DRILLING SERVICES

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Abstract-To understand all about Drilling Services in Oil and Natural Gas Corporation. Covering all aspects of Drilling Technologies which are currently being use. Detail information about currently in use conventional methods, description about maintenance of it. Compact and useful engineering technologies for Oil & Gas manufacturers & drillers. Important information about drill sight and technologies. Production technologies of crude oil.

Keywords- Oil & Gas, Mechanical Engineering, Drilling technologies, Natural gas, Petroleum, Industrial, Electrical, Maintenance.

INTRODUCTION OF ONGC

- Oil and Natural Gas Corporation Limited (ONGC) is an Indian multinational oil and gas company headquartered in Dehradun,Uttarakhand, In dia. It is a Public Sector Undertaking (PSU) of the Government of India, under the administrative control of the Ministry of Petroleum and Natural Gas. It is India's largest oil and gas exploration and production company. It produces around 69% of India's crude oil (equivalent to around 30% of the country's total demand) and around 62% of its natural gas.

- ONGC was founded on 14 August 1956 by Government of India, which currently holds a 68.94% equity stake. It is involved in exploring for and exploiting hydrocarbons in 26 sedimentary basins of India, and owns and operates over 11,000 kilometres of pipelines in the country. Its international subsidiary ONGC Videsh currently has projects in 17 countries. ONGC has discovered 6 of the 7 commercially producing Indian Basins, in the last 50 years, adding over 7.1 billion tonnes of In-place Oil & Gas volume of hydrocarbons in Indian basins. Against a global decline of production from matured fields, ONGC has maintained production from its brownfields like Mumbai High, with the help of aggressive investments in various IOR (Improved Oil Recovery) and EOR (Enhanced Oil Recovery) schemes. ONGC has many matured fields with a current recovery factor of 25–33%. Its Reserve Replacement Ratio for between 2005 and 2013 has been more than one. During FY 2012–13, ONGC had to share the highest ever under-recovery of INR 494.2 million

(an increase of INR 49.6 million over the previous financial year) towards the under-recoveries of Oil Marketing Companies (IOC, BPCL and HPCL).

- OPERATIONS:

ONGC's operations include conventional exploration and production, refining and progressive development of alternate energy sources like coal-bed methane and shale gas. The company's domestic operations are structured around 11 assets (predominantly oil and gas producing properties), 7 basins (exploratory properties), 2 plants (at Hazira and Uran) and services (for necessary inputs and support such as drilling, geo-physical, logging and well services).

- VISION:

To be global leader in integrated energy business through sustainable growth, knowledge excellence and exemplary governance practices.

- MISSION:

World Class

- Dedicated to excellence by leveraging competitive advantages in R&D and technology with involved people.
- Imbibe high standards of business ethics and organizational values.
- Abiding commitment to safety, health and environment to enrich quality of community life.
- Foster a culture of trust, openness and mutual concern to make working a stimulating and challenging experience for our people.
- Strive for customer delight through quality products and services.

Integrated In Energy Business

- Focus on domestic and international oil and gas exploration and production business opportunities.
- Provide value linkages in other sectors of energy business.
- Create growth opportunities and maximize shareholder value.

Dominant Indian Leadership

- Retain dominant position in Indian petroleum sector and enhance India's energy availability.

FIELD MAINTENANCE

(MECHANICAL)

In Field Maintenance department maintenance of all machine parts which are used for drilling, cementing, etc. has been carried out.

Purpose of Maintenance:

- To maintain
- Keep in existing condition
- Preserve, protect
- Keep from failure or decline

FUNCTION OF FIELD MAINTENANCE DEPT:

- If any problem arises during working on RIG or Drilling and if field technician are unable to solve the problem then technician working on RIG will ask for solution to the FIELD MAINTENANCE Dept.
- FIELD MAINTENANCE Dept. will go for temporary and quick solution.
- In case of FIELD MAINTENANCE are unable to handle the problem then the faulty parts will go for its solution to the Workshop or to the Central Workshop for permanent solution.

LIST OF PARTS SHOWN DURING VISIT TO THE F.M. Dept.:

Rotary Table

Crown Block

Hook

Travelling Block

Kelly Spinner

Tong

Elevators

Mud Swivel

Draw Works

Torque Convertor/Gear Box

Single Acting Triplex Mud Pump

Drill Bit

Mud Tanks

FIELD MAINTENANCE

(ELECTRICAL)

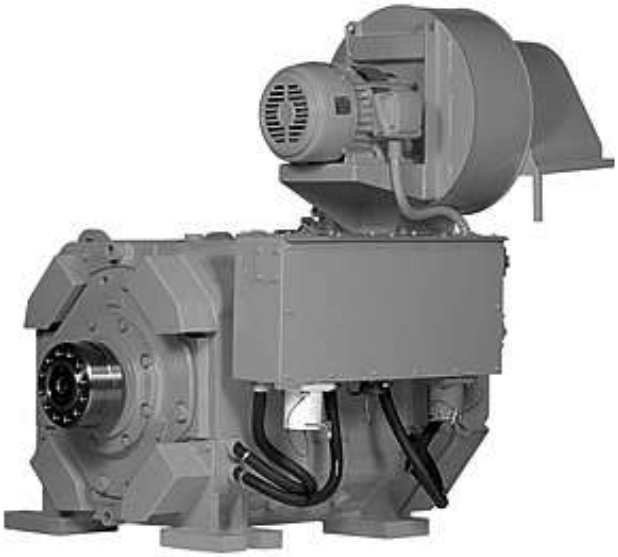
FUNCTION OF FIELD MAINTENANCE (ELEC.) Dept.:

