Oil and Gas Well Drilling and Servicing eTool

The oil and gas industry employs hundreds of thousands of people and is a vital component of the national economy. Worker safety and health are important to this industry. This eTool* identifies common hazards and possible solutions to reduce incidents that could lead to injuries or fatalities.

Explore the Potential Hazards of this Industry

Each drilling and servicing company has its own safety program. This eTool is not a replacement for those programs nor does it establish any industry consensus standards (industry disclaimer). Rather, it can be used as a resource in identifying workplace hazards and providing possible solutions that may be relevant to their safety programs. This eTool does not purport to identify all hazards and solutions. This eTool focuses on land based operations.

Worker safety awareness is necessary for injury prevention during all phases of drilling and servicing operations. Procedures and processes will include safety meetings, Job Safety Analyses, and general and task-specific training. At the end of each section, resources are identified that provide more details for establishing safe work practices and procedures.

A key element of any effective safety program is the Job Safety Analysis (JSA). This eTool may be useful in preparing JSAs for your worksite.

Additional Industry References
There are numerous references to API, AESC, and IADC publications, industry safety handbooks, safety programs, training facilities and programs, under the heading of "Additional Information," which can provide more complete and detailed information.

*eTools are "stand-alone," interactive, web-based training tools on occupational safety and health topics. As indicated in the disclaimer, eTools do not create new OSHA requirements.

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THE JOB SAFETY ANALYSIS PROCESS

Today, many companies within the oil and gas industry use the Job Safety Analysis Process (also referred to as a JSA, Job Hazard Analysis, or JHA). The JSA is a very effective means of helping reduce incidents, accidents, and injuries in the workplace. It is an excellent tool to use during new employee orientations and training and can also be used to investigate "near misses" and accidents.

To start the JSA Process, select the job or task to be performed. Any job that has hazards or potential hazards is a candidate for a JSA. An uncommon or seldom-performed job is also a candidate for a JSA.

Forms or worksheets (see sample worksheet) may vary from company to company but the idea remains the same. Identify all steps, hazards, and safe work procedures before starting the job.

The JSA Process is a multi-step process:

- **Basic Job Steps:**

  Break the job into a sequence of steps. Each of the steps should accompany some major task. That task will consist of a series of movements. Look at each series of movements within that basic task.

- **Potential Hazards:**

  To complete a JSA effectively, you must identify the hazards or potential hazards associated with each step. Every possible source of energy must be identified. It is very important to look at the entire environment to determine every conceivable hazard that might exist. Hazards contribute to accidents and injuries.

- **Recommended Safe Job Procedures:**

  Using the *Sequence of Basic Job Steps* and *Potential Hazards*, decide what actions are necessary to eliminate, control, or minimize hazards that could lead to accidents, injuries, damage to the environment, or possible occupational illness. Each safe job procedure or action must correspond to the job steps and identified hazards.

Everyone involved in implementing a job or task should be present when the JSA is written! The JSA should be reviewed, approved, and signed by the supervisor **before** the task is started. Understanding every job step is very important! Whenever a job step changes or a new step is introduced, the JSA must be reviewed and updated.

Remember, the key reasons for completing a JSA are to encourage teamwork (especially with new employees), to involve everyone performing the job in the process, and to elevate awareness!

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Job Safety Analysis: Sample Worksheet

Job Safety Analysis Worksheet					Job To Be Performed:		Tripping Pipe in Hole
Department				Task performed by: (names)			Date
				Dave	Driller		
JSA written by:				Darrel	Derrickman		
Dave the Driller				Mike	Motorman		Supervisor
				Fred	Floorman		Terry Toolpusher
				Frank	Floorman		
Personal Protective Equipment, Special Tools and Other Equipment Required:							Supervisor Approval (Signature)
Hardhat, Safety toe Boots, Safety Glasses							Terry Toolpusher

Step No.	Sequence of Basic Job Steps	Potential Hazards	Recommended Safe Job Procedures
1	Traveling block moving up derrick	Swinging blocks hitting sides of derrick. Tong counterweight line getting hooked on blocks or elevators	Stabilize blocks and elevators. Do not put tongs on pipe too soon. Look up and live!
2	Put make-up tongs on and wrap spinning chain	Pinch points when latching tongs to pipe.	Keep hands and fingers on designated handles. Keep good tail on spinning chain. Keep control of chain.
3	Latching pipe into elevators	Pinch points of elevators and pipe. Dropping stand across derrick. Swinging pipe.	Derrickman should tail out pipe and stabilize stand after pickup. Floormen watch for snag or short stand.
4	Stabbing pipe	Slipping while tailing pipe. Pinch points of pipe and tongs. Missing box.	Get firm hold. Give driller clear view. Place hands and legs properly.
5	Throwing chain, torquing pipe, unlatching tongs	Chain breaking, stuck by chain, pinch points - getting hand or fingers in chain. Tongs slipping.	Make sure tongs are latched properly. Hold tongs out of way after unlatching. Stay clear of chain and out of swing of tongs
6	Pulling slips	Strains	Proper lifting techniques. Lift together. Use moving pipe as leverage.
7	Lowering pipe	Hitting bridge, line parting brake, or hydromatic failure	Lower pipe at controlled speed. Watch weight indicator.
8	Set slips and unlatch elevators	Pinch points at slip handles, elevator links, and elevator latch	Slow down pipe and set slips. All hands should work together. Proper lifting and hand placement.

Oil and Gas Well Drilling and Servicing eTool

General Safety and Health

- Safety and Health Program
  - General Safety and Health Resources
  - Slips, Trips, and Falls
  - Strains and Sprains
  - Weather Conditions
- Hot Work/Welding
  - Hot Work, Fire, and Explosive Hazards
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- H_2S Special Precautions
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Welding with fire control

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General Safety and Health >> Safety and Health Program

This page lists many general safety and health concerns. Each topic is linked to a page with more information about the activity and sources of information.

Fig. 1. Welding with fire control

- Establish a safety and health program. For further guidance see Safety and Health Management Systems eTool. Contact your workers compensation insurance provider engineering group for further information about behavior based safety programs. See Oil and Gas Well Drilling and Servicing Safety and Health Topics pages.
- Contact OSHA consultation services. From the OSHA consultation service employers can find out about potential hazards at their worksites, improve their occupational safety and health management systems, and even qualify for a one-year exemption from routine OSHA inspections.
- General Safety and Health Resources
- Slips, Trips, and Falls
- Strains and Sprains
- Weather Conditions

General Safety and Health Resources ^ TOP

Crane, Derrick, and Hoist Safety

Electrical Systems

Fire Safety

H_2S Controls

- Confined Spaces
- Handling Pressure Cylinders
  - Compressed Gas Equipment
  - Control of Hazardous Energy (Lockout/Tagout)
- Hydrogen Sulfide

- Ventilation
- **OSHA Interpretation:**
  - 04/14/1993 - Respiratory protection as it relates to oil fields. (H_2S)

Hot Work - Welding

Lockout-Tagout

Motor Vehicles Safety

Powered Industrial Trucks

Protective Clothing and Equipment

- Eye and Face Protection
- Foot Protection
- Head Protection
- Hearing Protection
- Respiratory Protection
- Work Clothes

Using Hand and Power Tools

Slips, Trips, and Falls

^ TOP

There are many ways to protect from slips, trips, and falls. Even so, they still happen and the following are means to either prevent slips, trips, and falls or to minimize the consequences if they should happen.

- Wear personal protective equipment (such as hard hats, work gloves, safety shoes, and eye protection).
- Be aware of the slipping and falling hazards when working on the drilling floor, servicing rig floors or other platforms.
- Keep all work areas clean and clear of oil, tools, and debris.
- Use non-skid surfaces where appropriate.
- Provide guardrails and guards around work areas that are prone to slips, trips, and falls.
- Install, inspect, and secure stairs and handrails. [1926.1052]
- Instruct workers on proper procedures for using and installing ladders.
- Use only ladders in good repair that do not have missing rungs.
- Do not install stairs with missing or damaged steps. Repair them before installing them.
- Keep walkways clean and free of debris and tripping hazards. [1910.22]

- Keep all cords and hoses orderly and clear of walking spaces.
- Cover open cellars.
- Conduct a pre-job inspection to identify, then eliminate or correct hazardous work surfaces.
- Walking/Working Surfaces Standard requires [1910.22(a)(1)]: Keep all places of employment clean and in an orderly condition.
- Keep aisles and passageways clear and in good repair, with no obstruction across or in aisles that could create a hazard [1910.22(b)(1)]. Provide floor plugs for equipment so power cords need not run across pathways.
- Use waterproof footgear to decrease slip/fall hazards.

Additional Resources:

- Walking/Working Surfaces, Safety and Health Topics page
- 1910.22 Walking/working surfaces, general requirements
- Walking/working Surfaces, OSHA small business training
- Fall Protection
  - ANSI Z359.1
  - Body Harness (Please recognize that there is a weight limit, including equipment)
  - IADC Fall Protection Guidance
  - Webbing

Strains and Sprains

∧ TOP

General solutions for strains and sprains include:

- Use proper lifting technique.
- Hoist slowly to limit pipe momentum.
- Seek assistance when moving awkward and heavy guards and covers.
- Use proper stance and slip-lifting techniques. Slips have three handles and should be lifted jointly by more than one person.
- Use lifting equipment and limit manual positioning of elevators.
- Practice proper hand placement and use of pullback (tail) ropes.
- Use mechanical lifting aids, proper lifting techniques, and team lifting where appropriate.
- Use proper hand and body positioning.
- Ergonomics

- Hand Injury
- Lifting
- Repetitive motions

Weather Conditions

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Weather conditions can create hazardous working conditions: therefore it is necessary to monitor weather conditions and forecasts to allow time to prepare for such conditions as may occur. Lightning is especially hazardous and unpredictable. When lightning is present, crews must avoid situations where they could become part of potential current paths.

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General Safety and Health >> Hot Work/Welding

Hot work is any work that involves burning, welding, using fire- or spark-producing tools, or that produces a source of ignition. Welding and cutting operations are common to drilling and servicing operations. Test for flammable gases in the work area before starting any hot work. Potentially hazardous areas include, but are not limited to, well heads, fuel tanks, mud tanks, tank batteries, gas separators, oil treaters, or confined spaces where gases can accumulate.

Fig. 1. Hot work - welding

- Hot Work, Fire, and Explosive Hazards
- Welding, Cutting and Brazing
- Cylinder Storage
- Grinding
- Well Site Ignition Sources

Hot Work, Fire, and Explosive Hazards

^ TOP

Workers performing hot work such as welding, cutting, brazing, soldering, and grinding are exposed to the risk of fires from ignition of flammable or combustible materials in the space, and from leaks of flammable gas into the space, from hot work equipment.

Fig. 2. Welding with fire control

Potential Hazard:

- Getting burned by fires or explosions during hot work.

Possible Solutions:

The basic precautions for fire prevention are:

- Perform hot work in a safe location, or with fire hazards removed or covered. [1910.252(a)(1)(i)]
- Use guards to confine the heat, sparks, and slag, and to protect the immovable fire hazards. [1910.252(a)(1)(ii)]

Special Precautions:

- Do not perform hot work where flammable vapors or combustible materials exist. Work and equipment should be relocated outside of the hazardous areas, when possible. [1910.252(a)

(1)(ii)]

- Make suitable fire-extinguishing equipment immediately available. Such equipment may consist of pails of water, buckets of sand, hose, or portable extinguishers. [1910.252(a)(2)(ii)]
- Assign additional personnel (fire watch) to guard against fire while hot work is being performed. Fire watchers are required whenever welding or cutting is performed in locations where anything greater than a minor fire might develop. [1910.252(a)(2)(iii)(A)]
  - Fire watchers shall:
    - Have fire-extinguishing equipment readily available and be trained in its use.
    - Be familiar with facilities for sounding an alarm in the event of a fire.
    - Watch for fires in all exposed areas, try to extinguish them only when obviously within the capacity of the equipment available, or otherwise sound the alarm.
    - Maintain the fire watch at least a half hour after completion of welding or cutting operations to detect and extinguish possible smoldering fires. 1910.252(a)(2)(iii)(B)

Potential Hazard:

- Getting burned by a flash fire or explosion that results from an accumulation of flammable gases, such as Methane or Hydrogen Sulfide, around the wellhead area.

Possible Solutions:

- Monitor the atmosphere with a gas detector. If a flammable or combustible gas exceeds 10 percent of the lower explosive level (LEL), the work must be stopped.
- Identify the source of the gas and repair the leakage.

Additional References:

- OSHA Standards
  - 1910.106, Flammable and Combustible Liquids.
  - 1910.252, Welding, Cutting, and Brazing - General Requirements.
  - 1910.253, Oxygen-fuel gas welding and cutting.
  - 1910.254, Arc welding and cutting.
  - 1910.255, Resistance welding.
- API RP54, Recommended Practice for Occupational Safety for Oil and Gas Well Drilling and Servicing Operations
- API Publication 2201
- NFPA 30, 51-B, Flammable and Combustible Liquids Code, National Fire Protection Association
- Hot Work. AESC, 12 KB PDF, 2 pages.

Welding, Cutting and Brazing

^ TOP

All hot work is potentially hazardous and a hazard assessment should be performed to determine where the hazards exist.

Fig. 3. Welding - hot work

Potential Hazard:

- Injury and illness caused by hot work (such as, welding fumes, UV light, sparks, noise, or skin injury).

Possible Solutions:

- Inspect the work area to ensure that all fuel and ignition sources are isolated by shielding, clearing the area, lockout/tagout, soaking flammable material with water.
- Wear appropriate PPE, such as face shield, leather welder's vest, and gauntlet gloves. Use cotton or denim clothing.
- Provide UV shielding for arc welding where practical.
- Inspect welding and cutting equipment before use (arc or gas welding/burning).
- Leak test gas torches, gauges, and hoses.
- Review the hot work permit if available.
- Ensure the availability of adequate fire watch/fire protection equipment.
- Ensure adequate ventilation from toxic welding and cutting fumes.

Special Hazard:

- Accumulation of toxic gases within a confined space.
- A hazardous atmosphere exists in oxygen-deficient (atmospheric concentration of less than 19.5 percent) or oxygen-enriched (atmospheric concentration of more than 23.5 percent). 1910.146 confined space entry.

Possible Solutions:

- Ventilate toxic metal fumes mechanically, if entering a confined space, such as inside of a mud tank, water tank, oil tanks, hoppers, sump, pit or cellar.
- Use a written permit system to document authorization to enter, the work to be performed, and the results of the gas monitoring where there is a potential for toxic, flammable, or oxygen-deficient atmosphere. Both a hot work and confined entry permit may be required for welding, cutting or brazing within a confined space.

Additional Information:

- AESC Recommended Safe Procedures and Guidelines for Oil and Gas Well Servicing. Section X, Welding, Cutting and Brazing and Hot Work, pp. 77-80, April 2000.
- ANSI Z49.1-67 Safety in Welding and Cutting, American National Standards Institute.
- AWS Z49.1-88, Safety in Welding and Cutting and Applied Processes, American Welding society.

Cylinder Storage

∧ TOP

Fig. 4. Properly stored cylinders

Potential Hazard:

- Falling or rolling injuries from improper gas cylinder storage

Possible Solutions:

- Ensure cylinders are properly stored in an upright position and chained in separate racks.
- Store full and empty cylinders separately.

Potential Hazard:

- Valve opening or break off, exposing workers to toxic fumes and flammable gas, caused by improper gas cylinder storage

Possible Solutions:

- Store cylinder properly.
- Always remove gauges and regulators, and install protective valve caps before transporting.

Potential Hazard:

- Gas cylinders causing fires or explosions

Possible Solutions:

- Store cylinders in a dry, well-ventilated location.
- Avoid storing flammable substances in the same area as gas cylinders.
- Avoid storing cylinders of oxygen within 20 feet of cylinders containing flammable gases.
- Store all cylinders upright and chained in separate racks.
- Store full and empty cylinders separately.

Additional Information:

- Compressed Gas Cylinders. AESC, 16 KB PDF, 3 pages.

Grinding

∧ TOP

Fig. 5. Hand grinding

Potential Hazard:

- Grinding (that results in sparks, noise, eye and skin injury from flying metal filings, grinding wheel pieces, etc.).
- Having fingers or hands caught in the grinding wheel, resulting in amputation.
- Being struck by portable grinder.

Possible Solutions:

- Wear appropriate PPE, such as face shield. Use cotton or denim clothing.

- Inspect grinding equipment before use.
- Review the hot work permit if available.
- Ensure the availability of adequate fire watch/fire protection equipment.

Well Site Ignition Sources

^ TOP

There are a number of potential sources of ignition for flammable gases and liquids on the drill site. It is necessary to provide for a general ignition safety program which could pre-empt potential hazards of fire and explosion.

Fig. 6. Ignition source

Potential Hazard:

- Ignition and explosions of flammable gases or vapors from:
  - Internal-combustion engine sparks
  - Open flames from any source
  - Smoking
  - Welding operations
  - Electric power tools
  - Two-way radios
  - Vehicles with catalytic converters
  - Portable generators

Possible Solutions:

- Provide spark arrestors for internal-combustion engines.
- Post "NO SMOKING" signs wherever a flammable gas or vapor hazard exists.
- Locate "spark producing" equipment or facilities well away from potential hazard areas.
- Prohibit vehicles with catalytic converters from the immediate vicinity of the rig.
- Prohibit open flames from the vicinity of the rig.

Additional Information:

- API, 500, 505
- API, RP54
- IADC, Accident Prevention Reference Guide
- AESC, Recommended Safe Procedures and Guidelines for Oil and Gas Well Servicing
- 1910.106, OSHA Flammable and Combustible Liquids.
- 1910 Subpart S, OSHA Electrical

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General Safety and Health >> Hydrogen Sulfide Gas

Note: It is not the intent of this section to create an H_2S contingency plan.

Hydrogen Sulfide or *sour gas* (H_2S) is a flammable, colorless gas that is toxic at extremely low concentrations. It is heavier than air, and may accumulate in low-lying areas. It smells like "rotten eggs" at low concentrations and causes you to quickly lose your sense of smell. Many areas where the gas is found have been identified, but pockets of the gas can occur anywhere. [more]

Iron sulfide is a byproduct of many production operations and may spontaneously combust with air.

Flaring operations associated with H_2S production will generate Sulfur Dioxide ($S0_2$), another toxic gas.

Active monitoring for hydrogen sulfide gas and good planning and training programs for workers are the best ways to prevent injury and death.

Also see: NIOSH Classification of H_2S Hazard Areas.

Fig. 1. Hydrogen Sulfide warning sign

- Release of H_2S
- Metal Fatigue
- Accumulation of H_2S
- Additional Information
- Appendix A - Physical Properties and Physiological Effects of Hydrogen Sulfide

Release of H_2S ^ TOP

All personnel working in an area where concentrations of Hydrogen Sulfide may exceed the 10 Parts Per Million (PPM) should be provided with training before beginning work assignments.

Potential Hazard:

- H_2S exposure greater than the Permissible Exposure Limit (PEL)

Possible Solutions:

Implement an H_2S contingency plan (see API) including, but not limited to:

- Appropriate instruction in the use of hydrogen sulfide safety equipment to all personnel present at all hydrogen sulfide hazard areas.
- Gas detection where hydrogen sulfide may exist.
- Appropriate respiratory protection for normal and emergency use. Respiratory Protection Standard, [1910.134] (H_2S).

For emergency response information, see Hazardous Waste and Emergency Response (HAZWOPER) Standard, [1910.120].

Comprehensive training should be provided for workers in H_2S operations. Example topics include:

- The characteristics, sources, and hazards of Hydrogen Sulfide.
- Proper use of the Hydrogen Sulfide detection methods used on the site.
- Recognition of, and proper response to, Hydrogen Sulfide warnings at the workplace.
- Symptoms of Hydrogen Sulfide exposure.
- Proper rescue techniques and first-aid procedures to be used in a Hydrogen Sulfide exposure.
- Proper use and maintenance of personal protective equipment. Demonstrated proficiency in using PPE should be required.
- Worker awareness and understanding of workplace practices and maintenance procedures to protect personnel from exposure to hydrogen sulfide.
- Wind direction awareness and routes of egress.
- Confined space and enclosed facility entry procedures.
- Locations and use of safety equipment.
- Locations of safe briefing areas.

Fig. 2. SCBA

Fig. 3. Gas detector

- Use and operation of all Hydrogen Sulfide monitoring systems.
- Emergency response procedures, corrective action, and shutdown procedures.
- Effects of Hydrogen Sulfide on the components of the Hydrogen Sulfide handling system.
- The importance of drilling fluid treating plans prior to encountering Hydrogen Sulfide.

Additional Information:

- API RP 49, 2.02 MB PDF. Recommended Practice for Drilling and Well Servicing Operations Involving Hydrogen Sulfide, Current Edition.
- Use of Respirators. AESC, 68 KB PDF, 18 pages.
- H_2S precautions. AESC, 16 KB PDF, 2 pages.

Metal Fatigue

∧ TOP

Metal fatigue, including Hydrogen embrittlement or Sulfide stress cracking, can result in a release of Hydrogen Sulfide gas.

Fig. 4. H_2S metal fatigue

Potential Hazard:

- Being exposed to Hydrogen Sulfide.
- Getting Injured due to equipment failure.

Possible Solutions:

- Select materials in accordance with the National Association of Corrosion Engineers (NACE MR 0175) criteria for H_2S service.
- Treat drilling fluids to chemically reduce corrosion failures.

Accumulation of H_2S

∧ TOP

It is possible for Hydrogen Sulfide gas to accumulate in any low or enclosed area, such as a gas venting system, mud system, cellars, pits, and tanks.

Potential Hazard:

- Being exposed to Hydrogen Sulfide.

Possible Solutions:

- Provide adequate ventilation for the removal of any accumulation of H_2S.
- Implement effective confined space entry program.

Additional Information

∧ TOP

Additional guidance materials are available from:

- American Petroleum Institute (API) in the recommended practice document RP 49 (*Drilling and Well Servicing Operations Involving Hydrogen Sulfide*, Current Edition) and Spec 6A
- Association of Energy Service Companies (AESC)
- National Association of Corrosion Engineers (NACE)
- International Association of Drilling Contractors (IADC)

- OSHA Standard Interpretation 04/14/1993 - Respiratory protection as it relates to oil fields. Respiratory Protection Standard, [1910.134]
- NFPA 70, National Electrical Code. See the National Fire Protection Agency website (NFPA) 2002 Edition

State Programs:

- **California**: Cal/OSHA Standards: California Code of Regulations, Title 8; Chapter 4, Division of Industrial Safety; Subchapter 14. Petroleum Safety Orders--Drilling and Production
- **Texas**: Texas Administrative Code (TAC); Title 16. Economic Regulation; Part 1. Railroad Commission of Texas; Chapter 3. Oil and Gas Division
- **Utah**: Title 34A, Chapter 6, Utah Occupational Safety and Health Act of 1973. Rule R614-2. Drilling Industry
- **Wyoming**: Employment, Dept. of Occupational Health & Safety - Oil & Gas Well Drilling - Rules
- Alaska: Oil and Gas Commission Alaska Administrative Code Title 20 - Chapter 25

Training Programs

- TEEX
- ASSE: Hydrogen Sulfide Safety Training, ASC Z390

H_2S Training and Information Links

- American Petroleum Institute (API) in the recommended practice document RP 49 (*Drilling and Well Servicing Operations Involving Hydrogen Sulfide*, 3rd Edition, 2001) and Spec 6A
- National Association of Corrosion Engineers (NACE)
- International Association of Drilling Contractors (IADC)

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General Safety and Health >> H_2S Special Precautions

Hydrogen Sulfide gas is very corrosive and causes metals to become brittle. Therefore, employers need to take special precautions when choosing equipment when they may reasonably expect to encounter H_2S. This may include appropriate H_2S trimming of equipment in accordance with National Association of Corrosion Engineers (NACE) Standards.

All well-drilling sites should be classified according to areas of potential and/or actual exposure to H_2S. The recommendations and employee instruction will vary depending on the type of area.

- No Hazard Condition
- API Condition I - Low Hazard
- API Condition II - Medium Hazard
- API Condition III - High Hazard

Hydrogen Sulfide warning sign

Additional Information:

- API
- ANSI
- IADC HSE Reference Guide
- AESC - Recommended Safe Procedures and Guidelines for Oil and Gas Well Servicing
- NACE
- ASSE
- NIOSH

No Hazard Condition ^ TOP

Any well that will not penetrate a known Hydrogen Sulfide formation would be categorized as a No Hazard Area. Special Hydrogen Sulfide equipment is not required.

API Condition I - Low Hazard ^ TOP

Work locations where atmospheric concentrations of H_2S are less than 10ppm.

Recommended for Area:

- Hydrogen Sulfide warning sign with green flag warning device present.
- Keep all safety equipment in adequate working order.
- Store the equipment in accessible locations.

API Condition II - Medium Hazard

^ TOP

Work locations where atmospheric concentrations of H_2S are greater than 10ppm and less than 30ppm.

Recommended for Area:

- Legible Hydrogen Sulfide warning sign with yellow flag warning device present.
- Keep a safe distance from dangerous locations if not working to decrease danger.
- Pay attention to audible and visual alarm systems.
- Follow the guidance of the operator representative.
- Keep all safety equipment in adequate working order.
- Store the equipment in accessible locations.
    - An oxygen resuscitator.
    - A properly calibrated, metered hydrogen sulfide detection instrument.

API Condition III - High Hazard

^ TOP

Work locations where atmospheric concentrations of H_2S are greater than 30ppm.

Recommended for Area:

- Post legible Hydrogen Sulfide warning sign with red flag warning device.
- Post signs 500 feet from the location on each road leading to the location, warning of the hydrogen sulfide hazard.
- Check all Hydrogen Sulfide safety equipment to ensure readiness before each tour change.
- Establish a means of communication or instruction for emergency procedures and maintain them on location, along with contact information of persons to be informed in case of emergencies.
- Ensure usability of two exits at each location.
- Do not permit employees on location without hydrogen Sulfide safety training. (Employees may be permitted on location for specific Hydrogen Sulfide training purposes that does not include general rig training.)
- Pay attention to audible and visual alarm systems.
- Store the equipment in accessible locations.
    - Two Hydrogen Sulfide detectors should be present (one should be a properly calibrated, metered detection instrument, and the other should be a pump type with detector

tubes. The maximum permissible exposure limit (PEL) is 20 ppm. Respiratory protection would be required if periodic testing indicates employee exposures to H_2S at concentrations above the PEL. See OSHA Standard Respiratory Protection, [1910.134]).

- Oxygen resuscitator.
- Three wind socks and streamers.
- Two NIOSH/MSHA 30-minute, self-contained breathing apparatus for emergency escape from the contaminated area only.

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Physical Properties and Physiological Effects of Hydrogen Sulfide

A.1 Physical Data

- Chemical Name: Hydrogen Sulfide
- CAS Number: 7783-06-4
- Synonyms: Sulfureted hydrogen, hydrosulfuric acid, dihydrogen sulfide
- Chemical Family: Inorganic sulfide
- Chemical Formula: H_2S
- Normal Physical State: Colorless gas, slightly heavier than air. Vapor density (specific gravity) at 59°F (15°C) and 1 atmosphere = 1.189.
- Auto ignition Temperature: 500° F
- Boiling Point: -76° F
- Melting Point: -117.2° F
- Flammable Limits: 4.3-4.6 percent vapor by volume in air
- Solubility: Soluble in water and oil: solubility decreases as the fluid temperature increases
- Combustibility: Burns with a blue flame to produce sulfur dioxide (SO2). Refer to Appendix B Odor and Warning Properties: Hydrogen sulfide has an extremely unpleasant odor, characteristic of rotten eggs, and is easily detected at low concentrations: however, due to rapid onset of olfactory fatigue and paralysis (inability to smell) ODOR SHALL NOT BE USED AS A WARNING MEASURE.

A.2 Exposure Limits

The American Conference of Governmental Industrial Hygienists recommends a Threshold Limit Value of 10ppm and a short-term exposure (STEL) limit of 15 ppm averaged over 15 minutes. Exposure at the STEL should not be repeated more than four times per day with at least 60 minutes between successive exposures in this range.

A.3 Physiological Effects

Inhalation at certain concentrations can lead to injury of death. The 300 ppm is considered by the ACGIH as Immediately Dangerous to Life and Health. Hydrogen sulfide is an extremely toxic, flammable gas that may be encountered in the production of gas well gas, high-sulfide, high sulfur content crude oil, crude oil fractions, associated gas, and waters. Since hydrogen sulfide is heavier than air, it can collect in low places. It is colorless and has a foul rotten egg odor. In low concentrations, H_2S sometimes can be detectable by its characteristic odor; however, the smell cannot be relied upon to forewarn of dangerous concentrations (greater than 100ppm) of the gas because it rapidly paralyzes the sense of smell due to paralysis of the olfactory nerve. A longer exposure to the lower concentrations has a similar desensitizing effect on the sense of smell.

It should be well understood that the sense of smell will be rendered ineffective by hydrogen sulfide, which can result in an individual failing to recognize the presence of dangerously high concentrations. Exposure to hydrogen sulfide causes death by poisoning the respiratory system at the cellular level. Symptoms from repeated exposures to low concentrations usually disappear after not being exposed for a

period of time. Repeated exposures to low concentrations that do not produce effects eventually may lead to irritation if the exposures are frequent.

A.4 Respiratory Protection

Respiratory protection shall be worn above the action level. Refer to 6.6 for proper breathing equipment recommendations for oil and gas well drilling and servicing operations involving hydrogen sulfide.

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Site Preparation

Site preparation for an oil and gas well, in most instances, looks like any other construction site. OSHA uses Safety and Health Regulations for Construction [1926] to assess safety compliance during this phase of the development of a drilling site.

Once the location for the site has been established, the area is prepared for drilling, with the following steps:

- Site Preparation
  - Leveling Site
  - Excavating and Trenching
- Conductor-rathole-mousehole
  - Conductor Hole and Pipe
  - Rathole
  - Mousehole
- Transporting Equipment
  - Transporting Equipment by Truck
  - Unload at Drill Site


Fig. 1. Clearing the drilling site

Leveling Site ^ TOP

The site is leveled (if necessary) with a bulldozer and/or a grader.

Potential Hazards:

- Damaging buried pipelines and cables.
- Unpredictable weather changes can create unexpected hazards.
- Irritant and toxic plants, pollens, and other entrained materials.
- Uneven ground may cause bulldozers to roll over.


Fig. 2. Leveling uneven ground

Possible Solutions:

- Perform a site line location survey.

- Plan for hazards due to unpredictable changing weather.
- After weather changes, conduct inspections for new hazards.
- Protect employees engaged in site clearing from hazards of irritant and toxic plants. Teach the employees about available first aid treatments. [1926.604(a)(1)]
- Provide rollover guards on all equipment used in site clearing operations. [1926.602]
- Provide overhead and rear canopy guards on rider-operated equipment. [1926.604(a)(2)]

Excavating and Trenching

^ TOP

The scale and duration of excavating and trenching are very minor and site-specific. On some drilling sites, a below-ground-level *cellar* may be excavated. This is where the main borehole is to be drilled. A reserve pit and settling pits may be excavated and are used for water or drilling fluid (*mud*) discharges.

Fig. 3. Reserve pit

Potential Hazards:

- Dust and other airborne contaminants can cause respiratory problems or allergic reactions.
- Damaging buried pipelines and cables.

Fig. 4. Excavating at a drill site

Possible Solutions:

- Wear appropriate respiratory protection. [1910.134]
- Perform a site line location survey.

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Oil and Gas Well Drilling and Servicing eTool

Site Preparation >> Conductor Hole, Rathole, and Mousehole

Prior to commencing the rig-up process, the conductor, rathole and mousehole are completed.

Special companies may be hired to begin drilling these three holes.

- Conductor Hole and Conductor Pipe
- Rathole
- Mousehole

Fig. 1. Conductor hole

Conductor Hole and Conductor Pipe

∧ TOP

This is a large diameter hole, lined with pipe, also called a starter hole, varies in depth down of tens of feet to a few hundred feet depending on the local geology.

Some sites do not require a conductor hole.

Potential Hazard:

- Being struck by hoisting line or suspended drill or casing.

Possible Solutions:

- Wear Personal Protective Equipment: hard hats, safety glasses, safety toe boots, and work gloves. [1910.135], [1910.133], [1910.136]
- Keep employees away if they are not working at this job.

Fig. 2. Installing conductor hole casing

Rathole

^ TOP

A rathole is a hole in the rig floor, 30 to 35 feet deep, lined with casing that projects above the floor, into which the kelly is placed when hoisting operations are in progress.

This is either done by the portable rig that drills the conductor hole or can be done by the primary rig after rigging-up.

Potential Hazard:

- Falling or stepping into an uncovered rathole.

Possible Solution:

- Cover the hole until it is lined with casing or other material during rigging-up.

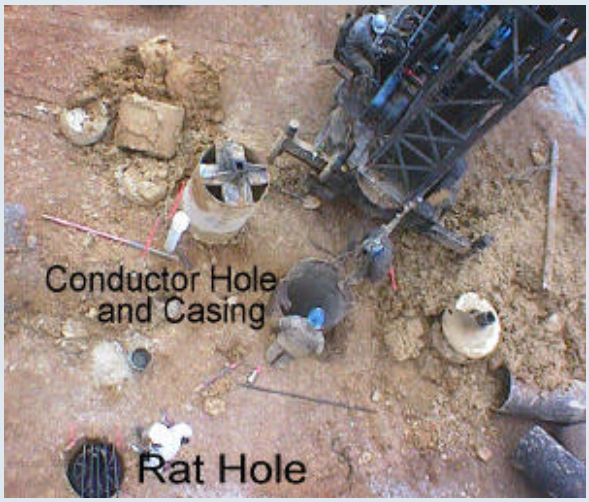

Fig. 3. Rat hole - covered

Mousehole

^ TOP

A mousehole is a shallow bore hole under the rig floor, usually lined with pipe, in which joints of drill pipe are temporarily placed.

This is either done by the portable rig that drills the conductor hole or can be done by the drilling rig after rigging-up.

Potential Hazard:

- Falling or stepping into an uncovered mousehole.

Possible Solution:

- Cover the hole until it is lined with casing or other material during rigging-up.

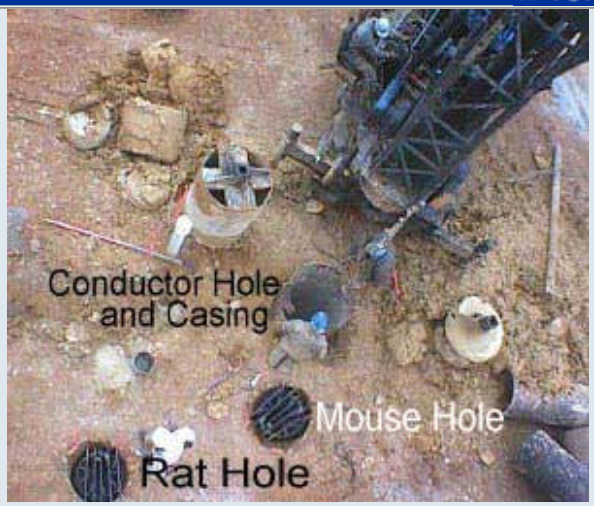

Fig. 4. Mousehole - covered

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Site Preparation >> Transporting Equipment to the Site

Depending on the location of the well, access to the site may require preparation of a road bed. A site, and its access road, must accommodate a large number of temporary and semi-permanent structures and tanks, all brought in by truck. The tasks are:

- Transporting Equipment by Truck
- Unload at Drill Site

Fig. 1. Transporting equipment

Transporting Equipment by Truck

^ TOP

Equipment is loaded on trucks at the previous drill site or storage yard, secured and transported to the new drill location.

Potential Hazards:

- At a newly prepared drill site, the soils may not be compacted sufficiently to support the incoming load. This could cause the load to become unstable.
- The load may not be secured properly, causing it to shift or the tie-downs to fail.
- In slick conditions, the truck may slide off the road.

Fig. 2. Transporting derrick

Possible Solutions:

- Make sure that the access road and drill pad at the drill site has been properly prepared before attempting to drive on it.
- Drive slowly; always being cautious of shifting weight.
- Loads should be tied down with proper devices and inspected before and during transport. U.S. Department of Transportation, [393.100] General rules for protection against shifting or falling cargo.
- Always drive with caution, whatever the conditions.

Unload at Drill Site

^ TOP

Equipment is unloaded and placed approximately where it will be rigged up.

Potential Hazard:

- Improperly secured loads could cause equipment to slide or collapse during unloading.

Possible Solution:

- Inspect loads before loading or unloading.

Fig. 3. Unloading doghouse

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Oil and Gas Well Drilling and Servicing eTool

Drilling

Worker safety awareness is necessary for injury prevention during all phases of drilling operations. Procedures and processes will include safety meetings, JSAs, and general and task-specific training. At the end of each card, resources are identified which provide more details for establishing safe work practices and procedures.

Drilling Rig

- Rigging Up
  - Setting up the Substructure
  - Setting up Rig Floor and Mast or Derrick
  - Installing Handrails, Guardrails, Stairs, Walkways, and Ladders
  - Installing the Power Systems
  - Rigging up the Circulating System
  - Installing the Auxiliary Equipment
  - Inspecting the Rig
  - Rigging Down
- Drilling Ahead
  - Handling Tubulars
  - Preparing Drilling Fluid
  - Starting Drilling
  - Making a connection
    - Preparing to Break Out Pipe
    - Breaking Out Pipe
    - Making Up Pipe in Mouse Hole
    - Raising the Kelly and New Joint
    - Adding Pipe to the String
  - Resuming Drilling
  - Coring
  - Drilling Fluid
    - Drilling Fluid Functions
    - Drilling Fluid Types
    - Drilling Fluid Additives
  - MSDS
- Tripping out/In
  - Setting Slips
  - Breaking Out and Setting Back the Kelly
  - Attaching Elevators to Elevator Links
  - Latching Elevators to Pipe
- Maintenance Activities
  - Rig Floor
  - Drilling Line Maintenance
  - Wire Rope Maintenance
  - Mud Circulating System
  - Generator, Electric Motors and Electrical System
  - Engines
  - Derrick Equipment Maintenance
- Well Control
  - Monitoring and Maintaining Mud System
  - Installing BOP's, Accumulator, and Choke Manifold
  - Testing BOP's, Accumulators, and Choke Manifold
  - Maintaining Surface Control System

General Safety & Health

- Safety and Health Program
- Hot Work/Welding
- Hydrogen Sulfide Gas
- H_2S Special Precautions

- Working on the Monkeyboard
- Maneuvering Pipe to Racking Area
- Tripping in - Latching Elevators to Top of Stand

- Casing Operations
  - Installing Casing Tools
  - Running Casing into the Hole
  - Installing Casing Accessories
  - Circulating and Cementing

Related Safety and Health Topics

- Powered Industrial Trucks
- Personal Protective Equipment (PPE)
- Ergonomics

This eTool describes potential hazards commonly found on a wide variety of drilling rigs. Specific rig designs may have unique potential hazards which should also be addressed in the site JSA.

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Oil and Gas Well Drilling and Servicing eTool

Drilling >> Rigging Up

Rigging up is placing and assembling the various parts of equipment that make up the rig, and preparing the rig for drilling.

There are many rig designs, and this eTool does not cover each type individually. This eTool focuses on the common hazards and solutions that many rig designs share.

During assembly of the rig, some equipment may be handled and set with crane, rig up trucks, or forklift, depending on the size of the rig. It should be noted that overhead hazards such as high voltage power lines may be present.

There may be two or more crews (teams) working together in the rigging up process. The rigging up process includes the following steps, some of which are done simultaneously: (See Servicing - Rigging Up)

Fig. 1. Hoisting the mast

- Setting up the Substructure
- Setting up Rig Floor and Mast or Derrick
- Installing Handrails, Guardrails, Stairs, Walkways, and Ladders
- Installing Power Systems
- Rigging up the Circulating System
- Installing the Auxiliary Equipment
- Inspecting the Rig
- Rigging Down

Setting Up the Substructure

^ TOP

Equipment is unloaded and positioned at or near the exact location that it will occupy during operations.

The substructure is assembled, pinned together, leveled, and made ready for other rig components on the floor.

Equipping the cellar begins but can be done throughout the rigging up process. This includes welding on a drilling nipple to the conductor pipe and attaching a flow line.

Fig. 2. Setting up the substructure

Potential Hazards:

- Being struck by the crane, load, truck, or forklift tipping.

- Pinched fingers when assembling equipment.
- Burns from cutting and welding on the drilling nipple.
- Temporary eye irritation from welding light flash.
- Falling from heights.

Possible Solutions:

- Instruct all workers in safety procedures and ensure that they are knowledgeable about job hazards. This can be done during pre-job safety meetings or JSA briefings.
- Instruct workers to stand clear and keep hands and other body parts away from pinch points.
- Wear proper long sleeve clothing to protect from burns.
- Wear proper welding eye/face protection.
- Avoid looking directly at the flame or arc when welding.
- Wear fall protection when working from heights. Fall Protection, Safety and Health Regulations for Construction - [1926.500, part M.]

Setting Up The Rig Floor and Mast or Derrick

^ TOP

Once the substructure is set in place, the process of setting up the rig floor begins. Begin by installing stairways and guardrails to allow access to the rig floor. Then, the drawworks is set in place and secured to the substructure. On mechanical rigs, the engines are set in place and the compound and associated equipment connected to the drawworks. On electric rigs, the electric cables (lines) are strung to the drawworks.

Fig. 3. Raising the doghouse and rig floor

The bottom of the mast is raised to the rig floor and pinned in place. The crown section is then raised into place on the derrick stand. The "A-legs" are raised and pinned into place. The monkey board is pinned in place on the mast and all lines and cables are laid out to prevent tangling when the mast is raised. A thorough inspection of the mast should be made before raising the mast/derrick. The mast is now ready to be raised. The engines are started (see Installing the Power System), and the drilling line is spooled onto the drawworks drum. Once the mast has been raised and pinned, the remaining floor equipment can be set into place. If the rig has safety guylines, they must be attached to the anchors and properly tensioned prior to continuing the rigging up process. A derrick emergency escape device is installed on the mast.

