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भाग 1 यांत्रिक चालन
(दूसरा पुनरीक्षण)

**Selection of Diamond Core Drills —
Code of Practice**
Part 1 Mechanical Drive
(*Second Revision*)

ICS 73.100.30

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भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुर शाह ज़फर मार्ग, नई दिल्ली - 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI - 110002
www.bis.gov.in www.standardsbis.in

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FOREWORD

This Indian Standard (Part 1) (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Diamond Core and Waterwell Drilling Sectional Committee, had been approved by the Mechanical Engineering Divisional Council.

The criteria laid down in this standard are generally used for exploration, mining, drifting, foundation testing, grout drilling and soil/strata investigation may serve as guidelines for use by the manufacturers and the users of diamond core drills.

This standard was first published in 1986 and subsequently revised in 2005. This revision has been brought out for incorporating the modifications found necessary as a result of experience gained with the use of this standard. Also, in this revision, the standard has been brought into the latest style and format of Indian Standards, and references wherever applicable have been updated. The following major changes have been incorporated in this revision:

- a) The scope and title of the standard has been modified;
- b) Selection of surface drills have been modified; and
- c) Test method for drills have been incorporated with the revision of the standard.

The composition of the Committee responsible for the formulation of this standard is given in [Annex A](#).

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.

Indian Standard

SELECTION OF DIAMOND CORE DRILLS — CODE OF PRACTICE

PART 1 MECHANICAL DRIVE

(*Second Revision*)**1 SCOPE**

This standard (Part 1) covers selection for diamond core drills generally used for exploration of all minerals including coal.

2 REFERENCES

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

<i>IS No.</i>	<i>Title</i>
IS 2266 : 2019	Steel wire ropes for general engineering purpose — Specification (<i>fifth revision</i>)
IS 10208 : 1982	Diamond core drilling equipment — Specification

3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply:

3.1 Maximum Hook Load — Weight of drill string at maximum drill capacity (for the maximum depth attainable by the drilling machine) when suspended in the air in vertical position that is ninety degrees. The weight of conventional (W) and of wire line (+) series rods is given in [Table 1](#).

4 SELECTION CRITERION

4.1 The selection of a top drive hydrostatic drill depends mainly upon the depth to be drilled and the core diameter required at the final depth. Other selection parameters such as type of prime mover, mounting, transmission, feed arrangement, rotation head, rod holder and optional assemblies like wire line hoist, type of control, recording mechanism, mast, safety attachments, etc depend upon

individual requirement which are detailed in relevant clauses of this standard.

4.2 Construction of drill, however, depends upon following location of use and type of operating system:

- a) Surface; and
- b) Underground.

NOTE — This standard covers the requirement for surface drill only.

5 SELECTION OF SURFACE DRILL**5.1 Capacity of Drills**

5.1.1 Capacity of the drill is usually defined by maximum hook load, which can be safely handled by the hoisting system of the drill as defined in [3.1](#). The standard capacity ranges are given in [Table 2](#).

5.1.2 The capacity of the mast shall be twice the rated capacity of the drill that includes maximum weight of the drill strings (rods and barrels with core). The rated capacity of the drill WLH and WLP size shall be declared by the manufacturer.

5.1.3 For depth ranges other than those mentioned above, the capacity would be decided by mutual agreement between the purchaser and the manufacturer.

5.1.4 Capacity of the drill should also be considered for selection of suitable circulating triplex fluid pump with maximum fluid specific gravity of 1.2 (unit).

5.1.5 Although, drilling is the main function of a core drill, its capacity is generally specified by the weight of the drill string it is able to hoist in free air in vertical position that is ninety degrees. This is so because the power required for hoisting operation is higher than that required during actual drilling operation. Further, maximum stresses are developed in components of the transmission mechanism during hoisting and hence the hoisting operation is more critical for design consideration.

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Table 1 Weight of Wireline Drill Rods

(Clause 3.1)

SI No.	Size Code	Weight of 3 m Long Steel Drill Rod, in kg
(1)	(2)	(3)
i)	WLA	14.1
ii)	WLB	18.2
iii)	WLN	23.6
iv)	WLH	34.9
v)	WLP	56.0

Table 2 Capacity of the Drills

(Clause 5.1.1)

SI No.	Capacity Designation	Depth (m)	Rod Size
(1)	(2)	(3)	(4)
i)	Shallow	< 200	WLN
ii)	Moderate	201 to 500	WLN
iii)	Medium	501 to 1 000	WLN
iv)	Deep	1 001 to 2 000	WLN
v)	Very Deep	> 2 001	WLN

NOTE — Corresponding depth for WLP and WLH rod size shall be as per the mutual agreement between byer and purchaser.

