INTERNATIONAL STANDARD

ISO 8100-32

First edition
2020-06

Lifts for the transportation of persons and goods —

Part 32: Planning and selection of passenger lifts to be installed in office, hotel and residential buildings

Ascenseurs pour le transport des personnes et des charges —

Partie 32: Critères de sélection des ascenseurs à installer dans les immeubles de bureaux, les hôtels et les immeubles d'habitation

Reference number
ISO 8100-32:2020(E)

Contents

Page

Foreword .... **v**
Introduction .... **vi**
1 Scope **1**
2 Normative references **2**
3 Terms and definitions **2**
4 Symbols and abbreviated terms **8**
5 Use of this document **8**
5.1 Overview 8
5.2 Design process 9
5.3 Selection of analysis method 9
5.4 Selection of design criteria 10
5.4.1 General 10
5.4.2 Design criteria for calculation method 10
5.4.3 Design criteria for simulation method 11
5.4.4 Further criteria and considerations 12
5.5 Initial lift configuration 12
6 Basic, derived and assumed data **12**
6.1 Basic and derived data for calculation and simulation methods 12
6.2 Building data 13
6.3 Determining the population 13
6.3.1 General 13
6.3.2 Office buildings 13
6.3.3 Hotels 14
6.3.4 Residential buildings 14
6.4 Passenger data 14
6.5 Lift data 15
6.5.1 Special considerations for accessibility of persons with disabilities 15
6.5.2 Selection of rated speed 15
6.5.3 Selection of rated load and available car area 16
6.5.4 Other lift parameters 17
7 Calculation method **17**
7.1 Uppeak equations 17
7.2 Lift selection graphs 19
8 Simulation method **19**
8.1 Basis of the method 19
8.2 Series of simulations 19
8.3 Simulation requirements 20
8.4 Evaluation and review of simulation results 21
9 Reporting **23**
9.1 General 23
9.2 Authorship data 23
9.3 Information related to the building 23
9.4 Design criteria 24
9.5 Data related to lift installation 24
9.6 Calculated lift performance output data 25
9.7 Simulated output data 25
Annex A (informative) **Selection of rated load and available car area** **26**
Annex B (informative) **Speed selection** **28**
Annex C (informative) **Lift selection charts** **29**

Annex D (informative) **Example of calculation method and report** **37**
Annex E (informative) **Example of simulation method and report** **41**
Annex F (informative) **Building data form** **44**
Annex G (informative) **Flow chart of design process** **46**
Bibliography **47**

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).

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).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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*.

This first edition cancels and replaces ISO 4190-6:1984.

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

Introduction

A lift installation describes a set of lifts by detailing the number, size, floors served, speed and various other characteristics of the lifts. An appropriate lift installation is usually one which provides good service to potential passengers with the least cost in terms of building core space.

In earlier years, the lift industry relied on probability based uppeak analysis formulae which calculated interval and handling capacity values. If the interval and handling capacity values of a specific lift installation meet recommended criteria, then the configuration is assumed to be acceptable. This traditional uppeak analysis worked well when lifts were relay-based and is still used for evaluating simple situations or to obtain initial estimates for more complex situations.

Some lifts now include sophisticated computer program-based traffic control systems. These control systems are difficult to describe with formulae but can be evaluated with the use of computer simulation programs.

This document provides two methods to determine an appropriate lift installation. The methods areas follows.

1) Calculation: the calculation method uses traditional uppeak analysis formulae. Selection charts in Annex C based on the calculation method provide a quick way of determining the lift installation for simple scenarios. The calculation method determines interval and handling capacity values that can be used to evaluate a lift installation. This method is recommended for relatively simple situations or to obtain an initial lift installation to be further analysed via simulation. The ISO calculation method is described in Clause 7 and a typical example using the formulae is given in Annex D.

2) Simulation: the simulation method is used to clarify service levels with different traffic control systems such as destination control. This method is recommended in complex situations or when detailed information other than interval and uppeak handling capacity values is desired. The ISO simulation method is described in Clause 8 and a typical example is given in Annex E.

Both levels require building, passenger and lift data (Clause 6). An initial data form is shown in Annex F.

