers, Isolators and Switching Devices
- Lightning Protection Systems

## **7.0 Technical Authority**

- 7.1 Technical advice and assistance on petroleum infrastructure matters can be obtained from DIO. Approaches may be made through local DIO offices or directly to the petroleum Technical Authority:

Principal Mechanical Engineer  
Head of Mechanical and Fuels Infrastructure  
Professional and Technical Services  
Defence estates  
Kingston Road  
Sutton Coldfield  
B75 7RL

Tel: 0121 311 2069

Fax: 0121 311 3636

This Practitioner Guide, Inspection, Maintenance and Testing of Equipment Installed at Petroleum Installations – Mechanical and Electrical, has been devised for use of the Crown and its contractors in the execution of contracts for the Crown and, subject to the Unfair Contracts Terms Act 1977, the Crown will not be liable in any way whatever including but without limited negligence on the part of the Crown its servants or agents) where the specification is used for other purposes.

## Section 2

### 1.0 Inspection, Maintenance and Testing Index

#### 1.1 Mechanical Works

Job No	Description of Job and Criteria
<b>1.0</b>	<b>Petroleum Installations (General)</b>
1.1	Valve pits, ducts, chambers, equipment buildings, access ways, bunds.
1.2	Mechanical equipment, fittings, pipework
<b>2.0</b>	<b>Storage Tanks</b>
2.1	General
2.2	Above ground tanks
2.3	Below ground tanks
<b>3.0</b>	<b>Tank Ancillary Equipment</b>
3.1	Low level – alarm/ control
3.2	High level shut off valve – alarm/control
3.3	Contents gauges
3.4	Foot valves and strainers
3.5	Internal coils and heaters
3.6	Swing arm and floating suction units
<b>4.0</b>	<b>Environmental Containment</b>
4.1	Tank bunds and equipment catchment areas
4.2	Oil interceptors and drain tanks
<b>5.0</b>	<b>Pipelines and Pipework</b>
5.1	Above ground pipework
5.2	Below ground pipework
<b>6.0</b>	<b>Valves</b>
6.1	Pressure relief/vacuum valves
6.2	Manually operated valves
6.3	Automatic valves
<b>7.0</b>	<b>Monitoring Equipment</b>
7.1	Maintenance of flow meters
7.2	Accuracy testing of meters
7.3	Pressure (and differential pressure) gauges
7.4	Leak detection equipment
7.5	Additive injection equipment



Job No	Description of Job and Criteria
<b>8.0</b>	<b>Mechanical Equipment</b>
8.1	Pumps and drivers
8.2	Filters and strainers
<b>9.0</b>	<b>Fuelling Equipment</b>
9.1	Fuel hoses and couplings
9.2	Hydrant pit couplings and valves
9.3	Loading arms and pantographs
<b>10.0</b>	<b>Marine Facilities</b>
10.1	Off-shore unloading facilities
10.2	Shore facilities – jetties, docks etc.
10.3	Floating and submarine hoses – sacrificial anodes
10.4	Records
<b>11.0</b>	<b>Cathodic Protection</b>
11.1	Maintenance of cathodic protection equipment

## 1.2 Electrical Works

Job No	Description of Job and Criteria
	<b>Within DSEAR Zonal Area</b>
12.0	Visual Inspection - Equipment certified EEx'd'/FLP, EEx 'e' - ATEX Category II (2G), or EEx 'n' (or variants) - ATEX Category II (3G)
13.0	Visual Inspection - Equipment certified EEx'i' (or variants) ATEX Category II 1G
14.0	Visual Inspection - Equipment certified EEx'p' Apparatus. Or ATEX Category II 2G
15.0	Close Inspection - Equipment certified EEx'd'/FLP, EEx 'e' - ATEX Category II (2G), or EEx 'n' (or variants) - ATEX Category II (3G)
16.0	Close Inspection - Equipment certified EEx'i' (or variants) ATEX Category II 1G
17.0	Close Inspection - Equipment certified EEx'p' Apparatus. Or ATEX Category II 2G
18.0	Initial / Detailed Inspection of Electrical Apparatus Certified EEx'd. Or ATEX Category II 2G
19.0	Initial / Detailed Inspection of Electrical Apparatus Certified EEx'e. Or ATEX Category II 2G
20.0	Initial / Detailed Inspection of Electrical Apparatus Certified EEx'i'. Or ATEX Category II 1G
21.0	Initial / Detailed Inspection of Electrical Apparatus Certified EEx'p'. Or ATEX Category II 2G
22.0	Initial / Detailed Inspection of Electrical Apparatus Certified EEx'n'. Or ATEX Category II 3G
23.0	Inspection of Certified Electric Motors EEx'd'/EEx'e/EEx'n' (or variant) ATEX Category II (2G) and (3G)
	<b>All petroleum installations</b>
24.0	Safety Signs and Notices.
25.0	Earthing
26.0	Alarm and Shutdown Testing
	<b>Outside DSEAR Zonal Area</b>
27.0	Continuity Testing of Protective Conductors, Main and Supplementary Bonding
28.0	Continuity of Ring Final Circuits
29.0	Insulation Resistance Tests
30.0	Site applied Insulation

Job No	Description of Job and Criteria
31.0	Separation of Circuits
32.0	Barriers and Enclosures
33.0	Correct Polarity
34.0	Earth Electrode(s) Resistance excluding Lightning Protection
35.0	Earth Fault Loop Impedance
36.0	Residual current Devices (RCDs)
	<b>All petroleum installations</b>
37.0	Lightning Protection Systems

## 2.0 Maintenance, Inspection and Testing Schedule

### 2.1 Mechanical Works

Job No	Description of Job and Criteria	Interval
1.0	<b>Petroleum Installations (General)</b>	
1.1	<p>All working areas (valve pits, ducts, chambers equipment buildings), access ways and bunds shall be inspected to ensure they are:</p> <ul style="list-style-type: none"> <li>a) Clear of combustible materials, explosive hazards, loose equipment, standing water/oil and materials.</li> <li>b) Monitored for corrosion or damage to their integrity.</li> <li>c) All access ways are free from obstructions.</li> </ul>	3 Monthly
1.2	<p>All mechanical equipment, fittings and pipework shall be visually inspected for:</p> <ul style="list-style-type: none"> <li>a) Fuel leaks</li> <li>b) Coating defects and deterioration</li> <li>c) Mechanical damage</li> </ul> <p>This Practitioner Guide does not cover inspection and maintenance of buildings at petroleum installations. However any defects identified during inspections that could pose a possible threat to building or equipment integrity should be reported to the Operating Authority.</p>	3 Monthly

Job No	Description of Job and Criteria	Interval
2.0	<b>Storage tanks</b>	
2.1	<p>General</p> <p>Records of all tank inspections, tests, repairs and any other remedial actions are to be maintained for the operational life of the tank.</p> <p>Where installed, cathodic protection on tanks should be maintained in accordance with Job No 11.1 and in accordance with the manufacturer's recommendations.</p>	
2.2	<b>Above ground tanks</b>	
2.2.1	<p>Internal tank cleaning</p> <p>Internal tank cleaning is to be undertaken prior to any of the following operations:</p> <ul style="list-style-type: none"> <li>a) Internal tank inspection.</li> <li>b) Clearing of accumulated solid matter, silt or wax on the tank floor and fittings.</li> <li>c) Performance of maintenance and repairs inside tank.</li> <li>d) A change of product to be stored is required by the Operating Authority.</li> <li>e) The tank is being taken out of commission.</li> </ul> <p>Tank cleaning is to be undertaken by competent contractors or depot personnel (experienced in working in confined spaces) in accordance with JSP 375 Volume 3 Chapter 5 Petroleum and DW Function Standard 031 Internal Cleaning of Fuel Tanks.</p>	
2.2.2	<p>External inspection</p> <p>The exterior of above ground storage tanks shall be visually inspected for:</p> <ul style="list-style-type: none"> <li>a) Signs of leaks, drips or spills</li> <li>b) Tank (or support) settlement. Ensure rain water is being diverted away from base and check for leakage from tank base</li> <li>c) Mechanical damage or corrosion on shell and roof plates (deformations, dents, warping, laminations)</li> <li>d) Where tank bottom can be viewed inspect for damage and corrosion, particularly on supports or saddles.</li> </ul>	3 Monthly

Job No	Description of Job and Criteria	Interval
2.2.3	<p>e) Cracks and signs of stress, deterioration or leakage from manways, nozzles and reinforcing plates.</p> <p>f) External protection/coating damage on tank roof/shell and associated appurtenances.</p> <p>g) Integrity of steelwork and corrosion/damage to wind girder and access stairways/ladders.</p> <p>h) Correct operation and condition of pipework and ancillary equipment (as Job No 3)</p> <p>i) On floating roof / pontoon type tanks inspect roof seal systems (refer EEMUA 159 section 12.3 – Roof Seals)</p> <p>j) Inspect wire gauze, hoods and flame arrestors fitted to free vents in tank roof to ensure free from dirt and debris.</p> <p>Special attention should be given to vulnerable areas such as welded or riveted seams, saddles, water ingress or lodgement which could lead to corrosion (e.g. tank toe sealing).</p> <p>Internal inspection</p> <p>Internal tank inspection shall be undertaken to determine the:</p> <p>a) Condition of the internal tank lining</p> <p>b) Mechanical integrity of the storage tank and its internal mechanical component</p> <p>All surfaces and seams shall be inspected for signs of leaks, corrosion, pitted plates and breakdown or damage to lining material.</p> <p>Internal tank equipment shall be inspected in accordance with the requirements of Job Nos. 3.1 to 3.6 inclusive.</p> <p>For detailed procedures and inspection scope refer to API standard 653 and EEMUA 159 – Tank Inspection, Repair, Alteration and Reconstruction.</p> <p>After inspection and completion of any other necessary internal works, the manholes shall be replaced (using new gaskets with cleaned and greased bolts).</p>	

Job No	Description of Job and Criteria	Interval																													
2.2.4	<p>The following information shall be stencilled on the manhole cover in 25mm letters:</p> <p>a) Date of inspection and/or cleaning.</p> <p>b) Carried out by.</p> <p>c) Date of next inspection/clean.</p> <p><b>Tank Internal Inspection Frequency</b></p> <p>The frequencies provided below are for aviation fuel tanks. The frequency of inspection for other fuel tanks should be determined by the Practitioner Guide for the Inspection of Petroleum Installations and Flammable Dangerous Goods Stores</p> <p>Internal inspection of steel tanks shall take place in accordance with the schedule below, unless previous inspection reports indicate that a shorter frequency is required.</p> <p>Tank entry shall only be undertaken where safe access can be achieved and approved by the AP Petroleum. When tank entry is not acceptable, inspection shall be visually from the tank manhole.</p> <table border="1" data-bbox="411 1220 1174 1832"> <thead> <tr> <th rowspan="2">Tank type</th> <th colspan="2">Tank Interior Uncoated</th> <th colspan="2">Tank Interior Coated</th> </tr> <tr> <th>Without inlet filter/ separator</th> <th>With inlet filter/ separator</th> <th>Without inlet filter/ separator</th> <th>With inlet filter/ separator</th> </tr> </thead> <tbody> <tr> <td>Operating Tanks (ie tanks which directly serve refuelling vehicles or hydrant systems)</td> <td>3 years</td> <td>5 years</td> <td>5 years</td> <td>8 years 5 years **</td> </tr> <tr> <td>Bulk Storage or buffer tanks</td> <td>4 years</td> <td>6 years * 5 years **</td> <td>6 years 5 years **</td> <td>8 years 5 years **</td> </tr> <tr> <td>Bulk Storage (barge or tanker delivery)</td> <td>3 years</td> <td>5 years *</td> <td>5 years</td> <td>8 years 5 years **</td> </tr> <tr> <td>Drain Tanks (fuel recover unit)</td> <td colspan="4">Normally inspected and cleaned concurrently with the inspection/cleaning of operating storage tank (This does not apply to small drain or slop tanks with limited access.)</td> </tr> </tbody> </table> <p>* If a filter/separator or micromic filter is installed in the receipt systems.</p> <p>** The shorter interval applies if the equipment installed in the tank requires more frequent maintenance and inspections.</p>	Tank type	Tank Interior Uncoated		Tank Interior Coated		Without inlet filter/ separator	With inlet filter/ separator	Without inlet filter/ separator	With inlet filter/ separator	Operating Tanks (ie tanks which directly serve refuelling vehicles or hydrant systems)	3 years	5 years	5 years	8 years 5 years **	Bulk Storage or buffer tanks	4 years	6 years * 5 years **	6 years 5 years **	8 years 5 years **	Bulk Storage (barge or tanker delivery)	3 years	5 years *	5 years	8 years 5 years **	Drain Tanks (fuel recover unit)	Normally inspected and cleaned concurrently with the inspection/cleaning of operating storage tank (This does not apply to small drain or slop tanks with limited access.)				
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Job No	Description of Job and Criteria	Interval
2.2.5	<p>Note: Newly constructed tanks must be inspected after one year of initial filling to check the condition of the interior coating, an item still under warranty.</p> <p>Tank Non Destructive Testing (NDT)</p> <p>NDT shall be carried out on all BFI single skin above ground, mounded and accessible buried tanks greater than 15 years old or sooner should the inspection, completed to the extant Practitioner Guide for the Inspection of Petroleum Installations and Flammable Dangerous Goods Stores determine otherwise.</p> <p>NDT shall be undertaken in conjunction with the next planned internal tank inspection after the 15 years.</p> <p>The Initial NDT shall be sufficient to provide assurance of complete tank integrity. Tank plates and their associated welds must be examined to identify any metal loss or internal deficiencies.</p> <p>NDT shall be carried out in accordance with API 653 and/or EEMUA 159. The data from the test results shall be evaluated and used by a qualified inspector able to provide professional judgement to determine the tanks life expectancy, the scope and frequency of future inspection and testing.</p>	



