TECHNICAL SPECIFICATION

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Lifts for the transport of persons and goods —

Part 21: Global safety parameters (GSPs) meeting the global essential safety requirements (GESRs)

Elévateurs pour le transport de personnes et d'objets —

Partie 21: Paramètres de securité repondant aux exigences essentielles de sécurité globale des ascenseurs

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Foreword

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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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www. iso.org/patents).

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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 178, *Lifts, escalators and moving walks*.

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.

A list of all parts in the ISO 8100 series can be found on the ISO/TC 178 website.

This first edition cancels and replaces ISO/TS 22559-2.

Introduction

This document was prepared in response to the need to set global safety parameters for lifts (elevators).

The objective of the ISO 8100 series 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. If such innovations become state of the art, they can be integrated into the detailed local safety standard at a later date;

c) help remove trade barriers.

ISO 8100-20 establishes global essential safety requirements (GESRs) for lifts (elevators) by addressing hazards and risks that can be encountered on a lift (elevator). The GESRs, however, state only the safety objectives of a lift (elevator).

This document provides guidance and criteria for achieving conformance with safety requirements of GESRs by specifying global safety parameters (GSPs) for use and implementation, where applicable, in a lift (elevator) to eliminate hazards or mitigate safety risks addressed in the GESRs. However, GSPs are not mandatory.

Clause 4 describes the approach and methodology used in the development of this document. Clause 5 gives instructions for the use and implementation of GSPs. The GSPs are presented in Clause 6 in the sequence of GESRs in ISO 8100-20.

This document is a product safety standard in accordance with ISO/IEC Guide 51.

Lifts for the transport of persons and goods —

Part 21:
Global safety parameters (GSPs) meeting the global essential safety requirements (GESRs)

1 Scope

This document:

a) specifies global safety parameters (GSPs) for lifts (elevators), their components and their functions;

b) complements the system and methods specified in ISO 8100-20 for mitigating safety risks that can arise in the course of the operation and use of, or work on, lifts (elevators).

NOTE Hereinafter, the term "lift" is used instead of the term "elevator".

It is applicable to lifts that can:

a) be located in any permanent and fixed structure within or attached to a building, except lifts located in:

   1) private residences (single family units); or

   2) means of transport, e.g. ships;

b) have any:

   1) rated load, size of load-carrying unit (LCU) and speed; and

   2) travel distance and number of landings;

c) be affected by fire in the load-carrying unit, earthquakes, weather or floods;

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

This document does not specifically cover

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

b) risks arising from:

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

   2) use of lifts for firefighting and emergency evacuation;

   3) vandalism;

   4) fire outside the LCU;

   5) explosive atmosphere;

   6) transportation of dangerous goods.

1) Although the GESRs mentioned in this document have been identified and evaluated by risk assessment, not all disabilities or combinations of disabilities of users have necessarily been addressed.

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

ISO 22199, *Electromagnetic compatibility — Product family standard for lifts, escalators and moving walks — Emission*

ISO 22200, *Electromagnetic compatibility — Product family standard for lifts, escalators and moving walks — Immunity*

ISO 8100-20, *Safety requirements for lifts (elevators) — Part 1: Global essential safety requirements (GESRs)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 14798 and the following apply.

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

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

3.1
authorized person
person with authorization to access restricted *lift* (3.8) areas [e.g. machinery spaces, lift *well (hoistway)* (3.5), pit and LCU top] and 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)* (3.9)

[SOURCE: ISO 8100-20:2018, 3.1]

3.2
counterweight
mass that contributes traction in the case of a traction *lift* (3.8), or mass that saves energy by balancing all or part of the mass of the *LCU* (3.9) (car) and the *rated load* (3.15)

[SOURCE: ISO 8100-20:2018, 3.3]

3.3
door
landing (3.7) or *LCU* (3.9) mechanical device (including devices that partially or fully enclose the opening) used to secure an LCU or landing entrance

3.4
electromagnetic compatibility
EMC
degree of immunity to incident electromagnetic radiation and level of emitted electromagnetic radiation of electrical apparatuses

3.5
well (GB)
hoistway (US)
travel path(s) (3.19) of the *LCU* (3.9) and related equipment, plus the spaces below the lowest *landing* (3.7) and above the highest landing

3.6
enclosure
well enclosure (GB)
hoistway enclosure (US)
fixed structural elements that isolate the *well (hoistway)* (3.5) from all other areas or spaces

3.7
landing
floor, balcony or *platform* (3.14) used to receive and discharge persons or goods (freight) from the *LCU* (3.9)

3.8
lift (GB)
elevator (US)
lifting appliance intended to transport persons with or without goods or freight by means of a power-ope *rated load* (3.15) -carrying unit that is guided by a fixed guiding system from one *landing* (3.7) 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* (3.14) or baskets, or lifting appliances used in the course of construction of buildings or structures.

Note 2 to entry: See ISO/TR 11071-1:2004, Clause 2, for use of the term “lift” versus the term “elevator” in current national standards for lifts.

[SOURCE: ISO 8100-20:2018, 3.17]

3.9
load-carrying unit
LCU
car
part of a *lift* (3.8) designed to carry persons and/or other goods for the purpose of *transportation* (3.18)

[SOURCE: ISO 8100-20:2018, 3.18]

3.10
machinery space
space inside or outside the *well (hoistway)* (3.5), which contains the lift's mechanical equipment, and can also contain electrical equipment used directly in connection with the *lift* (3.8)

Note 1 to entry: This space can also contain the electric driving machine, the hydraulic machine or means for emergency operation.

3.11
maintenance
process of examination, lubrication, cleaning, adjustment and routine replacement of *lift* (3.8) parts to ensure the safe and intended functioning of the lift and its components after completion of the installation and throughout its life cycle

3.12
non-user
person in the vicinity of a *lift* (3.8), but not intending to access or use the lift

3.13
overload
load in the *LCU* (3.9) that exceeds the *rated load* (3.15) of the *lift* (3.8)

3.14
platform
part of the *LCU* (3.9) that accommodates persons and load for the purpose of *transportation* (3.18)

3.15
rated load
load that the *lift* (3.8) is designed and installed to transport

3.16
relative movement
situation where a *lift* (3.8) 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 can 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)* (3.5).

3.17
safety parameter
SP
quantitative unit, the value of which, in the form of numerical values or references to International Standards or other standards, provides a level of safety consistent with that provided by relevant standards in current use in the *lift* (3.8) industry and good engineering practices

Note 1 to entry: A global safety parameter (GSP) is a globally agreed upon safety parameter.

