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Approval requirement 70

Mechanical fittings for plastic piping systems.

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Foreword

This GASTEC QA (Dutch version) approval requirement has been approved by the Board of Experts product certification GASTEC QA, in which relevant parties in the field of gas related products are represented. This Board of Experts supervises the certification activities and where necessary require the GASTEC QA approval requirement to be revised. All references to Board of Experts in this GASTEC QA approval requirement pertain to the above mentioned Board of Experts.

This GASTEC QA Approval requirement will be used by Kiwa Nederland BV in conjunction with the GASTEC QA general requirements and the KIWA regulations for certification.

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1 Introduction

1.1 General

This GASTEC QA approval requirement in combination with the GASTEC QA general requirements include all relevant requirements, which are adhered by Kiwa as the basis for the issue and maintenance of a GASTEC QA certificate for mechanical fittings for plastic piping systems.

This GASTEC QA Approval requirements replaces the GASTEC QA Approval Requirements 70 “Mechanical fittings for plastic piping systems” dated September 2018.

Overview of changes:

- Change of maximum operating pressures
- References to clauses are changed
- References in table 6 are changed
- Textual review

The product requirements have not changed

1.2 Scope

The approval requirements specify the requirements for mechanical fittings made of for polyethylene (PE) and polyvinylchloride (PVC-HI) plastic piping systems for the supply of gaseous fuels of the 2nd and 3rd family according to EN 437.

De mechanical fittings can be full-end-load or non-end-load and made from plastic or metal. The maximum operating temperature is -20 °C to 40 °C.

The maximum operating pressure for each application is mentioned in the table below.

Type of pipe	MOP	MOP NEN 7244	Application and use
PE 80 SDR 17,6	4,8 bar	4 bar	Main- and serviceline
PE 80 SDR 11	8 bar	4 bar	Main- and serviceline
PE 100 SDR 17,6	6 bar	8 bar	Main- and serviceline
PE 100 SDR 11	10 bar	4 bar	Main- and serviceline
PVC-HI SDR 41	4,5 bar	200 mbar	Main- and serviceline

Table 1: MOP (mathematic and according to NEN 7244) for each pipe type

2 Definitions

In this approval requirement, the following terms and definitions are applicable:

Mechanical fittings: fittings for assembling plastics pipes with each other, which includes one or more compression zones to provide pressure integrity, leak tightness and resistance to end loads.

Full-end-load resistance: Combination of component and joint design and characteristics such that under any load the plastic pipe will fail first.

End-load resistance: Resistance to end load transmitted via the connecting pipe and generated by internal pressure, pipeline internal interference, and thermally induced stress in any combination.

Non-end-load resistance: Lack of resistance to axial loads without additional external mechanical axial support.

Appearance, signs of damage: Visible deformation, broken parts and signs of cutting and boring which are not in the design of any component of the unused fitting.

Transition fittings: A construction element which is designed to join a plastics pipe on one side and a other pipe material on the other side.

SDR: Standard Dimension Ratio.

High impact PVC (PVC-HI): A mixture of an un-plastified polyvinylchloride with a high impact modifier.

3 Product requirements

3.1 Field of application for mechanical fittings

The manufacturer shall declare, depending on the intended use, the medium supplied, the Maximum Operating Pressure (MOP), installation and operating temperature limits and the pipe material(s) to be jointed to the mechanical fittings. Also the use of an insert, the end load resistance class, the corrosion resistance, the use of lubricants or greases, ash content for glass reinforced materials as applicable shall be declared. This information shall be included in the installation manual of the fitting in the Dutch language.

3.2 Materials

3.2.1 General

The suitability of the materials below can be demonstrated by providing test reports or by reference to relevant product standards of similar products in which the material is specified as being suitable for use.

3.2.2 Plastic materials

The compound/formulation used to manufacture any plastic components of the mechanical fitting exposed to ultraviolet radiation shall be able to withstand ultraviolet radiation, the manufacturer shall declare that the fittings are protected to the effects of ultraviolet radiation.

Pressure-bearing components shall be produced from virgin materials, own reprocessable material or a combination of virgin and own reprocessable material. Recycled materials shall not be used. For glass reinforced materials, only virgin materials shall be used.

3.2.3 Metal materials

The metal materials for producing mechanical fittings shall be demonstrable suitable for its application (pressure, ambient temperature range, long term behavior) and shall be specified according to the relevant material standard.

The metal materials for producing mechanical fittings should be corrosion resistant or should be protected against corrosion, according to their intended end-use conditions unless otherwise stated in manufacturer’s declaration (see paragraph 3.1).

3.2.4 Elastomers

The type of elastomeric sealing used in mechanical fittings shall be in accordance to EN 682, type GAL or GBL.

3.3 Appearance

When viewed without magnification, the internal and external surfaces of fittings shall be smooth, clean and shall have no scoring, cavities and other surface defects.

