Appendix B2, *Framework for the activities of Registered Laboratories for measurements of thermal conductivity curve, maximum service temperature and chloride content (insulation products for building equipment and industrial installations)*

Contents

Page

1 Introduction

The role of the registered laboratories is to conduct Initial Type Testing and Audit Testing for the characteristics listed below, according to EN 13172, EN 13787 and the Specific Scheme Rules for thermal insulation products for building equipment and industrial installations.

In order to ensure transparency and fair competition on the open European market, there is a need to obtain European conformity requirements for the thermal conductivity curve, maximum service temperature and quantities of water soluble chloride fluoride, silicate, sodium ions and pH value and if relevant the water vapour transmission properties measurements.

To ensure conformity with these requirements, registered laboratories shall be designated in accordance with the requirements of these scheme rules. These registered laboratories shall be in agreement with the European conformity requirements for the four tests as follows:

- For thermal conductivity as a function of temperature
  - $\lambda(\vartheta)$ for flat products from - 180 °C to 850 °C, extrapolated to a temperature difference of zero.
  - $\lambda(\vartheta_m)$ for cylindrical products is related to a surface temperature (ϑ_c), depending on the temperature range
    - -70 °C to 100 °C: ϑ_c = 20 °C
    - 100 °C to 300 °C: ϑ_c = 50 °C
- For maximum service temperature, MST
- For trace quantities of water soluble chloride fluoride, silicate, sodium ions and pH value
- For water vapour transmission properties, if relevant

Laboratories shall be registered for the temperature range for which they prove their testing capability.

In addition to the registered laboratories, a group, whose members are laboratories in the field of these tests and work with identified reference equipment, shall be designated so as to define the European levels of conformity requirements for the different tests.

The term 'European level of conformity requirement' is used for the evaluation of the checks performed in comparative testing where the same test specimens/samples are used by both laboratories and registered laboratories. It is defined by showing compliance with the relevant EN standards and reference material(s).

NOTE The progress of work shall be monitored by the Laboratory group in collaboration with the Notified Bodies group SG-19.

2 Requirements and tasks for a registered laboratory

2.1 Requirements

A laboratory shall fulfil the following requirements in order to be accepted by the laboratory group as a registered laboratory:

1. The laboratory shall be accredited against EN ISO 17025 (EA accreditation). In particular, the laboratory shall be able to demonstrate participation in inter-laboratory comparative testing for the relevant test methods.
2. The laboratory shall be notified within the frame of the CPR for insulation products for the relevant characteristics.
3. The laboratory shall have recent experience with test procedures (conditioning, ageing and measuring according to product specifications) according to the specific product standards.
4. The competence of staff and fitness for purpose of the equipment used for testing within the scheme shall comply with the requirements of relevant European standards:
   - For thermal conductivity curve EN 1946-1, 2 (Guarded Hot Plate, GHP) and 5 (pipe) and EN ISO 8497 and CEN/TS 15548-1.
   - For maximum service temperature EN 14706 and EN 14707
   - For trace quantities of water soluble chloride fluoride, silicate, sodium ions and pH EN 13468.
   - For water vapour transmission properties EN 12086 and EN 13469, if relevant

   Documentary evidence of compliance shall be retained by the laboratory for the purposes of auditing.
5. Measurements shall be carried out with registered test equipment.
6. Results shall be in agreement with the European levels of conformity requirements for the three tests as follows:
   - For thermal conductivity curve, $\lambda(\vartheta)$
     - ± 3 % for temperature range from -180 °C up to 500 °C
     - ± 5 % for temperatures above 500 °C
   - For thermal conductivity curve, $\lambda(\vartheta_m)$ a)
     - ± 3 % for temperature range from -70 °C up to 300 °C
   - For maximum service temperature (MST) ± 0,5 % deformation at a chosen temperature (equipment verification in comparative testing)
   - For trace quantities of water soluble chloride fluoride, silicate, sodium ions ± 1.5 ppm
   - For water vapour transmission properties, criteria to be defined later

   The listed values are provisional.

   To be demonstrated by the laboratory's participation in one programme of comparative testing approx. every third year.

NOTE 1 A laboratory may become registered for one or more of the test methods (the thermal conductivity curve, maximum service temperature and chloride content measurements)

NOTE 2 Where a registered laboratory is contracted by a manufacturer to conduct testing for the manufacturer's own factory production control, the acceptance of that registered laboratory to conduct testing for a Certification Body for this scheme, will be at the discretion of the Certification Body. In such a case the certification body shall inform the Quality Assurance Committee (QAC).

2.2 Tasks

- To participate in comparative testing campaigns between registered laboratories.
- To pay a fee of 500 € to the leading lab for the participation in each comparative test
- To participate in other actions of the Quality Assurance Committee (QAC).
- Accept the periodic audit one per 6 years.

3 Requirements and tasks for a member of the laboratory group

3.1 Requirements

In order to be accepted as a member of the laboratory group by the scheme, the person shall be able to demonstrate experience of testing with the different test methods by working for a registered laboratory fulfil all the requirements of Appendix B and/or being involved in the European standardisation of related test standards.

The members of the laboratory group will be chosen in such a way that all types of insulation products within the scope of the Scheme are covered.

3.2 Tasks

- To audit candidate registered laboratories as requested by the laboratory group.
- To assess and report the outcome of comparative testing.
- To give expert advice on particular issues as requested by the laboratory group.
- To provide “reference” samples, i.e. test specimens with measured values, for comparative testing between registered laboratories.
- To audit registered laboratories.

3.3 Establishment of European thermal conductivity reference

The laboratory group decides on one specific reference for GHP test and one pipe tester.

