

Subsea Intervention Workover Control Systems

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Subsea Intervention Workover Control Systems

1 Scope

This document provides the requirements for the design, manufacture, and testing of intervention workover control system (IWOCS) equipment. Blowout prevention (BOP) control systems are outside the scope of this Recommended Practice and typically are not connected to the IWOCS.

Some requirements in this document are specific to the execution of end user–defined safety functions. It is the end users' responsibility to define the safety functions (i.e. timed sequence of events to operate a safety class device) as an input to this document. This document defines “safety class control functions” used to operate safety class devices. Annex A provides guidance on the determination of safety class control functions based on the end user–provided safety functions.

This document identifies the IWOCS equipment typically used in a thru-blowout preventer intervention riser system (TBIRS) and an open-water intervention riser system (OWIRS); see API 17G for more details on these systems and associated components. The IWOCS equipment described in this document may be used for other system types. Table 1 lists equipment typically controlled by an IWOCS. Refer to Figure 1 and Figure 2 for example IWOCS block diagrams for both system types.

Table 1—Equipment Typically Controlled by Intervention System Type

TBIRS	OWIRS
Surface tree	Surface tree
Lubricator valve	Lubricator valve
Retainer valve	Retainer valve
Subsea test tree assembly (SSTTA)	Emergency disconnect package
Tubing hanger running tool	Well Control Package
Tubing hanger or tree re-entry spool	Tree running tool
Downhole monitoring and flow control functions	Subsea tree
SCSSV and associated downhole functions	Downhole monitoring and flow control functions
External IWOCS for tree control	SCSSV

IWOCS equipment may be configured in one of the control system architectures listed below. It is not the intent of this document to mandate the type of control system architecture used for a given application.

- Direct hydraulic control system (see 3.1.2 for definition);
- Discrete hydraulic control system (see 3.1.3 for definition);
- Electro-hydraulic (EH) control system (see 3.1.4 for definition);
- Multiplex (MUX) control system (see 3.1.7 for definition).

The IWOCS equipment may be deployed using one of the methods listed below (see Figure 3 for typical deployment methods). It is not the intent of this document to mandate the type of deployment method used. All normal class and safety class control functions (see 3.1.8 and 3.1.12, respectively) need to conform to the requirements given within this document regardless of deployment method.

- Dependent Riser Based Deployment Method: The dependent riser deployment method supports the umbilical's weight by attaching it to an existing riser (e.g., drilling marine riser or open water riser). Deployment and recovery of the IWOCS using this mode is often dependent on the riser to which the IWOCS is attached.
- Independent Riser Based Deployment Method: The independent riser deployment method supports the umbilical's weight using a dedicated riser for the IWOCS. This dedicated riser may be a wire, cable or the umbilical itself. The independent riser deployment method may use a launch and recovery system (LARS) and sheave to overboard the umbilical during deployment and retrieval. Deployment and recovery of IWOCS using this mode is often independent of other risers on the vessel or rig.
- ROV Based Deployment Method: The ROV based deployment method is very similar to the independent riser method; however, it uses a ROV winch, sheave, and LARS arrangement to deploy and recover the ROV and its umbilical. The ROV based deployment method may additionally use a ROV skid (i.e., belly skid) for additional functionality if required.