No component of the fitting shall show any signs of damage, scratches, pitting, bubbles, blisters, inclusions or cracks.

The transitions in shapes or dimensions shall be without sharp edges to avoid the effects of notch.

For injecting moulded fittings the edges of chambers (e.g. for sealing components) shall be rounded.

Edges in the chambers of the plastic fittings shall not damage the rubber sealings or result in unacceptable stress in the fitting which affect the functionality and lifetime of the mechanical fitting.

3.4 Colour

The color of PVC-HI fittings shall be yellow, preferably RAL 1004 according to NEN 3050.

3.5 Construction

Plastic fittings should have an end stop for the pipe when inserted into the mechanical fitting to avoid passing through the fitting.

Parts of mechanical fittings produced from (moulded) PE material can be assembled by butt-welding. The butt-welding shall be in accordance to Approval requirement 200.

Rubber elements used in the non-end-load fitting to make a coupling with the pipe shall be fixated, as declared by the manufacturer, to avoid movement of the rubber elements. The construction of the fixation shall be made to withstand normal installation forces and without pushing the rubber element out of the construction. This aspect shall be tested in accordance to NEN7231 Annex A.

3.5.1 Inserts

For connecting a full-end-load resistant mechanical fittings with PE pipes an insert is required. The insert shall be supplied with the fitting or separate available.

The insert shall be rigid and provide support over the entire compression area. The insert shall not be able to displace in longitudinal direction after assembly.

An insert shall be available with the mechanical fitting for each combination of diameter and SDR series of the pipe with which it is assembled.

After installation of the insert, the pipe shall show no signs of damage, scratches or cracks. The material of the insert shall be fit for purpose.

The minimal internal bore diameter of the pipe shall be stated by the manufacturer in his installation manual.

The insert shall support the pipe from the beginning of the pipe end to at least 0,3 x D_{mean} past the clamp construction of the fitting.

When necessary to cut thread or grooves in the pipe for mounting the fitting, it is only allowed on parts of the pipes without tangential stress due to inner pressure.

3.5.2 Connections

Connection (e.g. threads, flanges and butt- or electrofusion welding) shall be in accordance to the relevant GASTEC QA approval requirements and/or national or international standards

3.5.3 Transition couplers

Transition couplers from plastic pipe to steel pipe, steel coated pipe, copper pipes or PE spigot fittings ends are allowed. These pipes shall fulfil the relevant GASTEC QA approval requirements.

3.5.4 Twisting

The mechanical fitting shall not induce twisting of pipes during assembly.

3.6 Geometrical aspects

3.6.1 General

Mechanical fittings and inserts shall meet the dimensions and tolerances of the technical drawings supplied by the manufacturer. This drawings shall be added to the certification report of the certification body and used for annual product verification.

For non-end-load fittings made of PVC-HI and PE the additional requirements of clause 3.6.3 or 3.6.4 shall be fulfilled.

3.6.2 Pipes for mechanical fittings

Mechanical fittings for connecting PVC pipes shall be manufactured with such dimensions and within such tolerances as will permit their use with pipes conforming NEN 7231.

Mechanical fittings for connecting PE pipes shall be manufactured with such dimensions and within such tolerances as will permit their use with pipes conforming GASTEC QA Approval requirements 8.

3.6.3 Non-end-load fittings made of PVC-HI

Dimensions and tolerances of non-end-load mechanical fittings made of PVC-HI for connecting PVC-HI pipes shall meet the geometrical requirements of NEN 7231.

3.6.4 Non-end-load fittings made of PE

Dimensions and tolerances of non-end-load mechanical fittings made of PE for connecting PVC-HI pipes shall meet the geometrical specifications of the manufacturer. The allowable depth of the pipe insertion and wall thickness shall be conform table 2 and 3.

Connection size (mm)	Minimum depth of insertion (mm) [1)]
63	40
75	42
90	44
110	47
160	54
200	60
[1)] *distance between the stop and the rubber sealing*.	

Table 2: Depth of insertion of the pipe for fittings made of PE.

Connection size (mm)	Minimum wall thickness fitting (e_1) (mm)	Minimum wall thickness in welding area (e) (mm)	Maximum length of the welding area (L) (mm)
63 – 110	10	7	14
160	13	10	17
200	14	13	9

Table 3: Minimum wall thickness for fittings made of PE.

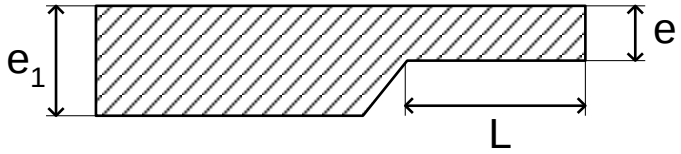

Figure 1: cross section of the pipe wall at the side of the butt weld.

In any section of the socket the difference between the largest and smallest measured inner diameter of the socket shall not exceed 0,007 x d_e (d_e = nominal outer diameter of the corresponding pipe) the accuracy of the calculated value is 0,1 mm.

