European Technical Assessment

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**Technical Assessment Body issuing the European Technical Assessment: UBAtc.
UBAtc has been designated according to Article 29 of Regulation (EU) No 305/2011 and is member of EOTA (European Organisation for Technical Assessment)**

Trade name of the construction system	Murfor® Compact
Product family to which the construction product belongs	Ancillary components for masonry: bed joint reinforcement for structural use
Manufacturer	NV Bekaert SA Bekaertstraat 2 8550 ZWEVEGEM Belgium
Manufacturing plants	Bekaert Production plants 01, 02 & 03
Website	http://www.bekaert.com
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of:	European Assessment Document (EAD): 170008-00-0604
This European Technical Assessment contains:	12 pages, including 2 annexes, which form an integral part of this ETA.

European Organisation for Technical Assessment

Legal bases and general conditions

1 This European Technical Assessment is issued by UBAtc (Union belge pour l'Agrément technique de la construction, i.e. Belgian Union for technical Approval in construction), in accordance with:

- Regulation (EU) N° 305/2011[1] of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC;
- Commission Implementing Regulation (EU) N° 1062/2013[2] of 30 October 2013 on the format of the European Technical Assessment for construction products;
- European Assessment Document (EAD) 170008-00-0604.

2 Under the provisions of Regulation (EU) No 305/2011, UBAtc is not authorized to check whether the provisions of this European Technical Assessment are met once the ETA has been issued.

3 The responsibility for the conformity of the performances of the products with this European Technical Assessment and the suitability of the products for the intended use remains with the holder of the European Technical Assessment.

4 Depending on the applicable Assessment and verification of constancy of performance (AVCP) system, (a) notified body(ies) may carry out third-party tasks in the process of assessment and verification of constancy of performance under this Regulation once the European Technical Assessment has been issued.

5 This European Technical Assessment allows the manufacturer of the construction product covered by this ETA to draw up a declaration of performance for the construction product.

6 CE marking should be affixed to all construction products for which the manufacturer has drawn up a declaration of performance.

7 This European Technical Assessment is not to be transferred to other manufacturers, agents of manufacturers, or manufacturing plants other than those indicated on page 1 of this European Technical Assessment.

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13 Subject to the application introduced, this European Technical Assessment is issued in English and may be issued by the UBAtc in its official languages. The translations correspond fully to the English reference version circulated in EOTA.

14 This European Technical Assessment was first issued by UBAtc on 18 June 2018.

[1] OJEU, L 88 of 2011/04/04

[2] OJEU, L 289 of 2013/10/31

Technical provisions

1 Technical description of the product

1.1 General

The bed joint reinforcement is a wire mesh – ladder type, provided on rolls – and consists of multiple longitudinal 3-wire cords (3 x a diameter between 0,40 and 0,80 mm and transverse interwoven glass roving. Around the longitudinal cords, a pure polypropylene yarn is woven to connect the cords with cross glass roving. The longitudinal cords are of high carbon steel protected against corrosion or of corrosion resistant steel. A coating on the mesh generates the stiffness. The number of longitudinal cords is related to the product width (see figures in Annex 1).

Murfor® Compact is manufactured at NV Bekaert SA, plants 01, 02 and 03 (known at UBAtc).

1.2 The steel cords

The steel cords are manufactured by the company "NV Bekaert SA".

The steel wires are of high carbon steel or corrosion resistant steel. The characteristics of the steel wires and the steel cords are detailed in this ETA, clause 3.2 and in Table 3.

1.3 The glass roving

The glass roving is a single end roving and has a silane based sizing. The product is made using glass fibre, combining the electrical and mechanical properties of traditional E glasses with the acid corrosion resistance of E-CR glass. The glass roving meets the requirements of both E and E-CR glass according to EN ISO 2078. The single end roving is manufactured in conformity with ISO 2797.

The characteristics of the glass roving are detailed in this ETA, Table 4.

1.4 The polypropylene yarn

The material is pure polypropylene high tenacity. The yarn is woven around each cord. The characteristics of the polypropylene yarn are detailed in this ETA, Table 5

2 Specification of the intended use(s) in accordance with the applicable EAD

2.1 General

Murfor® Compact is an ancillary component for masonry and intended to be used as bed joint reinforcement for structural use. The bed joints may be of normal purpose mortar or thin layer mortar

The provisions made in this European Technical Assessment are based on an assumed intended working life of 50 years, when installed in the works, provided that the product is subject to appropriate installation. These provisions are based upon the current state of the art and available knowledge and experience, provided that the assembled product is subject to appropriate use and maintenance, in accordance with this ETA.

