BS EN 295-2:2013

BSI Standards Publication

Vitrified clay pipe systems for drains and sewers

Part 2: Evaluation of conformity and sampling

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National foreword

This British Standard is the UK implementation of EN 295-2:2013. It supersedes BS EN 295-2:1991 and, together with BS EN 295-1:2013, BS EN 295-4:2013, BS EN 295-5:2013, BS EN 295-6:2013, and BS EN 295-7:2013, it supersedes BS EN 295-10:2005, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/505, Wastewater engineering.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Published by BSI Standards Limited 2013.

ISBN 978 0 580 70647 9

ICS 23.040.50; 91.140.80; 93.030

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 28 February 2013.

Amendments issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 295-2

February 2013

ICS 93.030

Supersedes EN 295-10:2005, EN 295-2:1991

English Version

Vitrified clay pipe systems for drains and sewers - Part 2: Evaluation of conformity and sampling

Systèmes de tuyaux et accessoires en grès pour les réseaux de branchement et d'assainissement - Partie 2: Evaluation de la conformité et échantillonnage

Steinzeugrohrsysteme für Abwasserleitungen und -kanäle - Teil 2: Bewertung der Konformität und Probenahme

This European Standard was approved by CEN on 1 December 2012.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 295-2:2013: E

Contents

Page

Foreword 3

1 Scope 4

2 Normative references 4

3 Terms and definitions 5

4 Abbreviations 5

5 Evaluation of conformity 5
5.1 General 5
5.2 Initial type testing (ITT) and type testing (TT) 6
5.2.1 General 6
5.2.2 Sampling procedure 6
5.2.3 Test reports 11
5.3 Factory production control (FPC) 12
5.3.1 General 12
5.3.2 Requirements 12
5.3.3 Equipment 13
5.3.4 Raw materials and components 13
5.3.5 Product testing and evaluation 13
5.3.6 Change in batch condition 14
5.3.7 Records 14
5.3.8 FPC testing of pipes, special fittings, adaptors and compatible accessories manholes and inspection chambers, perforated pipes and jacking pipes 14
5.3.9 FPC testing of fittings according to EN 295-1:2013 and EN 295-5:2013 19
5.3.10 FPC testing of joint assemblies according to EN 295-1:2013 23
5.3.11 FPC of polyurethane sealing elements according to EN 295-1:2013, 6.1.2 23
5.3.12 FPC Testing of polypropylene sleeve couplings according to EN 295-1:2013, 6.1.3 24
5.3.13 FPC of rigid fairing materials according to EN 295-1:2013, 6.1.4 26
5.3.14 FPC testing of adaptors and connectors to EN 295-4:2013, 5.7 26
5.3.15 FPC testing of metal banded flexible couplings and adaptors according to EN 295-4:2013, Annex A 27
5.3.16 FPC testing of connectors, insertable fittings and sealing rings for cut pipes for making connections to existing pipelines, manholes or building works according to EN 295-4:2013, Annex B 28
5.3.17 FPC testing of heatshrinkable sleeves according to EN 295-4:2013, Annex C 28
5.3.18 FPC testing of watertightness of manholes and inspection chambers 29
5.3.19 FPC testing of compressive strength of jacking pipes according to EN 295-7:2013 29
5.3.20 FPC testing of joint assemblies of jacking pipes according to EN 295-7:2013 29

Annex A (normative) **Acceptability determination and switching rules** 31
A.1 General 31
A.2 Inspection by attributes 31
A.2.1 Acceptability determination 31
A.2.2 Operation of switching rules 32
A.2.3 Tightened inspection for rejected batches 32
A.3 Inspection by variables 32
A.3.1 Distribution 32
A.3.2 Acceptability determination 33
A.3.3 Operation of switching rules 33

Bibliography 38

Foreword

This document (EN 295-2:2013) has been prepared by Technical Committee CEN/TC 165 “Wastewater engineering”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by August 2013, and conflicting national standards shall be withdrawn at the latest by August 2013.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 295-2:1991 and together with EN 295-1:2013, EN 295-4:2013, EN 295-5:2013, EN 295-6:2013 and EN 295-7:2013 it supersedes EN 295-10:2005.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

The main changes with respect to the previous edition are listed below:

— clauses on Evaluation of conformity revised in accordance with the framework given by the CEN Construction sector;

— requirements for the resistance to high pressure water jetting added;

— requirements for water absorption added.

The standard series EN 295 "Vitrified clay pipe systems for drains and sewers" consists of the following parts:

— *Part 1: Requirements for pipes, fittings and joints*

— *Part 2: Evaluation of conformity and sampling* (the present document)

— *Part 3: Test methods*

— *Part 4: Requirements for adaptors, connectors and flexible couplings*

— *Part 5: Requirements for perforated pipes and fittings*

— *Part 6: Requirements for components of manholes and inspection chambers*

— *Part 7: Requirements for pipes and joints for pipe jacking*

According to the CEN/CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard specifies requirements for the evaluation of conformity of products manufactured from vitrified clay and other materials (referred to as "products") specified in the following standards:

— pipes, fittings and joints according to EN 295-1;

— adapters, connectors and flexible couplings according to EN 295-4;

— perforated pipes and fittings according to EN 295-5;

— components of manholes and inspection chambers according to EN 295-6; and

— pipes and joints for pipe jacking according to EN 295-7.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document 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.

EN 295-1:2013, *Vitrified clay pipe systems for drains and sewers — Part 1: Requirements for pipes, fittings and joints*

EN 295-3:2012, *Vitrified clay pipe systems for drains and sewers — Part 3: Test methods*

EN 295-4:2013, *Vitrified clay pipe systems for drains and sewers — Part 4: Requirements for adaptors, connectors and flexible couplings*

EN 295-5:2013, *Vitrified clay pipe systems for drains and sewers — Part 5: Requirements for perforated pipes and fittings*

EN 295-6:2013, *Vitrified clay pipes systems for drain and sewers — Part 6: Requirements for components of manholes and inspection chambers*

EN 295-7:2013, *Vitrified clay pipe systems for drains and sewers — Part 7: Requirements for pipes and joints for pipe jacking*

EN 681-1, *Elastomeric seals — Materials requirements for pipe joint seals used in water and drainage applications — Part 1: Vulcanized rubber*

EN 681-4, *Elastomeric seals — Materials requirements for pipe joint seals used in water and drainage applications — Part 4: Cast polyurethane sealing elements*

EN ISO 10012, *Measurement management systems — Requirements for measurement processes and measuring equipment (ISO 10012)*

ISO 2859-1, *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

ISO 3951 (all parts), *Sampling procedures for inspection by variables*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
initial type testing
complete set of tests or other procedures (e.g. calculation) described in the harmonised technical specification, to determine the performance of samples of products representative of the product type

Note 1 to entry: In the case of a CE marked product, the initial type testing provides the reference for the declared performance concerning the essential characteristics.

3.2
type testing
test or series of tests aimed at approving a project to determine that the element designed is able to fulfil the requirements of the product specification

3.3
factory production control
permanent internal control of production exercised by the manufacturer

3.4
batch
clearly identifiable collection of units manufactured essentially from the same materials and under the same conditions

3.5
isolated batch
clearly identifiable collection of unassessed units manufactured essentially from the same materials but not necessarily all manufactured or fired at the same time

4 Abbreviations

AQL Acceptance quality limit

MDV Manufacturers declared value

FPC Factory production control

PU Polyurethane

PP Polypropylene

5 Evaluation of conformity

5.1 General

The conformity of the products covered by this European Standard, with the requirements of the corresponding specific product standards (i.e. EN 295-1:2013, EN 295-4:2013, EN 295-5:2013, EN 295-6:2013 and EN 295-7:2013) and with the declared values (including classes) shall be demonstrated by:

— initial type testing and type testing,

— factory production control by the manufacturer, including product assessment.

The manufacturer shall always retain the overall control and shall have the necessary means to take responsibility for the product.

5.2 Initial type testing (ITT) and type testing (TT)

5.2.1 General

Initial type testing and type testing shall be performed to demonstrate compliance of the products with the relevant specific product standards.

All essential characteristics **in bold in Table 1** for which the manufacturer declares performances, are subject to initial type testing. In addition, the need to perform Type Tests applies to the characteristics according to 5.2.2 and 5.2.3 when the manufacturer claims compliance, unless the standard gives provisions (e.g. use of previously existing data, CWFT and conventionally accepted performance) for declaring performances without performing tests.

Tests previously performed in accordance with the provisions of this standard may be taken into account provided that they were made to the same or a more rigorous test method, under the same system of attestation of conformity on the same product or products of similar design, construction and functionality, such that the results are applicable to the product in question.

ITT shall be performed at the beginning of the production of a new type of the product or at the beginning of a new method of production, where this may affect the stated properties. Tests previously performed in accordance with the provisions of the specific product standard (i.e. same product, characteristic(s), test method, sampling procedure, system of attestation of conformity, etc.) may be taken into account for the ITT purpose of that specific product.

Where components of the products are used whose characteristics have already been determined by the component manufacturer on the basis of conformity with other product standards, these characteristics need not be reassessed provided that

— the components' performance or method of assessment remain the same,

— the characteristics of the component are suitable for the intended end use of the finished product, and

— insofar as the manufacturing process does not have a detrimental effect on the determined characteristics.