On these two-identified equipment, a homogeneous, isotropic material will be used to establish thermal conductivity related to temperatures. The curve from the pipe tester equipment has to be recalculated to infinitesimal temperature difference (lambda material) to be compared with the curve generated from the GHP equipment using the formula given in figure 1. A three-degree polynomial will be used to determine the thermal conductivity vs temperature.

$$\lambda(T) = c_0 + c_1 T + c_2 T^2 + c_p T^3 = \sum_{k=0}^{3} c_k T^k$$

The polynomial coefficient will be given by

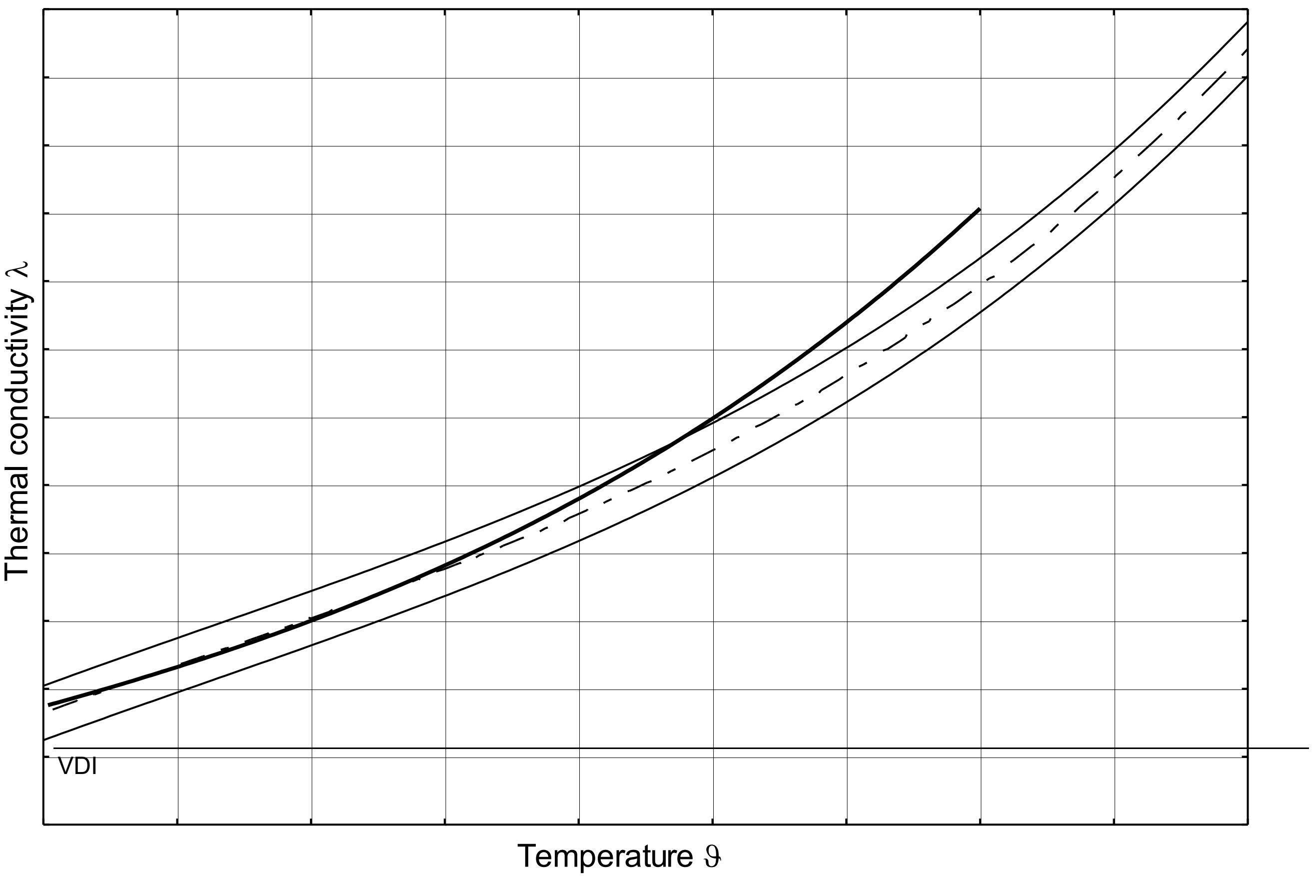
$$A^{-1}Y = \begin{bmatrix} c_0 \\ c_1 \\ c_2 \\ c_3 \end{bmatrix}$$

with

$$A = \begin{bmatrix} \sum_{i=1}^{n}\left(T_{hot_i} - T_{cold_i}\right) & \frac{1}{2}\sum_{i=1}^{n}\left(T_{hot_i}^2 - T_{cold_i}^2\right) & \frac{1}{3}\sum_{i=1}^{n}\left(T_{hot_i}^3 - T_{cold_i}^3\right) & \frac{1}{4}\sum_{i=1}^{n}\left(T_{hot_i}^4 - T_{cold_i}^4\right) \\ \frac{1}{2}\sum_{i=1}^{n}\left(T_{hot_i}^2 - T_{cold_i}^2\right) & \frac{1}{2}\sum_{i=1}^{n}\frac{\left(T_{hot_i}^2 - T_{cold_i}^2\right)\left(T_{ch_i}^2 - T_{cold_i}^2\right)}{2\left(T_{hot_i} - T_{cold_i}\right)} & \frac{1}{2}\sum_{i=1}^{n}\frac{\left(T_{hot_i}^3 - T_{cold_i}^3\right)\left(T_{hot_i}^2 - T_{fr_i}^2\right)}{3\left(T_{hot_i} - T_{fr_i}\right)} & \frac{1}{2}\sum_{i=1}^{n}\frac{\left(T_{hot_i}^4 - T_{fr_i}^4\right)\left(T_{hot_i}^2 - T_{cold_i}^2\right)}{4\left(T_{hot_i} - T_{fr_i}\right)} \\ \frac{1}{3}\sum_{i=1}^{n}\left(T_{hot_i}^3 - T_{cold_i}^3\right) & \frac{1}{3}\sum_{i=1}^{n}\frac{\left(T_{hot_i}^3 - T_{cold_i}^3\right)\left(T_{hot_i}^2 - T_{cold_i}^2\right)}{2\left(T_{hot_i} - T_{cold_i}\right)} & \frac{1}{3}\sum_{i=1}^{n}\frac{\left(T_{hot_i}^3 - T_{cold_i}^3\right)\left(T_{hot_i}^3 - T_{cold_i}^3\right)}{3\left(T_{hot_i} - T_{cold_i}\right)} & \frac{1}{3}\sum_{i=1}^{n}\frac{\left(T_{hot_i}^3 - T_{cold_i}^3\right)\left(T_{hot_i}^4 - T_{cold_i}^4\right)}{4\left(T_{hot_i} - T_{fr_i}\right)} \\ \frac{1}{4}\sum_{i=1}^{n}\left(T_{hot_i}^4 - T_{cold_i}^4\right) & \frac{1}{4}\sum_{i=1}^{n}\frac{\left(T_{hot_i}^4 - T_{cold_i}^4\right)\left(T_{hot_i}^2 - T_{cold_i}^2\right)}{2\left(T_{hot_i} - T_{cold_i}\right)} & \frac{1}{4}\sum_{i=1}^{n}\frac{\left(T_{hot_i}^3 - T_{cold_i}^3\right)\left(T_{hot_i}^4 - T_{cold_i}^4\right)}{3\left(T_{hot_i} - T_{cold_i}\right)} & \frac{1}{4}\sum_{i=1}^{n}\frac{\left(T_{hot_i}^4 - T_{fr_i}^4\right)\left(T_{hot_i}^4 - T_{cold_i}^4\right)}{4\left(T_{hot_i} - T_{cold_i}\right)} \end{bmatrix}$$