The real working life may be, in normal use conditions, considerably longer without major degradation affecting the basic requirements for works. The real working life of the product incorporated in a specific works depends on the environmental conditions to which that works is subject, as well as on the particular conditions of design, execution, use and maintenance of that works. Therefore, it cannot be excluded that in certain cases the real working life of the product may also be shorter than referred above.

2.2 Intended uses

The Murfor® Compact – bed joint reinforcement is intended to be used in horizontal masonry joints. The bed joints may be of normal purpose mortar or thin layer mortar. The masonry may be subjected to severe climate conditions, moderate climate conditions or passive conditions (MX1, MX3 or MX4 cf. EN 1996-2) depending on the type of the Murfor® Compact used:

- Murfor® Compact A: for use in masonry with thin layer mortar or normal purpose mortar and AAC blocks in internal conditions (passive conditions of exposure MX1)
- Murfor® Compact I: for use in masonry with thin layer mortar or normal purpose mortar and clay masonry units, masonry units of concrete or calcium silicate masonry units in internal conditions (passive conditions of exposure MX1)
- Murfor® Compact E: for use in masonry with normal purpose mortar or thin layer mortar and clay masonry units, masonry units of concrete or calcium silicate masonry units in external conditions (moderate and severe conditions of exposure MX3 and MX4)

2.3 Assumptions

2.3.1 Provisions related to manufacturing, packaging, transportation and storage

Murfor® Compact is delivered on rolls of 30 m length and shall be applied on site according to manufacturer's instructions and according to the conditions of EN 1996 1-1 and EN 1996-2 for reinforced masonry.

2.3.2 Packaging, transportation, storage, installation, maintenance, replacement and repair

Each roll is individually packed under PE foil. Rolls are stacked in pre-printed cardboard boxes. Each roll is marked with a small label holding traceability info. Each box is pre-printed – with product info and the CE marking.

36 boxes are packed on a wooden pallet. The pallets are packed under a wrapping foil + cover sheet. Each pallet is provided with an identical label stating product type – content.

Concerning product packaging, transport, storage, installation, maintenance, replacement and repair it is the responsibility of the manufacturer to undertake the appropriate measures and to advise his clients on the transport, storage, installation, maintenance, replacement and repair of the product as considered necessary.

2.3.3 Provisions related to the design and use of the product

The design of reinforced masonry with Murfor® Compact shall be according the technical instructions of the manufacturer, the technical files of the manufacturer and EN 1996-1-1.

The installation instructions including special installation techniques and provisions for the qualification of the personnel are given in the manufacturer's technical documentation.

2.4 Recommendations

2.4.1 Recommendations to the designer and the installer

Reinforced masonry made with Murfor® Compact shall be carried out by qualified personnel and under the supervision of a technically qualified person responsible for technical matters of the building site.

2.4.2 Recommendations on packaging, transport and storage

Murfor® Compact shall be handled and stored with care, protected from accidental damage.

It is the responsibility of the manufacturer of the Murfor® Compact to ensure that the information on these provisions is given to those concerned.

2.4.3 Recommendations on use, maintenance and repair

It is always necessary to make a reinforcement plan according to the instructions of the manufacturer or of the designer of the reinforced masonry.

It is the responsibility of the manufacturer of the Murfor® Compact to ensure that the information regarding characteristics of the Murfor® Compact is given to those concerned.

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

3.1 Dimensions of the Murfor® Compact

The dimensions of Murfor® Compact and the symbols used, are defined by the length (L), width (W), profile height (t), wire size (c), cord cross sectional area (Ac), pitch of the inner longitudinal cords (f), pitch of the outer longitudinal steel cords (e) and the pitch of the interwoven glass roving (b). These have been determined according to EAD 170008-00-604, clauses 3.4.1, 3.4.2 and 3.4.3 (see also clause 3.9).

3.2 Characteristic yield strength, tensile strength and total elongation of the longitudinal cords

The characteristic yield strength of the longitudinal cords, without removing any organic coating and polypropylene yarn has been assessed by the method of EN ISO 15630-3 using specimens each containing at least two interwoven glass roving wire connections within the gauche length (see also clause 3.9).

