BS ISO 22559-1:2014

BSI Standards Publication

Safety requirements for lifts (elevators)

Part 1: Global essential safety requirements (GESRs)

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National foreword

This British Standard is the UK implementation of ISO 22559-1:2014. It supersedes DD ISO/TS 22559-1:2004 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee MHE/4, Lifts, hoists and escalators.

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INTERNATIONAL STANDARD

ISO 22559-1

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Safety requirements for lifts (elevators) —

Part 1: Global essential safety requirements (GESRs)

Exigences de sécurité des ascenseurs —

Partie 1: Exigences essentielles de sécurité globale des ascenseurs

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Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
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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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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 178, *Lifts, escalators and moving walks*.

This first edition of ISO 22559 cancels and replaces ISO/TS 22559-1:2004.

ISO 22559 consists of the following parts, under the general title *Safety requirements for lifts (elevators)*:

— *Part 1: Global essential safety requirements (GESRs)*

— *Part 2: Safety parameters meeting the global essential safety requirements (GESRs)* (Technical Specification)

— *Part 3: Global conformity assessment procedures (GCAP) — Prerequisites for certification of conformity of lift systems, lift components and lift functions* (Technical Specification)

— *Part 4: Global conformity assessment procedures (GCAP) — Certification and accreditation requirements* (Technical Specification)

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Introduction

0.1 After the publication of ISO/TR 11071-1 and ISO/TR 11071-2, discrepancies were noted in the lift safety standards, and it was agreed that there was a need for an ISO publication that would set global essential safety requirements for lifts (elevators). The work, however, could start only after ISO 14798 was completed. This methodology was a critical tool in the development of this part of ISO 22559 on safety requirements for lifts.

0.2 The objective of the ISO 22559 series of documents is to:

a) define a common global level of safety for all people using, or associated with, lifts (elevators);

b) facilitate innovation of lifts (elevators) not designed according to existing local, national or regional safety standards, while maintaining equivalent levels of safety; and

c) help remove trade barriers.

NOTE ISO/TS 22559-2 contains global safety parameters (GSPs) for lifts (elevators) that should further assist in the use and implementation of the global essential safety requirements (GESRs) specified in this part of ISO 22559.

0.3 Clause 4 describes the approach and methodology used in the development of this part of ISO 22559. Clause 5 gives instructions for the use and implementation of GESRs. The GESRs are presented in Clause 6. Each GESR specifies a safety objective, i.e. what is to be achieved, not how to do it. This allows innovation and development of future technologies. Annex A gives an overview of GESRs in relation to lift subsystems.

0.4 This part of ISO 22559 does not supersede National Regulations. Users of this part of ISO 22559 should comply with the National Regulations. This part of ISO 22559 is intended to support national regulations on safety assessment of new lifts.

0.5 The hazards associated with lifts are similar worldwide. For achieving an appropriate uniform safety level, the requirements in this part of ISO 22559 should be considered in any safety assessment of new lifts.

0.6 ISO 22559-1 GESRs or the EU Lifts Directive 95/16/EC essential health and safety requirements (EHSRs), as well as those EHSRs of the Machinery Directive 2006/42/EC applicable to lifts, when complied with, give an appropriate level of safety for lifts. See Annex B for application of European legislation.

0.7 The ISO 22559 series of documents provides a process for assessment of conformity of lift systems, lift components or lift functions with the safety requirements specified in ISO 22559-1. It includes a structured methodology for establishing, documenting and demonstrating that necessary and appropriate protective measures are taken to eliminate hazards or sufficiently mitigate risks. This process is particularly useful for establishing safety of lift systems, lift components or lift functions involving innovative design or new technologies.

NOTE If one is using the process, parts 1 to 4 of the ISO 22559 series should be used.

0.8 ISO/IEC Guide 51 has been taken into account as far as practicable at the time of drafting of this part of ISO 22559. The process of risk reduction described in ISO/IEC Guide 51 is accomplished using ISO 14798.

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INTERNATIONAL STANDARD ISO 22559-1:2014(E)

Safety requirements for lifts (elevators) —

Part 1: Global essential safety requirements (GESRs)

1 Scope

This part of ISO 22559

— specifies GESRs for lifts (elevators), their components and functions, and

— establishes a system and provides methods for minimizing safety risks that may arise in the course of, the operation and use of, or work on, lifts (elevators).

NOTE 1 Hereinafter in this part of ISO 22559, the term "lift" is used instead of the term "elevator".

NOTE 2 See Clause 5 regarding the use and application of this part of ISO 22559.

This part of ISO 22559 is applicable to lifts that are intended to carry persons or persons and goods that can

a) be located in any permanent and fixed structure or building, except lifts located in means of transport, (e.g. ships);

b) have any

   1) rated load, size of load carrying unit and speed, and

   2) travel distance and number of landings;

c) be affected by fire in the load-carrying unit (LCU), earthquake, weather, or flood;

d) be foreseeably misused (e.g. overloaded) but not vandalized.

This part of ISO 22559 does not cover

a) all needs of users with disabilities[1)], or

b) risks arising from

   1) work on lifts under construction, testing, or during alterations and dismantling,

   2) use of lifts for fire fighting and emergency evacuation,

   3) vandalism, and

   4) fire outside the LCU.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

1) Although the GESRs specified in this part of ISO 22559 have been identified and evaluated by risk assessment, not all disabilities or combinations of such disabilities of users have necessarily been addressed.

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ISO/IEC Guide 51:1999, *Safety aspects — Guidelines for their inclusion in standards*

ISO 14798:2009, *Lifts (elevators), escalators and moving walks — Risk assessment and reduction methodology*

3 Terms, definitions and abbreviated terms

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

3.1
authorized person
person with authorization to access restricted lift areas [e.g. machinery spaces, lift well (hoistway), pit and LCU top] skilled and trained to work therein, for the purpose of inspecting, testing, repairing and maintaining the lift or for rescuing users from a stalled load-carrying unit (LCU)

3.2
cause
circumstance, condition, event, or action that in a hazardous situation contributes to the production of an effect

[SOURCE: ISO 14798, definition 2.1]

3.3
counterweight
mass that contributes traction in the case of a traction lift, or mass that saves energy by balancing all or part of the mass of the load-carrying unit (LCU) (car) and the rated load

3.4
door
⟨landing or load-carrying unit (LCU)⟩ mechanical device (including devices that partially or fully enclose the opening) used to secure an LCU or landing entrance

3.5
effect
result of a cause in the presence of a hazardous situation

[SOURCE: ISO 14798, definition 2.2]

3.6
electromagnetic compatibility
EMC
degree of immunity to incident electromagnetic radiation and level of emitted electromagnetic radiation of electrical apparatus

3.7
essential health and safety requirement
EHSR
requirement intended to eliminate or sufficiently mitigate the risk of harm to users, non-users and authorized persons using, or associated with, lifts

3.8
fully loaded load-carrying unit (LCU)
LCU (car) with its rated load

3.9
global essential safety requirement
GESR
globally agreed upon essential safety requirement

Note 1 to entry: See 4.3.3.

