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**Lifts (elevators), escalators and passenger  
conveyors — Risk analysis methodology**

*Ascenseurs, escaliers mécaniques et trottoirs roulants — Méthodologie de  
l'analyse du risque*

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of normative document:

- an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;
- an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed every three years with a view to deciding whether it can be transformed into an International Standard.

Attention is drawn to the possibility that some of the elements of this Technical Specification may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/TS 14798 was prepared by Technical Committee ISO/TC 178, *Lifts (elevators), escalators and passenger conveyors*.

This document is being issued in the Technical Specification series of publications as a “prospective standard for provisional application” in the field of risk analysis for lifts (elevators), escalators and passenger conveyors because there is an urgent need for guidance on how safety requirements contained in standards for lifts, escalators and passenger conveyors should be evaluated.

This document is not to be regarded as an “International Standard”. It is proposed for provisional application so that information and experience of its use in practice may be gathered. Comments on the content of this document should be sent to the ISO/TC 178 Secretariat.

A review of this Technical Specification will be carried out no later than three years after its publication with the options of extension for another three years, conversion into an International Standard or withdrawal.

Annexes A, B, C and D form a normative part of this Technical Specification. Annex E is for information only.

## Introduction

This Technical Specification has been prepared in response to ISO/TC 178 Resolution 104/1994, in which the Technical Committee requested that WG 4 undertake a method of analysis to review the fundamentals of safety requirements, based upon ISO/IEC Guide 51. Furthermore, in its Resolution 131/1996, the Technical Committee requested WG 4 to “develop and formulate a report on risk analysis methodology as applicable to lifts and similar devices”.

Adherence to this Technical Specification will provide an orderly means to identify hazards, assess the risks, and recommend appropriate risk reduction measures.

Any amendments and additions to this Technical Specification will be handled by ISO/TC 178/WG 4 through the use of a database maintained by the Working Group.

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# Lifts (elevators), escalators and passenger conveyors — Risk analysis methodology

## 1 Scope

This Technical Specification establishes requirements and procedures for carrying out risk analysis for lifts (elevators), escalators and passenger conveyors.

It is intended for use by experts, trained in this methodology, to determine equipment safety and performance or to develop codes and standards.

## 2 Normative reference

The following normative document contains provisions which, through reference in this text, constitute provisions of this Technical Specification. For dated references, subsequent amendments to, or revisions of, this publication does not apply. However, parties to agreements based on this Technical Specification are encouraged to investigate the possibility of applying the most recent edition of the normative document indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO/IEC Guide 51:1999, *Safety aspects — Guidelines for their inclusion in standards*,  
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## 3 Terms and definitions

For the purposes of this Technical Specification, the following terms and definitions apply.

### 3.1

#### **cause**

trigger mechanism to the hazard, which will cause the incident or effect

### 3.2

#### **frequency**

probability of occurrence of an incident

### 3.3

#### **harm**

physical injury or damage to the health of people, or damage to property or the environment

[ISO/IEC Guide 51:1999, definition 3.3]

### 3.4

#### **hazard**

potential source of harm

NOTE The term hazard can be qualified in order to define its origin or the nature of the expected harm (e.g. electric shock hazard, crushing hazard, cutting hazard, toxic hazard, fire hazard, drowning hazard).

[ISO/IEC Guide 51:1999, definition 3.5]

**3.5  
harmful event**

occurrence in which a hazardous situation results in harm

[ISO/IEC Guide 51:1999, definition 3.4]

**3.6  
hazardous situation**

circumstance in which people, property or the environment are exposed to one or more hazards

[ISO/IEC Guide 51:1999, definition 3.6]

**3.7  
incident (effect)**

unforeseen event or occurrence which can, but does not necessarily result in harm, i.e. death, injury, property or damage to the environment

**3.8  
major damage**

harm that cannot be reversed without repair or replacement of a major system component

**3.9  
minor damage**

harm that can be reversed with repair or replacement of a non-major system component