Job No	Description of Job and Criteria	Interval
2.3	<b>Below ground tanks</b>	
2.3.1	<p>General</p> <p>This category covers the following tank types:</p> <ul style="list-style-type: none"> <li>a) Mild steel - single skin</li> <li>b) Mild steel - double skin</li> <li>c) Glass reinforced plastic (GRP) – single skin</li> <li>d) Glass reinforced plastic (GRP) – double skin</li> <li>e) Composite – double skin.</li> </ul>	
2.3.2	<p>External inspection</p> <p>In general it is not possible to carryout a full external inspection of buried or mounded tanks.</p> <p>Where tell-tales have been installed beneath the tank bases, these should be monitored to check for product leaks.</p>	Monthly
2.3.3	<p>Internal inspection</p> <p>Where internal access to the tank is possible, inspection should be in accordance with 2.2.3</p>	
2.3.4	<p>Tank Non Destructive Testing (NDT)</p> <p>Single skin tanks</p> <p>Where neither internal nor external inspection of buried or mounded tanks can be undertaken, they should be subjected to a precision tightness test in years 20, 25, 30 and every 2 (two) years thereafter, unless the underground tank assessment in accordance with the extant version of the Practitioner Guide for the Inspection of Petroleum Installations and Flammable Dangerous Goods Stores indicates a shorter period is required.</p> <p>Where internal access to the tank is possible, NDT shall be carried out as determined by the professional inspection in accordance with the extant Practitioner Guide for the Inspection of Petroleum Installations and Flammable Dangerous Goods Stores.</p> <p>The data from the test results shall be used to determine the tank life expectancy and the date of the next inspection.</p> <p>Double skin tanks</p> <p>Double skin tanks do not need to be tightness tested, provided the tank is fitted with an automatic interstitial leak</p>	

Job No	Description of Job and Criteria	Interval
	<p data-bbox="443 275 643 304">detection facility.</p> <p data-bbox="395 336 1150 396">If a leak detection facility has not been fitted the tank should be tested as a single skin tank.</p>	

Job No	Description of Job and Criteria	Interval
<p><b>3</b></p> <p>3.1</p> <p>3.2</p> <p>3.3</p>	<p><b>Tank ancillary equipment</b></p> <p>Low level – alarm/control</p> <p>Check the operation of low level alarm/control when the tank is being emptied (or by manual over-ride)</p> <p>Ensure pump stops and alarm is given when the liquid level drops to the desired cut-off level, or the pump loses suction.</p> <p>Maintain the equipment in accordance with the manufacturer's recommendations.</p> <p>High level shut-off valve – alarm/control</p> <p>When tank is empty inspect the float mechanism (or other high level shut off/alarm mechanism) for</p> <ul style="list-style-type: none"> <li>a) Ease of operation</li> <li>b) Corrosion and or deterioration</li> <li>c) Fuel in float chamber</li> </ul> <p>When tank is being filled (or by manual override) check:</p> <ul style="list-style-type: none"> <li>d) The high level shut off control valve (or alarm) operates and shuts off fuel into the tank.</li> <li>e) The high and high/high level alarms operate and relay signals as required.</li> </ul> <p>Maintain the equipment in accordance with the manufacturer's recommendations.</p> <p>Contents gauge</p> <ul style="list-style-type: none"> <li>a) Inspect sensing heads, probes, floats, wires and other contents gauge components</li> <li>b) Check working isolations on external contents gauges and condition of sight glass.</li> </ul> <p>Maintain in accordance with manufacturers recommendations</p>	<p>12 Monthly when tank is being emptied</p> <p>12 Monthly when tank is empty</p> <p>12 Monthly</p> <p>Internal when empty</p> <p>External equipment 12 Monthly</p>

Job No	Description of Job and Criteria	Interval
3.4	<p>Foot valves and strainers</p> <p>Inspect foot valves and strainers ensuring they are:</p> <ul style="list-style-type: none"> <li>a) Clean and free from sludge</li> <li>b) Operate freely and seat/seal correctly.</li> </ul> <p>Maintain in accordance with the manufacturers recommendations.</p>	Following internal tank cleaning or inspection
3.5	<p>Internal coils and heaters</p> <p>Inspect coils and heaters for :</p> <ul style="list-style-type: none"> <li>a) Mechanical damage</li> <li>b) Evidence of corrosion</li> <li>c) Security of fixing</li> </ul> <p>The coils should be pressure tested to 150% of normal working pressure.</p>	<p>Following internal tank cleaning or inspection</p> <p>36 Months</p>
3.6	<p>Swing arm and floating suction units</p> <p>Inspect and test units for:</p> <ul style="list-style-type: none"> <li>a) Mechanical damage and corrosion</li> <li>b) Fuel in floats</li> <li>c) Ease of operation</li> <li>d) Integrity of winch rope and anchorages</li> <li>e) Safe operation of winch.</li> </ul> <p>Replace seals on swing arm units</p>	<p>External equipment – 12 Monthly</p> <p>Internal equipment following emptying/cleaning</p> <p>As manufacturers recommendations</p>

Job No	Description of Job and Criteria	Interval
4.0	<b>Environmental containment</b>	
4.1	<p>Tank bunds and equipment catchment areas</p> <p>Visually inspect and check the following items:</p> <ul style="list-style-type: none"> <li>a) Bunds (including equipment catchment areas) and their sumps shall be checked for (construction and expansion) joint integrity, spalling or cracking of concrete.</li> <li>b) Check integrity of seals for pipework passing through concrete bund walls.</li> <li>c) Check bund drain valves (where installed) are capable of being shut and locked when not subject to controlled drain down.</li> <li>d) Check for correct operation of level alarms in bund and catchment area sumps (where installed)</li> <li>e) Ensure integrity of any drainage pipe or channel (where installed) between tank bund or catchment area and interceptor.</li> <li>f) Conduct bund integrity test (water tightness test)</li> </ul>	<p>3 Monthly</p> <p>3 Monthly</p> <p>3 Monthly</p> <p>3 Monthly</p> <p>36 Months</p> <p>36 Months</p>
4.2	<p>Oil interceptors and drain tanks</p> <p>Oil interceptors and drain tanks to be maintained in accordance with the manufacturers recommendations. This to include:</p> <ul style="list-style-type: none"> <li>a) Visual check on interceptor outflow for signs of petroleum product.</li> <li>b) Check levels of petroleum product within interceptor. Excessive levels require investigation.</li> <li>c) Check for damage, leakage or malfunction.</li> <li>d) Check for sludge and debris</li> <li>e) Check correct operation of gauges and high level alarms</li> <li>f) Sample outflow for hydrocarbons.</li> <li>g) Clean when required</li> </ul>	<p>Weekly</p> <p>Weekly</p> <p>3 Monthly</p> <p>3 Monthly</p> <p>3 Monthly</p> <p>3 Monthly</p> <p>As Required</p>

Job No	Description of Job and Criteria	Interval
<p><b>5.0</b></p> <p>5.1</p> <p>5.2</p>	<p><b>Pipelines and Pipework</b></p> <p>Above ground pipework</p> <p>The following shall be visually inspected on all above ground pipework:</p> <ul style="list-style-type: none"> <li>a) Check for leaks from pipework and joints, with the system under highest working pressure.</li> <li>b) Inspect pipework for signs of mechanical damage or movement.</li> <li>c) Inspect pipe supports and anchors.</li> <li>d) Visually inspect the pipework for deterioration/corrosion and damage to coating/wrap material.</li> <li>e) Check bonding/grounding.</li> <li>f) Check to ensure isolation from buried cathodic protection systems</li> <li>g) The following detailed inspection shall also be undertaken</li> </ul> <p>Perform UT (ultrasonic test) on pipework at 12, 3, 6, and 9 o'clock positions to confirm residual wall thickness. The position of testing points along the pipeline length should include those areas likely to be affected by high corrosion e.g. road crossing, culverts and low points</p> <p>The locations and results of UT inspections shall be recorded and repeat measurements taken during subsequent inspections, to allow rate of deterioration and residual life to be assessed.</p> <p>Below ground pipework</p> <p>The following checks/inspections should be undertaken:</p> <ul style="list-style-type: none"> <li>a) Ground above buried pipelines/pipework should be checked for signs of leakage, for example dead vegetation etc.</li> <li>b) Pipework within culverts should be inspected for signs of leakage</li> <li>c) All pipelines/pipework shall be pressure tested to 150% of the maximum working pressure.</li> </ul> <p>Pressure testing is to be undertaken in accordance with DW Practitioner Guide No 05 Specification for Specialist Works on Petroleum Installations – Mechanical.</p>	<p>3 Monthly</p> <p>3 Monthly</p> <p>3 Monthly</p> <p>3 Monthly</p> <p>6 Monthly</p> <p>6 Monthly</p> <p>12 Monthly</p> <p>3 Monthly</p> <p>6 Monthly</p> <p>36 Months</p>

Job No	Description of Job and Criteria	Interval
6.0	<b>Valves</b>	
6.1	Pressure/Vacuum valves  Test pressure relief and vacuum valve operation under simulated pressure and vacuum conditions. Maintain in accordance with manufacturers recommendations	24 months or as recommended by valve manufacturer if sooner
6.2	Manually operated valves  Manually operated valves (including vent and drain valves) shall be maintained in accordance with the manufacturer's recommendations. This shall include: <ul style="list-style-type: none"> <li>a) Examination for leaks</li> <li>b) Checks for deterioration and corrosion</li> <li>c) Manually operate valve to check for ease of operation</li> <li>d) Lubrication and repacking.</li> </ul>	3 Monthly  3 Monthly  3 Monthly  As Required
6.3	Automatic valves  Automatic valves (as detailed below) and including control valves are to be maintained in accordance with the manufacturer's recommendations. This shall include checks for: <ul style="list-style-type: none"> <li>1. Fuel leaks</li> <li>2. Deterioration and corrosion on external casing</li> <li>3. Correct operation of valve. For example, simulate the required conditions to evaluate if the valves operate within the prescribed criteria.               <ul style="list-style-type: none"> <li>a) Pressure reducing Ensure a constant preset pressure in accordance with the operating criteria is maintained regardless of flow.</li> <li>b) Flow control Ensure the preset rate of product flow is achieved in accordance with the operating criteria regardless of the line pressure at the valve inlet</li> <li>c) Surge arrestor Ensure the downstream pressure will rise to no more than 110% of the normal operating pressure.</li> </ul> </li> </ul> The unit charge pressure should be checked in accordance with the manufacturers recommendations	3 Monthly  3 Monthly  6 Monthly

Job No	Description of Job and Criteria	Interval
	<p>d) Excess flow shut off Ensure cut off at the preset rate of flow</p> <p>e) Shut off Ensure 'full flow' and 'shut off' and that the surge pressure is limited to not more than 10% above the safe working pressure of the system.</p> <p>f) Pressure relief Ensure the pressure is limited to 110% of the normal working pressure</p> <p>g) Check valve Ensure the valve closes against reverse flow</p> <p>h) Overfill protection valves Ensure valve operates at the preset level of fuel in tank</p> <p>i) Air eliminators Ensure air is vented during filling operation and check no product leakage when vessel is full</p> <p>Where correct operation is not proven, repair or replacement should be undertaken in accordance with the manufacturer's recommendations.</p>	<p>12 Monthly</p> <p>12 Monthly</p> <p>12 Monthly</p> <p>12 Monthly</p> <p>12 Monthly</p> <p>12 Monthly</p>



