EUROPEAN ASSESSMENT DOCUMENT

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SPECIAL FILLING PRODUCTS FOR POST-TENSIONING KITS

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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) No 305/2011 as a basis for the preparation and issuing of European Technical Assessments (ETA).

European Technical Assessments (ETAs) issued before publication of the EAD in the OJEU on the basis of the corresponding ETAG 013 used as EAD according to Art 66 (3) of Regulation (EU) No 305/2011 are deemed to have been issued on the basis of this European Assessment Document.

Contents

1 SCOPE OF THE EAD

1.1 Description of the construction product

This EAD serves to obtain ETAs for special filling products for post-tensioning kits, according to EAD 160004 (EAD 160004 only covers PT kits containing anchorages meant to be placed on or embedded in concrete).

The special filling product according to this EAD are:

• Grease: this EAD considers mineral oil-based grease used as filling material for PT systems for prestressing of structures for ducts for external or internal tendons, and as filling material for monostrands. Grease of metallic basis such as lithium is considered for filling materials. Potash and sodium alkaline soaps are not considered as suitable for filling materials. For monostrands, grease usually permits performance levels to be achieved as specified for the fabricated monostrands after the production process, see Annex EAD 160004.

• Wax: this EAD covers petroleum-based wax suitable for filling material for PT systems for prestressing of structures, for ducts for external or internal tendons.

• Cementitious grout: this EAD enables to issue an ETA for grout complying with EN 447 and complements described in this EAD.

This Document considers special filling products for post-tensioning kits.

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

Special filling products play a major role to protect tensile elements from corrosion. They are consequently one of the main factors for the durability of the structure and have to be applied diligently by qualified and experienced personnel to ensure the quality of filling.

Some of the tests are done with strands (for example to control wick induced bleeding in the case of cementitious grout). That does not mean that the product is only valid for strands but that strand provides the most severe conditions for the studied phenomenon. Hence it is also valid for other tensile elements such as bars or wires.

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.

Manufacter's instructions should give guidance on:

- Mixing and filling equipment (for grout, the manufacturer has to provide guidance about the kind of mixer which has to be used on site)
- Transport, storage and handling
- Duct filling (measurement and recording)

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)

Special filling products are to be used with post-tensioning kits (see EAD 160004) for the following uses:

- Cementitious grout is used for internal bonded tendon or external tendon when filled directly around bare strands inside ducts. It is used for internal or external unbonded tendons when filled around monostrands inside ducts.
- Wax and grease is used for internal or external unbonded tendons.

1.2.2 Working life/Durability

1.2.2.1 Cementitious grout

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 cementitious grout for the intended use of 100 years when installed in the works (provided that the cementitious grout and the PT kit are 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.

1.2.2.2 Wax and grease

For wax and grease filling materials, as the current knowledge and state of the art is not sufficient to assess for 100 years working life, this EAD covers these products only if they are used with exchangeable tendons or with individually protected and sheathed strands (also called monostrands) or if the wax and grease is inspectable and fully replaceable. Section 2 gives essential characteristics for wax and grease, but there is no guarantee that these filling materials will keep their performance during the estimated design working life of the structure.

1.3 Specific terms used in this EAD (if necessary in addition to the definitions in CPR, Art 2)

1.3.1 Batch

Quantity of product generally manufactured in one operation. The notion of batch shall be agreed between the TAB and the manufacturer and presented to the NB.

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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 following definition seems to be reasonable:

For grease and wax:

The batch is defined as a barrel of a maximum 150 to 200 litre from one charge of filling material (grease or wax).

For grout according EN 447:

Batch is defined according to EN 477 and additional rules at the place of construction works.

For grout applied in construction works directly on site:

Batch is defined according to rules at place of construction.

1.3.2 Component Manufacturer

Company, which manufactures specific constituent materials for filling materials according to the specification of the ETA holder.

1.3.3 Exchangeable tendon

This is a tendon that can be exchanged at some time during the design working life of the structure, i.e. the existing tendon can be removed from the structure and a new tendon can be installed in its place.

1.3.4 Grout

A cementitious filling material with characteristics according to EN 447 or this EAD.

1.3.5 Monostrand

A single strand with its individual protection by grease and HDPE sheathing. It is permanently unbonded from the structure.

1.3.6 Post-Tensioning System

For ease of reference it is called “PT system” in the text.

1.3.7 PT Specialist Company

Company which carries out installation, stressing and filling of duct of the PT system.

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the product

Table 1 shows how the performance of filling materials according to this EAD is assessed in relation to the essential characteristics.

