Deutsches Institut für Bautechnik

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Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

Designated according to Article 29 of Regulation (EU) No 305/2011 and member of EOTA (European Organisation for Technical Assessment)

European Technical Assessment ETA-17/0770 of 13 March 2018

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	JET-Vario-Therm S
Product family to which the construction product belongs	Self supporting translucent roof kits
Manufacturer	JET Tageslicht & RWA GmbH Weidehorst 28 32609 Hüllhorst DEUTSCHLAND
Manufacturing plant	JET Tageslicht & RWA GmbH Weidehorst 28 32609 Hüllhorst DEUTSCHLAND
This European Technical Assessment contains	81 pages including 73 annexes 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	ETAG 010, Edition September 2002, used as EAD according to Article 66 Paragraph 3 of Regulation (EU) No 305/2011.

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Deutsches Institut für Bautechnik
Kolonnenstraße 30 B | 10829 Berlin | GERMANY | Phone: +49 30 78730-0 | Fax: +49 30 78730-320 | Email: dibt@dibt.de | www.dibt.de

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Specific part

1 Technical description of the product

1.1 Kit description and setup

The 'JET-Vario-Therm S' roof kit is made up of components which are factory-made and assembled on site as a self-supporting translucent roof kit.

The structural design of the roof system "JET-Vario-Therm S" complies with the category "Plane roof systems with additional bearing profiles parallel to the span" as listed in Section 5.1.1.1.1 b) of the ETAG 010[1].

The roof kit comprises 1.2 m- or 2.1m-wide translucent PC multi-wall sheets which are positioned on bearing profiles and protected from wind loads with covering profiles. The sheets are mounted on the eaves side and ridge side. The multi-wall sheets are abutted along their longitudinal edges via a bearing profile. For the 2.10m-wide sheets, one (for double-span systems) or two (for triple-span systems) additional bearing profiles are arranged as intermediate supports parallel to the end load bearing profiles.

The following components are used for the manufacture of the 'JET-Vario-Therm S' self-supporting translucent roof kit:

- translucent polycarbonate (PC) multi-wall sheets of thickness 10 mm (PC 10), 16 mm (PC 16), 25 mm (PC 25) or 32 mm (PC 32),
- 3 mm solid sheets made from polycarbonate (optionally arranged on top of a 16 mm multi-wall sheet),
- aluminium bearing, edge and covering profiles,
- aluminium ridge profiles and cross beams,
- eaves profile and (optional) roof sheeting connecting profiles made from PVC,
- connecting bracket made from steel,
- sealing profiles,
- connecting devices.

The components and the system setup of the product are given in Annexes A 1 to A 4.

The material values, dimensions and tolerances of the roof kit not indicated in the annexes shall correspond to the values laid down in the technical documentation[2] of this European Technical Assessment.

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1 ETAG 010:2002-09 European Technical Approval Guideline - Self supporting translucent Roof Kits

2 The technical documentation comprises all information of the holder of this ETA necessary for the production,installation and maintenance of the roof kit; these are in particular the structural analysis, design drawings and the manufacturer's installation instructions. The part to be treated confidentially is deposited with Deutsches Institut für Bautechnik.

1.1.1 Multi-wall sheets

The following multi-wall sheets made from polycarbonate (PC) in accordance with the harmonised European standard EN 16153[3] may be used.

Table 1: PC-sheets

Manufacturer	Trade name	Sheet height [mm]	Annex
Covestro AG D – Leverkusen	Makrolon multi UV 4/10-6	10	A 4.1
DS Smith Kaysersberg F – Kaysersberg	Akyver Sun Type 16/7W-12	16	A 4.2
Covestro AG D – Leverkusen	Makrolon multi UV 5M/25-20	25	A 4.3
Covestro AG D – Leverkusen	Makrolon multi UV7M/25-28	25	A 4.4
Covestro AG D – Leverkusen	Makrolon multi UV 5M/32-20	32	A 4.5
Covestro AG D – Leverkusen	Makrolon multi UV 7M/32-28	32	A 4.6

The multi-wall sheets have unfilled hollow chambers and weatherproofing on the outer surfaces which are unmistakably identified.

1.1.2 Optional (full-surface) covering supplements: Solid sheets

The 3 mm-thick solid polycarbonate (PC) sheet 'PC UVP 3 mm' produced by Polycasa N.V., BE-2440 Geel, and having a weight per unit area of 3.6 kg/m² in accordance with the harmonised European standard EN 16240[4] can be used.

1.1.3 Bearing, edge and covering profiles

The aluminium profiles are made from the aluminium alloy EN AW-6060 T66 in accordance with EN 15088[5] and exhibit the dimensions given in Annexes A 3.1 and A 3.2 of the ETA.

1.1.4 Ridge profiles and crossbeams

The aluminium profiles are made from EN AW-6060 T66 in accordance with EN 15088 and have the dimensions given in Annexes A 3.5, A 3.6 and A3.8.

1.1.5 Eaves profile and optional roof sheeting connecting profile

1.1.5.1 Eaves profile

The extruded profile made from polyvinyl chloride PVC U-E-D-L-082-05-28 in accordance with EN ISO 1163-1[6] has the dimensions given in Annex A 3.3.

1.1.5.2 Roof sheeting connecting profiles (optional)

The extruded profiles made from polyvinyl chloride PVC U-E-D-L-082-05-28 in accordance with EN ISO 1163-1 have the dimensions given in Annex A 3.4.

[3] DIN EN 16153:2015-05 Light transmitting flat multiwall polycarbonate (PC) sheets for internal and external use in roofs, walls and ceilings - Requirements and test methods; German version EN 16153:2013+A1:201

[4] DIN EN 16240:2014-03 Light transmitting flat solid polycarbonate (PC) sheets for internal and external use in roofs, walls and ceilings - Requirements and test methods; German version EN 16240:2013

[5] DIN EN 15088:2006-03 Aluminium and aluminium alloys - Structural products for construction works - Technical conditions for inspection and delivery; German version EN 15088:2005

[6] DIN EN ISO 1163-1:1999-10 Plastics - Unplasticized poly(vinyl chloride) (PVC-U) moulding and extrusion materials -Part 1: Designation system and basis for specifications (ISO 1163-1:1995); German version EN ISO 1163-1:1999

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1.1.6 Connecting bracket made from steel

The connecting brackets are made of galvanised steel in accordance with EN 10025-2[7] and have the dimensions given in Annex A 3.8 of the ETA.

1.1.7 Sealing profile

The sealing profile is made from ethylene-propylene terpolymer (EPDM) and has the dimensions given in Annex A 3.7. The Shore A hardness is 60° +/- 5° in accordance with EN ISO 868[8].

1.1.8 Connecting devices

The bearing profile and the covering profile are connected using self-tapping screws and washers made of stainless steel in accordance with ETA-10/0184 as shown in in Annex A 3.9.

1.1.9 'JET-Vario-Therm S' roof kit

The roof kit is made up of the components described in Sections 1.1.1 and 1.1.3 to 1.1.8. and optional 1.1.5.2 (roof sheeting connecting profiles).

The following combinations are possible:

Table 2: Design oft he roof kit

Covering	Multi-wall sheet(s) as per Annex	Support system with or without crossbar		
		single-span system	double-span systems	triple-span systems
PC 10	A 4.1	–	X	–
PC 16	A 4.2	–	X	X
PC 25	A 4.3	–	X	X
	A 4.4	X	–	–
PC 32	A 4.5	–	X	X
	A 4.6	X	–	–

Solid sheets in accordance with Section 1.1.2 can optionally be used on top of PC 16 multi-wall sheets in accordance with Annex A 4.2 (outward facing side) for the covering "PC 3+16". Edge profile 22 in accordance with Annex A 3.2 is used for this purpose. Details are given in Annexes A 1.5 and A 2.1.2

2 Specification of the intended use in accordance with the applicable European Assessment Document

The self-supporting translucent roof kit may be used in the roof area for open or closed structures. The multi-wall sheets may be combined to form continuous rooflights of any length with rectangular bases.

The pitch of the covering is between 5° and 90°.

The roof kit is not a walk-on system; it may not be used for bracing of the roof support structure.

The performance data given in Section 3 is only valid if the roof kit is used in compliance with the specifications and the conditions given in Annexes A to D.

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[7] DIN EN 10025-2:2005-04:2005-04 Hot rolled products of structural steels - Part 2: Technical delivery conditions for non-alloy structural steels; German version EN 10025-2:2004

[8] DIN EN ISO 868:2003-10 Plastics and ebonite - Determination of indentation hardness by means of a durometer (Shore hardness) (ISO 868:2003); German version EN ISO 868:2003

The verifications and assessment methods on which this European Technical Assessment (hereinafter referred to as 'ETA') is based lead to the assumption of a working life of the roof kit of at least ten years. The indications given on the working life cannot be interpreted as a guarantee given by the manufacturer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the construction works.

Dimensioning, installation and execution of the roof kit shall be in compliance with the national technical specifications. These differ in terms of their content as well as their status within the legal frameworks of the Member States.

Should no national provisions exist, dimensioning can be carried out in accordance with Annexes B.

Installation, packaging, transport, storage as well as use, maintenance and repair shall be carried out in accordance with the manufacturer's instructions (extract see Annex D).

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

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic structural resistance of the multi-wall sheets to forces (actions) resulting from downward loads and uplift loads [kN/m²]	See Annex B 1.3
Limitation of deflection	See Annex B 1.4
Consideration of the effect of load duration	See Annex B 1.2
Consideration of ageing and environmental effects	See Annex B 1.3
Consideration of thermal effects	See Annex B 1.3
Values for characteristic structural resistance of aluminium bearing and covering profiles	The European standards shall apply.

3.2 Safety in case of fire (BWR 2)

3.2.1 Reaction to fire of the components

Essential characteristic	Performance
Multi-wall sheets/ coverings	Declaration of performance as per EN 16153/ at least class E as per EN 13501-1[9]
Solid sheet	Declaration of performance as per EN 16240/ at least class E as per EN 13501-1
Eaves profile and roof sheeting connecting profiles	Class E as per EN 13501-1
Sealing profile	No contribution to fire spread in accordance with EOTA TR 021 (Version June 2005)
Bearing and covering profiles	Class A1 as per EN 13501-1 (without further testing as per Commission Decision 96/603/EC, as amended by Commission Decisions 2000/605/EC and 2003/424/EC)
Connecting bracket	
Connecting devices	

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[9] DIN EN 13501-1:2010-01 Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests; German version EN 13501-1:2007+A1:2009

3.2.2 Resistance to fire of the roof kit

Essential characteristic	Performance
Fire performance in case of external fire exposure	No performance assessed in accordance with EN 13501-5[10]
Reaction to fire	Class E in accordance with EN 13501-1
Resistance to fire	No performance assessed in accordance with EN 13501-2[11]

3.3 Hygiene, health and the environment (BWR 3)

Essential characteristic	Performance
Content, emission and/or release of dangerous substances	
CMR-Substances	
Substance/s classified as EU-cat. Carc. 1A and/or 1B [a)]	The kit does not contain these dangerous substances.[b)]
Substance/s classified as EU-cat. Muta. 1A and/or 1B [a)]	
Substance/s classified as EU-cat. Repr. 1A and/or 1B [a)]	
Release scenario regarding BWR 3: S/W 2	
Watertightness and condensation	Category 1 (no leaks with no differential air pressure) up to an inclination (pitch) of the substructure from the horizontal: 5° Design details as per information deposited with DIBt

a) In accordance with Regulation (EC) No 1272/2008
b) Assessment based on the detailed manufacturer's statements

3.4 Safety and accessibility (BWR 4)

Essential characteristic	Performance
Resistance to damage by impact loads with a soft object (50 kg)	SB 0 (no requirement)
Resistance to impact loads from a hard object (250 g)	Passed (declaration of performance in accordance with EN 16153)
Resistance to horizontal live loads	No performance assessed

3.5 Protection against noise (BWR 5)

No performance assessed

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10 DIN EN 13501-5:2016-12 Fire classification of construction products and building elements - Part 5: Classification using data from external fire exposure to roofs tests; German version EN 13501-5:2016

11 DIN EN 13501-2:2016-12 Fire classification of construction products and building elements - Part 2: Classification using data from fire resistance tests, excluding ventilation services; German version EN 13501-2:2016

3.6 Energy economy and heat retention (BWR 6)

3.6.1 Thermal resistance

See Annex C

3.6.2 Air permeability

No performance assessed

3.6.3 UV transmittance

Light transmittance and total solar energy transmittance in line with the declaration of performance for multi-wall sheets made from polycarbonate (PC) in accordance with the harmonised European standard EN 16153

3.7 Sustainable use of natural resources (BWR 7)

No performance assessed

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

In accordance with ETAG 010 used as EAD the applicable European legal act is: 98/600/EC

The system to be applied is:

Product	Intended use	Levels or classes (reaction to fire)	Systems
'JET-Vario-Therm S' roof kit	For general use in roofs and roof structures	E	3

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 with Deutsches Institut für Bautechnik.

Issued in Berlin on 13 March 2018 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow
Head of Department

beglaubigt:
Wachner

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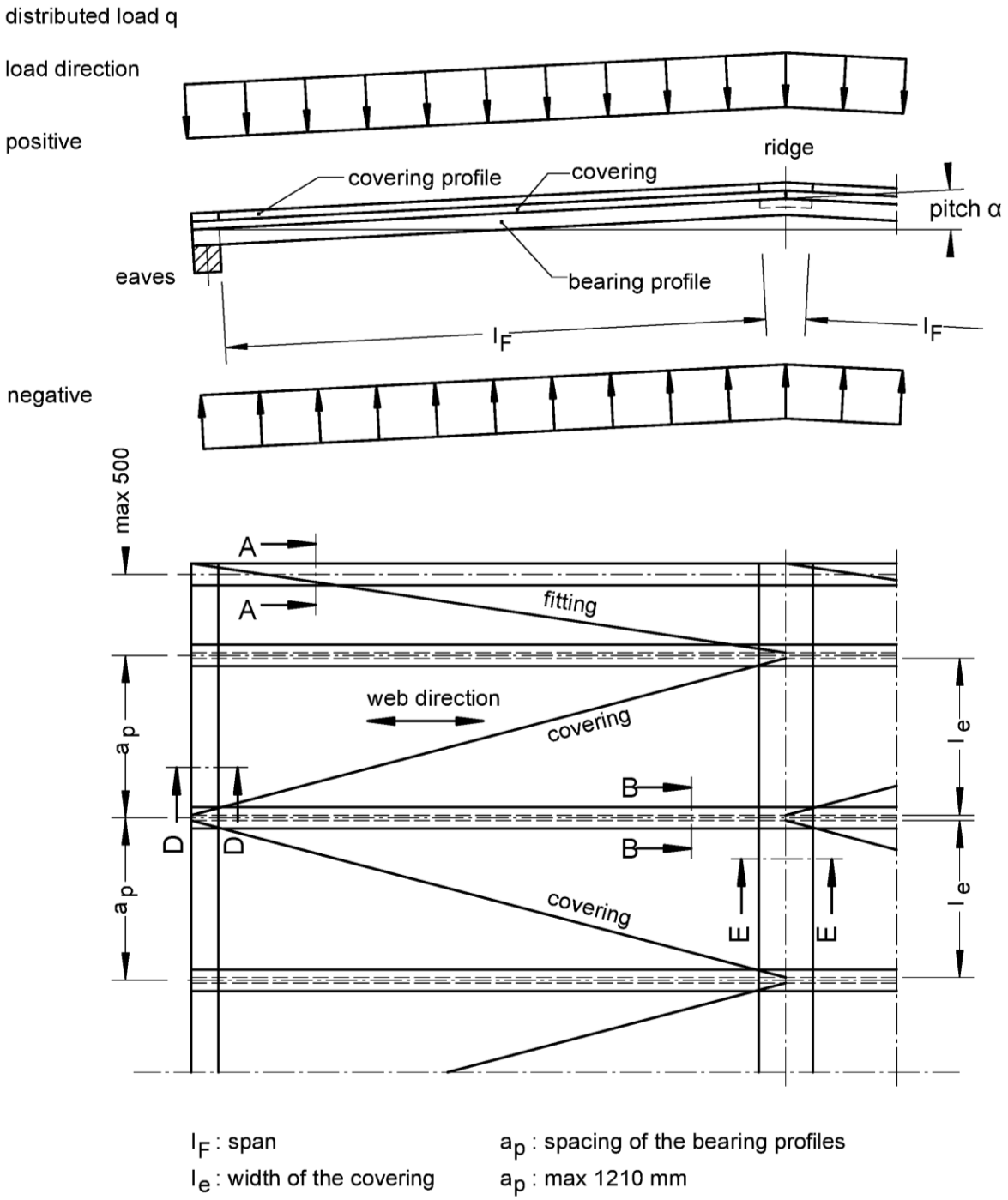

l_F : span
l_e : width of the covering
a_p : spacing of the bearing profiles
a_p : max 1210 mm

JET-Vario-Therm S	Annex A 1.1
System overview 1-span-system	

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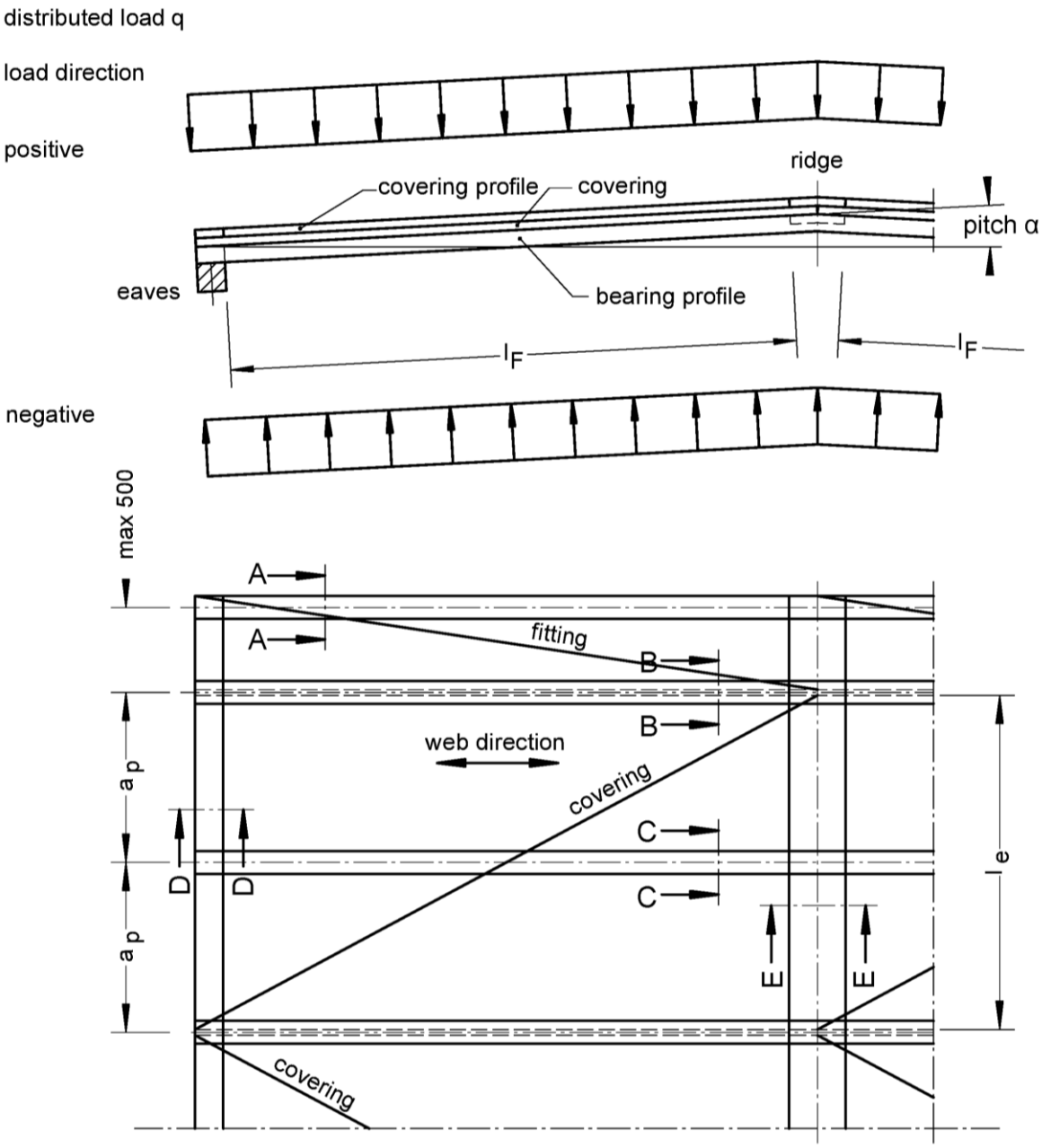

l_F : span
l_e : width of the covering
a_p : spacing of the bearing profiles
a_p : max 1055 mm

JET-Vario-Therm S	Annex A 1.2
System overview 2-span-system	

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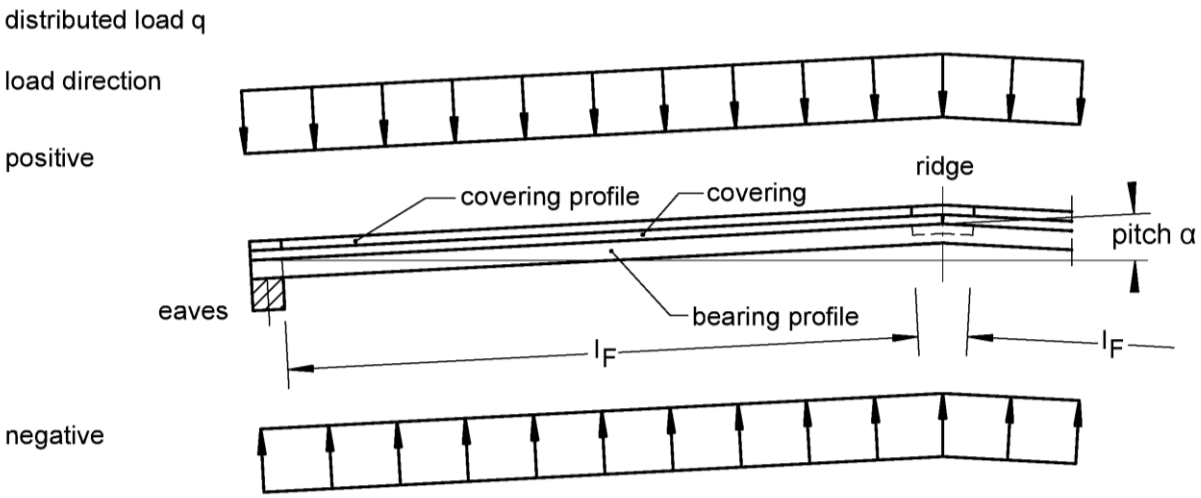

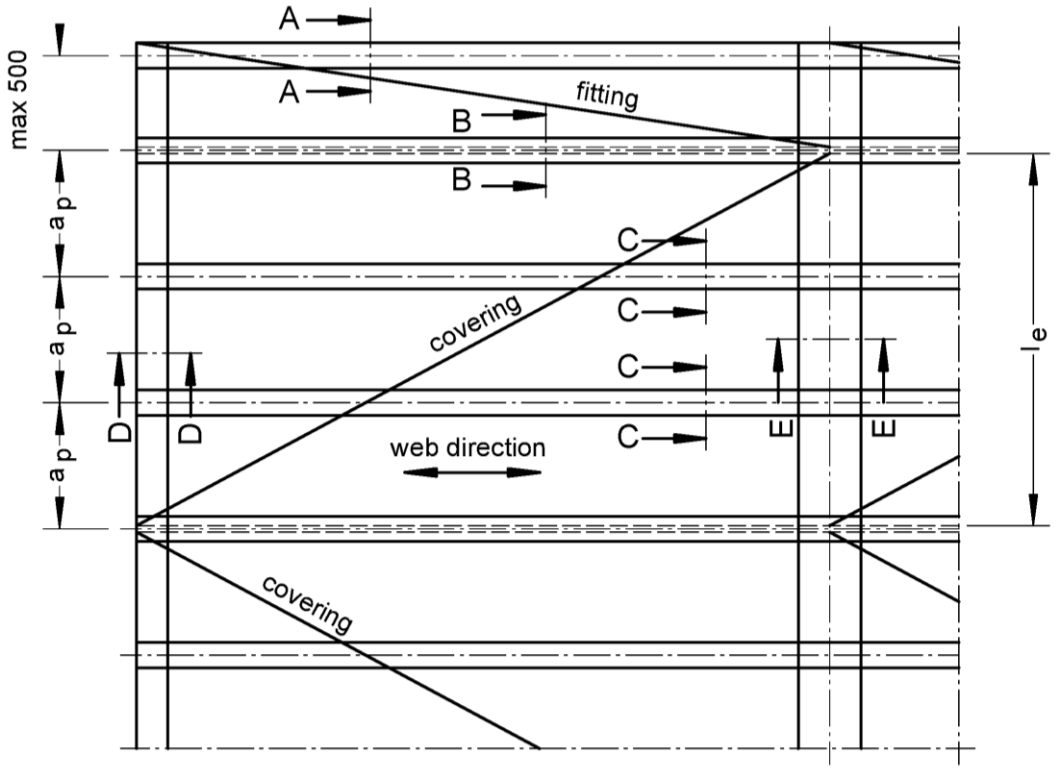

l_F : span
l_e : width of the covering
a_p : spacing of the bearing profiles
a_p : max 703 mm

JET-Vario-Therm S	Annex A 1.3
System overview 3-span-system	

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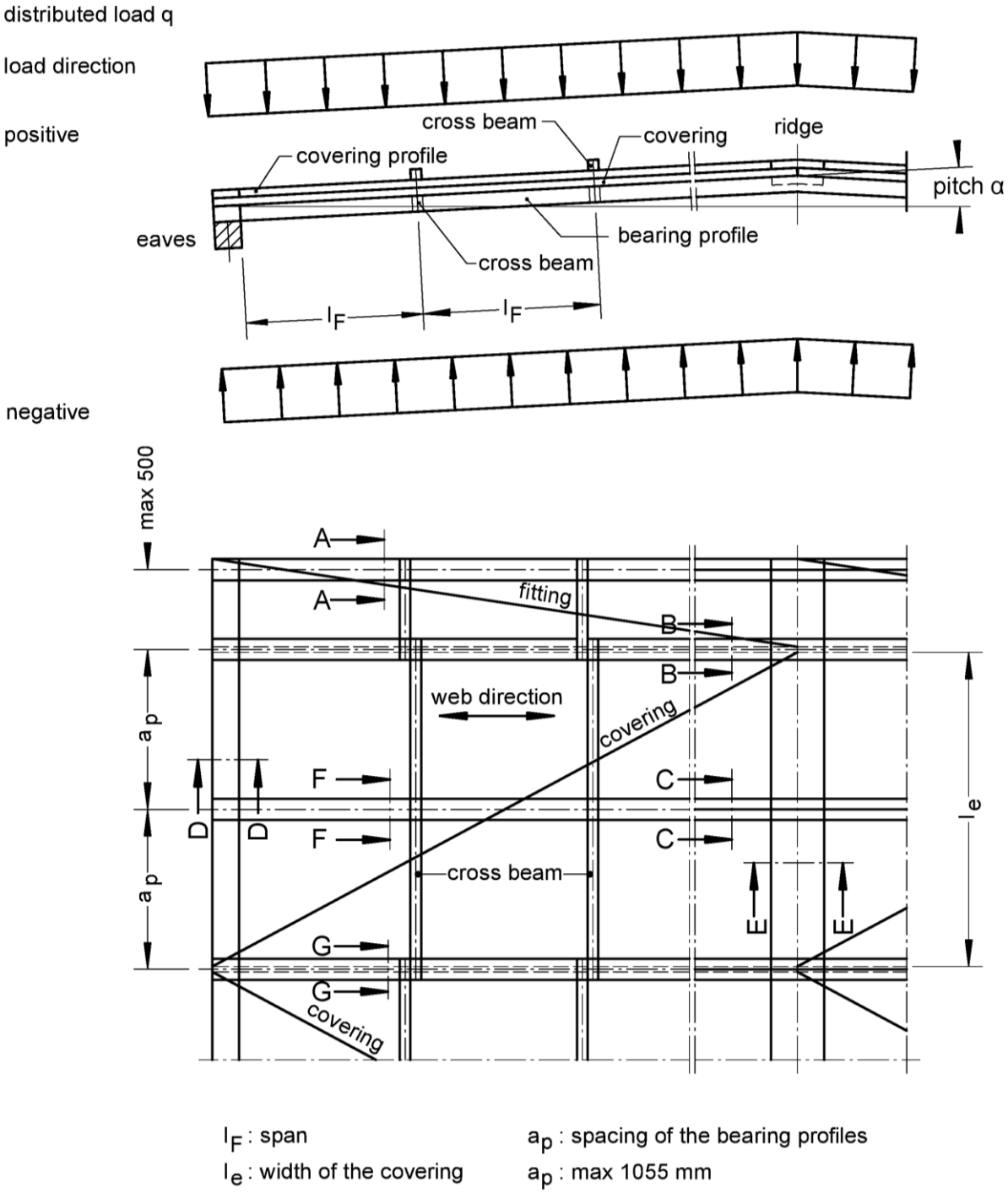

l_F : span
l_e : width of the covering
a_p : spacing of the bearing profiles
a_p : max 1055 mm

JET-Vario-Therm S

System overview
2-span-system for example with cross beam

Annex A 1.4

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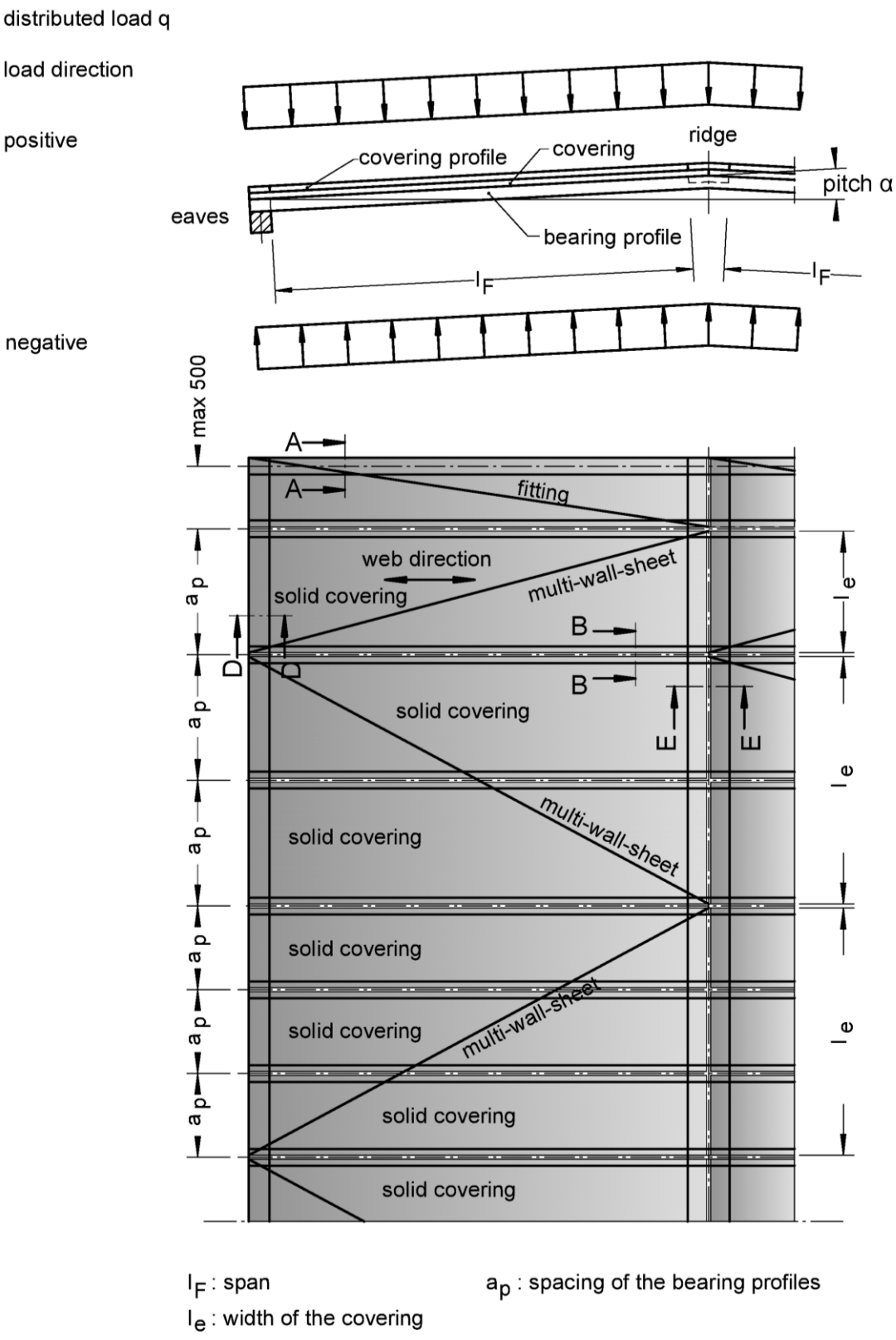

l_F : span

a_p : spacing of the bearing profiles

l_e : width of the covering

JET-Vario-Therm S	Annex A 1.5
Overview of multi-wall-sheet in combination with solid covering Example	

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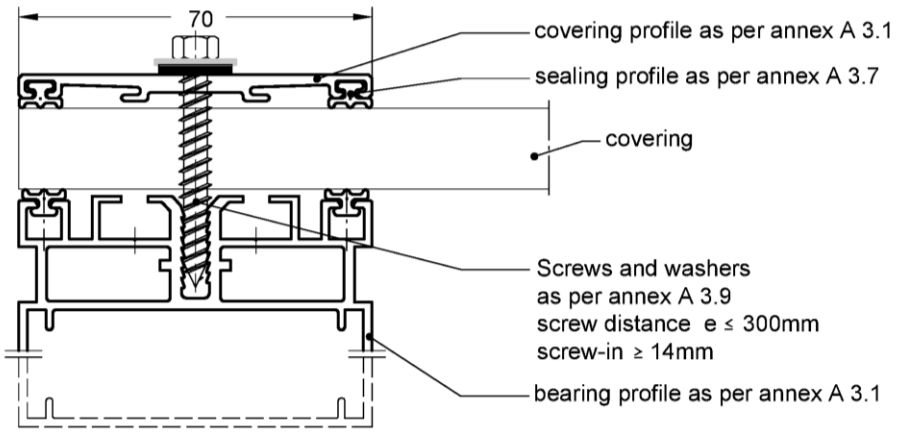
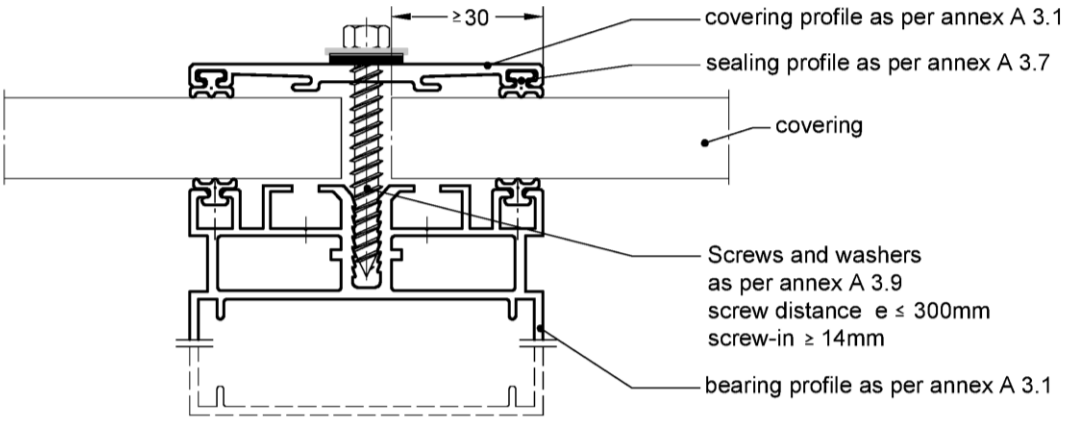
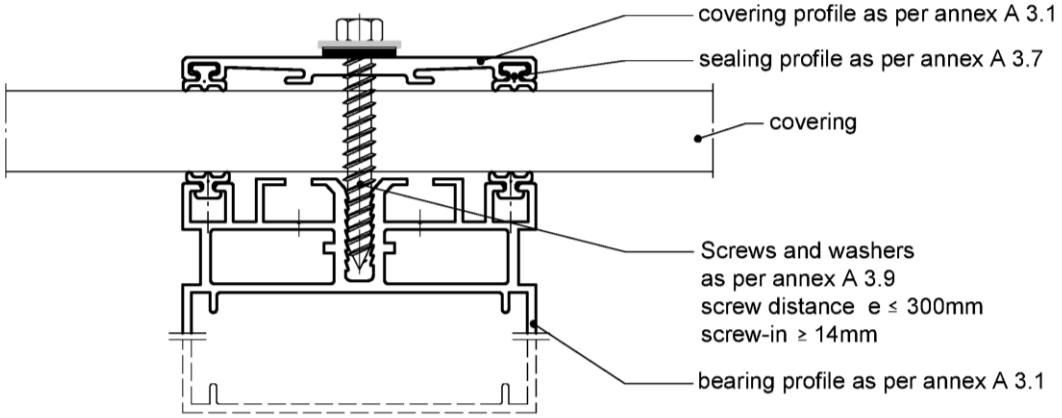
section A-A



section B-B



section C-C



schematic drawing - covering and screws
All dimensions in mm

JET-Vario-Therm S	Annex A 2.1.1
Combinations of bearing profiles Section A-A, B-B and C-C	

