BRL K17605
20-02-2014

Evaluation guideline

for the Kiwa technical approval with product certificate for plastics piping systems for water supply with or without pressure – Glass-reinforced thermosetting plastics (GRP) based on unsaturated polyester resin (UP).

Preface

This evaluation guideline has been accepted by the Kiwa Board of Experts CWK, wherein all the relevant parties in the field of plastics piping systems for water supply with or without pressure – Glass-reinforced thermosetting plastics (GRP) based on unsaturated polyester resin (UP)" are represented. These Boards 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 Boards of Experts.

This evaluation guideline will be used by Kiwa in conjunction with the Kiwa-Regulations for Product 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.

The product requirements and determination methods are based on the requirements of NEN- EN 1796. The aspects of the assessment of conformity are based on NPR-CEN/TS 14632. The guideline includes additional requirements and test methods set by the Board of Experts.

This evaluation guideline is to be assessed by the Board of Experts at least every 5 years, but at the latest on 20-02-2019.

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Validation
This evaluation guideline has been validated by Kiwa on 20-02-2014.

Contents

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 plastic piping systems for water supply with or without pressure – Glass-reinforced thermosetting plastics (GRP) based on unsaturated polyester resin (UP).

This evaluation guideline replaces BRL K551 dated 02-02-2012.
Certificates issued on the basis of this guideline lose their validity after 20-02-2014.

For the performance of its certification work, Kiwa is bound to the requirements as included in the clause 4.6 of "conditions and procedures for granting, maintaining, extending, suspending and withdrawing certification".

1.2 Object of certification

The object of certification is products for piping systems when made from glass reinforced thermosetting plastics (GRP) based on unsaturated polyester resin (UP) intended to be used for the conveyance of tap water with or without pressure.
The objects of certification are pipes, fittings and joints.

Clause 6 is applicable to fittings be made using any of the following techniques:

1) fabricated from straight pipe;
2) moulded by:
   i) filament winding;
   ii) tape winding;
   iii) contact moulding (hand lay up);
   iv) hot or cold press moulding.

This evaluation guideline is applicable to joints which are or are not intended to be resistant to axial loading:

1) socket-and-spigot (either integral with pipe or sleeve coupling) or mechanical joint;
2) locked socket-and spigot joint;
3) cemented or wrapped joint;
4) bolted flange joint.

1.3 Field of application / scope

The field of application is underground piping systems and its components made from glass-reinforced thermosetting plastics (GRP) based on unsaturated polyester resin (UP) intended to be used for water supply (tap water), with or without pressure. In a pipework system, pipes and fittings of different nominal pressure and stiffness ratings may be used together.

The evaluation guideline is applicable to pipes, fittings and their joints (flexible or rigid) of nominal diameters from DN 100 to DN 4000, which are intended to be used for the conveyance of tap water at temperatures up to 50 °C.

In this application, the products are not intended for use under continuously varying load. With a continuously varying load is meant here cycling loads with a frequency of at least 1 cycle per minute varying between two load levels.

Note: The product could be used under continuously varying load in internal pressure applications. In that case test should be carried out according to ISO 15306.

1.4 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:

- NEN-EN-ISO/IEC 17025 for laboratories;
- NEN-EN-ISO/IEC 17020 for inspection bodies;
- NEN-EN 45011 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 institutions with which the RvA an agreement of mutual acceptance has been concluded.

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

1.5 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 in annex I.

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 water cycle "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.

Note: 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.

Fitting: pressure-tight, fluid-containing component with a geometry different from straight pipe.

Joint: means of connecting between two or more components, for example: plain pipe to a fitting or plain pipe to plane pipe.

For the purpose of this document, the terms and definitions given in EN 1796 and NPR-CEN/TS 14632 and listed in table 1 apply. The following English terms shall be translated to Dutch as follows:

Table 1 - Abbreviations, terms in English and Dutch.

Abbreviation	Term	
	English	**Dutch**
BRL	Evaluation guideline	Beoordelingsrichtlijn
BoE	Board of Experts	College van Deskundigen
BoE - CWK	Board of Experts – Water cycle	College van Deskundigen – Waterketen
RvA	Dutch accreditation council	Raad voor de accreditatie
	Supplier	Leverancier
IQC scheme	Internal quality control scheme	Intern kwaliteitsbewakingsschema
UP	Unsaturated polyester	Onverzadigde polyester
GRP	Glass reinforced thermosetting plastics	Met glas versterkte thermohardende kunststof
	Filament winding	Kruislings wikkelen
	Tape winding	Tape wikkelen
	Centrifugally cast	Centrifugaal gegoten
	Contact moulding hand lay-up	Handlamineren
	Hot or cold press moulding	Heet of koud persen
	Cemented joint	Gelijmde verbinding
	Wrapped joint	Gelamineerde verbinding
	Fitting	Fitting
	Joint	Verbinding
	Locking key	Borgsnoer
DN	Nominal size	Nominale afmeting
DN-ID	Nominal size, internal diameter	Nominale afmeting, binnendiameter
DN-OD	Nominal size, external diameter	Nominale afmeting, buitendiameter
PN	Nominal pressure	Nominale druk
SN	Nominal stiffness	Nominale stijfheid
CE	CE-marking	CE-markering
	Pre-certification	Toelatingsonderzoek
	Certification	Certificatie
S	Specific ring stiffness	Specifieke ringstijfheid
S_0	Initial specific ring stiffness	Specifieke initiële ringstijfheid
STIS (NEN 7037)	Specific tangential initial stiffness	Specifieke tangentiële initiële stijfheid
STES (NEN 7037)	Specific tangential end stiffness	Specifieke tangentiële eind stijfheid
α	Reduction factor, associated with creep, determined according to NEN 7037:1981	Reductiefactor die verband houdt met kruip en die wordt bepaald volgens NEN 7037:1981
β	Reduction factor, associated with ageing in water, determined according to NEN 7037:1981	Reductiefactor die verband houdt met veroudering in water die wordt bepaald volgens NEN 7037:1981
TT	Type testing	Type test
AT	Audit test	Audit test
BRT	Batch release test	Batch release test
PVT	Process verification test	Proces verificatie test
RLTT	Reduced long-term test	Verkorte lange duur test

d_m	Mean diameter	Gemiddelde diameter
d_i	Mean internal diameter	Gemiddelde binnendiameter
d_u	Mean outer diameter	Gemiddelde buitendiameter
e	Wall thickness	Wanddikte
$e_{0,tot}$	Mean total wall thickness	Gemiddelde totale wanddikte
e_{eff}	Mean structural layer thickness	Gemiddelde effectieve wanddikte
ω	Winding angle	Wikkelhoek
$\alpha_{x,creep,wet}$	Wet creep factor	Natte kruipfactor
$S_{x,wet}$	Calculated long-term specific ring stiffness	Berekende lange duur specifieke ring stijfheid
R_{RF}	Re-rating factor	Herwaarderingsfactor
σ_{LA*}, σ_{LB*}, σ_{LC*}.	Initial longitudinal tensile strength Subscript A, B, C refers to the used test method	Initiële longitudinale treksterkte Onderschrift A, B, C verwijst naar de gebruikte beproevingsmethode
σ_{cA*}, σ_{cB*}, σ_{cC*}.	Initial circumferential tensile wall strength Subscript A, B, C refers to the used test method	Initiële tangentiële treksterkte Onderschrift A, B, C verwijst naar de gebruikte beproevingsmethode
	Nominal length	Werkende lengte
	Rubber seal (lock) joint	Mof en spie verbinding met rubber dichtingselement.
	Double bell coupler	Dubbele mof en spie verbinding met rubber dichtingselement
	Adhesive bonded joints	Lijmverbindingen
	Flange joints	Flensverbindingen
	Laminated joints	Laminaatverbindingen
	Flexible joint	Flexibele verbinding
	Rigid joint	Starre verbinding
	End-load-bearing	Trekvast
	Non-load-bearing	Niet-trekvast
	Fixation of the elastomeric sealing element. The fixation of the elastomeric sealing element means the preservation of the elastomeric sealing element in the groove while pushing the spigot end into the socket	Fixering van het rubberdichtingselement. De fixering van het rubberdichtingselement is het in de groef houden van het rubberdichtingselement bij het inschuiven van het spieëind in de mof
D	Draw	Longitudinale verplaatsing
T	Total draw	Totale longitudinale verplaatsing
M	Misalignment	Verkeerde uitlijning
δ	Angular deflection	Vrije hoekverdraaiing
	Socket-and-spigot (either integral with pipe or sleeve coupling) or mechanical joint	mof en spie-eind (hetzij integraal met buis of klemkoppeling) of mechanische verbinding
	Locked socket-and spigot joint	Trekvaste mof en spie-eind verbinding

