



IEEE Standard for Preferred Power Supply (PPS) for Nuclear Power Generating Stations (NPGS)

IEEE Power Engineering Society

Sponsored by the
Nuclear Power Engineering Committee

765TM

IEEE
3 Park Avenue
New York, NY 10016-5997, USA

18 October 2006

IEEE Std 765TM-2006
(Revision of
IEEE Std 765-2002)

IEEE Standard for Preferred Power Supply (PPS) for Nuclear Power Generating Stations (NPGS)

Sponsor

**Nuclear Power Engineering Committee
of the
IEEE Power Engineering Society**

Approved 8 June 2006

IEEE-SA Standards Board

Abstract: The design criteria of the preferred power supply (PPS) and its interfaces with the Class 1E power system, switchyard, transmission system, and alternate ac (AAC) source are described. This standard provides PPS requirements for nuclear power plants and guidance in the areas of AAC power source interfaces with PPS, physical independence of the PPS power and control circuits, and expanded PPS criteria for multi-unit stations.

Keywords: AAC, alternate ac source, Class 1E, NPGS, nuclear power generating station, PPS, preferred power supply, switchyard, transmission system

The Institute of Electrical and Electronics Engineers, Inc.
3 Park Avenue, New York, NY 10016-5997, USA

Copyright © 2006 by the Institute of Electrical and Electronics Engineers, Inc.
All rights reserved. Published 18 October 2006. Printed in the United States of America.

IEEE is a registered trademark in the U.S. Patent & Trademark Office, owned by the Institute of Electrical and Electronics Engineers, Incorporated.

Print: ISBN 0-7381-4988-8 SH95548
PDF: ISBN 0-7381-4989-6 SS95548

No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher.

IEEE Standards documents are developed within the IEEE Societies and the Standards Coordinating Committees of the IEEE Standards Association (IEEE-SA) Standards Board. The IEEE develops its standards through a consensus development process, approved by the American National Standards Institute, which brings together volunteers representing varied viewpoints and interests to achieve the final product. Volunteers are not necessarily members of the Institute and serve without compensation. While the IEEE administers the process and establishes rules to promote fairness in the consensus development process, the IEEE does not independently evaluate, test, or verify the accuracy of any of the information contained in its standards.

Use of an IEEE Standard is wholly voluntary. The IEEE disclaims liability for any personal injury, property or other damage, of any nature whatsoever, whether special, indirect, consequential, or compensatory, directly or indirectly resulting from the publication, use of, or reliance upon this, or any other IEEE Standard document.

The IEEE does not warrant or represent the accuracy or content of the material contained herein, and expressly disclaims any express or implied warranty, including any implied warranty of merchantability or fitness for a specific purpose, or that the use of the material contained herein is free from patent infringement. IEEE Standards documents are supplied “**AS IS.**”

The existence of an IEEE Standard does not imply that there are no other ways to produce, test, measure, purchase, market, or provide other goods and services related to the scope of the IEEE Standard. Furthermore, the viewpoint expressed at the time a standard is approved and issued is subject to change brought about through developments in the state of the art and comments received from users of the standard. Every IEEE Standard is subjected to review at least every five years for revision or reaffirmation. When a document is more than five years old and has not been reaffirmed, it is reasonable to conclude that its contents, although still of some value, do not wholly reflect the present state of the art. Users are cautioned to check to determine that they have the latest edition of any IEEE Standard.

In publishing and making this document available, the IEEE is not suggesting or rendering professional or other services for, or on behalf of, any person or entity. Nor is the IEEE undertaking to perform any duty owed by any other person or entity to another. Any person utilizing this, and any other IEEE Standards document, should rely upon the advice of a competent professional in determining the exercise of reasonable care in any given circumstances.

Interpretations: Occasionally questions may arise regarding the meaning of portions of standards as they relate to specific applications. When the need for interpretations is brought to the attention of IEEE, the Institute will initiate action to prepare appropriate responses. Since IEEE Standards represent a consensus of concerned interests, it is important to ensure that any interpretation has also received the concurrence of a balance of interests. For this reason, IEEE and the members of its societies and Standards Coordinating Committees are not able to provide an instant response to interpretation requests except in those cases where the matter has previously received formal consideration. At lectures, symposia, seminars, or educational courses, an individual presenting information on IEEE standards shall make it clear that his or her views should be considered the personal views of that individual rather than the formal position, explanation, or interpretation of the IEEE.