- If problem arises in any electrical components, then Field Maintenance will work for it.
- If any problem arises during working on RIG or Drilling and if field technician are unable to solve the problem then technician working on RIG will ask for solution to the FIELD MAINTENANCE Dept.
- FIELD MAINTENANCE Dept. will go for temporary and quick solution.
- In case of FIELD MAINTENANCE are unable to handle the problem then the faulty parts will go for its solution to the Workshop or to the Central Workshop for permanent solution.
- All types tested in electrical connections are carried out, checked in calibrations here.it consists of different types of measuring instrument like ammeter, voltmeter and ohmmeter.

AC GENERATOR:

MANUFACTURE BY: Stamford (Alternator)
VOLTS: 415 V
AMPS: 765.2 A
KVA: 550
RPM: 1500
AMBIENT TEMP: 40^0 C

EXCITATION VOLTS: 48 V
EXCITATION AMP: 2.3 A



DC MOTOR

AC MOTOR

- EQUIPMENT UNDER MAINTENANCE DURING VISIT:

I. ECD, No-6859975, ONE CALL(I_7-I_8) Earthiest
Sent to Baroda Running HRS: 1654 hour

II. 380 KVA DC SET(Jeevan)-CWS Baroda
MANUFACTURER: Crompton Greaves

III. 1430KVA Alternator No.-4612070
MANUFACTURER: BHEL, BHOPAL.

CEMENTING SERVICES

- Cementing an oil or gas well comprises the displacement of cement slurry down the drill string, tubing or casing to a pre-defined section of annulus of the well. The cement slurry itself typically contains water, Portland cement, various additives.

PURPOSE OF CEMENTING:

Casing that is cemented in place, aids the drilling process in several ways:

- Prevent contamination of fresh water well zones.
- Prevent unstable upper formations from caving in and sticking the drill string or forming large caverns.
- Provides a strong upper foundation to use high-density drilling fluid to continue drilling deeper.
- Isolates different zones, which may have different pressures or fluids - known as zonal isolation, in the drilled formations from one another.
- Seals off high pressure zones from the surface, avoiding potential for a blowout
- Prevents fluid loss into or contamination of production zones.
- Provides a smooth internal bore for installing production equipment.

- Oil Rig Casing:

A slightly different metal string, called production tubing, is often used without cement in the smallest casing of a well completion to contain production and convey them to the surface from an underground reservoir.

DIFFERENT METHOD OF PLACEMENT OF CEMENT SLURRY:

I. Primary cementing
II. Liner cementing
III. Squeeze cementing
IV. Plug back cementing

FUNCTION OF CEMENTING:

1. Isolate a hydrocarbon bearing formation from other formations.
2. Protect and secure the casing in the well.
3. Prevent caving of the hole.
4. Provide a firm seal and anchor for the wellhead equipment.
5. Protect casing from corrosion by sulphate rich formation waters.

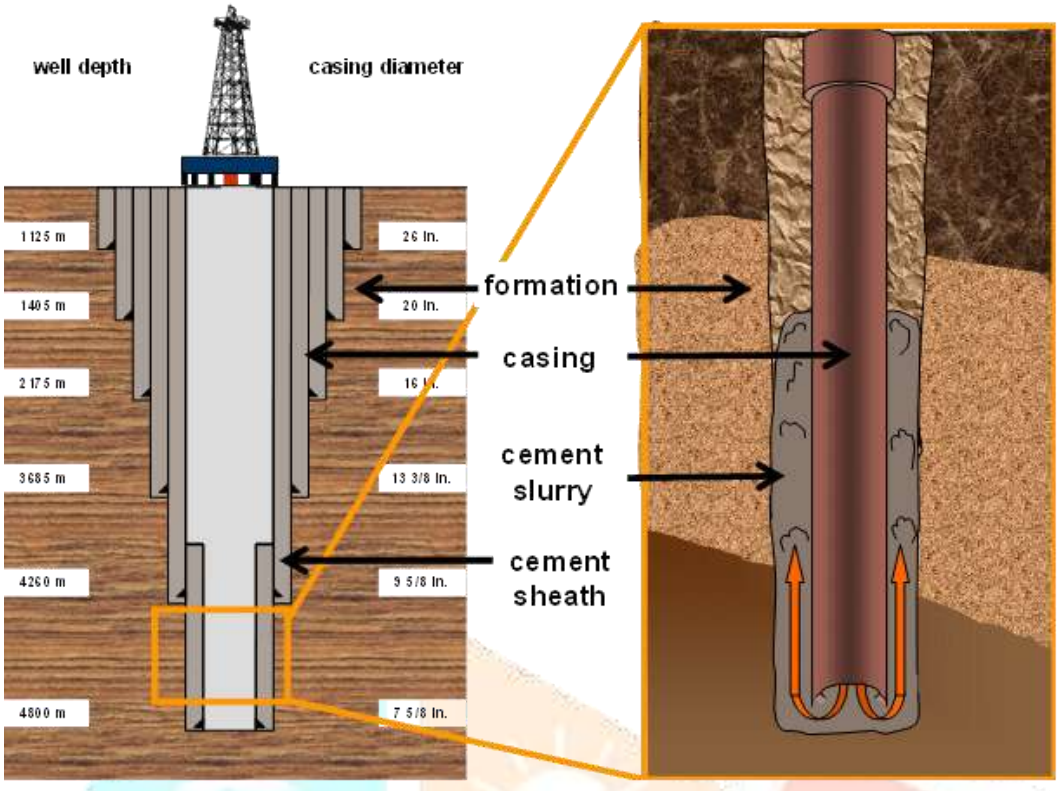
There are different grades of cement from grade A to grade H which are used depending on formation strength and depth.

