Process Systems Onboard Offshore Units and Installations

July 2015

Rule Note
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BUREAU VERITAS

MARINE & OFFSHORE DIVISION

GENERAL CONDITIONS

ARTICLE 1

1.1. - BUREAU VERITAS is a Society the purpose of whose Marine & Offshore Division (the "Society") is the classification (" Classification ") of any ship or vessel or offshore unit or structure of any type or part of it or system therein collectively hereinafter referred to as a "Unit" whether linked to shore, river bed or sea bed or not, whether operated or located at sea or in inland waters or partly on land, including submarines, hovercrafts, drilling rigs, offshore installations of any type and of any purpose, their related and ancillary equipment, subsea or not, such as well head and pipelines, mooring legs and mooring points or otherwise as decided by the Society.

The Society:

- "prepares and publishes Rules for classification, Guidance Notes and other documents (" Rules ");
- "issues Certificates, Attestations and Reports following its interventions (" Certificates ");
- "publishes Registers.

1.2. - The Society also participates in the application of National and International Regulations or Standards, in particular by delegation from different Governments. Those activities are hereafter collectively referred to as " Certification ".

1.3. - The Society can also provide services related to Classification and Certification such as ship and company safety management certification; ship and port security certification, training activities; all activities and duties incidental thereto such as documentation on any supporting means, software, instrumentation, measurements, tests and trials on board.

1.4. - The interventions mentioned in 1.1., 1.2. and 1.3. are referred to as " Services ". The party and/or its representative requesting the services is hereinafter referred to as the " Client ". **The Services are prepared and carried out on the assumption that the Clients are aware of the International Maritime and/or Offshore Industry (the "Industry") practices.**

1.5. - The Society is neither and may not be considered as an Underwriter, Broker in ship's sale or chartering, Expert in Unit's valuation, Consulting Engineer, Controller, Naval Architect, Manufacturer, Shipbuilder, Repair yard, Charterer or Shipowner who are not relieved of any of their expressed or implied obligations by the interventions of the Society.

ARTICLE 2

2.1. - Classification is the appraisement given by the Society for its Client, at a certain date, following surveys by its Surveyors along the lines specified in Articles 3 and 4 hereafter on the level of compliance of a Unit to its Rules or part of them. This appraisement is represented by a class entered on the Certificates and periodically transcribed in the Society's Register.

2.2. - Certification is carried out by the Society along the same lines as set out in Articles 3 and 4 hereafter and with reference to the applicable National and International Regulations or Standards.

2.3. - **It is incumbent upon the Client to maintain the condition of the Unit after surveys, to present the Unit for surveys and to inform the Society without delay of circumstances which may affect the given appraisement or cause to modify its scope.**

2.4. - The Client is to give to the Society all access and information necessary for the safe and efficient performance of the requested Services. The Client is the sole responsible for the conditions of presentation of the Unit for tests, trials and surveys and the conditions under which tests and trials are carried out.

ARTICLE 3

3.1. - **The Rules, procedures and instructions of the Society take into account at the date of their preparation the state of currently available and proven technical knowledge of the Industry. They are a collection of minimum requirements but not a standard or a code of construction neither a guide for maintenance, a safety handbook or a guide of professional practices, all of which are assumed to be known in detail and carefully followed at all times by the Client.**

Committees consisting of personalities from the Industry contribute to the development of those documents.

3.2. - **The Society only is qualified to apply its Rules and to interpret them. Any reference to them has no effect unless it involves the Society's intervention.**

3.3. - The Services of the Society are carried out by professional Surveyors according to the applicable Rules and to the Code of Ethics of the Society. Surveyors have authority to decide locally on matters related to classification and certification of the Units, unless the Rules provide otherwise.

3.4. - **The operations of the Society in providing its Services are exclusively conducted by way of random inspections and do not in any circumstances involve monitoring or exhaustive verification.**

ARTICLE 4

4.1. - The Society, acting by reference to its Rules:

- "reviews the construction arrangements of the Units as shown on the documents presented by the Client;
- "conducts surveys at the place of their construction;
- "classes Units and enters their class in its Register;
- "surveys periodically the Units in service to note that the requirements for the maintenance of class are met.

The Client is to inform the Society without delay of circumstances which may cause the date or the extent of the surveys to be changed.

ARTICLE 5

5.1. - **The Society acts as a provider of services. This cannot be construed as an obligation bearing on the Society to obtain a result or as a warranty.**

5.2. - **The certificates issued by the Society pursuant to 5.1. here above are a statement on the level of compliance of the Unit to its Rules or to the documents of reference for the Services provided for.**

In particular, the Society does not engage in any work relating to the design, building, production or repair checks, neither in the operation of the Units or in their trade, neither in any advisory services, and cannot be held liable on those accounts. Its certificates cannot be construed as an implied or express warranty of safety, fitness for the purpose, seaworthiness of the Unit or of its value for sale, insurance or chartering.

5.3. - **The Society does not declare the acceptance or commissioning of a Unit, nor of its construction in conformity with its design, that being the exclusive responsibility of its owner or builder.**

5.4. - The Services of the Society cannot create any obligation bearing on the Society or constitute any warranty of proper operation, beyond any representation set forth in the Rules, of any Unit, equipment or machinery, computer software of any sort or other comparable concepts that has been subject to any survey by the Society.

ARTICLE 6

6.1. - The Society accepts no responsibility for the use of information related to its Services which was not provided for the purpose by the Society or with its assistance.

6.2. - **If the Services of the Society or their omission cause to the Client a damage which is proved to be the direct and reasonably foreseeable consequence of an error or omission of the Society, its liability towards the Client is limited to ten times the amount of fee paid for the Service having caused the damage, provided however that this limit shall be subject to a minimum of eight thousand (8,000) Euro, and to a maximum which is the greater of eight hundred thousand (800,000) Euro and one and a half times the above mentioned fee. These limits apply regardless of fault including breach of contract, breach of warranty, tort, strict liability, breach of statute, etc.**

The Society bears no liability for indirect or consequential loss whether arising naturally or not as a consequence of the Services or their omission such as loss of revenue, loss of profit, loss of production, loss relative to other contracts and indemnities for termination of other agreements.

6.3. - All claims are to be presented to the Society in writing within three months of the date when the Services were supplied or (if later) the date when the events which are relied on of were first known to the Client, and any claim which is not so presented shall be deemed waived and absolutely barred. Time is to be interrupted thereafter with the same periodicity.

ARTICLE 7

7.1. - Requests for Services are to be in writing.

7.2. - **Either the Client or the Society can terminate as of right the requested Services after giving the other party thirty days' written notice, for convenience, and without prejudice to the provisions in Article 8 hereunder.**

7.3. - The class granted to the concerned Units and the previously issued certificates remain valid until the date of effect of the notice issued according to 7.2. here above subject to compliance with 2.3. here above and Article 8 hereunder.

7.4. - The contract for classification and/or certification of a Unit cannot be transferred neither assigned.

ARTICLE 8

8.1. - The Services of the Society, whether completed or not, involve, for the part carried out, the payment of fee upon receipt of the invoice and the reimbursement of the expenses incurred.

