



RP 12-1

ELECTRICAL SYSTEMS AND INSTALLATIONS - GENERAL

April 1994

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BP GROUP RECOMMENDED PRACTICES AND SPECIFICATIONS FOR ENGINEERING											
Doc. No. RP 12-1		Issue Date Latest Amendment Date	April 1994								
Document Title ELECTRICAL SYSTEMS AND INSTALLATIONS - GENERAL											
APPLICABILITY Regional Applicability: International											
SCOPE AND PURPOSE This document is an introduction to the BP Group RP 12 series (replacing BP CP 17) of Recommended Practices. It outlines the scope of the series and provides a general guide for their use. Additionally, basic practice, common to all the Recommended Practices in the BP Group RP 12 series is detailed.											
AMENDMENTS <table border="0" style="width: 100%;"> <tr> <td style="width: 15%;">Amd</td> <td style="width: 20%;">Date</td> <td style="width: 20%;">Page(s)</td> <td style="width: 45%;">Description</td> </tr> <tr> <td colspan="4"> </td> </tr> </table>				Amd	Date	Page(s)	Description				
Amd	Date	Page(s)	Description								
CUSTODIAN (See Quarterly Status List for Contact) Electrical											
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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 is the general guide for the series of Recommended Practices which are the Electrical Engineering guidance on systems design considered appropriate to the businesses of BP. The BP Group RP 12 series embody the range of electrical engineering advice which is available and the BP Group GS 112 series represent the specifications which, in turn, are the technical specifications for purchase of equipment which would form part of the electrical system. This document provides the basis for the approach to producing the BP Group RP 12 series and therefore subsequently the BP Group GS 112 series. This document will provide an indication of approach sufficient to enable extrapolation to take place in relative confidence.

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 document replaces BP CP 17 Part 1 and has been updated to reflect emerging BP, European and International Standards.

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. SCOPE

This Recommended Practice provides information common to all BP Group RP 12 series documents together with an illustration of the approach which has been adopted in the preparation of the BP Group RP 12 series.

2. SCOPE OF THE BP GROUP RP 12 SERIES

The BP Group RP 12 series of documents represent guidance for designers, constructors and operators of power systems. The approach is from a basic design viewpoint with legislation, safety and best practices in mind and constructors and operators should supplement the documentation with detailed practices to cover maintenance and procedural construction practices. The BP Group RP 12 series therefore forms part of an overall series of electrical engineering guidance.

Although the following items may form part of electrical systems and installations in certain petrochemical installations, they have not been included in BP RPs. Wherever necessary relevant national or international standards should be employed to these systems:-

2.1 Design and installation of overhead lines.

BP RPs do not detail the use of overhead distribution or transmission systems. This is because Oil Industry practice tends to employ an underground cable approach which is more appropriate to hazardous area considerations. However the use of overhead distribution and transmission (as distinct from cables routed on trays or otherwise above ground) has an important application where there are appreciable distances between load centres of an operation and there are no hazardous areas to be traversed. Where such conditions exist overhead transmission is to be encouraged wherever there is cost benefit without overriding security reduction.

Although there are examples throughout the world where overhead transmission is used within Petrochemical plant areas, these applications should be considered with care. There are many normal environmental/atmospheric conditions and situations which can lead to overhead line arcing and this type of probability is not readily accepted by all authorities which may be concerned with safety regardless of the strict application of hazardous area classification and the probability that there will be no hazardous areas at the height of the overhead line. Notwithstanding this, overhead distribution and transmission is very often a low capital cost method of providing power over relatively long distances. Where adopted, overhead transmission/distribution design should be arranged in accordance with any local-to-site regulations or standards in order to be assured of the most cost effective use of materials and practices.

2.2 Design and installation of large power rectification plant.

The use of d.c. systems is generally limited to shutdown system, emergency supply systems, machine auxiliary/start up and UPS systems. Large power supplies using d.c. is not generally contemplated for Petrochemical Plants. Where large d.c. systems will be encountered this should be generally in accordance with the



dictates of the plant under construction and should be designed and installed in accordance with the national/international standards appropriate for that plant.

- 2.3 Design and installation of electrical systems which are special to mine winding plant, earth moving equipment, conveying, crushing and similar types of treatment plants.
- 2.4 Electrical systems in ships.
- 2.5 Electrical systems for subsea installations.
- 2.6 Electrical installations in commercial, administrative or domestic premises.
- 2.7 Electrical systems within oil or water wells.