This document applies the recommendation of ISO/TR 11071-2 which says:

> “While the entire subject of capacity and loading has historically been treated in safety codes as one and the same, it might be more meaningful in the future writing of safety codes to cover loading as a separate issue from capacity. One refers more appropriately to the traffic handling capacity, whereas the other refers to the maximum carrying capacity, which has a direct bearing on safety.”

Accordingly, this document distinguishes car capacity and car loading by passengers when discussing the selection of rated load and available car area (6.5.3 and Annex A).

This document is intended to be a reference in the early stages of a project and can be especially useful to clients or building owners, architects, general and specialized engineering consultants, building managers, lift consultants, lift contractors, building developers, principal contractors and other interested parties.

This document reflects the requirements of the global marketplace and takes into account the special needs such as accessibility of persons with disabilities (6.5.1). Although this document does not give recommendations for the planning or selection of goods (US: freight[1]) lifts, goods lifts are an important aspect of lift planning.

1) Hereinafter, the term "goods" is used in place of the term "freight".

Lifts for the transportation of persons and goods —

Part 32: Planning and selection of passenger lifts to be installed in office, hotel and residential buildings

1 Scope

This document covers traffic planning and selection of new passenger lift installations in office, hotel and residential buildings. The requirements and recommendations given are applicable to both simple and complex lift installations.

This document gives guidance to select the most appropriate method of traffic planning for each case within the scope.

This document permits the number and configuration of lifts and their main characteristics to be determined at the early stages of building design, provided that the size and intended use of the building is known.

This document is applicable to lifts classified according to Table 1.

Table 1 — Classification of lifts according to ISO 8100-30

Class	Purpose
Class I	Lifts designed for the transport of persons
Class II	Lifts designed mainly for the transport of persons but in which goods can be carried
Class VI	Lifts designed to suit buildings with intensive traffic, i.e. lifts with speeds of 2,5 m/s and above

This document is applicable to mixed use buildings provided that the mixed use can be evaluated separately as either office, residential or hotel use. This document proposes a standardized method of lift traffic planning. Alternative methods can be valid but are not in the scope of this document.

This document gives basic requirements and recommendations as part of the planning and selection of lift(s) relating to:

a) the design criteria to be evaluated;

b) the values of design criteria to be used;

c) a calculation method (see Clause 7) to be used as part of simple planning and selection of lifts (5.3);

d) a simulation method (see Clause 8) to be used as part of simple and more complex planning and selection of lifts (5.3);

e) output report format of lift planning and selection analysis to be provided to interested parties;

f) consideration of existing safety standards and cultural norms for determining the number of persons that can fit into a specific size of car[2)];

g) accommodation for luggage, bicycles, prams, etc., or other non-personal items that can be transported with passengers in the lifts;

h) accessibility for persons with disabilities.

2) The European Lift Directive 2014 refers to the car as a carrier.

This document does not address:

i) the transportation of goods only;

j) the transportation of passengers using multiple cars sharing a single hoist way;

k) the transportation of passengers using double deck systems;

l) terminal to terminal travel in excess of 200 m and/or rated speed above 7 m/s;

m) variations to the calculation method (e.g. traffic conditions other than uppeak, door dwell time definitions, unequal floor heights, unequal floor populations, speed not being reached in one floor jump, etc.);

n) variations to the simulation method (e.g. passenger batches or traffic templates with variable passenger demand);

o) design of simulator models or traffic control systems;

p) advanced passenger features (e.g. walking speed);

q) performance verifications of the design after installation.

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 4190-5, *Lift (Elevator) installation — Part 5: Control devices, signals and additional fittings*

ISO 8100-30:2019, *Lifts for the transport of persons and goods — Part 1: Safety requirements for passenger and goods passenger lifts*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4190-5, ISO 8100-30 and the following apply.

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

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

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

3.1
available car area
A_{car}
area of the car, which is available for passengers or goods during operation of the lift

Note 1 to entry: The available car area is expressed in m^2.

[SOURCE: EN 81-20:2014, 3.3, modified — Note 1 to entry has been added.]

3.2
conventional control system
lift system with collective control that requires call buttons on each landing and floor selection buttons in the car

3.3
destination control system
lift system that provides landing controls for selecting destination floors, lobby indicators designating which lift to board, and a car indicator designating the floors at which the car will stop

Note 1 to entry: Also called hall call allocation or destination-oriented lift system (DO) (see ISO 4190-5:2006, 3.1.3).

