Drilling rigs and rig types. Rig components

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A Drilling Rig

A drilling rig is a device used to drill, case and cement water, oil and gas wells.

Types of Rigs

Drilling rigs are classified as:

- Land rigs
- Offshore rigs

Offshore rigs

There are two types of offshore rigs:

1. Floating rigs:

- Semisubmersible
- Drillships

2. Bottom-supported rigs: There are three types:

- Jack-ups
- Platform
- Barge

Floating rigs:

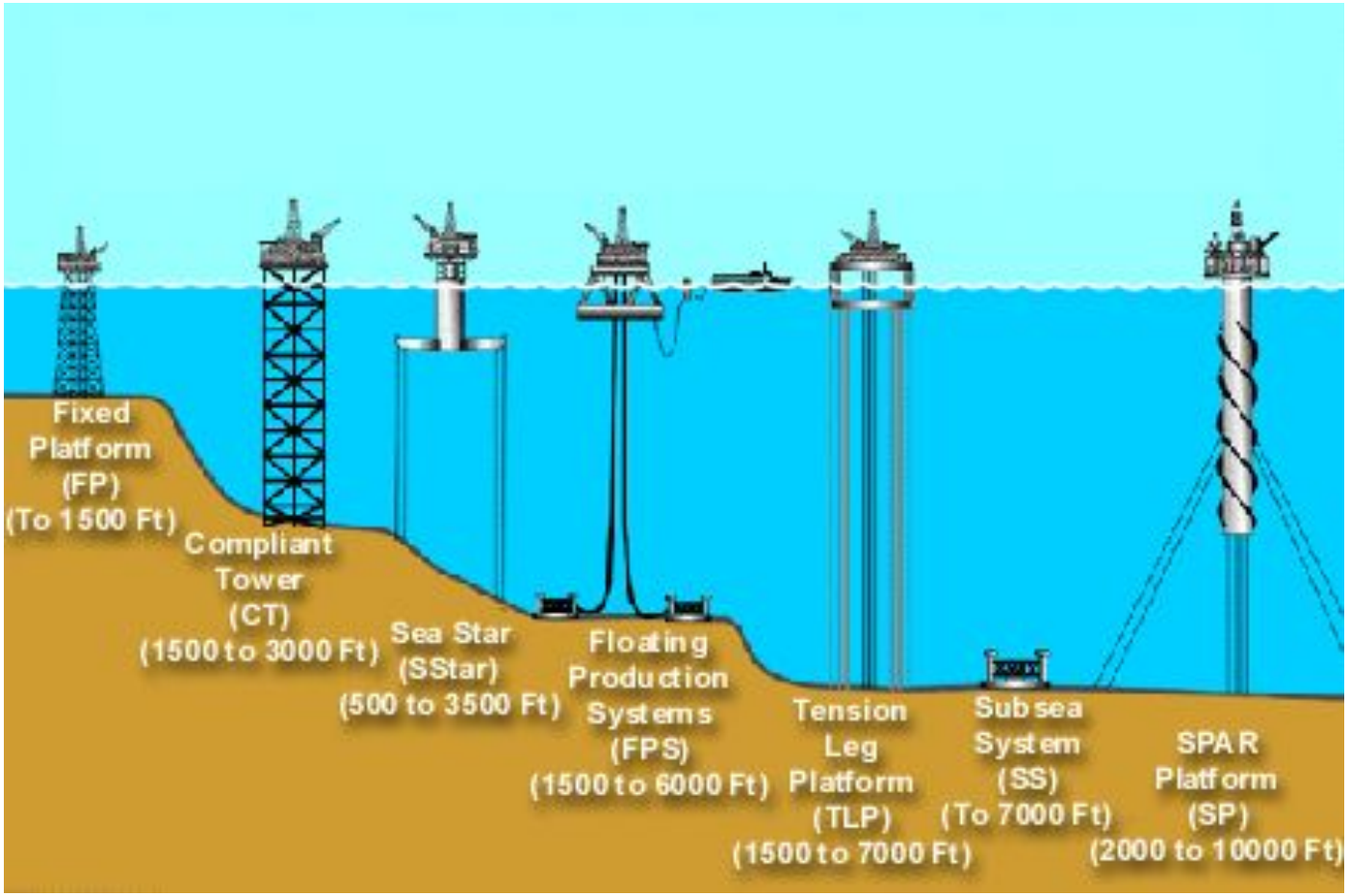
Floating rigs:

Floating rigs:

Bottom-supported rigs:

Bottom-supported rigs:

Bottom-supported rigs:



Rig components

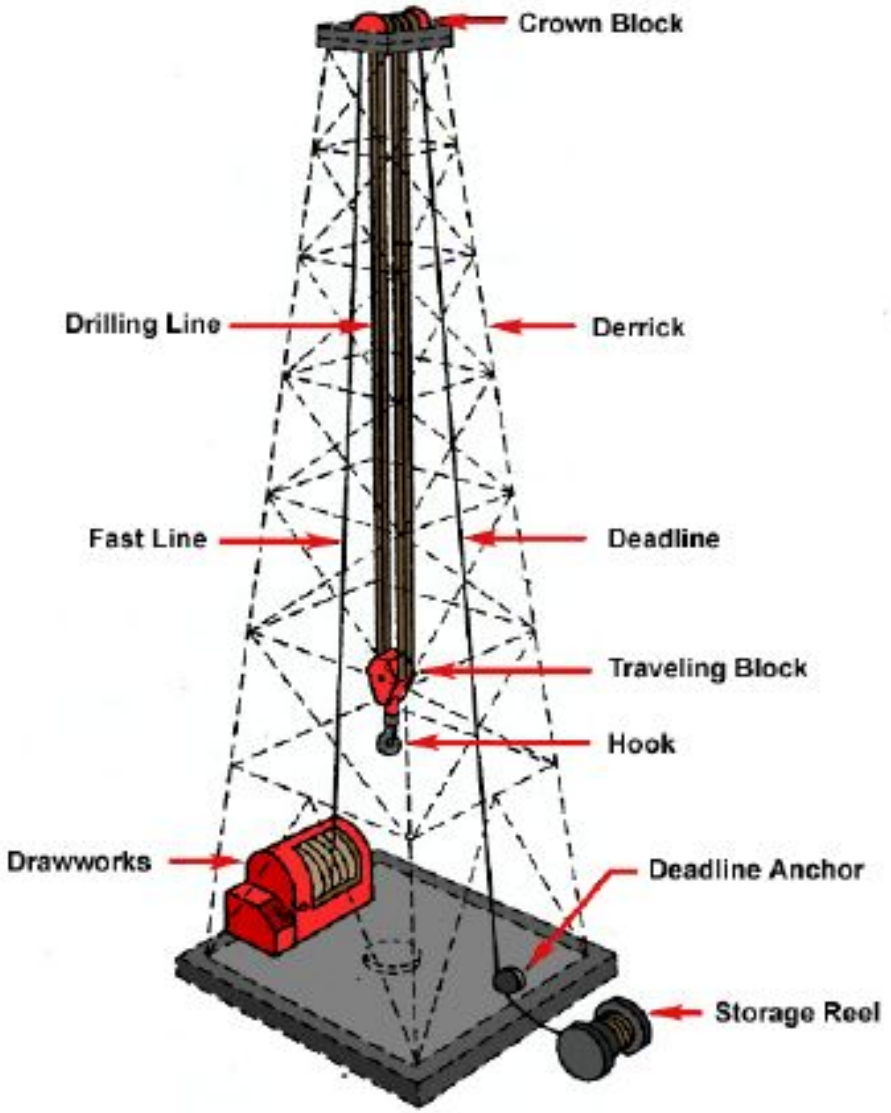
The major components that need to be selected and sized for the purpose of rig sizing are:

1. Hoisting System
2. Rotating System
3. Circulating System
4. Tubular Goods
5. Well control system
6. Derrick Capacity And Substructure
7. Power Requirements for the above

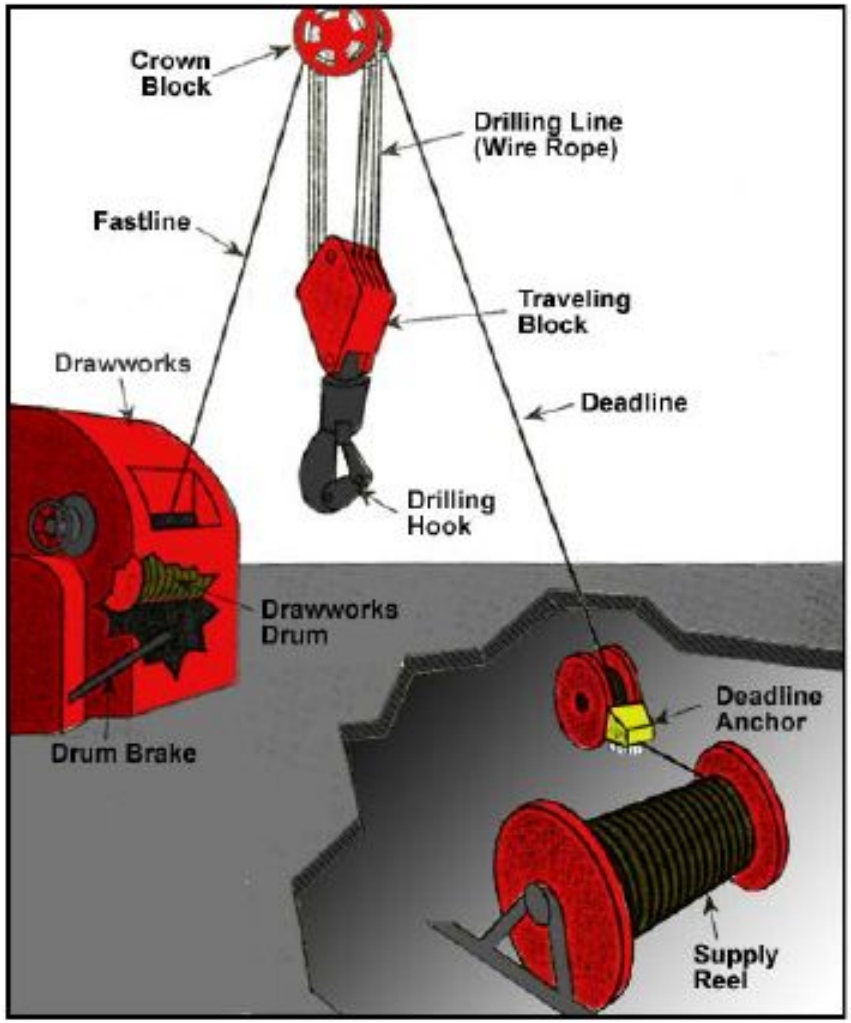
Hoisting System

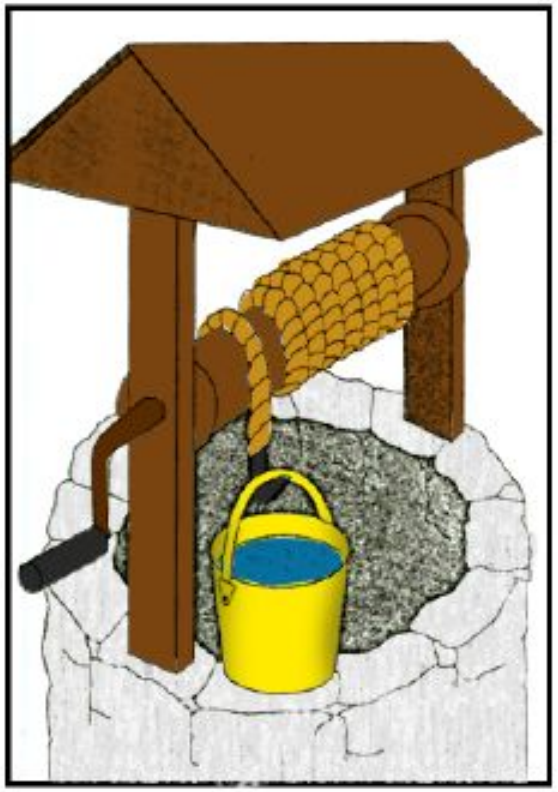
- The main objective of this system is to provide lifting and dropping force towards drill string and any components around rig floor.

