



RP 32-5

INSPECTION AND TESTING OF PLANT IN SERVICE (ELECTRICAL EQUIPMENT)

June 1994

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SCOPE AND PURPOSE This Recommended Practice gives constructive guidance on the requirements for assessing the integrity of electrical equipment in service and is applicable to all fixed and temporarily fixed installations from energy source through interconnecting conductors/cables up to and including the utilisation equipment. It is also applicable to electrical instrumentation, portable and transportable equipment. Advice is included on the requirements for assessing the specialised electrical equipment used in hazardous areas. Its purpose is to give guidance on those requirements considered essential for assessing equipment and systems integrity, from which more specific requirements can be developed by site engineers.											
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FOREWORD

Introduction to BP Group Recommended Practices and Specifications for Engineering

The Introductory Volume contains a series of documents that provide an introduction to the BP Group Recommended Practices and Specifications for Engineering (RPSEs). In particular, the 'General Foreword' sets out the philosophy of the RPSEs. Other documents in the Introductory Volume provide general guidance on using the RPSEs and background information to Engineering Standards in BP. There are also recommendations for specific definitions and requirements.

Value of this Recommended Practice

This document represents the accumulated practices of the BP Group Companies for ensuring a high standard of plant integrity within the constraints for cost effective engineering.

Application

Text in *italics* is Commentary. Commentary provides background information which supports the requirements of the Recommended Practice, and may discuss alternative options.

This document may refer to certain local, national or international regulations but the responsibility to ensure compliance with legislation and any other statutory requirements lies with the user. The user should adapt or supplement this document to ensure compliance for the specific application.

Principal Changes from Previous Edition

This Recommended Practice is part of a major revision of [BP CP 52](#) - Inspection and Testing of Plant in Service which was last revised in January 1991, and which has now been split into separate documents and updated to give more constructive guidance on the requirements for assessing the integrity of electrical equipment in service.

Feedback and Further Information

Users are invited to feed back any comments and to detail experiences in the application of BP RPSE's, to assist in the process of their continuous improvement.

For feedback and further information, please contact Standards Group, BP International or the Custodian. See Quarterly Status List for contacts.



1. INTRODUCTION

To reflect BP's international operations the main text of this Recommended Practice does not reference any national legislative documents, codes or standards. For information on a particular country's statutory obligations associated with this guidance and for more information on particular aspects of the guidance, reference should be made to the appended Regional Annex. (UK only in this issue.)

The guidance given is applicable to all fixed and temporarily fixed installations from energy source through interconnecting conductors/cables up to and including the utilisation equipment. It is also applicable to electrical instrumentation, portable and transportable equipment. Furthermore, advice is included on the requirements for assessing the specialised electrical equipment used in hazardous areas.

In view of the large variety of electrical equipment used throughout BP's centres and the many diverse and variable operating conditions to be found in 'Offshore' and 'On-shore' locations, full and detailed requirements for assessment cannot be given in this document. However, guidance is given on those requirements considered essential for assessing equipment and systems integrity from which more specific requirements can be developed by site engineers.

Where guidance for assessing equipment or systems of a type not specifically considered in this document is required, reference to the nearest type should provide a reasonable guide.

Integrity failures on low voltage systems can in certain instances lead to fault conditions having serious consequences, therefore no distinction is drawn between the requirements for various voltage levels. Site engineers will need to take account of local circumstances and risk potential in deciding what allowances if any should be made for low voltage equipment.

2. GENERAL REQUIREMENTS

2.1 Identification

All fixed installations and temporarily fixed installations must be clearly and permanently identified. Circuit identification must relate unambiguously to the connected equipment.

2.2 Registration

A register should be compiled of all equipment requiring regular test and inspection. Each item should be uniquely identified (tagged) and registered before being taken into service.



2.3 Fault Level Register

A register of distribution system 'Fault Levels' including calculations, should be maintained. A person should be appointed as the custodian with responsibility for ensuring it is updated in the light of any modification.

2.4 Support Documentation

For each plant, a dossier containing all relevant data for equipment should be compiled. A person should be appointed as the custodian with responsibility for ensuring it is updated and readily accessible to Engineers preparing and implementing these procedures. Dossiers should include manufacturer's handbooks, general arrangement drawings, single - line and schematic drawings and Ex certification when applicable. The sites associated installation single line, wiring and control schematics should also be incorporated. Furthermore, for each plant a record should be maintained of the calculations and settings applied to associated protective relay systems.

2.5 Inspection Procedures

For each circuit and/or component part, test and inspection programmes which include procedures outlining the extent and frequency should be prepared. In preparing procedures, account should be taken of the guidance given in this document, history records, local environment and severity of duty.

Procedures need to stress the requirement for the centre's Safety Rules and 'Permit to Work' systems to be applied before any work is undertaken on electrical equipment.

Special procedures should be available for the handling/containment/disposal of synthetic polychlorinated biphenyl (PCB) insulation.

Procedures should stress the need for test voltages to be the lowest value possible consistent with achieving a satisfactory test.

2.6 Records

A file or other suitable permanent record should be established for all items/circuits to be regularly tested/inspected. The system should contain a permanent operational history including details of faults, repairs, modifications and the results of tests and inspections carried out.

This history shall provide the evidence, where necessary, to third parties or statutory bodies, that all reasonable steps have been taken to ensure the integrity of the electrical systems.

2.7 Solid-state Components

There is a high risk of damaging solid state devices when performing routine testing. It is therefore important that these devices be disconnected when test voltages are applied to the associated circuits. Testing of these devices should only be carried out strictly in accordance with manufacturers' recommendations.

2.8 Examination Requirements

Mechanical equipment is scheduled for examination according to a four tier grading system (see [BP Group RP 32-3](#)). While this approach could be applied to electrical systems it is not considered to be the most appropriate and the following alternative is recommended.

- (a) Initial Examination - This examination is intended to identify problems which often become evident shortly after commissioning. These could be due to manufacturing faults, deficient design or poor installation practices. Evidence of overheating on cables and loose terminations are typical of the faults anticipated. It is likely that such faults would develop into serious failures if undetected.

The period over which Initial Examination intervals prevail, wherever possible, should be that associated with one post commission examination. However the principle is that one should have confidence that conditions are not changing in an unstable manner and that the Regular examination interval is satisfactory.

- (b) Scheduled thorough examinations (on a regular or otherwise arranged basis) - Are intended to identify those problems more likely to occur as a consequence of age, severity of duty and environmental condition e.g. deterioration on insulation, earthing system degradation, corrosion on protective housings and slow or inoperative protection etc.
- (c) Intermediate Inspections - Are intended to be non-intrusive visual inspection to assess the general condition of enclosures and interconnecting systems. Guidance will be given where this is applicable.