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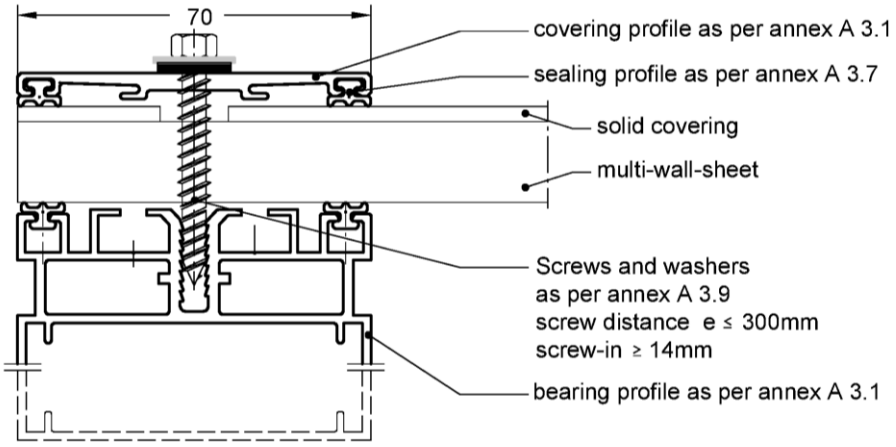
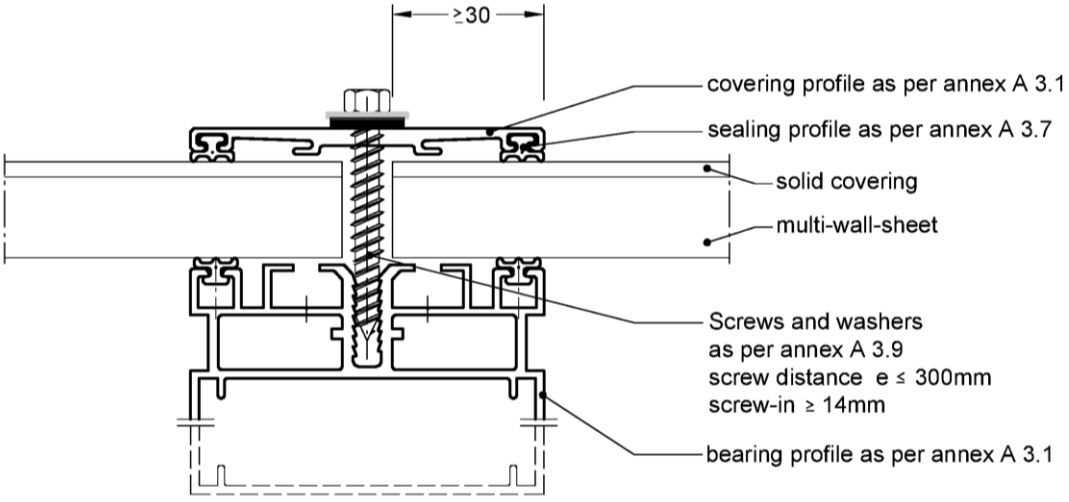
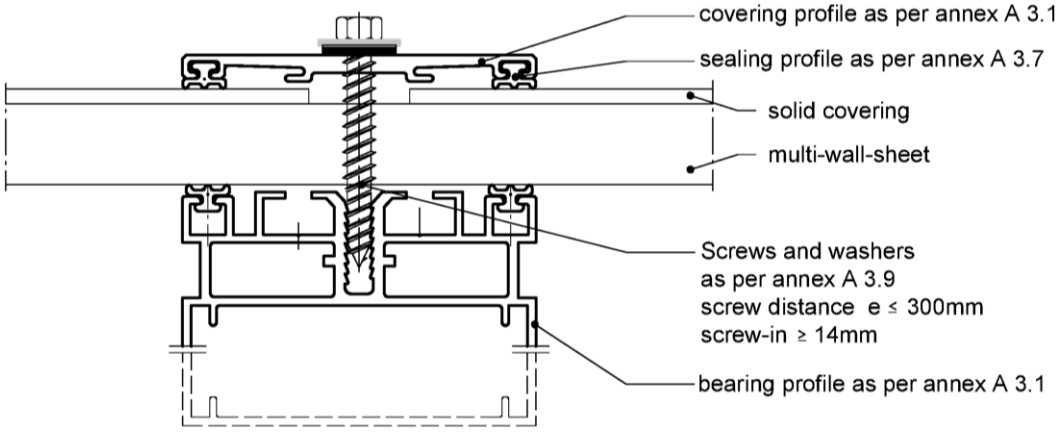
section A-A



section B-B



section C-C



schematic drawing - covering and screws
All dimensions in mm

JET-Vario-Therm S	Annex A 2.1.2
Combinations of bearing profiles Section B-B and C-C	

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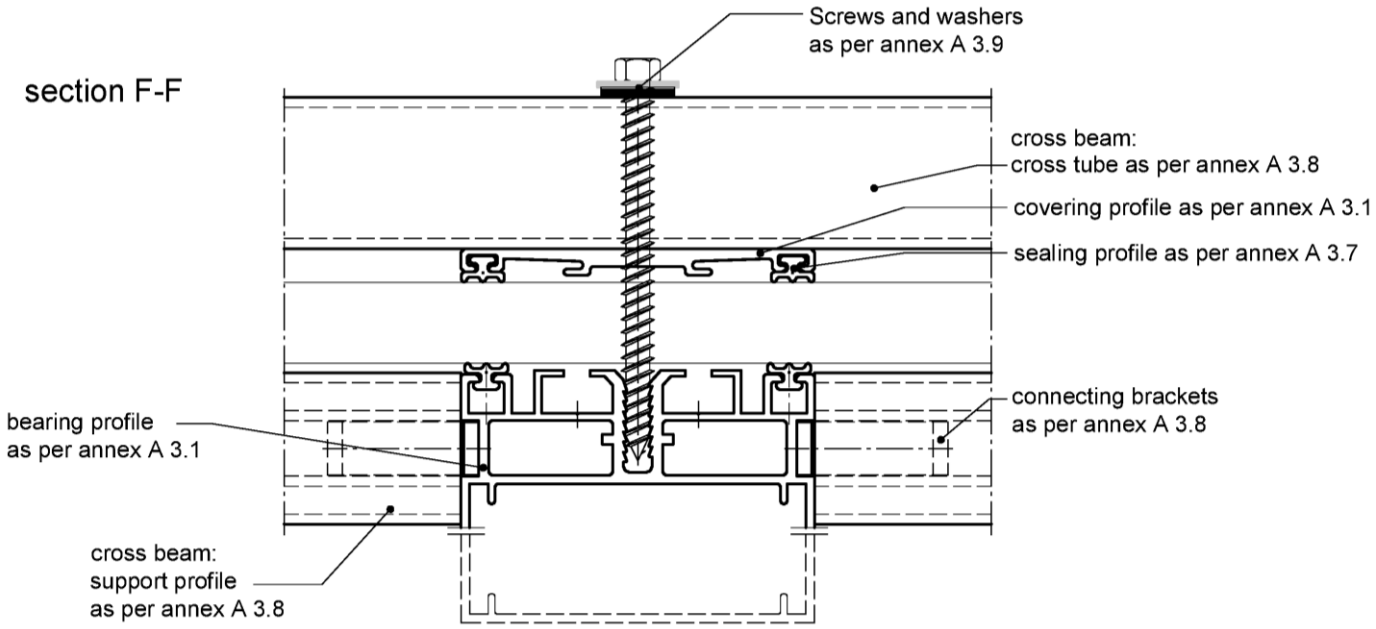

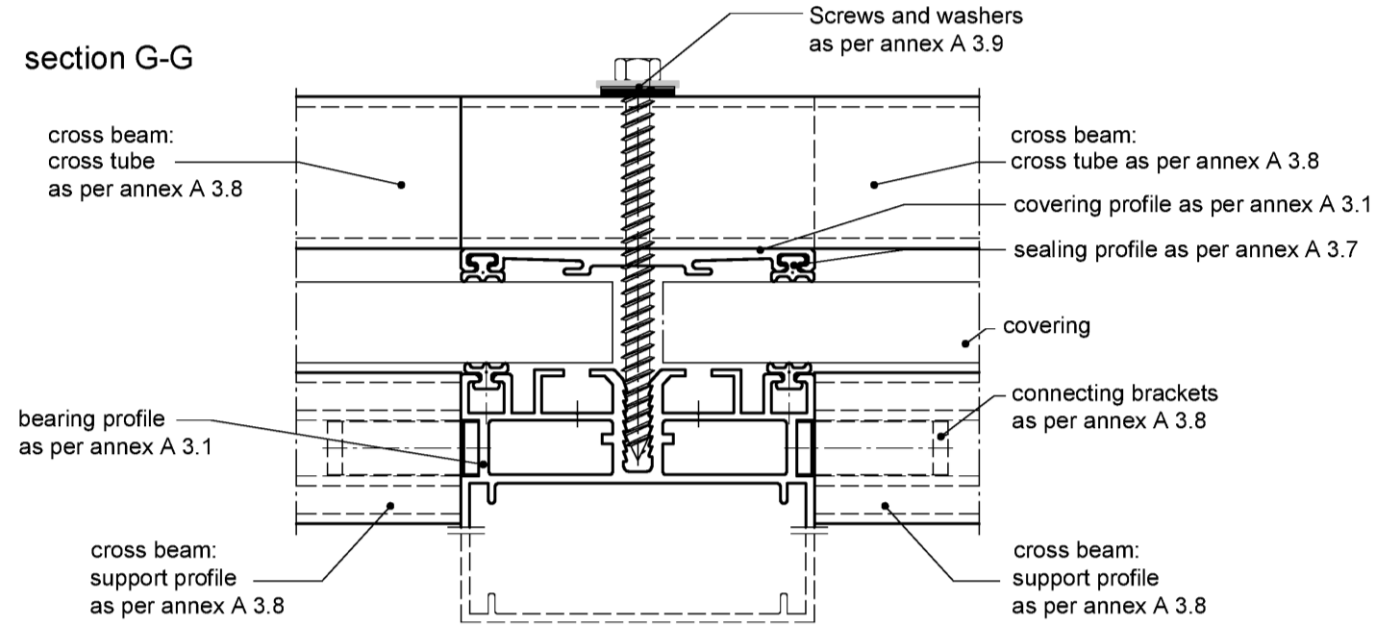

schematic drawing - covering and screws
All dimensions in mm

JET-Vario-Therm S	Annex A 2.2
Combinations of bearing profiles Section F-F and G-G	

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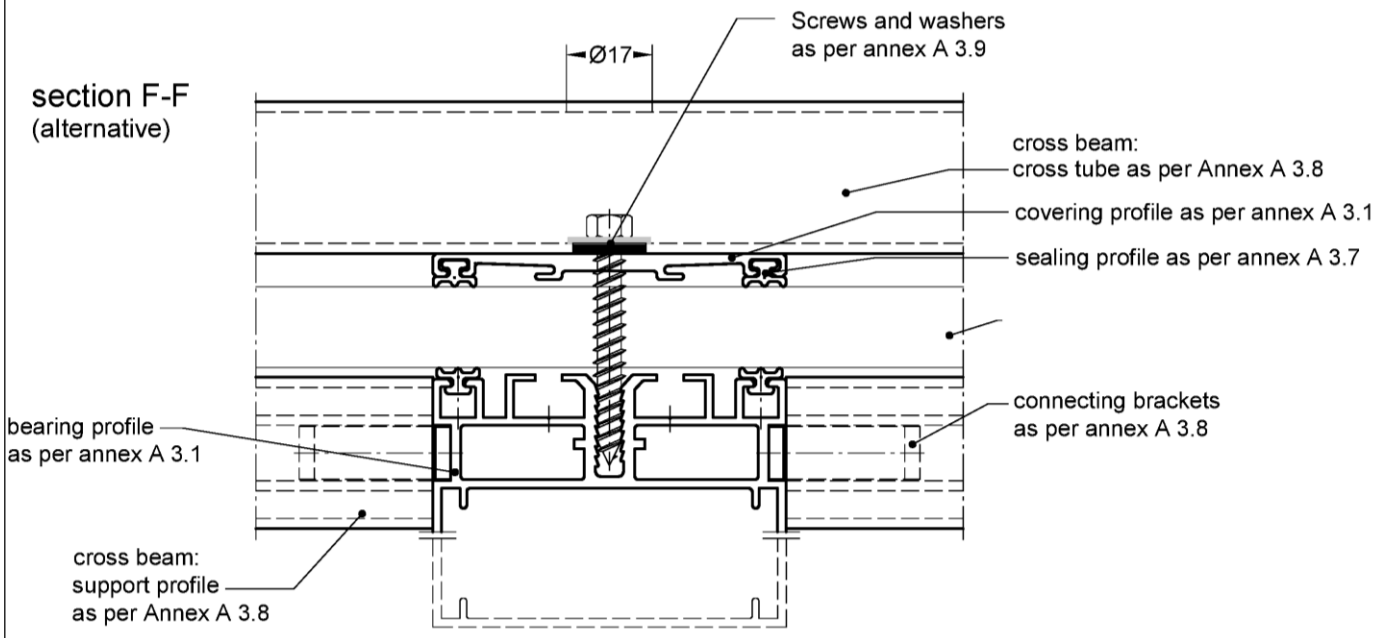

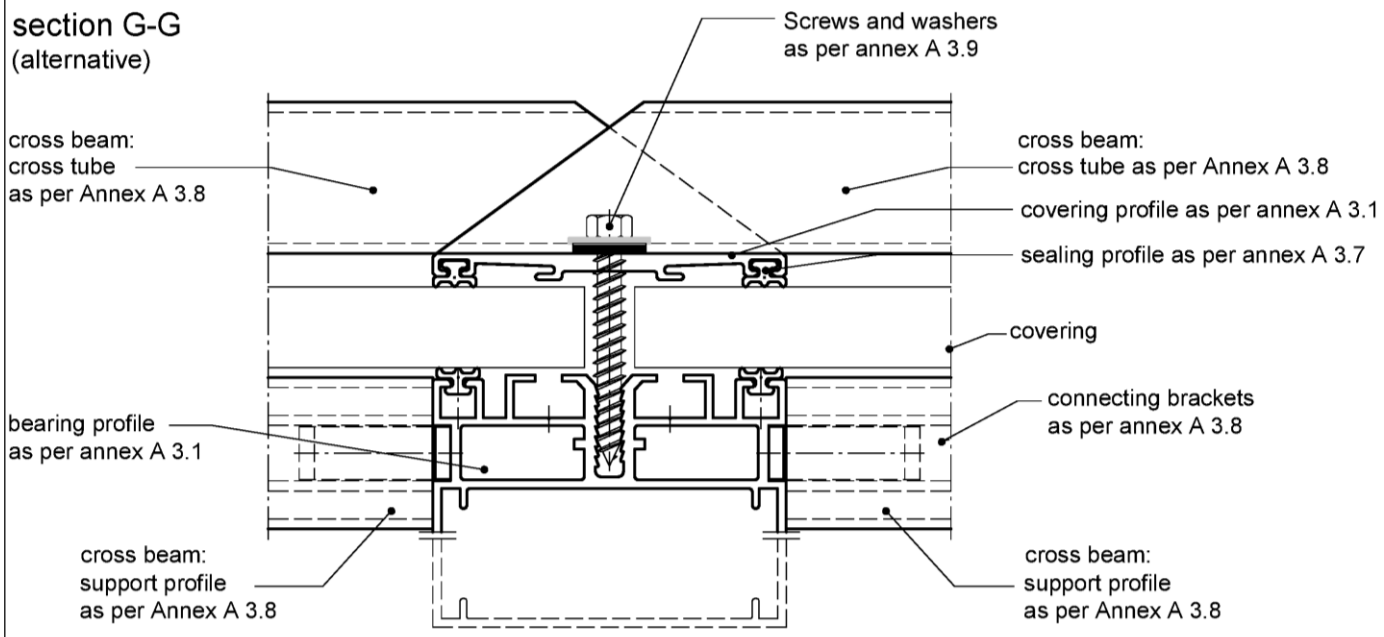

schematic drawing - covering and screws
All dimensions in mm

JET-Vario-Therm S	Annex A 2.3
Combinations of bearing profiles Section F-F and G-G	

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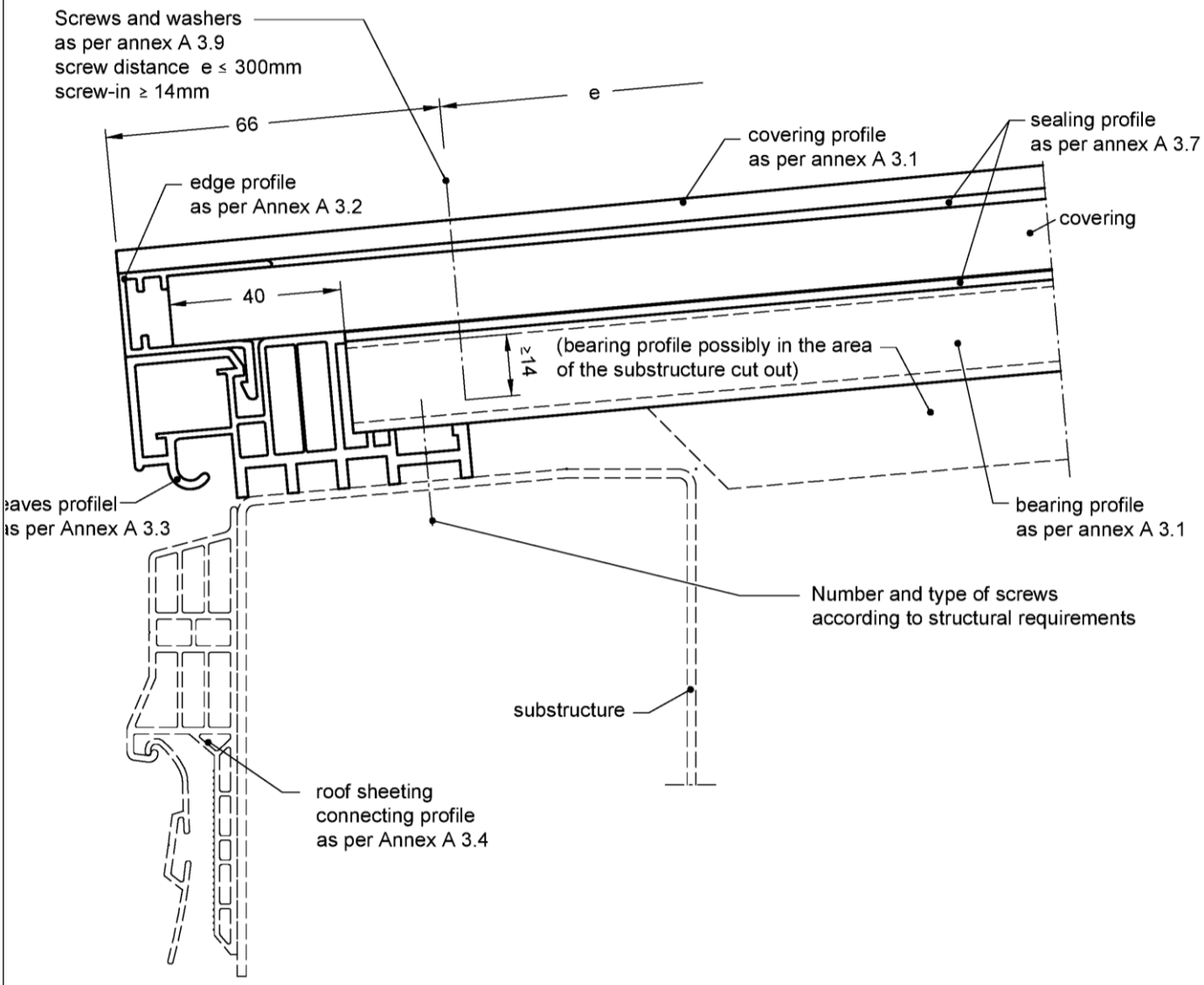
section D-D (eaves)



JET-Vario-Therm S	Annex A 2.4
Example of flat design Section D-D (eaves)	

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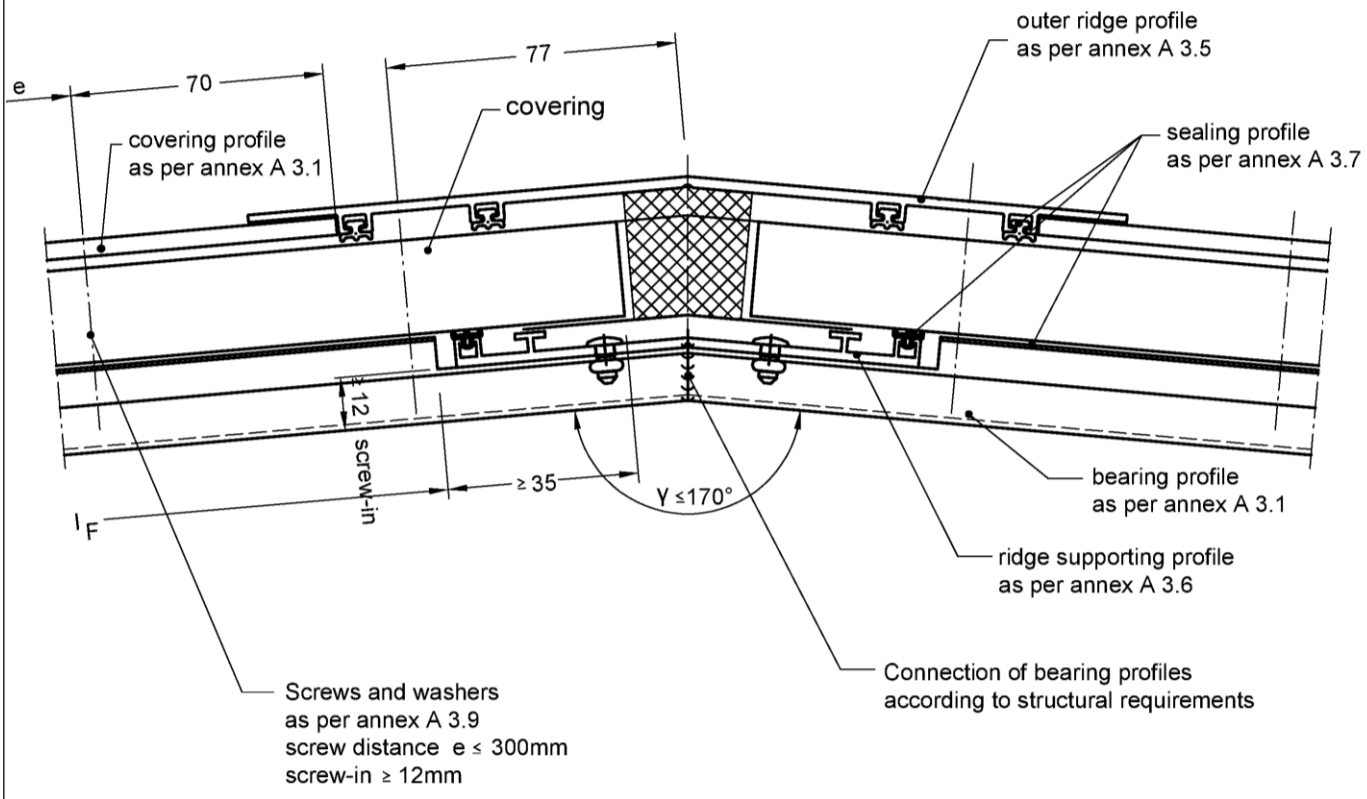
section E-E (ridge)



JET-Vario-Therm S	Annex A 2.5
Example of flat design Section E-E (ridge)	

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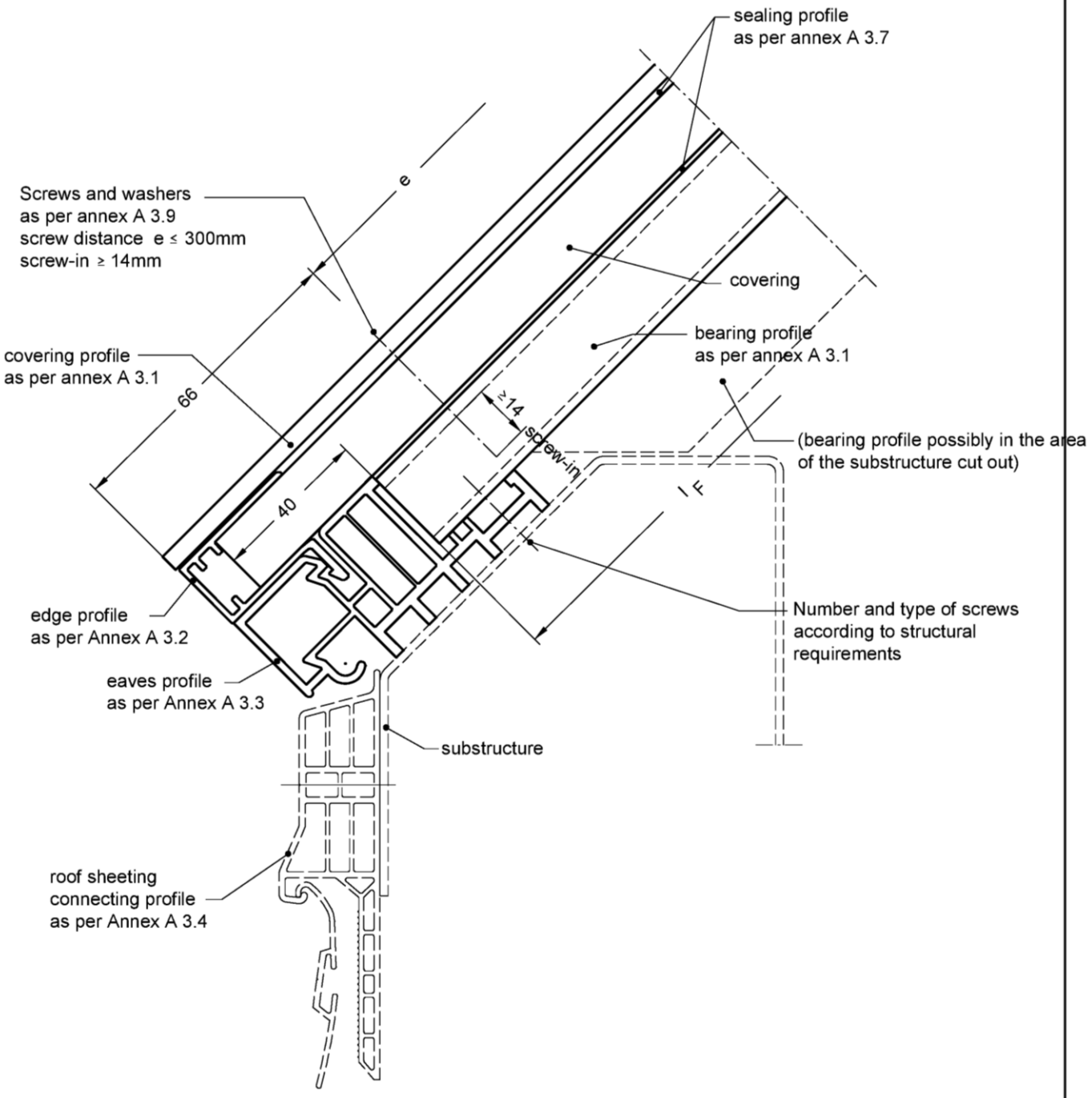
section D-D (eaves)



JET-Vario-Therm S	Annex A 2.6
Example of 45° execution Section D-D (eaves)	

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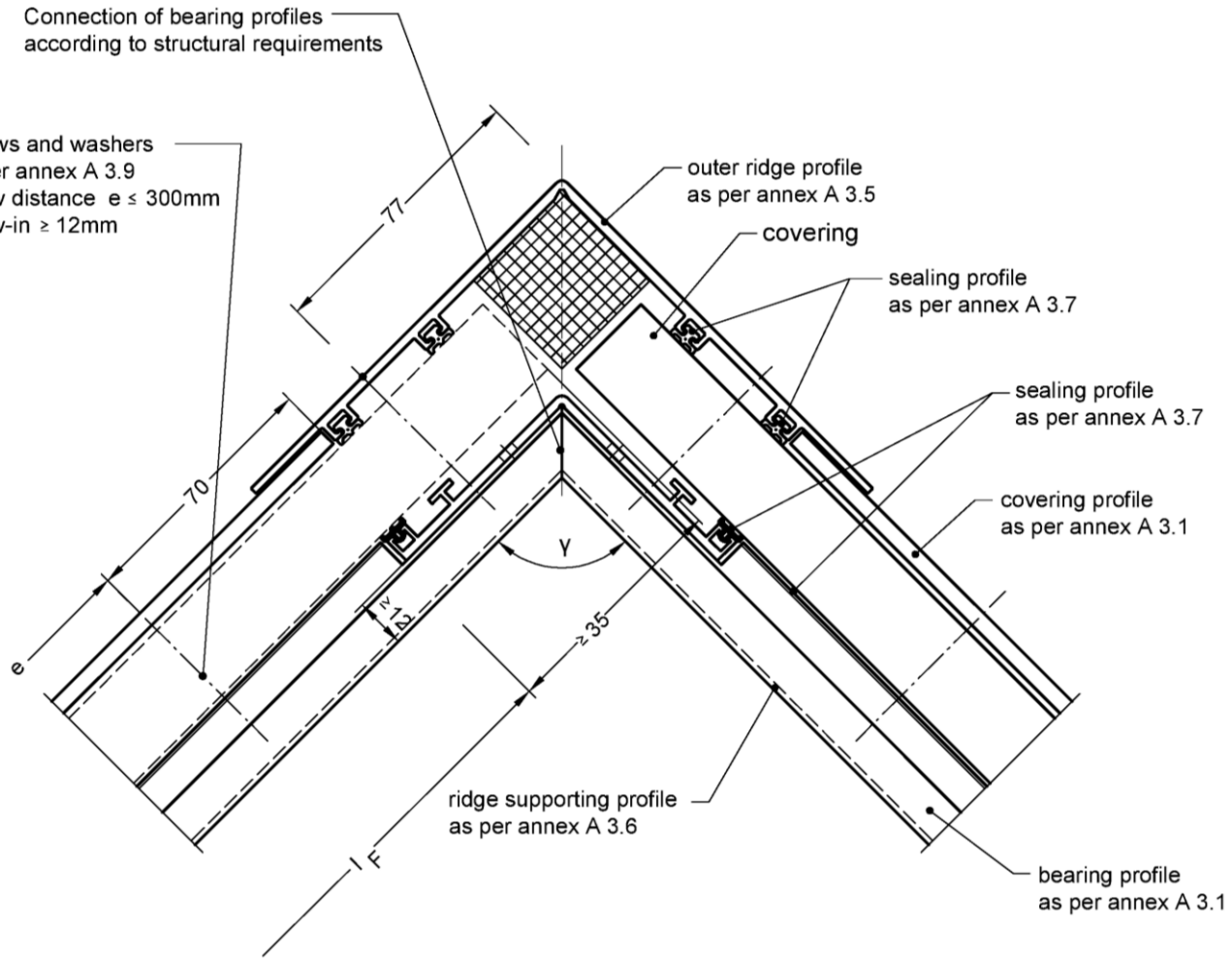
section E-E (ridge)



JET-Vario-Therm S	Annex A 2.7
Example of 45° execution Section E-E (ridge)	

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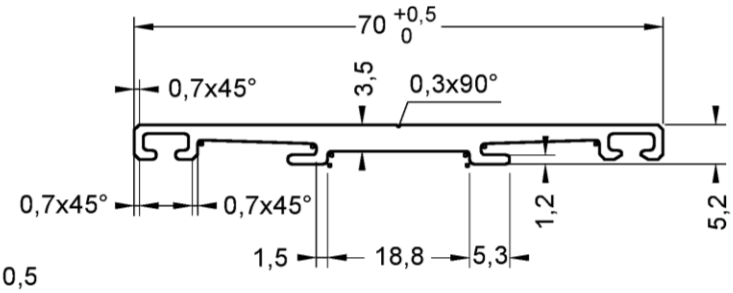
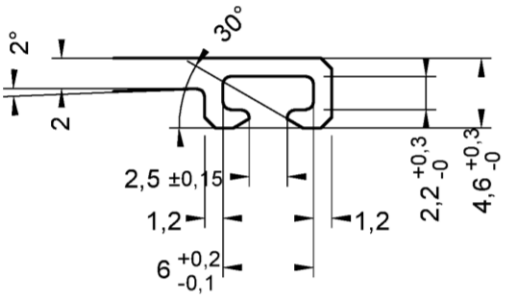
covering profile

