Professional Certificate in Subsea Engineering for Oil and Gas

Subsea Inspection and Maintenance

Subsea Inspection and Maintenance Key Terms and Vocabulary

Subsea inspection and maintenance are critical components of the oil and gas industry, ensuring the safety, efficiency, and longevity of subsea assets. To navigate this complex field effectively, it is essential to understand key terms and vocabulary associated with subsea engineering. Below is an extensive explanation of essential terms in the realm of subsea inspection and maintenance.

1. Subsea Engineering
Subsea engineering involves the design, construction, installation, and maintenance of underwater structures and equipment for the oil and gas industry. It encompasses a wide range of disciplines, including mechanical, electrical, civil, and marine engineering, to operate in harsh underwater environments.

2. Subsea Inspection
Subsea inspection refers to the process of visually assessing the condition of underwater infrastructure, such as pipelines, risers, and subsea equipment. Inspections are crucial for identifying defects, corrosion, and structural damage that could compromise the integrity of assets.

3. Subsea Maintenance
Subsea maintenance involves activities performed to ensure the proper functioning and longevity of subsea equipment and structures. This includes repairs, replacements, and upgrades to address issues identified during inspections and prevent future failures.

4. ROV (Remotely Operated Vehicle)
ROVs are unmanned underwater vehicles controlled by operators on the surface. They are equipped with cameras, sensors, and manipulator arms to perform subsea inspections and maintenance tasks in challenging underwater environments.

5. AUV (Autonomous Underwater Vehicle)
AUVs are self-propelled, untethered underwater vehicles that operate autonomously to collect data and perform tasks without direct human intervention. They are used for mapping seabeds, conducting surveys, and gathering environmental data in subsea operations.

6. Pipeline Inspection Gauge (PIG)
PIGs are devices inserted into pipelines to inspect for defects, measure wall thickness, and clean the pipeline interior. They can be equipped with various sensors to detect anomalies such as corrosion, cracks, or blockages in subsea pipelines.

7. Cathodic Protection
Cathodic protection is a technique used to prevent corrosion on metal surfaces by making the protected metal the cathode in a corrosion cell. This method is commonly employed in subsea environments to

extend the life of pipelines, structures, and equipment.

8. Corrosion Monitoring
Corrosion monitoring involves the continuous assessment of metal degradation in subsea assets. Various techniques, such as corrosion coupons, electrical resistance probes, and ultrasonic thickness measurements, are used to detect and quantify corrosion rates.

9. Non-Destructive Testing (NDT)
NDT is a group of techniques used to evaluate the integrity of materials and components without causing damage. Common NDT methods in subsea inspection include ultrasonic testing, magnetic particle testing, radiography, and visual inspection.

10. Structural Integrity
Structural integrity refers to the ability of a component or structure to withstand external loads and environmental conditions while maintaining its functionality and safety. Subsea assets must undergo regular inspections to ensure their structural integrity is maintained.

11. Fatigue Analysis
Fatigue analysis is the assessment of the potential for failure in materials subjected to cyclic loading. In subsea environments, structures are exposed to fluctuating stresses from waves, currents, and operational loads, making fatigue analysis crucial for predicting asset lifespan.

12. Subsea Pigging
Subsea pigging involves the use of PIGs to clean, inspect, and maintain subsea pipelines. This process helps remove debris, scale, and buildup inside pipelines, improving flow efficiency and preventing corrosion and blockages.

13. Subsea Umbilical
Subsea umbilicals are cables or hoses that provide power, communication, and control functions to subsea equipment, such as valves, sensors, and control systems. They are essential for maintaining connectivity between surface facilities and subsea installations.

14. Risk-Based Inspection (RBI)
RBI is a methodology used to prioritize inspection activities based on the risk of failure, consequences of failure, and the likelihood of detection. This approach helps optimize inspection schedules and resources in subsea operations.

15. Subsea Wellhead
A subsea wellhead is the component at the top of an underwater well that provides a mechanical connection between the wellbore and the surface facilities. Wellheads are critical for controlling the flow of hydrocarbons and ensuring safe drilling operations in subsea environments.

16. Subsea Control Systems
Subsea control systems are equipment used to operate and monitor subsea valves, chokes, and other components remotely from the surface. These systems enable operators to control production, injection,

and safety functions in subsea fields.

17. Subsea Tree
A subsea tree is an assembly of valves and sensors installed on a wellhead to control the flow of hydrocarbons from the reservoir to the surface. Trees are essential components of subsea production systems, allowing for the isolation and regulation of well fluids.

