COURSE OVERVIEW DE1004
Drill String Components (E-Learning Module)

Course Title
Drill String Components
(E-Learning Module)

Course Reference
DE1004

Course Format & Compatibility
SCORM 1.2. Compatible with IE11, MS-Edge, Google Chrome, Windows, Linux, Unix, Android, IOS, iPadOS, macOS, iPhone, iPad & HarmonyOS (Huawei)

Course Duration
30 online contact hours
(3.0 CEUs/30 PDHs)

Course Description

This E-Learning course is designed to provide participants with a detailed and up-to-date overview of drill string component. It covers the BHA design, drilling bits, heavy weight drill pipe and drill pipe; the measurement while drilling and logging while drilling; the drilling specialty tools, bottom hole assemblies design, force components and basic rotary assembly types; the drilling parameters used in BHA analysis; the pendulum assembly, generic angle building (fulcrum) assembly, packed hole assembly and directional assemblies; the drillstring design issues and the effects of gravity and inclination; and the drillstring configurations, drill string design and classification of rotary rigs.

Further, the course will also discuss the stabilizers, jar and accelerator, shocks absorber, drilling tools and bit selection; the drill collar features and drill sting accessories; the calculation based in total length & drill pipe dimensions; the PDC terminology and features; the components of bit profile, typical back rake angles, design factors, vibrations and drill bit technology; and the bearing and seal system, hydraulics system, directional drilling and fishing operations.

During this course, participants will learn the weldneck/upset design, engineered materials and weld technology; the lift subs and lift plugs, rotary subs, prevention of drill stem failures and components of a drill stem; the prevention of tensile and torsional failures, sulfide stress cracking failures and fatigue failures; the real-time down hole vibration detection, washout detection methods and good materials & component design; the reduction of corrosive effects; the good rig site operating practices; the four areas for inspection policy; and the drill string design recommendations.

Course Objectives

Upon the successful completion of this course, participants will be able to:-

- Apply and gain an in-depth knowledge on drill string components
- Discuss BHA design, drilling bits, heavy weight drill pipe and drill pipe
- Define measurement while drilling and logging while drilling
- Identify drilling specialty tools, bottom hole assemblies design, force components and basic rotary assembly types
- Describe the drilling parameters used in BHA analysis as well as pendulum assembly, generic angle building (fulcrum) assembly, packed hole assembly and directional assemblies
- Recognize the drillstring design issues and the effects of gravity and inclination
- Carryout drillstring configurations, drill string design and classification of rotary rigs
- Discuss stabilizers, jar and accelerator, shocks absorber, drilling tools and bit selection
- Identify drill collar features and drill sting accessories as well as calculate based in total length & drill pipe dimensions
- Define PDC terminology and features as well as identify the components of bit profile, typical back rake angles, design factors, vibrations and drill bit technology
- Recognize bearing and seal system, hydraulics system, directional drilling and fishing operations
- Set the drilling jar prematurely and describe weldneck/upset design, engineered materials and weld technology
- Discuss lift subs and lift plugs, rotary subs, prevention of drill stem failures and components of a drill stem
- Prevent tensile and torsional failures, sulfide stress cracking failures and fatigue failures
- Carryout real-time down hole vibration detection, washout detection methods and good materials & component design
- Reduce corrosive effects, apply good rig site operating practices, follow four areas for inspection policy and perform drill string design recommendations

Who Should Attend

This course covers systematic techniques on drill string components for drilling supervisors, drilling operations section leaders and drilling engineering section leaders.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course.

Certificate Accreditations

Certificates are accredited by the following international accreditation organizations: -

- USA International Association for Continuing Education and Training (IACET)

  Haward Technology is an Authorized Training Provider by the International Association for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 1-2013 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 1-2013 Standard**.

  Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Association for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

  Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

Training Methodology

This Trainee-centered course includes the following training methodologies:-

- Talking presentation Slides (ppt with audio)
- Simulation & Animation
- Exercises
- Videos
- Case Studies
- Gamification (learning through games)
- Quizzes, Pre-test & Post-test

Every section/module of the course ends up with a Quiz which must be passed by the trainee in order to move to the next section/module. A Post-test at the end of the course must be passed in order to get the online accredited certificate.

Course Fee

As per proposal

Course Contents

- BHA Design
- BHA Design (Components)
- Drilling Bits (Rock & PDC)
- Bit Sub (Including Float Valve)
- Shock Sub (SS)
- Drill Collar (DC)
- String Stabilizers (S.STB) & Near Bit Stabilizers (NB.STB)
- Roller Reamer (RR) – (String & Near Bit)
- Jar (H/M & Fully Hydraulic)
- Heavy Weight Drill Pipe (HWDP)
- Drill Pipe (DP)
- Motor
- MWD (Measurement While Drilling)
- LWD (Logging While Drilling)
- BHA Design (Types)
- Drilling Abbreviations