3.18
transportation
process in the course of which persons enter, or goods are moved into, an *LCU* (3.9), which is then lifted or lowered to another *landing* (3.7), where the person exits, or goods are removed from, the LCU

3.19
travel path
path and related space between the *lift* (3.8) terminal *landings* (3.7) within which an *LCU* (3.9) travels

Note 1 to entry: For "space" above and below terminal landings, see 3.15.

3.20
uncontrolled movement
situation where the *LCU* (3.9)

— moves when, according to the design of the *lift* (3.8), it was to remain stationary; or

— 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 1 The LCU starts to move away from a *landing* (3.7) while the *users* (3.21) are entering or leaving the LCU due to failure or breakdown of lift components, such as the speed control or brake system.

EXAMPLE 2 The LCU speed exceeds its designed speed or does not decelerate or stop as intended due to failure or breakdown of lift components, such as the speed control or brake system.

3.21
user
person using the *lift* (3.8) for the purpose of normal *transportation* (3.18), 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.

3.22
vandalism
deliberate destruction of, or damage to, property for no obvious gain or reason

3.23
working area
working space
area or space defined for use by *authorized persons* (3.1) to perform *maintenance* (3.11), repair, inspection or testing of the *lift* (3.8)

4 Development of global safety parameters (GSPs)

4.1 Purpose of GSPs

To enable verification that the lift and its selected components and functions have achieved safety objectives of applicable GESRs, GSPs, such as strength, clearances, acceleration or retardation values, are provided in this document in the form of numerical values or references to International Standards or other standards.

NOTE For the definition of GESR, see ISO 8100-20:2018, 3.9.

According to ISO 8100-20:2018, 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.". ISO 14798 describes a risk assessment process that can help to establish that the GESRs have been fulfilled with a specific design or lift configuration. In order to mitigate specific risks identified in the risk assessment process, specific components, functions or GSPs may be used.

ISO 8100-20 and this document do not mandate the use of specific designs of components and functions (such as specific designs of "safety gear", "door interlocks" or "spring buffers") as they are commonly specified and required in prescriptive lift standards. Such components and functions are not mandated in this document as that would inhibit design innovations.

All applicable GESRs shall be fulfilled, in accordance with ISO 8100-20, irrespective of whether or not there is a GSP specified in this document.

4.2 Approach

As was the case with development of ISO 8100-20, the development of this document also involved experts from various parts of the world working in three regional study groups (North American, European and Asia-Pacific). Specialized task groups carried out research in areas, such as anthropometric, ergonomic, spatial and environmental influences by review of relevant International Standards and other standards.

Individual experts and task groups derived safety parameters from independent research of existing standards, anthropometric data, clearances, forces, etc., and a comparison of major codes. GSPs that were determined to provide sufficient mitigation of risks related to relevant GESRs are included in this document.

5 Understanding and implementing GSPs

5.1 Overall objective

Consistent with the purpose described in 4.1, global safety parameters in relation to individual GESRs are specified in Clause 6.

The objective of the global safety parameters in Clause 6 is to:

a) introduce parameters that provide universal means to demonstrate compliance with GESRs; and

b) stimulate the harmonization of safety parameters in existing standards.

To accomplish the safety objective of a GESR, a GSP, although not mandatory, can be an adequate means of achieving compliance. The list of GSPs in Table 2 is not exhaustive.

Table 2 specifies fixed minimum or maximum values. Where the GSP gives a possible range of values in the referenced International Standards, dependent on the circumstance in which it is used, justification that the correct value has been chosen can be required to suit the particular hazardous situation(s).

Listed GSPs should not be interpreted as the only measure of conformity with a GESR. Conformance with a GESR can be achieved by deviating from the listed GSPs, provided that the risk is mitigated using other equally effective protective measures. Parameters consistent with good engineering practices (see also 5.4 and Table 2 remark to GSP 1) or selected from applicable codes or standards may be used. In such cases, it shall be demonstrated that the type of parameters chosen:

a) sufficiently mitigate the risk addressed in the GESR; and

b) ensure that any new risks created by implementation of the parameter(s) are sufficiently mitigated.

NOTE See ISO 14798:2009, 4.4.1.3.

5.2 Properties and use of GSPs

5.2.1 GSPs

The GSPs are listed in Table 2.

NOTE 1 International Standards and other standards have been used wherever applicable for developing GSPs as they represent long-standing history in lift safety or scientifically developed data which has been applied for some time in safety-related applications. The other standards include lift safety codes, electrical codes, anthropometric standards and various materials standards. In all cases, the use of the relevant standard is to assist the user of this document.

NOTE 2 This document recognizes that slightly different or non-identical values for safety-related criteria have been used around the world in order to ensure the safe operation of lifts. Examples of these are safety factors, space sizes to prevent body part entry, space sizes to allow body part entry, forces, deceleration levels and illumination levels. In many cases, the values vary only slightly (e.g. as a result of conversions of imperial to SI units of measurement or due to different origins of the units). Nevertheless, these slightly differing values have proven to result in safe lift operation over many years.

Safety factors should be considered relative to the material being used and its application, based on good engineering practice (see also 5.4 and Table 2 remark to GSP 1).

It is recognized that electronic safety devices and programmable electronic systems in safety-related applications (i.e. PESSRAL) are being extensively used in many industries. Where used in lift safety applications, guidance on safety integrity levels (SILs) is provided in ISO 22201-1.

For devices using electro-mechanical or non-programmable electronic devices, methods such as Failure Modes and Effects Analysis (FMEA) should be considered to establish the safety level.

The values in Table 2 are globally harmonized values based upon current applicable standards, with the recognition that some of the values are not absolute in nature.

When existing lift safety standards are revised, these GSPs, (i.e. these values and generic International Standards) should be considered.

5.2.2 Process of implementing GSPs

In evaluating a lift system or component for compliance with a particular GESR, the following risk assessment and risk reduction process, in accordance with ISO 14798, shall be applied:

a) the risk scenario, which includes the hazardous situation addressed in a GESR and the harmful event, shall be formulated;

b) risk shall be estimated, evaluated and assessed;

c) if the risk level requires mitigation, protective measures are proposed. The protective measures should eliminate the hazard or reduce the risk. Reducing the risk may include implementing GSPs;

d) after applying the protective measures, the risk shall be re-assessed. Step c) shall be repeated until the risk has been sufficiently mitigated;

e) if a new hazard is created as a result of mitigating a given risk, the risk resulting from this new hazard shall be fully mitigated using the above-mentioned process.

