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European Technical Assessment

ETA-10/0431
of 26.07.2018

General part

Technical Assessment Body issuing the European Technical Assessment

Österreichisches Institut für Bautechnik (OIB)
Austrian Institute of Construction Engineering

Trade name of the construction product

ZZ M20

Product family to which the construction product belongs

Fire Stopping and Fire Sealing Products:
Penetration Seals

Manufacturer

Karl Zimmermann
Miltzstraße 29
51061 Köln
GERMANY

Manufacturing plant

Karl Zimmermann GmbH
Marconistraße 7-9
50769 Köln
GERMANY

This European Technical Assessment contains

41 pages including Annexes A-1 to J-1 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

European Assessment Document
EAD 350454-00-1104 „Fire stopping and fire sealing products – Penetration seals”

This European Technical Assessment replaces

European technical approval ETA-10/0431 with validity from 25.06.2013 to 24.06.2018

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

2.1 Intended use

“ZZ M20” is intended to be used as a mixed penetration seal to temporarily or permanently reinstate the fire resistance performance of flexible wall constructions, rigid wall constructions and rigid floor constructions where they have been provided with apertures which are penetrated by various cables, waveguides, conduits / tubes, metal pipes, plastic pipes and cable support constructions (perforated or non-perforated steel cable trays and steel ladders).

The thickness of the penetration seal has to be minimum 144 mm or 200 mm (depending on the fire resistance classification; see Annex J-1 of the ETA).

The minimum perimeter length to seal area ratio of the penetration seal in rigid floors is – according to clause 13.5.2 of EN 1366-3:2009 – 5,333 m/m², resp. 0,005333 mm/mm² (for penetration seals with a nominal thickness of 144 mm) – or 4,857 m/m², resp. 0,004857 mm/mm² (for penetration seals with a nominal thickness of 200 mm).

The maximum opening size of the penetration seal has to comply with the dimensions as specified in the following table.

Blank penetration seals with maximum opening sizes as specified in the following table have been tested.

“ZZ M20” can be installed only in the types of separating elements as specified in the following table.

Separating element	Construction	Maximum opening size of the penetration seal (width x height)
Flexible walls	<ul style="list-style-type: none"> > Steel studs or timber studs lined on both faces with minimum 2 layer of boards (minimum thickness 12,5 mm), or minimum one layer of boards (minimum thickness 25 mm) with classification A2-s1,d0 or A1 according to EN 13501-1 > For timber stud walls there shall be a minimum distance of 100 mm of the penetration seal to any timber stud. The cavity between the penetration seal and the timber stud has to be closed with minimum 100 mm of insulation with classification A1 or A2 according to EN 13501-1 > Minimum thickness 94 mm > Classification according to EN 13501-2: ≥ EI 60 > This European Technical Assessment does not cover sandwich panel constructions and flexible walls where the lining does not cover studs on both sides. Penetrations in such constructions shall be tested on a case by case basis 	<p>600 mm x 1000 mm</p> <p style="text-align: center;">or</p> <p>1000 mm x 600 mm</p>

Penetrating element	Construction characteristics of the penetrating element in "ZZ M20" in flexible walls, rigid walls and rigid floors
Conduits / Tubes	<ul style="list-style-type: none"> > Steel conduits / tubes, $\varnothing \leq 16$ mm, wall thickness minimum 1,5 mm (with / without cables): steel conduits according to EN 61386-21 > Plastic conduits, $\varnothing \leq 16$ mm, wall thickness 1,0 mm to 3,0 mm (with / without cables) according to EN 61386-21 or EN 61386-22 > Plastic conduits, $\varnothing \leq 40$ mm, wall thickness 1,0 mm to 3,0 mm (with / without cables) according to EN 61386-21 or EN 61386-22 > Plastic conduits, $\varnothing \leq 63$ mm, wall thickness 1,0 mm to 3,0 mm (with / without cables) according to EN 61386-21 or EN 61386-22 > Bundles with a maximum \varnothing of 100 mm consisting of plastic conduits, $\varnothing \leq 63$ mm, wall thickness 1,0 mm to 3,0 mm (with / without cables) according to EN 61386-21 or EN 61386-22 > "speed-pipe®" from manufacturer "gabo Systemtechnik GmbH" of dimension (diameter x wall thickness) 7 mm x 0,75 mm, 10 mm x 1,0 mm, 12 mm x 1,1 mm, 7 mm x 1,5 mm, 10 mm x 2,0 mm and 12 mm x 2,0 mm (with / without optical fibre cables) > Bundles with a maximum \varnothing of 80 mm consisting of "speed-pipe®" from manufacturer "gabo Systemtechnik GmbH" of dimension (diameter x wall thickness) 7 mm x 0,75 mm, 10 mm x 1,0 mm, 12 mm x 1,1 mm, 7 mm x 1,5 mm, 10 mm x 2,0 mm and 12 mm x 2,0 mm (with / without optical fibre cables)
Plastic pipes	<ul style="list-style-type: none"> > PVC-U pipes according to EN ISO 1452-1 and DIN 8061 / DIN 8062 with diameters and wall thicknesses as defined in Annex E-4 of the ETA. For interpolation between pipe diameters and wall thicknesses see Annex E-4 of the ETA. > PE-HD pipes according to EN 1519-1 and DIN 8074 / DIN 8075 with diameters and wall thicknesses as defined in Annex E-4 of the ETA. For interpolation between pipe diameters and wall thicknesses see Annex E-4 of the ETA.

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2.4.6 The assessment does not cover the avoidance of destruction of the penetration seal or of the adjacent building element(s) by forces caused by temperature changes in case of fire. This has to be considered when designing the piping system.

2.5 Manufacturing

The European Technical Assessment is issued for the product on the basis of agreed data / information, deposited with the Österreichisches Institut für Bautechnik, which identifies the product that has been assessed and judged. Changes to the product or production process, which could result in this deposited data / information being incorrect, should be notified to the Österreichisches Institut für Bautechnik before the changes are introduced.

The Österreichisches Institut für Bautechnik will decide whether or not such changes affect the European Technical Assessment and consequently the validity of the CE marking on the basis of the European Technical Assessment and if so whether further assessment or alterations to the European Technical Assessment, shall be necessary.

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

Basic requirements for construction works	Essential characteristic	Method of verification	Performance
BWR 2	Reaction to fire	EN 13501-1	Clause 3.1.1 of the ETA
	Resistance to fire	EN 13501-2: 2007+A1:2009 and EN 13501-2: 2016	Clause 3.1.2 of the ETA and Annex J-1 of the ETA
BWR 3	Air permeability	EN 1026:2016	Clause 3.2.1 of the ETA
	Water permeability	No performance assessed	
	Content, emission and/or release of dangerous substances	EAD 350454-00-1104 clause 2.2.5	Clause 3.2.3 of the ETA
BWR 4	Mechanical resistance and stability	No performance assessed	
	Resistance to impact / movement	No performance assessed	
	Adhesion	No performance assessed	
	Durability	EAD 350454-00-1104 clause 2.2.9	Clause 3.3.4 of the ETA
BWR 5	Airborne sound insulation	EN ISO 10140-2: 2010	Clause 3.4.1 of the ETA
BWR 6	Thermal properties	EN 12667:2001 and EN 12664:2001	Clause 3.5.1 of the ETA
	Water vapour permeability	No performance assessed	

3.1 Safety in case of fire (BWR 2)

3.1.1 Reaction to fire

The components of "ZZ M20" were assessed according to EAD 350454-00-1104 clause 2.2.1 and classified according to EN 13501-1:2007+A1:2009.

Component	Class according to EN 13501-1:2007+A1:2009
ZZ 230	E
ZZ 333	E
ZZ 451	E
ZZ 330	E
Intumescent inlay of ZZ 430	E
Sheet steel housing of ZZ 430	A1

3.1.2 Resistance to fire

"ZZ M20" was tested according to EAD 350454-00-1104 clause 2.2.2, prEN 1366-3.2:N185:2007-07 and EN 1366-3:2009 in conjunction with EN 1363-1:1999 and EN 1363-1:2012.

Based upon the gained test results and the field of application specified within prEN 1366-3.2:N185:2007-07 and EN 1366-3:2009 "ZZ M20" has been classified according to EN 13501-2:2007+A1:2009 and EN 13501-2:2016. The individual fire resistance classes are listed in Annex J-1 of the ETA.

The maximum fire resistance class of the penetration seal in vertical or horizontal separating element depends on the fire resistance class of the penetrating elements. The fire resistance class of the penetration seal is reduced to the fire resistance class of the penetrating element with the lowest fire resistance classification.

The resistance to fire classification listed in Annex J-1 of the ETA is only valid if "ZZ M20" is installed according to Annex A-1 to A-7 of the ETA.

3.2 Hygiene, health and the environment (BWR 3)

3.2.1 Air permeability

The air permeability of "ZZ 230" with a thickness of 144 mm was tested according to EN 1026:2016 in a flexible wall with a thickness of 100 mm. The aperture was lined with 1 layer of ≥ 20 mm thick calcium silicate boards (classification A1 according to EN 13501-1) with a width of 144 mm. The opening size was 560 mm x 360 mm (width x height), resp. 0,202 m².

"ZZ M20" was tested as blank penetration seal according to EAD 350454-00-1104 clause 2.2.3.

The components "ZZ 333", "ZZ 451", "ZZ 330" and "ZZ 430" were not included in these tests. The measurement accuracy was 0,01 m³/h.

The values given in the following table are the mean values from the pressure- and suction tests.

Δp in Pa	50	100	150	200	250	300	450	600
q/A in $m^3/(h \cdot m^2)$	1,12	1,79	2,38	2,92	3,79	4,42	5,98	7,65

The air permeability of "ZZ 230" with a thickness of 200 mm was tested according to EN 1026:2016 in a flexible wall with a thickness of 100 mm. The aperture was lined with 1 layer of ≥ 20 mm thick calcium silicate boards (classification A1 according to EN 13501-1) with a width of 200 mm. The opening size was 355 mm x 550 mm (width x height), resp. 0,195 m^2 .

"ZZ M20" was tested as blank penetration seal according to EAD 350454-00-1104 clause 2.2.3.

The components "ZZ 333", "ZZ 451", "ZZ 330" and "ZZ 430" were not included in these tests. The measurement accuracy was 0,01 m^3/h .

The values given in the following table are the mean values from the pressure- and suction tests.

Δp in Pa	50	100	150	200	250	300	450	600
q/A in $m^3/(h \cdot m^2)$	0,82	1,43	1,74	2,28	3,07	3,74	4,97	6,61

The air permeability of "ZZ 330" with a thickness of 144 mm was tested according to EN 1026:2016 in a flexible wall with a thickness of 100 mm. The aperture was lined with 1 layer of ≥ 20 mm thick calcium silicate boards (classification A1 according to EN 13501-1) with a width of 144 mm. The opening size was 360 mm x 360 mm (width x height), resp. 0,130 m^2 .

"ZZ M20" was tested as blank penetration seal according to EAD 350454-00-1104 clause 2.2.3.

The components "ZZ 230", "ZZ 333", "ZZ 451" and "ZZ 430" were not included in these tests.

The values given in the following table are the mean values from the pressure- and suction tests.

Δp in Pa	50	100	150	200	250	300	450	600
q/A in $m^3/(h \cdot m^2)$	0,39	0,73	1,18	1,58	1,89	2,12	3,24	4,09

The air permeability of "ZZ 330" with a thickness of 200 mm was tested according to EN 1026:2016 in a flexible wall with a thickness of 100 mm. The aperture was lined with 1 layer of ≥ 20 mm thick type calcium silicate boards (classification A1 according to EN 13501-1) with a width of 200 mm. The opening size was 350 mm x 350 mm (width x height), resp. 0,123 m^2 .

"ZZ M20" was tested as blank penetration seal according to EAD 350454-00-1104 clause 2.2.3.

The components "ZZ 230", "ZZ 333", "ZZ 451" and "ZZ 430" were not included in these tests.

