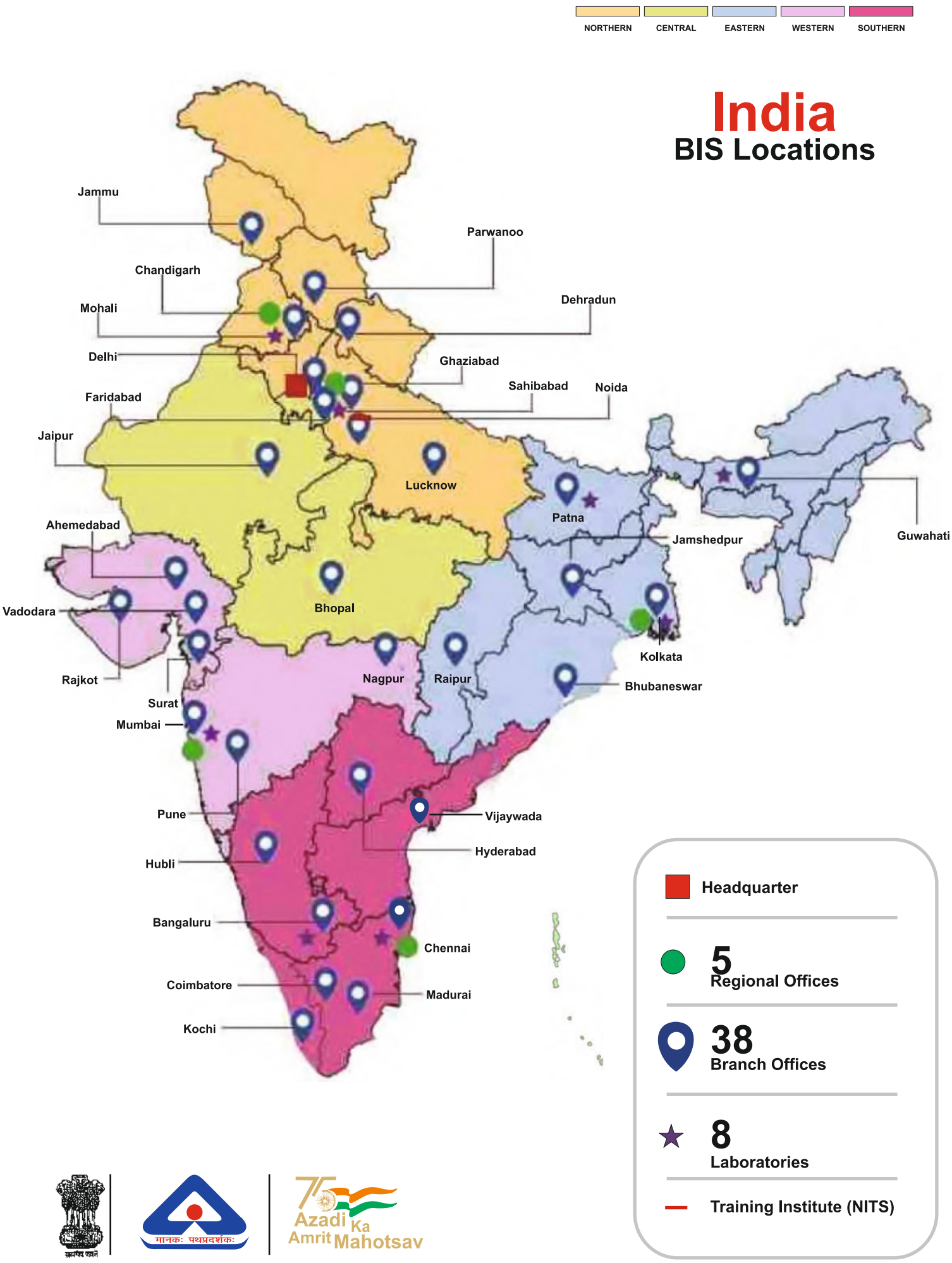
INDIAN STANDARDS ON MACHINE SAFETY BY PRODUCTION AND GENERAL ENGINEERING DEPARTMENT

BUREAU OF INDIAN STANDARDS
Ministry of Consumer Affairs,
Food and Public Distribution
Government of India

भारतीय मानक ब्यूरो
उपभोक्ता मामले, खाद्य और
सार्वजनिक वितरण मंत्रालय
भारत सरकार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Azadi Ka Amrit Mahotsav

ABOUT BIS

Bureau of Indian Standards (BIS), the National Standards Body (NSB) of India was established under the *BIS Act*, 1986 and came into existence on 1 April 1987 assuming the functions of the erstwhile Indian Standards Institution (ISI). The ISI was established on 6 January 1947. *The BIS Act*, 2016 came into force on 12 October 2017 superseding BIS Act 1986. *The BIS Act*, 2016 provides for the establishment of a national standards body for the harmonious development of the activities of standardization, conformity assessment and quality assurance of goods, articles, processes, systems and services and for matters connected therewith or incidental thereto.

BIS through its core activities of standardization and conformity assessment, has been benefiting the national economy by providing safe, reliable and quality goods; minimizing health hazards to consumers; protecting the environment; controlling over proliferation of varieties; promoting exports and imports substitutes, etc. The standardization and conformity assessment schemes of BIS apart from benefitting the consumers and industry also support various public policies especially in areas of product safety, consumer protection, food safety, environment protection, building and infrastructure development, etc.

BIS also represents India in international standards bodies like International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) and participates actively in the international standardization work undertaken by these bodies. BIS presents the national viewpoints on new areas taken up for international standardization and on various draft international standards during the process of development of these standards so that the country's interest is protected and reflected in these standards. This also enables the BIS technical committees to consider adoption of the international standards as Indian Standards, with or without modifications, in order to enable our products and services to integrate with global trade and commerce.

What are Standards?

Standard is a document, established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context.

Importance of Standardization

Standardization is the process of developing technical standards through consensus of different parties.This standardization aims to address one or all of compatibility, interchangeability, variety control, safety, environment protection, product protection and fitness for purpose. Standards provide numerable benefits to the technologists, producers, consumers and traders besides defining purpose for each of these entities.

Standards can be formulated at various levels ranging from an individual through National (IS) to International level (ISO). Also, depending on the subject in hand, standards can be made on various aspects such as terminology, specification, sampling, testing, code of good practice, systemes and services.

STANDARDIZATION ACTIVITY OF BIS

Standardization Structure

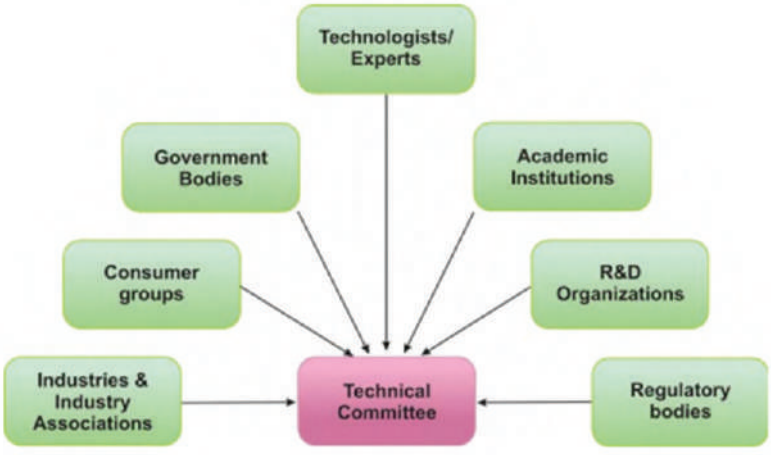
There are 16 Technical Departments formulating standards in various subject areas. Corresponding to these departments, 16 division councils exist. Each division council has several sectional committees working under it. The standards cover important segments of economy and help the industry in upgrading the quality of their goods and services.

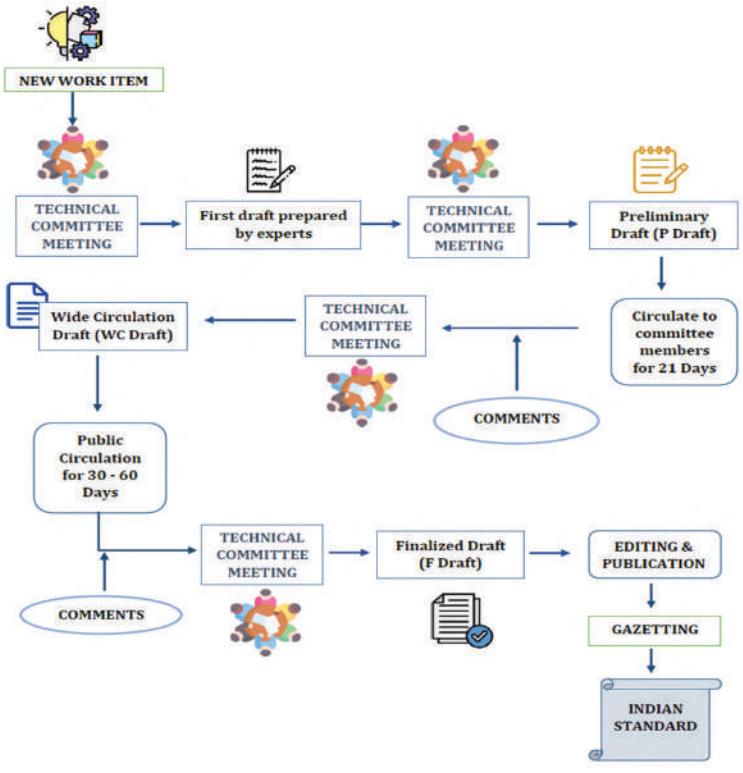
Ayush Division Council (AYDC)	Chemical Division Council (CHDC)	Civil Engineering Division Council (CEDC)	Electro-Technical Division Council (ETDC)
Electronics & Telecommunication Division Council (LITDC)	Food and Agriculture Division Council (FADC)	Mechanical Engineering Division Council (MEDC)	Management and Systems Division Council (MSDC)
Metallurgical Engineering Division Council (MTDC)	Medical Equipment & Hospital Planning Division Council (MHDC)	Petroleum, Coal & Related Products Division Council (PCDC)	Production and General Engineering Division Council (PGDC)
Transport Engineering Division Council (TEDC)	Textile Division Council (TXDC)	Water Resources Division Council (WRDC)	Service Sector Division Council (SSDC)

Standards Formulation Process

The Indian Standards are developed by technical committees that are representative of various stakeholders having interest in the relevant subject of standardization under the scope of such committees through a process of consultation so that views of all are given due consideration and a consensus is evolved in formulating a standard. The stakeholders involved in national standardization can broadly be categorized as industry, consumers/ users, technologists (R&D and scientific institutions, academia, individual subject experts, etc) and government departments/regulators.

