



Well Control for Drilling Operations — Introductory Course

Core Curriculum and
Related Learning Outcomes

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WellSharp™ Introductory Course

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1.0 Introductory Course Overview

The purpose of the Introductory course core curriculum is to identify a body of knowledge and a set of job skills needed by the rig personnel during drilling operations. See the below table for a listing of positions for whom this course is recommended.

This curriculum incorporates both surface and subsea topics. All topics must be covered.

Recommended Attendees: IADC recommends that persons in certain positions or job roles attend this Introductory-level course. These positions are listed in the table below.

Company Type	Position or Job Role
Contractor	Barge Engineer
	Captain/Master
	Pit Hand, Pump Man, Shaker Man
	Subsea Engineer
	Derrickman
	Floorman
	Blowout Preventer (BOP)/Subsea Engineer, Lower Marine Riser Package (LMRP) Engineer, and Dynamic Positioning Officer
Contractor/Operator/Service Company	Managed Pressure Drilling (MPD)/Underbalanced Drilling (UBD) wellsite service personnel (non-supervisory)
Operator	Operator Offshore Installation Manager (OIM)
	Onshore monitoring crew
	Wellsite Geologist and office-based Operations Geologist
	OIM (for installations not primarily involved with drilling)

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Service Company	Casing Crew Supervisor
	Cementer
	Remotely Operated Vehicle (ROV) personnel (supervisory)
	Mud Engineer
	Mud Logger/Wellsite Drilling Data Engineer
	Directional Driller
	Fishing Tool Operators (non-pressure operations)

Acceptable Delivery Methods: Instructor-led training, self-study workbook, and e-Learning delivery (for example, computer-based training, web-based training, or other electronic delivery) are permitted for this course. A knowledge assessment is required.

Minimum Course Length: Sixteen (16) classroom hours or an equivalent timeframe for e-Learning delivery are required for delivery of this course. The self-study workbook and e-Learning are self-paced study.

Training providers developing the course must dedicate 12 hours (or equivalent for self-study) to the curriculum topics identified in Section 2 of this document. An additional 4-hour module must be added to the course. Course content for the 4-hour module will be supplied by IADC.

Introductory Course Curriculum Notes: The curriculum that follows includes five components: Training Module, Sub-Modules, Learning Topics, AIM, and Learning Objectives and Assessment Guidelines.

AIM: The AIM letters indicate the level of knowledge and skills required at the job level:

A = Awareness of Learning Topic

I = Implements Learning Topic at this job level; needs an increased level of knowledge because they may have to take action related to the topic.

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M = Mastery of Learning Topics at this job level; needs a full knowledge because they have to take action, perhaps unsupervised, of some task related to the topic.

Learning Topics: This section provides detailed guidance for instructors on what trainees should learn.

Learning Objectives and Assessment Guidelines: This section defines what trainees should be able to do at the conclusion of the training and provides some examples of how to meet the objectives.

Assessment Notes: Questions on the Knowledge Assessment will be graded as a cumulative score. To pass the course, the trainee must earn at least a 70% score. Questions will come from both the core curriculum defined in this document and from the module supplied by IADC.

Trainee Certification: An IADC WellSharp™ Certificate of Completion should be issued to each trainee completing the course and passing the knowledge assessment.

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2.0 Introductory Course Curriculum

2.1 Well Control Concepts

Module Name: 2.1 Well Control Concepts			
Sub-Modules	AIM	Learning Topics	Learning Objectives and Assessment Guidelines
		The Instructor will impart knowledge on:	The attendee will be able to:
Well Control Terminology & Formation Characteristics	A	The term Rock Matrix.	Select the definition of Rock Matrix.
	A	The term Porosity.	Select the definition of Porosity.
	A	The term Permeability.	Select the definition of Permeability.
Formation Fluids and Pressure	A	Types of formation fluids and their characteristics. Definition of formation pressure.	Name the main types of formation fluids (for example, water, oil, hydrocarbon gas, hydrogen sulfide [H ₂ S], and carbon dioxide [CO ₂]).
			Define formation pressure (for example, normal, abnormal, subnormal).
Mud Hydrostatic Pressure	A	Concept of hydrostatic pressure and role of mud.	Define the term hydrostatic pressure and describe the role of mud in exerting hydrostatic pressure (for example, role of mud in maintaining primary well control).
Bottomhole Pressure	A	Concept of Bottomhole Pressure.	Define the term Bottomhole Pressure (BHP) and name its components (for example, hydrostatic pressure, shut-in pressures, annular circulating friction, and surge & swab pressure).
Balance-Overbalance-Underbalance	A	The terms Balance, Overbalance, and Underbalance in relation to a well.	Define the terms balance, underbalance, and overbalance in relation to primary well control.
Kick	I	The term Kick in relation to well control.	Define the term kick and state how it can happen.
Blowout	A	The term Blowout in relation to well control.	Define the term blowout and state how it can happen.
Formation Strength	A	The term Formation Strength in relation to well control.	Define the term formation strength. Introduce concept of a 'drilling window' (for example, the difference between formation fluid pressure and formation fracture).

