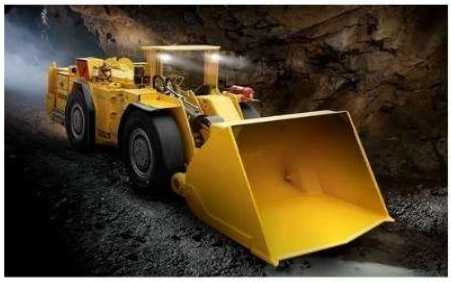
BUREAU OF INDIAN STANDARDS

COMPENDIUM OF STANDARDS ON MINING TECHNIQUES AND EQUIPMENTS

PREPARED BY :
MECHANICAL ENGINEERING DEPARTMENT



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NEW DELHI

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INTRODUCTION TO MINING TECHNIQUES AND EQUIPMENTS

The Mining Techniques and Equipment Committee under the Bureau of Indian Standards (BIS) is responsible for developing and maintaining standards related to mining methods and machinery used in both surface and underground mining. Mining plays an important role in supporting industries such as power generation, steel, cement, and infrastructure. As mining activities are becoming more advanced, deeper, and highly mechanized, there is a growing need for clear and well-defined standards to ensure safety, consistency, and efficient operations across the country.

This committee deals with a wide range of mining equipment and systems, including drilling and blasting tools, continuous miners, longwall equipment, load–haul–dump machines, haul trucks, roof bolting machines, conveyors, ventilation systems, and other safety-related installations. The standards focus on important aspects such as equipment design, performance, braking systems, stability, fire resistance, explosion protection, dust and noise control, and overall operator safety. Special attention is given to underground mining, where risks like gas explosions, roof falls, machinery accidents, and electrical hazards are more common and require strict safety measures.

Apart from traditional equipment, the committee also considers new technologies in mining. These include battery-operated vehicles, remote-controlled and automated machines, proximity warning systems, digital monitoring, and predictive maintenance tools. The standards also take into account environmental and sustainability factors to encourage safer and more responsible mining practices. By aligning Indian standards with international practices while considering local conditions, the committee helps improve safety, support local manufacturing, and promote technological development in the mining sector.

1. OPENCAST (SURFACE) MINING:

Opencast mining involves removal of overburden to extract minerals from near-surface deposits. It includes drilling, blasting, loading, hauling, and dumping operations.

1.1. IS 14480: 2006 – Side - Discharge loaders for underground coal mines - Safety requirements, operation and maintenance - Code of practice (First Revision)

This standard specifies the safety requirements, operational procedures, and maintenance practices for side-discharge loaders used in mines. It focuses on safe material handling and efficient loading operations, which are also relevant to opencast mining environments. The code provides guidelines to prevent mechanical failures and accidents during operation. It also emphasizes regular inspection and proper maintenance to ensure reliability. Overall, it enhances operational safety and productivity

1.2. IS 13202: 2012 – Mine haulage tracks - Code of practice (First Revision)

This standard lay down guidelines for the design, installation, and maintenance of mine haulage tracks. It ensures proper alignment, gradient, and stability of tracks used for transportation systems. The standard helps in minimizing derailments and improving smooth movement of mine cars and equipment. It also includes safety provisions to avoid accidents during haulage operations. It is applicable in both opencast and underground mining conditions

Fig.1.Opencast mining

1.3. IS 16511: 2017 – Management systems for Eco - Friendly Non - Coal mining operations – Requirements

This standard focuses on establishing eco-friendly management systems in non-coal mining operations, especially opencast mining. It includes requirements for environmental protection, waste management, and sustainable resource utilization. The standard promotes reduced environmental impact and compliance with regulatory norms. It also encourages rehabilitation and reclamation of mined land. Overall, it supports sustainable and responsible mining practices

