मानकः पथप्रदर्शकः

COMPENDIUM OF STANDARDS ON

EARTH MOVING EQUIPMENTS

PREPARED BY :

MECHANICAL ENGINEERING DEPARTMENT

BUREAU OF INDIAN STANDARDS

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MED 07: Earth Moving Equipment

Earth moving machinery refers to a broad category of heavy-duty equipment designed for operations involving earthwork and material handling in sectors such as construction, mining, road building, and infrastructure development. These machines are integral to tasks such as excavation, grading, lifting, leveling, and transportation of soil, rocks, debris, and other bulk materials. Their robust design and high operational efficiency make them indispensable in large-scale projects where speed, precision, and productivity are crucial.

Common types of earth moving equipment include excavators, bulldozers, wheel and track loaders, motor graders, backhoe loaders, scrapers, trenchers, and dump trucks. Each machine is tailored for specific functions—for example, excavators are primarily used for digging and material handling, while graders are employed for creating a smooth and level base. These machines often work in coordination on project sites to carry out activities such as site preparation, foundation laying, trenching, embankment construction, and material loading and hauling.

With growing demands for operational efficiency, safety, and environmental compliance, modern earth moving machinery increasingly incorporates advanced technologies such as GPS-based machine control, telematics, automation, hybrid/electric powertrains, and real-time diagnostics. These innovations not only improve the performance and fuel efficiency of the equipment but also enhance operator productivity and project monitoring capabilities. Standardization of such equipment, including performance criteria, safety features, and testing methods, is essential to ensure interoperability, quality assurance, and alignment with international best practices. The MED 07 committee plays a pivotal role in developing and maintaining these standards, supporting industry growth and technological advancement.

Excavating Equipment

i) EARTH - MOVING MACHINERY - SAFETY: PART 5 REQUIREMENTS FOR HYDRAULIC EXCAVATORS (IS 17055 (PART 5) : 2018)

The Indian Standard establishes comprehensive safety requirements specific to hydraulic excavators used in construction, mining, and related industries. This standard is part of a broader framework aimed at minimizing risks associated with the operation, maintenance, and transport of earth-moving machinery. Part 5 focuses on the unique hazards posed by hydraulic excavators, detailing design and functional requirements to ensure operator safety, equipment stability, emergency procedures, and environmental considerations. By aligning with international practices and incorporating region-specific safety needs, IS 17055 (Part 5): 2018 supports manufacturers, operators, and regulatory bodies in promoting safe and efficient machinery use in India's rapidly evolving infrastructure sector.

ii) EARTH-MOVING MACHINERY — SAFETY PART 12 REQUIREMENTS FOR CABLE EXCAVATORS (IS 17055 (PART 12) : 2020)

The Indian Standard establishes comprehensive safety guidelines specifically for cable excavators used in construction and earth-moving operations. Developed under the purview of the Bureau of Indian Standards (BIS), this standard aligns with international best practices while addressing regional operational conditions and safety challenges. It outlines essential safety requirements concerning machine design, operator controls, visibility, stability, and access systems to minimize risks during operation and maintenance. By promoting consistent safety practices, IS 17055 (Part 12): 2020 aims to enhance the safe use of cable excavators, protect machine operators and workers, and support manufacturers and contractors in achieving compliance with statutory regulations in India.

iii) EARTH MOVING MACHINERY - HYDRAULIC EXCAVATORS - LABORATORY TESTS AND PERFORMANCE REQUIREMENTS FOR OPERATOR PROTECTIVE GUARDS (IS/ISO 10262 : 1998)

The standard specifies the laboratory testing methods and performance criteria for operator protective guards used on hydraulic excavators. This standard ensures that operator enclosures provide adequate protection against hazards such as falling objects and rollovers. It outlines procedures for testing the strength and effectiveness of protective structures under controlled conditions, thereby promoting operator safety and equipment reliability in hazardous working environments.

iv) EARTH-MOVING MACHINERY — SAFETY PART 4 REQUIREMENTS FOR BACKHOE LOADERS (IS 17055 (PART 4) : 2020)

The Indian Standard establishes comprehensive safety guidelines specifically tailored for backhoe loaders used in construction and earth-moving operations. This standard outlines essential safety requirements to minimize risks to operators and bystanders by addressing

hazards associated with the design, operation, and maintenance of these machines. It aligns with international practices and incorporates technical criteria such as visibility, stability, access systems, operator controls, and protective structures. The standard is instrumental in promoting safe manufacturing practices and operational procedures, ensuring equipment complies with rigorous safety benchmarks in the Indian context.