Job No	Description of Job and Criteria	Interval
7.0	<b>Monitoring equipment</b>	
7.1	<p>Maintenance of flow meters</p> <p>Flow meters shall be maintained in accordance with the manufacturer's recommendations. This shall include:</p> <p>a) Check for leaks and inspect for deterioration and corrosion.</p> <p>b) Legibility of register</p> <p>c) Lubrication</p>	<p>3 Monthly</p> <p>3 Monthly</p> <p>As Required</p>
7.2	<p>Accuracy testing of meters</p> <p>Meters shall be tested for accuracy in accordance with the manufacturers recommendations and in line with the following:</p> <p>a) The meter is to be tested using a master meter connected in series. Certificate of accuracy should be available for the master meter together with correction factors for flow, pressure and viscosity.</p> <p>b) The test conditions i.e. flow and pressure shall be similar to normal operating conditions.</p> <p>c) Test quantity shall be 4 (four) times the maximum rated capacity of the meter.</p> <p>d) Aviation bulk meters are to be accurate to +/- 0.1% at the test flow rate.</p> <p>The following records shall be maintained at individual establishments:</p> <ul style="list-style-type: none"> <li>• Date of test</li> <li>• Serial number of meter under test</li> <li>• Serial number of master meter including copy of calibration certificate.</li> <li>• Rate of flow and pressure during test.</li> <li>• Master meter reading and test meter reading after test</li> <li>• Tester's details.</li> <li>• Any remedial actions required.</li> </ul>	<p>12 Monthly</p>
7.3	<p>Pressure (and differential pressure) gauges and transmitters</p> <p>a) Pressure gauges shall be calibrated over their full working range against an approved master meter or with a suitable test rig. Deviations between the gauge under test and the master meter are to be noted and repair/replacement undertaken as required.</p>	<p>12 Monthly</p>

Job No	Description of Job and Criteria	Interval
7.4	<p>The maximum permissible error on differential gauges is +/- 0.5 psi</p> <p>b) Correct function of transmitters shall be checked.</p> <p>Leak detection equipment</p> <p>Leak detection equipment shall be maintained in accordance with the manufacturer's recommendations. This shall include:</p>	12 Monthly
	<p>a) Inspection for leaks.</p> <p>Leaks are to be simulated on monitored pipework, tanks or equipment to check correct operation of the leak detection system (within its designated sensitivity).</p>	3 Monthly
7.5	<p>b) Check for deterioration and corrosion</p> <p>Additive injection equipment</p> <p>Additive injection equipment shall be maintained in accordance with the manufacturer's recommendations. This shall include:</p>	3 Monthly
	<p>a) Inspection for leaks and checks for deterioration and corrosion.</p> <p>b) Calibration of injection equipment with checks to ensure correct dosing rates.</p>	12 Monthly

Job No	Description of Job and Criteria	Interval
<p><b>8.</b></p> <p>8.1</p>	<p><b>Mechanical equipment</b></p> <p>Pumps and drivers</p> <p>Pumps and their drivers shall be maintained in accordance with the manufacturer's recommendations.</p> <p>All pumps and drivers should be subjected to inspection and servicing by experienced and approved personnel.</p> <p>1. Maintenance activities shall include:</p> <ul style="list-style-type: none"> <li>a) Lubrication of bearings, seals and glands. Levels of oil/lubricant/coolant to be checked.</li> <li>b) Check pump coupling alignment and bolt torque settings</li> <li>c) Check pump primer unit and air relief valves for correct operation</li> <li>d) Check correct operation of by-pass valve positive displacement pumps.</li> <li>e) Check operation of centrifugal pumps for product circulation</li> </ul> <p>2. Check correct operation of pumps and drivers, noting:</p> <ul style="list-style-type: none"> <li>a) Any leaks</li> <li>b) Excessive vibration</li> <li>c) Abnormal noise</li> <li>d) High bearing temperature</li> <li>e) Operating pressure and flow</li> <li>f) Lubricant levels</li> </ul> <p>Ensure correct operation of pump/driver monitoring systems (high temperature, vibration, over-speed protection etc).</p>	<p>3 Monthly or as required by maintenance guidelines</p> <p>6 Monthly</p>

Job No	Description of Job and Criteria	Interval
8.2	<p>Filters and strainers (inc. filter water separators fuel monitors and pre-coat filters)</p> <p>Performance requirement and test methods for filter water separators, gasoline and kerosene fuels are detailed in Defence Standard 49 – 3</p> <p>Filter water separators, fuel monitors and pre-coat filters shall be maintained in accordance with the manufacturer's recommendations. This shall include:</p> <ul style="list-style-type: none"> <li>a) Monitoring the pressure differential across the unit</li> <li>b) Inspect unit for leaks, mechanical damage and corrosion.</li> <li>c) Ensuring correct operation of unit.</li> <li>d) Test automatic water drains (where fitted) in accordance with manufacturers approved original test procedure.</li> <li>e) Ancillary equipment on the units (air eliminators, test drain valves, differential pressure gauges and pressure relief valves) shall be maintained in accordance with the relevant sections of this Practitioner Guide.</li> <li>f) Where high pressure drops are recorded, clean/replace filters/strainers. The criteria for changing the cartridges or filter media will be advised by the Operating Authority. This will be determined in conjunction with the manufacturer's recommendations.</li> </ul> <p>Details of inspections and tests undertaken should be recorded in the maintenance register, together with dates of cartridge replacement – which should also be stencilled on the outside of the unit.</p> <p>An approved procedure for isolation, drain down and refill of the unit, must be followed.</p>	<p>3 Monthly</p> <p>6 Monthly</p> <p>6 Monthly</p> <p>6 Monthly</p> <p>As Required</p> <p>As Required</p>

Job No	Description of Job and Criteria	Interval
9.	<b>Fuelling equipment</b>	
9.1	<p>Fuel hoses and couplings</p> <p>Hoses and their couplings shall be maintained in accordance with the manufacturer's recommendations. This shall include</p> <ul style="list-style-type: none"> <li>a) Visual inspection to check for any damage to hose or couplings.</li> <li>b) Check screw threads and coupling mating surfaces for cracks, mechanical damage or corrosion and ensure they are clean and that the seals are in good condition.</li> <li>c) Check dry break couplings function correctly.</li> <li>d) Lubricate and maintain couplings.</li> <li>e) Electrical continuity test of hose.</li> <li>f) Pressure testing of hose assembly. Testing to be in accordance with manufactures recommendations.</li> <li>g) Condition of sacrificial anodes on floating hoses – refer to Job No 10 – Marine</li> </ul>	<p>3 Monthly</p> <p>3 Monthly</p> <p>3 Monthly</p> <p>As Required</p> <p>6 Monthly</p> <p>12 Monthly</p> <p>12 Monthly</p>
9.2	<p>Hydrant pit couplings and valves</p> <p>Hydrant pit coupling/valves shall be maintained in accordance with the manufacturer's recommendations. This shall include:</p> <ul style="list-style-type: none"> <li>a) Pit box inspection, checking for water/fuel, condition of lining and pit lid seal.</li> <li>b) Check valve and components are free from leaks.</li> <li>c) Inspection of operating handles and associated cables/connections.</li> <li>d) Manually determine integrity of the main valve seal.</li> <li>e) Test closure time of valve is between 2 and 5 seconds.</li> </ul>	<p>Monthly</p> <p>Monthly</p> <p>Monthly</p> <p>Monthly</p> <p>3 Monthly (without dead man's handle)</p> <p>6 Monthly (with dead man's handle)</p>
9.3	<p>Loading arms and fixed pantographs</p> <p>Loading and pantographs shall be maintained in accordance with the manufacturer's recommendations. This shall include:</p> <ul style="list-style-type: none"> <li>a) Inspection for mechanical damage and corrosion</li> </ul>	<p>3 Monthly</p>

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Job No	Description of Job and Criteria	Interval
	<ul style="list-style-type: none"> <li>b) Check for any leaks</li> <li>c) Check operation is free in action.</li> <li>d) Lubrication as required.</li> <li>e) Pressure test to 150% of normal working pressure</li> </ul>	<ul style="list-style-type: none"> <li>3 Monthly</li> <li>6 Monthly</li> <li>As Required</li> <li>12 Monthly</li> </ul>

Job No	Description of Job and Criteria	Interval
<b>10.0</b>	<b>Marine facilities</b>	
10.1	<p>Off-shore unloading facilities</p> <p>The following inspections should also be undertaken:</p> <ul style="list-style-type: none"> <li>a) Offshore flexible hoses shall be maintained in accordance with the manufacturer's recommendations</li> <li>b) Inspect navigation aids and mooring buoys for correct operation and for evidence of damage and/or possible movement/dragging by vessels, currents or winds.</li> <li>c) After every storm, floating hose 'strings' should be inspected for damage.</li> <li>d) Mark wrecks or other navigational hazards and initiate action for their removal.</li> <li>e) Inspect mooring hawsers, lines, deck hoses, chains, flange adaptors, gaskets and any other gear used in the mooring of vessels and in the connecting tanker, unloading hoses to the side of tanker or to the tanker's manifold</li> <li>f) Divers should inspect tanker offloading hoses, navigational and mooring buoys and their mooring chains, shackles and anchors for signs of developing failures or signs of rapid wear of parts subject to wave motion or abrasion on the ocean floor.</li> <li>g) Divers should inspect subsea pipeline end manifolds for damages and leaks. Manual valves should be operated and any debris cleared.</li> <li>h) Hydrostatically test the entire unloading system to 150% of maximum working pressure.</li> <li>i) Damage found on hoses by inspections, should be repaired in accordance with the manufacturers recommendations or the hose be replaced.</li> <li>j) All lifting equipment including pickup bouys, pick up chains and snubbing chain are to be inspected and maintained in accordance with Lifting Operations and Lifting Equipment Regulations (LOLER)</li> </ul>	<p>3 Monthly</p> <p>As Required</p> <p>3 Monthly</p> <p>At Each Use</p> <p>12 Monthly</p> <p>36 Months</p> <p>36 Months</p>
10.2	<p>Shore facilities – jetties, docks etc.</p> <ul style="list-style-type: none"> <li>a) Inspect pipelines, valves and dock/jetty hoses for signs of mechanical damage, deterioration or corrosion.</li> <li>b) Inspect all mooring lines, cleats, bollards, bits, pulley blocks and steel wire ropes and winches for signs of damage.</li> </ul>	<p>3 Monthly</p> <p>3 Monthly</p>

	<p>c) Inspect dock/jetty for signs of serious damage.</p> <p>d) Hydrostatically test the entire unloading system to 150% of maximum working pressure</p>	<p>3 Monthly</p> <p>36 months</p>
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<b>Job No</b>	<b>Description of Job and Criteria</b>	<b>Interval</b>
10.3	<p>Floating and submarine hoses – sacrificial anodes</p> <p>Sacrificial anodes, attached to flanged joints in the 'hose string', shall be checked for degradation during any routine inspection.</p>	As required
10.4	<p>Records</p> <p>Record cards should be kept for each individual hose (submerged or floating) giving the following details:</p> <p>a) Hose reference number.</p> <p>b) Initial test date and pressure.</p> <p>c) Date installed.</p> <p>d) Hose position in the 'string'</p> <p>e) In-situ test dates and pressures.</p> <p>f) Extension at test.</p> <p>g) Details and date of any repairs undertaken.</p> <p>h) Date removed from service.</p>	As required



Job No	Description of Job and Criteria	Interval
11.0	<b>Cathodic Protection</b>	
11.1	<p>Maintenance of cathodic protection equipment.</p> <p>Cathodic protection equipment shall be maintained in accordance with the designers/manufacturers recommendations. This shall include as a minimum:</p> <ul style="list-style-type: none"> <li>a) Check power source for supply.</li> <li>b) Inspect rectifier/anodes for signs of damage.</li> <li>c) Record voltage and ampere measurements.</li> <li>d) Undertake a potential measurement survey.</li> <li>e) Check correct function of isolating flanges and joints</li> </ul>	<p>6 Monthly</p> <p>6 Monthly</p> <p>6 Monthly</p> <p>12 Monthly</p> <p>6 Monthly</p>

