

AR 211

September 2018

Approval requirement 211

Plastic corrugated protection pipe



Trust
Quality
Progress

Foreword

This GASTEC QA 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 product certification.

Approved by Board of Experts : 4 September 2018

Accepted by Kiwa Nederland B.V. : 4 September 2018

Kiwa Nederland B.V.

Wilmersdorf 50
Postbus 137
7300 AC Apeldoorn

Tel. 088 998 33 93
Fax 088 998 34 94
info@kiwa.nl
www.kiwa.nl

© 2017 Kiwa N.V.

All rights reserved. No part of this book may be reproduced, stored in a database or retrieval system, or published, in any form or in any way, electronically, mechanically, by print, photoprint, microfilm or any other means without prior written permission from the publisher.

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

Contents

	Foreword	1
	Contents	2
1	Introduction	3
1.1	General	3
1.2	Scope	3
2	Definitions	4
3	Product requirements	5
3.1	Material composition	5
3.2	Appearance	5
3.3	Dimensions	5
4	Performance requirements and testing methods	6
4.1	Corrugated protection pipe, resistance to compression	6
4.2	Determining the resistance against impact	8
4.3	Determining the mass per length	8
5	Marking, instructions and packaging	9
5.1	Marking on the corrugated protection pipe	9
5.2	Instructions	9
5.3	Packaging	9
6	Summary of tests	10
6.1	Test matrix	10
7	List of referenced documents and source	11
7.1	Standards / normative documents	11
7.2	Source	11

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 plastic corrugated protection pipe for multilayer systems.

1.2 Scope

This approval requirement specify the requirements for plastic corrugated protection pipe for the use in combination with multi-layer pipe systems.

Remark:

The use of pipe sleeves is obligatory as mentioned in NPR 3378-6. The inner diameter of the pipe sleeve shall be $\geq D_{\text{multilayer pipe}} + 2\text{mm}$, for outside diameters of multilayer pipes $\leq 63\text{ mm}$. And $\geq 1,1 \times D_{\text{multilayer pipe}}$ for outside diameters of multilayer pipes $> 63\text{ mm}$.

2 Definitions

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

Board of experts: the Board of Experts GASTEC QA

Compression: Difference between the initial diameter and the diameter of a test piece after compression at a specified load for a given time at a given temperature, the difference being referred to the initial thickness.

Compression set: The difference between the initial diameter and the final diameter of a test piece after compression for a given time at a given temperature and after a given recovery time, the difference being referred to the initial diameter.

Inside diameter: Measured inside diameter at any point, rounded up to the nearest 0,1 mm.

Outside diameter: Measured outside diameter through its cross section at any point of a pipe or spigot end of a fitting, rounded up to the nearest 0,1 mm.

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.

3 Product requirements

3.1 Material composition

The material used for production of corrugated protection pipe shall be specified by the manufacturer in its quality system (ICQ).

3.2 Appearance

The profile of the corrugated protection pipe shall be regular. The inner and outer surface shall be smooth and free from holes, bubbles, contamination or other damages

3.3 Dimensions

The dimensions of the corrugated protection pipe shall be specified in the technical drawing of the manufacturer. The measurement of the dimensions shall be according to ISO 3126.

4 Performance requirements and testing methods

4.1 Corrugated protection pipe, resistance to compression

Requirement

The compression after 5 minutes constant load shall not be more than 22%.
After neutralization of the load for a given period, the outside diameter must be at least 85% of its original value

Principle

A test piece is maintained for a specified time at a specified temperature under constant load and the effect on the outer diameter of the test piece is determined after compression and after recovery of this compression load for a specified time.

Apparatus

Compression testing machine, as specified in ISO 9969, but capable of producing at least the specified diametric deflection of the test piece at the applicable speed.
Dimensional and force measuring devices, conforming to ISO 9969, but capable of measuring diametric deflections up to at least the specified deflection and the corresponding compressive forces.

Test pieces

Marking and number of test pieces

The pipe of which the resistance to compression is to be determined shall be marked on its outside with a line along one generatrix over its entire length. The marked line shall be exactly on one of the axial weld lines of the pipe sample. Four test pieces, a, b, c and d, respectively, shall be taken from this marked pipe such that the ends of the test pieces are perpendicular to the pipe axis and their lengths.

Length of test pieces

The length of each test piece shall be (100 ± 1) mm.

Conditioning

The test pieces shall be conditioned in air at $(23 \pm 2)^\circ\text{C}$ for at least 24 h prior to testing.

Procedure

All tests and measurements shall be performed at a temperature of $(23 \pm 2)^\circ\text{C}$.

The outside diameters, d_{0a} , d_{0b} , d_{0c} and d_{0d} , of the respective test pieces, a, b, c and d (see 6.1), shall be determined at mid-length cross-section by in accordance with ISO 3126 at the positions respectively 0° , 90° , 180° and 270° in relation to the marking line on the pipe. Measurements on the outside diameter shall take into account at least two ribs of the corrugated profile of the pipe.

NOTE By definition: $d_{0a} = 0^\circ\text{C}$, $d_{0b} = 90^\circ\text{C}$, $d_{0c} = 180^\circ\text{C}$ and $d_{0d} = 270^\circ\text{C}$.

The parallel plates of the compression testing machine shall be positioned so that contact between the plates is made over the complete area of the plates. This position of the closed plates is set as zero value ($y_0=0$).

Adjust the position of the parallel plates to be able to place the first test piece in such a way that the marking line is in contact with the upper parallel plate. In the loading device, rotate the three other test pieces, b, c and d, respectively 90°, 180° and 270° in relation to the position of the first test piece (a) when placing them in the loading device. Position the test piece with its longitudinal axis parallel to the plates and with its middle point vertically under the centre-line of the load cell.

