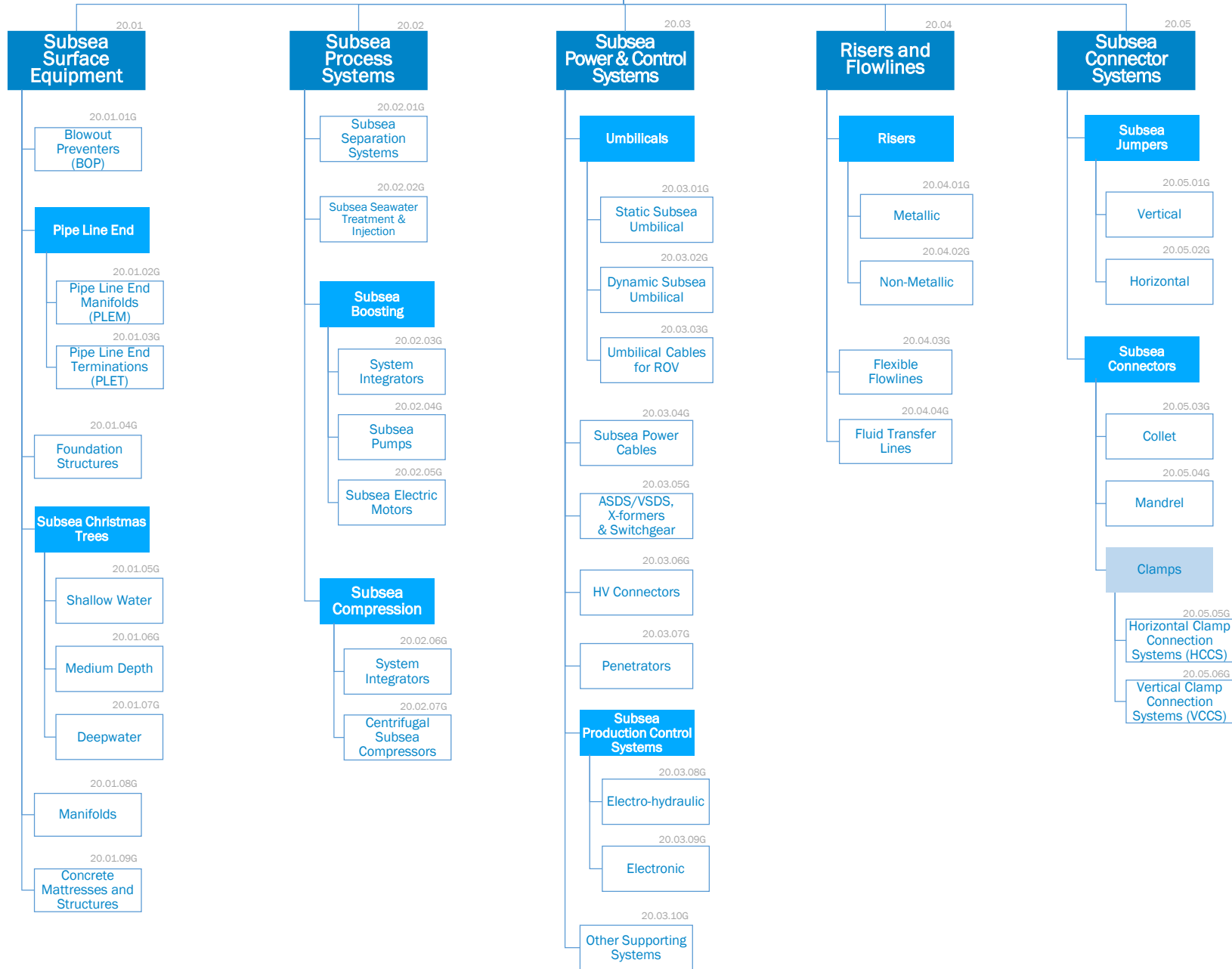


Subsea Equipment



Subsea Equipment

This Group of Categories covers a wide range of subsea equipment and technologies that are required to develop offshore Oil&Gas fields. The range of applications vary across varying pressure, temperature and water depth requirements and are driven by the complexities of the subsea environment.