2.9 Examination Intervals

In view of the varying operating environments and variety of equipment, it is not possible to give actual intervals between examinations. However, Table 1 contains guidance on intervals regarded as typical for the type of equipment under reasonable operating and environmental conditions. These frequencies are for guidance only and should be adjusted to take account of any local factors such as :-

- Statutory regulations
- Recognised international/national codes and standards
- Manufacturers recommendations
- Severity of duty
- Deterioration rates
- Consequences of failure
- Provision of duplicate services and the demands of the production programme
- Environmental conditions
- The possibility of inadvertent damage
- Associated equipment's scheduled examinations e.g., pumps in the case of motors
- Associated work programmes e.g. Re-lamping programmes

Intervals allocated on the basis of the above considerations should not be regarded as fixed and should be increased or decreased in the light of experience.

See the footnote to Table 1.

2.10 Operational History

Although conditions between installations can vary widely, there is nevertheless some similarity between the application and performance of the same electrical systems at different sites. This is especially true for conventional equipment with proven performance. Therefore, previous recorded history and failure rate data for similar electrical equipment from existing operational installations may be used to assist in specifying examination requirements and examination frequencies for new equipment/systems.

2.11 Condition Monitoring

The application of appropriate monitoring techniques may be incorporated into the inspection and maintenance activity to reduce the requirements for unnecessary shutdown or invasive work. Specific methods which are relevant to the operation of electrical equipment include thermography, for identifying the condition of electrical connections (e.g. busbar connections), envelope analysis for assessing bearing condition, Noise analysis for assessing the condition of switchgear, Oil analysis for monitoring the condition of transformer windings and phase current analysis for examining motor stator and rotor condition.



3. INSPECTION ORGANISATION

3.1 Managements General Responsibilities

It is the responsibility of management at each centre to:-

- (a) ensure that existing installed equipment is suited for its current service and that it is in a safe condition to operate.
- (b) have confirmed that new equipment has been designed constructed, installed and tested according to codes, standards or specifications approved by BP, and that documentation to this effect is available.
- (c) ensure compliance with national statutory regulations applicable to design, inspection, test and certification of equipment.
- (d) to have an organisation in place with responsibilities allocated for ensuring that the integrity of the facility is maintained in accordance with guidance given in this code and the statutory regulations.

The senior manager at each centre should delegate the responsibility - and the authority - for the correct application of this code to those persons or departments having the necessary technical abilities and qualifications. These delegated responsibilities should be formally written with recipients declaring their understanding and acceptance.

Responsibilities should be written in detail defining the activities for which post holders will be accountable.

Where for organisational reasons (devolved management), the responsibilities for inspection is fragmented and the accountability for inspection requirements can be conflicting with operational/engineering pressures, it is advisable to delegate a person or department the overall co-ordination/monitoring responsibility. It is important that those given the co-ordination role are technically capable of appreciating the significance of any deficiencies and that they have direct access to senior management for the resolution of any serious conflicting issues.

Where the electrical inspection authority cannot be divorced from the day to day operating pressures which can conflict with the inspection function, it may be considered prudent to delegate an audit function to an independent department such as 'Plant Inspection'.

3.2 Basic Inspection Authority Responsibilities

The basic responsibilities for the electrical inspection authority are:-



- (a) to carry out the inspection of electrical systems in accordance with the requirement of this code, insofar as it is adopted and adapted by the operating centre.
- (b) to identify, categorise and register equipment together with detailed and comprehensive records of each item or system.
- (c) to monitor the implementation of test and inspection programmes and ensure management is advised of any departures from the agreed inspection requirements/schedules for the plant.
- (d) to ensure deficiencies are acted upon and that serious problems are notified to management and operating authorities.
- (e) to ensure that repairs, modifications or renewals to equipment are carried out to correct specifications.
- (f) to be assured of the competence of persons engaged in the inspection of instrument systems.
- (g) to continually assess the effectiveness of the programmes and adjust where optimisation can be affected or deficiencies need to be addressed.
- (h) to ensure recurring deficiencies are highlighted for re-design or upgrading considerations.

3.3 Inspection Staff (Inspectors)

For electrical systems the inspection function is normally undertaken by electricians (or equivalent). These can be company employees, contractors or manufacturers employees. Whichever is employed, it is important for them to be technically and practically competent. In addition, they should have high personal integrity to ensure a professional approach to the function.

Where indirect employees such as contractors are employed to perform the inspection function, it is important that contract documents clearly define:-

- (a) the requirements in terms of competency and integrity for the inspection personnel, with contract companies asked to demonstrate their staffs compliance to the BP contract supervisor's satisfaction.
- (b) the demarcation of responsibilities with respect to who is responsible for accepting the inspection findings, recommendations, taking action and compiling reports.



- (c) who is responsible for gaining occupation, achieving safe isolation of the system to be inspected.

3.4 External Inspection Authorities

In some countries statutory regulation require companies to use independent inspection bodies. It is also possible for BP to elect to use such an organisation.

Where an external inspection body is used, the BP Inspection Authority will normally be responsible for ensuring:-

- (a) that management is advised of all requirements for statutory inspection.
- (b) that all records of the examination are made available to BP.
- (c) that recommendations for repairs, renewals and refurbishment etc. are adequately discussed and agreed with BP.

The statutory regulations express only the minimum necessary to satisfy safety requirements. The documentation supplied by an external inspection body following their examination is essentially a certificate that states the examination has been performed and that the requirements of the legislation have been met. When the scope of the inspection is not sufficient for BP purposes, and provided the statutory authorities have no objection, the external inspection may be supplemented by additional work, to be performed at the same time.

3.5 Engineering Co-operation

Every opportunity should be taken to optimise the use of resources and plant outage times by integrating inter-discipline inspections. Therefore, organisation should be flexible to allow close links between inspection organisation.

4. EQUIPMENT/SYSTEMS

4.1 Switchgear and Starters

4.1.1 Introduction

This section is applicable to switchgear in all its many forms, from simple isolators to sophisticated vacuum breakers. Because many items of switchgear are operated by remote devices such as push button stations, the requirements below are also applicable to these devices and the interconnecting circuit.

The duty of this equipment in terms of switching current especially motor starting is very demanding with gradual deterioration inevitable.



Switching under fault conditions can be even more demanding with consequential deterioration.

To ensure the equipment remains safe and reliable, regular examination is essential.

4.1.2 Essential Requirements for Inspection and Testing

Because there is such variety to this type of equipment, some of the requirements stated here may not be appropriate to particular types. The requirements should therefore be used as a general guide only, applied in equivalent service.

4.1.2.1 Insulation Systems

Insulation systems must be closely inspected for signs of overheating, cracking, tracking and other defects.

Insulation strength tests must be carried out in accordance with the following guide:-

Equipment Line Voltage	Test Voltage Applied d.c.
Less than 400 Volts (Auxiliary wiring and components)	500 V
Up to 1000 Volts	1 kV*
Above 1000 Volts and up to 3.6 kV	2 kV*
Above 3.6 kV	5 kV*

* Test voltages must be applied between phases and between each phase and earth.

It is very important that records are maintained of insulation levels to aid trend assessment

4.1.2.2 Insulating Oils (OCB's)

Insulating oil may be changed on a routine basis. However, it is recommended that an electrical strength test be carried out. Where records indicate that a circuit breaker has opened under fault conditions, oil analysis may be undertaken to ensure that the integrity of the oil has not suffered.

