BUREAU OF INDIAN STANDARDS

DRAFT FOR COMMENTS ONLY

भारतीय मानक **मसौदा**

घूर्णी मेज सहित प्रत्यक्ष परिचालन घूर्णी वेधन रिग — विशिष्टि

(*दूसरा पुनरीक्षण*)

DRAFT *Indian Standard*

DRILLING RIGS WITH ROTARY TABLE — SPECIFICATION

[*Second Revision* of IS 7206 (Part 1)]

ICS 23.040.70

Diamond Core and Water Well Drilling Sectional Committee, MED 21	**Last date for receipt of comments is 10 May 2022**

FOREWORD

(*Adoption clauses to be added later*)

This Indian Standard (Part 1) lays down the general requirements for use as guidelines by the manufacturers and the users, for direct circulation rotary drilling rig with rotary table. It is proposed to cover general requirements for direct circulation rotary drilling rig with a top drive for water well construction in Part 2 of the standard.

This standard was first published in 1974 and then revised in 1986.

Major changes in this revision are as follows:

a) Title has been modified (previously it was ‘General requirements for direct circulation rotary drilling rigs Part 1 With rotary table);
b) Classification has been added;
c) Mast/ derrick requirement has been modified;
d) Swivel/ kelly/ kelly drive bushing requirement has been added; and
e) Additional operating equipment and small tool requirement has been added.

The circulation rotary drilling rigs are being employed to construct water wells for the supply of water for drinking, irrigation, and industrial purposes.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2:2022 'Rules for rounding off numerical values (second revision)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

DRAFT *Indian Standard*

DRILLING RIGS WITH ROTARY TABLE — SPECIFICATION

[*Second Revision* of IS 7206 (Part 1)]

1 SCOPE

This standard lays down the general requirements for a direct rotary drilling rig with a rotary table used for water well construction.

2 REFERENCES

The standards listed below contain provisions, which through reference in this text constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreement based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
402 : 1990	Cold chisels — Specification (*third revision*)
694 : 2010	Polyvinyl chloride insulated unsheathed and sheathed cables/cords with rigid and flexible conductor for rated voltages up to and including 450/750V (*fourth revision*)
800: 2007	General construction in steel — Code of practice (*third revision*)
802 (Part 1 / Sec 1) : 2015	Use of structural steel in overhead transmission line towers — Code of practice: Part 1 Materials, loads and design strengths: Sec 1 Materials and loads (*fourth revision*)
844: 1979	Specification for screwdrivers
(Part 1)	Part 1 Technical supply conditions (*second revision*)
(Part 2)	Part 2 Dimensions (*second revision*)
(Part 3)	Part 3 Dimensions for screw drivers for recessed head screws (*second revision*)
1161: 2014	Steel tubes for structural purposes — Specification (*fifth revision*)
1269 (Part 2) : 1997	Legal metrology — Material measures of length: Part 2 Steel tape measures
1480 :1970	Specification for metric scales for general purposes (*first revision*)
1481 : 1970	Specification for metric steel scales for engineers (*first revision*)
1554 (Part 1) : 1988	Specification for PVC insulated (heavy duty) electric cables: Part 1 For working voltages up to and including 1 100 V (*third revision*)

