

International Standard



3127

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Unplasticized polyvinyl chloride (PVC) pipes for the transport of fluids — Determination and specification of resistance to external blows

Tubes en polychlorure de vinyle (PVC) non plastifié pour le transport des fluides — Détermination et spécification de la résistance aux chocs extérieurs

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 3127 was developed by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, and was circulated to the member bodies in March 1977.

It has been approved by the member bodies of the following countries :

Australia	Ireland	Norway
Austria	Israel	Poland
Belgium	Italy	Romania
Czechoslovakia	Japan	Spain
Denmark	Korea, Rep. of	Sweden
Finland	Mexico	Turkey
India	Netherlands	United Kingdom

The member bodies of the following countries expressed disapproval of the document on technical grounds :

France
New Zealand

Unplasticized polyvinyl chloride (PVC) pipes for the transport of fluids — Determination and specification of resistance to external blows

Section one : Method for the determination of resistance to external blows

1 Scope and field of application

This International Standard specifies the apparatus and the procedure to be applied for the determination of the resistance to external blows of unplasticized PVC pipes for the transport of fluids, where the ratio of outside diameter to wall thickness is equal to or greater than 13,5.

The method can be applied to samples taken from continuous production or from isolated batches and the test may be carried out at either 0 °C or 20 °C.

The severity of this test method can be adjusted to suit different specification requirements by choosing the appropriate mass of the falling weight and the fall height. It is not technically correct to vary the severity of this test by choosing other values for TIR (true impact rate).

2 Principle

Subjection of cut lengths of pipe to a blow from a falling weight dropped from a known height at specified positions round the circumference of the pipe, and determination of the true impact rate (TIR) of the batch or of the series in question.

The TIR is the total number of failures divided by the total number of blows, expressed as a percentage, as if the whole batch had been tested. In practice, test pieces are drawn at random from the batch and the TIR is only an estimate for that batch.

NOTE — It should be appreciated that a completely definitive result can only be reached by testing the whole batch, but in practice a balance is necessary between the statistical possibility of a definitive result and the cost of further testing.

3 Apparatus

A falling weight testing machine incorporating the following basic components (see figure 1) shall be used :

3.1 Main frame, rigidly fixed in the vertical position.

3.2 Guide rails, fixed to the main frame to accommodate the falling weight and allowing it to fall freely in the vertical plane.

The falling weights, of various masses up to a maximum of 7,5 kg, shall have a hemispherical striking surface of 25 mm diameter. The striking surface shall be free from all imperfections.

3.3 Test piece support, consisting of a 120° vee-block of length at least 200 mm, positioned so that the point of impact of the falling weight is in the axis of the vee-block or not more than 2,5 mm from this axis.

3.4 Release mechanism, such that the falling weight can fall through a height which can be adjusted up to 2 m, as measured from the top surface of the test piece.

4 Test pieces

The test pieces shall be cut from pipe selected at random from the batch or the series of pipe to be tested.

Their length shall be 150 mm for pipes with outside diameters less than or equal to 75 mm, and 200 mm for all other outside diameters.

The cut ends shall be square to the axis of the pipe, clean and free from damage.

