Marcogaz Guidance concerning a Quality Plan for PE Pipes, Fittings and Valves for Use in Natural Gas Supply Systems

1 Aim

The quality and safety level of a gas distribution network is characterised by the quality of the individual components and by the level of quality handled during the construction of the network.

At the European level there is no specific technical regulation concerning the use of PE products by gas distribution system operators. In some countries national certification schemes involving accredited certification bodies exist and are commonly used by the gas distribution system operators.

This guide establishes, on the basis of a voluntary agreement among the gas companies, the minimum quality plan for the manufacturing of PE pipes, fittings and valves for the construction of gas distribution systems. The quality plan includes also elements for the PE compound to be used.

This guide will also be a feature to improve the revision and the drafting of current and new European Standards for gas supply systems in polyethylene.

Its application should benefit the gas industry through high quality and cost-effective polyethylene products. It will also assist in complying with art. 18 of the Procurement Directive 93/38 EEC and in avoiding discriminatory demand from individual gas utilities.

2 Basic Requirements

The aim of this guide is to apply common requirements by gas companies, based on existing EN standards as drafted by CEN/TC 155, when purchasing PE pipes, fittings and valves for gas supply systems in the market place.

The purpose is not to seek harmonisation of existing certification schemes for PE products already existing in some Marcogaz member countries, but to include the requirements of this guide in the existing certification schemes, if they exist. This guide includes in its informative annex 3 the list of certification bodies operating in the Marcogaz member countries.

It only describes the conditions for **type testing** (TT) and **audit testing** (AT) in mutual acceptance of test results between gas companies under the umbrella of this Marcogaz Guidance. Other tests, e.g. batch release tests (BRT), are not handled in this guide and are subject of individual agreements between users and manufacturers.

References are included in this document, to the manufacturer's quality management system (QMS) and also requirements regarding the safe operation of gas systems.

The Standards EN 1555 Part 1 up to 5 applies for this guide. Whereas the quality plan is based on Part 7 of this Standard.

Furthermore, to achieve mutual acceptance of test results a list of registered accredited laboratories shall be set up.

The conditions for these testing laboratories are also included in this document.

Note:

The manufacturers acting under the quality plan of this Marcogaz Guidance for producing compounds, pipes, fittings and valves have to be registered for traceability purposes at the website 'www.traccoding.com' managed by the ISO Committee for plastics systems for Gas Supply: ISO TC 138 SC 4 as described in ISO 12176-4.

3 PE Compounds

3.1 General

PE pipes, valves and fittings for the construction of gas distribution networks are manufactured from a PE compound conforming to the class PE 80 or PE 100 according to EN 1555-1.

3.2 Quality plan

The compound manufacturer shall handle the quality plan for the assessment of conformity specified in CEN/TS 1555-7 for PE compounds.

The PE compound manufacturer shall operate a quality management system during the production process according to ISO EN 9001:2000 or equivalent, checked and periodically audited by an accredited certification body.

3.3 Testing of conformity

The performance class of the PE compound (PE 80 or PE 100) shall be verified on the basis of EN ISO 9080.

A laboratory, accredited according to ISO/IEC 17025[1], for the tests specified in CEN/TS 1555-7 shall establish a technical file indicating the performance class of the PE compound. For this purpose, that laboratory, accredited for hydrostatic testing, shall carry out the tests mentioned in EN ISO 9080. The same laboratory or the involved certification body shall also undertake the sampling.

The conformity of the PE compound to EN 1555-1 shall be demonstrated through a type-testing programme as described in CEN/TS 1555-7 – type tests for a compound. A laboratory accredited according to ISO IEC 17025[1] for the tests specified in CEN/TS 1555-7 carries out the tests. Sampling shall be carried out as laid down in CEN/TS 1555-7 by the accredited laboratory or by the third party certification body.

The main performance characteristics such as rapid cracking propagation (RCP), slow crack growth (SCG) and long term hydrostatic strength at 80°C and 20 °C (LTHS) shall all be tested using pipes manufactured from the same batch of compound. The manufacturer shall register the main characteristics of the compound – i.e. those mentioned in the standard EN 1555-1 – in a technical file.

3.4 Technical file for the compound

The compound manufacturer shall produce a technical file with the following information, to be confirmed by an accredited laboratory or a third party certification body, as mentioned above;

- Trade name and performance class of the raw material;
- Test results, confirming RCP, SCG and LTHS measured on the same batch of pipes;
- Other characteristics as described in EN 1555-1.

[1] "A laboratory, accredited according to ISO/IEC 17025 by an Accreditation body which is a member of the European co-operation for Accreditation (EA) and signed the Multilateral Agreements (MLA) for Testing and Calibration"

3.5 Periodic control

At least every two years, a periodic verification of the characteristics shall be carried out by a laboratory accredited according to ISO/IEC 17025 for the testing of PE pipes and fittings on the basis of the requirements and tests mentioned in CEN/TS 1555-7 for audit testing (AT).

The user shall be notified in advance of any physical change in the raw material. In certain cases, a change may lead to re-qualification of the product (see CEN/TS 1555-7).

After four periodic verifications checks or maximum eight year after the initial type tests, the performance class shall be re-verified. For this purpose, up to 80 % of the points verified can be taken from the manufacturer's own testing data, while at least 20 % of the data are tested by an accredited laboratory, as mentioned above. The test points verified by the laboratory are equally spread over long and short term periods and on at least two different temperatures and stress levels.

In case of conflict, the accredited laboratory shall carry out a complete test programme. The accredited laboratory or the third party certification body shall organise the sampling.
The manufacturer shall maintain a traceability database with its production data, which shall be kept for at least ten years. After this period, the users may wish to maintain the database at their own cost. The minimum data to be kept are test results and batch identification information.

4 PE Pipes

4.1 General

PE pipes shall be manufactured from compounds that have been accepted by the user according to the procedure described in chapter 3 above.

The use of reworked raw materials from the manufacturer's own production is permitted, provided a written agreement between the supplier and user exists.

The pipes are black, yellow or "orange", with or without identification stripes, and are manufactured according to EN 1555-2.