**3.10  
minor injury**

impairment that can be reversed

**3.11  
minor illness**

disease that can be reversed

**3.12  
severe injury**

impairment that cannot be reversed

**3.13  
severe illness**

disease that cannot be reversed

**3.14  
severity**

qualitative measure of the worst possible incident (effect) that could be caused by a specific hazard

**3.15  
risk**

combination of the probability of occurrence of harm and the severity of that harm

[ISO/IEC Guide 51:1999, definition 3.2]

**3.16  
residual risk**

risk remaining after protective measures have been taken

[ISO/IEC Guide 51:1999, definition 3.9]

**3.17  
tolerable risk**

risk which is accepted in a given context based on the current values of society

[ISO/IEC Guide 51:1999, definition 3.7]

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**3.18****risk analysis**

systematic use of available information to identify hazards and to estimate the risk

[ISO/IEC Guide 51:1999, definition 3.10]

NOTE This method aims at systematically identifying and assessing hazards, evaluating risks and recommending risk reduction measures.

**3.19****risk evaluation**

procedure based on the risk analysis to determine whether the tolerable risk has been achieved

[ISO/IEC Guide 51:1999, definition 3.11]

**3.20****risk assessment**

overall process comprising a risk analysis and a risk evaluation

[ISO/IEC Guide 51:1999, definition 3.12]

**3.21****risk profile**

decision tool consisting of an x-y matrix used to visualize the assessed hazards

**3.22****protective measure**

means used to reduce risk

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NOTE Protective measures include risk reduction by inherently safe design, protective devices, personal protective equipment, information for use and installation, and training.

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[ISO/IEC Guide 51:1999, definition 3.8]

**3.23****system****machine**

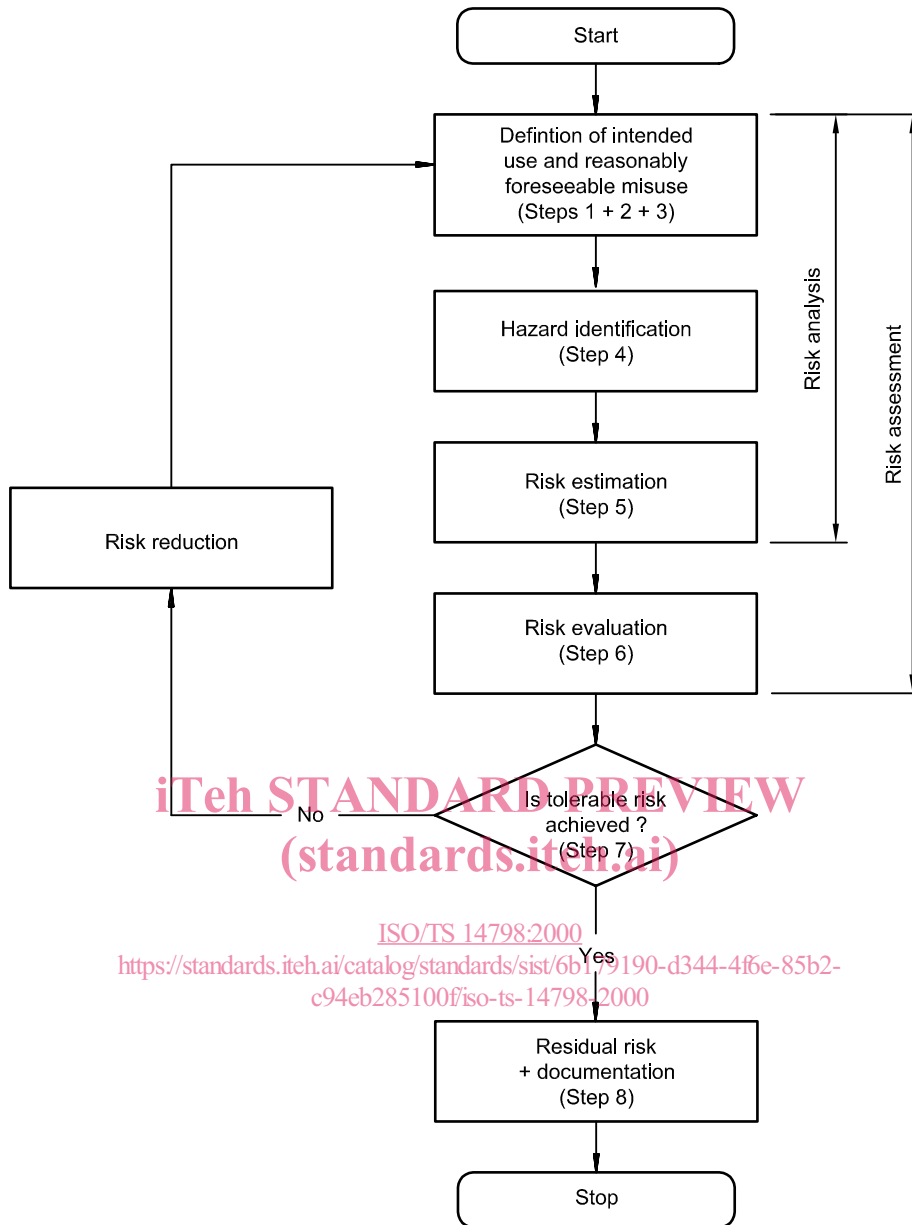
combination of people, procedures, facilities and/or equipment that are integrated to perform a specific operational task or function within a specific environment