and

$$\begin{bmatrix} W_1 \\ W_2 \\ W_3 \\ W_4 \end{bmatrix} = \begin{bmatrix} \sum_{i=1}^{n} y_i\left(T_{hot_i} - T_{coldi}\right) \\ \frac{1}{2}\sum_{i=1}^{n} y_i\left(T_{hot_i}^2 - T_{cold_i}^2\right) \\ \frac{1}{3}\sum_{i=1}^{n} y_i\left(T_{hot_i}^3 - T_{cold_i}^3\right) \\ \frac{1}{4}\sum_{i=1}^{n} y_i\left(T_{hot_i}^4 - T_{cold_i}^4\right) \end{bmatrix} = Y$$



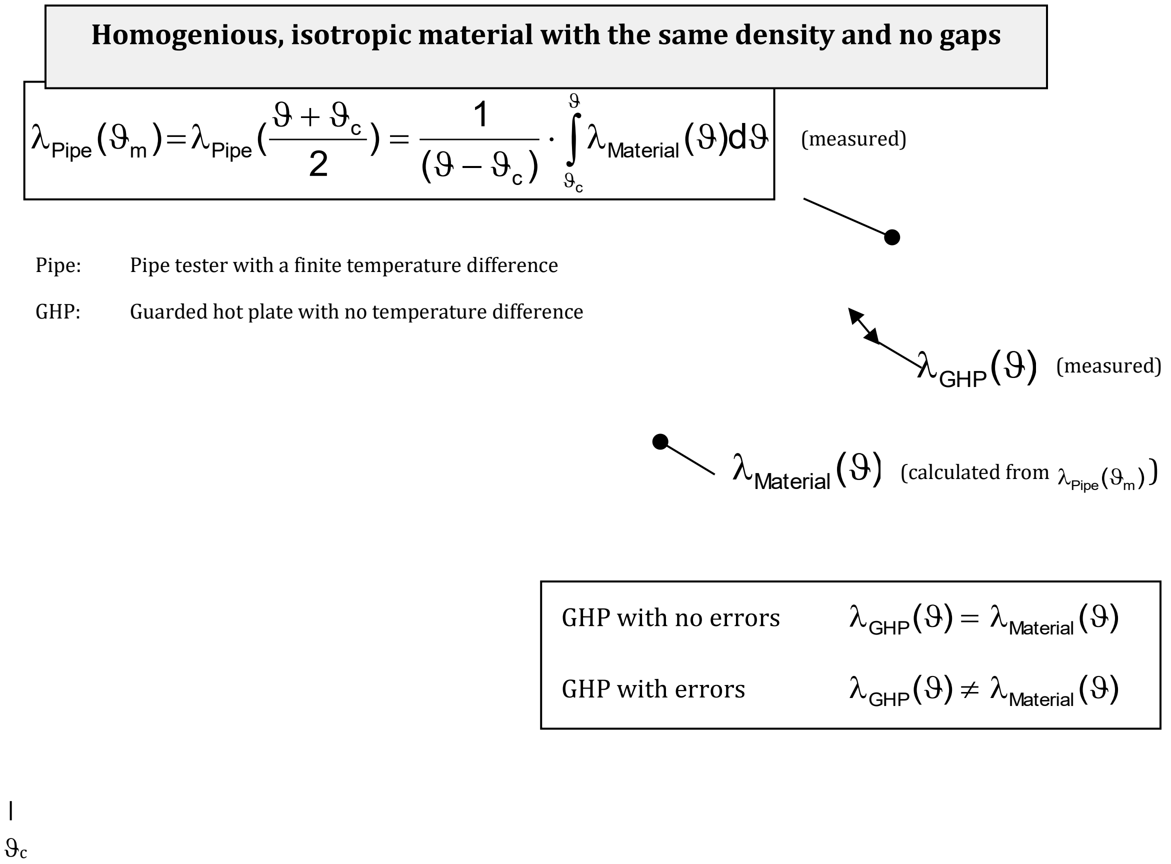


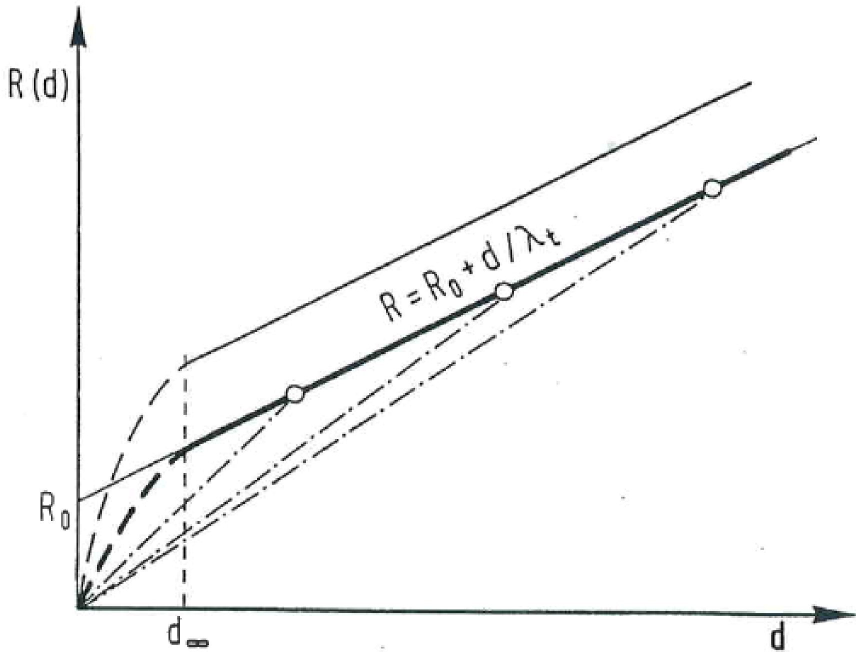
Figure 1 – Comparability of thermal conductivity curve for GHP versus pipe tester

This relationship applies however only to the thermal conductivity of radiation-impermeable materials. If a radiation permeability is present, then the different testing equipment will not give the same result.

