District heating from the Datteln 4 power plant

Greater efficiency through efficiently insulated pipe systems

With the Datteln 4 power plant currently under construction, Uniper will supply an estimated 100,000 households in the central Ruhr region with district heating. To this end, a district heating line with a length of approx. 13 km is being installed. For construction phases 1 and 2 of this major project, the Opti pipe by LOGSTOR Deutschland GmbH was selected. The construction site welds are field insulated with PlateJoint, an electric welding joint that is force-fitted and welded to the pipe sheath and the moulded parts.

The new Datteln 4 power plant will be one of the ten largest CHP plants in Germany. The Datteln 4 power plant will produce up to 380 MW(th) in combined heat and power (CHP) generation. This essentially allows Datteln 4 to secure a reliable and environmentally-friendly supply of district heating to the central Ruhr region. Datteln 4 will deliver the largest share of Uniper's entire grid feed-in in the Ruhr region and supply an estimated 100,000 households heating.

Through the application of the CHP technology, the fuel use rate - also known as total efficiency - can be significantly increased. This may increase, depending on the operating state of the entire system, above 60%. This makes it possible to avoid CO_2 emissions, which is, in addition to the already high efficiency rate of the generation of power from coal, an additional contribution to environmental protection through energy efficiency.

The aim to ensure the long-term supply of district heating from CHP in Uniper Wärme GmbH grids in the central Ruhr region for the cities of Recklinghausen, Herne and parts of Bochum requires the connection of Datteln 4 to the existing district heating grid by means of a new district heating line. The Datteln-Recklinghausen district heating line, with a nominal width of 2 x DN 800 has a route length of about 13 km (*Figure 1*); of which more than 11 km will be installed underground in a plastic sheath pipe. The outside diameter of the plastic sheath pipe is 1000 mm. The tender for the construction of the pipeline was awarded to the District Heating Line Datteln-Recklinghausen joint venture, consisting of the Austrian company Bilfinger VAM Anlagentechnik GmbH and the Cologne company Max Bögl Stiftung & Co. KG.

The order for the supply of the components for the pipeline parts to be installed underground has been divided between two plastic sheath pipe suppliers. LOGSTOR Deutschland GmbH, Hamburg is supplying the material for construction phases 1 and 2, which are currently in progress. For these sections of the major transport line, the LOGSTOR Optipipe from semi-continuous production was selected. Approx. 1500 construction site welds must be field insulated with the LOGSTOR PlateJoint (*Figure 2*). The combination of these components contributes to the economical construction as well as the economical operation of the line.

Production of the Opti pipes

To produce Opti pipes, the service pipes are inserted into a closed casting form, which is afterwards filled through six foam mixing heads with the required quantity of PUR rigid foam.

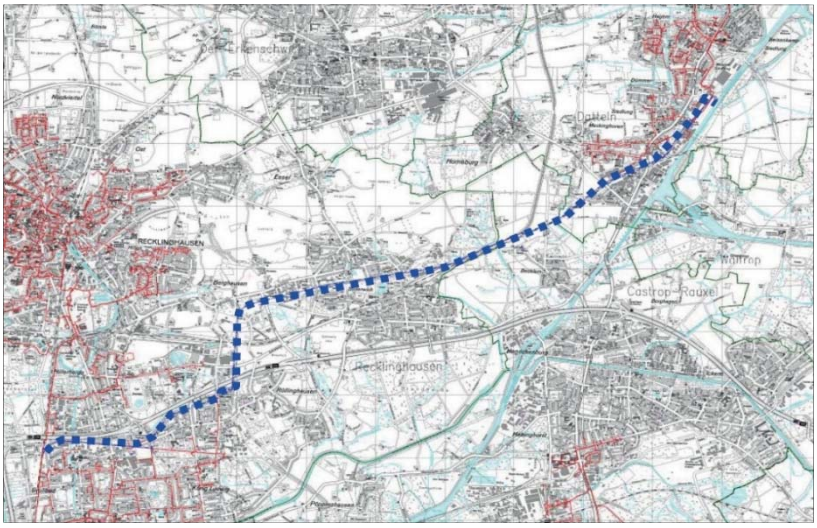

Figure 1. The Datteln-Recklinghausen pipeline is approx. 13 km long

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By injecting the PUR rigid foam simultaneously at several points, the foam is very homogeneous over the entire pipe length. With this process, the density of the foam, and thus its insulating properties, can be optimised compared to conventional casting technologies. This achieves a specific heat conductivity of λ = 0.025 W/ mK.

