



IEC/TC OR SC:	SECRETARIAT:	DATE:
18	NORWAY	2018-10-11

### A. ELECTRICAL INSTALLATIONS OF SHIPS AND OF MOBILE AND FIXED OFFSHORE UNITS

#### A.1 SCOPE

To prepare standards for electrical installations and equipment of ships and of mobile and fixed offshore units, incorporating good practice and aligning as far as possible existing regulations and IEC Publications.

The standards will chiefly concern:

- a) factors promoting the safety of ships and of mobile and fixed offshore units;
- b) factors promoting safety of life;
- c) factors promoting preservation of the environment.

The standards specify:

- i. practical interpretation and implementation of the requirements of the International Convention on Safety of Life at Sea (IMO SOLAS), and International Convention on Mobile Offshore Drilling Unit (IMO MODU)
- ii. documents for Authorities and Administrators to refer to in their regulations.
- iii. a coherent set of requirements, based on recommended practices, to be used by owners, builders and appropriate organizations.

The standards also foster interchangeability of parts and ease the selection and procurement of equipment, including cables for transport of energy, signals and data, by indicating, as appropriate, IEC standards of ratings, types, dimensions, materials, quality, test methods, etc., whether or not these are influenced by regulations, and will thus facilitate interchanges between purchaser and supplier.

#### A.2 DATE OF ESTABLISHMENT OF THE TECHNICAL COMMITTEE AND A BRIEF HISTORICAL BACKGROUND

The IEC Committee of Action, during its meeting in Bellagio in 1927, decided to nominate a specific Advisory Committee to study the questions relating to the standardization of electrical installations in ships.

This decision was taken as a result of a proposal made by the Netherlands National committee to undertake the study. The British National committee was asked to act as Secretary and the President was authorized to designate the National Committees to be invited to take part in the work.

Subsequently, at a TC 18 meeting held in Bergamo in 1986, it was decided to enter work on the standardization of electrical installations in mobile and fixed petroleum units.

#### A.3 CURRENT TITLE, MAIN AND SUB-COMMITTEE

TC 18: Electrical installations of ships and of mobile and fixed offshore units

SC 18A: Electric cables for ships and mobile and fixed offshore units

**B. MANAGEMENT STRUCTURE**

<b>Secretariat:</b> Norway		<b>Chair:</b> United Kingdom
<b>Subcommittees</b>		
SC 18A	Electric cables for ships and mobile and fixed offshore units Maintenance team in charge of IEC 60092-350, -352, -360, -353, -354, -376 and IEC TR 60092-370	
<b>Advisory Groups</b>		
AG 27	CAG - Chair's Advisory Group	
<b>Joint Working Groups</b>		
JWG 28	Utility connections in port	
JWG 31	Subsea electrical power equipment and systems	
<b>Maintenance Teams</b>		
MT 2	Maintenance team in charge of IEC 60092-101, -201, -202, -401 and 504	
MT 3	Maintenance Team in charge of IEC 60092-502	
MT 6	Maintenance team in charge of IEC 60092-301, -302, -303, -304, -305, -306, -307, and -503	
MT 18	Maintenance of IEC 61892 Series of standards	
MT 21	Maintenance Team in charge of IEC 60533	
MT 22	Maintenance Team in charge of IEC 60092-507	
MT 24	Maintenance Team in charge of IEC 60092-501	
MT 25	Maintenance team in charge of IEC 60092-506	
MT 29	Maintenance Team in charge of IEC 61363-1	
MT 30	Maintenance team in charge of IEC 60092-509	
<b>Project Teams</b>		
PT 62742	Electrical and electronic installations in ships - Electromagnetic compatibility - Ships with a non-metallic hull	
<b>Working Groups</b>		
WG 33	Primary DC distribution system design architecture	

### **C. BUSINESS ENVIRONMENT**

TC 18 has an established formal relationship with the International Maritime Organisation (IMO).

In economic terms, the investment in the electrical equipment and installation on new ships and offshore-units, continues to increase in percentage of the overall value.

