

**RIGID NON-PLASTICISED
PVC PIPES AND FITTINGS****Technical document No. 055-01**

Specifications applicable to all groups
(Discharge, Pressure, Axially-Oriented
Pressure, Siphonic Discharge)

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MODIFICATION HISTORY

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00	21/12/2018	Update to the document layout and reference

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Part 1. MONITORING ARRANGEMENTS - GENERAL

The tests are carried out in accordance with the standards cited in technical documents 055-02 to 055-05.

The examinations and tests are carried out during the audit in the presence of the auditor by the applicant in its laboratory or by the body responsible for the tests in a laboratory designated in Part 5 of the **certification reference system**.

The acceptance criteria, cases of retesting or cases where the test is declared non-compliant are described in the table below.

FOR PIPES

Measurement or test	No. of pipes or specimens per type tested	Acceptance	Repeating tests	Non-compliant test
Average external diameter	5 pipes	No measurements outside tolerances	If 1 value is outside tolerances, repeat testing on 10 other pipes	If more than 1 value is outside tolerances, with or without repeat testing
Appearance Marking Colour Length Any diameter Thickness Sockets (depth of groove)	5 pipes	On 5 pipes, 1 or no measurements outside tolerances (in each series of measurements), extra thickness accepted	If 2 values are outside tolerances (in each series of measurements): repeat testing on 10 other pipes, extra thickness accepted	If more than 2 values are outside tolerances, with or without repeat testing
Density	3 test specimens cut from 1 pipe	Average of 3 measurements compliant with specifications	-	Average of 3 measurements outside tolerances
Vicat softening temperature	2 test specimens cut from 1 pipe	Average of 2 measurements compliant with specifications	If the variance between the results obtained is $> 2^{\circ}\text{C}$ repeat testing on 2 new specimens	Average of 2 measurements outside tolerances
Tensile characteristics (maximum stress and elongation at break)	<p>Factory: For admission: 3 test specimens cut from 3 pipes For follow-up: 5 test specimens cut from 3 pipes Laboratory: 5 test specimens cut from 3 pipes</p>	<p>In factory: Average of 3 measurements compliant with specifications (with the 3 individual values compliant)</p>	<p>In factory: If average of 3 compliant measurements with 1 individual measurement outside tolerances, repeat testing on 2 new specimens</p>	<p>In factory: If average of measurements is outside tolerances (with or without repeat testing) or more than 1 individual value is outside tolerances</p>
		<p>In laboratory: Average of 5 measurements compliant with specifications with at least 4 individual values compliant</p>	<p>In laboratory: If average of 5 compliant measurements with 2 individual measurements outside tolerances, repeat testing on 5 new specimens</p>	<p>In factory: If average of measurements is outside tolerances (with or without repeat testing) or more than 2 individual values are outside tolerances</p>

Measurement or test	No. of pipes or specimens per type tested	Acceptance	Repeating tests	Non-compliant test
Impacts	See En 744	TIR<10%	-	TIR>10%
Reversion at 150°C	3 test specimens cut from 3 pipes	Result on each specimen compliant with specifications	If 1 measurement is outside tolerances, repeat testing on 3 new specimens taken from 3 pipes from the same batch	If 2 or more measurements are outside tolerances, with or without repeat testing, or average is outside tolerances, with or without repeat testing
Resistance to pressure at 20°C – 1 hr	<p>Factory: 3 test specimens taken from 3 pipes</p> <p>Laboratory: For admission: 5 test specimens spread over 3 pipes</p> <p>For follow-up: 3 test specimens spread over 3 pipes</p>	Result on each specimen compliant with specifications	<p>In factory: If 1 specimen is non-compliant with specifications, repeat testing on 2 additional specimens taken from 2 pipes from the same batch</p>	If more than 2 specimens are non-compliant, with or without repeat testing
			<p>In laboratory: If 1 specimen is non-compliant with specifications, repeat testing on 5 additional specimens taken from 3 pipes from the same batch</p>	
Resistance to pressure 20°C – 100 hrs	1 specimen	Result on the specimen compliant with specifications	-	Result non-compliant with specifications
Resistance to pressure at 20°C – 10 hrs	1 specimen	Result on the specimen compliant with specifications	-	Result non-compliant with specifications
Resistance to pressure at 20°C – 3000 hrs	1 specimen	Result on the specimen compliant with specifications	-	Result non-compliant with specifications
Resistance to pressure at 60°C – 10 hrs	1 specimen	Result on the specimen compliant with specifications	-	Result non-compliant with specifications
Resistance to pressure at 60°C – 1000 hrs	1 specimen	Result on the specimen compliant with specifications	-	Result non-compliant with specifications
Ring stiffness	3 test specimens spread over 1 pipe	Average value of 3 measurements compliant with specifications (with no non-compliant individual values)	If 1 individual value is non-compliant, retest 3 specimens	One individual value from the repeat test is non-compliant with specifications

