

NORSOK STANDARD
COMMON REQUIREMENTS
SUBSEA COLOUR AND MARKING

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1 FOREWORD

This standard has been developed by the NORSOK Standardisation Work Group for the widest possible national and international application.

2 SCOPE

This standard shall specify the minimum requirements for the colour and marking system on subsea production systems, designed for subsea intervention, with an acceptable level of quality in conformance with relevant regulations.

3 NORMATIVE REFERENCES

No regulations and standards are referred to for the subsea colour and marking system.

4 DEFINITIONS AND ABBREVIATIONS

4.1 Definitions

Subsea intervention	Inspection, maintenance and repair (IMR) as well as other relevant work carried out subsea by use of an intervention system, primarily remotely operated tools/vehicles (ROT/ROV).
Intervention system	Required elements to perform work subsea such as surface support (normally a vessel or rig), handling system, complementary system, diving-, ADS-, ROV- or ROT system.
ROT system	Comprises negatively buoyant, wire suspended and guidewire-guided tools and a common tool carrier for performing dedicated intervention tasks. The intervention tasks to be carried out by the ROT (tool carrier and tool) are such as replacement of control pods, pull-in and connection of flowlines and replacement of insert chokes and valves.

4.2 Abbreviations

ADS	Atmospheric Diving Suit
PGB	Production Guide Base
RAL	"Reichsausschuss für Lieferbedingungen". A colour system by German paint manufacturers.
ROT	Remote Operated Tool
ROV	Remote Operated Vehicle
E	Electric
C	Chemical
H	Hydraulic
M	Methanol
P	Production
GI	Gas Injection
T	Test
WI	Water Injection

5 FUNCTIONAL REQUIREMENTS

5.1 General

The identification system to be used on subsea production systems shall be a combined use of colours and marks.

The colour and marking of subsea production systems shall act as a guidance map for the intervention systems by:

- identifying the structures and orientation
- identifying the equipment mounted on the structures
- identifying the position of any given part of the structure relative to the complete structure
- identifying the components and intervention interfaces
- identifying the status of the respective equipment, e.g. connector lock/unlock and valve open/close.

All equipment on the subsea production systems that are designed for subsea intervention shall have a colour and marking system enabling an easy and unique identification.

The marking system shall enable positive verification of the end stop and/or lock-in position for retrievable components such as guideposts to lock-down clamps etc.

5.2 Colour design

The main elements of the colour design are:

- object colour
- background colour
- foreground colour
- relative object size
- distance to object.

The colours shall be clearly distinguishable at a distance of minimum 10 meters in artificial lighting with adjustable intensity and the red part of the light spectre with the highest intensity.

The darker colour shall not be used on large structural parts. White colours on large structural elements shall be avoided. Grating which may be required to see through must have darker colours, e.g. metallic grey (unpainted), to avoid light reflection. Furthermore colours that may be misinterpreted (taken for shadows/bottom etc.) shall not be used. The foreground should appear less bright than the object and background.

Elements such as pad eyes, lifting systems, connectors i.e. "active" parts during intervention, shall be marked with orange colour.

The ROV operating spindles (valve spindle/spindle extension) shall not be painted due to the tolerance between the spindle and the torque tool.

5.3 Colour selection

The colours to be used on the subsea production systems are:

White : RAL 9002

Yellow : RAL 1004

Orange : RAL 2004

Black : RAL 9017

Grey : RAL 7038 or unpainted metallic grey.

Based on project requirements, layers of selfpolishing clear (transparent) antifouling shall be applied in addition to the coating, to maintain long term intervention capabilities.

