

**BRL K17504/03**

2018-10-10

# Evaluation Guideline

for the Kiwa product certificate for vulcanised rubber products  
for cold and hot drinking water applications



**Trust  
Quality  
Progress**



## Preface

This evaluation guideline has been accepted by the Kiwa Board of Experts CWK , wherein all the relevant parties in the field of vulcanised rubber products for drinking water applications are represented. This Board of Experts also supervises the certification activities and where necessary require the evaluation guideline to be revised. All references to Board of Experts in this evaluation guideline pertain to the above mentioned Board of Experts.

This evaluation guideline will be used by Kiwa in conjunction with the Kiwa-Regulations for Certification. This regulation details the method employed by Kiwa for conducting the necessary investigations prior to issuing the product certificate and the method of external control.

### *Specific additional information*

The requirements in this evaluation guideline cover the mechanical requirements of EN 681-1 for the applications WA, WB and WE at different temperature levels.

In this guideline additional requirements are included for some special features to rings, such as a hard nose or a hard base, a hard under-layer or fixation rings.

This evaluation guideline is to be assessed by the Board of Experts at least every 5 years, but at the latest on 2023-10-10.

### **Kiwa Nederland B.V.**

Sir Winston Churchillaan 273  
Postbus 70  
2280 AB RIJSWIJK  
The Netherlands

Tel. +31 88 998 44 00  
Fax +31 88 998 44 20  
info@kiwa.nl  
www.kiwa.nl

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The use of this evaluation guideline by third parties, for any purpose whatsoever, is only allowed after a written agreement is made with Kiwa to this end.

### **Validation**

This evaluation guideline has been validated by the Director Certification and Inspection of Kiwa on 2018-10-10.

# Amendment BRL K17504/03 vulcanised rubber products for cold and hot drinking water applications

Date ammendment 17-07-2021

Validated by Kiwa Board of Experts Water Chain (CWK) on 29-07-2021



The use of this evaluation guideline for any purpose whatsoever shall only be allowed after the conclusion of a written agreement with Kiwa in which the right of use is arranged.

## Validity

This amendment is related to Evaluation Guideline K17504/03 dated 10 October 2018. All certificates already issued shall comply with this change starting January 1, 2022. Existing certificates stay valid.

## Validation

This amendment has been validated by Kiwa on 30 August 2021.

## Corrections:

*Add the following phrase to paragraph 4.1:*

For all products and materials, the requirements of paragraph 4.2 and 4.3 are applicable. Guidance to the other requirements is given in paragraph 4.1.1.

*In the complete document:*

Replace ISO 48 by ISO 48-2; ISO 815 by ISO 815-1; ISO 3384 by ISO 3384-1 and ISO 3302 by ISO 3302-1.

*Replace in paragraph 8.6: IATF 16494 by IATF 16949*

*Replace the table in chapter 9 Titles of standards with:*

NEN-ISO 10508	Plastics piping systems for hot and cold water installations - Guidance for classification and design
Amendment sheet NEN-ISO 10508/A1	Plastics piping systems for hot and cold water installations - Guidance for classification and design.
NEN-EN 681-1	Elastomeric seals – Materials requirements for pipe joint seals used in water and drainage applications – Part 1: Vulcanised rubber
Amendment sheet NEN-EN 681-1/A1	Elastomeric seals – Materials requirements for pipe joint seals used in water and drainage applications – Part 1: Vulcanised rubber
Amendment sheet NEN-EN 681-1/A2	Elastomeric seals – Materials requirements for pipe joint seals used in water and drainage applications – Part 1: Vulcanised rubber
Corrigendum NEN-EN 681-1/C1	Elastomeric seals – Materials requirements for pipe joint seals used in water and drainage applications – Part 1: Vulcanised rubber
Amendment sheet NEN-EN 681-1/A3	Elastomeric seals – Materials requirements for pipe joint seals used in water and drainage applications – Part 1: Vulcanised rubber
NEN-EN 806-2	Specification for installations inside buildings conveying water for human consumption – Part 2: Design

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## vulcanised rubber products for cold and hot drinking water applications

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NEN-ISO 34-2	Determination of the tear strength of small test pieces (Delft test pieces)
NEN-ISO 37	Rubber, vulcanised or thermoplastic - Determination of tensile stress - strain properties
NEN-ISO 48-2	Rubber, vulcanized or thermoplastic - Determination of hardness - Part 2: Hardness between 10 IRHD and 100 IRHD
NEN-ISO 188	Rubber, vulcanised – Accelerated ageing or heat-resistance tests
NEN-ISO 813	Rubber, vulcanised - Determination of adhesion to a rigid substrate – 90 degree peel method
NEN-ISO 815-1	Rubber, vulcanized or thermoplastic - Determination of compression set - Part 1: At ambient or elevated temperatures
NEN-ISO 1431-1	Rubber, vulcanised or thermoplastic - Resistance to ozone cracking - Part 1: Static strain test
NEN-ISO 1817	Rubber, vulcanised – Determination of the effect of liquids
NEN-ISO 2285	Rubber, vulcanised or thermoplastic - Determination of tension set at normal and high temperatures
NEN-ISO 3302-1	Rubber - Tolerances for products - Part 1: Dimensional tolerances
NEN-ISO 3384-1	Rubber, vulcanized or thermoplastic - Determination of stress relaxation in compression - Part 1: Testing at constant temperature
NEN-ISO 3601-1	Fluid power systems - O-rings - Part 1: Inside diameters, cross-sections, tolerances and designation code
NEN-ISO 3601-3	Fluid power systems - O-rings - Part 3: Quality acceptance criteria
NEN-ISO 3865	Rubber, vulcanized or thermoplastic - Methods of test for staining in contact with organic material
NEN-ISO 6914	Rubber, vulcanized; Determination of ageing characteristics by measurement of stress at a given elongation
NEN-ISO 9691	Rubber – Recommendation for the workmanship of pipe joint rings – Description and classification of imperfections
NEN-ISO 23529	Rubber – General procedures for preparing and conditioning test pieces for physical test methods
NEN-EN-ISO 9001	Quality management systems - Requirements
IATF 16949	Technical Specification Quality management system requirements for automotive production and relevant service parts organisations

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# 1 Introduction

## 1.1 General

This evaluation guideline includes all relevant requirements which are adhered to by Kiwa as the basis for the issue and maintenance of a certificate for vulcanised rubber products for cold and hot drinking water applications.

This evaluation guideline replaces BRL K17504/02 dated 3 September 2009, including amendment of 11 October 2013.

Certificates issued on the basis of this guideline keep their validity.

For the performance of its certification work, Kiwa is bound to the requirements as included in NEN-EN-ISO/IEC 17065 "Conformity assessment - Requirements for bodies certifying products, processes and services".

## 1.2 Field of application / scope

The products are intended to be applied as sealing systems for drinking water. For other applications as mentioned here a more explicit testing might be necessary to assure a correct function of the products. Special types of products are described in more detail in paragraph 2.1.

In this evaluation guideline the products are classified in the following areas of use:

- I Water supply at temperatures up to 50 °C (see footnote <sup>1</sup>).
- II Water supply at temperatures intermittently up to 110 °C, or water supply up to 110 °C in serviceable piping systems.
- III Hot water circulation systems based on the classification class 2 in ISO 10508.

I is equal to that used in EN 681-1.

II is based on the one mentioned in EN 681-1. The difference is a limitation with respect of the application area: discontinuously (intermittent) hot or easy serviceable. III is for the more severe conditions applicable for these systems. Here a continuously high temperature of 70°C is assumed for the system (class 2 of NEN-ISO 10508). To set the requirements for this class III, a lifetime expectation of at least 50 years for a piping system is assumed for setting up the tests in this Evaluation Guideline. This is in line with the requirements for such systems as given in EN 806-2.

In this guideline the different classes are referred to as class I, II and III.

Certification is intended for actual products (seals). To reduce unnecessary testing it is also possible to issue a certificate on a rubber material intended to be used for the production of products afterwards. Having such a certificate will reduce the tests needed to be carried out on the actual products.

## 1.3 Acceptance of test reports provided by the supplier

When by the manufacturer reports from test Institutions or laboratories are produced in order to demonstrate that the product meets the requirements of this evaluation guideline, the institute or laboratory shall meet one of the applicable accreditation norms, being;

- EN-EN-ISO/IEC 17025 for laboratories;
- EN-EN-ISO/IEC 17020 for inspection bodies;
- EN-EN-ISO/IEC 17065 for certification bodies certifying products.

This requirement is being considered to be fulfilled when a certificate of accreditation can be shown, either issued by the Board of Accreditation (RvA) or one of the

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<sup>1</sup> In the Netherlands the maximum allowed drinking water temperature in piping systems is 25°C.

institutions with which the RvA an agreement of mutual acceptance has been concluded.

The accreditation shall refer to the examination as required in this evaluation guideline. When no certificate of accreditation can be shown, Kiwa will verify whether the accreditation norm is fulfilled.

