SPECIFICATIONS OF 2000 HP VFD DRILLING RIG with TOP DRIVE (ITEM NO. 10)

SECTION 1: DRAW-WORKS

DRAW-WORKS

One (1) 2000 HP AC variable frequency drive (VFD) draw-works with under-noted features /specification:

The Single or Dual Speed Gear Driven approximately 500 Short Ton (454 MT) capacity, 2000 HP (1491 kW) rated draw-works with Single / Dual speed gear box mounted directly onto the drum shaft. The drum shaft to be mounted on spherical roller bearings bolted to the draw-works frame. The drum directly driven by the dual speed gear box. The motor shaft to be connected to the gear box input shaft using a gear tooth coupling to reduce the overall size & weight and to reduce down time for motor replacement. Shifting between high/low speeds under no load/no speed conditions using air powered shifting mechanism for Dual speed gear boxes. This feature to be integrated into the driller's Amphion or similar controls for the draw-works.

Primary/dynamic braking to be performed with AC motors by generating power into braking resistors. The motor and frequency drive should be capable of holding full load at zero speed. Load and speed is limited within motor capacity by the control system.

A pneumatically operated multi-plate disc brake system should be provided for parking and emergency situations, consisting of multi-plate air / water cooled discs with spring applied brake, static braking by springs expanding & forcing all the brake discs together (fail safe). The brake assembly is to be mounted to the end of the drum shaft & is secured to the drum support uprights. This multi-plate disc brake system should be operated remotely via the draw-works Amphion or similar control system. Emergency brake controls on the draw-works should allow the load to be manually lowered using the multi-plate disc brake system.

Specifications:

Input Rating	: 2,000 hp (1491 kW)
Number of Motors	: 2
Hoisting Capacity	: 480 Short Ton (435 MT or 960,000 lbs) with 12 Lines
Nominal depth rating	: 6096 M (20,000 ft) with 4.1/2" OD drill pipe of length range 30-31 ft.
Drum Grooving	: Lebus Type either for 1.3/8" or 1.1/2" wire line.
Auxiliary Brake	: 1 (Multi disc type brake system)
Disc Brake Cooling	: Air / water

AC CAGE INDUCTION MOTOR, MIN. 1100 HP, VFD

Two (2) 1100 HP (minimum) each AC cage VFD induction motors in accordance with the following:
AC induction motors, designed specifically to handle jobs with typically heavy loads for continuous draw-works oilfield drilling duty. High quality materials, heavy duty construction, state of the art design technology and ISO 9001 manufacturing standards ensuring reliable performance in the naturally hostile oil rig environment.

Features:

At continuous horsepower : 880 to 1400 RPM, Max Speed 3000RPM
Minimum 1100 HP continuous, 3pH, 600V, 1440 amps continuous
VF drive constant torque 0-880 RPM (9050 Ft. - lbs), 45ÚC Ambient
Class H VPI form wound
IP44 Enclosure
Approximately 7000 lbs
Two heavy duty anti-friction bearings, re-greaseable, insulated
Single shaft with hub
RTDs: 6 x PT100, 2 per phase in stator 2 x PT100, 1 bearing

Main terminal box IP56
Differential Pressure Switch
Space Heater
Mounting dimensions same as GEB 28
Blower Assembly 20 HP, 480/3/60 4200 CFM Minimum
Mounted Encoder, Avtron or similar

SECTION 2: MAST & SUBSTRUCTURE

MAST

One (1) "Swing lift" Cantilever Beam Leg Mast. Floor mounted cantilever open face mast, designed in accordance with latest API spec. 4F (PSL 1, SSL E2/U2). "Drilling and Well Servicing Structures". Mast should be designed to accommodate a 500 Short Ton (454 MT or 1,000,000 lbs.) capacity portable top drive system.

MAST & ACCESSORIES

1. Minimum 142 ft. (43.28 M) clear height x 30 ft. (9.14 M) base mast stem, single front leg, single pin connected, with raising sheaves and shafts, cat line sheave brackets, and tugger sheave bracket.
2. One (1) A-frame assembly consisting of one pair of front and rear A-frame legs with raising sheaves, mast drive pins, bolts & deadline anchor support mounted either on the mast leg or sub-structure basement or at any appropriate position on driller's side. Hydraulic snubbing system to be installed in 'A' frames allowing driller to have full control of "break-over" during the raising and lowering operation. The snubbing system should be complete with FLP electric motor driven hydraulic pumping unit & controls.
3. Full height straight ladder (complete with carrier rail, clamps, safety cage & two safety belts) with at least three rest platforms between drill floor & crown. The ladder lengths should be equal to Mast Sections for ease of transportation
4. Mast sections should be equipped with lifting eyes. Tested & certified.
5. Mast section should be so designed in order to meet the transportation dimensions as indicated in Section - 20 using heavy duty oilfield truck tractor / trailer.
6. Mast should be designed to operate in humid weather environment with relative humidity ranging from 50 – 100% & temperature range of 6° C to 41° C.

MAST SPECIFICATIONS

Mast clear height	: Not less than 142 ft. (43.28 M)
Base width	: Not less than 30 ft. (9.14 M)
Static Hook load Capacity	: With 12 lines strung on traveling block, min. 500 Short Ton (454 MT or 1,000,000 lbs.)
Maximum wind load Capacity	: 115 mph (185 Kmph) - no setback
Maximum wind load Capacity	: 100 mph (160 Kmph) - with rated setback

WINDLOADING SPECIFIED TO MEET API 4F SPECIFICATIONS AND DESIGN CRITERIA.
(Note: The raising of the mast should be possible with 10 lines.)

7. One (1) set of suitable capacity Leveling Equipment for Mast with shims, i.e. hydraulic jacks, hand pumps, hoses, gauges and connections. Bidder to indicate the capacity, make & model of offered jacks.
8. Two (2) single mast boom kit 2.5 Short Ton (2.27 MT or 5,000 lbs) capacity, around 6.1 M (20 ft.) long boom & complete with 203.2 mm (8 inch) snatch blocks, brackets and support line for mounting on both the rear mast leg.
9. One (1) set of mast raising lines with equalizer unit. (Draw-works & drill floor to be raised to drilling position by use of power from the draw-works & mast raising lines. Mast raising lines need only to be moved from 'A' frame sheaves to sheaves on drill floor elevators to complete rigging for erection.

10. One (1) 305 mm (12 inch) survey sheave unit, grooved .092" with tapered bearing mounted beneath crown frame at suitable place.
11. Two (2) 355.6 mm (14 inch) tugger (cat line) sheave unit, grooved 5/8" wire line and swivel mounted, with tapered roller bearings, swivel mounted beneath crown frame.
12. Clause deleted
13. One (1) 55 Short Ton (50 MT or 110,000 lbs) hanging pad eyes for hanging the traveling block & top drive.

    (Note: All pad eyes to be tested to one & half the S.W.L & certified according to API. All pad eyes to be painted safety yellow & marked with the SWL limit.)
14. One (1) block hanging line to hold traveling block when slipping drill line, approx. 108' long x 1-1/4" (33 M x 31.75 mm).
15. Four (4) sets of Dual Stand pipe Clamps for 127 mm (5 inch) diameter standpipe to be provided on off-Driller's side of Mast complete with clamp cups & bolts.
16. One (1) set of mast stands equipped with lifting pad eyes (one around 1.8 M (6 ft) high for supporting the mast during assembly & another around 4.9 M (16 ft) high for supporting the mast during assembly of racking board) & complete with wooden headrest.
17. Access platforms (fold up) with safety belt rope connecting loop to be provided at:

    a) Stand pipe gooseneck connection.
    b) Casing stabbing board.
    b) Sheave unit lubrication position.
    b) The platforms less handrails.
18. Pad eyes mounted in mast to accommodate:

    Two (2) – 10 Short Ton (9 MT or 20,000 Lbs) cat line sheaves
    One (1) – 10 Short Ton (9 MT or 20,000 Lbs) core line unit
    One (1) – 55 Short Ton (50 MT or 110,000 Lbs) hang-off line for traveling block

RACKING PLATFORM

Heavy duty Racking Platform with a Capacity for racking at least 220 stands (in thribbles) of 5" O.D. drill pipe of Range–II and 8 stands (in thribbles) of 8" drill collar and 4 stands of 9 ½" / 10" drill collar. The length of each single will be in the range 9.14 M to 9.44 M (30 ft to 31 ft) & hence the thribbles length will be 27.43 M to 28.35 M (90 ft to 93 ft).

- It should be side racking type with adjustable & foldable centre diving board with hinged extension.
- Adjustable from 25 M to 26.5 M (82 ft to 87 ft) above drill floor level complete & complete with safety chains on all fingers and expanded metal 2' wide walkways on three sides.
- Fold up floor slab on the fingers on the driller's side (initially the pipes will be racked in fingers on off-driller's side till it is full, during this time the fingers on driller's side will remain covered with foldable floor slab for safety reasons).
- Racking board access platform with at least 1 M (3'-6") high Handrails & toe plate on three sides.
- Geronimo escape line system with easy and safe access.
- One (1) Sure-Lock retractable lifeline complete with ground brackets & to be mounted above diving board.
- Mounting bracket to accommodate pullback winch.

TUBING (BELLY BOARD)

One (1) tubing support frame (no fingers) mounted at around 45’ elevation above drill floor, complete with walkway, and 1 M (3’-6”) high handrails with toe plates and access to mast ladder.

TONG COUNTERWEIGHTS

Two (2) sets of tong counterweight buckets mounted on mast leg & complete with guides, snatch blocks, wire lines, etc.
One (1) spin-up wrench counterweight bucket, guide and sheave unit, located at convenient place towards the off-driller’s side.

CROWN BLOCK ASSEMBLY

One (1) 650 Short Ton (590 MT or 1,300,000 lbs.) capacity Crown Block Assembly conforming to API Specification 4F & consisting of:

- Working cluster consisting of at least six (6) nos. of minimum 60” (1524 mm) diameter sheaves, grooved for 1-3/8” or 1-1/2” diameter wire line complete with tapered roller bearings. Shaft drilled with greased fitting for each bearing with grease seals.
- One (1) no. of minimum 60” (1524 mm) diameter fast line sheave, grooved for 1-3/8” or 1-1/2”, complete with bearing shaft and grease seals.
- The cluster & fast line assemblies to be mounted on a high strength minimum weight crown frame fabricated from steel shapes and plate.
- One (1) set of wooden bumper blocks for safety.
- Shaft mounting pedestals for working cluster and fast line sheave.
- Line guards complete with sheave guard.
- Crown safety platform with checker plate flooring with at least 1 M (3’-6”) high handrails and toe plates, safety gate at ladder opening, and frame lifting eyes.
- A suitably rated rotating jib crane mounted on crown platform, complete with snatch block, pulleys, etc. to be used for sheave repair / replacement.
- One (1) 20” (508 mm) diameter core line sheave unit, grooved for 9/16” dia. Wire line mounted on tapered bearings (with hanging pad eyes).
- Two (2) 16” (406 mm) diameter cat line sheave units, grooved for 5/8” dia. Wire line mounted on tapered bearings (with hanging pad eyes).
- Two (2) 14” (356 mm) diameter Air Hoist sheave units, grooved for 9/16” dia. Wire line mounted on tapered bearings (with hanging pad eyes).

CASING STABBING BOARD

One (1) air powered heavy duty counterbalanced Casing Stabbing Board with the following features:

- Frame should be heavy duty, fabricated from beams.
- Unit to permit travel from 7 M to 14 M (23 ft to 47 ft) above drill floor.
- Platform should be raised and lowered by air operated chain hoist / wire-line. The chain / wire-line attaches to the platform at a spring -loaded safety latch, ensuring that the safety latch engages at any loss of tension in the chain.
- The hoist should be equipped with a positive engaging brake.
- The platform should include a foot operated latch for fixing the platform at the desired elevation.
- The platform and handrails should fold against the tracks when the unit is out of service..

SUBSTRUCTURE

One (1) Light Weight Substructure designed to split for transport. Substructure section should be so designed in order to meet the transportation dimensions as indicated in Section - 20 using heavy duty oilfield truck tractor / trailer.

SPECIFICATIONS

Height and Base:
Floor – Minimum **25'** (**7.62 M**) overall height with at least **21'** (**6.40 M**) clear height under rotary beams.

Minimum Floor Dimensions:
Length – **35'** (**10.67 M**) x Width – **40'** (**12.19 M**)
(*Excluding the Doghouse and ODS wing supports.)*

Capacities:
Setback – Minimum 300 Short Ton (272 MT or 600,000 lbs).
Rotary – Minimum 500 Short Ton (454 MT or 1,000,000 lbs).
Designed to accommodates – 2000 HP VFD Draw-works
(Note: The setback load is simultaneous with the hook load & /or the rotary load)

RIG-UP

The swing lift self elevating substructure with aforesaid drill floor should be supported by welded box sub-bases around 18 M (59 ft) long x 2.4 M (8 ft) wide x 1.37 M (4 ft – 6 inches) high on both sides, including cross tie members to hold sub-bases apart during assembly & erection of the structure.
The sub-bases (bottom boxes) to be complete with Mast & 'A' Frame shoes, 0.6 M x 0.6 M (2 ft x 2 ft) access window on the Driller's side for Air, water & BOP closing lines entry and two 8 Cubic meter (50 Barrels US) capacity water tanks one in each sub-base near to the rear of the rig constructed of plate ends and top with man-ways & covers, a 50.8 mm (2 inch) diameter vent pipe and a 101.6 mm (4 inch) drain plug to be fitted.
Draw-works & drilling floor to be raised to drilling position by use of draw-works power & mast raising lines, no other rigging or wire line required. The process of rigging up the mast & floors using the draw-works power should complete in around 30-40 minutes including the time for mast pinning.
Substructure should be complete with all bracing & support material while in an erect position and has been constructed in accordance to API 4F specification latest edition.
The 'A' frames to be assembled to sub-bases and are to be folded into them for transportation, the transport height should be approx. 2.7 M (9 ft). 'A' Frames can be erected with a Gin Pole Truck. No. 'A' Frame spreader is required. Front end of sub-bases (Bottom Box Extensions) can be removed for ease of entry of the BOP stack & during the drilling operation.
Special alignment guides to be provided whereas applicable for faster assembling of components.

DRILL FLOOR

One (1) set of drill floor panels with ¼" thick checkered plate for the substructure and 3/8" thick checkered plate around the rotary area and should be complete with handrails 1 M (3'-6") high with toe plates for the perimeter of the drill floor. Most of the drill floor panels, handrails and floor mounting equipments to be set into position at ground level and raised with the Draw-works & setback support.
A minimum of four (4) lifting rings / slots for each section of the drill floor panel to be provided.

ROTARY BEAMS & ROTARY FLOOR SUPPORT UNITS

One (1) set of rotary beams & rotary floor support units designed to accommodate a 952.5 mm (37.1/2 inch) independent drive rotary table. The rotary floor should be flush with the drill floor / working floor.

ANTI-SLIP MATTING

One (1) set of anti-slip vinyl / rubber matting (maximum thickness 5 mm) for working area of around 3 feet (914 mm) circumferentially on floor all along the rotary table . The matting should be fixed over the checkered plate flooring.

ROTARY / SETBACK SPREADER

One (1) rotary/setback spreader complete with framed mouse hole opening, and recess to accommodate 6" (152mm) thick timber (or canvas reinforced rubber composite) over 3/8" (9.5mm) flat plate.
Pin tabs are equipped with drop through stops (safety locks).
Reinforced floor with 152.4 mm (6 inches) thick Timber or canvas reinforced rubber composite installed.
The parallogram type setback support should be designed to support at least 300 Short Ton (272 MT or 600,000 lbs) of racked pipe simultaneously with 500 Short Ton (454 MT or 1,000,000 lbs) of casing load. The setback support is to be pinned to the Mast while in the horizontal position & raised with the mast.

GRASS HOPPER & CABLE ELEVATOR

One (1) Grasshopper type cable elevator with box for collecting cables for rig movement should be furnished.

STAIRS & HANDRAILS

Three (3) sets with 1 M (3'-6") handrails, two from substructure floor to ground and one from substructure to mud tank (stairs with serrated bar grating).
One (1) lot of 1 M (3'-6") high removable handrails (1 ¾" pipe) around perimeter of the working floor with toe board.

V-DOOR RAMP & STAIRS

One (1) around 7.62 M (25 ft) high ramp 1.8 M (6 ft) wide with 12.7 mm (½") thick plate down to the 1066.8 mm (42 inch) high catwalk elevation with framing and stairs continuing to ground level & complete with 76.2 mm (3 inch) diameter x 0.61 M (2 ft) high pipe rail on both sides of the ramp adjacent to the stairs.
The stairs to be located on the driller's side and should have 1 M (3'-6") removable handrails on one side only.

CATWALK

One (1) around 1066.8 mm (42 inch) high x 1524 mm (5 ft) wide x 14.6 M (48 ft) long catwalk, made in two sections (length wise). Top with 9.5 mm (3/8 inch) thick smooth MS plate with 19 mm (¾ inch) plate x 1524 mm (5 ft) long on ramp end & catwalk end bumper stopper and complete with anchor post & lift eyes for each section.

TONG BACK-UP

Set of two (2) tong back up supports bolted to rig floor.

PADESTALS FOR AIR WINCHES

Two (2) mounting pedestals for air winches located on drill floor (one on driller's side & other on off-Driller's side).

RATHOLE & MOUSEHOLE

To provide openings for rat hole and mouse hole assemblies. O.D. – 273 mm (10-3/4 inch)
One (1) Rat hole guide for drilling out rat hole at ground level.

RECEPTACLE FOR IRON ROUGHNECK

One (1) suitable receptacle for ST-120 Iron Roughneck of National Oilwell Varco should be provided on rig floor at appropriate position for installation of Iron Roughneck in future.

DOGHOUSE AND ODS TOOL ROOM SUPPORTS

Two (2) sets of folding floor modules supports to accommodate doghouse on driller's side & tool room on off-Driller's side each on two (2) supports. Support pins to driller's and off-driller's side floor elevator boxes.

DOGHOUSE / DRILLER'S CABIN

As described in Section – 12.

TOOL ROOM

One (1) tool room not less than 3.66 M (12 ft) long x 2.44 M (8 ft) wide x 2.44 M (8 ft) high mounted on a three runner skid with load rolls. Exterior side panels fabricated of 4.76 mm (3/16") crimped wall panels and top of skid deck covered with 6.35 mm (¼ inch) checkered plate, doghouse should be complete with:
One (1) personnel door
One (1) window to view well
One (1) window to view exterior
One (1) ladder for roof access
Two (2) tool box/bench 8ft long
One (1) set of interior lights

DRILLING LINE SPOOLER

One (1) electric / hydraulic powered drilling line spooler, Capacity: not less than 1524 M (5,000 ft) of 1.3/8" or 1.1/2" diameter wire rope, designed to spool, unspool and store drilling line.

FEATURES -

1. The customer supplied steel spool of wire rope is installed on the spooler shaft where it is driven by adjustable pins. The dimensions of steel spool are:
   Maximum OD = 1.88 M (74")
   Maximum outer width (flange to flange) = 1.448 M (57")
   Maximum flange thickness = 101 mm (4")
   Central bore diameter = 130 mm (+1 mm, –0 mm)
2. Split pillow block bearing housings allow for easy removal and installation of the spooler shaft for wire rope spool replacement.
3. The spooler shaft chain drive is engaged by the motor sprocket to provide a positive drive for the wire rope spool. It can be dis-engaged to allow the spool to free wheel.
4. The spooler shaft and drive assembly is mounted on a heavy duty structural steel frame.
5. Lifting lugs and tie-down bolt holes are provided on the spooler frame for handling and field installation.

DRILLING / CASING LINE

One (1) reel / spool of 1.3/8" or 1.1/2" drilling / casing line, 6 X 19, Right Regular Lay, IWRC, IPS, length approximately 1524 M (5000'), conforming to API Spec. 9A latest edition & with API monogram embossed. The dimensions of spool should meet the dimensions specified under the heading "DRILLING LINE SPOOLER, HYDRAULIC DRIVE".

FALL ARRESTER WITH FULL BODY HARNESS

Two (2) Self retracting lifeline with 20 M (65 ft) of 3/16" galvanized cable and a full arrest body harness.

BOP TROLLEY BEAMS & BOP HANDLING SYSTEM

One (1) set of BOP trolley beams designed to pin under the substructure floor allowing for front entry of BOP stack.
One (1) set of complete manually / pneumatically operated BOP handling system complete with necessary trolleys, hoist, etc. with a system capacity of not less than 20 Short Ton (18.14 MT or 40,000 lbs) having vertical lift of around 4.3 M (14 feet).

ESCAPE SLIDE

One (1) escape slide constructed in steel designed to suit the floor height and to move personnel from the rig floor in an emergency to be provided on driller's side. Escape slide to break down into transportable sections with limitations as indicated in Section - 20.

AIR WINCH FOR RACKING BOARD

One (1) Ingersoll-Rand make BU7A Classic Air Winch for Racking Board having a capacity of at least 0.5 Short Ton (0.45 MT or 1000 lbs) having the following features:

Enclosed construction which excludes dirt and dust, seals in oil and grease, and assures complete lubrication of all moving parts.
Ball and roller bearings reduce friction.
Reliable band type brake for holding rated load.
Disengaging clutch (permits free wheeling of the rope drum for hand unwinding).
Powerful radial piston air motor gives positive starting with precise control.
Self-closing throttle shuts off automatically when released, giving well graduated control for spotting loads.
Reversible motor permits full control of load by the throttle when lifting, lowering and pulling.
Throttle Valve is designed to eliminate air leakage when the winch is idle.
Minimum 3.5:1 design factor at first layer stall load.
Minimum 5:1 design factor at half drum load rating.
Includes Drum Guard
1000 lbs Capacity (Mid Layer Rated)

AIR WINCH (MAN-RIDER)

One (1) Ingersoll-Rand make FA2MRA-24MA1G Air Winch having the following features:

- ANSI/ASME A10.22 rated Man rider winch

Personnel Ratings at 8 to 1 design factors:
- 1.1 Short Ton (1 MT or 2200 lbs) capacity
- 28 mts./min. (92 fpm) line speed up (at 2200 lbs)
- 21 mts./min. (71 fpm) line speed down (at 2200 lbs)

Utility Ratings at 5 to 1 design factors:
- 1.76 Short Ton (1.6 MT or 3520 lbs) capacity
- 20 mts./min. 66 fpm line speed down (at 3520 lbs)

- Battery powered line speed monitor with 120 volt charger
- Dual drum brakes, one automatic and one manual
- Up and down limit switches
- Winch mounted control with automatic spring return “lift & shift” double action throttle lever to prevents accidental starts
- Drum Guard
- 122 M (400 ft) of 12.7 mm (½ inch) wire rope spooled on drum (IWRC, EIPS, 6 x 36, RRL, non-rotating)

AIR WINCH (DRILLING USE)

Two (2) Ingersoll-Rand make Model FA5A-24XK1G Air Winch having the following features:
- Force-Five ‘Third Generation’ air winch
- 5 short Ton (4.54 MT or 10,000 lbs) Line pull (half drum)
- Variable line speed to 50 fpm (half drum)
- 4 short Ton (3.63 MT or 8000 lbs) line pull (full drum)
- Variable line speed to 62 fpm (full drum)
- First layer (max) stall should be 8.5 Short Ton (7.7 MT or 17,000 lbs).
- Average cfm: 700
- 610 mm (24 inch) drum length
- Automatic disc brake
- Winch mounted throttle control
- Drum guard
- Filter (with drain)
- Lubricator
- Strainer
- Muffler

Meets ASME 30.7 Safety Standard & should be complete with One (1) 183 M (600 ft) of 5/8” wire rope spooled on drum (IWRC, EIPS, 6 x 36, RRL, bright, Non-rotating)

CHECK LIST & DOCUMENTATIONS FOR SECTION 1 & 2

TECHNICAL

Sl. No.	PARAMETERS/REQUIREMENTS			BIDDER’S OFFER (To indicate details or yes/no, as applicable)	REMARKS, IF ANY
1	Draw-works	a	Input Horsepower		
		b	Nominal Depth Rating		
		c	Hoisting Capacity		
		d	Drilling line size		
		e	Lubrication system		
		f	Greasing System		
		g	Auxilary brake		
2	Mast	a	Clear Height from ground		
		b	Static hook load Capacity		
		c	Wind load resistance		
3	Crown Block	a	Capacity		
		b	No. of Sheaves		
		c	Drilling line diameter		
4	Racking / Tubing Board	a	Capacity		
		b	Adjustable height range		

5	Sub-structure	a	Static rotary capacity		
		b	Pipe set back capacity		
		c	Combined capacity		
		d	Work floor dimensions		

DOCUMENTATIONS

Sl. No.	DESCRIPTIONS	DOCUMENT ENCLOSED Yes or No	REMARKS, IF ANY
1	Technical leaflets with detailed dimensional diagram and specifications, Make & Model of draw-works, auxilary brake, mast, sub-structure, etc.		
2	Copies of API Certificates & Authorizations (if any)		

Signature _____
Name _____
Designation _____
Date _____

SECTION 3: DEADLINE ANCHOR

One (1) 50 Short Ton (45.4 MT or 100,000 lbs) minimum capacity, National Oilwell Varco or Dreco make deadline anchor suitable for use with 1.3/8” or 1.1/2” casing / drilling line. The deadline anchor should be designed and manufactured to API Specification 8C latest edition, PSL-1.

SECTION 4: HYDRAULIC CATHEADS

Two (2) Hydraulic Catheads, National Oilwell Varco make, mounted on a heavy fabricated steel main frame & tied down to rig flooring for use in conjunction with tongs on the drill floor to either make-up or break-out tool joints in the drill string & mouse hole.

Type of Catheads	:	Hydraulic
Operating Line pull (min.)	:	11.8 MT (26000 lbs) @ 2000 psi to 14.7 MT (32500 lbs) @ 2500 psi
Stroke	:	2.13 M (84 inch)
Cylinder Stroke	:	1.07 M (42 inch)
Load indicator	:	directly in lbs. of line pull
Wire Line	:	5/8” or 7/8” Diameter around 12.2 M (40 ft) long (API 9A)
Hydraulic Flow Requirement	:	29 to 35 US GPM (110 to 132 lpm)

One (1) Hydraulic power unit, electrically driven with remote control panel (for selecting cathead 1 or 2) & all required lines, accessories, etc. for operating the hydraulic cathead.

SECTION 5: ROTATING & HOISTING EQUIPMENTS

ROTARY TABLE

One (1) 37.1/2" Rectangular base Rotary Table with cover conforming to API Specification 7K latest edition & with following specification:

Opening: 37.1/2" (952.5 mm)
Static Load Rating: Approximately 650 Short Ton (590 MT or 1,300,000 lbs) 5850 kN
Max. Speed: Not less than 300 RPM
Centre line spacing: 53.1/4" (1352.55 mm)

INDEPENDENT ROTARY TABLE DRIVE

One (1) suitable independent rotary drive for 37.1/2" rotary table complete with AC Motor, suitable drive system, Inertia Disc Brake for IRD Component & full guard..

MOTOR FOR INDEPENDENT ROTARY TABLE DRIVE

One (1) Variable speed AC Motor having following specification:

Rated power: Not less than 800 HP (597 kW)
Rated voltage: 600 V
Cooling type: Air forced ventilation 3200 cfm @ 8 inch WC

MASTER BUSHING

One (1) split body pin drive master bushing for 37.1/2" Rotary Table, complete with API No.3 bowl, Lifting sling, and bit breaker plate.

INSERT BOWLS

One (1) API No. 1 insert bowl for 37.1/2" Rotary Table for use with 11.3/4" – 13.3/8" pipe or casing complete with lifting sling.
One (1) API No. 2 insert bowl for 37.1/2" Rotary Table for use with 9.5/8" – 10.3/4" pipe or casing complete with lifting sling.

SPLIT CASING BUSHING

One (1) 37.1/2" x 20" split casing bushing with lifting sling for 37.1/2" Rotary Table.

MUD GUARD

One (1) mud guard complete with lifting eyes & chain for 5" Drill Pipe.

TRAVELING BLOCK

One (1) 500 Short Ton (454 MT or 1,000,000 lbs) capacity traveling block conforming to API Specification 8C latest edition & with following features & specification:

Features:

Heavy Steel Fabricated Main Frame
Heavy Wireline Guards
Steel Sheaves with Flame Hardened API Wireline Grooves
Tapered Roller Bearings in Sheaves
Oil Quenched and Tempered Alloy Steel Pin with Individual Grease Passages to Each Center Pin Bearing
High Strength Steel Beckett

Specifications:

Load Capacity : 500 Short Ton (454 MT or 1,000,000 lbs)

Lift eye Capacity	: 65 Short Ton (59 MT or 130,000 lbs)
Number of Sheaves	: 6
Minimum Sheave Diameter	: 1270 mm (50”)
Wire line size	: 1.3/8” or 1.1/2”
Approximate Shaft Diameter	: 254 mm (10”)
Coating	: Three Coat Epoxy Paint System
Standard Color	: Safety Yellow

SECTION 6: TOP DRIVE SYSTEM

One (1) 500 Short Ton (454 MT or 1,000,000 lbs) rated AC Top Drive System (Portable) complete with following:

Motor Housing, Motor Housing Guard, Onboard Hydraulic Power Unit, Roller-style Carriage, Bail, Pipe Handler, Integral Swivel with Gooseneck & 7500 psi "S-Pipe" assembly and a Shipping/Storage Skid. Drilling Fluids path pressure limit to be around 7,500 psi (517 bar).

The unit should be equipped with a 7,500 psi Wash Pipe assembly, forced air cooled AC Drilling Motors (800 HP Total), a 10.5:1 Double Reduction, Helical, quiet Gear Drive, Hydraulic Disc Brakes, Powered Rotating Head, Bail, and Counterbalance with Stand Jump.

ONBOARD PIPE HANDLER

The on-board Pipe Handler should be complete with 500 ton rated Link Adapter Assembly (Solid Body Elevator), remote operated, dual crank Upper IBOP Safety Valve, manually operated Lower IBOP Safety Valve, Lower Gripping Jaw (Torque Back-Up), and Hydraulic Link Tilt assembly. The Pipe Handler should be dressed for operation with an NC50 API RH tool joint.

ELECTRICAL PACKAGE

Package should include all Electrical Components (cables, cable glands, connectors, junction boxes, electrical solenoid valves, switches, mounting hardware, etc.) mounted on the Top Drive Motor Housing Assembly.
Service Loop Termination should preferably be on the RH side of the Top Drive. Solenoid Valves are operated with 24 Volts DC Power. Drive Motor cooling Blowers powered by 415 Volts, 3 phase, 50 Hz, 4 HP, TEFC motors.

HYDRAULIC PACKAGE

Package should include the Hydraulic Pump with Electric Motor, Misc. Hydraulic components. Directional Control Valves, Filters, Manifolds and general hydraulic piping components. Electrical components must comply with DGMS (India) requirements for use in Hazardous areas of Oil mines.
In other places, wherever mentioned, UL certification shall be considered as equivalent to CMRI (India) certification; however DGMS (India) approval shall be binding and final for all equipments to be used in Hazardous areas as per DGMS Guidelines/ Directive
(**Annexure-Hazardous area guideline map may be referred**).

CARRIER PACKAGE

Package should include a Carriage (Frame) with rollers for guiding the TDS in the Guide Beam and for reacting torque from the TDS to the Guide Beam. Also to include the hardware to secure the Carriage to the TDS and Locking Dogs to secure the TDS in the Shipping Skid.

PIPE HANDLER PACKAGE

Pipe Handler Package should provide for the functions of clamping onto the drill string to provide Back-Up for making and breaking of the Drill String tool joints at the Top Drive, opening and closing of Upper IBOP Valve and Hydraulic Elevator Link Tilt. Also to include in the package are one Upper IBOP valve, one Lower IBOP valve and one Saver Sub for an NC50 API RH tool joint complete with Locking Rings for the API 6-5/8" Reg connections. The Clamping Mechanism can be positioned to provide Back-Up for removal and installation of the Saver Subs, Lower IBOP Valve and Upper IBOP Valve.
This Package configured with IBOP Valves with H2S Trim and for use with 350 Ton Elevator Links.

COUNTERBALANCE PACKAGE

Counterbalance Package should include Counterbalance Cylinders and required hydraulic piping to integrate with Motor Housing Assembly Hydraulic Piping. For use with Bail lengths up to and including 120 inches and for applications utilizing a Hook, Block, Block Adapter or with a Counterbalance Beam.

S-PIPE PACKAGE

Package should include a 7500 psi capable S-Pipe with 20 degree elbow. The connection for the Rotary Hose should preferably be a Female, 4 inch Fig 1002 or Fig 1003 Union. Pressure rating of the package, as assembled at the factory, should be 7500 psi. The Rotary Hose connection should be on the Right Hand side of the TDS (viewing TDS from the front) and positioned toward the front of the TDS.
The Elbow should have an upper connection to the S-Pipe that is a Fig 1002 or Fig 1003 Union with the Female half being on the S-Pipe. The Elbow can be removed to have a 4" Female Fig 1002 or Fig 1003 Union pointing straight down for connection of the Rotary Hose directly to the S-Pipe.

BAIL PACKAGE

Package should include an API 500T Swivel Bail with a nominal length of 120 inches, Bail Pins with retaining devices, Bail Pin Bushings and Counterbalance Cylinder Mounting Brackets. All components should be factory installed on the TDS.
This package should be suitable for applications using a hook and applications utilizing an Adapter Becket. The 120" Bail to be used when direct coupling to a Traveling Block.

SHIPPING PACKAGE

Shipping Package should include Lower Section of Guide Beam integrated into a Shipping Skid, Shipping Support for Pipe Handler and Shipping / Lifting Bar for TDS Bail. Shipping Skid should be suitable for Tail Boarding and includes lifting shackles.

LUBRICATION KIT

Package should include TDS gear box lubricant, hydraulic system fluid and hand pump for high temperature service. Suitable for ambient temperatures of around 45°C.

TOOL KIT

Package to include a Lower IBOP Hex Wrench, Valve Seat Wrench and Valve Seat Puller, along with a NC50 Saver Sub, a Spacer Sub and a Cross-over Sub for use during well-control procedures.

COUNTER BALANCE ATTACHMENT KIT

All required hardware for attaching the Counterbalance Cylinders to the Traveling Block, utilizing the included Counterbalance Beam.

GUIDE BEAM KIT

The guide beam to provide guided traveling of the Top Drive and torque reaction. Torque to be transmitted to the derrick/mast structure via the lower tieback. The lower tieback to be designed to interface with a horizontal spreader beam mounted at approximately 10 ft above the drill floor. The guide beam should consist of several segments, allowing easy rig-up / rig-down. Configured for the offered mast height.

BASIC TIEBACK KIT

Kit to include Tieback Link and hardware to tie the lower end of the Guide Beam to a Spreader Beam or structural member of Mast for lateral and torsional support of the Guide Beam. Also to include a Guide Beam Intermediate Tieback and a Guide Beam Hang off Link Tieback.

VIDEO MONITORING SYSTEM

Dual Camera video monitoring for top man area to be included at appropriate place for better control of operations by driller.

KIT, SERVICE LOOP

Kit to include the Power Cables from the point of Mast Termination to the Top Drive, the Auxiliary Power Cable from the Top Drive thru the Mast Termination & an additional 33.5 M (110 ft) and the Composite (Multi-conductor Control) Cable from the Top Drive thru the Mast Termination & an additional 110 feet. All cables to be provided with connectors on each end. Power Cables to be provided with 4 foot long leads at the Mast end and 3 foot long leads at the Top Drive end. All cables to be provided with means of securing to the Top Drive and Mast Termination points as well as Ring Assemblies to secure the cables together between the Top Drive and Derrick Termination points.

MAST LEG CABLE KIT

To includes three power cables and one ground cable (with suitable connectors on both ends) to run from the Mast Termination to the TDS Control House. The Kit should be suitable for a cable run length of 47.2 M (155 ft) from the Mast Termination to the Control House Termination Points. The Cables to be sheathed together as a single assembly for a length of 41.1 M (135 feet) from the Derrick Termination suspension point.

MAST TERMINATION KIT

To include mounting brackets for supporting the Power Loop at mid derrick, allowing for quick disconnect. Also includes Support Saddle for Composite Control Loop, plus mounting hardware.

VDC CABLE ASSEMBLY

Cable assembly should comprise of Twisted and Shield pairs of conductors for communication between the TDS Drillers Console and the TDS Control House. Including suitable connectors on each end of the Cable Assembly for connection to the Drillers Console and Control House.

CONNECTION KIT, INCOMING POWER CABLE

Kit should contain Connector Pins, which can be installed at the Power Source. VFD Incoming Power Cables will interface with these Pins, allowing quick disconnect of VFD / Control House Power at the source.

CABLE KIT, JUMPER

Should include Power and Composite cables. Cables connect between Control House and the Derrick Leg Cables.

CABLE KIT, INCOMING POWER

This cable kit is to be used to connect the incoming power from the source (generator set / transmission line) to the TDS Control House. A connector to be provided on each end of each power cable assembly.

U-BOLTS & CLAMP for 500 TON ELEVATOR LINK

Set of U-Bolts for accommodating 500 Ton capacity Elevator Links.
Clamp for accommodating 500 Ton capacity Elevator Links.

WELDLESS LINKS (As per API Spec. 8C)

One (1) pair of 350 Short Ton (317 MT) Capacity Weld less Links, 2-3/4" x 120" (70 mm x 3048 mm)
One (1) pair of 350 Short Ton (317 MT) Capacity Weld less Links, 2-3/4" x 132" (70 mm x 3353 mm)
One (1) pair of 500 Short Ton (454 MT) Capacity Weld less Links, 3-1/2" x 120" (89 mm x 3048 mm)
One (1) pair of 500 Short Ton (454 MT) Capacity Weld less Links, 3-1/2" x 132" (89 mm x 3353 mm)

WEAR GUIDE, MASTER BUSHING AND ADAPTER RING, WEAR GUIDE

Wear Guide Assembly to fit into Pin Drive Master Bushing and complete with "U" shaped Base Plate with split and hinged Wear Guide Ring. Assembly should protect the Master Bushing by limiting the movement of the Drill Pipe during drilling.
Adapter Ring should fit in the Master Bushing Wear Guide for use with drill pipes. The Adapter Rings to fit into the same Master Bushing Wear Guide Assembly. This is a component expected to wear in service.
The master bushing wear guide & adapter ring for wear guide for undernoted drill pipe range:
One (1) set for 3.1/2” to 5” OD drill pipes and
One (1) set for 5.1/2” to 6.5/8” OD drill pipes

SECTION 7: HYDRAULIC POWER UNIT & CONTROLS

All the rig accessories requiring hydraulic power should have independent hydraulic power unit with standard controls.

SECTION 8: MUD PUMPS

Two (2) 1600 HP (1193 kW) Input Horse Power rated Triplex Mud Pumps, National Oilwell Model 12-P-160 with following specifications:

A. TYPE OF PUMP:

Slush pumps triplex single acting, horizontal piston pump with replaceable cylinder liners of various sizes to obtain desired discharge and pressure at rated SPM, complete with standard equipment, skidded and master skidded with AC motor.

B. CAPACITY OF PUMP:

Input Horse Power rating	: 1600 HP (1193 kW)
Discharge	: Minimum 1575 LPM (416 US GPM) at 351 Kg/sq cm (5000 PSI)
	And 2700 LPM (713 US GPM) at 210 Kg/sq cm (2990 PSI)
Discharge pressure	: Max. 351 Kg/sq cm (5000 PSI)

The above parameters are to be obtained with replaceable liners and pistons at rated speed of the pump. Liners to be fitted on the pump at the time of supply to obtain maximum discharge of 3000 Litres/min.
Suitable liners to be fitted with pump to get maximum desired discharge of 3,000 – 3,127 LPM at working pressure.

C. SLUSH PUMP FEATURES:

a. Fully enclosed steel plate fabrication power end.
b. Double helical / herringbone gear for crankshaft gear and pinion shaft gear.
c. Double extended pinion shaft.
d. Self-aligning spherical main and pinion shaft bearing, Roller bearing at crank and crosshead end of connecting rod. (Bearing make should be Torrington, SKF or FAG only).
e. Interchangeable standard module (suction and discharge) with shot penned inner surface.
f. Fast change valve covers.
g. Two piece fast change piston rods with clamp.
h. Suction and discharge manifold with suction dampener.
i. Piston - liner lubricant spray system with AC 3 Ph. 50 Hz electric motor driven pump with reservoir.
j. Oil-bath and positive flow lubrication systems
k. External circulating lube oil pump and filter with AC motor, oil gauge and associated piping
l. The pump should be complete with all the components of fluid end and power end.

D. ACCESSORIES:

Each mud pump package should be assembled with the following accessories:

I. One (1) Discharge Strainer Cross Assembly complete with suitable strainer, 5" (125 mm) 5000 psi (351 Kg/sq cm) WP discharge flange connection, 4"(100 mm) – 5000 PSI (351 Kg/sq cm) WP top connection for pulsation dampener and 5" (125 mm) - 5000 PSI (351 Kg/sq cm) WP end connection for strainer clean out.

II. One (1) 3.1/2" ID (4" API LP thread) x 12'or15' (88.9 mm x 3,657.6 mm or 4,572.0 mm), vibrator hose Grade D, 5,000 PSI WP, 10,000 PSI TP with fig 1002/1003 integral union (male & female welded) & hose hobbles(both ends). Built & manufactured according to API spec 7K

III. One (1) Discharge Pulsation Dampener (Make- HYDRIL Model- K-20-5000), maximum service pressure 5000 PSI (351 Kg/sq cm), surge capacity 75 Litres (20 gallons). Connections - 4" (100 mm) API 5000 RTJ, Diaphragm – Hydrogenated Nitrile or equivalent.

IV. One (1) Pressure gauge (Make- OTECO), 0 - 6000 PSI range with 2" (50 mm) line pipe female connection, and there should be provision to isolate the gauge with a 2" (50 mm) flex seal valve (Make- OTECO)

V. One (1) Manual reset (type-B) relief valve, RR, 3"(75 mm) manual reset 1500 – 6000 PSI WP (Make- OTECO or RETSCO).

VI. One (1) Charging hose assy. for pulsation dampener

VII. One (1) Jib crane with trolley installed on pump to handle fluid end parts

VIII. One (1) Yale hand hoist, 1/2 ton LH 8 Ft lift

E. PUMP DRIVE AND MOTOR SKID:

Dual rear mounted V-belt electric motor pump drive for the offered mud pump, including extended skid frame, motor supports, tensioning screws, belt guards to be mounted on the master skid. Pumps are to be fitted with suitable sheaves (including hub) at both sides of pumps. Pump drive should be complete with banded V-belts for use with AC motor and belt guard.

F. PUMP DRIVE MOTOR:

Each mud pump shall be driven by two (2) heavy-duty AC Induction motor compatible with the mud pump

All the motors for auxiliary lube oil pump (if any) to be supplied by mud pump supplier should be rated as follows:

Voltage 3-phase, 415 V, 50 Hz. HP will depend on pump but shall be limited to 5 HP for each motor. RPM will depend on pump. Terminal box - fitted with double compression type FLP gland suitable for cable OD 14 mm. Enclosure - flameproof, suitable for use in hazardous area Zone-I gas group IIA & IIB.

G. MUD PUMP SPARE PARTS & SPECIAL TOOLS:

The following spare parts and tools should be included in the scope of supply. These spare parts & tools are to be quoted separately indicating part numbers in technical bid and prices in commercial bid respectively. The cost of these spares & tools will be considered for evaluation of the offers. However, OIL reserves the right to decide whether to purchase these spare parts along with the pump or not.

I. Spares for mud pump with required quantity:

a)	Liner 7"	:	30 No
b)	Liner 6"	:	36 No
c)	Piston Assembly 7"	:	48 No
d)	Piston Assembly 6"	:	60 No.
e)	Piston Rod complete	:	6 No.
f)	Valve seat	:	25 No.
g)	Valve assy. with polyurethane insert	:	100 No
h)	Valve Insert (polyurethane)	:	200 No
i)	Valve spring	:	24 Nos.
j)	Valve cover gasket	:	200 No
k)	Liner gasket, 7"	:	90 No
l)	Liner gasket, 6"	:	90 No
m)	Wear plate gasket	:	12 No

n)	Wear plate	:	6 No
o)	Suction module	:	3 No
p)	Discharge module	:	3 No
q)	Banded power belt	:	2 No

II. Special Tools:

a) One (1) no. of complete valve seat puller assembly (Type & Make to be specified) suitable for above mentioned valve seat.
b) One (1) set of special hand tools for fluid end maintenance must be included with each pump set to be supplied.
c) Suitable Stroke Counter Meter should be provided in each pump.

H. TECHNICAL CHECK LIST FOR MUD PUMP

[THE FOLLOWING CHECK LIST MUST BE COMPLETED AND RETURNED WITH THE OFFER. ALSO ENSURE THAT ALL THESE POINTS ARE COVERED IN YOUR OFFER. THESE WILL ENSURE THAT YOUR OFFER IS PROPERLY EVALUATED. PLEASE TICK MARK '**YES**' OR '**NO**' TO THE FOLLOWING QUESTIONS, IN THE RIGHT HAND COLUMN]

Sl. No.	Points	Remarks
1	Whether quoted as OEM of Pump and whether documentary evidences submitted to this effect?	YES/ NO
2	Whether quoted as Assembler?	YES/ NO
3	Whether quoted as Authorized Dealer of OEM (Pump), if so, has the dealer submitted documentary evidences in this regard?	YES/ NO
4	Whether the Pump offered is rated for continuous operation at full load?	YES/ NO
5	Whether the offered pump design is of two piece Module?	YES/ NO
6	Whether the input HP of the Pump set 1600 HP to obtain the desired Hydraulics as per our NIT.	YES/ NO
7	Whether the pump offered having double helical (herringbone) main gear & pinion shaft with double helix gear?	YES/ NO
8	Whether the offered pump sets are skidded on a master skid?	YES/ NO
9	Whether the pump is equipped with belt driven system as asked for?	YES/ NO
10	Whether auxiliary motors are flame proof and suitable for use in hazardous area?	YES/ NO
11	Whether auxiliary motors are CMRI certified and DGMS approved? *A visual guideline/ map / diagram of demarcation of areas as per DGMS guidelines is attached as* ***Addendum-Electrical: Hazardous Area Guidelines Map***	YES/ NO
12	Whether detail specifications of Pump along with technical literature / catalogue /schematic layout (plan & elevation) of the pump offered enclosed with the offer?	YES/ NO
13	Whether spare parts for the offered pump will be available for next 10 years from now?	YES/ NO
14	Whether 3 sets of part list with part numbers, quantity and unit rate recommended for two years of operation are submitted along with the bid?	YES/ NO
15	Whether separately highlighted any deviation from the technical specification sought for?	YES/ NO
16	Whether Test Certificates of Pump will be submitted along with the supply?	YES/ NO
17	Whether Spares parts & Special tools for the pumps mentioned in Section - 8 para G will be supplied?	YES/ NO

Offer Ref ..... Dated .....
OIL's Tender No..... Signed .....
For & on behalf of ..... Designation .....

SECTION 9: HIGH PRESSURE MUD PIPING

HIGH PRESSURE PIPING SYSTEM FOR TWO PUMPS AND DUAL STANDPIPE

One (1) dual 5" (127 mm) x 5,000 PSI (351 Kg/sq cm) WP high mud pressure delivery system for two mud pumps as follows:

- Pressure gauge and relief valve (relief lines to suction tank) at each pump discharge.
- Discharge of each pump complete with one 5" (127 mm) x 5,000 PSI (351 Kg/sq cm) WP BW gate valve and one (1) 5" Fig 1002 or Fig 1003 integral union.
- One (1) 3.1/2" ID (4" API LP thread) x 12'or15' (88.9 mm x 3,657.6 or 4,572.0 mm), vibrator hose Grade D, 5,000 psi WP, 10,000 psi TP with fig 1002/1003 integral union (male & female welded) & hose hobbles(both ends). Built & manufactured according to API spec 7K
- 5" XXS substructure lines complete with integral unions at break points and heavy-duty clamps for mounting. Two vibrator hoses for connecting to standpipe manifold.
- Dual standpipe manifold and high pressure piping.
- Goose neck with 4" Fig 1002 or Fig 1003 Integral Union
- One (1) Kill line kit consisting of a suitable length of XXS pipe (around 150 Mtrs.), swivel joints & integral unions
- One (1) 9.14 M (30 ft) long low pressure fill line hose with 2" Fig 1002 or Fig 1003 Integral union at each end.
- Sufficient no. of additional intermediate 5,000 PSI (351 Kg/sq cm) rated WP pipes to facilitate extension of the delivery pipe up to 170 ft.; to meet the 15m spacing between the wells in cluster locations.

NINE VALVE STANDPIPE MANIFOLD

Standpipe Manifold on the Drill Floor should include:

Mud Standpipe Manifold, 5" (127 mm) x 2" (50.8 mm) 5,000 psi (351 Kg/sq cm) WP, Standard Service.
Mud Gate Valves, 5" (127 mm) Butt Weld XXS, Steel Buna Trim, Standard Service.
Mud Gate Valves, 2" (50.8 mm) Butt Weld XXS, Steel Buna Trim, Standard Service
Gooseneck c/w Integral Bull Plug, 5" (127 mm) 5K Butt Weld XXS, Standard Service.
Forged Block Tee, 5" 5K Butt Weld XXS, Standard Service.
Forged Reducing Block Tee, 5" (127 mm) x 2" (50.8 mm) 10K Butt Weld XXS, Standard Service.
Integral Union,1502 Butt Weld XXS, Standard Service.
Integral Union Sub c/w Nut, 5" Fig 1502 Male Butt Weld XXS, Standard Service.
Integral Union Sub c/w Lip Seal, 2" Fig 1502 Female Butt Weld XXS, Standard Service.
Integral Union Suc/w Nut, 2" Fig 1502 Male Threaded End, Standard Service.

CEMENT STANDPIPES

One (1) single 2" XXS cement standpipe for suitable elevation including gooseneck and 2" Fig 1502 Integral union at gooseneck. Standpipe prepared for welding to rig floor manifold.

VIBRATOR HOSE

3.1/2" ID (4" API LP thread) x 12'or15' (88.9 mm x 3,657.6 or 4,572.0 mm), vibrator hose Grade D, 5,000 psi WP, 10,000 PSI TP with fig 1002/1003 integral union (male & female welded) & hose hobbles(both ends). Built & manufactured according to API spec 7K.

ROTARY HOSE

Two (2) 3" or 4" (76.2 mm or 101.6 mm) ID, 10,000 PSI (702 Kg/sq cm) test pressure, 5000 PSI (351 Kg/sq cm) Working Pressure rotary hoses with 4" Fig 1002 or Fig 1003 Integral Union (Male x Female) as per API spec. 7K with Safety Clamp and Chain (on both ends) of appropriate length (bidder must indicate the length in technical bid).

SECTION 10: MUD & WATER SYSTEM

MUD & WATER TANK SYSTEM WITH ACCESSORIES:

One (1) Mud & Water Tank System consisting of the following:

1A: Active and Reservoir Mud Tanks: 3 + 3 = Six (6) tanks
- One (1) Shaker tank – 47.7 cum (300 Barrels US)
- One (1) Intermediate tank – 47.7 cum (300 Barrels US)
- One (1) Suction tank – 47.7 cum (300 Barrels US)
- Three (3) Reserve tanks of Capacity 47.7 cum (300 Barrels US) each (i.e. Total capacity: 900 Barrels US) complete with Mixing Pumps and Mud agitators

1B: Water / Chemical Tanks: Three (3) tanks

1C: Auxiliary Equipment & Accessories for the Mud Tank System:
- One (1) Mud Loading System
- One (1) Mud Pump Super Charger System
- One (1) Feed Pump System for Solid Control System

TECHNICAL DETAILS OF THE ABOVE:

1A: Active and Reservoir Mud Tanks:

Each mud tank should have approximately the following dimensions:
Length: 9900 mm (excluding 300 mm skid extension on each end for tail boarding)
Breadth: 2285 mm
Height: 2250 mm (excluding skid height)

Tank Walls: The walls of each of the tanks (including partition walls) are to be constructed with 8 mm thick MS crimped plates. Tank bottoms, to be constructed with 8 mm thick plain plates, should be sloped gradually to a maximum of 3" (75.0 mm) towards the tank cleaning doors to facilitate cleaning.

Master Skid: The tanks should be mounted on three runner oilfield type skids fabricated from 300 mm beams (ISMB) reinforced with suitable channels and angles. The ends of the skid should project out from the tank by 300mm and curve upwards. 150 NB X Sch 80 pipe with provision for lifting should reinforce the end of the skids for tail boarding.

Tank Doors: Two (2) clean out gates should be provided at the rear of each reserve, suction and intermediate tanks and three (3) clean out gates in the shaker tanks.

Sand Traps of approx. 10 – 12 cum capacity are to be provided in the Shaker Tanks. Approx. 3" (75 mm) slope is to be maintained towards the clean out gate end.

Valves and Couplings: Dresser type pipe couplings, butterfly valves and dumb valves with flanged ends should be provided.

Mud Channels and gates: Mud channel with diversion gates should be provided in all the tanks per the mud system requirement.

Water, Mud and Equalizing Lines: Square tubings of sizes 152 X 6 mm and 101 X 6 mm shall be used for Mud rolling line and Water rim line respectively. Equalizing lines (273mm) should be provided between shaker tank and intermediate tank with dresser type pipe couplings for end connections. These lines should be provided with suitably placed manifolds / isolating butterfly valves and gates etc. for separation or isolation of tanks or tank in the system. The rim line water tapping for mud system shall be with 1" NPT vertical insert and a plug (2 nos. for each tank). Suction lines of 250 mm (10") nominal dia with butterfly valves and Dresser type pipe

couplings for two nos. of mud pumps should be provided in the Suction Tank and in the Intermediate Tank. The suction valves and suction valve system shall be supplied with 10" NB X 6.3 mm thick pipes. Mud hopper suction line of 200mm (8") nominal dia. with butterfly valve and Dresser type pipe coupling should be provided in the Suction Tank and all the reserve tanks.

Tank Top, Handrails and Staircases: All tank top open spaces should be covered with iron serrated bar gratings (Heavy-duty grills) and should have sufficient support and fixing arrangements to ensure stiffness and ruggedness. Removable handrails at least 1 metre high with two-rail railings and 0.15 metre high toe board should be provided on the open side of the tanks per safety standards. All handrails should consist of top rail, knee rail and tick board. Stairways of 1000-mm width and 45 degree maximum angle with handrails as described above on both sides should be provided at convenient places for climbing on to the tanks from ground level and from cable tray to suction tank. These staircases shall be resting on the walkway and also wherever possible be permanently attached / anchored to the tanks. All tanks should have fixed staircases without handrails from tank top to tank bottom for going into the tank. The walkway arrangement shall be Folding type flush with tank top.

Tank Volume Measuring Scale: All the tanks should be provided with permanently attached measuring scale made of anti-corrosive metal / alloy graduated in inch and foot to indicate volume per inch height.

Bottom Mud Gun: On the low pressure mud rolling lines a sufficient number of bottom mud guns complete with nipples, pipes, butterfly valves, hammer unions and a handle to rotate the gun from tank surface etc. should be provided in all the tanks.

Mud Agitator: Each mud tank shall be equipped with mud agitators so positioned to have proper churning of mud, each complete with flameproof electric motor(s) of suitable hp (to be specified by the bidder) which shall operate on 415 Volts, 3-phase, 50 Hz AC power supply. The mud agitators should be of aerofoil design impeller and heli-bevel type gearbox. The turn-over rate of the agitators should be around 50 seconds.

Provision for Mounting Solids Control Equipment: Provision should be kept for mounting / installing solids control equipment on the shale shaker and intermediate tanks. Two (2) shale shaker units, placed side by side, with shale slide, mounted on Shale Shaker Tank; one (1) desander unit mounted on shaker tank and one (1) mud cleaner with desilter unit mounted on suction / intermediate tank; one (1) centrifuge & one (1) vacuum degasser unit mounted at suitable place on intermediate & shaker tank respectively. The required partitions, outlets with 200 mm(8") butterfly valves and dresser type couplings should be provided in the shale shaker tank and intermediate tank for operating all these solid control equipment and degasser in the mud system. The skid with feed pumps to all these equipment should be placed in front of the shale shaker/ intermediate tank near their interconnections. A common manifold for suction and delivery of the feed pumps for solid control equipment is to be provided with isolating valves to use either of the two pumps to feed desander, desilter or degasser.

Surface Preparation/ Sand Blasting/ Painting: All oil deposits should be removed by using approved de-greasing agents with special attention to drilled holes, bolt holes etc. The tanks shall be sand-blasted and painted with one coat of inorganic zinc primer 70 microns in thickness and two coats of Repack high build polyurethane.

Electrical Earthing System:

(i) Each mud tank should have two nos. of GI straps 50 X 6 mm mounted on the out side of the walls facing mud pumps and mud mix skid side.

ii) The straps 50 X 6 mm should be welded to the sturdy supports that are welded to the tank wall. The gap between tank wall and strap: 50mm. Spacing between supports: 1000mm. The strap length should be the same as the tank length/ width. Gap between straps should be 150mm.

iii) Holes to be drilled in each strap are: (a) one no of 15mm dia. hole near each agitator (b) two nos. of 15mm dia. holes with a spacing of 100mm near each strap end.
iv) Straps should be mounted at a convenient height for ease of connection.
v) Galvanization of the straps should be of the high quality to withstand the corrosive environment. 2 nos. each 25 X 3 mm GI strips shall be welded to the main strips and the agitator skids (approx. perpendicular to the main strips 50 X 6mm).
vi) Two (2) GI straps of size 50 X 6 mm shall be suitably mounted on each skid to facilitate independent double earthing of the pump motors.
vii) Holes to be drilled in each strap are: a) two nos. of 15 mm dia holes with a spacing of 100 mm near each motor b) two nos. of 15 mm dia holes with a spacing of 100 mm near each strap end.
viii) Foldable type hangers should be mounted on tank wall below the earthing straps to support the mud system cables. Spacing between hangers should be 1000mm. Width of the hangers: 300mm

Mounting of Push button station: Mounting assembly for push button station of each mud/ water tank agitator to be welded to the tank near respective agitator assembly.

Mud Pill Chamber: A chamber of approx. 12 cum (75 Barrels US) capacity with isolating valves should be provided inside the suction tank for preparation of special mud pills. A suitable sized agitator of stainless steel 304 Aerofoil 3 blade design of approx. dia 36" coupled with flameproof electric drive motor of maximum 10-hp capacity should be provided in this chamber for proper mixing of the mud additives. The pill tank agitator is to be such that it should not foul with the bottom/ internal piping. This chamber should be connected with the suction line for the rig pumps and also with an independent line from the mud loading system with isolating valves.

Chemical Operator's Cabin: One (1) cabin of size approximately 4.2 m long x 2 m wide x 2.5 m high skid-mounted cabin with proper heat insulation & ventilation, complete with one sliding door, safety glass windows, adequate provision for keeping mud testing equipment and accommodating 2 (two) persons, and with tool box, oilfield mud balance such as Baroid and MF viscometer. The cabin should be placed near the intermediate tank at the level of the walkways.

Tank should be covered with steel collapsible type stackable system and adequate individual lighting arrangement and ventilation facility.

1B: Water / Chemical Tanks:

Three (3) water / chemical tanks fabricated as detailed above for item 1(A) and having approx. dimensions:

Length : 9900 mm (excluding 300 mm skid extension on each end for tail boarding)
Breadth : 2285 mm
Height : 2250 mm (excluding skid height)
Capacity : 47.7 cum (300 Barrels US)

Master Skid for Water / Chemical Tank: One Master Skid having 4 runners with a dimension of 3.05 M (10 ft) wide x 9.75 M (32 ft) long for placing the three water tanks. The skid should be fitted with two nos. of centrifugal pumps (as Water Booster) having a minimum flow rate of 80 cum per hour and with 55 mtr. head driven by 40 HP explosion proof 415 volts, 50 Hz, 3 phase electric motors and complete with suction and discharge lines for operation of either or both pumps

The following features should be provided in the water / chemical tanks: -

Two tanks should have open top and one tank should have covered top with two manholes.

- Both the open top tanks should be covered with the serrated floorings as described above at 1A(h).
- 2" line size hopper shall be fabricated and assembled on one open tank. The maximum height of the hopper shall be limited to the height of the mud agitator and should not exceed 3400 mm.
- Small, rugged, collapsible type platforms of preferable size 2000 mm (L) x 2000 mm (B) x 500 mm (H) should be provided near the hopper to stack a few sacks of chemicals prior to loading.
- All the three tanks should be provided with strongly built sturdy ladder both from inside and outside the tanks. Handrails are to be provided for the two (2) open-top tanks with bar grating platforms and walkway between the two tanks.
- Two (2) clean out gates should be provided at the rear side of each tank. These gates should be provided with 12" Butterfly valves. Approx. 3" (75 mm) slope is to be maintained towards the clean out gate side.
- All the tanks should be provided with 100 mm drain out plug at the floor of the tanks.
- The open tanks should be provided with permanently attached measuring scale made out of anti-corrosive metal / alloy graduated in inch and foot to indicate volume per inch height.
- The inlet feed line shall be supplied with 100 mm (4") Sch.40 ASTM 106 Grade 'B' pipes with butterfly valve and should be anchored firmly with the sidewall of the tank. The rim line water tapping for water tanks shall be with 1" NPT vertical insert and a plug (2 nos. for each tank).
- All the tanks shall be provided with 152.4mm (6") Sch.40 ASTM 106 Grade 'B' pipes with butterfly valve in the front side of the tanks.
- The open top tanks should be provided with bottom guns at four sides of the tanks with rotating (180^0) facility from the tank top.
- Each open-top tank should be provided with two (2) agitators having heli-bevel type gear box.The mud agitators shall be with stainless steel 304 Aerofoil 3 blade design of approx. dia 36". The agitators should be driven by maximum 10 hp, 415 volts, 3-phase, 50 Hz horizontal foot mounted, squirrel cage rotor induction motor with bi-directional cooling fan at NDE. The motor should be fully enclosed fan cooled and offering protection to IP55. Insulation: Class F but the temperature rise should be limited to that of Class B. Earthing: Two nos. of earth points on the enclosure and one no. inside the terminal box. Termination: Motors should have terminal box with studs for connection of supply cable. Canopy: Motors should be provided with a removable type canopy for protection against rain. Canopies should be supported on agitator skids. Paint: Motors should be painted with epoxy paint of DA Grey shade.
- One of the chemical mixing tanks should have two chambers. One of the chambers should have 100-150 bbl capacity. Both the chambers should have independent suction line and one agitator each. Both the chambers should be connected to hopper for chemical mixing independently with suitable valve arrangements.

The overall height of the tanks including the agitators should not exceed 3400 mm for transport limitations.

Two (2) 100 HP electric motor driven horizontal multistage centrifugal pumps set complete with piping/ Dresser type couplings and butterfly valves should be mounted on an independent three runner oilfield skid. These pump sets will be used to load chemicals through hoppers to water tanks, to gun the mixture and to feed chemical-mixed (gauging) water in the cement hopper for preparation of cement slurry. The two horizontal multi stage centrifugal pumps should have cast steel body, bronze / cast iron impeller, EN 8 shaft with gland type packing and each should be capable of developing 150 m. of head. The discharge of each pump should be about 60.0 m^3 / hr at 1450 rpm.

1(C): Auxiliary Equipment & Accessories for the Mud Tank System:

I. Mud Loading System: One (1)
II. Mud Pump Super Charger System: One (1)

III. Feed Pump System for Solid Control System: One (1)

I. Mud Loading System:

The following equipment should be mounted on an oilfield three runner skid and top floor with inter connections through piping, dresser type couplings and butterfly valves:

Centrifugal Pump sets: Four (4) centrifugal pumps of Mission Magnum – I or equivalent make of size 8" x 6" x 14" with approx. 12.1/2" size impeller. The mud mix system shall be provided with 10" suction valve system with 8" suction header.
Each pump will be coupled to a 100 hp, 415 Volts, 3-phase, 50 Hz 1500-rpm flameproof weatherproof electric motor. The motors, starters and the cable glands should be suitable for use in hazardous areas and duly certified by CMRI (UL or the equivalent certifying authority of the country of origin)and approved by DGMS for Zone I and Gas group IIA & IIB of Oil Mines.
The bidder should submit copies of CMRI certificates (UL or the equivalent certifying authority of the country of origin) & DGMS approvals for all the flameproof electric motors, starters and cable glands with the quotation.
In other places, wherever mentioned, UL certification shall be considered as equivalent to CMRI (India) certification; however DGMS (India) approval shall be binding and final for all equipments to be used in Hazardous areas as per DGMS Guidelines/ Directive
*(**Annexure-Electrical: Hazardous area guideline map may be referred**).*

Loading Hoppers: Four (4) hoppers shall be provided for Bentonite / Barite loading. Two (2) hoppers should be suitable for use for loading barites and two (2) other hoppers coupled with two (2) High Performance Aqua–Shear Jet Shearing / Mixing System capable of handling 1000 GPM of fluid, should be suitable for loading polymer chemicals. The Jet shearing system shall be provided with hopper having 4" line size on a separate skid which shall be placed on one active Active mud mix tank and one on Reserve tank. The inlet and outlet of the jet shearing system shall be connected to one of the mud mix hopper lines with necessary isolation valves. All line connections are to be made in such a way that all the hoppers can be operated simultaneously if situation arises.

II Two Mud Pump Supercharging System:

Two (2) 8" x 6" x 14" size Mission Magnum – I or equivalent pumps with approx. 12.1/2" impeller should be suitably positioned and mounted on a three runner oilfield skid and floor with inter connections through piping, dresser type couplings and butterfly valves to super-charge the mud pumps suction. Gap between supercharger system and mud tank shall be approx. 900 mm to facilitate / ease of slinging of supercharger skid. The supercharger system shall be provided with 10" isolation Butterfly valves and 10" suction header.
Each pump will be coupled to a 100 hp, 415 Volts, 3-phase, 50 Hz 1500-rpm flameproof weatherproof electric motor. The motors, starters and the cable glands should be suitable for use in hazardous areas and duly certified by CMRI (UL or the equivalent certifying authority of the country of origin)and approved by DGMS for Zone I and Gas group IIA & IIB of Oil Mines.
The bidder should submit copies of CMRI certificates (UL or the equivalent certifying authority of the country of origin) & DGMS approvals for all the flameproof electric motors, starters and cable glands with the quotation.
In other places, wherever mentioned, UL certification shall be considered as equivalent to CMRI (India) certification; however DGMS (India) approval shall be binding and final for all equipments to be used in Hazardous areas as per DGMS Guidelines/ Directive
*(**Annexure-Electrical: Hazardous area guideline map may be referred**).*

III. Feed Pump System for Solid Control System:

Desander, Desilter, centrifuge and Degasser Feed Pump Set: Two (2) 8" x 6" x 14" size Mission Magnum – I or equivalent pumps with 12.1/2" size impeller should be suitably positioned and mounted on a three runner oilfield skid and floor with inter connections through piping, dresser type desilter and degasser units. Gap between mud mix system and mud tank shall be approx. 900mm to facilitate / ease of slinging of mud mix skid.
Each pump will be coupled to a 75 hp, 415 Volts, 3-phase, 50 Hz 1500-rpm flameproof weatherproof electric motor. The motors, starters and the cable glands should be suitable for use in hazardous areas and duly certified by CMRI (UL or the equivalent certifying authority of the country of origin)and approved by DGMS for Zone I and Gas group IIA & IIB of Oil Mines.
The bidder should submit copies of CMRI certificates (UL or the equivalent certifying authority of the country of origin) & DGMS approvals for all the flameproof electric motors, starters and cable glands with the quotation.
In other places, wherever mentioned, UL certification shall be considered as equivalent to CMRI (India) certification; however DGMS (India) approval shall be binding and final for all equipments to be used in Hazardous areas as per DGMS Guidelines/ Directive
*(**Annexure-Electrical: Hazardous area guideline map may be referred**).*
All components of the tanks should be new, unused and free from all defects.
The tanks should be hydraulically tested for 24 hours.

MUD LOADING SYSTEM/ BARITES RAMP:

One (1) Mud Loading System / Barites Ramp of 600 – 800 sq. ft. area and 4 ft high for placement adjacent to the Active Mud System, with shade over the ramp for storing Bentonite, Barites and other bulk chemicals

TRIP TANK:

One (1) trip tank, 10 m^3 (60 Barrels US) capacity with two nos. centrifugal pumps driven by electric motor with fps gauging system visible from Derrick Floor. Tank to be constructed with 8 mm thick MS crimped plates, mounted on oilfield type skid & complete with following:

One (1) suitable hole filling pump driven by a approximately 25 HP electric motor & complete with all valves, piping & fittings.
Access ladder both inside & outside.
Casing fill-up line

PRE-FLUSH TANK:

One (1) pre-flush tank, 100 barrel capacity for cementing jobs, preparation of soaking solution, etc.

LWC TANK:

A standard LWC Tank, Capacity: 100 Barrels (Approx) with connection to Suction & Pre-flush tanks

SHALE SHAKER:

Two (2) units of Linear motion "High G" (Minimum 7G) shale shakers with suitable flow divider & mounted side by side on a rugged oilfield type master skid over the shaker tank, each unit of LMSS rated at 500 GPM and capable of running up to 250 plus mesh size screens without overflowing. (The units of LMSS should not be permanently fixed on to the skid but should be designed for easy attaching & detaching on to the skid).
The dimensions of the master skid & LMSS unit should meet the transportable dimensions stated in Section - 20.

MUD CLEANER:

One (1) Linear motion mud cleaner complete with sixteen (16) 4" desilter cones with capacity not less than 1000 GPM (US).

DESANDER:

One (1) 2-cone Desander with manifold constructed of 8" Sch 40 pipe, mounted the third shaker, having two (2) 10" polyurethane cones with grooved end inlet and overflow, Desanding Capacity: 1000 GPM (US).

VACUUM DEGASSER:

One (1) Vertical Vacuum Degasser, mounted on oilfield skid, with one (1) 5 hp, 230 /415 Volt AC, 3-phase, 50 Hz explosion-proof motor, starter, complete with suction and discharge piping, jet nozzles, etc. Degassing Capacity: 1000 GPM

"POOR BOY" DEGASSER:

One (1) "Poor Boy" mud gas separator mounted on oilfield type skid having chequered floor plates; with inlet from flow line and choke manifold, one outlet, one drain, one 8" vent and one 20" man way
Diameter: 1220 mm (48 Inch) approx.
Should be of adjustable height to match the system.

CENTRIFUGE

One (1) High G-force capacity Centrifuge with long clarification area to process approx.170 gallons of mud per minute with feed density of 9.3 ppg mud at more than 2000G. The function of solids sedimentation, separation and draining are all to be combined in the centrifuge. The unit should be complete with charging pump, main drive motor (FLP Type), hydraulic drive and torque control assembly.

All solid control equipments must be either of Brant (NOV), Derrick or Swaco make. All electrical equipments required to run the Solid control equipments are to be rated at 415Volts, three phase, 50 Hz and must be DGMS approved.
A visual guideline/ map / diagram of demarcation of areas as per DGMS guidelines is attached as ***Addendum-Electrical: Hazardous Area Guidelines Map***

TOOLS & SPARE PARTS FOR SECTION 10:

Following additional spares in specified quantity as indicated should be supplied along with the unit. Specific description, part nos., make, etc. and unit price (in commercial bid) of each and every item shall clearly be indicated in the bid.