The deviation of the given angle for bends and elbows shall not exceed 3°.

3.6.5 Insert dimensions

The minimum wall thickness of Polyethylene (PE) pipes with a DN ≤ 32 mm used in existing gas distribution systems in the Netherlands can deviate from the recommended wall thickness of EN 1555-2 “Plastic piping systems for the supply of gaseous fuels – Polyethylene (PE) – Part 2: Pipes”.

DN	EN 1555-2, Table 2		Existing systems	
	Wall thickness		Wall thickness	
	SDR 17	SDR 11	SDR 17,6	SDR 11
25 mm	2,3 mm	3,0 mm	2,0 mm	2,3 mm
32 mm	2,3 mm	3,0 mm	2,0 mm	3,0 mm

Table 4: Minimum wall thickness of existing gas distribution systems.

Inserts of fittings intended to be used in existing gas distribution systems (e.g. repair fittings) shall accommodate these wall thicknesses.

3.7 Physical aspect

3.7.1 Plastic material

The physical aspects of plastic material shall meet the requirements of ISO 17885:2015 clause 8.1 (evaluation of the MRS value) and 8.2 (verification of the long-term behavior).

3.7.2 Material related characteristics

Fitting material shall meet the requirement of table 5.

Plastic materials				
Material	**Aspect**	**Requirement**	**Parameters**	**Test method**
PVC-HI (injection moulded)[a]	Vicat softening temperature	> 74 °C	50 °C/h	ISO 2507-2
	Influence of heating	ISO 6993-2 ISO 6993-3	150 °C	ISO 580:2005 (Method A)
	K-value	> 57	Dissolution in THF	ISO 13229
PVC-HI (produced from pipe)	DCMT	No visual damage at 15 °C	Immersion in dichloromethane 30 minutes	EN 580
PE	OIT	≥ 20 min.	200°	ISO 11357-6
	MFR	± 20% difference on the batch and the fitting	190°/5 kg	ISO 1133-1
	Influence of heating	≤ 3% (≤ 5% for bend and T-pieces) No signs of bubbles and cracks	110 ± 2 °C 60 ± 5 minutes	
POM	MFR	≤ 4 g/10 min	190°/2,16 kg	ISO 1133-1
PA	Viscosity number	ISO 17885 Annex D		
	Ash content	ISO 17885 Annex D		
PPSU	MFR	± 30% difference on the batch and the fitting	365 °C/5 kg (alternative condition: 360 °C/10 kg)	ISO 1133-1
Metal materials				
Material	**Aspect**		**Test method**	
CU alloys	Dezincification resistance		Manufacturer has to confirm corrosion resistance, according to ISO 6509, for specific application where the dezincification resistance is required	
FE alloys	Corrosion resistance		Manufacturer has to declare corrosion resistance for specific application or has to define how the end-user has to provide a proper corrosion protection.	

[a] PVC-HI fittings made of pipe shall meet the following aspects of NEN 7230 before production of the fitting: appearance, material, heating and hydrostatic pressure.
[b] Tested in form of pipe (see ISO 17885, clause 8.4.2)

Table 5: Material related characteristics of the fitting

3.7.3 Resistance to gas constituents

Gas bearing fittings material shall be resistance to gas constituent in accordance with ISO 17885:2015, clause 8.4.2.

4 Performance requirements and test methods

4.1 Test samples

The tests shall be carried out on pipe and fitting assembled in accordance with the manufacturer's instructions. The tests shall include all types of joint design.
The pipe(s) used in the test assemblies shall conform to the corresponding product standard if available.

A test assembly contains a (straight) fitting with a connected pipe on both ends with a free length of 250 mm, unless otherwise stated in the test methods.
All test are performed on three test assemblies.

NOTE Since there are PE (polyethylene) materials such as PE 63, which are available only in some markets, the testing under performance requirements are also applicable and if the products meet this requirements, they can be approved for the particular use.

PVC-HI non-end-load fittings shall be assembled without the use of lubricants or greases on PVC-HI pipes SDR33 according to NEN 7230.

4.2 Summary of test.

For initial testing (type testing), all relevant characteristics shown in Table 6 should be carried out on one diameter of each size group, of each pressure classes (PN) and types.