4.1.2.3 Contacts/Contactors

Inspection of main contactors for excessive wear and over-heating must be undertaken and the mechanisms checked for freedom of movement. Note: It is important that manufacturers manuals are referenced for

equipment specific detailed instructions e.g. methods for determining the contact gap and effectiveness of contacts within vacuum bottles.

4.1.2.4 Terminals

All terminals must be checked for firmness and signs of overheating.

4.1.2.5 Cables

Power and control cables must be examined (see section 4.3) together with the connected equipment.

4.1.2.6 Busbars

Busbars shall be subjected to periodic inspection (see section 4.2).

4.1.2.7 Protection

The accuracy of protective devices must be checked against manufacturers characteristics and the recorded set points verified. For this purpose, low voltage secondary injection will be necessary. On modern equipment there should be no need to disconnect devices as test plugs for this purpose are usually provided. However, on older equipment, where test plugs are not provided and terminals may need to be disconnected to perform the tests, it is essential for the reinstated connections to be verified.

Note: Primary injection is not considered necessary for the purpose of routine testing, unless there has been some dismantling of the primary/secondary circuits on current transformers, or there is some suspicion of mal-operation.

Fuse type and ratings must be checked against design specification and records.

4.1.2.8 Control/Protection/Indication/Interlocks/Intertripping Circuits

The correct functionality of these circuits must be checked against the relevant schematic diagrams as part of the examination programme.

In addition to the examination checks, distribution feeder trip and closure controls should be switched in service wherever practicable.

4.1.2.9 Voltage Transformers

Apart from visual inspection, insulation testing and cleaning, no other work is necessary.

4.1.2.10 Ex Certification Compliance

Where relevant, compliance checks shall be carried out in accordance with the requirements of Section 4.12



4.1.2.11 Earthing

Earthing conductors must be inspected and continuity assessed. All terminations must be checked for firmness. (See also Section 4.7)

4.1.2.12 Shutters and Locking

Mechanisms must be checked for freedom of movement and correct function with inhibiting mechanical and electrical (interlocks) proven.

4.1.3 Frequency of Examination

Because there are many types of switchgear in widely varying conditions of use the frequency for examinations can be expected to vary from one site to another. However, based on BP's general experience, as a guide an initial three year interval would be appropriate followed by regular examinations at four yearly intervals. More frequent intervals can be expected for equipment having onerous duties e.g. Motor starters subjected to frequent stop/starting. Where switchgear is situated in outside locations, particularly offshore, intervals in the order of two years would be more appropriate. It is also recommended that distribution feeder trip and closure functionality should be tested at intervals in the order of one year.

4.2 Busbars

4.2.1 Introduction

Busbars are robust and normally very reliable. However, faults that do occur can have very serious consequences. Vibration can cause connection and barrier assemblies to loosen, dust build up can develop into serious failures, oil can leak from chambers etc. These occurrences are rare and generally develop over long periods. However, where a serious short circuit has occurred, damage to busbars may be immediate which may not be evident unless examined. There is therefore, justification for regular examination

To examine fully a busbar system will require isolation which can often impact on the operating facility. Their examination is therefore normally performed during plant down time.

4.2.2 Essential Requirements for Inspection and Testing

Busbar systems must be regularly strength tested in accordance with the guide given in Section 4.1.2.

For distribution boards fitted with isolators e.g. Motor Control Centres, the condition of the isolator connections, springs, contacts and cable connections must be checked.

Insulation systems must be checked for signs of stress, overheating, cracking, tracking and other defects.



Where the isolation of a busbar is impracticable, visual inspection together with a thermographic survey can sometimes be considered. However, for this purpose a clear view of the bars will be necessary, most likely requiring covers to be removed with the equipment live. This would only apply on system voltages below 1000 volts and then only where there is no opportunity to isolate

4.2.2.1 Protection

Bus-Zone protection CTs must be examined as part of the busbar examination .

Relay operability must be verified by secondary injection and the trip setting proven.

4.2.3 Frequency of Examination

Unless there are adverse operating or environmental conditions, examination of the bus bars can be carried out at 10 yearly intervals. However, for those fitted with integral isolators, shorter intervals in the order of four years are recommended.

The verification of Busbar protection should be carried out at intervals in the order of four years.

4.3 Cables and Accessories

4.3.1 Introduction

Cables properly selected, sized and installed with due regard to the operating conditions and environment are unlikely to fail with normal usage, except after a very long time. However, cable faults do occur for reasons other than inherent cable deterioration.

The factors most likely to cause cables to fail are:-

- (a) Impact damage associated with manoeuvring heavy equipment, civil excavations and erecting scaffolding
- (b) Ingress of water into terminal and junction boxes
- (c) Prolonged exposure to hydrocarbons and solvents
- (d) Excessive overloads including fault conditions
- (e) High voltage transient conditions.

While cable faults can not be eliminated, regular examination can often detect deterioration before the cable actually fails.



4.3.2 Essential Requirements for Inspection and Testing

4.3.2.1 Insulation

Insulation resistance tests between cores and from cores to earth must be carried out on all power and control cables.

Pressure testing of HV cables on a regular basis is not recommended.

Attention should always be drawn to the potential for long cables to charge up during the application of test voltages, with the subsequent need for cables to be immediately discharged following tests.

Test voltages should be in accordance with the guide given in Section 4.1.2

4.3.2.2 Terminations

Terminals must be examined for signs of overheating and confirmation of soundness

4.3.2.3 Glands

Glands must be examined to confirm mechanical condition and the electrical integrity of the earth continuity where appropriate. Glands fitted to equipment in hazardous areas must be checked and their suitability to the hazard zoning confirmed (see also section 4.12).

4.3.2.4 Cable Supports

Conduits, traywork, clips and trunking must be examined to confirm mechanical integrity and fitness for purpose.

4.3.3 Frequency of Examination

The examination of cables may be subject to scheduled inspection on an individual basis. However, it is more appropriate and acceptable practice to include cable examinations as part of the connected equipment's examination programmes. Where cables are to be examined separately, intervals in the order of four years would be in order.

4.4 Transformers

4.4.1 Introduction

This section applies to fixed transformers of all types used for power distribution, instrument supplies, rectifier equipment and other power system applications.

Normally power transformers are very reliable and need very little attention. However, distribution transformers, regulating equipment

(tap changers) and protective devices can develop faults on contacts and terminations after long periods in service. Therefore limited examination of the auxiliary equipment is necessary. The testing of insulating oil on a regular basis can also indicate actual oil deterioration and possible signs of incipient winding problems.

4.4.2 Essential Requirements for Inspection and Testing

4.4.2.1 Insulation

Normally transformers are totally enclosed with access to coils limited. Therefore, examination of insulation is limited to strength testing. For this purpose test voltages in accordance with the guide given in Section 4.1.2 must be applied.

An additional insulation test must be performed between the primary and secondary windings at the same test voltage as the low voltage side. For safety reasons the winding not under test must be earthed.