- Bidder to quote set of handling & special tools (for screen replacement, vibrator replacement, deck / basket angle adjustment, cone replacement, etc.) required for carrying out operation, repair & maintenance on Shale Shaker, Desander, mud cleaner & Desilter including one torque wrenches & one digital accelerometer (vibration meter). Bidder must forward a list of such tools quoted by them indicating the make & model. **Price of these should be indicated in commercial bid & will be considered for evaluation purpose**.

- Bidder to quote for the following Shale Shaker Screens of nearby mesh size, Desander & Desilter spares to be procured along with rig package. **Price of these should be indicated in commercial bid & will be considered for evaluation purpose**.

20 mesh Shale Shaker Screens - Quantity 30
40 mesh Shale Shaker Screens - Quantity 30
60 mesh Shale Shaker Screens - Quantity 40
80 mesh Shale Shaker Screens - Quantity 40
100 mesh Shale Shaker Screens - Quantity 40
150 mesh Shale Shaker Screens - Quantity 40
175 mesh Shale Shaker Screens - Quantity 30
220 mesh Shale Shaker Screens - Quantity 30
250 mesh Shale Shaker Screens - Quantity 30

175 mesh Mud cleaner Screens - Quantity 30
220 mesh Mud cleaner Screens - Quantity 30
250 mesh Mud cleaner Screens - Quantity 30

Desander cones, complete – 5 Nos.
Desilter cones, Complete – 10 Nos.
Victaulic Clamps with seals for Desander cone – 10 Nos.
Victaulic Clamps with seals for Desilter cone – 20 Nos.

- Two extra sets of vibrator motor & starter of Shale shaker.

- Two extra sets of vibrator motor & starter of Mud Cleaner.

- High pressure – low volume suitable water jet cleaner with all accessories – 1 No. (for cleaning the shale shaker screens). **Bidder to quote the specification with price in commercial bid & will be considered for evaluation purpose.**

SECTION 11: HIGH PRESSURE TEST UNIT

One (1) Portable Testing Unit having a nominal working pressure of 15,000 psi (1055 Kg/sq.cm.) & consisting of the following:

- One (1) 43:1 ratio volume pneumatic pump
- One (1) 300:1 ratio pneumatic pressure pump
- One (1) Fluid suction manifold and strainer
- One (1) High pressure testing manifold complete with 0-20,000 psi gauge, all required valves (incl. safety & bypass), high pressure fittings, etc.
- One (1) 1" Air supply manifold with lubricator
- One (1) Adjustable air regulator set to limit hydraulic output to desired test pressure
- One (1) 50 gallon reservoir complete with 1/2" -3,000 psi working pressure control valve, 0-6,000 psi gauge and 3,500 psi relief valve
- Heavy duty skid to contain all of above

Stand Mounted Chart Recorder consisting of:

- 0-15,000 psi recorder, spring chart drive, 8 day wind, 24 hr. / 96 minute chart rotation, 12" diameter chart, single pen style with over range protection.
- Shock mounted for vibration protection.
- Unit mounted on heavy duty steel skid.

Test Hose 20,000 psi (1406 Kg/sq.cm.) rated WP & 10' (3 Mtr.) long to connect Chart recorder to test unit.

High pressure test/ glycol injection hose complete with end fittings, 5,000 - 20,000 psi, 15 M (50 ft) long.

SECTION 12: RIG INSTRUMENTATION & CONTROL SYSTEM

1.0 DRAW-WORKS CONTROLS

Features:

- Automatic Shifting between high/low speeds under no load/no speed conditions for draw-works having Duel speed gearboxes.
- Emergency brake control system
- RTDs: 6 x Pt100 (2 per phase in stator 2 x Pt100), 1 bearing Pt100
- Differential Pressure Switch

1.1 DRILLER'S CABIN/DRAWWORKS INTERFACE CONTROLS

1.1.1 The integrated rig control system should be Amphion or equivalent make with the following features:

- It should be able to manage, control and monitor rig floor equipment in independent and activity-based operations.
- It should be designed to allow operators to focus on Drilling, Tripping and Casing processes by providing an efficient and intuitive rig floor command center.
- The system should be interactive through the use of color-graphic data and control screens viewed on touch screens integrated into the operator workstations.
- Touch screens should allow the Driller to supervise and control all drilling-related functions.
- The integrated system should have control cabinet, network devices, operator workstations and control modules to drive the rig equipment. All modules should have communication hardware and user software interface functionality.
- The control system shall be designed to avoid single point failures through a robust network with redundant touch screens.
- The control network shall be designed using touch screens and/or to workstation hardware (such as joysticks) to provide monitoring and control of each tool, plus local and remote access to integrated diagnostics, maintenance and documentation.

1.1.2 AUTO DRILLING FEATURE

The auto drilling feature should be Amphion or equivalent make with the following minimum features:

- The Auto Drilling/Electronic Drilling Control Algorithms should be designed to help drillers to significantly reduce drilling costs and improve rig safety.
- The software module should have draw-works control systems to provide unique automatic drilling functionality.
- Superior drilling performance feature should be incorporated by precisely controlling the drilling line, monitoring or maintaining up to four parameters simultaneously - WOB, ROP, Drilling Torque and Delta-P (differential down-hole motor pressure.) The module required for precise and proportional draw-works braking capability, which is accomplished by regenerative braking through the AC VFD (Variable Frequency Drive) system should be included in the system. The system shall ensure variable continuous feed of the drill line from very slow drilling rates to up to 2000 feet/hour.
- Auto Drilling Electronic Drilling Control Algorithms should be designed to provide significant economic benefits:
  - ❖ Constant steady state control at the bit.
  - ❖ Longer bit life, optimum bit performance, reducing bit usage and bit trips.
  - ❖ Maximized Rate of Penetration, reducing drilling time and days on location.
  - ❖ Controlled drilling (constant ROP) to improve directional drilling control and accuracy.

The system package should have the following minimum features:

Workstation
- ❖ Wrap Around Operator Chair
- ❖ Touch-screen displays

Tool Controllers
- ❖ Draw-works Control Module
- ❖ Top Drive Control Module
- ❖ Auxiliary Tool Control Module
- ❖ Mud Pumps Control Module
- ❖ Power System Interface Module
- ❖ Driller's Chair Control Module
- ❖ V-DAQ Drilling Information Module

Multi-Tool Control Cabinet
- ❖ MTC with diagnostic touch-screen
- ❖ Power Control MTC Cabinet with touch-screen

Miscellaneous Components
- ❖ Mud Pump Remote I/O
- ❖ E-Stop Controller
- ❖ MCC Interface
- ❖ UPS
- ❖ Mud Logger Output Module
- ❖ Rotary Table Interface Kit
- ❖ Standpipe Pressure Transducers 2 (Two) for use with Auto Drill software
- ❖ Compression Type Triple Redundant Electronic Load Cell for use in dead line anchor

1.1.3 WORKSTATIONS

Wrap Around Operator Station

A Wrap-Around workstation is to be provided for the Driller to monitor and control specific drilling parameters. The workstation shall be ergonomically designed chair along with Touch screens and discrete controls for the drilling equipment that is currently in use allowing the operator to operate a wide range of equipment around the drill floor while maintaining an optimal work environment. Control functions and information to be integrated into the touch screens and discrete controls in the respective chairs as required.

The armrests should be positioned to accommodate a wide range of heights for different people as well as a variety of positions the operator may wish to take.

Touch screens

The Safe Area touch screens should be rugged industrial LCD display to be used indoors on drilling rigs. It should be suitable for operation in bright sunlight to low night light conditions.

The touch screens should provide the Operator's interface for control, data input, and monitoring of drilling activities. The equipment controls to be integrated into the touch screen resulting in efficient operations. A standard suite of screens is provided for selection, status and input of the control and information parameters.

TOOL CONTROLLERS

Draw-works Control Module

The Draw-works Control Module should respond to joystick movement and touch screen commands to control the draw-works. It should access and manipulate data from the draw-works remote I/O and user interface to provide monitoring and control such as raising and lowering the block and setting high and low travel set points.

Standard screens:

- Drilling operation (including back reaming)
- Tripping operation
- Draw-works status
- Draw-works Motor/VFD status
- Draw-works Diagnostics and Alarm

Top Drive Control Module

The Top Drive Control Module should respond to touch-screen commands to control the Top Drive. It should access and manipulate data from the Top Drive remote I/O and user interface to provide monitoring and control such as setting torque limits.

Standard screens:

- Top Drive primary control
- Top Drive Diagnostics and Alarm

AUXILIARY TOOL CONTROL MODULE

The Auxiliary Control Module should respond to touch screen commands to control various auxiliary equipments. It should access and manipulate data from the auxiliary remote I/O and user interface to provide monitoring and control such as setting Cat Head torque limits etc.

Standard screens:

- Tool control, diagnostics, & alarms
  Duty: HPU, Hydraulic Catheads, Rotary Table, etc.

MUD PUMPS CONTROL MODULE

The Mud Pump Control Module should respond to touch-screen commands to control both the Mud Pumps. It should access and manipulate data from both the Mud Pumps remote I/O and user interface to provide monitoring and control such as setting SPM limits.

Standard screens:

- Mud Pump primary control
- Mud Pump Diagnostics and Alarm

MUD PUMPS LOCAL CONTROL PANEL

The Mud Pump Local Control Panel to operate one or both the mud pumps from local station (near to mud pump) in addition to the controls through touch screen commands.

POWER SYSTEM CONTROL MODULE

The Power System Control Module should accesses power system data from the generator control modules, feeder breakers, bus breakers, rectifiers & ground fault detectors.

Standard screens:

- Generator Status
- Rectifier Status
- Drive Status
- Ground fault / feeder status
- Ground Fault / feeder status

V-DAQ CONTROL MODULE

The V-DAQ is to provide an interface between the Control Network, Touch-screen and Rig Sense system or equivalent.

Following minimum features should be included:

- Electronic Gauges for primary drilling instrumentation
- Pit volume Totalizer (PVT) for monitoring mud pits
- Electronic Driller Recorder for strip chart trending
- Interface to support four connections
- Software license for four seats.

E-STOP CONTROLLER

The E-Stop Controller shall consist of required hardware to facilitate an E-stop of supplied tools. The controller shall consist of failsafe system to accomplish the appropriate E-Stop action.

UPS
On-line UPS of suitable capacity for emergency backup of the Control System and the Power System controls for a period of 6 hours. Two UPS's will provide backup for control system and two will provide back up for the power system. The UPS's shall include bypass switches which will allow line power to be fed directly to the load in case of UPS failure.

MUD LOGGER OUTPUT MODULE
The Analog Output Option is to provide minimum 6 pre-defined analog signals (4-20mA) to be exported from the system to a third Party service company PLC, such as a Mud logger.

DRILLER'S CABIN
The driller's cabin is to be designed in order to provide the drilling operator a safe and comfortable work environment. The driller's cabin and other control panels are to be designed to make the operator able to work long shifts without stress or strain. The positioning of instruments and controls has to be thoroughly evaluated with regard to frequency of use, interrelation and ease of operation and help reduce fatigue to the driller.

Layout
From the driller's cabin the operator should able to control most of the equipment used in the drilling process. Most controls used should to be integrated into the driller's chair, minimizing additional hardware. The driller's cabin should be designed to have a clear line of sight to the operating machinery and people on the drill floor. The equipment/control panels in the driller's cabin should be placed in the most visual / convenient position.

Driller's Cabin should have the following minimum features
- ❖ Driller's cabin enclosure material: carbon steel
- ❖ Protections bars to be provided on overhead windows
- ❖ Internal and External lighting
- ❖ Noise & vibration insulation
- ❖ Insulated walls, roof and floor
- ❖ Architectural items such as wall panels, ceiling panels, floor cover, door and windows
- ❖ Window wiper and washer system
- ❖ Independent HVAC system
- ❖ Knowledge Box (stainless)
- ❖ Talk back system consisting of pre-amplifier, PSU, audio speaker (outside cabin), microphone (inside cabin), footswitch (inside cabin)

1.1.4 RIGSENSE OR EQUIVALENT SYSTEM

Suitable drilling information management system, utilizing a combination of proven technologies, providing reliable services with the capability of meeting the customer's needs should be provided. It should provide critical information for making intelligent decisions about drilling operations. It should be a comprehensive system with the ability to gather data from multiple sensors and input sources. Typical users of the system will be Tool pusher, Drillers and Assistant Drillers, Rig Managers, Operator Representatives, Mud and Drilling Engineers.

The quoted system should provide the following minimum functionality:
- Historical and real-time data viewing and printing
- User customization of screens to their own channel preferences
- Digital read-out display of numerical real-time data
- It should provide accurate time and event based ton-mile measurements

- Modifiable alarm parameters for changing conditions and rig activity
- Storage and access to historical information and notifications, as well as messaging capability with other workstations on the network
- Generate IADC reports for billing and payroll purposes with electronic transmission capability
- The quoted system should be scalable
- The system shall provide minimum four different types of printed reports including Drill Log, ROP/Gas Log, ROP Report and Pipe Tally Report
- The proposed system should consist of Server, Workstations, suitable UPS & Printers
- The display should be in English Language only

1.1.5 DRILLING PARAMETERS

Following minimum parameters shall be displayed at the derrick floor for continuous operation and monitoring:

1. Hook Load
2. Weight on Bit
3. Stand Pipe Pressure
4. Casing Pipe Pressure
5. Choke Manifold Pressure
6. Kill Line Pressure
7. Tong Line Pull
8. SPM Mud Pump 1
9. SPM Mud Pump 2
10. Total SPM
11. RPM, Rotary Table
12. RPM, Top Drive
13. Rotary Torque
14. Top Drive Torque
15. ROP
16. Hole Depth
17. Bit Position
18. Mud Loss/Gain Volume
19. Active Mud Tank Volume
20. Total Mud Tank Volume
21. Trip Tank Volume
22. Mud Return Flow
23. Mud Density In
24. Mud Density Out
25. Mud Temperature In
26. Mud Temperature Out
27. Ton Mile
28. Flammable Gas at Shale Shaker/Bell Nipple
29. H_2S Gas at Shale Shaker/Bell Nipple
30. Mud Conductivity In/Out

1.1.6 ALARMS

Audio visual alarm shall be provided for the following minimum parameters:

1. Active Pit Level
2. Mud Return Flow Rate High/Low
3. Flammable Gas
4. H_2S Level
5. Rate of Penetration High
6. Pump Pressure High/Low

7. Block Proximity Crown & Floor

2.0 TOP DRIVE INSTRUMENTATION SYSTEMS

The Operating Switches, RPM & Torque Meters, Indicator Lights, Throttle, etc. are to be housed in a purgeable stainless steel enclosure

3.0 HYDRAULIC POWER UNIT CONTROLS

Hydraulic control panel suitable for draw-works control, disc brake control, cathead control and any other control required for the rig package shall be supplied by the manufacturer.

4.0 MUD PUMPS

One Pressure gauge (Make - OTECO), 0 - 6000 PSI range with 2" (50 mm) line pipe female connection and a 2" (50 mm) flex seal valve (Make - OTECO) for isolation of the gauge should be supplied for each pump.

5.0 RIG AIR SYSTEM

One (1) suitable Air System consisting of following:
1. PLC/Microprocessor based control system for air compressors
2. Refrigerated air dryer controls with online dew point meter
3. Air receiver complete with safety relief valve, pressure gauge and auto drain

6.0 INSTRUCTIONS / NOTES

6.1 CONTROL CABLES

Length of all the instrumentation control cables should be sufficient enough to facilitate extension up to 170 ft. from original location i.e. to meet the 15 metres spacing between the wells in cluster locations (the static will remain at original location & moving the mast & sub-Structure only to forward cluster locations). Bidder to confirm the same while quoting.

6.2 CABLE TRAYS

Cable trays with galvanized steel covers suitable for elevating with derrick floor shall be used for leading and supporting all instrumentation control cables. No cable will be allowed to be laid on ground outside of a cable tray. Length of cable tray should be sufficient enough to facilitate extension up to 170 ft. from original location i.e. to meet the 15 metres spacing between the wells in cluster locations (the static will remain at original location & moving the mast & sub-Structure only to forward cluster locations). Bidder to confirm the same while quoting.

6.3 STORAGE & TRANSPORTATION

Suitable arrangement should be made for proper storing of all the instrumentation equipment / sensors including cables after dismantling during rig down operation for rig movement. Bidder to forward the specification of the same with drawing. The dimensions of such container should be within the specified limits indicated under Section – 20 of this document.

6.4 SPARE PARTS

Instrumentation spares for two years normal operation for all equipment/system should be included in the offer indicating item, part no. & quantity required. Item wise price of such spares should also be provided in commercial bid. Bidder should indicate the part nos. against each item along with OEM's part no. if any. The cost of these spares will not be considered for price comparison.

6.5 PARTS CATALOGUE, INSTRUCTION MANUAL & DRAWING

Supplier shall provide three sets of instrument spare parts catalogue and six sets of Operation and Maintenance Manual for all instrumentation and control systems along with schematics. Two sets of the above documents shall be supplied in compact disc.

6.6 CERTIFICATION REQUIREMENT

All the electronic instruments required to be installed in hazardous area are to be approved by Directorate General of Mines Safety (DGMS), Dhanbad, India for installation in Zone 1, Gas Group IIA and IIB classified area. Copies of approvals to be forwarded with the technical bid.
A visual guideline/ map / diagram of demarcation of areas as per DGMS guidelines is attached as ***Addendum-Electrical: Hazardous Area Guidelines Map***

7.0 MAINTENANCE

Bidder shall also quote for three (3) year ON-SITE maintenance, troubleshooting and support service package for the complete rig instrumentation and control system for the following:

- Draw Works Controls
- Draw Works Interface Controls
- Auto Drilling Controls
- Work Stations
- Rigsense or Equivalent System
- Top Drive Instrumentation Controls
- Hydraulic Power Unit Controls
- Rig Air System Controls

The maintenance package shall include services of one competent instrumentation engineer as well as provision of special tools, tackles and instruments. Also, bidder/ supplier shall have minor spare parts at site for immediate replacement so that rig operation does not suffer.

The following points shall be considered for the AMC for rig instrumentation:

- For maintenance and trouble shooting of rig instrumentation & controls one qualified expert engineer shall be employed.
- The person shall be fully conversant with the complete system of rig instrumentation & control system. He should be physically fit for working in the well site. He shall also be able to work with his own hands.
- The spares required for maintenance will either be provided by OIL or will be procured from the service provider if required urgently.

For other matter related to AMC not spelt out above, bidder shall be guided by the “General Notes” under Section 20.

Broad activities:

- Maintenance of the rig instrumentation & control system including sub-systems, input/output modules, remote modules, re-programming or modification of the control system software as per drilling requirement etc.
- Familiarizing the instrumentation crew with the above mentioned equipments/systems and imparting hands-on training for basic troubleshooting and maintenance.
- Preparation of inventory and spare list
- Rectification of any problems, abnormalities, anomalies and defects noticed/logged during the course of a well.

Bidder/ supplier shall arrange for hiring / summoning the services of technical experts in case site engineer is unable to rectify/ troubleshoot a particular problem, at no extra cost to OIL.

SECTION 13: RIG ENGINES

Four (4) CAT 3512 B Series or latest model diesel engines coupled to alternators conforming Tier-I emission norms. Each engine should be with following specifications:

Caterpillar 12-cylinder, direct-injected, turbocharged, after cooled diesel oilfield engine; 4 cycle, 170 mm bore x 191 mm stroke (6.7 in bore x 7.5 in stroke) with separate-circuit after- cooler and optimized for low emissions. Engine rotation: standard (counter-clockwise as viewed from flywheel end). Engine Rating = 1250 to 1300 gross horse power at 1000 RPM.

EMISSION NORMS

The engine shall conform to minimum Tier-I or latest emission norms, it shall be bidder's endeavor to offer Caterpillar make engines only. **Engine Fault Diagnostic Tools (both software as well as hardware) shall be supplied along with the unit. Bidder shall categorically confirm in the bid that the offered software is for the particular engine.**

Each engine should be complete with the following:

AIR INLET SYSTEM
After cooler core, corrosion resistant Air cleaner, Heavy duty, with soot filter. Service indicators.

CONTROL SYSTEM
Caterpillar ADEM - II ECM or any advanced version as per engine design, LEFT HAND. Requires 24V DC 10-amp continuous, 20- amp intermittent, clean electrical power.

COOLING SYSTEM
In order to ensure compliance in use, optional or customer-supplied radiators must be capable of rejecting enough heat to allow proper operation at worst case site conditions, and also must supply 122 deg F (50 deg C) SCAC cooling water to the after cooler inlet, with an SCAC flow rate of at least 100 GPM (379 l/m) with an ambient temperature of 86 deg F (30 deg C) and at-site conditions (including altitude considerations). Maximum allowable SCAC flow rate is 115 GPM (435 l/m).

RADIATOR COOLED LAND BASED:
Outlet controlled thermostat and housing. Jacket water pump, gear driven. Dual outlets: 88.9 mm O.D. (3.5 in) elbow hose connections. After cooler fresh water cooling pump (SCAC), gear driven centrifugal SCAC pump circuit contains a thermostat to keep the after cooler coolant from falling below 30 deg C (85 F).

EXHAUST SYSTEM
Exhaust outlet: 292 mm I.D. (11.5 in).
12-10.5 mm dia holes EQ SP, 376 mm bolt hole dia.
Exhaust flexible fitting:
318 I.D. mm (12.5 in)
12-14 mm dia. holes EQ SP, 375 mm bolt hole dia. 306.6 mm tall with compressed gasket.
Exhaust adapter:
297 mm I.D. to 340 mm I.D. (11.7 in to 13.4 in).
12-10.5 mm dia. holes EQ SP, 376 mm bolt hole dia.
12-13.8 mm dia. holes EQ SP, 430 mm bolt hole dia.
158.5 mm tall with compressed gasket.
Weldable flange:
360 mm I.D. (14.2 in).
12-13.8 mm dia. holes EQ SP, 430 mm bolt hole dia.

17.4 mm wide with compressed gasket.
Exhaust manifolds, dry.
Dual turbochargers with w/c bearings.

12” SPARK ARRESTING MUFFLER – INDUSTRIAL GRADE:
Includes nuts, bolts, and flanges for connections.

FLYWHEELS & FLYWHEEL HOUSINGS
Flywheel, SAE No. 00
Flywheel housing, SAE No. 00
SAE standard rotation

FUEL SYSTEM
Fuel filter.
Fuel transfer pump
Flexible fuel lines
Fuel priming pump, LEFT HAND
Electronically-controlled unit injectors.

INSTRUMENTATION
Electronic instrument panel, LEFT HAND.
Analog gauges with digital display data for:
Engine oil pressure gauge.
Engine water temperature gauge.
Fuel pressure gauge.
System DC voltage gauge.
Air inlet restriction gauge.
Exhaust temperature (prior to turbochargers) gauge.
Fuel filter differential pressure gauge.
Oil filter differential pressure gauge.
Service meter (digital display only).
Tachometer (digital display only).
Instantaneous fuel consumption (digital display only).
Total fuel consumed (digital display only).
Engine start-stop (off, auto start, manual start, cooldown timer).

LUBE SYSTEM
Crankcase breather
Oil cooler
Oil filter.
Shallow oil pan
Oil pan drain valve, 2' NPT female connection
Lubricating oil, SAE 10W30, Caterpillar DEO (CG4) 643 L.

MOUNTING SYSTEM
Rails, mounting, floor type, 254 mm (10 in).

POWER TAKE-OFFS
Accessory drive.
Lower LEFT HAND front (available for PTO usage).
Front housing, two-sided

PROTECTION SYSTEM
ADEM - II ECM or any advanced version monitoring system provides engine de-ration, or shutdown strategies to protect against adverse operating conditions. Selected parameters are customer-programmable. Status available on engine- mounted instrument panel and can be broadcast

through the optional customer communications module or programmable relay control module(s). Initially set as follows:
Safety shutoff protection, electrical: Oil pressure, water temperature, over speed, crankcase pressure, after cooler temperature. Includes air inlet shutoff, activated on over speed or emergency stop.

Alarms, electrical:
ECM voltage, oil pressure, water temperature (low and high), over speed, crankcase pressure, after cooler temperature, low water level, air inlet restriction, exhaust stack temperature, filter differential pressure (oil and fuel).

Derate, electrical:
High water temperature, crankcase pressure, after cooler temperature, air inlet restriction, altitude, exhaust temperature.
Emergency stop push button, located on instrument panel. Alarm switches (oil pressure and water temperature), for connection to alarm panel.

STARTING SYSTEM
Air starting motor, RIGHT HAND, 620 to 1034 kPa (90 to 150 psi), LEFT HAND
Control Air silencer

GENERAL
Paint, Caterpillar Yellow
Vibration damper and guard
Lifting eyes

WITH THE FOLLOWING ACCESSORIES INCLUDED:

GOVERNOR CONVERSION:
TECHNICAL: Converts engine to direct rack controls requiring 0-200 MA DC control.

FLEXIBLE COUPLING:
Viscous damped.
Includes flywheel guard.

COUPLING HUB - 127 MM DIA MAX:
FOR USE WITH: 127 mm (5 in) diameter maximum shaft, 31.7 x 31.7 mm (1-1/4 x 1-1/4 in) key.

ACOUSTIC ENCLOSURE:

The acoustic enclosure shall be designed for minimum 25 db(A) insertion loss or for meeting the ambient noise standards, whichever is on the higher side. (As per guideline of Central Pollution Control Board, Januray 2008 (Ministry of Environment & Forests, Govt of India)
The DG set shall be provided with proper exhaust muffler with insertion loss of minimum 25 db(A)
Authorised agencies for certification as per CPCB

i) Automotive Research Association of India, Pune
ii) National Physical Laboratory, New Delhi
iii) Naval Science & Technology Laboratory, Visakhapatnam
iv) Fluid Control Research Institute, Palghat.
v) National Aerospace Laboratory, Bangalore

COMPONENTS TO BE OFFERED WITH POWER PACK
Two (2) sets of standard tool kit as per ANNEXURE-I (indicated at the end of this section) for carrying out normal maintenance of engine should be supplied in a conventional tool box.
In addition to above, the special tools as mentioned below should be supplied along with the engine

- Alternator Alignment Tool kit with Instruction Manual - 2 Nos.
- Blow-by Measurement Tool kit - 1 No.
- Fuel Injector Timing setting tool - 1 No.
- Air Restriction Measurement tool - 1 No.
- Heavy Duty Digital Multimeter – 2 Nos.
- Lube Oil testing Kit - 2 Nos.
- Infra Red Digital Tachometer(0 to 9999 RPM) – 2 Nos.
- Belt Tension Gauge - 2 Nos.
- Laptop (ET) for monitoring Engine Parameters. – 1 No.
- CAT battery Charger/ Charging Alternator & 24 V Battery for ECM for each unit – 1 Set
- Rechargeable Emergency lamp - 2 Nos.

Bidder has to quote the price of the tool kit and special tools separately. The cost of the tool kit and special tools will be considered for commercial evaluation.

OPERATING SITE CONDITION

The engines should be suitable for operation at the following site condition –

Engine site temperature	-	41°Cent. (Max)
Engine site temperature	-	6°Cent. (Min)
Maximum relative humidity at 21°C	–	100%
Maximum relative humidity at 35°C	-	95%
Maximum relative humidity at 41°C	-	70%
Altitude above sea level	-	150 m.
Average annual rainfall	-	343 cms.

NOTES FOR SECTION 13

1. SPARE PARTS

Spares for two years normal operation of engine and its accessories should be included in the offer. Item wise breakdown price of spares should also be provided. Bidder should indicate the part nos. against each item along with supplier's part no. if any. The cost of spares will not be considered for price comparison.

2. PARTS LIST, INSTRUCTION MANUAL & DRAWING, TECHNICAL INFORMATION & BULLETIN.

The supplier should provide 6 (six) set of parts list, dimensional drawing of all major components, operations manual & service manual covering all the items with the delivery of the material. Technical details of the engine, etc. along with 1 (one) set of part list, dimensional drawing of all major components, operation manual & service manual are to be provided along with the offer.

The supplier has to provide installation diagram of the complete set along with performance curve along with the quotation for our technical scrutiny.

The bidder shall furnish technical data sheets and dimensional drawing along with the quotation.

3. TEST CERTIFICATE

The complete sets have to be load tested at manufacturers work & test certificate have to be provided along with the delivery of material. Our engineer will visit to witness the load test.

The nature of after sales services, which can be provided by the successful bidder during initial commissioning as also in subsequent operation, should be clearly indicated.

Supplier must categorically confirm regarding compliance with the inspection / test procedure and other terms and conditions detailed above are very essential. Offers will be liable for rejection in the absence of such confirmation.

Deviation in respect of any specification as detailed above should be highlighted with technical calculation / catalogue/literature etc.

4. TECHNICAL CHECK LIST FOR CATERPILLAR ENGINE

[THE FOLLOWING CHECK LIST MUST BE COMPLETED AND RETURNED WITH THE TECHNICAL BID. ALSO ENSURE THAT ALL THESE POINTS ARE COVERED IN YOUR OFFER. THESE WILL ENSURE THAT YOUR OFFER IS PROPERLY EVALUATED. PLEASE TICK MARK '**YES**' OR '**NO**' TO THE FOLLOWING QUESTIONS, IN THE RIGHT HAND COLUMN]

Sl. No.	Points	Remarks
1	Whether the offered engine is four stroke diesel engine having direct injection, turbocharged, after cooled and counter clock-wise rotation (as viewed from flywheel end) ?	YES/ NO
2	Whether the offered engine is capable of developing gross horse power 1250 to 1300 at 1000 RPM and should be capable to drive the Alternator of 1215 KVA capacity ?	YES/ NO
3	Whether the offered engine is compatible to power and torque trend (varying loading pattern), responsive to instantaneous load and torque changes?	YES/ NO
5	Whether the offered engine is for continuous duty?	YES/ NO
6	Whether the offered engine is compatible to SCR or Variable Frequency Drive (VFD) and suitable for drilling rig application?	YES/ NO
7	Whether detail specifications of engine and alternator along with technical literature / catalogue /schematic layout (plan & elevation) of the engine and alternator offered enclosed with the offer?	YES/NO
8	Whether the RPM of the engine is provided?	YES/ NO
9	Has the bidder clearly mentioned the specification of the cooling system of the offered engine. Whether the bidder provided the heat load calculations for offering Radiator along with the offer for OIL's scrutiny. ?	YES/ NO
10	Has the bidder clearly mentioned the specification of all the general accessories /fittings of the offered engine?	YES/ NO
11	Has the bidder included the list of spare parts for engine and its accessories required for normal operation of the offered engine for two years? Has the bidder mentioned the price of each spare separately?	YES/ NO
12	Has the bidder provided the general arrangement / dimensional drawing of the offered engine and alternator?	YES/ NO
13	Whether the bidder gives assurance that after sales service in respect of engine and alternator will be provided by their respective OEMs or authorized dealer for 10 years?	YES/ NO
14	Whether the bidder gives the confirmation from the OEMs that the equipment to be supplied are not going to be obsolete for next 10 years and provision for supplying spares of the equipment to be continued?	YES/ NO
15	Whether the bidder will install and commission the power packs at site in and around Duliajan, Assam, India. ?	YES/ NO
16	Do you agree to the conditions that power packs will be inspected in stages by OIL's representatives before despatch and load testing of the same shall be carried out in presence of OIL's representative at manufacturer's works?	YES/ NO
17	Has the bidder separately highlighted any deviation from the technical specifications?	YES/ NO
18	Whether the Emission norms of the Supplied Engines are as per Tier-I?	YES/ NO
19	Has the bidder mentioned any other items/ points not indicated/ included in the	YES/ NO

	specifications, but deemed necessary for installation/ commissioning and efficient control, operation and protection of the alternators and engines?	
20	Whether the bidder will supply the Special Tools as mentioned?	YES/ NO
21	Whether noise level produced by the engine is not exceed 90 DB while delivering the rated output?	YES/ NO
22	Whether the bidder will supply the Tool Box as per Annexure I as mentioned?	YES/ NO
23	Whether acoustic enclosure of the power pack is provided as per NIT?	YES/ NO

Offer Ref .....…… Dated .....

OIL's Tender No. .....…… Signed ……..…..…..

For & on behalf of .....Designation .....

ANNEXURE –I

STANDARD TOOL KIT CONSISTS OF FOLLOWING TOOLS FOR CATERPILLAR ENGINES

1) One (1) each of OPEN JAW DOUBLE ENDED SPANER, SIZES (in MM): 6 x 7 , 8 x 9 , 10 x 11, 12 x 13 , 14 x 15 , 16 x 17 , 18 x 19 , 20 x 22 , 21 x 23 , 24 x 26 , 25 x 27 , 28 x 30 , 30 x 32 (TOTAL 13 NOS.)
MAKE: GRIPHOLD / MEKASTER / STANLEY

2) One (1) each of DOUBLE ENDED RING SPANNER, SIZES (in MM): 6 x 7 , 8 x 9 , 10 x 11, 12 x 13 , 14 x 15 , 16 x 17 , 18 x 19 , 20 x 22 , 21 x 23 , 24 x 26 , 25 x 27 , 28 x 30 , 30 x 32 (TOTAL 13 NOS.)
MAKE: GRIPHOLD / MEKASTER / STANLEY

3) One (1) each of HEAVY DUTY DOUBLE HEX. STD. SOCKETS IN 1/2" SQ. DRIVE, ISIZES (in MM): 8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32 & 34 (TOTAL 26 NOS.)
MAKE: GRIPHOLD / MEKASTER / STANLEY

4) One (1) REVERSIBLE RATCHET IN 1/2" SQ.DRIVE, OVERALL LENGTH: 260 MM.
MAKE: GRIPHOLD / MEKASTER / STANLEY

5) One (1) SLIDING T-HANDLE IN 1/2" SQ.DRIVE, OVERALL LENGTH: 300 MM.
MAKE: GRIPHOLD / MEKASTER / STANLEY

6) One (1) each of EXTENSION BAR IN 1/2" SQ.DRIVE, with OVERALL LENGTH 75 MM, 125 MM & 300 MM respectively.
MAKE: GRIPHOLD / MEKASTER / STANLEY

7) One (1) UNIVERSAL JOINT IN 1/2" SQ.DRIVE, OVERALL LENGTH: 78 MM.
MAKE: GRIPHOLD / MEKASTER / STANLEY

8) One (1) SWIVEL HANDLE IN 1/2" SQ.DRIVE, OVERALL LENGTH: 380 MM.
MAKE: GRIPHOLD / MEKASTER / STANLEY

9) One (1) L-HANDLE IN 1/2" SQ.DRIVE, OVERALL LENGTH: 210 MM.
MAKE: GRIPHOLD / MEKASTER / STANLEY

10) One (1) ADAPTER 3/4" F x 1/2" M
MAKE: GRIPHOLD / MEKASTER / STANLEY

11) One (1) ADAPTER 3/4" M x 1/2" F
MAKE: GRIPHOLD / MEKASTER / STANLEY

12) One (1) each of UNIVERSAL SOCKET WRENCH,1/2" DRIVE, SIZE: 1/4", 3/8", 1/2", 9/16" & 5/8" (TOTAL 5 NOS.)
MAKE: GRIPHOLD / MEKASTER / STANLEY

13) One (1) each following TORQUE WRENCHS
CAPACITY: 0-250 LBF-FT
CAPACITY: 0-1000 LBF-FT
MAKE: GRIPHOLD / MEKASTER / STANLEY

14) One (1) SCREW DRIVER ENGINEER PATTERN: 200 X 10
MAKE: GRIPHOLD / MEKASTER / STANLEY

15) One (1) SCREW DRIVER PHILLIPS PATTERN: 8 X 150
MAKE: GRIPHOLD / MEKASTER / STANLEY

16) One (1) each of ADJUSTABLE WRENCH: 8" & 12" respectively.
MAKE: GRIPHOLD / MEKASTER / STANLEY

17) One (1) set of ALLEN KEYS 1.5 MM TO 10 MM
MAKE: GRIPHOLD / MEKASTER / STANLEY

18) One (1) COMBINATION PLIER: 6"
MAKE: GRIPHOLD / MEKASTER / TAPARIA / EVEREST.

19) One (1) LONG NOSE PLIER: 160 MM
MAKE: GRIPHOLD / MEKASTER / STANLEY

20) One (1) CIRCLIP PLIER -INTERNAL: 175 MM
MAKE: GRIPHOLD / MEKASTER / STANLEY

21) One (1) CIRCLIP PLIER -EXTERNAL: 175 MM
MAKE: GRIPHOLD / MEKASTER / STANLEY

22) One (1) CENTRE PUNCHES: 4"
MAKE: GRIPHOLD / MEKASTER / STANLEY

23) One (1) BALL PIEN HAMMER: 200 GMS
MAKE: GRIPHOLD / MEKASTER / STANLEY

24) One (1) PLASTIC TIP HAMMER:25 MM DIA
MAKE: GRIPHOLD / MEKASTER / STANLEY

25) One (1) FEELER GAUGE-300 MM (26 BLADES) INCH AND MM COMBINED
MAKE: GRIPHOLD / MEKASTER / STANLEY

26) One (1) FOOT RULE: 12" (Stainless Steel)

27) One (1) MEASURING TAPE: 3 MTS (METALLIC)

28) One (1) DIAGONAL CUTTING PLIER: 160 MM
MAKE: GRIPHOLD / MEKASTER / STANLEY

29) One (1) each THREAD GAUGE: For BSW, METRIC & UNC threads.
MAKE: GRIPHOLD / MEKASTER / STANLEY

30) One (1) OUTSIDE CALIPER 6"
MAKE: MAKE: GRIPHOLD / MEKASTER / STANLEY

31) One (1) INSIDE CALIPER 6"
MAKE: MAKE: GRIPHOLD / MEKASTER / STANLEY

32) One (1) SCREW EXTRACTOR SET (HEXAGONAL) CONTAINING DRILL SIZE IN INCHES: 1/4", 3/16", 3/8", 5/16", 7/16", 9/16", 1/2", 5/8", 3/4", 11/16", 1/8", 13/16", 7/8" (TOTAL 13 NOS)
MAKE: SNAP ON

33) One (1) SPIRIT LEVEL 30 CM (12”)

34) One (1) ULTRA LOW FLAT JACK REMOTE CONTROL COMPLETE WITH HYDRAULIC HAND PUMP, PRESSURE RELIEF VALVE, PRESSURE GAUGE AND 2.5 TO 3 MTS HYDRAULIC HOSE .
CAPACITY: 10 TON, CLOSED HEIGHT: 40-43 MM, STROKE: 10-12 MM, RAM DIA: 34-38 MM, WEIGHT OF THE JACK: 2 TO 4 KG.
MAKE: MAKE: GRIPHOLD / MEKASTER / STANLEY

SECTION 14: RIG AIR SYSTEM

One (1) suitable Air System consisting of following:

- Two (2) Sullair model 4509 or equivalent AC/AC heavy-duty industrial rotary screw compressors each rated 267 CFM at 125 PSI, with 415 volts AC, 3 phase, 50 Hz TEFC motors, WS microprocessor controller standard, starters, controls in NEMA 4 enclosed.
- One (1) Sullair Model SRL-700 or equivalent Refrigerated Air Dryer designed to provide a pressure dew-point of 35-39 deg F. with an inlet flow of 700 scfm, an inlet pressure of 100 psig, an inlet temperature of 100 deg F and 100 deg F. Ambient. Electrical 415 volts AC, 3 phase, 50 Hz. Includes suitable One each Pre-filter & after filter.
- One (1) suitable cold start reciprocating air compressor unit, two stage, two-cylinder; pressure lubricated and to provide 42.4 CFM at 175 psig. The compressor should be powered by a suitable air cooled diesel engine. Unit includes intake filter, V-belt drive and guard, pneumatic pilot and clutch PTO. The compressor and engine should be mounted on a rigid steel base.
- Two (2) Vertical Air Receiver of capacity of around 400 US gallon (53 cu. Ft.), Vertical air receiver with 2" NPT inspection opening and saddles, size 36"x 101" ASME code 165# MWP, to come complete with relief valve, pressure gauge and auto/drain.

SPECIAL NOTE:

1. All the components of the Air system are to be accommodated in the Power Pack Skids and within the Acoustic Enclosure.
2. HP rating of the Electrical motor to be matched to get desired pressure & capacity.

SECTION 15: RIG FUEL SYSTEM

One (1) suitable Fuel System consisting of following:

02 (Two) nos. of Fuel tanks with total capacity of around 500 bbl (80 KL), mounted on a two runner oilfield skid. The diameter and the length of the tank shall be 243.83 cm (8 ft) and 914.4 cm (30 ft) respectively. Tank(s) should be cylindrical & to have exterior and interior ladder, man way, and vent.

The bidder shall provide Tank Calibration Chart in centimeter scale. The tanks shall be complete with graduated scale on a suitable place so that fuel depth can be measured from outside

One (1) FUEL FILTER SYSTEM

This filter package should be three-stage filter type. There is a pre-filter to remove dirt, a coalescer element to form dissolved water into droplets and separator element to make the water droplets drop out of the fuel.

PRE-FILTER: Contains a quantity of **three** pleated paper filter elements each rated to remove solids to five (5) microns. The three elements will hold approximately twenty pounds of dirt before time to change out the elements. The purpose of the pre-filter is to trap solids or dirt before they can reach the coalescer.

COALESCER**:** Contains a quantity of **two** coalescer elements and two separator elements. The purpose of the coalescer element is to separate the water from the fuel by forming the water into droplets so that the water will fall out of the fuel by gravity. The purpose of the separator element is to repel any droplets that do not fall out of the fuel. This tank has an automatic drain valve to let the separated water out. This is what is commonly referred to as two-stage separation. It is important to remember that even though the coalescer and separator elements will remove dirt, their primary function is to remove water. Rated to remove water to 5 parts per million or 99.999995%

DIESEL FUEL TRANSFER PUMPS-- Two packages each having a gear pumps with built in relief valve, rated at 35-39 GPM mounted on a base with a Flexible coupling, OSHA coupling guard and a 3 HP, 1500 RPM, explosion proof motor, 415 volt, 3 phase, 50 Hz.
HP rating of the Electrical motor to be matched to get desired pressure & capacity.

MOUNTING: These two filter tanks along with the two pump packages to be mounted on a base, piped with valves for series flow through the tanks or to bypass the filters. The pumps will be manifold together so that product can flow through either pump while the other pump is operating. Pressure gauges are mounted on each of the tanks to measure pressure drop and know when to change filters. The system will also include an **automatic drain for water**, and all necessary valves, unions etc. to make it a complete functional unit. The system only requires a hose from the main fuel storage and a hose to the day tank. The total unit is painted with a two part catalyst setting epoxy.

SECTION 16: RIG INTERCOM SYSTEM

One (1) suitable Rig Intercom system consisting of following:

- One (1) Line Balance Assembly, for Division 2 areas.
- One (1) Wall Mount Audio Messenger Interface.
- Four (4) Outdoor Station, 5 party line for Division 2 areas consisting of:
  - Handset/ speaker amplifier with press bar handset and an auxiliary receptacle.
  - Weather proof metallic enclosure at Driller's position, shakers and choke manifold.
- One (1) Indoor Wall Station for Division 2 areas, consisting of:
  - Handset/ Speaker Amplifier with press bar handset an auxiliary jack.
  - Indoor enclosure SCR house.
- Four (4) Indoor Wall Stations, 5 Party Line for Class 1, Division 2, consisting of:
  - Handset/ speaker amplifier with press bar handset
  - Indoor enclosure at Doghouse, tool pusher office, company man office, safety supervisor office.
- Nine (9) Weatherproof Driver Unit for Division 2 areas, rated 30 watts at 16 ohms.
- Nine (9) Weatherproof Re-entrant Horns.
- Nine (9) Speaker Mounting Assemblies.
- One (1) Headset/ Microphone Assembly. Includes double receiver, gooseneck noise canceling microphone and a five foot coil cord.
- One (1) extension cable for use with headset microphone includes push-to-talk button, belt clip and 6-pin plug for Derrick man (at Racking Board).
- One (1) 1 KVA UPS system with internal batteries that will provide a 1 KVA backup for 10 minutes and standby for 1 hour based on the system offered.
- One (1) lot of cables and disconnects for this rig intercom system.

SECTION 17: MATHEY WIRELINE UNIT

One (1) Mathey Surveyor 2007 or equivalent wire line unit of following specification:

DRUM ASSEMBLY:
Capacity: 7620 M (25,000 ft) of 0.092 in. wire line
Large diameter drum shaft
Pillow block bearings each end
Hand crank to be provided for rig up/rig down operation

OPERATOR CONTROLS:
All controls located so that unit is operated from front of unit. All control levers, knobs, etc. should be located conveniently for operator.

BRAKE ASSEMBLY:
Disc brake, Mechanical brake lever convenient to operator

DRIVE ASSEMBLY:
Chain and sprocket drive
Transmission, 3 speeds forward, 1 reverse

POWER DRIVE ASSEMBLY:
15 HP explosion proof electric motor, 3-phase, 50 HZ, 415 volt AC, Class I, Group D, Division I, 55°C ambient temp., Explosion proof starter box with start/stop station, Explosion proof coupling between starter box and motor, All components UL / CSA rated.
In other places, wherever mentioned, UL certification shall be considered as equivalent to CMRI (India) certification; however DGMS (India) approval shall be binding and final for all equipments to be used in Hazardous areas as per DGMS Guidelines/ Directive
*(**Annexure-Hazardous area guideline map may be referred**).*

HYDRAULIC ASSEMBLY:
Open loop system, 2,000 PSI working pressure
Relief valve; adjustable
Hydraulic pump
Hydraulic motor
Governor valve (Speed Control)
Directional valve (4-Way)
Diverter valve (Run / Stop)
System pressure gauge
Large hydraulic reservoir with sight gauge
Filtration system
All hoses and fittings sized for maximum flow
All controls located for operator efficiency and comfort

SPOOLING/MEASURING ASSEMBLY:
Rack arm post; installed (for installation of Rack Arm assembly)

MOUNTING:
Skid mounted, Raised drum for ease of operation, Lifting shackles, Forklift pockets, Sheet steel cover guards & Compact footprint.

PAINT: 3-COAT PAINT SYSTEM
Abrasive blast to bright metal
Prime coat - Inorganic zinc rich primer
Intermediate coat – epoxy
Topcoat – Acrylic urethane

APPROXIMATE PERFORMANCE:
Line Pull 3400 lbs. (1542 kg)
Speed 1375 fpm (419 mts/min)

APPROXIMATE SPECIFICATIONS:
Wt. 2000 lbs. (900 kg)
Dim. 36" F-B (914.4 mm); 60" H (1701 mm); 48" W (1219 mm)

One (1) WIRELINE .092" x 25,000' Conforming to API Spec. 9A with API Monogram.

One (1) WIRELINE CLAMP (0.082-3/16)

One (1) Floor Sheave Assembly with Line Wiper, 7", (0.066-0.092)
Weight around 17.9 Pound & Consisting of 7" Hay Pulley machined for .066" through .092" diameter wire line, 7" Floor Stand, and Line Wiper.

One (1) "O" METER, 7 INCH, METERAGE MEASURE, DIRECT, .092
Meterage Measure; counter attached to meter

One (1) DOUBLE RACK ARM ASSY

One (1) WEIGHT INDICATOR, ENGLISH, 0-2000 LBS

SECTION 18: RIG ELECTRICALS

Contents:
Broad outlines

Chapter I: Specification of Items/ Equipment
- IA: Power packs
  - IA1: Engine
  - IA2: Alternators
- IB: Power Control Rooms
  - IB1: Main PCR
  - IB2: Auxiliary Control PCR (ACPCR)
- IC: Drive Motor Specifications
  - IC1: DrawWorks Motor Specifications
  - IC2: Rotary Drive Motor Specifications
  - IC3: Top Drive Motors
  - IC4: Mud Pump Drive Motor Specifications
  - IC5: AC Auxiliary Motors
- ID: Cables
- IE: Auxiliary Equipment & Systems
  - IE1: Rig Lighting System
  - IE2: Well-site Area & Crew Hut Illumination Control Panel, Skid Mounted
  - IE3: Cable handling system consisting of Cable trays, Cable boxes and grasshopper arrangement to derrick floor
  - IE4: Rig Earthing System
  - IE5: Electrician's tools, instruments, special tools, computers for the control system

Chapter II: Standards, Statutory Rules and Regulations to be followed

Chapter III: Spares

Chapter IV: Approval of Drawings, Stage Inspection, Performance Testing at Works, Training and Support Service package

Chapter V: Electrical Annexures
- VA Electrical Annexure- Statutory- Hazardous area classification, Cables
- VB Electrical Annexure- Standards
- VC Electrical Annexure- Main PCR MCC Starters/ Feeders
- VD Electrical Annexure- ACPCR MCC Starters/ Feeders
- VE Electrical Annexure- Schedule of Submission of Drawings/ Documents
- VF Electrical Annexure- Datasheet
- VG Electrical Annexure- Indicative Drawings
- VH Electrical Annexure- Commissioning Schedule of Electrical Equipment

BROAD OUTLINES

Electrical Scope of the rig shall encompass complete Design, Engineering and Manufacture, Supply, Commissioning and Testing of the different electrical equipment/drives to be used in the rig with their connected loads. In addition, all current/ latest statutory Indian rules, regulations and standards as well as International standards applicable shall be mandatory in design, engineering, application and commissioning.
The electrical system of the rig shall be complete in all respect. All equipments specified below shall be new, unused, of recent manufacture and free from all manufacturing defects. Equipment should be of proven design, and running successfully under similar conditions of operation.
Bidder/ supplier should integrate all supplied equipment and systems and functionally test the complete setup.
In case any of the following equipment/ items is/are outsourced, bidder shall clearly indicate country and company of origin.
All documents, technical drawings, manuals, literatures, brochures etc. pertaining to the equipment below shall be in English language (UK or US).

The following chapters give the detailed specifications for the Rig Electricals.

CHAPTER I: SPECIFICATIONS OF ITEMS / EQUIPMENT

A. **GENERAL:**

The rig shall be powered by captive power packs consisting of turbo-charged diesel engine driven alternators. Number of power packs should be commensurate with the total power to be consumed during full drilling operations with all auxiliary systems including power requirement for the site camps. The power packs shall be suitable for generating alternating voltage at 600 V, 50 Hz (cps).

Bidder shall also include in the package, auxiliary electrical systems for operation of the rig, viz. all electrical motors of the solid control system, rig lighting system, utility system (compressed air, water etc.), cable system including cable trays, boxes & grasshopper/ elevators, earthing system, maintenance and testing facility for rig control system, complete set of spares etc.

Control system for the power packs and all electrical drives, lighting loads and auxiliary electrical system shall be housed inside power control rooms (PCRs). Various drives & equipment of the rigs will be powered from the PCRs by electrical/ electronic/ digital signal, power and control cables.

A suitable integrated proven rig control system (electronic) shall be used to enable:
The driller to assign and control the Main drives and auxiliary drives from his cabin/ control panel
Communicate among various drives and the driller and monitor/ offer real time status of various parameters including engine/ alternator status, motor drives status, current, voltage, power etc. along with the major drilling parameters.

The main drive motors shall be VFD controlled AC cage induction motors. The VFD system shall preferably be PWM / direct torque control system, suitable for controlling drilling motors.

The Electrical System of the rig should be broadly designed to operate the following major equipment:

Power Packs (minimum 4 nos.) – Specified in Section - 13.
Draw-works drive- with 02 nos. of VFD controlled AC drilling cage motors
Top drive (electrical) - Separate feeder / fully functional VFD cubicle for top drive shall be available in the main power control room.
Rotary table- with 1 no. suitable rotary drive AC cage motor
Mud pumps (2 nos.)- with 2 nos. each VFD controlled AC cage drilling motors

Auxiliary braking system: The auxiliary/dynamic braking system shall be integrated with the VFD control, in conjunction with braking resistors.

In addition, the Electrical system shall also operate the auxiliary electrical equipment.

Rig shall be designed for cluster drilling operation and be capable of drilling 1+3 cluster wells from the same plinth, without moving the PCRs. Each well is 15 metres apart.

I. A: Power Pack

Qty.: Minimum 4 (four) nos.
Engine coupled with the alternator shall be unitized and enclosed in a weather-proof, acoustical, skid mounted enclosure. Power packs shall be

Compatible for varying loading pattern, quick responsive to instantaneous load and torque changes
Suitable for VFD controlled AC drives
Easily serviceable both at site and at workshop
Compatible with suitable control signals coming from Power Control Rooms (these may be actuator control / speed sensor signals).
The alternators (with the engines) shall be suitable for parallel operation.

***I.A.1 Engine*:** Detailed specifications are available elsewhere

Engine Control: Engine control system shall be integral to the engine. The system shall be complete in all respect including controlling/ operation, protection features with emergency shutdown etc.
Electronic load sharing governor with speed adjust, idle/run switch, and isochronous/droop switch shall be provided with the engine control panel.

I.A.2 Alternators:

Alternators shall be matched to the engines. They shall be of heavy-duty construction, designed for drilling applications, which require heavy duty motor starting and predominantly non-linear loads such as SCRs /VFDs. The alternator shall be able to withstand the shock and vibration associated with the frequent relocation of drilling rigs, as also to withstand severe environmental conditions including heat and high humidity. Rotors should be dynamically balanced and engineered to withstand 125% over nominal speed.

Alternators should be manufactured to international standards and should meet or exceed BIS, NEMA, IEEE, ANSI and IEC requirements. **Bidder to confirm standards followed in design and construction**.

(Clarification: Though a myriad of International/ National manufacturing standards have been referred to in the bid document, the Indian National Standard, BIS, will be the standard guidelines to be followed. Wherever BIS is not available/ specific, other International standard like IEC and IEEE shall be considered applicable)

The following are the minimum specifications for the alternator

1.	Rated voltage	600 VAC
2.	Capacity:	Minimum 1215 kVA (850 kW at 0.7 p.f.)
3.	Power factor	0.7 lagging
4.	Phases	3 phase,3 wire star connected with isolated ungrounded neutral, but neutral available at terminal box
5.	Frequency	50 Hz
6.	Speed	1000 RPM
7.	Duty	Continuous, at 55 deg. C ambient
8.	Insulation Class	H for exciter, rotor and stator
9.	Enclosure	Open drip proof IP 23 minimum, Terminal box IP 44 minimum

10.	Temperature rise	80 deg. Celsius at full load and max. ambient taken as 55 deg C.
11.	Type of cooling	Forced air type blower fan on DE
12.	Alternator waveform	Deviation factor : 5 % max Crest factor : 1.41± 0.07 Form factor : 1.11 ± 0.05 Harmonics content : 3 % max. (total) : 2 % max (individual)
13.	Voltage regulation	Voltage regulation shall be within ± 2%
14.	Voltage balance	With balanced loads, the voltage to be held within 1.0% between phases

Constructional Features of the Alternators:

1. The alternator should be mounted in a single skid with the engine.
2. Rotor and stator shall be vacuum pressure impregnated and dried.
3. Drip proof enclosure and drip proof removable cover for exciter shall be provided.
4. Terminal box shall be of termite and dust proof construction with removable cover.
5. Stator leads shall be terminated on suitably rated copper straps (standoff connectors) for connection to load side.
6. Two non-corrosive stainless steel ground pads mounted diagonally opposite each other on generator frame shall be provided.
7. Plate for main cable entry should be of non-magnetic materials to avoid heating by generation of eddy currents, as single core power cable will be used for termination.
8. Insulation barrier should be provided to separate power and control terminals.
9. Two nos. eye bolts for lifting the machine should be provided on the main frame.
10. Channel mounted terminal block shall be provided for terminating the following-
    a) RTD Leads
    b) Exciter field leads
    c) Space heater leads
    d) Engine actuator leads, if required
    e) Magnetic pickup leads, if required
    f) Engine protection system leads
11. Two nos. of single core 300 sq. mm cables are to be used for each phase.
12. Plugs / Sockets should be Amphenol / Pyle National /Connectwell / Cutler Hammer make.
13. Cable glands shall be provided for safe and proper entry of all cables
14. All the terminals shall be labeled properly.

Technical Notes:

A. The Alternator make should be **Kato/ Caterpillar/ Baylor**
B. Complete power pack should be load tested prior to dispatch and to be commissioned in field.
C. Reports of following standard commercial tests performed on the offered alternators (in accordance with IEEE Std. 115, NEMA MG-1, or MIL-Std. 705 standards) ***shall be attached with the technical bid***.
    - Resistance on all windings (cold)
    - Insulation resistance on all windings
    - High potential test on all windings
    - Open-circuit saturation curve
    - Voltage balance on windings
    - Current balance on windings
    - Phase sequence
    - Mechanical balance (vibration)
    - Circulating current (when applicable)
    - Three-phase build-up short-circuit (conducted if the generator has a PMG or SBO)
    - Voltage transient at rated kVA (voltage regulation, stability, and response)

D. ***Bidder shall submit the datasheet of the offered alternator along with the technical bid***, which shall include the data of the offered alternator. The following shall also be mentioned:
   I. Overload capacity: In percentage along with short-circuit capability
   II. Phase unbalance capacity (negative sequence component)
   III. Efficiency at 25%, 50%, 75%, 100%
   IV. Permissible vibration limit: In micron & mm/sec for bearing & foundation pad
   V. Radial & axial clearance for DE / NDE bearings: Maximum & minimum tolerable clearances

   Any other details may be mentioned.

I B: Power Control Rooms (PCRs)

Power control room (s) shall house controls for main drives and auxiliary drives of the rig.
Features:

There shall be two (2) PCRs, as follows:

1. Main PCR, which is the primary control room, shall house
   - Generator control panels,
   - Rectifier and VFD panels,
   - Auxiliary motor control panels (auxiliary motors required for the main drilling motors, air compressors, water pumps etc as shown in the indicative single line diagram of Main PCR.).
   - Auxiliary brake controller/ chopper shall be housed in the Main PCR; however, braking resistors if used, shall be outside the PCR enclosure, but on the same skid.
   - Plug socket compartments for interconnection with various main and auxiliary loads.
   - Any other electrical system like air conditioners etc., necessary for operation of the rig electrical equipment
2. Auxiliary Control PCR (ACPCR) shall house
   - MCC for all other auxiliary motor starters/ feeders(as shown in the indicative single line diagram of ACPCR)
   - One Main transformer, 2 nos. lighting transformers and 1 no. isolation transformer
   - Aviation (white) warning light controller
   - Plug socket compartments for interconnection with various main and auxiliary loads.
   - Any other electrical system necessary for operation of the rig electrical equipment

Constructional features:

PCR (s) shall have the following dimensions for the structure (not including projections due to door handles, rain protection canopies, light pole brackets etc).

Limiting Dimensions: Length 12.0 mtrs. x Width 3.0 mtrs. x Height 3.0 mtrs.
Limiting weight: 28.0 Tonnes
(Note: The skid should be four runner type & the spacing between the middle runners to be kept more for better stability)

The Main PCR should be an out-door, weather proof, transportable steel housing with self-supporting skid suitable for oil field application and should not be weighing more than 25 Tones.

"*Also, the PCRs, particularly the socket boards, shall be designed to withstand effects of torrential rains (prevalent in the region for eight to nine months a year) lashing at up to 45 degree inclination to the vertical"*.

Main PCR should be designed for lifting from the bottom. In addition to this top lifting arrangement may also be provided.

Main PCR house columns and ceiling frame are to be constructed from structural steel seam welded. The outside shall be fabricated from twelve-gauge sheet steel. All corners are to be formed by bending leaving

no sheet edge exposed. Roof of the PCR should have proper slopes so that no water logging takes place during rainy season.

Walls to be insulated with three-inch thick polystyrene block insulation. The floor and the wall with the receptacles and plugs will not be insulated. The inside surface of the walls shall be finished with a sandwich style insulating board three eight's of an inch thick with white pebble coating on the interior side and aluminum foil on the exterior side. A rubber neoprene mat should be provided over the **full floor area of the house.** ("Features furnished above are indicative only. Bidder may quote for other type of insulation and surface finish which may offer similar/ higher insulation efficiency so as to maintain the PCR inside temp. within the range indicated in this tender")

Panel line up can be provided in centre or wall attached on both sides with centre corridor. Supplier can offer their standard panel line up arrangement in the PCR. The panel line-up should be such that the PCR is load balanced for easy lifting, with CG in the centre. All components of the panels including Bus bars shall be easily accessible for maintenance and repair.

Plug panel for the Generator and Drilling motor cables to be provided on the front side plug panel (side facing the DW). In case it is difficult to provide generator plug panel on front side then standard arrangement of supplier i.e. generator plug panel recessed type on the side facing power packs can be provided but height of the plug panel should be around 1.5 mtrs from bottom of the PCR.

Fluorescent lighting fixtures (2 x 40 Watt) is to be provided for aisle lighting. Four- (4) 240 volt Phase – Phase duplex receptacles (suitable for Indian style plug pins) to be included, two at each end of the house. The PCR shall be equipped with two portable (for working in panels) emergency lights which shall adequately light up the PCR in the event of a blackout. Additionally, two emergency lighting fixture with EXIT signs to be also included at each end of the House. 240 V Phase-Phase AC power supply shall be supplied from Main PCR lighting feeder and space heaters supply.

Two (2) doors with anti panic hardware will be furnished - one at each end and on opposite sides of the house. Both doors shall be designed to open to the outside by pushing on the crash bar. Doors should have a rubber sealing lining.

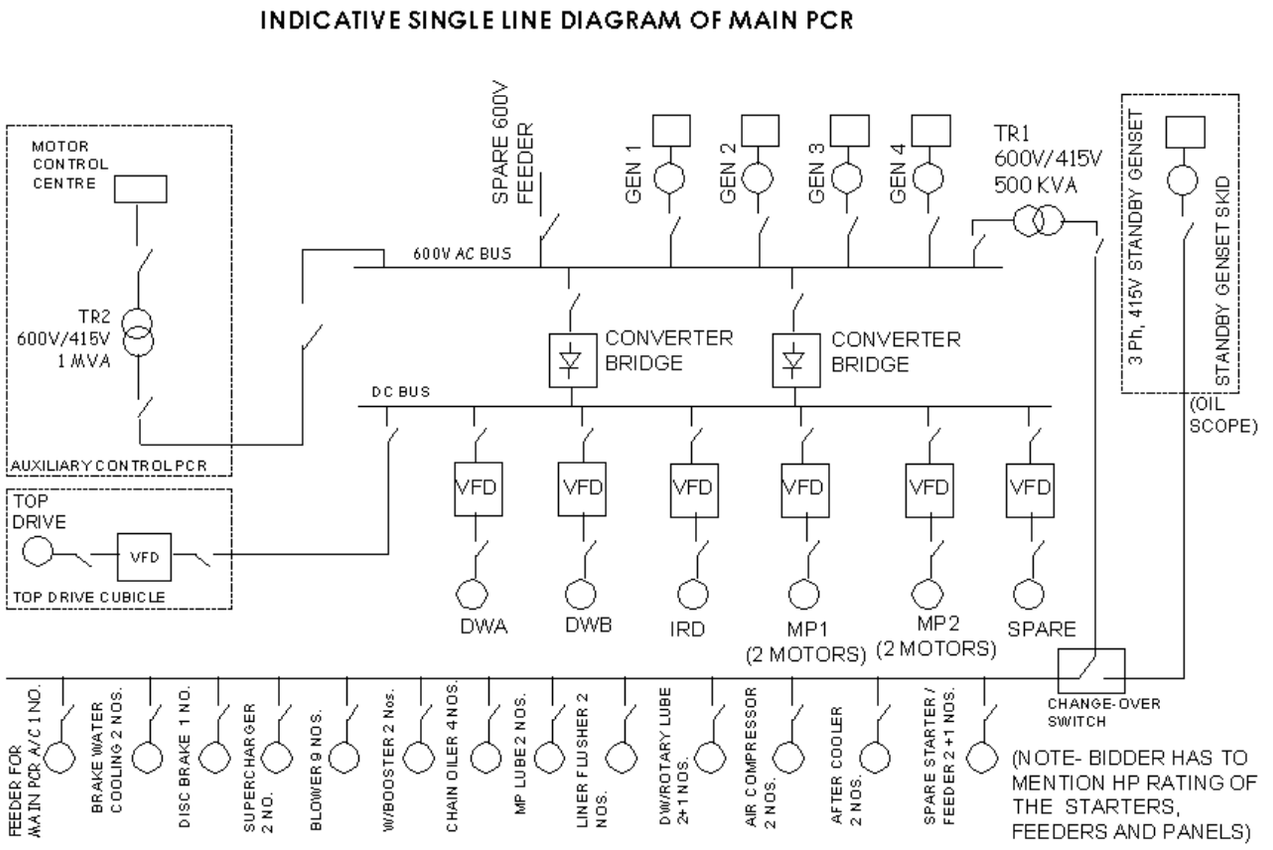
Complete air conditioning system for the PCR should be mounted on the same skid.

PCR is to be provided with four brackets to hold flood light poles.
The Main PCR should have a recessed panel on the rear end to feed electrical equipments mounted on the ACPCR such as the primary side of the transformers and other electrical equipments as required. Plug Panel for 4 x 20 core cable interconnection with AC PCR to be provided on the front side.

Surface preparation: Surface finishing should be Commercial Metal Blast Grade (SSPC-SP-6) 1.5 to 2.5 mils anchor profile before primer painting. Primer and final top coat shall be of premium quality. Top coat colour will be urethane linear white.
Over all dry film thickness of the painting should not be less than 8 mils (200 microns).
Surface preparation and painting shall be adequate for the harsh rainy & humid environmental conditions.
("Features furnished above are indicative only. Bidder may quote for other type of insulation and surface finish which may offer similar/ higher insulation efficiency so as to maintain the PCR inside temp. within the range indicated in this tender")
Both the PCRs shall be fitted with adequately rated tinned copper bus bars, insulated with sleeves, cable alleys/trays and vertical bus chambers.
Hardware for all bus connections shall be of stainless steel bolts, aircraft locking nuts with nylon inserts suitable for bus bar operating temperature at full load or alternatively hardware with plain & spring washers to be used.

I. B. 1 MAIN PCR

Indicative Single Line Diagram of the Main PCR:



Main components:

a) Rig Control System (Programmable)

Features of the Rig Control System

i) The control system shall assign the drive motors among the VFD drive cubicles in a one-to-one or dedicated mode."

ii) The control system shall include the main driller's control (D'CON) with control switches to control main drive motors and various indication meters, speed controllers, display screen with touch screen control and display of alternator/ engine parameters, VFD converter/ inverter panels' fault & status etc. In addition, fault storage facility and history/ trend data should be available in the system with built-in self-diagnostic features.

iii) **The control system should be complete with all necessary software, hardware and remote communication capability. User license for all software, including hardware keys (if needed) shall be provided to Oil India Limited. Such Licenses should not have expiration dates.**

iv) In case of failure of rig control system/ communication, the system will be provided with a standby/backup control option for sustaining emergency drilling operation.

v) The rig control system shall also include two Emergency Stop controllers for facilitating emergency stopping of major equipments, one for stopping the main drives (VFD units) and the other for stopping the power packs (for total rig power shutdown).

vi) The rig control system shall be suitable for communication with remote consoles and other rig components and devices. In addition, fault storage facility and history/ trend data should be available in the system with built-in self-diagnostic features.

vii) The rig control system shall be field proven, running successfully for a minimum of 3 (three) years in land drilling rigs. Bidder shall submit credentials/ certificates from users to this effect along with the bid. The rig control system shall encompass the drives for main drilling motors, power packs, Drillers cabin, and display/ indication of various parameters, faults, status, fault storage and history/data trends of these equipment.

The rig control system shall perform the following functions and have the features for overall VFD control, interlock with accessories and monitoring.

- Shall incorporate the VFD control logic.
- Should be suitable for a cable length of up to 100 meters from Main PCR to Driller Console to meet cluster drilling requirement.
- Shall provide status, alarm and diagnostic tools.
- Will provide automatic starting of Mud Pump and Draw works auxiliaries with indicating lights on console.
- Shall have touch screen (inside the main PCR) for all miscellaneous indications for generators & VFD panels, indications for various drives, ground faults, power limits, VFD assignment (if provided) , Hour meter, current & voltage metering, trending of historic data & faults etc.
- Shall have a bypass switch (for backup/ bypass mode) to allow for minimum assignment (for example, one DWKS motor+ two mud pump motors+ IRD motor) in the event there is a failure in the control system.

Touch Screen (in the Main PCR):
A touch screen/soft button display screen shall be provided in the Main PCR cubicle. The following represents data to be displayed preferably on multiple screens.

Miscellaneous indicators

System Communication OK
Generator ON (For each Generator)
Ground Fault (600 VAC/ 415 VAC/ DC/ VFD)
Power Limit
Driller Console Assignment
Rectifier/ converter panel indications

VFD Indicators (To be repeated for each VFD panel)

The following parameters shall be displayed-
VFD ON
DC bus volts
Inverter output current
Inverter temperature
Motor voltage
Motor speed
Motor torque
Motor power

Mud Pump Indicators (To be repeated for each Pump)

MP 1, 2 Chain Oilers ON (if provided)

MP 1, 2 Main Lubes ON (if provided)
MP1A, MP1B, MP2A, MP2B Blowers ON
MP 1, 2 Liner Washers ON
Charging Pump 1 ON
Charging Pump 2 ON
MP1A, MP1B, MP2A, MP2B current

Draw Works/ Rotary Indicators (Repeated for Each Motor)

DWA/DWB/ Rotary ON
DWA/DWB/ Rotary Blower ON
DW/ Rotary Lube pump (s) ON
DWA/DWB/ Rotary current

Top drive Indicators

Blowers ON
Lube pump ON
Current

Generator Cubicle Indicators (Repeated for each Generator Cubicle)

Running Hours for Power packs

b) Generator control panel

The control for power pack engines (ECM – Engine Control Modules) should be integral to the engine (detailed specs for control of power packs are available elsewhere). The input from the alternator control panel to the ECM shall be indicated by the bidder

Generator control panel shall be suitable for operating/ controlling/ protecting the generator. The generator control system shall be suitable for control of the generator, individual running or paralleling & load sharing with other power packs. **There shall be one alternator control panel per alternator.** All control switches, devices, and meters should be available on the front fascia of the panel.

Generator control panels are to be fitted with the following:

i) Generator control unit (package) –for operation, control, metering and protection of alternator
ii) Withdrawable type incomer air circuit breaker of sufficient nominal rating, breaking/ withstand and making capacity, manually chargeable, electric closing, with solid state trip unit, UV release and necessary auxiliary contacts. Breaker should be interchangeable with VFD panel breakers.
iii) Breaker ON/OFF (”Close”/ ”Open”) pushbuttons
iv) Engine control switch OFF-IDLE-RUN (this switch shall duplicate with the OFF-IDLE-RUN switch in engine control panel).
v) Manual engine speed & alternator voltage adjust potentiometer
vi) Reactive power sharing
vii) Meters- Analog Ammeter and Voltmeter with selector switch, power factor meter, KW meter, KVAR meter, Generator Hour meter, Alternator winding and bearing temperature meter. **However digital display for all the parameters may be offered as an ADDITIONAL option.**
viii) LED Indication lamps (with low voltage glow protection) -Gen. RUN, Gen. ON-LINE, Gen. SYNCH, Gen. FAULT, Engine FAULT
ix) Control Transformers, fuses, links, terminal blocks etc.
x) Any other Electronic control system for remote communication with other devices/ equipment
xi) Synchronizing controls consisting of reverse power relay, synchronizing lights and switch- on one panel only (if the synchronizing control system is placed in one of the generator panels)

Each panel should be fitted with the following meters

- Alternator Ammeter 0-2000 A (selectable for all three phases)
- Alternator Kilowatt meter 0-2000 KW

- Alternator Kilovar meter 0-2000 KVAR
- Alternator power factor meter (–)1.0 – 0 – (+)1.0
- Alternator On-line lamp
- Alternator running lamp
- Generator cumulative running Hours meter
- Alternator temperature meter and switch

Suitable kW load sharing scheme should be implemented. Bidder to indicate scheme / type of load sharing employed. ***However KW load control shall be provided with the Engine Control Module. This shall be offered with the engine (engine specifications given elsewhere)****.*

Engine control should include:
Electronic engine governor with the following-

- The speed regulation (Engine governor)
- **Speed feedback/MPU Signal Range: Bidder to specify**
- **Engine throttle/actuator signal range: Bidder to specify**

Voltage regulator with the following:

- Electronic AVR
- The voltage regulation is to be limited to 3% droop (Max.)