Size groups for selection of the test samples:

	1	2	3	4	5
Pipe diameter (mm)	≤ 40	>40 - ≤63	>63 - ≤110	>110 - ≤250	>250

Characteristic	Fitting		Test method
	Full-end-loaded	Non-end-loaded	Clause
Pressure resistance of the plastic fitting body	X	X	4.3
Leak tightness under internal pressure	X	X	4.4
Leak tightness under external pressure	X	X	4.5
Long-term hydrostatic strength	X	X	4.6
Tensile load at 23 °C [a]	X	--	4.7
Tensile load on the weld at 23 °C [a,b]	X	X	4.8
Tensile load after relaxation [a,c]	X	--	4.9
Tensile load at 0 °C [a,c]	X	--	4.10
End load at 80 °C [d,e,i]	X	--	4.11
Tensile load 800h [c,d,e]	X	--	4.12
Leak tightness after temperature cycling	X	X	4.13
Leak tightness while subjected to bending [a,d,l]	X	X	4.14
Angular deflection / deformation [d,f,g]	--	X	4.15
Resistance to impact at 0 °C [j]	X	X	4.16
Repeated assembly [k]	X	--	4.17
Flow rate / pressure drop	X	X	4.18
Resistance to corrosion [h]	X	X	4.19

X Applicable
-- not tested or not applicable
[a] Only valid for pipes ≤ 63 mm
[b] Only valid for welded fittings
[c] Only valid for full-end-loaded PVC-HI fittings for PE pipes
[d] Test of joint design. Normally performed on uniaxial fitting assemblies
[e] Only valid for PE pipes ≤ 63 mm
[f] PVC pipes all diameters, PE pipes ≤ 63 mm.
[g] Only valid for elastomeric sealing ring type sockets
[h] Only valid for fittings containing brass components
[i] Not valid for PVC-HI fittings
[j] Only valid for PVC-HI fittings
[k] When applicable
[l] Not valid for transition fittings

Table 6: summary of test

4.3 Pressure resistance of the plastic fitting body.

For testing plastic fitting bodies, special sealing plugs according ISO 1167-3, as well as special (reinforced) end-closures, may be used.
For plastic materials where an ISO 9080 evaluation has been carried out or where requirements to the long-term pressure resistance exists in a product standard, the test pressure for the fitting body is given in formula:

$$p_t = PN \times \frac{\sigma_{tF}}{\sigma_s}$$

where
p_t is the test pressure of the fitting body (bar);
PN is the nominal pressure of the fitting (bar);
σ_{tF} is the test stress of the fitting material (MPa);
σ_s is the design stress of the fitting material (MPa).

The test parameters given in ISO 17885, Annex C shall be followed, using test procedure given in ISO 1167-1. No failure shall occur during the test

NOTE The design stress depends on the application, e.g. to 20 °C/50 years.

4.4 Leak tightness under internal pressure.

When the test assemblies are tested in accordance with ISO 3458, the test assemblies shall be leak tight.

Fitting material	Test medium	Test duration	Test temperature	Test pressure
All (except PVC-HI full-end-load fittings)	Air or inert gas	1h low pressure followed by 1h high pressure	20 °C ± 5 °C	25 mbar followed by 1,5 x MOP
PVC-HI, full-end-load fittings	Air or inert gas	15 minutes	0 °C	0-400 mbar

Table 7: Test parameters leak tightness under internal pressure

4.5 Leak tightness under external pressure.

When the test assemblies of clause 4.1 are tested to test method below, the test assemblies shall be leak tight.

Test method:
Subject the test specimens to an external water pressure of 10 ± 1 kPa for 2 hours.
Subsequently, subject the same test specimens to an external water pressure of 80 ± 8 kPa for 2 hours.
The temperature of the water shall be 23 ± 2 °C.

Pipes made of PVC-HI assembled to the test samples shall be deformed 10 ± 2 % at a distance of d_n ± 2 mm of the fitting.

Check the specimens for water ingress.

4.6 Long-term hydrostatic strength

When the test assemblies are tested in accordance with ISO 3458, ISO 1167-1, ISO 1167-4 and table 8, the test assemblies shall be leak tight.
Non-end-load fittings shall be tested with B type end caps.

Pipe material	Test duration (h)	Test temperature (°C)	Test stress[a] (MPa)	Test pressure
PE 80	1000	80[c]	4,0[b]	
PE 100	1000	80[c]	5,0[b]	
PVC-HI	1000	20		1,2 x PN[d]
PE-X (mono)	1000	95[c]	4,4[b]	
Multi-layer	1000	20		1,2 x PN[d]

[a] Test stress of the pipe
[b] If the fitting material is PVC-HI, the test duration will be 1000h, the test temperature 60 °C and the test pressure 0,4 MPa
[c] If some components of the fitting cannot be tested at 80 °C or 95 °C, another temperature level and the corresponding testing time may be chosen, taking into account the long-term hydrostatic regression curves.
[d] PN of the fitting

Table 8: Parameters for long-term hydrostatic strength test.