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Module Name: 2.1 Well Control Concepts			
Sub-Modules	AIM	Learning Topics	Learning Objectives and Assessment Guidelines
		The Instructor will impart knowledge on:	The attendee will be able to:
Shallow Gas	I	Shallow Gas.	Define shallow gas. State why shallow gas is a serious problem (for example, can be high pressure, cause a blowout, unable to shut-in due to formation strength, can happen very quickly).
Barriers	I	The purpose of well control barriers and the need to ensure they are maintained at all times.	Name the common types of barriers and state the purpose of each type.
U-Tube	A	How a u-tube works.	State what would happen if a certain weight of fluid was pumped into one leg of the u-tube and how this might affect fluid levels and BHP.

2.2 Calculations

Module Name: 2.2 Calculations			
Sub-Modules	AIM	Learning Topics	Learning Objectives and Assessment Guidelines
		The Instructor will impart knowledge on:	The attendee will be able to:
Force, Area, Pressure	I	The relationship between pressure, force and area.	Calculate pressure when given a force and an area.
Hydrostatic Pressure	A	Method to calculate hydrostatic pressure.	Use data to calculate hydrostatic pressure.
Volume of Pits	I	Method to calculate pit volume.	Use data to calculate volume of mud in a pit.
Pipe Displacement & Capacity	A	Method to calculate pipe capacity and displacement.	Use data to calculate capacity and displacement of drill pipe and collars, and calculate 'strokes to pump.' Relate to kill sheet.

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Module Name: 2.2 Calculations

Sub-Modules	AIM	Learning Topics	Learning Objectives and Assessment Guidelines
		The Instructor will impart knowledge on:	The attendee will be able to:
Annular Capacity & Volume	A	Method to calculate annular capacity and volume.	Use data to calculate annular capacity and volume, and the pump strokes required to fill them. Relate to kill sheet.

2.3 Mud & Pit Management

Module Name: 2.3 Mud& Pit Management

Sub-Modules	AIM	Learning Topics	Learning Objectives and Assessment Guidelines
		The Instructor will impart knowledge on:	The attendee will be able to:
Mud Functions	I	Key functions of mud in relation to drilling and well control.	Select key functions of mud (for example, exert hydrostatic pressure, carry cuttings, suspend cuttings, bit hydraulics, form filter cake).
Types of Muds	I	Main types of mud and their key constituents.	State the main types of mud (for example, water-based, non-aqueous) and their basic constituents (for example, viscosifiers, weighting agents).
Cement	I	Role of cement in a well.	State the role of cement in a well (for example, cement casing, cement plugs).
Completion Fluid	I	Role of completion fluids in a well.	State the role that completion fluids play in a well.
Mud Weight & Viscosity	M	The importance of regular mud weight and viscosity measurements.	State purpose of regular mud weight and viscosity measurements (for example, changes in mud weight affect hydrostatic, causes of viscosity change, where to take measurements, how often, who to inform).
Mud Balance	M	Types of mud balances and their importance to kick prevention.	Describe the function of the two main types of mud balance (for example, standard and pressurized).

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2.4 Risk Management

Module Name: 2.4 Risk Management			
Sub-Modules	AIM	Learning Topics	Learning Objectives and Assessment Guidelines
		The Instructor will impart knowledge on:	The attendee will be able to:
Risk Management	I	Role of risk management in well control.	State how well control risks are managed during the life cycle of the well (for example, in design phase, standard procedures, written instructions, meetings, stop-work process, management of change process, crew handovers).
Well Plan	A	The well plan is developed to manage risks.	State the purpose of the well plan.