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 certificate. This person evaluates the results and decides whether the certificate can be granted or additional data and/or tests are necessary.

4 General product requirements and test methodes: pipes, fittings and joints

4.1 General

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

4.2 Material – toxicological requirements

Products and materials, which (may) come into contact with water, drinking water or warm tap water, are not allowed to release substances in such quantities which can jeopardise the health of the consumer or the quality of the drinking water. For that the products or materials have to meet the toxicological, microbiological and organoleptical requirements which are laid down in the valid "Ministerial Regulation materials and chemicals drinking water- and warm tap water supply" (published in the Government Gazette). This means that de 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 [1)], issued by e.g. a foreign certification institute, are allowed to be used in the Netherlands, provided that the Minister has declared this quality declaration equivalent to the quality declaration as meant in the Regulation.

4.3 Normative references

The documents listed in chapter 11, in whole or in part, are normatively referenced in this guideline and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

4.4 Declaration of the characteristics of the products

Characteristics shall be declared on the basis of type tests. Data from the type testing shall be provided to Kiwa to be able to verify the manner in which the values have been obtained.

4.5 Competence of personnel

The *supplier* shall demonstrate in his quality plan education, training and/or work experience of the personnel (see also clause 6.1.2).

4.6 Classification

Pipes, fittings and joints type shall be classified according to nominal size (DN) and nominal pressure (PN) according to NEN-EN 1796.
In addition pipes shall include nominal stiffness (SN) in their classification (see table 2).

[1)] A quality declaration issued by an independent certification institute in another member state of the European Community than the Netherlands or another state party to the agreement to the European Economic Area, is equivalent to a recognised quality declaration, to the extent that, to the judgment of the Minister of the first mentioned quality declaration, is fulfilled the at least equivalent requirements as meant in the Regulation materials and chemicals drinking water- and warm tap water supply.

Table 2 - Nominal stiffness class (SN), unit (N/m²).

630	5000
1250	10000
2500	-

Note 1: Nominal stiffness classes higher than 10000 N/m² could be required in special piping systems like casings for wells subject to external load and/or offshore piping subject to possible large water heads, piping systems under runways of airports.

Note 2: In Europe it is common practice to classify stiffness on the basis of the specific initial (ring) stiffness. In the Netherlands it is usual to classify pipes by means of their specific tangential end stiffness or long-term specific ring stiffness calculated on the basis of a period of use of 50 years.

For underground applications in the Netherlands a so-called specific tangential end stiffness (STES) of 2000 (N/m²) is required. This STES value is defined by:

$$STES = STIS \times \alpha \times \beta \qquad (1)$$

where:
STIS is the specific tangential initial stiffness, determined according to NEN 7037;
α is the reduction factor, associated with creep, determined according to NEN 7037;
β is the reduction factor, associated with ageing in water, determined according to NEN 7037.

The STIS shall be determined according to NEN 7037. The STIS may also be determined according to ISO 7685. α the reduction factor, associated with creep, may also be determined according to ISO 7684. The STES shall be calculated using equation 1.

Note 3: In special cases, it is possible to apply a piping system with a STES lower than 2000 N/m². In these special cases, the manufacturer shall demonstrate to Kiwa applicability of the piping system.

The nominal pressure (PN) shall conform to one of those given in table 3.

Table 3 - Nominal pressure class (PN)

1	12,5
2,5	16
4	20
6	25
8	32
10	-

Note 4: Components marked PN 1 are non-pressure (gravity) components.

4.7 Materials

The pipe or fitting shall be constructed using chopped and/or continuous glass filaments, strands, or rovings, mats, or fabric, glass or synthetic veils, and polyester resin with or without fillers and if applicable additives necessary to impart specific properties of the resin. The pipe and fitting may also incorporate aggregates.

4.7.1 Reinforcement

The glass used for the manufacture of the reinforcement shall be one of the types listed in NEN-EN 1796.

4.7.2 Resin

4.7.2.1 Resin type

Application of this evaluation guideline shall be limited to the manufacture of rigid components made from thermosetting resins (GRP components). Typical resins are polyester and vinyl ester.

4.7.2.2 Temperature of deflection

The resin used in the inner layer and the structural layer shall have a temperature of deflection of at least 70 °C when the test specimen is tested in accordance with method A of NEN-EN-ISO 75-2.

4.7.3 Particle size aggregates

The size of particles in aggregates and fillers shall not exceed 1/5 of the total wall thickness of the pipe or fitting or 2,5 mm, whichever is the lesser.

4.7.4 Constancy of the material composition

The constancy of the material composition of the wall construction of the product shall be determined according to ISO 7510. The following constituents can be distinguished: resin, aggregate and filler and type and arrangement of the glass layers. The difference in mass of each constituent of two samples, taken in two diametrically opposite places in one cross-section shall not exceed 5%, when based on the lowest value determined.

4.7.5 Elastomers

Each elastomeric material of the sealing component shall conform to the applicable requirements of BRL K17504 (class 1).

The *supplier* shall demonstrate to Kiwa possibilities of good mounting of the sealing component and GRP component(s) by means of drawings of all dimensions and tolerances of the components.

4.7.6 *Fixation of the elastomeric sealing element*

For judgement of the fixation of the elastomeric sealing element, the end of a pipe shall be pushed into the socket after the elastomeric sealing element is mounted into the socket. The pipe shall have a length of at least 3 meters.
The elastomeric sealing element shall be mounted into the inner side of the socket according to the instructions of the manufacturer. When pushing the pipe into the socket no measures concerning centring shall be taken, the test shall be carried out at a way similar to practice.

To meet the requirements concerning the fixation of the elastomeric sealing element, the pipe shall be able of being pushed into the socket without the elastomeric sealing element being pushed out of the groove.

Furthermore, flexible socket-spigot joints and flexible double socket couplings are considered to satisfy the requirements, if they can withstand the additional tests according to NEN-EN 1119, with maximum draw and angular deflection without leakage, after the joint is completed.

4.7.7 Locking key

The locking key of the rigid locked joint with elastomeric sealing ring shall be made of a pressure resistant and shear resistant material e.g. polyvinylchloride, polyamide or a material equivalent to it. In the latter case the equivalency shall be proved, whether by documentation or by testing.