Components and raw materials, marked in accordance with appropriate harmonised European specifications, may be presumed to have performances as declared. However, this does not replace the responsibility of the product manufacturer to ensure that such products, as a whole, are correctly designed and their components have the necessary performance values to meet the design according to the relevant specific product standard.

Tests shall be repeated for the appropriate characteristics wherever a change occurs in the product design, in the raw material or in the supplier of the components, or in the production process, which could affect significantly one or more of the characteristics.

Full reports of these tests shall be retained by the product manufacturer and shall be available for examination. Complete test reports shall be kept for at least 10 years.

5.2.2 Sampling procedure

Test samples shall be selected from a batch at random, without any consideration given to the condition or quality of the selected products. Sampling shall be carried out in accordance with Tables 1 to 5 according to the relevant specific product standard.

Table 1 — Number of units and conformity criteria for initial type testing and type testing of pipes, fittings and joints according to EN 295-1:2013

Characteristic	Requirement according to EN 295-1: 2013, clause	Test method according to	Number of units	Conformity criteria
Pipes and fittings:				
Material, manufacture, appearance	5.1.1, 5.1.2 and 5.1.4	Visual inspection	3 samples of each nominal size	"Pass"
Water absorption	5.1.3	EN 295-3:2012, Clause 28	3 samples	"Pass"
Dimensions and tolerances	5.2 to 5.8, 6.3, 6.4	Measurement, EN 295-3:2012 Clauses 5 and 6, where applicable	3 samples of each nominal size	"Pass"
Crushing strength	5.9	EN 295-3:2012, Clause 7	3 samples of each nominal size	"Pass" acc. to the value declared
Chemical resistance	5.15	EN 295-3:2012, Clause 13	3 samples	"% loss"
Bending moment resistance	5.11	EN 295-3:2012, Clause 9	3 samples of each nominal size	"Pass" acc. to the value declared
Watertightness of pipes and juctions	5.14	EN 295-3:2012, Clause 12	1 sample of each nominal size	"Pass"
Airtightness of pipes	5.18	EN 295-3:2012, Clause 16	1 sample of each nominal size	"Pass"
Bond strength of fittings	5.12	EN 295-3:2012, Clause 10	1 sample of each nominal size	"Pass"
Watertightness and airtightness of fittings	5.19	EN 295-3:2012, Clause 16	1 sample of each nominal size	"Pass"
Resistance to high pressure water jetting	5.20	EN 295-3:2012, 17.2 and 17.3	3 samples	"Pass"
Joints:				
Material:				
— Rubber sealing elements	6.1.1	EN 681-1	See EN 681-1	See EN 681-1
— Polyurethane sealing elements	6.1.2	EN 681-4	See EN 681-4	See EN 681-4
— Polypropylene sleeve couplings	6.1.3	EN 295-3:2012, Clause 19	one sample per moulding plant	"Pass"
— Creep resistance of rigid fairing materials	6.1.4	EN 295-3:2012, 25.1 or 25.2, as appropriate	one sample per moulding plant	"Pass"
— Other jointing materials	6.1.5	Manufacturer's declaration	–	MDV
Watertightness of joint assemblies	6.2	EN 295-3:2012, Clause 21	1 joint assembly of each nominal size	"Pass"
Chemical and physical resistance to effluent	6.5	EN 295-3:2012, Clause 23	one size of joint assembly	"Pass"
Thermal cycling stability	6.6	EN 295-3:2012, 24.1	1 joint assembly of each system	"Pass"
Long-term thermal stability	6.7	EN 295-3:2012, 24.2	1 joint assembly of each system	"Pass"

NOTE 1 For reaction to fire see EN 295-1:2013, 7.1.
NOTE 2 For durability see EN 295-1:2013, 7.2.
NOTE 3 For dangerous substances see EN 295-1:2013, 7.3.

Table 2 — Number of units and conformity criteria for initial type testing and type testing of adaptors, connectors, flexible couplings and heat shrinkable sleeves according to EN 295-4:2013

Characteristic	Requirement according to	Test method according to	Number of units	Conformity criteria
Adaptors, connectors and flexible couplings:				
Vitrified clay material, manufacture, appearance	EN 295-4:2013, 5.1, A.3.1, B.2 to B.4 and C.2	Visual inspection	3 samples of each nominal size	"Pass"
Joint materials: — Rubber sealing elements	EN 295-4:2013, 5.1.2	EN 681-1	see EN 681-1	See EN 681-1
— Polyurethane sealing elements	EN 295-4:2013, 5.1.3	EN 681-4	see EN 681-4	See EN 681-4
— Tension band strength	EN 295-4:2013, A.3.3.4	EN 295-4:2013, A.3.4.2	one sample of each size group	"Pass"
Water absorption	EN 295-4:2013, 5.1.1, B.2 to B.4	EN 295-3:2012, Clause 28	3 samples	"Pass"
Dimensions and tolerances	EN 295-4:2013, 5.2 to 5.5, A.3.2, B.2 to B.4 and C.3	Measurement, EN 295-3:2012 Clauses 5 and 6, where applicable	3 samples of each nominal size	"Pass"
Tightness of adaptors and connectors	EN 295-4:2013, 5.7	EN 295-3:2012, Clause 12 or 16	1 sample of each nominal size	"Pass"
Bond strength of fittings	EN 295-4:2013, 5.6	EN 295-3:2012, Clause 19	1 sample of each nominal size	"Pass"
Chemical resistance	EN 295-4:2013, 5.8	EN 295-3:2012, Clause 13	3 samples	"Pass"
Watertightness of joint assemblies	EN 295-4:2013, 5.9, B.4 and B.5	EN 295-3:2012, Clause 21	1 joint assembly of each nominal size	"Pass"
Watertightness of metal banded flexible couplings and adaptors	EN 295-4:2013, A.3.3.2 and A.3.3.3	EN 295-3:2012, Clause 21	Once for each new joint design or new joint material	"Pass"
	EN 295-4:2013, A.3.4.1	EN 295-3:2012, Clause 21	Only one joint assembly of specific size	"Pass"
Chemical and physical resistance to effluent	EN 295-1:2013, 6.5	EN 295-3:2012, Clause 23	one size of joint assembly	"Pass"
Thermal cycling stability	EN 295-1:2013, 6.6	EN 295-3:2012, 24.1	1 joint assembly of each system	"Pass"
Long-term thermal stability	EN 295-1:2013, 6.7	EN 295-3:2012, 24.2	1 joint assembly of each system	"Pass"
Watertightness of Heatshrinkable sleeves	EN 295-4:2013, C.4	EN 295-3:2012, Clause 21	1 joint assembly of specific size	"Pass"

NOTE 1 For reaction to fire see EN 295-1:2013, 6.1.
NOTE 2 For durability see EN 295-1:2013, 6.2.
NOTE 3 For dangerous substances see EN 295-1:2013, 7.3.

Table 3 — Number of units and conformity criteria for initial type testing and type testing of perforated pipes according to EN 295-5:2013

Characteristic	Requirement according to EN 295-5:2013, Clause	Test method according to	Number of units	Conformity criteria
Perforated pipes:				
Material, manufacture, appearance	4.1	Visual inspection	3 samples of each nominal size	"Pass"
water absorption	4.1	EN 295-3:2012, Clause 28	3 samples	"Pass"
Dimensions and tolerances	4.2 to 4.7	Measurement, EN 295-3:2012 Clauses 5 and 6, where applicable	3 samples of each nominal size	"Pass"
Crushing strength	4.8	EN 295-3:2012, Clause 7	3 samples of each nominal size	"Pass"
Chemical resistance	4.9	EN 295-3:2012, Clause 13	3 samples	"% loss”"

NOTE 1 For reaction to fire see EN 295-1:2013, 6.1.
NOTE 2 For durability see EN 295-1:2013, 6.2.
NOTE 3 For dangerous substances see EN 295-1:2013, 7.3.

Table 4 — Number of units and conformity criteria for initial type testing and type testing for components for manholes in accordance with EN 295-6:2013

Characteristic	Requirement according to	Test method according to	Number of units	Conformity criteria
Components for manholes:				
Material, manufacture, appearance	EN 295-6:2013, 4.1	Visual inspection	3 samples of each nominal size	"Pass"
water absorption	EN 295-6:2013, 4.1	EN 295-3:2012, Clause 28	3 samples	"Pass"
Joint materials: — Rubber sealing elements	EN 295-6:2013, 4.1.2	EN 681-1	See EN 681-1	See EN 681-1
— Polyurethane sealing elements	EN 295-6:2013, 4.1.3	EN 681-4	See EN 681-4	See EN 681-4
— Polypropylene sleeve couplings	EN 295-6:2013, 4.1.4	EN 295-3:2012, Clause 19	one sample per moulding plant	"Pass"
— Other jointing materials	EN 295-6:2013, 4.1.5	Visual inspection of manufacturer's declaration	–	MDV
Dimensions and tolerances	EN 295-6:2013, 4.2 to 4.5 and 4.12	Measurement, EN 295-3:2012, Clauses 5 and 6, where applicable	3 samples of each nominal size	"Pass"
Crushing strength	EN 295-6:2013, 4.6	EN 295-3:2012, Clause 7	3 samples of each nominal size	"Pass"
Bond strength of fittings	EN 295-6:2013, 4.8	EN 295-3:2012, Clause 19	1 sample of each nominal size	"Pass"
Chemical resistance	EN 295-6:2013, 4.10	EN 295-3:2012, Clause 13	3 samples	"% loss"
Watertightness of assembled components of manholes and inspection chambers	EN 295-6:2013, 4.11 and 4.12	EN 295-3:2012, Clause 26	1 assembly of each nominal size including one joint	"Pass"
Chemical and physical resistance to effluent	EN 295-1:2013, 6.5	EN 295-3:2012, Clause 23	one size of joint assembly according to EN 295-1	"Pass"
Thermal cycling stability	EN 295-1:2013, 6.6	EN 295-3:2012, 24.1	1 joint assembly of a system according to EN 295-1	"Pass"
Long-term thermal stability	EN 295-1:2013, 6.7	EN 295-3:2012, 24.2		"Pass"

NOTE 1 For reaction to fire see EN 295-1:2013, 6.1.
NOTE 2 For durability see EN 295-1:2013, 6.2.
NOTE 3 For dangerous substances see EN 295-1:2013, 7.3.

