Technical Report

ISO/TR 24679-4

Fire safety engineering — Performance of structures in fire —

Part 4: Example of a fifteen storey steel-framed office building

Ingénierie de la sécurité incendie — Performance des structures en situation d'incendie —

Partie 4: Exemple d'un immeuble de bureaux en structure acier de quinze étages

Sample Document
get full document from standards.iteh.ai

Second edition
2026-11

Reference number
ISO/TR 24679-4:2026(en)

© ISO 2026

ISO/TR 24679-4:2026 • https://standards.iteh.ai/catalog/standards/iso/fcfbe72a-00dd-4ac5-93ca-87df99a35d76/iso-tr-24679-4-2026

Sample Document

get full document from standards.iteh.ai



COPYRIGHT PROTECTED DOCUMENT

© ISO 2026

All rights reserved.

This ISO publication is protected by copyright and is owned by ISO and/or its licensors.

The content of this ISO publication is provided under licence, not sold. Use is subject to the applicable licence terms issued by ISO, an ISO member body, or an authorized third-party distributor.

Except as required for implementation or expressly permitted by a separate licence, no part of this ISO publication may be reproduced, distributed, modified, used, or made available in any form or by any means – electronic or mechanical, including photocopying, scanning, recording, or posting on internal or external digital platforms.

Any use beyond the scope of the granted rights is prohibited and may result in legal action.

ISO copyright office
CP 401 • CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

ISO/TR 24679-4:2026 • https://standards.iteh.ai/catalog/standards/iso/fcfbe72a-00dd-4ac5-93ca-87df99a35d76/iso-tr-24679-4-2026

Contents

Page

Foreword ..... **iv**
Introduction ..... **v**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **1**
4 Symbols **2**
5 Design strategy for fire safety of structures **3**
6 Quantification of the performance of structures in fire **4**
6.1 General 4
6.2 Step 1: Scope of the project for fire safety of structures 5
6.2.1 Built environment characteristics 5
6.2.2 Fire load 8
6.2.3 Mechanical actions 9
6.3 Step 2: Identify objectives, functional requirements and performance criteria for fire safety of structures 9
6.4 Step 3: Trial design plan for fire safety of structures 10
6.5 Step 4: Design fire scenarios and design fires 10
6.5.1 Design fire scenarios 10
6.5.2 Design fires (thermal actions) 10
6.6 Step 5: Thermal response of the structure 12
6.6.1 Steel columns and beams 12
6.6.2 Other construction elements 14
6.7 Step 6: Mechanical response of the structure 14
6.7.1 Steel columns 14
6.7.2 Steel beams 15
6.8 Step 7: Assessment against the fire safety objectives 16
6.9 Step 8: Documentation of the design for fire safety of structures 16
6.10 Factors and influences to be considered in the quantification process 17
6.10.1 Thermal properties 17
6.10.2 Mechanical strength of steel material 17
6.10.3 Uncertainty of material properties 17
7 Guidance on use of engineering methods **17**
7.1 Using calculation methods 17
7.2 Using experimental method 18
7.3 Using engineering judgement 18
Annex A (informative) **Building and framing design** **19**
Annex B (informative) **Fire load and structural load** **28**
Annex C (informative) **Fire temperatures** **33**
Annex D (informative) **Maximum temperature of insulated steel elements** **38**
Annex E (informative) **Critical temperatures of steel columns, girders and beams** **44**
Bibliography **51**

Sample Document
Standards.iteh.ai

© ISO 2026 – All rights reserved

ISO/TR 24679-4:2026 • https://standards.iteh.ai/catalog/standards/iso/fcfbe72a-00dd-4ac5-93ca-87df99a35d76/iso-tr-24679-4-2026

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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.

Sample Document

This document was prepared by Technical Committee ISO/TC 92, *Fire safety*, Subcommittee SC 4, *Fire safety engineering.*

This second edition cancels and replaces the first edition (ISO/TR 24679-4:2017), which has been technically revised.

get full document from standards.iteh.ai

The main changes are as follows:

— scope updated;

— Clause 3 terms and definitions updated;

— structure of document revised, with new figures included.

