API Specification

17D

2nd Edition, May 2011

Specification for Design and Operation of Subsea Production Systems—Subsea Wellhead and Tree Equipment

ISO 13628-4 (Identical), Design and operation of subsea production systems—Part 4: Subsea wellhead and tree equipment

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API Specification 17D: 2nd Edition, May 2011
Specification for Design and Operation of Subsea Production Systems—Subsea Wellhead and Tree Equipment

1.0 Product Description

Specification 17D includes the following requirements for product ordered and may be applicable in addition to any product-specific requirements listed in other sections identified herein:

1.1 PRODUCTS

1.1.1 API Specification 17D – Introduction
This guide is not intended to inhibit a vendor from offering, or the purchaser from accepting, alternative equipment or engineering solutions for the individual application. This can be particularly applicable where there is innovative or developing technology. Where an alternative is offered, it is the responsibility of the vendor to identify any variations from this Specification and provide details.

1.1.2 API Specification 17D – Annex J.1
Level 1 identifies possible chemical and or physical changes in selected materials. Level 1 is intended to provide general information that can be published by either chemical suppliers and/or manufacturers. Level 2 looks for chemical and/or physical changes in non-metallic materials, such as swelling, when the material resides in a confined space. Level 2 testing also uses more specific concentrations and operating conditions defined by the end user for a particular application. Level 2 results are likely to be proprietary and project-specific and might not necessarily be directly comparable to other published level 2 data. Level 3 is an in-depth test to determine the useful operating life of non-metallic materials in the presence of the additive using accelerated-life-estimation testing procedures based on the Arrhenius principle.

1.1.3 API Specification 17D – Annex M.1
Annex M provides recommended guidelines for inquiry and purchase of equipment covered by this part of ISO 13628. Annex M is informative; however users may, by agreement between the interested parties, consider the provisions to be either requirements or guidelines. This is especially the case when determining PSL.

1.1.4 API Specification 17D – Annex M.3
PSLs are defined in 5.2 and 5.3, and in ISO 10423. PSLs apply to pressure-containing and pressure-controlling parts and assembled equipment as defined in this part of ISO 13628. Determination of the PSL is the responsibility of the purchaser. Selection of PSL can depend on whether equipment is primary or secondary equipment, as defined in ISO 10423. For this part of ISO 13628 primary equipment shall include, as a minimum, the tubing head/high-pressure housing, the first two actuated (master and/or wing) valves downstream of the tubing hanger, the lower tree connector, and any other flowline or isolation valve in direct communication with the well bore upstream of the second actuated valve.

1.1.5 API Specification 17D – Annex M.3

- PSL 2: recommended for general (non-sour) service at working pressure 34,5 MPa (5 000 psi) and below; recommended for secondary equipment for working pressure of 69 MPa (10 000 psi) or below;

- PSL 3: recommended for primary equipment in sour service, all working pressures, and general service above pressures of 34,5 MPa (5 000 psi); recommended for primary and secondary equipment, sour or general service, for pressures above 69 MPa (10 000 psi) or for maximum temperature ratings above 121 °C (250 °F).

- Other considerations that can lead the user to consider PSL 3 over PSL 2 include water depth, composition of retained or

injected fluids, field infrastructure, difficulty of intervention, acceptance of risk, sensitivity of environment, and useful field life.

- PSL 3G: same recommendations as for PSL 3, with additional considerations for wells that are gas producers, have a high gas/oil ratio or are used for gas injection.

1.1.6 API Specification 17D – Annex M.3

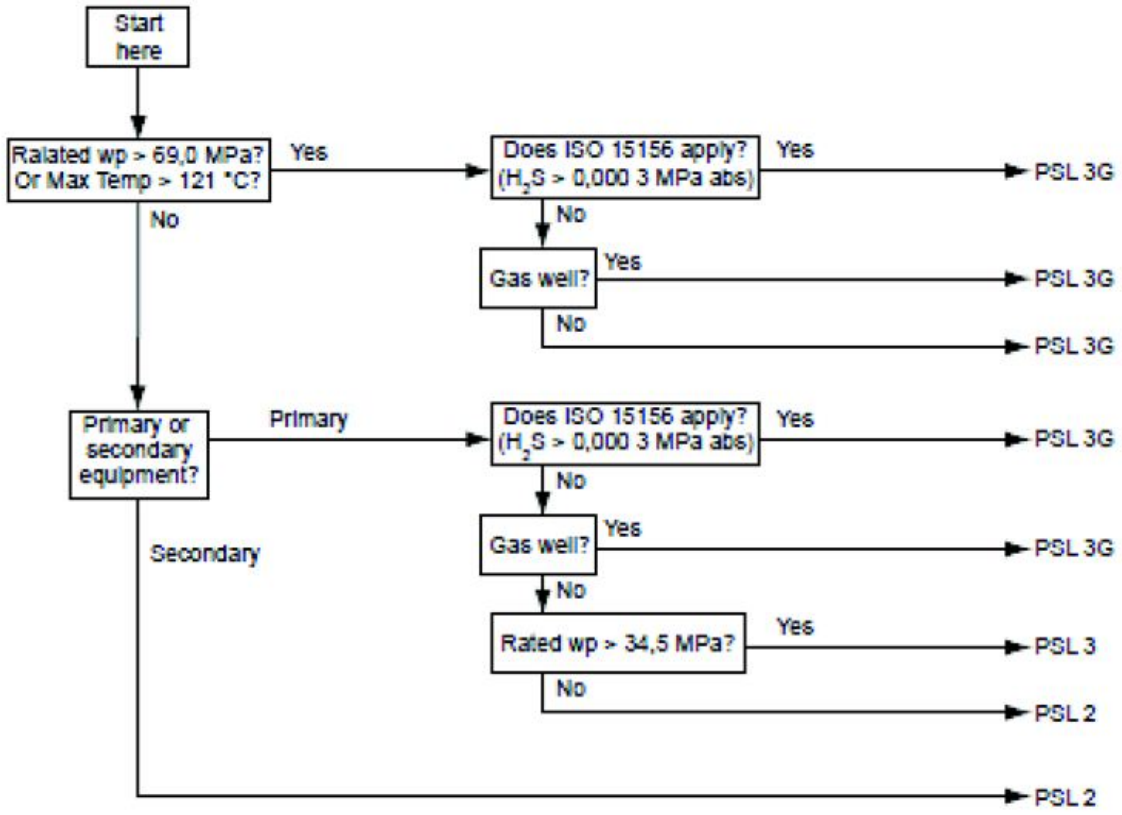


Figure M.1 — PSL decision tree for subsea equipment

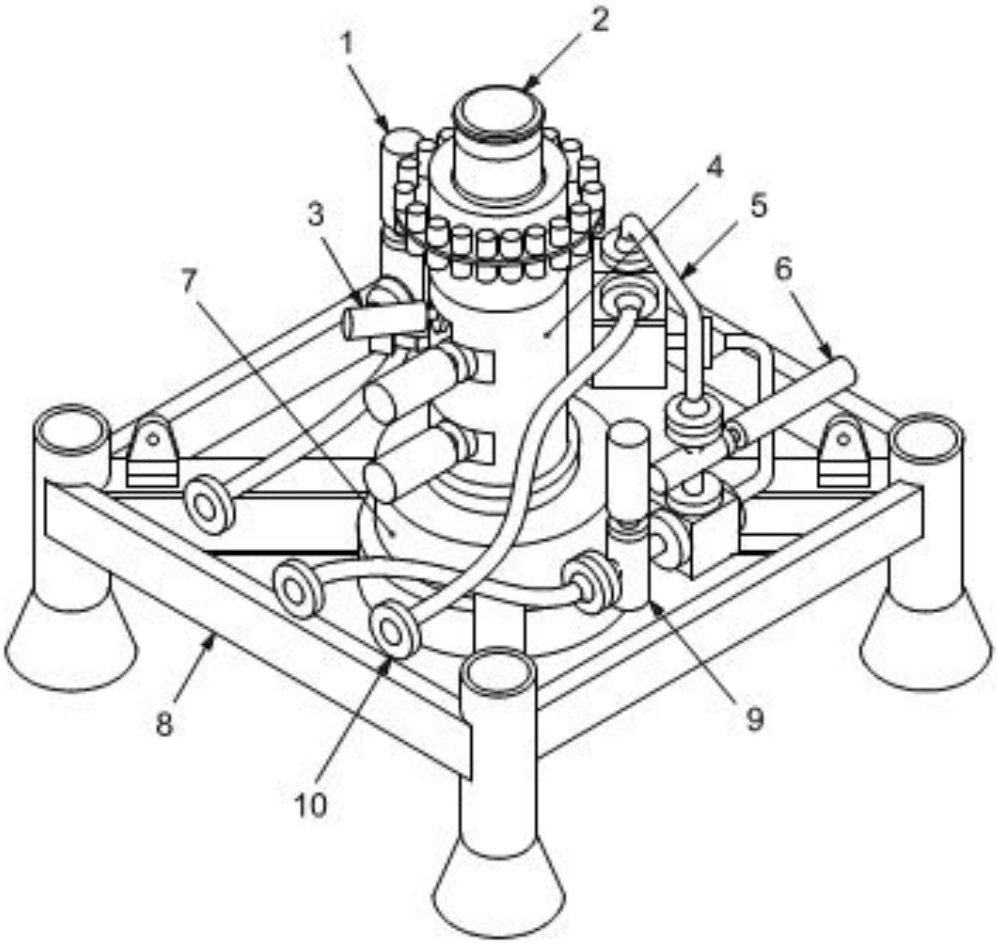
1.1.6 API Specification 17D – Annex N
The use of the Monogram on products constitutes a representation and warranty by the Licensee to purchasers of the products that, on the date indicated, the products were produced in accordance with a verified quality management system and in accordance with an API product specification.