8.2. - **Overdue amounts are increased as of right by interest in accordance with the applicable legislation.**

8.3. - **The class of a Unit may be suspended in the event of non-payment of fee after a first unfruitful notification to pay.**

ARTICLE 9

9.1. - The documents and data provided to or prepared by the Society for its Services, and the information available to the Society, are treated as confidential. However:

- "Clients have access to the data they have provided to the Society and, during the period of classification of the Unit for them, to the **classification file** consisting of survey reports and certificates which have been prepared at any time by the Society for the classification of the Unit ;
- "copy of the documents made available for the classification of the Unit and of available survey reports can be handed over to another Classification Society, where appropriate, in case of the Unit's transfer of class;
- "the data relative to the evolution of the Register, to the class suspension and to the survey status of the Units, as well as general technical information related to hull and equipment damages, may be passed on to IACS (International Association of Classification Societies) according to the association working rules;
- "the certificates, documents and information relative to the Units classed with the Society may be reviewed during certificating bodies audits and are disclosed upon order of the concerned governmental or inter-governmental authorities or of a Court having jurisdiction.

The documents and data are subject to a file management plan.

ARTICLE 10

10.1. - Any delay or shortcoming in the performance of its Services by the Society arising from an event not reasonably foreseeable by or beyond the control of the Society shall be deemed not to be a breach of contract.

ARTICLE 11

11.1. - In case of diverging opinions during surveys between the Client and the Society's surveyor, the Society may designate another of its surveyors at the request of the Client.

11.2. - Disagreements of a technical nature between the Client and the Society can be submitted by the Society to the advice of its Marine Advisory Committee.

ARTICLE 12

12.1. - Disputes over the Services carried out by delegation of Governments are assessed within the framework of the applicable agreements with the States, international Conventions and national rules.

12.2. - Disputes arising out of the payment of the Society's invoices by the Client are submitted to the Court of Nanterre, France, or to another Court as deemed fit by the Society.

12.3. - **Other disputes over the present General Conditions or over the Services of the Society are exclusively submitted to arbitration, by three arbitrators, in London according to the Arbitration Act 1996 or any statutory modification or re-enactment thereof. The contract between the Society and the Client shall be governed by English law.**

ARTICLE 13

13.1. - **These General Conditions constitute the sole contractual obligations binding together the Society and the Client, to the exclusion of all other representation, statements, terms, conditions whether express or implied. They may be varied in writing by mutual agreement. They are not varied by any purchase order or other document of the Client serving similar purpose.**

13.2. - The invalidity of one or more stipulations of the present General Conditions does not affect the validity of the remaining provisions.

13.3. - The definitions herein take precedence over any definitions serving the same purpose which may appear in other documents issued by the Society.

BV Mod. Ad. ME 545 L - 7 January 2013

RULE NOTE NR 459

NR 459
Process Systems Onboard Offshore Units and Installations

July 2015

Section 1 General

Section 2 General Systems Design Requirements

Section 4 Certification of Equipment

Section 5 Construction Survey and Testing

SECTION 1 GENERAL

1 Scope of PROC notation

1.1 General

1.1.1 The following systems are covered by additional class notation **PROC**:

- Process and process utility systems including power generation
- Flaring and venting system
- Control and safety systems
- Fire and gas detection
- Passive and active fire and blast protection
- Escape and evacuation
- Cryogenic spillage protection.

1.2 Application

1.2.1 The present Rule Note deals with particular provisions applicable to offshore units, including hydrocarbon processing facilities, intended to receive additional class notation **PROC**, in conditions defined by the applicable Rules for Classification as defined in [2.1] and in order to maintain at a minimum level the risk to personnel, environment and assets.

The following principles will apply:

- Prevention of occurrence and limitation of consequences of abnormal condition of operations
- Prevention of loss of containment of hazardous materials (flammable, toxic, cryogenic) under abnormal conditions operations
- Safe collection and disposal of flammable liquids
- Prevention of explosive or toxic atmosphere formation by dilution and dispersion of gas or vapour leaks
- Suppression of ignition sources in hazardous areas and in safe areas which may become hazardous in case of abnormal conditions
- Early detection of abnormal and hazardous situations
- Containment and mitigation of abnormal and hazardous situations
- Protection of personnel against hazardous events
- Safe evacuation of personnel in case of uncontrolled situations.

The requirements stipulated in the present Rule Note neither concern the performance nor availability of the oil and gas processing plant.

1.3 Applicable requirements

1.3.1 Process and utilities equipment and systems fitted on production units or installations intended to receive additional class notation **PROC** are to be designed, built and tested according to a set of rules, codes, standards recommended practice and regulations, complying with the present Rule Note, applicable to the Project and which is to be agreed by the Society.

2 Classification requirements

2.1 Applicable rules for classification

2.1.1 When refered to in this Note, "Rules for Classification" means, as applicable:

- NR445 Rules for the Classification of Offshore Units
- NR542 Classification of Offshore Floating Gas Units.

Codes and standards of practice which have been proven to be effective by actual application by the offshore industry which are not in conflict with this Rule Note, and which are acceptable to the Society, may be applied as an alternative to these provisions.

2.2 General principle of classification

2.2.1 The general principle of classification are detailed in NR445, Part A.

3 Statutory requirements

3.1 International regulations

3.1.1 Attention is directed to the international regulations process systems of unit or installation may have to comply with.

3.2 National Authorities requirements

3.2.1 Attention is drawn to special legal provisions enacted by National Authorities which units or installations may have to comply with according to their flag, type, size, operational site and intended service, as well as other particulars and details.

3.3 Classification and statutory requirements

3.3.1 Compliance with statutory requirements mentioned in [3.1] and [3.2] is not included in classification scope but, in case of conflict between the Rules and these requirements, the latter ones are to take precedence over the requirements of the present Rule Note.

3.4 Classification matters

3.4.1 Deviations to requirements of the present Rule Note may be considered, if judged acceptable by the Society, in case of approval by National Authorities of less stringent arrangements than those provided for in the present Rule Note.

3.5 Abbreviations

3.5.1 Throughout the present Rule Note, the following abbreviations are used:

AD : Arbeitsgemeinschaft Drückbehalten (Germany)

ALPEMA: Brazed Aluminium Plate-Fin Heat Exchanger Manufacturers' Association

API : American Petroleum Institute

ASME : American Society of Mechanical Engineers

BS : British Standard

HAZOP : Hazard and Operability Study

IGC : International Gas Carrier Code

IEC : International Electrotechnical Commission

IEEE : Institute of Electrical and Electronics Engineers

ISO : International Organization for Standardization

IMO : International Maritime Organisation

MARPOL: International Convention for Prevention of Pollution by Ships

NACE : National Association of Corrosion Engineers (U.S.A.)

NORSOK: Norwegian Petroleum Industry Standards

OCMA : Oil Companies Materials Association

SOLAS : IMO resolution for Safety Of Life At Sea

TEMA : Tubular Exchangers Manufacturers' Association (U.S.A.).

SECTION 2 GENERAL SYSTEMS DESIGN REQUIREMENTS

1 General

1.1

1.1.1 Each system is to comply with requirements of the present Rule Note, and, in addition, with the latest edition code or standard, as listed here under, according to its nature, any mix-up of different codes or standards being avoided.