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.

© ISO 2026 – All rights reserved

ISO/TR 24679-4:2026 • https://standards.iteh.ai/catalog/standards/iso/fcfbe72a-00dd-4ac5-93ca-87df99a35d76/iso-tr-24679-4-2026

Introduction

This document is an example of the application of ISO 24679-1. It includes only those subclauses of ISO 24679-1 that describe the steps of the methodology for assessing the performance of structures in fire. It preserves the numbering of subclauses in ISO 24679-1 and so omits numbered subclauses for which there is no text or information relevant to this example.

The technical contents are based on the performance-based verification methods for fire resistance in the Building Standards Law of Japan. This document is not intended to demonstrate full conformance to a performance-based fire engineering regulation of Japan where extensive and detailed descriptions are needed to obtain approval. Not all the details are presented in this document, but only a few examples of verification are demonstrated following the procedure determined in ISO 24679-1.

The fire safety engineering applied in this example to the office building with respect to its fire resistance considers specific design fire scenarios as well as the corresponding fire development. It takes into account fully developed compartment fires. In realistic situations, activation of fire suppression systems and/or intervention of fire brigade are expected, but their beneficial effects are not considered. These severe fire scenarios have been selected for fire resistance purposes.

Global structural behaviour is not explicitly considered, but implicitly assumed in the calculation formulae by limiting excessive thermal deformation. In addition, since the building of this example is located in a seismic region, principal structural elements are rigidly connected to each other. Load redistribution from heated elements to cold surrounding elements does exist, but the beneficial effect was not taken into account in the design calculations because of simplification. This approach is applicable to ductile structural frame where restraint from surrounding cold structures would not cause excessive thermal stress to cause lateral torsional buckling. By this approach, design is considered to be conservative, while the process of safety checking is greatly simplified and clear. As a result, all the calculations were carried out by explicit algebraic formulae.

Sample Document

get full document from standards.iteh.ai

© ISO 2026 – All rights reserved

ISO/TR 24679-4:2026 • https://standards.iteh.ai/catalog/standards/iso/fcfbe72a-00dd-4ac5-93ca-87df99a35d76/iso-tr-24679-4-2026

Sample Document

get full document from standards.iteh.ai

Fire safety engineering — Performance of structures in fire —

Part 4:
Example of a fifteen storey steel-framed office building

1 Scope

This document provides a fire engineering application relative to the fire resistance assessment of a fifteen-storey steel framed building following the methodology given in ISO 24679-1. This document describes the adopted process which follows the same step by step procedure as that provided in ISO 24679-1. The annexes of this document present the detailed assessment results for this building.

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 13943, *Fire safety — Vocabulary*

ISO 23932-1, *Fire safety engineering — General principles — Part 1: General*

ISO 24679-1, *Fire safety engineering — Performance of structures in fire — Part 1: General*

Sample Document
get full document from standards.iteh.ai

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 13943, ISO 23932-1, ISO 24679-1 and the following apply.

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

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

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

3.1
critical temperature
temperature critical to cause any failure of an element by overall buckling, local buckling, excessive thermal deformation or connection failure and so on

Note 1 to entry: It is expressed in °C.

3.2
design heat release of a room
amount of heat to be released in a room including movable fire load, fixed fire load and heat transferred from adjacent rooms

Note 1 to entry: It is expressed in MJ.

© ISO 2026 – All rights reserved

ISO/TR 24679-4:2026 • https://standards.iteh.ai/catalog/standards/iso/fcfbe72a-00dd-4ac5-93ca-87df99a35d76/iso-tr-24679-4-2026

3.3
equivalent fire duration
duration of heating by a standard time-temperature curve as specified in ISO 834-1 that gives equivalent thermal effect on structural elements with a real fire

Note 1 to entry: It is expressed in min.

3.4
heat penetration ratio
ratio of heat penetrated from adjacent rooms to the room in consideration

Note 1 to entry: It is dimensionless.

3.5
movable fire load density
heat of combustion of movable room contents such as furniture, commodities and so on per unit floor area of fire room

Note 1 to entry: It is expressed in MJ/m^2.