Up to a pressure difference of 600 Pa no air permeability was measured. The measurement accuracy of the test facility was 0,01 m³/h, so that the air permeability at $\Delta p = 600$ Pa is less than 0,08 m³/(h*m²).

The air permeability of "ZZ 333" with a thickness of 100 mm was tested according to EN 1026:2016 in a flexible wall with a thickness of 100 mm. The aperture was lined with 1 layer of ≥ 20 mm thick type calcium silicate boards (classification A1 according to EN 13501-1) with a width of 100 mm. The opening was filled on both sides of the flexible wall with "ZZ 333" with a thickness of 15 mm to 25 mm flush to the surface of the flexible wall. The opening size was 100 mm x 100 mm (width x height), resp. 0,01 m².

"ZZ M20" was tested as blank penetration seal according to EAD 350454-00-1104 clause 2.2.3.

The components "ZZ 230", "ZZ 451", "ZZ 330" and "ZZ 430" were not included in these tests.

Up to a pressure difference of 600 Pa no air permeability was measured.

3.2.2 Water permeability

No performance assessed.

3.2.3 Content, emission and/or release of dangerous substances

The release of semi-volatile organic compounds (SVOC) and volatile organic compounds (VOC) has been determined for "ZZ 230", "ZZ 333", "ZZ 451" and "ZZ 330" according to EAD 350454-00-1104 clause 2.2.5.1 and prEN 16516:2015. The loading factor used for emission testing was 0,007 m²/m³.

Component	Total emission of SVOC after 3 days in mg/m ³	Total emission of SVOC after 28 days in mg/m ³
ZZ 230	< 0,005	< 0,005
ZZ 333	< 0,005	< 0,005
ZZ 451	0,060	0,020
ZZ 330	0,024	0,011

Component	Total emission of VOC after 3 days in mg/m ³	Total emission of VOC after 28 days in mg/m ³
ZZ 230	0,008	0,006
ZZ 333	0,042	0,015
ZZ 451	< 0,005	< 0,005
ZZ 330	0,027	< 0,005

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3.3 Safety and accessibility in use (BWR 4)

3.3.1 Mechanical resistance and stability

No performance assessed.

3.3.2 Resistance to impact / movement

No performance assessed.

Provisions shall be taken to prevent a person from stepping onto a horizontal penetration seal or falling against a vertical penetration seal (e.g. by covering with a wire mesh).

3.3.3 Adhesion

No performance assessed.

3.3.4 Durability

All components of "ZZ M20" fulfil the requirements for the intended use condition.

"ZZ M20" is therefore appropriate for internal use with humidity equal to or higher than 85 % RH, excluding temperatures below 0 °C⁵, without exposure to rain or UV, and can – according to EAD 350454-00-1104 clause 2.2.9.3.1 – be categorized as Type Z₁. Since the requirements for Type Z₁ are met, also the requirements for Type Z₂ are fulfilled.

3.4 Protection against noise (BWR 5)

3.4.1 Airborne sound insulation

The airborne sound insulation of "ZZ 230" with a thickness of 144 mm was tested according to EN ISO 10140-2:2010 in a flexible wall with a thickness of 200 mm. The aperture was lined with 1 layers of ≥ 25 mm thick type calcium silicate boards (classification A1 according to EN 13501-1) with a width of 144 mm. The opening size was 350 mm x 350 mm (width x height), resp. 0,123 m².

"ZZ M20" was tested as blank penetration seal according to EAD 350454-00-1104 clause 2.2.10. The components "ZZ 333", "ZZ 451", "ZZ 330" and "ZZ 430" were not included in these tests.

The reached values for the airborne sound insulation in accordance with EN ISO 717-1:2013 are given in the following table.

D _{n,e,w} in dB	C in dB	C _{tr} in dB	R _w in dB	C in dB	C _{tr} in dB
64	-1	-6	44	-1	-6

The airborne sound insulation of "ZZ 230" with a thickness of 200 mm was tested according to EN ISO 10140-2:2010 in a flexible wall with a thickness of 200 mm. The aperture was lined with 1 layer of ≥ 20 mm thick type calcium silicate boards (classification A1 according to EN 13501-1) with a width of 200 mm. The opening size was 360 mm x 360 mm (width x height), resp. 0,130 m².

"ZZ M20" was tested as blank penetration seal according to EAD 350454-00-1104 clause 2.2.10. The components "ZZ 333", "ZZ 451", "ZZ 330" and "ZZ 430" were not included in these tests.

⁵ These uses apply for internal humidity class 5 in accordance with EN ISO 13788

The reached values for the airborne sound insulation in accordance with EN ISO 717-1:2013 are given in the following table.

D_{n,e,w} in dB	C in dB	C_{tr} in dB	R_w in dB	C in dB	C_{tr} in dB
68	-4	-11	49	-4	-11

The airborne sound insulation of "ZZ 330" with a thickness of 144 mm was tested according to EN ISO 10140-2:2010 in a flexible wall with a thickness of 200 mm. The aperture was lined with 1 layers of ≥ 25 mm thick calcium silicate boards (classification A1 according to EN 13501-1) with a width of 144 mm. The opening size was 350 mm x 350 mm (width x height), resp. 0,123 m².

"ZZ M20" was tested as blank penetration seal according to EAD 350454-00-1104 clause 2.2.10. The components "ZZ 230", "ZZ 333", "ZZ 451" and "ZZ 430" were not included in these tests.

The reached values for the airborne sound insulation in accordance with EN ISO 717-1:2013 are given in the following table.

D_{n,e,w} in dB	C in dB	C_{tr} in dB	R_w in dB	C in dB	C_{tr} in dB
62	-1	-5	42	-1	-5

The airborne sound insulation of "ZZ 330" with a thickness of 200 mm was tested according to EN ISO 10140-2:2010 in a flexible wall with a thickness of 200 mm. The aperture was lined with 1 layers of ≥ 20 mm thick calcium silicate boards (classification A1 according to EN 13501-1) with a width of 200 mm. The opening size was 360 mm x 360 mm (width x height), resp. 0,130 m².

"ZZ M20" was tested as blank penetration seal according to EAD 350454-00-1104 clause 2.2.10.

The components "ZZ 230", "ZZ 333", "ZZ 451" and "ZZ 430" were not included in these tests.

The reached values for the airborne sound insulation in accordance with EN ISO 717-1:2013 are given in the following table.

D_{n,e,w} in dB	C in dB	C_{tr} in dB	R_w in dB	C in dB	C_{tr} in dB
66	-1	-6	47	-1	-6

3.5 Energy economy and heat retention (BWR 6)

3.5.1 Thermal properties

The thermal properties of “ZZ 230” and “ZZ 330” were tested according to EN 12667:2001.

Component	$\lambda_{10,23/50}$ in W/(m*K)
ZZ 230	0,103
ZZ 330	0,088

The thermal properties of “ZZ 451” were tested according to EN 12664:2001.

Component	λ_{10} in W/(m*K)
ZZ 451	0,396

3.5.2 Water vapour permeability

No performance assessed.

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

4.1 AVCP system

According to the Decision 1999/454/EC⁶, amended by Decision 2001/596/EC⁷ of the European Commission the system of assessment and verification of constancy of performance (see Annex V of Regulation (EU) No 305/2011) is given in the following table.

Product(s)	Intended use(s)	Level(s) or class(es) (resistance to fire)	System of assessment and verification of constancy of performance
Fire Stopping and Fire Sealing Products	for fire compartmentation and/or fire protection or fire performance	any	1

In addition, according to the Decision 1999/454/EC, amended by Decision 2001/596/EC of the European Commission the system(s) of assessment and verification of constancy of performance, with regard to reaction to fire, is given in the following table.

Product(s)	Intended use(s)	Level(s) or class(es) (reaction to fire)	System of assessment and verification of constancy of performance
Fire Stopping and Fire Sealing Products	for uses subject to regulations on reaction to fire	A1*, A2*, B*, C*	1
		A1**, A2**, B**, C**, D, E	3
		(A1 to E)***, F	4
* Products/materials for which a clearly identifiable stage in the production process results in an improvement of the reaction to fire classification (e.g. an addition of fire retardants or a limiting of organic material) ** Products/materials not covered by footnote (*) *** Products/materials that do not require to be tested for reaction to fire (e.g. products/materials of class A1 according to Commission Decision 96/603/EC, as amended)			

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 the Technical Assessment Body Österreichisches Institut für Bautechnik.

The notified product certification body shall visit the factory at least twice a year for surveillance of the manufacturer.

Issued in Vienna on 26.07.2018
by Österreichisches Institut für Bautechnik

The original document is signed by:

Rainer Mikulits
Managing Director

⁶ Official Journal of the European Communities no. L 178, 14.7.1999, p. 52

⁷ Official Journal of the European Communities no. L 209, 2.8.2001, p. 33

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1 General

- > “ZZ M20” can be used in apertures in walls (vertical separating element) and floors (horizontal separating element) according to clause 2.1 of the ETA.
- > The penetration of cables, waveguides, conduits / tubes, metal pipes, plastic pipes and cable support constructions according to clause 2.1 of the ETA is permitted.
- > The total cross section of the installations (including insulation and cable support constructions) must not be more than 60 % of the opening size of the penetration seal.
- > Each cable, waveguide, conduit / tube, metal pipe and plastic pipe which is to be sealed off has to be protected by the appropriate precaution as described in clause 2 of Annex A-2 to A-6 of the ETA.

1.1 Pipe end configuration

- > For plastic pipes classified with pipe end configuration U/C the pipe end configuration can be U/C and C/C.
- > For metal pipes classified with pipe end configuration C/U the pipe end configuration can be C/U and C/C.
- > Plastic conduits were tested U/C.
- > Steel conduits / tubes were tested U/C.

1.2 Orientation of the penetrating elements

- > Conduits / tubes, metal pipes and plastic pipes have to be installed perpendicular to the surface of the penetration seal.
- > Metal pipes insulated with prefabricated pipe shells (e.g. “Rockwool 800”) according to clause 1 of the ETA can be installed in all angles between 90° and 45°.

1.3 Service support constructions

- > All types of cables, waveguides, conduits / tubes, metal pipes and plastic pipes – in flexible walls and rigid walls – have to be supported on both side of the separating element by steel cable trays (perforated or non-perforated), steel ladders or alternative service support constructions (e.g. pipe hangers) made of metal with a melting or decomposition point greater or equal than 945 °C for EI 60, or 1006 °C for EI 90, or 1049 °C for EI 120 (e.g. stainless steel or galvanized steel) according to the ETA-holder’s installation instructions.
- > All types of cables, waveguides, conduits / tubes, metal pipes and plastic pipes – in rigid floors – have to be supported at least on the top side of the separating element by steel cable trays (perforated or non-perforated), steel ladders or alternative service support constructions (e.g. pipe hangers) made of metal with a melting or decomposition point greater or equal than 945 °C for EI 60, or 1006 °C for EI 90, or 1049 °C for EI 120 (e.g. stainless steel or galvanized steel) according to the ETA-holder’s installation instructions.

ZZ M20

- Details for installation -

ANNEX A-1

- > Alternatively the thickness of the wall can be increased to at least 144 mm or 200 mm (depending on the fire resistance classification; see Annex J-1 of the ETA) by fitting a board frame, minimum 50 mm wide, around the opening (see Annex B-1 of the ETA). Minimum 1 layer of $\geq 12,5$ mm thick type F gypsum boards according to EN 520 (classification A2-s1,d0 according to EN 13501-1) or silicate- or calcium silicate boards (classification A1 according to EN 13501-1) with a minimum density of 450 kg/m^3 can be used. The aperture within the wall has to be lined with steel studs with a thickness of minimum 0,6 mm (construction and installation according to the ETA-holder's installation instructions).The board frame has to be installed and fixed according to the ETA-holder's installation instructions.
- > If the opening size is maximum 450 mm x 500 mm (width x height) and no aperture lining is necessary (in case the thickness of the wall is equal to the thickness of penetration seal) or a board frame is used, the whole cavity within the wall has to be filled with material wool (stone wool with classification A1 according to EN 13501-1, a minimum apparent density of 40 kg/m^3 and a melting point $\geq 1000 \text{ }^\circ\text{C}$ according to DIN 4102-17) minimum 100 mm around the aperture.
- > Joints between the aperture lining and the aperture have to be filled with "ZZ 333" or gypsum joint filler (non-combustible material with classification A2-s1,d0 or A1 according to EN 13501-1 which is dimensionally stable) on both sides of the penetration seal according to the ETA-holder's installation instructions.

