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भारतीय मानक मसौदा

**जल कूप वेधन
भाग 2 वायुचालित रिग्स (अनुविवर हैमर अथवा मिट्टी घूर्णी वेधन)
के लिए सामान्य अपेक्षाएं – विशिष्टि**

(पहला पुनरीक्षण)

DRAFT Indian Standard

**WATER WELL DRILLING — SPECIFICATION
PART 1 GENERAL REQUIREMENTS FOR PNEUMATIC RIGS
(DOWN-THE-HOLE HAMMER OR MUD ROTARY DRILLING)**

(First Revision)

ICS 25.080.40; 73.020

Diamond Core and Water Well Drilling
Sectional Committee, MED 21

Last date for receipt of comments
is **27 July 2023**

FOREWORD

(Formal clause to be added later)

This standard lays down the general requirements, for use as guidelines for the manufacturers and the users, for down-the-hole hammer hydraulic rigs.

This standard was first published in 1989.

The other parts in this series under the general title ‘Water well drilling — Specification’ is given below:

Part 1 General requirements for hydraulic rigs (Down-the-hole hammer or mud rotary drilling)

Major changes in this revision is as follows:

- a) The title and scope has been revised; and
- b) Marking requirements have been added.

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.

1 SCOPE

This standard covers the general requirements for pneumatic rigs [down-the-hole (DTH) hammer or mud rotary drilling] for water well drilling.

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 agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below.

<i>IS No.</i>	<i>Title</i>
IS 1161 : 2014	Steel tubes for structural purposes — Specification (<i>fifth revision</i>)
IS 2062 : 2011	Hot rolled medium and high tensile structural steel — Specification (<i>seventh revision</i>)
IS 4270 : 2001	Steel tubes used for water wells — Specification (<i>third revision</i>)
IS 9439 : 2022	Glossary of terms used in water well drilling technology (<i>second revision</i>)

3 TERMINOLOGY

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

4 PRINCIPAL

This type of drilling rigs are used for water-well drilling and exploration purposes in predominantly hard rock formations. The DTH hammer which is always operating at the bottom of the rope and is supplied with compressed air through the drill pipes, carries out drilling operation. The piston of the hammer delivers successive blows at a high frequency to the bit which breaks the formation into smaller fragments. The compressed air after operating the hammer is exhausted through the bit and brings out the cutting to the surface. Lubricating oil for the hammer is injected into the compressed air and lubricates various parts of the DTH hammer. The drill string is rotated at a low speed (rev/min) suitable to the formation so that the buttons of the bit strikes fresh surface after each blow. DTH hammer is also used for drilling in overburden as pneumatically operated rigs do not develop sufficient torque for drilling in overburden with drag/rock roller bits.

5 CONSTRUCTION

5.1 In pneumatic DTH rigs rotation and feed mechanism are operated by air motors. Only raising and lowering of the mast (levelling jacks and rod breaking system) may be carried out hydraulically. The hydraulic pump is driven by an air motor. It may also be driven by prime mover of the compressor or by the truck engine through power-take-off (PTO). Thus ultimately all the functions of the rig are powered by compressed air and a single compressor of suitable capacity is provided to meet the requirements of the rig. Construction details of a typical pneumatic DTH drilling rig are described in **5.2** to **5.13**. These are only guidelines for manufacturers and users of drilling rigs and do not constitute any specific recommendations.

5.2 Supporting Frame

Constructed of welded structural steel sections, the frame is usually designed to be mounted directly on the chassis or the flat bed of the carrier selected. The mast is mounted on the frame.

5.3 Mast

The mast is constructed either from steel conforming to Grade E 250 of IS 2062 or steel tubes conforming to IS 1161. The mast shall be capable of being lowered to horizontal position for transportation and raised to vertical position for drilling operation. The length of the mast depends upon the lengths of the drill pipe used for drilling. The rotation unit travels on the mast. The feed mechanism is by a chain going endlessly over two sprockets at the two ends of the mast. The chain is driven by a pneumatic feed motor through a worn gear. The retract force developed by feed mechanism shall be adequate for pulling out drill string for the rated depth. It is desirable that the design of the feed mechanism shall incorporate a provision for applying negative feed force. When drilling has progressed to a depth at which the weight of the drill string exceeds the desired bit load. At the lower end of the mast, a drill pipe support fitted with different guide slips to suit different dimensions of drill pipes and casing tubes is provided. The mast is raised and lowered hydraulically.

5.4 Top Head Rotary Drive/Rotation Unit

The rotation unit is mounted on the mast and is powered by air motor of adequate power to provide necessary torque for drilling. The rotation unit shall have a steplessly variable spindle speed from 0 to 50 rev/min. The spindle which is connected to the drill pipe is provided with suitable specified threads.