Suitable kVAR load sharing scheme should implemented. Bidder to indicate scheme / type of load sharing employed.

Alternator Protection features:

The alternator protection features shall include:

- Overcurrent – Set to trip at 110% of max. rated current
- Overvoltage – Set to trip at 116% of alternator terminal voltage (600 V), with 10 mSec. delay
- Overfrequency – Set to trip at 110% (i.e. 55 Hz) of rated frequency (50 Hz)
- Underfrequency – Set to trip at 42 Hz (16% below rated)
- Reverse Power – Set to trip at 8-10% of rated kW

Each alternator-engine control panel should be independent and complete in all aspects with switching and control devices. Loss of one panel should not affect the others. However, they will communicate with one another for load sharing.

c) Synchronizing system

A Synchronizing switch shall be provided with positions for each generator, bus and off. This should be visible from all alternator control panels, and allow each alternator to be brought on-line. The panel shall feature the following minimum instruments:

- Synchroscope
- Synchronising lamps – clear (dark lamp synchronizing)
- Voltmeters for incoming generator and running (bus)
- Frequency meters for incoming generator and running (bus).
- **Synch. Check system to check either two phases or there should be additional phase sequence check**

Sync Check Relay:

There shall be a synch-check relay to allow alternator to be synchronized with the bus. The circuit breaker "close" signal shall be interlocked with this relay.
Synchronization system may be placed in one of the generator panel front fascia or independently.

d) Converter/ Rectifier panels

Two (2) or more suitably rated incomer/rectifier sections shall be provided in the main PCR for supplying the VFD line-up, each of which shall include the following:

i) Withdrawable type incomer air circuit breaker of sufficient nominal rating, breaking/ withstand and making capacity, manually chargeable, electric closing, with solid state trip unit, UV release and necessary auxiliary contacts
ii) Fixed mount 2 pole motor operated disconnect switch
iii) 6-pulse air-cooled dide bridge rectifier
iv) High Speed semiconductor fuses with indicator switches
v) Heat sink-mounted temperature RTDs
vi) Heat sink-mounted temperature switches
vii) communication modules for control system
viii) Input line reactor of sufficient rating
ix) AC & DC voltmeters
x) Digital Multifunction Panel Meter
xi) Emergency Stop Circuit
xii) Surge suppressor
xiii) Panel heater with thermostat

e) VFD/ Inverter Panels

The Main PCR shall house air cooled VFD panels of sufficient capacity, suitable for driving the following:

- One 2000 HP DW (driven by two AC cage motors)
- One Independent rotary drive AC cage motor
- Two mud pumps (each mud pump driven by two AC motors)
- One Top Drive (driven by AC cage motors)
- One spare panel (fully functional, rated for the highest powered drive)

Drive Assign ability: The system shall be designed such that any drive is assignable from at least two different VFD panels. No VFD panel should be assignable to more than two drives.

Proper schemes for the following shall be employed:

- Load sharing of the two motors of a mud pump, if two motors per pump are employed, and they are run from the same panel
- Current & torque limiting features for rotary/ draw works and
- Mud pump single/ double motor operation, if two motors per pump are employed.

All necessary protection like over temperature, over current etc. should also be incorporated in the respective panels.

Each VFD panel shall consist of the following main equipments:

- Suitably rated Air circuit breaker with adjustable trip, Draw-out type. Each breaker to be manually Chargeable, electrically closed and electrically tripped and with auxiliary contacts. Alternatively, DC isolation switch and DC fuses may be offered.
- Voltmeter, 0-1000 VAC – analog / digital display
- Ammeter, 0-2000 AAC – analog / digital display
- VFD "ON" indicating lamp, (Red) LED type
- Inverter (s), suitably rated
- semiconductor fuses with indicator switches
- Common mode DC link filters
- control module (s), card (s), cables
- communication modules
- Drive control pushbutton LCD operator panel
- inverter firmware package

- Emergency Stop Safety Relay
- Cubicle Space Heater (To be "ON" when VFD is not in operation)
- Blower unit for cooling of the VFD panel
- Drive / assignment fault alarm should be available in the Main PCR with external electrical hooter.

f) Brake Chopper Panel

One or more chopper panel shall be housed in the main PCR consisting of the following:

- DC Brake Chopper with suitably rated continuous current output to match the full dynamic braking of the draw-works with sufficient overload capacity
- Suitably rated Air circuit breaker with adjustable trip, Draw-out type. Each breaker to be manually chargeable, electrically closed and electrically tripped and with auxiliary contacts. Alternatively, DC isolation switch and DC fuses may be offered.
- Semiconductor fuses with indicator switches
- Resistor bank Temperature monitoring circuit
- Resistor bank cooling fan pressure monitoring circuit
- DC Bus indication lamp
- Fuse fault lamp
- Thermostatically controlled cabinet heater

g) Braking Resistor Banks

Suitably rated resistor banks shall be provided for brake chopper. The banks shall be on the same skid, but outside the enclosure. The resistor banks shall consist of:

- Stainless steel air cooled resistors, suitably rated
- cooling fan
- Thermal limit switch
- Pressure sensing switch
- IP 55 Stainless steel resistor bank enclosure
- IP 56 Stainless steel cable termination box

h) Hands Off Cranking Circuit (HOC)- If offered

The HOC shall supply power for the engine starting circuit and the pulse pick-up circuit in each of the engine generator modules with the following:

- 2 nos. – 12 VDC batteries
- 1 no. – Battery charger PC card
- 1 no. – Double pole circuit breaker

i) Power Limit Controller

The Power Limit Controller is to be provided to monitor the KW & KVAR/current of each of the engine – generator sets. If either of these parameters reach its limits, the Power Limit Controller shall reduce the power being delivered to the loads, so that the load on each generator is held at its limit until the loads on the VFD drives are reduced (by other action) to a level below the generator limit. The Controller will allow for adjustment of each parameter independent of the other.

The range of adjustment will allow the Power Limit to be lowered to 80% or raised to 110%. A meter on the Driller's Console/cabin shall also be provided to indicate percent Power Limit. A warning lamp is illuminated on the Drillers Console at a load level just below the power limit.

j) Ground fault detection system

Ground fault detection system consisting of the following items;

i) *600 VAC ground fault detection*
Ground fault detection circuit, 3 nos. ground fault lights (for each phase), percentage AC ground fault meter

ii) *DC ground fault detection (for rectifier+ DC bus/ link system)*

DC ground fault detection system with percentage DC ground fault meter (+/0/-), test pushbutton

iii) Variable AC voltage ground detection circuit for AC drilling motors with GF lamps and meters

iv) 415 VAC (AC auxiliary bus)- with NGR system

All ground fault alarms shall be audio as well as visual.

In the 415 V auxiliary bus, IT system of neutral grounding with maximum ground fault current limited to 750 mA using suitable NGR as per Indian Electricity (IE) Rules is to be used. All breakers, MCCB shall be suitable for IT system as per IEC 947-2. The neutral shall not be served and supply from the 415 V MCC bus shall be 3 Phase & 3 Wire.

CBCT type earth leakage relays are to be used in the output of the main supply transformer, contacts of which will be used for ground fault alarms.

For 415 VAC systems, individual earth leakage devices shall be provided in each starter/feeder panel.

k) Air conditioning

The PCR (s) will be air conditioned and humidity controlled. The ambient air is expected to vary from 6 Deg C to 41 Deg C.

The air conditioning for the PCR (s) shall be properly sized and air conditioning units located to take into account the heat generated by internal equipment in full load conditions in high ambient locations. Air conditioning system components shall preferably be located on the same skid as the PCR.

In case AC units require dismantling during transportation (e.g. roof mounted ACs/ separately skidded) the ducts/ mating faces shall be adequately blanked off and proofed against torrential rainfalls prevalent in the North-Eastern parts of India for eight to nine months a year.

The temperature inside the PCR (s) shall not exceed 25 deg C under full load conditions and maximum ambient temp. The humidity should be considered for a maximum of 100%. The AC system should have 50% redundancy.

Bidder to furnish details of Air Conditioners

l) Driller's control console/ cabin & Mud Pump Control Console

Driller's control console/ cabin or D'CON and Mud pump control console shall be integral parts of the rig control system.

The D'CON should consist of the following minimum controls and display functions:

- HMI to enable the driller to monitor and control the entire drilling operation.
- Control switches/assignment switches to control main drive motors
- Indicators and meters
- Speed controllers to control speed and direction of various main motors- DW, Rotary, top drive & Mud pumps
- alternator/ engine parameters, VFD converter status/ alarm etc.
- Supercharger pumps shall be started & stopped manually from Driller's Console.
- Two emergency stop button, one for the main drive motors, and another for the power packs (total power shutdown)

The MP Console or MPCON shall be provided for local control of mud pumps, with suitable switches, speed control and indication system. It shall also be able to communicate with the rig control system. The MPCON shall be able to control the mud pumps up to full speed.

The controller to be used shall be suitable for communication with remote consoles and other rig components and devices.

m) Transformer (Power, air-conditioning and lighting)

This shall be specially built dry type class 'H' insulated, **copper wound** type transformers. Impedance shall be matched to 5 percent. The transformer shall be used to power the auxiliary AC bus of Main PCR

for supplying the auxiliary AC loads (Details of loads are given later-*"Annexure - Main PCR Starters/ Feeders"*).

The transformer will operate in places of high moisture and high dust. The enclosure should be adequate for these conditions. The transformer, in its enclosure shall also be able to withstand vibration of moderate to severe levels.

Specifications:
1 no. main transformer, copper wound, air cooled to meet the auxiliary motor/ Air conditioner and lighting / other load requirement as described in the starter/feeder list of Main PCR.

- Capacity – 500 kVA minimum, continuous rating
- Voltage – 600/415 volts
- Vector Group – Dyn11, star connected secondary with neutral terminal available in terminal box [*This shall not be connected to the neutral bus available in the auxiliary AC bus- described later*]
- Frequency – 50 Hz
- Phases – 3 phase
- Impedance – 5% for connection
- Ambient temperature – 55 Deg C
- Temperature rise above ambient – 115 Deg C. The transformer shall not exceed this temperature rise when operating continuously at full load capacity.
- Insulation – Class H (or 220 Deg C)
- Cooling- Air Natural cooled
- Rated power freq. withstand – 3 kV (RMS) or better

Standards – Indian Standard IS: 11171 or equivalent international standard
Primary and secondary side terminations:

1. Three nos. of single core cables for 600V side and three nos. of single core cables for 415V side.
2. Size of cable: 1x 300sq.mm flexible copper for all phases.
3. Stand off copper termination (termination using copper flats) shall be provided. All cable lugs shall be terminated using removable nut and bolts.

The transformer shall be supplied through suitably rated MCCBs in the primary and secondary sides.
The Transformer shall be placed at suitable position, taking into consideration working space, socket board positions, equal distribution of weight of the PCR etc.

n) Motor control center (MCC) in Main PCR
The starters/feeders as given in *"Annexure - Main PCR Starters/Feeders"* are to be incorporated in the main PCR.
All motors shall be started from MCC located inside PCRs only. No starter panel shall be located near the motors.

All starters below 55 kW (75HP) should be DOL type. Starters above this shall be provided with a "soft starter", with suitable contactor arrangement.

MCC specifications:

Broad Specifications:

- Bus voltage – 415 Volts AC
- Bus current (nominal) – 800 Amps (*indicative -Bidder to calculate and confirm*)
- Bus material – Tinned Copper bars, insulated
- Spare cubicles – As per list given in "Annexure Main PCR Starters/Feeders"
- Cubicle type – Drawout
- Bus Fault Level –suitably rated

Other features:

- Motor control center or MCC shall be fed from the auxiliary 415 AC bus in Main PCR fed from the secondary of the main transformer (600 V/ 415 V, 3 phase, 50 Hz) in the Main PCR. Various auxiliary motor drives, Main PCR lighting and air-conditioning system shall be supplied from the MCC panel through switchgear.
- Auxiliary 415 VAC bus system shall consist of tinned copper bus, bus chamber and cable alleys in a suitable arrangement. Panels shall be in vertical configuration.
- MCC will have a neutral bus, but this will not be used in any of the starter panels
- MCC starter panels shall be suitably rated to cater to auxiliary electrical drive.
- Automatically controlled starters for blower motors and mud pump/DW/RT lubrication/auxiliaries shall have facility of manual start / stop from panels. A selector switch Hand-Off-Auto shall be provided for these starters.
- The interlocks of blower starters and mud pump/DW/RT lubrication/auxiliaries shall be available for interlocking in respective main AC drive controls. All other starters are operated from push button stations mounted near the respective drive motors.
- Motors 55 kW and above shall be started using a soft-starter. There shall be one soft- starter for a group of maximum 4 (four) similar sized motors.
- Superchargers shall have on/off control at D'CON.

Protection: All starters and feeders shall have individual MCCBs as incomers, except those started with the soft starters. However, for the soft starter started motor groups, there will be a single incomer MCCB per group, with sufficient current carrying capacity for simultaneous running of all motors in the group at full load.
All starters shall have at least the following protection/ features:

- Short Circuit Protection
- Overload (Thermal type)
- Contactor
- Earth leakage trip which shall cut off the power supply in case of an earth fault in that particular circuit (100 mA & 300 mA selectable)
- Remote PBS (Push Button Station) / Hand Off Auto feature as required
- Control Circuit voltage shall not exceed 110V
- Control Circuit including Remote PBS shall have earth leakage protection

All breakers/ MCCBs used in the MCC shall be suitable for IT system as per IEC 947-2 / IS 13947. **All breakers, MCCBs used in the MCC shall be suitable for disconnection and shall have positive visual isolation. The neutral shall not be served and supply from the MCC bus shall be 3 Phase & 3 Wire**. However the neutral bus is to be provided in the MCC.

MCCB for individual feeders- These shall be 3 pole MCCBs, fitted with RCD, as the primary device for protection and isolation in all starters. Fuse systems instead of MCCB will not be accepted.
Features –

- The MCCBs should be suitable for DOL motor starting (Induction motors) for all motors below 55 KW.
- Control supply of individual starters shall be tapped from its own line, the starter shall be in-operative if the MCCB is off.
- The MCCB shall have clear ON/OFF/TRIP positions.
- The MCCB should have facility for time delayed-Overload protection (adjustable 0~10 sec, 0.4~1.0 In), Short circuit protection (10 x In), and separate (add-on) RCD **with trip setting of 100mA and 300mA**
- MCCB should be of Line-Load reversible type.
- The MCCB will be of fixed mounting type, without extended operating handles.
- Operating handle should be accessible from the exterior of the MCC cubicle, with the door shut.

- All the power cable terminations are to done with proper colour coded terminal blocks (R phase (phase-1): Red; Y phase (phase-2): yellow, B-phase (phase -3): Blue,

The selection of MCCB, contactors and relays for the starter panels should be as per Type 2 coordination (IS 13947 or IEC60947).
All components fitted in the starter panels should be preferably of a single make.

Each motor panel should have the following minimum components located on the front fascia

- One overload reset button,
- MCCB operating handle / lever with TRIP, ON, OFF positions marked,
- LED Indication lamps (with LVGP feature) for motor ON/OFF/OVERLOAD,
- Selector switch for HAND / OFF / AUTO **for required starters**
- One ammeter to indicate motor current

All MCCB shall be suitable for secondary injection testing of tripping characteristic by a test kit.

Lighting and air-conditioning supply:

The feeder for the lighting/air-conditioning supply (from MCC) shall be connected to a TPN DB (neutral unused) through a TP MCCB of suitable rating. The TPN DB rating shall be sufficient for supplying the air-conditioning units (total connected) and full Main PCR lighting.
Provision shall be given for supplying the lighting/AC DB from the ACPCR, in case of failure of the transformer. Accordingly, a suitably rated socket shall be provided in the MAIN PCR socket board, and the socket shall be wired up to the lighting DB supply.

Internal Cabling
All internal wiring of the MCC starter panels shall be done with 1.1 KV grade fire retardant PVC insulated tinned copper multi-stranded flexible cables with proper lugs.

Bidder shall submit a complete and detailed list of all auxiliary electrical drives required for operation of the rig.

Type of Earthing:
IT system of neutral grounding with maximum ground fault current limited to 750 mA using suitable NGR as per IE Rules is to be used. All breakers, MCCB shall be suitable for IT system as per IEC 947-2. The neutral shall not be served and supply from the main MCC bus shall be 3 Phase & 3 Wire.
Main Transformer output shall be provided with a Residual Current Monitor (RCM) for indication/ alarm. Scheme, Type, Make and Model of RCM shall be approved by OIL.

NGR System:
The NGR system shall have the following features:
- Maximum earth fault current is 750 mA
- Restricted earth leakage protection at 500 kVA transformer star connected secondary

NGR shall be provided with a NGR monitoring device of reputed make (Bender RC48N or equivalent) with audio-visual alarm in the PCR for monitoring NGR continuity and leakage current. Scheme, Type, Make and Model of the NGR device shall be approved by OIL. NGR scheme shall be a failsafe system and shall not let the leakage current to exceed 750 mA.

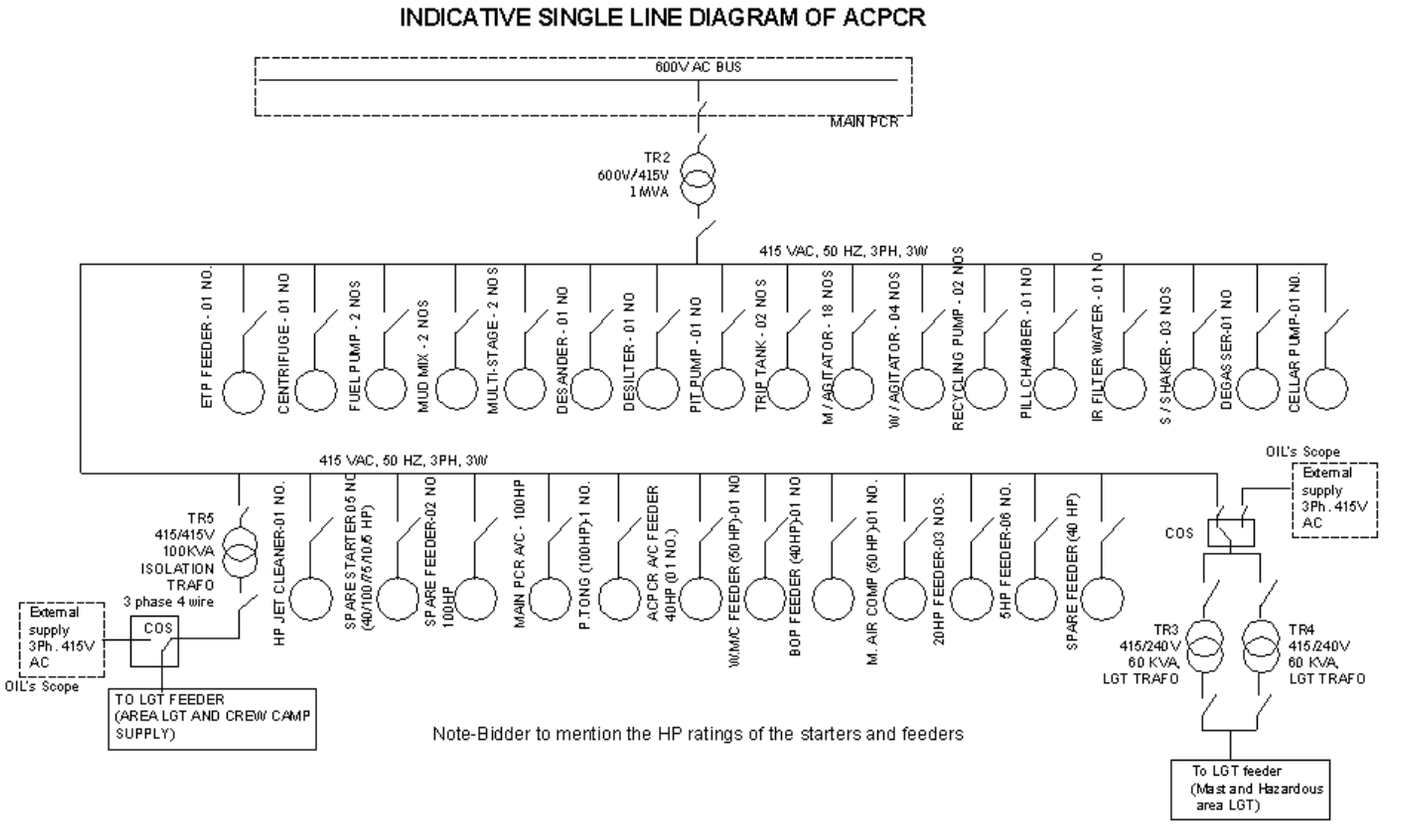
o) Plug and Socket Panels
Suitable plug and socket arrangement shall be provided for interconnection of the Main PCR with alternators, motors, auxiliary loads, remote interface modules, ACPCR etc. with cables. Socket compartments shall be suitable for ease of quick rig-up and rig-down operations. Matching plugs will be fitted in the cables.

Socket compartments should be preferably located to either end of the Main PCR. Alternator and Drilling motor power and control cable socket board shall be towards the derrick.
The plug / socket compartments shall be well illuminated and suitably marked for ease of identification of circuits / loads.
The plug sockets cable termination shall be crimped type. Horizontal steel bars shall be provided in the compartments for supporting the layers of cables.

There should be adequate no. of spare sockets of each type available in the socket board.

I. B. 2. Auxiliary Control PCR (ACPCR)

Indicative Single Line Diagram of the ACPCR:



General:
The limiting dimensions, weight and constructional features of the ACPCR will be identical to the Main PCR.

The power to ACPCR will be fed from 600 V main bus in Main Power control room through the 600/415 AC main transformer. The starters/feeders to be housed in the ACPCR are given in the Annexure, *"Annexure-ACPCR Starters/Feeders"*.

a) Construction:
Construction shall be similar to the Main PCR, as detailed above.

b) Dimensions:
Limiting Dimensions and Weight shall not exceed those given in Main PCR.

c) Air Conditioning:

Four numbers split AC units, of sufficient rating are to be provided. Two of these will be in operation, whereas two will remain as standby, i.e., 100% redundancy will be assured. **Supplier has to provide suitable capacity AC's, after AC requirement calculation taking into consideration the normal running of all loads from the ACPCR.**

d) Transformers:

- There shall be four power transformers in all:
  i. One Main Transformer (1000 kVA) for MCC supply. [Alternatively, two transformers with combined equivalent capacity of 1000 KVA (or more), with identical % impedance for parallel operation] for MCC supply
  ii. Two Lighting transformers (60 kVA each) for lights in hazardous areas
  iii. One isolation transformer (100 kVA) for camp-site power & general lighting
- All the transformers shall be protected through suitably rated MCCBs in the primary and secondary sides.
- All live parts of the transformers not insulated shall be protected adequately.
- Transformers shall be placed at suitable positions, taking into consideration working space, socket board positions, equal distribution of weight of the PCR etc.

i) Main Transformer for MCC supply:

1 no. main transformer, dry type, copper wound, air cooled to meet the auxiliary motor/ other load requirement as described in "Annexure ACPCR MCC starter/feeder".

- Capacity – 1000 kVA minimum, continuous rating (rating commensurate with the load)
- Voltage – 600/415 volts
- Vector Group – Dyn11, Star connected secondary (neutral available at terminal box)
- Frequency – 50 Hz
- Phases – 3 phase
- Impedance – 5% for connection
- Ambient temperature – 55 Deg C
- Temperature rise above ambient – 115 Deg C. The transformer shall not exceed this temperature rise when operating continuously at full load capacity
- Insulation – Class H (or 220 Deg C)
- Cooling- Air Natural cooled
- Rated power freq. withstand – 3 kV (RMS) or better

Standards – Indian Standard IS: 11171 or equivalent international standard

Primary and secondary side terminations:

1. Three nos. of single core cables on both primary and secondary sides.
2. Size of cable: 1x 300sq.mm flexible copper cable for all phases.
3. Stand-off copper termination (termination using copper flats) shall be provided. All cable lugs shall be terminated using removable nut and bolts.

ii) Lighting supply transformers for mast and rig lighting (hazardous area lighting):

2 nos. lighting supply transformer [fed from the main 415 VAC bus of ACPCR], Minimum 60 KVA, dry type, 415 V/ 240 V phase-to-phase, 50 Hz, copper wound, air cooled to meet the hazardous area lighting load, as per the following broad specifications:

Quantity – 2 (Two) transformers
Capacity – 60 kVA, continuous rating
Voltage – 415/240 volts (Phase-to-Phase)
Frequency – 50 Hz
Phases – 3 phase
Impedance – 4%
Vector Group – Dyn11, Star connected secondary, neutral available for connection
Enclosure – IP23 type, with provision for natural circulation of cooling air.

Ambient temperature – 55 Deg C
Temperature rise above ambient – 80 Deg C
Insulation – Class F
Rated power freq. withstand – 3 kV (rms) or better
Standard – Indian standard IS: 11171

Primary and secondary side terminations:

1. One no. of 3 core, 35 mm2 cable for 600V side and one no. 3 core, 35 mm2 cable for 240V side.
2. Stand off copper termination (termination using copper flats) shall be provided. All cable lugs shall be terminated using removable nut and bolts.

The lighting transformer secondary shall be connected to a suitable lighting distribution board, located on the MCC.

iii) Isolation Transformer:

1 No. 100 kVA dry type isolation transformer with the same specification as the lighting transformers, except the following:

Quantity – 1(one) transformer
Capacity– 100 kVA, continuous rating
Voltage – 415/415 volts, Dyn11, neutral available for connection.

The isolation transformer shall be used to supply the general rig area lighting, crew camp supply and auxiliary loads which need a 240 V phase-to-neutral connection. Neutral of the isolation transformer shall be grounded solidly.

Primary and secondary side terminations:

1. Two nos. 3 core, 35 mm2 cable for both primary and secondary sides.
2. Stand-off copper termination (termination using copper flats) shall be provided. All cable lugs shall be terminated using removable nut and bolts.

e) Motor Control Centre - ACPCR MCC Panel (1 set):

The starters/feeders as given in *"Annexure-ACPCR Starters/Feeders"* are to be incorporated in the ACPCR MCC.

All motors shall be started from MCC located inside PCRs only. No starter panel shall be located near the motors.

All starters below 55 kW (75HP) should be DOL type. Starters above this shall be provided with a "soft starter", with suitable contactor arrangement.

Broad Specifications:

- Bus voltage – 415 Volts AC
- Bus current (nominal) – 4000 Amps (indicative)
- Bus material – Copper bars, insulated
- Spare cubicles – As per list
- Cubicle type – Panel type, non-draw-out.
- Bus Fault Level –suitably rated

Other features

- All the starters for AC motors (except LMSS/LMMC, BOP, Bug blower & centrifuge) irrespective of rating are to be housed in the MCC panel of power control room and only push button stations with On/Off controls are to be located near respective equipment. All motors and push button stations will be directly connected to the power control room through individual cables and plug sockets. Various auxiliary motor drives, ACPCR interior lighting and air-conditioning system shall be supplied from the MCC panel through switchgear.
- All the components including MCC bus should be approachable from the front. Supplier shall study the total requirement with the space available and shall submit various options of panel

arrangement for OIL's approval. Starters shall be provided with individual cubicle; however 2-4 Feeders (not starters) can be combined in one cubicle.

- The AC busbars shall be adequately rated. A voltmeter and 'bus bar live' indicator lamp shall be provided to find out the bus status. Bus shall be accessible for maintenance. AC bus bars shall be insulated properly.
- Bus system shall consist of TPN tinned copper bus (neutral bus will not be used), bus chamber and cable alleys in a suitable arrangement. Panels shall be in vertical configuration.
- MCC bus shall be fed from the main 1000 KVA transformer (600 V/ 415 V, 3 phase, 50 Hz) in the ACPCR.
- MCC starter panels shall be suitably rated to cater to auxiliary electrical drive.
- Each panel shall contain suitably rated MCCBs, contactors, thermal overload relays, earth leakage circuit breaker, ammeter; OLR reset push button, Hand-Off-Auto selector, indication lamps etc.
- Each motor panel should have the following minimum components located on the front fascia:
  - One overload reset button,
  - MCCB operating handle / lever with TRIP, ON, OFF positions marked,
  - LED Indication lamps (with LVGP feature) for motor ON/OFF/OVERLOAD,
  - Selector switch for HAND / OFF / AUTO **for required starters**
  - One ammeter to indicate motor current
- Components shall be mounted on sheet steel base and all apparatus shall be suitable for front removal. However, ammeters and indication lamps may be mounted on panel doors. MCCBs, Soft starters, HOA, ELCB reset, OL reset switches etc. shall be suitable for operation from outside, without opening the panel door.

All breakers/ MCCBs used in the MCC shall be suitable for IT system as per IEC 947-2 / IS 13947. **All breakers, MCCBs used in the MCC shall be suitable for disconnection and shall have positive visual isolation**. **The neutral shall not be served and supply from the MCC bus shall be 3 Phase & 3 Wire**. However the neutral bus is to be provided in the MCC.

Each individual starter panel/lighting/ AC unit feeder panel shall be provided with an earth leakage circuit breaker which shall cut off the power supply in case of an earth fault in that particular circuit. Trip setting should be at 300 mA.

Protection:
All starters and feeders shall have individual MCCBs as incomers, except those started with the soft starters. However, for the soft starter started motor groups, there will be a single incomer MCCB per group, with sufficient current carrying capacity for simultaneous running of all motors in the group at full load.

- Short Circuit Protection
- Overload
- Contactor
- Earth leakage trip (100mA & 300mA selectable)
- Remote (Push Button Station) PBS/ Hand Off Auto feature as required
- Control Circuit voltage shall not exceed 110V
- Control Circuit including Remote PBS shall have earth leakage protection

IT system of neutral grounding shall be used in the ACPCR. As per IT system, line to neutral supply cannot be used and hence individual control transformer (415V/110 V) shall be provided for each starter panel. Earth leakage protection shall be provided on the secondary side of the control transformer for all starters with external/remote PBS for protection of PBS circuit from earth leakage. Control Transformer secondary should be connected to ground.
Main transformer secondary MCCB shall be 4 pole type, supplying the TPN bus. A single NGR on the neutral bus shall be provided.

MCCB for individual starters/feeders- There will be 3 pole MCCB, fitted with RCD, as the primary device for protection and isolation in all starters. Fuse systems instead of MCCB will not be accepted.
Features –

- The MCCBs should be suitable for DOL motor starting (Induction motors) for all motors below 55 KW.
- Control supply of individual starters shall be tapped from its own line, the starter shall be in-operative if the MCCB is off.
- The MCCB shall have clear ON/OFF/TRIP positions.
- The MCCB should have facility for time delayed-Overload protection (adjustable 0~10 sec, 0.4~1.0 In), Short Ckt protection (10 In), and RCD **with trip setting of 100mA and 300mA**
- MCCB should be of Line-Load reversible type.
- Operating handle should be accessible from the exterior of the MCC cubicle, with the door shut.
- The MCCB will be of fixed mounting type, without extended operating handles.
- All starters above 30KW shall be provided with individual soft starters.
- All the power cable terminations are to done with proper colour coded terminal blocks (R phase(phase-1)-Red, Y phase(phase-2)-yellow,B-phase(phase-3)-Blue,Neutral-Black).

The selection of MCCB, contactors and relays for the starter panels should be as per Type 2 coordination (IS 13947 / IEC60947).

(Clarification: Though a myriad of International/ National manufacturing standards have been referred to in the bid document, the Indian National Standard, BIS, will be the standard guidelines to be followed. Wherever BIS is not available/ specific, other International standard like IEC and IEEE shall be considered applicable)

All components fitted in the starter panels should be preferably of a single make.

All MCCB shall be suitable for secondary injection testing of tripping characteristic by a test kit.

Lighting supply:
Secondary side of the lighting transformers (415/240 VAC, phase-to-phase, supplied from the AC main 415 bus) shall be connected to the 3-phase rig lighting DB. The lighting DB rating shall be sufficient for supplying the full rig and mast lighting. All outgoing feeders from the DB shall be 240 VAC, phase-to-phase, 2-pole MCB units, with built-in residual current protection (RCBO), tripping at 300mA.
Provision shall be given for supplying the lighting DB from external supply, in case of failure of the lighting transformers. Accordingly, a suitably rated change over switch shall be provided in the MCC panel, in conjunction with the feeder supplying the lighting transformers.

Air conditioner supply:
Air conditioning supply will be 415 VAC, 3 phase, without requirement of neutral wire.

Power Feeders

Apart from motor starter panels, certain other loads are also required, e.g. Welding sets, Hand tools, etc. There should be individual feeders for such loads.

Internal Cabling
All internal wiring of the MCC starter panels shall be done with 1.1 KV grade fire retardant PVC insulated tinned copper multi-stranded flexible cables with proper lugs.

Push Button Stations
Push Button Stations shall be provided, containing Emergency Stop / Lockout pushbuttons, Local-Remote and Start-Stop push buttons for local control of Electrical equipment. The PBS should have facility for lockout of the motor in order to enable maintenance work to be done. All PBS should have IP66 type protection and canopies for rain shade. All PBS should satisfy requirements for installation in Zone 1 Hazardous area, Gas groups IIA & IIB.

f) Type of Earthing:
IT system of neutral grounding with maximum ground fault current limited to 750 mA using suitable NGR as per IE Rules is to be used. All breakers, MCCB shall be suitable for IT system as per IEC 947-2. The neutral shall not be served and supply from the main MCC bus shall be 3 Phase & 3 Wire.
Main Transformer output shall be provided with a Residual Current Monitor (RCM) for indication/ alarm. Scheme, Type, Make and Model of RCM shall be approved by OIL.

g) NGR System:
The NGR system shall have the following features:
- Maximum earth fault current is 750 mA
- Restricted earth leakage protection at 1000 kVA transformer star connected secondary

NGR shall be provided with a Permanent Insulation Monitor (PIM) and NGR monitoring device of reputed make (Bender RC48N or equivalent) with audio alarm in the PCR for monitoring NGR continuity and leakage current. Scheme, Type, Make and Model of PIM shall be approved by OIL. NGR scheme shall have to conform to National/International standards.

h) Plug and Socket Panels
Suitable plug and socket arrangement shall be provided for interconnection of the ACPCR with motors, auxiliary loads, lighting socket board etc. with cables. Socket compartments shall be suitable for ease of quick rig-up and rig-down operations. Matching plugs will be fitted in the cables.
Socket compartments should be located to either end of the ACPCR. The plug / socket compartments shall be well illuminated and suitably marked for ease of identification of circuits / loads.
The plug sockets cable termination shall be crimped type. Horizontal steel bars shall be provided in the socket compartments for supporting the layers of cables. Plug-in type connections are not permissible at motor end.

I. C. DRIVE MOTOR SPECIFICATIONS:

I. C. 1: DRAW WORKS MOTORS

AC drilling motor, inverter duty rated, suitable for driving 2000 HP electrical draw-works. Type: Ex-p, pressurized enclosure, suitable for use in hazardous atmospheres, Gas groups IIA & IIB.

Quantity	: 2 nos.
Electrical rating	: minimum 1100 HP.
RPM range at constant torque	: **To be specified by bidder**
RPM range at continuous full horse power	: **To be specified by bidder**
Temp. rise	: Class H
Duty	: Continuous drive with constant torque, at 55 Deg. Centigrade
Stator insulation	: Class H VPI form wound
Bearing	: Two heavy duty roller bearing, re-greasable
single shaft with hub	

Motors should be complete with the following:
- Main terminal box with IP56 protection. Terminal box should be easily accessible for connection.
- Differential pressure switch (air flow relay/switch) for pressure sensing
- Blower assembly with suitable capacity explosion proof motor, 415 VAC, 50 Hz rated
- Space heater

I. C. 2: ROTARY DRIVE AC MOTOR
AC drilling motor, inverter duty rated, suitable for independent rotary drive. Type: Ex-p, pressurized enclosure, suitable for use in hazardous atmospheres, Gas groups IIA & IIB.

Quantity : 1 no.
Electrical rating : minimum 1100 HP.
RPM range at constant torque : **To be specified by bidder**
RPM range at continuous full horse power: **To be specified by bidder**
Temp. rise : Class H
Duty : Continuous drive with constant torque, at 55 Deg. Centigrade
Stator insulation : Class H VPI form wound
Bearing : Two heavy duty roller bearing, re-greasable
Single shaft with hub

Motor should be complete with the following:

- Main terminal box with IP56 protection. Terminal box should be easily accessible for connection.
- Differential pressure switch (air flow relay/switch) for pressure sensing
- Blower assembly with suitable capacity explosion proof blower motor, 415 VAC, 50 Hz rated
- Space heater

I. C. 3: TOP DRIVE MOTORS

AC motor, inverter duty rated, suitable for variable speed 800 HP top drive unit. Type: Ex-p, pressurized enclosure, suitable for use in hazardous atmospheres, Gas groups IIA & IIB
Quantity: 2 nos.
Electrical rating : Total minimum 800 HP.
RPM range at constant torque : **To be specified by bidder**
RPM range at continuous full horse power: **To be specified by bidder**
Temp. rise : Class H
Duty : Continuous drive with constant torque, at 55 Deg. Centigrade
Stator insulation : Class H VPI form wound
Bearing : Two heavy duty roller bearing, re-greasable
Single shaft with hub

Motors should be complete with the following:

- Main terminal box with IP56 protection. Terminal box should be easily accessible for connection.
- Differential pressure switch (air flow relay/switch) for pressure sensing
- Blower assembly with suitable capacity explosion proof blower motor, 415 VAC, 50 Hz rated
- Space heater

I. C. 4: MUD PUMP DRIVE MOTORS

AC drilling motors, inverter duty rated, suitable for heavy duty 1600 HP slush pump application. Type: Ex-p, pressurized enclosure, suitable for use in hazardous atmospheres, Gas groups IIA & IIB.

Quantity: Total 4 nos., 2 each for 2 mud pumps
Electrical rating : minimum 1100 HP.
RPM range at constant torque : **To be specified by bidder**
RPM range at continuous full horse power: **To be specified by bidder**
Temp. rise : Class H
Duty : Continuous drive with constant torque, at 55 Deg. Centigrade
Stator insulation : Class H VPI form wound
Bearing : Two heavy duty roller bearing, re-greasable
Single shaft with hub

Motors should be complete with the following:

- Main terminal box with IP56 protection. Terminal box should be easily accessible for connection.
- Differential pressure switch (air flow relay/switch) for pressure sensing

- Blower assembly with suitable capacity explosion proof blower motor, 415 VAC, 50 Hz rated
- Space heater

The draw-works and slush pump motors shall be of the same make and power rating such that interchangeability of the motors is maintained.

I. C. 5: AC AUXILIARY MOTORS

Bidder shall submit list of all AC auxiliary drive motors.

Motors shall be rated for 415 Volts 3 phase AC, 50 Hz supply. All motors are to be flameproof /explosion-proof, weather proof and conforming to IP65 suitable for use in Zone 1 & 2, Gas groups IIA & IIB [as per Indian & European (CENELEC) Standards] or Class 1, Div. 2, Gas groups C & D [North American Standards] Hazardous areas of oil mines.
Motors to be used in the Hazardous areas of the rig, as classified by DGMS (India), shall be approved by DGMS (India) for use in such areas.
A visual guideline/ map / diagram of demarcation of areas as per DGMS guidelines is attached as ***Addendum-Electrical: Hazardous Area Guidelines Map***
Motors shall be fitted with FLP/Exp double compression cable glands, terminal studs and earthing leads for connection to common earth bus.
Plug-in type connections are not permissible at motor end.

I. D.: CABLES

All cables from the VFD panels shall be rated for use with VFDs / Inverters.
Various sized cables shall be used for connection of alternators of power packs, Drilling motors, AC auxiliary motors, lighting fixtures, D'CON, electronic control system and its components. All cables shall be suitable for use in oil field environment. All cables used in the rig shall have copper conductors only.

All cables to be used in Hazardous areas of oil mines should be approved by DGMS (India).
Refer Electrical Annexure-Statutory for details of cables.
A visual guideline/ map / diagram of demarcation of areas as per DGMS guidelines is attached as ***Addendum-Electrical: Hazardous Area Guidelines Map***

a) Alternator power cables, Drilling motor power cables, main transformer cables shall be single core, multi-stranded, flexible, 1100V grade, unscreened copper cables with EVA (Ethyl Vinyl Acetate rubber) insulation and EVA (Ethyl Vinyl Acetate rubber) sheath. These cables should be heavy duty, acid, oil and abrasion resistant, flame retardant.

b) Suitable Top drive cables with auxiliary drive cables if any

c) Auxiliary AC motor/ 3- phase electrical equipment cables shall be multi-stranded, minimum voltage grade 1100 V, flexible, ethylene-propylene rubber (EPR) insulated, HOFR elastomeric CSP sheathed, either individually or collectively copper screened, 4 core copper conductor cables with fourth core having 50% conductivity of the largest conductor and the combined screen having 50% conductivity of the largest conductor. Cables shall be of various cross sectional areas to suite different ratings of motors/ equipment. All terminals shall be properly crimped.

d) Control cables shall be 2.5 mm2 cross-section, minimum voltage grade 1100 V, EPR insulated and HOFR elastomeric CSP sheathed, copper screened flexible multi-stranded copper conductor having cores up to a maximum of 20. Each individual core should be identifiable by means of colour / number and each core terminal shall be marked with cable markers / ferrules to identify the connections. Cables shall generally conform to IS:9968.

e) Cables for light fittings shall be EPR insulated and HOFR elastomeric CSP sheathed 3 core, minimum voltage grade 1100 V copper conductor cables.

f) Control system shall be supplied with suitable twisted pair cable for communication with the remote controllers in Driller & MP Consoles. These should be shielded twisted pair (STP), able to withstand the rigors of a drilling rig. Bidder to confirm if the distances as provided in his layout diagram are adequate for STP cables or any signal booster is needed. Bidder should indicate route of such STP cables, and also take adequate measures to ensure that STP cables used for communication are free from noise due to power cables running in the same cable trays.

All the cables including power, control, lighting etc. shall be supplied complete with suitable male/female plug/ connectors which shall go into proper male/female plug/connectors mounted in the Main PCR, ACPCR, D'CON, MP'CON, lighting fixtures and motor Terminal boxes.

No soldered terminal socket will be allowed. All terminations shall be properly crimped.

Lengths of cables:

All the cables for draw works, rotary, top drive power and control cables, mast lighting, D'CON control cables, Brake water cooling system power and control cables and any other cables required for cluster drilling operation shall be suitable for drilling 1 + 3 cluster wells. *Oil India drills cluster wells 15 metres apart on the surface, on a straight line*.

I. E. AUXILIARY EQUIPMENT & SYSTEMS

Auxiliary electrical system shall include the following systems:

I. E. 1. Rig lighting system:

Rig lighting system shall cover the following areas:

Hazardous areas (classified and within a radial distance of 30 m from well-head):

i) Mast, racking board and aviation obstruction lighting
ii) Rig floor/ draw works lighting
iii) Pipe rack and area lighting
iv) Substructure lighting
v) Mud tank lighting
vi) Mud mix/ storage skid lighting
vii) Mud pump lighting
viii) Fuel pump/ tank area lighting
ix) Trip tank pump lighting
x) Choke manifold lighting
xi) Water tank area lighting

Un-classified (general) areas:

xii) Power pack lighting
xiii) Air compressor/ utility house lighting
xiv) BOP unit lighting
xv) General plinth and periphery lighting (supplied from isolation transformer)
xvi) Offices, chemical/ geological lab and crew camp lighting (supplied from isolation transformer)

All lighting load for hazardous areas shall be supplied from 2 nos. 60 KVA, 415 V/ 240 V Phase to Phase transformers, as detailed in the paragraph for ACPCR lighting transformer [Para I. B. 2. (d) (ii)].
All other lighting load for general area lighting, camps and un-classified areas shall be supplied from the isolation transformer [Para I. B. 2. (d) (iii)].
For external source supply (in case the main 415 V bus is not energized), a changeover switch with mechanical interlock will be provided, serving both the 60 KVA transformers through suitable incomer circuit breakers.
All lighting circuits shall have RCBO/ RCD for current leakage sensitivity of 300 mA. Vertical discriminating type RCDs shall be used wherever required.

Heavy duty flameproof and weather proof light fittings (in classified hazardous areas) and normal weather proof light fittings shall be used for illumination.
[Classified Hazardous areas are Zone 1 & 2, for Gas groups IIA & IIB as per Indian/ European standards and Class 1, Division 1 & 2, Gas groups C & D as per North American standards]

Each light fitting shall have the following features:

- Weather proof plug and receptacle disconnect to allow safe and easy removal of fitting for service or movement to another location day or night without interruption of any power or illumination. Disconnects are to be provided at appropriate mast breaks, sub-separation etc. for easy rig up/ rig down of lighting system.
- Suitable for use in hazardous areas supplied with suitable plug socket disconnects
- Shall have safety cables/ chains to secure in mast and substructure
- Complete with thermal and shock resistant glass lens, lamps, ballasts, ignitors, p.f. improvement capacitor, guards, safety chains/ cables etc.
- All the FLP light fittings shall be DGMS approved.
  A visual guideline/ map / diagram of demarcation of areas as per DGMS guidelines is attached as ***Addendum-Electrical: Hazardous Area Guidelines Map***
- For mud tank lighting, suitable mounting/ hanging arrangement with tubular structures (see sl. No. 7 below) for well glass fittings shall be provided on the tanks.
- All the light fittings shall include the necessary control gears needed for smooth operation.

The minimum number and type of light fittings and accessories to be supplied for the rig lighting system are given below-

Sl. No.	Type of Light Fitting	Quantity	Remarks
1	FLP "compact fluorescent lamp" well glass light fitting for 2 x 20W CFL Lamps, type-Screw cap E-27	90 nos.	Light fittings shall be provided with lamps
2	FLP flood light fittings for HPMV 1 x 250 W lamps	10 nos.	Light fittings shall be provided with lamps
3	Weather proof, 250 W metal Halide light fitting for area lighting	10 nos.	Light fittings shall be provided with lamps
4	Weather proof, 400W HPSV light fitting for area lighting	20 nos.	Light fittings shall be provided with lamps
5	Red aviation LED type warning lamp Double fitting Single fitting	 02 nos. 01 no.	Light fittings shall be provided with lamps
6	Aviation obstruction (daytime aviation warning) lamp	01 no.	With necessary cable, control panel and other accessories
7	Portable small size "T" type light pole for mud tank and mud pump illuminations, 50 mm OD, 4000 mm height- fitted with anti-vibration devices	40 nos.	Indicative diagram of the "T" pole is attached
8	Galvanized and non corrosive swaged type (stepped) steel tubular poles of length 9 m along with double brackets for fixing of HPSV/ HPMV type light fittings	20 nos.	

A mast lighting socket board (FLP/Exp type) should be supplied at a convenient place outside the driller's cabin/ dog house to facilitate easy connection/ disconnection for mast/ derrick area lights.

Aviation warning / obstruction lamps, consisting of the following:

i) Aviation obstruction day time white flasher unit (one no.) shall be fixed atop the mast (near crown block). This unit shall be complete with controller, suitable cable, mounting hardware, photo-electric cell etc.

Day time: 20,000 Cd, flasher type with 40 flashes per minute (White)
Night time: 2,000 Cd, fixed (white)
With automatic change over from day to night

j) Red aviation LED warning lamps: LED lamps, continuous glow, to be fixed near the white flasher unit.

Bidder shall submit a complete and detailed list of light fittings and lighting schematic to be used in the rig.

I. E. 2. Well-site Area & Crew Hut Illumination Control Panel, Skid Mounted

Details:
An oilfield type skid mounted electrical control panel for supplying power to area/ boundary lights and crew houses (camp site) shall be supplied.
The system shall consist of incomers, changeover switch, distribution feeders (MCBs/ switches), plugs and sockets etc., mounted on an oil-field type skid. The complete system will be designed to meet the present load demand as well as the increase in near future. The panel shall be fed from the ACPCR 415/415 V isolation transformer feeder with a changeover option for running from standby camp/ auxiliary genset.

Construction:

a) The panel shed shall be an outdoor, weatherproof, transportable steel house on a self supporting oil field skid suitable for tail boarding from either end in balanced condition. The shed shall be suitable for either top or bottom lift. There shall be provision for lifting the skid at both ends. **Shed shall be of man height**. Overall dimensions of the shed shall be calculated for working comfortably inside.

The shed shall be a fabricated sheet steel (not less than twelve-gauge) structure and shall house the incomer plug socket compartment, incomer MCCBs (with built-in Over current/ short circuit and earth leakage protection), changeover switch, TPN bus and distribution board, outgoing Plugs-sockets, and plug socket compartments. The power to the bus is to be fed from either isolation transformer feeder in AC Power control room or from the auxiliary genset, through a changeover switch.

The side panels containing the incomer and outgoing feeder plug socket arrangement shall swing out for ease of connections / maintenance. Another panel/cover shall be provided outside the socket board panels for protection of the socket board panels during transportation. The outer panel shall be hinged at the top and provided with supports, so that it can also give rain protection to the plug-socket panels, when in operation. All corners of the shed are to be formed by bending, leaving no sheet edge exposed. Skid and panel shall be painted with anti-corrosive paint.
b) Lighting and camp loads shall be equally distributed on the three phases (240 V Phase to neutral). Each outgoing feeder shall be fed through a suitably rated RCBO, of leakage current setting of 300 mA. There shall be minimum 6 (six) outgoing feeders from each phase. Identical nos. of plugs and sockets (3 Phase, 5 pin) shall be provided in the outgoing plug socket compartment.

- Tinned copper Busbars
- Phase indication lamps
- Voltmeter (on both incomers)
- Internal shed illumination with 1 no. 2x40 W fluorescent indoor industrial corrosion proof luminaire, IP-65, with clear cover, complete with MCB on/off switch mounted outside, wiring (with armoured copper cable, suitably glanded to fitting) at a suitable place
- Internal wiring/cabling- Cables shall be of suitable size, 4 core, copper, screened, FRLS PVC/Elastomer insulated, sheathed and of reputed make
- Plug-sockets (fitted)

- Incomer MCCBs and outgoing RCBO / RCDs
- Changeover switch
- Provision for earthing of the skid

I. E. 3. **Cable handling system consisting of Cable trays, cable boxes and grasshopper arrangement to derrick floor**

Grasshopper cable rack suitable for elevating with derrick floor shall be used for leading and supporting draw works, rotary and top drive cables including control, lighting, and auxiliary motor cables.
No cable will be allowed to be laid on ground outside of a cable tray / cable racks. Sturdy and durable cable trays with non-skid type, hinged, galvanized steel covers shall be provided. Tray covers shall also double up as a convenient walkway. No. of cable trays shall be sufficient for 1+3 cluster well operation.
For mud/water tank cables, foldable type cable hangers should be mounted on mud/ water tank walls, to support the mud system cables. Suggested spacing between hangers is 1000 mm, width of the hangers is 300 mm.
In addition to the cable trays, there should be at least 5 (five) steel cable boxes, skid mounted, for cable storage during rig movement. Cable boxes shall be designed for in-line arrangement.

Design of cable trays/ boxes:

Trays:

Tray frames shall be made of channel section steel of suitable size (preferably 75x40mm cross section structural steel channel beams and 65x65x6mm and 40x40x5mm support channels), designed for carrying heavy cable loads. Lifting lugs shall be provided on the bases. Tray covers shall be of 5 mm thick chequered steel galvanized plate, having loosely fitted lifting handles. Each top cover shall have minimum three no. of hinges for sturdy operation. Each large cable tray shall have 5 hinged top covers. These covers shall be galvanized. Locking arrangement for tray covers shall be provided. Trays shall be designed such that control and power cables run separately on wooden cleats. Sufficient gap shall be maintained from the tray cover to the cable supports. Earthing arrangement shall be provided on the trays.

Indicative dimensional drawing for cable trays is attached.

Cable Boxes (5 nos.):

Cable box frame and skid shall be made of channel (100 x 50mm) and beam (150 x 75mm) of structural steel. Skid shall have lifting arrangement at all the four corners and suitable for balanced lifting. Box structure shall have cross members on the sides to prevent stress and deformation during lifting and transportation. Mild steel sheet, hot rolled, shall be used for sides. Floor of the box shall be constructed of channels with 50 mm gap in between adjacent channels. Additional support shall be provided in the centre with channel/ angle. Ends of the box shall have half doors and will open from a height of 600 mm from ground (hinges to be provided at 600 mm from ground). A round pipe of NB 65 is to be provided at both ends for smooth sliding and pulling out of cables. The end covers shall be designed for locking from inside of the box. End covers shall be designed such that they cannot be opened without opening the top covers.

Five nos. top cover shall be provided, of 5 mm chequered plate (with chequered surface facing up), hinged on one side with sturdy hinges, and free on the other side with locking arrangement. **These covers shall be galvanized**. Middle cover will be designed such that it cannot be opened without opening the other two top covers. Additional locking bar (removable type) shall be provided on the top to lock all the three top covers with suitable locking arrangement.
Earthing leads shall be provided at both ends of the box.
Indicative dimensional drawing for box is attached.

The galvanization thickness of the cable tray/cable box covers shall be minimum 85 microns to withstand the corrosive environment. The painting of the cable boxes/trays shall be done with Epoxy paint with minimum 180 microns thickness.
No. of trays given below is indicative.

Size of cable trays: Mini (with hinged cover) – 1 m (L) X 1 m (W) X 0.5 m (H) – 18 nos.
Intermediate (with hinged cover)-for placing between mini and small/large trays with more height- 1 m (L) X 1 m (W) X (0.5-0.7) m (H) – 02 nos.
Small (with hinged cover) – 1 m (L) X 1 m (W) X 0.8 m (H) – 20 nos.
Large (with hinged cover) – 5 m (L) X 1 m (W) X 0.8 m (H) – 20 nos.
Size of cable box: (with hinged cover) – 4 m (L) X 1 m (W) X 1.2 m (H)

I. E. 4. Rig earthing system

Complete rig earthing system shall be supplied, consisting of G.I. earth electrodes, clamps and suitable size G.I. straps to connect all generators, motors, junction boxes, light fittings, mud tanks, mud pumps, sub structure, water/ fuel tanks, houses, lighting poles and the main PCR (s) to the earth.
Earth electrodes shall be of two sizes, 1200 mm and 2000 mm length, each of 50 mm OD heavy duty steel tube with galvanization. Electrodes shall have holes drilled in the body, MS plates welded on the top for connection of earth straps.

Indicative dimensional drawing for earth electrode is attached.

Frames of all electrical equipment including motors, alternators, junction boxes, light fittings, push button stations, light fitting mounting poles etc. shall be connected to earth using two (2) nos. separate and distinct suitably sized earth conductors as per IE rules (Rule no. 61), which in turn shall be connected to the main earth grid. The whole earthing should be in accordance with IS: 3043.
Earthing of Tanks (including mud tanks, water tanks etc.) –

i) Each mud tank should have two nos. of GI straps 50 X 6 mm mounted on the out side of the walls facing mud pumps and mud mix skid side.
ii) The straps 50 X 6 mm should be welded to the sturdy supports that are welded to the tank wall. The gap between tank wall and strap: 50mm. Spacing between supports: 1000mm. The strap length should be the same as the tank length/ width. Gap between straps should be 150mm.
iii) Straps should be mounted at a convenient height for ease of connection.
iv) The Galvanization thickness of the straps should be minimum 85 microns, to withstand the corrosive environment. 2 nos. each 25 X 3 mm GI strips shall be welded to the main strips and the agitator skids (approx. perpendicular to the main strips 50 X 6mm).
v) Two (2) GI straps of size 50 X 6 mm shall be suitably mounted on each skid to facilitate independent double earthing of the pump motors.

The Earthing scheme along with the electrode layout should be submitted along with the bid.

I. E. 5. Electrician's tools, instruments, special tools, computers for the rig system

This specification covers the details of Electrician's Tool Kit required for general maintenance & trouble shooting of the Electrical controls for the Rig.

- Set of Standard Maintenance Tools – 1 Lot
- Set of Alignment Tools – 1 Lot
- Air Pressure regulator for engine starting – 1 No.

Technical Details:

Tool kit should comprise of 1 each of following instruments/tools:

1 Digital Multimeter: Model Fluke 177, Make Fluke with meter hanging kit along with other accessories
2 Analog multimeter
3 Digital Clamp meter: Model Fluke/ Megger
4 Digital Insulation Tester (with analog indication): Model BM123, Make AVO/Megger
5 Earth resistance tester , make: Megger, model No DET5/4D – AVO UK
6 Phase rotation meter
7 Combined temperature and humidity meter, make: Fluke
8 Infrared Temperature Meter

9 Sound level (dB) meter
10 Vibration meter, make: Entek IRD
11 Tachometer (Non-contact type)
12 Cable Height Meter
13 Lux meter range- 0-50 lux
14 Soldering Iron 25W, 240VAC, make Soldron, with soldering aid set (Solder wire, soldering flux)
15 Desoldering tool (Vacuum pump type)
16 Screw Driver set
17 Wire tracer
18 Combination Pliers- 2 sizes, 6", 8"
19 Long Nose Pliers
20 Side Cutting Pliers with cable stripper
21 Socket Set (22 sockets + 5 Accessories)
22 Open ended spanner set up to 42 mm
23 Ring ended spanner set up to 42 mm
24 "Mekaster" tool set for foundation bolts of alternators and AC main drilling motors
25 Adjustable wrench spanner
26 Chain pulley with frame-01 no.
27 Crimping tool (0.5sqmm – 16sqmm cables)
28 Wire stripper (0.5sqmm – 6sqmm cables)
29 Allen key set 1.5 mm to 10 mm (9 piece set)
30 Portable Hand Drill (up to drill bit size 25 mm)
31 Industrial duty vacuum cleaner in SS body
32 Crimping tool kit for 20 pin plug & sockets – Pyle National USA Make
33 Long handled hand crimping tool
34 Torque wrench
35 Hydraulic Crimping Tool for Generator and AC motor 300 sq mm cables
36 Dual channel Oscilloscope with programmable screen, battery operated and portable
37 Function generator
38 Laptop computer with latest configuration for control system programming- **bidder to provide details**
39 Desktop computer with latest configuration- **bidder to provide details**
40 Multifunction printer (with fax, copy and scan facilities- suitable for A3/A4 size paper)
41 Software for **CONTROL SYSTEM** with license
42 Secondary injection test kit for Generator/Top Drive/Transformer feeder breakers

CHAPTER II: STANDARDS, STATUTORY RULES AND REGULATIONS TO BE FOLLOWED

a) Standards

Though a broad outline on the requirement has been made, yet the scope should include anything not mentioned but required for completeness of the system to meet the requirement of oil well deep drilling rig (drilling capacity 5000 meters depth) and make the same suitable for dismantling, transportation and installation very often in rough well site conditions.

The system offered should have proven performance record. All relevant safety systems are to be incorporated and safety codes, relevant international codes to be strictly followed.
Systems to be designed & manufactured to the latest version/ editions of the following International and Indian Standards wherever applicable & should meet all present accepted international standards for the product/application:
NEC / IEC / IEEE-45 / API 500 / NEMA / I.S. (Indian Standards)

(Clarification: Though a myriad of International/ National manufacturing standards have been referred to in the bid document, the Indian National Standard, BIS, will be the standard guidelines to be followed.

Wherever BIS is not available/ specific, other International standard like IEC and IEEE shall be considered applicable)

All components, modules, subsystems shall be of current generation with latest technology which must be in production and must not face obsolescence in near future. The supplier and the manufacturer in turn shall guarantee that spare parts shall be available for at least fifteen years.

The controls i.e. all electronics including modules and different electronic components, PLC etc. shall have high levels of noise immunity. They shall have high level of EMC and shall be immune from noise generated by future AC Variable Frequency Drive for Top Drive inclusion that will be powered from the 600 VAC Top Drive Feeder in the PCR.

The system including all sub-assemblies and components should be designed to facilitate backward integration of future modules, cards etc without any modification.

b) Rules and Regulations:

Notwithstanding the conformity of the electrical equipment to the standards as mentioned above in Para (a), the following Rules shall be taken as final and absolute standard as applicable in India.

Indian Electricity Rules, 1956 with amendments
Oil Mines Regulations, 1984 with latest amendments

1. The electrical equipment to be used in hazardous areas of oil mines as classified by DGMS (India) [**Extract of the Directive from DGMS given as *Annexure-DGMS*** shall be approved by DGMS (India) for ZONE-1 and ZONE-2, Gas groups IIA and IIB of oil mines.

   The DGMS (India)'s approval for all electrical equipment to be used in the hazardous areas shall be submitted with technical bid.
   *A visual guideline/ map / diagram of demarcation of areas as per DGMS guidelines is attached as **Addendum-Electrical: Hazardous Area Guidelines Map***

2. All electrical equipment not suitable for hazardous area, e.g., Power Control Rooms (PCR), Power Packs etc. shall be placed at least 30 metres away from well head. Bidder to furnish rig layout drawing indicating dimensions.
   As per Indian Oil Mines Regulations, 1984- Rule 67 (3) i.e.
   *No naked light or open flame or **spark** shall be permitted within 30 metres of any well or any place where petroleum is stored.*

Note: Since PCR (controls) is placed at least 30 m away, cable length from PCR to Driller's Electric Console, Draw works, any other derrick equipment etc. shall be approximately 50 m. OIL carries out cluster drilling up to a surface distance of 45 m from 1st well. This makes cable length of approximately 100 m for these equipment. The electrical system including Variable Frequency Drive cables shall be suitable for this requirement. **Bidder to confirm this.**

CHAPTER III: ELECTRICAL SPARES

The following categories of rig electrical spares are required to be considered.

A) SPARES IN THE SCOPE OF SUPPLY [To be supplied with the rigs to meet operational requirement for 03 (three) years]
B) SPARES TO BE QUOTED (NOT to be supplied)
C) SPARES FOR COMMISSIONING OF THE RIGS

A) SPARES IN THE SCOPE OF SUPPLY (***per rig***):
The spare parts for rig electricals as per the following table **shall be included in the scope of supply for each rig**. The list is indicative and if for any individual item, the supplier/manufacturer recommends a

higher quantity, then the higher quantity shall be supplied. *Since this is only an indicative list, supplier should exercise their own discretion and may add/delete items so that operational requirement for spares for 03 (three) years is covered.* Bidder/ supplier should also include consumables like proprietary grease, cleaning agent etc. with the spares list, with required make/ quantity to be supplied with the spares supply.

The spares supplied with the rigs shall be used in the **Expert Services Contract** (appearing in this addendum and "AMC" in page 93 & 121 of 123 of original bid document).
It is to be noted that period of Guarantee/Warranty and Expert Services Contract will be overlapping for one year. Bidder/supplier, therefore, has to submit a list of electrical spares to be covered under guarantee/warranty. Procurement of replacement spares under guarantee/warranty sometimes may take considerable time (if brought from outside India). If the item to be replaced under guarantee/warranty is available with OIL (as spares to be used under Expert Service Contract, para above), supplier/ contractor shall arrange for immediate replacement of the same from OIL's stock, with due authorization from OIL. Contractor shall also immediately arrange for replenishment of the same within the stipulated time for procurement of spares under guarantee/warranty period (page 116 of 123).

Set implies a complete set of items used in one particular panel/ equipment, including control switches, indication meters, control pots, relays, thermal overload relays, contactors, fuses, fuse isolators, control cards, PCBs, transformers, RCDs, soft starters etc.
Assortment implies a complete set of one particular item, say fuses for MPCR, used in the MPCR of all makes/models/ratings/used quantity.

Sl. No.	Spare item	Used in	Qty.
1	Full set of Components of exciter unit of rig alternators	Rig alternator	01 set
2	Full set of components including incomer of one rig alternator control panel	MPCR Generator control panel	01 set
3	Full set of components including incomer of one converter panel	MPCR converter control panel	01 set
4	Full set of components including incomer of one inverter/VFD panel (maximum rated, e.g. Draw Works drives) including DC link components	MPCR VFD control panel	01 set
5	Full set of components including incomer of the Top Drive panel/ house (if separately supplied)	Top drive VFD control panel	01 set
6	Full set of PLC system components	Main PCR, ACPCR, D'cabin, MPCon	01 set
7	Full sets of components of ground fault detection panels (all voltage levels)	Main PCR & ACPCR	01 set each
8	Full set of components of one brake chopper panel/s	Main PCR	01 lot
9	Full assortment of fuses in MPCR	Main PCR	01 lot
10	DW/MP/IRD AC motor with one complete blower unit	AC drilling motor drives	01 no.
11	Top drive motor with one complete blower unit	Top Drive	01 no.
12	Full set of components including incomer of one 100 HP starter panel	ACPCR	01 set
13	Full set of components including incomer of one 50 HP starter panel	ACPCR	01 set
14	Full set of components including incomer of one 40 HP starter panel	ACPCR	01 set
15	Full set of components including incomer of one 20 HP starter panel	ACPCR	01 set
16	Full set of components including incomer of one 10	ACPCR	01 set

	HP starter panel		
17	Full set of components including incomer of one 5 HP starter panel	ACPCR	01 set
18	Full assortment of fuses in ACPCR	ACPCR	01 lot
19	Full set of components of one air conditioning unit control and power system (including both evaporator and condenser units)	MPCR	01 set
20	Full set of components of one air conditioning unit control and power system (including both evaporator and condenser units)	ACPCR	01 set
21	Full set of electrical components, e.g., control switches, indication meters, pots, relays, contactors, fuses, control cards, PCBs etc. of Driller's cabin and MP'con	Driller's cabin and MP'Con	01 set each
22	Light fittings	Area illumination	01 no. of each type
23	Bulbs/ tubes	Area illumination	20 nos. of each type
24	Plug and socket set	Main PCR, ACPCR, D'con, MPcon	06 sets of each type

B) SPARES TO BE QUOTED

The following table is an ***indicative list*** of **spares for rig electricals which are to be quoted**, INDICATING PART NUMBERS (AND OEM PART NUMBERS IN CASE OF BOUGHT OUT EQUIPMENT) IN TECHNICAL BID AND PRICES IN COMMERCIAL BID RESPECTIVELY. **Quotation of the spares WILL NOT be evaluated.** This is required for preparation of inventory.

Individual component level assessment should be based on a realistic consideration, a basis beyond which management of inventory of spares will be impractical and not justifiable. *Bidder should exercise their own discretion in this regard*.

Bidder should also quote consumables like proprietary grease, cleaning agent etc. with the spares list.

Sl. No.	Spare item	Used in	Remarks
1	Rotating rectifier assembly	Alternator of power pack	Complete unit as well as Individual components
2	Exciter unit	Alternator of power pack	Complete unit
3	Generator panel components including breakers	Alternator control panel of MPCR	Individual components
4	Converter panel components incl. breakers/incomers	Converter/ rectifier panels	Individual components
5	VFD panel components including breakers/incomers/ isolators	VFD/inverter panel	Individual components
6	DC link components including line filters etc.	DC bus	Individual components
7	PLC system components	Main PCR, ACPCR, D'cabin, MPCon	Individual components
8	Components of g/fault detection panels (all voltage levels)	Both MPCR & ACPCR	Individual components
9	Components of brake chopper panel	MPCR	Individual components

10	Top Drive panel/ house (if separately supplied) components	Top drive panel/ house (if separately supplied)	Individual components
11	PLC system components	Driller's cabin, MPCon, MPCR, ACPCR	Individual components
12	100 HP starter panel components	ACPCR	Individual components
13	50 HP starter panel components	ACPCR	Individual components
14	40 HP starter panel components	ACPCR	Individual components
15	20 HP starter panel components	ACPCR	Individual components
16	10 HP starter panel components	ACPCR	Individual components
17	5 HP starter panel components	ACPCR	Individual components
18	Air conditioning unit control and power system components (including both evaporator and condenser units)	MPCR	Individual components
19	Air conditioning unit control and power system components (including both evaporator and condenser units)	ACPCR	Individual components
20	Driller's cabin and MP'con electrical items	Driller's cabin and MP'con	Individual components
21	Light fittings of each type	Illumination	Each
22	Bulbs/ tubes of each type	Illumination	Each
23	Plug and socket set of each type	Main PCR, ACPCR, D'con, MPcon	Each
24	PBS unit	AC motors	Each
25	Blower unit (for drilling motor) complete with drive motor	AC drilling motors	Each
26	Blower unit (for top drive motor) complete with drive motor	Top drive motors	Each
27	DW/MP/IRD AC drilling motor with complete blower unit	AC drives	Each
28	Top drive motor with complete blower unit	Top Drive	Each
29	Rig alternator (one complete unit)	Rig alternator	Each
30	Emergency lamp	PCRs	Each

C) COMMISSIONING SPARES (**per rig**):

Supplier shall submit a list of commissioning spares with the bid, to be supplied along with the rigs, one set per rig. These spares shall be used for commissioning of the rigs- if unused these should be handed over to OIL. It is the responsibility of the supplier to provide adequate commissioning spares and consumables required during commissioning.

CHAPTER IV : APPROVAL OF DRAWINGS, STAGE INSPECTION, PERFORMANCE TESTING AT WORKS, TRAINING & SUPPORT SERVICE PACKAGE

Following minimum drawings, documents and details of electrical equipment shall be submitted by the party for approval:

Schedule for submission of drawings and documents are attached in the Annexure- Schedule of Submission of Drawings and Documents

i) Rig layout drawing, showing relative distances of all equipment
ii) Interconnect drawings (power, network, signal)
iii) PCR (s) dimensions
iv) Rig earthing layout
v) Single line power flow diagram of the rig
vi) Cable specifications/ details

In case of the successful bidder, OIL shall study the drawings and incorporate modifications/ corrections if required. The bidder shall incorporate the modifications in the drawings and submit the same to OIL for approval. Only after getting due approval of drawings from OIL, the bidder/ manufacturer shall proceed for manufacturing/ integration of the electrical system.

Bidder/ supplier shall submit the following along with the supply of materials:

- Twenty (20) sets of drawings as above - in hard copy & Ten (10) sets of drawings as above - in CD-ROM
- Operation and Maintenance manuals of PCRs, generators, AC drive motors, auxiliary AC motors, components of panels, light fittings, rig control system etc.
- "As built" drawings (Corrected and final drawings after commissioning)
- "As built" Bill of Materials (BOM)- Final after commissioning

Inspection of Equipment by Oil India Limited (OIL):

Bidder shall agree to stage-wise inspection as per following schedule, of the major electrical equipment, as well as the complete rig package by OIL personnel, at various stages of manufacture, before dispatch.