5.2.3 Ways of using GESRs and GSPs

5.2.3.1 With respect to a specific task affecting lift safety, such as designing a lift or its components, GESRs and related GSPs may be used in two ways, namely:

a) one can begin with the risk assessment of scenarios related to the task in order to identify the applicable GESRs and related GSPs, as in 5.2.3.2; or

b) one can begin with a review of all GESRs in order to identify those that can be applicable to the task, as in 5.2.3.3.

NOTE In addition to designing, tasks can include installing or servicing, or writing design-prescriptive safety standards for lifts or their components.

5.2.3.2 When designing a lift or its components, a review of the intended use, foreseeable misuse (see ISO 14798:2009, 4.5.5.4) and design should be made, in which all possible risk scenarios are formulated and risk assessment is performed in order to find out which, if any, GESRs and relevant GSPs are applicable to the design. All risk scenarios that can occur during operation and use should be considered, as well as during the maintenance, repair or inspection of the lift.

The risk scenarios shall include specifications of all hazardous situations, combined with all harmful events (i.e. 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 proposed design needs to be continually improved until the applicable GESRs have been fulfilled.

EXAMPLE By following this process, risk scenarios similar to those in Cases 1.1 or 1.2 of Table 1 can be formulated and it can be concluded that there is a possibility of injury to persons exposed to shearing, crushing or abrasion hazards. The assessment of the risk indicates that the risk needs further mitigation, which is achieved by changing the design. If this is not feasible, further mitigation is achieved by implementing other protective measures in order to comply with GESR 6.1.5 and the corresponding GSP specified in Table 2.

NOTE 1 For the practical use of GESRs, see ISO 8100-20:2018, 5.2.

NOTE 2 Rationales for the GESRs, given in notes following each GESR in Table 2, are intended to provide further understanding of the intent and use of GESRs.

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

EXAMPLE In the case of the GESR 6.1.5 in Cases 1.1 or 1.2 of Table 1, one would observe the lift design or installation to find out whether any person travelling in the LCU, entering or exiting the LCU, or being around the lift travel path or well (hoistway), or in a similar situation, can be exposed to shearing, crushing, abrasion or a similar hazard that can cause harm.

5.2.4 Applicability of GESRs and GSPs

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

Table 2 addresses safety hazards in specific GESR. The relevant GSP(s) given for a GESR does/do not necessarily mitigate all risks relevant to a specific lift system, component or function. However, such risks would be addressed by another GESR and associated relevant GSP(s).

5.2.5 Safety objectives of GSPs

When designing a lift, appropriate components and functions should be selected in terms of specific GSPs (see Table 2). Examples are size, dimensions, strength, force, energy, material and acceleration. Reliability of performance of safety-related parts, as applicable, and their ability to eliminate or sufficiently mitigate the risks to achieve compliance with the objective specified in the GESR should be established.

Table 1 contains examples that illustrate the methods described in 5.2.3.1. The examples are consistent with the corresponding examples in ISO 8100-20:2018, Table 1.

a) Cases 1.1, 1.2, 2.1 and 2.2 illustrate the method described in 5.2.3.1 a), where a GESR and corresponding GSP are used to mitigate a risk.

b) Cases 3 and 4 illustrate the method described in 5.2.3.1 b), where applicable GESRs are identified, and a risk assessment is carried out on a specific scenario. A GSP is used to mitigate the risk.

c) The examples are not comprehensive, in that other risks pertaining to the scenarios are not addressed. A comprehensive risk assessment would address all risks.

In Cases 1.1 or 1.2 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, the following shall be determined:

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

b) the maximum perforation (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;

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 LCU sides (see also GSP for GESR 6.4.4 in Table 2) and LCU travel path or well (hoistway) sides (see 6.2.1 in Case 2.1 or 2.2 of Table 1 and GSP for GESR 6.2.1 in Table 2). 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 All GESR headings from ISO 8100-20 are listed in Table 2 and aligned with their relevant GSPs.

Table 1 — Examples of risk scenarios related to GERSs and GSPs using method described in 5.2.3.1 a) (Cases 1.1, 1.2, 2.1 and 2.2) and 5.2.3.1 b) (Cases 3 and 4)

Case No.	Applicable GESR	Scenario			Estimation of risk elements		Protective measures (risk reduction measures)	After protective measures		Residual risk
		Hazardous situation	Harmful event		S	P		S	P	
			Cause	Effect						
1.1	N/A	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; the hand or foot engages with external lift objects.	User's hand or foot is sheared, crushed, or cut.	2	B	NOTE This hazard is addressed by GESR 6.2.5. Conform to GSP 6.2.5. [p1] Where a full imperforate enclosure is not provided, see ISO 13857. [p2] Where enclosure is provided on all sides, but perforated, see ISO 13857:2008, Tables 5 and 6, 4.2.2 and 4.2.3. [p3] Where enclosure is not provided on all sides, see ISO 13857:2008, Table 2 for the distances a, b, and c, and also Figures 1 and 2, 4.2.2 and 4.2.3.	4	E	None
1.2	N/A	Users are in the lift entrance area and enter the LCU, when the entrance 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.	2	A	NOTE This hazard is addressed by GESR 6.2.5 and 6.4.1. Conform to GSPs 6.2.5 and 6.4.1.	3	E	None

Comments:

1) The severity level in cases 1.1 is reduced from level 2 to level 4 as the hazard is effectively eliminated by design changes consistent with relevant ISO standards. The probability level is correspondingly reduced.

2) The severity level in case 1.2 is reduced from level 2 to level 3, as the force and kinetic energy has been reduced, but not eliminated. The probability has been correspondingly reduced.

3) The example is not comprehensive in that other risks, e.g. falling from the LCU are not addressed. A comprehensive risk assessment would address all risks.

S – Levels of severity of the harm*: 1 – High; 2 – Medium; 3 – Low; 4 – Negligible.

P – Level of probability of occurrence of harm*: A – Highly probable; B – Probable; C – Occasional; D – Remote; E – Improbable; F – Highly improbable.

* See ISO 14798:2009, 4.5.3.1 and 4.5.4.1.

