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European Assessment Document for

Rigid seismic sway brace for fire sprinkler pipe work

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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).

Contents

1 SCOPE OF THE EAD

1.1 Description of the construction product

This EAD covers kits (placed on the market by the manufacturer) which are rigid seismic sway brace(s) for Fire Sprinkler Pipe Work, hereinafter referred to as seismic sway brace(s), with a brace angle (ϴ) of at least 30° and up to 90° seismic sway brace(s) according to Reaction to Fire Class A1 composed exclusively of metallic components without organic coatings, complying with CWT (classified without testing) under Commission Decision 96/603/EC as amended by Commission Decisions 2000/605/EC and 2003/424/EC. The total organic content of the kit is ≤1% by mass or volume (whichever is more onerous). Products not fulfilling these conditions are outside the scope of this EAD and an ETA cannot be issued.

Seismic sway brace(s) are kits consisting of piping-attached components, e.g., pipe clamps and building-attached components, e.g., structural attachment fittings, beam clamps. The specific components will depend upon the type of building construction and the pipe size.

Evaluation of the load capacity of the brace member that connects the building-attached component and the piping-attached component is not included within the scope of this EAD, as it is not part of the kit placed on the market.

To support this process, short brace members are used during testing to assess the performance of the kit components. The specification of the brace member used shall be identified in the ETA along with the performance characteristics of the kit components (building-attached and piping-attached components).

Typical layouts of seismic sway brace(s) installations are shown in Figure 1.1.1 for two-way seismic sway brace(s) (longitudinal or lateral) and Figure 1.1.2 for four-way seismic sway brace(s) for vertical pipes.

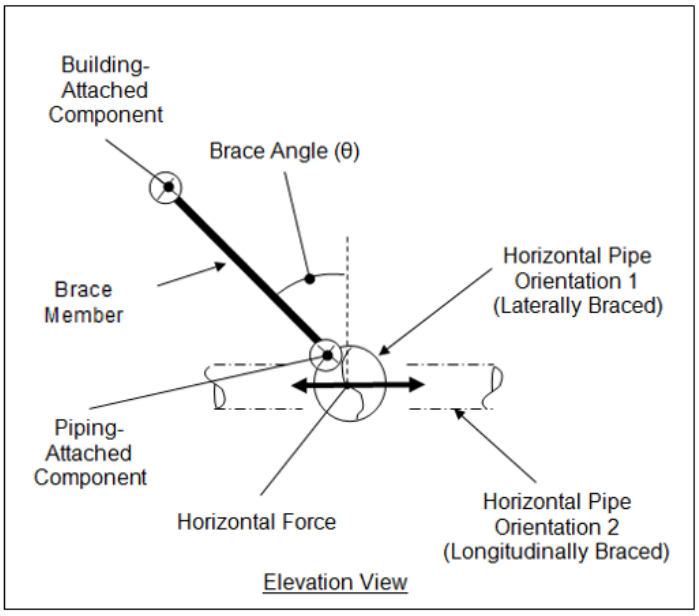

Figure 1.1.1 Typical Brace Layout, Horizontal Pipe.