#### **1.4 Quality declaration**

The quality declarations to be issued by Kiwa are described as Kiwa product certificate.

A model of the certificate to be issued on the basis of this Evaluation Guideline has been included as an Annex.



## 2 Terms and definitions

In this evaluation guideline the following terms and definitions are applicable:

**Evaluation Guideline:** the agreements made within the Board of Experts on the subject of certification.

**Board of Experts:** The Board of Experts "CWK".

**Supplier:** the party that is responsible for ensuring that the products meet and continue to meet the requirements on which the certification is based.

**IQC scheme:** a description of the quality inspections carried out by the supplier as part of his quality system.

**Product requirements:** requirements made specific by means of measures or figures, focusing on (identifiable) characteristics of products and containing a limiting value to be achieved, which limiting value can be calculated or measured in an unequivocal manner.

**Pre-certification tests:** tests in order to ascertain that all the requirements recorded in the Evaluation Guideline are met.

**Inspection tests:** tests carried out after the certificate has been granted in order to ascertain whether the certified products continue to meet the requirements recorded in the Evaluation Guideline.

### *Remark*

The test matrix contains a summary showing what tests Kiwa will carry out in the pre-certification stage and in the event of inspections as well as showing the frequency with which the inspection tests will be carried out.

**Product certificate:** a document, in which Kiwa declares that a product may, on delivery, be deemed to comply with the product specification recorded in the product certificate.

**Tap water** (origin NEN 1006:2002): water intended for drinking, cooking, food preparation or other domestic purposes.

Furthermore, especially for the class III seals, there are two principles in use:

- sealing because of a low rate of stress relaxation which keeps the pressure between the surfaces high enough for a long period of time; for this the term 'compression sealing' is used in this guideline; most known using this principle of sealing are rubbers like EPM, EPDM, NBR, SBR.
- sealing because of swelling in combination with a material that has an outstanding resistance to aging and can deal with swelling without deterioration; for this the term 'swelling sealing' is used in this guideline; this principle is in practice only used by IIR, although also FKM might seal using this principle.

# 3 Procedure for granting the quality declaration

## 3.1 Pre certification tests

The pre certification-tests to be performed are based on the (product) requirements as included in this evaluation guideline including the test methods and contain, depending on the nature of the product to be certified:

- Type testing to determine whether the products comply with the product and/or functional requirements,
- Production Process Assessment
- Assessment of the quality system and the IQC-scheme,
- Assessment on the presence and functioning of the remaining procedure

## 3.2 Granting the quality declaration

After finishing the pre-certification tests the results are presented to the person deciding on granting of certificates. This person evaluates the results and decides whether the certificate can be granted or additional data and/or tests are necessary.

# 4 Requirements and test methods

## 4.1 General

This chapter contains the requirements the rubber products have to fulfil. These requirements will make part of the technical specification of the products, as included in the certificate.

In case a product is meant to be used for more than one class, for instance for class I and II or for class II and III or even for all three classes, only testing for the highest class is assumed to be sufficient for the purpose of certification as meant under this evaluation guideline.4.

### 4.1.1 *Types of rubber seals*

#### 4.1.1.1 *Solid rubber products*

The rubber shall fulfil the requirements of this Evaluation Guideline in paragraph 4.4 and 4.5.

Joints shall also fulfil the requirements in paragraph 4.6.1 and 4.6.2. In case joints are present in class II or class III products such products having a joint shall be used for testing.

#### 4.1.1.2 *O-rings*

The rubber shall fulfil the requirements of this Evaluation Guideline in paragraph 4.4 and 4.5.

Joints shall also fulfil the requirements in paragraph 4.6.1 and 4.6.2.

In this Evaluation Guideline test methods for O-rings are included in annex H. In annex B a classification of O-ring sizes in groups is given. For each group the compression set at the relevant elevated temperature has to be verified before approval by a certification institute can be granted.

#### 4.1.1.3 *Rubber products combining two different rubber compounds (i.e. a hard and a soft rubber)*

Both rubbers shall fulfil the requirements of this evaluation guideline. The adhesion between the two rubbers shall fulfil the requirements of paragraph 4.6.

In cases where one of the rubbers is meant to be a kind of back up ring, only the rubber for the product shall fulfil all requirements. The rubber used for the back-up function shall fulfil the requirements with respect to the toxicological aspects (4.3.2) and the mechanical properties (4.5.3). The adhesion between the two rubbers shall fulfil the requirements of paragraph 4.6.

The adhesion between both types of rubber shall be at least 100 N/25 mm when tested according to ISO 813. In cases where the test piece is too small for a test according to ISO 813 the rubber shall tear and not detach when it is tried to separate the bond.

#### 4.1.1.4 *Rubbers vulcanized or attached to rigid materials*

The rubber shall fulfil the requirements of this evaluation guideline in paragraph 4.4 and 4.5. The adhesion between rubber and the other material shall be at least 100 N/25 mm when tested according to ISO 813. In cases where the rigid parts are too small for a test according to ISO 813 the rubber shall tear and not detach when it is tried to separate the bond.

#### 4.1.1.5 *Rubber products containing other rigid non-adhered materials (eg metal springs)*

The rubber shall fulfil the requirements of this evaluation guideline in paragraph 4.4 and 4.5.

The non-rubber material shall not have a negative influence on the functioning of the rubber, for instance by having sharp edges that could cut the rubber under deformation. This shall be judged by deforming the complete assembly in a way as intended during use followed by an inspection for damage to the rubber (outside and inside).

#### 4.1.1.6 *Product containing voids (not porosity)*

The rubber shall fulfil the requirements of this evaluation guideline in paragraph 4.4 and 4.5.

Joints shall also fulfil the requirements in paragraph 4.6.1 and 4.6.2.

In cases where the part containing the void has to function in the same manner as a solid rubber the complete product shall fulfil the requirements for the compression set as given in section 4.5.4 measured at the place of the void.

## 4.2 Materials

### 4.2.1 *General*

Within the scope of this evaluation guideline all types of vulcanised rubber may be used for manufacturing products.

### 4.2.2 *Blends of rubber polymers*

Blends of rubber polymers may only be used for the manufacture of products with permission of the manufacturer of the pipes and/or fittings. Both the customer and the inspection body shall be notified of the ratio of the polymers used.

## 4.3 Functional requirements

### 4.3.1 *General*

The rubber products shall be suitable for the intended purpose. The design, the type(s) of rubber selected and the construction shall be such that, with regard to the type of application, a good sealing of the joints under normal circumstances is assured. Depending on the type of product and the construction used the materials have to be tested as follows:

### 4.3.2 *Fitness for contact with drinking water*

To prevent deterioration of the drinking water quality, the following regulatory requirements apply.

Products and materials, which (may) come into contact with drinking water or warm tap water, are not allowed to release substances in quantities which can jeopardise the health of the consumer or the quality of the water. Therefore the products or materials have to meet the toxicological, microbiological and organoleptical requirements which are laid down in the valid "Materials and chemicals in the supply of drinking water and warm tap water Regulation" (published in the Government Gazette). This means that the procedure for obtaining a recognised quality declaration, as meant in the valid Regulation, has to be concluded with positive results.

Products and materials with a quality declaration<sup>2</sup>, issued by e.g. a foreign certification body, are allowed to be used in the Netherlands, provided that the

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<sup>2</sup> The "Regulation" (article 16) states: "A quality certificate issued by an independent certifying body in another Member State of the European Union than the Netherlands or in another signatory state to the Agreement on the European Economic Area shall be considered the equivalent of a recognised quality statement, provided the Minister deems the quality certificate of the other state in compliance with similar or better criteria than those set forth in the present Regulation."

Minister has declared this quality declaration at least equivalent to the quality declaration as meant in the Regulation.

#### **4.3.3 Resistance to chemicals**

The rubber products have to be resistant to any chemicals drinking water can contain under usual circumstances.

#### **4.3.4 Effect of rubber products on the pipe and/or fitting material**

The rubber products may not contain substances that, under normal circumstances, can have an adverse effect on the material of the pipes and fittings.  
In case of doubt a suitable method to verify this can be taken out of ISO 3865.

### **4.4 Appearance, homogeneity and dimensions**

#### **4.4.1 Appearance**

The appearance of the rubber products shall comply with ISO 9691. For the appearance of O-rings also reference can be made to ISO 3601-3. The appearance is judged on, at least five, random selected rubber products.

#### **4.4.2 Homogeneity**

The rubber products may not contain foreign bodies and shall be free of cracks, entrapped air, bubbles or other irregularities, i.e. ISO 9691. For testing take a random selection of at least five products and cut them in flat slices or parts of about 2 mm in thickness. Stretch the slices approximately 100% and record the findings.

#### **4.4.3 Dimensions**

The nominal measurements of the rubber products and the acceptable deviations shall be in accordance with the figures stated by the manufacturer and they shall be laid down in a drawing. Tolerances shall be specified from the appropriate classes of ISO 3302.

For dimensions of O-rings also reference could be made to NEN-ISO 3601-1.