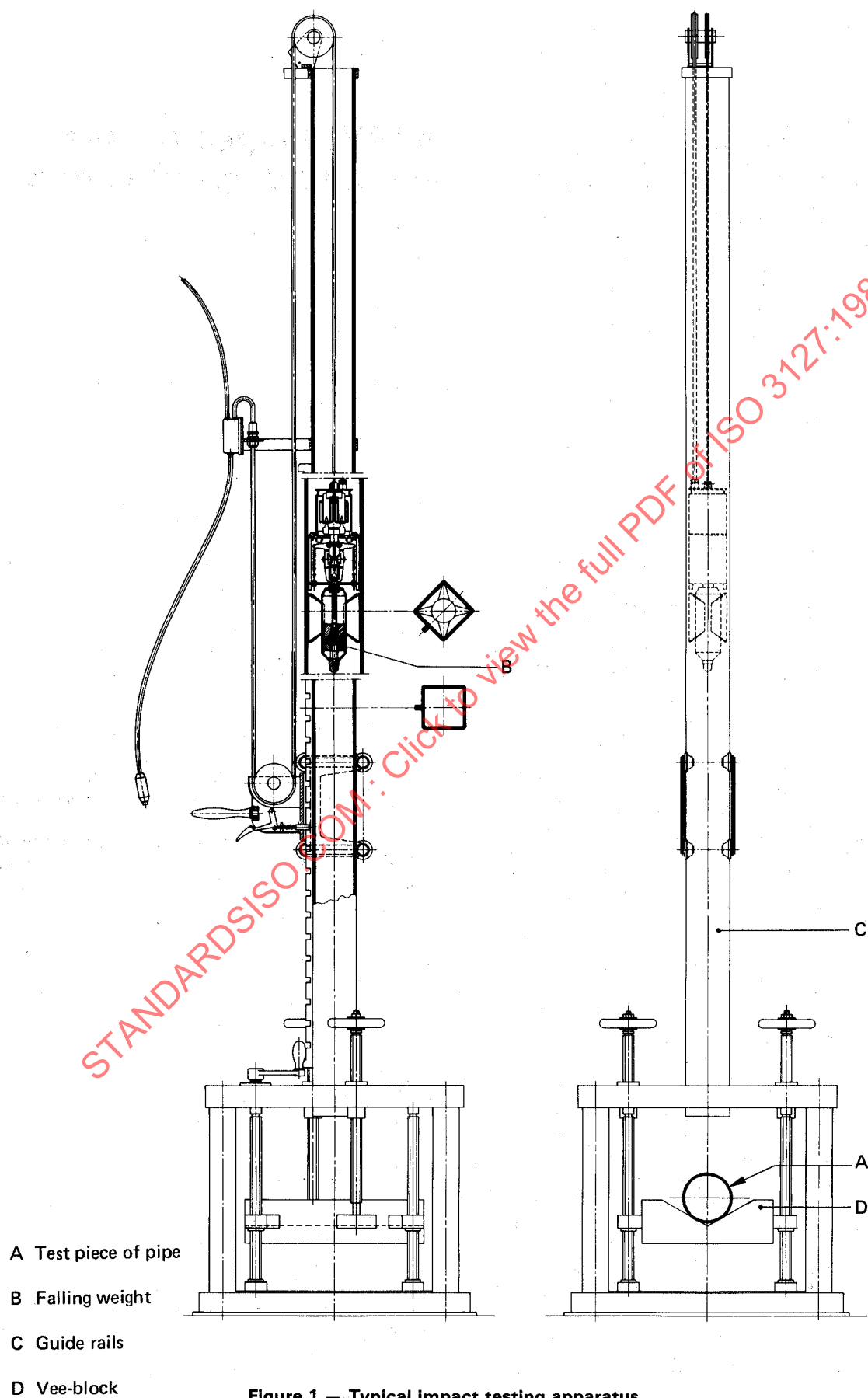


Figure 1 — Typical impact testing apparatus

For pipes with outside diameters smaller than or equal to 40 mm, only one blow per test piece can be applied. For pipes with outside diameters greater than 40 mm, equidistant straight lines shall be drawn along the length of each test piece, so that each test piece, according to the diameter of the pipe, has the number of lines indicated in table 1.

Table 1 — Number of equidistant lines to be drawn on the test pieces

Nominal outside diameter	Nominal size	Number of equidistant lines to be drawn
mm		
< 40	< 1 1/2	—
50	—	3
63	2	3
75	2 1/2	4
90	3	4
110	4	6
125	—	6
140	5	8
160	6	8
180	—	8
200	7	12
225	8	12
250	9	12
280	10	16
315	12	16
355	14	16
> 400	> 16	24

5 Sampling

5.1 Sampling from continuous production

For tests during production, the number of test pieces to be taken shall be the responsibility of the manufacturer.

For a quality mark scheme, the number and rate of sampling shall be agreed with the inspecting authority. The quantity used for this test may vary from pipe size to pipe size and from factory to factory, but shall not exceed 0,5 % of the pipe produced.

It is recommended that, in view of the nature of this test method, manufacturers and purchasers should make use of a quality mark scheme.

5.2 Sampling from an isolated batch

5.2.1 General

When deciding on the number of test pieces to be taken as the sample from an isolated batch, the following considerations should be kept in mind.

Generally speaking, the precision of the test method is poor according to statistical laws. For example, when testing at 0 °C on a sample taken at random from a batch, if two test pieces fail out of 100 blows, this result can only be interpreted as indicating that the batch will have a TIR between 0,5 and 5 % (with 90 % confidence).

The failure of nine test pieces out of 100 blows indicates that the TIR is higher than 5 %.