18. Subsea Tieback
A subsea tieback is a connection between an existing offshore platform or facility and a new subsea well or field. Tiebacks enable the production of additional reserves without the need for new surface infrastructure, reducing costs and environmental impact.

19. Integrity Management
Integrity management is a systematic approach to ensuring the reliability, safety, and performance of subsea assets throughout their lifecycle. This process involves risk assessment, inspection planning, maintenance strategies, and compliance with regulatory requirements.

20. Subsea Pig Launcher/Receiver
A subsea pig launcher/receiver is a device used to launch PIGs into subsea pipelines for inspection and maintenance purposes. These systems allow for the safe and efficient deployment of PIGs from surface vessels to subsea infrastructure.

21. Subsea Compression
Subsea compression is a technology used to increase the pressure of hydrocarbons on the seabed to enhance production rates in subsea fields. This method eliminates the need for costly topside compression facilities, enabling efficient recovery of reserves.

22. Subsea Flow Assurance
Subsea flow assurance involves managing the flow of hydrocarbons from the reservoir to production facilities to prevent blockages, hydrate formation, and wax deposition. Flow assurance strategies ensure uninterrupted production and optimize asset performance.

23. Well Integrity
Well integrity refers to the condition of a wellbore and its components to prevent leaks, blowouts, and environmental contamination. Monitoring well integrity is essential in subsea operations to ensure the safety and reliability of production wells.

24. Subsea Well Intervention
Subsea well intervention involves activities performed to maintain, repair, or enhance the performance of subsea wells. Interventions may include wireline operations, hydraulic workovers, and coiled tubing interventions to address wellbore issues and optimize production.

25. Subsea Asset Management
Subsea asset management encompasses the planning, monitoring, and optimization of subsea equipment and infrastructure to maximize value and minimize risks. Effective asset management strategies enhance

operational efficiency and extend the life of subsea assets.

26. Subsea Inspection Class (IC)
Subsea Inspection Class (IC) is a classification system that defines the inspection requirements based on the criticality and risk associated with subsea assets. IC levels range from IC1 (highest risk) to IC4 (lowest risk), guiding inspection planning and frequency.

27. Subsea Pigging Campaign
A subsea pigging campaign is a series of pigging operations conducted to inspect, clean, or maintain multiple subsea pipelines or flowlines. Campaigns are planned based on asset condition, operational needs, and maintenance schedules to optimize pigging activities.

28. Subsea Corrosion Protection
Subsea corrosion protection involves applying coatings, inhibitors, and cathodic protection systems to prevent or mitigate corrosion on subsea equipment and structures. Effective corrosion protection measures extend asset life and reduce maintenance costs.

29. Subsea Inspection Report
A subsea inspection report documents the findings, recommendations, and observations from underwater inspections of subsea assets. These reports provide crucial information for asset integrity management, decision-making, and regulatory compliance.

30. Subsea Inspection Tooling
Subsea inspection tooling refers to specialized equipment and tools used to conduct underwater inspections of subsea infrastructure. These tools include cameras, sensors, crawlers, and manipulators designed to access and assess hard-to-reach areas in subsea environments.

31. Subsea Remote Monitoring
Subsea remote monitoring involves using sensors, cameras, and communication systems to monitor subsea assets and conditions in real-time from onshore or offshore facilities. Remote monitoring enhances situational awareness, early detection of issues, and proactive maintenance planning.

32. Subsea Life Extension
Subsea life extension involves implementing strategies and interventions to prolong the operational life of aging subsea assets beyond their original design life. Life extension measures include repairs, upgrades, and integrity assessments to ensure continued asset performance.

33. Subsea Inspection Regime
A subsea inspection regime is a structured program that outlines the frequency, scope, and methods of inspecting subsea assets to maintain their integrity and performance. Inspection regimes are tailored to asset types, operating conditions, and regulatory requirements.

34. Subsea Valve Actuators
Subsea valve actuators are devices used to open, close, and control valves on subsea equipment remotely. Actuators can be hydraulic, pneumatic, or electrically operated, enabling operators to regulate flow,

pressure, and safety functions in subsea systems.

35. Subsea Pipeline Integrity
Subsea pipeline integrity refers to the condition and performance of underwater pipelines to transport hydrocarbons from production wells to processing facilities. Pipeline integrity management includes inspections, repairs, and monitoring to prevent leaks and ensure safe operations.

