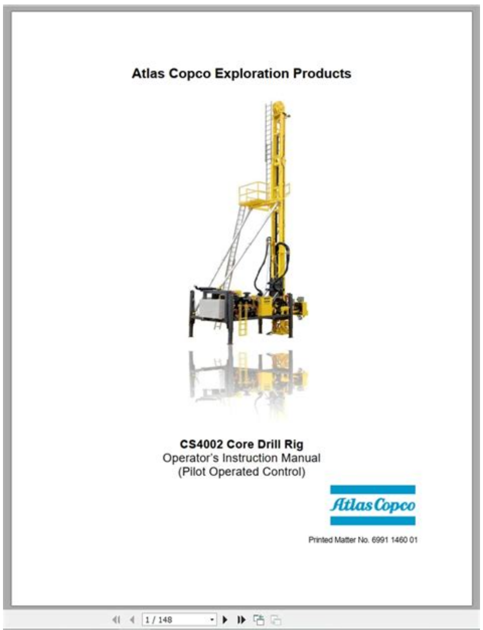
Drill Rig Operation Manual



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Book Descriptions:

Drill Rig Operation Manual

For offshore oil rig, see Oil platform. For drilling tunnels, see Tunnel boring machine. For handheld drilling tool, see Drill. Drilling rigs can be massive structures housing equipment used to drill water wells, oil wells, or natural gas extraction wells, or they can be small enough to be moved manually by one person and such are called augers. Drilling rigs can sample subsurface mineral deposits, test rock, soil and groundwater physical properties, and also can be used to install subsurface fabrications, such as underground utilities, instrumentation, tunnels or wells. Drilling rigs can be mobile equipment mounted on trucks, tracks or trailers, or more permanent land or marinebased structures such as oil platforms, commonly called offshore oil rigs even if they dont contain a drilling rig.Hoists in the rig can lift hundreds of tons of pipe. Other equipment can force acid or sand into reservoirs to facilitate extraction of the oil or natural gas; and in remote locations there can be permanent living accommodation and catering for crews which may be more than a hundred. Marine rigs may operate thousands of miles distant from the supply base with infrequent crew rotation or cycle.It was used to drill many water wells in that area—many of those wells are still in use. RC drilling proved much faster and more efficient, and continues to improve with better metallurgy, deriving harder, more durable bits, and compressors delivering higher air pressures at higher volumes, enabling deeper and faster penetration. Diamond drilling has remained essentially unchanged since its inception.Drilling rigs used for rock blasting for surface mines vary in size dependent on the size of the hole desired, and is typically classified into smaller presplit and larger production holes. Underground mining hard rock uses a variety of drill rigs dependent on the desired purpose, such as production, bolting, cabling, and tunnelling.http://vitraze.skloart.cz/media/upload/upload/cpu-315f-2-dp-manual.xml

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In more recent times drilling rigs are expensive custombuilt machines that can be moved from well to well. Some light duty drilling rigs are like a mobile crane and are more usually used to drill water wells. Larger land rigs must be broken apart into sections and loads to move to a new place, a process which can often take weeks.Rigs can range from 100 ton continuous flight auger CFA rigs to small air powered rigs used to drill holes in quarries, etc. These rigs use the same technology and equipment as the oil drilling rigs, just on a smaller scale.Drilling rigs can be described using any of the following attributesA single joint of pipe is typically some 30 feet long. Derricks of this size are uncommon on land based operations, but utilized in offshore drilling. This is the design of the most modern rigs. The direction is controlled by a wireless controller to drill the hole in any way that the driller requires.Each has its advantages and disadvantages, in terms of the depth to what it can drill, the type of sample returned, the costs involved and penetration rates achieved. Some types included are rotary cut, rotary Abrasive, rotary reverse, cable tooling, and sonic drilling.Hollow stem auger drilling is used for softer ground such as swamps where the hole will not stay open by itself for environmental drilling, geotechnical drilling, soil engineering and geochemistry reconnaissance work in exploration for mineral deposits. In some cases, mine shafts are dug with auger drills. Small augers can be mounted on the back of a utility truck, with large augers used for sinking piles for bridge foundations.It is cheap and fast.Air or a combination of air and foam lift the cuttings.RAB produces lower quality samples because the cuttings are blown up the outside of the rods and can be contaminated from contact with other rocks.http://faxime-k.com/userfiles/cpu-315-2dp-manual-pdf.xml