4.2 Quality plan

The pipe manufacturer shall handle the quality plan for the assessment of conformity specified in CEN/TS 1555-7 for PE pipes.

The pipe manufacturer shall operate a quality management system for the production process according to EN ISO 9001:2000 or equivalent, checked and periodically audited by an accredited certification body.

If required by the user, the extrusion line shall be qualified based on a written agreement between user and manufacturer: diameters, SDR series, identification and capacity of the extruder are subject to this agreement. For this purpose, the manufacturer shall have carried out tests to demonstrate that finished pipes achieve the expected characteristics considering all together the compound, pipe diameter, wall thickness and extrusion machine. Sampling shall be carried out as specified in EN 1555-7 for type testing. The tests are carried out by the pipe manufacturer or by a laboratory of his choice.

All qualified extrusion lines shall be equipped with a device for automatic wall thickness and diameter control and registration.

4.3 Testing of conformity

The conformity of the pipes to EN 1555-2 and EN 1555-5 shall be demonstrated through a type-testing programme as described in CEN/TS 1555-7 – type tests for pipes. A laboratory accredited according to ISO IEC 17025 for the tests specified in CEN/TS 1555-7 or a laboratory working under a quality scheme based on ISO IEC 17025 for tests and test methods specified in CEN/TS 1555-7 and operated by a third party certification body accredited according to EN 45011 carries out the tests. The same accredited laboratory or third party certification body shall also undertake the sampling.

For safety reasons the RCP resistance of PE pipes with diameters = 250 mm and for use in gas supply systems with a maximum operating pressure = 5 bars, shall be measured. For this purpose, the type testing of size group 3 shall include a S4 test, in accordance with the conditions of EN 1555-1. In case of doubt, a full-scale test shall be carried out.

A squeeze test shall also be carried out on a pipe with diameter DN 250 – SDR 11. The pipe shall be tested following EN 12106:1997.

4.4 Periodic control

Periodic checks (audit test) shall be carried out minimum every two-year according to the quality plan laid down in CEN/TS 1555-7 – audit test. A laboratory accredited according to ISO IEC 17025 for the tests specified in CEN/TS 1555-7 or a laboratory working under a certification scheme operated by a third party certification body accredited according to EN 45011 carries out the tests. The same accredited laboratory or third party certification body shall also do the sampling.

For size group 3 a S4 test in accordance with the conditions of EN 1555-1 shall also be carried out. In case of doubt, a full-scale test shall be carried out.

The manufacturer shall maintain a traceability database with its production data, which shall be kept for at least ten years. After this period, the users may wish to maintain the database at their own cost. The minimum data to be kept are dimensional checks, test results and batch identification information.

5 PE Fittings and Valves

5.1 General

PE fittings and valves shall be manufactured from compounds that have been accepted by the user according to the procedure described in chapter 3 above.

The use of reworked raw material from the manufacturer's own production is permitted, provided a written agreement between the supplier and user exists.

The PE fittings and valves are black, yellow or "orange" and are manufactured according to EN 1555-3 for fittings and EN 1555-4 for valves.

5.2 Quality plan

The fitting/valve manufacturer shall handle the quality plan for the assessment of conformity specified in CEN/TS 1555-7 for PE fittings and valves.

The manufacturer shall operate a quality management system for the production process according to ISO EN 9001:2000 or equivalent, checked and periodically audited by an accredited certification body.

If required by the user, the production equipment shall be qualified, based on a written agreement between user and manufacturer: type of fitting/valve, diameters, SDR series and identification and capacity of production equipment are subject to this agreement. For this purpose, the manufacturer shall have carried out tests to demonstrate that finished fittings/valves achieve the expected characteristics considering all together the compound, fitting/valve diameter, wall thickness and the manufacturing equipment. Sampling shall be carried out as specified in CEN/TS 1555-7 for type testing. The tests are carried out by the fitting/valve manufacturer or by a laboratory of his choice.

5.3 Testing of conformity

The conformity of the fittings/valves to EN 1555-3/EN 1555-4 and EN 1555-5 shall be demonstrated through a type-testing programme as described in CEN/TS 1555-7 – type tests for fittings or valves. A laboratory, accredited according to ISO IEC 17025 for the tests specified in CEN/TS 1555-7, or a laboratory working under a quality scheme based on ISO IEC 17025 for tests and test methods specified in CEN/TS 1555-7 and operated by a third party certification body accredited according to EN 45011, carries out the tests. The same laboratory or third party certification body shall also undertake the sampling. (see 5.5).The manufacturer shall register the main characteristics of the compound – i.e. those mentioned in the standard EN 1555-3 or EN 1555-4 – in a technical file.

5.4 Technical file for fittings and valves

The manufacturer shall produce a technical file with the following information for each type of fitting or valve:

- Information regarding the compound used;
- Dimensions and tolerances, including drawings of the fittings and valves;
- Scope of application (temperature and pressure limits);
- Assembling and fusion instructions;
- Test results, confirming the conformity with EN 1555-3 or EN 1555-4.

5.5 Periodic control

Periodic checks (audit test) shall be carried out minimum every two-year according to the quality plan laid down in CEN/TS 1555-7 – audit test. A laboratory accredited according to ISO IEC 17025 for the tests specified in CEN/TS 1555-7 or a laboratory working under a certification scheme operated by a third party certification body accredited according to EN 45011 carries out the tests. The same laboratory or third party certification body shall also do the sampling.

The manufacturer of fittings and/or valves shall maintain a traceability database with its production data, which shall be kept for at least ten years. After this period, the user may wish to maintain the database at its own cost. The minimum data to be kept are dimensional checks, test results and batch identification information.

Annex 1

List of laboratories under mutual acceptance of test results

This annex contains a list of laboratories under mutual acceptance for this Marcogaz Guidance.

This list of laboratories, being representative for the gas industry, has been established with information provided by Marcogaz members and is not exclusive.

The laboratories mentioned in this annex are accredited according to ISO IEC 17025 for tests and test methods specified in CEN/TS 1555-7. Some non accredited laboratories but working under a quality scheme based on ISO IEC 17025 for tests and test methods specified in CEN/TS 1555-7 and operated by a third party certification body accredited according to EN 45011 are also mentioned.