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3.10
harm
physical injury or damage to the health of people, or damage to property or the environment

[SOURCE: ISO 14798, definition 2.3 and ISO/IEC Guide 51:1999, definition 3.3]

3.11
harmful event
occurrence in which a hazardous situation results in harm

[SOURCE: ISO 14798, definition 2.4 and ISO/IEC Guide 51:1999, definition 3.4]

3.12
hazard
potential source of harm

[SOURCE: ISO 14798, definition 2.5 and ISO/IEC Guide 51:1999, definition 3.5]

3.13
hazardous situation
circumstance in which people, property or the environment are exposed to one or more hazards

[SOURCE: ISO 14798, definition 2.6 and ISO/IEC Guide 51:1999, definition 3.6]

3.14
hoistway
well
travel path(s) of the load-carrying unit (LCU) and related equipment plus the spaces below the lowest landing and above the highest landing

3.15
hoistway enclosure
well enclosure
fixed structural elements that isolate the well (hoistway) from all other areas or spaces

3.16
landing
floor, balcony or platform used to receive and discharge persons or goods (freight) from the load-carrying unit (LCU)

3.17
lift (GB)
elevator (US)
lifting appliance intended to transport persons with or without goods or freight by means of a power-operated load-carrying unit (LCU) that is guided by a fixed guiding system from one landing to another, at an angle of more than 75° to the horizontal

Note 1 to entry: This term does not include mobile or other working platforms or baskets, or lifting appliances used in the course of construction of buildings or structures.

Note 2 to entry: See ISO/TR 11071-1, Clause 2, for use of the term “lift” versus the term “elevator” in current national standards for lifts.

3.18
load-carrying unit
LCU
car
part of a lift designed to carry persons and/or other goods for the purpose of transportation

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3.19
maintenance
process of examination, lubrication, cleaning and adjustments of lift parts to ensure the safe and intended functioning of the lift and its components after the completion of the installation and throughout its life cycle

3.20
non-user
person in the vicinity of a lift but not intending to access or use the lift

3.21
overload
overloaded
load in the load-carrying unit (LCU) that exceeds the rated load of the lift

3.22
platform
part of the load-carrying unit (LCU) that accommodates persons and load for the purpose of transportation

3.23
protective measure
means used to reduce risk

[SOURCE: ISO 14798, definition 2.8 and ISO/IEC Guide 51:1999, definition 3.8]

Note 1 to entry: Protective measures include risk reduction by inherently safe design, protective devices, use of personal protective equipment, information for use and installation, and training.

3.24
rated load
load that the lift is designed and installed to transport

3.25
relative movement
situation where a lift component moves in the vicinity of another lift component that is stationary or that moves at a different speed or in a different direction

Note 1 to entry: This may also occur in a situation where a lift component moves in the vicinity of a structure where persons can be present.

EXAMPLE Building floor surrounding the lift well (hoistway).

3.26
risk
combination of the probability of occurrence of harm and the severity of that harm

[SOURCE: ISO 14798, definition 2.10 and ISO/IEC Guide 51:1999, definition 3.2]

3.27
risk analysis
systematic use of available information to identify hazards and to estimate the risk

[SOURCE: ISO 14798, definition 2.11 and ISO/IEC Guide 51:1999, definition 3.10]

3.28
risk assessment
overall process comprising a risk analysis and a risk evaluation

[SOURCE: ISO 14798, definition 2.12 and ISO/IEC Guide 51:1999, definition 3.12]

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3.29
risk evaluation
consideration of the risk analysis results to determine if the risk reduction is required

[SOURCE: ISO 14798, definition 2.13]

3.30
scenario
sequence of a hazardous situation, cause and effect

[SOURCE: ISO 14798, definition 2.14]

3.31
severity
level of potential harm

[SOURCE: ISO 14798, definition 2.15]

3.32
transportation
process in the course of which persons enter, or goods are moved, into a load-carrying unit (LCU), which is then lifted or lowered to another landing, where the person exits, or goods are removed from, the LCU

3.33
travel path
path and related space between the lift terminal landings within which an LCU travels

Note 1 to entry: For "space" above and below terminal landings, see definition 3.14 for "hoistway" or "well".

3.34
uncontrolled movement
situation where the load-carrying unit (LCU) travels at a speed that is beyond the control of the means designed and intended to control the LCU speed during the lift operation

EXAMPLE The LCU speed exceeds its designed speed or does not decelerate or stop as intended, due to failure of, or breakdown in, lift components, such as the speed control or brake system.

3.35
unintended movement
situation where the load-carrying unit (LCU) moves when, according to design of the lift, it was to remain stationary

EXAMPLE The LCU starts to move away from a landing while the users are entering or leaving the LCU, due to failure of, or breakdown in, lift components, such as the speed control or brake system.

3.36
user
person using the lift for the purpose of normal transportation, without any help or supervision, including a person carrying goods and a person using a specially dedicated operating system to transport goods or loads

Note 1 to entry: An example of use of a specially dedicated operating system is "independent service" for transport of hospital patients, whereby the operation of the lift is under the sole control of the patient's attendant.

3.37
vandalism
deliberate destruction of, or damage to, property for no obvious gain or reason

3.38
working area or space
area or space defined for use by authorized persons to perform maintenance, repair, inspection or testing of the lift

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4 Approach and methodology

4.1 Background

4.1.1 During the 1970s, the ISO 4190 series of documents were published, which specifies the building dimensions necessary to permit the installation of lifts. This series also specified criteria for the planning and selection of lifts and the standards for lift fittings.

4.1.2 In order to facilitate further standardization of lift installations and components, ISO/TC 178 carried out extensive comparisons of regional and national safety standards and codes for lifts. The results were published in the ISO/TR 11071 series of documents. These Technical Reports gave directions for possible harmonization of several specific design- and safety-related rules in regional and national standards. No agreement among the experts could be reached for global harmonization of most rules, mainly for the following reasons:

a) the compared standards and codes were based on different assumptions and experiences and written at different stages of industry development, without using a consistent methodology or consistent procedures, as recommended in ISO/IEC Guide 51; and

b) they were written in prescriptive rather than performance language.

4.1.3 It further became clear that prescriptive standards not only continually lag behind the development of lift technologies and the state of the art, but also present impediments to the progress and innovation of industry. Differences in regional and national safety requirements affecting lift designs also pose barriers to free trade. Therefore, a new approach to the development of lift standards affecting lift safety must be taken.

4.2 Approach

ISO/IEC Guide 51 has been taken into account as far as practicable at the time of drafting of this part of ISO 22559.

4.2.2 The intent was to develop EHSRs for lifts whereby the lift is defined in broad terms as a “unit” carrying load from one floor to another, without any design constraints such as those that are usually specified in the regional or national lift standards.

A load-carrying unit (LCU) of a lift in this part of ISO 22559 is not necessarily a “car” that consists of a platform with fully enclosed sides and ceiling. The space in which the unit travels is not necessarily a fully enclosed “well” or “hoistway” as these terms are defined in national standards.

4.2.3 By taking this approach and by using the systematic risk assessment process in accordance with ISO 14798, it was possible to establish EHSRs for lifts without imposing restrictions on the design of, or materials and technologies used in, the lifts.

4.3 Methodology

4.3.1 In order to involve experts from various parts of the world, three regional study groups were formed (North American, European and Asia-Pacific) with broad participation of local lift experts.

4.3.2 Following the risk assessment process set out in ISO/IEC Guide 51 and the methodology specified in ISO 14798 each study group

a) identified all safety risk scenarios, including hazardous situations and harmful events (causes and effects and possible resulting harm) that could arise at all stages and in all conditions of the operation and use of lifts,

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b) assessed the risk, and

c) formulated EHSRs that, when implemented, would mitigate the risks.