- Drawworks
- Crown Block
- Dead Line Anchor
- Travelling Block
- The Hook
- Drilling Line



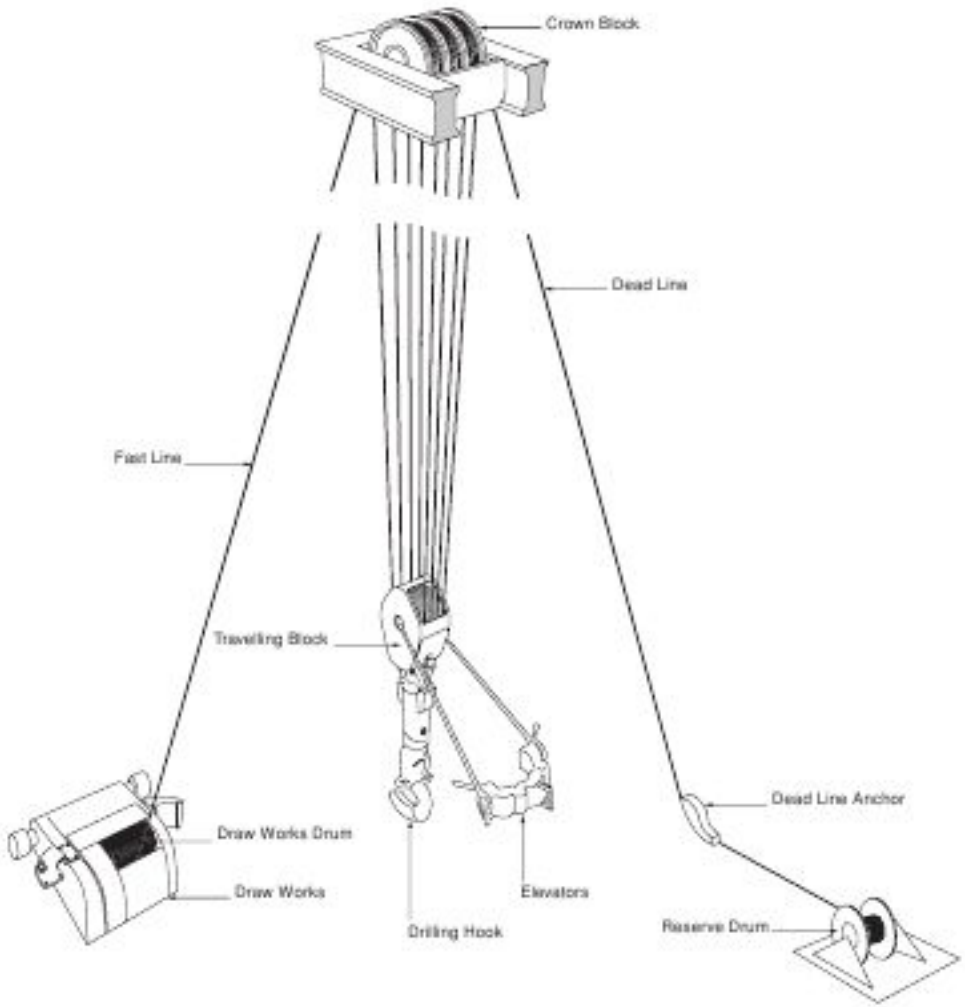
Hoisting System





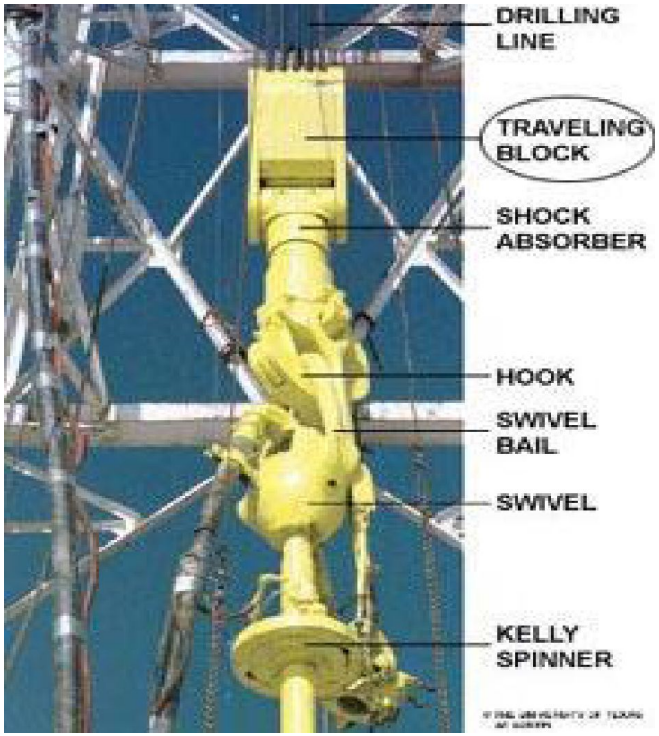
A Windlass hoists water from a well

Crown Block


Crown Block
Dead Line
Fast Line
Travelling Block
Draw Works Drum
Draw Works
Drilling Hook
Elevators
Dead Line Anchor
Reserve Drum

Traveling block

- Traveling Block - The block and tackle which is rigged with the crown block by multiples of drilling line strung between the crown block and the traveling block.