1856 : 2021	Steel wire ropes for haulage purposes — Specification (*fourth revision*)
1931: 2000	Engineer's files — Specification (*third revision*)
2028 : 2004	Open jaw wrenches (spanners) — Specification (*fifth revision*)
2029 : 1981	Ring wrenches (spanners) — Specification (*fourth revision*)
2030 : 1989	Box spanners — Specification (*second revision*)
2062 : 2011	Hot rolled medium and high tensile structural steel — Specification (*seventh revision*)
2266 : 2019	Steel wire ropes for general engineering purpose — Specification (*fifth revision*)
2594 : 2003	Hacksaw blades — Specification (*second revision*)
IS 3082 : 2008/ ISO 2936 : 2014	Assembly tools for screws and nuts—hexagon socket screw keys (*third revision*)
3650 : 1981	Specification for combination side cutting pliers (*second revision*)
3961 (Part 2) : 2017	Recommended current ratings for cables: Part 2 PVC insulated and PVC sheathed heavy duty cables (*first revision*)
3961 (Part 3) : 1968	Recommended current ratings for cables: Part 3 Rubber insulated cables
4003 (Part 2) : 1986	Specification for pipe wrenches: Part 2 Heavy duty (*first revision*)
4003 (Part 1) : 1978	Specification for pipe wrenches: Part 1 General purpose
4123 : 1982	Specification for chain pipe wrenches (*first revision*)
4561: 1968	Specification for oil cans
(Part 1)	Part 1 Light duty oil cans
(Part 2)	Part 2 Conical oil cans
(Part 3)	Part 3 Feeding oil cans
(Part 4)	Part 4 Detachable spout oil cans
(Part 5)	Part 5 Lever type oil cans
5169 : 1986	Specification for hacksaw frames (*first revision*)
5706 : 1993	Optical instrument — Spirit levels for use in precision engineering — Specification (*first revision*)
6149 : 1986	Specification for single-ended open-jaw adjustable wrenches (*first revision*)
7794 : 1984	Specification for manual portable grease guns (*first revision*)
9181 : 1998	Specification for C-Clamps (*first revision*)
9439: 2022	Glossary of terms used in water-well drilling technology (*second revision*)
9968 (Part 1) : 1988	Specification for elastomer insulated cables: Part 1 For working voltages up to and including 1 100 volts (*first revision*)

9968 (Part 2) : 2002	Specification for elastomer insulated cables: Part 2 For working voltages from 3.3 kV up to and including 33 kV (*first revision*)
10002 : 1981	Specification for performance requirements for constant speed compression ignition (Diesel) engines for general purposes (Above 20 kW)
12360 : 1988	Voltage bands for electrical installations including preferred voltages and frequency
12615 : 2018	Line operated three phase a.c. motors (IE code) "Efficiency classes and performance specification" (*third revision*)
IS 15999 (Part 1) : 2021/ IEC 60034-1 : 2017	Rotating electrical machines: Part 1 Rating and performance (*second revision*)
IS 16491 (Part 1) : 2016/ ISO 13385-1 : 2011	Geometrical product specifications (GPS) — Dimensional measuring equipment: Part 1 Calipers; design and metrological characteristics
IS/IEC 60947-1 : 2007	Low-voltage switchgear and control gear: Part 1 General rules (*first revision*)
IS/IEC 60947-2 : 2016	Low-voltage switchgear and control gear: Part 2 Circuit-breakers (*first revision*)
IS/IEC 60947-3 : 2012	Low-voltage switchgear and control gear: Part 3 Switches, disconnectors, switch disconnectors and fuse-combination units (*first revision*)
IS/IEC 60947-4-1 : 2012	Low-voltage switchgear and control gear: Part 4 Contactors and motor-starters: Sec 1 Electromechanical contactors and motor - starters (*first revision*)
IS/IEC 60947-4-2 : 2011	Low-voltage switchgear and control gear: Part 4 Contactors and motor-starters: Sec 2 A.c. semiconductor motor controllers and starters (*first revision*)
IS/IEC 60947-4-3 : 2014	Low-voltage switchgear and control gear: Part 4 Contactors and motor-starters: Sec 3 A.c. semiconductor motor controllers and contractors for non-motor loads (*second revision*)

3 TERMINOLOGY

For the purpose of this standard terminology as given in IS 9439 shall apply.

4 CLASSIFICATION

The classification and selection of drilling rigs into light, medium, and heavy-duty as specified below is based on the diameter of the hole, depth of the hole, size of the drill rods, tool weight, and formation to be encountered during drilling:

Table 1 Rotary Direct Circulation

(*Clause* 4)

Sl No.	Classification	Diameter of Hole (mm)	Depth of Hole (mm)	Size of Drill Rods (mm)
(1)	(2)	(3)	(4)	(5)
i)	Light	200	Up to 250	Up to 73
ii)	Medium	200	Up to 450	Up to 89
iii)	Heavy	200	Above 450	Above 89

NOTE — Direct circulation rotary drilling rigs are suitable for drilling in hard abrasive alluvial, soil, clay shell, etc., formation

5 FUNCTIONS AND CONSTRUCTIONAL DETAILS

5.1 The drilling rig is used to construct deep wells for water supply and exploration purposes in formations varying from soft and medium to hard.