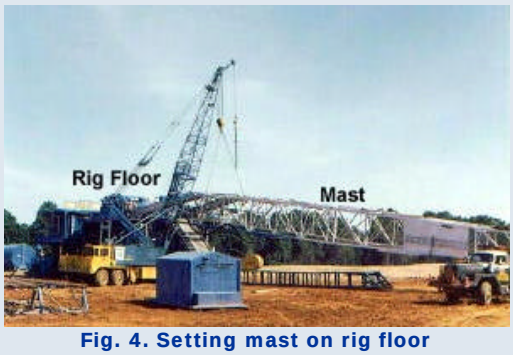

Fig. 4. Setting mast on rig floor

Potential Hazards:

- Falling or tripping during rigging up.

- Falling from rig floor.
- Being struck by swinging equipment.
- Being struck by falling tools.
- Being crushed or struck by equipment due to failure or overloading of hoisting equipment.
- Getting entangled in lines during raising of the derrick or mast.
- Failure to properly install derrick emergency escape device.

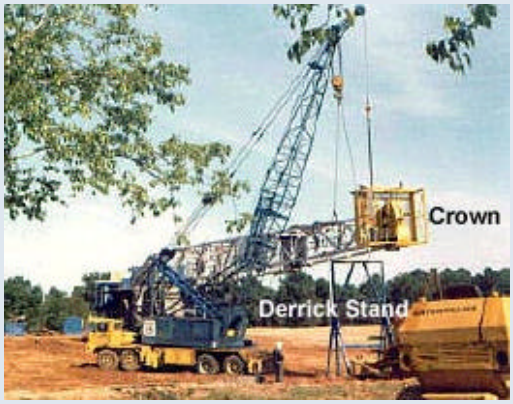

Fig. 5. Setting crown on derrick stand


Fig. 6. Rigging up the mast


Fig. 7. Raising the mast

Possible Solutions:

- Install, inspect, and secure stairs and handrails. [1926.1052]
- Do not use guardrails for anchor points or for lifting or supporting loads.
- Use fall protection when installing or removing guardrails.
- Use a tag line to guide equipment, rather than positioning yourself under suspended loads.
- Check the derrick for unsecured tools before raising it.
- Allow only the operator raising the mast to be on the rig floor.
- Uncoil all lines so that they are clear of all workers when the mast or derrick is raised.
- Attach safety lines to all tools hanging from the rig.
- Keep a safe distance from moving equipment.
- Install derrick emergency escape device properly in accordance with manufacturers recommendations.

Installing Handrails, Guardrails, Stairs, Walkways, and Ladders ^ TOP

Handrails, guardrails, stairways, walkways, and ladders are installed where they are needed for safety and access.

Potential Hazards:

- Falls from ladders.
- Falls or slips from ladders and stairs due to

damaged or missing rungs or steps.

- Slips or falls on walkways due to debris or uneven surfaces.
- Falls from heights.
- Falling into the mud pit or mixing tank.

Possible Solutions:

- Follow established procedures and best work practices.
- Instruct workers on proper procedures for using and installing ladders.
- Use only ladders in good repair that do not have missing rungs.
- Do not install stairs with missing or damaged steps. Repair them before installing them.
- Keep walkways clean and free of debris and tripping hazards. [1910.22]
- Use proper fall protection.

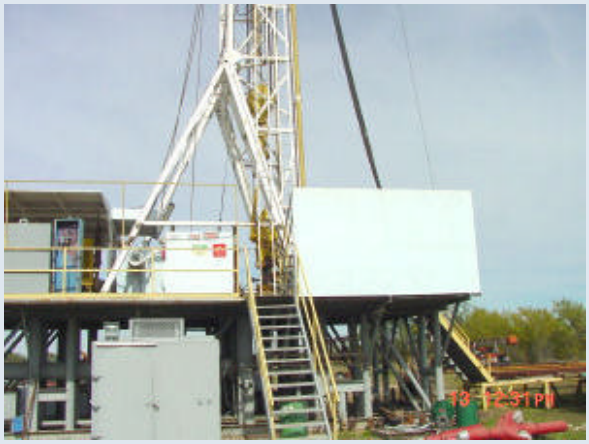

Fig. 8. Stairways, guardrails, and ladders

Fig. 9. Stairways

- Place guardrails in place prior to working in elevated areas. [1910.23]

Installing the Power System

∧ TOP

Installing the power system is usually done simultaneously with setting up the rig floor, because power is needed to operate the equipment. Today there are generally two types of rigs being used on land. A mechanical rig is powered by engines and compound. An electric rig is powered by engines and generators. This type supplies power to electric motors, which drive the machinery.

All power cords, belts, and chains need to be connected to the machinery from their associated power source. Simultaneously, the fuel lines and tanks need to be hooked up. Then, start the engines.

Fig. 10. Engines and generators

Potential Hazards:

- Tripping on power cords and hoses.
- Slips and falls on slick walking services.
- Getting caught in pinch points.
- Exposure to chemical hazards.
- Being shocked or electrocuted.

Fig. 11. Power House

Possible Solutions:

- Keep all cords and hoses orderly and clear of walking spaces.
- Clear and clean all walkways and walking surfaces of slipping hazards.
- Use caution around all chain and belt pinch point areas. Install all guards.
- Use proper PPE when working with chemicals. Toxic and Hazardous Substances: Hazard Communication. - [1910.1200]
- Use proper lockout/tagout/ procedures. The control of hazardous energy (lockout/tagout). - [1910.147]

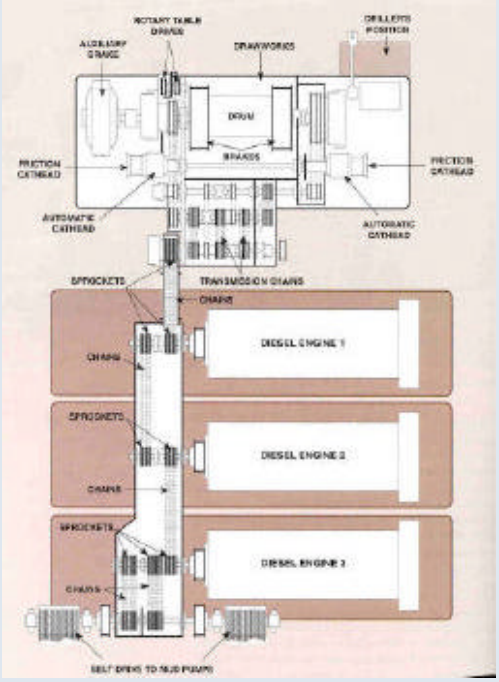

Fig. 12. Compound with chains and sprockets

Rigging Up the Circulating System

∧ TOP

While one crew finishes preparing the rig floor, another crew might be rigging up the circulating system.

The mud tanks and mud pumps are set into the predetermined location.

The mud lines are then connected and electric cords are strung.


Fig. 13. Mud pumps

Potential Hazards:

- Being struck by or crushed by equipment being set into place.
- Getting caught in pinch points.
- Being struck by crane, load, truck or forklift tipping.
- Being struck by hammer when connecting mud line unions.


Fig. 14. Mud system

Possible Solutions:

- Keep a safe distance from equipment that is coming together or moving.
- Maintain a safe distance from all pinch points.
- Stand clear of workers that may be swinging hammers.

Installing the Auxiliary Equipment

∧ TOP

All remaining drilling and auxiliary equipment must be set into place and installed where needed.

The catwalk and pipe racks are positioned and the pipe and drill collars are set on the racks.

Fig. 15. Tubulars on pipe racks

Potential Hazards:

- Getting struck or pinched by, or caught in between, tubulars being loaded onto racks.
- Having feet pinched or crushed when setting up the pipe racks and catwalk.

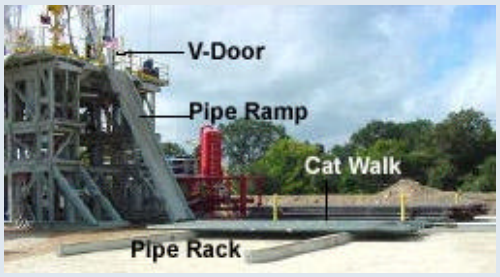

Fig. 16. Pipe rack and v-door

Possible Solutions:

- Keep a safe distance from equipment that is coming together.
- Use a tag line to guide the pipe racks and catwalks into position.

Inspecting the Rig

∧ TOP

Perform a complete inspection of the rig before operating. The driller and/or rig superintendent/toolpusher/manager should walk around the entire rig and inspect for missing or loose pins and bolts, equipment guards, adequate guard railings, proper line and cable placement, and unclear walkways.

Fig. 17. Inspecting the rig

Potential Hazards:

- Falling from the rig.
- Tripping on power cords and hoses.
- Slipping and falling on slick walking services.

Fig. 18. Inspecting rig equipment

Possible Solutions:

- Use proper fall protection. Fall Protection, Safety and Health Regulations for Construction - [1926.500, part M].
- Keep all cords and hoses orderly and clear of walking spaces.
- Clear and clean all walkways and walking surfaces of slipping hazards.

Rigging Down

∧ TOP

After production casing is run and cemented, the rig is taken down and moved to another site. The rigging down process is basically the reverse of rigging up.

The hazards and solutions are similar to those for rigging up.

Fig. 19. Loading doghouse onto trailer

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Drilling >> Drilling Ahead

Drilling ahead means the actual drilling of the well.

Specific drilling processes vary, but many of the work hazards are similar. The following generic tasks assume the use of a kelly and rotary table. Other rig designs may include the use of a top drive.

- Handling Tubulars
- Preparing Drilling Fluid
- Starting Drilling
- Making a connection
  - Preparing to Break Out Pipe
  - Breaking Out Pipe
  - Making up Pipe in Mousehole
  - Raising the Kelly and New Joint
  - Adding Pipe to the String
- Resuming Drilling
- Coring

Fig. 1. Drilling rig

Handling Tubulars

^ TOP

The pipe is unloaded from trucks onto the pipe rack. The floor crew brings pipe from the pipe rack and catwalk, using the catline, air hoist or hydraulic winch, up to the drilling floor and places it in the mousehole. This is done for every connection.

Note: The rig supervisor should hold a pre-job meeting with the crew to review responsibilities and to coordinate the operations to be performed.

Potential Hazards:

- Being struck by rolling or falling tubulars.
- Being struck by or caught between tubulars and other objects during movement (for example, being struck by tubulars being tailed into the rig floor).
- Slips, trips, and falls.

Possible Solutions:

- Use powered industrial truck (forklift) properly.
- Work the tubulars from the ends from ground level.
- Chock or pin tubulars on the racks properly.
- Level your pipe racks properly.
- Stand clear of suspended, hoisted, or moving loads. Be aware of tubulars or equipment being lifted through the V-door.

Potential Hazards:

- Getting struck by falling tubulars due to lifting equipment failure.

Fig. 2. Loading tubulars

Possible Solutions:

- Instruct workers in the need for proper use, inspection, and maintenance practices. Before each tour inspect the:
  - Wire rope and slings,
  - Catline ropes and knots (do not allow a rope to lie in standing water), and
  - Chains and hooks.
- Stand clear of suspended, hoisted or moving loads and be aware of your surroundings.

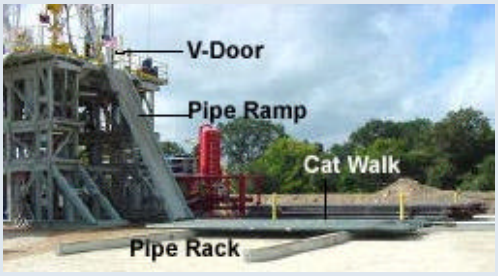

Fig. 3. Catwalk and V-door

Additional Information:

- API, RP 54
- IADC Accident Prevention Guide
- IADC and PETEX, Home Study Courses: Rotary Drilling Series
  - Unit I: The Rig and Its Maintenance
  - Unit II: Normal Drilling Operations
  - Unit III: Non-routine Rig Operations
  - Unit IV: Man Management and Rig Management

Preparing Drilling Fluid

∧ TOP

Drilling fluid is an important component in the drilling process [more]. A fluid is required in the wellbore to:

- Cool and lubricate the drill bit
- Remove the rock fragments, or drill cuttings, from the drilling area and transport them to the surface,

- Counterbalance formation pressure to prevent formation fluids (i.e. oil, gas, and water) from entering the well prematurely (which can lead to a blowout), and
- Prevent the open (uncased) wellbore from caving in.

The mud is monitored throughout the drilling process. A mud engineer and/or the Derrickman may periodically check the mud by measuring its viscosity, density, and other properties.

Fig. 4. Drilling fluid - mud

Potential Hazards:

- Burns, or physical injury caused by contact with skin or eyes.
- Being exposed to explosions or violent reactions from chemicals mixed improperly.
- Being exposed to inhalation hazards.
- Receiving strains and sprains.
- Slips, trips and falls.

Fig. 5. Mud Mixing Hopper

Possible Solutions:

- Ensure workers follow the safe handling procedures found in Material Safety Data Sheets (MSDS). [Example MSDS], [1910.1200]
- Wear appropriate personal protective equipment, including, eye and face protection. [1910.132], [1910.133]
- Wear appropriate respiratory protection when handling chemicals and/or mud additives. [1910.134]
- Provide an eyewash station and other appropriate flushing apparatus as recommended by the MSDS. [1910.151(c)]
- Provide adequate ventilation.
- Use proper mixing procedures.

Fig. 6. Caustic soda mixing container

- Use designated containers for mixing certain chemicals (for example, baffled container with lid).
- Substitute less hazardous materials or use pre-mixed mud.
- See General Safety & Health.

Note: Tank cleaning is a high-hazard operation requiring confined space entry procedures, training for personnel, PPE, and specialized equipment. [1910.146]

Starting Drilling

∧ TOP

Fig. 7. Lowering drill bit

To start drilling, a surface drill bit is attached to a bottomhole drill collar, which is in turn attached to the kelly. Once made up, the driller lowers the bit through the rotary table and engages the mud pump(s) and checks for leaks and other abnormalities. The driller lowers the drill string and the kelly bushing is set in the rotary drive bushing and the rotary is engaged. The driller then slowly lowers the bit to bottom and begins the drilling operation.

Potential Hazards:

- Being struck by the tongs, the make-up chain, or pipe.
- Being caught between collars and tongs, spinning chain, and pipe.

Possible Solutions:

- Implement an effective pipe handling, make-up, break-out procedure:
  - Stand outside the tong swing radius when breaking pipe.
  - Use proper tong latching techniques and use proper hand and finger placement on tong handles.
  - Stand clear of the rotary table when it is rotating.
- Use a tail rope on the spinning chain to keep hands away.

Potential Hazards:

- Receiving strains and sprains during lifting or controlling movement of drill collars, bit breaker, pipe, and tongs.

Possible Solutions:

- Use proper lifting technique.
- Hoist slowly to limit pipe momentum.
- Use mechanical lifting aids such as a rig floor winch.
- Use tail rope to guide as necessary.

Potential Hazards:

- Slips, trips, and falls.

Possible Solutions:

- See Slips, Trips, and Falls.

Potential Hazards:

- Encountering shallow gas

Possible Solutions:

- See well control - Blowout Prevention Program.

Additional Information:

- IADC, WellCAP

Preparing to Break Out Pipe

^ TOP

The driller stops the drill string from rotating, and hoists the drill string with the drawworks until the kelly is out of the rotary table. The driller then shuts down the mud pump(s). The floor hands set the slips around the joint of pipe. The tongs are then latched onto the tool joints above and below the connection.

Fig. 8. Setting slips

Potential Hazards:

- Pinching fingers or other body parts between slips or slip handles and rotary table.
- Experiencing muscle strain from improper lifting technique.
- Pinching fingers when latching the tongs onto the pipe.

Possible Solutions:

- Implement effective, safe work procedures for using slips and tongs, which include:
  - Proper finger and hand placement on slip handles and tong handles
  - Proper stance and slip lifting techniques
  - Proper tong latching techniques

Additional Information:

- API, RP 54
- IADC, WellCAP
- IADC and PETEX, Home Study Courses: Rotary Drilling Series

Breaking Out Pipe

∧ TOP

The tongs and cathead are used to break out the pipe. Either the rotary table or kelly spinner is used to spin the drill string or kelly to unscrew it from the drill pipe joint.

Fig. 9. Breaking out drill pipe

Potential Hazards:

- Being struck by:
  - Swinging tongs if the tong dies fail, or the tong counterweight lines were to break
  - The slip handles if the rotary table is used to spin the drill string
  - Reverse backlash of tongs (backbiting) during spinning out operations
  - The tongs if a snub line breaks or the tongs come unlatched
  - Pipe

Possible Solutions:

- Inspect tong dies, counterweight cables, and snub lines tourly and prior to each trip.
- Implement an effective spinning out pipe procedure:
  - Personnel other than tong operators stand outside the tong swing radius when breaking pipe.
  - No one should stand in the red zone (see Diagram 1)
  - Use proper tong latching techniques and use proper hand and finger placement on tong handles.
  - Stand clear of the rotary table when it is rotating.
  - Use special operational procedures when using a high torque connection.
- Maintain good communication between floor crew and driller.

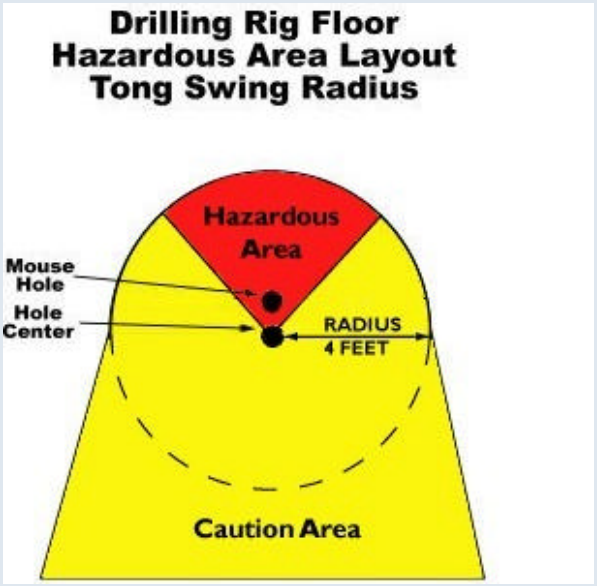

Diagram 1: Drilling rig floor
Hazardous area layout
Tong swing radius

Potential Hazards:

- Release of excess drilling mud resulting in skin contact, loss of footing, etc.

Possible Solutions:

- Use a mud bucket to direct mud down into the rotary table.
- Close the mud saver valve on the kelly (if present).

Additional Information:

- API RP 54
- IADC APRG
- IADC/PETEX Rotary Drilling Series

Making Up Pipe in Mousehole

∧ TOP

The crew swings the kelly out over the mousehole and stabs it into a new joint of pipe. The driller then spins up the kelly using the kelly spinner or spinning chain and the crew uses tongs to torque the joint.

Fig. 10. Making up mousehole joint

Potential Hazards:

- Being struck or pinched by the kelly.
- Losing footing while swinging the kelly out over the mousehole and stabbing it into a new joint of pipe.
- Being struck by or caught in the spinning chain.

Possible Solutions:

- Use proper hand placement
- Keep the work area around the rotating table clean and clear of mud, ice, snow, debris and other materials that may cause slipping or tripping.
- Inspect chain for broken or distorted links. Chains with the metal reduced by wear at any point less than 90 percent of its original cross section area should be discarded.
- Lubricate and maintain guide rollers to prevent undue wear on the chain or cable.

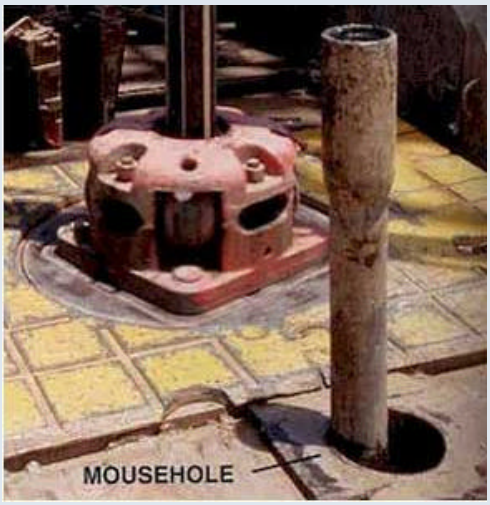

Fig. 11. Pipe in mousehole

Additional Information:

- IADC, APRG
- IADC/PETEX Rotary Drilling Series

Raising the Kelly and New Joint

∧ TOP

The driller uses the drawworks to raise the kelly and attached joint out of the mousehole.

Fig. 12. Raising the traveling block and kelly

Potential Hazards:

- Being struck by debris or overhead objects if the traveling block runs into the crown block or if the traveling block or swivel hits the derrick.
- Being struck by kelly or pipe.

Possible Solutions:

- Install a crown safety device on the drawworks and ensure proper functioning.
- Keep personnel clear of the potential swing path of the kelly and pipe.

Adding Pipe to the String

^ TOP

The new joint is guided over to the drill hole, the tool joint is doped, and stabbed into the end of the pipe suspended in the rotary table with the slips.

The joints are threaded together using the pipe spinner, kelly spinner, or spinning chain. Final torque is provided by the tongs.

The drawworks lifts the kelly and attached string to facilitate removal of the slips.

Fig. 13. Applying pipe dope to a connection

Potential Hazards:

- Being struck by:
  - Swinging kelly and pipe
  - Tongs if the stabber misses the stump
  - The jerk or spinning chain
- Being caught between the swinging pipe and the tongs.
- Being caught between the joint of pipe being stabbed and the stump.
- Getting pinched between tongs or pipe spinner and pipe.
- Slips, trips, and falls.

Fig. 14. Pulling slips

Possible Solutions:

- Never step over a jerk chain and stay clear of spinning chain when a connection is being made.
- Keep hands away from end of stump or inside of pipe.
- Keep feet and legs away from underneath tongs when the pipe is being stabbed.
- Use proper tong latching techniques and hand and finger placement on tong handles.
- Never stand or walk under suspended loads.
- Keep the work area around the rotary table clean and clear of drilling fluids, mud, ice, snow, debris, and other materials that may cause slipping or tripping.
- Inspect chains for worn or damaged links, and replace a chain having a broken or distorted link with the metal reduced by wear at any point less than 90 percent of its original cross section area.
- See Slips, Trips, and Falls.

Resuming Drilling

^ TOP

The driller starts the pump and picks up off the slips. The drill crew then removes the slips. The driller lowers the string until the kelly drive bushing engages the master bushing. Once the bushings are in place, the driller begins rotating the drill string, lowers the bit back to bottom, and continues making hole.

Fig. 15. Lowering kelly bushing

Potential Hazards:

- Being thrown off the rotary table when engaged.
- Getting caught by loose clothing.

Possible Solutions:

- Stand clear of the rotary table.
- See Work Clothes.

Coring

^ TOP

In some cases the operator orders a core sample of the formation for testing. A special core barrel is lowered to the bottom on the drill string and is rotated to cut a core from the formation. This core is brought to the surface and examined in a laboratory.

Fig. 16. Drill core

Potential Hazards:

- Being pinched or struck by the core barrel and associated tools during floor operations.
- Being struck by the core as it is removed from the barrel.
- Encountering other hazards similar to those encountered during tripping out/in.

Possible Solutions:

- Wear appropriate PPE.
- Instruct workers in handling and using the special tools required during drill core extraction.

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Oil and Gas Well Drilling and Servicing eTool

Drilling >> Drilling Ahead >> Drilling Fluid

- Drilling Fluid Functions
- Drilling Fluid Types
- Drilling Fluid Additives

Additional References

Drilling Fluid Functions

∧ TOP

Drilling fluid is an important component in the drilling process. A fluid is required in the wellbore to:

- Cool and lubricate the drill bit,
- Remove the rock fragments, or drill cuttings, from the drilling area and transport them to the surface,
- Counterbalance formation pressure to prevent formation fluids (such as oil, gas, and water) from entering the well prematurely (which can lead to a blowout), and
- Prevent the open (uncased) wellbore from caving in.

Fig. 1 Drilling fluid (Mud)

Drilling Fluid Types

∧ TOP

There are several types of drilling fluids used depending on the drilling conditions encountered:

- Water-based muds are used most frequently. The base may be either:
  - fresh water, or
  - salt water.
- Oil-based muds.
- Synthetic materials. The oil and gas extraction industry has developed many new oleaginous (oil-like) base materials from which to formulate high-performance drilling fluids. A general class of these fluids is called synthetic materials, such as

- The vegetable esters,
- Poly alpha olefins,
- Internal olefins,
- Linear alpha olefins,
- Synthetic paraffins,
- Ethers, and
- Linear alkylbenzenes, among others.

- Air and foam fluids may be used in drilling wells.
  - These fluids are less dense than drilling muds.

Drilling Fluid Additives

∧ TOP

Drilling muds typically have several additives. (Air and foam fluids typically do not contain many additives because the additives are either liquid or solid, and will not mix with air and foam drilling fluids.) The following is a list of the more significant additives:

Fig. 2 Additive mixing hopper

- Weighting materials, primarily barite (barium sulfate), may be used to increase the density of the mud in order to equilibrate the pressure between the wellbore and formation when drilling through particularly pressurized zones. Hematite (Fe_2O_3) sometimes is used as a weighting agent in oil-based muds (Souders, 1998).
- Corrosion inhibitors such as iron oxide, aluminum bisulfate, zinc carbonate, and zinc chromate protect pipes and other metallic components from acidic compounds encountered in the formation.
- Dispersants, including iron lignosulfonates, break up solid clusters into small particles so they can be carried by the fluid.
- Flocculants, primarily acrylic polymers, cause suspended particles to group together so they can be removed from the fluid at the surface.
- Surfactants, like fatty acids and soaps, defoam and emulsify the mud.
- Biocides, typically organic amines, chlorophenols, or formaldehydes, kill bacteria and help reduce the souring of drilling mud.
- Fluid loss reducers include starch and organic polymers and limit the loss of drilling mud to under-pressurized or high-permeability formations.

This Material Safety Data Sheet (MSDS) contains information on the use and procedures for handling Caustic Soda. There are data sheets on all the hazardous chemicals used in the drilling industry. Data sheets must be supplied by the manufacturer and/or supplier each time the chemical is introduced into the workplace. See Hazard Communication: Toxic and Hazardous Substances [1910.1200]

MATERIAL SAFETY DATA SHEET

CAUSTIC SODA (NaOH)

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

TRADE NAME: CAUSTIC SODA (NaOH)
UN/NA (PIN) No.: 1823
CHEMICAL CLASS: Bases, alkalies (inorganic).
APPLICATIONS: Oil well drilling fluid additive. pH modifier.
EMERGENCY TELEPHONE: 281-561-1600
SUPPLIER: Supplied by a Business Unit of M-I L.L.C.
P.O. Box 42842, Houston, Texas 77242-2842
See cover sheet for local supplier.
TELEPHONE: 281-561-1509
FAX: 281-561-7240
CONTACT PERSON: Sam Hoskin

2. COMPOSITION, INFORMATION ON INGREDIENTS

INGREDIENT NAME:	CAS No.:	CONTENTS :	EPA RQ:	TPQ:
Sodium hydroxide	1310-73-2	100 %	1 000 lbs	

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW:

DANGER! CAUSES EYE AND SKIN BURNS. Do not get in eyes or on skin or clothing. Avoid breathing airborne product. Keep container closed. Use only with adequate ventilation. Wash thoroughly after handling. Avoid contact with water or moisture, which may generate sufficient heat to ignite combustible materials. This product is a white pellet or flake material. Slippery when wet.

ACUTE EFFECTS:

HEALTH HAZARDS, GENERAL:

Contact with this product is severely irritating to the eyes, skin, and respiratory tract and may cause severe eye injury.

INHALATION: Severely irritating to the respiratory tract if inhaled.
INGESTION: May cause burns in mucous membranes, throat, esophagus, and stomach.
SKIN: Corrosive to skin.
EYES: Corrosive to eyes.

CHRONIC EFFECTS:

CARCINOGENICITY:

IARC: Not listed. OSHA: Not regulated. NTP: Not listed.
10296 - CAUSTIC SODA (NaOH)

ROUTE OF ENTRY:

Inhalation. Skin and/or eye contact.

TARGET ORGANS:

Respiratory system, lungs. Skin. Eyes.

4. FIRST AID MEASURES

GENERAL: Persons seeking medical attention should carry a copy of this MSDS with them.
INHALATION: Move the exposed person to fresh air at once. Perform artificial respiration if breathing has stopped. Get medical attention.
INGESTION: Drink a couple of glasses water or milk. Do NOT induce vomiting unless directed to do so by a physician. Never give anything by mouth to an unconscious person. Get medical attention.
SKIN: Wash skin thoroughly with soap and water. Remove contaminated clothing. Get medical attention if any discomfort continues.
EYES: Promptly wash eyes with lots of water while lifting the eye lids. Continue to rinse for at least 15 minutes. Get medical attention if any discomfort continues.

5. FIRE FIGHTING MEASURES

AUTO IGNITION TEMP. (°F): N/D
FLAMMABILITY LIMIT - LOWER(%): N/D
FLAMMABILITY LIMIT - UPPER(%): N/D
EXTINGUISHING MEDIA:

Carbon dioxide (CO2). Dry chemicals. Foam.

SPECIAL FIRE FIGHTING PROCEDURES:

No specific fire fighting procedure given.

UNUSUAL FIRE & EXPLOSION HAZARDS:

Upon contact with certain metals and water or moist air, hydrogen gas is generated, forming explosive mixtures with air.

HAZARDOUS COMBUSTION PRODUCTS:

Irritating gases/vapors/fumes.

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS:

Wear proper personal protective equipment (see MSDS Section 8).

SPILL CLEAN-UP PROCEDURES:

Avoid generating and spreading of dust. Shovel into dry containers. Cover and move the containers. Flush the area with water. Do not contaminate drainage or waterways. Repackage or recycle if possible.

7. HANDLING AND STORAGE

HANDLING PRECAUTIONS:

Avoid handling that causes dust to generate. Wear full protective clothing for prolonged exposure and/or high concentrations. Make eye wash and emergency shower available at the work place. Wash hands often and change clothing when needed. Provide good ventilation. Provide mechanical ventilation or local exhaust ventilation.

STORAGE PRECAUTIONS:

Store at moderate temperatures in dry, well ventilated area. Keep in original container.

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

		OSHA PEL:	ACGIH TLV:	OTHER:	
INGREDIENT NAME:	**CAS No.:**	**TWA: STEL:**	**TWA: STEL:**	**TWA: STEL:**	**UNITS:**
Sodium hydroxide	**1310-73-2**	2	2 C*		mg/m3

*C = Ceiling Limit

PROTECTIVE EQUIPMENT:
ENGINEERING CONTROLS: Use appropriate engineering controls such as exhaust ventilation and process enclosure to reduce air contamination and keep worker exposure below the applicable limits.
VENTILATION: Supply natural or mechanical ventilation adequate to exhaust airborne product and keep exposures below the applicable limits.
RESPIRATORS: Use at least a NIOSH-approved N95 half-mask disposable or reuseable particulate respirator. In work environments containing oil mist/aerosol, use at least a NIOSH-approved P95 half-mask disposable or reuseable particulate respirator.
PROTECTIVE GLOVES: Use gauntlet type rubber gloves.
EYE PROTECTION: Use tight-fitting goggles if dust is generated. Wear splash-proof eye goggles to prevent any possibility of eye contact.
PROTECTIVE CLOTHING: Wear appropriate clothing to prevent any possibility of skin contact. Provide eyewash station and safety shower.
HYGIENIC WORK PRACTICES: Wash promptly with soap and water if skin becomes contaminated. Change work clothing daily if there is any possibility of contamination.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE/PHYSICAL STATE: Pellets or flakes.
COLOR: White.
ODOR: Odorless or no characteristic odor.
SOLUBILITY DESCRIPTION: Soluble in water.
BOILING POINT (°F, interval): 2530 PRESSURE: 760mmHg
MELT./FREEZ. POINT (°F, interval): 604
DENSITY/SPECIFIC GRAVITY (g/ml): 2.13 TEMPERATURE (°F): 68
BULK DENSITY: 133 lb/cu. ft.; 2131 kg/m3
VAPOR DENSITY (air=1): N/A
VAPOR PRESSURE: 42 mmHg TEMPERATURE (°F): 1832
pH-VALUE, DILUTED SOLUTION: 13 CONCENTRATION (%,M): 1%

10. STABILITY AND REACTIVITY

STABILITY: Normally stable.
CONDITIONS TO AVOID: Reacts strongly with water. Avoid contact with acids.
HAZARDOUS POLYMERIZATION: Will not polymerize.
POLYMERIZATION DESCRIPTION: Not relevant.
MATERIALS TO AVOID: Organochlorine solvents, nitro and nitroso compounds, organic peroxides; aluminum, zinc, tin and their alloys.
HAZARDOUS DECOMPOSITION PRODUCTS: No specific hazardous decomposition products noted.

11. TOXICOLOGICAL INFORMATION

Component: Sodium hydroxide

TOXICOLOGICAL DATA:

24 hours. Eye. Rabbit. 1 mg Severe Irritation Corrosive effects.
24 hours. Skin. Rabbit. 500 mg Severe Irritation Corrosive effects.
LDLo. Oral. Rabbit. 500 mg/kg Acute toxicity.

TOXIC DOSE - LD 50: 1350 mg/kg (skn-rbt)

12. ECOLOGICAL INFORMATION

LC 50, 96 HRS, FISH, mg/l: 125 (Mosquitofish)

EC 50, 48 HRS, DAPHNIA, mg/l: 100

ACUTE AQUATIC TOXICITY:

This product passes the mysid shrimp toxicity test required by the U.S. Environmental Protection Agency (EPA) Region VI (Gulf of Mexico) NPDES Permit, which regulates offshore discharge of drilling fluids, when tested in a standard drilling fluid. Contact M-I's Environmental Affairs Department for more information.
This product is approved for use under the U.S. Environmental Protection Agency (EPA) Region IX (California) General NPDES Permit which regulates offshore discharges of drilling fluids. Contact M-I's Environmental Affairs Department for more information.

13. DISPOSAL CONSIDERATIONS

WASTE MANAGEMENT:

This product, should it become a waste, is hazardous by U.S. RCRA criteria.
THIS CONTAINER MAY BE HAZARDOUS WHEN EMPTY. Empty containers retain residues. All labeled precautions must be observed.

DISPOSAL METHODS:

Recover and reclaim or recycle, if practical. Should this product become a waste, dispose of in a permitted industrial landfill. Ensure that containers are empty by RCRA criteria before disposal in a permitted industrial landfill.

14. TRANSPORT INFORMATION

LABEL FOR CONVEYANCE:
PROPER SHIPPING DESCRIPTION II: Sodium hydroxide, solid, 8, UN1823, PG II
GENERAL: RQ = 1000
EMERGENCY RESPONSE GUIDE No.: 154

U.S. DOT:

UN/NA No.: 1823
U.S. DOT HAZARD LABEL: CORROSIVE (Black/white diam.) DOT17
U.S. DOT CLASS: Class 8 - Corrosive Material
U.S. DOT PACKING GROUP: II
U.S. DOT PACKAGING INSTRUCTIONS: 49 CFR 173.154; 173.212; 240

CANADIAN TRANSPORT:

TDGR CLASS: Class 8 - Corrosives
TDGR LABEL: Corrosive

SEA TRANSPORT:

UN No. SEA: 1823
IMDG CLASS: Class 8 - Corrosives
IMDG PAGE No.: 8225-1
IMDG PACK GR.: II
EmS No.: 8-06
MFAG TABLE No.: 705

AIR TRANSPORT:

UN No., AIR: 1823
ICAO CLASS: Class 8 - Corrosives
AIR PACK GR.: II

15. REGULATORY INFORMATION

REGULATORY STATUS OF INGREDIENTS:	CAS No:	TSCA:	CERCLA:	SARA 302:	SARA 313:	DSL (CAN):
NAME: Sodium hydroxide	1310-73-2	Yes	Yes	No	No	Yes

US FEDERAL REGULATIONS:

WASTE CLASSIFICATION: A hazardous waste by U.S. RCRA criteria

REGULATORY STATUS: This product or its components, if a mixture, is subject to following regulations (Not meant to be all-inclusive, selected regulations represented):

SECTION 313: This product does not contain toxic chemical subject to the reporting requirements of Section 313 of Title III of the Superfund Amendment and Reauthorization Act of 1986 and 40 CFR Part 372.

SARA 311 Categories:

1: Immediate (Acute) Health Effects

5. Reactivity Hazard

The components of this product are listed on or are exempt from the following international chemical registries:

TSCA (U.S.)

DSL (Canada)

STATE REGULATIONS:

STATE REGULATORY STATUS: This product or its components, if a mixture, is subject to following regulations (Not meant to be all-inclusive, selected regulations represented):

Illinois Right-to-Know
New Jersey Right-to-Know
Pennsylvania Right-to-Know
PROPOSITION 65: This product does not contain chemicals considered by the State of California's Safe Drinking Water and Toxic Enforcement Act of 1986 as causing cancer or reproductive toxicity, and for which warnings are now required.

CANADIAN REGULATIONS:

LABELS FOR SUPPLY:

REGULATORY STATUS:

This Material Safety Data Sheet has been prepared in compilance with the Controlled Product Regulations.
Canadian WHMIS Classification: E - Corrosive Material D2B - Other Toxic Effects: Toxic Material

16. OTHER INFORMATION

NPCA HMIS HAZARD INDEX: 3 Serious Hazard

FLAMMABILITY: 0 Minimal Hazard

REACTIVITY: 1 Slight Hazard

NPCA HMIS PERS. PROTECT. INDEX: X Ask your supervisor for guidance

USER NOTES: N/A = Not applicable N/D = Not determined

INFORMATION SOURCES:

OSHA Permissible Exposure Limits, 29 CFR 1910, Subpart Z, Section 1910.1000, Air Contaminants.
ACGIH Threshold Limit Values and Biological Exposure Indices for Chemical Substances and Physical Agents (latest edition). Sax's Dangerous Properties of Industrial Materials, 9th ed., Lewis, R.J. Sr., (ed.), VNR, New York, New York, (1997).
Product information provided by the commercial vendor(s).

PREPARED BY: Sam Hoskin

REVISION No./Repl. MSDS of: 1 / June 3, 1996

MSDS STATUS: Approved.

DATE: June 9, 1998

DISCLAIMER:

MSDS furnished independent of product sale. While every effort has been made to accurately describe this product, some of the data are obtained from sources beyond our direct supervision. We cannot make any assertions as to its reliability or completeness; therefore, user may rely on it only at user's risk. We have made no effort to censor or conceal deleterious aspects of this product. Since we cannot anticipate or control the conditions under which this information and product may be used, we make no guarantee that the precautions we have suggested will be adequate for all individuals and/or situations. It is the obligation of each user of this product to comply with the requirements of all applicable laws regarding use and disposal of this product. Additional information will be furnished upon request to assist the user; however, no warranty, either expressed or implied, nor liability of any nature with respect to this product or to the data herein is made or incurred hereunder.

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Drilling >> Tripping Out/In

Tripping refers to the process of removing and/or replacing pipe from the well when it is necessary to change the bit or other piece of the drill string, or when preparing to run certain tests in the well bore.

The activities that comprise tripping out are listed below. Tripping in essentially comprises the same steps in reverse order.

Additional Information:

- IADC/PETEX Rotary Drilling Series
- IADC APRG
- API RP 54

Fig. 1. Setting back a stand of drill pipe

Tripping Out

- Setting Slips
- Breaking Out and Setting Back the Kelly
- Attaching Elevators to Elevator Links
- Latching Elevators to Pipe
- Working on the Monkeyboard
- Breaking Out Pipe
- Maneuvering Pipe to Racking Area

Tripping In

- Elevators raised
- Latching Elevators to Top of Stand
- Moving pipe to rotary
- Pipe is made up
- Slips are pulled
- Slips are set
- Elevators are unlatched
- Process repeated for all stands
- Pickup kelly and attach to drill string
- Break circulation, and
- Resume drilling

Tripping Out - Setting Slips ^ TOP

The floor crew sets slips around the drill stem.

Potential Hazards:

- Getting fingers or other body parts pinched between

slips or slip handles and rotary table.

- Receiving muscle strain from improper lifting technique.

Possible Solutions:

- Use proper hand placement when setting slips.
- Use proper stance and slip lifting techniques. Slips have three handles and should be lifted jointly by more than one person.

Additional Information:

- IADC/PETEX Rotary Drilling Series
- IADC APRG
- API RP 54

Fig. 2. Setting slips

Breaking Out and Setting Back the Kelly

^ TOP

Breakout the kelly and set it into the rathole.

Potential Hazards:

- Release of excess drilling mud resulting in skin contact, loss of footing, etc.

Possible Solutions:

- Shut down the mud pumps before breaking out the kelly.
- Close the mud saver valve on the kelly (if present).
- Use a mud bucket to divert flow of excess mud.

Fig. 3. Kelly set into rathole

Potential Hazards:

- Being struck by the slip handles if the rotary table is used to spin the drill string.

Possible Solutions:

- Stand clear of the rotary table when it is rotating.
- Consider other technologies (such as a pipe spinner, kelly spinner, or top drive unit) to eliminate this hazard.

Potential Hazards:

- Being struck by the kelly if the pullback line unhooks when kelly is being pulled toward the rathole.

Possible Solutions:

- Implement an effective pullback line attachment procedure.
- Ensure workers stand in a safe location away from the pullback line and rathole during this pullback operation.

Attaching Elevators to the Elevator Links

^ TOP

The crew attaches elevators to the elevator links.

Fig. 4. Red elevator links

Potential Hazards:

- Being pinched by the elevator links while attaching elevators (or attaching elevator links to the hook).
- Being struck by the elevators.
- Receiving strains and sprains.

Possible Solutions:

- Use proper hand placement when attaching elevator links.
- Ensure workers stand away from swing-path of the elevators and elevator links.
- Use lifting equipment and limit manual positioning of elevators.
- Use proper mounting procedures.

Latching Elevators to Pipe

^ TOP

The floor crew latches the elevators onto the pipe.

Fig. 5. Elevators latched onto the pipe

Potential Hazards:

- Getting hands or fingers pinched in elevators.
- Being struck by elevators not securely latched.
- Getting hands or fingers caught between elevators and stump.