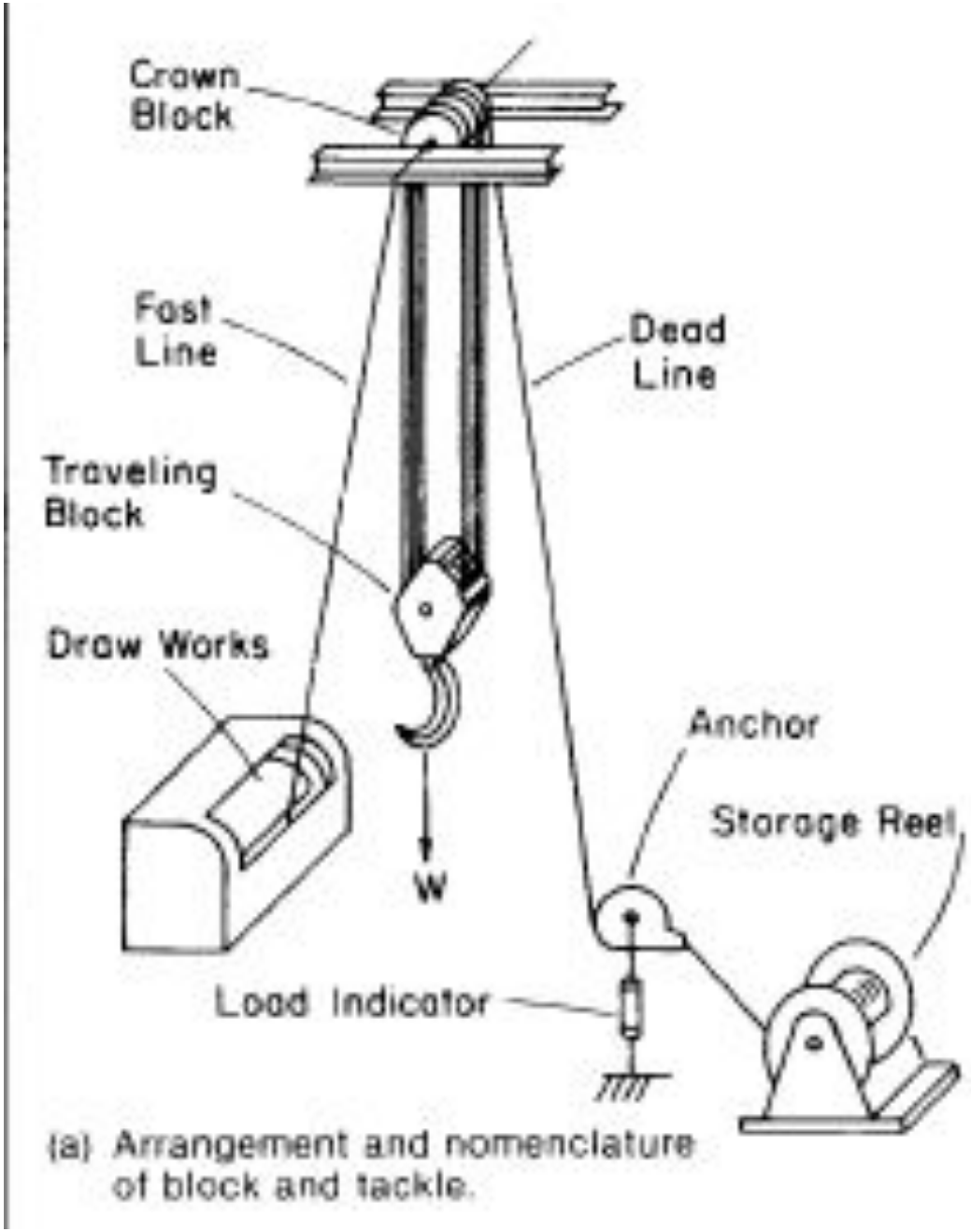


Drawworks

Hoisting System

Dead Line Anchor

The Hook



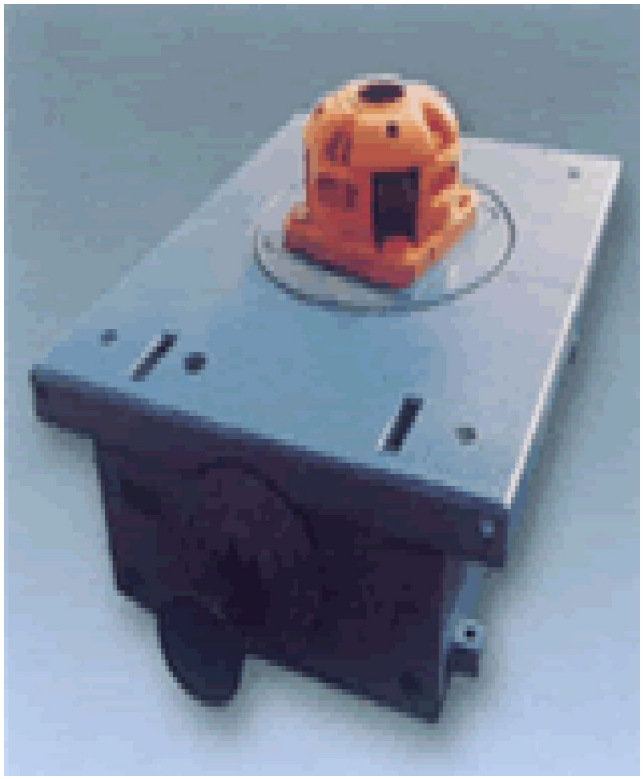
(a) Arrangement and nomenclature of block and tackle.

Rotating System

The main objectives of this system is to create rotation force towards drill bit at the bottom hole and provide helps when tightening and loosing pipe connection.

1. Rotary table
2. Top Drive (this is equivalent to the Kelly and rotary table, i.e. either top drive or Kelly/rotary table
3. Kelly
4. Swivel
5. Rotary hose

Rotary table



The Kelly/Top Drive

The Kelly/ top drive provide the rotation required for rock breakage (drilling). The Kelly is the rotating link between the rotary table and the drill string.

Swivel

- Swivel That part of the drill sting which connects the rotary hose to the drill string and allows circulation and rotation at the same time.

