English translation

AR 208
March 2025
Dutch version

Approval requirement 208

Ductile cast iron wide range couplings for use with pipes of different materials



Trust
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Progress

Foreword

This, translated from Dutch, approval requirement (AR), is approved by the Board of Experts (BoE) 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, translated from Dutch, AR will be used by Kiwa Nederland BV in conjunction with the GASTEC QA general requirements and the KIWA regulations for certification.

Kiwa has a method which is established in the certification procedure for the execution of:

- The investigation for provisioning and maintaining a GASTEC QA product certificate based on this AR.
- The periodic evaluations of the certified products for the purpose of maintaining a provided GASTEC QA product certificate based on this AR.

This, translated from Dutch, AR, is used as supporting document. In case of doubt of interpretation of this AR, the English version is leading.

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1 Introduction

1.1 General

This GASTEC QA approval requirement (AR) in combination with the GASTEC QA general requirements, is applied by Kiwa as the basis for the issuing and maintaining the GASTEC QA product certificate for ductile cast iron wide range couplings for use with pipes of different materials.

With this product certificate, the certificate holder can demonstrate to his or her customers that an expert independent organization monitors the production process of the certificate holder, the quality of the product and the related quality assurance.

Next to the requirements established in this AR and the general requirements, Kiwa has additional requirements in the sense of general procedural requirements for certification, as laid down in the internal certification procedures.

This GASTEC QA approval requirement replaces the version of May 2019.

List of changes:

- These approval requirements have been fully reviewed textually.
- Update of definitions.
- Chapter 4 has been revised.
- List of documents updated.

The product requirements have not changed.

1.2 Scope

This inspection requirement applies to ductile iron wide range couplings intended for leak-tight connections over a wide diameter range of pipes or other components made of ductile iron, grey cast iron, PVC-U, PVC HI, PE, steel or fibre cement.

- To convey gas of the 1st, 2nd and 3rd family gasses according to table 1 of EN 437.
- With a maximum operating pressure of 8 bar to be installed below ground or above ground inside a building or cabinet.
- Diameter range of DN 32 to DN 400
- for ambient temperatures between:
    - -5 °C and +30 °C class A
    - -10 °C and +40 °C class B

The manufacturer shall declare in the instructions if the couplings are for one time use or repeated use. In case the couplings are suitable for repeated use, the manufacturer shall declare if parts should be replaced.

2 Definitions

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

Board of Experts (BoE): The Board of Experts GASTEC QA.

Coupling: Casting other than a pipe which allows material, diameter or directional change.

Ductile cast iron: Ductile cast iron is a cast steel with a carbon content of up to 3.8% carbon, where the carbon is present in a spherical form (nodules) in the crystal structure.

End-load resistance: Combination of components and joint design and characteristics such that under any load condition pipe will fail first.

Flange: End of a pipe or fitting extending perpendicular to its axis, with bolt holes equally spaced on a circle.

NOTE A flange may be fixed or adjustable; an adjustable flange comprises a ring, in one or several parts assembled together, which bears on an end joint hub and can be freely rotated around the axis before jointing.

Flexible joint: Joint which permits an angular deflection (see paragraph 4.2) both during and after installation and which can accept an offset of the centreline.

Flanged joint: Joint between two flanged ends.

Gasket: Sealing component of a joint.

Insertion depth: Distance between the end of the pipe and the face of the socket.

Joint: Connection between the ends of two pipes and/or couplings in which a gasket is used to affect a seal.

Joint angular deflection: Angle between the axis of two connected pipeline components which a flexible joint can accommodate.

Joint gap: The largest axial distance between the ends of the two pipes to be connected, or the largest axial distance between the end of the pipe and the face of the opposite part such as flange, end cap, spigot (See also 4.5.2).

Leak tightness test pressure: Pressure applied to a component to determine its leak tightness.

Maximum operating pressure (MOP): Maximum pressure that a component is capable of withstanding continuously in service under normal operating conditions.

Nominal size (DN): Alphanumerical designation of size for components of a pipework system, which is used for reference purposes. It comprises the letters DN followed by a dimensionless whole number which is indirectly related to the physical size, in millimeters, of the bore or outside diameter of the end connections.