A constant effort is ongoing in developing technologies to increase oil recovery for mature projects and to develop new projects that may otherwise be considered economically unviable or inaccessible. A new generation of standardized subsea production equipment and systems is underway, especially for deepwater applications.

This Group is characterized by a small number of large international players. In fact, different segments require different and sophisticated technology, creating a "winner-takes-all" market.

MAIN RATIONALES BEHIND THE STANDARD CATEGORIZATION

Subsea Surface Equipment

- The competition across these Family changes mainly on the basis of the water depth. For the purposes of this Standard Categorization, the following water depth apply:
 - Shallow water is up to 100 m
 - Medium depth is 100-750 m
 - Deepwater is above 750 m
- Blowout Preventers (BOP) – ram type of annular type - are used to seal, control and monitor wells to prevent blowout, the uncontrolled release of Oil&Gas from well. They are usually installed redundantly in stacks.
 - The terms Blowout Preventer, Blowout Preventer Stack and Blowout Preventer System are used interchangeably;
 - Main components are: electrical and hydraulic lines, control pods, hydraulic accumulators, test valve, kill and choke lines valves, riser joint, hydraulic connectors, support frame.
- Subsea Christmas Trees are the primary means of flow control for subsea wells. They are not "wellhead" as sometimes incorrectly referred to.
 - Different types of Subsea Christmas Trees are typically manufactured by all types of players:
 - Horizontal vs Traditional tree
 - Mono Bore, Dual Bore, Full Bore Tree
 - Diverless
 - Main components are: Valves, Controls equipment, Structural material, Fittings and flanges.
 - Mechanical and hydraulic Subsea Christmas Trees are increasingly replaced by electric.
- Subsea Manifolds and Templates allow produced fluid to be commingled or diverted and allow injection fluids to be distributed to desired flow paths.
 - Main components are: Valves, Piping, Controls equipment, Structural material, Fittings and flanges.
 - They cover both Internal or External Pigging Loops
- Foundation Structures refer to subsea structures only, and not – for example – to Offshore Wind Farm structures.

Subsea Process Systems

- Subsea Production System (SPS) are based on "packages" of complex components and require advanced technology.
 - Even higher reliability is required as oil exploration site goes deeper into sea, thus heightening the entry barrier. Therefore, the market is consolidated, with the top 4 players holding 80%+ market share.
- Subsea Processing and Compression systems have multiple functions:
 - Separate produced fluid into different phases debottlenecking flowline, risers and topsides;
 - Separate produced water at the wells and re-inject it underground for disposal, saving energy to transport unnecessary water to surface;
 - Boost the pressure for long distance facilities.
- Subsea seawater injection refers to only those projects utilizing a subsea pump to inject seawater and does not include typical water injection using a pump on a topside facility.

Subsea Power & Control Systems

- Dependable power supply and distribution is vital for production facilities on the seabed, together with efficient communication. Subsea HV & AC/DC Power and Control Systems:
 - ensure the power and control of the Subsea Production Systems for safe and efficient operations;
 - receive feedback from components ion indicating various process parameters
- The umbilical delivers power, chemical and control signals via subsea equipment.
- The technology development trend is for faster subsea communication through fiber optics.
- Most commonly used is the electro-hydraulic multiplexed system.

- Riser, flowlines, fluid transfer lines and jumpers are critical to offshore oil and gas production systems. They are subject to extreme temperatures, pressures, physical stresses and corrosive materials - yet must still ensure reliable connections and optimal product flow.
- Risers are dynamic lines suspended in the water column connecting production facilities to subsea infrastructure; Risers deliver Oil&Gas extracted from sea bed to above sea.
- Flowlines are static pipelines used to carry fluids on the seabed.
- Fluid transfer lines are typically large diameter pipelines connecting two structures which are often dynamic.
- Technology development focus is now on increasingly temperature and pressure resistant Risers.

Subsea Connector Systems

- Jumpers are short lengths of pipe connecting two fixed structures either above or below water:
 - Vertical and Horizontal Jumpers can be either Rigid Jumpers and Tie-In spools.
- Collet connectors are used for both integral and non-integral connection systems.