**Table A.79** *(continued)*

| Name | Description | Unit or code list | Priority |
|---|---|---|---|
| Shut-off pressure | Maximum differential pressure when valve closed (design)<br>For PSVs: set-point opening pressure | Pascal (bar) | Low |
| Valve material | Type | Carbon steel (CS), stainless steel (SST), duplex, alloy type, composite, titanium | High |
| Stem sealing | Type | Stuffing box, duplex, lip seal, O-ring | High |
| Seat design | Type of seat design | Soft seated, metal-to-metal seated | Medium |
| Actuation principle [b] | Actuator operating principle | Single-acting, double-acting, actuation by line/process pressure, actuation by gravity | Medium |
| Actuation – opening | Type of actuation force | Electrical, hydraulic, pneumatic, mechanical (spring), manual, combinations, none | High |
| Actuation – closing | Type of actuation force | Electrical, hydraulic, pneumatic, mechanical (spring), manual, combinations, none | Medium |
| Manufacturer – actuator | Name of actuator manufacturer | Specify | Low |
| Manufacturer – pilot valve | Name of pilot-valve manufacturer | Specify | Low |
| Manufacturer – solenoid valve | Name of solenoid-valve manufacturer | Specify | Low |
| Pilot-valve configuration | Number and configuration (applicable for pilot-operated valves only) | Specify, e.g. 1 × 3/2 (= single 3/2 pilot valve), 2 × 4/3 (= double 4/3 pilot valve) | Low |
| Fail-safe principle pilot valve | Fail-safe principle | Energized, de-energized | Low |
| Solenoid-valve configuration | Number and configuration (applicable for solenoid-operated valves only) | Specify, e.g. 1 × 3/2 (= single 3/2 pilot valve), 2 × 4/3 (= double 4/3 pilot valve) | Low |
| Fail-safe principle solenoid valve | Fail-safe principle | Energized, de-energized | Low |
| Valve fail-safe position | Fail-safe position | Fail-open, Fail-close, Fail-as-is | High |
| Trim type | Type (applicable for control valves only) | Noise reduction, anti-cavitation, multi-stage, single-stage | High |
| Valve leakage class | Specify according to applicable reference standard (e.g. for valves complying with API Spec 6D, see ISO 5208:2015) | ISO 5208:2015, Annex A, Table 4 | High |

[a] Benign (clean fluids, e.g. air, water, nitrogen).

Moderately corrosive/erosive (oil/gas not defined as severe, sea water, occasionally particles).

Severe corrosive/erosive [sour gas/oil (high $H_2S$), high $CO_2$ content, high sand content].

[b] Primary actuation principle:

1 single-acting = actuation force by gas (air) or hydraulic fluid for either opening or closing the valve;

2 double-acting = actuation force by gas (air) or hydraulic fluid for both opening and closing the valve;

3 actuation by line/process pressure or actuation by gravity = no actuation apart from possible backup actuation.

### A.2.5.5 Nozzles

**Table A.80 — Type classification — Nozzles**

| Equipment class — Level 6 | | Equipment type | |
|---|---|---|---|
| **Description** | **Code** | **Description** | **Code** |
| Nozzles | NO | Deluge | DN |
| | | Sprinkler | SR |
| | | Water mist | WM |
| | | Gaseous | GA |

