

## Expansion Joints

Quality Assurance  
RAL-GZ 719

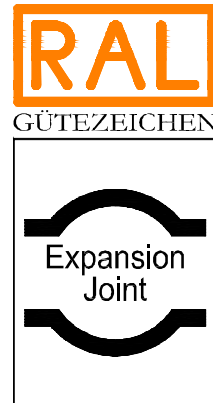
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## Expansion Joints

Quality Assurance  
RAL-GZ 719

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The RAL-GZ 719 quality and test specifications are based on the accepted standards for quality marks by the „RAL Deutsches Institut für Gütesicherung und Kennzeichnung e.V.“ (RAL German Institute for Quality Assurance and Marking) in a test project, assisted by the Federal Minister of Economics in cooperation with the relevant engineering and industry authorities.

RAL Deutsches Institut  
für Gütesicherung  
und Kennzeichnung e.V.

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## Quality levels and test specifications for fabric expansion joints

### General

#### 1.1 Definition of terms

These quality and test specifications apply to fabric expansion joints. Fabric expansion joints are materials which can be easily deformed in three dimensions by the application of slight pressure.

It is the function of fabric expansion joints to form a tight and flexible connection between pipe ends, duct ends and any other junctions. They absorb thermal expansion in duct components and the inevitable dimensional deviations which arise during assembly or from foundation settling.

When connected to fans or blowers, they reduce the transmission of vibrations and structure-borne noise.

#### 1.1.1 Applicable Standards and regulations

EN 10204 2.2	Metallic products – Types of inspection documents; German version EN 10204:2004, Publication date: 2005-01
DIN 53504	Testing of Rubber and Elastomers -Determination of Tensile Strength, Maxi-mum Stress, Elongation at Fracture and Stress Values by a Tensile Test
ISO 7619-1	Rubber, vulcanized or thermoplastic – Determination of indentation hardness – Part 1: Durometer method (Shore hardness)
DIN 53508	Testing of Rubber and Elastomers - Accelerated Ageing
ISO 1817	Elastomers - Determination of the Resistance to Liquids
ISO 132	Rubber, vulcanized or thermoplastic – Determination of flex cracking and crack growth (De Mattia) (ISO 132:2005), Publication date: 2008-07
EN ISO 13934-1	Textiles – Tensile properties of fabrics – Part 1: Determination of maximum force using the strip method (ISO 13934-1:1999); German version EN ISO 13934-1:1999; Publication date: 1999-04
ZfP 1 DECHEMA Information Sheet	Non-destructive test methods in chemical plants. Leak tests on apparatus and components of chemical plants

Furthermore all Technical Information of the Quality Association are available on [www.qafej.org](http://www.qafej.org).

#### 1.1.2 Structure and function

Fabric expansion joints are single-ply expansion joints or multi-ply expansion joints.

### **Single-ply expansion joints**

consist of elastomers or thermoplasts which are joined firmly together by full-surface welding or vulcanization. They can be of solid design, in which case they are made only of these materials, or composite designs, in which case they are reinforced with supporting material.

### **Multi-ply expansion joints**

consist of several layers of materials such as:

Thin film, supporting materials. composite materials, coated fabrics and insulation materials

The various layers are loose in the area of the bellow, but they are joined together in the area where the expansion joint is fixed to its mounting.

### **1.1.3 Material**

Fabric expansion joints consist of thin layers or sheets of thermoplasts or elastomers which are reinforced by metallic, mineral or synthetic materials (see section 2.1.1 and section 3.1.1 for further details).

## **1.2 Design**

Fabric expansion joints must be designed to absorb such movements as notified to the manufacturer in all spatial dimensions, magnitudes and frequencies, but must not thereby be subjected to any tension by the flanges.

The notified conditions such as temperature, pressure and chemical loading have to be considered.

Supporting materials in composite structures are not permitted to impair the mechanical, chemical or thermal stability of the expansion joint.

In multi-ply expansion joints the layers must be arranged so that the maximum permissible temperature of each layer is not exceeded by the given temperature distribution.

## **1.3 Field of application**

The field of application is duct work which convey liquid, gaseous or vapour media, including those carrying or charged with solid particles, such as those found in power Station and plant engineering, e. g.:

Chemical and petrochemical plant Ventilation plant

Flue gas treatment plant, such as:

- denitrogenizing plant
- flue gas desulphurizing plant

Single-ply expansion joints are particularly well suited for high chemical loading such as occurs, for example, when the temperature falls below the dew point. They are liquid-tight.

