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NB/T 11121-2023

**Digital construction of underground coal mine - Evaluation
index and method**

井工煤矿数字化建设评价指标和评价方法

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Foreword

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It is a NB/T standard: recommended rather than compulsory, but it is the text a Chinese reviewer applies when assessing a submission.

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1 Scope

NB/T 11121-2023 sets out how the digitalisation of an underground coal mine is evaluated and graded. Chinese policy is pushing coal mines towards intelligent operation - automated faces, remote-controlled equipment, integrated monitoring and data-driven management - and this standard provides the common yardstick for judging how far a given mine has actually come. It is an evaluation method rather than a technical specification. The standard gives the scope, the normative references and the defined terms and abbreviations, then the grading scheme: a mine is scored out of one thousand points across five levels, and classed as a Grade I, II or III digital coal mine above set thresholds, or as not yet digital below the lowest. It sets out the basic requirements a mine must meet before it can be evaluated, then the evaluation content level by level - the infrastructure level with networks, data centres and positioning; the equipment level with the digitalisation of mining, tunnelling, hoisting, transport, ventilation, drainage and power supply; the systems level with monitoring, safety and production control platforms; the management level with planning, maintenance and business processes; and the decision support level with data integration and analytics. The evaluation procedure, the scoring rules and the report follow, with the annexes giving the detailed scoring tables for each level and the standards each requirement rests on.

This document specifies the evaluation indicators and evaluation method for the digital construction of underground coal mines, covering the classification of digital construction evaluation, the evaluation index system for digital construction and the evaluation method for digital construction.

This document is applicable to the evaluation of the digital construction of newly built, reconstructed (expanded) and producing underground coal mines.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NB/T 11120-2023 Digital construction of underground coal mine - Technical requirements.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in NB/T 11120-2023 apply.

4 Classification of digital construction evaluation

Based on the category of construction conditions of the digital mine and the established graded evaluation index system for digital coal mines, the construction results of the digital mine are comprehensively evaluated, and the evaluation result of each category of digital mine is subdivided into three grades: Grade I digital coal mine, Grade II digital coal mine and Grade III digital coal mine, as shown in Table 1.

Table 1 Classification of evaluation grades of digital coal mines: No. 1 is the Grade I digital coal mine, No. 2 is the Grade II digital coal mine and No. 3 is the Grade III digital coal mine.

5 Evaluation index system for digital construction

5.1 Evaluation index system of the digital mine: in accordance with the requirements of NB/T 11120-2023, the evaluation index system and evaluation indicators shall be established on five layers, from the bottom to the top of the digital mine application architecture: the equipment layer, the production control layer, the production execution layer, the business management layer and the decision support layer. The evaluation index system of digital underground coal mines is given in Annex A.

5.2 Equipment layer: the indicators mainly cover hardware systems and software systems such as sensors, actuators, power supplies, industrial cameras and mobile terminals.

5.2 a) The equipment layer mainly realizes information identification and perception of the 'personnel, machines and environment' at the production site, fault self-diagnosis, data exchange for automatic control, and execution of commands from the upper layers.

5.2 b) At this layer, normative descriptions shall be given for the degree of intelligence, reliability, unique coding, location information, device interaction protocols and sensor network requirements of all objects, so as to achieve plug-and-play of sensing devices, data exchange and standardized transmission.

5.3 Production control layer: the indicators mainly cover the automation systems, the backbone network and the integrated automation platform.

5.3 a) The production control layer consists mainly of the automation systems, the backbone network and the integrated automation platform, including the underground backbone network, the surface network and the individual automation systems; it mainly realizes real-time monitoring and automatic and coordinated operation control of the

'personnel, machines and environment' at the production site, equipment fault diagnosis and disaster early warning.

5.3 b) At this layer, standardization requirements shall be put forward for network security and network resources; classification and coding standards shall be established for mine spatial information and metadata; data storage specifications, standardized protocol formats for data exchange, and description methods and criteria for metadata and structured information shall be put forward for different types of systems to meet data exchange needs between systems; and intelligent functional requirements shall be put forward for different types of systems to achieve disaster early warning and coordinated control of production processes, with the goal of unattended operation of key production processes.

5.4 Production execution layer: the indicators mainly cover information systems for production, dispatching, electromechanical, geological survey, ventilation and safety. The production execution layer mainly includes these information systems, the business management systems, the coordinated management and control platform and shared storage resources, supporting the daily safety and production management of each business department.

5.5 Business management layer: the indicators mainly cover the office system and the enterprise management system.

5.6 Decision support layer: the indicators mainly cover decision support provided through data mining and analysis for the intrinsic safety of the mine, cost reduction and efficiency improvement in production, lean management and disaster rescue.

5.6 a) The decision support layer mainly provides decision support through data mining and analysis for intrinsic mine safety, cost reduction and efficiency improvement, lean management and disaster rescue. It mainly includes storage resources and data service resources (which may be shared with the coordinated management and control layer) and the decision support software platform.

5.6 b) At this layer, according to the actual production and business management requirements of the coal mine user, rich specialized applications may be built on existing data, decision support software covering mine safety, production and management may be developed and deployed, and a knowledge base may be constructed.

6 Evaluation method for digital construction

6.1 Requirements for layer indicators of digital construction: the indicators of the five layers of digital construction are scored item by item as first-level, second-level and third-level indicators on a percentage basis, with corresponding weights set for each level of indicator according to its importance; the scores of the relevant evaluation content are calculated in accordance with the scoring criteria, and the maturity of the digital mine is obtained and