The characteristics are determined for the characteristic yield strength, the maximum force, the percentage total elongation at maximum force (A_{gt}) and the ratio of tensile strength to the yield strength ($R_m/R_{p0.2}$).

The characteristic yield strength and breaking strength have been calculated for a fractile 95% and a confidence level of 90%.

The percentage total elongation at maximum force and the ratio of tensile strength to the yield strength have been calculated for a fractile of 90% and a confidence level of 90%.

3.3 Ductility of longitudinal strands

Based on the assessment of the total elongation at maximum force (A_{gt}) and the ration of tensile strength to the yield strength ($R_m/R_{p0.2}$). The ductility category is 'low' (see also clause 3.9).

3.4 Breaking force and elongation at break of roving wires

The arithmetic mean of the breaking force, according to ISO 3341 is given in this ETA, Table 4.

3.5 Bond strength and anchorage length

The bond strength in relation to the anchorage length of 250mm is determined according to EN 846-2 for the following combinations:

- Murfor® Compact A-80 + AAC blocks (group1)+ thin layer mortar
- Murfor® Compact I-100 + clay blocks (group 2) + normal purpose mortar
- Murfor® Compact E-70 + clay bricks (group 1) + normal purpose mortar

The specimen formats related to the dimensions of the masonry elements are according to EAD 17008-00-604, Figure 1 (see also clause 3.10).

3.6 In-plane flexural strength

The flexural strength in-plane is tested by the method of EN 846-9:2016, method 8.6.1 and fig (1,a) for the following combinations:

- Murfor® Compact A-40 + AAC blocks (group1)+ thin layer mortar
- Murfor® Compact I-100 + dense aggregate concrete blocks (group 2) + normal purpose mortar

The specimen formats related to the dimensions of the masonry elements are according to EAD 1700808-00-604, Figure 2. The test results have been verified by a calculation according to EN 1992-1-1 and EN 1996-1-1 (see also clause 3.11). The verification model for the calculation is given in this ETA, Annex 2.

3.7 Shear resistance

The shear resistance of the wall beams is assessed according EN 846-9 for the following combinations:

- Murfor® Compact A-40 + AAC blocks (group1)+ thin layer mortar
- Murfor® Compact I-100 + dense aggregate concrete blocks (group 2) + normal purpose mortar

More information about the used materials, specimen formats and test results is given in this ETA, clause 3.11.

3.8 Out-of-plane flexural strength

The flexural strength out-of-plane, perpendicular to the bed joint, has been assessed by the method of EN 1052-2 for the following combinations:

- Murfor® Compact A-40 + AAC blocks (group1)+ thin layer mortar
- Murfor® Compact I-100 + dense aggregate concrete blocks (group 2) + normal purpose mortar

The test specimens meet the requirements of EN 1052-2:2016, Table 2, for the plane of failure perpendicular to the bed joints. The test results have been verified by a calculation according to EN 1992-1-1 and EN 1996-1-1, clause 3.11, without taking into account any tolerances. The verification model for the calculation is given in this ETA, Annex 2.

3.9 Tensile strength

Dimensions (length, width, profile height, wire sizes, pitch of cords) have been specified in this ETA, Table 2.

The characteristic yield strength of the longitudinal cords and the ductility of the longitudinal cords have been specified in this ETA, Table 3

The strength of the cross cords has been specified in this ETA, Table 4.

3.10 Bond strength

The bond strength and anchorage length have been specified in this ETA, Table 6.

3.11 Flexural strength

The in-plane flexural and shear strength have been specified respectively in this ETA, Tables 7 and 8. The out-of-plane flexural strength has been specified in this ETA, Table 9.

3.12 Durability of performance characteristics (against corrosion)

The durability of performance characteristics (against corrosion) is determined by the material/coating reference. The reference codes have been specified in this ETA, Table 10.

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

In accordance with Regulation (EU) N° 305/2011, Article 65, Directive 89/106/EEC is repealed, but references to the repealed Directive shall be construed as references to the Regulation.

The applicable European legal act is Decision[3] 1997/740/EC of the European Commission for masonry and related products, as amended by Decision[4] 2001/596/EC of 8 January 2001.

The system to be applied has been specified in Table 1.

