VTT EXPERT SERVICES LTD

Kemistintie 3, Espoo
P.O.Box 1001, FI-02044 VTT, FINLAND
www.vttexpertservices.fi

Designated according to Article 29 of Regulation (EU) No 305/2011

Member of EOTA
www.eota.eu

European Technical Assessment ETA 14/0415 of 21/05/2018

General Part

Technical Assessment Body issuing the ETA	**VTT Expert Services LTD**
Trade name of the construction product	**ISOVER FireProtect® 150** **ISOVER FireProtect® 150F**
Product family to which the construction product belongs	Fire protection of loadbearing steel structures
Manufacturer	**Division Isover** **Saint-Gobain Construction Products CZ a.s.** **Počernická 272/96, Prague 10, 108 03** **Czech Republic**
Manufacturing plant	Division Isover Saint-Gobain Construction Products CZ a.s. Masarykova 197, Častolovice, 517 50 Czech Republic
This European Technical Assessment contains	14 pages including 2 Annex which form an integral part of this assessment
This European Technical Assessment is issued in accordance with regulation (EU) No 305/2011, on the basis of	EAD 350142-00-1106 "Fire protective board, slab and mat products and kits", September 2017
This version replaces	ETA 14/0415, issued 3/3/2017

Specific Part

1 Technical description of the product

ISOVER FireProtect® 150 and ISOVER FireProtect® 150F are stone wool slabs. ISOVER FireProtect® 150 is unfaced and ISOVER FireProtect® 150F is faced with glass fibre tissue.

Dimensions and density of the slabs are given in Table 1.

Table 1. Dimensions and density of ISOVER FireProtect® 150 and ISOVER FireProtect® 150F.

	Nominal value	Tolerance
Density	thickness 20 - 25 mm: 165 kg/m^3 thickness 30 - 100 mm: 150 kg/m^3	
Length	1200 mm	± 8 mm
Width	600 mm and 1000 mm	± 5 mm
Thickness	20 - 100 mm	≤ -1 mm, ≤ +3 mm

ISOVER FireProtect® 150 and ISOVER FireProtect® 150F slabs are CE-marked according to harmonized product standard EN 14303 with designation code MW–EN14303–T5–CS(10)20–ST(+)700–WS1–CL10. Mechanical fasteners required for installation are described in Annex 1. The fasteners are not covered by this ETA and cannot be CE-marked on the basis of it.

2 Specification of the intended use in accordance with the applicable European Assessment Document (hereinafter EAD)

ISOVER FireProtect® 150 and ISOVER FireProtect® 150F are intended to be used for fire protection of structural steel columns and beams as specified in Table 2.

Table 2. Intended use of ISOVER FireProtect® 150 and ISOVER FireProtect® 150F.

Product	Use category	Protection of	Climatic conditions use category
ISOVER FireProtect® 150 ISOVER FireProtect® 150F	Type 4	Load-bearing steel elements as specified in Annex 1	Type Z_2 and Type Y

The provisions made in this European Technical Assessment are based on an assumed intended working life of 25 years provided that the product is subject to appropriate installation and maintenance.

The indication given as to the working life of the construction product cannot be interpreted as a guarantee neither given by the product manufacturer or his representative nor by the Technical Assessment Body issuing this ETA, but is regarded only as a means for expressing the expected economically reasonable working life of the product.

The completed building (the works) shall comply with the building regulations (regulations on the works) applicable in the Member States in which the building is to be constructed. The procedures foreseen in the Member State for demonstrating compliance with the building regulations shall also be followed by the entity held responsible for this act. This ETA does not amend this process in any way.

3 Performance of the product and references to the methods used for its assessment

Table 3. Basic requirements for construction works and essential characteristics

Basic requirement and essential characteristics	Performance
BWR 2. Safety in case of fire	
Reaction to fire	Clause 3.1
Resistance to fire	Clause 3.2
Durability and serviceability	Clause 3.3
BWR 3. Hygiene, health and the environment	
Water permeability	No performance assessed
BWR 4. Safety and accessibility in use	
Flexural strength	No performance assessed
Dimensional stability	No performance assessed
BWR 6. Energy economy and heat retention	
Thermal resistance	Clause 3.4
Water vapour transmission coefficient	Clause 3.5

3.1 Reaction to fire

ISOVER FireProtect® 150 and ISOVER FireProtect® 150F fire protective slabs have been tested and classified according to Commission Delegated Regulation (EU) No 2016/364. Reaction to fire class is A1.

