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Guidance on Practice for Uninterruptible Power Systems (UPS) and D.C. Power Supplies

GP 12-35

BP GROUP
ENGINEERING TECHNICAL PRACTICES

Foreword

This is the first issue of Engineering Technical Practice (ETP) GP 12-35. This Guidance on Practice (GP) is based on the following heritage documents from merged BP companies:

Amoco (ACES)

A EL-UPS-00-P Electrical—Uninterruptible Power Supply—Specification

ARCO (APCES)

ES 317-91F Instrument Power Supply Systems.

BP GOMDW

EL-SP-4050 Uninterruptible Power Supplies

EL-SP-4052 Batteries

BP Chemicals

CP 17-17-1 Uninterruptible Power Supply

CP 17-9-1 Station Batteries and Battery Chargers

BP (RPSE)

RP 12-5 Electrical Systems and Installations – Power Supplies for Control Systems

GS 112-10 Guidance for Specification GS 112-10 - Secure Static AC power Supplies for Control Systems

GS 112-11 Guidance for Specification GS 112-11 - DC Power Supplies

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1. Scope

This GP provides guidance for design, installation, and operation of uninterruptible power systems (UPS) and d.c. power supplies.

2. Normative references

The following normative documents contain requirements that, through reference in this text, 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)

DS 12-351	Uninterruptible power systems data sheet (IEC)
DS 12-352	Uninterruptible power systems data sheet (NEMA)
DS 12-354	Station battery data sheet (IEEE)
DS 12-356	Battery charger data sheet (NEMA)
GIS 12-051	Guidance on Industry Standard for Transformers (IEC)
GIS 12-052	Guidance on Industry Standard for Transformers (ANSI)
GIS 12-351	Guidance on Industry Standard for Uninterruptible Power Systems (IEC)
GIS 12-352	Guidance on Industry Standard for Uninterruptible Power Systems (ANSI)
GIS 12-354	Guidance on Industry Standard for Station Batteries (IEEE)
GIS 12-356	Guidance on Industry Standard for Battery Chargers (ANSI)
GIS 12-357	Guidance on Industry Standard for D.C. Power Supplies
GP 12-05	Guidance on Practice for Transformers
GP 12-25	Guidance on Practice for Earthing/Grounding

International Electrotechnical Commission (IEC)

IEC 60269-1	Low voltage fuses – Part 1: General requirements
IEC 60269-2	Low voltage fuses – Part 2: Supplementary requirements for fuses for use by authorized persons (Fuses mainly for industrial application)
IEC 60529	Classification of degrees of protection provided by enclosures
IEC 62040	Uninterruptible power systems (UPS) – All Parts

Institute of Electrical and Electronic Engineers (IEEE)

IEEE 446	Recommended practice for emergency and standby power systems for industrial and commercial applications
IEEE 484	Recommended practice for installation design and installation of vented lead-acid batteries for station applications
IEEE 485	Recommended practice for the selection and sizing lead-acid batteries for stationary applications
IEEE 1100	Recommended practice for powering and grounding sensitive electronic equipment (Emerald Book)
IEEE 1184	Guide for the selection and sizing of batteries for uninterruptible power supplies



National Electrical Manufacturers Association (NEMA)

NEMA PE 1	Uninterruptible power systems
NEMA PE 5	Utility type battery chargers
NEMA 250	Enclosures for electrical equipment (1000 Volts Maximum)

National Fire Protection Association (NFPA)

NFPA 70	National electrical code.
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Underwriters Laboratories (UL)

UL 1778	Standard for uninterruptible power supply equipment
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3. Classification of control systems and their power supplies**3.1. General**

- a. For ease of definition in this document the classifications, Class A, Class B, or Class C are used to describe the integrity required from a power supply. Control systems and their power supplies should be selected to reflect the following factors:

1. The required availability of each part of the overall system
2. The importance of the connected load in terms of overall plant operation
3. The quality and reliability of the primary power source

Class A systems typically are those for which the highest degree of security is required. These generally require two batteries and two rectifiers such that any one from the four elements could provide power.

Class B systems are those which would require one battery and an alternative mains derived supply.

Class C systems are those that could operate from mains power.

- b. Control system loads should be tabulated and their classification defined.
- c. Emergency and shutdown (ESD) systems should be classified Class A.

ESD systems are those that require the highest order of power supply security. On power loss the ESD system operates and the plant is shut down.

3.2. Class A systems

- a. Class A systems can be defined as those which by malfunction or failure could cause any of the following:

1. A shutdown of the whole or major part of a plant or process
2. A failure to shut down, under emergency conditions, the whole or major part of a plant or process
3. A loss of monitoring facilities on any equipment that may itself cause a shutdown of the whole or major part of a plant or process

Flame failure devices or monitoring equipment on certain items of machinery, which are critical to the whole or major part of a plant, should be considered as Class A systems.

4. A loss of alarm annunciation for fire and gas detection
5. A loss of alarm annunciation for any other system essential to a process such as burner logic alarms, etc



Alarm annunciation facilities in addition to those for fire and gas detection, which may be considered as Class A systems, could include:

Shutdown annunciators

Major machinery alarms, etc.

3.3. Class B systems

- a. Class B systems can be defined as those which by malfunction or failure could cause any of the following:

1. A degradation of normal control or monitoring of the plant or process if alternative methods of control such as local plant control panels, etc are available

This requirement is typified by systems such as:

A computer control supervisory system where instrumentation back-up exists in the event of failure of the computer system.

Control room operation where a control panel local to the plant exists.

The form of back-up control will usually lead to a demand for a temporary increase in operational staff which the operational organisation has to meet and this should be considered in system design.

2. An acceptable temporary loss of control of the whole or part of a plant or process

Typical of this would be for 50% of central control room screens to be supplied from one Class B UPS system. If the UPS output fails, the remaining 50% of screens would be supplied from a second Class B UPS.

3. A loss of alarm annunciation facilities not covered by 3.2

3.4. Class C systems

- a. Class C systems can be defined as those which by malfunction or failure could not seriously impair the continued safe operation of a plant or process, or the ability of the operator to monitor and control critical features of a plant or process.

Examples could be chart recorders and logging instruments which provide trends for later analysis but which do not influence the immediate plant operation.

4. Basic design requirements

4.1. General

- a. IEEE Std 446 chapter 5 gives guidance on the application of stored energy standby power systems.
- b. D.C. power supplies should comply with GIS 12-357.
- c. A.C. power supplies should comply with GIS 12-351 and GIS 12-352.

New technology trends in power supplies not covered by the above documents should not be discounted. Rotating UPS arrangements could be useful for the larger or intermittent load types of demand or if diesel engine back-up is also part of the UPS system.

- d. The security and configuration of the supply and distribution equipment should be consistent with the requirements of the overall control and standby supply philosophy.