Possible Solutions:

- Ensure workers are instructed in proper latching procedure, including the use of handles on elevators as they are descending into place over the stump or tool joint.
- Inspect and maintain elevators.

Additional Information:

- API RP 8B Inspection, Maintenance, Repair, and Remanufacture of Hoisting Equipment

Working on the Monkeyboard

^ TOP

The derrickman climbs up the derrick to the monkeyboard. From here he unlatches the elevators and guides the stands of pipe into the fingerboard.

The elevators are then lowered and attached to the next stand of pipe.

Potential Hazards:

- Falling while climbing up or down the ladder.
- Falling from monkeyboard or fingerboard.
- Slips, trips, and falls.
- Falling during an emergency descent.

Possible Solutions:

- Use climb assist device.
- Wear appropriate fall protection including a full body harness. For Fall Protection guidance, consult:
  - [1910.23(c)(1)], Fall Protection when working from platforms.
  - [1910.66 App (C)], Fall Protection guidelines.
  - [1910 Subpart D], Walking-Working Surfaces.
- Wear the proper Personal Protective Equipment such as:
  - Hard hat
  - Work gloves
  - Safety-toed footwear
- Practice 100% tie-off while working in the derrick.
- Use slip-resistant coatings or materials on working surfaces.
- Train personnel in use of emergency escape device.

Potential Hazards:

- Being caught between pipe and other objects
- Receiving strains and sprains.

Possible Solutions:

- Practice proper hand placement and use of pullback (tail) ropes.

Potential Hazards:

Fig. 6. Climbing Assist Device and PPE

Fig. 7. Derrickman on monkeyboard

Fig. 8. Handling pipe from monkeyboard

- Being struck by dropped objects.

Possible Solutions:

- Implement a dropped objects program, such as tie-off for all tools.
- Use extra caution while personnel are working overhead.
- Do not carry tools while climbing the derrick ladder. Raise tools with a line to any worker above the derrick floor.

Additional Information:

- Fall Protection
  - ANSI Z359.1
  - Personal Fall Arrest Systems (Please recognize that there is a weight limit, including equipment)
  - IADC Fall Protection Guidance

Breaking Out Pipe

∧ TOP

The crew uses the tongs and cathead to breakout the pipe. The rotary table may be used to spin out the pipe after breaking the connection.

Fig. 9. Using the tongs to breakout the pipe

Potential Hazards:

- Being struck by swinging tongs if they break free from the pipe.
- Being struck by the slip handles if the rotary table is used to spin the drill string.
- Being struck by reverse backlash of tongs (backbiting) during breakout operations.
- Being struck by the tongs if a snub line breaks or the tongs come unlatched.

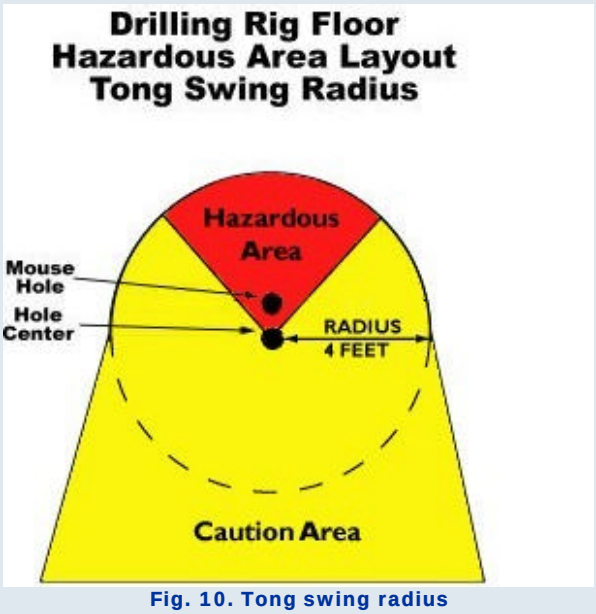

Fig. 10. Tong swing radius

Possible Solutions:

- Implement an effective breakout pipe procedure:
  - Personnel other than tong operators stand outside the tong swing radius when breaking pipe.
  - No one should stand in the red zone. (see Diagram 1)
  - Use proper tong latching techniques and use proper hand and finger placement on tong handles.
  - Stand clear of the rotary table when it is rotating.
  - Use special operational procedures when making high torque connections.
- Inspect tong dies and snub lines each tour.
- Maintain good communication between floor hands and driller.

Maneuvering Pipe to Racking Area

^ TOP

The stand is raised and maneuvered to the pipe racking area.

Fig. 11. Crew maneuvers stand into racking area

Potential Hazards:

- Getting hands and fingers pinched between stands of pipe.
- Getting feet or toes crushed or amputated under a stand of pipe.
- Slips, trips, and falls.
- Receiving strains and sprains.

Possible Solutions:

- Keep hands and fingers from between pipe stands.
- Position feet away from the bottom of the pipe stands.
- See General Safety & Health.

Tripping in - Latching Elevators to Top of Stand

^ TOP

The derrickman latches the elevators onto the pipe from the monkeyboard.

Fig. 12. Derrickman latching elevators onto the pipe

Potential Hazards:

- Getting hands or fingers pinched in elevators.
- Being struck by elevators not securely latched.
- Getting hands or fingers caught between elevators and stump.

Possible Solutions:

- Ensure workers are instructed in proper latching procedure.
- Inspect and maintain elevators.

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Drilling >> Casing Operations

Casing is pipe usually larger in diameter and longer than drill pipe and is used to line the hole. Casing operations occur periodically throughout the drilling process starting with the surface casing, intermediate casing, and ending with production string which takes place during well completion.

The activities involved in casing operations can vary according to the type of casing being installed, but generally fall into these steps:

- Installing Casing Tools
- Running Casing into the Hole
- Installing Casing Accessories
- Circulating and Cementing

Fig. 1. Installing casing

Installing Casing Tools

^ TOP

Specialized casing handling tools are necessary to run casing.

Note: The special service supervisor should hold a pre-job meeting with the special service crew and other involved personnel to review responsibilities and to coordinate the operations to be performed.

Potential Hazards:

- Being struck by or caught between tubulars and other objects during movement (such as being struck by tubulars being tailed into the rig floor).
- Experiencing strains and sprains from maneuvering tools.
- Falling from work platform and/or stabbing

Fig. 2. Special casing elevators

board.

Possible Solutions:

- Stand clear of suspended, hoisted or moving loads. Be aware of tubulars or equipment being lifted through the V-door.
- Use proper hand and foot placement to avoid pinch points, including use of tag lines.
- Use rig floor winch or other powered equipment to handle heavy casing tools.

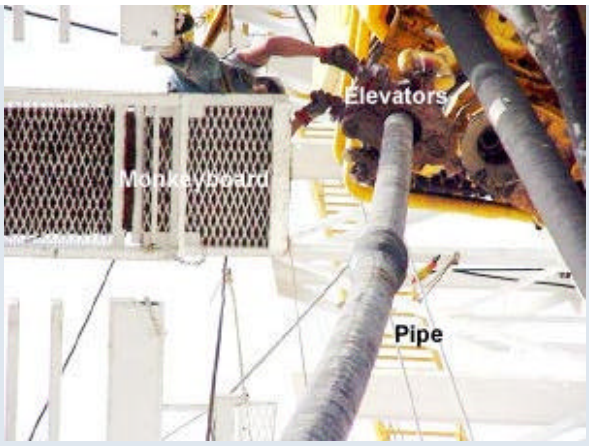

Fig. 3. Derrickman latching elevators

- Use fall protection while installing equipment in the derrick.
- See Slips, Trips, and Falls.

Running Casing into the Hole

∧ TOP

Casing is run into the hole to a pre-determined depth.

Note: The special service supervisor should hold a pre-job meeting with the special service crew and other involved personnel to review responsibilities and to coordinate the operations to be performed.


Fig. 4. Lifting casing onto rig floor

Potential Hazards:

- Hazards are similar to those for drilling ahead or tripping.
- Getting caught between, struck by, or pinched by the power tongs, casing or other equipment.
- Being struck by or caught between tubulars and other objects during movement (for example, struck by tubulars being tailed into the rig floor).
- Falling from the stabbing board or work platform.
- Getting struck by dropped objects.


Fig. 5. Casing stabber

Possible Solutions:

- Include the casing crew and the drilling crew when conducting a JSA and pre-job safety meeting to coordinate the activities of casing operations.
- Stand clear of suspended, hoisted, or moving loads. Be aware of tubulars or equipment being lifted through the V-door.

- Emphasize all normal worker safety procedures, such as fall protection, PPE, placement of hands and feet, and teamwork and communication between workers.
- Implement full fall protection program for the casing stabber.
- Identify clearance between the stabbing board and casing elevators.
- Secure all items used by the casing stabber overhead with a safety line.

Installing Casing Accessories

∧ TOP

As casing is being run, accessories such as centralizers, scratchers, guide shoe, and a float collar are installed and used as needed.

Note: The special service supervisor should hold a pre-job meeting with the special service crew and other involved personnel to review responsibilities and to coordinate the operations to be performed.

Fig. 6. Casing guide shoe

Potential Hazards:

- Dropping guide shoe or float collar onto legs or foot.
- Getting fingers pinched between tools and casing tongs when manually moving guide shoe or float collar.
- Back strain
- Exposure to hazardous materials, especially thread lock compounds.

Fig. 7. Installing casing centralizer

Possible Solutions:

- Use winch, air hoist, or other powered equipment to handle guide shoe, float collar, or other heavy casing equipment.
- Use appropriate PPE as required by the MSDS.

Circulating and Cementing

∧ TOP

After the casing is landed, drilling fluid is circulated through the casing and annulus to remove any residual gases and to condition the mud.

After circulating and conditioning the mud, the casing is cemented. During this process the casing is reciprocated or rotated to allow the scratchers to work to remove excess wall cake to give the cement a better bond.

Usually another special servicing company is hired to conduct cementing operations.

Fig. 8. High pressure lines

Potential Hazards:

- Being struck by high-pressure lines failing if not secured properly.
- Having a high pressure connection failure caused by mismatched or excessively worn hammer unions.

Possible Solutions:

- Hobble high-pressure lines properly.
- Use proper equipment inspection techniques to include hammer unions (Note: This is a particular problem with 602 and 1502, as they will couple but will not hold beyond the lower pressure rating number).
  - See IADC Alert 98-01, High Pressure Lines And Hammer Unions.
  - See IADC Alert 99-33, More On Mismatched Hammer Unions.
  - See IADC Alert 00-15, Additional Serious Incidents With Mismatched Hammer Unions.
  - See IADC Meeting Minutes 02 November1999, Mismatched Hammer Unions, Industry wide meeting.

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Drilling >> Maintenance Activities

Proper maintenance prevents premature equipment failure, which may cause injuries or fatalities. Drilling equipment is subjected to stress and vibration during operations. Maintenance is a necessary and ongoing activity on the drilling site.

Maintenance activities include maintaining the:

- Rig Floor
- Drilling Line Maintenance
- Wire rope maintenance
- Mud Circulating System
- Generator, Electric Motors and Electrical Systems
- Engines
- Derrick Equipment Maintenance

Fig. 1. Welding

Rig Floor

^ TOP

Maintenance activities include inspecting, adjusting, and servicing on equipment such as drawworks, rotary, catheads, tongs, air hoists, and wire rope.

Potential Hazards:

- Slips, trips, and falls.

Possible Solutions:

- Wear personal protective equipment (such as hard hats, work gloves, safety shoes, and eye protection).
- Be aware of the slipping and falling hazards when performing maintenance on the drilling floor.
- Keep all work areas clean and clear of oil, tools, and debris.
- Use non-skid surfaces where appropriate.

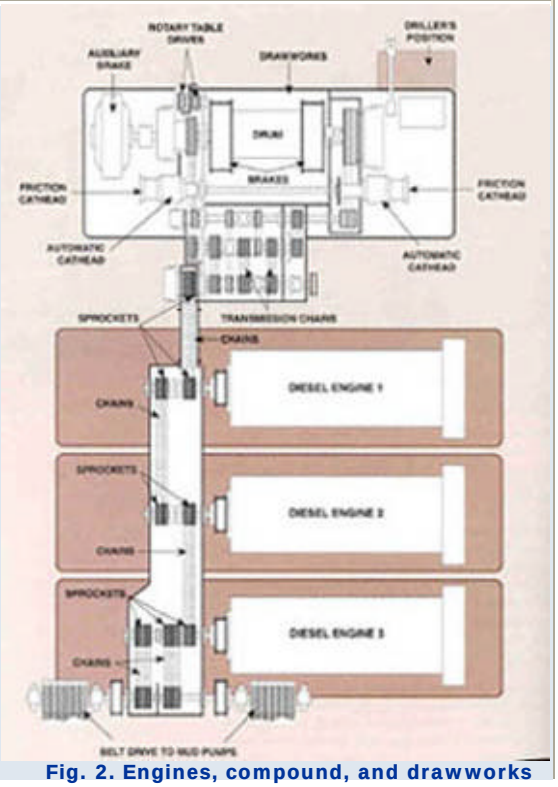

Fig. 2. Engines, compound, and drawworks

Potential Hazards:

- Being caught in chains or other moving equipment.
- Getting fingers and hands pinched in machine guards or covers.
- Receiving sprains and strains.

Possible Solutions:

- Wear personal protective equipment (such as hard hats, work gloves, safety shoes, and eye protection).
- Use proper lockout/tagout procedures. [1910.147]
- Seek assistance when moving awkward and heavy guards and covers.
- Maintain all machinery free of leaks by regular preventive maintenance and repairing when necessary.

Drilling Line Maintenance

^ TOP

The drilling line is the steel wire rope reeved through the crown block and traveling block. It must be inspected, slipped and cut regularly.

Fig. 3. Drilling line

Potential Hazards:

- Receiving injuries to face and eyes from flying chips of metal when slipping and cutting the line.
- Being caught in moving equipment.
- Slips, trips, and falls.
- Being struck by drilling line.

Possible Solutions:

- Use proper lockout/tagout procedures. [1910.147]
- Wear proper personnel protective equipment when cutting line.
- Attach a red flag or other warning device to the drawworks clutch lever as a reminder to the driller whenever the crown safety device is moved or deactivated to allow the traveling block to be raised above the the preset stopping point.
- Secure drilling line ends prior to cutting.

Wire Rope Maintenance

∧ TOP

Visually inspect wire ropes daily or per maintenance schedule.

Potential Hazards:

- Getting cuts from the wickers or loose strands on the rope.
- Receiving injuries to face and eyes from flying chips when cutting wire rope.

Possible Solutions:

- Wear proper personnel protective equipment when cutting wire rope.
- Seize wire rope before cutting.

Fig. 4. Improper wire rope clamp placement "Never saddle a dead horse"

Fig. 5. Proper wire rope clamp placement

Mud Circulating System

∧ TOP

Maintenance activities include inspecting, adjusting, servicing on equipment such as mud pumps, hoses, hose connections, pop-off valve, shale shakers, belts, and guards.

Potential Hazards:

- Being caught between, or struck by equipment.
- Slips, trips, and falls.
- Receiving a foreign body or fluid in the eye.
- Burned by fluid contact.
- Drowning in mud tank/pit.
- Receiving strains and sprains.

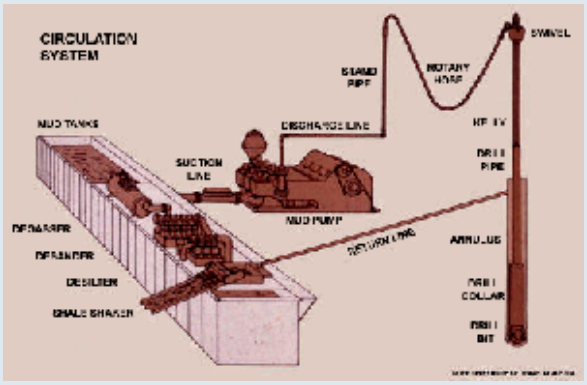

Fig. 6. Circulating system

Possible Solutions:

- Use proper lockout/tagout procedures.
- Wear personal protective equipment (such as hard hats, work gloves, safety shoes, and eye protection).
- Be aware of the slipping and falling hazards when working on the mud circulating system.
- Provide guardrails and guards around mud tanks.

Generator, Electric Motors and Electrical Systems

^ TOP

Electrical connections and power cords need to be checked for wear for deterioration and replaced if needed.

Electric motors need to be serviced at recommended intervals. All guards should be present and correctly installed and motors electrical connections need to be kept sealed.

Fig. 7. Electric control panel

Potential Hazards:

- Receiving flash burns or shocks when servicing motors, generators, and breaker panels.

Fig. 8. Electric rig motor

Possible Solutions:

- Do not wash down generators, electric motors and breaker panels with water hose.
- Use proper lockout/tagout procedures.
- Wear appropriate personal protective equipment.
- Avoid wearing jewelry.
- Do not stand directly in front of breakers when operating.
- Use dielectric mat in front of control panel or breaker panel.

Potential Hazards:

- Being caught in moving equipment.

Possible Solutions:

- Avoid wearing jewelry.
- Use proper lockout/tagout procedures.
- Wear appropriate personal protective equipment.
- Cover with appropriate shields or guards all exposed revolving parts such as belts, flexible drives, generators, shafts and other moving parts to prevent contact and injury.

Additional Information:

- Proper Electrical Safety (including hot sticks). AESC, 20 KB PDF, 4 pages.
- OSHA Safety and Health Topics:
  - Electrical
  - Machine Guarding

Engines

^ TOP

Engines require servicing at recommended intervals.

Fig. 9. Diesel rig engines

Potential Hazards:

- Getting burned by hot fluids or engine parts.

Possible Solutions:

- Wear appropriate personal protective equipment.
- Let engine cool down before working on it.
- Use proper lockout/tagout procedures.

Potential Hazards:

- Being caught in moving equipment or moving parts.

Possible Solutions:

- Wear appropriate personal protective equipment.
- Use proper lockout/tagout procedures.
- Cover all exposed revolving parts with appropriate shields and guards.

Derrick Equipment Maintenance

^ TOP

Maintenance activities in the derrick consists of lubricating the swivel, traveling block, and crown block, and replacement of swivel packing.

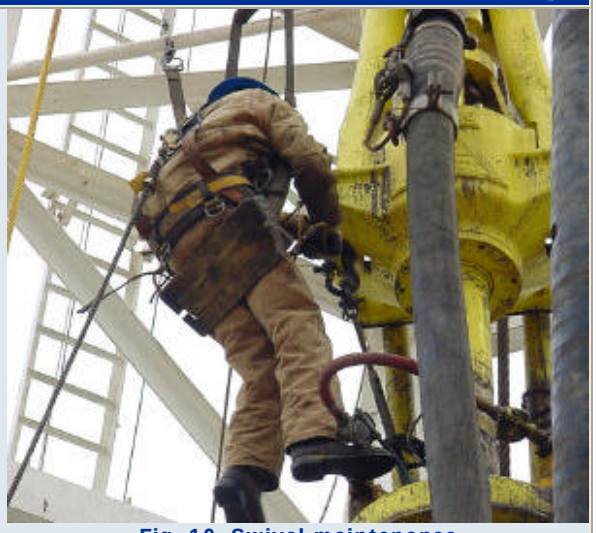

Fig. 10. Swivel maintenance

Potential Hazard:

- Getting caught between equipment and objects.

Possible Solutions:

- Use proper lockout/tagout procedures.

Potential Hazard:

- Falling from heights.

Possible Solutions:

- Use appropriate fall protection.

Potential Hazard:

- Being struck by falling tools or equipment.

Possible Solutions:

- Wear appropriate personnel protective equipment.
- Minimize the number of personnel working on the rig floor.
- Tie off tools.

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Oil and Gas Well Drilling and Servicing eTool

Drilling >> Well Control

Properly trained personnel are essential for well control activities. Well control consists of two basic components: an active component consisting of drilling fluid pressure monitoring activities, and a passive component consisting of the Blowout Preventers (BOPs). [More... BOPs]

The first line of defense in well control is to have sufficient drilling fluid pressure in the well hole. During drilling, underground fluids such as gas, water, or oil under pressure (the formation pressure) opposes the drilling fluid pressure (mud pressure). If the formation pressure is greater than the mud pressure, there is the possibility of a blowout.

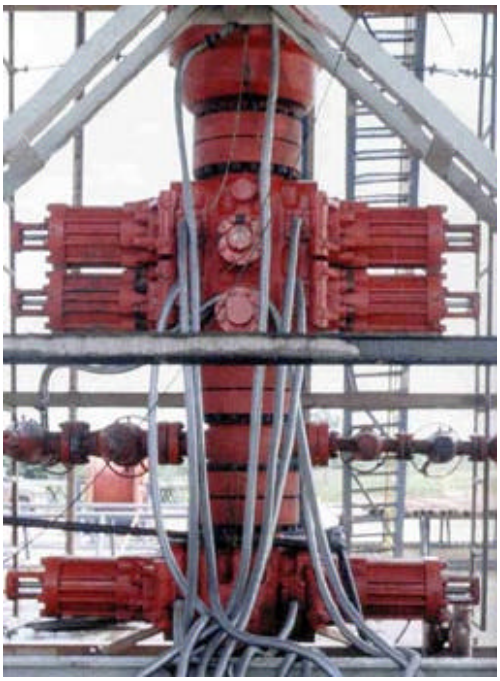

Fig. 1. Blowout preventer stack (BOP)

The activities involved in well control are:

- Blowout Prevention Program
- Monitoring and Maintaining Mud System
- Installing BOPs, Accumulator, and Choke Manifold
- Testing BOPs Accumulators, and Choke Manifold
- Maintaining BOPs

Blowout Prevention Program ^ TOP

Potential Hazard:

- Receiving injuries caused by loss of well control.

Possible Solutions:

- Appropriate training for tasks performed. Example topics include the following: (per IADC WellCAP)
  - Causes of kicks, including detection
  - Pressure concepts and calculations
  - Well control procedures
  - Gas characteristics and behavior

- Fluids
- Constant bottom hole pressure well control methods
- Well control equipment
- Regulatory information

- Use of appropriate well control equipment per API RP 53
  - Specification
  - Installation
  - Maintenance

Monitoring and Maintaining Mud System

∧ TOP

The mud circulatory system consists of the elements shown in the graphic to the right.

Each part of this system must function and be in good repair to maintain well control. [See Maintenance Activities for more...]

If the mud level increases, it may be a sign that a kick is in progress.

On some rigs there is a mud float level gage which sounds an automatic alarm if the mud exceeds a pre-specified level.

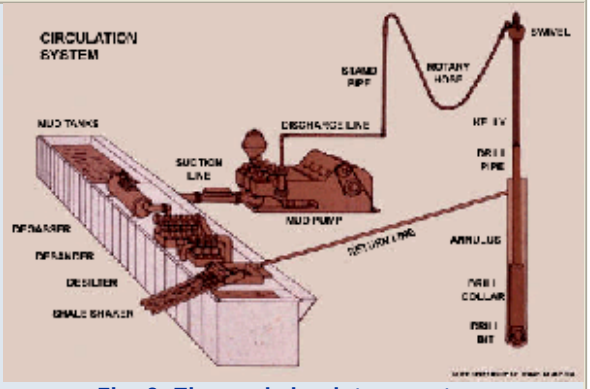

Fig. 2. The mud circulatory system
View larger image

Potential Hazard:

- Loss of well control (blowout)

Possible Solutions:

- Keep the mud circulating system in good working order.
- Check and maintain the properties of the drilling fluid, including proper pit level periodically.
- Properly train crew in monitoring and well control procedures.
- Maintain a properly functioning surface control system.

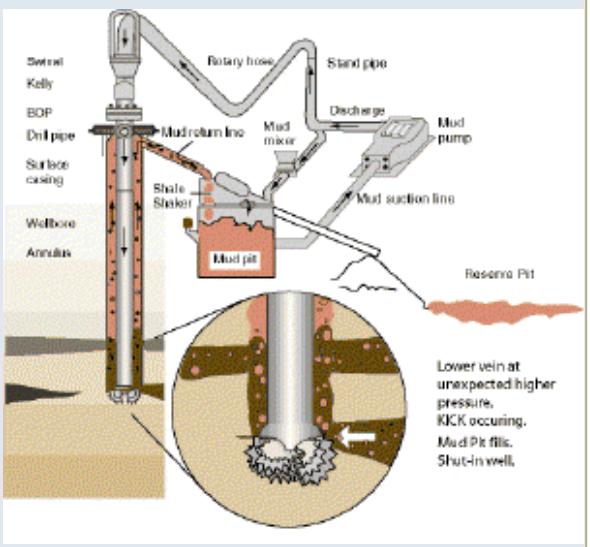

Fig. 3. Kick animation
View kick animation

Installing BOPs, Accumulator, and Choke Manifold

^ TOP

The blowout preventer (BOP), accumulator and choke manifold are installed by the rig crew after the surface casing is set and cemented. The accumulator and choke manifold have been set into place during rigging up and now need to be hooked up and tested.

Potential Hazards:

- Being crushed by falling equipment if hoisting slings fail.
- Being struck by, pinched by or caught between equipment during installation.

Possible Solutions:

- Ensure workers stand clear of equipment being hoisted and tag lines are used where appropriate.
- Coordinate hoisting tasks with rig crew.
- Inspect the hoisting slings for wear before any hoisting operation.
- Ensure all personnel wear proper PPE.

Additional Resources:

- The API has a recommended specification for the installation, use, and maintenance of this equipment: *RP 53 Blowout Prevention Equipment Systems for Drilling Operations, Current Edition.*

Fig. 4. Blowout Preventer (BOP)

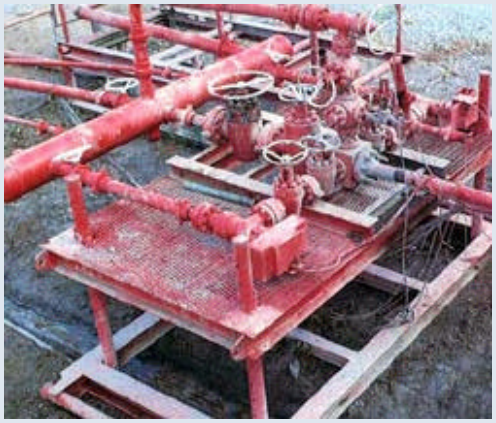

Fig. 5. Choke manifold

Testing BOPs, Accumulators, and Choke Manifold

^ TOP

The BOPs, accumulators, and choke manifold should be tested and properly maintained.

Potential Hazards:

- Being hit by hoses or sprayed by hydraulic fluid if there is a seal or hydraulic line failure during pressure testing.

Possible Solutions:

- Ensure workers stand clear of pressurized lines during testing procedures.

Fig. 6. Choke manifold

Maintaining Surface Control System

^ TOP

Properly maintain the surface control system.

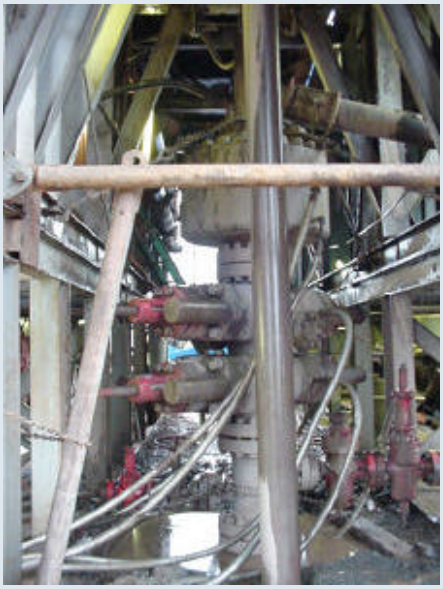

Fig. 7. BOP

Potential Hazards:

- Protruding pipes and objects
- Being struck by dropped objects.
- Slips, trips, and falls.
- Atmospheric hazards

Possible Solutions:

- Wear appropriate personal protective equipment (such as hard hats, work gloves, safety shoes, and eye protection).
- Implement injury awareness training (such as dropped objects, working from heights)
- Use appropriate fall protection.
- Ensure workers are aware of the slipping and falling hazards.
- Monitor for potential hazards (H_2S, methane, O_2 deficiency).

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Oil and Gas Well Drilling and Servicing eTool

Drilling >> Well Control >> Blowout Preventers

The second line of defense for the workers and the well to prevent a blowout is the group of equipment called blowout preventers (BOPs). BOPs and associated valves are installed on top of the casing head before drilling ahead after rigging up. These high-pressure safety valves and associated equipment are designed to shut off the well hole and prevent the escape of the underground fluids and prevent a blowout from occurring.

After installation, the BOP and associated valves are pressure tested to insure integrity and proper operations.

The BOP and associated equipment consists of:

- BOP Stack
- Annular BOP
- Ram-Type BOP
- Choke Manifold
- Accumulator

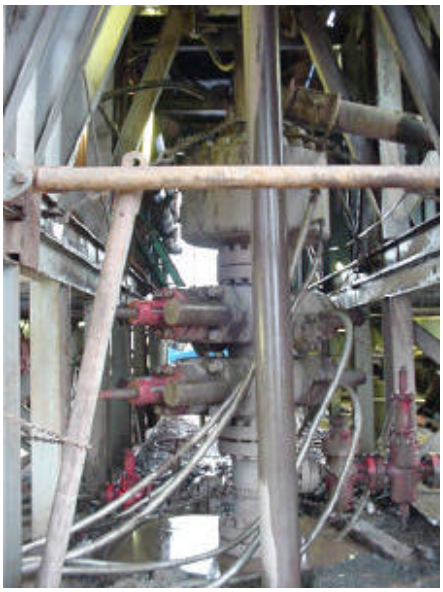

Fig. 1. Blowout preventer stack

BOP Stack

^ TOP

A BOP installation could consist of both annular and ram type BOPs assembled into a stack. Also, there can be a kill line valve and a choke line valve.

The choke line valve is used to redirect the mud from the well bore to the choke manifold during a kick.

The kill line valve is used to direct drilling fluid to the BOP during a kick.

Fig. 2. Blowout preventer stack

Annular BOP

∧ TOP

Annular BOPs are designed to form a seal in the annular space between the drill pipe and the wellbore and are usually mounted at the top of the BOP stack.

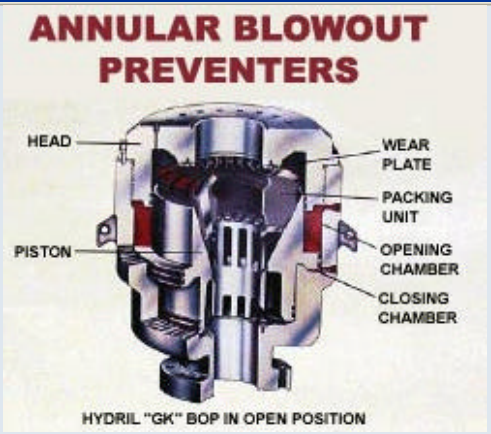

Fig. 3. Annular blowout preventer

Ram Type BOP

∧ TOP

Ram type BOPs have rubber faced steel rams that come together with great force to seal the wellbore. Usually two or more ram-type BOP's are mounted in the BOP stack.

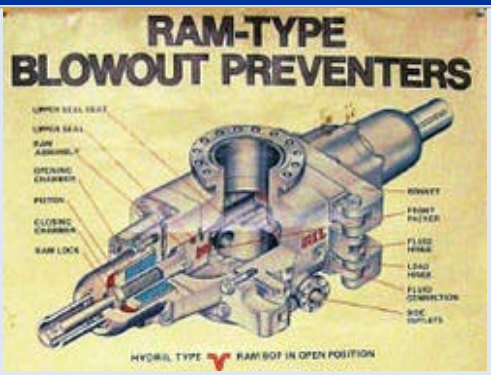

Fig. 4. Ram type blowout preventer

Choke Manifold

∧ TOP

A choke manifold is a system of valves used to circulate out a kick and to circulate mud in of the proper weight. This device responds automatically to a kick and can prevent a blowout if properly installed and maintained.

Fig. 5. Choke manifold

Accumulator

∧ TOP

The BOP control system, called an accumulator, provides the energy to operate the blowout preventers.

This system consists of:

- Compressed gas bottles,
- Regulator valves,
- Pumps,
- Hydraulic reservoir,
- Control manifold, and
- Control valves.

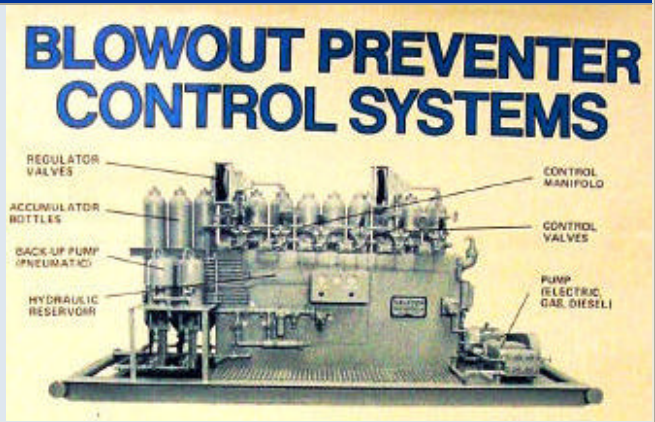

Fig. 6. Accumulator

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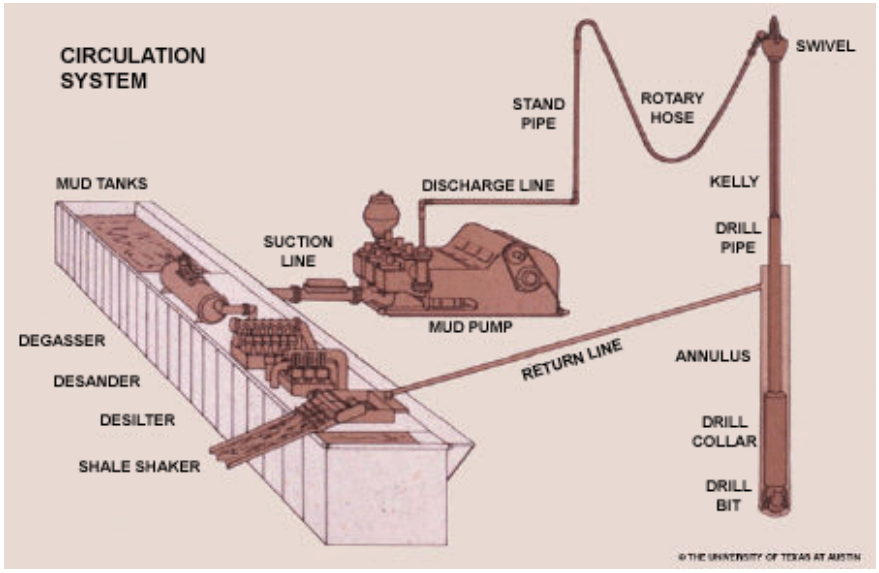
CIRCULATION SYSTEM
SWIVEL
STAND PIPE
ROTARY HOSE
KELLY
DISCHARGE LINE
MUD TANKS
SUCTION LINE
DRILL PIPE
MUD PUMP
DEGASSER
RETURN LINE
ANNULUS
DESANDER
DESILTER
DRILL COLLAR
SHALE SHAKER
DRILL BIT
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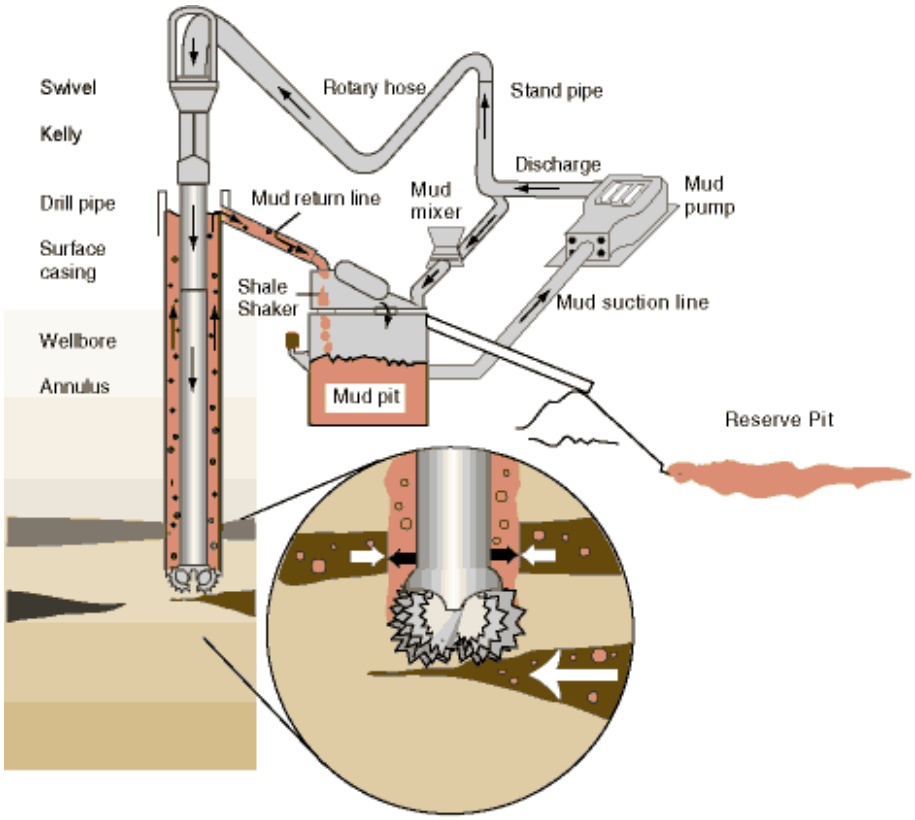
Swivel
Kelly
Drill pipe
Surface casing
Wellbore
Annulus
Rotary hose
Stand pipe
Discharge
Mud return line
Mud mixer
Mud pump
Shale Shaker
Mud suction line
Mud pit
Reserve Pit

Well Completion

Once the design well depth is reached, the formation must be tested and evaluated to determine whether the well will be completed for production, or plugged and abandoned.

To complete the well production, casing is installed and cemented and the drilling rig is dismantled and moved to the next site.

A service rig is brought in to perforate the production casing and run production tubing. If no further pre-production servicing is needed, the christmas tree is installed and production begins.

Well completion activities include:

- Conducting Drill Stem Test
- Setting Production Casing
- Installing Production Tubing
- Starting Production Flow
- Beam Pumping Units

After production starts, the well may need further servicing.

If it's decided that the well will not be completed, then it will be plugged and abandoned.

Fig. 1. Completed well

Fig 2. Well completion service rig

Conducting Drill Stem Test ^ TOP

To determine the potential of a producing formation, the operator may order a drill stem test (DST). The DST crew makes up the test tool on the bottom of the drill stem, then lowers it to the bottom of the hole. Weight is applied to the tool to expand a hard rubber sealer called a packer. Opening the tool ports allows the formation pressure to be tested. This process enables workers to determine whether the well can be produced.

Potential Hazards:

- Being pinched or struck by the drill stem test tools during floor operations.
- Swabbing the hole on the way out with the test tool could cause a kick to occur, which could result in a blowout leading to injuries and deaths.
- Being exposed to unexpected release of H_2S or other gases or liquids.
- A packer seat failure or fluid loss to an upper formation could cause a kick that might result in a blowout causing injuries and deaths.
- Other hazards are similar to those encountered during trippingout/in.

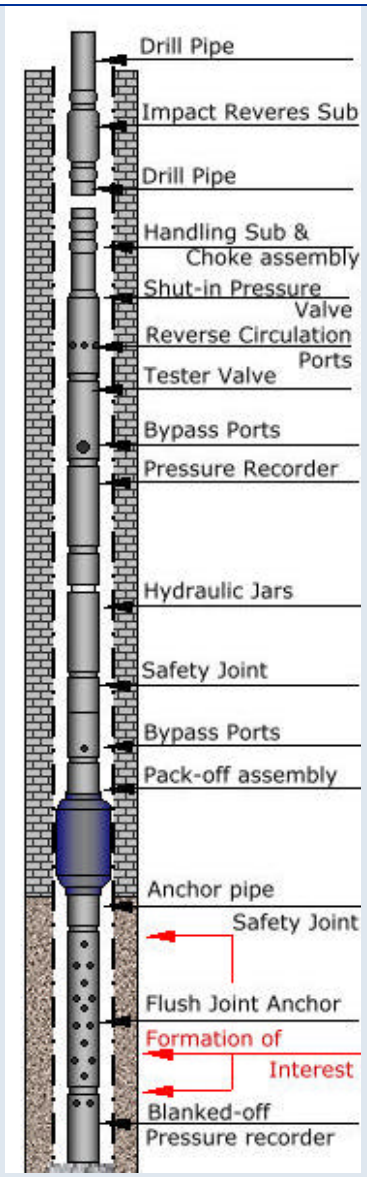

Fig. 3. Drill stem test assembly

Possible Solutions:

- Wear appropriate PPE.
- Instruct workers in handling and using the special tools required during drill stem testing.
- Keep a method for filling the hole in place at all times. Before any test starts, the rig management must ensure that the blow-out prevention system includes a kill system that is capable of pumping fluid into the well below the annular preventer and at least on-set of pipe rams.
- Run a pump-out-sub or downhole circulating device in the test string to to enable the system to be reversed.
- Ensure all workers on the location understand the dangers before starting any drill stem test. They should be fully informed of and trained in appropriate safety procedures, including the use of safety equipment and breathing apparatus. If in an H_2S area, post a sign indicating the test in full view for the general public to see. Post reliable people to stop them from coming to the location. Define a minimum of two muster points with all vehicles parked in an appointed area.

Setting Production Casing

∧ TOP

Production casing is the final casing in a well. It can be set from the bottom to the top. Sometimes a production liner is installed.

This casing is set the same as other casings, then cemented in place.

See Casing Operations and Cementing for more information on specific hazards and solutions.


Fig. 4. Installing production casing

Installing Production Tubing

^ TOP

A well is usually produced through tubing inserted down the production casing. Oil and gas is produced more effectively through this smaller-diameter tubing than through the large-diameter production casing.

Fig. 5. Tubing on rack

Joints of tubing are joined together with couplings to make up a tubing string. Tubing is run into the well much the same as casing, but tubing is smaller in diameter and is removable.

The steps for this activity are:

- Tubing elevators are used to lift tubing from the rack to the rig floor.
- The joint is stabbed into the string, which is suspended in the well, with air slips.
- Power tongs are used to make-up tubing.
- This process is repeated until tubing installation is complete.
- The tubing hanger is installed at the wellhead.