Table 1 gives examples of risk scenarios related to GESRs.

4.3.3 Reports on the assessment of all risk scenarios and essential safety requirements proposed by each study group were compared and debated within ISO/TC 178 before the final proposals for GESRs for lifts specified in Clause 6 were established.

Table 1 — Examples of risk scenarios related to GESRs

Risk scenarios **NOTE: Risk assessment of all scenarios concluded that all identified risks need mitigation**	**- Hazards** **- Persons exposed**	**Applicable GESR requiring implementation of protective measures**
EXAMPLE 1	Shearing, crushing or abrasion hazards, when:	**6.1.5 Hazards due to relative movement**
1.1 Users are on a moving LCU that has low or perforated guards on its sides. User extends a hand or protrudes a foot beyond the LCU perimeters; user's hand or foot engages with external lift objects and become sheared, crushed or cut.	1.1 persons inside the LCU	Users and non-users shall be protected from the effects of shearing, crushing or abrasion, or other injuries due to a) the relative movement of the LCU and external objects; and b) the relative movement of the lift equipment. NOTE 1: For authorized persons, see 6.5.9. NOTE 2: This GESR addresses the safety of persons located inside and outside the LCU.
1.2 Users are in the lift entrance area and enter the LCU when the door is closing. The doors contact the users who are entering the LCU. Persons are crushed or sheared or they are destabilized, possibly resulting in an injury due to a fall.	1.2 entering/exiting the LCU; or	
1.3 Non-users are at the floor area in the vicinity of the lift entrance or at the floor around the LCU travel path; enclosure around the LCU travel path is low in height or perforated. Person extends a hand or protrudes a foot towards the moving LCU or any other moving lift equipment in the travel path, which engages with the hand or foot, the person's hand or foot is sheared, crushed or cut.	1.3 located at the floor area in the vicinity of an operating lift	
EXAMPLE 2	**Falling into the lift well**	**6.2.1 Falling into the well (hoistway)**
2.1 There are no guards between the LCU travel path and the floors surrounding the travel path are high above the bottom of the well; a person is close to the well A person leans over the floor edge or the entrance opening sill. The person falls down the well (hoistway).	2.1 Persons close to unguarded well.	Means shall be provided to sufficiently mitigate the risk to users, non-users, and authorized persons of falling into the well (hoistway). NOTE: This GESR addresses the risk of falling into the well (hoistway) —from surrounding floors, and —from landing doors when the LCU is absent.
2.2 Guards in example 2.1 are provided but do not have adequate strength. A person leans against a guard The person breaks through the guard and fall down into the well (hoistway).	2.2 Persons inside LCU or close to the well, whose guard is not sufficiently strong.	
EXAMPLE 3	**Various hazards**	**6.1.3 Equipment inaccessible to users and non-users**

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Table 1 *(continued)*

Risk scenarios **NOTE: Risk assessment of all scenarios concluded that all identified risks need mitigation**	**- Hazards** **- Persons exposed**	**Applicable GESR requiring implementation of protective measures**
Users or non-users have access to lift machinery and/or the equipment installed to move or control the LCU. Persons inadvertently or deliberately come into contact with moving or rotating machinery or electrical equipment. This contact results in death or serious injury if the person is drawn into or comes into contact with the machinery; or the a person is electrocuted if he comes into contact with exposed electrical equipment.	Unauthorized persons in areas containing lift machinery or equipment	Equipment that is hazardous shall not be directly accessible to users and non-users. NOTE: Locations that are not accessible include the location behind the enclosure, a locked cover or door, or out-of-reach locations.
EXAMPLE 4 An authorized person is working on top of the LCU. The working space that does not have sufficient strength to support the authorized person and tools; the working surface collapses. The authorized person falls into the LCU sustaining serious injuries.	**Falling from working area** Authorized person in a designated working area.	**6.5.4 Strength of working areas** Means shall be provided to accommodate and support the mass of authorized person(s) and associated equipment in any designated working area(s). NOTE: The number of authorized persons and the equipment that they carry or use to fulfil the anticipated working activities should be determined. Those activities do not include major repairs when the working area needs to be enlarged and reinforced.

5 Understanding and implementing GESRs

5.1 Overall objective

5.1.1 Clause 6 contains a complete set of safety objectives for lifts in the form of global essential safety requirements (GESRs), which shall be taken into consideration when mitigating safety risks that lifts can present.

5.1.2 The objectives of the global essential safety requirements in Clause 6 are to:

a) introduce a universal approach to identifying and mitigating potential safety risks on new lift or lift component designs that use new technologies, materials or concepts that are not adequately addressed in existing standards, and

b) stimulate harmonization of current lift safety standards.

5.1.3 The GESRs contained in this part of ISO 22559 shall be followed wherever possible. However, given the present state of the art, the objectives that the GESRs specify are sometimes unattainable. In such cases, the lift or its components shall be designed and built in such a way as to approximate to those objectives to the greatest possible extent.

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5.1.4 A GESR states only the safety objective, or "what" shall be done or accomplished but not "how" to accomplish the objective. Therefore, in order to achieve the safety objective of a GESR, appropriate designs of lift components and functions shall be selected and their compliance with the GESR shall be verified. In other words, the ability of the selected components, functions or GSPs to eliminate or sufficiently mitigate the safety risks shall be demonstrated.

5.2 Use of GESRs

5.2.1 Basis

Each GESR specified in Clause 6 was established after performing the risk assessment of one or more "risk scenarios" that can result in harm to persons (see Table 1). Consequently, when assessing the safety of a lift or its components or functions, all risk scenarios shall be analysed and applicable GESRs shall be identified.

The risk assessment shall be carried out in accordance with ISO 14798.

5.2.2 Ways of using GESRs

5.2.2.1 With respect to a specific task affecting lift safety, such as designing a lift or its components, GESRs can be used in two ways:

— one can begin with the risk assessment of risk scenarios related to the task in order to identify the applicable GESRs as in 5.2.2.2; or

— one can begin with a review of all GESRs in order to identify those that could be applicable to the task, as in 5.2.2.3.

NOTE In addition to designing, tasks could include servicing of, or writing design-prescriptive safety standard for, lifts or components thereof.

5.2.2.2 When designing a lift or its component, a review of the intended use, foreseeable misuse (see 4.5.5.4 of ISO 14798) and the design shall be made, in which all possible risk scenarios are formulated, and risk assessment is performed, in order to find out which, if any, GESRs are applicable to the design. All risk scenarios that could occur during operation and use shall be considered, as well as during the maintenance or inspection of the lift.

The risk scenarios shall include specifications of all hazardous situations, combined with all harmful events (causes, effects and possible levels of harm). The risk analysis of a scenario shall be followed by the process of risk estimation and evaluation in accordance with the methodology specified in ISO 14798. As long as a risk is assessed as not sufficiently mitigated, the design will have to be continually improved until the applicable GESR has been fulfilled.

EXAMPLE By following this process, risk scenarios similar to those in Example 1.1 in Table 1 could be formulated and it could be concluded that there is a possibility of injury to persons exposed to shearing, crushing or abrasion hazards. The assessment of the risk will indicate that the risk needs further mitigation, which shall be achieved by changing the design. If it is not feasible, further mitigation shall be achieved by implementing other protective measures in order to comply with 6.1.5 in Clause 6.