1.2 SUBSEA TREE EQUIPMENT

1.2.1 API Specification 17D – 1. Scope
Subsea trees:

- tree connectors and tubing hangers
- valves, valve blocks, and valve actuators
- chokes and choke actuators
- bleed, test and isolation valves
- TFL wye spool
- re-entry interface
- tree cap
- tree piping
- tree guide frames
- tree running tools
- tree cap running tools
- tree mounted flowline/umbilical connector
- tubing heads and tubing head connectors
- flowline bases and running/retrieval tools
- tree mounted controls interfaces (instrumentation, sensors, hydraulic tubing/piping and fittings, electrical controls cable and fittings)

1.2.2 API Specification 17D – Annex A

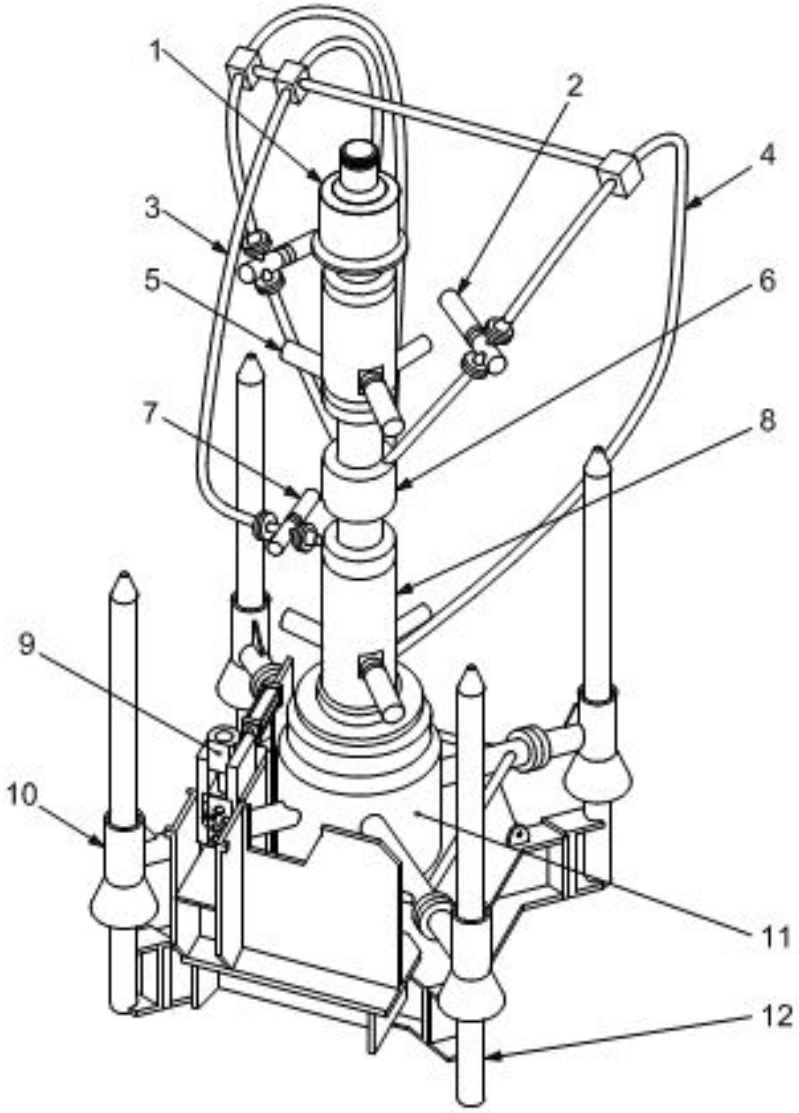


Key

1	production wing valve	6	crossover valve
2	tree cap	7	tree connector
3	production swab valve	8	tree guide frame
4	master valve block	9	annulus wing valve
5	flow loop	10	flow line connection

Figure A.1 — Guideline style vertical tree

1.2.3 API Specification 17D – Annex A

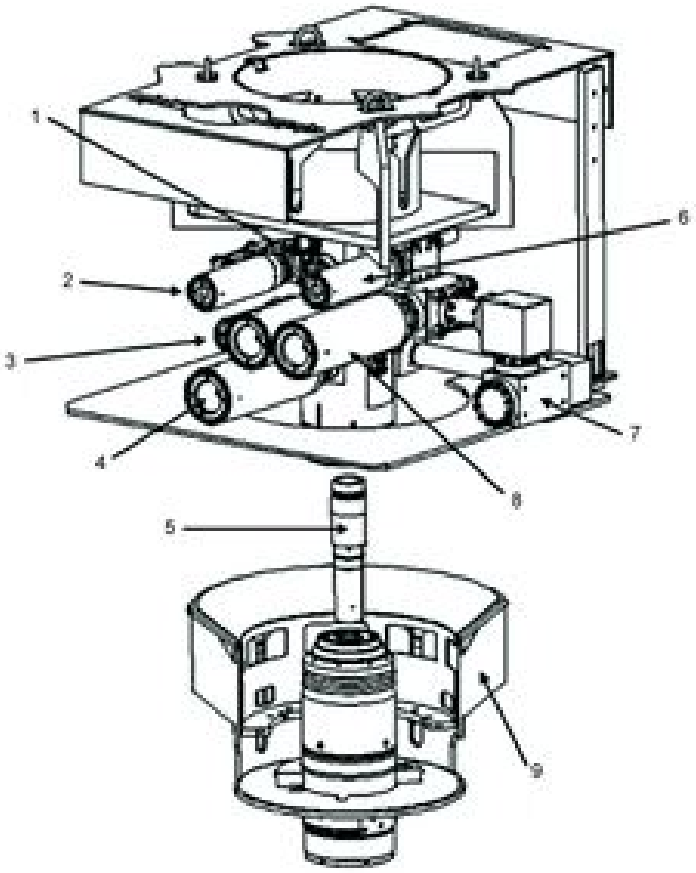


Key

1	tree cap assembly	5	swab valves	9	flow line connector
2	wing valve	6	wye spool and diverter	10	tree guide frame
3	annulus loop	7	annulus wing valve	11	tree connector
4	TFL flow loop	8	master valve block	12	wellhead guidebase

Figure A.2 — Guideline style TFL tree

1.2.4 API Specification 17D – Annex A



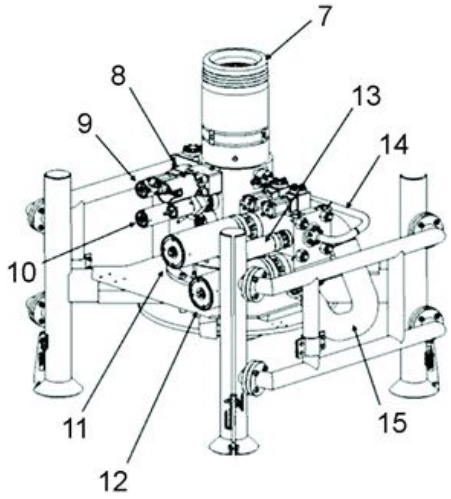
Key

1	swab valves	5	tubing hanger	9	GRA, CGB, or tubing head
2	annulus wing valve	6	crossover valve		
3	annulus master valve	7	production outlet		
4	master valve	8	wing valve		

Figure A.3 — Guidelineless style vertical tree

1.2.5 API Specification 17D – Annex B

Common names for individual components are included in the numbered key. The two items not identified are the casing hangers (blue) and tree (yellow).