FOR FITTINGS

Measurement or test	No. of pipes or specimens per type tested	Acceptance	Repeating tests	Non-compliant test
Average external diameter Any diameter	5 identical fittings	No measurements outside tolerances	If 1 value is outside tolerances, repeat testing on 5 other fittings per diameter	If more than 2 values are outside tolerances per diameter, with or without repeat testing
Sockets Appearance Marking Colour Assembly dimensions Thickness				If more than 1 value is outside tolerances per diameter, with or without repeat testing
Vicat softening temperature	2 test specimens cut from 1 fitting	Average of 2 measurements compliant with specifications	If the variance between the results obtained is > 2°C repeat testing on 2 new specimens (fittings from the same batch)	Average of 2 measurements outside tolerances
Density	3 test specimens cut from 1 fitting	Average of 3 measurements compliant with specifications	-	Average of 3 measurements outside tolerances
Resistance to pressure at 20°C – 1 hr	For admission: 3 identical fittings	Each fitting compliant with specifications	If 1 fitting is defective, repeat testing of 3 new fittings from the same batch	With or without repeat testing, from 2 fittings non-compliant with specifications
Oven test at 150°C	For follow-up: 2 identical fittings			
Resistance to alternating pressure stress	<u>Factory:</u> For admission: 3 fittings (1 fitting per geometric shape) For follow-up: 3 identical fittings <u>Laboratory:</u> For admission: 1 test per type of fitting sampled 1 test = 3 samples for 1 identical fitting For follow-up: 3 samples for 1 identical fitting	individual values compliant with specifications	If 1 individual value is non-compliant with an average of 3 compliant tests, retest 3 specimens	One individual value from the repeat test is non-compliant with specifications
Resistance to pressure at 20°C – 1000 hrs	1 fitting	Result compliant with specifications	-	Result non-compliant with specifications
Resistance to pressure at 60°C – 1000 hrs	1 fitting	Result compliant with specifications	-	Result non-compliant with specifications

FOR ASSEMBLIES (PIPES – PIPES)

Measurement or test	No. of pipes or specimens per type tested	Acceptance	Repeating tests	Non-compliant test
Socket resistance to pressure	3 assemblies composed of a portion of pipe and at least 1 socket connected to another pipe	Compliance of the tested assembly with specifications		Does not meet specifications
Suitability for use of sockets				
Resistance to negative pressure				
Hermetic seal under internal pressure	1 assembly composed of 2 pipes			
Hermetic seal against external pressure	2 assemblies composed of a pipe with a spigot and another with a socket			
Hermetic seal against negative pressure				
Quality of elastomer rings	Plate provided by the manufacturer + seal			
Short-term internal hydrostatic pressure hermetic seal test	1 assembly composed of a portion of pipe and at least 1 socket connected to another pipe			
Short-term negative air pressure hermetic seal test	1 assembly composed of a portion of pipe and at least 1 socket connected to another pipe			
Long-term internal hydrostatic pressure hermetic seal test	1 assembly composed of a portion of pipe and at least 1 socket connected to another pipe			
Cyclic pressure test	1 assembly composed of a portion of pipe and at least 1 socket connected to another pipe			

