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Petroleum and natural gas industries — Design and operation of subsea production systems —

Part 9: Remotely Operated Tool (ROT) intervention systems

Industries du pétrole et du gaz naturel — Conception et exploitation des systèmes de production immergés —

Partie 9: Systèmes d'intervention utilisant des dispositifs à commande à distance (ROT)

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 3.

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 part of ISO 13628 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 13628-9 was prepared by Technical Committee ISO/TC 67, *Materials, equipment and offshore structures for petroleum and natural gas industries*, Subcommittee SC 4, *Drilling and production equipment*.

ISO 13628 consists of the following parts, under the general title *Petroleum and natural gas industries — Design and operation of subsea production systems*:

— *Part 1: General requirements and recommendations*

— *Part 2: Flexible pipe systems for subsea and marine applications*

— *Part 3: Through flowline (TFL) systems*

— *Part 4: Subsea wellhead and tree equipment*

— *Part 5: Subsea control umbilicals*

— *Part 6: Subsea production control systems*

— *Part 7: Workover/completion riser systems*

— *Part 8: Remotely Operated Vehicle (ROV) interfaces on subsea production systems*

— *Part 9: Remotely Operated Tool (ROT) intervention systems*

Introduction

This part of ISO 13628 is considered to be closely related to ISO 13628-1 and ISO 13628-8. ISO 13628-1 provides general requirements and overall recommendations for development of complete subsea production systems for the petroleum and natural gas industries, from design to decommissioning, and gives a description of how the ROT intervention systems relate to the total subsea production system.

The objective of subsea intervention systems, including vessel and deck handling equipment, is to facilitate safe and efficient intervention on subsea installations.

Petroleum and natural gas industries — Design and operation of subsea production systems —

Part 9:
Remotely Operated Tool (ROT) intervention systems

1 Scope

This part of ISO 13628 provides functional requirements and recommendations for ROT intervention systems and interfacing equipment on subsea production systems for the petroleum and natural gas industries.

This part of ISO 13628 does not cover manned intervention and ROV-based intervention systems (e.g. for tie-in of sealines and module replacement). Vertical wellbore intervention, internal flowline inspection, tree running and tree running equipment are also excluded from this part of ISO 13628.

2 Terms, definitions and abbreviated terms

For the purposes of this part of ISO 13628, the following terms, definitions and abbreviated terms apply.

2.1 Terms and definitions

2.1.1
subsea intervention
all work carried out subsea

2.1.2
primary intervention
all work carried out during the scheduled intervention task

2.1.3
ROT system
dedicated, unmanned, subsea tools used for remote installation or module replacement tasks that require lift capacity beyond that of free-swimming ROV systems

NOTE The ROT system comprises wire-suspended tools with control system and support-handling system for performing dedicated subsea intervention tasks. They are usually deployed on liftwires or a combined liftwire/umbilical. Lateral guidance may be via guidewires, dedicated thrusters or ROV assistance.

2.1.4
deployment system
all equipment involved in the launch and recovery of the ROT system

2.1.5
heave-compensated system
system that limits the effect of vertical vessel motion on the deployed ROT system

2.1.6
skid system
storage, transportation, lifting and testing frames to facilitate movement of the ROT systems and the modules and components to be replaced or installed

NOTE Skids are used in combination with a skidding system.

2.1.7
sealines
all pipelines, flowlines, umbilicals and cables installed on the seabed

2.1.8
termination head
part of the PICS interfacing with the end of the sealine

2.1.9
pull-in head
part of the pull-in system acting as attachment point for the end of the pull-in wire

2.2 Abbreviated terms

CB	centre of buoyancy
CF	connection function
CG	centre of gravity
CT	connection tool
FAT	factory acceptance test
HPU	hydraulic power unit
ICS	intervention control system
ID	internal diameter
IP	ingress protection
LCC	life cycle cost
MQC	multi quick connector
NAS	National Aerospace Standard Institute
PGB	permanent guide base
PICS	pull-in and connection system
PIF	pull-in function
PIT	pull-in tool
ROT	remotely operated tool
ROV	remotely operated vehicle
SPS	subsea production system

SWL	safe working load
WOCS	workover control system

3 System selection

3.1 General

The design, configuration and operation of the ROT intervention system impacts directly on the LCC for the entire SPS. In order to obtain an SPS design providing safe and cost-effective intervention operations, it is important to obtain a closed loop between SPS design and intervention system design. See Figure 1.