4.7.8 Metals

Where metal components are used, there shall be no evidence of corrosion of the components after the fitting has been immersed in an aqueous sodium chloride solution, 30 g/l for seven days at (23 ± 2) °C.

4.8 Pipe type test groups

A pipe type test group consists of a range or family of products made such that the results of the long-term type tests are applicable to all products in the group.
A pipe type test group shall contain products:

- manufactured by the same process;
- with the same material specifications;
- with the same pipe wall construction (i.e. the sequence of layers, layer compositions, material properties);
- design method;
- tested with the same loading condition (end load bearing or not end load bearing).

The quality management system shall document all process details that could influence type test performance. The quality management system shall document the complete product design method and demonstrate how the results of the type tests are used to proven product designs and establish pipe type test groups.

4.9 Wall construction

The wall construction consists of:

- inner layer (liner);
- structural layer;
- outer layer;

and shall consist the following constituents in the individual layers, when appropriate:

- glass fibre reinforcement;
- thermosetting polyester resin;
- fillers;
- aggregates.

The wall construction (the sequence and composition of the individual layers comprising the pipe or fitting) shall be documented by the *supplier*. The *supplier* shall translate the product design into detailed process specifications to control the amount and placement of material components.

The specifications of the constituents and semi-finished products shall be part of the IQC scheme (annex II) of the *supplier*.

The minimal total wall thickness, including the inner layer, shall be declared by the *supplier* and shall not be less than 3 mm.

The inner, structural and outer layer shall comply to the requirements of NEN-EN 1796.

4.10 Determination of dimensions

Measurements shall be made in accordance with clause 4.5.5 of NEN-EN 1796.

4.11 Appearance of pipes and fittings

Both internal and external surfaces shall be free from irregularities, which would impair the ability of the component to conform to the requirements of this evaluation guideline.

The *supplier* shall demonstrate to Kiwa which irregularities are allowable defects, repairable defects, and defects which shall impair the ability of the component to conform to the requirements of this evaluation guideline.

Note: Classifying visual defects in glass-reinforced plastics laminate parts could be carried out according to ASTM D 2563.

4.12 Reference conditions for TT and AT

The reference conditions for type testing and audit testing, such as:

1) temperature;
2) properties of the water for testing;
3) loading conditions;
4) pre-conditioning;
5) measurements of dimensions;

shall conform to the requirements listed in NEN-EN 1796, clause 4.5.

4.13 Reference conditions for BRT and PVT

The manufacturer shall describe in his IQC-scheme the limits of the conditions for example temperature and relative humidity at which BRT's and PVT's shall be carried out in his laboratory.

4.14 Elapsed or extrapolated time for determination of the long-term properties, (x)

The subscript x, in for example $S_{x,wet}$, denotes the elapsed or extrapolated time for which the long-term property is to be determined. Unless otherwise specified, the long-term properties shall be determined at 50 years (438 000 h).

4.15 Joints

Joint shall conform to the appropriate requirements listed in NEN-EN 1796, clause 4.7.

4.16 Temperature effects

When properties are determined at (23 ± 5) °C their values are applicable to products used at temperatures up to, and including, 35 °C. For service temperatures over 35 °C type tests have to be carried out, at least at the design service temperature $^{+5}/_{0}$ °C, to establish re-rating factors for all properties used in design.

4.17 Protection of products during storage and transport

The products shall be protected during storage and transport to prevent contamination of all product-parts intended to be in contact with drinking water. See for information annex III: "products for transport of drinking water: guidance for prevention of contamination during transport and storage".

5 Product requirements and test methods: pipes

The pipes shall conform to the requirements according to NEN-EN1796.

5.1 Geometrical characteristics

5.1.1 Diameter

The diameter of the GRP-UP pipes shall be designated by nominal size (DN) in accordance with one of the following two series listed in NEN-EN 1796:

- **Series A** - which specifies the internal diameters in millimetres (mm), DN-ID;
- **Series B** - which specifies external diameters in millimetres (mm), DN -OD.

NOTE In standardising the diameters of (GRP-UP) pipes, difficulties are encountered because of the varying methods of manufacture (e.g. filament winding, centrifugal casting or contact moulding). GRP-UP pipes are typically produced by controlling either the internal diameter, or the external diameter to a fixed value.

Tolerances on the internal diameter or external diameter shall conform to NEN-EN 1796.

The mean internal diameter d_i and mean external diameter d_u shall be determined as follows.
Measure at one cross section four times the internal diameter by turning each time the callipers at an angle of 45 °C. The mean internal diameter d_i is the average of the four measured values.

Alternatively, the mean external diameter d_u may be determined by measuring the circumference of the pipe divided by 3,14159.

5.1.2 Total wall thickness

The minimum total wall thickness, including the inner layer, shall be declared by the *supplier* and shall not be less than 3 mm.
The wall construction comprise an:

- inner layer;
- structural layer;
- outer layer.

The inner layer shall comprise one of the following:

- a thermosetting resin layer with or without aggregates or fillers and with or without reinforcement of glass or synthetic filaments;
- a thermoplastic liner.

The wall construction shall be declared by the *supplier*.

5.1.3 Thickness of structural layer (e_{eff}) and inner and outer layers.

The thickness of the structural layer and inner and outer layer shall be determined as follows. Cut a piece of cross section from the pipe (or fitting) and measure the thicknesses of the separate layers using a magnifying glass with a minimum magnification of seven and an accuracy of 0,1 mm.

5.1.4 Material composition of the pipe

See clause 4.7.4 of this evaluation guideline.

5.1.5 Winding angle

When applicable, the winding angle of the pipes for each type is recorded in the quality system of the *supplier* .

The winding angle is determined using a representative glass filament and the following equation:
$\tan \omega = a/b$

where:
a is the outside circumference of the pipe
b is the pitch of the winding

5.1.6 Length

The pipe shall confirm to the requirements of NEN-EN 1796, clause 5.1.3.

5.1.7 Sockets and spigots formed at the pipe or formed on the pipe end provided with a elastomeric sealing

The socket-spigot joint may be end load bearing or not end load bearing, depending on the practical situation. The dimensions and tolerances of the socket, the spigot, sealing element and locking key shall be recorded on drawings.

5.1.7.1 Out-of-roundness of the socket

End load bearing joint with elastomeric sealing element.
Measure at one cross-section, at the place where the elastomeric sealing is located, the largest and the smallest internal diameter.
In any cross-section of the socket, the difference between the largest and smallest internal diameter may not exceed 0,007 times the average inner diameter $d_{i.}$

Not load bearing joint.
Measure at one cross-section, at the place where the elastomeric sealing is located, the largest and the smallest internal diameter at maximum draw.
In any cross-section of the socket, the difference between the largest and smallest internal diameter may not exceed 0,007 times the average inner diameter $d_{i.}$

Note: Maximum draw (i.e. total draw) of flexible joints means: the maximum permissible displacement of the spigot in the socket, when the leak tightness is maintained.

5.1.7.2 Out-of-roundness of the spigot for elastomeric sealing elements

Measure at the groove for the elastomeric sealing the largest and the smallest outer diameter and determine from this the out-of-roundness.
In any cross-section of the spigot, the difference between the largest and smallest external diameter may not exceed 0,007 times the average outer diameter $d_{u.}$

5.1.8 Sockets and spigots formed on the pipe for the purpose of bonded joints

The dimensions and tolerances of the inner diameter of the socket, outer diameter of the spigot, insertion depth and conical shape, as well as the dimensions of the socket and spigot shall be recorded on drawings.

5.1.8.1 Out-of-roundness of the spigot

At midway of the spigot the difference between the largest and the smallest measured outer diameter shall not exceed 0,007 times de average outer diameter d_u.

