

TRAINING AND COMPETENCE OF WELDERS OF PLASTIC PIPES

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Welding of plastic pipes and fittings is the last stage of processing of most plastics. International and national industry standards state that the qualifications of the welder can ensure the quality of welding. However a lack of welders' qualifications is quite problematic as Keith Mole said when he commented on dropping levels of training for welders at Plastic Pipes XV (Vancouver, September 2010) (1).

The author has been studying welding of plastic pipes since 1981 when an educational institution was established in Kazan following a decision by the Ministers Council of USSR. There are two conflicting trends observed in Russia, USA (1) and other countries: most construction companies want to improve the skills of welders however managers don't give training the attention needed.

Let's look at some of the misconceptions.

1. You only need to show how the welding machine works.

Some sellers of welding equipment intentionally support this idea. Welders get certificates from manufacturing companies to substitute professional education. It is an unequal replacement.

2. Qualification of the welder does not matter if you buy a highly automatic welding machine.

The advantages of highly automated welding machines are unfounded and exaggerated as well as recklessly supported by a number of Russian standards. Some clauses in a number of documents (see 2–4) differentiate quality checking procedures for joints made with highly automated welding machines from the ones made with less automated welding machines. The main feature of highly automated machinery, according to these documents, is an automatic heat plate extraction. Automatic welding processes are, indeed, effective for in-house welding of fittings and specialists are well aware that with favorable on-site conditions, the influence of high levels of automation on the quality of welded seams and processing speed is insignificant. Moreover, the highly important preparation of pipes and fittings prior to the welding process is not automated – it is controlled by the welder only, regardless of the automation level of the welding machine.

There are significantly more faults in welded seams made using highly automated welding equipment in adverse conditions compared to those made with manual welding machines.

Adverse conditions include low ambient temperatures, a temperature differential during a work shift, and welding in uncomfortable positions e.g. during pipe relining, pipe renovation, pulling pipe into casings or horizontal directional drilling. In such conditions welders have to opt for less automated welding machines.

According specialists from Western Europe, highly automated machines are only a small fraction of welding equipment and highly qualified welders and specialists provide the maintenance of the machines.

International standard ISO 12176-1 [5] says that butt-welding equipment can be a different configuration to mechanical drive and hydraulic systems with a hand pump to an automatic machine.

The same applies to electrofusion. Welding of larger sized fittings requires more skills and qualifications than welding with a hot plate.

3. It is enough to have one welding program for each PE grade (e.g. PE 100) in the welding machine memory and any welder can start it up.

Pic. 1. Mechanical tests of welded joints approved by Mosvodokanal



Welding in tough conditions has been mentioned above and it is clear that weather conditions must always be considered when welding options are chosen. It is a possibility that the widening range of PE grades may lead to the optimization of basic welding parameters. Studies of the macromolecular structure of PE and welding modes are an important field within PE pipe technology research and it is obvious that relatively easy-flowing types of PE and highly viscous 'low sagging' types should be welded differently.

It should be noted that international guidelines recommend a variation of major welding parameters and offer different welding procedures (6).

Therefore, the idea that unqualified personnel can be actively involved in the welding of PE pipes is groundless. Moreover, welder qualification requirements are constantly changing due to the ongoing development of welding equipment and the widening range of PE pipe grades.

Four categories of welders are highlighted below:

Level 1 welders are employees who provide welding works. Their competence is vital and they must have theoretical knowledge as well as practical skills. Specialist competencies should be differentiated as small diameters, medium, large and extra-large diameters. Fitting welders must have the right level of special competence and the right qualifications.

Level 2 welders support the technological process of welding. They must have academic knowledge of theory and sound knowledge of standards.

Level 3 welders (process planners or technologists) should design and apply welding process specifications depending on the specific technical task. The process planners should develop specifications based on international welding guidelines and Russian operating procedures. Their role is very important because of the problems with the existing guidelines (7).

Level 4 welders are specialists (experts) with strong academic knowledge of welding and process engineering. They have the right to practice teaching and training.

We ought to mention controllers, who are specialists who determine the quality of welding. Their professional competence must include good knowledge of regulations and practical skills in controlling procedures.

Detailed data on general, professional and special competencies as well as studies and innovations are held by educational institutions (8). We constantly update our research database in relation to the welding of plastics (9).

New data received in 2011 includes the results of research on the welding of polypropylene pipes of D=500x45 mm and the welding of super-size thick-walled polyethylene pipes. Their production began in summer 2011.

TEP LLC – Kazan National Research and Technology University increases its potential by co-operating with foreign colleagues and has shared its knowledge and



Pic. 2. Welding Practical Course at Klimovsk Pipe Plant

experience in welding and installation with specialists from Russian and CIS for over 40 years.

We are proud of the achievements of some of our graduates from POLYPLASTIC Group, Kazanorgsintez OJSC, Techstroy CJSC, Mosvodokanal Centre for technical diagnostics and hundreds industrial and construction companies from Russia and CIS.

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