3. APPROACH TO STANDARDISATION

All of the BP Group RPSEs have been produced with an international application in mind. For this reason the referenced standards throughout all documents tend to be IEC (International Electrotechnical Commission) standards. Only where IEC specifications are unavailable have other standards been referenced in the text of the documents.

This approach may be modified for use within any situation where there are dominant national standards by introducing a regional annex which provides acceptable local standards in the stead of any referenced IEC documents. The regional annex can be used to modify text within the main body of the RPs and in an extreme could completely represent the RP for that Region.

4. SPECIFICATIONS AND DRAWINGS

- 4.1 A number of BP Group Guidance for Specification for electrical equipment (BP Group GS 112 series) are referred to in the various Parts of BP Group RP 12 series.
- 4.2 Alternative specifications and standard drawings from companies acting on behalf of BP may be applied under some circumstances and where these will be equal or superior to the BP RPSEs and where advantages are apparent.

Where it has been decided that a Contractors normally applied Codes of Practices and Standards for equipment purchase will provide an equally acceptable installation to the BP RPSEs and there will be time and cost savings incurred, then adopting the Contractors standards will be sensible. However care should be taken to ensure that there will be



no later difficulties should the installation require any spares or practices which would prove unusual for the operational area which the installation will be subjected to.

5. STATUTORY REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

- 5.1 All electrical systems and installations must comply with the relevant national and local regulations. These may be less stringent than the requirements of RP 12 series. In a number of countries, the relevant regulations are supported by codes or other guidance material produced by national standards organisations, licensing or similar certification bodies.

Where local standards would be less stringent than the provisions of a BP Group RP 12 series document a policy decision needs to be taken prior to the application of BP Group RP 12 series for design purposes. Often the local regulations can be based upon industry which differs greatly from the petrochemical industry and adherence to regulations which are based upon that industry could jeopardise the petrochemical operation. Should it be decided that BP Group RP 12 series are inappropriate, it is recommended that a design review be undertaken at a preliminary stage of the project in order that basic safety and operability are assured.

- 5.2 In general the text of BP Group RP 12 series documents draw heavily on UK practice but it is not intended that the RPs should be limited to UK locations exclusively. For areas where UK practice is not fully appropriate, a supplementary list of statutes and standards should be developed and used for each application.

- 5.3 In the UK, electrical installations in premises which are within the scope of the Health and Safety at Work Act 1974, must comply with The Electricity at Work Regulations 1989. Installations in UK offshore waters must comply with the United Kingdom Mineral Workings (Offshore Installations) Act, 1971 and Statutory Instrument (SI) 289, 1974. Further guidance on this legislative document can be found in the relevant part of the Department of Energy, Offshore Installations: Guidance on Design, Construction and Certification. It is the responsibility of the application engineer to be aware of the impact which European Directives are bringing to the Legislative requirements and to be assured that the designs are in accord with such legislation.

Legislation in Europe is currently being forged and presented by means of European Directives. The directives lead to the preparation of suitable European standards and these in turn are being based upon those IEC documents. Since the BP Group RPSEs are themselves based upon IEC documents the approach adopted should be aligned with the current way in which European Directives are being interpreted. Notwithstanding this it is necessary to always be alert to any changes occurring in the developing Standards and to modify or align the BP approach as necessary.



6. MATERIALS AND WORKMANSHIP FOR ELECTRICAL INSTALLATIONS

- 6.1 For any particular new (or extension to an existing) project, the appropriate standards for construction should be identified prior to the design stage. The materials and workmanship for electrical systems and installations should therefore comply with this standard.

This Specification may be one assembled specific to a Project or may take the form of BP Group GS 112-1 'Electrical Engineering Specification for Materials and Workmanship'.

- 6.2 Items of specialist electrical equipment e.g. switchgear, control gear, etc. should where practicable and economical be installed, erected and commissioned by the manufacturer of the equipment. Alternatively the manufacturer should be asked to provide supervision of handling and erection and undertake the commissioning.

In this manner the manufacturers recommendations which may be particular to his equipment would be followed, together with any recommendations regarding the use of special tools and test equipment.