Multy-ply expansion joints are particularly applicable to high thermal loads.

If the fluid medium contains solid particles, the expansion joint must be protected against abrasion by metal sleeves.

There are limitations to the suitability of single-ply or multy-ply fabric expansion joints used on flanges subject to strong vibrations(e.g. on vibratory troughs) or subject of continuous cycling from positive to negative pressure.

As a general rule, fabric expansion joints can only be used within the following ranges:

Distance between flanges	Temperature [°C]	Axial movement [mm]	Lateral movement [mm]	Pressure [hPa]
200 mm	≤ 400	≤ - 40 mm	≤ + 20 mm	≤ 160 hPa
300mm	≥ 400	≥ - 60 mm	≥ + 30 mm	≥ 80 hPa

## 1.4 Designation

The designation of a single-ply fabric expansion joint must include reference to the elastomeric or thermoplastic material and, if present, the supporting material.

In the case of multi-ply expansion joints, each layer must be designated according to its particular function.

## 1.5 Details of fixing method

The manufacturer must give details of the fastening method, in accordance with the operating conditions quoted by the customer, e. g.:

- surface quality of finish of the connecting flanges
- minimum pitch of the bolt hole
- size and type of bolts
- specification of the maximum and minimum bolt tightening torque, etc.

## 1.6 Fitting instructions

The manufacturer must issue assembly instructions (irrespective of whether the fitting is carried out by the manufacturer, the client or a third party). Aside from describing the different procedural steps, the instructions must also state whether it is necessary to retighten the bolting at its clamping points after initial pressurization under operating conditions.

## 2 Quality and test specifications for single-ply fabric expansion joints

### 2.1 Quality specifications

Single-ply fabric expansion joints must comply with the following requirements.

#### 2.1.1 Materials

Elastomers and thermoplasts

Elastomers are, e. g.:

- fluorcarbon rubber (FPM)
- ethylene-propylene-terpolymer (EDPM)
- butyl rubber (II R, C II R, B II R)
- chlorsulphonated polyethylene (GSM)

Thermoplasts are, e. g.:

- polytetrafluorethylene (PTFE)
- polyvinylchloride (PVC)

Support materials are knitted or woven fabrics made of e.g.:

- stainless steel
- glass
- synthetic
- fibre composite materials

All the materials used by the manufacturer must be listed on the material data sheet.

The manufacturer's specifications, e. g. in his leaflets, must be consistent with the characteristic data of the material data sheet.

### **2.1.2 Material data sheet**

The material data sheet must contain at least the following characteristic data of the elastomers/thermoplasts:

- (1) An identifiable material designation
- (2) The permissible maximum temperature

- in continuous operation
- under critical load

A critical load is defined as a nonrecurring rise in temperature and/or pressure for a maximum duration of 15 minutes only once in the lifetime.

- (3) Chemical resistance

The chemical resistance can be quoted by reference e. g. to the DECHEMA Material Table. Where individual specifications of chemical resistance are issued with respect to special media, it is necessary to quote the acting medium, its concentration, its temperature and its duration of action.

- (4) Mechanical characteristic values must be specified in terms of:

- Tensile strength
- elongation at fracture
- shore A hardness

### **2.1.3 Production data sheet**

The production data sheet must list the same materials used for the fabric expansion joint as are specified in the material data sheet. The production data sheet must include as a minimum:

- the materials used
- the design
- processing instructions
- dimensional specifications

### **2.1.4 Tightness**

Using the fastening method selected by the manufacturer and with the flange surface specified by him, the expansion joint must be tight in both the bellows and clamping area. "Tight" as used here is defined by the latest edition of the DECHEMA Information Sheet ZfP 1, Supplementary Sheet 2, Paragraph 2.2; Bubble method with foaming liquid ("nekal-tight").

### **2.1.5 Fatigue strength under cyclic bending stresses**

The compound material, including its splice/butt joint, must withstand 100,000 reversed bending cycles.

## **2.2 Test specifications**

### **2.2.1 Design**

The design of the fabric expansion joint must be supported by a drawing or scheme in addition to the production data sheet.

### **2.2.2 Materials**

The identity of the elastomers/thermoplasts used must be verified in respect to their mechanical characteristics by a works certificate in conformance with EN 10204/2.2. The identity of the raw and processed materials must be verified by a works certificate issued by the manufacturer of the primary product in accordance with EN 10204/2.1.