1.1.2 Upon preliminary agreement of the Society, other codes and standards than those listed here under may be used.

2 General codes and standards

2.1

2.1.1 The recognized codes and standards are as follow:

- NORSOK standard S-001 Technical Safety
- NFPA 59 "Standard for the storage and handling of Liquefied Petroleum Gases at utility gas plants
- NFPA 59A "Standard for the production, storage and handling of Liquefied Natural Gas (LNG)"
- EN 1473 "Installations and equipment for liquefied natural gas - Design of onshore installations"
- API 2FPS Recommended Practice for Planning, Designing and Constructing Floating Production Systems
- IMO SOLAS international Convention for the Safety of Life at Sea
- IMO MARPOL International Convention for the Prevention of Pollution from Ships
- IGC Code International Gas Carrier Code
- IMO MODU Mobile Offshore Drilling Units Code.

3 Topside Layout

3.1

3.1.1 Topside layout is to be designed to minimize the probability and consequences of an accident by segregating sources of fuel from sources of ignition and protecting manned areas from hazardous areas by distances or lower risk level areas using a risk ranking principle.

The recognized codes and standards are as follow:

- NR445, Part C, Chapter 4 or NR445, Part D, Chapter 1, or NR542, Sec 13
- EN ISO 13702 "Control and Mitigation of Fires and Explosions on Offshore Production Installations
- NORSOK standard S-001 Technical Safety.

4 Ventilation and area Classification

4.1

4.1.1 Refer to NR445, Part C, Chapter 4 or NR445, Part D, Chapter 1, or NR542, Sec 12.

5 Fire and explosion safety

5.1

5.1.1 With regards to fire & gas detection, passive fire & blast protection, fire fighting the recognized codes and standards are as follow:

- NR445, Part C, Chapter 4 or NR445, Part D, Chapter 1, or NR542, Sec 12
- IMO FSS Code International Code for Fire Safety Systems
- EN ISO 13702 "Control and Mitigation of Fires and Explosions on Offshore Production Installations
- NORSOK standard S-001 Technical Safety
- API RP 14 G Recommended Practice for Fire Prevention and Control on Fixed Open-type Offshore Production Platforms
- NFPA 11 Standard for Low-, Medium-, and High-Expansion Foam
- NFPA 12 Standard on Carbon Dioxide Extinguishing Systems
- NFPA 15, Standard for Water Spray Fixed Systems for Fire Protection
- NFPA 16 Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems
- NFPA 20 Standard for the Installation of Stationary Pumps for Fire Protection.

6 Fire or Explosion Survivability

6.1

6.1.1 Components which are essential to the safety of the unit in the event of a fire or explosion are to be designed and constructed, or protected so as to resist fire for the expected service duration or the explosion pressure.

7 Escapes and evacuation

7.1

7.1.1 Refer to NR445, Part C, Chapter 4 or NR445, Part D, Chapter 1, or NR542, Sec 12.

8 Structural members

8.1

8.1.1 The structural members, subject of this paragraph are the topsides, the flare tower and other structures above main deck, included in the scope of the PROC notation.

Main structural members are to be designed, and constructed in compliance with NR445, Part D, Chapter 1 or other recognised standard.

The drawings of primary structural members included in the scope of the PROC notation are to be submitted for review.

Structural analysis and fatigue analysis of the structural members included in the scope of PROC notation are to be submitted, if relevant.

The structural analysis is to take into account static, normal operation (with environment), accidental and test conditions including transit if relevant. Wind, Green water, Snow and ice loads are to be taken into account if relevant. Thermal loads are to be taken into account for the flare tower structural analysis.

9 Machinery installations

9.1

9.1.1 All machinery, electrical equipment, boilers and other pressure vessels, associated piping systems, fittings and wiring shall be of a design and construction adequate for the intended service and shall be so installed and protected as to reduce to a minimum any danger to persons on board, due regard being paid to moving parts, hot surfaces and other hazards. The design shall have regard to materials used in construction, and to the marine and industrial purposes for which the equipment is intended, the working conditions and the environmental conditions to which it will be subjected. Consideration shall be given to the consequences of the failure of systems and equipment essential to the safety of the unit.

10 Process systems

10.1

10.1.1 The following standards are to be used as guidelines:

- NORSOK standard P-001 Process Design
- NORSOK standard P-100 Process Systems.

10.2 Segregation of systems

10.2.1 Piping systems for the process are to be segregated from other non-hazardous piping systems onboard the unit or installation.

10.2.2 Drainage systems for safe areas are to be entirely segregated and distinct from drainage systems from hazardous areas.

10.2.3 When process or cargo fluids are intended to be used as fuel, requirements of NR445, Part D, Ch 1, Sec 13 are to be complied with.

10.3 Piping systems construction requirements

10.3.1 All piping systems are to be suitable for the design pressure and temperature following the definitions of NR445, Part C, Chap 1, Sec 7.

10.3.2 Process piping is not to pass through any space other than those devoted to production purposes.

10.3.3 Except otherwise permitted, production pipes, pumps, accessories and other production equipment are to be permanently fixed. Mobile fittings are permitted only for emergency transfer of hydrocarbon products.

10.4 Hazardous and chemical products

10.4.1 Arrangements are to be made in order to ensure that substances which are flammable, toxic or are likely to present a hazard due to reaction when mixed are kept separated.

10.4.2 Sections of piping which may contain hazardous liquids or gases and which can be isolated are to be suitably protected from overpressure. Relief valve discharges are to be led to a safe location.

10.4.3 Details of air and sounding pipes to tanks containing chemical products will be the subject of a special examination by the Society.

10.5 Fired process

10.5.1 The use of fired process equipment is to be avoided.

Electrical or indirect heating systems are to be preferred.

11 Instrumentation and control systems

11.1 General

11.1.1 All systems listed under Sec 1, [1.1] are to be provided with all control equipment deemed necessary to ensure safety and complying with requirements of the present Article and of the applicable Rules for Classifications as defined in Sec 1, [2].

The recognized codes and standards are as follow:

- NR445, Part C, Chapter 3
- API RP 14C "Analysis, Design, Installation and Testing of Basic Surface Safety Systems for Offshore Production Platforms"
- ISO 10418, Petroleum and natural gas industries - Offshore production installations - Basic surface process safety systems
- IEC 61511-1 Functional safety - Safety instrumented systems for the process industry sector
- NI524 Classification and Certification of High Integrity Protection Systems (HIPS).

11.2 Power supply

11.2.1 Power supplies for the control systems are to be arranged so that automatic change-over to a standby supply is available in the event of a failure of normal supply.

11.2.2 Electro-hydraulic systems are to be designed in such a way as to avoid misplaced operations in the event of short interruptions of power supply, for instance when switching from main to emergency power.

11.3 Control station

11.3.1 Control station is to include the following monitoring, control and alarm systems:

- indication of equipment status
- valve monitoring and indication of position
- visual and audible alarms in case of malfunction of the processing plant or a fault of the monitoring and control system.

11.4 Fault detection and in-service testing

11.4.1 Monitoring and control systems are to be designed for fault detection.

11.4.2 Provision is to be made for in-service testing of the monitoring and control system.

11.5 Control lines

11.5.1 Cables and pneumatic or hydraulic power lines for control systems are to be, routed away from possible sources of damage, or so installed that the risk of failure is minimised.

11.5.2 Where necessary, cables and pneumatic and hydraulic power lines for control systems are to be protected against shocks by means of appropriate casings, ducts or conduits.

These casings, ducts or conduits are to be efficiently protected against corrosion.

11.5.3 Control system cables carrying circuits the integrity of which is necessary during a fire are to be of a fire resisting type.