2.5 Causes of Kicks

Module Name: 2.5 Causes of Kicks			
Sub-Modules	AIM	Learning Topics	Learning Objectives and Assessment Guidelines
		The Instructor will impart knowledge on:	The attendee will be able to:
Reduction of Mud Weight or Mud Level	I	How a reduction in mud weight or drop in mud level can reduce BHP.	Explain how mud weight change or mud level drop can cause a drop in BHP (for example, use pressure formula to show how changes to the two key parameters affect pressure).
Mud Weight	I	Causes of mud weight reduction both in the hole and on surface.	Select common causes of mud weight reduction (for example, surface contamination, barite settling, formation fluid contamination such as gas/oil/water, and excessive solids removal with mud cleaning equipment).
Losses	A	Losses to the formation and how they can affect BHP.	Describe lost circulation, how to recognize losses, the effect on BHP, and first actions to take.

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Module Name: 2.5 Causes of Kicks			
Sub-Modules	AIM	Learning Topics	Learning Objectives and Assessment Guidelines
		The Instructor will impart knowledge on:	The attendee will be able to:
Failure to Keep Hole Full	I	Situations where mud level can drop.	Describe situations that can lead to a drop in mud level (for example, tripping out of the hole, equipment leaks below the flow line).
Swabbing & Surging	I	The effect of pipe movement on BHP.	Describe how pipe movement affects BHP (for example, effect of swabbing, effect of surging, trip speeds).
Abnormal Formation Pressure	A	Abnormal formation pressure.	State how an increase in formation pressure can cause a kick (for example, if formation pressure increases, but mud weight stays the same, the well can go underbalanced).

2.6 Abnormal Pressure Warning Signs

Module Name: 2.6 Abnormal Pressure Warning Signs			
Sub-Modules	AIM	Learning Topics	Learning Objectives and Assessment Guidelines
		The Instructor will impart knowledge on:	The attendee will be able to:
Cuttings and Cavings - Shape, Size, and Volume	M	How return of cuttings at the shaker can assist in kick prevention.	State how cuttings and cavings at the shakers can indicate changing conditions downhole (for example, difference between cuttings and cavings, possible increasing formation pressure; actions include monitor trends and inform Driller).
Mud Condition	I	How the general 'look' and 'feel' of the mud can assist in kick prevention.	Describe mud condition changes that should be reported to the Driller (for example, color, texture, smell, evidence of contamination, gas cutting, and change in temperature profile).
Consequence of Not Communicating	M	What can happen if warning signs are not communicated to supervisors in a timely manner.	State the risk if warning signs are not communicated (for example, increased risk of a kick, downtime, and possible drilling complications).

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2.7 Kick Detection

Module Name: 2.7 Kick Detection			
Sub-Modules	AIM	Learning Topics	Learning Objectives and Assessment Guidelines
		The Instructor will impart knowledge on:	The attendee will be able to:
Pit Gain	M	Role of pit level monitoring in kick detection and lost circulation.	State why pit level monitoring is essential to well control (for example, unplanned gains can indicate a kick and unplanned loss can indicate lost circulation downhole; maintain records in pit area).
Mud Flow	I	Role of mud flow monitoring in kick detection and lost circulation.	State why flow rate monitoring is essential to well control (for example, unplanned gains can indicate a kick and unplanned loss can indicate lost circulation downhole).
Flow with Pump Off	I	Flow check as a means to detect a kick.	Describe a flow check and state how it can indicate a kick downhole (for example, difference between flow check when drilling and when tripping; role of rig floor crew during a flow check).
Incorrect Hole Fill	I	How trip monitoring practices can detect downhole swabbing or surging.	State why the Driller monitors the trip when pulling out and running in the hole (for example, pipe displacement will affect volume of mud in hole, need to measure volume changes equal pipe displacement, what an abnormal volume could mean, line up for trip monitoring).
Well Monitoring Alarms	I	Importance of alarm systems for monitoring pit level and flow rate.	State why pit level and flow rate changes are alarmed (for example, to detect a change as early as possible; typical alarm limits).
Why Early Detection is Critical	M	Importance of detecting a kick in the earliest possible time.	State why it is important to detect a kick early (for example, reduce kick size, less surface pressure and less complications for killing the well, prevent a blowout or release of gas, pollution, fire, risk to life).
Difficulty with Detection Subsea	I	How floating drilling can affect well monitoring.	List situations that can affect accuracy of pit and flow measurements on a floating rig.

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Module Name: 2.7 Kick Detection			
Sub-Modules	AIM	Learning Topics	Learning Objectives and Assessment Guidelines
		The Instructor will impart knowledge on:	The attendee will be able to:
False Kick Indicators	I	What operations can give a false indication of a kick.	List operations that lead to a 'false' indication of a kick (for example, surface fluid additions, surface line drainage, slugging the pipe, etc.).