Table 1: System of assessment and verification of constancy of performance

Product(s)	Intended use(s)	Level(s) or class(es)	AVCP system[a]
Bed joint reinforcement	Walls and partitions	-	3

[a] See Annex V to Regulation (EU) N° 305/2011

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

5.1 Tasks of the ETA-holder

The cornerstones of the actions to be undertaken by the manufacturer of the product in the process of verification of constancy of performance are specified in EAD 170008-00-0604.

5.2 Tasks for the Technical Assessment Body

Results of assessment testing shall be used by notified bodies (cf. Regulation (EU), Annex V, clause 1.6)

6 References

As far as no edition date is given in the list of standards hereafter, the standard in the version at the time of issuing the European Technical Assessment, is of relevance.

EN 845-3	Specification for ancillary components for masonry – Part 3: Bed joint reinforcement of steel meshwork
EN 846-2	Methods of test for ancillary components – Part 2: Determination of bond strength of prefabricated bed joint reinforcement in mortar joints
EN 846-9	Methods of test for ancillary components – Part 9: Determination of flexural resistance and shear resistance of lintels
EN 846-13	Methods of test for ancillary components – Part 13: Determination of resistance to impact, abrasion an corrosion of organic coatings
EN 1052-2	Methods of test for masonry – Part 2: Determination of flexural strength
EN 1992-1-1	Eurocode 2: Design of concrete structures – Part 1-1: General rules for buildings
EN 1996-1-1	Eurocode 6 – Design of masonry structures – Part 1-1: General rules for reinforced and unreinforced masonry structures
EN 1996-2	Eurocode 6 – Design of masonry structures – Part 2: Design considerations, selection of materials, and execution of masonry
EN ISO 1889	Reinforcement yarns – Determination of linear density
EN ISO 2078	Textile glass – Yarns – Designation
EN ISO 15630-1	Steel for reinforcement an prestressing of concrete – Test methods – Part 1: Reinforcing bars, wire rod and wire
EN ISO 15630-2	Steel for reinforcement an prestressing of concrete – Test methods – Part 2: Welded fabric
EN ISO 15630-3	Steel for reinforcement an prestressing of concrete – Test methods – Part 3: Prestressing steel
EN ISO 16120-2	Non-alloy steel wire rod for conversion to wire - Part 2: Specific requirements for general purpose wire rod
ISO 1887	Textile glass – Determination of combustible matter content
ISO 1888	Textile glass – Roving – Basis for a specification
ISO 3341	Textile glass – Yarns – Determination of breaking force and breaking elongation

[3] Official Journal L 299 of 4 November 1997

[4] Official Journal L 209 of 2 August 2001

Table 2 : Dimensions of the different types of Murfor® Compact

Type	L	W	t	c	Ac	f	e	b	Number of cords	Total steel section
	[m]	[mm]	[mm]	[mm]	[mm²]	[mm]	[mm]	[mm]	[-]	[mm²]
Murfor® Compact A-40	30	40	1,7	0,54	0,687	10	5	33	7	4,83
Murfor® Compact A-80	30	80	1,7	0,54	0,687	10	5	33	14	9,66
Murfor® Compact I-50	30	50	1,7	0,54	0,687	10	7,5	33	7	4,83
Murfor® Compact I-100	30	100	1,7	0,54	0,687	10	7,5	33	14	9,66
Murfor® Compact E-35	30	35	1,7	0,54	0,687	7,5	5	33	7	4,83
Murfor® Compact E-70	30	70	1,7	0,54	0,687	7,5	5	33	14	9,66
Tolerances	1.5%	±5	-0,2/ +0,4	0,02	0,05	2,0	1,0	10%	-	

Table 3 : Characteristic yield strength, tensile strength and total elongation of the longitudinal cords

Type	Murfor® Compact A	Murfor® Compact I	Murfor® Compact E	Reference
Essential characteristic	Value			
Yield strength	1770 N/mm²	1770 N/mm²	1480 N/mm²	EN ISO 15630-3 EAD 170008-00-604
Tensile strength	2100 N/mm²	2100 N/mm²	1725 N/mm²	EN ISO 15630-3 EAD 170008-00-604
Total elongation at maximum force	2,2%	2,2 %	2,2 %	EN ISO 15630-3 EAD 170008-00-604
Ratio tensile strength – yield strength	>1,08	> 1,08	> 1,08	EN ISO 15630-3 EAD 170008-00-604
Ductility category	low	low	low	EN 845-3:2013+A1:2016, Table 4

