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1 November 2006

National Evaluation Guideline

For the KOMO® product certificate for TPE pipe joint seals for non-pressure waste water

Technical scope F2: Piping systems waste water

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For the KOMO product certificate for TPE pipe joint seals for non-pressure waste water

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Preface Kiwa

General

This KOMO evaluation guideline has been prepared by Kiwa's Board of Experts " Plastic piping systems (Leidingsystemen Kunststof, CvD- LSK), in which the parties interested in the area of TPE pipe joint seals for non -pressure waste water are represented. This Board of Experts also guides the performance of certification and adjusts this Evaluation Guideline where necessary. Wherever the term 'Board of Experts' is used in this Evaluation Guideline, the above mentioned Board of Experts is meant.

Kiwa will use this Evaluation Guideline in conjunction with the Kiwa Regulations for Product Certification. The said regulations embody the examination procedure laid down by Kiwa for the issue of a certificate as well as the procedure for the external inspection.

Specific additional information

The requirements in this evaluation guideline cover the mechanical requirements in EN 681-2.

In this BRL additional requirements to EN 681-2 are included because of the following reasons:

1. The stress relaxation tests in EN 681-2 gives only information for low temperatures, the (known) effect of short periods at higher temperatures and the effect of aging are not taken into account.
2. The aging test in EN 681-2 is too short to give information for a period of 50 years and therefore the temperatures and time of this test were raised.

Certification of TPE seals and/or TPE raw material

In principle product certificates are issued on TPE seals. Therefore TPE seal and TPE sheet material will be examined according to table 8, annex A.

It is also possible to grant a certificate on the TPE raw material based on this evaluation guideline. This can be combined later with a TPE seal certificate.

Amendment sheet NEN-EN 681-2/A1

In the amendment sheet NEN-EN 681-2/ A1 the requirements for the attestation of conformity system 4 are laid down. System 4 (see CPD Annex III.2.ii, third possibility) means initial type testing by the manufacturer and manufacturer's factory production control.

The manufacturer or his authorised representative established within the EU or EFTA is responsible for the affixing of the CE marking.

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1 Introduction

1.1 General

The requirements included in this Evaluation Guideline are used by Kiwa when handling an application and maintaining a product certificate for TPE sealing rings for non-pressure waste water.

In the performance of its certification work certification bodies are bound by the requirements set out in the Chapter entitled 'Agreements on the performance of certification.

Annex B is an informative annex with general information.

1.2 Application area

The different types of TPE seals which, at least partly, have been manufactured from TPE are intended for use in piping systems for non-pressure underground drainage and sewerage at temperatures up to 45°C, intermittently up to 90 °C. At this moment the application area is specified as follows:

- Standardised ring seal sockets in PVC, PP or PE pipes in outside building drainage and sewage systems according to:
 - EN 1401-1, EN 1852-1, EN 14578;
 - prEN 13476-1 (2004 - 08).
- Standardised ring seal sockets in PVC, PP or PE pipes in inside building soil and waste water systems according to:
 - EN 1329-1 and EN 1451-1.

These joints include both joints between pipes and joints between pipes and fittings. For other applications then mentioned here a more explicit testing could be necessary to assure the function of the seals.

Dimensions and tolerances of ring seal sockets for which the TPE seals are intended are specified in the product certificate.

1.3 Terms

In this Evaluation Guideline (BRL) the following terms shall have the following meanings:

- Evaluation Guideline: the agreements made within the Board of Experts on the subject of certification;
- Board of Experts: The Board of Experts "Experts "Commission for the Quality Requirements for Water Supply Components (CKW)";
- 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.

1.4 Requirements and determination methods

In this Evaluation Guideline requirements and determination methods are included, by which the following is meant:

1.4.1 Requirements

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.

1.4.2 Determination methods

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.

The test matrix contains a summary showing what tests will be carried out by certification body 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.

1.5 Acceptance of research reports supplied by the supplier

If the supplier submits reports from research bodies or laboratories to show that the requirements of the Evaluation Guideline are met, it will have to be shown that such reports were prepared by a body meeting the prevailing accreditation standard, i.e.

- NEN-EN-ISO/IEC 17025 for laboratories;
- NEN-EN 45004 for inspection bodies;
- NEN-EN 45011 for certification bodies certifying products;
- NEN-EN 45012 for certification bodies certifying systems;
- NEN-EN 45013 for certification bodies certifying persons.
- The body is deemed to meet these criteria if an accreditation certificate can be submitted which has been issued by Raad voor Accreditatie (Board of Accreditation) or an accreditation body with which Raad voor Accreditatie has concluded a mutual acceptance agreement.