NOTE 1 For practical use of GESRs, see 5.3.

NOTE 2 Guidance and examples for use of GESRs are given in notes in Clause 6, following each GESR. They should assist in understanding of the intent and use of GESRs.

5.2.2.3 The process can start with a review of GESRs. In this case, one considers the design, the lift or its components with intent of identifying those GESRs that could be applicable to the design of the lift or its components. Compliance with each identified GESRs shall be assessed. If the compliance is not self-evident, risk assessment shall be completed to demonstrate compliance.

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EXAMPLE In the case of the GESR in 6.1.5 in Example 1 in Table 1, one would examine the lift design or the installed lift to determine whether any person travelling in the LCU, entering or exiting the LCU, being around the lift travel path or well (hoistway), or in any similar situation could be exposed to shearing, crushing, abrasion or similar hazard that can cause harm.

5.2.3 Applicability of GESRs

When analysing the safety of a lift design or component, or when writing a design prescriptive requirement or standard, the applicability of all GESRs shall be determined. Only systematic descriptions of all risk scenarios combined with the risk assessment of all scenarios (see ISO 14798) would determine applicability of individual GESRs.

NOTE The GESR in 6.1.12, related to effects of earthquake on lifts, and the GESR in 6.4.13, related to the risk of an LCU being affected by flood, are examples of GESRs that are not applicable to every lift.

5.2.4 Safety objectives of GESRs

5.2.4.1 GESRs are not "protective measures" in terms of ISO 14798. A GESR states only the safety objective; it does not specify how to achieve the objective. Therefore, when designing a lift, appropriate components and functions shall be selected in terms of parameters such as size, dimensions, strength, force, energy, material, acceleration, reliability of performance of safety-related parts, etc., as applicable, and their ability to eliminate or sufficiently mitigate risks to achieve compliance with the objective specified in the GESR shall be established.

NOTE For more details on safety parameters in relation to GESRs see ISO/TS 22559-2.

5.2.4.2 Table 1 contains examples that illustrate the method described in 5.2.2.2. In the case of Example 1 of Table 1, in order to eliminate or mitigate the risks to persons inside the LCU, in the lift entrance area and in the area around the LCU travel path, one would have to determine:

a) the minimum height of the guards or walls on the sides of the LCU platform to avoid the shearing, crushing and abrasion hazards;

b) the maximum size of perforations (openings) in the LCU guards or walls, if any;

c) the maximum permissible impact, force, speed, kinetic energy, if any, of the door when closing on the person;

d) the minimum height of the guards or wall separating the LCU travel path and other moving components from the lift landing and floor area around the lift; and

e) the maximum perforation (openings) in the guards or walls around the travel path, if any.

NOTE 1 There are additional GESRs applicable to the guards on the LCU sides (see 6.4.4) and the LCU travel path or well (hoistway) sides (see 6.2.1 in Example 2 of Table 1); they are related to the risk of persons falling into the travel path from the LCU and from the floors around the travel path.

NOTE 2 For illustration of the use of method described in 5.2.2.3 see cases 3 and 4 in Table 1 of ISO/TS 22559-2.

5.2.4.3 When assessing the risk of a lift system, it is recommended that the lift be divided into subsystems and all risk scenarios be formulated and all risks be assessed in relation to one subsystem at a time. However, one GESR can be applicable to more than one subsystem (see Annex A).

5.2.5 Verification of compliance

In order to establish the ability of a selected lift component or function to eliminate or sufficiently mitigate a risk, as required in 5.2.4, risk assessment in accordance with ISO 14798 shall be carried out.

Furthermore, a component can be assessed as being able to eliminate or sufficiently mitigate a risk, but the same component can create a new hazard or the component can incorporate elements that could

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fail and make the protective function of the whole component void. For that reason, the reliability of components, built-in elements and functions to perform as intended shall be established through the risk analysis and assessment process.

EXAMPLE A failure of a single solid state or software element in the LCU speed-control components, which are provided for compliance with the GESR in 6.4.6, can make the component non-functional, allowing the LCU to move out of control.

5.3 Use of this part of ISO 22559

5.3.1 Users

This part of the ISO 22559 series provides a uniform process for assessing the safety of lifts. The GESRs are intended for use by the following:

a) writers of safety or safety-related standards for lifts; the type of the standard may be a product safety standard or a product standard containing safety aspects as defined in ISO/IEC Guide 51:1999, 7.1;

b) lift designers, manufacturers and installers, and maintenance, repair and service organizations;

c) independent (third-party) conformity assessment bodies; and

d) inspection and testing bodies and similar organizations.

5.3.2 Standards writers

5.3.2.1 Standards writers (e.g. standards writing committees) should use GESRs when

a) reviewing, updating or revising existing standards; and

b) formulating new standards, including those related to new innovative designs and concepts of lifts or their components not previously covered in published standards.

5.3.2.2 When reviewing, updating or revising existing standards, standards writers should refer to the applicable GESRs to verify that the existing standards provide sufficient rules to ensure full compliance with the safety objectives set in the GESRs.

5.3.2.3 New standards related to lift safety can be performance-type (goal-oriented) or design-prescriptive type standards. In either case, each GESR should be considered, adopted or referenced and used as a basis when specifying safety requirements.

EXAMPLE The GESR in 6.4.2 states "*means shall be provided to support the fully loaded LCU and reasonably foreseeable overload*". Based on this GESR, which addresses the means supporting the LCU (e.g. hydraulic direct-plunger drive) or the means on which the LCU is suspended (e.g. the ropes in traction-type drive), the standards writers should

— in the case of performance-type standards, establish more specific performance requirements for the LCU support or suspension means, such as the minimum working life, resistance to environmental conditions, inspection criteria,

— in the case of a design-prescriptive-type standard, specify design requirements, such as the minimum number of suspension ropes, minimum rope diameter, minimum safety factor, minimum drive-sheave to rope ratio.

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5.3.3 Designers, manufacturers, installers, and maintenance, repair and service organizations

5.3.3.1 Lift systems, lift components and lift functions

Lift systems, lift components and lift functions shall be designed, manufactured, installed, adjusted and maintained

a) in accordance with locally adopted lift standards or other applicable standards, intended to meet the protection level required by the GESRs;

b) in accordance with this part of ISO 22559, in which case the lift systems, selected lift components and lift functions shall be proved to meet the safety objective of the GESRs through the risk assessment process in accordance with ISO 14798; or

c) in accordance with a combination of a) and b) and, if necessary, shall be tested, certified and assessed for conformity with applicable regional or local regulations.

5.3.3.2 Proof of compliance

5.3.3.2.1 Compliance with 5.3.3.1 a) is achieved by meeting all of the requirements of a standard that is aligned with the GESRs and other regulations applicable to the jurisdiction in which the lift is to be operated (e.g. local fire standards, building standards).

5.3.3.2.2 Compliance with 5.3.3.1 b) is achieved by identifying all risk scenarios (see 5.2.2) related to the particular lift design and by conducting risk assessment using the methodology of ISO 14798, in order to demonstrate that the requirements specified in all applicable GESRs have been complied with, and their safety objectives achieved.

NOTE According to ISO 14798, a balanced team of experts who have experience in the design, manufacture, installation, maintenance, repair and inspection of lifts should conduct the risk assessment. The team should be led by a facilitator who is well versed and experienced in lift technology and in the use of ISO 14798. The results of the study should be documented. Any identified risks should be sufficiently mitigated. This approach is particularly useful for innovative products that have not been covered by existing design-prescriptive standards.