36. Subsea Corrosion Monitoring System
A subsea corrosion monitoring system consists of sensors, probes, and data acquisition devices installed on subsea assets to measure corrosion rates and conditions. These systems provide real-time data for assessing asset integrity, predicting failures, and optimizing maintenance activities.

37. Subsea Inspection Campaign
A subsea inspection campaign involves a series of planned inspections conducted on subsea assets within a specified timeframe to assess their condition and performance. Inspection campaigns are scheduled based on asset criticality, operational needs, and regulatory requirements.

38. Subsea Integrity Management System
A subsea integrity management system is a comprehensive framework that integrates risk assessment, inspection planning, maintenance strategies, and regulatory compliance to ensure the reliability and safety of subsea assets. These systems optimize asset performance and minimize operational risks.

39. Subsea Corrosion Control Measures
Subsea corrosion control measures include protective coatings, sacrificial anodes, corrosion inhibitors, and impressed current systems to prevent or mitigate corrosion on underwater structures. Effective corrosion control measures extend asset life and reduce maintenance costs.

40. Subsea Inspection Data Management
Subsea inspection data management involves collecting, storing, and analyzing inspection data from subsea assets to track trends, identify anomalies, and make informed decisions on maintenance strategies. Data management systems facilitate asset integrity assessments and regulatory compliance.

41. Subsea Pig Tracking System
A subsea pig tracking system is a technology that monitors the movement and location of PIGs inside subsea pipelines during pigging operations. These systems provide real-time tracking data to ensure the successful completion of inspection and maintenance tasks.

42. Subsea Equipment Integrity
Subsea equipment integrity refers to the ability of subsea components, such as valves, connectors, and controls, to perform their intended functions safely and reliably in underwater environments. Monitoring equipment integrity is essential to prevent failures and ensure operational efficiency.

43. Subsea Corrosion Monitoring Techniques
Subsea corrosion monitoring techniques include coupon tests, electrical resistance probes, ultrasonic thickness measurements, and corrosion rate sensors to assess the corrosion levels on underwater structures.

These techniques help identify corrosion hotspots and prioritize maintenance activities.

44. Subsea Inspection Planning
Subsea inspection planning involves developing a comprehensive strategy to schedule, prioritize, and execute inspections on subsea assets. Planning considerations include asset criticality, operational impact, regulatory requirements, and available resources to optimize inspection effectiveness.

45. Subsea Pigging System Design
Subsea pigging system design includes selecting the appropriate PIG type, launching and receiving equipment, tracking systems, and inspection tools to conduct efficient and effective pigging operations on subsea pipelines. Well-designed pigging systems improve asset integrity and performance.

46. Subsea Corrosion Risk Assessment
Subsea corrosion risk assessment involves evaluating the likelihood and consequences of corrosion failures on underwater structures and equipment. Risk assessments help prioritize corrosion control measures, inspection frequencies, and maintenance activities to mitigate potential risks.

47. Subsea Inspection Technology
Subsea inspection technology encompasses a range of tools and equipment used to assess the condition of underwater assets, including cameras, sensors, crawlers, and drones. Advanced inspection technologies enhance data quality, accessibility, and efficiency in subsea operations.

48. Subsea Pigging Operation
A subsea pigging operation involves launching a PIG into a pipeline to remove debris, inspect for defects, or maintain the pipeline integrity. Pigging operations are essential for ensuring efficient flow, preventing blockages, and extending the life of subsea pipelines.

49. Subsea Corrosion Management Plan
A subsea corrosion management plan outlines the strategies, procedures, and controls implemented to prevent, monitor, and mitigate corrosion on underwater structures. Corrosion management plans aim to optimize asset integrity, performance, and lifespan in subsea environments.

50. Subsea Inspection Program
A subsea inspection program is a systematic approach to planning, executing, and evaluating inspections on subsea assets to ensure their integrity and compliance with industry standards. Inspection programs are tailored to asset types, operational conditions, and regulatory requirements.

51. Subsea Pigging Tool
A subsea pigging tool is a device inserted into pipelines to clean, inspect, or maintain the interior surface and condition of the pipeline. Pigging tools vary in design, size, and functionality to address specific pipeline requirements and operational objectives.

52. Subsea Corrosion Monitoring Plan
A subsea corrosion monitoring plan outlines the methods, locations, and frequencies of monitoring corrosion levels on underwater structures and equipment. Monitoring plans help identify corrosion trends,

predict failures, and optimize maintenance activities to prevent asset degradation.

