

**GRAVITY DRAINAGE SYSTEMS MADE OF  
THERMOPLASTIC MATERIALS**

**Technical document No. 442-03**

Specifications applicable to the structured-wall piping with  
profiled external and smooth internal surface group  
(Type B)

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## MODIFICATION HISTORY

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## Partie 1

### SCOPE

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This Technical Document covers the structured-wall piping with profiled external and smooth internal surface group (Type B), in the U zone, according to Standard NF EN 13476-3.

#### 1.1 APPLICABLE REFERENCE STANDARDS AND COMPLEMENTARY SPECIFICATIONS

##### 1.1.1 Reference standards and documents:

EN 13476-1 (September 2007)	Plastics piping systems for non-pressure underground drainage and sewerage - Structured-wall piping systems of unplasticised poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE) - Part 1: General requirements and performance characteristics.
NF EN 13476-3+A1 (March 2009)	Plastics piping systems for non-pressure underground drainage and sewerage — Structured-wall piping systems of unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE) — Part 3: Specifications for pipes and fittings with smooth internal and profiled external surface and the system, Type B.

**Appendix 1:** PE or PP externally recycled or reclaimed materials specifications.

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**PURPOSE:** This document defines the conditions that must be met to use externally reclaimed materials.

### 1.1.2 Complementary specifications and additional requirements

The reference specifications and test methods for the NF Mark – Thermoplastic material drain or sewer system operating without pressure are defined in the tables below. They are based on the abovementioned standards with possible additions or changes.

Designation of Type B wall structures:

#### **Figure 1 in Standard NF EN 13476-3**

Type B wall structures need system design parameter information in order to meet the requirements of leaflet 70.

The nature of the design parameters, the calculation methods for these parameters and their use in the mechanical design of the system are included in technical document no. 1 paragraph 2.15 of this reference system.

The values used to mechanically size the system, specific to each certified manufacturer, are included on the certificate.

**TABLE 1:**
**Specifications for Pipes and Fittings**

Characteristics and test methods (1)	PVC-U	PP Extruded pipes and injected <b>and/or</b> fabricated fittings	PE Extruded pipes and injected <b>and/or</b> fabricated fittings	PE Rotomoulded fittings
Reference standard	NF EN 13476-3			
	Notwithstanding appendices D (§ D.2.2) and F (§ F.2.2) of standard NF EN 13476-3, the use of externally produced regrind or reclaimed materials covered by a recognised specification is authorised for pipes and fabricated fittings on the condition that these materials comply with standard NF EN 13476-3 as defined below as well as in appendix 1 of this document: PE or PP externally recycled or reclaimed materials specifications*			
<b>Material tests (resins)</b> Vicat  Density  MFR  OIT on finished product (200°C)  Resistance to internal pressure (INTERNAL AND EXTERNAL LAYER pipe formulation)  Tensile strength (yield point) (MPa)	Pipes $\geq 79^{\circ}\text{C}$ Fittings: U $\geq 77^{\circ}\text{C}$  $\geq 1360 \text{ kg/m}^3$  /  /  60°C 1000 hrs pipe $\sigma$ : 10 MPa fitting $\sigma$ : 6.3 MPa  45 MPa	/  /  $< 1.5 \text{ g/10min}$ (230°C/2.16kg)  $\geq 8 \text{ min}$  95 °C 1000 hrs $\sigma$ : 2.5 MPa 80°C, 140 hrs $\sigma$ : 4.2 MPa  23 MPa	/  $\geq 930 \text{ kg/m}^3$  $< 1.6 \text{ g/10min}$ (190°C/5kg)  $\geq 20 \text{ min}$  80 °C 1000 hrs $\sigma$ : 2.8 MPa 80°C, 165 hrs $\sigma$ : 4.0 MPa  19 MPa	/  $\geq 925 \text{ kg/m}^3$  $3 \text{ g/10min} < \text{MFR} < 16$ $\text{g/10min}$ (190°C/5kg)  $\geq 10 \text{ min}$  60°C 1000 hrs $\sigma$ : 3.2 MPa 60 °C, 165 hrs $\sigma$ : 3.9 MPa  /
External layer colour	Medium, clear grey-blue similar to RAL 7037	Grey, black and orange-brown with the exception of medium, clear grey-blue 1624 & 1625 in accordance with standard NF X 08-002		
Dimensions DN See 7.2 (2)	Tables (5 & 6 NF EN 13476-3 + A1 Series DN/ID and DN/OD; in the case of DN/OD, mandatory indication of the inside diameter Dim under standard NF EN 13476-3 + A1 on products and in sales documents) The useful length of the pipes is defined in the manufacturer's sales documents.			
Pipe thicknesses	ec, e4, e5 see 7.2.5.2 and Table 5 of NF EN 13476-3 + A1 Wave crest thicknesses are defined by the manufacturer.			
Socket dsm, Amin	See 7.2.4, 7.2.5.3 and Table 5 of NF EN 13476-3 + A1			
Thicknesses of injected, fabricated and rotomoulded fittings	See 7.2.5.4, 7.2.5.5 and 7.2.5.6 of NF EN 13476-3 + A1			

\*: The use of recycled PVC is not taken into account in this reference system but will be in a future revision when a request is made.

- (1) With additional clarifications indicated in Part 2 of Technical Document 1.
- (2) Sections of pipes with axial internal ribbing must be watertight.