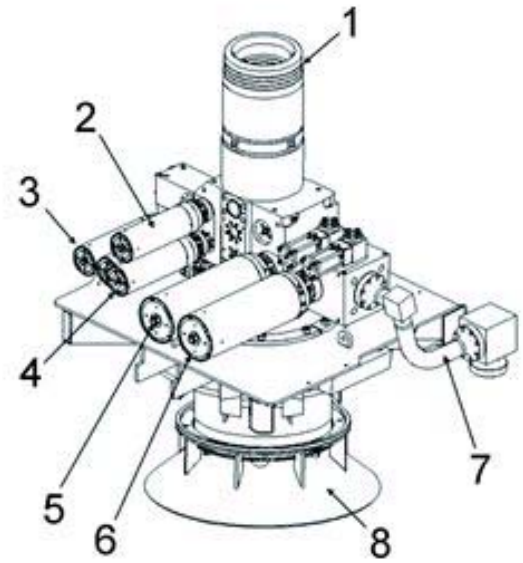


Key

1	crown plugs	6	extended tubing hanger	11	master valve
2	debris cap	7	re-entry interface	12	wing valve
3	internal tree cap	8	annulus swab valve	13	crossover valve
4	tubing hanger	9	annulus wing valve	14	crossover flowloop
5	locking debris cap	10	annulus master valve	15	production outlet

Figure B.1 — Guideline style horizontal tree

1.2.6 API Specification 17D – Annex B



Key

1	re-entry interface	5	master valve
2	annulus swab valve	6	wing valve
3	annulus wing valve	7	production outlet
4	annulus master valve	8	guidelineless re-entry funnel (funnel down)

Figure B.2 — Guidelineless style horizontal tree

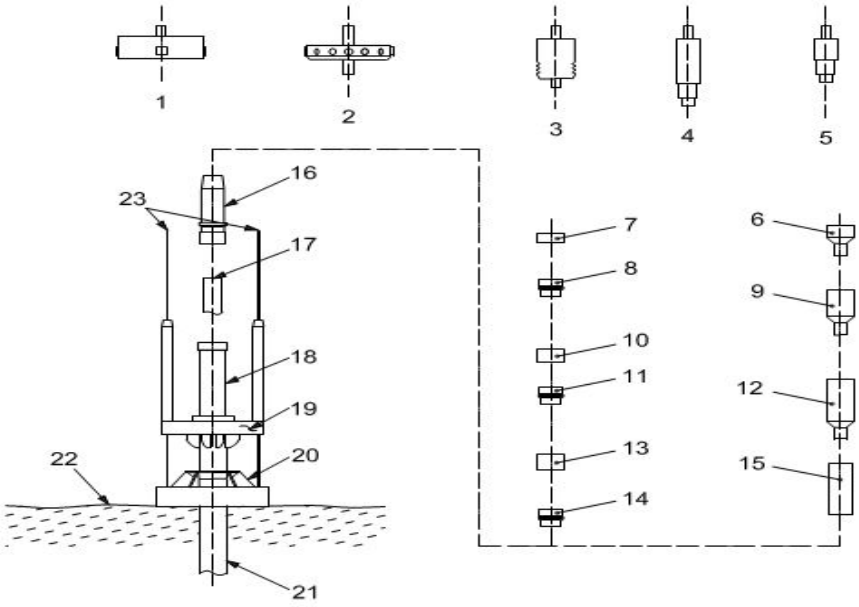
1.3 SUBSEA WELLHEAD EQUIPMENT

1.3.1 API Specification – 1. Scope

Subsea wellheads:

- conductor housings
- wellhead housings
- casing hangers
- seal assemblies
- guidebases
- bore protectors and wear bushings
- corrosion caps

1.3.2 API Specification 17D – Annex C



Key

1 temporary guidebase running tool
2 762 mm (30 in) housing running tool
3 high-pressure housing running tool
4 casing hanger running tool (drillpipe or fullbore)
5 test tool
6 178 mm (7 in) wear bushing
7 245 mm × 178 mm (9-5/8 in × 7 in) annulus seal assembly
8 178 mm (7 in) casing hanger
9 245 mm (9-5/8 in) wear bushing
10 340 mm × 245 mm (13-3/8 in × 9-5/8 in) annulus seal assembly
11 245 mm (9-5/8 in) casing hanger
12 340 mm (13-3/8) wear bushing
13 508 mm × 340 mm (20 in × 13-3/8 in) annulus seal assembly
14 340 mm (13-3/8) casing hanger
15 housing bore protector
16 high-pressure wellhead housing
17 surface casing [normally 508 mm (20 in)]
18 low-pressure conductor hsg [normally 762 mm (30 in)]
19 permanent guidebase
20 temporary guidebase
21 762 mm (30 in) conductor casing
22 seafloor
23 guidelines

Figure C.1 — Subsea wellhead

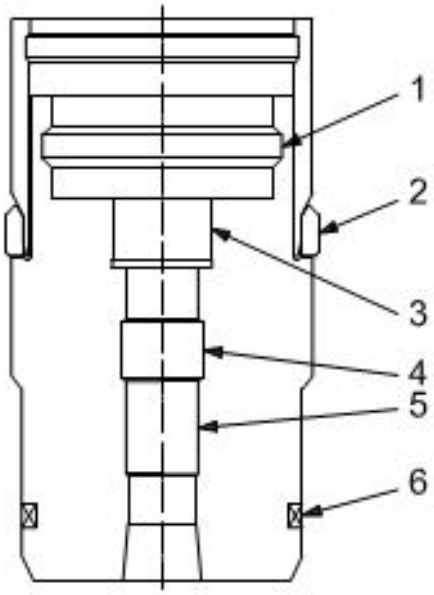
1.4 TUBING HANGER SYSTEM EQUIPMENT

1.4.1 API Specification – 1. Scope

Tubing hanger systems:

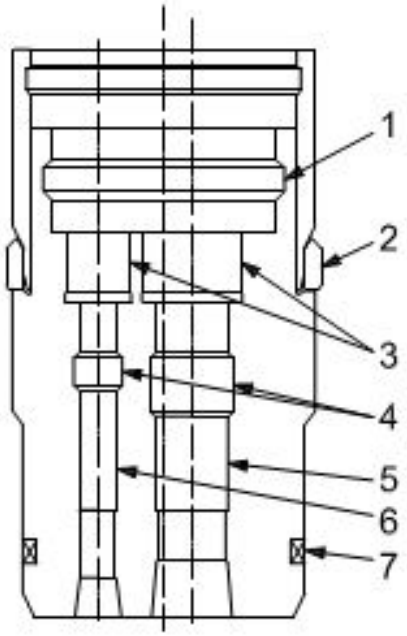
- tubing hangers
- running tools

1.4.2 API Specification 17D – Annex D



Key
1 running tool latching groove
2 lockdown
3 stab sub seal pockets
4 wireline plug profiles
5 production bore
6 seal

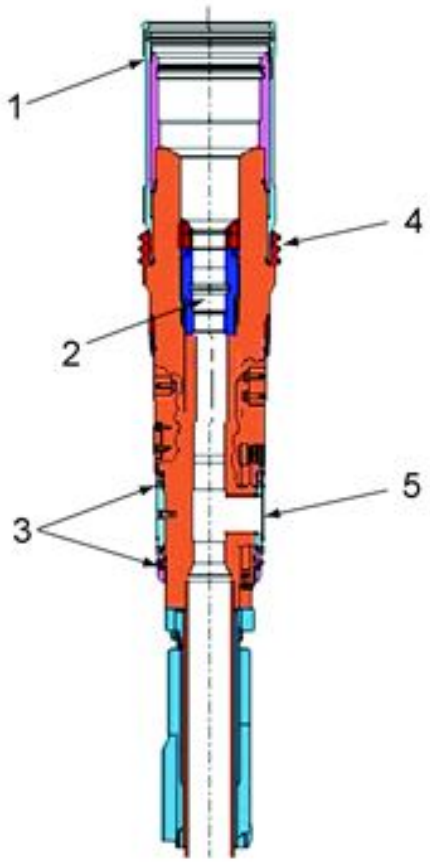
Figure D.1 — Concentric tubing hanger



Key
1 running tool latching groove
2 lockdown
3 stab sub seal pockets
4 wireline plug profiles
5 production bore
6 annulus bore
7 seal

Figure D.2 — Tubing hanger with multiple bores

1.4.3 API Specification 17D – Annex D

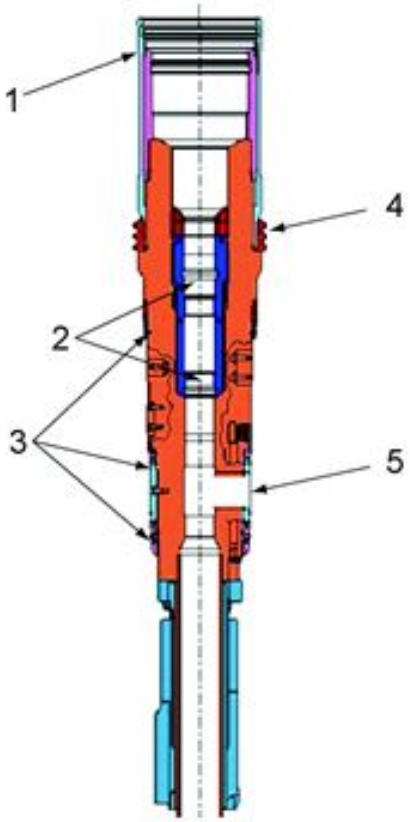


Common names for individual components are included in the numbered key. The two items not identified are the casing hangers (blue) and tree (yellow).

Key
1 running tool latching groove
2 wireline plug profile or closure device
3 seal
4 lockdown
5 production outlet

Figure D.3 — Tubing hanger for horizontal tree

1.4.4 API Specification 17D – Annex D



Common names for individual components are included in the numbered key. The two items not identified are the casing hangers (blue) and tree (yellow).