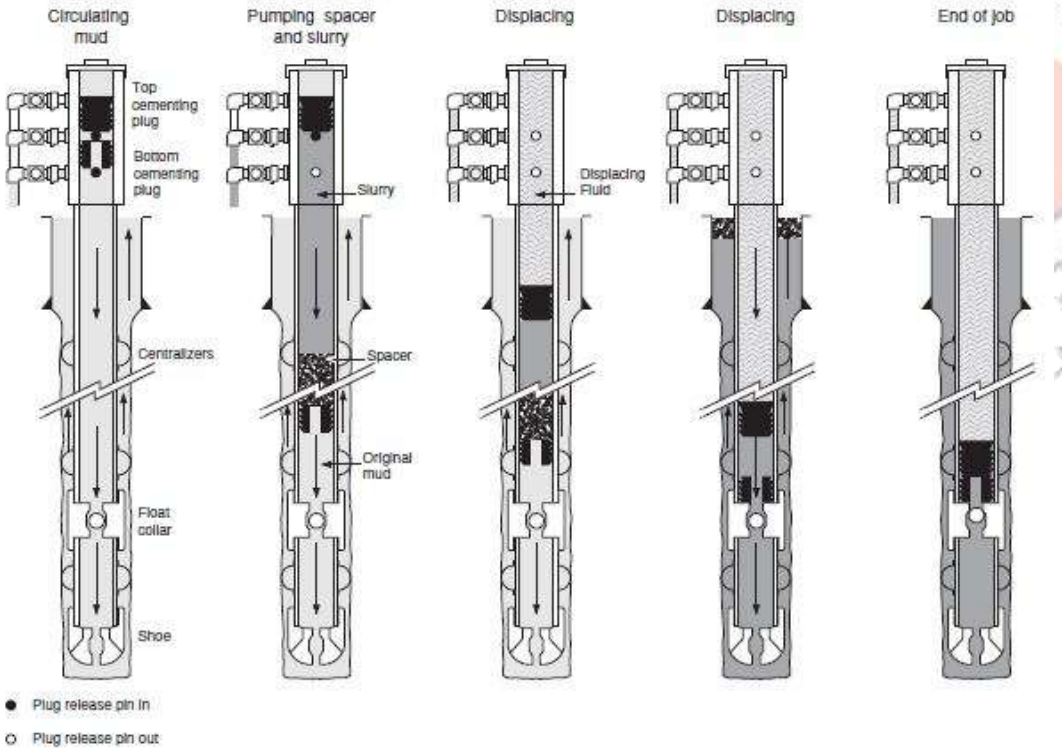
Cementing a casing:

At the well, the cementing team mixes the dry cement with water to form slurry-a thin, watery mixture that is easy to pump. Many kinds of mixers are available to blend the water and cement into uniform mixture as the cement pumps move it down the casing. Special high-pressure pumps move the slurry through very strong pipes, or lines, to a cementing head, or plug container. The cementing head is mounted on the topmost joint of casing hanging in the mast or derrick. Just before the slurry arrives at the head, a crew member releases a rubber plug, a bottom plug, from the cementing head. The bottom plug separates the cement slurry from any drilling fluid inside the casing and prevents the mud from contaminating the cement. The slurry moves the bottom plug down the casing. The plug stops, or seats, in the float collar.

Continued pumping break a membrane on the bottom plug and opens a passage. Slurry then goes through the bottom plug and continues down the last few joints of casing. It flows through an opening in the guide shoe and up the annular space between the casing and the hole. Pumping continues until the slurry fills the annular space.