Nominal pressure (PN): Alphanumerical designation used for reference purposes related to a combination of mechanical and dimensional characteristics of a component of a pipework system. It comprises the letters PN followed by a dimensionless number.

NOTE All equipment of the same nominal size DN designated by the same PN number have compatible mating dimensions.

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

Outside diameter OD: Outside diameter of the pipe(s) to be connected.

Shelf life: The length of time a product may be stored without becoming unsuitable for use**.**

Spigot: Male end of a pipe or coupling.

Wide range coupling: Coupling intended for connecting pipes or other components with a spigot end of the same or different materials which have the same nominal diameter (DN) on one side of the joint, and which allows radial and axial displacements during installation.

The wide range coupling can be provided in several types:

- Coupling – Coupling
- Coupling – Flange connection
- Coupling - Spigot end
- Coupling – End cap

NOTE Some couplings are designed such that they can slide over the pipes in order to facilitate easy assembly.

See also the definitions mentioned in the GASTEC QA general requirements.

3 Material and product requirements

This chapter contains the material and product requirements that the raw materials, materials, and products used shall meet.

3.1 Material requirements

The materials used for the wide range couplings should be based on the following requirements:

	Material	Requirements
Spigot	Ductile cast iron/ PE 100(RC)	See 3.4.2.1/ 3.4.2.2
Body	Ductile cast iron	See 3.6
Clamp ring/ clamp	Ductile cast iron	See 3.6
Flanges	Ductile cast iron	See 3.6
Coating of the body (internal and external)	Epoxy or polyamide	See 3.7
Coating of bolts	Dry anti-galling coating	See 3.7.2
Rubber	NBR	See 3.8
Bolts and nuts	Steel/ Stainless steel	See 3.9

Table 1: Material requirements

3.2 Diameter range

The wide range couplings are defined by the minimum and maximum outside diameters of the pipes to be connected. The diameter range shall be specified by the manufacturer. Within this diameter range, the performance shall be guaranteed at the manufacturer's declared MOP. A coupling can be used to connect different diameters.

The minimum diameter range for wide range couplings is given in table 2.

Maximum DN of the pipes to be connected	Minimum diameter range (mm)
32 < DN ≤ 100	20
100 < DN ≤ 200	23
200 < DN ≤ 300	33
300 < DN ≤ 400	41

Table 2: Minimum diameter range

Informative Annex A gives the outside diameters of existing pipes, according to current ISO, EN or national standards.

3.3 Surface condition and repairs

Wide range couplings shall be free from defects and surface imperfections which could lead to non-compliance with chapters 3 and 4.

When necessary, couplings may be repaired, for example by welding, to remove surface imperfections and localized defects which do not extend through the entire wall thickness, provided that:

- the repairs are carried out according to the manufacturer's written procedure.
- the repaired couplings comply with all the requirements of chapters 3 and 4.

3.4 Type of joints and interconnection

3.4.1 Flanged joints

Flanged joints shall be constructed in such a way that they may be attached to flanges whose dimensions and tolerances comply with EN 1092-2.

Flanges may be designed to be compatible with different DN (e.g., DN 50-60-65) and/or different PN (e.g., PN 10/16).

Certain flange joints, especially for repair purposes, are designed to cater for flanges other than EN 1092-2. Consequently, some dimensions (e.g., thickness, bolt holes) have been designed to suit. Such flange joints shall not compromise functionality or compatibility with EN 1092-2 flanges.

3.4.2 Spigot connection

3.4.2.1 Ductile cast iron spigot end

The material of the ductile cast iron spigot end shall comply with paragraph 3.6 of this AR and shall be part of the body of the coupling.

3.4.2.2 PE Spigot

The PE spigot connection shall be made of PE 100 and shall comply with EN 1555-2.

3.4.3 End cap

The material of the end cap shall comply with paragraph 3.6 of this AR and shall be part of the body of the joint. When the end cap is provided with a threaded hole, the thread shall comply with ISO 7-1 or EN 10226-1.

3.4.4 Wide range joint

Wide range couplings shall be end-load resistant or non-end-load resistant and shall meet the performance requirements detailed in chapter 4.

The manufacturer shall declare for which pipe materials, components and MOP, the joint is end-load or non-end-load resistant.