Top drive

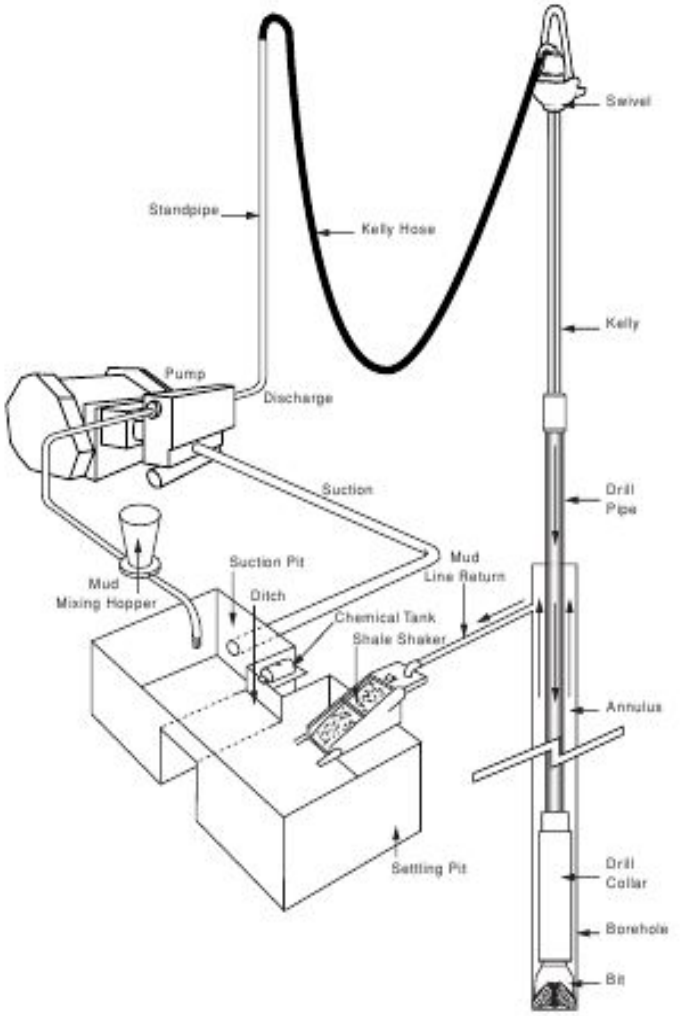
What is it? – Watch the video…

The top drive is basically a combined rotary table and Kelly. It is powered by a separate motor and transmits rotation to the drill string directly without the need for a rotary table.

Circulating System

The main objective of circulation system is to pump fluid through the whole active fluid system. The complete circuitous path that the drilling fluid travels starting at the:

- main rig pumps
- surface piping
- standpipe
- kelly hose (rotary)
- kelly
- drillpipe
- drill collars
- bit nozzles
- openhole and casing strings
- flowline
- mud-cleaning equipment
- mud tanks
- positive displacement main rig pumps



Functions of Drilling Fluids:

- Lift-up cuttings
- To cover the underground pressure
- To restrain the well bore
- To create mud cake and prevent filtrate loss
- To lubricate drill bit and drill string
- Down hole information gathering media and well logging
- To transfer hydraulic force to downhole motor

Circulating System

The principal components of the rig circulating system include:

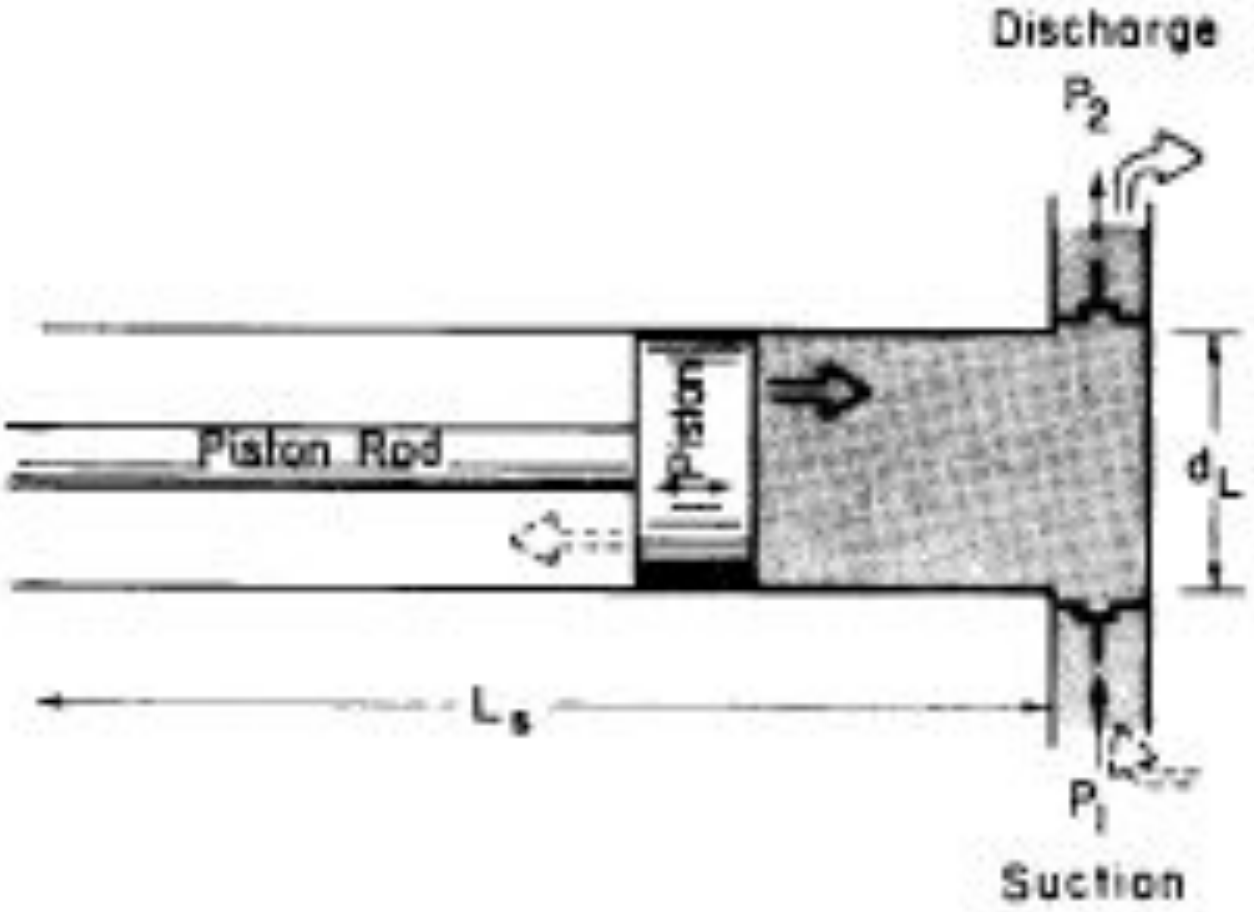
1) Mud pumps
2) Mud pits
3) Mud mixing equipment
4) Solids control equipment