Ship owners, builders, insurers, classification societies and authorities are interested in consistent maritime standards for electrical installations, including ship and offshore cables. The IEC 60092 and IEC 61892 series of standards, as well as other standards prepared by TC 18, aim to support this demand.

For offshore units, there are complex installations, often combining both production and storage facilities, as in the so called Floating Production, Storage and Offloading Facilities (FPSO). Arctic areas represent special challenges regarding the environmental conditions which add complexity to industry HSE practices.

Equipment and cable manufacturers comprise big multinational companies as well as many small and medium sized companies.

The major ship yards are in China, South Korea and Japan for bulk carriers, LNG, FPSO etc, while passenger vessels and cruise ships are mainly manufactured in Europe (Italy, Germany, Finland, France). Many yards are specialized, e.g. for building certain types of ships such as offshore supply and anchor handling vessels.

Offshore production platforms and FPSOs are sometimes built at yards far away from the location where they are to be installed and operated. This increases the need for international standards. Mobile drilling units are built at yards specialising in this type of units and according to generic performance specifications set by an owner. These performance requirements may at some point be assessed according to any actual legislative requirements valid on the location of operation, which may vary during the life of the unit.

Historically cable standards have been published by IEC and JIS (Japanese) for commercial vessels, while the offshore market has been driven by IEC, NEK (Norwegian), IEEE and BS standards among others. The cable manufacturers play an important role in the maritime sector.

### **D. MARKET DEMAND**

The IEC 60092 series is referenced in the International Maritime Organisation - Safety of Life at Sea Convention (SOLAS) and IEC 61892 series is referenced in the Code for Mobile Offshore Drilling Units (MODU Code).

SOLAS is applicable to all commercial seagoing ships of 500 gross tonnes and above, thus the standards are used extensively. For commercial ships below this level the mandatory requirements for electrical installation is usually set by the National Flag State Authority where the ship/unit is registered. Several authorities rely on the IEC 60092 and IEC 61892 series of when they develop broad experience base in exemplified use of TC 18 standards and the degree of acceptance by the international industry may support local Authorities to reduce their need to develop and maintain 'home grown' technical regulations.

The IEC 60092 and the IEC 61892 series of standards are employed world-wide by naval architects, marine engineering design and consulting companies, design houses, ship and offshore unit builders, cable manufacturers, electrical equipment manufacturers, installers, classification bodies, test houses, ship owners, operators and national and international authorities.

TC 18 and SC 18A have representation from most of the industries and authorities that it serves. The standards are typically used to support marine regulation and are often quoted by National authorities and project specific contract documents to set minimum engineering performance level.

In US competing standards for equipment / materials are developed by Underwriters Laboratory (UL), National Electrical Manufacturers Association (NEMA), American Society for Testing and Material (ASTM) and American National Standards Institute (ANSI). Competing standards for installations on ships and mobile and fixed offshore units are primarily developed by the Institute of Electrical and Electronics Engineers (IEEE). In additions standards for installations on mobile and fixed offshore units are developed by the American Petroleum Institute (API).

As technology continues to advance there will remain a need for the TC/SC to produce new standards and to maintain the existing ones.

International oil companies are requesting standards for subsea electrical equipment.

## **E. TRENDS IN TECHNOLOGY AND IN THE MARKET**

### **E.1 Technology**

As the electrical efficiency requirements of modern ships continue to increase there is a trend to higher operating voltages for power consumers, propulsion and machinery auxiliaries. Reliable semiconductor devices in power electronics are rapidly changing the way marine and offshore power systems can be designed and operated.

Currently the most important technical developments in the shipbuilding and offshore industry relate to the increasing extensive use of computer hardware and software control and monitoring systems resulting in distributed machinery control and the introduction of additional and more sophisticated passenger/crew safety systems including addressable fire alarm and low-level lighting systems, also passenger and crew address systems. Problems are already being seen with complex systems on board vessels where the advances in complexity have outstripped the ability of the builders and operators to understand and deal with the systems installed.

There is also an increasing awareness of the dangers of fire and the consequences of fire spread and the dangers of smoke products. For these reasons, fire performances such as flame retardant, fire resistance, low smoke, no corrosion and halogen free materials are more requested, both for electrical equipment in general and for cables.