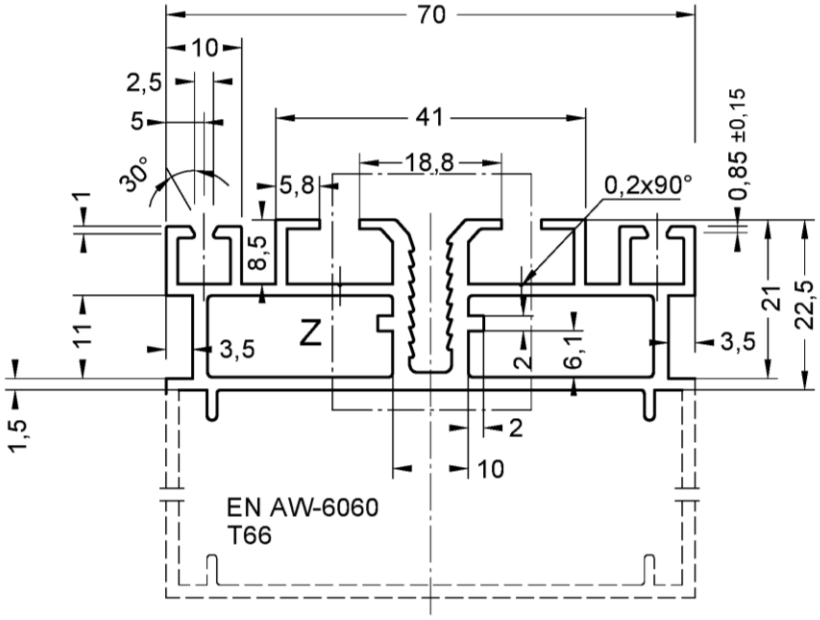
EN AW-6060
T66

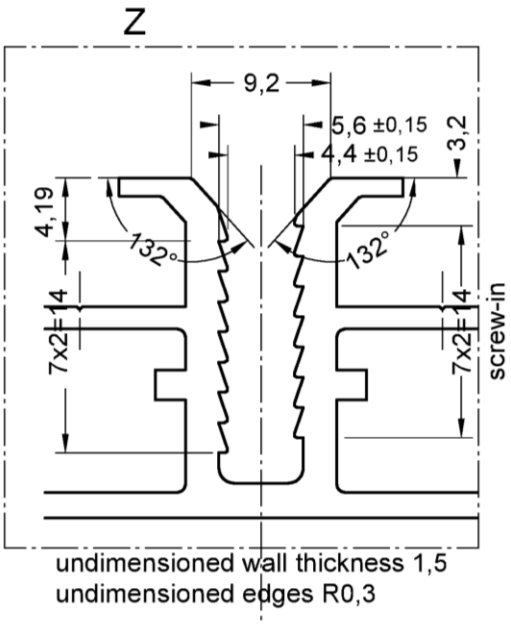


•= R 0,5
undimensioned edges R0,2



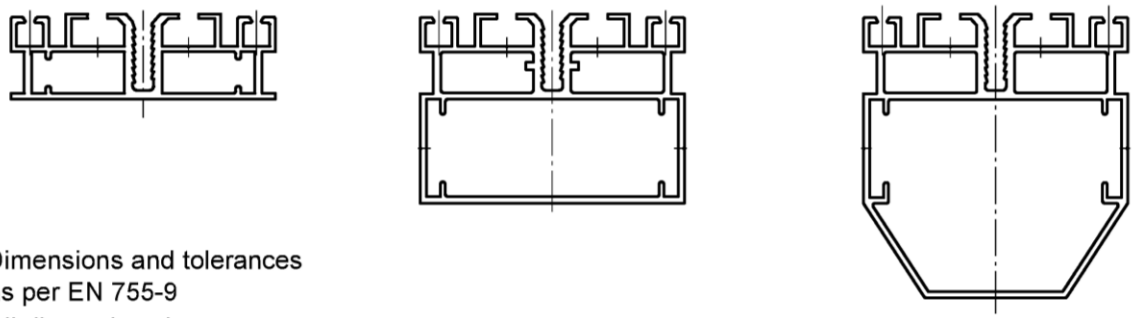
bearing profile





undimensioned wall thickness 1,5
undimensioned edges R0,3

Example



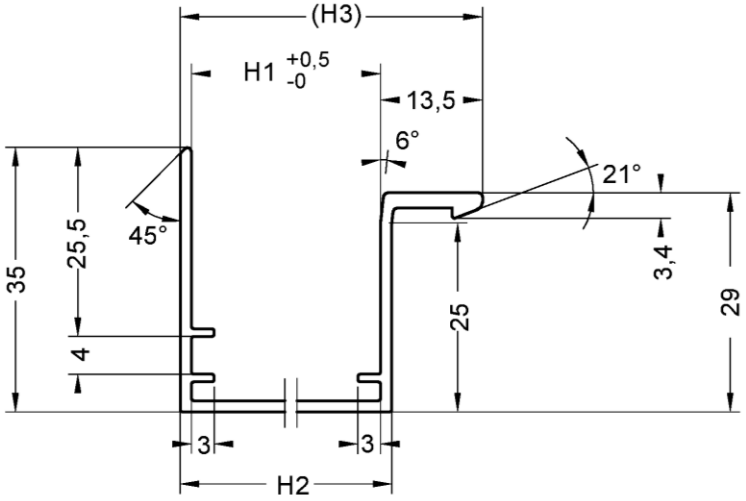
Dimensions and tolerances
as per EN 755-9
All dimensions in mm

JET-Vario-Therm S	Annex A 3.1
Covering and bearing profiles Sections	

electronic copy of the eta by dibt: eta-17/0770

Deutsches Institut für Bautechnik DIBt

edge profile



EN AW-6060
T66

	H1	H2	H3
edge profile 10	10	13	25
edge profile 16	16	19	31
edge profile 22	22	25	37
edge profile 25	25	28	40
edge profile 32	32	35	47

Dimensions and tolerances
as per EN 755-9
All dimensions in mm

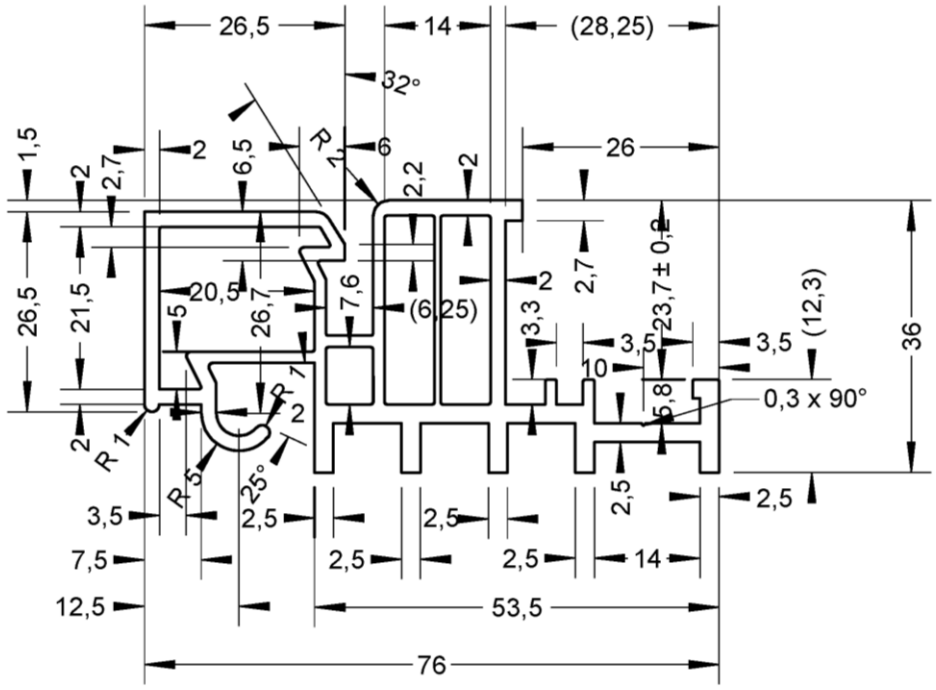
undimensioned wall thickness 1,5
undimensioned edges R0,3

JET-Vario-Therm S	Annex A 3.2
Edge profile (eaves) sections	

electronic copy of the eta by dibt: eta-17/0770

Deutsches Institut für Bautechnik DIBt

eaves profile



inner radius R 0,3

outer radius R 0,2

undimensioned wall thickness 1,5

All dimensions in mm

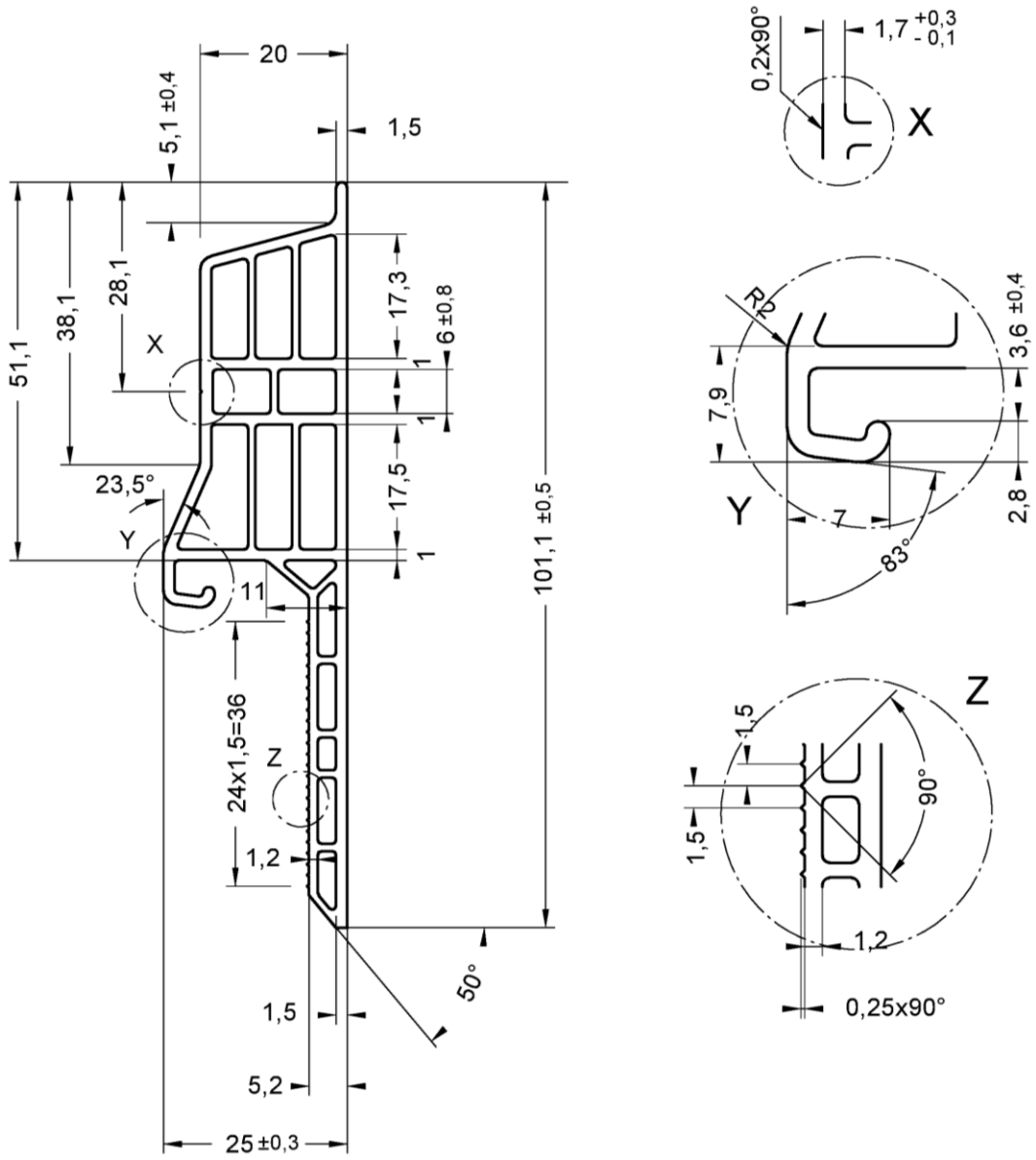
ISO 1163-PVC-U, EDL, 082-05-T28

JET-Vario-Therm S	Annex A 3.3
Eaves profile sections	

electronic copy of the eta by dibt: eta-17/0770

Deutsches Institut für Bautechnik DIBt

roof sheeting connecting profile



undimensioned wall thickness 1,5 mm

All dimensions in mm ISO 1163-PVC-U, EDL, 082-05-T28

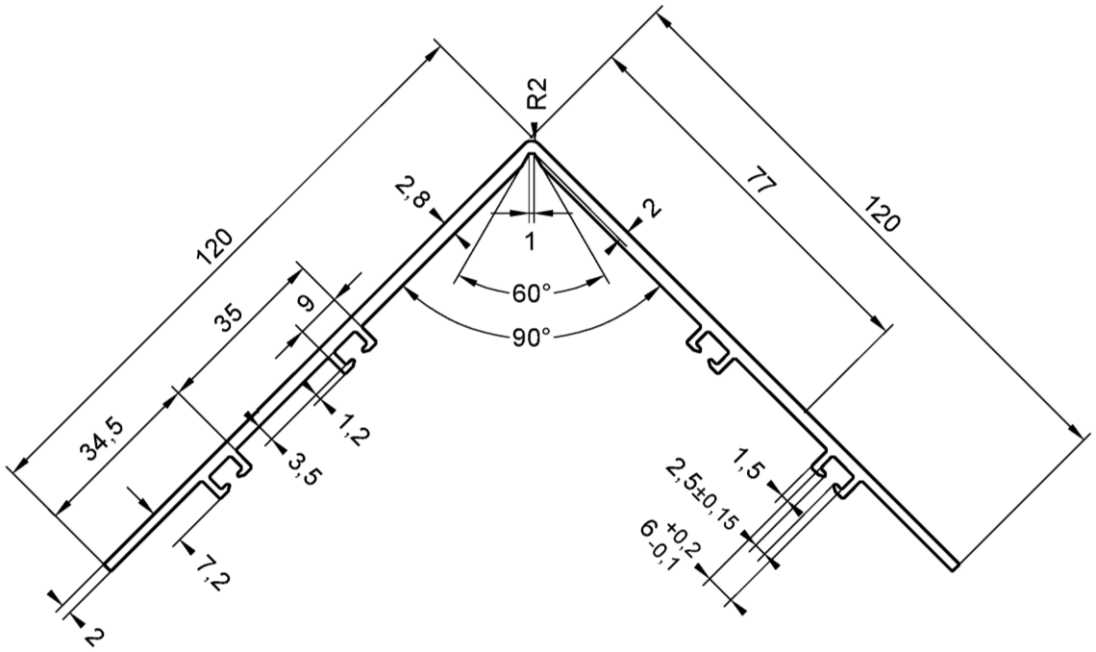
JET-Vario-Therm S	Annex A 3.4
Roof sheeting connecting profile sections	

electronic copy of the eta by dibt: eta-17/0770

Deutsches Institut für Bautechnik DIBt

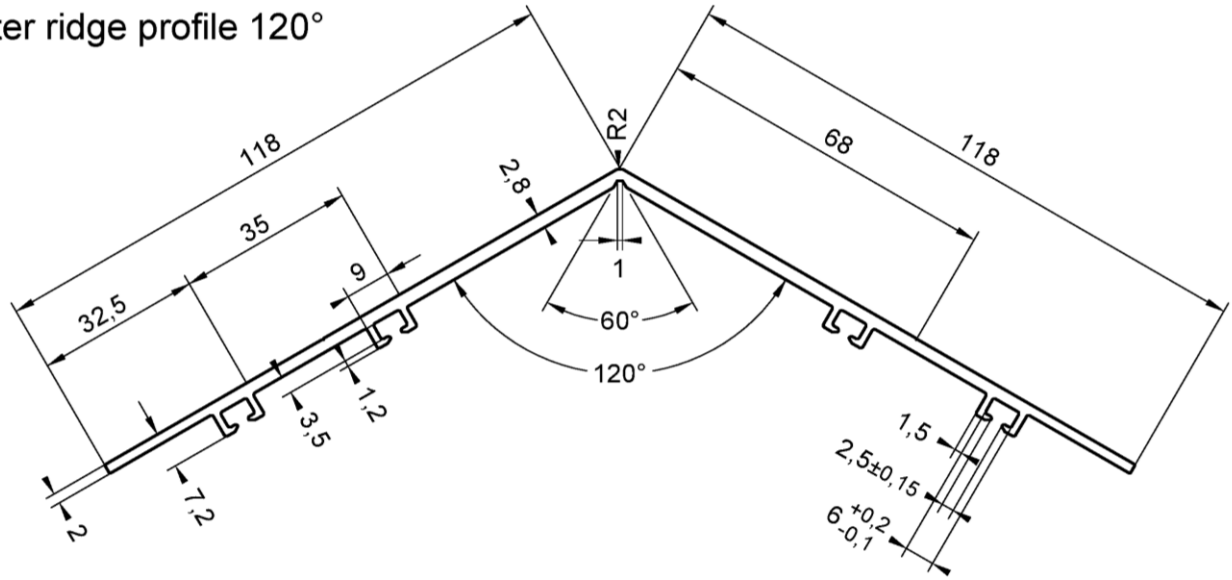
outer ridge profile 90°

outer ridge profile edged according to individual design



outer ridge profile edged according to individual design

outer ridge profile 120°



EN AW-6060,
T4

undimensioned edges R0,3

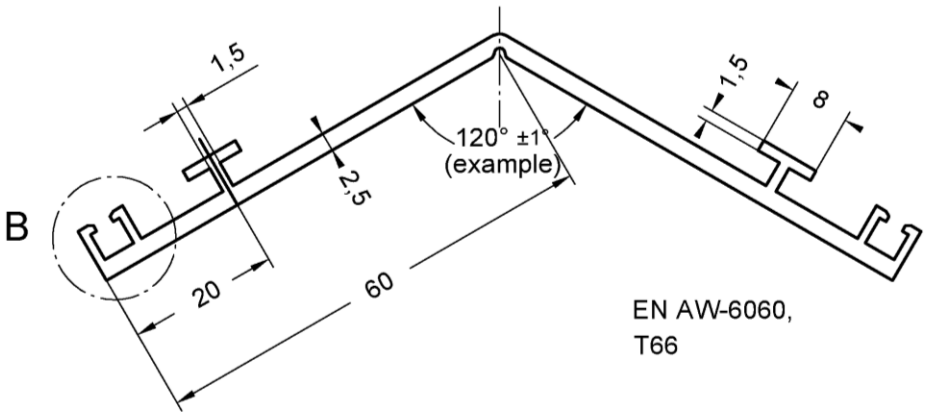
Dimensions and tolerances
as per EN 755-9
All dimensions in mm

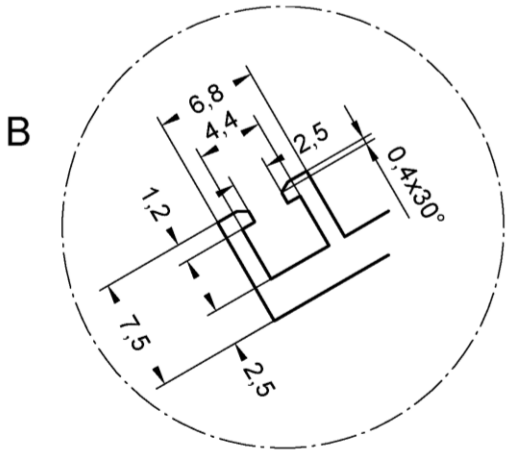
JET-Vario-Therm S	Annex A 3.5
Outer ridge profile sections	

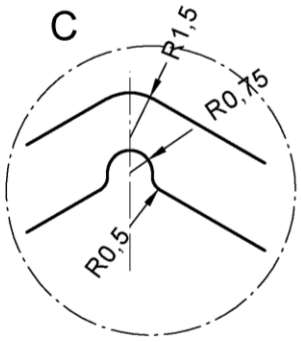
electronic copy of the eta by dibt: eta-17/0770

Deutsches Institut für Bautechnik DIBt

ridge supporting profile





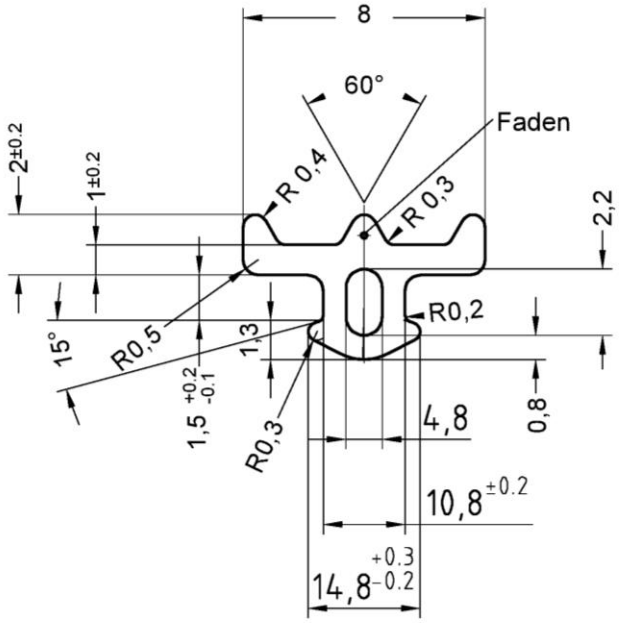


Dimensions and tolerances
as per EN 755-9
All dimensions in mm

JET-Vario-Therm S	Annex A 3.6
Ridge supporting profile sections	

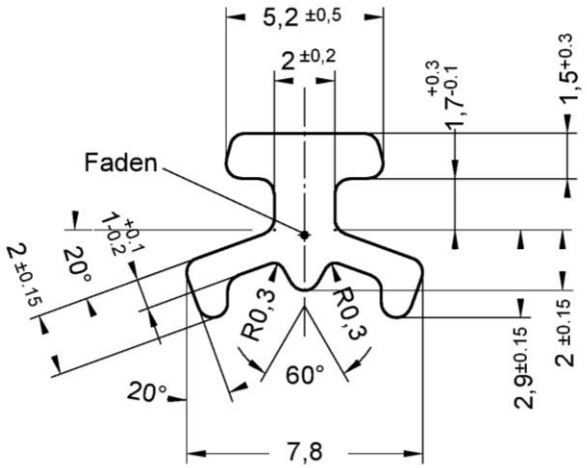
electronic copy of the eta by dibt: eta-17/0770

Deutsches Institut für Bautechnik DIBt



EPDM
(60±5) Shore A
as per EN ISO 868

T-Nut sealing profile



EPDM
(60±5) Shore A
as per EN ISO 868

undimensioned edges R0,5

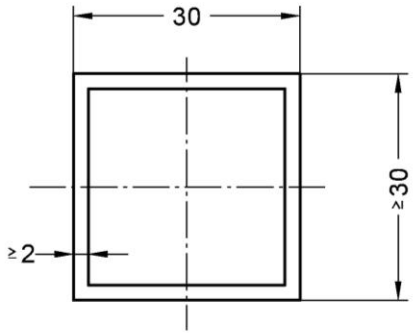
All dimensions in mm

JET-Vario-Therm S	Annex A 3.7
Sealing profiles sections	

electronic copy of the eta by dibt: eta-17/0770

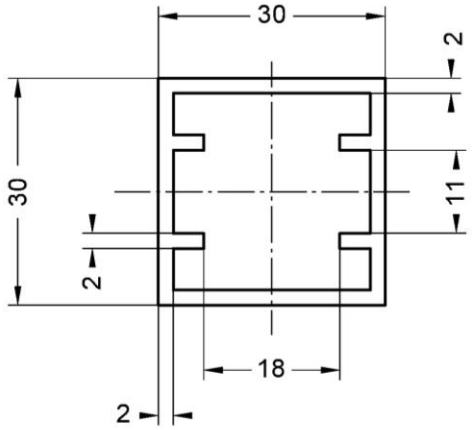
Deutsches Institut für Bautechnik DIBt

cross tube



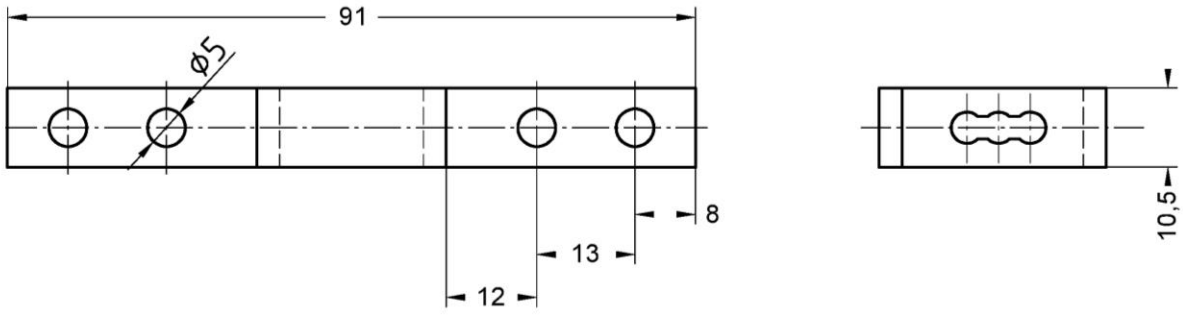
EN AW-6060,
T66

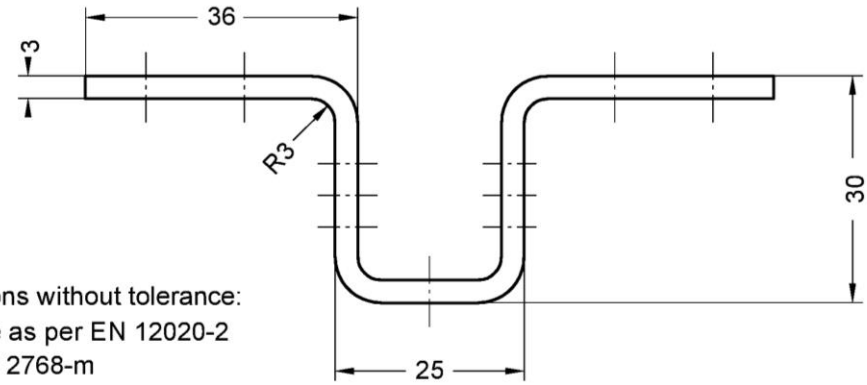
support profile



EN AW-6060,
T66

connecting bracket





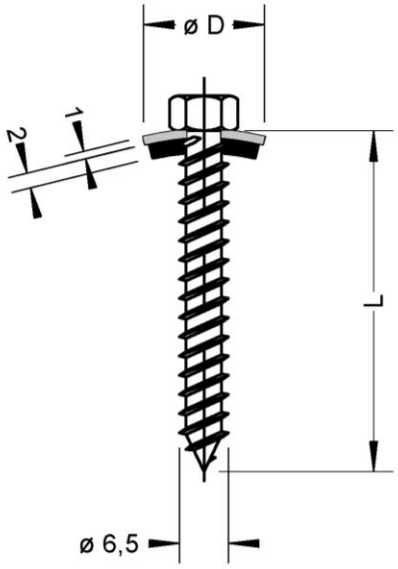
S 235 JR,
galvanised in
accordance with
EN 10025-2

Dimensions without tolerance:
tolerance as per EN 12020-2
bzw. ISO 2768-m

JET-Vario-Therm S	Annex A 3.8
Cross intermediate support; connecting brackets Section; views	

electronic copy of the eta by dibt: eta-17/0770

Deutsches Institut für Bautechnik DIBt



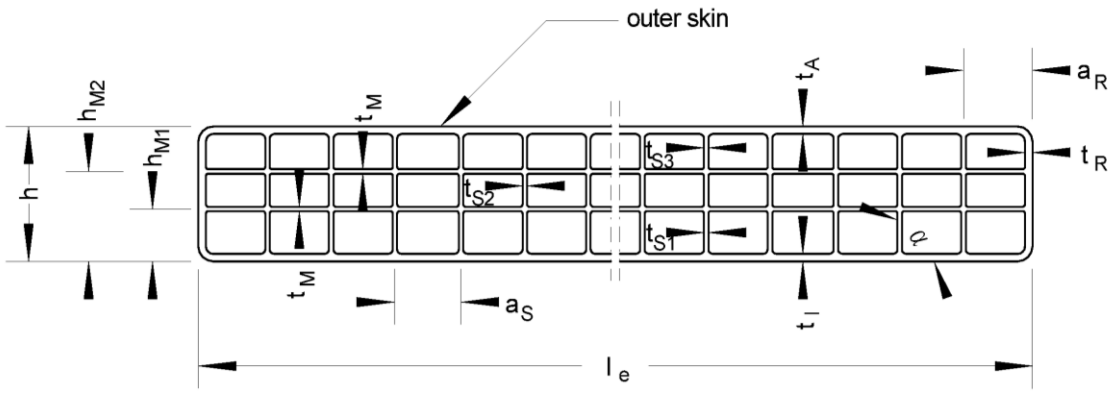
screw: stainless steel (1.4301) - EN 10088
washer: stainless steel (1.4301) - EN 10088

electronic copy of the eta by dibt: eta-17/0770

JET-Vario-Therm S	Annex A 3.9
Connecting means Screws and washers	

Deutsches Institut für Bautechnik DIBt

Sheet: **Makrolon multi UV 4/10-6**
Manufacturer: **Covestro AG**
Resin: **ISO 7391-PC,EL,61-03-9**



l_e mm	h mm	h_{M1} mm	h_{M2} mm	a_S mm	a_R mm	t_A mm	t_I mm	t_{S1} mm	t_{S2} mm	t_{S3} mm
2100	10,0	3,4	6,8	6,0	3,2	0,44	0,44	0,23	0,16	0,20
+ 6 - 2	+ 0,5 - 0,5	+ 0,4 - 0,3	+ 0,35 - 0,45	+ 0,25	+ 0,3	- 0,04	- 0,05	- 0,04	- 0,05	- 0,03

t_M mm	t_R mm	weight per area kg/m²	difference $\lvert\Delta\alpha\rvert$ to 90°
0,08	0,26	1,73	≤8°
- 0,02	- 0,08	+0,10 - 0,02	

Minimum performance levels or classes for the sheets (as declared in the DoP in accordance with EN 16153)

mechanical resistance (deformation behavior)				
B_x	B_y	S_y	$M_{b,pos}$	$M_{b,neg}$
49,0 Nm²/m	23,1 Nm²/m	2152 N/m	47,4 Nm/m	39,6 Nm/m

$M_{b,pos}$: outer skin under pressure

$M_{b,neg}$: inner skin under pressure

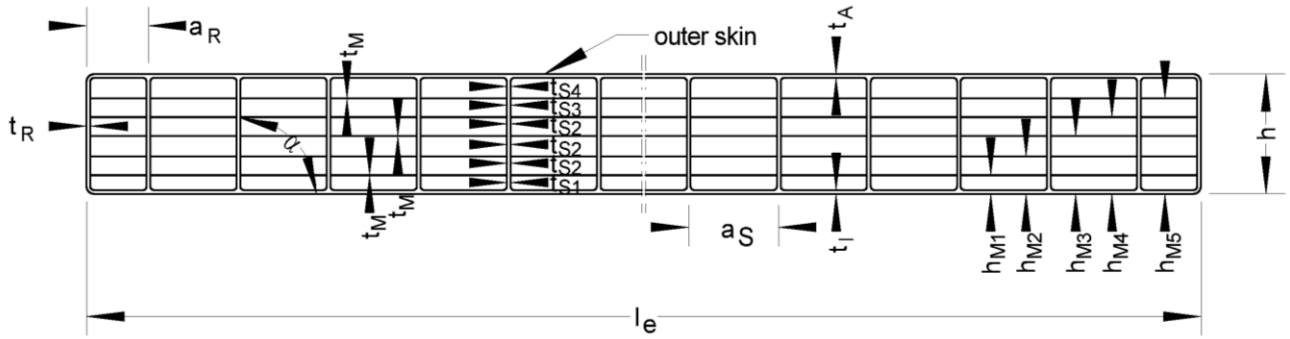
Durability, as variation (after ageing)			
of yellowness index	of the light transmittance	of deformation flexural modulus	of tensile strength
10 % (ΔA)	5 % (ΔA)	Cu 1	Ku 1

electronic copy of the eta by dibt: eta-17/0770

JET-Vario-Therm S	Annex A 4.1
Geometry/ weight per area, Minimum performance levels or classes for the sheets in accordance with EN 16153 "Makrolon multi UV 4/10-6"	

Deutsches Institut für Bautechnik DIBt

Sheet: Akyver Sun Type 16/7w-12 2600
Manufacturer: DS Smith Plastics France
Resin: ISO 7391-PC,EL,61-03-9



l_e mm	h mm	h_{M1} mm	h_{M2} mm	h_{M3} mm	h_{M4} mm	h_{M5} mm	a_S mm	a_R mm	t_A mm	t_I mm
2100	16,0	2,4	4,9	7,7	10,4	12,9	12,0	6,5	0,56	0,52
+6 -2	± 0,5	+ 0,5 - 0,25	+ 0,45 - 0,4	+ 0,4 - 0,55	+ 0,25 - 0,3	+ 0,3 - 0,3	+ 0,40	+ 2,5	- 0,10	- 0,08

t_{S1} mm	t_{S2} mm	t_{S3} mm	t_{S4} mm	t_M mm	t_R mm	weight per area kg/m²	difference $\lvert\Delta\alpha\rvert$ to 90°
0,41	0,39	0,44	0,44	0,06	0,58	2,56	
- 0,10	- 0,12	- 0,09	- 0,10	- 0,02	- 0,27	+ 0,15 - 0,09	≤ 4°

Minimum performance levels or classes for the sheets
(as declared in the DoP in accordance with EN 16153)

mechanical resistance (deformation behavior)				
B_x	B_y	S_y	$M_{b,pos}$	$M_{b,neg}$
176,5 Nm²/m	58,8 Nm²/m	2703 N/m	68,8 Nm/m	59,1 Nm/m

$M_{b,pos}$: outer skin under pressure
$M_{b,neg}$: inner skin under pressure

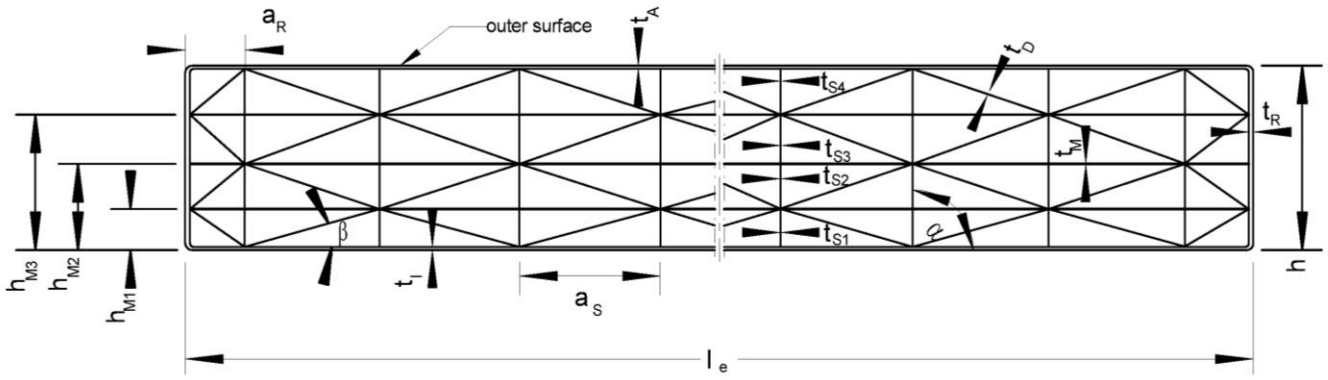
Durability, as variation (after ageing)			
of yellowness index	of the light transmittance	of deformation flexural modulus	of tensile strength
10 % (ΔA)	5 % (ΔA)	Cu 1	Ku 1

electronic copy of the eta by dibt: eta-17/0770

JET-Vario-Therm S	Annex 4.2
Geometry/ weight per area, Minimum performance levels or classes for the sheets in accordance with EN 16153 "Akyver Sun Type 16/7w-12 2600"	

Deutsches Institut für Bautechnik DIBt

Sheet: Makrolon multi UV 5M/25-20 - 2100
Manufacturer: Covestro AG
Resin: ISO 7391-PC,EL,61-03-9



l_e mm	h mm	h_{M1} mm	h_{M2} mm	h_{M3} mm	a_S mm	a_R mm	t_A mm	t_I mm	t_M mm	t_D mm
2100	25,0	6,7	12,5	17,9	19,1	12,2	0,84	0,85	0,04	0,07
+6 -2	± 0,5	+ 0,25 - 0,25	+ 0,3 - 0,4	+ 0,5 - 0,45	+ 0,5	+ 2,6	- 0,07	- 0,04	- 0,01	- 0,01

t_{S1} mm	t_{S2} mm	t_{S3} mm	t_{S4} mm	t_R mm	weight per area kg/m²	difference $\lvert\Delta\alpha\rvert$ to 90°	difference $\lvert\Delta\beta\rvert$ to 13°
0,41	0,35	0,33	0,42	0,45	3,42		
- 0,04	- 0,05	- 0,05	- 0,03	- 0,07	+ 0,21 - 0,04	≤ 1°	≤ 1°