Key
1 running-tool latching groove
2 wireline plug profile or closure devices, two
3 seal
4 lockdown
5 production outlet

Figure D.4 — Extended tubing hanger for horizontal tree

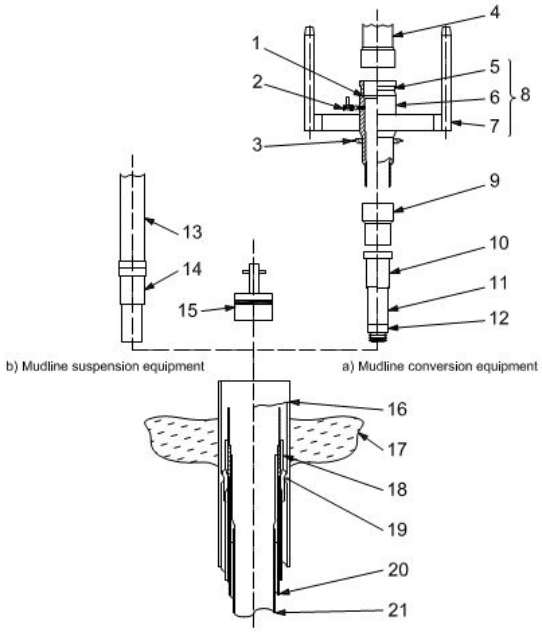
1.5 MUDLINE SUSPENSION SYSTEM EQUIPMENT

1.5.1 API Specification – 1. Scope

Mudline suspension systems:

- wellheads
- running tools
- casing hangers
- casing hanger running tool
- tieback tools for subsea completion
- subsea completion adaptors for mudline wellheads
- tubing heads
- corrosion caps

1.5.2 API Specification 17D – Annex E

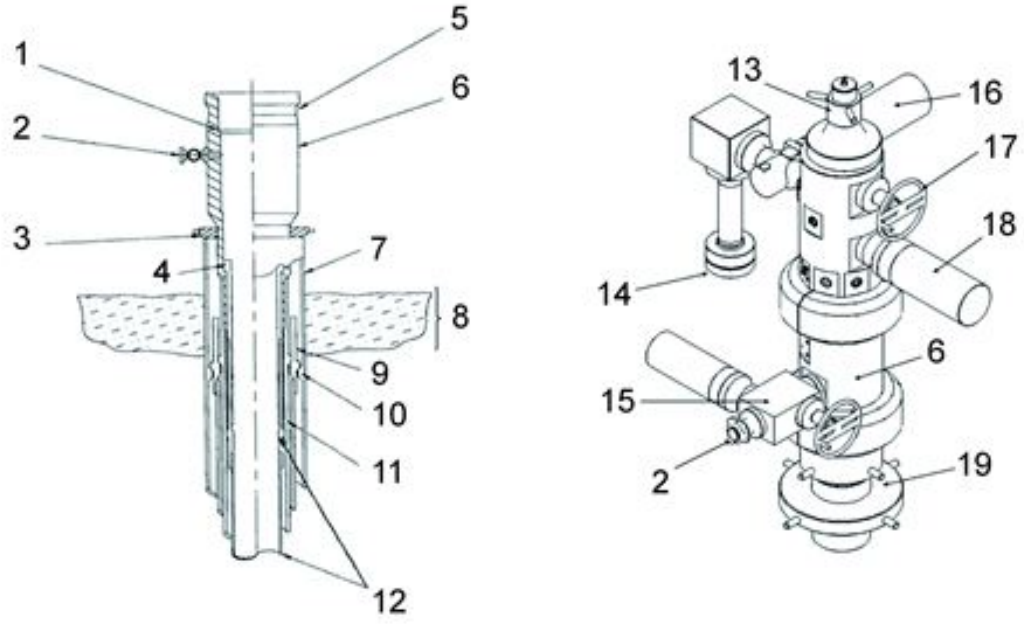


Key

1 tubing hanger profile
2 annulus outlet
3 structural support ring (optional)
4 workover completion riser
5 connector profile
6 wellhead adapter
7 permanent guidebase
8 tubing heads
9 annulus seal assembly
10 tieback adapter
11 casing
12 tieback tool (tieback sub)
13 casing riser (to jack up)
14 casing hanger running tools (landing subs) or tieback tools (tieback subs)
15 abandonment cap
16 762 mm (30 in) conductor casing
17 mudline
18 508 mm (20 in) casing hanger
19 762 mm (30 in) landing ring
20 340 mm (13-3/8 in) casing hanger
21 245 mm (9-5/8 in) casing hanger

Figure E.1 — Mudline suspension (wellhead) and conversion equipment

1.5.2 API Specification 17D – Annex E



a) **Mudline conversion equipment (installed)**

b) **Subsea tree on a mudline suspension conversion**

Key

1 tubing hanger profile
2 annulus outlet
3 structural support ring (optional)
4 casing hanger tieback adapter
5 connector profile
6 tubing head
7 conductor casing, 762 mm (30 in)
8 mudline
9 mudline casing hanger, 508 mm (20 in)
10 mudline landing ring, 762 mm (30 in)
11 mudline casing hanger, 340 mm (13-3/8 in)
12 mudline casing hanger, 245 mm (9-5/8 in)
13 tree cap
14 production outlet
15 annulus valves
16 wing valve
17 swab valve
18 master valve
19 mudline conversion

Figure E.2 — Mudline conversion equipment

1.6 DRILL THROUGH MUDLINE SUSPENSION SYSTEM EQUIPMENT

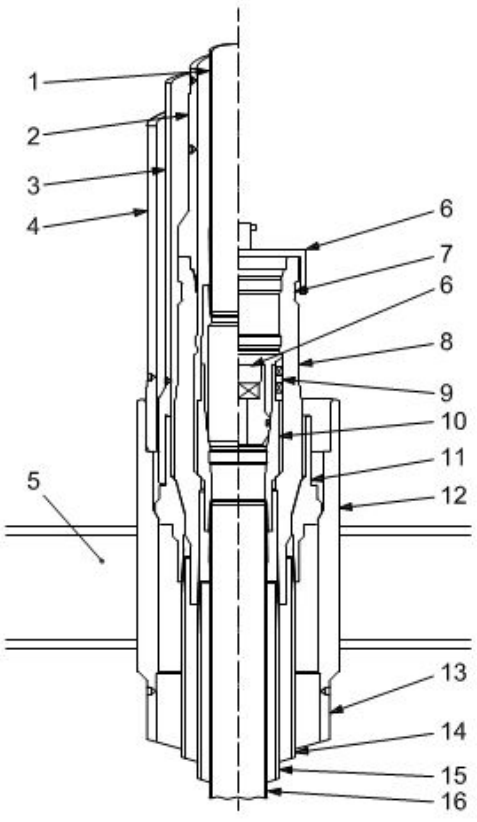
Description:

1.6.1 API Specification – 1. Scope

Drill through mudline suspension systems:

- conductor housings
- surface casing hangers
- wellhead housings
- casing hangers
- annulus seal assemblies
- bore protectors and wear bushings
- abandonment caps

1.6.2 API Specification 17D – Annex E



Key
1 casing, 244 mm to 273 mm (9 5/8 in to 10 3/4 in)
2 riser, 406 mm (16 in)
3 riser, 610 mm (24 in)
4 environmental tie-back pipe
5 guidance equipment
6 abandonment cap
7 connector profile
8 wellhead housing
9 seal assembly
10 production casing hanger
11 hanger, 473 mm to 508 mm (18 5/8 in to 20 in)
12 conductor housing
13 conductor, 762 mm (30 in)
14 casing, 473 mm to 508 mm (18 5/8 in to 20 in)
15 casing, 340 mm (13 3/8 in)
16 casing, 244 mm to 273 mm (9 5/8 in to 10 3/4 in)

Figure F.1 — Drill-through mudline suspension system

1.7 MISCELLANEOUS EQUIPMENT

Description: API Specification – 1. Scope
Miscellaneous equipment:

- flanged end and outlet connections
- clamp hub-type connections
- threaded end and outlet connections
- other end connections
- studs and nuts
- ring joint gaskets
- guideline establishment equipment

2.0 Purchaser's Responsibility

2.1 MATERIAL CLASS

2.1.1 API Specification 17D – 4.1.4
Choosing material class and specific materials for specific conditions is ultimately the responsibility of the purchaser.

2.1.2 API Specification 17D – 4.1.5
It is the responsibility of the end user to specify materials of construction for pressure-containing and pressure–controlling equipment. Material classes AA-HH as defined in Table 1 shall be used to indicate the material of those equipment components. Guidelines for choosing material class based on the retained fluid constituents and operating conditions are given in Annex M.

2.1.3 API Specification 17D – Annex M.4
Material-class manufacturing requirements are given in ISO 10423 and in Table 1. Material class shall be determined by the purchaser with consideration to the various environmental factors and production variables listed below:

a) pressure;

b) temperature;

c) composition of produced or injected fluid, particularly H2S, CO2, and chlorides;

d) pH of water phase or brine;

e) exposure to salt water during installation or operation;

f) use of inhibitors for scale, paraffin, corrosion or other reasons;

g) possibility of acidizing and concentration of acidizing solutions;

h) anticipated production rates;

i) sand production and other potential for erosion;

j) anticipated service life;

k) future operations that can affect pressure, temperature or fluid content;

l) risk analysis.