Table 4 : Breaking force and elongation at break of transverse roving wires

Type	Murfor® Compact A	Murfor® Compact I	Murfor® Compact E	Reference
Essential characteristic	Value			
Linear density	1200 ± 90 tex			EN ISO 1889
Tensile force	380 N			ISO 3341
Total elongation at break	1,4 %			ISO 3341

Table 5 : Tenacity and elongation at break of the polypropylene yarns

Type	Murfor® Compact A	Murfor® Compact I	Murfor® Compact E	Reference
Essential characteristic	Value			
Linear density	660 dtex			EN ISO 1889
Number of filaments	72			
Tenacity	(6,4 ± 0,3) cN/dtex			ISO 3341
Total elongation at break	(20,0 ± 3,0) %			ISO 3341

Table 6 : Bond strength

Type of masonry elements and masonry mortar	Air content	Flexural strength (28 days)	Compressive strength (28 days)
Mortar YTOCOL (thin layer mortar)	18.8 %	4,2 N/mm²	14,8 N/mm²
Weber Mix MM 301 E (normal purpose mortar)	22.1 %	3.4 N/mm²	12,5 N/mm²
AAC blocks C3/450 -600x150x250			4,0 N/mm²
Perforated clay block Ploegsteert Barry, 288x138x138 - group 2 unit (EC6)			22,5 N/mm²
Solid clay brick Vandersanden Barok 210x100x65 – group 1 unit (EC6)			36,1 N/mm²

Combinations	Embedment length	Characteristic value of bond strength
AAC blocks + Mortar YTOCOL+ Murfor® Compact A-80	250 mm	9.33 kN
Perforated clay blocks + Mortar Weber Mix + Murfor® Compact I-100	250 mm	8.42 kN
Solid clay bricks + Mortar Weber Mix + Murfor® Compact E-70	250 mm	8.07 kN

Table 7 : In-plane flexural strength

Type of masonry elements and masonry mortar	Flexural strength (28 days)	Compressive strength (28 days)
Mortar YTOCOL (thin layer mortar)	2,77 N/mm²	14,4 N/mm²
Weber Beamix M10 302 E (normal purpose mortar)	3.1 N/mm²	14,0 N/mm²
AAC blocks C3/450 -600x150x250	-	4,0 N/mm²
Solid dense aggregate concrete blocks Doubeton, 290/140/190 - group 1 unit (EC6)	-	15,0 N/mm²

Combinations	Effective span	Effective height	Width	Mean value of maximum load	Characteristic value of maximum load	Mid span deflection at maximum load
AAC blocks + Mortar YTOCOL+ Murfor® Compact A-40	1800 mm	306 mm	249 mm	19,00 kN	17,1 kN	17.97 mm
PerforatSolid dense aggregate concrete blocks+ Mortar Weber Mix + Murfor® Compact I-100	2400 mm	404 mm	138 mm	36,58 kN	32,90 kN	47,98 mm

Table 8 : Shear strength

Type of masonry elements and masonry mortar	Flexural strength (28 days)	Compressive strength (28 days)
Mortar YTOCOL (thin layer mortar)	2,77 N/mm²	14,4 N/mm²
Weber Beamix M10 302 E (normal purpose mortar)	3.1 N/mm²	14,0 N/mm²
AAC blocks C3/450 -600x150x250		4,0 N/mm²
Solid dense aggregate concrete blocks Doubeton, 290/140/190 - group 1 unit (EC6)		15,0 N/mm²

Combinations	Effective span	Effective height	Width	Mean value of maximum load	Characteristic value of maximum load
AAC blocks + Mortar YTOCOL+ Murfor® Compact A-40	1800 mm	306 mm	249 mm	10,6 kN	9,54 kN
Solid dense aggregate concrete units + Mortar Weber Mix + Murfor® Compact I-100	2400 mm	404 mm	138 mm	23,8 kN	21,45 kN

Table 9 : Out-of-plane flexural strength

Type of masonry elements and masonry mortar	Flexural strength (28 days)	Compressive strength (28 days)
Mortar YTOCOL (thin layer mortar)	2,77 N/mm²	14,4 N/mm²
Weber Beamix MM 302 E (normal purpose mortar)	3.1 N/mm²	14,0 N/mm²
AAC blocks C3/450 -600x150x250		4,0 N/mm²
Solid dense aggregate concrete blocks Doubeton, 290/140/190 - group 1 unit (EC6)		15 N/mm²