The measured value depends on the experimental conditions, geometry of the testing equipment, the emissivity of the bounding surfaces and the thickness of the test specimen. It is called transfer factor in accordance with EN ISO 9288 "Heat transfer by radiation" transfer factor and does not correspond to the thermal conductivity (thermal transmissivity) of the material.

A loose – fill of glass beads with a bulk density of 250 kg/m^3 is used as a comparison material for both geometrical forms of the testing equipment (guarded hot plate and pipe tester) and meets the conditions regarding the requirement for homogeneity and isotropy.

Regarding the radiation permeability, the effects are shown in figure 2.



The thickness d_∞ indicates the beginning of the straight portion of the plot of thermal resistance, R. A reduction of apparatus emissivity shifts the bold line upwards.

if $d < d_\infty$	The ratio of an increment in specimen thickness, Δd, to the corresponding increment in measured thermal resistance, ΔR, is not constant; the thermal transmissivity, λ_t, cannot be measured; the transfer factor, J, is not an intrinsic material property, as it depends on experimental conditions.
if $d > d_\infty$	The ratio $\Delta d/\Delta R$ is constant; the thermal transmissivity λ_t, that is an intrinsic material property independent of experimental conditions, can be measured. In this case, the radiativity λ_r and the gaseous and solid thermal conductivity λ_{cd} can also be defined as material properties and put $\lambda_t = \lambda_{cd} + \lambda_r$. Nevertheless $J = d/R$ is not yet independent of the thickness d, see dashed and dotted lines.

Figure 2 - Thermal resistance, R, as a function of the specimen thickness, d

With extensive series of measurements, the transfer function of the glass beads was determined with a density of 250 kg/m^3 with testing equipment of different geometrical forms (plate, pipe and sphere), and different emissivities of the bounding surfaces and for different material layer thicknesses. Using a correction calculation according to VDI 2048 [1] with physical secondary conditions and with consideration of the radiation permeability the thermal conductivity as function of the temperature $\lambda_t(\vartheta)$ of the glass beads is determined with a confidence interval of ± 0.2 %.

The transfer factor is derived from the measured value by the respective measuring equipment from the following equation:

$$\Im = \frac{1}{\dfrac{E^*}{4 \cdot \sigma \cdot T_m^3} + \dfrac{1}{\lambda_t(\vartheta)}} \qquad (1)$$

With E * as a modified extinction parameter for the different forms of the testing equipment, which is defined as follows:

plate:

$$E^* = \frac{1}{d \cdot (a + \frac{b}{\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1})} \qquad (2)$$

pipe:

$$E^* = \frac{1}{\frac{D_1 + D_2}{4} \cdot \ln \frac{D_a}{D_i} \cdot (a + \frac{b}{\frac{1}{\varepsilon_1} + \frac{D_1}{D_2}(\frac{1}{\varepsilon_2} - 1)})} \qquad (3)$$

$$T_m = 273{,}15 + \vartheta \qquad (4)$$

where:

d: thickness of the material layer in m

D_1 inner diameter of the test pipe in m

D_2 outer diameter of the test specimen in m

a: modified coefficient for the spectral directional extinction coefficient

b: modified coefficient for the spectral directional optical thickness

σ: Stefan-Boltzman's Constant $5{,}67 \cdot 10^{-8}$ W/(m²·K⁴)

ϑ: temperature in °C

$\varepsilon_1;\varepsilon_2$: emissivity of the bounding surfaces e.g. hot or cooling plate

T: thermodynamic temperature in K.

[1] VDI 2048 Blatt 1, Uncertainties of measurement during acceptance tests on energy-conversion and power plant fundamentals

To ensure consistency with the thermal conductivity at lower temperatures the GHP equipment shall show compliance with the European reference material IRMM 440 at a temperature interval from approx. 40 to 70 ºC.

3.4 Establishment of European maximum service temperature (MST) reference

At least 2 different products (if relevant from different product families) shall be tested.

Test specimens for each product to be distributed among the laboratories shall be selected from the same lot and care taken that the test specimens will be as homogeneous as possible.

The tests shall be done both for flat products and for cylindrical products, if relevant.

Test procedure as well as number of test specimens to get a test result shall be in accordance with the EN standards EN 14706 and EN 14707, except that thickness changes are determined at chosen temperatures only.

3.5 Establishment of European Chloride content measurement reference

Comparative testing on a MW product including test specimen preparation and on an eluate.

4 The Laboratory Group secretariat

Some of the duties are:

1. To organise periodic meetings between members of the laboratory group and registered laboratories.
2. To organise and maintain the liaison with the Notified Bodies Group SG-19.
3. To organise the rotation of test specimens between the registered laboratories for the comparative tests.
4. To report to the Quality Assurance Committee and keep records of the outcome of the comparative tests.
5. To keep a register of the identified reference and test equipment used within the laboratory group and the registered laboratories, respectively.

5 Relationship between the Quality Assurance Mark and SG-19 parties

The following chart describes the relationships between the various QAC schemes and SG-19 parties.