The process of standards development of BIS is aligned with accepted international best practices that are based on the core principles of openness, transparency, impartiality and consensus. The process begins with the identification of the standardization needs of the given sector or subject following which the development of the standard is taken up and planned bythe relevant technical committee. Apart from consultation within the technical committees, draft standards are also open for public views/comments.





Standards Development Process Flow

PRODUCTION AND GENERAL ENGINEERING DEPARTMENT (PGD)

Production Engineering deals with standardization of planning, designing, developing and managing of various manufacturing processes to produce high quality products. General engineering deals with subjects like measurement, design, symbols, etc that are horizontally utilized by other disciplines such as electrical, chemical, mechanical, civil, architectural and computer engineering. Production & Engineering Department (PGD) of BIS covers both these disciplines and has been formulating standards in various fields, such as basic engineering; engineering drawings, screw threads and fasteners; transmission devices; weights and measures; engineering metrology; ergonomics; bearings and tribology; gears; horology; machine tools, hand tools, cutting tools and pneumatic tools; fluid power systems; meteorological instruments; mountaineering equipment; arms and ammunition for civilian use; metal containers; automation in manufacturing and robotics; consumer products and allied equipment; metal forming machines; abrasives; lubricating equipment; educational instruments and equipment; optics and photonics; conveyor belts; and sports goods. The policy making body of PGD, called Production and General Engineering Division Council (PGDC), has twenty-seven (27) Sectional Committees under its purview and these sectional committees have formulated more than 2500 standards as on date. Amongst these standards, 1462 are product standards, 161 are code of practice standards, 159 are test methods standards, 104 are terminology standards, 359 are dimensions standards, 5 are system standards, 28 are safety standards and 242 standards pertain to other categories. Many of the product standards including those of Tools for Pressing, Stamping or Punching and Ball Bearing & Roller Bearing Parts are also referred in various regulations to make their compliance mandatory for manufacturers.

Aspect	No. of Standards
Product Standards	1385
Methods of Test	180
Codes of Practice	155
Terminology	78
Dimensions	301
System Standard	6
Safety Standard	30
Others	186
Total	**2516**

Membership status of PGD in ISO committees:

1. Participating membership: This department is contributing in 59 ISO technical committees as 'P' member and nominated various Indian Experts to represent INDIA on ISO platform for putting the Indian perspective and making sure that Indian stakeholders are well represented in International standardisation and their viewpoints are being considered by the ISO.

2. Observer: PGD is a member in 29 committees as observer and observing the work of these committees.

TECHNICAL COMMITTEES WORKING UNDER PGD

Under PGD, there are 27 Sectional Technical Committees working in various subject areas. List of committees with their scope is as follows:

Technical Committee Number	Technical Committee Name	SCOPE
PGD 01	Basic Standards Sectional Commiittee	Formulation of Indian Standards on terminology, units, quantities, symbols and other basic subjects of general applicability to all Division Councils.
PGD 04	Metal Forming Machines Sectional Commiittee	Standardization in the field of various technical aspects of metal forming machines both by hot and cold processes and their machines (Presses, press brakes, shears, shear blades, moulds including plastic injection moulds, forging machines, nibs and dies for wire and tube drawing operations, aluminium diecasting dies, and their related tooling).
PGD 08	Pneumatic and Hydraulic Tools Sectional Commiittee	Standardization in the field of portable type Hydraulic/Pneumatic tackles, tools and accessories
PGD 09	Abrasives Sectional Commiittee	Standardization in the field of coated abrasives, grinding wheels and diamond/cubic boron nitride abrasive tools
PGD 13	Bearing Sectional Commiittee	Formulation of standards for rolling element bearings and hydro-mechanic bearing (including plain, thrust bush bimetallic, hydrostatic bearing and hydro dynamic bearings etc.)
PGD 14	Consumer Products And Allied Equipments Sectional Commiittee	Standardization in the field of: All types of (a) Fasteners for Consumer Goods; (b) Hair Cutting, Shaving and Shearing Equipment; (c) Umbrella & its Components, and (d) Miscellaneous Consumer Products not covered under any other Committee
PGD 15	Ergonomics Sectional Commiittee	Standardization is the field of ergonomics including terminology, technology, methodology and human and other factors related to ergonomics common to all the spheres of life.
PGD 18	Industrial Automation Systems and Robotics Sectional Commiittee	a) Standardization in the field of industrial automation systems and integration concerning discrete part manufacturing and encompassing the application of multiple technologies i.e. information systems, machines, equipment communication (Bus communication, telecommunication etc. excluded): - Process automation; - Electrical electronics equipment; - Programmable logical controllers for general application; - Sensors. b) Standardization in the field of Robotics.
PGD 19	Lubricating Equipments Sectional Commiittee	Formulation of standards on lubricating equipment, systems and accessories.
PGD 21	Meteorological Instruments Sectional Commiittee	Preparation of standards for rain gauges; air measures; anemometers; windvanes; Psychrometers; thermometer screen (Single and double); Evaporimeters; barometers; thermographs; hygrograph barographs etc.
PGD 22	Educational Instruments and Equipment Sectional Commiittee	(a) Formulation of standards for instruments and equipment for school and college Laboratories. (b) Formulation of standards for surveying instruments, drawing instruments; Optical instruments (excluding medico - optical instruments) and their components and materials.

PGD 23	Horology Sectional Commiittee	Formulation of standards for time measuring, time keeping and time recording devices.
PGD 24	Drawings Sectional Commiittee	Formulation of code of practice for general engineering drawings and related standards
PGD 25	Engineering Metrology Sectional Commiittee	Formulation of standards on limits and fits and on gauges for plain and threaded work pieces; precision measuring equipment; surface finish and other allied items
PGD 26	Weights And Measures Sectional Commiittee	Formulation of standards for weights, measures, weighing and measuring equipment intended to be used in transactions, for industrial production or for protection
PGD 27	Mountaineering and Adventure Sports Sectional Commiittee	Standardization in the field of mountaineering, skiing, adventure sports and recreational equipment
PGD 28	Arms And Ammunition For Civilian Use Sectional Commiittee	Preparation of standards for fire arms and ammunition for civilian use besides sporting arms and ammunition
PGD 32	Cutting Tools Sectional Commiittee	a) Standardization in the field of twist drills, reamers, countersink and counterbore, drills, screwing taps, dies and other threading tools, milling cutters and milling machine arbors and accessories, saw and saw blades, gear cutting tools, broaches and their holding devices, single point tools, carbide tips, indexable (Throwaway) inserts, tool shanks, tool blanks and hard metal burrs. b) Liaison with (i) ISO/TC 29/SC 2 High speed steel cutting tools and their attachments (P-Member). c) Co-ordination of work with: (i) ISO/TC 29 Small tools (P-Member)
PGD 33	Transmission Devices Sectional Commiittee	a) Formulation of standards for gears, transmission chains; shaft ends and axle heights; splines and serrations; clutches and couplings and keys & keyways. b) Co-ordination of work with: (i) ISO/TC 14 Shafts for machinery and accessories (O-Member) (ii) ISO/TC 60 Gears (O -Member) (vi) ISO/TC 100 Chains and chain sprockets for power transmission and conveyors (P-Member)
PGD 34	Hand Tools Sectional Commiittee	a) Standardization in the field of pliers, nippers, wrenches, files, non-spark safety tools and other assembly tools, b) Standardization in the field of earth working, metal working tools and wood working hand tools and manually portable forest machinery c) Co-ordination of work with: (i) ISO/TC 29 Small tools (P-Member) (ii) ISO/TC 29/SC 10 Assembly tools for screws and nuts, pliers and nippers (O-Member) (iii) ISO/TC 23/SC 17 Manually portable forest machinery (O-Member)
PGD 35	Machine Tools, Machine Tool Elements, and Holding Devices Sectional Commiittee	Standardization in the field of machine tools, basic machine tool elements, jigs and fixtures, modular units, evaluation of all machine tools for the working of metal, wood and plastics.
PGD 36	Fluid Power System Sectional Commiittee	a) Standardization in the field of terminology, classifications, symbols, fluid logic, and fluid properties, contamination control, components

