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## **Petroleum and natural gas industries — Offshore production installations — Basic surface process safety systems**

*Industries du pétrole et du gaz naturel — Plates-formes de production  
en mer — Analyse, conception, installation et essais des systèmes  
essentiels de sécurité de surface*



Reference number  
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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 10418 was prepared by Technical Committee ISO/TC 67, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries*, Subcommittee SC 6, *Processing equipment and systems*.

This second edition cancels and replaces the first edition (ISO 10418:1993), which has been technically revised including the following:

- reference to IEC 61511 is made for instrumentation used as secondary protection;
- risk-based methods of analysis are included as an alternative to the use of safety analysis tables (SATs) and safety analysis checklists (SACs);
- additional guidance is provided on the setting of safety integrity levels for fire and gas and ESD systems;
- additional guidance is provided concerning toxic gases and bypassing and annunciation.

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## Introduction

Effective management systems are required to address the health and safety aspects of the activities undertaken by all companies associated with the offshore recovery of hydrocarbons<sup>1)</sup>. These management systems should be applied to all stages in the life cycle of an installation and to all related activities. Such a management system, which has been developed for environmental issues, is described in ISO 14001<sup>[4]</sup> and the principles contained in this International Standard can also be applied to issues relating to health and safety.

One key element of effective management systems is a systematic approach to the identification of hazards and the assessment of the risk in order to provide information to aid decision-making on the need to introduce risk-reduction measures.

Risk reduction is an important component of risk management, and the selection of risk-reduction measures will predominantly entail the use of sound engineering judgement. However, such judgements may need to be supplemented by recognition of the particular circumstances, which may require variation to past practices and previously applied codes and standards.

Risk-reduction measures should include those to prevent incidents (i.e. reducing the probability of occurrence), to control incidents (i.e. limit the extent and duration of a hazardous event) and to mitigate the effects (i.e. reducing the consequences). Preventative measures such as using inherently safer designs and ensuring asset integrity should be emphasized wherever practicable. Measures to recover from incidents should be provided based on risk assessment and should be developed taking into account possible failures of the control and mitigation measures. Based on the results of the evaluation, detailed health, safety and environmental objectives and functional requirements should be set at appropriate levels.

The level and extent of hazard identification and risk assessment activities will vary depending on the scale of the installation and the stage in the installation life cycle when the identification and assessment process is undertaken. For example:

- complex installations, e.g. a large production platform incorporating complex facilities, drilling modules and large accommodation modules, are likely to require detailed studies to address hazardous events such as fires, explosions, ship collisions, structural damage, etc.;
- for simpler installations, e.g. a wellhead platform with limited process facilities, it may be possible to rely on application of recognized codes and standards as a suitable base which reflects industry experience for this type of facility;
- for installations which are a repeat of earlier designs, evaluations undertaken for the original design may be deemed sufficient to determine the measures needed to manage hazardous events;
- for installations in the early design phases, the evaluations will necessarily be less detailed than those undertaken during later design phases and will focus on design issues rather than management and procedural aspects. Any design criteria developed during these early stages will need to be verified once the installation is operational.

Hazard identification and risk assessment activities may need to be reviewed and updated if significant new issues are identified or if there is significant change to the installation. The above is general and applies to all hazards and potentially hazardous events.

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1) For example, operators should have an effective management system. Contractors should have either their own management system or conduct their activities consistently with the operator's management system.

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Process protection system is a term used to describe the equipment provided to prevent, mitigate or control undesirable events in process equipment, and includes relief systems, instrumentation for alarm and shutdown, and emergency support systems. Process protection systems should be provided based on an evaluation that takes into account undesirable events that may pose a safety risk. The results of the evaluation process and the decisions taken with respect to the need for process protection systems should be fully recorded.

If an installation and the associated process systems are sufficiently well understood, it is possible to use codes and standards as the basis for the hazard identification and risk assessment activities that underpin the selection of the required process protection systems. The content of this International Standard is designed to be used for such applications and has been derived from the methods contained in API RP 14C<sup>[8]</sup> that have proven to be effective for many years. Alternative methods of evaluation may be used, for example based on the structured review techniques described in ISO 17776. Having undertaken an appropriate evaluation, the selection of equipment to use may be based on a combination of the traditional prescriptive approach and new standards that are more risk based.

Particular requirements for the control and mitigation of fires and explosions on offshore installations are given in ISO 13702. General requirements for fire and gas and emergency shutdown (ESD) systems are also included in ISO 13702.