2.2 Details for installation in rigid walls (see Annex B-2 and B-3 of the ETA)

- > For walls thinner than the minimum thickness of the penetration seal (144 mm or 200 mm; depending on the fire resistance classification, see Annex J-1 of the ETA) the opening shall be lined with minimum 2 layers of $\geq 12,5$ mm thick type F gypsum boards according to EN 520 (classification A2-s1,d0 according to EN 13501-1) or silicate- or calcium silicate boards (classification A1 according to EN 13501-1) with a minimum density of 450 kg/m^3 and a minimum thickness of 25 mm. The boards shall be at least 144 mm or 200 mm (depending on the fire resistance classification; see Annex B-3 and J-1 of the ETA) wide. The boards have to be installed and fixed according to the ETA-holder's installation instructions.
- > Alternatively the thickness of the wall can be increased to at least 144 mm or 200 mm (depending on the fire resistance classification; see Annex J-1 of the ETA) by fitting a board frame, minimum 50 mm wide, around the opening (see Annex B-3 of the ETA). Minimum 1 layer of $\geq 12,5$ mm thick type F gypsum boards according to EN 520 (classification A2-s1,d0 according to EN 13501-1) or silicate- or calcium silicate boards (classification A1 according to EN 13501-1) with a minimum density of 450 kg/m^3 can be used. The board frame has to be installed and fixed according to the ETA-holder's installation instructions.

<p>ZZ M20 - Details for installation -</p>	<p>ANNEX A-5</p>
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- > Joints between the aperture lining and the aperture have to be filled with “ZZ 333”, or gypsum joint filler or mineral mortar (non-combustible material with classification A2-s1,d0 or A1 according to EN 13501-1 which is dimensionally stable) on both sides of the penetration seal according to the ETA-holder’s installation instructions.

2.3 Details for installation in rigid floors (see Annex C-1 and C-2 of the ETA)

- > For floors thinner than penetration seals with a nominal thickness of 200 mm the opening shall be lined with minimum 2 layers of $\geq 12,5$ mm thick type F gypsum boards according to EN 520 (classification A2-s1,d0 according to EN 13501-1) or silicate- or calcium silicate boards (classification A1 according to EN 13501-1) with a minimum density of 450 kg/m³ and a minimum thickness of 25 mm. The boards shall be at least 200 mm wide (see Annex C-2 of the ETA). The boards have to be installed and fixed according to the ETA-holder’s installation instructions.
- > Alternatively the thickness of the floor can be increased to at least 200 mm by fitting a board frame, minimum 50 mm wide, around the opening (see Annex C-2 of the ETA). Minimum 1 layer of $\geq 12,5$ mm thick type F gypsum boards according to EN 520 (classification A2-s1,d0 according to EN 13501-1) or silicate- or calcium silicate boards (classification A1 according to EN 13501-1) with a minimum density of 450 kg/m³ can be used. The board frame has to be installed and fixed according to the ETA-holder’s installation instructions.
- > Joints between the aperture lining and the aperture have to be filled with “ZZ 333”, or gypsum joint filler or mineral mortar (non-combustible material with classification A2-s1,d0 or A1 according to EN 13501-1 which is dimensionally stable) on both sides of the penetration seal according to the ETA-holder’s installation instructions.
- > For penetration seals with a nominal thickness of 144 mm areas without penetrating element (free areas) have to be supported with steel elements at least every 180 mm on the bottom side of the floor. For penetration seals with a nominal thickness of 200 mm areas without penetrating element (free areas) have to be supported with steel elements at least every 500 mm on the bottom side of the floor. Alternatively a glass fabric according to the ETA-holder’s installation instruction can be installed at least every 180 mm between “ZZ 230” (For details see Annex F-1 of the ETA).

ZZ M20

- Details for installation -

ANNEX A-6

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3 Minimum working clearances

- > The minimum working clearances (a1, a2, a3; for pipes only linear arrangement is permitted, no clusters) and the minimum clearance between the penetration seals are specified in Annex D-1 of the ETA.

4 Subsequent addition (retrofitting) and removal

- > Subsequent addition (retrofitting) and removal of cables, waveguides, conduits / tubes, pipes and cable support constructions according to the ETA holder's installation instructions is allowed.
- > Retrofitting and removal without addition of cables, waveguides, conduits / tubes, pipes and cable support constructions shall be done according to the ETA holder's installation instructions and the regulations of Annex A-2, clause 2 of the ETA.

5 Transport and storage

- > The indications of the manufacturer regarding transport and storage (minimum and maximum storing temperature, maximum duration of storage) have to be followed.

6 Use, maintenance and repair

- > The fire resistance of the penetration seal shall not be negatively affected by future changes to buildings or building elements.
- > The assessment of the fitness for use is based on the assumption that necessary maintenance and repair if required is carried out in accordance with the manufacturer's instructions during the assumed intended working life.

ZZ M20

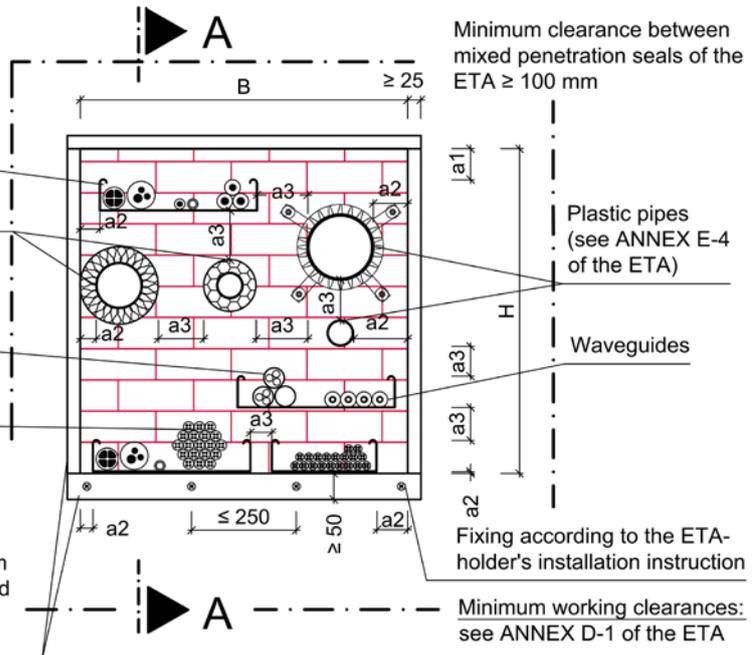
- Details for installation -

ANNEX A-7

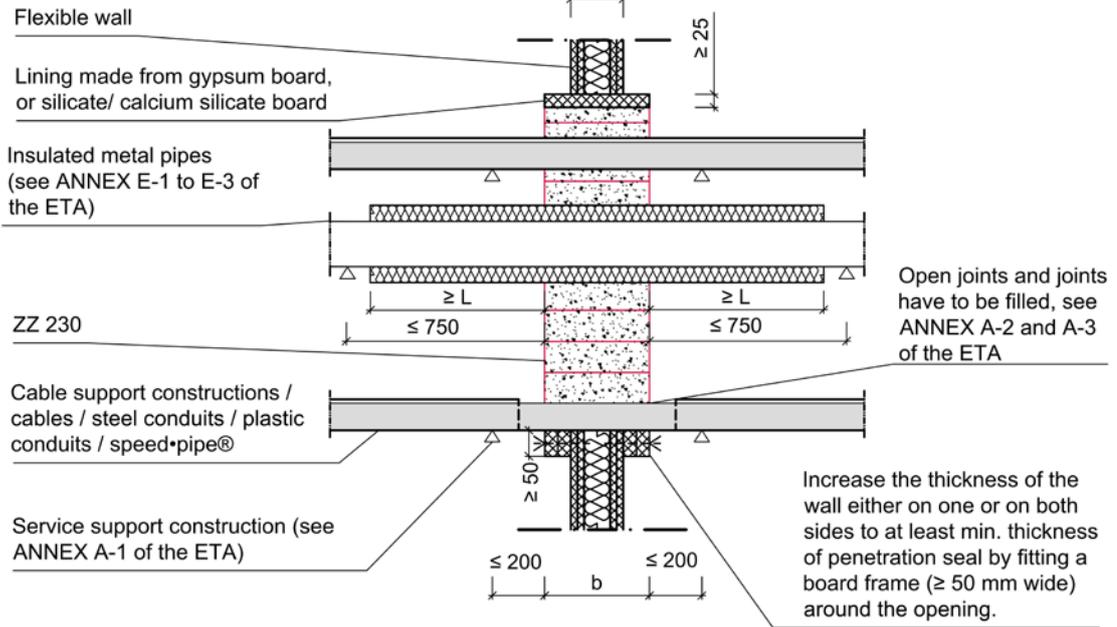
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View:

- Cable support constructions / cables / steel conduits / plastic conduits / speed-pipe®
- Insulated metal pipes (see ANNEX E-1 to E-3 of the ETA)
- Bundles $\varnothing \leq 100$ mm consisting of plastic conduits ($\varnothing \leq 63$ mm)
- Tied cable bundles $\varnothing \leq 100$ mm
- Lining (min. two layers of gypsum board of thickness $\geq 12,5$ mm or min. one layer of silicate/calcium silicate board of thickness ≥ 25 mm), alternatively frame made from gypsum board or silicate/ calcium silicate board ≥ 50 mm width around the opening (see ANNEX A-4 of the ETA)



Cross Section A-A:



All dimensions in mm

Separating element	Fire resistance classification	Wall thickness c [mm]	Max. opening size		Thickness of penetration seal b [mm]
			H [mm]	B [mm]	
Flexible wall	see ANNEX J-1 of the ETA	≥ 94	≤ 1000	≤ 600	see ANNEX J-1 of the ETA
			≤ 600	≤ 1000	

ZZ M20

- Installation in flexible wall, thickness c ≥ 94 mm -

ANNEX B-1

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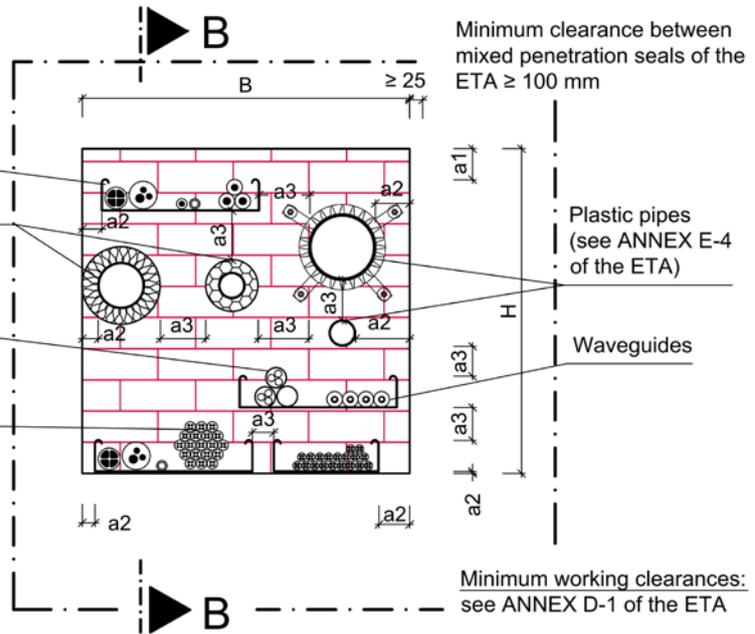
View:

Cable support constructions / cables / steel conduits / plastic conduits / speed•pipe®