5.2 Under direct rotary drilling method the hole is drilled by rotating the drilling string. Drilling fluid is pumped into the hole from a suction pit through delivery lines and drilling string. The drilling fluid circulated, removes the drill cuttings from the bottom of the hole, and gets collected at the suction pit. Thus the circulation of the drilling fluid is a continuous process while drilling is in progress (*see* Fig. 1). The drilling fluid pumped into the hole forms a coating on the side walls preventing the hole from collapsing and preventing the loss of circulation of water and keeps the cuttings in suspension. In addition, it cools and lubricates the drilling string and the bit.

5.3 The functions and constructional details of the various units of the water well drilling rig are given in Fig. 2. This figure is intended to be typical only and does not constitute a specific recommendation but is only a guideline for the manufacturers and the users of the direct rotary drilling rigs.

5.3.1 *Hoisting System*

5.3.1.1 The function of the hoisting system is to provide necessary equipment used with the rig for lowering and hoisting the drill string, casing pipes, and miscellaneous operations such as lowering of assembly, pump installation, etc. The total mass of drilling string is an important consideration taken into account in the design of the hoisting equipment although due consideration is given for the casing loads which may be heavier than the drill pipes at times.

5.3.1.2 The main components of the hoisting system include the draw-works, the mast or derrick, rotary table, travelling block, etc.

5.3.2 *Mast or Derrick*

5.3.2.1 The derrick/mast shall be designed and fabricated to carry safely all loads which may occur in actual operations. The largest dead load imposed on the derrick is normally the heaviest drill string or the casing assembly run in the well. The maximum vertical load imposed on the derrick is on account of pulling up the entire drill string or casing assembly, which gets stuck up in the hole during drilling operations. The designer shall design the mast with a safety factor of three times the load of the drill string/ casing assembly to be lowered.

5.3.2.2 The derrick/mast shall also be designed to withstand heavy wind loads as specified in IS 800 or in IS 802 (Part 1 / Sec 1). The horizontal force of the wind on the derrick and the vertical load of the drill pipe shall be given due consideration.