Table 1 *(continued)*

2.1	N/A	There are no guards between the LCU travel path and the floors surrounding the travel path, high above the bottom of the well (hoistway). A person is standing close to the well (hoistway).	The person leans over the floor edge or the entrance opening sill.	The person falls down the well (hoistway).	1	A	NOTE This hazard is addressed by GESR 6.2.1. Conform to GSP 6.3.1. [p1] Landing doors to resist impact with 100 kg mass moving at 3 m/s velocity (This will result in an impact energy value of 450 J and will allow permanent deformation with structural integrity). [p2] Well (hoistway) wall(s) of sufficient height and strength to be provided. NOTE See also remarks in GSP 6.3.1 relating to static and dynamic forces in Table 2.	1	F	None
2.2	N/A	Guards in Case 1.1 are provided but do not have adequate strength. Users in LCU.	A person leans against the guard.	Person breaks through the guard and falls down into the well (hoistway).	1	C		1	F	None
Comment: After the guards/enclosures around the LCU and the well (hoistway) have been put in place, severity remains the same as the height between the landing and the well (hoistway) floor is the same, i.e. falling hazard remains, but probability has been reduced to F.										
3	GESR 6.2.3 Equipment that is hazardous shall not be directly accessible to users and non-users. GESR 6.2.9 Where electricity is provided, means shall be provided to sufficiently mitigate the risk to users and non-users of exposure to electrical shock	Users or non-users have access to lift machinery and/or the equipment installed to move or control the LCU	Person inadvertently or deliberately comes 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 person is electrocuted if he comes into contact with exposed electrical equipment.	1	C	Conform to GSP 6.2.3. [p1] Where a full imperforate enclosure is not provided, see ISO 13857. [p2] Where equipment is covered on all sides, but perforated, see ISO 13857:2008, Tables 5 and 6 for mechanical protection. [p3] Where equipment is not covered on all sides, see ISO 13857:2008, Table 2 for the distances a, b and c and also Figures 1 and 2. [p4] For electrical protection, see GESR 6.2.9. Conform to GSP 6.2.9.	1	E	Hazardous spaces may be left open and unlocked, and non-authorized persons may enter being exposed to hazards
S – Levels of severity of the harm*: 1 – High; 2 – Medium; 3 – Low; 4 – Negligible. P – Level of probability of occurrence of harm*: A – Highly probable; B – Probable; C – Occasional; D – Remote; E – Improbable; F – Highly improbable. * See ISO 14798:2009, 4.5.3.1 and 4.5.4.1.										

Table 1 *(continued)*

Comment: The risk level 2E falls into Risk Group II (see Table D.3 in ISO 14798), but the review of the residual risk concluded that no further protective measures are needed.										
4	GESR 6.6.4 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.	An authorized person is working on top of the LCU or in some other working space	The working space does not have sufficient strength to support the authorized person and tools. The working surface collapses.	The authorized person falls into the LCU or into well (hoistway) sustaining seriously injuries.	2	B	Conform to GSPs 6.6.4. [p1] Working platforms to be provided in accordance with ISO 14122-2. [p2] Ladders to be provided in accordance with ISO 14122-3 or ISO 14122-4.	2	F	None
Comment: After the strength and size of the working area is properly designed, the probability of "falling" has become "F-highly improbable".										
S – Levels of severity of the harm*: 1 – High; 2 – Medium; 3 – Low; 4 – Negligible. P – Level of probability of occurrence of harm*: A – Highly probable; B – Probable; C – Occasional; D – Remote; E – Improbable; F – Highly improbable. * See ISO 14798:2009, 4.5.3.1 and 4.5.4.1.										

5.3 Use of ISO 8100-20 and this document

This document shall supplement ISO 8100-20 in providing a uniform process for assessing the safety of lifts. The GESRs and GSPs are intended for use by:

a) writers of safety or safety-related standards for lifts;

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

c) independent [third-party] conformity assessment bodies; and

d) inspection and testing bodies and similar organizations.

NOTE For details on the procedures followed by these types of users, see ISO 8100-20:2018, 5.3.2 to 5.3.5. For an overview of GESRs, in relation to lift subsystems, see ISO 8100-20:2018, Annex A.

5.4 Good engineering practice

Good engineering practice is essential to ensure the safety of lift equipment. It should take into account all service conditions and failure modes. It should embrace the expectations and considerations to be taken into account for design of a lift component. Below are some relevant factors.

For every calculation of a design all probable load cases need to be defined and several assumptions should be made specific to the issue under consideration.

These assumptions should be based on commonly understood technical and engineering theory and practice and on the experience of the experts responsible for the design. For example, the dynamic factor in the case of counterweight jump when the empty car is stopped by the safety gear, the frictional forces imparted on the guide brackets in case of safety gear application through guide clips or the support of driving machines on structural steel members according to deflection criteria.

The load spectrum and frequencies of different loads should be defined. From this, it should be decided which lead to endurance/fatigue stresses and which are occasionally applied loads which lead to corresponding stresses.

Tolerances of parts, friction factors and possible variations during assembly need to be considered, e.g. tightening torque of fasteners to be defined.

The probability of a combination of worst cases of all influences has to be described, considering that the simple combination of all worst assumptions may lead to unnecessarily heavy designs in some cases.

The material properties and characteristics must be considered and safety margins selected accordingly.

Established analysis and design standards and relevant Codes, including textbooks, handbooks and expert publications can be applicable or give the necessary design input to validate the design. This includes materials, parameters, safety factors, etc.

When using calculation methods, whether traditional or finite element analysis, due consideration should be given to the inclusion of the inherent simplifications and error factors as well as any assumptions, for example, working to design criteria which are based on known acceptable stress limits rather than ultimate tensile strength.

It is important that suitable materials be selected dependent upon the application and loading conditions. Material properties in the final use condition (i.e. after machining, heat treatment grinding, etc., and accounting for use and environmental influences such as wear, corrosion) should be considered. In evaluating stress factors it is important to consider size factors, shape factors, changes in section, geometry and size of radii and fillets at section changes, surface finish, material hardness, etc.

It is also important to consider material properties such as ultimate tensile strength, yield strength, elongation before rupture, impact strength, fracture toughness, endurance strength, etc., as applicable.

The applicable failure criteria need to be established, dependent upon the application e.g. tresca, (maximum shear stress), von mises (yield criteria), octahedral (shear stress), energy of distortion, low cycle fatigue, high cycle fatigue, euler and rankine elastic stability criteria, etc.

The designer also has the responsibility to determine whether the analyses and calculations are adequate and whether additional endurance and/or breaking tests are required.

Good engineering practice also entails a subsequent design review by a peer(s) or an expert(s) in the appropriate discipline. Such practice may also be covered by the quality assurance system, e.g. ISO 9000, of the organization responsible for the design.

NOTE 1 Such peer(s) or expert(s) can be employees of the same organization responsible for the design or external expert(s) as long as they are suitably qualified.