## 2.2 Electrical Works

Hazardous Area installed apparatus

Job No	Description of Job and Criteria	Interval
12.0	<p><b>Visual Inspection:</b></p> <p>Equipment certified EEx'd'/FLP, EEx 'e' - ATEX Category II (2G), or EEx 'n' (or variants) - ATEX Category II (3G)</p> <p>This inspection shall be carried out in accordance with BS EN 60079 Part 17.</p> <p>Check that:</p> <ul style="list-style-type: none"> <li>a) Apparatus certification details meet the minimum requirement of Hazardous Area Classification Drawing.</li> <li>b) Cable entry devices, adapters and stop plugs are compatible with the enclosure certification, (no more than one adapter per gland), and are fitted correctly.</li> <li>c) Enclosure, glasses and glass/metal seals are satisfactory.</li> <li>d) All cover bolts are fitted, tight and of the correct type (visual check only).</li> <li>e) The sealing of trunking, ducts, pipes and or conduits is satisfactory (visual check only).</li> <li>f) Proximity of surfaces to flange faces &gt; 10 mm for IIA sub group (Ex'd' only).</li> <li>g) No visible unauthorised modifications have taken place.</li> <li>h) Earthing and any supplementary bonds are satisfactory (visual only).</li> <li>i) Check that there is no obvious damage to cables, cable sheaths or cable glands.</li> <li>j) Check protection against the weather and corrosion is adequate.</li> <li>k) Check that there is no undue accumulation of dust and dirt.</li> </ul> <p>Record findings on the 'Visual Inspection Checklist for EX'd' or Ex'e' or Ex'n' Apparatus as appropriate.</p> <p>Check cable markers, apparatus ID and certification labels are correct, legible and in place, correct as necessary.</p> <p>All non conformities with the above should be recorded on the checklist. If the integrity of the method of protection has been affected rectification works should be under taken immediately.</p>	12 Monthly

Job No	Description of Job and Criteria	Interval
13.0	<p><b>Visual Inspection: Equipment certified EEx'i' (ATEX Category II 1G)</b></p> <p>This inspection shall be carried out in accordance with BS EN 60079 Part 17.</p> <p><b>SAFETY</b></p> <p>Visual Inspection may be carried out on live apparatus/circuits. Only Intrinsically Safe certified test equipment to BS EN 5501 may be used on the hazardous side of any safety barrier or energy limiting device. Any circuit disconnected from the specified safety barrier is no longer Intrinsically Safe unless it is connected to Intrinsically Safe earth.</p> <p>Defects should be rectified during the inspection if practicable and recorded on the inspection sheet, where the defect materially affects type of protection and cannot be rectified immediately the apparatus should be removed from service.</p> <p><b>APPARATUS</b></p> <p>1. Documentation The following documentation is required as a minimum. (Specified in BS EN 60079-17 5.3)</p> <ul style="list-style-type: none"> <li>a) Circuit safety documents, where appropriate; manufacturer, apparatus type, and certificate numbers, category, apparatus group and temperature class.</li> <li>b) Where appropriate, electrical parameters such as capacitances and inductances, length, type and route of cables.</li> <li>c) Special requirements of the apparatus certificate, and detailed methods by which such requirements are met in the particular installation.</li> <li>d) Physical location of each item of plant.</li> </ul> <p>2. Unauthorised modifications.</p> <ul style="list-style-type: none"> <li>a) Check that no visible unauthorised modification has taken place.</li> <li>b) Electronic equipment shall only be repaired by OEM with the exception of dry joints.</li> </ul> <p>3. Safety Barrier Units.</p> <ul style="list-style-type: none"> <li>a) Safety barrier units, relays and other energy limiting devices are to be of the approved type, installed in accordance with the certification requirements and securely earthed where required.</li> </ul>	12 Monthly

Job No	Description of Job and Criteria	Interval
	<p><b>INSTALLATION</b></p> <ol style="list-style-type: none"> <li>1. Cables           <ol style="list-style-type: none"> <li>a) Check that there is no obvious damage to cables.</li> <li>b) Check that the sealing of trunking, ducts, pipes and or conduits is satisfactory.</li> <li>c) Check that cables not in use are correctly terminated.</li> </ol> </li> <li>2. Check that earthing conductors maintain the type of protection.</li> <li>3. Check that separation is maintained between intrinsically safe and non-intrinsically safe circuits in common distribution boxes or relay cubicles.</li> <li>4. Check that apparatus is adequately protected against weather, corrosion, vibration and other adverse factors</li> <li>5. Check that there is no undue external accumulation of dust and dirt.</li> </ol>	

Job No	Description of Job and Criteria	Interval
14.0	<p><b>Visual Inspection: Equipment Certified EEx'p' (ATEX Category II 2G)</b></p> <p>This inspection shall be carried out in accordance with BS EN 60079 Part 17.</p> <p>All interconnected apparatus shall be inspected together. The inspection of each item shall be appropriate to its type of protection.</p> <p>Where the type of protection certificate number has an X as a suffix the special condition of use should be referred to, prior to commencing inspection.</p> <p>Motors are not covered by this job.</p> <p>Any enclosure opened to adjust or calibrate or to investigate a defect shall be inspected against the detailed checklist.</p> <p><b>APPARATUS</b></p> <p>Check that:</p> <ul style="list-style-type: none"> <li>a) Apparatus is certificated appropriate to area classification</li> <li>b) Apparatus certification is available</li> <li>c) Enclosure, glass parts and glass to metal sealing is in good condition</li> <li>d) There are no visible unauthorised modifications</li> </ul> <p><b>INSTALLATION</b></p> <p>Check that:</p> <ul style="list-style-type: none"> <li>a) The cable is not obviously damaged</li> <li>b) Earthing connections, including any supplementary earthing connections are satisfactory, visual only</li> <li>c) Ducts, pipes and enclosures are in good condition</li> <li>d) Protective gas is substantially free from contaminants</li> <li>e) Protective gas pressure and or flow is adequate</li> </ul> <p><b>ENVIRONMENT</b></p> <p>Check that:</p> <ul style="list-style-type: none"> <li>a) Apparatus is adequately protected against corrosion, weather, vibration and other adverse factors</li> <li>b) There is no undue accumulation of dust and dirt.</li> </ul>	12 Monthly

Job No	Description of Job and Criteria	Interval
15.0	<p><b>Close Inspection of Equipment certified EEx'd'/FLP, EEx 'e' - ATEX Category II (2G), or EEx 'n' (or variants) - ATEX Category II (3G)</b></p> <p>This does not require isolation or the opening of the enclosures (This schedule is does not apply to motors).</p> <p>Check that:</p> <ul style="list-style-type: none"> <li>a) Apparatus certification details meet the minimum requirement of gas subgroup IIB, temperature classification T3 or better.</li> <li>b) Cable glands, adapters and stop plugs are of appropriate type, (no more than one adapter per gland), and are fitted correctly.</li> <li>c) Enclosure, glasses and glass/metal seals are satisfactory.</li> <li>d) All cover bolts are fitted, tight and of the correct type.</li> <li>e) The sealing of trunking, ducts, pipes and or conduits is satisfactory.</li> <li>f) Flange gap dimensions are &lt; maximum allowed (Ex'd' only)</li> <li>g) Proximity of surfaces to flange faces &gt; 10 mm for IIA sub group (Ex'd' only).</li> <li>h) No visible unauthorised modifications have taken place.</li> <li>i) Earthing and any supplementary bonds are satisfactory (visual only).</li> <li>j) Check that there is no obvious damage to cables, cable sheaths or cable glands.</li> <li>k) Check protection against the weather and corrosion adequate.</li> <li>l) Check that there is no undue accumulation of dust and dirt.</li> </ul> <p>Record findings on the 'Close Inspection Checklist for Ex'd' or Ex'e' or Ex'n' Apparatus as appropriate.</p> <p>Check cable markers, apparatus ID and certification labels are correct, legible and in place, correct as necessary</p> <p>All non conformities with the above should be recorded on the checklist. If the integrity of the method of protection has been affected rectification works should be undertaken immediately.</p>	12 Monthly

Job No	Description of Job and Criteria	Interval
16.0	<p><b>Close Inspection: Equipment certified EEx'i' (ATEX Category II 1G)</b></p> <p>This inspection shall be carried out in accordance with BS EN 60079 Part 17.</p> <p><b>SAFETY</b></p> <p>Close Visual Inspection may be carried out on live apparatus/circuits. Only Intrinsically Safe certified test equipment may be used on the hazardous side of any safety barrier or energy limiting device. Any circuit disconnected from the specified safety barrier is no longer Intrinsically Safe unless it is connected to Intrinsically Safe earth.</p> <p>Defects should be rectified during the inspection if practicable and recorded on the inspection sheet, where the defect materially affects type of protection and cannot be rectified immediately the apparatus should be removed from service.</p> <p><b>APPARATUS</b></p> <p>1. Documentation The following documentation is required as a minimum (specified in BS EN 60079-17 5.3).</p> <ul style="list-style-type: none"> <li>a) Circuit safety documents, where appropriate</li> <li>b) Manufacturer, apparatus type, and certificate numbers, category, apparatus group and temperature class</li> <li>c) Where appropriate, electrical parameters such as capacitances and inductances, length, type and route of cables</li> <li>d) Special requirements of the apparatus certificate, and detailed methods by which such requirements are met in the particular installation</li> </ul> <p>2. Physical location of each item of plant.</p> <p>Check that:</p> <ul style="list-style-type: none"> <li>a) Apparatus installed is that specified in the documentation – fixed apparatus only.</li> <li>b) The circuit and or apparatus category and group and temperature class are correct.</li> <li>c) Labels are legible and correspond to the circuit documents at all location.</li> <li>d) No visible unauthorised modification has taken place. Electronic equipment shall only be repaired by the OEM with the exception of dry joints.</li> </ul>	12 Monthly

Job No	Description of Job and Criteria	Interval
	<p>e) Safety barrier units, relays and other energy limiting devices are of the approved type, installed in accordance with the certification requirements and securely earthed where required.</p> <p><b>INSTALLATION</b></p> <ol style="list-style-type: none"> <li>1. Cables. <ol style="list-style-type: none"> <li>a) Check that there is no obvious damage to cables.</li> <li>b) Check that the sealing of trunking, ducts, pipes and or conduits is satisfactory.</li> <li>c) Check that cables not in use are correctly terminated.</li> </ol> </li> <li>2. Check that earthing conductors maintain the type of protection.</li> <li>3. Check that separation is maintained between intrinsically safe and non-intrinsically safe circuits in common distribution boxes or relay cubicles</li> <li>4. Check that apparatus is adequately protected against weather, corrosion, vibration and other adverse factors.</li> <li>5. Check that there is no undue external accumulation of dust and dirt.</li> </ol>	



Job No	Description of Job and Criteria	Interval
17.0	<p><b>Close Inspection Schedule for EEx'p' (ATEX Category II 2G) Apparatus.</b></p> <p>This inspection shall be carried out in accordance with BS EN 60079 Part 17</p> <p>All interconnected apparatus shall be inspected together. The inspection of each item shall be appropriate to its type of protection.</p> <p>Where the type of protection certificate number has an X as a suffix the special condition of use should be referred to, prior to commencing inspection.</p> <p>Motors are not covered by this job.</p> <p>Any enclosure opened to adjust or calibrate or to investigate a defect shall be inspected against the detailed checklist.</p> <p>All installed apparatus shall be Inspected as detailed below.</p> <p><b>APPARATUS</b></p> <p>Check that:</p> <ul style="list-style-type: none"> <li>a) Apparatus is certificated appropriate to area classification</li> <li>b) Enclosure, glass parts and glass to metal sealing is in good condition</li> <li>c) There are no visible unauthorised modifications</li> </ul> <p><b>INSTALLATION</b></p> <p>Check that:</p> <ul style="list-style-type: none"> <li>a) The cable is not obviously damaged</li> <li>b) Earthing connections, including any supplementary earthing connections are satisfactory, visual only</li> <li>c) Ducts pipes and enclosures are in good condition</li> <li>d) Protective gas is substantially free from contaminants</li> <li>e) Protective gas pressure and or flow is adequate</li> </ul> <p><b>ENVIRONMENT</b></p> <p>Check that:</p> <ul style="list-style-type: none"> <li>a) Apparatus is adequately protected against corrosion, weather, vibration and other adverse factors</li> </ul> <p>There is no undue accumulation of dust and dirt.</p>	12 Monthly