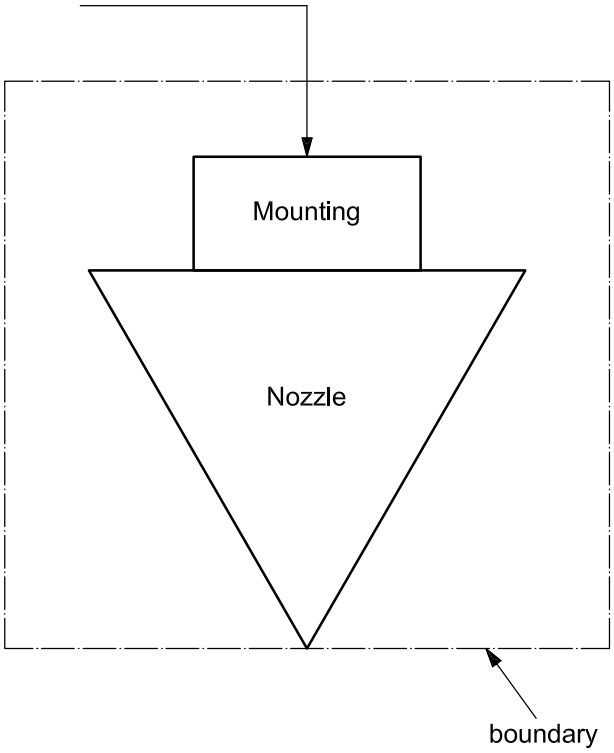



**Figure A.28 — Boundary definition — Nozzles**

**Table A.81 — Equipment subdivision — Nozzles**

| Equipment unit | Nozzles | | |
|---|---|---|---|
| **Subunit** | **Nozzle** | **Mounting assembly** | **Miscellaneous** |
| Maintainable items | Fusible bulb | Mounting connector | Others |
| | Nozzle body with internals | Seals | |
| | Nozzle head | | |
| | Protective coating | | |
| | Screen | | |
| | Solder | | |

**Table A.82 — Equipment-specific data — Nozzles**

| Name | Description | Unit or code list | Priority |
|---|---|---|---|
| Application | Where in the process applied | Deluge, sprinkler | High |
| Hazards protection | Type of protection | Electrical, Ex, fuel oil, glycol, HC gas, hydrogen gas, lubricants, methanol, combustibles, radioactivity, toxic gas, toxic liquid | High |
| Location on plant | Where located in the plant | Air inlet, compressor, diesel engine, drilling, electric motor, FW inlet, gas-metering, generator, header, heat exchanger, living qt., mud-processing, pigging station, pipeline, pump, separator, turbine, utility, vessel, wellhead, wellhead flowline, wellhead injection line, X-mas tree | High |
| Nozzle material | Specify | Brass, chrome-plated, electrode-less nickel-plated, lead-coated, stainless steel | High |
| Nozzle length | Specify | Millimetres | High |
| Nozzle width | Specify | Millimetres | High |
| Installation category | How installed | Concealed, horizontal sidewall, pendent, recessed, upright, vertical sidewall | Low |
| Fluid handled – nozzles | Main fluid only | Potable water, sea water, Inergen, $CO_2$ | Medium |
| Fluid corrosiveness/ erosiveness | Classify as shown in the footnote [a] | Benign, moderate, severe | Medium |
| Discharge temperature | At operating condition | Degrees Celsius | Low |
| Flowing pressure | Specify | Pascal (bar) | Medium |
| Flow rate | Specify | Litres per minute | Medium |
| Shut-off pressure | Maximum differential pressure when valve closed (design)<br>For safety pressure-relief valves: set-point opening pressure | Pascal (bar) | Low |
| Fluid temperature | Specify | Degrees Celsius | Low |
| Connection size | Specify | Millimetres (inches) | High |
| Type of nozzle end | Specify | Bolted flange, clamped flange, screwed, welded | Medium |
| Spray angle | Specify | Degrees | Medium |
| Spray type | Specify | Droplets, mist | Medium |
| Actuation | Specify | Fusible bulb, solder, external | Medium |
| Nozzle screen | Whether or not installed | Yes/No | Low |

[a] Benign (clean fluids, e.g. air, water, nitrogen).
Moderately corrosive/erosive (oil/gas not defined as severe, sea water, occasionally particles).
Severe corrosive/erosive [sour gas/oil (high $H_2S$), high $CO_2$ content, high sand content].

### A.2.5.6 Lifeboats

The lifeboats addresses lifeboats mounted on offshore oil & gas facilities, and also drilling rigs. Note that lifeboats, in Arctic areas, are not addressed in this International Standard.

The diving technical equipment within self-propelled hyperbaric lifeboats is not covered by this International Standard, but by NORSOK U-100:2015.

Note that there are two types of Free fall lifeboats, drop or skid.

