STANDARD FOR CERTIFICATION

No. 2.7-2

Offshore Service Modules

MAY 2013

The electronic pdf version of this document found through http://www.dnv.com is the officially binding version

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FOREWORD

DNV is a global provider of knowledge for managing risk. Today, safe and responsible business conduct is both a license to operate and a competitive advantage. Our core competence is to identify, assess, and advise on risk management. From our leading position in certification, classification, verification, and training, we develop and apply standards and best practices. This helps our customers safely and responsibly improve their business performance. DNV is an independent organisation with dedicated risk professionals in more than 100 countries, with the purpose of safeguarding life, property and the environment.

Standards for Certification

Standards for Certification (previously Certification Notes) are publications that contain principles, acceptance criteria and practical information related to the Society's consideration of objects, personnel, organisations, services and operations. Standards for Certification also apply as the basis for the issue of certificates and/or declarations that may not necessarily be related to classification.

Any comments may be sent by e-mail to *rules@dnv.com*

CHANGES

General

This document supersedes Standard for Sertification 2.7-2, December 1995 and amendments November 2008.

Text affected by the main changes in this edition is highlighted in red colour. However, if the changes involve a whole chapter, section or sub-section, normally only the title will be in red colour.

Main Changes

All sections have been extensively revised and extended to include all temporary offshore service equipment which may be mounted on a frame or inside a container. The focus is on the safety of this equipment and any hazards it may introduce to the installation on which it is placed.

Editorial Corrections

In addition to the above stated main changes, editorial corrections may have been made.

CONTENTS

1 Introduction

This Standard for Certification has been issued in order to collect into one document a suitable collection of requirements with relevant appropriate references to various international codes and standards which are applicable to the design and installation of offshore service modules.

Offshore service modules are designed to perform temporary services on offshore installations and may be placed on different offshore installations and units in different national waters.

This Standard for Certification applies basic requirements from other DNV Rules and Standards to service modules and has been based primarily on recognised practices for the offshore industry. It is intended that the standard will be suitable for global usage. It should, however, be noted that some shelf or flag states may have stricter or other requirements than those given in this standard.

Modules designed and manufactured in compliance with DNV 2.7-2 are intended to meet the basic requirements of SOLAS, MODU code and DNV Offshore Standards relevant to the functions of the equipment and as applicable at date this standard was issued. All subject to adequate installation of the equipment when located on the offshore installation (which is out with the scope of this standard).

1.1 Relationship with other standards, codes and regulations

1.1.1 *The International Maritime Organization (IMO)*

The requirements in the SOLAS Code apply for offshore service modules utilised on ships and certain floating offshore installations. The requirements in the MODU Code apply for offshore service modules utilised on floating offshore drilling units, including jack-up installations. This applies irrespective of the time such modules are installed and used.

DNV 2.7-2 is intended to meet the basic safety requirements of SOLAS and MODU code with regard to escape provision, fire detection and fire protection.

1.1.2 *DNV Rules for Classification of Ships / DNV Offshore Standards.*

Offshore Service Modules that are installed on a DNV Classed Offshore Installation may be subject to classification requirements, either in main class or other class notations. DNV 2.7-2 includes the basic requirements of these documents, for main class items, when applied to temporary installations. DNV 2.7-2 is not intended to replace certification to the DNV Rules for Classification of Ships/DNV Offshore Standards for permanently installed equipment or conversions.

When equipment is located on a DNV Classed Offshore Installation it is required to be assessed by DNV to ensure any aspects which interface with a class systems have been correctly installed and to ensure that general safety principles have been adhered. This focusses on the location and installation of the equipment and additionally confirms specific installation/hook-up requirements detailed within the DNV 2.7-2 Certificate has been adequately addressed. It is not the intention of this standard to address the requirements for commissioning on a DNV Class unit, these remain the responsibility of the vessel/offshore unit owner/ manager.

1.1.3 *Relationship to previous revision of standard*

This revision of the standard contains multiple updates to requirements as well as encompassing a broader range of equipment types. Equipment which was certified to previous revisions of this standard may not meet all the applicable requirements of this revision.

Design assessment to previous revisions of this standard shall not be conducted following release of this revision.

2 General

2.1 Objective

The objective of this Standard for Certification is to set requirements for offshore equipment modules but focussed on the safety impact to the offshore installation upon which the equipment is installed.

When installed and used on floating offshore installations, service containers are subject to the regulations applicable to an offshore installation (i.e., IMO MODU/SOLAS, Class, flag state and national regulations). When offshore service containers are installed and used on fixed offshore installations, national regulations will apply.

It has been recognised that individual interpretations of all the various codes and standards may sometimes lead to conflicting requirements. This Standard for Certification intends to prescribe solutions which will provide an equivalent level of safety as the codes and standards referred to throughout this document.

Certification by DNV provides a document which may be presented to users of the module to document its technical standard and safety performance. The certificate also defines conditions for transportation to, and installation on, an offshore installation.

2.2 Definitions

Accommodation Space

Those used for public spaces, corridors, lavatories, cabins, offices, hospitals, cinemas, games and hobbies rooms, pantries containing no cooking appliances and similar spaces. Public spaces are those portions of the accommodation which are used for halls, dining rooms, lounges and similar permanently enclosed spaces.

Category A Machinery Space:

All spaces which contain internal combustion-type machinery used either for main propulsion or for other purposes where such machinery has in the aggregate a total power of not less than 375 kW or which contain any oil-fired boiler or oil fuel unit; and trunks to such spaces.

Equipment mass, TE:

The mass in kilograms (kg) of insulation and all permanently fitted or installed equipment, etc.

Certified Safe equipment:

Certified safe equipment is equipment certified by an independent national test institution or competent body to be in accordance with a recognised standard for electrical apparatus in hazardous areas.

Essential/safety system:

Module integrated systems including required utilities, which are provided to prevent, detect or warn of an accidental event and/or mitigate its effect. This may include;

— lighting
— fire and Gas Detection Systems
— shutdown Systems
— PA/GA Systems
— supplies from emergency power or UPS sources
— fire protection and extinguishing system.

Fitted out mass, TF:

The mass in kilograms (kg) of the container ready for use, including both the structural mass and the equipment mass, i.e. TF = TS + TE

1) The term “tare mass”, T, as used for offshore containers in DNV 2.7-1, is not suitable for offshore service containers. The “tare mass” of a service container is fitted out mass, TF.

Gas tight:

Doors, walls or dampers which will maintain a pressure differential between adjacent areas, the allowable leakage rate will not exceed 0.5 m^3/ m^2h at +50Pa.

Important Services:

Services provided by the module to the offshore installation which are critical to the safety of the offshore installation or modules that prevent, protect or mitigate from the effects of an accidental event. Examples may include accommodation units, emergency generator units, well intervention equipment.

Low flame spread:

A surface, which in accordance with the IMO Fire Test Procedures (FTP) Code, will adequately restrict the spread of flame.

Manned:

Manned for more than 2 hours in every 24 hour period. If the manning is located at an external position requirements around emergency lighting and ventilation are not mandatory.

Non-combustible material:

Material which neither burns nor gives off flammable vapours in sufficient quantity for self-ignition when heated to approximately 750ºC, this being determined in accordance with the IMO Fire Test Procedures (FTP) Code.

Offshore container:

A portable container with a maximum gross mass not exceeding 25,000 kg, for repeated use in the transport of goods or equipment, handled in open seas, to, from or between fixed and/or floating offshore installations and ships. See DNV 2.7-1 for a more detailed definition.

Offshore Installation:

This is used as a short term and may be a fixed offshore installation, a mobile offshore unit or a ship on which the module may be located.

Offshore service module:

A unit built and equipped for a special service task, mainly for temporary installation, on offshore installations.

This applies equally to offshore frames with equipment but for ease of reference we will refer throughout the standard to Offshore Service modules.

Payload, P:

The maximum permissible mass in kilograms (kg) of cargo or loose equipment which may safely be transported by the container.

Portable Offshore Unit:

A "POU" (Portable Offshore Unit) is a package or unit intended for repeated or single offshore transportation and installation/lifting. POU's may also be designed for subsea lifting. See DNV 2.7-3 for more detailed definition.

Primary deck covering:

Deck covering which will not readily ignite in accordance with the IMO Fire Test Procedures (FTP) Code.

Rating, R:

Maximum gross mass of the container and its cargo in kilograms (kg). The Rating consists of the mass of the structure, fitted equipment and the payload, i.e. R=TF + P.

Source of Release

Point or location from which a flammable substance may be released into the room or building such that an explosive gas atmosphere could be formed.

Standard fire test:

A test in which specimens of the relevant bulkheads or decks are exposed in a test furnace to temperatures corresponding approximately to the standard time-temperature in accordance with the test method specified in the IMO Fire Test Procedures (FTP) Code.

Structural mass (TS):

The mass in kilograms (kg) of structural components, including both primary and secondary structure.

Unmanned:

Areas which are not manned as defined above.

2.3 Referenced Class Rules, Regulations and Standards

The following standards include provisions which, through reference in the text, constitute provisions of this standard. The latest issue of the references will be used unless otherwise agreed. Other recognised standards may be used provided it can be demonstrated that these meet or exceed the requirements of the standards referenced below:

— IMO Requirements:

  — CSC, IMO Convention for Safe Containers
  — IMO FSS, International Code for Fire Safety Systems
  — IMO FTP, International Code for Application of Fire Test Procedures
  — MSC.1/Circ. 1275 – Unified Interpretation of SOLAS Chapter II-2 on the number and arrangement of portable fire extinguishers on board ships
  — MODU, IMO Code Mobile Offshore Drilling Units
  — SOLAS, IMO Convention Safety of Life at Sea.

— DNV Classification Note No. 8 Conversion Of Ships
— DNV Offshore Standards:

  — DNV-OS-A101- Safety Principles and Arrangements
  — DNV-OS-D101- Marine and Machinery Systems and Equipment
  — DNV-OS-D201- Electrical Installations
  — DNV-OS-D301- Fire Protection
  — DNV-OS-E101- Drilling Plant
  — DNV-OS-E201- Oil and Gas Processing Systems
  — DNV-OS-E402- Offshore Standard for Diving Systems.

— DNV Rules for Ships Pt.3, Ch.1 - Hull Structural Design
— DNV Service Specification DNV-DSS-105- Rules for Classification of Diving Systems
— DNV Standard DNV-DS-E403- Standard for Surface Diving Systems
— DNV Standard for Certification:

  — DNV STC 1.2 Type Approval
  — DNV STC 2.22 Lifting Appliances
  — DNV STC 2.4 Environmental Test Specification for Instrumentation and Automation Equipment
  — DNV STC 2.7-1 Offshore Containers
  — DNV STC 2.7-3 Portable Offshore Units.

— IEC Publications:

  — IEC 60079 Series - Explosive atmospheres
  — IEC 60092 Series - Electrical installations in Ships
  — IEC 61892 Series - Mobile and fixed offshore units – Electrical installations.

— NORSOK Publications:

  — Norsok E-001 – Electrical Systems
  — Norsok Z-015 – Temporary Equipment.

2.4 Abbreviations

CCR	Central Control Room
DNV	Det Norske Veritas
EMC	Electro Magnetic Compatibility
EN	European Normative Standard
ESD	Emergency Shutdown
EU/EEA	European Union / European Economic Area
F&G	Fire and Gas
FSS	Fire Safety Systems
FTP	Fire Test Procedure
IEC	International Electro-technical Commission
IMDG	The International Maritime Dangerous Goods Code
IMO	International Maritime Organisation
IP	Ingress Protection
LEL	Lower Explosive Limit
MODU	IMO Code Mobile Offshore Drilling Units
MOU	Mobile Offshore Unit
P & ID	Piping and Instrumentation Diagram
PA/GA	Public Address / General Alarm
PFP	Passive Fire Protection
PLC	Programmable Logic Controller
POU	Portable Offshore Unit
SOLAS	IMO Convention Safety of Life at Sea
STC	DNV Standard for Certification
UPS	Uninterruptable Power Supply

3 Structural Technical Requirements

3.1 General

Service modules will be subject to static or dynamic loads during transport and handling, and while installed on an offshore installation. Such loads may be either external, e.g. environmental loads, or internal, e.g. from a winch or machinery in the module.