5.5 Rod Handling System

With 100 mm nominal DTH hammer, drill pipes of 76 mm diameter and 3 m long are most commonly used. The weight of such drill pipes being around 30 kg, these are usually manually handled. However for drilling with 152 mm nominal DTH hammers, drill pipes of 114 mm diameter are used which are quite heavy for manual handling and the rigs shall have arrangement for lifting the drill pipes. A suitable mechanism, preferably with an air winch with suitable rod changer, of adequate capacity shall be provided.

5.6 Hydraulic System

This consists of an air motor driven hydraulic pump and a hydraulic oil tank of suitable capacity for powering the mast raising cylinder, hydraulic jack, and break-out wrench. Spool valves are provided for controlling the different hydraulic cylinders.

5.7 Hydraulic Break-Out Wrench

This may be provided for breaking the drill pipe joints. Hydraulic break-out wrench is generally not used for drill pipes up to 76 mm diameter as these can be broken with manual wrenches.

5.8 Hydraulic Jacks

Hydraulic jacks are provided for levelling the machine and lifting the wheels of the carrier off the ground for drilling operations.

5.9 Air Line Lubricator

Air line lubricator of sufficient capacity shall be provided for lubricating the DTH hammer and air motors.

5.10 Water Injection Pump

An air operated water injection pump capable of injecting water under pressure into the compressed air line shall be provided for dust control as well as to help flushing of moist clay or similar formations.

5.11 Lighting System

The drilling operations are carried out throughout day and night. A lighting system powered by the compressor battery shall be provided for adequate illumination.

5.12 Controls

All the controls required for drilling operations shall be grouped together and mounted on either right or left side of the driller's station. The controls for setting up the rig shall be grouped separately so that they are not accidentally operated while drilling.

5.13 Air Compressor

The compressor of the rig shall be either mounted on the rig or carried on a separate trailer/carrier. The free air delivery of the compressor shall be adequate for meeting the requirements of the DTH tool and for achieving minimum return velocity of 1 370 metres per minutes besides meeting the requirements of air motors. The minimum air pressure for DTH drilling is 0.7 MPa. Depending upon the type and operating pressure of DTH hammer used air pressure requirement may vary from 0.7 MPa to 2.45 MPa for light to heavy DTH rig.

6 MOUNTING

All the above components put together comprise one DTH drill rig. The whole equipment shall be mounted on a steel welded structure mounted on a roadworthy truck of adequate capacity or on a trailer chassis with pneumatic wheels suitable for towing by tractor or trucks. The total length, width and height of the rig shall conform to the Statutory Acts, Rules Regulations and other specific orders.

7 DRILLING TOOLS AND ACCESSORIES

Following are the essential tools, accessories required for drilling operations.

7.1 Drill Pipes

Drill pipes shall conform to IS 4270 and shall be fitted with tool joints. The diameter of the drill pipes depends on the size of the hammer.

7.2 Down-the-Hole Hammer

The hammers are of two varieties, namely:

- a) Low/medium pressure hammers which operate at air pressures ranging between 0.7 MPa to 1.36 MPa; and
- b) High pressure hammers which operate at air pressures above 1.26 MPa.

7.3 Bits

The down-the-hole hammers use button/cross bits of various sizes for drilling in hard rock and overburden.

7.4 Wrenches

Wrenches for breaking out drill pipe joints and bits shall be provided.

7.5 Grinder

Air operated hand grinder for button bits shall be provided.

8 TESTING

Testing shall be as agreed to between the purchaser and the supplier.

9 MARKING

9.1 The drilling rig shall be marked with the following:

- a) Type and capacity of drilling operations in respect of DTH and rotary system;

- b) Maximum diameter and depth that can be drilled by DTH and rotary system of drilling;
- c) Overall dimensions, front axle-load, rear axle load, make and model of the chassis, wheel base in case of trucks, towing arrangement particularly in case of trailer;
- d) Air compressor : make, model, type of mounting, specified pressure, specified quantum of air delivered and type of cooling (*see* IS 6430);
- e) Number of cylinders provided for raising mast;
- f) Number of hydraulic jacks provided for levelling and their capacity;
- g) Capacity of the hydraulic pump, its speed in rev/min, discharge, maximum pressure and tank capacity, and hydraulic line diagram;
- h) Pull down system: capacity, chain feed or cable feed;
- j) Lifting capacity;

- k) Drill rods: size, thickness, length, and weight of the drill pipe;

9.2 BIS Certification Marking

The product may also be marked with Standard Mark.

9.2.1 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 products may be marked with the Standard Mark.