NOTE 2 See also 5.1 and 5.2.1 and Table 2, Remarks to GSP 1.

6 Global safety parameters

GSPs listed in Table 2 shall be applied as described in Clause 5.

GSPs are grouped in Table 2 in the same order as GESRs are grouped in ISO 8100-20, which is based on locations where a person can be exposed to a hazard, such as spaces adjacent to a lift, lift entrance and egress, space inside the LCU and working areas. Users of this document, who prefer the regrouped GESRs and related GSPs based on the lift subsystems, should use ISO 8100-20:2018, Table A.1.

Table 2 — Global safety parameters (GSPs) for specific GESRs

GESR	GSPs referenced in this part of ISO 22559[a]	Remark/illustration/comment
6.1 Common GESRs and GSPs related to persons at different locations (ISO 8100-20:2018, 6.2)		
1. Supports for lift equipment **(ISO 8100-20:2018, 6.2.1)**	[p1] The relevant parameters for this GESR are illustrated under other GESRs (e.g. for foreseeable overload), see 6.5.1 [p3].	Regarding safety factors: Should be selected based on good engineering practice as per 5.4. These should take account of: — material properties; — intended use and loading conditions, including foreseeable overloads; — life cycle; — dynamic conditions (e.g. counterweight jump). Regarding building interface: interfaces between the lift equipment and the building should be taken into consideration, including any supporting beams, brackets and attachments of guides to walls.
2. Lift maintenance and repair **(ISO 8100-20:2018, 6.2.2)**	No parameter required.	Remarks on "appropriate instructions": The maintenance instructions should be written in accordance with EN 13015 and contain appropriate information such as: — a schedule of maintenance operations; — the relevant local regulations, other requirements, and their implications on the lift maintenance; — the need for maintenance to be carried out by a qualified maintenance organization employing competent personnel; — information about the use of emergency unlocking devices.
3. Equipment inaccessible to users and non-users **(ISO 8100-20:2018, 6.2.3)**	[p1] Where a full imperforate enclosure is not provided, see ISO 13857. [p2] Where equipment is covered on all sides, but is perforated, see ISO 13857:2008, Tables 5 and 6, for mechanical protection. [p3] Where equipment is not covered on all sides, see ISO 13857:2008, Table 2, for the distances a, b and c, and Figures 1 and 2. [p4] For protection against electrical hazards, see GESR 6.2.9.	Enclosures should have adequate strength and rigidity to prevent hazardous equipment becoming accessible to users and non-users.

[a] Before using any GSPs from Table 2, 5.1 and 5.2 shall be conformed to, in order to ensure that all hazards are sufficiently addressed.

Table 2 *(continued)*

GESR	GSPs referenced in this part of ISO 22559[a]	Remark/illustration/comment
4. Floors of the LCU and working areas **(ISO 8100-20:2018, 6.2.4)**	[p1] No ledges or non-uniform projections >6 mm. [p2] For guidance on slipping, see ISO 14122-2:2016, Annex A. [p3] Slope of LCU floors ≤1 % (during normal operation). [p4] Slope of working areas ≤5 %. [p5] Any recesses or ducts with a depth of more than 50 mm and a width between 50 mm and 500 mm wide should be covered.	Comments on [p1]: Many floor finishes for both public and industrial applications require the use of patterned floor surfaces to enhance resistance to slip by providing greater traction between the floor surface and the user's footwear or to produce harder-wearing surfaces. Many such floor coverings achieve this by having uniform projections and recesses that are not considered tripping hazards. [p1] Does not apply to equipment projections in the vicinity of working areas.
5. Hazards due to relative movement **(ISO 8100-20:2018, 6.2.5)**	[p1] Where a full imperforate enclosure is not provided, see ISO 13857. [p2] Where enclosure is provided on all sides, but is perforated, see ISO 13857:2008, Tables 5 and 6, and 4.2.2 and 4.2.3. [p3] Where enclosure is not provided on all sides, see ISO 13857:2008, Table 2, for the distances a, b and c, and Figures 1 and 2, and 4.2.3 and 4.2.3. [p4] When closed, the running clearance between door panels, or between panels and uprights, lintels or sills, should not exceed 10 mm, including an allowance for wear. [p5] the face on the landing side or on the LCU side of automatic power operated sliding doors should not have recesses or projections exceeding 3 mm. [p6] Under an application of 150 N in the direction of opening, the clearances are to be less than 30 mm for side opening doors and 45 mm in total for centre opening doors.	Comment on [p2]: An imperforate enclosure is preferred. However, where an enclosure with perforations is provided, care should be taken where objects can pass through and cause injury. See also 6.4.1. Comment on [p4]: Special attention with regard to trapping of children's fingers should be placed on clearances and gaps for glass doors e.g. EN 81-20 requires a maximum 4 mm installation gap and a maximum 5 mm gap with wear. The 10 mm value is the maximum and includes wear of the system. To allow for wear of the door system a smaller initial gap should be considered e.g. EN 81-20 requires a 6 mm maximum gap on installation.

[a] Before using any GSPs from Table 2, 5.1 and 5.2 shall be conformed to, in order to ensure that all hazards are sufficiently addressed.

Table 2 *(continued)*

GESR	GSPs referenced in this part of ISO 22559[a]	Remark/illustration/comment
6. Locking landing doors and closing LCU door **(ISO 8100-20:2018, 6.2.6)**	[p1] Landing (hoistway) or LCU door is not closed if gap >10 mm measured when there is no force applied. [p2] When locked, locking device to resist an opening force ≥1 000 N for sliding doors and an opening force ≥3 000 N for swing doors. [p3] the locking elements should engage by at least 7 mm before the electric safety device is activated.	Comments on [p1]: For side-opening doors, 10 mm should be measured from jam to door edge. For centre-opening doors, 10 mm should be measured from door edge to door edge. Any powered movement of LCU with open doors is unacceptable, except those mentioned in NOTE 2 of the GESR. The 10 mm value is the maximum and includes wear of the system. To allow for wear of the door system a smaller initial gap should be considered e.g. EN 81-20 requires a 6 mm maximum gap on installation. Comments on [p2]: Parameter [p2] is intended to be applied to horizontally sliding doors. For other types of doors, different parameters can need to be considered. The landing (hoistway) door can still be locked, even if it is open up to <10 mm.
7. Evacuation **(ISO 8100-20:2018, 6.1.7)**	[p1] For guidance on openings for access and egress, see Annex A (anthropometric data) and ISO 15534-1, 2 and 3.	Remark: See also GSP 6.4.4.
8. Sharp edges **(ISO 8100-20:2018, 6.2.8)**	See remarks.	Remarks: Sharp edges present a cutting, shearing or scraping hazard if exposure to body parts occurs. Removal of sharp edges should be considered as the first course of action. The radius of an edge which sufficiently mitigates the risk of injury and satisfies the GESR depends on the following: — material properties of the edge; — surface finish of the edge; — relative velocity of body part to the edge at the time of contact; — level of protection (if any) of the body part, e.g. clothing. Moreover, the probability of contact influences the risk. The risk can also be mitigated by shielding the user from the sharp edge. Good engineering practice, considering all the variables, should be used in reaching a safe conclusion.