3.2 Resistance to fire

Fire resistance for assemblies incorporating ISOVER FireProtect® 150 and ISOVER FireProtect® 150F stone wool slabs have been tested according to EN 13381-4:2013 and classified according to EN 13501-2:2016. Description of the tested assemblies are presented in Annex 1.

Resistance to fire performance classes of the tested assemblies are R 30 - R 180. Tables of insulation thickness required to achieve the fire resistance class, in relation to section factor and design temperature, are presented in Annex 2.

3.3 Durability and serviceability

Working life of the slabs is 25 years if not more than accidental wetting is to be expected.

Categories of intended climatic conditions of ISOVER FireProtect® 150 and ISOVER FireProtect® 150F are Type Z_2, Fire protective slabs intended for internal use only, and Type Y, Fire protective slabs intended for internal and semi-exposed use.

3.4 Thermal resistance

Thermal conductivity of ISOVER FireProtect® 150 and ISOVER FireProtect® 150F is λ_D is 0,036 W/mK.

3.5 Water vapour transmission coefficient

Water vapour transmission coefficient (μ) is 1 for ISOVER FireProtect® 150 and ISOVER FireProtect® 150F.

4 Assessment and verification of constancy of performance (hereinafter AVCP) system applied, with reference to its legal base

According to the European Commission Decision 99/454/EC as amended, the system of assessment and verification of constancy of performance is System 1.

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at VTT Expert Services Ltd.

Issued in Espoo on May 21, 2018
by VTT Expert Services Ltd

Pertti Jokinen
Product Manager

Tiina Tirkkonen
Senior Expert

ANNEX 1. Installation of ISOVER FireProtect® 150 and ISOVER FireProtect® 150F fire protection

1. Fire protective slabs and fastenings

Components:

Fire protection material	Stone wool slabs ISOVER FireProtect® 150 and ISOVER FireProtect® 150F
Slab sizes	600 mm x 1200 mm 1000 mm x 1200 mm
Nominal density	thickness 20 - 25 mm: 165 kg/m^3 thickness 30 - 100 mm: 150 kg/m^3
Nominal thickness	20 mm - 100 mm
Fastenings:	
Welding pins and washers	Cup head pins or pins and washers, where diameter of pin is Ø 2,7 mm and diameter of the washer is Ø 30 mm
Spiral spring screws	Spiral spring screws, steel quality according to EN 10270-1, wire diameter 1,6 mm, screw head diameter 20 mm

2. Tested applications

ISOVER FireProtect® 150 and ISOVER FireProtect® 150F were tested to cover following applications:

Structural members	Beams and columns, maximum depth (h) of the cross-section 600 mm
Protection	Up to three and four sided fire exposure
Steel sections	I/H sections and structural hollow sections as well as angles, channels and T-sections for same section factor, whether used as individual elements or as bracing
Section factor, A_p/V	Beams: from 50 m^{-1} to 357 m^{-1} Column: from 45 m^{-1} to 357 m^{-1}
Design temperature	450 °C to 700 °C

3 Installation

ISOVER FireProtect® 150 and ISOVER FireProtect® 150F slabs limit the temperature rise in steel. The slabs work equally well for steel supporting columns and beams. The slabs can be used for fire protection of structural steel with fire resistance from R 30 up to R 180.

There are two possibilities how to fix the slabs to the steel members:

a) with spiral spring screws having double the length of the insulation thickness
b) with cup head pins or pins and washers (pin Ø 2,7 mm, washer Ø 30 mm)

Method a) Use of spiral spring screws

1) Fixing of slabs to fitted pieces

Fixing of fire protective slabs ISOVER FireProtect® 150 or ISOVER FireProtect® 150F is done with spiral spring screws, with distance less than or equal to 200 mm perpendicular to the length of the beam/column, to fitted pieces from the same slab of the width 100 mm and a length corresponding to the distance between flanges plus (2 to 3) mm. However, a minimum slab thickness of 40 mm must be used for the fitted pieces.