11.6 Safety shutdown systems

11.6.1 Safety shutdown systems are to be installed:

- to prevent accidental releases of hydrocarbons
- to limit the quantity of release liable to occur
- to minimise the consequences of releases.

These safety functions are achieved through:

- the detection of abnormal situations
- the sectionalisation of hydrocarbon flow and the de-energisation of ignition sources
- the depletion of hydrocarbon inventory and of potential pressure energy by depressurization.

11.6.2 System design requirements

a) The system is to comply with requirements of recognized standards mentioned under [14.1]

b) Shutdown systems are to be arranged to operate independently from other monitoring, control and alarm systems

c) Shutdown systems are to be designed according to fail-safe principle and arranged so as to prevent inadvertent manual operation

d) Shutdown systems are to include:

- audible and visual alarms displayed at main control station and other appropriate locations, enabling to locate alarmed failure
- audible alarm belonging to general alarm system, at final stage of shutdown
- means for manual initiation from the main control station (ESD) and main evacuation station
- manual reset facilities.

11.6.3 Safety Valves

Safety valves are to be of the fail-safe type and actuated in compliance with requirements of [11.2.2].

Actuating energy of fail-safe valves may be mechanical (spring) or hydraulic/pneumatic. In the latter case, the accumulator capacity is to be sufficient for at least three valve operations in the most stringent service conditions. The accumulator monitoring the valve in the fail safe position it to be located as close as possible to the valve actuator.

11.6.4 Redundancy

a) As necessary to fulfil the intent of [14.7] without leading to too numerous shutdowns due to minor malfunctions, two levels of safety systems are to be provided (with safety devices of different natures), the first one providing alarms without causing automatic shutdown

b) Safety devices are to be arranged in such a way that they cannot be activated inadvertently

c) Monitoring and control systems are to be arranged to prevent failure of monitoring due to a single component failure.

11.6.5 Post-shutdown hazards

Due consideration is to be given to possible hazards involved by systems remaining active after shutdown.

11.6.6 Temporary disconnections

Shutdown systems may include means for temporary disconnection of some items, as necessary in particular conditions (start-up, process change-over, emergency, maintenance).

11.6.7 Programmable controllers

The following requirements are applicable where programmable controllers (PCs) are used in safety shutdown systems.

a) PC equipment is to be designed according to a recognised standard to be compatible with the operation of other shutdown equipment.

b) PC equipment are to be suitable for the environment in which they are to be installed, even under emergency condition.

c) Hardware components and equipment are to be adequately protected against fluctuation or failure of voltage or current at any part of the PC.

d) Systems are to be designed to facilitate hardware and function testing. As far as practicable, essential functions are to be provided with self-checking and fault diagnosis techniques. In the event that a true shutdown signal is received during system testing, the testing operations are to be automatically abandoned and the appropriate trip action initiated.

e) Failure of PC equipment including peripheral devices is to initiate an audible and visual alarm at the main control station. Consideration is to be given to identify alarms as either software or hardware malfunctions.

f) Faults on any peripheral device are not to cause the PC based shutdown system to become ineffective.

g) The quality of the software is to be adequately checked and in this respect, the quality assurance plan for the software being given special consideration.

Software modifications are to be made in accordance with the software quality assurance plan.

h) Care is to be exercised to ensure software is secure from interference by unauthorised personnel.

12 Depressuring venting and flaring

12.1 General

12.1.1 Regarding depressuring venting and flaring systems The recognized codes and standards are as follow:

- API RP 521/ISO 23251: 2006 "Guide for Pressure-relieving and Depressuring Systems"
- API Std 520, Sizing, Selection and Installation of Pressure-Relieving Devices in Refineries
- ISO 23251: 2007, Petroleum, petrochemical and natural gas industries - Pressure-relieving and depressuring systems.

12.2 Pressure relief arrangements

12.2.1 Where necessary, a test rig is to be supplied to enable the pressure setting of the safety and relief devices to be checked.

12.2.2 Relieving system design shall take into consideration the risk of hydrates formation, temperature drop or slugging.

12.2.3 The arrangement of safety and relief discharges is to be such that there is no possibility of dangerous reaction between the substances involved.

12.2.4 Where provision is made for the isolation of safety relief devices from vessels and/or systems for maintenance purposes, not less than two such safety devices are to be fitted.

12.2.5 The isolating or blocking valves are to be arranged so that at least one safety relief device remains in communication with the vessel or system under all conditions.

12.3 Permissible radiation levels

12.3.1 Exposure levels from flare or ignited vent are not to exceed permissible ones listed in Tab 1.

Table 1 : Permissible radiation levels for personnel exposure

Conditions of exposure **(1)**	Radiation level (kW/m^2)
Working areas where personnel may be continually exposed	1,6
Areas where emergency actions may be required by personnel	4,7
Structures and areas where personnel access is restricted	15,8

(1) As specified in Design Criteria Statement or other documents submitted to the Society.

Note 1: The radiation levels do not include solar radiation.

Note 2: The values for personnel represent maximum safe design exposure levels for adequately clothed personnel.

Note 3: In areas where transient rates greater than 6,3 kW/m^2 are anticipated, special attention is to be given to possibilities of personnel evacuation from the area.

13 Drainage of process areas

13.1

13.1.1 Means are to be provided to collect and safely dispose of liquid leaks from process equipment.

13.1.2 The leaks from process equipment are to be collected as close as possible to their expected sources and the system is to be partitioned to prevent leak spreading to adjacent equipment.

13.1.3 The system is to be dimensioned so as to accommodate the maximum water flow from the fire-fighting water system of the process area.

13.1.4 The heights of the coamings around drip trays are to be commensurate with the amount of potential spillage, with a minimum of 150 mm.

14 Systems and equipment design principles

14.1 General

14.1.1 Components and systems are to be designed according to the requirements of the present Rule Note and to the applicable codes and standards (refer to [1]).

14.2 Strength

14.2.1 All components and systems are to be designed with sufficient strength to resist to the worst predictable normal operating conditions, including possible uncertainties and transitory phases (start-up, shutdown and other ones as necessary).

14.2.2 Equipment essential to the safety of the unit or installation, or containing products the spillage of which may involve a major hazard, are to be designed with sufficient strength to resist to the worst predictable emergency conditions including the maximum angles of inclination calculated in damage conditions.

14.2.3 Safety factors used for the application of [14.2.1] and [14.2.2], except otherwise specified in the present Rule Note, are to be those considered in the codes and standards applied (refer to [1]).

These safety factors are to be specified in the calculation notes submitted to the Society.

14.2.4 Systems are to be designed with sufficient flexibility to withstand imposed displacements due to:

- unit's strains (applicable in particular to truss secondary structures, which are to be supported in an appropriate way)
- Unit hogging, sagging and hull deflection displacements
- expansion due to passage of heated fluids or contraction due to cryogenic fluids (piping systems in particular)
- displacements of support due to loads (for riser accessories, for instance).

14.3 Fastening of equipment

14.3.1 The arrangement of equipment supports is to be such that equipment are not submitted to abnormal stresses, taking into account their own mass, the metal they are made of, and, where relevant, the nature and characteristics of the fluid contained, as well as the imposed displacements mentioned in [14.2.4].

14.3.2 As possible, switchboards and other electrical apparatus, exhaust pipes of internal combustion engines and smoke ducts of boilers are to be located well apart from other equipment.