Supporting sleeves (inserts) may be necessary depending on pipe material, on pipe wall thickness, on joint design and on local authorities. They shall provide adequate support over the entire compression area of the gasket. The manufacturer shall specify the support sleeve (dimensions, material, shape) and indicate when supporting sleeves shall be used.

3.5 Dimensional requirements

3.5.1 Wall thickness

The minimum wall thickness shall be as given in table 3, provided that they comply to the requirements of chapter 4.

Maximum DN of the pipes to be connected	Minimum wall thickness (mm)
32 < DN ≤ 200	4,0
200 < DN ≤ 300	5,0
300 < DN ≤ 400	6,0

Table 3: Minimum wall thickness

3.5.2 Joint gap and insertion depth

The manufacturer shall declare the minimum and maximum insertion depth and the minimum joint gap (see figures 1 to 4 below). The minimum joint gap should not be less than the values given in table 4.

Maximum DN of the pipes to be connected	Couplings with two joints	Coupling with one joint
32 < DN ≤ 100	20	15
100 < DN ≤ 200	25	20
200 < DN ≤ 300	35	30
300 < DN ≤ 400	55	40

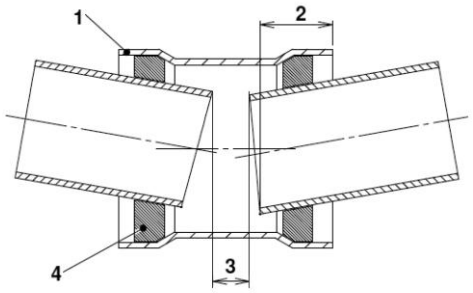
Table 4: Minimum required joint gap (mm)

NOTE: The minimum joint gap between the pipes or between a pipe and the house of the coupling may be affected by pipe contraction or expansion occurring as a result of temperature or pressure change.

The insertion depth is related to the joint design. The manufacturer shall declare the minimum and maximum insertion depth (see figures 1 to 4) in the jointing instructions for each type of pipe material.

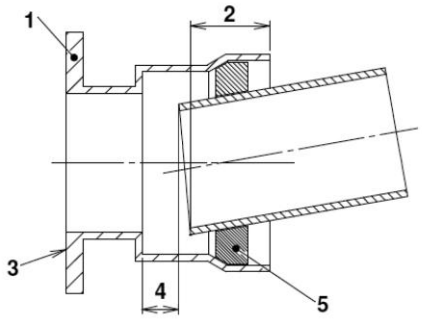
The minimum insertion depth shall be such that the pipes can support the loads imparted by the jointing system.

The maximum insertion depth shall be as such that the minimum joint gap between the pipes or between a pipe and house of the coupling is guaranteed.



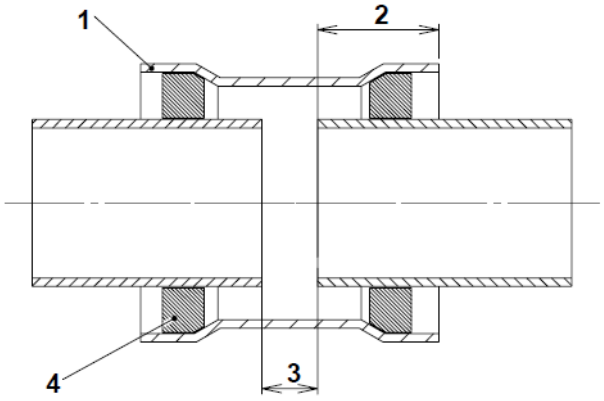
Key
1 Joint
2 Insertion depth
3 Joint gap
4 Joint gasket

Figure 1: Joint gap and insertion depth for wide range couplings – coupling-coupling (example)



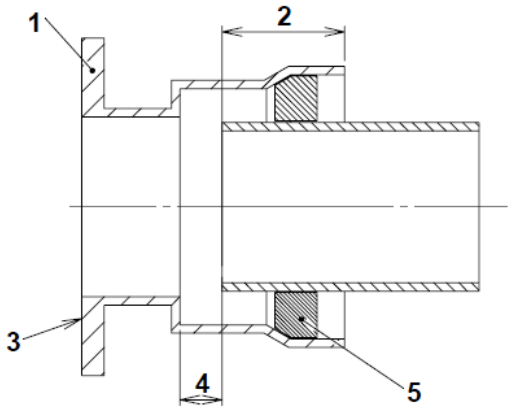
Key
1 Flange joint
2 Insertion depth
3 Flange face
4 Joint gap
5 Joint gasket