3.2 Transport Loads

There are three structural categories related to the transport requirements. Units certified to DNV 2.7-2 must, as a minimum, be certified in accordance with one of the following:

— Offshore containers certified by DNV according to DNV 2.7-1 (includes IMO/MSC/Circ.860).
— Portable Offshore Units certified by DNV according to DNV 2.7-3.
— Ship type service containers – Not for lifting between vessels and/or offshore installations at sea.

Guidance note 1:

Offshore containers certified by another organisation shall only be considered for DNV 2.7-2 modules on a case by case basis.

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Guidance note 2:

Building units as ISO/CSC containers will facilitate international transport by sea, since such units can be carried as standardized cargo units on container carriers and other dry cargo ships. Modules that are not ISO/CSC containers will normally be transported as special cargo.

Modules built according to ISO freight container standards, ISO 1496 must be certified to IMO's Convention for Safe containers, CSC. The structural requirements in ISO 1496 and CSC are related to transport and handling, and are not generally relevant for units when installed on ships or offshore installations and as such will be subject to the additional requirements outlined in this Section.

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Figure 1 below defines the Relationships for Structural assessment

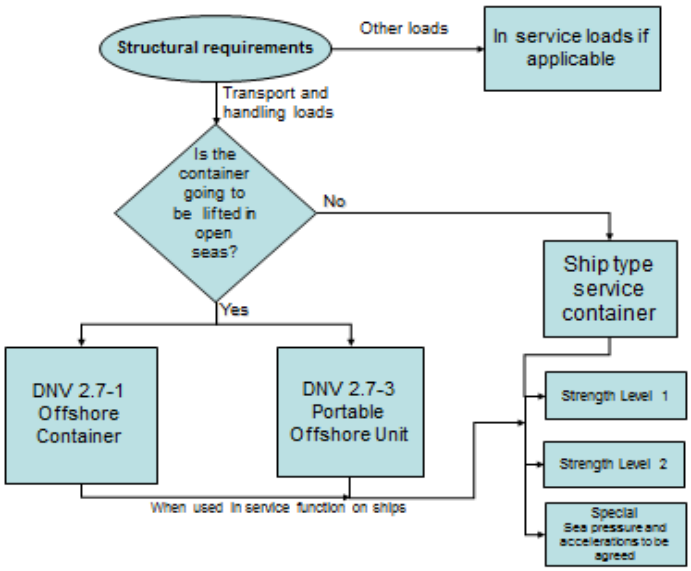

Figure 3-1
Containers - Various use and related structural assessments

3.2.1 *Additional fittings for lifting*

In addition to the pad eyes and slings used for offshore handling, some containers and portable offshore units are built with extra sets of fittings for lifting and handling. These may include, for example, pad eyes that are only used for moving the module internally on an offshore installation. Such equipment, including the supporting structure, must be dimensioned according to DNV Standard for Certification No. 2.22, Lifting Appliances.

These additional lifting fittings must not be used to lift a module to or from a supply vessel. This will be stated in the certificate and is to be clearly marked on the module.

3.3 Offshore Installation Induced Loads

3.3.1 *General*

Offshore Service Modules categorised for "Important Service" (as defined in 2.2) shall be assessed for non-transport related loads i.e. service modules shall be designed for the loads imposed from the ship or offshore unit on which it is installed.

It should be noted that offshore installation induced loads are the responsibility of the end user to define, but a vendor may select values for approval to suit his intended client market.

Allowable bending and shear stresses shall be taken as $160f_1$ and $90f_1$ N/mm^2 respectively where f_1 is the relevant material factor (reference DNV Rules for Classification of Ships, Pt3. Ch.1)

Design loads and accelerations will be specified in the DNV 2.7-2 certificate. The thickness of walls must not be less than 4 mm. Special attention should be paid to buckling control of thin-plated structures subjected to compression stress in the face plate caused by local bending.

Note:

The plate flanges of corrugated/stiffened-plates should be checked for buckling in accordance with DNV Rules for Ships Pt.3 Ch.1 Sec. 13. The compression stress σ_b in the plate flange, induced by lateral pressure and local bending of the plate profile, should not exceed the critical buckling stress times utilisation factor for normal load level $\sigma_c \, x \, \eta$. For loads applied on normal load level $\eta = 0.80$.

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3.3.2 *External / Environmental Loads*

For installation on ships, the strength will be calculated according to Pt.3, Ch.1, Sec.10 of the Rules for Classification of Ships.

Two types of sea loads may be applicable depending upon the offshore installation and location:

— Sea pressure.
— Accelerations due to vessel motion.

These loads will vary according to vessel type and the actual location on vessel, in general environmental loads on MOUs will be less than those on ships.

Table 3-1 and Table 3-2 below define the applicable minimum ratings; these are simplified values based on DNV Rules for Classification of Ships, Pt.3, Ch.1, Sec.4. Where considered appropriate more accurate loads may be calculated to these rules or to DNV Classification Note 8.

Note:

The level of these factors will ensure that service modules can be placed in most locations on most of the ships used offshore.

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Table 3-1 Sea pressure loads

Strength level	*Location on Vessel*	*Sea pressure load**
Level 1	Exposed location	Sea pressure = 30 MPa
Level 2	Protected location	Sea pressure = 15 MPa
Special Case	As specified on certificate	Sea pressure to be agreed on a case by case basis
*Average pressure over whole container wall		

Table 3-2 Accelerations

Strength level	*Vessel Type*	*Accelerations (m/s^2)*	
		Vertical (Note) $(g_0 + 0.5\, a_v)$	*Horizontal* $0.67\, a_t$
Level 1	High accelerations	a_v = 15m/s^2 / 5m/s^2	a_h = 6 m/s^2
Level 2	Moderate accelerations	a_v = 13m/s^2 / 7m/s^2	a_h = 4 m/s^2
Special Case	As specified on certificate	Acceleration to be agreed on a case by case basis	
Note; Assessment shall consider compression and tensile forces; the first figure is intended to maximize the compressive effect, the second figure is intended to maximize the tensile effect.			

Guidance note:

Strength Level 1 -Sea pressures and accelerations will be suitable for installation on most Offshore Support Vessels. This level should be chosen for service module that may be placed in any location on a vessel.

Strength Level 2 - Sea pressures and accelerations will normally be sufficient for installation on FPSOs and other larger ships, and for installation in protected / low acceleration locations on offshore support vessels.

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3.3.3 *Accidental Loads*

Offshore service modules for Important Services may be required to be evaluated against accidental collision, grounding or similar events in order to accommodate for safe securing. Modules installed on vessels which are covered by classification requirements must be evaluated for a minimum longitudinal acceleration of $0.5g_o$ in the forward direction and $0.25g_o$ in the aft direction.

3.3.4 *Other service loads*

Service modules may be subject to other particular loads specified below, (or combinations).

— Wind Loads acting on module structure should not be taken less than 2.5 kN/m^2, unless otherwise documented.
— Snow and Ice Loads - Ice accretion from sea spray, snow, rain and air humidity should be considered, where relevant. Snow and ice loads may be reduced or neglected if snow and ice removal procedures are established.
— Blast Loads – Shall be considered if a service module is to be located in an unprotected area close to a hazardous area. Blast loads must be in accordance with DNV-OS-A101 unless otherwise specified.
— Loads internal to the module (e.g. winch loads, pressure loads, etc.) must be considered where relevant to the specific module type.

3.4 Securing to offshore installation

Service modules must be able to be secured safely to the offshore installations, either by having suitable fittings for securing or structural parts suitable for bolting or welding to a deck. For securing on ships refer to DNV Classification Note No. 8 Sec 3.

Securing devices and bolts must be safe against unwanted opening or release. Securing devices such as container twistlocks may be used, but must be mechanically secured in the locked position. Only manually operated twistlocks can be used, not semi-automatic or fully automatic twistlocks. Securing devices shall be certified by DNV.

The main pad eyes on offshore container or portable offshore unit shall not be utilised as securing points.

Service modules may be stacked to two or more levels on offshore installations. Securing and support loads based on the loads described in 3.3 must be taken into account. Where one container acts as a supporting structure for another container, this must be considered and evaluated on a case-by-case basis.

3.5 High Stressed Locations

For offshore service modules intended for long term use in a single high stress location on an vessel or mobile offshore unit it will be necessary to evaluate the effect of repetitive cyclic loading from vessel motions or service loads.

Fatigue criteria are a project specific matter which cannot be define at the manufacturers design stage and as such are not covered within the scope of this standard.

4 Safety Related Technical Requirements

4.1 General

4.1.1 *Detailed Requirements*

The details given in this chapter describe the technical requirements which apply to an offshore service module; some requirements are generic and will apply to all units. Others are specific and shall only be applied when defined in 5.

4.1.2 *Hazardous vs Safe Area*

Modules located on open deck on an offshore installation shall be suitably rated for the actual rating of zone in which they are located, but it is important to recognise that all equipment is required to be made safe in case of accidental release of gas. This means that any equipment which remains electrically energised or has the potential to have surface temperatures in excess of 200°C following shutdown on gas detection shall be designed and installed to meet the requirements of minimum zone 2 and in some cases zone 1.

Equipment which remains energised during gas detection or produces a hot surface shall meet a minimum of Gas Group IIA and Temperature Class T3.

4.1.3 *Alternative solutions*

Alternative solutions may be substituted where shown to provide an equivalent or higher level of integrity or safety than the requirements under this standard. Justification of alternative solutions shall be documented.

Where alternative solutions have been accepted this shall be documented on the DNV 2.7-2 certificate.

4.2 Environmental Requirements

Modules shall be suitable for defined environmental conditions. Table 4-1 is applicable to all modules, Table 4-2 shall be considered for particular modules designed for Important Services as defined in 2.2.

Table 4-1 Environmental Conditions – All Modules

Outside Ambient Temperature:	–20ºC to +45°C
Humidity:	Up to 96% without condensation when heating is provided (mounted indoors) or 100% with condensation when mounted outdoors.
Electromagnetic Compatibility	All electrical equipment shall be selected and installed so as to avoid EMC problems. Reference standards which can be used to demonstrate compliance: IEC 61000-6-2 (Immunity) IEC 61000-6-4 (Emissions)
Inclination	The maximum operational inclination for the module should be specified. This maximum shall be defined at the point where continued operation of the equipment changes to a level where it presents a risk to the operator, offshore installation or if there is an increase in surface temperature beyond 200°C. Should no inclination values be specified the module shall be marked on the certificate as suitable for use on a fixed offshore installation only.

Table 4-2 Environnemental Conditions – Important Service Modules

Vibration level:	Ref Standard for Certification 2.4 Vibration class B 3 to 25 Hz: 1.6 mm displacement amplitude (peak value) 25 to 100 Hz: 4 g acceleration		
Inclination	Equipment and components on floating offshore installations shall be designed to operate satisfactorily under the following inclinations of the offshore installation:		
	Ships		
	All conditions	List 22.5°	Trim 10°
	Column-stabilised &self-elevating units		
	Static Condition	List 15°	Trim 15°
	Dynamic Condition	List 22.5°	Trim 22.5°
	Emergency condition	List 25°	Trim 25°
	Other values may be accepted if justified by calculations for the particular offshore installation. Should the inclination requirements stated above not be achieved, the manufacturer should supply details of inclination that can be achieved with limitations detailed in the design assessment and DNV 2.7-2 certificate.		

Guidance note:

Ambient temperature requirements specified in Table 4-1 are provided to align with DNV Rules for Classification of Ships and DNV Offshore Standards. Alternative temperature range shall be considered on a case by case basis and noted on the DNV 2.7-2 certificate.

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4.3 Noise

Where applicable, modules shall be provided with a noise assessment to determine the working environment in or around the module. The noise level shall detail the maximum sound pressure level at 1 m from the module and the maximum point internal to the module.

The need for hearing protection shall be marked on units where noise levels are in excess of 85dB. Audible alarms required by other parts of this document shall be supplemented with a warning beacon when the noise level is above 85dB.

4.4 Asbestos Declarations

In accordance with SOLAS Ch.II-1 Reg.3.5 and MSC.1/Circ.1379 asbestos is prohibited from any product intended for installation on any SOLAS certified offshore installation. No asbestos is to be used in the fabrication of the module. An Asbestos free declaration is to be issued by the manufacturer.