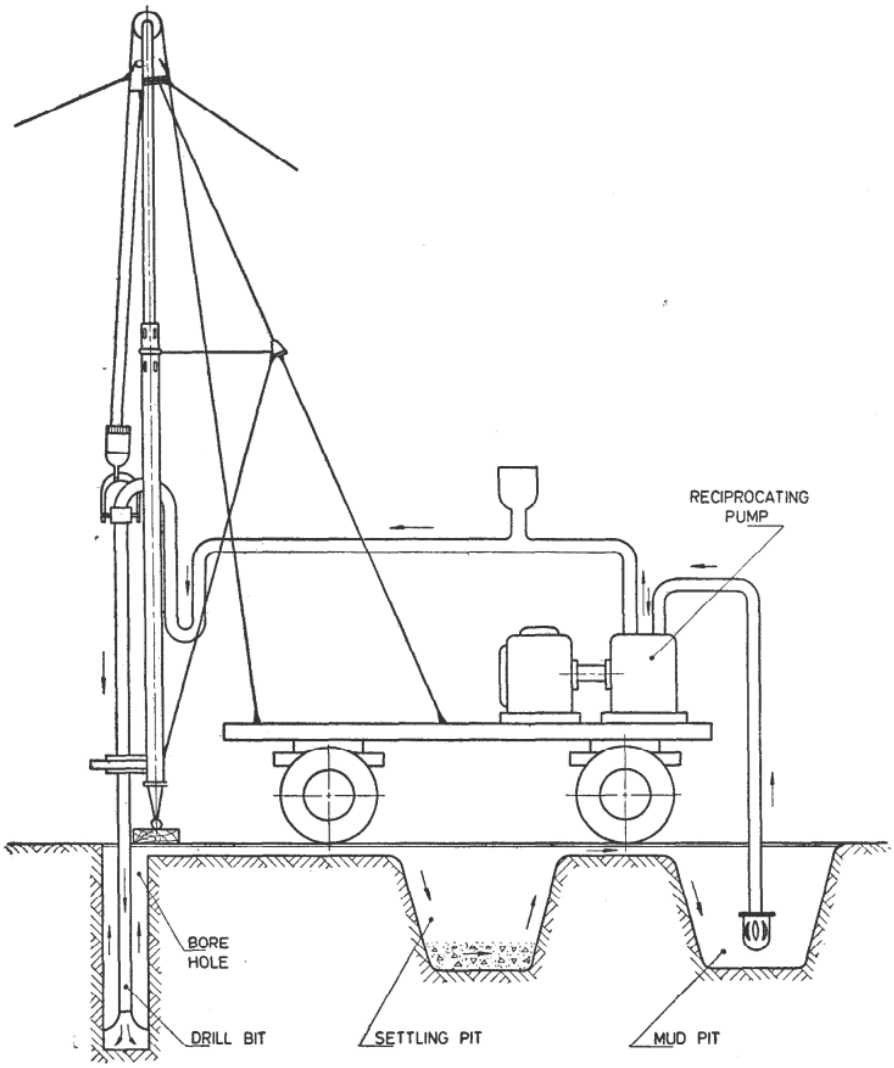

FIG. 1 ROTARY DRILLING SYSTEM

5.3.2.3 The derrick shall have a clear working height to facilitate the handling of drill string and casing and shall be of sufficient width to handle, with ease, the changing of drilling bits. The mast shall be able to accommodate a rotary table, the desired number of double sheave pulleys, travelling block swivel hook, haulage wire ropes, and other drilling accessories. The hook providing connection between travelling block and swivel shall be designed to handle with safety the complete drill string, casing assembly, etc., with a factor of safety of two.

5.3.2.4 The material used in the construction of mast shall conform to IS 2062 or steel tube conforming to IS 1161. The material shall be capable of handling the maximum load without distortion, with the factor of safety being not less than three in any case.

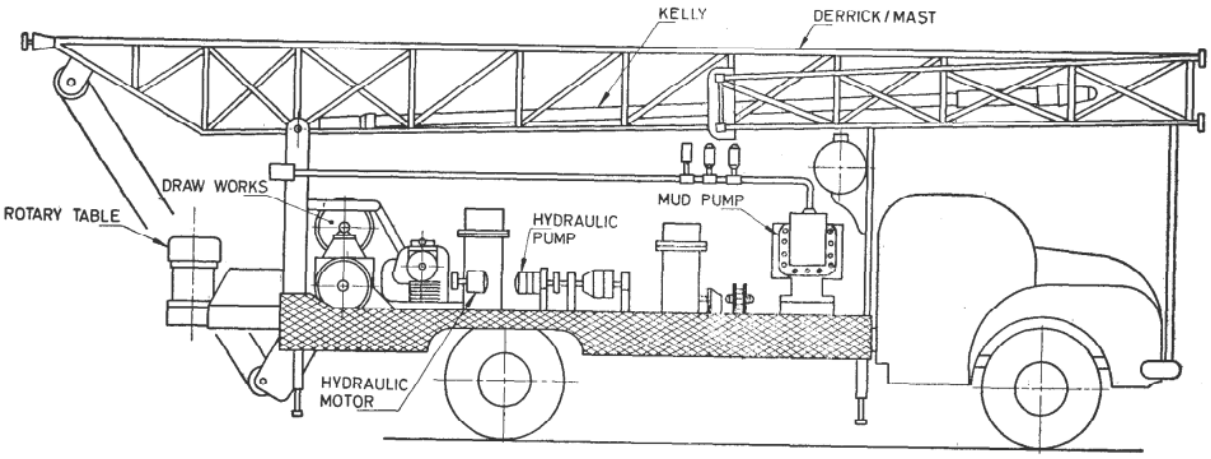

FIG. 2 ROTARY DRILLING RIG

5.3.2.5 The mast shall be fabricated with cross members to distribute the load uniformly. They shall be properly welded without cracks. The line of centre to the crown pulley block shall be perpendicular to the centre of the rotary table. Sufficient working room shall be provided on the derrick floor after its erection. The mast may be made in two parts in case of the heavy-duty rigs for easy transportation on the highways.

