



OFFSHORE SERVICE CONTAINERS

DECEMBER 1995

FOREWORD

DET NORSKE VERITAS (DNV) is an autonomous and independent Foundation with the object of safeguarding life, property and the environment at sea and ashore.

DET NORSKE VERITAS CLASSIFICATION AS (DNVC), a fully owned subsidiary Society of the Foundation, undertakes classification and certification and ensures the quality of ships, mobile offshore units, fixed offshore structures, facilities and systems, and carries out research in connection with these functions. The Society operates a world-wide network of survey stations and is authorised by more than 120 national administrations to carry out surveys and, in most cases, issue certificates on their behalf.

Certification Notes

Certification Notes are publications which contain principles, acceptance criteria and practical information related to the Society's consideration of objects, personnel, organizations, services and operations, in connection with issuance of certificates or declarations, which are not necessarily related to classification.

An updated list of Certification Notes is available on request. The list is also given in the latest edition of the Introduction-booklets to the "Rules for Classification of Ships", the "Rules for Classification of Mobile Offshore Units" and the "Rules for Classification of High Speed and Light Craft".

In "Rules for Classification of Fixed Offshore Installations", only those Certification Notes which are relevant for this type of structure have been listed.

CONTENTS

1. General	4	5.3 Function requirements.....	19
1.1 Objective.....	4	5.4 Containers for important services and conditions for inhibit of automatic shut down in case of detected gas.	19
1.2 Definitions	4	6. Heating, Ventilation and Air Conditioning	19
1.3 Reference Regulations	6	6.1 General	19
2. Certification	6	6.2 Ventilation arrangement.....	19
2.1 General	6	6.3 Technical requirements related to fan powered ventilation and air heating	20
2.2 Certification Procedures, new containers	7	6.4 Over pressure ventilation systems.....	20
2.3 Certification of existing containers.....	9	7. Public address and main alarm systems	22
2.4 Alternative certification	9	7.1 General.....	22
2.5 Validity of certificates	9	7.2 Installation in containers	22
3. Structural requirements	10	7.3 PABX system.....	22
3.1 Requirements related to offshore transport and handling	10	8. Fire Protection	22
3.2 Additional fittings for lifting	10	8.1 General.....	22
3.3 Requirements related to loads on containers during service	10	8.2 Passive fire protection	22
4. Electrical equipment	10	8.3 Fire detection and alarm system.....	23
4.1 Scope	10	8.4 Active fire protection	23
4.2 General requirements.....	10	8.5 Escape routes	24
4.3 Arrangement of electrical equipment	11	8.6 Application principles.....	25
4.4 Design of electrical systems	12	9. Noise and vibration	26
4.5 Requirements for electrical equipment exposed to hazardous atmospheres	12	10. Marking and instructions	26
4.6 Installation, repair and maintenance of Ex equipment...	13	10.1 Marking.....	26
4.7 Earthing	14	10.2 Instructions for hook-up/installation.....	27
4.8 Cables	15	11. Certificates	27
4.9 Lighting system	15	11.1 Certificates and test reports.....	27
4.10 Emergency shut down and electrical isolation	16	12.	27
4.11 Hook up of electrical supplies and controls.....	17	12. Appendix A Offshore Container Certificate	28
4.12 Miscellaneous equipment	17	13. Appendix B Certificate for Offshore Service Container	30
5. Gas detection system	18		
5.1 General	18		
5.2 Arrangement of system.....	18		

Introduction

This Certification Note has been issued in order to collect into one document, the main parts of the various requirements from different regulations, which users of offshore service containers have to work to.

Offshore service containers are often designed to perform temporary services on installations/vessels and therefore may be moved among different offshore installations/units and into different national waters. This imposes a challenge to use technical solutions which comply with all regulations at the same time.

The Certification Note has been based mainly on recognised practice for the offshore industry in the North Sea, and aims to cover applicable statutory regulations and classification societies' requirements. Since the activities in this area are based on internationally recognised standards, the Certification Note is considered a standard suitable for world wide use.

1. General

1.1 Objective

The objective of this Certification Note is to cover items related to safety of personnel, reliability and performance of equipment. The requirements cover transportation and operational phases.

In line with the referred regulations the safety aspect is considered to be the main objective. Reliability and performance are also considered to have influence on safety as a secondary effect.

Offshore service containers are exposed to rough handling during transportation. One of the aims of the Certification Note is to ensure that the container, and its equipment are arranged and protected to avoid damage. Suitability for repeated use shall be ensured through the choice of materials and arrangement.

The requirements are concentrated on the container's main structure shell and its fixed systems for maintaining safety and comfort for personnel. Where a container has built-in additional systems or equipment to prepare the container for special tasks, this may be covered by the certification process, according to prior agreement. Examples of such systems may be generators, pumps and well logging equipment. Certification should then be based on a set of standards and regulations applicable for such equipment. This should be agreed in advance, before the certification procedure starts. Details of such agreements will be stated on the final 2.7-2 certificate.

With regard to the main principles of design, the document aims to be stand alone.

However, with regard to detailed construction, the quoted reference documentation should be used (e.g. electrical installations).

For electrical equipment in hazardous areas it should be noted that American and European installation codes of practice differ to various extents and therefore should not be mixed. This Certification Note has been directed towards the European practice. However, where equivalence can be demonstrated the American practices and equipment may be accepted. Reference is made to sec 2.4 Alternative certification.

It has been recognised that individual interpretations of all the various regulations may sometimes lead to conflicting requirements. Some regulations may contain requirements of a general nature or certain requirements may have been practised in a special manner. This Certification Note is therefore trying to describe practical solutions which will provide the same level of safety as the referred regulations. Certification by Det Norske Veritas provides a document which may be presented to users of the container in order to clarify its technical standard and safety performance. The certificate also defines conditions for transportation to, and installation on, an offshore installation/vessel.

The Certification Note or parts thereof may otherwise be used as a reference standard for specification of containers and for other skid-types of equipment.

1.2 Definitions

Client

The person or company who has entered into an agreement with DNV about certification based on this Certification Note.

Offshore container:

Portable unit up to 25 tonnes for repeated use in transport of goods or equipment, handled in open seas, to, from or between fixed and/or floating installations and ships.

Offshore service container:

Offshore container built and equipped for a special service task, mainly for temporary installation. (Examples are, laboratories, workshops, stores, power plants, control stations.)

Offshore freight container:

Offshore container built for transport of goods.

(See "Certification Note 2.7-1, Offshore Containers.)

Installation/vessel:

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

Prototype:

An equipment item, considered to be representative for the product to be approved, used for prototype testing. The prototype may either be manufactured specially for type testing or selected at random from a production series.

Classification rules

Rules developed by the classification authority which are the basis of the classification certificate for the ship/offshore installation.

Statutory regulations.

Regulations imposed by governmental authorities in the actual country where the equipment is used.

Recognised standards.

Standards found acceptable by Det Norske Veritas. Examples are ISO, IEC, CEN, CENELEC.

Reference Regulations, standards etc.

Abbreviated term for the classification rules, the statutory regulations and the recognised standards which are basis for the Certification Note.

Primary structure:

Load carrying and supporting frames and load carrying panels. Side and roof panels (including corrugated panels) are normally not considered to be part of the primary structure.

Secondary structure:

Parts which are not load carrying (for instance doors, plates in sides and roof).

Structural mass¹, T_S

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

Equipment mass, T_E

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

Fitted out mass¹, T_F

The mass in kilograms (kg) of the container ready for use, including both the structural mass and the equipment mass, i.e. $T_F = T_S + T_E$

Payload, P

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

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. $R = T_F + P$

Recognised test institution for Ex equipment.

Private or governmental testing laboratories who have obtained an international status as independent and recognised testing institution for electrical equipment in explosive atmospheres.

Ex certificate

A certificate issued by a recognised test institution as proof that the equipment has been tested and conforms to a specified standard.

Ex equipment

Equipment having an Ex certificate

Basic and safety systems

Fixed installed systems and equipment for electrical power supply distribution, ventilation, heating, gas detection, fire protection and lighting.

Utility systems and equipment.

Fixed installed or portable systems and equipment for use by the operators to perform a service. Examples are equipment for well logging, tool machines, power engines, office equipment, various testing equipment, etc.

Portable equipment

Equipment not permanently installed and electrical equipment connected to power or control systems by the use of plugs or sockets.

Non-combustible material

Material which neither burns nor gives off flammable vapours in sufficient quantity for self-ignition when heated to approximately 750°C, according to IMO Res.A.472 (XII) or an equivalent test procedure. Any other material is a "combustible material".

Low flame spread surface material

Material which will adequately restrict the spread of flames. Testing of low flame spread is to be based on IMO Res. A.653(16) or an equivalent test procedure.

Primary deck covering

Deck covering which will not readily ignite or give rise to toxic or explosive hazards at elevated temperatures. Testing is to be based on IMO Res. A.214 (VII) or an equivalent test procedure.

Standard fire test

¹ The term "tare mass", T , as used for offshore freight containers, is not suitable for offshore service containers. The "tare mass" of a service container is fitted out mass, T_F .

Test in which specimens of the relevant bulkheads or decks are exposed in a test furnace to temperatures corresponding approximately to a standard time-temperature curve. Reference is made to IMO Res. A:517(13) - "Recommendation and Fire Test Procedures for "A", "B" and "F" Class Divisions".

"A" and "B" class divisions

Divisions formed by bulkheads and decks which comply with the requirements in DNV Rules for Classification of Mobile Offshore Units, part 4, chapter 6.

Total flooding fire-extinguishing system

A permanently fixed system designed for extinguishing in the complete volume of an enclosure.

1.3 Reference Regulations

The Certification Note is based on the following regulations and standards.

When the reference regulations are used direct as supplementary reference for the design, the latest issue at that time is to be used.

1.3.1 DNV Rules and Certification Notes

- DNV Rules for Classification of Mobile Offshore Units
- DNV Rules for Classification of Fixed Offshore Installations
- DNV Rules for Classification of Ships, class notation 1A1
- DNV Rules for Certification of Lifting Appliances
- DNV Certification Note No. 1.1, Certification Services - General Description
- DNV Certification Note No. 2.7-1, Offshore Containers

1.3.2 Statutory regulations

- IMO, "Code for the Construction and Equipment of Mobile Offshore Drilling Units"
- IMO, "International Convention for the Safety of Life at Sea"
- Norwegian Maritime Directorate, "Regulations for mobile offshore units"
- IMO, MSC/Circular 613, "Guidelines for the approval of containers handled in open seas"
- Electricitetsrådet, Denmark, "Stærkstrømsreglementet"
- Norwegian Petroleum Directorate, "Regulations concerning lifting appliances and lifting gear in the petroleum activities"
- Norwegian Petroleum Directorate, "Acts, regulations and provisions for the petroleum activity"
- Norwegian water recourses and energy administration, "Regulation for Electrical Installations Maritime Installations"
- Norwegian water recourses and energy administration, "Regulation for Electrical Installations in buildings, §808 applicable to production installations for the Norwegian Waters"

It should be noted that some of the above regulations refer to other regulations, therefor the list is not to be considered complete.