The system effects of electromagnetic disturbances and interference between interconnected systems are increasingly being addressed. A new and larger extent of such initiatives are exemplified by the increasing number of ships/units connected to shore-grid.

A reduction of greenhouse gas emissions from ships is on the agenda of IMO. This may lead to more efficient power generation and distribution systems. Hybrid solutions including renewables will require improved and modified standards. TC 18 maintains a leadrole in the development of technical requirements for DC primary distribution in marine units.

In the offshore industry there is a trend to use variable speed drives (VSD) for supply of large pumps and compressors. The use of subsea equipment is becoming common. This is a special challenge as few (if any) standards are available for such equipment. The end users are especially discussing standards for high voltage penetrators and connectors, subsea power transformers, subsea high and low voltage switchgear and subsea high voltage variable speed drives.

Fibre optics is becoming common. However, neither TC 18 nor SC 18A have developed any standards dealing with fibre optics, but their use is referenced in several TC 18 publications. Photovoltaic technology is becoming more common for use on unmanned platforms and other offshore structures.

### **E.2 Market**

The IMO goal to reduce CO<sub>2</sub>, SO<sub>x</sub> and NO<sub>x</sub> emissions from ships is causing a rethink in the industry. The marine sector is looking to optimize operational performance and utilisation of new technologies to address these environmental issues. The scope for improvement is huge, varying between simple improvements such as reducing operational speeds to implementing hybrid propulsion technologies and/or adding renewables to the energy mix.

Ships with Dynamic Positioning or other types of ships/units with larger variations in power consumption may have significant advantages utilizing new technology for "peak shaving" purposes. The demand for batteries and DC systems on this kind of vessels is therefore rapidly increasing driven by cost gains in better fuel savings and in some countries, subsidies by Authorities. Fuel cells and various energy storage technologies are being introduced on a large scale. Hybrid systems with various sources of energy are demonstrated, such as LNG and Hydrogen with batteries and other energy storage systems being essential design components.

For ferries, especially on shorter routes, batteries as the only main source of energy is introduced. Due to short stops, charging of the batteries can be a challenge as the capacity of the onshore grid may not be sufficient to allow rapid charging. This can in some cases be solved by battery packs onshore, which are rapidly discharged and charges the battery on the vessel, during the short quayside stop for the ferry. This market development also leads to potential large investments on shore.

The increase in the size of vessels and of the installed electrical load leads to use of higher voltage systems. The return to electric propulsion systems coupled with the advances in solid state power devices and the need for variable speed auxiliary drives has led to more strict control of EMC, which is reflected in the extensive updating of the TC's EMC standard. All together this increases the relative value/cost of the electrical installation and its components compared to the total value of the vessel/unit.

Related to the environment the market is not only affected by the demand for reducing CO<sub>2</sub> and NO<sub>x</sub>. The awareness of disturbing the life at sea is also increasing. Shipping and offshore industry has moved

closer to arctic areas and other areas at sea are e.g. categorized as vulnerable to operations. This affects the market either by reduced activity, or the need for specially designed units and equipment to be able to operate within these special areas. Electro technology is one key factor to solve many of these challenges.

The trend of connecting vessels to shore grid, either for “hotel duty” or for charging of batteries, affects the quality of the electrical parameters in the shore-grid. This EMC issue is one of the biggest concerns of the grid-owners. The market may respond to the introduction of EMC requirements by investing in equipment to reduce such emissions.

Offshore wind energy is an increasing market driven by the demand for clean energy and subsidies from some Authorities. These installations will often be permanently connected to shore grid but may also function off-grid as supply to an offshore unit (islanded operation) under any applicable Petroleum Safety Authority rules.

### **E.3 Environmental aspects**

TC18 is primarily concerned with the installation of electrical equipment, the ultimate disposal of the installation on board the ship or offshore unit is beyond the scope of the committee. However, TC 18 is aware of that regulation in different countries focus on the restrictions on the usage of hazardous materials, substances and processes.

SC 18A is primarily concerned with the manufacturing of shipboard and offshore cables.