### **2.2.3 Thermostability**

The test must be based on DIN 53508. The test period shall run for 28 days at the continuous service temperatures specified for the various elastomers or thermoplasts.

After 28 days the elongation at breakpoint must not differ by more than 30 % from the initial value.

After the test period of 28 days there must not be a change of more than +/- Shore A in the hardness according to ISO 7619-1.

### **2.2.4 Chemical resistance**

The chemical resistance test must be based on ISO 1817. Details concerning the specific application must be discussed with the independent test centre so that they can be taken into account in its testing.

The test period shall run for 28 days, with interim results recorded after 7 and 14 days in accordance with ISO 1817.

The maximum permissible change of hardness is +/- 10 Shore A. After the test period of 28 days the mass swelling must not exceed 10 %. Should the quoted mass swelling value be exceeded after 28 days, the swelling curve must exhibit an asymptotic approximation to a state of equilibrium. After the approximation is established, the mass swelling must not exceed 30 % under any circumstances.

### **2.2.5 Mechanical values**

Testing of the mechanical values quoted in the material data sheet must be based on DIN 53504 and ISO 7619-1.

### **2.2.6 Tightness**

The flange of the test apparatus must display the same quality of surface specified by the manufacturer in accordance with Section 2.1.4.

The leak test must be based on the DECHEMA Information Sheet ZfP1, Supplementary Sheet 2 Section 2.2: "Bubble method with foaming liquid".

No bubbles must appear when applying a test pressure equal to one-and-a-half times the nominal pressure but at least 50 hPa.

### **2.2.7 Fatigue strength under cyclic bending stresses**

Testing of the fatigue strength under cyclic bending stresses must be based on ISO 132. The specimen, however, must be at least 100 mm wide. The samples used in this case do not have a notch. The frequency shall be 1 Hz per second.

The test must be carried out with the expansion joint material as well as with its seam/joint.

A total of 100.000 cycles must be reached without any signs of damage.



### **3 Quality and test specifications for multiply fabric expansion joints**

#### **3.1 Quality specifications**

Multiply fabric expansion joints and their connectors must comply with the following requirements.

##### **3.1.1 Materials**

(a) Suitable insulation in the form of nonwovens, felts and wovens consisting of e.g.:

- glass fibres
- ceramic fibres
- silicate fibres

(b) Suitable coatings and sealing layers are e. g.:

- nitrile rubber (MBR)
- chloroprene (CR)
- chlorosulphonated polyethylene (CSM)
- butyl rubber(IIR, C II R, B II R)
- ethylene propylene terpolymer (EDPM)
- fluorcarbon rubber (FPM)
- silicon rubber (O)
- polytetrafluoroethylene (PTFE)

(c) Suitable supporting layers in the form of knitted or woven fabrics consisting of e. g.:

- polyester
- aramide
- glass
- stainless steel

All the materials used by the manufacturer must be listed on the material data sheet.

The manufacturer's specifications, e. g. in his leaflets, must be in accordance with the data on the material data sheet.

##### **3.1.2 Material data sheet**

The material data sheet must contain at least the following characteristic data of all the materials used.

##### **Quality levels and test specifications**

(1) An identifiable material designation

(2) The permissible maximum temperature

- in continuous operation
- under critical load

A critical load is defined as a non-recurring rise in temperature and/or pressure for a maximum duration of 15 minutes only once in the lifetime.

(3) Resistance to chemicals

Is only relevant for the area in contact with the process media. It can be quoted by reference e. g. to the DECHEMA Material Table.

Where individual specifications of chemical resistance are issued with respect to special media, it is necessary to quote the acting medium, its concentration, its temperature, and its duration of action.

(4) Mechanical strength

is conditional on the supporting layers. It can be quoted in terms of tensile strength or maximum stress.

### **3.1.3 Production data sheet**

The production data sheet must list the same materials used for the fabric expansion joint as are specified in the material data sheet.

It must include at least:

- the materials used
- the design
- processing instruction
- dimensional specifications

### **3.1.4 Tightness**

A multiply fabric expansion joint, which is designated as "nekal-tight", must contain one or more sealing layer/s that is/are nekal-tight under the service conditions specified in the manufacturer's data sheet. And the nekal-tight finish also applies to the seam splice and clamping areas of the sealing layer.

Using the fastening method selected by the manufacturer and with the flange surface specified by him, the expansion joint must be tight in the clamping area. Tight" as used here is defined by the latest edition of the DECHEMA Information Sheet ZfP 1, Supplementary/ Sheet 2, Section 2.2: Bubble method with foaming liquid.