The laboratories mentioned in this section are only under mutual acceptance for the tests covered by their accreditation scheme.

For this purpose, the list gives the identification of the laboratory and the list of tests with the referring standard covered by its accreditation.

Name	Address	Contact person	Accreditation decision
ofi - Österreichisches Forschungsinstitut für Chemie und Technik	Arsenal Objekt 213 Franz-Grill-Strasse 5 A - 1030 Wien	Udo Pappler fon: +43 1 798 16 01 – 0 fax: +43 1 798 16 01 – 8 udo.pappler@ofi.co.at	**Accreditated laboratory** (BMwA 92714 / 630-IX/2/98 according to EN 45004 an ISO IEC 17025 Notification Body No. 1058 www.ofi.co.at
TGM - Versuchsanstalt für Kunststoff- und Umwelttechnik	Wexstraße 19-23 A-1200 Wien	Heinz Dragaun fon: 43-1-33126-478 fax: 43-1-33126-678 heinz.dragaun@tgm.ac.at	**Accreditated laboratory** Nr. 83; (BMwA 92714 / 589-IX/2/97) (according to ISO IEC 17025 and EN 45004) Notification body n° 1532 www.kunststoff.ac.at

List of tests (X) for which the testing houses (1, 2 see footnote) are accredited

Marcogaz Guide - Tests according to the standards EN 1555-1 to 5																	
Pipes	***1***	***2***	***3***	***4***	***5***	***Fittings***	***1***	***2***	***3***	***4***	***5***	***Valves***	***1***	***2***	***3***	***4***	***5***
Hydrostatic strength (20 °C, 100 h)	X	X				Hydrostatic strength (20 °C, 100 h)	X	X				Hydrostatic strength (20 °C, 100 h)	X	X			
Hydrostatic strength (80 °C, 165 h)	X	X				Hydrostatic strength (80 °C, 165 h)	X	X				Hydrostatic strength (80 °C, 165 h)	X	X			
Hydrostatic strength (80 °C, 1000 h)	X	X				Hydrostatic strength (80 °C, 1000 h)	X	X				Hydrostatic strength (80 °C, 1000 h)	X	X			
Elongation at break	X	X				Decohesive resistance	X	X				Leaktightness of seat and packing	X				
Resistance to slow crack growth $e \leq 5$ mm (Cone test)	X	X				Cohesive strength	X	X				Pressure drop					
Resistance to slow crack growth $e > 5$ mm (Notch test)	X	X				Tensile strength for butt fusion	X	X				Operating torque	X				
Resistance to rapid crack propagation		X				Impact resistance	X	X				Stop resistance	X				
Oxidation induction time (Thermal stability)	X	X				Pressure drop						Actuation mechanism resistance	X				

Marcogaz Guide - Tests according to the standards EN 1555-1 to 5

Pipes	1	2	3	4	5	Fittings	1	2	3	4	5	Valves	1	2	3	4	5
Melt mass-flow rate (MFR)	X	X				Oxidation induction time (Thermal stability)	X	X				Resistance to bending between supports	X	X			
Longitudinal reversion	X	X				Melt mass-flow rate (MFR	X	X				Thermal cycling resistance (d_n > 63 mm	X				
Resistance to weathering	X	X										Leaktightness under bending with thermal cycling ($d_n \leq 63$ mm	X				
a) oxidation induction time b) hydrostatic strength (165 h at 80 °C) c) elongation at break	X	X										Leaktightness under tensile loading	X				
Tensile strength for butt fusion	X	X										Leaktightness under and after bending applied to the operating mechanism	X				
												Impact loading resistance	X				
												Resistance to long-term internal pressure loading	X				
												a) Leaktightness of seat and packing b) Operating torque c) Impact loading resistance	X				
												Oxidation induction time (Thermal stability)	X	X			
												Melt mass-flow rate (MFR)	X	X			
												Tensile strength for butt fusion	X	X			

Marcogaz Guide - Tests according to the standards EN 1555-1 to 5																	
Compound (granule)	***1***	***2***	***3***	***4***	***5***	***Compound (pipe)***	***1***	***2***	***3***	***4***	***5***	***Butt Fusion***	1	***2***	***3***	***4***	***5***
Conventional density	X	X				Resistance to gas condensate	X	X				Tensile strength for butt fusion (d_n : 110 mm or 125 mm - SDR 11)	X	X			
Oxidation induction time (Thermal stability) > 20 min	X	X				Resistance to weathering	X	X									
Melt mass-flow rate (MFR)	X	X				- oxidation induction time - hydrostatic strength (165 h at 80 °C) - elongation at break	X	X									
Volatile content	X	X				Resistance to rapid crack propagation		X									
Water content	X					Resistance to slow crack growth (d_n: 110 mm or 125 mm - SDR 11)	X	X									
Carbon black content	X	X															
Carbon black dispersion	X	X															
Pigment dispersion	X	X															

1= ofi 2= TGM

Name	Address	Contact person	Accreditation decision
Becetel	Gontrode Heirweg 130 9090 Melle – Belgium	Philippe Vanspeybroeck philippe.vanspeybroeck@becetel.be Joris Vienne joris.vienne@becetel.be Anja Dewilde anja.dewilde@becetel.be Tel: +32 9 272 50 70 Fax: +32 9 272 50 72 www.becetel.be	Accredited laboratory by BELTEST (nr 242-T) www.belac.be

