
**Polyethylene (PE) materials for
piping systems — Determination
of resistance to slow crack growth
under cyclic loading — Cracked
Round Bar test method**

*Matériaux polyéthylène (PE) pour systèmes de tuyauterie —
Détermination de la résistance à la propagation lente de fissures sous
un chargement cyclique — Méthode d'essai de la barre ronde fissurée*



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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established 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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#)

The committee responsible for this document is ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 5, *General properties of pipes, fittings and valves of plastic materials and their accessories — Test methods and basic specifications*.

Introduction

Knowledge about the resistance to long-term failure mechanisms as a result of crack initiation and slow crack growth (SCG) is important for the ranking and pre-selection of thermoplastic materials, especially for long-term applications such as pipes and fittings made of polyethylene. Several tests to determine the relevant failure mechanisms are available today where elevated temperatures and also the combination with stress cracking liquids are used to decrease the time frame for testing.

However, developments in modern raw materials have led to a significant increase of resistance of polyethylene to crack initiation and SCG so that testing with available methods exceeds practical time frames. Therefore, new acceleration methods, preferably at application relevant temperatures and without additional time reducing liquids, are required.

This test method achieves a significant decrease of testing time even at ambient temperatures of 23 °C. This is more relevant to the temperature range of many applications and testing at this temperature does not change the structural status of the polymer. Acceleration of material testing is achieved by the specimen geometry and the cyclic loading regime to result in completion of testing in a relatively short time.^{[2],[3],[4]}

Polyethylene (PE) materials for piping systems — Determination of resistance to slow crack growth under cyclic loading — Cracked Round Bar test method

1 Scope

This International Standard specifies a method to determine the resistance to slow crack growth (SCG) of polyethylene materials, pipes, and fittings. The test is applicable to samples taken from compression moulded sheet or extruded pipes and injection moulded fittings of suitable thickness.

This International Standard provides a method that is suitable for an accelerated fracture-mechanics characterization at ambient temperatures of 23 °C of different polyethylene grades, especially for PE 80 and PE 100 types for pipe applications.

NOTE This test method could be adapted for other thermoplastics materials by developing the procedure using different test parameters.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 291, *Plastics — Standard atmospheres for conditioning and testing*

ISO 2818, *Plastics — Preparation of test specimens by machining*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 crack length

a

depth of the crack at any time during a test measured from the specimen surface to the crack tip

Note 1 to entry: It is expressed in millimetres (mm).

3.2 cycle

N

smallest segment of a load-time or stress-time function which is repeated periodically

3.3 failure cycle number

N_f

total number of *cycles* (3.2) from the beginning until failure of the test specimen

3.4 frequency

f

number of *cycles* (3.2) within one second

Note 1 to entry: It is expressed in hertz (Hz).