### **3.1.5 Fatigue strength under cyclic bending stresses**

The sealing and supporting layers must withstand 10.000 reversed bending cycles in accordance with the selected expansion joint structure.

## **3.2 Test specifications**

### **3.2.1 Design**

The design of the fabric expansion joint must be verified by a drawing or scheme and by a production data sheet.

### **3.2.2 Materials**

The identity of the materials must be verified by a test report in conformance with EN 10204 2.2

### **3.2.3 Thermostability**

The test must be based on DIN 53508. The test period shall run for 28 days at the continuous service temperature specified for the materials.

After the thermal loading, the tensile strength of the layers must not have fallen below 50 % of the initial value. The tensile strength of the reinforcing layers must be tested in accordance with EN ISO 13934-1.

After the thermal loading, the nekal-tight sealing layers must be leak-proof as defined by the leak test (Section 3.2.6).

### **3.2.4 Chemical resistance**

The chemical resistance test is to be performed as a submerge test referring back to ISO 1817. The resistance to chemicals must be tested in accordance with the specifications in the material data sheet. Details concerning the specific application must be discussed with the independent test centre so that they can be taken into account in its testing.

The test period shall run for 28 days.

After the test, the sealing layers designated to be "nekal-tight" must still be leak-proof as defined by the leak test (see Section 3.2.6).

The tensile strength of the reinforcing layers must not have fallen below 50 % of the initial value.

### **3.2.5 Mechanical values**

Testing of the mechanical values quoted in the material data sheet must be based on EN ISO 13934-1.

### **3.2.6 Tightness**

Sealing layers designated as "nekal-tight" must be subjected to the same leak test as single-layer expansion joints (see Section 2.2.6).

### **3.2.7 Fatigue strength under cyclic bending Stresses**

Testing of the fatigue strength under cyclic bending stresses must be based on ISO 132. The specimen must consist of sealing and reinforcing layers in conformance with the selected expansion joint structure and be at least 100 mm wide. The samples used in this case do not have a notch. The frequency shall be equal to 1 Hz per second.

A total of 10.000 cycles must be reached without any signs of damage.

## **4 Quality monitoring**

The quality monitoring consists of

- an initial inspection
- monitoring by the manufacturer (internal monitoring) and monitoring by an independent centre (external monitoring).

### **4.1 Initial inspection**

The initial inspection of the fabric expansion joints consists of tests performed by an independent test centre (independent monitoring inspection). See Section 4.3 for the scope of the initial inspection.

### **4.2 Own quality monitoring (internal monitoring)**

Within the scope of his own Quality Assurance monitoring system, the manufacturer must compile data sheets for all the materials subject to the quality assessment. These data sheets must reflect the requirements imposed in Sections 2.1 and 3.1.

The manufacturer of the fabric expansion joints is responsible for monitoring his production continuously. The tests and inspections must be extensive enough to ensure the constant quality of the expansion joints. The results must be recorded in writing and the records must be kept for a minimum of five years.

### **4.3 Monitoring by an independent test centre (external monitoring)**

The test centre is instructed by contract to monitor the manufacturer of the fabric expansion joints at least twice a year. The tests in Sections 2.2.3 to 2.2.7 and in Sections 3.2.3 to 3.2.7 will be conducted once a year.

At the initial inspection and the regular checks the test centre will

- examine the manufacturer's material and production date sheets
- perform complete tests on at least one material but not less than 10 % and not more than three of the materials used from each of the following material groups:

single-ply fabric expansion joints

- elastomer/thermoplast
- composite

multilayer fabric expansion joint

- insulation
- sealing layers
- supporting layers
- check in one random sample whether the production sequences comply with the production data sheet

The samples for the tests and inspections will be drawn from batches (mixtures and fabrics) which have been cleared for production. The samples must be vulcanized in accordance with the manufacturer's instructions, if required, for the tests.

#### **4.4 Test Report**

The test centre shall issue a test report on the results of the tests and any repeat tests. One copy is sent directly to the Gütegemeinschaft (Quality Association) and one to the user of the quality mark.

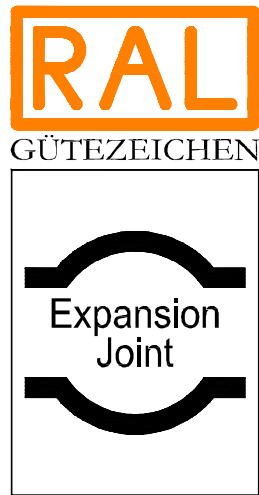
#### **4.5 Repeat tests**

If a manufacturer fails to pass an inspection test a repeat test is to be performed no later than four weeks after the test results are notified to the user of the quality mark.