Determine the dimensions by means of appropriate measuring equipment (see ISO 23529).

### **4.5 Physical and mechanical properties of the rubber**

#### **4.5.1 General**

Unless stated otherwise, tests shall be carried out at a temperature of 23 °C according to ISO 23529.

The allowed tolerances for all mentioned test durations and test temperatures shall be according to ISO 23529.

For tests carried out at the production location during inspection, a temperature between 15 °C and 30 °C is allowed.

Annex G and H describe details about the preparation of test pieces from products and testing in case the products are O-rings.

## 4.5.2 Hardness

### 4.5.2.1 General

The hardness shall be suitable for the material and the construction of the joints for which the rubber products are intended.

Therefore the hardness shall be set in consultation between the manufacturer of the pipes and fittings and the manufacturer of the rubber products.

Then the hardness concerned shall be reported to the inspection body as nominal hardness with the tolerance range  $\pm 5$  IRHD.

The hardness shall be determined according to NEN-ISO 48.

Only in the case where the form and the dimensions of the ring do not allow measurement according to the standard mentioned previously, or in case of a check measurement (non destructive), the apparent hardness shall be determined in a way which both parties (buyer and manufacturer) have agreed upon. In that case the following issues must be laid down and submitted to the certification institute, for approval: the nominal apparent hardness plus the corresponding tolerance, the method of measurement and the place(s) of measurement.

### 4.5.2.2 Difference in hardness

The difference in hardness (the difference between the highest and lowest value measured) of a product shall not exceed 5 IRHD.

### 4.5.2.3 Class of hardness

The products shall have a nominal hardness falling within the range of values of table 1. The manufacturer shall submit the value of this nominal hardness, which shall be within the range of a class of hardness. All other tolerances only apply within the nominal hardness range of one class, as specified in table 1.

Table 1 - Class of hardness

Class of hardness in IRHD	Tolerance range of hardness class in IRHD
40	$\geq 36$ and $\leq 45$
50	$\geq 46$ and $\leq 55$
60	$\geq 56$ and $\leq 65$
70	$\geq 66$ and $\leq 75$
80	$\geq 76$ and $\leq 85$
90	$\geq 86$ and $\leq 95$

### 4.5.2.4 Hardness after ageing

After ageing according to NEN-ISO 188 for a period of 168 hours at a temperature of 70 °C (class I) or 125 °C (class II and III), the hardness (see 4.5.2.1) may not have changed by more than +8/-5 IRHD.

For the swelling products used for class III

- After ageing according to NEN-ISO 188 for a period of 504 hours at a temperature of 125 °C shall be within the limits -5 and +10 IRHD.

## 4.5.3 Mechanical properties

The tear resistance measured according to NEN-ISO 34-2 shall be at least 20 N. See annex G and H.

Tensile strength and elongation at break according to NEN-ISO 37 shall, depending on the class of hardness, meet the requirements laid down in table 2B, 2C or 2D. Dumbbell shaped test pieces of type 2 shall be used preferably. In case of O-rings the test may be carried out on complete rings, depending on the product dimensions, see annex G and H. The test report shall state the test piece that is used (dumbbell type or complete ring).

After ageing for 168 hours according to NEN-ISO 188 at a temperature of 70 °C (class I) or 125 °C (class II):

- the tensile strength may not have decreased by more than 20%, and
- the elongation at break may not have increased by more than 10 % or decreased by more than 30% for rubbers having a hardness up till 80 IRHD. Harder rubbers are allowed decrease maximum 40 %.

For the swelling products used for class III, it goes that after ageing according to NEN-ISO 188 for a period of 504 hours at a temperature of 125 °C:

- the change in tensile strength shall be maximum 25 %;
- the change in elongation at break shall be between -40 and +10 %.

Table 2B: Tensile strength and elongation at break for class I rubbers.

Hardness class IRHD	Tensile strength MPa	Elongation at break %
40	9	400
50	9	375
60	9	300
70	9	200
80	9	125
90	9	100

Table 2C: Tensile strength and elongation at break for class II rubbers.

Hardness class IRHD	Tensile strength MPa	Elongation at break %
50	9	250
60	9	200
70	9	150
80	9	100
90	9	100

Table 2D: Tensile strength and elongation at break for class III rubbers.

Hardness class IRHD	Tensile strength MPa	Elongation at break %	
		on sheet	on products
60	9	200	175
70	9	150	130
80	9	100	100

#### 4.5.4 Compression set

The compression set of the rubber determined according to NEN-ISO 815 (small test pieces or O-rings, see annex G and H) using the test conditions of table 3 (A or B) shall not exceed the values given in the table.

The low temperature value determined after 30 minutes of recovery.

Where the cross section is too small to obtain compression set buttons from the product, as an alternative to moulding buttons or sheets, the tension set may be determined using the method specified in ISO 2285 with a strain of 50%. For this alternative test method the same test conditions (except strain) and requirements apply as used for the determination of the compression set.

Table 3A: Compression set for class I rubbers.

Test conditions		Maximum permanent deformation in relation to the compression in % at a nominal hardness in IRHD			
Temperature °C	Duration of compression h	40 - 50	60	70	80 - 90
-10	72	40	50	50	60
23	72	12	12	15	15
70	24	20	20	20	20

Table 3B: Compression set for class II and III rubbers.

Test condition		Maximum permanent Deformation in relation to the Compression in %
Temperature °C	Duration of compression h	
23	72	15
125	24	20

#### 4.5.5 Compression set in water (class III rubbers only)

The compression set determined using the method given in EN 681-1 annex B shall be maximal 40 % after 10000 hours in water at a temperature of 110 °C.

If the result after 3000 hours is below 20% the test can be stopped and the material is OK for this aspect. If the result after 3000 hours is above 30% the test can be stopped and the material is not OK for this aspect.

#### 4.5.6 Stress relaxation

The stress relaxation shall be determined in accordance with ISO 3384 (compression, method A, cylindrical test pieces or O-rings, see annex G and H) or ISO 6914 (tension, test pieces or O-rings from product group A, see annex D, G and H).

Minimum measurements shall be taken after 3 hrs, 1, 3, 7 days for the 7 day test and after 3 hrs, 1, 3, 7, 30, 100 days for the 100 days test. The values obtained by regression shall not exceed the maximum values given in table 4 (A to C).

The 100 days test shall be considered as a type approval test. The requirement in respect of relaxation per logarithmic decade shall also be regarded as a type approval requirement.

The best fit straight line shall be determined by regression analysis using a logarithmic time scale. The 7 and 100 days requirements are those derived from this straight line.

If the test piece is taken from a product, the measurement shall be carried out as far as possible in the direction of compression of the product in service.

Where the cross section is too small to obtain compression buttons from the product, as an alternative to moulding buttons, the stress relaxation in tension of the product may be determined, at a temperature of 23 °C, using method A specified in ISO 6914 with the same requirements as for stress relaxation in compression.



Table 4A: Stress relaxation for class I rubbers.

Hardness class IRHD	Stress relaxation in % after (ISO 3384 or ISO 6914)		Stress relaxation in % per logarithmic decade
	7 days at 23 °C	100 days at 23 °C	
40	13	19	5,1
50	14	20	5,5
60	15	22	5,9
70	16	23	6,3
80	17	25	6,7
90	18	26	7,1

Table 4B: Stress relaxation for class II rubbers.

Hardness class IRHD	Stress relaxation in % after (ISO 3384 or ISO 6914)		
	7 days at 23 °C	100 days at 23 °C	7 days at 125 °C *
50	15	20	30
60	15	22	30
70	15	23	30
80	18	25	30
90	18	26	30

Table 4C: Stress relaxation for class III rubbers.

Hardness class IRHD	Stress relaxation in % after			
	(ISO 3384 or ISO 6914)			(ISO 6914)
	7 days at 23 °C	100 days at 23 °C	7 days at 125 °C *	4 weeks at 140 °C *
60, 70, 80	15	22	30	55

\* These tests do not comply for swelling seals.

#### 4.5.7 Resistance to ozone attack

This requirement does not need to be tested for 100 % EPM/EPDM or IIR compounds.

The rubber shall show no cracks when tested in accordance with NEN-ISO 1431-1 method A under conditions as given in table 5A and table 5B.

The resistance class to be used shall be established by mutual agreement between the manufacturer, the client and the inspection body depending on the intended use (see the explanatory notes under table 5).

Table 5A - Resistance to ozone attack

Class of resistance	Ozone concentration [pphm]	Period of exposure [h]	Temperature [°C]
I	50	120	40
II	50	48	40
III	25	48	40

Table 5B - Elongation to be used in the ozone test

Hardness class	Elongation in %
40 - 70	20 %
80	15 %
90	10 %

### Explanatory notes

**Class of resistance I** is intended for products with a high risk of attack by ozone, for instance in case of separately supplied products without sufficient packaging or in case of connections with preinstalled rubbers.

**Class of resistance II** is intended for products for which a normal resistance to ozone is required.

**Class of resistance III** is only permissible for rubbers which are never (partly) exposed to the open air when they are in tension. Transport shall always take place in sealed packages.

