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**Full face tunnel boring machines - Safety requirements for hard
rock tunnel boring machines**

全断面隧道掘进机 岩石隧道掘进机安全要求

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Foreword

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1 Scope

China's national safety requirements for hard rock tunnel boring machines. It belongs to the full face tunnel boring machine series and complements the shield machine safety standard. The hazards of a hard rock machine are its own. The cutterhead carries disc cutters loaded to hundreds of kilonewtons each, and changing them means a person entering the space between the head and the rock face - the most dangerous routine operation in tunnelling, done in a confined space under unsupported ground with the head's stored hydraulic energy present. On an open machine the tunnel behind the head is unlined, so rockfall is a live hazard along the whole working area, and the grippers that react the thrust bear on rock that may be less sound than it appears. Add the dust from cutting rock, the noise, and a conveyor carrying muck the length of the machine, and the safety case has to be built hazard by hazard.

3 Low-voltage switchgear and control equipment - Part 3: Switches, isolators, isolating switches and fuse combinations

1 Safety components related to machinery safety control system - Part 1: General rules for design

2 Machinery Safety Approaching Machinery Fixtures Part 2: Working Platforms and Channels

2 Normative references

The contents of the following documents constitute essential provisions of this document through normative references in the text: Among them, dated citations documents, only the version corresponding to that date applies to this document; for undated references, the latest edition (including all amendments) applies to this document:

GB/T 150 (all parts) Pressure Vessels GB/T 1094:

11 Power Transformers Part 11: Dry-Type Transformers GB/T 1251:

2 General requirements, design and inspection of visual signals for ergonomic hazards

GB/T 1985-2014 High-voltage AC isolating switch and grounding switch GB 2893 Safety Color

GB/T 3766 General rules and safety requirements for hydraulic transmission systems and their components

GB/T 3956-2008 Conductor of cables

GB/T 4208 enclosure protection class (IP code)

GB/T 5226.1-2019 Mechanical and Electrical Safety Mechanical and Electrical Equipment Part 1: General Specifications GB 5226:

3 Mechanical Safety Mechanical Electrical Equipment Part 11: Voltages higher than

1000Va:c: or 1500Vd:c: but not exceeding Technical conditions of 36kV high voltage equipment GB/T 6067:

GB 7247:1-2012 Safety of Laser Products Part 1: Equipment Classification and Requirements

GB/T 7932 General rules and safety requirements for pneumatic systems and their components

GB/T 8196 General requirements for the design and manufacture of fixed and movable guards for mechanical safety guards

GB 8410 Combustion Characteristics of Automotive Interior Materials

GB/T 8420 Earth-moving machinery driver's body size and the driver's minimum activity space

GB/T 9969 General Principles of Instruction Manual for Industrial Products

GB/T 11345 Ultrasonic Testing Technology, Testing Grade and Evaluation for Nondestructive Testing of Welds GB/T 14048:

GB/T 15706 General Principles of Mechanical Safety Design Risk Assessment and Risk Reduction

GB/T 16754 Design Principles of Mechanical Safety Emergency Stop GB/T 16855:

GB/T 17771 Earthmoving Machinery Falling Object Protection Structure Laboratory Test and Performance Requirements GB/T 17888:

GB 19517-2009 National Electrical Equipment Safety Technical Specification