3.4
door closing delay time
t_{cd}
delay after passenger clearance before door closing

Note 1 to entry: The door closing delay time is expressed in s.

3.5
door closing time
t_c
period of time measured from the instant the car doors start to close until the doors are closed

Note 1 to entry: The door closing time is expressed in s.

3.6
door opening time
t_o
period of time measured from the instant that the car doors start to open until they are open to a specified width

Note 1 to entry: Measurements may be completed at the instant that the doors are either 800 mm open or until the doors are fully open.

Note 2 to entry: The opening width used shall be reported.

Note 3 to entry: The door opening time is expressed in s.

3.7
door pre-opening time
advance door opening time
t_{pre}
period of time measured from the instant that the car doors start to open until the lift is level at a landing

Note 1 to entry: Door pre-opening may compensate for lift levelling, which is the final (slow) approach of the lift to a landing.

Note 2 to entry: The door closing time is expressed in s.

3.8
entrance bias
proportion of traffic attributed to a specific *entrance floor* (3.9)

3.9
entrance floor
floor with building entrance or utility floor, e.g. restaurant, which attract people from populated floors

3.10
express zone
building zone situated between an *entrance floor* (3.9) and served floors where lift travels nonstop

3.11
flight time
t_f
period of time from the instant the lift starts to move until the lift is level at the next stop floor

Note 1 to entry: Flight time is usually calculated by assuming ideal lift kinematics based on the rated speed, rated acceleration and jerk.

3.12
handling capacity
C_h
maximum sustainable number of passengers per specified time period that a single lift or a *lift group* (3.15) can transport for a specific *traffic mix* (3.34) under specified loading constraints

Note 1 to entry: Handling capacity is usually expressed as a number of passengers per five minutes (C_h) or as a percentage of population per five minutes ($\%C_h$).

Note 2 to entry: Typical loading constraints are limiting the number of passengers in the cars and are determined by comfort and/or safety considerations that may reflect cultural and/or national norms.

Note 3 to entry: The average waiting time increases rapidly and passengers are constantly left behind the departing lift, when passenger demand exceeds handling capacity.

3.13
incoming traffic
component of traffic where passengers travel from *entrance floors* (3.9) to the populated floors

3.14
interfloor traffic
component of traffic where passengers travel between the populated floors

3.15
lift group
set of lifts having the management of calls in common

Note 1 to entry: Usually a lift group serves the same set of floors, for example, low rise served, high rise served, etc.

3.16
loading limit
F_l
ratio between the maximum number of passengers allowed in the car during simulation, P_{sim} (Clause 4), and the *rated passenger capacity* (3.26)

Note 1 to entry: Used in selection of rated load according to Formula (4).

Note 2 to entry: Loading limit is in the range 0,5 to 1,0, where a value of 0,8 or less should be selected to avoid overcrowding.

3.17
lunch traffic
traffic that mostly consists of *incoming* (3.13) and *outgoing* (3.20) passengers and also contains *interfloor* (3.14) traffic

Note 1 to entry: Lunch traffic is typical for office buildings. A typical traffic mix can be 45 % incoming, 45 % outgoing and 10 % interfloor for office buildings.

3.18
net internal area
A_{ni}
usable area within a building measured (at each floor level) to the internal finishes of structural external or party walls, but excluding washrooms, mechanical equipment rooms, stairs and lift well, common entrance halls, lobbies and corridors, internal structural walls and columns

Note 1 to entry: Net internal area and other similar terms are defined in more detail by other documents; they may depend on national norms and local practice.

Note 2 to entry: The net internal area is expressed in m^2.

3.19
nominal travel time
theoretical time of travel
t_{nt}
time period in seconds for a lift to travel from the lowest floor to the highest floor without any stops at *rated speed* (3.27)

Note 1 to entry: The nominal travel time is expressed in s.

3.20
outgoing traffic
component of traffic where passengers travel from the populated floors to *entrance floors* (3.9)

3.21
passenger demand
λ
rate at which people request service from a lift system normally expressed in conjunction with a *traffic mix* (3.34)

Note 1 to entry: Passenger demand is usually expressed as a number of passengers per five minutes (λ) or as a percentage of population per five minutes (%λ).