Job No	Description of Job and Criteria	Interval
18.0	<p><b>Detailed Inspection of Electrical Apparatus Certified EEx'd' (ATEX Category II 2G)</b></p> <p>This inspection shall be carried out in accordance with BS EN 60079 Part 17.</p> <p>All interconnected apparatus shall be inspected together. The inspection of each item shall be appropriate to its type of protection.</p> <p>Where the type of protection certificate number has an X as a suffix the special condition of use should be referred to, prior to commencing inspection.</p> <p>Motors are not included in this job.</p> <p>If at any intermediate time any enclosure is opened to adjust or calibrate or to investigate a defect it shall be inspected against the detailed checklist. Only flame paths disturbed need be inspected.</p> <p><b>SAFETY</b></p> <p>Securely isolate all electrical supplies before removing any covers.</p> <p>Insulation tests shall only be undertaken with all covers correctly fitted.</p> <p>Allow sufficient time to elapse following isolation for any charges and internal temperature to fall below that which is required to prevent ignition.</p> <p>Defects should be rectified during the inspection if practicable and recorded on the inspection sheet, where the defect materially affects type of protection and cannot be rectified immediately the apparatus should be removed from service.</p> <p><b>APPARATUS</b></p> <p>All installed apparatus shall be Inspected as detailed below..</p> <ol style="list-style-type: none"> <li>1. Cables (appropriate checks are made at the safe area terminals also). <ol style="list-style-type: none"> <li>a) Check all cables are of the correct specification for their duty.</li> <li>b) Inspect all cable entry devices; check certification is compatible with the enclosure and that they are correctly installed. Only one adapter per gland is allowed, all conduits should have suitable stopping devices fitted and direct entry apparatus have barrier glands fitted where required.</li> </ol> </li> </ol>	12 Monthly

Job No	Description of Job and Criteria	Interval
	<p>c) Check the cable type is appropriate, that all cores, including those not in use, are terminated correctly, connections are tight, and that there is no sign of overheating, no visible damage to core insulation and the insulation is clean and dry.</p> <p>d) From the safe area, carryout insulation measurements core to core and core to earth. Where necessary, temporarily interconnect cables to enable readings to taken.</p> <p>e) Prove the integrity of Phase Conductors and ensure correct connection/polarity.</p> <p>f) Earth Loop Impedance should be measured as <math>R_1+R_2</math> with a suitable test instrument after ensuring satisfactory earthing visibly in place.</p> <p>Note:</p> <ol style="list-style-type: none"> <li>1. Disconnect electronic apparatus before carrying out insulation tests.</li> <li>2. Charges injected by insulation test may be retained and all cores should be earthed prior to reopening the enclosure.</li> <li>3. Earth loop impedance testers are not to be used for measurements in or into hazardous areas. It should be noted that for supplies with a capacity exceeding 100 amps that these instruments may give inaccurate results and that calculation should be used. Where the supply is taken from a 3<sup>rd</sup> party transformer the Earth Loop Impedance should be obtained from the 3<sup>rd</sup> party as they may make changes to the supply arrangement which alters the fault capacity of the supply adversely affecting the type of protection being used.</li> </ol> <p><b>COMPONENTS</b></p> <p>Check:</p> <ol style="list-style-type: none"> <li>a) The condition, type and rating of all components.</li> <li>b) The mechanical operation of all devices and if wear is excessive replace/repair (only components detailed as part of the apparatus certificate may be used).</li> <li>c) For signs of overheating and investigate if found.</li> <li>d) That lamp rating, type and position are correct.</li> </ol>	

Job No	Description of Job and Criteria	Interval
	<p><b>ENCLOSURE</b></p> <p>Check:</p> <ul style="list-style-type: none"> <li>a) Certification details are appropriate for the area in which the apparatus is installed (e.g., IIB, <math>\geq</math> T3 for location).</li> <li>b) Circuit Identification is correct.</li> <li>c) All flame paths are clean and undamaged.</li> <li>d) All flame path dimensions are within limits.</li> <li>e) Operating shafts and spindles operate freely.</li> <li>f) No unauthorised modifications have been carried out.</li> <li>g) That no obstructions within the enclosure are present which could cause pressure piling i.e. silica gel packs.</li> <li>h) That the enclosure is free from corrosion and clean/remove any dirt, paying particular attention to the prevention of cooling paths becoming obstructed.</li> <li>i) All cover bolts and fixing threads are clean and sound. Blind threaded holes should not have grease packed into them as this could cause hydraulic fractures of the enclosure.</li> <li>j) Sealing gaskets are correctly fitted and in good condition. Only manufacturer's gaskets/seals are allowed.</li> </ul> <p>Dimensions of small shafts and spigots do not normally require checking if they are undamaged.</p> <p>Note:</p> <ol style="list-style-type: none"> <li>1. One wrap of DENSO tape is allowed.</li> <li>2. Enclosures fitted with glass windows have compound seals, which should not have deteriorated/cracked. Refer to manufacturers for advice.</li> </ol> <p>Apply approved grease to flame paths to protect against water ingress (i.e. copper grease).</p> <p>Check that no surface adjacent to the flame paths, other than those which the apparatus design allows, has a proximity of &gt; 30mm. For IIB sub group.</p> <p>Check that earthing connections are satisfactory (e.g. connections are clean, tight and greased and conductors are of adequate cross section).</p> <p>Check circuit protection devices are as specified in the site drawings (operation of automatic protection devices is covered by other schedules).</p>	

Job No	Description of Job and Criteria	Interval
19.0	<p><b>Detailed Inspection Schedule for Ex'e' (ATEX Category II 2G) Apparatus.</b></p> <p>This inspection shall be carried out in accordance with BS EN 60079 Part 17.</p> <p>All interconnected apparatus shall be inspected together. The inspection of each item shall be appropriate to its type of protection.</p> <p>Where the type of protection certificate number has an X as a suffix the special condition of use should be referred to, prior to commencing inspection.</p> <p>Motors are not covered by this job:</p> <p>Any enclosure opened to adjust or calibrate or to investigate a defect shall be inspected against the detailed checklist.</p> <p><b>SAFETY</b></p> <p>Securely isolate all electrical supplies before removing any covers.</p> <p>Insulation tests shall only be undertaken with all covers correctly fitted.</p> <p>Allow sufficient time to elapse following isolation for any charges and internal temperature to fall below that which is required to prevent ignition.</p> <p>Defects should be rectified during the inspection if practicable and recorded on the inspection sheet, where the defect materially affects type of protection and cannot be rectified immediately the apparatus should be removed from service.</p> <p><b>APPARATUS</b></p> <p>All installed apparatus shall be Inspected as detailed below.</p> <ol style="list-style-type: none"> <li>1. Cables (appropriate checks are to be made at the safe area terminals also). <ol style="list-style-type: none"> <li>a) Check all cables are of the correct specification for their duty. Nominally current density is restricted to 4A/mm<sup>2</sup>.</li> <li>b) Inspect all cable entry devices; check certification is compatible with the enclosure and that they are correctly installed. Only one adapter per gland is allowed, all conduits should have suitable stopping devices fitted and where required direct entry apparatus have barrier glands fitted.</li> <li>c) Check the cable type is appropriate, that all cores are</li> </ol> </li> </ol>	12 Monthly

Job No	Description of Job and Criteria	Interval
	<p>terminated correctly; connections are tight, that there is no sign of overheating; no visible damage to core insulation and the insulation is clean. All cores should be terminated.</p> <p>d) From the safe area, carryout insulation measurements core to core and core to earth. Where necessary, temporarily interconnect cables to enable readings to be taken.</p> <p>Note:</p> <ol style="list-style-type: none"> <li>1. Disconnect electronic apparatus before carrying out insulation tests.</li> <li>2. Charges injected by insulation test may be retained. All cores should be earthed prior to reopening enclosure.</li> <li>3. Earth loop impedance testers are not to be used for measurements in or into hazardous areas. It should be noted that for supplies with a capacity exceeding 100 amps that these instruments may give inaccurate results and that calculation should be used. Where the supply is taken from a 3<sup>rd</sup> party transformer the Earth Loop Impedance should be obtained from the 3<sup>rd</sup> party as they may make changes to the supply arrangement which alters the fault capacity of the supply adversely affecting the type of protection being used.</li> </ol> <p><b>COMPONENTS</b></p> <p>Check:</p> <ol style="list-style-type: none"> <li>a) The condition, type and rating of all components, only certified components should be found and only an approved supplier can add components to an enclosure.</li> <li>b) Mechanical operation of all devices and if wear is excessive replace/repair. Direct replacement only.</li> <li>c) For signs of overheating and investigate if found.</li> <li>d) To confirm lamp rating, type and position is correct.</li> </ol> <p><b>ENCLOSURE</b></p> <p>Check:</p> <ol style="list-style-type: none"> <li>a) Certification details are appropriate for the area in which the apparatus is installed.</li> <li>b) Circuit identification is correct.</li> <li>c) That no unauthorised modifications have been carried</li> </ol>	

Job No	Description of Job and Criteria	Interval
	<p>out.</p> <ul style="list-style-type: none"> <li>d) That the enclosure is free from corrosion, clean and remove any dirt, paying particular attention to the prevention of cooling paths becoming obstructed.</li> <li>e) All cover bolts and fixing threads are clean and sound. Blind threaded holes should not have grease packed into them as this could cause hydraulic fractures of the enclosure.</li> <li>f) Sealing gaskets are correctly fitted and in good condition. Only manufacturer's gaskets/seals are allowed.</li> <li>g) Enclosures fitted with glass windows have compound seals, which should not have deteriorated/cracked. Refer to manufacturers for advice.</li> <li>h) Earthing connections are satisfactory (e.g. connections are clean, tight and greased and conductors are of adequate cross section).</li> <li>i) Circuit protection devices are as specified in the site drawings (operation of automatic protection devices is covered by other schedules).</li> </ul>	

Job No	Description of Job and Criteria	Interval
20.0	<p><b>Detailed Inspection Schedule for EEx'n' (ATEX Category II 3G) Apparatus.</b></p> <p>This inspection shall be carried out in accordance with BS EN 60079 Part 17.</p> <p>All interconnected apparatus shall be inspected together. The inspection of each item shall be appropriate to its type of protection.</p> <p>Where the type of protection certificate number has an X as a suffix the special condition of use should be referred to, prior to commencing inspection.</p> <p>Motors are not covered by this job.</p> <p>Any enclosure opened to adjust or calibrate or to investigate a defect shall be inspected against the detailed checklist.</p> <p><b>SAFETY</b></p> <p>Securely isolate all electrical supplies before removing any covers.</p> <p>Insulation tests shall only be undertaken with all covers correctly fitted.</p> <p>Allow sufficient time to elapse following isolation for any charges and internal temperature to fall below that which is required to prevent ignition.</p> <p>Defects should be rectified during the inspection if practicable and recorded on the inspection sheet, where the defect materially affects type of protection and cannot be rectified immediately the apparatus should be removed from service.</p> <p><b>APPARATUS</b></p> <p>All installed apparatus shall be Inspected as detailed below</p> <ol style="list-style-type: none"> <li>1. Cables (appropriate checks are to be made at the safe area terminals also). <ol style="list-style-type: none"> <li>a) Check all cables are of the correct specification for their duty.</li> <li>b) Check all cable entry devices; check certification is compatible with the enclosure and that they are correctly installed. Only one adapter per gland is allowed, all conduits should have suitable stopping devices fitted and where required direct entry apparatus have barrier glands fitted.</li> </ol> </li> </ol>	12 Monthly



Job No	Description of Job and Criteria	Interval
	<p>c) Check that the cable type is appropriate, that all cores are terminated correctly, connections are tight, that there is no sign of overheating, no visible damage to core insulation and the insulation is clean. All cores should be terminated.</p> <p>d) From the safe area, carryout insulation measurements core to core and core to earth. Where necessary, temporarily interconnect cables to enable readings to taken.</p> <p>Note:</p> <p>1. Electronic apparatus only are exempt from insulation tests. Charges injected by insulation tests may be retained; all cores should be earthed prior to reopening enclosure.</p> <p><b>COMPONENTS</b></p> <p>Check:</p> <p>a) The condition, type and rating of all components.</p> <p>b) For signs of overheating and investigate if found.</p> <p>c) To confirm lamp rating, type and position is correct.</p> <p>d) The condition of any hermetically sealed components.</p> <p><b>ENCLOSURE</b></p> <p>Check:</p> <p>a) Certification details are appropriate for the area in which the apparatus is installed. This equipment should only be installed in a Zone 2 area.</p> <p>b) Circuit identification is correct.</p> <p>c) That no unauthorised modifications have been carried out.</p> <p>d) That the enclosure is free from corrosion, clean and remove any dirt, paying particular attention to the prevention of cooling paths becoming obstructed.</p> <p>e) That all cover bolts and fixing threads are clean and sound. Blind threaded holes should not have grease packed into them as this could cause hydraulic fractures of the enclosure.</p> <p>f) Sealing gaskets are correctly fitted and in good condition. Only manufacturer's gaskets/seals are allowed.</p>	