5.2.2 Batch without quality mark

If an isolated batch is claimed to have a TIR of 5 % but has no quality mark, this can be confirmed as follows :

- if, from a sample of 100 blows, two failures or less occur, reasonable confirmation is obtained that this batch has a TIR equal to or less than 5 %;
- if more than nine test pieces fail out of 100 blows, the batch can be judged to have a TIR greater than 5 %;
- if between three and nine failures occur out of 100 blows, further samples must be taken so that a decision can be made. This decision is reached on the basis of the cumulative result of all the samples tested.

5.2.3 Batch with quality mark

If an isolated batch is claimed to have a TIR of 5 % and this claim is supported by a quality mark, this can be confirmed as follows :

- if, from a sample of 100 blows, less than nine failures occur, reasonable confirmation is obtained that this batch has a TIR equal to or less than 5 %;
- if nine or more failures occur, the claim given by the quality mark is not confirmed.

If required, the TIR can be confirmed by testing according to 5.2.2.

6 Conditioning

Condition the test pieces in a liquid bath at a temperature of 0 ± 1 °C or 20 ± 2 °C, as appropriate for at least 0,5 h before testing.

For testing at 0 °C and 20 °C, the test pieces shall be tested within 10 s of their removal from the conditioning bath. If this interval is exceeded, the test piece shall be returned to the bath for 5 min for reconditioning. For testing at 20 °C, where the ambient temperature is 20 ± 5 °C, the interval between removal from the bath and testing may be extended to 60 s.

7 Procedure

The mass of the falling weight and the fall height appropriate to the pipe size shall be selected from table 2 or table 3 according to the temperature of testing.

Subject the test piece to a blow by allowing the weight to fall on one of the marked lines. If the test piece does not fail, rotate it in the vee-block to the next marked line and again subject it to a blow from the falling weight, after conditioning if necessary.

Continue the test until the test piece fails or until all marked lines have received one blow.

8 Expression of results

Depending on the test temperature, the TIR, with 90 % confidence, shall be expressed as A, B or C for the batch or the series of pipe as follows :

A TIR below 5 % (test at 0 °C) or below 10 % (test at 20 °C).

B No decision can be made on the basis of the number of test pieces used.

C TIR above 5 % (test at 0 °C) or above 10 % (test at 20 °C).

NOTE — The number of broken test pieces, as compared to the total number of blows, should not be expressed as a percentage, to avoid confusion with the TIR of which the percentage is only an estimate.

9 Test report

The test report shall state the following :

- a) size of pipe and application specification;
- b) description of isolated batch or continuous production from which the test pieces were sampled;
- c) number of test pieces;
- d) the test temperature, in degrees Celsius;
- e) the number of failed test pieces;
- f) the total number of blows;
- g) the TIR, as A, B or C (see clause 8).

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Section two : Unplasticized polyvinyl chloride (PVC) pipe for the transport of potable water — Requirement for resistance to external blows

10 Test method

The method of test specified in section one shall be used. The mass of the falling weight as given in tables 2 and 3 shall be applied, depending on the temperature chosen.

One test may be preferred to the other for reasons of convenience or previous experience.

11 Resistance to external blows at 0 °C

The TIR shall not exceed 5 % (see figure 2) when the pipe is tested under the conditions specified in table 2.

12 Resistance to external blows at 20 °C

The TIR shall not exceed 10 % (see figure 3) when the pipe is tested under the conditions specified in table 3.

13 Definition of failure

A failure is registered if, at any point round the periphery, the pipe shatters splits or cracks. Indentation of the test piece resulting in a cavity is not considered a failure.

Table 2 — Test at 0 °C — Mass and height

Nominal outside diameter	Nominal size	Mass of falling weight	Fall height
mm		kg	mm
< 25	< 3/4	0,25	500
32	1	0,25	1 000
40	1 1/4	0,25	1 000
50	1 1/2	0,25	1 000
63	2	0,25	2 000
75	2 1/2	0,25	2 000
90	3	0,5	2 000
110	4	0,5	2 000
> 125	> 5	1	2 000