Corrosion, stress-corrosion cracking (SCC), erosion-corrosion, and sulfide stress cracking (SSC) are all influenced by the interaction of the environmental factors and the production variables. Other factors not listed can also influence fluid corrosivity.

The purchaser shall determine whether materials shall meet ISO 15156 (all parts) for the sour service environment. ISO 15156 (all parts) addresses metallic material requirements to prevent stress cracking within ISO 15156-specified environmental conditions, but does not address all aspects of corrosion resistance.

Consideration shall also be given to the partial pressure of carbon dioxide, which is related generally to corrosion in Table 1.

2.2 MATERIAL SELECTION

2.2.1 API Specification 17D – 5.1.2.1.2.1
Whenever feasible, assembled equipment that contains and controls well pressure, such as valves, chokes, wellhead housings and connectors, shall be specified by the purchaser, and designed and manufactured to one of the following standard rated working pressures: 34,5 MPa (5 000 psi), 69 MPa (10 000 psi) or 103,5 MPa (15 000 psi).

2.2.2 API Specification 17D – 5.1.2.3.2
Material selection is the ultimate responsibility of the user as he has the knowledge of the production environment as well as control over the injected treatment chemicals. The user may specify the service conditions and injection chemicals, asking the supplier to recommend materials for his review and approval.

2.3 DATA SHEETS

2.3.1 API Specification 17D – Annex M.5.1

M.5 provides suggested data sheets that can be used for enquiry and purchase of subsea wellhead and tree equipment.

NOTE Interactive electronic forms of the data sheets can be accessed by clicking where indicated on the line immediately below the subclause heading.

The data sheets are designed to perform three functions:

a) assist the purchaser in deciding what he wants;

b) assist the purchaser in communicating his particular needs and requirements, as well as information on the well environment, to the manufacturer for his use in designing and producing equipment;

c) facilitate the communication regarding purchaser requirements, relative to the supplier's options and/or capabilities such that a common understanding is agreed.

A copy of the data sheets should be completed as accurately as possible. The typical configurations should be referred to, as required, to select the required equipment. The decision tree in Figure M.1, together with its instructions, provides the recommended practice as to which PSL each piece of equipment should be manufactured. A copy of the data sheet should then be attached to the purchase order or request for proposal.

Data sheets from ISO 10423, Annex A, may also be useful in selecting specific wellhead equipment components.

2.3.2 API Specification 17D – Annex M.5.1

a) Location and water depth

	Description	Comments
Number of wells		
Well identifier		
Well location(s)	Block: Location X: Location Y:	 Latitude: Longitude:
Water depth	metres (feet)	

b) Reservoir flow rates and pressures

		Comments
FWHP (at wellhead)	MPa (psi)	
FWHT	°C (°F)	
SIWP	MPa (psi)	

c) Metocean data

	Description	Comments
Current profile vs. Water depth	Water depth velocity m (ft) m/s (ft/s)	
Current direction	☐ Aligned to waves ☐ Other specify:	
Significant and Maximum wave height	H_s : m (ft) H_{max}: m (ft)	
Wave period	T_p : sec	
Wave spectrum	☐ Jonswap ☐ Pierson – Moskowitz ☐ Other specify:	

d) Drilling plan

Type of drilling vessel	Plan for well completion
☐ Jackup rig	☐ Drill and complete
☐ Moored semi	☐ Drill, abandon and complete
☐ DP semi	☐ Complete previously drilled well
☐ Moored drillship	Other specify:
☐ DP drillship	
☐ Lightweight intervention	
Other specify:	

e) Wellhead interface

	Baseline	Options
Wellhead type	☐ mudline suspension ☐ subsea	☐ Other specify:
Wellhead size	☐ 18-3/4"	☐ 16-3/4" ☐ Other specify:
Wellhead working pressure rating	☐ 69,05 MPa (10 000 psi) ☐ 103,5 MPa (15 000 psi)	☐ Other specify:
Shallow water flow system?	☐ No	☐ Yes. Specify surface casing size(s):
Rigid lock/Preloaded high-pressure housing	☐ No	☐ Yes
Guidance	☐ Guideline (GL)	☐ Guidelineless (GLL) ☐ Funnel up (GLL) ☐ Funnel down (GLL) ☐ Guidelineless orientation, specify:
Surface pipe installation	☐ Drilled , requires TGB ☐ Jetted, requires jetting tool ☐ Drill-ahead tool	☐ Other specify: ☐ Size (OD/wall), specify:
On template?	☐ No	☐ Yes, specify:
Casing program	☐ 30"x20"x13-3/8"x9-5/8" H_2S: Yes ☐ No ☐	☐ Other specify:
Number of submudline and/or liner hangers to be suspended in wellhead	Specify: H_2S: Yes ☐ No ☐	
Max. number of hangers that can be suspended in wellhead	Specify:	

	Baseline	Options
Anticipated tubing hanger completion	☐In the wellhead ☐Separate tubing head	☐Other specify:
Casing hanger lockdown bushing?	☐No H_2S: Yes ☐ No ☐	☐Yes ☐Other specify:
Wellhead top profile	☐Clamp hub ☐Mandrel	☐Other specify: ☐Gasket type specify:
Production casing hanger size	☐9-5/8" ☐10-3/4"	☐Other specify:
Casing hanger thread profile	☐Buttress	☐Other specify:
Production casing drift diameter	Specify:	
Production casing hanger has CRA seal surface on ID (for enhanced tubing hanger seal)	☐No	☐Yes
Distance from mudline to top of surface pipe or high pressure wellhead housing	☐3 – 4,6 m (10 – 15 ft)	☐Other specify:
Marine drilling riser loads (i.e. normal, extreme, accidental, and fatigue) and load combinations (see ISO 13628-1, 5.6.2.2)		
Seabed hydrates anticipated	☐No	☐Yes
Low pressure outlets	☐No	☐Yes

f) Downhole interface

	Description
Tubing size	OD: Weight: lbs/ft Material grade: Type of connection: Insulated: ☐no ☐yes Describe insulation if insulated:

g) Service life requirements

Subsea service life		Reusability	
Baseline	Options	Baseline	Options
☐10 year service life	☐20 year service life ☐Other specify:	☐Do not reuse	☐Refurbishment & reuse ☐Other specify:

h) Anticipated well tieback

Type of tieback	Comments
fixed platform tieback	
Floating (or compliant) platform tieback	
Subsea completion	

M.5.3 Subsea tree data sheet

The purpose of the following data sheets is to capture information about a subsea tree for the application.

a) Location and water depth

	Description	Comments
Number of wells		
Well identifier	Inj. Prod. Interchangeable	
Well location(s)	Block: Location X: Location Y:	 Latitude: Longitude:
Water depth	metres (feet)	
Seabed temperature	°C (°F)	

b) Reservoir general information

		Comments
Flow rates/zone		
- Gas	(m^3/d) SCFD	SCFD
- Oil or condensate	(m^3/d) BPD	(m^3/d) BPD
- Water	(m^3/d) BPD	(m^3/d) BPD
FWHP (at wellhead)	MPa (psi)	
FWHT	°C (°F)	
SIWP	MPa (psi)	
Commingling	☐yes ☐no	
Completion type	(open hole, cased well, gravel pack, etc.)	
Producing life	years	
Gas lift point	☐not required ☐required, specify location:	

- Reservoir fluid properties

	Description	Comments
Reservoir pressure	MPa (psi)	
Reservoir temperature	°C (°F)	
Reservoir properties	0 per specify:	
Fluid type	☐Oil ☐Gas	
Gas-oil ratio	m^3/m^3 (scf/bbl)	
API gravity	°API	
Gas gravity		
Condensate yield	m^3/m^3 (bbl/scf)	
H_2S	MPa pp (psi pp) mol %	
CO_2	MPa pp (psi pp) mol %	
Cloud point temperature	°C (°F)	
Paraffin	mass % Deposition rate:	
Asphaltenes	mass % Precip. pressure: MPa (psi)	
Formation water salinity or dissolved NaCl concentration	mass % or ppm	
Formation water pH		
Sand production	Sand rate: g/m^3 (lb/bbl) of produced fluid Particle size: micron Particle type: (smooth, angular)	

d) Metocean data

	Description	Comments
Current profile vs. water depth	Water depth velocity m (ft) m/s (ft/s)	
Current direction	☐ Aligned to waves ☐ Other specify:	
Significant and maximum wave height	H_s: m (ft) H_{max}: m (ft)	
Wave period	T_p: sec	
Wave spectrum	☐ Jonswap ☐ Pierson – Moskowitz ☐ Other specify:	

e) Vessel plan

Type of completion vessel	Plan for well completion
☐ Jackup rig	☐ Drill and complete
☐ Crane capacity	☐ Specify:
☐ Moored semi	☐ Drill, abandon and complete
☐ DP semi	☐ Complete previously drilled well
☐ Moored drillship	Other specify:
☐ DP drillship	
☐ Lightweight intervention	
Other specify:	