v) EARTH-MOVING MACHINERY — SAFETY PART 10 REQUIREMENTS FOR TRENCHERS (IS 17055 (PART 10) : 2020)

Indian Standard specifies the safety requirements and guidelines for the design, construction, and operation of trenching machines used in earth-moving activities. This standard aims to ensure the safety of operators, maintenance personnel, and other workers by addressing potential hazards associated with trenchers, such as mechanical risks, operational controls, stability, and emergency measures. By defining clear safety criteria, protective features, and testing protocols, IS 17055 (Part 10) helps manufacturers produce safer trenching equipment and promotes safer usage practices on construction sites, thereby minimizing the risk of accidents and injuries during trench excavation tasks.

vi) EARTH - MOVING MACHINERY - HYDRAULIC EXCAVATORS - LIFT CAPACITY (IS/ISO 10567 : 2007)

The BIS standard IS/ISO 10567:2007, titled "Earth-Moving Machinery – Hydraulic Excavators – Lift Capacity," specifies procedures for evaluating the lifting capacity of hydraulic excavators. This standard ensures uniformity and safety by defining test conditions and methods for determining rated lift capacities, taking into account factors such as machine configuration, operating position, and load stability. It is critical for manufacturers, operators, and safety regulators to use this standard to assess performance, ensure safe operation, and maintain compliance with international norms in the construction and heavy equipment industry.

Loading & Hauling Equipment

i) EARTH - MOVING MACHINERY - SAFETY: PART 3 REQUIREMENTS FOR LOADERS (IS 17055 (PART 3) : 2018)

The Indian Standard establishes comprehensive safety requirements for the design and operation of loaders used in earth-moving applications. This standard aligns with international safety practices while addressing conditions specific to India. It covers key aspects such as operator visibility, access systems, control functions, stability, braking systems, and rollover protective structures (ROPS), among others. By mandating rigorous safety protocols and performance criteria, the standard aims to minimize occupational hazards, enhance operational reliability, and ensure the protection of machine operators and nearby personnel during usage of loaders in construction and industrial environments.

ii) EARTH-MOVING MACHINERY - LOADERS AND BACKHOE LOADERS PART 1 CALCULATION OF RATED OPERATING CAPACITY AND TEST METHOD FOR VERIFYING CALCULATED TIPPING LOAD (IS/ISO 14397-1 : 2007)

This Indian standard provides standardized procedures for determining the rated operating capacity and verifying the tipping load of loaders and backhoe loaders. This ensures uniformity and safety in the performance assessment of such machinery. The standard outlines the methods for calculating the rated capacity based on stability and sets out the testing protocol to confirm these values under controlled conditions. By adhering to this standard, manufacturers and operators can ensure the reliability, safety, and efficiency of earth-moving equipment in real-world applications.

iii) EARTH - MOVING MACHINERY – SAFETY PART 6 REQUIREMENTS FOR DUMPERS (IS 17055 (PART 6) : 2021)

The Indian Standard provides comprehensive safety guidelines specifically for dumpers used in earth-moving operations. This standard lays down essential safety requirements aimed at minimizing risks associated with the operation, design, and maintenance of dumpers, which are critical machines in construction, mining, and related industries. It addresses factors such as operator protection, stability, control systems, and safety features to ensure safe usage under various working conditions. By adhering to this standard, manufacturers, operators, and safety personnel can ensure that dumpers meet uniform safety benchmarks, thereby enhancing operational safety, preventing accidents, and promoting workforce wellbeing in earth-moving activities across India.

iv) EARTH-MOVING MACHINERY — SAFETY PART 7 REQUIREMENTS FOR SCRAPERS (IS 17055 (PART 7) : 2020)

Indian Standard provides comprehensive safety requirements specifically for scrapers, a category of earth-moving machinery used extensively in construction, mining, and civil engineering projects. This standard outlines essential design, operational, and maintenance safety guidelines to ensure the safe use of scrapers, thereby minimizing risks to operators and other personnel. It addresses critical factors such as machine stability, braking systems, visibility, emergency controls, and protective structures, aligning with modern safety practices to enhance workplace safety and equipment reliability. By adhering to IS 17055 (Part 7), manufacturers, users, and safety professionals can promote safer handling and operation of scrapers within the earth-moving machinery sector in India.