53. Subsea Inspection Methodology
Subsea inspection methodology defines the approach, techniques, and procedures used to assess the condition of subsea assets during inspections. Methodologies may include visual inspections, NDT methods, remote monitoring, and data analysis to evaluate asset integrity and performance.

54. Subsea Pigging Operation Procedure
A subsea pigging operation procedure details the steps, safety measures, and equipment requirements for conducting pigging operations on subsea pipelines. Procedures ensure the efficient and safe execution of pigging activities to maintain asset integrity and prevent operational disruptions.

55. Subsea Corrosion Monitoring Program
A subsea corrosion monitoring program establishes a framework for monitoring, analyzing, and responding to corrosion threats on underwater structures. Monitoring programs help assess corrosion risks, prioritize mitigation measures, and optimize maintenance strategies to protect subsea assets.

56. Subsea Inspection Data Analysis
Subsea inspection data analysis involves interpreting, evaluating, and reporting inspection findings to assess the condition and integrity of subsea assets. Data analysis helps identify defects, trends, and anomalies for informed decision-making on maintenance actions and asset management.

57. Subsea Pigging Operation Guidelines
Subsea pigging operation guidelines provide best practices, recommendations, and standards for conducting pigging operations on subsea pipelines. Guidelines ensure the safe, efficient, and effective execution of pigging activities to maintain pipeline integrity and optimize flow performance.

58. Subsea Corrosion Monitoring System Installation
Subsea corrosion monitoring system installation involves deploying sensors, probes, and data acquisition devices on underwater structures to measure corrosion rates and conditions. Proper installation ensures accurate data collection, monitoring effectiveness, and asset protection in subsea environments.

59. Subsea Inspection Data Reporting
Subsea inspection data reporting involves documenting and communicating inspection findings, recommendations, and observations to stakeholders and regulatory authorities. Inspection reports provide critical information for asset management, decision-making, and compliance with industry standards.

60. Subsea Pigging Operation Safety
Subsea pigging operation safety focuses on implementing procedures, controls, and precautions to ensure the safety of personnel and equipment during pigging activities on subsea pipelines. Safety measures include risk assessments, equipment checks, and emergency response protocols to prevent accidents and incidents.

61. Subsea Corrosion Monitoring System Maintenance
Subsea corrosion monitoring system maintenance involves inspecting, calibrating, and replacing sensors

and probes to ensure the accuracy and reliability of corrosion data. Regular maintenance extends the lifespan of monitoring systems and enhances their performance in subsea applications.

62. Subsea Inspection Data Management System
A subsea inspection data management system is a software platform that collects, stores, and analyzes inspection data from subsea assets to facilitate decision-making and asset management. Data management systems streamline data processing, reporting, and compliance in subsea operations.

63. Subsea Pigging Operation Efficiency
Subsea pigging operation efficiency focuses on optimizing the performance, effectiveness, and cost-effectiveness of pigging activities on subsea pipelines. Efficient pigging operations enhance flow rates, prevent blockages, and minimize downtime to maximize asset productivity and longevity.

64. Subsea Corrosion Monitoring System Integration
Subsea corrosion monitoring system integration involves incorporating corrosion data into asset management systems to enhance decision-making and maintenance planning. Integration allows for real-time monitoring, analysis, and reporting of corrosion risks to protect subsea assets effectively.

65. Subsea Inspection Data Validation
Subsea inspection data validation ensures the accuracy, completeness, and reliability of inspection findings before making decisions on maintenance actions or asset integrity. Validation processes verify data integrity, consistency, and relevance to support effective asset management in subsea environments.

66. Subsea Pigging Operation Optimization
Subsea pigging operation optimization aims to improve the efficiency, performance, and outcomes of pigging activities on subsea pipelines. Optimization strategies include pig selection, scheduling, and execution to enhance flow assurance, prevent corrosion, and extend pipeline life.

67. Subsea Corrosion Monitoring System Calibration
Subsea corrosion monitoring system calibration involves adjusting sensors and probes to ensure accurate and consistent measurement of corrosion rates on underwater structures. Calibration procedures maintain data integrity, reliability, and relevance for effective corrosion management in subsea applications.

68. Subsea Inspection Data Interpretation
Subsea inspection data interpretation involves analyzing, evaluating, and deriving insights from inspection findings to assess the condition and integrity of subsea assets. Data interpretation helps identify defects, trends, and risks for informed decision-making