2. UNDERGROUND MINING

Underground mining is a method of extracting minerals and ores located deep beneath the Earth's surface. It is used when mineral deposits are too deep for surface mining techniques to be economical or safe. This method involves the construction of tunnels, shafts, and chambers to access and transport materials. Advanced machinery and support systems are required to ensure operational efficiency and worker safety. Underground mining plays a crucial role in supplying essential resources such as coal, metals, and minerals for industrial and energy needs

2.1. Bord and Pillar Mining

Bord and Pillar Mining is a widely used underground mining method in which the ore body is divided into a series of horizontal galleries (bords) while leaving behind pillars of material to support the roof. This method is particularly suitable for relatively flat and tabular deposits such as coal seams. The pillars act as structural supports, ensuring stability during extraction operations. It allows for systematic extraction and can be adapted for partial or complete pillar recovery at later stages. Bord and Pillar Mining is known for its simplicity, safety, and efficiency in underground mining operations

2.1.1. IS 13219: 1992 – Rock bolts for mines (Cement Grouted) - General requirements

This standard specifies the general requirements for cement grouted rock bolts used in underground mines. It ensures proper roof support in bord and pillar mining by improving rock stability. The standard covers material specifications, installation methods, and testing procedures. It helps in preventing roof falls and enhancing worker safety. It is widely used in coal mining operations

2.1.2. IS 13517: 1992 – Rock bolts - Resin type - Specification

This standard deals with resin-type rock bolts used for quick and effective roof support. It specifies materials, performance requirements, and installation techniques. Resin bolts provide faster setting compared to cement grouted bolts, improving efficiency. The standard ensures better support in weak and fractured rock conditions. It is highly useful in modern underground mining practices.

2.1.3. IS 12464: 2024 – Roof Bars Used in Mines — Methods of Test (First Revision)

This standard provides methods for testing roof bars used in underground mining. It ensures that roof bars meet required strength and durability standards. The testing procedures help

verify load-bearing capacity and performance. It supports quality assurance and reliability of roof support systems. This is essential for maintaining safety in bord and pillar mining

2.1.4. IS 8473: 2025 – Roof Bars Used in Mines - Specification (Second Revision)

This standard specifies the design, material, and dimensional requirements of roof bars used in mines. It ensures that roof bars provide adequate support to underground structures. The standard works alongside rock bolting systems for effective roof control. It helps prevent collapses and ensures safe working conditions. It is a critical component in bord and pillar mining

2.1.5. IS 9171: 2024 – Maintenance and Use of Friction and Hydraulic Props and Link Bars - Code of Practice (First Revision)

This standard provides guidelines for the maintenance and proper use of friction and hydraulic props. It ensures that these supports function effectively under load conditions. The code includes inspection, servicing, and operational practices. It reduces the risk of support failure and accidents. It is essential for safe underground mining operations

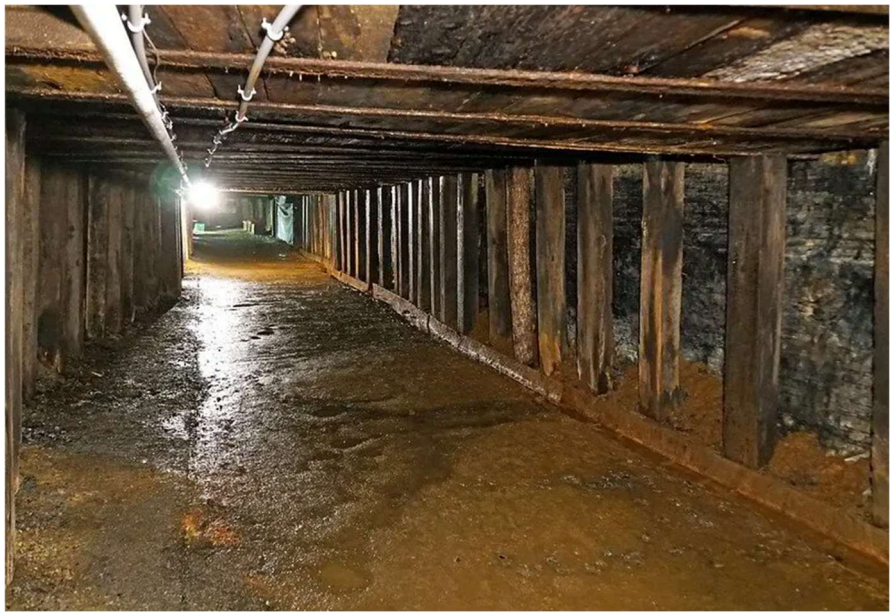

Fig.2.1. Bord and Pillar Mining (Underground)