This accreditation should relate to the tests required for this Evaluation Guideline.

If no accreditation certificate can be submitted, certification body itself shall verify whether the accreditation standard has been met or carry out the tests concerned itself, or have same them carried out.

1.6 Quality certificate

Any quality certificate issued on the basis of this Evaluation Guideline is referred to as a 'KOMO' product certificate'.

The model of this quality certificate has been included in this Evaluation Guideline as annex 2.

1.7 Definitions

TPE: Thermoplastic material made from a polymer or blend of polymers that does not require vulcanization or crosslinking during processing, yet has elastic and rubberlike properties, at its service temperature. These properties disappear at processing temperature, so that further processing is possible, but return when the material is returned to its service temperature.

2 Product requirements and determination methods

2.1 General

This chapter contains the requirements to be met by the TPE pipe joint seals for non-pressure waste water. These requirements will form part of the technical specification of the product, which will be included in the product certificate.

Annex A, table 8 contains a summary of the requirements for TPE seals.

All properties must be determined on test pieces of TPE sheet and a reduced set of properties on test pieces of seals, according to table 8, annex A.

2.2 Material

2.2.1 General

Within the scope of this evaluation guideline all types of TPE may be used for manufacturing rings.

2.2.2 Colour

The colour of the TPE seals is free but is preferred to be black.

2.2.3 Correct functioning

When manufacturing, no substances may be used which could impair the correct functioning or which could lead to major quality variation. Also see 2.3.2 and 2.3.3.

2.2.4 Homogeneity

All ingredients shall be mixed in the TPE homogeneously.

2.3 Functional requirements

2.3.1 General

The TPE seals shall be suitable for the intended purpose. The design, the type(s) of TPE 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 seal and the construction used the materials have to be tested as follows:

2.3.2 Resistance to chemicals

2.3.2.1 General

The TPE seals are considered to be resistant to any chemicals waste water can contain under usual circumstances.

2.3.2.2 Specific requirements

In cases where the seals are used in pipes by way of which special chemicals will be drained off, or chemicals in varying concentrations, as is the case with industrial waste water, this should be taken into account when selecting the type of polymer. This also applies when the rings come into contact with such chemicals from the outside. If necessary, the resistance to chemicals must be determined according to a procedure suitable for the purpose, see for instance ISO 1817. The requirements shall be laid down by mutual agreement of the manufacturer and the buyer.

2.3.3 Effect of TPE seals on the pipe and/or fitting material

The TPE seals may not contain substances that, under normal circumstances, can have an adverse effect on the material of the pipes and fittings.

Remark:

Since there is no general workable method to determine any adverse effects, it is advisable that both the manufacturer of the seals and the manufacturer of the pipes and attachments establish that their products do not contain substances that can, under normal circumstances, have an adverse effect on each other.

2.3.4 Types of TPE seals

2.3.4.1 Solid TPE seals

The TPE seals should fulfil the requirements of this BRL in paragraph 2.4 and 2.5.

2.3.4.2 TPE seals out of two types of TPE

If both types of TPE take part in the sealing function they both should fulfil all requirements in this BRL.

2.3.4.3 TPE attached to TPE or other materials

The TPE should fulfil the requirements of this BRL in paragraph 2.4 and 2.5. The adhesion between TPE and the other material should be at least 100 N/25 mm when tested in a way similar to ISO 813. In cases where the rigid parts are too small for a real test based on ISO 813 the TPE should tear and not detach when it is tried to separate the bond pulling under an angle of about 90°.

2.4 Appearance, homogeneity, dimensions and volume

2.4.1 Appearance

The appearance of the TPE seals shall comply with ISO 9691.

2.4.2 Homogeneity

The TPE seals may not contain foreign bodies and shall be free of imperfections and defects such as cracks, entrapped air, bubbles or other irregularities, i.e. ISO 9691. Test according to 2.7.2.

2.4.3 Dimensions and volume

The nominal measurements - and in case it is relevant for the application - the nominal volume of the TPE seals 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 in ISO 3302. Test according to 2.7.3.