Job No	Description of Job and Criteria	Interval
	<ul style="list-style-type: none"> <li data-bbox="483 275 1169 365">g) Enclosures fitted with gaskets have compound seals, which should not have deteriorated/cracked. Refer to manufacturers for advice.</li> <li data-bbox="483 398 1090 488">h) That earthing connections are satisfactory (e.g. connections are clean, tight and greased and conductors are of adequate cross section).</li> <li data-bbox="483 521 1121 589">i) Circuit identification and protection devices are as specified in the site drawings.</li> <li data-bbox="483 611 1153 678">j) That restricted breathing enclosures are satisfactory (refer to manufacturers instructions).</li> </ul>	

Job No	Description of Job and Criteria	Interval
21.0	<p><b>Detailed Inspection Schedule for Ex'i' (ATEX Category II 1G) Apparatus.</b></p> <p>This inspection shall be carried out in accordance with BS EN 60079 Part 17.</p> <p>All interconnected apparatus shall be inspected together. The inspection of each item shall be appropriate to its type of protection.</p> <p>Where the type of protection certificate number has an X as a suffix the special condition of use should be referred to, prior to commencing inspection.</p> <p>After any enclosure is opened to adjust, calibrate or to investigate a defect, it shall be ensured that upon closure the type of protection is maintained.</p> <p><b>SAFETY</b></p> <p>Before the disconnection of any Intrinsic Safety earth all circuits shall be electrically isolated.</p> <p>All circuits within a multicore cable shall be inspected at the same time.</p> <p>Insulation tests shall be undertaken to demonstrate the connection/isolation to/from earth as required in the circuit documentation.</p> <p>Visual Inspection may be carried out on live apparatus/circuits. Only Intrinsically Safe certified test equipment to BS EN 5501 may be used on the hazardous side of any safety barrier or energy limiting device.</p> <p>Any circuit disconnected from the specified safety barrier is no longer Intrinsically Safe unless it is connected to Intrinsically Safe earth.</p> <p>Defects should be rectified during the inspection if practicable and recorded on the inspection sheet, where the defect materially affects type of protection and cannot be rectified immediately the apparatus should be removed from service.</p> <p>All installed apparatus shall be Inspected as detailed below.</p> <p><b>APPARATUS</b></p> <p>1. Documentation The following documentation is required as a minimum (specified in BS EN 60079-17 5.3)</p> <p>a) Circuit safety documents, where appropriate.</p>	12 Monthly

Job No	Description of Job and Criteria	Interval
	<p>b) Manufacturer, apparatus type, and certificate numbers, category, apparatus group and temperature class.</p> <p>c) Where appropriate, electrical parameters such as capacitances and inductances, length, type and route of cables.</p> <p>d) Special requirements of the apparatus certificate, and detailed methods by which such requirements are met in the particular installation.</p> <p>e) Physical location of each item of plant.</p> <p>2. Installation.</p> <p>Check that the apparatus which is installed is that specified in the documentation – fixed apparatus only.</p> <p>3. Certification</p> <p>Check that the circuit and or apparatus category and group and temperature class, are correct.</p> <p>4. Labelling</p> <p>Labels shall be legible and correspond to the circuit documents at all location.</p> <p>5. Unauthorised modifications.</p> <p>Check that no unauthorised modification has taken place. Electronic equipment shall only be repaired by OEM with the exception of dry joints.</p> <p>6. Safety Barrier Units.</p> <p>Check that safety barrier units, relays and other energy limiting devices are of the approved type, installed in accordance with the certification requirements and securely earthed where required.</p> <p>7. Connections</p> <p>Check all electrical connections are tight.</p> <p>8. Printed circuit boards</p> <p>Check that printed circuit boards, where they are designed for user inspection, are clean and undamaged.</p>	

Job No	Description of Job and Criteria	Interval
	<p><b>INSTALLATION</b></p> <p>1. Cables.</p> <p>a) Check that cables are installed in accordance with the documentation. Cable entry devices shall maintain the IPXX rating of the enclosure. If Ex'd'/Ex'e' glands are fitted they shall be installed as per manufacturers instructions, only one adapter per gland is allowed. All conduits should have suitable stopping devices fitted and direct entry apparatus have barrier glands fitted where required.</p> <p>b) Check the cable type is appropriate, that all cores, including those not in use, are terminated correctly, connections are tight, and that there is no sign of overheating, no visible damage to core insulation and the insulation is clean and dry.</p> <p>c) Cable screens shall only be connected to earth at one location, usually in the safe area. Care is required to ensure that the hazardous area connection is correctly isolated from earth.</p> <p>d) Carryout insulation measurements core to core and core to earth include all apparatus with the exception of electronic devices, which should be disconnected.</p> <p>Note:</p> <p>1. DO NOT interconnect cables to enable readings to be taken. Charges injected by insulation test may be retained and all cores should be earthed prior to reopening enclosure.</p> <p>2. Earthing.</p> <p>Check that earth connections are clean and tight and that CSA of bonding conductors is adequate. Earthing conductors maintain the type of protection.</p> <p>3. Separation.</p> <p>Check that separation is maintained between intrinsically safe and non-intrinsically safe circuits in common distribution boxes or relay cubicles</p> <p>4. Power supply electrical protection.</p> <p>As applicable, short-circuit protection of the power supply is in accordance with the documentation.</p> <p>5. Special condition of use.</p> <p>Check that any special condition of use is being complied with.</p>	

Job No	Description of Job and Criteria	Interval
	<p data-bbox="437 302 639 331">6. Environment</p> <p data-bbox="483 365 1139 454">Check that apparatus is adequately protected against weather, corrosion, vibration and other adverse factors. No undue external accumulation of dust and dirt.</p>	

Job No	Description of Job and Criteria	Interval
22.0	<p><b>Detailed Inspection Schedule for EEx'p' (ATEX Category II 2G) Apparatus.</b></p> <p>This inspection shall be carried out in accordance with BS EN 60079 Part 17</p> <p>All interconnected apparatus shall be inspected together. The inspection of each item shall be appropriate to its type of protection.</p> <p>Where the type of protection certificate number has an X as a suffix the special condition of use should be referred to, prior to commencing inspection.</p> <p>Motors are not covered by this job.</p> <p>Any enclosure opened to adjust or calibrate or to investigate a defect shall be inspected against the detailed checklist.</p> <p>All installed apparatus shall be Inspected as detailed below</p> <p><b>APPARATUS</b></p> <p>Check:</p> <ul style="list-style-type: none"> <li>a) Apparatus is certificated appropriate to area classification</li> <li>b) Enclosure, glass parts and glass to metal sealing is in good condition</li> <li>c) There are no unauthorised modifications</li> <li>d) Lamp rating type and positions are correct</li> </ul> <p><b>INSTALLATION</b></p> <p>Check:</p> <ul style="list-style-type: none"> <li>a) Type of cable is correct and undamaged</li> <li>b) Earthing connections, including any supplementary earthing connections are satisfactory.</li> <li>c) Earth Fault Loop Impedance is satisfactory, measured as <math>R_1 + R_2</math>.</li> <li>d) Automatic electrical protective devices are set and operate correctly.</li> <li>e) Protective gas inlet temperature is below maximum specified.</li> </ul>	12 Monthly

	<p>f) Ducts pipes and enclosures are in good condition.</p> <p>g) Protective gas is substantially free from contaminants.</p> <p>h) Protective gas pressure and or flow is adequate.</p> <p>i) Pressure and or flow indicators and interlocks function correctly.</p> <p>j) Pre-energizing purge period is adequate.</p> <p>k) That the condition of spark and particle barriers of ducts for exhausting the gas in hazardous area is satisfactory.</p> <p>l) Special conditions of use (if applicable ) are complied with</p> <p><b>ENVIRONMENT</b></p> <p>Check:</p> <p>a) Apparatus is adequately protected against corrosion, weather, vibration and other adverse factors.</p> <p>b) That there is no undue accumulation of dust and dirt.</p>	
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Job No	Description of Job and Criteria	Interval
23.0	<p><b>Inspection of Certified EEx'd'/FLP, EEx 'e - ATEX Category II (2G), or EEx 'n' (or variants) - ATEX Category II (3G) Apparatus (motors) .</b></p> <p>This inspection shall be carried out in accordance with IEC 60079 Part 19.</p> <p><b>SAFETY</b></p> <p>As necessary Isolate all electrical supplies before opening any enclosure not certified as EEx'i' (heaters, instruments etc.).</p> <p>The motor may be caused to rotate by process flow if valves are open/opened.</p> <p>Ensure Power Factor Correction systems are fully discharged. Rotation shall be checked when ever the machine has been disconnected.</p>	
23.1	<p><b>CABLES AND TERMINATION ENCLOSURES</b></p> <p>Inspection as per equivalently certified apparatus in Job No. 20 – 25</p>	See Job No. 20 - 25
23.2	<p><b>MOTORS WITH CONDITION MONITORING FITTED</b></p> <p>Record Vibration and Operating Temperatures and compare results. Any step change should be investigated; together with any gradual increase (note greasing bearings will normally result in increase levels immediately after application).</p>	Monthly
23.3	<p><b>MOTORS WITHOUT CONDITION MONITORING FITTED</b></p> <p>Vibration and temperature readings should be taken with suitably certified and calibrated handheld equipment. Any step change should be investigated; together with any gradual increase (greasing bearings will normally result in increase levels immediately after application).</p>	6 Monthly
23.4	<p><b>MOTOR BEARINGS</b></p> <p>When bearings are overhauled/replaced etc., care should be taken to ensure any insulation in the form of gaskets, shims etc are replaced to prevent circulating currents.</p> <p>Vibration condition monitoring and manufacturers instructions shall be used to determine the frequency of replacement of bearings, normally this requires the removal of the machine to an external facility at which time a detailed inspection of the machine will take place.</p>	10 Yearly
23.5	<p><b>MOTOR STATOR WINDINGS</b></p> <p>Insulation Resistance measurement shall be undertaken, with all covers correctly fitted, from the safe area where</p>	12 Monthly

Job No	Description of Job and Criteria	Interval
23.6	<p>practicable. The applied voltage shall be as per manufacturer's instructions. Trend analysis shall be carried out on the values measured. Motors which have not been run for a time and are in damp environments may give earthy values minimum values given in relevant BSI standards should be followed in deciding when IR values require further investigation. Low IR values on warm machines should be investigated further immediately.</p> <p>Partial Discharge Monitoring techniques for High Voltage motors is now possible and should be considered as part of the integrity monitoring program</p> <p><b>MOTOR PROTECTION SYSTEMS</b></p> <p>Periodic testing of motor overload, motor stall and non-fuse based overcurrent protection shall be undertaken. This shall be carried out by secondary injection testing methods with the results being verified against required disconnection times and manufacturers provided time curves.</p> <p>EExe certified motors conditions of use specified by the manufactures shall be complied with.</p> <p>No adjustment shall be made without written authorisation</p>	5 yearly
23.7	<p><b>MOTOR OVERHAUL/INSPECTION</b></p> <p>All overhauls of certified motors shall be undertaken by competent persons trained and in compliance with BS IEC 60079 – 19.</p> <p>Frequency of overhauls shall be determined as a result of a risk assessment taking into account conditions of bearings, IR results of stator windings and manufactures recommendations.</p> <p>Motors shall also be overhauled whenever faults such as bearings requiring replacing.</p>	10 yearly

Job No	Description of Job and Criteria	Interval
24.0	<p><b>Safety Signs and Notices.</b></p> <p>Check safety signs, labels, notices and posters fixed on or adjacent to electrical equipment and appliances are:</p> <ul style="list-style-type: none"> <li>a) Securely fixed</li> <li>b) Clearly readable at normal operating or maintenance positions and correctly identify the equipment or appliance and/or its purpose.</li> <li>c) In accordance with BS 7671, are fitted to equipment within which a voltage exceeding 250 volts exists and where a voltage exceeding 250 volts exists in separate enclosures which, although separated, are simultaneously accessible.</li> <li>d) In accordance with BS 7671, are fitted at the point of connection of every earthing conductor and earth electrode, the main equipotential bonding and the points of connection of every bonding conductor to extraneous conductive part.</li> <li>e) Prominently displayed as specified in JSP 375 Volume 3 Chapter 3 Electricity.</li> </ul>	12 Monthly