2.8 Shut-In Procedures and Verification (Surface and Subsea)

Module Name: 2.8 Shut-In Procedures and Verification (Surface and Subsea)			
Sub-Modules	AIM	Learning Topics	Learning Objectives and Assessment Guidelines
		The Instructor will impart knowledge on:	The attendee will be able to:
Shut-in Process-Surface	I	How a well is shut in.	State reason for shut-in and procedure (prevent further influx from formation, difference between shut-in while drilling and shut-in while tripping, rig floor crew responsibilities; full opening valves verses non-return string valves).
Shut-in Process-Subsea	I	How a well is shut in.	State reason for shut-in and procedure (prevent further influx from formation, difference between shut-in while drilling and shut-in while tripping, rig floor crew responsibilities; full opening valves verses non-return string valves).
Diverting	I	Rationale for diverting and associated hazards.	State reasoning and the process of diverting a well, and state immediate actions to be taken by rig floor crew.

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2.9 Post Shut-In Monitoring & Activities

Module Name: 2.9 Post Shut-In Monitoring & Activities			
Sub-Modules	AIM	Learning Topics	Learning Objectives and Assessment Guidelines
		The Instructor will impart knowledge on:	The attendee will be able to:
Recordkeeping - Pit Level	I	Actions for the crew to take following shut-in.	List actions crew must take following shut-in (for example, assist Driller to verify well is shut-in with no leaks, assist if required to mix mud, line up equipment).
	I	Importance of keeping accurate pit level measurements.	State why an accurate measure of pit level following a kick is important (for example, to allow accurate measure of influx size in the hole, to note how long pit has been gaining volume).

2.10 Well Control Drills

Module Name: Well Control 2.10 Well Control Drills			
Sub-Modules	AIM	Learning Topics	Learning Objectives and Assessment Guidelines
		The Instructor will impart knowledge on:	The attendee will be able to:
Pit	I	Importance of well-organized Pit Drills.	State why regular well control drills are carried out, and the crewmembers role in each drill.
Trip	I	Importance of well-organized Trip Drills.	
Diverter	I	Importance of well-organized Diverter Drills.	

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2.11 Well Control Methods

Module Name: 2.11 Well Control Methods			
Sub-Modules	AIM	Learning Topics	Learning Objectives and Assessment Guidelines
		The Instructor will impart knowledge on:	The attendee will be able to:
Main Methods: Driller's and Wait & Weight	A	Common constant bottomhole methods employed in killing a well.	State key objectives of a kill method (for example, safely remove influx and replace with kill mud to restore primary control, avoid additional kicks, avoid excessive surface and downhole pressure that may damage equipment or cause formation breakdown [underground blowout]).
			Name two main methods of killing a well (for example, Driller's, Wait & Weight).
Role of Crew During a Well Kill	I	Role of the rig crew during a well kill operation.	State actions to be taken by crewmembers during the kill process (for example, verify shut-in, assist with mud mixing, line-up valve).

2.12 Kill Sheet and Pre-Recorded Data

Module Name: 2.12 Kill Sheet			
Sub-Modules	AIM	Learning Topics	Learning Objectives and Assessment Guidelines
		The Instructor will impart knowledge on:	The attendee will be able to:
Kill Sheets	A	The purpose of a kill sheet and type of calculations involved.	State the function of a kill sheet and how it is used during circulation to maintain constant BHP.
Pre-Recorded Data	A	Where the pre-recorded data comes from and how it is obtained	List the sources and types of pre-recorded data (for example, sizes of pipe, wellbore geometry, pump rates and displacements).

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2.13 Equipment

Module Name: 2.13		Equipment	
Sub-Modules	AIM	Learning Topics	Learning Objectives and Assessment Guidelines
		The Instructor will impart knowledge on:	The attendee will be able to:
Pit Level	M	How pit levels are monitored.	State how pit levels are monitored (for example, pit level sensors, readouts in dog-house, hi-lo alarm system, mechanical measure at pits [nut & rope]; basic maintenance on sensors [ensure movement of sensor if applicable]).
Mud Returns	I	How flow rate is monitored.	State how flow rate is monitored (for example, flow rate sensor, readouts in dog-house, hi-lo alarm system; basic maintenance on sensor [ensure movement of sensor if applicable]).
Suction and Return Pits	M	Importance of correct line-up of mud pits.	State problems that can arise from incorrect pit line-up (for example, potential to contaminate other mud systems, dump mud, overflow a pit, pump wrong mud, not lined up to Pit Volume Totalizer [PVT] and alarm system, by-pass shakers/settling pits/mud cleaning equipment).
Mud Mixing Equipment	I	Importance of mud-mixing equipment in well control.	State why well maintained mud mixing system is essential in well control operations (for example, maintain correct mud weight, increase to kill weight, and increase weight of returns, failure of system will lead to delays in kill process [under pressure for longer time]).
Mud Cleaning Equipment	I	Role of mud cleaning equipment and how it can affect well control.	State reason for using mud cleaning equipment (desanders, desilters, centrifuges) and how their use can impact well control (for example, clean mud of unwanted solids, remove 'good' solids, helps maintain acceptable viscosity and control surge pressures, remove viscosifiers and barite, monitor outputs and underflows).