For conservator type oil insulated transformer, insulating oils must be sampled and subjected to water content and strength test. Oil levels must be checked, and breather silica-gel changed as required.

On large transformers on critical duties, to give an early indication of incipient winding failure, gas analysis may be considered.

4.4.2.2 Tap Changers

Tap Changers must be examined for signs of overheating and their operating mechanism's checked.

4.4.2.3 Protection

Buchholz Relays must be tested and the trip and alarm functions proven. Oil and winding temperature indicators must also be inspected and calibrated.

Explosion vent or relief (Qualitrol and Pyropress) valves where fitted must be examined for leaks.

For transformers equipped with frame leakage protection, the insulation of the tank from earth must be measured using a low voltage d.c. supply. Insulation values in the order of 100 ohms or greater are considered satisfactory.

4.4.2.4 Forced Draft Cooling

Fans/pumps and their drivers must be examined as part of the transformer programme and in accordance with the motor and switchgear specifications.



4.4.2.5 Earthing

Transformer frame and neutral earthing must be closely examined with the mechanical and electrical integrity assessed.

4.4.2.6 Tank and Coolers

A careful check of the exterior condition of the tank must be carried out with particular attention being given to checking coolers for corrosion or possible leaks.

4.4.3 Frequency of Examination

Because transformers are normally very reliable, examinations need only be carried out at intervals in the order of four years. However, non-intrusive intermediate inspections including oil sampling tests should be performed at more frequent intervals e.g. annual.

4.5 Rotating Electrical Machines

4.5.1 Introduction

This Section applies to rotating electrical machines used for:-

- (a) Generation
- (b) Rotating and reciprocating plant, (e.g. pumps, fans, compressors, mechanical drives etc.)

Electrical machines are normally very reliable. Failures which do occur are usually attributable to reasons other than electrical. e.g. Most of the serious machine failures where rotor and stators sustain damage are a direct result of bearing failures.

Insulation will deteriorate over long periods although severe overload conditions can have a considerable impact on insulation durability.

Symptoms leading to these failures can often be detected and the failure predicted.

Deterioration in bearings may be anticipated by periodic vibration survey, using envelope analysis to verify the condition of the races, elements and lubrication.

Rotor and Stator integrity can be assessed by phase current analysis. This may involve measurements being taken by a specialist contractor on a six monthly or annual basis initially in order to establish an initial footprint. The technique involves an analysis of the current signal from the indication or protection current transformers. It can identify Stator defects and Rotor bar defects, insulation breakdown and electromagnetic problems.

4.5.2 Essential Requirements for Inspection and Testing

4.5.2.1 Insulation

Insulation systems must be periodically strength tested in line with the recommendations given in Section 4.1.2. For machines on line voltages greater than 440 Volt, where low insulation values are apparent, a polarisation index test should be carried out and the extent of deterioration since the last test evaluated.

Polarisation index testing on machines using XLPE insulation (typically used for "wet" designs of machine) do not yield information which is of great use. This type of test is best reserved for windings of the mass or vacuum impregnated type for which there is a great deal of historic information.

Phase current analysis (see commentary to Section 4.5.1) is an additional technique which may be considered as a non-invasive alternative to Dielectric Loss Analysis (DLA) or Partial Discharge Analysis.(PDA)

On HV Machines, where practicable, the condition of windings including wedges and overhangs must be established.

In the case of large machines operating on system voltages at or above 11 kV, to predict winding deterioration, advantage may be taken of the Dielectric Loss Analysis (DLA) technique. This technique based on a capacitive bridge, can give an indication of a windings condition with the extrapolation of the data used to predict likely failures. It is a trending system for which the best results are obtained with an analysis based on initial construction test data(the machines signature). Alternative techniques (Rogowski coils) for evaluating insulation systems are available and may also be used.

It is considered that DLA or PDA type analysis, carried out on lower voltage machines would offer useful indication of the state of contamination of the windings. This type of information could be useful for those critical machines of the Ex(e) or Ex(N) designs where contaminated windings could infringe the safety requirements of the explosion protection of the machine.

4.5.2.2 Terminations

The terminals and cable/winding tails must be examined for signs of over-heating and the soundness of the terminals confirmed. The condition of terminal boxes, cables and glands must also be examined.

4.5.2.3 Ex certification

Compliance checks must be carried out in accordance with the guidance given in Section 4.12

4.5.2.4 Bearings

Bearings should be subject to monitoring in accordance with site's condition monitoring policy.

Bearings may be assessed by vibration measurement as part of a condition monitoring programme. The recommended technique in terms of accuracy and ease of interpretation is envelope analysis.

4.5.2.5 Frames

The general condition of the frames must be inspected with particular attention being given to the fan and couplings.

Cooling systems must be examined to ensure air ways and filters are free from debris and obstructions.

Air to air exchanger on CACA machines must be examined for leaks (corroded tubes).

Anti-condensation heater insulation and continuity must be tested and the control function proven.

4.5.2.6 Earthing

Earthing bonds must be examined to confirm mechanical and electrical integrity.

4.5.2.7 Pedestal Insulation

Pedestal insulation must be tested.

4.5.2.8 Field Circuit

For synchronous motors and generators, field windings must be tested. Care must be taken to ensure that solid state devices cannot be inadvertently subjected to test voltages and currents.

Field circuit breakers and exciters must be kept free of dust and the protective devices tested with the set points proven.

Where separate exciters are installed they must be examined in accordance with the requirements of this section. Slip rings must be examined for excessive wear and eccentricity.

4.5.2.9 Current Transformers

Where protection CTs. are accessible they must be examined and the soundness of the terminations checked.

4.5.3 Frequency of Examinations

Generators and motors, provided they are maintained and operated properly are normally very reliable. However, where practicable, initial

examination should be undertaken one year after commissioning to establish the condition of terminations and winding condition. Provided initial examinations reveal no areas of concern, four yearly intervals between examinations would be appropriate. Where machines are included in a routine monitoring programme, including regular bearing assessment and periodic phase current analysis, there should be no requirement to perform any scheduled intrusive maintenance that is not initiated by the monitoring activity.

The inspection of terminations, frames, earthing and pedestal insulation may be undertaken during repair activities identified by monitoring.

All machines should be subject to non-intrusive inspections at more frequent intervals in order to confirm the integrity of the machines external condition and compliance with Ex certification (Section 4.12)

4.6 Fixed Lighting Installations

4.6.1 Introduction

Lighting systems used both for normal and emergency lighting purposes are installed extensively throughout all the company's facilities. On process plant the fittings and circuit cables are exposed to inadvertent damage, in addition to general deterioration with age . To maintain them fit for purpose, routine inspection is necessary with a particular emphasis required on the systems installed in hazardous areas.

4.6.2 Essential Requirements for Inspection and Testing

Cables must be examined in accordance with the requirements of Section 4.3.

Circuit breakers and switches must be examined in accordance with the requirements of Section 4.1.

Luminaries must be examined and their electrical and mechanical integrity confirmed.

Ex certified equipment must be inspected in accordance with the requirements of Section 4.12 and the compliance confirmed.

