

# ADVANCED DRILL STRING DESIGN

# DRL013

## COURSE DESCRIPTION

Specifications of drill string components, design methods for overload and fatigue including combined loads, calculation of working capacity, specification of inspection programs, and the use of Standard DS-1 as reference material are the salient features of this course. The purpose of this course is to reduce the probability of drill stem failures in operations. To accomplish this goal, the course summarizes drill stem and gives recommended inspection procedures. The course covers to moderate practices angle well bores, extended reach and horizontal drilling. Loads simple drill stem design for vertical applied by tension, combined torsion, burst pressure, collapse pressure, compression, slip and stability forces are considered. Design steps to reduce fatigue damage are also covered.

## COURSE GOAL

To enhance the participants' knowledge, skills, and attitudes necessary to understand the probability of drill stem failures in operations.

## COURSE OBJECTIVES

By the end of this course, participant will be able to:

- Place the drill string design process in context with other planning and operational considerations.
- Refresh underlying physics of drill string failures and mechanical properties of drill string materials.
- Clarify performance properties of drill string components and how to apply design margins.
- Design cost-effective BHAs and match them to the bit.
- Analyze common load cases for both near-vertical and high-angle situations.
- Understand the basis for industry software design tools, including torque and drag, casing wear, and hydraulics.
- Identify drilling tools and operational practices to reduce both torque and drag and casing wear.
- Diagnose and mitigate vibration to reduce drill string damage and failure.
- Gain insight into emerging drill string technologies and the possible benefits to the operations.
- Describe metallurgy and manufacturing process.
- Complete overload and fatigue design.
- Set operating limits for drill string including tension, torsion and combined loading.
- Select connections to meet project-specific needs.

- Identify the differences between overload and fatigue failures and specify steps to reduce the risk of additional failures.
- Determine location of drill string buckling and maximum WOB.
- Describe drivers for fatigue and tools available to manage fatigue.
- Explain source of casing wear and mitigation steps available.
- Illustrate sources of drill string vibration.
- Design and qualify heavy duty landing strings.
- Understand how back-off failures occur while under reaming and how to prevent them.
- Specify drill string inspection programs including methods, acceptance criteria and procedures.
- Schedule drill string inspection for specific wells and drilling campaigns.
- Understand the advantages and limitations of inspection methods when selecting an inspection program.

## WHO SHOULD ATTEND

- Drilling engineers.
- Drilling supervisors.
- Senior engineers and team drilling engineering's/ operations.

## COURSE DURATION

5 Working Days

## COURSE OUTLINES

- Design assumptions
- Design objectives
- Fatigue
- Design factors
- Vertical to moderate angles well bores
  - Choosing drill collar size, connection and connection features.
  - Determining torsional strength of drill collar connections.
  - Determining minimum lengths of drill collars and HWDP section.
  - Checking slip crushing forces.
  - Calculating allowable and working tension loads.
  - Calculating maximum permissible length of each drill pipe section.

- Extended reach well bores:
  - Load predication.
  - Load analysis
  - Jar placement.
  - Fatigue mitigation and buckling.
- Build and hold well bores
- Bucking initiation paints low tangent point
- Buckling above kickoff point below buckling below tangent point
- Stabilizers in high angle hole
- Jar placement
- Dropping wellbores
- How drill stem fail
- Drill pipe failure prevention plan
- Drill pipe tube fatigue failure
- BHA connections fatigue failure
- BHA connection stress relief I BSR
- Drill crew five second checks
- Drill string care and handling practices Lunch-
- Basic jar operations
- Pump open force
- Cocking/ tripping the jar
- Drilling accelerator
- Jar rules I placement guide line
- Down hole equipment failure
- Tool failure causes
- Factors influence tool selection
- Rig site tool selection / inspection
- Inspection methods
- Standard inspection programs Visual tube inspection

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