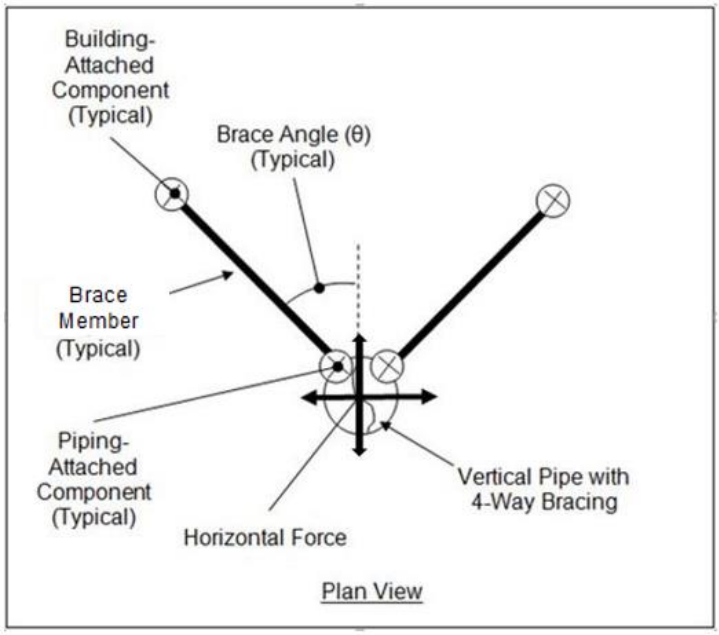

Figure 1.1.2: Typical Brace Layout, Vertical Pipe.

Seismic sway braces for fire sprinkler pipework do not meet any of the device definitions in EN 15129,. While superficially similar, Rigid Connection Devices (RCD) as defined in harmonised standard EN 15129 are designed to connect parts of structures across expansion joints, not to brace pipework systems. Permanent Connection Devices are designed for similar structural applications as RCDs, but with different performance characteristics than required for fire sprinkler pipework bracing. Displacement Dependent Devices involve energy dissipation through materials deformation, unlike the rigid bracing function of seismic sway braces. Velocity Dependent Devices are dynamic damping systems irrelevant to the static bracing function of seismic sway braces. Seismic Isolators are designed to decouple structures from ground motion, not to brace secondary systems like pipework. Combination Devices combine functions of the above devices, none of which apply to seismic sway braces.

Harmonised standard EN 15129 primarily addresses devices used in structural engineering for building or civil engineering works to reduce seismic impact on the primary structure. Seismic sway braces for fire sprinkler pipework are used to protect secondary systems during seismic events, with fundamentally different performance requirements and assessment methods.

The essential characteristics in harmonised standard EN 15129 are tailored for structural anti-seismic devices and are not relevant for assessing the performance of seismic sway braces for fire sprinkler systems. The primary essential characteristic for seismic sway braces is horizontal nominal load, which is not adequately addressed in harmonised standard EN 15129.

The non-harmonized version EN 15129:2018 maintains the same structural focus and therefore remains inapplicable to seismic sway braces for fire sprinkler pipework for the same reasons outlined above.

The non-harmonized standard EN 12845-3 details the design of a seismic sway brace system, including determining the required load capacity of a single brace, i.e., the horizontal design load for that brace. EN 12845-3 does not cover the detailed evaluation of the load capacity of seismic sway braces, but states piping-attached and building-attached components shall be designed to support the horizonal design load. This EAD supplies information used in that design (RHn).

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.

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

1.2.1 Intended use(s)

Seismic sway brace(s) are used to resist and minimize the differential movement between the Fire Sprinkler Pipe Work being braced and the structure to which it is attached, during an earthquake. The components are used to produce a seismic sway brace with a bracing angle of 30° to 90°.

Seismic sway bracing may be of either two-way or four-way compositions. Two-way braces resist either longitudinal or lateral movement with respect to the axis of the pipe. Lateral movement is perpendicular to longitudinal movement. Four-way sway bracing resists differential movement in all horizontal directions.

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 seismic sway bracings for the intended use of 50 years when installed in the works provided that the seismic sway bracings are subject to appropriate installation and maintenance. 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[1].

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 Building-attached component

Component intended to provide a means of attachment to a structural element of a building.

1.3.2 Displacement

The change in distance between the top and bottom plates of the test apparatus during horizontal nominal load testing.

1 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.

1.3.3 Horizontal nominal load (RHn)

For the tested brace orientation (Θ), the horizontal nominal load (RHn) is the nominal load (Rn) multiplied by the Sin (Θ). No factor of safety is included. When RHn is used to design a sway brace in accordance with EN12845-3 the factor of safety shown in EN12845-3 shall be applied by the designer.