Emergency fittings where supplied with integral batteries and associated electronic controllers must be examined in accordance with the requirements of Section 4.10.

Where emergency lighting installations are provided as total systems with central batteries, separate cabling and control equipment, the inspection and test approach shall take into consideration both the components of the system individually and the total operation of the system. See also Section 4.9.2



4.6.3 Frequency of Examination

Inspection of luminaries should also be included in lamp changing programmes, with the frequency dictated by the lamps life (depends on the type of lamp in the area and the operating hours).

Where block lamp changing programmes are undertaken on extensive lighting installations, sampling can be considered. However, where re-lamping is done on an ad-hoc basis, inspection of the luminaries should be included in each fittings lamp changing programme.

The lighting systems cables, junction boxes and control switchgear examinations should also, whenever possible, coincide with bulk re-lamping programmes with a 10% sampling principle applied. Where ad-hoc re-lamping is undertaken separate examination in accordance with the relevant sections above will need to be undertaken.

4.7 Earthing and Bonding Systems

4.7.1 Introduction

This section applies to earthing, neutral earthing and bonding systems provided to give adequate protection against the potential hazards associated with electrical systems, lightning and static electricity. It also covers those systems provided to minimise electrical interference on instrumentation and communication circuits. Furthermore it applies to the bonds, groundbeds, etc., forming part of a cathodic protection system.

Earthing and bonding systems are essential to the safe operation of all installations and although the systems are normally robust, corrosion, human interference and inadvertent damage can often negate the effectiveness. Consequently regular inspection is necessary to ensure the systems integrity is maintained.

4.7.2 Essential Requirements for Inspection and Testing

4.7.2.1 Equipment Earthing

Earthing bonds attached to all electrical equipment e.g. switchgear and motors etc. must be examined with the mechanical and electrical integrity established. Where practicable, terminations should be broken and inspected to ensure continuity is not impaired.

4.7.2.2 Earthing Systems

Earth electrodes must be closely examined. Where practicable they should be disconnected and the impedance measured.

Note: This may only be carried out when plant operating conditions permit.



Earth nests must be closely examined and the mechanical integrity assessed. Terminations should be broken and inspected to ensure electrical continuity is not impaired.

All connections to structures, tanks, vessels and towers must be closely examined with the electrical and mechanical integrity assessed. Where practicable, terminations should be broken and inspected to ensure continuity is not impaired.

The earth bonding system to the roof on floating roof tanks must be closely examined and the electrical and mechanical integrity assessed. Where practicable, terminations should be broken and inspected to ensure continuity is assessed. Scraping earths must be closely examined and the integrity of the bonding assessed.

Neutral earthing resistors must be inspected and the mechanical and electrical integrity confirmed. The resistance must be measured and the value assessed against the design specification.

Where the equipment, or any part of the associated circuit is in a hazardous area, care must be taken to ensure that the testing does not in itself create a hazard.

At loading terminals, flexible bonding systems should be closely examined with mechanical and electrical integrity established. Earth monitoring systems must be closely inspected with the functionality of monitoring/interlocks and alarm functions proved.

4.7.3 Frequency of Examinations

The earthing associated with electrical equipment should normally be included in the equipment's routine examination programme.

The examination (including testing) of fixed earthing systems should not be necessary at frequent intervals, provided connection are reinstated following disconnection and damaged conductors are expediently repaired as they occur. Examinations at interval in the order of six years should be used as a general guide.

For systems installed in hazardous areas, inspections should be carried out at more frequent intervals, dictated by a sites particular circumstances and environment. Typically, for loading gantries, flexible connections may need to be checked at weekly intervals.

Tank and vessel earthing systems are normally included in their respective inspection programmes.

4.8 Portable and Transportable Electrical Equipment

4.8.1 Introduction

This section applies to electrical equipment which can be portable or transportable, self powered or mains operated at voltages less than 650 Volts. It may be a tool and/or supply system e.g. transformers and distribution system or electrical inspection equipment etc. It is also



applicable to lighter duty equipment e.g. office equipment, IT equipment, type writers, fans and heaters etc.

Portable equipment used in the field e.g. drills, grinders, hand lamps and temporary 110 Volt distribution systems etc. are often subject to robust treatment, where the physical condition can deteriorate very quickly and to such an extent that the risk of electric shock or arcs associated with short circuits is greatly increased. Therefore, as the equipment is likely to be hand held or readily moved by hand, its regular examination is considered essential.

As much of this equipment is brought onto sites by contractors, it is strongly recommended that consideration be given to applying these essential requirements to the contractors equipment as it enters factory gates.

4.8.2 Essential Requirements for Inspection and Testing

All portable equipment including extension leads must be inspected and approved suitable for the purpose intended. The equipment must be registered and a record maintained of subsequent inspection findings.

Portable equipment for use in the field (plant) must be tagged with a label which clearly shows when the equipment must be re-examined.

Plug, sockets and operating voltage must be examined to ensure compatibility with the systems on site.

For all equipment there must be a careful inspection for signs of damage or deterioration, including for example, the casing, weatherproof seals, the plug/sockets, terminals, cables and anchoring devices.

The special features of certified (Ex equipment) must be checked for compliance. Certification labels must be firmly attached.

Transforming equipment must be inspected and its electrical integrity checked. For isolating transformers the insulation between primary and secondary windings must be verified and the output voltage checked for compliance with factory standards.

Protective devices where fitted must be tested and their functionality confirmed.

Equipment provided with basic insulation and having an earthed metal frame for protection, must have the earth conductor subjected to a substantial current continuity test. The insulation must also be measured. Note: For this purpose a portable appliance tester may be useful.

Portable generators must have:-

- (a) Winding to frame IR measured.



- (b) Controls examined and functionally tested.
- (c) Protection tested.

The inspection of welding equipment should ensure that separate earth free terminals have been provided.

Portable testing equipment must be regularly inspected and calibrated against standard supplies. This is particularly important for equipment used to test at high voltage i.e. Phasing Sticks. Leads used with test equipment must also be closely examined and their electrical and mechanical integrity established.

4.8.3 Frequency of Examination

Portable instruments used for the purpose of proving circuits dead, should themselves be proved immediately prior to and after proof testing.

For general equipment, because there is such a wide range of equipment likely to be used in many differing environments, intervals for examinations will be very dependent on the type and, severity of the duty. The frequency should therefore, be determined in the light of experience, by a qualified person on site.

As a guide, industrial equipment should be examined on an annual basis. However, under very onerous conditions such as those found on unit overhauls, frequencies in the order of weeks may be more appropriate, particularly on Ex equipment.

Light duty equipment, such as found in offices, is subject to less severe conditions and examination frequencies in the order of three/four years would be appropriate.

4.9 Building Installations

4.9.1 Introduction

This section applies to the fixed installation within offices, laboratories, stores, workshops, control and store rooms etc. This section is not intended to be applicable to the domestic type appliances and movable equipment e.g. type writers, PC's and kettles etc. used in buildings which are covered in Section 4.8

Building installations are normally very reliable. However, human interference, inadvertent damage, accidental ingress of water, insulation deterioration and loose connections are factors which can cause failures. Failures can lead to fire and electric shock with consequential loss of property and personal injury. Therefore, while these circuits are relatively innocuous in petrochemical terms, their integrity needs to be established on a regular basis.