Table 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 *(level, class, description)*
Basic Works Requirement 1: Mechanical resistance and stability			
Grease			
1	*Consistency*	Clause 2.2.1	Level
2	*Heat resistance, dropping point*	Clause 2.2.2	Level
3	*Heat resistance, flash point*	Clause 2.2.3	Level
4	*Stability*	Clause 2.2.4	Level
5	*Oxidation stability*	Clause 2.2.5	Level
6	*Corrosion protection*	Clause 2.2.6	Class
7		Clause 2.2.7	Class
8		Clause 2.2.8	Level
9		Clause 2.2.9	Level
10	*Content of aggressive elements*	Clause 2.2.10	Level
11	*Possible interaction with PE duct*	Clause 2.2.11	Level
12	*Water content*	Clause 2.2.12	Level
Wax			
13	*Congealing point*	Clause 2.2.13	Level
14	*Heat resistance, dropping point*	Clause 2.2.14	Level
15	*Heat resistance, flash point*	Clause 2.2.15	Level
16	*Consistency*	Clause 2.2.16	Level

17	*Cold resistance*	Clause 2.2.17	Level
18	*Stability*	Clause 2.2.18	Level
19	*Oxidation stability*	Clause 2.2.19	Level
20	*Corrosion protection*	Clause 2.2.20	Level
21		Clause 2.2.21	Class
22		Clause 2.2.22	Class
23		Clause 2.2.23	Level
24	*Content of aggressive elements*	Clause 2.2.24	Level
25	*Viscosity*	Clause 2.2.25	Level
26	*Possible interaction with PE duct*	Clause 2.2.26	Level
Grout			
27	*Grout: general properties*	Clause 2.2.27	Level
28	*Grout : sedimentation property*	Clause 2.2.28	Level
Basic Works Requirement 2: Safety in case of fire			
29	*Reaction to fire*	Clause 2.2.29	Class
Basic Works Requirement 3: Hygiene, health and the environment			
30	Content, emission and/or release of dangerous substances	Clause 2.2.30	Description

Note: The TAB shall check that there is no interaction between grease/wax and HDPE-plastic duct (complying with Annex D of EAD 160004). Experience is sufficient to assess this criterion.

Note 2: Tests shall be done on 3 different samples coming from 3 different fabrication runs.

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

2.2.1 Consistency of grease

Test method: cone penetration according to ISO 2137. (60 strokes at 25°C are applied). Required performance: test result between 220 and 300 (expressed in 1/10 mm).

Note: This required performance originates in ETAG 013 (June 2002).

2.2.2 Heat resistance of grease, dropping point

Test method can be the one described by ISO 2176 or the automated method described in European Pharmacopeia (2.2.17 in 7th edition).

Required performance: dropping point ≥ 150 °C.

Note: This required performance originates in ETAG 013 (June 2002).

2.2.3 Heat resistance of grease, flash point

Test method: EN ISO 2592.

Flash point temperature has to be stated in the ETA. Value should not be less than 250°C.

2.2.4 Stability of grease, oil separation

Test method: BS 2000-121.

Required performance:

- ≤ 2.5 % at 72 hours
- ≤ 4.5 % at 7 days.

Note: This required performance originates in ETAG 013 (June 2002).

2.2.5 Oxidation stability of grease

Test method: ASTM D 942.

Required performance:

- ≤ 0.06 MPa after 100 hours at 100°C
- ≤ 0.2 MPa after 1000 hours at 100°C.

Note: This required performance originates in ETAG 013 (June 2002).

2.2.6 Corrosion protection provided by grease – I

Test sample: a structural steel plate S355 with a surface roughness comparable to prestressing wire and strand. The plate is covered with a layer of grease of a maximum thickness of 125 μm. This thickness can be controlled with eddy current or by measuring the mass.

Test method: EN ISO 9227 (with NSS test).

Required performance: no corrosion after 1000 hours at 35 °C or no corrosion after 168 hours at 35°C. The corresponding testing time has to be stated in the ETA.

Note: This required performance originates in ETAG 013 (June 2002).

2.2.7 Corrosion protection provided by grease – II

Test sample: similar to 2.2.6.

Test method: EN ISO 6270-2 AHT.

Required performance: no corrosion after 1000 hours at 35°C or no corrosion after 168 hours at 35°C. The corresponding testing time has to be stated in the ETA.

Note: This required performance originates in ETAG 013 (June 2002).

2.2.8 Corrosion protection provided by grease – III

Test sample: similar to 2.2.6.

Test method: ISO 11007, test with solution of sodium chloride.

Required performance: grade = 0.

Note: This required performance originates in ETAG 013 (June 2002).

2.2.9 Corrosion protection provided by grease - IV

Test sample: similar to 2.2.6.

Test method: soak test, one half of the sample is immersed in a 5% salt solution and exposed to a 5% salt fog at 37.8 °C during an exposure time of 720 h. This test is to determine the ability of the grease or wax to provide corrosion protection after having been exposed to standing water for a period of time.