Minimum performance levels or classes for the sheets
(as declared in the DoP in accordance with EN 16153)

mechanical resistance (deformation behavior)				
B_x	B_y	S_y	$M_{b,pos}$	$M_{b,neg}$
600,5 Nm²/m	537,0 Nm²/m	27117 N/m	81,6 Nm/m	106,9 Nm/m

$M_{b,pos}$: outer skin under pressure
$M_{b,neg}$: inner skin under pressure

Durability, as variation (after ageing)			
of yellowness index	of the light transmittance	of deformation flexural modulus	of tensile strength
10 % (ΔA)	5 % (ΔA)	Cu 1	Ku 1

electronic copy of the eta by dibt: eta-17/0770

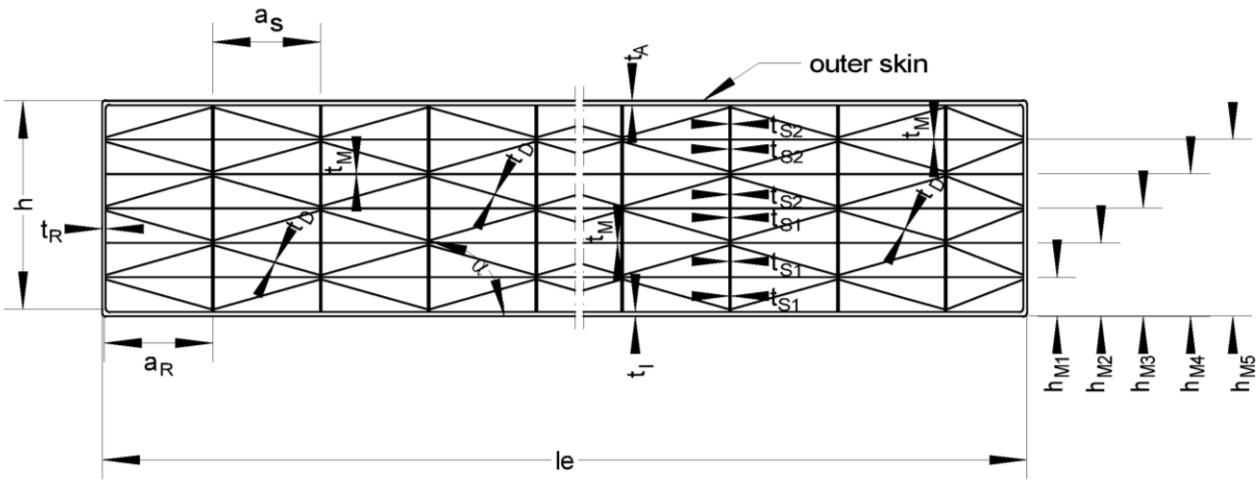
JET-Vario-Therm S

Geometry/ weight per area, Minimum performance levels or classes for the sheets in accordance with EN 16153 "Makrolon multi UV 5M/25-20 - 2100"

Annex A 4.3

Deutsches Institut für Bautechnik DIBt

Sheet: Makrolon multi UV 7M/25-28 - 1200
Manufacturer: Covestro AG
Resin: ISO 7391-PC,EL,61-03-9



l_e mm	h mm	h_{M1} mm	h_{M2} mm	h_{M3} mm	h_{M4} mm	h_{M5} mm	a_s mm	a_R mm
1200	24,8	4,6	8,4	12,2	16,6	20,4	13,9	8,8
+ 6 - 2	± 0,50	+ 0,3 - 0,2	+ 0,3 - 0,4	+ 0,5 - 0,3	+ 0,3 - 0,4	+ 0,3 - 0,3	+ 0,4	+ 1,0

t_A mm	t_I mm	t_M mm	t_D mm	t_{S1} mm	t_{S2} mm	t_R mm	weight per area kg/m²	difference $\lvert\Delta\alpha\rvert$ to 90°
0,71	0,69	0,07	0,05	0,30	0,20	0,82	3,34	
- 0,12	- 0,06	- 0,01	- 0,02	- 0,03	- 0,03	- 0,12	+ 0,20 - 0,03	≤ 1°

Minimum performance levels or classes for the sheets
(as declared in the DoP in accordance with EN 16153)

mechanical resistance (deformation behavior)				
B_x	B_y	S_y	$M_{b,pos}$	$M_{b,neg}$
495,3 Nm²/m	440,4 Nm²/m	17773 N/m	84,7 Nm/m	70,3 Nm/m

$M_{b,pos}$: outer skin under pressure

$M_{b,neg}$: inner skin under pressure

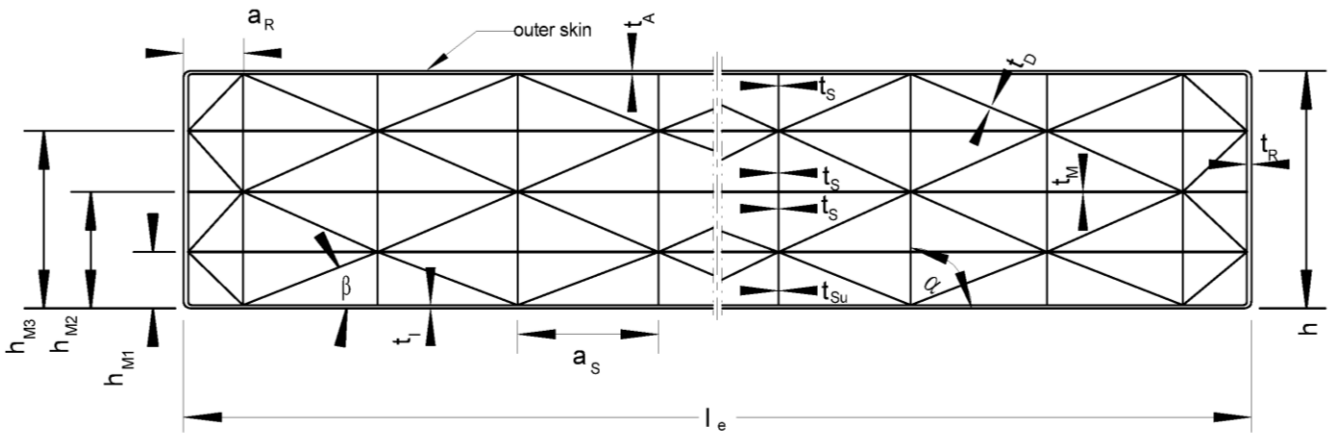
Durability, as variation (after ageing)			
of yellowness index	of the light transmittance	of deformation flexural modulus	of tensile strength
10 % (ΔA)	5 % (ΔA)	Cu 1	Ku 1

electronic copy of the eta by dibt: eta-17/0770

JET-Vario-Therm S	Annex A 4.4
Geometry/ weight per area, Minimum performance levels or classes for the sheets in accordance with EN 16153 "Makrolon multi UV 7M/25-28 - 1200"	

Deutsches Institut für Bautechnik DIBt

Sheet: Makrolon multi UV 5M/32-20
Manufacturer: Covestro AG
Resin: ISO 7391-PC,EL,61-03-9



l_e mm	h mm	h_{M1} mm	h_{M2} mm	h_{M3} mm	a_S mm	a_R mm	t_A mm	t_I mm	t_M mm	t_D mm
2100	32,1	8,8	16,7	24,0	19,3	12,2	0,89	0,89	0,04	0,07
+6 -2	± 0,5	+ 0,55 - 0,35	+ 0,4 - 0,55	+ 0,35 - 0,35	+ 0,7	+ 2,7	- 0,07	- 0,10	- 0,01	- 0,01

t_S mm	t_{Su} mm	t_R mm	weight per area kg/m²	diference $\|\Delta\alpha\|$ to 90°	diference $\|\Delta\beta\|$ to 13°
0,32	0,35	0,49	3,65		
- 0,09	- 0,04	- 0,16	+ 0,22 - 0,07	≤ 1°	≤ 1°

Minimum performance levels or classes for the sheets
(as declared in the DoP in accordance with EN 16153)

mechanical resistance (deformation behavior)				
B_x	B_y	S_y	$M_{b,pos}$	$M_{b,neg}$
1110,7 Nm²/m	728,2 Nm²/m	20572 N/m	107,2 Nm/m	121,4 Nm/m

$M_{b,pos}$: outer skin under pressure
$M_{b,neg}$: inner skin under pressure

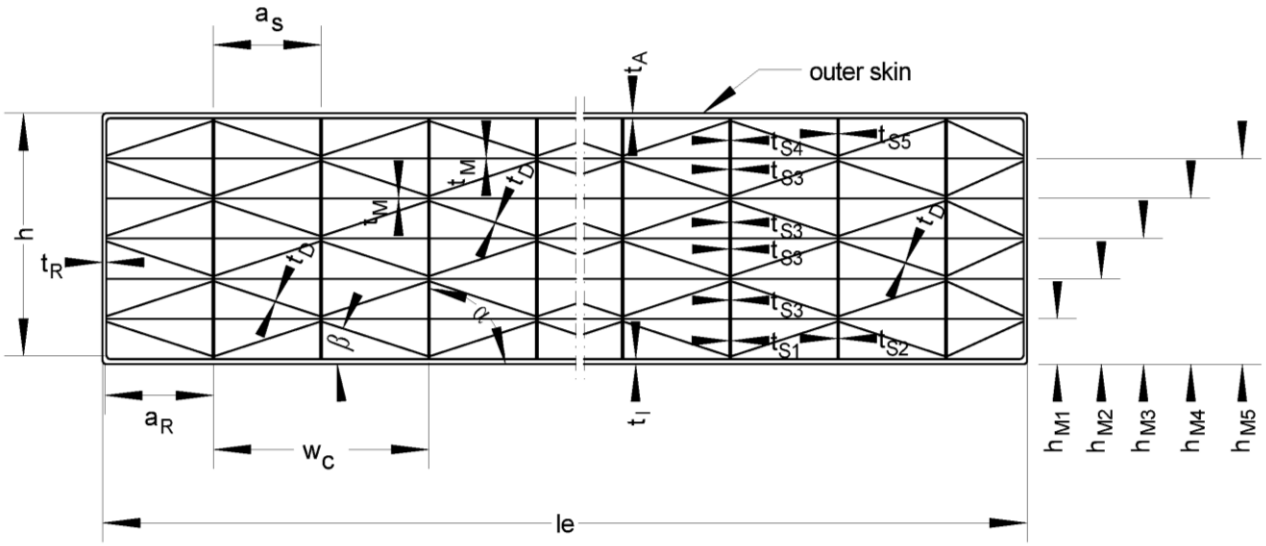
Durability, as variation (after ageing)			
of yellowness index	of the light transmittance	of deformation flexural modulus	of tensile strength
10 % (ΔA)	5 % (ΔA)	Cu 1	Ku 1

electronic copy of the eta by dibt: eta-17/0770

JET-Vario-Therm S	Annex A 4.5
Geometry/ weight per area, Minimum performance levels or classes for the sheets in accordance with EN 16153 "Makrolon multi UV 5M/32-20"	

Deutsches Institut für Bautechnik DIBt

Sheet: Makrolon multi UV 7M/32-28 - 1200
Manufacturer: Covestro AG
Resin: ISO 7391-PC,EL,61-03-9



l_e mm	h mm	h_{M1} mm	h_{M2} mm	h_{M3} mm	h_{M4} mm	h_{M5} mm	a_s mm	a_R mm	t_R mm	t_A mm
1200	31,5	5,5	9,9	14,8	20,9	26,6	14,0	7,2	0,48	0,68
+ 6 - 2	± 0,50	+ 0,40 - 0,35	± 0,50	+ 0,90 - 0,85	+ 1,10 - 1,05	+ 0,90 - 0,85	+ 0,45	+ 2,40	- 0,25	- 0,10

t_I mm	t_M mm	t_D mm	t_{S1} mm	t_{S2} mm	t_{S3} mm	t_{S4} mm	t_{S5} mm	weight per area kg/m²	difference $\lvert\Delta\alpha\rvert$ to 90°	β °
0,68	0,04	0,05	0,31	0,20	0,32	0,37	0,28	3,54		16
- 0,09	- 0,01	- 0,02	- 0,03	- 0,03	- 0,05	- 0,03	- 0,02	- 0,05	≤ 1°	± 2

Minimum performance levels or classes for the sheets
(as declared in the DoP in accordance with EN 16153)

mechanical resistance (deformation behavior)				
B_x	B_y	S_y	$M_{b,pos}$	$M_{b,neg}$
878,4 Nm²/m	740,0 Nm²/m	23856 N/m	79,2 Nm/m	92,3 Nm/m

$M_{b,pos}$: outer skin under pressure
$M_{b,neg}$: inner skin under pressure

Durability, as variation (after ageing)			
of yellowness index	of the light transmittance	of deformation flexural modulus	of tensile strength
10 % (ΔA)	5 % (ΔA)	Cu 1	Ku 1

electronic copy of the eta by dibt: eta-17/0770

JET-Vario-Therm S

Geometry/ weight per area, Minimum performance levels or classes for the sheets in accordance with EN 16153
"Makrolon multi UV 7M/32-28"

Annex A 4.6

JET-Vario-Therm S **Annex B 1**

Provisions for design and dimensioning

B 1 Load-bearing capacity and serviceability of the covering

B 1.1 General

The design and arrangement of the multi-wall sheets as described in Section 1.1.1 in the translucent roof kit shall correspond to the specifications given in Annexes A 1 to A 4. The design specifications (see Section 2) shall be complied with.

The stability shall be verified for the ultimate limit state (ULS)

$E_d \leq R_d$

and for the serviceability limit state (SLS)

$E_d \leq C_d$.

E_d: design value of the action

R_d: design value of the structural resistance for verification of the ultimate limit state

C_d: design value of the structural resistance for verification of the serviceability limit state

The multi-wall sheets shall not be used for bracing the aluminium structure.

The multi-wall sheets shall not be walked on.

Assessment pertaining to fall-through protection is not included in this ETA.

The bearing construction consisting of the bearing profile, the covering profile and, where applicable, one or several cross beams, their fixing as well as the substructure shall be verified on a case-by-case basis; for the verification of bearing profiles which are used as intermediate supports for multi-span systems (see Annex A 2.1, section C-C), the effect of the continuity of the multi-wall sheets shall be factored in using a factor of 1.25 (for double-span systems) and 1.1 (for triple-span systems) for load determination.

The mechanical resistance of the screws in accordance with Section 1.1.8 shall be verified on a case-by-case basis (see B 1.3). They may not be considered for the transfer of loads in the plane of the multi-wall sheets.

B 1.2 Design values for actions, E_d for ULS and SLS verification

The design values for the actions shall be determined in accordance with the applicable European specifications.

The action resulting from the dead weight of the multi-wall sheets may be neglected in the roof kit verifications in accordance with Section B.1.3.

Live loads are not permitted.

The design value of the action results from the characteristic values of the actions, taking into account the partial safety factors γ_F, the coefficients ψ and the factors for the effects of action duration K_t or C_t. The load cases 'summer' and 'winter' shall be differentiated.

For the wind and temperature effects to be considered in the load case 'summer' the ψ coefficient defined in EN 1990 may be applied. In design situations where the wind is applied as the dominant variable action, the ψ coefficient may be considered in the design value of the structural resistance R_d (see Section B.1.3).

The actions E_k shall be increased through multiplication by the factors $K_t = C_t$ in consideration of the action duration and based on load.

Load action	Duration of load action	$K_t = C_t$
Wind	very short	1.00
Snow as an extraordinary snow load (e.g. in the low-lying plains of northern Germany)	short: up to one week	1.15
Snow	medium: up to three months	1.20
Dead Load	constantly	1.50

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B 1.3 Design values for structural resistance R_d (ULS) and C_d (SLS)

The design values for structural resistance R_d and C_d result from the characteristic value of structural resistance R_k in consideration of the material safety factor γ_M, the factor taking into account the effects of media C_u and the temperature factor C_θ as follows:

$$R_d = \frac{R_k}{\gamma_{MR} \cdot C_u \cdot C_\theta} \qquad C_d = \frac{C_k}{\gamma_{MC} \cdot C_u \cdot C_\theta}$$

The following factors shall be applied:

Factor taking into account the effects of media and ageing C_u		1.10
Temperature factor C_θ	summer	1.20
	winter	1.00

The following material safety factors shall be applied as a function of the consequence class (CC) in accordance with EN 1990:

Consequence class	Material safety factor γ_{MR}	Material safety factor γ_{MC}
CC 1	1.25	1.09
CC 2	1.30	1.13

In design situations where wind is considered to be the dominant variable action, the reduction in structural resistance due to temperature may be reduced by means of the ψ coefficient for the summer load case. For this design situation a reduction factor for temperature of $C'_\theta = 1 + \psi \cdot (C_\theta - 1.0)$ may be applied.

The characteristic values for the component's structural resistances R_k and C_k for the variants PC 10, PC 16, PC 25 and PC 32 shall be taken from the following Annexes for the given multi-wall sheets, spans and direction of loading:

Covering	**Multi-wall sheet in accordance with Annex**	**System**	**Characteristics values of structural resistance [kN/m²] see Annex**			
			downward load		**uplift load**	
			R_k	**C_k**	**R_k**	**C_k**
PC 10	A 4.1	2-span	B 2.1	B 2.2	B 2.3	B 2.4
PC 16	A 4.2	2-span	B 2.5	B 2.6	B 2.7	B 2.8
		3-span	B 2.9	B 2.10	B 2.11	B 2.12
PC 25	A 4.3	2-span	B 2.13	B 2.14	B 2.15	B 2.16
		3-span	B 2.17	B 2.18	B 2.19	B 2.20
	A 4.4	1-span	B 2.21	B 2.22	B 2.23	B 2.24
PC 32	A 4.5	2-span	B 2.13	B 2.14	B 2.15	B 2.16
		3-span	B 2.17	B 2.18	B 2.19	B 2.20
	A 4.6	1-span	B 2.25	B 2.26	B 2.27	B 2.28

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For the screw connection between the covering and the bearing profile, the following characteristic values for the tensile strength in the screw axis may be applied. Sheer action on the screws shall be avoided by appropriate constructive measures. The spacing of the screws shall be e ≤ 300 mm.

Connector	**Connection between the covering and the bearing profile**	**Embedment depth in mm**	**Tensile strength $N_{R,k}$ in kN**
As per Section 1.1.8 and Annex A 3.9	Standard as per Annexes A 2.4 and A 2.6	≥ 14	4.6
	For the released section at the ridge Annexes A 2.5 and A 2.7	≥ 12	4.0

B 1.4 Limitation of deflection (SLS)

The design value of the component's structural resistance C_d to deflection results from the design value of the limitation of deflection $f_{R,d}^{GZG}$. Deflection for loads that are distributed evenly shall be verified as follows assuming a linear-elastic material behaviour:

$$\frac{f_{E,d}^{GZG}}{f_{R,d}^{GZG}} \leq 1{,}0$$

$f_{E,d}^{GZG}$: design value of deflection caused by E_d

$f_{R,d}^{GZG}$: design value of the limitation of deflection

The deflection values $f_{E,k}$ shall be taken from the following Annexes for the relevant characteristic action and clear span l_F, multiplied by the action-specific factor C_t and added together subsequently.

Intermediate values may be interpolated:

Covering	**Multi-wall sheet in accordance with Annex**	**System**		
		1-span	2-span	3-span
PC 10	A 4.1	–	B 3.1	–
PC 16	A 4.2	–	B 3.2	B 3.3
PC 25	A 4.3	–	B 3.4	B 3.5
	A 4.4	B 3.6	–	–
PC 32	A 4.5	–	B 3.4	B 3.5
	A 4.6	B 3.7	–	–

The dead weight shall be taken from the Annexes A 4.

The design value of the limitation of deflection is therefore:

$$f_{R,d}^{GZG} = \frac{f_{R,k}}{C_u \cdot C_\theta \cdot \gamma_{MC}}$$

The limitation of deflection ($f_{R,k}$) shall be determined in such a way that proper functioning is not jeopardised. The deflection shall be evaluated on a case-by-case basis to avoid water pockets or ingress of water etc.

The material safety factors and effects given in Section B 1.3 shall be taken into consideration.

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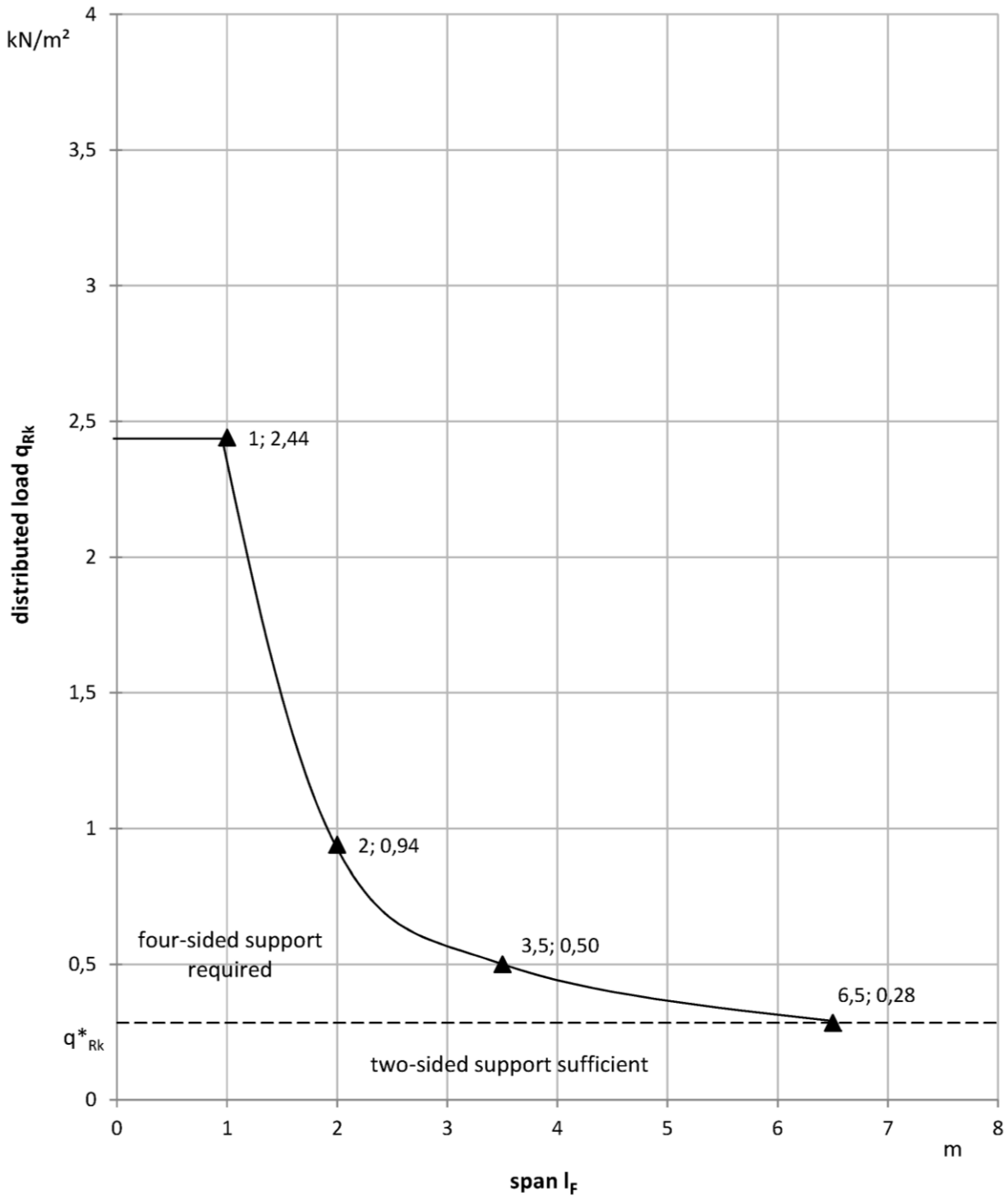

characteristic resistance (four sided support)
distributed load q_{Rk} as a function of span l_F for wind and snow loads

in case of two-sided supporting the limit q^*_{Rk} of 0,28 kN/m² has to be complied

JET-Vario-Therm S	Annex B 2.1
Makrolon multi UV 4/10-6 two span system, load direction positive characteristic values; load- bearing capacity (ULS)	

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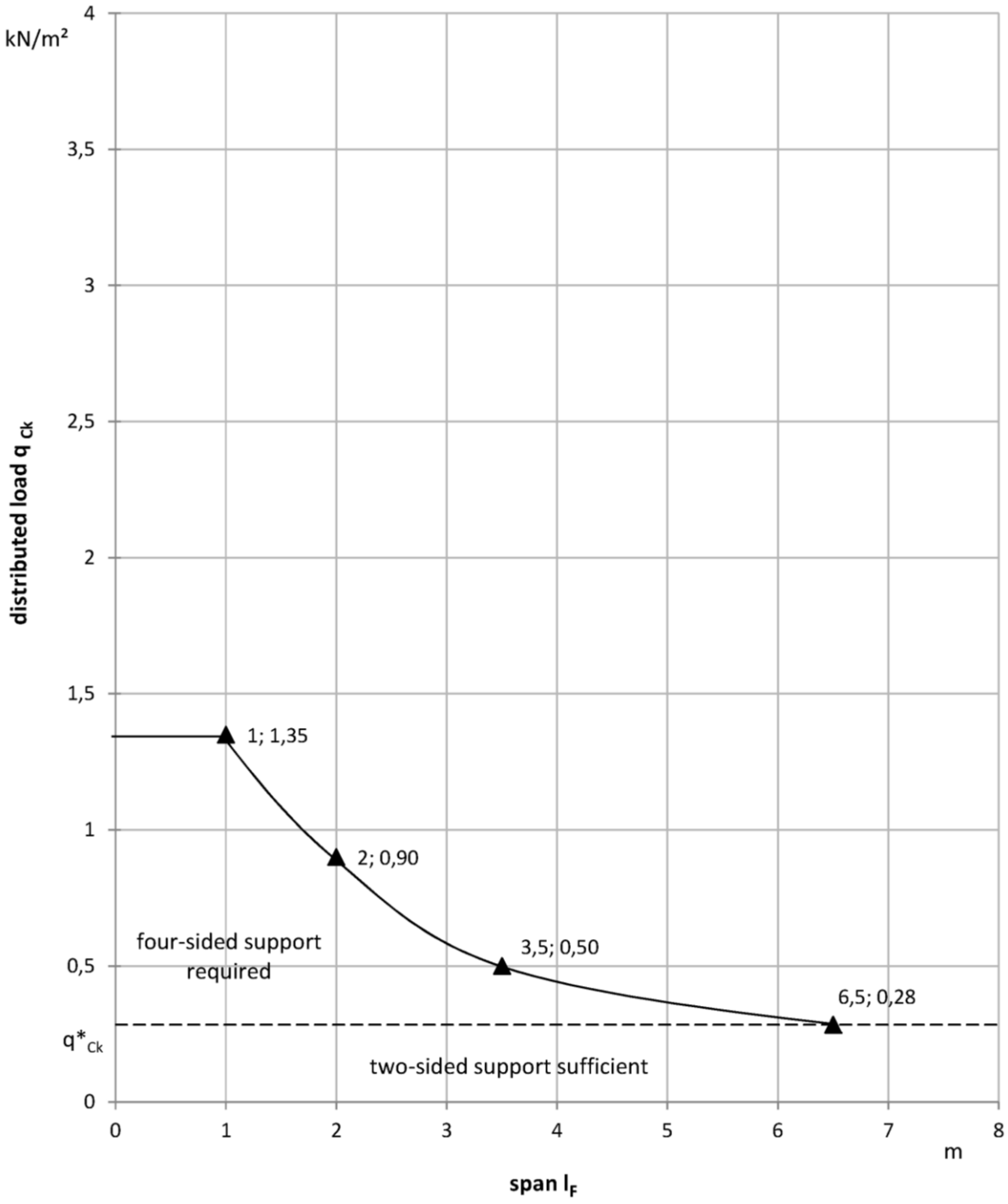

characteristic resistance (four sided support)
distributed load q_{Ck} as a function of span l_F for wind and snow loads

in case of two-sided supporting the limit q^*_{Ck} of 0,28 kN/m² has to be complied

JET-Vario-Therm S	Annex B 2.2
Makrolon multi UV 4/10-6 two span system, load directions positive characteristic values; serviceability (SLS)	

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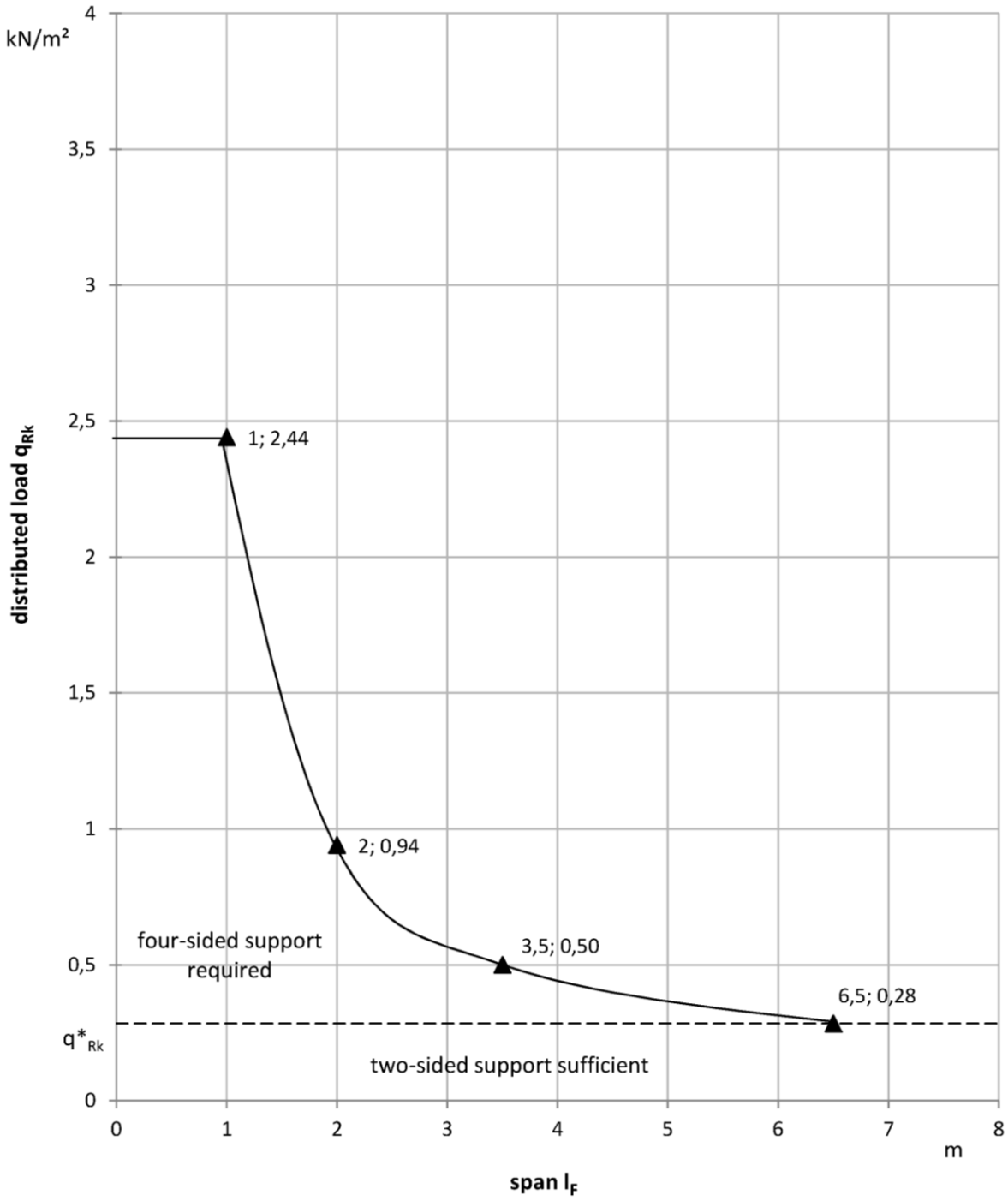

characteristic resistance (four sided support)
distributed load q_{Rk} as a function of span l_F for wind load

in case of two-sided supporting the limit q^*_{Rk} of 0,28 kN/m² has to be complied

JET-Vario-Therm S	Annex B 2.3
Makrolon multi UV 4/10-6 two span system, load directions negative characteristic values; load- bearing capacity (ULS)	

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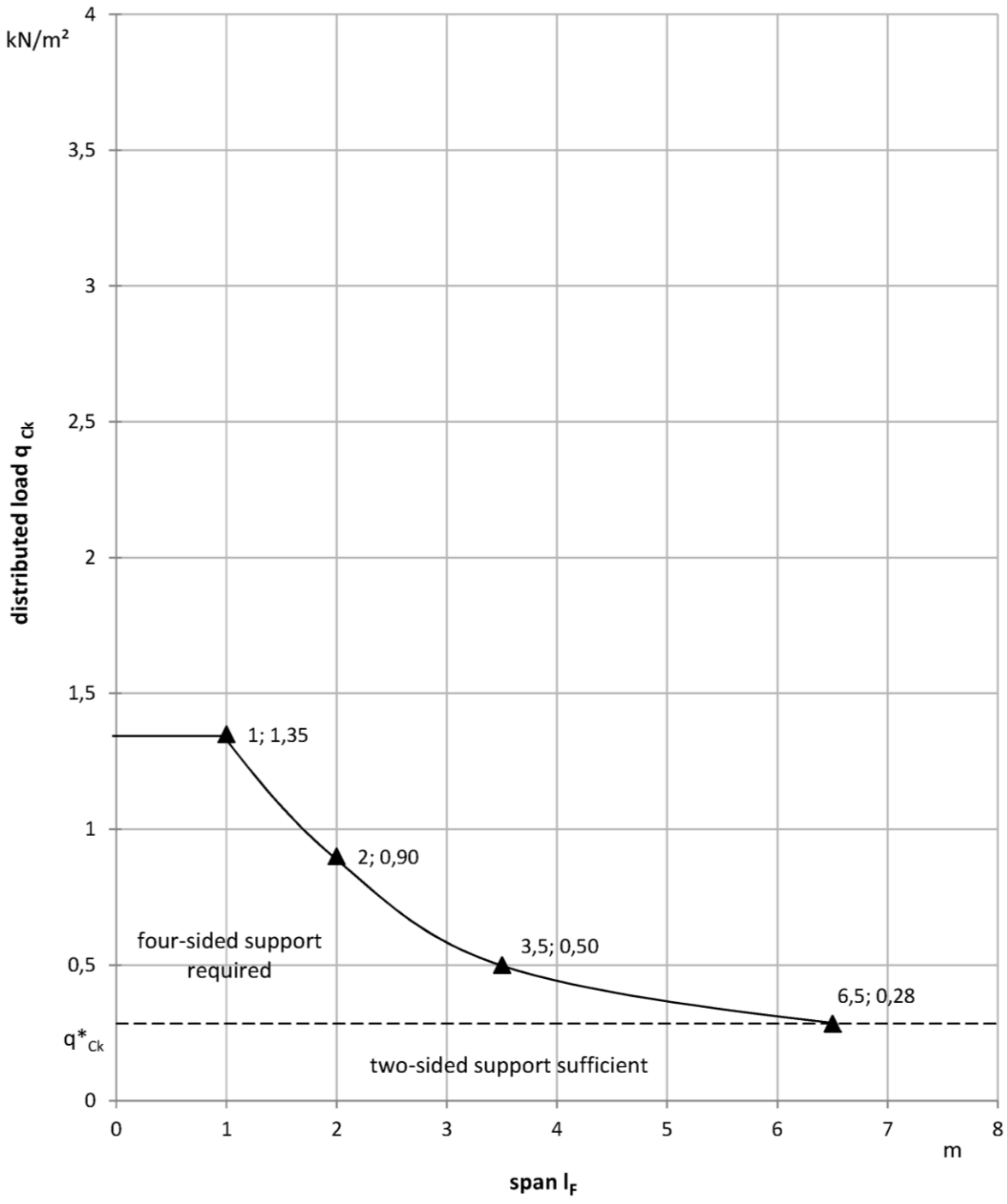

characteristic resistance (four sided support)
distributed load q_{Ck} as a function of span l_F for wind load

in case of two-sided supporting the limit q^*_{Ck} of 0,28 kN/m² has to be complied