The Inspection cum Acceptance process would include the following minimum steps/tasks, (valid for that stage of manufacture / integration) -

1. Physical verification/inspection of all the items/fittings/accessories including all Parts Catalogue, Maintenance & Service Manuals, Schematics.
2. Operational / functionality testing of each & every system under load (if applicable) / no load. Performance parameters shall match quoted specifications. However, if load testing is not possible for a particular system, OIL/TPI may waive the same at their discretion; supplier shall, in that case, guarantee the performance of the same to the rated load.
3. Any modification requirement arising out of design aspect consideration (on the part of the supplier) shall be in the scope of the supplier at no extra cost to OIL.
4. The minutes of inspection process would be prepared at the end of each inspection and jointly signed by both the parties.
5. Supplier shall confirm in writing compliance of all the points raised in the minutes of inspection as well as any other subsequent additions/changes, felt necessary.
6. Supplier will affect dispatch of the unit only on receipt of OIL's dispatch advice.

	Intermediate Assembly of individual equipment, after FAT, at manufacturer's works	Complete Assembly of individual equipment, after FAT, at manufacturer's works	Complete, integrated rig package, at suitable location, before dispatch for string and load test
Main PCR	✓	✓	✓
Auxiliary PCR	✓	✓	✓
Power Packs	-	✓	✓
Auxiliary systems- Lighting, earthing, crew cabin, cables etc.	-	-	✓
Complete Rig	-	-	✓

Package			

FAT – Field Acceptance tests / Manufacturers standard acceptance procedures, valid for that stage of manufacture.

Inspection of individual equipment – equipment include the PCRs, Power Packs etc.

Training:

Bidder shall quote a structured training programme specially designed for electrical operation and maintenance crew and engineers. The following minimum training modules are to be included in the programme.

Course / Level	Basic	Intermediate	Advanced
	To be attended by		
Theory of AC drive technology and application of the same in drilling rigs	Elect. crew		
Maintenance and troubleshooting of AC drives (for the particular model of AC drive fitted in the rig) including converter panels and DC link	Elect. Crew and engineer	Elect. engineer	Elect. engineer
Rig control system	Elect. engineer	Elect. engineer	Elect. engineer
Maintenance & overhauling of alternators and AC drilling motors	Elect. Crew and engineer	Elect. Crew and engineer	Elect. Crew and engineer
Maintenance and troubleshooting of electrical top drive system including motors	Elect. Crew and engineer	Elect. engineer	Elect. engineer

(Wherever appearing, the 'Training' for electrical engineers and crews will be IN ADDITION to the Training requirement to be imparted immediately after the inspection. However both the phases of training will be evaluated.
Training modules/ programmes will be such that objectives/ requirement as per the different modules of the training program are achieved.)

Training should comprise of classroom as well as hands-on training at workshop, as appropriate. Number of participants per course shall be indicated by bidder. Location of these courses shall be fixed after mutual discussion between OIL and the supplier.

Cost of training package will be evaluated.

MAINTENANCE

HIRING FOR EXPERT SERVICES FOR RIG ELECTRICALS

Supplier shall quote for a comprehensive expert service contract for troubleshooting, maintenance and support services for the electricals of the two rigs under the scope of supply, which is outlined as follows. This contract will be part of the *Annual Maintenance Contract* appearing in "General Notes-Clauses (k) & (l)" of page 121 of 123 (and elsewhere) of original bid document. ***However, notwithstanding anything stated to the contrary in the original bid document, the commencement of electrical part of the expert service contract/ AMC shall be from the date of successful commissioning of EACH rig***.

A) SCOPE OF WORK FOR ELECTRICAL:

i) a) Troubleshoot and rectify faults in the rig electrical system as and when they occur:

[*Troubleshooting implies Detection, Solution and Rectification of electrical faults*]

The rig electrical system shall refer to the following equipment/ machine/ tool/sub-system and shall be inclusive of associated control system and components for the particular machine or equipment.

- Electricals of the rig control system in the driller's cabin (part of the complete package comprising electronics/instrumentation/ signals/PLC/electricals of the complete rig control system)
- Rig alternators and their controls
- PCRs (both MPCR & ACPCR) and all controls/equipment/panels within
- Top drive house (if separately supplied) and all controls/equipment/panels within
- All drilling motors and associated controls
- The auxiliary systems, including mud circuit system, cable systems, transformers, earth leakage monitoring systems and controls, air compressor controls etc.
- Any other electrical drives/controls, not mentioned/ enumerated here, but installed as part of the rig supply package

b) To attend any numbers of breakdown reports/ calls initiated within the contractual period

c) To submit job completion report/ certificate for each breakdown report (for billing) along with the details of rectification jobs done
(including any modification, if carried out), spares consumed etc.

ii) a) Carry out periodic maintenance activities on the various parts of the electrical system as per schedule, as outlined below:

- Maintenance of the electricals of the rig control system including sub-systems, input/output modules, remote modules, re-programming or modification of the control system software as per drilling requirement etc.
- Periodic maintenance of the MPCR and ACPCR including their subsystems
- Periodic maintenance of the rig alternators and electrical drive motors including AC drilling motors
- Any other job as recommended by the manufacturer in O&M Manual of a particular machine
- Any other job which may not have been specified either in the contract or in the manual but required for smooth & trouble free operation/performance of a machine/ system shall be attended.

b) Carry out any modification/ adjustment of equipment/settings/ controls- as and when necessary

iii) Give support services by

- Helping to build up in-house expertise for troubleshooting by explaining and coaching regarding procedures, inherent theory, principle of operation of a particular equipment/faults encountered to OIL engineers/crews after completion of the job
- Familiarizing the OIL electrical crew with the above mentioned equipments/systems
- Helping in the Preparation of spare list and inventory

B) MANPOWER FOR THE CONTRACT

There shall be one (or more) competent electrical engineer, normally stationed at OIL Headquarters at Duliajan, available on a 24 x7x365 basis for carrying out above mentioned jobs. ***However, in case the rig (s) is / are transferred to a location where to and from movement from Duliajan is time consuming and difficult, the expert(s) will be stationed at either the camping site (if provided for rig crew) or at any suitable place to be decided by OIL***

The following are the basic requisite qualities of the expert (s).
a) The expert(s) will be qualified graduate/ diploma holder in electrical/ electronics engineering and fit for working continuously for long hours in typical rig environment.
b) The person (s) shall be fully conversant with the complete system of supplied rig electricals as well as the supplied rig control system. He (they) shall be trained specifically for troubleshooting jobs of the supplied/ equivalent rig control system. He (they) must have thorough knowledge of the system and be able to independently troubleshoot and rectify faults.
c) He (they) shall also be able to work with his (their) own hands.

d) The expert (s) must be fluent in English (US or UK) and should have amiable, pleasant personality.
e) He (they) should respond to OIL's summon with alacrity and immediate effect.
f) Contractor shall arrange for hiring/ summoning the services of technical experts in case site expert is unable to rectify/ troubleshoot a particular problem, at no extra cost to OIL. In such a case, the locally stationed expert and OIL shall jointly decide to give such call.
g) Contractor shall submit credentials of the expert(s) to be engaged before mobilization of the contract and obtain OIL's approval before deployment.
h) Contractor shall arrange for replacement personnel well ahead of the scheduled release/ leave of the working crew. However, for unplanned/ unforeseen circumstances certain relaxation may be exercised.
h) The personnel employed shall be fully conversant with the Indian Statutory Rules and Regulations applicable to oil mines.
i) The personnel employed should preferably be Indian nationals.

C) SPARES, TOOLS AND INSTRUMENTS REQUIREMENT

a) SPARES:
Bidder/ supplier to go through page 1-3 of this Addendum *[Section 18, Chapter III - Rig Electricals]* for the details.

Spares required for maintenance shall be supplied along with the rig, as per Clause (A), page 1 of this Addendum. However, in case a particular spare/spares is unavailable, which is/are essential for immediate recovery in case of breakdown, contractor shall arrange for supplying the same to OIL at the earliest. OIL shall reimburse the contractor cost of such spare(s) at actuals.
During the warranty period of the rig, faulty/defective manufactured parts shall be supplied by the supplier free of cost. These shall, hence, not be covered under the expert services contract clauses.

b) TOOLS AND INSTRUMENTS:
The contractor shall supply the expert (s) with any special tools, tackles and instruments required for carrying out the jobs. Customs duty/ import duty/ other charges on these tools/ instruments shall be borne by the contractor. If these tools/instruments require replacement/ calibration, contractor shall arrange for the same. Copies of calibration certifications shall be submitted to OIL for maintaining of records.

OIL will only provide standard/ general tools, manpower and facility for lifting / handling / carrying heavy equipment.
For other matters related to contract not spelt out above, bidder shall be guided by the "General Notes" under Section 20.

D) STATUTORY REQUIRMENTS:

a) Contractor shall have to provide all safety gadgets to his crew. The condition of all PPE (personal protective equipment) and other safety gadgets provided by the contractor to his crew shall be in proper/ good condition.
b) Safe and proper working procedure shall be followed while carrying out jobs to ensure safety of equipment and personnel.
c) Contractor shall ensure compliance of all Indian Statutory Rules and Regulations applicable to oil mines.
d) The contractor's personnel while on duty/ work must use the following minimum personal protective equipment.

1) Safety Shoe
2) Helmet
3) Safety Goggles (wherever/whenever needed)
4) Hand Gloves (wherever/whenever needed)

CHAPTER V: ELECTRICAL ANNEXURES

V .A ELECTRICAL ANNEXURE – STATUTORY [As per DGMS(India) Guidelines]

A visual guideline/ map / diagram of demarcation of areas as per DGMS guidelines is attached as ***Addendum-Electrical: Hazardous Area Guidelines Map***

1. Classification of areas in oil mines into different zones according to the degree of probability of the presence of hazardous atmosphere, as given below:

A. Drilling and Work-over Operations :

(1) Well-head area :

(a) When the derrick is not enclosed and the substructure is open to ventilation, the area in all directions from the base of rotary table extending up to 3.0 m shall be Zone 2 hazardous area. Any cellars, trenches and pits below the ground level shall be Zone 1 hazardous area; the area lying up to 3.0 m in horizontal direction from the edge of any cellars, trenches or pits and 0.5 m vertically above the cellars, trenches or pits shall be Zone 2 hazardous area.

(b) When the derrick floor and substructure are enclosed, the enclosed substructure below the derrick floor, including cellars, pits or sumps below the ground level, shall be Zone 1 hazardous area; the enclosed area above the derrick floor shall be Zone 2 hazardous area.

(2) Mud Tank and Channel :

The free space above the level of mud in tank and channel shall be Zone 1 hazardous area; the area in a radius of 3.0 m in all directions from the edge of mud tank and channel shall be Zone 2 hazardous area.

(3) Shale Shaker:

(a) The area within a radius of 1.5 m in all directions from the shale shaker to open air shall be Zone 1 hazardous area. The area beyond 1.5 m and up to 3 m in all directions from the shale shaker shall be Zone 2 hazardous area.

(b) When the shale shaker is located in an enclosure, the enclosed area shall be Zone 1 hazardous area to the extent of the enclosure. The area outside the shale shaker and up to 1.5 m in all directions from the shale shaker shall be Zone 2 hazardous area.

(4) Degasser :

The area within a radius of 1.5 m from the open end of the vent extending in all directions shall be Zone 1; the area beyond 1.5 m and up to 3 m in all directions from the open end of vent shall be Zone 2 hazardous area.

(5) Desander and Desilter :

The area within a radius of 1.5 m in all directions from the desander and desilter located in open air shall be Zone 2 hazardous area.

(6) Effluent Pit and Open Sump :

The free space above the level of flammable liquid within the effluent pit or sump shall be Zone 1 hazardous area; the free space lying up to 3.0 m in horizontal direction from the edge of any effluent pit or sump and 0.5 m vertically above the effluent pit or open sump shall be Zone 2 hazardous area.

C : Oil and Gas Processing and Storage Equipment :

Storage Tanks :

(a) In case of floating roof tank, the space above the floating roof and inside the enclosure up to top level of the enclosure wall shall be Zone 1 hazardous area; the area beyond Zone 1 hazardous area and up to a radius of 4.5 m in all directions from tank shell and shell top shall be Zone 2 hazardous area. In case of a dyke, Zone 2 hazardous area shall extend vertically up to the height of the dyke and horizontally up to the physical boundary of the dyke.

(b) In case of fixed roof tank, the area inside the tank and within a radius of 1.5 m from all openings including breather valve, dip hatch, thief latch and safety valve shall be Zone 1 hazardous area; the area beyond Zone 1 hazardous area and up to a radius of 3 m in all directions from shell and roof of the tank shall be Zone 2 hazardous area. In case of a dyke, the sump in the dyke shall be Zone 1 hazardous area and an area extending vertically up to a height of the dyke and horizontally up to the physical boundary of the dyke shall be Zone 2 hazardous area.

2. Use of flexible cables in drilling rigs and in other similar equipments in Oil Mines

1.0 Flexible cables are in use with drilling rigs and in other similar equipments in oil mines.

2.0 The electrical equipment used in a drilling rig is high capacity DC motors, 3 phase AC motors, their control gears, light fittings and instrumentations.

3.0 Flexible cables used with circuits exceeding low voltage shall be provided with flexible metallic screening or pliable armouring.

4.0 Such flexible metallic screening if used as a means of protection from mechanical Injury it shall not be used by itself to form an earth conductor, but it may be used for that purpose in conjunction with an earthing core.

5.0 Though the metallic screening shall not be used by itself to form an earth conductor the same shall have conductivity at all parts and at all joints at least equal to 50 per cent of the conductivity of the largest conductor.

6.0 IS: 14494-1998 "Elastomer insulated flexible cables for use in mines-specification" and IS: 9968 Part I & II, “Specifications for elastomer insulated cables” are the relevant Indian Standards available on elastomer insulated cables.

7.0 IS: 14494-1998 is mainly for flexible cables used in below ground and open cast mines. This standard does not cover flexible cables used in oil mines. Though IS:9968(Part-I) does not speak about metallic screening for cables at voltages above low voltages, however, to afford protection against mechanical injury, it is imperative that flexible cables for use in oil mines must have metallic screening also.

8.0 Hence it becomes mandatory that

(a) The flexible cables used to connect 3 phase electrical equipments shall be EPR (Ethylene Propylene Rubber [IE-2]) insulated and HOFR (heat resisting, oil resisting & flame retardant) Elastomeric CSP (Chloro- Sulphonated Polyethylene) sheathed, either individually or collectively copper screened, 4 core copper conductor cables with fourth core having 50% conductivity of the largest conductor and the combined screen having 50% conductivity of the largest conductor.

(b) The flexible cables used to connect light fittings shall be EPR insulated and HOFR elastomeric CSP sheathed unscreened 3 core copper conductor cables.

(c) The flexible cables used with alternators and motors shall be single core EVA (Ethyl Vinyl Acetate rubber) insulated and sheathed, copper conductor cables, and,

(d) The flexible cables used for control connections shall be EPR insulated, and HOFR elastomeric CSP sheathed, copper screened flexible copper conductor cables having cores up to 20 and shall generally conform to IS:9968 (Part-1).

9.0 Termination of flexible cables with electrical equipments installed in hazardous area shall be through appropriate size of double compression glands and with electrical equipments installed in non-hazardous areas shall be through a readily detachable plug and socket assembly.

V .B ELECTRICAL ANNEXURE-STANDARDS

STANDARDS TO BE FOLLOWED BY DIESEL ELECTRICAL AC-VFD RIGS IN OIL'S MINING AREAS

Sl. No.	Item	Statutory Rules/ Guidelines/ Directives	OIL's Remarks	Remarks by Bidder
1	Distance of PCR and power packs (engine + alternator) from well shall be 32.0 m	OMR-1984 (Amended 1996) specifies 30.0 m	OIL's practice is 32.0 m [As per I. S. Code 5572 (1994)]	
2	All electrical equipment including motors, starters, push button stations, lighting fixtures, plugs and sockets, glands/ connectors, junction boxes and accessories etc. used in hazardous/ dangerous areas of oil mines shall be either flameproof/ explosion proof (Ex-d) or increased safety type (Ex-e) and must have approval from DGMS (India) for use in Zone 1 and Zone 2, gas groups IIA and IIB of Oil Mines. *A visual guideline/ map / diagram of demarcation of areas as per DGMS guidelines is attached as* ***Addendum-Electrical: Hazardous Area Guidelines Map***	DGMS Directive and OMR Rules 73, 75	It is a statutory requirement and must be complied with.	
3	Every power feeder, motor and lighting feeder shall be provided with an Earth Leakage Circuit Breaker/ Residual Current Device [above 5 KW and medium voltage(≥ 250 V)]	Indian Electricity Rules, 1956 (Amended 2002): Rule 61 A	ELCB will disconnect the supply instantly at the occurrence of earth fault or leakage current.	
4	600 V ungrounded generator system with AC/DC GFD system shall have audio-visual annunciation.		Audio annunciation IS TO BE PROVIDED	
5	Power supply to lighting circuits shall be from phase-to-phase, 240 V, 50 Hz			

	Aviation warning lamp: **Day lamp**: 20,000 Cd, flasher type with 40 flashes per minute (WHITE) **Night lamp**: 40 Cd, fixed (RED) *[5 nos. of flashers are indicated, one at crown and four nos. at thribble board, colour unspecified]*	Ministry of Defence, (Govt. of India) directive	The lights shall be operational at all times from the moment the mast is raised until the mast is finally lowered irrespective of well operation.	
6	*General Illumination Level to be maintained*: Pump-house shed- 100 Lux Derrick floor- 80 Lux Pipe rack area- 60 Lux Monkey Board- 30 Lux Compressor shed-100 Lux Sub-structure- 150 Lux Engine room- 80 Lux Peripheral/ General area- 10 Lux	As per OIL requirement		
7	Pressurized type D'CON/ foot throttle shall be used; alarm will be provided for loss of purging.	This is required as an additional safety feature; but these items are outside DGMS classified hazardous areas. Purging required as per OMR spec. 67.		
8	Emergency shut off device (ESD) system- at Driller's control panel			

V .C ELECTRICAL ANNEXURE- Main PCR MCC STARTERS/ FEEDERS

SL. NO.	STARTER PANEL	MOTOR/ FEEDER LOAD (HP)	QUANTITY	PANEL CAPACITY (HP)	REMARKS
1	LINER FLUSHER, MUD PUMPS	3	2	5	
2	MAIN LUBE, MUD PUMPS	1	2	5	If supplied
3	CHAIN OILER, MUD PUMPS	1	4	5	If supplied
4	SUPER CHARGERS	75	2	100	
5	BLOWER MOTORS	7.5	9	10	Including 1 no. for IRD
6	WATER BOOSTERS	30	2	40	
7	DWKS LUBE PUMP	5	3	5	Including 1 no. for IRD
8	DW BRAKE WATER COOLING	60	2	100	
9	DISC BRAKE C/WATER PUMP	60	2	100	
10	AIR COMPRESSOR	40	2	50	
11	AFTER COOLER	1	2	5	
12	MAIN PCR AIR CONDITIONER	50	1	100	
13	SPARE STARTER	-	1	100	
14	SPARE STARTER	-	1	40	
15	SPARE STARTER	-	1	10	
16	SPARE FEEDER	-	1	40	

V.D ELECTRICAL ANNEXURE- ACPCR MCC STARTERS/ FEEDERS

SL. NO.	STARTER PANEL	MOTOR/ LOAD (HP)	QUANTITY	PANEL CAPACITY (HP)	REMARKS
1	MUD AGITATOR	10	18	10	
2	WATER AGITATOR	10	4	10	
3	PILL CHAMBER	10	1	10	
4	DESANDER	100	1	100	
5	DESILTER	100	1	100	
6	MUD MIXERS	100	4	100	
7	MULTI-STAGE PUMPS	100	2	100	
8	PIT PUMP	75	1	100	
9	SOURCE WATER WELL	5	2	5	
10	SHALE SHAKERS	5	3	5	
11	DEGASSER	5	1	5	
12	CELLAR	5	1	5	
13	FUEL PUMPS	5	2	5	
14	BUG BLOWER	5	1	5	
15	TRIP TANK	15	2	20	
16	RECYCLING PUMP	5	2	10	
17	IR FILTER, WATER	1	1	5	
18	MUD CLEANER	5	2	5	
19	HIGH PRESSURE JET CLEANER	1	1	5	
20	POWER TONG	60/70	1	100	
21	AC PCR AIR CONDITIONER	40	1	40	
22	BOP FEEDER	40	1	40	
23	FEEDER FOR LIGHTING TRANSFORMERS	60	2	100	
24	RIG LIGHTING D.B.	-	-	-	
25	EC BRAKE	50	1	100	
26	WELDING MACHINE	50	1	60	
27	3 WIRE 240 V Ph-Ph FEEDER	-	2	5	
27	2 WIRE 240 V Ph-Ph FEEDER	-	3	1	
28	HAND LAMP	1	2	5	
29	110 V SUPPLY FEEDER	1	1	5	
30	AIR DRIER	1	1	5	
31	INST. MANAGER'S CABIN	10	1	20	
32	MOBILE AIR COMPRESSOR, FOR CEMENTING	40	1	50	
33	TORQUE WRENCH, BOP	2	1	5	
34	EASY TORQUE	5	1	5	
35	MUD VOLUME TOTALIZER	1 KVA	1	5	

36	BOP TROLLEY	20	1	20	
37	CENTRIFUGE	25 + 15	2	30	
38	SPARE STARTER	-	1	100	
39	SPARE STARTER	-	1	40	
40	SPARE STARTER	-	2	10	
41	SPARE FEEDER	100	2	100	
42	SPARE FEEDER	20	2	20	
43	SPARE FEEDER	10	2	10	

V .E ELECTRICAL ANNEXURE- SCHEDULE OF SUBMISSION OF DRAWINGS/ DOCUMENTS

Sl. No.	Details of drawings / documents (as appearing in relevant chapters/clauses)	Submission schedule		
		With the bid	At the time of inspection	After commissioning
1	Indicative single line power flow diagram of the rig, showing all voltage levels***, current ratings & short circuit making/ breaking capacities of breakers/ isolators, bus ampere rating (taking into account all generators fully loaded) etc.***	√		
2	***Details of the Short circuit calculation of the complete electrical system***	√		
3	Indicative Rig Layout diagram (Plan), showing relative distances of all electrical equipment	√		
4	Indicative PCR dimensional drawings, including details of rain protection for transformers, cable & plug sockets etc.	√		
5	Layout of the complete earthing system including earthing of PCRs, AC motors, alternators, diesel tanks & any other electrical equipment used for the purpose	√		
6	***Equipment literature/ Third party (quality control) inspection report***	√	√	
7	DGMS approval for all electrical equipment ***to be used*** within classified areas	√		
8	~~***Mandatory***~~ Spare parts/ Spare equipment / Consumables list ***and quotations of spares***	√		
9	Rig lighting schematic with light fittings used	√		
10	*Annexure-Datasheet* (given later ***as Annexure V. F)*** with all relevant Documents: ***Details of equipment which may not be submitted with the bid shall be submitted to OIL/ Third party inspector during inspection stage. However, if the make/ model of the equipments are outside the list of makes/vendors as given in "Make of Electrical Rig Accessories" (page 118/120 of 123), bidder/supplier shall take prior approval from OIL, well in advance before inspection.***	√	√	
11	"As-built" drawings, operation and workshop manuals, ***Bill of Materials*** and any other relevant documents		√	√

V.F ELECTRICAL ANNEXURE- DATASHEET

CHAPTER	Information requested from bidder	Bidder's reply	Remarks (if any)
Statutory			
Chapter II, Para (b) (1)	All electrical equipment to be used in classified Hazardous areas to be DGMS (India) approved. Bidder will arrange for approval from DGMS. Bidder to forward the DGMS (India)'s approval for all electrical equipment to be used in the hazardous areas along with the technical bid. *A visual guideline/ map / diagram of demarcation of areas as per DGMS guidelines is attached as* ***Addendum-Electrical: Hazardous Area Guidelines Map***		
	Restricted neutral earth system used in the system shall have a maximum earth fault current of 750 milliAmps using NGR. Bidder to confirm.		
	Earth fault system to have both audio and visual alarms. Bidder to confirm.		
General			
Chapter I A, General Outline	Complete electricals of the rig offered?		
	Any deviation/ non-submission regarding above shall be given in a separate sheet.		
Chapter IV	Is the training module/ package offered along with the bid (*prices to be quoted in the commercial bid*)? Cost of training package to be evaluated.		
	Does the bidder agree to stage-wise inspection of the major electrical equipment as well as final rig package?		
	Has the bidder quoted for the on-site maintenance package?		
	Generation system voltage: 600 VAC- Offered?		
	Completer rig control system- offered?		
	Emergency Stop controllers on D'con/Drillers cabin- Offered?		
	Entire Electrical AC system frequency shall be 50 Hz- Bidder to confirm.		
	Main drive motors shall be assignable to different VFD panels. Bidder to confirm.		
	"Spares" offered?		
	Vintage/ year of manufacture of equipment- New/ Unused / recent manufactured- Bidder to indicate.		
	System shall be suitable for 1+3 cluster well drilling, with continuous cable lengths of up to 100 metres. Bidder to confirm.		
	Top drive cable length shall be suitable for cluster drilling, as explained above. Bidder to confirm		

415 VAC auxiliary system			
	Spare MCC cubicles (with at least one from each size of starter/ feeder) available?		
	Each individual panel in the 415 VAC MCC provided with RCD / ELCB for power circuit as well as control circuit. Bidder to confirm		
	Control voltage (e.g. 110 VAC or lower) employed in motor control circuits		
	Permanent Insulation monitor provided in the NGR system?		
	Bidder to indicate Standards followed for selection of MCCB, contactors and relays for motor starting / power feeders at AC MCC (415 VAC)		
Power packs			
Chapter I A	No. of power packs offered		
	Make of alternator offered		
	Alternator rating (kVA)		
	Alternator temp. rise above ambient (degree C)		
	Speed (RPM)		
	Bidder to indicate standards followed in design and construction of alternator.		
	Datasheet of the offered alternator- Bidder to submit		
	Are the alternators suitable for VFD controlled AC drive?		
	HOC circuit offered?		
	Reports of standard commercial tests performed on the offered alternators (in accordance with IEEE Std. 115, NEMA MG-1, or MIL-Std. 705 standards) attached		
	Type of engine control system offered- AC module (Hill Graham/ Ross Hill type)/ engine & alternator control separate/ any other type- Bidder to specify.		
Rig control system			
Chapter I B, 1 (a)	Rig control system is field proven and running for a minimum period of 3 years? Credentials for this to be submitted with bid.		
	The control system should be complete with all necessary software, hardware and remote communication capability. Bidder to confirm.		
	All software, including hardware keys (if needed) should be licensed to Oil India Limited. Such Licenses should not have expiration dates. Bidder to confirm.		
	Bypass mode provided (in case the control system fails)? Bidder to confirm.		
Power Control Rooms			
Chapter I B	Dimensions (as given in Specifications) to be adhered to- Bidder to confirm.		
	Weight (as given in Specifications) to be adhered		

	to- Bidder to confirm.		
	PCRs are suitable for bottom lifting- Bidder to confirm		
	PCRs oil field type Skid mounted- Bidder to confirm		
	PCRs suitable for heavy rain/humid areas		
	Plug socket cable terminations are of crimped type- Bidder to confirm		
	PCR to be weight-balanced with CG at centre		
VFD panels			
Chapter I B, 1 (e)	No. of panels offered- sufficient panels should be available for simultaneous running of all drives, with one spare panel: Bidder to indicate		
	Amps rating of VFD panel: Bidder to indicate		
	Type of auxiliary braking employed in Draw works- Bidder to indicate.		
Air conditioning			
Chapter I B, 1 (k) and Chapter I B, 2 (c)	Cooling Capacity (tons) – Bidder to provide tonnage requirement for each PCR individually and details of the air conditioning system.		
	Type (Split / window/ package)		
	Full redundancy (100%) provided for air conditioning? Bidder to confirm.		
	Mounting of Air conditioners on the same skid as PCR – Bidder to confirm		
	Make of AC offered		
	Model of AC offered		
Transformer (main transformer in Main PCR)			
Chapter I B, 1 (m)	Capacity offered – Minimum 1 x 500 KVA- bidder to confirm.		
	Voltage ratio		
	Transformer temperature rise above ambient (C)		
	Transformer & associated switchgear suitable for parallel operation (Yes/No)		
	Transformer insulation class		
	Transformer impedance (%)		
	Transformer Enclosure type (IP 23 etc) if offered		
	Transformer terminations – primary and secondary (Stand off / cable connected in air filled enclosure)		
	Transformer make		
	Transformer model		
	Provision for Star connected secondary with neutral terminal available in terminal box		
Transformer (main transformer in ACPCR)			
Chapter I B, 2 (d) (i)	Capacity offered – Minimum 1 x 1000 KVA		
	Voltage ratio		
	Transformer temperature rise above ambient (C)		
	Transformer & associated switchgear suitable for parallel operation (Yes/No)		

	Transformer insulation class		
	Transformer impedance (%)		
	Transformer Enclosure type (IP 23 etc) if offered		
	Transformer terminations – primary and secondary (Stand off / cable connected in air filled enclosure)		
	Transformer Make		
	Transformer model		
	Provision for Star connected secondary with neutral terminal available in terminal box		
Transformer (Lighting- ACPCR)			
Chapter I B, 2 (d) (ii)	Capacity offered – Minimum 2 x 60 KVA		
	Voltage ratio		
	Transformer temperature rise above ambient (C)		
	Transformers suitable for parallel operation (Yes/No)		
	Transformer insulation class		
	Transformer impedance (%)		
	Transformer Enclosure type (IP 23 etc) if offered		
	Transformer terminations – primary and secondary (Stand off / cable connected in air filled enclosure)		
	Transformer Make		
	Transformer model		
	Provision for Star connected secondary with neutral terminal available in terminal box		
Transformer (Isolation - ACPCR)			
Chapter I B, 2 (d) (iii)	Capacity offered – Minimum 1 x 100 KVA		
	Voltage ratio		
	Transformer temperature rise above ambient (C)		
	Transformers suitable for parallel operation (Yes/No)		
	Transformer insulation class		
	Transformer impedance (%)		
	Transformer Enclosure type (IP 23 etc) if offered		
	Transformer terminations – primary and secondary (Stand off / cable connected in air filled enclosure)		
	Transformer Make		
	Transformer model		
	Provision for Star connected secondary with neutral terminal available in terminal box		
MCC-Main PCR			
Chapter I B, 1 (n)	The starters as given in “Annexure-Main PCR Starters/Feeders” are to be incorporated in the MCC panel of Main PCR. Bidder to indicate deviations and additions if any.		
	The MCCBs, contactors and relays for the starter panels shall be as per Type 2 coordination (IS 13947 or IEC60947). Bidder to confirm.		

	(Clarification: Though a myriad of International/ National manufacturing standards have been referred to in the bid document, the Indian National Standard, BIS, will be the standard guidelines to be followed. Wherever BIS is not available/ specific, other International standard like IEC and IEEE shall be considered applicable)		
MCC-ACPCR			
Chapter I B, 2 (e)	The starters as given in "Annexure-ACPCR Starters/Feeders" are to be incorporated in the MCC panel of ACPCR. Bidder to indicate deviations and additions if any.		
	The MCCBs, contactors and relays for the starter panels shall be as per Type 2 coordination (IS 13947 or IEC60947). Bidder to confirm. (Clarification: Though a myriad of International/ National manufacturing standards have been referred to in the bid document, the Indian National Standard, BIS, will be the standard guidelines to be followed. Wherever BIS is not available/ specific, other International standard like IEC and IEEE shall be considered applicable)		
Socket Board- Main PCR & ACPCR			
Chapter I B, 1 (o) and Chapter I B, 2 (h)	Type, make and no. of plug-sockets provided. Bidder to indicate.		
Drive Motors			
Chapter I C 1- Draw works motors	AC inverter duty motor offered?		
	Capacity- HP/KW		
	Voltage		
	Speed (RPM) range at full HP output		
	Speed (RPM) range at constant torque		
	Max. Current (FLC, in Amps)		
	ambient temperature (C)		
	Torque (lb-ft)		
	Make		
	Model		
Chapter I C 2- Rotary drive	AC inverter duty motor offered?		
	Capacity- HP/KW		
	Voltage		
	Speed (RPM) range at full HP output		
	Speed (RPM) range at constant torque		
	Max. Current (FLC, in Amps)		
	ambient temperature (C)		
	Torque (lb-ft)		

	Make		
	Model		
Chapter I C 3- Top drive	AC inverter duty motor offered?		
	Capacity- HP/KW		
	Voltage		
	Speed (RPM) range at full HP output		
	Speed (RPM) range at constant torque		
	Max. Current (FLC, in Amps)		
	ambient temperature (C)		
	Torque (lb-ft)		
	Make		
	Model		
Chapter I C 4- Mud pump motors	AC inverter duty motor offered?		
	Capacity- HP/KW		
	Voltage		
	Speed (RPM) range at full HP output		
	Speed (RPM) range at constant torque		
	Max. Current (FLC, in Amps)		
	Temperature rise(C)		
	Rated torque (lb-ft)		
	Make		
	Model		
Chapter I C 5- AC auxiliary motors	The motors as given in “Annexure-Main PCR Starters/Feeders” are to be supplied. Bidder to indicate deviations and additions if any.		
	The motors as given in “Annexure-ACPCR Starters/Feeders” are to be supplied. Bidder to indicate deviations and additions if any.		
	DGMS approval for electrical equipment (motors) to be used in hazardous areas to be obtained and submitted as per “Annexure- Schedule for Submission of Documents”. Bidder to confirm.		
	Motors shall be fitted with FLP/Exp double compression cable glands- Bidder to confirm		
Cables			
Chapter I D	Cable lengths shall be designed taking into account the requirement for 1+3 cluster wells. Bidder to confirm.		
Refer Annexure-Statutory for Cables.	Type of cable for 3 phase equipment- HOFR, EPR insulated, CSP sheathed and copper screened 4 core copper conductor. Bidder to confirm.		
	Type of cable for light fittings- HOFR, EPR insulated, CSP sheathed and copper 3 core copper conductor. Bidder to confirm.		
	Type of cable for alternators & Motors- single core EVA insulated and sheathed copper conductor. Bidder to confirm.		
	Type of cable for control connections- HOFR, EPR		

	insulated, CSP sheathed and copper screened copper conductor having cores up to 20. Bidder to confirm.		
	All the cables including power, control, lighting etc. shall be supplied complete with suitable male/female plug/ connectors. Bidder to confirm.		
	Cores shall be identifiable by colour/ number.		
Rig lighting system			
Chapter I E, 1	All the FLP light fittings shall be DGMS approved. Bidder to confirm.		
	All the light fittings shall be provided with necessary control gears and lamps. Bidder to confirm.		
	Mast lighting socket board offered?		
	Lighting voltage (e.g. 240 volt phase to phase in Hazardous areas/ 240 volt phase to neutral for other areas)?		
	Aviation warning lights offered – Red colour, continuous glow(night), white colour – flashing(day)		
	Lighting scheme and details of submitted?		
Area lighting panel			
Chapter I E, 2	Offered as per specifications? Bidder to confirm.		
Cable handling system			
Chapter I E, 3	Cable trays, boxes, grasshopper arrangement offered as per specifications?		
Rig earthing system			
Chapter I E, 4	The Earthing scheme along with the electrode layout submitted? Bidder to confirm.		
Tools and Tackles			
Chapter I E, 5	The list of tools and tackles as given in the specifications are to be supplied. Bidder to indicate deviations and additions if any.		
	Laptop and desktop computers for control system programming. Bidder to provide details.		
Crew work/ rest room			
Chapter I E, 6	Offered as per specifications? Bidder to confirm.		
Spares			
Chapter III	“spares” as given in the specifications are to be supplied. Bidder to confirm and indicate deviations and additions if any.		
Drawings and Documents to be submitted with the bid			
	Schedule for submission of drawings and documents are attached in the Annexure-Schedule of Submission of Drawings and		

	Documents		
	i) Rig layout drawing, showing relative distances of all equipment ii) Interconnect drawings (power, network, signal) iii) PCR (s) dimensions iv) Rig earthing layout v) Single line power flow diagram of the rig vi) Cable specifications/ details vii) Lighting scheme and details viii) List and details of all electrical equipment us the rig, including alternators, motors, cables, fittings, push button stations, plug & soc junction boxes, starters etc. used in the rig		

Checked and Confirmed

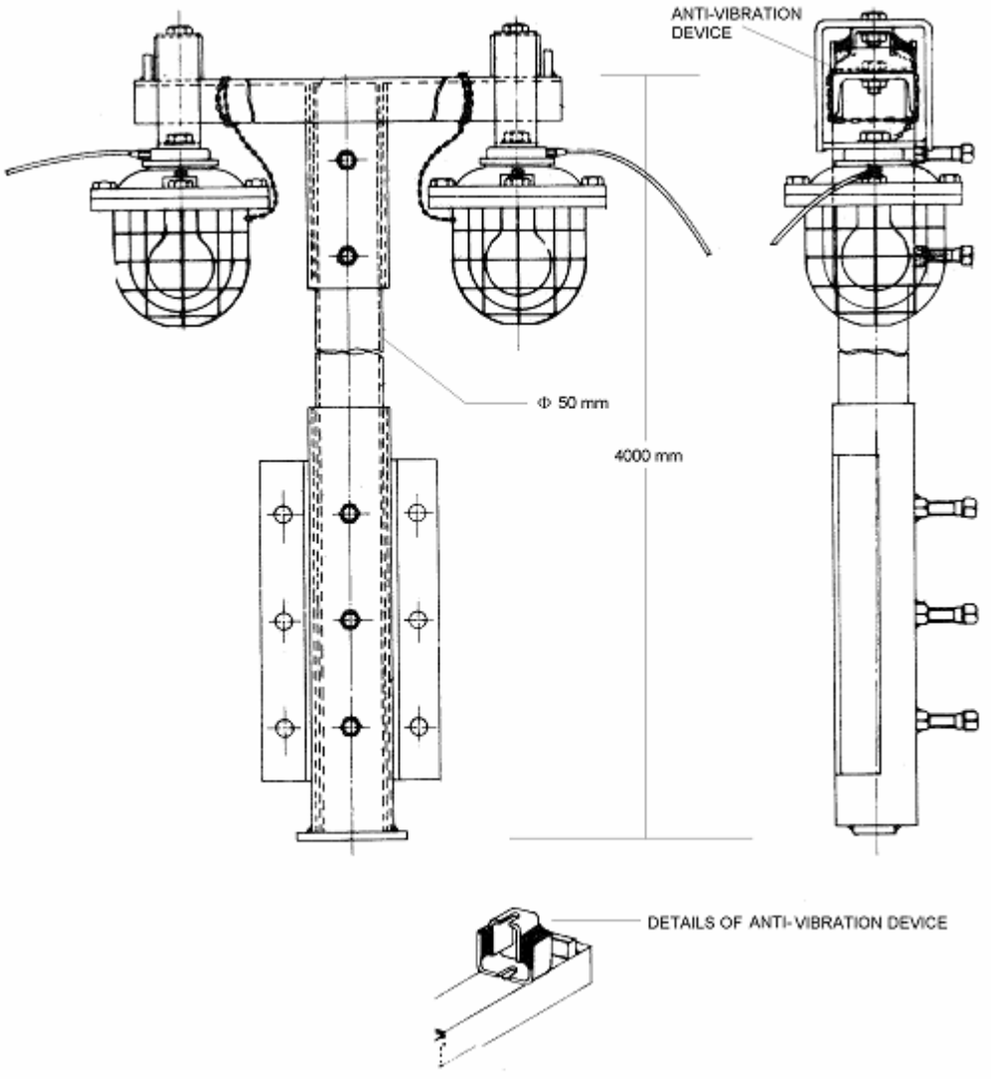
_____

(Signature)

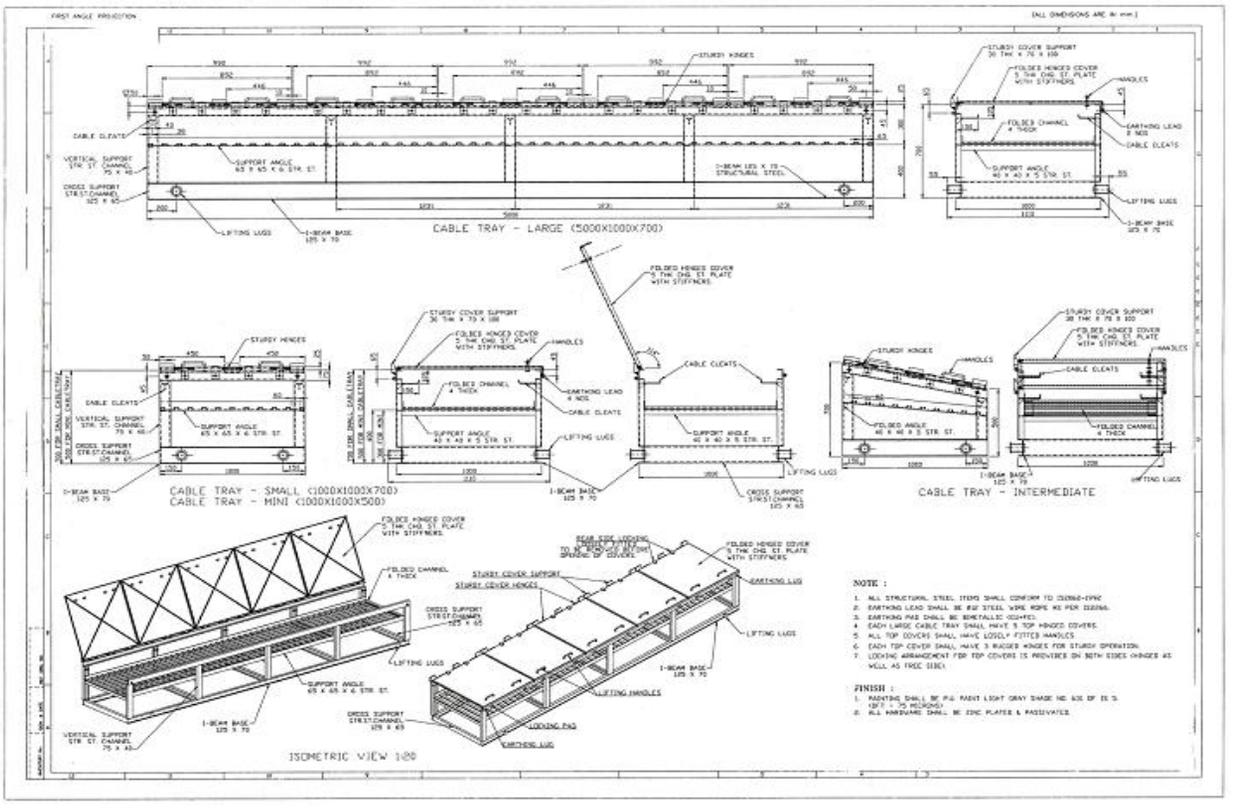
V.G ELECTRICAL ANNEXURE- INDICATIVE DRAWINGS

1. Indicative diagram of 'T' –pole
2. Indicative diagram of cable trays
3. Indicative diagram of cable box
4. Indicative diagram of earth electrode

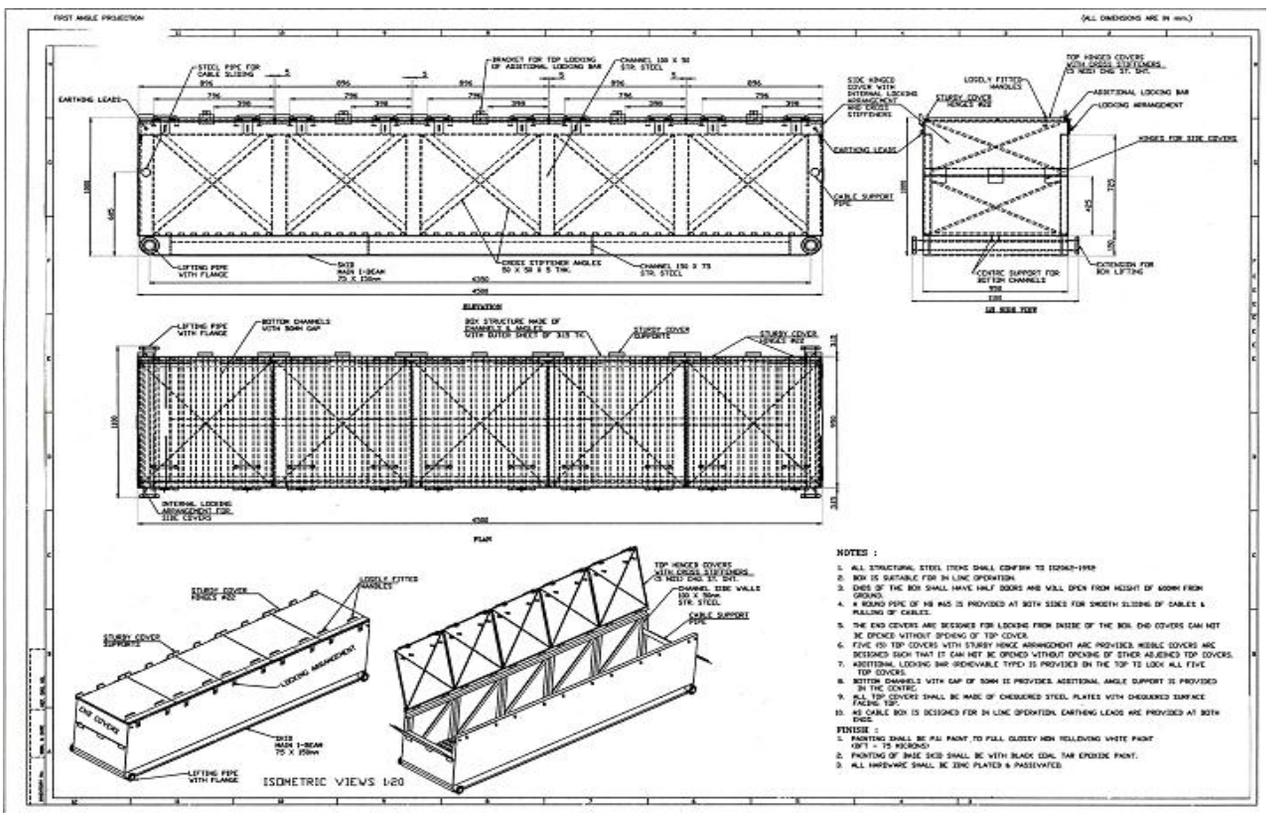
INDICATIVE DIAGRAM: “T”- POLE



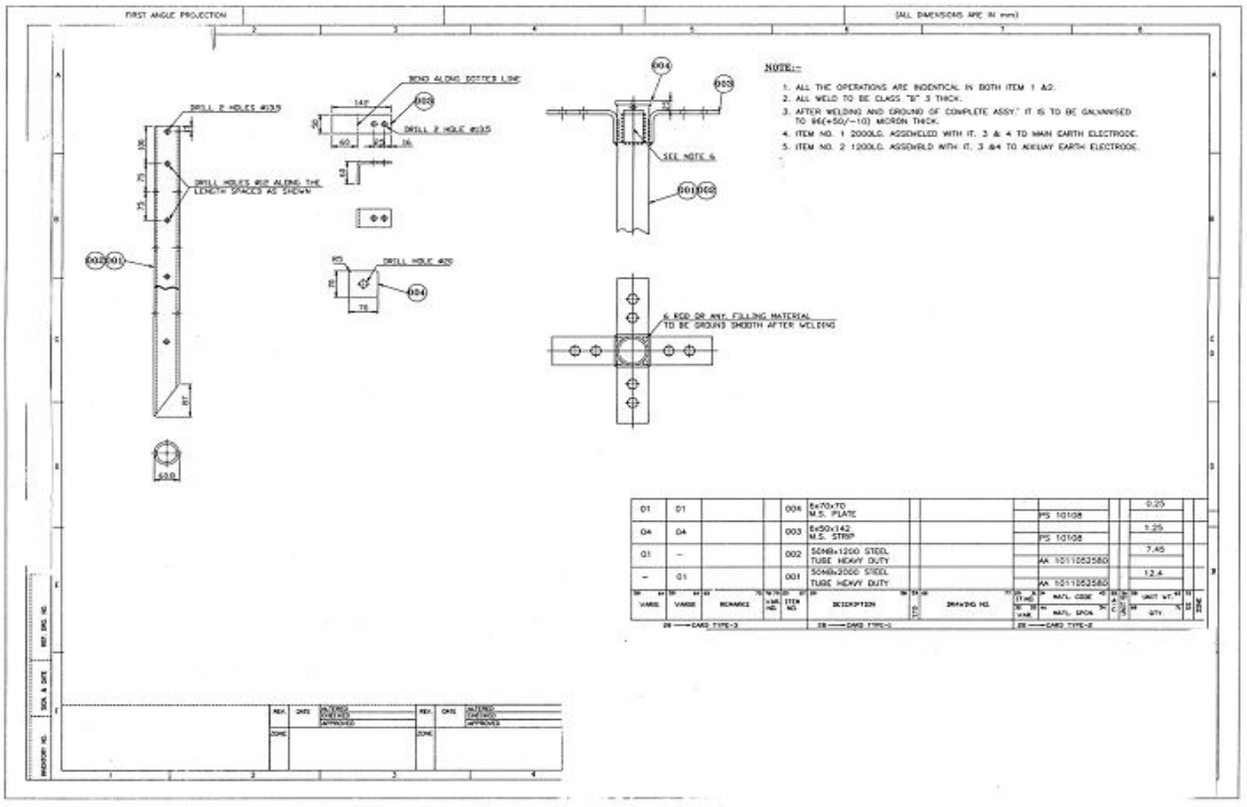
INDICATIVE DIAGRAM- CABLE TRAYS



INDICATIVE DIAGRAM- CABLE BOX



INDICATIVE DIAGRAM- EARTH ELECTRODE



V.H ELECTRICAL ANNEXURE- COMMISSIONING SCHEDULE OF ELECTRICAL EQUIPMENT

COMMISSIONING STAGES

Installation, wiring and laying out of equipment: On arrival of equipment and materials (commissioning spares etc.) at OIL's premises the supplier should carry out inspection of the supplied items to ascertain and certify that there is no transit damage and items are complete in all respect and ready for installation. In case of any discrepancy, supplier shall take necessary action for immediate replacement/ replenishment of the same before installation.
After receipt, the equipment shall be installed at site. This will include wiring/ cabling, fitting of plugs and sockets and any other activity required to make the equipment ready for commissioning.

Initial commissioning after start up connection: This activity will cover insulation checks, wiring checks, phasing up (powering up) of individual equipment and the system as a whole. After start up connection and powering up, the complete system shall be tested at no load and minimum/ low load at OIL's well site. Any modification/ re-wiring/ repair shall be carried out at this stage.

Final commissioning:
Any problems, abnormalities, anomalies and defects noticed/ logged during the completion of the well (operation at full/rated load) shall be rectified by the supplier. This will cover setting/ adjustment/ calibration of limits in the control system, drives etc.

Sl. No.	**Equipment**	**Commissioning schedule**		
		Installation, wiring and laying out of equipment	Initial commissioning after start up connection	Final commissioning
1	MAIN PCR	Pre-wired	√	√
2	ACPCR	Pre-wired	√	√
3	Cables (termination with proper lugs/ sockets)	√		
4	Main drives (drilling motors): Connection, preliminary checks and power up	√	√	√
5	Auxiliary drives (AC motors): Connection, preliminary checks and power up	√	√	√
6	Rig lighting system: Connection, preliminary checks and power up	√	√	√
7	Rig earthing system: Connection, measurement of earth resistance	√		

- ***Supplier's commissioning engineer and personnel shall be available at all the three stage of commissioning as explained above during the complete period.***
- ***Any equipment that fails during commissioning at any stage shall be REPLACED at suppliers cost. Supplier shall ensure adequate commissioning spares/ consumables are dispatched.***

SECTION 19: MISCELLANEOUS ITEMS / EQUIPMENT

CELLAR PUMP:

A. One (1) Gorman Rupp make diaphragm pump of model 4DB or similar pump having same capacity driven by explosion proof electric motor with matching frequency complete with all suction and delivery lines mounted on a 1 feet high suitable oil field type skid, for cellar cleaning purpose. Pump should be suitable for class I, dir. 2 areas and gas group I, IIA & IIB and with Flexible coupling. [Alternately, a suitable cellar ejection system may be offered]

B. One (1) Vertical Type Vortex Pump (Make: Flygt)
Model: H 8044 (complete package with control & monitoring data)

TOOLS & WRENCHES SET:

One (1) set of tools & wrenches with tool boxes for every accessories / system viz. draw-works, mud pumps, engines & compressor unit, mud tanks, electrical system, top drive, mast & substructure, etc.

RIG WASHER

2 (Two) nos. of suitable electrically operated (single phase 220 V 50 Hz ac power) high pressure portable cleaning pump complete with suitable electric motor, 20 ft long cable & necessary fittings. The pump should have 1" suction port & 40 ft. long delivery hose with nozzle for cleaning the draw-works & mast with water jet.

BUG BLOWER

2 (Two) nos. of suitable exploration-proof electric motor driven bug blowers complete with guard & 48" (1219 mm) impeller.

SOURCE WATER PUMP:

01(one) no. of Diesel Engine Driven Reciprocating type Duplex Double acting pump having different sizes of liners with a maximum flow rate of **60** cubic mtr per hour and a maximum head of **35** mtr. The power transmission shall be through belt & pulley drive and suitable power take-off (Clutch) arrangement.

SUBMERSIBLE PUMP:

02(Two) nos. of Electric Motor driven submersible pumps with 2" delivery outlet having a maximum flow rate of 10 cubic mtr per hour and maximum head of 30 mtr.

RATHOLE ASSEMBLY:

One (1) Rathole assembly with digger unit or suitable mechanical device for drilling rat hole and mouse hole complete with suitable size scabbards.

MOUSEHOLE SCABBARD ASSEMBLY:

One (1) Mousehole Scabbard Assembly

TOOLS & WRENCHES SET:

One (1) set of tools & wrenches with tool box for following (List of tools & quantities should be furnished in bid document):

1. Draw-Works
2. Mast & Sub-Structure
3. Mud Pumps

CASING LINE CUTTER

1 (One) no. of manually operated wire line cutter suitable for cutting 1.1/8" & smaller size wire line (casing line).

SOUND LEVEL METER & CALIBRATOR

2 (Two) nos. of portable battery operated Sound Level Meter with Liquid Crystal Display (LCD) providing readings in 0.1 dB increments with 40-130 dBA measurement range. The sound level meter should have low battery indicator, RFI-shielded construction, all required accessories, certified to be intrinsically safe & complete with storage case.

1(One) no. of sound meter Calibrator to verify accuracy of sound meter.

SECTION 20: INSTRUCTIONS / NOTES

TRANSPORT DIMENSIONS LIMITATION & DESIGN:

1.0 All major items of the rig package viz. Power Control Room (PCR), Power-pack, Tanks, Pumps, Gen-sets, etc. shall be mounted on heavy duty self-loading skid used in oilfields.

2.0 OVERALL DIMENSION OF INDIVIDUAL ITEM HAVING SKID should not preferably exceed (including skid) 9.0 meter × 2.50 meter × 2.5 meter (L x W x H). However, for PCR, Power-pack, Mud pump & Draw Works same (including skid) may be up to 12.0 meter X 3.0 meter X 3.0 meter (L x W x H).

2.1 OVERALL DIMENSION OF INDIVIDUAL ITEM WITHOUT SKID like, mast part, etc. should not preferably exceed 10.0 meter x 2.5 meter x 2.75 meter (L x W x H). However, for major derrick parts and other critical items, same may be up to 10.0 meter X 3.0 meter X 2.75 meter (L x W x H). In all cases the items shall be so designed that they can be evenly placed on trailers with proper load distribution as well as within the above specified dimensions of 2.5 meter width & 2.75 meter height for ease of transportation (3.0 meter width for major mast parts and other critical items as above). Dimensions of the sub base should not exceed 12meter X 3meter X 2.5meter (L X B X H).

3.0 The overall weight of single individual item (with or without skid) including all accessories mounted on it and the skid as applicable should be as minimum as possible and should not preferably exceed 18.0 MT. However, weight of major items like PCR, Power -pack, Mud Pump, Draw works, Sub base etc. can be up to 28.0 MT.

4.0 Each longitudinal channel of a skid shall be of single length and shall have smooth finish underneath and curve finish at both the end, so that the skid can roll over smoothly on surfaces/truck body without any obstruction.

4.1 For skids of width 2.5 meter & above, there should be at least 4(four) longitudinal channels with two mid channels kept sufficiently apart so that the unit can be placed evenly on narrow trailers (general width of trailers 2.4 to 2.6 meters only) with proper load distribution & balancing. This is essential as because for a skid of width 2.5 meter & above, the extreme two side channels shall rest only partially on a narrow trailer platform.

5.0 The skid so designed should be sufficiently strong and properly welded at joints and should be able to withstand shocks which are bound to come while being handled and transported over rough and slushy roads/locations. Height of the joint used for the longitudinal members should be minimum 20 cm.

6.0 As far as possible, the length of the skid should be at least 1.00 meter longer than the overall length of the equipment mounted on it, and same equally distributed on either ends. On no account should a skid be less than 3.00 meter in length irrespective of the length of the equipment mounted on it. CG (Center of Gravity) of the equipment with the skid should be at centre of the complete unit to the extent possible.

7.0 The roof and side walls of equipment, tools hut, bunkhouse, etc, as applicable, should be rounded off at the corners for safe & ease of loading, offloading & transportation.

8.0 Suitable lifting lugs should be provided for each individual item. For items with skid, 4(four) lugs at each corner of the skid should be provided.

PAINTING INSTRUCTIONS:

At least 3 coats after applying primer. Under Coating with Anti Corrosive Treatment for cement & rust and polyurethane paint. The preferred color shade should be as under.

MAST (Bottom Section)	-	WHITE
MAST (Top 20 ft. Section)	-	RED
CROWN	-	RED
RACKING BOARD	-	WHITE

ALL HAND RAILS	-	YELLOW
MUD PUMPS	-	BLUE
MUD PUMP SKID	-	GREY
TRAVELLING BLOCK	-	YELLOW
DRAW-WORKS	-	BLUE
AIR TANK / UTILITY HUT	-	WHITE
MUD & WATER TANK	-	GREY
VFD CONTROL ROOM	-	WHITE
HSD TANK	-	SILVER

All operating and warning labels on equipment should be in English

TEST CERTIFICATE

The complete sets have to be functional tested at manufacturers work & test certificate have to be provided along with the delivery of material.

Supplier must categorically confirm regarding compliance with the inspection / test procedure and other terms and conditions detailed above are very essential. Offers will be liable for rejection in the absence of such confirmation.

Deviation in respect of any specification as detailed above should be highlighted with technical calculation / catalogue/literature etc.

SPARE PARTS:

Spares for two years normal operation of all equipment / system should be included in the offer indicating item, part no. & quantity required. Item wise price of such spares should also be provided in commercial bid. Bidder should indicate the part nos. against each item along with OEM's part no. if any. The cost of spares will not be considered for price comparison. Purchase of these spares will be optional. The price of such spares should not change for next 2 years from the date of quotation. Bidders must confirm the same along with the availability of spares for next 10 years.

PARTS CATALOGUE, OPERATION / INSTRUCTION MANUAL & DRAWING, TECHNICAL INFORMATION & BULLETIN:

The bidder should provide at least one set of parts list, operations manual & service manual covering all the items & its accessories including any special / alignment tools for the same along with the technical offer. Technical details of the engine, draw-works, mast & sub-structure, top drive, rig controls, mud system, electrical system with dimensional drawing (including circuit diagrams) must also be forwarded along with the technical offer.

The supplier should provide the following information wherever applicable along with the technical offer –

a) Dynamic load
b) Static load
c) Unbalance load
d) Location of centre of gravity.

The catalogue should include

- Weight of each & every major component such as draw-works, mast, engine, sub-structure, etc.

- All principal dimensions, including those required for foundation / skid mounting & maintenance clearance.
- All horizontal & vertical clearance required for assembling & dismantling.

Installation, operation & maintenance manual should cover the following:

- Start up, normal shut down, emergency shut down, operating limits & operational procedures.
- Rig-up & rig-down sequence.
- Layout drawing of all components on the unit with details of load distribution

Foundation & site layout drawings with load bearing capacity / distribution for various components of the rig package covering the following:

- Assumed parameters of design of CC / RCC foundations shall be furnished.
- The Safe Bearing Capacity (CBC) of soil may be assumed as 8 Tonne/sq.mtr. (1486 lbs/sq.ft.) for design of the CC / RCC foundations.
- All design for foundation shall confirm to BIS - 456:2000.
- For Machine Foundation the code to be followed are IS – 2974 & IS – 13301 respectively.

MANUALS & CATALOGUES

Supply of 6(six) sets of Catalogue indicating exploded view of each & every Spare Parts with part nos. & quantity, Workshop & Service Manual, etc. for all major components/systems like Engines, Draw-works, Mast & Sub-structure, Top Drives, hoisting & rotating equipments, mud system & solid control equipments, electrical system, etc. including it's sub-assemblies complete with all schematics along with the unit.

In addition, supply of 2 (Two) sets catalogue/manual in compact disc.

All manuals & catalogues should be in English.

DOCUMENTATION AND BID SUBMISSION

Bidder's response should clearly be defined – specific details/specifications are to be provided in the bid. Response like - 'As per NIT Specifications/ Technical Leaflet', 'Noted', 'Accepted' or in any similar fashion is not encouraged.

The following documents shall be submitted along with the bid for bid evaluation -

Technical leaflets with detailed dimensional diagram and specifications, Make & Model of each & every accessories / system, etc.

Copies of valid API Spec 4F, 7-1, 7K, 8C & 9A respectively of other concerned manufacturer(s) also in case any of the accessories / component will be outsourced by bidder.

GUARANTEE / WARRANTY

The complete package / unit shall be under guarantee / warranty by the supplier (or the successful bidder) for a minimum period of 1 (one) year from the date of successful commissioning of the complete unit at site.

OIL reserves the right to inspect, test & if necessary reject any parts / parts after delivery at site (including incomplete manuals, catalogues, etc.) in case of any fault on the part of the supplier. It shall in no way be waived by the reason that the unit / item was previously inspected & passed by OIL as per Inspection Clause detailed elsewhere in the NIT.

To keep the unit fully operational, in case of failure of any item during the warranty period, it is the supplier's responsibility to arrange replacement / repairing at site at their own cost including custom duty, freight, etc. within a period of maximum 3 (three) weeks from the date of notification of such failure.

Note: OIL at its discretion may engage one of the TPI agencies as mentioned below to carry out inspection during manufacturing process and Factory Acceptance Testing (FAT) at manufacturer's

plant as per procedure and scope of work followed Internationally by reputed TPI. Bidders are required to confirm categorically their acceptance towards such TPI and confirm to extend all required facilities for TPI at respective plants during various steps of rig manufacturing with no extra charge to OIL. However the cost of TPI will be borne by OIL.

1. Moduspec, Singapore
2. Aberdeen Drilling Consultant, UK
3. Oil Field Audit & Service Inc. USA
4. EMI-TUV, Budapest

(Broad Scope of inspection, in case of inspection by third party inspection agency has been furnished vide Annexure – 5)

PRE-DESPATCH INSPECTION

Complete package of drilling rig (with all accessories) after assembling & testing should be offered for inspection & functional testing at manufacturer's yard by OIL's team (comprising of engineers from Drilling, Chemical, Technical Services, Field Engineering, Instrumentation, Transport & Electrical) prior to dispatch with at least one month notice. Bidder should indicate their acceptance in the technical bid.

The Inspection cum Acceptance process would include but not limited to the following minimum steps/tasks -

1. Physical verification/inspection of all the items/fittings/accessories including all Parts Catalogue, Maintenance & Service Manuals, Schematics, all tools under complete tool kit as well as other tools, all spares as per the Spare Parts List, etc.
2. Operational / functional testing of the Power Packs, Draw-works, Top Drive, Electric & Lighting system, Mud Pumps, Air Compressors, Rig-up & Rig-down sequence, etc.
3. Supplier shall have to take note of any minor modification(s) for operational requirement suggested by the inspection team and comply with the same at no extra cost.
4. The minutes of inspection process would be prepared at the end of the inspection and jointly signed by both the parties.
5. Supplier shall confirm in writing compliance of all the points raised in the minutes of inspection as well as any other subsequent additions/changes, following deliberation with the inspector after arrival at Duliajan.
6. Supplier will affect dispatch of the unit only on receipt of OIL's dispatch advice.
7. Any other testing / joint inspection indicated elsewhere in this tender.

DELIVERY OF THE UNIT

IN CASE OF FOREIGN SUPPLIER

The shipment of the unit to **KOLKATA** port, India.
Transportation from KOLKATA to OIL, Duliajan by road.

IN CASE OF INDIGENOUS SUPPLIER

Safe transportation of the unit from manufacturing plant to OIL, Duliajan will be under the full responsibility of the supplier.

TRAINING

The supplier should arrange for comprehensive training programme **immediately after the pre-dispatch inspection** for 2 (two) Mechanical Engineers (one each from Technical Services and Field Engineering departments), 1 (one) Instrumentation Engineer, 1 (one) Electrical Engineer, 1 (one) Transport Engineer & 4 (four) Drilling Engineer of OIL at their manufacturing plant / works for a period not more than 2 (two) weeks on Operation (including simulator training), Maintenance, Troubleshooting & Working Principle of following system / items in the unit amongst other relevant subjects **[Bidder should indicate the training module with duration. Traveling expenses (i.e.**

from Duliajan, India & back), boarding, lodging & fooding expenses during training) will be on OIL's account].

For Mechanical Engineer (Technical Services & Field Engineering):
Power Packs & Generating Set Engine systems including their adjustments
Mud Pump & accessories
Draw-works, Rotary Table, Rotary Swivel & other Major Rig Equipment
Air system

For Instrumentation Engineer:
Draw-works control & Electronic digital monitoring system.
Rig sense or equivalent system for Mud Parameters.
Sensor Calibration & maintenance.
Report generation, printing & documentation.
Instrumentation for auxiliary equipment.
Training on software for programming & trouble shooting of drilling instrumentation system.

For Electrical Engineer:
Generating sets
Power Control
Power distribution
VFD Control training

For Drilling Engineer
Various controls & operation (including simulator training)
Draw-works
Hydraulic system
Top Drive & controls

For Transport Engineer
Rig assembling & dismantling

MAKE OF RIG ACCESSORIES

Make of rig accessories for supply with rig package should be as per the undernoted options only:

Sl. No.	Equipment Detail	Make / Name of Vendor	API Specification
1.	Crown Block Assembly	No Option	4F
2.	Mast & Sub-Structure	No Option	4F
3.	Top Drive System (Portable)	1. Aker Maritime 2. Can Rig 3. National Oilwell Varco 4. Tesco	-
4.	Disc Brake (Auxiliary Draw-works brake)	1. Eaton Corporation 2. National Oilwell Varco 3. Wichita, UK	-
5.	Rotary Table	1. American Block Company 2. Bharat Heavy Electricals Ltd 3. Drillmec S.p.A. 4. Hackers Industries 5. National Oilwell Varco 6. Varco BJ	7K
6.	Traveling Block & Hook	1. American Block Company 2. Bharat Heavy Electricals Ltd 3. Drillmec S.p.A. 4. National Oilwell Varco	8C

		Or Equivalent ***For equivalent make, other than the listed, the bearings should be Torrington or SKF or FAG only.***	
7.	Elevator Links	1. Blohm & Voss GmbH 2. National Oilwell Varco 3. Varco BJ	8C
8.	Dead Line Anchor	1. Dreco Energy Services 2. National Oilwell Varco	8C
9.	Casing / Drilling Line	1. Bridon American Corp. 2. Usha Martin Limited. 3. Wire Rope Corporation of America Inc.	9A
10.	Rotary Hose	1. Dunlop Argentina 2. Phoenix Beattle 3. Gates Corpn., USA	7K
11.	Solid Control Equipments (Shale Shakers, Desander, Mud Cleaner cum Desilter, Degasser & Centrifuge)	1. Derrick Equipment Co. 2. National Oilwell Varco 3. Swaco Norge AS / MI Swaco	-
12.	Drilling Instruments & Gauges	1. Can Global 2. Martin Decker 3. Oteco 4. Wagner	-
13.	Pneumatic Winches	1. Ingersoll Rand International 2. Braden, USA 3. JDN Nehaus Ltd., UK 4. Red Rooster, UK	-
14.	Rotary Swivel	1. American Block Company 2. Bharat Heavy Electricals Ltd 3. National Oilwell Varco 4. Soilmec Or Equivalent ***For equivalent make, other than the listed, the bearings should be Torrington or SKF or FAG only.***	8C
15.	Kelly	1. NOV Grant Prideco 2. VAM Drilling 3. Smith Services 4. Weatherford U.S. 5. Diado Steel Co. Ltd. 6. Hacker Industries	7-1
16.	Kelly Bushing	1. National Oilwell Varco 2. FORUM 3. Den-Con Tools Co. 4. Cam-Tech Products 5. Drillmec SPA	7K
17.	Master Bushing	1. Blohm & Voss Repairs GmbH 2. National Oilwell Varco 3. Hacker International	7K

		4. Den-Con Tools Co. 5. Cam-Tech Products 6. Drillmec SPA 7. FORUM	
18.	Drill Pipe Spinner	1. Blohm & Voss Repairs GmbH 2. National Oilwell Varco	-
19.	Kelly Spinner	1. National Oilwell Varco 2. Weatherford	-
20.	Alternator	1. Kato 2. Caterpillar 3. Baylor	-
21.	AC drilling motor	1. GE 2. Baylor 3. BHEL	-
22.	VFD panels (including converters)	1. ABB 2. Siemens	-
23.	Soft starters	1. ABB 2. Siemens	-
24.	MCC panel components	1. GE 2. Siemens 3. ABB 4. Allen-Bradley 5. Group Schneider	-
25.	Air Circuit Breaker	1. Merlin Gerin (Group Schneider) 2. ABB 3. GE 4. Siemens	-
26.	MCCB	1. Merlin Gerin (Group Schneider) 2. Siemens	-
27.	Plug Sockets	1. Amphenol (Pyle National) 2. Connectwell 3. Cutler Hammer	-
28.	Power Pack Engine	1. Caterpillar	-
29.	Mud Pump	1. National Oilwell Varco	-
30.	Centrifugal Pumps	1. Tengl-Mission 2. Harrisburg	-
31.	Air Compressor	1. Sulair 2. Ingersoll Rand	-
32.	HP Valves & fittings	1. Oteco 2. Audco	-
33.	Hoses	1. Gates 2. Dunlop, Arentina Or equivalent	-

(Note: The equipment confirming to API specifications must have the API monogram die stamped on the body)

GENERAL NOTES (In addition to notes mentioned elsewhere in this tender.)

(a) All the offered items of Rig package shall be brand new, unused, of recent manufacture, and free from any manufacturing defect. This shall be categorically stated by the bidders in their quotations.

(b) 1. Any deviation(s) from the tender specification should be clearly highlighted specifying justification in support of deviation.
2. The word 'equivalent' appearing after any indicated make of an item / equipment / accessories implies that any other make of such item / equipment / accessories is also acceptable provided the specification as indicated in tender is met in toto.

(c) Offers shall be complete in all respects and all the items/equipment as specified in the tender must be included in the package. Offers deemed to be incomplete shall be liable for outright rejection. (Bidders may quote additional items / equipment or accessories, other than **Handling Equipment** & **Well Control Equipment,** not covered in this enquiry, if felt necessary for the completeness and efficient operation of the rig package).

(d) The Bidder shall categorically confirm that the compatibility of all equipment offered has been thoroughly scrutinized and verified for smooth and trouble-free operation of the entire package to avoid unwarranted hitches during commissioning.