Table 5 — Number of units and conformity criteria for initial type testing and type testing for vitrified pipes and joints for pipe jacking according to EN 295-7:2013

Characteristic	Requirement according to	Test method according to	Number of units	Conformity criteria
Pipes and fittings for pipe jacking:				
Material, manufacture, appearance	EN 295-7:2013, 4.1	Visual inspection	3 samples of each nominal size	"Pass"
water absorption	EN 295-7:2013, 4.1	EN 295-3:2012, Clause 28	3 samples	"Pass"
Dimensions and tolerances	EN 295-7:2013, 4.2.2 to 4.2.8	Measurement, EN 295-3:2012, Clauses 5 and 6, where applicable	3 samples of each nominal size	"Pass"
Crushing strength	EN 295-7:2013, 4.3.1	EN 295-3:2012, Clause 7	3 samples of each nominal size	"Pass"
Watertightness of pipes	EN 295-7:2013, 4.4	EN 295-3:2012, Clause 12	1 sample of each nominal size	"Pass"
Airtightness of pipes	EN 295-7:2013, 4.5	EN 295-3:2012, Clause 16	1 sample of each nominal size	"Pass"
Joints for pipe jacking:				
Joint materials: — Rubber sealing elements	EN 295-7:2013, 5.1.1	EN 681-1	See EN 681-1	See EN 681-1
— Polyurethane sealing elements	EN 295-7:2013, 5.1.2	EN 681-4	See EN 681-4	See EN 681-4
— Polypropylene sleeve couplings	EN 295-7:2013, 5.1.4	EN 295-3:2012, Clause 19	one sample per moulding plant	"Pass"
— Stainless steel	EN 295-7:2013, 5.1.3	Manufacturer's declaration	–	MDV
— Other jointing materials	EN 295-7:2013, 5.1.5	Manufacturer's declaration	–	MDV
Watertightness of joint assemblies	EN 295-7:2013, 5.3	EN 295-3:2012, Clause 21	1 joint assembly of each nominal size	"Pass"
Chemical and physical resistance to effluent	EN 295-7:2013, 5.6	EN 295-3:2012, Clause 23	one size of joint assembly	"Pass"
Thermal cycling stability	EN 295-1:2013, 6.6	EN 295-3:2012, 24.1	1 joint assembly of a system	"Pass"
Long-term thermal stability	EN 295-1:2013, 6.7	EN 295-3:2012, 24.2	1 joint assembly of a system	"Pass"

NOTE 1 For reaction to fire see EN 295-1:2013, 6.1.
NOTE 2 For durability see EN 295-1:2013, 6.2.
NOTE 3 For dangerous substances see EN 295-1:2013, 7.3.

5.2.3 Test reports

The results of all type tests shall be recorded and held by the manufacturer for at least 10 years after the last date of production of the product(s) to which they apply.

5.3 Factory production control (FPC)

5.3.1 General

The manufacturer shall establish, document and maintain an FPC system to ensure that the products placed on the market comply with the declared performance of the characteristics. The FPC system shall consist of procedures, regular inspections and tests and/or assessments and the use of the results to control raw and other incoming materials or components, equipment, the production process and the product. All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures.

This production control system documentation shall ensure a common understanding of conformity evaluation and enable the achievement of the required product characteristics and the effective operation of the production control system to be checked. Factory production control therefore brings together operational techniques and all measures allowing maintenance and control of the compliance of the product with the declared performance of the essential characteristics.

5.3.2 Requirements

The manufacturer is responsible for organising the effective implementation of the FPC system. Tasks and responsibilities in the production control organisation shall be documented and this documentation shall be kept up-to-date.

The manufacturer shall draw up and keep up-to-date documents defining the factory production control. The manufacturer's documentation and procedures, including regular internal inspections and test and/or assessments and the use of the results to control raw and other incoming materials or components, equipment and the production process, should be appropriate to the product and manufacturing process. The FPC system should achieve an appropriate level of confidence in the conformity of products placed on the market. This involves:

a) the preparation of documented procedures and instructions relating to factory production control operations, in accordance with the requirements of the technical specification to which reference is made;

b) the effective implementation of these procedures and instructions;

c) the recording of these operations and their results;

d) the use of these results to correct any deviations, repair the effects of such deviations, treat any resulting instances of non-conformity and, if necessary, revise the FPC to rectify the cause of non-conformity.

The responsibility, authority and the relationship between personnel that manage, perform or verify work affecting product conformity, shall be defined. This applies in particular to personnel that need to initiate actions preventing component non-conformities from occurring, actions in case of non-conformities and to identify and register component conformity problems. Personnel performing work affecting component conformity shall be competent on the basis of appropriate education, training, skills and experience for which records shall be maintained.

In each factory, the manufacturer may delegate the action to a person having the necessary authority to:

— identify procedures to demonstrate conformity of the product at appropriate stages;

— identify and record any instance of non-conformity;

— identify procedures to correct instances of non-conformity.

Where subcontracting takes place, the manufacturer shall retain the overall control of the product and ensure that he receives all the information that is necessary to fulfil his responsibilities according to this European Standard.

If the manufacturer has part of the product designed, manufactured, assembled, packed, processed and/or labelled by subcontracting, the FPC of the subcontractor may be taken into account, where appropriate for the product in question.

The manufacturer who subcontracts all of his activities may in no circumstances pass these responsibilities on to a subcontractor.

NOTE Manufacturers having an FPC system, which complies with EN ISO 9001 series standards and which addresses the requirements of this European Standard are recognised as satisfying the FPC requirements of the Council Directive 89/106/EEC.

Acceptability and switching rules to be applied for the FPC are given in Annex A.

5.3.3 Equipment

5.3.3.1 Testing

All weighing, measuring and testing equipment shall be calibrated and regularly inspected according to documented procedures, frequencies and criteria. The measurement and calibration of inspection equipment shall be carried out in accordance with the requirements of EN ISO 10012.

5.3.3.2 Manufacturing

All equipment used in the manufacturing process shall be regularly inspected and maintained to ensure use, wear or failure does not cause inconsistency in the manufacturing process. Inspections and maintenance shall be carried out and recorded in accordance with the manufacturer's written procedures and the records retained for the period defined in the manufacturer's FPC procedures.

5.3.4 Raw materials and components

The specifications of all incoming raw materials and incoming components for each type of the product according to the relevant specific product standard shall be documented together with the inspection scheme for ensuring their conformity.

5.3.5 Product testing and evaluation

5.3.5.1 General

The manufacturer shall establish procedures to ensure that the declared values of all of the characteristics are maintained. Conformity of the products, representative of the production to the relevant requirements, shall be evaluated. Test procedures and test frequencies shall be established.

5.3.5.2 Visual inspection

Products shall be visually inspected for freedom from such flaws as would impair their function when in service. Samples shall be selected for testing after the rejection of such flawed products.

5.3.5.3 Rejection after retest

In the event of a batch being rejected after re-testing, as an alternative to rejecting the entire batch, it can be 100 % tested for the feature in question, and only those items found to comply will be accepted.

Any batch of pipes and/or fittings/or joints, which has failed to meet requirements not subject to threshold values of the appropriate specific product standard may be offered for an alternative specification for which it qualifies and marked accordingly. For example, a batch of pipes that fail the crushing test for one strength class, could be offered for sale at lower strength class (provided they pass the crushing test for the lower strength).

5.3.6 Change in batch condition

For the purposes of the FPC requirements, each of the following, either singly or in combination, illustrate a change in condition, whereby units of fired clay shall be placed in a different batch. They cannot be considered as being from the same batch as they are not manufactured essentially from the same materials and/or under the same conditions:

a) alterations to firing conditions (other than those required to maintain a setting);

b) a clay blend formula is changed;

c) any experimental work with temperature or clay blends.

5.3.7 Records

Records shall be maintained for a minimum period of 10 years, including the following:

a) data indicating the blend (or stockpile) of clay used and the dates of production of fired ware manufactured from that blend from any kiln;

b) details of pipes and fittings, which have been glazed and the glaze used;

c) details of fired fittings, which have been surface treated after firing together with the specification(s) of materials used;

d) the specification of materials used for fixing fired parts together with supplier(s)´s declaration(s) in respect of each consignment of the material showing compliance with the specification(s);

e) functional dimensions for sealing elements and fairings for every design and nominal size of flexible mechanical joint;

f) details of materials used for fairings or sealing elements for every design and nominal size of flexible mechanical joint, together with supplier(s)´s declaration(s) in respect of each consignment of the material showing compliance with the specification(s).