5.4 Colour scheme

The following table specifies the colours that shall be used on the different components and equipment on the subsea production system:

	Black	Orange	Yellow	Unpainted	White	Grey
a) Structures						
Protective structure			X			
Base structure			X			
Guide posts						X
Pull-in porches/pull-in ramps			X(ramps)		X (porches)	
Grating (natural colour from electrolytic zinc treatment)				X		
Pad eyes, hinges, ROV attachment/intervention points etc.		X				
b) Process Manifold						
Manifold structure			X			
Piping					*X	
Manifold valves					X	
Valve reaction points, ROV attachment/intervention points etc.		X				
Valve spindle				X		
Valve status	X(text)		X (background)			
Termination hubs						X
Termination hub clamps, Protection caps, etc.		X				
* White or Uncoated depending on project requirement.						

	Black	Orange	Yellow	Unpainted	White
<i>c) Control System</i>					
Control pod body		X			
Control pod ROT hub				X	
Control pod connector clamp				X	
Panels for ROV operation			X		
ROV operated valve handles, ROV attachment/intervention points etc.		X			
Control distribution system structure			X		
<i>d) Christmas Tree System</i>					
Wellhead connector skirt			X		
Piping connectors			X		
Piping bends for ROV intervention, wall thickness measurement etc.		X			
Christmas tree valve block (body)					X
Christmas tree valve actuators		X			
Tree cap with connector			X		
Override release rods				X	
Panel for ROV operations			X		
Valve reaction points, ROV attachment/intervention points etc.			X		
Valve spindle for ROV torque tool				X	
Valve status indicators on panels	X (text, indicator)		X (background)		
Protection frame			X		
<i>e) ROT - and Replacement Frame System</i>					
Steel structures			X		
ROV operated handles, ROV attachment/intervention points, etc.		X			

5.5 Marking System

5.5.1 Primary and secondary marking

The marking is divided into primary and secondary marking.

Primary marking is defined as marking of major structural members, systems that need to be identified for operational, installation and retrieval purpose. 170 to 500 mm. character size. Antifouling type on permanently installed equipment.

Secondary marking is defined as marking used within a major system or location to identify components such as valves, hydraulically operated components, local tapping points used for sensing equipment, probes etc. 50 to 150 mm character size. Antifouling type on permanently installed equipment.

Smaller sizes may be used when specified size is impractical.

The location of the identification marks shall be such that they do not obstruct intervention work to be carried out on equipment and components, and such that the risk of damaging or tearing off the marks are minimal.

Attachment

The marks shall be designed for mechanical attachments to the structure, equipment or component such that they remain in place and are not damaged during intervention.

Welded attachments to production piping shall not be used. If bonding is used, this shall be based on thoroughly tested and verified techniques.

Visibility

All marks shall be designed to be clearly visible in artificial light from a minimum distance of 5 meters depending upon the particle content in the water.

Design life

The marks shall be designed to provide protection against marine fouling for the design life of the subsea production system.

Language

All instructions written on the marks shall be in English.

Cross reference

All symbols, characters, figures etc. on the marks shall be easily identified and cross referenced with the operational documentation.

5.5.2 Marking of structures

The structures shall preferably be defined such that rig heading and template heading are identical during rig operations. The following marking shall be used:

- Front side of the structure : FORE
- Star board of the structure : STB
- Port side of the structure : PORT
- Back side of the structure : AFT

On the port and star board side of the upper structure, main identification marks shall be fitted to enable a positive identification of the entire subsea production system. The main identification marks shall as a minimum display the field name, block number(s) and name of installation.

A common coordinate system shall be established for the structures in the horizontal plane. The system shall be based on alphabetic letters along one of the axes (short side) and digital numbers along the other (long side).

The marks shall on the sides be fitted on both top and bottom of the structures, such that they are clearly visible from the outside of the structures. Inside the structure marks shall be fitted to the structural members to enable a positive and easy orientation. This shall be done by fitting the marks on the vertical members surrounding e.g. a well slot, with the symbols facing towards the centre of the slot.

The marks shall be fitted at an elevation suitable for the foreseen work to be carried out in the respective areas.

5.5.3 Marking of guideposts

Guidepost numbering shall suit the expected rig heading and a rig guidewire numbering system based on that the forward and starboard guidewire being wire no. 1, the aft and starboard guidewire being wire no. 2 and so on going clockwise. The posts shall be marked with black rings 200 mm. below top indicating the post number.