1.3.3 Standards, specifications, publications and guidance.

- pr EN 12079 Offshore Containers - Design, construction, testing, inspection and marking.
- International Electrical Commission, "Relevant IEC publications"
- EN 50081-2 and EN 50082-2 for testing of electromagnetic compatibility.
- The Institution of Electrical Engineers, "Recommendations for the electrical and Electronic Equipment of Mobile and fixed Offshore Installations"
- UK, Dep. of Energy and Health and Safety Executive "Guidance on Design, Construction and Certification"

2. Certification

2.1 General

Det Norske Veritas may issue a "Certificate of Conformity" for containers. Certification consists of the following steps as applicable:

- Design assessment
- Prototype tests
- Production inspection
- Production testing
- Inspection of the completed installation
- Functional testing
- Issuance of certificates
- Plating and marking

Certification of structure strength for the transportation etc. will be based on DNV Certification Note 2.7-1. For each container an Offshore Container Certificate and an Offshore Service Container Certificate will be issued. The Offshore Container Certificate may be used separately as an independent document. Separate work orders may also be agreed. 2.7-1 and 2.7-2 certification may be for different clients.

It is generally recommended that contact between DNV and the client is established at an early phase in order to ensure an acceptable design from the beginning. Documentation is to be submitted to the applicable DNV station. Fees are to be agreed, and order confirmation established. The documentation will in turn be forwarded to an approval office where relevant. Preliminary documentation may be submitted in one copy. The final documentation for approval is to be submitted in three copies.

The "Certificate for Offshore Service Container (see 11 Appendix A) is to be regarded as the final certificate for a single container and should be based on the following certificates or reports:

- Design Verification Report covering the design view of signboards assessment based on the documentation package. The technical scope will be subject to agreement, and may cover the 2.7-1 or the 2.7-2 certification or both.
- The Offshore Container Certificate (2.7-1 certificate) covering lifting and transportation. This is normally issued before service equipment is installed into the container.
- Survey reports covering inspections and testing
- Type Approval Certificate where applicable.

2.2 Certification Procedures, new containers

Certification consist of two main activities; design assessment and surveys/testing.

2.2.1 Design assessment

Design assessment includes checking that the documentation package contains all relevant information and that the design complies with the requirements.

An individual ("case-by-case") approval of the design will be suitable for new designs when the manufacturer intends to produce one or more containers. If series production of containers is intended, Type Approved of the design may be given.

When all documentation has been found satisfactory a Design Verification Report may be issued.

2.2.2 Required documentation

The documentation shall enable the following aspects to be evaluated where relevant to the agreed regulations and standards:

- Strength of structure, lifting set and other permanent equipment.
- Material specifications.
- Welding and other joining methods
- Function evaluation of systems covered by the certification
- Arrangement of systems
- Suitability of components, cables and materials in systems
- Ex certification and type certification of materials and components
- Fire protection
- Plating
- Marking
- Testing

The following types of documentation should submitted:

2.2.2.1 General:

- Instructions for hook up/installation on the offshore installation/vessel.

- Operating instructions where relevant for equipment of importance to safety.

2.2.2.2 Structural: - (For further details, please refer to 2.7-1)

- Plans showing arrangement, dimensions, scantlings of strength members, pad eyes, and design details as well as specifications of materials to be used.
- Particulars of joining methods (welding, bolted and riveted connections).
- Particulars of corrosion protection and painting. (Type, application, dry film thickness.)
- Design calculations (for information).
- Other documentation as required for special purpose containers or for special equipment.

2.2.2.3 Electrical:

- Arrangement drawings of the container showing the location of electrical equipment and cable routes.
- Explanation how equipment is fixed and protected to resist shocks at transportation.
- One line diagrams for power distribution circuits.
- Logic wiring diagrams for power distribution and controls.
- Electrical material lists giving main data for components. The material lists shall have identification keys enabling the components to be traced to the one line diagrams, wiring diagrams or the arrangement/assembly drawings.
- Manufacturers data sheets for components of safety importance or for other components with influence on the certification is to be added where necessary to show their rating and identification and to give the precise data for the components needed for evaluation of their suitability.
- Cable lists showing main data for cables. Alternatively the same information and identification keys for cables may be given in the one line diagrams and wiring diagrams.
- Construction data and test references for cables including certificates for if available.
- Wiring diagrams for intrinsically safe circuits.
- Listing of all EX certified components. The list shall include identification system for each component towards the drawings, and shall show type of ex protection, certificate No. and indicate whether the certificate contain special conditions to be taken into account.
- For Intrinsically safe circuits the list shall show that all relevant data for compatibility between the barrier and the field components has been complied with, i.e. max. voltages, current, capacitance, inductance etc.
- Ex certificates arranged in an indexing system.
- Drawings showing the hook up of electrical, control and signal system, in particular the hook up to the installation/vessel control room
- Documentation of programmable controllers according to 4.12.4

2.2.2.4 HVAC:

- Relevant types of documentation listed under electrical installation.
- Arrangement drawings 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.

2.2.2.5 Gas detection system:

- Relevant types of documentation listed under electrical installation.
- Operational description of the gas detection system.

2.2.2.6 Public address and alarm systems

- Relevant types of documentation listed under electrical installation.
- Operational description of the systems.

2.2.2.7 Fire protection:

- Relevant types of documentation listed under electrical installation.
 - Operational description for fire protection systems.
 - General arrangement of the fire alarm system, together with type and location of detectors with details of how the signals are transmitted.
 - Description of wall constructions and materials used for passive fire protection.
 - Certificates of non-combustibility and fire resistance of materials used.
 - Certificates/information on doors, windows, bulkheads, ceilings and fire dampers used in the construction.
 - Details of penetrations, location of fire dampers and general arrangement of the ventilation system.
 - Type and number of portable extinguishers with certificates.
 - Description of any fixed fire extinguishing system.
- DNV certificates or certificates from other recognised bodies for important components in the fire alarm and extinguishing system.

2.2.3 Type Approval

If series of identical containers are to be manufactured, Type Approval may be suitable. If the design of a container is based on new (not proven) technology a number of units should be certified individually to gain experience with the design.

Guidance

For equipment installed in containers there is often a need to have individual solutions, and thus Type Approval may not be the most suitable procedure.

Type Approvals must be related to an ongoing production, and are therefore issued to manufacturers only. A separate Type approval certificate according to Certification Note 2.7-1 may be issued.

Testing may be performed to verify the ability to meet specific requirements i.e. type testing. This should be performed in accordance with an agreed test programme.

Type Approval is to be renewed every 4 years.

Type approval Certificates are issued by the DNV head office at Høvik.

Certification of each container built according to a type approved design will be simplified.

2.2.4 Inspection and testing

Surveys for inspection and testing are to be agreed between DNV and the client as a part of the certification agreement.

The steel structure is to be built and tested under supervision of a Surveyor according to Certification Note 2.7-1. The requirements for manufacturing and survey of the structural parts, i.e. pad eyes, framework, panels (excluding fire protection), etc., are found in chapter 4 of the Certification Note 2.7-1.

The structure should be inspected and structural tests carried out before insulation and/or equipment is installed.

It should be noted that a prototype test is included in the design requirements for Offshore Containers, ref. Certification Note 2.7-1.

Guidance

As an alternative to surveys by a DNV surveyor, certification may be based on the Society's surveillance of the manufacturer's quality assurance system. The procedure is called "Manufacturing Survey Arrangement" (MSA). On the basis of this system, the terms of survey, testing and frequency of attendance is to be agreed between the parts.

An MSA is an approved arrangement in form of a document stating the role of Det Norske Veritas and the manufacturer in connection manufacturing surveys and certification. The Society's Quality System Certification Service is described in DNV Certification Note 1.3, Conformity Certification Services - Quality System Certification.

Manufacturing and surveys for structural parts not covered by 2.7-1 are to be according to the agreed referenced standard for these structures.

Guidance

If manufacturing and survey are not covered by the referenced standard, DNV Rules for Mobile Offshore Units should be used as a minimum.

Surveys of electrical systems should normally include:

- Checking that all documentation represents the as built status of the unit, and that all equipment is sufficiently documented. Any deviations are to be dealt with as deemed appropriate by the attending surveyor.

- Final approval of electrical components including checking of marking and main data. Checking Ex certificates.
- Installation details such as earthing, cables and other items as deemed appropriate by the attending surveyor.
- Function tests of electrical-, alarm- HVAC systems etc.

When all surveys have been completed and documentation is approved, the Offshore Service Container Certificate will be issued. Certification marking should be according to chapter 10. Copies of reports and of the certificate should be submitted to the approval office.

2.3 Certification of existing containers

Upgrading of certificates for containers that have previously been certified by DNV may be carried out. The re-certification will then be based on already existing certificates as far as practical.

Existing containers that have previously not been certified by Det Norske Veritas may be certified after special consideration.

All relevant available documentation should be submitted for review. If the documentation is incomplete, additional requirements may be specified by DNV. Each container is to be thoroughly inspected and tested as appropriate.

If the container is found not to comply fully with the requirements, de-rating or other limitations may be relevant, or modifications may be agreed.

2.4 Alternative certification

Containers that do not comply with the basic parts of Certification Note 2.7-2 will not be certified as Offshore Service Containers. The same may apply to skid units and other equipment of portable type, or otherwise intended for a special task.

As an alternative DNV may certify such units according to a suitable agreement with the client. The client should then prepare a list of specifications/standards which the certification shall be based on. The list may include parts of Certification Notes 2.7-1 and 2.7-2. DNV may be consulted for establishment of the list.

For alternative certification a "Product Certificate of Conformity" (form no. 40.91a) will be issued instead of the standard: "Certificate for Offshore Service Containers" (form no. 59.01a).

Guidance

It is advised that before specifying a certification scheme, the client should ascertain that the requested certificates are suitable to meet the mandatory requirements.

2.5 Validity of certificates

2.5.1 Offshore Container Certificate

To maintain the validity of the Offshore Container Certificate, (2.7-1) certificate, at least an annual inspection of the structure is required. Inspection reports are to be attached to the container certificate and the inspection plate marked as appropriate.

After renewal or repair of damaged parts of the primary structure, the container should be re-certified. This may include additional testing. Renewal or repair of damaged parts should be carried out according to approved plans and procedures.

The repair should be noted on the new revision of the certificate, and a repair report should be attached to the certificate as an appendix.

If the container is rebuilt or re-fitted a new certificate is to be issued. The old certificate should be marked "Deleted" and attached to the new certificate.

Det Norske Veritas can upon request carry out annual inspection and re-certification.