As the last cement slurry enters the casing, a crew member releases a topping from the cementing head. A top plug is like a bottom plug except that it has no membrane or passage. The top plug separates the last of the cement to go into the casing from displacement fluid. Displacement fluid, which is usually salt water or a specially formulated drilling mud, moves, or displaces, the cement from the casing as the cement pump applies pressure to move the cement and fluid down the casing. Continued pumping moves the cement, the top plug, and the displacement fluid down the casing. Most of the cement slurry flows out of the casing and into the annular space. Soon, the top plug seats on, or bumps, the bottom plug in the float collar. When it bumps, the pump operator shuts down the pumps. Cement is only in the casing below the float collar and in the annular space. Most of the casing is full of displacement fluid.





After the cementing team pumps the cement and removes its equipment, the operator and drilling contractor wait a specified time for the cement to harden. This period is referred to as "waiting on cement" or simply WOC. WOC can vary from a few hours to several, depending on the cement formulation, well temperature, and other factors.

After the cement hardens, the team usually runs tests to ensure that the cement job is satisfactory. If it is, then crewmembers can get back to drilling. If it is not, the team uses special remedial procedures to alleviate the problem. Remedial cementing involves

determining the depth of the problem and then,by using special equipment, placing cement at that that depth to rectify it.

Squeeze cementing operation:

In this operation tubing is set at a particular depth where the cementing operation is to be done. Following set of steps are then followed:

1. Circulation operation is made for determining how much column of water and cement is required.
2. Pre flush operation is performed.
3. Pumps cement slurry.
4. After flush is performed.
5. Mud displacement is done.(usually underbalance)
6. Tubing is finally pulled out.

Application of squeeze cementing operation:

1. Casing shoe
2. Liner top/overlap
3. Perforation
4. Plug a producing zone or section a zone
5. Seal lost circulation problem

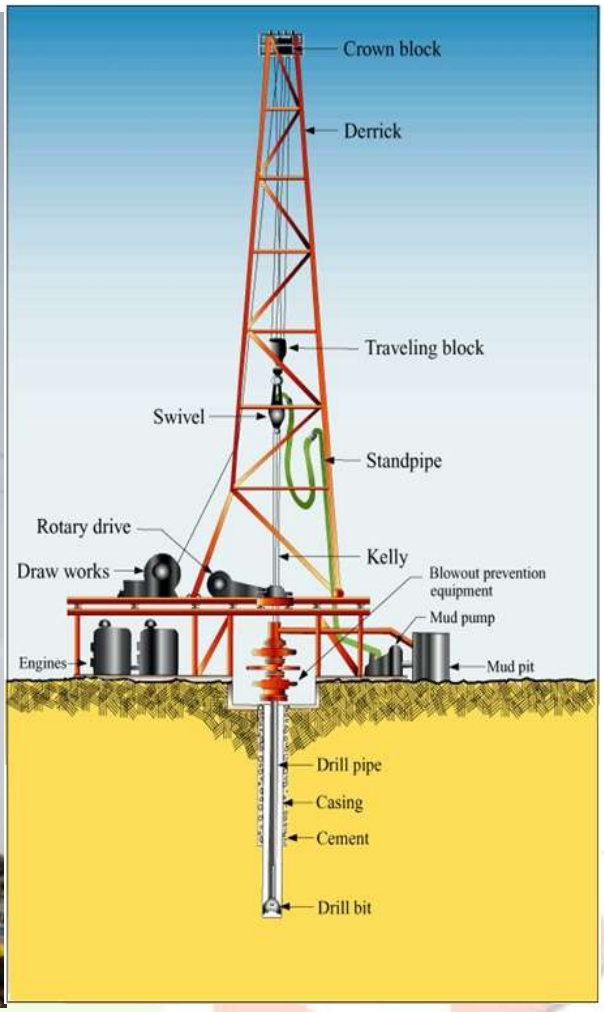
Different units seen at cementing services:

1. SNS (Stewart and Starvation)
2. TIL (Tractor India Limited)
3. BPCL (Bharat Pumps & Compressor Limited)

Different equipment seen at cementing services:

1. Cementing head
2. Bottom plug
3. Top plug
4. jet

RIG CW-7-IPS-700-M-CW-VI



M- Mechanical RIG

700- 700HP of Draw works rating

VII- It is the 7th rig of its type

FIELD: Nandasan

TYPE OF THE RIG: Mobile

TYPE OF THE WELL: Development

ORIENTATION: Inclined

TYPE OF DRILLING: Directional

PROJECTED DEPTH: 1635m (MD), 1580m (TVD)