#### 4.5.8 Swelling in water

The change in volume after immersion for 168 hours at 70°C (class I) or 95°C (class II and III) in accordance with NEN-ISO 1817 shall be within the limits -1 and +8% (v/v).

For swelling seals it also goes that the change in volume after immersion for 10 weeks at 150°C in accordance with NEN-ISO 1817 shall be more than 10% (v/v). After the immersion the samples shall be intact and it must be possible to handle them without problems before the measurements.

## 4.6 Properties for special types of products

### 4.6.1 General requirements

A ring made of rubber which has been vulcanized in advance shall not contain more than one weld, separate from eventual joints between compounds, except by agreement between the manufacturer and the client.

A ring made from two compounds shall not contain more than one weld in the direction of the outline of the products.

### 4.6.2 Behaviour at elongation

#### 4.6.2.1 Massive products with a weld

Elongate each rubber product with a weld with a tensile speed of 500 mm/min to 100% elongation, unless a reduced elongation has been agreed upon by both the buyer and the manufacturer. This must be reported to the inspection body. Keep the rings in an elongated state for at least 30 seconds. When tested the weld shall not crack or contract.

#### 4.6.2.2 Products made from two compounds

Elongate test pieces containing the joint between the two materials with a tensile speed of 500 mm/min to 100% elongation. Keep the test pieces in an elongated state for at least 30 seconds. When tested the joint shall not crack or contract.

#### 4.6.2.3 Elongation test for welded products after ageing

After ageing for 168 hours at  $70 \pm 2^\circ\text{C}$  in accordance with NEN-ISO 188 the test of 4.6.2.1 or 4.6.2.2 is repeated. When tested the weld or joint shall not crack or contract.

## **4.7 Sampling, test material and test pieces**

### **4.7.1 Sampling**

The sample shall be representative for the product to be checked and been taken out of a normal production lot.

### **4.7.2 Test material**

#### **4.7.2.1 Test pieces from products**

If the dimensions of the rubber products are such that it is possible to take out the test pieces from them, the tests shall be carried out on such test pieces.

Depending on the dimensions of the products it is allowed and can be necessary to take test pieces with other (smaller) dimensions than those prescribed in the standards. A guideline for this preparation is given in annex G or annex H.

#### **4.7.2.2 Test piece of complete product**

In carrying out the tests according to 4.3.4 and 4.4.1 up to 4.4.3 inclusive a complete rubber product or an unmachined part of a rubber product shall be used.

#### **4.7.2.3 Test pieces from test plates**

If the dimensions of the rubber products are such that the test pieces required cannot be manufactured from them, test plates produced in the manufacturer's own laboratory shall be used. Care has to be taken that the vulcanisation conditions for the sheets are similar to those for the products to obtain matching properties. Details with respect to the vulcanisation and the direction of milling shall be given to the inspection body.

### **4.7.3 Test pieces**

The test pieces required shall, in accordance with ISO 23529, be made out of the products (see 4.7.2.1) or out of the test sheets (see 4.7.2.3).


By preparing test pieces out of actual products it is unavoidable that some deviations from the standards are allowed. For details see 4.7.2 and Annex G. In case the products are O-rings a more product specific approach is chosen. For such products the procedure as mentioned in Annex H has to be followed.

In cases where test sheets are used, the test pieces for tensile strength and elongation at break, as well as those for tear resistance, shall be taken perpendicular to the direction of milling and compression moulding or the direction of injection moulding flow.

# 5 Marking

## 5.1 Certification mark

After concluding a Kiwa certification agreement the certified products shall, beside the marks indicated in the respective standards, be indelible marked with:

- name of manufacturer or the deposited trade mark;
- the wordmark "KIWA" and additionally the Kiwa watermark ;
- the nominal dimension or dimensions;
- the nominal hardness;
- the year of manufacturing and preferably the quarter;
- the type of rubber applied by means of the letter codes of the nomenclature according to ISO 1629;
- temperature class (I, II or III)
- on products from blends, the letter B ("blend") shall be placed behind the first letter code;
- the ozone resistance class ("Ozone I, II or III"). For rubber rings made from two compounds the compound with the lowest class is valid.

If the dimensions of the products are such that the indications applied to them may impair the product, the products may be marked per package in consultation with the manufacturer, the buyer and the inspection body.

Products produced by cutting or die cutting out of sheets may be marked per package.

# 6 Requirements in respect of the quality system

This chapter contains the requirements which have to be met by the supplier's quality system.

## 6.1 Manager of the quality system

Within the supplier's organizational structure an employee must have been appointed who is in charge of managing the supplier's quality system.

## 6.2 Internal quality control/quality plan

The supplier shall have an internal quality control scheme (IQC scheme) which is applied by him.

The following must have been demonstrably recorded in this IQC scheme:

- what aspects are checked by the producer;
- according to what methods such inspections are carried out;
- how often these inspections are carried out;
- in what way the inspection results are recorded and kept.

This IQC scheme should at least be an equivalent derivative of the model IQC scheme included in the addendum.

## 6.3 Procedures and working instructions

The supplier shall be able to submit the following:

- procedures for:
  - dealing with products showing deviations;
  - corrective actions to be taken if non-conformities are found;
  - dealing with complaints about products and/or services delivered;
- the working instructions and inspection forms used
- instructions for packaging and closing off of products during storage and transport.

## 6.4 Quality control of rubber products

The following routine tests shall be carried out according to the test methods mentioned in this evaluation guideline:

- a. dimensions
- b. surface imperfections
- c. hardness
- d. tensile strength and elongation at break
- e. compression set for 24 hours at 70 °C

The product control tests shall be carried out on lots of finished components using sampling procedures in accordance with either:

- a) ISO 2859-1 with a specified inspection level of S2 and an AQL of 2,5 % for attributes; or
- b) ISO 3951 with a specified inspection level of S3 and an AQL of 2,5 % for variables.

These requirements do not preclude the use by the manufacturer of more stringent combinations of inspection levels and AQL values from ISO 2859-1 and ISO 3951.

# 7 Summary of tests and inspections

This chapter contains a summary of the following tests and inspections to be carried out in the event of certification:

- Pre-certification tests;
- Inspection test as to toxicological requirements and product requirements;
- Inspection of the quality system.

The frequency with which Kiwa will carry out inspection tests is also stated in the summary.

## 7.1 Test matrix

Description of requirement	Article BRL	Tests within the scope of		
		Pre-certification	Supervision by Kiwa after granting of certificate	
			Inspection <sup>1)</sup>	Frequency (no./year)
Fitness for contact with drinking water	4.3.2	X	X	1x year
Resistance to chemicals	4.3.3	X		
Effect of rubber products on the pipe and/or fitting material	4.3.4	X		
Appearance	4.4.1	X	X <sup>2)</sup>	1x year
Homogeneity	4.4.2	X	X <sup>2)</sup>	1x year
Dimensions	4.4.3	X	X <sup>3)</sup>	1x year
Hardness	4.5.2	X	X	1x year
Hardness after ageing	4.5.2.4	X	X	1x year
Tear resistance	4.5.3	X		
Tensile strength	4.5.3	X	X	1x year
Tensile strength after ageing	4.5.3	X	X	1x year
Elongation at break	4.5.3	X	X	1x year
Elongation at break after ageing	4.5.3	X	X	1x year
Compression set	4.5.4	X	X	1x year
Compression set in water (class III rubbers only)	4.5.5	X		
Stress relaxation	4.5.6	X	X <sup>4)</sup>	1x year
Resistance to ozone attack	4.5.7	X <sup>5)</sup>	X <sup>5)</sup>	1x year
Swelling in water	4.5.8	X		
Behaviour at elongation	4.6.2	X	X	1x year
Certification mark	5.1	X	X <sup>3)</sup>	1x year

- 1) In case of significant changes of the product or production process, compliance of the product to the performance requirements shall be determined. Properties not marked in the table for inspection shall be tested by the manufacturer at least once per 5 years, to be verified by the inspector during inspections.
- 2) These product properties are only visually controlled during the inspection. In case of reasonable doubt samples will be taken and send to an accredited test laboratory for determination of these properties.
- 3) These product properties are determined during the inspection.
- 4) Only 7 days test; at 23 °C for class I and II rubbers and at 125 °C for class III rubbers.
- 5) Not for EPM/EPDM or IIR.

## **7.2 Inspection of the quality system**

The quality system will be checked by Kiwa on the basis of the IQC scheme.

The inspection contains at least those aspects mentioned in the Kiwa Regulations for Certification

# 8 Agreements on the implementation of certification

## 8.1 General

Beside the requirements included in these evaluation guidelines, also the general rules for certification as included in the Kiwa Regulations for Certification apply.

