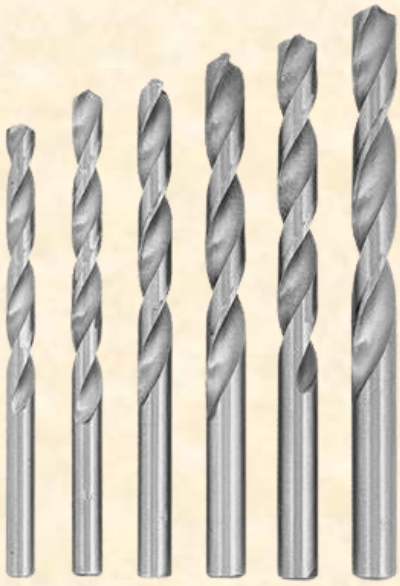
Compendium of Indian Standards on Drills and Reamers



Prepared By:

Production and General
Engineering Department

BUREAU OF INDIAN STANDARDS

New Delhi

Table of Contents

Introduction

Drills and reamers are among the most widely used cutting tools in metalworking and manufacturing industries. They are essential for a variety of machining operations such as drilling, enlarging, and finishing holes with precision and accuracy. These tools are fundamental to sectors like automotive, aerospace, construction, heavy engineering, and general manufacturing, where dimensional accuracy and surface finish are critical.

The quality and performance of drills and reamers significantly affect the efficiency, accuracy, and longevity of machining operations. To ensure consistency in design, material properties, dimensional accuracy, performance, and safety, the Bureau of Indian Standards (BIS), under the Cutting Tool Sectional Committee, has formulated several standards on these tools. These Indian Standards define specifications related to tool geometry, material composition, manufacturing tolerances, surface finish, and performance testing.

This compendium aims to provide a comprehensive overview of Indian Standards related to drills and reamers, offering insights into their specifications, functional requirements, and appropriate applications. It is intended for use by tool manufacturers, design engineers, production managers, quality control professionals, academic institutions, and regulatory bodies, promoting better understanding and compliance with recognized standards in tool design and use.

1 Drills

Drills are one of the most fundamental cutting tools used in manufacturing, construction, and fabrication processes. Their primary function is to create round, precise holes in a wide range of materials, including metals, plastics, wood, composites, and ceramics.

The functional parameters specified in the standards on drills are:

- Dimensions: Cutting diameter *(d)*, overall length *(l)*, and flute length *(l_1)*.
- Material and Hardness: Requirements for tool material and hardness to ensure durability.
- Tolerances: Specifications for tolerances of the drills.
- Flute Design: Design considerations for efficient chip removal and improved surface finish.

The published Indian Standards on various types of drills are categorized below.

1.1 Twist Drills

Twist drills are the most widely used and versatile drilling tools. They have helical flutes that facilitate chip removal and provide a continuous cutting edge. Available in various lengths (stub, jobber, carbide tipped, long series), they are suitable for general-purpose drilling in metals, plastics, and wood. Twist drills are made from high-speed steel (HSS).

The twist drills are sub categorized as mentioned below.

1.1.1 Stub Series Twist Drills

The stub series refers to cutting tools, such as taps and drills, that are shorter in length compared to standard tools. These tools can be designed for either right-hand or left-hand cutting, depending on the desired cutting direction and application.

IS No.	*Title*
IS 5100 : 1969	Specification for twist drills, parallel shanks, stub series for right hand cutting
IS 5362 : 1969	Specification for twist drills, parallel shanks, stub series, left hand cutting for automatics
IS 16060 : 2013	Solid carbide parallel shank twist drills stub series — Specification

1.1.2 Jobber Series Twist Drills

Jobber series twist drills are the most commonly used type of drill bits in manufacturing, maintenance, and general machining. These drills are designed for general-purpose drilling in a variety of materials, including metals, wood, and plastics.

IS No.	*Title*
IS 5101 : 1991	Twist drills, parallel shank, jobber series — Specification (*first revision*)
IS 16059 : 2013	Solid carbide parallel shank twist drills jobber series — Specification

1.1.3 Carbide Tipped Twist Drills

Carbide-tipped twist drills are cutting tools designed with a high-speed steel (HSS), a carbide tip brazed or bonded onto the cutting end. They are engineered to combine the toughness of steel with the hardness and wear resistance of carbide, making them ideal for high-performance drilling in hard and abrasive materials.

IS No.	*Title*
IS 8306 : 1976	Specification for carbide tipped twist drills, morse taper shank
IS 8307 : 1976	Specification for carbide tipped, twist drills, parallel shank

1.1.4 Subland Twist Drills

Subland twist drills are specialized drill bits designed to create holes that are slightly smaller than the nominal size, allowing for precise tapping of screw threads. The "subland" refers to the portion of the drill bit just below the cutting edges, which is slightly reduced in diameter to accommodate the tap's lead thread.