Figure 2: Joint gap and insertion depth for wide range coupling- flange connection (example)



Key
1 Fitting
2 Insertion depth
3 Joint gap
4 Joint gasket

Figure 3: Joint gap and insertion depth for wide range couplings – coupling-coupling (example)



Key
1 Flange joint
2 Insertion depth
3 Flange face
4 Joint gap
5 Joint gasket

Figure 4: Joint gap and insertion depth for wide range coupling – flange connection (example)

3.5.3 Ductile cast iron spigot

The dimensions of the ductile cast iron spigot shall comply with the dimension given in table 5. The free length of the cast iron spigot shall comply with NEN 7231 table 3.

d_n	outside diameter	
	Min	Max
50	50	50,7
63	63	63,7
75	75	75,7
90	90	90,7
110	110	110,7
125	125	125,7
160	160	160,7
200	200	200,7
250	250	250,8
280	280	280,9
315	315	316,0
400	400	401,0

Table 5: Dimensions ductile cast iron spigot

3.5.4 PE Spigot

A PE100 (RC) spigot shall comply with:

- The material requirements of EN 1555-1.
- Dimensions according to the requirements of pipes with an SDR class off 1 according to EN 1555-2.
- A minimum free length according to table 6.

Pipe diameter (mm)	Spigot free length (mm)
63	160
90	210
110	210
160	260
200	270
250	300
315	340
400	370

Table 6: Minimum free length PE spigot

3.6 Mechanical properties of ductile cast iron

3.6.1 Tensile properties

Ductile cast iron couplings shall have a minimum tensile strength, R_m, of 420 MPa and a minimum elongation at fracture of 5 %. The tensile strength test shall be carried out in accordance with ISO 6892-1.

3.6.2 Hardness

The Brinell hardness shall be tested in accordance with ISO 6506-1 and shall not exceed 250 HB. The test shall be performed on the casting or on a sample cut from the casting.

3.7 Coatings

3.7.1 General

Unless otherwise agreed between manufacturer and purchaser, all couplings shall be delivered externally and internally coated (epoxy or polyamide). The external and internal coatings shall comply with EN 14901-1.

All coatings shall be works-applied.

The suitability of the coating shall be verified by performing the cathodic disbondment test according to paragraph 4.8.

3.7.2 Coating of bolts and nuts

Bolts and nuts shall be suitably protected with an anti-galling coating to inhibit cold-welding of the threads. Bolts shall be coated with a dry anti-galling coating. It is recommended not to use harmful substances for the coating.

3.8 Rubber material

Rubber gasket materials shall comply with the requirements of EN 682. For type GA or GB, they shall meet the requirements for ambient temperature for class A and for Type GAL or GBL for class B.

3.9 Bolts and nuts

The mechanical properties of the bolts and nuts shall comply with ISO 3506-1 and ISO 3506-2 grade A2 and/or A4. The dimensional properties shall comply as a minimum with the requirements of ISO 4016 and ISO 4034.

4 Performance requirements and test methods

This chapter contains the performance requirements and associated test methods that the products shall meet. This chapter also specifies the limit values, if applicable.

4.1 General

In order to ensure the fitness for purpose of the wide range couplings, there shall be a performance test using at least one from each of the groupings given below:

- DN 32 to DN125 (preferred around 100 mm).
- DN 150 to DN 300 (preferred around 200 mm).
- DN 350 to DN 400 (preferred around 400 mm).

One outside diameter is representative of a grouping when the performances are based on the same design parameters throughout the size range. The performance tests shall be carried out either on fitting or flange adaptor, provided the joint design is identical.

If a grouping covers products of different designs and/or manufactured by different processes, the grouping shall be sub-divided.

The product shall be tested using the smallest and largest pipe size specified by the manufacturer.

The performance tests shall be carried out using supporting sleeves (inserts) when necessary (see paragraph 3.4.4).

The wide range coupling shall be tested in combination with a PE spigot and flanged coupling.