		marking systems and identification codes, sealing devices and their related parameters; hydraulic components and their testing, maintenance and installations; pneumatic components and their testing, installation and maintenance. b) Standardization in the field of ports, fittings, tubes and tube, hoses & hose assemblies and their testing. c) Liaison with: (i) ISO/TC 131 Fluid power systems (P-Member) (ii) ISO/TC 131/SC 1 Terminology, Classification and symbols (P-Member) (iii) ISO/TC 131/SC 2 Pumps, motors and integral transmissions (P-Member) (iv) ISO/TC 131/SC 3 Cylinders (P-Member) (v) ISO/TC 131/SC 4 Connectors and similar products and components (Member) (vi) ISO/TC 131/SC 5 Control products and components (P-Member) (vii) ISO/TC 131/SC 6 Contamination control (P-Member) (viii) ISO/TC 131/SC 8 Product testing (P-Member) (ix) ISO/TC 131/SC 9 Installations and systems (P-Member)
PGD 37	General Engineering and Fasteners Standards Sectional Commiittee	a)Formulation of standards on (i)Basic mechanical engineering subjects for general applicability such as fasteners of all types (bolts, nuts, rivets, pins, nails, washers etc.), knurls, relief grooves, countersunks and counterbores, and (ii)Screw threads including basic profiles, pitch-diameter combination, terminology, technical requirement and tolerances but excluding screw thread gauges. b) Coordination of work with: (i) ISO/TC 1 Screw Thread (P-Member) (ii) ISO/TC 2 Fasteners (P-Member) (iii) ISO/TC 2/SC 7 Reference standard (P-Member) (iv) ISO/TC 2/SC 11 Fasteners with metric external thread (P-Member) (v) ISO/TC 2/SC 12 Fasteners with metric internal thread (P-Member) (vi) ISO/TC 2/SC 13 Fasteners with non-metric thread (P-Member) (vii) ISO/TC 2/SC 14 Surface coatings (O-Member)
PGD 38	Metal Containers Sectional Commiittee	Standardization in the field of metal containers
PGD 39	Optics and Photonics Sectional Commiittee	Standardization of terminology, requirements, interfaces and test methods in the field of optics and photonics. This includes complete systems, devices, instruments (excluding medico – optical instruments like ophthalmological and endoscope related), optical and photonic components, auxiliary devices and accessories, as well as materials.
PGD 40	Conveyor Belts Sectional Commiittee	a. Formulation of standards on terminology, dimensional, testing and other specifications for Pulleys, belts including V-Belts and Synchronous belts drive; belts used in conveyors, elevators of various sizes and shapes b. Co-ordination of work with: i. ISO/TC 41 Pulleys and belts including V-belts (P-Member) ii. ISO/TC 41/SC 1 Friction (P-Member) iii. ISO/TC 41/SC 3 Conveyor belts (P-Member) iv. ISO/TC 41/SC 4 Synchronous belt drives (P-Member) v. ISO/TC 101 Continuous mechanical handling equipment (P-Member)
PGD 41	Sports Goods Sectional Commiittee	To formulate Indian Standards for terminology; safety requirements, methods of sampling and test; specifications for sports goods and related products and activities including Gymnasium equipment and physical fitness equipments, excluding amusement rides, mountaineering and adventure sports

Safety of Machine Tools

Machine tools are the backbone of modern manufacturing and fabrication industries, shaping the world around us with precision and efficiency. These powerful machines, such as lathes, milling machines, drills, grinders, and CNC machines, are indispensable in creating countless everyday products we rely on. From the intricate components of your smartphone to the sturdy foundations of skyscrapers, machine tools play a vital role in shaping our world.

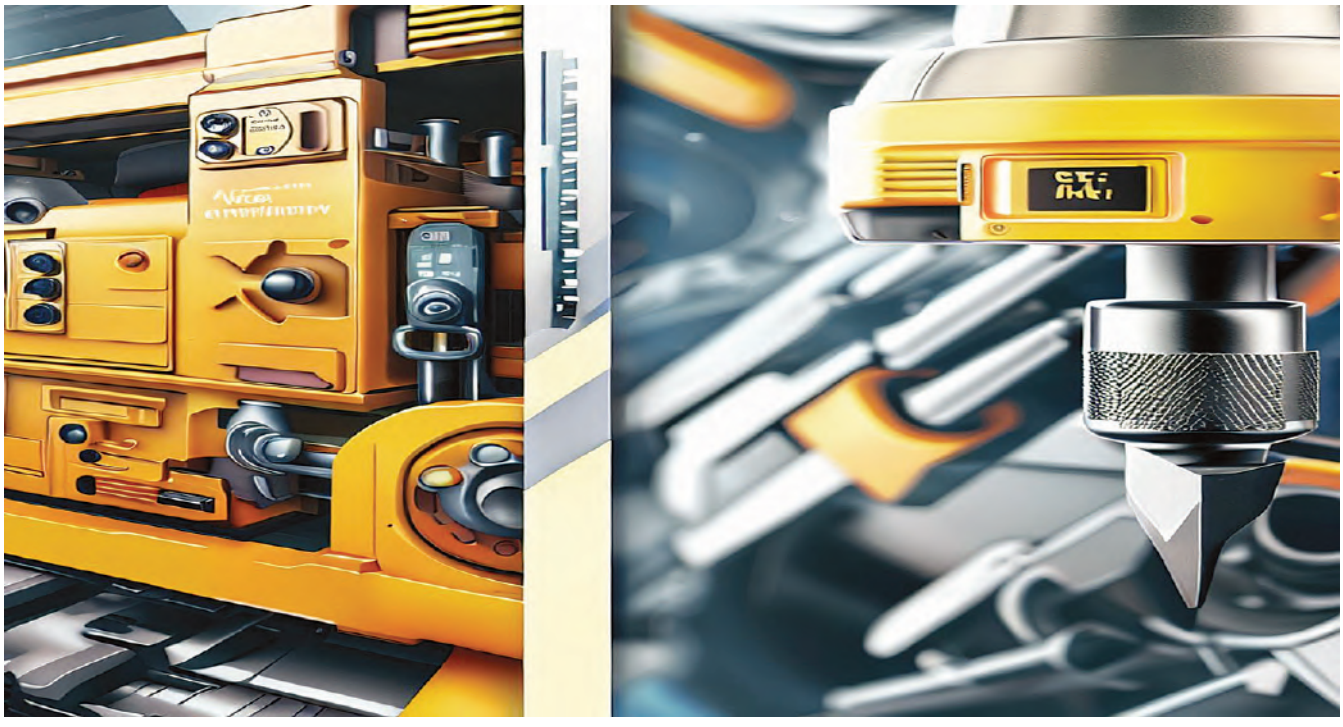


Figure 1: A milling machine, which is used to cut and shape metal or wood

However, with their incredible capabilities come inherent risks. The very mechanisms that make machine tools powerful also make them potentially dangerous when not handled with care and knowledge. Accidents involving machine tools can result in severe injuries or even fatalities, causing not only personal suffering but also economic setbacks for businesses.

One of the cornerstones of mitigating these risks is the establishment and adherence to standardized safety protocols and guidelines. This comprehensive guide, "Ensuring Machine Tool Safety Through Standardization," aims to enlighten individuals across industries on the paramount significance of standardization in the realm of machine tool safety.

This comprehensive guide is designed to equip you with the essential knowledge of safety standards needed to work with machine tools safely and effectively. Whether you are a seasoned professional, a student, or someone exploring a career in manufacturing, this guide is a valuable resource for understanding the potential hazards and learning the best practices to mitigate them.

Before we go into details, lets have a quick look into the Machine Tools Safety Standards formulated by BIS.

1 UNDERSTANDING MACHINE TOOL HAZARDS

The Foundation of Safe Operations

Before delving into the world of standards and guidelines, it is essential to grasp the nature of the hazards posed by

machine tools. This understanding serves as the foundation upon which safety standards are built. Let's explore some of the common hazards associated with these machines:

1.1 Moving Parts

Machine tools are intricate systems with multiple moving parts, such as rotating spindles, cutting tools, and conveyor belts. The rapid and precise movements of these components can pose a significant risk of injury if not controlled and safeguarded properly.

Figure 2 Rapid movement of a spindle in a CNC milling Machine

1.2 Electrical Systems

Machine tools often rely on complex electrical systems to operate. Electrical hazards, including short circuits, exposed wiring, and malfunctioning control panels, can lead to electric shock, fires, or damage to the equipment.

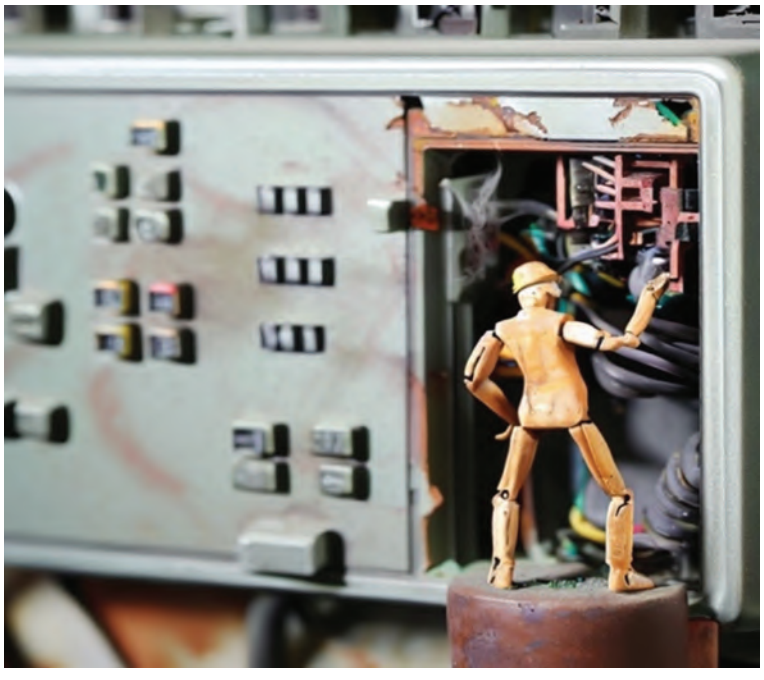


Figure 3 Damaged electric panel can be a potential hazard in a machine tool

1.3 Sharp Tools and Workpieces

The cutting tools and workpieces used in machine tools are often extremely sharp. Mishandling or accidental contact with these objects can result in severe cuts, lacerations, or amputations.

Figure 4 Close up image of sharp cutting tool used in lathe machines

1.4 Other Hazards:

- Ejected Materials: During machining, materials like metal chips, abrasive dust, or coolant can be ejected from the machine at high speeds, posing a risk to operators and nearby workers.
- Pinch Points: Machine components with moving or adjustable parts can create pinch points that can trap and injure operators.
- Hearing Damage: Machine tools can produce high levels of noise, which can lead to hearing loss if operators are not adequately protected.
- Vibration: Prolonged exposure to machine tool vibration can cause musculoskeletal disorders and other health problems.
- Coolants and Lubricants: Many machine tools use coolants and lubricants, which may contain hazardous chemicals. Exposure to these substances can lead to skin irritation, respiratory issues, or chemical burns.
- Hot Surfaces: Machine components can become extremely hot during operation, posing a risk of burns if touched.
- Welding and Cutting: Processes like welding and plasma cutting involve high temperatures that can cause severe burns if not properly controlled.
- Chips and Fragments: The cutting or grinding process can produce flying chips or fragments that can cause eye injuries or lacerations.
- Tool Changes: Changing cutting tools can be hazardous if not done correctly, as it may involve sharp tools and awkward positions.
- Workpiece Handling: Moving and securing workpieces can be risky, especially for heavy or awkwardly shaped materials.

