



SLOVENSKI STANDARD
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Welding of thermoplastics - Machines and equipment for hot gas welding (including extrusion welding)

Schweißen von Thermoplasten - Maschinen und Geräte für das Warmgasschweißen (einschließlich Warmgas-Extrusionsschweißen)

Soudage des thermoplastiques - Machines et appareillages pour le soudage au gaz chaud (y compris le soudage par extrusion)

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EUROPEAN STANDARD

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Welding of thermoplastics - Machines and equipment for hot gas welding (including extrusion welding)

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This European Standard was approved by CEN on 23 April 2004.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (EN 13705:2004) has been prepared by Technical Committee CEN/TC 249 "Plastics", the secretariat of which is held by IBN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2005, and conflicting national standards shall be withdrawn at the latest by January 2005.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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EN 13705:2004 (E)**1 Scope**

This document specifies general performance requirements of the machines and equipment for welding by hot gas of semi-finished products made from thermoplastics, including hot gas extrusion welding.

2 Normative references

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

EN 562, *Gas welding equipment — Pressure gauges used in welding, cutting and allied processes.*

EN ISO 2503, *Gas welding equipment — Pressure regulators for gas cylinders used in welding, cutting and allied processes up to 300 bar (ISO 2503:1998).*

3 Requirements**3.1 General requirements****3.1.1 Marking**

All machinery and equipment shall be permanently and clearly marked detailing manufacturer, type of machinery/equipment, serial number or production characteristic number, characteristic data and mains supply.

3.1.2 Documentation

Operational and servicing requirements shall be provided with each item of equipment. The minimum details are:

- technical description of the equipment;
- specification of suitable welding nozzles;
- servicing schedule;
- fault diagnosis and recommended corrective action.

A list of possible malfunctions and errors is recommendable, also containing their causes and details of how they can be remedied.

3.1.3 Accessories – Nozzles

Welding nozzles shall be designed to be firmly fastened during operation but easily removable for interchangeability. The material used for nozzles shall be corrosion resistant, shall not produce particulates and not be of copper or copper alloy.

3.2 Hot gas welding requirements

3.2.1 Manual welding equipment

3.2.1.1 Equipment with external air supply

3.2.1.1.1 General

The welding gun is composed of handle, heater element and shroud, gas feed hose and electricity supply cable. The design shall be suitable for continuous use without overheating the handle or hot gas temperature variations once set.

3.2.1.1.2 Design and construction

- Optimum position of centre of gravity;
- functionally designed handle;
- infinitely variable adjustment of power consumption;
- control built into the handle designed and arranged so that accidental actuation is prevented;
- handle material impact resistant, temperature-resistant, heat-insulating and non-conductive;
- hoses and cables light and flexible;
- hoses that exhibit no permanent deformation after they have been squeezed.

3.2.1.1.3 Air supply

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For hot gas welding, air is generally used which is supplied from a compressed air circuit, a compressor, a pressure-gas cylinder or a blower.

- The air supplied should be as free as possible from water, oil and other pollutions. If the air is taken from a compressed air circuit or compressor, appropriate oil and water filters shall be fitted.
- The volume of air supplied to the equipment shall be adjustable and kept constant.

3.2.1.2 Equipment with built-in blower

3.2.1.2.1 General

The equipment consists essentially of handle, built-in blower, shroud, heater, nozzle and connection cable. It can be used where there is no external air supply. However, because of its dimensions and weight it is less suitable for longer welding operations.

3.2.1.2.2 Design and construction

3.2.1.1.2 applies. The following further requirements shall also be met:

- the fan shall supply the volume of air required for all the nozzles to be used for welding the various types of plastics; heating can be switched off when the fan is operating;
- the electrical circuit shall ensure that the heating can only be switched on when the fan is also operating.

EN 13705:2004 (E)**3.2.1.3 Accessories****3.2.1.3.1 Nozzles**

The following requirements apply, in addition to those given in 3.1.3:

- to reduce heat radiation, nozzle surface shall be as smooth as possible, for example polished;
- to reduce friction, the inside surfaces of draw-nozzle sliding contacts shall be polished. The same applies to the sliding surfaces of tack-nozzles;
- to avoid air turbulence at nozzle outlet, round nozzles shall have a straight length of at least 5 x D before the mouth (D = outlet diameter of nozzle).