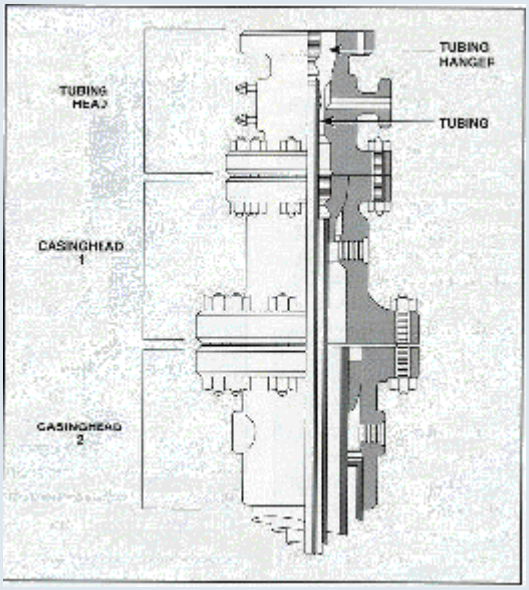

Fig. 6. Tubing head

New technology allows tubing to be manufactured in a continuous coil, without joints. Coiled tubing is inserted into the well down the production casing without the need for tongs, slips, or elevators, which takes considerably less time to run.

Fig. 7. Installing coil tubing

Potential Hazards:

- Getting pinched fingers and hands from tongs and slips.
- Being struck by swinging tubing and tubing elevators.
- Getting caught between the joint and tongs or stump.
- Being struck by the tubing hanger wrench if it should slip.
- Getting fingers and hands pinched and caught between tubing hanger and tubing head.

Possible Solutions:

- Keep all fingers and hands away from pinch points.
- Instruct workers to be on alert when on the rig floor and pipe racking area.
- Avoid placing hands on the end of the tubing stump.
- Use the correct tools for each task.
- Inspect the tools before use.
- Use coiled tubing.

Starting Production Flow

∧ TOP

Production flow is started by washing in the well and setting the packer. Washing in means to pump in water or brine to flush out the drilling fluid. Usually this is enough to start the well flowing. If not, then the well may need to be unloaded. This means to swab the well to remove some of the brine. If this does not work the flow might be started by pumping high-pressure gas into the well before setting the packer.

If the well does not flow on its own, well stimulation or artificial lift may need to be considered.

Fig. 8. Starting production flow

Potential Hazards:

- A blowout may be possible whenever well pressures are changed.

Possible Solutions:

- Monitoring of well pressures and working blow out preventers (BOP's) are the best way to prevent blowouts.

Beam Pumping Units

∧ TOP

If the well doesn't produce adequately, a beam pumping unit may be installed.

There are four basic types of beam pumping units. Three involve a walking beam, which seesaws to provide the up and down reciprocating motion to power the pump. The fourth reciprocates by winding a cable on and off a rotating drum. The job of all four types is to change the circular motion of an engine to the reciprocating motion of the pump.

Fig. 9. Beam pumping units

The pump units are brought in disassembled on trucks and off-loaded onsite. The many parts of the pump unit include large heavy metal pieces that need to be assembled.

Potential Hazard:

- Being pinched, struck, or crushed by falling or swinging parts during assembly.

Possible Solutions:

- Ensure that the work crew understands the assembly procedures and hazards involved in the tasks.
- Wear appropriate PPE.

Fig. 10. Assembling beam pumping unit

Oil and Gas Well Drilling and Servicing eTool

Servicing

Servicing operations assumes that the well has been completed and initial production has begun.
All servicing activity requires specialized equipment.
The equipment is transported in and rigged up.

Servicing is done by specialized crews and includes:

- Transporting Rig & Rigging Up
  - Transporting Rig
  - Rigging up Service Rig
  - Set up Work Area
- General Servicing
  - Removing the Horsehead
  - Removing the Wellhead
  - Pulling and Running Rods
  - Pulling and Running Tubing
- Special Services
  - Wireline Operations
  - Well Logging
  - Perforating
  - Cementing
  - Stimulation
  - Swabbing
  - Hot Oiling
  - Snubbing
  - Coil Tubing
- Workover
  - Sand Cleanout
  - Repairing Liners and Casing
  - Well Recompletions
    - Sidetracking
    - Plug-Back

Fig. 1. Servicing rig

General Safety & Health

- Safety and Health Program
- Hot Work/Welding
- Hydrogen Sulfide Gas
- H_2S Special Precautions

Related Safety and Health Topics

- Powered Industrial Trucks
- Personal Protective Equipment (PPE)
- Ergonomics

Oil and Gas Well Drilling and Servicing eTool

Servicing >> Transporting Rig & Rigging Up

Transporting and rigging up the equipment is the first step in well servicing operations. After these steps, servicing activities commence.

- Transporting Rig
- Rigging up Service Rig
- Set up Work Area

Fig. 1. Servicing rig

Transporting Rig

^ TOP

After the drilling rig is removed, the well site is cleaned and re-leveled for the service rig. A workover rig is driven or transported to the site and positioned at the well.

Fig. 2. Transporting Rig

Potential Hazards:

- Working in unstable or slippery conditions on the lease road/drill site.
- Striking fixed objects such as power line poles.
- Contacting electrical service lines.
- Being involved in vehicular accidents.
- Getting caught between the rig and the wellhead.
- Being struck by a moving rig.

Possible Solutions:

- Inspect the route in advance for adequate vehicle access and satisfactory surface conditions.
- Ensure adequate driver training.

- Ensure proper vehicle maintenance.
- Establish and follow a specific procedure for positioning the rig.
- Use a ground guide while backing the rig.
- Keep all personnel clear of the moving rig.

Additional Information:

- AESC, Recommended Safe Procedures and Guidelines for Oil and Gas Well Servicing
- Vehicle Operator Safety. AESC, 12 KB PDF, 2 pages.
- AESC, Video, Workover Rig: Driver Safety Training

Rigging Up Service Rig

^ TOP

Before rigging up, guyline anchors are set into the ground and pull tested. The service rig is then spotted over the well.

The truck- or trailer-mounted rig is stabilized and leveled by manual or hydraulic jacks. All guy lines are uncoiled and laid out to remove kinks or knots.

The mast is readied for raising, then raised and guyed into place. The derrick emergency escape device is rigged up and the work platform is readied for service operations. (See Drilling-Rigging Up)

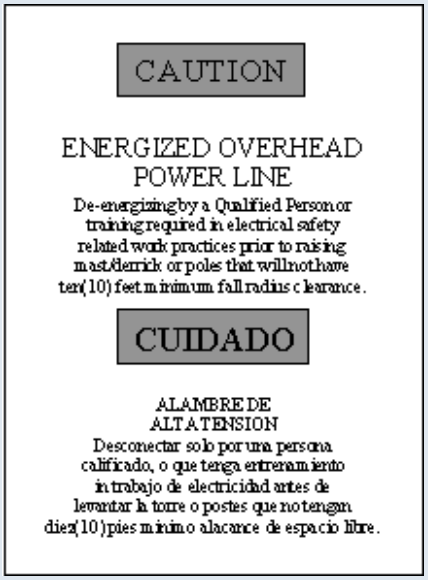

Fig. 3. Caution - Energized overhead power line

Potential Hazards:

- Being electrocuted by overhead power lines.
- Slips, trips, and falls as a result of unstable or slippery conditions.
- Being caught between the mast and mast cradle or being struck by or caught in guy lines and cables when mast is being raised.
- Being struck by a toppling mast if the carrier shifts.
- Being sprayed with oil if the hydraulic cylinder or hoses fail as mast is being raised.
- Twisting and falling of the mast if a guy line or anchor breaks or fails.
- Receiving strains and sprains.
- Getting hand, finger, and foot injuries during rig up.
- Getting the climbing assist counterweight

Fig. 4. Birds eye view

tangled in the mast.

Possible Solutions:

Fig. 5. Service rig

- Identify all electrical hazards and maintain adequate clearances. [1910.303 Table S3]
- Take appropriate precautions to mitigate slip, trip, and fall hazards.
- Stay clear of the unit while the mast is being raised, lowered, or telescoped.
- Uncoil and visually inspect all cables before starting to raise the mast. Stand to the side of lines and cables as the mast is being raised.
- Inspect the well pad and set additional foundation materials as appropriate.
- Inspect all high-pressure hoses and fittings.
- Ensure that the unit operator assesses the wind speed and direction to determine if the mast can be raised safely.
- Allow no personnel on the unit, other than the operator working at the controls, when raising or lowering the mast. All others stand clear.
- Inspect all anchors before rigging up the mast. Anchors should meet API specifications for loads and guying patterns. (API, RP4G)
- Use proper lifting techniques.
- Use proper hand and foot placement. See general safety and health.
- Control the position of the counterweight by maintaining tension on the guywire to keep the weight away from the mast.

Fig. 6. Installing guy line anchor

Additional Information:

- AESC, Recommended Safe Procedures and Guidelines for Oil and Gas Well Servicing
- Use of Anchors and Guywires. AESC, 72 KB PDF, 12 pages.
- API, RP4G, latest edition
- 1910.303 Table S3, Elevation of Unguarded Energized Parts Above Working Space

Set Up the Work Area

^ TOP

The work area is prepared by setting up all relevant equipment for the job, including the derrick emergency escape device.

Potential Hazards:

- Being struck by or caught between equipment.
- Receiving strains and sprains.
- Getting hand, finger, and foot injuries.
- Slips, trips, and falls.
- Failing to properly install derrick emergency escape device when personnel may be expected to work in the derrick.
- Getting burned or exposed to respiratory hazards due to ignition of flammable liquids, vapors, and gases.

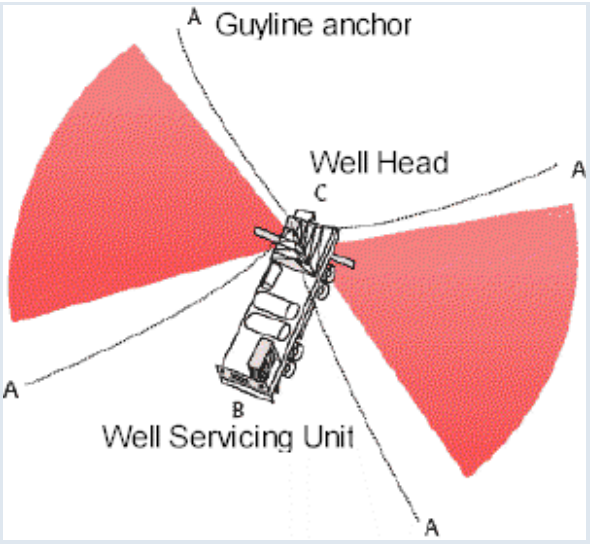

Fig. 7. Rig fall zone

Possible Solutions:

- Install guardrails as required. [1910.23], AESC, Recommended Safe Procedures and Guidelines for Oil and Gas Well Servicing.
- Inspect equipment integrity such as slings, tongs, and hand tools. [1910.184]
- Train crew to select and use the proper tools for the job.
- Instruct workers to stand clear of suspended loads.
- Use a tag line to guide equipment into position.
- Inspect hoses and connections before and after attaching to the tongs.
- Connect hoses *after* the tongs have been positioned.
- Properly install derrick emergency escape device in accordance with manufacturer's recommendations.
- Proper equipment type and placement. See Well Site Ignition Sources.

Additional Information:

- AESC, Recommended Safe Procedures and Guidelines for Oil and Gas Well Servicing
- Cranes. AESC, 16 KB PDF, 4 pages.
- Portable Ladders. AESC, 20 KB PDF, 4 pages.
- Fall Protection. AESC, 16 KB PDF, 4 pages.
- Scaffolding. AESC, 24 KB PDF, 7 pages.
- API, RP4G
- OSHA, [1910.23]
- OSHA, [1910.184]

Oil and Gas Well Drilling and Servicing eTool

Servicing >> General Servicing

Wells often need maintenance or service on surface or down-hole equipment. Working on an existing well to restore or increase oil and gas production is an important part of today's petroleum industry. A well that is not producing to its full potential may require service or workover.

Maintenance activities associated with the well when using a workover/service rig are:

- Removing the Horsehead (Pumping unit only)
- Removing the Wellhead
- Pulling and Running Rods
- Pulling and Running Tubing

Fig. 1. Service rig

Removing the Horsehead (Pumping unit only)

^ TOP

Typically, the horsehead of a pumping unit must be removed to gain access to the wellhead equipment.

Potential Hazards:

- Having the unit start up while working on equipment.
- Being struck by counterweights on the pumping unit.

Possible Solutions:

- Use lockout/tagout, to include mechanically securing the flywheel.

Potential Hazards:

Fig. 2. Servicing horsehead and bridle

- Being struck by dropped horsehead or caught between horsehead and walking beam.
- Getting fingers and hands pinched and caught between tools and/or equipment.
- Being struck by falling tools or equipment.
- Falling from an elevation.

Possible Solutions:

- Inspect all slings before use.
- Use tag lines to position the horsehead when removing or lowering and to keep personnel clear of suspended load.
- Use the correct tools for each task.
- Inspect the tools before each use.
- Keep fingers and hands away from pinch points.
- Secure tools from falling and keep the area below clear of personnel.
- Use proper PPE and fall protection as required.

Additional Information:

- AESC video (currently in production)
- AESC, Recommended Safe Procedures and Guidelines for Oil and Gas Well Servicing
- API RP54

Removing the Wellhead

∧ TOP

To begin the process, the wellhead must be removed from the casing flange.

Fig. 3. Wellhead on flowing well

Potential Hazards:

- Being struck by released pressure or flying particles.
- Being struck by the wrench or hammer while removing bolts and fittings.
- Getting caught between wellhead, hydraulic wrenches, and wellhead fittings.
- Getting fingers and hands pinched and caught between flanges or valves.
- Slips, trips, and falls.
- Entering into well cellars.

Possible Solutions:

- Stand clear of valves and fittings when removing fitting or bleeding off pressure.
- Check wellhead pressure and bleed pressure off before removal.
- Use the correct tools for each task.
- Inspect the tools before each use.
- Wear proper PPE including safety glasses.
- Keep fingers and hands away from pinch points.
- Cover open cellars.
- Wear fall protection as appropriate.
- Implement a confined space entry program.

Pulling and Running Rods

^ TOP

To service, repair, or replace the rods or pump, the sucker rod string must be pulled out of the hole. Pulling rods refers to the process of removing rods from the well. Running rods refers to the process of replacing rods in the well.

Potential Hazards:

- Falling from heights.

Possible Solutions:

- Wear appropriate fall protection including a full body harness. For Fall Protection guidance, consult:
  - [1910.23(c)(1)], Fall Protection when working from platforms.
  - [1910.66 App (C)], Fall Protection guidelines.
  - [1910 Subpart D], Walking-Working Surfaces.
- Never disconnect personal fall arrest systems while working in the derrick.

Fig. 4. Sucker rods

Potential Hazards:

- Getting fingers or hands pinched in or between rod wrenches, rod elevators, power tongs, rod hook, rod transfer, and rod fingers.

Possible Solutions:

- Ensure that workers are instructed in proper hand and finger placement when making and

breaking rod connections or setting rods on the rod fingers.

- Ensure that workers are instructed in proper latching procedures while pulling and running rods.

Potential Hazards:

- Being struck by dropped objects.

Possible Solutions:

- Wear the proper Personal Protective Equipment such as:
  - Hard hat
  - Work gloves
  - Safety-toed footwear
- Use extra caution while people are working overhead.
- Avoid carrying tools while climbing the derrick ladder. Raise tools with a line to any worker above the derrick floor.
- Ensure that all tools and equipment being used are secured with the proper safety lines.

Additional Information:

- API RP54
- AESC Videos
  - Rod Wrenching: Safe and Sound
  - "Hand & Finger Safety"

Fig. 5. Rod elevator and tools

Fig. 6. Manual rod wrench

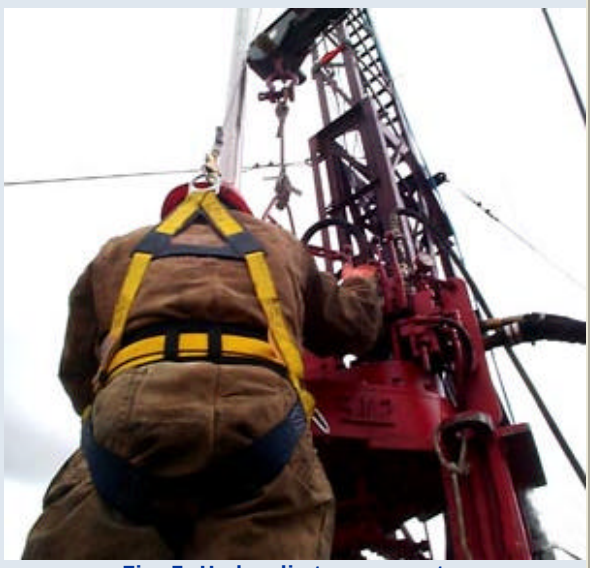

Fig. 7. Hydraulic tong operator

Pulling and Running Tubing

∧ TOP

Among the reasons for pulling tubing includes replacing a packer, locating a tubing leak, or plugged tubing.

Raising or Lowering Traveling Block and Elevator

Potential Hazards:

- Being struck by the elevators and traveling block as they are raised or lowered.
- Getting fingers and hands pinched between elevators and tongs or tubing collar.

Possible Solutions:

- Instruct workers to stand clear of tong and slip area

Fig. 8. Tubing rig

when lowering the elevator and traveling block.

- Use handles on elevators as they are descending into place over the tubing.

Latching or Unlatching Elevators onto the Tubing

Potential Hazards:

- Pinching hands or fingers in the elevators.
- Being struck by elevators not securely latched.

Possible Solutions:

- Ensure that workers are instructed in proper latching procedure.
- Inspect and maintain elevators.

Occupational Safety & Health Administration
200 Constitution Avenue, NW
Washington, DC 20210

Oil and Gas Well Drilling and Servicing eTool

Servicing >> Special Services

Special services are operations that use specialized equipment and workers who perform support well drilling and servicing operations.

Coordination between all personnel is critical for site safety. Therefore, all special services operations should conduct a pre-job safety meeting to include all personnel on the job site.

- Wireline Operations
- Well Logging
- Perforating
- Cementing
- Stimulation
- Swabbing
- Hot Oiling
- Snubbing
- Coil Tubing

Fig. 1. Servicing rig

Wireline Operations

^ TOP

All wireline operations require special precautions. Wireline operations may include slick line and electric line operations. Operations completed through the use of wireline include logging, perforating, setting of downhole tools, fishing, bailing, and swabbing.

Note: The special service supervisor should hold a pre-job meeting with the special service crew and other involved personnel to review responsibilities and to coordinate the operations to be performed.

Potential Hazard:

- Being struck by wireline due to line failure.

Possible Solutions:

Fig. 2. Wireline hazard zone

- Keep all non-essential workers out of the immediate work area.
- Inspect wireline, rope sockets, and cable heads for defects before use.
- Operate the wireline at a safe speed.
- Use an appropriate method to determine the end of line location.

Potential Hazards:

- Being struck by wireline, lubricator, sheaves, or other equipment.
- Getting caught in wireline.

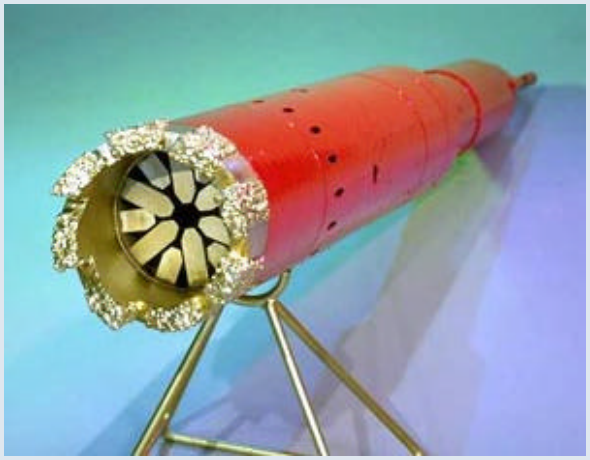

Fig. 3. Fishing junk basket

Possible Solutions:

- Keep all non-essential workers out of the immediate work area.
- Inspect all slings, chains, pins or other attachment devices before lifting or suspending tools or equipment.

Potential Hazards:

- Pinching hands and fingers.
- Getting sprains, strains or suffering from overexertion.

Fig.4. Fishing magnet

Possible Solution:

- Minimize manual handling of lubricators and other equipment.
- Use proper hand placement and tag lines to avoid pinch points.

Potential Hazards:

- Falling from a height.
- Receiving burns or being exposed to a respiratory hazard due to a fire.

Fig. 5. Fishing overshot

Possible Solutions:

- Use proper fall protection.
- Position the unit properly with respect to wind direction and distance from potential gas or vapor sources. API RP54

Potential Hazard:

- Being exposed to an unexpected release of pressure.

Possible Solutions:

- Install a pressure release valve in the lubricator sub.
- Bleed pressure from lubricator sub before breaking connections.
- Check for an unusually tight connection that may indicate that pressure has not been released.

Potential Hazard:

- Toppling mast or boom.

Possible Solution:

- Install foundation, outriggers, and guying according to the manufacturer's recommendations.

Additional Information:

- API RP54

Well Logging

∧ TOP

Well logging is used to identify formation and other downhole properties of the well bore.

Logging tools can include radioactive, electric, mechanical, and sonic tools, among others.

Note: See also Wireline Operations and Perforating for descriptions of additional hazards.

Fig. 6. Radioactive logging tool

Potential Hazards:

- Being exposed to radiation.

Possible Solutions:

- Keep non-essential workers away from the rig floor and marked-off areas where radiation hazards may be present.
- Wear appropriate personnel protective equipment (PPE).
- Allow only authorized and qualified logging company personnel to handle the logging tools.
- Report any damage to radioactive logging tools.

Fig. 7. Radiation symbol

Potential Hazard:

- Getting injured due to an unexpected release of pressure.

Possible Solutions:

- Check for the presence of trapped pressure before opening the tool housing.

Additional Information:

- Ionizing Radiation, OSHA Safety and Health Topic.
- AESC, Recommended Safe Procedures and Guidelines for Oil and Gas Well Servicing
- 10 CFR 39, Nuclear Regulatory Commission, Licenses and Radiation Safety Requirements for Well Logging.

Perforating

^ TOP

A specialized crew transports and operates the perforating equipment. Upon arrival to the site, the tools are assembled, then lowered into the well by a wireline unit or conveyed by tubing. Then, a specialized gun shoots small holes into the casing of the producing zone.

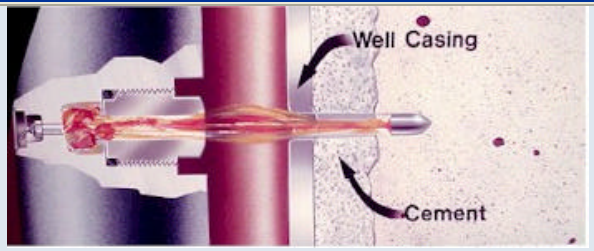

Fig. 8. Perforation of casing and formation

The perforations allow the oil or gas to flow into the casing or liner. If pressure is sufficient, the oil or gas will rise to the surface.

Detailed operational procedures and trained personnel are necessary for the safe handling of explosives. The solutions below illustrate possible solutions; for more detailed information see Additional Information below.

Note: The special service supervisor should hold a pre-job meeting with the special service crew and other involved personnel to review responsibilities and coordinate the operations to be performed.


Fig. 9. Perforating gun

Potential Hazards:

- Surface detonation of explosives.

Possible Solutions:

- Keep all non-essential personnel out of the immediate work area.
- Post warning signs and prohibit the use of radios, telephones, or navigational systems.
- Shut down non-essential electrical systems during gun-arming operations.
- Perform operations involving explosives under the direct supervision of the special services supervisor.
- Report any suspected remnants of explosives to the special services supervisor.

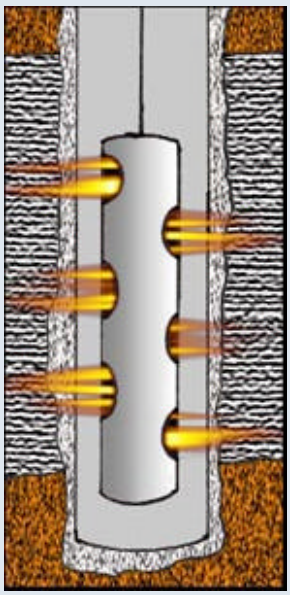
Fig. 10. Charges perforating the casing

Additional Information:

- API RP54, RP67

- AESC, Recommended Safe Procedures and Guidelines for Oil and Gas Well Servicing
- API Publication, "Wireline Operations and Procedures"
- IME (Institute for the Makers of Explosives)

Cementing

∧ TOP

Fig. 11. Cementing truck

Cementing and pumping operations may be performed by specialized pumping services or in conjunction with well servicing operations (such as, casing, squeezing, and zone isolations). The hazards involved will vary with mode of dry cement delivery and mixing as well as the primary designed function of the pumping equipment.

Note: The special service supervisor should hold a pre-job meeting with the special service crew and other involved personnel to review responsibilities and coordinate the operations to be performed.

Rig Up - Spotting and assembly of equipment to perform cementing or pumping operations.

Potential Hazards:

- Being struck by moving vehicles.
- Being exposed to potential ignition and respiratory hazards.
- Overexerting, or getting sprains and strains.
- Being exposed to pinch points (for example, hammer union wings and hammers, pump iron and racks).
- Being hit by flying particles.
- Falling from heights.
- Slips, trips, and falls.
- Being struck by falling equipment.

Possible Solutions:

- Preplan equipment locations and use a spotter(s) to position equipment out of fall lane of the derrick and upwind of vapor and gas sources.
- Use mechanical lifting aids, proper lifting techniques, and team lifting where appropriate.
- Use proper hand and body positioning.
- Wear proper PPE including fall protection and respiratory protection where appropriate.
- Conduct a pre-job inspection to identify, then eliminate or correct hazardous work surfaces.
- Require all non-essential personnel to stand clear.

- Secure all elevated lines.

Pumping - Executing the job

Potential Hazards:

- Being struck by high pressure lines or unexpected release of pressure (due to, mismatched or excessively worn hammer unions, line failure).
- Being exposed to chemical hazards (such as, silica, toxic liquids, and gases).
- Being exposed to high noise levels.
- Slips, trips, and falls.
- Overexerting, or receiving sprains and strains while handling materials (such as sacks and buckets).

Possible Solutions:

- Direct all non-essential personnel to stand clear.
- Require pump operator to stay by the controls.
- Conduct adequate pressure tests on pump(s) and lines before pumping. API RP54
- Hobble high-pressure lines properly.
- Use proper equipment inspection techniques to include hammer unions (Note: This is a particular problem with 602 and 1502, as they will couple but will not hold beyond the lower pressure rating number).
    - See IADC Alert 98-01, High Pressure Lines And Hammer Unions.
    - See IADC Alert 99-33, More On Mismatched Hammer Unions.
    - See IADC Alert 00-15, Additional Serious Incidents With Mismatched Hammer Unions.
    - See IADC Meeting Minutes, 02 November 1999, Mismatched Hammer Unions, Industry wide meeting.
- Wear proper personal protective equipment (for example, respiratory, skin, and hearing) as appropriate for the hazards present.
- Conduct a pre-job inspection to identify, then eliminate or correct hazardous work surfaces.
- Use mechanical lifting aids, proper lifting techniques, and team lifting where appropriate.

Rig Down - Disassembly and demobilization of equipment

Potential Hazards:

- Being struck by moving vehicles.
- Being exposed to potential ignition and respiratory hazards.
- Overexerting or receiving sprains and strains.
- Being exposed to pinch points (such as, hammer union wings and hammers, pump iron and

racks).

- Being hit by flying particles.
- Falling from heights.
- Slips, trips, and falls.
- Being struck by falling equipment.

Possible Solutions:

- Use a spotter(s) to direct equipment movement.
- Use mechanical lifting aids, proper lifting techniques, and team lifting where appropriate.
- Use proper hand and body positioning.
- Wear proper PPE including fall protection and respiratory protection where appropriate.
- Conduct a post-job inspection to identify, then eliminate or correct hazardous work surfaces.
- Require all non-essential personnel to stand clear.

Additional Information:

- See PPE and Skin Exposure Safety Health Topics

Stimulation

^ TOP

Well stimulation involves techniques to optimize well performance. This may include pumping of acids, energized fluids, and various other chemicals to improve formation flow characteristics.

Note: The special service supervisor should hold a pre-job meeting with the special service crew and other involved personnel to review responsibilities and to coordinate the operations to be performed.

Note: When pumping energized fluids (such as, carbon dioxide or liquid nitrogen) substantial increased hazards exist related to asphyxiation, temperature extremes, and unexpected pressure releases. Use special procedures to ensure the safety of personnel.

Rig Up - Spotting and assembly of equipment to perform stimulation operations.

Fig. 12. Hobbled high-pressure line

Potential Hazards:

- Being struck by moving vehicles.
- Being exposed to potential ignition and respiratory hazards.
- Overexerting or receiving sprains and strains.

- Being exposed to pinch points (such as, hammer union wings and hammers, pump iron and racks).
- Being hit by flying particles.
- Falling from heights.
- Slips, trips, and falls.
- Being struck by falling equipment.
- Being injured due to potential ignition of flammable or combustible carrier or base fluids.

Fig. 13. Connecting blender up to manifold

Possible Solutions:

- Preplan equipment locations and use a spotter (s) to position equipment out of fall lane of the derrick and upwind of vents, vapor and gas sources.
- Use mechanical lifting aids, proper lifting techniques, and team lifting where appropriate.
- Use proper hand and body positioning.
- Wear proper PPE including fall protection and respiratory protection where appropriate.
- Conduct a pre-job inspection to identify, then eliminate or correct hazardous work surfaces.
- Require all non-essential personnel to stand clear.
- Secure all elevated lines.
- Provide adequate bonding and grounding for blending, pumping and sand transfer equipment.
- Use hose covers or shielding for transfer or suction lines containing flammable liquids.

Fig. 14. Frac Equipment

Fig 15. Frac truck

Pumping - Executing the job

Potential Hazards:

- Being struck by high-pressure lines or unexpected release of pressure (for example, mismatched or excessively worn hammer unions, line failure).
- Being exposed to chemical hazards (such as, silica, toxics, asphyxiants).
- Being exposed to high noise levels.
- Slips, trips, and falls.

- Overexerting or receiving sprains and strains while handling materials (such as sacks and buckets).
- Being exposed to temperature extremes.
- Being exposed to radiation associated with radioactive tracer materials.

Possible Solutions:

- Require all non-essential personnel to stand clear.
- Direct equipment operators to stay by their controls.
- Conduct adequate pressure tests on pump(s) and lines and ensure proper valve alignment before pumping. Install a check valve as close to the well head as possible. API RP54
- Hobble high pressure lines properly.
- Use proper equipment inspection techniques to include hammer unions (Note: This is a particular problem with 602 and 1502, as they will couple but will not hold beyond the lower pressure rating number).
    - See IADC Alert 98-01, High Pressure Lines And Hammer Unions.
    - See IADC Alert 99-33, More On Mismatched Hammer Unions.
    - See IADC Alert 00-15, Additional Serious Incidents With Mismatched Hammer Unions.
    - See IADC Meeting Minutes, 02 November 1999, Mismatched Hammer Unions, Industry wide meeting.
- Wear proper personal protective equipment (such as respiratory, skin, and hearing) as appropriate for the hazards present.
- Conduct a pre-job inspection to identify, then eliminate or correct hazardous work surfaces.
- Use mechanical lifting aids, proper lifting techniques, and team lifting where appropriate.
- Keep non-essential personnel away from marked-off areas where radiation hazards may be present.
- Allow only authorized and qualified company personnel to handle radioactive tracer materials or radioactive densiometers.
- Prevent contamination and exercise proper personal hygiene when working around radioactive materials.

Rig Down - Disassembly and demobilization of equipment

Potential Hazards:

- Being struck by moving vehicles.
- Being exposed to potential ignition hazards, including flammable or combustible liquids or gases.
- Being exposed to potential skin and respiratory hazards.

- Overexerting or receiving sprains and strains.
- Being exposed to pinch points (such as, hammer union wings and hammers, pump iron and racks).
- Being struck by particles or fluid.
- Falling from heights.
- Slips, trips, and falls.
- Being struck by falling equipment.
- Being injured due to the unexpected release of trapped pressure.

Possible Solutions:

- Use a spotter(s) to direct equipment movement.
- Use mechanical lifting aids, proper lifting techniques, and team lifting where appropriate.
- Use proper hand and body positioning.
- Wear proper personal protective equipment (such as fall protection, respiratory, skin, and hearing protection) as appropriate for the hazards present.
- Conduct a post-job inspection to identify, then eliminate or correct hazardous work surfaces.
- Direct all non-essential personnel to stand clear.
- Follow procedures to release trapped pressure safely.

Additional Information:

- See PPE and Skin Exposure OSHA Safety and Health Topics.

Swabbing

^ TOP

Swabbing is the act of pulling fluid from the well bore through the use of wire rope and cup assembly. Swabbing equipment includes a swabbing assembly, lubricator with an oil saver, and shut-off valve on the well, also called a swabbing valve.

General precautions during all swabbing operations:

- Conduct swabbing operations during daylight hours.
- Keep all personnel clear of the derrick or within six feet (two meters) of the wellhead during swabbing operations.
- Locate swab tanks at least 100 feet (30 meters) from the well, where location allows.

Potential Hazard:

Fig. 16. Swabbing operation

Fig. 17. Swabbing rigs

- Loss of well control.

Possible Solutions:

- Use appropriate equipment, rated for the expected pressures, to shut in the well.
- Inspect lubricators, swages, and unions for defects such as cuts, corrosion, and thread damage before use.
- Adjust oil savers by remote control with a hydraulic pump placed safely away from the wellhead.
- Train all personnel in emergency evacuation procedures.

Potential Hazard:

- Fire, explosive, or respiratory hazard from leakage or venting of oil or gas from tanks, lines or lubricator.

Possible Solutions:

- Place fire extinguishers in accessible positions.
- Move sources of potential ignition (such as, open fires for melting of babbitt) to designated areas at a safe distance from the wellhead or flammable liquid storage areas such as the swab tank before swabbing.
- Make provisions to contain spilled flammable liquids.
- Monitor the oil saver for wear and potential leakage.
- Remove all spillage of flammable liquids from equipment, cellars, rig floor, and ground area adjacent to the wellhead.
- Wear proper PPE, including respiratory protection, as required.

Potential Hazard:

- Being struck by a pressurized line.
- Being exposed to a high-pressure connection failure caused by mismatched or excessively worn hammer unions.

Possible Solutions:

- Avoid approaching, walking over or standing near pressurized lines.
- Securely anchor pressurized lines to prevent whipping or bouncing caused by pressure surges.
- Use proper equipment inspection techniques to include hammer unions (Note: This is a particular problem with 602 and 1502 and others, as they will couple but will not hold beyond the lower pressure rating number).
    - See IADC Alert 98-01, High Pressure Lines And Hammer Unions.
    - See IADC Alert 99-33, More On Mismatched Hammer Unions.
    - See IADC Alert 00-15, Additional Serious Incidents With Mismatched Hammer Unions.

- See IADC Meeting Minutes, 02 November 1999, Mismatched Hammer Unions, Industry wide meeting.

Potential Hazard:

- Being struck by pressurized fluids or the lubricator when removing the lubricator from the well.
- Getting strains and sprains from handling the lubricator.

Possible Solutions:

- Close the shut-off valve and bleed the pressure from the lubricator before removing it.
- Use a lubricator that will allow removal of the swab or other tools with the well shut in (valve closed).
- Use a dolly or other method to minimize manual handling of the equipment.

Potential Hazard:

- Pinching fingers between swab assembly and lubricator when changing swab cups or mandrels.

Possible Solutions:

- Use a winch line, where available, not the swab line, to handle the lubricator.
- Use a lubricator that will allow removal of the swab or other tools with the well shut in (valve closed).

Additional Information:

- IADC Accident Prevention Guide, Swabbing
- AESC Recommended Safe Procedures and Guidelines for Oil and Gas Well Servicing. Swabbing and other Wireline Operations
- API RP54, Recommended Practice for Occupational Safety for Oil and Gas Well Drilling and Servicing Operations, Wireline Service

Hot Oiling

^ TOP

A hot oil unit is designed to circulate heated fluid into piping, tubing, casing, or tanks for a variety of reasons, including the removal of paraffin and tar-based oils.

Fig. 18. Hot oiling truck

Potential Hazard:

- Fire or explosion hazard from contact with flammable liquids, vapors, or gases.

Possible Solutions:

- Locate hot oil trucks and tanks a safe distance (100 feet is recommended) from the well and out of the fall line of the derrick, if it is on site. Where impractical, use additional safety

measures.

- Position hot oil units upwind or crosswind from potential sources of flammable liquids, vapors, or gasses. Wind direction indicator should be present and visible to the operator.
- Shut down hot oiling operation immediately if a leak occurs.
- Make fire extinguishers readily accessible to the hot oil operator.
- Avoid parking over or placing lines containing flammable fluids under trucks or other vehicles.
- Install check valve in the pump line as close to the well head as possible.
- Inspect all components of the hot oil unit before each use.
- Shut the burner down if the wind dies.
- Shut the burner down and reposition equipment if the wind changes direction so as to create a hazard.

Potential Hazard:

- Being burned by hot oil or hot oil line or frostbite injuries from contact with propane or propane lines.

Possible Solution:

- Wear proper personnel protective equipment such as heavy padded, insulated, leather gloves

Potential Hazards: Expert Review

- Unexpected release of pressure

Possible Solutions:

- Do not connect heavy joints of pipe to the small nipples on the pumping T.
- Secure all hot oil and discharge lines.
- Connect the hot oil line directly to the flow line if pump pressure exceeds safe limits (500 psi).
- Remain clear of pressurized lines.

Snubbing ∧ TOP

Snubbing is the control of a tubing string while running it in or out of a well bore under pressure.

Note: The special service supervisor should hold a pre-job meeting with the special service crew and other involved personnel to review responsibilities and to coordinate the operations to be performed.

Potential Hazards:

- Falling from heights.

- Being exposed to an unexpected release of pressure, and loss of well control.
- Being burned by a fire and explosion.
- Having limited ingress and egress.
- Working in an unstable basket due to lack of guy wires.
- Being caught between the rig assist pull down and crows nest.

Possible Solutions:

- Ensure proper fall protection.
- Inspect and maintain all pressure control equipment prior to operations.
- Provide adequate means of access to and exit from the basket.
- Provide emergency escape method. API RP54
- Rig all equipment in accordance with equipment recommendations.
- Ensure proper body and hand placement.

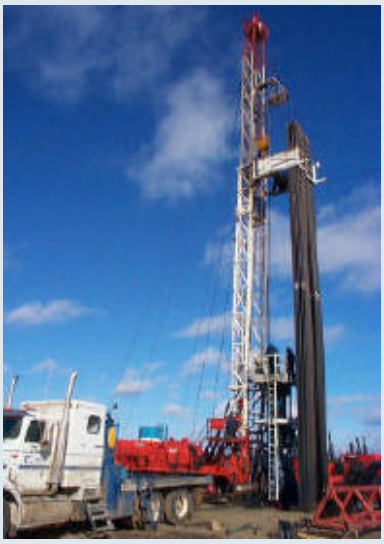

Fig. 19. Snubbing rig

Fig. 20. Snubbing operations

Fig. 21. Snubbing rig with blow out preventer (BOP)

Coil Tubing

^ TOP

Technology allows tubing to be manufactured in a continuous coil without joints. Coiled tubing is inserted into the well down the production casing without the need for tongs, slips, or elevators.

Fig. 22. Installing coil tubing

Potential Hazards:

- Pinching fingers and hands.
- Being exposed to an unexpected release of pressure.
- Getting struck by falling or shifting objects (such as suspended injector heads).
- Falling from heights.

Fig. 23. Coil tubing unit

Possible Solutions:

- Keep all fingers and hands away from pinch points (such as tubing spool, rollers, injector head).
- Inspect the tools and equipment before use.
- Rig up boom trucks in accordance with manufacturer's recommendations.
- Use fall protection.

eTool Home | Site Preparation | Drilling | Well Completion | Servicing | Plug & Abandon Well
General Safety | Additional References | Viewing/Printing Instructions | Credits | JSA
Safety and Health Topic | Site Map | Illustrated Glossary | Glossary of Terms

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Oil and Gas Well Drilling and Servicing eTool

Servicing >> Workover

Workover activities include one or more of a variety of remedial operations on a producing well to try to increase production.

- Sand Cleanout
- Repairing Liners and Casing
- Well Recompletions
  - Sidetracking
  - Plug-Back

Fig. 1. Example of a workover rig

Sand Cleanout

^ TOP

Sand cleanout operations are performed to remove buildup of sand in the wellbore. Hazards are

Potential Hazard:

- Hazards are similar to those for well servicing. See Wireline Operations.

Additional Information:

- API RP54

Repairing Liners and Casing

^ TOP

Liners and casing are essentially the same and repair procedures are the same for both. Casing can be damaged by corrosion, abrasion, pressure, or other forces that create holes or splits. A packer is run down the well to locate the hole in the casing. Fluid is pumped into the casing above the packer. A loss of pressure indicates a hole in the casing. The following are the principal methods for repairing casing:

- Squeeze cementing.

- Patching a liner.
- Replacing casing.
- Adding a liner.
- Opening collapsed casing.

Potential Hazard:

- Hazards are similar to those for installing casing. See Casing and Cementing.

Sidetracking

^ TOP

Sidetracking is the workover term for drilling a directional hole to bypass an obstruction in the well that cannot be removed or damage to the well, such as collapsed casing that cannot be repaired. Sidetracking is also done to deepen a well or to relocate the bottom of the well in a more productive zone, which is horizontally removed from the original well.

To sidetrack, a hole (called a window) is made in the casing above the obstruction. The well is then plugged with cement below the window. Special drill tools, such as a whipstock, bent housing, or bent sub are used to drill off at an angle from the main well. This new hole is completed in the same manner as any well after a liner is set.

