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OFF SHORE TECHNICAL SAFETY

(PROJECT STANDARDS AND SPECIFICATIONS)

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SCOPE

This Project Standard and Specification as far as possible, intended to replace oil company specifications and serve as references in the authorities' regulations.
This Project Standard and Specification, together with ISO 13702, defines the required standard for implementation of technologies and emergency preparedness to establish and maintain an adequate level of safety for personnel, environment and material assets.

REFERENCES

Throughout this Standard the following dated and undated standards/codes are referred to. These referenced documents shall, to the extent specified herein, form a part of this standard. For dated references, the edition cited applies. The applicability of changes in dated references that occur after the cited date shall be mutually agreed upon by the Company and the Vendor. For undated references, the latest edition of the referenced documents (including any supplements and amendments) applies.

1. API RP 14C	Recommended Practice for Analysis, Design, Installation, and Testing of Basic Surface Safety Systems for Offshore Production Platforms
2. API RP 521	Guide for Pressure-Relieving and Depressurizing Systems
3. EN 1838	Lighting applications – Emergency lighting
4. EN 13463 − (all parts)	Non-electrical equipment intended for use in potentially explosive atmospheres
5. IMO Res.A.653	Flame spread, surface materials and floorings
6. ISO 5660 - (all parts)	Reaction-to-fire tests – Heat release, smoke production and mass loss rate
7. ISO 10418	Petroleum and natural gas industries – Offshore production installations – Basic surface process safety systems
8. ISO 13702	Petroleum and natural gas industries – Control and mitigation of fires and explosions on offshore production installations – Requirements and guidelines
9. IEC/TR 60079-13	Electrical apparatus for explosive gas atmospheres – Part 13: Construction and use of rooms or buildings protected by pressurization

10. IEC 60331- (all parts)	Tests for electric cables under fire conditions – Circuit integrity
11. IEC 60332- (all parts)	Tests on electric and optical fibre cables under fire conditions
12. IEC 61508 - (all parts)	Functional safety of electrical / electronic / programmable electronic safety related systems
13. IEC 61511- (all parts)	Functional safety – Safety instrumented systems for the process industry sector
14. IEC 61892-7	Mobile and fixed offshore units – Electrical installations –
15. IP 15	Area Classification code for installations handling flammable fluids
16. ISO 23251	Petroleum, petrochemical and natural gas industries – Pressure-relieving and depressurizing systems
17. NFPA 20	Standard for the Installation of Stationary Fire Pumps for Fire Protection Spray Systems
18. ISO 17776	Petroleum and natural gas industries – Offshore production installations – Guidelines on tools and techniques for hazard identification and risk assessment
19. NFPA 13	Installation of Sprinkler Systems
20. NFPA 14	Standard for the Installation of Standpipe and Hose Systems
21. NFPA 15	Standard for Water Spray Fixed Systems for Fire Protection
22. NFPA 16	Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems
23. NFPA 750	Standard on Water Mist Fire Protection Systems

DEFINITIONS AND TERMINOLOGY

Area classification - division of an installation into hazardous areas and non-hazardous areas and the sub-division of hazardous zones

Dimensioning accidental load (DAL) - most severe accidental load that the function or system shall be able to withstand during a required period of time, in order to meet the defined risk acceptance criteria

Emergency lighting - lighting which will ensure adequate light conditions on the installation in the event of failure of the main power supply

Explosion load - time dependent pressure or drag forces generated by violent combustion of a flammable atmosphere

Fire area - area separated from other areas either by physical barriers (fire/blast partition) or distance which will prevent dimensioning fire to spread

Fire detection area - area, or areas, of similar environmental conditions and hazards, and with similar detection and protection arrangements defined for the purpose of grouping areas or rooms into similar F&G logic

Fire load - heat load from a fire for a specified time period

Firewater (FW) pump system - total system, which supplies water for fire fighting system, i.e. water inlets with filters, FW pumps, risers, power sources, power transmissions, fuel pipes/tanks and control systems

Hazardous area - three-dimensional space in which a flammable atmosphere may be expected to be present at such frequencies as to require special precautions for the control of potential ignition sources

Ignition source groups:

- non-essential equipment, Group 1, is equipment not affecting production availability or safety integrity

  Note Non-essential equipment may include equipment such as non-Ex lighting, heat tracing, welding socket outlets, electrical outlets for hand tools, air operated tools and other hot work activities.
- essential equipment, Group 2, is equipment that shall be kept alive to maintain production or drilling operations

  Note Affected equipment may include main power generator, main electrical distribution panels, all electrical consumers not required during ESD1, diesel engines, heaters, boilers, ventilation systems unless defined as a safety critical item.
- safety critical equipment, Group 3, is equipment that shall be in operation to ensure escape, evacuation and/or to prevent escalation

Intermittently manned - work area or work place where inspection, maintenance or other work is planned to last at least 2 hr, but less than 8 h a day for at least 50 % of the installation's operation time

Muster area - area where mustering shall take place in the event of general and/or evacuation alarm

Non-hazardous area - area in which an explosive gas atmosphere is not expected to be present in quantities such as to require special precautions for the construction, installation and use of electrical apparatus and equipment in "normal operation"

Note Normal operation is a situation when the plant is operating within its design parameters. Minor releases of flammable material may be part of normal operation. For example, releases from seals that rely on wetting by the fluid being pumped are considered to be minor releases. Failures (such as breakdown of pump seals, flange gaskets or spillage caused by accidents) that involve repair or shut down are not considered to be part of normal operation, and may require special precautions of potential ignition sources.