RAB drilling at extreme depth, if it encounters water, may rapidly clog the outside of the hole with debris, precluding removal of drill cuttings from the hole. These have sets of rollers on the side, usually with tungsten buttons, that constantly break down cuttings being pushed upwards. This, of course, is all dependent on the density and weight of the rock being drilled, and on how worn the drill bit is.The drill bit has three blades arranged around the bit head, which cut the unconsolidated ground. The rods are hollow and contain an inner tube which sits inside the hollow outer rod barrel. The drill cuttings are removed by injection of compressed air into the hole via the annular area between the innertube and the drill rod. The cuttings are then blown back to surface up the inner tube where they pass through the sample separating system and are collected if needed. Drilling continues with the addition of rods to the top of the drill string. Air core drilling can occasionally produce small chunks of cored rock.Where possible, air core drilling is preferred over RAB drilling as it provides a more representative sample. Air core drilling can achieve depths approaching 300 metres in good conditions. As the cuttings are removed inside the rods and are less prone to contamination compared to conventional drilling where the cuttings pass to the surface via outside return between the outside of the drill rod and the walls of the hole. This method is more costly and slower than RAB. This method of drilling was invented by Wallis Drilling a drilling company based in Perth, Western Australia.These slow rigs have mostly been replaced by rotary drilling rigs in the U.S. The majority of large diameter water supply wells, especially deep wells completed in bedrock aquifers, were completed using this drilling method.

Although this drilling method has largely been supplanted in recent years by other, faster drilling techniques, it is still the most feasible drilling method for large diameter, deep bedrock wells, and in widespread use for small rural water supply wells. The impact of the drill bit fractures the rock and in many shale rock situations increases the water flow into a well over rotary. During the drilling process, the drill string is periodically removed from the borehole and a bailer is lowered to collect the drill cuttings rock fragments, soil, etc.. The bailer is a bucketlike tool with a trapdoor in the base. If the borehole is dry, water is added so that the drill cuttings will flow into the bailer. When lifted, the trapdoor closes and the cuttings are then raised and removed. Since the drill string must be raised and lowered to advance the boring, the casing larger diameter outer piping is typically used to hold back upper soil materials and stabilize the borehole.The world record cable tool well was drilled in New York to a depth of almost 12,000 feet 3,700 m. The common BucyrusErie 22 can drill down to about 1,100 feet 340 m. Since cable tool drilling does not use air to eject the drilling chips like a rotary, instead using a cable strung bailer, technically there is no limitation on depth.They are mostly used in Africa or ThirdWorld countries. Being slow, cable tool rig drilling means increased wages for drillers. A cable tool rig can drill 25 feet 7.6 m to 60 feet 18 m of hard rock a day.RC drilling utilises much larger rigs and machinery and depths of up to 500 metres 1,600 ft are routinely achieved. RC drilling ideally produces dry rock chips, as large air compressors dry the rock out ahead of the advancing drill bit. RC drilling is slower and costlier but achieves better penetration than RAB or air core drilling; it is cheaper than diamond coring and is thus preferred for most mineral exploration work.

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The drill cuttings travel around the inside of the cyclone until they fall through an opening at the bottom and are collected in a sample bag. As the buttons wear down, drilling becomes slower and the rod string can potentially become bogged in the hole. This is a problem as trying to recover the rods may take hours and in some cases weeks. The rods and drill bits themselves are very expensive, often resulting in great cost to drilling companies when equipment is lost down the bore hole. Most companies will regularly regrind the buttons on their drill bits in order to prevent this, and to speed up progress. Usually, when something is lost breaks off in the hole, it is not the drill string, but rather from the bit, hammer, or stabilizer to the bottom of the drill string bit. This is usually caused by operator error, overstressed metal, or adverse drilling conditions causing downhole equipment to get stuck in a part of the hole. This helps to bring up the sample to the surface by making the sand stick together. Occasionally the collar may be made from metal casing. Collaring a hole is needed to stop the walls from caving in and bogging the rod string at the top of the hole. Collars may be up to 60 metres deep, depending on the ground, although if drilling through hard rock a collar may not be necessary.The support vehicle, normally a truck, holds diesel and water tanks for resupplying the rig. It also holds other supplies needed for maintenance on the rig. The auxiliary is a vehicle, carrying an auxiliary engine and a booster engine. These engines are connected to the rig by high pressure air hoses. Although RC rigs have their own booster and compressor to generate air pressure, extra power is needed which usually isnt supplied by the rig due to lack of space for these large engines. Instead, the engines are mounted on the auxiliary vehicle.Rig is currently set up for diamond drilling.