List of tests (X) for which the testing house is accredited

Marcogaz Guide - Tests according to the standards EN 1555-1 to 5																	
Pipes	**1**	**2**	**3**	**4**	**5**	***Fittings***	**1**	**2**	**3**	**4**	**5**	***Valves***	**1**	**2**	**3**	**4**	**5**
Hydrostatic strength (20 °C, 100 h)	X					Hydrostatic strength (20 °C, 100 h)	X					Hydrostatic strength (20 °C, 100 h)	X				
Hydrostatic strength (80 °C, 165 h)	X					Hydrostatic strength (80 °C, 165 h)	X					Hydrostatic strength (80 °C, 165 h)	X				
Hydrostatic strength (80 °C, 1000 h)	X					Hydrostatic strength (80 °C, 1000 h)	X					Hydrostatic strength (80 °C, 1000 h)	X				
Elongation at break	X					Decohesive resistance	X					Leaktightness of seat and packing	X				
Resistance to slow crack growth $e \leq 5$ mm (Cone test)						Cohesive strength	X					Pressure drop					
Resistance to slow crack growth $e > 5$ mm (Notch test)	X					Tensile strength for butt fusion	X					Operating torque	X				
Resistance to rapid crack propagation	X					Impact resistance						Stop resistance	X				
Oxidation induction time (Thermal stability)	X					Pressure drop						Actuation mechanism resistance	X				

Marcogaz Guide - Tests according to the standards EN 1555-1 to 5																	
Pipes	1	2	3	4	5	**Fittings**	1	2	3	4	5	**Valves**	1	2	3	4	5
Melt mass-flow rate (MFR)	X					Oxidation induction time (Thermal stability)	X					Resistance to bending between supports	X				
Longitudinal reversion	X					Melt mass-flow rate (MFR	X					Thermal cycling resistance (d_n > 63 mm	X				
Resistance to weathering												Leaktightness under bending with thermal cycling ($d_n \leq$ 63 mm	X				
a) oxidation induction time b) hydrostatic strength (165 h at 80 °C) c) elongation at break	X X X											Leaktightness under tensile loading	X				
Tensile strength for butt fusion	X											Leaktightness under and after bending applied to the operating mechanism	X				
												Impact loading resistance	X				
												Resistance to long-term internal pressure loading	X				
												a) Leaktightness of seat and packing b) Operating torque c) Impact loading resistance	X X X				
												Oxidation induction time (Thermal stability)	X				
												Melt mass-flow rate (MFR)	X				
												Tensile strength for butt fusion	X				

Marcogaz Guide - Tests according to the standards EN 1555-1 to 5																	
Compound (granule)	***1***	***2***	***3***	***4***	***5***	***Compound (pipe)***	***1***	***2***	***3***	***4***	***5***	***Butt Fusion***	***1***	***2***	***3***	***4***	***5***
Conventional density	X					Resistance to gas condensate	X					Tensile strength for butt fusion (d_n : 110 mm or 125 mm - SDR 11)	X				
Oxidation induction time (Thermal stability) > 20 min	X					Resistance to weathering											
Melt mass-flow rate (MFR)	X					- oxidation induction time - hydrostatic strength (165 h at 80 °C) - elongation at break	X X X										
Volatile content						Resistance to rapid crack propagation	X										
Water content						Resistance to slow crack growth (d_n: 110 mm or 125 mm - SDR 11)	X										
Carbon black content																	
Carbon black dispersion																	
Pigment dispersion																	

1= BECETEL

Name	Address	Contact person	Accreditation decision
Danish Technological Institute	Teknologiparken Kongsvamg Alle 29 8000 Århus C	Sten Kloppenborg Stenk@teknologisk.dk +4572201246 Kent Lemming kent.lemming@teknologisk.dk +4572201225	DANAK Nr 300 and 127 www.danak.dk
Force Technology	Park Alle 345 DK 2605 Broendby	Leif Egon Andersen lfa@force.dk +45 4326 7000	DANAK Nr 008 and 065 www.danak.dk

List of tests (X) for which the testing houses (1, 2 :see footnote) are accredited

Marcogaz Guide - Tests according to the standards EN 1555-1 to 5																	
Pipes	*1*	*2*	*3*	*4*	*5*	***Fittings***	***1***	***2***	***3***	***4***	***5***	***Valves***	***1***	***2***	***3***	***4***	***5***
Hydrostatic strength (20 °C, 100 h)	X	X				Hydrostatic strength (20 °C, 100 h)	X	X				Hydrostatic strength (20 °C, 100 h)	X	X			
Hydrostatic strength (80 °C, 165 h)	X	X				Hydrostatic strength (80 °C, 165 h)	X	X				Hydrostatic strength (80 °C, 165 h)	X	X			
Hydrostatic strength (80 °C, 1000 h)	X	X				Hydrostatic strength (80 °C, 1000 h)	X	X				Hydrostatic strength (80 °C, 1000 h)	X	X			
Elongation at break	X	X				Decohesive resistance	X	X				Leaktightness of seat and packing					
Resistance to slow crack growth $e \leq 5$ mm (Cone test)	X	X				Cohesive strength	X	X				Pressure drop	X	X			
Resistance to slow crack growth $e > 5$ mm (Notch test)	X	X				Tensile strength for butt fusion	X	X				Operating torque					
Resistance to rapid crack propagation						Impact resistance	X	X				Stop resistance					
Oxidation induction time (Thermal stability)	X	X				Pressure drop	X	X				Actuation mechanism resistance					

Marcogaz Guide - Tests according to the standards EN 1555-1 to 5

Pipes	1	2	3	4	5	*Fittings*	1	2	3	4	5	*Valves*	1	2	3	4	5
Melt mass-flow rate (MFR)	X	X				Oxidation induction time (Thermal stability)	X	X				Resistance to bending between supports					
Longitudinal reversion	X	X				Melt mass-flow rate (MFR	X	X				Thermal cycling resistance (d_n > 63 mm					
Resistance to weathering	X	X										Leaktightness under bending with thermal cycling ($d_n \le 63$ mm					
a) oxidation induction time b) hydrostatic strength (165 h at 80 °C) c) elongation at break	X X X	X X X										Leaktightness under tensile loading					
Tensile strength for butt fusion	X	X										Leaktightness under and after bending applied to the operating mechanism					
												Impact loading resistance	X	X			
												Resistance to long-term internal pressure loading	X	X			
												a) Leaktightness of seat and packing b) Operating torque c) Impact loading resistance					
												Oxidation induction time (Thermal stability)	X	X			
												Melt mass-flow rate (MFR)	X	X			
												Tensile strength for butt fusion	X	X			