7. OFFSHORE ELECTRICAL INSTALLATIONS

- 7.1 Offshore electrical installations contain features which are particular to that environment and require special attention. These special features ranging from Legislative through environmental to safety form the basis of advice contained in relevant BP Group RP 12 series documents. Where the design approach is modified from the RPSEs provisions, these features shall be fully considered to ensure that a short term or narrow view expediency does not compromise overall safety or economy.

These special features include:-

- (a) *The systems are normally self sufficient (not interconnected with a 'grid') and usually have integrated electrical generation by gas turbines. Diesel generators are generally used for emergency and 'black start' conditions.*
- (b) *A very large proportion of the electrical load consists of motors of which 60 to 70% may be connected directly at the generation voltage.*
- (c) *Several of the motor drives may be d.c.*
- (d) *Modular construction techniques are applied with the inherent consequences for cabling systems.*
- (e) *Individual module construction will frequently comprise an assembly of packages of plant and machinery with individual elements of electrical apparatus.*



- (f) *A considerable premium is placed on the weight and space requirements for erection and operation and maintenance of all equipment including that for electrical systems.*
- (g) *Offshore erection and construction is considerably more costly than similar activities for shore based installations.*
- (h) *The equipment is required to operate in particularly exposed and corrosive environments.*

Deviations from RPs are to be encouraged wherever there is the possibility of economy. There is often difficulty in determining whether the deviation is sensible as the 'full view' of the matter is not always possible. It is for this reason that one needs to consider the special environmental factors of Offshore Engineering.

8. ENVIRONMENTAL PROTECTION

- 8.1 Electrical equipment, components, installation materials, wiring, cabling and supporting arrangements should be specified suitably for the particular environmental and climatic conditions.

Electrical equipment should be specified for continuous operation at maximum or duty rating in an ambient temperature of 40°C, unless confident of an alternative value dictated by the environmental conditions.

- 8.2 In locations where electrical equipment, wiring and cabling etc. is exposed to direct sunlight for continuous periods, detachable metal sunshades may be provided to avoid the application of significant derating factors for solar gain.

The use of sun shades can also play a strong part in safety issues associated with hazardous area classification. Where local metal surfaces can exceed 55°C, Diesel fuel can be considered as a Classified material and can give rise to an area classification. In general it would be more convenient and more safe if the amount of classified areas is minimised.

- 8.3 The degree of ingress protection (IP) of electrical equipment shall, as a minimum, be as follows:-

Exposed to the environment	IP 54
Indoor locations	IP 42
Between adjacent compartments in electrical apparatus	IP 40

These degrees of protection shall be in accordance with the classifications given for electrical equipment in the relevant International Standard for that equipment e.g. [IEC 34](#) for Machines, or [IEC 529](#) for other equipment as appropriate.



In these classifications, the first numeral indicates, on a scale from 0 to 6, the degree of protection of persons against contact with live or moving parts inside the equipment and also the degree of protection against the ingress of solid foreign bodies. The second numeral indicates, on a scale from 0 to 8, the degree of protection against harmful ingress of water.

In offshore exposed locations, the need to enhance the degree of protection against the ingress of water shall be taken into account.

- 8.4 A reduction of the first numeral for indoor locations or between adjacent compartments may be permitted for equipment ventilation and rating purposes. However this should not be less than 2.

Where an IP value of less than 2 is allowed there will be a danger of contact between the compartments during maintenance activities and therefore it is considered dangerous to go below this value.

- 8.5 For equipment subject to water jets or heavy rainfall/spray over long or continuous periods, the second numeral (protection against ingress of liquid) should be increased to 5 as a minimum.

- 8.6 In saline atmospheres the use of dissimilar metals in contact with each other either in the external enclosure, or in the mounting or installation of the equipment, shall be avoided to prevent galvanic corrosion.



DEFINITIONS AND ABBREVIATIONS

Definitions

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

Abbreviations

CENELEC	European Standardisation Body (Electrical)
IEC	International Electrotechnical Commission
IP	Ingress Protection
UPS	Uninterruptible Power Supply

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.

International Standards

[IEC 34](#) Rotating Electrical Machines

[IEC 529](#) Specification for Degrees of Protection Provided for Enclosures (IP Code)

BP Group Documents

BP Group [GS 112-1](#) *Electrical Engineering Specification for Materials and Workmanship.
(replaces BP Std 121)*