5.3.8 FPC testing of pipes, special fittings, adaptors and compatible accessories manholes and inspection chambers, perforated pipes and jacking pipes

5.3.8.1 Requirements, tests and test frequencies

Testing under the factory production control shall be carried out to the requirements and test frequencies according to Table 6 to Table 10.

Table 6 — Testing of pipes according to EN 295-1:2013

Characteristic	Requirement according to EN 295-1: 2013, clause	Test method according to EN 295-3:2012, clause	Test frequency and sampling according to EN 295-2:2013, clause	Conformity criteria
Crushing strength	5.9	7	5.3.8.2 to 5.3.8.5	"Pass"
Bending moment resistance	5.11	9	5.3.8.7	"Pass"
Dimensional tolerances:				
— Minimum internal diameter	5.2	Measurement	5.3.8.2 to 5.3.8.5	"Pass"
— Length	5.3	Measurement	5.3.8.2 to 5.3.8.5	"Pass"
— Squareness of ends	5.4	5	5.3.8.2 to 5.3.8.5	"Pass"
— Deviation from straightness	5.5	6	5.3.8.2 to 5.3.8.5	"Pass"
— Joint interchangeability	6.4, Table 14, d_3 6.4, Table 13, d_4 [a]	Measurement	5.3.8.2 to 5.3.8.5	"Pass"
— Continuity of invert	6.3	22	5.3.8.2 to 5.3.8.5	"Pass"
Tightness of pipes or pipe sections and junctions:				
— Airtightness	5.18	16	5.3.8.6	"Pass"
— Watertightness	5.14	12	5.3.8.6	"Pass"
Water absorption	5.1.3	28	5.3.8.6	"Pass"
Marking	9.1	Visual inspection	3 samples of each nominal size	"Pass"
NOTE For reaction to fire, durability and dangerous substances see EN 295-1:2013, 7.1, 7.2 and 7.3 respectively.				
[a] If the diameters are measured to clay surfaces.				

Table 7 — Testing of adaptors, connectors and flexible couplings to EN 295-4:2013

Characteristics	Requirements according to EN 295-4:2013, Clause	Test according to Clause	Test frequency according to EN 295-2:2013, Clause	Conformity criteria
Dimensional tolerances:				
— Minimum internal diameter	5.2	Measurement	5.3.8.2 to 5.3.8.4	"Pass"
— Length	5.3	Measurement	5.3.8.2 to 5.3.8.4	"Pass"
— Angles	5.4	Measurement	5.3.8.2 to 5.3.8.4	"Pass"
— Squareness of ends	5.5	Measurement	5.3.8.2 to 5.3.8.4	"Pass"
— Joint interchangeability	5.5	Measurement	5.3.8.2 to 5.3.8.4	"Pass"
— Metal banded flexible couplings	A.3.2	Measurement	5.3.15.1	"Pass"
— Connectors, insertable fittings and sealing rings	B.2, B.3 and B.4	Measurement	5.3.16.1	"Pass"
— Heatshrinkable sleeves	C.3	Measurement	5.3.17.1	"Pass"
Tightness of adaptors and connectors:				
— Airtightness	5.7	EN 295-3:2012, Clause 16	5.3.14	"Pass"
— Watertigtness		EN 295-3:2012, Clause 12		"Pass"
Water absorption	5.1.1	EN 295-3:2012, Clause 28	5.3.8.6	"Pass"
Watertightness of metal banded flexible couplings	A.3.3	EN 295-3:2012, Clause 21	5.3.15.2	"Pass"
Strength of metal banded flexible couplings	A.3.3.4	EN 295-4:2012, A.3.4.2	5.3.15.2.3	"Pass"
Tightness of connectors insertable fittings and sealing rings	B.5	EN 295-3:2012, Clause 21	5.3.16.2	"Pass"
Watertightness of Heatshrinkable sleeves	C.4	EN 295-3:2012, Clause 21	5.3.17.2	"Pass"
Marking	7	Visual inspection	3 samples of each nominal size	"Pass"
NOTE For reaction to fire, durability and dangerous substances see EN 295-1:2013, 7.1, 7.2 and 7.3 respectively.				

Table 8 — Testing of perforated pipes according to EN 295-5:2013

Characteristics	Requirements according to EN 295-5:2013, Clause	Test according to EN 295-3:2012, Clause	Test frequency according to EN 295-2:2013, Clause	Conformity criteria
Crushing strength	4.8	7	5.3.8.2 to 5.3.8.5	"Pass"
Dimensions and tolerances:				
— Minimum internal diameter	4.2	Measurement	5.3.8.2 to 5.3.8.5	"Pass"
— Length	4.3	Measurement	5.3.8.2 to 5.3.8.5	"Pass"
— Deviation from straightness	4.4	6	5.3.8.2 to 5.3.8.5	"Pass"
— Angle of curvature and radius of bends	4.5	Measurement	5.3.9.2 to 5.3.9.4	"Pass"
— Branch angle of junctions	4.6	Measurement	5.3.9.2 to 5.3.9.4	"Pass"
— Perforations	4.7	Measurement	5.3.8.2 to 5.3.8.5	MDV
Water absorption	4.1	28	5.3.8.6	"Pass"
Marking	8	Visual inspection	3 samples of each nominal size	"Pass"
NOTE For reaction to fire, durability and dangerous substances see EN 295-1:2013, 7.1, 7.2 and 7.3 respectively.				

Table 9 — Testing of components of manholes and inspection chambers according to EN 295-6:2013

Characteristics	Requirements according to EN 295-6:2013 Clause	Test according to EN 295-3:2012, Clause	Test frequency according to EN 295-2:2013, Clause	Conformity criteria
Crushing strength	4.6	7	5.3.8.2 to 5.3.8.5	"Pass"
Bond strength of adhesives used for fixing fired clay parts together	4.8	10	5.3.8.2 to 5.3.8.5	"Pass"
Dimensional tolerances:				
— Minimum internal diameter of chamber rings and raising pieces	4.2.1	Measurement	5.3.8.2 to 5.3.8.5	"Pass"
— Minimum internal diameter of pipeline connections	4.2.2	Measurement	5.3.8.2 to 5.3.8.5	"Pass"
— Height	4.3	Measurement	5.3.8.2 to 5.3.8.5	"Pass"
— Angle of curvature and radius of channel bands	4.4	Measurement	5.3.8.2 to 5.3.8.5	"Pass"
— Branch angle of channel junctions	4.5	Measurement	5.3.8.2 to 5.3.8.5	"Pass"
— Joint systems	4.13	Measurement	5.3.8.2 to 5.3.8.5	"Pass"
Watertightness	4.11	26	5.3.18	"Pass"
Water absorption	4.1.1	28	5.3.8.6	"Pass"
Marking	7	Visual inspection	3 samples of each nominal size	"Pass"
NOTE For reaction to fire, durability and dangerous substances see EN 295-1:2013, 7.1, 7.2 and 7.3 respectively.				

Table 10 — Testing of pipes for pipe jacking according to EN 295-7:2013

Characteristics	Requirements according to EN 295-7:2013, clause	Test according to EN 295-3:2012, clause	Test frequency according to EN 295-2:2013, clause	Conformity criteria
Crushing strength	4.3.1	7	5.3.8.2 to 5.3.8.5	"Pass"
Compressive strength	4.3.3	27	5.3.19	"Pass"
Dimensional tolerances:				
— Minimum internal diameter	4.2.2	Measurement	5.3.8.2 to 5.3.8.5	"Pass"
— Continuity of invert	4.2.4	22	5.3.8.2 to 5.3.8.5	"Pass"
— External diameter	4.2.5	Measurement	5.3.8.2 to 5.3.8.5	"Pass"
— Length	4.2.6	Measurement	5.3.8.2 to 5.3.8.5	"Pass"
— Squareness of ends	4.2.7	5	5.3.8.2 to 5.3.8.5	"Pass"
— Straightness	4.2.8	6	5.3.8.2 to 5.3.8.5	"Pass"
Tightness				
— Watertightness	4.4	12	5.3.8.6	"Pass"
— Airtightness	4.5	16	5.3.8.6	
Water absorption	4.1	28	5.3.8.6	"Pass"
Marking	8	Visual inspection	3 samples of each nominal size	"Pass"
NOTE For reaction to fire, durability and dangerous substances see EN 295-1:2013, 7.1, 7.2 and 7.3 respectively.				

5.3.8.2 Batch sizes for pipes

The following batch sizes shall be used for:

a) continuous kilns - not greater than the production drawn from one kiln, within a one week period, sub-divided according to nominal size and strength class;

b) intermittent kilns - total production from one kiln, per firing, sub-divided according to nominal size and strength class;

c) isolated batch - not exceeding 3 200 units in number.