Marcogaz Guide - Tests according to the standards EN 1555-1 to 5																	
Compound (granule)	***1***	***2***	***3***	***4***	***5***	***Compound (pipe)***	***1***	***2***	***3***	***4***	***5***	***Butt Fusion***	***1***	***2***	***3***	***4***	***5***
Conventional density	X	X				Resistance to gas condensate	X	X				Tensile strength for butt fusion (d_n : 110 mm or 125 mm - SDR 11)	X	X			
Oxidation induction time (Thermal stability) > 20 min	X	X				Resistance to weathering	X	X									
Melt mass-flow rate (MFR)	X	X				- oxidation induction time - hydrostatic strength (165 h at 80 °C) - elongation at break	X X X	X X X									
Volatile content	X	X				Resistance to rapid crack propagation											
Water content	X	X				Resistance to slow crack growth (d_n: 110 mm or 125 mm - SDR 11)	X	X									
Carbon black content	X	X															
Carbon black dispersion	X	X															
Pigment dispersion	X	X															

1= Danish Technology Institute

2= Force Technology

Name	Address	Contact person	Accreditation decision
1 = Laboratoire National d'Essais	1, rue Gaston Boissier F-75724 PARIS cedex 15	Mrs PELISSIE Annick.Pelissie@lne.fr Tel: +33 (0)1 40 43 37 84 Fax: +33 (0)1 40 43 37 37	Accredited according to ISO 17025 by COFRAC (EA member)
2 = Georg Fischer Laboratory	Georg Fischer Wavin CH-8201 Schaffhausen	Mr Peter BARTH peter.barth@piping.georgfischer.com Tel : +41 (0)52-631 37 93 Fax : +41 (0)52-631 28 14	Accredited according to ISO 17025 by STS (EA member)
3 = Innoge	2, rue du Gabian BP289 MC-98007 Monaco Cedex	Mr Christophe BOUNIOL christophe.bouniol@innoge.com Tel: +377 92 05 50 13 Fax: +377 92 05 50 90	Testing Laboratory working under a product certification scheme operated by CERTIGAZ accredited according to EN 45011 by COFRAC (EA member)

List of tests (X) for which the testing houses (1,2,3 :see footnote) are accredited

Marcogaz Guide - Tests according to the standards EN 1555-1 to 5																	
Pipes	***1***	***2***	***3***	***4***	***5***	***Fittings***	***1***	***2***	***3***	***4***	***5***	***Valves***	***1***	***2***	***3***	***4***	***5***
Hydrostatic strength (20 °C, 100 h)		X				Hydrostatic strength (20 °C, 100 h)		X	X			Hydrostatic strength (20 °C, 100 h)		X	X		
Hydrostatic strength (80 °C, 165 h)		X				Hydrostatic strength (80 °C, 165 h)		X	X			Hydrostatic strength (80 °C, 165 h)		X	X		
Hydrostatic strength (80 °C, 1000 h)		X				Hydrostatic strength (80 °C, 1000 h)		X	X			Hydrostatic strength (80 °C, 1000 h)		X	X		
Elongation at break						Decohesive resistance		X	X			Leaktightness of seat and packing					
Resistance to slow crack growth $e \leq 5$ mm (Cone test)						Cohesive strength			X			Pressure drop			X		
Resistance to slow crack growth $e > 5$ mm (Notch test)		X				Tensile strength for butt fusion						Operating torque			X		
Resistance to rapid crack propagation						Impact resistance		X	X			Stop resistance					
Oxidation induction time (Thermal stability)	X					Pressure drop		X				Actuation mechanism resistance			X		

Marcogaz Guide - Tests according to the standards EN 1555-1 to 5

Pipes	***1***	***2***	***3***	***4***	***5***	***Fittings***	***1***	***2***	***3***	***4***	***5***	***Valves***	***1***	***2***	***3***	***4***	***5***
Melt mass-flow rate (MFR)	X					Oxidation induction time (Thermal stability)	X		X			Resistance to bending between supports					
Longitudinal reversion	X					Melt mass-flow rate (MFR	X					Thermal cycling resistance (d_n > 63 mm					
Resistance to weathering												Leaktightness under bending with thermal cycling ($d_n \leq$ 63 mm					
a) oxidation induction time b) hydrostatic strength (165 h at 80 °C) c) elongation at break												Leaktightness under tensile loading					
Tensile strength for butt fusion												Leaktightness under and after bending applied to the operating mechanism					
												Impact loading resistance					
												Resistance to long-term internal pressure loading		X			
												a) Leaktightness of seat and packing b) Operating torque c) Impact loading resistance		X (b)			
												Oxidation induction time (Thermal stability)	X		X		
												Melt mass-flow rate (MFR)	X				
												Tensile strength for butt fusion					

Marcogaz Guide - Tests according to the standards EN 1555-1 to 5																	
Compound (granule)	***1***	***2***	***3***	***4***	***5***	***Compound (pipe)***	***1***	***2***	***3***	***4***	***5***	***Butt Fusion***	***1***	***2***	***3***	***4***	***5***
Conventional density						Resistance to gas condensate						Tensile strength for butt fusion (d_n : 110 mm or 125 mm - SDR 11)					
Oxidation induction time (Thermal stability) > 20 min	X					Resistance to weathering	X										
Melt mass-flow rate (MFR)	X					- oxidation induction time - hydrostatic strength (165 h at 80 °C) - elongation at break	X										
Volatile content	X					Resistance to rapid crack propagation											
Water content						Resistance to slow crack growth (d_n: 110 mm or 125 mm - SDR 11)			X								
Carbon black content	X																
Carbon black dispersion	X																
Pigment dispersion	X																