Comments for revision of IEEE Standards are welcome from any interested party, regardless of membership affiliation with IEEE. Suggestions for changes in documents should be in the form of a proposed change of text, together with appropriate supporting comments. Comments on standards and requests for interpretations should be addressed to:

Secretary, IEEE-SA Standards Board
445 Hoes Lane
Piscataway, NJ 08854
USA

Authorization to photocopy portions of any individual standard for internal or personal use is granted by the Institute of Electrical and Electronics Engineers, Inc., provided that the appropriate fee is paid to Copyright Clearance Center. To arrange for payment of licensing fee, please contact Copyright Clearance Center, Customer Service, 222 Rosewood Drive, Danvers, MA 01923 USA; +1 978 750 8400. Permission to photocopy portions of any individual standard for educational classroom use can also be obtained through the Copyright Clearance Center.

Introduction

This introduction is not part of IEEE Std 765, IEEE Standard for Preferred Power Supply (PPS) for Nuclear Power Generating Stations (NPGS).

This standard was originally prepared to provide detailed design criteria for the preferred power supply (PPS) to ensure a design commensurate with its intended function and to provide sufficient detail to interpret, clarify, and expand on guidance given in Title 10, U.S. Code of Federal Regulations, Part 50 (10CFR50 [B1]^a), Appendix A, General Design Criteria 17 and General Design criteria 18, and IEEE Std 308TM-1991.

Title 10, U.S. Code of Federal Regulations, Part 50 (10CFR50), Appendix A, General Design Criteria 17 (GDC-17) for nuclear power generating stations requires that an offsite electric power system be provided to permit functioning of structures, systems, and components important to safety. In addition, General Design Criteria 18 (GDC-18) provides requirements for inspection and testing of electric power systems.

In 1988, Title 10, Part 50.63 was added to the U.S. Code of Federal Regulations. Part 50.63 requires each light water-cooled nuclear power generating station to withstand a station blackout for a specific duration and to recover from it. In addition, Part 50.63 defines the requirements for coping with a station blackout by utilizing an alternate ac (AAC) power source.

The Nuclear Utility Management and Resource Council (NUMARC)^b provided additional guidance in NUMARC 87-00-1988, Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors. Since NUMARC 87-00 (Revision 1 August 1991) is not available for general public distribution, the guidelines contained therein were considered by the Working Group. The design requirements of AAC are outside the scope of this standard.

The previous revision of the standard added Annex A, which provides guidelines that may be used to preserve the reliability of the Preferred Power Supply in a deregulated environment.

This revision of the standard added Annex B, which provides guidelines for transmission system studies to ensure voltage adequacy of the PPS.

Notice to users

Errata

Errata, if any, for this and all other standards can be accessed at the following URL: <http://standards.ieee.org/reading/ieee/updates/errata/index.html>. Users are encouraged to check this URL for errata periodically.

Interpretations

Current interpretations can be accessed at the following URL: <http://standards.ieee.org/reading/ieee/interp/index.html>.

^aThe numbers in brackets correspond to those of the bibliography in Annex C.

^bThe Nuclear Energy Institute (NEI), established in March 1994, incorporates NUMARC.

Patents

Attention is called to the possibility that implementation of this standard may require use of subject matter covered by patent rights. By publication of this standard, no position is taken with respect to the existence or validity of any patent rights in connection therewith. The IEEE shall not be responsible for identifying patents or patent applications for which a license may be required to implement an IEEE standard or for conducting inquiries into the legal validity or scope of those patents that are brought to its attention.

Participants

This standard was prepared by Working Group 4.6 of Subcommittee 4, Auxiliary Power, of the Nuclear Power Engineering Committee. The working group had the following membership at the time this standard was approved:

George Attarian, *Chair*

Robert Carruth
Kenneth Fleischer
David Gladey
Kuljit Hara

Harvey Leake
John Mallanda
Gerald Nicely
David Sehi

Tom Sims
Brandon Swartley
Michael Tucker
Jennifer Weber

The Subcommittee on Auxiliary Power (SC4) of Nuclear Power Engineering Committee that recommended approval of this standard had the following membership:

Gerald Nicely, *Chair*

Harvey Leake, *Vice Chair*

George Attarian, *Secretary*

Vincent Andreozzi
John Bonner
Keith Bush
R.C. Carruth
John Carter
Kenneth R. Fleischer
Robert Fletcher
Amritpal Gill

David Gladey
Dale Goodney
Kuljit Hara
Evan Heacock
Paul Johnson
Bruce Lord
John MacDonald
John Mallanda