2.5.2 Offshore Service Container Certificate

The certification (2.7-2 certification) does not, unless otherwise agreed, include any periodical follow up to verify that the certificate remains valid. For future use of the container, the user is responsible for checking possible modifications of, and the general condition of the equipment. Changes in the referred regulations may have influence on the application of the certificate. Renewal and updating of the certificate may be given upon request from customer. Periodical (annual) renewal may be agreed. At renewal the 2.7-2 certificate will be reissued as a new revision. The new revision shall contain information about any changes since last issue.

Guidance

Offshore installation/vessels are normally subject to periodical inspections as required by the applicable regulations. Containers installed on an installation/vessel will be covered by the periodical surveys applicable for that offshore installation. This may be e.g. annual surveys and more thorough surveys every fifth year.

For periodically used containers, the owner is recommended to implement procedures to ensure that they are inspected annually as a minimum.

Design verification reports have in principle the same validity as explained above for the 2.7-2 certificate.

For validity of Type Approvals, see 2.2.3.

3. Structural requirements

3.1 Requirements related to offshore transport and handling

The structure of service containers, including the attached lifting set, should comply with the Society's Certification Note 2.7-1 Offshore Containers.

In Certification Note 2.7-1, clause 1.2.4 and 1.2.5, structural parts are defined as primary and secondary structures. These definitions also apply for offshore service containers.

Guidance

This means that such structures as supports for tanks or heavy machinery are primary structures, while e.g. internal walls are secondary structures. Fittings and sub frames e.g. for insulation panels are not considered as parts of the container structure

Certification Note 2.7-1 contains requirements related to lifting operations to and from supply vessels in open seas, as well as handling by fork lift trucks. Structural loads on containers occurring during use on offshore installations are not covered. The Certification Note covers design and dimensioning, materials requirements, testing and production inspection and certification and marking.

Guidance

When preparing the specification for a service container, it is advised that the rating is chosen higher than the estimated fitted out mass, i.e. to specify a certain payload even if the container is not intended to carry cargo. This will allow for changes in the amount and mass of equipment fitted in a container during its operational life, and it may also be useful to be able to carry a certain amount of non-permanent equipment.

3.2 Additional fittings for lifting

In addition to the pad eyes and slings used for offshore handling, some containers are built with an extra set of fittings for lifting and handling. These may for example, be padeyes that are used for moving the container internally on an offshore installation. Such equipment, including the supporting structure, should be dimensioned according to DNV's Rules for Lifting Appliances.

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

3.3 Requirements related to loads on containers during service

Service containers may be subject to static or dynamic loads 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 container.

The container structure should be approved and/or tested for such loads according to national regulations if applicable, or according to applicable DNV requirements.

The container structure may, in addition to the above requirements, be verified according to the client's specification.

4. Electrical equipment

4.1 Scope

The requirements to electrical equipment are an extract of other statutory and classification regulations. The extract is selected to cover those items especially applicable to offshore service containers. For comprehensive details of requirements this Certification Note should be used in conjunction with the latest issue of the regulations and standards referred in section 1.3.

Additional functional and system requirements for electrical and control systems are given in each of the applicable sections 5, 6 and 7.

The requirements in this chapter apply to basic and safety systems for control and power distribution. In addition the requirements apply to customer utility systems and permanently installed equipment. Portable equipment may be covered according to agreement with the client. All equipment covered by DNV certification shall be listed or explained in the certificate. The approved documentation is to give the details of all equipment covered by the certification.

4.2 General requirements

4.2.1 Qualifications

The installation of electrical equipment should be carried out by qualified electricians using sound installation practice.

4.2.2 Safety requirements

Electrical equipment should be installed such that the risk of injury to personnel and damage to environment from the likes of short circuits, earth faults, fires, explosions and electrical shocks is minimised as far as is reasonably practicable.

Selected electrical equipment shall be suitable for the environment in which it is expected to operate.

Protective devices of appropriate rating are to be applied to prevent overload, excessive heating and damage in case of electrical faults.

Safety circuits whose functions could be impaired and lead to danger by electrical failures are to employ the fail to safety principle as far as practicable.

4.2.3 Components and equipment

Electrical components should as far as practicable be of types suitable for use offshore or onboard installations on ships and should be constructed according to an IEC or other recognised standard for such equipment. The rating of electrical components and cables shall be based on tests and recommendations according to relevant IEC publications or other equivalent or recognised standards. Other standards may be used after consideration. This will normally be noted on the container certificates issued by DNV.

Electrical components located in enclosures which may be opened for inspection or maintenance while the circuits are live, are to have covers or otherwise be arranged such that touching or short circuiting of live parts is unlikely.

Insulating materials are to be flame retardant. For testing methods IEC publication 707 or an equivalent may be used. Flammability categories should be BH2, FH2 and FV1 or better.

Electrical components mounted external to the container shall have an ingress protection classification of at least IP 56, i.e. resistant to heavy seas. Use of IP 55 may in special cases be agreed provided additional safety precautions are taken to prevent sea splash both during transportation and installation. Remarks in DNV certificate shall then be given. Rotating machines located exposed to outdoor atmosphere shall be suitably protected against icing. Motors are not to have external cooling fan.

Electrical components mounted inside weather tight containers shall be at least IP 20. If water fire extinguishing systems are provided, electrical equipment for safety functions shall be at least IP 56 (see also section 8, Fire protection).

Electrical and control equipment in general shall be suitable for use in conditions of outdoor ambient temperatures and humidity. Special attention is to be given to electrical components mounted external to containers and which may be directly exposed to sun radiation.

Electrical and electronic equipment covered by the certification is to be designed to function without degradation or malfunction in their electromagnetic environment. The equipment and components are not to adversely affect the operation of, or be adversely affected by other components or systems used inside the container or elsewhere onboard the installation/vessel.

The following standards may be used for testing:

- EN 50081-2 for testing of emission.
- EN 50082-2 for testing of immunity.

Electrical equipment and systems are to be suitable for the environment conditions given in Table 4-1.

Ambient temperature:	- 20 to + 45 degrees Celsius
Humidity:	In service: Up to 98 % without condensation when heating is provided. Otherwise 100 % with condensation. Out of service: 100 % with condensation
Vibration level:	3 to 25 Hz: 1,6 mm displacement amplitude (peak value) 25 - 100 Hz: 4 g acceleration

Table 4-1 Environment conditions

In addition to the above vibration requirements the equipment must be designed and fixed to withstand heavy shocks during transportation. See impact test specified in 2.7-1, item 3.7.2. The specified impact test is not required to be repeated for whole container for the 2.7-2 certification, but should be used as guidance. If found necessary to verify fixing methods for panels etc. specific details may be required to be tested using a similar drop test.

4.3 Arrangement of electrical equipment

Offshore containers are exposed to rough handling during transportation and storage. In order to keep the electrical equipment safe and fit for use the following requirements should be met.

- Electrical enclosures are normally not to be located external to the container. In the event that electrical enclosures require to be located external to the container, then they should be located in a suitably recess panel. The recess should be equipped with suitable hinged or removable cover plates for protection during transportation
- Electrical equipment is to be protected against corrosion.
- A system of space heating should be installed to keep the electrical equipment free from humidity and condensation. The normal container heating system may be used for this if suitable. Electrical enclosures which are located exposed to outside atmosphere and which are sensitive to moisture should be equipped with individual space heaters. This is however not required for simple junction boxes.
- This heating system should be activated whenever practical both onshore and offshore.
- Portable utility equipment is to be securely fixed. The construction and fixing of all equipment shall withstand the likely stresses imposed on them when the container is transported/lifted

4.4 Design of electrical systems

4.4.1 Electrical system main characteristics

The designer is free to select the voltage levels and frequencies to suit the requirements of the installation/vessel(s) on which the container may be located. The container may be designed for a defined voltage system or a multi set of systems. The certification will verify that the integrity of the voltage system is maintained throughout and that the systems are appropriately marked.

4.4.2 Earthed systems for power supply and controls.

The container earthing arrangement shall be selected to suit the requirements of the installation/vessel(s) on which the container may be located. It should be noted that container distribution systems using 4 wire system i.e. including N (neutral) conductors can not be connected to installations/vessels having insulated systems.

Where an earthed electrical system is used, the earthing is to be at one point only, which should normally be at the source, or at the secondary side of a transformer. A removable link shall be provided in the earthing connection.

All insulated electrical and control systems within the container are to have continuous insulation monitoring. The circulating current must not be above 30 mA. In the event of an earth fault either automatic tripping of the effected circuits should take place or an alarm generated. If automatic tripping is not implemented, means are to be provided for transmitting the alarm signal to the installation/vessel control room. If there are several circuits, one common alarm to the control room will normally be sufficient.

Where external power is supplied to the container, insulation monitoring is expected to be included at the installation/vessel. Additional monitoring within the container is such cases not required.

For minor systems, e.g. control circuits being located solely inside its panel, insulation monitoring is not required.

4.4.3 Protection devices in earthed systems for power supply and controls.

Non-linked pole fuses are not to be installed in N conductors or in the earthed poles of a single phase system.

Multi-pole circuit breakers, contactors and manual switches shall break all insulated poles simultaneously. Earthing and Neutral conductors need not be switched with the exception as given below.

Power supply circuits utilising N conductors or other earthed conductors shall have at least one point where a multipole switch, circuit breaker or equivalent is installed to give possibility for isolation of the whole circuit including the earthed conductor simultaneously with the phase conductors. Control circuits shall have the same possibility unless being isolated by the respective power system they serve.

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

4.5 Requirements for electrical equipment exposed to hazardous atmospheres

4.5.1 Certification of equipment

Electrical equipment for hazardous areas shall be designed, certified and categorised according to The IEC 79 series publications or other standards which are based on these publications, e.g. CENELEC standards, British Standards, etc.

The certification shall be by one of the following test institutions:

- Physikalisch-Technische Bundesanstalt (PTB), Federal Republic of Germany
- Berggewerkschaftliche Versuchsstrecke (BVS), Federal Republic of Germany
- British Approvals Service for Electrical Equipment in Flammable Atmospheres (BASEEFA)
- Laboratoire de Centre d'Etudes et Recherches des Charbonnages de France (CERCHAR)
- Laboratoire Central des Industries Electriques (LCIE), France
- Norges Elektriske Materiellkontroll (NEMKO)
- Prüfstelle für Explosions- und Schlagwetterschutz der Bundesversuchs- und Forschungsanstalt, Elektrotechnische Versuchsanstalt (ETVA), Austria
- Staatlich Autorisierte Versuchsanstalt des Technischen Überwachungsvereins Wien (TUV), Austria
- Institut National des Industries Extractives (INIEX), Belgium
- Centro Elettrotecnico Sperimentale Italy (CESI), Italy
- Statens tekniska Forskningscentral VTT, elektrotekniska laboratoriet, Esbo, Finland
- Materialprüfanstalt des Schweizerischen Elektrotechnischen Vereins (SEV), Switzerland
- Versuchsstrecke Freiburg (V.Fr.), Germany
- Statens Provningsanstalt, Sweden.
- Certificates from other test institutions may be found acceptable after consideration in each case. Type tests should then be equivalent to those tests recommended by IEC/CENELEC for the applicable zone classification. Tests should be documented. Examples of other test institutions are Underwriters Laboratories (UL), Canadian Standard Association (CSA), and Factory Mutual.(FM)

An Ex certificate from a recognised institution is considered as a proof that equipment has been examined, tested and documented and thereby fulfils the requirements of the specified standard for electrical equipment in hazardous areas. The certification process basically involves evaluation of one sample of the equipment. The process also includes procedures to follow up the manufacture in order to ensure that all manufactured units fulfil the same requirements.