Potential Hazard:

- The hazards associated with sidetracking are similar to Drilling.

Plug-Back

^ TOP

Plug-back places a cement plug at one or more locations in a well to shut off flow from below the plug. Plug-back is also used before abandoning a well or before sidetracking is done.

There are two methods for placing a cement plug in a well:

- Plug-back using tubing.
- Plug-back using a dump bailer (see Wireline Operations).

Potential Hazard:

- The hazards associated with plug-back are similar to Drilling and Cementing.

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Plug and Abandon the Well

A well is abandoned when it reaches the end of its useful life or is a dry hole.

- The casing and other equipment is removed and salvaged.
- Cement plugs are placed in the borehole to prevent migration of fluids between the different formations.
- The surface is reclaimed.


Fig. 1. A plugged and abandoned well site

Removing Casing

∧ TOP

The rig is used to remove the casing and plug the well. The wellhead is removed. After the casing is cut off, it is removed.

Potential Hazards:

- Being struck by rig equipment (such as casing jacks, power tongs, and casing elevators).
- Being exposed to other hazards similar to those encountered during regular drilling or workover operations.


Fig. 2. Wellhead

Possible Solutions:

- Solutions are similar to those found in Tripping out/in and Casing Operations.

Place Cement Plugs

∧ TOP

Cement plugs are placed in the borehole to prevent migration of fluids between the different formations. This also prevents the migration of gas or fluids to the surface.

Potential Hazards:

- Being struck by pressured lines when pumping cement.

Possible Solutions:

- Instruct personnel to stand clear of pressurized lines.

Additional Information:

- Additional materials can be found at API in *Bulletin E3 Well Abandonment and Inactive Well Practices for U.S. Exploration and Production Operations, Environmental Guidance Document, 1st Edition, January 1993.*

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Oil and Gas Well Drilling and Servicing eTool

Illustrated Glossary

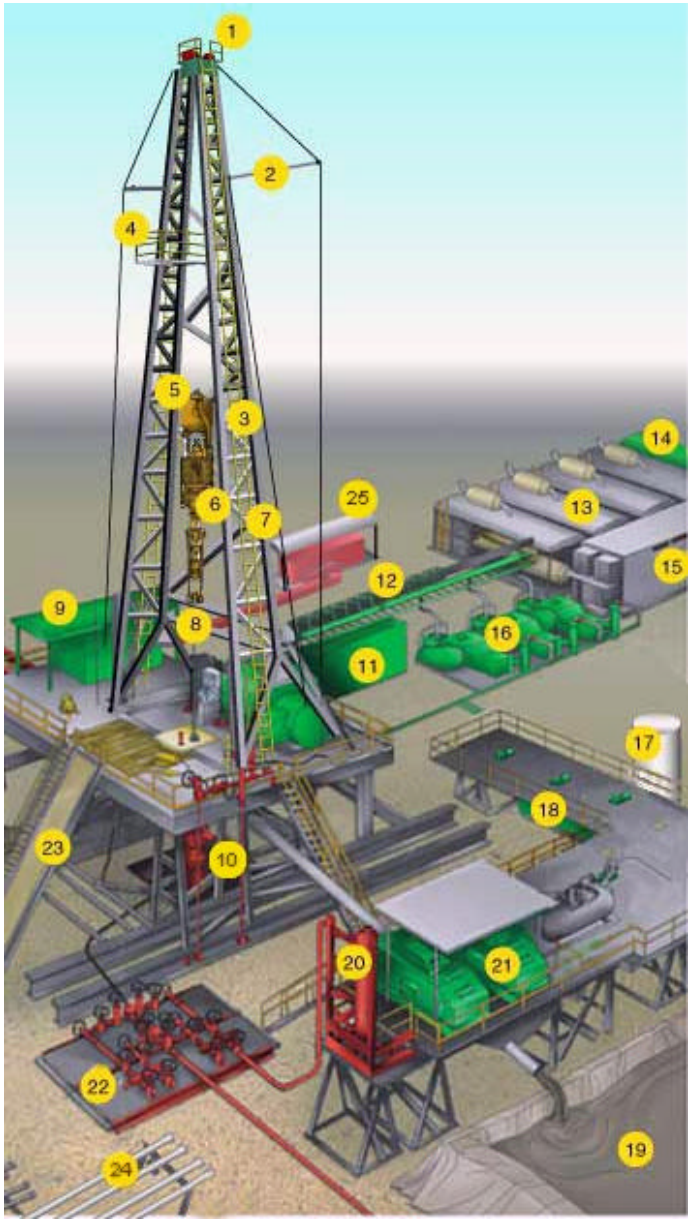
Drilling Rig Components

Click on the name below or a number on the graphic to see a definition and a more detailed photo of the object.

1. Crown Block and Water Table
2. Catline Boom and Hoist Line
3. Drilling Line
4. Monkeyboard
5. Traveling Block
6. Top Drive
7. Mast
8. Drill Pipe
9. Doghouse
10. Blowout Preventer
11. Water Tank
12. Electric Cable Tray
13. Engine Generator Sets
14. Fuel Tank
15. Electrical Control House
16. Mud Pumps
17. Bulk Mud Component Tanks
18. Mud Tanks (Pits)
19. Reserve Pit
20. Mud-Gas Separator
21. Shale Shakers
22. Choke Manifold
23. Pipe Ramp
24. Pipe Racks
25. Accumulator

Additional rig components not illustrated at right.

26. Annulus
27. Brake
28. Casing Head
29. Cathead
30. Catwalk
31. Cellar
32. Conductor Pipe
33. Degasser
34. Desander
35. Desilter
36. Drawworks



Equipment used in drilling

48. Ram BOP
49. Rathole
50. Rotary Hose

37. Drill Bit
38. Drill Collars
39. Driller's Console
40. Elevators
41. Hoisting Line
42. Hook
43. Kelly
44. Kelly Bushing
45. Kelly Spinner
46. Mousehole
47. Mud Return Line
51. Rotary Table
52. Slips
53. Spinning chain
54. Stairways
55. Standpipe
56. Surface Casing
57. Substructure
58. Swivel
59. Tongs
60. Walkways
61. Weight Indicator

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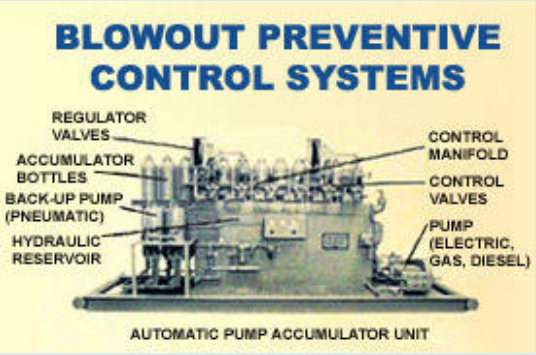
Illustrated Glossary

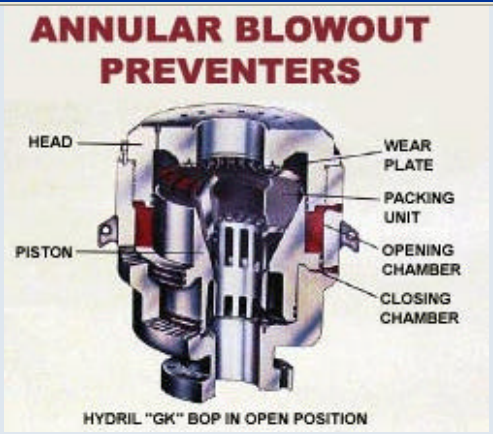
Accumulator

The storage device for nitrogen pressurized hydraulic fluid, which is used in operating the blowout preventers.



Annular Blowout Preventer

A large valve, usually installed above the ram preventers, that forms a seal in the annular space between the pipe and well bore. If no pipe is present, it forms a seal on the well bore itself.

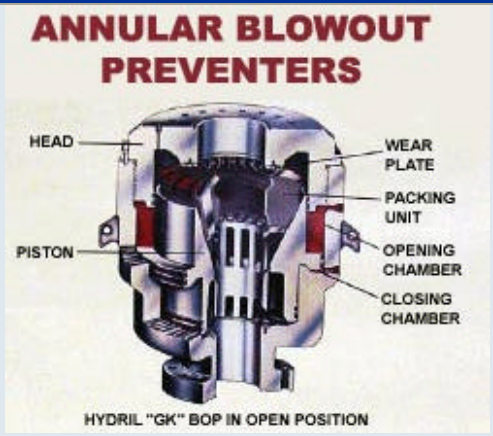


Annulus

The space around a pipe in a well bore, the outer wall of which may be the wall of either the bore hole or the casing; sometimes termed the annular space.

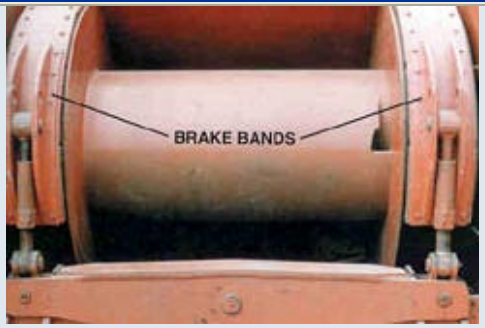
Blowout Preventer

A large valve, usually installed above the ram preventers, that forms a seal in the annular space between the pipe and well bore or, if no pipe is present, on the well bore itself.



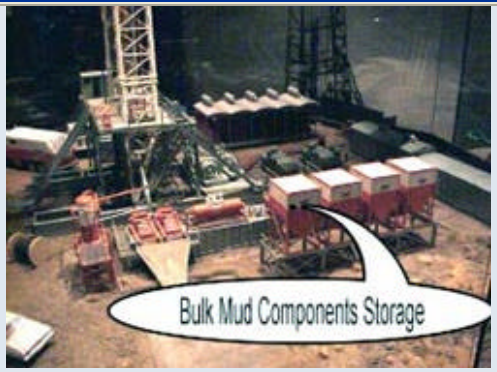
Brake

The braking device on the drawworks to stop a load being lifted.



Bulk Mud Components in Storage

Hopper type tanks for storage of drilling fluid components.

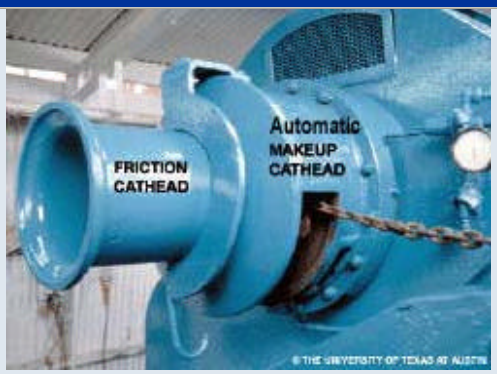


Casing Head

A heavy, flanged steel fitting connected to the first string of casing. It provides a housing for slips and packing assemblies, allows suspension of intermediate and production strings of casing, and supplies the means for the annulus to be sealed off. Also called a spool.

Cathead

A spool-shaped attachment on a winch around which rope for hoisting and pulling is wound.



Catline Boom and Hoist Line

A structural framework erected near the top of the derrick for lifting material.

Catwalk

The ramp at the side of the drilling rig where pipe is laid to be lifted to the derrick floor by the catline or by an air hoist.

Cellar

A pit in the ground to provide additional height between the rig floor and the well head to accommodate the installation of blowout preventers, ratholes, mouseholes, and so forth. It also collects drainage water and other fluids for disposal.

Choke Manifold

The arrangement of piping and special valves, called chokes, through which drilling mud is circulated when the blowout preventers are closed to control the pressures encountered during a kick.

Conductor Pipe

The largest diameter casing and the topmost length of casing. It is relatively short and encases the topmost string of casing.

Crown Block and Water Table

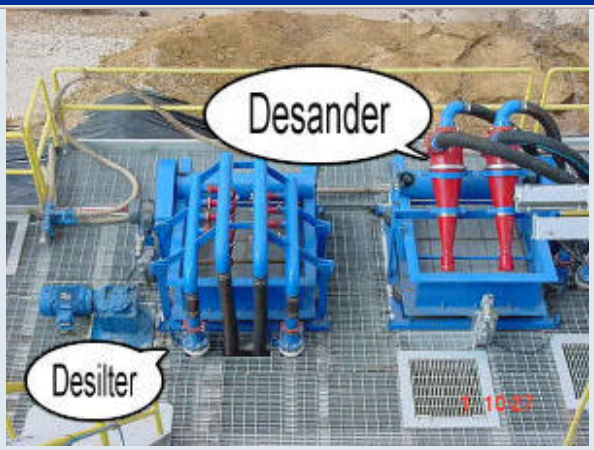
An assembly of sheaves or pulleys mounted on beams at the top of the derrick. The drilling line is run over the sheaves down to the hoisting drum.

Degasser

The equipment used to remove unwanted gas from a liquid, especially from drilling fluid.

Desander

A centrifugal device for removing sand from drilling fluid to prevent abrasion of the pumps. It may be operated mechanically or by a fast-moving stream of fluid inside a special cone-shaped vessel, in which case it is sometimes called a hydrocyclone.



Desilter

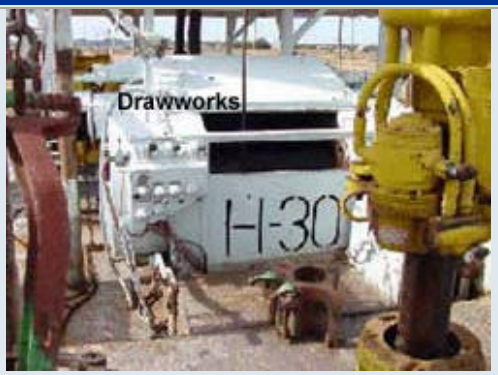
A centrifugal device, similar to a desander, used to remove very fine particles, or silt, from drilling fluid. This keeps the amount of solids in the fluid to the lowest possible level.

Doghouse

A small enclosure on the rig floor used as an office for the driller or as a storehouse for small objects. Also, any small building used as an office or for storage.

Drawworks

The hoisting mechanism on a drilling rig. It is essentially a large winch that spools off or takes in the drilling line and thus raises or lowers the drill stem and bit.



Drill Bit

The cutting or boring element used in drilling oil and gas wells. Most bits used in rotary drilling are roller-cone bits. The bit consists of the cutting elements and the circulating element. The circulating element permits the passage of drilling fluid and uses the hydraulic force of the fluid stream to improve drilling rates.

Drill Collar

A heavy, thick-walled tube, usually steel, used between the drill pipe and the bit in the drill stem. It is used to put weight on the bit so that the bit can drill.

Drill Pipe

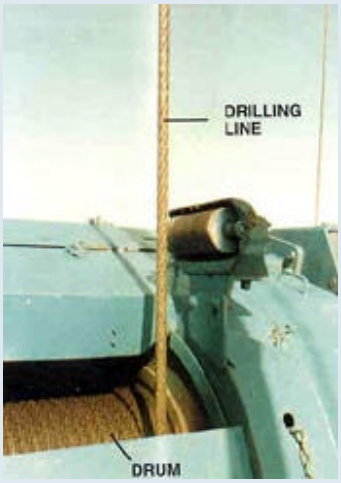
The heavy seamless tubing used to rotate the bit and circulate the drilling fluid. Joints of pipe 30 feet long are coupled together with tool joints.

Driller's Console

The control panel, located on the platform, where the driller controls drilling operations.

Drilling Line

A wire rope hoisting line, reeved on sheaves of the crown block and traveling block (in effect a block and tackle). Its primary purpose is to hoist or lower drill pipe or casing from or into a well. Also, a wire rope used to support the drilling tools.



Electric Control House

On diesel electric rigs, powerful diesel engines drive large electric generators. The generators produce electricity that flows through cables to electric switches and control equipment enclosed in a control cabinet or panel. Electricity is fed to electric motors via the panel.

Electric Cable Tray

Supports the heavy electrical cables that feed the power from the control panel to the rig motors.

Elevators

A set of clamps that grips a stand, or column, of casing, tubing, drill pipe, or sucker rods, so the stand can be raised or lowered into the hole.

Engine Generator Sets

A diesel, Liquefied Petroleum Gas (LPG), natural gas, or gasoline engine, along with a mechanical transmission and generator for producing power for the drilling rig. Newer rigs use electric generators to power electric motors on the other parts of the rig.

Fuel Tanks

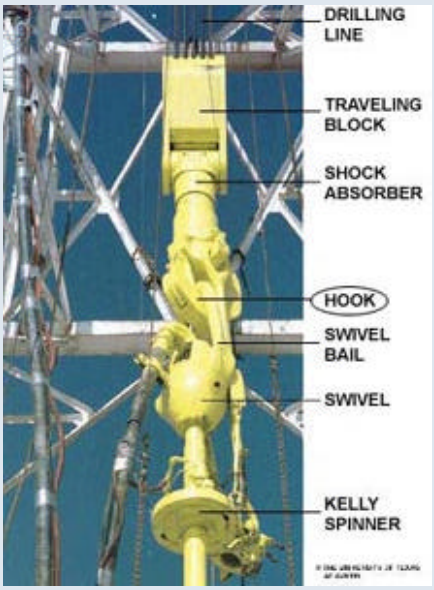
Fuel storage tanks for the power generating system.

Hoisting Line

A wire rope used in hoisting operations. Must conform to the API standards for its intended uses.

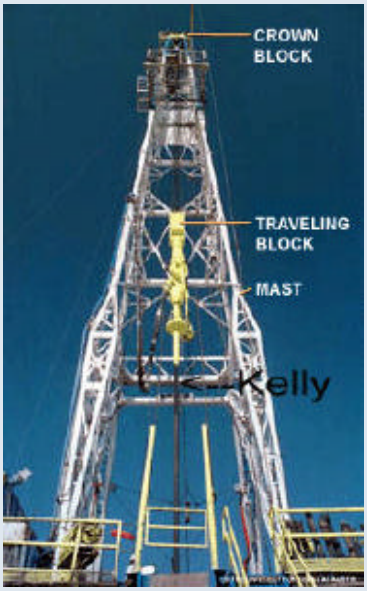
Hook

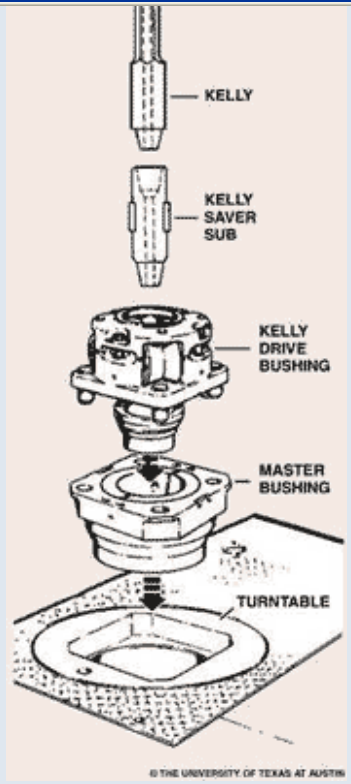
A large, hook-shaped device from which the elevator bails or the swivel is suspended. It is designed to carry maximum loads ranging from 100 to 650 tons and turns on bearings in its supporting housing.



Kelly

The heavy square or hexagonal steel member suspended from the swivel through the rotary table. It is connected to the topmost joint of drill pipe to turn the drill stem as the rotary table turns.



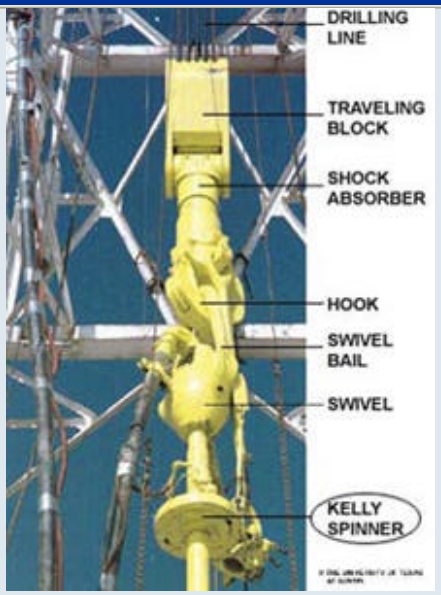


Kelly Bushing

A device fitted to the rotary table through which the kelly passes. It is the means by which the torque of the rotary table is transmitted to the kelly and to the drill stem. Also called the drive bushing.

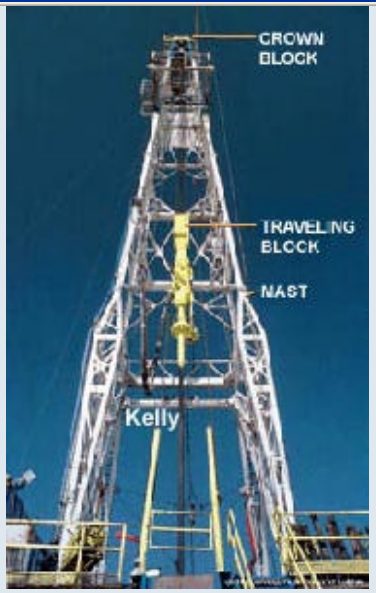
Kelly Spinner

A device for spinning the drill pipe. Replaces the spinning chain.



Mast

A portable derrick capable of being erected as a unit, as distinguished from a standard derrick, which cannot be raised to a working position as a unit.

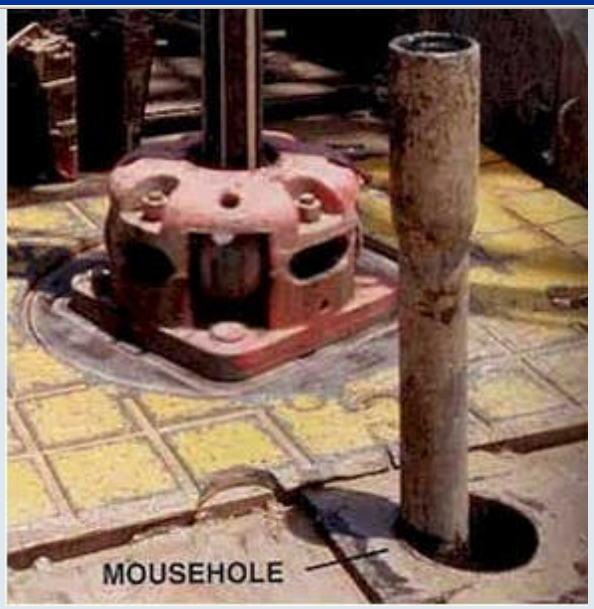


Monkeyboard

The derrickman's working platform. Double board, tribble board, fourable board; a monkey board located at a height in the derrick or mast equal to two, three, or four lengths of pipe respectively.

Mousehole

Shallow bores under the rig floor, usually lined with pipe, in which joints of drill pipe are temporarily suspended for later connection to the drill string.



Mud-Gas Separator

A device that removes gas from the mud coming out of a well when a kick is being circulated out.

Mud Pits

A series of open tanks, usually made of steel plates, through which the drilling mud is cycled to allow sand and sediments to settle out. Additives are mixed with the mud in the pit, and the fluid is temporarily stored there before being pumped back into the well. Mud pit compartments are also called shaker pits, settling pits, and suction pits, depending on their main purpose.

Mud Pump

A large reciprocating pump used to circulate the mud (drilling fluid) on a drilling rig.

Mud Return Line

A trough or pipe, placed between the surface connections at the well bore and the shale shaker. Drilling mud flows through it upon its return to the surface from the hole.

Pipe Racks

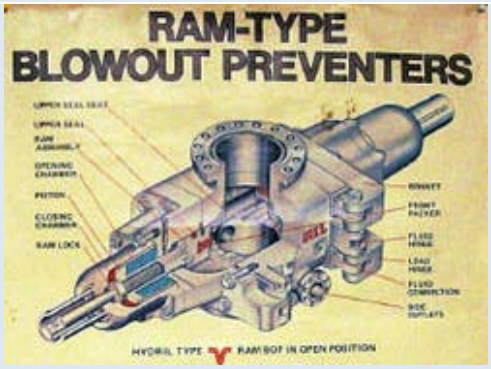
A horizontal support for tubular goods.

Pipe Ramp

An angled ramp for dragging drill pipe up to the drilling platform or bringing pipe down off the drill platform.

Ram Blowout Preventer

A blowout preventer that uses rams to seal off pressure on a hole that is with or without pipe. It is also called a ram preventer. Ram-type preventers have interchangeable ram blocks to accommodate different O.D. drill pipe, casing, or tubing.



Rathole

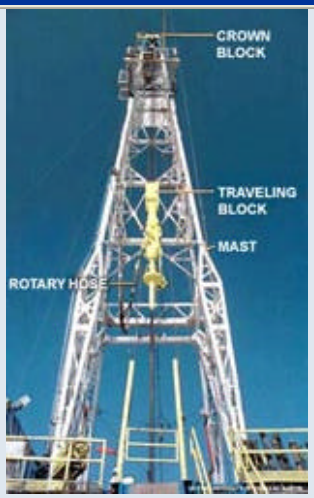
A hole in the rig floor 30 to 35 feet deep, lined with casing that projects above the floor. The kelly is placed in the rathole when hoisting operations are in progress.

Reserve Pits

A mud pit in which a supply of drilling fluid has been stored. Also, a waste pit, usually an excavated, earthen-walled pit. It may be lined with plastic to prevent soil contamination.

Rotary Hose

The hose on a rotary drilling rig that conducts the drilling fluid from the mud pump and standpipe to the swivel and kelly; also called the mud hose or the kelly hose.



Rotary Table

The principal component of a rotary, or rotary machine, used to turn the drill stem and support the drilling assembly. It has a beveled gear arrangement to create the rotational motion and an opening into which bushings are fitted to drive and support the drilling assembly.

Note the pipe spinner (in red) on the side of the swivel.

Shale Shaker

A series of trays with sieves or screens that vibrate to remove cuttings from circulating fluid in rotary drilling operations. The size of the openings in the sieve is selected to match the size of the solids in the drilling fluid and the anticipated size of cuttings. Also called a shaker.

Slips

Wedge-shaped pieces of metal with teeth or other gripping elements that are used to prevent pipe from slipping down into the hole or to hold pipe in place. Rotary slips fit around the drill pipe and wedge against the master bushing to support the pipe. Power slips are pneumatically or hydraulically actuated devices that allow the crew to dispense with the manual handling of slips when making a connection. Packers and other down hole equipment are secured in position by slips that engage the pipe by action directed at the surface.

Spinning Chain

A relatively short length of chain attached to the tong pull chain on the manual tongs used to make up drill pipe. The spinning chain is attached to the pull chain so that a crew member can wrap the spinning chain several times around the tool joint box of a joint of drill pipe suspended in the rotary table. After crew members stab the pin of another tool joint into the box end, one of them then grasps the end of the spinning chain and with a rapid upward motion of the wrist "throws the spinning chain"—that is, causes it

to unwrap from the box and coil upward onto the body of the joint stabbed into the box. The driller then actuates the makeup cathead to pull the chain off of the pipe body, which causes the pipe to spin and thus the pin threads to spin into the box.

Stairways

Stairs leading from one level to another. Protected with handrails.

Standpipe

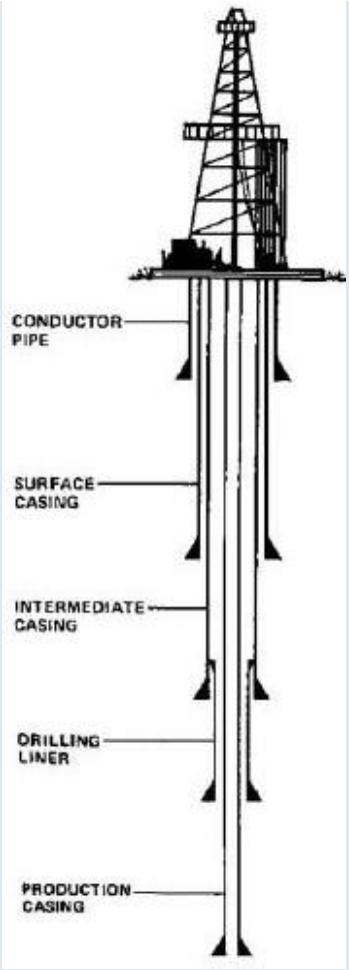
A vertical pipe rising along the side of the derrick or mast. It joins the discharge line leading from the mud pump to the rotary hose and through which mud is pumped going into the hole.

Substructure

The foundation on which the derrick or mast and usually the drawworks sit; contains space for storage and well control equipment.

Surface Casing

Usually the first casing to be run in a well. This is done after spudding-in so a blowout preventer can be installed before drilling is started.



Swivel

A rotary tool that is hung from the rotary hook and traveling block to suspend and permit free rotation of the drill stem. It also provides a connection for the rotary hose and a passageway for the flow of drilling fluid into the drill stem.

Tongs

The large wrenches used for turning when making up or breaking out drill pipe, casing, tubing, or other pipe; variously called casing tongs, rotary tongs, and so forth according to the specific use. Power tongs are

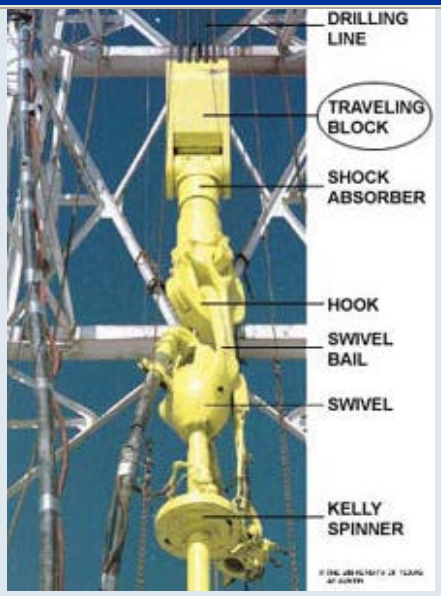
pneumatically or hydraulically operated tools that spin the pipe up and, in some instances, apply the final makeup torque.

Top Drive

The top drive rotates the drill string end bit without the use of a kelly and rotary table. The top drive is operated from a control console on the rig floor.

Traveling Block

An arrangement of pulleys or sheaves through which drilling cable is reeved, which moves up or down in the derrick or mast.



Walkways

An area cleared for moving through by personnel and protected with a handrail.

Water Tank

Is used to store water that is used for mud mixing, cementing, and rig cleaning.

Weight Indicator

A device for measuring the weight of the drill string. Monthly calibration to calculated drill string weight is required by API.

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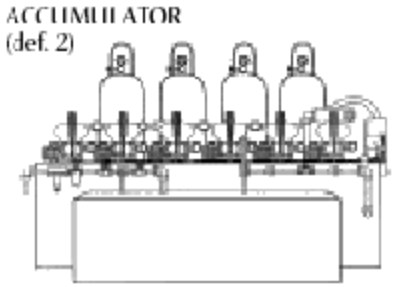
A

abandon v: to temporarily or permanently cease production from a well or to cease further drilling operations.

abnormal pressure n: pressure outside the normal or expected range.

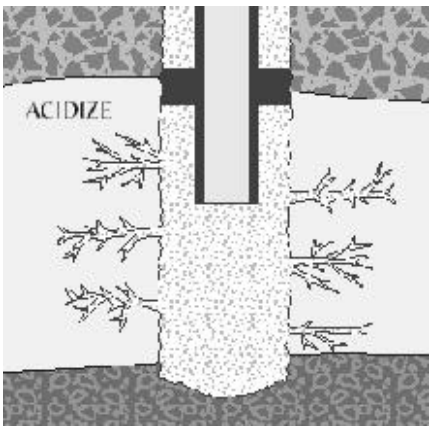
abrasion n: wearing away by friction.

accumulator n: the storage device for nitrogen pressurized hydraulic fluid, which is used in operating the blowout preventers.



acetic acid n: an organic acid compound sometimes used to acidize oilwells.

acid fracture v: to part or open fractures in limestone formations by using fluid under hydraulic pressure.



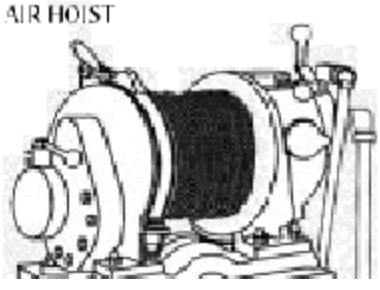
acidize v: to treat formations with acid for the purpose of increasing production.

acid stimulation n: a well stimulation method using acid. See acidize.

aeration n: the introduction of air or gas into a liquid.

AESC Association of Energy Service Companies n: a trade association that represents the interests of members of the energy service segment of the oil and gas industry. It offers publications regarding recommended industry practices and training materials. Address: 10200 Richmond Ave., #253; Houston, TX 77042; (713) 781-0758.

air hoist n: a hoist operated by compressed air; a pneumatic hoist. Air hoists are often mounted on the rig floor and may be used to lift joints of pipe and other heavy objects.



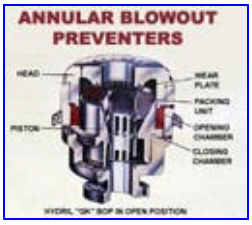
ANSI American National Standards Institute n: a non-profit organization (501(c)3) that administers and coordinates voluntary standardization and conformity assessment system. General Inquiries: Telephone: (212) 642-4900; Headquarters: 1819 L Street, NW, Washington, DC 20036, Telephone: (202) 293-8020; Fax: (202)

293-9287; New York Office: 25 West 43rd Street, New York, NY 10036 Telephone: (212) 642-4900; Fax: (212) 398-0023

API American Petroleum Institute n: a trade association and standards organization that represents the interests of the oil and gas industry. It offers publications regarding standards, recommended practices, and other industry related information. Address: 1220 L Street NW; Washington, DC 20005; (202) 682-8000

IADC International Association of Drilling Contractors n: a trade association that represents the interests of members of the drilling segment of the oil and gas industry. It offers publications regarding recommended industry practices and training materials. Address: 15810 Park Ten Place., #242; Houston, TX 77084; (281) 578-7171.

annular blowout preventer n: a well control device, usually installed above the ram preventers, that forms a seal in the annular space between the pipe and well bore or, if no pipe is present, over the well bore itself.



annular pressure n: pressure in an annular space.

annulus n: the space around a pipe in a well bore, sometimes termed the annular space.

API-monagram adj; the logo of the American Petroleum Institute (API) that is placed on certain pieces of oilfield equipment by the equipment manufacturer. API licenses the use of the monogram on equipment that meets the API's minimum standards. It offers publications regarding standards, recommended practices, and other industry related information. Address: 1220 L Street NW; Washington, DC 20005; (202) 682-8000

artificial lift n: any method used to raise oil to the surface after a well ceases to flow.

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B

babbitt v: line with a Babbitt metal. n: a lead/tin alloy with some copper and antimony.

backbite v: reverse backlash of tongs, left on a pipe or collar, during the pipe spinning operations.

back off v: to unscrew one threaded piece (such as a section of pipe) from another.

back-in unit n: a portable servicing or workover rig that is self-propelled, using the hoisting engines for motive power. Because the driver's cab is mounted on the end opposite the mast support, the unit must be backed up to the wellhead.

bail n: 1. a cylindrical steel bar (similar to the handle or bail of a bucket, only much larger) that supports the swivel and connects it to the hook.

bailer n: a long, cylindrical container fitted with a valve at its lower end, used to remove water, sand, mud, drilling cuttings, or oil from a well in cable-tool drilling.

ball-and-seat valve n: a device used to restrict fluid flow to one direction. It consists of a polished sphere, or ball, usually of metal, and an annular piece, the seat, ground and polished to form a seal with the surface of the ball. Gravitational force or the force of a spring holds the ball against the seat. Flow in the direction of the force is prevented, while flow in the opposite direction overcomes the force and unseats the ball.

ball-out v: to plug open perforations by using ball sealers.

barite n: barium sulfate, $BaSO_4$; a mineral frequently used to increase the weight or density of drilling mud. Its relative density is 4.2 (meaning that it is 4.2 times denser than water). See barium sulfate, mud.

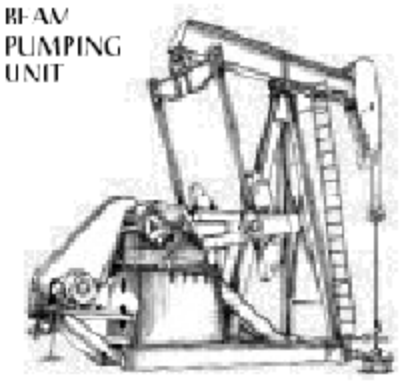
barium sulfate n: a chemical compound of barium, sulfur, and oxygen ($BaSO_4$), which may form a tenacious scale that is very difficult to remove. Also called barite.

barrel (bbl) n: 1. a measure of volume for petroleum products in the United States. One barrel is the equivalent of 42 U.S. gallons or 0.15899 cubic meters (9,702 cubic inches).

basket n: a device placed in the drill or work string that catches debris when a drillable object is being milled or drilled downhole.

beam n: a steel or other structural member.

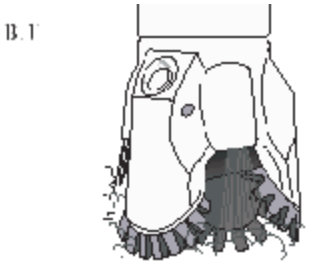
beam pumping unit n: a machine designed specifically for sucker rod pumping. An engine or motor (prime mover) is mounted on the unit to power a rotating crank. The crank moves a horizontal member (walking beam) up and down to produce reciprocating motion. This reciprocating motion operates the pump.



belt n: a flexible band or cord connecting and wrapping around each of two or more pulleys to transmit power or impart motion.

belt guard n: a protective grill or cover for a belt and pulleys.

bent sub n: a short cylindrical device (generally angular) installed in the drill stem between the bottommost drill collar and a downhole motor.



bit n: the cutting or boring element used in drilling oil and gas wells.

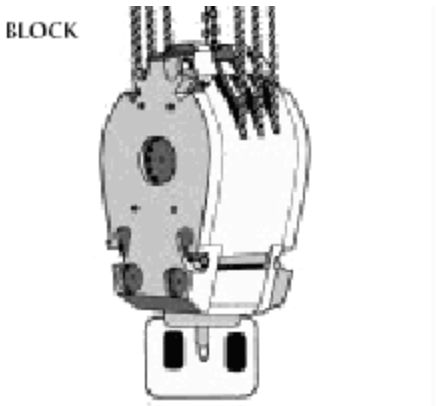
bit program n: a plan for the expected number and types of bits that are to be used in drilling a well.

bit record n: a report that lists each bit used during a drilling operation.

bit sub n: a sub inserted between the drill collar and the bit.

bleed v: to drain off liquid or gas, generally slowly, through a valve called a bleeder. To bleed down, or bleed off, means to release pressure slowly from a well or from pressurized equipment.

block n: one or more pulleys, or sheaves, mounted into a common framework in order to rotate on a common axis. The crown block is an assembly of sheaves mounted on beams at the top of the derrick or mast. The traveling block is an assembly of sheaves mounted in a framework that allows the block to move up and down by use of the drilling line that is reeved over the crown block sheaves an through the traveling block sheaves.



blowout n: an uncontrolled flow of gas, oil, or other well fluids from the well.

blowout preventer (BOP) n: one or more valves installed at the wellhead to prevent the escape of pressure either in the annular space between the casing and the drill pipe or in open hole (for example, hole with no drill pipe) during drilling or completion operations.

blowout preventer control panel n: controls, opens and closes the blowout preventers. See blowout preventer.

blowout preventer control unit n: a device that stores hydraulic fluid under pressure in special containers and provides a method to open and close the blowout preventers.

blowout preventer stack (BOP stack) n: the assembly of well control equipment including preventers, spools, valves, and nipples connected to the top of the wellhead.

BOP abbr: blowout preventer.

BOP stack n: the assembly of blowout preventers installed on a well.

bore n: 1. the inside diameter of a pipe or a drilled hole. v: to penetrate or pierce with a rotary tool. Compare tunnel.

bottomhole n: the lowest or deepest part of a well.

bottomhole assembly n: the portion of the drilling assembly below the drill pipe. It can be very simple, composed of only the bit and drill collars, or it can be very complex and made up of several specialty

components.

bottomhole plug n: a bridge plug or cement plug placed near the bottom of the hole to shut off a depleted, water-producing, or unproductive zone.

bottomhole pressure n: 1. the pressure at the bottom of a borehole. It is caused by the hydrostatic pressure of the wellbore fluid and, sometimes, by any backpressure held at the surface, as when the well is shut in with blowout preventers. When mud is being circulated, bottomhole pressure is the hydrostatic pressure plus the remaining circulating pressure required to move the mud up the annulus. 2. the pressure in a well at a point opposite the producing formation, as recorded by a bottomhole pressure measuring device.

bottomhole pressure test n: a test that measures the reservoir pressure of the well, obtained at a specific depth or at the midpoint of the producing zone. A flowing bottomhole pressure test measures pressure while the well continues to flow; a shut-in bottomhole pressure test measures pressure after the well has been shut in for a specified period of time. See bottomhole pressure.

bottomhole pump n: any of the rod pumps, high-pressure liquid pumps, or centrifugal pumps located at or near the bottom of the well and used to lift the well fluids. See centrifugal pump, hydraulic pumping, submersible pump, sucker rod pumping.

bottom plug n: a cement wiper plug that precedes cement slurry down the casing. The plug wipes drilling mud off the walls of the casing and prevents it from contaminating the cement. See cementing, wiper plug.

box threads n pl: threads on the female section, or box, of a tool joint. See tool joint.

brake n: The braking device on the drawworks or airhoist to stop a load being lifted. It is a device for arresting the motion of a mechanism, usually by means of friction, as in the drawworks and airhoist brakes.

brake band n: a part of the brake mechanism consisting of a flexible steel band lined with a material that grips a drum when tightened. On drawworks, the brake band acts on the drum to control the lowering of the traveling block and its load.

break circulation v: to start the mud pump for restoring circulation of the mud column. Because the stagnant drilling fluid has thickened or gelled during the period of no circulation, higher pump pressure is usually required to break circulation.

breaker points n: contacts that interrupt the current in the primary circuit of an electrical system such as in a spark-ignition engine.

break out v: 1. to unscrew one section of pipe from another section, especially drill pipe while it is being withdrawn from the wellbore. During this operation, the tongs are used to start the unscrewing operation. 2. to separate, as gas from a liquid or water from an emulsion.

breakout block n: a plate that fits in the rotary table and holds the drill bit while it is being unscrewed from the drill collar.

breakout cathead n: a device attached to the catshaft of the drawworks that is used as a power source for the tongs used in unscrewing drill pipe; usually located opposite the driller's side of the drawworks.

break tour (pronounced "tower") v: to begin operating 24 hours a day. Moving the rig and rigging up are usually carried on during daylight hours only. When the rig is ready for operation at a new location, crews break tour.