- Lack of Training: Inadequate training or inattention can lead to accidents, as operators may not understand the machine's safe operation or may make mistakes.
- Sparks and Hot Surfaces: Sparks generated during machining, as well as hot surfaces, can ignite flammable materials.
- Coolant Fires: Flammable coolant mist can catch fire if it comes into contact with hot surfaces or sparks.
- Dust and Fumes: The machining process can create airborne contaminants like metal dust or fumes, which can be harmful if inhaled.

Understanding these hazards is the first step toward ensuring safety. As we progress through this guide, we will see how standardized safety practices and guidelines address these risks comprehensively, leading to safer machine tool operations in various industrial settings.

In the following chapters, we will delve deeper into the importance of standardization, the key safety standards and organizations, practical implementation of standardized safety practices, training and education, compliance, and continuous improvement. Together, these insights will equip you with the knowledge and tools to foster a culture of safety while maximizing the potential of machine tools in your industry.

2 THE IMPORTANCE OF STANDARDIZATION FOR SAFETY

Building a Foundation for Safety

In the previous chapter, we explored the hazards inherent in machine tool operations. Now, let's shift our focus to the critical role that standardization plays in mitigating these risks and ensuring safe practices. Standardization is not just a bureaucratic exercise; it is the cornerstone upon which safe machine tool operations are built.

2.1 What is Standardization?

Before delving deeper, it's important to clarify what we mean by standardization in the context of machine tool safety. Standardization refers to the process of developing and implementing a set of agreed-upon guidelines, rules, and specifications that define safe practices, procedures, and equipment design within a particular industry or field. A schematic diagram is given below for showcasing the standards development process in BIS.

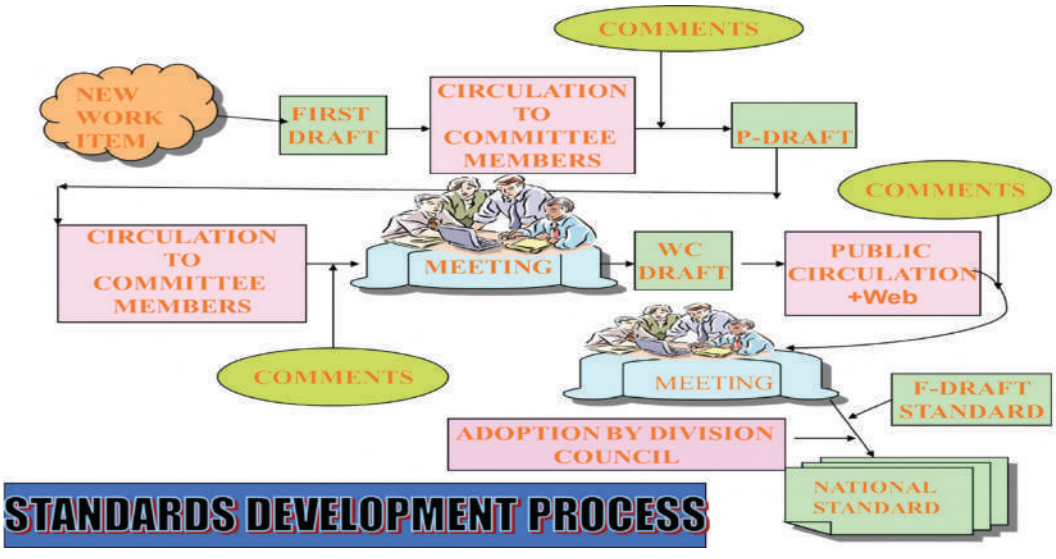


Figure 5 Standard development process in BIS

2.2 The Power of Consistency

The key advantage of standardization is consistency. It provides a common language and framework for machine tool users, manufacturers, and regulators alike. This consistency yields several significant benefits:

2.2.1 Improved safety

Standardized safety practices and equipment design are based on extensive research, industry expertise, and lessons learned from past incidents. They are, therefore, more likely to lead to safer working conditions and reduced accidents. Standards details various tests for checking the specification of particular equipment used for safety feature and this gives an edge to standardised equipment over non standardised equipment.

2.2.2 Interoperability

Standardized machine tools and safety features are more likely to be compatible and interchangeable, facilitating seamless integration into various industrial processes. This interoperability reduces the complexity of maintenance and ensures a higher degree of reliability.

2.2.3 Ease of Compliance

Machine tool users and manufacturers can more easily demonstrate compliance with safety regulations when standardized practices are followed. This simplifies the regulatory process and reduces the risk of legal consequences for non-compliance.

2.3 Global Harmonization

In today's interconnected world, machine tools and their components often cross international borders. Standardization transcends geographic boundaries, promoting global harmonization of safety practices. This ensures that the same high safety standards apply, regardless of where a machine tool is manufactured or used.

2.4 Standardization Bodies and Organizations

To maintain consistency and drive the development of safety standards, numerous organizations and committees exist at the national and international levels. These bodies bring together experts, industry representatives, and regulators to create, update, and disseminate safety standards. ISO and IEC organisations are the one playing a keyrole at international level for formulating standards in the field of Machine Tools Safety whereas in India, BIS is the national standard body formulating Indian Standards for the betterment of Machine Tool Industry.

By understanding the importance of standardization, you are better equipped to appreciate its impact on machine tool safety. Standardization isn't just a bureaucratic requirement; it is a powerful tool that helps protect lives, improve efficiency, and foster innovation in the field of machine tool operations.

3 RISK ANALYSIS FOR STANDARDS COMPLIANCE

Proactively Managing Hazards

In this chapter, we explore the importance of risk analysis in achieving compliance with standards for machine tool safety.

3.1 Risk Assessment Fundamentals

- Understand that risk analysis identifies, assesses, and prioritizes workplace hazards.
- Begin by identifying all potential hazards in machine tool operations, such as moving parts, electrical systems, and sharp tools.

3.2 Assessing Risks

- Assess risks by considering factors like likelihood, severity of potential injuries, and exposure frequency.
- Consult relevant BIS standards for guidance on risk assessment methodologies.

3.3 BIS Standards for Risk Analysis

- Familiarize yourself with standards (IS 16819/ISO 12100) addressing risk assessment in machine tool safety.
- l Use the standard as references for conducting risk assessments. (Reference may also be given to IS/ ISO 31000 Risk Management System)

3.4 Implementing Risk Controls

- Develop and implement risk controls and mitigation measures based on risk analysis outcomes.
- Controls may include safety features, procedures, and safeguards.

3.5 Documentation and Reporting

- Maintain detailed records of hazard identification, risk assessments, and risk control measures.
- Reporting is essential for demonstrating compliance with standards.

3.6 Periodic Reviews

- Regularly review and update risk analysis in alignment with standards.
- Consider factors like equipment aging and technological advancements.

3.7 Employee Involvement

- Involve employees in risk analysis, as their insights are valuable for hazard identification.
- Foster a culture of reporting safety concerns.

3.8 Integration with standards/regulatory Compliance

- Ensure that risk analysis seamlessly integrates with standards and regulatory requirements for machine tool safety.
- Showcase risk analysis as an integral part of your compliance efforts.

By incorporating risk analysis into your safety practices according to standards, you proactively manage hazards, enhance workplace safety, and maintain compliance with Indian regulations..

4 UNDERSTANDING OF TYPE A, TYPE B, AND TYPE C SAFETY STANDARDS

Tailoring Safety Standards to Machine Tool Specifics

In this chapter, we delve into the distinct categories of machine tool safety standards: Type A, Type B, and Type C. Understanding these classifications is essential for tailoring safety measures to the unique characteristics and risks associated with different types of machine tools.

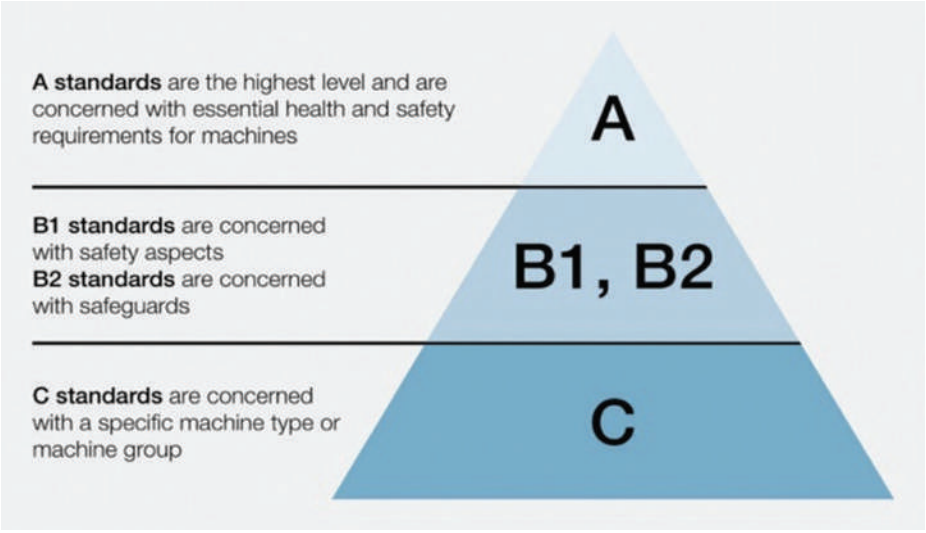


Figure 6 Classification of safety standards

4.1 Type A Safety Standards

- Type A standards primarily cover general safety principles applicable to a wide range of machine tools.
- They provide a foundational framework for risk assessment, risk reduction, and safety features common to most machines.
- Examples of Type A standards may include **IS 16819:2018/ISO 12100: 2010 Safety of Machinery - General Principles for Design - Risk Assessment and Risk Reduction**.