Normally not manned - work area or work place that is not permanently or intermittently manned

Safety function - physical measures which reduce the probability of a situation of hazard and accident occurring, or which limit the consequences of an accident

Temporary refuge - place provided where personnel can take refuge for a pre-determined period whilst investigations, emergency response and evacuation pre-planning are undertaken

SYMBOLS AND ABBREVIATIONS

SYMBOL/ABBREVIATION	DESCRIPTION
AC/h	air changes per hour
AFP	active fire protection
API	American Petroleum Institute
APS	abandon platform shut down
BD	blow down
BOP	blow out preventer
C&E	cause and effect
CAP	critical action panel
CCR	central control room
DAL	dimensioning accidental load

DHSV	down hole safety valve
DIFFS	deck integrated fire fighting system
EERS	evacuation, escape and rescue strategy
EN	European Standard
ESD	emergency shut down
F&G	fire and gas
FES	fire and explosion strategy
FPDS	fire protection data sheet
FPSO	floating production, storage and offloading
FW	firewater
GA	general alarm
HC	hydro carbon
HMI	human-machine interface
HVAC	heating, ventilation and air conditioning
IEC	International Electrotechnical Commission
IMO	International Maritime Organisation
IP	Institute of Petroleum
ISC	ignition source control
ISO	International Organization for Standardization
IR	infrared
LAHH	level alarm high high (trip level)
LEL	lower explosion limit
LELm	lower explosion limit meters
LER	local equipment room
LIR	local instrument room
LQ	living quarter
MOB	man over board
MODU	mobile offshore drilling unit
NA	not applicable
NFPA	National Fire Protection Association
NNMI	normally not manned installations
PA	public address
PFP	passive fire protection
PSD	process shut down
PSV	pressure safety valve
SAS	safety and automation system
SOLAS	International Convention for the Safety of Life at Sea
SSIV	subsea isolation valve
UHF	ultra high frequency
VDU	visual display unit
VHF	very high frequency

UPS uninterruptible power supply

MANAGEMENT OF TECHNICAL SAFETY

General

Technical safety management in project development and design processes comprises activities to identify risks, develop safety strategies and performance requirements for safety systems and barriers. Technical safety management shall also facilitate the design process to ensure that studies, analysis and reviews are performed in due time and properly documented with due consideration of the needs for timely input to design and procurement processes.

For modification projects (e.g. upgrading of existing installation/module, tie-in of satellite field), technical safety management activities adjusted to project scope and complexity shall be performed, including new analyses or updating of existing analyses for factors that are considered to be affected by the modification.

A follow-up system shall be established that enables proper documentation, handling, follow-up and closeout of agreed actions and recommendations from the various studies and analyses in the project.
The individual project or installation shall perform specific hazard identification and risk evaluation process, and supplement the requirements as necessary to manage the actual risk picture.

A flow diagram describing some of the main activities related to technical safety design is shown in Figure 1.