1.3.4 Load at failure

Term which relates to the actual load at which the test specimen is observed to fail either by mechanical fracture or by reaching the displacement given in Table A.1.1.

1.3.5 Nominal load (Rn)

Nominal load (Rn) is the lowest load at failure for the series of tests.

1.3.6 Pipe

Product being braced, that is pipe, tubing or conduit.

1.3.7 Piping-attached component

Component intended to provide a means of attachment to the pipe, tube or conduit.

1.3.8 Rigid Brace member

Component between the building-attached component and the piping-attached component.

1.3.9 Seismic sway brace

Assembly consisting of two components, a building-attached component and a piping-attached component, always interconnected by a rigid brace member (not part of the kit) intended to minimize the differential movement between the sprinkler system piping and the structure to which it is attached during an earthquake.

1.3.10 Two-way seismic sway brace

Two-way braces resist either longitudinal or lateral movement in the horizontal plane. Lateral movement is perpendicular to the pipe while longitudinal movement is along the long axis of the pipe in the horizontal direction.

1.3.11 Four-way seismic sway brace

Four-way sway bracing resists differential movement in the horizontal plane of a horizontal or vertical pipe in all directions at a single point or support.

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

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

2.1 Essential characteristics of the product

Table 2.1.1 shows how the performance of Rigid Seismic sway brace(s) for Fire Sprinkler Pipe Work 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 2: Safety in case of fire			
1	Reaction to fire	2.2.1	Class
2	Horizontal nominal load	2.2.2	Level and Description

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 characteristic in the Declaration of Performance, retesting of that component for issuing the ETA under the current EAD is not required.

The seismic sway brace(s) shall be described in the ETA in accordance with the minimum data for each component as indicated in clause 2.2.2.

2.2.1 Reaction to fire

The reaction-to-fire performance shall be classified. The following method of assessment shall be used:

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 on the basis of it fulfilling the conditions set out in that Decision and its intended use being covered by that Decision. This applies specifically to components made of materials listed in Table 1 of Decision 96/603/EC (as amended), such as metals without organic coatings (e.g., malleable iron, ductile iron, rolled steel, or heat-treated steel). Therefore, when the conditions referred to above are fulfilled, the performance of the products is A1 which shall be given in the ETA.

2.2.2 Horizontal nominal load

Purpose of the assessment

The purpose of this assessment is to obtain the resistance of the seismic sway brace to horizontal loads (RHn) at each orientation and installation angle of the brace member. RHn can then be used in accordance with EN 12845-3 in the design of a complete sway brace system.

Assessment method

The horizontal nominal load shall be assessed according to Annex A using standardized brace member proxies. The ETA shall indicate performance levels for each component with each brace member used during assessment.

Tests shall be performed for each component at each installation orientation (lateral or longitudinal), and installation angle for each specified brace member. The data shall then be analysed to determine the horizontal nominal load (RHn) (see clause A.2).

As thinner wall pipe of a given outside diameter will deform at a lower load than a thicker wall pipe of the same diameter, the horizontal nominal load for pipework attached components determined with thinner wall fire sprinkler pipe work may be used as the horizontal nominal load for thicker wall but not vice versa.

Expression of results

The following information shall be stated in the ETA:

- component reference (Manufacturers refence);
- type/intended use (e.g., building-attached or piping-attached);
- installation orientation: (lateral, longitudinal, perpendicular to beam, parallel to beam);
- installation angle(s);
- the minimum horizontal load according to clause A.2 of Annex A expressed in Newton, called horizonal nominal load (RHn), for each tested component (building-attached or piping-attached components), each given orientation (lateral or longitudinal), each angle range and each sprinkler pipe wall thickness as defined in clause A.2 of Annex A.
- specification of the brace member type(s) assessed including all of the following as appropriate to the brace member type:
    - Type (e.g., pipe, I-beam, L-section, proprietary brace shape);
    - Diameter (inside or outside as appropriate);
    - Wall thickness;
    - Material (i.e., type and grade);
    - Dimensions of proprietary brace as appropriate.