5.3.2.6 The mast shall be actuated by one or more double-acting hydraulic cylinders with safety checks to either raise or lower it. Mechanical locks shall be provided to hold the mast in vertical position. Adjustable leg supports shall be provided for levelling of the rig and also to take up the loads without disturbing its position.

5.3.2.7 Hydraulic pumps of adequate capacity shall be installed with control valves for using the hydraulic cylinders in case of hoisting and lowering the mast. Provision may be made to accommodate necessary water connection joints and an electric wiring system on the mast. The hydraulic system shall also have adequate capacity for rotary table retraction and hydraulic pull down units, if needed.

5.3.2.8 The derrick shall have provision to install the B J style tongs unit for making and breaking of joints of drill strings.

5.3.3 *Draw-works*

5.3.3.1 The draw-works is an equipment used to transmit the power required to remove the drill string from the hole and to lower the equipment in the hole. It consists of two or more drums to accommodate sufficient length of wire ropes of required size depending upon the capacity of the rig to handle the necessary equipment during drilling operations. Generally, three lines known as drilling line, hoisting line, and sand line ale accommodated.

5.3.3.2 The drilling line is used with the drilling string exclusively, and shall have sufficient capacity to handle the total load of the drill string. The casing line/hoisting line is used for assembly lowering and drill rod handling during operations. In case of failure of the drilling line, hoisting line may be used as drilling line. The sand line is used for material handling, bailing, etc.

5.3.3.3 The power for the draw-works may be conveyed either through pneumatic clutches or mechanical clutches.

5.3.3.4 The drums shall be operated with brake hands of adequate capacity. The shaft of the hoisting assembly shall be mounted on antifriction bearing on either side with adequate lubrication facilities. The drum shall be mounted in line for the handling of drill pipes, casing, etc. It shall be capable of exerting sufficient pull on drill string or other lines using single or multiple sheave pulleys through steel wire ropes conforming to IS 1856 or IS 2266 laid on both the drums. The hoisting system shall be able to operate at different hoisting speeds as per the requirement of loads.

5.3.3.5 Drilling line is used with the traveling block and the casing line shall have double pulley block with swivel hook.

5.3.3.6 All draw work shall be tested to demonstrate that the clutch system of draw work is capable of lifting the hook load specified and have sufficient capacity to hold the hook load specified.

5.3.3.7 *Swivel/ Kelly/ Kelly drive bushing*

The swivel of suitable static load capacity and diameter shall be provided. A suitable arrangement should be provided to connect the mud pump and air compressor, clamps for holding kelly during transportation to be provided on the mast.

5.3.4 *Rotary Table*

5.3.4.1 The rotary table is used to transmit the torque and impart rotary motion to the kelly and the drill string. The upper part of the rotary table accommodates kelly bushings used to rotate the kelly. It is made of cast alloy steel fitted underneath with ring gear shrunk onto the table. The table is supported either by ball bearing of taper roller bearings capable of supporting the total load of the drill string or casing assembly which have to be lowered into the well. Hence provision has to be made in the form of suitable bearings for holding the table as well as holding the kelly bush, casing slips, etc., in position. Suitable guards with oil seals

may be provided so that the mud or water does not leak to the gear or into the bearings. Ring gear and its driving pinion gear are generally of spiral bevel construction which provides smooth operation. The manufacturer shall specify the speed reduction from the pinion shaft to the table. The pinion shaft shall be fixed with antifriction bearings of taper roller design. This shall also be equipped with necessary oil seals and guards to prevent the entry of mud or water into the interior parts of the assembly.

5.3.4.2 Power for driving the rotary table may be taken by shaft drive or any other suitable drive to select various rotational speeds required to drill through different formations. The rig shall have at least four forward speeds and one reverse speed to suit the formations.

5.3.4.3 The power to the drive shall be from the main power unit or from a separate power unit with specified gear reductions. An independent clutch may be provided for imparting the rotary movement as and when required. It shall be able to carry the total load of the drill string and maximum housing assembly. A powerful hydraulic pull-down system may be provided to give positive downward pressure to the drill string if needed.