Measurement / observation: emulsion or not of the coating after the 720 h of exposure is to be stated in the ETA.

2.2.10 Content of aggressive elements for grease

Test method: NFM 07-023 is used for extraction method. Measurements are done with ion chromatography method. Cl^- is measured with EN ISO 10304-4. NO_3^-, SO_4^{2-} are measured with EN ISO 10304-1. S^{2-} is measured with a common ion chromatography method.

Required performance:

- $Cl^- \leq 50$ ppm;
- $S^{2-} \leq 50$ ppm;
- $NO_3^- \leq 50$ ppm;
- $SO_4^{2-} \leq 100$ ppm;

Suggested value for $NO_2^- \leq 10$ ppm.

For every elements quoted above, lower values can be stated in the ETA.

Note: This required performance originates in ETAG 013 (June 2002).

2.2.11 Possible interaction with PE duct

The aim of the test is to check the absence of possible interaction between the grease and a PE duct.

Testing is performed according to EN ISO 175 with 16 weeks test duration at 23 °C, but without changing the grease every 7 days as stipulated by the standard.

The sample taken is a piece of PE duct complying with Annex D.1 of EAD 160004 with a thickness of 1 mm (base material is a duct of diameter higher than 60 mm, from which a length and a developed

width of each 60 mm has been cut and thickness reduced to a value comprised between 1.0 mm and 1.1 mm). The kind of PE duct used in the test shall be stated in the ETA.

The following measurements are made and stated in the ETA:

- Alteration of tensile strength of PE duct (expressed in percentage)
- Alteration of elongation of PE duct (expressed in percentage)
- Alteration of volume of PE duct (expressed in percentage).

Tensile strength and elongation are determined according to EN ISO 527-2.

Test conditions are:

- Loading speed 100 mm/minute
- Temperature 23 °C

2.2.12 Water content for grease

Test method is ASTM D95.

Note: suggested value is < 0.1%.

The value has to be stated in the ETA.

2.2.13 Congealing point of wax

Test method: ISO 2207.

Acceptance criterion: ≥ 65 °C.

Note: This required performance originates in ETAG 013 (June 2002).

2.2.14 Heat resistance of wax, dropping point

Test method can be the one described by ISO 2176 or the automated method described in European Pharmacopeia (2.2.17 in 7th edition).

Value is to be stated in the ETA.

Note: suggested value ≥ 60°C.

2.2.15 Heat resistance of wax, flash point

Test method: EN ISO 2592.

Flash point temperature has to be stated in the ETA. Value should not be less than 250°C.

2.2.16 Consistency of wax

Test method: cone penetration at 25°C according to ISO 2137 (applied for petrolatum).

The value has to be stated in the ETA.

Note: suggested value for test result ≤ 125 (expressed in 1/10 mm).

2.2.17 Cold resistance of wax

Test method: the preparation of the specimen follows the same principles as the one described in ISO 2137 for petrolatum. The same portion container has to be used, the melting of the product is the same and the cooling up to 25 °C follows the same procedure. Once the sample is at 25 °C (before being introduced in the water bath), the specimen is cooled down up to -40°C in a way such that the final temperature is reached in less than 48 h. Once temperature is stabilised, the temperature is maintained for 2 hours and then the visual aspect is checked.

Required performance: no cracking at -40°C.

Note: This required performance originates in ETAG 013 (June 2002).

2.2.18 Stability of wax

Test method: bleeding at 40°C, BS 2000-121.

The value has to be stated in the ETA.

Note: suggested test result: ≤ 1% at 168 hours.

2.2.19 Oxidation stability of wax

Test method: ASTM D942

Required performance: ≤ 0.03 MPa after 100 hours at 100°C.

Note: This required performance originates in ETAG 013 (June 2002).

2.2.20 Corrosion protection provided by wax – I

Test method: Copper strip corrosion, 100 hours at 100°C, EN ISO 2160.

Required performance: class 1A

Note: This required performance originates in ETAG 013 (June 2002).

2.2.21 Corrosion protection provided by wax – II

Test sample : a structural steel plate S355 with a surface roughness comparable to prestressing wire and strand. The plate is covered with a layer of wax of a maximum thickness of 125 μm. This thickness can be controlled with eddy current or by measuring the mass.

Test method: EN ISO 9227 (with NSS test).

Required performance: no corrosion after 1000 hours at 35 °C or no corrosion after 168 hours at 35 °C. The corresponding testing time has to be stated in the ETA.

Note: This required performance originates in ETAG 013 (June 2002).

2.2.22 Corrosion protection provided by wax – III

Test sample: similar to 2.2.21.