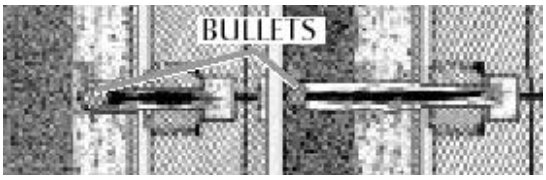
bridge plug n: a downhole tool, composed primarily of slips, a plug mandrel, and a rubber sealing element, that is run and set in casing to isolate a lower zone while an upper section is being tested or cemented.

brine n: water that has a quantity of salt, especially sodium chloride, dissolved in it; salt water.

buck up v: to tighten up a threaded connection (such as two joints of drill pipe).

bulk mud components in storage n: hopper type tanks for storage of drilling fluid components.

bulk tank n: on a drilling rig, a large metal bin that usually holds a large amount of a certain mud additive, such as bentonite, that is used in large quantities in the makeup of the drilling fluid.



bullet perforator n: a tubular device that, when lowered to a selected depth within a well, is engaged forcing the projectiles (bullets) through the casing and cement to provide holes through which the formation fluids may enter the wellbore.

bumped adj: in cementing operations, pertaining to a cement plug that comes to rest on the float collar.

bumper block n: Timbers wrapped with wire mesh or other retaining medium located below the crown to act as a cushion in the event the block is raised too far.

bushing n: 1. a pipe fitting on which the external thread is larger than the internal thread to allow two pipes of different sizes to be connected. 2. a removable lining or sleeve inserted or screwed into an opening to limit its size, resist wear or corrosion, or serve as a guide.

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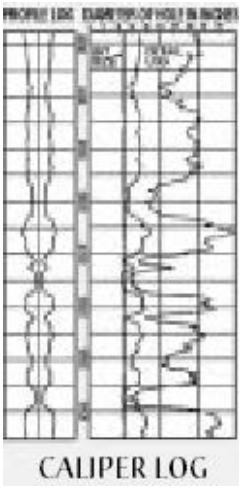
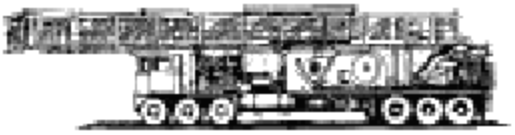
C

cable n: 1. a rope of wire, hemp, or other strong fibers. 2. braided wire used to conduct electricity, often called power cable.


CALIPER LOG

caliper log n: a record showing variations in wellbore diameter by depth, indicating undue enlargement due to caving in, washout, or other causes. The caliper log also reveals corrosion, scaling, or pitting inside tubular goods.

carrier rig n: a specially designed, self-propelled workover or drilling rig that is driven directly to the well site. Power from a carrier rig's hoist engine or engines also propels the rig on the road. A carrier rig may be a back-in type or a drive-in type.


CARRIER RIG

casing n: 1. steel pipe placed in an oil or gas well to prevent the wall of the hole from caving in, to prevent movement of fluids from one formation to another and to aid in well control.


CASING

cased hole n: a wellbore in which casing has been run.

casing centralizer n: a device secured around the casing at regular intervals to center it in the hole.

casing cutter n: a heavy cylindrical body, fitted with a set of knives, used to cut and free a section of casing in a well.

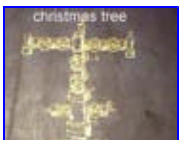
casing coupling (collar) n: a tubular section of pipe that is threaded inside and used to connect two joints of casing.

casing crew n: the employees of a company that specializes in preparing and running casing into a well.

casing gun n: a perforating gun run into the casing string.

casing hanger n: a circular device with a frictional gripping arrangement of slips and packing rings used to suspend casing from a casing head in a well.

casinghead n: a heavy, flanged steel fitting connected to the first string of casing. It provides a housing for slips and packing assemblies, allows suspension of intermediate and production strings of casing, and supplies the means for the annulus to be sealed off. Also called a casing spool.



casing point n: the depth in a well at which casing is set, generally the depth at which the casing shoe rests.

casing pressure n: the pressure in a well that exists between the casing and the tubing or the casing and the drill pipe.

casing spider n: see spider.

casing slip n: see spider.

casing string n: the entire length of all the joints of casing run in a well.

casing shoe n: see guide shoe.

casing tongs n pl: large wrench used for turning when making up or breaking out casing. See tongs.

casing-tubing annulus n: in a wellbore, the space between the inside of the casing and the outside of the tubing.

catch samples v: to obtain cuttings for geological information as formations are penetrated by the bit. The samples are obtained from drilling fluid as it emerges from the wellbore or, in cable-tool drilling, from the bailer.

cathead n: a spool-shaped attachment on the end of the catshaft, around which rope for hoisting and moving heavy equipment on or near the rig floor is wound. See breakout cathead, makeup cathead.

cathead clutch n: see cathead.

cathead spool n: see cathead.

catline boom and hoist line n: a hoisting or pulling line powered by the cathead and used to lift heavy equipment on the rig. A structural framework erected near the top of the derrick for lifting material.

catwalk n: 1. the elevated work area adjacent to the vdoor and ramp on a drilling rig where pipe is laid to be lifted to the derrick floor by the catline or by an air hoist. See catline. 2. any elevated walkway.

cellar n: a pit in the ground to provide additional height between the rig floor and the well head to accommodate the installation of blowout preventers, ratholes, mouseholes, and so forth. It also may collect drainage water and other fluids for subsequent disposal.

cement n: a powder consisting of alumina, silica, lime, and other substances that hardens when mixed with water. Extensively used in the oil industry to bond casing to the walls of the wellbore.

cement bond n: the adherence of casing to cement and cement to formation. When casing is run in a well, it is set, or bonded, to the formation by means of cement.

cement bond survey n: an acoustic survey or sonic-logging method that records the quality or hardness of the cement used in the annulus to bond the casing and the formation. Casing that is well bonded to the formation transmits an acoustic signal quickly; poorly bonded casing transmits a signal slowly. See acoustic survey, acoustic well logging.

cement casing v: to fill the annulus between the casing and wall of the hole with cement to support the casing and prevent fluid migration between permeable zones.

cement hydration n: reaction with water that begins when water is added to powdered cement. The cement gradually sets to a solid.

cementing n: the application of a liquid slurry of cement and water to various points inside or outside the casing.

cementing company n: a company whose specialty is preparing, transporting, and pumping cement into a well.

cementing head n: an accessory attached to the top of the casing to facilitate cementing of the casing. It has passages for cement slurry and retainer chambers for cementing wiper plugs. Also called retainer head.

cementing materials n pl: a slurry of cement and water and sometimes one or more additives that affect either the density of the mixture or its setting time. The cement used may be high early strength, common (standard), or slow setting. Additives include accelerators (such as calcium chloride), retarders (such as gypsum), weighting materials (such as barium sulfate), lightweight additives (such as bentonite), or a variety of lost circulation materials.

cement plug n: 1. a portion of cement placed at some point in the wellbore to seal it. 2. a wiper plug. See cementing.

cementing pump n: a high-pressure pump used to force cement down the casing and into the annular space between the casing and the wall of the borehole.

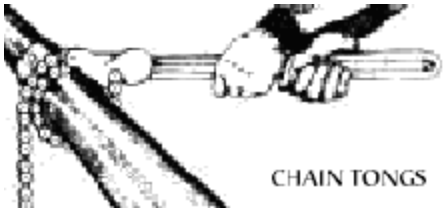
cementing time n: the total elapsed time needed to complete a cementing operation.

cement retainer n: a tool set temporarily in the casing or well to prevent the passage of cement, thereby forcing it to follow another designated path. It is used in squeeze cementing and other remedial cementing jobs.

centralizer n: see casing centralizer.

centrifugal pump n: a pump with an impeller or rotor, an impeller shaft, and a casing, which discharges fluid by centrifugal force. An electric submersible pump is a centrifugal pump.

chain tongs n pl: a hand tool used to tighten or loosen pipe, consisting of a handle and chain that resembles the chain on a bicycle.


CHAIN TONGS

change house n: a small building, or doghouse, in which members of a drilling rig or roustabout crew change clothes, store personal belongings, and so on.

channeling n: when casing is being cemented in a borehole, the cement slurry can fail to rise uniformly between the casing and the borehole wall, leaving spaces, or channels, devoid of cement. Ideally, the cement should completely and uniformly surround the casing and form a strong bond to the borehole wall. See cement channeling.

chemical cutoff n: a method of severing pipe in a well by applying high pressure jets of a very corrosive substance against the wall of the pipe. The resulting cut is very smooth.

chemical cutter n: a fishing tool that uses high-pressure jets of chemicals to sever casing, tubing, or drill pipe stuck in the hole.

chemical flooding n: a method of improved oil recovery in which chemicals dissolved in water are pumped into a reservoir through injection wells to mobilize oil left behind after primary or secondary recovery and to move it toward production wells.

choke n: a device with an orifice installed in a line to restrict the flow of fluids. Surface chokes are part of the Christmas tree on a well and contain a choke nipple, or bean, with a small-diameter bore that serves to restrict the flow. Chokes are also used to control the rate of flow of the drilling mud out of the hole when the well is closed in with the blowout preventer and a kick is being circulated out of the hole. See choke manifold.

choke line n: a line, or pipe, that runs from the blowout preventer stack to the choke manifold through which fluid from the hole is flowed when the well is shut in with the blowout preventer.

choke manifold n: the arrangement of piping and special valves, called chokes, through which drilling mud is circulated when the blowout preventers are closed to control the pressures encountered during a kick.

christmas tree n: the control valves, pressure gauges, and chokes assembled at the top of a well to control flow of oil and/or gas after the well has been drilled and completed. It is used when reservoir pressure is sufficient to cause reservoir fluids to rise to the surface.

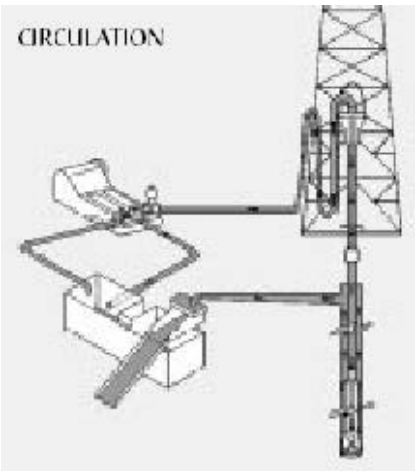
circulate v: to pass from one point throughout a system and back to the starting point. For example, drilling fluid is circulated out of the suction pit, down the drill pipe and drill collars, out the bit, up the annulus, and back to the pits while drilling proceeds.

circulating fluid n: see drilling fluid, mud.

circulating head n: an accessory attached to the top of the drill pipe or tubing to form a connection with the mud system to permit circulation of the drilling mud.

circulating pressure n: the pressure generated by the mud pumps and exerted on the drill stem.

circulation n: the movement of drilling fluid out of the mud pits, down the drill stem, up the annulus, and back to the mud pits. See normal circulation, reverse circulation.



circulation valve n: an accessory employed above a packer, to permit annulus-to-tubing circulation or vice versa.

clean out v: to remove sand, scale, and other deposits from the producing section of the well to restore or increase production.

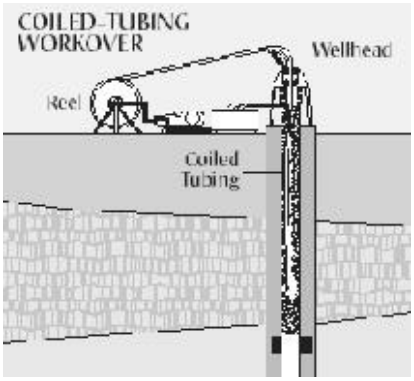
cleanout tools n pl: the tools or instruments, such as bailers and swabs, used to clean out an oilwell.

clutch n: a coupling used to connect and disconnect a driving and a driven part of a mechanism, especially a coupling that permits the former part to engage the latter gradually and without shock. In the oil field, a clutch permits gradual engaging and disengaging of the equipment driven by a prime mover. v: to engage or disengage a clutch.

coiled tubing n: a continuous string of flexible steel tubing, often hundreds or thousands of feet long, that is wound onto a reel, often dozens of feet in diameter. The reel is an integral part of the coiled tubing unit, which consists of several devices that ensure the tubing can be safely and efficiently inserted into the well from the surface. Also called reeled tubing.

coiled-tubing unit n: the equipment for transporting and using coiled tubing, including a reel for the coiled tubing, an injector head to push the tubing down the well, a wellhead blowout preventer stack, a power source (usually a diesel engine and hydraulic pumps), and a control console. A unique feature of the unit is that it allows continuous circulation while it is being lowered into the hole. A coiled tubing unit is usually mounted on a trailer or skid.

coiled-tubing workover n: a workover performed with a continuous steel tube, normally 0.75 inch to 1 inch (1.9 to 2.54 centimeters) outside diameter, which is run into the well in one piece inside the normal tubing. Lengths of the tubing up to 16,000 feet (4,877 meters) are stored on the surface on a reel in a manner similar to that used for wireline. The unit is rigged up over the wellhead. The tubing is injected through a control head that seals off the tubing and makes a pressure-tight connection.



collar n: 1. a coupling device used to join two lengths of pipe, such as casing or tubing. A combination collar has left-hand threads in one end and right-hand threads in the other. 2. a drill collar.

collar locator n: a logging device used to determine accurately the depth of a well; the log measures and records the depth of each casing collar, or coupling, in a well.

collar locator log n: see collar locator.

come out of the hole v: to pull the drill stem out of the wellbore to change the bit, to change from a core barrel to the bit, to run electric logs, to prepare for a drill stem test, to run casing, and so on. Also called trip out, tripping out (TOH).

company hand n: see company representative.

company man n: see company representative.

company representative n: an employee of an operating company who supervises the operations at a drilling site or well site and who may coordinate the hiring of logging, testing, service, and workover companies. Also called company hand, operator's representative, or company man.

complete a well v: to finish work on a well and bring it to productive status. See well completion.

completion fluid n: low-solids fluid or drilling mud used when a well is being completed. It is selected not only for its ability to control formation pressure, but also for the properties that minimize formation damage.

compound n: 1. a mechanism used to transmit power from the engines to the pump, the drawworks, and other machinery on a drilling rig. It is composed of clutches, chains and sprockets, belts and pulleys, and a number of shafts, both driven and driving. v: to connect two or more power producing devices, such as engines, to run driven equipment, such as the drawworks.

compression-ignition engine n: a diesel engine; an engine in which the fuel/air mixture inside the engine cylinders is ignited by the heat that occurs when the fuel-air mixture is highly compressed by the engine pistons.

compressor n: a device that raises the pressure of a compressible fluid such as air or gas. Compressors create a pressure differential to move or compress a vapor or a gas.

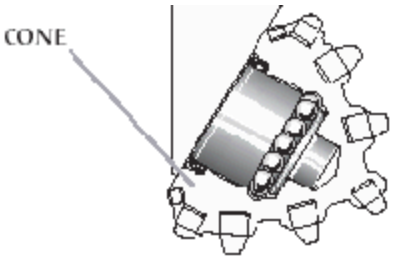
conductivity n: 1. the ability to transmit or convey (as heat or electricity). 2. an electrical logging measurement obtained from an induction survey, in which eddy currents produced by an alternating magnetic field induce in a receiver coil a voltage proportionate to the ability of the formation to conduct electricity. See induction log.

conductor casing n: generally, the first string of casing in a well. It may be lowered into a hole drilled into the formations near the surface and cemented in place; it may be driven into the ground by a special pile driver (in such cases, it is sometimes called drive pipe). Its purpose is to prevent the soft formations near the surface from caving in and to conduct drilling mud from the bottom of the hole to the surface when drilling starts. Also called conductor pipe, drive pipe.

conductor hole n: the hole where the crew starts the top of the well.

conductor pipe n: the largest diameter casing and the topmost length of casing. It is relatively short and encases the topmost string of casing.

cone n: a conical-shaped metal device into which cutting teeth are formed or mounted on a roller cone bit.



connection n: 1. a section of pipe or fitting used to join pipe to pipe or to a vessel. 2. a place in electrical circuits where wires join. 3. the action of adding a joint of pipe to the drill stem as drilling progresses.

consultant n: a person who contracts with an oil company to supervise the operations at a drilling site or well site who may coordinate the hiring of logging, testing, service, and workover companies.

contract n: a written agreement that can be enforced by law and that lists the terms under which the

acts required are to be performed. A drilling contract may cover such factors as the cost of drilling the well (whether by the foot or by the day), the distribution of expenses between operator and contractor, and the type of equipment to be used.

core n: a cylindrical sample taken from a formation for geological analysis.

core analysis n: laboratory analysis of a core sample that may determine porosity, permeability, lithology, fluid content, angle of dip, geological age, and probable productivity of the formation.

core barrel n: a tubular device, usually from 10 to 60 feet (3 to 18 meters) long, run in place of a bit and used to cut a core sample.

core sample n: 1. a small portion of a formation obtained by using a core barrel and core bit in an existing wellbore. See core bit. 2. a spot sample of the contents of an oil or oil product storage tank usually obtained with a thief, or core sampler, at a given height in the tank.

coring n: the process of cutting a vertical, cylindrical sample of the formations encountered as a well is drilled.

coring bit n: a bit that does not drill out the center portion of the hole, but allows this center portion (the core) to pass through the round opening in the center of the bit and into the core barrel.

corrosion n: any of a variety of complex chemical or electrochemical processes, such as rust, by which metal is destroyed through reaction with its environment.

corrosion inhibitor n: a chemical substance that minimizes or prevents corrosion in metal equipment.

counterbalance weight n: a weight applied to compensate for existing weight or force. On pumping units in oil production, counterweights are used to offset the weight of the column of sucker rods and fluid on the upstroke of the pump, and the weight of the rods on the downstroke.

coupling n: 1. in piping, a metal collar with internal threads used to join two sections of threaded pipe. 2. in power transmission, a connection extending between a driving shaft and a driven shaft.

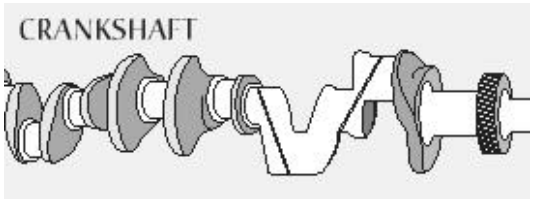
crane n: a machine for raising, lowering, and revolving heavy pieces of equipment.

crane operator n: a person who by training and experience is authorized to operate the crane and who may be in charge of the roustabout crew.

crank n: an arm keyed at right angles to a shaft and used for changing radius of rotation or changing reciprocating motion to circular motion or circular motion to reciprocating motion. On a beam pumping unit, the crank is connected by the pitman to the walking beam, thereby changing circular motion to reciprocating motion.

crank arm n: a steel member connected to each end of the shaft extending from each side of the speed reducer on a beam pumping unit.

crankshaft n: a rotating shaft to which connecting rods are attached. It changes up and down (reciprocating) motion to circular (rotary) motion.



crew n: 1. the workers on a drilling or workover rig, including the driller, the derrickhand, and the rotary helpers. 2. any group of oilfield service workers.

crooked hole n: a wellbore that has been drilled in a direction other than vertical.

crossover sub n: a sub that allows different sizes and types of drill pipe or other components to be joined.

crown n: 1. the crown block or top of a derrick or mast. 2. the top of a piston. 3. a high spot formed on a tool joint shoulder as the result of wobble.

crown block and water table n: an assembly of sheaves or pulleys mounted on

beams at the top of the derrick. The drilling line is run over the sheaves down to the hoisting drum.

crown saver n: a device mounted near the drawworks drum to keep the driller from inadvertently raising the traveling block into the crown block. A probe senses when too much line has been pulled onto the drum, indicating that the traveling block may strike the crown. The probe activates a switch that simultaneously disconnects the drawworks from its power source and engages the drawworks brake.

crude oil n: unrefined liquid petroleum. It ranges in gravity from 9°API to 55°API and in color from yellow to black.

cutout n: an area of deck grating removed to clear an obstruction or to permit pipes, ducts, columns, and the like to pass through the grating.

cuttings n pl: the fragments of rock dislodged by the bit and brought to the surface in the drilling mud. Washed and dried cuttings samples are analyzed by geologists to obtain information about the formations drilled.

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D

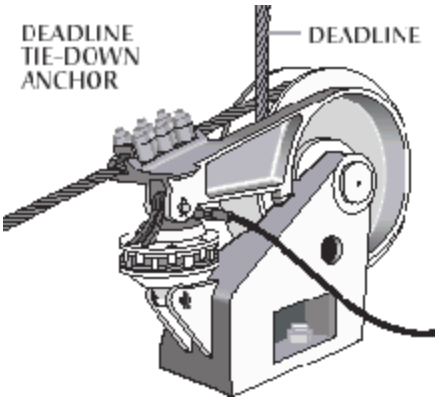
daily drilling report n: a record made each day of the operations on a working drilling rig and, traditionally, phoned, faxed, emailed, or radioed in to the office of the drilling company and possibly the operator every morning.

dampener n: an air or inert gas device that minimizes pressure surges in the output line of a mud pump. Sometimes called a surge dampener.

daylight tour (pronounced "tower") n: in areas where three eight-hour tours are worked, the shift of duty on a drilling rig that starts at or about daylight. Compare evening tour, morning (graveyard) tour.

day tour (pronounced "tower") n: in areas where two 12-hour tours are worked, a period of 12 hours, usually during daylight, worked by a drilling or workover crew when equipment is being run around the clock.

deadline n: the drilling line from the crown block sheave to the anchor, so called because it does not move. Compare fast line.



deadline anchor n: see deadline tie-down anchor.

deadline sheave n: the sheave on the crown block over which the deadline is reeved.

deadline tie-down anchor n: a device to which the deadline is attached, securely fastened to the mast or derrick substructure. Also called a deadline anchor.

deck n: (nautical) floor.

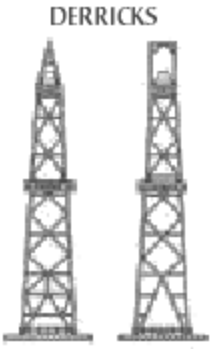
degasser n: the equipment used to remove unwanted gas from a liquid, especially from drilling fluid.

density n: the mass or weight of a substance per unit volume. For instance, the density of a drilling mud may be 10 pounds per gallon, 74.8 pounds/cubic foot, or 1,198.2 kilograms/cubic meter. Specific gravity, relative density, and API gravity are other units of density.

density log n: a special radioactivity log for open-hole surveying that responds to variations in the specific gravity of formations. It is a contact log (i.e., the logging tool is held against the wall of the hole). It emits neutrons and then measures the secondary gamma radiation that is scattered back to the detector in the instrument. The density log is an excellent porosity-measure device, especially for shaley

sands. Some trade names are Formation Density Log, Gamma-Gamma Density Log, and Densilog.

derrick n: a large load-bearing structure, usually of bolted construction. In drilling, the standard derrick has four legs standing at the corners of the substructure and reaching to the crown block. The substructure is an assembly of heavy beams used to elevate the derrick and provide space to install blowout preventers, casingheads, and so forth.



derrick floor n: also called the rig floor.

derrickhand n: the crew member who handles the upper end of the drill string as it is being hoisted out of or lowered into the hole. On a drilling rig, he or she may be responsible for the circulating machinery and the conditioning of the drilling or workover fluid.

derrickman n: see derrickhand.

desander n: a centrifugal device for removing sand from drilling fluid to prevent abrasion of the pumps. It may be operated mechanically or by a fast-moving stream of fluid inside a special cone-shaped vessel, in which case it is sometimes called a hydrocyclone.

desilter n: a centrifugal device, similar to a desander, used to remove very fine particles, or silt, from drilling fluid to lower the amount of solids in the fluid.

diamond bit n: a drill bit that has small industrial diamonds embedded in its cutting surface.

dies n: a tool used to shape, form, or finish other tools or pieces of metal. For example, a threading die is used to cut threads on pipe.

die insert n: a removable, hard-steel, serrated piece that fits into the jaws of the tongs and firmly grips the body of the drill pipe, drill collars, or casing while the tongs are making up or breaking out the pipe.

diesel-electric power n: the power supplied to a drilling rig by diesel engines driving electric generators.

diesel engine n: a high-compression, internal-combustion engine used extensively for powering drilling rigs. In a diesel engine, air is drawn into the cylinders and compressed to very high pressures; ignition occurs as fuel is injected into the compressed and heated air. Combustion takes place within the cylinder above the piston, and expansion of the combustion products imparts power to the piston.

diesel fuel n: a light hydrocarbon mixture for diesel engines; it has a boiling range just above that of kerosene.

dipmeter log n: see dipmeter survey.

dipmeter survey n: an oilwell-surveying method that determines the direction and angle of formation dip in relation to the borehole. It records data that permit computation of both the amount and direction of formation dip relative to the axis of the hole and thus provides information about the geologic structure of the formation. Also called dipmeter log or dip log.

directional drilling n: 1. intentional deviation of a wellbore from the vertical. Although wellbores are normally drilled vertically, it is sometimes necessary or advantageous to drill at an angle from the vertical. Controlled directional drilling makes it possible to reach subsurface areas laterally remote from the point where the bit enters the earth.

directional hole n: a wellbore intentionally drilled at an angle from the vertical. See directional drilling.

displacement fluid n: in well cementing, the fluid, usually drilling mud or salt water, that is pumped into the well after the cement is pumped into it to force the cement out of the casing and into the annulus.

dissolved gas n: natural gas that is in solution with crude oil in the reservoir.

dissolved-gas drive n: a source of natural reservoir energy in which the dissolved gas coming out of the oil expands to force the oil into the wellbore. Also called solution-gas drive. See reservoir drive mechanism.

doghouse n: a small enclosure on the rig floor used as an office and/or as a storehouse for small objects. Also, any small building used as an office or for storage.

dogleg n: 1. an abrupt change in direction in the wellbore, frequently resulting in the formation of a keyseat. 2. a sharp bend permanently put in an object such as a pipe, wire rope, or a wire rope sling.

double n: a length of drill pipe, casing, or tubing consisting of two joints screwed together.

downhole adj, adv: pertaining to the wellbore.

downhole motor n: a drilling tool made up in the drill string directly above the bit. It causes the bit to turn while the drill string remains fixed. It is used most often as a deflection tool in directional drilling, where it is made up between the bit and a bent sub (or, sometimes, the housing of the motor itself is bent). Two principal types of downhole motor are the positive-displacement motor and the downhole turbine motor.

drawworks n: the hoisting mechanism on a drilling rig. It is essentially a large winch that spools off or takes in the drilling line and thus lowers or raises the drill stem and bit.

drawworks brake n: the mechanical brake on the drawworks that can slow or prevent the drawworks drum from moving.

drawworks drum n: the spool-shaped cylinder in the drawworks around which drilling line is wound or spooled.

drill v: to bore a hole in the earth, usually to find and remove subsurface formation fluids such as oil and gas.

drillable adj: pertaining to packers and other tools left in the wellbore to be broken up later by the drill bit. Drillable equipment is made of cast iron, aluminum, plastic, or other soft, brittle material.

drillable packer n: a permanent packer that can only be removed by drilling it out.

drill ahead v: to continue drilling operations.

drill bit n: the cutting or boring element used in drilling oil and gas wells. Most bits used in rotary drilling are roller-cone bits. The bit consists of the cutting elements and the circulating element. The circulating element permits the passage of drilling fluid and utilizes the hydraulic force of the fluid stream to improve drilling rates.

drill collars n: a heavy, thick-walled tube, usually steel, used between the drill pipe and the bit in the drill stem, used to stiffen the drilling assembly an put weight on the bit so that the bit can drill.

drill collar sub n: a sub made up between the drill string and the drill collars that is used to ensure that the drill pipe and the collar can be joined properly.

driller n: the employee normally in charge of a specific (tour) drilling or workover crew. The driller's main duty is operation of the drilling and hoisting equipment, but this person may also be responsible for downhole condition of the well, operation of downhole tools, and pipe measurements.

driller's position n: the area immediately surrounding the driller's console.

drill floor n: also called rig floor or derrick floor. See rig floor.

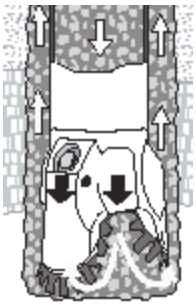
drill in v: to penetrate the productive formation after the casing is set and cemented on top of the pay zone.

drilling contract n: an agreement made between a drilling company and an operating company to drill a well. It generally sets forth the obligation of each party, compensation, identification, method of drilling, depth to be drilled, and so on.

drilling crew n: a driller, a derrickhand, and two or more helpers who operate a drilling or workover rig for one tour each day.

drilling engine n: an internal-combustion engine used to power a drilling rig. These engines are used on a rotary rig and are usually fueled by diesel fuel, although liquefied petroleum gas, natural gas, and, very rarely, gasoline can also be used.

drilling engineer n: an engineer who specializes in the technical aspects of drilling.


DRILLING FLUID

drilling fluid n: circulating fluid, one function of which is to lift cuttings out of the wellbore and to the surface. It also serves to cool the bit and to counteract downhole formation pressure.

drilling hook n: the large hook mounted on the bottom of the traveling block and from which the swivel is suspended.

drilling mud n: a specially compounded liquid circulated through the wellbore during rotary drilling operations. See drilling fluid, mud.

drill pipe n: the heavy seamless tubing used to rotate the bit and circulate the drilling fluid. Joints of pipe are generally approximately 30 feet long are coupled together by means of tool joints.

drill stem n: all members in the assembly used for rotary drilling from the swivel to the bit, including the kelly, the drill pipe and tool joints, the drill collars, the stabilizers, and various specialty items. Compare drill string.

drill stem test (DST) n: a method of formation testing. The basic drill stem test tool consists of a packer or packers, valves or ports that may be opened and closed from the surface, and two or more pressure-recording devices. The tool is lowered on the drill string to the zone to be tested. The packer or packers are set to isolate the zone from the drilling fluid column.

driller's console n: the control panel, where the driller controls drilling operations.

drilling line n: a wire rope hoisting line, reeved on sheaves of the crown block and traveling block (in effect a block and tackle), the primary purpose of which is to hoist or lower drill pipe or casing from or into a well.

drilling out n: the operation during the drilling procedure when the cement is drilled out of the casing.

drill string n: the column, or string, of drill pipe with attached tool joints that transmits fluid and rotational power from the kelly to the drill collars and the bit. Often, the term is loosely applied to include both drill pipe and drill collars.

drive bushing n: see kelly bushing.

drive chain n: a chain by means of which a machine is propelled.

drive-in unit n: a type of portable service or workover rig that is self-propelled, using power from the hoisting engines. The driver's cab and steering wheel are mounted on the same end as the mast support; thus the unit can be driven straight ahead to reach the wellhead.

drive pipe n: see conductor casing.

drum (rope) n: a rotating cylinder with side flanges on which wire or other rope used in machine

operation is wrapped.

dry hole n: any well that does not produce oil or gas in commercial quantities. A dry hole may flow water, gas, or even oil, but not in amounts large enough to justify production.

dual completion n: a single well that produces from two separate formations at the same time. Production from each zone is segregated by running two tubing strings with packers inside the single string of production casing, or by running one tubing string with a packer through one zone while the other is produced through the annulus. In a miniaturized dual completion, two separate casing strings are run and cemented in the same wellbore.

dump bailer n: a bailing device with a release valve, usually of the disk or flapper type, used to place, or spot, material (such as cement slurry) at the bottom of the well.

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electric cable tray n: supports the electrical cables that feed the power from the control panel to the rig motors.

electric control house n: On diesel electric rigs, diesel engines drive electric generators. The generators produce electricity that flow throw cables to electric switches and control equipment enclosed in a control cabinet or panel. Electricity is fed to electric motors via the panel.

electric log n: see electric well log.

electric rig n: a drilling rig on which the energy from the power source—usually diesel engines—is changed to electricity by generators mounted on the engines. The electrical power is then distributed through electrical conductors to electric motors. The motors power the various rig components. Compare mechanical rig.

electric submersible pumping n: a form of artificial lift that utilizes an electric submersible multistage centrifugal pump. Electric power is conducted to the pump by a cable attached to the tubing.

electric survey n: see electric well log.

electric well log n: a record of certain electrical characteristics (such as resistivity and conductivity) of formations traversed by the borehole. It is made to identify the formations, determine the nature and amount of fluids they contain, and estimate their depth. Also called an electric log or electric survey.

elevator links n pl: cylindrical bars that support the elevators and attach them to the hook.

elevators n pl: on rotary rigs and top drive rigs, hinged steel devices with manual operating handles that crew members latch onto a tool joint (or a sub).

engine n: a machine for converting the heat content of fuel into rotary motion that can be used to power other machines. Compare motor.

erosion n: the process by which material (such as rock or soil) is worn away or removed (as by wind or water).

evening tour (pronounced "tower") n: the shift of duty on a drilling rig that generally starts in the afternoon and runs through the evening. Sometimes called afternoon tour. Compare daylight tour.

external cutter n: a fishing tool containing metalcutting knives that is lowered into the hole and over

the outside of a length of pipe to cut it. The severed part of the pipe can then be brought to the surface. Also called an outside cutter. Compare internal cutter.

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fastline n: the end of the drilling line that is affixed to the drum or reel of the drawworks, so called because it travels with greater velocity than any other portion of the line. Compare deadline.

fingerboard n: a rack that supports the stands of pipe being stacked in the derrick or mast. It has several steel fingerlike projections that form a series of slots into which the derrickman can place a stand of drill pipe or collars after it is pulled out of the hole and removed from the drill string.

fire flooding n: a thermal recovery method in which the oil in the reservoir is ignited, the heat vaporizes lighter hydrocarbons and water pushes the warmed oil toward a producing well. Also called in situ combustion. See thermal recovery.

fish n: an object that is left in the wellbore during drilling or workover operations and that must be recovered before work can proceed. It can be anything from a piece of scrap metal to a part of the drill stem.

fishing n: the procedure of recovering lost or stuck equipment in the wellbore.

fishing magnet n: a powerful magnet designed to recover metallic objects lost in a well.

fishing tool n: a tool designed to recover equipment lost in a well.

fishing-tool operator n: the person (usually a service company employee) in charge of directing fishing operations.

fitting n: a small, often standardized, part (such as a coupling, valve, or gauge) installed in a larger apparatus.

float collar n: a special coupling device inserted one or two joints above the bottom of the casing string that contains a check valve to permit fluid to pass downward but not upward through the casing. The float collar prevents drilling mud from entering the casing while it is being lowered, allowing the casing to float during its descent and thus decreasing the load on the derrick or mast.

float shoe n: a short, heavy, cylindrical steel section with a rounded bottom that is attached to the bottom of the casing string. It contains a check valve and functions similarly to the float collar but also serves as a guide shoe for the casing.

flood v: 1. to drive oil from a reservoir into a well by injecting water under pressure into the reservoir formation. See waterflooding. 2. to drown out a well with water.

flow n: a current or stream of fluid or gas.

floor crew n: those workers on a drilling or workover rig who work primarily on the rig floor. See rotary helper.

floorhand n: see rotary helper.

floorman n: see rotary helper.

flowing well n: a well that produces oil or gas by its own reservoir pressure rather than by use of artificial means (such as pumps).

flow line n: the surface pipe through which oil or gas travels from a well to processing equipment or to storage.

flow rate n: the speed, or velocity, of fluid or gas flow through a pipe or vessel.

fluid injection n: injection of gases or liquids into a reservoir to force oil toward and into producing wells.

fluid loss n: the unwanted migration of the liquid part of the drilling mud or cement slurry into a formation, often minimized or prevented by the blending of additives with the mud or cement.

formation fluid n: fluid (such as gas, oil, or water) that exists in a subsurface formation.

formation gas n: gas initially produced from an underground reservoir.

formation pressure n: the force exerted by fluids or gas in a formation, recorded in the hole at the level of the formation with the well shut in. Also called reservoir pressure or shut-in bottomhole pressure.

formation testing n: the gathering of pressure data and fluid samples from a formation to determine its production potential before choosing a completion method.

formation water n: 1. the water originally in place in a formation. 2. any water that resides in the pore spaces of a formation.

frac fluid n: a fluid used in the fracturing process (for example, a method of stimulating production by opening new flow channels in the formation surrounding a production well). Under extremely high hydraulic pressure, frac fluids (such as distillate, diesel fuel, crude oil, dilute hydrochloric acid, water, or kerosene) are pumped downward through production tubing or drill pipe and forced out below a packer or between two packers. The pressure causes cracks to open in the formation, and the fluid penetrates the formation through the cracks. Sand grains, aluminum pellets, walnut shells, or similar materials (propping agents) are carried in suspension by the fluid into the cracks. When the pressure is released at the surface, the fracturing fluid returns to the well but leaves behind the propping agents to hold open the formation cracks.

frac job n: see fracturing.

fuel tanks n pl: fuel storage tanks for the power generating system.

fracture n: a crack or crevice in a formation, either natural or induced. See hydraulic fracturing.

fracture acidizing n: a procedure by which acid is forced into a formation under pressure high enough to cause the formation to crack. The acid acts on certain kinds of formations, usually carbonates, to increase the permeability of the formation. Also called acid fracturing.

fracture pressure n: the pressure at which a formation will break down, or fracture.

fracturing n: shortened form of formation fracturing. See formation fracturing.

fracturing fluid n: a fluid, such as water, oil, or acid, used in hydraulic fracturing. The fluid carries propping agents that hold open the formation cracks after hydraulic pressure dissipates. See acid fracturing, hydraulic fracturing, propping agents.

free-point indicator n: a device run on wireline into the wellbore and inside the fishing string and fish to locate the area where a fish is stuck. When the drill string is pulled and turned, the electromagnetic fields of free pipe and stuck pipe differ. The free-point indicator is able to distinguish these differences, which are registered on a metering device at the surface.

friction n: resistance to movement created when two surfaces are in contact. When friction is present, movement between the surfaces produces heat.

full-gauge bit n: a bit that has maintained its original diameter.

full-gauge hole n: a wellbore drilled with a full-gauge bit. Also called a true-to-gauge hole.

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gamma ray log n: a type of radioactivity well log that records natural radioactivity around the wellbore. Shales generally produce higher levels of gamma radiation and can be detected and studied with the gamma ray tool. See radioactivity well logging.

gas anchor n: a tubular, perforated device attached to the bottom of a suckerrod pump that helps to prevent gas lock. The device works on the principle that gas, being lighter than oil, rises. As well fluids enter the anchor, gas breaks out of the fluid and exits from the anchor through perforations near the top. Remaining fluids enter the pump through a mosquito bill (a tube within the anchor), which has an opening near the bottom. In this way, all or most of the gas escapes before the fluids enter the pump.

gas cap n: a free-gas phase overlying an oil zone and occurring within the same producing formation as the oil. See reservoir.

gas-cap drive n: drive energy supplied naturally (as a reservoir is produced) by the expansion of the gas cap. In such a drive, the gas cap expands to force oil into the well and to the surface. See reservoir drive mechanism.

gas-cut mud n: a drilling mud that contains entrained formation gas, giving the mud a characteristically fluffy texture. Gas cut mud may cause a lowering of mud weight.

gas drive n: the use of the energy that arises from the expansion of compressed gas in a reservoir to move crude oil to a wellbore. Also called depletion drive. See dissolved-gas drive, gas-cap drive, reservoir drive mechanism.

gas injection n: the injection of gas into a reservoir to maintain formation pressure by gas drive and to reduce the rate of decline of the original reservoir drive. One type of gas injection uses gas that does not mix (is not miscible) with the oil. Examples of these gases include natural gas, nitrogen, and flue gas. Another type uses gas that does mix (is miscible) with the oil. The gas may be naturally miscible or become miscible under high pressure. Examples of miscible gases include propane, methane enriched with other light hydrocarbons, methane under high pressure, and carbon dioxide under pressure. Frequently, water is also injected in alternating steps with the gas.

gas injection well n: a well into which gas is injected for the purpose of maintaining or supplementing pressure in an oil reservoir.

gasket n: any material (such as paper, cork, asbestos, stainless steel or other types of metal, or rubber) used to seal two essentially stationary surfaces.

gas lift n: the process of raising or lifting fluid from a well by injecting gas down the well through tubing or through the tubing-casing annulus. Injected gas aerates the fluid to make it exert less pressure than

the formation does; the resulting higher formation pressure forces the fluid out of the wellbore. Gas may be injected continuously or intermittently, depending on the producing characteristics of the well and the arrangement of the gas-lift equipment.

gas-lift mandrel n: a device installed in the tubing string of a gas-lift well onto which or into which a gas-lift valve is fitted. There are two common types of mandrel. In the conventional gas-lift mandrel, the gas-lift valve is installed as the tubing is placed in the well. Thus, to replace or repair the valve, the tubing string must be pulled. In the sidepocket mandrel, however, the valve is installed and removed by wireline while the mandrel is still in the well, eliminating the need to pull the tubing to repair or replace the valve.

gas-lift valve n: a device installed on a gas-lift mandrel, which in turn is put on the tubing string of a gas-lift well. Tubing and casing pressures cause the valve to open and close, thus allowing gas to be injected into the fluid in the tubing to cause the fluid to rise to the surface. See gas-lift mandrel.

gas-lift well n: a well in which reservoir fluids are artificially lifted by the injection of gas.

gas lock n: 1. a condition sometimes encountered in a pumping well when dissolved gas, released from solution during the upstroke of the plunger, appears as free gas between the valves. If the gas pressure is sufficient, the standing valve is locked shut, and no fluid enters the tubing. 2. a device fitted to the gauging hatch on a pressure tank that enables manual dipping and sampling without loss of vapor. 3. a condition that can occur when gas-cut mud is circulated by the mud pump. The gas breaks out of the mud, expands, and works against the operation of the piston and valves.

gas well n: a well that primarily produces gas. Legal definitions vary among the states.

gear reducer n: see speed reducer.

gel n: a semisolid, jellylike state assumed by some colloidal dispersions at rest.

geologist n: a scientist who gathers and interprets data pertaining to the formations of the earth's crust.