Combinations	L1	L2	tu	b	Char. value f_{xk2}	$M_{R,calc}$
AAC blocks + Mortar YTOCOL+ Murfor® Compact A-40	840 mm	420 mm	149 mm	1006 mm	0,32 N/mm²	1,45 kNm/m
Solid dense aggregate concrete blocks + Mortar Weber Mix + Murfor® Compact I-100	840 mm	420 mm	137 mm	794 mm	0,87 N/mm²	3,29 kNm/m

Table 10 : Durability

Type	Description	Material/coating reference; steel grade[a]
Murfor® Compact A	High carbon steel wire according to EN ISO 16120-2 grades C78D to C86D or equivalent	R20
Murfor® Compact I	High carbon steel wire according to EN ISO 16120-2 grades C78D to C86D or equivalent	R20
Murfor® Compact E	Austenitic stainless steel grade according to ASTM A580 n°316 (AISI 316)	R1

Durability of performance characteristics against corrosion is dependent on both the conditions of exposure of the masonry and the material/coating specification. This ETA follows the state of the art by giving material/coating specifications to suit

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This European Technical Assessment has been issued by UBAtc asbl, in Sint-Stevens-Woluwe, on the basis of the technical work carried out by the Assessment Operator, BCCA

On behalf of UBAtc asbl,

Peter Wouters,
director

On behalf of the Assessment Operator, BCCA responsible for the technical content of the ETA,

Benny De Blaere,
director

The most recent version of this European Technical Assessment may be consulted on the UBAtc website (www.ubatc.be).

ANNEX 1: Drawings

Murfor® Compact A-80 Murfor® Compact I-50 Murfor® Compact E-35

Figure 1: Examples of Murfor® Compact types

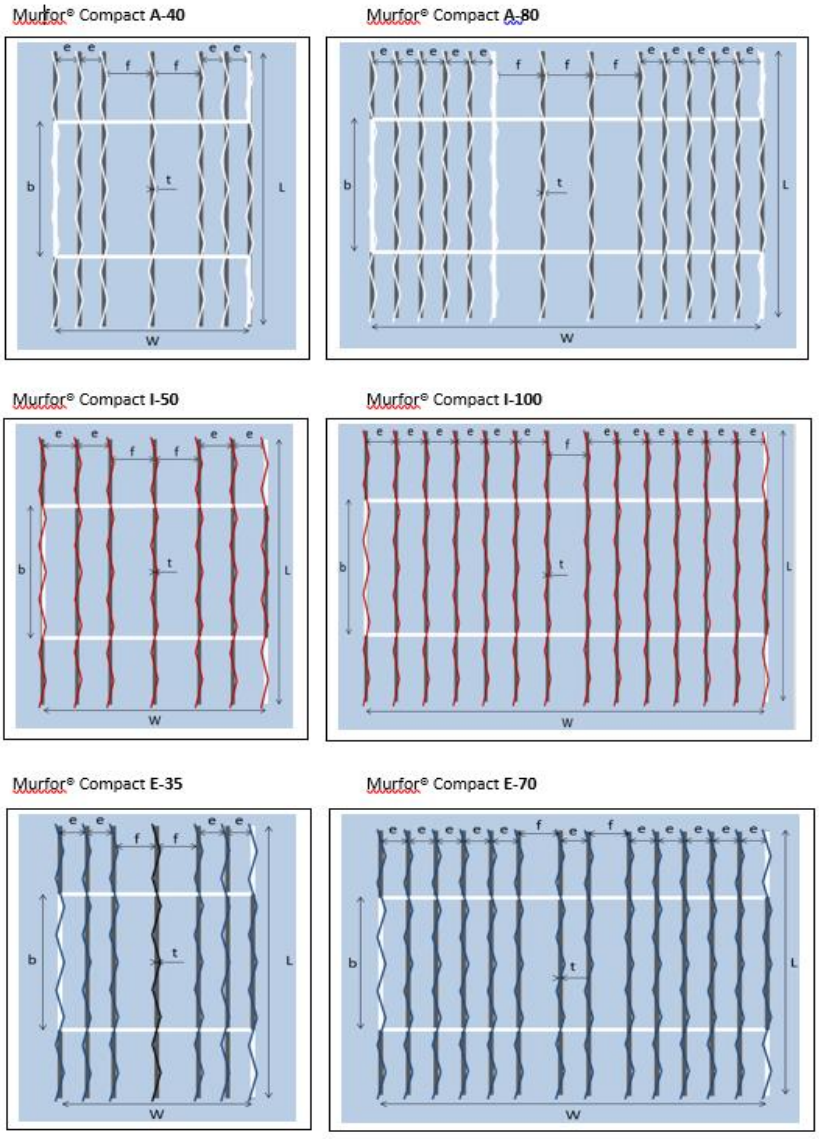
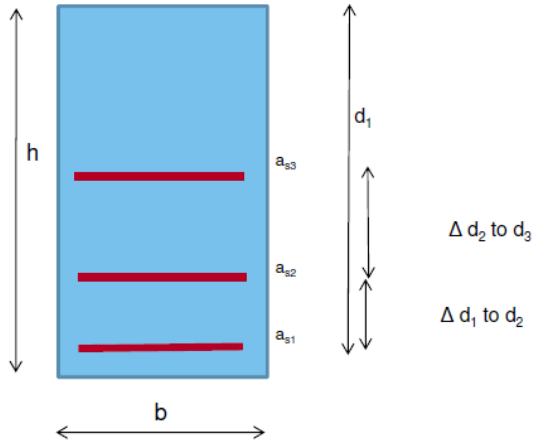