2.5 Physical and mechanical properties of the TPE seals

2.5.1 General

Unless stated otherwise tests must be carried out by temperatures of $23 \pm 2^\circ\text{C}$ and a humidity of 50% according to ISO 471.

2.5.2 Hardness

2.5.2.1 General

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

Therefore the hardness shall be determined in consultation between the manufacturer of the pipes and fittings and the manufacturer of the TPE seals.

Then the hardness concerned shall be reported to the inspection body as nominal hardness with the tolerance range which has been determined by mutual consent.

Usually the tolerance range for the TPE is ± 5 IRHD. When the customer or the sort of construction demands such a thing the tolerance range can be ± 3 IRHD.

The hardness shall be determined according to 2.7.4.1.

2.5.2.2 Difference in hardness

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

2.5.2.3 Hardness after ageing

After a period of conditioning of 14 x 24 h at a temperature of 80 ± 1 °C in accordance with 2.7.4.2, the hardness may not have changed by more than 7 IRHD.

2.5.3 Mechanical properties

Tensile strength and elongation at break shall meet the requirements laid down in table 8, annex A.

Determination must take place in accordance with 2.7.5.1 and 2.7.5.2.

After a period of conditioning of 14 x 24 h at a temperature of 80 ± 1 °C:

- the tensile strength may not have changed by more than 20%.
- the elongation at break may not have been changed by more than 30 %.

2.5.4 Compression set

The compression set of the TPE determined according to 2.7.6 shall not exceed the values given in table 2.

Table 2 – Compression set

Property	Dimension	Method A	Requirement
Compression set	%	ISO 815	
- 72 h, 23°C			Max. 25
- 24 h, 70°C			Max. 40
- 72 h, -10°C			Max. 65

2.5.5 Stress relaxation

The stress relaxation shall be determined in accordance with 2.7.7. The values obtained shall not exceed the maximum values given in table 3.

The 100 days test shall be considered as a pre certification test. The requirement in respect of the 100 days relaxation shall also be regarded as a pre certification requirement.

Table 3 – Stress relaxation

Property	Dimension	Method	Requirement
Stress relaxation	%	ISO 6914	
- 168 h at 23°C		or	Max. 22
- 100 days at 23°C		ISO 3384	Max. 32

2.5.6 Stress fall

The stress fall shall be determined in accordance with 2.7.10. The values obtained shall not exceed the maximum values given in table 4.

Table 4 – Stress fall

Property	Dimension	Method	Requirement
Stress fall - 168 h at 23°C with 2 times 1 hour at 70°C	%	ISO 6914 or ISO 3384	Max. 20-25

2.5.7 Resistance to ozone attack

The TPE seal should be resistant to ozone as given in table 5 using an elongation as given in table 5.

Table 5 - Resistance to ozone attack

Concentration of ozone (pphm)	Period of Exposure In h	Temperature in °C	Elongation in %
50	48	40 ± 1	20 % ± 2 %

After the testing in accordance with 2.7.8 has been completed, the TPE may not show any cracks.

2.5.8 Swelling in water

After conditioning and determination of the swelling in water in accordance with 2.7.9 the increase in volume of the test pieces concerned shall be within the limit -1 and +8%.

2.5.9 Resistance to oil

The volume change in oil shall be determined according to ISO 1817 and fulfil the requirements in table 6.

Table 6 – Resistance to oil

Property	Dimension	Method	Requirement
Volume change in oil, 72 h at 70°C, IRM 1	%	ISO 1817	+50 / -10

2.6 Sampling, test material and test pieces

2.6.1 Sampling

The sample shall be representative of the product to be checked.

2.6.2 Test material

2.6.2.1 Test pieces

The test pieces required shall, in accordance with ISO 23529 - 2004, be made out of the seals (see 2.6.2.2) and out of the test sheets (see 2.6.3).

2.6.2.2 Test pieces from seals

Depending on the dimensions of the seals 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 E.

In carrying out the tests according to 2.3.3 and 2.4.1 to 2.4.3 inclusive a complete TPE seal or an unmachined part of a TPE seal shall be used.

2.6.3 Test sheets

2.6.3.1 Type of TPE and compound

Test sheets must be produced from the same type of TPE and compound as that which is used for the manufacture of TPE seals.

2.6.3.2 Hardness

The hardness of the TPE of the test sheets must be within the tolerance range which applies to the hardness of the TPE seals.

2.6.3.3 Dimensions

The dimensions of the test sheets must be in accordance with table 7.