IS No.	*Title*
IS 12687 : 1989	Small tools — Subland twist drills with morse taper shank for holes prior to tapping screw threads — Specification
IS 12688 : 1989	Small tools — Subland twist drills with parallel morse taper shank for clearance holes and countersinks head screws — Specification
IS 12689 : 1989	Small tools — Subland twist drills with morse taper shank for clearance holes and counterbores for slotted cheese head screws — Specification
IS 12690 : 1989	Small Tools — Subland twist drills with morse taper shank for clearance holes and counterbores for slotted cheese head screws — Specification
IS 12691 : 2013	Subland twist drills with cylindrical shanks for holes prior to tapping screw threads
IS 12692 : 1989	Small tools — Subland twist drills with parallel shanks for clearance holes and countersinks for countersunk head screws — Specification

1.1.5 Long Series Twist Drills

Long series twist drills are a specialized type of drill bit designed for deep hole drilling where standard (jobber-length) drills fall short. These drills feature extra-long flutes and overall lengths while maintaining the standard geometry of twist drills.

IS No.	*Title*
IS 7822 : 2005	Twist drills — Extra-long morse taper shank — Specification (*second revision*)
IS 7823 : 2005	Twist drills — Extra-long parallel shank — Specification (*second revision*)

1.2 Core Drills

Core drills are used to enlarge or finish existing holes with improved surface finish and dimensional accuracy. They feature more than two cutting edges, which distribute the cutting load and reduce vibration. Since they lack a chisel edge, they are not suitable for initiating holes. It is used in toolrooms and machine shops for finishing pre-drilled holes in components, jigs, and fixtures.

IS No.	*Title*
IS 5365 : 1999	Core drills, parallel shanks — Specification (*second revision*)
IS 5366 : 1978	Specification for core drills, morse taper shanks (*first revision*)
IS 7772 : 1975	Specification for shell core drills
IS 9771 : 1981	Specification for carbide tipped core drills with morse taper shanks

1.3 Spot Drills

Spot drills are short, rigid tools designed to create shallow conical impressions that guide standard twist drills. They are essential for preventing drill wander and ensuring precise hole location. It is commonly used in CNC machining and precision drilling setups, especially for hard or angled surfaces.

IS No.	*Title*
IS 14775 : 2000	Spot drills — Dimensions

1.4 Micro Drills

Micro drills are specialized tools for producing very small diameter holes, often below 1 mm and are used in high-precision industries.

IS No.	*Title*
IS 5363 : 2017	Micro-drills — Specification (*second revision*)

1.5 Centre Drills

Centre drills are short, rigid drills with a tip angle of 60°, designed to create starter holes or conical center holes. These are often the first tools used before lathe operations to ensure alignment and support. It is used in turning setups, grinding, and inspection operations where components are supported between centers. The tool ensures axial alignment, and provides support points for live or dead centers during machining.

IS No.	*Title*
IS 6708 : 1977	Specification for centre drills type A (*first revision*)
IS 6709 : 1977	Specification for centre drills type B (*first revision*)
IS 6710 : 1977	Specification for centre drills type R (*first revision*)

2 Reamers

Reamers are precision rotary tools used to accurately size and finish pre-existing holes to tight tolerances and smooth surface finishes.

The functional parameters specified in the standards on reamers are

- Dimensions: Cutting diameter *(d)*, overall length *(l)*, and flute length *(l_1)*.
- Material and Hardness: Requirements for tool material and hardness to ensure durability.
- Tolerances: Specifications for tolerances of the reamer.
- Flute Design: Design considerations for efficient chip removal and improved surface finish.

2.1 Socket Reamers

Socket reamers are used to finish tapered holes typically found in sockets for tool and spindle alignment. It ensures precise tapering in the product, improved tool alignment, and secure fits with the work piece

IS No.	*Title*
IS 5907 : 1970	Specification for socket reamers with morse taper shank
IS 5882 : 1970	Specification for socket reamers with parallel shanks

2.2 Machine Taper Pin Reamers

These reamers are designed to cut or finish holes to fit standard taper pins. Used primarily in mechanical assemblies, they help align and lock components accurately and securely.

IS No.	*Title*
IS 10851 : 1984	Specification for taper pin machine reamers with parallel shank
IS 5918 : 1984	Specification for taper pin machine reamers with morse taper shanks

2.3 Hand Reamers

Hand reamers are manually operated tools used to finish holes with a high degree of control. They feature a slight taper at the front to help guide the tool into the hole and are ideal for maintenance and small-scale production work.

IS No.	*Title*
IS 5444 : 1978	Specification for parallel hand reamers with parallel shanks (*first revision*)

2.4 Hand Taper Pin Reamers

These are hand-operated tools specifically for taper pin holes. They are used in fitting and aligning mechanical parts manually where precision and alignment are essential.