2) Fixing of slabs at the corners

Adjacent slabs are at the corners connected by spiral spring screws at distances 150 mm; first screw is positioned at least 25 mm from the edge of the slab.

Method b) Use of pins

ISOVER FireProtect® 150 or ISOVER FireProtect® 150F slabs are fixed with welding pins in maximum distance of 300 mm. Maximum distance from the cladding's edges is 75 mm.

Both methods a) and b) can also be combined in practise.

Any tightening of joints between mineral wool slabs is not needed. It is only about installation of the slabs with tight connection between them.

ANNEX 2.

Table A1. Fire resistance period 15 min, design temperatures, section factors and thickness of fire protection material (mm) to maintain steel temperature below design temperature

Fire Resistance Period **15 min**

	Design temperature (°C)								
	450	500	525	550	560	600	620	650	700
Section factor (m^{-1})	Thickness of Fire Protection Material (mm) to Maintain Steel Temperature Below Design Temperature								
45	19	19	19	19	19	19	19	19	19
50	19	19	19	19	19	19	19	19	19
60	19	19	19	19	19	19	19	19	19
70	19	19	19	19	19	19	19	19	19
80	19	19	19	19	19	19	19	19	19
90	19	19	19	19	19	19	19	19	19
100	19	19	19	19	19	19	19	19	19
110	19	19	19	19	19	19	19	19	19
120	19	19	19	19	19	19	19	19	19
130	19	19	19	19	19	19	19	19	19
140	19	19	19	19	19	19	19	19	19
150	19	19	19	19	19	19	19	19	19
160	19	19	19	19	19	19	19	19	19
170	19	19	19	19	19	19	19	19	19
180	19	19	19	19	19	19	19	19	19
190	19	19	19	19	19	19	19	19	19
200	19	19	19	19	19	19	19	19	19
210	19	19	19	19	19	19	19	19	19
220	19	19	19	19	19	19	19	19	19
230	19	19	19	19	19	19	19	19	19
240	19	19	19	19	19	19	19	19	19
250	19	19	19	19	19	19	19	19	19
260	19	19	19	19	19	19	19	19	19
270	19	19	19	19	19	19	19	19	19
280	19	19	19	19	19	19	19	19	19
290	19	19	19	19	19	19	19	19	19
300	19	19	19	19	19	19	19	19	19
310	19	19	19	19	19	19	19	19	19
320	19	19	19	19	19	19	19	19	19
330	19	19	19	19	19	19	19	19	19
340	19	19	19	19	19	19	19	19	19
350	19	19	19	19	19	19	19	19	19
357	19	19	19	19	19	19	19	19	19

Section factor of 45 m^{-1} is applicable for columns only

The maximum permitted thickness for columns is 100 mm

Design temperatures required by the sponsor

Table A2. Fire resistance period 20 min, design temperatures, section factors and thickness of fire protection material (mm) to maintain steel temperature below design temperature

Fire Resistance Period **20 min**

	Design temperature (°C)								
	450	500	525	550	560	600	620	650	700
Section factor (m^{-1})	Thickness of Fire Protection Material (mm) to Maintain Steel Temperature Below Design Temperature								
45	19	19	19	19	19	19	19	19	19
50	19	19	19	19	19	19	19	19	19
60	19	19	19	19	19	19	19	19	19
70	19	19	19	19	19	19	19	19	19
80	19	19	19	19	19	19	19	19	19
90	19	19	19	19	19	19	19	19	19
100	19	19	19	19	19	19	19	19	19
110	19	19	19	19	19	19	19	19	19
120	19	19	19	19	19	19	19	19	19
130	19	19	19	19	19	19	19	19	19
140	19	19	19	19	19	19	19	19	19
150	19	19	19	19	19	19	19	19	19
160	19	19	19	19	19	19	19	19	19
170	19	19	19	19	19	19	19	19	19
180	19	19	19	19	19	19	19	19	19
190	19	19	19	19	19	19	19	19	19
200	19	19	19	19	19	19	19	19	19
210	19	19	19	19	19	19	19	19	19
220	19	19	19	19	19	19	19	19	19
230	19	19	19	19	19	19	19	19	19
240	19	19	19	19	19	19	19	19	19
250	19	19	19	19	19	19	19	19	19
260	19	19	19	19	19	19	19	19	19
270	19	19	19	19	19	19	19	19	19
280	19	19	19	19	19	19	19	19	19
290	19	19	19	19	19	19	19	19	19
300	19	19	19	19	19	19	19	19	19
310	19	19	19	19	19	19	19	19	19
320	19	19	19	19	19	19	19	19	19
330	19	19	19	19	19	19	19	19	19
340	19	19	19	19	19	19	19	19	19
350	19	19	19	19	19	19	19	19	19
357	19	19	19	19	19	19	19	19	19