JET-Vario-Therm S	Annex B 2.4
Makrolon multi UV 4/10-6 two span system, load directions negative characteristic values; serviceability (SLS)	

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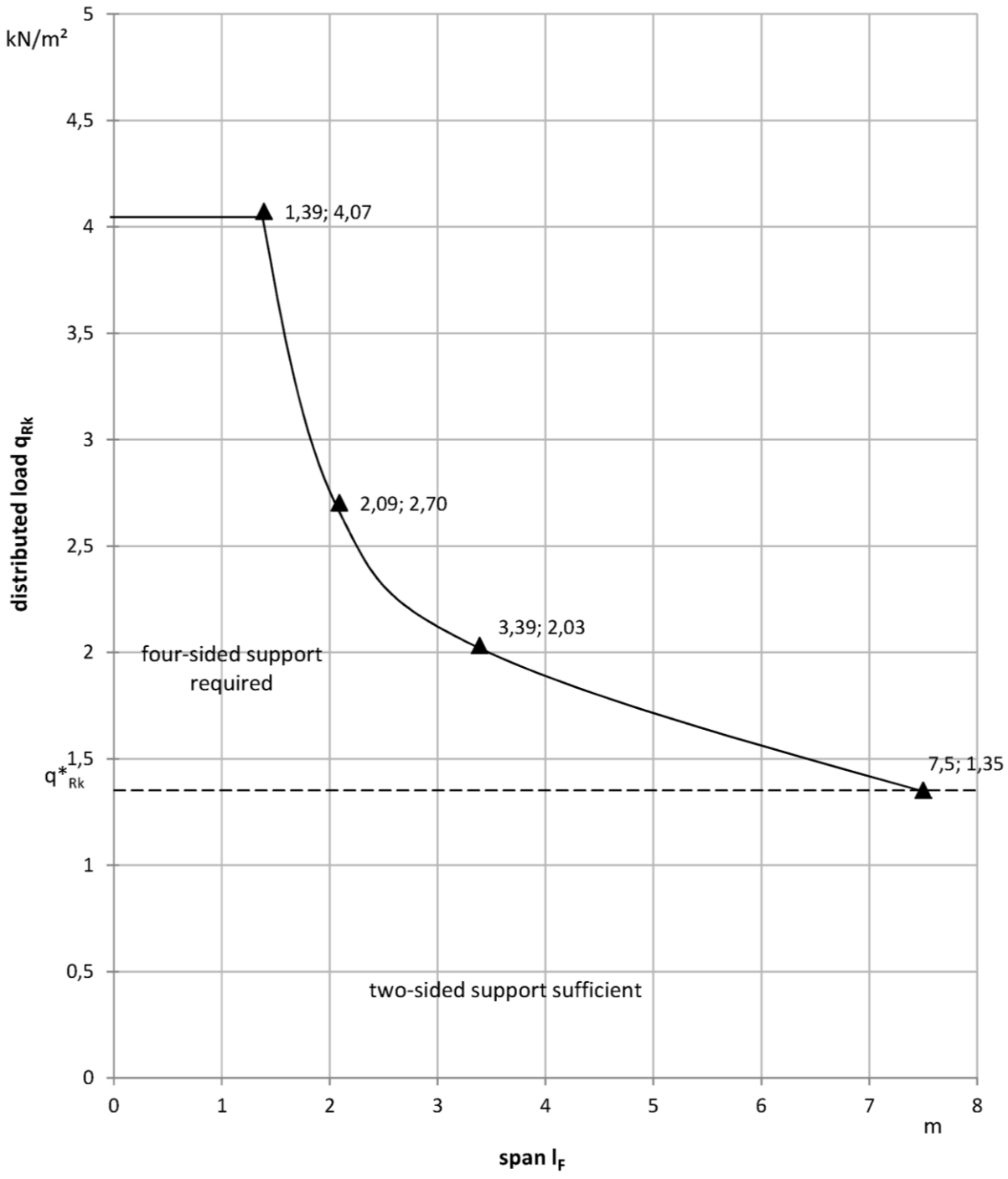

characteristic resistance (four sided support)
distributed load q_{Rk} as a function of span l_F for wind and snow loads

in case of two-sided supporting the limit q^*_{Rk} of 1,35 kN/m² has to be complied

JET-Vario-Therm S	Annex B 2.5
Akyver Sun Type 16/7w-12 two span system, load directions positive characteristic values; load- bearing capacity (ULS)	

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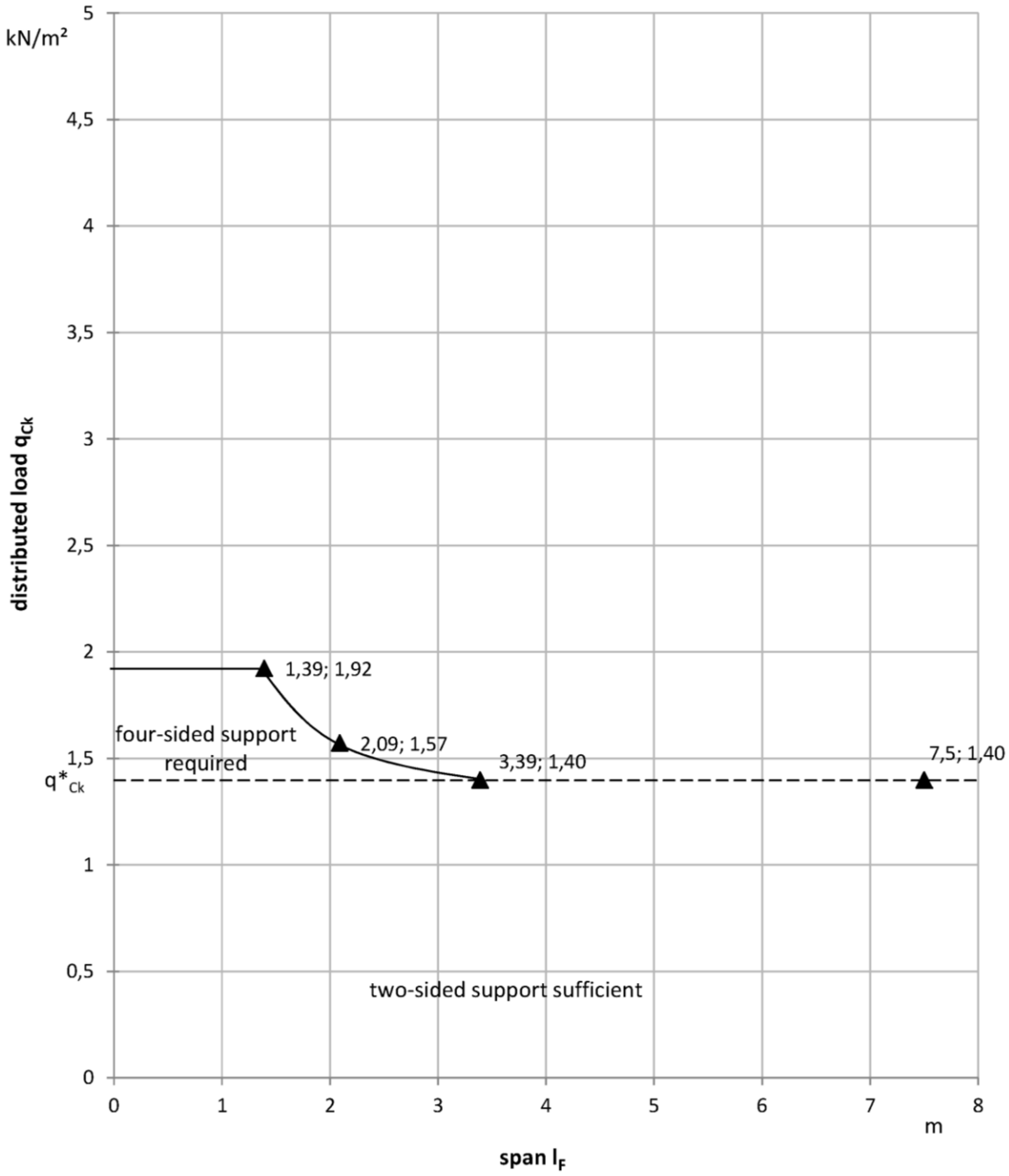

characteristic resistance (four sided support)
distributed load q_{Ck} as a function of span l_F for wind and snow loads

in case of two-sided supporting the limit q^*_{Ck} of 1,40 kN/m² has to be complied

JET-Vario-Therm S	Annex B 2.6
Akyver Sun Type 16/7w-12 two span system, load directions positive characteristic values; serviceability (SLS)	

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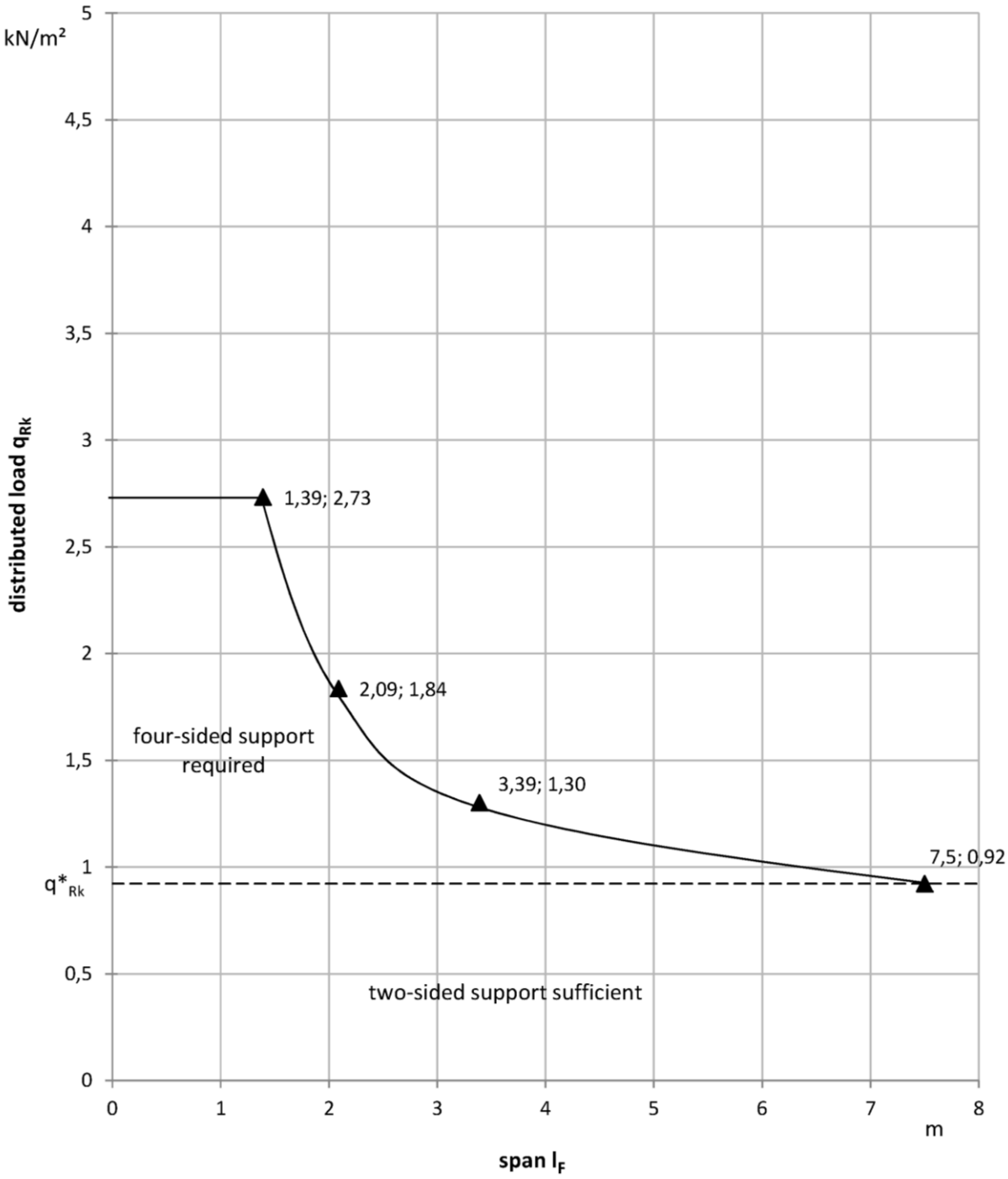

characteristic resistance (four sided support)
distributed load q_{Rk} as a function of span l_F for wind load

in case of two-sided supporting the limit q^*_{Rk} of 0,92 kN/m² has to be complied

JET-Vario-Therm S	Annex B 2.7
Akyver Sun Type 16/7w-12 two span system, load directions negative characteristic values; load- bearing capacity (ULS)	

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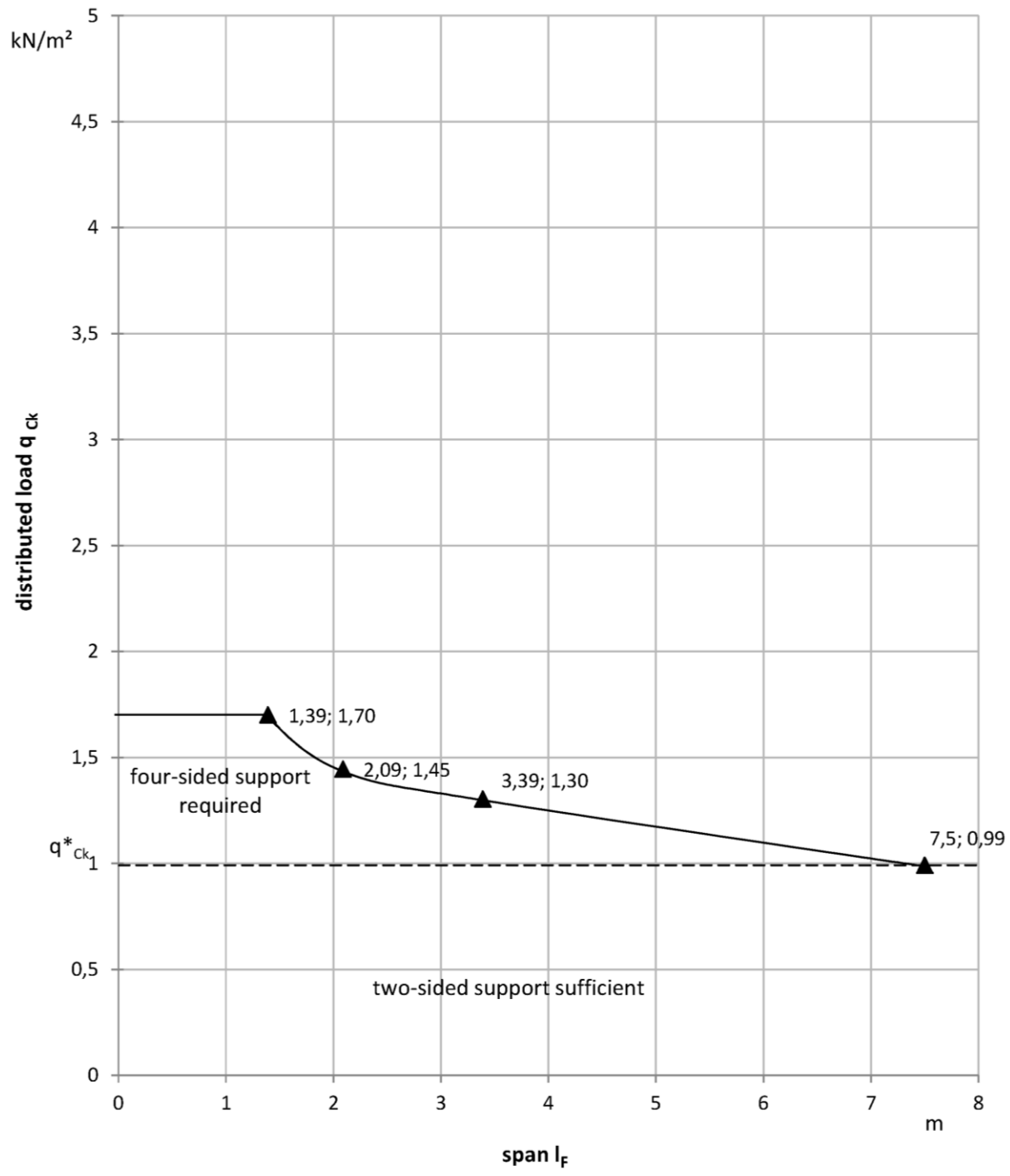

characteristic resistance (four sided support)
distributed load q_{Ck} as a function of span l_F for wind load

in case of two-sided supporting the limit q^*_{Ck} of 0,99 kN/m² has to be complied

JET-Vario-Therm S	Annex B 2.8
Akyver Sun Type 16/7w-12 two span system, load directions negative characteristic values; serviceability (SLS)	

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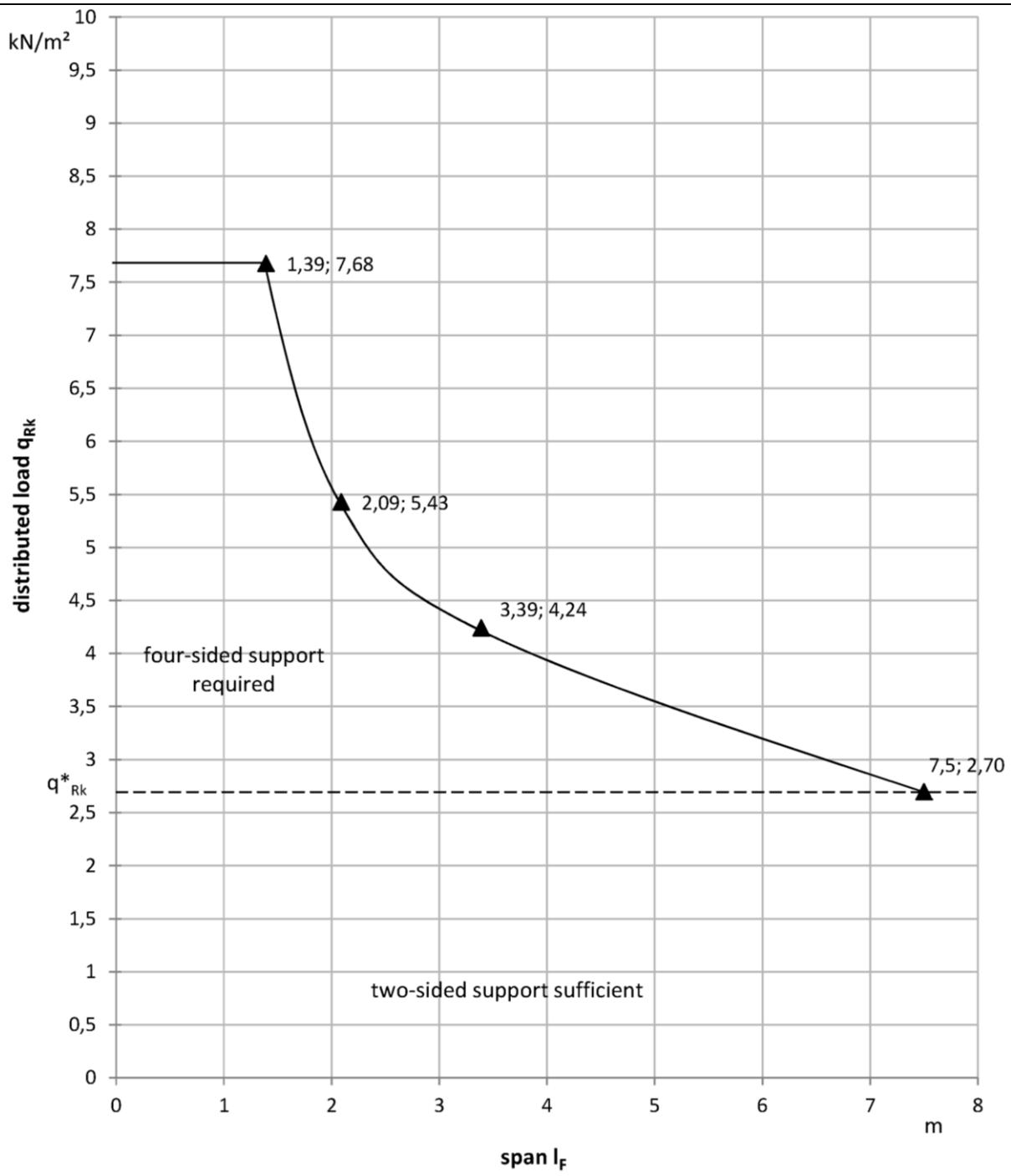

characteristic resistance (four sided support)
distributed load q_{Rk} as a function of span l_F for wind and snow loads

in case of two-sided supporting the limit q^*_{Rk} of 2,70 kN/m² has to be complied

JET-Vario-Therm S	Annex B 2.9
Akyver Sun Type 16/7w-12 three span system, load directions positive characteristic values; load- bearing capacity (ULS)	

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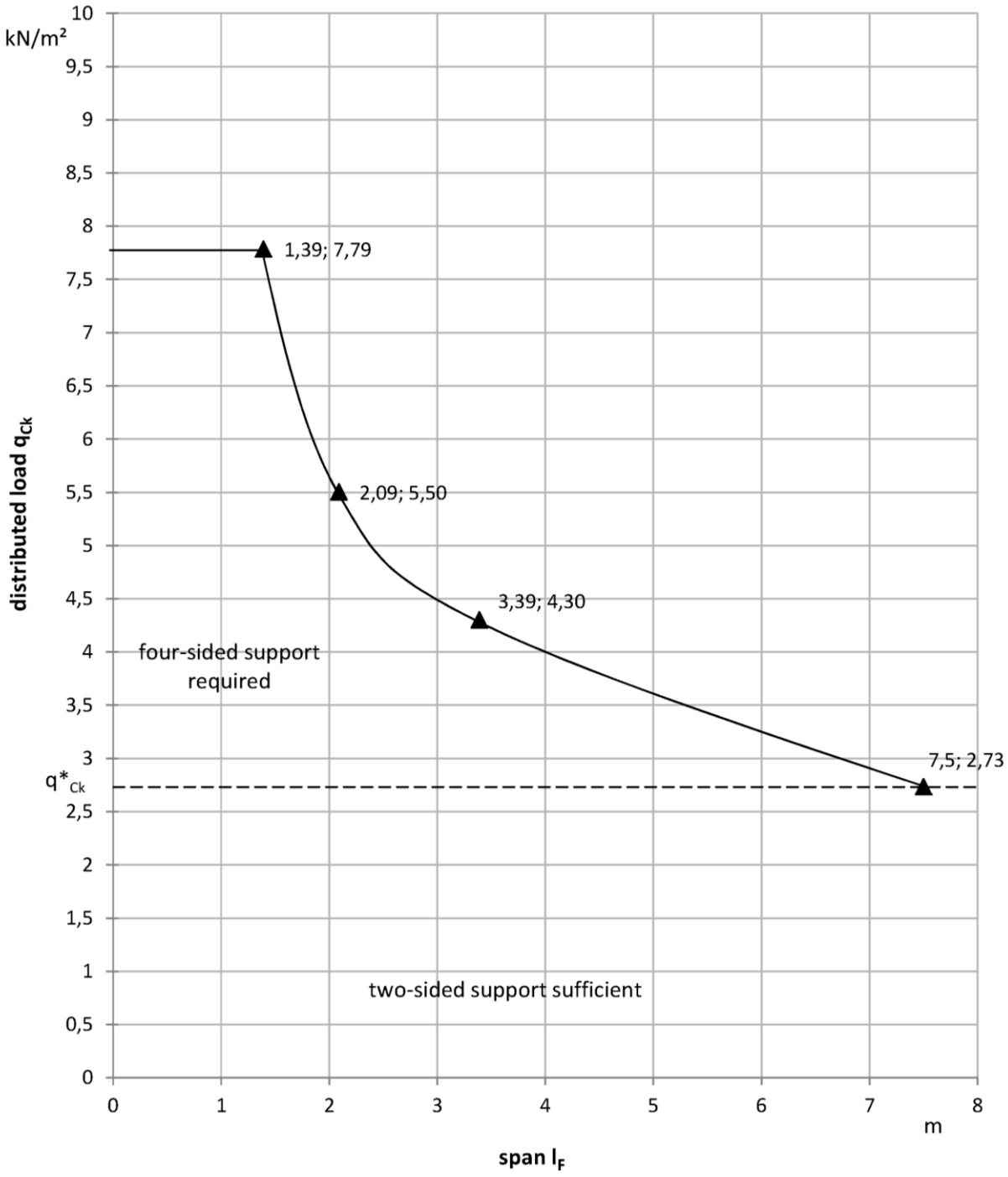

characteristic resistance (four sided support)
distributed load q_{Ck} as a function of span l_F for wind and snow loads

in case of two-sided supporting the limit q^*_{Ck} of 2,73 kN/m² has to be complied

JET-Vario-Therm S	Annex B 2.10
Akyver Sun Type 16/7w-12 three span system, load directions positive characteristic values; serviceability (SLS)	

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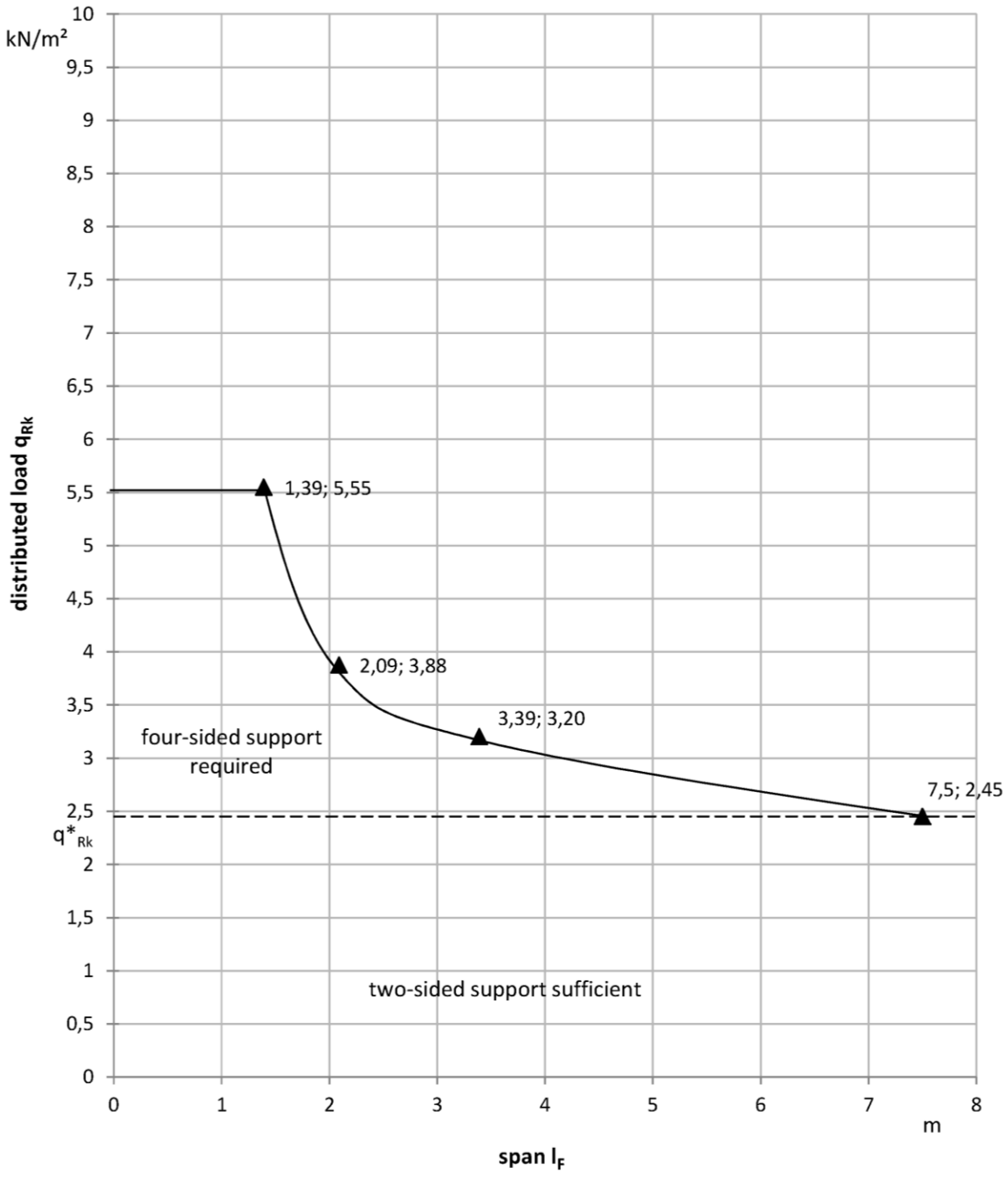

characteristic resistance (four sided support)
distributed load q_{Rk} as a function of span l_F for wind load

in case of two-sided supporting the limit q^*_{Rk} of 2,45 kN/m² has to be complied

JET-Vario-Therm S	Annex B 2.11
Akyver Sun Type 16/7w-12 three span system, load directions negative characteristic values; load- bearing capacity (ULS)	

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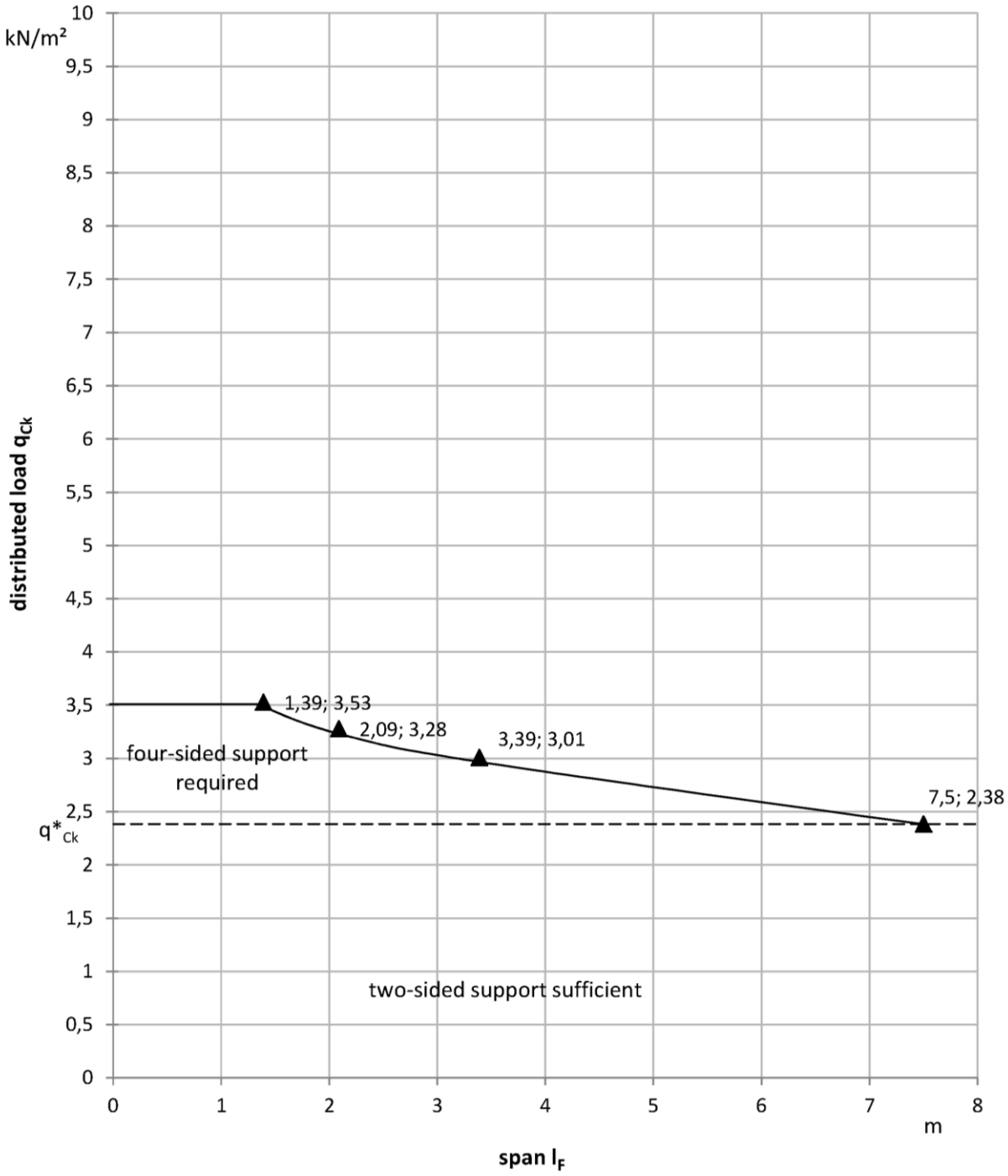

characteristic resistance (four sided support)
distributed load q_{Ck} as a function of span l_F for wind load

in case of two-sided supporting the limit q^*_{Ck} of 2,38 kN/m² has to be complied

JET-Vario-Therm S	Annex B 2.12
Akyver Sun Type 16/7w-12 three span system, load directions negative characteristic values; serviceability (SLS)	

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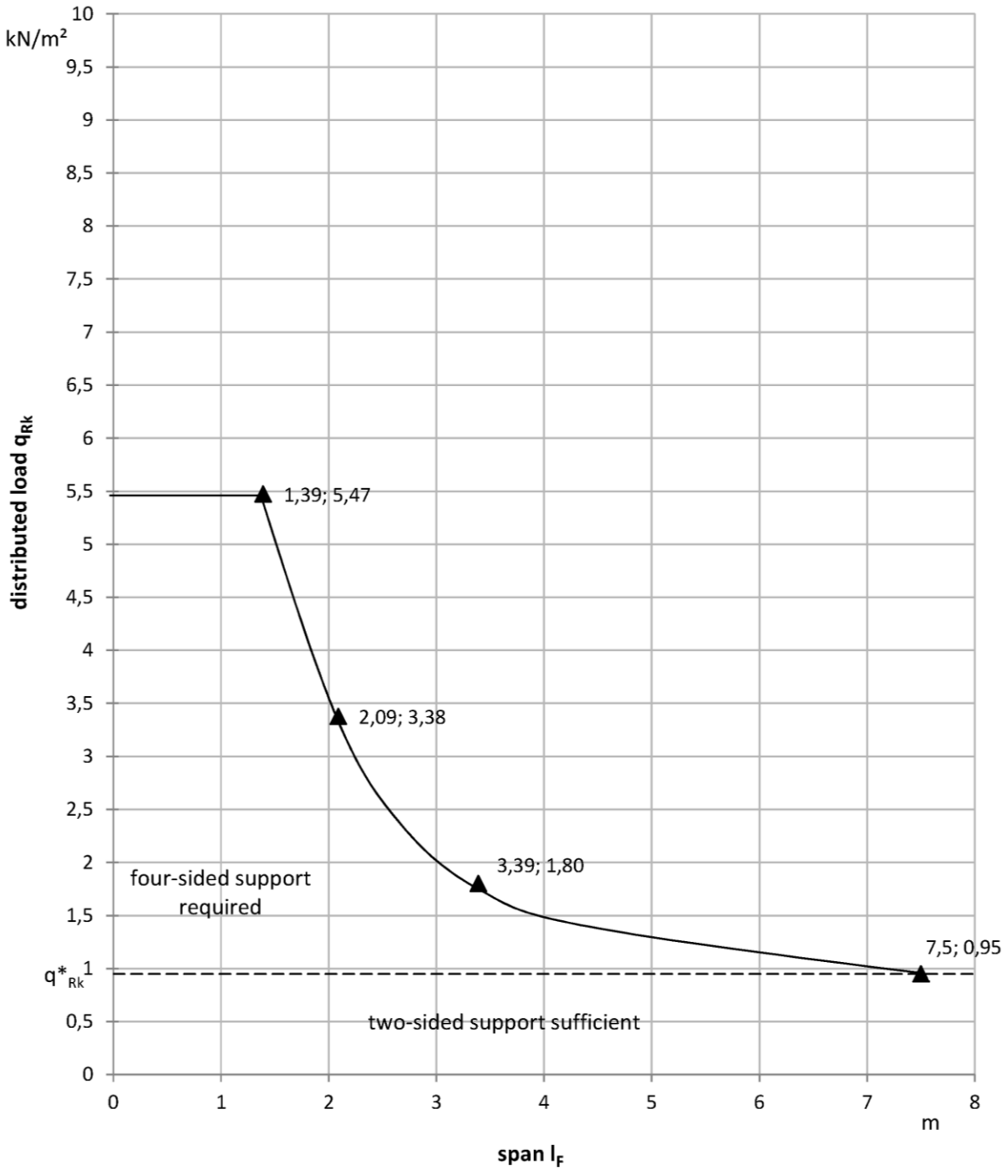

characteristic resistance (four sided support)
distributed load q_{Rk} as a function of span l_F for wind and snow loads

in case of two-sided supporting the limit q^*_{Rk} of 0,95 kN/m² has to be complied