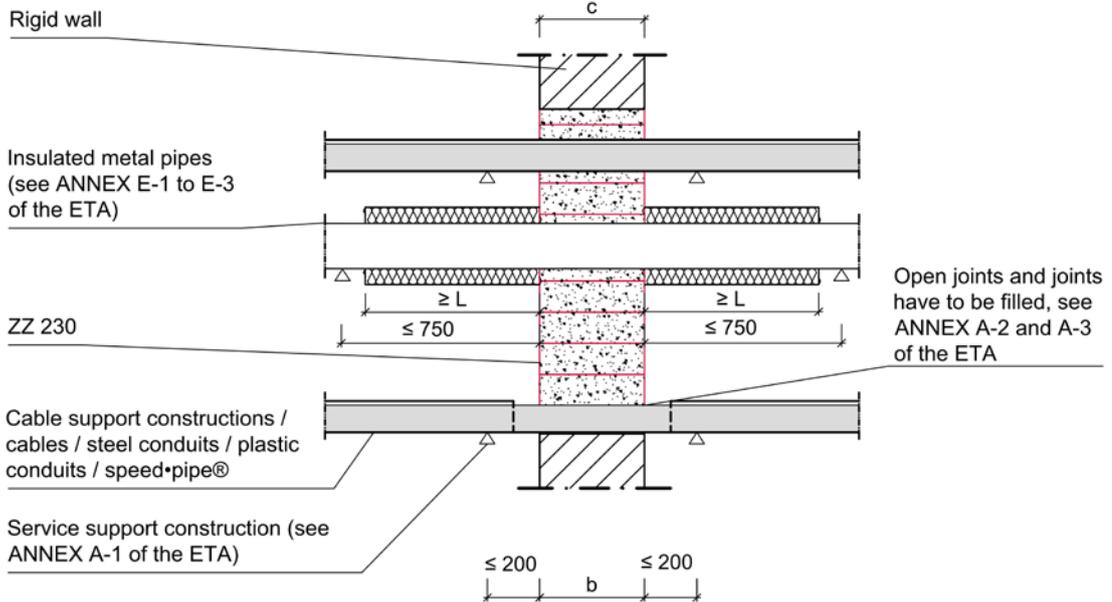
Insulated metal pipes (see ANNEX E-1 to E-3 of the ETA)

Bundles $\varnothing \leq 100$ mm consisting of plastic conduits ($\varnothing \leq 63$ mm)

Tied cable bundles $\varnothing \leq 100$ mm



Cross Section B-B:



All dimensions in mm

Separating element	Fire resistance classification	Wall thickness c [mm]	Max. opening size		Thickness of penetration seal b [mm]
			H [mm]	B [mm]	
Rigid wall	see ANNEX J-1 of the ETA	$\geq b$	≤ 1000	≤ 600	see ANNEX J-1 of the ETA
			≤ 600	≤ 1000	

ZZ M20

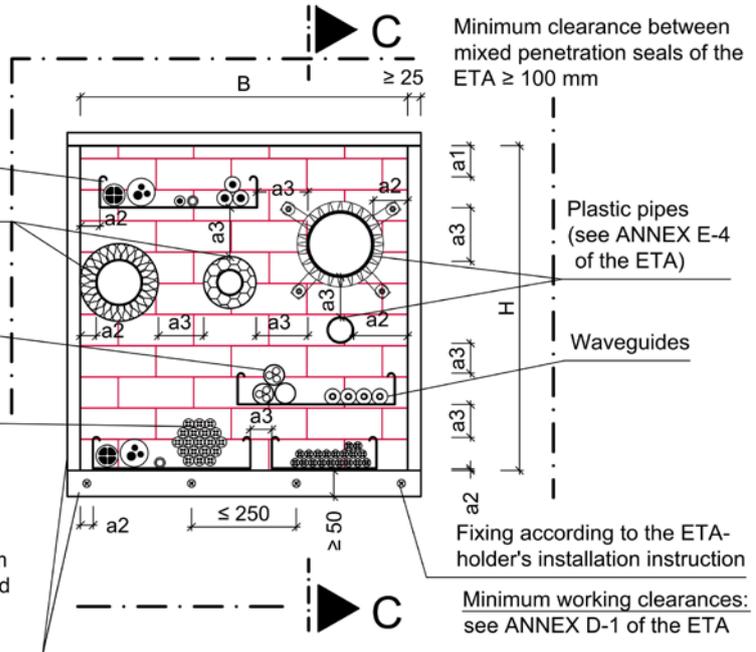
- Installation in rigid wall, thickness $c \geq b$ -

ANNEX B-2

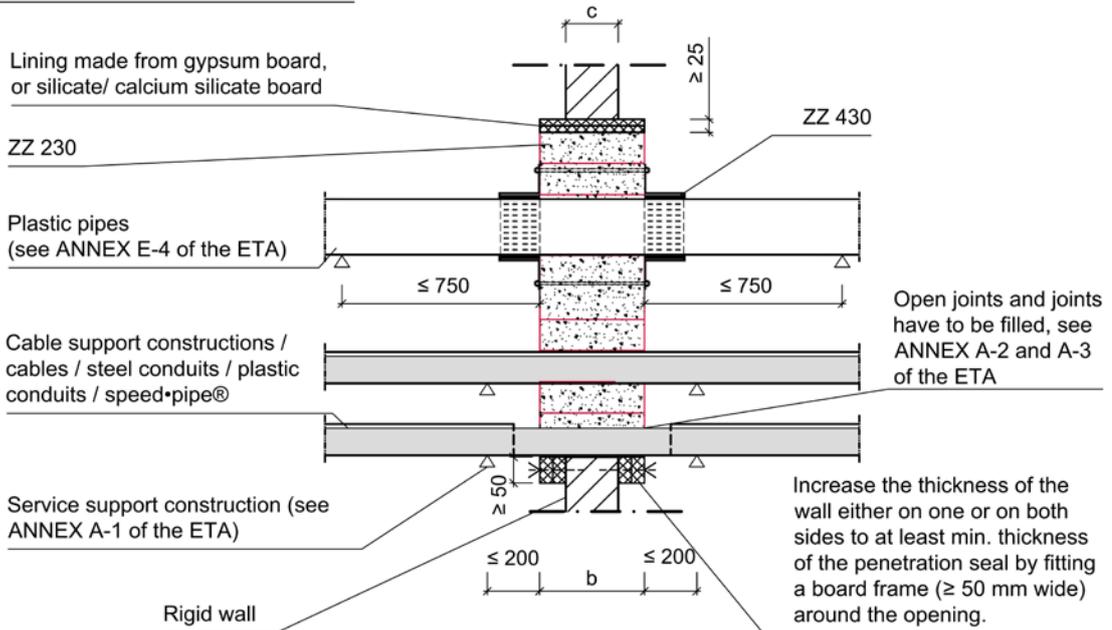
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View:

- Cable support constructions / cables / steel conduits / plastic conduits / speed•pipe®
- Insulated metal pipes (see ANNEX E-1 to E-3 of the ETA)
- Bundles $\varnothing \leq 100$ mm consisting of plastic conduits ($\varnothing \leq 63$ mm)
- Tied cable bundles $\varnothing \leq 100$ mm
- Lining (min. two layers of gypsum board of thickness $\geq 12,5$ mm or min. one layer of silicate/calcium silicate board of thickness ≥ 25 mm), alternatively frame made from gypsum board or silicate/ calcium silicate board ≥ 50 mm width around the opening (see ANNEX A-5 of the ETA)



Cross Section C-C:



All dimensions in mm

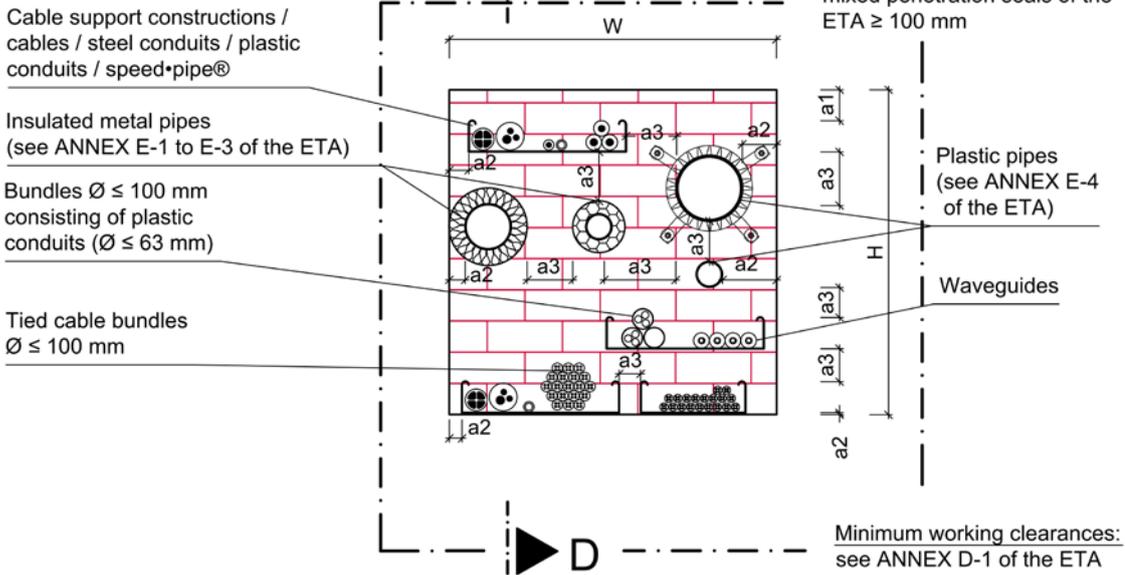
Separating element	Fire resistance classification	Wall thickness c [mm]	Max. opening size		Thickness of penetration seal b [mm]
			H [mm]	B [mm]	
Rigid wall	see ANNEX J-1 of the ETA	$100 \leq c < b$	≤ 1000	≤ 600	see ANNEX J-1 of the ETA
			≤ 600	≤ 1000	

ZZ M20

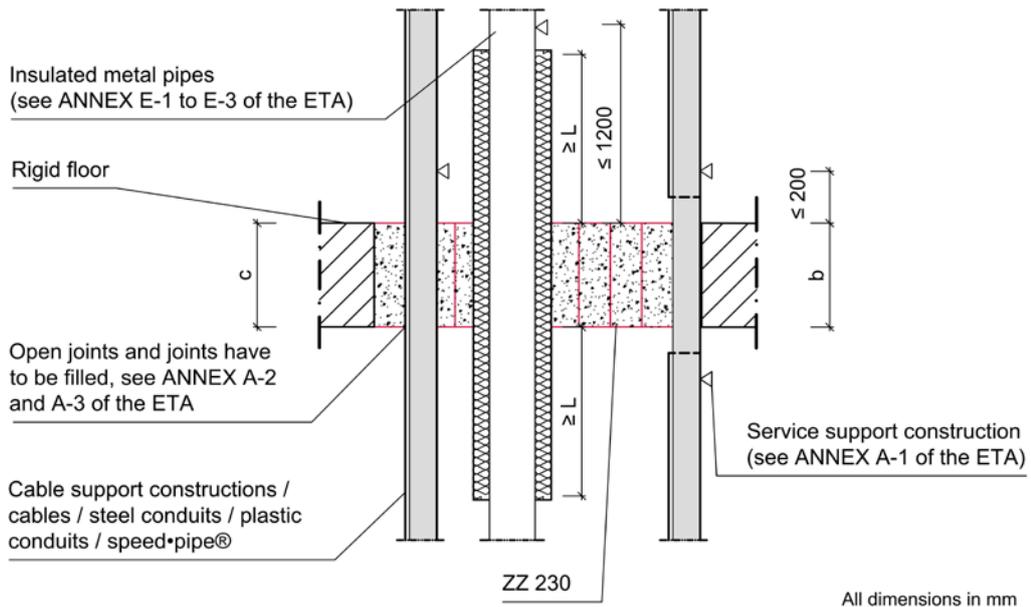
- Installation in rigid wall, thickness $100 \text{ mm} \leq c < b$ -

ANNEX B-3

Top View:



Cross Section D-D:



Separating element	Fire resistance classification	Floor Thickness c [mm]	Max. opening size *)		Thickness of penetration seal b [mm]
			Length/Width W [mm]	Height H [mm]	
Rigid floor	see ANNEX J-1 of the ETA	$\geq b$ (min. 150 mm)	b = 144 mm	b = 200 mm	≤ 375
			unlimited	unlimited	400
			6000	unlimited	450
			2250	4800	600
			1000	1300	700

*) The maximum length/width L depends on the height H of the penetration seal. For other combinations see ANNEX G-1 of the ETA.