4.5 Electrical Systems

4.5.1 *Safety Requirements*

Electrical equipment shall be designed and installed such that the risk of injury to personnel is minimised.

Protective devices of suitable rating are required to prevent overload, excessive heating and damage in case of electrical faults.

All electrical circuits for Safety related systems shall be designed to “fail safe” condition.

4.5.2 *Components and equipment*

Electrical components and equipment shall be suitable for use offshore or on board ships and shall be constructed according to relevant IEC publications or other internationally recognised equivalent standards.

Electrical components located in enclosures which may need to be opened for inspection or maintenance while the circuits are live shall have covers or otherwise be arranged such that touching or short circuiting of live parts is not possible.

Component insulating materials shall be flame retardant according to IEC 60092-101 or equivalent.

4.5.3 *Arrangement & location of equipment*

Offshore service modules are exposed to rough handling and environmental conditions during transportation and storage. In order to keep the electrical equipment safe and fit for use, the following requirements shall be met:

- Equipment shall be provided with mechanical protection to prevent damage during transportation and use.
- Electrical enclosures are normally not to be located external to the module. In the event that electrical enclosures need to be located external to the module, then they shall be located in a suitably recessed panel within the module outer frame. The equipment in the recess shall be protected from damage during transportation. (e.g. use of removable or hinged cover plates).
- Electrical equipment is to be protected against corrosion.
- A system of space heating may be required if there is a chance of humidity or condensation. The normal module heating system may be used for this if suitable. Electrical enclosures which are exposed to the outside atmosphere and which are sensitive to moisture shall be equipped with individual space heaters. This is, however, not required for simple junction boxes.
- The heating system shall be activated whenever practical both onshore and offshore.
- Portable utility equipment is to be securely fixed. The construction and fixing of all equipment shall result in the module being able to withstand the likely stresses imposed on it when the module is transported or lifted.
- External power outlets and sockets shall be located approximately 1500 mm above the base of the module.
- Internal power outlets and sockets and shall be located a minimum of 300 mm above the internal floor level.
- Socket outlets for a rated current in excess of 16 A shall be interlocked with a switch or have integral switching so that a plug cannot be inserted or withdrawn when the switch is in the ‘on’ position.
- Hook-up connections shall be protected to minimise the effects of splashing water. These shall be easily accessible for hook-up and maintenance purposes, and located between 600 mm and 1500 mm above the base of the module.

— External panels and/or control stations which are required to be operated by personnel during normal operation shall be located approximately 1500 mm above the base of the module. Consideration shall be given to the location of control panels and control stations within the module so as to be easily accessible to personnel operating the equipment.

Connection to offshore installation power supply system modules shall be prepared for cable hook-up according to the following:

— Suitable junction boxes are to be arranged in recesses on the outside wall. This arrangement may also be suitable for flexible cable types provided strain relief devices are fitted.
— Where an "A" fire rating is not required the module can be fitted with cable transits for connection into junction boxes inside the module. Cable transits shall be installed as to resist smoke or fire for 60 minutes.

Modules shall have their in-take circuits and components rated for defined values of nominal voltage, frequency, current, short circuit level and type of system, e.g. IT, TN-S, etc. This data shall be clearly marked at the connection point.

Enclosures for termination of external cables shall be arranged such that the cables can be conveniently connected, i.e. without excessive bending of the conductor ends and without having to unscrew terminals or other parts.

Guidance note:
The offshore installation should have pre-installed junction boxes or socket outlets within a reasonable vicinity such that the modules can be conveniently connected.

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A load switch shall be mounted at the main power intake. The switch may be a suitable circuit breaker, a manual switch or similar, and shall be certified safe equipment rated for the hazardous area in which it is located but for a minimum of zone 2. If the module has several power sources, one switch for each power source shall be installed. The switch(es) shall be readily accessible and be operable outside its enclosure and be arranged and marked in a suitable manner in order to provide a means for manual local emergency shutdown. Each switch shall be housed in a separate enclosure or shall otherwise be arranged to enable work without accidental touching of live parts.

4.5.4 *Ingress Protection*

Modules and their components shall have appropriate IP ratings in accordance with Table 4-3.

Table 4-3 Equipment Ingress Protection Requirements

Rating	*Typical Location*
IP 20	Electrical components mounted inside dry weather tight modules
IP 55	Use of IP 55 may be agreed to in special cases, provided additional safety precautions are taken to prevent sea splash both during transportation and installation. This will be noted on the DNV 2.7-2 certificate.
IP 56	Electrical equipment mounted external to the module or installed in non-enclosed or open modules shall a minimum of IP 56
	If water based fire extinguishing systems are provided, electrical equipment for safety functions shall be at least IP 56
	Modules where liquids may be present shall be at least IP 56 or be provided with protection to limit the risk of electrical equipment being in contact with liquids.

Guidance note:
Lower IP rating (limited at IP44) may be accepted if suitable protective covers are provided during shipment, storage and operation otherwise components shall be at least IP 56. Consideration must be given to ingress close to the edges of the cover

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4.5.5 *Electrical system main characteristics*

The module may be designed for single or multiple supply voltages. The certification will verify that the integrity of the voltage system is maintained throughout and that the systems are appropriately marked.

4.5.6 *Earthing*

4.5.6.1 Earthing of the module structure

A minimum of two earth bosses mounted diagonally, suitably recessed and opposite each other, are to be welded to the main steel structure on the outside at the module's lower part. Bolts for fixing the module to the

deck are not to be regarded as an earthing connection. Main structural earth boss shall be min M12. Protected/ Power Earth and Instrument Earth shall be connected to structure via separate earth bosses not less than 1 metre apart.

Welding the module to the deck is considered an alternative method of earthing.

4.5.6.2 Electrical System Neutral Point or Single Pole Earthing

All insulated electrical and control systems within the module are to have continuous insulation monitoring. The circulating current shall not be above 30 mA. In the event of an earth fault, either automatic tripping of the affected circuits shall occur or an alarm shall be generated. If automatic tripping is not implemented, means are to be provided for transmitting the alarm signal to the offshore installation control room. If there are several circuits, one common alarm to the control room will normally be sufficient. Local galvanic isolated systems may be earthed at one point.

Earth leakage circuit breakers are to be provided in the final sub-circuits or at a suitable location upstream.

4.5.6.3 Earthing of electrical enclosures and terminal boxes

Equipment made of conductive material are to be earthed either via the copper braid of the cable, a separate earth core within the cable, or via a separate earth conductor. Where copper braid is used, this shall have a cross sectional area as defined in Table 4-4. Where non-copper earth connections are used the cross section shall be increased dependent upon the increased resistance of the material compared to copper.

Hinged or bolted connections are not considered to be an earth therefore a separate earth connection shall be provided where required.

All earth bars shall be located at the front of enclosures and terminal boxes.

Table 4-4 Earth/Bonding Conductor Cross Sectional Area

Condition	*Cross Sectional Area*
Internal panel wiring	Same size as current carrying conductors however must be minimum 1.5 mm^2
Internal Static Bonding	Minimum 4 mm^2
External Static Bonding	Minimum 6 mm^2
Earth Conductor for Equipment *(Excludes internal panel wiring)*	Same cross section as the current carrying conductor up to and including 16 mm^2. 50% of the current carrying conductors cross section above 16 mm^2
Structural Earth Connection	Minimum 16 mm^2 however shall be at least the same size as the earth in the supply cable

4.5.6.4 Earth Conductors

Earth conductors shall be coloured yellow/green and shall not be used for any other purposes than earthing.

Only one earth conductor shall be connected to a single terminal/earthing point. Multiple connections can be made utilising an earth bar. An exception to this arrangement can be granted for components located inside the same enclosure when utilising a terminal or crimped connections which are designed to accept multiple cable entries.

External earth connections shall be secured by a minimum of M10 bolts and indoor earth connections shall be secured by a minimum of M8. All connections shall be assembled with star washers to prevent loosening due to vibration.

4.5.7 *Cables*

All cables shall have documented compliance with the following standards or equivalent.

Table 4-5 Applicable specification for cabling

Cable Type	*Reference Standard*
Power cables	IEC 60092-350: Electrical Installations in Ships –Shipboard Power Cables – General Construction and Testing Requirements
Instrumentation and communication cables for use up to 250V	IEC 60092-376: Electrical Installations in Ships – Cables for control and Instrumentation circuits 150/250 V (300 V)
All cables	Minimum of flame retardant according to IEC 60332-1-2 and IEC 60332-3-22 All cabling for equipment used as part of an essential/safety system shall be fire resistant to IEC 60331-21 or IEC60331-31. Essential/ safety system are defined in 2.2.

4.5.7.1 Fixing of cables

Cables are to be securely fixed and terminated in a durable manner. Cables shall be secured at a maximum distance as defined in Table 4-6.

Cables shall be secured close to the gland to provide support and prevent damage to the integrity of the cable or gland. This shall be as close as possible to the cable entry without applying additional mechanical forces to the connection, and shall not be greater than 10 cable diameters from the cable entry point.

Metallic ties must be used for the first securing point from the gland at each end. The routing of cabling shall be such as to ensure that it is possible to verify the required IP degree for the enclosure and that the glands are properly maintained.

Table 4-6 Maximum spacing for cable securing (Horizontal runs)

Outer Diameter of Cable (D)	*Wire Braid Armour or Un-armoured Cables (mm)*	*Spiral Steel Wound Armoured Cables (mm)*	*Mineral Insulated Copper Shielded Cables (mm)*
D ≤ 8mm	200	250	300
8 mm<D≤13mm	250	350	370
13 mm <D≤20mm	300	350	450
20 mm <D≤ 30mm	350	400	450
D>30 mm	400	450	450
Note: For vertical securing of cables, the above spacing can be increased by 25%.			

To prevent collapse of cabling in case of fires, metallic ties should be utilised. On horizontal runs photo-stable non-metallic ties may be used providing every third securing point utilises a metallic tie. The minimum bend radius of cabling shall be in accordance with the manufacturer's recommendations. In the absence of such information, the cable bending radius shall at a minimum be as recommended by IEC 61892-4. Reference is made to Table 4-7.

4.5.7.2 Conductor Sizing

The cross section of conductors versus current rating is specified in IEC 60092-352, Table A.3. Where multiple cables or conductors are laid in contact with each other, the de-rating factors stated in IEC 60092-352, Table A.6 shall apply.

The minimum cross section of power supply cables shall be 1.5 mm^2. For interconnections inside panels, the minimum cross section permitted is 1 mm^2.

The minimum acceptable cross sectional area of conductors in cables for control, data and instrumentation circuits up to 150 V is 0.5 mm^2. The circuit protection when utilising this cable size shall not exceed 5A.

Guidance note:

Where data cables are not used in safety systems or in control/monitoring functions which could lead to or cause escalation of an incident, these can be accepted in internal areas down to 0.22 mm^2.

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4.5.7.3 Terminations

All cable conductors shall be terminated in a suitable crimped ferrule or terminal with only one conductor per terminal. An exception to this arrangement can be granted when utilising a terminal or crimped connections which are designed to accept multiple cable entries.

Spare conductors shall be terminated at both ends in the same way as earth conductors. Spare conductor sleaving shall not be coloured yellow/green, but shall be marked "spare."

Termination methods shall be such that the cross section of conductors and braiding is not reduced, and that loosening is also prevented.

Cables shall be permanently marked at each end with the identifier which is traceable to the approved drawings.

Table 4-7 Bending radii for cables			
Bending radii for cables rated up to 1,8/3 kV			
Cable construction		*Outer Diameter (D)*	*Minimum internal radius of bend (x Diameter of cable)*
Insulation	Covering		
Thermoplastic or thermosetting with circular copper conductors	Unarmoured or unbraided	Up to 25 mm	4 (a)
		>25 mm	6
	Metal braid screened or armoured	Any	6
	Metal wire armoured Metal tape armoured or Metal sheathed	Any	6
	Composite polyester/metal laminate tape screened units or collective tape screening	Any	8
Thermoplastic or thermosetting with sector shaped copper conductors	Any	Any	8
(a) 6 D for defined circuit integrity			
Bending radii for cables rated at 3.6/6(7.2) kV and above			
Cable construction		*Overall diameter (D)*	*Minimum internal radius of bend (x Diameter of cable)*
Single-core cable		Any	12
3-core cables		Any	9
NOTE: For cables rated at 3.6/6(7.2) kV and above, employ flexible conductor stranding (Class 5) and braid insulation shields indicating a minimum bend radius of 6D for unarmoured cables and 8D for armoured cables, in concurrence with the approval of the cable manufacturer.			

