



Document No.	GIS 12-801
Applicability	Group
Date	26 November 2003

Guidance on Industry Standard for Power Generators (IEC)

GIS 12-801

BP GROUP
ENGINEERING TECHNICAL PRACTICES

Foreword

This is the first issue of Engineering Technical Practice (ETP) GIS 12-205. This Guidance on Industry Standard (GIS) is based on the following heritage documents from merged BP companies:

AMOCO (ACES)

A EL-MT-546-P Electrical—Generators—Synchronous—Supply Specification

ARCO (APCES)

ES 406-91 Form-Wound Brushless Synchronous Generators 500 Horsepower and Larger

BP (RPSE)

RP 12-11 Electrical Systems and Installations - Generators
GS 112-4 Guidance for Specification High Voltage Induction Generators

BP Chemical US

CP 17-3-3 Synchronous Generators

Copyright © 2003, BP Group. All rights reserved. The information contained in this document is subject to the terms and conditions of the agreement or contract under which the document was supplied to the recipient's organization. None of the information contained in this document shall be disclosed outside the recipient's own organization without the prior written permission of Manager, Standards, BP Group, unless the terms of such agreement or contract expressly allow.



Table of Contents

	Page
Foreword	2
1. Scope	5
2. Normative references.....	5
3. General.....	6
3.1. Documentation.....	6
3.2. Exceptions	6
3.3. Conflicts.....	6
3.4. Quality assurance	6
4. Standard design requirements	6
4.1. General.....	6
4.2. Certification for use in hazardous areas	6
5. Special design requirements.....	7
5.1. Duty and rating	7
5.2. Construction.....	7
5.3. Environmental protection	7
5.4. Windings and cable terminations	8
5.5. Excitation system	10
5.6. Bearings and lubrication.....	11
5.7. Critical speeds	12
5.8. Vibration	12
5.9. Plant identification.....	13
5.10. Mechanical handling	13
5.11. Painting.....	13
6. Noise	14
6.1. Noise emission	14
6.2. Noise reduction	14
7. Tests.....	14
7.1. Standard tests.....	14
7.2. Overspeed test	15
7.3. Heat run.....	15
7.4. Vibration	15
8. Documentation.....	15
8.1. Data sheet	15
8.2. Coil quality and interturn tests	15
8.3. Winding data.....	15
8.4. Test documentation	15
8.5. General arrangement drawing.....	15
9. Packaged units	16



9.1. Package Requirements.....	16
9.2. Special design requirements.....	17
9.3. Package testing	19
Bibliography	20

Uncontrolled Copy



1. Scope

This GIS provides guidance on industry standard for the design, materials, fabrication, inspection, testing, documentation, and preparation for shipment of power generators based on IEC standards.

2. Normative references

The following normative documents contain requirements that, through reference in this text, constitute requirements of this technical practice. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this technical practice are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies.

BP Engineering Technical Practices (ETP)

GIS 12-051	Guidance on Industry Standard for Transformers & Reactors (IEC)
GP 12-30	Guidance on Practice for Lighting and Small Power

British Standard (BS)

BS 4999-140	General requirements for rotating electric machines—Part 140: Specification for voltage regulation and parallel operation of a.c. synchronous generators
BS 5000-3	Rotating electrical machines of particular types of for particular applications—Part 3: Generators to be driven by reciprocating internal combustion engines

International Electrotechnical Commission (IEC)

IEC 60034-1	Rotating electrical machines – Part 1: Rating and performance.
IEC 60034-5	Rotating electrical machines – Part 5: Degrees of protection provided by the integral design enclosures of rotating electrical machines (IP code) – Classification.
IEC 60034-6	Rotating electrical machines – Part 6: Methods of cooling (IC code).
IEC 60034-7	Rotating electrical machines – Part 7: Classification of types of construction, mounting arrangements and terminal box position (IM Code).
IEC 60034-14	Rotating electrical machines – Part 14: Mechanical vibration of certain machines with shaft heights 56 mm and higher – Measurement, evaluation and limits of vibration.
IEC 60079	Electrical apparatus for explosive gas atmospheres – All Parts.

International Standards Organization (ISO)

ISO 281	Rolling bearings – Dynamic load ratings and rating life.
ISO 492	Rolling bearings—Radial bearings—Tolerances.
ISO 1940-1	Mechanical vibration—Balance quality requirements of rigid rotors—Part 1: Determination of permissible residual unbalance.



3. General

3.1. Documentation

A specification suitable for enquiry or purchasing can be derived from this section of the GIS by retaining the technical body unaltered but omitting the data page and all commentary.