5.1.8.2 Out-of-roundness of the socket

The socket is always manufactured at the factory and the tolerances of the dimensions, among which the out-of-roundness, shall be recorded on drawings, taking into account the volume that could be taken by the adhesive making the bound.

In any cross-section of the socket, the difference between the largest and smallest external diameter may not exceed 0,007 times the average inner diameter d_u.

5.2 Mechanical characteristics

In table 4 the required mechanical characteristics of a pipe are listed.

Table 4 - Mechanical characteristics, test method and requirement.

Characteristic	Test method	Requirement
Initial specific ring stiffness	ISO 7685	Declaration of nominal stiffness (SN)
Reducing factors α (creep) and β (ageing)	NEN 7037	$\alpha \times \beta > 0,6$
Long-term specific ring stiffness under wet conditions and calculation of the wet creep factor	ISO 10468	Declaration of wet creep factor obtained by extrapolation
Initial resistance to failure in a deflected condition	ISO 10466	As mentioned in clause 5.2.3.2 of NEN-EN 1796
Ultimate long-term resistance to failure in a deflected condition	ISO 10471	As mentioned in clause 5.2.4.2 of NEN-EN 1796
Initial longitudinal tensile strength	ISO 8513, method A, B or C	The requirements mentioned in clause 5.2.5 (table 13) of NEN-EN 1796 are applicable.
Initial failure and design pressure for pressure pipes. (initial circumferential tensile wall strength)	ISO 8521, method A, B, C, D, E or F	The requirements mentioned in clause 5.2.6.2 of NEN-EN 1796 are applicable.
Long-term failure pressure. Extrapolation procedure.	NEN-EN 1447 ISO 10928	As mentioned in clause 5.2.7.2 of NEN-EN 1796
Resistance to shock or impact	this guideline	see clause 5.2.1.

Tests listed in table 4 shall be performed and evaluated according to NEN-EN 1796.

5.2.1 Resistance to shock or impact

For the determination of the resistance to shock or impact an apparatus with the following features is needed:

- feature to acquire a constant hydrostatic pressure in the test sample;
- pressure gauge with an accuracy of 0,05 MPa, preferable a manometer setup capable of recording the pressure signal;
- end caps, to pursue an axial loading on the test sample;
- falling dart apparatus, an apparatus which is able to let a falling body fall down vertically without friction from a height varying from 500 to 1000 mm;
- the support of the test sample shall be a flat stiff plate;
- falling body having a mass of 500 g.;
- the falling body shall be spherical at the bottom with a 12,5 mm radius.

The length of the test sample of the pipe between end caps shall be at least 1,5 m.

Attach the end caps to the test sample. Fill the test sample with water and remove any entrapped air from the test sample. Place the test sample onto the support of the falling dart test apparatus. Execute the test by hitting the test sample four times at distances equally divided over the length of the test sample. In table 5 the mass and falling height required are listed.

Raise the hydrostatic pressure at the inside to 1,5 times the nominal pressure of the pipe. Repeat the falling dart test with the test sample under hydrostatic pressure but hit the sample at another location than during the falling dart test without hydrostatic pressure by turning the test sample. Keep the test sample at a constant hydrostatic pressure of 1,5 times the nominal pressure of the pipe for 168 hours. After the test the sample shall be examined for any defects or leakage.

The pipe shall either show any defects nor leakage.

Table 5.2 Mass of the falling body and falling height.

internal diameter (mm)	mass of the falling body[1)] (g)	falling height[1)] (mm)
< 80	500	500
80 up and including to 150		500
200 up and including 300		500
350 up and including 700		500
750 up and including 900		1000
1000 up and including 3000		1000

1) allowed deviation from mentioned value $(^{+5}/_{0})$

5.3 Marking of pipes

5.3.1 General

Marking details shall be printed or formed directly on the pipe in such a way that the marking does not initiate cracks or other types of failure.

If printing is used, the colouring of the printed information shall differ from the basic colouring of the product and such that the markings shall be readable without magnification.

The following marking details shall be on the outside of each pipe, and in the case of pipes of DN 600 or greater shall be either on the inside or on the outside surface:

- number of this evaluation guideline, i.e. BRL K17605;
- nominal size DN and diameter series, i.e. A, B1, B2, etc.;
- stiffness rating in accordance with Clause 4.6 of this guideline;
- pressure rating in accordance with Clause 4.6 of this guideline;
- manufacturer's name or identification;
- date or code of manufacture;
- if applicable, the letter "R" to indicate the pipe is suitable to be used with axial loading, or the letters “RA” to indicate the pipe is suitable to be used for axial loading and assessed in accordance with Annex A of NEN-EN 1796;
- letter “H” to indicate suitability for use above ground, if applicable;
- certificate number.

5.3.2 Certification mark

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

6 Product requirements: fittings and joints

6.1 General

6.1.1 Demonstration of soundness of fitting and joints design

The *supplier* shall demonstrate to Kiwa that the design and manufacturing of fittings and arrangements for the joints are in accordance with relevant design practices that results in a mechanical performance of the fitting or joint equal to or greater than that of a straight GRP-UP pipe of the same pressure and stiffness rating when installed in a piping system and, if appropriate, supported by anchor blocks or encasements.

The quality management system of the *supplier* shall document the procedures for designing and manufacturing the fittings and joints.

It also include the results of testing programs to verify performance and establish over what range the test results are applicable and how the design procedures are proven and how they apply across the product range.

It is likely that multiple tests will be required to qualify the full range of PN and DN for any given combination of fitting or joint configuration and loading condition and these results shall be documented as part of the quality management system.

The quality management system shall document the fabricated fitting and joint design procedures including materials, material properties, sequence of attaching and reinforcing layups, the process for applying layups and quality control procedures during and after fabrication for the entire range of fittings produced.

Note: The soundness of the design procedure can be demonstrated by means of a (validated) calculation program.

6.1.2 Demonstration of competence of the laminators

The *supplier* shall demonstrate to Kiwa the competence of the personnel manufacturing fittings including joint components, the latest when applicable.

It is recommended to demonstrated competence of the laminators by means of:

- certification of personnel according to NEN-EN-ISO/IEC 17024 or;
- DVS 2220 or;
- NEN-EN-ISO 9001, clause 6.2.

6.2 Fittings

6.2.1 General

Fitting shall conform to the requirements of clause 6 of NEN-EN 1796.

6.2.2 Dimension and tolerances

The relevant dimensions (i.e. diameter, angle, radius, length, laying length, body length, concentric/eccentric, wall thickness, etc.) and tolerances of fittings shall conform to the appropriate requirements according to clause 6 of NEN-EN 1796.

Dimensions and tolerances are specified in drawings.

6.2.3 Fitness for purpose of fittings

The fitting test shall be performed at a temperature of (23 ± 15) °C and other conditions agreed upon with Kiwa i.e. free of wind, rain etc. (lockable space).

Fittings shall be tested with or without end trust whatever applicable.

Non-end thrust loaded bends shall be tested using appropriately designed reinforced concrete encasement.

For branches the branch pipe shall be designed to resist end-loading due to end thrust and shall be tested with end thrust.

Branches (non pressure saddles), reducers, and flanges shall be tested using a typical test arrangement shown in figure 2 of ISO 8483 for testing with or without end thrust. Initial leakage shall be determined according to clause 7.3 of ISO 8483 using a test pressure of 1,5 times the PN for 15 minutes.

The fitting is inspected for signs of leakage. If leakage is not present proceed to the next test.