Building installations comprise many common systems with many common components. Therefore sampling examinations in relation to Section 2 are in order.

4.9.2 Essential Requirements for Inspection and Testing

4.9.2.1 Distribution Boards

Boards must be checked for mechanical and electrical integrity with an emphasis on loose connections and signs of overheating.

Protective devices where fitted must be manually tripped. Where residual current devices are installed, their effectiveness must also be verified by tests independent of integral test facilities.

Circuit breakers and busbars shall be subject to examination as outlined in Sections 4.1 and 4.2.

Main frame earthing connections must be checked for electrical and mechanical integrity.

4.9.2.2 Circuits

Circuit insulation must be megger tested with fuse and overload protection confirmed appropriate.

Polarity must be checked and the earth impedance of the power circuits measured.

Cable installations including trunking and tray work must be examined in accordance with Section 4.3

4.9.2.3 Emergency Lighting

Emergency lighting systems, whether supplied by remote battery back-up or integral batteries must be examined and their mechanical and electrical integrity checked. Emergency luminaries must be switched to back-up supply and the efficiency checked over the specified discharge period.

4.9.2.4 Fire Systems

Because of the sensitivity of the sensors and the sometimes sophisticated control systems, it is advisable to have the systems integrity examined by specialised technicians, possibly manufacturers representatives.

4.9.2.5 Kitchens and Laboratories

Kitchens are areas of high activity, in which condensation and water are often present. In such locations it is essential that the electrical integrity of the system and equipment is properly maintained. Therefore in addition to the requirements above, enclosure sealing

arrangements together with equal potential bonding must be closely examined.

Kitchens normally contain numerous appliances (portable) and it would therefore be prudent to examine them as part of the kitchen programme.

Laboratories are in a similar category to kitchens with the additional problem of corrosive substances and explosive vapours present. There is therefore, the potential for electrical fittings to deteriorate as a consequence, particularly on benches and equipment installed within fume cupboards. At these locations, all equipment must be examined and where certified (Ex), it must include examination in accordance with Section 4.12.

4.9.3 Frequency of Examination

Installations within buildings are subjected to little physical abuse and environmental degradation. Therefore the interval between examination should be about four years, with the possibility of shorter periods as found necessary.

For kitchens and laboratories in the higher risk categories, frequencies in the order of two years would be more appropriate.

4.10 Inverters, Chargers and Other Solid State Devices (Inclusive of Associated Batteries)

4.10.1 Introduction

Modern a.c./d.c. conversion equipment is very sophisticated and easily damaged by inexperienced technicians. It is therefore, advisable wherever possible, to have the integrity of this equipment assessed by manufacturers representatives or some specialised agent with the access to specialised data, drawings and know how. However, simple non-intrusive inspections are recommended.

4.10.2 Essential Requirements for Inspection and Testing

Examinations in accordance with manufacturers recommendations including a proof test of protective devices, electrical integrity checks and operational functionality must be carried out.

Back-up battery systems must be regularly inspected and maintained in accordance with the manufacturers recommendations. It is important to ascertain that batteries can continue to support loads for the periods specified. Therefore, load tests (discharge) must be carried out and the performance checked against the batteries discharge characteristic.

When assessing a battery's ability to support loads, it is very important to make allowances for voltage drop where long cable runs are involved.

Non-intrusive inspection must include a check of any air filter and ventilation fans. Capacitor banks, chokes, transformers and components generally must be checked for signs of overheating.

4.10.3 Frequency of Examination

Full examination may, depending on the arrangement, require the system to be taken out of service or put on by-pass. This may inconvenience plants or jeopardise reliability of critical supplies. It is therefore, common practice to tie full examinations into plant overhaul programmes. Acceptable examination intervals of up to three years are therefore common.

Non intrusive inspections will depend to a large extent on the local operating and environmental condition . However, as a general guide, a frequency in the order of one year would be appropriate.

4.11 Valve Actuators

4.11.1 Introduction

Valve actuators are electrically very reliable with most faults arising from mal-operation. Also, because some valves are infrequently used, problems can arise from lack of use. As most actuators are on hydrocarbon duties they are usually certified for hazardous areas and examination for compliance assessment is necessary.

4.11.2 Essential Requirements for Inspection and Testing

Integral motor and contactor insulation must be tested and inspected for signs of overheating on insulation, terminations and contacts.

Control circuits must be proved against schematics.

Integral torque and limit switches must be checked for correct settings.

The condition of the frame and cable glanding must be assessed and the compliance with the Ex certification confirmed.

4.11.3 Frequency of Examination

Non-intrusive inspection of actuators, including Ex certification checks, should be carried out at frequencies of two years. Major examinations including limit and torque switch checks, should be carried out at frequencies in the order of four years.

It is further necessary that the valve is operated (stroked) during plant shutdown in order to be assured that the valve is in fact operable and not in a seized condition.

4.12 Hazardous Area Equipment

4.12.1 Introduction

Several techniques and combination of techniques are now available to protect hazardous environments from the ignition sources associated with electrical equipment/systems. Each technique requires special



design features which are critical to its effectiveness. To ensure the continuing effectiveness of equipment/systems, the particular design features need to be understood with appropriate examination programmes developed and regularly carried out.

4.12.2 Essential Requirements for Inspection and Testing

4.12.2.1 All Types

The Ex certification of all components and the methods of installation must be examined for compliance with the classification requirements of the area. Attention must be given to any area classification revisions which may have been made since previous examinations were undertaken.

Enclosures, glasses, seals, glands rotating elements and special flanges etc. must be closely examined for defects which could impair the Ex effectiveness.

Weather proofing systems must be checked and effectiveness established.

Insulation of the equipment/systems must be measured. Terminations must be proved sound.

Earth bonds should be checked for soundness and the earth resistance and loop impedance measured.

These measurements may introduce stray current into hazardous areas and should therefore, only be conducted when it is safe to do so.

Fuses and protective devices including those which maintain certificated equipment at or below their maximum continuous rating and in compliance with their temperature('T') classification (where applicable) must be examined and the rating confirmed suitable. The device must be tested where it is appropriate, the operating characteristic checked and set point confirmed .

Electrical apparatus must not be opened in a hazardous area until it has been properly isolated (including the neutral) from its source of supply and precautions taken against its reinstatement.

4.12.2.2 I.S. (Ex 'i') Circuits Additional Requirements

Intrinsically safe diode safety barrier earths, transformer screen earths and barrier relay frame earths must be inspected and the resistance measured between the respective common earth rails and the main supply earth. Before testing, care must be taken to ensure that tests will not inadvertently damage any components in the equipment under test or any associated systems.

All fuses and lamps in intrinsically safe systems and self contained intrinsically safe apparatus which can easily be replaced, must be



inspected to ensure that they are of the type and rating specified in the documentation.