Test method: EN ISO 9227 (NSS is replaced by distilled water).

Required performance: no corrosion after 1000 hours at 35 °C or no corrosion after 168 hours at 35 °C. The corresponding class has to be declared in the ETA.

Note: This required performance originates in ETAG 013 (June 2002).

2.2.23 Corrosion protection provided by wax – IV

Test sample: similar to 2.2.21.

Test method: soak test, one half of the sample is immersed in a 5% salt solution and the other half is exposed to a 5% salt fog at 37.8 °C. This test is to determine the ability of the grease or wax to provide corrosion protection after having been exposed to standing water for a period of time.

Measurement / observation: emulsion or not of the coating after the 720 hours of exposure is to be stated in the ETA.

2.2.24 Content of aggressive elements for wax

Test method: NFM 07-023 is used for extraction method. Measurements are done with ion chromatography method. Cl^- is measured with EN ISO 10304-4. NO_3^-, SO_4^{2-} are measured with EN ISO 10304-1. S^{2-} is measured with a common ion chromatography method.

Required performance:

- $Cl^- \leq 50$ ppm;
- $S^{2-} \leq 50$ ppm;
- $NO_3^- \leq 50$ ppm;
- $SO_4^{2-} \leq 100$ ppm;

Suggested value for $NO_2^- \leq 10$ ppm.

For every elements quoted above, lower values can be stated in the ETA.

Note: This required performance originates in ETAG 013 (June 2002).

2.2.25 Kinematic viscosity of wax

Test method: kinematic viscosity of wax is measured at injection temperature according to EN ISO 3104. The injection temperature is specified by the manufacturer.

The value has to be stated in the ETA.

2.2.26 Possible interaction with PE duct

The aim of the test is to check the absence of possible interaction between the wax and a PE duct.

Testing is performed according to EN ISO 175 with 16 weeks test duration at 23 °C, but without changing the wax every 7 days as stipulated by the standard. In addition, wax may be heated to immerse the piece of duct.

The sample taken is a piece of PE duct complying with Annex D.1 of EAD 160004 with a thickness of 1 mm (base material is a duct of diameter higher than 60 mm, from which a length and a developed width of each 60 mm has been cut and thickness reduced to a value comprised between 1.0 mm and 1.1 mm). The kind of PE duct used in the test shall be stated in the ETA.

The following measurements are made and stated in the ETA:

- Alteration of tensile strength of PE duct (expressed in percentage)
- Alteration of elongation of PE duct (expressed in percentage)

- Alteration of volume of PE duct (expressed in percentage).

Tensile strength and elongation are determined according to EN ISO 527-2.

Test conditions are

- Loading speed 100 mm/minute
- Temperature 23 °C

2.2.27 Grout general properties

Assessment tests and requirements correspond to initial type tests specified by EN 445 and EN 447. This EAD requires that sieve test, fluidity, wick induced bleeding, resistance, setting time and density tests shall be carried out for (20 ± 3) °C and minimum and maximum temperature specified by the manufacturer in the ETA (generally 5 °C and 35 °C), with the most unfavourable water/cement ratio and the most unfavourable stabilizer (admixture) content (two combinations can be studied ; high W/C ratio associated with low stabilizer content and low W/C ratio associated with high stabilizer content) specified by the manufacturer in the ETA, to assess the robustness of the proposed grout mix design. The temperature is the temperature of the component before the test and the ambient temperature during the test (a tolerance of 3 °C is allowed).

Concerning fluidity, the manufacturer can choose to state values measured with:

- Test method according to EN 445 (cone method or grout spread method)
- Immersion method as described in EN 445:1996.

Test method has to be stated in the ETA.

It is advised to satisfy EN 447 requirements for fluidity if test method according to EN 445 is used. If immersion method is used, the values have simply to be stated in the ETA.

The manufacturer has to provide guidance about the kind of mixer which has to be used on site.

For the inclined tube test, the temperature is 20 °C ± 5 °C.

An additional requirement for bleeding is the following: when tested by the inclined tube test method given in EN 445, the bleeding shall not exceed 0.3 % of the initial volume of the grout after 24 h.

These required performances originate in ETAG 013 (June 2002).

2.2.28 Grout : sedimentation property

The test method is described in 0.

It is advised that the sedimentation value, expressed as variation of density, is ≤ 10%.

2.2.29 Reaction to fire

Components made of steel, cast iron, stainless steel, cement or mortar containing mineral binders are considered to satisfy the requirements for performance class A1 of the characteristic reaction to fire, in accordance with the provisions of EC Decision 96/603/EC (as amended) 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.

Therefore the performance of these components is class A1.

Other components may need to be tested according to EN 13501-1, depending on the class the manufacturer wants to declare.

