TECHNICAL DOCUMENT

GRAVITY DRAINAGE SYSTEMS MADE OF THERMOPLASTIC MATERIALS

Technical document No. 442-02

Specifications applicable to the smooth external structured-wall piping system group (Type A)

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MODIFICATION HISTORY

Revision No.	Application date	Modifications
03	**21/12/2018**	**Update to the document layout and reference**

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Part 1
SCOPE

This Technical Document covers the external structured-wall piping system group (Type A) in the U zone, according to Standard NF EN 13476-3.

1.1 APPLICABLE REFERENCE STANDARDS AND COMPLEMENTARY SPECIFICATIONS

1.1.1 Reference standards

EN 13476-1 (April 2018)	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 13476-2 (April 2018)	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 2: Specifications for pipes and fittings with smooth internal and external surface and the system, Type A.
NF EN ISO 3126 (September 2005)	Plastics piping systems – Plastics components – Determination of dimensions.

1.1.2 Complementary specifications and additional requirements

The reference specifications and test methods for the NF mark – Gravity drainage systems made of thermoplastic materials are defined in the tables below. They are based on the abovementioned standards with possible additions or changes.

TABLE 1:

Specifications for fabricated Pipes and Fittings

Characteristics and test methods (1)	PVC-U	PP	PE
Reference standard	NF EN 13476-2		
MATERIAL TESTS (resins)			
Density	≥ 1360 kg/m³	/	≥ 930 kg/m³
MFR	/	≤1.5 g/10min (230°C/2.16kg)	< 1.6 g/10min (190°C/5kg)
OIT on finished product (200°C) on internal and external layers	/	≥ 8 mn	≥ 20 mn
Resistance to internal pressure (pipe formulation on solid external layers)	60°C 1000 hrs Sigma: pipe 10 MPa	95°C 1000 hrs Sigma: 2.5 MPa and 80°C 140 hrs Sigma: 4.2 MPa	80 °C 1000 hrs Sigma: 2.8 MPa and 80°C 165 hrs Sigma: 4.0 MPa
Colour (visible external skin)	Homogeneous colour (clear, medium grey-blue between A624 and A625) in accordance with standard NF X 08-002 and the walls must be opaque. (1)	Black Orange-brown	Black Orange-brown
Dimensions DN/OD Thicknesses Sockets (2)	Pipes: Tables 5, 6 & 7 NF EN 13476-2 Series DN/OD Fabricated fittings: Chapter 7.2.5.6 of NF EN 13476-2 for Type A1 PVC pipes all required dimensions are defined in Table 2		
Lengths	Total length: ≤ 12 m - Tolerance ± 1% for L < 5 m and ± 5 cm for L ≥ 5 m		
Reversion after annealing at NF EN ISO 2505 - (1)	150°C/T ≤ 5% No blisters	150°C/T ≤ 2% No blisters	110°C/T ≤ 3% No blisters

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

Pipes

Characteristics and test methods (1)	PVC-U	PP	PE
Ring stiffness NF EN ISO 9969	SN 4: ≥4 kN/m² SN 8: ≥ 8 kN/m² SN 16: ≥ 16 kN/m²		
Impact resistance NF EN 744	Test performed at 0°C TIR ≤ 10% Testing parameters see Table 15 of Standard NF EN 13476-2 DN 110 and 125 in PVC: striker D25		
Impact resistance (2) NF EN 1411	Temperature -10°C H50 ≥ 1 m, one break max. and smaller than 0.5 m Testing parameters see Table 9 of standard NF EN 1852-1		
Tensile strength NF EN ISO 6259-1, ISO 6259-2 and ISO 6259-3	Maximum strength ≥ 45 MPa on the solid part or ≥ 20 MPa on the entire section of pipe		
Ring flexibility NF EN ISO 13968	No destructuration at 30% out-of-roundness Compliant with 9.1.2 of standard NF EN 13476-2		
Compression rate NF EN ISO 9967	PVC: Extrapolation to 2 years: ≤ 2.5 PP and PE: Extrapolation to 2 years: ≤ 4		

(1) With additional clarifications indicated in Part 2 of Technical Document 1.
(2) If claimed by the applicant/holder.

Applies only to coiled tubing

Characteristics and test methods (1)	PVC-U	PP	PE
Tensile strength of the seam NF EN 1979 – 15 mm/min	Compliant with 9.1.3 of Standard NF EN 13476-2		

Fabricated fittings: The fabricated fittings are made from NF A-certified Type A pipes

Characteristics and test methods (1)	PVC-U	PP	PE
Flexibility or mechanical strength only for fabricated fittings made from several parts NF EN 12256	No signs of tears, separation or leaks		

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

Assemblies

Characteristics and test methods (1)	Specifications
Leaktightness of elastomer sealing rings NF EN 1277 Conditions B and C at 23°C	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 (2)	NF EN 681-1 or NF EN 681-2 as the case may be

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

(2) 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.