JET-Vario-Therm S	Annex B 2.13
Makrolon multi UV 5M/25-20 and Makrolon multi UV 5M/32-20 two span system, load directions positive characteristic values; load- bearing capacity (ULS)	

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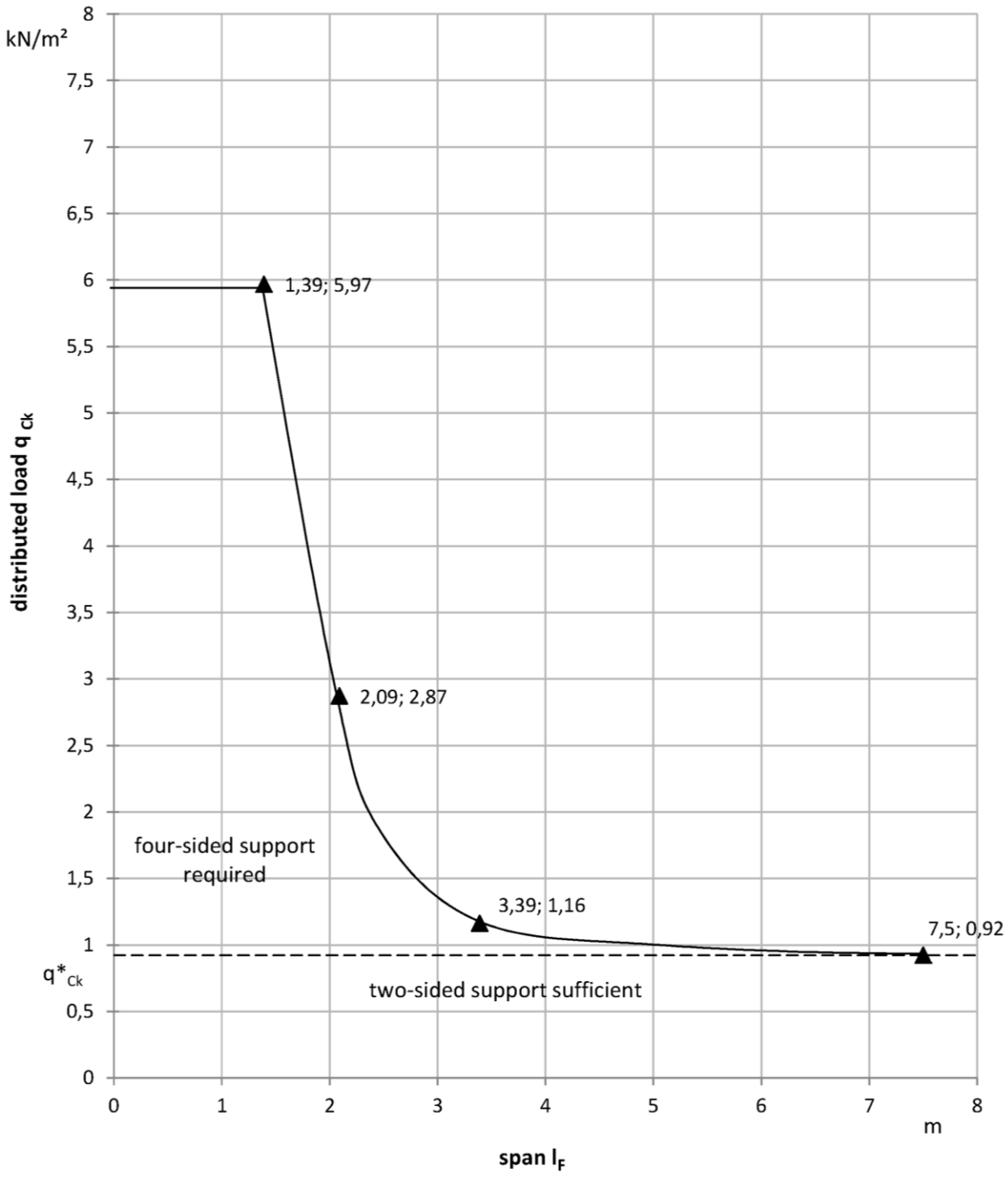

characteristic resistance (four sided support)
distributed load q_{Ck} as a function of span l_F for wind and snow loads

in case of two-sided supporting the limit q^*_{Ck} of 0,92 kN/m² has to be complied

JET-Vario-Therm S	Annex B 2.14
Makrolon multi UV 5M/25-20 and Makrolon multi UV 5M/32-20 two span system, load directions positive characteristic values; serviceability (SLS)	

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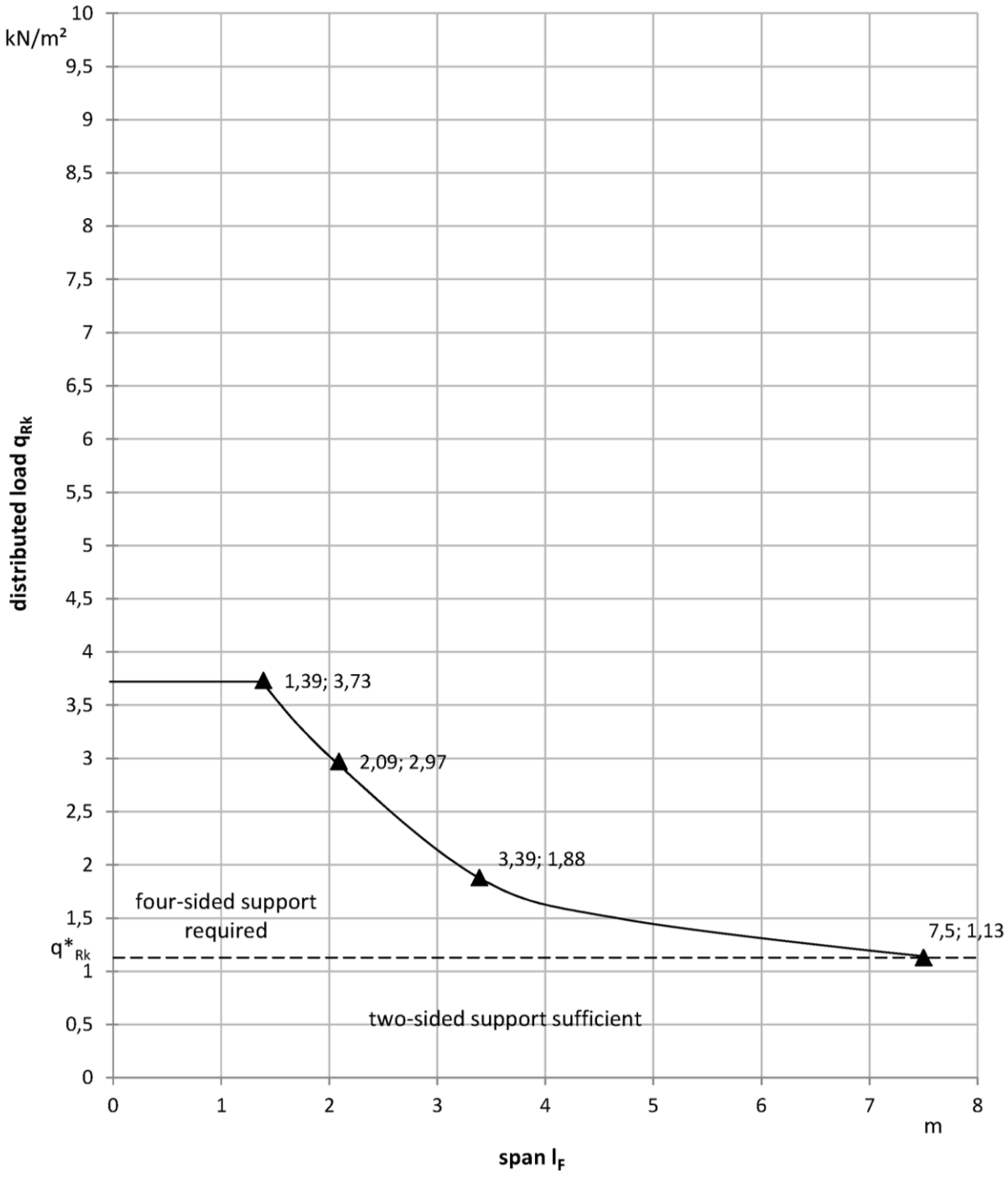

characteristic resistance (four sided support)
distributed load q_{Rk} as a function of span l_F for wind load

in case of two-sided supporting the limit q^*_{Rk} of 1,13 kN/m² has to be complied

JET-Vario-Therm S	Annex B 2.15
Makrolon multi UV 5M/25-20 and Makrolon multi UV 5M/32-20 two span system, load directions negative characteristic values; load- bearing capacity (ULS)	

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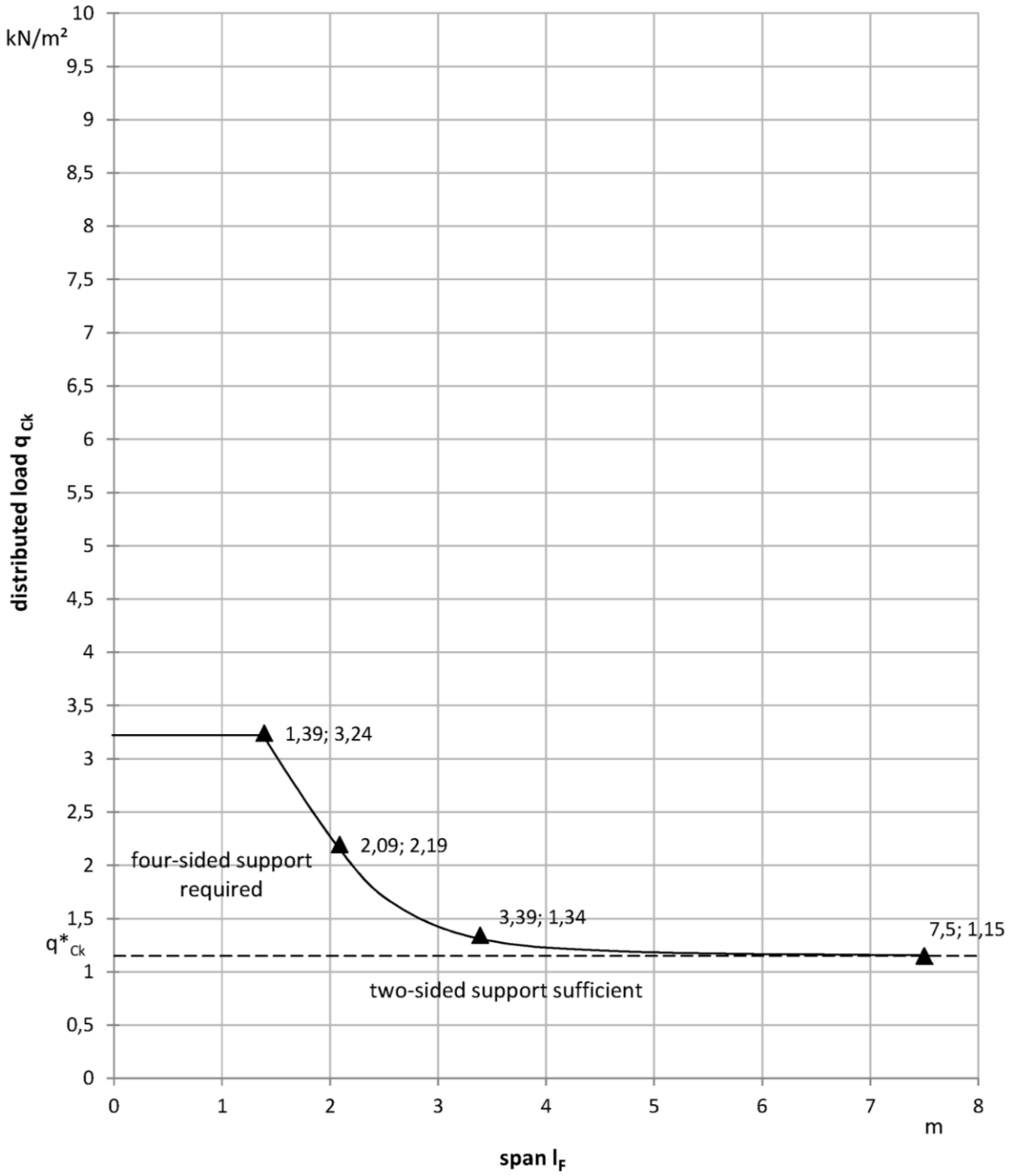

characteristic resistance (four sided support)
distributed load q_{Ck} as a function of span l_F for wind load

in case of two-sided supporting the limit q^*_{Ck} of 1,15 kN/m² has to be complied

JET-Vario-Therm S	Annex B 2.16
Makrolon multi UV 5M/25-20 and Makrolon multi UV 5M/32-20 two span system, load directions negative characteristic values; serviceability (SLS)	

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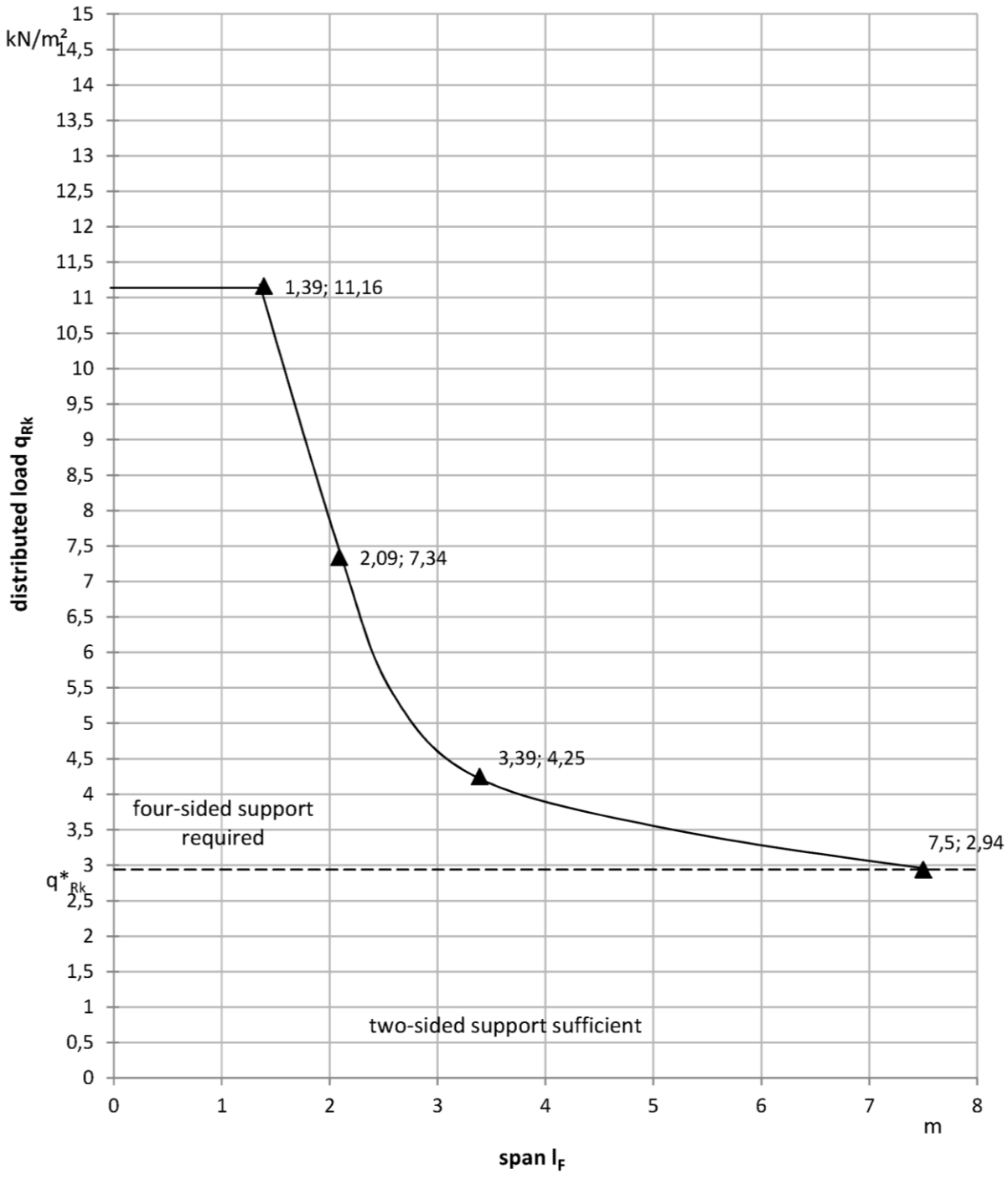

characteristic resistance (four sided support)
distributed load q_{Rk} as a function of span l_F for wind and snow loads

in case of two-sided supporting the limit q^*_{Rk} of 2,94 kN/m² has to be complied

JET-Vario-Therm S	Annex B 2.17
Makrolon multi UV 5M/25-20 and Makrolon multi UV 5M/32-20 three span system, load directions positive characteristic values; load- bearing capacity (ULS)	

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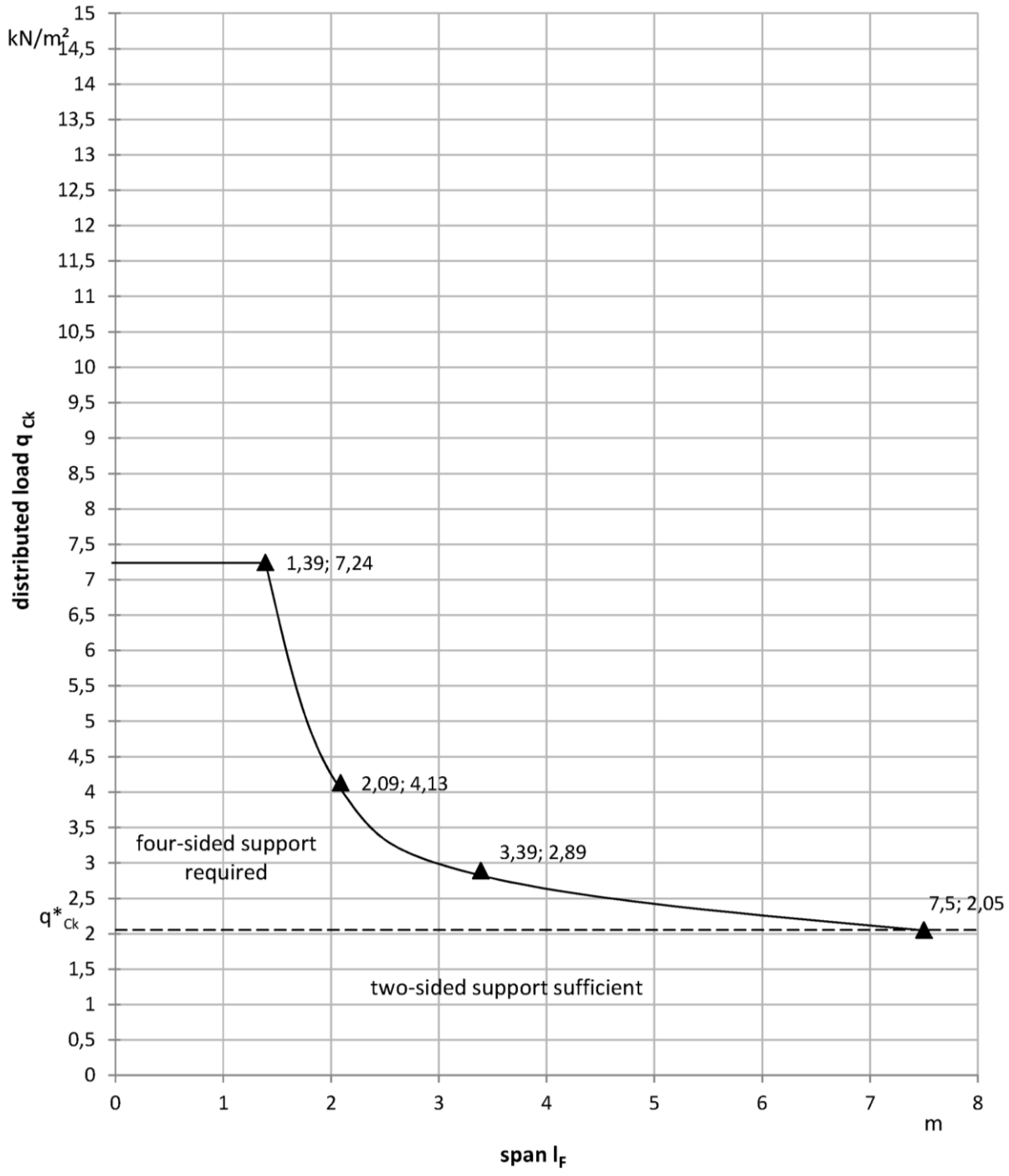

characteristic resistance (four sided support)
distributed load q_{Ck} as a function of span l_F for wind and snow loads

in case of two-sided supporting the limit q^*_{Ck} of 2,05 kN/m² has to be complied

JET-Vario-Therm S	Annex B 2.18
Anlagenbeschr Makrolon multi UV 5M/25-20 and Makrolon multi UV 5M/32-20 three span system, load directions positive characteristic values; serviceability (SLS)	

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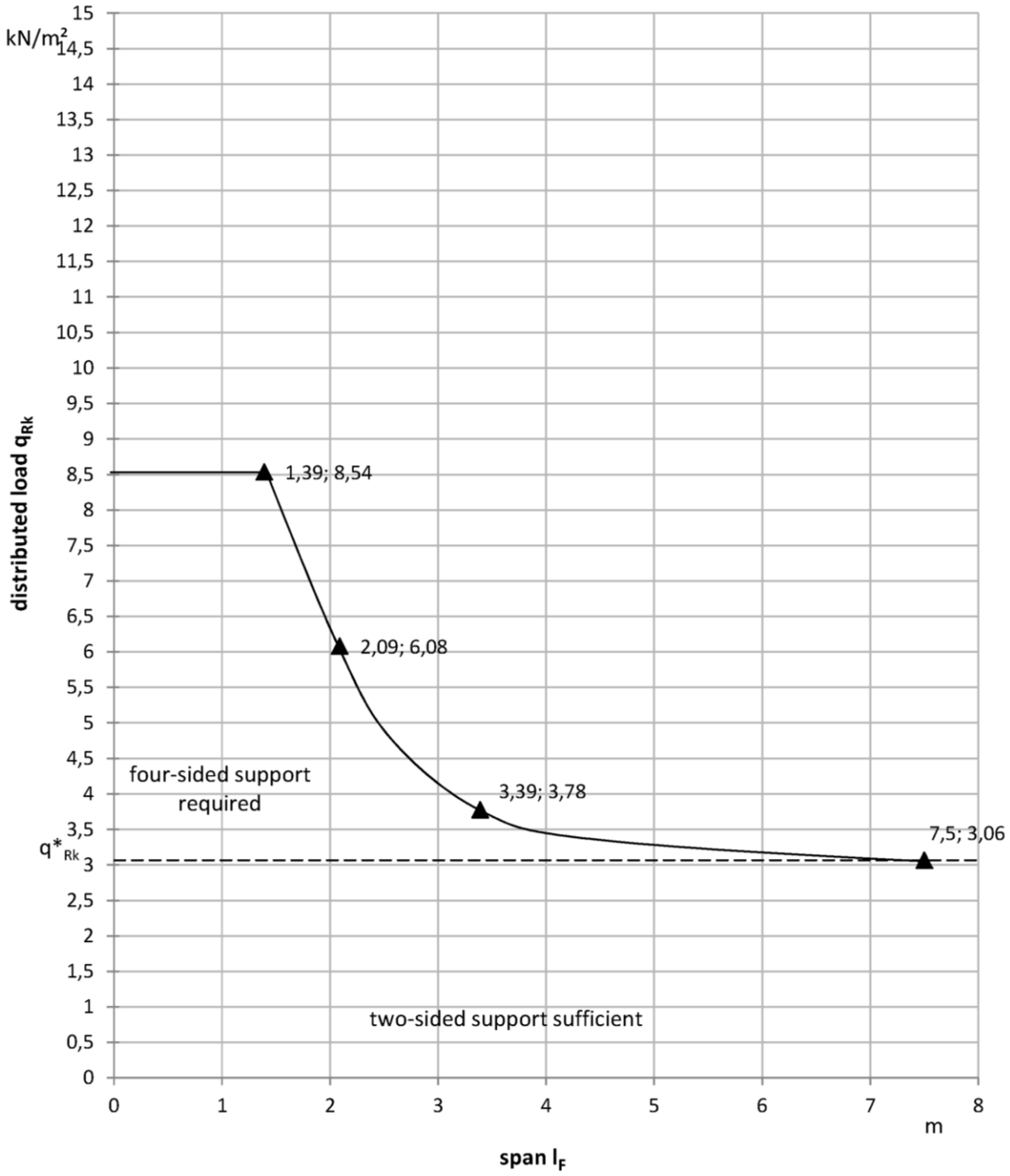

characteristic resistance (four sided support)
distributed load q_{Rk} as a function of span l_F for wind load

in case of two-sided supporting the limit q^*_{Rk} of 3,06 kN/m² has to be complied

JET-Vario-Therm S	Annex B 2.19
Makrolon multi UV 5M/25-20 and Makrolon multi UV 5M/32-20 three span system, load directions negative characteristic values; load- bearing capacity (ULS)	

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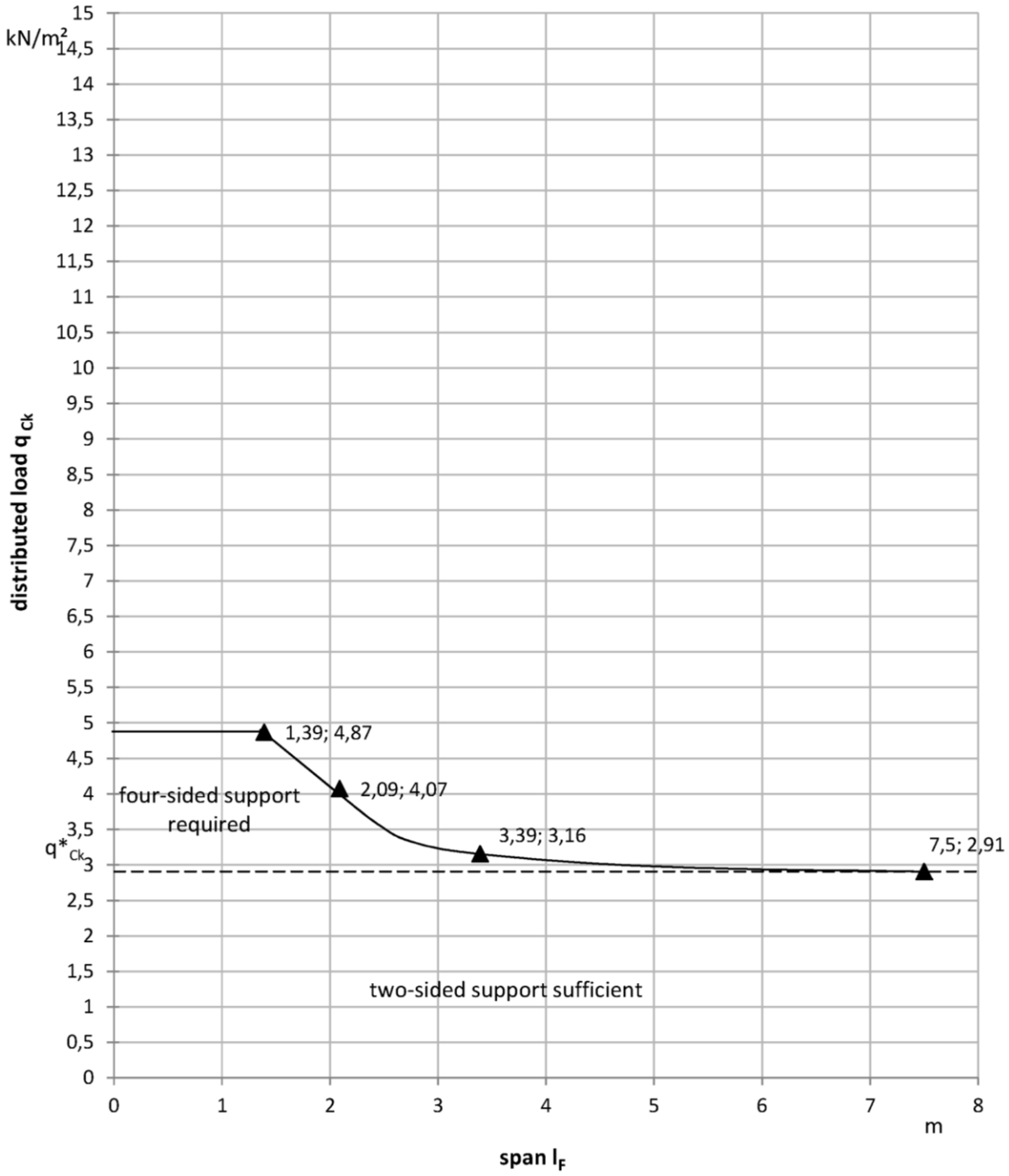

characteristic resistance (four sided support)
distributed load q_{Ck} as a function of span l_F for wind load

in case of two-sided supporting the limit q^*_{Ck} of 2,91 kN/m² has to be complied

JET-Vario-Therm S	Annex B 2.20
Makrolon multi UV 5M/25-20 and Makrolon multi UV 5M/32-20 three span system, load directions negative characteristic values; serviceability (SLS)	

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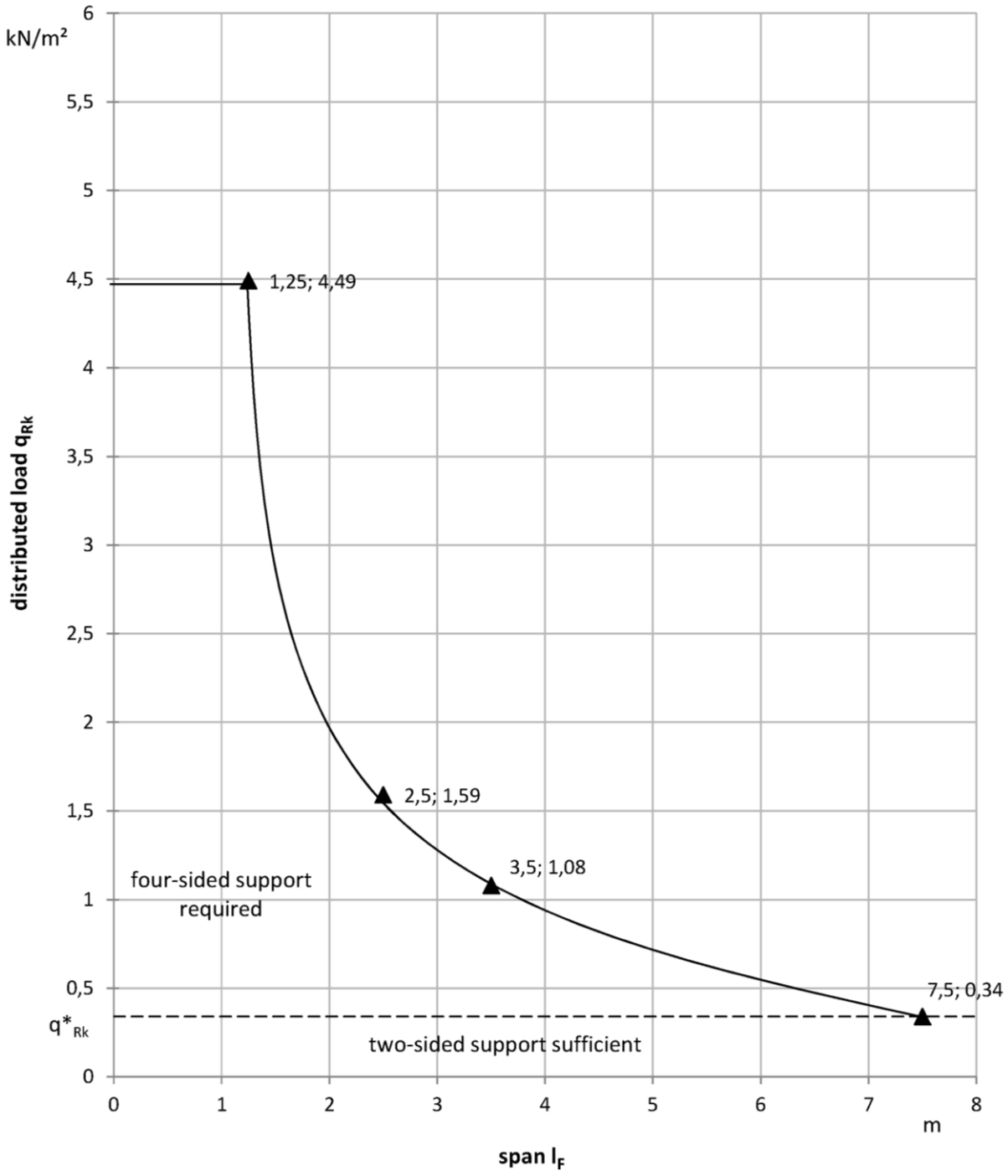

characteristic resistance (four sided support)
distributed load q_{Rk} as a function of span l_F for wind and snow loads

in case of two-sided supporting the limit q^*_{Rk} of 0,34 kN/m² has to be complied

JET-Vario-Therm S	Annex B 2.21
Makrolon multi UV 7M/25-28 single span system, load directions positive characteristic values; load- bearing capacity (ULS)	