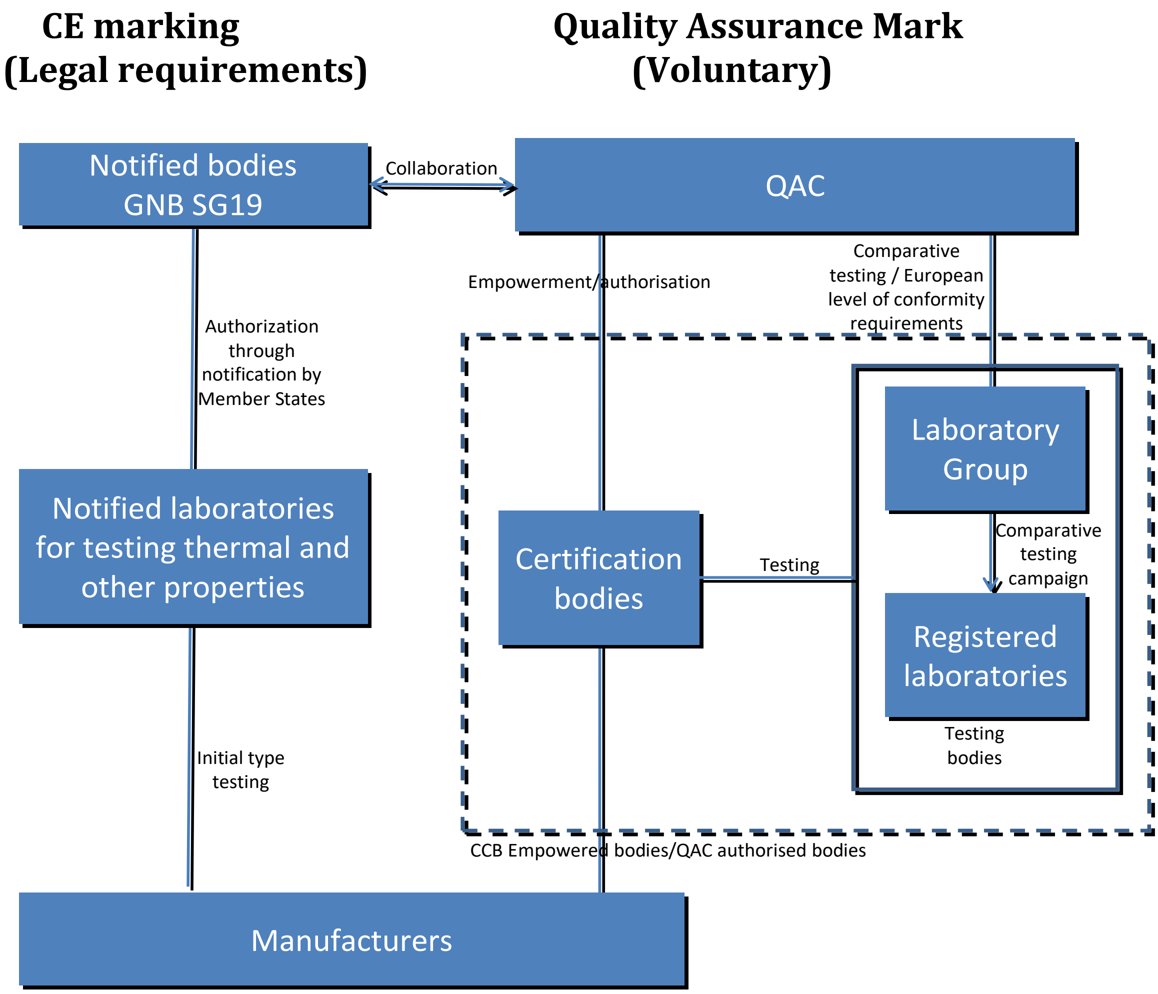


Figure 3 - Relationships between parties involved in thermal testing within SG-19 or QAC schemes

Note that some of the parties in this chart may be the same.

6 Financial matters

6.1 Laboratory group

6.1.1 Costs to be borne by the laboratory group

- Travel / meetings within the laboratory group.

6.1.2 Financial benefits

- Income from performing audits of registered laboratories.
- Payment from the Quality Assurance Committee for other tasks as required in Section 2.

6.2 Registered laboratories

6.2.1 Costs to be borne by the registered laboratories

- Auditing by the laboratory group (initial and periodic assessment).
- Participation in the comparative tests.

6.2.2 Financial benefits

- Payment for testing required by the certification bodies.
- Payment for testing requested by the manufacturers.

6.3 The Quality Assurance Committee

6.3.1 Costs to be borne by the QAC

- Periodic comparative testing according to the time schedule of Section 2.

6.3.2 Financial benefits

Income from the sale of reference test samples measured on the identified reference guarded hot plate equipment.

Annex 1: Organisation of comparative testing programmes between Registered Laboratories

It is important to ensure that the registered laboratories get results in agreement with the European conformity requirements for the three tests as follows:

- For thermal conductivity curve, $\lambda(\vartheta)$
  - ± 3 % for temperature range from -180 ºC up to 500 ºC
  - ± 5 % for temperatures above 500 ºC
- For thermal conductivity curve, $\lambda(\vartheta_m)$
  - ± 3 % for temperature range from -70 ºC up to 300 ºC
- For maximum service temperature (MST) ± 0,5 % deformation at a chosen temperature (equipment verification in comparative testing)
- Quantities of water soluble chloride fluoride, silicate, sodium ions ± 1.5 ppm

The listed tolerances are subject to confirmation by TG 5.

Therefore, laboratories already registered and the laboratories applying for first-time registration [1] shall participate in comparative testing programmes organised by the Laboratory Group. The comparative testing programme shall be organised approx. every 3rd year in the following way:

1. Selection of specimens to be used in the comparative testing programme

   The Laboratory Group shall identify reference apparatuses of the laboratory group for the different tests ($\lambda(\vartheta)$, $\lambda(\vartheta_m)$, MST and quantities of water soluble chloride fluoride, silicate, sodium ions and pH). This equipment is used to determine the "Quality Assurance Mark value" for selected test specimens. The test specimens may be prepared from different product families for different tests/comparative testing programmes (see also paragraphs 2.3, 2.4 and 2.5).

2. Measurements by the registered laboratories

   - The Laboratory Group secretariat organises the provision of the test specimens to the laboratories. Each laboratory measures the test specimens for the relevant test(s) and reports to the Laboratory Group secretariat.
   - Measurements shall be performed on all identified test equipment that the laboratory wishes to be part of the registration.

3. Outcome of the comparative testing programme

   The Laboratory Group secretariat collects the results and sends a written evaluation of the results to the relevant registered laboratory. The registration of a laboratory is granted (in the case of a laboratory applying for first-time registration) or renewed (in the case of a laboratory already registered) if the laboratory satisfies to the general requirements of Section 1 and if the value of the measurement for each test is within the European conformity requirement.

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[1] Throughout this annex reference is being made to both categories as "Registered Laboratories" for the sake of simplicity.

