मानकः पथप्रदर्शकः

COMPENDIUM OF
INDIAN STANDARDS ON

MECHANICAL TESTING OF METALS

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INTRODUCTION

This compendium offers a structured and comprehensive collection of Indian Standards on mechanical testing of metals, specifically focusing on destructive test methods such as tensile, impact, bend, hardness, fatigue, creep, and fracture toughness tests. Each standard included in this compilation is briefly described to provide a quick understanding of its application and relevance, as the titles of most test method standards are self-explanatory. These standards are formulated by the Mechanical Testing of Metals Sectional Committee, MTD 03, under the Bureau of Indian Standards (BIS).

The objective of this compendium is to serve as a ready reference for industry professionals, testing laboratories, technical institutions, regulators, and other stakeholders engaged in quality assessment and material characterization of metallic products. The committee ensures that the development of these standards follows a participatory approach involving experts from industry, academia, and government bodies.

Harmonization with international standards such as ISO is actively pursued wherever appropriate, to ensure alignment with global best practices. This not only facilitates easier exchange of technical information across borders but also enhances the credibility and acceptance of Indian Standards at the national and international levels, thereby supporting improved product quality, compliance, and competitiveness in global markets.

TABLE OF CONTENTS

This compendium covers the **classified and structured list of Indian Standards on Mechanical Testing of Metals.**

These standards have been published by *Mechanical Testing of Metals Sectional Committee (MTD 3) of Bureau of Indian Standards. This committee is in Liasion with ISO committee ISO TC 164 Mechanical Testing of Metals.*

1. Uniaxial Testing

Uniaxial testing involves applying a load along a single axis to evaluate fundamental mechanical properties such as tensile strength, yield strength, and elongation. These tests are essential for material characterization, quality control, and ensuring compliance with design requirements in structural and load-bearing applications.

IS Number	Title	Description
IS 13237:1991	Metallic foil – Tension testing	Method for tensile testing of metallic foils.
IS 13838:2023	Determination of Poisson's Ratio	Procedure for determining Poisson's ratio in metals.
IS 2854:1990	Determination of Young's, Tangen and Chord Moduli	Method for calculating elastic moduli from stress-strain data.
IS 3410:1993	Linear Thermal Expansion	Measures thermal expansion in metallic materials.
IS 3407 (Parts 1 & 2) :1983	Creep testing of steel at elevated temperatures	Test methods for tensile creep and stress-rupture.
IS 17795 : 2022/ ISO 204:2018	Uniaxial creep testing in tension	ISO 204 aligned method for high-temperature creep testing.
IS 4169 : 2014/ ISO 18265:2003	Calibration of force-proving instruments	For verifying force-measuring systems in test machines.
IS 1608 (Parts 1–3)/ ISO 6892 (Part 1–3)	Tensile testing at room, high, and low temperatures	Aligns with ISO 6892; procedures for different temperatures.
IS 1828 (Parts 1 & 2)/ ISO 7500 (Parts 1 & 2)	Verification of static uniaxial testing machines	Includes tension, compression, and creep testing machines.
IS 12872 : 2021/ ISO 9513 : 1999	Calibration of extensometers	Specifies methods for calibrating extensometer systems.
IS 17413 (Parts 1 & 2)/ ISO 26203 (Parts 1 & 2)	Tensile testing at high strain rates	Tests using elastic-bar and servo-hydraulic systems.

2. Ductility Testing

Ductility testing measures a material's ability to deform plastically without fracturing. Tests like bend, cupping, and flattening assess formability, which is critical in manufacturing processes like rolling, forging, and welding. High ductility ensures that metals can be shaped without cracking, enhancing durability and performance under stress.