**TABLE 2:**
**Dimensional characteristics and tolerances of PVC, PE and PP Type B pipe structures**

Nominal diameter	External diameter		Min. internal diameter (DN/ID) NF EN 13476-3	Thickness NF EN 13476-3		Structured-Wall	Socket	
	DN	min		max	e4		e5	ec thickness
100	Manufacturer specifications		95	1.0	1.0	Manufacturer specifications		32
125			120	1.2	1.0			38
150			145	1.3	1.0			43
200			195	1.5	1.1			54
225			220	1.7	1.4			55
250			245	1.8	1.5			59
300			294	2.0	1.7			64
400			392	2.5	2.3			74
500			490	3.0	3.0			85
600			588	3.5	3.5			96
800			785	4.5	4.5			118
1000			985	5.0	5.0			140

—Longueur totale :  $\leq 12$  m

—Tolérance  $\pm 1\%$  pour  $L < 5$  m

—  $\pm 5$  cm pour  $L \geq 5$  m



**TABLE 3:**  
**Pipes**

Characteristics and test methods (1)	PVC-U	PP	PE
Oven test ISO 12091	150°C / No detachment, crazing or bubbles	150°C / No detachment, crazing or bubbles	110 °C / No detachment, crazing or bubbles
Ring stiffness NF EN ISO 9969	SN4: $\geq 4 \text{ kN/m}^2$ SN8: $\geq 8 \text{ kN/m}^2$ SN16: $\geq 16 \text{ kN/m}^2$		
Impact resistance NF EN 744	Temperature 0°C TIR $\leq 10\%$ Testing parameters see Table 14 of standard NF EN 13476-3 + A1		
Impact resistance (1) NF EN 1411		H50 $\geq 1 \text{ m}$ , one break max. and smaller than 0.5 m Testing parameters see Table 9 of standard NF EN 1852-1	
Ring flexibility NF EN ISO 13968	- No destructurement at 30% out-of-roundness for pipes with DN ID $\leq 800$ and DN OD $\leq 1000$ - No destructurement at 20% out-of-roundness for pipes with DN ID $> 800$ and DN OD $> 1000$ - Compliant with 9.1.2 of standard NF EN 13476-3		
Compression rate NF EN ISO 9967	PVC: Extrapolation to 2 years: $\leq 2.5$ PP and PE: Extrapolation to 2 years: $\leq 4$		
Tensile strength of the seam NF EN 1979 Applies only to spirally-formed pipes (15 mm/min)	Compliant with 9.1.3 of Standard NF EN 13476-3 + A1		

(1) if claimed by the applicant/holder

**TABLE 4:**  
**Injected, rotomoulded and fabricated fittings**  
**Fabricated fittings: The fabricated fittings are made from NF A-certified Type B pipes**

Characteristics and test methods (1)	PVC-U	PP	PE
Oven test “Effects of heating” Method A of NF EN ISO 580 hot air	See b) from Table 9 of Standard NF EN 13476-3 + A1 Duration of heating: e ≤ 3 mm: 15 min 3 < e ≤ 10 mm: 30 min 10 < e ≤ 20 mm: 60 min Temperature: 150°C	See b) from Table 11 of Standard NF EN 13476-3 + A1 Duration of heating: e ≤ 3 mm: 15 min 3 < e ≤ 10 mm: 30 min 10 < e ≤ 20 mm: 60 min Temperature: 150°C	See b) from Table 13 of Standard NF EN 13476-3 + A1 Duration of heating: e ≤ 3 mm: 15 min 3 < e ≤ 10 mm: 30 min 10 < e ≤ 20 mm: 60 min Temperature: 110°C
Ring stiffness (a) NF EN ISO 13967 This specification does not apply to sleeves: (b)	SN 4: ≥ 4 kN/m <sup>2</sup> SN 8: ≥ 8 kN/m <sup>2</sup> SN16: ≥ 16 kN/m <sup>2</sup>		
Impact resistance (Drop Test) (4) NF EN 12061	No crazing in the wall; detached seals must be able to be put back in the correct place manually. A broken seal supporting ring is not considered a break.		
Flexibility or mechanical strength only for fabricated fittings made from several parts. NF EN 12256	No signs of tears, separation or leaks		

**(a) With additional clarifications indicated in Part 2 of Technical Document 1.**

*a When a fitting according to this standard has the same wall construction as a corresponding pipe, the stiffness of the fitting, because of its geometry, is equal to or greater than that of the pipe. Such fittings can be classified with the same stiffness class as that pipe without testing of the stiffness.*

*It should be emphasized that the stiffness of fittings is only one of the design parameters. Normally mechanical strength, heat resistance and a number of other parameters are more important than stiffness assuring good performance.*

**(b) When the spigot has a different mechanical structure from that of the pipe.**

*In addition to the minimum required wall thickness of sockets and spigots, as specified below, their ring stiffness when determined in accordance with EN ISO 9969, shall conform to the following Formula (4):*

$$S_{so} + S_{sp} \geq SN_{pipe} \quad (4)$$

*where*

*S<sub>so</sub> is the ring stiffness of the socket;  
S<sub>sp</sub> is the ring stiffness of the spigot;  
SN<sub>pipe</sub> is the nominal ring stiffness of the pipe.*

*For the test it is permitted to use cut off straight socket and spigot parts even if they do not conform to the length requirements specified in EN ISO 9969.*

**TABLE 5:**  
**Assemblies**

Characteristics and test methods (1)	Specifications
Leaktightness of elastomer sealing rings NF EN 1277 Conditions B and C at 23°C (2) (3) (5)	Deformation of the spigot: 10% Deformation of the socket: 5% Under P = 0.05 bar and 0.5 bar: No leaks Under P = -0.3 bar: Final P ≤ -0.27 bar
Watertightness (fabricated fittings) NF EN 1053	No leaks at 0.5 bar for 1 min
Tension on welded or fused joints NF EN 1979	No breaks in the assembly
Quality of elastomer sealing rings (6)	NF EN 681-1 or NF EN 681-2 as the case may be
Seam leaktightness production control test	Holder's internal procedure No leaks
Ring stiffness of assemblies	See 7.2.5.3.1 of the standard

- (1) With additional clarifications indicated in Part 2 of Technical Document 1.
- (2) Subcontracted sleeves must absolutely be provided by the holder at the same time as the pipes.
- (3) Instructions regarding the conditions for setting up assemblies must be made available to installation companies and the laboratory of the Mark and specify, in particular, the position of the seal on its spigot (paper documents, Internet, etc.).
- (4) The specimen must be a complete fitting with, if applicable, the seal and all means associated with fixing the component(s) in place.
- (5) Sections of pipes with axial internal ribbing must be watertight.
- (6) Ozone resistance test: Rubber sealing elements that are protected and packaged separately until the time of their assembly must meet the same requirements, except using an ozone concentration of (25 ± 5) ppm instead of (50 ± 5) ppm.