IS No.	*Title*
IS 5881 : 1984	Specification for taper pin hand reamers (*first revision*)

2.5 Chucking Reamers

Chucking reamers are machine-driven tools used for high-speed hole finishing and high volume manufacturing. They are typically held in chucks or collets and feature either straight or helical flutes for efficient cutting.

IS No.	*Title*
IS 5446 : 2017	Machine chucking reamers with parallel shanks — Specification (*second revision*)
IS 5447 : 2017	Machine chucking reamers with morse taper shank — Specification (*second revision*)
IS 10884 : 1984	Specification for carbide tipped chucking reamers with parallel shanks
IS 10885 : 1984	Specification for carbide tipped chucking reamers with morse taper shanks with short cutting edge
IS 11935 : 1987	Specification for carbide tipped chucking reamers with morse taper shank with long cutting edge

2.6 Machine Bridge Reamers

Bridge reamers are heavy-duty tools used to align and enlarge holes in structural applications. They are particularly useful in steel fabrication, bridge construction, and other large-scale projects.

IS No.	*Title*
IS 5919 : 2018	Machine bridge reamers (*second revision*)

2.7 Shell Reamers

Shell reamers consist of a replaceable cutting shell mounted on a reusable arbor. They are commonly used in large-diameter hole reaming and are cost-effective for repetitive operations.

IS No.	*Title*
IS 5926 : 1970	Specification for shell reamers

2.8 Carbide Tipped Reamers

These reamers have carbide cutting edges, making them suitable for hard or abrasive materials. They offer superior wear resistance and longer tool life under high-speed conditions.

IS No.	*Title*
IS 10923 : 1994	Carbide tipped and solid carbide tipped reamers

2.9 Machine Jig Reamers

Machine jig reamers are designed for use with jigs and fixtures to ensure precise, repeatable hole sizing. They are ideal for mass production where accuracy and consistency are critical.

IS No.	*Title*
IS 11002 : 1984	Specification for machine jig reamers morse taper shank
IS 11937 : 1987	Specification for carbide tipped machine jig reamer with morse taper shank

2.10 Long Fluted Reamers

Long fluted reamers feature extended cutting flutes, allowing them to maintain alignment and cutting stability in deep hole applications. They are used when standard reamers cannot reach the required depth such as aerospace components, engine blocks, deep bore machining.

IS No.	*Title*
IS 11936 : 1987	Specification for carbide tipped long fluted machine reamer with morse taper shank
IS 5445 : 1978	Specification for long fluted machine reamers with morse taper shanks (*first revision*)

3 Countersinks and Counterbores

Countersinks and counterbores are specialized cutting tools used in hole-finishing operations. While both modify the upper portion of an existing hole, their geometry and applications differ. These tools are essential in precision engineering, assembly, and fabrication work, where fastener heads must sit flush or below the surface of a workpiece.

The functional parameters specified in the standards on countersinks and counterbores are:

- Dimensions (d, d_1, d_2, l, l_1, l_2) for shanks, cutting ends, and pilot components (d = Cutting diameter, d_1 = Pilot diameter, d_2 = shank diameter, l = Overall length, l_1 = flute length, l_2 = Pilot length)
- Material and hardness requirements for tool material and hardness to ensure durability.
- Tolerances between pilot and countersink, counterbore respectively.
- Countersink angles *(α)* of 60°, 90°, and 120° as specified.

3.1 Countersinks

Countersinks are conical tools used to create a chamfered edge at the opening of a hole. This chamfer allows flat-head screws, rivets, or bolts to sit flush with or slightly below the surface. Countersinks typically have angles of 60°, 90°, or 120°, depending on the fastener standard (e.g., metric or imperial). They can come as single-flute, multi-flute, or combined drill-and-countersink tools.

IS No.	*Title*
IS 5693 : 1988	Specification for countersinks 90°, with parallel shanks and solid pilots (*first revision*)
IS 5703 : 1988	Specification for countersinks 90° with morse taper shanks and detachable pilots (*first revision*)
IS 13303 : 1992	Countersinks 60-degree, 90-degree and 120-degree with morse taper shank — Specification
IS 13304 : 1992	Countersinks 60°, 90° and 120° with parallel shank — Specification

3.2 Counterbores

Counterbores are cylindrical tools used to enlarge the upper portion of a hole to a fixed diameter and depth. This recessed pocket allows the head of a socket cap screw, bolt, or other fastener to sit below the surface. Unlike countersinks, counterbores produce flat-bottomed holes. They are usually guided by a pilot that fits into the pre-drilled hole for concentricity.

IS No.	*Title*
IS 5704 : 1988	Specification for counterbores with parallel shanks and solid pilots (*first revision*)
IS 5705 : 1988	Specification for detachable pilots for use with counterbores and countersink 90° (*first revision*)
IS 5710 : 1988	Specification for counterbores with morse taper shanks and detachable pilots (*first revision*)