[a] Before using any GSPs from Table 2, 5.1 and 5.2 shall be conformed to, in order to ensure that all hazards are sufficiently addressed.

Table 2 *(continued)*

GESR	GSPs referenced in this part of ISO 22559[a]	Remark/illustration/comment
9. Hazards arising from the risk of electrical shock **(ISO 8100-20:2018, 6.2.9)**	[p1] For guidance, see — IEC 60204-1; — IEC 60364-4-41; — IEC 60417-5036; — IEC 60417-12M; — IEC 60529; — IEC 61140; and — IEC/TS 61201.	Points to be considered a) Protection with regard to direct contact: — enclosure barrier; — insulation of live parts; — limited energy; — protective impedance; — voltage limitation; — protective separation between circuits. b) Additional protection by residual current-operated protective device (RCD) c) Protection with regard to indirect contact: — double reinforced insulation; — basic insulation and protective bonding; — additional protection by RCD.
10. Electromagnetic compatibility **(ISO 8100-20:2018, 6.2.10)**	[p1] Immunity in accordance with ISO 22200. [p1] Emissions in accordance with ISO 22199.	
11. Illumination of LCU and landings **(ISO 8100-20:2018, 6.2.11)**	[p1] For illumination on landings: ≥50 lx. [p2] For illumination in the LCU: ≥50 lx at floor level and on control devices. [p3] For emergency illumination in the LCU: ≥2 lx on lift control and emergency devices, including instructions, if any, for ≥1 h.	Comment related to [p1]: The provision of illumination on the landing is normally included in the building lighting system. Comments related to [p1], [p2] and [p3]: Manufacturers should design their products to achieve a level of illumination as indicated in the parameters, on the floor and on the control device. However, the practical consideration of different LCU finishes and degradation of the light source over time leads to small changes in the actual level of light under site conditions. The parameters are intended to safeguard against tripping hazards and to provide guidance in locating control devices in both normal and emergency operations. This can be achieved if the lighting levels are within a small variance of the figures given in this specification.
12. Effects of earthquake **(ISO 8100-20:2018, 6.2.12)**	[p1] For guidance, see ISO/TR 25741.	
13. Hazardous materials **(ISO 8100-20:2018, 6.2.13)**		

[a] Before using any GSPs from Table 2, 5.1 and 5.2 shall be conformed to, in order to ensure that all hazards are sufficiently addressed.

Table 2 *(continued)*

GESR	GSPs referenced in this part of ISO 22559[a]	Remark/illustration/comment
14. Environmental influences **(ISO 8100-20:2018, 6.2.14)**		Remark: Factors to consider should include dust, fog, moisture, temperature, sunlight (UV), wind, altitude, and lightning.
6.2 GESRs and GSPs related to persons adjacent to the lift (ISO 8100-20:2018, 6.3)		
15. Falling into the well (hoistway) **(ISO 8100-20:2018, 6.3.1)**	[p1] Landing doors and well (hoistway) wall(s), where accessible, to resist impact with 100 kg mass moving at 3 m/s velocity. A 75 % rate of energy absorbed is to be taken into account. [p2] Minimum height of well (hoistway) enclosure should be 1 100 mm.	Remark: See also GSP 6.2.6 for door locking strength. a) Dynamic forces The typical case is represented by the impact against the landing door of an individual moving at walking speed. More rarely, but not improbably, the impact speed can be that of a person running. Forces resulting from the energy of dynamic impact on doors and walls are difficult to estimate, since their values are related to the percentage of energy transmitted (coefficient of restitution), and also to the design of the landing door. It is very unlikely, for normal lift applications that the LCU walls would be subject to high-energy impacts. Typically, the body impact takes place at shoulder or hip level. The design of lift landing doors, frames and attachments should integrate the shock of a heavy human body (i.e. 100 kg) moving at 3 m/s. It should be recognized that not all of the energy is transferred to the doors e.g. EN 81-20 requires the doors to resist an impact of 355 J, which would correspond to approximately 75 % of the kinetic energy being absorbed by the door. b) Static forces Equivalent static forces that can be imposed on the doors and walls are less than those produced by the dynamic force requirements covered in [p1].

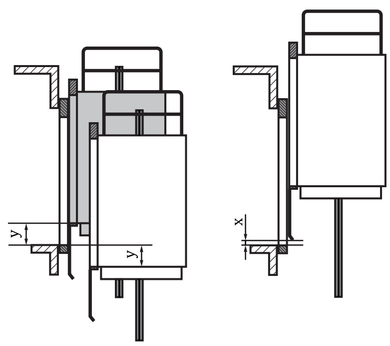
[a] Before using any GSPs from Table 2, 5.1 and 5.2 shall be conformed to, in order to ensure that all hazards are sufficiently addressed.