Geronimo n: see safety slide.

go in the hole v: to lower the drill stem, the tubing, the casing, or the sucker rods into the wellbore.

gone to water adj: pertaining to a well in which production of oil has decreased and production of water has increased (for example, "the well has gone to water").

gooseneck n: the curved connection between the rotary hose and the swivel. See swivel.

gravel n: sand or glass beads of uniform size and roundness used in gravel packing.

gravel packing n: a method of well completion in which a slotted or perforated liner, often wire-wrapped, is placed in the well and surrounded by gravel. If open hole, the well is sometimes enlarged by underreaming at the point where the gravel is packed. The mass of gravel excludes sand from the wellbore but allows continued production.

guide shoe n: 1. a short, heavy, cylindrical section of steel filled with concrete and rounded at the bottom, which is placed at the end of the casing string. It prevents the casing from snagging on irregularities in the borehole as it is lowered.

guy line anchor n: a buried weight or anchor to which a guy line is attached.

guy wire n: a rope or cable used to steady a mast or pole.

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hang rods v: to suspend sucker rods in a derrick or mast on rod hangers rather than to place them horizontally on a rack.

hard hat n: a hard helmet worn by oilfield workers to minimize the danger of being injured by falling objects.

headache n: (slang) the position in which the mast on a mobile rig is resting horizontally over the driver's cab.

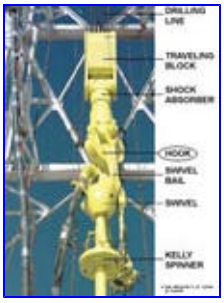
hex kelly n: see kelly.

hoist n: 1. an arrangement of pulleys and wire rope used for lifting heavy objects; a winch or similar device. 2. the drawworks. v: to raise or lift.

hoisting components n pl: drawworks, drilling line, and traveling and crown blocks. Auxiliary hoisting components include catheads, catshaft, and air hoist.

hoisting drum n: the large, flanged spool in the drawworks on which the hoisting cable is wound. See drawworks.

hoisting line n: a wire rope used in hoisting operations.



Hook n: a large, hook-shaped device from which the elevator bails or the swivel is suspended. It turns on bearings in its supporting housing.

hoisting system n: the system on the rig that performs all the lifting on the rig, primarily the lifting and lowering of drill pipe out of and into the hole. It is composed of drilling line, traveling block, crown block, and drawworks. See also hoisting components.

hook load n: the weight of the drill stem and associated components that are suspended from the hook.

hopper n: a large funnel- or cone-shaped device into which dry components (such as powdered clay or cement) can be poured to later mix with water or other liquids. The dry component is educted through a nozzle at the bottom of the hopper.

horsehead n: the generally horsehead-shaped steel piece at the front of the beam of a pumping unit to which the bridle is attached in sucker rod pumping.

horsepower n: a unit of measure of work done by a machine.

horizontal drilling n: deviation of the borehole from vertical so that the borehole penetrates a productive formation in a manner parallel to the formation.

hydraulic adj: 1. of or relating to water or other liquid in motion. 2. operated, moved, or effected by water or liquid.

hydraulic fluid n: a liquid of low viscosity (such as light oil) that is used in systems actuated by liquid (such as the brake system in a car).

hydraulic force n: force resulting from pressure on water or other hydraulic fluid.

hydraulic fracturing n: an operation in which a specially blended liquid is pumped down a well and into a formation under pressure high enough to cause the formation to crack open, forming passages through which oil can flow into the wellbore.

hydraulic jar n: a type of mechanical jar in which a fluid moving through a small opening slows the piston stroke while the crew stretches the work string. After the hydraulic delay, a release mechanism in the jar trips to allow a mandrel to spring up and deliver a sharp blow. Compare mechanical jar.

hydraulic pumping n: a method of pumping oil from wells by using a downhole pump without sucker rods. Subsurface hydraulic pumps consist of two reciprocating pumps coupled and placed in the well. One pump functions as an engine and drives the other pump (the production pump). The downhole engine is usually operated by clean crude oil under under pressure (power oil) that is drawn from a power-oil settling tank by a triplex plunger pump on the surface. If a single string of tubing is used, power oil is pumped down the tubing string to the pump, which is seated in the string, and a mixture of power oil and produced fluid is returned through the casing-tubing annulus. If two parallel strings are used, one supplies power oil to the pump while the other returns the exhaust and produced oil to the surface. A hydraulic pump may be used to pump several wells from a central source.

hydrocarbons n pl: organic compounds of hydrogen and carbon whose densities, boiling points, and freezing points increase as their molecular weights increase. Although composed of only two elements, hydrocarbons exist in a variety of compounds, because of the strong affinity of the carbon atom for other atoms and for itself. The smallest molecules of hydrocarbons are gaseous; the largest are solids. Petroleum is a mixture of many different hydrocarbons.

hydrogen sulfide cracking n: a type of corrosion that occurs when metals are exposed to hydrogen sulfide gas; it is characterized by minute cracks that form just under the metal's surface.

hydrostatic pressure n: the force exerted by a body of fluid at rest. It increases directly with the density and the depth of the fluid and is expressed in many different units, including pounds per square inch or kilopascals.

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I

IADC abbr: International Association of Drilling Contractors.

impeller n: a set of mounted blades used to impart motion to a fluid air or gas (such as, the rotor of a centrifugal pump).

impermeable adj: preventing the passage of fluid. A formation may be porous yet impermeable if there is an absence of connecting passages between the voids within it. See permeability.

impression block n: a block with lead or another relatively soft material on its bottom. It is made up on drill pipe or tubing at the surface, run into a well, and set down on the object that has been lost in the well. The block is retrieved and the impression is examined. The impression is a mirror image of the top of the fish; it also indicates the fish's position in the hole, for example, whether it is centered or off to one side. From this information, the correct fishing tool may be selected.

induction log n: an electric well log in which the conductivity of the formation rather than the resistivity is measured. Because oil-bearing formations are less conductive of electricity than water-bearing formations, an induction survey, when compared with resistivity readings, can aid in determination of oil and water zones.

inflatable packer n: a packer with an element that inflates by means of gas or liquid pumped from the surface through a line. It is deflated by means of slots that can be opened to allow the gas or liquid to flow out. They are used when a temporary packer is needed in a hole.

injection gas n: 1. a high-pressure gas injected into a formation to maintain or restore reservoir pressure. 2. gas injected in gas-lift operations.

injection log n: a survey used to determine the injection profile, that is, to assign specific volumes or percentages to each of the formations taking fluid in an injection well. The injection log is also used to check for casing or packer leaks, proper cement jobs, and fluid migration between zones.

injection water n: water that is introduced into a reservoir to help drive hydrocarbons to a producing well.

injection well n: a well through which fluids are injected into an underground stratum to increase reservoir pressure and to displace oil. Also called input well.

injector head n: a control head for injecting coiled tubing into a well that seals off the tubing and makes a pressure tight connection.

inland barge rig n: an off shore drilling structure consisting of a barge on which the drilling equipment

is constructed. It is positioned on location, then the barge is sunk.

insert n: 1. a cylindrical object, rounded, blunt, or chisel-shaped on one end and usually made of tungsten carbide, that is inserted in the cones of a bit, the cutters of a reamer, or the blades of a stabilizer to form the cutting element of the bit or the reamer or the wear surface of the stabilizer. Also called a compact.

insert pump n: a sucker rod pump that is run into the well as a complete unit.

intake valve n: 1. the mechanism on an engine through which air and sometimes fuel are admitted to the cylinder. 2. on a mud pump, the valve that opens to allow mud to be drawn into the pump by the pistons moving in the liners.

intermediate casing string n: the string of casing set in a well after the surface casing but before production casing is set to keep the hole from caving and to seal off formations. In deep wells, one or more intermediate strings may be required.

internal cutter n: a fishing tool containing metal-cutting knives that is lowered into the inside of a length of pipe stuck in the hole to cut the pipe. The severed portion of the pipe can then be returned to the surface. Compare external cutter.

International Association of Drilling Contractors (IADC) n: an organization of drilling contractors, oil and gas companies, and service companies that sponsors or conducts research on education, accident prevention, drilling technology, and other matters of interest to its membership and their employees. Its official publication is The Drilling Contractor. Address: Box 4287; Houston, TX 77210; (281) 578- 7171; fax (281) 578-0589.

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jar n: a percussion tool operated manually or hydraulically to deliver a heavy upward or downward blow to fish stuck in the borehole. v: to apply a heavy blow to the drill stem by use of a jar or bumper sub.

jar accelerator n: a hydraulic tool used in conjunction with a jar and made up on the fishing string above the jar to increase the power of the jarring force.

jerk line n: a wire rope, one end of which is connected to the end of the tongs and the other end of which is attached to the cathead.

jet n: 1. a hydraulic device operated by a centrifugal pump used to clean the mud pits, or tanks, and to mix mud components. 2. in a perforating gun using shaped charges, a highly penetrating, fast-moving stream of exploded particles that forms a hole in the casing, cement, and formation.

jet cutoff n: a procedure for severing pipe stuck in a well by detonating special shaped-charge explosives similar to those used in jet perforating. The explosive is lowered into the pipe to the desired depth and detonated. The force of the explosion makes radiating horizontal cuts around the pipe, and the severed portion of the pipe is retrieved.

jet cutter n: a fishing tool that uses shaped charges to sever casing, tubing, or drill pipe stuck in the hole. See jet cutoff. Compare chemical cutter.

jet gun n: an assembly, including a carrier and shaped charges, that is used in jet perforating.

jet-perforate v: to create holes through the casing with a shaped charge of high explosives instead of a gun that fires projectiles. The loaded charges are lowered into the hole to the desired depth. Once detonated, the charges emit short, penetrating jets of high-velocity gases that make holes in the casing and cement for some distance into the formation. Formation fluids then flow into the wellbore through these perforations. See bullet perforator, gun-perforate.

journal bearing n: a machine part in which a rotating shaft (a journal) revolves or slides. Also called a plain bearing.

joint of pipe n: a length of drill pipe or casing. Both come in various lengths.

junk n: metal debris lost in a hole. Junk may be a lost bit, pieces of a bit, pieces of pipe, wrenches, or any relatively small object that impedes drilling or completion and must be fished out of the hole. v: to abandon (as a nonproductive well).

junk basket n: a device made up on the bottom of the drill stem or on wireline to catch pieces of junk from the bottom of the hole. Circulating the mud or reeling in the wireline forces the junk into a barrel in

the tool, where it is caught and held. When the basket is brought back to the surface, the junk is removed. Also called a junk sub or junk catcher.

junk mill n: a mill used to grind up junk in the hole. See mill.

junk retriever n: a special tool made up on the bottom of the drill stem to pick up junk from the bottom of the hole. Most junk retrievers are designed with ports that allow drilling fluid to exit the tool a short distance off the bottom. This flow of fluid creates an area of low pressure inside the tool so that the junk is lifted and caught in the retriever by the higher pressure outside the tool. See junk, junk basket.

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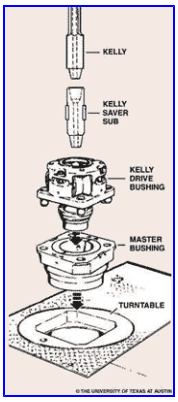
kelly n: the heavy square or hexagonal steel member suspended from the swivel through the rotary table and connected to the topmost joint of drill pipe to turn the drill stem as the rotary table turns.



kelly bushing n: a device fitted to the rotary table through which the kelly passes and the means by which the torque of the rotary table is transmitted to the kelly and to the drill stem. Also called the drive bushing.

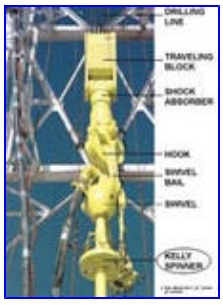
kelly bypass n: a system of valves and piping that allows drilling fluid to be circulated without the use of the kelly.

kelly cock n: a valve installed at one or both ends of the kelly. When a high-pressure backflow occurs inside the drill stem, the valve is closed to keep pressure off the swivel and rotary hose.

kelly drive bushing n: see kelly bushing.

kelly driver n: a device that fits inside the head and inside of which the kelly fits. The kelly driver rotates with the kelly.

kelly saver sub n: a heavy and relatively short length of pipe that fits in the drill stem between the kelly and the drill pipe. The threads of the drill pipe mate with those of the sub, minimizing wear on the kelly.



kelly spinner n: a pneumatically operated device mounted on top of the kelly that, when actuated, causes the kelly to turn or spin.

keyseat n: 1. an undergauge channel or groove cut in the side of the borehole and parallel to the axis of the hole. A keyseat results from the rotation of pipe on a sharp bend in the hole. 2. a groove cut parallel to the axis in a shaft or a pulley bore.

kick n: an entry of water, gas, oil, or other formation fluid into the wellbore during drilling. It occurs because the pressure exerted by the column of drilling fluid is not great enough to overcome the pressure exerted by the fluids in the formation drilled. If prompt action is not taken to control the kick, or kill the well, a blowout may occur.

kick fluids n pl: oil, gas, water, or any combination that enters the borehole from a permeable formation.

kick off v: 1. to bring a well into production; used most often when gas is injected into a gas lift well to

start production. 2. in workover operations, to swab a well to restore it to production. 3. to deviate a wellbore from the vertical, as in directional drilling.

kickoff point (KOP) n: the depth in a vertical hole at which a deviated or slant hole is started; used in directional drilling.

kill v: 1. in drilling, to control a kick by taking suitable preventive measures (for example, to shut in the well with the blowout preventers, circulate the kick out, and increase the weight of the drilling mud). 2. in production, to stop a well from producing oil and gas so that reconditioning of the well can proceed.

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land rig n: any drilling rig that is located on dry land.

latch on v: to attach elevators to a section of pipe to pull it out of or run into the hole.

latch sub n: a device, usually with segmented threads, run with seal subs on the bottom of a tubing string and latched into a permanent packer to prevent tubing movement.

lay n: 1. the spiral of strands in a wire rope either to the right or to the left, as viewed from above. 2. a term used to measure wire rope, signifying the linear distance a wire strand covers in one complete rotation around the rope.

lay down pipe v: to pull drill pipe or tubing from the hole and place it in a horizontal position on a pipe rack. Compare set back.

lead-tong hand (pronounced “leed”) n: the crew member who operates the lead tongs when drill pipe and drill collars are being handled. Also called lead-tong man.

lead tongs (pronounced “leed”) n pl: the pipe tongs suspended in the derrick or mast and operated by a chain or a wire rope connected to the makeup cathead or the breakout cathead.

lifting sub n: a threaded device placed in the end of tubulars, such as drill collars to aid in lifting; also called hoisting plug.

liner n: 1. a string of pipe used to case open hole below existing casing. A liner extends from the setting depth up into another string of casing, usually overlapping about 100 feet (30.5 meters) above the lower end of the intermediate or the oil string. Liners are nearly always suspended from the upper string by a hanger device. 2. a relatively short length of pipe with holes or slots that is placed opposite a producing formation. Usually, such liners are wrapped with specially shaped wire that is designed to prevent the entry of loose sand into the well as it is produced. They are also often used with a gravel pack. 3. in jet perforation guns, a conically shaped metallic piece that is part of a shaped charge. It increases the efficiency of the charge by increasing the penetrating ability of the jet. 4. a replaceable tube that fits inside the cylinder of an engine or a pump. See cylinder liner.

liner completion n: a well completion in which a liner is used to obtain communication between the reservoir and the wellbore.

liner hanger n: a slip device that attaches the liner to the casing. See liner.

location n: the place where a well is drilled. Also called well site.

log n: a systematic recording of data, such as a driller's log, mud log, electrical well log, or radioactivity log. Many different logs are run in wells to discern various characteristics of downhole formation. v: to record data.

log a well v: to run any of the various logs used to ascertain downhole information about a well.

logging devices n pl: any of several electrical, acoustical, mechanical, or radioactivity devices that are used to measure and record certain characteristics or events that occur in a well that has been or is being drilled.

long string n: 1. the last string of casing set in a well. 2. the string of casing that is set at the top of or through the producing zone, often called the oil string or production casing.

lost circulation n: the quantities of whole mud lost to a formation, usually in cavernous, pressured, or coarsely permeable beds. Evidenced by the complete or partial failure of the mud to return to the surface as it is being circulated in the hole.

lost pipe n: drill pipe, drill collars, tubing, or casing that has become separated in the hole from the part of the pipe reaching the surface, necessitating its removal before normal operations can proceed; for example, a fish.

lost time incident n: an incident in the workplace that results in an injury serious enough that causes the person injured to be unable to work for a day or more.

lubricator n: a specially fabricated length of casing or tubing usually placed temporarily above a valve on top of the casinghead or tubing head. It is used to run swabbing or perforating tools into a producing well and provides a method for sealing off pressure and thus should be rated for highest anticipated pressure.

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M

macaroni string n: a string of tubing or pipe, usually 3/4 or 1 inch (1.9 or 2.54 centimeters) in diameter.

make a connection v: to attach a joint or stand of drill pipe onto the drill stem suspended in the wellbore to permit deepening the wellbore by the length of the pipe.

make up v: 1. to assemble and join parts to form a complete unit (for example, to make up a string of drill pipe). 2. to screw together two threaded pieces. Compare break out. 3. to mix or prepare (for example, to make up a tank of mud). 4. to compensate for (for example, to make up for lost time).

makeup adj: added to a system (for example, makeup water used in mixing mud).

make up a joint v: to screw a length of pipe into another length of pipe.

makeup cathead n: a device that is attached to the shaft of the drawworks and used as a power source for making up joints of pipe. It is usually located on the driller's side of the drawworks. Also called spinning cathead.

makeup tongs n pl: tongs used for screwing one length of pipe into another for making up a joint. Compare breakout tongs. See also tongs.

male connection n: a pipe, coupling, or tool that has threads on the outside so that it can be joined to a female connection.

mandrel n: a cylindrical bar, spindle, or shaft around which other parts are arranged or attached or that fits inside a cylinder or tube.

manifold n: 1. an accessory system of piping to a main piping system (or another conductor) that serves to divide a flow into several parts, to combine several flows into one, or to reroute a flow to any one of several possible destinations.

mast n: a portable derrick that is capable of being raised as a unit, as distinguished from a standard derrick, which cannot be raised to a working position as a unit. For transporting by land, the mast can be divided into two or more sections to avoid excessive length extending from truck beds on the highway.

master bushing n: a device that fits into the rotary table to accommodate the slips and drive the kelly bushing so that the rotating motion of the rotary table can be transmitted to the kelly.

master valve n: 1. a large valve located on the Christmas tree and used to control the flow of oil and gas from a well. Also called master gate.

mechanical jar n: a percussion tool operated mechanically to give an upward thrust to a fish by the sudden release of a tripping device inside the tool. If the fish can be freed by an upward blow, the mechanical jar can be very effective.

mechanical log n: a log of, for instance, rate of penetration or amount of gas in the mud, obtained at the surface by mechanical means. See mud logging.

mechanical rig n: a drilling rig in which the source of power is one or more internal-combustion engines and in which the power is distributed to rig components through mechanical devices (such as chains, sprockets, clutches, and shafts). Also called a power rig. Compare electric rig.

mill n: a downhole tool with rough, sharp, extremely hard cutting surfaces for removing metal, packers, cement, sand, or scale by grinding or cutting.

miscible drive n: a method of enhanced recovery in which various hydrocarbon solvents or gases (such as propane, LPG, natural gas, carbon dioxide, or a mixture thereof) are injected into the reservoir to reduce interfacial forces between oil and water in the pore channels and thus displace oil from the reservoir rock. See chemical flooding, gas injection.

mixing tank n: any tank or vessel used to mix components of a substance (as in the mixing of additives with drilling mud).

mix mud v: to prepare drilling fluids.

monitor n: an instrument that reports the performance of a control device or signals if unusual conditions appear in a system.

monkeyboard n: the derrickhand's working platform. As pipe or tubing is run into or out of the hole, the derrickhand must handle the top end of the pipe, which may be as high as 90 feet (27 meters) or higher in the derrick or mast.

morning report n: see daily drilling report.

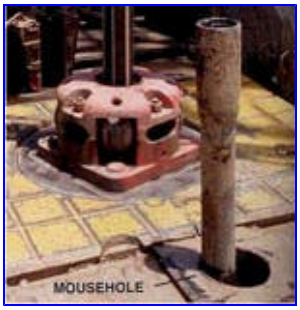
morning tour (pronounced "tower") n: a work shift that generally begins at or near midnight. See graveyard tour.

motorhand n: the crew member on a rotary drilling rig, who is responsible for the care and operation of drilling engines. Also called motorman.

motor n: any of various power units, such as a hydraulic, internal combustion, air, or electric device, that develops energy or imparts motion. Compare engine.

motorman n: see motorhand.

mousehole n: shallow bores under the rig floor, usually lined with pipe, in which joints of drill pipe are temporarily suspended for later connection to the drill string.



mousehole connection n: the procedure of adding a length of drill pipe or tubing to the active string.

mud n: the liquid circulated through the wellbore during rotary drilling and workover operations.

mud acid n: a mixture of hydrochloric and/or hydrofluoric acids and surfactants used to remove wall cake from the wellbore.

mud cake n: the sheath of mud solids that forms on the wall of the hole when liquid from mud filters into the formation. Also called filter cake or wall cake.

mud centrifuge n: a device that uses centrifugal force to separate small solid components from liquid

drilling fluid.

mud cleaner n: a cone-shaped device, a hydrocyclone, designed to remove very fine solid particles from the drilling mud.

mud engineer n: an employee of a drilling fluid supply company whose duty it is to test and maintain the drilling mud properties that are specified by the operator.

mud-gas separator n: a device that removes gas from the mud coming out of a well when a kick is being circulated out.

mud hopper n: see hopper.

mud hose n: also called kelly hose or rotary hose. See rotary hose.

mud line n: a mud return line.

mud logging n: the recording of information derived from examination and analysis of formation cuttings made by the bit and of mud circulated out of the hole. A portion of the mud is diverted through a gas-detecting device. Cuttings brought up by the mud are examined under ultraviolet light to detect the presence of oil or gas. Mud logging is often carried out in a portable laboratory set up at the well site.

mud motor n: see downhole motor.

mud pit n: originally, an open pit dug in the ground to hold drilling fluid or waste materials discarded after the treatment of drilling mud. For some drilling operations, mud pits are used for suction to the mud pumps, settling of mud sediments, and storage of reserve mud. Steel tanks are much more commonly used for these purposes now, but they are still usually referred to as pits.

mud pump n: a large, high-pressure reciprocating pump used to circulate the mud on a drilling rig. A typical mud pump is a two or three-cylinder piston pump whose replaceable pistons travel in replaceable liners and are driven by a crankshaft actuated by an engine or a motor.

mud return line n: a trough or pipe that is placed between the surface connections at the wellbore and the shale shaker.

mud tank n: one of a series of open tanks, usually made of steel plate, through which the drilling mud is cycled to remove sand and fine sediments.

mud weight n: a measure of the density of a drilling fluid expressed as pounds per gallon, pounds per cubic foot, or kilograms per cubic metre. Mud weight is directly related to the amount of pressure the column of drilling mud exerts at the bottom of the hole.

multiple completion n: an arrangement for producing a well in which one wellbore penetrates two or more petroleum-bearing formations. In one type, multiple tubing strings are suspended side by side in the production casing string, each a different length and each packed to prevent the commingling of different reservoir fluids. Each reservoir is then produced through its own tubing string. Alternatively, a small diameter production casing string may be provided for each reservoir, as in multiple miniaturized or multiple tubingless completions. See dual completion.

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Glossary of Terms

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*This is an abridged version of the **Dictionary of Petroleum Terms** provided by Petex and the University of Texas Austin

N

natural gas n: a highly compressible, highly expansible mixture of hydrocarbons with a low specific gravity and occurring naturally in a gaseous form.

neutron log n: a radioactivity well log used to determine formation porosity. The logging tool bombards the formation with neutrons. When the neutrons strike hydrogen atoms in water or oil, gamma rays are released. Since water or oil exists only in pore spaces, a measurement of the gamma rays indicates formation porosity. See radioactivity well logging.

night toolpusher n: an assistant toolpusher whose duty hours are typically during nighttime hours. Also known as a tourpusher.

nipple n: a tubular pipe fitting threaded on both ends used for making connections between pipe joints and other tools.

nipple up v: in drilling, to assemble the blowout preventer stack on the wellhead at the surface.

nitro shooting n: a formation-stimulation process first used about 100 years ago in Pennsylvania. Nitroglycerine is placed in a well and exploded to fracture.

normal circulation n: the smooth, uninterrupted circulation of drilling fluid down the drill stem, out the bit, up the annular space between the pipe and the hole, and back to the surface.

nozzle n: 1. a passageway through jet bits that causes the drilling fluid to be ejected from the bit at high velocity.

nuclear log n: see radioactivity log.

nuclear tracer n: a gas, liquid, or solid material that emits gamma rays.

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O

Occupational Safety and Health Administration (OSHA) n: a U.S. government enforcement agency that conducts worksite inspections and incident investigations, research into the causes of occupational diseases and accidents. Address: Department of Labor; 200 Constitution Avenue, NW; Washington, DC 20210; (800) 321-OSHA.

oil n: a simple or complex liquid mixture of hydrocarbons that can be refined to yield gasoline, kerosene, diesel fuel, and various other products.

oil-base mud n: a drilling or workover fluid in which oil is the continuous phase and which contains from less than 2 percent and up to 5 percent water. This water is spread out, or dispersed, in the oil as small droplets. See oil mud.

oil-emulsion mud n: a water-base mud in which water is the continuous phase and oil is the dispersed phase.

oilfield n: the surface area overlying an oil reservoir or reservoirs. The term usually includes not only the surface area, but also the reservoir, the wells, and the production equipment.

oil mud n: a drilling mud, such as, oil-base mud and invert-emulsion mud, in which oil is the continuous phase. It is useful in drilling certain formations that may be difficult or costly to drill with waterbase mud. Compare oil-emulsion mud.

oil sand n: 1. a sandstone that yields oil. 2. (by extension) any reservoir that yields oil, whether or not it is sandstone.

oil saver n: a gland arrangement that mechanically or hydraulically seals by pressure. It is used to prevent leakage and waste of gas, oil, or water around a wireline (as when swabbing a well).

oil spotting n: pumping oil, or a mixture of oil and chemicals, to a specific depth in the well to lubricate stuck drill collars.

oil string n: the final string of casing set in a well after the productive capacity of the formation has been determined to be sufficient. Also called the long string or production casing.

oilwell n: a well from which oil is obtained.

oil zone n: a formation or horizon of a well from which oil may be produced. The oil zone is usually immediately under the gas zone and on top of the water zone if all three fluids are present and segregated.

open formation n: a petroleum-bearing rock with good porosity and permeability.

open hole n: 1. any wellbore in which casing has not been set. 2. open or cased hole in which no drill pipe or tubing is suspended. 3. the portion of the wellbore that has no casing.

open-hole completion n: a method of preparing a well for production in which no production casing or liner is set opposite the producing formation. Reservoir fluids flow unrestricted into the open wellbore.

open-hole fishing n: the procedure of recovering lost or stuck equipment in an uncased wellbore.

open-hole log n: any log made in uncased, or open hole.

operator n: the person or company, either proprietor or lessee, actually operating a well or lease, generally the oil or gas company that engages the drilling, service, and workover contractors.

Organization of Petroleum Exporting Countries (OPEC) n: an organization of the countries of the Middle East, Southeast Asia, Africa, and South America that produce oil and export it. Update - members as of 1997 are Algeria, Ecuador, Gabon, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, the United Arab Emirates, and Venezuela. The organization's purpose is to negotiate and regulate production and oil prices.

out-of-gauge bit n: a bit that is no longer of the proper diameter.

out-of-gauge hole n: a hole that is not in gauge; that is, it is smaller or larger than the diameter of the bit used to drill it.

overshot n: a fishing tool that is attached to tubing or drill pipe and lowered over the outside wall of pipe or sucker rods lost or stuck in the wellbore. A friction device in the overshot, usually either a basket or a spiral grapple, firmly grips the pipe, allowing the fish to be pulled from the hole.

overthrust fault n: a low-dip angle (nearly horizontal) reverse fault along which a large displacement has occurred. Some overthrusts, such as many of those in the Rocky Mountain Overthrust Belt, represent slippages of many miles.

O-ring n: a circular seal common in the oil field. O-rings may be made of elastomer, rubber, plastic, or stainless steel. To seal properly, they all require enough pressure to make them deform against a sealing surface.

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P

packer n: a piece of downhole equipment that consists of a sealing device, a holding or setting device, and an inside passage for fluids.

packer fluid n: a liquid, usually salt water or oil, but sometimes mud, used in a well when a packer is between the tubing and the casing. Packer fluid must be heavy enough to shut off the pressure of the formation being produced, and should not stiffen or settle out of suspension over long periods of time, and must be non-corrosive.

packer squeeze method n: a squeeze cementing method in which a packer is set to form a seal between the working string (the pipe down which cement is pumped) and the casing. Another packer or a cement plug is set below the point to be squeeze-cemented. By setting packers, the squeeze point is isolated from the rest of the well.

packing n: 1. a material used in a cylinder on rotating shafts of an engine or pump in the stuffing box of a valve, or between flange joints to maintain a leak proof seal. 2. the specially fabricated filling in packed fractionation columns and absorbers.

packing assembly n: the arrangement of the downhole tools used in running and setting a packer.

packing elements n pl: the set of dense rubber, washer-shaped pieces encircling a packer, which are designed to expand against casing or formation face to seal off the annulus.

pack-off n: a device with an elastomer packing element that depends on pressure below the packing to effect a seal in the annulus. Used primarily to run or pull pipe under low or moderate pressures. Also called a stripper.

pack off v: to place a packer in the wellbore and activate it so that it forms a seal between the tubing and the casing.

paraffin n: a saturated aliphatic hydrocarbon having the formula C_nH_{2n+2} (for example, methane, CH_4; ethane, C_2H_6). Heavier paraffin hydrocarbons (for example, $C_{18}H_{38}$) form a waxlike substance that is called paraffin. These heavier paraffins often accumulate on the walls of tubing and other production equipment, restricting or stopping the flow of the desirable lighter paraffins.

paraffin scraper n: a tube with guides around it to keep it centered in the hole, and a cylindrical piece with blades attached. Spaces between the blades allow drilling fluid to pass through and carry away the scrapings.

parallel strings n pl: in a multiple completion, the arrangement of a separate tubing string for each

zone produced, with all zones isolated by packers.

parted rods n pl: sucker rods that have been broken and separated in a pumping well because of corrosion, improper loading, damaged rods, and so forth.

PDC bit n: a special type of diamond drilling bit that does not use roller cones.

penetration rate n: see rate of penetration.

perforate v: to pierce the casing wall and cement of a wellbore to provide holes through which formation fluids may enter or to provide holes in the casing so that materials may be introduced into the annulus between the casing and the wall of the borehole. Perforating is accomplished by lowering into the well a perforating gun, or perforator.

perforated completion n: 1. a well completion method in which the producing zone or zones are cased through, cemented, and perforated to allow fluid flow into the wellbore. 2. a well completed by this method.

perforated liner n: a liner that has had holes shot in it by a perforating gun.

perforated pipe n: sections of pipe (such as casing, liner, and tail pipe) in which holes or slots have been cut before it is set.

perforating gun n: a device fitted with shaped charges or bullets that is lowered to the desired depth in a well and fired to create penetrating holes in casing, cement, and formation.

perforation n: a hole made in the casing, cement, and formation through which formation fluids enter a wellbore. Usually several perforations are made at a time.

perforation depth control log (PDC log) n: a special type of nuclear log that measures the depth of each casing collar. Knowing the depth of the collars makes it easy to determine the exact depth of the formation to be perforated by correlating casing-collar depth with formation depth.

perforator n: see perforating gun.

permanent packer n: a nonretrievable type of packer that must be drilled or milled out for removal.

permeability n: 1. a measure of the ease with which a fluid flows through the connecting pore spaces of a formation or cement. The unit of measurement is the millidarcy. 2. fluid conductivity of a porous medium. 3. ability of a fluid to flow within the interconnected pore network of a porous medium.

petroleum n: a substance occurring naturally in the earth in solid, liquid, or gaseous state and composed mainly of mixtures of chemical compounds of carbon and hydrogen, with or without other nonmetallic elements such as sulfur, oxygen, and nitrogen. In some cases, especially in the measurement of oil and gas, petroleum refers only to oil—a liquid hydrocarbon—and does not include natural gas or gas liquids such as propane and butane.

pilot n: a rodlike or tubelike extension below a downhole tool, such as a mill, that serves to guide the tool into or over another downhole tool or fish.

pilot bit n: a bit placed on a special device that serves to guide the device into an already existing hole that is to be opened (made larger in diameter). The pilot bit merely guides, or pilots, the cutters on the hole opener into the existing hole so that the hole-opening cutters can enlarge the hole to the desired size.

pilot mill n: a special mill that has a heavy tubular extension below it called a pilot or stinger. The pilot, smaller in diameter than the mill, is designed to go inside drill pipe or tubing that is lost in the hole. It guides the mill to the top of the pipe and centers it, thus preventing the mill from by-passing the pipe. Also called a piloted mill.

pinch points n: the sections where body parts or other materials may be pinched.

pipe ramp and pipe on rack n: an angled ramp for dragging drill pipe, casing and other materials up to the drilling floor or bringing such equipment down.

pick up v: 1. to use the drawworks to lift the bit (or other tool) off bottom by raising the drill stem. 2. to use an air hoist to lift a tool, a joint of drill pipe, or other piece of equipment.

pin n: 1. the male threaded section of a tool joint. 2. on a bit, the threaded bit shank.

pipe n: a long, hollow cylinder, usually steel, through which fluids are conducted. Oilfield tubular goods are casing (including liners), drill pipe, tubing, or line pipe.

pipe racks n pl: horizontal supports for tubular goods.

pipe racker n: 1. (obsolete) a worker who places pipe to one side in the derrick. 2. a pneumatic or hydraulic device used to mechanize the rig floor.

pipe ram n: a sealing component for a blowout preventer that closes the annular space between the pipe and the blowout preventer or wellhead.

pipe ram preventer n: a blowout preventer that uses pipe rams as the closing elements. See pipe ram.

pipe tongs n pl: see tongs.

pipe upset n: that part of the pipe that has an abrupt increase of dimension.

pipe wiper n: a flexible disk-shaped device, usually made of rubber, with a hole in the center through which drill pipe or tubing passes. It is used to wipe off mud, oil, or other liquid from the pipe as it is pulled from the hole.

pit level n: height of drilling mud in the mud tanks, or pits.

pit-level indicator n: one of a series of devices that continuously monitor the level of the drilling mud in the mud tanks. The indicator usually consists of float devices in the mud tanks that sense the mud level and transmit data to a recording and alarm device (a pit-volume recorder) mounted near the driller's position on the rig floor. If the mud level drops too low or rises too high, the alarm may sound to warn the driller of lost circulation or a kick.

pitman n: the arm that connects the crank to the walking beam on a pumping unit by means of which rotary motion is converted to reciprocating motion.

plug n: any object or device that blocks a hole or passageway (such as a cement plug in a borehole).

plug and abandon (P&A) v: to place cement plugs into a dry hole and abandon it.

plug back v: to place cement in or near the bottom of a well to exclude bottom water, to sidetrack, or to produce from a formation higher in the well. Plugging back can also be accomplished with a mechanical plug set by wireline, tubing, or drill pipe.

plug-back cementing n: a secondary cementing operation in which a plug of cement is positioned at a specific point in the well and allowed to set.

plunger n: 1. a basic component of the sucker rod pump that serves to draw well fluids into the pump. 2. the rod that serves as a piston in a reciprocating pump. 3. the device in a fuel-injection unit that regulates the amount of fuel pumped on each stroke.

pole mast n: a portable mast constructed of tubular members. A pole mast may be a single pole, usually of two different sizes of pipe telescoped together to be moved or extended and locked to obtain maximum height above a well. Double-pole masts give added strength and stability. See mast.

polished rod n: the topmost portion of a string of sucker rods. It is used for lifting fluid by the rod-pumping method. It has a uniform diameter and is smoothly polished to seal pressure effectively in the stuffing box attached to the top of the well.

polycrystalline diamond compact (PDC) n: a disk (a compact) of very small synthetic diamonds, metal powder, and tungsten carbide powder that are used as cutters on PDC bits.

porosity n: 1. the condition of being porous (such as a rock formation). 2. the ratio of the volume of empty space to the volume of solid rock in a formation, indicating how much fluid a rock can hold.

portable mast n: a mast mounted on a truck and capable of being erected as a single unit. See telescoping mast.

possum belly n: 1. a receiving tank situated at the end of the mud return line. The flow of mud comes into the bottom of the device and travels to control mud flow over the shale shaker. 2. a metal box under a truck bed that holds pipeline repair tools.

power generating system n: a diesel, LPG, natural gas, or gasoline engine along with a mechanical transmission or generator for producing power for the drilling rig.

power wrench n: a wrench that is used to make up or break out drill pipe, tubing, or casing on which the torque is provided by air or fluid pressure. Conventional tongs are operated by a mechanical pull provided by a jerk line connected to a cathead.

preflush n: 1. an injection of water prior to chemical flooding that is used to induce reservoir conditions favorable to the surfactant solution by adjusting reservoir salinity and reducing ion concentrations. A preflush may also be used to obtain advance information on reservoir flow patterns. 2. fluid injected prior to the acid solution pumped into a well in an acid-stimulation treatment; sometimes called a spearhead. Compare overflush.

pressure depletion n: the method of producing a gas reservoir that is not associated with a water drive. Gas is removed and reservoir pressure declines until all the recoverable gas has been expelled.

preventer n: shortened form of blowout preventer. See blowout preventer.

preventive maintenance n: a system of conducting regular checks, routine maintenance and testing of equipment to lengthen the service life and to potentially permit replacement or repair of weakened or faulty parts before equipment failure results.

primary recovery n: the first stage of oil production in which natural reservoir drives are used to recover oil, although some form of artificial lift may be required to exploit declining reservoir drives.

production n: 1. the phase of the petroleum industry that deals with bringing the well fluids to the surface and separating them and storing, gauging, and otherwise preparing the product for delivery. 2. the amount of oil or gas produced in a given period.

production casing n: the last string of casing set in a well, inside of which is usually suspended a tubing string.

production maintenance n: the efforts made to minimize the decline in a well's production. It includes, for example, acid-washing of casing perforations to dissolve mineral deposits, scraping or chemical injection to prevent paraffin buildup, and various measures taken to control corrosion and erosion damage.

production packer n: any packer designed to make a seal between the tubing and the casing during production.

production rig n: a portable servicing or workover unit, usually mounted on wheels and self-propelled. A wellservicing unit consists of a hoist and engine mounted on a wheeled chassis with a self-erecting mast. A workover rig is basically the same, with the addition of a substructure with rotary, pump, pits, and auxiliaries to permit handling and working a drill string.

production test n: a test of the well's producing potential usually done during the initial completion phase.

production tubing n: a string of tubing used to produce the well.

production well n: in fields in which improved recovery techniques are being applied, the well through which oil is produced.

productivity test n: a combination of a potential test and a bottomhole pressure test the purpose of which is to determine the effects of different flow rates on the pressure within the producing zone of the well to establish physical characteristics of the reservoir and to determine the maximum potential rate of flow.

propping agent n: a granular substance (sand grains, aluminum pellets, or other material) that is carried in suspension by the fracturing fluid and that serves to keep the cracks open when fracturing fluid is withdrawn after a fracture treatment.

pulling unit n: a well-servicing outfit used in pulling rods and tubing from the well. See production rig.

pulsed neutron logging device n: a measuring instrument run inside casing to obtain an indication of the presence or absence of hydrocarbons outside the casing, to determine water saturation in a reservoir behind casing, to detect water movement in the reservoir, to estimate porosity, and to estimate water salinity.

pulsed-neutron survey n: a special cased hole logging method that uses radioactivity reaction time to obtain measurements of water saturation, residual oil saturation, and fluid contacts in the formation outside the casing of an oilwell.

pump n: a device that increases the pressure on a fluid or raises it to a higher level. Various types of pumps include the bottomhole pump, centrifugal pump, hydraulic pump, jet pump, mud pump, reciprocating pump, rotary pump, sucker rod pump, and submersible pump.

pump barrel n: the cylinder or liner in which the plunger of a sucker rod pump reciprocates.

pump-down adj: descriptive of any tool or device that can be pumped down a wellbore. Pump-down tools are not lowered into the well on wireline; instead, they are pumped down the well with the drilling fluid.

pumping unit n: the machine that imparts reciprocating motion to a string of sucker rods extending to the positive displacement pump at the bottom of a well. It is usually a beam arrangement driven by a crank attached to a speed reducer, coupled to a motor.

pump jack n: a surface unit similar to a pumping unit but having no individual power plant. Usually, several pump jacks are operated by pull rods or cables from one central power source.

pump rate n: the speed, or velocity, at which a pump is run. In drilling, the pump rate is usually measured in strokes per minute.

pup joint n: a length of drill or line pipe, tubing, or casing shorter than range 1 (18 feet or 6.26 meters for drill pipe) in length.

pusher n: shortened form of toolpusher.

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R

rack n: 1. framework for supporting or containing a number of loose objects, such as pipe. See pipe rack. 2. a bar with teeth on one face for gearing with a pinion or worm gear. 3. a notched bar used as a ratchet. v: 1. to place on a rack. 2. to use as a rack.

radiation logging n: see radioactivity well logging.

radioactivity log n: a record of the natural or induced radioactive characteristics of subsurface formations. Also called nuclear log. See radioactivity well logging.

radioactivity well logging n: the recording of the natural or induced radioactive characteristics of subsurface formations. A radioactivity log, also known as a radiation log or a nuclear log, normally consists of two recorded curves: a gamma ray curve and a neutron curve. Both help to determine the types of rocks in the formation and the types of fluids contained in the rocks.