This section of the GIS shall be read in conjunction with an enquiry or purchase order and all data sheets associated therewith.

The purchaser and vendor shall both complete the data sheets.

3.2. Exceptions

Tenders for the supply of equipment against this section of the GIS shall either include an unqualified affirmation regarding compliance with this section of the GIS or a complete list of exceptions.

A vendor may offer other suitable proposals if price or technical advantage may accrue, but such proposals shall form a supplement to the main tender.

3.3. Conflicts

If any of the reference documents conflict and the provisions of section 3 of this section of the GIS do not establish definition, then the vendor shall highlight this, and shall state the basis of design used.

3.4. Quality assurance

Verification of the vendor's quality system is normally part of the pre-qualification procedure, and is therefore not specified in the core text of this section of the GIS. If this is not the case, clauses should be inserted to require the vendor to operate and be prepared to demonstrate the quality system to the purchaser. The quality system should ensure that the technical and QA requirements specified in the enquiry and purchase documents are applied to all materials, equipment and services provided by sub-contractors and to any free issue materials.

4. Standard design requirements

4.1. General

Generators shall comply with all relevant parts of IEC 60034.

Any requirement to meet other national interpretations of IEC 60034, with or without CENELEC Harmonisation Document requirements, must be identified and agreed in writing between the purchaser and the vendor. This procedure is intended to be the means by which particular local needs can be met whilst at the same time properly documenting deviations from the normal BP requirements.

4.2. Certification for use in hazardous areas

Generators for use in hazardous areas shall comply with the relevant parts of IEC 60079 or alternatively the relevant parts of the CENELEC 500XX series of documents or national variants.

Generators for use in hazardous areas in the European Economic Area must comply with the relevant EN 500XX series CENELEC standards or national variants and these should be referenced in place of the IEC 60079 series for the relevant protection concepts.

The manufacturer shall submit copies of the relevant certification documents with the tender.



5. Special design requirements

5.1. Duty and rating

Generators shall have a continuous running duty designated as type S1 in accordance with paragraph 4.2.1 of IEC 60034-1. In addition, diesel driven units shall be capable of running at 110% load for one hour in every twelve.

Diesel engines are permitted to develop for limited periods an output in excess of their rated output, this is normally 10%. As an electrical machine having a maximum continuous rating in accordance with IEC 60034-1 has no specified sustained overload capacity it is necessary to make this provision. There are no temperature rise limits specified for this overload condition.

Generators shall be capable of meeting their specified duty for 26,000 hours (3 years) without being stopped for maintenance purposes.

Alternating current generators driven by reciprocating internal combustion engines shall comply with BS 5000 Part 3 or equivalent.

5.2. Construction

Generator frame and enclosure shall be of welded steel plate and sheet to form a rigid, self-supporting and torsion-resistant assembly that can be shipped in one piece. The base structure shall have adequate facilities for lifting, levelling, aligning and anchoring the entire machine.

The preferred configuration of the generator and brushless exciter shall be horizontal construction with two or three pedestal-type sleeve bearings on a common baseplate, allowing separate removal of generator and exciter.

The cooling arrangement shall be IC511 for air-cooled machines and IC71W for water-cooled machines.

Cooling water for water-cooled generators shall normally have a maximum temperature of 25°C unless higher temperatures are specified in the data sheet. Cooler materials shall ultimately be matched to the cooling water analysis (furnished to the successful bidder) and the proposed materials shall be identified. Provision should be made within the generator to prevent leakage of cooling water on to the windings or rotating parts of the generator.

In the case of critical (unspared) machines, consideration should be given to specifying heat exchangers with double tube arrangement. This will minimise the possibility of damage to the high-voltage stator winding, particularly in those situations where top-mounted coolers are employed.

Horizontally mounted machines shall be IM 1001 and vertical flange mounted machines shall be IM 3011 in accordance with Code II of IEC 60034-7.

5.3. Environmental protection

The degree of ingress protection shall be in accordance with IEC 60529 and suitable for the application and installation site. If no data is available to indicate a more stringent specification and if an outdoor installation is involved, the protection shall be IP55.

The degree of ingress protection required (IP55) is entirely suitable for situations where machines are not subject to excessive dust settlement or immersion in water. If any doubt exists then the particular conditions pertaining should be evaluated and a special enclosure agreed between purchaser and vendor. If the machine will be installed inside an enclosure a rating of IP20 may be contemplated. However if the enclosure is large and there could be moisture or dust/debris above the machine the minimum protection to be specified should be IP23