4.7 Tensile load at 23 °C

When the test assemblies are tested in accordance with ISO 13951, the test force is calculated from formula:

$$F_T = 2 \times \sigma_T \times \pi \times e_m \times (d_n - e_m) \text{ (N)}$$

Where

σ_T is the applicable stress (see table 8) (MPa)
e_m is the mean wall thickness of the pipe (mm)
d_n is the nominal outside diameter of the pipe (mm)

None of the following shall occur:

- No damage or permanent deformation of the fitting assembly
- Pull-out of the pipe
- Leakage before yielding or delamination of the pipe

Displacement of trapped air from free space within the fitting assembly, i.e. seal burping, shall not be considered leakage

Pipe material	Test stress (MPa)
PE 80	5,7
PE 100	6,6
PVC-HI	15,0
PE-X	5,5
Multi-layer	$\sigma_T = \frac{P_t \times (d_n - e_n)}{20 \times e_n}$

Table 9: Test stresses of the pipe material.

P_t is the calculated pressure and is half the of the value of the pressure (bar) at 1 h at 20 °C.

4.8 Tensile load of the weld at 23 °C

When fittings that are assembled by welding are tested in accordance to ISO 13953, the fittings shall not show any sign of brittle fractures in the welding zone.

The tensile testing shall be done at a temperature of 23 ± 2 °C and a speed of 5 ± 1 mm/min on three straight fittings.

4.9 Tensile load after relaxation

When the test assemblies are conditioned for 1000 (+72/-0) hours in water at 60 ± 0,5 °C and followed by 16 hours at 23 ± 2 ° in air, the test assemblies shall meet the requirements of clause 4.7.

4.10 Tensile load at 0 °C

When the fitting and pipes are conditioned at least for 16 hours at 0 ± 2 °C and mounted at 0 ± 2 °C, the test assemblies shall be placed in a tensile machine within 2 minutes at 23 ± 2 °C.

The test assemblies shall resist a tensile force which result in yield of the pipe. The tensile speed shall be (0,1 ± 0,05) x L in mm/min.

Where

L is the free length of the pipe (3 x d_n) (mm)
PE pipes according to EN 1555-2 with a maximum yield strength of 24,8 N/mm^2.

None of the following shall occur:

- Pull out of the pipe

Positioning of the fitting and the pipe shall not be considered as pull-out.

4.11 End load at 80 °C

When the test assemblies are tested in accordance with ISO 19899 the end load force *F* is calculated, in kN, from formula:

$$F = K \times \frac{MRS \times d_n^2}{SDR^2} \times (SDR - 1)$$

Where

K is a mathematic constant equal to $4\pi/10^4$
MRS is the minimum required strength of the pipe (MPa)
SDR is the standard dimension ration of the pipe
d_n is the nominal outside diameter of the pipe (mm)

None of the following shall occur:

- No damage or permanent deformation of the fitting assembly
- Leakage during a leak tightness test after the constant load.

Displacement of trapped air from free space within the fitting assembly, i.e. seal burping, shall not be considered leakage.

If the fitting or parts of the fitting cannot be tested at 80 ° C, a different temperature may be selected from the highest temperature line of the regression curve (ISO 9080 examination).

4.12 Tensile load 800h

When the test assemblies are tested for minimum 800 hours at a constant end load *F*(N), calculated from formula:

$$F = 10 \times \pi/4 \times (d_n^2 - (d_n - 2e_n)^2)$$

Where

d_n is the nominal outside diameter of the pipe (mm).
e_n is the nominal wall thickness of the pipe (mm)

None of the following shall occur:

- Breaking of the pipe or fitting.
- Pull-out of the pipe.
- Leakage before and after the test.

The accuracy of the load shall be 5%.

Perform a leak tightness test at 10 ± 1 kPa before placing the end load at the test assemblies and at the end of the test, before removing the end load. Determine leakage by using a soap solution.

4.13 Leak tightness after temperature cycling

When the test assemblies are tested in accordance with table 10, table 11 and ISO 3458, the test assembly shall be leak tight. The leak tightness shall be tested according to clause 4.4 after completion of the temperature cycling test.

Test method	**Test parameters**
Method A (two temperature regulated chambers)	Test medium = air in air Number of test cycles = 10 Internal pressure = 0,375 x PN and maximum 6 bar
Method B (one temperature regulated chamber)	Test medium = air in air Number of test cycles = 10 Internal pressure = 0,375 x PN and maximum 6 bar

Table 10 Parameters leak tightness after temperature cycling.

Test method	**Cyclic test procedure (1 cycle)**
Method A	1. Place the test assembly in the first chamber at T_{min} ± 2 °C for at least 2,5 hours 2. Place the test assembly, within 0,5 – 1 hour in the second chamber at T_{max} ± 2 °C for at least 2,5 hours 3. Place the test assembly, within 0,5 – 1 hour in the second chamber at T_{min} ± 2 °C 4. return to 1.)
Method B	1. Place the test assembly in the chamber and increase the temperature to T_{max} ± 2 °C at a minimum rate of 1 °C/min 2. Maintain at T_{max} ± 2 °C for at least 2 hours 3. Reduce the temperature to T_{min} ± 2 °C at a minimum rate of 1 °C/min 4. Maintain at T_{min} ± 2 °C for at least 2 hours 5. return to 1.)