FOR ASSEMBLIES (PIPES – FITTINGS)

Measurement or test	No. of pipes or specimens per type tested	Acceptance	Repeating tests	Non-compliant test
Socket resistance to pressure	1 assembly composed of a portion of pipe and at least 1 socket connected to another pipe	Compliance of the tested assembly with specifications		Does not meet specifications
Suitability for use of sockets				
Resistance to negative pressure				
Resistance to thermal shock	According to Standard NF T 54-037			
Quality of elastomer rings	Plate provided by the manufacturer + seal			
Watertightness	1 assembly following the reference standard (see technical appendix 1 Discharge)			
Airtightness				
Resistance to elevated temperature cycling	1 assembly in accordance with Standard NF EN 1055 fig. 2, using NF fittings			
Short-term internal hydrostatic pressure hermetic seal test	1 assembly composed of a portion of pipe and at least 1 socket connected to another pipe			
Short-term negative air pressure hermetic seal test	1 assembly composed of a portion of pipe and at least 1 socket connected to another pipe			
Long-term internal hydrostatic pressure hermetic seal test	1 assembly composed of a portion of pipe and at least 1 socket connected to another pipe			

FOR ASSEMBLIES (PVC-O PIPES – CAST IRON FITTINGS)

Measurement or test	No. of pipes or specimens per type tested	Acceptance	Repeating tests	Non-compliant test
Positive pressure hermetic seal test internal	1 assembly composed of a portion of pipe and a cast iron fitting	Compliance of the tested assembly with specifications		Does not meet specifications
Negative pressure hermetic seal test internal				
Cyclic pressure test				

1.1 INSPECTION CONDITIONS WHEN EXAMINING AN APPLICATION FOR THE RIGHT TO USE THE NF MARK

1.1.1 Type testing and taking samples

When examining an application for the right to use the NF mark, all testing for compliance with standards and complementary specifications is carried out under the conditions defined in article 1.1; type testing is carried out in the mark's laboratory. These are described in part no. 4 of each product group.

Samples for tests at the mark's laboratory are taken according to the instructions below, with reference to the sampling Standards NF X 06-021 and NF ISO 2859-1.

a) Case of pipes

The table below gives the number of types of pipes to be sampled according to the number of types submitted for admission (sampled randomly).

Number of types submitted for admission (per family)	Number of types to be sampled (per family)
1	1
2 to 8	2
9 to 15	3
16 to 25	5
26 to 50	8
51 to 90	13
91 to 150	20

b) Case of fittings

The table below gives the number of types of fittings to be sampled according to the number of fittings submitted for admission (sampled randomly).

Number of fittings submitted for admission (per family, per category and per type)	Number of fittings to be sampled (per family, category and type)
1	1
2 to 8	2
9 to 15	3
16 to 25	5
≥ 26	8

The samples taken must have been manufactured in the manufacturer's workshops under industrial manufacturing conditions.

The samples taken are marked by the officer in charge of verification with a distinctive sign allowing them to be authenticated subsequently and sent by the manufacturer and under its responsibility to the independent laboratory (see paragraph 5.3 of this certification reference document) in charge of performing the test, unless the officer in charge of verification decides to take responsibility for them.

Part 2. TEST PROCEDURES – GENERAL

MONITORING ARRANGEMENTS – GENERAL

IN ADDITION TO TESTING STANDARDS, THIS PARAGRAPH SPECIFIES THE SPECIFIC TEST PROCEDURES FOR RIGID NON-PLASTICISED PVC PIPES AND FITTINGS.

2.1 DENSITY (for pipes)

Measurements are taken on 3 specimens cut according to the instructions in Standard NF EN ISO 1183-1 Method A, on three generatrices at 120°C.

- Measure the density of the 3 specimens according to the instructions of Standard NF EN ISO 1183-1 Method A, at $23 \pm 2^\circ\text{C}$,
- Express the result by the average of the 3 values obtained.

Note: Other methods for structured-wall PVC (for example: sink-float method) may potentially be used by the manufacturers, as a manufacturing quality check, provided that they are well defined (establishment of an operating procedure); the previous method makes reference to this.