5.3.8.3 Sample size for pipes for quality control at the manufacturer's works

Sampling and testing procedures, in respect of any batch, shall be completed prior to removal from the works and shall be in accordance with:

a) Tables A.1, A.2 and A.4 and their switching rules, which are consistent with ISO 2859-1 at the AOL of 6,5 % and inspection level S3 for sampling of continuing series of batches by attributes. For EN 295-1:2012, 5.9, the AQL shall be 4,0 % and the inspection level S3 of ISO 2859-1; or

b) Tables A.6, A.7 and A.8 and their switching rules, which are consistent with ISO 3951 (all parts) at the AQL of 6,5 % and inspection level S3 for sampling of continuing series of batches by variables. For EN 295-1:2012, 5.9, the AQL shall be 4,0 % and the inspection level S3 of ISO 2859-1; or

c) Table A.5 for sampling of isolated batches by attributes (maximum batch size 3 200).

5.3.8.4 Retest procedure for pipes from rejected batches

As an alternative to rejecting entire batches or carrying out 100 % testing, batches rejected under the sampling procedure, specified in 5.3.8.3 or 5.3.8.5 can be resubmitted once, after the removal of pipes with previously undetected defects, under the tightened procedure given in Table A.5 in respect only of the defect that caused initial rejection.

5.3.8.5 Sampling after delivery from the manufacturer's works

Sampling shall be in accordance with Table A.1, except where a batch is resubmitted after rejection when 5.3.8.4 shall then apply.

5.3.8.6 Test frequency for water- and airtightness and water absorption

Watertightness of pipes according to EN 295-1:2013, 5.14, and EN 295-7:2013, 4.9, shall be tested at least once per week at the rate of one pipe or pipe section from each nominal size manufactured during that week.

Airtightness of pipes according to EN 295-1:2013, 5.18, and EN 295-7:2013, 4.10, and the bending moment resistance according to EN 295-1:2013, 5.11, shall be tested at least twice per year at the rate of one pipe or pipe section from each nominal size manufactured.

Water absorption according to EN 295-1:2013, 5.1.3 shall be tested once per week at one pipe or pipe section from each nominal size manufactured. In the event of a test failure, a further three tests shall be carried out on the same nominal size of pipe. Should a further failure on retest occur then the pipes will not comply with the requirements on the nominal size of pipe affected. Production shall be suspended until the cause of the failure has been identified and eliminated. Conformity may be re-established following three successful tests on the same nominal size.

5.3.8.7 Test frequency for bending moment resistance

The bending moment resistance according to EN 295-1:2013, 5.11, shall be tested at least every six months at the rate of one pipe or pipe section from each nominal size manufactured during the previous six months. In the event of a test failure, a further three tests shall be carried out on the same nominal size of pipe. Should a further failure on retest occur, then the pipes will not comply with the requirements on the nominal size of pipe affected. Production shall be suspended until the cause of the failure has been identified and eliminated. Conformity may be re-established following three successful tests on the same nominal size.

5.3.9 FPC testing of fittings according to EN 295-1:2013 and EN 295-5:2013

5.3.9.1 Requirements, tests and test frequencies

Testing shall be carried out on fittings for the requirements according to EN 295-1:2013, 5.2, 5.3, 5.6, 5.7, 5.8, 5.18, 5.19 and 6.4, Table 14 for the mean values of d_3 and Table 13 for the mean values of d_4 if the diameters are measured to clay surfaces.

Test frequencies shall be according to Table 12, to the applicable requirements given in Table 11.

NOTE Fittings listed in Table 11 are grouped and dealt with in EN 295-1 as fittings.

Table 11 — Applicable dimensional and performance requirements for fittings

Fitting group	Minimum Internal diameter [a]	Length	Water seal [b]	Angle of curvature	Branch angle	Water-tightness	Airtightness and tightness of fittings
	EN 295-1:2013, clause						
	5.2	5.3	5.6	5.7	5.8	5.14	5.18 and 5.19
Taper and splay pipes	X	X	–	–	–	–	X
Access and inspection pipes and chambers, Channels and taper channels	X	X	–	–	–	–	–
Bends, taper and rest	X	–	–	X	–	–	X
Channel bends, access and inspection bends, saddles and oblique saddles	X	–	–	X	–	–	–
Junctions	X	X	–	–	X	X	X
Channel junctions, access junctions, taper channel bends	X	X	–	X	X	–	–
Trapped gullies, low back traps, siphons and interceptors	X	–	X	–	–	–	–
Trapless gullies, hoppers and raising pieces	X	–	–	–	–	–	–

NOTE 1 The symbol "X" denotes the applicable clause in EN 295-1:2013.

NOTE 2 For reaction to fire, durability and dangerous substances see EN 295-1:2013, 7.1, 7.2 and 7.3 respectively.

[a] Applies to pipeline connections only.

[b] Where the dimensions of water seal are governed by a master mould, the appropriate dimensions of the master mould may be measured.

Table 12 —Testing of fittings according to EN 295-1:2013

Characteristic	Requirement according to EN 295-1:2013, Clause	Test according to EN 295-3:2012, Clause	Test frequency and sampling according to EN 295-2:2013, Clause	Conformity criteria
Bond strength of adhesive used for fixing fired clay parts together	5.12.1	10	5.3.9.9	"Pass"
Dimensional tolerances				
— Minimum internal diameter	5.2	Measurement	5.3.9.2 to 5.3.9.4	"Pass"
— Length	5.3	Measurement	5.3.9.2 to 5.3.9.4	"Pass"
— Water seal of fittings	5.6	Measurement	5.3.9.5 and 5.3.9.8	"Pass"
— Angle of curvature and radius of bends	5.7	Measurement	5.3.9.2 to 5.3.9.4	"Pass"
— Branch angle of junctions	5.8	Measurement	5.3.9.2 to 5.3.9.4	"Pass"
— Joint inter-changeability	6.4, Table 14, d_3 6.4, Table 13, d_4 [a]	Measurement	5.3.9.2 to 5.3.9.4	"Pass"
— Continuity of invert	6.3	22	5.3.9.2 to 5.3.9.4	"Pass"
Tightness				
— Airtightness	5.18 and 5.19	16	5.3.9.6 and 5.3.9.8	"Pass"
— Watertightness	5.14 and 5.19	12	5.3.9.7 and 5.3.9.8	"Pass"

NOTE For reaction to fire, durability and dangerous substances see EN 295-1:2013, 7.1, 7.2 and 7.3 respectively.

[a] If the diameters are measured to clay surfaces.

5.3.9.2 Batch sizes for fittings

The following batch sizes shall be used for:

a) continuous kilns - not greater than the production drawn from one kiln, within a period of one week, sub-divided into nominal size and fitting group;

b) intermittent kilns - total production from one kiln, per firing, sub-divided into nominal size and fitting group;

c) isolated batches - not exceeding 3 200 units in number;

d) for fittings made by fixing fired clay parts together, the batch size shall not exceed one week's production.

5.3.9.3 Sample size for fittings

Sampling and testing procedures in respect of any batch shall be completed prior to removal from the works and shall be in accordance with:

a) Tables A.1, A.2 and A.4 and their switching rules which are consistent with ISO 2859-1 at the AOL of 6,5 % and inspection level S3 for sampling of continuing series of batches by attributes; or

b) Tables A.6, A.7 and A.8 and their switching rules which are consistent with ISO 3951 (all parts) at the AQL of 6,5 % and inspection level S3, for sampling of continuing series of batches by variables; or

c) Table A.5 for sampling of isolated batches by attributes (maximum batch size 3 200).

5.3.9.4 Retest procedure for fittings from rejected batches

As an alternative to rejecting entire batches or carrying out 100 % testing, batches rejected under the sampling procedure, specified in 5.3.8.3 can be resubmitted once, after the removal of pipes with previously undetected defects, under the tightened procedure given in Table A.5 in respect only of the defect that caused initial rejection.

5.3.9.5 Test frequency for water seal of fittings according to EN 295-1:2013, 5.6

The measurement shall be carried out on fittings whose shape permits it, at least at monthly intervals at the rate of one fitting from each nominal size manufactured during that month.

5.3.9.6 Test frequency for airtightness of bends according to EN 295-1:2013, 5.18

This test shall be carried out at the rate of at least one bend from each nominal size manufactured during a period of six months. Where bends are fired in a plant alongside pipes, using the same materials and firing process, the airtightness of these bends is deemed to be that of these pipes. If pipes are not normally fired alongside these bends, short lengths of pipes made for test purposes, using the same material and firing process as for these bends, can be tested for compliance with the requirements of this clause.

5.3.9.7 Test frequency for water- and airtightness of junctions according to EN 295-1:2013, 5.14.

The watertightness test according to EN 295-1:2013, 5.14 shall be carried out at the rate of at least one junction from each nominal size manufactured during a month and at least one junction per production day rotating through the sizes up to and including DN 300.

Watertightness of junctions according to EN 295-1:2013, 5.14, shall be tested at least once per week at the rate of one junction from each nominal size manufactured during that week.

Airtightness of junctions according to EN 295-1:2013, 5.18, shall be tested at least twice a year at the rate of one junction from each nominal size manufactured.

5.3.9.8 Retest procedure for water seal of fittings, airtightness of bends and watertightness of junctions according to EN 295-1:2013, 5.6, 5.18 and 5.14 respectively

In the event of a test failure, a further three tests shall be carried out on the same nominal size of pipe or fitting. Should a further failure on retest occur, then normal inspection shall be instituted according to A.2.2.3. Reduced inspection according to 5.3.8.5 to 5.3.8.7 can be reinstated when at least ten consecutive batches have passed this level of inspection.