4.2 Type B Safety Standards

- Type B standards deals with one safety aspect or one type of safeguard that can be used across a wide range of machinery.
- Type-B1 standards on particular safety aspects (for example, safety distances, surface temperature, noise). A particular example is of this type of standards is IS 16810 (Part 1): 2018/ ISO13849-1:2015, Safety of machinery - Safety related parts of control systems: Part 1 general principles for design
- Type-B2 standards on safeguards (for example, two-hand controls, interlocking devices, pressuresensitive devices, guards). A particular example of this type of standards is (e.g. IS 16818:2018/ISO 13850:2015 **Safety of machinery - Emergency stop function - Principles for design**

4.3 Type C Safety Standards

- Type C standards (machine safety standards) deals with detailed safety requirements for a particular machine or group of machines
- They are highly detailed and provide comprehensive safety measures and controls.
- An example of this type of standard is IS 17258: 2019/ISO 23125: 2015 Machine Tools — Safety — Turning Machines, which focuses on safety requirements for Turning Machines.

4.4 Choosing the Appropriate Standard

- Determine the type of machine tool in use or development.
- Select the corresponding Type A, Type B, or Type C safety standard based on the machine's classification.
- Ensure that safety measures align with the chosen standard's specifications.

4.5 Continuous Monitoring and Adaptation

- Recognize that machine tools and their applications may evolve over time.
- Continuously monitor developments in Type A, Type B, and Type C safety standards to ensure ongoing compliance.

5 TYPE A STANDARD — EXAMPLE

IS 16819:2018/ISO12100:2010 Safety of machinery – General principles for design – Risk assessment and risk reduction

This standard provides comprehensive principles and guidelines for conducting risk assessments in various machinery applications, including machine tools. It outlines a structured approach to identify, assess, and manage risks associated with machinery operation.

Key aspects covered by IS 16819:2018/ISO 122100:2010 includes:

1. **Risk Identification**: The standard offers a systematic process to identify potential hazards and hazardous situations in machine tool operations. It emphasizes considering all phases of machine life, from installation to decommissioning.
2. **Risk Assessment**: IS 16819 guides users in evaluating and ranking risks based on criteria like severity, likelihood, and exposure. It emphasizes a scientific approach to assess and prioritize risks.
3. **Risk Reduction**: The standard provides guidelines on selecting and implementing risk control measures. It focuses on reducing risks to acceptable levels and includes considerations for inherent safety and protective measures.
4. **Documentation**: IS 16819 emphasizes the importance of documenting the risk assessment process. It outlines what information should be recorded, ensuring transparency and traceability.
5. **Integration with Standards**: The standard highlights the need to integrate risk assessment into the design and development phases of machinery. It also suggests using relevant BIS/ISO standards to aid in risk analysis.
6. **Review and Update**: IS 16819 stresses the importance of periodic reviews of risk assessments. It acknowledges that risks may change over time due to factors like technological advancements and operational changes.
7. **Communication**: The standard underlines the significance of communicating risk assessment findings to relevant stakeholders, including operators, maintenance personnel, and management.

Approach given in IS 16819/ISO 12100 can be understood by the schematic diagrams given above:

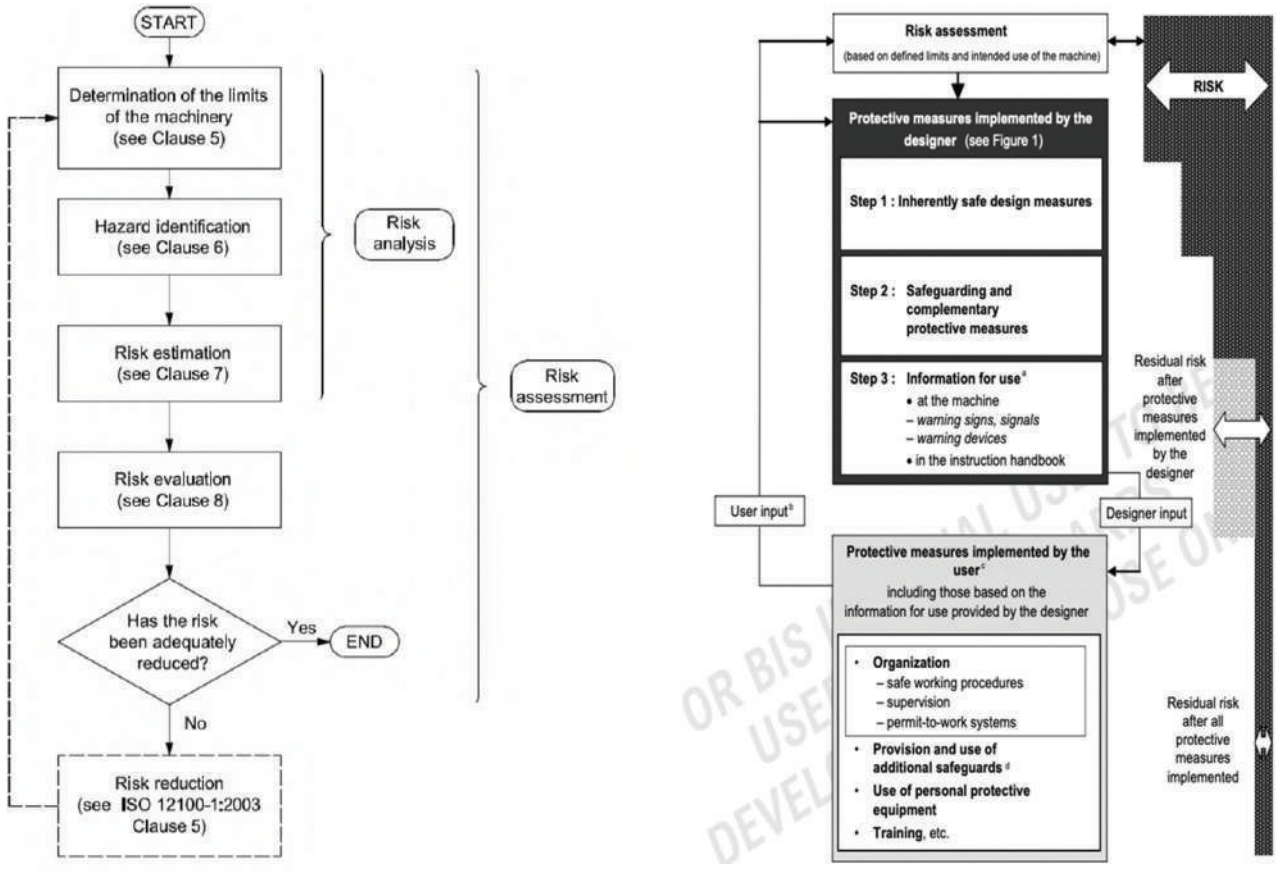


Figure 7 Risk Assessment and Risk Reduction

6 TYPE B STANDARD — EXAMPLE

IS 16814 : 2021/ISO 13857 : 2019 Safety of Machinery — Safety Distances to Prevent Hazard Zones Being Reached by Upper and Lower Limbs

This standard is an example of Type B1 standards which establishes values for safety distances in both industrial and non-industrial environments to prevent machinery hazard zones being reached. The safety distances are appropriate for protective structures. It also gives information about distances to impede free access by the lower limbs. This document covers people of 14 years and older. In addition, for upper limbs only, it provides information for children older than 3 years where reaching through openings needs to be addressed. Data for preventing lower limb access for children is not considered.

Let's initiate a concise conversation regarding how this standard plays a role in enhancing worker safety when machine hazards are present. The subsequent points provide a brief overview of the standard's aims and processes:

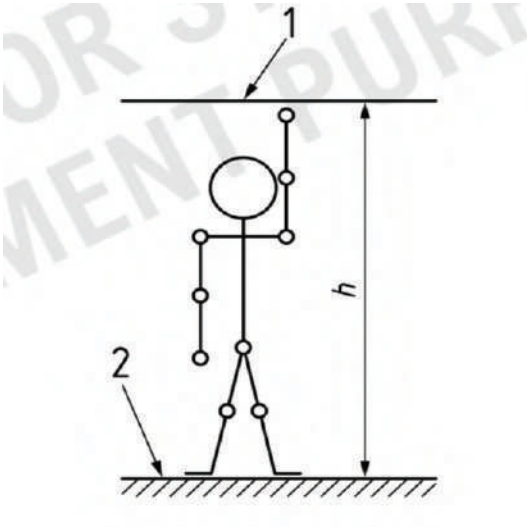
6.1 Risk Assessment:

The standard emphasizes the importance of conducting a thorough risk assessment as per Type A standard IS 16819/ISO 12100 to identify potential hazards associated with machinery. The safety distances defined in IS 16814/ISO 13857 are based on the results of this risk assessment.

6.2 Safety Distance Calculation:

IS 16814/ISO 13857 provides methods for calculating the safety distances required to prevent access to hazardous areas. It takes into account factors such as the speed of the moving parts, reaction times of operators, and

potential reach distances. This standard emphasizes the use of physical guarding and barriers as a primary means of preventing access to hazardous areas. It provides guidance on the design and construction of these guards to ensure their effectiveness.



Here, *1* is the hazard zone where the hand of the person operating the machine should not reach, now for desiging the safety guards, one must know the height *h*. IS 16814/ISO 13857 provides this safety distances to prevent hazard zones being reached. This safety distance can be used for installing physical safety guards.