IS Number	Title	Description
IS 10167:1982	Upsetting test	For determining ductility under compressive loading.
IS 5242:1979	Shear strength of metals	Measures resistance to shear deformation.
IS 1599 : 2023/ ISO 7438 : 2020	Bend test	Standard procedure for conducting bend tests.
IS 1403 (Part 1) : 1993/ ISO 7799:1985	Reverse bend test for sheet and strip	Evaluates flexibility and cracking in thin materials.
IS 1717 : 2018/ ISO 7800 : 2012	Torsion test for wires	Assesses wire strength under twisting.
IS 1716 : 2023/ ISO 7801:1984	Reverse bend test for wire	Determines ductility of metallic wires.
IS 1755 : 2018/ ISO 7802 : 2013	Wire wrapping test	Wrap test to evaluate ductility of wire materials.
IS 2329:2005/ ISO 8491:1998	Tube bend test	Assesses ductility of full-section tubes.
IS 2328 : 2018/ ISO 8492 : 2013	Tube flattening test	Determines the ability to flatten without cracking.
IS 2335:2005/ ISO 8493:1998	Drift expanding test	Measures ductility of metallic tubes.
IS 2330 : 2018/ ISO 8494:2013	Flanging test	Tests the ability of tube ends to form flanges.
IS 12260 : 2018/ ISO 8495 : 2013	Ring expanding test	Expansion of tube rings to evaluate ductility.
IS 12278 : 2018/ ISO 8496:2013	Ring tensile test	Tensile test on tube ring sections.
IS 12261:1987	Reverse torsion test	Evaluates wire ductility under torsion.
IS 11999 : 2022/ ISO 10113:2020	Plastic strain ratio	Determines r-value for sheet metal forming.

IS Number	Title	Description
IS 15756 : 2022/ ISO 10275:2020	Tensile strain hardening exponent	Measures n-value indicating formability.
IS 17146 (Parts 1 & 2)/ ISO 12004 (Parts 1 & 2)	Forming-limit curves	Provides methods for press shop and lab evaluation.
IS 17414 : 2020/ ISO 16630 : 2017	Hole expansion test	Evaluates edge stretchability in punched holes.
IS 17415 : 2023/ ISO 18338 : 2021	Torsion test at ambient temperature	General torsion test for metallic materials.
IS 17418 : 2020/ ISO 16842 : 2014	Biaxial tensile testing	Cruciform test for sheet and strip materials.
IS 17419 : 2025	High-speed compression test	For porous and cellular metals.
IS 10175 : 2018/ ISO 20482:2013	Erichsen cupping test	Measures drawing characteristics of sheet metals.
IS 19024 : 2022/ ISO 15363 : 2017	Tube ring hydraulic pressure test	Hydrostatic pressure ductility test.
IS 17937 : 2022/ ISO 13314 : 2011	Compression test for porous metals	Evaluates compressive ductility.
IS 17915 : 2022/ ISO 20032 : 2013	Superplastic material testing	Method to test tensile properties of superplastic alloys.

3. Hardness Testing

Hardness testing evaluates a metal's resistance to localized plastic deformation, typically through indentation. Common methods include Brinell, Vickers, Rockwell, and Instrumented Indentation. Hardness correlates with strength and wear resistance, making it a vital indicator for selecting materials in tooling, machining, structural applications, and surface engineering.

IS Number	Title	Description
IS 7096:1981, IS 172:1984, IS 10166:1982	Scleroscope hardness and verification	Dynamic rebound hardness method.
IS 6885 (Parts 1–4)/ ISO 4545 (Parts 1–4)	Knoop hardness test	Methods, calibration, and reference blocks
IS 1500 (Parts 1–4)/ ISO 6506 (Parts 1–4)	Brinell hardness test	Test method, verification, calibration, hardness tables.
IS 1501 (Parts 1–4)/ ISO 6507 (Parts 1–4)	Vickers hardness test	Complete test methodology and equipment calibration.

IS Number	Title	Description
IS 1586 (Parts 1–3)/ ISO 6508 (Parts 1–3)	Rockwell hardness test	Test method, equipment verification, and reference blocks.
IS 17144 (Parts 1–4)/ ISO 14577 (Parts 1–4)	Instrumented indentation	Measures hardness and other parameters with depth-sensing.
IS 17149 (Parts 1–3)/ ISO 16859 (Parts 1–3)	Leeb hardness test	Portable hardness test with rebound principle.
IS 4258 : 2018/ ISO 18265:2013	Conversion of hardness value	Standardizes conversion between different hardness scales.

4. Fatigue and Fracture Testing

These tests assess a metal's resistance to crack initiation and propagation under cyclic loading or stress concentration. Fatigue and fracture toughness tests are vital for predicting service life and ensuring safety in critical applications like aerospace, automotive, and pressure vessels, where failure from repeated stress can be catastrophic.

