

Postgraduate Certificate in Advanced Subsea Engineering for Oil and Gas

Advanced Subsea Umbilicals

Advanced Subsea Umbilicals are critical components in subsea oil and gas production systems, connecting surface facilities to underwater equipment such as blow-out preventers, manifolds, and wellheads. The umbilicals transmit various services, including electrical power, hydraulic fluids, chemicals, and communication signals, to ensure safe and efficient subsea operations. This explanation covers key terms and vocabulary related to Advanced Subsea Umbilicals in the Postgraduate Certificate in Advanced Subsea Engineering for Oil and Gas.

1. **Umbilical:** An umbilical is a cable or hose that connects a subsea system to a surface facility. It typically consists of a combination of electrical, hydraulic, and fiber-optic components.
2. **Electrical Umbilicals:** Electrical umbilicals transmit power and control signals between surface facilities and subsea equipment. They consist of insulated copper or aluminum wires that protect against electrical interference and ensure reliable power transmission.
3. **Hydraulic Umbilicals:** Hydraulic umbilicals transmit hydraulic fluids to subsea equipment, such as actuators, valves, and pumps. They consist of high-pressure hoses that can withstand extreme pressures and temperatures.
4. **Fiber-Optic Umbilicals:** Fiber-optic umbilicals transmit communication signals between surface facilities and subsea equipment. They consist of optical fibers that can transmit large amounts of data at high speeds.
5. **Steel Tube Umbilicals:** Steel tube umbilicals are used to transmit fluids, such as methanol or glycol, to prevent hydrate formation or provide chemical injection. They can withstand high pressures and temperatures, making them suitable for deepwater applications.
6. **Thermoplastic Umbilicals:** Thermoplastic umbilicals are used in shallow water applications where high pressure is not a concern. They are lighter and more flexible than steel tube umbilicals, making them easier to handle and install.
7. **Centralizers:** Centralizers are used to maintain the umbilical's position in the center of a wellbore, ensuring proper functioning and preventing damage to the umbilical.
8. **Tensioners:** Tensioners are used to maintain the umbilical's tension during installation and operation, preventing damage to the umbilical.
9. **Terminations:** Terminations are the connection points between the umbilical and subsea equipment or surface facilities. They consist of electrical, hydraulic, and fiber-optic connectors.
10. **ROVs (Remotely Operated Vehicles):** ROVs are used to install and maintain subsea umbilicals. They are equipped with cameras, manipulator arms, and other tools to perform various tasks.
11. **IWOCS (Intervention Workover Control Systems):** IWOCS are used to control and monitor subsea equipment during drilling, completion, and workover operations. They consist of a control panel, umbilical, and ROV.

12. Topside Installation: Topside installation refers to the process of installing the umbilical on the surface facility, such as a drilling rig or production platform.
13. Laying: Laying refers to the process of installing the umbilical on the seabed. It involves lowering the umbilical from the surface facility to the seabed while maintaining proper tension and positioning.
14. Pre-lay Survey: A pre-lay survey is conducted before installing the umbilical to map the seabed and identify any potential hazards, such as rocks or other obstructions.
15. Post-lay Inspection: A post-lay inspection is conducted after installing the umbilical to ensure proper placement and positioning, as well as to identify any damage or defects.
16. Cure Stages: Cure stages refer to the process of curing the umbilical's components, such as the steel tubes, hydraulic hoses, or electrical wires, to ensure proper bonding and strength.
17. Testing: Testing refers to the process of verifying the umbilical's functionality and performance, such as electrical continuity, hydraulic pressure, or fiber-optic communication.
18. Repair: Repair refers to the process of fixing any damage or defects in the umbilical, such as replacing a damaged hydraulic hose or electrical wire.
19. Maintenance: Maintenance refers to the ongoing care and upkeep of the umbilical, including inspections, cleaning, and lubrication.
20. Decommissioning: Decommissioning refers to the process of removing the umbilical and other subsea equipment at the end of its useful life.

Examples:

- * A deepwater subsea system requires a steel tube umbilical to transmit methanol to prevent hydrate formation.
- * An ROV is used to install a fiber-optic umbilical on a shallow water wellhead.
- * A post-lay inspection identifies a damaged hydraulic hose in an electrical umbilical, requiring repair.

Practical Applications:

- * Selecting the appropriate umbilical for a specific subsea application, based on factors such as water depth, pressure, temperature, and required services.
- * Designing and installing umbilicals to ensure proper positioning, tensioning, and protection against damage.
- * Testing and maintaining umbilicals to ensure reliable performance and longevity.

Challenges:

- * Installing and maintaining umbilicals in deepwater or harsh environments, where high pressures, temperatures, and other factors can pose significant challenges.
- * Ensuring the compatibility and interoperability of different umbilical components, such as electrical wires, hydraulic hoses, and fiber-optic cables.
- * Addressing the complexity and cost of umbilical design, installation, and maintenance, particularly for

large or complex subsea systems.

In conclusion, Advanced Subsea Umbilicals are a critical component of subsea oil and gas production systems, requiring a deep understanding of key terms and vocabulary, as well as practical applications and challenges. By mastering these concepts, engineers can design, install, and maintain subsea umbilicals that ensure safe and efficient subsea operations.