KICK OFF POINT: 480m

MAX. ANGLE: 19.46^{O} at 771.9m MD

DIRECTION: 273.29^{O}

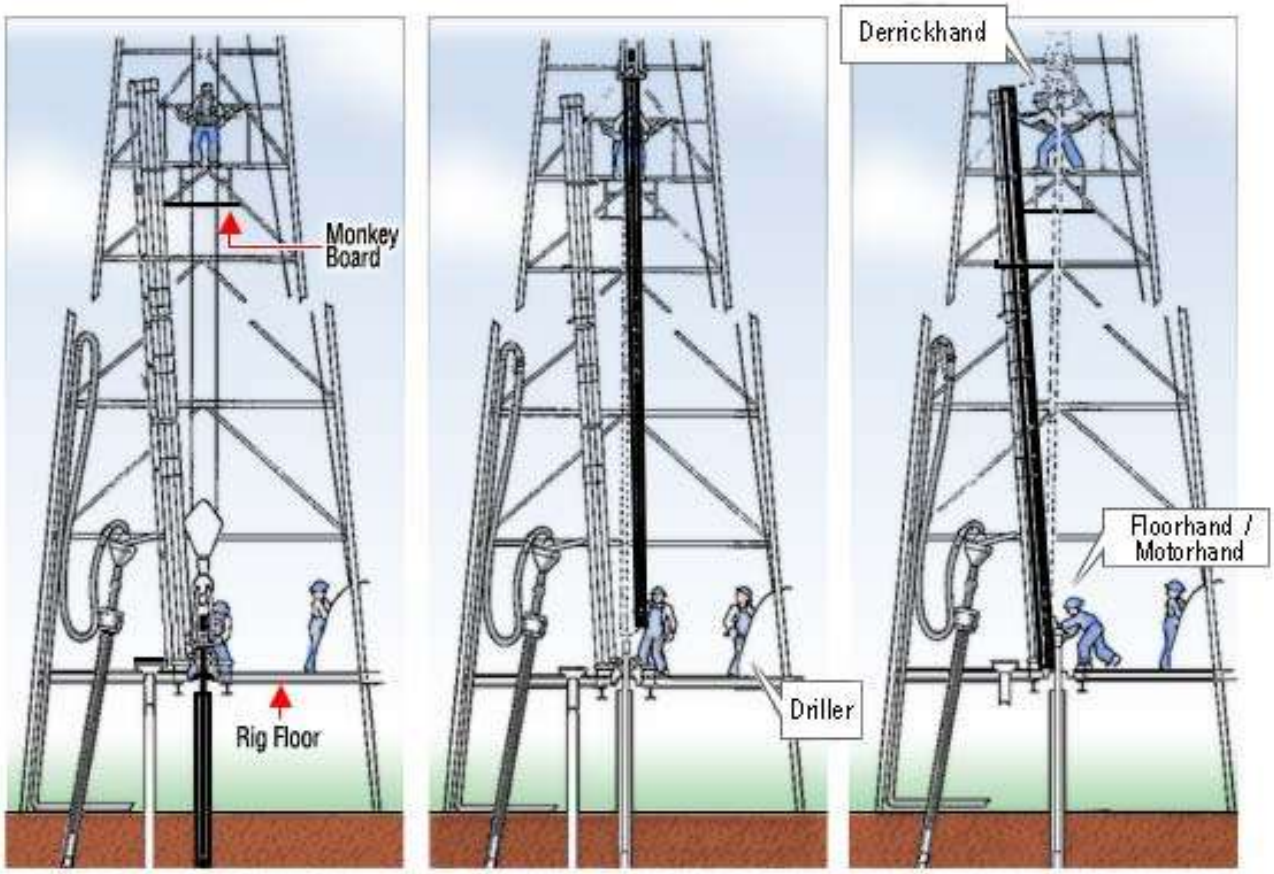
CATEGORY OF THE WELL: O.P.

TECHNICAL SPECIFICATION:

NAME OF RIG	IPS-700-M-CW-VII
TYPE OF RIG	MECHANICAL
DRAWWORKS	MECHANICAL
POWER TO DRAWWORKS	KV-700
SLUSH PUMP	PZJ-TRIPLEX (9)
POWER TO SLUSH PUMP	MECHANICAL
WELL HEAD SET	2CP 5M(9 5/8 " x 5 1/2 ")
TYPE OF B.O.P.	RAM+ANNULAR
MUD PUMP 1 & 2	GARDNER DENVER :-PZ9 1000 STROKE LENGTH :- 9" PISTON SIZE :-7" OR 6.5"
ROTARY TABLE	GARDNER DENVER 27.5"
HOOK	NATIONAL 200 T
GEN SET- I	JEEVAN DG 380KVA
GEN SET- II	JACKSON 500KVA
GENSET-III	CUMMINS 380KVA

OPERATION DURING VISIT:

- TRIPPING OPERATION:
  - 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.



Removing one stand of drill string

➢ **Tripping Out**

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

➢ **Tripping In**

- Elevators raised
- Tripping In -- 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

RIG CW-5-IPS-700-M-CW-V

The IPS-700-M-CW-V RIG, manufactured by American company CARDWELL.This rig was purchased by ONGC in 1989 at Ankleshwar and it is servicing at Mehsana since 1985.It provided a great deal of service to ONGC from a very long time.