2.2. Longwall Mining

Longwall Mining is an advanced underground mining method used for extracting large, continuous panels of coal or other minerals. It involves the use of a mechanized shearer that moves along a long face, cutting the material while hydraulic supports temporarily hold up the roof. As mining progresses, the supports are advanced forward, allowing the mined-out area behind to collapse in a controlled manner. This method enables high productivity, efficient resource recovery, and reduced manual labour. Longwall Mining is widely preferred for its automation, safety features, and ability to achieve large-scale extraction

2.2.1. IS 8421: 2025 – Hydraulic Props - Specification (First revision)

This standard specifies the requirements for hydraulic props used in underground mines. It ensures that the props can withstand high loads and provide reliable roof support. The standard includes design, material, and testing requirements. Hydraulic props are essential in mechanized longwall mining systems. It improves safety and operational efficiency

2.2.2. IS 9170: Part 1: 2005 – Endless haulage rope clips - Specification: Part 1 general requirements (First Revision)

This standard specifies the general requirements for rope clips used in endless haulage systems. It ensures proper fastening and secure handling of haulage ropes. The standard helps prevent slippage and mechanical failure. It includes guidelines for material quality and performance. It is important for safe transportation systems in longwall mining

2.2.3. IS 12450: Part 1: 2024 – Steel Headframes for Mines Part 1 Principles of Load Computation and Applicable Factors of Safety (First Revision)

This standard provides guidelines for the structural design of steel headframes used in mines. It focuses on load calculations and safety factors required for safe operation. The standard ensures stability and reliability of hoisting systems. It helps prevent structural failures during lifting operations. It is crucial for shaft-based mining systems

2.2.4. IS 9239: 2025 – Winding In Mines - Sheaves - Cast - Specification (Second Revision)

This standard specifies the requirements for cast sheaves used in mine winding systems. It ensures smooth operation and reduced wear of ropes. The standard includes design, material, and performance requirements. It improves efficiency of hoisting operations. It is essential for longwall and deep mining operations.

Fig.2.2. Longwall Mining

2.2.5. IS 9494: 2023 – Man Riding Cars used in Mines - Specification (First Revision)

This standard specifies the design and safety requirements for man-riding cars used in mines. It ensures safe transportation of personnel underground. The standard includes provisions for braking systems, seating, and structural strength. It reduces risks during movement within mines. It is important for large-scale mechanized mining

3. MINING EQUIPMENTS

Mining equipment refers to the specialized machinery used in both surface and underground mining operations for extraction, loading, transportation, and processing of minerals. These machines are designed to operate in harsh conditions while ensuring efficiency, safety, and productivity. Common equipment includes drilling machines, excavators, loaders, haul trucks, crushers, and conveyor systems. In underground mining, equipment such as continuous miners, shuttle cars, roof bolters, and longwall systems are widely used. The selection of mining equipment depends on the mining method, geological conditions, and type of mineral being extracted

3.1. IS 9999: 2026 – Specification and Safety Requirements for Diesel Locomotives used in Mines

This standard specifies the design and safety requirements for diesel locomotives used in mining operations. It includes provisions for engine performance, braking systems, and emission control. The standard ensures safe and reliable haulage operations. It also addresses fire and explosion safety. It is suitable for heavy-duty mining environments