#### **Parts of connecting devices for manholes and inspection chambers**

**Requirement:** The holder of a TD3 product must have in its range a technical solution (adapter) enabling each DN of TD3 pipes to be connected to the manholes and inspection chambers.

The below are adapters admitted in this reference system:

DN ID / DN OD: 100/110, 125/125, 150/160, 200/200, 225/250, 250/250, 300/315, 400/400, 500/500, 600/630, 800/800.

These parts must pass the following tests (type test) on admission:

- Dimensions are compliant with the standards corresponding to manhole and inspection chamber inlets and outlets (this check must be completed during the DN audit),
- Leak testing according to standard NF EN 1277 conditions D (manhole, thermoplastic inspection chamber, adapters and pipes) see TD1 paragraph 2.21

These tests are to be performed on 1 DN per process at the laboratory of the Mark.

These non-certified parts will be listed on the holder's certificate.

**Pipe colour: the colour of the internal layer of a certified range must be different from the colour of the internal layer of a non-certified range.**

## Part 2

# MARKING CONDITIONS – REFERENCING THE NF MARK

---

This Technical Document specifies the conditions for marking and referencing the NF mark provided in the certification reference system of the NF Mark – Gravity drainage systems made of thermoplastic materials.

### 2.1 REPRODUCING THE NF LOGO ON THE CERTIFIED PRODUCT

#### 2.1.1 General

Refer to § 2.5.1 of the body of the reference system.

The trade reference of the certified product must be reserved for the NF mark.





The NF logo must ensure identification of all certified products in accordance with the provisions set down in this technical document. The requirements relating to marking in the reference standards listed on page 2 of this Technical Document must also be followed.

The black and white version of the NF logo can be used.

#### 2.1.2 Marking pipes and fittings

##### 2.1.2.1 Marking pipes

Holders have the option to use:

- Either the new logo  followed by the letter A, as follows:  A
- Or, as an exception, when using the logo  creates technical and/or material difficulties, the old logo 

#### a) Pipe marking indicating the DN ID

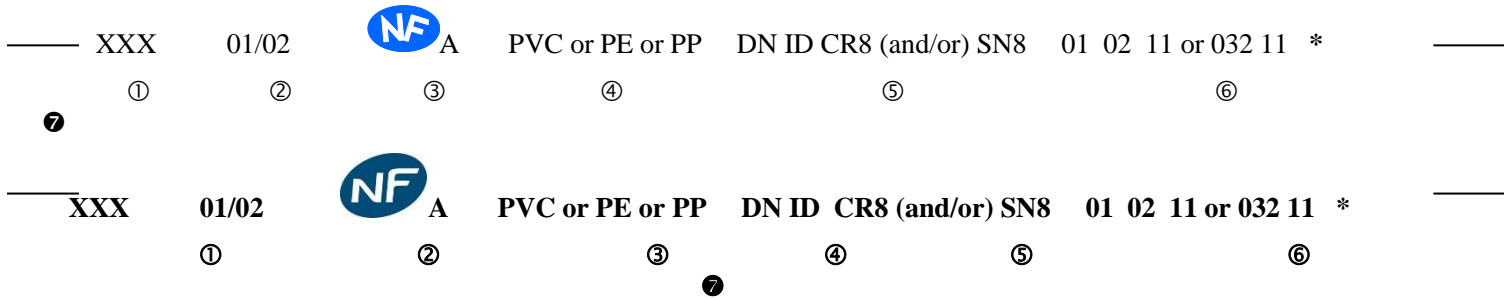
Marking of pipes must be carried out in a way that is visible and indelible and which can be read by the naked eye, on a generatrix and contain, every 2 metres or less, the following set of information:

- ① - the trademark or symbol filed by the applicant/holder with the mandated bodies,
- ② - the holder's identification number assigned upon notification of admission and possibly the production site designated upon notification of admission (if there are multiple factories),
- ③ - the NF logo and the symbol of the family: A,
- ④ - the material identification symbol: PVC / PE / PP,
- ⑤ - the pipe dimensions:  
**DN ID** and SN4 (CR4), SN8 (CR8) or SN16 (CR16)
- ⑥ - mark for production identification: date (dd/mm/yy) or day number and year of manufacture (xxx/yy) (or batch no. indicating the manufacturing date: in this case, the definition of this number must be sent to the mandated body).
- ⑦ - \*: impacts -10°C according to standard NF EN 1411 if claimed by the applicant/holder.

**Note:** the choice of marking method is left to the manufacturer. Any other additional marking is permitted on the condition that the sequence of NF information is not broken and it causes no confusion during use; in this case, the sequence of NF information must be framed by lines of approximately 3 cm.

Examples:

PVC pipes for sewerage systems



**b) Pipe marking indicating the DN OD**

Marking of pipes must be carried out in a way that is visible and indelible and which can be read by the naked eye, on a generatrix and contain, every 2 metres or less, the following set of information:

- ① - the trademark or symbol filed by the applicant/holder with the mandated bodies,
- ② - the holder's identification number assigned upon notification of admission and possibly the production site designated upon notification of admission (if there are multiple factories),
- ③ - the NF logo and the symbol of the family: A,

**Note:** a negative version of the logo can be used,

- ④ - the material identification symbol: PVC / PE / PP,
- ⑤ - the pipe dimensions:

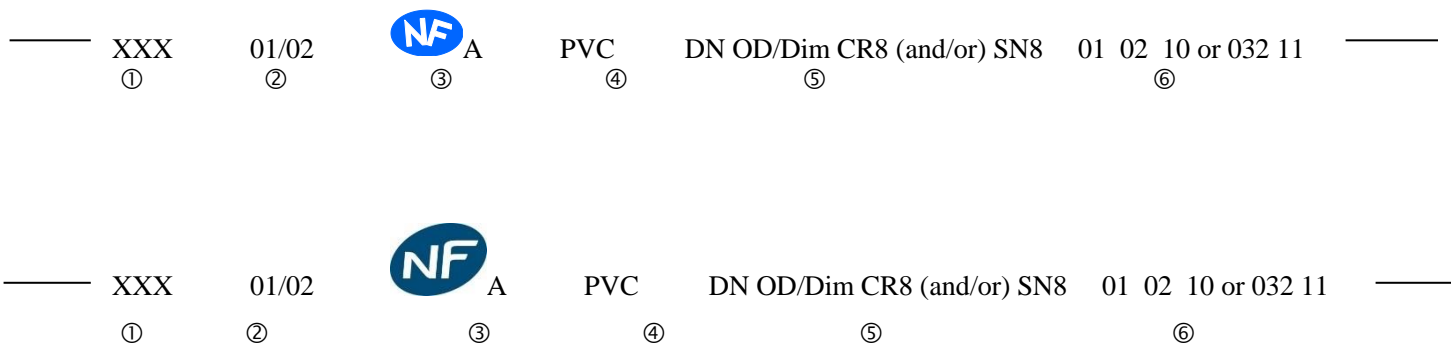
**DN OD and Dim** (Minimum internal diameter declared by the holder and conforming to the requirements of Table 5 of the standard) and SN4 (CR4), SN8 (CR8) or SN16 (CR16)

- ⑥ - mark for production identification: date (dd/mm/yy) or day number and year of manufacture (xxx/yy) (or batch no. indicating the manufacturing date: in this case, the definition of this number must be sent to the mandated body).

**Note:** the choice of marking method is left to the manufacturer. Any other additional marking is permitted on the condition that the sequence of NF information is not broken and it causes no confusion during use; in this case, the sequence of NF information must be framed by lines of approximately 3 cm.




Examples:

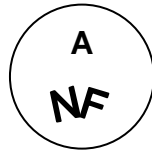
PVC pipes for sewerage systems



### 2.1.2.2 Marking fittings

Holders have the option to use:

- Either the new logo  followed by the letter A, as follows:  A
- Or, as an exception, when using the logo  creates technical and/or material difficulties, the following monogram:



The new certified products shall comply with the NF graphic charter in force.

#### a) Marking fittings to indicate the DN ID

Each fitting must bear the following information, marked indelibly (marking a permanently affixed label is permitted):

- ① trademark or symbol filed by the applicant/holder with the mandated bodies,
- ② - nominal dimensions **DN ID** (case of a single fitting or a reducing fitting; in the latter case, the order indicated for the designation must be followed),
  - values of connection angles,
- ③ - NF logo and the symbol of the family: A
- ④ - The stiffness class: SN4 (CR4), SN8 (CR8) or SN16 (CR16).
- ⑤ - The material PVC – PE – PP.

In cases of FF sleeve couplings and if moulding conditions do not allow marking of the NF monogram described above, this is optional, unless using the logo  A is possible.

- If multiple trademarks are filed with the mandated bodies, the identification number of the holder, assigned upon notification of admission, must be mentioned in addition to the above information.

In cases of fittings made from pipes which themselves are NF mark certified, the marking is completed on the pipes.

In cases of parts made from fittings which themselves are certified by the mark, the NF marking can be retained on the condition that the fittings were in no way modified.


**Note:** the location of the marking and the methods used are left to the manufacturer. Any other additional marking is permitted on the condition that its location is separate from the NF marking and it causes no confusion during use.

#### b) Fitting marking indicating the DN OD

Each fitting must bear the following information, marked indelibly (marking a permanently affixed label is permitted):

- ① - trademark or symbol filed by the applicant/holder with the mandated bodies,
- ② - nominal dimensions **DN OD / Dim** (Nominal internal diameter declared by the holder and conforming to the requirements of Table 5 of the standard) (case of a single fitting or a reducing fitting; in the latter case, the order indicated for the designation must be followed),

- values of connection angles,
- ③ - NF logo and the symbol of the family: A
- ④ - The stiffness class: SN4 (CR4), SN8 (CR8) or SN16 (CR16).
- ⑤ - The material PVC – PE – PP.

In cases of FF sleeve couplings and if moulding conditions do not allow marking of the NF monogram described above, this is optional, unless using the monogram  A is possible.

- If multiple trademarks are filed with the mandated bodies, the identification number of the holder, assigned upon notification of admission, must be mentioned in addition to the above information.

In cases of fittings made from pipes which themselves are NF mark certified, the marking is completed on the pipes.

In cases of parts made from fittings which themselves are certified by the mark, the NF marking can be retained on the condition that the fittings were in no way modified.

**Note:** the location of the marking and the methods used are left to the manufacturer. Any other additional marking is permitted on the condition that its location is separate from the NF marking and it causes no confusion during use.

### 2.1.2.3 Additional recommended information on fittings (optional)

Each fitting may bear the following information:

- the symbol identifying the material (PVC/PE/PP),
- a mark for production identification.

## 2.2 REPRODUCTION OF THE NF LOGO ON THE PACKAGING OF THE NF-CERTIFIED PRODUCT

- The following NF logo is to be used:



*or, by exception, due to technical difficulties, printing the NF logo on the packaging can be completed without the title of the application, in black and white:*



The NF logo must be associated with the symbol of the application in question, so that NF mark certified products can be distinguished from other products, without any risk of confusion, being:



**- Marking primary packaging (optional)** Primary packaging may include the following indelibly marked information:

Primary packaging may include the following indelibly marked information:

- \* company name and/or trademark filed,
- \* symbol identifying the material,

\* NF logo as defined below:



### 2.3 MARKING CERTIFIED AND ASSOCIATED CHARACTERISTICS

All documentation relating to an NF - Drain or sewer system operating without pressure certified product must use the following form:

- name and address of the applicant/holder,
- identification of the Reference System on which the certification is based (**see 2.5.2 of the body of the reference system**),
- (name and address of the delegate in France, if applicable),
- designation of the product (trademark and trade reference),
- licence or certificate number,
- certified product characteristics, pipes:
  - Dimensional characteristics (diameters, thicknesses, ~~out-of-roundness~~, sockets),
  - Impact resistance,
  - Behaviour when submitted to heating,
  - Ring stiffness,
  - Ring flexibility,
  - Compression rate,
  - Tensile strength of seam (only for spirally-formed pipes)
  - Pressure-tightness of the assemblies,
  - Quality of elastomer sealing rings.
- certified product characteristics, fittings:
  - Dimensional characteristics (diameters, thicknesses, ~~out-of-roundness~~, sockets),
  - Impact resistance,
  - Behaviour when submitted to heating,
  - Ring stiffness,
  - Mechanical strength or flexibility,
  - Leaktightness of sealing rings,
  - Quality of elastomer sealing rings,
  - Tension on welded or fused joints.