Section factor of 45 m^{-1} is applicable for columns only

The maximum permitted thickness for columns is 100 mm

Design temperatures required by the sponsor

Table A3. Fire resistance period 30 min, design temperatures, section factors and thickness of fire protection material (mm) to maintain steel temperature below design temperature

Fire Resistance Period **30 min**

	Design temperature (°C)								
	450	500	525	550	560	600	620	650	700
Section factor (m^{-1})	Thickness of Fire Protection Material (mm) to Maintain Steel Temperature Below Design Temperature								
45	19	19	19	19	19	19	19	19	19
50	19	19	19	19	19	19	19	19	19
60	19	19	19	19	19	19	19	19	19
70	19	19	19	19	19	19	19	19	19
80	19	19	19	19	19	19	19	19	19
90	19	19	19	19	19	19	19	19	19
100	19	19	19	19	19	19	19	19	19
110	19	19	19	19	19	19	19	19	19
120	19	19	19	19	19	19	19	19	19
130	19	19	19	19	19	19	19	19	19
140	19	19	19	19	19	19	19	19	19
150	19	19	19	19	19	19	19	19	19
160	19	19	19	19	19	19	19	19	19
170	19	19	19	19	19	19	19	19	19
180	19	19	19	19	19	19	19	19	19
190	19	19	19	19	19	19	19	19	19
200	19	19	19	19	19	19	19	19	19
210	19	19	19	19	19	19	19	19	19
220	19	19	19	19	19	19	19	19	19
230	19	19	19	19	19	19	19	19	19
240	19	19	19	19	19	19	19	19	19
250	19	19	19	19	19	19	19	19	19
260	19	19	19	19	19	19	19	19	19
270	19	19	19	19	19	19	19	19	19
280	19	19	19	19	19	19	19	19	19
290	19	19	19	19	19	19	19	19	19
300	19	19	19	19	19	19	19	19	19
310	19	19	19	19	19	19	19	19	19
320	19	19	19	19	19	19	19	19	19
330	19	19	19	19	19	19	19	19	19
340	19	19	19	19	19	19	19	19	19
350	19	19	19	19	19	19	19	19	19
357	19	19	19	19	19	19	19	19	19

Section factor of 45 m^{-1} is applicable for columns only

The maximum permitted thickness for columns is 100 mm

Design temperatures required by the sponsor

Table A4. Fire resistance period 45 min, design temperatures, section factors and thickness of fire protection material (mm) to maintain steel temperature below design temperature

Fire Resistance Period	45 min								
	Design temperature (°C)								
	450	500	525	550	560	600	620	650	700
Section factor (m^{-1})	Thickness of Fire Protection Material (mm) to Maintain Steel Temperature Below Design Temperature								
45	19	19	19	19	19	19	19	19	19
50	19	19	19	19	19	19	19	19	19
60	19	19	19	19	19	19	19	19	19
70	19	19	19	19	19	19	19	19	19
80	19	19	19	19	19	19	19	19	19
90	19	19	19	19	19	19	19	19	19
100	19	19	19	19	19	19	19	19	19
110	19	19	19	19	19	19	19	19	19
120	19	19	19	19	19	19	19	19	19
130	19	19	19	19	19	19	19	19	19
140	19	19	19	19	19	19	19	19	19
150	19	19	19	19	19	19	19	19	19
160	19	19	19	19	19	19	19	19	19
170	19	19	19	19	19	19	19	19	19
180	19	19	19	19	19	19	19	19	19
190	19	19	19	19	19	19	19	19	19
200	19	19	19	19	19	19	19	19	19
210	19	19	19	19	19	19	19	19	19
220	19	19	19	19	19	19	19	19	19
230	20	19	19	19	19	19	19	19	19
240	21	19	19	19	19	19	19	19	19
250	23	19	19	19	19	19	19	19	19
260	24	19	19	19	19	19	19	19	19
270	25	19	19	19	19	19	19	19	19
280	26	19	19	19	19	19	19	19	19
290	27	19	19	19	19	19	19	19	19
300	28	19	19	19	19	19	19	19	19
310	29	19	19	19	19	19	19	19	19
320	30	19	19	19	19	19	19	19	19
330	31	20	19	19	19	19	19	19	19
340	32	21	19	19	19	19	19	19	19
350	33	22	19	19	19	19	19	19	19
357	34	23	19	19	19	19	19	19	19