These rules are in particular

- The general rules for conducting the pre-certification tests, to be distinguished in:
  - the way suppliers are to be informed about an application is being handled,
  - how the test are conducted,
  - the decision to be taken as a result of the pre certification tests.
- The general directions for conducting inspections and the aspects to be audited,
- The measurements to be taken by Kiwa in case of Non Conformities,
- Measurements taken by Kiwa in case of improper Use of Certificates, Certification Marks, Pictograms and Logos,
- Terms for termination of the certificate,
- The possibility to lodge an appeal against decisions of measurements taken by Kiwa.

## 8.2 Certification staff

The staff involved in the certification may be sub-divided into:

- certification assessor/reviewer: in charge of review of the by the supplier supplied or to be supplied construction drawings and documents, admissions, reviewing of applications and the review of conformity assessments;
- site assessor: in charge of carrying out external inspections at the supplier's works;
- decision-makers: in charge of taking decisions in connection with the pre-certification tests performed, continuing the certification in connection with the inspections performed and making decisions on the need of corrective actions.

### 8.2.1 Qualification requirements

The following qualification requirements have been set by the Board of Experts for the subject matter of this Evaluation Guideline:

ISO/IEC 17065	Certification Expert	Inspector	Decision maker
<b>Education - general</b>	<ul style="list-style-type: none"> <li>• Technical higher-level professional education</li> <li>• Internal training certification and Kiwa policy</li> <li>• Training auditing</li> </ul>	<ul style="list-style-type: none"> <li>• Intermediate-level professional education</li> <li>• Internal training certification and Kiwa policy</li> <li>• Training auditing</li> </ul>	<ul style="list-style-type: none"> <li>• Higher level professional education</li> <li>• Internal training certification and Kiwa policy</li> <li>• Training auditing</li> </ul>
<b>Education - specific</b>	<ul style="list-style-type: none"> <li>• specific studies and training (know-how and skills)</li> </ul>	<ul style="list-style-type: none"> <li>• specific studies and training (know-how and skills)</li> </ul>	<ul style="list-style-type: none"> <li>• not applicable</li> </ul>



ISO/IEC 17065	Certification Expert	Inspector	Decision maker
<b>Experience - general</b>	<ul style="list-style-type: none"> <li>1 year of relevant work experience with at least 4 pre certification tests of which one carried out independent under supervision.</li> </ul>	<ul style="list-style-type: none"> <li>1 year of relevant work experience with at least 4 inspections of which one carried out independent under supervision</li> </ul>	<ul style="list-style-type: none"> <li>4 year of relevant work experience with at least 1 year in certification</li> </ul>
<b>Experience - specific</b>	<ul style="list-style-type: none"> <li>Detailed knowledge of the evaluation guideline and 4 certification tests carried out on the basis of the evaluation guideline or one related.</li> </ul>	<ul style="list-style-type: none"> <li>Detailed knowledge of the evaluation guideline and 4 inspections carried out on the basis of the evaluation guideline or one related.</li> </ul>	<ul style="list-style-type: none"> <li>general knowledge of the evaluation guideline</li> </ul>

The level of education and the experience of the certification staff involved shall be demonstrably recorded.

### 8.2.2 Qualification

The qualification of the Certification staff shall be demonstrated by means of assessing the education and experience to the requirements mentioned before. In case staff is to be qualified on the basis of deflecting criteria, written records shall be kept.

The authority to qualify staff is dedicated to:

- decision makers: qualification of certification experts and inspectors,
- Management of Kiwa: qualification of decision makers.

### 8.3 Report Pre certification tests

Kiwa records the results of the pre certification tests in a report. This report shall comply with the following requirements:

- completeness: the reports verdicts about all requirements included in the evaluation guideline,
- traceability: the findings on which the verdicts have been based shall be recorded traceable,
- basis for decision: the decision maker shall be able to base his decision on the findings included in the report.

### 8.4 Decision for granting the certificate

The decision for granting the certificate shall be made by a qualified decision maker which has not been involved in the pre certification tests. The decision shall be recorded traceable.

### 8.5 Lay out of quality declaration

The product certificate shall be conform the model included as an annex

### 8.6 Nature and frequency of external inspections

The certification body shall carry out inspections at the supplier at regular intervals to check whether the supplier complies with his obligations. About the frequency of inspections the Board of Experts decides.

At the time of validation of this Evaluation Guideline, the frequency was set at 4 inspection visits per year.

If the supplier has a proven well-functioning quality system based on a ISO 9001 or IATF 16494 certificate and additional specific aspects with respect to the production processes involved, the frequency can be reduced to 2 inspection visits per year.

Inspections shall invariably include:

- The product specifications laid down in the quality declaration;
- The production process of the supplier;
- The IQC-scheme of the supplier and the results of tests carried out by the supplier
- The correct marking of the certified products;
- The compliance with the required procedures.

The findings of each inspection shall be traceable recorded in a report.

### **8.7 Interpretation of requirements**

The Board of Experts may record the interpretation of requirements of these evaluation guidelines in a separate interpretation document.

### **8.8 Sanction policy**

The sanction policy and the weighing of shortcomings is available on the service page on the website of the certification body, which has formulated this quality assessment.

## 9 Titles of standards

NEN-ISO 10508	Plastics piping systems for hot and cold water installations - Guidance for classification and design
NEN-EN 681-1	Elastomeric seals – Materials requirements for pipe joint seals used in water and drainage applications – Part 1: Vulcanised rubber
Amendment sheet NEN-EN 681-1/A1	Elastomeric seals – Materials requirements for pipe joint seals used in water and drainage applications – Part 1: Vulcanised rubber
Amendment sheet NEN-EN 681-1/A2	Elastomeric seals – Materials requirements for pipe joint seals used in water and drainage applications – Part 1: Vulcanised rubber
Corrigendum NEN-EN 681-1/C1	Elastomeric seals – Materials requirements for pipe joint seals used in water and drainage applications – Part 1: Vulcanised rubber
NEN-EN 806-2	Specification for installations inside buildings conveying water for human consumption – Part 2: Design
NEN EN 1420-1	Influence of organic materials on water intended for human consumption - Determination of odour and flavour assessment of water in piping systems – Part 1: Test method
NEN EN 1622	Water analysis - Determination of the threshold odour number (TON) and threshold flavour number (TFN)
NEN EN 13052-1	Influence of materials on water intended for human consumption - Organic materials - Determination of colour and turbidity of water in piping systems - Part 1: Test method
NEN EN ISO 7887	Water quality - Examination and determination of colour
NEN-ISO 34-2	Determination of the tear strength of small test pieces (Delft test pieces)
NEN-ISO 37	Rubber, vulcanised or thermoplastic - Determination of tensile stress - strain properties
NEN-ISO 48	Rubber, vulcanised or thermoplastic - Determination of hardness (hardness between 30 and 85 IRHD)
NEN-ISO 188	Rubber, vulcanised – Accelerated ageing or heat-resistance tests
NEN-ISO 813	Rubber, vulcanised - Determination of adhesion to metal: one-plate method
NEN-ISO 815	Rubber, vulcanised or thermoplastic - Determination of compression set at ambient, elevated or low temperatures
NEN-ISO 1431-1	Rubber, vulcanised or thermoplastic - Resistance to ozone cracking - Part 1: Static strain test

NEN-ISO 1817	Rubber, vulcanised – Determination of the effect of liquids
NEN-ISO 2285	Rubber, vulcanised or thermoplastic - Determination of tension set at normal and high temperatures
NEN-ISO 3302	Rubber - Dimensional tolerances for use with products
NEN-ISO 3384	Rubber, vulcanised or thermoplastic – Determination of stress relaxation in compression at ambient and at elevated temperatures
NEN-ISO 3601-1	Hydrauliek en pneumatiek - O-ringen - Deel 1: Inwendige middellijnen, doorsneden , toleranties en codes voor de aanduiding
NEN-ISO 3601-3	Fluid power systems - O-rings - Part 3: Quality acceptance criteria
NEN-ISO 3865	Rubber, vulcanized or thermoplastic - Methods of test for staining in contact with organic material
NEN-ISO 4661	Rubber, vulcanised or thermoplastic – Preparation of samples and test pieces
NEN-ISO 6914	Rubber, vulcanized; Determination of ageing characteristics by measurement of stress at a given elongation
NEN-ISO 9691	Rubber – Recommendation for the workmanship of pipe joint rings – Description and classification of imperfections
NEN-ISO 23529	Rubber – General procedures for preparing and conditioning test pieces for physical test methods
IATF 16949	Technical Specification Quality management system requirements for automotive production and relevant service parts organisations