2.2.30 Content, emission and/or release of dangerous substances

The performance of the filling material related to the emissions and/or release and, where appropriate, the content of dangerous substances will be assessed on the basis of the information provided by the manufacturer [3] after identifying the release scenarios (in accordance with EOTA TR 034) taking into account the intended use 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:

IA1: Product with direct contact to indoor air.

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

S/W1: Product with direct contact to soil, ground- and surface water.

S/W2: Product with indirect contact to soil, ground- and surface water.

2.2.30.1 SVOC and VOC

For the intended use covered by the release scenario IA1 and IA2 the performance of the PT kit (including the filling material) concerning semi-volatile organic compounds (SVOC) and volatile organic compounds (VOC) are to be determined in accordance with EN 16516. For the assembling of the test specimen see clause 2.2.36.1 "SVOC and VOC" of EAD 14-16-0004-03.01 for POST-TENSIONING KITS FOR PRESTRESSING OF STRUCTURES.

2.2.30.2 Leachable substances

For the intended use covered by the release scenario S/W1 the performance of the PT kit (including the filling material) concerning leachable substances has to be assessed.

The test must be carried out within the scope of the use of the filling material in the PT kit (see clause 2.2.36.2 of EAD 14-16-0004-03.01).

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 98/456/EC

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[3] The manufacturer may be asked to provide to the TAB the REACH related information which he must accompany the DoP with (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
- to provide a written declaration to the TAB stating whether the product (or constituents of the product) contain(s) substances which are classified as dangerous according to Directive 67/548/EEC and Regulation (EC) No 1272/2008 and listed in the "Indicative list on dangerous substances" of the SGDS.

Any information provided by the manufacturer regarding the chemical composition of the products may not be distributed to EOTA or to TABs.

98/456/EC: Commission Decision 98/456/EC of 3 July 1998 on the procedure for attesting the conformity of construction products pursuant to Article 20(2) of Council Directive 89/106/EEC as regards post-tensioning kits for the prestressing of structures, Official Journal of the European Communities L 201 from 17 July 1998, page 112

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 2 Control plan for the manufacturer; cornerstones

No	Subject/type of control (product, raw/constituent material, component - indicating characteristic concerned)	Test or control method (refer to 2.2)	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					
Grease					
1	Grease : aspect (homogeneity, colour), visual inspection (documented by photography)	Testing		1	Each batch
2	Grease : cone penetration (60 strokes) at 25 °C	2.2.1	2.2.1	1	Each batch
3	Grease : dropping point	2.2.2	2.2.2	1	Each batch
4	Grease : oil separation : At 72 hours At 7 days	2.2.4	2.2.4	1	Each batch
5	Grease : chemical signature	3.4.1	2)	1	Each batch
Wax					
6	Wax : aspect (homogeneity, colour), visual inspection (documented by photography)	Testing		1	Each batch
7	Wax : dropping point	2.2.14	2.2.14	1	Each batch
8	Wax : cone penetration 25 °C	2.2.16	2.2.16	1	Each batch
9	Wax : bleeding at 40 °C during 168 hours	2.2.18	2.2.18	1	Each batch
10	Wax : kinematic viscosity at injection temperature in mm^2/s	2.2.25	2)	1	Each batch
11	Wax : chemical signature	3.4.1	2)	1	Each batch
Grout					
12	Grout : component	Check	2)	1	Each batch
13	Grout : cement	Check	2)	1	Each cement batch

14	Grout: admixtures, homogeneity/colour	Check	2)	1	Each batch
15	Grout: admixtures, dry solid content	Test (EN 480-8)	2)	1	Each batch
16	Grout: admixtures, chloride content	Test (EN 480-10)	2)	1	Each batch
17	Grout: compressive strength	Test (EN 445)	EN 447	1	3/year*
18	Grout: fluidity (0 and 30 min after mixing)	Test (EN 445)	EN 447	1	12/year*
19	Grout: wick induced bleeding test	Test (EN 445)	EN 447	1	6/year*
20	Grout: volume change	Test (EN 445)	EN 447	1	6/year*
21	Grout: total chloride content	Test	EN 447	1	3/year*

*: Tests shall be done on as many batches as possible.

2) Conformity with the specifications of the components

Note: the notion of batch shall be agreed between the TAB and the manufacturer.

3.2.1 General

The manufacturer shall perform permanent control of the factory production control (FPC).

The manufacturer has to provide the origin and composition of the filling material(s) to the TAB.

3.2.2 Permanent control of the factory production control (FPC)

The manufacturer shall exercise permanent internal control of the production. All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures. FPC and the prescribed test plan concern manufacturing. FPC systems which comply with EN ISO 9001 and which address the requirements of the ETA will be acceptable. Parts of the FPC may be transferred to an independent test laboratory. Nevertheless, the manufacturer has the full responsibility for all results of the FPC.

