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Oil and gas industries — Control and mitigation of fires and explosions on offshore production installations — Requirements and guidelines

Industries du pétrole et du gaz — Contrôle et atténuation des feux et des explosions dans les installations en mer — Exigences et lignes directrices

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO ~~documents~~document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 67, *Oil and gas industries including lower carbon energy*, Subcommittee SC 6, *Process equipment, piping, systems, and related safety*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 12, *Oil and gas industries including lower carbon energy*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This third edition cancels and replaces the second edition (ISO 13702:2015), which has been technically revised.

The main changes are as follows:

- ~~—~~visualized the risk treatment process in a flow diagram in [5.8.6.9](#);
- ~~—~~improved description of the explosion blast description in [Clause A.3](#)~~Clause A.3~~;
- ~~—~~improved guidance with respect to risk mitigation in [Clause B.1](#)~~Clause B.1~~;
- ~~—~~introduction of ESD hierarchy and guidance related to principles to protect pressurised equipment against fire in [Clause B.2](#)~~Clause B.2~~;
- ~~—~~improved guidance on ignition source control in [Clause B.3](#)~~Clause B.3~~;

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- ~~included~~ guidance for control of spills related to floating LNG in [Clause B.4](#) ~~Clause B.4~~;
- ~~expanded~~ guidance related to gas detection in [Clause B.6](#) ~~Clause B.6~~;
- ~~included~~ guidance related to ignition source control for firewater pump drivers and external power supplies in [B.8.2](#) ~~B.8.2~~;
- ~~addressing~~ personnel safety related to CO₂ or other asphyxiating gases in [B.8.11](#) ~~B.8.11~~;
- ~~introduced~~ guidance related to passive fire-retarding surface for helidecks in [B.8.13](#) ~~B.8.13~~;
- ~~introduced~~ guidance related to tests in [B.13](#) ~~B.13~~;
- ~~introduced~~ the terms A-class and H-class for fire barriers in [C.4.3](#) ~~C.4.3~~.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

The successful development of the arrangements required to promote safety and environmental protection during the recovery of hydrocarbon resources requires a structured approach to the identification and management of health, safety, and environmental hazards applied during the design, construction, commissioning, operation, inspection, maintenance, and decommissioning of a facility.

This document has been prepared primarily to assist in the development of new installations through their lifecycle.

The content of this document is arranged as follows.

- ~~—~~Objectives: lists the goals to achieved by the control and mitigation measures being described.
- ~~—~~Functional requirements: represent criteria to meet the stated objectives. The functional requirements are performance-orientated measures and, as such, are applicable to the variety of offshore installations utilized for the development of hydrocarbon resources throughout the world.
- [Annex A](#) — ~~Annex A~~: describes typical fire and explosion hazardous events.
- [Annex B](#) — ~~Annex B~~: describes recognized practices that can be considered in conjunction with statutory requirements, industry standards, and individual operator philosophy to determine that the measures necessary are implemented for the control and mitigation of fires and explosions. The guidance ~~are~~is limited to principal elements and are intended to provide specific guidance which, due to the wide variety of offshore operating environments, cannot be applicable in some circumstances.
- [Annex C](#) — ~~Annex C~~: describes typical examples of design requirements for large integrated offshore installations.

This document is based on an approach where the selection of control and mitigation measures for fires and explosions primarily caused from loss of containment is determined by an evaluation of hazards on the offshore installation. The methodologies employed in this assessment and the resultant recommendations differ depending on the complexity of the production process and facilities, type of facility (i.e. open or enclosed), staffing levels, and environmental conditions associated with the area of operation.

NOTE Requirements, rules, and regulations can, in addition, be applicable for the individual offshore installation concerned.

Oil and gas industries — Control and mitigation of fires and explosions on offshore production installations — Requirements and guidance guidelines

1 Scope

This document specifies the objectives and functional requirements for the control and mitigation of fires and explosions on offshore installations used for the development of hydrocarbon resources in oil and gas industries. The object is to achieve:

- ~~—~~safety of personnel;
- ~~—~~protection of the environment;
- ~~—~~protection of assets;
- ~~—~~minimization of financial and consequential losses of fires and explosions.

This document is applicable to the following:

- ~~—~~fixed offshore structures;
- ~~—~~floating systems for production, storage, and offloading.

Mobile offshore units and subsea installations are excluded, although many of the principles contained in this document can be used as guidance.