3.22
passenger transfer time
t_p
average time for a single passenger to enter or leave the car

Note 1 to entry: The passengers usually move out faster than they move in. Transfer time is an average of both of them.

Note 2 to entry: The passenger transfer time is expressed in s.

3.23
performance time
door-to-door time
t_{perf}
period of time between the instant the car doors start to close and the instant that the car doors are open to a specified width at the next adjacent floor

Note 1 to entry: The performance time is expressed in s.

Note 2 to entry: Measurements may be completed at the instant that the doors are 800 mm open or until the doors are fully open.

3.24
population
U
maximum population a target building is going to be designed for

3.25
rated load
Q
load for which the lift has been built and under which it is designed to operate

Note 1 to entry: The rated load is expressed in kg.

[SOURCE: ISO 8100-30:2019, 3.4.2, modified — The symbol *Q* and Note 1 to entry have been added.]

3.26
rated passenger capacity
maximum number of passengers in a lift car that must not be exceeded due to safety norms

3.27
rated speed
v_n
speed for which the lift has been built and at which it is designed to operate

Note 1 to entry: The rated speed is expressed in m/s.

[SOURCE: ISO 8100-30:2019, 3.4.1, modified —Note 1 to entry has been added.]

3.28
required handling capacity
$C_{h,req}$
number of passengers per specified time period that a single lift or a *lift group* (3.15) shall be able to sustainably transport according to the design criteria for a specific *traffic mix* (3.34) under specified loading constraints

Note 1 to entry: Required handling capacity is usually expressed as a number of passengers per five minutes ($C_{h,req}$) or as a percentage of population per five minutes ($\%C_{h,req}$).

Note 2 to entry: Typical loading constraints are limiting the number of passengers in the cars and are determined by comfort and/or safety considerations that can reflect cultural and/or national norms.

3.29
reversal floor
number of floors above the *entrance floor* (3.9) at which point the car reverses to return back to the entrance floor

Note 1 to entry: Used in the *round trip time* (3.31) calculation where it is calculated with a formula to determine an average value.

3.30
rise
set of floors served by a lift group

3.31
round trip time
t_{rt}
average period of time for a single lift car trip during uppeak traffic conditions, measured from the time the car doors open at the main terminal until the car doors reopen at the main terminal after serving the registered car calls

Note 1 to entry: The round trip time is expressed in s.

3.32
start delay time
t_{sd}
period of time from the instant the car doors are closed until the lift starts to move

Note 1 to entry: The start delay time is expressed in s.

3.33
time to destination
period of time from when a passenger either registers a landing call, or joins a queue, until the responding lift begins to open its doors at the destination floor

3.34
traffic mix
traffic consisting of specified proportions of *incoming* (3.13), *outgoing* (3.20), and *interfloor traffic* (3.14)

3.35
transit time
period of time from when a responding lift begins to open its doors at the boarding floor until the doors begin to open again at the destination floor

Note 1 to entry: The transit time commences when a passenger arrives, if the responding lift doors are open or opening.

3.36
two-way traffic
traffic mix (3.34) that consists of *incoming* (3.13) and *outgoing* (3.20) passengers without any *interfloor traffic* (3.14)

3.37
uppeak interval
t_{int}
average time between successive car departures from the main *entrance floor* (3.9)

Note 1 to entry: In the calculation method (Clause 7), the interval is defined as the round trip time divided by the number of lifts in the group.

Note 2 to entry: The uppeak interval is expressed in s.

3.38
uppeak traffic
traffic that consists mostly of *incoming* (3.13) passengers

Note 1 to entry: Pure uppeak traffic consists of 100 % of incoming passengers.

Note 2 to entry: In practice, pure uppeak is rarely encountered, and the traffic mix can include proportions of outgoing and interfloor traffic (e.g. 85 % incoming, 10 % outgoing and 5 % interfloor traffic).

3.39
utilization factor
F_u
ratio of the utilized space (where people are physically seated) in relation to the *net internal area* (3.18)

3.40
waiting time
period of time from when a passenger either registers a call on a landing, or joins a queue, until the responding lift that will accommodate the passenger begins to open its doors at the boarding floor

Note 1 to entry: The passenger waiting time continues if a passenger does not enter the responding lift, e.g. it is full (a refusal).