Figure 2: configuration of the different Murfor® Compact types

ANNEX 2: Calculation models

Annex 2.1: Calculation model for in-plane flexural strength (beam)



Sections to determine

- h
- d1
- Δ d1 to d2
- Δ d2 to d3
- b

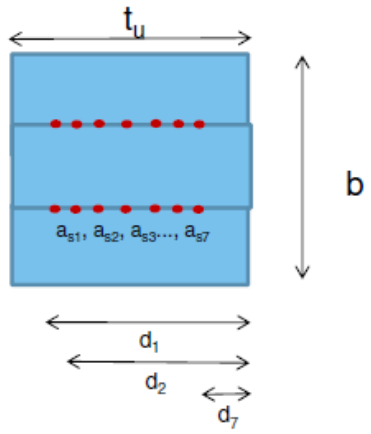
Masonry

α (according to EN 1996-1-1)	-
β (according to EN 1996-1-1)	-
f_b in horizontal direction	[N/mm²] (≤ 50 N/mm²)
f_m	[N/mm²] (≤ 20 N/mm²)
K (according to EN 1996-1-1)	-
$f_k = K.f_b^{\alpha}.f_m^{\beta}$	[N/mm²]
$f_d = f_k/\gamma_M$	[N/mm²]
λ = 0.8	[-]
ϵ_{mu}(according to EN 1996-1-1	[‰] : EN 1996-1-1: $\epsilon_{mu} \leq 3.5$ for group 1 units and $\epsilon_{mu} \leq 2$ for Group 2,3 and 4 units

Reinforcement

cord section: Ac	[mm²]
number of cords	[-]
f_{yk} (charact. yield strength)	[N/mm²]
$f_{yd} = f_{yk}/\gamma_M$	[N/mm²]
E_s : 180000	[N/mm²]
ϵs = 22,00	[‰]

Annex 2.2: Calculation model for out-of-plane flexural strength



Sections to determine (for example 7 cords)

h

d1

Δ d1 to d2

Δ d2 to d3

Δ d3 to d4

Δ d4 to d5

Δ d5 to d6

Δ d6 to d7

b

Masonry

a (according to EN 1996-1-1)	-
β (according to EN 1996-1-1)	-
f_b in horizontal direction	[N/mm²] (≤ 50 N/mm²)
f_m	[N/mm²] (≤ 20 N/mm²)
K (according to EN 1996-1-1)	-
$f_k = K.f_b^{\alpha}.f_m^{\beta}$	[N/mm²]
$f_d = f_k/\gamma_M$	[N/mm²]
$\lambda = 0.8$	[-]
ϵ_{mu} (according to EN 1996-1-1	[‰] : EN 1996-1-1: $\epsilon_{mu} \leq 3.5$ for group 1 units and $\epsilon_{mu} \leq 2$ for Group 1,3 and 4 units

Reinforcement

cord section: Ac	[mm²]
number of cords	[-]
f_{yk} (charact. yield strength)	[N/mm²]
$f_{yd} = f_{yk}/\gamma_M$	[N/mm²]
E_s : 180000	[N/mm²]
ϵ_s = 22,00	[‰]