Mud pumps

Mud pumps

- Mud pumps are used for circulating the drilling fluid down the drill pipe and out of the annulus. These are high-pressure and high-volume pumps. They can be double-acting duplex pumps or single-acting triplex pumps.
- A. The double-acting duplex pump has four pumping actions per pump cycle.
- B. The single-acting triplex pump has three pumping actions per pump cycle.

Mud Piston - Liner



Flow line and Solids control equipment

Mud pits and Solids control equipment

Mud mixing hopper

Waste pit

Tubular Goods

The components of the drill string are:

1. Drill pipe
2. Drill collars
2. Accessories including:
   - Heavy-walled drill pipe
   - Stabilizers
   - Reamers
   - Directional control equipment

Drill pipe

Drill collars

- It function to furnish the compressive load on bit.
- Keeps the drill pipes remain in tension.

STABILIZERS

Spiral Integral Blade Stabilizer

Straight Integral Blade Stabilizer

Non-Magnet Integral Blade Stabilizer

Pressure Control Equipment

Pressure Control Equipment

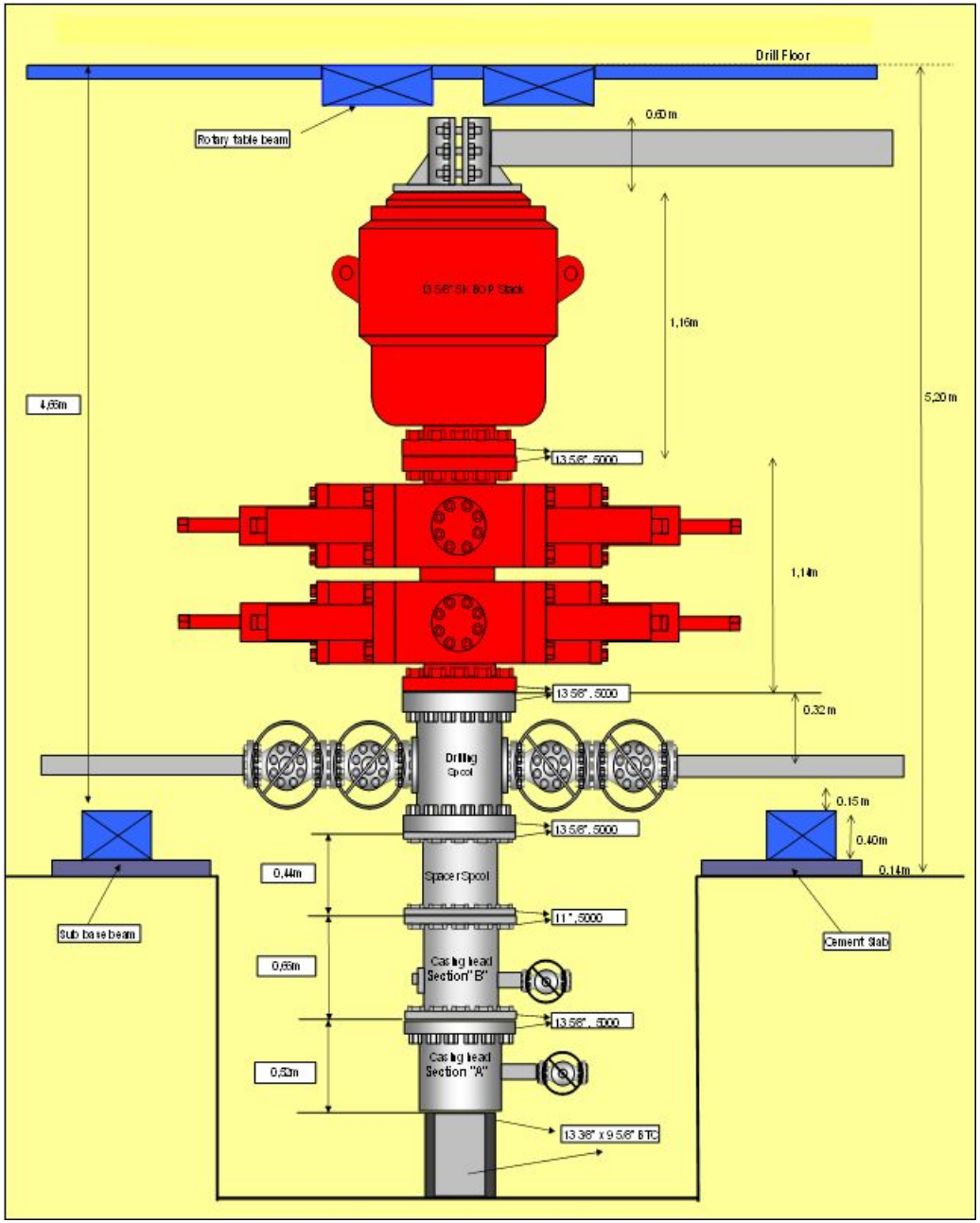
1. Diverter if required, usually for offshore operations during the drilling of top or surface hole. Make sure the

diverter discharge line is 12” or above.