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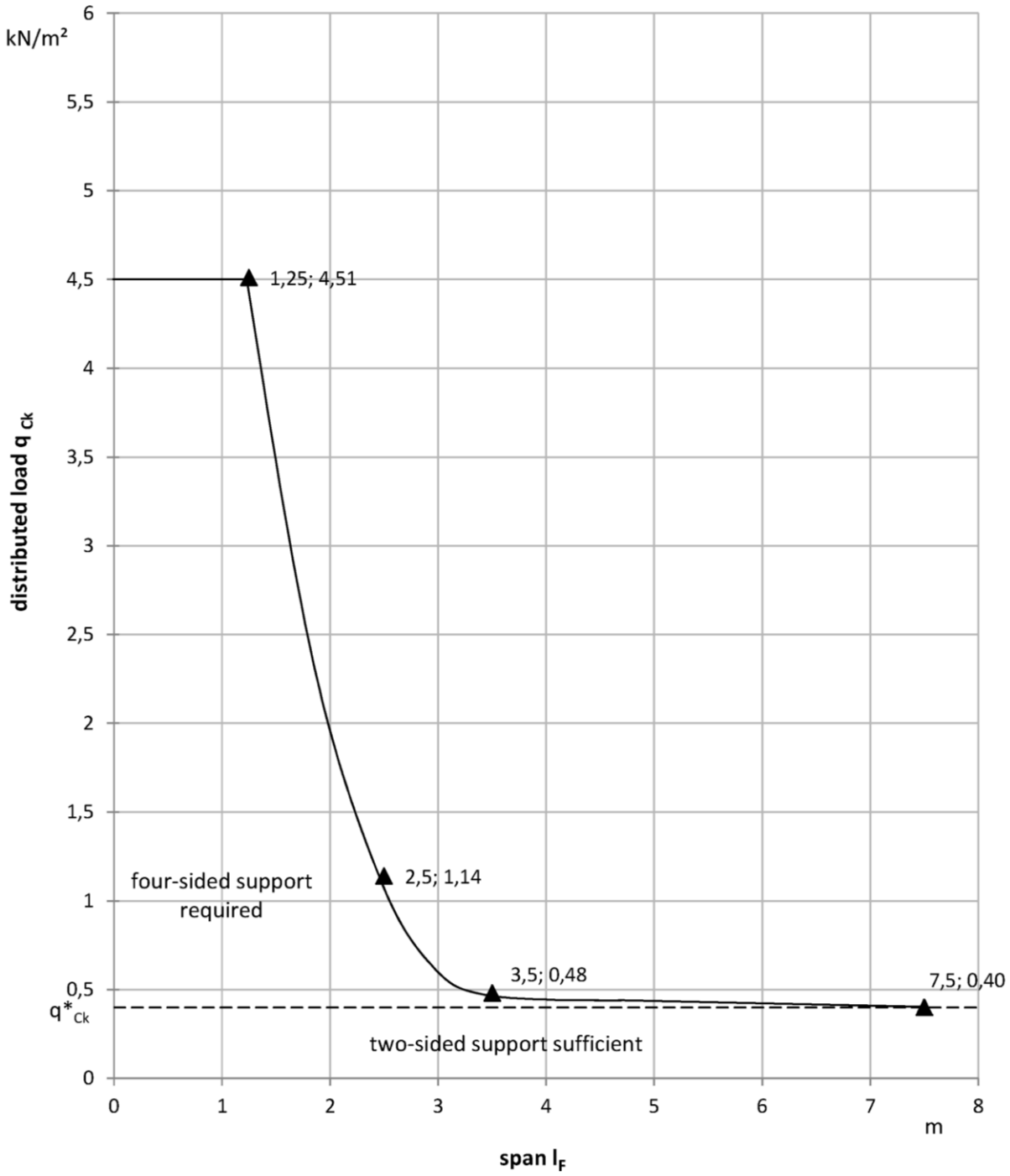

characteristic resistance (four sided support)
distributed load q_{Ck} as a function of span l_F for wind and snow loads

in case of two-sided supporting the limit q^*_{Ck} of 0,40 kN/m² has to be complied

JET-Vario-Therm S	Annex B 2.22
Makrolon multi UV 7M/25-28 single span system, load directions positive characteristic values; serviceability (SLS)	

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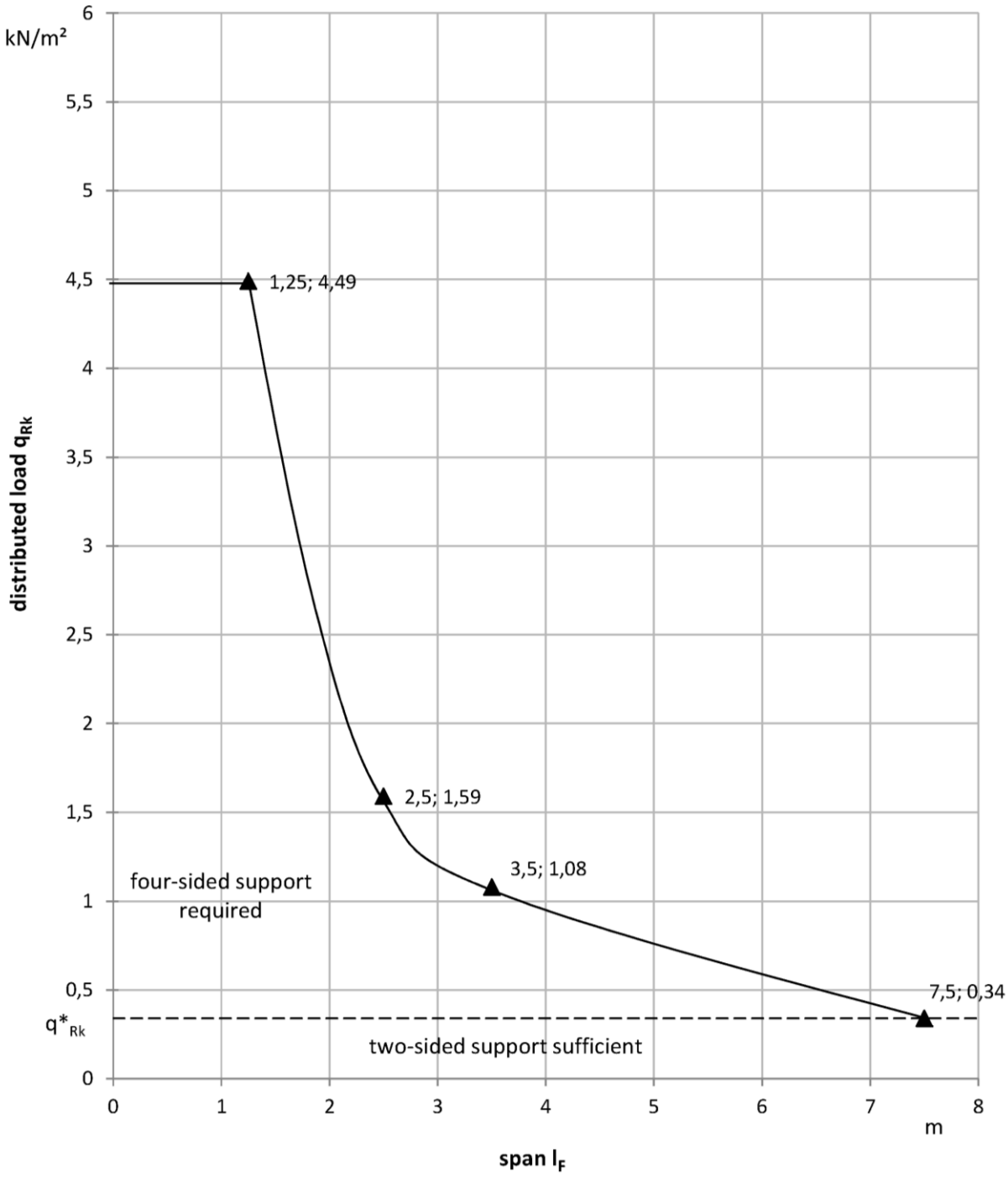

characteristic resistance (four sided support)
distributed load q_{Rk} as a function of span l_F for wind load

in case of two-sided supporting the limit q^*_{Rk} of 0,34 kN/m² has to be complied

JET-Vario-Therm S	Annex B 2.23
Makrolon multi UV 7M/25-28 single span system, load directions negative characteristic values; load- bearing capacity (ULS)	

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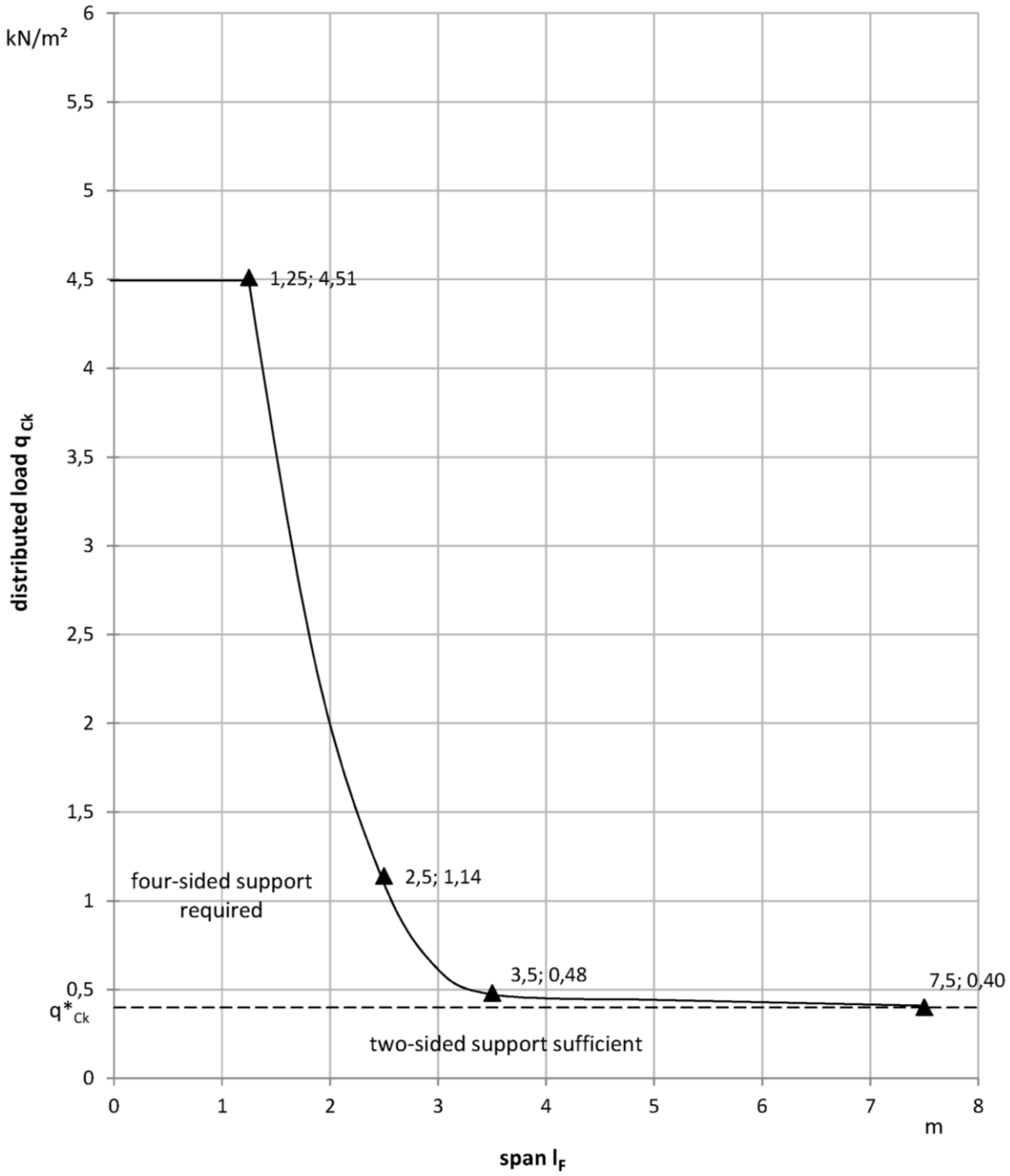

characteristic resistance (four sided support)
distributed load q_{Ck} as a function of span l_F for wind load

in case of two-sided supporting the limit q^*_{Ck} of 0,40 kN/m² has to be complied

JET-Vario-Therm S	Annex B 2.24
Makrolon multi UV 7M/25-28 single span system, load directions negative characteristic values; serviceability (SLS)	

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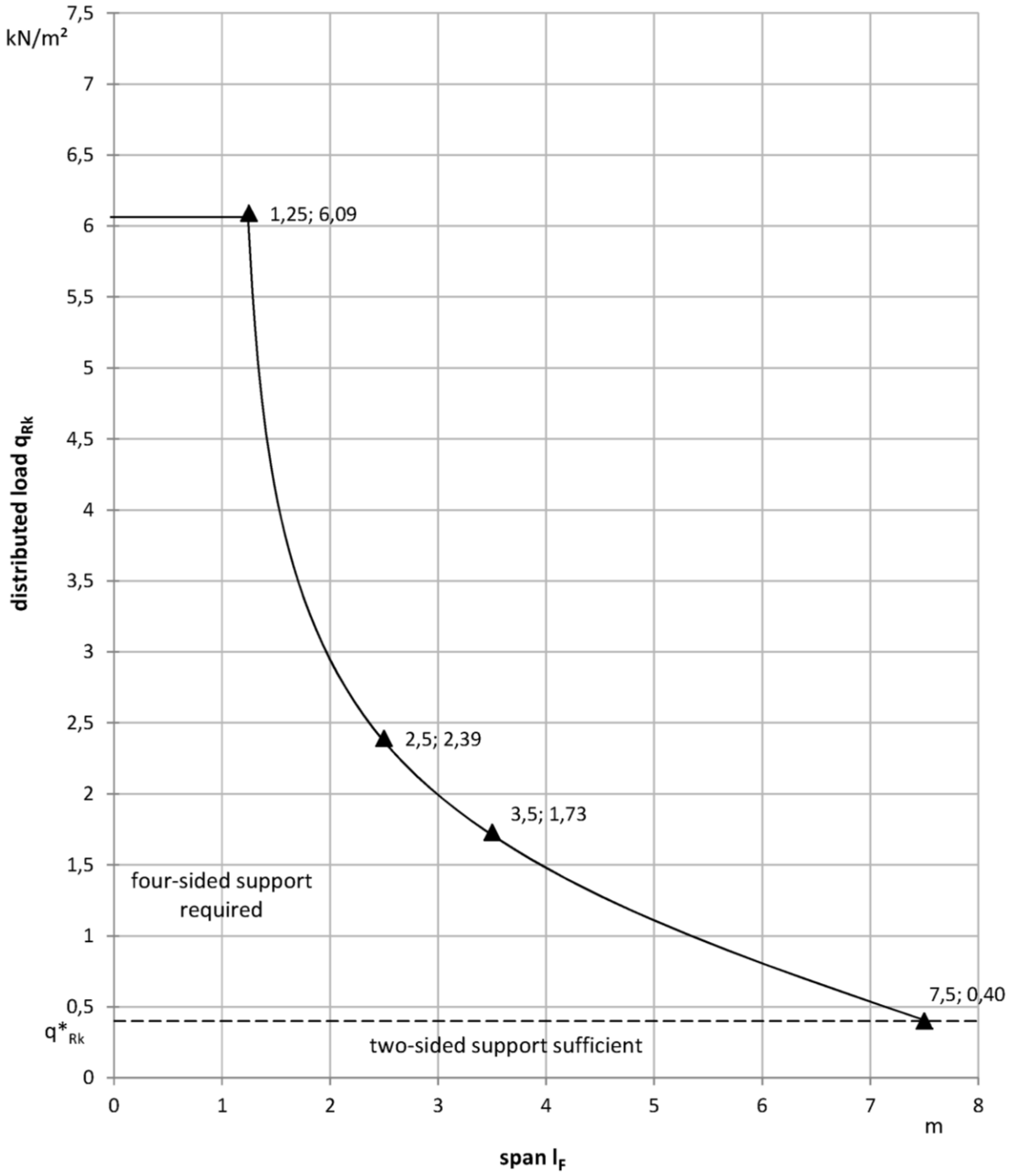

characteristic resistance (four sided support)
distributed load q_{Rk} as a function of span l_F for wind and snow loads

in case of two-sided supporting the limit q^*_{Rk} of 0,40 kN/m² has to be complied

JET-Vario-Therm S	Annex B 2.25
Anlagenbe Makrolon multi UV 7M/25-28 single span system, load directions positive characteristic values; load- bearing capacity (ULS)	

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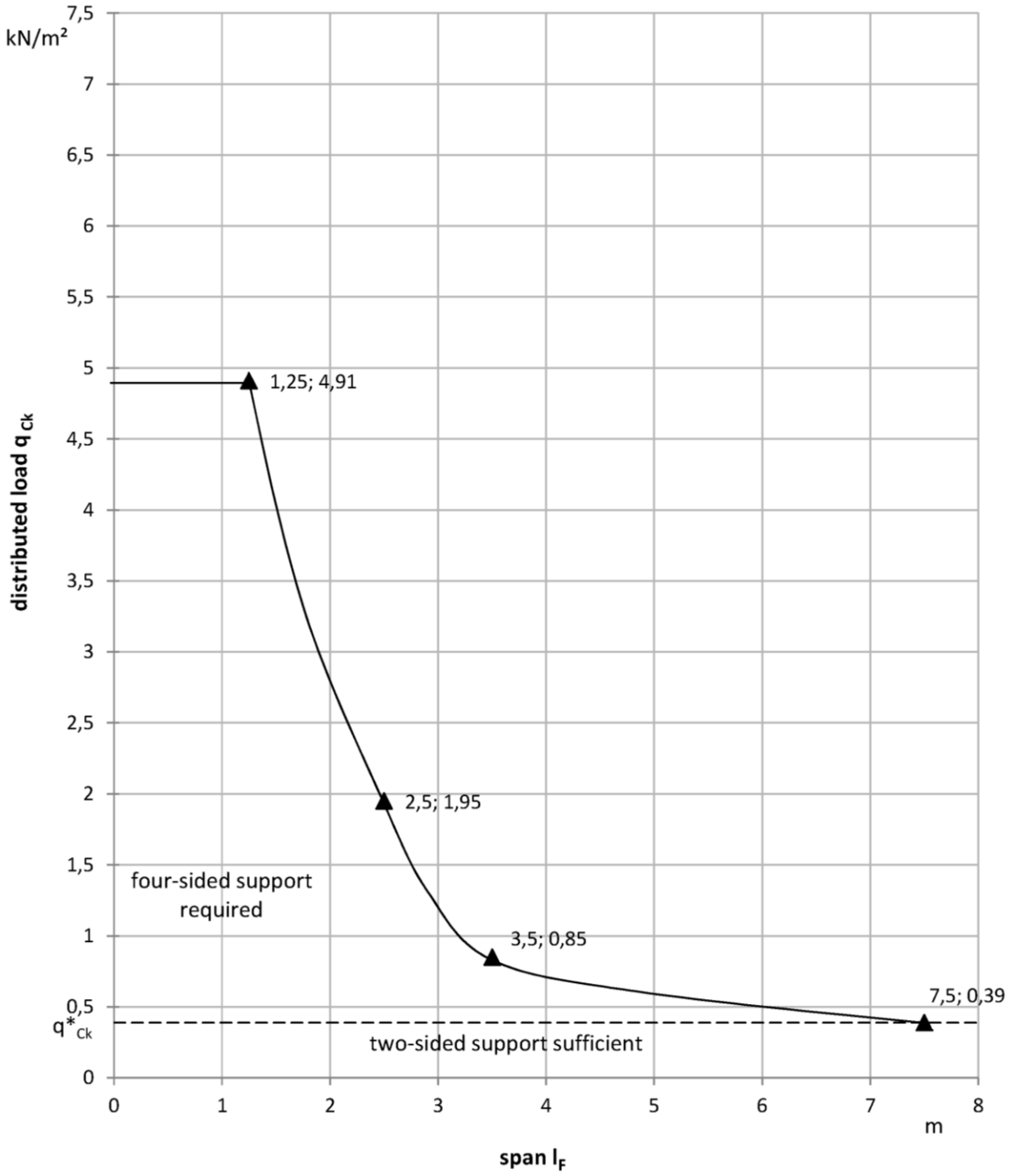

characteristic resistance (four sided support)
distributed load q_{Ck} as a function of span l_F for wind and snow loads

in case of two-sided supporting the limit q^*_{Ck} of 0,39 kN/m² has to be complied

JET-Vario-Therm S	Annex B 2.26
Anlagenb Makrolon multi UV 7M/25-28 single span system, load directions positive characteristic values; serviceability (SLS)	

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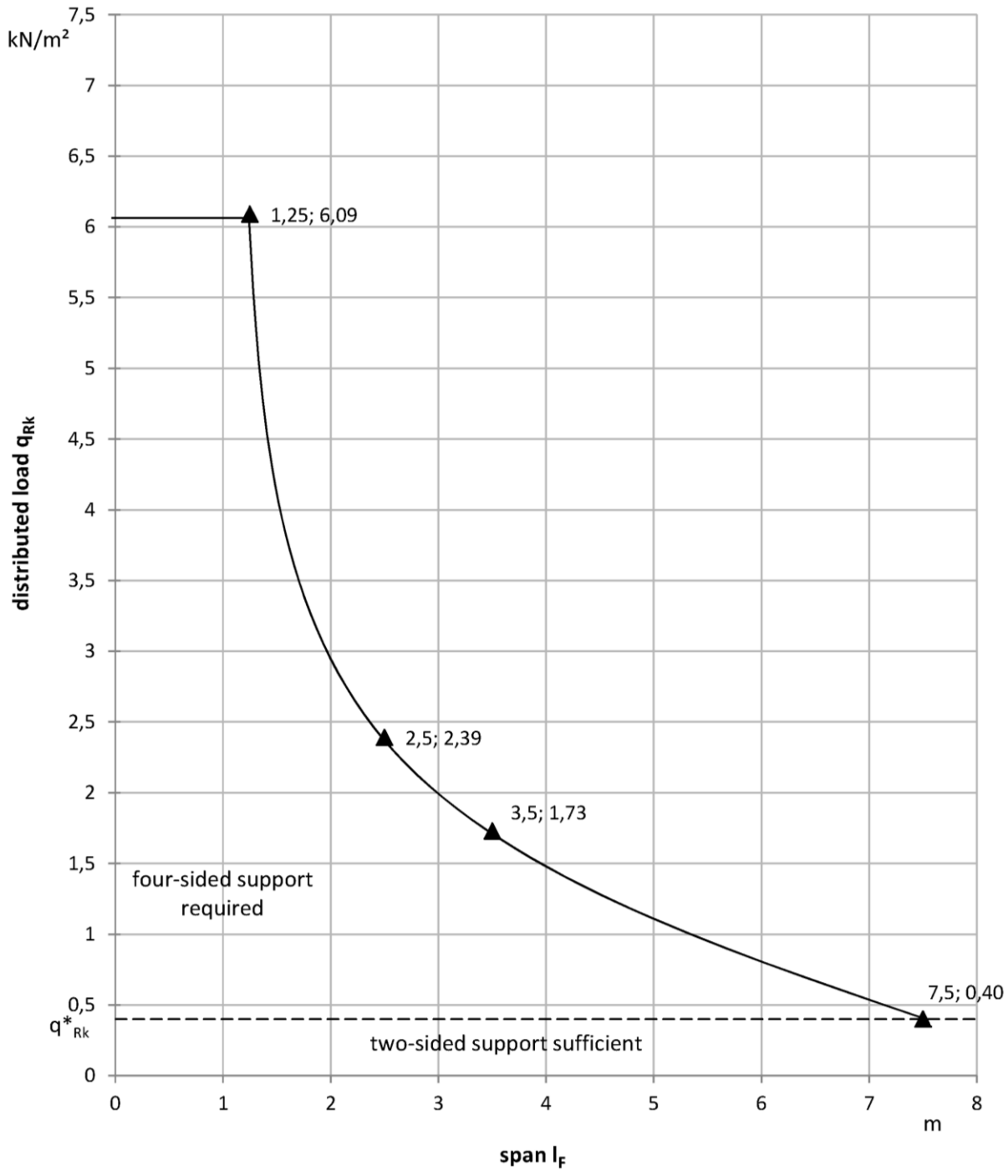

characteristic resistance (four sided support)
distributed load q_{Rk} as a function of span l_F for wind load

in case of two-sided supporting the limit q^*_{Rk} of 0,40 kN/m² has to be complied

JET-Vario-Therm S	Annex B 2.27
Makrolon multi UV 7M/32-28 single span system, load directions negative characteristic values; load- bearing capacity (ULS)	

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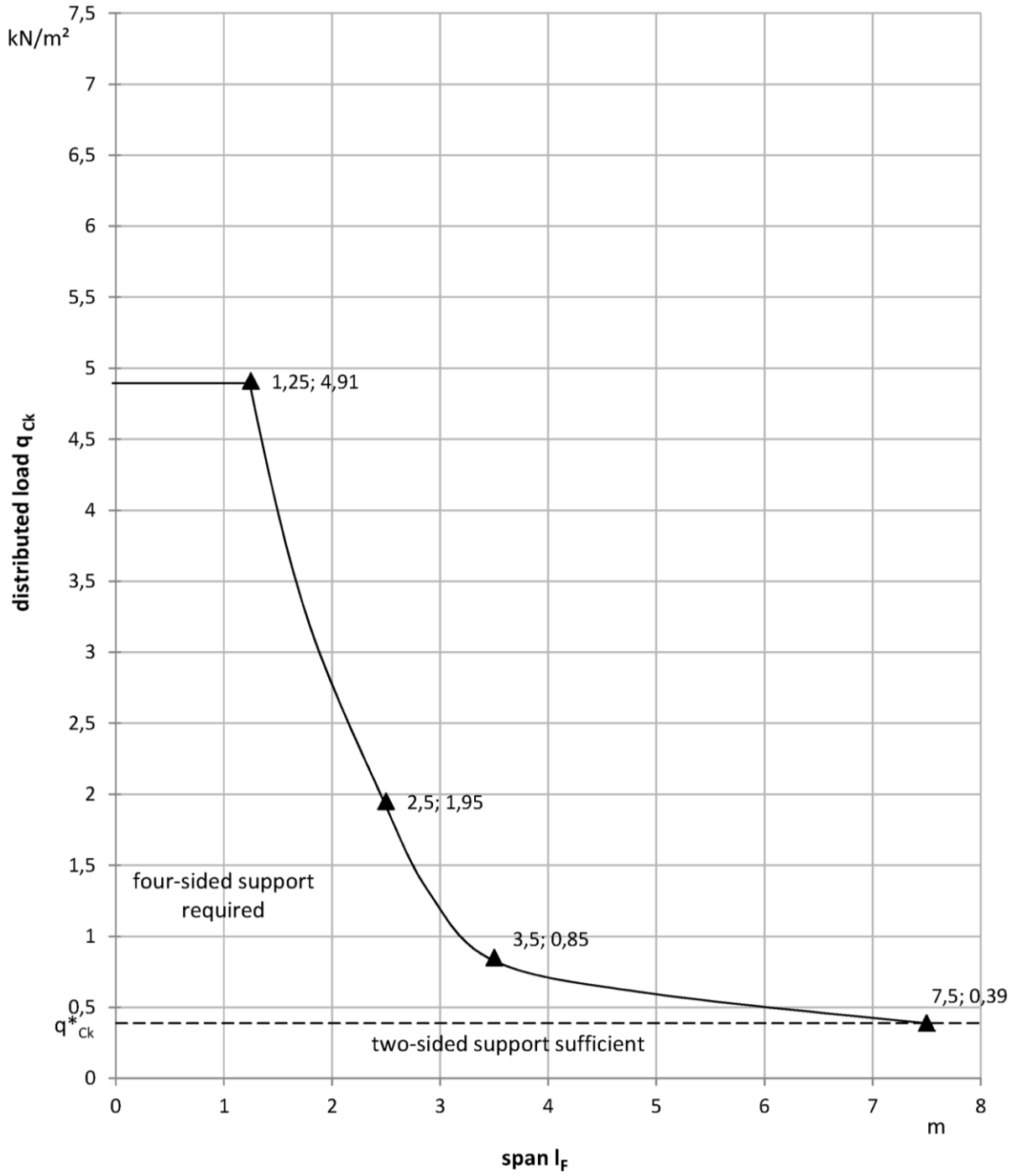

characteristic resistance (four sided support)
distributed load q_{Ck} as a function of span l_F for wind load

in case of two-sided supporting the limit q^*_{Ck} of 0,39 kN/m² has to be complied

JET-Vario-Therm S	Annex B 2.28
Makrolon multi UV 7M/32-28 single span system, load directions negative characteristic values; serviceability (SLS)	

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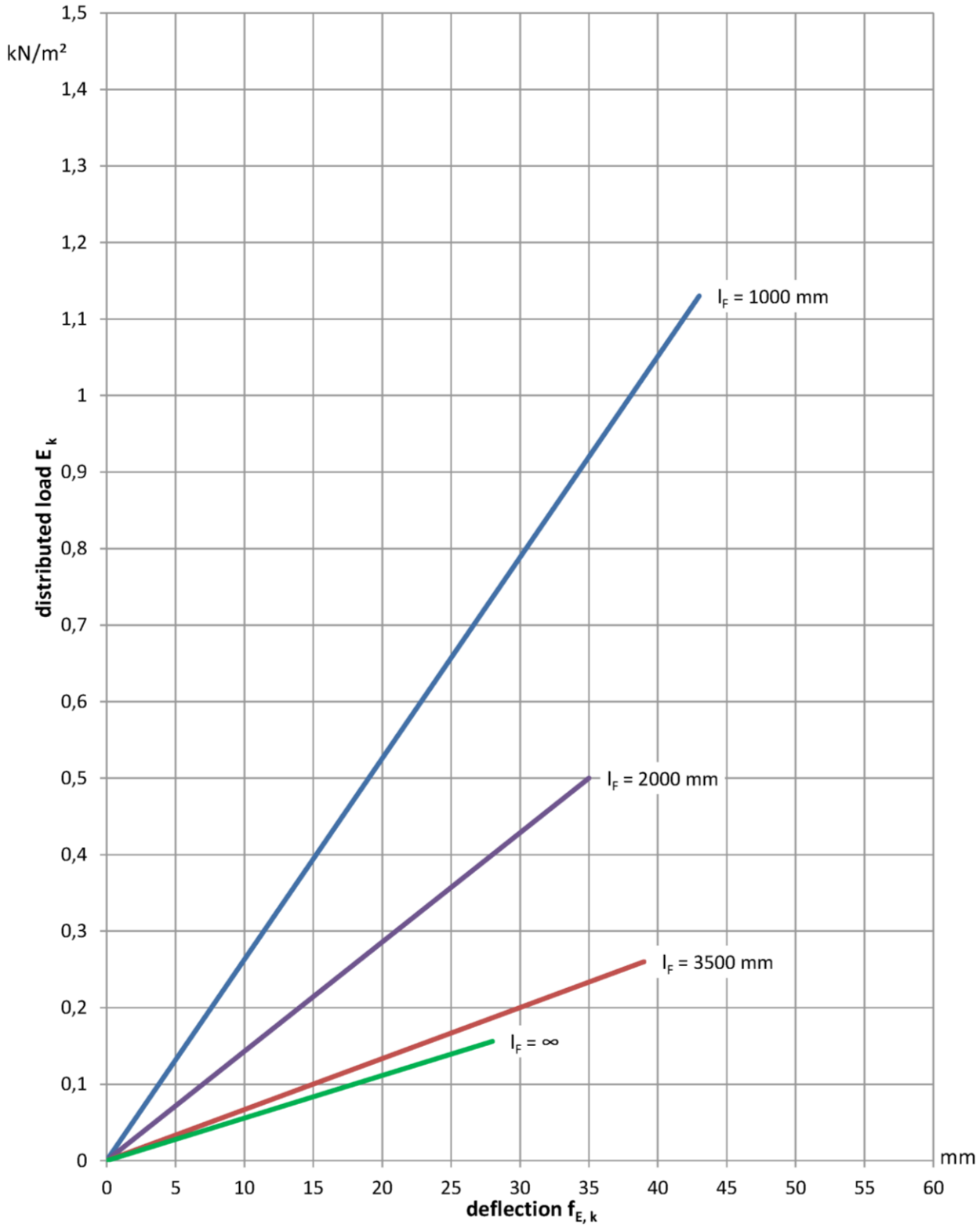

JET-Vario-Therm S	Annex B 3.1
Makrolon multi UV 4/10-6 diagram two span system characteristic values, max. deflection in mid span	

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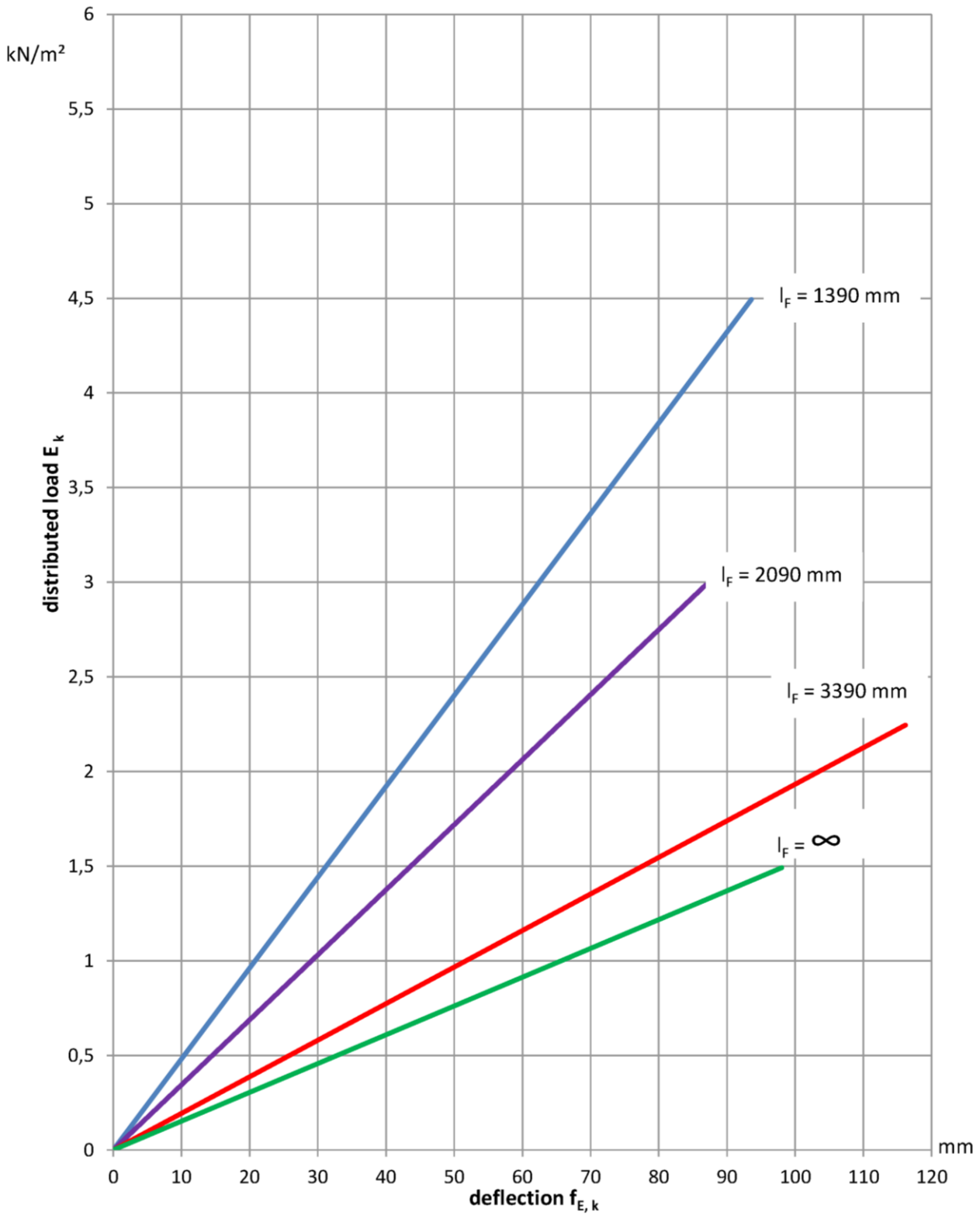