3.6
total heat release of a room
amount of heat possible to be released in a room including movable and fixed fire load

Note 1 to entry: It is expressed in MJ.

3.7
fire temperature rise coefficient
proportional coefficient to calculate fire room temperature as described by a function of 1/6-th power of time

Note 1 to entry: It is expressed in $K/min^{1/6}$.

Sample Document
get full document from standards.iteh.ai

4 Symbols

For the purposes of this document, the following symbols are used.

A_r	room floor area (m^2)
A_f	surface area of interior lining material (m^2)
f_a	heat penetration ratio
f_y	nominal yield strength of steel at normal temperature (MPa)
G	permanent load (kN/m^2)
K	kinematic load (kN/m^2)
q_l	movable fire load density (MJ/m^2)
q_f	heat of combustion of interior lining materials per unit area (MJ/m^2)
Q_r	design heat release of a room (MJ)
Q	live structural load (kN/m^2)
t	time (min)
t_A	approved fire resistance time of a construction element (min)

© ISO 2026 – All rights reserved

ISO/TR 24679-4:2026 • https://standards.iteh.ai/catalog/standards/iso/fcfbe72a-00dd-4ac5-93ca-87df99a35d76/iso-tr-24679-4-2026

t_f fire duration (min)

t_{eq} equivalent fire duration as replaced with ISO 834-1 standard time-temperature curve (min)

T_B limiting temperature for overall buckling of a column(°C)

T_{Bcr} limiting temperature for bending failure of a beam (°C)

T_{cr} critical temperature of a steel element (°C)

T_{DP} limiting temperature for excessive deformation (°C)

T_{CT} limiting temperature for connection failure (°C)

T_{LB} limiting temperature for local buckling (°C)

$T_{s.max}$ maximum steel temperature under design fire action (°C)

T_f fire temperature in a room (K)

T_0 initial temperature (K)

α fire temperature rise coefficient ($K/min^{1/6}$)

5 Design strategy for fire safety of structures

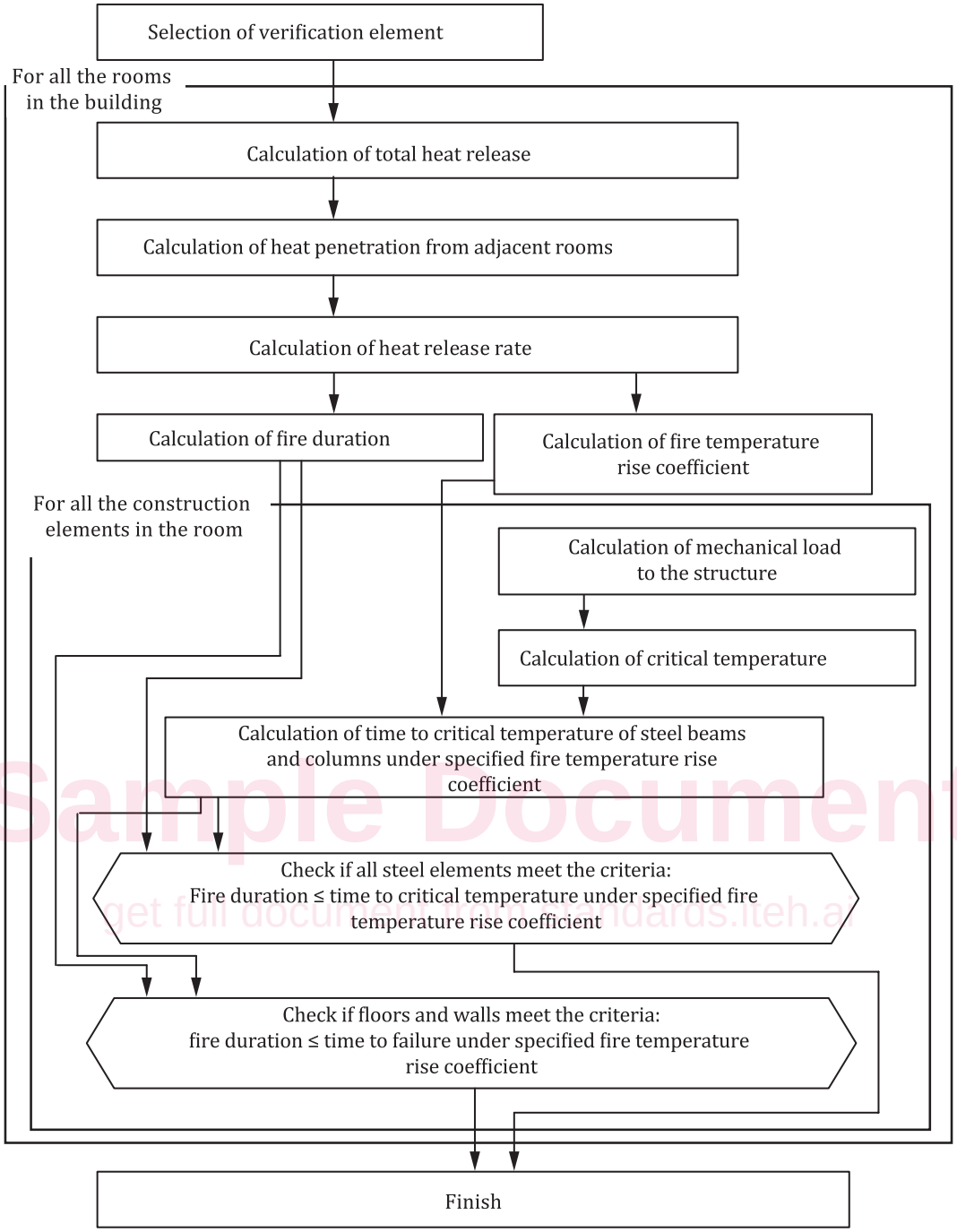
The built environment of this example is a medium-rise office building. Due to its use, the building is separated into multiple compartments by floors and walls to accommodate tenant office functions. As the combustible contents are distributed densely, fire is assumed to spread over a whole compartment. As a result, a fully developed compartment fire is expected in each room of the building.