5.3.3.2.3 The approach in 5.3.3.1 c) applies to lifts that meet most requirements of a standard aligned with the GESRs, but that have certain innovative features not specifically covered by the standard. Such cases may be handled as follows:

a) Identify all areas where the lift does not comply with specific prescriptive requirements of the standard.

b) Identify specific requirements of the standard that the innovative lift features do not meet. In addition, identify all GESRs related to the requirements that the lift, in combination with the innovative features, cannot meet.

c) Conduct risk assessment, as described in 5.3.3.2.2, of the aspects, areas or features of the lift that are expected to meet the GESRs identified in b). Any identified risk shall be sufficiently mitigated so as to achieve a safety level that is at least equivalent to that required by the standard.

5.3.4 Inspection and testing bodies

Where the inspection and testing procedure is not specified in the applicable standards, inspectors shall use this part of ISO 22559 when

a) verifying that applicable GESRs have been taken into account by the designer, manufacturer, installer or maintainer;

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b) verifying the suitability of the inspection and testing procedures proposed in the designer's or manufacturer's documentation, or when establishing their own procedure by using GESRs and analysing related risk scenarios; and

c) assessing the inspection and test results.

For this purpose a procedure similar to that described in 5.2 and 5.3.3 shall be followed.

NOTE Refer to Part 3 and 4 of the ISO 22559 series, for general requirements for certification of conformity.

6 Global essential safety requirements (GESRs)

A lift shall comply with the applicable safety requirements specified in this clause.

NOTE 1 The essential safety requirements are grouped in this clause on the basis of the locations where a person could be exposed to a hazard, such as the space adjacent to lift (see 6.2), entrance and egress areas (6.3), space inside the LCU (6.4) and working areas (6.5). The common GESRs are applicable to more than one location (6.1).

NOTE 2 Annex A is provided to give an overview of the GESRs that are potentially applicable to therein specified lift subsystems.

6.1 Common GESRs related to persons at different locations

6.1.1 Supports for lift equipment

The means used to support and secure the lift equipment shall be capable of sustaining all loads and forces (including impact forces) imposed during normal and emergency operation.

NOTE The forces referred to in 6.1.1 are those that result from the intended use, and reasonably foreseeable overload, of the lift during normal operation (loading, unloading, acceleration, braking, etc.) and emergency operation (safety gear operation, buffer impact, etc.).

6.1.2 Lift maintenance and repair instructions

Where maintenance or repair is required to ensure continued safety, appropriate instructions shall be provided emphasizing that suitably trained personnel perform any required work.

NOTE This applies to the lifts and lift components and functions that are subject to wear and tear, not to those designed for maintenance-free operation. Adequate maintenance is a key element in keeping the lift in safe operating condition. This GESR aims to prevent the performance of maintenance and repair work by incompetent persons.

6.1.3 Equipment inaccessible to users and non-users

Equipment that is hazardous shall not be directly accessible to users and non-users.

NOTE Locations that are not accessible include the location behind the enclosure, a locked cover or door, or out-of-reach locations.

6.1.4 Floors of the LCU and working areas

The floors of the LCU and standing areas of workplaces shall minimize the risk of tripping and slipping.

NOTE LCU and working area floors should be reasonably level, which means that they do not present a perceptible slope. When considering non-slip materials, attention should be paid to the fact that the roughness of a material does not remain consistent over time and can vary depending on housekeeping operations (e.g. cleaning).

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6.1.5 Hazards due to relative movement

Users and non-users shall be protected from the effects of shearing, crushing or abrasion, or other injuries due to

a) relative movement of the LCU and external objects; and

b) relative movement of the lift equipment.

NOTE 1 For authorized persons, see 6.5.9.

NOTE 2 This GESR addresses the safety of persons located inside and outside the LCU.

6.1.6 Locking landing doors and closing LCU doors

Any movement of the LCU that is hazardous to persons shall be stopped if any well (hoistway) door is open or unlocked or the LCU door is not closed.

NOTE 1 Well (hoistway) doors include lift landing doors, as well as auxiliary well (hoistway) doors or covers intended for use by authorized persons only (e.g. evacuation doors).

NOTE 2 Levelling and re-levelling (as well as docking or trucking operations) are not considered to be hazardous movements.

NOTE 3 See also GESR 6.4.9.

6.1.7 Evacuation

Means and procedures shall be provided to enable trapped users or authorized personnel to be safely released and evacuated.

NOTE The lift system should have means that would permit the movement of the LCU, under control of an authorized person, to the point of an evacuation opening. Alternative means (e.g. two-way communication means) that do not require movement of the LCU are not excluded. Extreme cases of LCU blockage (due to safety gear setting, material damaged due to earthquakes, etc.) can require external means, appropriate instructions and tooling.

6.1.8 Sharp edges

Means shall be provided to sufficiently mitigate the risk to users and non-users of exposure to sharp edges.

NOTE For authorized persons, see 6.5.

6.1.9 Hazards arising from the risk of electrical shock

Where electricity is provided, means shall be provided to sufficiently mitigate the risk to users and non-users of exposure to electrical shock.

NOTE For authorized persons, see 6.5.

6.1.10 Electromagnetic compatibility

The safe operation of a lift shall not be influenced by electromagnetic interferences (EMC). The electromagnetic emission of the lift shall be restricted to specified limits.

The immunity should be sufficient to prevent unsafe situations if the lift is submitted to foreseeable radiation. “Immunity” includes immunity to internal influences (self-generated radiation) and immunity to external influences. The tolerable amount of electromagnetic emission depends on the environment in which the lift is operating and is defined in specific standards.

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6.1.11 Illumination of the LCU and the landings

The LCU and the landings shall be provided with adequate illumination.

NOTE Adequate illumination means that the light intensity is sufficient for safe access and operation of the lift control devices, including

— detecting levelling inaccuracy,

— operating landing and LCU controls, and

— minimizing panic by users in the case of power outage.

6.1.12 Effects of earthquakes

In areas subject to earthquake, means shall be provided to minimize the risk to users, when inside the LCU, and authorized persons, of the foreseeable effects of earthquakes on the lift equipment.

The effects on the safety of users and authorized persons need to be considered at all stages: during the earthquake (as much as possible), during rescue from a stalled LCU, and when the lift is returned to normal operation. This assumes that there is no major building failure.

6.1.13 Hazardous materials

The characteristics and quantity of material used for the construction of the lift shall not lead to hazardous situations.

NOTE Hazardous situations for users, non-users and authorized persons refer to toxicity, fumes, exposure to chemicals, flammability, exposure to asbestos, etc.

6.1.14 Environmental influences

Users and authorized persons shall be protected from environmental influences.

Environmental influences include the foreseeable weather and operating conditions of the area where the lift is installed. Users and authorized persons should be protected against direct exposure to the influences (e.g. by heating or cooling the LCU or working space). In addition, there should be adequate protection of safety-related lift elements that are susceptible to weather and operating conditions (e.g. temperature limitations in the machinery space).

6.2 GESRs related to persons adjacent to the lift

6.2.1 Falling into the well (hoistway)

Means shall be provided to sufficiently mitigate the risk of users, non-users, and authorized persons falling into the well (hoistway).