Diode safety barriers must be inspected to ensure correct barriers are fitted and that they remain firmly fixed to the earth bar.

Diode safety barrier boxes and junction boxes must be inspected to ensure no wiring other than that specified in the documentation has been introduced.

All interposing relays and other devices acting as safety barriers between circuits must be checked to ensure segregation has been afforded.

Barrier devices should be disconnected prior to carrying out insulation test on equipment or cables.

4.12.2.3 Pressurised (Ex 'p') Special Requirements

Protective gas must be sampled and proved to be free of contaminants.

Pressure/flow must be checked for adequacy.

Pressure/flow alarms, indicators and interlocks must be tested and functionally checked.

Start up purge cycle equipment must be inspected and tested in accordance with specification.

The condition of ducting must be assessed and gas alarms tested.

The condition of pressurised enclosures must be inspected.

4.12.2.4 Increased Safety Devices(Ex'e') Special Requirements

The adequacy of motor air gaps and running clearances must be checked.

4.12.2.5 Type N protection(Ex 'n')

The adequacy of motor air gaps and running clearances must be checked.

Enclosed break and hermetically sealed devices must be checked for damage and correct operation.

4.12.3 Frequency of Examination

In view of the importance of having a high degree of integrity on all Ex systems, an initial examination (see Section 2.8(a)) should be performed within two years of commissioning.

Visual and non intrusive inspections to assess the external condition needs to be carried out at two yearly intervals.



Full examination programmes including the examination of protective devices should be undertaken on three yearly intervals.

See also Table 1 and associated footnote.

For discrete items of equipment which can be isolated from their supply e.g. electric motors, individual examinations must be carried out. On systems comprising complex networks made up of many components e.g. lighting system comprising numerous junction boxes and lighting fittings, examinations on a sample basis may be considered. The sample should not be less than 10% of the system including 10% of each type of component making up the system.

5. REGIONAL ANNEX

5.1 United Kingdom Applications and Support Documentation

5.1.1 Statutory Regulations

It is incumbent upon the designer of a system and an operator of a system to conform with Statutory Regulations. It is an offence not to do so and both company and individual can be liable for prosecution. Notwithstanding this, the Statutory Regulations set out to specify essential requirements for safety. They are not designed to be prescriptive in terms of method.

Within the UK, Statutory Regulations are derived from Acts of Parliament. There are two main Acts of Parliament which give rise to Statutory Regulations:-

- (1) The Health and Safety at Work Act 1974
- (2) The Mineral Workings (Offshore Installations) Act 1971

Regulations which effectively are Statutory requirements derived from the Acts of Parliament are termed "Statutory Instruments" (SIs).

Apart from the SIs applicable to UK installations (and those where UK Legislation applies) there are a growing number of European Directives to which member states of the EEC are obliged to conform. It is incumbent on designers and operators of plant and systems that they conform to these regulations.

However, notwithstanding the provisions of this RP, it should be borne in mind that the Operator of a system is charged with ensuring that his Inspection and Maintenance practices support the safety requirements of the legislation.

5.1.1.1 [Statutory Instrument 1989 No. 635](#) - The Electricity at Work Regulations 1989

These regulations made under the [Health and Safety at Work act 1974](#) came into force in April 1990. The purpose of these regulations is to



require that precautions be taken against the risk of death or personal injury from electricity in work activities.

By virtue of [SI 1977 No. 1232](#) - Health and Safety at Work Act 1974 (Application outside Great Britain) Order 1977, [SI 1989 No. 635](#) is not applicable to Offshore Oil Rigs.

However see the guidance notes to Section 5.1.1.2

While there are regulations applicable to the design, construction and operation of electrical systems, this BP Recommended Practice specifically addresses the requirements of Regulation 4 viz. 4.2 and 4.4. of the Regulations.

Regulation 4.2 Is concerned with the need for maintenance to be done in order to ensure safety of the system. The regulation obliges the company to maintain the system if danger would otherwise result.

Regular examinations of electrical systems is an essential requirement for meeting this obligation.

Records of examination are the means for establishing the condition of the equipment and the effectiveness of the maintenance policies.

Regulation 4.4 Is concerned with equipment provided to protect people working on or near electrical equipment. The obligation is the assurance that such equipment is maintained in condition suitable for that use.

Again with this regulation there is the requirement for the regular examination with records kept to confirm condition and effectiveness of maintenance policies.

For guidance on these regulations refer to :-

HSE Memorandum of guidance on the Electricity at Work Regulations 1989

5.1.1.2 [Statutory Instrument 1974 No 289](#) - Offshore Installations

These Regulations were based upon the requirements of the Mineral Workings (Offshore Installations) Act 1971. The SI contains a number of sections relating to engineering disciplines. This BP Recommended Practice sets out to satisfy Section 40 of the SI.

Following the publication of Lord Cullen's Report on the Piper Alpha Disaster (CM 1310), the HSE have amended parts of this SI in 1992 and have indicated an intention to produce a new SI to replace [SI 1974 No. 289](#). It is the intention that the new SI would not be prescriptive and would be based upon the identification of standards for safety and good practice. In the modifications made to the existing SI there is reference to the requirements of The Health and Safety at Work Act 1974. The SI derived from this Act is [SI 1989 No 635](#) which is specifically not applicable to Offshore Oil Installations. The validity for exclusion of [SI 1989 No. 635](#) from being considered for Offshore use must therefore be in some doubt. The approach to inspection and maintenance for Offshore Platforms should therefore be considered against the requirements of [SI 1989 No. 635](#) as well as [SI 1974 No 289](#).



5.1.2 Other Regulations

5.1.2.1 IEE Wiring Regulations 16th Edition(Current Edition)

The commonly known IEE Regulations have been issued as [BS 7671](#). The IEC equivalent is [IEC 364](#).

These are non statutory regulations which are applied mostly to systems with voltages up to 1000 volts. The regulations are a code of practice widely accepted in the industry and compliance with them, in so far as they apply, is likely to achieve compliance with the Electricity Regulations. If departure from these regulations is deemed necessary, there must be a sound justification which could be tested in court in the event of a serious incident.

5.1.2.2 IEE Recommendations for the Electrical and Electronic Equipment of Mobile and Fixed Offshore Installations

See the text for clause 5.1.2.1 above

5.1.2.3 IEE Regulations for the Electrical and Electronic Equipment of Ships with Recommended Practice for Their Implementation.

This document contains comprehensive reference to the statutory requirements associated with electrical installations in ships registered under the United Kingdom Merchant Shipping Act 1894.

5.1.3 National Codes & Standards

The following documents give detailed guidance on many of the recommended practices outlined in this code. They are not statutory. However, they do represent the standard practices for the industry in the U.K. and are referenced in the Electricity Regulations. Should departure from these codes be deemed necessary, there must be a sound justification for such departures which could be tested in court in the event of a serious incident.