ZZ M20

- Installation in rigid floor, thickness $c \geq b$ -

ANNEX C-1

Top View:

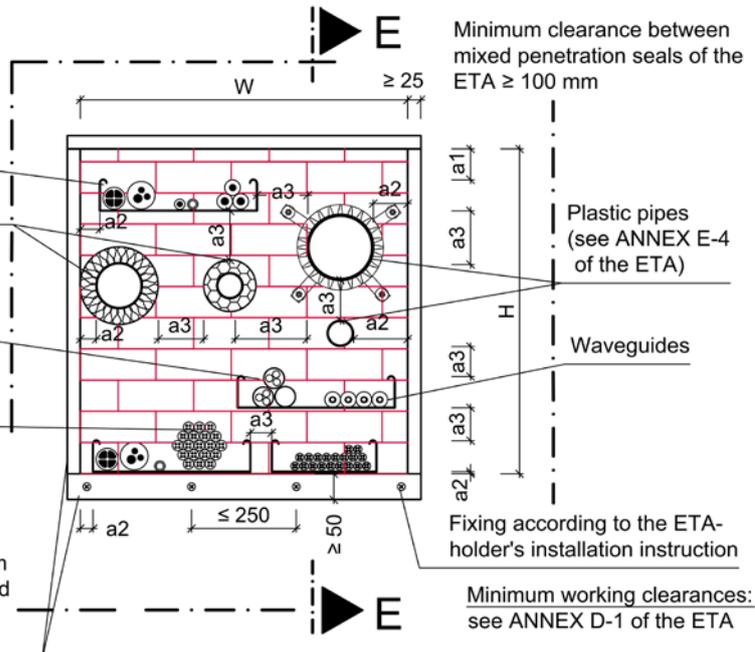
Cable support constructions / cables / steel conduits / plastic conduits / speed-pipe®

Insulated metal pipes (see ANNEX E-1 to E-3 of the ETA)

Bundles $\varnothing \leq 100$ mm consisting of plastic conduits ($\varnothing \leq 63$ mm)

Tied cable bundles $\varnothing \leq 100$ mm

Lining (min. two layers of gypsum board of thickness $\geq 12,5$ mm or min. one layer of silicate/calcium silicate board of thickness ≥ 25 mm), alternatively frame made from gypsum board or silicate/ calcium silicate board ≥ 50 mm width around the opening (see clause ANNEX A-6 of the ETA)



Cross Section E-E:

Plastic pipes (see ANNEX E-4 of the ETA)

Rigid floor

Lining made from gypsum board, or silicate/ calcium silicate board

ZZ 230

ZZ 430

Open joints and joints have to be filled, see ANNEX A-2 and A-3 of the ETA

Service support construction (see ANNEX A-1 of the ETA)

Increase the thickness of the floor either on one or on both sides to at least min. thickness of the penetration seal by fitting a board frame (≥ 50 mm wide) around the opening.

Cable support constructions / cables / steel conduits / plastic conduits / speed-pipe®

All dimensions in mm

Separating element	Fire resistance classification	Floor Thickness c [mm]	Max. opening size *)			Thickness of penetration seal b [mm]
			Length/Width W [mm] b = 144 mm	b = 200 mm	Height H [mm]	
Rigid floor	see ANNEX J-1 of the ETA	$150 \leq c < 200$	unlimited	unlimited	≤ 375	see ANNEX J-1 of the ETA
			6000	unlimited	400	
			2250	4800	450	
			1000	1300	600	
			---	1000	700	

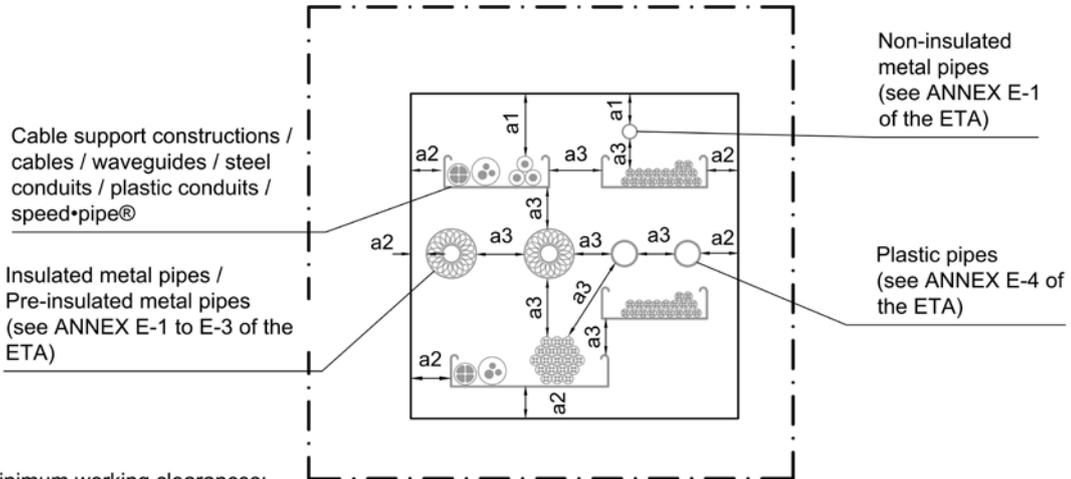
*) The maximum length/width L depends on the height H of the penetration seal. For other combinations see ANNEX G-1 of the ETA.

ZZ M20

- Installation in rigid floor, thickness $150 \text{ mm} \leq c < 200 \text{ mm}$ -

ANNEX C-2

View: Minimum working clearances



Minimum working clearances:

- a1: Penetrating element / top edge of penetration seal
- a2: Penetrating element / side or lower edge of penetration seal
- a3: Penetrating element / Penetrating element

Minimum working clearance			
Penetrating element	a1	a2	a3
Cables/ Waveguides/ Cable trays/ Conduits (incl. speed•pipe®)	50 mm	0 mm	<ul style="list-style-type: none"> • Cables/ Waveguides/ Cable trays/ Conduits 0 mm • Cable trays (vertical) 50 mm • Non-insulated metal pipes 60 mm • Other penetrating elements 50 mm
Mineral wool (see clause 1 of the ETA) insulated metal pipes	0 mm	0 mm	<ul style="list-style-type: none"> • Mineral wool insulated metal pipes 0 mm • Plastic pipes with pipe collar 0 mm • Non-insulated metal pipes 60 mm • Other penetrating elements 50 mm
Foamglas®-PSH insulated metal pipes	0 mm	0 mm	<ul style="list-style-type: none"> • Foamglas®-PSH insulated metal pipes 0 mm • Non-insulated metal pipes 60 mm • Other penetrating elements 50 mm
AF/Armaflex insulated metal pipes	35 mm	35 mm	<ul style="list-style-type: none"> • AF/Armaflex (thickness > 9 mm) insulated metal pipes 35 mm • AF/Armaflex (thickness 9 mm) insulated metal pipes 50 mm • Non-insulated metal pipes 60 mm • Other penetrating elements 50 mm
Non-insulated metal pipes	35 mm	35 mm	<ul style="list-style-type: none"> • Non-insulated metal pipes 60 mm • Other penetrating elements 60 mm
Pre-insulated metal pipes	0 mm	0 mm	<ul style="list-style-type: none"> • Pre- insulated metal pipes 0 mm • Non-insulated metal pipes 60 mm • Other penetrating elements 50 mm
Plastic pipes (without pipe collar)	50 mm	50 mm	<ul style="list-style-type: none"> • Plastic pipes (without pipe collar) 50 mm • Non-insulated metal pipes 60 mm • Other penetrating elements 50 mm
Plastic pipes (with pipe collar)	50 mm*	0 mm*	<ul style="list-style-type: none"> • Plastic pipes (with pipe collar) 0 mm • Mineral wool insulated metal pipes 0 mm • Non-insulated metal pipes 60 mm • Other penetrating elements 50 mm

*Measured from the surface of the pipe

ZZ M20

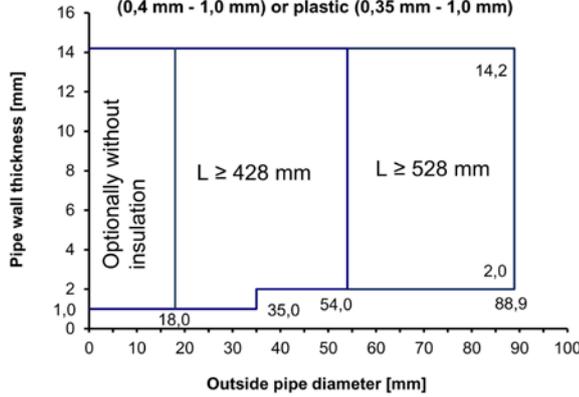
- Minimum working clearances -

ANNEX D-1

Field of application of metal pipes

Mineral wool (acc. to clause 1 of the ETA) insulated metal pipes acc. to clause 2.1 of the ETA (C/U) and (C/C)

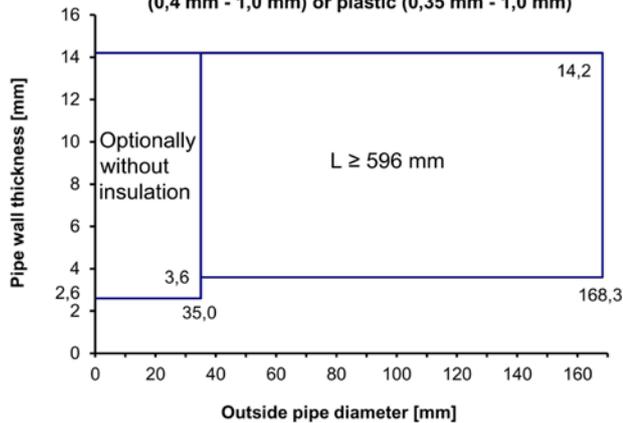
Metal pipes made of copper, steel, stainless steel, cast iron insulated with mineral wool, insulation optional sustained (LS, CS) or interrupted (LI, CI), optional clad with sheet steel (0,4 mm - 1,0 mm) or plastic (0,35 mm - 1,0 mm)



L measured from the surface of the penetration seal (see ANNEX B-1 to C-2 of the ETA).

Case	Density of mineral wool	Thickness of mineral wool
LI (local-interrupted)	≥ 90 kg/m ³	30 mm
LS (local-sustained)		30 mm
CI (continued-interrupted)		≥ 30 mm
CS (continued-sustained)		≥ 30 mm

Metal pipes made of steel, stainless steel, cast iron insulated with mineral wool, insulation optional sustained (LS, CS) or interrupted (LI, CI), optional clad with sheet steel (0,4 mm - 1,0 mm) or plastic (0,35 mm - 1,0 mm)



Case	Density of mineral wool	Thickness of mineral wool
LI (local-interrupted)	≥ 90 kg/m ³	50 mm
LS (local-sustained)		50 mm
CI (continued-interrupted)		≥ 50 mm
CS (continued-sustained)		≥ 50 mm

L measured from the surface of the penetration seal (see ANNEX B-1 to C-2 of the ETA).