Section factor of 45 m^{-1} is applicable for columns only

The maximum permitted thickness for columns is 100 mm

Design temperatures required by the sponsor

Table A5. Fire resistance period 60 min, design temperatures, section factors and thickness of fire protection material (mm) to maintain steel temperature below design temperature

Fire Resistance Period **60 min**

	Design temperature (°C)								
	450	500	525	550	560	600	620	650	700
Section factor (m^{-1})	Thickness of Fire Protection Material (mm) to Maintain Steel Temperature Below Design Temperature								
45	19	19	19	19	19	19	19	19	19
50	19	19	19	19	19	19	19	19	19
60	19	19	19	19	19	19	19	19	19
70	19	19	19	19	19	19	19	19	19
80	19	19	19	19	19	19	19	19	19
90	19	19	19	19	19	19	19	19	19
100	19	19	19	19	19	19	19	19	19
110	19	19	19	19	19	19	19	19	19
120	19	19	19	19	19	19	19	19	19
130	20	19	19	19	19	19	19	19	19
140	23	19	19	19	19	19	19	19	19
150	25	19	19	19	19	19	19	19	19
160	27	19	19	19	19	19	19	19	19
170	30	21	19	19	19	19	19	19	19
180	32	23	19	19	19	19	19	19	19
190	34	25	21	19	19	19	19	19	19
200	36	27	22	19	19	19	19	19	19
210	38	29	24	20	19	19	19	19	19
220	40	31	26	21	19	19	19	19	19
230	42	33	28	23	21	19	19	19	19
240	44	34	30	25	23	19	19	19	19
250	46	36	31	26	24	19	19	19	19
260	48	38	33	28	26	19	19	19	19
270	50	40	35	30	27	19	19	19	19
280	51	41	36	31	29	20	19	19	19
290	53	43	38	33	31	22	19	19	19
300	55	45	40	34	32	23	19	19	19
310	56	46	41	36	34	25	20	19	19
320	58	48	43	37	35	26	21	19	19
330	59	49	44	39	37	27	23	19	19
340	61	51	46	40	38	29	24	19	19
350	62	53	47	42	40	30	25	19	19
357	63	54	48	43	41	31	26	19	19

Section factor of 45 m^{-1} is applicable for columns only

The maximum permitted thickness for columns is 100 mm

Design temperatures required by the sponsor

Table A6. Fire resistance period 90 min, design temperatures, section factors and thickness of fire protection material (mm) to maintain steel temperature below design temperature

Fire Resistance Period **90 min**

	Design temperature (°C)								
	450	500	525	550	560	600	620	650	700
Section factor (m^{-1})	Thickness of Fire Protection Material (mm) to Maintain Steel Temperature Below Design Temperature								
45	19	19	19	19	19	19	19	19	19
50	19	19	19	19	19	19	19	19	19
60	19	19	19	19	19	19	19	19	19
70	21	19	19	19	19	19	19	19	19
80	26	19	19	19	19	19	19	19	19
90	30	23	20	19	19	19	19	19	19
100	35	27	24	20	19	19	19	19	19
110	40	32	28	24	23	19	19	19	19
120	44	36	32	28	27	21	19	19	19
130	49	40	36	32	30	24	21	19	19
140	53	44	40	36	34	28	25	20	19
150	57	48	44	39	38	31	28	23	19
160	61	52	47	43	41	35	31	26	19
170	65	56	51	47	45	38	35	30	21
180	69	59	55	50	48	41	38	33	24
190	72	63	58	54	52	45	41	36	27
200	76	66	62	57	55	48	44	39	30
210	79	70	65	61	59	51	48	42	33
220	83	73	69	64	62	55	51	45	36
230	86	77	72	67	66	58	54	48	39
240	89	80	75	71	69	61	57	52	42
250	93	83	79	74	72	65	61	55	45
260	96	87	82	77	75	68	64	58	48
270	99	90	85	81	79	71	67	61	51
280	102	93	88	84	82	74	70	64	54
290	105	96	92	87	85	78	74	68	57
300	N/A	99	95	90	88	81	77	71	60
310	N/A	102	98	93	91	84	80	74	63
320	N/A	105	101	96	95	87	83	77	67
330	N/A	N/A	104	99	98	90	86	81	70
340	N/A	N/A	N/A	102	101	93	90	84	73
350	N/A	N/A	N/A	N/A	104	97	93	87	77
357	N/A	N/A	N/A	N/A	N/A	99	95	89	79