However, the committees are conscious of the need to protect the environment and thus strive to ensure that the standards developed consider the selection of materials and avoid introducing requirements that could cause local or global pollution.

TC 18 is active within several projects to support the demand for new technology to reduce emissions. Examples of this are standards for the connections of ships/units to shore and standards for DC-distribution, which are necessary when utilizing batteries and fuel cells. Offshore units are also being permanently connected to shore which is also considered by TC 18.

**F. SYSTEM APPROACH ASPECTS (REFERENCE - AC/33/2013)**

TC 18 will actively continue to promote the establishment of liaisons to other committees

System Committees (TC 18 as a supplier of standards)	None	
Product Committees (TC 18/SC 18A as a customer of standards)	SC 17C	High-voltage switchgear and controlgear assemblies
	TC 20	Electric cables (Liaison by SC 18A)
	TC 21	Secondary cells and batteries
	SC 21A	Secondary cells and batteries containing alkaline or other non-acid electrolytes
	SC 22G	Adjustable speed electric drive systems incorporating semiconductor power converters
	SC 23H	Plugs, Socket-outlets and Couplers for industrial and similar applications, and for Electric Vehicles
	TC 31	Equipment for explosive atmospheres
	SC 31J	Classification of hazardous areas and installation requirements
	TC 64	Electrical installations and protection against electric shock
	TC 73	Short-circuit currents
	TC 77	Electromagnetic compatibility
	TC 80	Maritime navigation and radiocommunication equipment and systems
	TC 94	All-or-nothing electrical relays
	TC 99	Insulation co-ordination and system engineering of high voltage electrical power installations above 1,0 kV AC and 1,5 kV DC
	TC 121A	Low-voltage switchgear and controlgear
Other Committees (horizontal committees where Liaison should be considered)	TC 2	Rotating machinery
	TC 8	System aspects of electrical energy supply
	TC 17	High-voltage switchgear and controlgear
	TC 34	Lamps and related equipment
	TC 70	Degree of protection provided by enclosures
	TC 104	Environmental conditions, classification and methods of test

**G. CONFORMITY ASSESSMENT**

*The standards published are currently not used for conformity assessment by any of the IEC certification schemes (IECEE, IECEX, IECQ, IECRE)*

*The TC 18 standards contain some test requirements and may potentially be used for conformity assessment.*

*TC 18 standards are often referenced in IMO SOLAS, MODU code and classification society rule books.*

**H. 3-5 YEAR PROJECTED STRATEGIC OBJECTIVES, ACTIONS, TARGET DATES**

STRATEGIC OBJECTIVES 3-5 YEARS	ACTIONS TO SUPPORT THE STRATEGIC OBJECTIVES	TARGET DATE(S) TO COMPLETE THE ACTIONS
Prepare a more user-friendly set of standards for ships	Revise all standards in the IEC 60092-series taking into account the Systems Approach Philosophy.	Target date: 2025
Reduce the time to develop TC 18 deliverables and improve the consistency of the content	Secretary and Chair to participate in more MT/PT meetings  Conveners to form smaller task forces within the WGs that extensively use web-meetings between the WG-meetings.  Convenors to report to Secretary after each meeting and file MOM at the Collaboration tool website	Target date: 2020
Increase awareness of TC 18 publications	Marketing form to be completed by convenors. To be sent Central Office when closing of FDIS voting.  Hold a seminar in conjunction with the Plenary meeting to raise awareness with local industry.	Target date: 2020
Identify areas where IMO energy efficiency proposals will impact on the currently published standards and initiate work programs to deal with these.	Follow closely the work of IMO and propose changes to existing standards or new ones, if necessary	Target date: 2020
	Further develop the PAS currently published into a standard for DC-distribution systems, which will allow for the efficient connection to various sources of energy	Target date: 2020

Note: The progress on the actions should be reported in the RSMB.

**I. USEFUL LINKS TO THE IEC WEB SITE**

[TC 18 home page](#)

[TC 18 work programme](#)

[SC 18A home page](#)

[IEC directives](#)

Name and signature of the secretary

Arild Røed