~~This document is based on an approach where the selection of control and mitigation measures for fires and explosions primarily caused from loss of containment is determined by an evaluation of hazards on the offshore installation. The methodologies employed in this assessment and the resultant recommendations will differ depending on the complexity of the production process and facilities, type of facility (i.e. open or enclosed), manning levels, and environmental conditions associated with the area of operation.~~

~~NOTE — Requirements, rules, and regulations can, in addition, be applicable for the individual offshore installation concerned.~~

4.2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/~~IEC Guide 73~~ 31073, *Risk management — Vocabulary*

5.3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/~~IEC Guide 73~~ 31073 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ~~—~~ISO Online browsing platform: available at <https://www.iso.org/obp>
- ~~—~~IEC Electropedia: available at <https://www.electropedia.org/>

3.1

accommodation

place where personnel onboard sleep and spend their off-duty time

Note 1 to entry: It can include dining rooms, recreation rooms, lavatories, cabins, offices, sickbay, living quarters, galley, pantries, and similar permanently enclosed spaces.

3.2

active fire protection

AFP

equipment, systems, and methods which, following initiation, can be used to control, mitigate, and extinguish fires

3.3

ALARP

as low as reasonably practicable ~~ALARP~~

implementation of risk-reducing measures until the cost (including time, capital costs or other resources and assets) of further *risk* (3.35) reduction is grossly disproportional to the potential risk reducing effect achieved by implementing any additional measure

Note 1 to entry: See UK HSE^{[41][44]}.

3.4

area classification

division of an installation into *hazardous areas* (3.24(3.24)) and non-hazardous areas and the sub-division of *hazardous areas* (3.24(3.24)) into zones under normal operation.

Note 1 to entry: This classification is based on the materials that can be present and the probability of a flammable atmosphere developing. Area classification is primarily used in the selection of electrical equipment to minimize the likelihood of ignition if a release occurs.

3.5

cellulosic fire

CF

fire involving primarily cellulosic material such as wood, timber, or paper

3.6

control

limitation of the extent or duration of a *hazardous event* (3.25(3.25))

3.7

control station

place from which personnel can monitor the status of the installation, initiate appropriate shutdown actions, and undertake any emergency communication

Note 1 to entry: Control station is typically known as CCR or central point.

3.8

critical safety system

system that has a major role in the prevention and mitigation of releases, fires and *explosions* (3.21) and in any subsequent *escape, evacuation, and rescue* (3.19(3.19)) activities.

3.9

deluge system

system to apply fire-water through an array of open spray nozzles by operation of a valve on the inlet to the system

3.10**embarkation area**

place from which personnel leave the installation during *evacuation* (3.18(3.18))

EXAMPLE Helideck and associated waiting area or a lifeboat or life raft boarding area.

3.11**emergency depressurization****EDP**

controlled disposal of pressurized fluids to a flare or vent system when required to avoid or minimize a *hazardous event* (3.25(3.25))

3.12**emergency response**

action taken by personnel on or off the installation to control or mitigate a *hazardous event* (3.25(3.25)) or initiate and execute abandonment of the facility

3.13**emergency response team**

group of personnel who have designated duties in an emergency

3.14**emergency shutdown****ESD**

control (3.6) actions undertaken to shut down equipment or processes in response to a *hazardous event* (3.25(3.25))

3.15**escalation**

spread of impact from fires, *explosions* (3.21), toxic gas releases to equipment or other areas thereby causing an increase in the consequences of the initial *hazardous event* (3.25(3.25))

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3.16**escape**

act of personnel moving away from a hazardous event to a place where its effects are reduced or removed

3.17**escape route**

route that provides a safe path from an area of an installation leading to a *muster area* (3.31(3.32)), *temporary refuge (TR)* (3.37(3.38)), *embarkation area* (3.10(3.10)), or means of *escape* (3.16(3.16)) to the sea

3.18**evacuation**

planned method of leaving the installation in an emergency

3.19**escape, evacuation, and rescue****EER**

range of possible actions including *escape* (3.16(3.16)), *muster*, *refuge*, *evacuation* (3.18(3.18)), *escape to the sea*, and *rescue or recovery*

3.20**evacuation route**

escape route (3.17(3.17)) that leads from the *temporary refuge (TR)* (3.37(3.38)) to the place(s) used for *evacuation* (3.18(3.18)) from the installation

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3.21

explosion

event characterized by a rapid release of energy which has the potential to generate high blast overpressures and drag forces, as well as blast waves propagating away from the ignition point

3.22

fire and explosion strategy

FES

results of the process that uses information from the fire and *explosion* ~~(3.21)~~ evaluation to determine the measures required to manage these *hazardous events* ~~(3.25)~~ and the role of these measures

3.23

hazard

potential source of harm

EXAMPLE A source for potential human injury, damage to the environment, damage to property, or a combination of these.