Retrievable guideposts shall be fitted with easily readable status indicators showing locked ("L") and unlocked ("U") position of the locking mechanism.

5.5.4 Marking of manifold valves

A unique valve numbering system shall be established providing an easy identification of each valve and its function. All manifold valves shall be marked with an "XY"-number where "X" identifies which slot the pipe is connected to or which main line the valve is isolating. The "Y" number should then identify which number of valve from the slot (if several valves in line) and which function the line has.

The valves shall be marked with minimum one mark near the valve body facing upwards. The mark can be fixed on a support plate attached to one of the valve flange bolts, one of the interface flanges between the valve body and stuffing box or on the near structure.

To prevent damage to the marking system when intervention tasks are performed, they shall all be recessed.

5.5.5 Marking of piping system

As for the manifold valves, a unique numbering system for the piping system shall be established. The piping system (inclusive production and injection lines) between the well slots and pull-in porches shall be marked to identify each pipe length based on the established numbering system.

The piping may in addition to this be marked with colour strips of antifouling material at different locations in order to ease inspection.

5.5.6 Marking of pull-in porches

The pull-in porches shall be marked to reflect the type of lines.

The pull-in porches for the electric and hydraulic umbilicals shall be marked with "E" and "H" on the upper side. If combined electric and hydraulic umbilicals are used, the porch shall be marked with "E/H".

Pull-in porches for the flowlines and chemical injection/servicelines shall be marked as follows:

- P Production Flowline
- WI Water Injection Flowline
- GI Gas Injection Flowline
- T Testline
- C Chemical Injection
- M Methanol Injection

In addition to these letters, a number shall be added to each funnel reflecting the line or umbilical number.

5.5.7 Marking of pull-in ramps

The pull-in ramps shall be marked with a line indicating the ideal centreline of the line or umbilical. In addition a line on each side shall be added to indicate the maximum angular misalignment allowed.

Transversal lines every meter from the pull-in funnel entry point shall be included on the ramp. The distance shall be marked at the side of the misalignment lines enabling the ROV pilot to record the distance left during pull-in operations.

5.5.8 Marking of christmas tree system

All the christmas tree valves shall be marked with minimum two letters, for easy ROV observation with tool in position, e.g. Production Master Valve (PM).

The front of the tree is defined as the part of the tree containing the ROV valve panel.

A number shall be fitted on the ROV valve panel providing a unique identification for each christmas tree. Likewise the christmas tree cap shall be fitted with a unique identification number.

5.5.9 Status indicators

All moving parts shall be equipped with status indicators and shall be marked with clearly readable reference points. Symbols "U"=unlock and "L"=lock or "O" - open, "S" - shut, "B" - bleed shall be used to explain the reference points. The indicator shall travel a minimum 80 mm to 90 mm.

The distance between the status indicator arrow or marker and the reference points in the viewing direction, shall be made as short as possible and not greater than 5 mm, to reduce the sensitivity and effect of ROV viewing position. Direction of operation shall be indicated with an arrow.

5.5.10 Marking of control system components

The control system shall be marked to provide a positive identification of its respective components. The marks shall be fitted at regular intervals to enable an easy identification of all the control system components.

The control pod shall be marked with the identification number at minimum one location being clearly visible by ROV when approaching the pod. The character size shall be 100 mm.

All the electrical and hydraulic lines shall be marked at regular intervals to allow an easy identification of each line. The following guidelines shall be used:

- Each individual line shall be marked with a character for unique identification of the line and its function.
- Marks shall be fitted to the branch lines where they branch off to the different slots.
- Lines entering a valve panel, shall be marked on both panel sides.

5.5.11 Marking of retrievable ROT guideposts (if used)

ROT guidepost shall be marked with level indicator rings every meter using the top of the guidepost receptacle as the reference level.