**4 Risk analysis****4.1 Basic concept**

Risk analysis is a series of logical steps that enable a systematic study of hazards and their corresponding causes and effects. In this Technical Specification, risk analysis is applied to lifts (elevators), escalators and passenger conveyors.

The identification of hazards, when followed by an assessment of their severity and frequency (probability of occurrence), yields a measure of the risk associated with the individual hazards. Through the use of an iterative process, each hazard and effect is evaluated and either eliminated or, if necessary, controlled by means of appropriate protective measures that reduce the corresponding risk to a tolerable level.

The step-by-step procedure shown in Figure 1 is based largely on the definitions, requirements and processes described in ISO/IEC Guide 51 and the documents listed in the bibliography.



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Figure 1 — Overview of risk analysis

## 4.2 Risk analysis process

### 4.2.1 Step 1: Define the reasons for risk analysis

This risk analysis process is intended to be used for the following purposes:

- a) the writing of safety requirements/standards;
- b) review and assessment of the efficiency of safety requirements/standards;
- c) the design of safety-related components in instances where safety standards do not exist or are not applicable;
- d) verification that the risk associated with some equipment and/or an installation is tolerable.

#### 4.2.2 Step 2: Form a risk analysis team

Select the members of the analysis team and choose a team leader/moderator.

The members of the team and the team leader/moderator should, as a minimum, have a working knowledge of the product or process being analysed.

#### 4.2.3 Step 3: Define the products, processes and applications to be analysed

The following should be considered:

- a) products/processes
  - 1) codes and standards,
  - 2) electrical, hydraulic, and mechanical equipment,
  - 3) hardware and software,
  - 4) operating procedures,
  - 5) performance parameters, e.g. duty cycle, load limits, environment;
- b) aspects
  - 1) design,
  - 2) manufacturing,
  - 3) transport,
  - 4) installation,
  - 5) type of use,
  - 6) maintenance,
  - 7) dismantling and disposal,
  - 8) modernization,
  - 9) training,
  - 10) documentation;
- c) applications
  - 1) transport of passengers,
  - 2) transport of goods (freight).

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#### 4.2.4 Step 4: Identify hazards

**4.2.4.1** Identify the hazardous situation by defining the hazard, cause and effect.

**4.2.4.2** A systematic approach to the identification of hazardous situations (hazards, causes and effects) should yield the complete list necessary for risk analysis, assessment, and identification of risk reduction measures.