NOTE This GESR addresses the risk of falling into the well (hoistway)

— from surrounding floors, and

— from landing doors when the LCU is absent.

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6.3 GESRs related to persons at entrances

6.3.1 Access and egress

Safe means of access and egress shall be provided to the LCU at landings.

NOTE This is applicable to the process of entering and leaving the LCU during normal use of the lift. It suggests that adequate spaces, dimensions, instructions and correct relative positioning of the LCU at the landing should be provided.

6.3.2 Horizontal sill-to-sill gap

The horizontal gap between the sill of the LCU and that of the landings shall be limited.

This measurement is taken perpendicular to the moving direction of users. Children who are able to walk should be considered. The sizes of wheelchair wheels and walking aids should also be taken into account.

6.3.3 Alignment of the LCU and the landing

When users enter or exit the LCU, its platform and the landing floor shall be substantially aligned.

The step caused by the variation of the LCU load should be limited to avoid stumbling on the part of users; the step should be small enough to allow safe access for all users, including persons with impaired mobility.

6.3.4 Self-evacuation from the LCU

Self-evacuation of users shall be possible only when the LCU is at or near a landing.

NOTE "At a landing" means that: the LCU is not too far away from the landing and that the risk of tripping or falling is marginal. "Near a landing" means that: the gaps between the LCU and landing enables users to pass through and not to fall into the travel path.

6.3.5 Gap between the landing doors and the LCU doors

The gap between the landing doors and the LCU doors shall not allow the presence of users.

NOTE This GESR aims to prevent persons, including children, from entering sideways into the space between the LCU and landing doors. This situation can arise when there are:

— multiple panels on the LCU and landing doors, with loose synchronization, and

— combinations of the hinged landing doors and sliding LCU doors.

6.3.6 Means to reopen doors when the LCU is at the landing

Means shall be provided to reopen the LCU and the landing doors, if their closing is obstructed when the LCU is at the landing.

Obstacles interfering with the door movement should be detected. The movement of the doors and the LCU should be prevented until the obstacle is removed. Examples of obstacles are parts of user's body, trolleys, wheelchairs, etc.

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6.4 GESRs related to persons in the LCU

6.4.1 Strength and size

The LCU shall accommodate and support the rated load and foreseeable overload.

NOTE This GESR primarily addresses the transportation of people. "Accommodate" in this context means to provide space (volume) for the intended number of users, considering the dimensions and weight of persons. The foreseeable overload, in terms of users means:

— load normally carried by users (e.g. briefcase, luggage, but without tools such as trolleys),

— coincidence of users taller or heavier than average, and

— more users than the LCU is designed for.

6.4.2 LCU support/suspension

Means shall be provided to support the fully loaded LCU and a reasonably foreseeable overload.

NOTE This addresses the strength and failure of the suspension means when the LCU is loaded with its rated load. It is, however, understood that the integrity of the lift would be maintained if the foreseeable overload condition were reached. The rated performances, however, can be affected if the rated load is exceeded.

6.4.3 Overloaded LCU

Means shall be provided to prevent an overloaded LCU from attempting to move away from a landing.

NOTE In this context "to prevent from attempting to move away from a landing" means that the drive system of hoisting machine will not be activated. When the overload condition is detected, no command will be processed. This does not cover ropes stretch, loss of traction, etc. It is, however, understood that the integrity of the lift would be maintained if the foreseeable overload condition were reached.

6.4.4 Falling from the LCU

Means shall be provided to prevent users from falling from the LCU.

NOTE The requirement could be achieved by guards, barriers or walls around the perimeter of the LCU platform. Protection at any opening between the LCU and the well walls that a user could pass through is also required by this GESR, typically the gap between the edges of the LCU and the landing door panels.

6.4.5 LCU travel path limits

The vertical travel of the LCU shall be limited to prevent the LCU from uncontrolled running beyond the travel path.

Means should be provided for safe stopping of the LCU at the end of the travel path. Safe stopping involves no damage to the equipment and no harm to passengers in the LCU. The "end of travel path" includes a certain overrun from the position of normal terminal landings.

6.4.6 Uncontrolled movement of the LCU

Means shall be provided to limit uncontrolled movement of the LCU.

NOTE This GESR aims to protect against the effects resulting from the movement of LCU at a speed exceeding the designed speed and also to prevent effects resulting from unexpected starts of LCU movement. Examples of such occurrences are: travel of the LCU towards terminal landings at speed exceeding its rated speed, or movement of the LCU away from a landing when doors are open and users are entering or exiting. An example of the foreseeable failures that can cause such occurrences is the breakdown in lift components such as speed control, or drive or braking system.

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6.4.7 LCU collision with objects in or beyond the travel path

Means shall be provided to avoid collision of the LCU with any equipment in the travel path that could cause injuries to users.

Means should be provided to prevent the LCU from colliding with any equipment in the well (hoistway). There should be LCU guards or enclosures of adequate strength to avoid dangerous deflection due to horizontal forces. Deflection and deformation of the guards or enclosure should be limited so that they do not create hazardous situation. This GESR also addresses cases where the LCU or counterweight reaches the structural terminals of the well (hoistway). Eventual impact should be buffered so that it is not harmful.

6.4.8 LCU horizontal or rotational motion

Horizontal or rotational motion of the LCU shall be limited to sufficiently mitigate the risk of injury to users and authorized persons.

NOTE Horizontal or rotational free movement of the LCU is to be limited to prevent users from losing balance and falling.

6.4.9 Change of speed or acceleration

Means shall be provided to ensure that any change of speed or acceleration of the LCU shall be limited to minimize the risk of injury to the users.

NOTE This covers changes of speed and acceleration of the LCU for both normal and emergency operations. In the case of an extreme emergency operation (such as stopping a free-falling LCU), the possibility of minor injuries could be tolerated, due to the extremely remote probability of such an occurrence.

6.4.10 Objects falling on the LCU

LCU users shall be protected from falling objects.

NOTE Falling objects are those that can be reasonably expected as a result of misbehaviour, carrying tools or similar activities. Open well (hoistway) installations can also be subject to acts of vandalism (objects thrown from outside). Falling water is not addressed by this GESR.

6.4.11 LCU ventilation

Adequate ventilation shall be provided to the LCU.

NOTE The intent of this GESR is to provide trapped passengers with sufficient air renewal. It is accepted that normal operation does not require particular measures due to the air exchange from door movement and the fact that journeys are relatively short.

6.4.12 Fire/smoke in the LCU

The interior of the LCU shall be constructed of materials that are fire-resistant and that develop a low level of smoke.

NOTE The nature and quantity of the materials used in the LCU (e.g. decorations) can be a very serious source of harm during fire. Factors that need to be considered include the fire resistance, toxicity, etc., of materials. It is, however, understood that parts made of materials that do not strictly meet this specification may be used in small quantities inside the LCU (e.g. control buttons and lighting diffusers).

6.4.13 LCU in flooded areas

Where a risk exists that the LCU could descend into a flooded area, means shall be provided to detect and prevent descent into a flooded area.

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6.4.14 Stopping means inside the LCU

Means, located inside the LCU, of intentionally interrupting the movement of the LCU by the user shall only be allowed, if necessary, on lifts with a partially enclosed LCU or lifts for special applications.

NOTE An example of a lift for special application is a goods/passenger lift (freight elevator) with docking (trucking) operation.