# Annex A. Summary of the material requirements for rubber products and rubber sheets

Table 7: Summary of the requirements for class I rubber products

Property	Units	Method	Requirement for hardness classes					
			40	50	60	70	80	90
Hardness (a)*	IRHD	ISO 48	± 5	± 5	± 5	± 5	± 5	± 5
Tear resistance minimum	N	ISO 816	20, 25 or 55	20, 25 or 55	20, 25 or 55	20, 25 or 55	20, 25 or 55	20, 25 or 55
Tensile strength on sheet test piece	MPa	ISO 37	≥ 9	≥ 9	≥ 9	≥ 9	≥ 9	≥ 9
Tensile strength on product test piece (a)*	MPa	ISO 37	≥ 9	≥ 9	≥ 9	≥ 9	≥ 9	≥ 9
Elongation at break on sheet test piece	%	ISO 37	≥ 400	≥ 375	≥ 300	≥ 200	≥ 125	≥ 100
Elongation at break on product test piece (a)*	%	ISO 37	≥ 400	≥ 375	≥ 300	≥ 200	≥ 125	≥ 100
Ageing 168 hours in air at 70°C		ISO 188						
- change hardness	IRHD	ISO 48	+8/-5	+8/-5	+8/-5	+8/-5	+8/-5	+8/-5
- change tensile strength	%	ISO 37	-20	-20	-20	-20	-20	-20
- change elongation	%	ISO 37	+10/-30	+10/-30	+10/-30	+10/-30	+10/-30	+10/-30
Compression set	%	ISO 815						
- 72 h, -10°C			≤ 40	≤ 40	≤ 50	≤ 50	≤ 60	≤ 60
- 72 h, 23°C			≤ 12	≤ 12	≤ 12	≤ 15	≤ 15	≤ 15
- 24 h, 70°C (a)*			≤ 20	≤ 20	≤ 20	≤ 20	≤ 20	≤ 20
Stress relaxation	%	ISO 6914 or ISO 3384						
- 168 h at 23°C (a*)			≤ 13	≤ 14	≤ 15	≤ 16	≤ 17	≤ 18
- 100 days at 23°C			≤ 19	≤ 20	≤ 22	≤ 23	≤ 25	≤ 26
Ozone resistance (a)*	-	ISO 1431/1						
Class I			20 % No cracks	20 % No cracks	20 % No cracks	20 % No cracks	15 % No cracks	10 % No cracks
120h, 40°C, 50 pphm			20 % No cracks	20 % No cracks	20 % No cracks	20 % No cracks	15 % No cracks	10 % No cracks
Class II			20 % No cracks	20 % No cracks	20 % No cracks	20 % No cracks	15 % No cracks	10 % No cracks
48 h, 40°C, 50 pphm			20 % No cracks	20 % No cracks	20 % No cracks	20 % No cracks	15 % No cracks	10 % No cracks
Class III			20 % No cracks	20 % No cracks	20 % No cracks	20 % No cracks	15 % No cracks	10 % No cracks
48 h, 40°C, 25 pphm			20 % No cracks	20 % No cracks	20 % No cracks	20 % No cracks	15 % No cracks	10 % No cracks
Swelling in water	% (v/v)	ISO 1817						
- 168 h at 70°C				+8/-1	+8/-1	+8/-1	+8/-1	+8/-1

a) Properties marked with (\*) will be determined for a (reduced) test on product test pieces.

Table 8: Summary of the requirements for class II rubber products

Property	Units	Method	Requirement for hardness classes				
			50	60	70	80	90
Hardness (a)*	IRHD	ISO 48	± 5	± 5	± 5	± 5	± 5
Tear resistance, minimum	N	ISO 816	20, 25 or 55	20, 25 or 55	20, 25 or 55	20, 25 or 55	20, 25 or 55
Tensile strength on sheet test piece	MPa	ISO 37	≥ 9	≥ 9	≥ 9	≥ 9	≥ 9
Tensile strength on product test piece (a)*	MPa	ISO 37	≥ 9	≥ 9	≥ 9	≥ 9	≥ 9
Elongation at break on sheet test piece	%	ISO 37	≥ 250	≥ 200	≥ 150	≥ 100	≥ 100
Elongation at break on product test piece (a)*	%	ISO 37	≥ 250	≥ 200	≥ 150	≥ 100	≥ 100
Ageing 168 hours in air at 125°C - change hardness - change tensile strength - change elongation	IRHD % %	ISO 188 ISO 48 ISO 37 ISO 37	+8/-5 ≤ 20 +10/-30	+8/-5 ≤ 20 +10/-30	+8/-5 ≤ 20 +10/-30	+8/-5 ≤ 20 +10/-40	+8/-5 ≤ 20 +10/-40
Compression set - 72 h, 23°C - 24 h, 125°C (a*)	%	ISO 815	≤ 15 ≤ 20	≤ 15 ≤ 20	≤ 15 ≤ 20	≤ 15 ≤ 20	≤ 15 ≤ 20
Stress relaxation - 7 days at 23°C (a*) - 100 days at 23°C - 7 days at 125°C	%	ISO 6914 or ISO 3384	≤ 15 ≤ 20 ≤ 30	≤ 15 ≤ 22 ≤ 30	≤ 15 ≤ 23 ≤ 30	≤ 18 ≤ 25 ≤ 30	≤ 18 ≤ 26 ≤ 30
Ozone resistance (a)* Class I- 120 h, 40°C, 50 pphm Class II- 48 h, 40°C, 50 pphm Class III- 48 h, 40°C, 25 pphm	-	ISO 1431/1	20 % No cracks 20 % No cracks 20 % No cracks	20 % No cracks 20 % No cracks 20 % No cracks	20 % No cracks 20 % No cracks 20 % No cracks	15 % No cracks 15 % No cracks 15 % No cracks	10 % No cracks 10 % No cracks 10 % No cracks
Swelling in water - 168 h at 95°C	% (v/v)	ISO 1817	+8/-1	+8/-1	+8/-1	+8/-1	+8/-1

a) Properties marked with (\*) will be determined for a (reduced) test on product test pieces.

Table 9: Summary of the requirements for class III rubber products

Property	Units	Method	Requirement for hardness classes		
			60	70	80
Hardness (c*)	IRHD	ISO 48	± 5	± 5	± 5
Tear resistance	N	ISO 816	≥ 20	≥ 20	≥ 20
Tensile strength on sheet test piece (c*)	MPa	ISO 37	≥ 9	≥ 9	≥ 9
Tensile strength on product test piece (a*)	MPa	ISO 37	≥ 9	≥ 9	≥ 9
Elongation at break on sheet test piece (c*)	%	ISO 37	≥ 200	≥ 150	≥ 100
Elongation at break on product test piece (a*)	%	ISO 37	≥ 175	≥ 130	≥ 100
Ageing 168 hours in air at 125°C (c*)		ISO 188			
-change hardness	IRHD	ISO 48	+8/-5	+8/-5	+8/-5
-change tensile strength	%	ISO 37	≤ 20	≤ 20	≤ 20
-change elongation	%	ISO 37	+10/-30	+10/-30	+10/-30
Compression set	%	ISO 815			
- 72 h, 23°C			≤ 15	≤ 15	≤ 15
- 24 h, 125°C (a*)			≤ 20	≤ 20	≤ 20
Stress relaxation	%	ISO			
- 168 h at 23°C (a*)		6914	≤ 15	≤ 15	≤ 15
- 100 days at 23°C		or	≤ 22	≤ 22	≤ 22
- 168 h at 125°C		ISO	≤ 30	≤ 30	≤ 30
(d*)		3384	≤ 55	≤ 55	≤ 55
- 4 weeks at 140°C		(d*)			
Ozone resistance (a)*	-	ISO			
Class I- 120 h, 40°C, 50 pphm		1431/1	20 % No cracks	20 % No cracks	15 % No cracks
Class II- 48 h, 40°C, 50 pphm			20 % No cracks	20 % No cracks	15 % No cracks
Class III- 48 h, 40°C, 25 pphm			20 % No cracks	20 % No cracks	15 % No cracks
Volume change	%	ISO			
- 168 h, water at 95°C		1817	+8/-1	+8/-1	+8/-1
Compression set in water	%	ISO 815			
- 10000 h 110 °C (a, b)*	%	EN 681	≤ 40	≤ 40	≤ 40
(- 3000 h 110 °C)	%	Annex B	(≤ 20 / 30 b)	(≤ 20 / 30 b)	(≤ 20 / 30 b)

- a) Properties marked with (\*) will be determined for a (reduced) test on product test pieces.
- b) If the result after 3000 hours is below 20% the test can be stopped and the material is OK for this aspect; if the result after 3000 hours is above 30% the test can be stopped and the material is not OK for this aspect.
- c) Requirements for swelling seals are given in table 10
- d) This requirement and test does not comply for swelling seals.

Table 10: Requirements for swelling seals only, class III

<b>Property</b>	<b>Units</b>	<b>Method</b>	<b>Requirement</b>
Aging 3 weeks at 125 °C - change hardness - change tensile strength - change elongation at break	IRHD % %	ISO 188	+10/-5 ≤ 25 +10/-40
Changes after immersion in hot water for 10 weeks at 150 °C	%	ISO 1817	>10*

\* After the immersion the samples shall still be intact and it must be possible to handle them without problems for the measurements.



## Annex B. Categorisation of O-ring sizes

Table 11: Categorisation of O-ring sizes in groups

Groups of products	Cross section diameter	
	Minimum [mm]	Maximum [mm]
A	-	2,75
B	2,75	6,0
C	6,0	12
D	12	25
E	> 25	-

# Annex C. Explanations (informative)

## C.1 Explanations

### C.1.1. **Permanent seal under load**

When applying seals in pipe joints it must be kept in mind that under the load and the own weight of the pipe, after a certain lapse of time the deformation of the ring may be such that the seal is no longer sufficient on the opposite side. The pipe manufacturer is recommended to take measures to prevent this.

