International Standard

ISO 19426-3

Structures for mine shafts —

Part 3: Sinking stages

Structures de puits de mine —

Partie 3: Plates-formes de fonçage

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

This second edition cancels and replaces the first edition (ISO 19426-3:2018), which has been technically revised.

The main changes are as follows:

— stability consideration on the design procedure;

— additional definition of swell factor and lashing unit load equation updated to allow for different swell factors;

— addition of dewatering equipment to special loads;

— the scope of the document excludes mechanised shaft sinking methods.

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

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Many mining companies, and many of the engineering companies which provide designs for mines, operate globally so ISO 19426 series 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 series will facilitate improved safety and operational reliability.

The majority of the material in ISO 19426 series 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. It is also recognized that typical equipment varies from country to country, so the clauses in ISO 19426 series do not specify application of the principles to specific equipment. However, in some cases examples demonstrating the application of the principles to specific equipment are provided in informative annexes.

Structures for mine shafts —

Part 3:
Sinking stages

1 Scope

This document specifies the design loads and the design procedures for the structural design of stages and components of stages.

The loads specified in this document are not applicable for the design of stage ropes or sheaves. Rope sizes are determined in accordance with other standards.

This document does not cover matters of operational safety, or layout of the sinking stage and other mechanised methods of shaft sinking that shall be addressed using a rational method.

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 17607 (all parts), *Steel structures — Execution of structural steelwork*

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

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

EN 1999-1-1, *Eurocode 9 — Part 1: Design of aluminium structures — Part 1: General structural rules*

EN 1999-1-3, *Eurocode 9 — Part 1: Design of aluminium structures — Part 3: Structures susceptible to fatigue*

EN 1999-1-4, *Eurocode 9 — Par 1: Design of aluminium structures — Part 4: Cold-formed structural sheeting*

CEN/TS 13001-3-1, *Cranes — General design — Part 3-1: Limit states and proof competence of steel structures*

3 Terms and definitions

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

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

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

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

4 Symbols

C	lashing unit grab capacity (m^3)
E	emergency load, or load effect (N, Nm)
e_G	stage load eccentricity factor
E_a	emergency impact load (N)
E_p	emergency impact load on a protective platform (N)
E_R	emergency rope load (N)
F	design load, or load effect (N, Nm)
G	permanent load, or load effect (N, Nm)
G_D	jumbo unit self-weight (N)
G_L	lashing unit self-weight (N)
K	weight of the kibble and full load (N)
L	span of an element or floor beam (m)
L_1	lashing unit lever arm or the VSM lashing unit grab lever arm (m)
L_2	stage jack lever arm horizontal (m)
L_3	stage jack lever arm vertical (m)
L_4	jumbo unit centre of gravity lever arm or the VSM lashing unit centre of gravity lever arm (m)
L_{5i}	hydraulic cylinder horizontal lever arm to the boom pivot point (m)
L_{6i}	hydraulic cylinder vertical lever arm to the boom pivot point (m)
M_D	jumbo unit moment about the boom pivot point (Nm)
M_L	lashing unit moment about the boom pivot point (Nm)
N_L	total number of lashing unit cycles
P	payload used during doubling-down (N)
p_D	uniformly distributed load on stage decks (N/m^2)
P_A	canopy load (N)
P_B	blast load (N)
P_C	concentrated load on stage decks (N)
P_D	total uniformly distributed imposed load on stage decks (N)
P_G	stage skid load (N)
P_H	kibble cross-head support load (N)
P_J	stage jack load (N)

P_{JA} stage jack axial load (N)

P_{JT} stage jack transverse load (N)

P_K kibble guide load (N)

P_{DH} jumbo unit horizontal load (N)

P_{DV} jumbo unit vertical load (N)

P_{LH} horizontal lashing unit load (N)

P_{LV} vertical lashing unit load (N)

P_P special load (N)

P_R hand railing load (N/m)

P_T temporary stage support load (N)

P_W winch load (N)

Q_1 predominant imposed load, or load effect (N, Nm)

Q_3 to Q_n additional independent imposed loads, or load effects (N, Nm)

s_f Swell factor

V_E excavated volume of the shaft (m^3)

W_C weight of the kibble cross-head (N)

W_{CHi} horizontal hydraulic cylinder loads at maximum capacity (N)

W_{CVi} vertical hydraulic cylinder load (N)

W_G weight of the cactus grab including the grab crosshead (N)

W_{PL} weight of rock in the lashing unit grab (N)

W_{DL} jumbo drilling load (N)

W_K weight of kibble and full load (N)

W_R rated shutter winch load (N)

W_S weight of the shutter (N)

W_W grab winch safe working load (N)

α_B bellmouth impact factor

α_C impact factor for kibble cross-head support

α_D jumbo unit impact factor

α_E impact factor for emergency rope load

α_H hydraulic cylinder impact factor

α_K kibble guide impact factor

α_L lashing unit impact factor