An ROT intervention system typically comprises the following:

a) ROTs for dedicated intervention tasks,

b) deck handling equipment,

c) ICS,

d) deployment/landing equipment,

e) ROV spread interfaced with ROT systems.

An illustration of the main features of an ROT intervention system and associated equipment is shown in Figure 2.

The breakdown of the ROT intervention system into sub-elements and components as presented in this part of ISO 13628 should not pose limitations on the selection of new intervention concepts whose functionality and reliability can be documented.

Configurational options for the ROT intervention system and interfacing equipment, such as intervention vessel and ROV systems when used, are shown in Figure 3.

ROT intervention systems shall be evaluated for all phases of an intervention operation, which typically are:

— mobilization (specific issues at the location in question),

— deck handling and preparation,

— launch, descent and landing,

— intervention task,

— testing,

— complementary tasks,

— retrieval,

— demobilization,

— contingency.

During the evaluation, consideration shall be given to reasonably foreseeable misuse of the ROT intervention system.

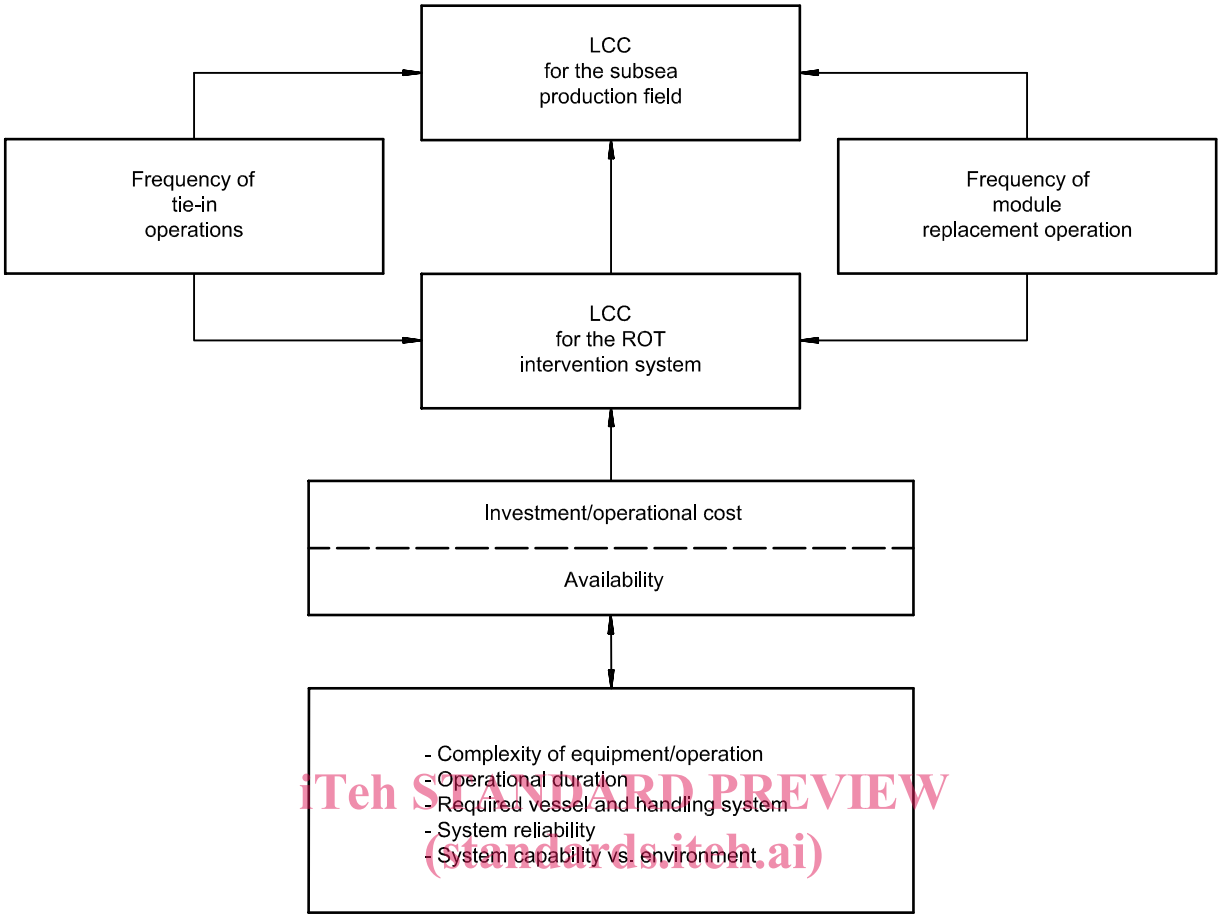

Figure 1 — Interaction of LCC

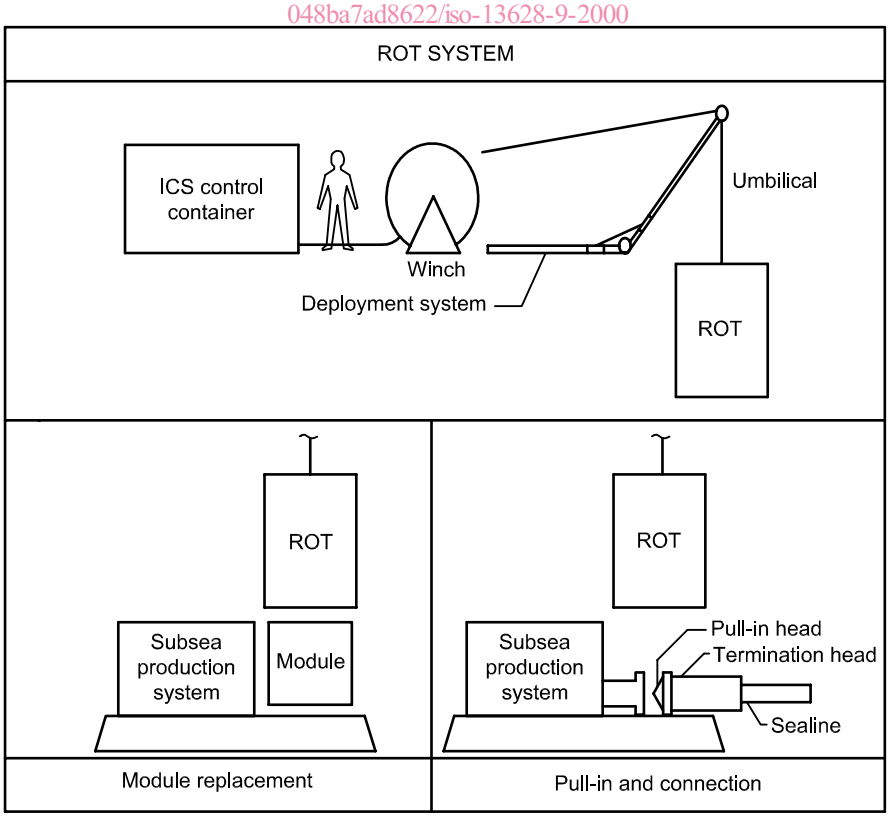

Figure 2 — Principal sketch of an ROT intervention system

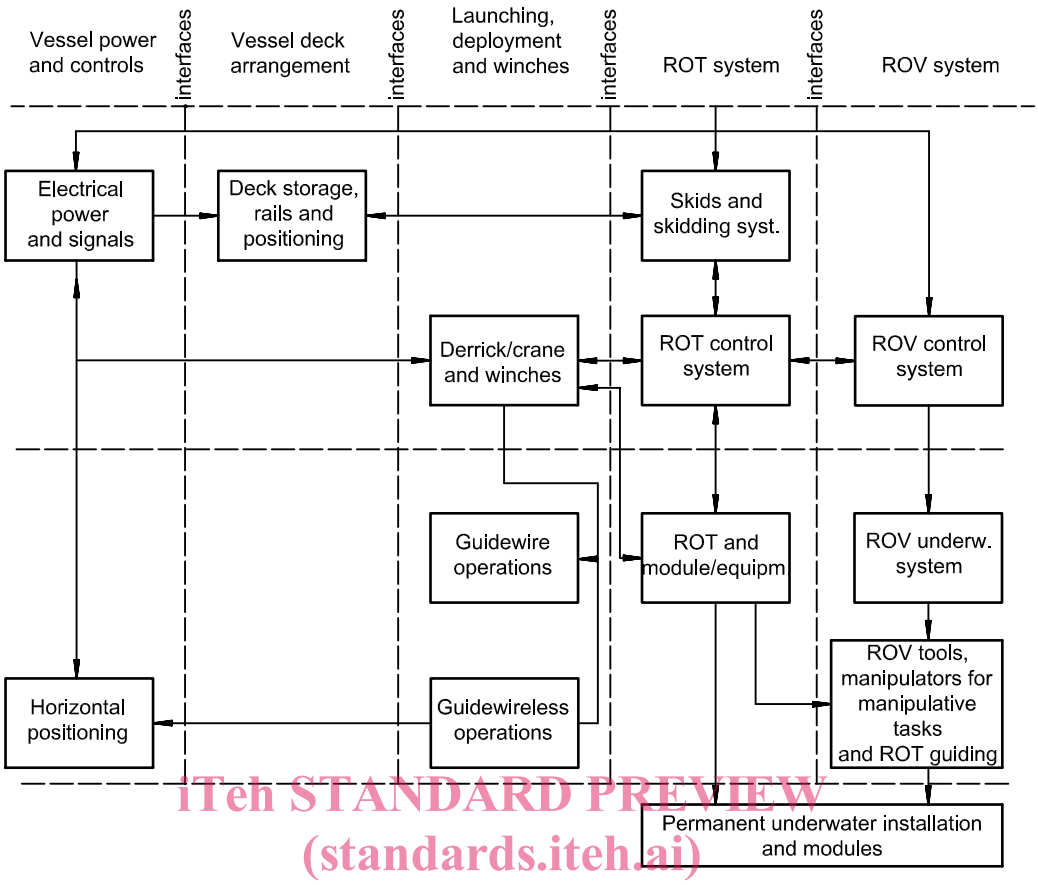

Figure 3 — Illustration of interfaces between the intervention vessel, the ROT system and, when used, the ROV system

3.2 Deck handling equipment

Deck handling equipment and launching techniques shall be selected to ensure that a wide range of vessels can be used. Flexibility shall be provided without compromising safety and reliability of the work, both on surface and subsea. Main issues are:

— means of moving intervention equipment on deck (skid systems vs. use of vessel cranes);

— means of deploying and landing ROT systems (winches and simple mobile A-frames vs. use of complex, purpose-made heave-compensated systems);

— means of installing on and removing from the intervention vessel.

The selection of equipment shall be dictated by the nature of the intervention task (e.g. tie-in operation, module replacement), environmental considerations affecting the operation and time available to carry out the required operation.

3.3 Intervention control system (ICS)

The ICS shall be designed for control and monitoring of

a) ROT function testing on deck,

b) ROT status during running, if required,

c) ROT functions during the intervention task.

These control functions may be provided either through

— ROT function testing on deck,

— a dedicated system for the ROT,

— an ROV control system, or

— a combined ROT/ROV system.

Main issues with respect to selection of the ICS configuration are

— complexity of the subsea work,

— cost and manning for a dedicated control system,

— level of modifications to a standard ROV control system,

— flexibility of the ROV during the subsea work,

— reliability and suitability of the subsystems within an ROV spread.

See Figure 4, which is meant to highlight the interrelationship between ROTs and ROVs and related interface requirements.