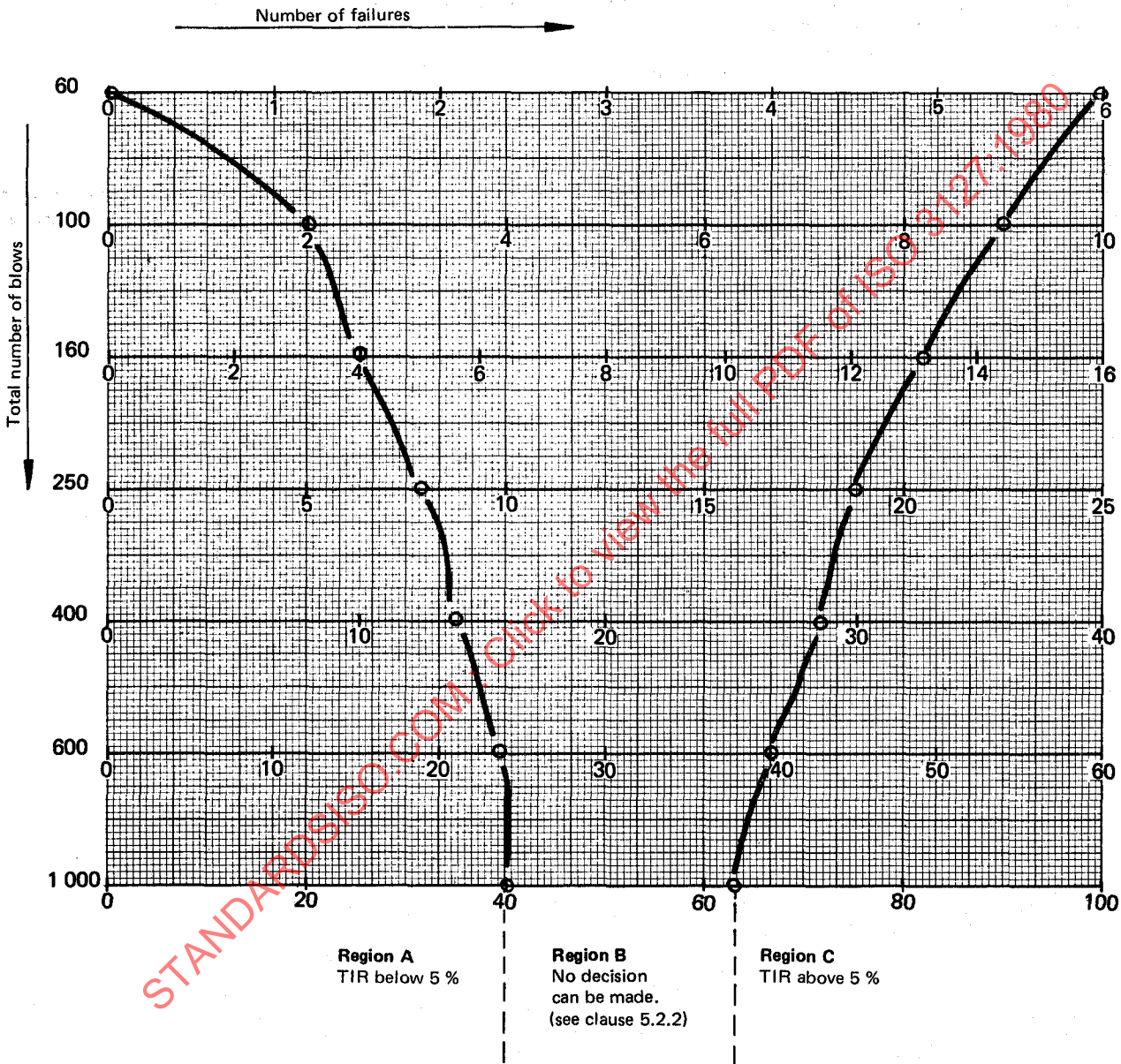


Figure 2 – Test at 0 °C – Number of test pieces for 5 % TIR (with a 90 % confidence level)

Table 3 — Test at 20 °C — Mass and height

Nominal outside diameter	Nominal size	Mass of falling weight	Fall height
mm		kg	mm
< 16	< 3/8	0,5	2 000 ± 10
20	1/2	0,75	
25	3/4	1	
32	1	1,25	
40	1 1/4	1,375	
50	1 1/2	1,5	
63	2	1,75	
75	2 1/2	2	
90	3	2,25	
110	4	2,75	
125	—	2,75	
140	5	3,25	
160	6	3,75	
180	—	3,75	
200	7	4	
225	8	5	
250	9	5,75	
280	10	6,25	
> 315	> 12	7,5	