2. Annular preventer
3. Ram preventers (determine minimum size of rams

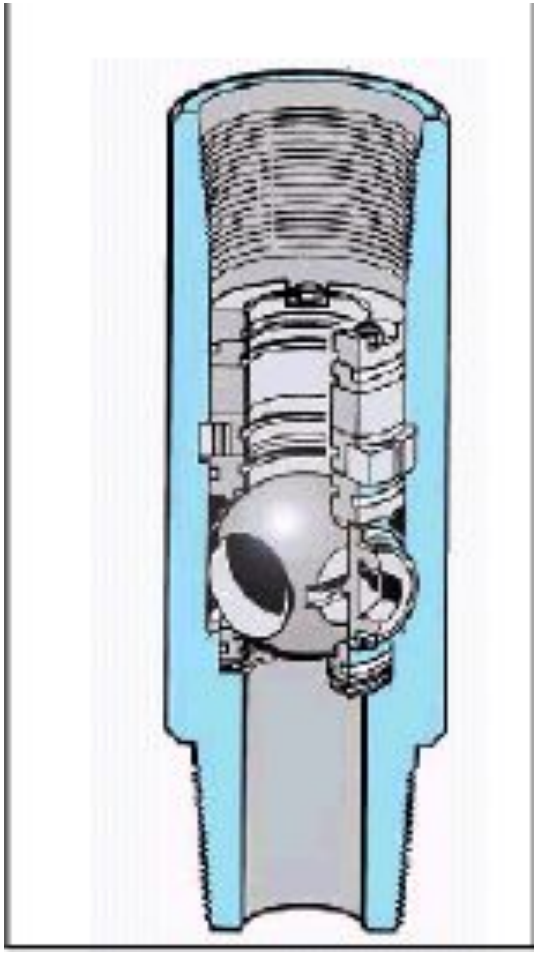
required to suit the drillstring)

4. Blind or Shear rams
5. Choke manifold
6. HCR valves
7. Choke and Kill lines
8. Accumulator and BOP Control System (Koomey Unit)


Drill Floor
Rotary table beam
0.60m
13 5/8" 5K BOP Stack
1,16m
4,65m
5,20 m
13 5/8", 5000
1,14m
13 5/8", 5000
0.32 m
Drilling Spool
0.15 m
0.40m
0,14m
13 5/8", 5000
0,44m
Spacer Spool
11", 5000
Casing head Section "B"
0,65m
13 5/8", 5000
Casing head Section "A"
0,52m
13 3/8" x 9 5/8" BTC
Sub base beam
Cement Slab

Choke line

Drill pipe blowout preventer



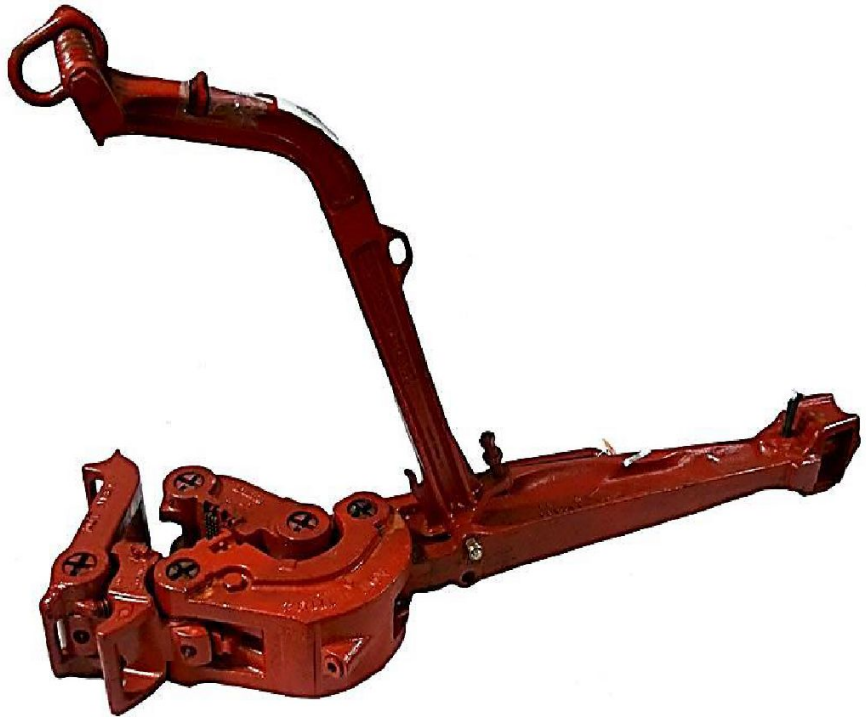
Rig Floor Equipment and Instruments

This is a large list and includes:

1. Tongs
2. Iron Roughneck
3. Slips
4. Bit breakers
5. Lift Nipples
6. Mud bucket
7. Elevators
8. Safety clamps

Tongs

- Tongs-Large wrench-like devices that are used to tighten up and break out tool joints or connections. The tongs are connected to the breakout and make up catheads. Hydraulic tongs are generally used to make up casing and tubing, deriving power from a hydraulic unit.



Slips

- Slips-Latch around the drill pipe and seat in the rotary bushing in the rotary table. The slips support and transmit the weight of the drill string to the rotary table while making a connection or tripping pipe.