The structural elements are composed of insulated steel. To prevent failure of the structural elements and connections, the thickness of insulation had been defined in order to limit their temperatures below their critical temperatures.

In the prescriptive code applicable to this example, columns must be three hours fire resistance rated construction on the first floor, two hours on the second to eleventh floors and one hour on the floors above. By carrying out fire calculations, the thickness of fire insulation is rationalized. The method is based on the performance-based verification methods for fire resistance in the Building Standards Law of Japan[1]. The standard procedure is shown in Figure 1. The fires are assumed at all the rooms respectively. The steel temperatures are calculated for fully developed fires. Critical temperatures are determined by the minimum of the limiting temperatures for overall buckling, local buckling, excessive deformation and connection failure. The interactions between elements were not explicitly assessed but assumed as the building frame is normally designed to be ductile to withstand the earthquake motion assumed the region. Finally, the maximum steel temperature is compared with critical temperature element by element.

© ISO 2026 – All rights reserved

ISO/TR 24679-4:2026 • https://standards.iteh.ai/catalog/standards/iso/fcfbe72a-00dd-4ac5-93ca-87df99a35d76/iso-tr-24679-4-2026



Sample Document
get full document from standards.iteh.ai

Figure 1 — Verification method of fire resistance in Building Standards Law of Japan

6 Quantification of the performance of structures in fire

6.1 General

The steps of the design process considered in the conducted fire safety engineering study are detailed in 6.2 to 6.9.

© ISO 2026 – All rights reserved

ISO/TR 24679-4:2026 • https://standards.iteh.ai/catalog/standards/iso/fcfbe72a-00dd-4ac5-93ca-87df99a35d76/iso-tr-24679-4-2026

6.2 Step 1: Scope of the project for fire safety of structures

6.2.1 Built environment characteristics

The built environment is a steel framed 15-storey office building. The total area is 8 236 m^2 and the building height is 68,5 m. See Annex A for building drawings. According to the regulations, the building must be constructed by fire-resistive constructions. In the prescriptive code,[8] columns must be three hours fire resistance rated construction on the first floor, two hours on the second to eleventh floors and one hour on the floors above. The building is separated horizontally by compartment floors at all levels. Vertical shafts such as stairs, lifts and service shafts are enclosed by one-hour fire resistance rated walls.