M- Mechanical RIG

700- 700HP of Draw works rating

V- It is the 5th rig of its type

FIELD: NORTH KADI

TYPE OF THE RIG: Mobile

TYPE OF THE WELL: Development

ORIENTATION: Inclined

TYPE OF DRILLING: Directional

PROJECTED DEPTH: 1568m

TECHNICAL SPECIFICATION:

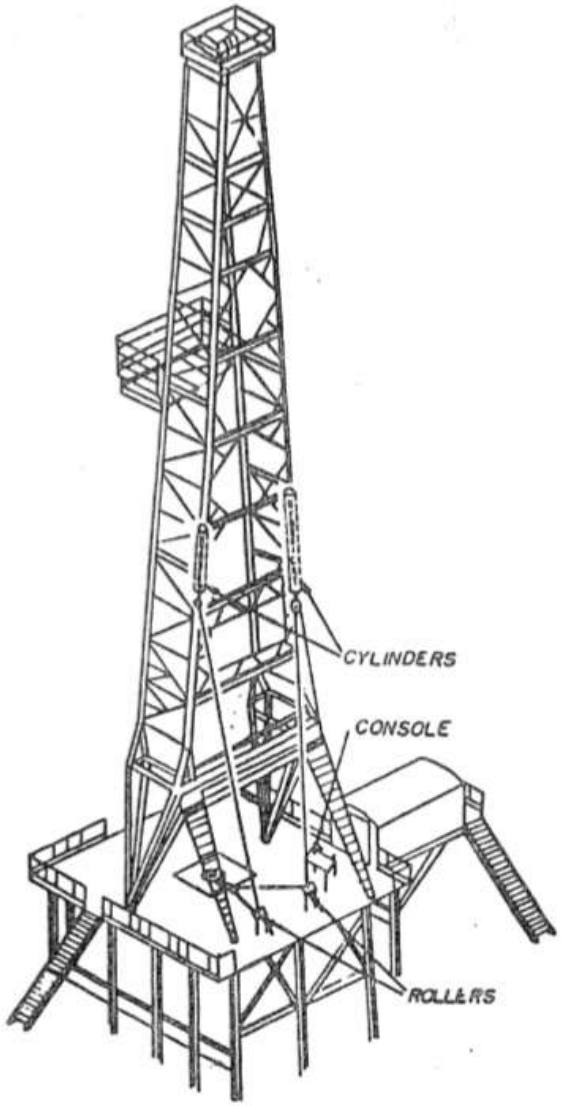
TYPE	MOBILE
DRAW WORKS	700HP
WIRE ROPE(CASING LINE)	11/8" (29 mm)
MUD PUMP 1 & 2	GARDNER DENVER :-PZ9 1000 STROKE LENGTH :- 9" PISTON SIZE :-7" OR 6.5"
ROTARY TABLE	GARDNER DENVER 27.5"
HOOK	NATIONAL 200 T
GEN SET- I	CATERPILLAR 550KVA
GEN SET- II	CUMMINS / SUDHIR 550KVA
GENSET-III	CUMMINS 380KVA
AIR WINCH	INGERSOLL RAND
CALLIE SPINNER	ITC / ACCESS 53/8" REG
PIPE SPINNER	SPIN MASTER HAWK
MECHANICAL COMPRESSOR	KHOSLA
ELECTRICAL COMPRESSOR – I	KIRLOSKAR ELECTRIC
ELECTRICAL COMPRESSOR-II	CHICAGO PNEUMATIC
HOOK LOAD CAPACITY	204 T
CYCLE SPEED	1594M/RM-AVG IN LAST TWO YEARS

IPS 700-M-V AT A GLANCE

Sr No.	ITEM	DESCRIPTION
1	BRIEF SPECIFICATION	IPS-700-M-CW-V. MAST 18'x118'
2	TOTAL METERAGE	35265m IN ANKLESHWAR, 2,92,638m IN MEHSANA UPTO LAST WELL #JNHD
3	TOTAL NO OF WELLS DRILLED	23 IN ANK. , 170 IN MEHSANA

4	MAJOR MODIFICATIONS	CAPITAL OVERHAULING 11/08/1999 to 22/12/1999 & 21/01/2008 to 28/01/2009
5	ACHIEVEMENTS	154% OF PLANNED METERAGE IN 2007-08
6	DOWNTIME	2012-13: REPAIR-176.53 HRS, SHUTDOWN-59.43 HRS 2013-14: REPAIR-203.07 HRS, SHUTDOWN-5.31 HRS 2014-15: REPAIR-115.73HRS SHUTDOWN-0.00 HRS (UPTO DEC-2014)

- MAST&SUB-STRUCTURE :



It consists of static hook load capacity 550000lbs. required accessories racking platform, crown block, ladder, mast raising lowering sling lines, pulleys etc. are provided.

Swing life self-elevating substructure to be raised by draw works power. Floor heights 25 feet or 18 feet.

- WATER SYSTEM:

  Consists of two tanks with open tops having total capacity of approx. 150 m^3.

- MUD SYSTEM :

  Five tank mud systems can be describe as below:

  - One shaker tank
  - One settling tank

- One suction tank
- Two reserve tanks
- Numbers of tanks& mud capacity can be changed on requirements.
- Mud system consists of mud mixing system, mud cleaning and agitating equipment.