**Table A.83 — Type classification — Lifeboats**

| Equipment class – Level 6 | | Equipment type | |
|---|---|---|---|
| **Description** | **Code** | **Description** | **Code** |
| Lifeboats | LB | Free fall | FF |
| | | Davit launched | DL |

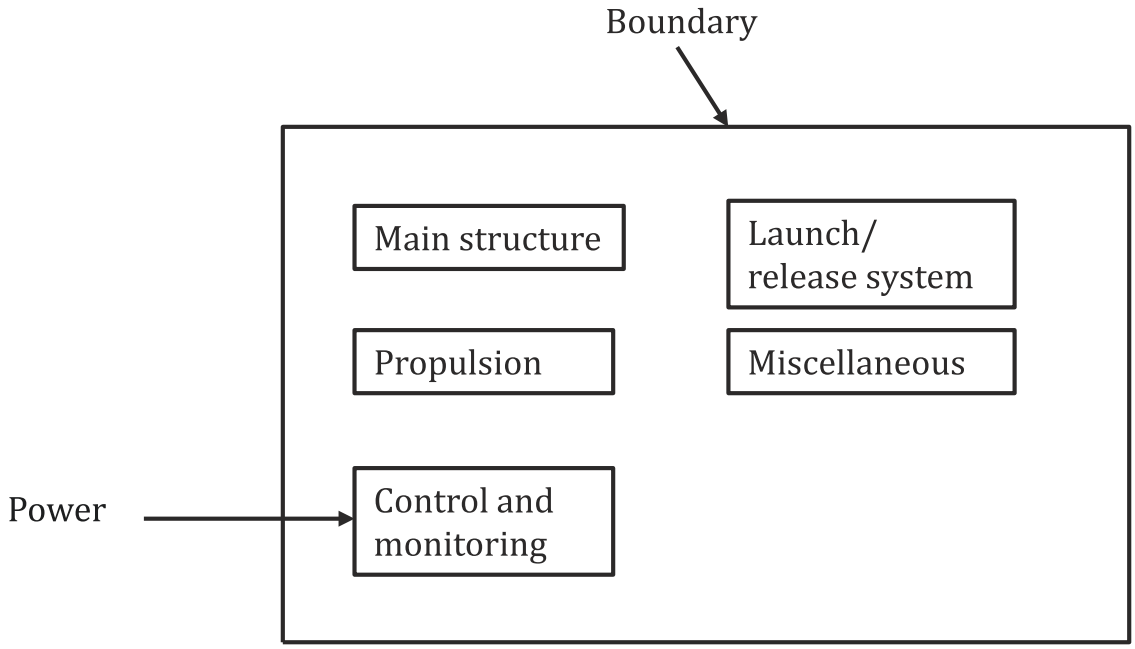



**Figure A.29 — Boundary definition — Lifeboats**

**Table A.84 — Equipment subdivision — Lifeboats**

| Equipment unit | Lifeboats | | | | |
|---|---|---|---|---|---|
| **Subunit** | **Main structure** | **Propulsion** | **Control and monitoring** | **Launch/ Release** [a] | **Miscellaneous** |
| Maintainable items | Hull<br>Innerliner<br>Superstructure<br>Seat/Seat belts<br>Lifting/Release hook attachment<br>Tanks [b]<br>Doors/Hatches | Engine<br>Gear box/ transmission<br>Propeller shaft<br>Propeller<br>Steering nozzle<br>Steering system<br>Waterjet [c] | Air regulator<br>Control panel [d]<br>Lifeboat release hook<br>Lifeboat release panel<br>Hydrostatic interlock system [e]<br>Limit switches [f] | Davit structure<br>Davit winch/gear/ motor<br>Davit wire<br>Davit winch HPU<br>Davit control panel<br>Hydraulic system [g]<br>Shackles<br>Hang-off wires<br>Skid arrangement [h] | Communication systems<br>Electrical system incl. lights and navigation<br>Deluge pump/ piping/nozzles<br>Air cylinder<br>Battery charger<br>Bilge pump<br>Emergency equipment [i] |

[a] These maintainable items are located on the host facility (e.g. platform and FPSO). Note that some of these items do not apply for all types of lifeboat (ref Table A.83). This system also covers the recovery of the launched lifeboat.