If this reveals impracticable, gutterways or masks are to be provided to prevent projections of liquid or steam on live parts.

14.4 Mechanical protection, thermal protection and lagging

14.4.1 Where necessary, equipment are to be protected against shocks by means of appropriate casings.

14.4.2 Equipment containing high temperature fluids and their accessories are to be suitably lagged in compliance with API RP 14E "Design and Installation of Offshore Production Platform Piping Systems".

14.5 Protection against overpressure

14.5.1 As a general rule, all systems and components are to be protected against overpressure.

14.5.2 Relief devices are to be provided on the discharge side of pumps and compressors to prevent discharge pressure from exceeding the design pressure of systems located on the discharge side of these pumps and compressors.

Discharge of relief devices are to be routed to a safe location and their vent lines are to be self-draining.

Note 1: equivalent arrangements may be considered, subject to a special examination by the Society.

14.5.3 The discharge capacity of the safety valves installed on pumps, compressors and pipes is to be so determined that the pressure cannot exceed by more than 10% the design pressure, in case of operation with closed discharge.

14.5.4 Where necessary, an additional pressure relieving device with sufficient capacity to prevent pressure vessels becoming liquid full during fire engulfment and/or to allow the discharge of the vapours generated under fire exposure, is to be fitted.

14.5.5 The arrangement of safety and relief discharges is to be such that there is no possibility of hazardous reaction between the substances involved.

14.5.6 Where provision is made for the isolation of safety relief devices from vessels and/or systems in operation for maintenance purposes, not less than two such safety devices are to be fitted.

The isolating or blocking valves are to be arranged so that at least one safety relief device remains in communication with the vessel or system under all conditions.

14.6 Motions - Action of environment

14.6.1 All systems and components intended to be fitted on a mobile unit are to be designed such as to ensure a safe operation under the motions to which the unit is intended to be subjected and, in all cases, to conditions of inclinations specified, if any, in the applicable Rules for Classification.

14.6.2 All systems and components are to be also designed such as to resist environmental conditions and loads they may be subjected to, as specified in the Design Criteria Statement:

- waves induced motion loads, if relevant
- wind loads
- temperatures loads
- earthquake, if relevant (fixed units)
- Loads and displacements due to hull flexural effects
- snow and ice, if relevant.

14.7 Redundancy

14.7.1 Systems are to be designed in such a way that no single failure of a component may impair the safety of the unit or installation.

Redundancy of power supply to process systems is not required as long as the loss of power does not affect the safety of the process installations.

15 Essential services

15.1

15.1.1 The essential services defined in NR445 are extended to systems associated to the oil and gas processing installations, and which are to be available to prevent the development of an undesirable event or mitigate the effects of such event.

16 Risk assessment

16.1

16.1.1 The following codes and standards are recommended guidelines to perform the risk assessment of topside systems:

- API RP 14J "Recommended Practice for Design and Hazards Analysis for Offshore Production Facilities"
- EN ISO 17776 "Guidelines on tools and techniques for hazard identification and risk assessment"
- NORSOK standard Z-013 Risk and emergency preparedness analysis.

17 Access and identification for inspection and maintenance

17.1 Access

17.1.1 Suitable access is to be provided to the systems, and in particular pressure vessels for inspection, including checks on the operation of mountings, fittings, controls and pressure relieving devices.

17.1.2 Cocks, valves and other piping accessories and other devices are generally to be placed so that they are easily visible and accessible for manoeuvring, control and maintenance.

17.2 Identification

17.2.1 Accessories such as cocks and valves on the fluid lines referred to in the present Rule Note are to be provided with name plates indicating the apparatus and lines they serve unless, due to their location on board, there is no doubt as to their purpose.

18 Documents to be submitted

18.1 General

18.1.1 In addition to the relevant documents listed in the applicable Rules for Classification the following drawings and documents are to be submitted to the Society, as applicable, for review or information:

- Safety concept
- Process and utilities flow diagrams
- Process and utilities piping and instrumentation diagrams
- Process and utilities specifications
- Process and utilities equipment specifications
- Piping specification
- SAFE charts
- Shutdown philosophy
- Sizing calculations of venting and flaring systems including gas dispersion and radiations levels
- HAZOP report
- General arrangement diagram of the control and safety systems
- Functional design specification of the control and safety systems
- General arrangement of system
- Equipment specification, defining operating envelope
- Diagrams of the control and electrical panels
- Specification and data sheets for rotating machines
- Diagrams of the control and safety systems
- Ex safety type certificates
- Component list, with proposal for component rating
- Inspection certificates issued by the Manufacturer, where required.

SECTION 3 DESIGN OF EQUIPMENT

1 General

1.1

1.1.1 Each equipment is to comply with requirements of the present Rule Note, and, in addition, with the latest edition code or standard, as listed here under, according to its nature, any mix-up of different codes or standards being avoided.

1.1.2 Upon preliminary agreement of the Society, other codes and standards than those listed here under may be used.

2 Wellheads and christmas trees

2.1

2.1.1 With regards to wellheads and christmas trees, the recognized codes and standards are the following:

- API Spec 6A "Specification for Wellhead and Christmas Tree Equipment"
- API Spec 14D "Specification for Wellhead Surface Safety Valves and Underwater Safety Valves for Offshore Service".

3 Swivels and swivel stacks

3.1

3.1.1 With regards to swivels and swivel stacks the recognized codes and standards are the following:

- NR445, Part D, Chapter 1
- API RP 2FPS Recommended Practice for Planning, Designing, and Construction Floating Production Systems.

4 Boilers

4.1

4.1.1 With regards to boilers, the recognized codes and standards are the following:

- NR445, Part C, Chapter 1
- ASME Boiler and Pressure Vessel Code, Section I, Power Boilers
- ASME Boiler and Pressure Vessel Code, Section IV, Rules for Construction of Heating Boilers
- EN 12952 Water-tube boilers and auxiliary installations
- EN 12953 Shell boilers
- PD 5500 Specification for unfired fusion welded pressure vessels.

5 Pressure vessels and heat exchangers

5.1

5.1.1 With regards to pressure vessels, the recognized codes and standards are the following:

- NR445, Part C, Chapter 1
- CODAP "Code des Appareils à pression" (France)
- AD Merkblätter "Technical Rules for Pressure Vessels"
- PD 5500 "Unfired Fusion Welded Pressure Vessels"
- ASME VIII, Div 1 and 2 "Rules for Construction of Pressure Vessels"
- TEMA Class R
- Std 660/ISO 16812:2007 Shell-and-tube Heat Exchangers
- Std 661/ISO 13706:2005 Air-Cooled Heat Exchangers for General Refinery Service
- ALPEMA Standards
- ISO 15547-1:2005 Petroleum, petrochemical and natural gas industries -- Plate-type heat exchangers -- Part 1: Plate-and-frame heat exchangers
- ISO 15547-2:2005 Petroleum, petrochemical and natural gas industries -- Plate-type heat exchangers -- Part 2: Brazed aluminium plate-fin heat exchangers
- ISO 16812:2007 Petroleum, petrochemical and natural gas industries -- Shell-and-tube heat exchangers.