Annex 2: Application form

Comparative testing for the purpose of establishing the European group of registered laboratories for measurements of thermal conductivity, maximum service temperature and chloride content

This form should be completed and submitted by the laboratories that wish to participate in the comparative testing that will form the basis for the selection of the laboratories that will form the European group of reference laboratories. The general part shall always be filled in. In addition, the parts for the individual tests shall be filled in for the tests, for which the laboratory applies.

2.a General
Administrative information:

Company / Laboratory:
…………………………………………………………………………………..

Contact person:
…………………………………………………………………………………..

Person(s) responsible for the tests:
…………………………………………………………………………………..

Address (location of the laboratory):
…………………………………………………………………………………..

Mailing address for samples (if different from above):
…………………………………………………………………………………..

Mailing address for letters (if different from above, e.g. P.O. Box):
…………………………………………………………………………………..

Tel:

Fax:

E-mail:

General laboratory information

Accreditation in conformity with EN ISO/IEC 17025 covering the following test methods (tick off where relevant):

EN 12667 (GHP) ☐
TS 15548 (GHP high temp.) ☐
EN ISO 8497 (Pipe) ☐
EN 14706 ☐
EN 14707 ☐
EN 13468 ☐

Is the laboratory a notified body within the framework of the CPR for insulation products?

………………………………………………………………………………..

Which thermal insulation product standards are covered by the notification?

………………………………………………………………………………..

2.b Thermal conductivity curve for GHP equipment

How many sets of test equipment for the measurement of the thermal conductivity does the laboratory presently use?

- guarded hot plate apparatuses:

………………………………………………………………………………..

Does the laboratory have experience on a regular basis with comparative testing for lambda levels? (If so, give details of the most recent.)

………………………………………………………………………………..

Does the laboratory have experience with the testing of products (conditioning and measuring according to product specification) within different families of insulation materials?
Specify: e.g. MW, FEF, CG, CS, XPS, PUR/PIR, EPS, PEF, PF.

………………………………………………………………………………..

Which identified test equipment is intended for use within the VDI scheme, and is it documented as in compliance with EN 1946-1 and 2?

………………………………………………………………………………..

Describe the reference material(s) used (IRMM 440 reference material [10°C] and others for temperatures above 100 °C)

………………………………………………………………………………..

Information concerning the test equipment:

In this section details must be given of the test equipment (guarded hot plate) that the laboratory wants to use for the tests (add extra photocopied page(s) for more than one piece of test equipment).
NOTE heat flow meter may be used for temperatures up to 70 ºC.

Brand and model:

…………………………………………………………………………………..

Internal (laboratory) identification number of the test equipment:

…………………………………………………………………………………..

Device declared in compliance with which standards?

…………………………………………………………………………………..

Is the laboratory accredited according to EN ISO/IEC 17025 for testing with this equipment?
If yes, give details (original date of accreditation, most recent audit, etc).

…………………………………………………………………………………..

Measurement range:

- thermal conductivity:
  - min:
  - max:
- thermal resistance:
  - min:
  - max:
- mean temperature:
  - min:
  - max:
- specimen thickness:
  - min:
  - max:
- specimen size:
  - min:
  - max:

- other?

……………………………………………………………………………..

Declared accuracy of measurement (reference to EN ISO/IEC 17025):

……………………………………………………………………………..

NOTE EN 1946-2 only covers part of the uncertainty calculation

Single or double specimen device?

……………………………………………………………………………..

Dimensions of the measurement zone:

……………………………………………………………………………..

Number of points for measuring the surface temperature of the hot side and the cold side (attach a sketch with positions if possible):

……………………………………………………………………………..

Is the measurement of the temperature difference between the hot side and the cold side performed directly or by subtraction of absolute temperatures?

……………………………………………………………………………..

Criteria applied for determining the stabilisation of the thermal conditions:

……………………………………………………………………………..

Thickness measurement principle during λ measurement (number of points, on the edges/entire surface, is the test thickness chosen imposed by the equipment, procedure difference between soft and rigid test specimens, etc.):

……………………………………………………………………………..

2.c Thermal conductivity curve for pipe tester

How many sets of test equipment for the measurement of the thermal conductivity does the laboratory presently use?

- Pipe tester apparatuses:

……………………………………………………………………………..

Does the laboratory have experience on a regular basis with comparative testing for lambda levels? (If so, give details of the most recent.)

…………………………………………………………………………………..

Does the laboratory have experience with the testing of products (conditioning and measuring according to product specification) within different families of insulation materials?
Specify: e.g. MW, FEF, CG, CS, XPS, PUR/PIR, EPS, PEF, PF.

…………………………………………………………………………………..

Which identified test equipment is intended for use within the VDI-Mark scheme, and is it documented as in compliance with EN 1946-1, and 5?

…………………………………………………………………………………..

Describe the reference material(s) used

…………………………………………………………………………………..

Information concerning the test equipment:

In this section details, must be given of the test equipment that the laboratory wants to use for the tests (add extra photocopied page(s) for more than one piece of test equipment).

Brand and model:

…………………………………………………………………………………..

Internal (laboratory) identification number of the test equipment:

…………………………………………………………………………………..

Device declared in compliance with which standards?

…………………………………………………………………………………..

Is the laboratory accredited according to EN ISO 17025 for testing with this equipment?
If yes, give details (original date of accreditation, most recent audit, etc.).

…………………………………………………………………………………..

Measurement range:

- thermal conductivity:
  - min:
  - max:

- thermal resistance:
  - min:
  - max:

- mean temperature:
  - min:
  - max:

- specimen thickness:
  - min:
  - max:

- pipe diameters:

- specimen length:
  - min:
  - max:

- other?

………………………………………………………………………………..

Declared accuracy of measurement (reference to EN ISO/IEC 17025):

………………………………………………………………………………..

Guarded end apparatus and/or calibrated/calculated end apparatus?

………………………………………………………………………………..

Length of the measurement zone:

………………………………………………………………………………..

Number of points for measuring the surface temperature of the hot side and the cold side (attach a sketch with positions if possible):

……………………………………………………………………………..

Is the measurement of the temperature difference between the hot side and the cold side performed directly or by subtraction of absolute temperatures?

……………………………………………………………………………..

Criteria applied for determining the stabilisation of the thermal conditions:

……………………………………………………………………………..

Thickness measurement principle during λ measurement (number of points, etc.):

……………………………………………………………………………..