[b] Tanks include fuel and water tanks and other bulkheads, of various material (e.g. GRP).

[c] Water-jet is seldom in use for lifeboats but is more normal for man-overboard boats (MOB).

[d] This is control panel onboard the lifeboat.

[e] This applies only for Davit launched lifeboats,

[f] Limit switch is physically located as part of the launch/release system on the host facility.

[g] Hydraulic system includes cylinders.

[h] Added to cover Free Fall lifeboat that use a skid that will not give a drop straight down.

[i] Emergency equipment includes first aid, water and food.

**Table A.85 — Equipment-specific data — Lifeboats**

| Name | Description | Unit or code list | Priority |
|---|---|---|---|
| Automatic release | Automatic release of lifeboat release hook | No, Yes | Medium |
| Breathing air capacity | Breathing air capacity | Minutes | Medium |
| Breathing air system | Breathing air system? | No, Yes | High |
| Personnel capacity | Personnel capacity (count) | Each | High |
| Sprinkler system | Sprinkler system? | No, Yes | High |
| Nautical speed rated | Rated nautical speed | Knots | Medium |
| Free-fall lifeboat installation height | Height above sea level | M | High |

## A.2.6 Subsea

### A.2.6.1 Subsea production control

**Table A.86 — Type classification — Subsea production control**

| Equipment class — Level 6 | | Equipment type | |
|---|---|---|---|
| **Description** | **Code** | **Description** | **Code** |
| Subsea production control | CS | Direct hydraulic | DH |
| | | Direct electro-hydraulic | EH |
| | | Multiplexed electro-hydraulic | MX |
| | | Discrete pilot hydraulic | PH |
| | | Sequential piloted hydraulic | SH |
| | | Telemetric hydraulic | TH |