6 Piping and flexible hoses

6.1

6.1.1 With regards to piping the recognized codes and standards are the following:

- NR445, Part C, Chapter 1
- API Spec. 6H "End Closures, Connectors and Swivels"
- API RP 14E "Design and Installation of Offshore Production Platform Piping Systems"
- ASME B 31.3 "Chemical Plant and Petroleum Refinery Piping"
- BS 3351 "Piping Systems for Petroleum Refineries and Petrochemical Plants"
- RP 17B/ISO 13628-11:2007 "Recommended Practice for Flexible Pipe"
- SAE J517 "Hydraulic Hose"
- SAE J1527 "Marine Fuel Hoses"
- SAE J1942 "Qualified Hoses for Marine Applications"
- EN 12434:2000 "Cryogenic flexible hoses".

7 Electrical equipment

7.1

7.1.1 With regards to electrical equipment the recognized codes and standards are the following

- IEC 60034 series, Rotating electrical machines
- IEC 62040 Uninterruptible power system (UPS)
- IEEE "Recommendations for the Electrical and Electronic Equipment of Mobile and Fixed Offshore Installations".

8 Pumps, compressors, turbines and turbo expanders

8.1

8.1.1 With regards to pumps, compressors, turbines, and turbo expanders the recognized codes and standards are the following:

- NR445, Part C, Chapter 1
- API STD 610/ISO 13709:2003 Centrifugal Pumps for Petroleum, Petrochemical and Natural Gas Industries
- API STD 616 "Gas Turbines for Refinery Services"
- API STD 617 "Axial and Centrifugal Compressors and Expander-compressors for Petroleum, Chemical and Gas Industry Services "
- API STD 618 "Reciprocating Compressors for Petroleum, Chemical, and Gas Industry Services"
- API STD 619 "Rotary-Type Positive Displacement Compressors for General Refinery Services".

9 Diesel engines

9.1

9.1.1 With regards to diesel engines the recognized codes and standards are the following:

- NR445, Part C, Chapter 1
- API Spec 7B-11C Specification for Internal-Combustion Reciprocating Engines for Oil Field Service
- OCMA MEC 1Recommendations for the Protection of Diesel Engines Operating Hazard Areas
- EEMUA PUB NO 107 Recommendations for the Protection of Diesel Engines for Use in Zone 2 Hazardous Areas.

10 Pressure relieving devices

10.1

10.1.1 With regards to pressure-relieving devices, the recognized codes and standards are the following:

- API Std 520, Sizing, Selection and Installation of Pressure-Relieving Devices in Refineries
- ISO 25457, Petroleum, petrochemical and natural gas industries - Flare details for general refinery and petrochemical service.

11 Cranes and lifting appliances

11.1

11.1.1 With regards to cranes and lifting appliances, the recognized codes and standards are the following:

- NR526 Rules for the Certification of Lifting Appliances onboard Ships and Offshore Units.

12 Materials

12.1 General

12.1.1 The materials to be used for components are to be suitable for the medium and service for which they are intended.

12.2 Manufacturing and testing

12.2.1 The materials used for pressure vessels and related piping are to be manufactured and tested in compliance with the applicable pressure vessel or piping construction code used for design.

The use of other materials will be subject to a special examination by the Society on the basis of detailed specification of the said materials and of the results of the checks and tests carried out in view of their approval.

12.3 Corrosion Control

12.3.1 With regards to corrosion control, the recognized codes and standards are the following:

- NI423 Corrosion Protection of Steel Offshore Units and Installations
- NACE MR0175/ISO 15156, "Petroleum and natural gas industries-Materials for use in H2S-containing environments in oil and gas production"
- NACE SP0106-2006, Control of Internal Corrosion in Steel Pipelines and Piping Systems.

12.3.2 In the case of particularly corrosive media, the material used is to be submitted for special examination by the Society in each particular case.

12.3.3 Components are to be efficiently protected against corrosion, particularly in their most exposed parts, either by selection of their constituent materials, or by an appropriate coating or treatment.

12.3.4 Means are to be provided as needed for internal corrosion monitoring, such as corrosion probes.

12.3.5 Steels intended for sulphide stress corrosion cracking services are to comply with requirements of NACE MR0175/ISO 15156 in particular as concerned with hardness of base materials and welds, which is to be limited to HRC 22.

12.4 Piping material

12.4.1 Piping is to comply with relevant requirements of the recognised codes or standards.

12.4.2 The use of flanged or threaded connections is to be limited as far as practicable.

12.5 Metallic materials for structural parts

12.5.1 Metallic materials for structural parts are to comply with provisions of the applicable Rules for Classification related to materials and with NR216 Rules on Materials and Welding for the Classification of Marine Units.

12.5.2 Metallic materials for structural parts directly welded on pressure parts are to comply with applicable requirements of the relevant pressure vessel and/or piping construction code.

12.6 Non-metallic material

12.6.1 Non-metallic sealing materials are to comply with relevant flange standards provisions.

12.6.2 Compatibility of non-metallic materials with environmental loads and fluids is to be demonstrated by tests or sufficiently documented by in-service experience.

SECTION 4 CERTIFICATION OF EQUIPMENT

1 General

1.1 Use of component ratings

1.1.1 According to their natures, components are rated according to [1.2] Inspection ratings A1, A2, A3.1, A3.3, A3.4 and A3.5 and corresponding scopes of inspections are defined in [2].

Note 1: when a component is liable to receive several inspection ratings, it will be given the highest possible one. If it includes electrical items, inspection will be performed according to the "electrical" inspection rating (A3.4 and A3.5) given for electrical items, and to "normal" (A1, A2, A3.1 and A3.3) otherwise.

1.2 Rating principles

1.2.1 Components not listed in [3]. will be rated according to the following principles:

- main components of primary importance for safety, requiring full design review, construction survey and testing, will be rated A1
- standard stock components of primary importance for safety, requiring limited design review, construction survey and testing by an independent Body, will be rated A2
- components of secondary importance for safety and normally covered by applicable codes and standards, will be rated A3.1
- components needing a statutory certificate will be rated A3.2
- components important for safety and requiring fire testing, will be rated A3.3
- electrical equipment will be rated A1, A3.4 or A3.5, according to its nature.

2 Components ratings

2.1 A1 rating

2.1.1 As a general rule, the following components will be rated A1:

- Main pumps
- Main pressure vessels and pressurised equipment and piping for flammable or toxic fluids
- Main pressure vessels and pressurised equipment and piping equal or above class 300 psi for non flammable or non toxic fluids
- Main boilers
- Main rotating machinery
- Main electrical components such as rotating machines above 100kW, switchboards, control panels and uninterruptible power supplies
- Main internal combustion engines
- Steam or gas turbines
- Well control equipment
- Safety shutdown systems.

2.1.2 Components rated A1 are to be certified by the Society as having been designed, built and supplied in accordance with the present Rules Note and based on a survey as per [2.1.3]

2.1.3 The scope of inspection of components rated A1 is to include, where applicable:

- Design approval (review of drawings, specifications and calculations notes)

Note 1: For type approved components, certificate is to be submitted. Specifications are to be sent for information.

- Traceability of materials and review of mill certificates
- Welders, and NDT operators qualifications
- Forming, heat treating, welding, NDT and other fabrication or testing qualifications
- Survey of the fabrication and witnessing of NDT at random
- Witnessing of tests such as hydraulic tests, running tests, dielectric tests, etc.
- Assessment of the Manufacturer's QA/QC dossier

Note 2: The actual level of survey at the construction works will be agreed with the company. The level of survey will take into account the level of vendor/engineer/company QA involvement and inspection.