Control of the incoming materials

Manufacturer has to check the incoming materials to comply with its specifications. For components covered by a harmonized EN or by an ETA, the verification of the performance of the said components (by the manufacturer or by the notified body will be limited to the verification of the Declaration of Performance of the component manufacturer to ensure that the component has the performance required by the kit manufacturer. The same will apply for all components of the kit which will be gradually covered by harmonised ENs (e.g. tensile elements) or ETAs.

Inspection and testing

The validity of the type and frequency of checks/tests conducted during production and on the final product shall be considered as a function of the production process. This will include the checks conducted during manufacture on properties that cannot be inspected at a later stage and for checks on the final product. These will normally include:

- Definition of the number of samples taken by the manufacturer
- Material properties and their proportions in the final product
- Documentation of tests and test results.

All tests shall be performed according to written procedures with suitable calibrated measuring devices. All test results shall be recorded in a consistent and systematic way. The manufacturer and the TAB

issuing the ETA shall agree on a prescribed test plan. gives the minimum procedures that have to be performed for the most important components, to be adapted by the TAB.

Control of non-conforming products

Products which are considered as not conforming to the prescribed test plan shall be immediately marked and separated from such products which comply. The prescribed test plan has to address control of non-conforming products.

Complaints

The prescribed test plan shall include provisions to keep records of all complaints about the special filling material.

3.3 Tasks of the notified body

The cornerstones of the actions to be undertaken by the notified body (NB) in the procedure of assessment and verification of constancy of performance for for filling materials according this EAD are laid down in Table 3.

Table 3 Control plan for the notified body; cornerstones

No	Subject/type of control *(product, raw/constituent material, component - indicating characteristic concerned)*	Test or control method *(refer to 2.2 or 3.4)*	Criteria, if any	Minimum number of samples	Minimum frequency of control
Initial inspection of the manufacturing plant and of factory production control					
1	FPC documentation system: procedures and technical forms	documents	check	all	
2	Records of the FPC documentation system	records	check	1 for type	
3	Factory organization: qualifications, tasks and responsibilities of the technical and management staff	documents and records(3)	check	all	
4	Production flow	documents	check	all	
5	Order management: offer, order and accompanying documentation	documents	check	1	
6	Preparation of the Register of Manufacturer and the Declaration of Performance	documents	check	all	
7	Criteria, methods and records of materials internal controls and checks of the acceptance controls	documents and records	check	1 for type	
8	Production management (frequency, number and location of samples of finished products or components, periodic tests; identification systems products and their components; certifications of materials)	documents and records	check	1 for type	
9	Records of tests performed by the Manufacturer	records	check	all	
10	Inspection of production plants and warehouses	visual	check	all	
11	Manufacturer testing lab: check of critical equipment for the purpose of experimental measurements and / or controls; assurance metrological traceability of measurement and control equipment	visual, documents and records	check	all	
12	Treatment of non-conforming products, criteria for declassification and segregation	visual	check	1	

13	Traceability of products, from raw materials to the job site and vice versa	visual and records	check	1	
Continuing surveillance, assessment and evaluation of FPC					
1	FPC documentation system: procedures and technical forms	documents	check	modifications only	1/year
2	Records of the FPC documentation system	records	check	1 for type	1/year
3	Factory organization: qualifications, tasks and responsibilities of the technical and management staff	documents and records	check	modifications only	1/year
4	Production flow	documents	check	modifications only	1/year
5	Register of Manufacturers	records	check	all	1/year
6	Records of audits of component manufacturers	records	check	all	1/year
7	Declaration of Performance	records	check	1	1/year
8	Order management: offer, order and accompanying documentation	records	check	1	1/year
9	Criteria, methods and records of materials internal controls and checks of the acceptance controls	records	check	1	1/year
10	Production management (frequency, number and location of samples of finished products or components, periodic tests; identification systems products and their components; certifications of materials)	records	check	1 for type	1/year
11	Records of tests performed by the Manufacturer	records	check	1	1/year
12	Inspection of production plants and warehouses	visual	check	all	1/year
13	Manufacturer testing lab: check of critical equipment for the purpose of experimental measurements and / or controls; assurance metrological traceability of measurement and control equipment	visual and records	check	all	1/year
14	Treatment of non-conforming products, criteria for declassification and segregation	visual and records	check	1	1/year
15	Traceability of products, from raw materials to the job site and vice versa	visual and records	check	1	1/year
Audit-testing of samples taken by the notified product certification body at the manufacturing plant or at the manufacturer's storage facilities					
Grease					
1	Grease : dropping point	2.2.2	2.2.2	1	1/year
2	Grease : cone penetration (60 strokes) at 25 °C	2.2.1	2.2.1	1	1/year
3	Grease : oil separation : At 72 hours At 7 days	2.2.4	2.2.4	1	1/year
4	Grease : content of agressive elements	2.2.10	2.2.10	1	1/year
5	Grease : chemical signature	3.4.1	[1)]	1	1/year