Table 2 *(continued)*

GESR	GSPs referenced in this part of ISO 22559[a]	Remark/illustration/comment
6.3 GESRs and GSPs related to persons at the entrances (ISO 8100-20:2018, 6.4)		
16. Access and egress **(ISO 8100-20:2018, 6.4.1)**	[p1] Height of door: ≥2 000 mm. [p2] Door clear opening: ≥800 mm. [p3] LCU out of level tolerance: <20 mm. [p4] Door kinetic energy: <10 J at average closing speed; <4 J at reduced closing speed (nudging). NOTE The average closing speed is calculated not including the final 50 mm for side-closing doors or 25 mm for centre-opening doors at each end. [p5] Door closing force: <150 N, applied after the first one third of its travel. [p6] See also GSP 5	Comment on [p1]: There is a trend for younger generations of people to be taller. Nevertheless, a 2 000 mm clear height for lift doors is sufficient for a safe access and egress for the vast majority of the world's population. Some countries where the trend of population height increase is more acute (Netherlands, Scandinavia) can have other local requirements (e.g. 2 100 mm). Comment on [p2]: A door clear opening of 800 mm permits the access of most of the wheelchairs designed to International Standards. More significant openings may be justified by the intended use of the lift. Comment on [p3]: The parameter is intended to reduce the risk of tripping associated with the difference in level of the LCU sill position with the sill of the landing under stopping, loading, levelling and re-levelling conditions. While the intent for the designer is clearly to produce a product where such misalignment is reduced to the minimum, technology used in the control of lift movement inevitably leads to some change in levels under different operating conditions, e.g. rope stretch and hydraulic fluid compression. Comment on [p4]: The normal operation of typical lift doors develops a kinetic energy which has an order of magnitude of 10 J, in average, which is generally indicated in the lift safety codes as the maximum accepted value for door impacts. Comment on [p5]: The normal operation of typical lift doors requires a pulling/pushing force on the door panels of 120 N to 150 N, a value which is generally indicated in the lift safety codes as the maximum accepted value for door closing force. This order of magnitude of the closing force alone is not harmful for typical lift use. Remark: See also Remarks pertaining to GSP 8.

[a] Before using any GSPs from Table 2, 5.1 and 5.2 shall be conformed to, in order to ensure that all hazards are sufficiently addressed.

Table 2 *(continued)*

GESR	GSPs referenced in this part of ISO 22559[a]	Remark/illustration/comment
17. Horizontal sill-to-sill gap **(ISO 8100-20:2018, 6.4.2)**	[p1] Gap ≤35 mm. NOTE See also GSP for 6.4.3.	Comment on [p1]: The intent of this parameter is to prevent the risk of tripping at the entrance threshold due to persons' footwear entering the gap or becoming trapped in it.
18. Alignment of the LCU and landing **(ISO 8100-20:2018, 6.4.3)**	[p1] LCU out of level tolerance ≤20 mm. NOTE See also GSP for 6.4.2.	Remark: The state of the art today states that acceptable stopping accuracy is around 10 mm to 13 mm. The parameter of 20 mm includes movement of the LCU due to loading and unloading.
19. Self-evacuation from an LCU **(ISO 8100-20:2018, 6.4.4)**	[p1] The landing doors cannot be unlocked and opened from inside the LCU when it is outside the unlocking zone, which is the maximum distance $y \leq 350$ mm. [p2] Vertical opening between bottom of LCU (e.g. apron) and landing including any deflection of the apron as a result of a 300 N force applied perpendicularly by a person: $x \leq 200$ mm. [p3] Manual door opening should be possible with a force not greater than 300 N, to open the car and landing door by hand.	This scenario envisages a number of sequential events as follows: a) The LCU unintentionally moves away from the floor with the doors open and is stopped by a UCM device per GESR 6.4.6. b) Consistent with GESR 6.4.4 codes such as EN81-20 and A17.1/B44 require that the landing doors be mechanically closed outside of the unlocking zone, which is defined as 350 mm maximum per GSP 6.4.4, [p1]. However, the scenario envisages that the person exits the LCU in such a manner that they fall between the bottom of the car apron and the landing. Based on many years of experience this is a very improbable situation. However as an additional precaution a gap of 200 mm maximum is deemed appropriate. This value is consistent with EN81–20.  **Key** *x* max vertical opening *y* max distance

[a] Before using any GSPs from Table 2, 5.1 and 5.2 shall be conformed to, in order to ensure that all hazards are sufficiently addressed.

Table 2 *(continued)*

GESR	GSPs referenced in this part of ISO 22559[a]	Remark/illustration/comment
20. Gap between the landing doors and LCU doors **(ISO 8100-20:2018, 6.4.5)**	[p1] Space between coupled sliding doors: ≤120 mm. [p2] Space between LCU flexible door and hinged landing door: ≤100 mm.	Comment on [p1]: 120 mm is the typical value based on the most commonly used horizontally sliding LCU and landing door arrangements. Other door arrangements should be subject to appropriate considerations. Comment on [p2]: For swinging and folding doors, the space is considered to be any space between the doors, when the doors are fully closed. NOTE See also 6.2.3.
21. Means to reopen doors when the LCU is at landing **(ISO 8100-20:2018, 6.4.6)**	GESR is self-explanatory.	Comment: This GESR is not intended to eliminate the “nudging” (i.e. closing doors at reduced speed) function.
6.4 GESRs and GSPs related to persons in the LCU		
22. Strength and size **(ISO 8100-20:2018, 6.5.1)**	[p1] For guidance on LCU dimensions and rated loads, see ISO 4190-1. [p2] Take into account the overload W 125 % of the rated load. NOTE In some specific cases, where the rated load is lower than is typical, the rated load can be significantly exceeded and, in this event, the overload should be adjusted accordingly to take this into account. [p3] Clear height of LCU: ≥2 000 mm.	Remark: See also GESRs 6.5.3 and 6.5.6. Comments on “overload” in [p2] Comment 1 There are two concepts of overload: a) Starting overload: The overload at which the lift is permitted to start and operate. This is addressed in comment to GESR 6.5.3. (based on AFNOR comment on 6.5.3) b) Static overload The overload that the LCU can physically accommodate and which should be taken into account as a design parameter, e.g. traction calculation. This is addressed in GESRs 6.5.1 and 6.5.2 Comment on [p2] Experiments have shown that overloads of 25 % of rated loads can be reached by people squeezing into the LCU. This value is widely used in lift standards and adopted.
23. LCU support/suspension **(ISO 8100-20:2018, 6.5.2)**	[p1] Take into account the static overload of 125 % of a rated load. [p2] For guidance on factors of safety, see 5.2.1.2 and 5.4. [p3] For guidance on hydraulic components, see ISO/TR 11071-2:2006, Clause 4.	Remark: See comments in 6.5.1.

[a] Before using any GSPs from Table 2, 5.1 and 5.2 shall be conformed to, in order to ensure that all hazards are sufficiently addressed.