The floor plan is shown in Figure 2. The office area is split into two rooms, XX01 and XX02, where the symbol XX denotes floor number. For example, 1502 denotes room number 2 on the 15^{th} floor. The two office rooms are separated by an EI60 (60 minutes of integrity and insulation) wall as determined by ISO 834-8. In addition, the office area is divided into two rooms by a non-fire resistance rated wall made of regular gypsum board. In order to prevent fire spread between office area and corridor, the doors between office rooms and corridor provide a fire resistance-rated E60 (60 minutes of integrity). The insulation criterion is not required for fire doors in the Japanese regulation.

The building structure is a rigid moment-resistant steel frame. Specification of members such as columns, beams and floor slabs are listed in Annex A. The columns, beams and girders are protected against fire by a 25 mm sprayed mineral wool cementitious mixture because this thickness is the minimum prescribed in Japan for stickability and integrity. This thickness can be changed as long as stickability and integrity are maintained.

NOTE This assumption is specific for this example.

— Span of primary beams: 13,6 m;

— Span of secondary beams: 6,4 m;

— Spacing of columns: 6,4 m in direction of primary beams and 13,6 m in direction of secondary beams.

Sample Document
get full document from standards.iteh.ai

The applied load of design on the floors is taken as follows:

— live load: 2,9 kN/m^2 (based on building code requirement);

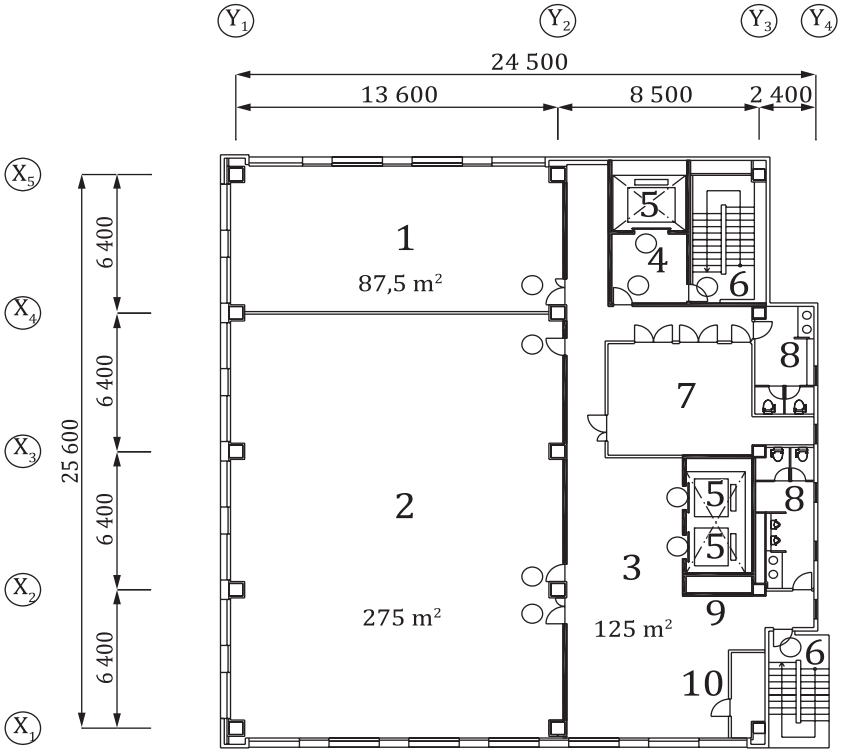
— self-weight of floor: 3,65 kN/m^2.

In this document, only the results of construction elements in office rooms number: 201, 202, 1501 and 1502 are demonstrated.

The external walls are fire resistance-rated for one hour in accordance to ISO 834-1 with exposure from the outside (integrity and insulation). The windows are not fire-resistant. However, it was assumed that upward fire spread was prevented by the use of appropriate materials conforming to the applicable regulations. The floors are composite constructions of concrete slabs and steel deck with a 1 h fire resistance rating (load bearing, integrity and insulation). The beams are connected rigidly with deck floor slab of normal weight concrete and profiled steel sheets with reinforcing bars.