- Drilling Specialty Tools
- Introduction
- Bridge Plugs
- Cement Retainers
- Key Seat wipers
- String Reamer
- Hole Openers
- Underreamers
- Stabilizers
- Shock Subs
- Drilling Jars
- Bottom Hole Assemblies Design
- Force Components
- Effect of Hole Inclination
- Weight Correction
- Basic Rotary Assembly Types
- Slick Angle Dropping Assembly
- The Pendulum Principle
- Generic Angle Dropping (Pendulum) Assembly
- Pendulum Assembly – Tally
- Drilling Parameters Used in BHA Analysis
- Pendulum Assembly – Performance
- The Fulcrum Principle
- Generic Angle Building (Fulcrum) Assembly
- Fulcrum Assembly – Tally
- Fulcrum Assembly – Performance
- Packed Hole Assembly
- Generic Packed Hole Assembly
- Packed Hole Assembly – Tally
- Packed Hole Assembly – Performance
- Typical Configurations – Summary
- Directional Assemblies
- Three-point Geometry

- Theoretical DLS
- 3-p Geometry vs. Planit BHA Analysis
- Results from Planit BHA Analysis
- Traditional Straight Mud Motor / Bent Sub
- Steerable Motor Assembly with Bent Housing Motor
- Generic Slick Steerable Assembly
- Generic Stabilized Steerable Assembly
- Steerable Assembly – Tally
- Steerable Assembly – Performance
- Steerable Assembly with AGS
- Double Bend Assembly
- Steerable Motor Assembly with Offset Pad
- Lick Pad Alignment
- Practical Bottom Hole Assemblies
- 12 ¼ Rotary Assembly (RHX1214)
- 12 ¼ Steerable Assembly (SXX1214)
- 12 ¼ Wiper Trip Assembly (RWX1214)
- 8 ½ Steerable Assembly (SXX0812)
- 8 ½ Wiper Assembly (RWX 0812)
- Drillstring Design Issues
- Design Goals
- Effects of Gravity & Inclination
- Drillstring Sections
- Drillstring Configurations
- References
- Drill String Design
- Objectives
- Physical Laws & Relationships
- Stress
- Stress – example
- Strain
- Strain – Example
- Stress-strain Relationships

- Youngs Modulus – example
- API Minimum Yield (Normal Strength Steel)
- Axial & Sidewall Forces
- Sidewall Forces – Tension & DLS
- Drill String Design Sections
- Bending Stress
- Drill String Design
- Fatigue Damage
- DP Fatigue
- Von Mises – a DD?
- Stiffness – BHA as a Hollow Cylinder
- Drill String Design – Buckling
- Drill String Design – Points of Interest
- Drill String Design – Maximum WOB for Buckling not to Occur Below Tangent Point
- Drill String Design – Maximum WOB for Buckling not to Occur Above KDP (1)
- Drill String Design – Maximum WOB for Buckling not to Occur Above KDP (2)
- Introduction to Drilling -Basic Operations & Tools
- History of NOV
- Company Overview
- Global Presence
- NOV Global Business Units
- History of Oil Well Drilling
- History of Drilling
- First Producer Wells
- Impact on World Economy
- How is Drilling Planned?
- A Rig, the Drilling Machine
- Main Rog Components
- Classification of Rotary Rigs
- Rig Types
- Well Types
- Well Profiles/Designs
- Well Profiles

- Typical Well Profiles
- What is Drill string?
- Drill String Components
- Drill Pipe Sizes
- Heavy weight Drill Pipe (Heviwates or HWDP)
- Drill Collars (DC's)
- Stabilizers
- Types of Stabilizers
- Jar & Accelerator
- Shocks Absorber
- Subs & Crossovers (XO's)
- Drilling Tools – Mud Motors
- Drilling Tools – Bits
- PDC Cutter Sizes
- What these Bits Good for?
- PDC Bits After Use
- Natural Diamond Bits
- TSP Bits
- Impregnated Bits
- Bit Selection
- Roller Cone Bits are Versatile
- Well Design & Construction
- Typical Well Sequence
- Drill String Design
- Kelly
- Drill Pipe
- Tool Joints
- Thread Forms
- Rotary Shoulder Connections
- Drill Collars
- Drill Collars Features
- Drill Sting Accessories
- Heavy-wall Drill Pipe

- Drilling Jar
- Stabilizers
- Reamers
- Shock Subs
- Tension
- Collapse
- Shock Loading
- Torsion
- Stretch of Drill Pipe
- Stretch due to weight Carried
- Critical rotary Speed
- Calculation based in Total Length & Drill pipe Dimensions
- Drill Collar Length
- Directional Drilling
- Understanding the Input Basics
- BHA's Supported by the Program
- BHA Analysis
- Completing the Basic BHA
- Formation Index – Sensitivity Analysis
- Hole Size & washout effect
- Effect of Stb 1 OD Change
- Effect of Stb 2 OD Change
- Introduction to PDC Bits
- Product lines: PDC Bits
- Product Lines: Diamond Bits
- Fixed Cutter Bits
- PDC Terminology & Features
- Components of Bit Profile
- Deep Cone Profiles
- Shallow Cone Profiles
- Nose Radius
- Location from Centerline
- Bit Profile types