5.3.9.9 Test frequency for bond strength of adhesive used for fixing fired clay parts together according to EN 295-1:2013, 5.12.1

One test piece shall be tested for each production week. Should test failure occur, all products made from that mix shall be rejected.

5.3.10 FPC testing of joint assemblies according to EN 295-1:2013

5.3.10.1 Requirements, tests and test frequencies for joint assemblies

Testing shall be carried out on fittings for the requirements according to EN 295-1:2013, 6.2.2, 6.2.3, 6.4 Table 13 for the mean values of d_4 and 6.5. Test frequencies shall be according to Table 13.

Table 13 —Testing of joint assemblies according to EN 295-1:2013

Characteristic	Requirement EN 295-1:2013, Clause	Test method according to EN 295-3:2012, Clause	Test frequency	Conformity criteria
Dimensions	6.4, Table 13, d_4 [a]	Measurement	3 samples twice a year for each nominal size	"Pass"
Watertightness under angular deflection	6.2.2	21.2		"Pass"
Watertightness under shear	6.2.3	21.4		"Pass"
Chemical and physical resistance to effluent	6.5	23	once a year representing current production	"Pass"
Thermal cycling stability	6.6	24.1		"Pass"
Long term thermal stability	6.7	24.2		"Pass"
NOTE For reaction to fire, durability and dangerous substances see EN 295-1:2013, 7.1, 7.2 and 7.3 respectively.				
[a] If the diameters are measured to clay surfaces.				

5.3.10.2 Retest procedure for joint assemblies

In the event of a test failure, a further three samples shall be tested. Should a failure on retest occur then production shall be suspended on the nominal size of pipe affected until the cause of the failure has been identified and eliminated. Conformity can be re-established following three successful tests.

5.3.11 FPC of polyurethane sealing elements according to EN 295-1:2013, 6.1.2

5.3.11.1 General

Hardness and compression set (24 h at 70 ºC) tests shall be conducted at a rate of one sample from each dispensing unit each day. Shore A hardness measurements in accordance with EN 295-3:2012, Clause 18, shall be used instead of IRHD.

Tensile strength and elongation at break tests shall be conducted at the rate of one sample from each dispensing unit at least once a month.

Stress relaxation (t = 10^4 min), ageing and hardness change at low temperature tests shall be conducted at the rate of one sample from each dispensing unit at six monthly intervals.

5.3.11.2 Retest procedure and sampling for hardness, compression set, tensile strength and elongation at break

In the event of a sample failing a test, select and test three further samples.

If a failure occurs on retest, the cause of the nonconformity shall be determined and performance tests to EN 295-1:2013, 6.2.2 and 6.2.3, shall be conducted on three joint assemblies. Should a failure occur, the batch shall be rejected.

5.3.11.3 Retest procedure and sampling for stress relaxation, ageing and hardness change at low temperatures

In the event of a test failure, a further three samples shall be tested from the same dispensing unit. Should a failure on retest occur then production shall be suspended until the cause of the failure has been identified and eliminated. Conformity may be re-established following three successful tests.

5.3.12 FPC Testing of polypropylene sleeve couplings according to EN 295-1:2013, 6.1.3

5.3.12.1 General

Testing shall be carried out on polypropylene sleeve couplings according to EN 295-1:2013, 6.1.3.1 or 6.1.3.2. Test frequencies shall be according to Table 14.

For sampling, each consignment shall be sub-divided, if applicable, by design and by nominal size.

Table 14 —Testing of polypropylene sleeve coupling according to EN 295-1:2013, 6.1.3

Characteristic	Requirement according to EN 295-1:2013, Clause	Test according to EN 295-3:2012, Clause	Test frequency and sampling according to EN 295-2:2013, Clause	Conformity criteria
Material requirements	6.1.3.1	19	5.3.12.2.1	"Pass"
Performance requirements	6.1.3.2	20	5.3.12.2.1	"Pass"
NOTE For reaction to fire, durability and dangerous substances see EN 295-1:2013, 7.1, 7.2 and 7.3 respectively.				

5.3.12.2 FPC acceptance procedures for the material requirements for couplings for sleeve joints according to EN 295-1:2013, 6.1.3.1

5.3.12.2.1 Tests and sampling

Tests and sampling shall be carried out as follows:

a) Inspection and tests on mouldings to check conformity with the dimensional ranges specified and freedom from visual defects shall be conducted on not less than one sample every eight hours from each cavity of each tool. Mouldings from each cavity shall carry the mould/cavity identification mark.

b) Inspection and test on assembled couplings to check freedom from visual defects shall be in accordance with the procedures in ISO 2859-1 at the AQL of 2,5 % and inspection level S4, or tighter if required by the manufacturer's quality assurance system.

c) Melt flow index, tensile strength, elevated temperature and elongation at break tests shall be conducted at a rate of one sample from a coupling from each tool every 48 h.

5.3.12.2.2 Retest procedures and sampling

In the following events, retesting shall be carried out:

a) In the event of a moulding failing the dimensional check, a minimum of six further samples from the same cavity shall be selected and checked for the dimension in question. If a failure occurs on re-test, all mouldings from that cavity shall be subject to individual examination until the cause of the non-conformity is determined and the necessary corrective action taken.

b) In the event of batches of couplings failing the visual defects check, they can be retested in accordance with the procedures in ISO 2859-1 at the AOL of 2,5 % and inspection level I or tighter if required by the manufacturer's quality assurance system.

c) In the event of a failure on retest for visual defects, the batch shall be isolated. Further inspection in accordance with the procedures given in 5.3.5.3 can be carried out.

d) In the event of a moulding failing a test for melt flow index, elevated temperature or tensile strength or elongation at break, select and test three further samples from the same cavity. If a failure occurs on re-test then production shall be suspended on the nominal size of coupling affected until the cause of the failure has been identified and eliminated. Conformity can be re-established following three successful tests.

5.3.12.3 FPC acceptance procedures for the performance requirements for couplings for sleeve joints to EN 295-1:2013, 6.1.3.2

5.3.12.3.1 Tests and sampling

Tests and sampling shall be carried out as follows:

a) Inspection and tests on couplings to check freedom from visual defects in ISO 2859-1 at the AQL of 2,5 % and inspection level II.

b) Line displacement test. The samples of couplings that have passed visual inspection shall be considered as the batch size for the selection of samples in accordance with procedures in ISO 2859-1 at the AQL of 2,5 % and inspection level II.

c) Samples of couplings that have passed the test shall be clearly identified and tested according to 5.3.13.

5.3.12.3.2 Retest procedures and sampling

In the following events, retesting shall be carried out:

a) In the event of visual defects or line displacement tests. In the event of batches of couplings failing the visual defects check or line displacement test, they can be retested in accordance with the procedures in ISO 2859-1 at the AOL of 2,5 % and inspection level III.

b) In the event of a failure on retest for visual defects, the batch shall be isolated. Further inspection in accordance with the procedures given in 5.3.5.3 of these quality control scheme requirements can be carried out. Defective couplings shall be rejected or the whole batch rejected.

c) In the event of a failure on retest for line displacement, the cause of the failure shall be identified and eliminated. All affected stocks shall be rejected or shall be subjected to further inspection in accordance with the procedures given in 5.3.5.3 of these quality control scheme requirements. Defective couplings shall be rejected or the whole batch rejected.

5.3.13 FPC of rigid fairing materials according to EN 295-1:2013, 6.1.4

5.3.13.1 General

Testing shall be carried out on rigid fairing materials according to EN 295-1:2013, 6.1.4.2, or 6.1.4.3. Test frequencies shall be according to Table 15.

Table 15 —Testing of rigid fairing materials according to EN 295-1:2013, 6.1.4

Characteristic	Requirement according to EN 295-1:2013, Clause	Test according to EN 295-3:2012, Clause	Test frequency and sampling according to EN 295-2:2013, Clause	Conformity criteria
Deformation	6.1.4.2	25.1	5.3.13.2	"Pass"
Indentation	6.1.4.3	25.2	5.3.13.3	"Pass"
NOTE For reaction to fire, durability and dangerous substances see EN 295-1:2013, 7.1, 7.2 and 7.3 respectively.				

5.3.13.2 Deformation

A deformation test shall be carried out at six monthly intervals and at the time of any change in material formulation.

5.3.13.3 Indentation

Indentation tests shall be carried out at a rate of one sample from each dispensing unit each day.

5.3.13.4 Retest procedure and sampling for indentation or deformation

In the event of a test failure, a further three samples shall be tested.

If a failure occurs on retest, the cause of the non-conformity shall be determined. When corrected, performance tests according to EN 295-3:2012, Clause 21 shall be carried out for angular deflection and shear resistance for requirements to EN 295-1:2013, 6.2.2 and 6.2.3 on three joint assemblies. Should a failure occur, the batch shall be rejected.

5.3.14 FPC testing of adaptors and connectors to EN 295-4:2013, 5.7

5.3.14.1 Test frequency for airtightness and watertightness

This test shall be carried out at the rate of at least one fitting from each nominal size manufactured during a month and at least one fitting per production day rotating through the sizes manufactured.

NOTE Where fittings are fired in a plant alongside pipes, using the same materials and firing process, a separate test can be omitted.

5.3.14.2 Retest procedure

In the event of a test failure, a further three samples of the same nominal size shall be tested. Should a failure on retest occur then production shall be suspended on the nominal size of fitting affected until the cause of the failure has been identified and eliminated. Conformity can be re-established following three successful tests.