### C.1.2. **Recommendations of a general nature**

#### C.1.2.1. *Percentage of compression*

The extent, to which different types of rubber are compressed in the joints, varies. General rules cannot be given. The following factors affect the acceptable percentage of compression:

- the type of rubber and the way the rings are manufactured;
- the construction of the joint;
- the conditions (temperature, pressure, medium and additional assembly tensions).

Therefore, the type of rubber to be used must always be determined in consultation with the buyer, the pipe manufacturer and the rubber manufacturer.

#### C.1.2.2. *Additional requirements*

Sometimes it is necessary to have additional requirements, e.g. with regards to rigidity. Also, it may be useful to demand better resistance against ozone when long-term storage under extreme conditions is planned.

If additional requirements are judged necessary, the manufacturer of the pipes or attachments shall inform the rubber manufacturer and the inspection body of such requirements.

#### C.1.2.3. *Application*

TR 7620 can be used as a first reference of application of the various types of rubber.

## C.2. **Recommendations for the storage and use of rubber products**

During storage and use of rubber products, appropriate measures must be taken to shield off environment influences (light, air, humidity and temperature).

The preservation of quality is aided as follows.

### C.2.1. **Storage in a warehouse or temporary indoor storage**

a. Preferably, use a separate and closed room:

- screened against artificial and day light;
- ventilated with air containing as little ozone as possible (ozone is produced e.g. by generators, electric motors and arc welding);
- with an ambient temperature between 5 and 25 °C;
- with a relative humidity between 40% and 70%;
- free of oil, grease and other hydrocarbons and/or vapours emanating from these.

b. Keep the storage time as short as possible.

Apply the "first in - first out" method.

In the case of indoor storage for a period exceeding 6 months, extra measures are required despite good conditions. These include airtight package, female ends of pipes, attachments or fittings.

Hanging or stacking may cause extra load -pressure, elongation or tensile- and thus the formation of cracks.

### **C.2.2. Outdoor transport and storage**

It is recommended to protect the rubber products as much as possible during transport or outdoor storage.

- a. Keep exposure to influences of weather as short as possible and certainly protect against frost (temperature below -5 °C).
- b. In the case of exposure to outdoor conditions for a period exceeding 2 weeks, extra measures are required such as packing, covering and screening against weather influences.  
Always prefer indoor storage or covered outdoor storage.

### **C.2.3. Processing**

Some general preventive rules for processing are:

- a. Keep attachments and ends free of dust, sand and dirt in order to prevent damage at assembly.
- b. At assembly, loose products shall be processed directly from the - possibly temporary - package.
- c. Rubber products are susceptible to mechanical damage caused by sharp objects, burrs, cutting edges and undue elongation, distortion and forcing. Check the male ends of the pipes for burrs etc. prior to assembly.
- d. In the case of repeated or long term arc welding in ambient air, the rubbers shall be protected.
- e. Avoid contact with oil, grease, petrol, etc. and their vapours.
- f. Cleaning with chemical products varies for many applications; follow the instructions of the manufacturer.
- g. Application of lubricants shall take place strictly according to the instructions of the manufacturer or supplier.
- h. After processing, make sure the joint is not exposed to frost; therefore cover in time.

### **C.2.4. Products in aboveground installations**

Rubber products in aboveground installations or in permanent contact with atmospheric conditions require extra attention with regard to long term resistance. Not all rubber compounds and/or types are suitable for long term aboveground applications. The choice of a rubber compound shall therefore be well-considered.

# Annex D. Model certificate

## Product certificate K12345

Issued

Replaces

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## Vulcanised rubber products for cold and hot drinking water applications

### STATEMENT BY KIWA

With this product certificate, issued in accordance with the Kiwa Regulations for Certification, Kiwa declares that legitimate confidence exists that the products supplied by

## Company

as specified in this product certificate and marked with the Kiwa®-mark in the manner as indicated in this product certificate may, on delivery, be relied upon to comply with Kiwa evaluation guideline BRL-K17504 "vulcanised rubber products for cold and hot drinking water applications" **dated [dd-mm-yyyy] inclusive amendment sheet dated dd-mm-yyyy.**



Luc Leroy  
Kiwa

### Kiwa Nederland B.V.

Sir Winston Churchilllaan 273  
Postbus 70  
2280 AB RIJSWIJK  
The Netherlands  
Tel. +31 88 998 44 00  
Fax +31 88 998 44 20  
info@kiwa.nl  
[www.kiwa.nl](http://www.kiwa.nl)

*Publication of this certificate is allowed.*

*Advice: consult [www.kiwa.nl](http://www.kiwa.nl) in order to ensure that this certificate is still valid.*

### Company

Tel.  
Fax

Certification process  
consists of initial and  
regular assessment of:

- quality system
- product



# Kiwa<sup>®</sup> Product certificate K12345

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## Vulcanised rubber products for cold and hot drinking water applications

### PRODUCT SPECIFICATION

The products as specified in the table below fulfil the requirements of BRL-K17504. BRL-K17504 covers the requirements of EN 681-1, "Elastomeric seals - Materials requirements for pipe joint seals used in water and drainage applications - Part 1: Vulcanized rubber".

### TECHNICAL SPECIFICATION OF THE PRODUCT

Rubber Compound	Nominal Hardness [IRHD]	Ozone class <sup>1</sup> :	Field of application class <sup>2</sup>	Cross Section [mm]	Nominal Dimensions [mm]	Product	Remarks or Drawings
Type Code	xx	I	I - WA	xx-xx	xx-xx	O-ring of naam van product	
Type Code	xx	I	I - WA	xx-xx	xx-xx	O-ring of naam van product	
Type Code	xx	I	I - WA	xx-xx	xx-xx	O-ring of naam van product	

1 Ozone resistance class according to BRL-K17504:  
I For products with a high risk of attack by ozone, for instance in case of separately supplied products without sufficient packaging or in case of connections with preinstalled rubbers under strain.  
II For products for which a normal resistance to ozone is required.  
III For rubbers which are never (partly) exposed to the open air when they are in tension. Transport shall always take place in sealed packages.

2 Field of application class according to BRL -K17504:  
I Water supply at temperatures up to 50 °C;  
II Water supply at temperatures intermittently up to 110 °C, or water supply up to 110 °C in serviceable piping systems;  
III Hot water circulation systems based on the classification class 2 in ISO 10508;

Field of application class according to EN 681-1:  
WA As in BRL-K17504 class I;  
WB As in BRL-K17504 class II;  
WE As in BRL-K17504 class II, for IIR-copolymer.

Details of the products are included in the drawing list, which forms a part of the IQC schedule. Kiwa authenticates this list. A copy of this list can be obtained from the producer.

### Fitness for contact with drinking water

This product is approved on the basis of the requirements for hygienic aspects set in the "Regeling materialen en chemicaliën drink- en warm tapwatervoorziening" ("Materials and chemicals in the supply of drinking water and warm tap water Regulation"; published in the Government Gazette).

These hygienic aspects are based on two main criteria. The product shall permanently comply with:


The product recipe approved during the assessment procedure. This recipe is not to be changed without prior approval by Kiwa according to the Kiwa approval procedure for the hygienic aspects;

Specific product requirements for the hygienic aspects.

The recipe and specific product requirements are laid down in the for confidentiality reasons undisclosed 'appendix hygienic aspects' to this certificate.

### MARKING

The following marks and indications must be provided on each product<sup>#</sup> and product packaging in a clear, legible and indelible way:

- the name of manufacturer or the deposited trade mark;
- The Kiwa<sup>®</sup>-mark products are marked with the word mark "KIWA". / "KIWA" 
- the nominal dimension or dimensions;
- the nominal hardness;
- the year of manufacturing and preferably the quarter;
- type of rubber applied by means of the letter codes of the nomenclature according to ISO 1629;
- the application class (I, II or III);
- on products from blends, the letter B ("blend") shall be placed behind the first letter code;
- the ozone resistance class ("Ozone I, II or III"). For rubber rings made from two compounds the compound with the lowest class is valid.

- # If the dimensions of the products are such that the indications applied to them may impair the product, the products may be marked per package in consultation with the manufacturer, the buyer and Kiwa. Products produced by cutting or die cutting out of sheets may be marked per package.

## **APPLICATION AND USE**

XXXXX

## **RECOMMENDATIONS FOR CUSTOMERS**

Check at the time of delivery whether:

- the supplier has delivered in accordance with the agreement;
- the mark and the marking method are correct;
- the products show no visible defects as a result of transport etc.

If you should reject a product on the basis of the above, please contact:

Company

and, if necessary,

Kiwa Nederland B.V.

Consult the supplier's processing guidelines for the proper storage and transport methods.