5.3.5 *Transmission Gear Box*

For obtaining different rotational speeds at the rated power from the prime mover to operate the rotary table as well as the hoisting drums according to the load conditions, a sturdy gearbox with four forward and one reverse speed with required gear reduction shall be provided. This unit is coupled to the power unit through the main clutch. Individual clutches may be provided for all the subunits. The gearbox shall be of simple design land the gear shall be of sturdy nature to withstand sudden loads.

5.3.6 *Compound Case*

These shafts are provided in an oil bath for compounding the power dissipated by the two prime movers. Oil bath compound case if provided shall combine the power of both the engines and run singly when required.

5.3.7 *Pull Down*

The pull down pressure shall be sufficient to give the required pressure on the drill string when needed. Pull down may have either hydraulic or mechanical chain feed.

5.3.8 *Mud Pump*

5.3.8.1 In direct circulation rotary drilling operations, drilling mud, pumped down through the drill pipe is discharged through the bit and returns to the surface through the annular space between the drill pipe and the walls of the hole.

5.3.8.2 Reciprocating, positive displacement, double acting (duplex), or centrifugal pumps of adequate capacity with suitable prime mover shall be provided with the direct circulation rotary drilling rigs. The pump shall be able to clearly flush out the cuttings from the bottom of the borehole to obtain the maximum drilling rate. The pump shall be designed to deliver the required quantity of mud fluid at adequate pressures corresponding to the depth and size of the boreholes. The cylinder liners of the mud pump shall be of a replaceable type. The pump shall have an

independent control deriving power either from the main power unit or from the auxiliary power unit. It shall be provided with an independent clutch to operate it when required. Necessary pipelines and high-pressure hoses for delivery and suction with suitable pressure gauges may be provided. To prevent damage to the hoses and pipelines a pressure release valve/safety valve shall be provided to relieve the excessive pressure if the pump develops high pressure. The section hose used in drilling rigs shall withstand the abrasive action of the circulating fluid. The pistons shall have replaceable rubber cups facing opposite directions at each end of the piston. The valves, actuated by the pressure in the fluid being pumped shall also be replaceable. The delivery hose is used to deliver the mud fluid from the upper end of the standpipe to the swivel connected at the top of the drill string.

5.3.9 *Power Units*

5.3.9.1 The various components of the drilling rig shall be run by either one or more prime movers depending upon the capacity of the rig. High-speed industrial diesel engines or electric motors of adequate capacity may be provided along with the drilling rigs.

5.3.9.2 Diesel engines used with drilling rigs shall be continuously rated engines conforming to IS 10002 and shall conform to the latest pollution norms and shall be easily accessible for simple repairs. The engine shall be capable of delivering an output of ten percent in excess of its rated output for at least a period of two hours in a cycle of 24 h.

5.3.9.3 The electrical motors, where used, shall be continuously rated and shall conform to IS 12615 or IS 15999. The switch gear shall conform to IS/IEC 60947 [Part 1 to 4 (Section 1 to 3)] as applicable. The cables shall conform to either IS 694 or IS 1554 (Part 1) or IS 9968 (Part 1 and 2). The cable shall be rated in accordance with IS 3961 (Part 2 and 3) as the case may be. The working voltages of motors shall be in accordance with IS 12360.

5.3.10 *Hydraulic Pumps*

Hydraulic pumps of adequate capacity may be provided for actuating mast raising cylinders, pull down system, rotary table, retraction, etc. These pumps may be driven with power drawn from the main prime mover or from the auxiliary prime mover.

5.3.11 *Controls*

5.3.11.1 All the controls shall be grouped together at the left side of the drillers station near the rotary table. The control shall be provided for the following operations:

a) To start/shut off the power unit;
b) For raising and lowering the mast;
c) For operating the hoisting, drilling and sand lines;
d) To operate rotary table of the drilling string;
e) To drive the mud pump;
f) To control the throttle of the prime movers;
g) To operate the gear shift levers; and
h) For lighting system.

5.3.11.2 In addition, gauges for mud pump pressure, hydraulic pressure, voltmeter and ammeter, etc., may be provided. Separate meters may be installed indicating the rotation speed, penetration rate and pull down pressure. Weight indicator may also be provided.