Liquids other than water can be used (for structured PVC).

2.2 SOCKET RESISTANCE TO PRESSURE/VACUUM

According to NF T 54-039, NF EN 13844 and NF EN 13845 with addendums below.

Apparatus

- Restraint device (clamp type) preventing displacement of the assembly being tested under the effects of pressure.
- Temperature controlled bath.
- Device enabling pressure to be maintained throughout the test, with a pressure control gauge.

Operating procedure

- For this test, the recesses provided for the rings can be equipped with special ring seals.
- After completing the assembly and before putting valves in place, insert a stiffener into the specimen (PVC pipe or other); the diameter of the stiffener is slightly smaller than the diameter of the pipe being tested. The length of the stiffener is equal to the length of the assembly less approximately 5 cm.
- It is possible to put a stiffener on the outside of the end of the socket in order to prevent the seal from being expelled.
- Position the specimen with its stiffener in the clamp inside the heat regulated bath and progressively apply test pressure.

2.3 REVERSION

The tests are carried out in the laboratory of the mark according to Standard NF EN ISO 2505 and Method B (hot air stove) with the following specifications:

- **Duration of the test:** The test duration shall comply with the specifications laid down in the product standards considered:

For Discharge pipes NF EN 1329-1 and NF EN 1453-1:

- Temperature of the enclosure: $150^{\circ}\text{C} \pm 2^{\circ}\text{C}$.
- Immersion time: 30 min.

For Pressure pipes NF EN 1452-2:

- Temperature of the enclosure: $150^{\circ}\text{C} \pm 2^{\circ}\text{C}$.
- Immersion time: 60 min for ≤ 8 mm thicknesses,
120 min for > 8 mm and ≤ 16 mm thicknesses,
- 240 min for > 16 mm thicknesses.

- **For all pipes:** Number of test specimens: (see Table of §1.1 of this Technical document No. 1).

In the event that the reversion test is performed using the air oven method:

- The specimen is a smooth piece of pipe of at least 200 mm;
- The 100 mm marks must be indicated in such a way that each mark is at least 10 mm away from the nearest end;
- The test specimen is hanging and free to move within the stove so that it is not in contact with the walls or the bottom of the stove.

In case of dispute, only the reversion test performed according to the liquid bath method in Standard NF EN ISO 2505 (Method A) will serve as the reference test.

As for quality assurance in production, the test method (A or B) is left to the holder's initiative.

In the event that the reversion test is performed using the liquid bath method (method A):

- The specimen is a smooth piece of pipe of at least 200 mm;
- The 100 mm marks must be indicated in such a way that each mark is at least 10 mm away from the nearest end;
- The distance between the liquid/air interface and the top mark shall be at least 30 mm.

2.4 TENSION

Tests carried out according to Standard NF EN ISO 6259-1 with the following specifications:

- Test specimens:

Shape defined in Standard ISO 6259-2 and/or NF EN ISO 527-2:

Cases of pipes with thicknesses < 12 mm: the specimens can be obtained either by cutting using a die (table 2 and figure 2 of the ISO 6259-2 Standard) or by machining (table 1 and figure 1 of the ISO 6259-2 Standard).

Cases of pipes with thicknesses > 12 mm: the specimens can only be obtained by machining (table 1 and figure 1 of the ISO 6259-2 Standard).

Cases of pipes with $\text{DN} < 40$ mm: the specimens can be obtained by machining (Standard NF EN ISO 527-2 Appendix A, 1BA type specimen).

The various types of specimens are explained in detail on the following page.

The machining cutting method is used in cases of disputes concerning a result.

. Number: (See table §1.1 of this technical document No. 1).

For information, if a die is used for cutting, the bands can be preheated at a temperature from 125°C to 130°C for 1 minute per millimetre of thickness.

. Measuring the sections: it is recommended that a micrometer screw gauge be used, with flat cylindrical measuring faces 2 mm in diameter.