1= Laboratoire National d'Essais 2= Georg Fischer Laboratory 3= Innoge

Name	Address	Contact person	Accreditation decision
IMA Materialforschung und Anwendungstechnik GmbH Labor für Kunststoffprüfung	Hermann-Reichelt-Str. D-01109 Dresden	Dr Hönninger www.ima-dresden.de 0049 3518837 404 530	DAR/DVGW Accreditation DAP-PL-1062.00
Materialprüfungsanstalt Abt. Kunststoffe	Grafenstr. 2 D-64283 Darmstadt	Dr Stagge www.tu-darmstadt.de 0049 6151 162741 165658	DAR/DVGW Accreditation DAP-PL-3289.00
TÜV Süddeutschland TÜV Anlagen und Umwelttechnik Institut für Kunststoffe	Ridlerstr. 57 D-80339 München	Demetz www.tuevs.de 0049 895190 3229 ……………. 3100	DAR/DVGW Accreditation DAP-P-02-722-03-98
Süddeutsches Kunststoffzentrum Abt. Prüfung und Forschung	Frankfurterstr. 15-17 D-97082 Würzburg	Dr Bastian www.skz.de 0049 9314104 0 ………………. 177	DAR/DVGW Accreditation DAP-PL-2005-00

List of tests (X) for which the testing houses (1, 2, 3, 4, see footnote) are accredited

Marcogaz Guide - Tests according to the standards EN 1555-1 to 5

Pipes	1	2	3	4	5	*Fittings*	1	2	3	4	5	*Valves*	1	2	3	4	5
Hydrostatic strength (20 °C, 100 h)	x	x	x	x		Hydrostatic strength (20 °C, 100 h)	x	x	x	x		Hydrostatic strength (20 °C, 100 h)	x	x	x	x	
Hydrostatic strength (80 °C, 165 h)	x	x	x	x		Hydrostatic strength (80 °C, 165 h)	x	x	x	x		Hydrostatic strength (80 °C, 165 h)	x	x	x	x	
Hydrostatic strength (80 °C, 1000 h)	x	x	x	x		Hydrostatic strength (80 °C, 1000 h)	x	x	x	x		Hydrostatic strength (80 °C, 1000 h)	x	x	x	x	
Elongation at break	x	x	x	x		Decohesive resistance				x		Leaktightness of seat and packing	x	x		x	
Resistance to slow crack growth $e \leq 5$ mm (Cone test)	x			x		Cohesive strength				x		Pressure drop	x	x		x	
Resistance to slow crack growth $e > 5$ mm (Notch test)	x	x		x		Tensile strength for butt fusion	x	x	x	x		Operating torque	x			x	
Resistance to rapid crack propagation	x					Impact resistance	x	x	x	x		Stop resistance	x			x	
Oxidation induction time (Thermal stability)	x	x	x	x		Pressure drop	x	x	x	x		Actuation mechanism resistance	x			X	

Marcogaz Guide - Tests according to the standards EN 1555-1 to 5

Pipes	1	2	3	4	5	Fittings	1	2	3	4	5	Valves	1	2	3	4	5
Melt mass-flow rate (MFR)	x	x	x	x		Oxidation induction time (Thermal stability)	x	x	x	x		Resistance to bending between supports				x	
Longitudinal reversion	x	x	x	x		Melt mass-flow rate (MFR	x	x	x	x		Thermal cycling resistance (d_n > 63 mm					
Resistance to weathering		x	x	x								Leaktightness under bending with thermal cycling ($d_n \leq 63$ mm					
a) oxidation induction time b) hydrostatic strength (165 h at 80 °C) c) elongation at break	x x x	x x x	x x x	x x x								Leaktightness under tensile loading					
Tensile strength for butt fusion	x	x	x	x								Leaktightness under and after bending applied to the operating mechanism					
												Impact loading resistance					
												Resistance to long-term internal pressure loading				x	
												a) Leaktightness of seat and packing b) Operating torque c) Impact loading resistance	x			x	
												Oxidation induction time (Thermal stability)	x	x	x	x	
												Melt mass-flow rate (MFR)	x	x	x	x	
												Tensile strength for butt fusion	x	x	x	x	

Marcogaz Guide - Tests according to the standards EN 1555-1 to 5

Compound (granule)	1	2	3	4	5	Compound (pipe)	1	2	3	4	5	Butt Fusion	1	2	3	4	5
Conventional density	x	x	x	x		Resistance to gas condensate			x	x		Tensile strength for butt fusion (d_n : 110 mm or 125 mm - SDR 11)	x	x	x	x	
Oxidation induction time (Thermal stability) > 20 min	x	x	x	x		Resistance to weathering	x	x	x	x							
Melt mass-flow rate (MFR)	x	x	x	x		- oxidation induction time - hydrostatic strength (165 h at 80 °C) - elongation at break	x	x	x	x							
Volatile content	x			x		Resistance to rapid crack propagation	x			x							
Water content	x	x		x		Resistance to slow crack growth (d_n: 110 mm or 125 mm - SDR 11)	x	x		x							
Carbon black content	x			x													
Carbon black dispersion	x	x		x													
Pigment dispersion	x	x		x													

1= IMA/Dresden 2= MPA/Darmstadt 3= TÜV Süd/München 4= SKZ/Würzburg

Name	Address	Contact person	Accreditation decision
Gastec	GASTEC Certification B.V. Wilmersdorf 50 NL-7327 AC Apeldoorn Mail address : P.O. Box 137 NL-7300 AC Apeldoorn	For certification details Jacques van Buren Manager Certification Bureau Tel: +31 55 5393221 E-mail: bu@gastec.nl	Gastec Certification accredited by the Dutch Council for Accreditation (EA member) under accreditation numbers L 326 (testing) and C 009 (certification).

