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#### Contents:

- 1 Scope
  - 2 General requirements
  - 3 Measures before welding
  - 4 Electro-socket welding
    - 4.1 Description of method
    - 4.2 Welding device
    - 4.3 Preparation of welding
    - 4.4 Welding procedure
  - 5 Testing of welded joints
  - 7 Other applicable standards and technical codes
  - 8 Explanations
- Appendix:  
Brief instructions for welding  
Testing of welded joints  
Welding record sheets

#### 1 Scope

This technical code applies for the electro socket-welding of fittings and tapping tees made of PE-HD<sup>1)</sup> according to DIN 16963, DIN 3543-4 and DIN 3544-1 with pipes made of PE-Xa (degree of cross-linking 75% to 90%) and PE-Xc (degree of cross-linking 60% to 75%) according to DIN 16892/93, that are being used for the conduction of gas, fluids and solids.

The electro socket-welding of PE-HD fittings with pipes made of PE-Xa or PE-Xc requires an additional proof by tensile creep tests according to DVS 2203-4 Supplement 1.

The maximum load of joints made with fittings of PE 80 and PE 100 corresponds with the allowed operating pressure according to tables 8 to 13 in DIN 8074 and DIN 16893.

#### 2 General requirements

The quality of welding joints depends on the qualification of the welder, the suitability of the utilized equipment and devices as well as on compliance with the welding standards. The welded joint can be tested by means of non-destructive and/or destructive methods.

The welding work must be monitored. Type and range of supervising has to be agreed between the contract partners. It is

recommended to record the welding data in welding protocols (sample see appendix) or on data carriers.

Within the framework of the quality assurance it is recommended to produce and test samples of joints before and during the welding works.

Every welder has to be trained and has to be in possession of a valid qualification certificate. The intended application range may be decisive for the kind of qualification.

The DVGW-specification GW 330 applies analogously as qualification proof for heated tool socket welding at the construction of gas and water supply systems. The specification can in turn be used as a proof of qualification for welding plastics for indoor applications.

The equipment and devices which are used for welding must correspond to the requirements in DVS 2208-1.

#### 3 Measures before welding

The welding zone must be protected against bad weather influences (e.g. wind, moisture). If it is essential by suitable measures (e.g. preheating, tent, heating) that the conditions are suitable for welding, work may be carried out at any outside temperature insofar as the welder is not hindered in his handling (see explanation). If necessary, an additional proof must be provided by carrying out sample welds under the mentioned conditions (section 7).

If the semi-finished product is heated up unevenly under influence of sunshine, a temperature compensation in the area of the welding joint can be reached by covering. A cooling down during the welding process by ventilation has to be avoided by closing the pipe-ends during welding. During the welding the pipe ends have to be closed additionally.

PE-HD-pipes from coils are straight and bent immediately after uncoiling. The pipe end must be prepared before welding, e.g. by careful heating up with a hot-air equipment and/or use of a suitable clamping or re-rounding device.

The joining zones of the components to be welded must be undamaged and have to be free of contaminations (e.g. dirt, grease, shavings).

<sup>1)</sup> The material indication is the specification of thermoplastics group and includes the types PE 60, PE 80 and PE 100. The information complies to the current standards.

This publication has been drawn up by a group of experienced specialists working in an honorary capacity and its consideration as an important source of information is recommended. The user should always check to what extent the contents are applicable to his particular case and whether the version on hand is still valid. No liability can be accepted by the Deutscher Verband für Schweißen und verwandte Verfahren e.V., and those participating in the drawing up of the document.

DVS, Technical Committee, Working Group "Joining of Plastics"

## 4 Electro-socket welding

### 4.1 Description of method

The joining areas (pipe surface and inside of the fitting) are overlapped and welded by resistance wires inside the fitting (heating coils) which are heated up by electric energy (see figure 1 and 2).

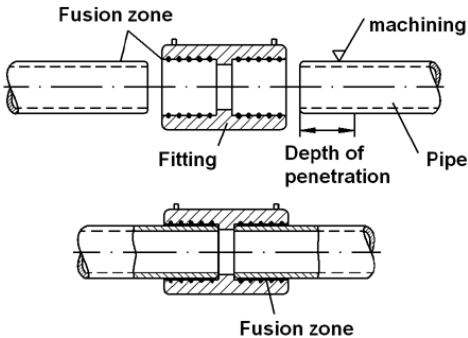


Figure 1. Electro-socket welding of a coupler (principle).