Short-term duration resistance to internal pressure shall be determined according to clause 7.6 of ISO 8483 using:

- a test pressure of 2,5 times PN for 100 hours or;
- 3,0 times PN for 0,1 hours.

Inspect fitting for signs of failure. If failure is not present it is proven that the fitting is designed properly.

The failure criteria and the detection of failure must comply to NEN-EN 1447.

Test method shall be used for type testing (TT) and audit tests (AT) and may be used for batch release test (BRT) and process verification test (PVT).

6.3 Fitness for purpose of joints

Joint performance shall conform to the requirements of NEN-EN 1796, chapter 7.

In table 6 a summary of tests required for the various types of joints is given.
The joint test shall be performed at a temperature of (23 ± 15) °C.

For non-pressure piping PN as used in the appropriate tables of NEN-EN 1796 is 1 bar.

The supplier must demonstrate to Kiwa which joints are part of the supplier's certificate.

Table 6 - Summery of tests required for various types of joints.

Joint type / standard	Properties to be tested	
Non-end-load-bearing flexible joint with elastomeric sealing rings. (NEN-EN 1119)	Initial leakage – initial pressure	
	External pressure differential - negative pressure	
	Misalignment and draw	Positive static pressure
		Positive cyclic pressure
	Angular deflection and draw	Initial pressure
		Positive static pressure
End-load-bearing flexible joints with elastomeric sealing rings. (ISO 7432)	Initial leakage – initial pressure	
	External pressure differential	Maintained pressure
		Positive cyclic pressure
	Short duration resistance - Maintained pressure	
	Resistance to bending	Preliminary hydrostatic pressure
		Maintained hydrostatic pressure
Wrapped or cemented joints. (ISO 8533)	Internal leakage – initial pressure	
	External pressure differential – negative pressure	
	Resistance to bending and pressure	Preliminary pressure
		Maintained pressure
		Positive cycling pressure
	Short duration resistance – maintained pressure	
Bolted flange joints. (ISO 8483)	Initial leakage – initial pressure	
	External pressure differential – negative pressure	
	Resistance to bending and pressure	Preliminary pressure
		Maintained pressure
	Resistance to internal pressure	Maintained pressure
		Positive cyclic pressure
	Short duration resistance – maintained pressure	

For a particular design of a non-end-load-bearing flexible joint, the *supplier* shall declare the allowable angular deflection and draw.

Test method shall be used for type testing (TT) and audit tests (AT) and may be used for batch release test (BRT) and process verification test (PVT).

6.4 Marking of fittings and joints

6.4.1 General

Marking details shall be printed or formed directly on the fittings and joints in such a way that the marking does not initiate cracks or other types of failure.

If printing is used, the colouring of the printed information shall differ from the basic colouring of the product and such that the markings shall be readable without magnification.

The following marking details shall be on the outside of each fitting:

- number of this evaluation guideline, i.e. BRL K17605;
- nominal size DN and diameter series, i.e. A, B1, B2, etc.;
- for bends, branches or saddles, the designated fitting angle;
- for reducers nominal sizes DN_1 and DN_2;
- stiffness rating in accordance with Clause 4.6 of this evaluation guideline;
- pressure rating in accordance with Clause 4.6 of this evaluation guideline;

- joint type in accordance with clause 4.15 of this evaluation guideline and whether or not end-load-bearing;
- manufacturer's name or identification;
- date or code of manufacture;
- if applicable, the letter "R" to indicate the fitting is suitable to be used with axial loading, or the letters “RA” to indicate the fitting is suitable to be used for axial loading and assessed in accordance with Annex A of NEN-EN 1796;
- letter “H” to indicate suitability for use above ground, if applicable;
- certificate number.

6.4.2 Certification mark

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

- the certification mark: KIWA , or
- (for small fittings) the abbreviated certification mark: KK.

7 Assessment of conformity

7.1 General

The conformity assessment shall be based on NPR-CEN/TS 14632.

The manufacturer shall describe in his quality plan and IQC scheme all relevant procedures relating to BRT and PVT.

7.2 Product changes / production changes

Tests to be performed to material changes are listen in table 7.

The *supplier* shall not make any changes that may be related to the quality of the products before Kiwa has agreed to such changes. After the *supplier's* proposed changes have been reported to Kiwa, Kiwa assesses whether further investigation is required and informs the *supplier* thereof.

Table 7 - Test to be performed to material changes.

Clause	Property to be tested	Standard
7.2.1	Amount of constituents	ISO 7510
7.2.2	Initial specific ring stiffness	ISO 7685
7.2.3	Initial resistance to ring deflection	ISO 10466
7.2.4	Initial circumferential tensile wall strength	ISO 8521
7.2.5	RLTT failure pressure	NEN-EN 1447
7.2.6	Creep factor	NPR-CEN/TS 14632
7.2.7	α and β factors	NPR-CEN/TS 14632

Tests to be performed to changes in design, process or joint materials are listed in table 8.

Table 8 - Test to be performed to changes in design, process and joint materials.

Clause	Property to be tested	Method
7.2.1	Amount of constituents	ISO 7510
7.2.2	Initial specific ring stiffness	ISO 7685
7.2.8	α and β factors	NPR-CEN/TS 14632
7.2.3	Initial resistance to ring deflection	ISO 10466
7.2.4	Initial circumferential tensile wall strength	ISO 8521
7.2.5	RLTT failure pressure	NEN-EN 1447
7.2.8	Joint performance tests	NPR-CEN/TS 14632

The proposed change shall be implemented only when the applicable requirements detailed in the evaluation guideline are fulfilled.

7.2.1 Amount of constituents (material composition)

The resin, glass, aggregate and filler contents and the type and arrangement of the constituent glass layers shall be determined according to ISO 7510.

A difference of more than 10% between the results before and after the proposed change, does require a new pre-certification of the product or type test, whichever is applicable. The results before the change refer to the declared values.

7.2.2 Initial Specific ring stiffness

The initial specific ring stiffness shall be determined according to ISO 7685. The initial specific ring stiffness shall not be less than the declared SN classification.

7.2.3 Initial resistance to ring deflection

The initial resistance to ring deflection shall be determined according to ISO 10466 and shall fulfil the requirements of NEN-EN 1796 clause "Initial resistance to failure in a deflected condition". This means that the test pieces shall be free from bore cracks and are without structural failure: i.e. interlaminar separation, tensile failure of the glass fibre reinforcement, buckling of the pipe wall, if applicable separation of the thermoplastic liner from the structural wall.
The results shall be evaluated in accordance with NPR-CEN/TS 14632.

7.2.4 Initial circumferential tensile wall strength

The initial circumferential tensile wall strength shall be determined according to ISO 8521.
The results shall be evaluated in accordance with NPR-CEN/TS 14632.

7.2.5 RLTT failure pressure

The RLTT shall be carried out on six test pieces according to NEN-EN 1447.
The internal pressure levels shall be selected from the relevant pressure design curve derived in accordance with the relevant procedures described in ISO 10928 for the following expected times to failure: 100 h, 600 h and 2000 h.
Two test pieces should be tested at each of the three determined pressures.
The results shall be evaluated in accordance with NPR-CEN/TS 14632 annex D.3.

7.2.6 Creep factor (24 h)

The dry creep factor is determined to assist in the evaluation of changes of resins and/or curing agents.
The test shall be performed and evaluated according to NPR-CEN/TS 14632.

7.2.7 α and β factors

The α and β factors are determined to assist in the evaluation of changes of resins and/or curing agents.
The test shall be performed and evaluated according to NPR-CEN/TS 14632.