- endorsement of a final manufacturer's inspection report for each different item (A unique final inspection report may however be issued for several items when these items are identical).

2.2 A2 rating

2.2.1 As a general rule, the following standard stock components will be rated A2:

- small pressure vessels
- internal combustion engines below 370 kW
- pipes, valves and fittings with diameter greater or equal to 4", below class 150 psi carrying steam, flammable or toxic fluids and below class 300 psi for other non toxic or non flammable fluids.

2.2.2 Components rated A2 are to be certified by the Society as having been designed, built and supplied in accordance with requirements of the present Rules Note and bases on a survey as per [2.2.3].

2.2.3 This level is to include, as applicable, the following reviews:

- assessment of an independent design review
- review of vendor's test reports / certificates
- witness of pressure and final tests.

2.3 A3.1 rating

2.3.1 This level is applicable to miscellaneous items for which a review by the Society of the Manufacturer's inspection certificate and/or tests reports is performed.

2.4 A3.2 rating

2.4.1 This level applies to statutory safety equipment such as safety and life saving appliances, navigation aids, etc., which are to be type approved by a National Administration which is a signatory to the SOLAS Convention 1974. It is the Manufacturer's responsibility to obtain this written approval and to submit the corresponding certificate to the Society for review.

2.5 A3.3 rating

2.5.1 As a general rule, the following components will be rated A3.3:

- Fire safe valves
- Passive fire protection materials, etc.

2.5.2 Equipment rated A3.3 is to be tested by a recognised laboratory recognized by The Society. It is the Manufacturer's responsibility to obtain the written approval and certificate of an independent inspection body. This certificate is to be submitted to the Society for review.

2.6 A3.4 rating

2.6.1 Electrical components, such as cables, switching devices, computer based systems, fire and gas detection equipment, fire fighting equipment and flexible hoses containing non-flammable and non-toxic fluids will be rated A3.4.

2.6.2 Components rated A3.4 are to be type approved by a recognized independent body.

2.6.3 The Society will:

- review the type approval certificates
- review the routine test inspection certificates issued by recognised independent inspection body.

2.7 A3.5 rating

2.7.1 Electrical components located in hazardous areas will be rated A3.5.

2.7.2 Components rated A3.5 are to be certified or equivalent and the type approval certificate issued by the national approval authority is to be supplied to the Society for review.

Note 1: The Society's Surveyor may endorse BASEEFA, LCIE, etc. documents.

3 Component rating

3.1

3.1.1 Process components, including pressure vessels, boilers, piping, pumps, compressors, turbines and flaring components, will be rated according to Tab 1 to Tab 4 within the scope of **PROC** additional class notation.

4 Spare parts

4.1

4.1.1 Spare parts, if provided, will receive the same rating as original parts, and will be submitted to the same survey scheme.

5 Documentation to be submitted

5.1 A1 rated components

5.1.1 For A1 rated components, as defined in [2.1], the following drawings and documents are to be submitted to the Society, as applicable, for review or information:

- Detailed operating specification, defining operating envelope
- Material certificate, construction and quality control specifications
- Piping and instrumentation diagrams
- Design drawings
- Strength and other design calculations
- Construction report
- Description of Q.A. system of the Manufacturer.

5.2 A2 rated components

5.2.1 For A2 rated components, as defined in [2.2], the following drawings and documents are to be submitted to the Society, as applicable, for review or information:

- Detailed operating specification, defining operating envelope
- Material certificate, construction and quality control specifications
- Piping and instrumentation diagrams
- Design drawings
- Construction report
- Inspection certificate issued by Manufacturer.

5.3 A3.1 rated components

5.3.1 For A3.1 rated components, as defined in [2.3], the following drawings and documents are to be submitted to the Society, as applicable, for review or information:

- Operating specification, defining operating envelope
- Manufacturer's inspection certificate and/or test reports.

5.4 A3.2 rated components

5.4.1 For A3.2 rated components, as defined in [2.4], the following drawings and documents are to be submitted to the Society, as applicable, for review or information:

- Operating specification, defining operating envelope
- Manufacturer's inspection certificate and/or test reports.

5.5 A3.3 rated components

5.5.1 For A3.3 rated components, as defined in [2.5], the following drawings and documents are to be submitted to the Society, as applicable, for review or information:

- Operating specification, defining operating envelope
- Fire test certificate, issued by a recognised laboratory
- Approval certificate issued by the Certifying Authority.

5.6 A3.4 rated components

5.6.1 For A3.4 rated components, as defined in [2.6], the following drawings and documents are to be submitted to the Society, as applicable, for review or information:

- Relevant type approval certificate issued by a recognised body
- Routine test inspection certificates issued by a recognised independent inspection body.

5.7 A3.5 rated components

5.7.1 For A3.5 rated components, as defined in [2.7], the following drawings and documents are to be submitted to the Society, as applicable, for review or information:

- Ex certificate issued by the national approval authority.

Table 1 : Rating of pressure vessels, piping, and associated

		Rating						
Component	Condition	A1	A2	A3.1	A3.2	A3.3	A3.4	A3.5
Pressure (unfired) vessels and heat exchangers	Containing flammable, cryogenic or toxic fluids with PV ≥ 1,5 **(1)**	X						
	Containing non flammable, non cryogenic or non toxic fluids with PV ≥ 1,5 **(1)**		X					
	Other pressure (unfired) vessels and heat Exchangers			X				
Boilers and fired pressure vessels	PV ≥ 3,5 bar	X						
Pipes, valves and fittings	Equal or above class 150 psi and containing steam or flammable or toxic or cryogenic fluids	X						
	Equal or above class 300 psi and containing non flammable and non toxic fluids	X						
	Below class 150 psi and containing steam or flammable or toxic fluids with diameter ≥ 4"		X					
	Below class 300 psi and containing non flammable and non toxic fluids with diameter ≥ 4"		X					
	Flexible hoses containing steam or flammable or toxic fluids	X						
	Flexible hoses containing non-flammable and non-toxic fluids						X	
	ESD valves	X **(2)**	X **(3)**			X		
	Other pipes, valves and fittings			X				
Wellheads and christmas trees		X						

(1) Design pressure P being expressed in bar and volume V in m^3
(2) For diameter ≥ 4"
(3) For diameter < 4"

Table 2 : Rating of pumps and machinery

		Rating						
Component	Condition	A1	A2	A3.1	A3.2	A3.3	A3.4	A3.5
Compressors	HC Gas Compressors	X						
	Other compressors (auxiliaries)			X				
Internal combustion engines	Below 370 kW		X					
	Above 370 kW	X						
Steam or gas turbines		X						
Pumps	Main pumps (liquid HC above 100 kW) or Cryogenic and Fire pumps	X						
	Main pumps (liquid HC below 100 kW)		X					
	Other pumps			X				

Table 3 : Rating of electrical components

		Rating						
Component	Condition	A1	A2	A3.1	A3.2	A3.3	A3.4	A3.5
Rotating machines	Above 100 kW	X						
	Less than 100 kW			X				
Switchboards		X						
Uninterruptible power supplies		X						
Control panels		X						
Cables							X	
Switching devices							X	
Computer based system							X	
Fire and gas detection equipment							X	
Instrumentation				X				
Other electrical equipment				X				
Any electrical equipment	Located in hazardous areas							X

Table 4 : Rating of other systems

		Rating						
Component	Condition	A1	A2	A3.1	A3.2	A3.3	A3.4	A3.5
ESD systems		X					X **(1)**	X **(1)**
Flare								X
(1) For electrical components only (refer to [1.1.1]), and according to actual locations.								