The diamonds used to make diamond core bits are a variety of sizes, fine to microfine industrial grade diamonds, and the ratio of diamonds to metal used in the matrix affects the performance of the bits cutting ability in different types of rock formations. The diamonds are set within a matrix of varying hardness, from brass to highgrade steel. Matrix hardness, diamond size and dosing can be varied according to the rock which must be cut. The bits made with hard steel with a low diamond count are ideal for softer highly fractured rock while others made of softer steels and high diamond ratio are good for coring in hard solid rock. Holes within the bit allow water to be delivered to the cutting face. This provides three essential functions — lubrication, cooling, and removal of drill cuttings from the hole.Drilling of 1200 to 1800 metres is common and at these depths, ground is mainly hard rock. Techniques vary among drill operators and what the rig they are using is capable of, some diamond rigs need to drill slowly to lengthen the life of drill bits and rods, which are very expensive and time consuming to replace at extremely deep depths.As the core is drilled, the core barrel slides over the core as it is cut. The winch is retracted, pulling the core tube to the surface. The core does not drop out of the inside of the core tube when lifted because either a split ring core lifter or basket retainer allow the core to move into, but not back out of the tube.The Drillers assistant unscrews the backend off the core tube using tube wrenches, then each part of the tube is taken and the core is shaken out into core trays. The core is washed, measured and broken into smaller pieces using a hammer or sawn through to make it fit into the sample trays. Once catalogued, the core trays are retrieved by geologists who then analyse the core and determine if the drill site is a good location to expand future mining operations.

Multicombination rigs are a dual setup rig capable of operating in either a reverse circulation RC and diamond drilling role though not at the same time. This is a common scenario where exploration drilling is being performed in a very isolated location. The rig is first set up to drill as an RC rig and once the desired metres are drilled, the rig is set up for diamond drilling. This way the deeper metres of the hole can be drilled without moving the rig and waiting for a diamond rig to set up on the pad.While this does not meet the proper definition of drilling, it does achieve the same result — a borehole. Direct push rigs include both cone penetration testing CPT rigs and direct push sampling rigs such as a PowerProbe or Geoprobe. Direct push rigs typically are limited to drilling in unconsolidated soil materials and very soft rock.Alternatively, small, light CPT rigs and offshore CPT rigs will use anchors such as screwedin ground anchors to create the reactive force.The speed and depth of penetration is largely dependent on the soil type, the size of the sampler, and the weight and power of the rig. Direct push techniques are generally limited to shallow soil sample recovery in unconsolidated soil materials. The advantage of direct push technology is that in the right soil type it can produce a large number of high quality samples quickly and cheaply, generally from 50 to 75 meters per day. Rather than hammering, direct push can also be combined with sonic vibratory methods to increase drill efficiency.This is preferred because there is no need to return intact samples to surface for assay as the objective is to reach a formation containing oil or natural gas. Sizable machinery is used, enabling depths of several kilometres to be penetrated. Rotating hollow drill pipes carry down bentonite and barite infused drilling muds to lubricate, cool, and clean the drilling bit, control downhole pressures, stabilize the wall of the borehole and remove drill cuttings.

The mud travels back to the surface around the outside of the drill pipe, called the annulus. Examining rock chips extracted from the mud is known as mud logging. Another form of well logging is electronic and is commonly employed to evaluate the existence of possible oil and gas deposits in the borehole. This can take place while the well is being drilled, using Measurement While Drilling tools, or after drilling, by lowering measurement tools into the newly drilled hole.For these reasons, redundant safety systems and highly trained personnel are required by law in all countries with significant production.However, there are several basic limiting factors which will determine the depth to which a bore hole can be sunk.Friction caused by the drilling operation will tend to reduce the outside diameter of the drill bit. This applies to all drilling methods, except that in diamond core drilling the use of thinner rods and casing may permit the hole to continue. Casing is simply a hollow sheath which protects the hole against collapse during drilling, and is made of metal or PVC. Often diamond holes will start off at a large diameter and when outside diameter is lost, thinner rods put down inside casing to continue, until finally the hole becomes too narrow. Alternatively, the hole can be reamed; this is the usual practice in oil well drilling where the hole size is maintained down to the next casing point.Air must be delivered to the piston at sufficient pressure to activate the reciprocating action, and in turn drive the head into the rock with sufficient strength to fracture and pulverise it. With depth, volume is added to the inrod string, requiring larger compressors to achieve operational pressures. Secondly, groundwater is ubiquitous, and increases in pressure with depth in the ground. The air inside the rod string must be pressurised enough to overcome this water pressure at the bit face. Then, the air must be able to carry the rock fragments to surface.

