

AENOR Certificate of Conformity Specific Rules for polypropylene (PP-R) and fiber glass (FV) piping systems for hot and cold water installations inside buildings

Note: This document is a translation of the Spanish document "RP . 01.72 rev 4" approved by the Plastics Technical Certification Committee (CTC-001). Spanish version always prevails over this translation.

RP 001.72

Revision 5

Date 2016-05-19

Index

- 1 Purpose and scope
- 2 Definitions and special requirements
- 3 Sampling and testing for granting and maintaining the AENOR certificate of conformity
 - 3.1 Test to be carried out in factory
 - 3.2 Sampling and tests to be done by the laboratory
- 4 Manufacturer internal control
 - 4.1 Characteristics under factory production control
- Annex A Request Form for the concession of AENOR certificate for Plastics
- Annex B General manufacturer information questionnaire
- Annex C-1 Pipes Description Questionnaire
- Annex C-2 Descriptive Questionnaire for systems of pipes and fittings
- Annex D Technical Specifications for polypropylene (PP-R)/polypropylene + fiber glass (PP-R+FV)/polypropylene (PP-R) piping systems for hot and cold water installations inside buildings

1 Purpose and Scope

The present Specific Rules describe the procedure for the application, granting and maintaining of the AENOR Certificate of Conformity for polypropylene (PP-R)/polypropylene + fiber glass (PP-R+FV)/polypropylene (PP-R) piping systems for hot and cold water installations inside buildings, at the design pressure and temperature according to the application class, in accordance with the technical specifications attached to these Specific Rules.

The RP 01.00 applies except for the marking of certified products part that is defined in paragraph 5 of this document. All the mentions of the AENOR Mark in the RP 01.00 mean Certificate of Conformity AENOR in this document.

2 Definition and special requirements

Reference: It is called a reference of pipes to the set of the same ones that have the same diameter and nominal thickness.

Groups of dimension:

The following groups of dimension are considered depending on the diameter

Group 1: nominal outside diameter $dn \leq 63$

Group 2: nominal outside diameter $75 \leq dn \leq 160$

Group 3: nominal outside diameter $180 \leq dn \leq 450$

By applying this Regulation, it is possible to obtain the AENOR certificate of compliance for the following products:

- Polypropylene Pipes (PP-R)/polypropylene + fiber glass (PP-R+FV)/polypropylene (PP-R) for hot and cold water installations inside buildings in accordance with the technical specifications attached to these Specific Rules
- Polypropylene (PP-R)/polypropylene + fiber glass (PP-R+FV)/polypropylene (PP-R) piping systems for hot and cold water installations inside buildings, in accordance with the technical specifications attached to these Specific Rules formed by polypropylene pipes (PP-R)/polypropylene + fiber glass (PP-R+FV)/polypropylene (PP-R) and polypropylene fittings (PP-R), essential requirement that fittings have previously AENOR Product certificate.

The certificate applicant must address an independent application for each different product.

Due the length of the test is not considered necessary that the thermal stability test by hydrostatic pressure test is completed to grant the certificate.

WATER QUALITY FOR HUMAN CONSUMPTION

With regard to potential adverse effects on water quality for human consumption caused by the products **included in the scope of this certificate**, the petitioners / licensees of the Mark, will provide to AENOR Technical Services during the inspection visit the evidence that their product complies with the RD 140/2003

Article 14 of the mentioned document states that “Products that are in contact with the water of human consumption, by themselves or by the practices that are used, shall not transmit to the water for human consumption, substances or properties that contaminate or get worse its quality, and involve a failure to comply the requirements specified in Annex I or a risk to the health of the population supplied

This evidence must be provided, either through migration tests and / or certificates issued by competent authorities of compliance with the RD / 140/2003.

3 Sampling and testing for granting and maintaining the AENOR product certificate

3.1 Test to be carried out in factory (See RP 01.00)

AENOR Services will carry out the tests indicated in table 1 during the initial or surveillance inspection.

3.2 Sampling and tests to be carried out by the laboratory (See RP 01.00)

AENOR Services will select and marked the necessary samples to carry out in the laboratory the tests indicated in tables 1 (pipes) and/or .2 (fittings and systems) as proceed.

