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# Thermoplastics pipes and fittings for the supply of gaseous fuels — Training and assessment of fusion-machine operators

*Tubes et raccords thermoplastiques pour le transport de combustibles gazeux — Formation et évaluation des opérateurs de soudage*

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 19480 was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 4/WG Fusion Operator, .

This second/third/... edition cancels and replaces the first/second/... edition (), [clause(s) / subclause(s) / table(s) / figure(s) / annex(es)] of which [has / have] been technically revised.

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## Introduction

The quality of a natural gas distribution system is to a large extent determined by the skills of the operators involved in installing the network. When installing PE or PEX pipes, the quality of the fusion joints is essential for the system.

Since fusion joints in PE or PEX systems can be made using various technologies, it is important that the fusion operator is trained and competent in the fusion technology employed in constructing the PE network.

Continued competence of the fusion operator is covered by periodic re-training and re-assessment.

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# Thermoplastics pipes and fittings for the supply of gaseous fuels — Training and assessment of fusion-machine operators

## 1 Scope

This International Standard provides a structure for use in the training, assessment and approval of fusion operators in order to establish and maintain competency in construction of PE and PEX Fusion System in accordance with ISO 10839 or ISO 14531-4<sup>1)</sup>.

The fusion methods covered by this standard are: butt fusion, electrofusion and socket fusion.

This international standard covers both the theoretical and practical knowledge necessary to ensure high quality fusion joints.

## 2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO nnn. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO nnn are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

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ISO 4437:1997, *Plastics pipes and fittings — Buried polyethylene (PE) pipes for the supply of gaseous fuels — Metric series — Specifications.*

ISO/TS 10839:2000, *Polyethylene pipes and fittings for the supply of gaseous fuels — Code of practice for design, handling and installation.*

ISO 12176-1:1998, *Plastics pipes and fittings — Equipment for fusion jointing polyethylene systems — Part 1: Butt fusion.*

ISO 12176-2:2000, *Plastics pipes and fittings — Equipment for fusion jointing polyethylene systems — Part 2: Electrofusion.*

ISO 12176-3: 2002 *Plastics pipes and fittings — Equipment for fusion jointing polyethylene systems — Part 3: Operator's badge.*

ISO 13953: 2001, *Polyethylene (PE) pipes and fittings — Determination of the tensile strength of test specimen from a butt fusion joint.*

ISO 13954:1997, *Plastics pipes and fittings — Peel decohesion test for polyethylene (PE) electrofusion assemblies of nominal outside diameter greater than or equal to 90 mm.*

ISO 13955:1997, *Plastics pipes and fittings — Crushing decohesion test for polyethylene (PE) electrofusion assemblies.*

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1) To be published

ISO DIS 13956:–<sup>1)</sup>, *Plastics pipes and fittings – Determination of cohesive resistance – Tear test for polyethylene (PE) saddle assemblies.*

ISO 14531-1: -<sup>1)</sup>, *Plastics pipes and fittings — Crosslinked polyethylene (PE-X) pipe systems for the transport of gaseous fuels. Metric series. Specification – Part 1:Pipes;*

ISO 14531-2: -<sup>1)</sup>, *Plastics pipes and fittings — Crosslinked polyethylene (PE-X) pipe systems for the transport of gaseous fuels. Metric series. Specification – Part 2:Fittings for heat fusion jointing.*

ISO 14531-4: -<sup>1)</sup>, *Plastics pipes and fittings — Crosslinked polyethylene (PE-X) pipe systems for the transport of gaseous fuels. Metric series. Specification – Part 4:System design and installation guidelines.*

ISO/IEC 17025: 1999, *General requirements for the competence of testing and calibration laboratories.*

EN 45004: 1995, *General criteria for the operation of various types of bodies performing inspection.*

EN 45013: 1989, *General criteria for certification bodies operating certification of personnel.*

### 3 Terms and definitions

For the purposes of this **part of ISO 19480**, the following terms and definitions apply

#### 3.1

##### **butt fusion cycle**

pressure/time diagram for a defined fusion temperature, representing the butt fusion operation

#### 3.2

##### **drag resistance**

frictional resistance due to the weight of the length of pipe fixed in the moveable clamp at the point at which movement of the moveable clamp is initiated (peak drag) or the friction occurring during movement (dynamic drag)

#### 3.3

##### **frictional resistance in the butt fusion machine**

force necessary to overcome friction in the whole mechanism of the butt fusion machine

#### 3.4

##### **fusion operator**

person trained to carry out fusion jointing between polyethylene (PE) pipes and/or fittings based on a written procedure agreed by the pipeline operator. The fusion operator is trained for one or more fusion-jointing procedures, involving the operation of manual and/or automatic fusion-jointing machines.

#### 3.5

##### **fusion operator certificate**

approval certificate issued by the examiner/assessor stating the knowledge and the skill of the fusion operator to produce fusion joints following a given fusion procedure.

#### 3.6

##### **fusion procedure**

document providing in detail the required variables and its values for a specific fusion process to assure repeatability, e.g. butt fusion procedure, electrofusion procedure

#### 3.7

##### **pipeline operator**

private or public organisation authorised to design, construct and/or operate and maintain the gas supply system

#### 3.8

##### **training centre**

establishment for training of fusion operators



## 4 Training organisation

### 4.1 Training course

A trainee fusion operator for underground PE or PEX systems for distribution of natural gas shall follow a training course at a training centre, in order to obtain a fusion operator certificate for PE or PEX pipes. The training centre shall provide the training courses under the conditions described in this standard. The training centre shall be as required by national authorities. The courses will be delivered by a competent trainer with the required experience of fusion processes and who has mastered the fusion technique involved. The trainer shall have a qualification as required by national requirements.

The training centre shall have a range of fusion machines representative of the equipment encountered on worksites for installing gas pipes, in order for the trainee fusion operator to become acquainted with the fusion equipment commonly used. The trainee fusion operator may be trained on one of these fusion machines or on a machine from his own company if accepted by the training centre. The fusion machine shall comply with the relevant ISO standards: ISO 12176-1 for butt fusion machines and ISO 12176-2 for electrofusion machines.

Preferably a training centre should not carry out activities related to contracting, supervision of construction work, or inspection of fusion joints.

### 4.2 Operator assessment

A trainee fusion operator who has followed a training course as described above shall then pass a theoretical and practical assessment in order to be qualified as a fusion operator for PE and PEX systems.

The assessor shall not be the trainer and shall have appropriate assessment qualifications.

NOTE The assessor can be a body accepted by the contracting parties or an accredited body e.g. EN 45004 or a certification body e.g. EN 45013.

### 4.3 Periodic operator certificate renewal

A qualified fusion operator shall renew his operator certificate every two year. For this purpose he shall pass a practical examination with an assessor body as specified in 7.

## 5 Training

### 5.1 Training curriculum

The training course should comprise of any combination of fusion packages based on the requirements of the pipeline operators. These packages may be given as individual modules or combined to suit requirements.

During the training, attention shall also be paid to safety. The course related to safety shall deal with safety related to the fusion process as indicated in Annex A.

### 5.2 Course

#### 5.2.1 General

An instructor who at least meets the requirements described in 4.1 above shall provide training.

All consumables and tools necessary for the training package shall be available during the training session.

The pipes and fittings used shall be conform to ISO 4437, ISO 8085 parts 1 to 3, ISO/FDIS 14531-1 and ISO/FDIS 14531-2 and corresponding to what is normally used locally for building gas systems.