5.3.12 *Lighting System*

Generally drilling operations are carried out during day and night. To enable round-the-clock operation, the entire rig shall be adequately illuminated. In the case of the rig mounted with a diesel engine, the power for lighting shall either be from the main engine or from any auxiliary equipment. In the other case where the electric power is available and the rig equipped with electrical motors, the power for the lights shall be tapped from the electrical main and in the case of rigs supplied to mines the voltage shall be either 110 V or 240 V. Panel lights for the gauges may also be provided. Suitable control switches shall be provided.

5.3.13 *Mounting*

All the above units put together comprises one drilling unit. The whole system shall be mounted on a steel welded structure forming a solid foundation for the entire machinery. This structural construction, in turn, may be mounted on either a self-propelled roadworthy truck of adequate capacity having sufficient wheel base or trailer chassis with pneumatic wheels with tow bar arrangements for shifting by tractors or trucks.

6 TOOLS AND ACCESSORIES

6.1 To operate the direct rotary drilling rig, a complete set of following operating equipment shall be provided.

a) Kelly;
b) External upset seamless drill pipes of different sizes as desired by the purchaser;
c) Drill collars of different sizes;
d) Double tube core barrels, with necessary subs;
e) One set of coring bits of different sizes and types to suit the core barrel;
f) Water swivel suiting to the size of drill pipes;
g) High pressure drill hoses;
h) Suction hoses with strainer depending upon capacity of the mud pump;

j)Travelling blocks with sheaves according to the capacity of the rig;

k) One set of rotary tongs to handle drill pipes;
m) Central latch elevators for hoisting the drill pipes and all sizes of casing assembly as required by the purchaser;
n) Hoisting plugs for hoisting the drill pipes to suit the drill pipe supplied;

p)All types of subs required for connecting the kelly, drill pipes, drill collars, rock roller, bits, drag hits, etc;

q) Spider bush with slips for handling pipes of different sizes;

r) 'C' clamps conforming to IS 9181;
s) Fishing tools — Right handed fishing tap and die (male and female) set for the drill pipes sizes supplied;
t) Two sets of pipe wrenches of nominal size 900 and 1 200 mm conforming to IS 4003; and
u) One set of RR bits of different sizes for all formations.

6.2 Small Tools

Following small tools shall be supplied with the direct circulation rotary drilling rig for use during maintenance:

a) Spirit level conforming to IS 5706;
b) Adjustable wrenches conforming to IS 6149;
c) Ring spanners sets conforming to IS 2029;
d) Double ended open jaw spanner sets conforming to IS 2028;
e) Box spanner sets conforming to IS 2030 suiting to the machinery;
f) Grease gun conforming to IS 7794;
g) Pliers conforming to IS 3650;
h) Pipe wrench conforming to IS 4003 (Part 1);

j) Chain pipe wrenches conforming to IS 4123;

k) Oil cans conforming to IS 4561 (Part 1 to 5);
m)Outside calipers conforming to IS 16491 (Part 1)/ ISO 13385-1;

n)Inside calipers conforming to IS 16491 (Part 1)/ ISO 13385-1;

p) Scales conforming to IS 1480 or IS 1481;

q)Steel tape conforming to IS 1269 (Part 2);

r) Tachometer;

s) Chisels conforming to IS 402;
t) Centre punch;
u) Set of files (flat, round and half round) conforming to IS 1931;
v) Hexagonal socket screw keys conforming to IS 3082;
w) Hacksaw frame (*see* IS 5169 for hacksaw frames with blade and IS 2594 for hacksaw blades);
y) Flexible grinder;
z) Screw drivers conforming to IS 844 (Part 1 to 3);
aa) Heavy duty puller for pump (liners/valve seat);

ab) Heavy duty travelling jacks — 20/25 tonne capacity (for rig levelling) - four numbers;

ac)100 tonne capacity mechanical/hydraulic jacks for fishing operations - two numbers;

ad) Clamps for pipes; and

ae) Clutch adjustable spanner for mud pump.

7 INFORMATION TO BE SUPPLIED BY THE PURCHASER

The following information shall be furnished by the purchaser at the time of enquiry or order:

a) The type of formation the rig is likely to encounter during drilling operations for ground water exploration:
b) Mean sea level of the operating area;
c) Anticipated depth and final size of the borehole and the anticipated assembly size;
d) Total height of the mast;
e) Mobility of the entire unit, either truck or trailer mounted;
f) Power available to drive the rig and mud pump;
g) Compounding gear box of prime movers;
h) Any special features required to be installed; and

j) Any special tools to be supplied.