	TESTS	GRANTING/MAINTENANCE	RESULTS EVALUATION
TESTS TO BE CARRIED OUT BY THE INSPECTOR IN THE FACTORY	Appearance	10 pipes at random	1
	Mean outside diameter	1 pipe per reference, minimum 10 pipes	2
	Total wall thickness	1 pipe per reference, minimum 10 pipes	3
	Minimum thickness of the inner layer (e_1) \geq 1/4 of the emin	1 pipe per reference	3

TESTS TO BE CARRIED OUT BY THE LABORATORY	Opacity (only if declares it)	1 reference, selecting the one with lowest wall thickness	1
	Impact resistance ball drop	20% ref. minimum 2	1
	Longitudinal retraction	20% ref. minimum 2	1
	Melt flow index(compound + on internal and external layer of the pipe) (1)	1 reference	1
	Resistance to internal pressure 1 h-20°C	20% references. Minimum 2	1
	Resistance to internal pressure 22 h-95°C	20% references Minimum 2	1
	Resistance to internal pressure 165 h-95°C	20% references Minimum 2	1
	Resistance to internal pressure 1000 h-95°C	1 reference randomly	1
	Thermal stability by hydrostatic pressure test (Only at the granting, every 5 years, or in case of formulation changes)	1 reference randomly	1
	Determination of the content of the total fiber glass and intermediate layer	1 reference per group of dimension	1

TABLE 1 (PIPES)

NOTE (1) When the manufacturer of the pipe pigment the raw material, he is not required to perform this test

TESTS TO BE CARRIED OUT BY THE LABORATORY	TEST	FREQUENCY
	Resistance to internal pressure 20°C 1h	5% references per type of join
	Resistance to internal pressure 95°C 1000 h	2% references per type of join
	Bending(2)	50% of the diameters
	Pull out (23°C and 80, 90 or 95°C 1h) (2)	50% of the diameters
	Thermal cycling (2)	1 diameter
	Pressure cycling (2)	50% of the diameters
	Vacuum (2)	50% of the diameters

TABLE 2 (FITTINGS AND SYSTEM)

NOTE (2) The realization of these functional test will be done for those types of connection of fittings that are applicable.

In general, for systems consisting of fittings which system of union is mechanical, there will be necessary to realize all applicable tests defined in Table 2.

In case the union is for termofusion or electrofusion only it will be necessary to realize the test of cycles of temperature

4 Manufacturer internal control

4.1 Characteristics under factory production control

Characteristics under factory production control are:

Raw materials: when the raw material has not been granted the AENOR product certificate, the manufacturer that uses it must guarantee that the mixtures and the compounds that intervene in the manufacture of the pipes possess the suitable characteristics.

Manufacturing controls: Tests and their frequency are stated in tables 3 and 4.

Final product controls: Tests and their frequency are stated in tables 3 and 4. Furthermore, all tests mentioned in the above table should be made any time under the following circumstances.

- change of the material supplier
- changing the polymerization process
- changing the chemical properties of co-monomer
- change of additives (eg: pigments, antioxidants)
- change of chemical or natural properties of the additive
- change of the supplier of fiber
- changing the chemical properties (eg. coating) on the fiber type
- changing the dimensions of the fiber type

TESTS	FREQUENCY
Appearance	Every 4 hours / production line
Mean outside diameter	
Total Wall thickness	
Minimum thickness of the inner layer (e_1)	
Opacity only if the manufacturer declares its	At the granting and in case of formulation changes

Impact resistance	Per period of production, minimum twice a week
longitudinal retraction	Per line. Minimum twice a week
Melt flow rate (composite + internal and external layer of the pipe)/(1)	Each batch of raw material
Resistance to internal pressure 1 h-20°C	Once a year per reference
Resistance to internal pressure 22 h-95°C	Once per period of production. Minimum once a week
Resistance to internal pressure 165 h-95°C	Every 3 manufacturing period of the same reference
Resistance to internal pressure 1000 h-95°C	One pipe per machine, minimum once per year
Thermal stability by hydrostatic pressure test	At the granting and in case of formulation changes
Determination of the total fiber glass content and intermediate layer	Once per period of manufacture. Minimum once a week

TABLE 3 (PIPES)

NOTE (1) When the manufacturer of the pipe pigment the raw material, he is not required to perform this test

TESTS	FREQUENCY
Resistance to internal pressure 20°C 1 h	Once per period of manufacture. Minimum 1 time per week
Resistance to internal pressure 95°C 1000 h	Once every 4 months
Bending (2)	Once per year
Vacuum (2)	Once per year
Pull out (23°C and 80, 90 or 95°C 1 h)/(2)	Once per year
Thermal cycling (2)	Once per year
Pressure cycling (2)	Once per year

TABLA 4 (FITTINGS AND SYSTEM)

NOTE (2) The realization of these functional test will be done for those types of connection of fittings that are applicable. In general,

For systems consisting of fittings which system of union is mechanical, there will be necessary to realize all applicable tests defined in Table 4.