1 area of upper limb reach,

2 area outside of upper limb reach (hazard zone),

h_h height of the point of the hazard zone which is nearest to the area of upper limb reach,

h_{ps} height of protective structure

S_h horizontal safety distance of the point of the hazard zone which is nearest to the area of upper limb reach

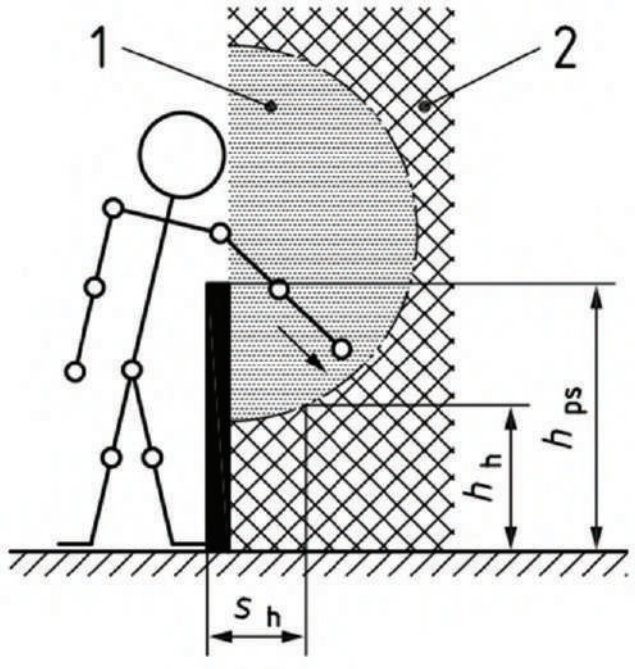


Figure 8 Demonstration of Safety Distance

6.3 Hazard Types:

The standard addresses various types of hazards, including:

- Mechanical hazards, such as moving parts or rotating equipment.
- Electrical hazards, such as live electrical components.
- Thermal hazards, such as hot surfaces.
- Radiation hazards, such as lasers or ionizing radiation.
- Biological hazards, where applicable.

6.4 Risk Reduction: The standard aims to reduce the risk of injury or harm caused by various types of hazards, including mechanical, electrical, thermal, radiation, and biological hazards. By setting safety distances, it helps minimize the likelihood of accidents and their severity. The figures provided below illustrate the concept of using safety distances to prevent individuals from accessing hazardous zones.

The tables found in IS 16814/ISO 13857 offer data regarding safety distances that are essential for designing interfaces between humans and hazard zones.

A list of type B standards published by the BIS for Machine Safety is given below for reference:

Table 1 List of type B standards

Sl N.	IS No	Name of the standard
1	IS 16806 (Part 1) : 2018/ ISO 29042-1:2008	Safety of machinery – Evaluation of the emission of airborne hazardous substances: Part 1 selection of test methods
2	IS 16806 (Part 2) : 2018/ ISO 29042-2:2009	Safety of machinery – Evaluation of the emission of airborne hazardous substances: Part 2 tracer gas method for the measurement of the emission rate of a given pollutant
3	IS 16806 (Part 3) : 2018/ ISO 29042-3:2009	Safety of machinery – Evaluation of the emission of airborne hazardous substances: Part 3 test bench method for the measurement of the emission rate of a given pollutant
4	IS 16806 (Part 4) : 2018/ ISO 29042-4:2009	Safety of machinery – Evaluation of the emission of airborne hazardous substances: Part 4 tracer method for the measurement of the capture efficiency of an exhaust system
5	IS 16806 (Part 5) : 2018/ ISO 29042-5:2010	Safety of machinery – Evaluation of the emission of airborne hazardous substances: Part 5 test bench method for the measurement of the separation efficiency by mass of air cleaning systems with unducted outlet
6	IS 16806 (Part 6) : 2018/ ISO 29042-6:2010	Safety of machinery – Evaluation of the emission of airborne hazardous substances: Part 6 test bench method for the measurement of the separation efficiency by mass of air cleaning systems with ducted outlet
7	IS 16806 (Part 7) : 2018/ ISO 29042-7:2010	Safety of machinery – Evaluation of the emission of airborne hazardous substances: Part 7 test bench method for the measurement of the pollutant concentration parameter
8	IS 16806 (Part 8) : 2018/ ISO 29042-8:2011	Safety of Machinery – Evaluation of the Emission of Airborne Hazardous Substances Part 8 Room Method for the Measurement of the Pollutant Concentration Parameter
9	IS 16806 (Part 9) : 2018/ ISO 29042-9:2011	Safety of machinery – Evaluation of the emission of airborne hazardous substances: Part 9 decontamination index
10	IS 16807 : 2020/ ISO 19353 : 2019	Safety of Machinery – Fire Prevention and Fire Protection (First Revision)
11	IS 16808 : 2018/ ISO 14159:2002	Safety of machinery – Hygiene requirements for the design of machinery

12	IS 16809 (Part 1) : 2018/ ISO 14122-1:2016	Safety of machinery – Permanent means of access to machinery: Part 1 choice of fixed means and general requirements of access
13	IS 16809 (Part 2) : 2018/ ISO 14122-2:2016	Safety of machinery – Permanent means of access to machinery: Part 2 working platforms and walkways
14	IS 16809 (Part 3) : 2018/ ISO 14122-3:2016	Safety of machinery – Permanent means of access to machinery: Part 3 stairs, stepladders and guard – Rails
15	IS 16809 (Part 4) : 2018/ ISO 14122-4:2016	Safety of machinery – Permanent means of access to machinery: Part 4 fixed ladders
16	IS 16810 (Part 1) : 2018/ ISO 13849-1:2015	Safety of machinery – Safety related parts of control systems: Part 1 general principles for design
17	IS 16810 (Part 2) : 2018/ ISO 13849-2:2012	Safety of machinery – Safety related parts of control systems: Part 2 validation
18	IS 16811 : 2018/ ISO 14120:2015	Safety of machinery – Guards – General requirements for the design and construction of fixed and movable guards
19	IS 16812 : 2018/ ISO 14119:2013	Safety of machinery – Interlocking devices associated with guards – Principles for design and selection
20	IS 16813 : 2019/ ISO 14118:2017	Safety of machinery – Prevention of unexpected start-up
21	IS 16814 : 2021/ ISO 13857:2019	Safety of machinery safety distances to prevent hazard zones being reached by upper and lower limbs
22	IS 16815 : 2019/ ISO 13855:2010	Safety of machinery – Positioning of safeguards with respect to the approach speeds of parts of the human body
23	IS 16816 : 2019/ ISO 13854:2017	Safety of machinery – Minimum gaps to avoid crushing of parts of the human body
24	IS 16817 : 2020/ ISO 13851:2019	Safety of Machinery – Two-Hand Control Devices – Principles for Design and Selection (First Revision)
25	IS 16818 : 2018/ ISO 13850:2015	Safety of machinery – Emergency stop function – Principles for design
26	IS 16819 : 2018/ ISO 12100:2010	Safety of machinery – General principles for design – Risk assessment and risk reduction
27	IS 16834 (Part 1) : 2018/ ISO 14123-1:2015	Safety of machinery – Reduction of risks to health resulting from hazardous substances emitted by machinery: Part 1 principles and specifications for machinery manufacturers
28	IS 16834 (Part 2) : 2018/ ISO 14123-2:2015	Safety of machinery – Reduction of risks to health resulting from hazardous substances emitted by machinery: Part 2 methodology leading to verification procedures
29	IS 16835 (Part 1) : 2018/ ISO 13856-1:2013	Safety of machinery – Pressure-sensitive protective devices: Part 1 general principles for design and testing of pressure-sensitive mats and pressure-sensitive floors

30	IS 16835 (Part 2) : 2018/ ISO 13856-2:2013	Safety of machinery – Pressure-sensitive protective devices: Part 2 general principles for design and testing of pressure-sensitive edges and pressure-sensitive bars
31	IS 16835 (Part 3) : 2018/ ISO 13856-3:2013	Safety of machinery – Pressure-sensitive protective devices: Part 3 general principles for design and testing of pressure-sensitive bumpers, plates, wires and similar devices
32	IS 16912 : 2018/ ISO 21469:2006	Safety of machinery – Lubricants with incidental product contact – Hygiene requirements
33	IS/ISO/TR 22100-2 : 2013	Safety of machinery Relationship with ISO 12100 Part 2: How ISO 12100 relates to ISO 13849-1
34	IS/ISO/TR 22100-3 : 2013	Safety of machinery Relationship with ISO 12100 Part 3: Implementation of ergonomic principles in safety standards

6 TYPE C STANDARD: EXAMPLE

IS 18165 : 2023/ISO 17916 : 2016 Safety of Thermal Cutting Machines

This Indian Standard specifies the safety requirements and measures for machinery covering design, construction, production, transport, installation, operation, maintenance, and putting out of service. This standard applies to machinery using thermal cutting and or marking processes such as oxy-fuel, and plasma arc. This standard applies to machinery the basis of which is either designed as an open gantry, cantilever machine, or the track of which is incorporated in the cutting table.

This standard does not cover design standards for specific tools, e.g. oxy-fuel hose standards, electrical requirements for plasma power supplies; handheld cutting equipment and cutting equipment which is combined with a constrained tracking system mounted on the workpiece; risks arising from laser radiation, except those caused by position indicating lasers. Machines that combine thermal processes with other processes (e.g. grinding, drilling, milling, etc.) are only partly covered by this standard.

6.1 Hazards Identified for Thermal Cutting Machines:

Table A.1 of IS 18165/ISO 17916 details the hazards associated with the thermal cutting machines and recommends that these hazards should be evaluated and risk assessment should be done on the basis of IS 16819/ISO12100.

Mechanical hazards: Moving axes and handling of cut material can be hazardous during setting, maintenance, and loading/ unloading activities.

Electrical hazards: Contact with live parts or connection, contact with an energized plasma arc, and contact with the workpiece during the active plasma process can be hazardous during commissioning, maintenance, troubleshooting and loading/unloading activities.

Figure 9 Thermal Cutting Machine

Thermal Hazards: Contact with hot workpiece, contact with hot tool, contact with hot slag spatter and flying sparks, and contact with gas flame or plasma arc can be hazardous during maintenance, troubleshooting, setting, monitoring, and loading/unloading activities.

Noise Hazards: Sound emission during the cutting process may cause hearing loss and interference with voice communication and acoustical signals.

Radiation Hazards: High emission of visible, UV, and IR light during monitoring and adjustment of laser pointer or measuring device can cause eye damage and loss of sight.