8 INFORMATION TO BE SUPPLIED BY THE MANUFACTURER/SUPPLIER

The following details of the direct rotary drilling rigs shall be furnished by the manufacturer/supplier at the time of delivery:

a) Total capacity of drilling in terms of the size of the rod, maximum load that can be handled, approximate rate of drilling under normal hydrogeological conditions;
b) Hoisting speed versus engine speed (rev/min), transmission gear ratio;
c) Rotary table speeds;
d) Mud pump capacity, namely, maximum discharge and pressure with respect to bore and stroke;
e) Maximum hook load capacity;
f) Maximum working height, width and constructional details of the drilling mast;
g) Wire line capacities with respect to various sizes provided in the draw-works;
h) Capacity of the main line and auxiliary lines:
j) Number and capacity of the mast raising cylinders;
k) Horse power of the prime mover and its transmission ratio;

m)Capacity of the hydraulic pump in terms of pressure and quantity delivered;

n) Compound case;

p) Capacity of the mast;

q) Types of clutches provided;
r) Capacity of the generator and its details;
s) Overall height of the mast in down position;
t) Overall length of the mast-in down position, axle load, wheel base, total length and width of the chassis and other general dimensions may be provided. However, these aspects shall be such as to meet the statutory motor vehicle rules and regulations;

u) The physical and chemical properties of the drill pipes, drill collar and kelly; and
v) Detailed operating instructions manual and parts catalogue of the equipment, such as:
    1) Functional details of the various instruments installed;
    2) A sketch diagram of the power transmission;
    3) Any other special features that am incorporated in the design and construction of the drilling rig;
    4) Recommended servicing system; and
    5) Trouble shooting and remedy chart for all the major components.

9 TESTING

The object of testing of the drilling rig is to determine the efficiency of the drilling rig in terms of its capacity to the specified diameter/depth of drilling and rate of penetration in semi consolidated and unconsolidated formations round the clock, till it reaches its rated capacity.

9.1 Duration of Test

The duration of test shall be sufficient to obtain the specified performance and consistent results of all the major components of the rig.

9.2 Observation during the Test

During the period of test, observation shall be carefully made in regard to the following:

a) The rig mounted on the chassis shall be inspected for axle loading on the front axle and the rear axle so that it shall be within its specified limits of the vehicle/trailer. The ability of the vehicle/trailer for driving on the road may be examined and shall meet the statutory motor vehicles rules and regulations. Thus the mobility of the drilling rig from one place to another place shall be checked;

b) The prime movers shall be checked for their performance on continuous loading and overloading of 10 percent for a period of two hours;

c) The handling capacity of the mast and draw-works in respect of hoisting and lowering system shall be verified according to the rated capacity;

d) The hydraulic system shall be operated and checked to its rated capacity and performance of the control valves, hoses, etc., shall be checked;

e) The rate of speed in erection of mast and commencement of drilling shall be noted;

f) The rig shall be operated to the maximum capacity and a log book shall be maintained to record the progress and performance of the rig, the depths achieved at various intervals, penetration rate and the nature of the soil and aquifers encountered during testing operations. If the rig fails to function, the defect shall be located in respect of operating equipment or if of any other nature and whether the same is found repeated. The reasons for the same shall be investigated and recorded.

Records shall be maintained in respect of details of the surface pipes lowered, pilot hole drilling with lithology, reaming and lowering of assembly;

g) The performance of the mud pump in respect of the consistent delivery and pressure shall be recorded at various depths and time taken in clearing of cuttings;

h) The average fuel consumption per hour may also be recorded during the test;

j) The drill pipes and the working tools shall conform to the specifications where specified and shall not develop any cracks or deformations during the testing of the rig;

k) The lubrication system of all units shall be checked;

m) Dampening of vibrations, hammering effects and undue shock loads shall be checked; and

n) All important components and controls of mast, rotary table draw-works and transmission system and lighting system shall be checked thoroughly for suitability and stability.

10 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the product(s) may be marked with the Standard Mark.