IS Number	Title	Description
IS 6886:1973	Dynamic calibration for fatigue machines	Uses strain gauges for load calibration.
IS 5075 : 2023/ ISO 1143 : 2021	Rotating bar bending fatigue test	Bending fatigue test for bars.
IS 5074 : 2023/ ISO 1099 : 2017	Axial fatigue test	Axial loading fatigue under force control.
IS 8632 : 2023/ ISO 3785:2006	Specimen orientation	Relates test axes to product texture.
IS 17143 : 2023/ ISO 1352 : 2021	Torque-controlled fatigue test	For fatigue loading under torsion.
IS 17417 (Parts 1 & 2)/ ISO 4965 (Parts 1 & 2)	Dynamic force calibration for fatigue	System and instrumentation-based calibration.
IS 17145 (Parts 1 & 2)/ ISO 12110 (Parts 1 & 2)	Variable amplitude fatigue testing	General method and cycle counting procedures.
IS 16842 : 2022/ ISO 12108 : 2018	Fatigue crack growth	Measures crack growth under cyclic loading.
IS 16843 : 2018/ ISO 12111 : 2011	Strain-controlled thermomechanical fatigue	Testing with combined strain and thermal cycling.
IS 17147 : 2019/ ISO 12107 : 2012	Statistical analysis in fatigue	Guidelines for analyzing fatigue test data.

5. Toughness Testing

Toughness testing determines a material's ability to absorb energy and resist fracture during sudden or impact loading. Tests such as Charpy and Izod are widely used to evaluate the material's performance in dynamic conditions, particularly in cold environments or structural applications where impact resistance is crucial.

IS Number	Title	Description
IS 1598:2024	Izod impact test	Measures energy absorption in a notched bar.
IS 5070:1985	Beam unnotched impact	Grey cast iron impact resistance.
IS 10180:1982	Plane strain fracture toughness	Determines K_IC of metallic materials.
IS 11240:1985	Falling weight test	Impact loading using a drop-weight.
IS 10623:2023	Drop weight tear test	Fracture resistance of ferritic steels.
IS 15420:2003	Charpy reference specimens	Prepares and characterizes Charpy verification samples.
IS 1757 (Parts 1–3)/ ISO 148 (Parts 1–3)	Charpy V-notch testing	Method, machine verification, and specimen preparation.
IS 17416 : 2024/ ISO 14556 : 2023	Instrumented Charpy test	Records force-displacement curves.
IS 17151 : 2023/ ISO 12135 : 2021	Quasistatic fracture toughness	Unified method for K and J values.
IS 17679 : 2021/ ISO 15653:2018	Fracture toughness of welds	Evaluates toughness in welded joints.

6. General Tests and Guidelines

This category includes foundational standards and guidelines applicable across various mechanical tests. It covers terminology, sampling procedures, test condition standardization, and data interpretation. These general provisions ensure consistency, accuracy, and traceability in mechanical testing practices, forming the basis for reliable material evaluation and compliance assessment.

IS Number	Title	Description
IS 2855:1991	Flexivity of thermostat metals	Measures deflection under temperature changes.
IS 3394:2024	Life test of resistance alloys	Accelerated testing for electrical heating alloys.

IS Number	Title	Description
IS 6243:1985	Hydrogen embrittlement test	For evaluating susceptibility in copper.
IS 10181:1982	Magnetic permeability	Measures relative permeability of steel and iron.
IS 3803 (Parts 1 & 2)/ ISO 2566-1 (Parts 1 & 2)	Elongation value conversion	Converts elongation for carbon, low-alloy, and austenitic steels.
IS 5069 : 2018/ ISO 23718 : 2007	Mechanical testing vocabulary	Terminology for standardizing mechanical test terms.
IS 3711 : 2020/ ISO 377 : 2017	Sampling and test piece preparation	Location and cutting for test specimens.

7. Abrasive and Wear Properties

These tests evaluate a metal's resistance to surface degradation caused by friction, abrasion, or erosive forces. Understanding wear behavior is essential in selecting materials for high-contact applications like gears, bearings, and cutting tools. The tests help predict performance, extend service life, and reduce maintenance requirements.

IS Number	Title	Description
IS 10636 (Parts 1–3)	Abrasive wear tests	Includes gouging, high-stress, and low-stress abrasion methods.
IS 11083:1984	Friction and wear test	Against steel surfaces under standard conditions.