Table 7 - Dimensions of the required test plates

Properties to be tested	Thickness (in mm)	Other dimensions and quantity
Tensile strength, elongation at break, ageing and resistance to ozone attack	$2 \pm 0,2$	Sheet material, at least 225 cm ² having a minimal dimension of 8 cm (i.e. 15 x 15 cm ²)
Water resistance	$2 \pm 0,1$	Sheet material, at least 100 cm ² having a minimal dimension of 5 cm (i.e. 10 x 10 cm ²)
Compression set Hardness and Stress relaxation	$6,3 \pm 0,3$	Sheet material, at least 100 cm ² having a minimal dimension of 5 cm (i.e. 10 x 10 cm ²)

2.7 Test Methods

2.7.1 Appearance

Judge the appearance aspect of a random selection of a number of (at least 5) TPE seals and test the findings against 2.4.1.

2.7.2 Homogeneity

Take a random selection of at least five seals and cut them in flat slices or parts of approx. 2 mm in thickness.

Stretch those 100% and test the findings by the requirements according to 2.4.2.

2.7.3 Dimensions and volume

Determine the dimensions by means of appropriate measuring equipment.

Determine the volume with an accuracy of 1 mg by weighing the TPE seals first in air and then in water.

In order to prevent air from attaching to the material while this is being weighed in water, the material must first be moistened with water to which a few drops of an agent that decreases the surface tension has been added. Determine the volume by means of the formula:

$$V = \frac{m_l - m_w}{\rho_w}$$

in which:

V is the volume of the test piece in cm³;

m_l is the mass of the test piece in air, in g;

m_w is the mass of the test piece in water, in g;

ρ_w is the density of the water, in g/cm³ (=1 g/cm³).

Both determinations shall be carried out at a temperature of 23 ± 2 ° C.

Test the findings against that which is laid down in 2.4.3.

2.7.4 Hardness

2.7.4.1 General

Determine the hardness according to NEN-ISO 48 at a temperature of 23 ± 2 °C.

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 inspection body: the nominal apparent hardness plus the corresponding tolerance, the method of measurement and the place(s) of measurement.

2.7.4.2 Hardness after ageing

After a test in accordance with 2.7.4.1 has been carried out, the test pieces required shall be conditioned in an oven for a period and a temperature mentioned in 2.5.2.4, according to NEN-ISO 188. After the test pieces have been cooling off for a period of 24 h, determine the hardness of the TPE according to 2.7.4.1.

2.7.5 Mechanical properties

2.7.5.1 General

The tensile strength and elongation at break shall be determined by the method specified in ISO 37. Dumbbell shaped test pieces of types 1, 2, 3 or 4 shall be used.

Type 2 is the preferred type. The test report shall state the dumbbell type whenever type 2 is not used.

For tests in which different sizes of test pieces are permissible, the same size of test piece shall be used for each batch and for any comparative purposes.

2.7.5.2 Mechanical properties after ageing

Condition the test pieces according to NEN-ISO 188 in an oven for a period of 14 × 24 h at a temperature mentioned in 2.5.3. Then, after the test pieces have been cooling off for a period of 24 h, determine the tensile strength and the elongation at break according to ISO 37.

2.7.6 Compression set in air

2.7.6.1 General

If the test piece is taken from a seal, then the measurement shall be carried out as far as possible in the direction of the compression of the seal in service. The test conditions specified in table 8, annex A apply.

2.7.6.2 Compression set at -10 °C, 23 °C and 70 °C

Determine the compression set by the method specified in ISO 815, at -10 °C, 23 °C and 70 °C using the small test piece.

Where the cross section is too small to obtain compression buttons from the product, as an alternative to moulding buttons, the tension set of test sheets may be determined using the

method specified in ISO 2285 with strain 50%. For this alternative test method the same test conditions (except strain) and requirements apply as used for the determination of the compression set.

Determine the -10 °C low temperature compression set by the method specified in ISO 815 using the 30 minute recovery measurement, at - 10 °C.

2.7.7 Stress relaxation

The stress relaxation shall be determined by method A of ISO 3384 using the small test piece after applying mechanical and thermal conditioning. 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 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 seal, then the measurement shall be carried out as far as possible in the direction of compression of the seal 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.

2.7.8 Resistance to ozone attack

The determination of the resistance to ozone shall be carried out in accordance with NEN-ISO 1431.1.

