**Designation: ~~F1057 – 19~~ F1057 – 21**

# Standard Practice for Estimating the Quality of Extruded Poly (Vinyl Chloride) (PVC) Pipe by the Heat Reversion Technique[1]

This standard is issued under the fixed designation F1057; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

## 1. Scope*

1.1 This practice covers a procedure for estimating the quality of extruded poly (vinyl chloride) (PVC) plastic pipes by observing the reaction of pipe specimens after exposure to hot air in the oven at ~~180~~180 °C ± 5 °C ~~(356~~(356 °F ± 9 °F) for 30 minutes minimum time duration.

1.2 The values stated in SI units are to be regarded as standard. The values given in parentheses after SI units are provided for information only and are not considered standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*



## 2. Significance and Use

2.1 This practice is applicable to distinguish between properly and improperly extruded PVC plastic pipe. It can be used to:

2.1.1 Reveal incomplete exsiccation of compound before or during extrusion (Note 1),

2.1.2 Determine the presence of stress in the pipe wall produced by the extrusion process (Note 2),

2.1.3 Determine whether unfused areas are present, and

2.1.4 Reveal contamination.

NOTE 1—Residual moisture in the compound vaporizes at extrusion temperatures and is normally evacuated as it forms vapor. Pockets of moisture trapped in the pipe wall result from incomplete exsiccation of the compound, and may reduce the physical properties of the pipe.

NOTE 2—Minor residual stress in the pipe will not impair field performance and handleability. High-residual stress has no proven effect on performance, but may impair handleability during installation.

[1] This practice is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.40 on Test Methods.
Current edition approved ~~Feb. 1, 2019~~Nov. 1, 2021. Published ~~March 2019~~November 2021. Originally approved in 1987. Last previous edition approved in ~~2017~~2019 as F1057~~–17.~~–19. DOI: ~~10.1520/F1057-19.~~10.1520/F1057-21.

***A Summary of Changes section appears at the end of this standard**

## 3. Apparatus

3.1 *Air Circulating Oven,* thermostatically controlled, capable of operating at ~~180~~180 °C ± 5 °C ~~(356~~(356 °F ± 9 °F) and capable of meeting the recovery requirement of 4.3. Additionally, the oven must have heat generation (power) capacity such that the recovery is achieved while at a constant oven set point. The air temperature within the oven (that is, the test temperature) is to be monitored within 3 in. from the outer edge of the test specimen; make assurances that the temperature measuring probe does not contact the test specimen.

NOTE 3—The oven should be vented to the outside of the building.

NOTE 4—Monitoring of the test temperature within the oven may require a secondary temperature monitoring device in addition to the temperature monitoring device within the oven control system.

## 4. Procedure

4.1 Prepare specimens of pipe 150 mm (6 in.) long or longer with ends cut square so that they stand perpendicular on end when placed in the oven.

4.1.1 Cut staves from pipes whose size prevents insertion of full round specimens in the oven. Prepare large-diameter pipe staves so that their lengths parallel to the pipe axis are 150 mm (6 in.) or longer.

4.2 Examine the specimens and note any unusual features such as discoloration, inclusions, or pinholes in the cut edge.

4.3 Place the specimens of whole pipe in the preheated oven so that each specimen stands on end with sufficient separation between them so that hot air can flow freely between the pipes. Place specimens of pipe staves on the floor of the preheated oven so that they rest on their longitudinal edges and so that hot air can flow freely around them. Record the time when the air in the oven directly adjacent to the test specimen recovers to 180 °C (356 °F). Recovery must occur within 15 minutes or less.



4.3.1 Pipe specimens with wall thickness less than 25.4 mm (1.0 in.): After an additional 30 minutes of exposure within the test temperature tolerance of ~~180~~180 °C ± 5 °C ~~(356~~(356 °F ± 9 °F), remove the specimens, taking care not to alter any heat effects.

4.3.2 Pipe specimens with wall thickness greater than 25.4 mm to ~~127~~38.1 mm (1.0 to 1.5 in.) maximum: After an additional 45 minutes of exposure within the test temperature tolerance of ~~180~~180 °C ± 5 °C ~~(356~~(356 °F ± 9 °F), remove the specimens, taking care not to alter any heat effects.



NOTE 5—For pipe with wall thickness greater than ~~127~~38.1 mm (1.5 in.) the exposure time may need to be extended beyond 45 minutes. The extended exposure time should be sufficient to allow cutting of the sample under test, which is typically achieved by a minimum core temperature within the sample of approximately 110 °C (230 °F).

4.4 Examine the specimens within 3 minutes after removal from the oven, while still hot. With a sharp knife, cut whole pipe specimens lengthwise at approximately 60° circumferential intervals, resulting in six pipe staves of approximately equal widths. Cut specimens being tested in the form of staves into three roughly equal segments. Note the following for the report:

4.4.1 The shape of the pipe ends and the pipe barrel,

4.4.2 The condition and appearance of both the inner and outer surfaces of the material, and

4.4.3 The condition and appearance of the cut edges of the material.

NOTE 6—Care should be exercised when removing samples from the oven, as pipe with thinner walls may have degraded during conditioning.