Wax					
6	Wax : dropping point	2.2.14	2.2.14	1	1/year
7	Wax : cone penetration at 25 °C	2.2.16	2.2.16	1	1/year
8	Wax : bleeding at 40°C during 168 hours	2.2.18	2.2.18	1	1/year
9	Wax : content of agressive elements	2.2.24	2.2.24	1	1/year
10	Wax : chemical signature	3.4.1	1)	1	1/year
Grout					
11	Grout: homogeneity, sieve test	EN 445	EN 447	1	1/year
12	Grout: fluidity, cone method or grout spread	EN 445	EN 447	1	1/year
13	Grout: bleeding, wick induced	EN 445	EN 447	1	1/year
14	Grout: bleeding, Inclined tube	EN 445	EN 447	1 (2 tubes)	1/year
15	Grout: volume change, wick induced	EN 445	EN 447	1	1/year
16	Grout: compressive strength	EN 445	EN 447	1 (2 halves)	1/year
17	Grout: setting time	EN 196-3	EN 447	1	1/year
18	Grout: density	EN 445	1)	1	1/year

Key:
1) Conformity with the specifications of the components

Note: concerning cementitious grout, audit testing shall be done at 20 ± 3 °C only.

Note 2: subject to the agreement between TAB and the manufacturer, the control plan can include the audit of component manufacturers every 5 years as was required by ETAG013. In the same way, the control plan can include the fact to take samples for audit tests directly from job sites.

3.3.1 General

The NB shall perform the:
- Initial inspection of the factory and FPC;
- Continuing surveillance, assessment and evaluation of FPC;
- Audit testing of samples taken at the manufacturing plant or at the manufacturer storage facility.

3.3.2 Initial inspection of the factory and FPC

The NB shall establish that, in accordance with the prescribed test plan, the manufacturing plant, in particular personnel and equipment, and the factory production control are suitable to ensure a continuous manufacturing of the special filling product according to the given technical specifications. The activities shall be conducted by the NB or under its responsibility which may include a proportion included by an external inspection body, witnessed by the NB. For the most important activities, Table 3 summaries the minimum procedure. The TAB has to adapt Table 3 according to the specific case.

3.3.3 Continuing surveillance, assessment and evaluation of FPC

The activities shall be conducted by the NB or under its responsibility which may include a proportion included by an external inspection body, witnessed by the NB.

The activities shall include:

- Surveillance inspections. The special filling product manufacturer shall be inspected at least once a year. The FPC is checked;

For the most important activities, Table 3 summarizes the minimum procedure. The TAB has to adapt Table 3 according to the specific case.

3.3.4 Audit testing of samples taken at the manufacturing plant or at the manufacturer storage facility

During surveillance inspection, the NB shall take samples of components of the filling material for independent testing. Audit testing is conducted at least once a year by the NB or under its responsibility which may include a proportion conducted by an indicated laboratory or by the manufacturer, witnessed by the NB or inspection bodies. For the most important components, Table 3 summarizes the minimum procedures. The TAB has to adapt Table 3 according to the specific case.

3.3.5 Decision of the NB

The NB verifies the results of the surveillance inspections, the inspection of components manufacturers and the results of independent testing to verify constancy of performance and establish conformity with the ETA. In case of severe non-conformities that relate to important performance aspect of the special filling material and that cannot be corrected in due time, the NB withdraws the Certificate of Conformity. The NB shall inform the TAB about the withdrawal of certification and report to him about the reasons. If minor deficiencies are detected, corrective measures shall be taken by the manufacturer. These can include:

- Action against warning from the NB
- Higher inspection and test frequency
- Implementation of changes.

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

3.4.1 Grease and wax

Test method: infra-red spectrum according to DIN 51451.

This method is used to identify that the product is the same as the one tested during the assessment of the essential characteristics of the product by the TAB (part 2).

4 REFERENCE DOCUMENTS

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

- EC/EOTA documents:

  CPR: Construction Products Regulation. Regulation (EU) no 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction

  Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006

  EOTA Technical Report 034, "General BWR 3 Checklist for EADs/ETAs "

  EAD 160004, Post-tensioning kits for prestressing of structures

- European Standards:

  EN 196-3, Methods of testing cement – Part 3: Determination of setting time and soundness

  EN 445, Grout for prestressing tendons – Test methods

  EN 445:1996, Grout for prestressing tendons – Test methods

  EN 447, Grout for prestressing tendons – Basic requirements.