Note 2 to entry: The passenger waiting time is zero, if the responding lift doors are open or opening when the passenger arrives.

Note 3 to entry: There can be a difference between waiting times measured at a site and waiting times produced by a simulation due to the difficulty of accurately measuring waiting times at an actual site.

3.41
workplace area
$\boldsymbol{A_{wp}}$
subset of an office area that represents the average amount of space allocated as working space for a single person

Note 1 to entry: The workplace area is expressed m^2 per person.

4 Symbols and abbreviated terms

A_p	average area per person (m^2)
C_h	handling capacity (passengers per 5 min)
$\%C_h$	handling capacity (% of population per 5 min)
D	terminal to terminal travel (m)
d_f	average interfloor distance (m)
H	average highest reversal floor
L	number of lifts
m_p	average mass per person (kg)
N	number of landings served above entrance floor
P_{calc}	average number of passengers in the car at departure from the main entrance floor (for calculation method)
P_{sim}	maximum number of passengers allowed in the car during simulation (input for simulation method)
S	probable number of stops
t_{aw}	average waiting time (s)
$t_{aw,req}$	required average waiting time (s)
$t_{int,req}$	required uppeak interval (s)
$t_f(1)$	single (1) floor flight time (s)
t_s	time consumed in stopping (s) NOTE Sometimes called time losses per stop or stop loss time.
t_v	time to travel between two standard pitch adjacent floors at rated speed (s)
$\%\lambda$	percentage passenger demand (% of population per 5 min)

5 Use of this document

5.1 Overview

The purpose of this document is to determine solutions for lift installations to serve the expected passenger demands in a building. The selection should meet the design criteria to avoid poor service at all times, as this can limit the usability of the building. It is also important to avoid an over provision of equipment and the excessive use of space.

Consideration should be given to the long-term use of the building and its potential changes in the future, including densification, accessibility, usage and signalling.

NOTE ISO 8100-30 gives a globally agreed range of standardized layouts, rated loads and rated speeds to meet different vertical transportation needs and also provides the type of and size of entrance, the shape of car, etc.

To achieve higher efficiency, buildings with large numbers of floors may be split into rises, for example, by dividing buildings into a low-rise group and a high-rise group with an express zone. Parking floors, restaurant levels, shopping areas, gyms, observation decks, etc., can be served by separate lifts or escalators.

5.2 Design process

The steps of the design process and their sequence aim to make the overall process comprehensive, reproducible and well documented. Each step is described in this document.

The processing order of the steps is important and shall be followed as described below (Annex G).

a) The building data shall be collected, including the type of the building and its population (6.3).

NOTE 1 The quality of any traffic design is dependent on the quality of the data obtained.

b) The method of traffic analysis shall be selected (5.3).

c) The design criteria shall be selected (5.4).

d) An initial lift configuration shall be chosen for each lift group (5.5).

NOTE 2 If there are multiple lift groups, each one is considered separately.

e) A traffic analysis for the chosen lift configuration shall be carried out, using the method selected above (Clauses 7 and 8).

f) The lift configuration shall be changed if the results from the traffic analysis do not meet the design criteria or are significantly in excess, or if alternative design criteria are considered (see also 5.4.3 and 6.1). If the lift configuration is changed, the process shall be repeated from step e).

g) The results from selected traffic analysis for the final lift installation shall be presented in a report that documents the assumptions and design decisions, as well as the method of the traffic analysis and its outcome (Clause 9).

5.3 Selection of analysis method

As part of a specific design process (5.2), this document uses two methods of traffic analysis.

For simpler cases, a calculation method (Clause 7) can be sufficient. It is based on the concept known as uppeak traffic and determines uppeak handling capacity and interval.

For all cases with more complex traffic demands and all cases with destination control systems, the simulation method (Clause 8) shall be used. In an analysis using the simulation method, the lift parameters and the served floors of lifts can be defined individually and the group control system shall be defined. The simulation method can produce diversified results including waiting times, and the saturation point can be analysed to show where the passenger demand is too high for the lifts to handle the traffic.

A design shall be considered as complex, when one or more of the following conditions apply, including:

a) the traffic control is a destination control system;