## 5. Interpretation

5.1 A suggested interpretation of the results observed is given in Appendix X1.

## 6. Report

6.1 Report the following information, where applicable:

6.1.1 Information given by the pipe marking, including the nominal size of pipe, the type of pipe, and the date code;

6.1.2 Form in which the pipe was tested;

6.1.3 Date of the test and test temperature;

6.1.4 Extent and nature of any distortion at the ends or in the barrel of the specimen;

6.1.5 Condition and appearance of the outer surface;

6.1.6 Condition and appearance of the inner surface;

6.1.7 Appearance of the cut edges, and

6.1.8 Any other changes attributable to the test.

6.1.9 Evidence of any of the conditions listed in 2.1: incomplete exsiccation of compound, stress in the pipe wall, unfused areas, and contamination.

## 7. Precision and Bias

7.1 No statement is made about either the precision or bias of Practice F1057 for estimating the quality of PVC pipe, since the result merely states whether there is conformance to the criteria for acceptability suggested by the interpretation.

## 8. Keywords

8.1 heat reversion; PVC pipe



## APPENDIX

**(Nonmandatory Information)**



### X1. SUGGESTED INTERPRETATION OF RESULTS

X1.1 The specimens should be deemed to be satisfactory if none of the following effects are reported:

X1.1.1 Evidence of the presence of stress in the pipe wall, commonly appearing as fish-scaling of any severity (see Fig. X1.1) for an illustration of fish-scaling);

X1.1.2 Evidence of the incomplete exsiccation of compound before or during extrusion, appearing as wall separation (see Fig. X1.2 and Fig. X1.3 for illustrations of wall separation);

X1.1.3 Evidence of incomplete exsiccation of compound or contamination, or both, appearing as blisters on the outer or inner surface (see Fig. X1.4 and Fig. X1.5 for illustrations of blistering);

X1.1.4 Contamination made evident by the test (see Fig. X1.4 for an illustration of contamination); and

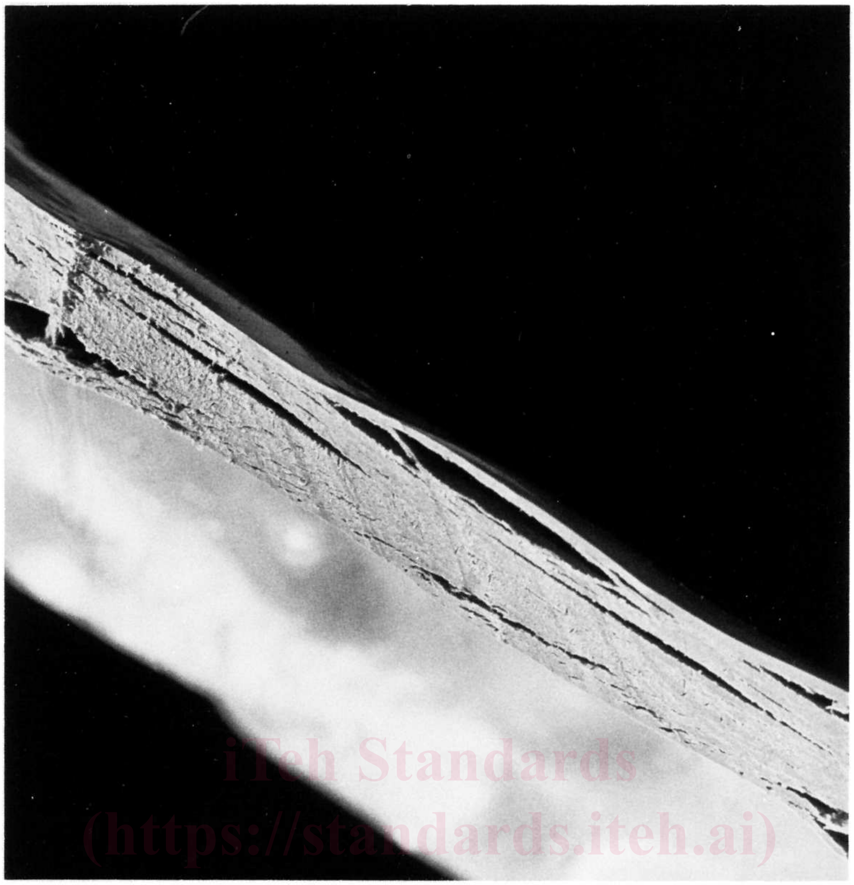
X1.1.5 Evidence of contamination, appearing as wall separation caused by pockets of granular material composed of unfused compound or foreign material. (Fig. X1.3 illustrates the general appearance, except that the voids will be filled with a granular




NOTE 1—Severe fish-scaling indicates uneven cooling in the sizing sleeve during extrusion. Resulting wall stresses are released by the heat reversion test. Note the flared end, another indication of this effect.

**FIG. X1.1 Severe Fish Scaling**

material and may appear at any point in the wall.)



NOTE 1—Severe wall separation reveals the presence of moisture in the extrudate. This usually indicates plugged or inadequate vacuum control.

**FIG. X1.2 Severe Wall Separation**