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European Assessment Document for

Structural steel composite wall panels for building systems

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This European Assessment Document (EAD) has been developed taking into account up-to-date technical and scientific knowledge at the time of issue and is published in accordance with the relevant provisions of Regulation (EU) 305/2011 as a basis for the preparation and issuing of European Technical Assessments (ETA).

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1 SCOPE OF THE EAD

1.1 Description of the construction product

The *structural steel composite wall panels for building systems* (hereinafter referred to as "panel(s)") are a modular kit made of:

- internal cold-formed steel frame;
- double composite lightweight sheathings;
- self-drilling screws for frame-sheathing connections;
- hold-down connectors for top/bottom connection;
- self-drilling screws for hold-down-to-frame connections;
- internal thermal insulation layer (optional).

The internal thermal insulation, if present, is made of mineral wool.

A schematic view of the kit is given in Figure 1.1.1.

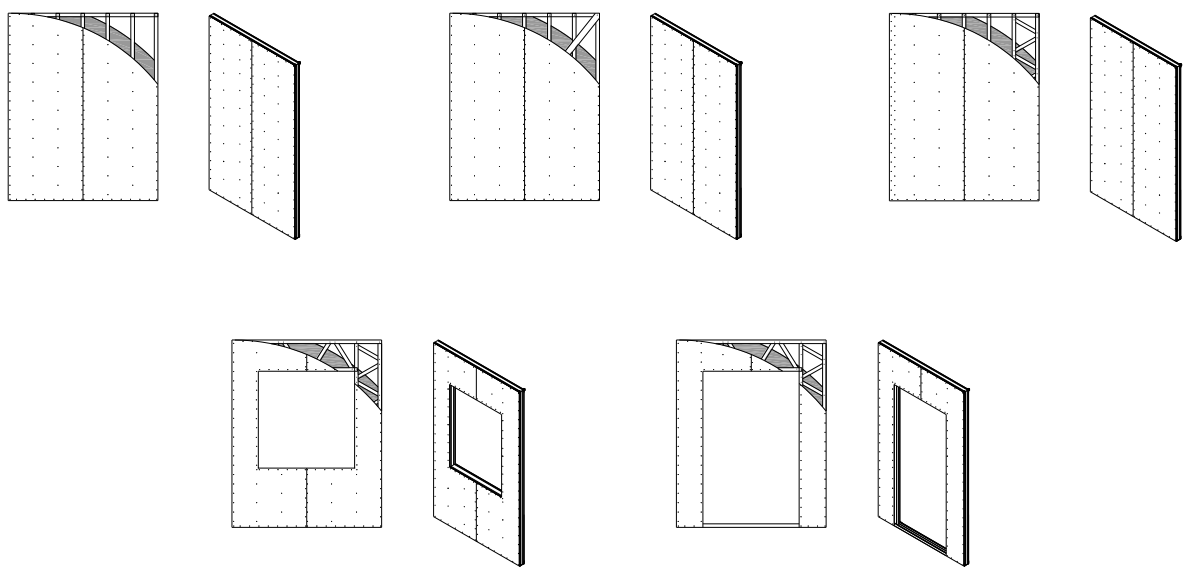

Figure 1.1.1 – Schematic frontal and axonometric views of the typical panel.

The internal frame modulus is characterised by cold-formed steel profiles connected each other through riveted connections. All the adopted profiles have a minimum of 275 g/m^2 of zinc surface protection (Z275 in accordance with EN 10346[1]) and constant cross-section. Several frame configurations are possible, with and without steel braces or truss members depending on the presence of window- or door-type openings. Main frame typologies are schematically summarized in Figure 1.1.2.

The sheathings are joined to the steel frame on both sides by means of self-drilling screws. The possible materials for sheathings are:

- fibre-cement flat sheet;
- cement-bonded board;
- cement-bonded reinforced lightweight concrete board;
- cement-bonded particleboard;
- gypsum plasterboard;
- gypsum board with fibrous reinforcement;

1 All undated references to standards in this EAD are to be understood as references to the dated versions listed in chapter 4.

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- oriented strand board.

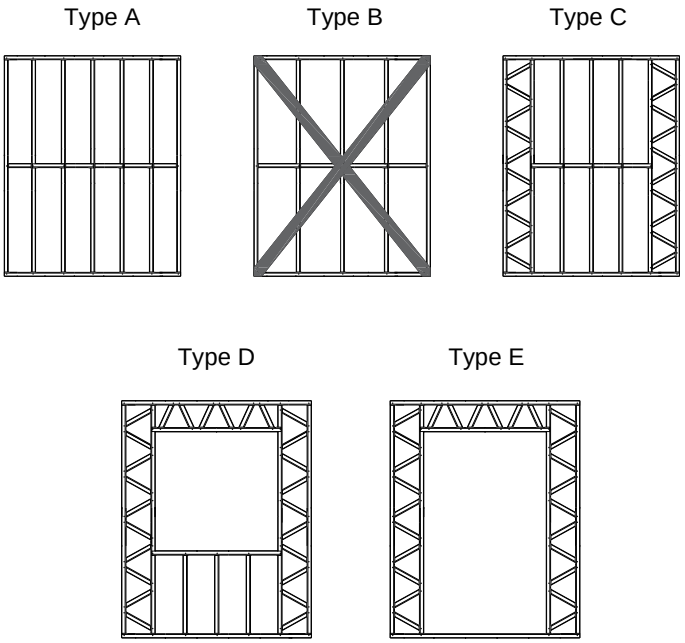

Figure 1.1.2 – Schematic view of the main cold-formed steel frame configurations

Panels are jointed with each other on-site in order to constitute walls of one or multi-storey buildings. Steel connections between panels are obtained by using metal fasteners which are not part of the kit. The connections between panels and substructures are done by means of shear connectors and hold-downs. The hold-downs are part of the kit. The shear connectors are not part of the kit.

Generally, the panel is covered by external finishings (e.g., claddings or plasters) in order to be protected against direct outdoor environment. The finishings are not part of the kit.

The product is not covered by a harmonised European standard (hEN).

Concerning product packaging, transport, storage, 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, maintenance, replacement and repair of the product as he considers necessary.

It is assumed that the product will be installed according to the manufacturer's instructions or (in absence of such instructions) according to the usual practice of the building professionals.

Relevant manufacturer's stipulations, e.g., with regard to the intended end use conditions, having influence on the performance of the product covered by this European Assessment Document shall be considered for the determination of the performance and detailed in the ETA as long as the details of the assessment methods as laid down in this EAD are respected.

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1.2 Information on the intended use(s) of the construction product

1.2.1 Intended use(s)

The structural steel composite wall panels for building systems are used as load-bearing and earthquake resistant wall panels for one or multi-storey buildings.

1.2.2 Working life/Durability

The assessment methods included or referred to in this EAD have been written based on the manufacturer's request to take into account a working life of the structural steel composite wall panels for building systems for the intended use of 50 years when installed in the works (provided that the structural steel composite wall panels for building systems is subject to appropriate installation (see 1.1)). These provisions are based upon the current state of the art and the available knowledge and experience.

When assessing the product, the intended use as foreseen by the manufacturer shall be taken into account. The real working life may be, in normal use conditions, considerably longer without major degradation affecting the basic requirements for works[2].

The indications given as to the working life of the construction product cannot be interpreted as a guarantee neither given by the product manufacturer or his representative nor by EOTA when drafting this EAD nor by the Technical Assessment Body issuing an ETA based on this EAD, but are regarded only as a means for expressing the expected economically reasonable working life of the product.

1.3 Specific terms used in this EAD

1.3.1 Panel configuration

Combination of specific cold-formed steel frame, sheathings, self-drilling screws, hold-down connectors, and internal thermal insulation layer (if present).