This is why depths in excess of 500 m for reverse circulation drilling are rarely achieved, because the cost is prohibitive and approaches the threshold at which diamond core drilling is more economic.However, water circulation must be maintained to return the drill cuttings to surface, and more importantly to maintain cooling and lubrication of the cutting surface of the bit; while at the same time reduce friction on the steel walls of the rods turning against the rock walls of the hole.While diamond is the hardest substance known, at 10 on the Mohs hardness scale, it must remain firmly in the matrix to achieve cutting. Weight on bit, the force exerted on the cutting face of the bit by the drill rods in the hole above the bit, must also be monitored.Please help improve this section by adding citations to reliable sources. Unsourced material may be challenged and removed. July 2012 Learn how and when to remove this template message This is because of the torque of the turning bit working against the cutting face, because of the flexibility of the steel rods and especially the screw joints, because of reaction to foliation and structure within the rock, and because of refraction as the bit moves into different rock layers of varying resistance. Additionally, inclined holes will tend to deviate upwards because the drill rods will lie against the bottom of the bore, causing the drill bit to be slightly inclined from true. It is because of deviation that drill holes must be surveyed if deviation will impact the usefulness of the information returned. Sometimes the surface location can be offset laterally to take advantage of the expected deviation tendency, so the bottom of the hole will end up near the desired location. Oil well drilling commonly uses a process of controlled deviation called directional drilling e.g., when several wells are drilled from one surface location.

These offer the same pressure and sealing capacity found in standard pipe rams, while offering the versatility of sealing on various sizes of drill pipe, production tubing and casing without changing standard pipe rams. Normally VBRs are used when utilizing a tapered drill string when different size drill pipe is used in the complete drill string.Similar to a pipe wrench. It contains jets through which the drilling fluid exits. One safety concern is the use of seatbelts for workers driving between two locations.Oneworld Publications.A smaller rig, known as a workover rig or completion rig, is moved over the well bore. The smaller rig is used for the remaining completion operations. Published by University of Calgary Press, 2005Retrieved 16 January 2015. By using this site, you agree to the Terms of Use and Privacy Policy. The IADC Drilling Manual includes 26 chapters including a glossary. Each chapter is also available as a standalone in electronic format. A comprehensive glossary of drilling terms is also included.Electronic chapters of the new IADC Drilling Manual. The following discloses the information gathering and dissemination practices for this Web site This information allows us to provide you with relevant information regarding the global drilling industry. Mailing information only is provided to approved INTERNATIONAL ASSOCIATION OF DRILLING CONTRACTORS business partners. Phone, fax, and email information is used only by IADC. Contact information is also used to communicate with the user when necessary for site administration. Email Policy IADC does not share your email with any third parties. IADC is not responsible for the privacy practices or the content of such Web sites. Computers and software that contain the information are kept in secure areas and are protected by passwords. Please note that no security system is 100% secure. New Knovel Search Widget Add a Knovel search bar to your internal resource page.

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Maintaining Surface Control System. 88. Maintenance activities. 89. Rig floor. 89. Drilling line maintenance. 91. Wire rope maintenance. 92. Mud circulation system. 93. Generators, electrical motors and electrical systems. 94. Engines. 95. An introduction to drilling operationsAppendices. 97. Appendix 1 Physical properties of H2S. 97. An introduction to drilling operationsADP Aluminium drill pipe MST Magnetic steering toll. AFE Authority for expenditure MW Mud weight. API American Petroleum Institute MWD Measurement while drilling. BHA Bottom hole assembly NMDC Nonmagnetic drill collar. BHO Sub Bottom hole orientation sub NPT Non productive time. BHP Bottom hole pressure OBM Oil based mud. BOD Basis of Design OD Outside diameter.

BOP Blow out preventer OIM Operations installation manager. CBL Cement bond log OWE Offshore well engineer. CLP Choke line pressure PBR Polished ball receptacle. CMC Carboxymethylcelluose PCWD Pressure control while drilling rotating diverter. DC Drill collar PDC Polycrystalline diamond compact. DDR Daily drilling report PDHG. DIMS Drilling information management system PDM Positive displacement mud motor. DMS Drilling management system PFD Process flow diagram. DP Drill pipe POB Personnel on board. DS Drill string standard POBM Pseudo oil based mud. DST Drill string test POOH Pull out of hole. DSV Down hole safety valve PPG Pounds per gallon. DSV Drilling supervisor PSI Pounds per square inch. ECD Equivalent circulating density PTW permit to work. ECP External casing packer PVT Pit volume totaliser. ECPICV External casing packer internal controlRDM Regional drilling manager. EMW Equivalent mud weight RIH Run in hole. ESD Emergency shut down ROV Remotely operated vehicle robotic submarine. FG Formation pressure equivalent density RPM Revolutions per minute. FIT Formation integrity test RTTS Retrievable packer. FMS Flush mounted slips SCR Slow circulation rate. FMS Formal method statement SCSSV Sub surface safety valve. FRAC Fracture SF Safety factor. GOR Gas oil ratio SICP Shut in casing pressure. HAZOP Hazard and operability analysis SIDPP Shut in drill pipe pressure. HCR High closing ratio SPM Strokes per minute. HP High pressure SSP Stand pipe pressure. HPE Hydrostatic pressure equivalent of 1bblTCL Tubing conveyed logging. HPHT High pressure high temperature TFA Total force area. HWDP Heavy weight drill pipe TIW Texas iron works. IBOP Internal blow out preventer TOC Top of cement. ID Internal diameter TRSSSV Tubing retrievable sub surface safety valve. IFG Influx density TVD Total vertical depth. ISP TVDRKB Total vertical depth rotary Kelly bushing. IWCF International well control forum UBD Under balanced drilling.