NOTE In order to obtain the correct reading from the load cell, it is necessary to position the test piece so the expected resulting force is approximately in line with the axis of the load cell.

Adjust the parallel plates with the sample in-between at a distance from each other equal to the measured outside diameter d_{0a} , d_{0b} , d_{0c} and d_{0d} . Keep the parallel plates at this position for (60 ± 2) s and then adjust the deflection gauge and load cell to zero.

Compress the test piece at a constant speed of $(2,0 \pm 0,1)$ mm/min, while continuously recording force and deflection measurements, until reaching a loading force, F , of (200 ± 2) N. This loading force shall be retained at (200 ± 2) N. At the moment that the full force F is achieved, start the timer ($t=0$). Determine the position of the parallel plates from each other (d_{1a} , d_{1b} , d_{1c} and d_{1d}) at (300 ± 2) s after the application of the full load.

Release the loading force (300 ± 2) s after the full force F was achieved to 0 N. After a recovering time of $(60^{+2/-0})$ s for the test piece, determine the positional outer diameters d_{2a} , d_{2b} , d_{2c} and d_{2d} at mid-length cross-section by in accordance with ISO 3126 of the respective test pieces at the same position as the initial measurement.

Calculations

Compression after 5 min of loading

Calculate the compression after loading ($C_{200N,5min}$) as the average of the four individual compression measurements as a percentage rounded to three significant figures.

$$C_{200N,5min} = \left\{ 1 - \frac{\left(\frac{d_{1,a}}{d_{0,a}} + \frac{d_{1,b}}{d_{0,b}} + \frac{d_{1,c}}{d_{0,c}} + \frac{d_{1,d}}{d_{0,d}} \right)}{4} \right\} \times 100\%$$

Compression set after 1 min of recovery

Calculate the compression set after recovery (CS_{1min}) as the average of the four measured test pieces as a percentage rounded to three significant figures.

$$CS_{1min} = \left\{ 1 - \frac{\left(\frac{d_{2,a}}{d_{0,a}} + \frac{d_{2,b}}{d_{0,b}} + \frac{d_{2,c}}{d_{0,c}} + \frac{d_{2,d}}{d_{0,d}} \right)}{4} \right\} \times 100\%$$

Requirements

$C_{200N,5min} \leq 22,0\%$

$CS_{1min} \leq 15,0\%$

4.2 Determining the resistance against impact

Requirement

After 10 impacts no breakage of the corrugated protection pipe shall occur. In case of 1 breakage repeat the test with twice the numbers of test pieces. Over a total of 30 test pieces not more than 2 breakage shall occur.

Apparatus

For the test a free-fall testing machine is needed, provided with a falling object with a spherical arm end with a radius of 12.5 mm and a V-shaped supporting block mounted at an angle of 120°. Besides this a cooling trough is needed, in which the test samples can be conditioned at a temperature of 0 ± 1 °C.

Test samples

For each pipe size 10 test samples are needed with a length of 100 mm. The test samples must be brought to a temperature of (0 ± 1) °C in water or air. For cooling in water, the cooling time is 30 minutes and for cooling in air it is 60 minutes.

Procedure

Lay the test samples on the V-block and let the falling object drop on the middles of the test samples. Each test sample must be tested within 10 seconds of being taken out of the cooling trough. The test conditions to be met for testing are shown in the table below:

Nominal external diameter of the tube concerned ¹⁾	Mass of falling object (in g, ²⁾	Drop height in mm ³⁾
Up to and including 25 mm	250	1000
> 25 mm	250	2000

¹⁾ This refers to the tubes that are concerned with the tube sleeves to be tested.
²⁾ Tolerance: - 0/+ 5 g.
³⁾ Tolerance: - 0/+ 5 mm.

Table: Test conditions for pipe sleeves

4.3 Determining the mass per length

Requirement

The mass per length of the corrugated protection pipe shall be specified by the manufacturer

Procedure

For determining the mass per length three tube sleeves are needed of a length of approximately 1m. The actual length must be determined as accurately as possible. The mass of these pipes must be determined to an accuracy of 0.1 gram with the aid of a weighing apparatus. The mass per length is taken to be the arithmetic mean value of the quotients of the measured lengths and weights.

5 Marking, instructions and packaging

5.1 Marking on the corrugated protection pipe

The tube sleeves shall be marked clearly and permanently at distances of a maximum of 2.5 m with at least the following information.

- GASTEC QA logo or word mark
- Inside diameter
- Manufacture name or logo
- Production code or date

5.2 Instructions

The supplier shall provide instructions. These instructions shall be in the Dutch language and describe that the product is Gastec QA certified. In addition the instructions shall contain information about:

- The use and installation of the product
- Minimum bending radius

5.3 Packaging

The product shall be pack in such a way that contamination or damaging is not possible.

6 Summary of tests

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

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

6.1 Test matrix

Description of requirement	Clause	Test within the scope of		
		Initial product assessment	Product verification	
			Verification	Frequency
	AR 211			
Corrugated protection pipe				
Material composition	3.1	X	X	Once a year
Appearance	3.2	X	X	Once a year
Dimensions	3.3	X	X	Once a year
Resistance to compression	4.1	X	X	Once a year
Resistance to impact	4.2	X	X	Once a year
Mass per length	4.3	X	X	Once a year
Marking on the corrugated protection pipe	5.1	X	X	Once a year
Instructions	5.2	X		
Packaging	5.3	X		

7 List of referenced documents and source

7.1 Standards / normative documents

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

ISO 3126	Plastics piping systems — Plastics components — Determination of dimensions
ISO 9969	Thermoplastics pipes — Determination of ring stiffness

7.2 Source

Parts of the text of this approval requirement have been based on BRL 5610.