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Structures for mine shafts —

Part 2: Headframe structures

Structures de puits de mine —

Partie 2: Chevalements

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 82, *Mining*.

A list of all parts in the ISO 19426 series can be found on the ISO website.

Introduction

Many mining companies, and many of the engineering companies which provide designs for mines, operate globally so ISO 19426 was developed in response to a desire for a unified global approach to the safe and robust design of structures for mine shafts. The characteristics of ore bodies, such as their depth and shape, vary in different areas so different design approaches have been developed and proven with use over time in different countries. Bringing these approaches together in ISO 19426 will facilitate improved safety and operational reliability.

The majority of the material in ISO 19426 deals with the loads to be applied in the design of structures for mine shafts. Some principles for structural design are given, but for the most part it is assumed that local standards will be used for the structural design.

Structures for mine shafts —

Part 2:
Headframe structures

1 Scope

This document specifies the design loads and the design procedures for the structural design of headframe structures of mine shafts and their components for permanent and sinking operations. The headframe includes all structures and their foundations, that are required at the head of all vertical and decline mine shafts for the purposes of supporting and installing winding and sinking ropes, conveyance guides, rope guides and rubbing ropes, equipment for loading and unloading conveyances, safety devices, as well as ancillary sinking and maintenance equipment. The headframe also includes the bank and sub-bank levels.

This document does not cover matters of operational safety or layout of the headframe.

This document adopts a limit states design philosophy.

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.

ISO 2394, *General principles on reliability for structures*

ISO 3010, *Bases for design of structures — Seismic actions on structures*

ISO 12122-1, *Timber structures — Determination of characteristic values — Part 1: Basic requirements*

ISO 10721-1, *Steel structures — Part 1: Materials and design*

ISO 19338, *Performance and assessment requirements for design standards on structural concrete*

ISO 19426-1, *Structures for mine shafts — Part 1: Vocabulary*

ISO 19426-3, *Structures for mine shafts — Part 3: Sinking stage*

ISO 19426-4, *Structures for mine shafts — Part 4: Conveyances*

ISO 22111, *Bases for design of structures — General requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 19426-1 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at http://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org

4 Symbols

D	rope or conveyance installation load (N)
D_{dd}	winding rope doubling-down load (N)
D_g	rope guide or rubbing rope installation load (N)
D_h	winding rope installation load (N)
D_t	tail rope installation or replacement load (N)
D_v	conveyance change-over load (N)
E	emergency load (N)
E_r	rope emergency load (N)
E_{r1} and E_{r2}	tensions in the ropes on each side of the winder drum (N)
E_{re}	energy release load following rope break (N)
E_{st}	short circuit torque (Nm)
E_{wb}	winder brake failure load (Nm)
e	base for natural logarithms (mathematical constant)
F	design load or load effect (N, Nm)
F_{ag}	pre-tension load of the crash-beam-anchor guy (N)
F_k	kibble load applied to the bank doors (N)
g	gravity acceleration constant (m/s^2)
G	permanent load or load effect (N, Nm)
G_a	additional permanent load or load effect from rope guides and rubbing ropes (N)
G_c	conveyance self-weight (N)
G_r	weight of the relevant length of winding rope, rope guide or rubbing rope (N)
G_t	weight of the relevant length of tail rope, rope guide or rubbing rope (N)
L	full length of the rope guide or rubbing rope (m)
m_r	unit mass of the rope guide or rubbing rope (kg/m)
n	number of winding ropes
P	payload used during doubling-down (N)
Q	imposed load or load effect (excluding rope load) (N, Nm)
Q_2	dominant imposed load or load effect under consideration (N, Nm)
Q_3 to Q_n	additional independent imposed loads or load effects (N, Nm)
R_h	varying rope guide or rubbing rope horizontal load under operating conditions (N)

R_v	varying rope guide or rubbing rope vertical load under operating conditions (N)
R_1 to R_n	rope operating loads (N)
T_r	minimum tension in a rope guide or rubbing rope, or the weight of the suspended tensioning block (N)
T_{st}	short circuit torque (Nm)
W_K	weight of kibble and payload (N)
α_c	rope or conveyance impact factor
α_{ch}	horizontal impact factor
α_{cv}	temperature factor
α_{st}	short circuit torque impact factor
α_v	vertical impact facto
μ	coefficient of friction between winding rope and winder drum
γ_e	partial load factor for all loads when combined with the rope emergency load (= 1,05)
γ	partial load factor for permanent load
γ_{f1}	partial load factor for rope-operating load
γ_{f2}	partial load factor for the dominant imposed load
γ_{f3} to γ_{fn}	partial load factors for imposed load
$\sum R$	governing combination of rope-operating loads under consideration
θ	angle of wrap of winding rope on winder drum
Ψ_3 to Ψ_n	load combination factors.

5 Materials

The materials used in the construction of headframes shall be structural steel complying with ISO 10721-1, structural concrete complying with ISO 19338 or structural timber complying with ISO 12122. The material used shall be specified on the structural drawings.

6 Nominal loads

6.1 Permanent loads

6.1.1 General

The permanent loads, *G*, shall be as given in ISO 22111, except as specified in 6.1.2 and 6.1.3.

6.1.2 Equipment permanent loads

Where winders, or other electrical or mechanical equipment, are mounted in the headframe, the nominal permanent loads shall include the weight of such equipment.

6.1.3 Additional permanent loads

After installation of the rope guides and rubbing ropes, the static component of their loads, i.e. their combined weight and tension, shall be treated as an additional permanent load, G_a (N):

$$G_a = T_r + m_r g L \quad (1)$$

where

T_r is the minimum tension in the rope guide or rubbing rope, or the weight of the suspended tensioning block (N);

m_r is the unit mass of the rope guide or rubbing rope (kg/m);

g is the gravity acceleration constant (m/s^2);

L is the full length of the rope guide or rubbing rope (m).

6.1.4 Crash beam anchor guy pre-tension loads

Where anchor guys are fitted to hold down the structure in the event of a crash, the crash beam anchor guy pre-tension loads, F_{ag}, shall be taken into consideration. The crash beam anchor guy pre-tension loads shall be calculated for each anchor guy.

6.2 Imposed loads (excluding rope loads)

6.2.1 General

The nominal imposed loads, Q, including earthquake, wind, snow, temperature, settlement and thermal loads, shall be as given in ISO 22111, except as specified in 6.2.2 to 6.2.10 (inclusive).

6.2.2 Floor and platform loads

The nominal imposed load on floors and platforms shall be

a) a uniformly distributed load of not less than 5 000 N/m^2 for personnel or equipment loading platforms, or

b) a concentrated load equal to the weight of a sheave or other heavy equipment, placed in the position that produces the most severe effects in the member under consideration, when these items might be stored on the floor or placed on the floor during maintenance.

6.2.3 Bin material loads and chute material loads

The nominal imposed loads applied to the headframe by material in bins and chutes shall be calculated assuming that the bins and chutes are completely full.

6.2.4 Conveyance operating loads

The nominal loads applied by conveyances to the headframe and bank steelwork shall be as determined in ISO 19426-4.

6.2.5 Headframe-mounted winder loads

Where winders are mounted on the headframe, the following loads shall be taken into account in addition to rope loads:

a) the maximum starting torque specified by the equipment supplier;