b) Wellhead interface

	Baseline	Options
Wellhead type	☐ mudline suspension ☐ subsea	☐ Other specify:
Wellhead size	☐ 18-3/4"	☐ 16-3/4" ☐ Other specify:
Wellhead working pressure rating	☐ 69,05 MPa (10 000 psi) ☐ 103,5 MPa (15 000 psi)	☐ Other specify:
Wellhead top profile	☐ Clamp hub ☐ Mandrel	☐ Other specify: ☐ Gasket type specify:
Rigid lock/preloaded high-pressure housing	☐ No	☐ Yes
Casing hanger lockdown bushing?	☐ No Capacity, specify:	☐ Yes ☐ Other specify:
Guidance	☐ Guideline (GL)	☐ Guidelineless (GLL) ☐ Funnel up (GLL) ☐ Funnel down (GLL) ☐ Guidelineless orientation, specify:
On template?	☐ No	☐ Yes, specify:
Tubing hanger completion	☐ In the wellhead ☐ Separate tubing head	☐ Other specify:
Production casing hanger size	☐ 9-5/8" ☐ 10-3/4"	☐ Other specify:
Number of hangers suspended in wellhead	Specify:	
Production casing drift diameter	Specify:	
Production casing hanger has CRA seal surface on ID (for enhanced tubing hanger seal)	☐ No	☐ Yes
Distance from mudline to top of surface pipe or high pressure wellhead housing	☐ 3 m to 4,6 m (10 ft to 15 ft)	☐ Other specify:
Marine drilling riser loads (i.e. normal, extreme, accidental, and fatigue) and load combinations (see ISO 13628-1, 5.6.2.2)		

g) Topsides, platform and field Information

	Description	Comments
Host location	Block: Location X: Location Y:	 Latitude: Longitude:
Water depth	m (ft)	
Offset distance	km (miles)	
Separator pressure	MPa (psi)	
Process capacity	Oil: m^3/d (BPD) Gas: m^3/d (SCFD) Water: m^3/d (BPD)	
Slug catcher size, if any	m^3 (bbl)	
J-Tubes: No. and size		
I-Tubes: No. and size		
No. of pipeline crossings		
Surface air temperature	Min.: °C (°F) Max.: °C (°F)	
Surface water temperature	Min.: °C (°F) Max.: °C (°F)	
Seabed temperature	°C (°F)	

h) Downhole interface

	Description
Tubing size	OD: Weight: lbs/ft Material grade: Type of connection: Insulated: ☐no ☐yes Drift – Special requirements: Describe insulation if insulated:
Subsurface safety valve (SCSSV)	Manufacturer: Model: Size: Working pressure: Control pressure required: Comments on type:

i) Service life requirements

Subsea service life		Reusability	
Baseline	Options	Baseline	Options
☐ 20 yr design life	☐ Other specify:	☐ Do not reuse	☐ Refurbishment & reuse Specify:

j) Well intervention requirements

Type of intervention	Anticipated frequency (example: 1 time each 5 years)
Wireline intervention	
Coiled tubing intervention	
Pull tubing intervention	
Drilling riser-BOP, C/WO riser, wellhead foundation load design basis	

k) Select type of subsea tree

Type of tree	Water depth	Guidance for installation
☐ Vertical tree with tubing hanger completed in wellhead ☐ Vertical tree with tubing hanger completed in tubing head ☐ Horizontal ☐ Mudline suspension	☐ < 100 m (< 300 ft) ☐ 100 m to < 300 m (300 ft to < 1 000 ft) ☐ 300 m to < 915 m (1 000 ft to < 3 000 ft) ☐ 915 m to < 2 300 m (3 000 ft to < 7 550 ft) ☐ 2 300 m to < 3 050 m (7 550 ft to < 10 000 ft) ☐ > 3 050 m (> 10 000 ft)	☐ Diver operated or assist ☐ Diverless (ROV) ☐ Guideline (GL) ☐ Guidelineless (GLL) ☐ Funnel up (GLL) ☐ Funnel down (GLL) ☐ Guidelineless orientation, specify:

l) Tree location

Baseline	Options
☐ Single satellite well	☐ Daisy chained wells on common flowline or flowine pair ☐ Multi well cluster manifold application ☐ On template wells ☐ Off template well, but tree to be compatible with on template application

m) Industry specifications

	Baseline	Options
Production valve size	Production bore Specify:	
Annulus valve size	☐ 2"	☐ Other specify:
Working pressure rating	☐ 34,5 MPa (5 000 psi) ☐ 69,05 MPa (10 000 psi) ☐ 103,5 MPa (15 000 psi)	☐ Other specify:
PSL level (see Figure M.1 — PSL decision tree for subsea equipment)	☐ 2 ☐ 3 ☐ 3G	
Material class	Specify:	
Chlorides	☐ < 20 000 ppm	☐ 20 000 ppm to 50 000 ppm ☐ 50 000 ppm to 100 000 ppm Other specify:
Temperature class	Specify:	Other requirements: (J-T cooling, Material Impacts temperature, etc)
TFL (see ISO 13628-3)	☐ Not required	☐ Specify requirements:

n) Downhole interface

	Baseline	Options
Tubing size, OD	Specify:	
Min. vertical access bore size required through tree	Specify:	
Tubing material	Specify:	
Subsurface safety valve type, model, size, working pressure	Specify:	Description:
Total number of SCSSV control lines	☐1	☐2 ☐3 ☐4 ☐Other specify:
Total number of other downhole hydraulic control lines (e.g. for intelligent well completions)	☐0	☐1 ☐2 ☐Other: Specify function(s):
Total number of downhole chemical injection lines	☐0	☐1 ☐2 ☐3 ☐Other: Specify function(s):
Total number of downhole electrical lines	☐0	☐1 ☐2 ☐3 ☐Other: Specify function(s):
Total number of downhole optical lines	☐0	☐1 ☐2 ☐3 ☐Other: Specify function(s):

o) Tubing hanger for vertical tree

	Baseline	Options
Working pressure rating	☐Same as tree	☐Other specify:
Wireline plug model, type, size, and pressure rating for production bore	Specify:	
Wireline plug model, type, size, and pressure rating for annulus bore (if applicable)	Specify:	☐Other specify: (check valve, etc)
Bottom production tubing type, size of thread connection	Specify:	
Bottom annulus bore type, size of thread connection (if applicable)	Specify:	☐Isolation valve Specify: ☐Other specify: (plug catcher, open, etc.)
Min. dia. of production bore	Specify:	
Draft requirements	Specify:	
Min. "flow" dia. of annulus bore (if applicable)	☐Tubing head Specify: ☐Tubing hanger Specify:	☐Other specify:
Bottom connection for SCSSV line(s)	Specify:	
Bottom connection for downhole chemical line(s), if applicable	Specify:	
Bottom connection for other downhole hydraulic line(s), if applicable	Specify:	
Bottom connection for electrical line(s)	Specify:	
Bottom connection for optic line(s)	Specify:	

p) Tubing hanger for horizontal tree

	Baseline	Options
Working pressure rating	☐ Same as tree	☐ Other specify:
Wireline plug model, type, size, and pressure rating for production bore	Specify:	
Bottom production tubing type, size of thread connection	Specify:	
Min. dia. of production bore	Specify:	
Bottom connection for SCSSV line(s)	Specify:	
Bottom connection for downhole chemical line(s), if applicable	Specify:	
Bottom connection for other downhole hydraulic line(s), if applicable	Specify:	
Bottom connection for electrical line(s)	Specify:	
Bottom connection for optic line(s)	Specify:	

q) Hydraulic operating pressures for valves and chokes

	Baseline	Options
Max. control pressure required to operate SCSSV	Specify:	
Max. allowable control pressure that can be applied to SCSSV	Specify:	
Max. control pressure required to operate valve or choke	Specify:	
Max. allowable control pressure that can be applied to valve or choke actuator	Specify:	

f) Valves common to vertical and horizontal trees

Valve	Baseline	Size	Pressure	Operator	Override/ Position indicator
☐PMV	Fail-closed				Specify qty.:
☐PWV	Fail-closed				Specify qty.:
☐AMV	Fail-closed				Specify qty.:
☐AWV	Fail-closed				Specify qty.:
☐XOV	Fail-closed				Specify qty.:
☐XOV	Fail-open				Specify qty.:
☐ FIV (or PSOV)	Optional				Specify qty.:
☐CIT1	Optional ☐w/ check valve ☐w/out check valve				Specify qty.:
☐CITx	Optional ☐w/ check valve ☐w/out check valve				Specify qty:
☐CIDx	Optional Select backup valve: ☐w/ check valve ☐w/out check valve				Specify qty:
☐SV1	Needle valve			Diver or ROV	No position indicator
☐SVx	Optional needle valve(s)			Diver or ROV	No position indicator Specify qty:
☐HYDx	Optional needle valve(s)			Diver or ROV	No position indicator Specify qty:
☐TST	Needle valve			Diver or ROV	No position indicator

g) Valves unique to vertical trees

Valve	Baseline	Size	Pressure	Operator	Override/ Position indicator
☐PSV	Manual			Diver or ROV	Specify qty:
☐ASV	Manual			Diver or ROV	Specify qty:
☐THST	Optional needle valve for tubing head			Diver or ROV	No position indicator

i) Valves unique to horizontal trees

Valve	Baseline	Size	Pressure	Operator
☐ AAV	Fail-closed			Specify qty:
☐ Penetration isolation value(s)	Needle valve		Diver or ROV	No position indicator