Depending on the class of resistance (see 2.5.7) the test conditions laid down in table 5 are applicable.

2.7.9 Swelling in water

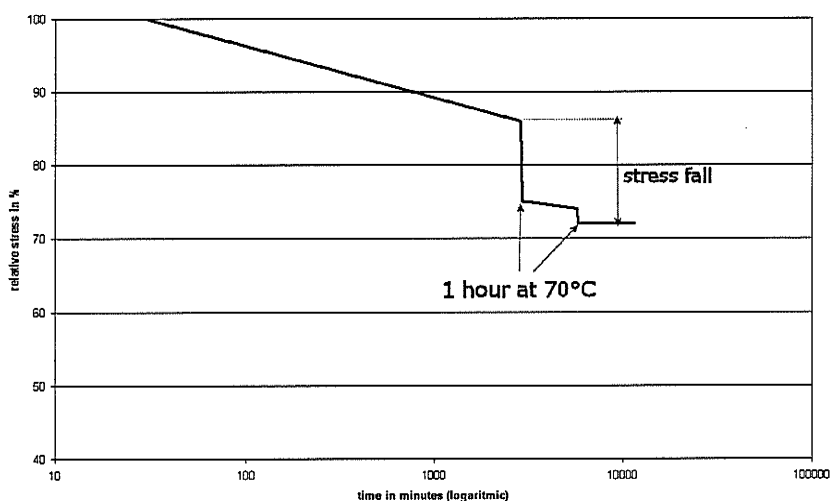
For the determination of the swelling in water three cylindrical test pieces with a thickness of 2 ± 0.1 mm and a diameter of 30 mm are required.

After the test pieces have been kept in demineralised water for 7 x 24 h at a temperature of 70 ± 2 °C determine the swelling in accordance with ISO 1817 in % (v/v).

2.7.10 Stress fall

The stress fall shall be determined based on the method given in the standard (ISO 6914). The test is started as a normal test at 23°C. After a period of 48 hours the test rig is carefully transferred to a temperature of 70°C. After 1 hour the test piece is placed back at 23°C. 47 hours later this is repeated. After the second period at 70°C the test piece is kept at 23°C for at least another 48 hours. The stress fall is the distance between the line before the first transfer to 70°C and the line at 23°C after the second transfer to 70°C. The principle is given in figure 1.

Figure 1: Example of relaxation curve and definition of stress fall



2.8 Marks to be applied

The TPE seals must carry the following indications in a clear and durable manner:

- name of manufacturer or the deposited trade mark;
- the nominal dimension or dimensions;
- the year of manufacturing and preferably the quarter;
- the type of TPE in a letter code; e.g. TPE-V;
- KOMO certification mark.

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

Fittings with co-injected seals shall be marked according to the requirements in the evaluation guideline for the fitting.

3 Requirements to be met by the quality system

3.1 General

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

3.2 Manager of the quality system

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

3.3 Internal quality control/quality plan

The supplier must have an internal quality control scheme (IQC scheme) that 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.

3.4 Procedures and working instructions

The supplier should be able to submit the following:

19 a procedure for:

- the handling of non-conforming products;
- the corrective actions to be taken if non-conformities are observed;
- the dealing with complaints regarding the products and/or services supplied;
- the work instructions and inspection sheets in use.

3.5 External inspection

The manufacturer's quality system shall be assessed by Kiwa with regard to at least the aspects mentioned in the Kiwa-Regulations for Product Certification.

The Central Board of Experts will determine the inspection frequency. At the time of validation of this evaluation guideline this frequency has been fixed at 4 inspection visits per year.

4 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 of the quality system.

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

4.1 Test matrix

Description of requirement	Article BRL	Tests within the scope of		
		Pre-certification tests	Supervision by Kiwa after granting of the certificate	
			Controle	Frequency
Marking on product	2.8	X	X	1x year
Resistance against chemicals	2.3.2	X	X	1x year
Appearance	2.4.1	X	X	1x year
Homogeneity	2.4.2	X	X	1x year
Dimensions	2.4.3	X	X	1x year
Volume	2.4.3	X	X	1x year
Hardness	2.5.2	X	X	1x year
Hardness after ageing	2.5.2.4	X	X	1x year
Mechanical properties (*)	2.5.3	X	X	1x year
Mech. Properties (*) after ageing	2.5.3	X	X	1x year
Compression set	2.5.4	X	X	1x year
Stress relaxation	2.5.5	X (100d)	X (7d)	1x year
Stress fall	2.5.6	X	X	1 x year
Resistance against ozon	2.5.7	X	X	1x year
Swelling in water	2.5.8	X	—	—
Resistance to oil	2.5.9	X	—	—

(*) Tensile strenght and elongation at break

5 Agreements on the implementation of certification

5.1 General

This chapter contains the agreements made within the Central Board of Experts on the implementation of the certification by Kiwa.