In case the union is for termofusion or electrofusion only it will be necessary to realize the test of cycles of temperature

5 Marking of certified products

The minimum required marking of the pipes is the following:

- Reference to the word AENOR CC
- Number of the contract signed with AENOR: 001 / XXX
- Manufacturer identification and/or Trademark
- Pipe material and its classification (PP-R/PP-R+FV/PP-R)
- Nominal outside diameter x thickness nominal
- Application class combined with design pressure;
- Opacity (only if the manufacturer has declared it);
- Manufacture's information (manufacturing period, year, month, etc.)

The marking on the pipes will carry out every meter as minimum.

Example:

AENOR CC N° 001 / XXX – Trademark – PP-R/PP-R+FV o GF/PP-R - 20 x 2,8 - SDR 6 - Manufacturer information

The minimum required marking of each fitting is the following:

- Trademark
- Nominal diameter
- identification of the material (only for fusion fittings);
- information provided by the manufacturer (year of manufacture).

The minimum required marking of the fittings packaging is the following:

- Reference to the word AENOR;
- AENOR Mark logotype, with a size not less than 3 mm;
- Number of the contract signed with AENOR: 001/XXX;
- Reference to the applicable standard;
- application class and design pressure;

- reference to the word "opaque" (only if the manufacturer has declared it)
- month and year of manufacture if not marked on the fitting.

Annex A

Request Form for AENOR Certification for polypropylene (PP-R)/polypropylene + fiber glass (PP-R+FV)/polypropylene (PP-R) piping systems for hot and cold water installations inside buildings

Mr., with identification nº or passport nº, in name and representation of with address in

IT SETS OUT

- 1 That it knows and it is committed to accept the General Rules on the Certification of Products and Services, the Technical Certification Committee of Plastics Specific Rules and the AENOR Mark Specific Rules applicable.
- 2 That it is committed to pay the corresponding expenses accordingly with what it is established in the Certification Specific Rules.
- 3 That it is committed to accept, without any reservation, the AENOR agreements relative to the transaction of this request and the verifications and later controls that are consequently made.

By all it:

IT ASKS FOR

To be granted the AENOR product Certificate for the references indicated in the descriptive attached questionnaire (annex C), with Trademark(s) produced on the factories (to indicate the manufacturer factory and manufacturing site of the pipe and the fitting).....

Chosen lab.....

....., on ... of of 20...

Annex B

Manufacturer's General Information Questionnaire

(To fill in by the manufacturer. A questionnaire for each factory)

-
- 1.1 COMPANY:
- 1.2 OFFICE ADDRESS:
- 1.3 Telephone
- 1.4 Telefax:
- 1.5 Company Fiscal Number:
- 1.6 Person that will sign the contract with AENOR:
- 1.7 Position (of 1.6):
- 1.8 Identification or passport number (of 1.6):
- 1.9 Contact person:
-
- 2.1 FACTORY ADDRESS:
- 2.2 Information about how to access to the factory (airport, train station, etc)
- 2.3 Telephone number:
- 2.4 Telefax:
- 2.5 Names and positions of the factory persons in charge of:
- 2.5.1 Production:
- 2.5.2 Quality
- 2.6 Contact person in factory:

3.1 Products, trademarks and references or other identification of products that have been applied for the award of the Certificate AENOR.

4.1 Total number of employees in the factory

— Technician and managers:

— Administrative officers:

— Production:

— Quality:

4.2 Qualification of the responsible for the quality department.

5.1 Raw materials and /or composites that are bought:

5.2 Briefly description of the different production stages and the means of production:

5.3 Briefly relation of the subcontracted works and name of the companies:

6.1 Quality documentation:

- Product specifications
- Quality manual
- Quality procedures manual
- Technical instructions of quality
- Documents of protocol, verification and tests
- Others (to detail)

6.2 To enumerate the quality control equipment:

6.3 To enumerate the tests performed, indicating whether they are in the production line or in the laboratory, and what percentage are.

7.1 Detailed list about the obtained Marks for the models required

7.2 List of entities that have counseled in the last three years.

The veracity of the data contented in this questionnaire is under responsibility of the applicant

..... (on)... (of)of 20...