5.2 Mounting

5.2.1 Normally the types of mounting as given in [5.2.2](#) to [5.2.4](#) are used for surface drill.

5.2.2 Truck Mounted

When the terrain for drilling is plain and maneuverability is easy, it is advantageous to have a truck mounted drill. The advantage of truck-mounted drill includes quick transportation and erection of drills by using hydraulic jacks. The disadvantage in this type of mounting is that the drill cannot negotiate steep gradients and undulated terrain.

5.2.3 Skid Mounted

5.2.3.1 This is the most commonly used type of mounting due to its versatility by having self-towing arrangement, both in the front and rear. It can negotiate any terrain on its own power.

5.2.3.2 The skid base shall be rigid, steel structural frame so that the unit is able to negotiate gradients of 1 in 4 under its own power without losing its stability. Skid surface shall be large enough for self-propelling of the unit. Construction of the base shall be of adequate strength to bear the weight of

the unit and also to overcome the wear and tear due to skidding during transport. Brass wear plates may be provided on the skid to take care for the wear and tear during retraction.

5.2.3.3 The skid surface shall be so designed that it does not cause any obstruction during angle hole drilling. If necessary, detachable front toes may be provided to achieve this aim.

5.2.3.4 On the requirement of the purchaser, an arrangement for sliding the prime mover on the skid may be made by the manufacturer for the ease of maintenance of drill assemblies. The skid can be made longer so that engine may slide backer any other design as per mutual agreement between the purchaser and the supplier.

5.3 Crawler Mounted

Crawler mounted drills are good in terms of maneuverability in hilly terrain and other treacherous terrain. The gradeability of crawler mounted drills shall be twenty-five degrees to thirty degrees. The width of the crawler shall be 1 900 mm to 2 000 mm up to 600 m of drills and beyond 600 m capacity with WLN rods shall be as agreed between manufacturer and buyer.

The following parameters shall be declared by the manufacturer:

- a) Gradeability;
- b) Width; and
- c) Ground pressure.

5.4 Hoisting System

5.4.1 The hoist will have planetary gears to provide speed range from 20 m/min to 100 m/min for hoisting system. The clutch and brake drum shall be of adequate dimension to take full load at the rated capacity of the drill. The drum shall have a manually controlled clutch and brake system of adequate capacity. These may be covered to protect against entry of water, oil, dirt, etc. The clutch shall be on the left side of the operator and brake shall be on the right side of the operator for ease of operation.

5.4.2 The hoist drum shall be provided with adequate length of steel rope suitable for single line pull, to lift the rods as per the rated capacity of the drill. The steel wire rope shall be of multi-strand type, left hand ordinary lay, non-rotating type, conforming to IS 2266. The size of the rope to be provided with the drum shall be as specified by the user. The winding of the rope in the drum shall be in such a way that the rope enters below the drum from the direction opposite of the controls.

5.5 Swivel Head

5.5.1 The assembly shall incorporate bevel gears, spiral bevel gears or hypoid gears running in oil bath/grease. The head shall be capable of swiveling through 360 degree range. The swivel head shall be of WLN, WLP and WLH size codes. Spindle may be circular or hexagonal, however, hexagonal is preferred. The hydraulic cylinder shall be of adequate capacity with minimum 40 percent overload capacity and micro fine feed control device may be fitted to regulate the flow of oil. The feed length of drills with hydraulic feed shall normally be 610 mm.

5.5.2 The spindle shall be provided with a balanced chuck having 4 jaws operated mechanically or hydraulically or both. The mechanical chuck shall be provided at the bottom of the spindle and the hydraulic shall be provided at the top of the spindle.

5.5.3 The hydraulic pump shall be of the constant volume or variable volume type of adequate capacity and min pressure rating of 10 MPa. It shall be capable of running continuously to provide constant hydraulic pressure. The drive to the hydraulic pump shall be from the main gear box, power take-off (PTO) and a provision to engage and disengage the pump as per the requirement.