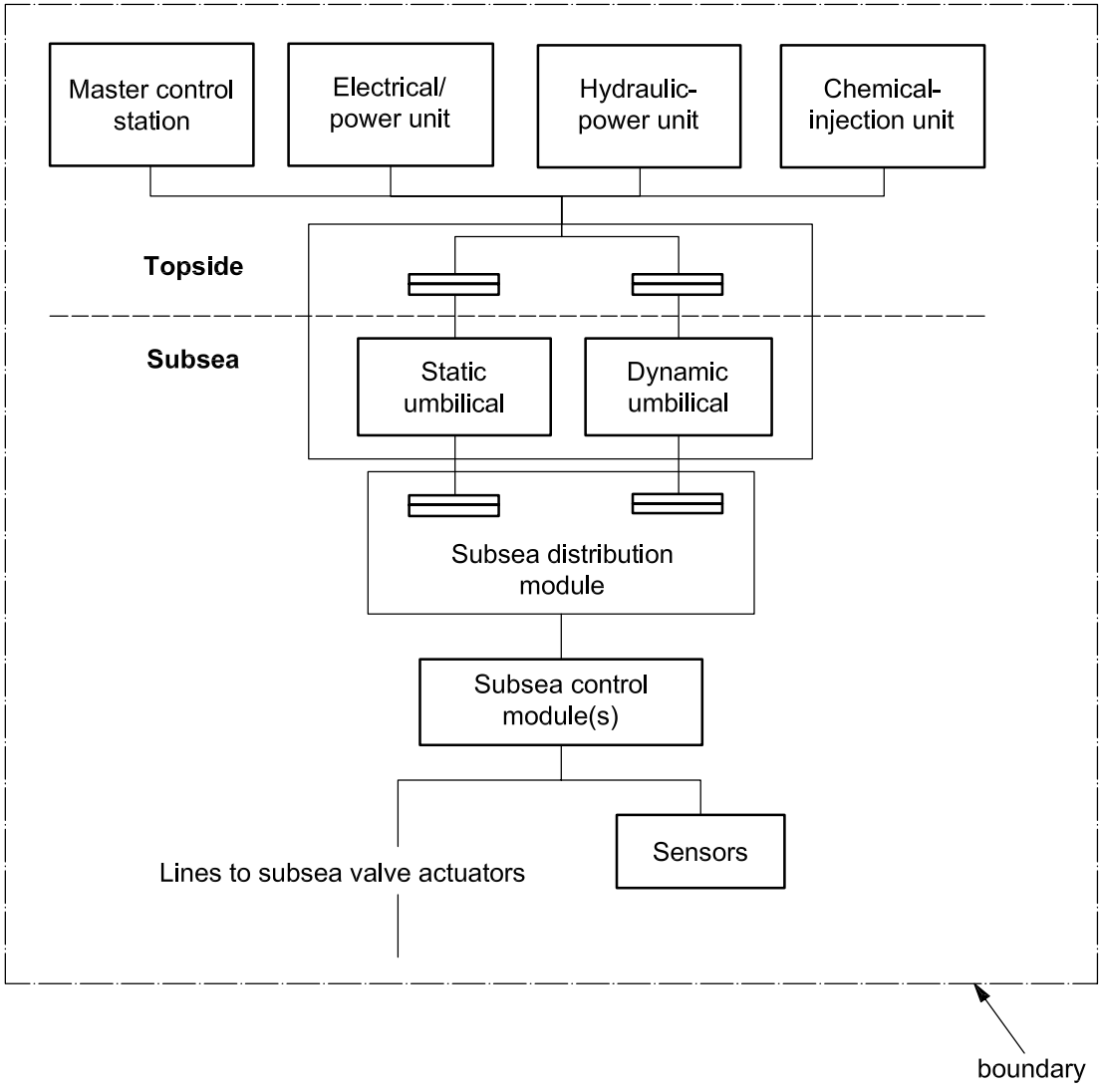



**Figure A.30 — Boundary definition — Subsea production control**

## Table A.87 — Equipment subdivision — Subsea production control

| Equipment unit | | Subsea production control | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Subunit** | **Chemical Injection (topside)** | **Dynamic umbilical** | **Static umbilical** | **Electric-power unit (top-side)** | **Hydraulic-power unit (top-side)** | **Master control (topside)** | **Subsea control module [f]** | **Subsea distr. module [b, f]** | **Sensors [a]** |
| Maintainable items | No breakdown | Bend restrictor<br>Buoyancy device<br>Hydraulic/ chemical line<br>J/I-tube seal<br>LV power/ signal line<br>Fibre-optic line<br>Sheath/ armour<br>Stabilizer<br>Tension- and motion-compen-sation equilibrium<br>Topside um-bilical-ter-mination unit (TUTU) | Bend restrictor<br>Hydraulic/ chemical line<br>LV power/ signal line<br>Fibre-optic line [i]<br>Sheath/ armour<br>Subsea [h] um-bilical-ter-mination unit (SUTU)<br>Topside um-bilical-ter-mination unit (TUTU) | No break-down | No breakdown | No break-down | Accumulator subsea<br>Module base plate<br>Chemical inj. coupling<br>Fibre-optic connector [d]<br>Filter<br>Hydraulic coupling<br>LV power/ signal con-nector [c]<br>Subsea electronic module [e]<br>Directional Control Valve (DCV)<br>IWIS [g] | Accumula-tor subsea<br>Subsea by-pass panel<br>Chemical inj. coupling<br>Fibre-optic connector [d]<br>Fibre-optic jumper [i]<br>Hose<br>Hydraulic/ chemical line<br>Hydraulic coupling<br>Piping<br>LV power/ signal con-nector [c]<br>LV power/ signal jumper<br>Subsea cabling<br>IWIS [g] | Flow<br>Leak<br>Level<br>Position<br>Combined pressure and temperature<br>Pressure<br>Temperature<br>Sand<br>Vibration |

[a] Sensors inside the subunit Subsea control module (SCM) should not be mixed with those external at other subsea equipment.

[b] A SUTU can be of different type, e.g. UTA (Umbilical Termination Assembly) or UTH (Umbilical Termination Head), depending on tie-in philosophy.

[c] LV power/signal connectors" in SCM (or Subsea distribution module; SDM) can include penetrators, which would be of penetrator type: LV power/signal penetrator. The "LV power/signal connectors" are thus Low Voltage level (up to 1kV). These connectors can be wet or dry mate.