The requirements and test conditions are summarized in table 7. The wide range joints shall exhibit no visible leakage, deformation or displacement of the pipe sections when subjected to the tests. The displacement shall reach a stable value and cease.

Type fitting	Test requirements	Pipe sections	Test method
Non-end- load resistance fitting + end-load resistance fitting	- test pressure: 25 mbar, 200 mbar, 1 bar (air) - test pressure: MOP (air or water) - test pressure: 1,5x MOP (water) - test duration: 5 minutes after stabilisation - no visible leakage	Stiff pipe of maximum OD	4.2, 4.5 and 4.6
End-load resistance fitting	- test pressure: 3x MOP + 5 bar (water) - test duration: 2 hours after stabilization - no deformation, visible leakage, or displacement of the pipe sections.	Stiff pipe of maximum OD	4.2 and 4.6 4.3, 4.4 and 4.6
End-load resistance fitting	- test pressure: 3x MOP + 5 bar (water) - test duration: 2 hours after stabilization - no deformation, visible leakage, or displacement of the pipe sections.	Stiff pipe of minimum OD	4.2 and 4.6 4.3, 4.4 and 4.6
End-load resistance fitting	- test pressure: 3x MOP + 5 bar (water) - test duration: 2 hours after stabilization - no deformation, visible leakage, or displacement of the pipe sections.	PVC pipe of minimum OD	4.3, 4.4 and 4.6
End-load resistance fitting	- test pressure: 3x MOP + 5 bar (water) - test duration: 2 hours after stabilization - no deformation, visible leakage, or displacement of the pipe sections.	PE pipe of minimum OD	4.4 and 4.6

Table 7: Performance testing of the joints: requirements and test conditions.

4.2 Angular deflection

All wide range couplings shall be designed to provide a flexible joint.

The allowable angular deflection declared by the manufacturer shall be not less than 3° for DN 32 to DN 400. For the performance testing the maximum angular deflection, declared by the manufacturer will be applied.

The leak tightness test shall be performed according to paragraphs 4.5 and 4.6.

4.3 Shear load

All couplings shall be performance tested with a resultant shear force of not less than 20 times the DN, in newtons, considering the weight of the pipe and of its contents and the geometry of the test assembly.

The shear load test condition is not required for PE pipes, due to their longitudinal flexibility.

Shear load for joints.

A vertical force *W* shall be applied to the fitting. The vertical force *W* shall be such that the resultant shear force *F* across each of the two joints is equal to the value specified in paragraph 4.3, considering the weight force *M* of the fitting and of its contents:

$W = 2F - M$

The leak tightness test shall be performed according to paragraph 4.6.

Shear load for flange joints.

The vertical force *W* applied to the flange joints shall be such that the resultant shear force *F* across the joint is equal to the value specified in paragraph 4.3, considering the weight force *M* of the flange adaptor and of its contents:

$W = F - M$

Where

W is the vertical force in newtons
F is the shear force in newtons
M is the weight force in newtons.

The leak tightness test shall be performed according to paragraph 4.6.

4.4 Maximum joint gap

The wide range joint shall show no visible leakage with the maximum joint gap (with a minimum insertion depth).

The maximum joint gap is created between the joint and the smallest pipe diameter for which the wide range joint is suitable as declared by the manufacturer (see paragraph 4.1). The smallest pipe diameter is selected form the standard pipe size ranges as mentioned in appendix A.

The leak tightness test shall be according to paragraph 4.6.

4.5 Leak tightness test of joints with air

4.5.1 Wide range joint

The test shall be carried out on an assembled joint comprising a ductile cast iron wide range fitting and two pipe sections (see figure 5).

The test apparatus shall be capable of providing suitable end and lateral restraints whether the joint is in the aligned position, deflected or subjected to a shear load. It shall be equipped with a pressure gauge with an uncertainty of ± 5 % reading.