- Testing speed: 5 ± 1 mm/min.
- Marking reference points: distance between the 2 marks is $25 \text{ mm} \pm 1 \text{ mm}$ (whatever the cutting method – die or machining).
- Determining maximum stress.
- Determining the elongation at failure from the distance measured between the two marks by connecting the two pieces of the specimens, 5 minutes after breaking or directly using an extensometer.

See Figure 1 Table 1 and Figure 2 Table 2 in Standard ISO 6259-2.

See test specimen defined in Standard ISO 527-2, 1BA type specimen.

2.5 OVEN TEST

Test carried out according to Standard NF EN ISO 580 - Method A with the following specifications:

- Test temperature: $150^{\circ}\text{C} \pm 2^{\circ}\text{C}$.
- Test duration: The duration of the test must comply with the specifications established in the product standards in question.

2.6 VICAT TEMPERATURE MEASUREMENT

Measurement taken in accordance with the NF EN 727 Standard; measuring specimens obtained by stacking is to be avoided if possible.

The VICAT temperature is expressed in degrees Celsius by rounding to the nearest whole number, using the half round up (0.5°C) method. For example: If a result of 75.4°C is obtained, the VICAT temperature value will be 75°C ; if a result of 75.5°C is obtained, the VICAT temperature value will be 76°C .

2.7 PRESSURE TEST

Test carried out according to Standard NF EN ISO 1167-1-2 with the following additions:

- Test specimens
 - . Number (see table §1.1 of this technical document No. 1).
 - Pipes in the Pressure family **et de la famille Irrigation** : End piece: type A or B. However, in the event of non-compliant results with type B end pieces, a new test must be carried out using type A end pieces (reference method).

Pipes in the Biaxially-Oriented Pressure family: type B end piece (with ties) only.

2.8 DIMENSIONAL CHARACTERISTICS

According to reference standards, with the following specifications for fittings: if possible, measure the assembly dimensions on the fittings, otherwise, proof of calculation and validation of these dimensions upon receipt of the moulds must be provided by the manufacturer (calculation from the drawings of the fittings).

2.8.1 Measuring the depths of specific sockets

If taking measurements is difficult (sink mark, chamfer, etc.), the functional compliance of the part can be verified with, for example, a pipe for measuring the full length of the socket and validating the inner diameter of the socket.

2.9 IMPACT TESTS

Tests performed in accordance with the NF EN 744 Standard.

- Test temperature: 0°C.
- Diameter of the striker: 90 mm or 25 mm, according to the NF EN 744 Standard.

Note: The specific conditions of the NF EN 744 Standard are used whenever possible. Otherwise, the manufacturer may, for its own quality assurance, use a simplified method related to the NF EN 744 Standard. In this case, it must define its own testing specifications in an operating procedure.

For masses less than or equal to 1 kg, the striker material may be composed of plastic or any low density and sufficiently hard materials.

The striker masses and the drop heights must be compliant with the values in table 9 of the NF EN 1453-1 Standard, for structured pipes in the Discharge family and table 17 of the NF EN 1329-1 Standard, for compact Discharge pipes.

For pressure pipes, the striker masses and drop heights must comply with table 6 of the NF EN 1452-2 Standard, the M/H (medium or high) test levels are defined in technical document 3 table 3 part 1 (page 6/30) of this certification reference system.

For Biaxially-Oriented Pressure pipes, this test is performed according to paragraph 7.2.1 of Standard NF T 54-948; that is to say at 20°C with a D90-type striker, a 15 kg mass and a height of 2.0 m.

The speed of the impact equipment striker's fall must be calibrated (for example, using a measuring chain composed of fibre optics and a frequency meter).

All of the masses and heights specified in the product standards must be tested so that a specific correction can be applied per machine per mass or height.

These corrections must be calculated at 95.5% of the striker's theoretical speed of fall.

Interpreting the results:

Specification of the TIR must be < 10% without taking into consideration the area on the curve; the test must be performed over 50 impacts and once a test on a specimen has started it must be completed: TIR < 10%: batch compliant and validated in stock and TIR > 10%: non-compliant, non-validated batch.