SIGNED

(Name, position, signature and stamp)

Annex C-1: Pipes Description Questionnaire

APPLICANT COMPANY

MANUFACTURER COMPANY

SITE OF MANUFACTURE:

PRODUCT:

TRADEMARK (S)

CONTENT FIBERGLASS TOTAL (%):

GLASSFIBER CONTENT OF THE MIDDLE LAYER(%):

DATE:

RANGE FOR WHICH THE MARK IS REQUESTED				
SERIES	DIAMETERS	APPLICATION CLASS	DESIGN PRESSURE	OPACITY YES/NO

For any modification of these data, the licensee company will send to the Committee secretary this descriptive questionnaire updated.

Manufacturer shall inform AENOR on all materials (formulations) used in order to ensure a clear identification of the materials for the purpose of the inspection. The manufacturer shall specify the glass fibers, description of the fiber, fiber type, fiber length, fiber diameter and fiber ratio (weight percent) of the intermediate layer and total.

STAMP OF THE MANUFACTURER

Annex C-2: Descriptive Questionnaire for pipes and fittings systems

APPLICANT COMPANY:

PIPES MANUFACTURER COMPANY:

FITTINGS MANUFACTURER COMPANY:

NUMBER OF AENOR CERTIFICATE FOR THE FITTINGS

TRADEMARK

DATE:

FITTINGS:

FIGURE	DIÁMETERS(mm)	MANUFACTURER REFERENCE	INTERNAL

For any modification of the indicated data, the licensee company shall send to the Committee Secretary this updated descriptive questionnaire.

SIGN AND MANUFACTURER STAMP

Annex D: Technical Specifications for polypropylene (PP-R)/polypropylene + fiber glass (PP-R+FV)/polypropylene (PP-R) piping systems for hot and cold water installations inside buildings

0 Prologue

These technical specifications, together with Specific Rules, are part of the documentation done by the AENOR Plastics Technical Certification Committee (CTC-001 "Plastics") for the obtaining the corresponding AENOR Certificate of Conformity, and both documents shall be applied on the whole.

This document is not a normative document.

1 Scope

This Technical Specifications are based on the standard UNE EN ISO 15874-2, in order to define the dimensions and characteristics that have to assembled the polypropylene / polypropylene + glass fiber / polypropylene (PP-R)/PP-R + FV / PP-R) pipes for installation of hot and cold water inside the structure of buildings, to the temperatures and pressures of design according to the attached table, as well as its corresponding test method.

The value for $S_{calc, max}$ for each application class is illustrated in table 1.

Note: For certification, when a plastic barrier layer is embedded in the wall of the polypropylene pipe, (for example to prevent or reduce the diffusion of gases and light transmission through the pipe wall), this structure will be covered by part 2 of the EN ISO 15874.

Table 1

p_D [bar ¹⁾]	Application class			
	Class 1	Class 2	Class 4	Class 5
	$S_{calc, max}$ -valores ²⁾			
4	6,9	5,3	6,9	4,8
6	5,2	3,6	5,5	3,2
8	3,9	2,7	4,1	2,4
10	3,1	2,1	3,3	1,9

¹⁾ 1 bar = 10⁵ N/mm²

²⁾ Values are rounded to the nearest one decimal place.

2 Documentation references

- UNE EN ISO 15874-1, 2, 3 y 5 – Plastic pipes system for installation of hot and cold water.
- UNE EN ISO 7686 – Determination of the opacity.
- UNE EN ISO 2505 – Longitudinal retraction
- UNE EN ISO 3126 – Determination of the dimensions
- UNE EN ISO 1167-1 y 2 – Determination of the resistance to internal pressure
- EN 1411 – Determination of the impact resistance (ball drop method)
- ISO 3451-1 – Determination of the percentage of glass fiber of the intermediate layer
- ISO 1133 – Determination of the melt flow index
- UNE 53526 – Linear expansion coefficient
- ISO 4065:1996 – Thermoplastic pipes – thickness universal table
- ISO 11922-1:1997 – Thermoplastic pipes for fluids conduction – Dimensions and tolerances – Part 1 metric series

3 Definitions and simbols

(According to chapter 3 of UNE EN ISO 15874-1:2003)

3.1 Characteristics of the pipes material

3.1.1 General

The material from which pipes are made is composed of polypropylene random copolymer, as well as a reinforcement consisting of polypropylene random copolymer and glass fiber.

