भारतीय मानक **IS 11710 (Part 2) : 2024**

Indian Standard

हीरक क्रोड़ वेधन का चयन — रीति संहिता

भाग 1 शीर्ष द्रव चालित

(दूसरा पुनरीक्षण)

Selection of Diamond Core Drills — Code of Practice

Part 1 Top Drive Hydraulic

(Second Revision)

ICS 73.100.30

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Diamond Core and Waterwell Drilling Sectional Committee, MED 21

FOREWORD

This Indian Standard (Part 2) (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, and may serve as guidelines for use by the manufacturers and the users of diamond core drills.

This Indian Standard (Part 2) 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 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 2 TOP DRIVE HYDRAULIC

(Second Revision)

1 SCOPE

This standard (Part 2) covers selection for top drive hydrostatic 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:

IS No.	*Title*
IS 2266 : 2019	Steel wire ropes for general engineering purpose — Specification (*fifth revision*)
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 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.

4.3 Drill parameters are same in both surface and underground drills but safety parameters differ in underground drills.

4.4 The variant in operating system shall be applicable to both surface as well as underground drills.

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.

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

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).

Table 1 Weight of Wireline Drill Rods

(*Clause* 3.1)

Sl No.	Wireline Rod Size	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)

Sl 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 100 0	WLN
iv)	Deep	100 1 to 200 0	WLN
v)	Very deep	> 2001	WLN

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 90° . 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.

5.2 Power Requirement of the Drill

5.2.1 The power required for the drill shall be provided by an engine of adequate capacity and speed (*see* Table 3). The power required for a given capacity shall be calculated by the following formula:

$$P = \frac{\mathrm{K} \times H_L \times V}{\eta \times 4\,500} \times 0.745$$

where

P = power required, in kw;

K = 1.65, a constant for fishing and running in casing load and also for pressure leakage, friction, etc in the hydraulic system;

H_L = maximum hook load, in kg;

V = minimum hoisting speed, in m/min, say 40 m/min; and

η = efficiency of mechanism, 85 percent.

NOTE — If K = 3 up to 1 200 m and 2.25 for 1 200 m to 2 500 m then the above formula holds good for hydrostatic drilling machine.

5.3 Mounting

5.3.1 Normally the types of mounting as given in **5.3.2** to **5.3.5** are used for surface drill.

5.3.2 *Truck Mounted*

When the terrain for drilling is plain and maneuverability is easy, it is advantageous to have a truck-mounted drill particularly for medium and deep capacity drills. The advantage of truck-mounted drill includes quick transportation and erection of drills by using hydrostatic jacks (*Min* 4 No.). The disadvantage in this type of mounting is that the drill cannot negotiate steep gradients and undulated terrain. Truck engine requirements as per latest emission norms shall be applicable.

5.3.3 *Trailer Mounted*

The drill is mounted on a trailer which requires a separate arrangement for towing of trailer. Trailer mounted is also used in plain terrain.

Table 3 Power Requirements in Drilling

(*Clause* 5.2.1)

Sl No.	Drilling Depth (m)	Power Requirement (HP)
(1)	(2)	(3)
i)	< 200	Up to 75
ii)	201 to 500	Up to 130
iii)	501 to 1 000	Up to 180
iv)	100 1 to 2 000	Up to 260
v)	> 2 001	320 and more

5.3.4 *Skid Mounted*

The drill is mounted on a skid and normally small capacity drills are mounted on skid. Construction of the base shall be of adequate strength to bear the weight of the unit. The skid surface shall be so designed that it does not cause any obstruction during angle hole drilling.

5.3.5 *Crawler Mounted*

Crawler mounted drills are good in terms of maneuverability in hilly terrain and other treacherous terrain. The gradability 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) Gradability;
b) Width; and
c) Ground pressure.

5.4 Hoisting System

The top drive hydrostatic drill will have the hoisting drum with hydraulic motor at the top of the mast or at the floor of the machine. Hoisting speed shall vary between 20 m/min to 50 m/min. 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.

Hoisting may also be done through hollow spindle in case of smaller capacity machines using feed cylinders. It will give additional advantage of breaking up of rod joints at a slower speed.