7.2.8 Joint performance tests

Joint performance test shall be carried out according to clause 6.3 of this evaluation guideline.
The results shall be evaluated in accordance with NPR-CEN/TS 14632.

8 Requirements in respect of the quality system

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

8.1 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.

8.2 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.

8.3 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.

9 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**: the investigation necessary in order to determine whether all requirements of the evaluation guideline are fulfilled.
- **Inspection visit:** the surveillance inspections carried out after issue of the certificate in order to determine whether the certified products continuously fulfil the requirements of this evaluation guideline. The inspections are carried out according to the frequency indicated.
- **Inspection of the quality system**: inspection with regard to the correct implementation of the IQC-schedule and procedures.

9.1 Investigation matrix for type testing and inspections

During the pre-certification, type tests have to be performed to determine whether the product meets the specified performance and product requirements.
The requirements that must be fulfilled in order to qualify for certification are listed in the tables 9, 10 and 11, in the column named pre-certification. After certification Kiwa shall periodically inspect the manufacturer for compliance with this evaluation guideline.

In case the product or production process changes significantly, the performance requirements must be determined once again as listed in clause 7.1 of this guideline.

All product properties that can be determined within the visiting time (maximum of one day) are determined by the inspector or by the *supplier* in the presence of the inspector. In case this is not possible, an agreement shall be made between the certification body and the *supplier* about how the inspection will take place.

When the frequency is not mentioned in the tables 9, 10 and. 11, the frequency can be found in the supplier's IQC-scheme.

Table 9 - Test and audit matrix - general product requirements.

Description of requirement	Clause BRL	Tests within the scope of		
		Pre-certification	Surveillance by Kiwa after issue of the certificate	
			inspection	Frequency
Material – toxicological requirements	4.2	x	x	
Declaration of the product	4.4	x	x	1 / year
Competence of personnel	4.5	x	x	1 / year
Classification (STIS-STES)	4.6	x	x [b)]	1 / year
Materials	4.7	x	x [a)]	
Reinforcement	4.7.1	x	x [a)]	
Resin	4.7.2	x	x [a)]	
Constancy of the material composition	4.7.3	x	x [b)]	1 / 5 year
Elastomers	4.7.4	x	x	1 / year
Fixation of the elastomeric sealing element	4.7.5	x	x [a)]	
Locking key	4.7.6	x	x [a)]	
Metals	4.7.7	x	x	1 / year
Pipe type test groups	4.8	x		

Wall construction	4.9	x	x [a)]	
Appearance	4.11	x	x [a)]	
Reference conditions for BRT and PVT	4.13	x	x [a)]	1 / year
joints	4.15	x	x [a)]	1 / year
Protection of products during storage and transport	4.16	x	x	1 / year

a) Requirement is compared with the for this aspect ascertained values that are listed in the supplier's IQC scheme;
b) Requirement that is part of audit testing.

Table 10 - Test and audit matrix (pipe)

Description of requirement	**Clause BRL**	**Tests within the scope of**		
		Pre-certification	**Surveillance by Kiwa after issue of the certificate**	
			inspection	**Frequency**
Diameter	5.1.1	x	x [a)]	
Total wall thickness	5.1.2	x	x [a)]	
Thickness of structural layer, inner and outer layer	5.1.3	x	x [a)]	
Material composition	5.1.4	x	x [a)]	
Winding angle (when applicable)	5.1.5	x	x [a)]	
Length	5.1.6	x	x [a)]	
Sockets and spigots at the pipe or formed on the pipe end provided with a elastomeric sealing	5.1.7	x	x [a)]	
Sockets and spigots formed on the pipe for the purpose of bonded joints	5.1.8	x	x [a)]	
Initial specific ring stiffness	5.2.1	x	covered by clause 4.4	
Long-term specific ring stiffness under wet conditions. i.e. creep under wet conditions.	5.2.2	x	x [b)]	1 / 5 years
Initial resistance to failure in a deflected condition	5.2.3	x		
Ultimate long-term resistance to failure in a deflected condition	5.2.4	x	x [b)]	1 / 5 years
Initial longitudinal tensile strength	5.2.5	x		
Initial failure and design pressure for pressure pipe (initial circumferential tensile wall strength)	5.2.6	x		
Long-term failure pressure	5.2.7	x	x [b)]	1 / 5 years
Resistance to shock or impact	5.2.8	x		
Marking of pipe	5.3	x	x	2 / year

a) Requirement is compared with the for this aspect ascertained values that are listed in the supplier's IQC scheme;
b) Requirement that is part of to audit testing according to NPR-CEN/TS 14632.

When the manufacturer fabricates fittings using pipes of the same classification from which the fittings are to be used, the audit test for the pipes covering mechanical and chemical characteristics cover these fittings. Where tests have been witnessed during routine inspections additional tests for audit purposes will not be required.

Reduced long-term type tests (RLTT) as detailed in NPR-CEN/TS 14632 may be used for satisfying the relevant audit test requirements, as well as proving that products

still conform to the original specifications. Reduced long-term tests can thus be used as a comparison with existing long-term data, but not as a basis for a new design.

Table 11 - Test and audit matrix (fittings and joints)

Description of requirement	Clause BRL	Tests within the scope of		
		Pre-certification	Surveillance by Kiwa after issue of the certificate	
			inspection	Frequency
Demonstration of soundness of design	6.1.1	x		
Demonstration of competence of the laminators	6.1.2	x	x a)	
Dimension and tolerances	6.2.2	x	x a)	
Mechanical characteristic of fitting	6.2.3	x	x	1 / 5 years
Joint performance	6.3	x	x b)	1 / 5 years
Marking of fittings and joints	6.4	x	x	2 / year

a) Requirement is compared with the for this aspect ascertained values that are listed in the supplier's IQC scheme.

b) Requirement that is subject to audit testing according to NPR-CEN/TS 14632.

9.2 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 Product certification

The manufacturer shall describe in his quality plan the limits used to define a batch for testing purposes. Typically, a quality control batch consists of products of a particular diameter, stiffness class and pressure class.

A batch may be released for supply when all the relevant tests and inspections have been carried out and the requirements have been met. If one or more items fail one or more tests or inspections, then the retest procedures detailed in NPR-CEN/TS 14632 shall be performed.

The manufacturer shall detail in his quality plan a verification procedures (PVT) and the frequency they are carried out. The frequency of these tests shall complement the frequency of audit tests (AT), if applicable.

The purpose of PVT tests is to assess the conformity of the long-term properties of the product.

10 Agreements on the implementation of certification

10.1 General

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

10.2 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.

10.2.1 Qualification requirements

The following qualification requirements have been set by the Board of Experts for the subject matter of this Evaluation Guideline (see table 12)

Table 12 - Education and experience of certification personnel.

EN45011	Certification Expert	Inspector	Decision maker
Education - general	Technical higher-level professional education in the concerning field. Basic training auditing.	Intermediate-level professional education in the concerning field. Basic training auditing.	Higher level professional education. Training auditing skills.

EN45011	Certification Expert	Inspector	Decision maker
Experience - general	1 year of relevant work experience participation in at least four pre-certifications of which one carried out independent under supervision.	1 year of relevant work experience participation in at least four inspections of which one carried out independent under supervision.	4 year work experience of which at least on year with respect to certification.

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

10.2.2 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.

10.3 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.

10.4 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.

10.5 Lay out of quality declaration

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

10.6 Nature and frequency of external inspections

The certification body shall carry out Audits 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 this Evaluation Guideline took effect, the frequency was set at number of three inspection visits per year.