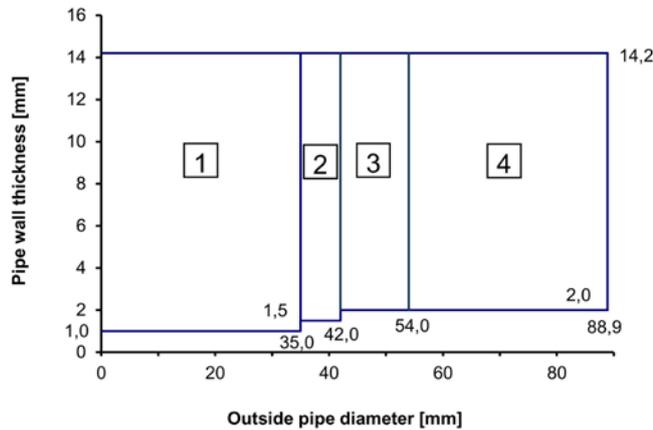
Interpolation between pipe diameters and wall thicknesses for metal pipes according to clause 2.1 of the ETA in flexible walls, rigid walls and rigid floors

ANNEX E-1

Field of application of metal pipes

AF/Armaflex insulated metal pipes (C/U) and (C/C)

Metal pipes made of copper, steel, stainless steel, cast iron insulated with AF/Armaflex, insulation sustained (LS or CS), minimum length 500 mm on both sides of mixed penetration seal

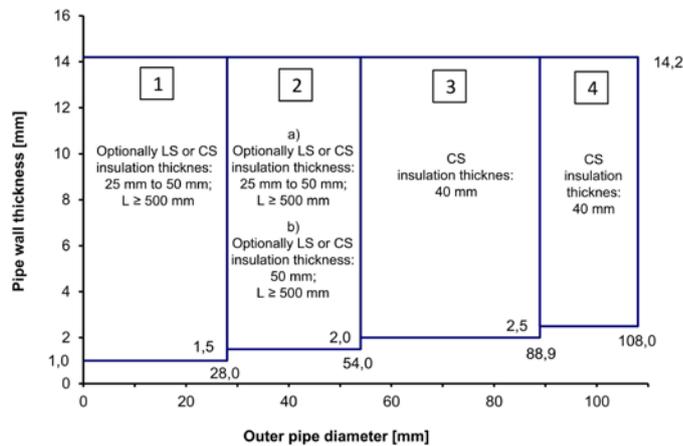


- 1 Insulation thickness 9,0 mm to 35,0 mm, $L \geq 500$ mm
- 2 Insulation thickness 9,0 mm to 36,5 mm, $L \geq 500$ mm
- 3 Insulation thickness 9,0 mm to 38,0 mm, $L \geq 500$ mm
- 4 Insulation thickness 41,5 mm, $L \geq 500$ mm

L measured from the surface of the penetration seal (see ANNEX B-1 to C-2 of the ETA).

Foamglas®-PSH insulated metal pipes (C/U) and (C/C)

Metal pipes made of copper, steel, stainless steel, cast iron insulated with Foamglas®-PSH



Fire resistance classification of Foamglas®-PSH insulated metal pipes for penetration seals with a minimum thickness of 200 mm

- 1 E 120-C/U / EI 120-C/U
- 2 a) Wall: E 120-C/U / EI 90-C/U; Floor: E 120-C/U / EI 120-C/U
- b) Wall: E 120-C/U / EI 120-C/U
- 3 Wall: E 120-C/U / EI 120-C/U; Floor: E 120-C/U / EI 90-C/U
- 4 Wall: E 120-C/U / EI 90-C/U; Floor: E 120-C/U / EI 120-C/U

L measured from the surface of the penetration seal (see ANNEX B-1 to C-2 of the ETA).

Interpolation between pipe diameters and wall thicknesses for metal pipes according to clause 2.1 of the ETA in flexible walls, rigid walls and rigid floors

ANNEX E-2

Field of application of metal pipes

Pre-insulated (CS) metal pipes used for air conditioning, heating and sanitary systems (C/U) and (C/C)

Penetrating element*	Outer diameter of the pipe (mm)	Pipe wall thickness (mm)	Insulation type	Insulation thickness (mm)	Additional precaution: ZZ 451
WICU® Eco	12,0	1,0	PUR	11,0	wall: one layer on both sides of the penetration seal (length** ≥ 150 mm, nominal thickness 3 mm) floor: one layer on the top side of the penetration seal (length** ≥ 150 mm, nominal thickness 3 mm)
	15,0	1,0		11,5	
	18,0	1,0		12,0	
	22,0	1,0		12,5	
	28,0	1,5		17,5	
	35,0	1,5		18,0	
	42,0	1,5		24,0	
	54,0	2,0		27,5	
WICU® Flex	12,0	1,0	PE	6	floor: one layer on the top side of the penetration seal (length** ≥ 150 mm, nominal thickness 3 mm)
	15,0	1,0		6	
	18,0	1,0		6	
	22,0	1,0		6	
WICU® Frio	6,0	1,0	PE	8	
	10,0	1,0		10	
	12,0	1,0		10	
	14,0	1,0		10	
	15,0	1,0		10	
	16,0	1,0		10	
	18,0	1,0		10	
	22,0	1,0		10	
WICU® Clim	6,35	0,762	PE	6	
	9,52	0,813		8	
	12,70	0,813		10	
	15,87	0,889		10	
	19,05	0,889		10	
	22,22	0,889		10	
Tubolit® Split / Tubolit® DuoSplit	6,35	0,8	PE	9	no additional precaution
	9,52	0,8		9	
	12,70	0,8		9	
	15,88	1,0		9	
	19,05	1,0		9	
	22,22	1,0		9	

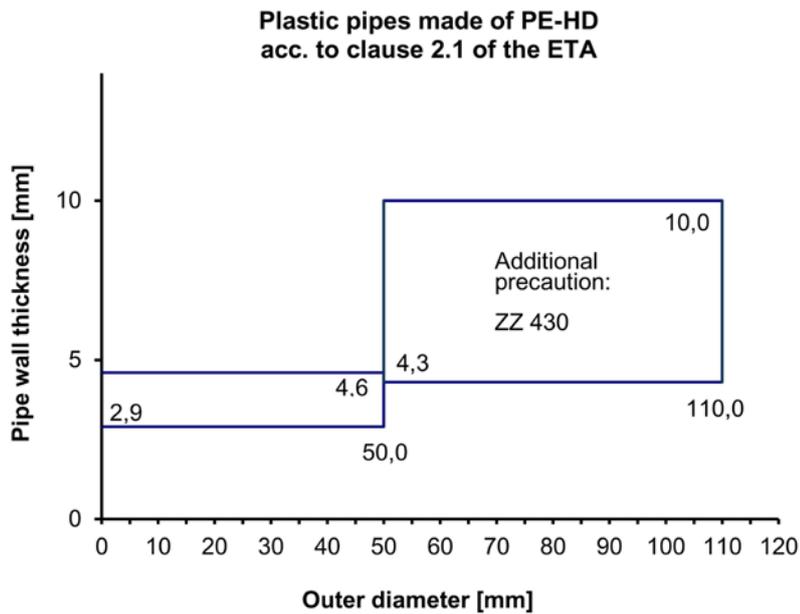
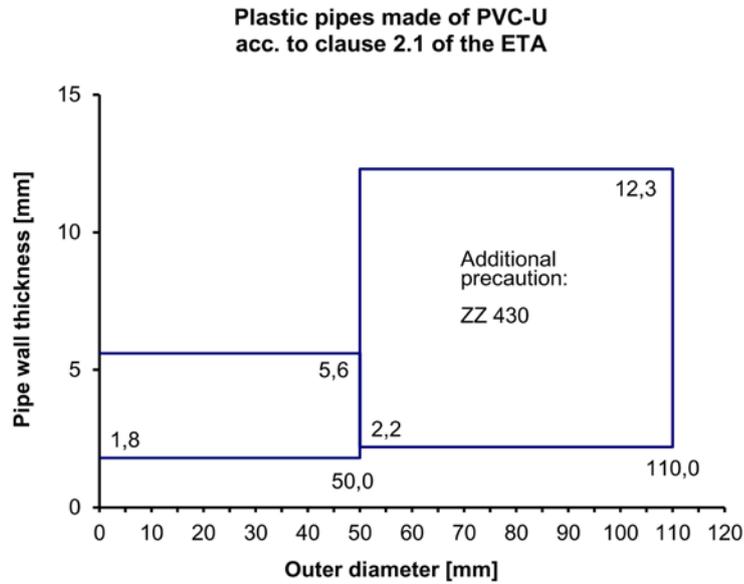
* copper pipes

** measured from the surface of the penetration seal

Pipe diameters and wall thicknesses for pre-insulated metal pipes according to clause 2.1 of the ETA in flexible walls, rigid walls and rigid floors

ANNEX E-3

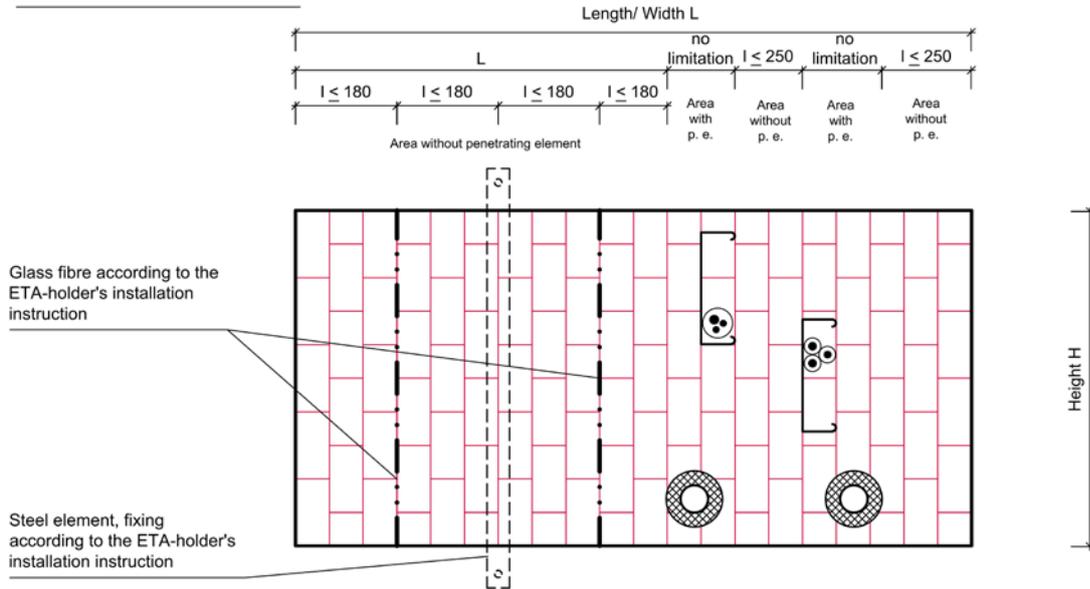
Field of application of plastic pipes (U/C) and (C/C):



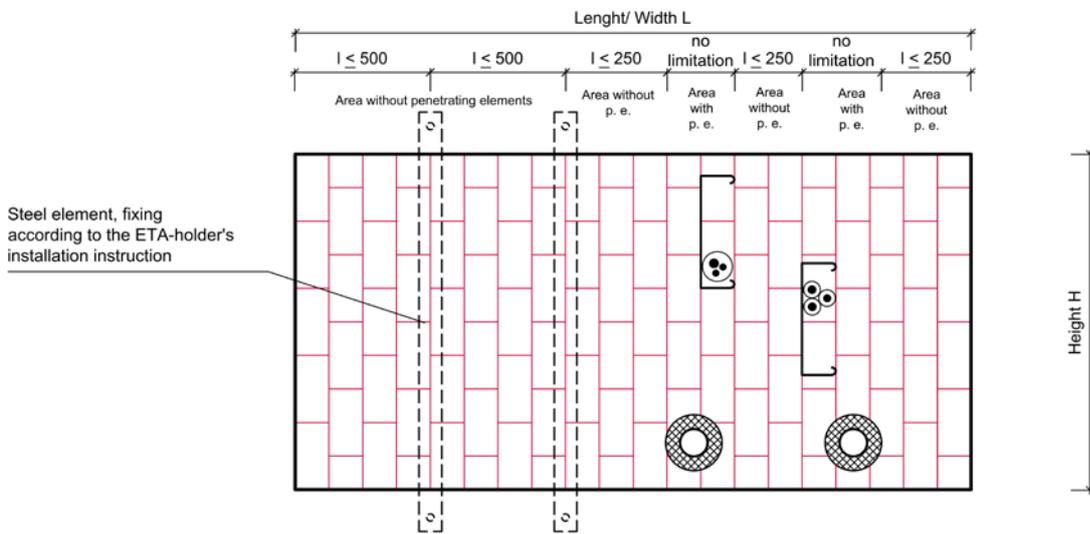
Interpolation between pipe diameters and wall thicknesses for plastic pipes according to clause 2.1 of the ETA in flexible walls, rigid walls and rigid floors

ANNEX E-4

Top view: Installation of glass fabric or steel element for $b = 144 \text{ mm}$



Top view: Installation of steel elements for $b = 200 \text{ mm}$



In case of installation in floor openings, free areas (without any elements penetrating the penetration seal) have to be supported with steel elements (minimum width of 40 mm and minimum thickness of 2 mm) on the bottom side of the floor. Alternatively it is possible to install a glass fabric according to the ETA-holder's installation instruction every 180 mm between "ZZ 230" (width of glass fabric $\geq b$). Areas with elements penetrating the penetration seal are not subject to any limitations.