4.5.2 Electrical equipment for zone 1 hazardous areas

Electrical equipment located in zone 1 hazardous areas shall have Ex certificate confirming that it is certified in one of the following categories:

-Flame proof	Ex d or EEx d
-Increased safety	Ex e or EEx e
-Intrinsically safe	Ex i or EEx i
-Pressurised	Ex p or EEx p
-Powder filled	Ex q or EEx q
-Special construction	Ex s or EEx s
-Encapsulated	Ex m or EEx m

In addition to the above, the equipment is to be certified and marked with gas group IIA, IIB or IIC. Where exposure to potentially explosive concentrations of hydrogen from batteries is anticipated gas group IIC equipment is required.

The temperature classification shall normally be T3 or better; i.e. T4, T5 or T6.

- T1 correspond to maximum surface temperature 450 degrees C
- T2 correspond to maximum surface temperature 300 degrees C
- T3 correspond to maximum surface temperature 200 degrees C
- T4 correspond to maximum surface temperature 135 degrees C
- T5 correspond to maximum surface temperature 100 degrees C
- T6 correspond to maximum surface temperature 85 degrees C

The marking for type of ex protection may then be as this:

EEx q IIA T3

The ex marking plate will also have the identification of the test institution and the certificate number.

When the letter "X" is included as part of ex marking certificate number, this indicates that the certification institution has specified special conditions for the safe use of the equipment. The letter "B" may also be used.

The letter "U" indicates that the equipment is only component certified and that it may only be used as part of a certified system permitting its use. E.g. cable glands and empty Exd enclosures.

The letter "S" may indicate that the equipment forms part of a certified system e.g. an intrinsically safe barrier

4.5.3 Equipment for zone 2

Electrical equipment located in zone 2 hazardous areas shall either be certified as for zone 1 or shall be:

- Type of protection Ex n, (gas groups and temperature classification as for zone 1)
- Non certified equipment protected at least to IP 44, is accepted in zone 2 provided it is "normally not a source of ignition". This applies to simple equipment which can obviously not be a source of sparks and have surface temperatures well below the ignition temperature.

4.6 Installation, repair and maintenance of Ex equipment

4.6.1 Inspection and Installation

The ex marking plate must be maintained in a legible condition. It shall show the actual type of ex protection, and give reference to the ex certificate. Valid Ex certificates from one of the recognised test institution are to be part of the documentation for the equipment.

Both the methods of installation and conditions of certification are to be verified

The following are examples of items which are to be checked:

- Area classification
- Ex marking of the equipment
- Type of gas hazardous atmosphere
- Temperature classification
- Cable types, cable entries, fixing and bending.
- Ambient conditions temperatures
- IP rating
- Earthing
- That bolts are correctly fitted and tightened
- Proper operation of moving parts on motor drives
- Setting of thermal protection devices
- General condition and corrosion protection of flame paths
- Protection against moisture and condensation
- Components nominal voltages and frequency
- Short circuit fault level
- Checking that lamp types are correct
- Mounting arrangement and the electrical parameters related to intrinsically safe circuits
- Checking that the conditions on the ex certificate have been met.

4.6.2 Installation of intrinsically safe circuits

Intrinsically safe circuits are normally to have a screen or suitable braiding to protect against interference from other circuits. A common screen may be used for multi-core cables containing several intrinsically safe circuits. If the circuits are wired to a zone 0 area, individual screens are to be used. Cables for IS circuits shall not contain other than IS circuits.

Cables for intrinsically safe circuits may in addition to the screen(s) have a (common) outer braiding. The outer braidings or armours shall be earthed in both ends as applicable for PE earthing. An intrinsically safe earth bar (IE earth) is to be established at the barrier end of the circuits. The above screen(s) are normally to be connected to this earth bar and thus earthed at one point only. The IE earth bar is to be mounted on insulated studs and is to be connected to the main earth path using an easily removable link or similar.

Short lengths of intrinsically safe cables, i.e. in the range of 1-2 m, may be accepted without screen provided they are not particularly exposed to interference. This may be applicable for small sealed devices which have a manufactory mounted cable tail.

Cables, cores and terminal rails for intrinsically safe circuits are to be coloured blue, separated, and are to be marked: "IS Circuits" at the cable terminations. Cables and cores other than blue may be used provided suitable permanent blue sleeves are put on at their ends and other places so that they may be identified. IE earth bars are to be coloured blue at the ends.

Within enclosures the intrinsically safe connections are to be separated 50 mm from other systems, or by an insulating or earthed metal barrier. Cores are to be bunched separately.

Intrinsically safe circuits are to be installed in accordance with any special conditions in their certificates.

4.6.3 Repairs

The basic principle is that no repair shall be carried out on Ex equipment unless confirmed by the applicable test institution or workshops approved by the test institution. Simple replacements of parts may, however, be performed by qualified electricians when the replaced part is identical to the original.

In the UK there is no formal requirement for approval of the repair shops by the test institutions. However, repair-shops must demonstrate technical competency in line with the BEMA code of practice. The technical requirements are considered equivalent. Containers are to follow the most stringent procedures in order to be suitable for location in all areas.

4.6.4 Modifications

Ex certificates may be invalidated by un-qualified or un-authorized repairs or modifications.

If the equipment is modified such that the conditions for the original certificate are changed, a new certificate is to be issued. The decision as to whether or not re-certification is necessary should be made by qualified personnel or an approved workshop.

The new certificate may in some cases be issued from another test institution, which then takes over the whole responsibility for the Ex certification. The new certification may be based on the original certificate.

In service inspection of Ex installations should consider the possibility of unauthorised rebuilding of equipment. If changes have been done, the ex marking is to show this.

The original documentation should be available to enable this check.

4.7 Earthing

4.7.1 Earthing of the container structure

Earth lugs mounted diagonally, suitable recessed, opposite each other are to be welded to the main steel structure on the outside at the container lower part. Bolts for fixing the container to the deck are not to be regarded as earthing connection.

Welding the container to the deck is considered an alternative way of earthing.

4.7.2 Earthing of electrical enclosures and terminal boxes

The requirements to earthing apply to AC systems above 30 V and DC systems above 50 V and to all electrical power systems for containers for hazardous areas regardless of voltage.

Electrical equipment and enclosures made of non insulating material are to be earthed by an earth conductor from the enclosures' external earth lug to the local part of the container main steel structure.

Components located inside the enclosures, such as those listed below, are to be earthed to a copper earth bar mounted within the enclosure, normally at the bottom:

- The component parts of the enclosure itself, door, etc.
- Exposed metal parts of electrical components.
- Cable braidings and armours unless terminated in Exd braid clamping glands.
- Earth conductors in cables
- Spare conductors

The earthing system as described may be divided into several internal connected earth bars if required.

Spare conductors shall be terminated at both ends in the same way as earth conductors. They shall not be yellow green, but shall be marked "spare". Common screws for several spare conductors may be used.

4.7.3 Earth connections

Earth conductors are to be coloured yellow/green. Where it is necessary to use conductors which are not green/yellow as earth conductors they are to be marked green/yellow using tapes or sleeves at each end.

Earth conductors are to have at least the same cross section as the phase conductors up to including 16 sqmm. Above 16 sqmm half the phase conductors cross sections is required. Screw connections are to be corrosion resistant, and are to be arranged so they can be easily inspected.

Main earth lugs on the outside of the container are to be minimum M12.

External earth conductors for outdoor equipment are to be at least 16 sq. mm and screws to the container main steel structure at least M10.

Indoor earth conductors on the outside of equipment and enclosures are to be at least 4 sq. mm and screws to the container main steel structure at least M8.

Earth conductors internal in enclosures shall be minimum 1.5 sq. mm.

Each earth conductor is to be connected using a separate screw. In small surveyable enclosures having no earth bar, a few conductors may in exceptional cases be connected under the same screw provided they serve internal components only, i.e. not for cables.

4.7.4 Termination of braidings, armours and screens

Cable braidings, armours and screens are to be carried through the gland when possible and be connected to the earth bar at both ends. This should be the normal procedure, however, when found necessary, for function or safety reasons, connection to earth at the supply end only may be used. Plastic junction box 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 braidings as an ordinary earth bar.

When braidings, armours and screens are earthed at one end only, the other end is to be carried through the gland and insulated and arranged in a reliable manner, preferably connected to an insulated terminal.

4.7.5 Additional national requirements

For operation within the Danish petroleum industry and in hazardous areas of the Norwegian petroleum industry there is an additional requirement that the earthing of electrical equipment is to be carried out by a copper earth conductor located within the supply cable. Cable copper braiding may be used if the cross section is suitable. This earth conductor shall be terminated to the earth bar inside the box or panel as described above.

Containers certified by DNVC which do not comply with this paragraph will receive a note in the certificate.

4.8 Cables

4.8.1 Applicable specifications

The construction and testing of power cables for permanent installations is to comply with the specifications of IEC Publication No. 92-350.

Instrumentation and communication cables for use on systems up to 60 V are to comply with IEC Publication No. 92-375. For systems up to 250 V IEC publication No. 92-376 is to be applied.

Flame retardant properties are to be acc. to IEC 332-3.

4.8.2 Fixing of cables

Cables are to be securely fixed and terminated in a durable manner. The fixing method for cables shall prevent collapse in case of fires. Termination methods shall be such that the cross section of conductors and braidings is not reduced and loosening is prevented. Special attention is to be paid to the gland arrangement and bending of cables near the entries. It shall be possible to verify that the required IP degree for the enclosure is maintained.

4.8.3 Dimensions

The cross section of conductors versus current rating is to be as specified in IEC 92-352, Table 1.

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

The minimum acceptable cross sectional area of conductors in cables for control and instrumentation circuits up to 60 V is 0.5 sq. mm. The fuses shall then be not above 5 amp.

4.9 Lighting system

4.9.1 Basis for requirements

The basic principle for installations/vessels is that two independent lighting systems shall be installed. Main lighting system supplied from the main power system and emergency lighting supplied from the emergency generator. In addition there shall be a battery back up of 60 minutes to ensure continuous supply of power.

Based on the above principle and the assumption that the containers need not be occupied for long periods of time in the event of a catastrophic incident the following requirements have been adopted. These requirements are intended to provide for practical solutions which do not necessitate excessive complexity.