4.5.7.4 Termination of braiding, armour and screens

Cables which are external or exposed on the module shall be with braid or armour. Full enclosing the cable in metallic cable pipe shall be considered as an alternative when braid/armour cannot be installed (i.e. on pre-fitted flying leads).

Cable braiding, armour and screens are to be carried through the gland when possible and be connected to the earth bar at both ends. However, when found necessary for function or safety reasons, connection to earth at the supply end only may be used. Plastic junction boxes used for loop through of circuits may be equipped with an earth bar which is not connected to the structure, but shall otherwise be marked and used for connection of the braiding as an ordinary earth bar.

When braiding, armours and screens are earthed at one end only, the other end is to be carried through the gland and connected to an insulated terminal.

4.5.8 *Batteries*

All circuits to/from the batteries are to be provided with adequate circuit protection devices. Short circuit proof cables are to be applied between the batteries and the circuit protection device.

Batteries located in modules on deck shall be in certified safe equipment enclosures suitable for at least zone 2. However, consideration must be given to the equipment being supplied. Where equipment supplied is not certified safe equipment, the batteries shall be supplied via an Ex-d isolator.

Batteries shall be of a valve regulated type and not exceed 200 Vah. Any higher capacities or other types can be considered on a case-by-case basis based on requirements from DNV-OS-D201.

4.5.9 *Equipment located external to module*

The external location of components (junction boxes, control panels, pipe connections, fans, etc.) should be avoided. Components that have to be located externally shall be installed within the equipment's outer frame to avoid damage of components due to lifting and handling of the module.

If located external to the module, electrical and control equipment shall be suitable for use in the applicable hazardous area zone and environmental conditions specified in 4.2 apply.

Special attention is to be given to electrical components mounted external to modules and which may be directly exposed to sun radiation.

Rotating machines exposed to the outdoor atmosphere shall be suitably protected against icing. Motors are not to have an external cooling fan unless the fan has been assessed as not being an ignition source and the overall equipment, including the fan, meets the ingress protection requirements.

4.5.10 *Programmable controllers*

When programmable controllers (PLCs) are used for safety functions, they shall be of types suitable for the environmental conditions as given in 4.2.

Programmable controllers (including the specific firmware/software) which are used for safety functions shall be demonstrated as "fail safe". The manufacturer shall be able to demonstrate the following fail safe conditions:

— failure of Hardware
— failure of Input / Output devices
— failure of Software / Firmware
— loss of electrical supply.

4.6 Ignition Prevention

4.6.1 *Requirements for electrical equipment exposed to hazardous atmospheres*

4.6.1.1 Certification of equipment

Electrical equipment for hazardous areas shall be designed, certified and categorised according to the IEC 60079 series publications or equivalent standards.

Where independent certification is required by the standards, this certification shall be carried out by an accredited Notified Body or other independent recognised institution.

When the letter "X" is included as part of marking or certificate number, this indicates that the certification institution has specified special conditions for the safe use of the equipment. Special conditions that are dependent upon final offshore installation shall be listed in the DNV 2.7-2 certificate.

Guidance note:
Certified safe equipment certificates may be invalidated by un-qualified repairs or modifications.

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4.6.1.2 Non Electrical Equipment in hazardous areas.

In addition to ignition risk from electrical equipment, assessments are required to ensure equipment does not present an ignition risk from mechanical (i.e. surface temperature, impact or friction), static discharge or lightening. Assessment for mechanical ignition risk shall follow the requirements of IEC 13463 series or equivalent.

4.6.1.3 Inspection and Installation

Installation of hazardous area equipment shall be in accordance with IEC 60079-14. An inspection plan shall be provided in accordance with IEC 60079-17. Records shall be retained to demonstrate that this inspection plan has been met during the life of the module.

The competence of the person carrying out the installation and inspections shall be demonstrated upon request to the satisfaction of DNV.

4.7 Fire & Gas Detection

4.7.1 Gas detection and alarm system

4.7.1.1 General

All air inlets shall be fitted with a gas detector upstream of the fire or gastight damper unless all installations are of certified safe equipment and the use of tools or equipment in the area will not create any ignition potential.

In certain cases it may be necessary to interface the gas system in the module with the offshore installation. Details should be provided within the operational manual on required hook-up, operation and testing.

Non-enclosed modules with equipment containing a source of hydrocarbon release shall be fitted with a minimum of one gas detector. Where this is not possible special requirements shall be noted on the DNV 2.7-2 Certificate detailing need for suitable gas detection to be provided by the offshore installation.

4.7.1.2 Gas detection inside the module

Gas detectors will be required inside the module if the following situations exist:

— At all ventilation outlets, if an internal source of release is present.
— Inside module, if a source of release is present (e.g. paint stores, gas turbine enclosures, laboratory) or if the module contains equipment which develops a hot surface.
— Inside module, if disconnection of battery supplied equipment is delayed on loss of pressurisation.

Gas detection inside the module does not replace the need for gas detection at the air inlet. The air inlet, for ventilation, is the point within the non-hazardous area from which the air is drawn.

4.7.1.3 Gas detection system

The gas detection system shall be capable of initiating the following actions, either through an integrated control system or in conjunction with the offshore installation:

Table 4-8 Gas detection and alarming required actions

Cause	*Effect*
Low level gas at the air inlet Range 10-30% LEL	— Audible and visible signals in the module — signal to the offshore installation CCR shall be provided.
High level gas at the air inlet Range 10-80% LEL	— audible and visible signals shall be given in the module — fans shall be stopped — non certified safe equipment inside the module shall be isolated — signal to the offshore installation CCR shall be provided — fire/gas tight dampers, if fitted, shall be closed.

The gas detection system shall alarm or shutdown within 10 seconds of detecting of gas at the appropriate level. A set of volt-free contacts for each of the low and high level signals to the offshore installation CCR shall be provided.

When a gas detector has been activated, resetting of the gas detection system shall only be possible following manual intervention.

The setting of the low and high levels of gas concentration can be adjustable. The levels defined above, for the low level and for the high level, are considered to be suitable ranges.

Guidance note:

Shelf states may stipulate other standards, e.g. EN 50381, requires high level gas shutdown at 20% LEL.

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Point detectors shall not be used for air velocities above 12 m/s unless specified as suitable from the detector manufacturer.

The gas detection and alarm system shall be active at all times including during periods when power sources within the module are shut down. The local gas alarm station shall be connected to the same source used to supply the offshore installation fire & gas detection system or have a battery backed supply sufficient for 24-hour operation.

Guidance note:

Should the gas detection system be powered from the offshore installation emergency switchboard the requirement for supply from the battery backed supply can be reduced to 2 hrs. However, the battery supply (transitional power) run time should be confirmed by as being of the same discharge duration as the offshore installation main F&G detection system (when running on battery/UPS supply).

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4.7.2 Fire detection and alarm system

4.7.2.1 Fire detectors and alarm

At least one fire detector shall be located in each area of the module which presents a fire risk. This may be omitted in small airlocks which contain only minimal certified safe equipment or no combustible materials.

The type of detector shall be selected as the best suitable for early and reliable detection according to the actual fire risk.

The fire alarm system shall be designed and installed with certified safe equipment for operation in a zone 1 hazardous area regardless of intended location on the offshore installation.

Table 4-9 Fire detection and alarming required actions		
Fire Detection Installation Type	*Cause*	*Effect*
Module with integral fire alarm system	Activated fire alarm — by detector or manual pushbutton	— Audible and visible signals in/around the module where persons may be present — Mechanical ventilation shall be stopped — Fire dampers shall close — Non certified safe equipment inside the module shall be isolated — signal to the offshore installation CCR shall be provided.
Module without integral fire alarm system	Activated fire alarm — by detector or manual pushbutton	Offshore installation shall ensure the following occur: — Mechanical ventilation to the module shall be stopped — Audible and visual alarms in modules where persons may be present. — Non certified safe equipment inside the module shall be isolated — Module fire dampers will close (on loss of power).

4.7.2.2 Modules fitted with an integral fire alarm system

A fire alarm push button connected to the integral fire alarm system shall be mounted at a suitable place on a manned module and shall be marked “Fire alarm.”

The fire alarm system shall initiate actions as defined in Table 4-9.

The fire detection and alarm system shall be active at all times including during periods when power sources within the module are shut down. The local fire alarm system shall be connected to the same source used to supply the offshore installation fire & gas detection systems or have a battery based supply sufficient for 24-hour operation. See 4.7.1.3 for suggested alternative solution.

4.7.2.3 Modules not equipped with an integral fire alarm system.

The fire detector(s) may be connected directly to the offshore installation main fire detection system. In such cases, the module shall be arranged with suitable junction boxes for hook-up to the offshore installation system.

Mounting of appropriate types of detectors may be carried out as part of the installation on board.

A fire alarm push button shall be mounted at a suitable place on manned module and shall be marked “Fire alarm”. The push button shall be wired to a suitable junction box for connection to the offshore installation.

When the fire detection system has been activated actions in accordance with Table 4-9 shall be initiated by the offshore installation’s system.

4.7.3 Emergency Shutdown Initiated from Offshore Installation

The module shall be provided with a means to receive an ESD signal from the offshore installation to isolate all ignition sources. This may be conducted by tripping of supply to the module.

All equipment intended to stay energised after an offshore installation shutdown signal shall be certified safe equipment for a zone 1 hazardous area.

4.8 Communications

4.8.1 Public address and general alarm system (PA/GA)

Modules that are manned shall be fitted with loudspeaker(s) that can be connected to the offshore installation’s PA/GA system.

All equipment for public address and alarm systems shall be certified safe equipment for operation in zone 1 hazardous areas.

In modules with noise levels are above 85 dBA, the audible alarm shall be supplemented by light signals as per the offshore installation’s requirements.

4.8.2 Telephone / Two way communication

All manned modules shall have equipment suitable for effective two way communication with the offshore installation CCR.

Telephone systems, if installed, are to be connected via the module emergency shutdown system. Certified safe equipment circuits are to be used for those parts not being shut down. PA/GA Loudspeakers and telephones shall not share the same cable.

4.9 Fire Fighting

Modules with equipment considered to be a category ‘A’ machinery space or accommodation space shall be fitted with a fixed fire-extinguishing system.

This document has considered the typical fire risk for each of the defined Module Groups and defines minimum requirements for fire fighting equipment in each case. (See 5.1) When considering fire risk the categories detailed in Table 4-10 shall be utilised.

Table 4-10 Categorisation of fire risk

Categorisation	*Definition*
No fire risk	Modules containing no energy sources (i.e. electrical, chemical or mechanical)
Low fire risk	Module for storage of non-flammable equipment such as tools, mechanical parts and electrical equipment not connected to power. The module itself contains only a minimum of necessary electrical equipment for lighting, heating, etc. A fire is not likely to be supported.
Medium fire risk	Modules containing electrical panels, testing equipment, work space for paper work. Modules which are normally manned (not accommodation modules).
High fire risk	Modules containing category 'A' machinery spaces, accommodation modules and stores for flammable liquids. Also high power electrical machinery.

4.9.1 Portable extinguishers

At least one portable extinguisher shall be located inside of the module in an easily accessible position. For modules required to have several means of escape, one portable fire extinguisher shall be available near each exit (normally not required for emergency exits).

The type and quantity of extinguishing systems shall be in accordance with MSC.1/Circ 1275 and MODU code table 9.3.

Minimum capacities for each fire extinguisher shall be:

— 5 kg for CO2 or Dry Powder
— 9 ltr for foam or water based extinguishers.

4.9.2 Fixed extinguishing systems

The following fixed fire systems are accepted:

— Fixed gas fire extinguishing systems designed according to the requirements of IMO FSS Code, Ch.5.
— Automatic sprinkler systems designed according to IMO FSS Code, Ch.8.
— Fixed foam and pressure water spraying systems designed according to IMO FSS Code, Ch.6 and 7.

Manual release facility shall be located at an easily accessible position outside the module. It should have suitable protection against unintentional operation and shall be clearly marked.