Table 11: Cyclic test procedure.

Note: Tmin and Tmax are installations temperatures as declared by the manufacturer

4.14 Leak tightness under internal pressure while subjected to bending

When the test assemblies are tested in accordance with ISO 3503 and table 12, the test assemblies shall be leak tight during the test.

Test temperature	Test medium	Bending radius (R)	Test pressure	Test duration
23 °C ± 2 °C	Air	PN ≤ 10: R = 15 x d_n PN > 10: R = 20 x d_n	25 mbar followed by 1,5 x PN	1 hour low pressure followed by 1 hour high pressure

Table 12: test parameters for leak tightness under internal pressure while subjected to bending

4.15 Angular deflection and deformation

4.15.1 Test pieces

The test piece is a straight fitting with connected pipe on both sides. The free length of the pipe om both sides of the fitting is 5 x d_e.

4.15.2 Apparatus

The apparatus must be able to install a test assembly and is preventing the axial displacement of the pipes out of the fitting. The apparatus has a construction to make an angular deflection between the fitting and the pipe and diametric deformation at distance d_e ± 2 mm on the pipe.

4.15.3 Leak tightness under internal pressure with angular deflection and deformation

When the test assemblies are tested according to table 13, the test assemblies shall be leak tight during the test.

Test	Angular displacement (°)	Deformation (mm)	Pressure (bar)	Time ± 20% (min)
Leak tightness	0	0	0,025 ± 0,005	10
Leak tightness	0	0	1 ± 0,02	10
Depressurize	0	0	0	5
Apply deformation	0	10 ± 2%	0	
Leak tightness	0	10 ± 2%	0,025 ± 0,005	10
Leak tightness	0	10 ± 2%	1 ± 0,02	10
Depressurize	0	0	0	5
Apply angular displacement	5 ± 1°	0	0	
Leak tightness	5 ± 1°	0	0,025 ± 0,005	10
Leak tightness	5 ± 1°	0	1 ± 0,02	10
Depressurize	0	0	0	5
Apply deformation	0	10 ± 2%	0	
Apply angular displacement	5 ± 1°	10 ± 2%	0	
Leak tightness	5 ± 1°	10 ± 2%	0,025 ± 0,005	10
Leak tightness	5 ± 1°	10 ± 2%	1 ± 0,02	10
Depressurize	0	0	0	5
Leak tightness	0	0	0,025 ± 0,005	10
Leak tightness	0	0	1 ± 0,02	10

Table 13: Parameters for leak tightness under internal pressure with angular deflection and deformation.

4.15.4 Leak tightness at external water pressure and mechanical load

When the test assemblies are tested according to table 14, the test assemblies shall be leak tight during the test.

Test	Angular displacement (°)	Deformation (mm)	Pressure external (bar)	Time ± 20% (min)
Leak tightness	0	10 ± 2%	0,8 ±0,02	120

Table 14: Parameters for leak tightness under external pressure with angular deflection and deformation.

4.16 Resistance to impact at 0 °C

When the test pieces are tested in accordance to EN 744 and table 15 with a mass with an spherical nose diameter of 25 ± 0,5 mm, only two failures are allowed in 100 strokes. If no failure occurs after 60 strokes the test can be stopped and the test pieces meet the requirements.

All strokes shall be performed random on the test piece, including on the injection point, seams and (sharp) edges.

T-pieces shall be supported by a flat plate in such a position where all sockets are in a horizontal plane. All other positions should be supported by a V-block. Sockets shall only be supported in axial direction.

Note 1: for reducer fittings a mass is used according to the connection size of the socket. Strokes at the transition of the reducer shall be performed with a mass according to the smallest connection size.

Note 2: The bottom of endcaps with a profiled bottom shall be excepted for resistance to impact at 0 °C

Connection size (DN) (mm)	Mass (g)	Height (mm)
50	750 (+5 / -0)	2000 (+5 / -0)
63	1000 (+10 / -0)	
75	1250 (+10 / -0)	
90	1500 (+15 / -0)	
110	1750 (+15 / -0)	
125	2000 (+15 / -0)	
160	2500 (+15 / -0)	
≥200	3000 (+15 / -0)	

Table 15: Parameters for resistance to impact at 0 °C.

4.17 Repeated assembly

When the test assemblies are ten times mounted and demounted according to the instructions of the principal, the test assemblies shall be leak tight according to clause 4.4.

Test assembly:
One straight fitting with on both sides a pipe. The free length of plastic pipes shall be at least 250 mm and for metal pipes at least 100 mm.

Note: This test shall be carried out if repeated assembly is declared by the manufacturer

4.18 Flow rate / pressure drop

When the test assemblies are tested in accordance to ISO 17778, the flow rate at ambient temperature corresponding to a pressure drop across the fitting shall be in conform the requirement of table 16.