TABLE 2:

Dimensional characteristics and tolerances of Type A1 PVC pipes with multi-layer or cellular-core structures

DN/OD	Mean external diameter Dext		Minimum mean internal diameter Dim min			Thicknesses		Assembly with seal ring	
	Min	Max	CR or SN4	CR or SN8	CR or SN8	Structured wall e4min	Cellular-core structure e4min	CR or SN4	CR or SN8
110	110.0	110.3	102	100	97	0.4	0.6	110.4	32
125	125.0	125.3	116	114	107	0.4	0.6	125.4	35
160	160.0	160.4	149	146	135	0.5	0.8	160.5	42
200	200.0	200.6	186	182	172	0.6	1.0	200.6	50
250	250.0	250.8	233	228	216	0.7	1.1	250.8	55
315	315.0	316.0	294	288	270	0.8	1.2	316.0	62
400	400.0	401.2	372	365	340	1.0	1.5	401.2	70
500	500.0	501.5	467	459	432	1.3	2.1	501.5	80
630	630.0	631.9	590	580	540	1.6	2.6	631.9	93
710	710.0	712.1	665	653	607	1.8	2.8	712.1	101
800	800.0	802.4	750	736	680	2.0	3.3	802.4	110
1000	1000.0	1003.0	935	920	864	2.5	3.5	1003.0	130

Total length: ≤ 12 m
- Tolerance ± 1% for L < 5 m
  ± 5 cm for L ≥ 5 m

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 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 NF logo.

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, at a minimum, 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: nominal external diameter and CR4 and/or SN4, CR8 and/or SN8, CR16 and/or SN16;

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). Additional information enabling traceability to be ensured may be included.

❼ - *****: 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 applicant/holder. 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.

Example:

PVC, PE and PP pipes for sewerage systems

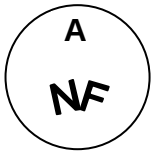
XXX	01/02	NF A	PVC or PE or PP	125	CR8 (and/or) SN8	01 02 10 or 032 10 *
①	②	③	④		⑤	⑥ ❼

XXX	01/02	NF A	PVC or PE or PP	125	CR8 (and/or) SN8	01 02 10 or 032 10 *
①	②	③	④		⑤	⑥ ❼

2.1.2.2 Marking fabricated fittings

Holders have the option to use:

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



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

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 (in the 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**:** CR4 and/or SN4, CR8 and/or SN8 or CR16 and/or SN16 according to the stiffness class of the pipe used to manufacture the fabricated fitting.

⑤ - the symbol identifying the material (PVC/PE/PP)

- 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.

Note: the location of the marking and the methods used are left to the applicant/holder. 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 information on fittings (optional)

- a mark for production identification.

2.2 REPRODUCTION DU LOGO NF SUR L'EMBALLAGE DU PRODUIT CERTIFIE NF

- 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:

* company name and/or trademark filed,
* symbol identifying the material,
* NF logo as defined below:

2.3 MARKING CERTIFIED AND ASSOCIATED CHARACTERISTICS

Definition: "Certified characteristic" means "all information the content of which is checked within the framework of the NF mark".

All documentation relating to an NF – Gravity drainage system 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 2.4.2 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, sockets),
  - Impact resistance,
  - Longitudinal (heat) reversion,
  - Ring stiffness,
  - Ring flexibility,
  - Compression rate,
  - Tensile strength of seam (only for spirally-formed pipes),
  - Leaktightness of assemblies,
  - Quality of elastomer sealing rings.

- certified product characteristics, fabricated fittings:
  - Dimensional characteristics (diameters, thicknesses, sockets),
  - Mechanical strength or flexibility,
  - Leaktightness of assemblies,
  - 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:

Part 3
APPLICANT/HOLDER QUALITY REQUIREMENTS

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 the Certification Reference System specific to each product group, unless otherwise indicated in the tables.

For pipes:

Materials (resins):

Measurements or tests (1)	Minimum sampling frequency	PVC-U	PE	PP
Density	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

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

Product:

Measurements or tests (1)	Minimum sampling frequency	PVC-U	PE	PP
OIT on finished product	Once per campaign	/	X	X
MFR on finished product	Once per campaign	/	X	X
Dimensions: diameter, thicknesses, appearance, colour, marking, length	By extruder: 1 every 4 hours	X	X	X
Reversion	1 test on 1 specimen at the start of the campaign and at least 1 test per week	X	X	X
Tension	1 test per campaign on 5 specimens 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 (1)	X	X	X
Ring flexibility	1 test per campaign and per batch of materials (1)	X	X	X
Impact resistance	1 test per campaign and per batch of materials (1)	X	X	X

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

For fabricated fittings:

Measurements or tests (1)	Minimum sampling frequency
Dimensions (spigots and sockets)	- per machine, per type and per dimensions: Once every 4 hours, with increased inspections at the start of the campaign (2 specimens during the first 2 hours of production)
Flexibility or mechanical strength only for fabricated fittings made from several parts. NF EN 12256	1 test per campaign

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

A campaign corresponds to the period between the start and stop of manufacturing of a product reference number and/or 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 this reference system.