2.d Maximum service temperature for flat products

How many sets of test equipment for the measurement of the maximum service temperature does the laboratory presently use?

- plate apparatuses:

……………………………………………………………………………..

Does the laboratory have experience on a regular basis with comparative testing? (If so, give details of the most recent.)

……………………………………………………………………………..

Does the laboratory have experience with the testing of products (conditioning and measuring according to product specification) within different families of insulation materials?
Specify: e.g. MW, FEF, CG, CS, XPS, PUR/PIR, EPS, PEF, PF.

……………………………………………………………………………..

Which identified test equipment is intended for use within the VDI scheme?

……………………………………………………………………………..

Information concerning the test equipment:

In this section details, must be given of the test equipment that the laboratory wants to use for the tests (add extra photocopied page(s) for more than one piece of test equipment).

Brand and model:

………………………………………………………………………………..

Internal (laboratory) identification number of the test equipment:

………………………………………………………………………………..

Device declared in compliance with which standards?

………………………………………………………………………………..

Is the laboratory accredited according to EN ISO/IEC 17025 for testing with this equipment?
If yes, give details (original date of accreditation, most recent audit, etc).

………………………………………………………………………………..

Measurement range:

- temperature:
  - max:

- specimen thickness:
  - min:
  - max:

- specimen size:
  - min:
  - max:

- other?

………………………………………………………………………………..

Declared accuracy of temperature and thickness measurement (reference to EN ISO/IEC 17025):

………………………………………………………………………………..

Dimensions of the measurement zone:

……………………………………………………………………………..

Number of points for measuring the surface temperature of the hot side:

……………………………………………………………………………..

Thickness measurement principle:

……………………………………………………………………………..

2.e Maximum service temperature for pipe insulation

How many sets of test equipment for the measurement of the maximum service temperature does the laboratory presently use?

- pipe apparatuses:

……………………………………………………………………………..

Does the laboratory have experience on a regular basis with comparative testing? (If so, give details of the most recent.)

……………………………………………………………………………..

Does the laboratory have experience with the testing of products (conditioning and measuring according to product specification) within different families of insulation materials?
Specify: e.g. MW, FEF, CG, CS, XPS, PUR/PIR, EPS, PEF, PF.

……………………………………………………………………………..

Which identified test equipment is intended for use within the VDI scheme?

……………………………………………………………………………..

Information concerning the test equipment:

In this section details must be given of the test equipment that the laboratory wants to use for the tests (add extra photocopied page(s) for more than one piece of test equipment).

Brand and model:

……………………………………………………………………………..

Internal (laboratory) identification number of the test equipment:

……………………………………………………………………………..

Device declared in compliance with which standards?

……………………………………………………………………………..

Is the laboratory accredited according to EN ISO/IEC 17025 for testing with this equipment? If yes, give details (original date of accreditation, most recent audit, etc.).

……………………………………………………………………………..

Measurement range:

- temperature:
  - max:
- pipe diameter(s):
- specimen thickness:
  - min:
  - max:
- specimen size:
  - min:
  - max:
- other?

……………………………………………………………………………..

Declared accuracy of temperature and thickness measurement (reference to EN ISO/IEC 17025):

……………………………………………………………………………..

Dimensions of the measurement zone:

……………………………………………………………………………..

Number of points for measuring the surface temperature of the hot side:

……………………………………………………………………………..

Thickness measurement principle:

………………………………………………………………………………..

2.f Quantities of water soluble chloride fluoride, silicate, sodium ions and pH

Test method used?

………………………………………………………………………………..

How many sets of test equipment for the measurement of the quantities of water soluble ions and pH value does the laboratory presently use?

………………………………………………………………………………..

Does the laboratory have experience on a regular basis with comparative testing? (If so, give details of the most recent.)

………………………………………………………………………………..

Does the laboratory have experience with the testing of products (conditioning and measuring according to product specification) within different families of insulation materials?
Specify: e.g. MW, FEF, CG, CS, XPS, PUR/PIR, EPS, PEF, PF.

………………………………………………………………………………..

Procedure/standard of conditioning the insulation material

………………………………………………………………………………..

Which identified test equipment is intended for use within the VDI scheme?

………………………………………………………………………………..

Information concerning the test equipment:

In this section details, must be given of the test equipment that the laboratory wants to use for the tests (add extra photocopied page(s) for more than one piece of test equipment).

Brand and model:

………………………………………………………………………………..

Internal (laboratory) identification number of the test equipment:

………………………………………………………………………………..

Device declared in compliance with which standards?

……………………………………………………………………………..

Is the laboratory accredited according to EN ISO 17025 for testing with this equipment?
If yes, give details (original date of accreditation, most recent audit, etc.).

……………………………………………………………………………..

Measurement range:

- ion content:
  - **chloride** min (detection limit):

……………………………………

  - **fluoride,** min (detection limit):

……………………………………

  - **silicate,** min (detection limit):

……………………………………

  - **sodium** min (detection limit):

……………………………………

- other?

……………………………………………………………………………..

Declared accuracy of measurement (reference to EN ISO/IEC 17025):

……………………………………………………………………………..

Date:

Signature:

Annex 3a: Result form - Thermal conductivity – flat products

European group of registered laboratories - Comparative testing
MEASUREMENT OF THERMAL CONDUCTIVITY – Flat products
This form must be filled out and submitted in addition to the standard measurement report of the laboratory

Laboratory							
Laboratory name							
Name of staff responsible							
Date of arrival of the sample							
Start date of the measurement							
Finish date of the measurement							
Apparatus details							
Type and identification code/no.	z						
Size of central metering part							m x m
Size of guard ring							m x m
Specimen details							
Specimen description							
Specimen identity code							
Date of production (when relevant)							
Date of preparation (when relevant)							
Specimen size (length x width)							m x m
Specimen thickness (EN 823)							m
Pressure plate (size , pressure)					m x m		Pa
Density, calculated with thickness			specimen		nominal		kg/m³
Conditioning details							
Conditioning conditions					°C		% rel. H.
Weight at start of conditioning							kg
Weight at finish of conditioning							kg
Time at conditioning conditions							days
Measured values							
Stability criteria							
Heat flow direction							
Surrounding climate					°C		% rel. H.
No.	1	2	3	4	5	6	
Time at temperature in apparatus							h
Measuring area							m²
Thickness during λ measurement							m
Hot surface temperature							°C
Cold surface temperature							°C
Surface temperature difference							K
Mean specimen temperature							°C
Power							W
Change in mass after measurement							%
Thickness after measurement							m
Remarks							
Results							
Temperature	50	100	200	300	400	500	°C
Thermal conductivity *) Please use 3 significant figures (e.g. 0.0503)							W/(m·K)

*) related to a temperature difference of zero (no recalculation needed if the temperature difference is ≤ 50 ºC)

NOTE For products subject to ageing, all relevant data should be provided.
If more than one specimen is used, the relevant values are mean values.