5.3.15 FPC testing of metal banded flexible couplings and adaptors according to EN 295-4:2013, Annex A

5.3.15.1 Dimensions and appearance

5.3.15.1.1 Testing and sampling

Couplings shall be inspected and tested in accordance with the requirements of EN 295-4:2013, A.3.1 and A.3.2. Sampling shall be in accordance with the procedures in ISO 2859-1 at the AQL of 2,5 % and inspection level II.

5.3.15.1.2 Retest procedures and sampling

In the event of batches of couplings failing, they can be retested in accordance with the procedures in ISO 2859-1 at the AQL of 2,5 % and inspection level III as an alternative to rejecting the entire batch.

In the event of a failure on retest for visual defects, the batch shall be isolated. Further inspection in accordance with the procedures given in 5.3.4.2 can be carried out. Defective couplings and adaptors shall be rejected or the whole batch rejected.

5.3.15.2 Performance

5.3.15.2.1 Testing and sampling for Type 1 couplings and adaptors

Tests shall be carried out twice per year on one adaptor and/or coupling to represent the range up to and including a nominal size of 200 mm and one adaptor and/or coupling of nominal size above 200 mm to represent larger nominal sizes, rotating through the sizes and using one representative pipe material for tests to EN 295-4:2013, A.3.3.2, excluding those of EN 295-1:2013, 6.6 and 6.7.

5.3.15.2.2 Testing and sampling for Type 2 couplings

Tests shall be carried out twice per year on one coupling to represent the range up to a nominal size of 300 mm and one coupling of nominal size above 300 mm and less than 600 mm and one coupling equal to or greater than 600 mm, rotating through the sizes, and using one representative pipe material for tests to EN 295-4:2013, A.3.3.3, excluding those of EN 295-1:2013, 6.6 and 6.7.

5.3.15.2.3 Testing and sampling for strength of tension band assemblies

Tests shall be carried out twice per year on two tension band assemblies from one coupling selected from within each of the size ranges of either Type 2A or Type 2B couplings as appropriate, rotating through the sizes for the requirement according to EN 295-4:2013, A.3.3.4.

5.3.15.2.4 Retest procedure

In the event of a test failure, a further three samples shall be tested. If one of those three samples fails, the products do not comply with the requirements. Production shall be suspended on the size affected until the cause of the failure has been identified and eliminated.

To re-establish conformity, three samples shall be tested without failure.

5.3.16 FPC testing of connectors, insertable fittings and sealing rings for cut pipes for making connections to existing pipelines, manholes or building works according to EN 295-4:2013, Annex B

5.3.16.1 Dimensions and appearance

5.3.16.1.1 Testing and sampling

Inspection and tests on connectors, insertable fittings and sealing rings for cut pipes for the requirements of B.2, B.3, B.4 or B.5 and to check freedom from visual defects shall be in accordance with the procedures in ISO 2859-1 at the AQL of 2,5 % and inspection level II.

5.3.16.1.2 Retest procedures and sampling

In the event of batches of connectors, insertable fittings and sealing rings for cut pipes failing the visual defects check, they can be retested in accordance with the procedures in ISO 2859-1 at the AQL of 2,5 % and inspection level III as an alternative to rejecting the entire batch.

In the event of a failure on retest for visual defects, the batch shall be isolated. Further inspection in accordance with the procedures given in 5.3.5.3 can be carried out. Defective connectors, insertable fittings and sealing rings for cut pipes shall be rejected or the whole batch rejected.

5.3.16.2 Performance

5.3.16.2.1 Testing and sampling for connectors, insertable fittings and sealing rings for cut pipes

Tests according to EN 295-4:2013, 5.9, shall be carried out twice per year on one connector, insertable fitting and/or sealing ring for cut pipes rotating through the sizes.

5.3.16.2.2 Retest procedure

In the event of a test failure, a further three samples shall be tested. If one of those three samples fails, the products do not comply with the requirements. Production shall be suspended on the size affected until the cause of the failure has been identified and eliminated.

To re-establish conformity, three samples shall be tested without failure.

5.3.17 FPC testing of heatshrinkable sleeves according to EN 295-4:2013, Annex C

5.3.17.1 Dimensions and appearance

5.3.17.1.1 Testing and sampling

Inspection and tests of heatshrinkable sleeves for the requirements of C.3 and to check freedom from visual defects shall be in accordance with the procedures in ISO 2859-1 at the AQL of 2,5 % and inspection level II.

5.3.17.1.2 Retest procedures and sampling

In the event of batches of heatshrinkable sleeves failing the visual defects check, they can be retested in accordance with the procedures in ISO 2859-1 at the AQL of 2,5 % and inspection level III as an alternative to rejecting the entire batch.

In the event of a failure on retest for visual defects, the batch shall be isolated. Further inspection in accordance with the procedures given in 5.3.5.3 can be carried out. Defective heatshrinkable sleeves shall be rejected or the whole batch rejected.

5.3.17.2 Performance

5.3.17.2.1 Testing and sampling of heatshrinkable sleeves

Tests according to EN 295-4:2013, 5.10, shall be carried out twice per year on one heatshrinkable sleeve rotating through the sizes.

5.3.17.2.2 Retest procedure

In the event of a test failure, a further three samples shall be tested. If one of those three samples fails, the products do not comply with the requirements. Production shall be suspended on the size affected until the cause of the failure has been identified and eliminated.

To re-establish conformity, three samples shall be tested without failure.

5.3.18 FPC testing of watertightness of manholes and inspection chambers

5.3.18.1 Testing frequency

The test shall be carried out annually on each nominal size of manhole or inspection chamber manufactured.

5.3.18.2 Retest procedure

Should the sample manhole or inspection chamber show any visible signs of water leakage, a further three samples shall be tested. If one of those three samples fails, the products do not comply with the requirements. Production shall be suspended on the size affected until the cause of the failure has been identified and eliminated.

To re-establish conformity, three samples shall be tested without failure.

5.3.19 FPC testing of compressive strength of jacking pipes according to EN 295-7:2013

5.3.19.1 Testing frequency

The test shall be carried out twice a year on each nominal size of jacking pipe manufactured.

5.3.19.2 Retest procedure

Should the minimum compressive strength of a sample pipe fail to comply with the requirement of EN 295-7:2013, 4.3.3, a further three samples shall be tested. If one of those three samples fails, the products do not comply with the requirements. Production shall be suspended on the size affected until the cause of the failure has been identified and eliminated.

To re-establish conformity, three samples shall be tested without failure.

5.3.20 FPC testing of joint assemblies of jacking pipes according to EN 295-7:2013

5.3.20.1 Requirements, tests and test frequencies for joint assemblies according to EN 295-7:2013

Testing shall be carried out on joint assemblies for the requirements according to EN 295-7:2013, 5.3, 5.4, 5.5.and 5.6. Test frequencies shall be according to Table 16.

Table 16 —Testing of joint assemblies according to EN 295-7:2013

Characteristic	Requirements according to EN 295-7:2013, Clause	Test method according to EN 295-3:2012, Clause	Test frequency	Conformity criteria
Watertightness under angular deflection	5.4	21.2	twice a year for each nominal size	"Pass"
Watertightness under shear	5.5	21.3		"Pass"
Chemical and physical resistance to effluent	5.6	23	once a year representing current production	"Pass"
Thermal cycling stability	5.7	24.1		"Pass"
Long term thermal stability	5.8	24.2		"Pass"
NOTE For reaction to fire, durability and dangerous substances see EN 295-1:2013, 7.1, 7.2 and 7.3 respectively.				

5.3.20.2 Retest procedure

In the event of a test failure, a further three samples shall be tested. If one of those three samples fails, the products do not comply with the requirements. Production shall be suspended on the size affected until the cause of the failure has been identified and eliminated.

To re-establish conformity, three samples shall be tested without failure.

Annex A
(normative)

Acceptability determination and switching rules

A.1 General

This annex gives requirements for determining from test samples whether the batch of products complies with the requirements of the standard and can be placed on the market (referred to as “acceptability determination”). It also lays down rules for allowing a reduction in sampling rates where previous inspection and testing show a high level of compliance with the standard, together with rules for increasing sampling rates where sample failures are identified.

A.2 Inspection by attributes

A.2.1 Acceptability determination

A.2.1.1 Single sampling

If the number of defectives found in the samples is equal to or less than the acceptance number, the batch shall be accepted. If the number of defectives is equal to or greater than the rejection number, the batch shall be rejected.

When reduced inspection is in effect and the acceptance number has been exceeded but the rejection number has not been reached, the batch shall be accepted and normal inspection reinstated.

If the rejection number has been reached or exceeded, the batch shall be rejected and normal inspection reinstated.

A.2.1.2 Double sampling

The number of sample units inspected shall be equal to the first sample size given in the plan. If the number of defectives found in the first sample is equal to or less than the first acceptance number, the batch shall be accepted. If the number of defectives found in the first sample is equal to or greater than the first rejection number, the batch shall be rejected. If the number of defectives found in the first sample is between the first acceptance and rejection numbers, the second sample of the size given in the plan shall be inspected.

The number of defectives found in the first and second samples shall be accumulated. If the cumulative number of defectives is equal to or less than the second acceptance number the batch shall be accepted. If the cumulative number of defectives is equal to or greater than the second rejection numbers, the batch shall be rejected. If this occurs on reduced inspection, normal inspection shall be reinstated for the next batch.