3.2. IS 11311: 2011 – Technical requirements for loaders for use in underground mines (First Revision)

This standard defines the technical requirements for loaders used in underground mining. It includes specifications for design, performance, and safety features. The standard ensures efficient loading of mined materials. It also addresses operational safety and maintenance aspects. It improves productivity in mining operations

3.3. IS 4001: 2017 – Mine tubs - specification (Third Revision)

This standard specifies the design and construction requirements for mine tubs. These tubs are used for transporting materials within mines. The standard ensures durability, stability, and load capacity. It includes requirements for wheels, axles, and body construction. It is essential for haulage systems in mines

3.4. IS 8166: 2024 – Rotary Drill Bits for Drilling Principally in Coal - Specification (Second Revision)

This standard specifies the requirements for rotary drill bits used in coal mining. It ensures high performance, durability, and wear resistance. The standard includes material and design specifications. It improves drilling efficiency and productivity. It is widely used in both underground and surface mining

Fig.3. Drilling Equipment

4. SAFETY IN MINING

Safety in mining is a critical aspect of operations due to the high-risk environment involving heavy machinery, confined spaces, and hazardous conditions. It focuses on protecting workers from accidents such as roof collapses, gas explosions, equipment failures, and dust exposure. Proper ventilation systems, ground support measures, and regular equipment maintenance are essential for ensuring a safe working environment. The use of personal protective equipment (PPE), safety training, and strict adherence to safety standards further reduce risks. Effective safety management systems and monitoring technologies play a vital role in preventing incidents and ensuring sustainable mining operations

4.1. IS 7577: 2020 – Gas Testing Flame Safety Lamps — Specification (Second Revision)

This standard specifies the requirements for flame safety lamps used in mines. These lamps help detect the presence of combustible gases. The design prevents ignition in explosive

atmospheres. The standard ensures reliability and safety in underground mining. It is essential in methane-prone environments

4.2. IS 14778: 2000 – Portable methanometer (Interferometer Type) - Specification

This standard specifies the requirements for portable methanometers used to measure methane gas concentration. It ensures accurate detection of hazardous gases in mines. The device helps prevent explosions and ensures worker safety. The standard includes performance and calibration requirements. It is a critical safety instrument

4.3. IS 14352: 2025 – Miner's Safety Goggles - Specification (First Revision)

This standard specifies the requirements for protective goggles used by miners. It ensures protection against dust, flying particles, and harmful substances. The standard includes impact resistance and clarity requirements. It enhances visibility and safety during operations. It is an essential personal protective equipment

4.4. Is 5114:2025 – Reflectorized Signs For Mines Specification First Revision

This standard specifies the requirements for reflectorized safety signs used in mines. It ensures high visibility in low-light and underground conditions. The signs help in hazard identification and navigation. The standard includes design, colour, and material specifications. It improves overall safety awareness in mining areas

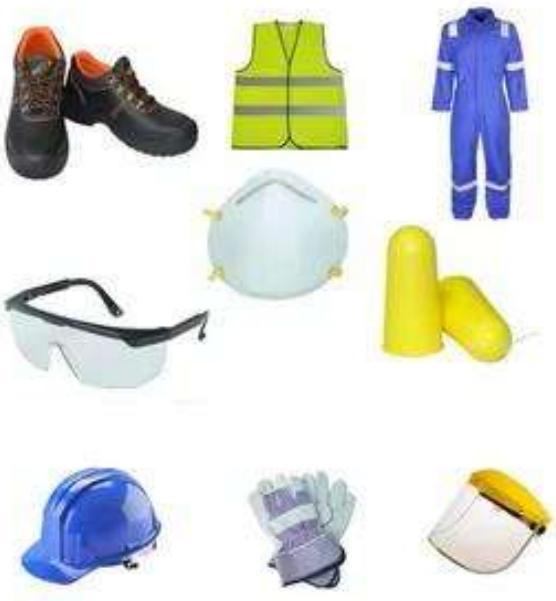

Fig.4. List of Safety Equipments in Mines