1.3.2 Symbols

A	[kNmm]	area under the envelope curve from zero to ultimate displacement (Δ_u) of the specimen
a	[mm]	panel height
b	[mm]	panel width
c	[mm]	initial diagonal length of the panel
c_m	[J/kg·K]	specific heat-capacity of the kit components
K_e	[kN/mm]	secant stiffness obtained at 40% of the maximum load P_u
K^+_e, K^-_e	[kN/mm]	secant stiffness values obtained at 40% of the maximum load values P^+_u, P^-_u
P	[kN]	lateral force recorded during the experimental test on the panel
P_u	[kN]	maximum recorded lateral force during the experimental test on the panel under monotonic lateral load

[2] The real working life of a 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 the 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 to above.

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P^{+}_{u}, P^{-}_{u}	[kN]	maximum recorded lateral force values during the experimental test on the panel under cyclic lateral load
P^{+}_{yield}, P^{-}_{yield}	[kN]	lateral force values obtained at the yielding condition on the simplified elastic-plastic (P-Δ) curve
R	[m²K/W]	thermal resistance of the kit components
R_T	[m²K/W]	total thermal resistance of the panel
R_w	[dB]	weighted sound reduction index of the panel
Y_{mn}	[W/(m²·K)]	periodic thermal admittance
α	[-]	amplification factor of the imposed maximum displacement of each primary cycle beyond the reference displacement Δ_R
Δ	[mm]	lateral top-displacement values recorded during the experimental test on the panel
Δ_R	[mm]	reference displacement for the definition of the load history of the cyclic tests
Δt	[h]	time shift
Δ^{+}_{u}, Δ^{-}_{u}	[mm]	ultimate lateral top displacement
Δ^{+}_{yield}, Δ^{-}_{yield}	[mm]	lateral top displacement values obtained at the yielding condition on the simplified elastic-plastic (P-Δ) curve
f	[-]	decrement factor
λ	[W/(m·K)]	thermal conductivity of the kit components
ρ	[kg/m³]	density of the kit components

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2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the product

Table 2.1.1 shows how the performance of the structural steel composite wall panels for building systems is assessed in relation to the essential characteristics.

Table 2.1.1 Essential characteristics of the product and methods and criteria for assessing the performance of the product in relation to those essential characteristics

No	Essential characteristic	Assessment method	Type of expression of product performance
Basic Works Requirement 1: Mechanical resistance and stability			
1	In-plane resistance and stiffness of the panel for increasing quasi-static lateral loading	2.2.1	Level and description P_u [kN] K_e [kN/mm]
2	In-plane cyclic resistance and stiffness of the panel under lateral load	2.2.2	Level and description P^+_u, P^-_u, P^+_{yield}, P^-_{yield} [kN] K^+_e, K^-_e [kN/mm] Δ^+_{yield}, Δ^-_{yield}, Δ^+_u, Δ^-_u [mm]
Basic Works Requirement 2: Safety in case of fire			
3	Reaction to fire	2.2.3	Class
4	Propensity to undergo continuous smouldering	2.2.4	Description
5	Resistance to fire	2.2.5	Class
Basic Works Requirement 3: Hygiene, health and the environment			
6	Content, emission and/or release of dangerous substances	2.2.6	Level and description
Basic Works Requirement 4: Safety and accessibility in use			
7	Impact resistance of the panels	2.2.7	Level
Basic Works Requirement 5: Protection against noise			
8	Airborne sound insulation	2.2.8	Level and description R_w [dB]
Basic Works Requirement 6: Energy economy and heat retention			
9	Thermal resistance	2.2.9	Level R_T [m²K/W]
10	Thermal inertia	2.2.10	Level ρ [kg/m³], c_m [J/(kgK)], λ [W/(m K)] Y_{mn} [W/(m²·K)], Δt [h], f [-]

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2.2 Methods and criteria for assessing the performance of the product in relation to essential characteristics of the product

This chapter is intended to provide instructions for TABs. Therefore, the use of wordings such as “shall be stated in the ETA” or “it has to be given in the ETA” shall be understood only as such instructions for TABs on how results of assessments shall be presented in the ETA. Such wordings do not impose any obligations for the manufacturer, and the TAB shall not carry out the assessment of the performance in relation to a given essential characteristic when the manufacturer does not wish to declare this performance in the Declaration of Performance.

If for any components covered by harmonised standards or European Technical Assessments the manufacturer of the component has included the performance regarding the relevant essential characteristic in the Declaration of Performance, retesting of that component for issuing the ETA under the current EAD is not required.

A complete description of the kit with reference to the panel configuration(s) shall be provided in the ETA. The panel configuration (see 1.3.1) is intended as a combination of specifically: cold-formed steel frame, sheathings, self-drilling screws, hold-down connectors, and internal thermal insulation layer (if present). Specifically, for each component of the kit, at least the following information shall be included: configuration or typology, geometry, materials, mechanical properties, and location within the kit.

2.2.1 In-plane resistance and stiffness of the panel for increasing quasi-static lateral loading

Purpose of the assessment

The aim of the test is the evaluation of the in-plane response of the panel under quasi-static monotonically increasing lateral loading.

Assessment method

The in-plane response of the panel shall be determined for each panel configuration in accordance with the test method described in Annex A of this EAD.

Expression of results

The following main mechanical parameters of the panel shall be reported in the ETA as described in Annex A, clause A.7:

- the maximum recorded lateral force P_u [kN];
- the secant stiffness K_e [kN/mm] at 40% of the maximum load (P_u).

Given the panel configuration (see 1.1 and 1.3.1), the maximum recorded lateral load (P_u) and the secant stiffness (K_e) at 40% of the maximum load shall be determined for each test. The average value and the coefficient of variation (CoV) of P_u shall be computed and reported in the ETA. The average value of the secant stiffness (K_e) shall be assumed as design secant stiffness, i.e., no statistical analysis of the results is needed and given in the ETA.

2.2.2 In-plane cyclic resistance and stiffness of the panel under lateral load

Purpose of the assessment

The aim of the test is the evaluation of the in-plane response of the panel under quasi-static cyclic increasing lateral loading in order to simulate the effect of the seismic action.

Assessment method

The in-plane response of the panel shall be determined for each panel configuration in accordance with the test method described in Annex B of this EAD.

Expression of results

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Given the panel configuration, for each test the following main seismic-response parameters of the panel shall be reported in the ETA as defined in Annex B, clause B.7:

- maximum recorded lateral force P^{+}_{u}, P^{-}_{u} [kN];
- secant stiffness K^{+}_{e}, K^{-}_{e} [kN/mm] at 40% of the maximum load values (P^{+}_{u}, P^{-}_{u});
- yielding lateral force P^{+}_{yield}, P^{-}_{yield} [kN];
- lateral top displacement values Δ^{+}_{yield}, Δ^{-}_{yield} obtained at yielding [mm];
- ultimate lateral top displacement Δ^{+}_{u}, Δ^{-}_{u} [mm].

Given the panel configuration, in addition to the above-reported parameters, average values and CoVs of maximum recorded lateral forces (P^{+}_{u}, P^{-}_{u}), yielding strengths (P^{+}_{yield}, P^{-}_{yield}), yielding lateral top displacements (Δ^{+}_{yield}, Δ^{-}_{yield}) and ultimate lateral top displacements (Δ^{+}_{u}, Δ^{-}_{u}) shall be computed on the actual number of performed tests (see clause B.3) and reported in the ETA. CoVs shall be determined in accordance with EN 1990, Annex D, clause D.7.2, Formula (D.3). The average value of the secant stiffnesses (K^{+}_{e}, K^{-}_{e}) shall be assumed as design secant stiffness, i.e., no statistical analysis of the results is needed.