### 2.4 REPRODUCING THE NF LOGO ON DOCUMENTATION AND IN PUBLICATIONS (technical and commercial documents, labels, posters, advertising, websites, etc.)

- The following NF logo is to be used:





## Partie 3

### APPLICANT/HOLDER QUALITY REQUIREMENTS

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#### 3.1 Quality control OPTION

The tests specified in these tables are to be performed with the number of specimens stipulated in the testing standards and addendums indicated in Technical Document 1 of this Certification Reference System specific to each product group, unless otherwise indicated in the tables.

##### a) For pipes:

**Materials compliant with Table 1 of this technical document (resins):**

Measurements or tests <sup>(1)</sup>	Minimum sampling frequency	PVC	PE	PP
Density on resin	On each delivery: certificate of conformity or analysis	X	X	
MFR on resin	On each delivery: certificate of conformity or analysis		X	X
Resistance to internal pressure (INTERNAL AND EXTERNAL LAYER pipe formulation)	Upon approval of each new material	X	X	X
OIT on finished product	Once per raw material batch		X	X
Tension	Once per raw material batch		X	X

##### **Product:**

Measurements or tests	Minimum sampling frequency	PVC	PE	PP
Dimensions: diameter, thickness, out-of-roundness <sup>(1)</sup> Appearance, colour, marking	By extruder: 1 every 4 hours	X	X	X
Oven test <sup>(1)</sup>	1 test on 1 specimen at the start of the campaign and at least 1 test per week	X	X	X
Ring stiffness	1 test at the start of the campaign with at least 1 test every other day <sup>(1)</sup>	X	X	X
Ring flexibility	1 test per campaign and per batch of materials <sup>(1)</sup>	X	X	X
Impact resistance <sup>(1)</sup>	1 test per campaign and per batch of materials <sup>(1)</sup>	X	X	X
Seam leaktightness production control test	Frequency to be defined by the applicant/holder in its quality assurance plan	X	X	X

(1) Methods specified in Technical Document 1 Part 2.

**b) For fittings \*:**

**Materials (resins):**

Measurements or tests <sup>(1)</sup>	Minimum sampling frequency	PVC Injected fittings	PP Injected fittings	PE Injected or rotomoulded fittings
Density on finished product	Once a month on 1 type at random	X		X
MFR on resin or finished product	On each delivery: certificate of conformity or analysis		X	X
Resistance to internal pressure (pipe formulation on solid external layers)	Upon approval of each new material	X	X	X
OIT on finished product	Either at least once per raw material batch or once per campaign (a campaign may not exceed 2 weeks)		X	X

**\* In the case of fabricated fittings, the material characteristics are checked during manufacture of the pipes.**

**Product:**

Measurements or tests <sup>(1)</sup>	Minimum sampling frequency	PVC	PE	PP
Dimensions: diameter, thickness, out-of-roundness Appearance, colour, marking	By extruder: 1 every 4 hours	X	X	X
Oven test (2)	1 test on 1 specimen at the start of the campaign and at least 1 test per week	X	X	X
Ring stiffness	1 test per campaign with at least 1 test every other day <sup>(1)</sup>	X	X	X
Impact resistance (drop test)	1 test per campaign <sup>(1)</sup>	X	X	X
Flexibility or mechanical strength (only for fabricated fittings made from several parts)	1 test per campaign with at least 1 test per week <sup>(1)</sup>	X	X	X
Seam leaktightness production control test	1 test per campaign	X	X	X

(1) Methods specified in Technical Document 1 Part 2.

(2) 1 specimen corresponding to as many fittings (cavities) as the mould used contains.

A campaign corresponds to the period between the start of manufacturing of a product reference number and the switch to the next number.

### 3.2 QUALITY MANAGEMENT OPTION

The implemented quality assurance plan must enable product compliance with the specifications of the standards and of these Rules.

Consequently, the applicant/holder must complete or ensure completion of the specified tests per the frequencies defined in the quality assurance plan, certain tests being able to be considered "type" tests (for putting new equipment in place or using a new formulation, for example).

Use of externally produced regrind or reclaimed materials is only handled in the context of the Quality Management option.

**Materials associated with the concession cited in Table 1 of this technical document:**

Measurements or tests <sup>(1)</sup>	Minimum sampling frequency	PE	PP
<b>Characteristics included in the specifications:</b> Density Tensile strength at threshold and elongation at break* MFR Ash content Impurities Volatile material	Acceptance certificate (type 3.1 defined in TD1) prepared at each delivery (or tests conducted by the holder/manufactureur)	X	X
Resistance to internal pressure (INTERNAL AND EXTERNAL LAYER pipe formulation)	Upon approval of each new material	X	X
OIT on finished product	Once per campaign	X	X

\* When the tensile test is carried out by the manufacturer/holder, it may be carried out after accepting the raw material batch in question.