Dozing & Grading Equipment

i) EARTH-MOVING MACHINERY - SAFETY PART 2 REQUIREMENTS FOR TRACTOR DOZERS (IS 17055 (PART 2) : 2020)

The Indian Standard establishes comprehensive safety requirements specific to tractor dozers used in construction, mining, and other earth-moving applications. This standard aligns with international best practices and aims to ensure the protection of operators and maintenance personnel by addressing hazards associated with the operation and servicing of such heavy machinery. It covers key safety aspects including access systems, operator stations, controls, visibility, guarding of moving parts, and stability requirements. By providing a structured framework for design and operational safety, IS 17055 (Part 2): 2020 supports manufacturers, suppliers, and users in achieving higher levels of workplace safety and equipment reliability.

ii) EARTH-MOVING MACHINERY — SAFETY PART 8 REQUIREMENTS FOR GRADERS (IS 17055 (PART 8) : 2020)

Indian Standard specifies the safety requirements and guidelines for the design, construction, and operation of graders used in earth-moving activities. This standard aims to enhance the safety of operators and nearby personnel by defining essential safety features, operational controls, protective devices, and marking requirements specific to graders. It addresses risks associated with machine operation such as stability, visibility, braking, and emergency measures, ensuring that graders meet uniform safety benchmarks. Overall, IS 17055 (Part 8): 2020 supports safer working conditions and promotes best practices within the construction and earth-moving machinery sector in India.

Compaction Equipment

i) EARTH-MOVING MACHINERY — SAFETY PART 13 REQUIREMENTS FOR ROLLERS (IS 17055 (PART 13) : 2020)

The Indian Standard establishes comprehensive safety guidelines for the design, construction, operation, and maintenance of rollers used in earth-moving operations. This standard is a critical part of the broader IS 17055 series, which aligns with international best practices and enhances operator and bystander safety. Part 13 specifically addresses the unique operational characteristics and hazards associated with rollers, such as vibration, machine stability, operator visibility, and control system safety. By standardizing these aspects, IS 17055 (Part 13): 2020 supports safer workplace environments, promotes the responsible use of machinery, and contributes to the harmonization of safety practices within the Indian construction and infrastructure sectors.

ii) VIBRATORY ROLLER - GENERAL REQUIREMENTS: PART 1 SELF - PROPELLED TANDEM DRUM (IS 5500 (PART 1) : 2004)

The standard specifies the essential technical and safety requirements for self-propelled tandem vibratory rollers used in road construction and compaction work. This standard outlines parameter such as dimensional characteristics, mass, engine performance, vibration systems, braking mechanisms, and operator controls to ensure uniformity, reliability, and operational safety across manufacturers and equipment types. It serves as a benchmark for quality and performance, facilitating consistency in design, manufacturing, and usage of these rollers within India's infrastructure development sector.

iii) VIBRATORY ROLLER - GENERAL REQUIREMENTS: PART 2 SELF PROPELLED SINGLE DRUM (IS 5500 (PART 2) : 2004)

The standard outlines the technical and operational requirements for self-propelled single drum vibratory rollers used in compaction of soil, granular materials, and similar applications in civil engineering. This standard specifies essential parameters such as dimensions, mass, engine power, vibration frequency, amplitude, and safety features to ensure uniformity, efficiency, and safety in usage. It serves as a critical guideline for manufacturers, quality inspectors, and contractors, helping maintain performance consistency and adherence to safety norms in road and infrastructure projects across India.

iv) SPECIFICATION FOR PNEUMATIC TYRED ROLLER (IS 5501 : 2021)

The standard outlines the technical requirements and performance parameters for pneumatic tyred rollers used in road construction and compaction work. This standard specifies key aspects such as dimensions, weight distribution, tyre pressure, rolling width, and safety features to ensure uniformity and operational efficiency across equipment manufactured in India. By standardizing the design and testing criteria, IS 5501:2021 helps promote safety, durability, and reliability in construction machinery, while also facilitating quality control and regulatory compliance in infrastructure development projects.

v) SMOOTH-WHEELED DIESEL ROAD ROLLER - GENERAL REQUIREMENTS (IS 5502 : 2023)

The standard specifies the essential technical and performance requirements for smooth-wheeled road rollers powered by diesel engines. These rollers are primarily used in the compaction of soil, granular material, and bituminous layers in road construction. The standard outlines parameters such as dimensions, weight distribution, rolling width, engine performance, safety features, and operational efficiency to ensure consistent quality and safety in construction practices. It aims to standardize manufacturing and performance expectations to enhance reliability, operational effectiveness, and environmental compliance in the use of road rollers across India.