2.2.3 Reaction to fire

Purpose of the assessment

The purpose of the assessment method herein presented is the evaluation of the reaction to fire of the panel.

Assessment method

The reaction to fire performance of the kit depends on the reaction to fire performance of its components and shall be assessed on that basis.

Depending on the type of component, one of the following assessment methods shall be used:

a) The component is covered by another harmonised product specification. In this case, the reaction to fire performance shall be taken from its own declaration of performance, if such declaration is available and the related performance declared, as long as the conditions for which the classification is valid covers the application of the component in the kit.
b) The component is considered to satisfy the requirements for performance class A1 of the characteristic reaction to fire in accordance with the Commission Decision 96/603/EC, as amended by Commission Decisions 2000/605/EC and 2003/424/EC, without the need for testing based on it fulfilling the conditions set out in that Decision and its intended use being covered by that Decision. Therefore, the performance class of the component is A1.
c) The component is considered to satisfy the requirements for performance of the respective class of the characteristic reaction to fire in accordance with one of the Commission Decisions related to a classification without the need for further testing (CWT/CWFT Decisions) on the basis of it fulfilling the conditions set out in the respective Decision and its intended use being covered by that Decision.
   Therefore, the performance depending on its type and the conditions under which the component is used shall be taken from the respective Decision applicable for the component.
d) If none of the above cases "a)" to "c)" applies, testing of the component is necessary. The component shall be tested using the test method(s) relevant for the corresponding reaction to fire class in accordance with EN 13501-1. The component shall be classified in accordance with Commission Delegated Regulation (EU) No 2016/364 in connection with EN 13501-1.

The internal insulation layer made of mineral wool belongs to the case “d)”, i.e., testing of the component is necessary. The provisions concerning mounting and fixing as well as the rules for the extended application of the test results provided in EN 15715 shall be taken into account.

For testing of the sheathings, in addition to EN 13501-1, the following indications concerning preparation, mounting, and fixing of specimens, as well as extrapolation rules, apply, as detailed in the following:

- fibre-cement flat sheet: see clause 7.5 of EN 12467;
- cement-bonded board: see Annex C of EAD 210024-00-0504;

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- cement-bonded reinforced lightweight concrete board: see Annex C of EAD 210024-00-0504;
- cement-bonded particleboard: see clause 5.8 of EN 13986;
- gypsum plasterboard: see clause 2.2.12 of EAD 070001-02-0504;
- gypsum board with fibrous reinforcement: see clause 2.2.12 of EAD 070001-02-0504;
- oriented strand board: see clause 5.8 of EN 13986.

Expression of results

The reaction to fire of the components of the panel shall be represented by their fire reaction classes. The reaction to fire class of the kit, assumed as the worst class assessed for the components, shall be given in the ETA.

2.2.4 Propensity to undergo continuous smouldering

Purpose of the assessment

The purpose of the assessment method herein presented is the evaluation of the propensity to undergo continuous smouldering of the panel.

Assessment method

The propensity to undergo continuous smouldering of the components of the panels shall be tested and assessed in accordance with EN 16733.

The conditions and parameters that shall be taken into account in the test as well as the rules for the application of the test results are specified in Annex C. The performance of the kit shall be considered as the most onerous performance of the kit components in question.

Expression of results

In accordance with EN 16733, clause 11, the ETA shall specify the following information for the kit, depending on the outcome of the assessment:

- “The kit does not show propensity to undergo continuous smouldering”, or
- “The kit shows propensity to undergo continuous smouldering”, or
- "Assessment of the propensity to undergo continuous smouldering of the kit is not possible".

2.2.5 Resistance to fire

Purpose of the assessment

The purpose of the assessment method herein presented is the evaluation of the resistance to fire of the panel.

Assessment method

Each panel configuration shall be tested in accordance with EN 1365-1 in order to be classified in accordance with EN 13501-2. Test configuration shall be defined in accordance with EN 1365-1. Given the panel configuration, one test shall be carried out.

Expression of results

The fire resistance of the panels shall be represented in the ETA by the class obtained by experimental tests, along with the specification of the tested panel configurations.

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2.2.6 Content, emission and/or release of dangerous substances

The performance of the kit regarding the emissions and/or release and, where appropriate, the content of dangerous substances shall be assessed on the basis of the information provided by the manufacturer[3] after identifying the release scenarios taking into account the intended use(s) of the product and the Member States where the manufacturer intends his product to be made available on the market.

The identified intended release scenarios for this product and intended use with respect to dangerous substances are:

IA2: Product with indirect contact to indoor air (e.g., covered products) but possible impact on indoor air

2.2.6.1 Pentachlorophenol (PCP)

The test accordance with the standard CEN/TR 14823 shall be carried out only for wood treated with the preservatives which contain pentachlorophenol (PCP). At least two parallel analyses shall be carried out. If results differ by more than 10%, an additional analysis shall be performed. Calculation and expression of results shall be elaborated in accordance with clause 9 of CEN/TR 14823.

The product performance shall be stated in the ETA as [mg/kg] unit.

2.2.6.2 SVOC and VOC

For the intended use covered by the release scenario IA2, semi-volatile organic compounds (SVOC) and volatile organic compounds (VOC) shall be determined in accordance with EN 16516. The loading factor used for emission testing shall be 1,0 m^2/m^3. This essential characteristic is only relevant for panels with sheathings made of oriented strand boards (OSB).

The preparation of the test specimen shall be performed by using a representative sample of the sheathing installed in accordance with the manufacturer's product installation instructions or in absence of such instructions the usual practice of the building professionals. The size of the test specimen shall be chosen in consideration of the test chamber size and intended loading factor.

Once the test specimen has been produced, as described above, it shall immediately be placed in the emission test chamber. This time is considered the starting time of the emission test.

The test results shall be reported for the relevant parameters (e.g., chamber size, temperature and relative humidity, air exchange rate, loading factor, size of test specimen, conditioning, production date, arrival date, test period, test result) after 3 and/or 28 days testing.

The product performance shall be stated in the ETA as [$\mu g/m^3$ or mg/m^3] unit.

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3 The manufacturer may be asked to provide to the TAB the REACH related information which shall accompany the DoP (cf. Article 6(5) of Regulation (EU) No 305/2011).

The manufacturer is **not** obliged to:
- provide the chemical constitution and composition of the product (or of constituents of the product) to the TAB, or
- provide a written declaration to the TAB stating whether the product (or constituents of the product) contain(s) substances which are classified as dangerous in accordance with Directive 67/548/EEC and Regulation (EC) No 1272/2008 and listed in the "Indicative list on dangerous substances" of the SGDS, taking into account the installation conditions of the construction product and the release scenarios resulting from there.

Any information provided by the manufacturer regarding the chemical composition of the products is not to be distributed to EOTA, to other TABs or beyond.

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2.2.7 Impact resistance of the panels

Purpose of the assessment

The purpose of the test method herein included is the evaluation of the impact resistance of the panels.

Assessment method

The impact resistance of the panels is split into the following characteristics:

- Resistance to functional failure from soft body impact load – 50 kg bag

  The resistance to functional failure from soft body impact load shall be determined in accordance with clause 2.2.6.1 of EAD 210005-00-0505.

- Resistance to functional failure from hard body impact load – 0,5 kg and 1 kg steel ball

  The resistance to functional failure from hard body impact load shall be determined in accordance with clause 2.2.6.2 of EAD 210005-00-0505.

Expression of results

The impact resistance shall be given in the ETA as a use category based on the tests performed in accordance with clauses 2.2.6.1 and 2.2.6.2 of EAD 210005-00-0505.