## Part 4

### MONITORING ARRANGEMENTS BY THE CSTB

#### 4.1 TEST PROCEDURES DURING AN APPLICATION FOR ADMISSION

##### a) For structured-wall piping with profiled external and smooth internal surface (Type B) PVC / PE / PP:

Measurement or test	Inspection or on-site factory test	Tests conducted in the laboratory of the mark
Mean external diameter Appearance Marking Colour Length Any diameter Thickness Sockets (depth of groove)	All the types submitted for admission	-
<b>Virgin materials</b>  Material tests: Density (PVC-U / PE) MFR and OIT (PP / PE) Resistance to internal pressure PVC-U / PP / PE <b>Tensile strength</b>	- Specifications accompanied by the attestation of conformity (type 2.1 defined in TD1 chap. 2.20) prepared during each delivery 1 test report (this test can be completed by the holder/manufacturer)	<b>Tensile strength:</b> - 1 type/material
<b>Recycled materials</b> <b>Characteristics included in the specifications:</b> Density Tensile strength at threshold and elongation at break MFR Ash content Impurities Volatile material <b>OIT</b> <b>Tensile strength</b> Resistance to internal pressure PP/PE	- Specifications accompanied by the acceptance certificate (type 3.1 defined in TD1 chap. 2.20) prepared during each delivery. (The tests can be carried out by the holder/manufacturer)  - 1 test report,	<b>Material study:</b> <b>Infrared:</b> - 1 type/material <b>DSC:</b> - 1 type/material <b>Tensile strength:</b> - 1 type/material
Impacts (1)	1 test	1 test per type sampled
Oven test (1)	1 test	1 test per type sampled
Ring flexibility	1 test	1 test per type sampled
Ring stiffness	1 test	1 test per type sampled
Compression rate (2) (4)	-	1 test or test report from an EN ISO 17025 accredited body of less than 5 years
Tensile strength of the seam NF EN 1979 (only spirally-formed pipes and to welded sockets)	1 test	1 test per type sampled
Technical solution for connecting pipe/manhole – inspection chamber	Dimensional inspection	Leak testing for each DN and pipe process
<b>Assembly</b>	Leaktightness of elastomer sealing rings (3)	- 3 diameters from throughout the range, if there is only one model of seal ring; 2 diameters per model of seal ring if the number of models is greater than 1.
	Quality of elastomer sealing rings	- 1 report of tests provided by the manufacturer of elastomer sealing rings.
	Ring stiffness of assemblies	- 1 test per type sampled

(1) With additional clarifications indicated in Part 2 of Technical Document 1.

(2) The compression rate on stiffness class 16 structured-wall pipes with  $DN \geq 315$  mm is not performed if the formulation is identical to that of  $DN < 315$  mm.

- If the formulation of pipes with  $DN \geq 315$  is different from that of those with  $DN < 315$  mm, the compression rate test will be carried out on a pipe with  $DN \leq 315$  mm made with this new formulation.
- (3) For SN (CR) 16 pipes with  $DN \leq 315$ , the leak test will be carried out under condition B (diametral deformation) and C (angular deflection).
- For SN (CR) 16 pipes with  $DN > 315$ :
    - if the design of the seal is the same for SN (CR) 8 or SN (CR) 4 pipes, the test will not be conducted.
    - if the design of the seal is different than that for SN (CR) 8 or SN (CR) 4 pipes, the test will be conducted under conditions B and C on an SN (CR) 8 or SN (CR) 4 pipe made for testing purposes with an assembly matching that of the SN (CR) 16 pipes.
- (4) This test is not to be performed as part of an extension application for one or more DN's produced using the same raw material, the same process and at the same production site as the NF mark certified products.

**b) For structured-wall fabricated fittings with profiled external and smooth internal surface (Type B) PVC / PE / PP:**

Measurement or test (3)		Tests conducted in the factory	Tests conducted in the laboratory of the mark
Mean external diameter Appearance Marking Colour Thickness Assembly dimensions		All the types submitted for admission: by dimensional inspection of stock on at least half the range presented and by verification of the inspection registers for the entire range	-
Sockets		All fittings submitted for admission	-
Flexibility or mechanical strength only for fabricated fittings made from several parts. NF EN 12256		-	1 test
<b>Assemblies</b>	Leaktightness of seal rings standard NF EN 1277 Conditions B and C at 23°C	-	1 diameter if there is only one model of seal ring; 1 diameter per model of seal ring if the number of models is greater than 1
	Quality of elastomer sealing rings <sup>(1)</sup>	-	1 report of tests provided by the manufacturer of elastomer sealing rings.
	Watertightness NF EN 1053	-	1 diameter if there is only one model of seal ring; 1 diameter per model of seal ring if the number of models is greater than 1
	Tension on welded or fused joints NF EN 1979	-	1 test

(1) If the seals are made of elastomer identical in quality to that used for the NF-certified pipes, this test is not conducted.

(2) Limited to 4 fittings.

(3) With additional clarifications indicated in Part 2 of Technical Document 1.

c) **For structured-wall injected or rotomoulded fittings with profiled external and smooth internal surface (Type B) PVC / PE / PP:**

Measurement or test (3)		Tests conducted in the factory	Tests conducted in the laboratory of the mark
Mean external diameter Appearance Marking Colour Thickness Assembly dimensions		All the types submitted for admission: by dimensional inspection of stock on at least half the range presented and by verification of the inspection registers for the entire range	-
Sockets		All fittings submitted for admission	-
Material tests: Density <b>(PVC-U / PE)</b> MFR and OIT <b>(PP / PE)</b> Resistance to internal pressure PVC-U / PP / PE		- Specifications accompanied by the attestation of conformity (type 2.1 defined in TD1 chap. 2.20) prepared during each delivery 1 report of tests provided by the raw material supplier (this test can be carried out by the holder/manufacturer)	
Oven test		1 test per fitting sampled <sup>(2)</sup>	1 test per fitting sampled <sup>(2)</sup>
Ring stiffness		1 test per fitting sampled <sup>(2)</sup>	1 test per fitting sampled <sup>(2)</sup>
Impact resistance (drop test)		1 test per fitting sampled <sup>(2)</sup>	1 test per fitting sampled <sup>(2)</sup>
<b>Assembly</b>	Leaktightness of seal rings NF EN 1277 Conditions B and C at 23°C	-	1 diameter if there is only one model of seal ring; 1 diameter per model of seal ring if the number of models is greater than 1
	Quality of elastomer sealing rings <sup>(1)</sup>	-	1 report of tests provided by the manufacturer of elastomer sealing rings.

(1) If the seals are made of elastomer identical in quality to that used for the NF-certified pipes, this test is not conducted.

(2) Limited to 4 fittings.

(3) With additional clarifications indicated in Part 2 of Technical Document 1.