5.6 Foot Clamp

The drills shall be provided with a foot clamp which may be actuated hydraulically. The foot clamp shall be provided with fail safe mechanism in case of hydraulic failure.

5.7 Retraction

The drill shall be provided with hydraulically retractable device for forward and backward movement of the entire drill unit with prime mover so that the machine is clear off the bore hole to facilitate running down of drill string.

5.8 Instrumentation and Controls

All control levers of the drill and the prime mover shall be conveniently grouped at a control panel for ease of operation. Drills shall be provided with following instruments/controls:

- a) Bit rpm meter;
- b) Relief valve;
- c) Feed valve;
- d) Emergency stop switch; and
- e) Time recorder — The prime mover shall be provided with a system to record the actual running time.

5.9 Auxiliary/Components

- a) Cat head — Cat head may be provided as an optional attachment, if required by the purchaser. It shall be top/side mounted with engagement and disengagement control. It shall be properly located for ease of operation and shall provide for variable rotational speed;
- b) Wire line hoist — Built-in type mechanically/ hydraulically driven wire line hoist with suitable power take-off incorporating a clutch, brake and an operating lever. In case of hydraulic operated hoists, no clutch and brakes are required as hydraulic circuit provides these operations;
- c) Lighting system — Lighting system shall be provided;
- d) Tools — Adequate tools for operation and maintenance of the drill;
- e) Hydraulic test kit — Hydraulic test kit comprising of pressure meter, flow meter regulating valve and necessary bases; and

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- f) Mud test kit — Mud testing kit comprising marsh funnel, mud balance, filter press, sand content measuring tube and pH meter may be provided if required by the purchaser.

5.10 Safety Fittings

- a) Emergency switches shall be provided;
- b) All rotating parts shall have safety guards; and
- c) Silencer shall be covered with heat insulation and safety guard.

6 TEST

6.1 Offsite Test

6.1.1 Test Duration

During the offsite testing, the rig shall be continuously operated for 12 h for observing the overheating components and the leakage in the system.

6.1.2 Observation During the Test

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

- a) Prime mover characteristics provided by the manufacturers shall be checked and verified as agreed between manufacturer and buyer. In case of electric motor, motor characteristics provided by the manufacturers shall be checked and verified as agreed between manufacturer and buyer;
- b) The test report hydraulic motors and pumps as supplied by OEM shall be checked and verified as agreed between manufacturer and buyer;
- c) The hook load/hoisting capacity of the mast and draw-works in respect of hoisting and lowering system shall be verified according to the rated capacity as per [3.1](#);
- d) The lubrication system of all units shall be checked for its proper functioning; and
- e) All components and controls of mast, rotary table draw-works and transmission system and lighting system shall be checked for its proper functioning.

6.1.3 Offline Compliance

If the requirement of [9.1.2](#) is fulfilled the machine can be said to conforming to the offsite test.

6.2 Onsite Test

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.

6.2.1 Test Duration

During the onsite testing, the rig shall be continuously operated for 12 h in actual field for minimum 2 bore holes of the rated capacity.

6.2.2 Observation During the Onsite Test

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

- a) The hydraulic system shall be operated and checked for its rated capacity;
- b) The performance of the rig shall be recorded at regular interval as deemed fit by the buyer;
- c) The performance of the pump in respect of the consistent delivery and pressure shall be recorded at various depths as deemed fit by the buyer. The performance of the pump shall be checked for different deliveries at different rpm and pressures;
- d) The fuel consumption per day may be recorded; and
- e) The rotation of the rig shall be verified and recorded for minimum and maximum rpm as claimed by the manufacturer.

6.2.3 Onsite Compliance

If the requirement of [6.2.2](#) is fulfilled the machine can be said to conforming to the onsite test.

6.3 Compliance

The machine can be said to be conforming to the standard if it conforms to both offsite and onsite tests.