2.2.8 Airborne sound insulation

Purpose of the assessment

The purpose of the methods herein included is the evaluation of airborne sound insulation of the panels.

Assessment method

The airborne sound insulation of the panels shall be determined by testing in accordance with EN ISO 10140-2. Tests shall be executed in the full-size configuration in accordance with clause 6.2 of EN ISO 10140-2. Special attention shall be paid to the installation of the panel in the test opening with the aim to be representative of the situation in the intended use in particular for connections and sealing conditions.

Given the panel configuration, one test shall be carried out. The description of the panel configuration (see clauses 1.1 and 1.3.1) shall be reported in the ETA.

Expression of results

The results shall be expressed in the ETA as a single number rating R_w [dB] in accordance with EN ISO 717-1. The tested panel configuration (with reference to clauses 1.1 and 1.3.1) shall also be reported in the ETA.

2.2.9 Thermal resistance

Purpose of the assessment

The purpose of the method herein included is the evaluation of the total thermal resistance of the panel.

Assessment method

The total thermal resistance of the panel shall be determined by calculation, in accordance with the method included in EN ISO 10211 for 3-D geometrical models, or by testing, in accordance with the hot box test reported in EN ISO 8990 and EN ISO 12567-1. The tests shall be carried out on specimens with

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characteristics and geometry representative of the panel, in accordance with clause 3.3 of EN ISO 8990 and clause 5.3 of EN ISO 12567-1.

Experimental testing in accordance with EN ISO 8990 and EN ISO 12567-1 shall be used as validation method or reference method in case of dispute.

Expression of results

The total thermal resistance of the panel R_T shall be expressed in the ETA as level in [m^2K/W] unit. The tested panel configuration (with reference to clauses 1.1 and 1.3.1) shall also be reported in the ETA.

2.2.10 Thermal inertia

Purpose of the assessment

The purpose of the method herein included is the evaluation of the thermal inertia of the panel in accordance with EN ISO 13786.

Assessment method

Thermal inertia shall be assessed in accordance with EN ISO 13786.

For the assessment of thermal inertia, for each panel configuration, in addition to the geometric characteristics, the following characteristics of the panel components are necessary and, therefore, shall be stated in the ETA, based on manufacturer product installation instructions or on tabulated values in accordance with EN ISO 10456:

- density ρ expressed in [kg/m^3];
- specific heat-capacity c_m expressed in [J/(kg K)];
- thermal conductivity λ [W/(m K)]

Expression of results

Thermal inertia assessed in accordance with EN ISO 13786, clauses 6 and 7, shall be expressed in ETA as periodic thermal transmittance (Y_{mn}) in [$W/(m^2 \cdot K)$] and decrement factor (f).

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3 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

3.1 System of assessment and verification of constancy of performance to be applied

For the products covered by this EAD the applicable European legal act is Commission Decision 2003/728/EC.

The system is 1.

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3.2 Tasks of the manufacturer

The cornerstones of the actions to be undertaken by the manufacturer of the product in the procedure of assessment and verification of constancy of performance are laid down in Table 3.2.1.

For kits: The manufacturer (regarding the components he buys from the market with DoP) shall take into account the Declaration of Performance issued by the manufacturer of that component. No retesting is necessary.

Table 3.2.1 Control plan for the manufacturer; cornerstones

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Factory production control (FPC) [including testing of samples taken at the factory in accordance with a prescribed test plan]					
1	*Incoming raw materials and components:* Identification	Visual check and measuring by means of tape meter or measurement gauge	Conformity with the order	---	Each delivery
2	*Incoming raw material (steel sheet and/or coil):* - Coating mass - Tensile strength	According to the Control Plan	According to the Control Plan	---	Each delivery
3	*Component (cold-formed steel frame and profiles):* Geometry (form and dimensions)	Visual check and measuring by means of tape meter or measurement gauge	According to the Control Plan	---	Each production
4	*Cold-formed steel frame and profiles (riveting process):* - Riveting pressure (if applicable) - Positioning of the rivets (verticality)	According to the Control Plan	According to the Control Plan	---	Each production
5	*Cold-formed steel frame and profiles (drilling process):* Dimensions of predrilled holes	According to the Control Plan	According to the Control Plan	---	Each production

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No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Factory production control (FPC) [including testing of samples taken at the factory in accordance with a prescribed test plan]					
6	*Component (rivets and self-drilling screws):* - Dimensions - Shear strength and tensile strength	According to the Control Plan	According to the Control Plan	---	Each delivery
7	*Component (lightweight sheathings):* - Dimensions - In-plane shear modulus - Density - Thermal conductivity - Reaction to fire	According to relevant harmonised standards or technical specifications, or EN standards For reaction to fire, see clause 2.2.3	According to the Control Plan	---	Each delivery
8	*Component (hold-down):* - Corrosion protection - Dimensions - Steel grade	According to the Control Plan. For steel grade and corrosion protection, Checking of 3.1 type certification in accordance with EN 10204	According to the Control Plan	---	Each delivery
9	*Component (thermal insulation layer):* - Dimensions - Density - Thermal conductivity - Organic content - Reaction to fire	According to the Control Plan For dimensions and thermal conductivity, in accordance with EN 13162 For reaction to fire, see clause 2.2.3	According to the Control Plan	---	Each delivery
10	*Finished panel:* Identification of the panel configuration in terms of components type: - Cold-formed steel frame - Sheathings (internal and external) - Self-drilling screws - Hold-down connectors - Internal thermal insulation	Visual check	According to the Control Plan	---	Every panel
Note: If a component is covered by an existing harmonised standard, the FPC is deemed to be satisfied by the application of FPC foreseen in the relevant standard, provided that relevant characteristics as of the control plan have been subject the FPC based on this standard. Otherwise, conformity of purchased components with the order shall be established by the kit manufacturer.					

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3.3 Tasks of the notified body

The cornerstones of the actions to be undertaken by the notified body in the procedure of assessment and verification of constancy of performance for the *structural steel composite wall panels for building systems* are laid down in Table 3.3.1.

Table 3.3.1 Control plan for the notified body; cornerstones

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Initial inspection of the manufacturing plant and of factory production control					
1	The notified Body will ascertain that, in accordance with the control plan, the manufacturing plant of the product manufacturer, in particular personnel and equipment, and the factory production control are suitable to ensure a continuous and orderly manufacturing of the components of the panels. Particular attention shall be paid to the activities reported in the factory production control established by the manufacturer concerning resistance and stiffness of the panel. The following items are considered crucial: - Identification of panel configuration with respect to its components - Dimensions and tolerance of cold-formed steel profiles and frames - Checking of technical specification of rivets, self-drilling screws and sheathings as specified in the control plan	Verification of the complete FPC as described in the control plan agreed between the TAB and the manufacturer	According to Control plan	According to Control plan	When starting the production or a new line
Continuous surveillance, assessment and evaluation of factory production control					
2	The Notified Body shall verify that the system of factory production control and the specified manufacturing process are maintained in accordance with the control plan in order to ensure the constancy of product performance. Particular attention shall be paid to the maintaining of the factory production control established by the manufacturer related to resistance and stiffness of the panel. The following items are considered crucial: - Identification of panel configuration with respect to its components - Dimensions and tolerance of cold-formed steel profiles and frames - Checking of technical specification of rivets, self-drilling screws and sheathings as specified in the control plan	Verification of the controls carried out by the manufacturer as described in the control plan agreed between the TAB and the manufacturer with reference to the raw materials, to the process and to the product as indicated in Table 3.2.1	According to Control plan	According to Control plan	One/year