Annex 3b: Result form - Thermal conductivity – pipe insulation products

European group of registered laboratories - Comparative testing
MEASUREMENT OF THERMAL CONDUCTIVITY – Pipe insulation products
This form must be filled out and submitted in addition to the standard measurement report of the laboratory

Laboratory							
Laboratory name							
Name of staff responsible							
Date of arrival of the sample							
Start date of the measurement							
Finish date of the measurement							
Apparatus details							
Type and identification code/no.							
Length of test pipe							m
Diameter of test pipe							mm
Edge control	guarded end		calibrated		calculated		
Specimen details							
Specimen description							
Specimen identity code							
Date of production (when relevant)							
Date of preparation (when relevant)							
Specimen inner diameter (EN 13467)							m
Specimen thickness (EN 13467)							m
Density (EN 13470)							kg/m³
Conditioning details							
Conditioning conditions						°C	% rel. H.
Weight at start of conditioning							kg
Weight at finish of conditioning							kg
Time at conditioning conditions							days
Measured values							
Stability criteria							
Heat flow direction							
Surrounding climate						°C	% rel. H.
No.	1	2	3	4	5	6	
Time at temperature in apparatus							h
Thickness during λ measurement							m
Hot surface temperature							°C
Cold surface temperature							°C
Surface temperature difference							K
Mean specimen temperature							°C
Power							W
Change in mass after measurement							%
Thickness after measurement							m
Remarks							
Results							
Mean specimen temperature	50	100	150	200	250	300	°C
Thermal conductivity *) Please use 3 significant figures (e.g. 0.0503)							W/(m·K)

*) related to a surface temperature (ϑ_c), depending on the temperature range -70 °C to 100 °C: ϑ_c = 20 °C and 100 °C to 300 °C: ϑ_c = 50 °C

NOTE For products subject to ageing, all relevant data should be provided.
If more than one specimen is used, the relevant values are mean values.

Annex 3c: Result form - Maximum service temperature – Flat products

European group of registered laboratories - Comparative testing
MEASUREMENT OF MAXIMUM SERVICE TEMPERATURE – Flat products

This form must be filled out and submitted in addition to the standard measurement report of the laboratory

Laboratory				
Laboratory name				
Name of staff responsible				
Date of arrival of the sample				
Start date of the measurement				
Finish date of the measurement				
Apparatus details				
Type and identification code/no.				
Size of central metering part				m x m
Specimen details				
Specimen description				
Specimen identity code				
Date of production (when relevant)				
Date of preparation (when relevant)				
Specimen size (length x width)				m x m
Number of specimens				
Mean specimen thickness (EN 823)				m
Pressure plate (size, pressure)			m x m	Pa
Density, calculated with thickness		specimen	nominal	kg/m^3
Conditioning details				
Conditioning conditions			°C	% rel. H.
Weight at start of conditioning				kg
Weight at finish of conditioning				kg
Time at conditioning conditions				days
Measured values				
Surrounding climate			°C	% rel. H.
Test load				Pa
Temperature of hot plate				°C
Temperature rate of increase				°C / h
Time at temperature in apparatus				h
Change in mass after measurement				%
Internal self-heating				
Remarks				
Results				
Temperature of the hot plate				°C
Change in thickness Please use 2 significant figures (e.g. 4.8)				%

NOTE If more than one specimen is used, the relevant values are mean values.

Annex 3d: Result form - Maximum service temperature – pipe insulation products

European group of registered laboratories - Comparative testing **MEASUREMENT OF MAXIMUM SERVICE TEMPERATURE – Pipe insulation products** *This form must be filled out and submitted in addition to the standard measurement report of the laboratory*				
Laboratory				
Laboratory name				
Name of staff responsible				
Date of arrival of the sample				
Start date of the measurement				
Finish date of the measurement				
Apparatus details				
Type and identification code/no.				
Length of test pipe				m
Diameter of test pipe				mm
Specimen details				
Specimen description				
Specimen identity code				
Date of production (when relevant)				
Date of preparation (when relevant)				
Specimen inner diameter (EN 13467)				m
Specimen thickness (EN 13467)				m
Density (EN 13470)				kg/m³
Conditioning details				
Conditioning conditions			°C	% rel. H.
Weight at start of conditioning				kg
Weight at finish of conditioning				kg
Time at conditioning conditions				days
Measured values				
Surrounding climate			°C	% rel. H.
Test load per length and ∅ of test pipe				Pa
Temperature of hot pipe				°C
Temperature rate of increase				°C / h
Time at temperature in apparatus				h
Change in mass after measurement				%
Internal self-heating				
Remarks				
Results				
Temperature of the hot plate				°C
Change in thickness Please use 2 significant figures (e.g. 4.8)				%

NOTE If more than one specimen is used, the relevant values are mean values.

Annex 3e: Result form - Trace quantity of Chloride ions content

European group of registered laboratories - Comparative testing **MEASUREMENT water soluble chloride fluoride, silicate, sodium ions content** *This form must be filled out and submitted in addition to the standard measurement report of the laboratory*							
Laboratory							
Laboratory name							
Name of staff responsible							
Date of arrival of the sample							
Start date of the measurement							
Finish date of the measurement							
Apparatus details							
Type and identification code/no.							
Method	ionic chromatography (chloride, fluoride)				ICP-OES (Sodium Silicate)		
Specimen details							
Specimen description							
Specimen identity code							
Date of production (when relevant)							
Date of preparation (when relevant)							
Conditioning details							
Conditioning conditions according to							
Measured values							
No.	1	2	3	4	5	6	
Individual values							mg/kg
Remarks							
Results							
Chloride content as mean value Please use 2 significant figures (e.g. 6.7)							mg/kg