- Back Rake Angle
- Typical Back Rake Angles
- Design Factors – Back Rake
- Number of Blades
- PDC Cutter Size
- General Application Guidelines
- Harder Formation
- Drilling Dynamics – Vibrations
- Vibrations
- Drill String Vibration
- Axial Vibration
- Axial Vibration: Recognizing
- Axial Vibration: Remedies
- Lateral Vibrations
- Lateral Vibrations: Types of Whirl
- Lateral Vibrations: Hole Quality
- Lateral Vibrations: Recognizing
- Lateral Vibrations: Remedy
- Torsional Vibrations
- Torsional Vibration (Stick Slip)
- Torsional Vibration: Recognizing
- Torsional Vibration: Remedies
- Summary: Drill String Vibration
- Search for Stability Zone
- Drill Bit Technology
- Objectives
- Wide Variety of Bit Types
- Roller Cone Bit Features
- Cutting Structure
- Journal Angle
- Cone Angles
- Offset
- Intermesh

- Projection & Pitch
- Tungsten Carbide Insert Design
- Cutting Structure
- Product Technology
- Diamond tech200 Hardfacing
- Standard Frame Body
- Modular Frame Body
- Standard Frame Design
- Arm & Shirttail Design
- Pressure Compensation
- Grease Reservoir
- Central Ball Race Bearing
- Precision Bearing “Hard Turn”
- Bearing & Seal System
- Stabilization Pads
- Hydraulics System
- Bit IADC Codes
- Summary
- The Dump Valve
- The Power Section
- The Rotor & Stator
- The Bearing Section
- The Lobes
- Double Acting Hydraulic Drilling Jar
- Description Control of Drilling Jar
- Advantages of Using Drilling Jar
- Universal Use in Oil & Gas Well Operations
- Easily Adjustable while in Use
- Long Term Capability
- High Strength Construction
- Directional Drilling
- Fishing Operations
- Double Acting Hydraulic Drilling Jar

- Going in the Hole
- Jar safety Clamp
- Picking up the Drilling Jar
- Operation
- Jar Load
- Jar Cycle
- Up Jarring Operation
- Down Jarring Operation
- Setting the Drilling Jar Prematurely
- Increasing Effectiveness
- Coming Out of the Hole
- Change Out Recommendations
- Optimum Drilling Jar Position
- Drilling Jar in Tension
- Placing Drilling Jar in Compression
- Jar Tension Drilling weight
- Transition Zone
- Weight Correction Tables
- No angle
- Core Drilling
- Directional Drilling
- Directional Drilling Motor
- Tables & Charts
- Drill Collars
- Materials
- Product Specifications
- API Specifications
- Slip & elevator Recesses
- Hardfacing
- Double Shouldered Connections
- Drill Collars – Recommended Make-up Torque & Bending Strength Ratios
- Care & Maintenance
- Heavy Weight Drill Pipe

- Materials
- Tri-Spiral Heavy Weight Drill Pipe
- Spiral-wate Drill Pipe
- Extreme Drilling 90 Grade Sour Service
- Introduction/Drill/Pipe
- Weldneck/Upset Design
- Engineered Materials
- Titanium Drill Pipe
- Slip-Proof Drill Pipe
- Manufacturing Processes
- Weld Technology
- Tuff Weld
- Normalized & Tempered
- Benchmark
- Traceability
- Hi Torque Connection
- sXtreme Torque Connection
- SST Low Stress Fatigue Resistant Thread form
- Hardfcing
- Make & Break
- Drill Steam Accessories
- Pup Joints
- Thread Protectors
- Lift Subs & Lift Plugs
- Rotary Subs
- Top Drive Pump-In Sub
- Rotary Kellys
- Prevention of Drill Stem Failures
- Introduction
- What is a Drill Stem Failure?
- What is a Drill Stem?
- Components of a Drill Stem
- Failure Types

- Sedco Forex Failure Analysis
- Failure Mechanism
- Tension Failures
- Tension Failure cross Section
- Torsional; Failures
- Sulfide Stress Cracking
- Fatigue Failures
- Three Type of Vibration
- Sources of Cyclic Loads
- Prevention of Drill Stem Failures
- Preventing Tensile & Torsional Failures
- Preventing Sulfide Stress Cracking Failures
- Prevention of Fatigue Failures
- Fatigue; Early Detection
- Real-time Down Hole Vibration Detection
- Part of MWD hardware
- Field data Shows
- Washout Detection Methods
- Good Materials & Component Design
- Cyclic Stresses & Stress Concentrators
- Corrosiveness of Environment
- Reducing Corrosive Effects
- Good Rig site Operating Practices
- Drill Pipe Handling to Avoid Damage
- Follow an Inspection Program
- Four Areas for Inspection Policy
- Summary & Review
- Mechanisms of Failure
- Prevention of Drill Stem Failures
- Inspection
- Closing
- Drill Stem Failures
- Drill String Design Recommendations

- Drill Pipe Properties
- Drill Collars
- Allowable Weight on Bit
- Tension
- Burst
- Collapse
- Pipe Torsion
- Fatigue
- Tool Joint Performance
- Combination Tube & Connection Performance
- Critical Rotary Speeds