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4 REFERENCE DOCUMENTS

EN 323:1993	Wood-based panels - Determination of density
EN 1365-1:2012+AC:2013	Fire resistance tests for loadbearing elements - Part 1: Walls
EN 1990:2023	Eurocode - Basis of structural and geotechnical design
EN 10204:2004	Metallic products - Types of inspection documents
EN 10346:2015	Continuously hot-dip coated steel flat products for cold forming - Technical delivery conditions
EN 12467:2012+A2:2018	Fibre-cement flat sheets - Product specification and test methods
EN 13162:2012+A1:2015	Thermal insulation products for buildings - Factory made mineral wool (MW) products - Specification
EN 13501-2:2023	Fire classification of construction products and building elements - Part 2: Classification using data from fire resistance tests, excluding ventilation services
EN 13820:2003	Thermal insulating materials for building applications - Determination of organic content
EN 13986:2004+A1:2015	Wood-based panels for use in construction - Characteristics, evaluation of conformity and marking
EN 15715:2009	Thermal insulation products - Instructions for mounting and fixing for reaction to fire testing - Factory made products
EN 16516:2017+A1:2020	Construction products: Assessment of release of dangerous substances - Determination of emissions into indoor air
EN 16733:2016	Reaction to fire tests for building products - Determination of a building product's propensity to undergo continuous smouldering
EN ISO 717-1:2020	Acoustics - Rating of sound insulation in buildings and of building elements - Part 1: Airborne sound insulation (ISO 717-1:2020)
EN ISO 8990:1996	Thermal insulation - Determination of steady-state thermal transmission properties - Calibrated and guarded hot box (ISO 8990:1994)
EN ISO 10140-2:2021	Acoustics - Laboratory measurement of sound insulation of building elements – Part 2: Measurement of airborne sound insulation (ISO 10140-2:2021)
EN ISO 10211:2017	Thermal bridges in building construction - Heat flows and surface temperatures - Detailed calculations (ISO 10211:2017)
EN ISO 10456:2007	Building materials and products - Hygrothermal properties -Tabulated design values and procedures for determining declared and design thermal values (ISO 10456:2007)
EN ISO 12567-1:2010+AC:2010	Thermal performance of windows and doors - Determination of thermal transmittance by the hot-box method - Part 1: Complete windows and doors (ISO 12567-1:2010+Cor 1:2010)
EN ISO 13786:2017	Thermal performance of building components - Dynamic thermal characteristics - Calculation methods (ISO 13786:2017, Corrected version 2018-03)
EN ISO 29466:2022	Thermal insulating products for building applications - Determination of thickness (ISO 29466:2022)
EN ISO 29470:2020	Thermal insulating products for building applications - Determination of the apparent density (ISO 29470:2020)
CEN/TR 14823:2003	Durability of wood and wood-based products - Quantitative determination of pentachlorophenol in wood - Gas chromatographic method
EAD 070001-02-0504	Gypsum plasterboards, gypsum boards with fibrous reinforcement and expanded glass boards with fibrous reinforcement for sheathing and lining of building elements
EAD 210005-00-0505	Internal partition kits for use as non-loadbearing walls
EAD 210024-00-0504	Cement-bonded board

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ANNEX A: EXPERIMENTAL METHOD FOR DETERMINING THE IN-PLANE RESPONSE OF THE PANEL UNDER MONOTONIC LATERAL LOAD

A.1 General

Testing procedure reported herein shall be adopted with the aim of determining the in-plane resistance and stiffness of the panel for increasing quasi-static lateral loading.

A.2 Test specimen

The specimen shall be representative of the panel configuration (see clause 1.3.1) intended to be used in service, in terms of:

- dimensions, typology, and location of each component (see clause 1.1);
- connections among cold-formed steel profiles;
- sheathing-to-frame connections;
- hold-downs.

Shear connectors shall be dimensioned in order to transfer the maximum horizontal load to the test base. Size, type, and location of the used shear connectors shall be reported in the ETA.

A.3 Number of tests

A minimum of three tests shall be performed for each panel configuration symmetrical with respect to their central axis (*y*-axis in Figure A.4.1). For panel configurations unsymmetrical with respect to their central axis (*y*-axis in Figure A.4.1), each test shall be performed along both the orientations (x^+ and x^- in Figure A.4.1), therefore, a minimum of six tests shall be carried out.

In addition, for each panel configuration, preliminary tests (i.e., one for symmetrical configurations and two for unsymmetrical configurations) shall be carried out with the aim of estimating the ultimate load value in the given orientation (hereinafter “estimated ultimate load”) to be used as reference for loading protocol definition (see clause A.5).

A.4 Test setup

The panel shall be mounted according to the manufacturer product installation instructions and in a way that the actual conditions of use are reproduced, as indicated below. A schematic view of the test setup is shown in Figure A.4.1.
The bottom of the panel shall be connected to a rigid support simulating the support conditions intended to be used in service. The top of the panel shall be connected to a load transfer beam. The connection shall be designed to transfer the expected racking load capacity. The test apparatus shall effectively support the specimen at the top, as necessary, to prevent out-of-plane displacement of the specimen, but in-plane displacement shall not be restricted. The racking load shall be applied in the central plane of the frame, at the top of the wall, in the direction normal to the wall height, or equivalently, in the direction parallel to the wall width. At this aim, a hydraulic jack or a similar loading device shall be used. The load shall be applied at a constant rate of displacement so that the displacement at the ultimate load is achieved in not less than 5 minutes. The beam used to transfer the load between the hydraulic jack and the test specimen shall be selected so that it does not contribute to the measured racking strength and stiffness. The lateral top displacement of the panel shall be recorded during the test. To this aim, a displacement transducer shall be positioned closest to the centroid of the top chord.

Test setup shall be designed and installed so that vertical (gravity) loads from test equipment applied to the specimen are negligible. Vertical loads shall not be added to the specimen unless justified by an analysis of actual building construction, taking into account the intended use, or the objective of the testing. If vertical

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loads are applied, they shall be distributed along the top of the specimen by means of a loading beam or other adequate device. The magnitude and test setup for the vertical load shall be reported along with the justification.

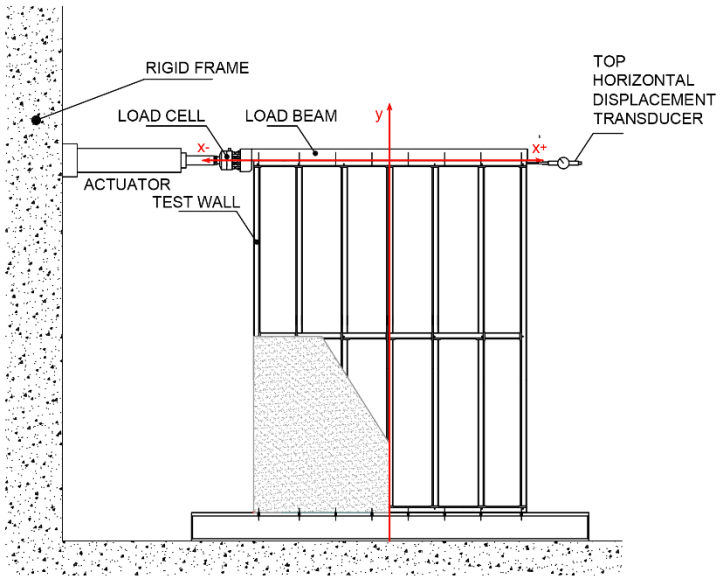

Figure A.4.1: Test setup

A.5 The test procedure

The preliminary test (i.e., aimed at the evaluation of the “estimated ultimate load”) shall be performed by applying monotonically increasing horizontal top displacement until the collapse of the panel is reached. Specifically, the test shall continue following the descending part of the load-displacement curve at least up to a load level of approximately 80% of the maximum recorded lateral load, if compatible with the wall load-bearing capacity. The “estimated ultimate load” shall be computed as the maximum recorded lateral load during the test.