Automatic release is recommended for modules containing high fire risk equipment.

The automatic release mechanism may be, e.g., a direct temperature sensitive device or may be operated by a signal from the fire detection system. Fire-extinguishing systems which may cause danger or harm to personnel shall be manually activated only.

If the fire-extinguishing medium is of a gaseous type harmful to personnel the system shall be designed according to DNV OS D301 Appendix A Section C.

Water based systems shall normally have automatic activation only.

Guidance note:
In order to make the system more resistant to false alarms, it is recommended that two or more fire detectors be used, and that the design logic be such that activation of one detector only will not release the system, but will give an alarm only.

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Control circuits for the fire extinguishing system release and corresponding alarms shall be active continuously, including periods when other power sources within the module are shut down. The system shall utilise certified safe equipment for operation in a zone 1 hazardous area regardless of intended location on the offshore installation and shall be connected to the same source used to supply the offshore installation fire & gas detection systems or have a battery backed supply sufficient for 24-hour operation. See 4.7.1.3 for suggested alternative solution.

When a fixed fire-extinguishing system has been released actions as detailed in Table 4-11 shall occur.

Table 4-11 Required actions following release of fixed fire system

Cause	*Effect*
Activated fixed fire fighting installation — Automatic or manual	— Audible release alarm activated inside module, signal shall be different and distinguishable from other signals — Mechanical ventilation shall be stopped — Fire dampers will close — Confirmed release alarm to offshore installation control room — Non certified safe equipment inside the module shall be isolated

4.10 Passive Fire Protection

4.10.1 General

The objectives of passive fire protection (PFP) are to prevent or mitigate the serious consequences from a fire, such as to:

— prevent escalation of fire from one area to an adjacent area
— protect personnel from the fire (heat and smoke) and make escape or evacuation possible
— protect systems and equipment of essential importance for safety.

Materials to be used for the purpose of passive fire protection shall be supplied with an approval certificate documenting compliance with an appropriate Fire resistant test code; e.g. FTP Code. Detailed information supporting the certificates showing required construction methods and limitations shall also be available.

Heat transmissions at intersections and termination points of required thermal barriers in fire rated divisions shall be specially considered.

Guidance note 1:

Any such heat bridge should be insulated to the same rating as the thermal barrier for a distance of not less than 900 mm, typically 450 mm on each side.

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Openings and penetrations in fire-rated divisions shall be arranged so as to maintain the fire rating of the divisions. Penetrations shall be of an approved type for the fire rating of the divisions where they are to be installed.

Guidance note 2:

Refer to SOLAS Ch II-2 Reg 9 for details on ducting and cable/pipe penetrations through fire rated bulkheads.

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4.10.2 Restricted use of combustible materials

Exposed surfaces in ceilings or any surfaces in concealed or inaccessible spaces for accommodation, service spaces and control stations shall have documented low flame-spread characteristics according to the IMO FTP Code Parts 2.

Primary deck coverings shall not readily ignite or give rise to toxic or explosive hazards at elevated temperatures in accordance with the IMO FTP Code Part 5.

4.11 Escape

4.11.1 Doors

A personnel door shall be fitted where users are expected to enter the equipment including for planned maintenance. All personnel access doors shall be self-closing. Container doors are not considered personnel doors unless they are fitted with a self-closing device and are capable of latching into a closed position.

Modules with mechanical ventilation containing ignition sources shall have self-closing doors. All other hatches and doors shall be closed when the module is energised.

All external doors shall open outwards.

The self-closing mechanism is to be capable of closing the door with an over- pressure ventilation system in operation. This requirement does not apply to transport doors or emergency exits. Doors fitted with self-closing mechanisms shall not be fitted with latching mechanisms to hold the door open.

Guidance note:
This requirement supersedes the requirements within DNV 2.7-1 for doors to be able to be latched in the open position.

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Where necessary to prevent unauthorised access, doors may be fitted with a lock. In such cases provision shall be made for safe egress from inside without a key.

Modules which present additional danger if locked in, e.g. air tight modules or refrigeration/freezer modules, an alarm shall be provided to raise attention of personnel trapped within the module. The alarm shall be supplied from an emergency source of power from the offshore installation or provided with a battery back-up should main power be lost. The alarm shall provide a visual and audible warning external to the module when activated.

4.11.2 Emergency exits and escape routes

Modules that are manned, and either have an internal area exceeding 20 m^2 or the distance to the external exit door exceeds 5 m, shall have a separate emergency exit. Any separate emergency exit shall be located in an easily accessible position and as widely spaced from the main exit as possible. Escape hatches shall have a minimum size of 800 mm x 800 mm and be possible to open from both sides by one person. Clearance shall be provided within the module to allow for manoeuvre of a stretcher through the emergency exit. Consideration shall be given to the arrangement and position of the emergency escape with regard to ease of access and distance to deck when egressing though the exit. Any considerations for the user shall be specified in the operational manual and if necessary marked on the emergency exit.

An unobstructed route of 650 mm minimum clear width shall be provided between areas where personnel may be present and exits.

Escape exits shall be marked with photo luminescent material on both sides with the words “EMERGENCY EXIT” and “NOT TO BE OBSTRUCTED”.

4.11.3 Emergency lighting

Manned modules shall be fitted with emergency lighting which shall be certified safe equipment to zone 1 requirements and fitting with integral battery sufficient for at least 60 minutes operation.

At least one emergency light shall be installed in each room of the module where persons may be present.

Battery backed emergency light shall be fitted above main and emergency exits.

Emergency lighting may be omitted in small air locks and in other secondary rooms if there is no closable door and no part of the floor is more than 2 m from the main room.

Guidance note:
Appropriate procedures or some automatic means is to be implemented to ensure that the emergency lighting battery is readily available and fully charged when the module is taken into operation.

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4.12 Heating, Ventilation and Air Conditioning

4.12.1 Air inlets/ outlets

All air inlets shall be fitted with a gas detector before the fire or gastight damper unless all equipment installed in the module is certified safe equipment and the use of tools or equipment in the area will not create any ignition sources.

Closure mechanisms shall be fail safe, i.e. de-energise to close. Simultaneous stop of all ventilation fans should be possible by manual activation of one handle, push button or similar control.

This manual facility may also isolate and/or initiate other functions, e.g., module shutdown/ electrical isolation.

The position of dampers shall be visible locally at the damper and on ventilation control system, if fitted.

The inlet and outlet openings shall be arranged for connection of ducts which can be routed for a fresh air supply/exhaust from/to a non-hazardous area. The design shall normally be arranged for location of the fan at the inlet end of the duct in the non-hazardous area, thus keeping the duct at an over-pressure relative to the surroundings.

Guidance note:
For modules which may be located both in non-hazardous and hazardous areas, it is recommended to design the fan and gas detector as a separate unit which can be attached to the module or alternatively can be mounted remotely by elongation of the air duct. One recommended method is to fit the fan unit into a recess on an outside wall.

If the offshore installation has specific areas which, as a result of risk analysis, etc., are considered to be less exposed to a gas release, and thus are better suited for ventilation air intake, the duct should be routed to this area. This will be at the discretion of the person responsible for the offshore installation and the applicable safety philosophy.

As stated above, the duct should normally have over-pressure, but if the fan is located at the module such that leakage into the duct due to under-pressure can occur, the construction of the duct should be of special gas tight rigid or welded construction or an additional gas detector should be mounted at the inlet to the module. This should be assessed when the module is installed and hence is left to the discretion of the responsible person on board the offshore installation.

If the above method of installation is utilised, the module gas detection system shall be capable of accepting at least one extra gas detector input or the offshore installation central F&G system should be used.

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4.12.2 Natural Ventilation

Natural ventilation may be applied for modules intended only for storage of non-hazardous/non-flammable materials and which are not manned.

The module shall be provided with suitable ventilation openings, located at the top and bottom of the bulkheads.

If a fire risk exists inside the module all ventilation openings, including louvers shall have facilities to be closed from outside the module.

If the module is designed as an open skid or frame, no ventilation system is required.

4.12.3 Mechanical ventilation

The requirements for heating and ventilation systems for offshore containers are based on the following:

— Personnel shall have sufficient fresh air and comfortable working temperatures.
— Ventilation may be used to keep the atmosphere free from explosive gasses and vapours. If the source of hazard is outside the container, the applicable means of ensuring this is to apply internal over-pressure with respect to the external environment.

Guidance note:
The statutory regulations may require a ventilation rate of minimum 12 litres per second of fresh air per person.

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The following modules require mechanical ventilation:

a) Modules in which ignition sources are present.
b) Modules that are manned (For requirements for fresh air refer to 4.12.3.1).
c) Modules in which equipment emits large amounts of heat.
d) Modules with an internal source of release.

The flow of ventilation air shall be continuously monitored. During operation, if inadequate ventilation is detected, a shut-down shall be initiated within a safe period of time unless the supply is automatically restored from alternative fans or any alternative power supply. It is recommended that this safe period should be less than 15 minutes however maximum time shall not exceed the value based on the following calculation:

$$Time\ (minutes) = Free\ volume\ of\ module\ (m^3) / (0.72 \times number\ of\ occupants)$$

4.12.3.1 Working areas (Heating and Air Condition)

For modules which are manned, sufficient heating and/or cooling is to be provided to ensure comfort. The system is to be designed such that the inlet air is not distributed to the work places unless it is conditioned (hot / cold / humidity).

The minimum required ventilation rate for working areas is 12 l/s of outside air per person. The module shall be marked with the maximum occupancy.

4.12.3.2 Cooling of equipment

Outside air intended for cooling of non-certified equipment shall not be fed directly onto the equipment being cooled. The air should instead be fed into the module in order to allow for the response time of gas detection systems.

4.12.3.3 Heating elements and air fans

Heating elements and air fans located in the inlet air duct shall be of hazardous area certified type. This also applies to space heaters for modules intended for location in zone 1 hazardous areas. The fan blades are to be non-sparking and shall have suitable protection against mechanical damage.

For modules intended for location in zone 2 and non-hazardous areas, non-certified safe space heaters may be used provided the exposed temperatures have been tested and confirmed to be below 200°C and a suitable mechanical risk assessment has been conducted in accordance with IEC 13463.

Heaters are to be interlocked with the ventilation fan switch or a flow switch such that they cannot be energised unless the fan is running

Heaters are to have at least one safety temperature sensor in addition to the normal service working temperature regulating devices.

Guidance note:

For testing of the maximum temperature, the test voltage should be 110%. Where relevant, the temperature rise shall be included after a built-in fan has stopped. The temperature is to be measured directly on the heating elements. If the elements are encapsulated in metal pipes or similar, which are gas tight also at the ends, the temperature may be measured on the pipes.

The following combinations of materials and clearances between impeller and duct are considered to be non-sparking:

- impellers and/or housing of non-metallic material, due regard being paid to the elimination of static electricity
- impellers and housings of non-ferrous metals
- impellers of aluminium alloys or magnesium alloys and a ferrous (including austenitic stainless steel) housing on which a ring of suitable thickness of non- ferrous materials is fitted, due regard being paid to static electricity and corrosion between ring and housing
- impellers and housing of austenitic stainless steel
- any combination of ferrous (including austenitic stainless steel) impellers and housing with not less than a 13 mm tip design clearance.

Any combination of an aluminium or magnesium alloy fixed or rotating component, and a ferrous fixed or rotating component, regardless of tip clearance, is considered a spark hazard and is not to be used.

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4.12.4 Over-Pressurised Ventilation Systems

Modules with ignition sources (e.g., non-certified hazardous area equipment) located in a hazardous area shall have over-pressure with monitoring. The value of the overpressure inside a module shall be kept above 50 Pa but shall not exceed 200 Pa.

Guidance note:

It should be noted that for pressurised modules built within EU/EEA countries this standard has not been fully aligned with the essential health and safety requirements of EN 50381. Where requirements differ between EN 50381 and DNV 2.7-2 guidance notes have been inserted. When pressurised equipment is intended for use in an EU/EEA member country it is recommended for the client to specify additional review to EN 50381 allowing this to be incorporated within the Offshore Service Module Certificate.

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Boundary doors shall be self-closing and gas-tight.

Enclosed spaces (e.g., panels, cupboards, cable ducting) shall not exceed 10% of the volume of the module without being provided with additional means of ventilation e.g. louvers. If an internal source of release exists in these enclosed spaces they shall be provided with additional ventilation regardless of volume.