SECTION 5 CONSTRUCTION SURVEY AND TESTING

1 General

1.1 Applicable documents

1.1.1 The present Section specifies general requirements applicable in all cases. As deemed necessary, the Society reserves the right to refer, according to the type of component or equipment concerned, to other documents issued by the Society, namely:

- Rules for classification
- Rule Notes other than the present one
- Guidance Notes
- other applicable documents.

2 Welding requirements

2.1 Qualification of welders and welding procedures

2.1.1 All welders and welding procedures (including possible repair procedures) are to be qualified according to the specified standard or construction code.

2.1.2 In case of modifications of welding parameters beyond limits specified by the applied Recommended Practice or standard, welding procedures are to be re qualified.

2.2 Welding conditions

2.2.1 Welding consumables storage and handling are to follow good practices in the field.

2.2.2 Filler metals are to be chemically compatible and have mechanical properties at least equal to those of base metal.

2.2.3 Shielding gases and fluxes are to be qualified by the welding procedure.

2.3 Heat treatment

2.3.1 Post weld heat treatment will be required as applicable in accordance with the construction code The qualification tests are to be performed in accordance with NR426 Construction Survey of Steel Structures of Offshore Units and Installations.

2.4 Non-destructive examination

2.4.1 Castings and forgings are to be magnetic particle or dye-penetrant inspected prior to welding as per the specified design and construction code.

In addition, forgings are to be inspected by U.T. or X-Ray, and castings in highly stressed areas are to be inspected by X-Ray, to detect possible internal defects.

2.4.2 The welds of pressure parts are to be radiographied as per the specified pressure vessel code.

3 Testing of pressure systems

3.1 General

3.1.1 Components and systems are to be pressure tested according to relevant provisions of the codes and standards used for their design.

3.2 Test pressure

3.2.1 If test pressure is not specified in codes and standards mentioned in [3.1], 1,5 times the design pressure will be taken. Nevertheless, in no case are nominal stresses to exceed 0,9 R_e, R_e being the yield strength of material.

3.3 Duration of test

3.3.1 Test pressure is to be maintained for a duration as per the recognized standard of the equipment, but if not specified at least 15 min after pressure stabilisation.

3.4 Records

3.4.1 Full records are to be taken of test conditions, procedures and results.

3.5 Safety and relief devices

3.5.1 Where necessary, a test rig is to be supplied to enable the pressure setting of the safety and relief devices to be checked.

4 Testing of safety and control systems

4.1 Quality assurance programme

4.1.1 Components of control systems are to be designed, fabricated and tested according to a quality assurance programme.

4.1.2 The quality assurance programme for integrated circuits is to specify three levels of quality:

- Level 1 for subsea equipment
- Level 2 for surface equipment which is either redundant or has graduated failure modes
- Level 3 for surface equipment the failure of which would not render the system inoperative.

4.1.3 Circuit test programmes are to include tests provided for in Tab 1.

Table 1 : Circuit test programmes

	Levels of quality	
Type of tests	Level 1	Level 2
Visual inspection, temperature rise, mechanical and electrical tests	X	X
Debugging tests	X	
Note 1: Circuit tests may be performed under the Manufacturer's quality assurance scheme.		

4.2 Acceptance tests of electrical components

4.2.1 The following electrical subassemblies are to be subjected to dielectric and/or insulation tests as appropriate:

- Electrical power units
- Electrical components of hydraulic power units
- Pilot electrovalves
- Sensors
- Electrical connectors.

4.2.2 High voltage test

a) The test is to be performed with alternating voltage at a frequency between 25 and 100 Hz of approximately sinusoidal form.

b) The test voltage is to be applied:
   - between all live parts connected together and earth
   - between each polarity and all the other polarities connected to earth for the test.

c) During the high voltage test, measuring instruments, ancillary apparatus and electronic devices may be disconnected and tested separately in accordance with the appropriate requirements.

d) The test voltage at the moment of application is not to exceed half of the prescribed value. It is then to be increased steadily within a few seconds to its full value. The prescribed test voltage is to be maintained for 1 minute.

e) The value of the test voltage for main and auxiliary circuits is given in Tab 2.

Table 2 : Testing voltage for dielectric test

Rated insulation voltage Ui (V)	Test voltage a.c. (r.m.s.) (V)
Ui ≤ 60	1000
60 < Ui ≤ 300	2000
300 < Ui ≤ 660	2500
660 < Ui ≤ 800	3000
800 < Ui ≤ 1000	3500

4.2.3 Measurement of insulation resistance

a) Immediately after the high voltage test, the insulation resistance is to be measured using a device with a direct current voltage of at least 500 V.

b) The insulation resistance between all current carrying parts and earth (and between each polarity and the other polarities) is to be at least equal to 1 MΩ.

4.3 Acceptance tests of programmable controllers

4.3.1 Programmable controllers are to be tested according to the same recognised standard used for their design.

4.4 Acceptance tests of hydraulic and pneumatic components

4.4.1 Components are to be tested according to provisions of the code or standard used for their design and fabrication.

4.5 Operational tests

4.5.1 Irrespective of the type of the control system (electrical, hydraulic, etc.), a technical specification of the operational tests is to be prepared and submitted to the Society's approval together with a functional specification of the system.

4.5.2 Individual tests of safety and alarm circuits are to be carried out, with checking of luminous and audible signals. As a general rule, this test is to be done directly by variation of the considered parameter or, if justified, by simulation.

Analogical sensors may be tested through an electric signal, the characteristics of which corresponds to the threshold setting point.

4.5.3 The following tests are to be carried out on fire detection systems, as fitted:

- checking of the good operation of the fire detection system (test facilities of the parts, system fault or supply failure alarms, etc.)
- checking of the good functioning of the detectors by means of equipment producing smoke, aerosol particles or other phenomena associated with incipient fires to which the detector is designed to respond.

4.5.4 Individual test of the automatic devices of various appliances are to be carried out for those which may be normally operated in this condition.

4.5.5 In addition, depending of their location and environment, systems may require to be submitted to vibration test, dry temperature test, heat and humidity test, salt fog test.

4.5.6 Performance test is to include power interruption trials in which the supply is cut off and restored several times; after these interruptions, the equipment is to continue to operate satisfactorily.

4.5.7 For electric and/or electronic equipment, the reference characteristics are to be ascertained on completion of 3 operating periods of at least 15 min, followed by transient variations. Combinations of conditions for these operating periods A, B and C, and transient variations D and E are defined in Tab 3.

During these various tests, the operational characteristics are to be satisfactory and are to remain within the limits indicated by the Manufacturer.

4.5.8 For hydraulic or pneumatic equipment, the operational characteristics are to be maintained when the supply pressure is constant and within ± 20% of the rated pressure.

Table 3 : Operating period and transient variations for electric / electronic equipment operational testing

Combination	Voltage variation (permanent)	Frequency variation (permanent)
A	+ 10%	+ 5%
B	+ 10%	– 5%
C	– 10%	– 5%
	Transient voltage variation (recovery time 3 s)	Transient frequency (recovery time 3 s)
D	+ 20%	+ 10%
E	– 20%	– 10%