The standard test (i.e., aimed at the evaluation of the in-plane resistance and stiffness of the panel) consists of the following phases.

- A preload cycle up to approximately 10% of the “estimated ultimate load” of the wall shall be performed. The load shall be hold for 5 min in order to remove the lacks of fit. The load shall be removed.
- Two loading and unloading cycles up to approximately one third and two thirds of the “estimated ultimate load” shall be performed. At a zero-loading condition, the recovery of the wall shall be recorded after 5 min.
- Increasing of the applied load until the maximum recorded lateral load is reached. The test shall continue following the descending part of the load-displacement curve at least up to a load level of approximately 80% of the maximum recorded lateral load, if compatible with the wall load bearing capacity.

During both preliminary or standard tests, the force and the lateral top displacement values shall be measured and recorded. The reading shall be done continuously or incrementally. If the incrementally reading approach is used, the load increment shall be selected such that non-linearity of the response can be adequately captured. The load shall be measured with an accuracy at least of 1%. The shear wall displacement measurement shall be accurate at least to 0,25 mm.

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A.6 Evaluation of the test results

The experimental response is expressed as lateral load-lateral top displacement curve (*P- Δ*) measured during the test. Given the panel configuration, the maximum recorded lateral load (P_u) and the secant stiffness (K_e) at 40% of the maximum load shall be determined for each test.

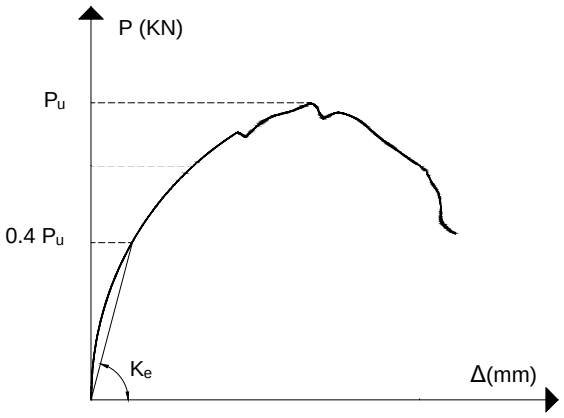

Figure A.6.1: Experimental lateral load-lateral top displacement curve (*P-Δ*)

A.7 Test records

At least the following information shall be recorded during the tests:

General

- Date and location of the tests
- Description of the test setup
- Description of the testing equipment (e.g., loading devices, load cells, measurement setup, data logging systems)
- Number of executed tests and identification of the tested specimens
- Parameters of load/displacement application (e.g., size of load/displacement increase steps, rate of increase of load/displacement)

Specific (for each test)

- Description of the specimens' assembly
- Description of the specimens in terms of dimension, materials, typology
- Applied vertical load as measured during the test (if vertical load is applied)
- Lateral load-lateral displacement curves
- Relevant experimental results:
    - the maximum recorded lateral force, P_u [kN];
    - the secant stiffness, K_e [kN/mm] at 40% of the maximum load (P_u), as reported in Figure A.6.1.
- Conventional failure mode and final damage state description

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ANNEX B: EXPERIMENTAL METHOD FOR DETERMINING THE IN-PLANE RESPONSE OF THE PANEL UNDER CYCLIC LATERAL LOAD

B.1 General

Testing procedure reported herein shall be adopted for determining the in-plane response of the panel under cyclic loading condition.

B.2 Test specimen

The specimen shall be representative of the *panel configuration* (see clause 1.3.1) intended to be used in service in terms of:

- dimensions, typology, and location of each component (see clause 1.1);
- connections among cold-formed steel profiles;
- sheathing-to-frame connections;
- hold-downs.

Shear connectors shall be dimensioned in order to transfer the maximum horizontal load to the test base. Size, type, and location of the used shear connectors shall be reported in the ETA.

B.3 Number of tests

A minimum of three cyclic tests shall be performed for each panel configuration.

In addition, for each panel configuration, preliminary monotonic tests shall be carried out in accordance with clauses A.3 and A.5 (see “preliminary test”, in particular) with the aim of assessing the “reference deformation” (Δ_R) to be used as reference for cyclic loading protocol definition (see clause B.5).

B.4 Test setup

The panel shall be mounted in accordance with the manufacturer product installation instructions and reproduce the actual conditions of intended use. A schematic view of the test setup is shown in Figure A.4.1. The bottom of the panel shall be connected to a rigid support simulating the support conditions intended to be used in service. The top of the panel shall be connected to a load transfer beam. The connection shall be designed to transfer the expected racking load capacity. The test apparatus shall effectively support the specimen at the top, as necessary, to prevent out-of-plane displacement of the specimen, but in-plane displacement shall not be restricted. The racking load shall be applied in the central plane of the frame, at the top of the wall, in direction normal to the wall height, or equivalently, in direction parallel to the wall width. At this aim, a double effect hydraulic jack or a similar loading device shall be used. The rate of displacement shall be controlled at either constant cyclic frequency or at a constant rate of displacement. The rate of displacement shall be between 0,2 and 5 mm/s. The test shall continue following the descending part of the load-displacement curve at least up to a load level of approximately 80% of the ultimate load P_u, i.e., the maximum recorded load during the test, if compatible with the wall load-bearing capacity. The load shall be distributed along the top of the specimen by means of a loading beam or other adequate device. The beam used to transfer the load between the hydraulic jack and the test specimen shall be selected so that it does not contribute to the measured racking strength and stiffness. The lateral top displacement of the panel shall be recorded during the test. To this aim, a displacement transducer shall be positioned closest to the centroid of the top chord.

Test setup shall be designed and installed so that vertical (gravity) loads from test equipment applied to the specimen are negligible. Vertical loads shall not be added to the specimen unless justified by analysis of actual building construction or the objective of the testing. If vertical loads are applied, they shall be distributed along the top of the specimen by means of a loading beam or other adequate device. The magnitude and test setup for the vertical load shall be reported along with the justification.

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B.5 The test procedure

The preliminary monotonic test aimed at the evaluation of the "reference deformation" (Δ_R) shall be performed by applying monotonically increasing horizontal displacement until collapse of the panel is reached. Specifically, the test shall continue following the descending part of the load-displacement curve at least up to a load level of approximately 80% of the ultimate load, if compatible with the wall load-bearing capacity. The load shall be applied at a constant rate of displacement so that the displacement at the ultimate load is achieved in not less than 5 minutes. Force and displacement shall be measured and recorded continuously or incrementally. If the incrementally reading approach is used, the load increment shall be selected such that non-linearity of the response can be adequately captured. The load shall be measured with an accuracy at least of 1%. The lateral top wall displacement measurement shall be accurate at least to 0,25 mm. The reference displacement Δ_R [mm] is associated with the first significant limit state that occurs during the test. Such displacement allows identifying the load history of the cyclic tests and it shall be defined as reported in Equation (B.5.1).

$$\Delta_R = 0{,}6 \cdot \Delta_u \qquad \text{(B.5.1)}$$

In Equation (B.5.1):

0,6 coefficient accounting for the different wall response between static and cyclic tests;
Δ_u lateral top displacement associated to $0{,}8 \cdot P_u$ on descending branch of the curve, if compatible with the wall load bearing capacity (Figure B.5.1)

If Δ_R is greater than 0,025 times the wall height, then 0,025 times the wall height shall be assumed as reference displacement Δ_R.