4.9.2 Lighting systems for containers

Containers shall be equipped with sufficient lighting for their intended operation. At least one light shall be installed in each room of the container where persons may be present. Battery powered emergency lighting is to be provided by (a) separate lighting(s), or alternatively for small containers one 2 bulb type combined main and emergency lighting may be used. One of the bulbs shall then have battery back up. A battery back up for minimum 60 minutes shall be provided for the emergency lighting. The battery power shall be switched on to the lamp automatically if the normal power supply should fail.

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 metres from the main room.

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 container is taken into operation.

4.10 Emergency shut down and electrical isolation

4.10.1 Main switch

A load switch shall be mounted at the main power intake. The switch may be e.g. a suitable circuit breaker, a manual switch or similar and shall be Ex certified except for containers for non hazardous areas. If the container has several power sources, one switch for each shall be installed. The switch(es) shall be readily accessible, lockable and be operable outside its enclosure and be arranged and marked in a suitable manner in order to provide a mean for manual local emergency shut down and safe isolation of all electrical equipment in case of maintenance work. It shall be housed in a separate enclosure or shall otherwise be arranged to enable work without accidental touching of live parts.

4.10.2 Installation/vessel ESD

Provision for emergency shut down from the installation/vessel shall be provided. Normally this can be carried out by implementing a trip at the installation/vessel switchboard where the supply is taken from. No extra facilities at the container are then necessary. It is assumed that this trip is controlled by the installation/vessel ESD system and procedures.

Containers serving an essential function should not be located in a hazardous area. If this is unavoidable it is recommended that all electrical equipment required for safety purposes should be suitable Ex certified for the hazardous area and therefore need not shutdown on loss of pressure or gas detection.

If the container includes local power sources, e.g. batteries, combustion equipment or electrical circuits from other sources, the container shall be provided with facilities which allow for control of this equipment from the installation/vessel ESD system.

Safety systems such as fire protection systems, PA systems and gas detection systems shall normally be excluded from ESD tripping.

4.10.3 Containers for important services and conditions for reduction of shut down scope.

This is related to type of activity as defined in Table 8-1, "Equipment and operations important for safety". See group 5 and 6. It is assumed that the containers are manned.

Such containers should not be located in hazardous areas unless absolutely necessary. If this is unavoidable the preferred solution is that the electrical equipment important for safety is of an ex certified design and thus need not be shut down due to loss of pressure or detected gas.

Installation of smoke detection in the air inlet should be considered if deemed necessary. Detected smoke should stop the ventilation.

In special cases where the container has to be prepared for location in hazardous areas and where it is not practical that the equipment important for safety can be of ex certified design, the following measures should be followed:

- The gas detection system for the air inlet and the over pressure ventilation system may be designed with a lockable key switch such that the automatic shut down actions can be overridden and an alarm generated instead of automatic shutdown. A suitable push button for manual shut down shall be provided. The override should cover the equipment important for safety only, and other non important equipment should be shut down according to the normal requirements.
- Gas detection inside the container should be installed in order to give additional information to the operators about any gas concentration inside the container. The monitoring system should be able to give continuous reading of the gas concentration.
- Detected gas in the air inlet
- Containers certified by DNV based on the described manual shut down procedure shall receive a note in the certificate. The note shall explain or refer to conditions for use and shall state that the use is dependent on approval from the authorities.

4.10.4 Systems Required in Emergencies.

In catastrophic emergency situations there is the possibility that explosive quantities of gas could extend outside those areas which have been given a gas hazardous classification, a well blow-out being a typical example. Safety equipment which must operate in these sorts of eventualities should be suitable for use in hazardous areas even although the equipment is located in an area which is normally "safe". Systems which may be in this category include:

- Fire protection circuits
- Emergency lighting
- Gas monitoring circuits
- Public address and General alarm circuits

- Unless special precautions are taken, no equipment shall have hot surfaces, i.e. above 200 degrees.

4.10.5 Conditions after container shut down.

Following an electrical shutdown some non-certified equipment may have non isolated internal voltages from small internal batteries. These sorts of batteries are normally provided for back-up of volatile memory in computers videos etc. and are not generally an ignition hazard.

It is recommended that such equipment can be accepted for location in non hazardous area and zone 2, but the final decision will be to the discretion of the person(s) responsible for the approval on the installation/vessel

Such equipment is to be marked:

“WARNING, INTERNAL VOLTAGES MAY REMAIN AFTER CONTAINER SHUT DOWN: ENSURE THAT ATMOSPHERE IS NON HAZARDOUS BEFORE OPENING/MAINTENANCE”.

Similar signboard is to be fitted also on other batteries located inside the container.

4.11 Hook up of electrical supplies and controls

4.11.1 General

It is assumed that the container when located on a floating installation/vessel is securely fixed to the deck. This is recommended also for fixed offshore installations.

Cables for power supply and other hook up is normally excluded from certification. The types of cables used and hook-up arrangements are the responsibility of installation/vessel electrical engineers.

4.11.2 Flexible cables

Guidance

For power supply to a container it may often be convenient to use a socket outlet on the installation/vessel. This arrangement implies the use of flexible cables which are normally of poor mechanical strength. However for short lengths and for short time use this arrangement may be found satisfactory provided that the cables can be suitably mechanically protected and arranged. It should be noted that most types of flexible cables do not comply with the applicable standards for shipboard cables, and the use of such cables may be subject to special approval from the authorities. Flexible cables located on the deck should have additional mechanical protection.

Flexible cables should preferably have a copper braid, but if H07RN-F or similar non braided types are used, better mechanical protection should be provided.

In particular it should be noted that termination of flexible types of cables is to be carried out using stretch relief devices. For termination into Ex e boxes, certified trumpet glands are to be used.

The preferred arrangement is to use cables for fixed installations terminated in junction boxes at both ends. The cables should be suitably arranged, supported and protected to avoid mechanical damage.

Special attention should be paid in areas with frequent crane operations.

4.11.3 Connection to installation/vessel power supply systems

Containers 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. These data shall be clearly marked at the connection point.

Offshore containers should be prepared for cable hook up according to the following alternatives:

- Suitable junction boxes are to be arranged in recess on the outside wall. This arrangement may also be suitable for flexible cable types provided stretch relief devices are fitted.
- The container walls are to be equipped with cable transits for connection into junction boxes inside the container. This arrangement is normally suitable for cables which do not need to be fitted during hook-up of the container.

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

Guidance

The installation/vessel should have pre-installed junction boxes or socket outlets in the reasonable vicinity such that the containers can be conveniently connected.

4.11.4 Volt free contacts for remote signalling

Where it is necessary to provide remote status of the container safety systems to the installation/vessel control room suitably certified termination facilities should be provided at a convenient location to allow hook-up to the installation/vessel cables. As a minimum, even for safe area containers, such termination facilities should be suitable for use in Zone 2 areas. Where voltages exist on internal components until isolated as part of the installation/vessel ESD such equipment is to be marked:

“WARNING, INTERNAL VOLTAGES MAY REMAIN AFTER CONTAINER SHUT DOWN: ENSURE THAT ATMOSPHERE IS NON HAZARDOUS BEFORE OPENING/MAINTENANCE”.

4.12 Miscellaneous equipment

Electrical equipment in general is to be constructed according to IEC or another recognised standard for such equipment.

4.12.1 Batteries

All circuits to/from the batteries are normally to be fused. Short circuit proof cables are to be applied between the batteries and the fuses/circuit breaker. Batteries are to be located in a separate box or locker giving protection against live parts and mechanical damage. Batteries are to be located in a dedicated enclosure or locker. If the energy rating is less than 5 kWh, natural ventilation provided by opening at the top and bottom of the enclosure or locker will normally be adequate. For larger battery systems forced ventilation systems may be necessary in order to ensure that explosive gases liberated during charging are adequate by dispersed and diluted. Where forced ventilation is arranged, the charger should be tripped on ventilation failure.

For small battery systems using sealed or recombination type batteries consideration may be given to location within equipment. e.g. fire alarm panels, or other proven construction.

See also 4.10.2, 4.10.3 and 4.10.5

4.12.2 Heaters

See 6.3.3

4.12.3 Socket outlets

Socket outlets on the outside of the container are to be installed as described in 4.3. Socket outlets inside the container are to be located such that the connected plugs and cables are not exposed to damage. They should normally not be at floor level.

4.12.4 Programmable controllers

When programmable controllers are used for safety functions such as over pressure monitoring, gas detection, fire detection etc. they are to be of types suitable for the environmental conditions as given in 4.2.3.

Guidance

It is recommended to use types having the hardware type approved by DNV

Documentation shall include:

- Description of how the program is protected against unauthorised changes.
- Description of software functions including programme revision and date.
- Details of the programme (source code, upon request).
- List of inputs and outputs signals.
- Block diagrams and functional wiring diagrams of the external circuits.
- Explanation showing that the system “fail safe” principle has been implemented.
- Functional test program. Simulation of failures to be included.

The system should as far as possible be designed to avoid danger in case of operator failures.

The final basis for approval of the system will be on the results of a functional test procedure.

The controller is to include adequate self monitoring facilities, e.g. the system shall revert into a fail safe state in case of the following or should give an alarm at a manned control station.:

- power failure
- sensor and actuator failure
- computer hardware failure
- software execution failure

Programmable controllers serving safety functions such as fire and gas system, over pressure monitoring and other ESD functions are normally not to be used for control of other utility systems.

5. Gas detection system**5.1 General**

For offshore installations/vessels the statutory regulations normally require gas detecting devices to be installed to cover the classified zones and the areas covered by mechanical ventilation. Ventilation air is normally required to be taken from non hazardous areas remote from potential release sources. However, following a catastrophic accidental event gas may reach outside the classified zones, and therefore all ventilation inlets should have gas detection.

In order to meet these requirements an offshore container should be designed as outlined in 5.2 and 5.3.

5.2 Arrangement of system

All gas monitoring and alarm systems are to utilise Ex certified equipment.

5.2.1 Gas detection for ventilation inlets

In case of mechanical ventilation, the gas detection system shall be arranged to monitor the inlet air. The gas detection device shall be located at the inlet end of the duct.

The requirement for gas detection at air inlet applies to containers located both in non hazardous and in hazardous areas.

The inlet should be located in non hazardous areas for both cases.

Refer to 6.4.2 guidance

5.2.2 Gas detection inside the container

Additional gas detectors may be required inside the container if a source of release is present there. This is considered to be an uncommon situation but may be unavoidable. (All equipment mounted inside the container is to be Ex certified). An example of this is a paint store.

It should be noted that the gas detection inside the container does not waive the need for gas detection at air inlet when applicable acc. to 5.2.1.

The gas monitoring unit should normally be located inside the container. For containers intended for long periods of operation, or otherwise preferred, the gas detectors may alternatively be hooked up to the installation/vessel Fire & Gas central system.