If the manufacturer fails to pass the repeat test, the Gütegemeinschaft (Quality Association) shall take further measures in accordance with its Statutes and regulations.

### **5 Marking**

Fabric expansion joints which comply with these quality and test specifications may be identified with the following quality mark:



The use of the quality mark shall be governed solely by the Regulations for the Award and Use of the Expansion Joint Quality Mark of the Gütegemeinschaft Weichstoff-Kompensatoren e.V. (Quality Association for Expansion Joints).

The quality mark must be accompanied by the manufacturer's name (or his mark).

## **6 Amendments**

Amendments to these quality and test specifications must be approved in writing by the RAL. Any amendments will be notified to the user of the quality mark by the Board and shall take effect after an acceptable period of notice.

# **Regulations for the Award and Use of the Expansion Joint Quality Mark**

## **1 Quality basis**

The basis for the quality mark is formed by the quality and test specifications for expansion joints. It is amended and revised in accordance with technical Innovation.

## **2 Award**

**2.1** The Gütegemeinschaft Weichstoff-Kompensatoren e.V. can award the right to use the "Expansion Joint Quality Mark" on manufacturers who make such an application.

**2.2** The application must be submitted in writing to: Gütegemeinschaft Weichstoff-Kompensatoren e.V., Heinestrasse 164, 70597 Stuttgart.

The application must be accompanied by a legally signed notice of obligation (see appendix I).

**2.3** The application will be examined by the Quality Committee. The Quality Committee will instruct sworn experts or on behalf of a government-approved test centre to perform the independent inspection required to verify the manufacturer's eligibility. For this purpose the expert or staff of the government-approved test centre shall be permitted in accordance with the quality and test specifications to make an unannounced tour of the applicant's factory, to take samples of products and to ask for and consult the documents mentioned in the quality and test specifications. The expert test centre will draw up a report on the test results and send it to the applicant and to the Board of the Gütegemeinschaft. The inspector must show his credentials before commencing his work. The costs of the inspection shall be borne by the applicant.

**2.4** If the test result is positive, the Board of the Gütegemeinschaft shall award the quality mark on the applicant by proposal of the Quality Committee. The award will be certified (appendix 2). If the test result is negative, the Quality Committee, shall reject the application. They must explain the reasons for their rejection in writing.

## **3 Use**

**3.1** Users of the mark are only allowed to use the quality mark for products which comply with the quality and test specifications.

**3.2** The Gütegemeinschaft (Quality Association) has sole right to arrange for the production of equipment to apply the quality mark (metal stamp, coining die, printing block, lead seals, seal stamps, rubber stamps, etc.), and to distribute them or have them distributed to the user of the mark, and to define exactly the manner of their use.

**3.3** The members of the general meeting may adopt special provisions for the use of the quality mark in advertising and in joint advertising in order to preserve fair competition and prevent abuse of the mark. Direct advertising may not be obstructed by the provisions of the members. It shall be governed by the same principles of fair competition.

**3.4** After Consulting with the RAL, the Quality Committee can decide to employ the quality mark in a different form for different products.

**3.5** If the right to use the mark is withdrawn, the certificates of award and all equipment for applying the quality mark must be returned; if there is no entitlement to reimbursement. The same shall apply if the right to use the quality mark lapses in some other way.

## **4 Control**

**4.1** The Gütegemeinschaft is entitled and undertakes to control the use of the quality mark and to observe the quality and test specifications. Proof of the continuity of this control must be submitted to RAL in the form of a control contract entered into with an independent test institute.

**4.2** Every user of the mark must observe the quality and test specifications and carry out regular inspections. He must keep a careful record of the tests carried out in his factory. The appointed independent test institute or expert may consult the records at any time. The user of the mark shall subject his quality marked products for testing by the appointed independent test Institute or expert as often and as many times as is required by the relevant requirements of the quality and test specifications. The user shall bear the costs of the inspection.

**4.3** Inspectors may request or take samples at any time in the factory of the user of the mark. Requested samples must be submitted forthwith. Inspectors shall be allowed to tour the factory at any time during production hours.

**4.4** If the results of the inspection are negative or if a delivery is rejected, the Quality Committee shall arrange for the inspection to be repeated. The user of the mark may also request a repeat inspection.

