
Global Certificate in Subsea Engineering

Well Control

Well Control is a critical aspect of the oil and gas industry, ensuring the prevention of uncontrolled release of oil or gas from a well. It involves the use of various barriers, equipment, and procedures to control the pressure in the well and ensure safe drilling and production operations.

Here are some key terms and vocabulary related to Well Control in the context of the Global Certificate in Subsea Engineering:

1. **Blowout Preventer (BOP):** A large mechanical device installed at the top of a well to prevent the uncontrolled release of oil or gas. It consists of a series of rams that can be closed around the drill pipe or casing to seal off the wellbore.
2. **Kick:** An unexpected influx of fluid or gas into the wellbore during drilling operations. A kick can lead to a blowout if not properly controlled.
3. **Drilling mud:** A dense fluid used to circulate through the drill string and maintain wellbore pressure during drilling operations. It also serves to cool the drill bit and remove cuttings from the wellbore.
4. **Shut-in:** The process of closing the BOP and stopping the flow of drilling mud and fluid in the wellbore. This is done to prevent a blowout or to control a kick.
5. **Pressure control:** The management of wellbore pressure to prevent a blowout or to control a kick. This involves monitoring drilling mud weight, flow rates, and pressures and adjusting them as necessary.
6. **Wellbore instability:** The tendency of the wellbore to collapse or deform due to factors such as high pressures, drilling fluid invasion, or geological formations.
7. **Circulating system:** The system of pumps, pipes, valves, and other equipment used to circulate drilling mud and fluid in the wellbore.
8. **Choke manifold:** A set of valves and chokes used to control the flow rate and pressure of drilling mud and fluid during shut-in or kick control operations.
9. **Casing:** A long, heavy pipe used to line the wellbore and provide structural support. Casing is installed in stages as the well is drilled deeper.
10. **Cementing:** The process of pumping cement through the casing and into the annulus (the space between the casing and the wellbore) to provide zonal isolation and support the casing.
11. **Primary well control:** The use of drilling mud and casing to maintain wellbore pressure and prevent a kick.
12. **Secondary well control:** The use of the BOP and other equipment to shut-in the well and control a kick.
13. **Well control equipment:** The mechanical devices and systems used to prevent or control a blowout, including the BOP, choke manifold, and drilling mud pumps.
14. **Well control procedures:** The step-by-step instructions and guidelines for preventing or controlling a blowout, including shut-in procedures, kick control techniques, and emergency response plans.

Challenge:

Imagine you are working on a subsea well in the Gulf of Mexico. A kick has occurred, and the drilling mud is

starting to flow out of the well. Describe the steps you would take to control the kick and prevent a blowout, using the well control equipment and procedures available on the rig.

Solution:

1. Recognize the kick: The first step in controlling a kick is to recognize that one has occurred. This can be done by monitoring the drilling mud returns, flow rates, and pressures.
2. Shut-in the well: Once a kick is detected, the well must be shut-in to prevent further influx of fluid or gas. This is done by closing the BOP and stopping the flow of drilling mud.
3. Control the choke manifold: After shutting-in the well, the choke manifold is used to control the flow rate and pressure of the drilling mud. The choke is adjusted to slowly bleed off the excess pressure in the wellbore and prevent a blowout.
4. Circulate the kick: Once the pressure has been stabilized, the drilling mud is circulated through the wellbore to remove the kicked fluid or gas. The mud weight is gradually increased to maintain wellbore pressure and prevent further kicks.
5. Cement the well: After the kick has been circulated out, the well is cemented to ensure zonal isolation and prevent further kicks. The cement is pumped through the casing and into the annulus, where it hardens and provides support for the casing.
6. Resume drilling operations: Once the well has been secured, drilling operations can resume. The drilling mud weight and flow rates are monitored closely to prevent further kicks.

Example:

Suppose a subsea well in the Gulf of Mexico is being drilled to a depth of 15,000 feet. The drilling mud weight is 12 pounds per gallon, and the flow rate is 500 gallons per minute. Suddenly, the drilling mud returns start to become frothy and the flow rate increases to 700 gallons per minute. This is a sign of a kick.

The driller immediately shuts in the well by closing the BOP and stopping the flow of drilling mud. The choke manifold is adjusted to slowly bleed off the excess pressure in the wellbore, and the drilling mud is circulated through the wellbore to remove the kicked fluid or gas. The mud weight is gradually increased to maintain wellbore pressure and prevent further kicks.

After the kick has been circulated out, the well is cemented to ensure zonal isolation and prevent further kicks. The cement is pumped through the casing and into the annulus, where it hardens and provides support for the casing. Drilling operations are then resumed, with the drilling mud weight and flow rates being monitored closely to prevent further kicks.

Conclusion:

Well control is a critical aspect of subsea engineering, ensuring the safety and integrity of well operations. Understanding the key terms and vocabulary related to well control, as well as the procedures and equipment used to prevent or control a blowout, is essential for anyone working in the oil and gas industry. By following well control procedures and using the appropriate equipment, subsea engineers can prevent kicks and ensure safe and efficient drilling and production operations.