  EN 480-8, Admixtures for concrete, mortar and grout - Test methods - Part 8 : determination of the conventional dry material content

  EN 480-10, Admixtures for concrete, mortar and grout – Test methods – Part 10: Determination of water soluble chloride content.

  EN 12390-7, Testing hardened concrete - Part 7 : density of hardened concrete

  EN 13501-1, Fire classification of construction products and building elements - Part 1 : classification using data from reaction to fire tests

- EN ISO and ISO standards:

  EN ISO 175, Plastics - Methods of test for the determination of the effects of immersion in liquid chemicals

  EN ISO 527-2, Plastics - Determination of tensile properties - Part 2 : test conditions for moulding and extrusion plastics

  EN ISO 2160, Petroleum products – Corrosiveness to copper – Copper strip test.

  EN ISO 2592, Determination of flash and fire points - Cleveland open cup method

  EN ISO 3104, Petroleum products – Transparent and opaque liquids – Determination of kinematic viscosity and calculation of dynamic viscosity.

  EN ISO 6270-2, Paints and varnishes – Determination of resistance to humidity – Part 2: Condensation-water atmospheres.

  EN ISO 9001, Quality management systems - Requirements

  EN ISO 9227, Corrosion tests in artificial atmospheres – Salt spray tests.

  EN ISO 10304-1, Water quality – Determination of dissolved anions by liquid chromatography of ions – Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulphate.

  EN ISO 10304-4, Water quality – Determination of dissolved anions by liquid chromatography of ions – Part 4: Determination of chlorate, chloride and chlorite in water with low contamination.

  ISO 2137, Petroleum products – Lubricating grease and petroleum – Determination of cone penetration.

  ISO 2176, Petroleum products – Lubricating grease – Determination of dropping point.

  ISO 2207, Petroleum waxes – Determination of congealing point.

ISO 6270-2, Paints and varnishes – Determination of resistance to humidity – Part 2: Condensation-water atmospheres.

ISO 11007, Petroleum products and lubricants – Determination of rust-prevention characteristics of lubricating greases.

- FIP Guides to Good Practice and Recommendations:
  Corrosion protection of prestressing steels, 1996.

- Other standards:
  ASTM D95, Standard Test Method for Water in Petroleum Products and Bituminous Materials by Distillation

  ASTM D942, Standard Test Method for Oxidation Stability of Lubricating Greases by the Oxygen Pressure Vessel Method

  BS 2000-121, Methods of test for petroleum and its products – Oil separation on storage of grease, 2005.

  DIN 51451 (English), Testing of petroleum products and related products – Analysis by infrared spectrometry – General working principles, 2004.

  European Pharmacopeia (7th edition).

  NF M07-023: Liquid fuels. Determination of chlorides in crude petroleum and petroleum products.

ANNEX A: SEDIMENTATION TEST

A.1 OBJECTIVE

This test serves to determine the sedimentation properties of a grout. It is considered as a measurement of the homogeneity of the grout mixed in the equipment intended to be used on site.

A.2 TEST METHOD

Sedimentation is measured as a percentage difference in density of the grout between the samples taken from the top and bottom of the test specimen.

A.3 TEST EQUIPMENT

- Two transparent PVC tubes, of approximately 60 to 80 mm internal diameter, and 1 m long, equipped with caps at each end.
- Grouting equipment as per the grouting method statement.
- A thermometer with automatic recording.

A.4 TEST PROCEDURE

The grout mix specified by the ETA applicant is prepared in the grout mixer intended to be used on site. The transparent tubes are placed and held vertically on a surface free from shocks or vibrations. The tubes are filled with grout to the top and sealed to prevent evaporation. At least 24 hours after filling, but after setting of the grout, the grout columns shall be removed gently from the tubes. The grout columns shall be marked and subsequently cut into equal slices of 50 mm each over the entire height. The relative position of each slice in the column shall be recorded. The density of each slice shall be measured with the method proposed by EN 12390-7 (applied on water saturated specimens here).

A.5 MEASUREMENTS AND OBSERVATIONS

The following measurements and observations shall be made and recorded:

- Record temperature of grout constituents before testing, and air temperature during test period
- Record the density of each slice of both grout columns
- Determine the segregation ratio, R, of each of the grout columns as the variation of grout density between the bottom, D Bot, to the top, D Top, of the column as follows:

  $$R = 1 – (D\ Top / D\ Bot)$$

- Report any particular observation such as eventual bleed water on top of the grout column at the time of removing the grout column (presence of water and quantity), or discoloration of grout columns.
- Photographic documentation and comments.