ARCl WELDING OF STEEL PIPE CONNECTIONS ON STEEL GAS PIPELINE IN SERVICE

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ABSTRACT

The paper presents an installing procedure (welding/drilling) of the steel tapping tees to the steel gas distribution network, without interruption of the consumer supplies. The steel tapping tee for welding/drilling installation procedure is standardized steel fitting, which is installed between steel gas distribution networks and the connected steel gas pipeline. Two types of steel tapping tees were described. After welding the fitting, the pipeline of the gas distribution network will have to be drilled. Welding/drilling procedure described in the paper is used for branching of the steel gas distribution networks as well as for connecting of the new consumer on the existing network. The practical experience has shown that the described procedure attains high-quality connection. The procedure is safe, reliable, economical and ecological.

1. INTRODUCTION

Even though for the building of the modern gas distribution networks application of polymeric materials prevails today, the steel gas distribution networks are still existing. The existing steel gas distribution networks will be still long in operation, until their end of life-time cycle.

It is desirable to branch the gas distribution networks (Figure 1) and to connect the new consumer (Figure 2) without interruption of the consumer supplies. In the case of steel gas distribution networks, such mounting enables welding/drilling procedure with use of the steel tapping tees (“hot tapping”).
An alternative of welding/drilling procedure is cutting/welding procedure with “T” fitting use, during which the part of the gas distribution network has to be isolated from other network parts. Before cutting and welding, the gas has to be removed from the pipes of the isolated network part, also.

The welding/drilling procedure with use of the steel tapping tees is already longer time present in application, so that until today different types of tapping tees were developed, almost for all pipe dimensions and pressures appeared in the steel gas distribution networks. Because welding is performed on the pipelines under pressure, and the pipelines contain flammable gas, engineers have to keep thinking about:

- work safety during welding/drilling procedure with use of the steel tapping tees
- quality of the installed connection,
- reliability of connection as well as gas distribution networks with higher number of those connections.

The procedure is performed on the field, in the different weather conditions, and the welding method used is shielded metal arc welding (SMAW).
Follows description of a variant of the procedure developed in company HEP Plin d.o.o. Osijek, which quality was confirmed during a long-standing application experience in practise [1, 2, 3].

2. THE STEEL TAPPING TEES FOR THE CONNECTION TO THE STEEL GAS PIPELINES WITH WELDING/DRILLING PROCEDURE

The different types of the steel tapping tees for connection to the steel gas pipelines can be purchased today. The one type of the steel tapping tees is presented on Figure 3. The components, for this type of tapping tees applications, include a full encirclement standardized fitting (two-piece, flange, dimensions, pressure) and standardized valve (flange, dimensions, pressure), as well as special taping machine. After the welding/drilling procedure is finished, the valve is closed and the tapping machine removed. The valve may be extended with a pipeline or it may be equipped with a measuring instrument.

![Figure 3 Tapping tees with valve and taping machine](image)

The Figure 4 shows the other type of tapping tee, equipped with tapping tool for drilling the hole after the welding was finished [3]. The practical experience shows that such type of tapping tees is safe and reliable. In Figure 5 is image of the used tapping tees presented.
3. INSTALLATION OF THE STEEL TAPPING TEES TO THE GAS DISTRIBUTION NETWORK IN SERVICE

After the manhole with the proper dimension was dug, starts the welding/drilling procedure of tapping tee installations on the pipeline of the gas distribution network in service. The first of all is the wall thickness control of pipe on which tapping tees will be installed. This control is performed with the ultrasound measuring device.

Figure 4   Tapping tees without valve and saddle, up to 4 bar [5]
Figure 5  Used tapping tees without valve and saddle
In Figure 6a the cutting of the new consumer pipeline is shown. The location of the cut has to match with the anticipated location and dimension of the tapping tee on the pipeline of gas distribution network. Figure 6 b) presents removing of the protective layer from the pipeline of gas distribution network in service.

![Figure 6 First (a) and second (b) step of the tapping tees installation](image)

After the removing of the protective layer from the pipelines with gas welding flame follows welding of the tapping tee on the new consumer pipeline. The welding is performed by flame gas welding (acetylene + oxygen, the filler material – flame gas welding wire).

![Figure 7 Third (a) and forth (b) step of the tapping tees installation](image)
Follows welding of the tapping tee on the pipeline of gas distribution network without interruption of the consumer supply. The welding is performed by SMAW process, using basic electrode EVB 50, with diameter 2.5 mm. Two pass welding are performed to insure tightness of the welded joint. Before welding starts, the electrodes have to be dried in the appropriate furnace and dry electrodes have to be carried in the dry-storage container to the work site. Special attention has to be given to the preparation of the zone of welding joint formation, to avoid cold cracks and other welding failures. After welding procedure was finished, the tightness of the welded joint has to be checked.

The end of welding procedure follows montage of the tapping tool for boring of the gas distribution network pipeline through the opening of the tapping tee. The boring bar has to be sealed with rubber O-rings and blocked by the steel Seger-ring (prevents ejecting of the tapping tool and in this manner prevents gas leakage in the environment).

Boring of the gas distribution network pipeline by the simple manual tapping tool (Figure 9) will take about 1.5 minutes. The end of the boring follows the shutting of the auxiliary opening by the screwed plug.

The welding/drilling procedure finished with final control of tapping tee tightens. The control is performed by the soup-suds.

After performed control the parts of the pipes around the tapping tee have to be protected against corrosion (Figure 10). The work is finished with burying of the manhole.
Figure 9  Manual boring of the gas distribution network pipeline

Figure 10  Corrosion protections of the pipes with band
4. WELDING PROCEDURE IN BRIEF

To perform a satisfactory welding procedure it is necessary:

- certificate of welder for appropriate welding position
- procedure qualification record and welding procedure specification for welding
- certificate of electrode drying oven
- valid dry-storage container for electrode
- clamp meter for welding current measurements
- voltmeter for welding voltage measurements
- relevant standards [6, 7, 8]

The welding is performed by basic electrode EVB 50, with diameter 2.5 mm. The power source used is manufactured by Fronius International GmbH, Austria. The electrode has to be couplet to “+” pole (anode). Mean welding current is 80 ÷ 100 A, mean welding voltage 16 ÷ 20 V. The welding joint has to be performed with many short welding paths (up to 20 mm long) in order to avoid the excessively heating of the pipeline under pressure. In the case of the welding joint on the connected pipelines, special attention has to be given to the removing of the welding slag.

5. SUITABILITY OF THE WELDING/DRILLING PROCEDURE FOR THE CONNECTION TO THE GAS DISTRIBUTION NETWORK IN SERVICE

The described welding/drilling technology for connection to the gas distribution networks under pressure has the following suitability:

- duration of the installation works (branching of the existing gas distribution networks, connecting of the new consumer on the existing network) is shortened,
- during works there is no needs to interrupt the consumer supply gas (homes, factories, hospitals, …),
- there are no gas loses, energy dissipation, loss of materials as well as environment pollutions,
- there are no additional costs for service restart and visiting the gas consumers,
- the costs of the installation works are significantly lower and
- there are reliable during installation works as well as during exploitation.

6. REFERENCES

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