William Mindick
D. Roger Parker
David Sehi
Tom Sims
Robert Stark
Brandon Swartley
James Thompson
Michael Tucker
Jennifer Weber

At the time this standard was approved, the Nuclear Power Engineering Committee (NPEC) had the following membership:

John Disosway, *Chair*

John MacDonald, *Secretary*

Satish K. Aggarwal
Ijaz Ahmad
George Attarian
George Ballassi
Farouk D. Baxter
Brij M. Bhartey
Wesley W. Bowers
Daniel F. Brosnan
Nissen M. Burstein
Robert C. Carruth
John P. Carter
Stephen Fleger

Robert J. Fletcher
Robert Fuld
James Gleason
Dale T. Goodney
Britton P. Grim
William L. Hadovski
David A. Horvath
Paul R. Johnson
Harvey C. Leake
J. Scott Malcolm
Alexander Marion

Michael H. Miller
Gerald L. Nicely
Roger D. Parker
James Parello
Glen E. Schinzel
Neil P. Smith
James E. Stoner
James E. Thomas
John Waclo
John White
Paul L. Yanosy
David J. Zaprazny

The following members of the individual balloting committee voted on this standard. Balloters may have voted for approval, disapproval, or abstention.

William Ackerman	David Gladey	Gerald Nicely
Satish Aggarwal	Dale Goodney	Joshua Park
George Attarian	Randall Groves	Tom Sims
Farouk Baxter	Dennis Horwitz	Neil Smith
John Bonner	Joseph Jancauskas	James Stoner
Wesley Bowers	Paul Johnson	Brandon Swartley
Mark Bowman	Yuri Khersonsky	Shanmugan Thamilarasam
Daniel Brosnan	Robert Konnik	James Thomas
Mary Capelli-Schellpfeffer	Harvey Leake	Michael Tucker
Robert Carruth	John MacDonald	T. J. Voss
John Carter	Omar Mazzoni	John Waclo
Guru Dutt Dhingra	John Merando	Jennifer Weber
John Disosway	Gary Michel	James Wilson
Gary Engmann	William Mindick	David Zaprazny
Ajit Gwal	Michael Newman	

When the IEEE-SA Standards Board approved this standard on 8 June 2006, it had the following membership:

Steve M. Mills, *Chair*
Richard H. Hulett, *Vice Chair*
Don Wright, *Past Chair*
Judith Gorman, *Secretary*

Mark D. Bowman	William B. Hopf	Greg Ratta
Dennis B. Brophy	Joseph L. Koepfinger*	Robby Robson
William R. Goldbach	David J. Law	Anne-Marie Sahazizian
Arnold M. Greenspan	Daleep C. Mohla	Virginia C. Sulzberger
Robert M. Grow	T. W. Olsen	Malcolm V. Thaden
Joanna N. Guenin	Glenn Parsons	Richard L. Townsend
Julian Forster*	Ronald C. Petersen	Walter Weigel
Mark S. Halpin	Tom A. Prevost	Howard L. Wolfman
Kenneth S. Hanus		

*Member Emeritus

Also included are the following nonvoting IEEE-SA Standards Board liaisons:

Satish K. Aggarwal, *NRC Representative*
Richard DeBlasio, *DOE Representative*
Alan H. Cookson, *NIST Representative*

Michelle Turner
IEEE Standards Program Manager, Document Development

Contents

1.	Overview.....	1
1.1	Scope.....	1
1.2	Purpose.....	1
2.	Normative references	2
3.	Definitions	3
4.	General design criteria	3
4.1	General.....	3
4.2	Safety classification	3
4.3	Function	3
4.4	Capacity and capability.....	4
4.5	Availability	4
4.6	Independence	7
4.7	Design basis	8
5.	Specific design criteria.....	9
5.1	Transmission system interface.....	9
5.2	Switchyard interface	10
5.3	Class 1E power system interface	10
5.4	AAC source interface.....	11
6.	Surveillance, control, and test requirements	11
6.1	Surveillance requirements.....	11
6.2	Control requirements	11
6.3	Test requirements.....	12
7.	Multi-unit considerations	12
7.1	Sharing of PPSs	12
7.2	Shared system capability	12
7.3	Surveillance	12
7.4	Protective systems.....	12
7.5	Design basis	13
7.6	Shared controls and indication.....	13
	Annex A (informative) Guidelines for preferred power system reliability in a deregulated environment....	14
	Annex B (informative) Guidelines for transmission system studies to ensure voltage adequacy of preferred power supply	17
	Annex C (informative) Bibliography.....	19