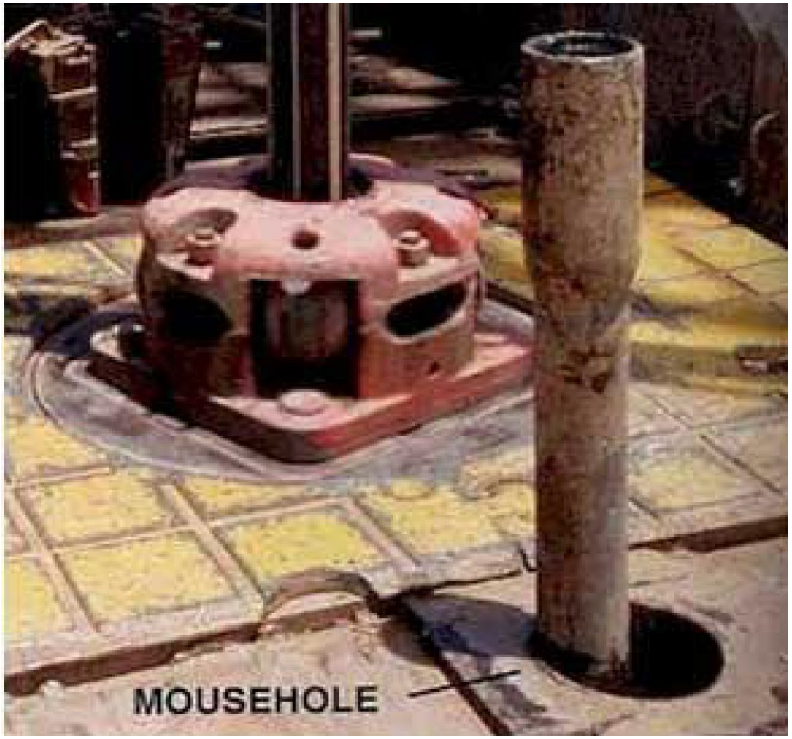
Elevators

- Elevators-The elevators are used for latching on to the **tool joint or lift sub of the drill pipe or drill collars.This enables the lifting and lowering of the drill string while making a trip.** The elevators are connected to the hoisting system(traveling block) by means of bails.

Rat Hole

- Rat Hole-The steel casing extending below the rig floor where the **Kelly and swivel** are stored while tripping

- Mouse Hole-A section of steel casing that extends below the rig floor where **drill pipe** is placed to be made up in the drill string or to the Kelly. It is further used in laying down drill pipe.



Monkey board

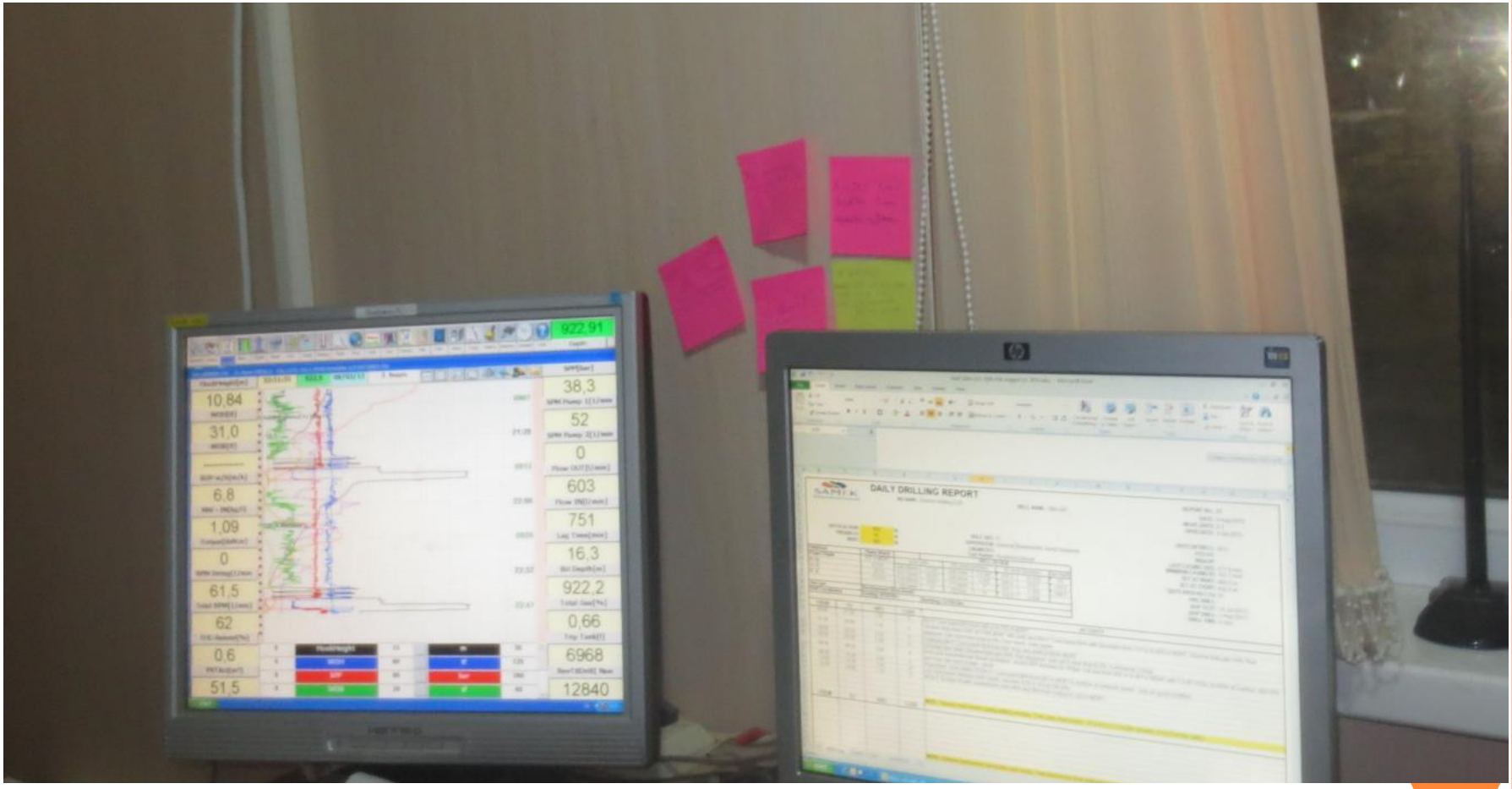
- Monkey board-(Stabbing board) The platform on which the derrick man works when tripping pipe.

Instruments

There are several instruments on the rig floor including:

- Standpipe pressure gauge
- Weight indicator
- Pump speed
- Pit level indicator
- Gas detectors

Instruments



Instruments

What is this?

Power system

The prime movers in a rotary drilling rig are those pieces of equipment that provide the power to the entire rig.

Recently, while diesel engines still compose the majority of power sources on rotary rigs, other types of engines are also in use.

Power system

Some rotary rigs may use electricity directly from power lines. Most rotary rigs these days require 1,000 to 3,000 horsepower, while shallow drilling rigs may require as little as 500 horsepower.

The energy from these prime movers is used to power the rotary equipment, the hoisting equipment, and the circulating equipment.

Thank you a lot for listening to my talk!