ii) Tree mounted chokes

	Baseline	Options
Production (or injection) choke	☐ None ☐ Specify Cv:	Check all options required: ☐ Hydraulic operated ☐ Electric operated ☐ ROV operated (primary or override) ☐ Diver operated (primary or override) ☐ Insert retrievable ☐ Adjustable, specify steps: ☐ fixed orifice ☐ Visual position indicator ☐ Electronic position indicator (LVDT) ☐ Specify other requirements:
Production orifice valve (POV)	☐ None ☐ Specify Cv:	☐ Fail-open (full bore) ☐ Fail-closed (orifice) ☐ ROV operated (primary or override) ☐ Diver operated (primary or override) ☐ Fixed orifice size, specify: ☐ Value size, specify: ☐ Valve pressure rating, specify:
Gas lift choke	☐ None ☐ Specify Cv:	Check all options required: ☐ Hydraulic operated ☐ Electric operated ☐ ROV operated (primary or override) ☐ Diver operated (primary or override) ☐ Insert retrievable ☐ Adjustable, specify steps: ☐ fixed orifice ☐ Visual position indicator ☐ Electronic position indicator (LVDT) ☐ Specify other requirements:

ii) Flowline connection methods and external loading

	Baseline	Options
Diver assist tree	☐(17DSS) Swivel flange	☐Clamp hub ☐Specify other requirements:
Diverless tree	☐Vertical hub ☐Horizontal hub (fixed)	☐Vertical flange (fixed) ☐Horizontal flange (fixed) ☐Horizontal hub (tree piping moves to accommodate connection) ☐Stab and hinge over (jumper resident active connector) ☐Flexible pipe (see ISO 13628-11) ☐Specify other requirements:
Flowline load design basis		
Snag load protection	☐Not required	☐Provided at tree flowline connection ☐Provided at flowline sled or manifold connection ☐Provided in flowline ☐Other specify:
Define snag load design basis		
Dropped object protection	☐Not required	☐Provided at tree flowline connection ☐Provided at flowline sled or manifold connection ☐Provided in flowline ☐Other specify:
Dropped object protection load design basis		
Remediation of hydrates in connector	Specify:	

y) Sensors

	Baseline	Options
Downhole pressure and temperature (DHPT)	☐ Not required	☐ Required, specify vendor:
Production bore in tree	☐ Not required	☐ Pressure ☐ Temperature ☐ Other specify: (upstream/downstream of choke, etc.)
Annulus bore in tree	☐ Not required	☐ Pressure ☐ Temperature ☐ Other specify: (upstream/downstream of choke, etc.)
Production (or injection) choke position	☐ Not applicable	☐ Position sensing by LVDT ☐ Other specify:
Gas lift choke position	☐ Not applicable	☐ Position sensing by LVDT ☐ Other specify:
Erosion detector	☐ Not required	☐ Intrusive wear-rate sand detector ☐ Acoustic sand detector ☐ Other specify:
Sand detection	☐ Not required	☐ Intrusive wear-rate sand detector ☐ Acoustic sand detector ☐ Other specify:
Pig detector	☐ Not required	☐ Magnetic, non-intrusive ☐ Other specify:
Flow meter	☐ Not required	☐ Transmit data from flow meter ☐ Other specify:
Downhole sensors for intelligent well completion	☐ Not required	Specify:

z) Flow assurance

	Baseline	Options
Downhole chemical injection	☐ Not required	☐ Corrosion inhibitor: specify chemical, flowrate and injection point: ☐ Scale inhibitor: specify chemical, flowrate and injection point: ☐ Paraffin inhibitor: specify chemical, flowrate and injection point: ☐ Hydrate inhibitor: specify chemical, flowrate and injection point: ☐ Other, specify: type, chemical, flowrate and injection point:
Tree chemical injection	☐ Not required	☐ Corrosion inhibitor: specify chemical, flowrate and injection point: ☐ Scale inhibitor: specify chemical, flowrate and injection point: ☐ Paraffin inhibitor: specify chemical, flowrate and injection point: ☐ Hydrate inhibitor: specify chemical, flowrate and injection point: ☐ Other, specify: type, chemical, flowrate and injection point:
Gas lift	☐ Not required	☐ Required, specify: gas lift pressure: MPa (psi) flow rate: m^3/d (scfd) gas lift choke: ☐ yes ☐ no
Pigging	☐ Not required	☐ Round trip pigging through flowline sleds or manifold, not through tree or well jumpers ☐ Round trip pigging to tree ☐ Subsea pig- launching from flowline sled or manifold ☐ Subsea pig-launching from tree ☐ Other specify:
Insulation	☐ Not required	Check all that apply: ☐ Tree flowloops ☐ All pressure-containing bodies on tree ☐ Well jumpers from tree to flowline sled or manifold ☐ Manifold ☐ Flowline jumpers from manifold to flowline sled ☐ Other specify:
Insulation cool down	☐ Not applicable	☐ Cool down from °C (°F) to °C (°F) shall take at least hours

	Baseline	Options
Flowline heating	☐ Not required	☐ Hot oil circulation ☐ Electrical heating ☐ Other specify:

2.4 OPERATING LOADS

Requirement: API Specification 17D – Annex 5.1.1.5
The purchaser should confirm that anticipated operating loads are within the operating limits of the equipment being used for the specific application.

3.0 Design Requirements

3.1 MISCELLANEOUS EQUIPMENT

API Specification 17D – 5.1.2.1.8
The design of other equipment, such as running, retrieval and test tools, shall comply with the purchaser's/manufacturer's specifications.

3.2 NON-COVERED EQUIPMENT

API Specification 17D – 5.4.1
For those components not covered in ISO 10423, equipment-specific quality-control requirements shall comply with the manufacturer's written specifications. Purchaser and manufacturer should agree on any additional requirements.

3.3 ACTUATORS

API Specification 17D – 7.10.2.2.4
Position indicators shall be incorporated on all actuators unless otherwise agreed with purchaser. They shall clearly show valve position (open/close and full travel) for observation by diver/ROV. Where the actuator incorporates ROV override, consideration should be given to visibility of the position indicator from the working ROV.

3.4 SUBSEA TREE EQUIPMENT

API Specification 17D – 7.16.2
The purchaser shall specify the operating criteria necessary for the tree installation. The manufacturer shall document the operating limits for which the tree running/retrieval tool is designed.

3.5 CONTROL INTERFACE

API Specification 17D – 7.16.4.1
The tree running tool interfaces with the tree upper connection. This interface shall be designed for emergency release at a running string departure angle as specified by the manufacturer or purchaser. This release shall not cause any damage to the subsea tree such that prevents meeting any other performance requirement.

3.6 CONNECTORS

API Specification 17D – 7.16.4.1
For use with dynamically positioned rigs, it is particularly important that the connector have a high-angle release capability and that the connector can be quickly unlocked. In some systems, the EDP connector design can meet these requirements. The manufacturer and/or purchaser shall specify the angle and unlocking time.

3.7 CHOKES

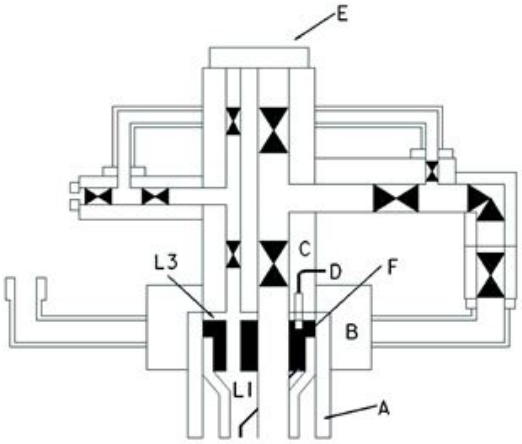
API Specification 17D – 7.21.2.14
The choke flow capacity is determined in accordance with requirements of ISA 75.01.01 and ISA 75.02 for anticipated or actual production flow rate and fluid conditions (pressures and temperature). The information shown in Annex M for purchasing guidelines shall be supplied to the choke manufacturer for the sizing of the choke.