List of tests (X) for which the testing house is accredited

Marcogaz Guide - Tests according to the standards EN 1555-1 to 5																	
Pipes	***1***	***2***	***3***	***4***	***5***	***Fittings***	***1***	***2***	***3***	***4***	***5***	***Valves***	***1***	***2***	***3***	***4***	***5***
Hydrostatic strength (20 °C, 100 h)	X					Hydrostatic strength (20 °C, 100 h)	X					Hydrostatic strength (20 °C, 100 h)	X				
Hydrostatic strength (80 °C, 165 h)	X					Hydrostatic strength (80 °C, 165 h)	X					Hydrostatic strength (80 °C, 165 h)	X				
Hydrostatic strength (80 °C, 1000 h)	X					Hydrostatic strength (80 °C, 1000 h)	X					Hydrostatic strength (80 °C, 1000 h)	X				
Elongation at break	X					Decohesive resistance	X					Leaktightness of seat and packing	X				
Resistance to slow crack growth $e \leq 5$ mm (Cone test)	X					Cohesive strength	X					Pressure drop	X				
Resistance to slow crack growth $e > 5$ mm (Notch test)	X					Tensile strength for butt fusion	X					Operating torque					
Resistance to rapid crack propagation	X					Impact resistance	X					Stop resistance					
Oxidation induction time (Thermal stability)	X					Pressure drop	X					Actuation mechanism resistance					
Melt mass-flow rate (MFR)	X					Oxidation induction time (Thermal stability)	X					Resistance to bending between supports					
Longitudinal reversion	X					Melt mass-flow rate (MFR	X					Thermal cycling resistance ($d_n > 63$ mm					

Marcogaz Guide - Tests according to the standards EN 1555-1 to 5

Pipes	***1***	***2***	***3***	***4***	***5***	***Fittings***	***1***	***2***	***3***	***4***	***5***	***Valves***	***1***	***2***	***3***	***4***	***5***
Resistance to weathering	X											Leaktightness under bending with thermal cycling ($d_n \leq 63$ mm					
a) oxidation induction time b) hydrostatic strength (165 h at 80 °C) c) elongation at break	X X X											Leaktightness under tensile loading					
Tensile strength for butt fusion	X											Leaktightness under and after bending applied to the operating mechanism					
												Impact loading resistance					
												Resistance to long-term internal pressure loading					
												a) Leaktightness of seat and packing b) Operating torque c) Impact loading resistance					
												Oxidation induction time (Thermal stability)	X				
												Melt mass-flow rate (MFR)	X				
												Tensile strength for butt fusion	X				

Marcogaz Guide - Tests according to the standards EN 1555-1 to 5																	
Compound (granule)	***1***	***2***	***3***	***4***	***5***	***Compound (pipe)***	***1***	***2***	***3***	***4***	***5***	***Butt Fusion***	***1***	***2***	***3***	***4***	***5***
Conventional density	X					Resistance to gas condensate	X					Tensile strength for butt fusion (d_n : 110 mm or 125 mm - SDR 11)	X				
Oxidation induction time (Thermal stability) > 20 min	X					Resistance to weathering	X										
Melt mass-flow rate (MFR)	X					- oxidation induction time - hydrostatic strength (165 h at 80 °C) - elongation at break	X										
Volatile content	X					Resistance to rapid crack propagation	X										
Water content	X					Resistance to slow crack growth (d_n: 110 mm or 125 mm - SDR 11)	X										
Carbon black content	x																
Carbon black dispersion	X																
Pigment dispersion	X																

1= GASTEC Certification B.V.

Ref.	Name	Address	Contact person	Accreditation decision
1	CEIS (Centro de Ensayos, Innovación y Servicios), S.L	Ctra. de Villaviciosa de Odón a Móstoles, km 1,5 28930 Móstoles (Madrid), Spain	Mr. Santos Santolino ssantolino@ceis.es Tel. +34 916 169 066 Fax +34 916 162 372	Laboratory working under an accreditation scheme operated by the Certification Body AENOR. Accreditation, according to ISO IEC 17025, for 21 test methods was applied for on March 25th, 2004. First audit should have been performed by the Accreditation Body ENAC on September, 2004.

List of tests (X) for which the testing house (1: see footnote) is accredited

Marcogaz Guide - Tests according to the standards EN 1555-1 to 5 and CEN/TS 1555-7.																	
Pipes	***1***	***2***	***3***	***4***	***5***	***Fittings***	***1***	***2***	***3***	***4***	***5***	***Valves***	***1***	***2***	***3***	***4***	***5***
Hydrostatic strength (20 °C, 100 h)	X					Hydrostatic strength (20 °C, 100 h)	(1)					Hydrostatic strength (20 °C, 100 h)					
Hydrostatic strength (80 °C, 165 h)	X					Hydrostatic strength (80 °C, 165 h)	(1)					Hydrostatic strength (80 °C, 165 h)					
Hydrostatic strength (80 °C, 1000 h)	X					Hydrostatic strength (80 °C, 1000 h)	(1)					Hydrostatic strength (80 °C, 1000 h)					
Elongation at break	X					Decohesive resistance						Leaktightness of seat and packing					
Resistance to slow crack growth $e \leq 5$ mm (Cone test)	(1)					Cohesive strength						Pressure drop					
Resistance to slow crack growth $e > 5$ mm (Notch test)	X					Tensile strength for butt fusion						Operating torque					
Resistance to rapid crack propagation						Impact resistance						Stop resistance					
Oxidation induction time (Thermal stability)	X					Pressure drop	(1)					Actuation mechanism resistance					

Marcogaz Guide - Tests according to the standards EN 1555-1 to 5 and CEN/TS 1555-7.																	
Pipes	***1***	***2***	***3***	***4***	***5***	***Fittings***	***1***	***2***	***3***	***4***	***5***	***Valves***	***1***	***2***	***3***	***4***	***5***
Melt mass-flow rate (MFR)	X					Oxidation induction time (Thermal stability)	X					Resistance to bending between supports					
Longitudinal reversion	X					Melt mass-flow rate (MFR	X					Thermal cycling resistance (d_n > 63 mm					
Resistance to weathering	X											Leaktightness under bending with thermal cycling ($d_n \le 63$ mm					
a) oxidation induction time	X											Leaktightness under tensile loading					
b) hydrostatic strength (165 h at 80 °C)	X																
c) elongation at break	X																
Tensile strength for butt fusion												Leaktightness under and after bending applied to the operating mechanism					
Resistance to internal pressure after squeeze-off	(1)											Impact loading resistance					
												Resistance to long-term internal pressure loading					
												a) Leaktightness of seat and packing					
												b) Operating torque					
												c) Impact loading resistance					
												Oxidation induction time (Thermal stability)					
												Melt mass-flow rate (MFR)					

Marcogaz Guide - Tests according to the standards EN 1555-1 to 5 and CEN/TS 1555-7.