(e) Quotations shall be accompanied by detailed technical specifications, manufacturer's printed specification sheets, literature, drawings, layout drawings & catalogues as indicated.

(f) Bidder must specify the weight of major components indicating the major dimensions.

(g) Bidders should specifically note the document submission schedule indicated elsewhere (i.e. in sections) including special documents requiring statutory clearances.

(h) All equipment to be supplied with the Rig Package shall be in full conformance to and monogrammed per the respective API Specification as mentioned in the tender viz. API Spec 4F, API Spec 5L, API Spec 7-1, API Spec 7-2, API Spec 7F, API Spec 7K, API Spec 8C, API Spec 9A, API RP 500 & API RP 13E, etc.

(i) Bidders shall confirm categorically that Installation & Commissioning of the Rig Package with all accessories would be carried out by their competent personnel at OIL's designated drill site, in Duliajan, ASSAM, INDIA. However, the basic facilities required for installation & commissioning such as to & fro transportation to site from Duliajan, Crane service, electric power, water supply, pressurized air and welding & cutting set shall be provided by OIL. Rig-up at designated site will be the responsibility of OIL but, supplier should provide the supervisory assistance by deputing their competent personnel including API certified welder (if required).

Bidders should specifically note that commissioning for rig electricals will be in two stages.

For details refer Section - 18, Chapter V (H) of this document.

Commissioning shall be completed within 8 (eight) weeks per rig after receipt of all the items at Duliajan.

(j) Bidders, quoting for any bought out item(s) should undertake & comply with Guarantee / Warranty clause indicated elsewhere in this tender.

(k) Bidder should confirm in their technical bid that they will agree for keeping their technical personnel at OIL's Headquarter Duliajan, Assam for trouble shooting & providing timely warranty/guarantee repair/replacement/maintenance services on regular basis during the normal warranty / guarantee (as stated elsewhere in this tender) for a period of 1 year (12 months) from successful commissioning of each rig package at site.

(l) Bidder should also confirm in their technical bid that they will agree for an Annual Maintenance Contract (AMC) with OIL for keeping their technical personnel at OIL's Headquarter Duliajan, Assam for carrying out the job as indicated against scope of work on regular basis after the successful commissioning of the rig. The charges for such AMC should

be indicated in the commercial bid. The bidder should indicate the year-wise break-up AMC charges for three years. This will be considered in evaluation of the tenders.

The scope of work for AMC in broad sense shall be as follows:

- Supervisory services for maintenance, trouble shooting & providing support services in keeping the complete rig packages in good health.
- The person(s) shall be fully conversant with the relevant system of the rig. The person(s) should be physically fit for working in the well-site. The person(s) shall also be able to work with his own hands & should be able to communicate in English.
- For further details on electrical part the scope of AMC may also be referred as indicated in section: 18 (Chapter IV) under the heading “Maintenance” on page 93.
- The service provider should have to arrange for the services required for their bought out items installed in the rig package.
- Supervisory services will be required for rig-up, rig-down & inter-location movement in proper way for top drive system and rig sense or equivalent system.
- The spares required for maintenance will either be provided by OIL or will be procured (if required urgently) from the service provider.
- The scope of AMC for instrumentation items should include the complete instrumentation and control system supplied as per the Section – 12 of this specification.
- List of all spares required for maintenance of instrumentation and control system along with price shall be provided by the service provider and the same shall be made available as and when required.
- The man power & tools including OIL’s own workshop facility required for carrying out the maintenance & trouble shooting will be made available by OIL.
- No accommodation, fooding, boarding & lodging will be provided by OIL. However an unfurnished office space limited to one room & local transportation will be made available by OIL.
- The personnel(s) of service provider during the AMC period should be available at Duliajan, Assam.
- The personnel(s) of service provider should preferably be Indian citizens fully trained by service provider for the AMC.

Annexure – A2

SPECIFICATIONS OF 2000 HP VFD CONVENTIONAL DRILLING RIG with provision for TOP DRIVE (ITEM NO. 20)

SECTION 1: DRAW-WORKS

Same as specified against item no. 10
(i.e. SPECIFICATIONS OF 2000 HP VFD DRILLING RIG with TOP DRIVE)

SECTION 2: MAST & SUBSTRUCTURE

Same as specified against item no. 10
(i.e. SPECIFICATIONS OF 2000 HP VFD DRILLING RIG with TOP DRIVE)

SECTION 3: DEADLINE ANCHOR

Same as specified against item no. 10
(i.e. SPECIFICATIONS OF 2000 HP VFD DRILLING RIG with TOP DRIVE)

SECTION 4: HYDRAULIC CATHEADS

Same as specified against item no. 10
(i.e. SPECIFICATIONS OF 2000 HP VFD DRILLING RIG with TOP DRIVE)

SECTION 5: ROTATING & HOISTING EQUIPMENTS

Same as specified against item no. 10
(i.e. SPECIFICATIONS OF 2000 HP VFD DRILLING RIG with TOP DRIVE)

SECTION 6: OTHER HOISTING & MISCLLANEOUS EQUIPMENTS

ROTARY SWIVEL:

One (1) Rotary swivel, manufactured & monogrammed per API Spec 8C, having static load rating of minimum 500 Short Tons (454 Tonnes or 1,000,000 lbs.), maximum speed 300 RPM, maximum working pressure 5000 psi (35 MPa), ID of mud passage 3" & complete with bail bumper support, goose neck connection to Rotary hose (4" fig 1002 or fig 1003 female), etc. manufactured & monogrammed per API Spec 8C.
Swivel pin connection: 6.5/8" API Reg. left hand.

Accessories for the above Rotary swivel: Swivel wash pipe assembly, complete - 3 sets

ELEVATOR LINKS:

One (1) pair of weldless elevator links, single piece high grade alloy steel. Link size 3.1/2" x 120" (89 mm x 3048.0 mm) long with Rated Capacity 500 Short Ton (454 MT) manufactured & monogrammed per API Spec 8C. The links should be compatible to traveling block & hook.

One (1) pair of weldless elevator links, single piece high grade alloy steel. Link size 2.3/8" x 120" (70 mm x 3048 mm) long with Rated Capacity 350 Short Ton (317 MT) manufactured & monogrammed per API Spec 8C. The links should be compatible to traveling block & hook.

DRILLING HOOK:

One (1) Varco BJ Model 5500 Dynaplex Hook or equivalent manufactured & monogrammed as per API Spec 8C, with positioner lock assembly and swivel lock assembly, rated for 500 TONS to match the above 500 TON Traveling Block & complete with the following features.

a) Built in hydraulic snubber which is a unique shock absorber that would eliminate usual bouncing action of the drilling string.
b) Hook positioner which should automatically rotate the elevator into the correct position for the derrickman to catch the next stand of pipe and also prevents the hook & elevator from being rotated by the spin up of drill string going in the hole.
c) Construction should be such to keep the hook load properly equalized & thereby prevents unequal loading on the ears of the elevator.
d) The hook may be locked in any one of eight different positions spaced at 45 deg.

KELLY:

1 (one) Hexagonal Kelly conforming to API Spec 7-1 & bearing the API monogram mark, manufactured from AISI 4145 H API modified alloy steel from specially straightened Kelly Bars, full length quenched and tempered, Brinell Hardness: 285-341, and with the following specification:

Nominal size	: 6" (152.4 mm)
Overall length	: 40 ft. (12.19 m)
Length of drive section	: 37 ft. (11.28 m)
Width across flats	: 6" (152.4 mm)
Width across corners	: 6.812" (173.02 mm)
Inside diameter	: 3.1/2" (88.90 mm)

Upper upset: 7.3/4" (196.85 mm) OD x 16" (406.4 mm) length with 6.5/8 API REG. Left hand box-up connection

Lower upset: 7" (177.80 mm) OD x 20" (508.0 mm) length with NC50 (4.1/2 API IF) right hand pin down connection.

The connection shall be with stress relief grooves and with copper plated or cold rolled phosphatised threads, complete with pressed steel protectors on both ends.

The Kelly shall bear the API monogram mark and should be supplied in 8.5/8" (219.075 mm) OD steel shipping scabbard and secured properly.

KELLY BUSHING:

1 (one) Pin drive Roller Kelly Bushing conforming to API Spec 7K & suitable for 6" (152.4 mm) hexagonal Kelly, complete with roller wrenches and wiper assy. The Kelly bushing should be compatible with 37.1/2" (952.5 mm) rotary table's master bushing.

Accessories for the above Kelly bushing : Roller assembly complete - 2 sets

DRILL PIPE SPINNER:

One (1) Drill Pipe Spinner, pneumatically operated, roller type with right hand & left hand rotation. The tool should be fitted with roller assembly for handling 5" (127 mm) OD Drill Pipe & complete with air filter-regulator-lubricator, muffler, hanger assembly & 1.1/4" (31.75 mm) OD x 20 ft. (6 mtrs.) long air hose with Quick disconnects.

Specifications for Drill Pipe Spinner:

Size Range (pipe)	: Should cover from 3.5” to 5.5” (89 mm to 140 mm)
Speed (with 5” drill pipe)	: Around 100 RPM
Stall Torque (with 5” drill pipe)	: Minimum 1000 ft. lbs. (1350 N-m)
Air Pressure : Minimum	: 90 psi (6.3 kg/sq.cm.)
Maximum	: 125 psi (8.8 kg/sq.cm.)
Air consumption	: around 240 cfm at 100 psi
Weight (with Hanger)	: Not more than 850 lbs (386 Kgs)
Height (with Hanger)	: Maximum 45” (1150 mm)
Length	: Maximum 55” (1397 mm)
Width	: Maximum 26” (660 mm)

Extra Accessories for Drill Pipe Spinner:

3 (three) set of Roller assembly for 5” (127 mm) OD drill pipe (2 nos./set)
1 (one) no. of 1.1/4” (31.8 mm) x 20’ (6 mtrs.) long air hose with quick disconnects.

KELLY SPINNER:

1 (one) Kelly Spinner, pneumatically operated with both right hand & left hand rotation. The Kelly Spinner should have 6.5/8” (168.3 mm) API Regular L.H. box-up & pin-down connection. Kelly Spinner should be complete with lift type thread protectors at top & regular thread protector at bottom, control valve, air filter-lubricator and 77 ft. (23.47 mtrs.) long air hoses with all required fittings.

Other Specifications:

Sub – Dimensions	: 8” (203.2 mm) OD, 3” (76.2 mm) ID
Speed	: Around 100 RPM
Maximum Stall Torque	: 1200 ft. lbs. (1622 N-m)
Air Pressure : Minimum	: 90 psi (6.3 kg/sq.cm.)
Maximum	: 125 psi (8.8 kg/sq.cm.)
Air consumption	: around 320 cfm at 100 psi
Weight	: Not more than 1200 lbs (545 Kgs)
Height	: Maximum 40” (1016 mm)

TOP DRIVE ACCESSORIES & CONTROLS:

All accessories & controls for the Top Drive System as specified against item no. 10 (i.e. specifications of 2000 HP VFD drilling rig with top drive) which are dedicated & fixed to rig should be installed. This excludes the top drive unit & other related portable accessories which can easily be shifted from one rig to other. Bidder should provide the list of all such portable accessories which will be common to both the rigs.
(Note: The Top Drive Unit will be commonly used in both of these rigs covered under item no. 10 & 20).

SECTION 7: HYDRAULIC POWER UNIT & CONTROLS

Same as specified against item no. 10
(i.e. SPECIFICATIONS OF 2000 HP VFD DRILLING RIG with TOP DRIVE)

SECTION 8: MUD PUMPS

Same as specified against item no. 10
(i.e. SPECIFICATIONS OF 2000 HP VFD DRILLING RIG with TOP DRIVE)

SECTION 9: HIGH PRESSURE MUD PIPING

Same as specified against item no. 10
(i.e. SPECIFICATIONS OF 2000 HP VFD DRILLING RIG with TOP DRIVE)

SECTION 10: MUD & WATER SYSTEM

Same as specified against item no. 10
(i.e. SPECIFICATIONS OF 2000 HP VFD DRILLING RIG with TOP DRIVE)

SECTION 11: HIGH PRESSURE TEST UNIT

Same as specified against item no. 10
(i.e. SPECIFICATIONS OF 2000 HP VFD DRILLING RIG with TOP DRIVE)

SECTION 12: RIG INSTRUMENTATION & CONTROL SYSTEM

Same as specified against item no. 10
(i.e. SPECIFICATIONS OF 2000 HP VFD DRILLING RIG with TOP DRIVE)

SECTION 13: RIG ENGINES

Same as specified against item no. 10
(i.e. SPECIFICATIONS OF 2000 HP VFD DRILLING RIG with TOP DRIVE)

SECTION 14: RIG AIR SYSTEM

Same as specified against item no. 10
(i.e. SPECIFICATIONS OF 2000 HP VFD DRILLING RIG with TOP DRIVE)

SECTION 15: RIG FUEL SYSTEM

Same as specified against item no. 10
(i.e. SPECIFICATIONS OF 2000 HP VFD DRILLING RIG with TOP DRIVE)

SECTION 16: RIG INTERCOM SYSTEM

Same as specified against item no. 10
(i.e. SPECIFICATIONS OF 2000 HP VFD DRILLING RIG with TOP DRIVE)

SECTION 17: MATHEY WIRELINE UNIT

Same as specified against item no. 10
(i.e. SPECIFICATIONS OF 2000 HP VFD DRILLING RIG with TOP DRIVE)

SECTION 18: RIG ELECTRICALS

Same as specified against item no. 10
(i.e. SPECIFICATIONS OF 2000 HP VFD DRILLING RIG with TOP DRIVE)

SECTION 19: MISCELLANEOUS ITEMS / EQUIPMENT

Same as specified against item no. 10
(i.e. SPECIFICATIONS OF 2000 HP VFD DRILLING RIG with TOP DRIVE)

SECTION 20: INSTRUCTIONS / NOTES

Same as specified against item no. 10
(i.e. SPECIFICATIONS OF 2000 HP VFD DRILLING RIG with TOP DRIVE)

ANNEXURE-B

BID REJECTION CRITERIA & BID EVALUATION CRITERIA

BID REJECTION CRITERIA (BRC):

The bids shall conform generally to the specifications and terms as well as conditions laid out in the tender. Bids will be rejected in case the items offered do not conform to the required parameters stipulated in the technical specifications and to the respective international/national standards wherever stipulated. Notwithstanding the general conformity of the bids to the stipulated specifications and terms and conditions, the following requirements will have to be met by the bids, without which, the same shall be considered as non-responsive and stand rejected.

(A) TECHNICAL:

1. Drilling Rig Package shall be suitable for operating in OIL's fields in Assam, India where temperatures ranges between a minimum of 6 degrees Celsius & a maximum of 41 degrees Celsius with Maximum relative humidity of 100 % at 21 deg Celsius, 95 % at 35 deg Celsius & 70 % at 41 deg Celsius; Avg annual rainfall: 343 cm. This shall be substantiated by the Manufacturer's printed specifications of the respective equipment.
2. The Input Horse Power Rating of the Draw-works of Drilling Rig shall not be less than 2000 HP and the draw-works must be AC variable frequency drive (VFD).
3. The Mast, Substructure and Crown Block Assemblies shall be manufactured & monogrammed per API Spec 4F, latest edition.
4. The Mast should be "swing lift" cantilever beam type with a minimum clear height of 142 feet and the sub-structure should have a minimum height of 25 feet from ground level.
5. The Substructure shall have a Minimum Clear Height under Rotary Beams of 21 feet.
6. The Minimum Static Hook Load Capacity of the Mast shall be 500 Short Ton (454 MT or 1,000,000 lbs) with a 12-line string-up.
7. Raising of Mast should be possible with 10 Lines.
8. The Maximum Wind Load Capacity of the Mast with full set back should be 100 miles/hr (160 Km/hr) without set back 115 miles/hr (185 Km/hr).
9. The Nominal Depth Rating of the Rig shall be a Minimum of 20,000 feet (6,096 metres) with 4.1/2" drill pipes of length range 30-31 ft (9.14-9.44 M).
10. The Substructure shall have a Minimum Static Rotary Capacity of 500 Short Ton (454 MT or 1,000,000 lbs) & a Simultaneous Pipe Setback Capacity of 300 Short Ton (272 MT or 600,000 lbs).
11. The Rig Package shall include two (2) Single Acting Triplex Mud Pumps each rated at 1600 Input Horse Power with a minimum discharge of 3000 LPM (792 GPM) at 210 kg/sq cm (2990 PSI). The maximum Discharge Pressure of the Pumps shall be 351 kg / sq cm (5000 PSI).
12. The Rig Package shall be complete with four (4) Power Packs each with one no. of Diesel engine having capacity not less than 1250 BHP at 1000 RPM coupled with alternator (as per Chapter I.A.2 of Section-18 of NIT).
13. The manufacturers shall have the experience of supplying at least 05 Nos. of 2000 HP or higher capacity Drilling Rig packages to reputed international drilling companies / service providers and submit a 'Track Record' of such supplies made during the last 5 years preceding the technical bid closing date.

Performance Certificates from end users towards at least three (3) rigs out of five mentioned above of same manufacturer to be provided by the bidder.

Manufacturer should certify to this effect and provide a list of Customers along with the following details together with documentary evidence:

(a) Customer's Name, Address & Contact Details.
(b) Supply Order No. & Date.
(c) Quantity Supplied.
(d) Invoice No. & Date.

Experience criteria as above shall not be applicable for manufacturers who has successfully supplied Drilling Rigs of same or Higher capacity to OIL in past.

14. Bids are invited from manufacturers of rig package or their duly authorized distributors/ dealers/ supply houses. The bidders, other than manufacturers, shall submit original certificate of authorization from the manufacturer for the offered rig package.

    However, the bidders quoting on behalf of the manufacturers must specifically submit undertaking in original from the rig manufacturer for offer & supply of rigs, warranty, back up guarantee, testing facilities, after sale services and uninterrupted supply of spares for at least 10 years.

    The authorized distributors / dealers/ supply houses should quote for the supply of rigs from the manufacturers who meet the experience & other criteria including BRC/BEC requirements mentioned in the bid document.

15. Manufacturer must be a valid licensee of API Spec. 4F for a period not less than 10 years continuously without any break preceding the bid (technical) opening date. Bids from bidders having API Spec 4F license (of Manufacturer) less than 10 years or having a break in between, preceding the bid opening date will not be considered (copies of API certificate for all the 10 years must be forwarded with technical bid).

16. Bidder must indicate regarding the services during guarantee / warranty & AMC (annual maintenance contract) in their technical bid (& quote for the same in commercial bid).

17. Bidder must indicate regarding the pre-dispatch inspection by OIL's team and training module in their technical bid.

18. Bidder must quote for both the rigs (i.e. one with Top Drive & other conventional having provisions to install the Top Drive whenever required)".

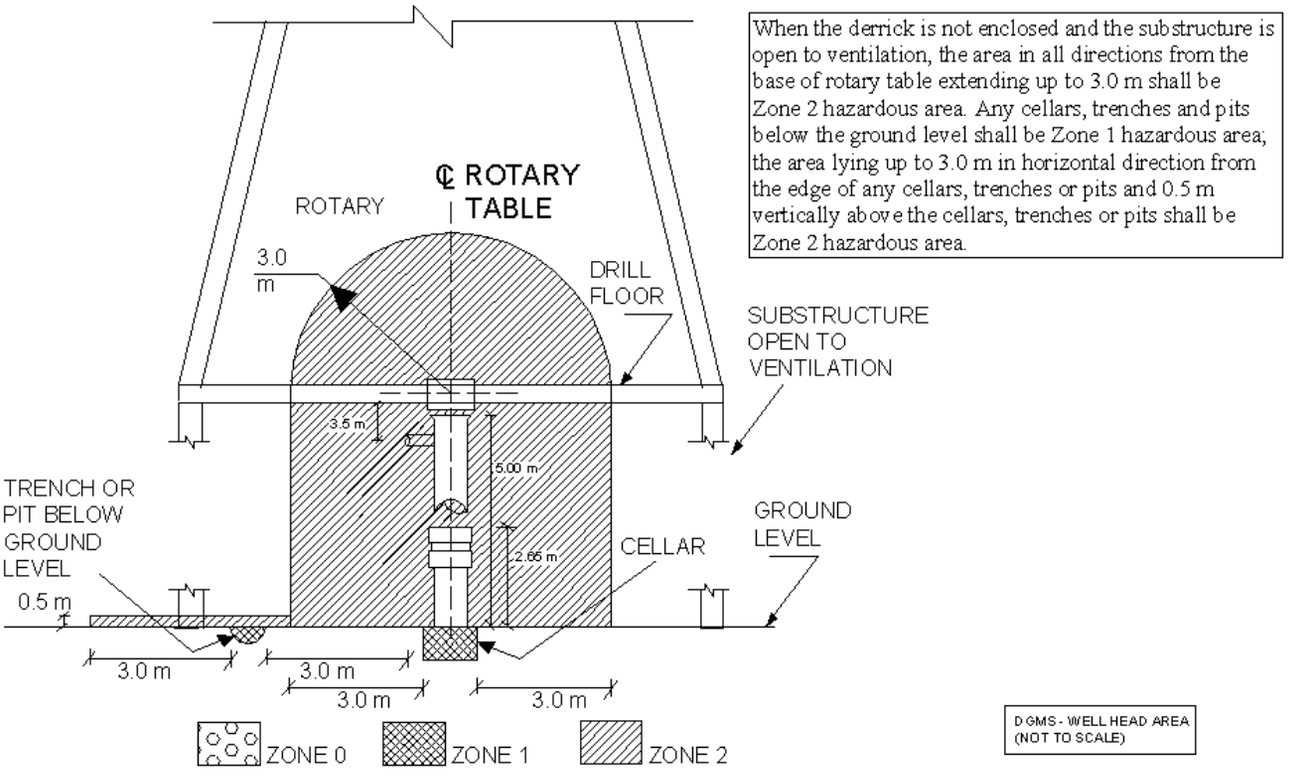
(II) <u>BID EVALUATION CRITERIA (BEC)</u> :

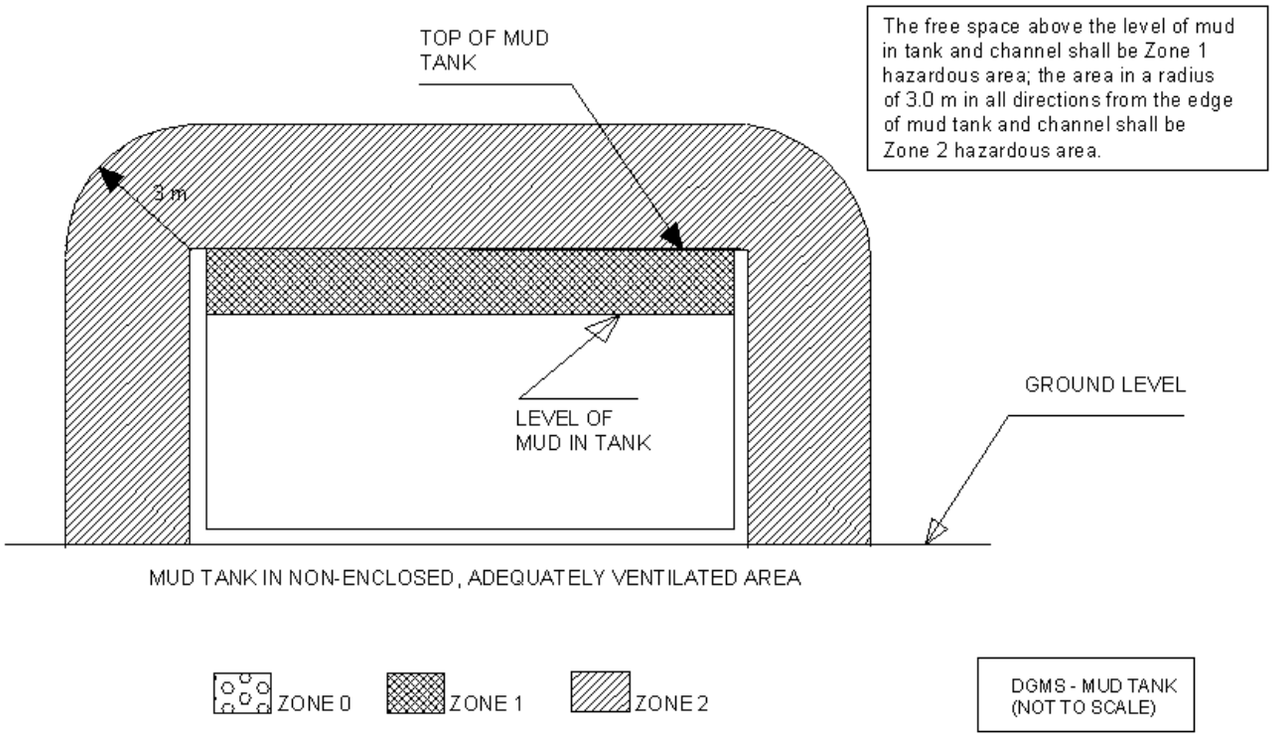
The bids conforming to the specifications, terms and conditions stipulated in the enquiry and considered to be responsive after subjecting to the Bid Rejection Criteria will be considered for further evaluation as per the Bid Evaluation Criteria given below:

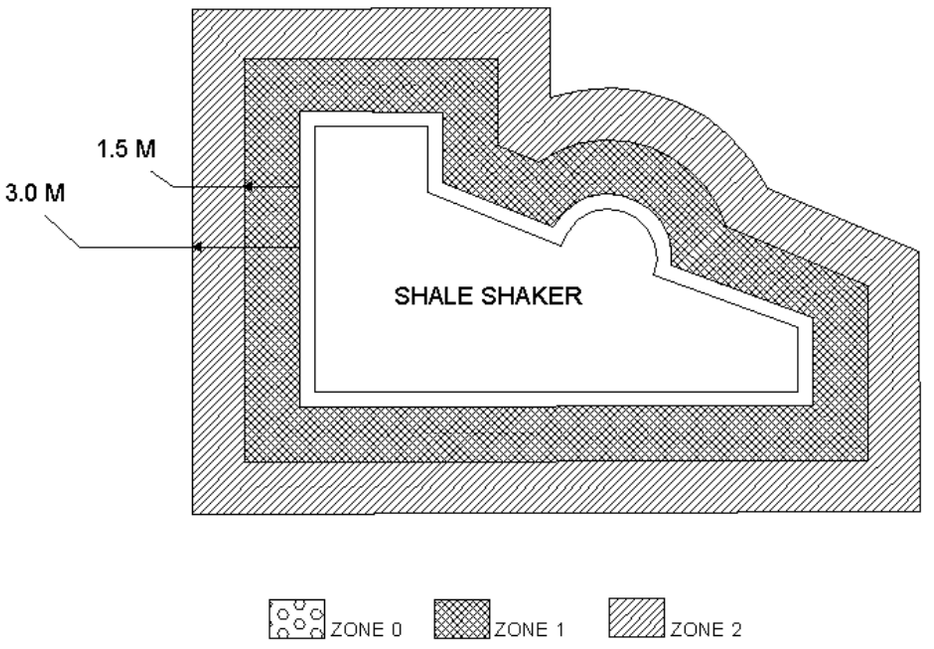
A. <u>TECHNICAL</u> :

1.0 Both the items (i.e. 2000 HP Drilling Rigs, one with Top Drive & other conventional) shall be procured from same source

HAZARDOUS AREA GUIDELINES MAP

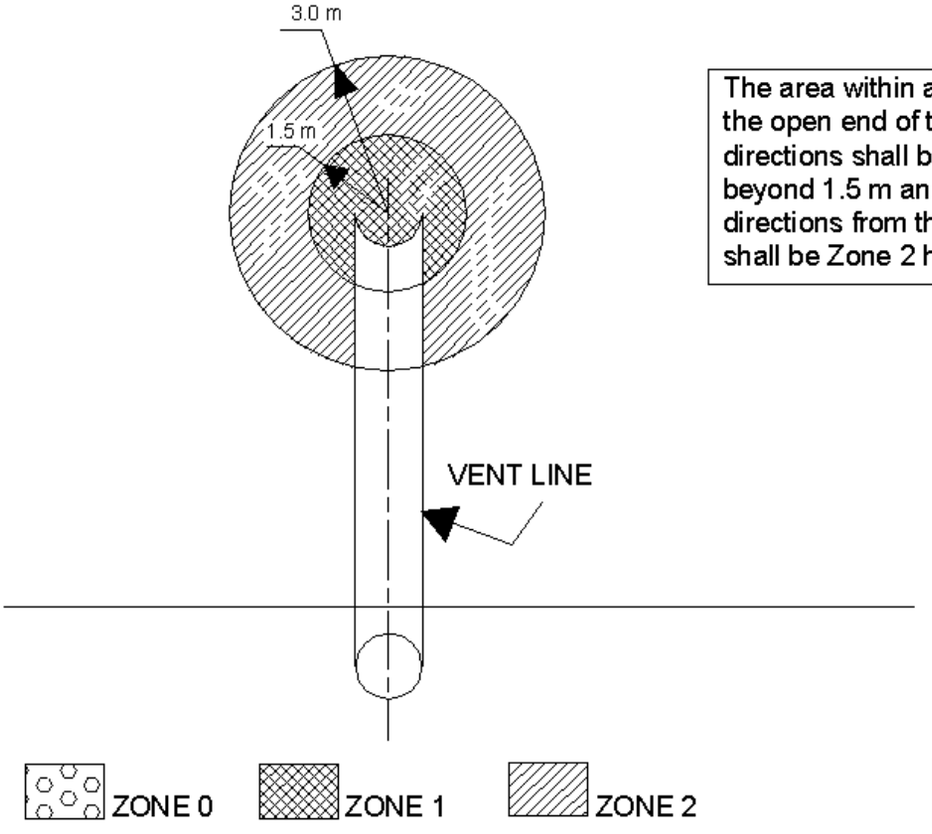






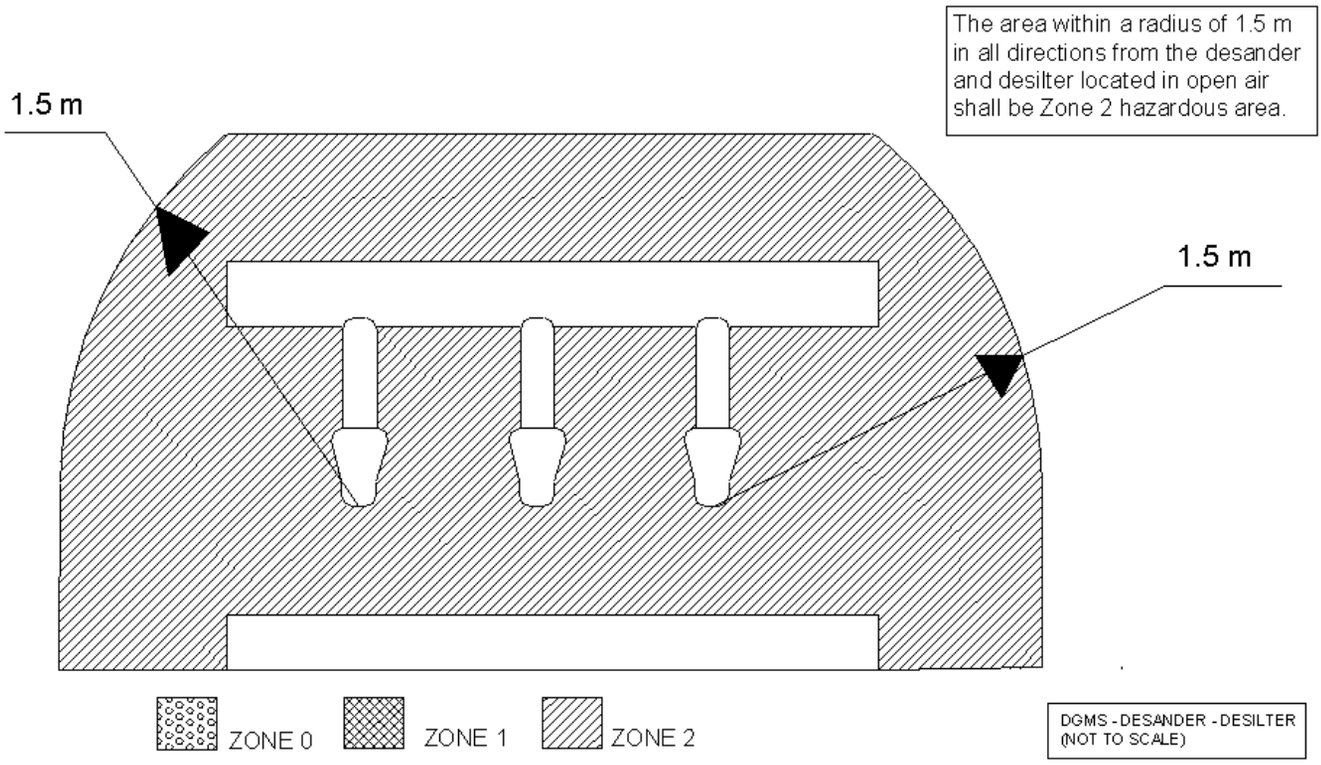
The area within a radius of 1.5 m in all directions from the shale shaker to open air shall be Zone 1 hazardous area. The area beyond 1.5 m and up to 3 m in all directions from the shale shaker shall be Zone 2 hazardous area.

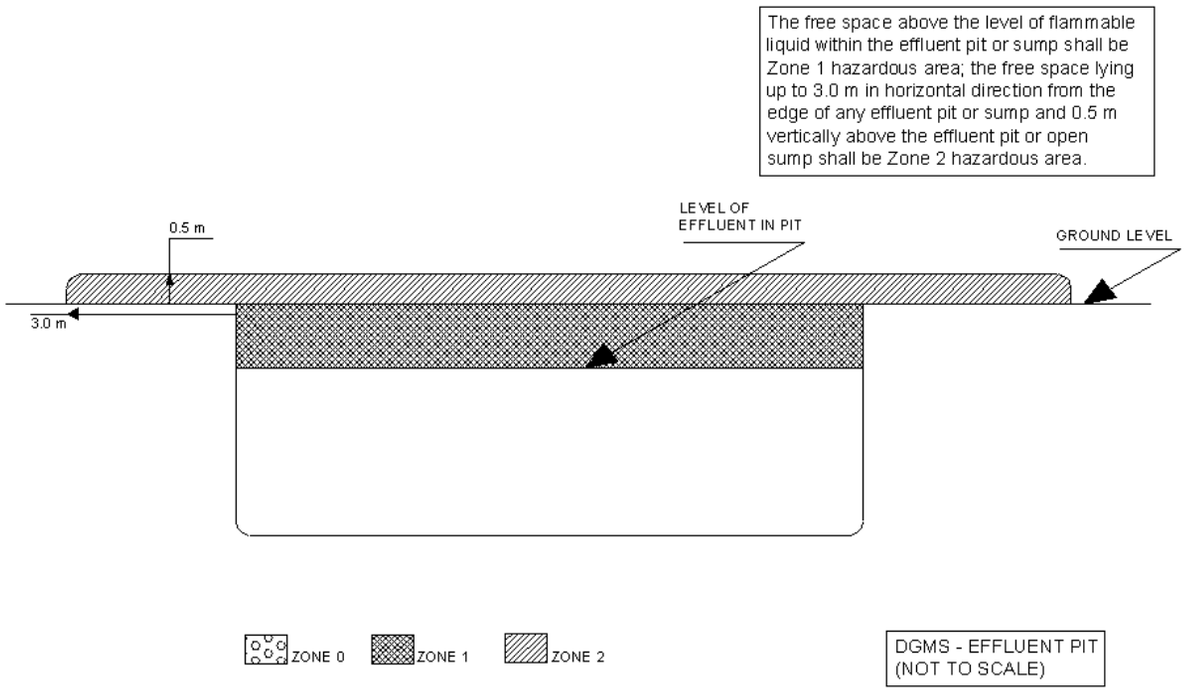
DGMS - SHALE SHAKER - NON-ENCLOSED (NOT TO SCALE)



The area within a radius of 1.5 m from the open end of the vent extending in all directions shall be Zone 1; the area beyond 1.5 m and up to 3 m in all directions from the open end of vent shall be Zone 2 hazardous area.

DGMS - DEGASSER VENT (NOT TO SCALE)


The area within a radius of 1.5 m in all directions from the desander and desilter located in open air shall be Zone 2 hazardous area.
1.5 m
1.5 m
ZONE 0
ZONE 1
ZONE 2
DGMS - DESANDER - DESILTER (NOT TO SCALE)


The free space above the level of flammable liquid within the effluent pit or sump shall be Zone 1 hazardous area; the free space lying up to 3.0 m in horizontal direction from the edge of any effluent pit or sump and 0.5 m vertically above the effluent pit or open sump shall be Zone 2 hazardous area.
LEVEL OF EFFLUENT IN PIT
GROUND LEVEL
0.5 m
3.0 m
ZONE 0
ZONE 1
ZONE 2
DGMS - EFFLUENT PIT (NOT TO SCALE)

Annexure- A

SPECIFICATIONS OF SELF-PROPELLED MOBILE DRILLING RIG RG PETRO MAKE TRUCK MOUNTED DRILLING RIG MODEL : ZJ30/1700CZ

SECTION 1: CARRIER

MAKE: RG-PETRO ; MODEL: XD70/14×8-00

1.0 DIMENSIONS

Overall Width	-	3.0 meters.
Overall Height	-	4.5 meters from ground.
Length - Carrier	-	16.70 meters.
- Overall	-	22.00 meters (with mast).
Rear Overhang	-	2.2 metre
Minimum Ground Clearance	-	35.00 cm.

Note : Rear overhang should be 30% of wheelbase.

2.0 DRIVE & AXLE

Drive	-	14 x 8. (3 front & 4 rear, 1st, 2nd, 5th,& 6th Powered. 3rd, 4th & 7th . Non- powered.)
Max. Permissible GVW	-	**76.00 MT (Weight without mast 58MT)**
Laden Weight	-	58.00 MT (Without Mast)
No. of Axles	-	7 axles in total, 3 front axles and 4 rear axles.
Front Axle Capacity	-	12.00 MT.
Rear Axle Capacity	-	15.00 MT.
Front Axle Loading	-	10.00 MT per axle.
Rear Axle Loading	-	12.00 MT per axle.

Note: Both drive & non-drive axles in front shall be of same capacity. Similarly, both drive & non-drive axles in front shall be of same capacity. No. 1 & No. 2 Front axles are Drive axles and No. 5 and No.6 Rear axles are Drive axles.

- No.1 and No. 2 axles will be steering and driven axle
- No.3 axle will be steering servo-driven axle
- No.4 and No.7 axle will be air suspension servo-driven axle
- No.5 and 6 axles will be series drive axles.

All drive axles shall have Inter Axle Lock and Differential Lock facilities.

Individual Load on each axle (all front and rear) shall be within 85% (Eighty Five percent) of maximum loading Capacity of the respective axle.

i.e Total Weight (Laden Weight) of the unit with all items including mast shall be within 85% (Eighty Five percent) of Maximum Permissible Gross Vehicle Weight (i.e. Total Axle Capacity) of the unit.

3.0 SUSPENSION

MAKE: RG PETRO

Rear Suspension: Equalizing Beam suspension with rigid type suitable for heavy duty oilfield operation

Front suspension: Leaf Spring suspension suitable for heavy duty oilfield operation with heavy duty double acting shock absorbers.

4.0 LOAD DISTRIBUTION

Proper positioning of all components/equipments on the platform for equal/even distribution of load on the axles. Details of load distribution on each axle will be as under:

- 1,2,3 Axle is 10 ton
- 4,5,6,7 Axle is 12 ton

5.0 STEERING & TURNING RADIUS

MAKE: RG PETRO ; MODEL: ZXB750 ; QTY: 1

Right Hand Drive (Steering Wheel on Right Hand Side of the Vehicle) Hydraulic Power Assisted Steering - **power assistance on all front wheels.**

Minimum Turning Circle radius shall be 19.00 meters.

Suitable power cut-off pneumatic / hydraulic mechanism (operating switch & visual indicator inside driver's cabin) to engage & disengage the steering pump from the engine as & when required – especially to avoid idle running of the pump during Rig operation. The visual indicator shall be complete with suitable transducer to sense status (rotation) of the steering pump.

6.0 WHEELS & RIMS

Suitable wheels with tyre size 18-22.5 (tubeless) at front wheels & 12-20 (tube type) at rear wheels. **One spare wheel for each type shall be supplied.** Suitable lifting and mounting arrangement facility for the spares wheel shall be provided. (The platform of the outfit shall be adequately built so that there is no seepage of oil on the wheels from the platform).

7.0 BRAKES

MAKE AND MODEL: RG PETRO BRAKES SYTEM 750

a. **Service Brake –** Pneumatic Multiple Circuit Foot-operated Power Brake acting on all wheels.
b. **Emergency/Parking Brakes** - Automatically engaged Emergency Brake acting on all rear wheels in the event of low air pressure. Manual Hand Operated Parking Brake acting preferably on all wheels.
c. **All Emergency/Parking Brake Servos shall have manual release mechanism (Screw Type) to release the brake manually in case of low/no air pressure for maintenance and towing the unit whenever necessary.**
d. **All wheel brake drums shall have dust cover.**

8.0 PERFORMANCE

Speed limit in Highway	-	40 Km/hr.
Gradeability	-	30 %

9.0 ELECTRICAL SYSTEM

MAKE: RG PETRO ; MODEL: DK750 ;

Lights & reflectors viz. Headlights, Parking lights, Brake lights, Side marker lights, Indicator lights, Hazard warning lights, rear and side reflectors, Cabin lights, etc. as per standard and suitable Reversing Audio Alarm with Blinker at rear of the unit.

In addition, 2(two) powerful searchlights with protective guard at suitable locations at rear of driver's cabin with operating switches inside the driver's cabin for illuminating the entire platform area.

While all lights shall be covered to the extent possible with suitable guard to prevent damage, all electrical fittings/components/connections shall be suitable to operate in hazardous oilfield area with preferably two wire system.

There shall be a suitable electrical power cut-off master switch to disconnect power supply to all carrier electrical components viz. engine starter, lights (including the two searchlights mentioned above), meters & gauges inside the driver's cabin, etc. during rig operation as a safety measure. The switch shall be positioned behind (outside) the driver's cabin in a suitable enclosure / box and at a suitable height for easy operation from ground.

10.0 PNEUMATIC SYSTEM

Make: RG PETRO ; Model: QD750 ;

The pneumatic system includes air compressor, air tank, control and valves of each circuit, the safety valve rated pressure will be 1.05MPa, automatic air exhaust device (when excessive pressure), water discharge switch will be equipped for energy storage, it is also used to supply air resource for pneumatic system and engine starting.
The compressed will be supplied by air compressor, through the desiccant then goes into air reserve cylinder, through the pressure regulator valve, oil and water separator, fog lubricator, alcohol antifreezer, and other air treatment device, then goes into pneumatic system for the main unit.

- Working pressure : 0.8 MPa
- Discharge: 700L/1200r/m x 2
- Volume of storage: 300L

Pneumatic system with suitable Air Dryer (replaceable element type) and suitable System Protection Valve(s) to keep rest of the circuits active in the event of failure/leakage of air in a particular circuit(s). All valves/components, piping/tubing, etc. underneath the carrier at easy access locations - preferably mounted on outer walls of the chassis. All air tanks shall have Drain Plugs.

Suitable tyre inflation valve with air pressure gauge shall be provided in the pneumatic system.

11.0 EXHAUST

Well-covered and non-conducting material wrapped Exhaust with heavy-duty spark arrester located behind the driver's cabin and projected above the top of driver's cabin.

12.0 DRIVER'S CABIN

Robust built comfortable full-width driver's cabin of steel construction, suitably upholstered, all controls at easy access positions, full view Windshield of non-splinter glass, adjustable type comfortable driver's seat, co-passenger's seats (for minimum 2 co-passengers to assist the driver in traffic) and complete with all fittings/accessories viz. Windshield Wipers, Electric Fan(s), Roof Lamps, Sun visors, twin Rear View Mirror, Air & Electric Horns, Fire Extinguisher, First Aid Box, Handgrips/Handles, Footsteps, Lockable Door(s) with moving window glass, etc.

For maximum visibility on all sides for the driver, adequate number of windows with sliding lockable toughen/non-splinter glass at both sides and rear of the cabin as well as there shall not be any object behind and sides of the cabin obstructing view. The rear windows shall be provided with protective wire net cover from behind.

2 (two) seats for co-passengers (to assist driver in traffic) at left side of the unit near to driver's seat.

13.0 GAUGES, METERS, ETC. IN DRIVER'S CABIN

All standard gauges & meters like Speedometer with Odometer (KM calibration)**,** Engine Oil Pressure Meter with low pressure warning buzzer, Engine Temperature Meter with high temperature warning buzzer, Engine Hour Meter, Engine Tachometer, Air Pressure Meter with low pressure warning buzzer, Ampere Meter, Transmission Oil Pressure Meter with low pressure warning buzzer, Transmission Oil Temperature Meter with high temperature warning buzzer, etc. with identification plate in driver's cabin **in addition to at Driller's console.**

14.0 TOWING HOOKS

Heavy-duty clevis pin type Towing Hooks both at front and rear capable of pulling/ towing the unit from bogged down situation in slushy areas in oilfields from front as well as rear.

15.0 SPARE PARTS FOR CARRIER

The spares in specified quantity as detailed in Annexure-B shall be supplied along with the unit.

16.0 TOOL KIT

Complete Tool Kit for general maintenance of the carrier (i.e. for all components / sub-assemblies covered in this section-1 of order), Wheel wrench / wrenches, Tyre inflating hose of 20 meters long with nipple, Tyre Pressure Gauge, etc. in a suitable portable Toolbox with lock & key provision, 1(one) no. minimum 20 kg capacity Heavy-duty Grease gun, 2(two) Nos. 50MT capacity Hydraulic Jacks with handles in addition to supply of similar tools, if any, as stipulated elsewhere in the order.
2(two) nos. Stopper Block for rear wheels – with suitable storage arrangement at easy access location(s) - to prevent accidental movement of unit while in stationary position.

17.0 PAINTING

Suitable shade (as stipulated elsewhere in the tender) painting after applying primer.
Under Coating with Anti Corrosive Treatment for cement & rust and polyurethane paint.

18.0 MANUALS & CATALOGUES

Supply of 6(six) sets of Spare Parts Catalogue and Workshop & Service Manual **in printed form** in addition to supply of the same in compact disc (CD) format for all major components/systems like steering, axles, front & rear suspension, pneumatic & electrical systems, brake system, etc. complete with all schematics along with the unit.

All above manuals, catalogues & CD shall contain only those components/systems that have been used in the unit i.e. the same must be CUSTOM ILLUSTRATED MANUALS/CATALOGUES ONLY – not the generalized ones.

Commissioning of the unit shall not be considered as complete until & unless all the printed manuals/catalogues are supplied.

19.0 DOCUMENTATION :

The following documents are to be submitted along with the supply/unit –

a. Sale Letter, Pollution & Roadworthy Certificate (in similar format of Form 21 & 22A of Indian Motor Vehicle Act - sample copies enclosed), Engine Emission Norms Certificate, etc. as required under Indian Motor Vehicle Act for registration of the unit in the name of **Oil India Limited.**

b. Final Chassis Built Up/Vehicle Content Record documents.

c. **Notwithstanding any clause mentioned elsewhere in the order, the invoice for *CARRIER WITH ENGINE & TRANSMISSION* shall be submitted separately, i.e. the same (invoice) shall include the cost of the chassis frame and all assemblies/components that are required for road movement of the unit only and the driver's cabin.**

20.0 VARIOUS DETAILS FOR CARRIER

Sl. No.	PARAMETERS/REQUIREMENTS					
1	Dimensions	a	Overall Width			3 meters
		b	Overall Height			4.5 meters from ground
		c	Length	i	Carrier	16.70 meters.
				ii	Overall	22.00 meters (with mast).
		d	Rear Overhang			2.2 meter
		e	Minimum Ground Clearance			35.00 cm
2	Chassis Make & Model (if any)					RG PETRO, MODEL: XD70/14X8.00
3	Make & Model of transmission & gear shifter					ALLISON, MODEL M5610AR
4	Drive					14×8
5	No. of Axles			a	Front	3
				b	Rear	4
6	Positions of Drive Axles			a	Front	1, 2
				b	Rear	5, 6
7	Make & Model of Axles			a	Front	MAKE: CHONGQING MODEL: 2300LGE1 MODEL: 2300LGE2 MODEL: 3000GE

		b	Rear	MAKE: CHONGQING MODEL:3200E MODEL:2500LE MODEL:2400LE MODEL:3200E
8	Maximum Permissible GVW of the carrier			76.00 MT
9	Total Weight (Laden Weight) of the unit			58.00 MT
10	Axle capacity (per axle)	a	Front	12.00MT
		b	Rear	15.00MT
11	Axle Loading (per axle)	a	Front	10.00MT
		b	Rear	12.00MT
12	Axle Loading within 85% of Max. Permissible GVW			Axle Loading within 85% of Max. Permissible GVW
13	Inter Axle Lock			To provide
14	Differential Lock (provided or not – in all drive axles)			To provide
15	Type, Make & Model of Suspension	a	Front	MAKE: RG-PETRO TYPE: Steel spring plate suspension
		b	Rear	MAKE: RG-PETRO TYPE: Double rear axle rigid suspension
16	Type, Size of Wheel & Tyre	a	Front	18-22.5 (SINGLE) -TUBELESS
		b	Rear	12-20 (DOUBLE) – WITH TUBE
17	Type of Service Brake	a	Front & Rear	MAKE: RG-PETRO **Service Brake:** Pneumatic Multiple Circuit Foot-operated Power Brake acting on all wheels.
		b	Rear	MAKE: RG-PETRO **Emergency/Parking Brakes:** Automatically engaged Emergency Brake acting on all rear wheels in the event of low air pressure. Manual Hand Operated Parking Brake acting preferably on all wheels.
18	Make, Model & Type of Steering System			MAKE: RG PETRO MODEL: ZXB750 Right Hand Drive (Steering Wheel on Right Hand Side of the Vehicle) Hydraulic Power Assisted Steering - power assistance on all front wheels.
19	Minimum Turning Radius			19.00 Meters
20	Reversing Alarm with Blinker Lights			Unit should have Reversing Alarm with Blinker Lights
21	Electrical fittings/equipments suitable for hazardous oilfield area			To provide
22	Speedometer/Odometer in Metric (KM) calibration			To provide
23	Additional gauges & meters inside driver's cabin as per NIT stipulations			To provide
24	Provision of Air Dryer in truck's pneumatic system			To provide
25	Towing Hooks at front & Rear of the carrier			To provide

21.0 SAMPLE OF FORM 21 & 22A

*This is a sample copy **similar to FORM 21 of Indian Motor Vehicle Act** only.*
The certificate to be issued by supplier shall contain following minimum information.

SALE CERTIFICATE

Certified that ……. (brand name of the vehicle) has been delivered by us to ……..…..…… on …… (date).

Name of the buyer ……..…….

Address ……..…….

The details of the vehicles are as under -:

1. Class of vehicle ……..
2. Maker's name & address ……..
3. Chassis No. ……..
4. Engine No. ……..
5. Horse power or cubic capacity ……..
6. Fuel used ……..
7. Number of cylinders ……..
8. Month and year of manufacturing ……..
9. Seating capacity (including driver) ……..
10. Unladen weight ……..
11. Maximum axle weight, number and description of tyres –
    (a) Front axle ……..
    (b) Rear axle/axles ……..
    (c) Any other axle ……..
12. Colour (s) ……..……..
13. Gross vehicle weight ……..

Date: ……. **Signature of the manufacturer / dealer**

*This is a sample copy **similar to FORM 22(A) of Indian Motor Vehicle Act** only. The certificate to be issued by supplier shall contain following minimum information.*

CERTIFICATE OF COMPLIANCE WITH POLLUTION STANDARDS / SAFETY STANDARDS OF COMPONENTS AND ROAD WORTHINESS

Certified that …… (brand name of the vehicle) bearing Chassis number …… and Engine number …….. Complies with the ……. (Name of Emission Standard – – Euro III, etc.) Emission standard as well as other Safety & Road Worthiness Standards as per provisions of the …… …….. (Name of Motor Vehicles Act of country of origin).

Signatures of Manufacturer / Body Builder

SECTION 2: ENGINE & TRANSMISSION

1. ENGINES

1.1. CATERPILLAR MODEL C-15 ACERT INDUSTRIAL ENGINE, 540 HP @ 2100 RPM, TIER 3/STAGE IIIA, I-6, 4-STROKE-CYCLE DIESEL

2 Nos. Cat Engines each will be naturally aspirated / turbo charged, inline, six cylinder, four stroke diesel engine, Caterpillar C-15 ACERT Model, each capable of developing a intermittent rating horse power of 540 BHP/continuous 440BHP at 2100 RPM with minimum compression ratio of 14.5:1 under standard reference conditions of atmospheric conditions of atmospheric temperature of 27 degree Celsius, altitude not exceeding 150 meter above mean, relative humidity 60% at 27 degree centigrade. The engine will be suitable for continuous duty & capable of developing 10% in excess of its rated output at its rated speed for a period of 1 hour in any period of 12 hours continuous running without undue heating or any other mechanical trouble. The engine will be anti clockwise while looking from the flywheel end

1.2. EMISSION NORMS

The engine shall confirm to minimum EURO-III emission norms, (Caterpillar make engines). **In case of engine with Electronic Controller System, Engine Fault Diagnostic Tools (both software as well as hardware) shall be supplied along with the unit.**

Technical characteristics:

- It will reduce the impact load and eliminate the torque shake and movable load from the engine
- It makes the engine drive calmly and even speedup and speed-down and make full use of the installed power and work in economical speed ;
- Equipped with speed reducer device, assisting the main brake to brake when truck go down along the long slope

1.3. The supplier shall provide the following information along with material.

- ❖ Deduction for altitude, temperature etc.
- ❖ Deduction for fan, alternator & ancillary equipment.
- ❖

1.4 The engine will be used as prime mover for draw works & also for movement.

1.5 The fuel used by the prime mover:-

High speed Diesel	:	Diesel to be used conforms to IS:1593-1982.
Cetane No.	:	42.5
Gross calorific valve:		19.480 BTU/LB (10.800 Cal /gm)

1.6 Each engine offered is to complete with the following components mounted on it.

2. AIR INLET SYSTEM

Heavy duty dry type air cleaner with pre cleaner
Turbocharger, mid-mounted, inlet 152.4mm
Air cleaner –Dual element

3. COOLING SYSTEM

Circulation pump –Centrifugal type, gear driven

Thermostat Housing, outlet vertical
Heavy duty Radiator for industrial use, mounted on the base rail with the engine and with sucker type fan & fan guard for ambient temperature having capacity at least 20% in excess of total heat rejection of the engine. Heat load calculations are to be submitted along with the offer for our scrutiny.
RH front water pump inlet.
RARDIATOR
FAN
FAN DRIVE 0.681 RATIO
FAN HEIGHT INSTRUCTIONS 558.8mm
SUCTION FAN ADIAPATER
DRY CHARGE COOLANT CONDITIONER
ELEMENT

4. FLYWHEEL & FLYWHEEL HOUSING

Flywheel with ring gear and resilent plate to suit Allison transmission supplied.
Flywheel Housing SAE # 1
SAE Standard Rotation

5. FUEL SYSTEM

Fuel pump
Fuel injection & Injection system.
Flexible Fuel Lines
Electronic unit injector
Fuel filter, secondary, mid-mount, (LH 2 micron high performance)
Fuel transfer pump, LH front.
Fuel priming pump, LH mid-mount
Fuel sample valve, mounted on fuel filter base.
PRIMARY FUEL FILTER/WATER SEP

6. FUEL PUMP GOVERNOR

Mechanically variable speed governor with PT Fuel pump.
Pneumatic throttle actuator

7. LUBE SYSTEM

Crankcase Breather
Oil Cooler
Additional cooler for torque converter oil
Oil Filter
Shallow Oil Pan
Oil Pan Drain Cover
Crankcase breather, top rear

8. EXHUST SYSTEM

Spark Arresting Muffler

Exhaust Fittings, Flexible
Exhaust Flange & Fittings, Weldable
Water Shielded Exhaust Manifold
Elbow Exhaust
Exhaust position should be as specified in SECTION – 1 (**Clause no. 11.0)**

9. EMERGENCY AIR SHUT OFF DEVICE

Inlet Air shut off device should be designed in such a way that it

- Can be operated manually at the Inlet manifold of the engine.
- Can be operated from Driller's console with a knob. Necessary hose connection in a **Plastic** conduit sealed to be provided.

10. INSTRUMENT PANEL (To be mounted rigidly with the engine)

Instrument Panel LH 8 Hole.7 Gauge
Oil Pressure
Fuel Pressure
Oil Filter Differential Pressure
Water Temperature
Electronic Tachometer
Service Meter
Exhaust Temperature
Engine starting switch with key
Engine stopping switch
Engine stopping switch (preferably push button type) also from Driller's console & from Driver's cabin.
Emergency air shut off switch from the Driller's console & from Driver's cabin.
Digital fuel tank meter with guard.
All gauges as per engine manufacturer's standard.

11. SAFETY SYSTEM

Low lube oil pressure switch. Range 8-12 PSI (0.5-0.8 Kg/Sq.cm.), with Alarm switch for low lube oil pressure.
High Water Temperature switch 96 Degree Centigrade with Alarm switch for high water temp.
Over speed switch with Alarm switch for over speed.
High inlet air temp. Switch 110 Deg. Cent, with Alarm switch.
High lube oil temp. Switch 110 Deg. Cent, with Alarm switch.
Air Inlet Shutoff
Manual Shutoff Control, LH
Emergency stop push button.
All gauges as per engine manufacturer's standard.

12. AIR DRYER for air compressor

Air dryer without heating system. **Make: Bendix, Model AD-IP, Qty: 1,** Mounted before the air receiver with pipe connection.

13. AIR COMPRESSOR

Make: Caterpillar, Model: 3042693, Qty : 1
Single / Twin cylinder air compressor with minimum capacity of 31 CFM (889 lpm), 120 PSI approx.

Suitable capacity air receiver mounted on the carrier shall be provided.
Air receiver to be tested at 1.5 times than the working pressure. **Test certificate to be provided along with supply.**

14. STEERING PUMP

Make : Vickers, Model : V101P7P 38D20H, Qty : 1
Driven from the lub oil pump of the engine with suitable coupling.
Suitable capacity
Suitable capacity mounted tank

Suitable power cut-off pneumatic mechanism (operating switch & visual indicator inside driver's cabin) to engage & disengage the steering pump from the engine as & when required – especially to avoid idle running of the pump during rig operation. The visual indicator will be complete with suitable transducer to sense status (rotation) of the steering pump.

15. STARTING SYSTEM

Each Engine Should have the two starting systems as :-

(a) Air starting motor RH, air pressure 90- 150 psi, Air silencer LH and Vapor Arrestor
Air Driven Pre lube pump

(b) 24 volt electric starting system

Two (2) nos. of Heavy duty batteries complete with cable & connection to be provided in a wooden box with lock & key placed & mounted suitably in the carrier near the engine. Each engine should have 24 volt battery charging alternator.

Note: In case of space constraint for accommodating both starting systems it is preferable to have Electrical starting system installed with each engine & provision to be kept for installing the air starters. In this event the air starters to be supplied uninstalled for future installation.

16. FUEL TANK

One (1) nos. 100 US gallon minimum capacity fuel tank (Aluminum) with filling cap with lock & key, drain plug etc. Fuel entry & return line from diesel tank to engine. Digital / analog fuel tank indicator with guard mounted at the top of the tank and also in the control panel. **Drain plug, Filling cap to be guarded.**

17. OPERATION SYSTEM

Single or dual engine operation as per load requirement.
System should be suitable for both engines for roading, however only one engine will be used for roading purpose.

18. HYDRAULIC SYSTEM

Two nos. of Hydraulic pumps to get positive suction from reservoir, each with minimum capacity 50 GPM @ 2500 psi.
Driven from PTO mounted on transmission.
Necessary pipe connection.
Control valve for hydraulic fluid installed at hydraulic control position.
Hydraulic system can be operated from each engine separately or both engines together.
Minimum 300 gallon (1130 ltrs.) hydraulic reservoir.

The system shall provide hydraulic for:

- Power Casing (3.1/2" – 14") / Tubing tongs
- Raising & lowering mast.
- Telescoping upper section of mast.
- Leveling jacks.
- Utility wrench.

19. GENERAL

Following items will also be included:

Vibration Dampner and guard
Lifting eyes
Fumes disposal
Engine barring group
Crankcase breather
Crankcase front electronic Tachometer
Heavy duty servicing hour meter
Front engine support
Maintenance tool
Standard painting of the engine

The engine should be mounted in such a way so that engine crankcase can be lowered during servicing/ maintenance of the engine without lowering the complete engine. There should be sufficient space between the two engines so that maintenance crew can get sufficient space to work around in case of breakdown.

The engine, radiator & its accessories and transmission assembly should be mounted on a common skid. This skid should be bolted to master skid of the carrier. This will allow to transfer the complete set to workshop for maintenance job as & when required.

Or as per engine manufacturer's standard.

All hydraulic & pneumatic lines should be plastic conduit sealed & suitable marking so that they can be identified as & when required.

Layout dimensional diagram should be forwarded.

The engine is to be supplied with all the components & accessories fitted.

20. ALLISON TRANSMISSION

Make : ALLISON, Model : M5610AR, Qty : 2

Technical details:

- Max. net input power: 410kW（550hp）
- Shift number : 5F+1R
- Transmission ratio of gears: I-4.0、II-2.68、III-2.01、IV-1.35、V :1.00、R-5.15
- It can reduce the impact load and eliminate the torque shake and movable load from the engine
- It makes the engine drive calmly and even speedup and speed-down and make full use of the installed power and work in economical speed
  Equipped with speed reducer device, assisting the main brake to brake when truck go down along the long slope

Two (2) Nos. of Allison Transmission, 5600 series with 4th Generation Controls, automatic Gear shifting, suitable model for transmitting minimum 450 hp directly coupled with engine with provision for mounting PTO driven hydraulic pump.

5 nos. forward & 1 reverse speed with Torque converter
Necessary air connection / controls to operate either from Driller's console (during drilling) or from Driver's cabin (during the movement)
Oil filter
Converter oil pipe
Transmission oil cooler with water connection.

BZX180 COMPOUND GEAR BOX

ZJ30/1700CZ Truck-mounted drilling rig transmission type: the power comes from the ALLISON case, and then pass the compound gear box, the power from the top outlet will be exported to angle gear box by transmission shaft and then transmit to the main drum by the chains to realize the tripping of drilling work; The power from middle outlet is to drive rotary table through transmission shaft; the power from the two bottom outlets will be transmitted to the front and rear axles by transmission shaft to drive carrier

- Model : BZX180
- Drive shaft of drawworks: 18KN.m
- Drive shaft of rotary table : 5.5KN.m
- Drive shaft of chassis: 9 KN.m
- Max. Rotary speed : 2100rpm
- Ratio : i1=1:1 i2=1.543 i3=1

ANGLE GEAR BOX

Angle gear box consists of input shaft, output shaft, big and small spiral cone gear, box body, bearing and accessories.

- Model :JX240B
- Ratio: 1.346
- Max. Input speed: 2100r/min
- Max. Output torque: 24KN •m

21. OPERATING SITE CONDITION.

The engine should be suitable for operation at the following site condition –

Engine site temperature	-	41°Cent. (Max)
Engine site temperature	-	6°Cent. (Min)
Maximum relative humidity at 21°C	–	100%
Maximum relative humidity at 35°C	-	95%
Maximum relative humidity at 41°C	-	70%
Altitude above sea level	-	150 m.
Average annual rainfall	-	343 cms.

22. MAKES FOR ENGINE & TRANSMISSION

Sl. No.	PARAMETERS/REQUIREMENTS	MAKES / MODELS
1	Make & Model of Engine	CATERPILLAR, MODEL C-15 ACERT
2	Make & Model of Transmission Assembly	ALLISON, MODEL M5610AR

3	Make & Model of Air Compressor	CATERPILLAR, MODEL : 3042693
4	Make & Model of Hydraulic pump	PARKER, MODEL : PGP050
5	Make & Model of Air Dryer	BENDIX, MODEL : AD-IP
6	Make & Model of Steering pump	VICKERS, MODEL : V101P7P38D20H
7	Make & Model of PTO	PARKER, MODEL : 852
8	Make & Model of Gear Shifter	MAKE : RG PETRO • COMPOUND GEAR BOX MODEL BZX180 • ANGLE GEAR BOX MODEL JX240B
9	Make & Model of Air Shut off Device	CATERPILLAR, 15 AIR SHUT OFF DEVICE

Engine shut off should be both by shutting fuel Cut off in the fuel pump as well as air shut off In the air inlet

23. SPARE PARTS FOR ENGINE & TRANSMISSION

The spares in specified quantity as detailed in Annexure – C1 shall be supplied along with the unit.

24. TOOL KIT FOR ENGINE & TRANSMISSION

Set of standard tools for carrying out normal maintenance of engine, transmission & hydraulic system as detailed in Annexure – C2 should be supplied in a convectional tool box.

NOTES FOR SECTION 2

1. PARTS LIST, INSTRUCTION MANUAL & DRAWING, TECHNICAL INFORMATION & BULLETIN.

6 (six) set of parts list, dimensional drawing of all major components, operations manual & service manual covering all the items shall be provided with the delivery of the material.

2. TEST CERTIFICATE

The complete sets have to be load tested at manufacturers work & test certificate have to be provided along with the delivery of material. Our engineer will visit to witness the load test.

Inspection / test procedure and other terms and conditions detailed above are very essential and shall be complied by you.

SECTION 3: DRAW-WORKS, MAST & SUBSTRUCTURE

1. DRAW WORKS:

Make : RG-PETRO, Model : JC28K, Qty : 1

Technical details:

- The drawworks mainly consists of the frame, shield, main drum, brake system, auxiliary brake, etc.
- The main drum surface has LEBUS rope groove that can keep the wireline in order and prolong the life of wireline. The main drum adopts circulating water-cooling method, its brake rim has circulating water jacket and water pipeline, and makes a water cooling circulating to acts on the brake rim by the water taps on both ends of drum shaft. The over-reel valveCrown saver is mounted on the main drum to limit the hook's journey and avoid the collision between the hook and crown block. The brake of main drum is band brake, auxiliary brake adopts EATON pneumatic water cooling thrust disc WCB324.
- Auxiliary brake water cooling tank will be independent skid structure, will be equipped with water pump of motor, radiator and 600m wireline of 1-1/8"

The drawworks conforms to API Spec 7K

- Wire line diameter: φ1-1/8"
- Pull of main drum fast line: 280kN
- Clutch model of main drum: Axial thrust disc clutch TPQ330
- Auxiliary brake : EATON WCB324
- Brake type: Band type brake
- Lubrication: BEKA-MAX (GERMAN DC24V)

Input horsepower rating: 750 hp (559 kW) minimum.
Nominal depth rating: 3000 m (9840 ft) with 4.1/2" OD drill pipe & 4000 m (14560 ft) with 3.1/2" OD drill pipe.
Minimum Hoisting capacity: 180 MT.
Single drum draw works having main drum lebus grooved for 1.1/8" drilling line.
The Draw works shall be operated by a maximum of two engines having a combined horsepower as indicated in Section 2.
The Draw works shall have a minimum of 4 forward speeds and 1 reverse speed for hoisting and rotary drive respectively.
The Draw works shall be provided with pneumatically operated clutch & drive line to the rear for driving rotary.
The Draw works shall have suitable brake water cooling system including pressure type water reservoir.
Main drum should be driven by high capacity airflex pneumatically operated clutches.
All draw-works drive sprockets with cottered type chains should confirm to API Spec 7F. These should be fully enclosed in independent type oil bath system.
Draw-works should have centralized greasing system.

2. DISC BRAKE:

Make : EATON, Model : WCB324, Qty : 1

One (1) suitable, pneumatic type, water-cooled disc brake assembly, to serve as assist brake to main drum friction brake, with suitable capacity water tank, valves and piping installed on the carrier.

Technical details:

- Model: EATON WCB324
- Max. Gliding speed: 715 r/m
- Max, free wheel speed: 1200 r/m

- Brake torque: 33895 N.m (air pressure 0.55MPa)

WCB324 auxiliary brake is installed the end of the main drum directly, the heat produced by brake be promptly taken out by water cooling circulation. Water cooling circulation system is one set of independent skid type water circulation device, and consists of water tank, one set of motor water pump and pipe etc, and share one system with water cooling circulation system on main drum brake.

3. TWIN STOP DEVICE (CROWN & FLOOR SAVER):

Make : RG-PETRO, Model : 400, Qty : 1

One (1) Pneumatically activated Twin-stop Device – Crown Saver to prevent collision between traveling block assembly and the crown block assembly, Floor Saver to prevent collision between the traveling block assembly and the drill floor. The device should be complete with override & reset buttons at driller's console.

4. DRILLER'S CONSOLE:

Driller's console, adjustable height, located at the rear of the carrier incorporating all functions to carry out drilling operations smoothly such as air controls for main drum clutch, engine (carrier) throttle, engine (carrier) shutdown, transmission, rotary table, catheads, hydraulic controls for auxiliary winch, Emergency engine (carrier) shutdown system, brake water control, etc.
Mechanical controls located adjacent to the console for draw-works brakes.
The Driller's console should be so designed that the Driller has full view of traveling block & racking board. A removable type shed shall be provided over the console in order to protect the driller from rain.
Additionally, following minimum instruments should be mounted in suitable enclosure at Driller's console arranged in such a manner to give clear view of each & every gauge to Driller while operating the draw-works.

- One (1) Weight Indicator system Type D metric E80, Martin Decker make with sensator. Should be complete with 6, 8, 10 & 12 line dials for 1.1/8" line size.
- One (1) Mud pressure gauges (6") 0-5000 PSI rated for standpipe pressure.
- One (1) Rotary Torque Indicator
- One (1) Rotary RPM Indicator
- One (1) Tong Torque Indicator
- All controls for draw-works & rotary.
- Two (2) Pump Stroke Counters for one Mud Pump with 50 ft. long cable.
- Controls for two rig engines (carrier) include stop, throttle & Emergency shut down. Start option shall be at the engines
- Controls for two mud pumps includes start / stop, throttle & Emergency shut down.
- Start & stop control for mud pump superchargers.
- Control for disc brake
- Any other instrument as felt necessary by the manufacturer.

5. ELEVATED ROTARY DRIVE:

Make : RG-PETRO, Model : ZJ30CZ-04, Qty : 1

Technical details

The rotary drive box mainly provide the power to rotary table and can realize the engage of power transmission and shift of forward and reverse rotary and release the rotary table anti-torque force, Consists of the forward and reverse shift box, lower chain box, intermediate gear shaft, upper chain box, radial thrust disc clutch and inertia brake device.
- Max. Input speed: 1500 r/min.
- Max. Output torque: 5.4 KN.m
- Ratio: 1.36:1

- Model of clutch: ATD 318 axial thrust disc type

Elevated chain rotary drive, with suitable mechanism for driving 27.1/2" Rotary Table by means of suitable pneumatic clutch drive from the rotary counter shaft or propeller shaft, with oil bath chain

guard, heavy duty spherical roller bearings, sprocket for rotary table & provision for Rotary Torque & Rotary Speed Sensors. The rotary drive should be complete with inertia brake.

6. SERVICE WINCH

Make : RG-PETRO, Model : YJ3C, Qty : 1

Hydraulic winch complete with ½" wire line, tail chain, control valve & hoses installed having bare drum line pull capacity of minimum 5000 lbs. & around 250' long line capacity.