In case of panel configurations unsymmetrical with respect to their central axis, the minimum value of Δ_R obtained from the two tests performed along both the orientations (see clause A.3) shall be assumed as reference displacement.

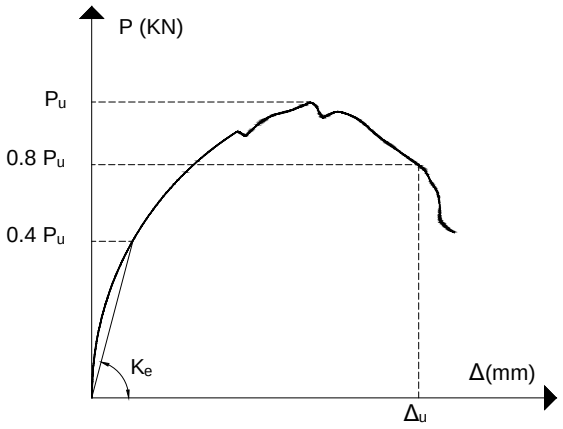

Figure B.5.1: Definition of Δ_u

The cyclic test consists of displacement cycles grouped in phases characterised by incremental displacement levels. The amplitude of the cycles is defined as a fraction of the reference deformation Δ_R. A summary of the load history is presented in Table B.5.1 and Figure B.5.2. If the panel has not failed at the end of Step 8 of Table B.5.1, then additional phases shall be added. Each n-th subsequent phase shall consist of three cycles with an increase in the amplitude equal to $n \cdot \alpha \cdot \Delta_R$, where n is a positive integer and α is a numerical coefficient lower or equal than 0,5.

During the test, the force and the lateral top displacement values shall be measured and recorded. The reading shall be done continuously at a minimum sampling rate of 100 readings per cycle. The load shall be measured with an accuracy at least of 1%. The shear wall measurement shall be accurate to 0,25 mm.

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Table B.5.1: Load history

Patter	Step	Number of cycles	Amplitude of the cycles % Δ_R
1	1	6	5
2	2	7	7,5
	3	7	10
3	4	4	20
	5	4	30
4	6	3	40
	7	3	70
	8	3	100
	9	3	100+100α (*)
	10	3	Additional increments of 100α up to collapse

(*) $\alpha \leq 0,5$

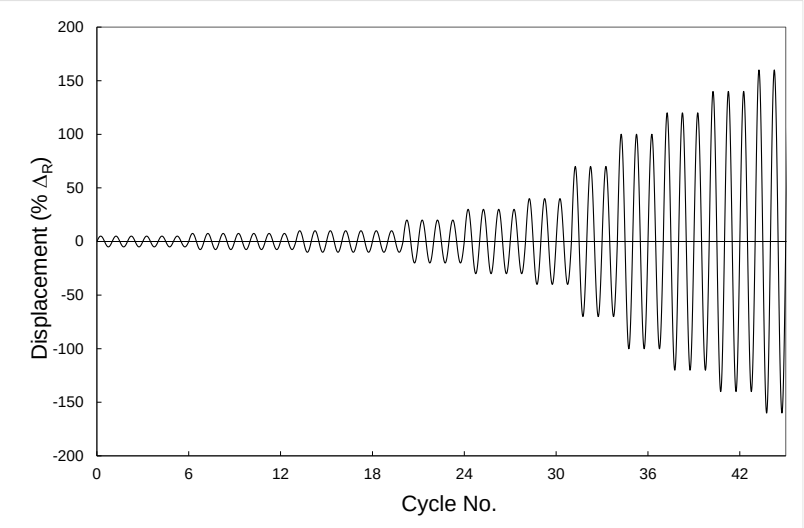

Figure B.5.2: Load history for cyclic shear test

B.6 Evaluation of the test results

For each test, the experimental response is expressed as lateral load - lateral top displacement hysteretic curves (*P-Δ*) measured during the test (Figure B.6.1).

The *P-Δ* diagram shall be analysed so to separately generate the positive and negative envelopes (bold lines in Figure B.6.1). Accordingly, two different set of performance parameters shall be obtained.

For each positive and negative envelope, the following parameters shall be firstly determined (see Figure B.6.2):

- maximum recorded lateral force P^+_u, P^-_u [kN];
- secant stiffness K^+_e, K^-_e [kN/mm] at 40% of the maximum load (P^+_u, P^-_u);
- lateral top displacement Δ^+_u, Δ^-_u [mm] corresponding to a drop in lateral load equal to 20% of maximum loads (P^+_u, P^-_u).

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In case of fragile failure occurred in one of the two applied displacement directions, the ultimate lateral top-displacement (Δ_u) shall be associated to the 20%-load drop observed on the envelope curve in that direction.

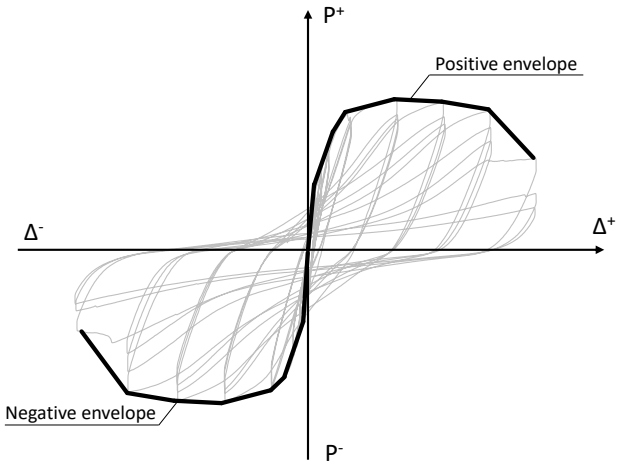

Figure B.6.1: Positive and negative envelopes of lateral load - top displacement hysteretic curves (P-Δ)

Then, yielding strength values (P^+_{yield}, P^-_{yield}) shall be computed according to Equations (B.6.1 and B.6.2) based on the energetic approach of Figure B.6.2, wherein A identifies the area underneath the envelope curve from zero to the ultimate displacement (Δ_u) of the specimen. Lateral top displacement values (Δ^+_{yield}, Δ^-_{yield}) shall be derived by dividing (P^+_{yield}, P^-_{yield}) by the corresponding secant stiffness (K^+_e, K^-_e).

$$P_{yield} = \left(\Delta_u - \sqrt{\Delta_u^2 - \frac{2A}{K_e}}\right) K_e \qquad \text{if } \Delta_u^2 > \frac{2A}{K_e} \qquad \text{(B.6.1)}$$

$$P_{yield} = 0{,}85 P_u \qquad \text{if } \Delta_u^2 \leq \frac{2A}{K_e} \qquad \text{(B.6.2)}$$

If fragile failure occurred in one of the two applied displacement directions, yielding force and displacement values (P_{yield}, Δ_{yield}) associated to that direction shall be only computed.