4.0 Testing Requirements

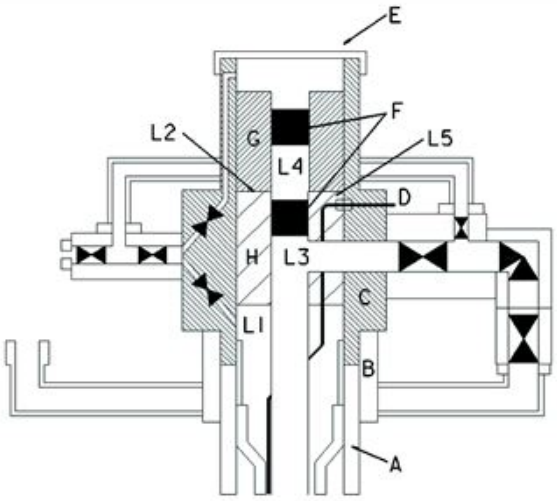
4.1 SUBSEA TREE EQUIPMENT

API Specification 17D – 6.3.2

Table 4 — Pressure test pictorial representations

Position	Description	RWP	Hydrostatic body test pressure	Lockdown retention test pressure
a) **Vertical subsea tree**				
				
A	Subsea wellhead	1,0 × RWP	1,5 × RWP	NA
B	Tubing head connector, Tubing head and tree connector	1,0 × RWP	1,5 × RWP	NA
C	Valves, valve block	1,0 × RWP	1,5 × RWP	NA
D	SCSSV flow passages and seal sub (pressure-containing)	1,0 × RWP up to RWP + 17,2 MPa (2 500 psi) max.	1,5 × RWP up to 1,5 × [RWP + 17,2 MPa (2 500 psi)]	NA
	SCSSV flow passages and seal sub (pressure-controlling)	1,0 × RWP up to RWP + 17,2 MPa (2 500 psi) max.	1,0 × RWP up to 1,0 × [(RWP + 17,2 MPa (2 500 psi)]	NA
E	Tree cap (passages and lock mechanism)	1,0 × RWP	1,5 × RWP	NA
F	Tubing hanger	1,0 × RWP	1,5 × RWP	NA
L1	Below installed tubing hanger	NA	NA	1,1 × RWP
L2 (not shown)	Above tubing plug	NA	NA	1,0 × RWP
	Below tubing plug	NA	NA	1,1 × RWP
L3	Gallery	1,0 × RWP up to RWP + 17,2 MPa (2 500 psi) max.	NA	NA

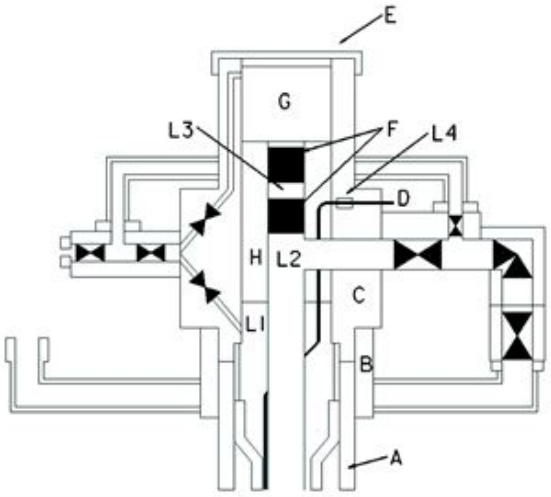
b) **Horizontal subsea tree with separate internal tree cap**



Position	Description	RWP	Hydrostatic body test pressure	Lockdown retention test pressure
A	Subsea wellhead	1,0 × RWP	1,5 × RWP	NA
B	Tree connector	1,0 × RWP	1,5 × RWP	NA
C	Valves, valve block	1,0 × RWP	1,5 × RWP	NA
D	SCSSV flow passages and seal sub (pressure-containing)	1,0 × RWP up to RWP + 17,2 MPa (2 500 psi) max.	1,5 × RWP up to 1,5 × [RWP + 17,2 MPa (2 500 psi)]	NA
	SCSSV flow passages and seal sub (pressure-controlling)	1,0 × RWP up to RWP + 17,2 MPa (2 500 psi) max.	1,0 × RWP up to 1,0 × [RWP + 17,2 MPa (2 500 psi)]	NA
E	Debris cap	PMR	PMR	NA
F	Crown plugs	1,0 × RWP	1,5 × RWP	NA
G	Internal tree cap	1,0 × RWP	1,5 × RWP	NA
H	Tubing hanger	1,0 × RWP	1,5 × RWP	NA
L1	Below installed tubing hanger	NA	NA	1,5 × RWP
L2	Below internal tree cap	NA	NA	1,5 × RWP
L3	Above lower crown plug[a]	NA	NA	1,0 × RWP
	Below lower crown plug[a]	NA	NA	1,5 × RWP
L4	Above upper crown plug	NA	NA	1,0 × RWP
	Below upper crown plug[a]	NA	NA	1,5 × RWP
L5	Gallery	1,0 × RWP up to RWP + 17,2 MPa (2 500 psi) max.	NA	NA

[a] If a lower crown plug is in place during the upper-crown-plug test from below, then the lower crown plug shall be pressure-equalized from above and below the lower crown plug during the test.

c) **Horizontal subsea tree without separate internal tree cap**



Position	Description	RWP	Hydrostatic body test pressure	Lockdown retention test pressure
A	Subsea wellhead	1,0 × RWP	1,5 × RWP	NA
B	Tree connector	1,0 × RWP	1,5 × RWP	NA
C	Valves, valve block	1,0 × RWP	1,5 × RWP	NA
D	SCSSV flow passages and seal sub (pressure-containing)	1,0 × RWP up to RWP + 17,2 MPa (2 500 psi) max.	1,5 × RWP up to 1,5 × [RWP + 17,2 MPa (2 500 psi)]	NA
	SCSSV flow passages and seal sub (pressure-controlling)	1,0 × RWP up to RWP + 17,2 MPa (2 500 psi) max.	1,0 × RWP up to 1,0 × [RWP + 17,2 MPa (2 500 psi)]	NA
E	Debris cap	PMR	PMR	NA
F	Crown plugs	1,0 × RWP	1,5 × RWP	NA
G	ROV tree cap	PMR	PMR	NA
H	Tubing hanger	1,0 × RWP	1,5 × RWP	NA
L1	Below installed tubing hanger	NA	NA	1,5 × RWP
L2	Above lower crown plug[a]	NA	NA	1,0 × RWP
	Below lower crown plug[a]	NA	NA	1,5 × RWP
L3	Above upper crown plug	NA	NA	1,0 × RWP
	Below upper crown plug[a]	NA	NA	1,5 × RWP
L4	Gallery	1,0 × RWP up to RWP + 17,2 MPa (2 500 psi) max.	NA	NA

[a] If a lower crown plug is in place during the upper-crown-plug test from below, then the lower crown plug shall be pressure-equalized from above and below the lower crown plug during the test.

4.2 SUBSEA TREE ASSEMBLIES

API Specification 17D – 6.3.5
Any disassembly, removal or replacement of parts or equipment after testing shall be as agreed with the purchaser.

4.3 SUBSEA TREE PIPING

API Specification 17D – 7.17.2.5
The manufacturer shall document the ability to pig tree piping where such piping is intended to be piggable. Demonstration of the piggability of the intended piping shall be agreed to by the purchaser and manufacturer.

4.4 SUBSEA TREE CONTROL INTERFACES

4.4.1 API Specification 17D – Annex L
If agreed between the purchaser and manufacturer, the hyperbaric test medium should be maintained at 4 °C ± 5 °C (40 °F ± 10 °F) throughout the test.

4.4.2 API Specification 17D – Annex L
If agreed between the manufacturer and purchaser, the hyperbaric functional test cycles may be in addition to life-cycle endurance testing and temperature cycling, such as that specified in ISO 10423, Annex F, for PR2. For example, a valve and actuator assembly may be subjected to a total of 400 functional cycles, of which 200 are hyperbaric as described in this annex, and 200 are as described in ISO 10423, Annex F, PR2, including 20 cycles at maximum rated temperature and at minimum rated temperature.

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5.0 Storage and Preservation Requirements

5.1 SUBSEA TREE EQUIPMENT

5.1.1 API Specification 17D – 5.1.2.2.4

If subsea equipment will be stored or tested on the surface at temperatures outside of its temperature rating, then the manufacturer should be contacted to determine if special storage or surface-testing procedures are recommended.

5.1.2 API Specification 17D – 5.6.10

Storage and preservation requirements for equipment after delivery to the user is beyond the scope of this part of ISO 13628. The manufacturer shall provide recommendations for storage to the user upon request.

5.2 SUBSEA TREE CONTROL INTERFACES

API Specification 17D – 7.20.3.2

After assembly, all tubing runs and hydraulically actuated equipment shall be flushed to meet the cleanliness requirements of SAE/AS 4059. The class of cleanliness shall be as agreed between the manufacturer and purchaser.

6.0 Shipping Requirements

6.1 SUBSEA TREE EQUIPMENT

API Specification 17D – 5.6.1
Prior to shipment, the total shipment including hydraulic lines shall be flushed and filled in accordance with the manufacturer's written specification. Exposed hydraulic end fittings shall be capped or covered. All pressure shall be bled from equipment, unless otherwise agreed between the manufacturer and purchaser.

7.0 Documentation Requirements

7.1 SUBSEA TREE EQUIPMENT, SUBSEA WELLHEAD EQUIPMENT, MUDLINE SUSPENSION SYSTEM EQUIPMENT, DRILL THROUGH MUDLINE SUSPENSION SYSTEM EQUIPMENT, TUBING HANGER SYSTEM EQUIPMENT, MISCELLANEOUS EQUIPMENT

7.1.1 API Specification 17D – 5.1.5

All design requirements shall be recorded in a manufacturer's specification, which shall reflect the requirements of this part of ISO 13628, the purchaser's specification or manufacturer's own requirements. The manufacturer's specification may consist of text, drawings, computer files, etc.

7.1.2 API Specification 17D – 5.1.5

The manufacturer shall define additional validation tests that are applicable and demonstrate that this validation testing can be correlated with the intended service life and/or operating conditions in accordance with the purchaser requirements