5.5 Rotation Head

5.5.1 There will be two types of rotation heads, one with hollow spindle and chuck (spindle drive) and the other having direct drive from the hydraulic motor-gear box, mounted on the top head drive. Rotation head speed may varies up to 1 200 rpm. The speed ranges of gear box should have minimum rpm differences or preferably the speed shall overlap.

5.5.2 The rotation head shall be driven by hydraulic motors and shall have in built mechanism for holding the rods. The direct drive rotation head is mounted on the carriage which slides on the mast and provides a long feed. The drill pipes are screwed to the output shaft of the motor/gear box and no chuck is used. The carriage is hinged/slides on one side and can be swung out to facilitate hoisting of drill string. The drive head may be driven directly or through a gearbox having variable speed ranges. In chuck in case of spindle drive, shall be capable of holding rods of WLA, WLB, WLN, WLH and WLP size.

5.5.3 The hydraulic feed/pull cylinder shall be of adequate capacity to provide head traverse to enable rod pull up to 3 m to 6 m through cylinders and chain or wire rope. The feed length of drills with hydraulic feed shall normally be 3 000 mm and up to 6 000 mm for deeper capacity drills.

5.5.4 The hydraulic pumps shall be of the constant volume or variable volume type of adequate capacity and pressure rating. It shall be capable of running continuously to provide constant hydraulic pressure.

5.6 Mast

The mast/feed frame shall be rigid steel column type which can be lowered horizontally with hydraulic cylinders while the rig is in transportation and can be erected while being used for drilling. The mast shall have arrangements of being tilted for drilling

angle holes. The feed frame shall be able to swivel 45 degrees to 90 degrees in the transverse plane. The provision will be applicable for diamond core drills only and will not be available on multipurpose combination drills. The mast may be single structure or collapsible telescopic type to provide variable length or stroke/pull. The mast cylinder shall be fitted with safety valve.

5.7 Rod Holder

The hydrostatic drills shall be provided with a rod holder actuated hydraulically. The hydraulic drills shall be provided with fail safe mechanism in case of hydraulic failure.

5.8 Instrumentation and Controls

All controls lever 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: (manufacturer to provide additional controls that are in use)

a) Bit rpm-meter;
b) Bit load or weight on bit meter;
c) Thrust valve;
d) Micro feed valve;
e) Emergency stop switch;
f) Rotary torque meter;
g) Drilling fluid pressure pump gauge;
h) Drilling fluid pump flow meter (optional);
j) Penetration rate meter (additional for hydraulic drill);
k) Time recorder — The prime mover shall be provided with a system to record the actual running time (optional); and
m) prime mover shall be provided with a system to record the actual running time (optional).

5.9 Testing of Drill

The testing facilities for testing the capacity of the drill shall be provided by the manufacturer.

5.10 Auxiliary/Components

a) Wire line hoist — Built-in type hydrostatically driven wire line hoist with suitable control should be provided with load control mechanism;

b) Recording system indicators — Recorder for drilling parameters shall be provided as per requirement of the purchaser;

c) Lighting system — Suitable and adequate lighting system shall be provided; and

d) Tools — Adequate tools for operation and maintenance of the drill.

5.11 Safety Fittings in Hydraulic Drills

a) The hoist of hydraulic rigs shall have fail safe brake mechanism;

b) Hydrostatic drills of heavy capacity shall be fitted with rod over run fittings that is automatic winch cut off;

c) All rotating parts shall have spin guard protection with rpm cutter mechanism;

d) High pressure hydraulic hose pipes shall be covered with safety shocks or spiral guard;

e) Emergency switches shall be fitted at all corner of drills;

f) All rotating parts shall have safety guards; and

g) Battery cutoff switches may be fitted in circuit.

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 6.1.2 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 min 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

Organization	*Representative*(*s*)
Geological Survey of India, New Delhi	SHRI AJAY AGARWAL **(*Chairperson*)**
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In Personal Capacity (*90 Mayur Vihar, Sec 48, Chandigarh*)	SHRI MAHESH CHANDRA JINDAL
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Member Secretary
SHRI SHUBHAM YADAV
SCIENTIST 'C'/DEPUTY DIRECTOR
(MECHANICAL ENGINEERING), BIS

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