



**SLOVENSKI STANDARD**  
**SIST ISO/TR 10837:1995**  
**01-maj-1995**

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Determination of the thermal stability of polyethylene (PE) for use in gas pipes and fittings

**iTeh STANDARD PREVIEW**

Détermination de la stabilité thermique du polyéthylène (PE) destiné à être utilisé dans les tubes et raccords pour la distribution du gaz

SIST ISO/TR 10837:1995

Ta slovenski standard je istoveten z: **ISO/TR 10837:1991**

**ICS:**

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83.140.30	Cevi, fitingi in ventili iz polimernih materialov	Plastics pipes, fittings and valves

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# TECHNICAL REPORT

**ISO**  
**TR 10837**

First edition  
1991-07-01

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## Determination of the thermal stability of polyethylene (PE) for use in gas pipes and fittings

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*Détermination de la stabilité thermique du polyéthylène (PE) destiné à  
être utilisé dans les tubes et raccords pour la distribution du gaz*

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Reference number  
ISO/TR 10837:1991(E)

## 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 main task of technical committees is to prepare International Standards, but in exceptional circumstances a technical committee may propose the publication of a Technical Report of one of the following types:

- type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;
- type 2, when the subject is still under technical development or where for any other reason there is the future but not immediate possibility of an agreement on an International Standard;
- type 3, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example).

Technical Reports of types 1 and 2 are subject to review within three years of publication, to decide whether they can be transformed into International Standards. Technical Reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

ISO/TR 10837, which is a Technical Report of type 2, was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*.

At the 23rd meeting of what was then ISO/TC 138/WG 4, *Plastics pipes and fittings for the supply of gaseous fuels*, held in Oslo, Norway, on 21st May, 1979, it was agreed to establish a "Thermal Stability" task group with the following confirmed terms of references:

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- a) To consider the available information on the determination of the anti-oxidant content of polyethylene by thermal-stability analysis with a view to incorporating a suitable test method in the polyethylene pipes and fittings specification for gas.
- b) If unsuccessful in a), to prepare a report of its findings to enable WG 5 to proceed with its work as quickly as possible.
- c) To report its findings to WG 4.

In the period 1979 to 1983, seven task group meetings were held, and only at the initial meeting were proposals put forward to WG 4. These were rejected. The task group was unable to agree further proposals, despite a very extensive round-robin test programme involving eleven laboratories.

It is apparent that agreement on a specification is not possible at this time, and therefore this Technical Report has been prepared in accordance with clause G.6 of the IEC/ISO Directives.

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## Introduction

### 0.1 General

Polyethylene pipes and fittings are designed to be joined together by means of fusion techniques which can involve temperatures in excess of 200 °C. To prevent the polymers from which the pipes and fittings are made from degrading during fusion, it is necessary to incorporate stabilizers which impart thermal stability to the polymers.

The measurement of the thermal stability of a polymer can be determined by either measurement of the oxidation induction temperature of the polymer, or measurement of the oxidation induction time at a set temperature. These determinations are generally carried out in oxygen or air.

The task group (see foreword) agreed that the measurement of the oxidation induction time should be the preferred method because it offered greater sensitivity. A standard method of test for the measurement of thermal stability by means of oxidation induction time has been prepared.

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### 0.2 Basic technical problem

In studying the polyethylenes used in the production of gas pipes and fittings and already shown to meet the performance requirements of national gas pipe and fitting specifications, the following major problem was identified which accounted for the task group's failure to reach agreement on proposals to be forwarded to the sub-committee.

When measuring the thermal stability of a polymer by determining the oxidation induction time at either 200 °C or 210 °C, two distinctly different stability levels were identified due to the use of different stabilizer systems.

It was therefore not possible to agree a specification level which could be met by acceptable polymers, yet ensure in all cases sufficient thermal stability to permit the assembly of pipes and fittings by fusion.

The problem faced by the task group is illustrated by figure 0 1.

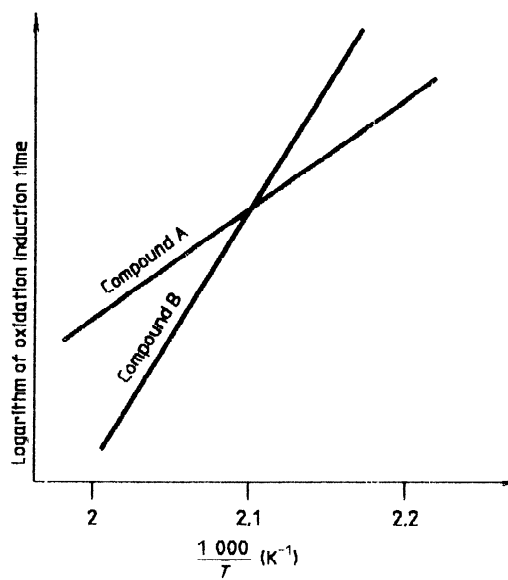


Figure 0.1 — Oxidation of two different stabilizer systems

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# Determination of the thermal stability of polyethylene (PE) for use in gas pipes and fittings

**WARNING** — The use of this Technical Report may involve hazardous materials, operations and equipment. This Technical Report does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this Technical Report to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

## 1 Scope

ISO 293:1986, *Plastics — Compression moulding test specimens of thermoplastic materials.*

This Technical Report specifies a method of measuring the oxidative thermal stability of polyethylene pipe and fitting material in oxygen at typical processing and welding temperatures. It may be used to measure the stability of either raw materials or finished products, and may be taken as an indication of polymer or anti-oxidant performance.

The recommended test temperatures of 200 °C and 210 °C are suitable for adequately stabilized pipe and fitting materials.

The thermal stability measured by this method is dependent on test specimen mass and size.

## 3 Principle

The test measures the time during which the anti-oxidant present in a test specimen inhibits oxidation whilst the specimen is held at 200 °C (or 210 °C) in a stream of oxygen.

The progress of the oxidation is monitored by measuring the difference in temperature between the specimen compartment and reference compartment of a thermal analyser and recording this against time. The thermal stability is then derived from this record.

## 2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this Technical Report. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this Technical Report are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

## 4 Apparatus and materials

### 4.1 Differential thermal analyser or differential scanning calorimeter, capable of

- recording the difference in temperature or in energy flow between specimen and reference compartments against time;
- maintaining the test temperature within  $\pm 0,5$  °C for the duration of the test;
- exposing the specimen to a flow of oxygen equal to  $50 \text{ cm}^3/\text{min} \pm 10 \%$ ;
- programming the specimen temperatures over the range 150 °C to 250 °C, at a rate of 1 °C/min or less;