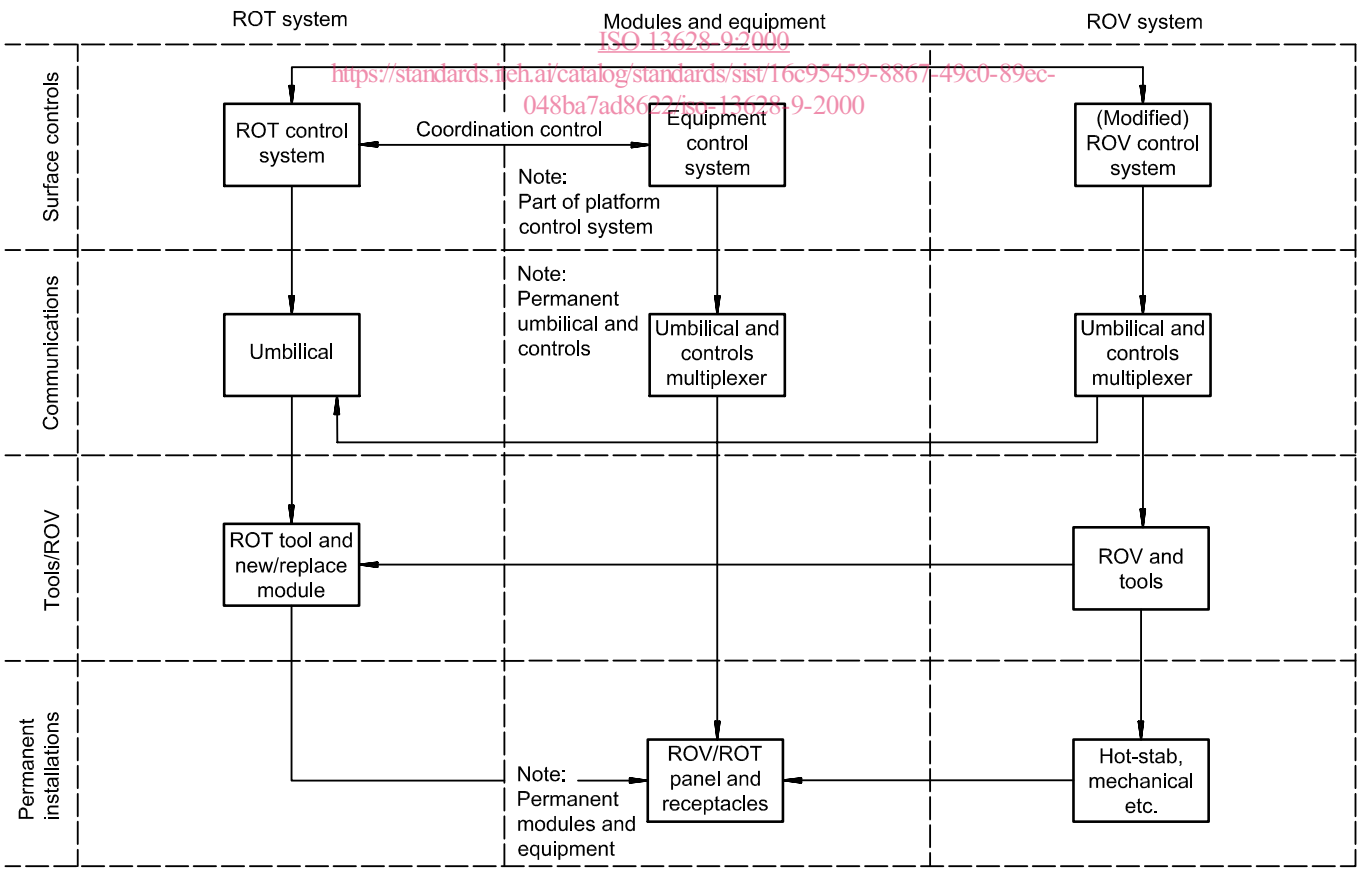

Figure 4 — Illustration of possible ICS options for ROT systems