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DRAINAGE SYSTEM USED IN UNDERGROUND ROCK CAVERNS

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1 SCOPE OF THE EAD

1.1 Description of the construction product

The drainage system consists of drainage pipe (PVC) which is connected with polyethylene foam sheet. To the both edges of the sheet there are heat laminated edge strips made of polyethylene foam. In between the edge strip and the foam sheet there is an annealed steel wire. Polyethylene foam sheet shall work as a moisture barrier and the drainage pipe shall lead the water to the drainage system of the rock cavern.

The drainage system may have an inspection hatch, through which the condition of the drainage and the possible blocks can be checked and repaired.

The drainage system is installed below mesh reinforcement against the rock face. The mesh reinforcement is nailed against the rock face with c/c 250-300 mm distance. After the mesh reinforcement is nailed, the drainage system will be covered with shotcrete. The mesh reinforcement, nails used in fastening the drainage system and shotcrete are not part of the kit.

The product is not fully covered by the following harmonised technical specification EN 13491¹ The product includes a PVC drainage pipe and the following essential characteristics are not covered by EN 13491:

- Peel resistance of the polyethylene foam edge strips
- Ring stiffness of the drainage pipe.

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 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.

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

1.2.1 Intended use(s)

The drainage system is intended to be used as a drainage system in underground rock caverns.

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 drainage system for the intended use of 25 years when installed in the works (provided that the drainage system 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 works².

¹ All undated references to standards or to EAD's in this EAD are to be understood as references to the dated versions listed in clause 4.

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.

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.

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the product

Table 1 shows how the performance of drainage system used in underground rock caverns is assessed in relation to the essential characteristics.

Table 2.1 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 4: Safety and accessibility in use			
1	Tensile strength and strain of the polyethylene foam sheet	Clause 2.2.1	Level
2	Resistance to impact of the polyethylene foam sheet	Clause 2.2.2	Level
3	Peel resistance of the polyethylene foam edge strips	Clause 2.2.3	Level
4	Ring stiffness of the drainage pipe	Clause 2.2.4	Level
5	Water permeability of the polyethylene foam sheet	Clause 2.2.5	Level

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.

2.2.1 Tensile strength and strain of the polyethylene foam sheet

The tensile strength and stain of the polyethylene foam sheet shall be determined according to the standard EN 1608.

The tensile strength and strain shall be given in ETA.

2.2.2 Resistance to impact of the polyethylene foam sheet

The resistance to impact of the polyethylene foam sheet shall be determined according to the standard EN 12691. Method A shall be used. The puncturing tool shall have a diameter of $S\varnothing = 25$ mm depart from standard EN 12691.

The drop height of the puncturing tool in millimetres, which has not caused the leakage of the sheet, shall be given in ETA as the resistance to impact.

2.2.3 Peel resistance of the polyethylene foam edge strips

The peel resistance of the polyethylene foam sheet edge strips shall be determined according to the standard EN 12316-2.

The peel resistance of the joints shall be given in ETA.

2.2.4 Ring stiffness of the drainage pipe

The ring stiffness of the PVC-pipe shall be determined according to the standard EN ISO 9969.

The ring stiffness shall be given in ETA.

2.2.5 Water permeability of the polyethylene foam sheet

The water permeability of the polyethylene foam sheet shall be determined according to the standard EN 14150. The test specimen is mounted to the test cell in test frame corresponding to the thickness of the material to be tested. Test frame shall be made of water impermeable material. The joint between the frame and tested material shall be made fully watertight using suitable adhesive. Exposed area of the tested material in the final assembly shall be the same as the diameter of the measuring chamber. If necessary sealant is used to mount the test frame to the test cell.

The water permeability shall be given in ETA.

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: Decision (EU) 2015/1958.

The system is: 2+.

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 2.

Table 3.2 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	Control of incoming raw materials	Material certificates	Acc. to the control plan	Acc. to the control plan	Each raw material batch
2	Density of the polyethylene foam sheet	Weighing of a test piece	Acc. to the control plan	3	Each batch
3	Visual inspection of the final product	-	Acc. to the control plan	Each final product	Once per day

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 drainage system are laid down in Table 3.

Table 3.3 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 <i>(for systems 1+, 1 and 2+ only)</i>					
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 drainage system.	Verification of the complete FPC as described in the control plan agreed between the TAB and the manufacturer	According to the control plan	According to the control plan	When starting the production or a new line
Continuous surveillance, assessment and evaluation of factory production control <i>(for systems 1+, 1 and 2+ only)</i>					
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	According to the control plan	According to the control plan	Once a year

4 REFERENCE DOCUMENTS

EN 13491:2004 and EN 13491:2004/A1:2006	Geosynthetic barriers. Characteristics required for use as a fluid barrier in the construction of tunnels and associated underground structures
EN 1608:2013	Thermal insulating products for building applications. Determination of tensile strength parallel to faces
EN 12691:2018	Flexible sheets for waterproofing. Bitumen, plastic and rubber sheets for roof waterproofing. Determination of resistance to impact
EN 12316-2:2013	Flexible sheets for waterproofing. Determination of peel resistance of joints. Part 2: Plastic and rubber sheets for roof waterproofing
EN ISO 9969:2016	Thermoplastics pipes. Determination of ring stiffness (ISO 9969:2016)
EN 14150:2019	Geosynthetic barriers. Determination of permeability to liquids

ANNEX 1 EXAMPLE OF THE DRAINAGE SYSTEM USED IN UNDERGROUND ROCK CAVERNS