JET-Vario-Therm S	Annex B 3.2
Akyver Sun Type 16/7w-12 diagram two span system characteristic values, max. deflection in mid span	

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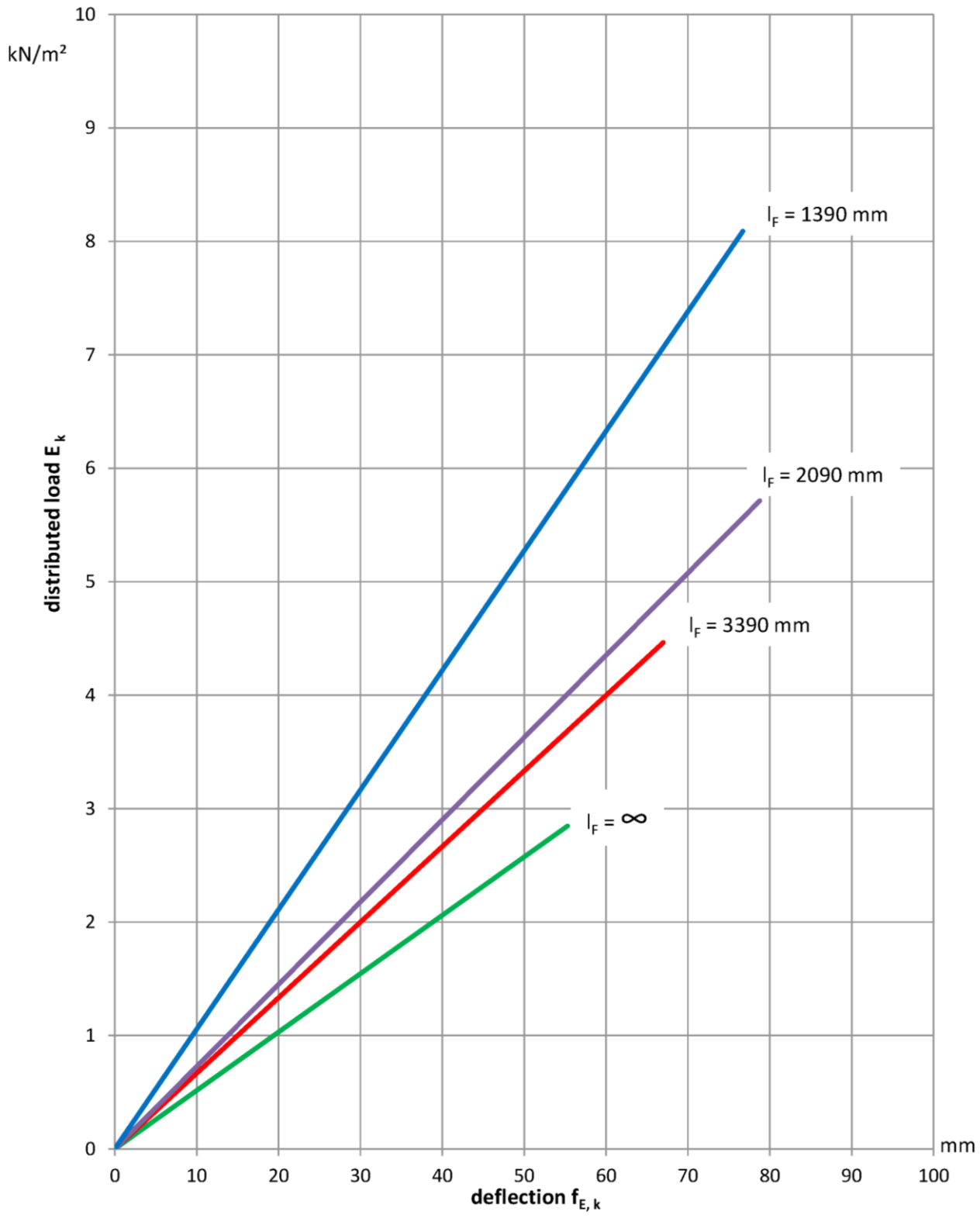

JET-Vario-Therm S	Annex B 3.3
Akyver Sun Type 16/7w-12 diagram three span system characteristic values, max. deflection in mid span	

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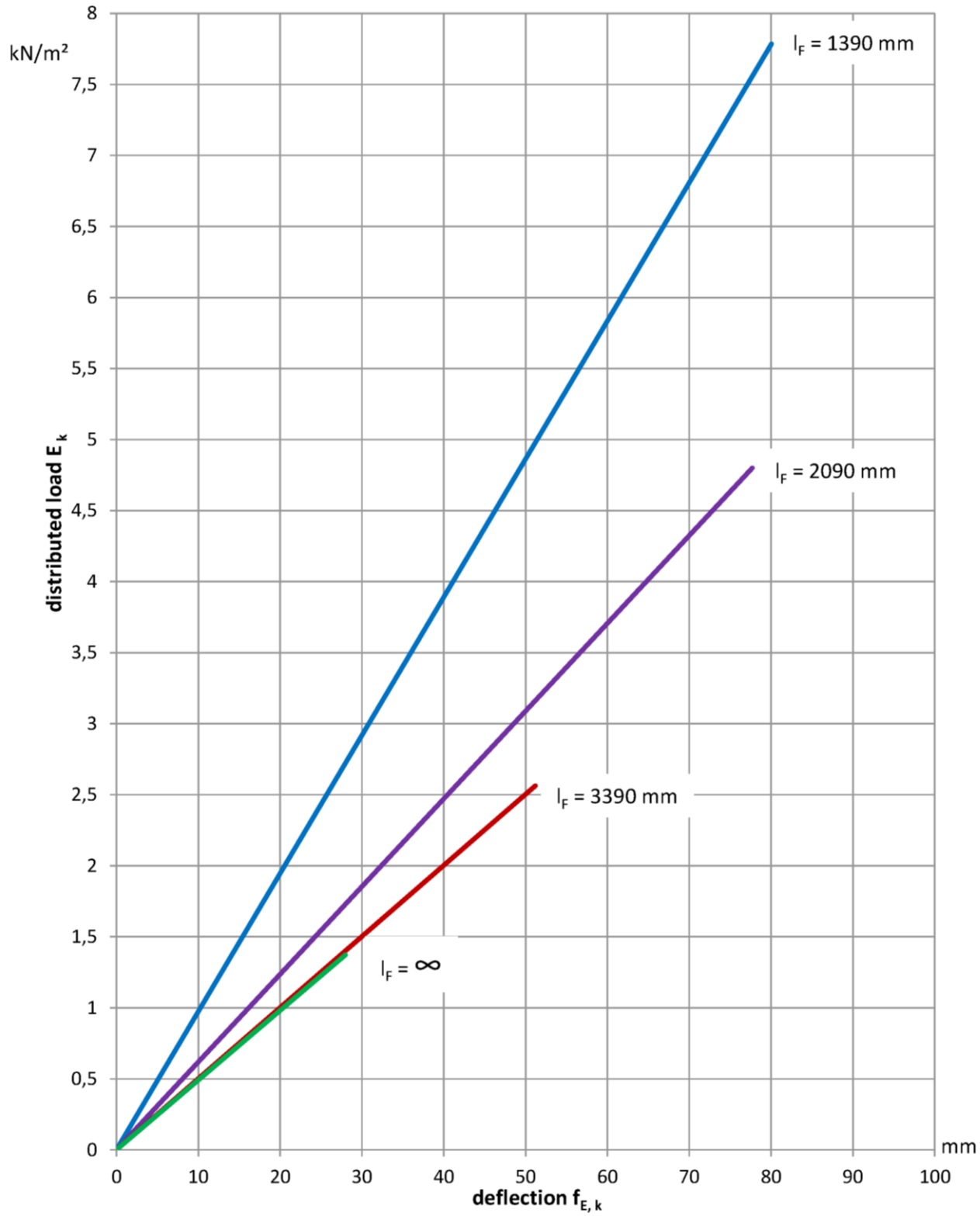

JET-Vario-Therm S	Annex B 3.4
Makrolon multi UV 5M/25-20 and Makrolon multi UV 5M/32-20 diagram two span system characteristic values, max. deflection in mid span	

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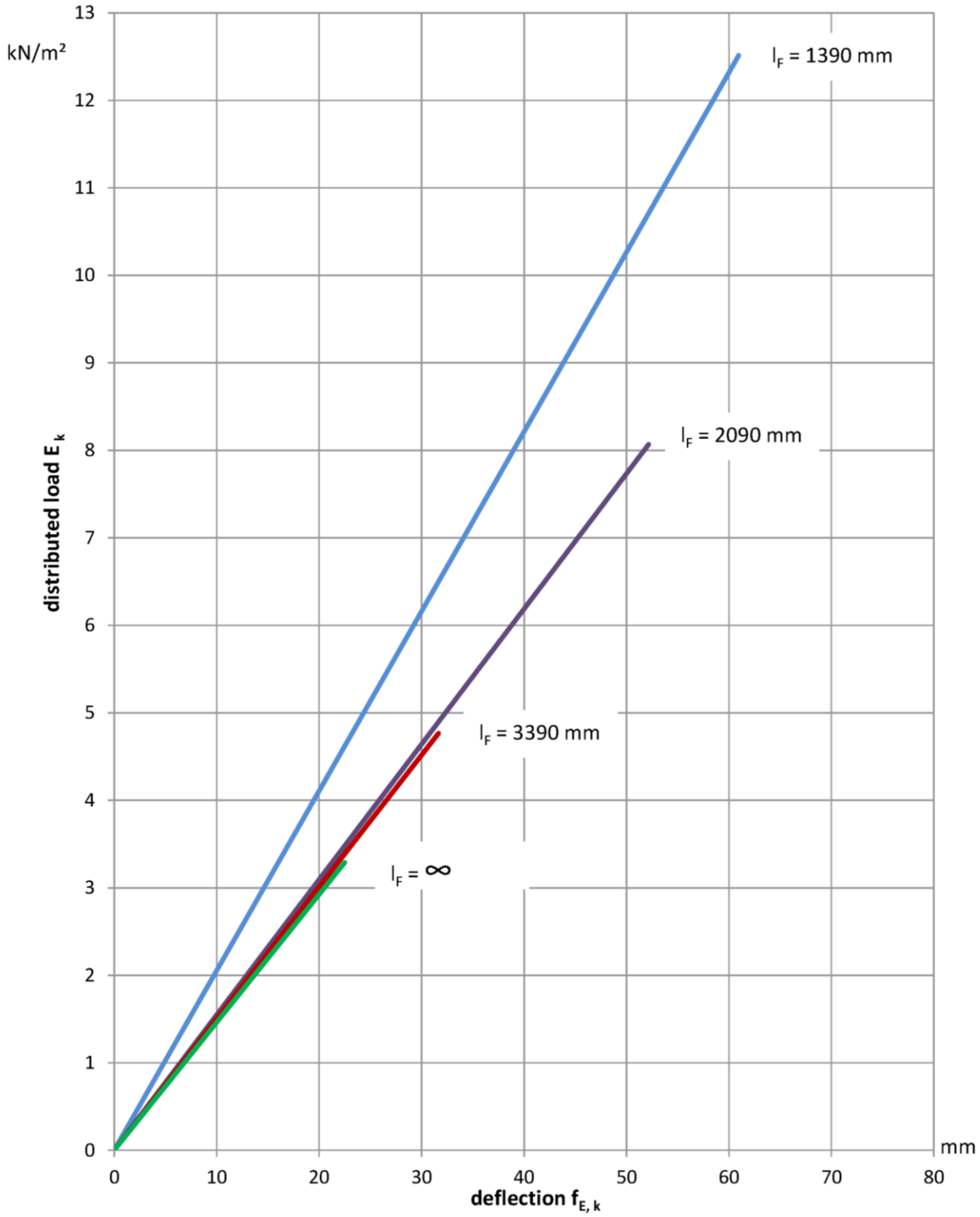

JET-Vario-Therm S	Annex B 3.5
Makrolon multi UV 5M/25-20 and Makrolon multi UV 5M/32-20 diagram three span system characteristic values, max. deflection in mid span	

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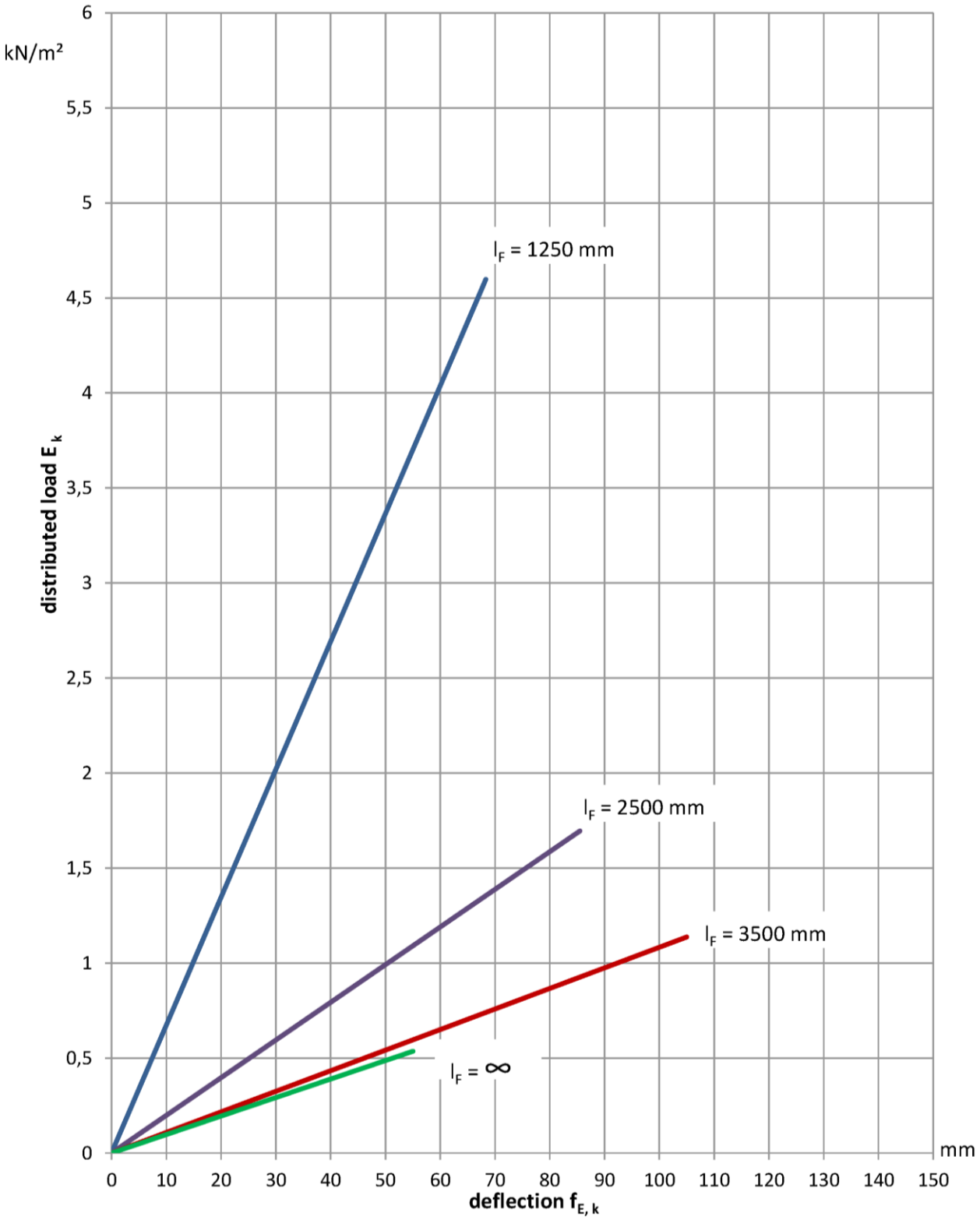

JET-Vario-Therm S	Annex B 3.6
Makrolon multi UV 7M/25-28 - 1200 diagram single span system characteristic values, max. deflection in mid span	

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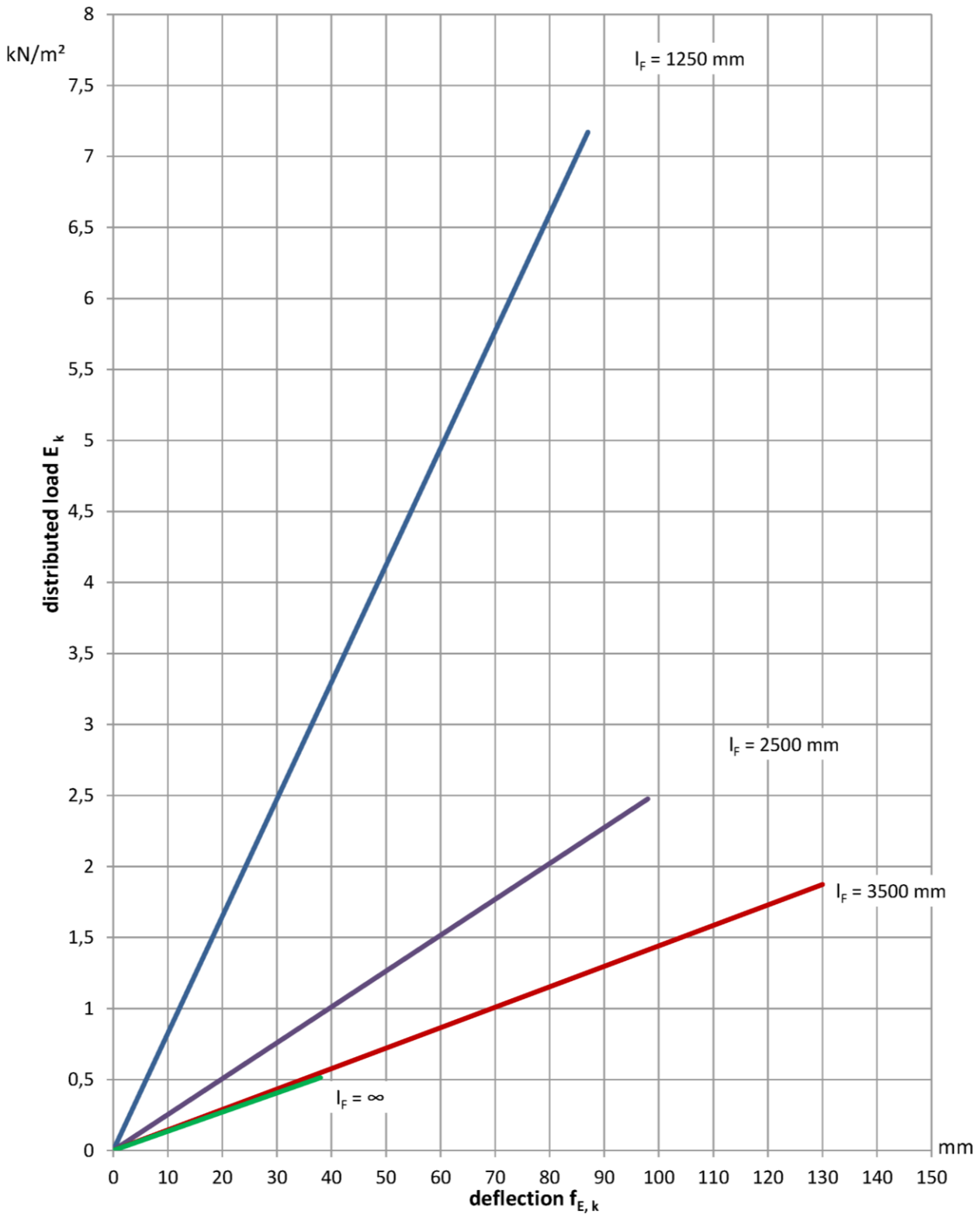

JET-Vario-Therm S	Annex B 3.7
Makrolon multi UV 7M/32-28 - 1200 diagram single span system characteristic values, max. deflection in mid span	

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JET-Vario-Therm S **Annex C**

Thermal resistance

If requirements as to the thermal resistance of the roof kit are imposed, the thermal transmittance U_{CW} shall be determined in accordance with EN ISO 10077-1[1] as the resultant of the thermal transmittance coefficients of the covering, weighted on the basis of the area as well as the length-weighted values of linear thermal transmittance coefficients ψ of the connecting profiles.

The respective area fractions shall be calculated for the translucent roof kit. For the calculation of the design value of the thermal transmittance coefficient U_{CW} of the translucent roof kit, the following equation shall be used:

$$U_{cw} = \frac{\sum(U_p \cdot A_p) + \sum(\Psi_f \cdot l_f)}{A_{ges}} \text{ [W/ (m²·K)]}$$

If the substructure (curb) is to be taken into account, the following formula shall be used:

$$U_{cw} = \frac{\sum(U_p \cdot A_p) + \sum(U_z \cdot A_z) + \sum(\Psi_f \cdot l_f)}{A_{ges}} \text{ [W/ (m²·K)]}$$

where:

- U_P: thermal transmittance coefficient of the PC multi-wall sheets in W/(m²K)
- A_P: area of the PC multi-wall sheets in m²
- U_Z: thermal transmittance coefficient of the substructure in W/(m²K)
- A_Z: area of the substructure in m²
- ψ_f: linear thermal transmittance coefficient at the level of the connecting profiles in W/(m K)
- l_f: connecting profile length in m
- A_{ges}: total area of the roof kit in m²

The values of thermal transmittance U_P of the coverings and linear thermal transmittance ψ_f of the connections shall be taken from following tables.

In case the substructure is taken into account, the thermal transmittance U_Z shall be determined in accordance with the applicable European specifications e.g. EN ISO 6946[2].

Table C1: Heat flow in dependency of the pitch of the coverings

pitch α								
-5°	0°	5°	15°	30°	45°	60°	75°	90°
upwards heat flow horizontal installation				horizontal heat flow vertical installation				

The thermal transmittance coefficients U_P depends on the selected covering as well as on their pitch. Differentiation is made between vertical installation (horizontal heat flow) and horizontal installation (upwards heat flow). Intermediate values can be determined according to table C1.

For the purpose of comparison of coverings in terms of EN 673[3] the U_P value for vertical installation shall be used.

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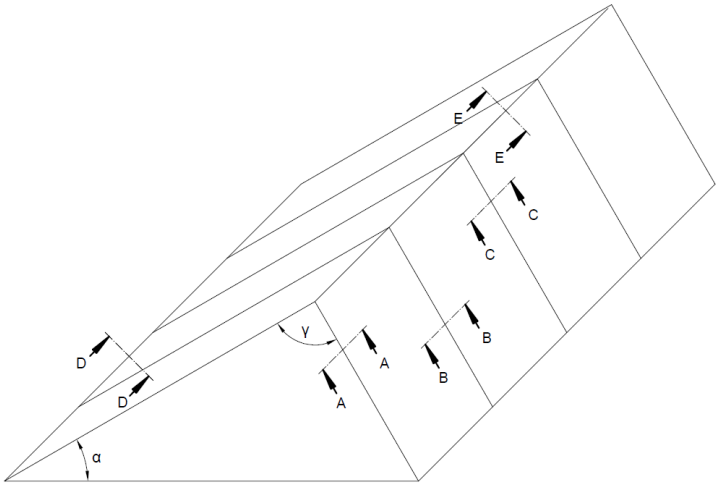
[1] DIN EN ISO 10077-1:2016-10 Thermal performance of windows, doors and shutters - Calculation of thermal transmittance - Part 1: General (ISO/FDIS 10077-1:2016); German and English version FprEN ISO 10077-1:2016

[2] DIN EN ISO 6946:2008-04 Building components and building elements - Thermal resistance and thermal transmittance - Calculation method (ISO 6946:2007); German version EN ISO 6946:2007

[3] EN 673:2011-04 Glass in building - Determination of thermal transmittance (U value) - Calculation method; German version EN 673:2011

Image C2: Overview of sections and angles



The sections and angles correspond to those given in annexes A1.1 - A1.5; A2.4 and A2.6

Table C3: Thermal transmittance coefficient of coverings

Covering	Multiwall sheet as per annex	vertical installation U_P [W/(m²·K)]	horizontal installation U_P [W/(m²·K)]
Makrolon multi UV 4/10-6	A 4.1	2,519	2,725
Akyver Sun Type 16/7W-12	A 4.2	1,815	1,920
Akyver Sun Type 16/7W-12+ PC3	A 4.2	1,581	1,659
Makrolon multi UV 5M/25-20	A 4.3	1,429	1,493
Makrolon multi UV 7M/25-28	A 4.4	1,276	1,326
Makrolon multi UV 5M/32-20	A 4.5	1,211	1,257
Makrolon multi UV 7M/32-28	A 4.6	1,103	1,141

The thermal transmittance coefficients ψ depend on the selected covering as well as in part on the pitch. Values for intermediate angles may each be linearly interpolated.

Three different variants can be calculated at the level of the eaves and gable side connection:

1. Thermal transmittance coefficient *excluding* substructure
2. Thermal transmittance coefficient *including* substructure but *excluding* roof sheeting connection
3. Thermal transmittance coefficient *including* substructure and *including* roof sheeting connection

The values can be taken from tables C4 to C9.

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Table C4:
Linear thermal transmittance coefficient at the level of the eaves; section D-D

as per. annex A1.1 - A1.5; A2.4 and A2.6 *excluding* substructure

	ψ [W/(m·K)]; pitch α						
Covering	**-5°**	**5°**	**15°**	**30°**	**45°**	**60°**	**75°**
Makrolon multi UV 4/10-6	0,028	0,049	0,069	0,105	0,154	0,239	0,471
Akyver Sun Type 16/7W-12	0,048	0,064	0,081	0,110	0,150	0,219	0,408
Akyver Sun Type 16/7W-12 + PC3	0,055	0,071	0,087	0,115	0,153	0,219	0,399
Makrolon multi UV 5M/25-20	0,060	0,075	0,091	0,118	0,155	0,219	0,393
Makrolon multi UV 7M/25-28	0,065	0,080	0,095	0,121	0,157	0,218	0,387
Makrolon multi UV 5M/32-20	0,067	0,082	0,097	0,122	0,157	0,218	0,385
Makrolon multi UV 7M/32-28	0,071	0,085	0,099	0,125	0,159	0,218	0,380

Table C5:
Linear thermal transmittance coefficient at the level of the eaves, section D-D

as per. annex A1.1 - A1.5; A2.4 and A2.6 *including* substructure but *excluding* roof sheeting connection as per annex A3.4

	ψ [W/(m·K)]; pitch α						
Covering	**-5°**	**5°**	**15°**	**30°**	**45°**	**60°**	**75°**
Makrolon multi UV 4/10-6	0,449	0,479	0,497	0,552	0,597	0,684	0,919
Akyver Sun Type 16/7W-12	0,469	0,493	0,509	0,557	0,592	0,664	0,580
Akyver Sun Type 16/7W-12 + PC3	0,476	0,500	0,519	0,562	0,595	0,663	0,848
Makrolon multi UV 5M/25-20	0,481	0,504	0,526	0,565	0,596	0,663	0,842
Makrolon multi UV 7M/25-28	0,485	0,508	0,532	0,569	0,598	0,663	0,835
Makrolon multi UV 5M/32-20	0,487	0,510	0,535	0,570	0,599	0,663	0,832
Makrolon multi UV 7M/32-28	0,491	0,513	0,540	0,572	0,600	0,633	0,828

Table C6:
Linear thermal transmittance coefficient at the level of the eaves, section D-D

as per. annex A1.1 - A1.5; A2.4 and A2.6 *including* substructure and *including* roof sheeting connection as per annex A3.4

	ψ [W/(m·K)]; pitch α						
Covering	**-5°**	**5°**	**15°**	**30°**	**45°**	**60°**	**75°**
Makrolon multi UV 4/10-6	0,276	0,307	0,301	0,344	0,389	0,478	0,706
Akyver Sun Type 16/7W-12	0,295	0,321	0,312	0,349	0,385	0,458	0,645
Akyver Sun Type 16/7W-12 + PC3	0,302	0,328	0,318	0,354	0,387	0,457	0,635
Makrolon multi UV 5M/25-20	0,307	0,332	0,322	0,357	0,389	0,457	0,628
Makrolon multi UV 7M/25-28	0,321	0,336	0,325	0,360	0,391	0,457	0,622
Makrolon multi UV 5M/32-20	0,314	0,338	0,327	0,361	0,391	0,457	0,619
Makrolon multi UV 7M/32-28	0,317	0,341	0,330	0,363	0,393	0,457	0,614

The punctual thermal bridge loss at the connection of the eave profile and the bearing profile as per annexes A2.4 and A2.6 may be neglected.

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Table C7:
Linear thermal transmittance coefficient at the level of section A-A gable side

as per annex A1.1 - A1.5; A2.4 and A2.6 *excluding* substructure (headpiece bottom).

	ψ [W/(m·K)]
Covering	**angle-independent**
Makrolon multi UV 4/10-6	0,009
Akyver Sun Type 16/7W-12	0,035
Akyver Sun Type 16/7W-12 + PC3	0,045
Makrolon multi UV 5M/25-20	0,051
Makrolon multi UV 7M/25-28	0,058
Makrolon multi UV 5M/32-20	0,060
Makrolon multi UV 7M/32-28	0,065

Table C8:
Linear thermal transmittance coefficient at the level of section A-A gable side

as per annex A1.1 - A1.5; A2.4 and A2.6 *including* substructure but *excluding* roof sheeting connection as per annex A3.4 (headpiece bottom)

	ψ [W/(m·K)]
Covering	**angle-independent**
Makrolon multi UV 4/10-6	0,629
Akyver Sun Type 16/7W-12	0,609
Akyver Sun Type 16/7W-12 + PC3	0,603
Makrolon multi UV 5M/25-20	0,600
Makrolon multi UV 7M/25-28	0,596
Makrolon multi UV 5M/32-20	0,595
Makrolon multi UV 7M/32-28	0,593

Table C9:
Linear thermal transmittance coefficient at the level of section A-A gable side

as per annex A1.1 - A1.5; A2.4 and A2.6 *including* substructure and *including* roof sheeting connection as per annex A3.4 (headpiece bottom)

	ψ [W/(m·K)]
Covering	**angle-independent**
Makrolon multi UV 4/10-6	0,354
Akyver Sun Type 16/7W-12	0,333
Akyver Sun Type 16/7W-12 + PC3	0,328
Makrolon multi UV 5M/25-20	0,324
Makrolon multi UV 7M/25-28	0,321
Makrolon multi UV 5M/32-20	0,319
Makrolon multi UV 7M/32-28	0,317

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At the level of the sheet joints, the thermal transmittance coefficient ψ depends on the selected covering. The punctual thermal influence of the fastening elements between the bearing profile and the covering profile may be neglected.

Table C10:
Linear thermal transmittance coefficient at the level of the sheet joints, section B-B or G-G

as per annex A1.1 - A1.5 and A2.1 - A2.3

	ψ [W/(m·K)]
Covering	**angle-independent**
Makrolon multi UV 4/10-6	-0,001
Akyver Sun Type 16/7W-12	0,001
Akyver Sun Type 16/7W-12 + PC3	0,002
Makrolon multi UV 5M/25-20	0,003
Makrolon multi UV 7M/25-28	0,003
Makrolon multi UV 5M/32-20	0,004
Makrolon multi UV 7M/32-28	0,004

At the level of the ridge, the thermal transmittance coefficient ψ depends on the selected covering as well as on their installation position (angle). Values for intermediate angles may each be linearly interpolated.

Table C11:
Linear thermal transmittance coefficient at the level of the ridge, section E-E

as per annex A1.1 - A1.5; A2.5 and A2.7

	ψ [W/(m·K)]; Ridge angle γ			
Covering	**60°**	**90°**	**120°**	**170°**
Makrolon multi UV 4/10-6	-0,179	-0,154	-0,146	-0,145
Akyver Sun Type 16/7W-12	-0,121	-0,093	-0,084	-0,080
Akyver Sun Type 16/7W-12 + PC3	-0,109	-0,079	-0,068	-0,063
Makrolon multi UV 5M/25-20	-0,101	-0,070	-0,058	-0,052
Makrolon multi UV 7M/25-28	-0,094	-0,060	-0,047	-0,041
Makrolon multi UV 5M/32-20	-0,090	-0,056	-0,043	-0,037
Makrolon multi UV 7M/32-28	-0,085	-0,050	-0,036	-0,029

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At the level of the ridge, the thermal transmittance coefficient ψ depends on the selected covering.

Table C12:
Linear thermal transmittance coefficient at the level of section A-A, gable side

as per annex A1.1 - A1.5 (headpiece top)

	ψ [W/(m·K)]
Covering	**angle-independent**
Makrolon multi UV 4/10-6	-0,068
Akyver Sun Type 16/7W-12	-0,061
Akyver Sun Type 16/7W-12 + PC3	-0,063
Makrolon multi UV 5M/25-20	-0,065
Makrolon multi UV 7M/25-28	-0,067
Makrolon multi UV 5M/32-20	-0,067
Makrolon multi UV 7M/32-28	-0,068

In case the substructure is taken into account, the thermal transmittance coefficient U_Z shall be determined in accordance with the applicable European specifications e.g. EN ISO 6946.

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JET-Vario-Therm S **Annex D**

Provisions for installation, packaging, transport, storage, use, maintenance and repair

D 1 Installation

The fixing of the roof kit on the substructure is not covered by this ETA. The stability shall be verified for the relevant substructure in accordance with the applicable European specifications.

Before the roof kit is installed, the dimensional stability of the substructure shall be checked. Particular care shall be taken to ensure that the substructure has a rectangular footprint. The compliance of the existing substructure with the substructure for which the load-bearing capacity was verified in the planning stage shall be checked visually.

The installation of the roof kit may only be performed by specialists who are specially trained for this purpose. The installation guidelines of the manufacturer shall be respected. The manufacturer of the roof kit shall inform the specialists that they may only carry out assembly and installation of the roof kit in accordance with his instructions and the provisions of the ETA. The hollow chambers of the multi-wall sheets shall not be filled.

If the translucent roof kit can systematically come into contact with chemical substances, the resistance of the multi-wall sheets and if necessary of other kit components to these substances shall be verified.

The eaves profile is placed on the substructure and fixed to it using the specified screws. The coverings are placed on the pre-assembled bearing profiles, eaves profiles and the ridge supporting profile, together with the edge profiles. They are then fixed at the sheet joints. Where applicable, they are fixed to the intermediate bearing and covering profiles. Finally, the outer ridge profile is screwed to the bearing profiles.
The translucent roof kit shall be installed and connected to the adjacent structure in a manner that ensures no moisture can penetrate into it and avoiding thermal bridges. These details shall be evaluated on a case-by-case basis.

D 2 Packaging, transport and storage

The components of the roof kit shall be stored and transported in accordance with the manufacturer's specifications such that the components cannot be damaged. In particular, for multi-wall sheets made from polycarbonate it shall be ensured that only those surfaces with UV protective coatings are exposed to UV radiation. The packaging shall protect the material from moisture and weather effects whilst avoiding heat build-up inside the packaging. It is the responsibility of the manufacturer to ensure that this information is passed on to the people in charge.

D 3 Use, maintenance, repair

The installed roof kit is not a walk-on system. For installation purposes, the roof kit may be walked on by a single person using boards laid across the substructure (at least two bearing profiles) for support; the boards shall run perpendicular to the loading direction of the bearing profiles.

For maintenance, the installed roof kit shall be visually inspected by a qualified expert once a year. The manufacturer shall be consulted if the PC multi-wall sheets show surface cracks or damage or if they are strongly discoloured. The aluminium components of the roof kit shall be examined for pronounced corrosion by visual inspection. Repair shall be arranged where necessary.

Only the components listed in the ETA may be used for replacement of components.

Cleaning agents shall be free of solvents and abrasives. Chemical and biological cleaning additives may only be used if they have been proven to be compatible with polycarbonate; otherwise only water and a soft cloth shall be used to clean the multi-wall sheets.

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