vi) EARTH-MOVING MACHINERY — SAFETY PART 11 REQUIREMENTS FOR EARTH AND LANDFILL COMPACTORS (IS 17055 (PART 11) : 2020)

The Indian Standard outlines the essential safety requirements specific to the design and operation of earth and landfill compactors. This standard is part of a broader series developed to enhance the safe use of earth-moving machinery in accordance with national and international best practices. Part 11 focuses on addressing the unique risks associated with compactors, such as stability, operator visibility, access systems, roll-over protection, and guarding of hazardous areas. By establishing uniform safety protocols, the standard helps manufacturers, operators, and regulatory authorities ensure that equipment used in earthwork and waste compaction meets stringent safety benchmarks, thereby reducing workplace hazards and improving operational reliability.

Utility & Specialized Equipment

i) EARTH-MOVING MACHINERY — SAFETY PART 9 REQUIREMENTS FOR PIPE LAYERS (IS 17055 (PART 9) : 2020)

Indian Standard establishes comprehensive safety guidelines specifically for pipe layers used in earth-moving operations. This standard addresses critical safety aspects to ensure the design, manufacture, operation, and maintenance of pipe-laying machinery minimize risks to operators and surrounding personnel. It covers requirements related to structural integrity, stability, control systems, operator protection, and safety devices tailored to the unique functions and hazards associated with pipe layers. By adhering to IS 17055 (Part 9), manufacturers and users can promote safer working conditions, reduce accident potential, and improve the reliability and efficiency of pipe-laying equipment in construction and infrastructure projects across India.

ii) EARTH-MOVING MACHINERY — SAFETY PART 15 REQUIREMENTS FOR COMPACT TOOL CARRIERS (IS 17055 (PART 15) : 2020)

The Indian Standard establishes comprehensive safety requirements specific to compact tool carriers (CTCs) used in earth-moving applications. This standard is part of a broader series aimed at enhancing operator safety and minimizing risks associated with machinery operation. It outlines critical design, operational, and maintenance criteria that manufacturers and operators must follow to ensure the safe use of compact tool carriers under varied working conditions. By aligning with international safety practices, IS 17055 (Part 15) serves as a crucial regulatory benchmark for both Indian manufacturers and importers, promoting uniformity, risk mitigation, and workplace safety in the construction and infrastructure sectors.

General Safety & Control System

i) EARTH-MOVING MACHINERY – SAFETY PART 1 GENERAL REQUIREMENTS (IS 17055 (PART 1) :2019/ISO 20474-2 : 2017)

The Indian Standard specifies the general safety requirements for earth-moving machinery. This standard establishes essential principles and guidelines to minimize risks associated with the design, operation, and maintenance of such machinery. It outlines the safety measures that manufacturers and stakeholders must implement to protect operators, service personnel, and bystanders from hazards inherent in machinery use, such as mechanical, electrical, and thermal risks. As a foundational part of a multi-part standard, it serves as a baseline for more specific safety requirements applicable to various types of earth-moving equipment, promoting harmonization with international best practices while catering to India's industrial and regulatory context.

ii) EARTH-MOVING MACHINERY FUNCTIONAL SAFETY PART 1 METHODOLOGY TO DETERMINE SAFETY RELATED PARTS OF THE CONTROL SYSTEM AND PERFORMANCE REQUIREMENTS (IS/ISO 19014-1 : 2018)

The Indian Standard provides a comprehensive framework for assessing and ensuring the functional safety of control systems in earth-moving machinery. Aligned with international standards, this document outlines the methodology for identifying safety-related parts of control systems, determining the performance requirements based on risk assessment, and establishing the necessary safety performance levels. The standard supports manufacturers and designers in implementing systematic approaches to risk reduction, ensuring that machinery operates safely under varying conditions. It plays a critical role in enhancing operator and bystander safety, reducing operational hazards, and fostering regulatory compliance in the construction and heavy equipment sectors.

iii) EARTH-MOVING MACHINERY - FUNCTIONAL SAFETY PART 3 ENVIRONMENTAL PERFORMANCE AND TEST REQUIREMENTS OF ELECTRONIC AND ELECTRICAL COMPONENTS USED IN SAFETY-RELATED PARTS OF THE CONTROL SYSTEM (IS/ISO 19014-3 : 2018)