## 4.2 TEST PROCEDURES DURING MONITORING OF CERTIFIED PRODUCTS

### d) For structured-wall piping with profiled external and smooth internal surface (Type B) PVC / PE / PP:

Measurement or test (1)	Tests conducted in the factory		Tests conducted in the laboratory of the mark
	Quality control	Quality management	
Mean external diameter	3 types/visit/structure/process/material		-
Appearance Marking Colour Length Any diameter Thickness Sockets (depth of groove)			-
<b>Virgin materials</b>  Material tests: Density (PVC-U / PE) MFR and OIT (PP / PE) Resistance to internal pressure PVC-U / PP / PE <b>Tensile strength</b>	- Specifications accompanied by the attestation of conformity (type 2.1 defined in TD1 chap. 2.20) prepared during each delivery  - 1 test report (this test may be carried out by the holder/manufacturer) if there is a change in raw materials (2)		-
<b>Recycled materials</b> <b>Characteristics included in the specifications:</b> Density Tensile strength at threshold and elongation at break MFR Ash content Impurities Volatile materials <b>OIT</b> <b>Tensile strength</b> Resistance to internal pressure PP/PE	- Specifications accompanied by the acceptance certificate (type 3.1 defined in TD1 chap. 2.20) prepared during each delivery. (The tests can be carried out by the holder/manufacturer)  -1 test report if there is a change in raw materials or modification of the specifications (2)		<b>Infrared:</b> - 1 type/year/material <b>DSC:</b> - 1 type/year/material
Oven test	1 type each visit / structure / process / material	1 type/year/structure/process/material	1 type/year/structure/process/material
Ring stiffness	1 type each visit / structure / process / material	1 type/year/structure/process/material	1 type/year/structure/process/material
Ring flexibility	1 type each visit / structure / process / material	1 type/year/structure/process/material	/
Compression rate	-	-	1 type every 5 years or 1 test report from an EN ISO 17025 accredited body of less than 5 years
Impacts	1 type each visit / structure / process / material	1 type/year/structure/process/material	1 type/year/structure/process/material
Tensile strength of the seam NF EN 1979 (only spirally-formed pipes)	-	-	1 type per year
<b>Assemblies</b> Leaktightness of elastomer sealing rings	-	-	1 type/year/structure/process/material
Technical and commercial documents and website (body of reference system, chap. 2.5.3.3)	All information and specifications mentioned on the certificate must be consistent with the technical and commercial documents and website of the holder.		

(2) With additional clarifications indicated in Part 2 of Technical Document 1.

(3) A change of raw material corresponds to a change of reference.



**e) For structured-wall fabricated fittings with profiled external and smooth internal surface (Type B) PVC / PE / PP:**

Measurement or test (1)	Tests conducted in the factory		Tests conducted in the laboratory of the mark	
	Quality control	Quality management		
Mean external diameter	3 types/visit/structure/process/material and at least 1 fitting per mould cavity		-	
Appearance Marking Colour Length Any diameter Thickness Sockets (depth of groove)			-	
Flexibility or mechanical strength only for fabricated fittings made from several parts. NF EN 12256	-	-	1 type/year/structure/process/material	
<b>Assemblies</b>	Leaktightness of elastomer sealing rings	-	-	1 type/year/structure/process/material
	Watertightness NF EN 1053	-	-	1 type/year/structure/process/material
	Tension on welded or fused joints NF EN 1979	-	-	1 type per year
Technical and commercial documents and website (body of reference system, chap. 2.5.3.3)	All information and specifications mentioned on the certificate must be consistent with the technical and commercial documents and website of the holder.			

(1) With additional clarifications indicated in Part 2 of Technical Document 1.

**f) For structured-wall injected, fabricated or rotomoulded fittings with profiled external and smooth internal surface (Type B) PVC / PE / PP:**

Measurement or test (1)	Tests conducted in the factory		Tests conducted in the laboratory of the mark
	Quality control	Quality management	
Mean external diameter	3 types/visit/structure/process/material and at least 1 fitting per mould cavity		-
Appearance Marking Colour Length Any diameter Thickness Sockets (depth of groove)			-
Material tests: Density <b>(PVC-U / PE)</b> MFR and OIT <b>(PP / PE)</b> Resistance to internal pressure PVC-U / PP / PE	Specifications accompanied by the attestation of conformity (type 2.1 defined in TD1 chap. 2.20) prepared during each delivery. 1 report of tests provided by the raw material supplier (the tests can be carried out by the holder/manufacturer).		-
Oven test	1 type each visit / structure / process / material	1 type/year/structure/process/material	1 type/year/structure/process/material
Ring stiffness	1 type each visit / structure / process / material	1 type/year/structure/process/material	1 type/year/structure/process/material
Impacts	1 type each visit / structure / process / material	1 type/year/structure/process/material	1 type/year/structure/process/material
<b>Assemblies</b> Leaktightness of elastomer sealing rings	-	-	1 type/year/structure/process/material
Technical and commercial documents and website (body of reference system, chap. 2.5.3.3)	All information and specifications mentioned on the certificate must be consistent with the technical and commercial documents and website of the holder.		

(1) With additional clarifications indicated in Part 2 of Technical Document 1.

## Appendix 1

### PE OR PP EXTERNALLY RECYCLED OR RECLAIMED MATERIALS SPECIFICATIONS

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**PURPOSE:** This document defines the conditions that must be met to use externally reclaimed materials.

The supplier of the externally produced regrind or reclaimed material and the products' applicant/holder must agree on a specification. It must, at a minimum, cover the characteristics listed in Tables 1 and 2 below for PP and PE.

#### **Evaluation by the applicant/holder of externally recycled or reclaimed materials:**

Recycled materials are externally-sourced materials composed 100% of non-virgin materials.

Approval of the specifications is contingent upon the compliance of a 1000-hour resistance to internal pressure test conducted on the externally recycled or reclaimed material.

The test is carried out under the supervision of the applicant/holder.

The characteristics of the externally recycled or reclaimed material used in the 1000-hour resistance to internal pressure test are the threshold values of the specifications of the material as set out in Tables 1, 2 and 3 of CP CEN/TS 14541.