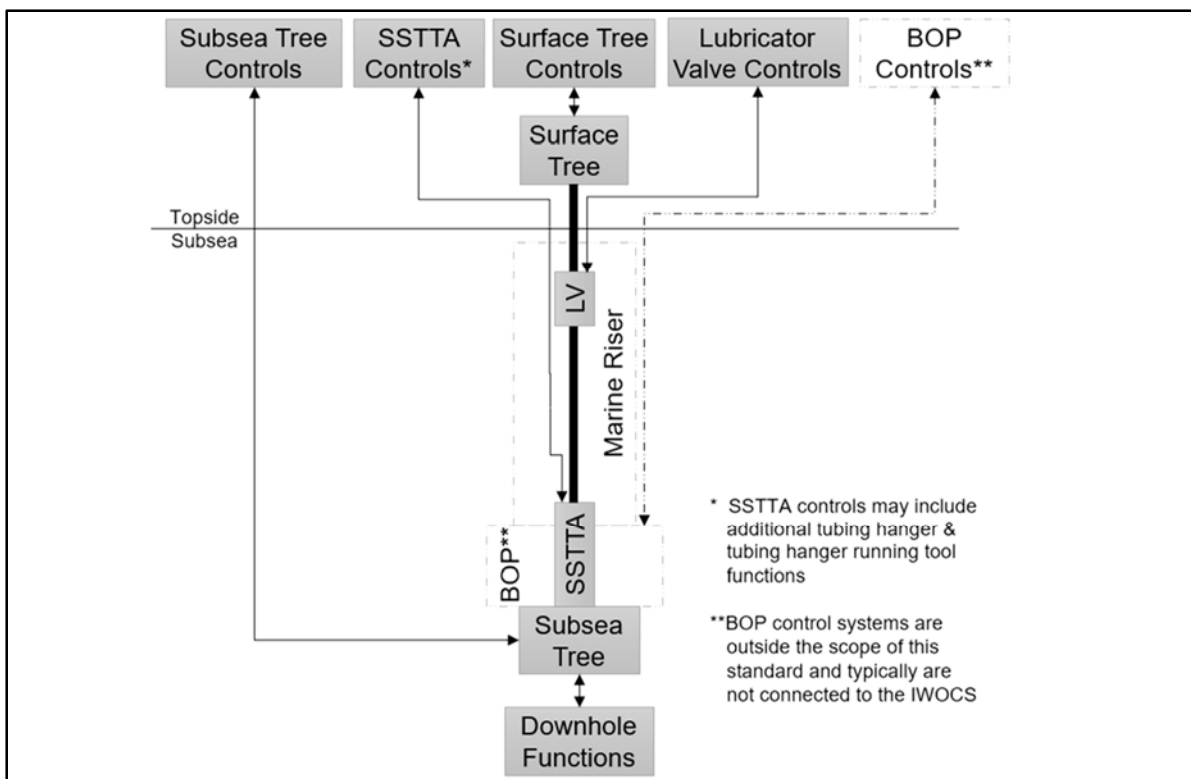


Figure 1—Typical TBIRS Control System

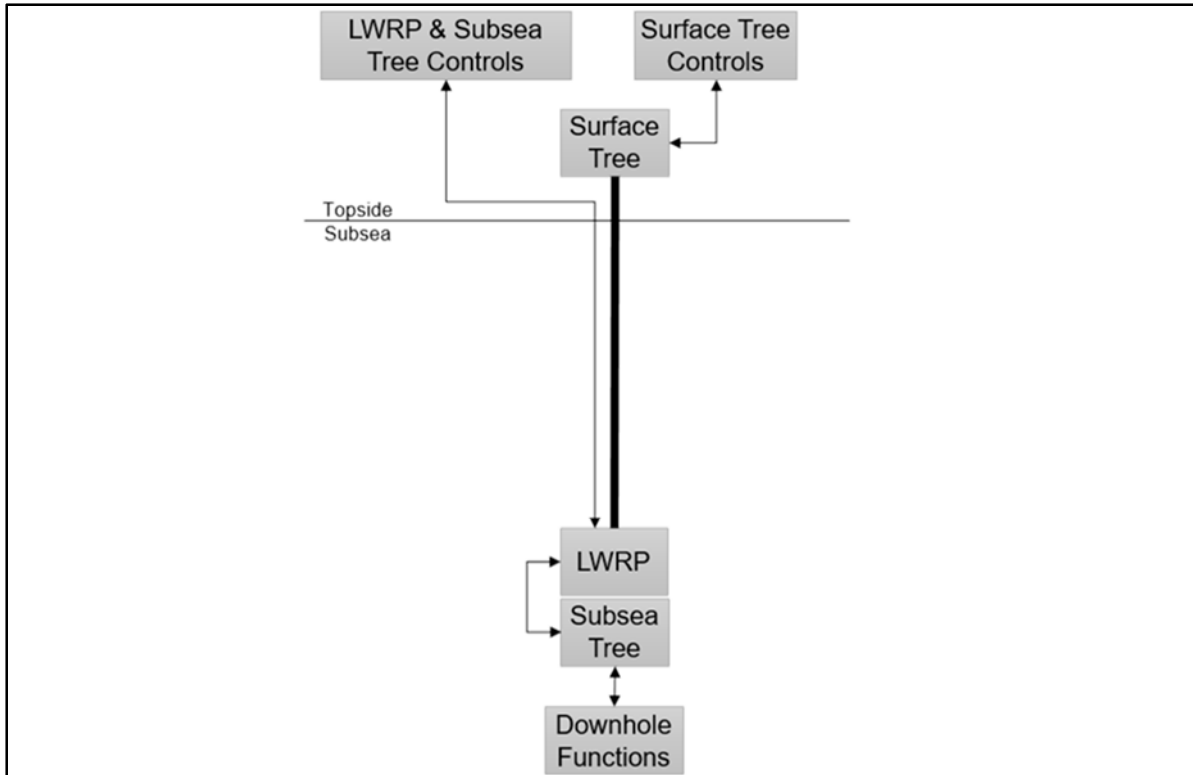


Figure 2—Typical OWIRS Control System

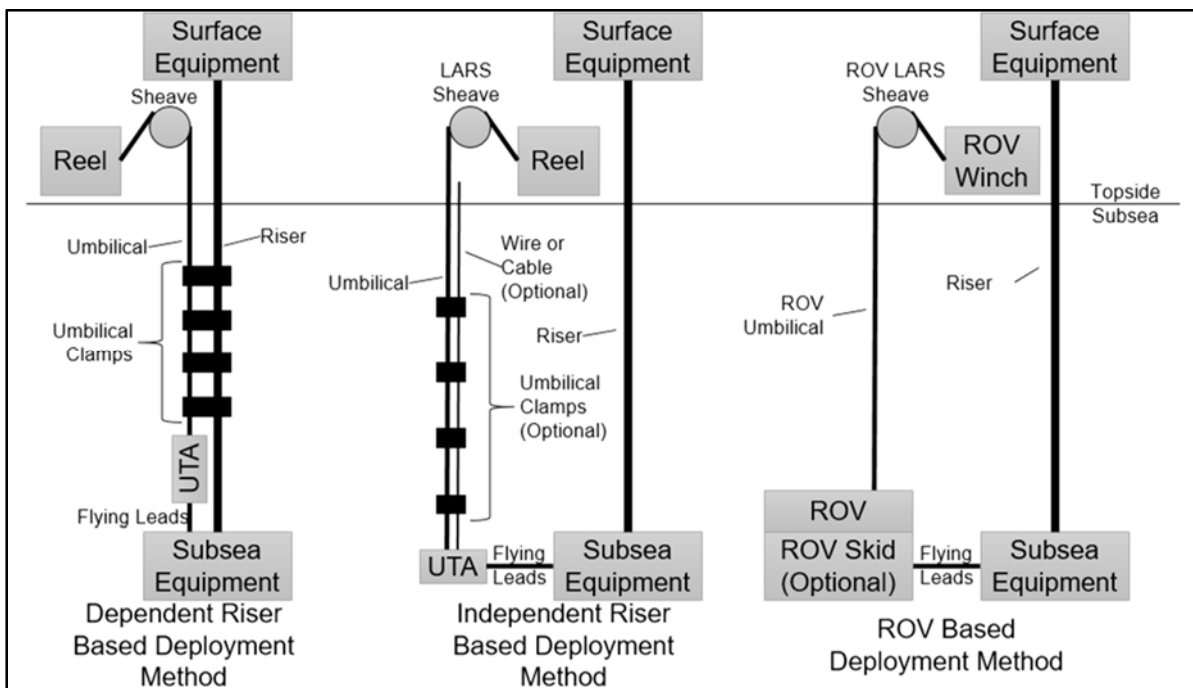


Figure 3—Typical IWOCs Deployment Methods

2 Normative References

The following referenced documents are indispensable for the application 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.

API Specification 16D, *Specification for Control Systems for Drilling Well Control Equipment and Control Systems for Diverter Equipment*

API Specification 17D, *Specification for Design and Operation of Subsea Production Systems – Subsea Wellhead and Tree Equipment*

API Specification 17E, *Specification for Subsea Umbilicals*

API Standard 17F, *Standard for Subsea Production Control Systems*

API Standard 17G, *Design and Manufacture of Subsea Well Intervention Equipment*

API 17H, *Recommended Practice for ROV Interfaces with Subsea Production Equipment*

ASME ¹ *Boiler and Pressure Vessel Code, Section VIII; Division 1: Rules for the Construction of Pressure Vessels*

BS 7201-2 ², *Hydraulic Fluid Power—Gas-Loaded Accumulators—Part 2: Dimensions of Gas Ports*

BS EN 14359, *Gas-loaded Accumulators for Fluid Power Applications*

IEC 60079-17 ³, *Explosive Atmospheres—Part 17: Electrical Installations Inspection and Maintenance*

IEC 60228, *Conductors of Insulated Cables*

IEC 60502-1, *Power Cables with Extruded Insulation and their Accessories for Rated Voltages from 1 kV ($U_m = 1,2$ kV) up to 30 kV ($U_m = 36$ kV)—Part 1: Cables for Rated Voltages of 1 kV ($U_m = 1,2$ kV) and 3 kV ($U_m = 3,6$ kV)*

ISO 10945 ⁴, *Hydraulic Fluid Power—Gas Loaded Accumulators—Dimensions of Gas Ports*

3 Definitions and Abbreviations

For the purposes of this document, the following terms and definitions apply.