Technical details:

- Fast rope pull: ≤30kN
- Working pressure: 14MPa

7. HYDRAULIC SYSTEM

Make : RG-PETRO, Model : YL750, Qty : 1

One (1) hydraulic system for heavy duty power casing tong (3.1/2"–14"), raising & lowering the mast & operating hydraulic winch. The system should have a pressure rating of 2500 psi at 50 GPM (minimum) & 37x commercial shearing motor & 25x commercial shearing pump. Minimum 300 gallon reservoir, safety bypass relief valve to prevent accidental pressure increase, torque regulating valve, filter, diverting valve with hydraulic outlets at rear of rig for connection to casing / tubing tong. System should be complete with two hydraulic pumps one on each Allison transmission should be installed.
(Note: Also refer pt. 18 under Section 2. Only one hydraulic system is required under section 2 & 3 respectively).

Technical details:

The hydraulic system consists of hydraulic pump, hydraulic winch, cylinder of manual tong, hydraulic jack, raising cylinder, telescoping cylinder, and some control valves.

HYDRAULIC PUMP

- Make: PARKER
- Model: PGP50
- Discharge volume of hydraulic pump: 208L/min x 2
- Pressure of hydraulic system: 14MPa

HYDRAULIC WINCH

- Make: RG PETRO
- Model: YJ3C
- Fast rope pull : ≤30k
- Working pressure: 14MPa

HYDRAULIC CATHEAD

- Make RG PETRO
- Model: Y15160
- Maximum pulling force:150kN
- Effective path:1600mm
- Pressure of system: 14MPa

HYDRAULIC JACK

- Make: RG PETRO
- Model: Y3030
- Path: 300mm
- Pressure of system: 14MPa

8. MAST:

Make : RG-PETRO, Model : JJ18038, Qty : 1

Technical details

- The mast will be two sections. Front Tilt and Front Open, with guy line, hydraulic raising and telescoping.
- The mast mainly consists of crown block, upper section, lower section, locking set of upper and lower sections, tong balance set, standpipe, ladders, racking platform, hook block bracket, etc.
- The main body of mast is joist frame structure by welded rectangle steel pipe, consists of upper section and lower section.
- Conform to API Spec 4F 《drilling and workover mast, substructure criterion
- Max. Hook load: 1800kN (180ton)
- Lifting type: hydraulic lift
- Moving type: truck-propelled
- Height: 38m
- Racking platform capacity: 3000m (41/2"DP, 19m setback)
- Racking platform height :22m/23m/24m
- Max. Wind capacity: 128km/h

One (1) Two-section Telescoping Mast manufactured & monogrammed per API Spec 4F (PSL 1, SSL E3/U3), latest edition, with hydraulic mast tilting & extending systems and automatic locking device to lock the mast into its fully extended operating position; with safety chokes to assure a safe descent rate to protect the mast in the event of failure of the hydraulic system / abrupt loss of hydraulic pressure; an unobstructed line of vision to the crown block
The mast shall have:
Clear height (below crown) from the ground: 124 feet (38 M) Approx.
Static hook load capacity: 1800kN with 10 lines strung.
Wind load resistance with full set back: Minimum 80 mph (128 kmph) with guy lines.

One (1) minimum 1800kN (180 ton) capacity Crown Block Assembly with adequate no. of sheaves for stringing up 10 lines (maximum) of size 1.1/8" with conventional block to hang flat with the mast.
One (1) Winch Line Sheave Assembly
One (1) Survey Line Sheave Assembly
One (1) Sheave Assembly (suitable for 5/8" wire line) for Power Casing Tong.
One (1) Traveling block cradle in the upper section of mast
At least two (2) Mast Load Guylines from Crown to the Front Mast Support
Four (4) wind guys to crown and two (2) cross guys to racking board
(Guy lines should be complete with thimbles, clamps, heavy duty turn buckles & guy posts)
One (1) Escape line complete with two safety trolleys for escape of persons from racking board in case of emergency.
Crown block assembly should be complete with sheaves for catline, survey line, sheave units for rig tongs, power tong / pipe spinner. Crown platform should be provided with metal flooring & handrails all around with entrance from ladder.
Two (2) sets Tong Counter Weight Boxes complete with guide, pulleys, lines, etc
One (1) Adjustable stabbing board for lowering casing of Range III length.
Full length ladder up to crown platform with inertia reel type safety climb apparatus for climber protection

Mast level & tilt indicators.

Mast rest pad complete with supporting frames should be suitably positioned on the carrier for resting the collapsed mast during transportation. The frame should not obstruct the driver's rear view in any case.

9. MAST CONTROLS:

Mast raising, lowering, and telescoping controls shall be installed at a convenient position near the base section of the mast close to the operator's console to give operator unobstructed view of mast during raising & lowering. **Should not involve Re-positioning or Removal of Driller's console & brake linkages during raising / lowering of mast.**
Mast Alarm - Located at & actuated by Latch pin. Should sounds air horn to signal latch pins are extended & locked. Suitable color painted for visual control.

10. TELESCOPIC FRONT & REAR LEVELLING JACK SCREWS

Hydraulically operated mechanically locked type jackscrews at the front & rear as well as a pair of belly jacks to stabilize the rig while the mast is being raised should be provided. The control of these jacks should be along with mast control. Each jack must have separate control.

11. RACKING / TUBING BOARD:

Make : RG-PETRO, Model : ECT750, Qty : 1

Racking board that automatically lowers into operating position and folds over the mast while loading
Shall be of adjustable height i.e. 52 ft., 53 ft., 54 ft., 55 ft., 56 ft., 57 ft. & 58 ft. from derrick floor level and mount at different positions.
Racking capacity: 3000m (41/2"DP, 19m setback).
Racking capacity: 3000 m (9840 ft) of 4.1/2" OD Drill Pipe of Range-II length in doubles. Provision should be made to rack 3800 m (12460 ft) of 3.1/2" OD Drill Pipe of Range-II length in doubles or 2.7/8" EUE Tubing of Range-II length in doubles.
At least twelve (12) nos. of 6.1/2" or 8" drill collars of Range-II length in doubles.
Locking chains on all fingers to prevent pipe swarming
Telescopic centre walkway and handrails around racking platform.

12. CATHEADS: Not included.

13. STAND PIPE:

Make : BOMCO, 4" X 5000PSI SINGLE STAND PIPE, Model : ZG-35, Qty : 1

Technical details:

One (1) 4" OD x 5000 PSI WP Single Stand pipe, top gooseneck, forged 160 degree, with threaded 4" fig 1002 hammer union for Rotary Hose connection, clamp-mounted on off-driller's side of the mast. Misaligning unions for connection to floor manifold. Top gooseneck, forged 160 degree, with threaded hammer union for rotary hose connection. Standpipe gooseneck should be at approx. 55 ft. from ground level for use with 40 ft. Kelly, 55 ft. hose & 20 ft. high sub-structure.

All connections will be quick couple Union type: 4"fig1002, and 2"fig1002.
- Nominal I.D.: 4" (φ102mm)
- Maximum working pressure: 5000psi (35Mpa)
- Test Pressure: 10000psi (70MPa)
- Size of Steel Tube: φ140×19
- Working Temperature: −29℃-+121℃
- Working Media: water, fluid, crude oil, fracturing fluid, etc.
- Connection: Union, 4"fig1002, and 2"fig1002
- Valve-driven approach: Manual

14. SUBSTRUCTURE ASSEMBLY:

Make : RG PETRO, Model : ZT225, Qty : 1

Technical details

Substructure assembly, telescoping or folding parallelogram type with provisions for mounting 27.1/2" Rotary Table manufactured & monogrammed per API Spec 4F.
Floor height: 19.68 ft. (6 m)

Clear height under Rotary Beams: 16 ft.
Static Rotary Capacity: 230 MT (2250 kN)
Pipe Setback Capacity: 137 Short Ton (125 MT or 275,600 lbs) Minimum.
Combined Static Rotary & Setback Capacity: 355 MT Minimum.
Work Floor Dimensions: 7.2 m×7.4m with wings folded out.
The Substructure shall be equipped / provided with:
Wooded setback area
Two-piece Rig Ramp complete with tire guides, jack supports and pin connection to substructure, for improved rig stability and to aid in placing rig in position during rig up
BOP trolley beam complete with two BOP trolleys & hoists to facilitate movement of BOPs including 13.5/8" x 5M BOP, into the side of the substructure.
Two (2) Rig tong back-up posts
Two stairways with proper railings from substructure floor to ground, one located on Driller's side & one on Off-Driller's side
Two stairways, one on each side, from substructure work area to Carrier bed
"Vee" door ramp with stairway to catwalk ("Vee" door mounts to be provided on Driller's side & setback side of substructure).
Provision for rat hole and mouse hole openings.
Sub-structure should meet the transportable dimensions stated in Section – 11 and should not have any cross / diagonal braces to foul with the well head.

Note:

1. **Sub-structure should be suitable to accommodate cellar having the inside dimensions of 2.2 M wide x 3.6 M long and overall dimensions of 2.6 M x 4.0 M considering the reinforcement.**
2. **The braces / cross braces of sub-structure should not obstruct the cellar opening of 2.2 M x 3.6 M.**

15. SURVEYOR WIRE LINE UNIT:

Make : MILLENNIUM WIRELINE, U.S.A

TECHNICAL SPECIFICATIONS:

Drum assembly to be of all steel construction and have a capacity of:
- 25,000 feet .092 inch wireline
- 20,000 feet .108 inch wireline
- 15,000 feet .125 inch wireline

Brake assembly will be dual band design with good stopping, holding, and heat dissipation characteristics. A positive locking mechanical brake lever will be installed at the operator's console.

Drive assembly to be chain and sprocket drive with an idler tensioning system. A transmission with three speeds forward and one reverse gear for even more pulling power will be installed. Shifting lever will be located convenient to the operator. Hydraulic motor will drive the transmission.
Power drive assembly will be by an electric motor producing 15 horsepower with UL/CSA approval. All electrical components will explosion proof rated to Class 1 Group D Division 1 standard. A matching starter control box will be installed. Voltage will be set at 3 phase 380 volt 50 hertz unless otherwise requested by the customer.
Electric motor will drive the hydraulic pump. Hydraulic assembly will be of open loop design, 2,000 psi working pressure with 3,000 psi for operator adjustable relief valve. A safety type pressure gauge, dual scale will be installed to monitor the system working pressure.
Hydraulic fluid will be supplied from a large capacity reservoir with breather/strainer type filler cap.
Filtration will be by a suction strainer and a return filter with bypass feature. A filter condition monitoring gauge will be installed. All hoses and fittings will be sized for maximum flow.
Spooling will be by a double rack arm assembly that is spring balanced. O-meter will be customer's choice (7" inch O Meter for .108" wireline) Footage or Metric
All controls will be located with operator safety, comfort, and convenience in mind.
Mounting frame will be of compact size requiring smaller space on the rig floor. Frame will be of all steel construction and will have single lifting eye and forklift pockets offering safer ease of handling.
Mounting holes will be located in the base for installation purposes.
The hydraulic reservoir will be installed within the confines of the frame.
Safety guards and covers will be installed.
Primer and acrylic enamel finish paint will be MWI TAN color unless otherwise requested by the customer.
Performance testing will be to MWI strictest standards.
Two sets operation, parts, maintenance manuals will be supplied with the wireline unit. English language. Optional languages will be additional cost.
All material used in the manufacture of this equipment will be of new

Performance

3,800 pounds pull and 1,250 feet per minute (1,590 kg and 304 mpm)

Weight and Dimensions

2,500 pounds with wire and fluids (1,132 kg)
61 inches tall x 46 inches wide x 36 1/2 inches deep

ACCESSORIES:

• *(10,000 feet .092 inch API 9A carbon steel wireline installed onto the drum assembly
• *O-measure meter with 7" inch register wheel and pressure wheel assembly. On an aluminum frame. Mechanical depth counter will be installed with ease of visibility for operator.
• Storage Case for 7" O-meter
• *Dual, Spring Balanced, Rack Arm Assembly
• Rigging sheave assembly (hay pulley) with full swivel mounting eye and side loading safety latch. Frame to be of billet aluminum for greater strength and lighter weight. 7 inch wheel for .108 inch wireline will be carburized for longer life.
• Floor sheave stand for above
• Line wiper .108 with mounting bracket
• Line clamp .108
• Line Oiler Assembly
• Weather resistant cover
• Weight indicator with 50 feet of hydraulic hose between the dial and the load cell. Dial is installed at operator's console and load cell hose storage rack will be installed Scale to be 0 to 2,000 lb unless otherwise requested.
• Wireline torsion integrity tester for testing of the wire line to API specs.
• Surveyor LCS cover
• SMWP Manual Stuffing Box

• Staff Assembly w 7" wheel for .092 for SMWP Stuffing Box
*Indicates must have accessories for full operation of this unit or Customers Request.
The wireline unit will be shall be mounted on the end of the cat walk.
The mounting area shall be out of hazardous area.

16. DEADLINE ANCHOR:

Make : NOV, Model : LOF75C, Qty : 1

One (1) Deadline Anchor suitably mounted on the Carrier Frame for anchoring the drill line of size 1.1/8". Designed

17. WALKWAYS:

Foldable type full length walkways complete with safety railings should be provided on both sides of draw-works. The walkways should be hinged to the carrier in such a way that it can be folded upward in small sections during transportation maintaining the overall width of the carrier (as indicated in Section-1).

18. TOOLS:

One (1) set of tools & wrenches for breakdown maintenance of draw-works & drilling equipments in proper size tool box mounted on the carrier with locking arrangement.

SECTION 4: DRILLING EQUIPMENT

1. ROTARY TABLE:

Make : American Block Company, Model : RK275, Qty : 1 Set

One (1) 27.1/2" Rotary Table, manufactured & monogrammed per API Spec 7K, with 27.1/2" (698.5 mm) table opening and static load rating of 500 Short Tons (453.6 MT or 1,000,000 lbs.). The rotary table should be complete with API Spec 7K square drive split master bushings, master bushing lifter, casing bushings complete with lifters suitable for 20" casings and API insert bowl No. 1 & 2 with lifters suitable for 13.3/8" & 9.5/8" casing respectively.

Triple Labyrinth seals at table top and bottom for additional protection against the entrance of drilling mud.
Oil-level check directly into oil sump for "always-true" oil level reading
Heavy-duty tapered roller bearing to absorb thrust of rotary gears
Tapered roller bearing is designed to accommodate thrust load, as opposed to self-aligning bearings which are designed for radial load.
Main and upthrust bearing are assembled onto table in plain view as opposed to installing them into the rotary base. This allows for ease of proper assembly and fitting of bearings.
Simple installation of table into base
Opening size: 27.1/2"
Max static capacity: 500Tons
Gear ratio: 3.16:1
Max torque: 22000 ft-lbs
Max speed: 400 rpm
Max oil capacity: 12 gal
Weight less master bushing: 11700 lbs

2. ROTARY SWIVEL:

Make : American Block Company, Model : A-300, Qty : 1

One (1) Rotary swivel, designed, manufactured & monogrammed per API Spec 8C, having static load rating of minimum 230 MT (2250 Kn) complete with bail bumper support, goose neck connection to Rotary hose (4" fig 1002 female) etc.
Swivel pin connection: 6.5/8" API Reg. left hand.

Technical details

A-300, 5000 psi working pressure rotary swivel
• 300 Ton rating
• API bearing rating 183 ton
• Net Wt : 3800 lbs
• one-piece forged bail
• Quick Change Washpipe is standard
• Washpipe packing assembly rated for 5000 psi working pressure
• Special high-pressure gooseneck with hole in top for use with measuring line, complete with high pressure plug and nut.
• Integral link bumper support
• Load path components traceable

3. TRAVELLING BLOCK & HOOK:

Make : American Block Company, Model : D30E200-1-125, Qty : 1

One (1) 225 MT (2250 kN) capacity unitized traveling block & hook, manufactured & monogrammed per API Spec 8C, with 5 (five) sheaves grooved for 1.1/8" OD wire line & fully compatible with the crown block assembly. Diameter of Sheaves : 914mm (36")

4. ELEVATOR LINKS:

Make : NOV, 250 TON 2 1/4" X 96", Qty : 1

One (1) pair weldless elevator links, 2.1/4" x 96" of Rated Capacity 250 Short Ton (226.8 MT or 500,000 lbs.) manufactured & monogrammed per API Spec 8C. The links should be compatible to traveling block & hook under sl. No. 3 above.

5. CASING / DRILLING LINE:

Make : USHA MARTIN, One (1) reel

LENGTH: 609.76 METER (2000 FEET)
SIZE: 1-1/8"
CONSTRUCTION: 6X19S
LAY: RHO
CORE: RHO
CORE: IWRC
COATING: UNGALVANIZE
TENSILE: IPS
AS PER: API 9A
Will be reeved and installed on the rig for drill line application during commissioning.

6. ROTARY HOSE:

MAKE AND MODEL: GATES USA, 44055R41002MXFS – ROTARY HOSE QTY. 1

3IN ID X 55FT GATES API 7K FSL 1 - GRADE D 5000 PSI SPEC 4774PE HOSE W/ 4 IN B/W Fitting W/ 4 IN FIG 1002 B/W MALE SUB & NUT 1ST END AND W/ 4 IN B/W Fitting W/ 4 IN FIG 1002 B/W FEMALE 2ND END W/ SAFETY CLAMPS AND CHAINS. & necessary fittings for connection to stand pipe & swivel goose neck (i.e. 4" fig 1002).

WT: APPROX 1190 LBS EACH CRATED

7. DRILL PIPE SPINNER:

MAKE: NOV, DRILL PIPE SPINNER 2.7/8"- 9.1/2"
MODEL: SSW-30, Qty - 1

One (1) Pneumatic Drill Pipe Spinner, size range 2.7/8" – 9-1/2", avg. torque 1285 ft lbs., right & left hand rotation, complete with spring hanger assembly, intake hose, muffler, chain and Operations & Maintenance Manual; lubricator & dryer shall be installed on the spinner unit

- Pneumatic Safety Spinning Wrench Model SSW-30, Right and Left Hand Rotation for 2.7/8" - 9-1/2"
- Complete with Vertical positioning System, Lubricator-Filter- Regulator
- Assembly and 25 Ft by 1.1/4" Air Hose with Fittings

8. KELLY SPINNER:

MAKE: NOV, MODEL: KS-6600, Qty – 1

One (1) Pneumatic Kelly Spinner designed, manufactured & monogrammed per API Spec 8C, 6.5/8" API Reg LH box up & pin down, Max. Stall torque 1200 ft lbs, with one motor for both right & left hand rotation, complete with controls, valves, fittings and hoses

Technical Details:

- Connections: 6-5/8" API Reg LH
- Height: 381/2" (978 mm)
- Diameter: 28" (711 mm)
- Weight: 1110 lbs (504 kg)
- Oil grade and Capacity: SAE 40 4 1/4 gal (4.8 l)
- Stall torque: 1200 ft-lbs (1622 Nm)
- Speed: 110
- Flow (Air 6600): 320 cfm (680 dm3/s)
- Flow (Hydraulic 6800): 24 GPM (91 l/min)
- Rotation: Right and Left
- Assembly numbers:

9. HYDRAULIC CATHEAD:

MAKE: NOV, MODEL: HC-26, Qty - 1

Hydraulic Catworks Make-Up and Break-Out.
127 mm (5") X 1,524 mm (60") breakout catworks cylinder, 14,900 kg. (31,000 lbs.) tong line pull. Mounted in the mast with hydraulic controls and line guide rollers.
127 mm (5") X 1,524 mm (60") make-up catworks cylinder, 2,348 kg (5,166 lbs.) tong line pull. Mounted in the mast with 6 part reeving for tong line, hydraulic controls and line guide rollers.

10. SPARE PARTS FOR SECTION 3 & 4:

The spares in specified quantity as detailed in Annexure - D shall be supplied along with the unit.

11. MANUALS & CATALOGUES (for Section 3 & 4)

Spare Parts Catalogue, operation, service & maintenance manuals **in printed form** in addition to supply of the same in compact disc (CD) format for all major components/systems like draw-works, disc brake, driller's console, hydraulic system, mast, sub-structure, rotary table, rotary swivel, traveling block, etc. complete with all schematics along with the unit - 6 (six) sets.

All above manuals catalogues & CD shall contain only those components/systems that have been used in the unit i.e. the same must be <u>CUSTOM ILLUSTRATED MANUALS/CATALOGUES ONLY</u> – not the generalized ones.

Commissioning of the unit shall not be considered as complete until & unless all the printed manuals/catalogues are supplied.

12. VARIOUS DETAILS FOR SECTION 3 & 4

Sl. No.	PARAMETERS/REQUIREMENTS			DETAILS
1	Draw-works	a	Input Horsepower	750 HP
		b	Nominal Depth Rating	3000m (9840ft) with 4 1/2" OD drill pipe 4000m (14560ft) with 3 1/2" OD drill pipe
		c	Hoisting Capacity	180 MT
		d	Drilling line size	1- 1/8"
		e	Lubrication system	BEAK-MAX (GERMAN) DC24
		f	Greasing System	DC24V
		g	Hydromatic brake	WCB324
2	Mast	a	Clear Height from ground	38m
		b	Static hook load Capacity	1800kN (180 MT)
		c	Wind load resistance	128 km/h
3	Crown Block	a	Capacity	1800kN (180 ton)
		b	No. of Sheaves	6
		c	Drilling line diameter	1-1/8"
4	Racking / Tubing Board	a	Capacity	3000m (41/2"DP, 19m setback).
		b	Adjustable height range	52 ft., 53 ft., 54 ft., 55 ft., 56 ft., 57 ft. & 58 ft. from derrick floor level and mount at different positions.
5	Sub-structure	a	Adjustable height range	19.68ft (6m)
		b	Static rotary capacity	230MT (2250 kN).
		c	Pipe set back capacity	125MT(1200kN)
		d	Combined capacity	355 MT
		e	Work floor dimensions	7.2 m×7.4m with wings folded out
6	Rotary Table	a	Size	27-1/2"
		b	Static load rating	500 Tons.
7	Rotary Swivel	a	Capacity	250 short ton(2250kN)
		b	Connection size	6-5/8" REG LH
8	Traveling Block	a	Capacity	225MT (2250kN)
		b	No. of Sheaves	5 (five)
7	Casing / Drilling line size			
8	Rotary Hose	a	ID x WP	3" x 5000 PSI
		b	Length	55 Feet

SECTION 5: SOLID CONTROL EQUIPMENT

1. MUD & WATER TANK SYSTEM WITH ACCESSORIES:

MAKE: BOHAI CNPC, MODEL: GK750, Qty - 1

One (1) Mud & Water Tank System consisting of the following:

1A: Active and Reservoir Mud Tanks: 3 + 3 = Six (6) tanks
- One (1) Shaker tank – 58 cum
- One (1) Intermediate tank – 58 cum
- One (1) Suction tank – 58 cum
- Three (3) Reserve tanks of Capacity 58 cum each complete with Mixing Pumps and Mud agitators

1B: Water / Chemical Tanks: Three (3) tanks

1C: Auxiliary Equipment & Accessories for the Mud Tank System:
- One (1) Mud Loading System
- One (1) Mud Pump Super Charger System
- One (1) Feed Pump System for Solid Control System

TECHNICAL DETAILS OF THE ABOVE:

1A: Active and Reservoir Mud Tanks:

Each mud tank should have approximately the following dimensions:
Length: 9900 mm (excluding 300 mm skid extension on each end for tail boarding)
Breadth: 2285 mm
Height: 2250 mm (excluding skid height)

a) Tank Walls: The walls of each of the tanks (including partition walls) are to be constructed, preferably, with 8 mm thick MS crimped plates. Tank bottoms, to be constructed with 8 mm thick plain plates, should be sloped gradually to a maximum of 3" (75.0 mm) towards the tank cleaning doors to facilitate cleaning.

b) Master Skid: The tanks should be mounted on three runner oilfield type skids fabricated from 300 mm beams (ISMB) reinforced with suitable channels and angles. The ends of the skid should project out from the tank by 300mm and curve upwards. 150 NB X Sch 80 pipe with provision for lifting should reinforce the end of the skids for tail boarding.

c) Tank Doors: Two (2) nos. 12" butterfly valve should be provided at the rear of each reserve, suction and intermediate tanks and three (3) nos. 12" butterfly valve in the shaker tanks **For Tank Clean Out.**

d) Sand Traps of approx. 10 – 12 cum capacity are to be provided in the Shaker Tanks. Approx. 3" (75 mm) slope is to be maintained towards the clean out gate end.

e) **Valves and Couplings:** Dresser type pipe couplings, butterfly valves and dumb valves with flanged ends should be provided.

f) **Mud Channels and gates:** Mud channel with diversion gates should be provided in all the tanks per the mud system requirement.

g) **Water, Mud and Equalizing Lines:** Square tubings of sizes 152 X 6 mm and 101 X 6 mm shall be used for Mud rolling line and Water rim line respectively. Equalizing lines (273mm) should be provided between shaker tank and intermediate tank with dresser type pipe couplings for end connections. These lines should be provided with suitably placed manifolds / isolating butterfly valves and gates etc. for separation or isolation of tanks or tank in the system. The rim line water tapping for mud system shall be with 1" NPT vertical insert and a plug (2 nos. for each tank).

   Suction lines of 250 mm (10") nominal dia with butterfly valves and Dresser type pipe couplings for two nos. of mud pumps should be provided in the Suction Tank and in the Intermediate Tank. The suction valves and suction valve system shall be supplied with 10" NB X 6.3 mm thick pipes. Mud hopper suction line of 200mm (8") nominal dia. with butterfly valve and Dresser type pipe coupling should be provided in the Suction Tank and all the reserve tanks.

h) **Tank Top, Handrails and Staircases:** All tank top open spaces should be covered with iron serrated bar gratings (Heavy-duty grills) and should have sufficient support and fixing arrangements to ensure stiffness and ruggedness. Removable handrails at least 1 metre high with two-rail railings and 0.15 metre high toe board should be provided on the open side of the tanks per safety standards. All handrails should consist of top rail, knee rail and tick board. Stairways of 1000-mm width and 45 degree maximum angle with handrails as described above on both sides should be provided at convenient places for climbing on to the tanks from ground level and from cable tray to suction tank. These staircases shall be resting on the walkway and also wherever possible be permanently attached / anchored to the tanks. All tanks should have fixed staircases without handrails from tank top to tank bottom for going into the tank. The walkway arrangement shall be Folding type flush with tank top.

i) **Tank Volume Measuring Scale:** All the tanks should be provided with permanently attached measuring scale made of anti-corrosive metal / alloy graduated in inch and foot to indicate volume per inch height.

j) **Bottom Mud Gun: MAKE & MODEL : DERRICK, 3" MUD GUN, QTY- 13 -** On the low pressure mud rolling lines a sufficient number of bottom mud guns complete with nipples, pipes, butterfly valves, hammer unions and a handle to rotate the gun from tank surface etc. should be provided in all the tanks.
   3" Low Pressure Mud Gun complete with rotating handle, jet nozzle and stabilizer

k) **Mud Agitator: MAKE AND MODEL: DERRICK, 10HP MUD AGITATOR, QTY – 14,** Each mud tank shall be equipped with mud agitators so positioned to have proper churning of mud, each complete with flameproof electric motor(s) of suitable hp which shall operate on 415 Volts, 3-phase, 50 Hz AC power supply. The mud agitators should be of aerofoil design impeller and heli-bevel type gearbox. The turn-over rate of the agitators should be around 50 seconds.
   Agitators complete with Helical-Bevel Gearbox, C-Face Explosion Proof Motor, 10hp at 50 Hz, 380V, 3 Phase, 1500RPM, 5/8" Mounting Plate, 8' Shaft, Impellar and Necessary Couplings, 34" Impellercanted.

l) **Provision for Mounting Solids Control Equipment:** Provision should be kept for mounting / installing solids control equipment on the shale shaker and intermediate tanks. Two (2) shale shaker units, placed side by side, with shale slide will be mounted on the Shale Shaker Tank; one (1) Desander unit mounted on shaker tank and one (1) Desilters unit mounted on suction/ intermediate tank; one (1) vacuum degasser unit will be installed on the shaker tank. The required partitions, outlets with 200mm (8.0") butterfly valves and dresser type couplings should be provided in the shale shaker tank and intermediate tank for operating all these solid control equipment and degasser in the mud system. The skid with feed pumps to all these equipment should be placed in front of the shale shaker/ intermediate tank near their interconnections. A common manifold for suction and delivery of the feed pumps for solid control equipment is to be provided with isolating valves to use either of the two pumps to feed Desander, Desilter or degasser.

m) **Surface Preparation/ Sand Blasting/ Painting:** All oil deposits should be removed by using approved de-greasing agents with special attention to drilled holes, bolt holes etc. The tanks shall be sand-blasted and painted with one coat of inorganic zinc primer 70 microns in thickness and two coats of Repack high build polyurethane.

n) **Electrical Earthing System:**
   (i) Each mud tank should have two nos. of GI straps 50 X 6 mm mounted on the out side of the walls facing mud pumps and mud mix skid side.
   ii) The straps 50 X 6 mm should be welded to the sturdy supports that are welded to the tank wall. The gap between tank wall and strap: 50mm. Spacing between supports: 1000mm. The strap length should be the same as the tank length/ width. Gap between straps should be 150mm.
   iii) Holes to be drilled in each strap are: (a) one no of 15mm dia. hole near each agitator (b) two nos. of 15mm dia. holes with a spacing of 100mm near each strap end.
   iv) Straps should be mounted at a convenient height for ease of connection.
   v) Galvanization of the straps should be of the high quality to withstand the corrosive environment. 2 nos. each 25 X 3 mm GI strips shall be welded to the main strips and the agitator skids (approx. perpendicular to the main strips 50 X 6mm).
   vi) Two (2) GI straps of size 50 X 6 mm shall be suitably mounted on each skid to facilitate independent double earthing of the pump motors.
   vii) Holes to be drilled in each strap are: a) two nos. of 15 mm dia holes with a spacing of 100 mm near each motor b) two nos. of 15 mm dia holes with a spacing of 100 mm near each strap end.
   viii) Foldable type hangers should be mounted on tank wall below the earthing straps to support the mud system cables. Spacing between hangers should be 1000mm. Width of the hangers: 300mm

o) **Mounting of Push button station:** Mounting assembly for push button station of each mud/ water tank agitator to be welded to the tank near respective agitator assembly.

p) **Mud Pill Chamber:** A chamber of approx. 10 cu m (63 bbls) capacity with isolating valves should be provided inside the suction tank for preparation of special mud pills. A suitable sized agitator of stainless steel 304 Aerofoil 3 blade design of approx. dia 36" coupled with flameproof electric drive motor of maximum 10-hp capacity should be provided in this chamber for proper mixing of the mud additives. The pill tank agitator is to be such that it should not foul with the bottom/ internal piping. This chamber should be connected with the suction line for the rig pumps and also with an independent line from the mud loading system with isolating valves.

q) Chemical Operator's Cabin: One (1) cabin of size approximately 4.2 m long x 2 m wide x 2.5 m high skid-mounted cabin with proper heat insulation & ventilation, complete with one sliding door, safety glass windows, adequate provision for keeping mud testing equipment and accommodating 2 (two) persons, and with tool box, oilfield mud balance such as Baroid and MF viscometer. The cabin should be placed near the intermediate tank at the level of the walkways.

1B: Water / Chemical Tanks: Three (3) water / chemical tanks fabricated as detailed above for item 1(A) and having approx. dimensions:
Length: 9900 mm (excluding 300 mm skid extension on each end for tail boarding)
Breadth: 2285 mm
Height: 2250 mm (excluding skid height)

The following features should be provided in the water / chemical tanks: -

- Two tanks should have open top and one tank should have covered top with two manholes.
- Both the open top tanks should be covered with the serrated floorings as described above at 1A(h).
- 2" line size hopper (1 No.) shall be fabricated & assembled on the surface in a suitable place between open tank & multistage gauging water pump skid. Suitable connection from delivery manifold of multistage pump should be provided with butterfly valve).
- A common skid for the hopper & chemical stacking of approx. size 4 m x 2m x 0.5 m should be supplied.
- Walkway between top cover & top open tank and handrails for top covered tank should also be provided. And all the three tanks should be connected with a common pipe manifold & suitable ditch coupling, butterfly valve etc.
- Two (2) clean out gates should be provided at the rear side of each tank. These gates should be provided with 12" Butterfly valves. Approx. 3" (75mm) slope is to be maintained towards the clean out gate side.
- All the tanks should be provided with 100mm drain out plug at the floor of the tanks.
- The top covered tank should be provided with a suitable vertically floating water depth measuring scale so that the level of water in the tank can be ascertained without climbing on the tank from a distance of 4 – 5 m.

- The inlet feed line shall be supplied with 100mm (4") Sch.40 ASTM 106 Grade 'B' pipes with butterfly valve and should be anchored firmly with the sidewall of the tank. The rim line water tapping for water tanks shall be with 1" NPT vertical insert and a plug (2 nos. for each tank).
- All the tanks shall be provided with 152.4mm (6") Sch.40 ASTM 106 Grade 'B' pipes with butterfly valve in the front side of the tanks.
- The open top tanks should be provided with bottom guns at four sides of the tanks with rotating (180^0) facility from the tank top.
- Each open-top tank should be provided with two (2) agitators having heli-bevel type gear box .The mud agitators shall be with stainless steel 304 Aerofoil 3 blade design of approx. dia 36". The agitators should be driven by maximum 10 hp, 415 volts, 3-phase, 50 Hz horizontal foot mounted, squirrel cage rotor induction motor with bi-directional cooling fan at NDE. The motor should be fully enclosed fan cooled and offering protection to IP55. Insulation: Class F but the temperature rise should be limited to that of Class B. Earthing: Two nos. of earth points on the enclosure and one no. inside the terminal box. Termination: Motors should have terminal box with studs for connection of supply cable. Canopy: Motors should be provided with a removable type canopy for protection against rain. Canopies should be supported on agitator skids. Paint: Motors should be painted with epoxy paint of DA Grey shade.

The overall height of the tanks including the agitators should not exceed 3400 mm for transport limitations.

Two (2) horizontal multistage centrifugal pumps with suitable capacity prime mover (**Pump: BEACON WEIR; MODEL: FQA-6 With 60HP Motor)**set complete with piping/ Dresser type couplings and butterfly valves should be mounted on an independent three runner oilfield skid. These pump sets will be used to load chemicals through hoppers to water tanks, to gun the mixture and to feed chemical-mixed (gauging) water in the cement hopper for preparation of cement slurry. The two horizontal multi stage centrifugal pumps should have cast steel body, bronze / cast iron impeller, EN 8 shaft with gland type packing and each should be capable of

developing 150 m. of head. The discharge of each pump should be about 60.0 m^3 / hr at 1450 rpm.

Two [2] horizontal centrifugal pump Make: BOHAI CNPC, Model: SB 3" X 4" X 10" & Motor: Crompton Greaves-20HP (15KW) complete with piping & fittings should be provided for supplying water from water tank to various equipment namely engine cooling, mud pump cooling, draw-works cooling, derrick floor cleaning, etc.

1(C): Auxiliary Equipment & Accessories for the Mud Tank System:

I. Mud Loading System: One (1)
II. Mud Pump Super Charger System: One (1)
III. Feed Pump System for Solid Control System: One (1)

I. Mud Loading System:

The following equipment should be mounted on an oilfield three runner skid and top floor with inter connections through piping, dresser type couplings and butterfly valves:

a) **Centrifugal Pump sets:- 2(Two) centrifugal pumps of Make: BOHAI CNPC, Model: SB 8" X 6" X 14", 100 HP equivalent to Mission Magnum – I pump** of size 8" x 6" x 14" with approx. 12.1/2" size impeller. The mud mix system shall be provided with 10" suction valve system with 8" suction header.
   Each pump will be coupled to a **100** hp, 415 Volts, 3-phase, 50 Hz 1500-rpm flameproof weatherproof electric motor. The motors, starters and the cable glands should be suitable for use in hazardous areas and duly certified by CMRI (UL or the equivalent certifying authority of the country of origin)and approved by DGMS for Zone I and Gas group IIA & IIB of Oil Mines.

b) **Loading Hoppers: MAKE: BOHAI CNPC, MODEL: HHQ/P 150×150, Qty – 2 -** Two (2) hoppers shall be provided for Bentonite / Barite loading with suitable top cover. One hopper should be suitable for use for loading barites and the other hopper coupled with one (1) High Performance Aqua–Shear Jet Shearing / Mixing System capable of handling 1000 GPM of fluid, should be suitable for loading polymer chemicals. The Jet shearing system shall be provided with hopper having 4" line size on a separate skid which shall be placed by the side of / parallel to mud mix skid. The inlet

   and outlet of the jet shearing system shall be connected to one of the mud mix hopper lines with necessary isolation valves.

II Two Mud Pump Supercharging System:

Two (2) centrifugal pumps of Make: BOHAI CNPC, Model: SB 8"X 6" X 14", 75 HP equivalent to Mission Magnum – I pump of size 8" x 6" x 14" with approx. 12.1/2" impeller should be suitably positioned and mounted on a three runner oilfield skid and floor with inter connections through piping, dresser type couplings and butterfly valves to super-charge the mud pumps suction. Gap between supercharger system and mud tank shall be approx. 900 mm to facilitate / ease of

slinging of supercharger skid. The supercharger system shall be provided with 10" isolation Butterfly valves and 10" suction header.
Each pump will be coupled to a 75 hp, 415 Volts, 3-phase, 50 Hz 1500-rpm flameproof weatherproof electric motor. The motors, starters and the cable glands should be suitable for use in hazardous areas and duly certified by CMRI (UL or the equivalent certifying authority of the country of origin)and approved by DGMS for Zone I and Gas group IIA & IIB of Oil Mines.

III. Feed Pump System for Solid Control System:

Desander, Desilter and Degasser Feed Pump Set: **Two (2) centrifugal pumps of Make: BOHAI CNPC, Model: SB 8" X 6" X 14", 75 HP equivalent to Mission Magnum – I pump of size** 8" x 6" x 14" with 12.1/2" size impeller should be suitably positioned and mounted on a three runner oilfield skid and floor with inter connections through piping, dresser type **Desilter** and **Degasser** units. Gap between mud mix system and mud tank shall be approx. 900mm to facilitate / ease of slinging of mud mix skid.
Each pump will be coupled to a 75 hp, 415 Volts, 3-phase, 50 Hz 1500-rpm flameproof weatherproof electric motor. The motors, starters and the cable glands should be suitable for use in hazardous areas and duly certified by CMRI (UL or the equivalent certifying authority of the country of origin)and approved by DGMS for Zone I and Gas group IIA & IIB of Oil Mines.
All components of the tanks should be new, unused and free from all defects.
The tanks should be hydraulically tested for 24 hours.

2. MUD LOADING SYSTEM/ BARITES RAMP:

One (1) Mud Loading System / Barites Ramp of 600 – 800 sq. ft. area and 4 ft high for placement adjacent to the Active Mud System, with shade over the ramp for storing Bentonite, Barites and other bulk chemicals

3. TRIP TANK:

One (1) trip tank, 10 cubic metres (62 barrels) capacity with two nos. centrifugal pumps, **Make: BOHAI CNPC, Model: 4 X 3 X 10 & 20HP Motor** with fps gauging system visible from Derrick Floor.

4. PRE-FLUSH TANK:

One (1) pre-flush rectangular tank of 15 cubic metres (100 barrel) capacity having approximate size 5 Mtr (L) x 2 Mtr. (W) x 1.5 Mtr. (H), for cementing jobs, preparation of soaking solution, etc.

5. LWC (Low Wax Crude) TANK:

A standard round LWC Tank, Capacity: 15 cubic meters (100 barrel) approximate capacity with connection to Suction & Pre-flush tanks over a staging of height 1750 mm & railing top around it's periphery.

6. SHALE SHAKER:

MAKE & MODEL: DERRICK, FLO-LINE SHALE SHAKER 2000 – 3 PANEL, Qty – 2

Two (2) units of Linear motion "High G" (7.0 G) shale shakers with suitable flow divider & mounted side by side on a rugged oilfield type master skid over the shaker tank, each unit of LMSS rated at 500 GPM and capable of running up to 250 plus mesh size screens without overflowing. (The units of LMSS should not be permanently fixed on to the skid but should be designed for easy attaching & detaching on to the skid).

The dimensions of the master skid & LMSS unit should meet the transportable dimensions stated in Section – 11.

COMPLETE WITH THREE PANEL SCREEN FRAME, I-BEAM SUPPORT STRUCTURE, AND EXPLOSION PROOF ELECTRICS. WITH THE FOLLOWING OPTIONS:

- RATCHEN A.W.D. (+5° UPHILL TO -1°DOWNHILL)
- STANDARD SCREEN UNDERFLOW SUMP
- WEIR FEED WITH BACK TANK

- SEALING RAPID CHANGE BOLT ASSEMBLY
- SUPER GTM VIBRATORS (380 Volt, 3 Phase, 50 Cycle)
- Operating, Maintenance and Parts Manual (English Version), One original & One copies
- DIMS:111-5/8"(L)x75-1/4"(W)x61-1/2"(H)
  2835mm(L)X1911mm(W)X1562mm(H)
- WGT: 4,537 LBS / 2,058KGS

7. DESANDER:

MAKE: DERRICK, MODEL : DSV-10-2, Qty – 2

One (1) 2-cone Desander with manifold constructed of 8" Sch 40 pipe, mounted the third shaker, having two (2) 10" polyurethane cones with grooved end inlet and overflow, Desanding Capacity: 1000 GPM minimum.

- Complete with 10" hydro cyclones, 2 cone vertical mount desander
- Makes a separation between 40 and 100 microns
- RATED 1,000 GPM/75FT. OF HEAD
- DIMS: 37-3/4"(L)x74-1/4"(W)x89-7/8" (H)
  959mm(L)X1886mm(W)X2283mm(H)
- WEIGHT: 1,400 LBS / 635KG

8. DESILTER:

MAKE: DERRICK, MODEL : S-420-S, Qty – 1

One (1) Desilter Assembly, 16-cone with manifold constructed of 8" Sch 40 pipe, mounted on an angle iron base, having sixteen (16) 4" cones with grooved end inlet and overflow, Desilting Capacity: 1000 GPM minimum.
- Makes a separation between 40 and 100 microns
- RATED 1,600 GPM/75FT. OF HEAD

9. VACUUM DEGASSER:

MAKE & MODEL: DERRICK, DERRICK® VACU-FLO 1200 DEGASSER, Qty – 1

One (1) Vertical Vacuum Degasser, mounted on oilfield skid, with one (1) 5 hp, 230 /415 Volt AC, 3-phase, 50 Hz explosion-proof motor, starter, complete with suction and discharge piping, jet nozzles, etc. Degassing Capacity: 1000 GPM minimum.
- WITH VESSEL AND VACUUM PUMP, MOUNTED TO A UNITIZED SKID
- COMPLETE WITH VENTURI AND EDUCATOR
- RATED AT 1200 GPM(75.6L/S) (380VOLT, 3 PHASE, 50 Hz)
- Leaf Area: 14,528in2 (369,011mm2)
- DIMS:87" (L) x 64-1/4" (W) x 79" (H)
  2210mm (L)X1632mm(W)X2007mm(H)
- WEIGHT: 2,700 LBS/ 1226KG

10. "POOR BOY" DEGASSER:

MAKE & MODEL: NOV, 40" POOR BOY DEGASSER, Qty – 1

One (1) "Poor Boy" mud gas separator mounted on oilfield type skid having chequered floor plates; with inlet from flow line and choke manifold, one outlet, one drain, one 8" vent and one 20" man way
Diameter: 48"
Should be of adjustable height to match the system.

11. TOOLS & SPARE PARTS FOR SECTION 5:

The spares & Tools in specified quantity as detailed in Annexure - E shall be supplied along with the unit.

SECTION 6: RIG INSTRUMENTATION & CONTROL

1.0 INSTRUMENTATION FOR CARRIER

MAKE & MODEL: MARTIN, DAQ DRILL WATCH W/RIGSENCE SERVER, Qty – 1

Technical Details:

• RigSense System, V2.0
• RigSense Catalog Number is: RS
• RigSense is a drilling information management system, utilizing a combination of proven technologies, providing reliable services with the capability of meeting the customer's needs today and in the future. It provides critical information for making intelligent decisions about drilling operations. It is a comprehensive system with the ability to gather data from multiple sensors and input sources.
Typical users of RigSense include Toolpushers, Drillers and Assistant Drillers, as well as Rig Managers, Operator Representatives, Mud and Drilling Engineers.

RigSense provides the following functionality:
• Data is viewed and printed (historical and real-time).
• The Electronic Drilling Recorder (EDR) with RigSense 2.0 offers unparalleled ease of use coupled with a high degree of flexibility. The tab based format of RigSense offers quick and easy access to commonly used operations based screens.
Individual users can customize screens to their own channel preferences.
• Digital read-outs display numerical real-time data.
• EZ view screens can display up to 25 channels that may be configured to display only the specific data needed for a particular rig operation.
• The RigSense Line Wear Screen provides accurate time and event based ton-mile measurements.
• Alarm parameters are modifiable for changing conditions and rig activity. A readily identifiable red or yellow background indicates alarm conditions.
• RigSense functions as a rig-wide user interface, allowing access to historical information and notifications, as well as messaging capability with other RigSense workstations on the network.
• IADC reports automate cumbersome data collection for billing and payroll purposes to provide IADC approved format for morning and payroll reports with electronic transmission capability.
• The RigSense system will be scalable. The basic building block is a single stand-alone computer called a RigSense
Application Server (app server). RigSense supports additional computers referred to as clients. The client computers are standard desktop workstations, or rig floor displays. RigSense client computers connect to the application server via the local area network. They display the same user interface and data as the app server. However, the clients receive the real-time data and historical data from the app server.

1.1 GAUGES, METERS ETC. IN DRIVER'S CABIN

The following minimum instruments shall be provided in driver's cabin with proper identification plates:

a) Speedometer with Odometer (KM calibration)
b) Engine Oil Pressure Meter with low pressure warning buzzer
c) Engine Temperature Meter with high temperature warning buzzer
d) Engine Hour Meter
e) Engine Tachometer
f) Air Pressure Meter with low pressure warning buzzer

g) Ampere Meter
h) Transmission Oil Pressure Meter with low pressure warning buzzer
i) Transmission Oil Temperature Meter with high temperature warning buzzer

2.0 INSTRUMENTATION FOR ENGINE & TRANSMISSION

2.1 INSTRUMENT PANEL FOR ENGINE

The following minimum instruments shall be provided in driver's cabin:

a) Lube Oil Pressure Gauge
b) Fuel Pressure Gauge
c) Oil Filter Differential Pressure Gauge
d) Cooling Water Temperature Gauge
e) Electronic Tachometer
f) Service Meter
g) Exhaust Temperature Gauge
h) Engine starting switch with key
i) Engine stopping switch from Drivers cabin & Drillers console
j) Emergency air shut off switch from Drivers cabin & Drillers console

2.2 SAFETY SWITCHES FOR ENGINE

The following minimum safety instruments shall be provided in the engine:

a) Low lube oil pressure switch with alarm
b) High water temperature switch with alarm
c) Over speed switch with alarm
d) High inlet air temperature switch with alarm
e) High lube oil temperature switch with alarm
f) Air inlet shutoff
g) Manual shutoff control
h) Emergency stop push button

2.3 Air Dryer: **MAKE & MODEL: SULLAIR, SRC-240** - The air dryer shall be suitable for producing instrument air having dew point -40^{o}C. Necessary timer control circuit along with solenoid valves, diaphragm operated valves and pressure gauges etc. are to be provided along with the dryer.

2.4 Air compressor: **MAKE & MODE SULLAIR, WS1810**

Air compressor control shall be PLC based and comprise of the following minimum safety instruments:

a) Compressor auto on/off control
b) Compressor load/unload control
c) High discharge pressure switch
d) High discharge temperature switch
e) High lube oil temperature switch
f) Low lube oil pressure switch
g) Low cooling water pressure switch

Note: Licensed software for PLC should be supplied along with the material.

2.5 Air receiver: **MAKE & MODEL BOMCO, C-2.5/1.0**

Air receiver should include the following minimum instruments:

a) Safety valve.
b) Pressure gauge.
c) Auto drains facility.

2.6 Allison Transmission

a) Allison 4th generation electronic control system.
b) Wiring diagram of the control system is to be provided along with the offer.
c) Layout diagram indicating the physical position of all the sensors, controllers etc to be provided along with the offer.
d) List of items used in the control system including sensors, controllers, solenoid valve etc. along with part nos. and maintenance manuals for the sub-units to be provided along with the offer.
e) Recommended spare parts list of instrumentation and control system for maintenance to be provided along with the offer.
f) Diagnostic Software (Licensed), communication cable and one laptop for Allison controller to be provided along with the material.
g) Parts Catalog, Principles of Operation, Service Manual and Troubleshooting Manual for Allison Control to be provided along with the material.

3.0 INSTRUMENTATION FOR DRAW-WORKS, MAST & SUBSTRUCTURE

3.1 DRILLER'S CONSOLE:

Driller's console should be complete with instrumentation system to carry out drilling operations smoothly such as air controls for main drum clutch, engine throttle, engine shutdown, transmission, rotary table, catheads, hydraulic controls for auxiliary winch, Emergency engine shutdown system, brake water control etc. Additionally, following minimum instruments should be mounted in suitable enclosure at Driller's console arranged in such a manner to give clear view of each & every gauge to Driller while operating the draw-works.

a) One (1) Weight Indicator system, Martin Decker Type FS, E542 with sensator. It should be complete with 6, 8, 10 & 12 line dials for 1.1/8" line size
b) Two (2) Standpipe pressure gauges, 0-6000 psi rating
c) One (1) Annulus pressure gauge, 0-6000 psi rating
d) One (1) Rotary Torque Indicator
e) One (1) Rotary RPM Indicator
f) One (1) Tong Torque/ Pull Indicator
g) All controls for draw-works & rotary
h) Two (2) Pump Stroke Counters for Mud Pumps
i) Controls for two rig engines includes start / stop, throttle & Emergency shut down
j) Controls for two mud pumps includes start / stop, throttle & Emergency shut down
k) Start & stop control for mud pump superchargers
l) Control for disc brake
m) Any other instrument as felt necessary by the manufacturer

4.0 DRILLING INSTRUMENTS

a) Monitoring System: Electronic digital monitoring system to be installed in Doghouse should include the following minimum parameters:
   - Flow in GPM
   - Flow out (%)
   - Hook Load
   - Weight on bit

- Rotary RPM
- Rotary Torque
- Rate of penetration
- Pump Pressure
- Total SPM
- Measured depth

b) Mud pit indicator: MD Totco "Mud watch" or equivalent "E-Mud" pit level and flow show monitoring system with alarm device complete with the following minimum features:
   - Total pit volume and individual pit volume
   - Trip tank volume and indicator, 0-100 per cent with 8 hours recorder
   - Mud pit gain or loss
   - Mud flow as percentage of total flow
   - SPM and continuous strokes for each mud pumps
   - Electronic digital monitoring/hard copy printout recording system for total volume and flow line
c) On-line Gas Monitoring System at the primary shale shaker and connected to audible or visual alarm near the Driller's stand
d) One (1) MD Totco MARTIN 7-pen drilling recorder complete with 24 hour clock & chart and all required accessories including transducers, sensors, cables, etc. to record the following parameters:
   - String Weight in metric system
   - Pump pressure
   - Rotary torque, Electric
   - Rotary table RPM, Electric
   - SPM – 2 Nos.
   - Rate of Penetration (ROP), wireless system including draw-works driven rate of penetration assembly
e) Ton-mileage Recorder to be installed in the Doghouse

5.0 INSTRUMENTATION FOR POWER PACK

5.1 INSTRUMENT PANEL FOR ENGINE

The following minimum instruments shall be provided in driver's cabin:

a) Lube Oil Pressure Gauge
b) Fuel Pressure Gauge
c) Oil Filter Differential Pressure Gauge
d) Cooling Water Temperature Gauge
e) Electronic Tachometer
f) Service Meter
g) Exhaust Temperature Gauge

5.2 SAFETY SWITCHES FOR ENGINE

The following minimum safety instruments shall be provided in the engine:

a) Low lube oil pressure switch with alarm
b) High water temperature switch with alarm
c) Over speed switch with alarm
d) High inlet air temperature switch with alarm
e) High lube oil temperature switch with alarm
f) Air inlet shutoff
g) Manual shutoff control
h) Emergency stop push button

5.3 SAFETY SWITCHES FOR GENERATOR

The generator breaker should have the following protection:

a) Low lube oil pressure
b) High water temperature
c) High oil temperature
d) High inlet air temperature
e) Engine over speed

NOTE: All the electrical/electronic instruments installed in hazardous area should have valid approval from DGMS for use in Zone-1 & 2, Gas Group IIA & IIB areas of oil mines.

SECTION 7: MUD PUMPS

Two (2) 1000 HP rated Triplex Mud Pumps, **BOMCO Model F 1000**, each of the following specifications:

SLUSH PUMPS [Mud Pump]:- Model : BOMCO F 1000

Two (02) nos. of triplex single acting, slush pumps with input HP rating of minimum 1000 HP driven by DC Drilling motors of matching HP rating. Pump should be suitable for continuous heavy duty application.

1. Maximum requirement of working pressure 5000 psi.

2. Pumps should be equipped with easily changeable piston and liner assy. to meet varied requirement of drilling operation.

3. Apart from standard accessories, each pump shall be equipped with 5000 PSI WP pulsation dampeners, charging hose assy., reset relief valve, bleed valves, inline suction stabilizer, jib crane with trolley, pull lift chain hoist, strainer cross etc.

4. Detailed specification of pump motor - GE Drilling Motor DC

   - GE high-torque, series wound, DC drilling motor for marine applications
   - Type: Horizontal, drip-proof fully guarded, blower ventilated.
   - Maximum Continuous hp: 1085 hp, 5900 ft. lbs., 1150 amps, 750 vdc, and 965 rpm
   - Intermittent duty cycle: 1320 hp, 7530 ft. lbs., 1400 amps, 750 vdc, and 920 rpm (60 sec. run – 30 sec. rest)
   - Maximum RPM: 2300
   - Temperature rating: 1550C rise over 400C ambient
   - Self excited series field.
   - Class H insulation
   - Single shaft extension with hub.
   - Pressurized connection box mounted on left “A” side of motor as viewed from commutator end, with double bolt-on armature cable connections and terminations for space heater, auxiliary switch, and pressure sensor. Connection box can be specified on right “B” side (must be specified on order).
   - Two RTD’s, 100-ohm platinum, embedded in 2 commutating coils.
   - Space heater, 240 volts, 185 watts, explosion-proof.
   - Auxiliary lockout switch, explosion-proof
   - Pressure sensor, explosion-proof
   - Blower assembly – 10hp, 460 volt, 60HZ, 40C motor providing a minimum of 2800 scfm of ventilation
   - Marine features including ABS certified shaft and armored cable

5. Drive media : Belt Drive

6. AC motor (min. 75 HP) driven TRW Mission (8” x 6” x 14”) or equivalent centrifugal pump 02 (Two) nos. for super charging (to handle mud up to 20 ppg) with appropriate independent suction and delivery manifold mounted on an oil field skid.

7. Parallel pumping: In certain events both the slush pumps will be used in parallel pumping. All arrangements should be made available for this purpose.

A. TYPE OF PUMP:

Slush pump triplex single acting; with individual (preferably two-piece) forge steel modules, horizontal piston pump with replaceable cylinder liners of various sizes to obtain desired discharge and pressure at rated SPM, complete with standard equipment, skidded and master skidded with DC motor. **Detail Drawing of Skid & Master Skid should be Provided before Fabrication for our Approval.**

B. CAPACITY OF PUMP:

i)	Input Horse Power	: Max. 1000 HP
ii)	Discharge	: Max. 2440 LPM (644 GPM) at 165 Kg/sq cm (2300 (PSI)
iii)	Discharge pressure	: Max. 351 Kg/sq cm (5000 PSI)

The above parameters are to be obtained with replaceable liners and pistons at maximum rated input HP and speed of the pump. Liners to be fitted on the pump at the time of supply to obtain maximum discharge of 595 GPM (2252 Litres/min.). Parameters are to be based on 90% mechanical efficiency and 100% volumetric efficiency.

C. SLUSH PUMP FEATURES:

i) Fully enclosed steel plate fabrication power end.
ii) Double helical gear for crankshaft gear and pinion shaft gear.
iii) Double extended pinion shaft.
iv) Self-aligning spherical main and pinion shaft bearing, Roller bearing at crank and crosshead end of connecting rod. (Bearing shall be SKF make).
v) Interchangeable standard module (suction and discharge) with shot penned inner surface.
vi) Fast change valve covers.
vii) Two piece fast change piston rods with clamp.
viii) Suction and discharge manifold with suction dampener.
ix) Piston - liner lubricant spray system with AC 3 Ph. 50 Hz electric motor driven pump with reservoir.
x) Pump fitted with super die-hard clamp type liners, premium piston, mission type seats and polyurethane valves assy.
xi) The pump should be complete with all the components of fluid end and power end.

(One hydraulic valve seat puller kit and one set of special hand tools for fluid end maintenance should be included with each pump set to be supplied).

D. ACCESSORIES:

Each mud pump package should be assembled with the following accessories:

I. One (1) Discharge Strainer Cross Assembly complete with suitable strainer, 5" (125 mm) 5000 psi (347 Kg/sq cm) WP discharge flange connection, 4"(100 mm) – 5000 PSI (347 Kg/sq cm) WP top connection for pulsation dampener and 5" (125 mm) - 5000 PSI (347 Kg/sq cm) WP end connection for strainer clean out.

II. One (1) 3.1/2” (88.9 mm) x 12’ (3.66 Mtrs.) vibrator hose

III. One (1) Discharge Pulsation Dampener (Make- HYDRIL Model- K-20-5000), maximum service pressure 5000 PSI, surge capacity 75 Litres (20 gallons). Connections - 4" (100 mm) API 5000 RTJ, Diaphragm – Hydrogenated nitrile.

IV. One (1) Pressure gauge (Make- OTECO), 0 - 5000 PSI range with 2" (50 mm) line pipe female connection, and there should be provision to isolate the gauge with a 2" (50 mm) flex seal Type valve (Make- OTECO)

V. One (1) Manual reset (type-B) relief valve, RR, 3"(75 mm) manual reset 1500 – 5000 PSI (347 Kg/sq cm) WP (Make- OTECO).

VI. One (1) Charging hose assy. for pulsation dampener

VII. One (1) Jib crane with trolley installed on pump to handle fluid end parts

VIII. One (1) Yale hand hoist, 1/2 ton LH 8 Ft lift, # 0001

E. PUMP DRIVE AND MOTOR SKID:

Single rear mounted V-belt electric motor pump drive for the offered mud pump, including extended skid frame, motor supports, tensioning screws, belt guards to be mounted on the master skid. Pumps are to be fitted with suitable sheaves (including hub) at both sides of pumps. Pump drive should be complete with banded V-belts for use with DC/AC shunt motor and belt guard.

F. PUMP DRIVE DC / AC MOTOR:

Each mud pump shall be driven by one (1) heavy-duty DC motor compatible with the mud pump.

All the auxiliary motors including lube oil pump (if any) to be supplied by mud pump supplier should be rated as follows:

Voltage 3-phase, 415 V, 50 Hz. HP will depend on pump but shall be limited to 5 HP for each motor. RPM will depend on pump. Terminal box - fitted with double compression type FLP gland suitable for cable OD 14 mm. Enclosure - flameproof, suitable for use in hazardous area Zone-I gas group IIA & IIB.

G. CONTROL PANEL:

One (1) Control Panel, for operating the Two (2) Mud Pumps shall be mounted at Driller's Console including Pump Throttle Valve and Pump Clutch Valve. Alternatively, a separate console for controlling the mud pumps, fitted with the above controls, shall be placed near the Driller's console.

H. SPARE PARTS & TOOLS FOR SECTION 7:

The spares in specified quantity as detailed in Annexure – F shall be supplied along with the unit.

One (1) no. of complete valve seat puller assembly suitable for valve seat and One (1) set of special hand tools for fluid end maintenance shall be supplied with each pump set. Suitable Stroke Counter Meter shall be provided with each pump. Also, Suitable belt tension meter for each slush pump (Refer Annexure-F).

SECTION 8: POWER PACK (MAIN ENGINES)

Two (2) Power Packs of the following specifications shall be supplied for the SCR module to power the Mud Pumps, Solids Control Equipment, Rig Auxiliaries, etc:

Each Power pack for the SCR module shall comprise of an Engine coupled with Alternator that should be unitized and enclosed in a weatherproof skid mounted enclosure. The Engine should be:

i) Compatible to power and torque trend (varying loading pattern).
ii) Compatible to SCR control and total rig environment (Ruggedness).

Engine and alternator should be load tested prior to dispatch and shall be commissioned in our field. Technical specifications of Engine and Alternator are as detailed below: -

ENGINE:

Two (2) Nos. (Make: CATERPILLAR, Model: 3512B DITA, TIER-I compliant Engine), Turbocharged, after cooled, four stroke, Air start, electronically controlled Oilfield diesel engines with counter clockwise rotation as viewed from flywheel end , capable of developing net Horsepower of minimum 1251 HP at 1000 RPM and should be capable to drive a alternator of 1215 KVA capacity. The engine should be suitable for continuous duty with an overload capacity of 10% for a period not exceeding one hour per 24 hour running. The Engines should conform to specifications IS: 10000 /BS: 5514 or equivalent. **Each power pack should be complete with SR4B Generator (Brushless), Two-Bearing free standing @1750 KVA for 50 cycles operation [For further details, please refer to Section 9, "Rig Electricals", Clause I.A.2, "Alternators].** The fuel for the engines should be readily available in India.

(1) Engines shall be compatible to Silicon Controlled Rectifier (SCR) / Variable Frequency AC (VFD-AC) drives and suitable for Land Drilling applications.

(2) Detailed dimensional /GA drawings of the Power pack including Footprint shall be submitted.

(3) Each Power pack shall comprise of an Engine coupled with Alternator that shall be in unitized condition and enclosed in a single, weather proof, skid mounted Acoustic Enclosure. Engine and Alternator shall be:

a) Compatible to power and torque trend (varying loading pattern), responsive to instantaneous load and torque changes including no load.
b) Easily serviceable in-situ and at outside the well-site Facility.
c) Of up-to-date technology.
d) Shall be able to withstand the shock and vibration associated with the frequent movement of rigs from place to place and also to withstand severe environmental conditions including heat and humidity. The Alternator rotor shall be dynamically balanced and engineered to withstand 125% load over normal load.
e) Shall be manufactured to International Standards and shall meet or exceed BIS, NEMA, IEEE, ANSI etc. requirements.
f) Engine and Alternator shall be load tested prior to dispatch and to be commissioned in Oil India Limited's drilling location.

(4) The specifications of Fuel to be used by the Engines are as follows:

High Speed Diesel: conforming to IS: 1593
Cetane No: 42.5
Gross Calorific value: 19.480 BTU/lb (10.800 Cal/gm)

(5) The Noise –level produced by the engine at full load should not exceed 75 Db measured at a distance of 1(one) meter from the source.

(6) **Acoustic Enclosure**:The acoustic enclosure shall be designed for minimum 25 db(A) insertion loss or for meeting the ambient noise standards, whichever is on the higher side. (As per guideline of Central Pollution Control Board, Januray 2008 (Ministry of Environment & Forests, Govt of India).
The DG set shall be provided with proper exhaust muffler with insertion loss of minimum 25 db(A)
Valid certificate shall be provided with the supply.

Authorised agencies for certification as per CPCB

i) Automotive Research Association of India, Pune
ii) National Physical Laboratory, New Delhi
iii) Naval Science & Technology Laboratory, Visakhapatnam
iv) Fluid Control Research Institute, Palghat.
v) National Aerospace Laboratory, Bangalore

THE ENGINE offered shall be complete in all respect with the following major components and systems mounted on it:

A) <u>Control System:</u>

Electronic Module control panel (EMCP) with suitable Battery and charging system.

B) <u>Components to be supplied with the Engines:</u>

i. Standard Tool Kit –02 sets
ii. Alternator Alignment Tool kit with Instruction Manual-01
iii. Blow-by Measurement Tool kit -01
iv. Fuel Injector Timing setting tool- 01
v. Air Restriction Measurement tool—01
vi. Heavy Duty Digital Multimeter –01
vii. Lube Oil testing Kit-01
viii. Digital Tachometer –01
ix. Belt Tension Gauge –01
x. Laptop with license password for monitoring Engine Parameters.

(7) The engine will be used as prime mover for 1215 KVA AC Generator of the Rig.

(8) The engine supplied should be complete with the following components mounted on it:

<u>AIR INLET SYSTEM:</u>
Single stage air cleaners dry panel type with soot filter service indicator, after cooler Core Corrosion Resistant

<u>COOLING SYSTEM:</u>

- High gloss black conventional core radiator (ship loose)
- Belt guard
- Radiator guard
- Blower fan
- Fan drive
- Fan pulley

- Thermostats and Housing (Dual Outlet)
- Jacket Water Pump-Gear Driven centrifugal

FLYWHEEL & FLYWHEEL HOUSING:

- Flywheel housing, SAE # 00
- Flywheel, SAE # 00
- SAE Standard Rotation
- The magnetic pick up should be mounted on the flywheel housing for speed feed back to AC control module. The resistance should be 150 Ohms. The pitch of the Flywheel teeth should be compatible with MPU tip.

FUEL SYSTEM:

- Fuel pump
- Fuel filter
- Fuel transfer pump
- Fuel line — hard, with flexible connection
- Fuel priming pump — LH
- Electronically controlled unit injectors

LUBE SYSTEM:

- Crankcase breather
- Oil cooler
- Oil filter
- Shallow oil pan
- Oil drain extension
- 2" NPT female connection

EXHAUST SYSTEM:

- Spark Arresting Muffler
- Exhaust Fittings
- Flexible Exhaust Flange & Expander
- Weld able
- Air Shielded water cooled Exhaust Manifold
- Elbow Exhaust

CONTROL SYSTEM:

- Caterpillar ADEM A3 ECU — LH, Includes adjustable speed droop capability
- Caterpillar ADEM A3 ECM, LH. Requires 24V DC, 10Amp Continuous, 20 Amp Intermittent, Clean Electrical Power
- Load Sharing Control Provided by SCR Supplier
- ENGINE GOVERNOR CONVERSION

INSTRUMENT PANEL:

Electronic instrument panel — LH

Analog gauges with digital display data for: engine oil pressure gauge, engine water temperature gauge, fuel pressure gauge, system DC voltage gauge, air inlet restriction gauge, exhaust temperature (prior to turbochargers) gauge, fuel filter differential pressure gauge, oil filter differential pressure gauge,

service meter (digital display only), tachometer (digital display only), instantaneous fuel consumption (digital display only), total fuel consumed (digital display only), engine start/stop.

SAFETY SYSTEM:

• ADEM A3 ECU monitoring system provides engine protection strategies to protect against adverse operating conditions. Selected parameters are customer programmable

NOTE:

Engine protection wiring will be done with single core 7/0.029 2.5 sq mm 660 V grade. PTFE insulated copper cable; MPU and actuator wiring will be done with two-core 14/0.2 sq. MM. 400 V grade PTFE insulated, tinned copper cable. Screen will be insulated at Engine end.

A flexible metallic conduit of size 30 mm, length 3 meter should be provided with one end fixed near flywheel housing and the other end for termination at existing alternator control box.
Wires marked 14 & 15 of engine protection system, MPU and actuator should be brought out through the conduit for termination at alternator control box .The exposed length of all the cables at terminal box end should be 30 cm. The generator breaker should trip for the following protection of the unit: -

- Low lube oil pressure
- High water temperature
- High oil temperature
- High inlet air temperature
- Engine over speed

The above protection system will be powered by 24 volts DC. All the protection switch should be of 1 NO + 1 NC with changeover type and the contact should be rated for 48 volts, 2 Amps DC.

STARTING SYSTEM:

Air starting motor RH, air pressure 90- 150 psi, Air silencer LH and Vapor Arrestor,
Air Driven Pre lube pump

GENERAL:

Vibration Dampener and guard, Lifting eyes, Fumes disposal, Flexible coupling, Coupling hub Explosion relief valve, Engine barring group, Crankcase breather, Crankcase front electronic Tachometer, Heavy duty servicing hour meter, Standard painting of the engine

GENERATOR

Brushless SR4B, two-bearing free standing 1750 kVA. Generator oversized for SCR drill rig service. 0.7 PF, 600 volt, 80 degree C temperature rise @50 degree C Ambient. Form wound, VPI insulation. Includes 1200 watt space heater, 10 ohm copper RTDs, bus bars, and coupling hub. Does not include voltage regulator. SE excited, form wound 6 lead, 0.7333 pitch. 60 hertz, 3 phase, 1000 rpm.

MOUNTING SYSTEM

• Oilfield base 7.85 m (25 ft 9 in) length
• Heavy-duty land rig inner base frame — three-point mount to oilfield base

POWER TAKE-OFFS

• Accessory drive

OPTIONAL EQUIPMENT INCLUDED

• Control System
• Governor conversion, 2301A load sharing governors

MOUNTING SYSTEM

• Inner base only

AIR SYSTEMS

• Air pressure regulator
• Heavy Duty Air Cleaners for use in extreme sand or dust. RH
• pre-cleaner fully installed. LH pre-cleaner not installed, mounting fully installed. Located at rear of engine; Pre-cleaners face downward.

COMPONENTS TO BE SUPPLIED WITH THE ENGINE ARE:

- Residential spark arresting type muffler capable of removing 55 % of all particles 10 microns or above with piping connection.
- Heavy duty radiator for industrial use, mounted on the base rail with the engine and with blower fan and fan guard for ambient temperature having capacity at least 20% in excess of total heat rejection of the engine. Heat load calculations are to be provided along with the offer for our scrutiny.
- Engine must have Inspection ports for individual cylinder heads for easy inspection, accessibility, serviceability of piston rods, big-end bearings, main bearings, cooling nozzles etc.

The engine is to be supplied with all the components & accessories fitted.

OPERATING SITE CONDITION:

The engine should be suitable for operation in desert conditions under the following site conditions –

Engine site temperature	:	41 ^{0}C. (max)
Engine site temperature	:	6 ^{0}C. (min)
Maximum relative humidity at 21^{0} C	:	100%
Maximum relative humidity at 35 ^{0}C	:	95%
Maximum relative humidity at 41 ^{0}C	:	70%
Altitude above sea level	:	150 m.
Average annual rainfall	:	343 cm.

PARTS CATALOGUE, OPERATION / INSTRUCTION MANUAL & DRAWING, TECHNICAL INFORMATION & BULLETIN:

The supplier should provide twelve set of parts list, operations manual & service manual covering all the items of each engine, alternator, flexible coupling, alignment tools & its accessories along with the delivery of the material.

TEST CERTIFICATE

The Power Packs shall be load tested at the Manufacturer's Works & Test Certificates thereof shall be provided along with the delivery of material.

SECTION 9: RIG ELECTRICALS

Make : BOMAY ; Model : JD750

Contents:

ELECTRICALS OF THE RIG : BROAD OUTLINES

Electrical Scope of the rig shall encompass complete Design, Engineering and Manufacture, Supply, Commissioning and Testing of the different electrical equipment/drives to be used in the rig with their connected loads. In addition, all current/ latest statutory Indian and International rules and regulations applicable shall be mandatory in design, engineering, application and commissioning. The electrical system of the rig shall be complete in all respect. All equipments specified below shall be new, unused, of recent manufacture and free from all manufacturing defects. Equipment should be of proven design, and running successfully under similar conditions of operation.