JSA Job Safety Analysis UBHOsub Universal bottom hole orientation sub. KOP Kick off point ULSEL Ultralong spaced electronic log. KPI Key performance indicator VBR Variable bore rams. KT Kick tolerance WOH Weight on hook. LMRP Lower marine riser package WBM Water based mud. LOT Leak off test WEG. LP Low pressure WOB Weight on bit. LTI Lost time incident WWD World wide drilling. LWD Logging while drilling. MAASP Maximum annular allowable surfaceMD Measured depth. An introduction to drilling operationsMPI Magnetic particle inspectionNote The drilling industry is characterized by abbreviations and namesAn introduction to drilling operationsThe following pages list general safety and health concerns. Each topicSpecific general health and safety topics covered herein areSafety and health program. General safety and health resources. General safety and health resource subject matters to cover areH2S ControlsAn introduction to drilling operationsPersonal Protective Equipment PPESlips trips and falls. There are many ways to protect from slips, trips, and falls. Even so,Repair themAn introduction to drilling operationsGeneral solutions for strains and sprains includeSlips have threeWeather conditions. Weather conditions can create hazardous working conditions thereforeLightning isWhen lightning is present,An introduction to drilling operationsHot work fire and explosiveWorkers pFigure 1 Hot work welding. Figure 2 Welding with fire control.The basic precautions for fire prevention areSpecial PrecautionsWork and equipment should beFire watchers are requiredPotential HazardSulfide, around the wellhead area. An introduction to drilling operationsIf a flammable orAdditional ReferencesOil and Gas Well Drilling and Servicing Operations, Wireline. Service.On Equipment Containing Flammables, 1995. Welding cutting and brazing. All hot work is potentiallyPotential Hazard. Figure 3 Welding Hot work.

An introduction to drilling operationsSpecial HazardPossible SolutionsBoth a hot work and confined entry permitAn introduction to drilling operationsWell Servicing. Association of Energy Services CompaniesCylinder storage Figure 4 Properly stored cylinders. Potential HazardPossible SolutionsAn introduction to drilling operationsPossible SolutionsPotential HazardPossible SolutionsGrinding. Figure 5 Hand Grinding. Potential HazardAn introduction to drilling operationsUse cotton or denimIgnition sources. There are a number of potential sources of ignition for flammableIt is necessary to provide for aPotential HazardPossible SolutionsAn introduction to drilling operationsOil and Gas Well Drilling and Servicing Operations, Wireline. Service.Installations at Petroleum. Facilities Classified as Class 1, Division 1 and Division 2.Electrical Installations at Petroleum. Facilities Classified as Class 1, Zone 0, Zone 1 and Zone 2.International AssociationHydrogen Sulfide or sour gas H S is aMany areas where the gas is foundFlaring operations associated with H S production will generate Sulfur. Dioxide S0 , another toxic gas.Also see NIOSH Classification of H S Hazard Areas.2. Figure 6 Hydrogen sulfide warning sign. Warning Hazardous Area is in yellowHazard, Fatal or Harmful if Inhaled. An introduction to drilling operationsRelease of H2S. All personnel working in an area where concentrations of Hydrogen. Sulfide may exceed the 10 Parts Per Million PPM should be providedPotential HazardPossible Solutions. Implement an H S contingency plan see API including, but notProtection Standard forFigure 7 SCBAComprehensive training should be provided for workers in H2SSulfide.Hydrogen Sulfide exposure.Demonstrated proficiency inSulfide handling system.Additional InformationOperations Involving Hydrogen Sulfide. American PetroleumFigure 8 Gas detectorMetal Fatigue. Metal fatigue, including hydrogenPotential HazardSulfide.Possible SolutionsCorrosion Cracking Resistance in Sour Oilfield.

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