5.2 Certification staff

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

- certification experts: they are in charge of carrying out the pre-certification tests and assessing the inspectors' reports;
- inspectors: they are in charge of carrying out external inspections at the supplier's works;
- decision makers: they are in charge of taking decisions in connection with the pre-certification tests carried out, continuing the certification in connection with the inspections carried out and taking decisions on the need to take corrective actions.

5.3 Qualification requirements

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

Certification staff	Education	Experience
Certification expert	Level of higher professional education (<i>HBO</i>) in one of the following disciplines: • Technical • Civil engineering • Technology in Chemistry	2 years
Inspector	Level of intermediate professional education (<i>MBO</i>) in one of the following disciplines: • Technical • Civil engineering • Technology in Chemistry	1 year
Decision-maker	Level of higher professional education (<i>HBO</i>) in one of the following disciplines: • Technical • Civil engineering • Technology in Chemistry	4 year work experience of which at least 1 year with respect to certification

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

5.4 Frequency of external inspections

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

6 List of documents stated

6.1 Standards / normative documents

CEN/TS 14578	Plastics piping systems for water supply and drainage and sewerage - Glass-reinforced thermosetting plastics (GRP) based on unsaturated polyester resin (UP) - Recommended practice for installation	2003
EN 45001	General criteria for the operation of testing laboratories	1989
EN 45004	General criteria for the operation of various types of bodies performing inspection	1995
EN 45011	General requirements for bodies operating product certification systems	1998
EN 45012	General requirements for bodies operating assessment and certification/registration of quality systems	1998
NEN-EN 681-1	Elastomeric seals – Materials requirements for pipe joint seals used in water and drainage applications – Part 1: Vulcanised rubber	1996
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	1998
NEN-EN 681-2	Elastomeric seals - Material requirements for pipe joint seals used in water and drainage applications - Part 2: Thermoplastic elastomers	2000
Amendment sheet NEN-EN 681-2/ A1	Elastomeric seals - Material requirements for pipe joint seals used in water and drainage applications - Part 2: Thermoplastic elastomers	2000
NEN-EN 1329	Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure - Unplasticized poly(vinylchloride) (PVC-U) - Part 1: Specifications for pipes, fittings and the system	1999
NEN-EN 1401-1	Plastics piping systems for non -pressure underground drainage and sewerage - Unplasticized poly(vinyl chloride) (PVC-U) - Part 1: Specifications for pipes, fittings and the system	1998
NEN-EN 1451-1	Plastics piping systems for soil and waste	1999

	discharge (low and high temperature) within the building structure - Polypropylene (PP) - Part 1: Specifications for pipes, fittings and the system	
NEN-EN 1852-1	Plastics piping systems for non-pressure underground drainage and sewerage – Polypropylene (PP) – Part 1: Specifications for pipes, fittings and the system	1997
NEN-ISO 37	Rubber, vulcanised or thermoplastic - Determination of tensile stress - strain properties	1994
NEN-ISO 48	Rubber, vulcanised or thermoplastic - Determination of hardness (hardness between 30 and 85 IRHD)	1994
NEN-ISO 188	Rubber, vulcanised – Accelerated ageing or heat-resistance tests	1998
NEN-ISO 471	Rubber; Temperatures, humidity's and times for conditioning and testing	1995
NEN-ISO 813	Rubber, vulcanised - Determination of adhesion to metal: one-plate method	1997
NEN-ISO 815	Rubber, vulcanised or thermoplastic - Determination of compression set at ambient, elevated or low temperatures	1991
NEN-ISO 1431/1	Rubber, vulcanised or thermoplastic - Resistance to ozone cracking - Part 1: Static strain test	1990
NEN-ISO 1817	Rubber, vulcanised – Determination of the effect of liquids	1999
NEN-ISO 2285	Rubber, vulcanised or thermoplastic - Determination of tension set at normal and high temperatures	2002
NEN-ISO 3302	Rubber - Dimensional tolerances for use with products	1996
NEN-ISO 3384	Rubber, vulcanised or thermoplastic – Determination of stress relaxation in compression at ambient and at elevated temperatures	1999
NEN-ISO 6914	Rubber, vulcanized; Determination of ageing characteristics by measurement of stress at a given elongation	1985
NEN-ISO 9691	Rubber – Recommendation for the workmanship of pipe joint rings – Description and classification of imperfections	1992