Material and substance hazards: Welding and cutting fumes, cooling liquid of plasma system, numbing effect of NO_x and accumulation of gases can be poisonous and gases under pressure can cause explosion.

Apart from the above, additionally, neglecting ergonomic principles in the design process, hazards associated with the environment in which the machine is used, and combination of hazards are also crucial for evaluation as per IS 16819/ISO 12100. For details please refer to IS 18165/ISO 17916.

6.2 Safety Requirements and Protective Measures

Item 5 of IS 18165/ISO 17916 details the safety requirements and protective measures. This standard helps to install protective measures against each hazard identified in this standard and reduces the risk associated with these hazards. Machines fulfilling the requirements of this standard shall be equipped with the protective measures and safety requirements listed in Table 1 of this standard. Some examples of these protective measures are given below:

1. Risk associated with mechanical hazard — Risk of collision between the operator and the machine: For risk reduction, this standard specifies the safety requirements such as:

    - The lower limit of the protective device,
    - The upper limit of the force, energy, and pressure in case of collision,
    - What to do w.r.t. the relative speed of the machine to the operator,

- Calculation of the compression corresponding to the acceptable maximum force in case of collision between the machine and a human body with an example
- This standard also makes a reference to the type B standards for safety devices such as IS 16810 (Part 1)/ISO 13849-1.
- Provision for the installation of a safe walking area on the table should be available to avoid injuries while walking on the table.

2. Risk associated with electrical hazards such as direct and indirect contact:

- This standard dictates that the electrical components of a machine must adhere to the guidelines set forth in IS 16504 (Part 1)/IEC 60204-1.
- Additionally, when it comes to a plasma machine, the electrical equipment must also meet the criteria outlined in IS 16593(Part 1)/IEC 60974-1.
- This standard emphasizes the necessity of implementing effective measures to establish a secure workpiece grounding system, which is essential for safeguarding workers against electric shock hazards.

Furthermore, aside from the aforementioned requirements, the standard imparts information concerning various risks associated with hazards as detailed in section **6.1**, along with strategies for mitigating these risks.

A list of type C standards published by the BIS for Machine Safety is given below for reference:

Table 2: List of type C standards

Sl No.	IS No.	Title
1.	IS 18165 : 2023	Safety of thermal cutting machines
2.	IS 17253 (Part 1) : 2019	Machine tools safety – Machining centres, Milling machines, Transfer machines – Part 1 Safety requirements
3.	IS 17277 (Part 1) : 2019	Machine tools safety – Presses – Part 1 General safety requirements
4.	IS 17277 (Part 2):2023	Machine Tools Safety Presses Part 2 Safety Requirement for Mechanical Presses
5.	IS 17277 (Part 3) : 2021	Machine tools safety – Presses – Part 3 Safety requirements for hydraulic presses
6.	IS 17277 (Part 4):2023	Machine Tools Safety Presses Part 4 Safety Requirements for Pneumatic Presses
7.	IS 17254 : 2019	Machine tools – Safety – Sawing machines for cold metal
8.	IS 17258:2019/ ISO 2315:2015	Machine Tools – Safety – Turning Machines
9.	IS 17259 : 2020	Machine tools – Safety – Electro-discharge machines
10.	IS 18057 : Part 1 : 2023	Woodworking machines Safety Part 1 Common requirements
11.	IS 18057 : Part 2 : 2023	Woodworking machines Safety Part 2 Horizontal beam panel circular sawing Machines

12.	IS 18057 : Part 3 : 2023	Woodworking Machines Safety Part 3 Numerically Controlled NC Boring and Routing Machines
13.	IS 18057 : Part 4 : 2023	Woodworking Machines Safety Part 4 Vertical Panel Circular Sawing Machines
14.	IS 18057 : Part 5 : 2023	Woodworking Machines Safety Part 5 Dimension Saws
15.	IS 18057 : Part 6 : 2023	Woodworking Machines Safety Part 6 Single Spindle Vertical Moulding Machines Toupies
16.	IS 18057 : Part 7 : 2023	Woodworking Machines Safety Part 7 Surface Planing Thickness Planing Combined SurfaceThickness Planing Machines
17.	IS 18057 : Part 8 : 2023	Woodworking machines Safety Part 8 Belt sanding and calibrating machines for straight workpieces
18.	IS 18057 : Part 9 : 2023	Woodworking machines Safety Part 9 Circular Saw Benches with and without sliding table
19.	IS 18057 : Part 10 : 2023	Woodworking Machines Safety Part 10 Building Site Saws Contractor Saws

7 IMPLEMENTING INDIAN STANDARDS FOR MACHINE TOOL SAFETY

Translating Standards into Safe Operations

In the previous chapter, we discussed the importance of BIS (Bureau of Indian Standards) in ensuring machine tool safety. Now, let's delve into the practical aspects of implementing these BIS standards in your workplace, ensuring safe machine tool operations.

7.1 Selecting Equipment in Compliance with Indian Standards

A fundamental step in ensuring machine tool safety is the selection of equipment and features that conform to Indian standards. Here are key considerations:

7.1.1 Safety Guards and Interlocking Mechanisms

Standards often mandate the use of safety guards and interlocking mechanisms to prevent access to hazardous areas during machine operation. Select and install guards that meet Indian standards and ensure they function correctly.

7.1.2 Emergency Stop Systems

Indian standards emphasize the importance of emergency stop systems that quickly and effectively halt machine operations in emergency situations. Verify that these systems are in place and operational.

7.1.3 Control Systems and User Interfaces

Ensure that control systems and user interfaces on machine tools are designed according to Indian standards. This includes clear labelling, intuitive controls, and easy access to safety features.

7.2 Employee Training and Awareness in Line with Indian Standards

Even with standardized safety features in place, proper training and awareness among employees are essential.

Implement training programs that educate operators on safe machine tool practices, specifically addressing Indian standards.

7.2.1 BIS Compliance Training

Design training modules that specifically address Indian standards relevant to your machine tools. Ensure that employees understand the standards and how they apply to their daily tasks.

7.2.2 Periodic Safety Drills

Conduct periodic safety drills to simulate emergency scenarios and test employees' ability to use emergency stop systems effectively, in accordance with Indian standards. This hands-on training is invaluable for ensuring preparedness.

7.3 Regular Maintenance and Inspection as per BIS Standards

Indian standards often include recommendations for the regular maintenance and inspection of machine tools. Establish a maintenance schedule that aligns with these BIS standards to keep your equipment in top working condition.

7.3.1 Inspection Reports and Records

Maintain detailed inspection records in compliance with Indian standards. These records should document inspections, repairs, and any deviations from standard operating procedures, as required by Indian regulations.

By implementing these standardized safety practices, in alignment with Indian standards, you are not only ensuring compliance but also creating a safer work environment for machine tool operations in accordance with Indian regulations. In the next chapter, we will explore the critical role of education and training, specifically focused on Indian standards, in ensuring compliance and fostering a culture of safety in the workplaceTop of Form

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8 COMPLIANCE VIS-À-VIS REGULATORY REQUIREMENTS ND ENFORCEMENT OF INDIAN STANDARDS

8.1 Draft Omnibus Technical Regulation for Safety of Machinery by Ministry of Heavy Industries.

Draft OTR

- Title: Machinery and Electrical Equipment Safety (Omnibus Technical Regulation) Order, 2022
- Notified on WTO TBT website on 26 Oct 2022
- Was intended to be implemented from 01 January 2023
- Applicable to machines and electrical equipment and their assemblies, sub-assemblies and components
- Exception: those covered under any other order made under section 16 of the Bureau of Indian Standards Act, 2016.
- Wide Consultation by MHI, comments received from 61 Govt and Private stakeholders received and resolved.

8.2 BIS (Conformity Assessment) Scheme 10 for implementation of OTR

Under this Scheme, the manufacturer may be granted –

- Licence for demonstration of conformity of the products, to the specified requirements;
- In addition, the manufacturer may opt for demonstration of conformity of management system to the specified requirements given in standard as per the provisions laid down in Scheme - III of the said regulation except the provisions of forms and fee specified in Scheme – III;
- The Bureau may grant certificate of conformity instead of licence in case the product is not desired to be manufactured on a continuous basis and in such a case, the manufacturer shall not be authorised to use the Standard mark.
- The firm applying licence under Scheme X will have to submit a **Technical file**, comprising all the design, manufacture and operation of products to the extent applicable and necessary for demonstration of compliance of conformity.

Figure 10 Standard Mark

WORLD TRADE ORGANIZATION

G/TBT/N/IND/236

26 October 2022

(22-8043) Page: 1/2

Committee on Technical Barriers to Trade Original: English

NOTIFICATION

The following notification is being circulated in accordance with Article 10.6

1.	**Notifying Member:** INDIA **If applicable, name of local government involved (Article 3.2 and 7.2):**
2.	**Agency responsible:** Ministry of Heavy Industries **Name and address (including telephone and fax numbers, email and website addresses, if available) of agency or authority designated to handle comments regarding the notification shall be indicated if different from above:** Mr Sanjiv Kumar Gupta, Under Secretary (HE&MT division), Ministry of Heavy Industries, Room No 124, Udyog Bhawan, New Delhi 110011.