RIG Accessories consists of:

1. Dog house
2. Pipe racks
3. Cat walks
4. Monkey stand
5. Rat hole

- CASING SIZE :

HOLE DIA.	CASING DIA.
17 1/2 ”	13 3/8 ”
12 1/4 ”	9 5/8 ”
8 1/2 ”	5 1/2 ”

OPERATION DURING VISIT:

Well had been drilled up till its last casing and casing had been set and cemented.

Mud Logging Section:

Mud logging unit has a task collect more information about the well. Firstly, they monitor various aspects of the drill sensors like RPM, ROP,and WOB etc. string through. If any abrupt changed in the values occurs, they take the counter action. The unit is also responsible for VSP test, to know about the formations underlying. Every 5mtrs drilled the drill cutting sample is brought to the lab for testing. They test the properties of the formations and observations are noted. The samples are preserved for further requirements.

ASSET WORKSHOP

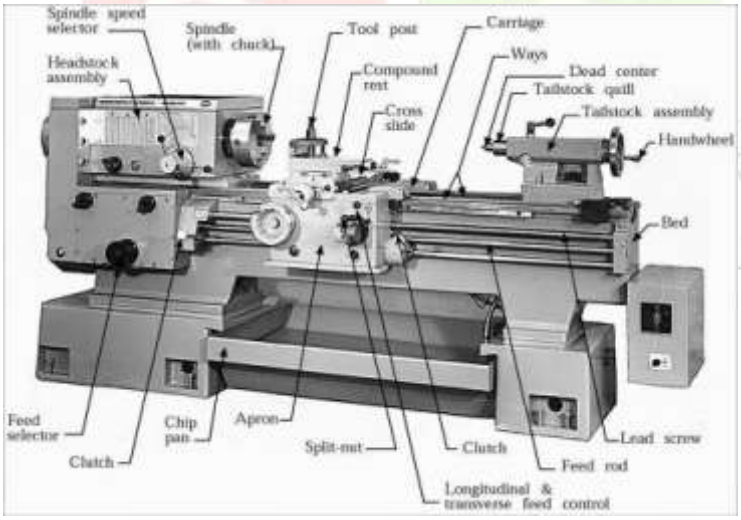
(MECHANICAL)

ONGC Workshop (Mechanical) consists of four shops. They are Machine Shop, Diesel Shop, Fabrication Shop and Assembly Shop. It mainly does the repairing work of the machines. A brief description about the different shops is given below:

- MACHINE SHOP:

- The machine shop does the different machine operations such as turning, drilling, threading, knurling, boring, facing, tapper turning, grinding, milling, broaching, reaming, shapering, etc.
- It consists of machines like drilling machine, lathe machine, shaper machine, etc.
- In this shop as per the job details, jobs are made on the machine as per given sample.

  - LATHE MACHINE:



  - LB-17 LATHE:

	MFG. BY: HMT MODEL: LB 17 BED LENGTH: 6.5 feet CENTRE HEIGHT:170 mm SWING OVER THE BED: 340mm

- H-22 8’ LATHE:

	MFG. BY: HMT MODEL: H22 BED LENGTH: 8 feet CENTRE HEIGHT: 220 mm

- NH-26 LATHE:

Some other lathe machines are:

- LB-20 10’
- LB-17 8’

- NH-26 A/B
- LB-17 B

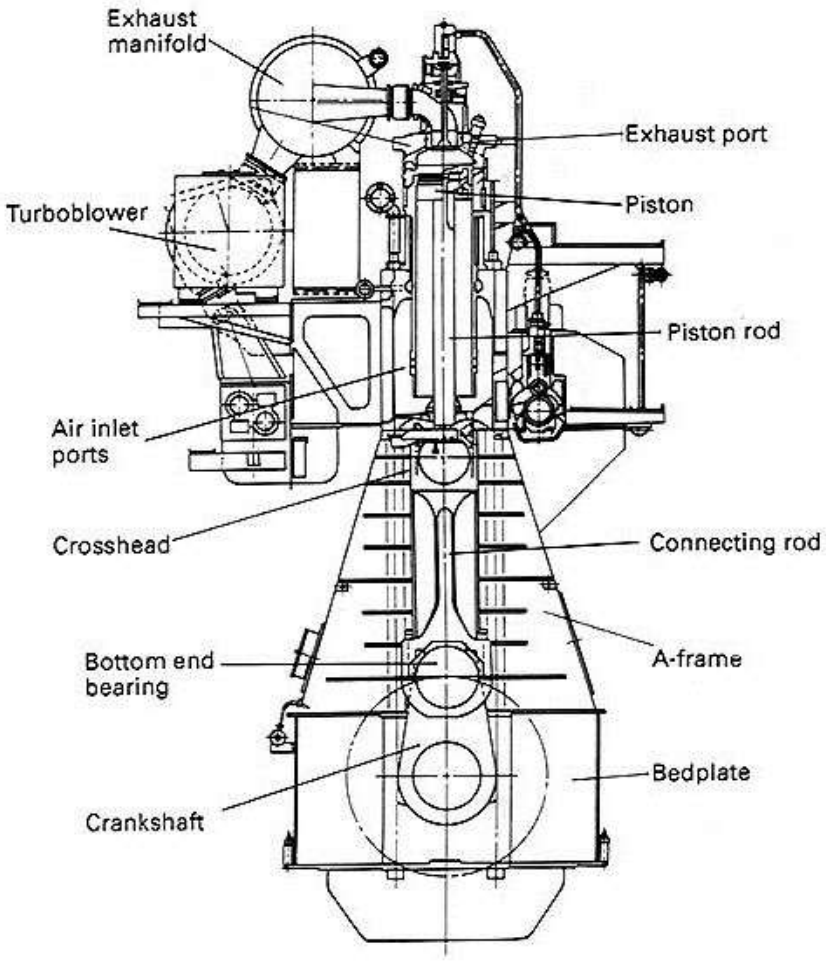
- DRILLING MACHINE:

