



Document No.	GIS 12-802
Applicability	Group
Date	31 October, 2003

Guidance on Industry Standard for Power Generators (API 546)

GIS 12-802

BP GROUP
ENGINEERING TECHNICAL PRACTICES

Foreword

This is the first issue of Engineering Technical Practice (ETP) GIS 12-802. This Guidance on Industry Standard (GIS) is based on the following heritage documents from merged BP companies:

BP (RPSE)

GS 112-6	Guidance for specification 112-6 electrical requirements for AC generators and generation packages
----------	--

BP Gulf of Mexico Deep Water (GOMDW)

EL-SP-4012	Synchronous generator addendum to API-546 “brushless synchronous machines”
------------	--

Uncontrolled Copy

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.



Downloaded Date: 6/17/2008 10:16:28 PM

The latest update of this document is located in the BP ETP and Projects Library

Documents
Document Sharing Hub
Page 2 of 17

Table of Contents

	Page
Foreword	2
Scope	4
1.6 Referenced Publications	4
Section 2 – Basic design.....	4
2.1 General.....	4
2.2 Electrical design.....	4
2.2.2 Stator windings	5
2.3 Insulation Systems.....	5
2.4 Mechanical design	6
Section 3 – Accessories.....	10
3.1 Terminal boxes	10
3.3 Bearing temperature detectors.....	11
3.4 Space heaters.....	11
3.5 Screens and filters	12
3.6 Alarms and control devices for generator protection	12
3.8 Vibration detectors	14
Section 4 – Inspection, testing, and preparation for shipment	14
4.2 Inspection	14
4.3 Final testing	15
Section 6 - Vendor's data.....	17
6.2 Contract data	17
Appendix B – Purchaser's synchronous generator data sheets.....	17



Scope

This document provides guidance on industry standard for the design, materials, fabrication, inspection, testing, documentation, and preparation for shipment of power generators based on API-546-1997, Brushless Synchronous Machines – 500 kVA and Larger. Numbering of the following sections and paragraphs corresponds to section and paragraph numbering of API-546-1997 and reflects additions, deletions, and revisions. Requirements of API-546-1997 that are not revised remain applicable.

1.6 Referenced Publications

Add:

American Society for Testing and Materials (ASTM)

D2471 Standard Test Method for Gel Time and Peak Exothermic Temperature of Reacting

National Fire Protection Association (NFPA)

NFPA 77 Recommended Practice on Static Electricity

Section 2 – Basic design

2.1 General

2.1.3 Revise to read:

Generator sound pressure level shall not exceed 85 dBA (reference = 10^{-12} W) measured at 3 ft.

2.1.7 Revise first sentence to read:

Electrical components and installations shall be suitable for the area classification (Class, Division, Group) specified on the data sheets and shall meet the requirements of NFPA 70, Article 500 as well as local codes.

2.2 Electrical design

2.2.1 Rating and voltage

2.2.2.1 Revise to read:

Unless specified otherwise on data sheets, generators shall be rated in accordance with Table 1.

Table 1 – Generator Ratings

kVA Ratings	Phase	Frequency (Hz)	Voltage
250-2500	3	60	480
250-10,000	3	60	4160
1000-12000	3	60	6900
4000-Above	3	60	13800



2.2.2 Stator windings**2.2.2.1 Revise to read:**

When differential protection is specified, neutral end of each stator-phase winding shall be brought out to terminal housing that encloses the current transformers.