5.3 Function requirements

The gas detection system shall be capable of initiating the following actions:

- At low level gas concentration at the air inlet, audible and visible signal shall be given in the container. Ventilation shall be stopped and ventilation openings closed. A set of volt free contacts for transmitting the low level signal to installation/vessel control room is to be provided
- At high level gas concentration at the air inlet, the same actions shall be initiated, but the visible signal shall indicate high gas level as will a second set of volt free contacts for transmitting the signal to installation/vessel control room is to be arranged. Non Ex certified equipment inside the container shall be shut down.
- When either of the 2 levels of gas detection has been activated, resetting of the gas monitoring units outputs shall only be possible by a dedicated and suitably marked button. This requirement also applies if the power to the gas monitoring unit should be switched off in the meantime. When using this button it is assumed that operators decide whether manual gas monitoring inside the container is necessary.
- The setting of the low and high levels of gas concentration is to be adjustable. 10-30% LEL for the low level and 10-80% LEL for the high level are considered to be suitable ranges.

The gas detection system shall be provided with the option of supply from the installation/vessel main or emergency power system. The final selection of the power supply source is the user's discretion based on their safety philosophy. The gas monitoring system for the air inlet is to be connected to the power systems such that it is functioning whenever the fan is running. Therefore, supply from the same source as the fan is recommended.

Gas monitoring systems for internal container areas as required in 5.2.2 and in 4.10.3 are to be supplied from the installation/vessel emergency power system such that it is in operation at all times.

5.4 Containers for important services and conditions for inhibit of automatic shut down in case of detected gas.

See 4.10.3.

6. Heating, Ventilation and Air Conditioning

6.1 General

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.
(The statutory regulations may require a ventilation rate of minimum 12 litres per second of fresh air per person.)
- 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.

However, should a source of hazard be present within the container the atmosphere is normally considered to be non hazardous when diluted to 5 times below the lower explosion level of the actual gas or vapour. Calculations are to be based on a worst case flammable substance release scenario.

Offshore service containers should be designed to meet these requirements in a suitable manner according to their application.

6.2 Ventilation arrangement

6.2.1 Mechanical ventilation

Mechanical ventilation, or fan powered inlet ventilation should be applied for containers intended as working space for personnel, and is generally recommended for the following reasons:

- A defined rate of fresh air changes can be achieved.
- Heating elements can be used to control the temperature of the inlet air.
- A defined point of inlet provides the possibility for monitoring the inlet air for gas or other contamination.
- Possibility for implementing an over pressure ventilation system and thus maintaining a non hazardous area inside containers located in hazardous areas.

6.2.2 Natural ventilation

Natural ventilation may be applied in the following cases:

- Containers intended only for storage purposes, or which will be occupied only occasionally for short periods of time may be arranged with natural ventilation only. The container should then be provided with suitable ventilation openings, located at the top and bottom of the bulkheads, in order to prevent accumulation of hazardous atmosphere.

- If the container is designed as an open skid or frame, no ventilation system is required. Electrical equipment installed in non-enclosed or open containers should be regarded as being installed in an external area. Such equipment should normally be to a minimum of IP 56.

6.3 Technical requirements related to fan powered ventilation and air heating

6.3.1 Working areas

For containers used as working areas, 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 preheated.

The minimum required ventilation rate for working areas is 12 l/s of outside air per person.

The air intake should be arranged for connection of external duct for remote supply of fresh air.

Ventilation inlet and outlet shall be equipped with fire dampers or other closing devices. Closure mechanisms should be arranged to “fail-safe” i.e. de-energise to close. Simultaneous closure of all ventilation openings and stopping of all ventilation fans should be possible by manual activation of one handle, push button or similar. This manual facility may also initiate other functions e.g. container shut down.

6.3.2 Cooling of electrical equipment

Outside air intended for cooling of non certified electrical equipment should not be fed directly into the electrical enclosures. The air should instead be fed into the container in order to allow for the response time of gas detection systems which may be in the region of 10 seconds or more.

Forced cooling of panels should be by separate systems.

6.3.3 Heating elements and air fans

Heating elements and air fans located in the inlet air duct are to be of Ex certified type. Similar apply to space heaters for containers intended for location in hazardous areas. The fan blades are to be non sparking, and shall have suitable protection against mechanical damage.

Guidance

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 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.

For containers intended for location in non hazardous areas, non Ex certified space heaters may be used provided the exposed temperatures have been tested and confirmed to be below 200 °C.

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

Guidance

For testing of the maximum temperature, the test voltage should be 110%. Where relevant the temperature rise after a built in fan has stopped is to be included. The temperature is to be measured direct 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.

Air heaters combined with fans are to be interlocked with the ventilation fan switch or a flow switch such that they can not be energised unless the fan is running.

6.4 Over pressure ventilation systems

6.4.1 Control of ventilation

The value of the over pressure inside a container should be kept above 50 Pa (5 mm Wg).

The over pressure is to be monitored and if the pressure drops below the above value for a pre-set time delay (normally 30 seconds) the internal of the container should no longer be considered as non hazardous. The following automatic actions should then be initiated:

- All electrical equipment inside the container which is not certified for the corresponding outside atmosphere is to be isolated.
- Safety systems such as fire protection system, emergency lighting, communication systems and gas detection system which are assumed to be based on Ex certified design shall not be shut down in this case.
- A facility should be provided to allow connection of a loss of pressurisation alarm to the installation/vessel control room.

The over pressure shall be monitored using 2 pressure sensors due to special requirements for production installations in the Norwegian waters. Containers not complying with this, may be certified with a note as not being suitable for those areas.

The switch for isolating non certified equipment as above is to be Ex certified.

An indicating instrument showing the actual differential pressure with regard to atmosphere is to be installed within the container. This improves the possibility of monitoring satisfactory operation of the over pressure ventilation system.

A local audible alarm for pressure drop inside the container is required. The alarm shall give an early warning of pressure drop to remind the personnel to close the door in order to avoid unintended shut down. A suitable time delay for this alarm may be 10 to 30 seconds.

Before non Ex certified equipment inside the container is energised a purge cycle of minimum 5 air changes is to be performed. 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 unit. (Additional tests including external ducts may be required after installation offshore if the ducts are very long.)

Similar to 6.4.1, 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.

Guidance

If it is likely to believe that gas may have been present in the area, electrical panels should be opened and vented.

6.4.2 Doors and openings

The inlet and outlet openings should be arranged for connection of ducts for the purpose of routing to a suitable place in a non hazardous area.

The design should 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

For containers 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 container or alternatively can be mounted remote by elongation of the air duct. One recommended way is to fit the fan unit into a recess on an outside wall.

If the installation/vessel has specific areas which as a result of risk analysis etc. are considered to be less exposed to a gas release, and thus being most suitable for ventilation air intake, the duct should be routed to this area. The ventilation air in- and outlet should be located at least 3 metres from a hazardous zone. This will be at the discretion of the person responsible for the installation/vessel and the applicable safety philosophy.

As stated above the duct should normally have over pressure, but if the fan is located at the container 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 container. This should be assessed when the container is installed and hence is left to the discretion of the responsible person onboard the installation/vessel.

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

Doors are to be self closing and are to be provided with a suitable gasket. The self closing mechanism is to be capable of closing the door with the over-pressure ventilation system in operation.

6.4.3 Air lock

The above recommended allowable delay time of 30 seconds for opening the container door has proved to be a practical compromise and has been commonly used. In the IEC publication 79-13, the safety philosophy is based on sufficient ventilation to give a positive air flow through an open door.

For containers it is in practice difficult to maintain a reliable air flow out of an open door taking into account the wind conditions experienced offshore. As an example an air flow of 2 m/s might require a fan capacity of 7000 m³/h.

The use of an air lock represents one solution to this problem. Even if an air lock will not be able to absolutely prevent ingress of outside air, the amount of air which can pass through will normally be small.

For installations/vessels it is further assumed that all zone 2 and zone 1 areas are covered by gas detection systems. It is assumed that these systems are able to detect the gas near the points of leakage and that such detection results instantaneously in container shut down. This assumption provides safety additional to the measures recommended in this Certification Note.

For containers not fitted with an air lock, the following recommended is given to ensure an acceptable level of safety:

- the container should be located in zone 2 (or non hazardous areas) only.
- Where possible the container should be located such that the door is facing away from the most likely ignition sources in that area.
- Switches, relays and other devices which are considered an ignition source in normal service should be located within enclosed panels. (Fuses and circuit breakers may be considered not to be an ignition source in normal service). Such panel are not to have built in cooling fans which would circulate air into it.

6.4.4 Containers for important services and conditions for inhibit of automatic shut down.

See 4.10.3.

7. Public address and main alarm systems

7.1 General

Regulations for installations/vessels require that the principal safety alarms cover all areas. The principal safety alarms may be fire alarm, gas alarm and muster alarms.

All areas must in addition have necessary equipment to receive verbal messages, and to be able to give messages to the installation/vessel control room.

7.2 Installation in containers

Guidance

When designing containers for these functions, problems with non-standardisation of equipment between different installations/vessels are faced. There are different voltage systems for PA loudspeakers. In some cases the main alarms are combined into the PA loudspeakers, and in other cases separate alarm units are used. Alarm units may be visible blinking or audible.

Most PA loudspeakers use built in transformers. Primary input voltage 100V is normally used, but also other voltages such as 70 V or 50 V and even 25 V may be used. If the transformer has primary tapplings, then it may be possible to fit into different voltage systems. This may be a good alternative to ensure compatibility with different installations/vessels.

The means for two way communication back to the main control room on the installation/vessel is equally difficult with regard to standardisation.

A PA loudspeaker, internal in the container is in most cases necessary for manned containers. However, for containers having no noisy equipment inside, a powerful loudspeaker mounted in the vicinity of the container may be sufficient. The need for fire and muster alarms is considered similar.

Communication with the installation/vessel control room can normally be done through the nearest local area telephone unit. From a safety point of view this may be considered satisfactory.

The final decision to what equipment is necessary will be up to the discretion of the person responsible on the installation/vessel when the location of the container has been decided.

As a conclusion to the above, the minimum requirements to permanent and periodically manned containers is to include a PA loudspeaker which shall (unless otherwise agreed) be suitable for 100V. The sound level shall be selected suitable acc. to the size etc. of the container.

In addition the container shall be prepared with suitable cable transits so that additional alarm units and telephones can be mounted as part of the hook-up to the installation/vessel. This solution has been implemented as the most simple alternative to fulfil this Certification Note. The requirement to install the necessary equipment offshore will be stated in the certificate.

In addition to the above certification of container PA systems shall be based on the client's own selection of equipment and system arrangement. The client shall prepare a PA system and alarm philosophy and arrangement description which shall be included in the documentation package for approval. Instructions for connection to the installation/vessel shall be included.

All equipment for public address and alarm systems are to be suitable for operation in zone 1 hazardous areas.

7.3 PABX system

Telephone exchange systems, if installed, are to be included in the container emergency shut down system. Ex rated circuits are to be used for those parts not being shut down.