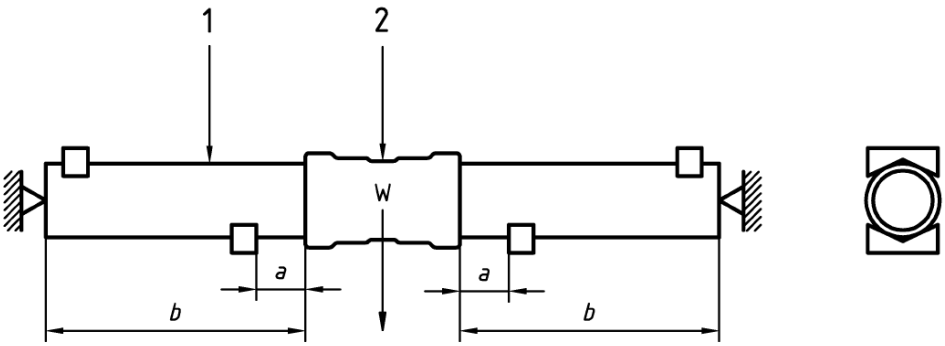


Figure 5: Test assembly for a fitting

Key
1 Pipe section
2 Wide range coupling
a distance of V shaped block
b length of pipe section
w vertical force

On the right side of figure 5 the side is visible of the set up.

The pipes shall be supported by means of V shaped blocks with an angle of 120°, located at a distance *a*, of 0.2 x OD in mm, from the fitting face, and up to a maximum of 50 mm. The length of each pipe section *b*, shall be at least 2 x OD in mm, and with a minimum of 1 m.

The test shall not begin before the temperature of the test assembly has stabilized between 10 °C and 25 °C. The pressure shall be raised steadily until it reaches the test pressure given in table 7.

For an end-load resistant joint, the test assembly, and the test procedure are identical, except that there shall be no end restraint so that the axial thrust is taken by the end-load resistant joint under test. In addition, possible axial movement of the spigot shall be monitored.

4.5.2 Flange joint

For a flange joint, half of the test apparatus shall be used (see figure 6).

The test procedure shall be as in paragraph 4.5.1.

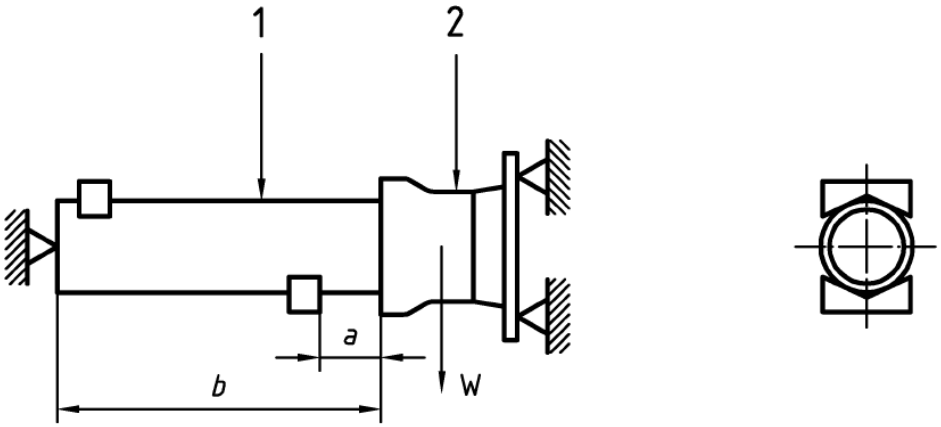


Figure 6: Test assembly for a flange adaptor

Key
1 Pipe section
2 Flange adaptor

4.6 Leak tightness test of joints with water

For the strength test the test set as described under paragraph 4.5.1 or 4.5.2 shall be used. The test assembly is filled with water. The test shall not begin before the temperature of the test assembly has stabilized between 10 °C and 25 °C. The pressure shall be raised steadily until it reaches the test pressure given in table 7.

4.7 Cathodic disbondment test

For each test specimen[1)], a plastic pipe section with d = 75 mm and h = 100 mm is sealed onto the coated surface using an electrically non-conducting adhesive, making sure to effectively seal the joint. The pipe is filled with a sodium chloride solution at a concentration of c(NaCl) = 0.5 mol/L.

Before sealing, remove the coating in the middle of the test plate with a face cutter so that there is an uncoated area with a diameter of 6mm.

Cathodic polarization of the pipe is achieved with a potentiostat, setting a nominal voltage of U0.1 AgCl = -1550 mV (corresponding to UH = -1260 mV, Ukalomel ges = -1500 mV).