An automatic system for control of the purging shall be implemented. The necessary time for purging shall be established based on tests and measurements of air flow on the built module.

A pressure drop for a limited period of 30 seconds during the purge phase may be acceptable. If the pressure drops for more than 30 seconds, the purge cycle should be automatically restarted.

Regardless of safe area or hazardous location, a purge cycle of minimum 6 air changes is to be performed before non-hazardous area certified equipment inside the module is energised.

Guidance note:

Shelf states may stipulate other requirements, e.g., EN 50381 which requires a minimum of ten or five volumetric air changes per hour for zone 1 and zone 2 hazardous areas respectively, and that air changes shall be doubled unless representative gas testing is conducted.

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Failure of over-pressure ventilation shall be alarmed at a manned location (local and remote). A pre-set time delay of up to 30 seconds may be applied to minimise spurious alarms when doors are intentionally opened.

Guidance note:

Shelf states may stipulate other requirements, e.g., EN 50381, which requires instantaneous shutdown of zone 1 modules or modules with an internal source of release unless an external door switch is fitted indicating the door has been left open.

An allowable delay time of 30 seconds for opening the module door has proved to be a practical compromise and has been commonly used.

On loss of over-pressure, isolation of the batteries may be delayed for up to 10 minutes. This requires an internal gas detector to be fitted for immediate isolation of batteries on gas detection.

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Ignition sources shall be isolated where ventilation cannot be restored within a short time, typically within 30 seconds and at a maximum 90 seconds, or if gas is detected within the area during ventilation failure.

The following automatic actions shall then be initiated:

— All electrical equipment inside the module which is not certified safe equipment for the corresponding outside hazardous area shall be isolated.
— Essential Safety systems (as defined in 2.2) shall not be shut down.
— A loss of pressurisation alarm is initiated to the offshore installation control room.

Guidance note:

Shelf states may stipulate other requirements, e.g., EN 50381, which requires shutdown of inlet and extract dampers upon the occurrence of ventilation failure and/or loss of pressurisation.

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The switch for isolating non-certified equipment for the above shall be certified safe equipment for use in a hazardous area.

An indicating instrument showing the actual differential pressure relative to atmosphere shall be installed within the module.

4.12.4.1 Air locks

Modules for use in zone 1 which contain ignition sources shall have overpressure ventilation and an air lock. In an air lock, the inner door should open into the module. (i.e. both doors open away from the airlock)

Guidance note:

Arrangements where the inner door of the airlock opens into the airlock shall also be considered providing there is sufficient space for the internal door to be closed prior to the external door being opened.

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Air locks shall consist of gas tight bulkheads and gas tight self-closing doors. The air lock shall be mechanically ventilated at a positive pressure against the adjacent hazardous area or outside atmosphere, and the air lock shall at a minimum be classified zone 2.

Where the airlock is gas tight use of a gas detector within the airlock in place of mechanical ventilation shall also be accepted. Gas detector shall be set to shutdown module at 25% LEL.

There are no requirements for an air lock in modules placed in non-hazardous and zone 2 areas. However, where an inner door is installed suitable purging of the space between the external door and the internal door shall be demonstrated in order to ensure that the accumulation of hazardous atmospheres cannot occur.

Guidance note:

Modules with internal and external doors with the space between not fitted with mechanical ventilation a control procedure shall be implemented to ensure that the internal door is open prior to purging commencing.

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4.12.4.2 Non Certified Safe Equipment in Pressurised Modules

To ensure full isolation of ignition sources within the module the following shall be applied:

— No battery operated devices (e.g. laptops, data recorders etc.) unless batteries are removed and adequately stored to prevent short circuit.
— Exposed surface temperatures on equipment shall be assessed and confirmed to be below 200°C (e.g. ovens, heaters, display monitors, computers, etc.).

The above requirements are to be included in the Modules Operational Manual to highlight the need for the end user to comply with the above when adding or using equipment within an approved module.

For zone 1 modules ovens, heaters and other equipment which generates a hot surface cannot be added to the unit and must be approved as part of the overall module assessment.

5 Module Service Types

These requirements are intended to clarify which parts of this standard shall be applied. It remains the responsibility of the manufacturer to ensure that all requirements applicable for the type/functions within the module are addressed.

Table 5-1 defines the module types specified within this standard. A module will always be of a type specified in type 1-9. Should functions/equipment specified in groups A-G be used all requirements of the applicable groups shall be satisfied. Applicable module groups shall be specified on the DNV 2.7-2 certificate.

Other types of module other than those listed here can be included in the DNV 2.7-2 certificate after special agreement.

Table 5-1 Module Types and Functional Groups

	GROUP	*DESCRIPTION*
MODULE TYPE	1	ACCOMMODATION MODULE
	2	PRESSURISED WORKSPACE
	3	NON-PRESSURISED WORKSPACE / MODULE
	4	LABORATORY (INTERNAL SOURCE OF RELEASE)
	5	WORKSHOP FOR HOTWORK
	6	FLAMMABLE MATERIAL/PAINT STORE
	7	REFRIGERATION ROOMS
	8	LOCAL EQUIPMENT ROOM (Electrical)
	9	NON-SPECIFIC EQUIPMENT MODULE
FUNTIONAL GROUP	A	COMBUSTION ENGINES
	B	AIR COMPRESSORS
	C	STEAM GENERATORS
	D	WELL INTERVENTION EQUIPMENT
	E	DIVING SYSTEMS
	F	HYDROCARBON CONTAINING EQUIPMENT (tanks, pressure vessels)
	G	DRILLING EQUIPMENT

5.1 Modules for Important Services

Modules for Important Services, defined in 2.2, can be manned or unmanned.

Equipment for important services may need to deviate from the electrical isolation strategy detailed within this standard. A separate electrical isolation strategy shall be developed for the module detailing how the module will present alarms to the operator and what actions to take.

Modules certified by DNV based on the strategy in the operational manual will have this documented on the DNV 2.7-2 certificate. The approved strategy with the procedure for shutdown of the equipment shall form part of the documentation that accompanies the module.

5.2 Module Types

Table 5-2 Summary of requirements based on module type

Section	Title	Accommodation Module	Pressurised Workspace	Non Pressurised Workspace	Laboratory (internal Source of Release)	Workshop for Hot Work	Flammable Material Store	Refrigeration Room	Local Equipment Room	Non Specific Equipment Module (A)
3	Structural	Structural assessments for dynamic loads are required for “Important Service” modules. Requirements for Sea fastenings shall always be applicable on floating offshore installations.								
4.1 - 4.5		Requirements for these sections shall always be considered.								
4.6	Ignition Prevention	1	X	3	X	3	4	1	X	3
4.7	Fire and Gas	X	X	X	X	X	X	5	X	X
4.8	Communications	6	X	7	X	7	7	7	7	7
4.9	Fire fighting	8	9	9	10	9	11	9	9 and 17	9
4.10	Fire Protection	12	12	13	12	13	13	-	13	13
4.11	Escape	X	X	X	X	X	14	15	14	X
4.12	Ventilation	X	7	7	7	7 and 16	7	7	7	7
4.12.4	Over-pressure	18	X	-	X	18	-	-	X	-

General
For Module Types 1-8, a basic fire risk assessment has been made in order to determine the above requirements, for Module Type 9 or variations on Types 1-8 an individual fire risk assessment shall be made by the manufacturer using Table 4-10 for reference.
(A) Module Type 9 - Depending upon function type certain requirements in Sections 4.7-4.10 may be provided directly by use of offshore installation systems rather than integral to the module. This will be detailed within the DNV 2.7-2 certificate.
X – Requirements shall always be applicable

1) Not permitted in hazardous areas.
2) Left blank
3) Refer to 4.1.2
4) The internal areas of the module are classified as a hazardous area. Zone category and extents of external zone around ventilation openings shall be determined based on the product’s emissions of flammable and explosive gases, and the exposure time if emissions occur. Certified safe equipment shall be for a minimum of group IIB and temperature rating T3. Materials with lower gas groups or auto ignition temperature below 200°C shall not be stored within the module unless electrical equipment installed is suitability rated.
5) Gas detection equipment shall be capable of detecting a release of refrigeration gas which may be harmful to personnel.
6) Minimum of two speaker loops shall be supplied with separate hook up points to the offshore installation to provide redundancy (i.e. one from each redundant PA system on the offshore installation).
7) Applicable if module is manned
8) Fixed fire fighting sprinkler system required. Portable extinguishers distributed according to SOLAS required.
9) Portable extinguishers distributed according to SOLAS required. Fixed fire fighting system based on documented fire risk.
10) Assessment of the quantities & type of flammable materials within the module shall be provided. This should consider the situation following loss of ventilation. Based on this assessment a fixed fire fighting system sufficient to extinguish the most prevalent fire risk shall be provided. Portable fire extinguishers shall be provided if the selected fixed fire system is not suitable for extinguishing fires from all type of materials stored within the module.
11) Details of the materials types permitted to be stored within the module shall be defined; this will determine the suitable type of fixed fire fighting equipment.
12) Shall be continuous steel construction as minimum otherwise Refer to SOLAS Ch.II-2 Reg.9 Table 9.3 and 9.4 should the equipment need additional fire ratings if used adjacent to control station or combustion engine.
13) Continuous steel construction. All openings shall be closable from outside the module and all penetrations and seals shall resist fire or smoke for 60 minutes. Please also refer to 5.3. for specific functional requirements.
14) Modules shall be fitted with lockable doors. (See 4.11.1)
15) See 4.11.1 with regard to provision for alarm and escape if occupant is locked within module.
16) If the module contains ignition sources, it shall be located in non-hazardous areas or meet the requirements in 4.12.4
17) Modules supporting important services shall be fitted with a suitable fixed fire system.
18) Optional depending upon client request

5.3 Specific Requirements for Functional Groups

5.3.1 *Combustion Engines*

Table 5-3 Summary of requirements for combustion engines

General	Combustion engines designed for location in non-hazardous areas shall be constructed to ensure that no ignition sources are present following shutdown of the equipment. This requires confirmation that the temperature of the exhaust gas is less than 300°C and all surface temperatures less than 200°C. Should the exhaust gas temperature be in excess of 300 °C the manufacturer can provide details of heat dissipation on the exhaust surface once the engine has been shutdown.
	It shall be defined whether the engine supports an Important service.
	If a marine specification engine is required NOx emissions shall be considered and documented in accordance with Marpol Annex VI
Ignition Prevention	Starting battery shall be connected via an Ex d isolator which will disconnect the batteries on confirmation of gas within the area. Battery terminals shall be constructed as to prevent accidental short circuit. Cabling between batteries and isolator shall be double insulated and in single cores. Cables shall be mechanically protected to prevent accidental short circuit.
Ignition Prevention – Fuel Supply	Drip tray shall be installed below engine to collect any diesel leaks. Operational manual to include regular checks on levels and emptying of the drip tray.
	Excess diesel shall be routed back to the diesel fuel tank and not to the pump feed chamber. The return area in the tank shall be separated and ventilated to avoid continuous agitation of diesel and pressure build-up in the diesel tank
	Diesel and lubricant hoses shall be made of hydrocarbon-resistant materials. Joints in proximity to the engine shall be taped to prevent splash of diesel onto engine. High pressure fuel pipes between the fuel pumps and the injectors shall be double skinned.
	Diesel fuel tanks shall meet requirements of IMDG code or transported with a maximum of 5 litres of fuel within the diesel system.
	Diesel tanks shall be fitted with a manual shut-off valve which can be closed from outside the module. Diesel supply to the engine shall be gravity fed or arranged such that the inclinations declared in Section 4.2 do not cause loss of suction.
	Diesel tanks shall be fitted with a gauge for manual determination of fuel level. Gauge shall be supplied via a manual value which cannot be secured open. Gauge materials shall be fire resistant.
	The cap and dipstick for lubrication oils shall be secured against coming loose due to vibration on in shipment.
Fire & Gas / Shutdown	All safety relief devices valves shall be certified and records available for current maintenance/calibration
	Gas detector shall be installed in air inlet.
	Suitable fire detector(s) shall be located within the module.
	The following emergency shutdown functions shall, as a minimum, be provided: 1) Local emergency stop accessible externally 2) Remote stop from offshore installation control room 3) Remote closure of diesel supply valve (outside space) 4) Overspeed 5) Low Oil pressure 6) High Cooling Water temperature 7) Automatic rapid closing valve in combustion air inlet
Fire Protection	Exhaust pipes shall have fireproof seals between flanged joints.
	Continuous steel construction module required. All openings shall be closable from outside the module and all penetrations and seals shall resist fire or smoke for 60 minutes. Personnel doors shall be self-closing and container end doors shall remain closed while operational
Module with combustion engines of 375 kW or greater	Fixed fire extinguisher system with automatic release and manual release external to the module shall be installed suitable for extinguishing of diesel/fuel type fire. Refer to 4.9.2
Module with combustion engines less than 375 kW	A 45 kg wheeled foam fire extinguisher shall be provided with the unit. This shall be removable to allow for location in proximity to the main entry to the module.
	Double skinned high pressure fuel pipes between the fuel pumps and the injectors are not mandatory.