8. Fire Protection

8.1 General

The actual requirements for fire protection depend on the fire risk inside the container and on the actual location on the installation/vessel. The fire protection measures are to be suitable according to the actual fire risk inside the container as a minimum.

This section describes various fire protection measures which container manufacturers may choose. The protective measures selected will dictate the conditions for installation and location on an offshore installation/vessel. It then follows that a container built according to more stringent requirements or with additional safety measures, will be more flexible with regard to installation on board an installation/vessel.

The fire protection philosophy for offshore containers is considered from 4 main points of view:

- 1) Passive fire protection
- 2) Fire detection
- 3) Active fire protection
- 4) Means of escape

8.2 Passive fire protection

8.2.1 General

The purpose of passive fire protection may be both preventing a fire from spreading from the inside of the container to the outside, and protecting equipment or personnel inside the container from flames or heat radiation from the outside.

Requirement to the external fire rating is given in Table 8-1.

Penetrations should generally not impair the fire technical resistance of the division.

Duct penetrations in the outer shell shall be fitted with automatic fire dampers. For internal penetrations see DNV Rules for ships Pt. 4 Ch. 6 Sec.10 for accepted penetration standard.

8.2.2 Restricted use of combustible materials

All linings, draught stops, ceilings and their associated grounds are to be of non-combustible materials.

Exposed surfaces are to have documented flame-spread and low smoke emission properties according to IMO Res. 653 and NT 004 or equivalent standards. All materials should also have low toxicity properties in a fire.

All insulating materials are to be non-combustible.

Primary deck coverings are to be of approved material which will not readily ignite, or give rise to toxic or explosive hazards at elevated temperatures.

8.3 Fire detection and alarm system

8.3.1 Fire detectors and alarm

At least one fire detector is to be located in each room of the container that has a fire risk. The type of detector is to be selected as the best suitable for early and reliable detection according to the actual fire risk. For office/control stations a smoke detector may be suitable. In case the container contains high fire risk equipment and materials, (see Table 8-1), there is in addition to be a flame or heat detector.

The fire alarm circuits are to be based on zone 1 certified equipment. Fire alarm components are to be delivered with a DNV type approval certificate or alternatively a certificate from a recognised body.

When the installation/vessel main fire alarm system has been activated either as a result of a fire inside the container or elsewhere, persons present in the container shall be able to receive this alarm. The container shall be suitably prepared for this, see section 7.

8.3.2 Containers not equipped with integral fire alarm system.

The fire detector(s) may be connected directly to the installation/vessels main fire detection system. The container should then be prepared with suitable cable transits or junction boxes for hook up to the installation/vessel system. Mounting of appropriate type of detectors may be carried out as part of the installation onboard if considered practical.

A manual fire alarm push button shall be mounted at a suitable place inside the container and shall be marked "Fire alarm". The push button is to be wired to a suitable junction box for connection to the installation/vessel as above.

When the fire detection system has been activated, the following shall take place:

- The ventilation shall be stopped. This can be done manually in the container. The control circuit for the ventilation may be prepared for interconnection to the Installation/vessel such that it can be stopped from the control room, or alternatively the control room can isolate the whole supply to the container.
- In this case it is assumed that there is no automatic extinguishing system and that the fire has to be put out manually.
- The installation/vessel main fire alarm system is assumed to be direct activated.

8.3.3 Containers fitted with integral fire alarm system

A manual fire alarm push button connected to the integral fire alarm system shall be mounted at a suitable place inside the container and shall be marked "Fire alarm". Detectors are to be as described in 8.3.1.

When the fire detection system has been activated, the following shall take place:

- The local fire alarm shall include an audible fire alarm which shall be activated. If the audible alarm serves other functions in addition or can be mixed with other signals, there is to be an additional visible signal.
- Mechanical ventilation shall be stopped and related ventilation openings and fire dampers shall be closed.

The container shall be prepared for hook up to the installation/vessel such that the following signals can be transmitted to the installation/vessel main control room:

- Signal of detected fire. The signal is assumed to activate the installation/vessel main fire alarm system.
- Signal of released extinguishing system if applicable.

The fire detection and alarm is to be active at all times including periods when all other power sources within the container may be shut down. The local fire alarm station should therefore be prepared for power supply from the emergency power system or should have an integrated battery sufficient for 24 hours.

8.4 Active fire protection

8.4.1 General

A fixed fire extinguishing system is generally considered to be more reliable than portable extinguishers. Portable extinguishers should be regarded as supplement to a fixed system. Table 8-1 gives requirements to fire extinguishing systems in different types of containers.

8.4.2 Portable extinguishers

At least one portable extinguisher is always to be located easily accessible inside any type of container. For containers required to have several means of escape, one portable extinguisher is to be available near each exit (normally not required for emergency exits). The type of extinguishing medium shall be decided based on the fire risk of the area, and shall be minimum.

CO ₂ :	6 kg
Powder :	12 kg
Water :	9 l

8.4.3 Fixed extinguishing systems

The following systems are accepted:

- Fixed gas fire extinguishing systems designed according to the requirements of DNV Rules for Ships Pt.4 Ch.6 Sec. 3. Halon systems are not permitted.
- Automatic sprinkler systems designed according to DNV Rules for Ships Pt.4 Ch.6 Sec.8.
- Fixed foam and pressure water spraying systems designed according to DNV Rules for Ships Pt.4 Ch.6 Sec.6.

Requirements for active fire protection of an offshore service container will be subject to evaluation in each separate case based on the fire risk of the equipment mounted inside the container, see also Table 8-1.

A fixed fire extinguishing system may be designed for manual release only, or may in addition have an automatic release mechanism. An automatic released system is recommended when the container contain high fire risk equipment.

The manual release facility should be located at an easily accessible position outside the container, usually near the entrance door. It should have suitable protection against unintentional operation and shall be marked e.g. "fire water release" or other as applicable. The automatic release mechanism may be e.g. a direct temperature sensitive device or may be by a signal from the fire alarm system. Extinguishing systems which may cause danger to personnel are to be manually activated.

Normally water based systems only are to have automatic activation.

Guidance

In order to make the system more resistant to false alarms it may be recommended to use two or more detectors and design the logic such that activation of one detector only will not release the system but give alarm only.

Similar to the fire alarm (see 8.3.3), the control circuits for the fire extinguishing system release and corresponding alarms are to be active at all times, including periods when all other power sources within the container are shut down, and are to be prepared for power supply from the emergency power system or should have an integrated battery sufficient for 24 hours. The circuits are to be designed based on zone 1 certified equipment.

Important components in fixed fire extinguishing systems are to be delivered with DNV certificates or certificates from a recognised body.

If the extinguishing medium is of the gas type, the system shall incorporate a suitable time delay from the moment of activation to the release of the gas. This is in order to allow evacuation of personnel, stop ventilation etc. In this period it shall be possible to reset the system manually.

When a fixed extinguishing system has been released, either as input from the fire alarm system or by the manual push button, and when the system has entered into the above required time delay period where applicable, the following shall take place:

- An audible extinguishing release alarm inside the container shall be activated. This shall be a separate alarm in order to be distinguished from all other signals
- Automatic stop of ventilation fans and closing of fire dampers.
- An indication signal is to be sent to the main control room. The container shall be prepared for this as a separate signal.
- All electrical power shall normally be shut off, except emergency lighting and power to the fire protection system. If the extinguishing medium is water, electrical equipment for safety functions required to be in continued operation shall have IP 56 degree of encapsulation.

An automatic released system may be equipped with a switch for overriding the automatic release function. The switch shall be suitably marked and shall have possibility for locking.

8.5 Escape routes

There are generally to be two separate means of escape from each compartment where personnel normally are employed, or in machinery spaces.

One of the means of escape may be dispensed with after special consideration, due regard being paid to the nature and location of spaces and to the numbers of persons who normally will be quartered or employed in the container.

An escape hatch can be accepted as a second emergency exit. The exit shall be a minimum of 800 x 800 mm. The doors and the escape hatch shall be possible to open from both sides by one person.

Containers in which it will represent danger to be locked in, e.g. air tight containers or cold stores, should be equipped with alarms according to the reference regulations.

For containers with overall length less than 5 m it is accepted to have only one door. This door should then be opening outwards and away from any source of hazard.

Escape exits should be marked on both sides with the words "EMERGENCY EXIT" and "NOT TO BE OBSTRUCTED" in both English and local language.

For most installations/vessels there will be a set of statutory regulations which will have to be met when installing the container. In cases of conflict it is assumed that the statutory regulations will prevail.

It should be noted that the table gives general recommendations. Results from risk analysis and evaluation of Dimensional Accidental Events should be included when deciding an actual case.

In the case of manned containers, the location should take into account external noise and vibration.

8.6 Application principles

In the following table a summary of conditions for installation versus combinations of fire safety measures has been given. They are to be regarded as DNV recommendations. The aim is to reflect the same safety philosophy and safety level as required in recognised standards and relevant statutory regulations.

Groups of containers acc. to type of equipment, materials and operations inside:	Passive fire protection:	Fire extinguishing system	Recommended location:
<p><u>Group 1</u></p> <ul style="list-style-type: none"> Low fire risk equipment and materials 	Minimum A-0 protected.	Fixed fire extinguishing system not required.	<ul style="list-style-type: none"> Non-hazardous areas. Zone 2 areas Zone 1, subject to special need and evaluation
<p><u>Group 2</u></p> <ul style="list-style-type: none"> Medium fire risk equipment and materials 	Minimum A-15 protected.	Fixed fire extinguishing system not installed	<ul style="list-style-type: none"> Non-hazardous areas Zone 2 areas
<p><u>Group 3</u></p> <ul style="list-style-type: none"> Medium fire risk equipment and materials 	Minimum A-15 protected.	Fixed fire extinguishing system installed	<ul style="list-style-type: none"> Non-hazardous areas. Zone 2 areas Zone 1, subject to special need and evaluation
<p><u>Group 4</u></p> <ul style="list-style-type: none"> High fire risk equipment and materials 	Minimum A-60 protected.	Fixed fire extinguishing system required.	<ul style="list-style-type: none"> Non-hazardous areas only.
<p><u>Group 5</u></p> <ul style="list-style-type: none"> Equipment and operations important for safety and. Low and medium fire risk equipment and materials 	Minimum A-60 protected.	Fixed fire extinguishing system not required.	<ul style="list-style-type: none"> Non-hazardous areas May be located in zone 2 provided the important electrical equipment is Ex-certified. (See also 4.10.3)
<p><u>Group 6</u></p> <ul style="list-style-type: none"> Equipment and operations important for safety and. High fire risk equipment and materials inside. 	Minimum A-60 protected.	Fixed fire extinguishing system required.	<ul style="list-style-type: none"> Normally not recommended unless proved safe by special risk analysis. The need for additional safety measures to be evaluated in each case.

Table 8-1 Recommended location and fire protection of containers on installations/vessels based on equipment and materials inside.