3.2.1.3.2 Temperature measuring equipment

The hot gas temperature is the maximum temperature measured inside the nozzle. It is measured inside the nozzle outlet (with speed-nozzles, the main nozzle aperture) at a depth of 5 mm. Precise measurement of this temperature is possible using a thermocouple which has welding bead diameter $\leq 1,5$ mm.

Before measurement, the welding equipment including nozzle shall be operated for at least ten minutes.

3.2.1.3.3 Blowers

Blowers are used to directly supply hand-welding equipment with external air supplies. The description of the equipment shall indicate the number of welding machines that can be connected with the admissible nozzle sizes and maximum hose lengths. All connected machines shall be capable of being supplied with the maximum air quantity required for welding at the welding temperature. The rated warm-up time of the welding machine shall be observed.

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3.2.1.3.4 Control equipment

Control equipment permits the adjustment (control) and regulation of temperature and flow volume of the hot gas. It permits the uniform reproducible delivery of the required heat.

a) Control equipment for setting and maintaining constant hot gas volume

When the gas is taken from a supply pipe, pressure regulators with connected or built-in flowmeters shall be used (construction: floater or measuring diaphragm with pressure indication calibrated in standard litres¹). The pressure regulators used shall conform to EN ISO 2503, and the pressure gauges shall conform to EN 562. The connected flowmeter may deviate by up to 3 % from the full-scale value. The type should normally be designed for 100 l in normal state/min at 20 °C with medium working pressures of the connected plant.

If the gas is taken from blowers, pressure gauges or liquid columns are required to monitor blower pressure, and spill valves and flowmeters shall be used.

Pressure gauges conforming to EN 562 or mercury resp. water columns shall be used. The spill valves shall be valves with a fixed cone. The connected flowmeter shall be designed for the pressure and temperature of the blower gas (temperature generally 30 °C, gas volume 100 l in normal state/min).

b) Control equipment for setting heat output

With constant gas volume and constant voltage, series resistances, variable-ratio ring transformers and electronic equipment (e.g. dimmers) are used as setting controls.

1) Standard litres = air volume in litres in normal state, i.e. 0 °C and 1 013 mbar.

Consideration shall be given to the effect of temperature on the series resistances. They shall therefore be well adjusted and large enough to reach their operating temperature after ten minutes heating-up time.

The output of the hot gas unit can be reduced by up to 7 % by the control system. Therefore, the output of the variable-ratio ring transformers shall be 20 % above the maximum heat output of the hot gas welding unit.

c) Temperature control equipment

To avoid overheating of the equipment, a temperature control should be fitted which automatically switches off the power supply if the temperature goes too high (e.g. due to failure of air supply).

To maintain the hot gas temperature constant, despite fluctuations in the gas volume and operating voltage, regulating units with temperature sensors should be used.

The hot gas temperature is measured by a temperature sensor and compared with a desired value. Heating output is regulated by a regulating element. The equipment shall be adapted to the hot gas unit output, with the temperature sensor mounted close to the welding nozzle in the hot gas flow.

3.2.1.3.5 Pressure rollers

To weld non-rigid thermoplastics, pressure rollers are required.

If a filler is used in welding, the feed and pressure roller adjusted to the filler profile shall also move smoothly within the operating temperature range.

When lap-welding liners, a cylindrical easy-action roller is used, generally made of an elastomer material.

3.2.2 Continuous liner welding machines

3.2.2.1 General

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Continuous liner welding machines consist of an electrically-driven carriage, the hot gas welding unit, built-in blower, heater and nozzle and connection cable, together with a filler reel if required. They are particularly suitable for the welding of plastic floor coverings and liners.

3.2.2.2 Design and construction

The following requirements shall be met in addition to those of 3.2.1.2.2:

- infinitely-variable adjustment of carriage speed;
- hot gas welding unit can be swivelled out in order to avoid burning the liners to be welded;
- automatic shut-off of feed and heater of hot gas welding unit if an obstacle is met.

3.2.2.3 Accessories

See 3.2.1.3.1.

3.3 Extrusion welding requirements

3.3.1 General

The machinery and equipment is composed of:

- a plastification system to plastify the welding material, either rod or granulate;
- a preheating system for warming the surfaces of the joint;