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Module Name: 2.13 Equipment			
Sub-Modules	AIM	Learning Topics	Learning Objectives and Assessment Guidelines
		The Instructor will impart knowledge on:	The attendee will be able to:
Trip Tank System & Trip Monitoring	I	How a trip is monitored.	Describe how a trip tank is used to monitor the trip and how data is recorded (for example, line up of trip tank, stand to pull before recording data, how to recognize abnormal hole fill by use of trip tank to monitor the well during flow check or other operations).
Design of BOP System within Kill Process	A	How a BOP is configured to allow a well to be controlled.	Describe a typical BOP stack configuration (for example, location of annular, rams, drilling spools, high closing ratio [HCR]/Failsafe valves, non-return valves).
Correct Manifold Alignment	I	Typical line-ups for drilling and killing.	Demonstrate a typical line-up for drilling ahead and for killing a well.
Surface and Subsea Variations	A	Main differences between surface and subsea equipment.	List the major differences between a surface and subsea BOP system (for example, surface mounted versus sea floor mounted, Riser System, choke and kill lines, and control system).
Well Control Equipment Tests	A	Types of tests.	State reason for testing the BOPs; state difference between a function and pressure test.
Annulars - Surface and Subsea	A	How an annular works.	State function of each item of equipment, and describe its basic operation.
Rams - Surface and Subsea	A	How rams and blind or blind/shear rams work.	
Wellheads & Connectors	A	Role of wellheads, casing heads and connectors.	
Choke & Kill Lines, HCRs & Failsafes, String Valves & Floats	A	Role of choke & kill lines, stack valves, drill string valves (full open and non-return) and downhole floats.	
Standpipe Manifold	I	Location and role of the standpipe manifold in well control.	State the location, function, and role of each item of equipment in a well control operation.

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Module Name: 2.13 Equipment			
Sub-Modules	AIM	Learning Topics	Learning Objectives and Assessment Guidelines
		The Instructor will impart knowledge on:	The attendee will be able to:
Choke Manifold	I	Location and role of the choke manifold in well control.	
Chokes	I	Location and role of the chokes in well control.	
Pump & Stroke Counter	I	Location and role of pump, pressure relief valve and stroke counter in well control.	
Pressure Gauges	I	Location of manifold pressure gauges and what they are used for.	
Closing Unit & Control Panel: Basic Function - Surface and Subsea	I	Role of the BOP Control Panel and Closing Unit.	State the role of the BOP closing unit (accumulator system) and associated Control Panels.
Mud Gas Separator & Degasser - General Purpose in Well Control	I	Role of de-gassing equipment in kick prevention and well kills.	State function of de-gassing equipment (for example, use of vacuum degasser versus mud gas separator, potential danger of 'blowthrough' with the mud gas separator).

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2.14 Practical Elements - Optional

Module Name: 2.14 Practical Elements - OptionalOptional			
Sub-Modules	AIM	Learning Topics	Learning Objectives and Assessment Guidelines
		The Instructor will impart knowledge on:	The attendee will be able to:
Line Up Manifolds	I	Line up requirements for drilling ahead.	Work with team members to line up manifolds (for example, standpipe and choke).
Line up BOP Panel	A	Line up of BOP for drilling ahead.	Work with team members to line up the BOP (for example, annulars, rams, valves, check pressures).
Setting Pit and Flow Alarms	A	Action required to set key alarms.	Under guidance from Instructor, set pit and flow alarms.
Drill Ahead	A	Drilling ahead process.	Observe the drilling ahead process.
Recognize Kick	A	Indicators that well is kicking.	Observe the indications of a kick.
Shut-In	A	Shut-in process.	Assist instructor in well shut-in.
Record Pressures	A	Data to collect following shut-in.	Assist instructor to record pressures and pit gain.