In case the quality system of the supplier is certified on the basis of NEN-EN-ISO 9001 the frequency is fixed at two inspection visits per year.

Inspections shall at least refer to:
- the suppliers IQC-scheme and the results obtained from inspections carried out by the supplier;
- the correct way of marking of certified products;

- complying with required procedures.

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

10.7 Interpretation of requirements

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

11 Titles of mentioned documents

11.1 Public law rules

Table 13 – Public law rules.

Standard	Title
Staatscourant van 29 juni 2011, nr. BJZ2011048144	Regeling materialen en chemicaliën drink- en warm tapwatervoorziening'

11.2 Standards / normative documents

Table 14 – List of in evaluation guideline mentioned documents

Standard	Title
ASTM D 2563:2008	Standard Practice for Classifying Visual Defects in Glass-Reinforced Plastic Laminate Parts.
BRL K17504/02:2009	Evaluation guideline for the Kiwa product certificate for vulcanized rubber products for cold and hot drinking water applications
DVS 2220:2011	Qualification testing of plastics laminators and adhesive bonders. Laminates as well as laminate and adhesive-bonded joints between GFRPs (UP-GF and EP-GF).
ISO 7432:2002	Glass-reinforced thermosetting plastics (GRP) pipes and fittings - Test methods to prove the design of locked socket-and-spigot joints, including double-socket joints, with elastomeric seals.
ISO 7510:1997	Plastics piping systems - Glass-reinforced plastics (GRP) components - Determination of the amounts of constituents using the gravimetric method.
ISO 7684:1997	Plastics piping systems - Glass-reinforced thermosetting plastics (GRP) pipes - Determination of the creep factor under dry conditions
ISO 7685:1998	Plastics piping systems - Glass-reinforced thermosetting plastics (GRP) pipes - Determination of initial specific ring stiffness.
ISO 8483:2003	Glass-reinforced thermosetting plastics (GRP) pipes and fittings - Test methods to prove the design of bolted flange joints.
ISO 8513:2011	Plastics piping systems - Glass-reinforced thermosetting plastics (GRP) pipes - Determination of longitudinal tensile properties.
ISO 8521:2009	Plastics piping systems - Glass-reinforced thermosetting plastics (GRP) pipes - Test methods for the determination of the apparent initial circumferential tensile strength.
ISO 8533:2003	Glass-reinforced thermosetting plastics (GRP) pipes and fittings - Test methods to prove the design of cemented or wrapped joints.
ISO 10466:1997	Plastics piping systems - Glass-reinforced thermosetting plastics (GRP) pipes - Test method to prove the resistance to initial ring deflection.
ISO 10468:2003	Glass-reinforced thermosetting plastics (GRP)

	pipes - Determination of the long-term specific ring creep stiffness under wet conditions and calculation of the wet creep factor.
ISO 10471:2003	Glass-reinforced thermosetting plastics (GRP) pipes - Determination of the long-term ultimate bending strain and the long-term ultimate relative ring deflection under wet conditions.
ISO 10928:2009	Plastics piping systems - Glass-reinforced thermosetting plastics (GRP) pipes and fittings - Methods for regression analysis and their use.
ISO 15306:2003/Amd 1:2012	Glass-reinforced thermosetting plastics (GRP) pipes - Determination of the resistance to cyclic internal pressure.
NEN-EN-ISO 75-2:2004	Plastics - Determination of temperature of deflection under load - Part 2: Plastics and ebonite.
NEN-EN 1119:2009	Plastics piping systems - Joints for glass-reinforced thermosetting plastics (GRP) pipes and fittings - Test methods for leak tightness and resistance to damage of non-thrust resistant flexible joints with elastomeric sealing elements.
NEN-EN 1447:2012	Plastics piping systems - Glass-reinforced thermosetting plastics (GRP) pipes - Determination of long-term resistance to internal pressure.
NEN-EN 1796:2013	Plastics piping systems for water supply with or without pressure - Glass-reinforced thermosetting plastics (GRP) based on unsaturated polyester resin (UP).
NEN-EN 45011:1998	General requirements for bodies operating product certification systems.
NEN 7037:1981	Buizen van met glasvezel versterkte thermoharde kunststoffen voor buitenriolering - Eisen en beproevingsmethoden.
NEN-EN-ISO 9001:2008	Quality management systems - Requirements
NEN-EN-ISO/IEC 17020:2012	Conformity assessment -General criteria for the operation of various types of bodies performing inspection.
NEN-EN-ISO/IEC 17024:2012	Conformity assessment - General requirements for bodies operating certification of persons.
NEN-EN-ISO/IEC 17025:2005	General requirements for the competence of testing and calibration laboratories.
NPR-CEN-TS 14632	Plastics piping systems for drainage, sewerage and water supply, pressure and non-pressure - Glass-reinforced thermosetting plastics (GRP) based on unsaturated polyester resin (UP) - Guidance for the assessment of conformity

I Model Certificate

Issued

Replaces

<TITLE>

STATEMENT BY KIWA

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

Name supplier

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 K17605 "Plastics piping systems for water supply with or without pressure – Glass-reinforced thermosetting plastics (GRP) based on unsaturated polyester resin (UP)".

Bouke Meekma
Kiwa

Publication of the certificate is allowed.

Advice: consult www.kiwa.nl in order to ensure that this certificate is still valid.

Supplier

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info@kiwa.nl
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Certification process consists of initial and regular assessment of:
- **quality system**
- **product**

130327

Kiwa® product certificate Certificate number

Product

Product specification
The products mentioned below belong to this certificate.
Product name

Toxicological requirements
Approval:
This product is approved on the basis of the requirements set in the "Regeling materialen en chemicaliën leidingwatervoorziening" ("Regulation Materials and Chemicals for Drinking Water Supplies"; published in the Staatscourant).
ATA criteria:
The ATA product certification is based on two main criteria. It should permanently comply with:

- The product recipe approved during the assessment procedure. The recipe is laid down in the for confidentiality reasons undisclosed appendix 1A to the certification agreement Kxxx. This recipe is not to be changed without prior approval by Kiwa according to the Kiwa-ATA-approval procedure;
- Specific ATA-product requirements, laid down in appendix 1A to the certification agreement Kxxx. For confidentiality reasons this appendix 1A is not public.

Nominal pressure class (PN)

Nominal Size (DN)

Nominal stiffness (SN)

Marking of pipes
Marking details shall be printed or formed directly on the pipe in such a way that the marking does not initiate cracks or other types of failure.

If printing is used, the coloring of the printed information shall differ from the basic coloring of the product and such that the markings shall be readable without magnification.

The following marking details shall be on the outside of each pipe, and in the case of pipes of DN 600 or greater shall be either on the inside or on the outside surface:

- Number of this evaluation guideline, i.e. BRL K17605.
- Nominal size DN and diameter series, i.e. A, B1, B2, etc..
- Stiffness rating in accordance with Clause 4 of this guideline.
- Pressure rating in accordance with Clause 4 of this guideline.
- Manufacturer's name or identification.
- Date or code of manufacture.
- If applicable, the letter "R" to indicate the pipe is suitable to be used with axial loading, or the letters "RA" to indicate the pipe is suitable to be used for axial loading and assessed in accordance with Annex A of EN 1796.
- Letter "H" to indicate suitability for use above ground, if applicable.
- Certificate number.

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

- KIWA ;

Marking of fittings
Marking details shall be printed or formed directly on the fittings and joints in such a way that the marking does not initiate cracks or other types of failure.