NEN-EN-ISO/IEC 17025	General requirements for the competence of testing and calibration laboratories	2000
prEN 13476-1	Thermoplastics piping systems for non-pressure underground drainage and sewerage - Structured-wall piping systems of unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE) - Part 1: Specifications for pipes, fittings and the system	2004-08
NEN-ISO 23529	Rubber - General procedures for preparing and conditioning test pieces for physical test methods	2004

7 Annex A: Summary of the material requirements for TPE seals and TPE sheets

Table 8: Summary of the requirements for TPE seal rings for the use in waste water piping systems

Property	Dimension	Method	Requirement	Reference
Hardness	IRHD	ISO 48	± 5	b)*
Tensile strength on sheet test piece (perpendicular to flow direction)	MPa	ISO 37	Min. 4	
Tensile strength on sheet test piece (in flow direction)	MPa	ISO 37	> 70 % of value measured on sheet test piece (perpendicular to flow direction)	
Tensile strength on seal test piece (in flow direction)	MPa	ISO 37	> 60 % of value measured on sheet test piece (in flow direction)	b)*
Elongation at break on sheet test piece (perpendicular to flow direction)	%	ISO 37	Min. 300	
Elongation at break on sheet test piece (in flow direction)	%	ISO 37	> 60 % of value measured on sheet test piece (perpendicular to flow direction)	
Elongation at break on seal test piece (in flow direction)	%	ISO 37	> 80 % of value measured on sheet test piece (in flow direction)	b)*
Compression set - 72 h, 23°C - 24 h, 70°C(*) - 72 h, -10°C	%	ISO 815	Max. 25 Max. 40 Max. 65	b) *
Volume change - 168 h, water at 70°C - 72 h, oil IRM 1 at 70°C	%	ISO 1817	-1 / +8 -10 / +50	
Stress relaxation - 168 h at 23°C (*) - 100 days at 23°C - Stress fall after 168 h at 23°C with 2 times 1 hour at 70°C(*)	%	ISO 6914 or ISO 3384 ISO 6914	Max. 22 Max. 32 Max. 25	b) * a) b) *
Ozone resistance 48 h, 40°C, 20%, 50 pphm	-	ISO 1431/1	No cracks	
Ageing 336 hours in air at 80°C - change hardness - change tensile strength - change elongation	IRHD % %	ISO 188	Max. 7 Max. 20 Max. 30	

- a) Stress fall is determined based on the method given in the standard (ISO 6914 or 3384). The test is started as a normal test at 23°C. After a period of 48 hours the test rig is gently transferred to a temperature of 70°C. After 1 hour the test piece is placed back at 23°C. 47 hours later this is repeated. After the second period at 70°C the test piece is kept at 23°C for at least another 48 hours. The stress fall is the distance between the line before the first transfer to 70°C and the line at 23°C after the second transfer to 70°C. The principle is given in figure 1.
- b) Properties marked with (*) will be determined for a (reduced) test on seal test pieces.

8 Annex B (Informative)

8.1 Explanations

8.1.1 *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.

8.1.2 *Recommendations of a general nature*

8.1.2.1 *Percentage of compression*

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

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

8.1.2.2 *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 TPE manufacturer and the inspection body of such requirements.

8.2 Recommendations for the storage and use of TPE seals

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

The preservation of quality is aided as follows.

8.2.1 *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.

8.2.2 *Outdoor transport and storage*

It is recommended to protect the TPE seals 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.

8.3 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 seals shall be processed directly from the - possibly temporary - package.
- c. TPE seals 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 TPE 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.

8.4 Seals in aboveground installations

TPE seals in aboveground installations or in permanent contact with atmospheric conditions require extra attention with regard to long term resistance.

Not all TPE compounds and/or types are suitable for long term aboveground applications.

The choice of a TPE compound shall therefore be well-considered.