Add:

- 2.2.2.3 Generator winding shall be capable of withstanding, without mechanical damage, for 30 seconds, a bolted three-phase and phase to ground short circuit at its terminals when operating at highest capability kVA, rated power factor, and at 5% over-voltage.
- 2.2.2.4 Windings shall also be capable of withstanding, without mechanical damage, for 30 seconds or less, a negative sequence current (I_2) at its terminals, expressed in terms of per unit stator current where $(I_2)^2 t$ is less than or equal to 30 or 40 (as specified on the data sheet), when operating at highest capability kVA, rated power factor and at 5% over-voltage.
- 2.2.2.5 Generator shall be capable of withstanding for 10 seconds, without damage, an excitation level in field winding corresponding to a fault current of 300% to 350% of full load current (per machine design) in addition to associated short circuit heating and forces in armature windings.
- 2.2.2.6 Generators shall be capable of withstanding the following without damage:
- 10% overload for 2 hours.
 - 50% overload for 30 seconds
- 2.2.2.7 Criteria for no injury to stator windings is that windings shall satisfactorily withstand a normal maintenance high-potential test and there is no visible abnormal deformation or damage to winding coils, wedges, blocking, lashings, connections or any other components of generator.

2.3 Insulation Systems**2.3.1 General requirements****2.3.1.1 Add:**

- Strand insulation shall, as a minimum, be fused Dacron glass applied over layer of enamel film or mica based resin impregnated system meeting or exceeding the total insulation temperature (Class F) and maximum voltage stress requirements.
- When fused, Dacron glass is used machines with operating turn-to-turn voltages in excess of 40 volts shall have an additional layer of turn insulation consisting of mica tape.

Add:

- 2.3.1.7 After each vacuum-pressure-impregnation (VPI) cycle, stators shall undergo a rotating cure process. After final cure, windings shall be given an anti-fungal treatment.
- 2.3.1.8 Stator coil and core assembly shall be immersed in VPI tank. "B-stage" VPI is prohibited.
- 2.3.1.9 Stator coils shall be free of voids.
- 2.3.1.10 VPI penetration inspection shall be performed in accordance with following procedure:
- Fabricate an extra (sacrificial) stator coil of core length.
 - Clamp in simulated stator slot portions.
 - Process with stator during VPI treatment
 - After VPI, dissect and analyze.
 - Verify that no voids exist in dissected sacrificial coil.



- 2.3.1.11 Verification, in accordance with ASTM D2471, of VPI epoxy resin viscosity and chemical polymerization (gel time) shall be provided when requested.

2.4 Mechanical design

2.4.1 Enclosures

2.4.1.1 General requirements

a. Revise to read:

Enclosure parts shall be made of heavy duty, corrosion resistant cast or nodular iron, cast steel, or steel plate.

b. Revise to read:

Air deflectors (baffles) shall be 316 SS.

c. Revise to read:

Enclosure bolts, studs, and other fastening devices shall be 316 SS. Internal fastening devices shall use locking nuts, lock-washers, or 316 SS tie-wire.

e. Revise to read:

Impact of potential risks due to circulating currents and static discharge in enclosure shall be considered for generators using multi-section enclosures installed in hazardous areas. NFPA 77, Recommended Practice on Static Electricity, shall be followed. Overheating or sparking due to possible circulating currents or static electricity shall be avoided by securing together the conducting components in a sound electrical and mechanical manner, and by providing equipotential bonding straps between the generator housing components and ground.

2.4.2 Frame and mounting plates

2.4.2.1 Revise second sentence to read (formula remains the same):

The frame of the completely assembled machine on the foundation with lateral stiffness greater than 1,000,000 lbf/in, with the rotor installed and rotating on its oil film, shall be free from structural resonance within +10% of the electric line frequency and twice line frequency and the following frequency ranges:

2.4.2.7.11 Revise to read:

Horizontal and vertical jacking bolts shall be 316 SS, ¾ inch minimum diameter with UNC threads

2.4.2.10 Revise second sentence to read:

Hold-down or foundation bolt holes shall be drilled perpendicular to the mounting surface or surfaces and, if the surface is a cast or other non-machined surface, spot faced to a diameter 200% of bolt head.

Add:

2.4.2.17 Mounting holes shall be 25% to 50% larger than the mounting bolt diameter.

2.4.2.18 Dowels, if provided, shall be Series 316 SS.

2.4.3 Frame connections

2.4.3.5 Revise to read:

Piping flanges shall conform to ASME B16.5, except as specified in 2.4.3.5.1 and 2.4.3.5.2.