This 1000-hour resistance to internal pressure test is conducted on an extruded pipe composed of the 100% externally recycled or reclaimed material being considered.

The resistance to internal pressure test enables mandatory thresholds to be defined in the context of accepting materials, particularly in terms of the following parameters:

- Density,
- Tensile strength at threshold and elongation at break,
- MFR,
- Ash content,
- Impurities,
- Volatile materials.

#### **Experience using externally recycled or reclaimed materials:**

Use of externally recycled or reclaimed materials is declared to CSTB.

Any applicant using externally recycled or reclaimed materials must provide proof of sufficient prior production experience (at least 6 months and 1000 m of pipes).

#### **Requirements concerning the supplier of the material:**

The supplier of the externally recycled or reclaimed materials must provide proof of conformity of its quality assurance system with the requirements set out in paragraph 2.3.2 "Minimum requirements for quality management" of the reference system.

Proof of conformity with these requirements can be provided either by a certificate of conformity with the requirements of standard NF EN ISO 9001: 2008 issued by a certifying body accredited by the COFRAC or a member of the EA (European cooperation for Accreditation) or by an equivalent form of proof.

If neither the holder-manufacturer nor the supplier is NF EN ISO 9001: 2008 certified, use of externally recycled or reclaimed materials is not authorised.

If the supplier of the externally recycled or reclaimed materials is NF EN ISO 9001: 2008 certified, AFNOR Certification may take certification issued by a certification body for systems into account, provided that:

- the ISO certificate is issued by an accredited certifying body:
  - the ISO certificate is issued by a certifying body accredited by the COFRAC or a member of the EA (European cooperation for Accreditation) – see signatories on the COFRAC website ([www.cofrac.fr](http://www.cofrac.fr)) – and recognised by AFNOR Certification
  - the ISO certificate is issued by AFNOR Certification in the context of the coordinated certification offer

When they are determined in accordance with the test methods given in Tables 1 and 2 below for PP and PE, the actual values for these characteristics must comply with the agreed-upon value.

The frequency of sampling must be the subject of an agreement between the supplier and the applicant/holder.

Each delivery must include a certificate demonstrating compliance with the approved specification made by the supplier of the material or by the manufacturer of the product, as well as the fact that it was accepted by both parties.

The characteristics of the finished product's material must be compliant with the requirements specified in the corresponding product standard.

A type test must be conducted on the finished product with the maximum quantity of reclaimed material specified and with each of the types of externally produced regrind or reclaimed material covered by an approved specification.

Compliant results shall be considered to also validate the conformity of components containing lower levels of the external or reclaimed material.

**Table 1 - Characteristics of reclaimed PP to be considered in the specification**

Characteristic	Unit	Test method (1)	Comment
Density (2)	kg/m <sup>3</sup>	NF EN ISO 1183-2	
Tensile strength at threshold and elongation at break	%	NF EN ISO 6259-1 et 3	
MFR (2)	g/10 min	NF EN ISO 1133 – 230 °C / 2.16 kg	
Ash content	%	NF EN ISO 3451-1	
Foreign polymers		IR or DSC analyses	Presence
Impurities		Sieving	Use an agreed-upon sieve mesh size
Type of pigments and/or additives		By analysis	Optional: the supplier and purchaser must come to an agreement
Volatile material / water content	%	NF EN 12099	
Thermal stability OIT	min	NF EN 728 Temperature 200° C	
<p>(1) The samples must be taken from either a batch of mixed and granulated materials or each individual batch of materials. The frequency of sampling must be the subject of an agreement between the supplier and the applicant/holder as well as the certifying body, if applicable.</p> <p>(2) If the origin of the material is consistent, for example pipes or fittings or other products manufactured under a quality mark, it is not necessary to test the characteristics of the material covered by the quality mark.</p>			
<p>NOTE: when making the decision on the number of characteristics to test, the frequencies with which these must be tested as well as the corresponding requirements, consider the following:</p> <ul style="list-style-type: none"> <li>- the reclaiming treatment and the source of the material due to the risk of impurities or other polymers being present</li> <li>- how the material is processed in the finished product</li> <li>- the desired characteristics of the finished product</li> <li>- the possible limits on sources for reclaimed material</li> <li>- the proportioning of the material considered</li> </ul>			

**Table 2 - Characteristics of reclaimed PE to be considered in the specification**

Characteristic	Unit	Test method (1)	Comment
Density (2)	kg/m <sup>3</sup>	NF EN ISO 1183-2	
Tensile strength at threshold and elongation at break	%	NF EN ISO 6259-1 and 3	
Environmental stress cracking	h	ASTM 1693B Surfactant: 10% Igepal Samples taken from compression-moulded parts	
MFR (2)	g/10 min	NF EN ISO 1133 – 190 °C /5kg	
Ash content	%	NF EN ISO 3451-1	
Foreign polymers		IR or DSC analyses	Presence
Impurities		Sieving	Use an agreed-upon sieve mesh size
Type of pigments and/or additives		By analysis	Optional: the supplier and purchaser must come to an agreement
Volatile material / water content	%	NF EN 12099	
Thermal stability OIT	min	NF EN 728 Temperature 200° C	
<p>(1): The samples must be taken from either a batch of mixed and granulated materials or each individual batch of materials. The frequency of sampling must be the subject of an agreement between the supplier and the applicant/holder as well as the certifying body, if applicable.</p> <p>(2): If the origin of the material is consistent, for example pipes or fittings or other products manufactured under a quality mark, it is not necessary to test the characteristics of the material covered by the quality mark.</p>			
<p>NOTE: when making the decision on the number of characteristics to test, the frequencies with which these must be tested as well as the corresponding requirements, consider the following:</p> <ul style="list-style-type: none"> <li>- the reclaiming treatment and the source of the material due to the risk of impurities or other polymers being present</li> <li>- how the material is processed in the finished product</li> <li>- the desired characteristics of the finished product</li> <li>- the possible limits on sources for reclaimed material</li> <li>- the proportioning of the material considered</li> </ul>			