Job No	Description of Job and Criteria	Interval
25.0	<p><b>Earthing Systems</b></p> <p><b>SAFETY</b></p> <p>The connection, disconnection, testing or modification of any earthing system or component may result in sparks or hazardous voltages appearing. These tasks shall only be undertaken as appropriate when:</p> <ul style="list-style-type: none"> <li>a) electrical systems are isolated and/or</li> <li>b) supplementary earthing is provided</li> </ul> <p>Earthing Systems should not be worked upon during electrical storms</p> <p>It is good practice to ensure Earthing Systems can be tested by isolating individual components without affecting the system integrity.</p> <p>Internal cable/apparatus protective conductors are tested with the apparatus to which they are connected.</p> <p>All extraneous metal work within touching distance of electrical apparatus shall be earthed/equipotential bonded.</p> <p>Where measurements are undertaken in hazardous areas, an environment that is less than 1% of the Lower Explosive Limit is required.</p> <p><b>INTRINSIC SAFETY SYSTEMS EARTHS</b></p> <p>See Job 26</p> <p><b>STATIC ELECTRICITY EARTHING.</b></p> <p>All above ground pipework shall maintain a connection to earth of less than 10 ohms.</p> <p>Inspect all static earth bonds to ensure they are:</p> <ul style="list-style-type: none"> <li>a) Free from corrosion</li> <li>b) Tight</li> <li>c) Adequately sized</li> <li>d) Free from damage</li> </ul> <p>Flexible hoses used within petroleum systems should maintain earth continuity. They shall be inspected at regular intervals.</p>	11 Monthly

Job No	Description of Job and Criteria	Interval
	<p><b>LIGHTNING PROTECTION EARTHING SYSTEMS.</b></p> <p>To be carried out at commissioning, where applicable and thereafter at the intervals indicated.</p> <p>The testing of a lightning protection system shall not be undertaken when a thunderstorm warning is in place or lightning activity is observed.</p> <p>Before disconnecting the lightning protection earth it should be tested to ensure that it is not “live” using an Intrinsically Safe non-contact voltage testing device.</p> <p><b>SYSTEM SCHEMATIC DIAGRAM</b></p> <p>A simple schematic diagram shall be included clearly showing the lightning protection system with all test points clearly labelled.</p> <p><b>VISUAL INSPECTION</b></p> <p>The lightning protection systems shall be subject to a visual inspection to check:</p> <ul style="list-style-type: none"> <li>a) The fixings of conductors and components for security.</li> <li>b) That there are no loose connections.</li> <li>c) For damage, deterioration and corrosion.</li> <li>d) That there are no visual indications of damage to surge suppression devices where they are installed.</li> <li>e) That the metallic sheath/armouring of the supply cable(s), metallic pipes, rails and guides entering an explosive building are bonded to the lightning protection installation at the point of entry above the test clamps.</li> <li>f) That there are no additions or alterations to the structure that would require additional protection or any added services or metallic objects added that would require bonding to the existing lightning protection system.</li> <li>g) That the labels required by BS EN 62305 are in place.</li> </ul> <p>Results of the visual inspection are to be recorded on an appropriate test sheet.</p> <p><b>TEST REQUIREMENTS</b></p> <p>The lightning protection systems are to be tested for compliance with the requirements of BS EN 62305 and BS7671.</p> <p>Testing is to follow the procedures detailed below and results documented on the test record sheets at the rear of this document.</p>	

Job No	Description of Job and Criteria	Interval										
	<p>Inaccessible Joints and Bonds</p> <p>All joints and bonds which cannot be accessed for inspection purposes shall be tested to ensure adequate continuity. A maximum resistance of 0.5 ohms shall be allowed across each bond or joint.</p> <p><b>EARTH ELECTRODES.</b></p> <p>Earth electrode resistance should be measured as described in BS 7671 Guidance Note 3. Note the safety requirements above (e.g. an Intrinsically Safe System is not certified if its earth is disconnected).</p> <p>The value of each electrode should be noted and the overall system values calculated. Remedial action is required when system values exceed those recommended by national standards. Measurements should be taken when the ground conditions would be at their least advantageous i.e. dry, as electrical protection devices should operate correctly with the highest earth loop impedance encountered.</p> <table border="1" data-bbox="432 976 1153 1541"> <thead> <tr> <th colspan="2" data-bbox="432 976 1153 1037">Typical values of earth electrode resistance</th> </tr> </thead> <tbody> <tr> <td data-bbox="432 1037 810 1104">Intrinsically Safe</td> <td data-bbox="810 1037 1153 1104">&lt; 1 ohm</td> </tr> <tr> <td data-bbox="432 1104 810 1227">Lightning Protection Systems</td> <td data-bbox="810 1104 1153 1227">&lt;10 ohms , with individual electrode no more than 10 x the No. of electrodes</td> </tr> <tr> <td data-bbox="432 1227 810 1294">Static Earthing Systems</td> <td data-bbox="810 1227 1153 1294">&lt; 10 ohms</td> </tr> <tr> <td data-bbox="432 1294 810 1541">Power Earthing Systems</td> <td data-bbox="810 1294 1153 1541">&lt; 4 ohms, though as low as practicable is desired to ensure protection devices work within required times. Maximums can be found in relevant standards.</td> </tr> </tbody> </table> <p>Bonding of different earthing system should be risk assessed and would normally only take place at main earth bars where any potential rise due to a fault in one system will have minimum impact on others. On large, geographically disparate sites, sub-systems should be considered based on location.</p> <p><b>EXTERNAL PROTECTIVE AND EQUIPOTENTIAL BONDING CONDUCTORS</b></p> <p>Inspect all connections to ensure that they are:</p> <ul style="list-style-type: none"> <li>a) Free from corrosion</li> <li>b) Tight</li> </ul>	Typical values of earth electrode resistance		Intrinsically Safe	< 1 ohm	Lightning Protection Systems	<10 ohms , with individual electrode no more than 10 x the No. of electrodes	Static Earthing Systems	< 10 ohms	Power Earthing Systems	< 4 ohms, though as low as practicable is desired to ensure protection devices work within required times. Maximums can be found in relevant standards.	
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Job No	Description of Job and Criteria	Interval
	<p>c) Adequately sized</p> <p>d) Free from damage</p> <p>e) Identification</p> <p>On live petroleum sites it is normal to measure the earth resistance of extraneous conductors, metal work etc. by using a wandering lead with reference to the main earth bar. This should be undertaken in a gas free environment or using a certified and approved Intrinsically Safe low ohm meter. Compare results to those previously obtained and those limiting values given in BS 7671 or applicable standards.</p> <p>1. System Testing in Isolation</p> <p>This is a test of the lightning protection system in isolation with all equipotential bonding to other facility earthing systems removed. With all earth electrodes connected to the system measure the resistance to earth of a system at points approximately equidistant between earth electrodes, the measured resistance shall not exceed 10 ohms.</p> <p>2. System Testing with Equipotential Bonding in Place</p> <p>This is a test of the lightning protection system with all equipotential bonding to other facility earthing systems in place. With all earth electrodes connected to the system measure the resistance to earth of a system at random points on the system; the measured resistance shall not exceed 10 ohms.</p> <p>During acceptance testing, the earth termination network is to be isolated from all other paths. All disconnections are to be recorded and checked off on reconnection after testing to ensure that they are correctly restored. This is only required at commissioning.</p> <p>Note:</p> <ol style="list-style-type: none"> <li>1. Normally, these measurements will be conducted at points outside the Petroleum Hazardous Area.</li> <li>2. Record the test results and investigate any significant changes from those obtained from the previous inspections.</li> <li>3. The inspection, testing and maintenance schedules must be carried out in conjunction with safe working requirements.</li> </ol>	

Job No	Description of Job and Criteria	Interval
26.0	<p><b>Alarm and Shutdown Testing</b></p> <p>All protective devices shall be tested so that the complete shutdown loop is proven. This shall be achieved by use of calibrated, traceable to national standards, test equipment. I.e. standard test gauges, hydraulic pressure pump and multimeter for pressure switches and transmitters.</p> <p>It should be proven that when a high pressure switch exceeds its set point the pump set/valve is stopped/closed to prevent risk of danger/damage.</p> <p>The following list is not exhaustive and devices not listed should be assessed and scheduled appropriately.</p> <p>Note:</p> <p>1. Process control devices are not specifically included in this category.</p>	
26.1	<p><u>Float switches or SIL Rated Electronic Equivalent</u></p> <p>a) Tank and/or Sump High or High-High Level Trip</p> <p>b) Tank Low Level (suction protection)</p> <p>c) Pump Seal Leakage</p>	3 Monthly
26.2	<p><u>Pressure Switches</u></p> <p>a) Terminal Pressure High</p> <p>b) Pipeline Ultimate High Pressure</p> <p>c) Pump Case High Pressure</p> <p>d) Pump Suction Pressure Low</p> <p>e) Hydraulic Power Pac Low Pressure</p>	6 Monthly
26.3	<p><u>Flow Switches</u></p> <p>a) Pump Low Flow</p>	3 Monthly
26.4	<p><u>Site Oil Interceptors</u></p> <p>a) Oil detectors</p> <p>b) Fire Alarm Shut Downs</p>	3 Monthly
26.5	<p><u>Process Interlocks</u></p> <p>a) Such as filter valve positions indication (to prevent excess flushing) etc.</p>	12 Monthly



26.6	<p><u>Pressure Control Systems</u></p> <p>Control valve performance is nominally monitored through its operation. The associated pressure transducers should be calibrated to ensure optimum operation.</p> <p>Where the transducers are also tied into shutdown systems the set point operation should be loop checked as per pressure switches.</p>	6 Monthly
26.7	<p><u>Process Critical Devices</u></p> <p>Such as:</p> <p>Valve position interlocks  Automatic body bleed monitors  Temperature transmitters  Density transmitters  Solid separators  Colour and opacity Instruments</p>	6 Monthly

Job No	Description of Job and Criteria	Interval
27.0	<p><b>Continuity Testing of Protective Conductors Including Main and Supplementary Bonding</b></p> <p>To be carried out at commissioning, where applicable and thereafter at the intervals indicated.</p> <p>Test Requirements</p> <ol style="list-style-type: none"> <li>1. Check and test the protective conductors and main and supplementary bonding to verify that they are electrically sound and correctly connected in accordance with BS 7671.</li> <li>2. Care must be taken to make an assessment of possible parallel paths which may affect the result.</li> </ol> <p>Testing</p> <ol style="list-style-type: none"> <li>1. Test the installation in accordance with BS 7671.</li> <li>2. Record the results of the inspection and tests.</li> <li>3. Compare the resistance test results with those obtained from previous tests and investigate any significant changes.</li> </ol> <p>Note:</p> <ol style="list-style-type: none"> <li>1. The inspection, testing and maintenance schedules must be carried out in conjunction with safe working requirements.</li> </ol>	36 Monthly

Job No	Description of Job and Criteria	Interval
28.0	<p><b>Continuity of Ring (and Radial) Final Circuit Conductors</b></p> <p>(To be carried out at commissioning (where applicable) and thereafter at the intervals indicated)</p> <p>Test Requirement</p> <ol style="list-style-type: none"> <li>1. Check and test the continuity of each conductor including the protective conductor of every final (or radial) circuit in accordance with BS 7671.</li> </ol> <p>Testing</p> <ol style="list-style-type: none"> <li>1. Test the installation in accordance with BS 7671.</li> <li>2. Record the results of the checks and tests.</li> <li>3. Compare the resistance test results with those obtained from previous tests and investigate any significant changes.</li> </ol> <p>Note:</p> <ol style="list-style-type: none"> <li>1. The inspection, testing and maintenance schedules must be carried out in conjunction with safe working requirements.</li> </ol>	36 Monthly

Job No	Description of Job and Criteria	Interval
29.0	<p><b>Insulation Tests</b></p> <p>(To be carried out at commissioning (where applicable) and thereafter at the intervals indicated)</p> <p>Test Requirements</p> <ol style="list-style-type: none"> <li>1. The insulation resistance to earth and between conductors shall be not less than 2M ohm.</li> </ol> <p>Testing</p> <ol style="list-style-type: none"> <li>1. Check the insulation of the installation for overheating, deterioration and damage.</li> <li>2. Test the insulation of conductors and fixed equipment for compliance with BS 7671 and prove that electrical conductors are adequately insulated from each other and from earth and/or protective conductors. This test is to ensure that the electrical integrity of each electrical conductor and each item of equipment under test meets its stated criteria. Tests should cover all permutations between each conductor, screen, metallic sheath, armour and earth.</li> <li>3. Record the lowest insulation resistance on Inspection and test record sheet.</li> <li>4. Record the results of the tests and compare with any previous tests and investigate any significant changes.</li> </ol> <p>Note:</p> <ol style="list-style-type: none"> <li>1. The inspection, testing and maintenance schedules must be carried out in conjunction with safe working requirements.</li> </ol>	36 Monthly