© ISO 2026 – All rights reserved

ISO/TR 24679-4:2026 • https://standards.iteh.ai/catalog/standards/iso/fcfbe72a-00dd-4ac5-93ca-87df99a35d76/iso-tr-24679-4-2026



Key

1	office room (XX01)
2	office room (XX02)
3	corridor
4	vestibule
5	lift
6	stairs
7	machinery room
8	toilet
9	duct space
10	pipe space
▬	fire resistance rated partition wall (EI60)
═	non-fire resistance rated partition wall
○	fire door (E60)

NOTE All the exterior walls are fire resistance rated (EI60).

Sample Document
get full document from standards.iteh.ai

Figure 2 — Typical floor plan

Preliminary designs, at room temperature, were carried out to determine the dimensions of the structural members. As the building is located in a seismic region, the members are designed against seismic actions as will be described later in 6.2.3.

The floor and beam plans are shown in Figure 3. The frame consists of simple 2 × 4 bays. The trial design of principal construction elements is listed in Table 1. On the second floor, large cross-section steel elements are used to withstand the large seismic actions. Under the fire condition, vertical loads are applied to second floor columns as well as in cold condition. On the 15th floor, the elements are made of relatively thin and small steel sections. The applied loads under the fire condition are small compared to the second-floor elements. Further details are shown in Annex A.

Columns and girders are made of SN490[9] steel with a yield strength of 325 MPa. Secondary beams are made of a SS400[10] steel with a yield strength of 235 MPa. Columns are made of box-sectioned tubes. Beams and girders are made of H-sectioned elements. To prevent excessive temperature rise, the elements are

© ISO 2026 – All rights reserved

ISO/TR 24679-4:2026 • https://standards.iteh.ai/catalog/standards/iso/fcfbe72a-00dd-4ac5-93ca-87df99a35d76/iso-tr-24679-4-2026

insulated with a sprayed mineral wool cementitious material of a thickness over 25 mm. The bulk density is at least 280 kg/m^3.

NOTE The mixing ratio of mineral wool and cement is 6:4.

The floor slab is made of composite structure of profiled steel plate and concrete. The thickness of concrete varies from 80 mm to 155 mm. The diameter of the reinforcing bars is 13 mm. The concrete cover of reinforcing bars from the bottom side of the slab is 20 mm. Reinforcing wire mesh with 6 mm diameter and spaced 100 mm, is located at 30 mm from the top side of the slab. The compressive strength of concrete is 21 MPa.

