International Standard

ISO 19426-4

Structures for mine shafts —

Part 4: Conveyances

Structures de puits de mine —
Partie 4: Moyens de transport

Second edition
2026-09

Reference number
ISO 19426-4:2026(en)

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Published in Switzerland

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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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For an explanation of 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 www.iso.org/iso/foreword.html.

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

This second edition cancels and replaces the first edition (ISO 19426-4:2018), which has been technically revised.

The main changes are as follows:

— in 11.4.3.3 a), paragraph below Formula (33), the wording and value have been corrected to read "but the rock size shall not be taken as less than 0,02 m^3.";

— emergency loads for friction winders included;

— conveyance function requirements;

— construction tolerances updated;

— Annex C on construction tolerances added.

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 4: Conveyances

1 Scope

This document specifies the loads, the load combinations and the design procedures for the design of the steel and aluminium alloy structural members of conveyances used for the transport of personnel, materials, equipment and rock in vertical and decline shafts. The conveyances covered by this document include personnel or material cages (or both), skips, kibbles, equipping skeleton cages, inspection cages, bridles, crossheads and counterweights.

This document is not intended to be used for the design of ropes, sheaves or attachments. Rope sizes are determined in accordance with other standards.

This document does not cover chairlifts.

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

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

ISO 10721-2, *Steel structures — Part 2: Fabrication and erection*

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

ISO 19426-2, *Structures for mine shafts — Part 2: Headgear structures*

ISO 19426-5, *Structures for mine shafts — Part 5: Shaft system structures*

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*

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

A_o	operating winder system acceleration/deceleration load (N)
A_t	trip-out winder deceleration load (N)
a_D	maximum permitted deceleration of the conveyance when the dogging system activates (m/s^2)
a_o	operating winder system peak acceleration/deceleration (m/s^2)
a_t	trip-out winder system peak deceleration (m/s^2)
C	impact load during loading of the conveyance (N)
C_h	horizontal impact load from rolling stock (N)
C_v	vertical impact load from rolling stock (N)
C_y	conveyed load (P, ΣM, U or R, as appropriate) (N)
D	dogging system load (N)
d_i	deformation of the skip door (m)
E_j	emergency dropback load (N)
E_r	rope emergency load (N)
e	maximum moving beam misalignment of the guide (m); lateral flare dimension (see Figure 1)
F	design load, or load effect (N, Nm)
F_v	friction induced vertical load (N)
G_1 and G_2	are the permanent loads, including the self-weight of the structure and the structural components, in newtons (N)
G_c	conveyance self-weight load (N)
g	acceleration due to gravity (m/s^2)
H	lateral imposed load (N)
H_r	rubbing block load (N)
H_s	lateral slipper plate load (N)
h_d	length through which the rock falls (m)
h_h	height to which the skip is filled above the lowest point of the skip door (m)
K	holding device engagement load (N)
K_c	holding device securing load (N)

K_g lateral stiffness of the steelwork at the guide mid-span or at the end of the flare (N/m)

K_s buffer spring stiffness (N/m)

L guide span, bunton to bunton or the length of the flare guide (m)

L_1 distance between the pivot and the centre of gravity of the skip, or the radial door (m)

L_2 distance between the pivot and the return-stop (or the tipping roller) (m)

L_T length of the crawler track (m)

L_C Length of conveyance measured between extreme end of slipper plates(m)

M load from each item of rolling stock or equipment (N)

M_1 heavier axle load (N)

m_c conveyance mass including all attachments, excluding rope attachments (kg)

m_r mass of largest rock that will be loaded into the skip (kg)

n number of winding ropes

P load from personnel (N)

p_o to p_3 skip pressures (N/m^2)

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

Q_2 to Q_n are the additional independent imposed loads, or load effects (N, Nm)

Q_e emergency load or load effect (N, Nm)

R static rock or slurry load (N)

R_d bridle and top transom load during filling (N)

R_f friction load on the skip door (N)

R_i single rock impact vertical load on the skip door (N)

R_k single rock impact horizontal load on the skip sides (N)

R_s load on skip return-stops (N)

R_t load on tipping rollers (N)

T load due to the tail rope (N)

U load due to slung equipment (N)

z maximum depth of rock or slurry contained in the conveyance (m)

Z_i impact energy of the falling rock (J)

α_d dynamic response factor

α_h horizontal load impact factor

α_k holding device impact factor