All supplied equipment and systems should be integrated. All equipment shall be functionally tested individually as well as integrated.

All documents, technical drawings, manuals, literatures, brochures etc. pertaining to the equipment below shall be in English language (UK or US).

The following chapters give the detailed specifications for the Rig Electricals.

CHAPTER I: SPECIFICATIONS OF ITEMS/EQUIPMENT

A. GENERAL:

Mud pumps and other auxiliary electrical system of the rig shall be powered by captive power packs consisting of turbo-charged diesel engine driven alternators. Number of power packs should commensurate with the total power to be consumed during full drilling operations with all auxiliary systems including power requirement for the site camps. The power packs shall be suitable for generating alternating voltage at 600 V, 50 Hz (cps).

Control system for the power packs and all electrical drives, lighting loads and auxiliary electrical system shall be housed inside a power control room (PCR). Various drives & equipment of the rigs will be powered from the PCR by electrical/ electronic/ digital signal, power and control cables.

A suitable integrated & proven control system (electronic, PLC based) shall be used:

- to enable the driller to control the Main drives (mud pumps) and auxiliary drives (e.g., supercharging pumps) from the D'con/ control panel, with emergency stop switches for power packs and main motor drives
- to provide real time status of various equipment parameters including engine/ alternator (of power packs), motor drives, current, voltage, power etc. (not limited to these) in an HMI display screen in the PCR house

The Electrical System of the rig should be broadly designed to operate the following major equipment:

a) Power Packs (2 nos.)
b) Mud pumps (2 nos.) with 1 no. each SCR controlled separately excited DC drilling motor

In addition, the Electrical system shall also operate the auxiliary electrical equipment as detailed below.

Features of the Control System

i) The control system shall include the main driller's control (D'CON) with control switches to control the main drive motors and auxiliary drives, various indications, meters, emergency stop switches for stopping the power packs & main motor drives, speed controllers, display screen (at PCR house) for display of main drive (mud pump) electrical status, parameters, power pack engine/alternator status and other parameters, drive fault/ status (as given in page 54 of 106) etc., but not limited to these. In addition, fault storage facility and history/ trend data should be available in the system with built-in self-diagnostic features.

ii) **The control system should be complete with all necessary software, hardware and remote communication capability. User license for all software, including hardware keys (if needed) shall be provided to Oil India Limited. Such Licenses should not have expiration dates.**

iii) **In case of failure of PLC controller system/ communication, the control system will be provided with a standby/backup control option for controlling the mud pump and auxiliary drives for sustaining emergency drilling operation.**

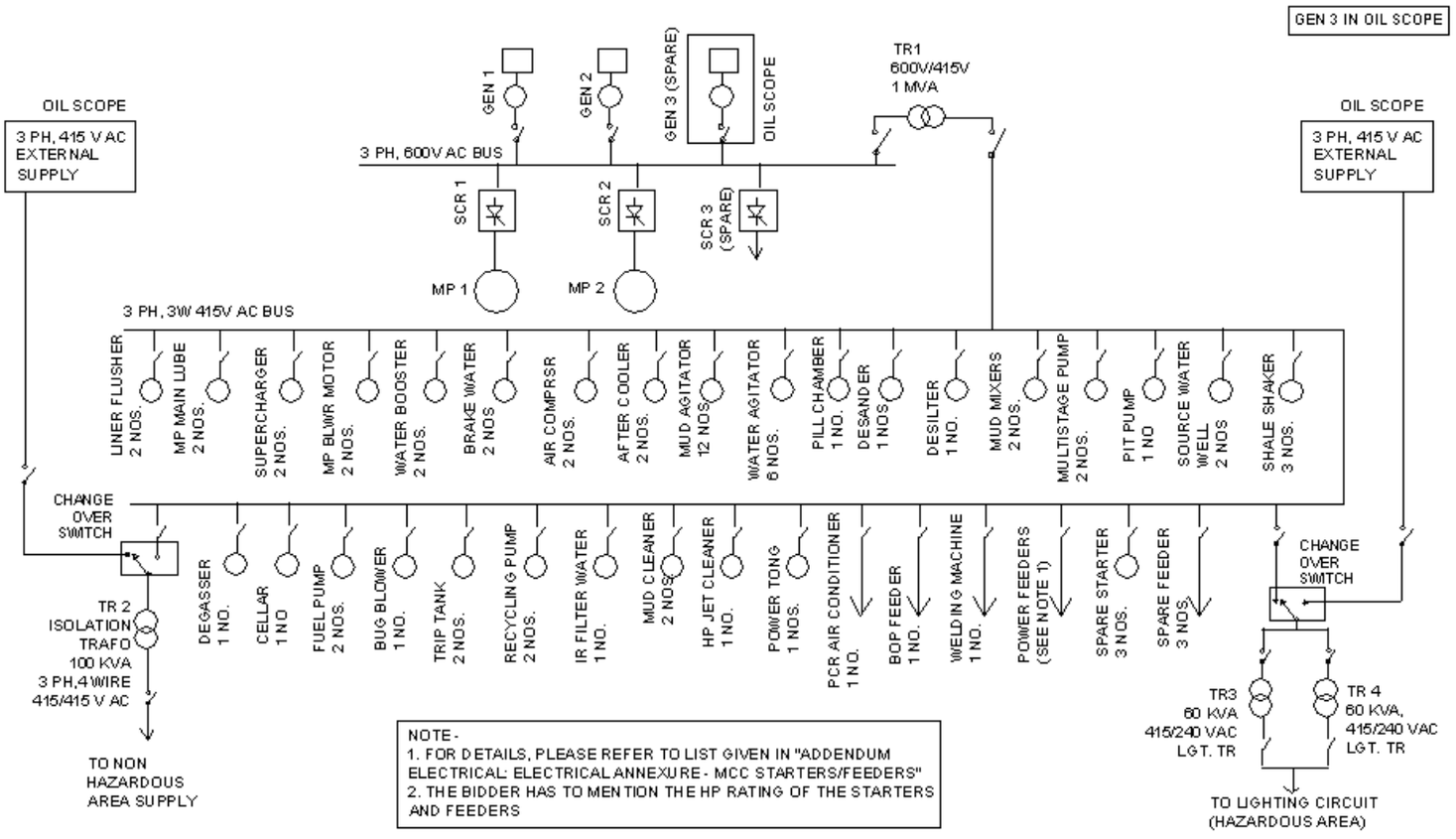
iv) The control system shall also include two Emergency Stop controllers at D'con for facilitating emergency stopping of major equipments, one for stopping the main DC drives (SCR drives for mud pumps) and the other for stopping the rig power packs.

v) The PLC controller to be used shall be suitable for communication with remote racks/modules (in D'con) and other rig components and devices, if available. In addition, fault storage facility and history/ trend data should be available in the system with built-in self-diagnostic features.

vi) The control system shall encompass the SCR drives for MP drive motors, power packs, Driller's console (for MP and supercharger drives), display/ indication of various parameters of the drives, faults, status, fault storage and history/data trends of these equipment, but not limited to these.

vii) In addition, auxiliary electrical systems for operation of the rig, viz., all electrical motors of the solid control system, rig lighting system, utility system (compressed air, water etc.), cable system including cable trays, boxes & grasshopper/ elevators, earthing system, maintenance and testing facility for control (digital/PLC) system, complete spares etc. shall be available with the rig.

INDICATIVE SINGLE LINE DIAGRAM OF PCR



I. A: Power Pack

Qty.: 2 (two) nos.
Engine coupled with the alternator shall be unitized and enclosed in a weather-proof, acoustical, skid mounted enclosure. Power packs shall be

i) Compatible for varying loading pattern, quick responsive to instantaneous load and torque changes
ii) Suitable for SCR controlled DC drives
iii) Easily serviceable both at site and at workshop

<u>Illumination of the Enclosure of the Power Pack</u>:

1. Fluorescent tube fittings shall be provided at suitable places (4 Nos., 2 x 40 Watts) for complete illumination of the interior of the power pack. Light fittings shall be Industrial type, weatherproof (IP65), corrosion-proof/corrosion-resistant and heat-resistant luminaire with transparent cover, suitable for ceiling/ suspension mounting application. The fittings shall be vibration resistant and complete with all accessories. Only fittings of reputed make shall be used, e.g., Philips/ Crompton Greaves/ GE. Fitting shall be stroboscopic type.
2. 3x 1.5 mm2 screened, EPR insulated, CSP sheathed copper cable shall be used for wiring of the light fittings. Light fittings & Cables shall be secured properly to the walls/ ceiling of the enclosure of the power pack, with provision for dismantling, in case the engine or alternator needs to be replaced. Proper glands will be used for entry of cables.

3. One metallic distribution box, fitted with 4 nos. of sockets (16 A, 415 V, 3 phase, 5 pin) – sockets internally looped- shall be fixed at a suitable height (above 1.8 m) on one side of the power pack. 4 nos. matching plugs shall be provided (one plug as incomer from the source, one no. as outgoing to other power packs, and 2 nos. for the 4 light fittings).

Complete power packs shall be load tested prior to despatch and to be commissioned in field. Technical specifications of Engine and Alternator are detailed below:

***I.A.1 Engine*:** Detailed specifications of the engine are available in Section – 8 [POWER PACK (MAIN ENGINES)].

Engine control system shall be integral to the engine. The system shall be complete in all respect including controlling/ operation, protection features with emergency shutdown etc.
Electronic load sharing governor with speed adjust, idle/run switch, and isochronous/droop switch shall be provided with the engine control panel.

I.A.2 Alternators: (Make – Caterpillar / KATO)

The Alternators shall be of heavy-duty construction, designed for drilling applications, which require heavy duty motor starting and predominantly non-linear loads such as SCRs /Variable Frequency Drives. The alternator shall be able to withstand the shock and vibration associated with the frequent relocation of drilling rigs, as also to withstand severe environmental conditions including heat and high humidity. Rotors should be dynamically balanced and engineered to withstand 125% over nominal speed.

Alternators should be manufactured to international standards and should meet or exceed BIS, NEMA, IEEE, ANSI and IEC requirements.

The power packs shall be compatible with suitable control system housed inside the Power Control Room (PCR).
The alternators (with the engines) shall be suitable for parallel operation.
The following are the minimum specifications for the alternator

Alternators shall be able to generate continuous **minimum** 1215 KVA at 600 Volts AC, 3 phase, 50 Hz, 0.7 p.f. lagging, at 1000 rpm to meet rig requirements. Detailed specifications are as follows:

1.	Rated voltage	600 VAC
2.	Capacity:	Minimum 1215 kVA (850 kW at 0.7 p.f.)
3.	Power factor	0.7 lagging
4.	Phases	3 phase,3 wire star connected with isolated ungrounded neutral, but neutral available at terminal box
5.	Frequency	50 Hz
6.	Speed	1000 RPM
7.	Duty	Continuous at 50 deg. C ambient
8.	Insulation Class	H for exciter, rotor and stator, resin vacuum pressure impregnation
9.	Enclosure	Open drip proof IP23 minimum, Terminal box IP44 minimum
10.	Temperature rise	80 deg. Celsius at full load and max. ambient taken as 45 deg.
11.	Space heater	One no., single phase, 240 VAC, 50 Hz
12.	Temp. detector	RTD type, six nos. (two per phase), preferably Copper/ Platinum having 10 Ohm/100 Ohms resistance at 25 deg. Celsius, all uniformly spaced along the stator periphery
13.	Surge suppressor	Transient surge suppressor, MOV type connected across rotating rectifier bridge output
14.	Type of cooling	Forced air type blower fan on DE
15.	Bearing	Independent two bearing design, re-greasable type
16.	Alternator waveform	Deviation factor : 5 % max Crest factor : 1.41± 0.07

		Form factor : 1.11 ± 0.05
		Harmonics content : 3 % max. (total)
		: 2 % max (individual)
17.	Voltage regulation	Voltage regulation shall be within ± 2%
18.	Voltage balance	With balanced loads, the voltage to be held within 1.0% between Phases

Constructional Features:

1. The alternator should be mounted in a single skid with the engine.
2. Rotor shaft shall have double bearing support.
3. Damper bars shall be brazed to damper winding ring and all the joints in the damper winding ring shall be brazed.
4. Drip proof enclosure and drip proof removable cover for exciter shall be provided.
5. Terminal box shall be of termite and dust proof construction with removable cover.
6. Stator leads shall be terminated on suitably rated copper straps (standoff connectors) for connection to load side.
7. Two non-corrosive stainless steel ground pads mounted diagonally opposite each other on generator frame shall be provided.
8. Plate for main cable entry should be of non-magnetic materials to avoid heating by generation of eddy currents, as single core power cable will be used for termination.
9. Insulation barrier should be provided to separate power and control terminals.
10. Two nos. eye bolts for lifting the machine should be provided on the main frame.
11. Channel mounted terminal block shall be provided for terminating the following-
    a) RTD Leads b) Exciter field leads c) Space heater leads d) Engine actuator leads, if required
    e) Magnetic pickup leads, if required f) Engine protection system leads
12. Two nos. of single core 300 sq. mm cables are to be used for each phase.
13. One no. 20 pin Amphenol/ Pyle National make socket (Part no ZREP-20-332 PN) with male pins to be provided on lead terminal box. Socket to control TB connection will be done with twenty core control cable of 2.5 mm2 CSA.
14. Cable glands shall be provided for safe and proper entry of the following cables (Number of glands is shown against the cable size).
    - 1 x 300 sq. mm power cable with outer diameter 35-36mm – 6 nos.
    - 3 x 1.5 sq. mm screened cable with outer diameter 14-15 mm – 2 nos.
    - Flexible metallic conduit for engine protection wiring with outer diameter 30 mm- 1 no.
15. All the terminals shall be labeled properly.

Technical Notes:

A. The alternator shall be **Model CAT SR4B 826** frame generator **similar to Kato model 17190 [Model 850-685351121 (C061-6619), Catalogue/ code no. 6P63150**

B. Complete power pack should be load tested prior to dispatch and to be commissioned in field.

C. Reports of following standard commercial tests performed on the alternators (in accordance with IEEE Std. 115, NEMA MG-1, or MIL-Std. 705 standards) ***shall be provided with the delivery of the material***.
   - Resistance on all windings (cold)
   - Insulation resistance on all windings
   - High potential test on all windings
   - Open-circuit saturation curve
   - Voltage balance on windings
   - Current balance on windings
   - Phase sequence
   - Mechanical balance (vibration)

- Circulating current (when applicable)
- Three-phase build-up short-circuit (conducted if the generator has a PMG or SBO)
- Voltage transient at rated kVA (voltage regulation, stability, and response)

D. *The balance details will be provided with the delivery of the material.*

I B: Power Control Room (PCR)

Power control room shall house controls for main drives and auxiliary drives of the rig.
Features:

- Shall house the following:
  - Generator control panels, thyristor (SCR) drives, field and auxiliary motor control panels [auxiliary motors of DC drilling (Mud pump) motors, solid control system, air compressors, water pumps etc as shown in the single line diagram of PCR]
  - One Main transformer (capacity 1 MVA)), 2 nos. lighting transformers and 1 no. isolation transformer
  - Aviation (white) light controller
  - 3 Phase Motor Control Centre
  - Plug socket compartments for interconnection with various main and auxiliary loads.
  - Any other electrical system necessary for operation of the rig electrical equipment, if required
- Outdoor type, weather proof
- Transportable, steel house on self supporting oil field type skid, suitable for bottom lifting

PCR shall have the following dimensions for the structure (not including projections due to door handles, rain protection canopies, light pole brackets etc).

Limiting Dimensions: Length 12.0 mtrs. x Width 3.0 mtrs. x Height 3.1 mtrs.
Limiting weight: 28.0 Tonnes
(Note: Refer Section – 11 for more details)

Constructional features:

The power control room should be an out door, weather proof, transportable steel housing with self supporting skid suitable for oil field application and should not be weighing more than 28 Tones.

PCR should be designed for lifting from the bottom. In addition to this top lifting arrangement shall also be provided.

PCR house columns and ceiling frame to be constructed from structural steel seam welded. The outside shall be fabricated from twelve-gauge sheet steel. All corners are to be formed by bending leaving no sheet edge exposed. Roof of the PCR should have proper slopes so that no water logging takes place during rainy season. Also, the PCR, particularly the socket boards, shall be designed to withstand effects of torrential rains (prevalent in the region for eight to nine months a year) lashing at up to 45 degree inclination to the vertical.

Walls to be insulated with three-inch thick polystyrene block insulation. The floor and the wall with the receptacles and plugs will not be insulated. The inside surface of the walls will be finished with a sandwich style insulating board three eight's of an inch thick with white pebble coating on the interior side and aluminum foil on the exterior side. A rubber neoprene mat should be provided over the **full floor area of the house.**

Bus bars should also be accessible for maintenance, if required. PCR panel line-up should be such that the PCR is load balanced for easy lifting, with CG in the centre.

Plug panel for the Generator and DC motor cables to be provided on the front side plug panel (side facing the DW). In case it is difficult to provide generator plug panel on front side then standard

arrangement of CPTDC i.e. generator plug panel recessed type on the side facing power packs can be provided but height of the plug panel should be around 1.5 mtrs from bottom of the PCR.

Fluorescent lighting fixtures (2 x 40 Watt) is to be provided for interior lighting. Four- (4) numbers of 240 volt Phase – Phase duplex receptacles (suitable for Indian style plug pins) to be included, two at each end of the house. The PCR shall be equipped with two portable (for working in panels) emergency lights which shall adequately light up the PCR in the event of a blackout. Additionally, two emergency lighting fixture with EXIT signs to be also included at each end of the House.

Two- (2) doors with anti panic hardware will be furnished - one at each end and on opposite sides of the house. Both doors shall be designed to open to the outside by pushing on the crash bar. Doors should have a rubber sealing lining.

Suitably sized and rated spreader bars and slings shall be provided with the PCR for bottom lifting.

Surface preparation: Surface finishing should be Commercial Metal Blast Grade (SSPC-SP-6) 1.5 to 2.5 mils anchor profile before primer painting. Primer and final top coat shall be of premium quality. Top coat colour will be urethane linear white.

Over all dry film thickness of the painting should not be less than 8 mils (200 microns).

Surface preparation and painting shall be adequate for the harsh rainy & humid environmental conditions.

The PCR shall be fitted with adequately rated tinned copper bus bars, insulated with sleeves, cable alleys/trays and vertical bus chambers.

Hardware for all bus connections shall be of stainless steel bolts, aircraft type locking nuts with nylon inserts suitable for bus bar operating temperature at full load or alternatively hardware with plain & spring washers to be used.

Major components of PCR:

a) PLC System

MAKE AND MODEL: SIEMENS SIMATIC S7-300

The programmable logic control panel shall perform the following minimum functions and have the features for overall SCR control, interlock with accessories and monitoring.

- The System Host PLC shall be a high speed, versatile modular PLC. The PLC shall be suitable for communication with remote racks / modules (wherever provided) and other rig components and devices, if available.
- All SCR drives will be on a common communication link with the PLC which will allow the user to monitor all SCR bays on the touch screen.
- The PLC system shall have provision for twisted pair cable for communication with the remote Racks in Driller & MP Console. If required signal repeater shall be provided. The controls including PLC should be suitable for the maximum required distance from PCR to Driller Console.
- The PLC shall have provisions for interfacing with the LAN. Interface with controls and indicators of the driller's console via the field I/O units. PLC shall provide status, alarm and diagnostic tools via local annunciation functions. PLC will provide automatic starting of Mud Pump auxiliaries with indicating lights on console. The supercharger pumps shall be started & stopped manually from Driller's Console.
- PLC shall have touch screen display panel (at the PCR) for all miscellaneous indications for all generators & all SCR panels, indications for various drives, ground faults, power limits, Driller assignment, Hour meter, current & voltage metering, trending of historic data & faults etc.
- PLC cubicle should be provided with CVT of adequate rating to avoid any effect of SCR system harmonics.

Components of the PLC system:

The PLC system shall mainly consist of the following:

- Modular Mini-PLC **(Siemens S7-300)**
- 32 Bit, Fixed & Floating Point CPU
- Up To 1024 Digital Inputs / 1024 Digital Outputs
- Up To 256 Analog Inputs / 256 Analog Outputs
- Complete Instruction Set With "Built-In" Functions
- Built-In Self Diagnostics
- System Status & Alarms When Used With Remote Display Screen
- Fiber Optic Communication Capability
- Remote Graphic "Touch" Screen Display

Touch Screen:

A touch screen / soft button display screen should be provided in the PLC cubicle. The following represents data to be displayed preferably on multiple screens. **MAKE AND MODEL: SIEMENS, MP377**

Miscellaneous indicators (MAKE AND MODEL: SCHNEIDER & GE)

PLC System Communication OK
Generator ON (For each Generator)
Ground Fault
% Power Limit (rig power packs)

SCR Indicators (To be repeated for each SCR panel in separate screens)

SCR ON
Bridge Temp Switch
Blown Fuse
Bridge Current meter
Bridge Voltmeter
Speed Reference

Mud Pump Indicators

MP 1, MP2 Field status
MP 1, MP2 Auxiliary (Main Lubes) status – If main lube motors are available.
MP1, MP2 Blowers status
MP 1, MP2 Auxiliary (Liner Flushers) status – If main lube motors are available.
Charging Pump 1 ON
Charging Pump 2 ON
MP1, MP2 field current
MP1, MP2 armature current

Generator Cubicle Indicators (Repeated for each Generator Cubicle)

Running Hours for Power packs

b) Generator control panel (Qty : 3 panels)

The control for power pack engines (ECM – Engine Control Modules) should be integral to the engine (detailed specs for control of power packs are available elsewhere in this order).
Generator control panel shall be suitable for operating/ controlling/ protecting the generator. The generator control system shall be suitable for control of the generator, individual running or paralleling & load sharing with other power packs. There shall be one alternator control panel per alternator with one additional spare panel, complete in all respect. All control switches, devices, and meters should be available on the front fascia of the panel.

Generator control panels are to be fitted with the following:

i) Generator control unit (package) –for operation, control, metering and protection of alternator
ii) Voltage regulator with voltage adjust rheostat
iii) Withdrawable type incomer air circuit breaker of sufficient nominal rating, breaking/ withstand and making capacity, manually chargeable, electric closing, with solid state trip unit, UV release and necessary auxiliary contacts. Breaker should be interchangeable with SCR converter panel breakers.
iv) Breaker ON/OFF pushbuttons
v) Engine control switch OFF-IDLE-RUN (this switch shall duplicate with the OFF-IDLE-RUN switch in engine control panel).
vi) Meters- Analog Ammeter and Voltmeter with selector switch, KW meter, KVAR meter, Generator Hour meter, Alternator Temperature meter, engine actuator current meter. **However digital display for all the parameters may be fitted as an ADDITIONAL option**.
vii) Indication lamps-Gen. RUN, Gen. ON-LINE, Gen. SYNCH, Gen. TRIP, Engine TRIP
viii) Control Transformers, fuses, links, terminal blocks etc.
ix) Any other Electronic control system for remote communication with other devices/ equipment
x) Synchronizing controls consisting of reverse power relay, synchronizing lights and switch- on one panel only (if the synchronizing control system is placed in one of the generator panels)

Each panel should be fitted with the following meters

- Each panel should be fitted with the following meters
- Alternator Ammeter 0-1500/2000 A (selectable for all three phases)
- Alternator Kilowatt meter 150-0-1500/2000 KW
- Alternator Kilovar meter 150-0-1500/2000 KVAR
- Alternator On-line lamp
- • Alternator running lamp
- • Engine cumulative running Hours meter
- • Alternator temperature meter and switch

Voltage regulator with the following-

- Electronic AVR
- The voltage regulation is to be limited to 3% droop (Max.)

Suitable kVAR load sharing scheme should implemented.

<u>Alternator Protection features:</u>

The alternator protection features include:

- Overcurrent – Set to trip at 110% of max. rated current
- Overvoltage – Set to trip at 116% of alternator terminal voltage (600 V), with 10 mSec. delay
- Overfrequency – Set to trip at 110% (i.e. 55 Hz) of rated frequency (50 Hz)
- Underfrequency – Set to trip at 42 Hz (16% below rated)
- Reverse Power – Set to trip at 8-10% of rated kW

Each alternator-engine control panel should be independent and complete in all aspects with switching and control devices. Loss of one panel should not affect the others. However, they will communicate with one another for load sharing.

PLC input – The alternator indications (including breaker status) should also be available on the PLC HMI display at the PCR.

c) SCR (Thyristor) Panels (MAKE AND MODEL: ROSSHILL 1400) (Qty : 3 panels)

The PCR shall house minimum 3 (three) nos. of SCR panels of sufficient capacity. The SCR Control system and bus bar shall be suitable for driving two Mud pumps (each mud pump driven by one DC motor).

SCR controlled drive panel should preferably be of standard NOV/Ross Hill design with analog DC regulator modules for shunt motors. All motors will be 1000 HP/1250 HP, 750 V DC, separately excited shunt wound motors of BHEL 4903CX / GE 752R models.

All necessary protection like SCR heat sink over temperature, over current suppression etc should also be incorporated in the respective panels.

Each SCR panel shall consist of the following main equipments:

- **1600 A** (indicative) rated ACB rated 600V AC, 3-pole, 50 Hz, 65 KA with adjustable trip, Draw-out type. Each breaker to be manually Chargeable, electrically closed and electrically tripped and with auxiliary contacts.
- The SCR Panel circuit breaker to be directly interchangeable with the Generator incomer circuit breaker. (The SCR breakers will have the same auxiliaries as the generators.)
- Voltmeter, 0-1000 VDC
- Ammeter, 0-2000 ADC
- SCR "ON" indicating lamp, (Red) LED type
- Logic circuit with LEDs
- 6-pulse, 2000 amp @ 750 VDC, vertical forced air (with blower fan) cooled SCR Bridge. The bridge shall be protected using semiconductor type fuses with form C contacts, which are activated when the fuse opens.
- Surge Suppression "ON" Indicating Lamp (Green) LED type.
- AC bus surge suppression module to clamp any transient voltages that may be damaging to the SCR devices- the surge suppressor to consist of a fused enclosure of metal oxide varistors (MOVS). Each SCR panel should have individual surge suppression MOVs connected in Delta mode.
- Set of DC contactors. DC contactors should be suitable to break full current at rated power. GE Series IC2800 or Siemens Type 700 contactors shall be provided. CPTDC to furnish full details of the proposed contactors.
- Cubicle Space Heater (To be “ON” when SCR is not in operation)
- Analog DC Module of Ross Hill design for shunt motors for firing control of the SCR drive. Full details of analog DC modules to be furnished along with the offer.
- 3 phase 600 V AC twin blower unit for cooling of the SCR bridges. SCR panel operation to be interlocked with blower. In case blower failure takes place during SCR working, SCR breaker to trip.
- The rating of the blower must be adequate for proper cooling of the SCR bridge.
- Field interlocks such as field loss contacts etc to be included in the system design so that operation cannot be done in case field loss relay does not pick-up.
- Drive / assignment fault alarm should be available in the PCR with external electrical hooter.

Communication & Input/ Outputs:

- Programmable analog and digital inputs, outputs, relay outputs
- Trouble indication: automatic memory / enquiry from software
- Hardware I/O connection for safety and monitoring functions
- Communication interface with driller’s control/ cabin

d) Field Supply Cubicle – (Make - Ross Hill)
Field supply cubicles shall also be housed in the PCR for external field supply units for the DC motors.

Mud pump field supplies shall be designed to facilitate operation of both motors. Field supply transformers should have tappings for adjustment of field current of the DC motors. Required fused protection for transformer primary and secondary should be provided.

Field currents & voltages should be adjustable/ selectable to match the DC motor requirements of various makes of motors (BHEL 4903CX / GE 752R models).
DC motor Field supplies shall also have Hands-Off-Auto (HOA) switch to facilitate energizing of field supplies without assigning drilling function. In Auto mode required MCC interlocking should be built into

the field supply circuits to ensure that field is energized only after DC motor blower (and in case of pumps, lube/ flusher/ oiler systems) picks up.

All field supplies shall have independent DC ammeters on the cubicle door.

The field supplies should have the following features:

- Shunt Field Over temperature protection and alarm
- Field or cable short fault alarm and shut down
- Field or cable open alarm and shut down.
- On-board LED display for setup and monitoring
- Adjustable/selectable field settings

The equipment to be consisting mainly of the following:

- Hand-Off-Auto selector switches for field supplies
- Field current ammeters for all motors
- Padlock Lock Out Devices

e) Hands Off Cranking Circuit (HOC)

The HOC shall supply power for the engine starting circuit and the pulse pick-up circuit in each of the engine generator modules with the following:

- 2 nos. – 12 VDC batteries
- 1 no. – Battery charger PC card
- 1 no. – Double pole circuit breaker

f) Synchronizing system

One Synchronizing switch shall be provided with positions for each generator, bus and off. This should be visible from all alternator control panels, and allow each alternator to be brought on-line. The panel shall feature the following minimum instruments:

- Synchroscope
- Synchronising lamps – clear (dark lamp synchronizing)
- Voltmeters for incoming generator and running (bus)
- Frequency meters for incoming generator and running (bus).
- Synch. Check system to check either two phases or there should be additional phase sequence check

Sync Check Relay:

There shall be a synch-check relay to allow alternator to be synchronized with the bus. The circuit breaker “close” signal shall be interlocked with this relay.
Synchronization system may be placed in one of the generator panel front fascia or independently.

g) Power Limit Controller

The Power Limit Controller is to be provided to monitor the KW & KVAR/current of each of the engine – generator sets. If either of these parameters reach its limits, the Power Limit Controller shall reduce the power being delivered to the loads, so that the load on each generator is held at its limit until the loads on the SCR drives are reduced (by other action) to a level below the generator limit. The Controller will allow for adjustment of each parameter independent of the other.
The range of adjustment will allow the Power Limit to be lowered to 80% or raised to 110%.

h) Ground fault detection system

Ground fault detection system consisting of the following items;

i) 600 VAC ground fault detection
Ground fault detection circuit, 3 nos. ground fault lights (for each phase), percentage AC ground fault meter

ii) DC ground fault detection
DC ground fault detection system with percentage DC ground fault meter (+/0/-), test pushbutton

iii) 415 VAC (AC auxiliary bus)- with NGR system

All ground fault alarms shall be audio as well as visual.

In the 415 V auxiliary bus, IT system of neutral grounding with maximum ground fault current limited to 750 mA using suitable NGR as per IE Rules is to be used. All breakers, MCCB shall be suitable for IT system as per IEC 947-2. The neutral shall not be served and supply from the 415 V MCC bus shall be 3 Phase & 3 Wire.
CBCT type earth leakage relays are to be used in the output of the main supply transformer, contacts of which will be used for ground fault alarms.

For 415 VAC system, individual earth leakage devices shall be provided in each starter/feeder panel.

i) Air conditioning

The PCR will be air conditioned and humidity controlled. The ambient air is expected to vary from 6 Deg C to 41 Deg C.

The air conditioning for the PCR shall be 2 x 7.5 Ton and air conditioning units located to take into account the heat generated by internal equipment in full load conditions in high ambient locations. Air conditioning system components shall preferably be located on the same skid as the PCR.
In case AC units require dismantling during transportation (e.g. roof mounted ACs/ separately skidded) the ducts/ mating faces shall be adequately blanked off and proofed against torrential rainfalls prevalent in the North-Eastern parts of India for eight to nine months a year.
The temperature inside the PCR shall not exceed 25 deg C under full load conditions and maximum ambient temp. The humidity should be considered for a maximum of 100%. The AC system should have 100% redundancy.

Make : TRANE 7.5 Ton Air Conditioner ; Model: TTA090A300FA / TWE090A300EL

j) Driller's control console (D'CON)

Driller's control console or D'CON shall be an integral part of the control system.
The D'CON should consist of the following minimum controls and display functions.

- Control switches and speed controllers to control main drive motors (for mud pumps)
- Indicators and meters
- Start/ stop control of Supercharger pumps
- Emergency stop switches

The PLC shall provide diagnostic tools via local annunciation functions.

In case of failure of PLC controller system / communication, the control system shall be provided with standby / backup control option for controlling the mud pump and auxiliary drives for sustaining emergency drilling operation. The backup select option shall be provided in the D'Con.

The D'Con shall also include two Emergency Stop controllers for facilitating emergency stopping of major equipments, one for stopping the main DC drives (SCR units for Mud pumps) and the other for stopping the power packs.

The D'Con shall be pressurized (air charging system), and always at a positive pressure with respect to the atmosphere. It should be suitable for Hazardous area Zone 1, Gas group 2A and 2B.

There shall be a selector switch (DCON/MPCON) on the DCON for choosing the point of control between DCON and MPCON.

k) Transformers (Power, lighting/ air-conditioning and isolation)

These shall be specially built dry type class 'H' insulated, copper wound Dry-type transformers. Impedance shall be matched to 5 percent. The transformer shall be used to power the auxiliary AC bus of PCR for supplying the auxiliary AC loads (Details of loads are given later-*"Annexure- MCC Starters/ Feeders"*).

The transformers will operate in places of high moisture and high dust. The enclosure should be adequate for these conditions. The transformer, in its enclosure shall also be able to withstand vibration of moderate to severe levels.

Specifications:

i) Main Transformer: MAKE AND MODEL: BOMAY, 1000KVA TRANSFORMER ; QTY:1

1 (one) No. main transformer, 1000 kVA minimum, continuous rating (Alternatively, two transformers with combined equivalent capacity of 1000 kVA or more, with identical % impedance for parallel operation), copper wound, air cooled to meet the auxiliary motor/ Air conditioner and lighting / other load requirement as described in the starter/feeder list of PCR.

- Capacity – 1000 kVA minimum, continuous rating
- Voltage – 600/415 volts
- Vector Group – Dyn11, Star connected secondary
- Frequency – 50 Hz
- Phases – 3 phase
- Impedance – 5% for connection
- Ambient temperature – 50 Deg C
- Temperature rise above ambient – 115 Deg C. The transformer shall not exceed this temperature rise when operating continuously at full load capacity.
- Insulation – Class H (or 220 Deg C)
- Cooling- Air Natural cooled
- Rated power freq. withstand – 3 kV (RMS) or better

Standards – Indian Standard IS: 11171/ or equivalent international standard
Primary and secondary side terminations:

1. Three nos. of single core cables for 600V side and three nos. of single core cables for 415V side.
2. Size of cable: 1x 300sq.mm flexible copper with O.D. -36mm for all phases.
3. Stand off copper termination (termination using copper flats) shall be provided. All cable lugs shall be terminated using removable nut and bolts.

The transformer shall be supplied through suitably rated MCCBs in the primary and secondary sides.
The Transformer shall be placed at suitable positions, taking into consideration working space, socket board positions, equal distribution of weight of the PCR etc.

ii) Lighting supply transformers for mast and rig lighting (hazardous area lighting):

MAKE AND MODEL: BOMAY, 80KVA 415V:240V TRANSFORMER *QTY:2 nos*.

2 nos. lighting supply transformer [fed from the main 415 VAC bus of PCR], Minimum 60 KVA, dry type, 415 V/ 240 V phase-to-phase, 50 Hz, copper wound, air cooled to meet the lighting load, as per the following broad specifications:

Quantity – 2 (Two) transformers
Capacity – 60 kVA each, continuous rating
Voltage – 415/240 volts (Phase-to-Phase)
Frequency – 50 Hz
Phases – 3 phase
Impedance – 4%
Vector Group – Dyn11, Star connected secondary, neutral available for connection
Enclosure – IP23 type, with provision for natural circulation of cooling air.
Ambient temperature – 55 Deg C
Temperature rise above ambient – 80 Deg C
Insulation – Class F
Rated power freq. withstand – 3 kV (rms) or better
Standard – Indian standard IS: 11171

Primary and secondary side terminations:

1. One no. of 3 core, 35 mm2 cable for 600V side and one no. 3 core, 35 mm2 cable for 240V side.
2. Stand off copper termination (termination using copper flats) shall be provided. All cable lugs shall be terminated using removable nut and bolts.

The lighting transformer secondary shall be connected to a suitable lighting distribution board, located on the MCC.

iii) Isolation Transformer:

MAKE AND MODEL: BOMAY, 100KVA TRANSFORMER , *QTY:1 no.*

1 No. 100 kVA dry type isolation transformer with the same specification as the lighting transformers, except the following:

Quantity – 1(one) transformer
Capacity– 100 kVA, continuous rating
Voltage – 415/415 volts, Dyn11, neutral available for connection.

The isolation transformer shall be used to supply the general rig area lighting, crew camp supply and auxiliary loads which need a 240 V phase-to-neutral connection. Neutral of the isolation transformer shall be grounded solidly.
Primary and secondary side terminations:

1. Two nos. 3 core, 35 sq. mm cable for 415 primary side and two nos. 3.5 core, 35 mm2 cable for 415 V secondary side.
2. Stand off copper termination (termination using copper flats) shall be provided. All cable lugs shall be terminated using removable nut and bolts.

iv) All the transformers shall be supplied through suitably rated MCCBs in the primary and secondary sides.
v) All live parts of the transformers not insulated shall be protected adequately.
vi) Transformers shall be placed at suitable positions, taking into consideration working space, socket board positions, equal distribution of weight of the PCR etc.

l) Motor control center (MCC)

MAKE AND MODEL: BOMAY, GCS

The starters as given in *"Annexure- MCC Starters/Feeders"* are to be incorporated in the PCR. Physical line-up of the MCC panel shall be opposite to the generator/SCR/field panels.
Motor control center or MCC shall be fed from the auxiliary 415 AC bus in PCR (fed from the secondary of the main 1000 KVA transformer) through a suitably rated MCCB. This MCCB shall be 4 pole for

supplying the TPN bus. As “IT” system of neutral grounding shall be used (detailed below), neutral will not be served. However, neutral bus is to be retained.
The bus system shall consist of tinned copper bus, bus chamber and cable alleys in a suitable arrangement. Panels shall be in vertical configuration. Busbars shall be adequately rated. A voltmeter and 'bus bar live' indicator lamp shall be provided to indicate the bus status. Bus shall be accessible for maintenance. Bus bars should be insulated.

Various auxiliary motor drives, PCR lighting and air-conditioning system shall be supplied from the MCC panel through switchgear.

MCC specifications:

i) MCC starter panels shall be suitably rated to cater to auxiliary electrical drives. These shall be draw-out type panels, containing suitably rated MCCBs, contactors, thermal overload relays, earth leakage circuit breaker, ammeter, OLR reset push button, Hand-Off-Auto selector, indication lamps etc.
ii) Automatically controlled starters for blower motors and mud pump lubrication/auxiliaries have facility of manual start / stop from panels. A selector switch Auto-Off-Manual shall be provided for these starters. The interlocks of blower starters and mud pump lubrication/auxiliaries shall be available for interlocking in respective main DC drive controls. All other starters are operated from push button station mounted near the respective drives. Superchargers shall have on/off control at D’CON.
iii) Components shall be mounted on sheet steel base and all apparatus shall be suitable for front removal. However, ammeters and indication lamps may be mounted on panel doors. MCCBs, HOA, ELCB reset, PBS reset switches etc. shall be suitable for operation from outside, without opening the panel door. Starters shall be provided with individual cubicle; however 2-4 Feeders can be combined in one cubicle.
iv) All the starters for AC motors (except LMSS/LMMC, BOP, Bug blower & centrifuge) irrespective of rating are to be housed in the MCC panel of power control room and only push button stations with On/Off controls are to be located near respective equipment. All motors and push button stations will be directly connected to the power control room through individual cables and plug sockets.
v) When the selector switch is in “Auto” position, an initiating contact from DC drilling motor starting control circuit shall start the auxiliary motor. In the “Hand” position, the motor shall be started immediately without any interlock.
vi) Each individual starter panel/lighting/ AC unit feeder panel shall be provided with an earth leakage circuit breaker which shall cut off the power supply in case of an earth fault in that particular circuit. Trip setting should be at 300 mA.
vii) All breakers/ MCCBs used in the MCC shall be suitable for IT system as per IEC 947-2 / IS 13947. All breakers, MCCBs used in the MCC shall be suitable for disconnection and shall have positive visual isolation. The neutral shall not be served and supply from the MCC bus shall be 3 Phase & 3 Wire.
viii) IT system of neutral grounding shall be used in the PCR. As per IT system, line to neutral supply cannot be used and hence individual control transformer (415V/110 V) shall be provided for each starter panel. Earth leakage protection shall be provided on the secondary side of the control transformer for all starters with external/remote PBS for protection of PBS circuit from earth leakage. Control Transformer secondary should be connected to ground.

ix) **Broad Specifications:**
- Bus voltage – 415 Volts AC
- Bus current (nominal) – 2000 Amps (indicative)
- Bus material – Copper bars, insulated
- Spare cubicles – As per list
- Cubicle type – Drawout
- Bus Fault Level –Suitably rated

x) **MCCBs for starters/ feeders**- **MAKE AND MODEL: SCHNEIDER, MERLIN GERIN** - All starters and feeders shall have individual MCCBs as incomers, fitted with a RCD, as the primary device for protection and isolation except those started with the soft starters. However, for the soft starter started motor groups, there will be a single incomer MCCB per group, with sufficient current carrying

capacity for simultaneous running of all motors in the group at full load. There shall be one soft-starter for a group of maximum 4 (four) similar sized motors. **Fuse systems instead of MCCB will not be accepted.**
MCCBs shall be connected to the Busbars through copper bus links.
Features –

- The MCCBs should be suitable for DOL motor starting (Induction motors) for all motors below 55 KW/ 75 HP.
- Control supply of individual starters shall be tapped from its own line, the starter shall be in-operative if the MCCB is off.
- The MCCB shall have clear ON/OFF/TRIP positions.
- The MCCB should have facility for time delayed-Overload protection (adjustable 0~10 sec, 0.4~1.0 In), Short circuit protection (10 In), and RCD (earth leakage detection device) with trip setting of 100 mA and 300 mA selectable
- MCCB should be of Line-Load reversible type.
- Operating handle should be accessible from the exterior of the MCC cubicle, with the door shut.
- The MCCB will be of fixed mounting type.
- Starters including 55 KW / 75 HP and above shall be provided with a soft starter, with suitable contactor arrangement.
- All the power cable terminations are to done with proper colour coded terminal blocks (R phase (phase-1)-Red, Y phase (phase-2)-yellow, B-phase (phase-3)-Blue

In addition, all starters shall have at least the following protection/ features:

- Contactor
- Remote (Push Button Station) PBS/ Hand Off Auto feature as required
- Control Circuit voltage shall not exceed 110V
- Control Circuit including Remote PBS shall have earth leakage protection

The selection of MCCB, contactors and relays for the starter panels shall be as per Type 2 co-ordination (IS 13947 or IEC60947).
All components fitted in the starter panels should be preferably of a single make.

Each motor panel should have the following minimum components located on the front fascia

- One overload reset button,
- MCCB operating handle / lever with TRIP, ON, OFF positions marked,
- LED Indication lamps (with LVGP feature) for motor ON/OFF/OVERLOAD,
- Selector switch for HAND / OFF / AUTO for required starters
- One ammeter to indicate motor current

All MCCB shall be suitable for secondary injection testing of tripping characteristic by a test kit.

xi) **Rig Lighting Supply:**

Secondary side of the lighting transformers (415/240 VAC, phase-to-phase, supplied from the AC main 415 bus) shall be connected to the 3-phase rig lighting DB through a TP MCCB of suitable rating. The lighting DB rating shall be sufficient for supplying the full rig and mast lighting. All outgoing feeders from the DB shall be 240 VAC, phase-to-phase, 2-pole MCB units, with built-in residual current protection (RCBO), tripping at 300mA.

xii) **PCR Lighting and air-conditioning supply:**

The feeder for PCR lighting/air-conditioning supply, supplied from the 415 VAC bus, shall be connected to a TPN DB through a TP MCCB of suitable rating. The TPN DB rating shall be sufficient for supplying the air-conditioning units (total connected) and full PCR lighting.

xiii) **Internal Cabling**
All internal wiring of the MCC starter panels shall be done with min 1.0 KV grade fire retardant PVC insulated tinned copper multi-stranded flexible cables with proper lugs.

xiv) **Push Button Stations**

Push Button Stations shall be provided, containing Emergency Stop / Lockout pushbuttons, Local-Remote and Start-Stop push buttons for local control of Electrical equipment. The PBS should have facility for lockout of the motor in order to enable maintenance work to be done. All PBS should have IP66 type protection and canopies for rain shade. All PBS should satisfy requirements for installation in Zone 1 Hazardous area, Gas groups IIA & IIB.

m) Plug and Socket Panels

Suitable plug and socket arrangement shall be provided for interconnection of the PCR with alternators, motors, auxiliary loads, PLC remote interfaces etc. with cables. Socket compartments shall be suitable for ease of quick rig-up and rig-down operations. Matching plugs will be fitted in the cables.
Socket compartments should be located to either end of the PCR. Alternator and DC motor power and control cable socket board shall be towards the derrick. However, the socket board for auxiliary motors may be placed on either end of the PCR. In case AC units are situated in the end, auxiliary motor may be placed in the side of the PCR. The plug / socket compartments shall be well illuminated and suitably marked for ease of identification of circuits / loads. Make of Plug-Socket: APPLETON
The plug sockets cable termination shall be crimped type. Horizontal steel bars shall be provided in the compartments for supporting the layers of cables.

Apart from the above, a spare set of 3 single core 1000 A sockets shall be provided in the main socket board, which will be wired up from the 600 VAC main bus through a suitably rated MCCB.

n) Type of Earthing:

IT system of neutral grounding with maximum ground fault current limited to 750 mA using suitable NGR as per IE Rules is to be used. All breakers, MCCB shall be suitable for IT system as per IEC 947-2. The neutral shall not be served and supply from the main MCC bus shall be 3 Phase & 3 Wire.
Main Transformer output shall be provided with a Residual Current Monitor (RCM) for indication/ alarm. Scheme, Type, Make and Model of RCM shall be approved by OIL.
Earth leakage detection and tripping not exceeding 300mA is required in all starter/feeders.

o) NGR System:

A single NGR on the neutral bus shall be provided. The NGR system shall have the following features:

- Maximum earth fault current is 750 mA
- Restricted earth leakage protection at 1000 kVA transformer star connected secondary

NGR shall be provided with a NGR monitoring device of reputed make (Bender RC48N or equivalent) with audio-visual alarm in the PCR for monitoring NGR continuity and leakage current. Scheme, Type, Make and Model of the NGR device shall be approved by OIL. NGR scheme shall be a failsafe system and shall not let the leakage current to exceed 750 mA.

I. C. DRIVE MOTOR SPECIFICATIONS:

I. C. 1: MUD PUMP DRIVE DC MOTORS (MAKE AND MODE: GE, 752)

DC drilling motor suitable for heavy duty slush pump application
Quantity: Total 2 nos., 1 each for 2 mud pumps
Type: Ex-p, pressurized enclosure, suitable for use in hazardous atmospheres, Gas groups IIA & IIB.
Electrical rating: 750 V DC motor, 1000 HP (indicative, minimum)
RPM at continuous horse power:1085 HP
Temp. rise: Class H
Duty: Continuous drive with constant torque, at 55 Deg. Centigrade
Stator insulation: Class H
Bearing: Two heavy duty roller bearing, re-greasable

Motor should be complete with the following:

- Main terminal box with IP56 protection
- Differential pressure switch for pressure sensing
- Blower assembly with suitable capacity explosion proof blower motor, 415 VAC, 50 Hz rated
- Space heater

I. C. 2: AC AUXILIARY MOTORS

Motors shall be rated for 415 Volts 3 phase AC, 50 Hz supply. All motors are to be flameproof /explosion-proof, weather proof and conforming to IP65 suitable for use in Zone 1 & 2, Gas groups IIA & IIB [as per Indian & European (CENELEC) Standards] or Class 1, Div. 2, Gas groups C & D [North American Standards] Hazardous areas of oil mines.
Motors to be used in the Hazardous areas of the rig, as classified by DGMS (India), shall be approved by DGMS (India) for use in such areas.
Motors shall be fitted with FLP/Exp double compression cable glands, terminal studs and earthing leads for connection to common earth bus.
Plug-in type connections are not permissible at motor end.

I. D.: CABLES

Various sized cables shall be used for connection of alternators of power packs, Drilling motors, AC auxiliary motors, lighting fixtures, D'CON, electronic control system and its components. All cables shall be suitable for use in oil field environment.

All cables to be used in Hazardous areas of oil mines should be approved by DGMS (India).
Refer Electrical Annexure-Statutory for details of cables.

a) Alternator power cables, DC motor power cables, main transformer cables shall be single core, multi-stranded, flexible, minimum 1000V grade, unscreened copper cables with EVA (Ethyl Vinyl Acetate rubber) insulation and EVA (Ethyl Vinyl Acetate rubber) sheath. These cables should be heavy duty, acid, oil and abrasion resistant, flame retardant.

b) Auxiliary AC motor/ 3- phase electrical equipment cables shall be multi-stranded, minimum 1000 V grade, flexible, ethylene-propylene rubber (EPR) insulated, HOFR elastomeric CSP sheathed, either individually or collectively copper screened, 4 core copper conductor cables with fourth core having 50% conductivity of the largest conductor and the combined screen having 50% conductivity of the largest conductor. Cables shall be of various cross sectional areas to suite different ratings of motors/ equipment. All terminals shall be properly crimped.

c) Control cables shall be 2.5 mm2 cross-section, minimum 1000 V grade, EPR insulated and HOFR elastomeric CSP sheathed, copper screened flexible multi-stranded copper conductor having cores up to 20. Each individual core should be identifiable by means of colour / number and each core terminal shall be marked with cable markers / ferrules to identify the connections. Cables shall generally conform to IS:9968.

d) Cables for light fittings shall be EPR insulated and HOFR elastomeric CSP sheathed 3 core, minimum 1000 V grade copper conductor cables.

e) Control system shall be supplied with suitable twisted pair cable for communication with the remote controllers in Driller & MP Consoles.
These should be shielded twisted pair, able to withstand the rigors of a drilling rig. The route of such STP cables should be clearly indicated in drawings, and adequate measures taken to ensure that STP cables used for communication are free from noise due to power cables running in the same cable trays.
All the cables including power, control, lighting etc. shall be supplied complete with suitable male/female plug/ connectors which shall go into proper male/female plug/connectors mounted in the PCR, D'CON, lighting fixtures and motor Terminal boxes.
No soldered terminal socket will be allowed. All terminations shall be properly crimped.

All the cables for power and control, mast lighting, PLC remote racks in D'CON, Brake water cooling system power and control cables and any other cables required for drilling operation shall be suitable for the maximum required distance.

I. E. AUXILIARY EQUIPMENT & SYSTEMS

Auxiliary electrical system shall include the following systems:

I. E. 1. Rig lighting system:

Rig lighting system shall cover the following areas:

Hazardous/ Non-sparking Equipment areas (within a radial distance of 30 m from well-head):

i) Mast, racking board and aviation obstruction lighting
ii) Rig floor/ draw works lighting
iii) Pipe rack and area lighting
iv) Substructure lighting
v) Mud tank lighting
vi) Mud mix/ storage skid lighting
vii) Mud pump lighting
viii) Fuel pump/ tank area lighting
ix) Trip tank pump lighting
x) Choke manifold lighting
xi) Water tank area lighting

Un-classified (general) areas:

xii) Power pack lighting (supplied from lighting transformer)
xiii) Air compressor/ utility house lighting (supplied from lighting transformer)
xiv) BOP unit lighting (supplied from lighting transformer)
xv) General plinth and periphery lighting (supplied from isolation transformer)
xvi) Offices, chemical/ geological lab and crew camp lighting (supplied from isolation transformer)

All lighting load for hazardous areas shall be supplied from 2 nos. 60 KVA, 415 V/ 240 V Phase to Phase transformers, as detailed in the paragraph for PCR lighting transformer [Para I. B. (k) (ii)].
All other lighting load for general area lighting, camps and un-classified areas can be supplied from lighting transformers as well as the isolation transformer [Para I. B. (k) (iii)].
For external source supply (in case the main 415 V bus is not energized), a changeover switch with mechanical interlock will be provided, serving both the 60 KVA transformers through suitable incomer circuit breakers.

All lighting circuits shall have RCBO/ RCD for current leakage sensitivity of 300 mA. Vertical discriminating type RCDs shall be used wherever required.

Heavy duty flameproof and weather proof light fittings (in classified hazardous areas) and normal weather proof light fittings shall be used for illumination.

[Classified Hazardous areas are Zone 1 & 2, for Gas groups IIA & IIB as per Indian/ European standards and Class 1, Division 1 & 2, Gas groups C & D as per North American standards]

Each fitting shall have the following features:

- Weather proof plug and receptacle disconnect to allow safe and easy removal of fitting for service or movement to another location day or night without interruption of any power or illumination. Disconnects are to be provided at appropriate mast breaks, sub-separation etc. for easy rig up/ rig down of lighting system.
- Suitable for use in hazardous areas supplied with suitable plug socket disconnects

- Shall have safety cables/ chains to secure in mast and substructure
- Complete with thermal and shock resistant glass lens, lamps, ballasts, ignitors, p.f. improvement capacitor, guards, safety chains/ cables etc.

A mast lighting socket board (FLP/Exp type) should be supplied at a convenient place outside the driller's cabin/ dog house to facilitate easy connection/ disconnection for mast/ derrick area lights and dog house air conditioners (if offered).

Aviation obstruction day time white flasher unit (one no.) shall be fixed atop the mast (near crown block) with the following specifications. This unit shall be complete with controller, suitable cable, mounting hardware, photo-electric cell etc.
Day time: 20,000 Cd, flasher type with 40 flashes per minute (White)
Night time: 2,000 Cd, fixed (white)
With automatic change over from day to night

The minimum number and type of light fittings and accessories to be supplied for the rig lighting system are given below **(Make : FCG)** -

Sl. No.	Type of Light Fitting	Quantity	Remarks
1	Flameproof& Weatherproof Well Glass light flxture (LT31220 2×20W CFL)	90 nos.	Light fittings shall be provided with lamps
2	Flood Light Fixture (F31400 250 HPMV	5 nos.	Light fittings shall be provided with lamps
3	Flood light fixture (LF31400, 250W , HPSV)	20 nos.	Light fittings shall be provided with lamps
4	Flood Light Fixture (LF31400, 400W/ MH)	20 nos.	Light fittings shall be provided with lamps
5	Red aviation LED type warning lamp Double fitting Single fitting	 02 nos. 01 no.	Light fittings shall be provided with lamps
6	FLP & WP Twin Aviation obstruction Light	05 no.	With necessary cable, control panel and other accessories
7	Portable small size "T" type light pole for mud tank and mud pump illuminations, 50 mm OD, 4000 mm height- fitted with anti-vibration devices	40 nos.	Indicative diagram of the "T" pole is attached
8	Galvanized and non corrosive swaged type (stepped) steel tubular poles of length 9 m along with double brackets for fixing of HPSV/ HPMV type light fittings	20 nos.	

- All the FLP light fittings shall be DGMS approved.
- For mud tank lighting, suitable mounting/ hanging arrangement with tubular structures (see sl. No. 6 above) for well glass fittings shall be provided on the tanks.
- All the light fittings shall include the necessary control gears needed for smooth operation.

CPTDC shall submit a complete and detailed list of light fittings and lighting schematic to be used in the rig.

I. E. 2. **<u>Well-site Area & Crew Hut Illumination Control Panel, Skid Mounted</u>**

Details:
An oilfield type skid mounted electrical control panel for supplying power to area/ boundary lights and crew houses (camp site) shall be supplied.
The system shall consist of incomers, changeover switch, distribution feeders (MCBs/ switches), plugs and sockets etc., mounted on an oil-field type skid. The complete system will be designed to meet the present load demand as well as the increase in near future. The panel shall be fed from the PCR

415/415 V isolation transformer feeder with a changeover option for running from standby camp/ auxiliary genset.

Construction:

a) The panel shed shall be an outdoor, weatherproof, transportable steel house on a self supporting oil field skid suitable for tail boarding from either end in balanced condition. The shed shall be suitable for either top or bottom lift. There shall be provision for lifting the skid at both ends. **Shed shall be of man height**. Overall dimensions of the shed shall be calculated for working comfortably inside.

The shed shall be a fabricated sheet steel (not less than twelve-gauge) structure and shall house the incomer plug socket compartment, incomer MCCBs (with built-in SC and earth leakage protection), changeover switch, TPN bus and distribution board, outgoing Plugs-sockets, and plug socket compartments. The power to the bus is to be fed from either isolation transformer feeder in Power control room (PCR) or from the auxiliary genset, through a changeover switch.

The side panels containing the incomer and outgoing feeder plug socket arrangement shall swing out for ease of connections / maintenance. Another panel/cover shall be provided outside the socket board panels for protection of the socket board panels during transportation. The outer panel shall be hinged at the top and provided with supports, so that it can also give rain protection to the plug-socket panels, when in operation. All corners of the shed are to be formed by bending, leaving no sheet edge exposed. Skid and panel shall be painted with anti-corrosive paint.

b) Lighting and camp loads shall be equally distributed on the three phases. Each outgoing feeder shall be fed through a suitably rated RCBO, of leakage current setting of 300 mA. There shall be minimum 6 (six) outgoing feeders from each phase. Identical nos. of plugs and sockets (3 Phase, 5 pin) shall be provided in the outgoing plug socket compartment.

- Tinned copper Busbars
- Phase indication lamps
- Voltmeter (on both incomers)
- Internal shed illumination with 1 no. 2x40 W fluorescent indoor industrial corrosion proof luminaire, IP-65, with clear cover, complete with MCB on/off switch mounted outside, wiring (with armoured copper cable, suitably glanded to fitting) at a suitable place
- Internal wiring/cabling- Cables shall be of suitable size, 4 core, copper, screened, FRLS PVC/Elastomer insulated, sheathed and of reputed make
- Plug-sockets (fitted)
- Incomer MCCBs and outgoing RCBO / RCDs
- Changeover switch
- Provision for earthing of the skid

I. E. 3. **Cable handling system consisting of Cable trays, cable boxes etc.**

No cable will be allowed to be laid on ground outside of a cable tray / cable racks. Sturdy and durable cable trays with non-skid type, hinged, galvanized steel covers shall be provided. Tray covers shall also double up as a convenient walkway.
For mud/water tank cables, foldable type cable hangers should be mounted on mud/ water tank walls, to support the mud system cables. Suggested spacing between hangers is 1000 mm, width of the hangers is 300 mm.

In addition to the cable trays, there should be at least 4 (four) steel cable boxes, skid mounted, for cable storage during rig movement. Cable boxes shall be designed for in-line arrangement.

Design of cable trays/ boxes:

Trays:

Tray frames shall be made of channel section steel of suitable size (preferably 75x40mm cross section structural steel channel beams and 65x65x6mm and 40x40x5mm support channels), designed for carrying heavy cable loads. Lifting lugs shall be provided on the bases. Tray covers shall be of 5 mm

thick chequered steel galvanized plate, having loosely fitted lifting handles. Each top cover shall have minimum three no. of hinges for sturdy operation. Each large cable tray shall have 5 hinged top covers. These covers shall be galvanized. Locking arrangement for tray covers shall be provided. Trays shall be designed such that control and power cables run separately on wooden cleats. Sufficient gap shall be maintained from the tray cover to the cable supports. Earthing arrangement shall be provided on the trays.
Indicative dimensional drawing for cable trays is attached.

Cable Boxes:

Cable box frame and skid shall be made of channel (100 x 50mm) and beam (150 x 75mm) of structural steel. Skid shall have lifting arrangement at all the four corners and suitable for balanced lifting. Box structure shall have cross members on the sides to prevent stress and deformation during lifting and transportation. Mild steel sheet, hot rolled, shall be used for sides. Floor of the box shall be constructed of channels with 50 mm gap in between adjacent channels. Additional support shall be provided in the centre with channel/ angle. Ends of the box shall have half doors and will open from a height of 600 mm from ground (hinges to be provided at 600 mm from ground). A round pipe of NB 65 is to be provided at both ends for smooth sliding and pulling out of cables. The end covers shall be designed for locking from inside of the box. End covers shall be designed such that they cannot be opened without opening the top covers.

Five nos. top cover shall be provided, of 5 mm chequered plate (with chequered surface facing up), hinged on one side with sturdy hinges, and free on the other side with locking arrangement. These covers shall be galvanized. Middle cover will be designed such that it cannot be opened without opening the other two top covers. Additional locking bar (removable type) shall be provided on the top to lock all the three top covers with suitable locking arrangement.
Earthing leads shall be provided at both ends of the box.
Indicative dimensional drawing for box is attached.

The galvanization thickness of the cable tray/cable box covers shall be minimum 85 microns to withstand the corrosive environment. The painting of the cable boxes/trays shall be done with Epoxy paint with minimum 180 microns thickness.

Size of cable trays: Mini (with hinged cover) – 1 m (L) X 1 m (W) X 0.5 m (H) – 20 nos.
Intermediate (with hinged cover)-for placing between mini and small/large trays with more height- 1 m (L) X 1 m (W) X (0.5-0.7) m (H) – 02 nos.
Small (with hinged cover) – 1 m (L) X 1 m (W) X 0.8 m (H) – 20 nos.
Large (with hinged cover) – 5 m (L) X 1 m (W) X 0.8 m (H) – 17 nos.
Size of cable box: (with hinged cover) – 4 m (L) X 1 m (W) X 1.2 m (H)

I. E. 4. **Rig earthing system**

Complete rig earthing system shall be supplied, consisting of G.I. earth electrodes, clamps and suitable size G.I. straps to connect all generators, motors, junction boxes, light fittings, mud tanks, mud pumps, sub structure, water/ fuel tanks, houses, lighting poles and the main PCR (s) to the earth.
Earth electrodes shall be of two sizes, 1200 mm and 2000 mm length, each of 50 mm OD heavy duty steel tube with galvanization. Electrodes shall have holes drilled in the body, MS plates welded on the top for connection of earth straps.
Indicative dimensional drawing for earth electrode is attached.

Frames of all electrical equipment including motors, alternators, junction boxes, light fittings, push button stations, light fitting mounting poles etc. shall be connected to earth using two (2) nos. separate and distinct suitably sized earth conductors as per IE rules (Rule no. 61), which in turn shall be connected to the main earth grid. The whole earthing should be in accordance with IS: 3043.

Earthing of Tanks (including mud tanks, water tanks etc.) –

i) Each mud tank should have two nos. of GI straps 50 X 6 mm mounted on the out side of the walls facing mud pumps and mud mix skid side.
ii) The straps 50 X 6 mm should be welded to the sturdy supports that are welded to the tank wall. The gap between tank wall and strap: 50mm. Spacing between supports: 1000mm. The strap length should be the same as the tank length/ width. Gap between straps should be 150mm.
iii) Straps should be mounted at a convenient height for ease of connection.
iv) The Galvanization thickness of the straps should be minimum 85 microns, to withstand the corrosive environment. 2 nos. each 25 X 3 mm GI strips shall be welded to the main strips and the agitator skids (approx. perpendicular to the main strips 50 X 6mm).
v) Two (2) GI straps of size 50 X 6 mm shall be suitably mounted on each skid to facilitate independent double earthing of the pump motors.

The Earthing scheme along with the electrode layout should be submitted for approval of Oil India.

***I. E. 5*. Electrician's tools, instruments, special tools, computers for the PLC system**

This specification covers the details of Electrician's Tool Kit required for general maintenance & trouble shooting of the Electrical controls for the Rig.

- Set of Standard Maintenance Tools – 1 Lot
- Set of Alignment Tools – 1 Lot
- Air Pressure regulator for engine starting – 1 No.

Technical Details:

Tool kit should comprise of 1 No. / set of following instruments/tools:

1 Digital Multimeter: Model Fluke 177, Make Fluke with meter hanging kit along with other accessories
2 Analog multimeter
3 Digital Clamp meter: Model Fluke-LH2015 GT-201
4 Digital Insulation Tester (with analog indication): Model BM123, Make AVO
5 Earth resistance tester , make: Megger, model No DET5/4D – AVO UK
6 Phase rotation meter
7 Combined temperature and humidity meter, make: Fluke
8 Infrared Temperature Meter
9 Sound level (dB) meter
10 Vibration meter, make: Entek IRD
11 Tachometer (Non-contact type)
12 Cable Height Meter
13 Lux meter range- 0-50 lux
14 Soldering Iron 25W, 240VAC, make Soldron, with soldering aid set (Solder wire, soldering flux)
15 Desoldering tool (Vacuum pump type)
16 Screw Driver set
17 Wire tracer
18 Combination Pliers- 2 sizes, 6", 8"
19 Long Nose Pliers
20 Side Cutting Pliers with cable stripper
21 Socket Set (22 sockets + 5 Accessories)
22 Open ended spanner set up to 42 mm
23 Ring ended spanner set up to 42 mm
24 "Mekaster" tool set for foundation bolts of alternators and DC drilling motors
25 Adjustable wrench spanner
26 Chain pulley with frame-01 no.
27 Crimping tool (0.5sqmm – 16sqmm cables)
28 Wire stripper (0.5sqmm – 6sqmm cables)
29 Allen key set 1.5 mm to 10 mm (9 piece set)

30 Portable Hand Drill (up to drill bit size 25 mm)
31 Industrial duty vacuum cleaner in SS body
32 Crimping tool kit for 20 pin plug & sockets – Pyle National USA Make
33 Long handled hand crimping tool
34 Torque wrench
35 Hydraulic Crimping Tool for Generator and DC Motor 300 sq mm cables
36 Dual channel Oscilloscope with programmable screen, battery operated and portable
37 Function generator
38 Laptop computer with latest configuration for control system programming- **DELL E6400**
39 Desktop computer with latest configuration- **Lenovo M8200T i7**
40 Multifunction printer (with fax, copy and scan facilities- suitable for A3/A4 size paper)
41 Software for rig control system with license
42 Secondary injection test kit for Generator/Transformer feeder breakers

CHAPTER II: STANDARDS, STATUTORY RULES AND REGULATIONS TO BE FOLLOWED

a) **Standards**

Though a broad outline on the requirement has been made, yet the scope should include anything not mentioned but required for completeness of the system to meet the requirement of oil well drilling rig (drilling capacity 3000 meters depth using 4.1/2" OD Drill pipes & 3800 m using 3.1/2" OD drill pipe) and make the same suitable for dismantling, transportation and installation very often in rough well site conditions.

The system offered should have proven performance record. All relevant safety systems are to be incorporated and safety codes, relevant international codes to be strictly followed.
Systems to be designed & manufactured to the latest version/ editions of the following International and Indian Standards wherever applicable & should meet all present accepted international standards for the product/application

NEC,
IEC,
IEEE-45,
API 500,
NEMA
& I.S. (Indian Standards)

All components, modules, subsystems shall be of current generation with latest technology which must be in production and must not face obsolescence in near future. CPTDC and the manufacturer in turn shall guarantee that spare parts shall be available for at least fifteen years.

The controls i.e. all electronics including modules and different electronic components, PLC etc. shall have high levels of noise immunity. They shall have high level of EMC and shall be immune from noise. .

The system including all sub-assemblies and components should be designed to facilitate backward integration of future modules, cards etc without any modification.

b) **Rules and Regulations:**

Notwithstanding the conformity of the electrical equipment to the standards as mentioned above in Para (a), the following Rules shall be taken as final and absolute standard as applicable in India.

Indian Electricity Rules, 1956 with amendments
Oil Mines Regulations, 1984 with latest amendments

1. The electrical equipment to be used in hazardous areas of oil mines as classified by DGMS (India) [**Extract of the Directive from DGMS given as *Annexure-DGMS*** shall be approved by DGMS (India) for Zone-1 and Zone-2, Gas groups IIA and IIB of oil mines.

   The DGMS (India)'s approval for all electrical equipment to be used in the hazardous areas shall be submitted before inspection of the rig by Oil India Limited. ***Despatch clearance of the rig will not be given unless OIL receives such approvals for all equipment to be used in hazardous areas. Hazardous areas shall be as defined by DGMS.***
   Regarding DGMS approvals – the following shall be followed:
   - DGMS approval for all electrical equipment to be used in hazardous areas to be given to OIL at least one month before final inspection of equipment / rig. All such approvals should be valid for at least six months after inspection date, and related to oil-mines. Outdated approvals and approvals put up for renewal, part approvals, invalid approvals shall be considered as "no DGMS approval" and be treated as such.

2. All electrical equipment not suitable for hazardous area, e.g., Power Control Rooms (PCR), Power Packs etc. shall be placed at least 30 metres away from well head. A complete rig layout drawing indicating dimensions shall be submitted for approval of OIL before manufacture.

As per Indian Oil Mines Regulations, 1984- Rule 67 (3) i.e.
No naked light or open flame or **spark** shall be permitted within 30 meters of any well or any place where petroleum is stored.
Note: Since all non-sparking equipment (PCR etc.) are placed at least 30 m away from well-head, all cable lengths should be appropriately sized.

CHAPTER III: SPARES

The following categories of rig electrical spares shall be supplied along with the rig:

A) SPARES IN THE SCOPE OF SUPPLY:

The spare parts for rig electricals as per Annexure – G shall be supplied along with the rig to meet the operational requirement for 02 (two) years.

B) COMMISSIONING SPARES:

CPTDC shall provide adequate commissioning spares and consumables required during commissioning.
All spares remaining left-over after both stages of commissioning of the rig is completed should be handed over to OIL.

CHAPTER IV : APPROVAL OF DRAWINGS, STAGE INSPECTION AND PERFORMANCE TESTING AT WORKS

Following minimum drawings, documents and details of electrical equipment shall be submitted for approval of OIL, before manufacture:

Schedule for submission of drawings and documents are attached in the Annexure- Schedule of Submission of Drawings and Documents

i) Rig layout drawing, showing relative distances of all equipment.
ii) Interconnect drawings (power, network, signal).
iii) PCR(s) dimensions.
iv) Rig earthing layout.
v) Single line power flow diagram of the rig.
vi) Cable specifications/ details.

OIL shall study the drawings and incorporate modifications/ corrections if required. Such modifications shall be incorporated in the drawings and re-submitted to OIL for approval. Only after getting due approval of drawings from OIL, CPTDC shall proceed for manufacturing/ integration of the electrical system.

CPTDC shall submit the following along with the supply of materials:

- Twenty (20) sets of drawings as above - in hard copy & Ten (10) sets of drawings as above - in CD-ROM
- "As built" drawings (Corrected and final drawings after commissioning)
- "As built" Bill of Materials (BOM)- Final after commissioning

CPTDC shall arrange to stage wise inspection of the following electrical equipment by OIL personnel, under various stages of manufacture, before dispatch. CPTDC shall give inspection calls sufficiently in advance.

- PCR
- Powerpacks
- Drilling motors

Performance testing of equipment: CPTDC shall also arrange to witness testing of performance of the complete rig package including performance of all electrical system at their works by OIL personnel.

Inspection of Equipment by Oil India Limited (OIL):

A stage-wise inspection as per following schedule, of the major electrical equipment, as well as the complete rig package, at various stages of manufacture, shall be carried out by OIL personnel.

The Inspection cum Acceptance process would include the following minimum steps/tasks, (valid for that stage of manufacture / integration) -

1. Physical verification/inspection of all the items/fittings/accessories including all Parts Catalogue, Maintenance & Service Manuals, Schematics.
2. Operational / functionality testing of each & every system under load (if applicable) / no load. Performance parameters shall match the specifications.
3. CPTDC shall have to take note of any modification/s for operational requirement suggested by the inspection team and comply with the same at no extra cost.
4. The minutes of inspection process would be prepared at the end of each inspection and jointly signed by both the parties.
5. CPTDC shall confirm in writing compliance of all the points raised in the minutes of inspection as well as any other subsequent additions/changes, felt necessary.