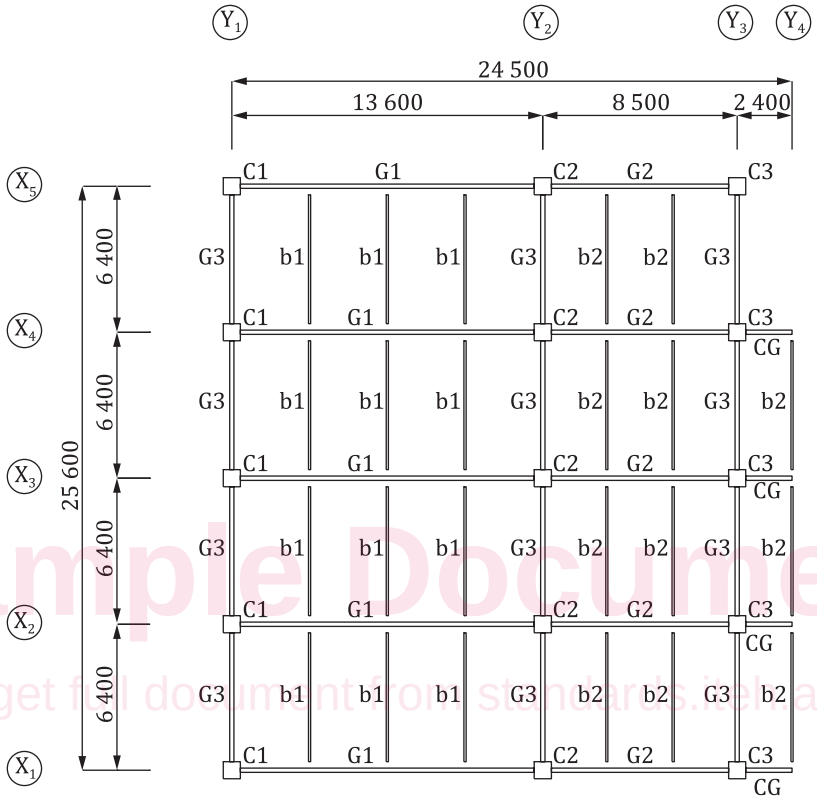


Figure 3 — Floor and beam plan

Table 1 — Summary of the structural members

Floor levels		2nd floor	15th floor
Column (four sides exposed) SN 490 steel, f_y = 325 MPa	C1	box-600 × 40	box-600 × 22
	C2	box-600 × 45	box-600 × 22
	C3	box-500 × 36	box-500 × 19
Primary beam (three sides exposed) SN 490, f_y = 325 MPa	G1	H-900 × 350 × 16 × 25	H-700 × 300 × 14 × 25
	G2	H-900 × 300 × 16 × 25	H-700 × 250 × 14 × 22
	G3	H-900 × 300 × 16 × 25	H-700 × 250 × 14 × 22
Secondary beam (three sides exposed), SS400, f_y = 235 MPa	b1	H-350 × 175 × 7 × 11	
	b2	H-450 × 200 × 9 × 14	
Composite slab, concrete strength: 21 MPa	Steel decking	1,2 mm	
	Concrete thickness	minimum 80 mm, maximum 155 mm	
NOTE See Annex A for details.			

Sample Document
get full document from standards.iteh.ai

© ISO 2026 – All rights reserved

ISO/TR 24679-4:2026 • https://standards.iteh.ai/catalog/standards/iso/fcfbe72a-00dd-4ac5-93ca-87df99a35d76/iso-tr-24679-4-2026

6.2.2 Fire load

Because the building is used as office space, significant amount of combustible is expected. See Annex B for details. The design heat release of a room, Q_r, is calculated as the sum of the following components.

1) Movable fire load based on the use of the room, $A_r q_l$.

The movable fire load density for an office area was selected to be 560 MJ/m^2 following the applicable building code [8]. The results are shown in Table 2. For design purposes, the fire load density is taken as the mean value plus 1,6 times of the standard deviation of existing surveys of fire load for office buildings. This allows to estimate the upper 95th percentile value assuming log-normal distribution.

2) Fixed fire load based on the type of interior finish materials, $\Sigma A_f q_f$.

The heat of combustion of interior finish materials is counted as fixed fire loads. The details of calculation are shown in B.5.2. The results are summarized in Table 2.

3) Heat penetrated from adjacent rooms, $\Sigma f_a\ (A_r q_l + \Sigma A_f q_f)$.

As the partition wall between the office areas XX01 and XX02 are not fire resistance rated, fire can spread between the rooms after the failure of the partition wall. As a result, a part of combustion heat in an adjacent room may affect the structural elements in the room of fire origin. The schematic process is shown in Figure 4. In case of two rooms are separated by a non-fire rated wall, fire can grow to fully developed stage in one of the rooms as shown in the left-side room in Figure 4(a). Then, the partition wall collapses and fire spread to the right-side room as shown in Figure 4(b). Even after the combustibles in the right-side room burnt out, fire heat from the left room penetrate into the right-side room as shown in Figure 4(c). As a result, the structural elements in the right-side room is heated by the fire from both rooms. As a simplified calculation rule, it was assumed that 40 % of the released heat is absorbed by the walls, ceiling and floor of room of fire origin. The remaining 60 % of heat penetrates equally in all directions as determined in reference [11]. To account for this *mutual heating* effect, it was estimated that 15 % of heat of combustion in room XX01 penetrates to XX02. Similarly, 15 % of heat of combustion in room XX02 penetrates to XX01. The calculated results are shown in Table 3.