5.3.2 *Air Compressors*

Table 5-4 Summary of requirements for air compressors	
General Requirements	It shall be defined whether the air compressor will support an important service.
Ignition Prevention	All mechanical ignition risks shall be assessed in accordance with EN13463. Fan belts shall be antistatic.
Fire and Gas / Shutdown	Gas detector shall be provided in the air intake to the compressor room or the compressor itself. Air compressors that are part of the start-up system for temporary diesel engines are exempt from the gas detector requirement.
	The following emergency shutdown functions shall be provided: 1) Local emergency stop 2) Remote emergency shutdown from control room 3) Automatic shut down on gas detection
Fire Protection	There are no specific requirements for fire protection provided no surface temperature in excess of 200°C is present and that no ignition sources are present following shutdown on gas detection.
Ventilation – Breathing air	Where breathing air is required the supply air shall be taken from a non-hazardous area. Air duct from non-hazardous area shall be designed and installed as to protect against leakage.
	The quality of the breathing air shall be in accordance confirmed on an annual basis by an external lab.

5.3.3 *Steam Generators*

Table 5-5 Summary of requirements for steam generator	
Ignition Prevention - General	Diesel fuel steam generators designed for location in non-hazardous areas shall be constructed to ensure that no ignition sources are present following shutdown of the equipment. This includes requiring the surface temperature of the exhaust to be below 300°C or below 200°C for all other surfaces. Should the exhaust gas temperature be in excess of 300 °C the manufacturer can provide details of heat dissipation on the exhaust surface once the boiler has been shut down.
	Spark arrester shall be fitted in the exhaust system and shall be certified in accordance with requirements in EN 1834-1.
Ignition Prevention – Fuel Supply	Excess diesel shall be routed back to the diesel fuel tank and not to the pump feed chamber. The return area in the tank shall be separated and ventilated to avoid continuous agitation of diesel and pressure build-up in the diesel tank.
	Diesel hoses shall be made of hydrocarbon-resistant materials. Joints in proximity to the engine shall be taped to prevent splash of diesel onto engine.
	Drip tray shall be installed below burner to collect any diesel leaks. Operational manual to include regular checks on levels and emptying of the drip tray.
	Diesel fuel tanks shall meet requirements of IMDG code or transported with a maximum of 5 litres of fuel within the diesel system.
	Diesel tanks shall be fitted with a manual shut-off valve which can be closed from outside the module. Diesel supply to the engine shall be gravity fed.
	Diesel tanks shall be fitted with a gauge for manual determination of fuel level. Gauge shall be supplied via a manual value which cannot be secured open. Gauge materials shall be fire resistant.
Fire & Gas / Shutdown	Gas detector shall be installed in air inlet.
	Suitable fire detector(s) shall be located within the module.
	All pressure relief devices/valves shall be certified and records available for current maintenance/calibration
	The following emergency alarms and shutdown functions shall, as a minimum, be provided: 1) Local emergency stop 2) Low water level in the boiler (alarm / shutdown) 3) High steam pressure alarm/shutdown 4) Remote stop from offshore installation control room 5) Closure of diesel supply valve
Fire Fighting	Fixed fire extinguisher system with automatic release and manual release external to the module shall be installed suitable for extinguishing of diesel fire.
Fire Protection	Continuous steel construction module required. All openings shall be closable from outside the module and all penetrations and seals shall resist fire or smoke for 60 minutes. Personnel doors shall be self-closing and container end doors shall remain closed while operational
	Exhaust pipes shall have fireproof seals between flanged joints.

5.3.4 *Well Intervention Equipment*

Table 5-6 Summary of requirements Well Intervention Equipment	
General Requirements	This is a composite functional group, each component of the well intervention package needs to be assessed individually based on its Module group and function. Consideration shall also be given to whether the equipment is intended for use in an *Important service*.
	Elements which interact with isolation of the well shall meet the requirements of the relevant API standard.
	Winches and lifting equipment shall be certified according to DNV STC 2.22 Lifting Appliances or alternative suitable standard.

5.3.5 *Diving Systems*

Table 5-7 Summary of requirements for Diving Systems	
General Requirements	Diving systems shall be defined as “Outer Areas” in accordance with DNV-OS-E402 and DNV-DS-E403
	The equipment installed in diving systems shall be certified according to the procedures given in DNV-DSS-105.
	Piping systems and electrical systems interconnecting modules used for diving systems shall meet the requirements given in DNV-OS-E402 and DNV-DS-E403.
Fire & Gas	All enclosed spaces in the diving system shall be provided with low oxygen alarms.
	Any spaces where oxygen is present (stored, used or piped) shall be provided with a High O_2 alarm.
	Any oxygen sensors shall be demonstrated as suitable for use in a helium environment.
Fire Fighting	Modules which are part of the “Outer Area” shall be provided with a fixed fire system.
Fire Protection	Modules which are manned, used for control of operations or essential for recovery of divers shall have a fire rating of A60.
Ventilation	Modules where accidental release of gasses may be a hazard, shall be provided with a suitable ventilation system.

5.3.6 *Hydrocarbon Containing Equipment*

Table 5-8 Summary of requirements for Hydrocarbon Containing Equipment e.g. Well test equipment	
General Requirements	Using DNV-OS-E201 Oil and gas processing systems as a reference all hydrocarbon handling equipment shall be certified as compliant with relevant normative standards in Chapter 1 Section 1 Table 1-2 applicable to the actual function.
	Well test package installations require additional “case by case” review based upon the specific configuration and application. Aspects relating to fire fighting, fire protection, ventilation and escape shall be assessed during this review. The manufacturer shall state the limitations of their equipment with regard to these requirements to support this review. The general requirements applicable to the equipment from section 4 shall be applied.

5.3.7 *Drilling Service equipment*

Table 5-9 Summary of requirements for Temporary Equipment related to Drilling services	
General Requirements	Category I Equipment shall be certified by DNV or other recognised 3rd party in accordance with DNV-OS-E101. Category II equipment shall be documented to meet the requirements of DNV-OS-E101 or equivalent.

5.4 Offshore Installations not intended for hydrocarbon related activities

Equipment intended for use on an offshore installation where hydrocarbon liquids or gasses will never be present are permitted to replace certain requirements in this standard with the alternatives listed in 5.4.1 to 5.4.4.

Where alternatives are applied according to this Clause, such limitations shall be noted on the DNV 2.7-2 Certificate.

Guidance note:
Proximity to hydrocarbons where accidental release may reach the offshore installation (i.e. work relating to subsea wells or platform support vessels) shall be considered as areas where hydrocarbons can occur.

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5.4.1 *Inclination on Non-Important Service Equipment*

Inclination angles do not impact the safe operation of the equipment under the following conditions:

— equipment is not used for an important service
and
— hydrocarbon gasses or liquids are not present.

Under these conditions the requirements for Inclination in Table 4-1 are not applicable.

5.4.2 *Batteries*

Batteries are not required to be in zone 2 certified safe equipment enclosures when hydrocarbons do not occur. Batteries shall be located in a battery box or locker.

5.4.3 *Gas Detection*

Gas detection on the equipment or at air intakes is not required where hydrocarbon gasses do not occur.

5.4.4 *Combustion Engines and Steam Generators*

When hydrocarbon gasses or liquids do not occur the maximum surface temperature of a combustion engine or steam generator shall be 220℃ and spark arrestors are not required.

6 Installation and Hook-up

6.1 General

Before the module is taken into service, it shall be safely secured to the deck or supporting structure (See Sec.3).

Cables for power supply and other hook-ups are excluded from certification to this standard however should be suitably protected, mechanically and electrically, when installed on site. Cabling shall be adequately secured to prevent mechanical damage or short circuit and shall not cause a hazard to the offshore installation.

6.2 Interfaces between module and offshore installation

To ensure correct and suitable connections to the module, the certification shall specify all relevant interfaces between the module and the offshore installation. These interfaces may include hook up of:

— electric power supplies
— telephones and PA/GA systems
— signals to and from the control room
— utility systems, e.g., air, nitrogen, steam, hydraulics, water, drains, diesel.

The specification of interfaces shall be sufficiently detailed and unambiguous that the equipment can be safely and correctly hooked up to the permanent utilities on the offshore installation.

6.2.1 *Signal from module or equipment to CCR*

Depending on the configuration of the module, the following signals shall be transmittable:

— Gas Detection
— Fire Detection / Fire Alarm Push button
— Fire extinguishing medium released
— Loss of pressurisation
— Status of monitoring /control systems on the module. These may be connected to a common alarm signal.
— Condition monitoring alarms.

Guidance note:

This includes alarms from monitoring systems for machinery, processes and similar alarms. Equipment, which has this local monitoring system, may have a condition monitoring signal output to the control room if the equipment can be operated unmanned.

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Suitably certified termination facilities should be provided at a convenient location to allow hook-up to the offshore installation cables. Signals from modules to the CCR shall be voltage-free contacts. Regardless of location, such termination facilities should be suitably certified safe equipment rated for the area in which it is located but minimum of zone 2.

Where voltages remain on internal components following shutdown, such equipment is to be marked:

"WARNING, INTERNAL VOLTAGES MAY REMAIN AFTER MODULE SHUTDOWN:
ENSURE THAT ATMOSPHERE IS NON-HAZARDOUS BEFORE OPENING."

6.2.2 *Signals from CCR to module or equipment*

Depending on the configuration of the module or equipment, the following signals shall be transmittable:

— Emergency stop (e.g., rotating/moving machinery).
— Emergency Shutdown, e.g., non-certified equipment and/or safety/battery systems.
— Information via the offshore installations alarm system (PA/GA system/Telephone).

6.3 Instructions for hook-up/installation

Instructions for hook-up/installation of the module shall always accompany the module detailing, at a minimum, the following:

— Instructions on hook-up of equipment incorporating input voltages and required protection settings from the offshore installation.
— Description of the conditions/functions the module shall perform and any safety precautions required to operate within prescribed condition.
— Maintenance requirements and periodic checks.
— Valid certificate of lifting equipment.

Instruction for hook-up/installation shall be provided for approval as part of the design assessment.

7 Marking and instructions

7.1 Information plate

Service modules shall be fitted with both the information plate required by DNV Standard for Certification 2.7-1 and an additional Offshore Service Module information plate. The information plate quality and positioning shall be as required in 6.1 of DNV Standard for Certification 2.7-1.

The additional name plate applicable for DNV 2.7-2 is given in Figure 7-1.

DNV 2.7-2
OFFSHORE SERVICE MODULE
Name of Manufacturer:
Manufacturer contact details:
Design Assessment Ref:
Date of Certification:
Serial Number:
Important Service Use:
Hazardous Area Rating:
Operation Temperature Range:
Minimum Purge Time
Manned Use:
Max. No. of Personnel within module:
Fitted out Mass:
Other Certificates/CoC:
USER MUST REFER TO DNV 2.7-2 CERTIFICATE FOR LIMITATION OF USE

Figure 7-1
Additional name plate for offshore service modules

7.2 Marking of Equipment

Components and cable connections shall be clearly marked to enable tracing to the approved drawings.

All marking plates and signboards shall be of permanent and durable construction. Lettering shall be of sufficient size and colour as to be easily readable from ground/deck level. Signage for shutdown or fire protection systems shall be marked in red with white lettering. Marking shall be secured in place by durable means (i.e. stainless steel screws, rivets or metal bands) Use of plastic cable ties or glue for securing of marking shall only be accepted on the basis of documented evidence that exposure to environmental condition in 4.2 shall not cause a deterioration or detachment of the marking.