If printing is used, the colouring of the printed information shall differ from the basic colouring of the product and such that the markings shall be readable without magnification.

The following marking details shall be on the outside of each fitting:

- Number of this evaluation guideline, i.e. BRL K17605.
- Nominal size DN and diameter series, i.e. A, B1, B2, etc..
- For bends, branches or saddles, the designated fitting angle.
- For reducers nominal sizes DN1 and DN2.
- Stiffness rating in accordance with Clause 4 of this evaluation guideline.
- Pressure rating in accordance with Clause 4 of this evaluation guideline.
- Joint type in accordance with clause 4 of this evaluation guideline and whether or not end-load-bearing.
- Manufacturer's name or identification.
- Date or code of manufacture.
- If applicable, the letter "R" to indicate the fitting is suitable to be used with axial loading, or the letters “RA” to indicate the fitting is suitable to be used for axial loading and assessed in accordance with Annex A of EN 1796.
- Letter “H” to indicate suitability for use above ground, if applicable.
- Certificate number.

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

- KIWA ;
- KK (only for small fittings)

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:

- Name supplier, and if necessary,
- Kiwa Nederland B.V.

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

II Model IQC-scheme

<table>
<tr><td><u>IQC-schedule</u>

<u>INTERNAL QUALITY PLAN</u></td><td colspan="2">Manufacturer / supplier :
Production location address :</td><td>Number of appendices:</td></tr>
<tr><td colspan="4"><u>Field(s) of application</u>

<u>According Evaluation Guideline(s)</u></td></tr>
<tr><td colspan="2"><u>Number of production shifts:</u></td><td colspan="2" rowspan="3"><u>Quality manual, procedures and working instructions</u>
Is the Quality Management System (QMS) certified according to ISO 9001[1)]?
If yes, by which certification body:
If yes, is the certification body accredited for the particular scope of certification?
The following procedure for dealing with <u>complaints</u> applies:

In case the QMS is <u>not</u> certified according to ISO 9001:
• Working instructions, test instructions and procedures are documented as follows:
• The following procedure for <u>nonconformity review</u> applies:</td></tr>
<tr><td colspan="2"><u>Quality Control</u>
Total number of employees in QC department :
Number of QC-operators per shift :

If no QC-inspections are carried out during night shifts, state the QC procedure(s)/instruction(s) to be followed: , documented in:</td></tr>
<tr><td colspan="2"><u>Inspection and test records</u>
All records shall be maintained for a minimum of years.</td></tr>
<tr><td colspan="2"><u>Specific agreements/comments/explanations</u></td><td colspan="2">Signature of the manufacturer/supplier:

Date :</td></tr>
</table>

[1)] 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.

A. Calibration of measuring and test equipment

Applicable procedure(s) nr(s):

Equipment to be calibrated	Calibration aspect	Calibration method	Calibration frequency	Calibration file (name and location)

B. Raw material and additives

Applicable procedure(s) nr(s):

B.1 Receipt

For each delivery of raw material or additives data with respect to dates, producers, types and quantities are recorded as follows:

B.2 Entry control

Type of raw material	Inspection aspect	Inspection method	Inspection frequency	Registration file (name and location)

C. Batch release tests per machine (including in-process and finished product testing)

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:

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

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

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

Specific agreements/comments/explanations:

Raw materials list **(not required to fill-out this appendix in case reference can be made to the Kiwa ATA part of the certification agreement)**	**Appendix I** Date: ……

I.1 The product is built-up of the following raw materials:

a) In case of products made from ready-made raw materials: listing of name and/or unique code of the raw material(s);

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);

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).

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List of technical drawings			**Appendix II** Date:……..
Drawing title and number	Drawing date	Drawing title and number	Drawing date

III Prevention of contamination

Products for transport of drinking water: Guidance for prevention of contamination during transport and storage

Importance of a hygienic operation
A hygienic operation is since decades an important issue for the transport and distribution of drinking water in the Netherlands.
The impact of pollution can have big consequences for the water distribution[1)] (normally chlorine is not used) and need substantial efforts to clean the system.

Already in the 1983 published "guideline for installation of PVC-U piping systems", this is described with chapter § 4.2: " 'Opslag' van de 'Richtlijnen voor de aanleg van hoofdleidingen van ongeplastificeerd polyvinylchloride (PVC) voor het transport van drinkwater' "
Also the aspect hygiene is mentioned in the Dutch "'Hygiënecode Drinkwater; Opslag, transport en distributie', 2010, including manuals for installers.
As result of the Hygienic code a wide range of courses for parties involved (installers, personnel of water companies, etc.) can be followed.
Last but not least the "Hygiëne code" is also mentioned in the drinking water law of 1 July 2011 and is therefore part of the Dutch law.

Protection of the used products
In the 'Hygiënecode Drinkwater; Opslag, transport en distributie" the aspect how to work hygienically extensively is described. Here actions for all used parts as pipes, fittings and valves in the complete system, from construction until operation are described.
The primary task in this case is "prevention". Secondary is also important the preparation of the main for the actual drinking water transport.

For all products coming from the production location, until installation in the drinking water system the same "preventive" measurements shall be taken[2),] to prevent pollution.
Therefore manufacturers shall demonstrate a procedure how to prevent pollution of certified (drinking water) products during production, transport and storage.

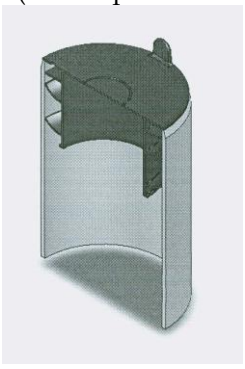
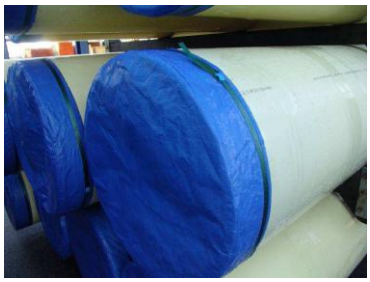
Requirements for the protection of products
For all preventive (protective) actions taken to protect the products against pollution it is important that the protection will last for the complete process of storage, transport and again storage.

remark :
1) mostly this is a microbiological contamination coming from the surrounding area on macro- and micro scale (like dust, but also faeces and dead beasts.
2) "protection" is the combination of packaging and closing the pipe/fitting ends.

How to protect: General
The used packaging depends on the product itself (shape, dimensions, etc.)
Some packaging solutions are mentioned below:

- a plastic bag (in a box) for small fittings (couplings, rings, rubber seals);
- 'Protection fill with inserted bubbles in combination with tape for big(ger) fittings;
- the combination of bags of GRP material or crimp-foil and the use of a box for smaller part;
- end-caps of stern material of plastics bags for the pipe mouth (where the complete pipe package is wrapped in foil).

How to protect: Pipes
In 2007 representatives of the manufacturers and the water companies organized in the commission 'Onderhandelings Commissie Kunststoffen' (OCK) have started a project to improve the packaging quality.
As result of this a guidance is made to use packaging products as shown with the pictures below.
The end cap is unmovable fixed in the pipe by using flaps in a labyrinth structure to let in air but prevent pollution.
The end cap is developed for a 110 mm PVC pipe but can also be developed for other diameters (50, 63, 75 , 90, 160, 200 and 250 mm), and for all used pipe materials.
For the protection of the pipe mouth for 315, 400, 500 and 630 mm PVC pipes a GRP foil with tape can be used (see the pictures below).

For smaller diameters this solution is not recommended.