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).

Part 4
MONITORING ARRANGEMENTS BY CSTB

4.1 TEST PROCEDURES DURING AN APPLICATION FOR ADMISSION

a) For structured-wall piping with smooth external surface (Type A) PVC-U / PE / PP:

Measurement or test (1)		Tests conducted in the factory	Tests conducted in the laboratory of the mark
Appearance Marking plan Colour **Dimensional inspection defined in Table 2 page 6 only**		All the types submitted for admission	/
Material tests: Density (**PVC-U / PE)** (1) MFR and OIT **(PP / PE)**		Specifications accompanied by the certificate of conformity or analysis (type 2.1 or greater as defined in TD1 chap. 2.19) prepared during each delivery	/
Material tests: Resistance to internal pressure PVC-U / PP / PE		1 report of tests provided by the raw material supplier (this test can be carried out by the holder/manufacturer).	/
Impacts		1 test	1 test per type sampled
Tension		1 test	1 test per type sampled
Reversion (1)		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
Ring flexibility		1 test	1 test per type sampled
Tensile strength of the seam NF EN 1979 (only spirally-formed pipes)		1 test	1 test per type sampled
Assemblies	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.

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

(2) For pipes with DN > 315 mm and in stiffness class 16, the compression rate is not performed if the formulation is identical to that of pipes with DN < 315 mm. If the formulation is different, the compression rate will be performed on a pipe with DN < 315 mm made with the second formulation.

(3) For SN (CR) 16 pipes with DN less than or equal to 315:
The leak test will be carried out under conditions B (diametral deformation) and C (angular deflection).
For SN (CR) 16 pipes with DN greater than 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 again as part of an extension application for one or more DNs produced using the same raw material, the same process and at the same production site as the NF mark certified products.

b) <u>For structured-wall fabricated fittings with smooth external surface (Type A) PVC / PE / PP:</u>

Measurement or test (1)		Tests conducted in the factory	Tests conducted in the laboratory of the Mark
Mean external diameter Appearance Marking Colour Length Dimensional inspection defined in Part 1 of this document		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
Assemblies	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	/	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) 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 smooth external surface (Type A) PVC / PE / PP:

Measurement or test (1)	Tests conducted in the factory		Tests conducted in the laboratory of the mark
	Quality control	Quality management	
Appearance Marking Colour Length Dimensional inspection defined in Table 2 page 6 only	3 types/visit/structure/process/material		-
Material tests: Density **(PVC-U / PE)**	Specifications accompanied by the certificate of conformity or analysis (type 2.1 or greater as defined in TD1 chap. 2.19) prepared during each delivery		-
Material tests: MFR and OIT **(PP / PE)**			
Material tests: Resistance to internal pressure PVC-U / PP / PE (in the case of a new material certification)	1 report of tests provided by the raw material supplier (this test can be carried out by the holder/manufacturer).		
Reversion at 150°C	Test record	Test record	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 (2)	-	-	1 type every 5 years or one 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
Tension	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/year
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.

(2) For pipes with DN $\geq$ 315 mm and in stiffness class 16, the compression rate is not performed if the formulation is identical to that of pipes with DN $\leq$ 315 mm. If the formulation is different, the compression rate will be performed on a pipe with DN $\leq$ 315 mm made with the second formulation.

For structured-wall fabricated fittings with smooth external surface (Type A) PVC / PE / PP:

<table>
<tr><th colspan="2" rowspan="2">Measurement or test (1)</th><th colspan="2">Tests conducted in the factory</th><th rowspan="2">Tests conducted in the laboratory of the mark</th></tr>
<tr><th>Quality control</th><th>Quality management</th></tr>
<tr><td colspan="2">Mean external diameter</td><td colspan="2" rowspan="2">3 types/visit/structure/process/material</td><td>-</td></tr>
<tr><td colspan="2">Mean external diameter
Appearance
Marking
Colour
Length
Dimensional inspection defined in Part 1 of this document</td><td>-</td></tr>
<tr><td colspan="2">Flexibility or mechanical strength only for fabricated fittings made from several parts.
NF EN 12256</td><td>-</td><td>-</td><td>1 type/year/structure/process/material</td></tr>
<tr><td rowspan="3">Assemblies</td><td>Leaktightness of elastomer sealing rings</td><td>-</td><td>-</td><td>1 type/year per structure/process/material</td></tr>
<tr><td>Watertightness NF EN 1053</td><td>-</td><td>-</td><td>1 type/year per structure/process/material</td></tr>
<tr><td>Tension on welded or fused joints NF EN 1979</td><td>-</td><td>-</td><td>1 type/year</td></tr>
<tr><td colspan="2">Technical and commercial documents and website (body of reference system, chap. 2.5.3.3)</td><td colspan="3">All information and specifications mentioned on the certificate must be consistent with the technical and commercial documents and website of the holder.</td></tr>
</table>

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