Test medium	Test pressure	Pressure drop	Requirement
Air	25 mbar	$d_n \leq 63$ mm: 0,5 mbar $d_n > 63$ mm: 0,1 mbar	Air flow rate (value indicated by the manufacturer

Table 16: Parameters for flow rate pressure drop relationship.

4.19 Stress corrosion test

When the fitting assembly are tested in accordance to ISO 6957 and table 17, the requirements of table 17 shall be met.

Number of test pieces	pH value of test solution	Requirement
1	10,0	No cracks

Table 17: Parameters for stress corrosion.

5 Marking, instructions and packaging

5.1 Marking

Plastic fittings shall be yellow or clearly marked as a fitting for gas application conform the scope of this approval requirements.

Metal fittings shall be marked by punch or cast or a non-erasable method to the product for gas application conform the scope of this approval requirements.

Fittings shall be marked in a clear and permanent method with the following aspects:

- Name of the manufacturer;
- The name or logo of GASTEC QA quality mark*;
- Material*;
- Nominal connection size(s);
- The maximum operating pressure for which the fitting is designed*;
- SDR class 33 or 41 for PVC-HI fittings*;
- Production date or code*;
- D_{mean} x wall thickness on separate inserts and packages up to and including 32 mm. From 32 mm D_{mean} and SDR class for PE pipe*;

*This information may be on the product, on a label attached to the product or on the smallest packaging.

5.2 Instructions

The manufacturer shall supply an installation manual with the fittings in the Dutch language. The installation manual shall at least consist the following:

- Use of lubricants or greases
- If suitable for repeated assembly

5.3 Packaging

Fittings and additional components required for its assembly can be packed in bulk or individual. The packaging shall prevent deterioration and contaminations of the fittings and additional components.

Packaging shall have information with the manufacturer's name, type of fitting, nominal diameter of the pipe, number of fittings and storage conditions.

6 Quality system requirements

The supplier shall make a risk assessment of the product and production process according to chapter 3.1.1.1 and 3.1.2.1 of the GASTEC QA general requirements. The risk assessments shall be available to Kiwa for review.

7 Summary of tests

This chapter contains a summary of tests to be carried out during:

- The initial product assessment;
- The periodic product verification;

7.1 Test matrix

Description of requirement	Clause	Test within the scope		
		Initial Product assessment	Product verification	
			Verification	Frequency
General aspects				
Field of application	3.1	X		
Materials	3.2			
General	3.2.1	X	X	Once a year
Plastic materials	3.2.2	X	X	Once a year
Metal materials	3.2.3	X	X	Once a year
Elastomers	3.2.4	X	X	Once a year
Appearance	3.3	X	X	Once a year
Colour	3.4	X	X	Once a year
Construction	3.5	X		
Inserts	3.5.1	X		
Connections	3.5.2	X		
Transition couplers	3.5.3	X		
Twisting	3.5.4	X		
Geometrical aspects	3.6			
Fittings	3.6.1	X	X	Once a year
Pipes for mechanical fittings	3.6.2			
Non-end-load fittings made of PVC-HI	3.6.3	X	X	Once a year
Non-end-load fittings made of PE	3.6.4	X	X	Once a year
Insert dimensions	3.6.5	X	X	Once a year
Physical aspects	3.7			
Plastic material	3.7.1	X		
PVC-HI – Vicat	3.7.2	X	X	Once a year
PVC-HI – Influence of heating	3.7.2	X	X	Once a year
PVC-HI – K-value	3.7.2	X	X	Once a year
PVC-HI – DCMT	3.7.2	X	X	Once a year
PE – OIT	3.7.2	X	X	Once a year
PE – MFR	3.7.2	X	X	Once a year
PE – Influence of heating	3.7.2	X	X	Once a year
POM – MFR	3.7.2	X	X	Once a year
PA – Viscosity number	3.7.2	X	X	Once a year
PA – Ash content	3.7.2	X	X	Once a year
PPSU – MFR	3.7.2	X	X	Once a year
CU alloys – Dezincification resistance	3.7.2	X	X	Once a year
FE alloys – Corrosion resistance	3.7.2	X	X	Once a year
Resistance to gas constituents	3.7.3	X		

Description of requirement	Clause	Test within the scope		
		Initial Product assessment	Product verification	
			Verification	Frequency
Performance requirements				
Pressure resistance of the plastic body material	4.3	X		
Leak tightness under internal pressure	4.4	X	X	Once a year
Leak tightness under external pressure	4.5	X		
Long-term hydrostatic strength	4.6	X	X	Once a year
Tensile load at 23 °C	4.7	X	X	Once a year
Tensile load on the weld at 23 °C	4.8	X	X	Once a year
Tensile load after relaxation	4.9	X		
Tensile load at 0 °C	4.10	X		
End load 80 °C	4.11	X		
Tensile load 800h	4.12	X		
Leak tightness after temperature cycling	4.13	X		
Leak tightness while subjected to bending	4.14	X		
Angular deflection / deformation	4.15	X	X	Once a year
Resistance to impact at 0 °C	4.16	X	X	Once a year
Repeated assembly	4.17	X		
Flow rate / pressure drop	4.18	X		
Resistance to corrosion	4.19	X		
Marking, instructions and packaging	5			
Marking	5.1	X	X	Once a year
Instruction	5.2	X		
Packaging	5.3	X		

8 List of referenced documents and source

8.1 Standards / normative documents

All normative references in this Approval Requirement refer to the editions of the standards as mentioned in the list below.