3.1 Terms and Definitions

3.1.1

chemical injection unit

Device that provides pressurized chemicals for injection at various locations including the lubricator valve, subsea well intervention package, XT, and downhole.

¹ American Society of Mechanical Engineers, Two Park Avenue, New York, New York 10016, www.asme.org.

² British Standards Institution, 389 Chiswick High Road, London, W4 4AL, United Kingdom, www.bsigroup.com.

³ International Electrotechnical Commission, 3 rue de Varembe, P.O. Box 131, CH 1211, Geneva 20, Switzerland, www.iec.ch.

⁴ International Organization for Standardization, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, www.iso.org.

3.1.2**direct hydraulic control system**

System using hoses to transmit hydraulic pressure directly to assigned functions.

3.1.3**discrete hydraulic control system**

System using pilot hoses to transmit hydraulic pressure signals to activate pilot-operated valves assigned to functions.

3.1.4**electro-hydraulic control system**

System using electrical cables in a subsea umbilical to transmit command signals to solenoid-operated valves, which in turn activate pilot-operated control valves assigned to functions.

3.1.5**hydraulic power unit****HPU**

Unit that provides a stable and filtered supply of hydraulic fluid to the control system.

3.1.6**master control station****MCS**

Unit that controls and monitors the control system. It can range in complexity from a manual hydraulic panel to an automated system.

3.1.7**multiplex control system**

System using electrical cables or fiber optics in a subsea umbilical such that, on each element, multiple distinct functions are independently operated by dedicated serialized coded commands.

NOTE Solenoid-operated valves in turn activate pilot-operated valves assigned to functions.

3.1.8**normal class control function**

Individual control system function that operates a “normal class device”; see API 17G for normal class definition.

3.1.9**open-water intervention riser system****OWIRS**

See API 17G.

3.1.10**remote control panel**

Enclosure displaying an array of switches, push buttons, lights, and/or valves and various pressure gauges or meters to control or monitor functions.

NOTE Installation locations typically include the on deck, drill floor, and driller's cabin.

3.1.11**riser control module****RCM**

Modules typically deployed as part of a TBIRS inside of a marine drilling riser and BOP stack to monitor, control, and operate the tubing hanger, SSTTA, and downhole functions.

3.1.12**safety class control function**

Individual control system function that operates a “safety class device”; see API 17G for safety class definition.

3.1.13**safety function**

See API 17G.

3.1.14**stab plates**

Mechanism comprised of two mating sub-assemblies, one of which is made of a number of hydraulic and/or electric and/or optical coupler halves, each carrying a separate service, that mate simultaneously with corresponding coupler halves on the other sub-assembly when the two sub-assemblies are brought together.

3.1.15**thru-BOP intervention riser system****TBIRS**

See API 17G.

3.1.16**umbilical**

Group of functional components, such as electric cables, optical fiber cables, hoses, and tubes, laid up or bundled together in combination with each other that provides hydraulics, fluid injection, power, and/or communication services.

NOTE Other elements or armoring may be included for strength, protection, or weight considerations.

3.1.17**umbilical clamps**

Secure umbilical to another piece of equipment (e.g. marine riser, choke or kill line, cable, wire).

3.1.18**umbilical reel**

Facilitates controlled deployment and retrieval of the umbilical to the desired working depth while also acting as a storage and transport device for the umbilical.

3.1.19**umbilical sheave**

Route and support the umbilical during installation, retrieval, and operation.

3.1.20**uninterruptible power supply****UPS**

Supplies power to topside control equipment in the event of loss of rig power.

3.1.21**workover control module****WCM**

Electro- and/or hydraulic system used in an OWIRS to control and operate workover and intervention functions via the master control station (MCS) and to monitor, control, and operate the emergency disconnect package (EDP) and well control package (WCP).

3.2 Abbreviated Terms

For the purposes of this document, the following abbreviations apply.

BOP	blowout preventer
CIU	chemical injection unit
EDP	emergency disconnect package
EFAT	extended factory acceptance test
EH	electro-hydraulic
EPU	electrical power unit
EQD	emergency quick disconnect
ESD	emergency shutdown
FAT	factory acceptance test
HMI	human-machine interface
HPU	hydraulic power unit
IR	insulation resistance
IWOCS	intervention workover control system
LARS	launch and recovery system
MCS	master control station
MUX	multiplex
OWIRS	open-water intervention riser system
P&ID	pipng and instrumentation diagram
PSD	process shutdown
RCM	riser control module
ROV	remotely operated vehicle
SCSSV	surface-controlled subsurface safety valve
SEM	subsea electronics module
SSTTA	subsea test tree assembly
TBIRS	thru-blowout preventer intervention riser system