3 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

3.1 System(s) 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 96/577/EC, as amended by 2002/592/EC.

The system is 1.

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.

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	Main dimensions and marking: • Component length and width and depth • Material thickness • Threaded connections (as appropriate) • Diameter of holes • Legibility of markings	Verification of dimensions per manufacturers technical file	As defined in control plan	As defined in control plan	At beginning of each production run, thereafter every 4 hours
2	Tension and compression test	Measurement of load and displacement of finished product in accordance with clause 3.4.1	As defined in control plan	As defined in control plan	At beginning of each production run

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 seismic sway brace(s) 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	Notified Body will ascertain that the factory production control with the staff and equipment are suitable to ensure a continuous and orderly manufacturing of the seismic sway brace(s).	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 will ascertain that the system of factory production control and the specified manufacturing process are maintained taking account of 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	1 / year

3.4 Special methods of control and testing used for the assessment and verification of constancy of performance

3.4.1 Tension and compression test procedure

Monotonic tension and compression testing of each building or piping-attached component shall be performed.

Testing shall be performed in accordance with the method detailed in Appendix A but loading shall be limited to the first half cycle (i.e., zero to the initial starting load to zero Newton).

Testing of at least 1 sample shall be conducted in each loading direction (tensile and compression). The installation angle, rate of loading and acceptance criteria shall be defined in the Control Plan.

The specimen(s) shall be subjected to load in the appropriate direction, the load shall be increased uniformly until the specimen fractures, or the acceptance criteria defined in the Control Plan are met.

Values for load and displacement shall be measured using calibrated equipment and recorded.

4 REFERENCE DOCUMENTS

EN 15129:2009	Anti-seismic devices
EN 12845-3:2024	Fixed firefighting systems – Automatic sprinkler systems – Part 3: Guidance for earthquake bracing

ANNEX A: HORIZONTAL NOMINAL LOAD TEST PROCEDURE

A.1 Test overview

Each brace member intended to be used with the kit shall be evaluated with the kit and RHn determined for that combination.

Each specimen shall be subjected to the force history shown in figure A.1.2. The horizontal nominal load (RHn) shall be determined from the results of the cyclic tests.

The testing for piping-attached components shall be performed using a 180 mm nominal length of sprinkler pipe work and a length of brace member which shall be described in the ETA as detailed in Section 2.2.2 – Expression of results. The testing for building-attached components shall be performed using fixtures representing the structure and a length of brace member which shall be described in the ETA as detailed in Section 2.2.2 – Expression of results. The load frame shall be equipped with a calibrated load-cell and a displacement measuring device. The test shall be conducted according to the following procedure:

Install the building/pipe-attachment in the test fixture at a defined brace installation angle and subject it to the following cyclic loading profile until either the specimen breaks or the displacement given in table A.1.1 (in relation to the installation angle) is reached.

Record the load in N and displacement in mm during the test.

The initial load shall be selected such that the total number of cycles at the conclusion of the test shall be a minimum of 15 cycles (considered the minimum number of cycles that define the nominal load) and a maximum of 60 cycles (to avoid the possibility of fatigue of the component being tested influencing the test result).

With the component installed in the test fixture, and the initial load determined, subject the specimen to 15 cycles alternating in direction to cause tension and compression within the seismic sway brace assembly as shown below. After the initial 15 cycles, the loading shall then change to an increasing increment based on the following equation:

$$Force = X \text{ for } n \leq 15 \text{ cycles}$$

$$Force = X \times \left(\frac{15}{14}\right)^{\frac{(n-15)}{2}} N \text{ for } n > 15$$