After removing the casting form, the rigid foam can be visually inspected along the entire length (*Figure 3*). This procedure requires no spacer between the service pipe and the sheath, which means that no thermal bridges can form. Afterwards, the fully insulated pipe passes a ribbon belt extruder in rotation and thus obtains its HDPE sheath at this point as a coil extrusion.

Figure 2. Start of pipe route after service pipe bridge at newly constructed power plant with mounted casing joints

This method allows for an adjustment of the sheath thickness according to customer specification by controlling the feed rate. The optimised insulation properties of this pipe type in this case allow for a reduction of heat losses by approximately 6% compared to pipes from conventional production.

PlateJoints

The construction site welds are field insulated with PlateJoints. PlateJoints are electric weld sleeves that are force-fitted and welded on to the sheath of the pipes and fittings through a computer-controlled welding process. These connecting joints are open casing joints and are placed - unlike closed pull-over joints - directly on the sheath only when they are being installed.

This type of casing joint has two key advantages: Firstly, there is no risk that the casing joints will soil in the pipe trench between the welding of the service pipes and the installation of the joints, which saves not only time for cleaning the joints, but also increases the quality of the eventual connection. Secondly, these casing joints can be mounted, even if fitted parts are welded directly onto each other, which precludes the prior sliding on of closed joints. In the present case, this is a significant advantage, as the route section in itself has approx. 30 U-expansion bends, for which the factory-insulated bends were produced with individually adjusted leg lengths according to statics and local requirements to prevent the welding of fitted pieces.

This means that it is not necessary to take the possibility of sliding on closed casing joints into account; accordingly, costly and time-consuming installation joints are not required.

Welding of the casing joints

To weld these casing joints (*Figure 4*), the Logstor Weldmaster is used (*Figure 5*). Dabei

Figure 3. During the production of the Opti pipe, the foam is visually checked along its full length

Figure 4. Installation of the LOGSTOR PlateJoints on the pipelines

This is a multifunctional PE welding device, which uses the latest PDA, GPS, GPRS and 2D barcode technologies. This allows for fast and safe installation of the casing joints.

Efficiency, traceability and documentation are thus ensured. The Weldmaster is based on a computer-controlled, thermoplastics welding technique, by means of which casing joints and PE sheaths can be welded together through a heat conductive metal injected between them using electrical current to form an inseparable pipe connection. These are tried and tested methods in a combination of welding devices, PDA and a 2D barcode on the casing joint, which enable web-based documentation to be created.

Figure 5. The LOGSTOR Weldmaster is a multifunctional PE welding device which allows for quick and secure installation of the casing joint

Every casing joint is equipped with a 2D barcode, which contains the product data and welding parameters. The PDA serves to monitor the exchange of data between the casing joint and the welding device. After the correct placing of the casing joint, the welding parameters scanned from the barcode are read into the welding device with the PDA. Potential human error can be avoided, and the settings can be made much faster than in conventional PE welding.

If anything unforeseen should occur during the welding process, e.g.

cable damage, power outage or a short circuit, the fitter must be informed immediately about the fault. The welding device will restart only after the error has been eliminated. Once the welding process is underway, the fitter has full control over the process and can already prepare the installation of the next casing joint. The PDA automatically informs about the completion of the installation of the casing joint, which increases the efficiency of the installation works.

Documentation

The PDA has an integrated GPS receiver, which registers the position of each installed casing joint, as well as the date and time of the execution of the works using the satellite system. These data are integrated into the subsequent documentation, which allows the customers to check the entire process and to retrieve each individual installation.

After the processor has approved the quality of the weld, all the data from the welding are recorded in the PDA and transmitted together with the product data of the casing joint to a dedicated web server. A website displays the process in graph form for each individual welding, as well as the time, temperature, electrical current performance parameters. In addition, the GPS position, date, time and the personal data of the fitter are apparent from the report. As the position of the casing joint can be displayed with Google Maps, each individual joint can be located. All data are protected, and access is provided exclusively via a user login and password. Quality documentation and traceability ability are now available for each individual connection or joint installation.

Conclusion

One of the currently most significant district heating projects in Germany benefits from the combination of highly efficient insulation of the pipe lengths through an innovative manufacturing process and insulation joints, the installation of which can be documented precisely through the use of state-of-the-art communication systems. The result is an efficient transport line, which offers minimum heat loss in line with the target of economical use of resources and maximum operational security for the end customer.

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