Job No	Description of Job and Criteria	Interval
30.0	<p><b>Site Applied Insulation</b></p> <p>To be carried out at commissioning, where applicable and thereafter at the intervals indicated.</p> <p>Test Requirements</p> <ol style="list-style-type: none"> <li>1. These tests are applicable to insulation applied during installation and repair.</li> </ol> <p>Testing</p> <ol style="list-style-type: none"> <li>1. The insulation should be tested for compliance with BS 7671.</li> <li>2. Record the results of the inspection and tests.</li> <li>3. Compare the resistance test results with those obtained from previous tests and investigate any significant changes.</li> <li>4. Where heat shrink sleeving is applied in accordance with manufacturers instructions and the manufacturer has quoted electrical properties of the sleeving, only a visual inspection is required to ensure compliance with the installation instruction and the absence of any mechanical damage. An insulation test need only be carried out on new installations. The standard insulation test will be sufficient for subsequent tests.</li> </ol> <p>Note:</p> <ol style="list-style-type: none"> <li>1. The inspection, testing and maintenance schedules must be carried out in conjunction with safe working requirements.</li> </ol>	36 Monthly

Job No	Description of Job and Criteria	Interval
31.0	<p><b>Separation of Circuits</b></p> <p>To be carried out at commissioning, where applicable and thereafter at the intervals indicated.</p> <p>Where protection is provided by separation of circuits, inspection and testing to verify compliance with BS 7671 for the following cases is required:</p> <ul style="list-style-type: none"> <li>a) Where protection is provided by SELV and PELV</li> <li>b) For SELV circuits, note that although Part 6 of the Wiring Regulations does not require specific tests for SELV circuits, tests should be performed to confirm compliance with the Regulations.</li> <li>c) Where protection is provided by only electrical separation of circuits.</li> </ul> <p>Record the results of the inspection and tests.</p> <p>Note:</p> <ol style="list-style-type: none"> <li>1. The inspection, testing and maintenance schedules must be carried out in conjunction with safe working requirements.</li> </ol>	36 Monthly

Job No	Description of Job and Criteria	Interval
32.0	<p><b>Barriers and Enclosures</b></p> <p>To be carried out at commissioning, where applicable and thereafter at the intervals indicated.</p> <p>Visually check the barriers and enclosures for deterioration, damage and security of fixings. If the barriers or enclosures have been modified since the last inspection, confirm compliance with BS 7671. This test is not generally required for unmodified factory built equipment.</p> <p>Record the results of the inspection.</p> <p>Note:</p> <ol style="list-style-type: none"> <li>1. The inspection, testing and maintenance schedules must be carried out in conjunction with safe working requirements.</li> </ol>	36 Monthly

Job No	Description of Job and Criteria	Interval
33.0	<p><b>Correct Polarity</b></p> <p>To be carried out at commissioning, where applicable and thereafter at the intervals indicated.</p> <p>Test the polarity of all circuits to verify that:</p> <ul style="list-style-type: none"> <li>a) Every fuse and single pole control and protective device is connected in the phase conductor only.</li> <li>b) Centre-contact bayonet and Edison screw lamp holders to BS 6776 in circuits having an earthed neutral conductor have the outer or screwed contacts connected to the neutral conductor.</li> <li>c) Wiring has been correctly connected to socket outlets and similar accessories.</li> </ul> <p>Record the results of the tests.</p> <p>Note:</p> <ol style="list-style-type: none"> <li>1. The inspection, testing and maintenance schedules must be carried out in conjunction with safe working requirements</li> </ol>	36 Monthly



Job No	Description of Job and Criteria	Interval
34.0	<p><b>Earthed Electrode(s) Testing excluding Lightning Protection</b></p> <p>To be carried out at commissioning, where applicable and thereafter at the intervals indicated.</p> <p>Test Requirement</p> <ol style="list-style-type: none"> <li>1. Measure the earth electrode resistance to the general mass earth.</li> </ol> <p>Testing</p> <ol style="list-style-type: none"> <li>1. Each earth electrode (or group of electrodes) must be disconnected before testing.</li> <li>2. Record the test results.</li> <li>3. Compare the resistance measured with previous resistance tests. Any significant changes in earth electrode resistance are to be investigated.</li> </ol> <p>Note:</p> <ol style="list-style-type: none"> <li>1. This measurement will generally be done at a point outside the explosives facility. The instrument used may generate dangerous voltages and currents within an explosives area. Therefore, the location of the test position should be agreed with the Site Safety Officer in advance.</li> <li>2. The inspection, testing and maintenance schedules must be carried out in conjunction with safe working requirements.</li> </ol>	11 Monthly

Job No	Description of Job and Criteria	Interval
35.0	<p><b>Earth Fault Loop Impedance Measurements</b></p> <p>To be carried out at commissioning, where applicable and thereafter at the intervals indicated.</p> <p>Test instruments of the current impulse type shall have an impulse duration not greater than 40 ms and shall give an indication of polarity and protective conductor continuity before the impulse is applied.</p> <p>The line/earth fault loop impedance shall be measured at the following locations as appropriate:</p> <ul style="list-style-type: none"> <li>a) The origin of the installation.</li> <li>b) Sub main distribution boards.</li> <li>c) Final circuit distribution boards.</li> <li>d) Socket outlet circuits. Test at a random selection of socket outlets with a minimum of two per circuit or which one shall be the socket outlet which is electrically most remote from the distribution board.</li> <li>e) Each lighting circuit.</li> <li>f) Isolation switches/control devices for fixed appliances.</li> <li>g) Exposed conductive parts of fixed appliances.</li> </ul> <p>In addition, for ring final circuits, measure the neutral/earth fault loop impedance.</p> <p>The total earth loop impedance <math>Z_s</math> shall be measured.</p> <p>Measure the earth fault loop impedance using conventional techniques.</p> <p>The test should be undertaken to prove compliance with BS 7671.</p> <p>Record the results of the tests.</p> <p>Compare with the previous test results. Any significant changes in impedance values should be reported and recorded for investigation and remedial action.</p> <p>Note:</p> <ol style="list-style-type: none"> <li>1. The inspection, testing and maintenance schedules must be carried out in conjunction with safe working requirements.</li> </ol>	36 Monthly

Job No	Description of Job and Criteria	Interval
<p><b>36.0</b></p>	<p><b>Residual Current Devices (RCDs)</b></p> <p>To be carried out at commissioning, where applicable and thereafter at the intervals indicated.</p> <p>Test the tripping operation of RCDs in accordance with the requirements of BS 7671.</p> <p>On completion of the tests, operate the test push button or other test facility integral with the circuit breaker to test the effectiveness of the integral testing device.</p> <p>Record the results of the tests and any defects noted.</p> <p>Note:</p> <ol style="list-style-type: none"> <li>1. The inspection, testing and maintenance schedules must be carried out in conjunction with safe working requirements.</li> </ol>	<p>12 Monthly</p>

Job No	Description of Job and Criteria	Interval
37.0	<p><b>Circuit Breakers, Isolators and Switching devices</b></p> <p>To be carried out at commissioning, where applicable and thereafter at the intervals indicated.</p> <p>Manually operate all devices to ensure that they disconnect the supply.</p>	36 Monthly

## APPENDIX A Quick reference frequency schedule

Frequency	Job No	Description of Job and Criteria
Weekly	4.2	Oil interceptors and drain tanks - Items (a), (b)
Monthly	2.3.2	Below ground tanks – inspect tell tales beneath tank bases
	9.2	Hydrant pits – couplings/valves – items (a) to (d)
Three monthly	23.2	Motors with Condition Monitoring Fitted
	1.1	Clear working areas of debris, materials etc.
	1.2	Mechanical equipment – check for damage, leaks etc.
	2.2.2	Tanks – external inspection – items (a) to (k)
	4.1	Tank bunds and equipment catchment areas - Items (a) to (d)
	4.2	Oil interceptors and drain tanks – items © to (f)
	5.1	Above ground pipework – items (a) to (d)
	5.2	Below ground pipework – item (a)
	6.2	Manual valves – items (a) to (c)
	6.3	Automatic valves – (1) check for fuel leaks and (2) deterioration and corrosion
	7.1	Maintenance of flow meters – items (a), (b)
	7.4	Leak detection equipment – items (a), (b)
	7.5	Additive injection equipment – item (a)
	8.1	Pumps and drivers – item (1) (a) to (e)
	8.2	Filters and strainers – item (a)
	9.1	Fuelling equipment – items (a), (b), (c)
	9.2	Hydrant pit couplings and valves – item (e)
9.3	Loading arms and pantographs – item (a), (b)	
10.1	Off-shore unloading facilities – items (b), (d)	
10.2	Shore facilities – jetties, docks etc. items (a), (b), (c)	
26.1	Float switches or SIL rated electronic equivalent – items (a) to (c)	
26.3	Flow switches – item (a)	

	26.4	Site oil interceptors – items (a) to (b)
<b>Frequency</b>	<b>Job No</b>	<b>Description of Job and Criteria</b>
Six monthly	5.1	Above ground pipework – items (e), (f)
	5.2	Below ground pipework – item (b)
	6.3	Automatic valves – correct operation of valves – item (3) (a) to (i)
	8.1	Pumps and drivers – item (2) (a) to (f)
	8.2	Filters and strainers – items (b), (c), (d)
	9.1	Fuel hoses and couplings – item (e)
	9.2	Hydrant pit couplings and valves – item (e)
	9.3	Loading arms and pantographs – item ©
	11.1	Maintenance of cathodic protection equipment – items (a), (b), (c), (e)
	23.3	Motors without condition monitoring fitted
	26.2	Pressure switches – items (a) to (e)
	26.6	Pressure control systems
	26.7	Process critical devices
	11 monthly	25.0
34.0		Earthed electrode(s) testing excluding lightning protection
12 monthly	3.1	Low level alarm/control – check operation of equipment
	3.2	High level shut off valve – items (a) to (e)
	3.3	Contents gauges – item (b)
	3.6	Swing arms and floating suction units – inspect and test external equipment
	5.1	Above ground pipework UT inspection – item (g)
	6.3	Automatic valves – charge pressure items (d) to (i)
	7.2	Accuracy testing of meters – items (a) to (d)
	7.3	Pressure and differential pressure gauges – items (a), (b)
	7.5	Additive injection equipment – item (b)
9.1	Fuel hoses and couplings – items (f), (g)	

	9.3	Loading arms and pantographs – item (e)
	10.1	Off-shore unloading facilities – item (f)
	11.1	Maintenance of cathodic protection equipment – item (d)
	12.0	Visual Inspection: - Equipment certified EEx'd'/FLP, EEx 'e', or EEx 'n'(or variants)
	13.0	Visual Inspection: - Equipment certified EEx'i' (or variants)
	14.0	Visual Inspection: - Equipment certified EEx'p' Apparatus.
	23.5	Motor Stator Windings
	24.0	Safety Signs and Notices.
	26.5	Process interlocks
	36.0	Residual current devices
	15.0	Close Inspection: - Equipment certified EEx'd'/FLP, EEx 'e', or EEx 'n'(or variants)
	16.0	Close Inspection: - Equipment certified EEx'i' (or variants)
	17.0	Close Inspection: - Equipment certified EEx'p' Apparatus.
	18.0	Initial / Detailed Inspection of Electrical Apparatus Certified EEx'd
	19.0	Initial / Detailed Inspection of Electrical Apparatus Certified EEx'e'
	20.0	Initial / Detailed Inspection of Electrical Apparatus Certified EEx'n'
	21.0	Initial / Detailed Inspection of Electrical Apparatus Certified EEx'i'
	22.0	Initial / Detailed Inspection of Electrical Apparatus Certified EEx'p'
24 Months	6.1	Pressure/Vacuum Valves
36 Months	3.5	Internal coils and heaters
	4.1	Tank Bunds and equipment catchment areas – items (e), (f)
	5.2	Below Ground Pipework – item ©
	10.1	Off-shore unloading facilities – item (g)

	10.2	Shore facilities – item (d)
	27.0	Continuity testing of protective conductors including main and supplementary bonding
	28.0	Continuity of ring (and radial) final circuit conductors
	29.0	Insulation tests
	30.0	Site applied insulation
	31.0	Separation of circuits
	32.0	Barriers and enclosures
	33.0	Correct polarity
	35.0	Earth fault loop impedance measurements
	37.0	Circuit breakers, isolators and switching devices
5 Yearly	23.6	Motor Protection systems
10 Yearly	23.4	Motor Bearings
	23.7	Motor Overhaul/Inspection