

PUBLICLY AVAILABLE SPECIFICATION

PRE-STANDARD

Electrical installations in ships – Primary DC distribution – System design
architecture

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**ELECTRICAL INSTALLATIONS IN SHIPS –
Primary DC distribution – System design architecture**

FOREWORD

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A PAS is a technical specification not fulfilling the requirements for a standard, but made available to the public.

IEC PAS 63108 has been processed by IEC technical committee 18: Electrical installations of ships and of mobile and fixed offshore units.

The text of this PAS is based on the following document:

This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document

Draft DPAS	Report on voting
18/1560/DPAS	18/1574/RVDPAS

Following publication of this PAS, which is a pre-standard publication, the technical committee or subcommittee concerned may transform it into an International Standard.

This PAS shall remain valid for an initial maximum period of 3 years starting from the publication date. The validity may be extended for a single period up to a maximum of 3 years, at the end of which it shall be published as another type of normative document, or shall be withdrawn.

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INTRODUCTION

The majority of existing distribution systems of ships are AC systems with electric power generated by fixed speed generator sets and a fixed frequency and voltage for the distribution system. This is also reflected by the current parts of the IEC 60092 series. The ship owners are facing new environmental regulations and are asking for more flexible solutions to meet the new market demands. It is acknowledged that the maritime industry is developing new innovative power and distribution solutions enabling reduced emissions to air, as well as reduced fuel consumption. Next generation of distribution systems involves use of a variety of power sources and DC distribution architecture. Novel concepts for design and operation of electrical systems with energy storage and advanced control of main and emergency power sources, including essential load services such as propulsion systems have evolved. These energy systems combine a wide range of technologies that will improve the fuel and emission profiles and performance of ship operations.

The primary DC distribution system exploit new and radical approaches for system design/configuration, operation and control compared to conventional solutions for power generation and distribution systems.

This PAS intends to describe these solutions. A new IEC International Standard is scheduled to replace this PAS.

The main intention with this PAS is to set design and test criteria to power systems with primary DC distribution. Semiconductor devices used as breaker shall fulfil requirements for breaking current and isolation according to IEC 60947-2 and IEC 60947-3.

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ELECTRICAL INSTALLATIONS IN SHIPS –

Primary DC distribution – System design architecture

1 Scope

This PAS specifies the requirements of primary DC distribution systems and interconnected installations.

The requirements of this PAS establish general principles for

- operations, without degrading unit and human safety, capable of a reduced environmental footprint,
- existing and new power generating units, new DC distribution concepts for electrical power, energy storage and advanced control of a total power balance, including semiconductor converters (AC to DC, DC to DC and DC to AC power converters) and dynamic load controllers, and
- relevant system studies and calculations demonstrating a protection philosophy as needed for necessary selectivity, segregation methods and equipment.

This PAS also gives guidelines for integration of energy sources of different nature and suitable ways to identify locations of such installations.

2 Normative references

[IEC PAS 63108:2017](https://standards.iteh.ai/catalog/standards/sist/8a19d1e2-3d9e-4907-b151-fc182104bpa118-3)

[https://standards.iteh.ai/catalog/standards/sist/8a19d1e2-3d9e-4907-b151-](https://standards.iteh.ai/catalog/standards/sist/8a19d1e2-3d9e-4907-b151-fc182104bpa118-3)

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60034 (all parts), Rotating electrical machines

IEC 60092 (all parts), *Electrical installations in ships*

IEC 60092-101:1994, *Electrical installations in ships – Part 101: Definitions and general requirements*

IEC 60092-101:1994/AMD1:1995

IEC 60092-301, *Electrical installations in ships – Part 301: Equipment – Generators and motors*

IEC 60092-302, *Electrical installations in ships – Part 302: Low-voltage switchgear and controlgear assemblies*

IEC 60092-352, *Electrical installations in ships – Part 352: Choice and installation of electrical cables*

IEC 60092-401, *Electrical installations in ships – Part 401: Installation and test of completed installation*

IEC 60364-4-41, *Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock*

IEC 60533, *Electrical and electronic installations in ships – Electromagnetic compatibility (EMC) – Ships with a metallic hull*

IEC 60947-2, *Low-voltage switchgear and controlgear – Part 2: Circuit-breakers*

IEC 60947-3, *Low-voltage switchgear and controlgear – Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units*

IEC 61557-8, *Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. – Equipment for testing, measuring or monitoring of protective measures – Part 8: Insulation monitoring devices for IT systems*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

NOTE Other relevant terms and definitions can be found in IEC 60092-101 and other parts of the IEC 60092 series.

3.1 shore power charging system

Note 1 to entry: Definition under consideration IEC PAS 63108:2017

3.2 DC bus

DC distribution system which interconnects DC loads and power sources

3.3 DC assembly

cabinet with modules interconnected with DC bus for loads and power sources

3.4 energy management system EMS

system controlling, monitoring and protecting energy sources and loads to ensure safe operation

3.5 battery management system BMS

system protecting battery, controlling battery charging and/or discharging, and monitoring battery conditions (i.e. state of charge, cell temperature etc.)

Note 1 to entry: The definition is under consideration.

4 General requirements

4.1 General

Attention is drawn to the requirements of the International Convention for the Safety of Life at Sea. Clause 4 contains conditions and requirements which are common to all apparatus and installations within the scope of this PAS.

Semiconductor devices used as breaker shall fulfil requirements for breaking current and isolation according to IEC 60947-2 and IEC 60947-3.

4.2 Acceptance of substitutes or alternatives

Where in this PAS any special type of apparatus, construction or arrangement is specified, the use of any other apparatus, construction or arrangement is admissible, provided it fulfils the requirements of the original apparatus.

4.3 Provisions for maximum load

All components and systems shall be of such size as to be capable of carrying, without their respective ratings being exceeded, the current which can normally flow through them. They shall be capable of carrying anticipated overloads and transient currents, for example the capacitor inrush currents, without operational degradation.

4.4 Additions and alterations

An addition or alteration, temporary or permanent, shall not be made to an existing installation until it has been definitely ascertained that the ratings and the condition of existing accessories, conductors, switchgear, etc. affected are adequate for the new situation.

Special attention is taken to those factors affecting the existing system design such as current-carrying capacity, maximum fault current level, harmonic content, power quality and proper discrimination of the protective devices.

4.5 Environmental conditions (standards.iteh.ai)

Electrical equipment shall operate satisfactorily under various environmental conditions. The environmental conditions of IEC 60092 (all parts) shall apply.

4.6 Power supply system characteristics

4.6.1 General

NOTE The use of primary DC distribution are characterized by

- DC-grids including various sources of power and consumers with power electronic controllers forming operational interfaces, with high dynamics,
- fast response times and small reaction times and inductances in DC-grid systems compared to conventional AC-grid systems, and
- voltage sourced converters, diode bridges, etc., which will create special fault mitigation scenarios by their ability to block in one direction, and lead in the opposite direction.

4.6.2 DC distribution systems limits

When batteries are used as power supply systems, adequate measures should be taken to keep the voltage within the specified limits during charging, quick charging, gas-charging and discharging of the battery.

4.7 Mechanical protection

Electrical equipment shall be placed so that, as far as practicable, it is not exposed to risk of mechanical damage according to IEC 60092-101 and IEC 60092-352.

Safety barriers shall be established in design and arrangement of energy sources.

4.8 Enclosures

Enclosures shall comply with the degrees of protection in IEC 60092-302.