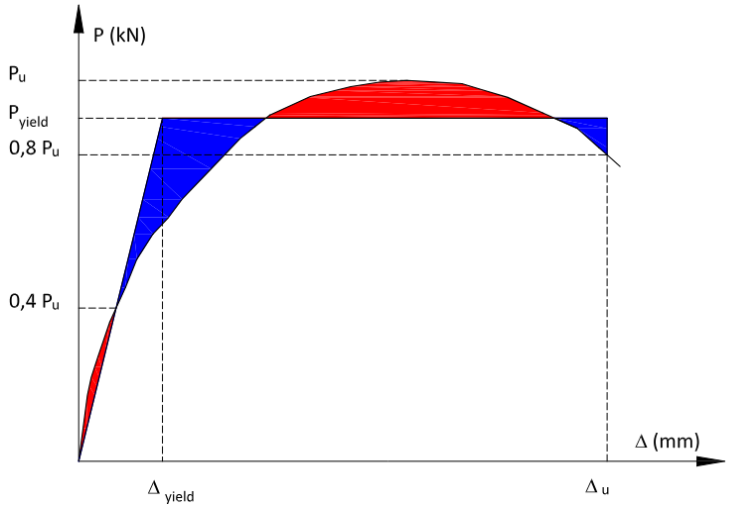

Figure B.6.2: Definition of a simplified load-displacement curve

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B.7 Test records

At least the following information shall be recorded during the tests:

General

- Date and location of the tests
- Description of the test setup
- Description of the testing equipment (e.g., loading devices, load cells, measurement setup, data logging systems…)
- Number of executed tests and identification of the tested specimens
- Parameters of load/displacement application (e.g., size of load/displacement increase steps, rate of increase of load/displacement)

Specific

- Description of the specimen assembly
- Description of the specimen in terms of dimension, materials, typology
- Applied vertical load as measured during the test (if vertical load is applied)
- Lateral load-lateral displacement curves
- Relevant experimental results:
    - secant stiffness values K^{+}_{e}, K^{-}_{e} [kN/mm] at 40% of the maximum loads (P^{+}_{u}, P^{-}_{u});
    - yielding lateral force values P^{+}_{yield}, P^{-}_{yield} [kN];
    - maximum recorded lateral force values P^{+}_{u}, P^{-}_{u} [kN];
    - lateral top displacement values Δ^{+}_{yield}, Δ^{-}_{yield} obtained at yielding [mm];
    - ultimate lateral top displacement Δ^{+}_{u}, Δ^{-}_{u} [mm], corresponding to a drop in lateral load equal to 20% of maximum loads (P^{+}_{u}, P^{-}_{u}).
- Conventional failure mode and final damage state description

If fragile failure occurred in one of the two displacement directions, ultimate lateral top displacement (Δ_u), yielding force and displacement values (P_{yield}, Δ_{yield}), associated to that direction shall be only reported.

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ANNEX C: CONDITIONS AND PARAMETERS FOR THE DETERMINATION OF THE KIT'S PROPENSITY TO UNDERGO CONTINUOUS SMOULDERING

C.1 Provisions for wood-based sheathings with and without perforations of the surface

C.1.1 Sample taking

In addition to EN 16733, the following conditions and parameters shall be considered when performing sampling and preparing test specimens:

- product-variations of a product family (as defined by a certain combination of raw materials, e.g., wood type of the wood shapes / wood fibres etc., and produced in a certain production process)[4];
- the product or product variant with the highest as well as the lowest density of the wood-based board / panel, determined by tests in accordance with EN 323 on at least six specimens;
- the product or product variant with the highest thickness of the wood-based board / panel, determined by tests in accordance with EN ISO 29466 on at least three specimens;
- each different produced shape / fibre orientation (i.e., lengthwise and crosswise to the length direction of the specimen).

C.1.2 Preparation of tests specimens

The tests shall be done without consideration of the intended end-use conditions, because propensity to undergo continuous smouldering is hardly affected by end-use conditions. If the paragraph 6.2.5 of EN 16733 applies, a permanent contact among the pieces shall be assured (there might be more than two pieces).

C.1.3 Extended application of test results

The results of tests considering the aforementioned parameters in full are also valid for products:

- of the same defined product-type family (e.g., composition of wood-based boards / panels),
- with all densities of wood-based boards / panels between those evaluated,
- with lower thickness of wood-based boards / panels and also with higher thickness when 100 mm thick specimens were tested,
- with all shape / fibre orientations, if all relevant orientations had been tested,
- with any external non-substantial facings or coatings or suchlike,
- for any end-use conditions,
- without perforations of the surface,
- with all areas of perforations (in percentage related to the surface area of the material in question) between those evaluated,
- with all diameters of the perforations between those evaluated,
- with equal or lower distances between neighboured perforations.

4 To permit the TAB to apply EXAP-rules for test results within the assessment, it is recommended that the manufacturer should provide (but he is not obliged to do it) sufficient information (e.g., on the basis of the composition of the products in question), allowing the TAB to determine which products or product variants should be submitted to testing and to reduce the number of tests required.

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C.2 Provisions for thermal insulation layer made of mineral wool

C.2.1 Sample taking

In addition to EN 16733, the following conditions and parameters shall be considered when performing sampling and preparing test specimens:

- the product variations of a product family (as defined by a certain combination of raw materials and other additives and produced in a certain production process) (see footnote 4)[4];
- the product or product variant with the highest organic content (in percentage per mass), determined in accordance with EN 13820;
- the product or product variant with the highest density as well as a density of about 100 kg/m³ (± 15 %); if the highest density is lower than 115 kg/m³, then only the product or product variant with the highest density (density determined in accordance with EN ISO 29470;
- the product or product variant with the highest thickness; if the highest thickness is greater than 100 mm, then the specimen thickness shall be reduced from the reverse (non-exposed) side to the maximum testable thickness of about 100 mm (thickness determined in accordance with EN 29466 on at least three specimens).
- each different produced fibre orientation, i.e., lengthwise and crosswise to the length direction of the specimen as well as perpendicular to the surface of the specimen front side;
- without any facings, coatings (or similar) – existing facings or coatings shall be removed when preparing the test specimens.

C.2.2 Preparation of tests specimens

The tests shall be done on free-hanging specimens without consideration of the intended end-use conditions, because propensity to undergo continuous smouldering is hardly affected by end-use conditions, and without any joints (see further).

If the kit component is only available in lengths lower than 800 mm, the test specimens shall be prepared by using two (or more) smaller pieces of the mineral wool, which shall be put together with a butt joint. This joint shall be positioned in the maximum possible distance to the bottom edge of the test specimens. Connection of the pieces of the test specimens shall be carried out in such a manner that a permanent and close contact is ensured between both pieces at the joint for the entire testing and monitoring time.

C.2.3 Extended application of test results

The test results considering the aforementioned parameters are also valid for products:

- of the same defined product-family,
- with lower organic content,
- with all lower densities,
- with lower thickness and also with higher thickness when 100 mm thick specimens were tested,
- with all fibre orientations,
- with any facings or coatings and
- for any end-use conditions.

C.3 Provisions for factory-made components made of materials other than those covered by clauses C.1 and C.2

C.3.1 Sample taking

In addition to EN 16733, the following conditions and parameters shall be considered when performing sampling and preparing test specimens:

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- product-variations of a product family (as defined by a certain combination of raw materials, e.g., type of fibres, type of binder and additives / treatment, and produced in a certain type of production process) (see footnote 4) ;
- if applicable, at least the product or product variant with the highest organic content (in percentage per mass) determined in accordance with EN 13820 shall be taken as the critical case for testing;
- at least the product or product variant with the highest and lowest density, determined by tests in accordance with EN ISO 29470;
- at least the product or product variant with the highest thickness or – if greater than 100 mm – with the thickness of 100 mm, determined by tests in accordance with EN ISO 29466 on at least three specimens;
- if relevant, each different product orientation, (i.e., lengthwise and crosswise to the length direction of the specimen) shall be tested.

C.3.2 Preparation of tests specimens

The tests shall be done without consideration of the intended end-use conditions, because propensity to undergo continuous smouldering is hardly affected by end-use conditions.

If clause 6.2.5 of EN 16733 applies, permanent contact between the pieces shall be assured.

C.3.3 Extended application of test results

The results of tests considering the aforementioned parameters in full are also valid for products:

- of the same defined product family,
- with lower organic content (if applicable),
- with all densities between those evaluated,
- with lower thickness and also with higher thickness if 100 mm thick specimens were tested,
- with all the tested product orientations,
- for any end-use conditions.

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