6. CPTDC will affect dispatch of the unit only on receipt of OIL's dispatch advice.

	Intermediate Assembly of individual equipment, after FAT, at manufacturer's works	Complete Assembly of individual equipment, after FAT, at manufacturer's works	Complete, integrated rig package, at suitable location, before dispatch for string and load test
PCR	✓	✓	✓
Power Packs	-	✓	✓
Auxiliary systems- Lighting, earthing, cables crew cabin, etc.	-	-	✓
Complete Rig Package	-	-	✓

FAT – Field Acceptance tests / Manufacturers standard acceptance procedures, valid for that stage of manufacture.

Inspection of individual equipment – equipment include the PCRs, Power Packs etc.

ANNEXURE TO SECTION -9

CHAPTER V: ELECTRICAL ANNEXURES

V.A ELECTRICAL ANNEXURE – Statutory

1. DGMS Circular for Demarcation of Hazardous Areas

Drilling and Work-over Operations :

(1) Well-head area :

(a) When the derrick is not enclosed and the substructure is open to ventilation, the area in all directions from the base of rotary table extending up to 3.0 m shall be Zone 2 hazardous area. Any cellars, trenches and pits below the ground level shall be Zone 1 hazardous area; the area lying up to 3.0 m in horizontal direction from the edge of any cellars, trenches or pits and 0.5 m vertically above the cellars, trenches or pits shall be Zone 2 hazardous area.

(b) When the derrick floor and substructure are enclosed, the enclosed substructure below the derrick floor, including cellars, pits or sumps below the ground level, shall be Zone 1 hazardous area; the enclosed area above the derrick floor shall be Zone 2 hazardous area.

(2) Mud Tank and Channel :

The free space above the level of mud in tank and channel shall be Zone 1 hazardous area; the area in a radius of 3.0 m in all directions from the edge of mud tank and channel shall be Zone 2 hazardous area.

(3) Shale Shaker:

(a) The area within a radius of 1.5 m in all directions from the shale shaker to open air shall be Zone 1 hazardous area. The area beyond 1.5 m and up to 3 m in all directions from the shale shaker shall be Zone 2 hazardous area.

(b) When the shale shaker is located in an enclosure, the enclosed area shall be Zone 1 hazardous area to the extent of the enclosure. The area outside the shale shaker and up to 1.5 m in all directions from the shale shaker shall be Zone 2 hazardous area.

(4) Degasser :

The area within a radius of 1.5 m from the open end of the vent extending in all directions shall be Zone 1; the area beyond 1.5 m and up to 3 m in all directions from the open end of vent shall be Zone 2 hazardous area.

(5) Desander and Desilter :

The area within a radius of 1.5 m in all directions from the desander and desilter located in open air shall be Zone 2 hazardous area.

(5) Pump or Gas Compressors :

(a) Where a pump handling a flammable liquid or a gas compressor is located in open air or under well ventilated shed without walls, the area lying up to 3m in all directions from the pump or compressor shall be Zone 2 hazardous area

(b) Where a pump or compressor is located in an adequately ventilated building, the entire interior of such building including an area within 1.5 m of the vent shall be Zone 2 hazardous area.

(c) Pits, sumps, trenches below the ground level shall be Zone 1 hazardous area and the area lying up to 3.0 m in horizontal direction from the edge of any trench or pit and 0.5 m vertically above the pits, sumps or trenches shall be Zone 2 hazardous area.

(6) Storage Tanks :

(a) In case of floating roof tank, the space above the floating roof and inside the enclosure up to top level of the enclosure wall shall be Zone 1 hazardous area; the area beyond Zone 1 hazardous area and up to a radius of 4.5 m in all directions from tank shell and shell top shall be Zone 2 hazardous area. In case of a dyke, Zone 2 hazardous area shall extend vertically up to the height of the dyke and horizontally up to the physical boundary of the dyke.

(b) In case of fixed roof tank, the area inside the tank and within a radius of 1.5 m from all openings including breather valve, dip hatch, thief latch and safety valve shall be Zone 1 hazardous area; the area beyond Zone 1 hazardous area and up to a radius of 3 m in all directions from shell and roof of the tank shall be Zone 2 hazardous area. In case of a dyke, the sump in the dyke shall be Zone 1 hazardous area and an area extending vertically up to a height of the dyke and horizontally up to the physical boundary of the dyke shall be Zone 2 hazardous area.

2. **Use of flexible cables in drilling rigs and in other similar equipments in Oil Mines.**

1.0 Flexible cables are in use with drilling rigs and in other similar equipments in oil mines.

2.0 The electrical equipment used in a drilling rig are high capacity DC motors, 3 phase AC motors, their control gears, light fittings and instrumentations.

3.0 Flexible cables used with circuits exceeding low voltage shall be provided with flexible metallic screening or pliable armouring.

4.0 Such flexible metallic screening if used as a means of protection from mechanical Injury it shall not be used by itself to form an earth conductor, but it may be used for that purpose in conjunction with an earthing core.

5.0 Though the metallic screening shall not be used by itself to form an earth conductor the same shall have conductivity at all parts and at all joints at least equal to 50 per cent of the conductivity of the largest conductor.

6.0 IS: 14494-1998 "Elastomer insulated flexible cables for use in mines-specification" and IS: 9968 Part I & II, “Specifications for elastomer insulated cables” are the relevant Indian Standards available on elastomer insulated cables.

7.0 IS: 14494-1998 is mainly for flexible cables used in below ground and open cast mines. This standard does not cover flexible cables used in oil mines. Though IS:9968(Part-I) does not speak about metallic screening for cables at voltages above low voltages, however, to afford protection against mechanical injury, it is imperative that flexible cables for use in oil mines must have metallic screening also.

8.0 Hence it becomes mandatory that

(a) The flexible cables used to connect 3 phase electrical equipments shall be EPR (Ethylene Propylene Rubber [IE-2]) insulated and HOFR (heat resisting, oil resisting & flame retardant) Elastomeric CSP (Chloro-Sulphonated Polyethylene) sheathed, either individually or collectively copper screened, 4 core copper conductor cables with fourth

core having 50% conductivity of the largest conductor and the combined screen having 50% conductivity of the largest conductor.

(b) The flexible cables used to connect light fittings shall be EPR insulated and HOFR elastomeric CSP sheathed unscreened 3 core copper conductor cables.

(c) The flexible cables used with alternators and DC motors shall be single core EVA (Ethyl Vinyl Acetate rubber) insulated and sheathed, copper conductor cables, and,

(d) The flexible cables used for control connections shall be EPR insulated, and HOFR elastomeric CSP sheathed, copper screened flexible copper conductor cables having cores up to 20 and shall generally conform to IS:9968 (Part-1).

9.0 Termination of flexible cables with electrical equipments installed in hazardous area shall be through appropriate size of double compression glands and with electrical equipments installed in non-hazardous areas shall be through a readily detachable plug and socket assembly.

V.B ELECTRICAL ANNEXURE-STANDARDS

STANDARDS TO BE FOLLOWED BY DIESEL ELECTRICAL AC-SCR RIGS IN OIL'S MINING AREAS

Sl. No.	Item	Statutory Rules/ Guidelines/ Directives	Remarks
1	Distance of PCR and power packs (engine + alternator) from well shall be 32.0 m	OMR-1984 (Amended 1996) specifies 30.0 m	32.0 m [As per I. S. Code 5572 (1994)]
2	All electrical equipment including motors, starters, push button stations, lighting fixtures, plugs and sockets, glands/ connectors, junction boxes and accessories etc. used in hazardous/ dangerous areas of oil mines shall be either flameproof/ explosion proof (Ex-d) or increased safety type (Ex-e) and must have approval from DGMS (India) for use in Zone 1 and Zone 2, gas groups IIA and IIB of Oil Mines.	DGMS Directive and OMR Rules 73, 75	It is a statutory requirement and must be complied with.
3	Every power feeder, motor and lighting feeder shall be provided with an Earth Leakage Circuit Breaker/ Residual Current Device [above 5 KW and medium voltage(≥ 250 V)]	Indian Electricity Rules, 1956 (Amended 2002): Rule 61 A	ELCB will disconnect the supply instantly at the occurrence of earth fault or leakage current.
4	600 V ungrounded generator system with AC/DC GFD system shall have audio-visual annunciation.		Audio annunciation IS TO BE PROVIDED.

5	Power supply to lighting circuits in Hazardous areas shall be phase-to-phase 240 VAC, 50 Hz	Indian Electricity Rules: Rule 131	
6	Aviation warning lamp: **Day lamp**: 20,000 Cd, flasher type with 40 flashes per minute (WHITE) **Night lamp**: 40 Cd, fixed (RED) *[5 nos. of flashers are indicated, one at crown and four nos. at thribble board, colour unspecified]*	Ministry of Defence, (Govt. of India) directive	The lights shall be operational at all times from the moment the mast is raised until the mast is finally lowered irrespective of well operation.
	Minimum Illumination Level to be maintained: Pump-house shed- 100 Lux Derrick floor- 80 Lux Pipe rack area- 60 Lux Monkey Board- 30 Lux Compressor shed-100 Lux Sub-structure- 150 Lux Engine room- 80 Lux Peripheral/ General area- 10 Lux	As per Oil India Practice	
7	Pressurized type D'CON/ foot throttle shall be used; alarm will be provided for loss of purging.	This is required as an additional safety feature; but these items are outside DGMS classified hazardous areas. Purging required as per OMR spec. 67.	
8	Emergency shut off device (ESD) system- at Driller's control panel		

Make of instruments / equipment / auxiliaries:

Sl. No.	Equipment / instrument / auxiliaries	Make / model
1	Alternator	Kato
2	DC Drilling motor	GE
3	SCR panels	Ross Hill
4	Air Circuit Breaker	Merlin Gerin (Group Schneider) & ABB
5	MCCB	Group Schneider
6	MCC panel components	ABB & Group Schneider
7	Soft starters	ABB & Siemens
8	Plug Sockets	Amphenol (Pyle National)

V.C ELECTRICAL ANNEXURE- MCC STARTERS/ FEEDERS

SL. NO.	STARTER PANEL	MOTOR / LOAD (Indicative HP)	QUANTITY	STARTER CAPACITY (HP)
1	LINER FLUSHER, MUD PUMPS	3	2	5
2	MAIN LUBE, MUD PUMPS	1	2	5
3	SUPER CHARGERS	75	2	100
4	BLOWER MOTORS	7.5	2	10
5	WATER BOOSTERS	30	2	40
6	BRAKE WATER	60	2	100
7	AIR COMPRESSOR	40	2	50
8	AFTER COOLER	1	2	5
9	MUD AGITATOR	10	12	10
10	WATER AGITATOR	10	6	10
11	PILL CHAMBER	10	1	10
12	DESANDER	75	1	100
13	DESILTER	75	1	100
14	MUD MIXERS	75	2	100
15	MULTI-STAGE PUMPS	100	2	100
16	PIT PUMP	75	1	100
17	SOURCE WATER WELL	5	2	5
18	SHALE SHAKERS	5	3	5
19	DEGASSER	5	1	5
20	CELLAR	5	1	5
21	FUEL PUMPS	5	2	5
22	BUG BLOWER	5	1	5
23	TRIP TANK	15	2	20
24	RECYCLING PUMP	5	2	10
25	MUD CLEANER	5	2	5

SL. NO.	FEEDER PANEL	FEEDER / LOAD (Indicative HP)	QUANTITY	FEEDER PANEL CAPACITY (HP)
1	IR FILTER, WATER	1	1	5
2	HIGH PRESSURE JET CLEANER	1	1	5
3	POWER TONG	60/70	1	100
4	PCR AIR CONDITIONER	40	1	40
5	BOP FEEDER	40	1	40
6	FEEDER FOR LIGHTING TRANSFORMERS (HAZARDOUS AREA LIGHTING)	60 KVA	2	-
7	RIG LIGHTING D.B.	-	-	-
8	WELDING MACHINE	50	1	50
9	3 WIRE 240 V Ph-Ph FEEDER	-	2	5
10	2 WIRE 240 V Ph-Ph FEEDER	-	3	1
11	HAND LAMP (24 V) SUPPLY FEEDER	1	2	5
12	110 V SUPPLY FEEDER	1	1	5

13	AIR DRIER FEEDER	1	1	5
14	ISOLATION TRANSFORMER SUPPLY	10O KVA	1	-
15	MOBILE AIR COMPRESSOR FOR CEMENTING	40	1	50
16	TORQUE WRENCH, BOP	2	1	5
17	EASY TORQUE	5	1	5
18	MUD VOLUME TOTALIZER	1 KVA	1	-
19	BOP TROLLEY	20	1	20
20	SPARE FEEDER	-	2	100
21	SPARE FEEDER	-	2	40
22	SPARE FEEDER	-	2	10
23	SPARE STARTER	-	1	100
24	SPARE STARTER	-	1	40
25	SPARE STARTER	-	1	10

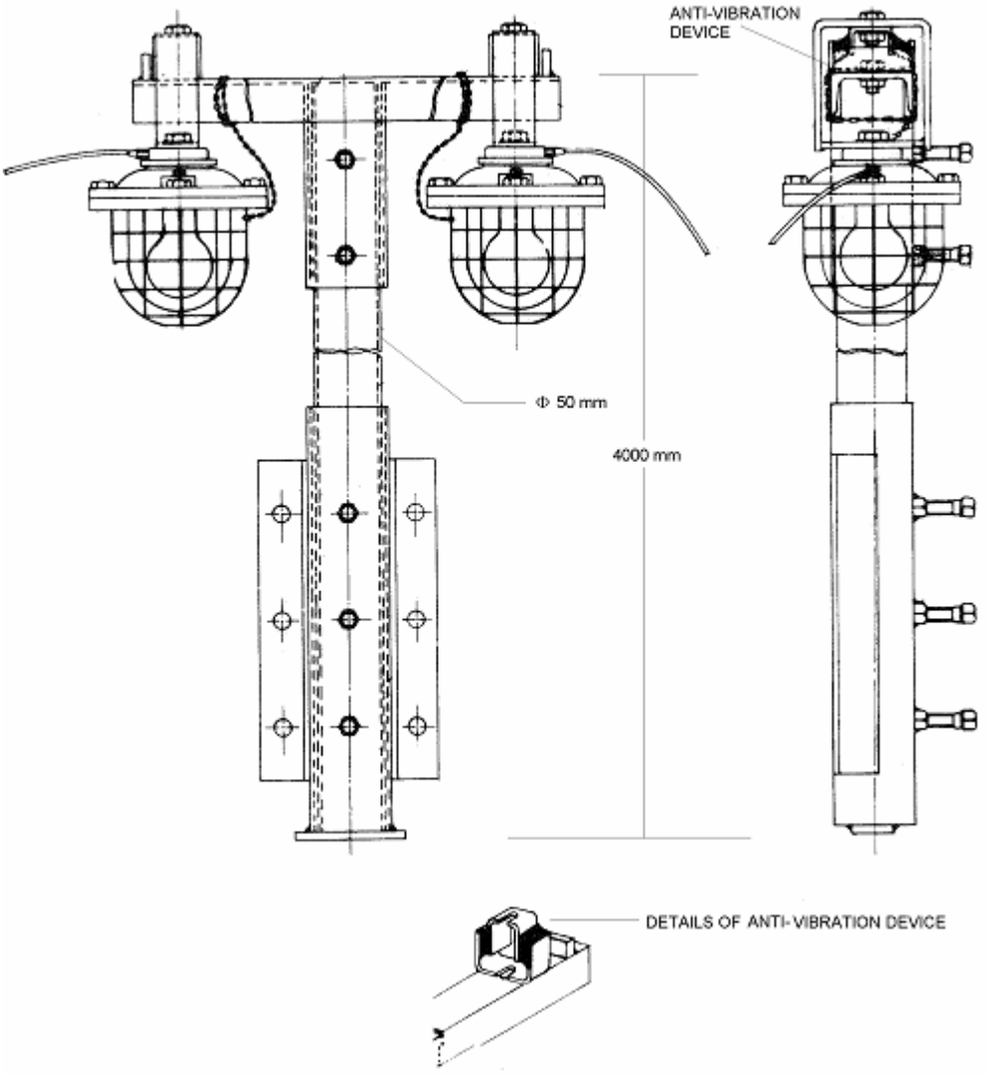
V.D ELECTRICAL ANNEXURE- SCHEDULE OF SUBMISSION OF DRAWINGS/ DOCUMENTS

Sl. No.	Details of drawings / documents (as appearing in relevant chapters/clauses)		Submission schedule	
			At the time of inspection	After commissioning
1	***Equipment literature/ Third party (quality control) inspection report***		√	
2	DGMS approval for all electrical equipment ***to be used*** within classified areas		**(Refer General Note in Section 11)**	
3	***Details of equipment which may not be mentioned in the order shall be submitted to OIL/ Third party inspector during inspection stage***.		√	
4	"As-built" drawings, operation and workshop manuals, ***Bill of Materials*** and any other relevant documents		√	√

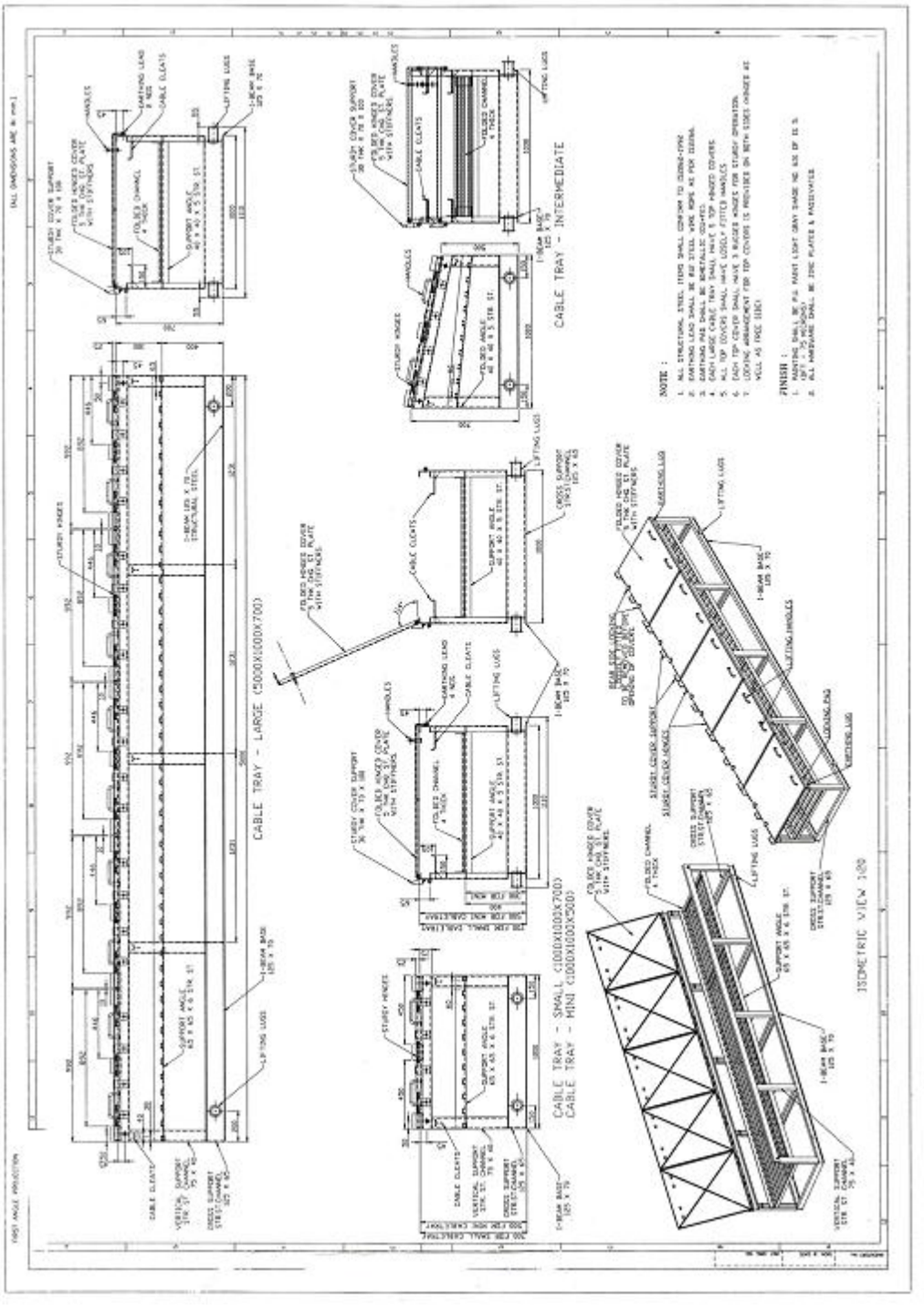
V.E ELECTRICAL ANNEXURE- INDICATIVE DRAWINGS

1. Indicative diagram of ‘T’ –pole
2. Indicative diagram of cable trays
3. Indicative diagram of cable box
4. Indicative diagram of earth electrode

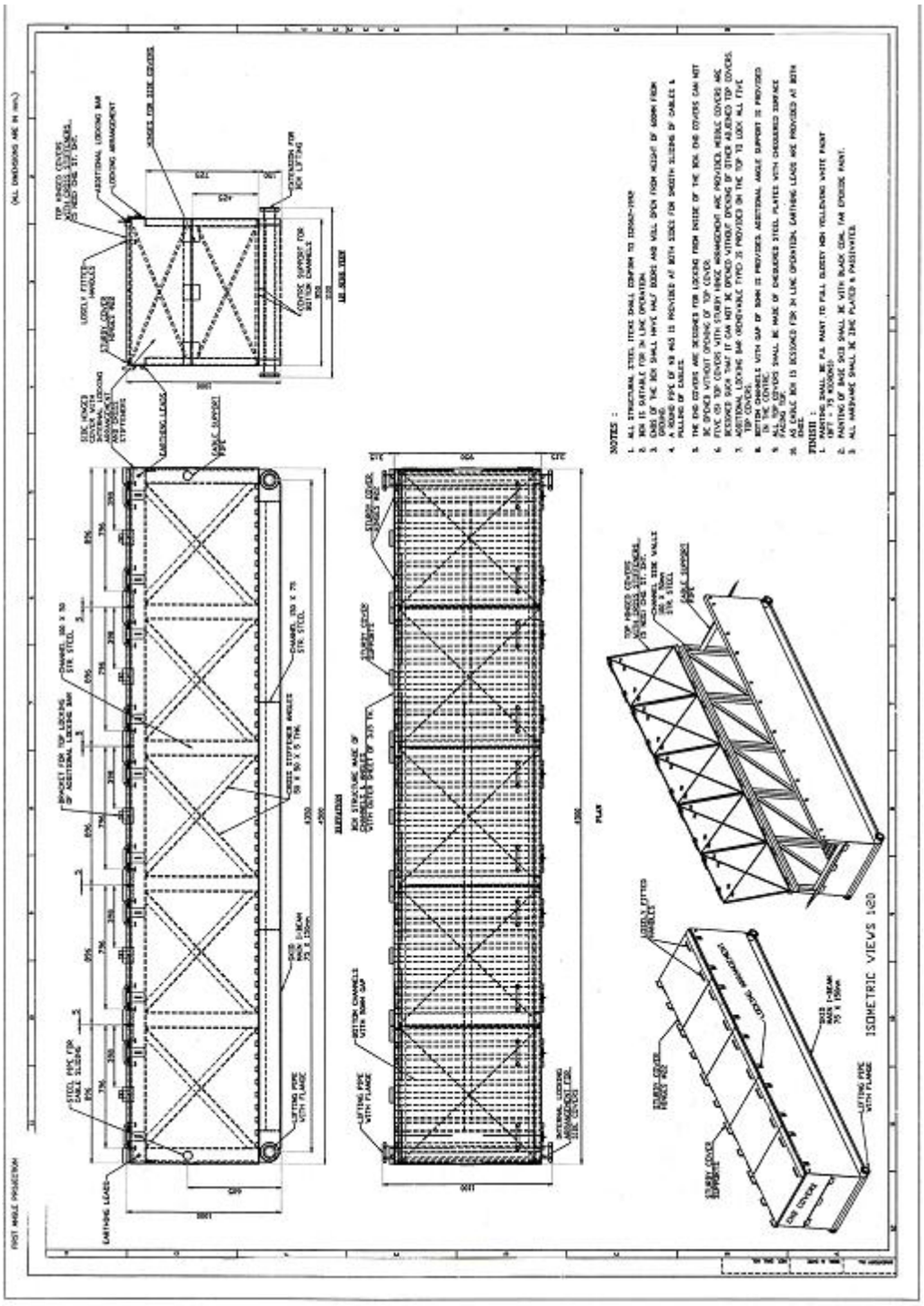
INDICATIVE DIAGRAM: “T”- POLE



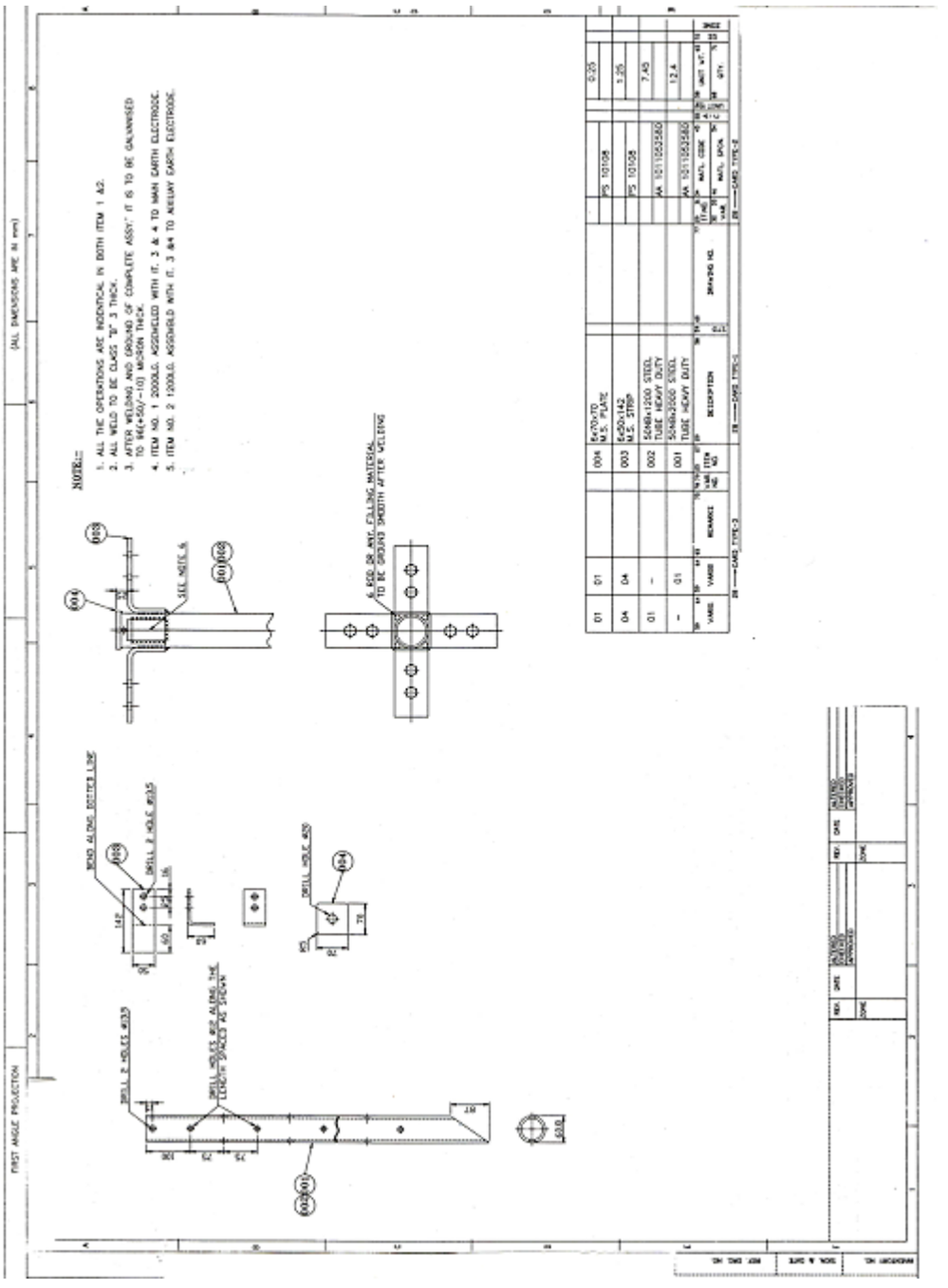
INDICATIVE DIAGRAM- CABLE TRAYS



INDICATIVE DIAGRAM- CABLE BOX



INDICATIVE DIAGRAM- EARTH ELECTRODE



V.F ELECTRICAL ANNEXURE- COMMISSIONING SCHEDULE OF ELECTRICAL EQUIPMENT

COMMISSIONING STAGES

Installation, wiring and laying out of equipment: On arrival of equipment and materials (commissioning spares etc.) at OIL's premises CPTDC should carry out inspection of the supplied items to ascertain and certify that there is no transit damage and items are complete in all respect and ready for installation. In case of any discrepancy, CPTDC shall take necessary action for immediate replacement/ replenishment of the same before installation.
After receipt, the equipment shall be installed at site. This will include wiring/ cabling, fitting of plugs and sockets and any other activity required to make the equipment ready for commissioning.

Initial commissioning after start up connection: This activity will cover insulation checks, wiring checks, phasing up (powering up) of individual equipment and the system as a whole. After start up connection and powering up, the complete system shall be tested at no load and minimum/ low load at OIL's well site. Any modification/ re-wiring/ repair shall be carried out at this stage.

Final commissioning:
Any problems, abnormalities, anomalies and defects noticed/ logged during the completion of the well (operation at full/rated load) shall be rectified by CPTDC. This will cover setting/ adjustment/ calibration of limits in the control system, drives etc.

Sl. No.	**Equipment**	**Commissioning schedule**		
		Installation, wiring and laying out of equipment	Initial commissioning after start up connection	Final commissioning
1	PCR	Pre-wired	√	√
2	Cables (termination with proper lugs/ sockets)	√		
3	Main drives (drilling motors): Connection, preliminary checks and power up	√	√	√
4	Auxiliary drives (AC motors): Connection, preliminary checks and power up	√	√	√
5	Rig lighting system: Connection, preliminary checks and power up	√	√	√
6	Rig earthing system: Connection, measurement of earth resistance	√		

CPTDC's commissioning engineer and personnel shall be available at all the three stage of commissioning as explained above during the complete period.

Any equipment that fails during commissioning at any stage shall be REPLACED at CPTDCs cost.

CPTDC shall ensure adequate commissioning spares/ consumables are dispatched.

SECTION 10: MISCELLANEOUS ITEMS / EQUIPMENT

1. DOG HOUSE:

MAKE: BOMCO ; MODEL: PF750 ; QTY: 1

One (1) doghouse with wall mounted air conditioner, approximately 10 ft long x 5 ft wide having a sliding door with tempered glass window and additional window near the knowledge box & tool board.

2. AIR COMPRESSOR & RECEIVER

Air System:

A. Rig air compressor package consisting of the following mounted on a single hut.

i) Two Nos. of Electric motor driven screw air compressors each have a capacity & working pressure as under, complete with all accessories. **Make: SULLAIR ; Model: WS1810**

- Rated capacity: 2.6m3/min
- Rated pressure: 1.0MPa
- Max. pressure: 1.05MPa

ii) One number Cold Start Compressor **Make: SULLAIR**; **Model: HV-1.0/10** having a capacity & working pressure as under, driven by a suitable diesel engine **Make: Caterpillar**

- Capacity: 1m3
- Working pressure: 1.0Mpa
- Speed: 860rpm

iii) Two (2) nos. of Air Receiver **Make: SULLAIR** ; **Model: SRC-220** hydraulically tested within last three years with documentary evidence each having a capacity of 80 CFT and rated for 200 psig working pressure complete with **Refrigerator Type Air Dryer**, safety relief valve, pressure gauge, condensate trap etc.

B. Two (2) nos. of extra Air Receiver each having a capacity of 80 CFT mounted on a single oilfield type skid complete with SRV & Pressures gages for immediate use in derrick floor to be placed near the entrance of the staircase .

SPECIAL NOTE:

All the components of the Air system other than Item B are to be accommodated in the Power Pack Skids and within the Acoustic Enclosure.

3. SUCTION AND DELIVERY SYSTEM of Slush Pump

MAKE: BOMCO; MODEL: GH750

a) Suitable length 3.1/2" ID x 5000 psi WP vibrator hose.

b) Suction hose should interconnect Rig Pump #1 and #2 with butterfly valves in between.

c) BOMCO 5000 psi WP stand pipe manifold complete with gate valves, pressure gauge of 5000 psi rating and other standard fittings.

d) 4" OD x 5000 psi WP stand pipe of suitable length with manifold to match the operating conditions with Range-II drill pipes complete with gooseneck, hammer union or unibolt couplings for making up rotary hose with safety clamp attached. It should be designed to suit Kelly.

e) 3" ID x 5000 psi WP, rotary drilling hoses with suitable connection to make up on to the standpipe and rotary swivel. The length of Rotary hose should suit the rig for drilling operations.

f) Rig pump delivery manifold shall be connected to the vibrator hoses through rigidly supported strainer cross

g) There shall be 5000 Psi working pressure gate valve on each mud delivery manifold.

h) From each pump delivery manifold, suitable bleed line and valve should be provided.

i) Pump delivery manifold shall have arrangements for hole fill-up line and kill line connections of suitable sizes with Gate valves.

j) The 5000 Psi pulsation dampeners on each pump shall be complete with charging valve, pressure gage, hose assembly for charging and any other accessories required.

k) Required length of intermediate 5000 psi WP delivery pipes complete with bend, `T's and valves to connect the pumps (2 Nos.) independently to the stand pipes

l) Necessary anchoring arrangement of all high pressure delivery lines

Note: All High pressure Gate valves of 5000 PSI rating will be of OTECO design.

3. PNEUMATIC WINCH:

MAKE: INGERSOLL RAND ; MODEL: FA2.5A–24XK1G

One (1) Pneumatic Winch with Automatic Disc Brake and standard winch mounted throttle with the following specifications:

- Capacity (Mid-drum line pull): 5000 lbs on drum @ 90 psig
- Mid-drum Line Speed: 135 fpm @ 90 psig
- Max Stall on 1st Layer: 10,400 lbs
- Wire Rope Storage Capacity (full drum): 625 ft of 5/8" line
- Drum length: 20"
- Drum Root Diameter: 9.1/4"
- Avg. Air Consumption: 560 SCFM
- Air Inlet: 1.1/2"
- Motor HP: 25 hp
- Automatic Disc Brake
- Winch mounted single lever throttle for lifting & lowering, spring return to neutral with lift & shift engagement mechanism
- Corrosion resistant paint with thermoplastic coating

- Exhaust muffler
- Air lubricator, strainer
- Air hose – 50 ft x 1.1/2" ID
- Drum guard

4. STANDPIPE MANIFOLD:

MAKE: DEMCO

One (1) 4" x 5000 PSI WP Standpipe Manifold to connect to standpipe consisting of:

- One (1) 4" x 5000 PSI WP mud gate valve
- One (1) 2" x 5000 PSI WP mud gate valve for kill / fill line
- Two (2) 4" fig 1002 hammer unions
- One (1) 2" connection for pressure gauge with fig 1002 hammer union
- One (1) 2" connection for pressure transducer with API flange
- One (1) suitable pressure gauge 0-6000 psi rating.

5. VIBRATOR HOSE: MAKE : JINGBO PETROLEUM MACHINERY CO. LTD.

Two (2) Vibrator Hoses, 4" API Grade 'D' 5000 PSI WP, 10000 PSI Test Pressure of suitable length (15 ft) complete with 4" API male coupling at each end including hose hobble at each end

6. HIGH PRESSURE GROUND MANIFOLD: MAKE : BOMCO

One (1) High Pressure Ground Manifold for two (2) mud pumps consisting of:

- Two (2) 4" x 5000 PSI WP mud gate valves
- One (1) long sweep tee
- Two (2) 4" 90 degree long sweep elbows
- Three (3) 4" fig 1002 hammer unions
- One (1) 6 ft x 6 ft base for mounting ground manifold

7. PUMP DELIVERY LINES: MAKE : BOMCO

Two (2) 4" Pump Delivery Lines of suitable length with Fig 1002 hammer unions at each end

8. KILL LINE & FILL LINE: MAKE : BOMCO

Kill Line kit for field installation consisting of:

- 2" XXS pipe of suitable length (150 m)
- Three (3) 2" x 6000 PSI Style 50 Swivel Joints
- Two (2) 2" Fig 1002 Hammer Unions

Low-pressure Fill Line of suitable length (30") with 2" Fig 1002 Hammer Union at each end

9. BELL NIPPLE: MAKE : BOMCO

One (1) Bell Nipple, funnel & telescoping style, mounted in the substructure with flange to match BOP flange

10. FLOW LINE:

One (1) 10" to 12" Flow Line from Bell Nipple to Shale Shaker Unit complete with butterfly valves and couplings

11. RATHOLE ASSEMBLY:

MAKE: BOHAI CNPC ; MODEL:SD750

One (1) Rathole assembly with digger unit or suitable mechanical device for drilling rat hole and mouse hole complete with suitable size scabbards.

12. MOUSEHOLE SCABBARD ASSEMBLY:

MAKE: BOHAI CNPC ; MODEL:XSD750

One (1) Mousehole Scabbard Assembly

13. CATWALK ASSEMBLY:

MAKE: BOHAI CNPC ; MODEL:MD750

One (1) Two-piece Catwalk Assembly (3.5 ft to 4 ft wide x 40 to 50 ft long x 3.6 ft high) with built-in stair and provision to hinge pipe rack on each side.

14. PIPE RACKS:

MAKE: BOHAI CNPC ; MODEL:GPJ750

One (1) lot of twelve (12) Triangular Pipe Racks, 3.1/2 ft x 3.1/2 ft x 14 ft long, fabricated from Sch 160 pipe, for stacking tubular with suitable provisions to hinge with catwalk assembly.

15. CELLAR PUMP:

A. Gorman Rupp make diaphragm pump of model 4D-X3 3P 4" driven by explosion proof electric motor with matching frequency **(Make : Crompton Greaves, Model ND100L-4, 3HP))** complete with all suction and delivery lines mounted on a **2** feet high suitable oil field type skid, for cellar cleaning purpose. Pump should be suitable for class I, dir. 2 areas and gas group I, IIA & IIB and with Flexible coupling.

B. Vertical Type Vortex Pump (Make: Flygt)
Model: H 8044 (complete package with control & monitoring data)

16. FUEL TANK & PUMPS:

MAKE: BOHAI CNPC ; MODEL:YG750

Two (2) nos. **40** KL Capacity on separate skids (total **80** KL Capacity), Cylindrical, Horizontal Diesel Storage Tanks fabricated on heavy duty oilfield type skid (length with skid should not exceed 9.0 mtrs.) with standard accessories such as man ways on top with ladder rungs attached to wall for access into each compartment and rungs on OD for access to top of tank, tank level indicator, etc
The tank should be complete with two (2) nos. of 1" fuel charge pumps & all required fittings for supply of fuel to engines of generators. Make of Pump : BOHAI CNPC (SB 8" x 6" x 14", 100 HP); Make of Motor : Crompton Greaves (Model ND280S-4, 75 KW)

17. TOOLS & WRENCHES SET:

MAKE: BOHAI CNPC

One (1) set of tools & wrenches with tool box for following :

1. Draw-Works
2. Mast & Sub-Structure
3. Engine & Transmission
4. Electrical system
5. Mud Pumps
6. Mud system

18. RIG WASHER

MAKE: BOHAI CNPC

2 (Two) nos. of suitable electrically operated (Single Phase 220 V 50 Hz AC power) high pressure portable cleaning pump complete with suitable electric motor, 20 ft long cable & necessary fittings. The pump should have 1" suction port & 40 ft. long delivery hose with nozzle for cleaning the draw-works & mast with water jet.

19. CASING LINE CUTTER

MAKE: BOHAI CNPC ; MODEL: CUTTER750

1 (One) no. of manually operated wire line cutter suitable for cutting 1.1/8" & smaller size wire line (casing line).

20. SOUND LEVEL METER & CALIBRATOR

MAKE: BOHAI CNPC ; MODEL: SK750

1 (One) no. of portable battery operated Sound Level Meter with Liquid Crystal Display (LCD) providing readings in 0.1 dB increments with 40-130 dBA measurement range. The sound level meter should have low battery indicator, RFI-shielded construction, all required accessories, certified to be intrinsically safe & complete with storage case.
1(One) no. of sound meter Calibrator to verify accuracy of sound meter.

SECTION 11: INSTRUCTIONS / NOTES

1. TRANSPORT DIMENSIONS LIMITATION & DESIGN:

1.0 All major accessories such as Power Control Room, Tanks, Pumps, Gen-sets, etc. shall be mounted on self-loading skid.
2.0 Overall dimensions of all accessories of rig package should preferably not to exceed 9m x 2.5m x 2.5m (Length x Breadth x Height) **unless otherwise stated elsewhere in this order**.
3.0 The overall weight of single item including skid should not exceed 28 MT.
4.0 For a skid of 2.5m width, there should be at least four longitudinal main sections, preferably each one of single length and should have a smooth finish underneath and curve finish at both the end, so that the skid can roll over the loading roller and body of the truck without any obstruction.
5.0 The skid so designed should be sufficiently strong and properly welded at joints and should be able to withstand any shocks which are bound to come while being handled and transported over rough and slushy roads/locations. Height of the joint used for the longitudinal members should be minimum 20 cm.

2. PAINTING INSTRUCTIONS:

At least 3 coats after applying primer. Under Coating with Anti Corrosive Treatment for cement & rust and polyurethane paint. The preferred color shade should be as under.

MAST	-	WHITE
CROWN	-	RED
DOUBLE BOARD	-	RED
TRUCK & DRAW-WORKS	-	BLUE
ALL HAND RAILS	-	YELLOW
MUD PUMPS	-	BLUE
TRAVELLING BLOCK	-	YELLOW
AIR TANK	-	WHITE
MUD & WATER TANKS	-	GREY
ELECTRICAL CONTROL ROOM	-	WHITE

All operating and warning labels on equipment must be in English

3. SPARE PARTS:

The spares of the Rig Package should available for minimum 10 years.

4. PARTS CATALOGUE, OPERATION / INSTRUCTION MANUAL & DRAWING, TECHNICAL INFORMATION & BULLETIN:

Installation, operation & maintenance manual should cover the following:

- Start up, normal shut down, emergency shut down, operating limits & operational procedures.

- Rig-up & rig-down sequence.
- Technical leaflets with detailed diagram, specification & make of axle, suspension, steering, wheel & rim, brake, etc.
- Detailed dimensional drawing showing construction dimensions with material description of Driver's cabin.
- Layout drawing of all components on the unit with details of load distribution

Foundation & site layout drawings with load bearing capacity / distribution for various components of the rig package covering the following should be forwarded on receipt of the order:

- Assumed parameters of design of CC / RCC foundations shall be furnished.
- All design for foundation shall confirm to BIS - 456:2000.
- For Machine Foundation the code to be followed are IS – 2974 & IS – 13301 respectively.

5. MANUALS & CATALOGUES

Supply of 6(six) sets of Spare Parts Catalogue and Workshop & Service Manual for all major components/systems like Carrier, Engines, Draw-works, Mast & Sub-structure, transmission, axles, pneumatic & electrical systems, brake hydraulic system (if any), etc. including it's sub-assemblies complete with all schematics along with the unit.
In addition, supply of 2 (Two) sets catalogue/manual in compact disc.
All manuals & catalogues should be in English.

6. MAKE OF RIG ACCESSORIES

Make of rig major rig accessories for supply with rig package should be as per the following options. Bidder should confirm the make of these items in technical bid accordingly.

Sl. No.	Equipment / Accessories	Make / Name of Vendor	API Specification
1.	Mast & Sub-Structure	RG-PETRO	4F
2.	Disc Brake	Eaton Corporation	-
3.	Draw-works & Rotary Chains	Shanghai Dalong Chains Works Co. Ltd.	7F
4.	Rotary Table	American Block Company	7K
5.	Rotary Swivel	American Block Company	8C
6.	Traveling Block & Hook	American Block Company	8C
7.	Elevator Links	National Oilwell Varco	8C
8.	Dead Line Anchor	National Oilwell Varco	8C
9.	Casing / Drilling Line	Usha Martin Limited.	9A
10.	Rotary Hose	Gates, USA	7K
11.	Solid Control Equipments (Shale Shakers, Desander, Desilter, Degasser)	Derrick	-

12.	Drilling Instruments & Gauges	Martin Decker	-
13.	Mud Pumps	BOMCO	-
14.	Pneumatic Winch	Ingersoll Rand	-
15.	Kelly Spinner	National Oilwell Varco	8C
16.	Drill-Pipe Spinner	National Oilwell Varco	-
17	Hydraulic Cathead	National Oilwell Varco	
18.	Alternator (Main Power Pack)	Caterpillar	-
19.	DC Motors	G.E.	-
20.	Generator & SCR Control	Ross Hill	-
21.	Carrier engine & Power Pack (Main Engine)	Caterpillar	

(Note: The equipment confirming to API specifications must have the API monogram die stamped on the body)

7. <u>GENERAL NOTES (In addition to notes mentioned elsewhere in this order)</u>

(a) All equipment to be supplied with the Rig Package shall be in full conformance to and monogrammed per the respective API Specification as mentioned in the tender viz. API Spec 4F, API Spec 5L, API Spec 7-1, API Spec 7-2, API Spec 7F, API Spec 7K, API Spec 8C, API Spec 9A, API RP 500 & API RP 13E, etc

(b) (i) Supplier has to obtain DGMS approval for all electrical equipment and instrumentation & control system to be deployed in Hazardous areas as defined by DGMS, India.

(ii) OIL should receive copies of such approvals at least one month before final inspection of the equipment / package by OIL nominated Third Party Inspection (TPI) agency. TPI agency will check & accept such certificates during the process of FAT / final inspection. Dispatch clearance will be given by OIL only after acceptance of submitted such DGMS approvals in Original. In case of OIL not nominating any TPI agency, DGMS approvals shall be checked and accepted by OIL.

(iii) All such DGMS approvals should be valid for a minimum period of six months after final inspection date and related to Oil Mines. Part approval of equipment, outdated / invalid approvals, field trial approvals & approvals put for renewal will be considered as "No DGMS Approval".

(iv) If the supplier fails to obtain DGMS approval, the equipment shall not be allowed to be deployed / mobilized and delay shall be on the supplier's account. Any charges incurred thereof shall be to the supplier's account.

(c) Supplier must submit the detailed foundation design & drawing, relevant documents and lay-out drawing within 15 days from receipt of order.

(d) Supplier shall provide services on call out basis after the normal warranty & guarantee (as stated elsewhere in this order) for a period not less than 3 years on chargeable basis.

****

Annexure-A1
To Order no. 7950722/SDG/P7

SCOPE OF WORK FOR THIRD-PARTY INSPECTION FOR 750 HP MOBILE DRILLING RIG

BROAD SCOPE OF WORK :

The rig Supplier / Manufacturer shall be responsible for all operational (including erection of rig, accessories, etc. & necessary testing) and documentation formalities required to inspect the Rig. During the inspection & acceptance testing the crew of rig manufacturing yard will open & prepare equipment for inspection, run the equipment for testing assist in carrying out the pressure & load testing of various items.

1. Checking the complete specification of rig package with ordered specifications (including instructions / Notes / DGMS approvals for electrical / electronics equipments, various test certificates, make, etc. as applicable).
2. Verification of purchase documents related to bought out items including but not limited to documents audit, API monogram & PSL verification (wherever applicable), etc.
3. Verification of the make & model of equipment / accessories and it's components as mentioned in the purchase order.
4. Certify (by random verification) the NDT report of critical drilling equipments such as Mast & Sub-Structure, Draw works, Dead Line anchor foundation / sheave, air winch foundation, link, bails, clamps, etc. issued by the manufacturer, as applicable.
5. Witness the function testing & certify the calibration of critical gauges on the drill floor instrumentation panel, stand pipe manifold, drillers console, mud pumps, load cells etc. as applicable.
6. Witness the function testing & certify the Calibration of relief valve (same should be tagged with test pressure and test date).
7. Inspection of safety equipment as applicable.
8. Submission of detailed inspection & acceptance testing report for each rig (in English language only).

The scope of work will be sufficient to ensure the unit is fit for purpose and fully operational and will include, but not necessarily be limited to, the following functions:

PRE-INSPECTION CHECK:

Before carrying out tests / detailed inspection, the TPI agency shall perform the following checks:

a) Receipt of all documents, datasheets, drawings, test certificates etc. from the rig manufacture.
b) Verification of Bill of materials as per OIL' approved documents.
c) Visual inspection as per OIL's Purchase Order (for rigs) / approved drawings (if any).
d) Dimensional check as per OIL's Purchase Order (for rigs) / approved drawings (if any).

e) Provision for lifting and double earthing in all equipment.
f) To verify the documentation & equipment serial / asset number etc on Nameplate and / or Identity marking on equipments.

DETAILED SCOPE OF WORK FOR INSPECTION & ACCEPTANCE TESTING OF 750 HP MOBILE LAND DRILLING RIG:

Section No. as per Rig Tender	Equipment	Inspection Work to be performed
1	Carrier	• Manufacturer's commissioning documentation. • Full functional testing. • Verification of turning radius, ground clearance, dimensions, braking system, electrical system, pneumatic & hydraulic system, etc. • Verification cum Certification of weight of Carrier (with Mast & without Mast). • Verification of various parameters, displays, alarm system, etc. • Drive testing with full load at all speeds/gears for at least two hours period. • Witness & certify temperature, noise, vibration etc. to acceptable limits.
2	Engines (Carrier)	• Manufacturer's commissioning documentation. • Verification of make, specifications & features. • Function test of all engines for six hour period. • Verification of load sharing. • Function testing of safety shutoff devices. • Verification of calibrations of various meters and tools that are to be provided along with the Rig Engines. • Witness & certify temperature, noise, vibration etc. to acceptable limits.
2	Transmission	• Manufacturer's commissioning documentation. • Verification of make, specifications & features. • Function test with full load at all speeds / gears for at least six hour period. • Witness & certify temperature, noise, vibration etc. to acceptable limits.
3	Draw-works	• Fully function testing at maximum load. • Verification of hoisting capacity. • Verification of lebus grooving & wireline size. • Running traveling block between Crown to drill floor in all speeds for at least twenty operations. • Witness & certify temperature, noise, vibration etc. to acceptable limits. • Verification of lubrication & cooling system.
3	Disc Brake	• Manufacturer's commissioning documentation. • Examination of unit integrity.

		• Fully function tested at maximum load during draw-works testing. • Witness & certify temperature, noise, vibration etc. to acceptable limits. • Check, verify and witness electrical/instruments panels, safety interlocks, audible alarms etc. as per supplied Piping & Instrumentation diagrams. • Check & verify for double earthing in all electrical equipment.
3	Driller's Console	• Full functional testing. • Verification of various parameters, displays, alarm system, etc.
3	Mast	• Auditing the quality control measures during construction including NDT & endorsement of the same. • Close inspection of visual integrity. • Examination & verification of leveling jacks, mast controls, raising system, safety devices & lines. • Raising & lowering the mast for at least six Operations. • Witness Load Test of Mast and Substructure as per standard practice. • Verification of clear height, base width & hook load capacity. • Verification of racking platform's position, dimensions & capacity. • Examination of the crown for structural integrity including operational testing with maximum load on the draw-works. • Verification of Crown Block capacity, no. of sheaves, sheaves diameter & groove, fixation of sheaves and wire runs not obstructed during operation. • Check & verify for double earthing. • Verification cum Certification of weight of Mast. Note: As 'well glass' type light fittings are to be used in the mast, the telescoping sections, while retracting/extending check that the sections do not foul with the fittings and sufficient clearance is maintained.
3	Substructure	• Auditing the quality control measures during construction including NDT & endorsement of the same. • Close Inspection of visual integrity. • Witness raising and lowering substructure for at least two Operations. • Verification of various dimensions, setback & rotary load capacities. • Verification of dimensions & safety aspects for drill floor, stairs & handrails, etc. • Verification cum Certification of weight of Sub-structure.
3	Deadline	• Fully functional testing at maximum load.

	Anchor	• Functional testing during draw-works & mast testing.
4	Rotary Table	• Manufacturer's commissioning documentation. • Verification of different parameters including load capacity. • Full function testing at all speeds/gears. • Rotational testing for at least six Hours. • Witness & certify temperature, noise, vibration etc. to acceptable limits.
4	Swivel	• Verification of specification & features. • Pumping through fluids using the Mud Pumps. • Rotational testing of the swivel for at least six hours.
4	Traveling Block & Hook	• Examination of the traveling block & hook for structural integrity. • Verification of specification & features. • Operational testing with maximum load on the Draw-works. • Functional testing of hook lock mechanism and snubber assembly.
4	Drill Pipe Spinner & Kelly Spinner	• Examination of structural integrity. • Verification of specification & features. • Operational testing for at least twenty times.
4	Hydraulic Catheads	• Examination of unit integrity. • Recording of various parameters including line pull, wireline size, hydraulic flow, etc.
5	Mud & Water Tanks system	• Verification of specification, dimensions & capacity. • Verification cum Certification of weight of Mud & Water Tanks. • Witness & recording the hydrostatic test. • Function testing of all the agitators, valves, superchargers, loading pumps, etc. • Check & verify for double earthing, cable hangers, cable trays. • Check, verify & witness proper illumination level.
5	Solid Control Equipments (viz. Shale Shaker, Desander, Desilter, Vacuum Degasser & Poor Boy Degasser)	• Manufacturer's commissioning documentation. • Verification of specification, features, dimensions & capacity. • Function test for all for at least six hours at maximum capacity. • Witness & certify temperature, noise, vibration etc. to acceptable limits. • Check & verify for double earthing in all electrical equipment.
6	Instrumentation for carrier	• Full functional testing of all instrumentation system in drivers cabin • Verification of manufacturer's documentation along with spare parts list
6	Instrumentation for engine & transmission	• Full functional testing of all instruments and safety switches connected with Engine, Air Dryer, Air Compressor and Air Receiver.

		• Full functional testing of Allison Transmission along with diagnostic software, parts catalogue etc. • Verification of manufacturer's documentation along with spare parts list
6	Instrumentation for draw-works, mast & sub-structure	• Full functional testing of all instruments and safety switches of drillers console
6	Drilling instruments	• Full functional testing of all instruments connected with monitoring system, mud management system, online gas monitoring system, various recorders
6	Instrumentation for power pack	• Full functional testing of all instruments and safety switches connected with engine and generator
6	Documentation	• Verification of technical documentation including service and operation manuals, physical layout drawings, as built diagrams, spare parts list etc. • Verification of DGMS (India)'s approval for all electrical and instrumentation equipment supplied for use in the hazardous area of the rig. (A visual guideline/ map / diagram of demarcation of areas as per DGMS guidelines is attached as **Addendum-Electrical*: Hazardous Area Guidelines Map.)***
7	Mud Pumps	• Manufacturer's commissioning documentation. • Verification of specification & features. • Verification cum Certification of weight of each Mud Pump. • Witness & certify the NDT of welded joints on the body of the pumps. • Function Testing of SRVs with verification of relevant certifications. • Function test of mud pumps for six hour period at maximum strokes and pressure. • Check & verify for double earthing in all electrical equipment.
7	Relief Valve	• Verification of specification. • Certification related to relief valves. • Witness & certify the Location.
8	Power Pack (Main Engines)	• Manufacturer's commissioning documentation. • Verification of make, specification & features. • Verification cum Certification of weight of each Power Pack. • Function test of all engines for six hour period. • Verification of load sharing. • Function testing of safety shutoff devices. • Verification of Acoustic Enclosure performance (i.e. 75 dbA at 1.0 meter from source). • Verification of calibrations of various meters and tools that are to be provided along with the Rig Engines. • Witness & certify temperature, noise, vibration etc. to acceptable limits.

		• Check, verify and witness proper illumination level inside enclosure.
9	Supply of complete electricals [Chapter I A, General Outline]	**Check and verify** • Manufacturer's commissioning documentation and procedure. • Supply of complete electrical system package, including auxiliary electrical systems for operation of the rig, viz. Generators, all electrical motors, Transformers, air conditioners, rig lighting system, utility system (compressed air, water etc.), cable system including cable trays, boxes & grasshopper/ elevators, earthing system, maintenance and testing facility for rig control system, complete set of spares etc. • Nameplate rating and make/ model of all electrical equipment against ordered specification. • Submission of detailed Piping & Instrumentation diagrams of all Electrical systems, control system, air conditioners etc. Applicable standards to be followed - Approved drawings / Industry best practices / applicable IS code.
9	Rig control system [Chapter I A: General]	**Check and verify** • Manufacturer's commissioning documentation and procedure. • Also witness Functional tests of all supplied hardware and software including Touch screen(s), PLCs, modules, uploading and downloading of programs etc. • Control system complete with all necessary software, hardware and remote communication capability. • Separate instrument earthing bus • All software, including hardware keys are licensed to Oil India Limited. Such Licenses shall not have expiration dates. All software licenses shall include India as geographical location of use, as per software distribution rights are concerned. • Manual bypass mode provided (in case of the control system failure) • Also witness Fault annunciation on simulated possible faults. • Details of spares supplied with equipment. Applicable standards to be followed - As per relevant standards/ tests of control system manufacturer.
9	Power pack (engine alternator) [Chapter I A]	**Check & verify** • Manufacturer's commissioning documentation and procedure. • Double earthing provision. • Proper foundation bolts and operation • Cable duct, proper illumination level, proper cable termination.

		• Double earthing provision. • Submission of open circuit & short circuit characteristic, Type Test and Routine Test records of alternators as per standards. • Details of spares supplied with equipment. **Check, verify and witness** • 100% load test of all power packs (individually) • Verification of load sharing (all possible power pack combinations) • Testing of safety devices like emergency stops, over speed trip, LLOP, HAT, HWT etc. in engine and E-stop switches from D'con • Certify temperature, noise, vibration etc. to acceptable limits. <u>Applicable standards to be followed</u> - Alternators shall be manufactured and tested as per IS 13364, Part 2 1992, IEEE Std. 115, NEMA MG-1, or MIL-Std. 705 ANSI C50.12, BS 4999, CSA, C22.2NO.100, IEC 34, API-546
9	Power Control Room (PCR) *Physical parameters* [Chapter I B]	**Check & verify** • Manufacturer's commissioning documentation and procedure. • Physical dimensions and weight as per order/drawing • Lifting provision (Suitable for bottom lifting). • Oil field type skid mounted. • Suitability of PCR house design for heavy rain/humid areas. Witness and certify for no water ingress/seepage. • NDT for lifting lugs and critical areas and wherever welding is done • Surface preparation • Painting/powder coating thickness verification. • Sufficient working space (min. 1mtr. in front of panels) • Double earthing provision. • Operation of anti-panic locks on doors. • Anti-corrosion treatment at PCR bottom. • Maintainability (easily removable & fixing) of ACBs, blowers, power contactors etc. **Check, verify and witness** • To be weight balanced at the centre (C.G. check) • Lifting operation for minimum 3 times and check for proper clearance between PCR body and lifting slings while lifting. • Testing of alarm hooter and light on PCR body (outside). • Proper illumination and quality of floor mat.

		Panels- • Electrical clearances (phase to phase and phase to ground). • Electrical creepage distance. • Tightness of all connections in bus bars, links and supports. • Terminations for proper crimping and tightness. • Wiring by ferrule numbers and tracing of wires as per drawing reference provided by equipment supplier along with the equipment. • Hot spots with infra-red thermometer (in load condition). • No. of starters along with spare starters as per order (Check & Verify). • Each individual panel in the MCC provided with RCD / ELCB for power circuit as well as control circuit • IR value test using 1000 V IR tester all around (with all breakers open)- main 600 VAC bus, 415 VAC auxiliary bus, DC bus. • Power frequency voltage test for 1 minute. • Mechanical operation of all ACBs/ MCCBs/ switches/ doors/ door latches/ locks etc. • Functional testing of all individual panels • Proper rating, setting and functional trip test by current injection of MCCBs. • Proper rating, setting and functional trip test of Overload relays. • Proper rating, setting and functional trip test of earth fault leakage detection devices. • Recording of amps readings during testing. • Calibration of all panel meters for proper reading. (initial calibration results may be provided by the manufacturers themselves). • Functional test as well as performance evaluation of air conditioners for cooling capacity (tons) – tonnage and details (type, full redundancy-100%, make, model, mounting etc.) of the air conditioning system as per order. • Plug socket cable terminations are of crimped type • Submission of calibration reports of all the panel meters as per standards. • Details of spares supplied with equipment. Applicable standards to be followed - PCR shell and components shall be manufactured as per IS Codes- 513, 613, 694, 1248, 1646, 1897, 1901, 2026, 2062, 2071 (2), 2102, 2147, 2551, 3043, 5578, 6875, 8084, 8623, 10118, 12021, 13118, 13703, 13947 etc. or *their equivalent international standards like IEC, NEMA*, IEC 60947 etc. and conform to Indian Electricity Rules 1956 *Wherever values are mentioned in the order, for example,*

		"SCR blowers should be capable of "X" CFM of air per minute or second", this has to be verified. *All starters below 55 kW (75HP) should be DOL type. Starters above this shall be provided with a "soft starter", with suitable contactor arrangement.*
9	Generator Panels [Chapter I B (b)]	**Check & verify** • Manufacturer's commissioning documentation and procedure. • Terminations for proper crimping and tightening • Also witness Functional test of each panel including all switches, speed/ voltage adjust pots. • Calibration of all panel meters for proper reading. • Also Witness Synchronization and load sharing of generators (in all possible combinations). • Also Witness Hot spots with infra-red thermometer (in load condition). • Also Witness Fault annunciation on simulated faults on alternator/ engine • Submission of calibration reports of all the panel meters as per standards. • Details of spares supplied with equipment. <u>Applicable standards to be followed</u> - As per approved drawings
9	Thyristor panels [Chapter I B (c)]	**Check & verify** • Manufacturer's commissioning documentation and procedure. • Tightness of all connections in busbars, links and supports • Terminations for proper crimping and tightening • Submission of calibration reports of all the panel meters as per standards. • Details of spares supplied with equipment. **Check, verify and witness** • Assignment verification. • Power contactors for proper rating and operation. • Functional test of all panels including all ACBs, MCCBs, switches, meters, indication lamps, logic circuit, adjustment pots etc. • Calibration of all panel meters for proper reading. • Panel blowers for proper rating, delivery, interlocks and operation. • Full load testing from all panels. • Hot spots with infra-red thermometer (in load condition) • Fault annunciation on simulated faults. <u>Applicable standards to be followed</u> - As per approved drawings
9	Field Supply panels	**Check & verify** • Manufacturer's commissioning documentation and

	[Chapter I B (d)]	procedure. • Tightness of all connections, links and supports • Terminations for proper crimping and tightening • Submission of calibration reports of all the panel meters as per standards. • Details of spares supplied with equipment. **Check, verify and witness** • Assignment verification. • Calibration of all panel meters for proper reading. • Panel blower for proper rating, delivery, interlocks and operation (if provided). • Functional test of all panels including all Fuses, MCCBs, switches, meters, indication lamps, etc. • Full load testing from all panels (with Thyristor panels). • Hot spots with infra-red thermometer (in load condition) Applicable standards to be followed - As per approved drawings
9	D'con (Driller's control console) [Chapter I B (j)]	**Check & verify** • Manufacturer's commissioning documentation and procedure. • Terminations for proper crimping and tightening • Submission of calibration reports of all the panel meters as per standards. • Details of spares supplied with equipment. • Proper mounting arrangement with vibration dampers and provision of canopy for protection from rain water. **Check, verify and witness** • Assignment verification. • Functional tests of all switches, throttles (up to 100%) and meters and annunciation • Functional test of foot throttle. • Functionality test of pressurization (air purging system) in D'con and foot throttle • Rotary torque current limit. • Illumination level of all indication lamps. • Calibration of all panel meters for proper reading. Applicable standards to be followed - As per approved drawing
9	DC drilling motors [Chapter I C 1 Mud pump Motors]	**Check & verify** • Manufacturer's commissioning documentation and procedure. • Foundation bolts (for both main and blower motor) • Double earthing provision (for both main and blower motor) • Submission of type test and routine test certificates as per standard.

		Check, verify and witness • Record of insulation testing. • Functional test of pressurization of blower and pressure switch/ relay. • Functional test of all interlocks. • Operation test - full load and single/double motor in pumps • Load sharing in double motor operation
9	Auxiliary motors [Chapter I C 2]	**Check & verify** • Manufacturer's commissioning documentation and procedure. • Number, type / rating etc. of motors as per order. • Nameplates detailing DGMS approval and embossed DGMS logo on motor body. • Nameplates detailing DGMS approval and embossed DGMS logo on PBS body. • Double compression glands at cable entry to Motor and PBS. • Double earthing provision. • Submission of type test and routine test certificates as per standard. **Check, verify and witness** • Record of insulation resistance • Functional test- no load/ partial load/ full load Applicable standards to be followed - Manufactured and tested as per IS- 325, 1231, 2148, 3682
9	Ground fault detection and Neutral grounding system of PCR [Chapter I B (h)]	**Check & verify** • Manufacturer's commissioning documentation and procedure. • Details of spares supplied with equipment. **Check, verify and witness** • Functional test of ground fault detection system including audio-visual alarm/ indication (600VAC & 750VDC bus) in PCR. • NGR system of PCR for proper rating and setting as per order. • Functional test of and records (including audio/ visual alarm tests) of restricted neutral earth system used in the system designed for maximum earth fault current of 750milliAmps using NGR. • Permanent Insulation monitor provided in the NGR system. Applicable standards to be followed - IS-3043, Indian Electricity Rules; Approved drawings
9	Transformers [Chapter I B (k)]	**Check & verify** • Manufacturer's commissioning documentation and procedure. • Name plate rating as per order. • Proper termination arrangement along standard

		color coded marking – primary and secondary (Stand off / cable connected in air filled enclosure). • Provision for Star connected secondary with neutral terminal available in terminal box (for isolation transformer) • Provision rollers for taking out the transformer for maintenance. • Submission of type test and routine test certificates as per standard. **Check, verify and witness** • Full load test including temp. rise. Applicable standards to be followed - Standard – Indian standard IS-11171, 2026 or equivalent international NEMA/ IEC
9	Rig Lighting system [Chapter I E, 1]	**Check & verify** • Quantity and type of light fittings • All the FLP light fittings DGMS (India) approved. Nameplates detailing DGMS approval and embossed DGMS logo on light fittings. • All light fittings provided with necessary control gears and lamps. • Proper mounting/fixing arrangement of all light fittings. • Provision of mast lighting socket board. • Lighting voltage (e.g. 240 volt phase to phase in Hazardous areas/ 240 volt phase to neutral for other areas). In non-hazardous areas separate 240 volt phase-to-neutral 4-wire system is used e.g. bunk houses, area lighting, canteen, security facilities etc. For this system isolation transformer is used with neutral grounded. • Also Witness Functional test of aviation warning lights– (a) Red colour, continuous glow (night), (b) white colour – flashing (day) as per order. Proper mounting arrangement. • Lighting scheme and details of light fittings. • Also Witness Trip test of all lighting circuits with RCBO/RCD for current leakage sensitivity of 300mA • Also Witness Illumination levels/values should be checked at all important locations and verified for proper value. • Details of spares supplied with equipment. Applicable standards to be followed - DGMS (India) approval & as per order specifications.
9	Area and crew cabin illumination system [Chapter I E, 2]	**Check & verify** • As per order • In non-hazardous areas separate 240 volt phase-to-neutral 4-wire system is used e.g. bunk houses, area lighting, canteen, security facilities etc. For this system isolation transformer is used with neutral

		grounded. • Also Witness Functional test of all feeders. • Also Witness Trip test of all lighting circuits with RCBO/RCD for current leakage sensitivity of 300mA • Details of spares supplied with equipment.
9	Cables and cable handling system [Chapter I D]	**Check & verify** • Type of cable for 3 phase equipment, light fittings, alternators, motors, controls connections- HOFR, EPR insulated, CSP sheathed and copper screened copper conductor, EVA insulated and sheathed copper conductor- as per order • Cable system suitable for 1+3 cluster drilling (length, size etc). • Cable trays, cable boxes, grasshopper etc. are provided. • Cable trays, cable boxes, grasshopper etc. to be provided with earthing links for earthing continuity. • All the cables including power, control, lighting etc. supplied complete with suitable male/female plug/ connectors • Cores identifiable by colour/ number • Details of spares supplied with equipment. Applicable standards to be followed - DGMS (India) approval & as per order specifications.
9	Rig Earthing system [Chapter I E, 4]	**Check & verify** • Quantity, quality and size of earth electrodes including connecting hardware. • Earthing scheme along with the electrode layout. • Double earthing provision in all equipments. • Details of spares supplied with equipment. Applicable standards to be followed - IS-1573, 3043
9	Electrical tools and instruments [Chapter I E, 5]	**Check & verify** • Calibration of all electrical tools and submission of calibration records by manufacture. • Laptop and desktop computers for control system programming - of latest models. Applicable standards to be followed - As per order specifications.
9	Spares [Chapter III]	• Check and verify details of spares supplied as per order quantity, make, model/type etc. Applicable standards to be followed - As per order specifications.
9	DGMS approval for Hazardous equipments [Chapter I C (5), 2, I E (1), various places]	**Check & verify** • DGMS (India)'s approval for all electrical equipment supplied for use in the hazardous areas of the rig. • Submission all relevant documents by supplier. • All such equipments are fixed with nameplates bearing DGMS approval no. and embossed DGMS logo.

		Applicable standards to be followed - Oil Mines Regulation 1984.
9	Surface finish and painting [Chapter I B]	**Check & verify** • All applicable equipment- as per order. • Painting/ powder coating thickness verification. Applicable standards to be followed - IS-5, 101
10	Rig Air System	• Verification of specification & features. • Full functional testing of system. • Witness & certify the Hydraulic Testing of Air Vessels and function testing of SRVs fitted to the Air system. • Function Testing of Air Dryer unit. • Witness & certify the NDT of welded joints of Air vessels. • Check, verify and witness for double earthing of all electrical equipment including utility hut. • Check, verify and witness automatic loading/unloading and interlocks. • Check, verify and witness proper illumination level inside enclosure. • Check, verify and witness submission of detailed Piping & Instrumentation diagram.
10	Suction & Delivery System (incl. Standpipe & ground Manifold)	• Verification of specification. • Witness & recording the pressure testing (at least 100% of working pressure). • Witness & certify the NDT of welded joints & pipes. • Function testing of all the valves.
10	Cellar Pumps	• Full Functional Testing. • Check, verify and witness for double earthing in all electrical equipment.
10	Pneumatic Winch	• Verification of features & specification including load capacity. • Functional testing at full load. • Operational testing at maximum load for at least 20 times.
10	Fuel System	• Verification of specification & features. • Full functional testing. • Suitability of construction. • Verification of Fuel transfer. • Witness & certify the Hydraulic Testing of Fuel Tanks. • Witness & certify the NDT of welded joints in the Fuel tanks. • Verification of Calibration Chart / Scale for Fuel Tanks as provided by Manufacturer. • Check, verify and witness for double earthing of fuel tanks, electrical motors and PBS.