3.1.2 Influence of materials on water quality

When used in the manner for which they are designed, the materials that are in contact with drinking water should not constitute a toxic hazard, should not allow microbial growth and should not cause any smell or taste, or turbidity or water discoloration. Where applicable, the pipes should be in accordance with national regulations that may apply, in relation to materials in contact with drinking water.

3.1.3 Clasification of the material

Do not use reprocessed material obtained from external sources or recycled materials.

The manufacturer will inform to AENOR about all materials (formulations) that it should use in order to assure a clear identification of the same ones during the inspection.

The manufacturer shall specify the glass fibers, description of the fiber, fiber type, fiber length, fiber diameter and fiber ratio (weight percent) of total and intermediate layer.

3.2 General characteristics of the pipes

3.2.1 Appearance

The internal and external surfaces of pipes shall be smooth, clean and free from scoring, cavities and other surface defects when viewed without magnification. The material shall not contain visible impurities. Each end of the pipe shall be cut clean and perpendicular to its axis.

3.2.2 Opacity

If it is required that the pipe is opaque for use in underground installations, the pipe wall will not transmit more than 0.2% of visible light, when tested in accordance with the UNE EN ISO 7686.

3.3 Geometrical characteristics of the pipes

3.3.1 General

The dimensions of the pipes have to measure up according to UNE EN ISO 3126.

3.3.2 Dimensions of the pipes

3.3.2.1 Outside diameter.

The outside diameter of the pipe must be in accordance with Table 2.

Tabla 2 – Mean outside diameter

Nominal outside diameter (d_n)(mm)	Minimum nominal outside diameter ($d_{em,min}$) (mm)	Maximum nominal outside diameter ($d_{em,max}$) (mm)
20	20,0	20,30
25	25,0	25,30
32	32,0	32,30
40	40,0	40,40
50	50,0	50,50
63	63,0	63,60
75	75,0	75,70
90	90,0	90,90
110	110,0	111,00
125	125,0	126,2
140	140,0	141,3
160	160,0	161,5
180	180,0	181,7
200	200,0	201,8
225	225,0	227,1
250	250,0	252,3
280	280,0	282,5
315	315,0	317,5
355	355,0	358,2
400	400,0	403,6
450	450,0	453,8

3.3.2.2 Nominal wall thickness (e_n).

The wall thickness (minimum thickness (e_{min}) and maximum thickness (e_{max}) should be in accordance with Table 3.

Table 3 – Nominal wall thickness (e_n)

Nominal diameter (mm)	S 5		S 3,2		S 2,5	
	Minimum thickness (e_{min})(mm)	Maximum thickness (e_{max})(mm)	Minimum thickness (e_{min})(mm)	Maximum thickness (e_{max})(mm)	Minimum thickness (e_{min})(mm)	Maximum thickness (e_{max})(mm)
20	1,9	2,2	2,8	3,2	3,4	3,9
25	2,3	2,7	3,5	4,0	4,2	4,8
32	2,9	3,3	4,4	5,0	5,4	6,1
Nominal diameter (mm)	S 5		S 3,2		S 2,5	
	Minimum thickness (e_{min})(mm)	Maximum thickness (e_{max})(mm)	Minimum thickness (e_{min})(mm)	Maximum thickness (e_{max})(mm)	Minimum thickness (e_{min})(mm)	Maximum thickness (e_{max})(mm)
40	3,7	4,2	5,5	6,2	6,7	7,5
50	4,6	5,2	6,9	7,7	8,3	9,3
63	5,8	6,5	8,6	9,6	10,5	11,7
75	6,8	7,6	10,3	11,5	12,5	13,9
90	8,2	9,2	12,3	13,7	15,0	16,6
110	10,0	11,1	15,1	16,8	18,3	20,3
125	11,4	12,7	17,1	19,0	20,8	23,0
140	12,7	14,1	19,2	21,3	23,3	25,9
160	14,6	16,2	21,9	24,2	26,6	29,5
180	16,4	18,3	24,6	27,3	29,0	32,1
200	18,2	20,3	27,4	30,4	33,2	36,8
225	20,5	22,8	30,8	34,1	37,4	41,4
250	22,7	25,2	34,2	37,9	-	
280	25,4	28,2	38,3	42,4	-	
315	28,6	31,7	-		-	
355	32,2	35,7	-		-	
400	36,3	40,2	-		-	
450	40,9	45,2	-		-	

3.3.2.3. Wall thickness of inner layer(e_1)

The thickness of inner layer (e_1) will be major or equal to 1/4 of the specified thickness (e_{min})

3.4 Mechanical characteristics of the pipes

On having realized the tests, according to method and parameters indicated in table 4, the mechanical characteristics of the pipes, must fulfill the requirements indicated in the above mentioned table.