iTeh Standards
(https://standards.iteh.ai)
Document Preview
ISO/TR 24679-4:2026
get full document from standards.iteh.ai



(a) Fully developed fire in the left room (b) After the partition wall collapsed and fire spread to right room (c) After the left room is burnt out, but right room is still burning

Figure 4 — Schematic process of heat penetration

Table 2 — Total fire load of rooms XX01 and XX02 (XX = 2nd and 15th floors)

Floors	Room No.	Usage	Movable fire load density q_l (MJ/m^2)	Floor area A_r (m^2)	Movable fire load $A_r q_l$ (MJ)	Fixed fire load $\Sigma A_f q_f$ (MJ)	Total fire load of room (MJ)
2 to 15	201, 1501	office	560	87,5	49 000	7 649	56 649
	202, 1502	office	560	275	154 000	22 397	176 397
	corridor	pathway	32	125	4 000	13 722	17 722

© ISO 2026 – All rights reserved

ISO/TR 24679-4:2026 • https://standards.iteh.ai/catalog/standards/iso/fcfbe72a-00dd-4ac5-93ca-87df99a35d76/iso-tr-24679-4-2026

Table 3 — Design heat release of a room considering heat penetration from adjacent rooms

Floor	Room	Adjacent rooms	Total fire load of adjacent rooms (MJ)	Heat penetration ratio f_a (-)	Penetrated heat (MJ)	Design fire load (MJ)
2 to 15	201 1501	202,1502	176 397	0,15	26 460	83 108
		Corridor	17 722	0,0	0,0	
	202 1502	201,1501	56 649	0,15	8 497	184 894
		Corridor	17 722	0,0	0,0	

6.2.3 Mechanical actions

The mechanical actions in fire situation are determined in accordance with the applicable building code. Permanent and movable vertical loads are considered, while no horizontal actions are considered such as seismic and wind actions. As a result, the load combination is [8]:

$$1{,}0G + 1{,}0Q \tag{1}$$

where G is sum of all the permanent loads, i.e. self-weight of the building and Q for the movable loads representing the contents of the building. No snow load was considered in this document as the building is located in non-snow region.

As the building is located in seismic region, the following load combination is applied for seismic resistance design:

$$1{,}0G + 1{,}0Q + 1{,}0K \tag{2}$$

where K is the (horizontal) kinetic action. Common to most buildings in Japan, the cross-sectional dimensions are governed by seismic design. As a result, the load ratios of structural elements are fairly small during normal use such as in the case of non-seismic and non-windy conditions.

Sample Document
get full document from standards.iteh.ai

6.3 Step 2: Identify objectives, functional requirements and performance criteria for fire safety of structures

As the building is used by multiple occupants, the building must not collapse during egress, firefighting and rescue. In addition, as the building is located in an urban area, the building must not collapse during the whole process of fire and subsequent cooling period to prevent fire spread to urban scale. As a result, structural stability during the whole process of fire is necessary [8]. To fulfil this objective, the functional requirement is to have no failure of the principal building construction elements during the whole process of fire, including the cooling phase. Consequently, the following performance criteria, in terms of structural stability, are considered on an element-by-element basis.

— The temperature of the steel columns do not exceed the minimum of the critical temperatures for overall buckling, local buckling, excessive deformation nor connections failures.

— The temperature of the steel beams and girders do not exceed the limit for bending failure nor connection failure. Shear failure does not precede the bending failure.

— Floor construction does not exceed the limit for mechanical failures, typically bending failure.

In addition, the following performance criteria are considered in terms of fire containment. The fire resistance rated constructions are selected so as to satisfy the followings:

— Fire compartment walls and floor constructions do not transmit excessive heat that can ignite combustibles in opposite side (insulation criterion).

— Fire compartment walls and floor constructions and fire doors do not penetrate flame and/or hot gases that causes fire spread beyond them (integrity criterion).

© ISO 2026 – All rights reserved

ISO/TR 24679-4:2026 • https://standards.iteh.ai/catalog/standards/iso/fcfbe72a-00dd-4ac5-93ca-87df99a35d76/iso-tr-24679-4-2026