All dimensions in mm

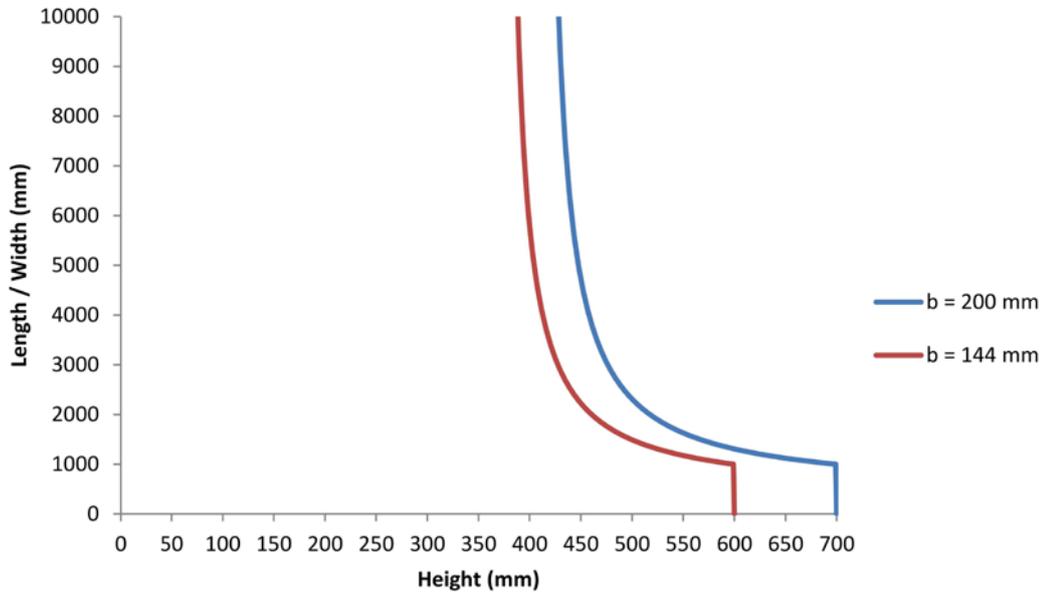
ZZ M20

- Rigid floors: Installation of glass fibre / steel elements -

ANNEX F-1

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Maximum dimensions of Mixed penetration seal "ZZ M20" in rigid floors



The maximum length (width) of the seal in rigid floors has to be calculated as follows:

$$length\ (width) = \frac{height}{(((c_{tested} / 2) * height) - 1)}$$

	Seal thickness b = 144 mm	Seal thickness b = 200 mm
Maximum height	600 mm	700 mm
Minimum perimeter length to seal area ratio (C _{tested})	0,005333 mm / mm ²	0,004857 mm / mm ²
length (width)	$\frac{height}{(((0,005333\text{mm}/\text{mm}^2 / 2) * height) - 1)}$ ex.: H = 500 mm → L = 1500 mm	$\frac{height}{(((0,004857\text{mm}/\text{mm}^2 / 2) * height) - 1)}$ ex.: H = 500 mm → L = 2333 mm

The area on the left side of the graph gives an overview of all possible combinations of length (width) and height where the minimum perimeter length to seal area ratio is ≥ C_{tested}.

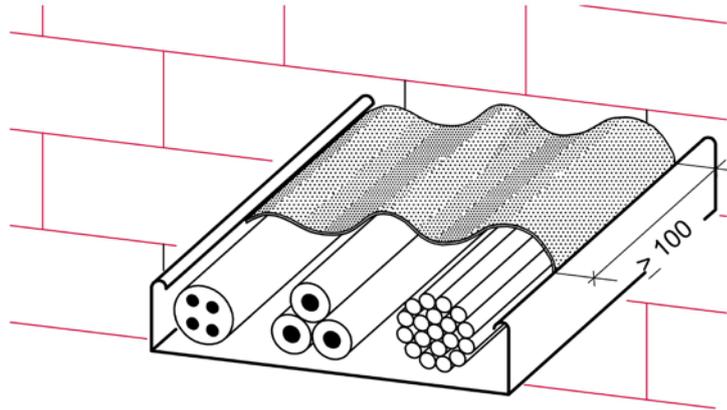
For a height smaller than 375 mm (b = 144 mm) and 412 mm (b = 200 mm) no limitation of length (width) is required.

Note: The dimensions of the graph are not true to scale.

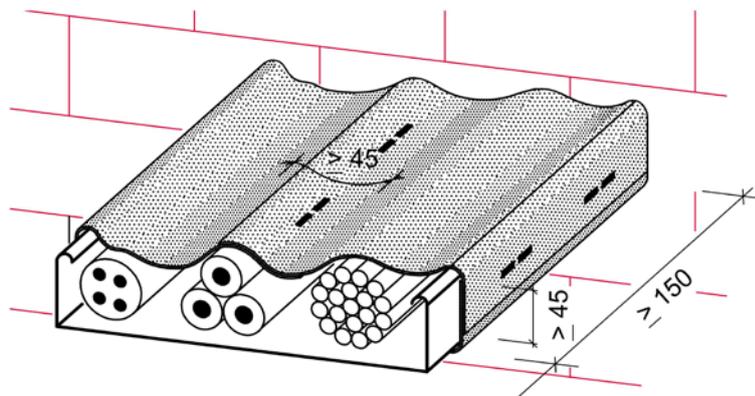
ZZ M20 - Installation in rigid floor – perimeter length to seal area ratio -	ANNEX G-1
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Arrangement of ZZ 451 for fire resistance classification EI 90 / EI 120 (see ANNEX J-1 of the ETA):

Step 1: Place a strip of min. 100 mm width of "ZZ 451" on top



Step 2: Wrap the cables/ cable bundles and cable trays with "ZZ 451"



Step 1, only for EI 120: On both sides of the Mixed penetration seal a strip of "ZZ 451" of at least 100 mm width has to be placed on top of the cables.

Step 2, for EI 90 and EI 120: The cables or cable trays have to be wrapped with strips of "ZZ 451" of at least 150 mm width on both sides.

The glass fabric reinforcement fixed to one side of the wrap has to be on the outside.

The ends of the wrap have to be fixed with two steel clips or steel wire according to the ETA-holder's installation instruction.

Strips have to overlap each other at least 45 mm.

All dimensions in mm

ZZ M20

- Arrangement of "ZZ 451" -

ANNEX H-1

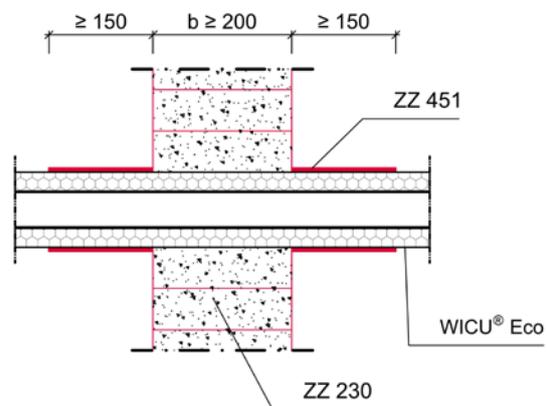
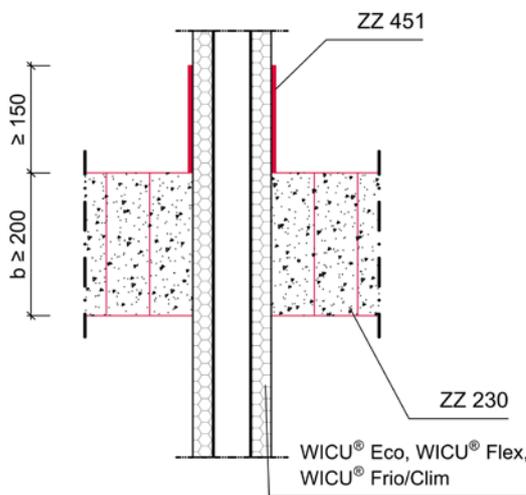
Arrangement of ZZ 451 for pre-insulated (CS) metal pipes used for air conditioning, heating and sanitary systems (C/U) and (C/C) (see ANNEX J-1 of the ETA):

Additional precaution for WICU[®] Flex and WICU[®] Frio/Clim, WICU[®] Eco

Additional precaution for WICU[®] Eco

Installation in floor:

Installation in wall:



All dimensions in mm

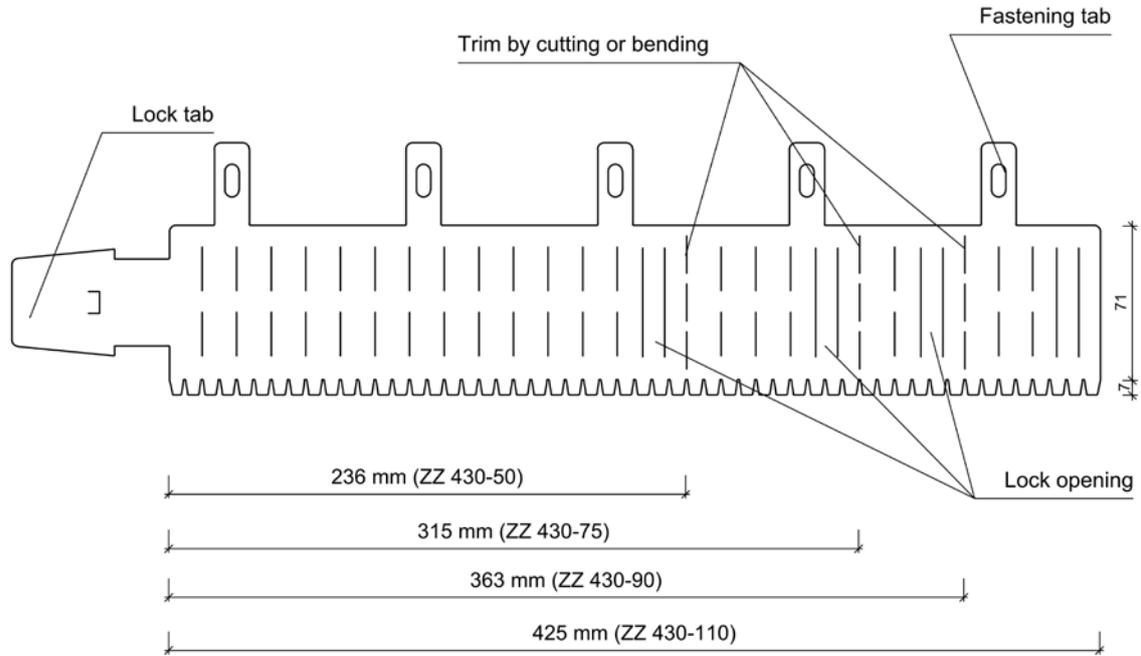
The pre-insulated metal pipes have to be wrapped with strips of ZZ 451 of at least 150 mm width. The glass fabric reinforcement fixed to one side of the wrap has to be on the outside. The ends of the wrap have to be fixed with two steel clips or steel wire according to the ETA-holder's installation instruction. Strips have to overlap each other at least 45 mm. Two pre-insulated metal pipes of type WICU[®] Flex and WICU[®] Frio/Clim in a distance of 0 mm can be wrapped with one concerted ZZ 451.