Table 4: Mechanical Characteristics

Characteristics	Requirements	Test parameters				Test method
Resistance to internal pressure	Without fault during the test period	Hydrostatic effort (tangential) MPa	Test temperature °C	Test time h	Number of test pieces	ISO 1167
		16.0	20	1	3	
		4.3	95	22	3	
		3.8	95	165	3	
		3.5	95	1000	3	
		General Test parameters				
Sampling procedure		Unspecified 1)				
Type of plug		Type a)				
Orientation of the test pieces		Unspecified				
Type of test		Water-in-water				

1)As a guide see the Technical Specification CEN ISO/TS 15874-7

3.5 Physical characteristics of the pipes

On having realized the tests, according to method and parameters indicated in table 5, the physical characteristics of the pipe, must fulfill the requirements indicated in the above mentioned table.

Table 5: Physical characteristics

Characteristics	Requirements	Test parameters		Test method
		Characteristics	Value	
Longitudinal retraction	$\leq 1\%$	Temperature Test time for $e_n < 8 \text{ mm}$ $8\text{mm} \leq e_n \leq 16\text{mm}$ $e_n > 16 \text{ mm}$ Number of test pieces	135°C 1h 2h 4h 3	UNE EN ISO 2505 (oven test)
Thermal stability by hydrostatic pressure test	Without break during the test (after realizing the test, should perform an analysis in order to check the adherence between the layers with a magnifying glass of 8 increases as minimum) .	Sampling Hydrostatic stress (tan) Test temperature Type of test Plug Length Number of test pieces	a) 1.9 Mpa 110°C Water-in-Air Plug a) 8760h 1	UNE EN ISO 1167
Impact resistance (BALL DROP)	Series S2.5 and 3.2 Value H50 \geq 1,0 m Without break < 0,5 m Series S.5 Value H50 \geq 0,7 m Without break < 0,5 m	Hammer mass Height Temperature	According to table 6 under point 3.5.1. of this RP	EN 1411:1996
Melt flow index (COMPOSITE)	$\leq 0.5 \text{ g}/10 \text{ min}$	Test Temperature Mass Number of test pieces	230°C 2,16 kg 3	ISO 1133
Melt flow index (difference between composite and inner and outer layer of the pipe)	$\leq 30\%$	Test temperature Mass Number of test pieces	230°C 2,16 kg 3	ISO 1133
Determination of the percentage of glass fiber of the intermediate layer	According to value declared by the manufacturer $\pm 3\%$ will not be able to be lower than 15%	Test temperature Mass Time Test pieces	verify for each reference. According to the % of alleged fiber 30 min Minimum 3	UNE EN ISO 3451-1 (Method A)

Characteristics	Requirements	Test parameters		Test method
		Characteristics	Value	
Determination of the percentage of the total fiber glass	According to value declared by the manufacturer $\pm 3\%$ will not be able to be lower than 5,0%	Test temperature Mass Time Specimens	verify for each reference. According to the % of alleged fiber 30 min Minimum 3	UNE EN ISO 3451-1 (Method A)
a) Not specify the sampling procedure. As a guide, see Technical Specification CEN ISO/TS 15874-7				

3.5.1. Test method impact drop ball

Tabla 6 Method requirements of drop ball

(series S 2.5 y S 3.2)

Diameter(mm)	20	25	32	40	50	63	75	90	≥ 110
Temperature(°C)	0	0	0	0	0	0	0	0	0
Hammer Mass (Kg)	0,25	0,5	0,8	1,25	2,0	3,2	10,0	16,0	16,0
Energy required	2,5	4,9	7,8	12,3	19,6	31,4	98,1	157,0	157,0
H50 Height (m)	$\geq 1,0$								

(series S 5)

Diameter(mm)	20	25	32	40	50	63	75	90	≥ 110
Temperature(°C)	0	0	0	0	0	0	0	0	0
Hammer Mass (Kg)	0,25	0,5	0,8	1,25	2,0	3,2	10,0	16,0	16,0
Energy required	1,7	3,4	5,5	8,6	13,7	22,0	68,7	109,9	109,9
H50 Height(m)	$\geq 0,7$								

4.- Characteristics and system test method

It applies the established in the UNE-EN ISO 15874-3 and UNE-EN ISO 15874-5.