6.4.15 Landing and controls indication

Means shall be provided to identify landings and controls for the users in the LCU.

NOTE Ignorance of the controls or one's location can create confusion and unpredictable reactions. In normal conditions, this is probably not a safety issue but it can be significant in emergency situations (fire fighting, etc.).

6.5 GESRs related to persons in working areas

6.5.1 Working area(s) or space(s)

Adequate and safe working area(s) or space(s) shall be provided.

NOTE "Adequate" takes into account the ergonomic principles related to the tasks to be performed.

6.5.2 Accessible equipment

All lift equipment requiring maintenance or repair shall be safely accessible to authorized persons.

If the lift elements requiring maintenance or repair are not accessible, they can be neglected, which would render the use of the lift unsafe. The elements of the lift should be designed taking this into account. "Safely" indicates safe and easy access for maintenance and repair operations.

6.5.3 Access to and egress from working spaces in the well (hoistway)

Access to and egress from working spaces in the well (hoistway) shall be safe.

NOTE Safe egress may be achieved with assistance.

6.5.4 Strength of working area(s)

Means shall be provided to accommodate and support the mass of authorized person(s) and associated equipment in any designated working area(s).

The number of authorized persons and the equipment that they carry or use to fulfil the anticipated working activities should be determined. Those activities do not include major repairs when the working area needs to be enlarged and reinforced.

6.5.5 Restrictions on equipment in lift spaces

Only equipment related to the lift installation or its protection shall be placed in the space containing the lift equipment.

NOTE The intent is to exclude non-authorized personnel (and personnel not acquainted with the dangers of lift operation) from access to spaces needed for the location of the lift equipment [the machine room and well (hoistway)] and to prevent the use of these spaces for storage.

6.5.6 Falling from working areas

Means shall be provided to sufficiently mitigate the risk to authorized person of falling from any working area.

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Working places in the well (hoistway), such as the LCU roof, temporary platforms, should be equipped with protective devices (e.g. balustrades) if there is a risk of falling [e.g. a gap between the LCU roof and the well (hoistway) wall].

The means of prevention (e.g. balustrade) should have sufficient height and strength.

6.5.7 LCU movement under control of an authorized person

Only authorized persons shall be provided with means to prevent or to enable the movement of the LCU when they are in the travel path. When an authorized person is within reach of unprotected moving parts of the lift, that person shall be able to prevent or activate movement of the lift equipment.

NOTE Equipment includes all possible moving parts, such as the LCU, counterweight.

6.5.8 Uncontrolled or unintended equipment movement inside the well (hoistway)

Means shall be provided to protect authorized persons from the effects related to uncontrolled or unintended movement of equipment inside the well (hoistway). Any acceleration or deceleration to which an authorized person is subjected as a result of uncontrolled or unintended movement shall be limited to sufficiently mitigate the risk of harm.

If the contact with lift components whose uncontrolled or unintended movement can be harmful, authorized persons should be provided with means to mitigate such risk, such as controls over equipment movement or permanently available screens that separate the moving parts from the working area to guard against accidental contact. “Equipment” includes all possible moving parts, such as the LCU, counterweight.

6.5.9 Means of protection from various hazards

Means shall be provided to adequately protect an authorized person, in working spaces, from the effects of shearing, crushing, abrasion, laceration, high temperature, entrapment, etc.

NOTE List of hazards is not all inclusive. Specific hazards need to be considered according to the circumstances. See also 6.1.4.

6.5.10 Falling objects in the well (hoistway)

While in the well (hoistway), authorized persons shall be adequately protected from falling objects.

NOTE Objects that can fall because of an accidental reaction on the part of a person, e.g. hand-held tools, loose material placed on LCU (car) roof, etc.

6.5.11 Electric shock in working spaces

Equipment shall be designed and installed to minimize harm to authorized persons due to the effects of electricity.

NOTE Lift service sometimes requires that authorized people access live parts of electrical equipment.

6.5.12 Illumination of working spaces

All working spaces and access thereto shall be provided with adequate illumination for the use of authorized persons.

“Adequate illumination” means that the light intensity is sufficient for safe access and for performance of any maintenance or repair operation of the lift equipment. Illumination may be switched off in the absence of authorized persons. Emergency lighting should be provided in places where movement of authorized persons in darkness is dangerous.

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Annex A
(informative)

Overview of GESRs in relation to lift subsystems

A.1 General

Global essential safety requirements [GESRs] are specified in Clause 6 and are grouped according to the lift locations where a person can be exposed to a hazard, a hazardous situation or event. This annex is provided to assist users who view a lift as a combination of clearly distinguishable subsystems. Table A.1 gives an overview of all GESRs listed in Clause 6 in relation to lift subsystems.

Table A.1 — Cross-referencing of GESRs in Clause 6 and lift subsystems

GESR No.	Global essential safety requirement in Clause 6	Lift subsystem (see A.2 for symbols)									
		B	C	E	G	H	L	M	Sf	Sp	W
6.1	**Common GESRs related to persons at different locations**										
6.1.1	**Supports for lift equipment** The means used to support and secure the lift equipment shall be capable of sustaining all loads and forces (including impact forces) imposed during normal and emergency operation.	X			O	O				O	O
6.1.2	**Lift maintenance and repair instructions** Where maintenance or repair is required to ensure continued safety, appropriate instructions shall be provided emphasizing that suitably trained personnel perform any required work.	O	O	O	O	O	O	O	O	O	O
6.1.3	**Equipment inaccessible to users and non-users** Equipment that is hazardous shall not be directly accessible to users and non-users.	O	O	O		X	O	O	O		O
6.1.4	**Floors of the LCU and working areas** The floors of the LCU and standing areas of workplaces shall minimize the risk of tripping and slipping.						X				X
6.1.5	**Hazards due to relative movement** Users and non-users shall be protected from the effects of shearing, crushing or abrasion, or other injuries due to a) the relative movement of the LCU and external objects; and b) the relative movement of the lift equipment.		O	X	O	X	X				
6.1.6	**Locking landing doors and closing of LCU doors** Any movement of the LCU that is hazardous to persons shall be stopped if any well (hoistway) door is open or unlocked or the LCU door is not closed.		O	O			O	O	X		

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Table A.1 *(continued)*

GESR No.	Global essential safety requirement in Clause 6	Lift subsystem (see A.2 for symbols)									
		B	C	E	G	H	L	M	Sf	Sp	W
6.1.7	**Evacuation** Means and procedures shall be provided to enable trapped users or authorized personnel to be safely released and evacuated.	O	O	X		O	X	O	O		X
6.1.8	**Sharp edges** Means shall be provided to sufficiently mitigate the risk to users and non-users of exposure to sharp edges.			X		O	X				
6.1.9	**Hazards arising from the risk of electrical shock** Where electricity is provided, means shall be provided to sufficiently mitigate the risk to users and non-users of exposure to electrical shock.		X	O			O		O		
6.1.10	**Electromagnetic compatibility** The safe operation of a lift shall not be influenced by electromagnetic interferences (EMC). The electromagnetic emission of the lift shall be restricted to specified limits.		X						O		O
6.1.11	**Illumination of the LCU and the landings** The LCU and the landings shall be provided with adequate illumination during use.	O		X			X				
6.1.12	**Effects of earthquakes** In areas subject to earthquake, means shall be provided to minimize the risk to users, when inside the LCU, and authorized persons, of the foreseeable effects of earthquakes on the lift equipment.	O	X		O	O	X	O	O	O	X
6.1.13	**Hazardous materials** The characteristics and quantity of material used for the construction of the lift shall not lead to hazardous situations.	O		O		X	X				X
6.1.14	**Environmental influences** Users and authorized persons shall be protected from environmental influences.	O	O			O	X		O		X
6.2	**GESRs related to areas adjacent to the lift**										
6.2.1	**Falling into the well (hoistway)** Means shall be provided to sufficiently mitigate the risk to users, non-users, and authorized persons of falling into the well (hoistway).	O		X		X			O		X
6.3	**GESRs related to persons at the entrances**										
6.3.1	**Access and egress** Safe means of access and egress shall be provided to the LCU at landings.	O	O	X			X		O		
6.3.2	**Horizontal sill-to-sill gap** The horizontal gap between the sill of the LCU and that of the landings shall be limited.			X	O		X				
6.3.3	**Alignment of the LCU and the landing** When users enter or exit the LCU, its platform and the landing floor shall be substantially aligned.		X	O			O	O			