ANNEX A

(Foreword)

COMMITTEE COMPOSITION

Diamond Core and Waterwell Drilling Sectional Committee, MED 21

<i>Organization</i>	<i>Representative(s)</i>
Geological Survey of India, New Delhi	SHRI AJAY AGARWAL (Chairperson)
Aqseptence Group (India) Pvt Ltd (Formaly Known as Johanson Screens India Pvt Ltd), Sanand	SHRI SHIV NARAYAN SINGH SHRI SHIVEN AMIN (<i>Alternate</i>)
Atlas Copco (I) Ltd, Pune	SHRI SHUDHANSHU NIGAM SHRI S. DATTA MAJUMDAR (<i>Alternate</i>)
Central Ground Water Board, Faridabad	SHRI G. L. MEENA SHRI NIDHISH VERMA (<i>Alternate</i>)
Central Mine Planning and Design Institute, Ranchi	SHRI ANIL SAVANUR SHRI A.V. RAMAKRISHNA (<i>Alternate</i>)
Epiroc Mining India Limited, Nashik	SHRI SUJEET KUMAR SHRI CHANDAN GHOSH (<i>Alternate</i>)
Geological Survey of India, Kolkata	SHRI ANUP KUMAR JOHRI SHRI C. B. TIWARI (<i>Alternate I</i>) SHRI S. SHANKAR (<i>Alternate II</i>)
Indian Institute of Technology, Kanpur	PROF J. RAMKUMAR PROF SUDHANSHU SHEKHAR SINGH (<i>Alternate</i>)
Indian Institute of Technology, Kharagpur	PROF KHANINDRA PATHAK SHRIMATI SUNITA MISHRA (<i>Alternate</i>)
Indian Institute of Technology, Roorkee	PROF B. K. GANDHI SHRI VARUN KUMAR SHARMA (<i>Alternate</i>)
Indian Pump Manufacturers Association, Mumbai	SHRI YOGESH MISTRY SHRI UTKARSH A. CHHAYA (<i>Alternate</i>)
Indian Institute of Technology (ISM), Dhanbad	SHRI MOHAMMED HAMID SIDDIQUE SHRI PAWAN GUPTA (<i>Alternate I</i>) SHRI VINAY KUMAR RAJAK (<i>Alternate II</i>)
Kores (India) Ltd, Mumbai	SHRI SANDEEP DHOLI
Mining Associates Pvt Ltd, Asansol	SHRI RAM BABU BANSAL
Rites Ltd, Gurugram	SHRI S. KUNAL
Rockdrill (India), Jodhpur	SHRI KAMAL KISHOR GUPTA SHRI RAVINDRA KU. GUPTA (<i>Alternate</i>)
Sandvik Smith Asia Limited, Medak	SHRI RANGAYYA NAIDU SHRI N. BHASKARA REDDY (<i>Alternate</i>)

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<i>Organization</i>	<i>Representative(s)</i>
In Personal Capacity (<i>F-401, Maruti Sadan, Begumpet, Hyderabad</i>)	SHRI A. B. ANAND
In Personal Capacity (<i>D-5/10, Rail Vihar, Indirapuram, Ghaziabad</i>)	SHRI P. C. DEWLI
In Personal Capacity (<i>90 Mayur Vihar, Sec 48, Chandigarh</i>)	SHRI MAHESH CHANDRA JINDAL
BIS Directorate General	SHRI K. V. RAO, SCIENTIST 'F'/SENIOR DIRECTOR AND HEAD (MECHANICAL ENGINEERING) [REPRESENTING GENERAL (<i>Ex-officio</i>)]

Member Secretary
SHRI SHUBHAM YADAV
SCIENTIST 'C'/DEPUTY DIRECTOR
(MECHANICAL ENGINEERING), BIS

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BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002

Telephones: 2323 0131, 2323 3375, 2323 9402

Website: www.bis.gov.in

Regional Offices:

	Telephones
Central : 601/A, Konnectus Tower -1, 6 th Floor, DMRC Building, Bhavbhuti Marg, New Delhi 110002	{ 2323 7617
Eastern : 8 th Floor, Plot No 7/7 & 7/8, CP Block, Sector V, Salt Lake, Kolkata, West Bengal 700091	{ 2367 0012 2320 9474
Northern : Plot No. 4-A, Sector 27-B, Madhya Marg, Chandigarh 160019	{ 265 9930
Southern : C.I.T. Campus, IV Cross Road, Taramani, Chennai 600113	{ 2254 1442 2254 1216
Western : 5 th Floor/MTNL CETTM, Technology Street, Hiranandani Gardens, Powai Mumbai 400076	{ 2570 0030 2570 2715

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