To the above table the following clarifications apply:

Low fire risk equipment and materials: Examples may be stores of non typical flammable equipment and things such as tools, mechanical parts, and electrical equipment not connected to power. The container itself contains only a minimum of necessary electrical equipment for lighting, heating, etc. A fire is not likely to be supported.

Medium fire risk equipment and materials: Examples may be electrical panels, testing equipment, work space for paper work. Spaces where normally manned should also be considered as part of this category (not accommodation spaces).

High fire risk equipment and materials: Examples may be combustion machinery and stores for flammable liquids. Also high power electrical machinery.

Equipment and operations important for safety: This is applicable for example to electrical or control equipment for operations which need to be in continuous service to maintain the direct safety for personnel or safety for ongoing operations. Sudden loss of control functions could lead to increased danger. One typical example could be control stations for critical sub sea operations.

Location in Hazardous zones: This is dependent on the condition that the electrical equipment is suitable for such a location or, over pressure ventilation system is applied.

Remark to the table

Where the passive fire protection requirement is A-0 or A-15 this is based on that the main safety aspect is to give protection for persons inside the container in case of fire on the outside, and that escape will be necessary relatively soon. It is also assumed that a fire inside the container will not last long.

9. Noise and vibration

Any noise and vibration sources situated within the container shall be addressed.

The requirements for noise and vibration will depend on the type of activity within the container, the following regulations are to be complied with:

HSE, Guidance on Design and Construction, 4th edition, sec 52.

NPD, Regulation for systematically follow up of the working conditions in the petroleum activity of 8. March 1995

10. Marking and instructions

10.1 Marking

10.1.1 Information plate

Offshore service containers should be fitted, both with the information plate required by Certification Note 2.7-1, and an additional Offshore Service Container information plate. The information plate quality and positioning should be as required in section 6.1 of Certification Note 2.7.1.

On the information plate required by Certification Note 2.7-1, the "Tare mass" should be replaced by the "Structural mass", as defined under item 1.2 in this Note.

<p>OFFSHORE SERVICE CONTAINER</p> <p>DNV CERTIFICATION NOTE 2.7-2</p> <p>Name of Manufacturer:</p> <p>DNV Certificate no.:</p> <p>Date of (last) Certification:</p> <p>Container Group</p> <p>Hazardous Zone Class:</p> <p>Fitted out Mass:</p>

Figure 10-1 Additional name plate for Offshore Service Containers

10.1.2 Marking of Equipment

In addition to the requirements for marking given in section 5 of Certification Note 2.7.1, the following marking should also be included:

Structural:

If the container is fitted with additional lifting pad eyes or any other lifting device, other than the lifting arrangement covered by the Certification Note 2.7-1 certification, details of these should be clearly marked. The marking of equipment is to be evaluated on a case-by-case approach.

Electrical installations:

All electrical equipment shall have markings detailing the equipment's main data, the marking plate should be displayed in such a position where it is clearly visible, where reasonably practical. If this is not possible, an alternative layout may be agreed. All marking plates and signboards shall be of durable construction. On no account shall self adhesive tape be used, unless it is tested and proved to be special durable marking tape.

Electrical components and cable connections shall be clearly marked, to enable tracing to the drawings.

- Fuse holders shall be marked with ampere value and circuit designation.
- Adjustable thermal protection devices shall be marked with the appropriate setting.
- Terminal rails shall be marked with the appropriate voltage.
- Panels shall be marked with voltage on the outside.
- Emergency lighting shall be marked.
- All push buttons and signal devices shall be properly marked.
- Any door on the container which utilises the over pressure ventilation system shall be marked: "WARNING - OVER PRESSURE VENTILATED AREA, CLOSE THIS DOOR".
- The relays for the setting of the purge period, and any other time delay related to the control of over-pressure ventilation systems, are to be marked with their function and their correct settings.
- The portable fire extinguisher holder will be marked with the extinguisher type and size.
- Junction boxes and their terminals for hook up to the platform shall be marked with system voltage, max. upstream fuse value, max. load current, max. load power, frequency, type of system (i.e. IT or TN system).
- The power intake junction boxes will be marked with the supply type i.e. Main power or Emergency Power.
- The power isolating switch as required in 4.10 shall be clearly marked. If the container has several electrical supply points, each of the switches shall have a signboard with information that all need to be isolated for safe maintenance.
- Intrinsically safe systems shall be marked.
- All earth terminals will be marked either with a yellow/green colour code, or using the 'Earth Sign'. Earth conductors shall also be colour coded yellow/green.
- Warning for internal voltages acc. to 4.10.5.

However, when the I.S. and instrument earth systems comply with the requirements of the PE systems, the colour coding yellow/green shall also be used for these systems. An additional method of colour coding or identification should also be used for RE and IE earth systems, to prevent any mistakes on interpretation of the equipment's identification. Blue is recommended for IE earth, and red for RE earth.

Spare conductors will be terminated in the same way as earth conductors, preferably at both ends. The colour coding on these spare conductors will not use the conventional yellow/green, but be marked "spare".

Containers which are intended for connection to platform power supply systems, shall have the following data clearly marked at the connection point:

- nominal voltage
- frequency
- current
- rated short circuit breaking capacity
- type of system, e.g. IT, TN, etc.

Fire safety

All escape routes should be clearly marked. Escape exits should be marked on both sides with the words "EMERGENCY EXIT", and "NOT TO BE OBSTRUCTED" in both English and the local language of the units destination.

10.2 Instructions for hook-up/installation

An approved set of instructions for hook-up/installation of the container on an offshore installation/vessel together with copies of the container certificates shall always accompany the container.

11. Certificates

11.1 Certificates and test reports

The following certificates and report forms are available, as part of the documentation for a certified container.

- Design Verification Report, (Form no. 40.91a).
- Type approval certificate, (Form no. 20.91a).
- Offshore Container Certificate, (Form no. 49.07a). A sample of this form is enclosed in 11 Appendix A.
- DNV Certificate for Offshore Service Containers, (Form no. 59.01a). A sample of this form is enclosed in 13 Appendix B.

One Certificate should be issued for each container, but documentation for fabrication and testing may cover a series of containers.

12. Appendix A Offshore Container Certificate



DET NORSKE VERITAS

**CERTIFICATE FOR
OFFSHORE CONTAINER**

Certificate No.:

Part 1

Offshore Container Type:			
Max. Gross Mass (Rating):		Tare Mass:	Payload:
External Dimensions (LxWxD):		Design Temperature:	
Det Norske Veritas Type Approval No.:		Assembly Drawing No.:	
Fabricator:			
Type Designation:		Fabrication No.:	Date of Fabrication:
Specification of lifting set (certificates should be recorded in part 2) The certificate is only valid when the container is fitted with approved lifting set.			
Min. shackle bolt diameter:	Max. angle of legs (from vertical):	Min. safety factor (against breaking): Chain, shackles, rings, links Wire rope	
Proof testing This offshore container, or another offshore container from the same fabrication series, has been subjected to the following proof test:			
Fabrication no. of the offshore container(s) tested:		Total test load (2,5R):	Test date:
This Offshore Container has been designed, approved and tested in accordance with Det Norske Veritas Certification Notes no. 2.7-1 "Certification of Offshore Freight Containers".			
The container also complies with the following requirements and regulations:			
Remarks			
Date:	Place:	Surveyor	
<small>It is agreed that save as provided below Det Norske Veritas, its subsidiaries, bodies, officers, directors, employees and agents shall have no liability for any loss, damage or expense allegedly caused directly or indirectly by their mistake or negligence, breach of warranty, or any other act, omission or error by them, including gross negligence or willful misconduct by any such person with the exception of gross negligence or willful misconduct by the governing bodies or senior executive officers of Det Norske Veritas. This applies regardless of whether the loss, damage or expense has affected anyone with whom Det Norske Veritas has a contract or a third party who has acted or relied on decisions made or information given by or on behalf of Det Norske Veritas. * However, if any person uses the services of Det Norske Veritas or its subsidiaries or relies on any decision made or information given by or on behalf of them and in consequence suffers a loss, damage or expense proved to be due to their negligence, omission or default, then Det Norske Veritas will pay by way of compensation to such person a sum representing the proved loss. * In the event Det Norske Veritas or its subsidiaries may be held liable in accordance with the sections above, the amount of compensation shall under no circumstances exceed the amount of the fee, if any, charged for that particular service, decision, advice or information. * Under no circumstances whatsoever shall the individual or individuals who have personally caused the loss, damage or expense be held liable. * In the event that any provision in this section shall be invalid under the law of any jurisdiction, the validity of the remaining provisions shall not in any way be affected.</small>			

DET NORSKE VERITAS CLASSIFICATION AS , VERITASVEIEN 1, N-1322 HØVIK, NORWAY, TEL. INT: +47 67 57 99 00, TELEFAX: +47 67 57 99 11
Form No.: 49.07a Issue: April 95 Page 1 of 2

Certificate No.:

CERTIFICATE FOR OFFSHORE CONTAINER, Part 2

Owner:		Owner's Identification no.:					
Lifting set Lifting set and replacement sets to be listed							
Description of parts	Supplier/Fabricator	Certificate No.	Date				
Periodical inspection and recertification							
I Date	II Description of Inspection	III Status*	IV Report no./ Test Cert. no.	V Sign./ Stamp**	VI Remarks		
<p>* The Status should be indicated by one of the following codes:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> <p>RE Recommendation. Immediate repair and inspection.</p> <p>MO Memorandum. Container accepted for use, but to be kept under observation.</p> <p>CO Comment.</p> <p>OK Container in satisfactory condition.</p> </td> <td style="width: 50%; vertical-align: top;"> <p>** The signature of the competent person certifies that the Offshore Container, including its lifting sling, has been thoroughly examined, and that no defects affecting its safe working condition were found, other than those shown in columns III, IV or VI.</p> </td> </tr> </table>						<p>RE Recommendation. Immediate repair and inspection.</p> <p>MO Memorandum. Container accepted for use, but to be kept under observation.</p> <p>CO Comment.</p> <p>OK Container in satisfactory condition.</p>	<p>** The signature of the competent person certifies that the Offshore Container, including its lifting sling, has been thoroughly examined, and that no defects affecting its safe working condition were found, other than those shown in columns III, IV or VI.</p>
<p>RE Recommendation. Immediate repair and inspection.</p> <p>MO Memorandum. Container accepted for use, but to be kept under observation.</p> <p>CO Comment.</p> <p>OK Container in satisfactory condition.</p>	<p>** The signature of the competent person certifies that the Offshore Container, including its lifting sling, has been thoroughly examined, and that no defects affecting its safe working condition were found, other than those shown in columns III, IV or VI.</p>						



DET NORSKE VERITAS
APPENDIX TO
CERTIFICATE FOR
OFFSHORE SERVICE CONTAINER

Certificate No:

Rev:

DNV Certification Note 2.7-2

(The main body of the page contains a large, faint rectangular area, likely a placeholder for a certificate or a very faded document. The text within this area is illegible.)