## **Annex E. Model IQC schedule**

See next pages

<b><u>IQC-schedule</u></b> <b><u>INTERNAL QUALITY PLAN</u></b>	Manufacturer / supplier : Production location address :	Number of appendices:
<u>Field(s) of application</u>		
<u>According Evaluation Guideline(s)</u>		
<u>Number of production shifts:</u>	<u>Quality manual, procedures and working instructions</u>	
<u>Quality Control</u>	Is the Quality Management System (QMS) certified according to ISO 9001 <sup>1)</sup> ?	
Total number of employees in QC department :	If yes, by which certification body:	
Number of QC-operators per shift :	If yes, is the certification body accredited for the particular scope of certification?	
If no QC-inspections are carried out during night shifts, state the QC procedure(s)/instruction(s) to be followed: , documented in:	In case the QMS is <b>not</b> certified according to ISO 9001:	
<u>Inspection and test records</u>	<ul style="list-style-type: none"> <li>• Working instructions, test instructions and procedures are documented as follows:</li> <li>• The following procedure for dealing with <u>complaints</u> applies:</li> <li>• The following procedure for <u>nonconformity review</u> applies:</li> </ul>	
All records shall be maintained for a minimum of        years.		
<u>Specific agreements/comments/explanations</u>	Signature of the manufacturer/supplier:	
	Date :	

<sup>1)</sup> In case the QMS is ISO 9001 certified and covers the scope of the product certificate(s), reference to the applicable procedure(s) on the next pages is sufficient and the tables A till F do in principle not have to be further filled-out except for the frequency of tests/inspections (to be approved by Kiwa) in tables B, C and D.



<b>A. Calibration of measuring and test equipment</b> Applicable procedure(s) nr(s):				
Equipment to be calibrated	Calibration aspect	Calibration method	Calibration frequency	Calibration file (name and location)

<b>B. Raw material and additives</b> Applicable procedure(s) nr(s):				
<b>B.1 Receipt</b> For each delivery of raw material or additives data with respect to dates, producers, types and quantities are recorded as follows:				
<b>B.2 Entry control</b>				
Type of raw material	Inspection aspect	Inspection method	Inspection frequency	Registration file (name and location)

<b>C. Batch release tests per machine (including in-process and finished product testing)</b> Applicable procedure(s) nr(s): Production process(es):				
Type of product	Type of test	Test method	Test frequency	Registration file (name and location)

Specific agreements/comments/explanations:

<b>D. Process verification tests</b> Applicable procedure(s) nr(s):				
Type of product	Type of test	Test method	Test frequency	Registration file (name and location)

<b>E. Control of nonconforming and/or rejected products</b> Applicable procedure(s) nr(s):				
<b>E.1 Method of registration</b>				
<b>E.2 Method of identification</b>				
<b>E.3 Method of nonconformity review and disposition</b>				

<b>F. Inspection with regard to packaging, storage and transportation of the finished product</b> Applicable procedure(s) nr(s):				
Inspection aspects	Inspection method	Inspection frequency	Registration file (name and location)	
<b>F.1 Packaging/storage/ transportation etc</b>				

Specific agreements/comments/explanations:

<b>Raw materials list</b> (not required to fill-out this appendix in case reference can be made to the Kiwa hygienic aspects part of the certification agreement)	<b>Appendix I</b> Date: .....
<b>I.1 The product is built-up of the following raw materials:</b> <b>a) In case of products made from ready-made raw materials: listing of name and/or unique code of the raw material(s);</b> <b>b) In case of products made from own compounded raw materials: reference to raw material/compound sheets which are (only) available at the production location and which have to be authenticated by Kiwa (e.g. by the Kiwa inspector);</b> <b>c) In case of composed products (e.g. plastics fitting body, with separate nut, clamp ring and rubber sealing ring): of each part a specification according to a) or b) (whatever applicable).</b>  -  -  -  -  -  -  -  -  -	

<b>List of technical drawings</b>		<b>Appendix II</b> Date:.....	
Drawing title and number	Drawing date	Drawing title and number	Drawing date

## Annex F. Difference between requirements on raw material and those on products (informative)

In the table beneath an overview is given on what tests are applicable in case of starting the application for certification with the rubber compound and afterwards with the product manufactured from that compound.

	Raw material (vulcanised sheet)	Product 1)
Hardness	X	X
Tensile strength	X	X
Elongation at break	X	X
Compression set in air (Class I rubbers - cold) - 72 h at 23 °C - 24 h at 70 °C - 72 h at -10 °C	X X X	X
Compression set in air (Class II and III rubbers - hot) - 72 h at 23°C - 24 h at 125°C	X X	X
Compression set in water (Class III rubbers only) - 3000 h at 110 °C - 10000 h at 110 °C	2) 2)	X X
Swelling in water - 168 h in water at 70 °C (Class I rubbers) - 168 h in water at 95 °C (Class II and III rubbers) - 10 weeks in water at 150 °C (Class III rubbers, only swelling seals)	X X X	
Stress relaxation - 168 h at 23 °C (Class I rubbers) - 100 days at 23 °C - 168 h at 125 °C (Class II and III rubbers, not swelling seals) - 672 h at 140 °C (Class III rubbers, not swelling seals)	X X X X	X X
Ozone resistance (not for EPM/EPDM or IIR)	X	X
Strength of bond or weld (if applicable)		X

- 1) When dimensions of products are suitable.  
2) Covered by test on product.

## Annex G. Test pieces from products

Out of end products it is often not possible to prepare test pieces having all the dimensions as prescribed in the standard. Still knowing about the properties of the actual products is useful because they have to function well in practice. Therefore it is decided for this evaluation guideline that some deviations with respect to the dimensions are to be allowed.

Most end products are rings. There using a knife the rubber part can be separated from eventually present other materials. From that point further preparation can be done using the techniques given in ISO 23529. By selecting the appropriate shape and part of the product for preparing the test pieces the following things should be kept in mind:

- For hardness also small pieces can be used by taking the micro method of ISO 48
- For tensile strength and elongation, ISO 37 gives also smaller test pieces (type 3 and 4) and ring test pieces, but using type 2 is preferred. Furthermore having a constant cross section of the parallel section is the most important. Using thinner test pieces or missing a few parts of the clamping sections will hardly influence the results as long as failure stays within the parallel section. This combined with the possible smaller test pieces make that almost every end product can be tested.
- Compression set is a material property which is not very sensitive to dimensions of the test pieces. Taking rectangular test pieces lead to the same results. Combined with the possibility of stacking up to three layers almost every product can be tested. In case of too thin material available the test pieces can be scaled down to a smaller thickness. Then of course other spacers have to be applied to get a compression of about 25 %. More important then having a compression of exact 25 % is knowing the compressed height exactly. It is known that a compression between 20 and 30 % will lead to the same results.
- For the change in volume the thickness is more important then length or width. Also here it is not really necessary to have complete flat test pieces. Often parts of the full products can be used without having different results.
- For stress relaxation more or less the same applies as with compression set, although here knowing the exact deformation is of no importance at all.
- For ozone resistance it is important to have none machined surfaces. Here, for small products, taking full sections of the products is often better and giving more realistic results then trying to get the test pieces as mentioned in the standard.

For all preparations it goes that after preparation the test pieces should be conditioned at least 16 hours before testing.

# Annex H. Testing in case the products are O-rings

How to test depends on the size of the rings.

## **Over 100 x 10 mm**

These products are big enough to prepare proper test pieces in accordance with ISO 23529 and annex G. No special instructions are needed.

## **Between 15 x 2 mm and 100 x 10 mm**

These rings are most of the time too small to prepare exact test pieces out of them. However in this case well defined testing is possible on complete rings or sections of complete rings.

- Hardness is measured in micro-IRHD on the rings. Care shall be taken to place the device on top of the ring. Normally the highest values are the most accurate as a small misplacement of the device always will lead to a lower value for the hardness.
- Tensile tests can be done on complete rings with the devices mentioned in ISO 37. Most dimensions are best tested using the small clamps. At least 5 rings shall be tested.
- Tear resistance is possible with those rings where the cross section is 7 mm or more. In those cases the test pieces can be prepared according to ISO 23529 with only small deviations from the prescribed dimensions. For smaller rings the tear strength has to be carried out on test sheets.
- Compression set can be measured on complete rings or in case the rings are too large for the clamps on sections of the rings. Method is further as given in ISO 815. A small higher value (3 to 5 %) can be the result but normally there will be enough distance of the limits.
- Stress relaxation at compression. Here goes the same as for compression set although here no higher values are found. Stress relaxation at tension can be measured on complete rings. This is limited to rings with cross section of max 2,75 mm and internal diameter of max 30 mm.
- Stress relaxation at tension can be measured on complete rings. This is limited to rings with cross section of max 2,75 mm and internal diameter of max 30 mm.
- Ozone test can be done on either stretching the cut open parts of the rings or by stretching the complete rings by mounting them on a thorn in such a way that the required elongation is obtained.
- Swelling test can be done on complete rings or on section in those cases that the complete rings are too big.