[d] Fibre-optic connectors can include penetrators in SCM or SDM, which would be penetrator types = Fibre-optic penetrators.

[e] The Subsea Electrical module (SEM) inside SCM can include penetrators, which would be of penetrator type = Electrical (instrument/signal) or Optical penetrators. Power supply handled as part of SEM. Note also that in addition to penetrators, a SEM contains other electronic and mechanical components.

[f] Penetrator which is defined as "a permanent connection through a bulkhead", might be identified as a separate maintainable item in some data collection and/or estimation.

[g] Intelligent Well Interface Standard (IWIS) card(s) can be located inside SCM as a separate canister, or as part of SEM, or as a separate external module to SCM.

[h] The connection between dynamic and static called a SUTU can also be a transition joint.

[i] During data collection precision is required to ensure sufficient information is captured enabling differentiation between failures affecting single fibre and failures affecting multiple fibres/bundle of fibres.

## Table A.88 — Equipment-specific data — Subsea production control

| Name | Description | Unit or code list | Priority |
|---|---|---|---|
| Well identification number | Operator description | Number or name | High |
| Application | Where used | HIPPS, manifold, SSIV, pump, wellhead, X-mas tree, multi-purpose | Medium |
| Type of control fluid | — | Oil-based, water-based | Medium |
| Type of control system | — | Closed, open | Medium |
| Redundancy | — | Yes/no | Medium |

**Table A.88** *(continued)*

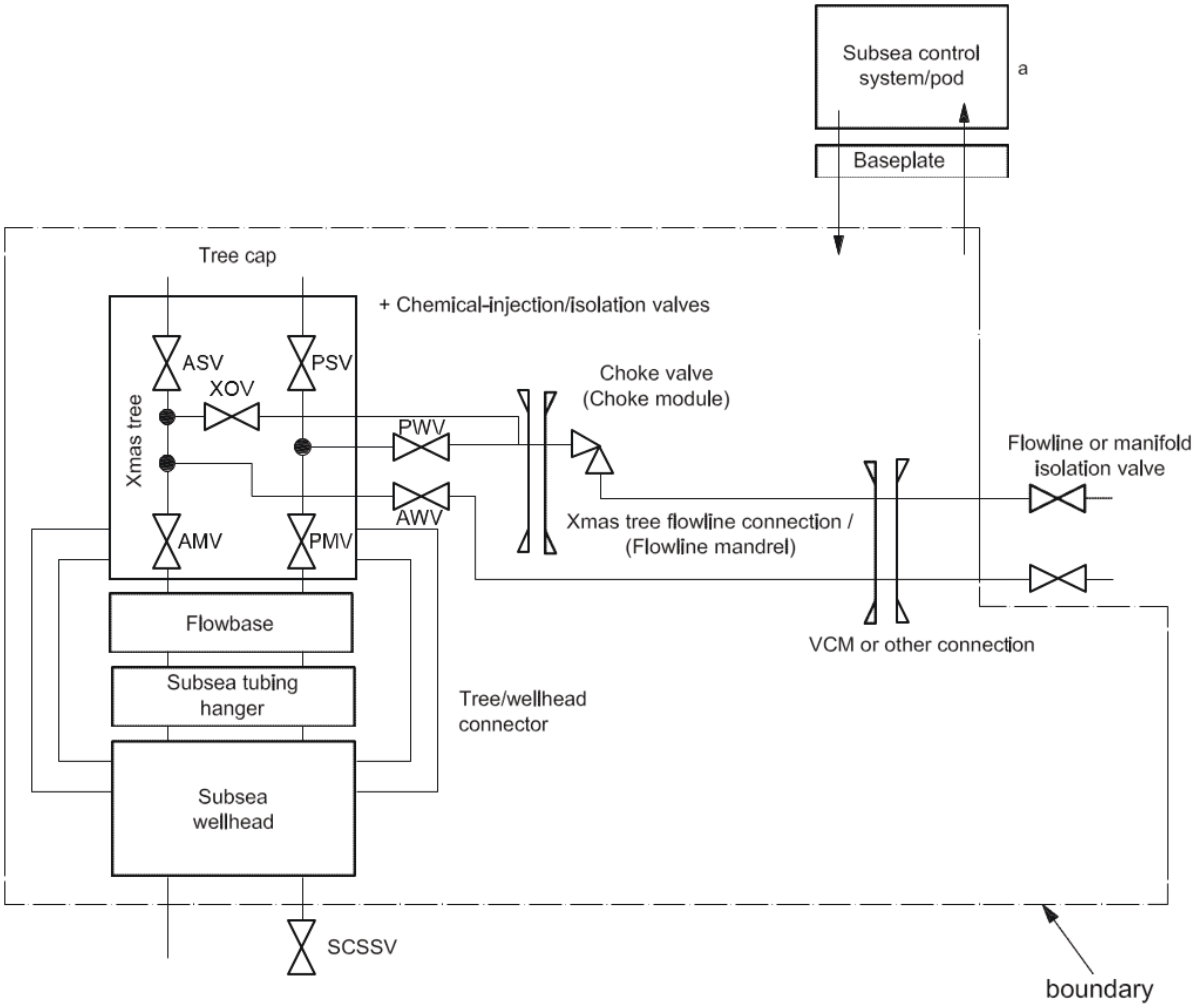
| Name | Description | Unit or code list | Priority |
|---|---|---|---|
| Manufacturer | Specify | Free text | High |
| Model type | Specify | Free text | Low |
| Multilateral wells | — | Yes/no | Low |