[SOURCE: ISO/IEC Guide 51:2014^[13], 3.2, modified ~~Note to entry — Example has been~~ added^[13].]

3.24

hazardous area

three-dimensional space in which a flammable atmosphere can be expected to be present at such frequencies as to require special precautions for the *control* ~~(3.6)~~ of potential *ignition sources* ~~(3.27)~~ as a result of *area classification* ~~(3.4)~~ studies.

3.25

hazardous event

event that can cause harm

EXAMPLE The incident that occurs when a *hazard* ~~(3.23)~~ is realized such as release of gas, fire, loss of buoyancy.

[SOURCE: ISO/IEC Guide 51:2014^[13], 3.3, modified, — Example ~~has been~~ added^[13].]

3.26

human factors

environmental, organisational, and job factors that influence behaviour of work in a way that can affect health and safety outcomes including the performance of *critical safety systems* ~~(3.7)~~

3.27

ignition source

source with sufficient energy to initiate combustion

3.28

integrated installation

offshore installation that contains on the same load-bearing structure *accommodation* ~~(3.1)~~ and utilities, in addition to process or wellhead facilities

3.29

jet fire

JF

turbulent diffusion flame resulting from the combustion of a fuel continuously released with momentum in a particular direction

3.30**manned installation**

installation on which people are routinely accommodated

3.31**mobile offshore unit**

mobile platform, including drilling ships, equipped for drilling for subsea hydrocarbon deposits and mobile platform for purposes other than production and storage of hydrocarbon deposits

Note 1 to entry: It includes mobile offshore drilling units, including drill ships, *accommodation* (3.1) units, construction and pipelay units, and well servicing and well stimulation vessels.

3.3231**muster area**

designated area where personnel report when required to do so

3.3332**operator**

individual, partnership, firm, or corporation having control or management of operations on the leased area or a portion thereof

Note 1 to entry: The operator can be a lessee, designated agent of the lessee(s), or holder of operating rights under an approved operating agreement.

3.3433**passive fire protection****PFP**

coating or cladding arrangement or free-standing system which, in the event of fire, will provide thermal protection to restrict the rate at which heat is transmitted to the object or area being protected

3.3534**pool fire**

turbulent diffusion fire burning above a horizontal pool of vaporizing flammable or combustible liquid under conditions where the liquid has zero or very low initial momentum

3.3635**risk**

combination of the probability of occurrence of harm and the severity of that harm

[SOURCE: ISO/IEC Guide 51:2014^[13], 3.9^[13], 3.9 — Note to entry has been removed.]

3.3736**running liquid fire**

fire involving a flammable liquid flowing over a surface

3.3837**temporary refuge****TR**

place provided where personnel can take refuge for a predetermined period while investigations, *emergency response* (3.12), and *evacuation* (3.18) preplanning are undertaken

64 Abbreviated terms

AB	accommodation block
API	American Petroleum Institute

BOP	blowout preventer
CCR	central control room
CS	control station
DIFFS	deck integrated fire fighting system
F&G	fire and gas
GOR	gas oil ratio
HC	hydrocarbon
HMI	human machine interface
HVAC	heating, ventilation, and air conditioning
IEC	International Electrotechnical Commission
IMO	International Maritime Organization
PA	public address
SSIV	sub-sea isolation valve
SSSV	sub-surface safety valve
TEMPSC	totally enclosed motor-propelled survival craft
UA	utility area
UPS	uninterruptable power supply
WH	wellhead area

7.5 Fire and explosion evaluation and risk management

7.15.1 Management system

All companies associated with the offshore recovery of hydrocarbons shall have, or conduct their activities in accordance with, an effective management system that addresses safety and environmental issues. As an example, operators should have an effective system management, contractors should have either their own management system or conduct their activities consistently with the operators' management system and additionally addresses issues relating to health and safety. One key element of such management systems shall be a process of evaluation and risk management which shall take place in a framework which provides the policies, procedures, and organizational arrangements that will embed risk management throughout the organization.

7.25.2 Risk assessment and the risk management framework

This document assumes that the risk assessment is performed within the principles and guidelines for risk management described in IEC 31010 [\(12\)\(12\).1](#)

In particular, those carrying out risk assessments shall be clear about the following:

- a) ~~a)~~ organization's risk management policy, its objectives, and the context in which the organization operates;
- b) ~~b)~~ extent and type of risks that are tolerable and how to treat any risks that are deemed not to be tolerable;
- c) ~~c)~~ how risk assessment integrates into organizational processes;