A similar polarization effect may also be achieved by simply causing a short circuit with a magnesium anode, provided that the voltage is approximately UH = -1200 mV.
This test lasts 30 days and is performed at a temperature of (23 ± 2) °C.

In order to determine the cathodic disbondment, make 6 radial cuts, starting from the uncoated area and proceeding to the coating surface of the cast. An hour after the end of the test, the coating is removed from the uncoated middle area with a blade.
In this context, the mean disbonded depth (= adhesion loss of the coating) is determined from the edge of the uncoated area to the adherent coating.

The following limits for the cathodic disbondment are valid: Temperature	Test duration	Cathodic disbondment
23 ± 2 °C	30 days	≤ 10 mm

[1)]For fittings whose shape or size make them ineligible for cathodic disbonding tests test plates may be used instead. The test plate is approx. 100 x 110 x 15 mm. It must be of the same material as the fittings to be coated. One of the flat surfaces should be moulded with "normal" foundry sand and the other with core-making sand. The side using core-making sand should be marked with the letter K in one corner during the casting process. The test plate is clamped in a DN 150 fitting in such a way that the “core side” of the test plate is on the inside. The complete test piece is blasted in this position. Clean fibre-free gloves must be used when removing test plates. The test plate is coated without the fitting.

Source: Gütegemeinschaft Schwerer Korrosionsschutz

5 Marking, instructions and packaging

5.1 Marking

All fittings shall be legibly and durably marked and shall bear at least the following information:

- GASTEC QA, GASTEC QA logo or punch mark.
- Manufacturer's name or mark.
- Identification of ductile cast iron.
- DN and PN rating of flanges when applicable.
- The minimum and maximum outside diameters (range of external diameters over which the product works).
- MOP of the fitting.
- Production or assembling date (at least month and year) of the product.

The first five markings given above shall be cast-on or cold stamped the other markings can be applied by any method, e.g., painted on the casting.

5.2 Instructions

The supplier shall provide instructions in the language of the country in which the products are used and in Dutch and it shall contain the following information:

- The use and installation of the product.
  - minimum and maximum insertion depth.
  - minimum joint gap.
  - maximum allowable angular deflection.
  - pipe materials for which the fitting is intended to be used.
  - end-load or non-end-load resistance.
  - need for supporting sleeves (insert).
  - bolt torque.
- The conditions under which it shall be used.
- How it can be determined if the product is correctly installed.
- The way the product shall be stored.
- The maximum shelf life of the product.

5.3 Packaging

The products, including the associated components required for its assembly, shall be packaged individually.

Special storage or handling conditions shall be specified on the packaging.

The packaging shall protect the products from dirt, dust and other contaminants during transport and storage till the point of use where the packaging will be removed.

6 Quality system requirements

The requirements for the quality system are described in the GASTEC QA general requirements. An important part of this are the requirements for drawing up a risk analysis (e.g., an FMEA) of the product design and the production process in accordance with chapters 3.1.1.1 and 3.1.2.1. This risk analysis shall be available for inspection by Kiwa.

7 Summary of evaluation

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

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

7.1 Evaluation matrix

Description of requirement	Clause	Test within the scope of		
		Initial product assessment	Product verification	
			Verification	Frequency
Material	3.1	X	X	Once a year
Diameter range	3.2	X	X	Once a year
Surface conditions and repairs	3.3	X		
Types of joints	3.4	X		
Dimensional requirements	3.5	X	X	Once a year
Mechanical properties of ductile cast iron	3.6	X		
Coatings	3.7	X	X	Once a year
Rubber material	3.8	X	X	Once a year
Bolt and nuts	3.9	X	X	Once a year
Performance requirements of joints	4.2 UTAI 4.7	X	X	Once a year
Cathodic disbondment	4.8	X		
Marking, instructions and packaging	5	X	X	Once a year