ZZ M20

- Arrangement of "ZZ 451" for pre-insulated metal pipes -

ANNEX H-2

Material: stainless steel (1.4301) acc. to EN 10088
 Sheet thickness: 0,6 mm +/- 0,1 mm



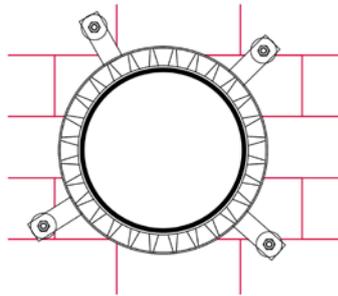
All dimensions in mm

Pipe outer diameter (mm)	Size of ZZ 430	Thickness of intumescent inlay (mm)	Width of intumescent inlay (mm)	Minimum number of fixing lugs to be fastened (pcs)
50	ZZ 430-50	7	70	3
75	ZZ 430-75	7	70	3
90	ZZ 430-90	7	70	3
110	ZZ 430-110	7	70	4

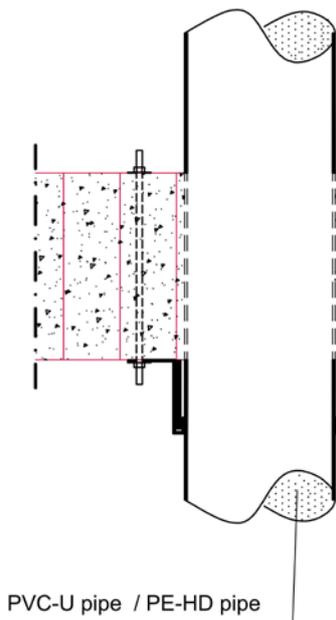
Description of "ZZ 430"

ANNEX H-3

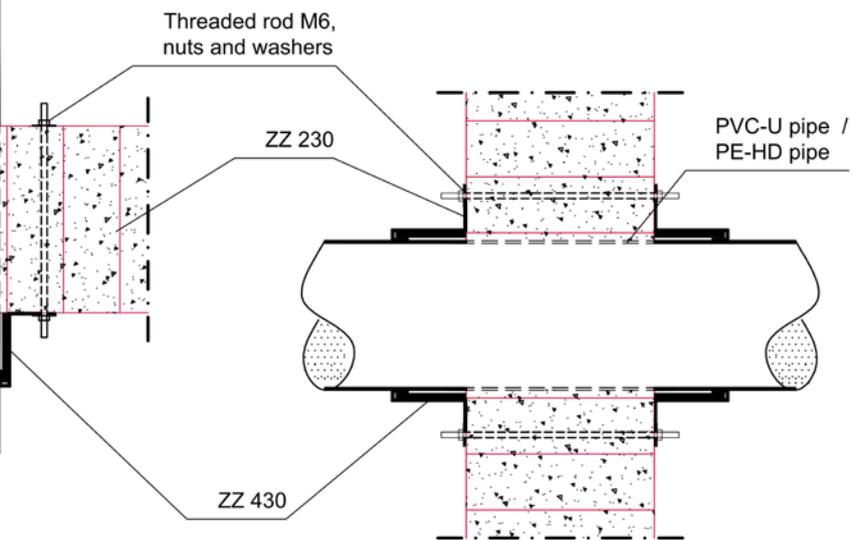
Installation of ZZ 430 for plastic pipes acc. to clause 2.1 of the ETA with a diameter of > 50 mm (see ANNEX J-1 of the ETA):



Installation in floor:



Installation in wall:



All dimensions in mm

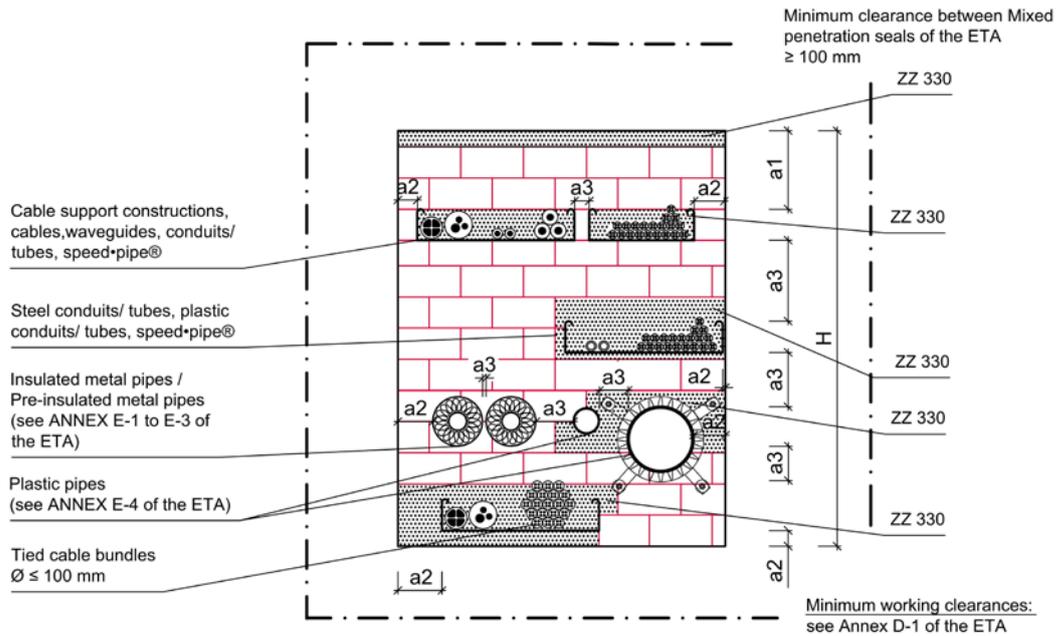
The threaded steel rods (thread size M6; length \geq thickness of the penetration seal) can be pushed through ZZ 230 / ZZ 330 and have to be fixed on both sides of the penetration seal with washers and nuts (corresponding to the outer diameter of the threaded steel rods).

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- Installation of "ZZ 430" for plastic pipes with a diameter > 50 mm -

ANNEX H-4

Application of ZZ 330:



Max. area to be closed with ZZ 330 is 450 mm x 500 mm (width x height) or 0,225 m² (see ANNEX A-2 to A-7 of the ETA).

All dimensions in mm

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- Application of "ZZ 330" -

ANNEX I-1

Fire resistance classifications:

Installation in flexible walls of at least 94 mm thickness, rigid walls of at least 100 mm thickness or rigid floors of at least 150 mm thickness

Penetrating element		Min. thickness of Mixed penetration seal	
		b ≥ 144 mm	b ≥ 200 mm
Cables	Sheathed electrical/ telecommunication /optical fibre cables up to a maximum outer diameter of 21 mm	E 60 EI 60	E 120 EI 90 / EI 120 ²⁾
	Sheathed electrical/ telecommunication /optical fibre cables up to a maximum outer diameter of 50 mm	E 60 EI 60	E 120 wall: EI 90 / EI 120 ²⁾ floor: EI 90 ^{1) or 2)} / EI 120 ²⁾
	Sheathed electrical/ telecommunication /optical fibre cables up to a maximum outer diameter of 80 mm	E 60 EI 60	E 120 EI 90 ^{1) or 2)} / EI 120 ²⁾
	Tied bundles up to 100 mm overall diameter containing sheathed electrical/ telecommunication /optical fibre cables up to a max. outer diameter of 21 mm	E 60 EI 60	E 120 EI 90 / EI 120 ²⁾
	Non-sheathed cables up to a maximum outer diameter of 24 mm	E 60 wall: EI 45 floor: EI 60	E 120 EI 60
	Waveguides**	-	E 120-U/C EI 120-U/C
Conduits / tubes	Steel conduits/ tubes up to Ø 16 mm with/ without cables	E 60-U/C EI 60-U/C	E 120-U/C EI 120-U/C
	Plastic conduits up to Ø 63 mm and bundles up to Ø 80 mm consisting of plastic conduits (Ø ≤ 63 mm) with/ without cables	E 60-U/C EI 60-U/C	E 120-U/C EI 120-U/C
	Plastic conduits up to Ø 63 mm and bundles up to Ø 100 mm consisting of plastic conduits (Ø ≤ 63 mm) with/ without cables	E 60-U/C EI 60-U/C	wall: E 120-U/C / EI 90-U/C floor: E 90-U/C / EI 90-U/C
	speed-pipe® up to Ø 12 mm and bundles up to Ø 80 mm consisting of speed-pipe® (Ø ≤ 12 mm) with/ without optical fibre cables	E 60-U/C EI 60-U/C	wall: E 120-U/C / EI 120-U/C floor: E 90-U/C / EI 90-U/C
Non-insulated metal pipes	Copper pipes up to a max. outer diameter of 18 mm*	E 60-C/U EI 60-C/U	E 120-C/U EI 60-C/U
	Steel pipes up to a max. outer diameter of 35 mm*	E 60-C/U EI 60-C/U	wall: E 120-C/U / EI 90-C/U floor: E 90-C/U / EI 90-C/U
Pre-insulated metal pipes	WICU® Frio pipes up to a max. outer diameter of 22 mm*	-	wall: E 120-C/U / EI 120-C/U floor: E 120-C/U ³⁾ / EI 120-C/U ³⁾
	WICU® Clim pipes up to a max. outer diameter of 22,22 mm*	-	wall: E 120-C/U / EI 120-C/U floor: E 120-C/U ³⁾ / EI 120-C/U ³⁾
	WICU® Flex pipes up to a max. outer diameter of 22 mm*	-	wall: E 120-C/U / EI 90-C/U floor: E 120-C/U ³⁾ / EI 90-C/U ³⁾
	WICU® Eco pipes up to a max. outer diameter of 54 mm*	-	E 90-C/U ³⁾ EI 90-C/U ³⁾
	Tubolit® Split / Duosplit pipes up to a max. outer diameter of 22,22 mm*	-	E 120-C/U EI 120-C/U
Insulated metal pipes	Mineral wool insulated metal pipes up to a max. outer diameter of 88,9 mm*	E 60-C/U EI 60-C/U	wall: E 120-C/U / EI 90-C/U floor: E 120-C/U / EI 120-C/U
	Mineral wool insulated steel pipes up to a max. outer diameter of 168,3 mm*	E 60-C/U EI 60-C/U	wall: E 120-C/U / EI 120-C/U floor: E 90-C/U / EI 90-C/U
	AF/Armaflex (thickness ≥ 9 mm) insulated metal pipes up to a max. outer diameter of 88,9 mm*	E 60-C/U EI 60-C/U	E 120-C/U EI 90-C/U
	Foamglas®-PSH insulated metal pipes up to a max. outer diameter of 108 mm*	-	see ANNEX E-2 of the ETA
Plastic pipes / -tubes	Plastic pipes up to a max. outer diameter of 50 mm*	E 60-U/C EI 60-U/C	E 120-U/C EI 120-U/C
	Plastic pipes up to a max. outer diameter of 110 mm*	E 60-U/U ⁴⁾ EI 60-U/U ⁴⁾	wall: E 120-U/U ⁴⁾ / EI 120-U/U ⁴⁾ floor: E 90-U/U ⁴⁾ / EI 90-U/U ⁴⁾

*) For permitted pipe wall thickness and insulation see ANNEX E-1 to E-4 of the ETA

**) For permitted waveguides see clause 2.1 of the ETA

- 1) Cables have to be coated at a length of minimum 30 mm (measured from the surface of the penetration seal) with ZZ 333 with a minimum thickness of 5 mm on both sides of the penetration seal
- 2) ZZ 451 has to be applied on both surfaces of wall or floor (For details see ANNEX H-1 of the ETA)
- 3) ZZ 451 has to be applied on both surfaces of wall or top surface of floor (For details see ANNEX H-2 of the ETA)
- 4) ZZ 430 has to be applied on both surfaces of wall or bottom surface of floor (For details see ANNEX H-4 of the ETA)

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- Fire resistance classification -

ANNEX J-1