### A.2.6.2 Subsea wellhead and X-mas trees

NOTE Applies only for (wet) Subsea X-mas trees. The (dry) Surface X-mas tree is described in A.2.7.7.

**Table A.89 — Type classification — Subsea wellhead and X-mas trees**

| Equipment class — Level 6 | | Equipment type | |
|---|---|---|---|
| **Description** | **Code** | **Description** | **Code** |
| Subsea wellhead and X-mas trees | XT | Vertical | VX |
| | | Horizontal | HX |




ASV/PSV: Annulus/Production swab valve
AMV/PMV: Annulus/Production master valve
AWV/PWV: Annulus/Production wing valve
XOV: Crossover valve
SCSSV: Surface-controlled subsurface safety valve

**Key**

a Sensors mounted on the Subsea X-mas tree, but covered by subunit sensor in Table A.87.

**Figure A.31 — Boundary definition — Subsea wellhead and X-mas trees**

## Table A.90 — Equipment subdivision — Subsea wellhead and X-mas trees

| Equipment unit | Subsea wellhead and X-mas trees | | | | | |
|---|---|---|---|---|---|---|
| **Subunit** | **Subsea wellhead** | **Subsea X-mas tree** | **Tubing hanger** | **Flowbase** | **Flow control module** [a] | **Vertical connection module (VCM)** |
| Maintainable items | Permanent guide base (PGB)<br>Temporary guide base (TGB)<br>Conductor housing<br>Wellhead housing (high-pressure housing)<br>Casing hangers<br>Annulus seal assemblies (pack-offs) | Chemical inj. coupling<br>Flowspool<br>Piping (hard pipe)<br>High pressure cap<br>Hoses (flexible piping)<br>Debris cap<br>Tree-guide frame<br>Connector<br>Internal isolation cap<br>Internal tree-cap valve<br>Internal tree-cap plug<br>Tree cap [b]<br>Valve, check<br>Valve, choke<br>Valve, control<br>Valve, other<br>Valve, process isolation<br>Valve, utility isolation<br>Valve, workover | Chemical inj. coupling<br>Hydraulic coupling<br>LV/power signal connector [d]<br>Tubing-hanger body<br>Tubing-hanger isolation plug | Frame<br>Hub/mandrel [c]<br>Valve, check<br>Valve, process isolation<br>Valve, utility isolation | Chemical inj. coupling<br>Connector<br>Flow loop<br>Frame<br>Hoses<br>Hydraulic connector<br>Piping<br>Valve, check<br>Valve, choke<br>Valve, control | VCM connector<br>Valve and actuator<br>Control system compensation<br>Swivel<br>Funnel guide<br>ROV-panel override system<br>ROV panel |

[a] This can also be designated as choke module.