- MILLING MACHINE:

➢ DIESEL SHOP:

- In this shop mainly maintenance of different engines are done but especially of diesel engine.
- In this shop testing, cleaning, maintenance and any problems that are encountered in engine are found out and then the engine is repaired accordingly by the skilful team.
- The engines available here are generally of four types compressor engine, generator engine and production engine, fire engine.
- Currently the engines seen are 6-cylinder (Cummins), 8-cylinder (Crompton).

- DIESEL MACHINE:



- N-743-T-F DIESEL ENGINE:

MAKE: Cummins N-743 series

#T: Shows turbo -charger compresses inlet air

#F: Shows it is used for Fire Pumps

- N-T-A-855-P:

	# T and A: represents the presence of a turbocharger and an after-cooler in this engine #P:shows its use in transmitting power t to a production drilling rig

SPECIFICATION OF 6 CYLINDER 4STROKE ENGINE:

- Manufacturer: Cummins
- No. of Cylinder: 6
- Use: used in mud pump also to drive alternators.
- Firing order: 1-5-3-6-2-4
- It is water cooled.

- MANUFACTURER: Crompton Greaves
- Engine no: 13060850228
- Model no: TBD3v8
- Use: used in A.C. generator
- Machine NO: GIR 225/43.12
- RPM: 1500&KVA:225
- Rating: 313(hp/kw)
- Firing order: 1-3-4-2

FIRING ORDER OF DIESEL ENGINE:

The firing order is the sequence of power deliver of each cylinder in a multi cylinder as below,

3 Cylinders: 1-3-2
4 Cylinders: 1-3-4-2
6 Cylinders: 1-5-3-6-2-4
8 Cylinders: 1-2-7-3-4-5-6-8

SOME ENGINE PARTS AT WORKSHOP:

Piston

Crankshaft

Camshaft

Fuel Injector

General problems in engine in diesel shop:

- Oil and Diesel leakage
- Vibration problem
- Problem engine consumption
- Engine misfiring
- Compression leakage

➢ ASSEMBLY SHOP:

- In assembly shop dismantling, repairing, and again assembling of the machines are done.
- Machines like compressor, plunger pump, mud swivel,etc. are repaired in this shop.

▪ HYDRAULIC PRESS:

The hydraulic press depends on Pascal's principle: the pressure throughout a closed system is constant. One part of the system is a piston acting as a pump, with modest mechanical force acting on a small cross-sectional area; the other part is a piston with a larger area which generates a correspondingly large mechanical force. Only small-diameter tubing (which more easily resists pressure) is needed if the pump is separated from the press cylinder.

- PUMPS:

Two types of pumps are mainly repaired at workshop:

- Reciprocating pumps

Rotary pumps

Some available Pumps at Workshops:

- Reciprocating plunger pump(Made by BPCL)
- Reciprocating piston type pump

➢ FABRICATION SHOP:

- In this shop welding of machine parts are carried out.
- Gas welding (oxy-acetylene welding), transformation arc welding and generator arc welding are the types of welding carried out here.

○ OXY-ACETYLINE:

- In oxy-fuel welding, a welding torch is used to weld metals. Welding metal results when two pieces are heated to a temperature that produces a shared pool of molten

metal. The molten pool is generally supplied with additional metal called filler. Filler material depends upon the metals to be welded.

- In oxy-fuel cutting, a torch is used to heat metal to its kindling temperature. A stream of oxygen is then trained on the metal, burning it into a metal oxide that flows out of the kerf as slag.

- ARC WELDING:

- Arc welding is a type of welding that uses a welding power supply to create an electric arc between an electrode and the base material to melt the metals at the welding point. They can use either direct (DC) or alternating (AC) current, and consumable or non-consumable electrodes. The welding region is usually protected by some type of shielding gas, vapour, or slag. Arc welding processes may be manual, semi-automatic, or fully automated.

Some important points from fabrication shop:

- Steel is difficult to cut by normal rods. So for chamfer rods are used.
- Minimum 180A current is used for these chamfer rods.
- For most metals forward polarity is used.
- The tip of the torch has to be kept slightly away from the job otherwise it will be ineffective.