Table 2 *(continued)*

GESR	GSPs referenced in this part of ISO 22559[a]	Remark/illustration/comment
24. Overloaded LCU **(ISO 8100-20:2018, 6.5.3)**	GESR is self-explanatory.	Comment: The intent of this GESR is to prevent the LCU from starting when the load is above the rated load. However, there are factors influencing the design, where a reasonable overload can be accommodated to allow the lift to start and operate as indicated in GESR 6.5.1, comment 1 a).
25. Falling from an LCU **(ISO 8100-20:2018, 6.5.4)**	[p1] Gap between LCU platform and well (hoistway) guard: ≤150 mm. [p2] Where the gap is >150 mm, at a minimum a permanently fixed imperforate barrier is to be fitted. [p3] Height of barrier: ≥1,1 m. [p4] Strength of barrier. Barrier to resist force ≤300 N static force over an area of 5 cm^2 with deflection ≤30 mm in accordance with ISO 14122-3:2016, 7.3. Barrier to resist impact: 100 kg at 1,5 m/s. [p5] For maximum barrier apertures, see ISO 13857. [p6] Where the gap is greater than 150 mm, the LCU door shall not be able to be opened outside the unlocking zone.	The term “barrier” is used to mean guards, barriers or walls around the perimeter of the LCU platform. Comment on [p1] to [p5]: These parameters are limited to mitigate a falling hazard and not shearing, crushing and other hazards. Comment on [p2]: Enclosed LCU barriers are preferable. Comment on [p3]: This parameter only addresses normal operation and not panic situations, entrapments or foreseeable misuse. Comment on [p4]: See commentary on GSP 6.3.1 [p1].
26. LCU travel path limits **(ISO 8100-20:2018, 6.5.5)**	[p1] For values of deceleration, see 6.5.9. [p2] For guidance on electrical slowdown devices, see 5.2.1.3.	Remark: For refuge spaces beyond travel limits, see 6.5.9.

[a] Before using any GSPs from Table 2, 5.1 and 5.2 shall be conformed to, in order to ensure that all hazards are sufficiently addressed.

Table 2 *(continued)*

GESR	GSPs referenced in this part of ISO 22559[a]	Remark/illustration/comment
27. Uncontrolled movement of an LCU **ISO 8100-20:2018, 6.5.6)**	[p1] While travelling with all doors closed, any hazardous overspeed of the LCU should be detected and LCU slowed down with a deceleration ≤1 g. NOTE See GESR 6.5.9 for more on deceleration. [p2] Unintended movement of LCU from landing to address crushing hazard; the movement should be detected and the LCU stopped within a distance of ≤1 200 mm. Vertical opening between bottom of LCU (e.g. apron) and landing: ≤200 mm. [p3] The car should be maintained at floor level without loss of traction when loaded to 125 %. See GSP 18.	Comments and rationale: [p1] Hazardous overspeed is considered to be a speed in excess of that for which safety devices are designed. If the LCU exceeds a speed for which the safety devices are rated, the devices can fail or not operate appropriately. Therefore, the overspeed should be detected before such speeds are reached and deceleration of the LCU is initiated. [p2] Unintended movement of LCU from landings with open doors should be interrupted in consideration of the following: a) Stop the movement before a crushing hazard would become significant. Limiting the movement to 1 200 mm seems appropriate, since this would leave 800 mm clear (with doors of 2 000 mm). b) Stop the movement in the upward direction before space under the LCU would allow falling into the well (hoistway) (see 6.3.4). Vertical opening between bottom of LCU and landing: $x \leq 200$ mm). c) Stop the movement, with deceleration not exceeding 1 g.
28. LCU collision with objects in or beyond the travel path **(ISO 8100-20:2018, 6.5.7)**	GESR is self-explanatory.	
29. LCU horizontal and rotational motion **(ISO 8100-20:2018, 6.5.8)**	[p1] Average horizontal acceleration: ≤0,1 g. [p2] No peak horizontal acceleration: >0,1 g for durations >0,125 s.	Comments on [p1] and [p2]: Stability of standing people subject to accelerations in the horizontal plane, as a result of back and forth, transverse or rotational velocity changes, is affected by the resultant acceleration magnitude, direction and time of exposure. Stability criteria established in North America for inclined lifts indicate that an average resultant horizontal acceleration of ≤0,1 g is appropriate, provided no peak value in excess of 0,1 g is present for >0,125 s. These parameters are more than sufficient for the normal use of lifts as defined in this document.
30. Change of speed or acceleration **(ISO 8100-20:2018, 6.5.9)**	[p1] Average deceleration rate: ≤1 g. [p2] No peak retardations: >2,5 g for durations >0,04 s.	

[a] Before using any GSPs from Table 2, 5.1 and 5.2 shall be conformed to, in order to ensure that all hazards are sufficiently addressed.

Table 2 *(continued)*

GESR	GSPs referenced in this part of ISO 22559[a]	Remark/illustration/comment
31. Objects falling on the LCU **(ISO 8100-20:2018, 6.5.10)**	GESR is self-explanatory.	Remark: Location of equipment and machinery inside the well (hoistway) should be given special consideration to address this hazard.
32. LCU ventilation **(ISO 8100-20:2018, 6.5.11)**	GESR is self-explanatory.	Remark: Local weather conditions should be considered.
33. Fire/smoke in LCU **(ISO 8100-20:2018, 6.5.12)**	GESR self-explanatory.	
34. LCU in flooded areas **(ISO 8100-20:2018, 6.5.13)**	GESR self-explanatory.	
35. Stopping means inside the LCU **(ISO 8100-20:2018, 6.5.14)**	GESR self-explanatory.	
36. Landing indication **(ISO 8100-20:2018, 6.5.15)**	[p1] For guidance, see ISO 4190-5.	Remarks: When providing indication, factors, such as size, illumination and location of letters, numerals and symbols should be taken into consideration. Other issues, such as audible indication and tactile characteristics, may also be considered.
6.5 GESRs and GSPs related to persons in working areas (ISO 8100-20:2018, 6.6)		
37. Working space **(ISO 8100-20:2018, 6.6.1)**	[p1] Minimum dimensions to stand or move: — apply ISO 15534-1, ISO 15534-2 and ISO 15534-3, using 99th percentile values. [p2] Minimum distance to danger zones should be protected with — guard/cover in accordance with ISO 13857:2008, 4.2.1 and 4.2.2, and Table 1; or — guard/cover in accordance with ISO 14119 and ISO 14120. [p3] Openings in protective structure or guard/cover should be in accordance with ISO 13857. [p4] Electric shock — see 6.5.11	Remark: Equipment that is maintained should be readily accessible.
38. Accessible equipment **(ISO 8100-20:2018, 6.6.2)**	[p1] For guidance, see ISO 13854, ISO 13857 and ISO 14122 (all parts). NOTE See also 6.1.9, 6.5.1, 6.5.4 6.5.9, and 6.5.11.	

[a] Before using any GSPs from Table 2, 5.1 and 5.2 shall be conformed to, in order to ensure that all hazards are sufficiently addressed.