When reduced inspection is in effect and, after inspecting the second sample, the acceptance number has been exceeded but the rejection number has not yet been reached, the batch shall be accepted and normal inspection reinstated.

A.2.2 Operation of switching rules

A.2.2.1 Normal inspection

The sample size appropriate to the batch size and the values of acceptance and rejection numbers of defectives shall be in accordance with Table A.1. Sample units shall be selected at random.

A.2.2.2 Normal to reduced inspection

A reduced inspection level as shown in Table A.2 can be used when normal inspection is in effect provided that the following conditions are satisfied:

a) the preceding ten batches (except where they consist of less than 30 samples units in total, see Table A.3) have been on normal inspection, and none has been rejected on original inspection;

b) the total number of defectives in the samples from the ten preceding batches (or such other number required by Table A.3) is equal to or less than the applicable numbers given in Table A.3.

When double sampling is in use, all samples inspected shall be included, not only first samples.

A.2.2.3 Reduced to normal inspection

When reduced inspection is in effect, normal inspection shall be reinstated if a batch is rejected, or if a batch is accepted without either acceptance or rejection criteria having been met (see A.2.1.1 and A.2.1.2).

A.2.2.4 Tightened inspection

Tightened inspection as shown in Table A.4 shall be used either when inspecting a new product or when two or more batches have been rejected in any five consecutive batches of normal inspection.

A.2.2.5 Tightened to normal inspection

Tightened inspection shall continue until five consecutive batches are accepted when normal inspection can be resumed.

A.2.2.6 Discontinuation of inspection

If ten consecutive batches remain on tightened inspection, the provision of these sampling plans shall be discontinued pending action to improve the quality of the submitted products.

A.2.3 Tightened inspection for rejected batches

Tightened inspection as shown in Table A.5 shall be used when inspecting a batch which has previously been rejected, after removal of pipes with previously undetected visible defects.

A.3 Inspection by variables

A.3.1 Distribution

This method is only applicable for continuous production and where there is reason to believe that the distribution of the variable is normal.

A.3.2 Acceptability determination

A.3.2.1 Mean and standard deviation

From a random sample of the appropriate size according to the batch size, calculate the sample mean *x*, and, the estimated standard deviation *s* of the batch from the sample. If *x* is below the specification limit, the batch shall be rejected.

A.3.2.2 Acceptability criteria for specification limit

Calculate the quality statistic for the lower specification limit:

$$Q_{\mathrm{L}} = \frac{x - L}{s} \qquad (1)$$

where

Q_{L} is the quality statistic for the lower specification limit;

L is the lower specification limit;

x is the sample mean;

s is the estimated standard deviation of the batch.

Then compare the quality statistic with the acceptability constant *k* obtained from Table A.6, A.7 or A.8, as appropriate.

If the quality statistic for the lower specification limit is greater than or equal to the acceptability constant, the batch shall be accepted, and if less, rejected, as follows:

— accepted, if $Q_{\mathrm{L}} \geq k$, and

— rejected, if $Q_{\mathrm{L}} < k$.

A.3.3 Operation of switching rules

A.3.3.1 Normal inspection

The sample size appropriate to the batch size and the value of the acceptability constant shall be in accordance with Table A.6. Sample units shall be selected at random.

A.3.3.2 Normal to reduced inspection

A reduced inspection level shown in Table A.8 can be used when normal inspection is in effect provided that the following conditions are satisfied:

a) the preceding ten successive batches would have been acceptable, if Table A.7 had been used;

b) production is in statistical control.

A.3.3.3 Reduced to normal inspection

When reduced inspection is in effect, normal inspection shall be reinstated, if any of the following occur on original inspection:

a) a batch is rejected;

b) production becomes irregular or delayed;

c) other conditions warrant that normal inspection shall be instituted.

A.3.3.4 Tightened inspection

Tightened inspection, as shown in Table A.7, shall be used if two batches on original normal inspection are rejected within any five or less successive batches.

A.3.3.5 Tightened to normal inspection

Tightened inspection shall continue until five consecutive batches are accepted on original inspection when normal inspection can be resumed.

A.3.3.6 Discontinuation of inspection

If ten consecutive batches remain on tightened inspection, the provision of these sampling plans shall be discontinued pending action to improve the quality of the submitted products.

Table A.1 — Normal inspection for both single and double sampling plans by attributes single sampling

Single sampling						
	AQL = 6,5 %			**AQL = 4,0 %**		
Batch size	**Sample size**	**Acceptance number**	**Rejection number**	**Sample size**	**Acceptance number**	**Rejection number**
2 to 50	2	0	1	3	0	1
51 to 500	8	1	2	13	1	2
501 to 3 200	13	2	3	13	1	2
3 201 to 35 000	20	3	4	20	2	3
35 001 to 150 000	32	5	6	32	3	4
Double sampling						
Batch size	**1st sample size**	**Acceptance number**	**Rejection number**	**2nd sample size**	**Acceptance number**	**Rejection number**
2 to 50	not applicable			–	–	–
51 to 500	5	0	2	5	1	2
501 to 3 200	8	0	3	8	3	4
3 201 to 35 000	13	1	4	13	4	5
35 001 to 150 000	20	2	5	20	6	7

Table A.2 — Reduced inspection for both single and double sampling plans by attributes single sampling

Single sampling							
		AQL = 6,5 %			AQL = 4,0 %		
Batch size		Sample size	Acceptance number	Rejection number	Sample size	Acceptance number	Rejection number
2 to 50		2	0	1	2	0	1
51 to 500		3	0	2	5	0	2
501 to 3 200		5	1	3	5	0	2
3 201 to 35 000		8	1	4	8	1	3
35 001 to 150 000		13	2	5	13	1	4
Double sampling							
Batch size		**1st sample size**	**Acceptance number**	**Rejection number**	**2nd sample size**	**Acceptance number**	**Rejection number**
2 to 50		not applicable			–	–	–
51 to 500		2	0	2	2	0	2
501 to 3 200		3	0	3	3	0	4
3 201 to 35 000		5	0	4	5	1	5
35 001 to 150 000		8	0	4	8	3	6

Table A.3 — Limit numbers for reduced inspection

Number of sample units from last ten batches	Limit number of defectives
20 to 29	0 [a]
30 to 49	0
50 to 79	0
80 to 129	2
130 to 199	4
200 to 319	8

[a] The number of sample units from the last ten batches is not sufficient for reduced inspection. In this instance, more than ten batches can be used for the calculation, provided that the batches are the most recent ones in sequence, that they have all been on normal inspection and that none have been rejected while on original inspection.

Table A.4 —Tightened inspection for both single and double sampling plans by attributes single sampling

Single sampling						
	AQL = 6,5 %			AQL = 4,0 %		
Batch size	Sample size	Acceptance number	Rejection number	Sample size	Acceptance number	Rejection number
2 to 50	3	0	1	5	0	1
51 to 3 200	13	1	2	20	1	2
3 201 to 35 000	20	2	3	20	1	2
35 001 to 150 000	32	3	4	32	2	3
Double sampling						
Batch size	1st sample size	Acceptance number	Rejection number	2nd sample size	Acceptance number	Rejection number
2 to 50	not applicable			–	–	–
51 to 3 200	8	0	2	8	1	2
3 201 to 35 000	13	0	3	13	3	4
35 001 to 150 000	20	1	4	20	4	5

Table A.5 —Tightened inspection for resubmission of rejected batches and isolated batches

Batch size	Sample size	Acceptance number	Rejection number
2 to 25	3	0	1
26 to 500	13	1	2
501 to 1 200	20	2	3
1 201 to 10 000	32	3	4
10 001 to 35 000	50	5	6
35 001 to 150 000	80	8	9

Table A.6 — Normal inspection by variables

Batch size	Sample size	Acceptability constant (*k*)	
		AQL 6,5 %	AQL 4,0 %
3 to 280	3	0,765	0,958
281 to 500	4	0,814	1,01
501 to 1 200	5	0,874	1,07
1 201 to 3 200	7	0,955	1,15
3 201 to 10 000	10	1,03	1,23
10 001 to 35 000	15	1,09	1,30
35 001 to 150 000	20	1,12	1,33

Table A.7 —Tightened inspection by variables

Batch size	Sample size	Acceptability constant (*k*)	
		AQL 6,5 %	AQL 4,0 %
3 to 280	3	0,958	1,12
281 to 500	4	1,01	1,17
501 to 1 200	5	1,07	1,24
1 201 to 3 200	7	1,15	1,33
3 201 to 10 000	10	1,23	1,41
10 001 to 35 000	15	1,30	1,47
35 001 to 150 000	20	1,33	1,51

Table A.8 — Reduced inspection by variables

Batch size	Sample size	Acceptability constant (*k*)	
		AQL 6,5 %	AQL 4,0 %
3 to 280	3	0,566	0,765
281 to 500	3	0,566	0,765
501 to 1 200	3	0,566	0,765
1 201 to 3 200	3	0,566	0,765
3 201 to 10 000	4	0,617	0,814
10 001 to 35 000	5	0,675	0,874
35 001 to 150 000	7	0,755	0,955

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[2] ISO 2859-2:1985, *Sampling procedures for inspection by attributes — Part 2: Sampling plans indexed by limiting quality (LQ) for isolated lot inspection*

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