British Standards

[BS 6423](#) (1983)

Maintenance of Electrical Switchgear and Controlgear for Voltages up to and Including 650 V

[BS 6626](#) (1985)

Maintenance of Electrical Switchgear and Controlgear for Voltages above 650 V and up to and Including 36 KV

[BS 6867](#) (1987)

Maintenance of Electrical Switchgear for Voltages Above 36 KV

[BS 5730](#) (1979)

Maintenance of insulating oils

[BS 5345](#) (1976)



Selection, Installation and Maintenance of Electrical Apparatus for Use
In Potentially Explosive Atmospheres (other than mining applications
or explosives processing and manufacture)
Parts 1-12

[BS 171](#) (1970)
Power Transformers

[BS 148](#) (1984)
Insulating Oil for Transformers and Switchgear

[BS 5490](#) (1977)
Specification for Degrees of Protection Provided by Enclosures

[BS 4999](#) (1987) Part 0 and Parts 101- Parts 147
General Requirements for Rotating Machinery

[BS 4675](#) (1987)
Mechanical Vibration in Rotating Machinery

[BS 5000](#) (1981)
Rotating Electrical Machines of Particular Types or for Particular
Applications

[BS 6651](#) (1990)
Code of Practice for Protection of Structures Against Lightning

[BS CP 1013](#) (1965)
Earthing

[BS CP 7361](#) (1991)
Cathodic Protection

International Standards

[IEC 34](#)
Rotating Electrical Machines

[IEC 76](#)
Power Transformers

[IEC 79](#) Electrical Apparatus for Explosive Gas Atmospheres

[IEC 529](#) Degree of Protection Provided by Enclosures (IP code)

[IEC 567](#)
Guide for the sampling of gases and of oil from oil filled electrical
equipment and for the analysis of free and dissolved gases.

[IEC 422](#)
Code of Practice for the Maintenance of Insulating Oils

[ISO 2372](#)
Mechanical vibration of machines with operating speeds from 10 to 200
rev/s.

Other Regulations, Codes and Guidance:-

HOME OFFICE [Petroleum\(Consolidation\) Act, 1928](#)

Model Code of Principles of Construction and Licensing Conditions
(Part 1)

for

The storage of cans, drums and other receptacles and Petrol Filling
Stations

and

Model Code of Principles of Construction and Licensing Conditions
(Part 2)

for

Distribution Depots and Major Installations

*Currently there is a transition of responsibilities for the administration of this act
from the local authorities to the HSE.*

*The [HSE Guidance Notes No's 51,\(HS\(G51\) \)](#) replaces the 'Home Office Model
Code of Principles of Construction and Licensing Conditions Part 1 Section 1;
Storage of Cans, Drums and Other Receptacles.*

For filling stations [HS\(G\)41](#) replaces the guidance given in Part I Section 2

*Part 2 dealing with distributing depots and major installations has been replaced
by [HS\(G\)50](#) and [HS\(G\)52](#)*

[IS 128 \(ROSPA/ICY\)](#)

Portable electrical apparatus

I.E.E. Recommendations for the electrical and electronic equipment of
mobile and offshore installations.

5.1.4 Proposed European Directives

The European Commission is drafting Directives that will be enacted as
National Statutory Regulations (WARNING: These Directives may
change before acceptance). This Recommended Practice is considered
to include within its scope the current (1993) understanding of the
Proposals for the following:-

(a) ATEX 100A DGIII - [Directive No. 10518/91](#)

Proposal for a Council Directive on the approximation of the
laws of the member states concerning Equipment and Protective
Systems Intended for use in Potentially Explosive Atmospheres
- COM (91) 516.



(b) ATEX 118A DGV - [Directive No. 0427/2/93 EN](#)

Draft Proposal for a Council Directive on the approximation of the laws of the member states concerning minimum requirements for improving the safety and health protection of workers potentially at risk from Explosive Atmospheres.

Note: The current draft excludes 'Extractive Industries' i.e. offshore production platforms.



EQUIPMENT SYSTEM TYPE	SECTION	EXAMIN. INTRVLS			COMMENTS
		Initial (Years)	Regular (Years)	Intermediate Inspection (Years)	
Switchgear and starters	4.1	3 2 (+)	4 2 (+)	1 (-)	(+) For S/G situated in outside locations offshore (-) Distribution Feeder Functionality Checks
Bus Bars	4.2	4 (+)	10 4 (+)	-	(+) For bus bars fitted with integral isolators and for protection testing
Cables and Accessories	4.3	-	4	-	Cables and accessories should normally be included in the connected equipments examination programmes
Transformers	4.4	1	4	1	
Rotating Electrical Machines	4.5	1	4(-)	3 (+) (-)	(+) To assess external condition and ex certification. (-) As an alternative, inspection interval may be determined by routine monitoring.
Fixed Lighting Installation	4.6	2 (+)	4	3 (+)	(+) To assess external condition and ex certification
Earthing and Bonding	4.7	-	6	(*)	(*) Flexible earthing associated with loading gantries may need to be checked weekly
Portable and Transportable Electrical Equipt.	4.8	-	1 4 (+)	(*)	(*) Onerous condition may dictate that inspections at weekly intervals particularly on ex equipment may be necessary. (+) Office Type Portable Equipment
Building Installations	4.9	-	4 2 (+)	-	(+) Kitchen and Laboratories
Inverters and Other Solid State Devices	4.10	-	3	1	Full examination should be carried out by specialist e.g. manufacturers
Valve Actuators	4.11	-	4	2 (+)	(+) Non-intrusive ex assessment
Hazardous Area Equipment (Certified)	4.12	2	4	2	

Note: Although BS 5345 indicates that 2 years should be the period for inspection associated with the common methods of explosion protection, it is generally understood to be a recommendation rather than a mandatory requirement. It is allowed that the period could differ from the 2 year value to account for particular conditions and circumstance. BP Practice would generally suggest extending the period to 3 years for motors and lighting systems except where environmental conditions would indicate shorter periods.

TABLE 1
- ELECTRICAL EQUIPMENT - EXAMINATION INTERVALS - GUIDE



DEFINITIONS AND ABBREVIATIONS**Definitions**

Standardised definitions may be found in the BP Group RPSEs Introductory Volume.

Abbreviations

ATEX	Atmosphere Explosive
BS	British Standard
CACA	Cooling air/Cooling Air (applied to heat exchangers)
CT	Current Transformer
HSE	Health and Safety Executive
HV	High Voltage
IR	Insulation Resistance
OCB	Oil Circuit Breaker
XLPE	Cross Linked Polyethylene



LIST OF REFERENCED DOCUMENTS

A reference invokes the latest published issue or amendment unless stated otherwise.

Referenced standards may be replaced by equivalent standards that are internationally or otherwise recognised provided that it can be shown to the satisfaction of the purchaser's professional engineer that they meet or exceed the requirements of the referenced standards.

BS 5345 Selection, Installation and Maintenance of Electrical Apparatus for Use in Potentially Explosive Atmospheres (Others Than Mining Applications or Explosives Processing and Manufacture). Parts 1-12

BP Group RP 32-3 Inspection & Testing of In Service Civil and Mechanical Plant - Management Principles
(replaces the relevant parts of BP CP 52)

See 5.1.3 for references applicable in the UK