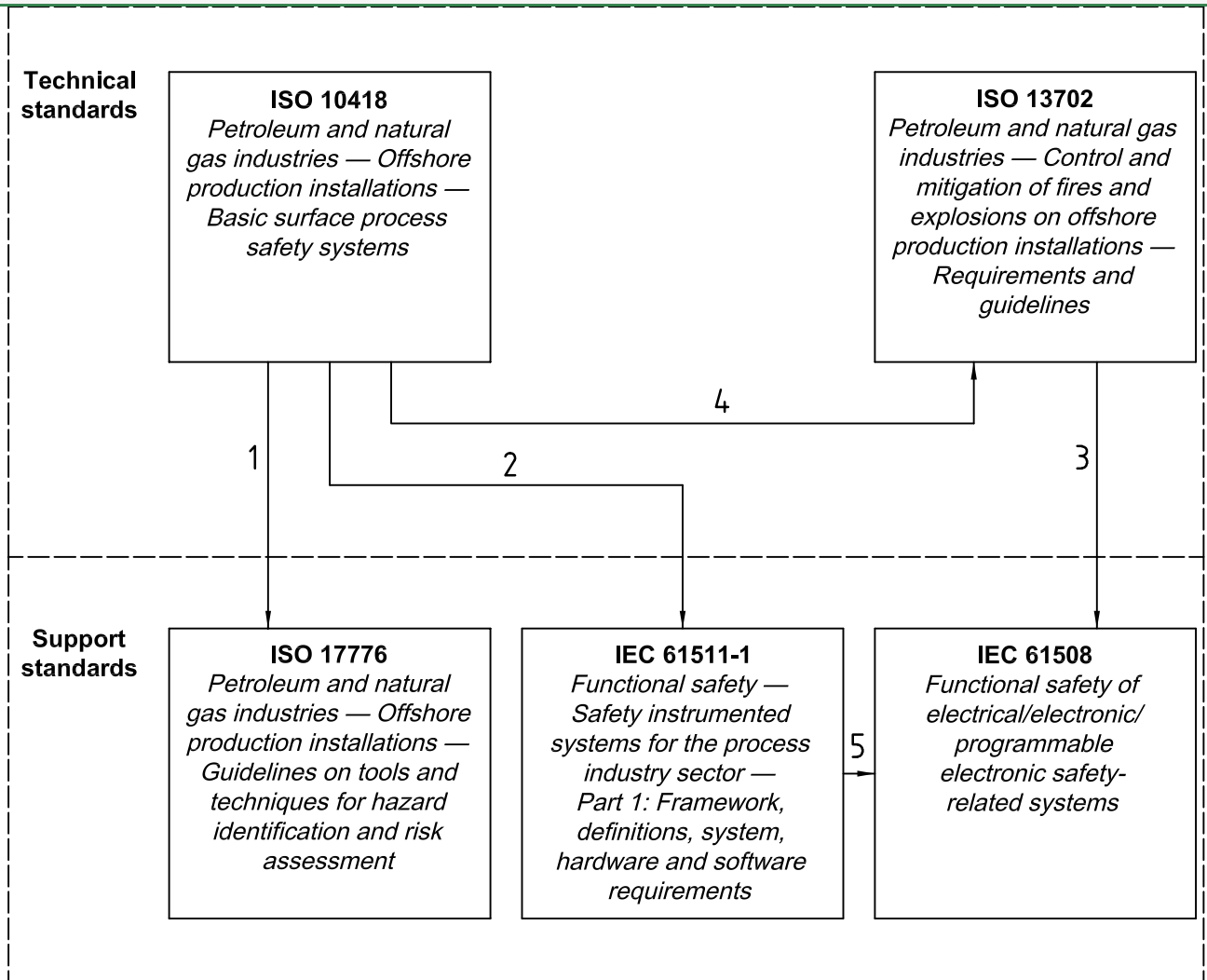
This International Standard and ISO 13702 reference new standards on functional safety of instrumented systems. This International Standard refers to IEC 61511-1, which is the process sector implementation of the generic standard IEC 61508 that is referred to in ISO 13702. The relationship between the standards referred to above is presented in Figure 1.

The approach described in this International Standard should be applied in an iterative way. As design proceeds, consideration should be given as to whether any new hazards are introduced and whether any new risk-reduction measures need to be introduced.

It should be recognized that the design, analysis and testing techniques described in this International Standard have been developed bearing in mind the typical installations now in use. Due consideration should therefore be given during the development of process protection systems to the size of the installation, the complexity of the process facilities, the complexity and diversity of the protection equipment and the manning levels required. New and innovative technology may require new approaches.

This International Standard has been prepared primarily to assist in the development of new installations, and as such it may not be appropriate to apply some of the requirements to existing installations. Retrospective application of this International Standard should only be undertaken if it is reasonable to do so. During the planning of a major modification to an installation, there may be more opportunity to implement the requirements and a careful review of this International Standard should be undertaken to determine those clauses which can be adopted during the modification.

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#### Key

- 1 Tools and techniques for systematic hazard identification and risk analysis
- 2 Requirements for instrument systems used for sole or secondary protection
- 3 For safety integrity requirements for fire and gas and emergency shutdown systems
- 4 Requirements for fire and explosion strategy and support systems
- 5 Requirements for instrument products used for safety that have not been proven by "prior use"

**Figure 1 — Relationship between offshore-relevant standards**