**4.5** The appointed test institute must draw up a test report on each test result. One copy will be submitted to the Gütegemeinschaft and one to the user of the mark.

**4.6** If deliveries are rejected without reason, the objector shall bear the costs of the inspection; if they are rejected with good reason, the user of the mark shall bear the costs.

## **5 Punishment of infringements**

**5.1** If the Quality Committee discovers shortcomings in the quality assurance system, it will propose penalty measures to the Board of the Gütegemeinschaft. Depending on the seriousness of the infringement the penalties are:

5.1.1 Additional conditions imposed on the manufacturer's control system

5.1.2 More control by the independent test centre

5.1.3 A warning

5.1.4 A contractual fine to the sum of € 10.000 maximum

5.1.5 A temporary or permanent withdrawal of the mark

**5.2** Users of the mark who infringe against Section 3 or 4 may be warned.

**5.3** Instead of a warning it is possible to impose a contractual fine of up to € 10.000 for each case of infringement. The contractual penalty must be remitted to the Gütegemeinschaft Weichstoff-Kompensatoren e.V. within 14 days of the notice taking legal force.

**5.4** The measures listed in Section 5.1 can be combined.

**5.5** The mark will be withdrawn temporarily or permanently from users who repeatedly or grossly infringe against Section 3 or 4. The same applies for users of the mark who delay or obstruct the inspections.

**5.6** The user in question has the right to justify himself before any measures are taken.

**5.7** In urgent cases the Chairman of the Gütegemeinschaft can withdraw the quality mark temporarily with immediate effect. Such action must be

confirmed by the Board within 14 days of hearing the Quality Committee.

**5.8** The above mentioned penalty measures shall take immediate effect. Legal action will not cause any delay.

## **6 Objections**

**6.1** Users of the mark can lodge an objection against a notice of penalty within 4 weeks of its receipt. Such objections must be addressed to the Quality Committee.

**6.2** If the Quality Committee rejects the objection, the applicant can take legal action within 4 weeks for receiving notice of the rejection. Section 11 of the Statutes of the Gütegemeinschaft Weichstoff-Kompensatoren e.V. shall apply.

## **7 Re-conferment**

If the right to use the mark is withdrawn, at least three months must pass before it can be re-awarded. The procedure shall be governed by Section 2. but the Board of the Gütegemeinschaft may impose additional conditions.

## **8 Amendments**

These regulations with attached specimens (Notice of Obligation, Certificate of Award) have been approved by the RAL. Any amendments, including those of an editorial nature, require the prior written approval of the RAL to be effective. After notification by the Board of the Gütegemeinschaft, they shall come into force within an acceptable period of notice.

## Notice of Obligation

1 The undersigned person/company applies herewith to the

Gütegemeinschaft Weichstoff-Kompensatoren e. V.

for membership<sup>\*)</sup>

for conferment of the right to use the  
Quality Mark Expansion Joints

2 The undersigned confirms that he has taken note of

The statutes of the Gütegemeinschaft Weichstoff-Kompensatoren e. V.,  
the quality mark statutes,  
the quality and test specifications for expansion joints,  
the regulations for conferment and use of the expansion joint quality  
mark, including specimens 1 and 2

and acknowledges them unreservedly as binding

\_\_\_\_\_  
Place, Date

\_\_\_\_\_  
Stamp and Signature

\_\_\_\_\_  
<sup>\*)</sup> make a cross if applicable



## Awarding Certificate

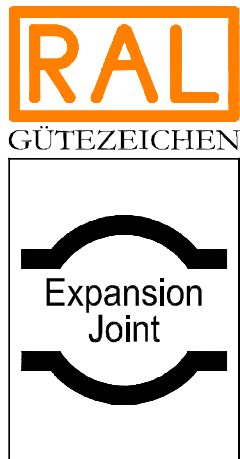
The “Gütegemeinschaft Weichstoff-Kompensatoren e. V.“

Herewith awards  
Due to the test report of its Quality Committee

---

(company)

The Quality Mark Expansion Joint



This quality mark, accepted by the  
RAL Deutsches Institut für Gütesicherung und Kennzeichnung e.V.  
(RAL German Institute for Quality Assurance and Marking)  
is protected by the law of trademarks

**GÜTEGEMEINSCHAFT WEICHSTOFF-KOMPENSATOREN E. V.**

Stuttgart, den

---

Chairman

---

Managing Director