EN 437:2018	*Test gases - Test pressures - Appliance categories*
EN 682:2002	*Elastomeric seals - Materials requirements for seals used in pipes and fittings carrying gas and hydrocarbon fluids*
EN 744:1995	*Plastics piping and ducting systems - Thermoplastics pipes - Test method for resistance to external blows by the round-the-clock method*
EN 1555-2:2010	*Plastics piping systems for the supply of gaseous fuels - Polyethylene (PE) - Part 2: Pipes*
ISO 17885:2015/A1:2016	*Plastics piping systems - Mechanical fittings for pressure piping systems - Specifications*
NEN 7200:2017	*Plastics pipelines for the transport of gas, drinking water and waste water - Buttwelding of PE pipes and PE fittings*
NEN 7230:2011	*Plastics piping systems for gas supply - Pipes of high-impact poly(vinyl chloride) (PVC-HI) - Requirements and test methods*
NEN 7231:2011	*Plastics piping systems for gas supply - Fittings of modified poly(vinyl chloride) (modified-PVC) - Requirements and test methods*
NEN 7240:2011	*Plastics piping systems for gas supply - Tensile resistant couplings of high-impact poly(vinyl chloride) (PVC-HI) - Requirements and test methods*
NEN 3050:1972/C1:2002	*Identification colours for pipes conveying fluids in liquid or gaseous condition in land installations and on board ships*
ISO 580:2005	*Plastics piping and ducting systems - Injection-moulded thermoplastics fittings - Methods for visually assessing the effects of heating*
ISO 1133-1:2011	*Plastics - Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics - Part 1: Standard method*
ISO 1167-1:2006	*Thermoplastics pipes, fittings and assemblies for the conveyance of fluids - Determination of the resistance to internal pressure - Part 1: General method*
ISO 1167-3:2007	*Thermoplastics pipes, fittings and assemblies for the conveyance of fluids - Determination of the resistance to internal pressure - Part 3: Preparation of components*

ISO 1167-4:2007	*Thermoplastics pipes, fittings and assemblies for the conveyance of fluids - Determination of the resistance to internal pressure - Part 4: Preparation of assemblies*
ISO 2507-2:2017	*Thermoplastics pipes and fittings - Vicat softening temperature - Part 2: Test conditions for unplasticized poly(vinyl chloride) (PVC-U) or chlorinated poly(vinyl chloride) (PVC-C) pipes and fittings and for high impact resistance poly (vinyl chloride) (PVC-HI) pipes*
ISO 3458:2015	*Plastics piping systems - Mechanical joints between fittings and pressure pipes - Test method for leaktightness under internal pressure*
ISO 3503:2015	*Plastics piping systems - Mechanical joints between fittings and pressure pipes - Test method for leaktightness under internal pressure of assemblies subjected to bending*
ISO 6509-1:2014	*Corrosion of metals and alloys - Determination of dezincification resistance of copper alloys with zinc - Part 1: Test method*
ISO 6957:1988	*Copper alloys - Ammonia tests for stress corrosion resistance*
ISO 9080:2012	*Plastics piping and ducting systems - Determination of the long-term hydrostatic strength of thermoplastics materials in pipe form by extrapolation*
ISO 11357-6:2018	*Plastics - Differential scanning calorimetry (DSC) - Part 6: Determination of oxidation induction time (isothermal OIT) and oxidation induction temperature (dynamic OIT)*
ISO 13229:2011	*Thermoplastics piping systems for non-pressure applications - Unplasticized poly(vinyl chloride) (PVC-U) pipes and fittings - Determination of the viscosity number and K-value*
ISO 13951:2015	*Plastics piping systems - Test method for the resistance of plastic pipe/pipe or pipe/fitting assemblies to tensile loading*
ISO 13953:2001/ Amd 1:2020	*Polyethylene (PE) pipes and fittings - Determination of the tensile strength and failure mode of test pieces from a butt-fused joint*
ISO 17778:2015	*Plastics piping systems - Fittings, valves and ancillaries - Determination of gaseous flow rate/pressure drop relationships*
ISO 19899:2010	*Plastics piping systems - Polyolefin pipes and mechanical fitting assemblies - Test method for the resistance to end load (AREL test)*

8.2 Source

Parts of the text of this approval requirement have been based on ISO 17885: 2015, NEN 7231, NEN 7240 and approval requirement 131.