The TIR is calculated using the following formula with a 90% level of confidence:

$$\text{TIR} = [(\text{Number of breaks}/\text{total number of impacts}) \times 0.90] \times 100$$

*

Table 3: Number of equidistant lines to draw on the specimens

Nominal external diameter d_n ¹⁾ (mm)	Number of equidistant lines to draw
$d_n \leq 40$	—
$40 < d_n \leq 63$	3
$63 < d_n \leq 90$	4
$90 < d_n \leq 125$	6
$125 < d_n \leq 180$	8
$180 < d_n \leq 250$	12
$250 < d_n \leq 355$	16
$355 < d_n$	24

1) For pipes with a nominal diameter designated other than using the d_n , the nominal dimension in millimetres must be taken in place of d_n .

2.10 RESISTANCE TO TEMPERATURE CYCLING

The fittings used for assembly must be fittings that are already **NF**-mark certified.

2.11 AMOUNT OF LEAD

This test is carried out in accordance with a CSTB test protocol using flame spectrophotometry.

2.12 SEAL TEST OF FITTING ASSEMBLIES

The testing conditions applicable to fittings are as follows:

The test is carried out according to the general conditions of the NF EN 1277 Standard.

- The angular deflection is applied to the two seals while keeping the assembly fixed in front of the fitting.

- If, for dimensional or geometrical reasons, it is impossible to apply a 5% deformation of the DN to the fitting's socket, then only a 5% deformation of the DN will be applied to the pipe.

2.13 QUALITY OF THE ASSEMBLIES' ELASTOMER SEALING RINGS

The conditions and the testing parameters are defined in Standard EN 681 parts 1 or 2, as the case may be.

The tests for which the manufacturer of the elastomer sealing rings is responsible are requested for each type used by manufacturers of pipes or fittings.

Application tests (pipes or fittings associated with the sealing ring: tests defined in technical documents No. 2 to 6) are requested by the manufacturer of pipes or fittings and processed in the same way as any application for extension.

Part 3. PACKAGING, PRESERVATION OF THE PRODUCT

WHEN THE MANUFACTURER PACKAGES ITS PRODUCTS AND IN ADDITION TO THE REQUIREMENTS OF THE NF EN ISO 9001 STANDARD CONCERNING THE PRESERVATION OF THE PRODUCT, THIS PARAGRAPH SPECIFIES THE QUALITY ASSURANCE METHODS SPECIFIC TO PIPES PACKAGED IN A WOODEN FRAME.

Where fittings and connection chambers are concerned, the requirements of the "Preservation" chapter in the ISO 9001 Standard apply.

The packaging must be designed to preserve the quality and suitability for use of the products in the storage, transport and handling conditions defined (including stresses) by the manufacturer and documented.

To do so, the audit body will verify that the manufacturer's quality assurance system includes the following:

3.1 CONTROL OF PACKAGING SUPPLY PURCHASES

Specifications regarding packaging supplies (wood, strapping, etc.).

Inspections on receipt of supplies.

3.2 PACKAGING DATA SHEET

Description and packaging methodology.

The technical description and the implementation of the packaging must be documented.

For all modifications or any new packaging, validation must be established by the holder.

3.3 PERIODIC INSPECTION OF IN-STOCK PACKAGED PRODUCTS

A record of the inspections must be documented. These inspections must be completed according to a predetermined frequency.

The verification must focus on the following points:

3.3.1 Compliance with the data sheet

3.3.2 Deterioration of the packaging, including:

- Sagging frames,
- Sagging straps,
- Broken wood,
- Missing wood,
- Sliding pipes (free pipes),

Framework is parallel with regular spacing.

3.3.3 Deterioration of products, including:

Broken product.

3.4 COMMUNICATION

On request, the manufacturer provides its clients with the conditions under which the packaging enables storage, transport and handling of products.

3.5 ANALYSIS OF DISCREPANCIES FOR PARAGRAPHS 3.1 to 3.4

Failure to respect the conditions in Part 3 will lead to a discrepancy that will be analysed by the mark committee.