Where installation of equipment has changed the tare of the module from the original marking provided when certified to the applied lifting standard, the tare and payload shall be remarked to reflect the fitted out mass.

The following specific markings shall be applied, where applicable:

— Fuse holders shall be marked with Ampère value and circuit designation.
— Adjustable thermal protection devices shall be marked with the appropriate setting.
— Terminal rails shall be marked with the appropriate voltage.
— Electrical enclosures shall be marked with voltage on the outside.
— Battery backed emergency lighting shall be easily identifiable on the external of the lighting fixture.
— All operator control devices/buttons and emergency stops shall be clearly marked with their function.
— Junction boxes provided for hook-up shall be marked with the required function/type, i.e., Main power or Emergency Power.
— Main isolating switches as required by 4.5.3 shall be marked to identify function and supply. i.e., Main power isolator
— Enclosures containing intrinsically safe circuits shall be marked.
— Warning for internal voltages shall be marked.
— Portable fire extinguisher holder shall be marked with the extinguisher type and size.

Modules intended for connection to platform power supply systems shall have the following data clearly marked at the connection point:

— system voltage(s)
— maximum supply protection value
— frequency
— short circuit current
— rated short circuit breaking capacity
— type of distribution system, e.g. IT, TN, etc.

8 Approval and Certification Procedures

8.1 General

Certification consists of the following steps as applicable:

— design assessment
— production inspection & testing
— inspection of the completed installation
— functional testing (if applicable)
— plating and marking
— issuance of certificates.

DNV may issue an "Offshore Service Module Certificate" (DNV 2.7-2 certificate: Form number 49.03a) for containers which are designed, manufactured and tested according to the requirements of this standard.

The DNV 2.7-2 certificate shall state the scope of DNV's involvement and any requirements or limitations for the use of the offshore service module. The DNV 2.7-2 certificate will include reference to the applicable certification for the lifting structure.

8.2 Application for Certification

An application for approval and certification should be sent to the local DNV office. The following information shall be included:

— A description of the type of module (See Sec.5).
— Whether the module is for important service as defined in Section 5.1.
— Whether the container structure is already approved and which standard has been used.
— The hazardous area in which the container may be located.
— Whether the module is going to be manned or unmanned.
— The place of manufacture.
— Details of other standards and regulations to be covered.

8.3 Approval Schemes

If a manufacturer plans to build only one module or a single, limited batch of modules, DNV may give an individual (case-by-case) approval valid for that batch only. The manufacturer shall specify the number of containers to be covered by the approval.

If series production is intended, or if further orders for the same container design are expected in the future, type approval will normally be given. Type Approval Certificates are normally issued to the manufacturer of the container. If containers are made by a manufacturer on behalf of the owner of a design type, both the owner of the design type and the manufacturer will be listed in the Type Approval Certificate.

For further details on Type Approval process please refer to DNV Standard for Certification 1.2 Type Approval

DNV type approvals are listed in the DNV Exchange on DNV's website, www.dnv.com.

8.4 Design Assessment

For a design assessment, the documentation listed in Table 8-1 is to be submitted to the DNV local station. This table details typical documentation however, additional requirements may apply depending upon the function of the module. Documents should be submitted electronically, preferably as a PDF file correctly formatted for printing, or in three paper copies, in ample time before manufacturing.

In cases where experience and/or other findings show that safety hazards may arise in connection with items not covered directly by the existing requirements, DNV may decide to determine, at any time, supplementary requirements which shall be met in order to reach and maintain the overall safety standard.

8.5 Survey and testing

Surveys are required to confirm assembly and functionality of the module in accordance with the approved drawings. Surveys may be delayed should design documentation not be submitted in adequate time to allow the assessment to be concluded.

Depending upon the assembly or functions within the module (e.g. passive fire protection) interim surveys may be required to confirm assembly to the approved design.

Table 8-2 details typical survey, functional test and documentation review requirements. Additional requirements may apply depending upon the function of the module.

Table 8-1 Design Assessment Documentation	
Structural	Evidence of DNV 2.7-1 or EN 12079 certification OR documentation according to those codes for approval.
	Offshore installation induced loads shall be defined.
	Design calculations for offshore installation induced loads
	Other documentation as required for special purpose containers or for special equipment.
General	General Arrangement Drawing
Electrical	Single line diagram
	Cable schedule including certification
	Wiring diagrams and calculations for intrinsically safe circuits
	Certified Safe Equipment & certificates (Details as per table B1 in DNV-OS-D201 Sec. 11)
	Bill of Materials for Pressurised Units
	Cause & Effect drawing detailing all shutdown functions
	Shutdown philosophy for modules with important services.
	Installation / hook-up drawings
Fire Detection	Certification / Approval for Fire detection control system
	General arrangement of the fire detection and alarm system, wiring diagrams and approval certificates for components, together with the type and location of detectors, with details of how the signals are transmitted
	Data sheets for fire system components
Gas Detection	Certification / Approval for Gas detection control system
	General arrangement of the gas detection and alarm system, wiring diagrams and approval certificates for components, together with the type and location of detectors, with details of how the signals are transmitted
	Data sheets for gas system components
Communication	Operational description of system and manual
	PA / Alarm system philosophy
	Arrangement drawing including connection to offshore installation
Fire fighting	Identification of fire risks inside container including limitation of materials to be stores or limitation on the work to be conducted within the module
	Operational description for fire protection systems to address potential fire risks
	The type and number of portable extinguishers with approval certificates
	The description arrangement and details of any fixed fire extinguishing systems including certification of components.
Passive Fire Protection	Structural fire protection drawing including; — Horizontal and vertical fire divisions — Materials to be used — Method of construction — Typical method of heat bridge insulation — Integrity and types of doors being used
	Penetration drawings showing typical arrangements including materials used for ducting, piping or cables through fire divisions
	Approval certificates for passive fire protection material
	Approval Certificates for doors, windows, bulkheads, ceilings, penetrations and fire dampers used in the construction
Escape	Escape routes (including sizes) and lighting shall be shown on general arrangement and safety documentation
Ventilation/Over Pressure	Ducting and Instrumentation drawings (D&IDs) for the ventilation system
	Operational description of over-pressure ventilation system if relevant
	Calculation of over-pressure ventilation system purge time
	Calculation of ventilation, heating and cooling capacity
	Test data from representative unit to support purging calculations/method if module is sub divided.

Table 8-2 Typical production survey and testing requirements	
Survey	Confirm assembly of the unit in accordance with approved drawings and accordance with requirements in this standard.
	Confirm certified safe equipment is installed as per certificate and accurate to hazardous area schedule.
	Review manufacturing records to determine suitable insulation and testing of electrical equipment. Records of competency for installation/inspection personnel to nationally recognised procedures may be requested.
	Operating instructions where relevant for safe operation of the module. Ensure any special precautions for use and limitations are clearly identified.
Functional Testing	Function tests of essential-/safety systems including, e.g., electrical, alarm and HVAC systems.
	Function tests of shut-down actions as per approved shutdown arrangement.

8.6 Certification of existing containers

Existing modules which have previously been certified by DNV may be re-certified after modification or upgrading. Such re-certification will be based on already existing certificates as far as applicable, in addition to approval and inspection of new installations.

Existing modules that have not previously been certified by DNV may in certain cases be considered for certification. All relevant documentation shall be submitted for review as if the module were new. If the documentation is incomplete, additional requirements may be specified by DNV. Each module is to be thoroughly inspected and tested as appropriate.

8.7 Retention of certificates

8.7.1 *Maintenance of certificates /Periodic Inspections*

Offshore Service Modules which are installed or intended for installation on a DNV Classed Offshore Installation are considered part of the class scope and shall be inspected by a DNV surveyor at the inspection intervals applicable to the offshore installation.

Modules which are also certified to DNV 2.7-1 or 2.7-3 require annual inspection according to these standards. Modules which are based on a ship service container must be subject to structural inspections at the same intervals as hull structures.

Guidance note:

Shelf state legislation or client specific requirements may require periodic inspection of the offshore service module. These inspections shall be requested by the owner to the local DNV office where the scope according to the specific requirements can be assessed.

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8.7.2 *Repair or Modifications*

A module is considered to be rebuilt or modified when;

— Components not on approved design are used.
— Modification of equipment from the approved design.
— Function or performance is changed.

Rebuilt or modified modules shall be re-certified by DNV. The scope of re-certification shall be agreed with DNV on a case by case basis.

Repair or modification of structural aspects shall be surveyed according to the requirements of the original structural standard. Note any hot work to the primary structure shall be especially considered.

Guidance note:

Replacement of components or minor repairs to original approved condition - DNV involvement is not necessary.

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8.7.3 *Withdrawal of Certification*

Should a module issued with a DNV 2.7-2 certificate be subsequently found not to comply with the requirements of this standard, DNV may withdraw the certificate for that module.

Detailed justification shall be provided to the manufacturer or owner of the module describing the reasons for withdrawal of certification. Following rectification of any nonconformity, the DNV 2.7-2 certificate may be re-instated.

Appendix A
Certificate for Offshore Service Module

DET NORSKE VERITAS

Certificate No.: XXXX -2.7-2

Rev: 0

CERTIFICATE FOR OFFSHORE SERVICE MODULE

DNV Standard for Certification 2.7-2 (2013)

Equipment Description: XXXXX	Identification marking: xxxx
Client for certification (Name, address): XXXXX	
Manufacturer (Name, address): XXXXX	
Equipment Owner: XXXXX	

The Certificate is based on the following other certificates.

Transportation and lifting is covered by Certificate No: XXXX

The design is approved separately by DVR/Type Approval No: XXXX **Revision** X **Dated** yyyy-mm-dd

Module Type XXXX Functional Group(s) XXXXX

Operational Limitations

Ship Use	XXXX	Floating Installation	XXXX	Inclination Limtation	XXXX
Fixed Installation	XXXX	Hydrocarbon Installation Use	XXXX	Important Service Use	XXXX

Main Supply Voltage Range	XXXXX	V ac/dc	Secondary Supply Voltage Range	XXXXX	V ac/dc
Main Supply Frequency	XXXXX	Hz	Secondary Supply Frequency	XXXXX	Hz
Main Supply Current Protection (max)	XXXXX	Amps	Sec. Supply Current Protection (max)	XXXXX	Amps
Intended Hazardous Area Location	XXXXX		Operational Temperature Range	XXXXX	°C
Gas Group	XXXXX		Temperature Class	XXXXX	

Please refer to appendix for any additional limitations

Certification statement

This is to certify that the module has been designed, examined and tested in compliance with DNV Standard for Certification 2.7-2 (2013). The documentation package has been stamped approved and hereby found to be complete and as built. The certificate includes an appendix which is to be considered as a part of the certificate.

Certification is issued with/without deviations from the Certification Standard. Any Deviations are listed in the Appendix to this certificate. The end user must satisfy themselves that these deviations from the Standard are acceptable with regard to their intended use.

The certification has only considered the requirements of the aspects of the Codes and Standards referenced. If applicable, compliance with any additional requirements with regards to relevant EU Directives or local legislative requirements have not been considered however the standards referenced may assist in demonstration of compliance with these requirements.

Other Certificates/Standard covering equipment

XXXX

Validity period

This certificate remains valid for the life of the module providing it is not modified or repaired (Reference to section 8.7.1 of the Standard).

Det Norske Veritas B.V.

Place:
XXXXXXX
Date:
XXXXXXX

XXXXX
Surveyor

DET NORSKE VERITAS

Certificate No.: XXXX 2.7-2

Rev: 0

APPENDIX TO CERTIFICATE FOR OFFSHORE SERVICE MODULE

DNV Standard for Certification 2.7-2 (2013)

Deviations

XXXX

Comments

XXXXX

Specific Installation/Hook-Up Requirements

XXXXXX

Structural / Locating Requirements

Sea Pressure Load	XXXXXX	Accelerations	XXXXXX

Sea fastening shall be in accordance with drawing(s) XXXXXX XXXXXXXXXX

DNV Internal References

Design Review / T.A Project No.	XXXXXXX	Survey Project Number	XXXXX