Section factor of 45 m^{-1} is applicable for columns only

The maximum permitted thickness for columns is 100 mm

Design temperatures required by the sponsor

Table A7. Fire resistance period 120 min, design temperatures, section factors and thickness of fire protection material (mm) to maintain steel temperature below design temperature

Fire Resistance Period **120 min**

	Design temperature (°C)								
	450	500	525	550	560	600	620	650	700
Section factor (m^{-1})	Thickness of Fire Protection Material (mm) to Maintain Steel Temperature Below Design Temperature								
45	19	19	19	19	19	19	19	19	19
50	22	19	19	19	19	19	19	19	19
60	30	23	20	19	19	19	19	19	19
70	37	30	27	23	22	19	19	19	19
80	44	36	33	29	28	23	21	19	19
90	51	43	39	35	34	29	26	22	19
100	58	49	45	41	40	34	31	27	21
110	64	55	51	47	45	39	36	32	26
120	71	61	57	53	51	45	42	37	30
130	77	67	63	58	57	50	47	42	35
140	83	73	69	64	62	55	52	47	39
150	89	79	74	70	68	61	57	52	44
160	94	84	80	75	73	66	62	57	49
170	100	90	85	80	79	71	68	62	54
180	N/A	95	91	86	84	77	73	67	59
190	N/A	101	96	91	89	82	78	73	64
200	N/A	N/A	101	96	95	87	83	78	69
210	N/A	N/A	N/A	102	100	92	88	83	74
220	N/A	N/A	N/A	N/A	105	97	94	88	79
230	N/A	N/A	N/A	N/A	N/A	103	99	93	84
240	N/A	N/A	N/A	N/A	N/A	N/A	104	98	89
250	N/A	N/A	N/A	N/A	N/A	N/A	N/A	104	94
260	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	99
270	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	105
280	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
290	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
300	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
310	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
320	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
330	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
340	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
350	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
357	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Section factor of 45 m^{-1} is applicable for columns only

The maximum permitted thickness for columns is 100 mm

Design temperatures required by the sponsor

Table A8. Fire resistance period 180 min, design temperatures, section factors and thickness of fire protection material (mm) to maintain steel temperature below design temperature

Fire Resistance Period 180 min

	Design temperature (°C)								
	450	500	525	550	560	600	620	650	700
Section factor (m^{-1})	Thickness of Fire Protection Material (mm) to Maintain Steel Temperature Below Design Temperature								
45	41	34	30	27	26	22	20	19	19
50	47	39	36	33	31	27	25	21	19
60	59	50	46	43	41	36	34	30	25
70	70	61	57	53	51	46	43	39	33
80	82	72	67	63	61	55	52	48	41
90	93	82	77	73	71	64	61	57	49
100	103	93	87	83	81	74	70	65	58
110	N/A	103	97	92	90	83	79	74	66
120	N/A	N/A	N/A	102	100	92	88	83	75
130	N/A	N/A	N/A	N/A	N/A	101	98	92	83
140	N/A	N/A	N/A	N/A	N/A	N/A	N/A	101	92
150	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	101
160	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
170	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
180	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
190	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
200	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
210	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
220	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
230	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
240	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
250	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
260	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
270	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
280	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
290	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
300	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
310	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
320	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
330	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
340	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
350	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
357	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Section factor of 45 m^{-1} is applicable for columns only

The maximum permitted thickness for columns is 100 mm

Design temperatures required by the sponsor