KOMO®

productcertificaat

ANNEX C



Nummer	-	Vervangt	-
Uitgegeven	-	d.d.	-
Geldig tot	Onbepaald	Pagina	25 van 28

VERKLARING VAN KIWA

Dit productcertificaat is afgegeven op basis van BRL - "-" d.d. -afgegeven door Kiwa, conform het Kiwa-Reglement voor Productcertificatie.

Kiwa verklaart dat het gerechtvaardigd vertrouwen bestaat, dat de/het door de producent vervaardigde (naam product) bij voortduring voldoet aan de in dit productcertificaat vastgelegde (technische en/of milieuhygiënische) specificatie(s), mits (naam product) voorzien is van het KOMO®-merk op een wijze als aangegeven in dit productcertificaat.

ing. B. Meekma
directeur Certificatie en Keuringen, Kiwa N.V.

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Advies: raadpleeg www.kiwa.nl om na te gaan of dit certificaat geldig is.

Beoordeeld is:
kwaliteitssysteem
product
Periodieke controle

PRODUCTSPECIFICATIE

Merken

De producten worden gemerkt met het KOMO®-merk

De uitvoering van dit merk is als volgt:

Invullen

WENKEN VOOR DE GEBRUIKER

Inspecteer bij aflevering of:

- geleverd is wat is overeengekomen;
- het merk en de wijze van merken juist zijn;
- de producten geen zichtbare gebreken vertonen als gevolg van transport en dergelijke.

Indien u op grond van het hiervoor gestelde tot afkeuring overgaat, neem dan contact op met:

-

en zo nodig met:

- Kiwa N.V.

Raadpleeg voor de juiste wijze van opslag, transport en verwerking de verwerkingsvoorschriften van de certificaathouder.

LIJST VAN VERMELDE DOCUMENTEN*

NEN 1234

* Voor de juiste versie van de vermelde normen wordt verwezen naar het laatste wijzigingsblad bij BRL -

Annex D

Example model IQC-schedule

Controleonderwerpen	Controleaspecten	Controlemethode	Controlefrequentie	Controleregistratie
Raw materials or materials supplied: • recipe sheets • incoming goods inspection raw materials	• Recipe according annex product agreement • Hardness • Tensile strength • Elongation at break	Comparison supplied certificate with agreement NEN-ISO 48 NEN-ISO 37 NEN-ISO 37	Each delivery Each delivery	Entry control document
Production process, production equipment, material: • Procedures • Equipment • Release of product	• Tuning parameters • Maintenance aspects • Dimensions and roundness	Adjustments of machine Maintenance schedule Measuring and visual inspection	Continuously Continuously Start up new productt	Digital Work sheet Inspection document
End products	• Soundness • Dimensions • Tensile strength • Compression set	Visual Measuring NEN-ISO 37 NEN-ISO 815	Continuously Every 3 hours Per day per product per machine	End control Documents
Measuring and testing equipment • Measuring equipment • Calibration	• Proper functioning • Accuracy within range of measurement	During usage Record of non-conformities	Continuously 1 x year	End control document Calibration document
Logistics • Internal transport • Storage • Preservation • Packaging • Identification	• Circumstances in practice • Comparison with order	Comparison with procedure Visual inspection	Continuously	Keep logistical procedures up to date

9 Annex E (Informative)

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 BRL that some deviations with respect to the dimensions are to be allowed.

Most end products are rings. There using a knife the TPE part can be separated from eventually present other materials. From that point further preparation can be done using the techniques given in ISO 23529:2004. 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 than 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 than 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 than 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.

10 Annex F (Informative)

Difference between requirements on raw material and those on products

In the table beneath an overview is given on what tests are applicable for each certificate.

	Raw material (sheet)	Product
Hardness	X	X
Tensile strength on test piece out of sheet material		
- flow direction	X	
- perpendicular to flow direction	X	
Elongation at break on sheet material		
- flow direction	X	
- perpendicular to flow direction	X	
Tensile strength on test piece out of product		X
Elongation at break on test piece out of product		X
Compression set		
- 72 h at 23°C	X	
- 24 h at 70°C	X	X
- 72 h at -10°C	X	
Volume change		
- 168 h in water at 70°C	X	
- 72 h in oil IRM 1 at 70°C	X	
Stress relaxation		
- 168 h at 23°C	X	X
- 100 days at 23°C	X	
- stress fall test	X	X
Ozone resistance	X	
Ageing	X	
Strength of the bond (if applicable)		X