8 List of referenced documents and source

8.1 Standards / normative documents

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

EN 682: 2002	Elastomeric seals - Materials requirements for seals used in pipes and fittings carrying gas and hydrocarbon fluids
EN 1092-2: 2023	Flanges and their joints - Circular flanges for pipes, valves, fittings and accessories, PN designated - Part 2: Cast iron flanges
EN 1555-1: 2021	Plastics piping systems for the supply of gaseous fuels - Polyethylene (PE) - Part 1: General
EN 1555-2: 2021	Plastics piping systems for the supply of gaseous fuels - Polyethylene (PE) - Part 2: Pipes
EN 10226-1: 2004	Pipe threads where pressure tight joints are male on the treads – Part 1 taper external threads and parallel internal threads.
EN 14901-1: 2014 +A1: 2019	Ductile iron pipes, fittings and accessories - Epoxy coating (heavy duty) of ductile iron fittings and accessories - Requirements and test methods
ISO 7-1: 1994+Cor 1: 2007	Pipe threads where pressure-tight joints are made on the threads - Part 1: Dimensions, tolerances and designation
ISO 3183: 2019	Petroleum and natural gas industries - Steel pipe for pipeline transportation systems
ISO 3506-1: 2020	Mechanical properties of corrosion-resistant stainless steel fasteners - Part 1: Bolts, screws and studs
ISO 3506-2: 2020	Mechanical properties of corrosion-resistant stainless steel fasteners - Part 2: Nuts
ISO 4016: 2022	Hexagon head bolts - Product grade C
ISO 4034: 2013	Hexagon regular nuts (style 1) - Product grade C
ISO 6506-1: 2014	Metallic materials - Brinell hardness test - Part 1: Test method
ISO 6892-1: 2019	Metallic materials – tensile testing – part 1: method at room temperature
NEN 7231: 2020	Plastics piping systems for gas supply - Fittings of modified polyvinyl chloride (modified-PVC) - Requirements and test methods

8.2 Source of informative documents

EN 437: 2021	Test gases- test pressure – appliance categories
General requirements GASTEC QA	

Appendix A: outside diameters of existing pipes

	Ductile Iron	Steel	PVC-HI	PE	Fibre-Cement			
	NEN 7244-4	EN 10208-1	NEN 7230	EN 1555-2	DIN 19800a			
Sizes (DN)					PN6	PN10	PN12,5	PN16
25				$25^{+0,3}_{-0}$				
32				$32^{+0,3}_{-0}$				
40				$40^{+0,4}_{-0}$				
50		$60,3^{+0,5}_{-0,5}$	$50^{+0,2}_{-0}$	$50^{+0,4}_{-0}$			83	85
63			$63^{+0,2}_{-0}$	$63^{+0,4}_{-0}$				
75			$75^{+0,3}_{-0}$	$75^{+0,5}_{-0}$		98	100	104
80	$98^{+1}_{-2,7}$	$88,9^{+0,7}_{-0,7}$						
90			$90^{+0,3}_{-0}$	$90^{+0,6}_{-0}$				
100	$118^{+1}_{-2,8}$	$114,3^{+0,9}_{-0,9}$						
110			$110^{+0,4}_{-0}$	$110^{+0,7}_{-0}$	118	120	124	130
125			$125^{+0,4}_{-0}$	$125^{+0,8}_{-0}$				
140			$140^{+0,5}_{-0}$					
150	$170^{+1}_{-2,9}$	$168,3^{+1,3}_{-1,3}$						
160			$160^{+0,5}_{-0}$	$160^{+1,0}_{-0}$	145	149	153	159
180			$180^{+0,6}_{-0}$					
200	$222^{+1}_{-3,0}$	$219,1^{+1,6}_{-1,6}$	$200^{+0,6}_{-0}$	$200^{+1,2}_{-0}$	172	178	182	190
225			$225^{+0,7}_{-0}$					
250	$274^{+1}_{-3,1}$	$273,0^{+2,0}_{-2,0}$	$250^{+0,8}_{-0}$	$250^{+1,5}_{-0}$				
300	$326^{+1}_{-3,3}$	$323,9^{+2,4}_{-2,4}$						
315			$315^{+1,0}_{-0}$	$315^{+1,9}_{-0}$	226	234	240	252
355			$355^{+1,0}_{-0}$	$355^{+2,2}_{-0}$				
400	$429^{+1}_{-3,5}$	$406,4^{+3,0}_{-3,0}$	$400^{+1,0}_{-0}$	$400^{+2,4}_{-0}$	278	286	296	308

Table A.1: Outside diameters of existing pipes (in mm), according to current ISO, EN and national standards