The standard establishes requirements for ensuring the environmental durability and performance of electronic and electrical components integral to the safety functions of earth-moving machinery. This standard ensures that such components can withstand harsh operating conditions such as temperature extremes, vibration, humidity, and electromagnetic interference. By specifying rigorous testing and qualification criteria, it supports the reliable functioning of control systems that are critical to the safety of operators and bystanders, thereby enhancing overall machinery safety and compliance with functional safety frameworks.

iv) EARTH-MOVING MACHINERY OPERATOR'S CONTROLS (IS/ISO 10968 : 2020)

The Indian Standard provide the identification, and actuation of operator controls used in earth-moving machinery. Harmonized with the international ISO 10968:2020, this standard aims to enhance safety, efficiency, and operator ergonomics by ensuring consistency in control interfaces across different types of machines. It covers both manually operated and electronically controlled systems, detailing requirements for symbols, control arrangements, and functional grouping to minimize operator confusion and errors. The adoption of this standard promotes interoperability, reduces training time, and aligns with global best practices in machinery design and user interface uniformity within the construction and mining equipment sectors.

v) EARTH - MOVING MACHINERY – FIELD OF VISION OF SURVEILLANCE AND REAR VIEW MIRRORS: PART 2 PERFORMANCE CRITERIA (IS/ISO 14401-2 : 2009)

The Indian Standard establishes critical performance requirements for the visual aids used in earth-moving equipment. This standard ensures that operators of such machinery have a clear and adequate field of vision to the rear and sides of the vehicle, thereby enhancing safety on construction and mining sites. It specifies technical criteria for the effectiveness, durability, and positioning of surveillance systems and rear-view mirrors, aligning with international best practices. By adhering to these standards, manufacturers and operators contribute to the

reduction of accidents caused by limited operator visibility, thus promoting a safer working environment and improving operational efficiency.

vi) EARTH-MOVING MACHINERY ELECTRICAL SAFETY OF MACHINES UTILIZING ELECTRIC DRIVES AND RELATED COMPONENTS AND SYSTEMS PART 1 GENERAL REQUIREMENTS (IS/ISO 14990-1 : 2016)

The Indian Standard establishes comprehensive safety guidelines for the design and operation of earth-moving machinery equipped with electric drive systems. This standard outlines essential electrical safety principles to ensure the protection of operators, maintenance personnel, and the surrounding environment from electrical hazards. It covers fundamental aspects such as insulation, wiring, grounding, and protection against electric shock, in alignment with international safety practices. By harmonizing with ISO 14990-1:2016, the standard promotes the safe integration of emerging electric technologies in heavy equipment, supporting India's goals for modernization, safety, and environmental sustainability in the construction and mining sectors.

vii) EARTH-MOVING MACHINERY – SAFETY REQUIREMENTS FOR REMOTE OPERATOR CONTROL SYSTEMS (IS/ISO 15817 : 2012)

The Indian Standard establishes comprehensive safety guidelines for the design, implementation, and operation of remote control systems used in earth-moving machinery. This standard ensures that remote operator control systems are engineered to provide equivalent levels of safety as conventional onboard systems, thereby minimizing operational risks. It addresses critical aspects such as functional reliability, communication protocols, emergency procedures, and human-machine interface design to safeguard both operators and bystanders. The standard aligns with international best practices by adopting the ISO 15817:2012 specification, promoting uniform safety benchmarks across the industry while supporting India's growing emphasis on automation and operator safety in heavy machinery operations.

viii) EARTH-MOVING MACHINERY – OBJECT DETECTION SYSTEMS AND VISIBILITY AIDS - PERFORMANCE REQUIREMENTS AND TESTS (IS/ISO 16001 : 2017)

The Indian Standard outlines essential criteria for the design, functionality, and testing of systems that assist operators of earth-moving machinery in detecting nearby objects. This standard aims to enhance operational safety by mitigating blind spots and improving situational awareness, especially in hazardous environments such as construction and mining sites. It specifies the performance requirements for technologies like camera-monitor systems, ultrasonic sensors, radar, and other detection aids. Through detailed test procedures and compliance benchmarks, the standard ensures that these systems are reliable, durable, and effective under various operating conditions, thereby contributing to accident prevention and overall equipment safety.

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BUREAU OF INDIAN STANDARDS

(Ministry of Consumer Affairs, Food & Public Distribution, Govt. of India)
Manak Bhawan, 9, Bahadur Shah Zafar Marg New Delhi – 110 002