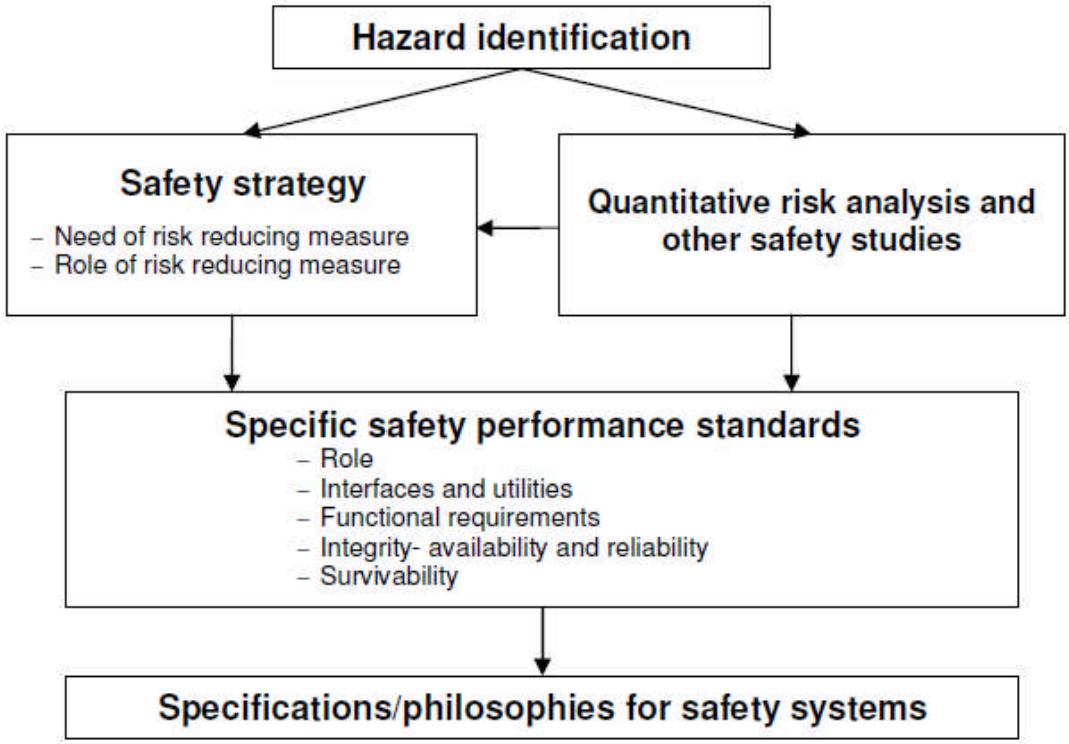

Figure 1 - Technical safety design

Risk Reduction Principles – Inherent Safety Design

In concept optimization and design development, priority shall always be given to use of preventive measures/exposure barriers and inherently safer design principles. The objectives with risk reduction principles and inherent safety design are to:

- reduce potential hazards,
- reduce probability of unwanted events,
- reduce inventory and damage potential,
- strive for simplicity and reliability,
- prevent escalation, e.g. by safety barriers.

Safety Performance Standards

Safety performance standard shall be the verifiable standard to which safety system elements are to perform. The objective of the specific safety performance standards is to add any supplemental safety requirements other than those specified by authority requirements and standards.

The performance standards shall be based on the safety strategy document(s) and these should be read in conjunction with each other.
The specific safety performance standards shall ensure that barriers, safety systems or safety functions

- are suitable and fully effective for the type hazards identified,
- have sufficient capacity for the duration of the hazard or the required time to provide evacuation of the installation,
- have sufficient availability to match the frequency of the initiating event,
- have adequate response time to fulfil its role,
- are suitable for all operating conditions.

Qualification of Technology

New technology is defined as systems or components for which an acceptable reliability is not demonstrated by a documented track record for the particular application. New technology shall be qualified following a systematic approach, in order to demonstrate that it meets specified functional requirements and reliability targets.

Experience Transfer

To ensure transfer of technical safety experience from relevant installations in operation, an experience transfer activity prior to start of detail engineering should be carried out. Sources of experience should include:

- operational experience of relevant installations,
- project execution of relevant installations and modification to these,
- good technical solutions,
- solutions/equipment to be avoided.

Integrity – Availability and Reliability

The minimum requirements to availability and reliability for safety functions/systems shall be determined based on IEC 61508 or IEC 61511 or other specific safety analysis/risk assessments as relevant for the safety function in question.
All relevant safety function/systems shall be subject to testing at regular intervals. Test intervals should be determined based on relevant standards, criticality analysis and experience.
The design of safety functions/systems shall, where practical, allow for required testing to be carried out without interrupting production or operations.
The applicable safety system or affected parts of it shall go to a predefined safe state in the event of detectable malfunction.

If not fail-safe, the same level of safety shall be achieved by redundancy, diagnostics and alarm to control room. Single faults/errors should not prohibit actions on demand.

Dimensioning Accidental Load (DAL)

DALs shall be established based on quantitative risk analysis and the comparison of estimated risk with risk acceptance and/or design criteria. Dimensioning loads shall be revised upon modifications, e.g. layout, equipment density and natural ventilation conditions.
Dimensioning load shall not cause loss of safety functions or escalation (locally). The following principles shall apply:

- dimensioning explosion loads shall be established using a recognised method and a representative geometric explosion model. The loads shall be defined for relevant local horizontal and vertical area dividers (pressure and impulse from explosion) and equipment (pressure/drag forces);
- explosion loads shall also be defined for areas external to the initial explosion location (typical LQ, utility modules etc.);
- fire loads, (e.g. heat loads). Unless specific fire analysis is performed, Table 1 applies;
- ship collisions (e.g. impact loads to be absorbed by installation structure);
- falling loads and dropped objects (e.g. impact loads to be absorbed by installation structure).

Table 1 - Heat flux values

	Jet fire		**Pool fire** kW/m^2
	For leak rates m > 2 kg/s kW/m^2	**For leak rates 0,1 kg/s < m < 2 kg/s** kW/m^2	
Local peak heat load	350	250	150
Global average heat load	100	0	100

The effect of area deluge is not accounted for in Table 1. The effect of deluge may be taken into account for process piping/equipment (not for main structural elements and fire partitions) provided proper documentation is available on the effect of deluge as well as on the reliability of the FW supply system.
The global average heat load represents the average heat load that expose a significant part of the process segment or structure. The global average heat load provides the major part of the heat input to the process segment and, hence, affects the pressure in the segment.
The local peak heat load exposes a small (local) area of the process segment or of the structure to the peak heat flux. The local peak heat load, with the highest heat flux, determines the rupture temperature of different equipment and piping