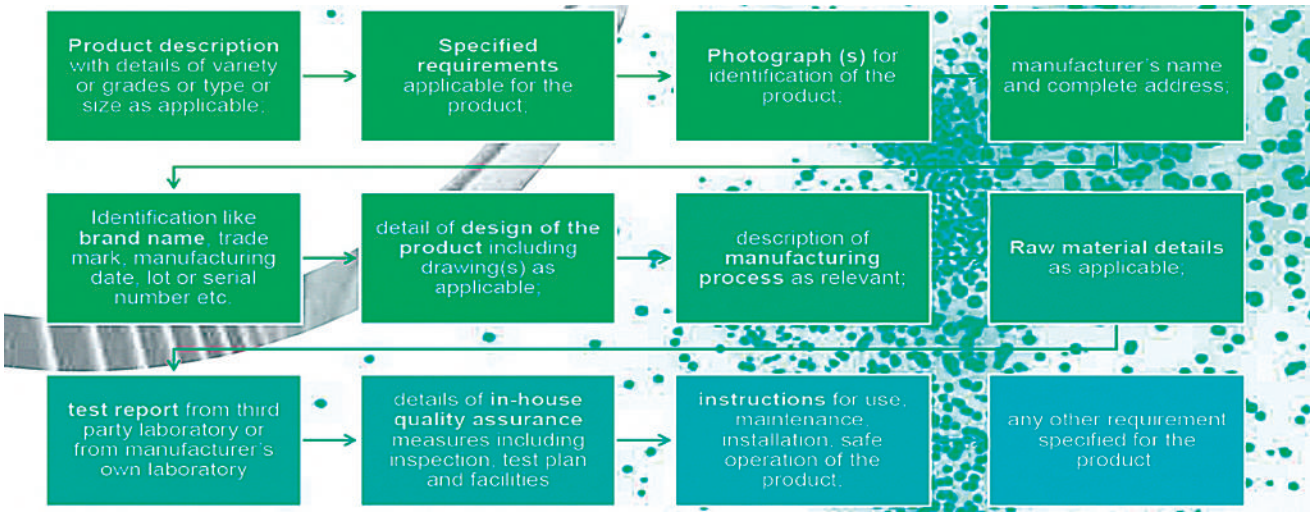
Page:

Figure 11 Notification Published on WTO Website*Top of Form*

3.	**Notified under Article 2.9.2 [X], 2.10.1 [ ], 5.6.2 [X], 5.7.1 [ ], 3.2 [ ], 7.2 [ ], other:**
4.	**Products covered (HS or CCCN where applicable, otherwise national tariff heading. ICS numbers may be provided in addition, where applicable):** Refer Annexure
5.	**Title, number of pages and language(s) of the notified document:** Machinery and Electrical Equipment Safety (Omnibus Technical Regulation) Order, 2022; (27 page(s), in English), (0 page(s), in Hindi)
6.	**Description of content:** An omnibus Technical Regulation towards the safety of Machinery and Electrical Equipment's.
7.	**Objective and rationale, including the nature of urgent problems where applicable:** Omnibus Technical Regulation (OTR) on Machinery and Electrical Equipment Safety serves a vital objective to instil confidence in users that Machinery and Electrical Equipment which they are using or going to purchase are safe and reliable without any unidentified/unknown hazards.
8.	**Relevant documents:** Draft Machinery and Electrical Equipment Safety (Omnibus Technical Regula 2022 to be published in Gazette of India (available in Hindi and English) accessed at: https://heavyindustries.gov.in/writereaddata/UploadFile/Circulation%20of%2 Ma chinery.pdf
9.	**Proposed date of adoption:** 1 January 2023 **Proposed date of entry into force:** 1 January 2024; After one year from the date of its publication in the Official Gazette - as per draft
10.	**Final date for comments:** 60 days from notification
11.	**Texts available from: National enquiry point [ ] or address, telephone and fax numbers and email and website addresses, if available, of other body:** Bureau of Indian Standards, Manak Bhawan 9, Bhadur Shah Zafar Marg, New Delhi - 110002, Tel: +91 11 23230131, 23233375, 23239402 (10 lines) Fax : +91 11 23234062, 23239399 Email: cmd1@bis.gov.in / info@bis.org.in Website: www.bis.org.in https://members.wto.org/crnattachments/2022/TBT/IND/22_7255_00_x.pdf

Technical File

"Technical file" means documentation covering design, manufacture and operation of products to the extent applicable and necessary for demonstration of compliance of conformity.



Technical file Requirements

9 CONTINUOUS SAFETY IMPROVEMENT AND INNOVATION

Evolving to Meet the Future

In this chapter, we explore strategies for achieving continuous safety improvement and fostering innovation in machine tool operations. Staying ahead of emerging risks and technologies is essential for maintaining a safe and efficient workplace.

9.1 Embracing Continuous Improvement

- Recognize that safety is an ongoing process that requires vigilance and adaptation.
- Commit to a culture of continuous improvement in machine tool safety.

9.2 Leveraging Technology

- Explore the latest technological advancements that enhance machine tool safety.
- Incorporate innovations such as sensors, automation, and real-time monitoring to minimize risks.

9.3 Training and Skill Development

- Invest in ongoing training and skill development for employees.
- Keep them up-to-date with evolving safety practices and emerging technologies.

9.4 Safety Audits and Feedback Loops

- Conduct regular safety audits to identify areas for improvement.
- Create feedback loops that involve employees in suggesting safety enhancements.

9.5 Collaborating with Industry Peers

- Collaborate with industry peers to share best practices and insights.
- Participate in industry associations and forums focused on safety and innovation.

9.6 Regulatory Updates and Compliance

- Stay informed about updates to BIS standards and Omnibus Technical Regulations.
- Ensure that compliance efforts align with evolving regulatory requirements.

9.7 Risk Forecasting and Mitigation

- Implement proactive risk forecasting methodologies.
- Develop strategies to mitigate emerging risks before they become significant threats.

9.8 Safety Culture

- Cultivate a strong safety culture where employees prioritize safety in all actions.
- Celebrate safety milestones and recognize individuals for their contributions to safety.

9.9 Environmental Responsibility

- Consider the environmental impact of machine tool operations.
- Seek eco-friendly innovations that align with safety goals.

9.10 Crisis Preparedness

- Develop crisis preparedness plans for potential safety incidents.
- Ensure that employees are well-trained in emergency response procedures.

By adopting these strategies for continuous safety improvement and innovation in machine tool operations, you not only maintain a safer workplace but also position your organization to thrive in a rapidly evolving industrial landscape. In the final chapter, we will summarize key takeaways and emphasize the long-term benefits of prioritizing machine tool safety through BIS standards compliance and ongoing improvement efforts.

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BIS CARE APP

A tool for Consumer Empowerment

Main features of the App

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- Check the authenticity of Hallmarked Jewellery items with HUID number by using 'verify HUID'.
- Select 'Know your Standards' for information on any Indian Standard, licenses against it and laboratories for this product.
- Check the authenticity of electronic products with R-number by using 'Verify R-number' under CRS.
- Register complaints regarding quality of product or misuse of mark by using 'Complaints'.

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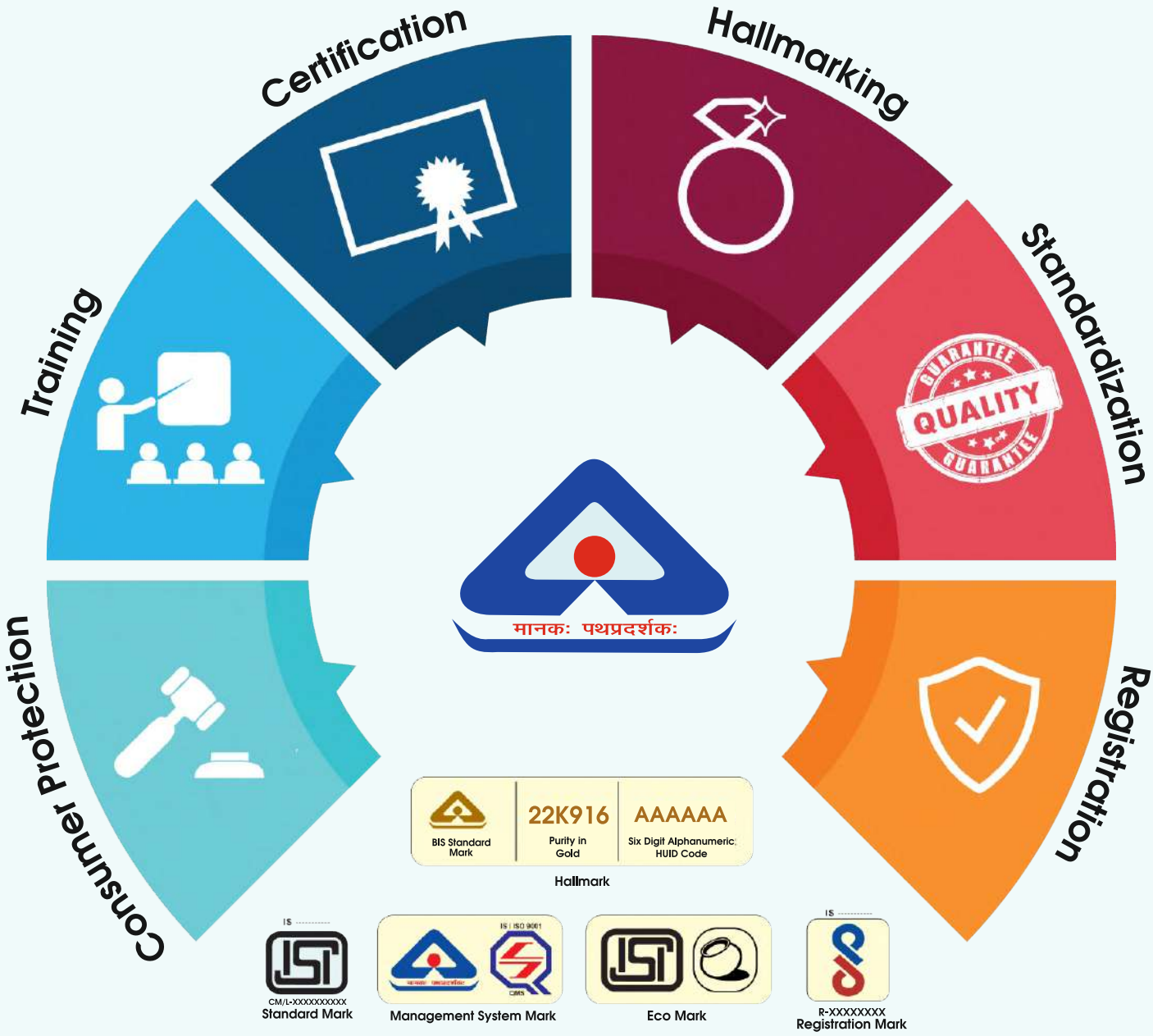

BUREAU OF INDIAN STANDARDS

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