[b] The tree cap, which is able to be replaced independently, can also be considered as a subunit of the X-mas tree.

[c] This can also be designated as flowline mandrel as well as be considered as a subunit of the X-mas tree.

[d] General carefulness with respect to sensors and interface between tubing hanger and downhole control system.

## Table A.91 — Equipment-specific data — Subsea wellhead and X-mas trees

| Name | Description | Unit or code list | Priority |
|---|---|---|---|
| Well identification number | Operator description | Number or name | High |
| Install/retrieve guide | Guideline/guideline-less, diver-assisted and diver-less lay-away | Guideline, guideline-less | High |
| Well type | Production, injection | Production, injection | High |
| Protection type | Over-trawlable, trawl-catching, etc. | Trawl-catching, trawl-deflecting, none | High |
| Water depth | — | Metres | High |
| Design pressure | Pressure rating of wellhead and X-mas tree | Pascal (bar) | High |
| Artificial lift well | Type of artificial lift in the well | Gas lift, ESP, PCP, none | High |
| Number of connections | Number of lines connected to the tree block | Number | Low |

[a] Neutral (clean fluids with no corrosive effects).

Sweet [moderately corrosive/erosive (oil/gas not defined as severe, raw sea water, occasional particles)].

Sour {severely corrosive/erosive [sour gas/oil (high $H_2S$), high $CO_2$, high sand content]}.

**Table A.91** *(continued)*

| Name | Description | Unit or code list | Priority |
|---|---|---|---|
| Control principle | Defines the control principle for X-mas tree functions and actuators | — | Low |
| Piggable | Specify if piggable or not | Yes/no | Low |
| Size of tree | Dimensions and mass | Metres, kilograms | Low |
| Mudline suspension system | Define whether a mudline suspension system exists | Yes/no | Low |
| Multilateral well | Define | Yes/no | Low |
| Well flow rate | Representative well flow rate (production or injection) | Specify | Medium |
| Fluid produced/injected | Main fluid only: oil, gas, condensate, injection water | Oil, gas, condensate, injection water, oil and gas, gas and condensate, oil/gas/ water, $CO_2$, gas and water, produced water | High |
| Fluid corrosiveness | Classify as shown in the footnote [a] | Neutral, sweet, sour | High |
| Fluid erosiveness | Erosiveness of the well fluid | Benign, clean, moderate, severe, unknown | Medium |
| Valve application | X-mas tree valve function | Annulus master (AMV), Annulus swab (ASV), Annulus wing (AWV), Injection wing (IWV), Injection master (IMV), Injection swab (ISV), Production master (PMV), Production swab, Production wing (PWV), Crossover (XOV) | High |
| Valve design class | Type of X-mas tree valve design | Ball, Butterfly, Diaphragm, Double expanding gate, Flapper, Gate, Needle, Piston, Ram, Swing | High |
| Valve actuation | Classify | Hydraulic, Electrical, Manual | Medium |
| Asphaltenes | Specify | Yes/no | Low |
| Scale formation | Specify | Yes/no | Low |
| Wax formation | Specify | Yes/no | Low |
| Hydrate formation | Specify | Yes/no | Low |
| Sand production | Specify | Yes/no | Low |

[a] Neutral (clean fluids with no corrosive effects).
Sweet [moderately corrosive/erosive (oil/gas not defined as severe, raw sea water, occasional particles)].
Sour {severely corrosive/erosive [sour gas/oil (high $H_2S$), high $CO_2$, high sand content]}.

### A.2.6.3 Risers

Note that the equipment class Dry tree risers (e.g. for dry well completion riser tie-back when TLP's and SPAR's) riser are listed as a separate equipment class in Table A.4, but is not covered by the equipment class Risers in A.2.6.3.

**Table A.92 — Type classification — Risers**

| Equipment class — Level 6 | | Equipment type | |
|---|---|---|---|
| **Description** | **Code** | **Description** | **Code** |
| Risers | PR | Rigid | RI |
| | | Flexible | FL |