Compound (granule)	***1***	***2***	***3***	***4***	***5***	***Compound (pipe)***	***1***	***2***	***3***	***4***	***5***	*Butt Fusion*	***1***	***2***	***3***	***4***	***5***
Conventional density	X					Resistance to gas condensate	X					Tensile strength for butt fusion (d_n : 110 mm or 125 mm - SDR 11)					
Oxidation induction time (Thermal stability) > 20 min	X					Resistance to weathering	X										
Melt mass-flow rate (MFR)	X					- oxidation induction time - hydrostatic strength (165 h at 80 °C) - elongation at break	X										
Volatile content	X					Resistance to rapid crack propagation											
Water content	(1)					Resistance to slow crack growth (d_n: 110 mm or 125 mm - SDR 11)	X										
Carbon black content	X																
Carbon black dispersion	X																
Pigment dispersion	X																

1 = **CEIS (Centro de Ensayos, Innovación y Servicios), S.L.**

NOTES: (1) Test method to be implemented during 2004. Accreditation for the test methods shown has been applied on March 25th, 2004

Annex 2

List of Marcogaz members who have accepted the document

Country	MARCOGAZ member	Comments	Decision date
Austria	ÖVGW (Österreichische Vereinigung für das Gas- und Wasserfach)		04.03.2005 (email from J. Grafeneder - ÖVGW)
Belgium	SYNERGRID	Only for the laboratories listed in annex 1 which are ISO 17025 accredited	14.07.2005 (email from G. Carens - ARGB)
Denmark	DGC (Danish Gas Technology Center)		14.05.2004 (J. Fentz during the MARCOGAZ General Assembly)
France	AFG (Association Française du Gaz)		13.05.2004 (J.F. Carrière – AFG during the Executive Board)
Germany	DVGW (Deutsche Vereinigung des Gas- und Wasserfaches e. V.)		14.12.2004 (email from T. Jannemann - DVGW)
The Netherlands	EnergieNed (Association of the Dutch Energy Companies)	Full acceptance for a first 2 year period and after this period expected to have only accredited ISO 17025 laboratories	20.10.2005 (J. Koningstein - EnergieNed letter)
Spain	Sedigas		22.03.2005 (email from C. Villalonga - Sedigas)

Annex 3 (informative)

List of certification bodies in Marcogaz member countries for PE pipes, fittings and valves

This annex contains a list of certification bodies operating in the Marcogaz member countries.
At the European level there is no specific technical regulation concerning the use of PE products by gas distribution system operators. In some countries national certification schemes involving certification bodies exist and are commonly used by the gas distribution system operators.

The goal of Marcogaz is not to harmonise at the European level the national existing certification schemes.

Certification body definition:

Impartial body, governmental or non-governmental, possessing the necessary competence and responsibility to carry out certification of conformity according to given rules of procedure and management

Country	Name	Address	Contact person
Belgium	BCCA(Belgian Construction Certification Association)	Aarlenstraat 53 BE-1040 Brussel BELGIUM	Mr Benny De Blaere and Mr Paul Blomme mail@bcca.be Tel: +32 2 238 24 11 Fax : +32 2 238 24 01 website : www.bcca.be
Czech Republic	GAS s. r. o.	Komenského nám. 1619 CZ-251 01 Ŕícany u Prahy Czech Republic	Dipl. Ing. Milan Šanta certifikace@gasinfo.cz Tel.: +420 377 539 000
Denmark	Danish Standards Association Certification	Kollegievej 6 DK-2920 Charlottenlund	Mr. Mark Krølner mak@ds.dk Tel: +45 39966334 Fax: +45 39966103

Country	Name	Address	Contact person
France	AFNOR Certification, certification body which has given a mandate to the following bodies : **For pipes** Laboratoire National d'Essais **For fittings & valves** CERTIGAZ	1, rue Gaston Boissier F-75724 Paris cedex 15 62, rue de Courcelles F-75008 Paris	Mrs Pelissie Annick.Pelissie@lne.fr Tel: +33 (0)1 40 43 37 84 Fax: +33 (0)1 40 43 37 37 Mr Paul Moffroid Paul.Moffroid@afgaz.fr Tél: +33 (0)1 44 01 87 64 Fax: +33 (0)1 44 01 87 90
Germany	DVGW Zertifizierungsstelle	Postfach 14 03 62 D-53058 Bonn	Mr Theo Jannemann jannemann@dvgw.de Tel: +49 228 9188 800 Fax: +49 228 9188 995
The Netherlands	Gastec	GASTEC Certification B.V. Wilmersdorf 50 NL-7327 AC Apeldoorn Mail address: P.O. Box 137 NL-7300 AC Apeldoorn	Jacques van Buren Manager Certification Bureau Tel: +31 55 5393221 bu@gastec.nl
Spain	***Compounds and pipes*** AENOR – Certificación de Producto	Génova, 6 28004 Madrid (Spain)	Mr. Ricardo Pascual rpascual@aenor.es Tel: +34 914 326 037 Fax: +34 913 104 683

Annex 4

Standard bibliography

ISO 12176-4 (2003) Plastics pipes and fittings – Equipment for fusion jointing polyethylene systems – Part 4 Traceability coding

EN 1555-1 (2003) Plastics piping systems for the supply of gaseous fuels – Polyethylene (PE):

— Part 1: General

— Part 2: Pipes

— Part 3: Fittings

— Part 4: Valves

— Part 5: Fitness for purpose of the system

CEN/TS 1555-7 (2003) Guidance for the assessment of conformity

ISO 9001 (2000) Quality management systems – Requirements

EN ISO/IEC 17025(2000) General requirements for the competence of testing and calibration laboratories

EN 45011 (1998) General requirements for bodies operating product certification systems

EN 12106 (1997) Plastics piping systems - Polyethylene (PE) pipes - Test method for the resistance to internal pressure after application of squeeze-off

EN ISO 9080 (2003) Plastics piping and ducting systems – Determination of the long-term hydrostatic strength of thermoplastics materials in pipe form by extrapolation