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Table A.1 *(continued)*

GESR No.	Global essential safety requirement in Clause 6	Lift subsystem (see A.2 for symbols)									
		B	C	E	G	H	L	M	Sf	Sp	W
6.3.4	**Self-evacuation from the LCU** Self-evacuation of users shall be possible only when the LCU is at or near a landing.		X	O		O	X		O		
6.3.5	**Gap between the landing doors and the LCU doors** The gap between the landing doors and the LCU doors shall not allow the presence of users.			X			X				
6.3.6	**Means to reopen doors when the LCU is at the landing** Means shall be provided to reopen the LCU and the landing doors, if their closing is obstructed when the LCU is at the landing.		X	O			O		X		
6.4	**GESRs related to persons in the LCU**										
6.4.1	**Size and strength** The LCU shall accommodate and support the rated load and foreseeable overload.				O		X		O		
6.4.2	**LCU support/suspension** Means shall be provided to support the fully loaded LCU and reasonably foreseeable overload.				O		X	O	O	X	
6.4.3	**Overloaded LCU** Means shall be provided to prevent an overloaded LCU from attempting to move away from a landing.		X				X	O	O		
6.4.4	**Falling from the LCU** Means shall be provided to prevent users from falling from the LCU.						X				
6.4.5	**LCU travel path limits** The vertical travel of the LCU shall be limited to prevent the LCU from uncontrolled running beyond the travel path.		X		X		O	O	X	O	
6.4.6	**Uncontrolled movement of the LCU** Means shall be provided to limit uncontrolled movement of the LCU.		X	O			O	X	X		
6.4.7	**LCU collision with objects in or beyond the travel path** Means shall be provided to avoid collision of the LCU with any equipment in the travel path that could cause injuries to users.		O		O	O	X		X	O	
6.4.8	**LCU horizontal or rotational motion** Horizontal or rotational motion of the LCU shall be limited to sufficiently mitigate the risk of injury to users and authorized persons.	O	O		X	O	X				O
6.4.9	**Change of speed or acceleration** Means shall be provided to ensure that any change of speed or acceleration of the LCU shall be limited to minimize the risk of injury to the users.		X					O	X		
6.4.10	**Objects falling on LCU** LCU users shall be protected from falling objects.	O				O	X				—

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Table A.1 *(continued)*

GESR No.	Global essential safety requirement in Clause 6	Lift subsystem (see A.2 for symbols)									
		B	C	E	G	H	L	M	Sf	Sp	W
6.4.11	**LCU ventilation** Adequate ventilation shall be provided to the LCU.		O			O	X				
6.4.12	**Fire/smoke in the LCU** The interior of the LCU shall be constructed of materials that are fire-resistant and that develop low level of smoke.						X				
6.4.13	**LCU in flooded areas** Where there is a risk that the LCU could descend into a flooded area, means shall be provided to detect and prevent descent into a flooded area.	O	X				O		O		
6.4.14	**Stopping means inside the LCU** Means, located inside the LCU, of intentionally interrupting the movement of the LCU by the user shall only be allowed, if necessary, on lifts with a partially enclosed LCU or lifts for special applications.		X				X		O		
6.4.15	**Landing and controls indication** Means shall be provided to identify landings and controls for the users in the LCU.		X	X			X				
6.5	**GESRs related to persons at working areas**										
6.5.1	**Working area(s) or space(s)** Adequate and safe working area(s) or space(s) shall be provided.	O				O					X
6.5.2	**Accessible equipment** All lift equipment requiring maintenance or repair shall be safely accessible to authorized persons.		O	O	O	O	O	O	O	O	X
6.5.3	**Access to and egress from working spaces in the well (hoistway)** Access to and egress from working spaces in the well (hoistway) shall be safe.	O	O	O		O	O				X
6.5.4	**Strength of working area(s)** Means shall be provided to accommodate and support the mass of authorized person(s) and associated equipment in any designated working area(s).	O				O	O				X
6.5.5	**Restrictions on equipment in lift spaces** Only equipment related to the lift installation or its protection shall be placed in the space containing the lift equipment.	O				O	O				X
6.5.6	**Falling from working areas** Means shall be provided to sufficiently mitigate the risk to authorized persons of falling from any working area.			O		O	O				X

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Table A.1 *(continued)*

GESR No.	Global essential safety requirement in Clause 6	Lift subsystem (see A.2 for symbols)									
		B	C	E	G	H	L	M	Sf	Sp	W
6.5.7	**LCU movement under control of an authorized person** Only authorized persons shall be provided with means to prevent or to enable the movement of the LCU when they are in the travel path. When an authorized person is within reach of unprotected moving parts of the lift, that person shall be able to prevent or activate movement of the lift equipment.		X			O	O		O		X
6.5.8	**Uncontrolled or unintended equipment movement inside the well (hoistway)** Means shall be provided to protect authorized persons against effects related to uncontrolled or unintended movement of equipment inside the well (hoistway). Any acceleration or deceleration to which an authorized person is subjected as a result of uncontrolled or unintended movement shall be limited to sufficiently mitigate the risk of harm.		X			O	O		O		X
6.5.9	**Means of protection from various hazards** Means shall be provided to adequately protect an authorized person, in working spaces, from the effects of shearing, crushing, abrasion, laceration, high temperature, entrapment, etc.	O	O	O	O	O	O	O	O	O	X
6.5.10	**Falling objects in well (hoistway)** While in the well (hoistway), authorized persons shall be adequately protected from falling objects.	O				O	O				X
6.5.11	**Electric shock in working spaces** Equipment shall be designed and installed to minimize harm to authorized persons due to the effects of electricity.		X	O		O	O	O	O		X
6.5.12	**Illumination of working spaces** All working spaces and access thereto shall be provided with adequate illumination for the use of authorized persons.	O	O	O		O	O				X

A.2 References and symbols in Table A.1

A.2.1 Symbols in the table heading identifying lift subsystems

B – building, including its structure, well (hoistway), machinery space, and building equipment not provided by lift contractor

C – control subsystem, including electrical equipment and wiring, except “Sf” (safety devices)

E – landing and LCU entrances

G – guiding of the LCU and counterweight system

H – well (hoistway), including interior and surrounding guards or enclosures

L – load-carrying unit (LCU), including its top, if applicable

M – machine, including breaking system

Sf – safety devices

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