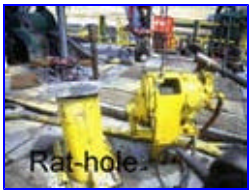
ram n: the closing and sealing component on a blowout preventer. One of three types—blind, pipe, or shear—may be installed in several preventers mounted in a stack on top of the wellbore. Blind rams, when closed, form a seal on a hole that has no drill pipe in it; pipe rams, when closed, seal around the pipe; shear rams cut through drill pipe and then form a seal.

ram blowout preventer n: a blowout preventer that uses rams to seal off pressure on a hole that is with or without pipe. It is also called a ram preventer. Ram-type preventers have interchangeable ram blocks to accommodate different O.D. drill pipe, casing, or tubing.

range of load n: in sucker rod pumping, the difference between the polished rod peak load on the upstroke and the minimum load on the downstroke.

rate of penetration (ROP) n: a measure of the speed at which the bit drills into formations, usually expressed in feet (meters) per hour or minutes per foot (meter).

rathole n: 1. a hole in the rig floor, some 30 to 40 feet (9 to 12 meters) deep, which is lined with casing that projects above the floor, into which the kelly and the swivel are placed when hoisting operations are in progress. 2. a hole of a diameter smaller than the main hole and drilled in the bottom of the main hole. v: to reduce the size of the wellbore and drill ahead.



rathole connection n: the addition of a length of drill pipe or tubing to the active string using the rathole instead of the mousehole, which is the more common connection. The length to be added is placed in the rathole, made up to the kelly, pulled out of the rathole, and made up into the string. Compare mousehole connection.

rathole rig n: a small, usually truck-mounted rig, the purpose of which is to drill ratholes for regular drilling rigs that will be moved in later. A rathole rig may also drill the top part of the hole, the conductor hole, before the main rig arrives on location.

ream v: to enlarge the wellbore by drilling it again with a special bit.

reamer n: a tool used in drilling to smooth the wall of a well, enlarge the hole to the specified size, help stabilize the bit, straighten the wellbore if kinks or doglegs are encountered, and drill directionally.

reciprocating motion n: back-and-forth or up-and-down movement, such as that of a piston in a cylinder.

reciprocating pump n: a pump consisting of a piston that moves back and forth or up and down in a cylinder. The cylinder is equipped with inlet (suction) and outlet (discharge) valves. On the intake stroke, the suction valves are opened, and fluid is drawn into the cylinder. On the discharge stroke, the suction valves close, the discharge valves open, and fluid is forced out of the cylinder.

recompletion n: after the initial completion of a well, the action and techniques of reentering the well and redoing or repairing the original completion to restore the well's productivity.

reeve (the line) v: to string a wire rope drilling line through the sheaves of the traveling and crown blocks to the hoisting drum.

refracturing n: fracturing a formation again.

remote BOP control panel n: a device placed on the rig floor that can be operated by the driller to direct air pressure to actuating cylinders that turn the control valves on the main BOP control unit, located a safe distance from the rig.

remote choke panel n: a set of controls, usually placed on the rig floor, or elsewhere on location, that is manipulated to control the amount of drilling fluid being circulated through the choke manifold. This procedure is necessary when a kick is being circulated out of a well. See choke manifold.

reserve pit n: 1. (obsolete) a mud pit in which a supply of drilling fluid is stored.

reserves n pl: the unproduced but recoverable oil or gas in a formation that has been proved by production.

reserve tank n: a special mud tank that holds mud that is not being actively circulated. A reserve tank usually contains a different type of mud from that which the pump is currently circulating. For example, it may store heavy mud for emergency well-control operations.

reservoir n: a subsurface, porous, permeable or naturally fractured rock body in which oil or gas are stored. Most reservoir rocks are limestones, dolomites, sandstones, or a combination of these. The four basic types of hydrocarbon reservoirs are oil, volatile oil, dry gas, and gas condensate. An oil reservoir generally contains three fluids—gas, oil, and water—with oil the dominant product. In the typical oil reservoir, these fluids become vertically segregated because of their different densities. Gas, the lightest, occupies the upper part of the reservoir rocks; water, the lower part; and oil, the intermediate section. In addition to its occurrence as a cap or in solution, gas may accumulate independently of the oil; if so, the reservoir is called a gas reservoir. Associated with the gas, in most instances, are salt water and some oil. Volatile oil reservoirs are exceptional in that during early production they are mostly productive of light oil plus gas, but, as depletion occurs, production can become almost totally completely gas. Volatile oils are usually good candidates for pressure maintenance, which can result in increased reserves. In the typical dry gas reservoir natural gas exists only as a gas and production is only gas plus fresh water that condenses from the flow stream reservoir. In a gas condensate reservoir, the hydrocarbons may exist as a gas, but, when brought to the surface, some of the heavier hydrocarbons condense and become a liquid.

reservoir drive n: see reservoir drive mechanism.

reservoir drive mechanism n: the process in which reservoir fluids are caused to flow out of the reservoir rock and into a wellbore by natural energy. Gas drive depends on the fact that, as the reservoir is produced, pressure is reduced, allowing the gas to expand and provide the principal driving energy.

Water drive reservoirs depend on water and rock expansion to force the hydrocarbons out of the reservoir and into the wellbore. Also called natural drive energy.

reservoir oil n: oil in place in the reservoir; retained in a reservoir as residual gas saturation is an inverse function of the pressure, due to the physics of gas.

reservoir pressure n: the average pressure within the reservoir at any given time. Determination of this value is best made by bottomhole pressure measurements with adequate shut-in time. If a shut-in period long enough for the reservoir pressure to stabilize is impractical, then various techniques of analysis by pressure buildup or drawdown tests are available to determine static reservoir pressure.

reservoir rock n: a permeable rock that may contain oil or gas in appreciable quantity and through which petroleum may migrate.

resistivity n: the electrical resistance offered to the passage of current; the opposite of conductivity.

resistivity log n: a record of the resistivity of a formation. Usually obtained when an electric log is run. See resistivity well logging.

resistivity well logging n: the recording of the resistance of formation water to natural or induced electrical current. The mineral content of subsurface water allows it to conduct electricity. Rock, oil, and gas are poor conductors. Resistivity measurements can be correlated to formation lithology, porosity, permeability, and saturation and are very useful in formation evaluation.

retrievable packer n: a packer that can be pulled out of the well to be repaired or replaced.

reverse circulation n: the course of drilling fluid downward through the annulus and upward through the drill stem, in contrast to normal circulation in which the course is downward through the drill stem and upward through the annulus. Seldom used in open hole, but frequently used in workover operations.

rework v: to restore production from an existing formation when it has fallen off substantially or ceased altogether.

rig n: the derrick or mast, drawworks, and attendant surface equipment of a drilling or workover unit.

rig down v: to dismantle a drilling rig and auxiliary equipment following the completion of drilling operations. Also called tear down.

rig floor n: the area immediately around the rotary table and extending to each corner of the derrick or mast—that is, the area immediately above the substructure on which the rotary table, and so forth rest.

rig up v: to prepare the drilling rig for making hole, for example, to install tools and machinery before drilling is started.

rod blowout preventer n: a ram device used to close the annular space around the polished rod or sucker rod in a pumping well.

rod hanger n: a device used to hang sucker rods on the mast or in the derrick.

rod pump n: see sucker rod pump.

rod string n: a sucker rod string, that is, the entire length of sucker rods, which usually consists of several single rods screwed together. The rod string serves as a mechanical link from the beam pumping unit on the surface to the sucker rod pump near the bottom of the well.

roller chain n: a type of chain that is used to transmit power by fitting over sprockets attached to shafts, causing rotation of one shaft by the rotation of another. Transmission roller chain consists of offset links, pin links, and roller links.

rotary n: the machine used to impart rotational power to the drill stem while permitting vertical movement of the pipe for rotary drilling. Modern rotary machines have a special component, the rotary or master bushing, to turn the kelly bushing, which permits vertical movement of the kelly while the stem is turning.

rotary bushing n: see master bushing.

rotary drilling n: a drilling method in which a hole is drilled by a rotating bit to which a downward force is applied. The bit is fastened to and rotated by the drill stem, which also provides a passageway through which the drilling fluid is circulated. Additional joints of drill pipe are added as drilling progresses.

rotary helper n: a worker on a drilling or workover rig, subordinate to the driller, whose primary work station is on the rig floor. Sometimes called floorhand, floorman, rig crew member, or roughneck.

rotary hose n: the hose on a rotary drilling rig that conducts the drilling fluid from the mud pump and standpipe to the swivel and kelly; also called the mud hose or the kelly hose. It is a steel-reinforced, flexible hose that is installed between the standpipe and the swivel or top drive.

rotary shoe n: a length of pipe whose bottom edge is serrated or dressed with a hard cutting material and that is run into the wellbore around the outside of stuck casing, pipe, or tubing to mill away the obstruction.

rotary speed n: the speed, measured in revolutions per minute, at which the rotary table is operated.

rotary support table n: a strong but relatively lightweight device used on some rigs that employ a top drive to rotate the bit. Although a conventional rotary table is not required to rotate the bit on such rigs, crew members must still have a place to set the slips to suspend the drill string in the hole when tripping or making a connection. A rotary support table provides such a place but does not include all the rotary machinery required in a regular rotary table.

rotary table n: The principal component of a rotary, or rotary machine, used to turn the drill stem and support the drilling assembly. It has a beveled gear arrangement to create the rotational motion and an opening into which bushings are fitted to drive and support the drilling assembly.

roughneck n: see rotary helper.

round trip n: the procedure of pulling out and subsequently running back into the hole a string of drill pipe or tubing. Also called tripping.

run casing v: to lower a string of casing into the hole. Also called to run pipe.

run in v: to go into the hole with tubing, drill pipe, and so forth.

run pipe v: to lower a string of casing into the hole. Also called to run casing.

TOP

Occupational Safety & Health Administration
200 Constitution Avenue, NW
Washington, DC 20210

Glossary of Terms

A B C D E F G H I J K L M N O P R S T U V W

*This is an abridged version of the **Dictionary of Petroleum Terms** provided by Petex and the University of Texas Austin

S

safety clamp n: a clamp placed tightly around a drill collar that is suspended in the rotary table by drill collar slips.

safety joint n: an accessory to a fishing tool, placed above it. If the tool cannot be disengaged from the fish, the safety joint permits easy disengagement of the string of pipe above the safety joint. Thus, part of the safety joint and the tool attached to the fish remain in the hole and become part of the fish.

safety slide n: a device normally mounted near the monkey board to afford the derrickhand a means of quick exit to the surface in case of emergency. It is usually affixed to a wireline, one end of which is attached to the derrick or mast and the other end to the surface. To exit by the safety slide, the derrickhand grasps a handle on it and rides it down to the ground. Also called a Geronimo.

salinity log n: a special nuclear well log that produces an estimate of the relative amounts of oil, gas, or salt water in a formation. This log is electronically adjusted to reflect gamma ray emissions resulting from the collision of neutrons with chlorine atoms in the formations.

samples n pl: 1. the well cuttings obtained at designated footage intervals during drilling. From an examination of these cuttings, the geologist determines the type of rock and formations being drilled and estimates oil and gas content. 2. small quantities of well fluids obtained for analysis.

sand n: 1. an abrasive material composed of small quartz grains formed from the disintegration of pre-existing rocks.

sand consolidation n: any one of several methods by which the loose, unconsolidated grains of a producing formation are made to adhere to prevent a well from producing sand but permit it to produce oil and gas.

sand control n: any method by which large amounts of sand in a sandy formation are prevented from entering the wellbore. Sand in the wellbore can cause plugging and premature wear of well equipment.

sandfrac n: method of fracturing subsurface rock formations by injecting fluid and sand under high pressure to increase permeability. Fractures are kept open by the grains of sand.

sandline n: a wireline used on drilling rigs and well-servicing rigs to operate a swab or bailer, to retrieve cores or to run logging devices. It is usually 9/16 of an inch (14 millimeters) in diameter and several thousand feet or meters long.

sandstone n: a sedimentary rock composed of individual mineral grains of rock fragments between 0.06 and 2 millimeters (0.002 and 0.079 inches) in diameter and cemented together by silica, calcite, iron oxide, and so forth.

saver sub n: an expendable substitute device made up in the drill stem to absorb much of the wear between the frequently broken joints (such as between the kelly or top drive and the drill pipe).

scale n: 1. a mineral deposit (for example, calcium carbonate) that precipitates out of water and adheres to the inside of pipes, heaters, and other equipment. 2. an ordered set of gauge marks together with their defining figures, words, or symbols with relation to which position of the index is observed when reading an instrument.

scraper n: any device that is used to remove deposits (such as scale or paraffin) from tubing, casing, rods, flow lines, or pipelines.

scratcher n: a device that is fastened to the outside of casing to remove mud cake from the wall of a hole to condition the hole for cementing.

screening effect n: the tendency of proppants to separate from fracture fluid when the speed, or velocity, of the fluid is low.

secondary recovery n: 1. the use of water-flooding or gas injection to maintain formation pressure during primary production and to reduce the rate of decline of the original reservoir drive. 2. water-flooding of a depleted reservoir. 3. the first improved recovery method of any type applied to a reservoir to produce oil not recoverable by primary recovery methods. See primary recovery.

self-potential (SP) n: see spontaneous potential.

self-propelled unit n: see carrier rig.

service company n: a company that provides a specialized service, such as a well-logging service or a directional drilling service.

service rig n: see production rig.

service well n: 1. a nonproducing well used for injecting liquid or gas into the reservoir for enhanced recovery. 2. a saltwater disposal well or a water supply well.

set back v: to place stands of drill pipe and drill collars in a vertical position to one side of the rotary table in the derrick or mast of a drilling or workover rig. Compare lay down pipe.

set casing v: to run and cement casing at a certain depth in the wellbore. Sometimes called set pipe.

set pipe v: see set casing.

set up v: to harden (as cement).

shaker n: shortened form of shale shaker. See shale shaker.

shale n: a fine-grained sedimentary rock composed mostly of consolidated clay or mud. Shale is the most frequently occurring sedimentary rock.

shale shaker n: a vibrating screen used to remove cuttings from the circulating fluid in rotary drilling operations. Also called a shaker.

shear ram n: the component in a blowout preventer that cuts, or shears, through drill pipe and forms a seal against well pressure.

shear ram preventer n: a blowout preventer that uses shear rams as closing elements.

sheave (pronounced "shiv") n: 1. a grooved pulley. 2. support wheel over which tape, wire, or cable rides.

shoulder n: 1. the flat portion machined on the base of the bit shank that meets the shoulder of the drill collar and serves to form a pressure-tight seal between the bit and the drill collar. 2. the portion of the box end or the pin end of a tool joint; the two shoulders meet when the tool joint is connected and form

a pressure-tight seal.

shut in v: 1. to close the valves on a well so that it stops producing. 2. to close in a well in which a kick has occurred.

shut-in bottomhole pressure (SIBHP) n: the pressure at the bottom of a well when the surface valves on the well are completely closed. It is caused by formation fluids at the bottom of the well.

sidetrack v: to use a whipstock, turbodrill, or other mud motor to drill around the original planned path of the well.

single n: a joint of drill pipe. Compare double.

single-pole rig n: a well-servicing unit whose mast consists of but one steel tube, usually about 65 feet (19.8 meters) long.

sinker bar n: a heavy weight or bar placed on or near a lightweight wireline tool. The bar provides weight so that the tool will lower properly into the well.

slack off v: to lower a load or ease up on a line. A driller will slack off on the brake to put additional weight on the bit.

sleeve n: a tubular part designed to fit over another part.

slick line n: see wireline.

slip-and-cutoff program n: a procedure to ensure that the drilling line wears evenly throughout its life. After a specified number of ton-miles (megajoules) of use, the line is slipped—for example, the traveling block is suspended in the derrick or propped on the rig floor so that it cannot move, the deadline anchor bolts are loosened, and the drilling line is spooled onto the drawworks drum. Enough line is slipped to change the major points of wear on the line, such as where it passes through the sheaves. To prevent excess line from accumulating on the drawworks drum, the worn line is cut off and discarded.

slip bowl n: a device in a rotary table or other tool into which tubing or drill pipe it is wrapped with specially shaped wire that is designed to prevent the entry of loose sand into the well as it is produced. It is also often used with a gravel pack.

slips n: wedge-shaped pieces of metal with teeth or other gripping elements that are used to prevent pipe from slipping down into the hole. Rotary slips fit around the drill pipe and wedge against the master bushing to support the pipe. Power slips are pneumatically or hydraulically actuated devices. Packers and other down hole equipment are secured in position by slips that engage the pipe by action directed at the surface.

sloughing hole n: a condition wherein shale that has absorbed water from the drilling fluid expands, sloughs off, and falls downhole. A sloughing hole can jam the drill string and block circulation.

slug n: a quantity of fluid injected into a reservoir to accomplish a specific purpose, such as chemical displacement of oil.

slurry n: 1. in drilling, a plastic mixture of cement and water that is pumped into a well to harden. There it supports the casing and provides a seal in the wellbore to prevent migration of underground fluids. 2. a mixture in which solids are suspended in a liquid.

solution gas n: lighter hydrocarbons that exist as a liquid under reservoir conditions but that effervesce as gas when pressure is released during production.

sonic log n: a type of acoustic log that records the travel time of sounds through objects, cement, or formation rocks. Often used to determine whether voids exist in the cement behind the casing in a wellbore.

sour corrosion n: embrittlement and subsequent wearing away of metal caused by contact of the metal with hydrogen sulfide.

sour crude oil n: oil containing hydrogen sulfide or another acid gas.

SP abbr: spontaneous potential or self potential.

spear n: a fishing tool used to retrieve pipe lost in a well. The spear is lowered down the hole and into the pipe being fished.

speed reducer n: a set of gears installed between a prime mover and the equipment it drives to reduce the running speed. For example, on a beam pumping unit, the engine may run at a speed of 600 revolutions per minute, but the pumping unit it drives may need to operate at 20 strokes per minute. The speed reducer makes it possible to obtain the correct pump speed.

spent adj: descriptive of a substance whose strength or merit has been exhausted in a process. For example, after a well has been acidized, any acid that remains in the well is said to be a spent acid because its strength has been used up in the acidizing process.

spinning cathead n: see makeup cathead, spinning chain.

spinning chain n: a relatively short length of chain attached to the tong pull chain on the manual tongs used to make up drill pipe. The spinning chain is attached to the pull chain so that a crew member can wrap the spinning chain several times around the tool joint box of a joint of drill pipe suspended in the rotary table. After crew members stab the pin of another tool joint into the box end, one of them then grasps the end of the spinning chain and with a rapid upward motion of the wrist "throws the spinning chain"—that is, causes it to unwrap from the box and coil upward onto the body of the joint stabbed into the box. The driller then actuates the makeup cathead to pull the chain off of the pipe body, which causes the pipe to spin and thus the pin threads to spin into the box.

spinning wrench n: air-powered or hydraulically powered wrench used to spin drill pipe in making or breaking connections.

spontaneous potential (SP) n: one of the natural electrical characteristics exhibited by a formation as measured by a logging tool lowered into the wellbore. Also called self-potential or SP.

spontaneous potential (SP) curve n: a measurement of the electrical currents that occur in the wellbore when fluids of different salinities are in contact. The SP curve is usually recorded in holes drilled with freshwater-base drilling fluids. It is one of the curves on an electric well log. Also called self-potential curve.

spontaneous potential (SP) log n: a record of a spontaneous potential curve.

spool n: the drawworks drum. Also a casing head or drilling spool. v: to wind around a drum.

spot v: to pump a designated quantity of a substance (such as acid or cement) into a specific interval in the well. For example, 10 barrels (1,590 litres) of diesel oil may be spotted around an area in the hole in which drill collars are stuck against the wall of the hole in an effort to free the collars.

spud v: 1. to begin drilling a well; such as, to spud in. 2. to force a wireline tool or tubing down the hole by using a reciprocating motion.

spud in v: to begin drilling; to start the hole.

spud mud n: the fluid used when drilling starts at the surface, often a thick bentonite-lime slurry.

split master bushing n: a master bushing that is made in two pieces.

squeeze n: 1. a cementing operation in which cement is pumped behind the casing under high pressure to recement channeled areas or to block off an uncemented zone.

squeeze cementing n: the forcing of cement slurry by pressure to specified points in a well to cause seals at the points of squeeze. It is a secondary cementing method that is used to isolate a producing formation, seal off water, repair casing leaks, and so forth. Compare plug-back cementing.

squeeze job n: a remedial activity whereby a cement slurry is pumped into open perforations, split casing, or a fractured formation, to effect a blockage.

squeeze packer n: a downhole permanent, or drillable, packer that is set by lowering some of the weight of the tubing string onto the packer. The weight expands the packer's sealing element to prevent flow between the tubing string and the casing below the packer.

squeeze point n: the depth in a wellbore at which cement is to be squeezed.

squeeze tool n: a special retrievable packer set at a particular depth in the wellbore during a squeeze cementing job. See also squeeze cementing.

stabilizer n: 1. a tool placed on a drill collar near the bit that is used, depending on where it is placed, either to maintain a particular hole angle or to change the angle by controlling the location of the contact point between the hole and the collars.

stack n: 1. a vertical arrangement of blowout prevention equipment. Also called preventer stack. See blowout preventer. 2. the vertical chimney-like installation that is the waste disposal system for unwanted vapor such as flue gases or tail-gas streams.

stack a rig v: to store a drilling rig on completion of a job when the rig is to be withdrawn from operation for a time.

stairways n: stairs leading from one level to another.

stand n: the connected joints of pipe racked in the derrick or mast when making a trip. On a rig, the usual stand is about 90 feet (about 27 meters) long (three lengths of drill pipe screwed together).

standard derrick n: a derrick that is built piece by piece at the drilling location, as opposed to a jackknife mast, which is preassembled. Compare mast.

standing valve n: a fixed ball-and-seat valve at the lower end of the working barrel of a sucker rod pump. The standing valve and its cage do not move, as does the traveling valve. Compare traveling valve.

standpipe n: a vertical pipe rising along the side of the derrick or mast, which joins the discharge line leading from the mud pump to the rotary hose and through which mud is pumped going into the hole.

steam flooding n: a thermal recovery method in which steam is injected into a reservoir through injection wells and driven toward production wells. The steam reduces the viscosity of crude oil, causing it to flow more freely. The heat vaporizes lighter hydrocarbons; as they move ahead of the steam, they cool and condense into liquids that dissolve and displace crude oil. The steam provides additional gas drive. This method is also used to recover viscous oils. Also called continuous steam injection or steam drive. Compare thermal recovery.

steel-tooth bit n: a roller cone bit in which the surface of each cone is made up of rows of steel teeth. Also called a milled bit, although some steel teeth are forged.

stimulation n: the action of attempting to improve and enhance a well's performance by the application of horsepower using pumping equipment, placing sand in artificially created fractures in rock, or using chemicals such as acid to dissolve the soluble portion of the rock.

straight hole n: a hole that is drilled vertically. The total hole angle is restricted, and the hole does not change direction rapidly.

string n: the entire length of casing, tubing, sucker rods, or drill pipe run into a hole.

string up v: to thread the drilling line through the sheaves of the crown block and traveling block. One end of the line is secured to the hoisting drum and the other to the drill-line anchor.

structural mast n: a portable mast constructed of angular as opposed to tubular steel members.

stuck pipe n: drill pipe, drill collars, casing, or tubing that has inadvertently become immovable in the hole. Sticking may occur when drilling is in progress, when casing is being run in the hole, or when the drill pipe is being hoisted.

stuck point n: the depth in the hole at which the drill stem, tubing, or casing is stuck. Also called freeze point.

stuffing box n: a device that prevents leakage along a piston, rod, propeller shaft, or other moving part that passes through a hole in a cylinder or vessel. It consists of a box or chamber made by enlarging the hole and a gland containing compressed packing. On a well being artificially lifted by means of a sucker rod pump, the polished rod operates through a stuffing box, preventing escape of oil and diverting it into a side outlet to which is connected the flow line leading to the oil and gas separator or to the field storage tank. For a bottomhole pressure test, the wireline goes through a stuffing box and lubricator, allowing the gauge to be raised and lowered against well pressure. The lubricator provides a pressure-tight grease seal in the stuffing box.

sub n: a short, threaded piece of pipe used to adapt parts of the drilling string that cannot otherwise be screwed together because of differences in thread size or design. A sub (a substitute) may also perform a special function. Lifting subs are used with drill collars to provide a shoulder to fit the drill pipe elevators; a kelly saver sub is placed between the drill pipe and the kelly to prevent excessive thread wear of the kelly and drill pipe threads; a bent sub is used when drilling a directional hole.

submersible pump n: a pump that is placed below the level of fluid in a well. It is usually driven by an electric motor and consists of a series of rotating blades that impart centrifugal motion to lift the fluid to the surface.

substructure n: the foundation on which the derrick or mast and usually the drawworks sit; contains space for well control equipment.

sucker rod n: a special steel pumping rod. Several rods screwed together make up the mechanical link from the beam pumping unit on the surface to the sucker rod pump at the bottom of a well. Sucker rods are threaded on each end and manufactured to dimension standards and metal specifications set by the petroleum industry. Lengths are 25 or 30 feet (7.6 or 9.1 meters); diameter varies from 1/2 to 1 1/8 inches (12 to 30 millimeters). There is also a continuous sucker rod (trade name: Corod™).

sucker rod pump n: the downhole assembly used to lift fluid to the surface by the reciprocating action of the sucker rod string. Basic components are barrel, plunger, valves, and hold-down. Two types of sucker rod pumps are the tubing pump, in which the barrel is attached to the tubing, and the rod, or insert, pump, which is run into the well as a complete unit.

sucker rod pumping n: a method of artificial lift in which a subsurface pump located at or near the bottom of the well and connected to a string of sucker rods is used to lift the well fluid to the surface. The weight of the rod string and fluid is counterbalanced by weights attached to a reciprocating beam or to the crank member of a beam pumping unit or by air pressure in a cylinder attached to the beam.

surface casing n: see surface pipe.

surface hole n: that part of the wellbore that is drilled below the conductor hole but above the intermediate hole.

surface pipe n: the first string of casing (after the conductor pipe) that is set in a well. It varies in length from a few hundred to several thousand feet (meters).

surface stack n: a blowout preventer stack mounted on top of the casing string at or near the surface of the ground or the water.

suspending agent n: an additive used to hold the fine clay and silt particles that sometimes remain after an acidizing treatment in suspension; for example, it keeps them from settling out of the spent acid until it is circulated out.

swab n. a hollow mandrel fitted with swab cups used for swabbing. v. to operate a swab on a wireline to lower the pressure in the well bore and bring well fluids to the surface when the well does not flow naturally. Swabbing is a temporary operation to determine whether the well can be made to flow. If the

well does not flow after being swabbed, a pump is installed as a permanent lifting device to bring the oil to the surface.

swab cup n: a rubber or rubberlike device on a special rod (a swab), which forms a seal between the swab and the wall of the tubing or casing.

swage n: a solid cylindrical tool pointed at the bottom and equipped with a tool joint at the top for connection with a jar. It is used to straighten damaged or collapsed casing or tubing and drive it back to its original shape. v: to reduce the diameter of a rod, a tube, or a fitting by forging, hammering, or other method.

swamper n: (slang) a helper on a truck, tractor, or other machine.

sweet crude oil n: oil containing little or no sulfur, especially little or no hydrogen sulfide.

swivel n: a rotary tool that is hung from the rotary hook and traveling block to suspend and permit free rotation of the drill stem. It also provides a connection for the rotary hose and a passageway for the flow of drilling fluid into the drill stem.

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Glossary of Terms

A B C D E F G H I J K L M N O P R S T U V W

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T

tally v: to measure and record the total length of pipe, casing, or tubing that is to be run in a well.

taper tap n: a tap with a gradually decreasing diameter from the top. It is used to retrieve a hollow fish such as a drill collar and is the male counterpart of a die collar. The taper tap is run into a hollow fish and rotated to cut enough threads to provide a firm grip and permit the fish to be pulled and recovered.

tapered bowl n: a fitting, usually divided into two halves, that crew members place inside the master bushing to hold the slips.

TD abbr: total depth.

tag v: to touch an object downhole with the drill stem.

tag line n: in crane and truck operations, a rope attached to the bottom of a load suspended by the crane or truck, which, when grasped by a crew member, allows the crew member to prevent rotation and to assist in guiding the load.

tear down v: see rig down.

telescoping mast n: a portable mast that can be erected as a unit, usually by a tackle that hoists the wireline or by a hydraulic ram. The upper section of a telescoping mast is generally nested (telescoped) inside the lower section of the structure and raised to full height either by the wireline or by a hydraulic system.

temperature log n: a survey run in cased holes to locate the top of the cement in the annulus. Since cement generates a considerable amount of heat when setting, a temperature increase will be found at the level where cement is found behind the casing.

temperature survey n: an operation used to determine temperatures at various depths in the wellbore. It is also used to determine the height of cement behind the casing and to locate the source of water influx into the wellbore.

tertiary recovery n: 1. the use of improved recovery methods that not only restore formation pressure but also improve oil displacement or fluid flow in the reservoir. 2. the use of any improved recovery method to remove additional oil after secondary recovery. Compare primary recovery, secondary recovery.

thermal recovery n: a type of improved recovery in which heat is introduced into a reservoir to lower the viscosity of heavy oils and to facilitate their flow into producing wells. The pay zone may be heated by injecting steam (steam drive) or by injecting air and burning a portion of the oil in place (in situ

combustion).

throw the chain v: to jump the spinning chain up from a box end tool joint so that the chain wraps around the pin end tool joint after it is stabbed into the box. The stand or joint of drill pipe is turned or spun by a pull on the spinning chain from the cathead on the drawworks.

tight formation n: a petroleum- or water-bearing formation of relatively low porosity and permeability.

tight sand n: sand or sandstone formation with low permeability.

tight spot n: a section of a borehole in which excessive wall cake has built up, reducing the hole diameter and making it difficult to run the tools in and out. Compare keyseat.

tongs n pl: the large wrenches used for turning when making up or breaking out drill pipe, casing, tubing, or other pipe; variously called casing tongs, rotary tongs, and so forth according to the specific use. Power tongs or power wrenches are pneumatically or hydraulically operated tools that serve to spin the pipe up and, in some instances, to apply the final makeup torque.

toolpusher n: an employee of a drilling contractor who is in charge of the entire drilling crew and the drilling rig. Also called a rig superintendent, drilling foreman, or rig supervisor.

top drive n: a device similar to a power swivel that is used in place of the rotary table to turn the drill stem.

top plug n: a cement wiper plug that follows cement slurry down the casing. It goes before the drilling mud used to displace the cement from the casing and separates the mud from the slurry. See cementing, wiper plug.

torque n: the turning force that is applied to a shaft or other rotary mechanism to cause it to rotate or tend to do so. Torque is measured in foot-pounds, joules, newton-metres, and so forth.

total depth (TD) n: the maximum depth reached in a well.

tour (pronounced "tower") n: a working shift for drilling crew or other oilfield workers. Some tours are 8 hours; the three daily tours are called daylight, evening (or afternoon), and graveyard (or morning). 12-hour tours may also be used; they are called simply day tour and night tour.

tourly (pronounced "towerly") adv: during each shift. See **tour**.

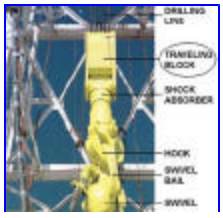
tracer n: a substance added to reservoir fluids to permit the movements of the fluid to be followed or traced. Dyes and radioactive substances are used as tracers in underground water flows and sometimes helium is used in gas. When samples of the water or gas taken some distance from the point of injection reveal signs of the tracer, the route of the fluids can be mapped.

tracer log n: a survey that uses a radioactive tracer such as a gas, liquid, or solid having a high gamma ray emission. When the material is injected into any portion of the wellbore, the point of placement or movement can be recorded by a gamma ray instrument. The tracer log is used to determine channeling or the travel of squeezed cement behind a section of perforated casing.

trailer rig n: a rig mounted on a wheeled and towed trailer. It has a mast, a rotary, and one or two engines.

transmission n: the gear or chain arrangement by which power is transmitted from the prime mover to the drawworks, the mud pump, or the rotary table of a drilling rig.

traveling block n: an arrangement of pulleys, or sheaves, through which drilling cable is reeved, which moves up or down in the derrick or mast.



traveling valve n: one of the two valves in a sucker rod pumping system. It moves with the movement of the sucker rod string. On the upstroke, the ball member of the valve is seated, supporting the fluid load. On the downstroke, the ball is unseated,

allowing fluid to enter into the production column. Compare standing valve.

trip n: the operation of hoisting the drill stem from and returning it to the wellbore. v: to insert or remove the drill stem into or out of the hole. Shortened form of "make a trip."

trip in v: to go in the hole.

trip out v: to come out of the hole.

tripping n: the operation of hoisting the drill stem out of and returning it into the wellbore.

truck-mounted rig n: a well-servicing and workover rig that is mounted on a truck chassis.

tubing n: relatively small-diameter pipe that is run into a well to serve as a conduit for the passage of oil and gas to the surface.

tubing coupling n: a special connector used to connect lengths of tubing.

tubing hanger n: an arrangement of slips and packing rings used to suspend tubing from the tubing head.

tubing head n: a flanged fitting that supports the tubing string, seals off pressure between the casing and the outside of the tubing, and provides a connection that supports the Christmas tree.

tubing pump n: a sucker rod pump in which the barrel is attached to the tubing. See sucker rod pump.

tubular goods n pl: any kind of pipe. Oilfield tubular goods include tubing, casing, drill pipe, drill collars and line pipe. Also called tubulars.

tungsten carbide n: a fine, very hard, gray crystalline powder, a compound of tungsten and carbon. This compound is bonded with cobalt or nickel in cemented carbide compositions and used for cutting tools, abrasives, and dies.

tungsten carbide bit n: a type of roller cone bit with inserts made of tungsten carbide. Also called tungsten carbide insert bit.

turntable n: see rotary table.

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A B C D E F G H I J K L M N O P R S T U V W

*This is an abridged version of the **Dictionary of Petroleum Terms** provided by Petex and the University of Texas Austin

U

uncased hole n: see open hole.

unconsolidated formation n: a loosely arranged, apparently unstratified section of rock.

unconsolidated sandstone n: a sand formation in which individual grains do not adhere to one another. If an unconsolidated sandstone produces oil or gas, it will produce sand as well if not controlled or corrected.

undergauge bit n: a bit whose outside diameter is worn to the point at which it is smaller than it was when new. A hole drilled with an undergauge bit is said to be undergauge.

undergauge hole n: that portion of a borehole drilled with an undergauge bit.

unit operator n: the oil company in charge of development and production in an oilfield in which several companies have joined to produce the field.

unloading a well n: removing fluid from the tubing in a well, often by means of a swab, to lower the bottomhole pressure in the wellbore at the perforations and induce the well to flow.

upper kelly cock n: a valve installed above the kelly that can be closed manually to protect the rotary hose from high pressure that may exist in the drill stem.

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valve n: a device used to control the rate of flow in a line to open or shut off a line completely, or to serve as an automatic or semiautomatic safety device. Those used extensively include the check valve, gate valve, globe valve, needle valve, plug valve, and pressure relief valve.

V-belt n: a belt with a trapezoidal cross section, made to run in sheaves, or pulleys, with grooves of corresponding shape.

V-door n: an opening at floor level in a side of a derrick or mast. The V-door is opposite the drawworks and is used as an entry to bring in drill pipe, casing, and other tools from the pipe rack.

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W

waiting on cement (WOC) adj: pertaining to the time when drilling or completion operations are suspended so that the cement in a well can harden sufficiently.

walkways n: an area cleared for moving through by personnel.

walking beam n: the horizontal steel member of a beam pumping unit that has rocking or reciprocating motion.

wash over v: to release pipe that is stuck in the hole by running washover pipe. The washover pipe must have an outside diameter small enough to fit into the borehole but an inside diameter large enough to fit over the outside diameter of the stuck pipe. A rotary shoe, which cuts away the formation, mud, or whatever is sticking the pipe, is made up on the bottom joint of the washover pipe, and the assembly is lowered into the hole. Rotation of the assembly frees the stuck pipe. Several washovers may have to be made if the stuck portion is very long.

washover pipe n: an accessory used in fishing operations to go over the outside of tubing or drill pipe stuck in the hole because of cuttings, mud, and so forth, that have collected in the annulus. The washover pipe cleans the annular space and permits recovery of the pipe. It is sometimes called washpipe.

washover string n: the assembly of tools run into the hole during fishing to perform a washover. A typical washover string consists of a washover back-off connector, several joints of washover pipe, and a rotary shoe.

water drive n: the reservoir drive mechanism in which oil is produced by the expansion of the underlying water and rock, which forces the oil into the wellbore. In general, there are two types of water drive: bottom-water drive, in which the oil is totally underlain by water; and edgewater drive, in which only a portion of the oil is in contact with the water.

water pump n: on an engine, a device, powered by the engine, that moves coolant (water) through openings in the engine block, through the radiator or heat exchanger, and back into the block.

water tank n: the water tank is used to store water that is used for mud-mixing, cementing, and rig cleaning.

water well n: a well drilled to obtain a fresh water supply to support drilling and production operations or to obtain a water supply to be used in connection with an enhanced recovery program.

weight indicator n: an instrument near the driller's position on a drilling rig that shows both the weight

of the drill stem that is hanging from the hook (hook load) and the weight that is placed on the bottom of the hole (weight on bit).

weight indicator n: a device for measuring the weight of the drill string.

weight on bit (WOB) n: the amount of downward force placed on the bit.

well n: the hole made by the drilling bit, which can be open, cased, or both. Also called borehole, hole, or wellbore.

wellbore n: a borehole; the hole drilled by the bit. A wellbore may have casing in it or it may be open (uncased); or part of it may be cased, and part of it may be open. Also called a borehole or hole.

wellbore soak n: an acidizing treatment in which the acid is placed in the wellbore and allowed to react by merely soaking. It is a relatively slow process, because very little of the acid actually comes in contact with the formation. Also called wellbore cleanup. Compare acid fracture.

well completion n: 1. the activities and methods of preparing a well for the production of oil and gas or for other purposes, such as injection; the method by which one or more flow paths for hydrocarbons are established between the reservoir and the surface. 2. the system of tubulars, packers, and other tools installed beneath the wellhead in the production casing; that is, the tool assembly that provides the hydrocarbon flow path or paths.

well control n: the methods used to control a kick and prevent a well from blowing out. Such techniques include, but are not limited to, keeping the borehole completely filled with drilling mud of the proper weight or density during operations, exercising reasonable care when tripping pipe out of the hole to prevent swabbing, and keeping careful track of the amount of mud put into the hole to replace the volume of pipe removed from the hole during a trip.

well fluid n: the fluid, usually a combination of gas, oil, water, and suspended sediment, that comes out of a reservoir. Also called well stream.

wellhead n: the equipment installed at the surface of the wellbore. A wellhead includes such equipment as the casinghead and tubing head. adj: pertaining to the wellhead.

well logging n: the recording of information about subsurface geologic formations, including records kept by the driller and records of mud and cutting analyses, core analysis, drill stem tests, and electric, acoustic, and radioactivity procedures.

well servicing n: the maintenance work performed on an oil or gas well to improve or maintain the production from a formation already producing. It usually involves repairs to the pump, rods, gas-lift valves, tubing, packers, and so forth.

well-servicing rig n: a portable rig, truck-mounted, trailer-mounted, or a carrier rig, consisting of a hoist and engine with a self-erecting mast. See carrier rig. Compare workover rig.

well site n: see location.

well stimulation n: any of several operations used to increase the production of a well, such as acidizing or fracturing. See acidize.

wickers n pl: broken or frayed strands of the steel wire that makes up the outer wrapping of wire rope.

wildcat n: 1. a well drilled in an area where no oil or gas production exists.

window n: 1. a slotted opening or a full section removed in the pipe lining (casing) of a well, usually made to permit sidetracking.

wireline n: a slender, rodlike or threadlike piece of metal usually small in diameter, that is used for lowering special tools (such as logging sondes, perforating guns, and so forth) into the well. Also called slick line.

wireline formation tester n: a formation fluid sampling device, actually run on conductor line rather than wireline, that also logs flow and shut-in pressure in rock near the borehole. A spring mechanism

holds a pad firmly against the sidewall while a piston creates a vacuum in a test chamber. Formation fluids enter the test chamber through a valve in the pad. A recorder logs the rate at which the test chamber is filled. Fluids may also be drawn to fill a sampling chamber. Wireline formation tests may be done any number of times during one trip in the hole, so they are very useful in formation testing.

wireline log n: any log that is run on wireline.

wireline logging n: see well logging.

wireline operations n pl: the lowering of mechanical tools, such as valves and fishing tools, into the well for various purposes. Electric wireline operations, such as electric well logging and perforating, involve the use of conductor line.

wireline survey n: a general term used to refer to any type of log being run in a well.

wireline tools n pl: special tools or equipment made to be lowered into and retrieved from the well on a wireline, for example, packers, swabs, gas-lift valves, measuring devices.

wire rope n: a cable composed of steel wires twisted around a central core of fiber or steel wire to create a rope of great strength and considerable flexibility.

WOB abbr: weight on bit.

WOC abbr: waiting on cement; used in drilling reports.

workover n: the performance of one or more of a variety of remedial operations on a producing well to try to increase production. Examples of workover jobs are deepening, plugging back, pulling and resetting liners, and squeeze cementing. See recompletion.

workover fluid n: a special drilling mud used to keep a well under control while it is being worked over. A workover fluid is compounded carefully so that it will not cause formation damage.

workover rig n: a portable rig used for working over a well.

work string n: 1. in drilling, the string of drill pipe or tubing suspended in a well to which is attached a special tool or device that is used to carry out a certain task, such as squeeze cementing or fishing. 2. in pipeline construction, the string of washpipe that replaces the pilot string in a directionally drilled river crossing. The work string remains in place under the river until the actual pipeline is made up and is ready to be pulled back across the river.

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Additional References

OSHA Safety and Health Topics:

- Confined Spaces
- Control of Hazardous Energy (Lockout/Tagout)
- Electrical
- Ergonomics
- Fall Protection
- Noise and Hearing Conservation
- Oil and Gas Well Drilling and Servicing
- Oil well Derrick Stability: Guywire Anchor Systems
- Powered Industrial Trucks
- Personal Protective Equipment (PPE)
- Walking/Working Surfaces

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