X = The initial starting load

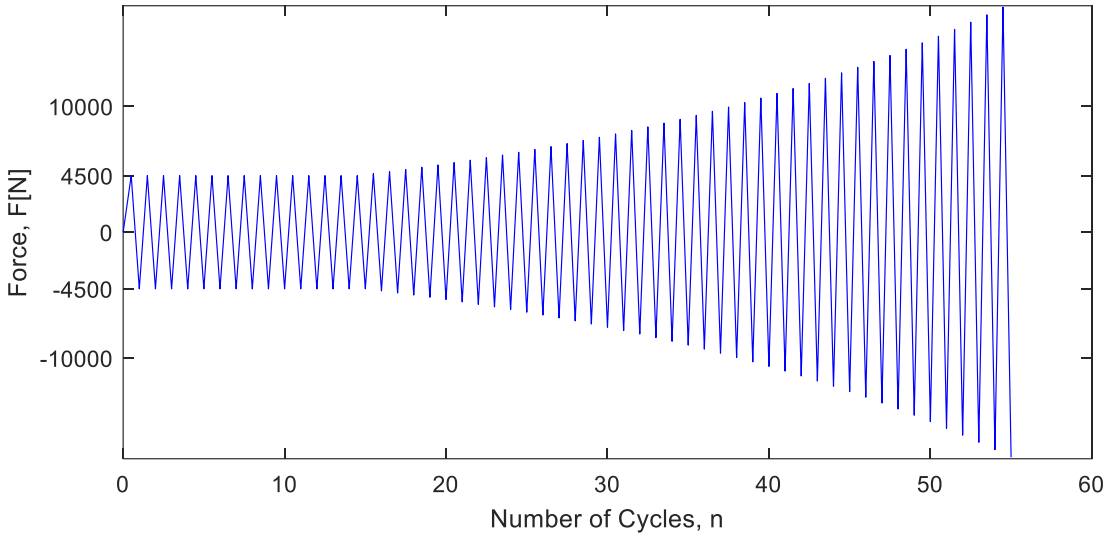

Figure A.1.2 – Example representation of the load/cycle equation shown above.

If the brace fails during the test (buckles or fractures) it shall be replaced with a stronger brace and the tests repeated. The brace pulling out of the piping-attached or building-attached component is not considered a brace failure (brace pullout is equivalent to reaching the displacement limit).

Once the specimen has been observed to either break, or the displacement has been reached, the test is complete. Replace the specimen with a new specimen twice and repeat the cyclic test, for a total of three tests.

The nominal load (Rn) along the seismic sway brace for the tested installation angle is then found from examining the data and identifying the lowest magnitude load reading from the three specimens at the point where the specimen was observed to fail, or the displacement was reached (See Table A.1.1). From this point, back up on the load history to the previous complete cycle and record that value. The lowest value from the three tests conducted for each component at a given orientation (lateral or longitudinal) and installation angle combination shall be considered the nominal load (Rn) for that component's orientation and installation angle combination.

Table A.1.1 Displacement along the brace depending on the horizontal displacement

Installation angle (Θ)	Testing displacement (mm) considering the horizontal displacement Hd (mm)
30°	Hd x sin (30)
45°	Hd x sin (45)
60°	Hd x sin (60)
90°	Hd x sin (90)
Where: Hd = Horizontal displacement shall be 25 mm.	

A.2 Determining horizontal nominal load

Determine the minimum horizontal nominal load for each of the brace installation angle (Θ) ranges requested by the manufacturer, for example,

- 30° ≤ Θ < 45°
- 45° ≤ Θ < 60°
- 60° ≤ Θ < 90°
- Θ = 90°

In order to determine the minimum horizontal nominal load applicable to each of these ranges, test the component at the endpoints of each range (i.e., at the brace angles of 30°, 45°, 60° and 90°), the lowest rating determined shall be considered the rating for that range.

The determination of the horizontal nominal load (RHn) begins with the analysis of the load-displacement recording collected in Clause A.1.

For the tested seismic sway brace installation angle (Θ), the horizontal nominal load (RHn) shall be obtained by multiplying the nominal load (Rn) along the brace by the Sin (Θ).