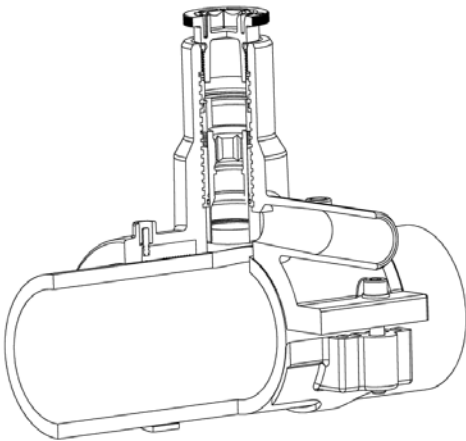


Figure 2. Electro-socket welding of a tapping tee (principle).

### 4.2 Welding equipment

Only welding equipment adjusted to the parts to be welded may be used. Automatic welding equipment is preferred – possibly with recording. The welding equipment must supply the required welding parameters for the fitting to be welded such as welding time, current and voltage. The device must switch off as soon as the necessary quantity of heat has been fed to the welding zone.

### 4.3 Preparation of welding

Clean surfaces and a stress free installation are very important for the fabrication of perfect welding joints. With the choice of pipes with limited diameter tolerance according to DIN 16893 the installation of fittings is easier.

For axial pipe connections the pipes have to be cut rectangular by means of a suitable device. In case of a bevelled shrink of the pipe cut edge the untreated pipe has to show the nominal diameter  $d$  (figure 3) at the designated insert depth minimum in the area of the heated socket. If necessary the pipe end should be shortened immediately before welding.

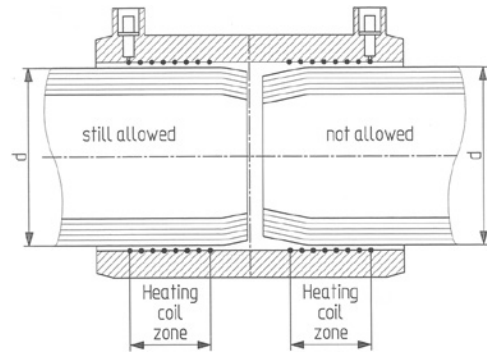


Figure 3. Bevelled shrink of the pipe end.

The ovality of the pipe may exceed 1,5% of the outside diameter, max. 3 mm. If necessary, re-rounding devices can be used.

The surface of the pipe or fitting in the welding zone has to be completely machined. A scraping tool with a constant wall thickness removal of approx. 0,2 mm must be used. **Take care for a small annular gap!**

The pipe end has to be deburred inside and outside, shavings have to be removed without contacting the joining areas.

The fitting may only be removed from the protective package immediately before the installation.

The treatment of the joining areas has to be done immediately before the welding process starts.

In case of contamination of the pipe surface after machining it must be cleaned. It has to be considered that no contaminant is rubbed to the welding zone. The cleaning agents or means moistened cloths in a lock-up plastic bag have to consist of a 100% vaporizing solvent, e.g. 99 parts ethanol with a purity grade of 99,8% and 1 part MEK (methyl ethyl ketone, denaturation). Agents tested according to DVGW 600 comply with this requirement. The use of ethanol causes a reduction of quality because of the contained water.

The paper for cleaning has to be clean, unused, absorbent, non-fuzzy and non-coloured, it has to be air afterwards.

The joining area of the fitting or tapping tee has to be cleaned similar to the pipe.

The correct insert depth of the pipe has to be controlled by means of a mark or suitable device. The fitting may neither be tilted nor pushed into the pipe end with force (low stress installation). The tapping fitting has to be clamped on the pipe by means of a suitable device under consideration of the manufacturer's instructions.

The contact socket for the connection of the welding cable must be easy to change.

The fitting and pipe have to show the same temperature level before the welding process. Concerning welding equipment with automatic temperature compensation take care that the measured environment temperature corresponds to the conditions of the welding location. If necessary the welding equipment as well as the pipe and fitting have to be protected e.g. against direct sun radiation.

### 5 Testing of welding joints

Various tests can be used to test the quality of individual welding processes. Differentiation is made between destructive and non-destructive tests. For details see table 1. Tests and sampling can be carried out prior to or during welding work according to agreement.