TECHNIQUES TO ENSURE CONTINUITY OF GAS TRANSMISSION

Plugging (stoppling) techniques | Component fabrication
Welding methods | Testing and inspection
Mobile compressors | Mobile natural gas supply
Operators of gas pipeline grids have to constantly maintain the service capability of the infrastructure and adapt it to changing requirements.

This calls for systematic planning and the efficient use of manpower, machinery and material, whether you are maintaining pipeline systems, replacing valves and fittings, repairing pipe damage or expanding the grid. Our range of services provides support and reduces your workload in all phases of your construction projects and includes the entire engineering from initial planning through to commissioning.

During construction and repairs on gas supply systems, certain jobs like welding or inspection or hot tapping and plugging often have to be done with the pipeline in service. We can do this work on your behalf thanks to our team of specialists with long-standing experience and extensive expertise in this field, for example in hot tapping and plugging (stoppling1) pipelines when installing bypass piping.

By taking advantage of our services you can complete your project safely and efficiently without having to shut down operations during the construction or repair works. We can provide these services not just for natural gas pipelines but for all piping transporting gaseous or liquid media, e.g. industrial gases, oil, water, district heating water and steam. For many years, we have been successfully providing this kind of service to gas transmission networks, coke oven plants, power plants, refineries and the chemical industry throughout Germany and across the rest of Europe.

In the run-up to a construction project, we scrutinise all factors affecting the efficient execution of the project and identify solutions to optimise work processes and make optimum use of material and manpower. On this basis we prepare a detailed performance specification to provide you with an overview and a basis for your decision-making criteria.

We advise you on a case-to-case basis, and with due consideration for all technical, economic and ecological factors, about the best technology to use to avoid interruptions to the gas supply.

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1The term “stopple” is now the patented name for the pipeline plugging device developed in the USA.

Our services

- Planning
- Calculation/pricing
- Design
- Material production and delivery
- Site handling
- Inspection and testing
- Acceptance testing by independent experts
- Support with commissioning
- Documentation of all work performed and test results

In addition, we provide comprehensive advice about optimising the scope of construction, repair and maintenance work and reducing the associated costs for your pipeline grid.

Your contact

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Hot tapping and plugging without interrupting gas flow

Plugging (stoppling)

The hot tapping and plugging method for pressurised pipelines has been around for over 65 years. We have constantly modified and improved it since we started using it in 1971, e.g.:

- When installing bypass lines, the method we use requires just two instead of four hot taps. This reduces the work and time involved as well as the costs of material.

- When tapping the pipeline, the piece of pipe that has been cut out is firmly attached to the tapping machine using special devices and can be removed safely, facilitating the workflow and preventing disruptions.

Using these methods, our team of specialists has conducted around 1,500 hot tapping and plugging projects on high-pressure pipelines at up to 100 bar, not just in Germany but also throughout the rest of Europe. The hot tapping method allows new pipelines to be tied in without interrupting the supply. The plugging process enables repairs or tie-ins to be carried out without shutdowns and also reduces methane emissions to a minimum.

We offer an all-round service based on your needs and work with you to develop custom solutions.

Our range of services

<table>
<thead>
<tr>
<th>Type of work</th>
<th>Pipe diameter (DN)</th>
<th>Pressure range (bar)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot tapping</td>
<td>25 to 1,500</td>
<td>up to max. 100</td>
</tr>
<tr>
<td>High-pressure plugging</td>
<td>25 to 1,200</td>
<td>up to max. 100</td>
</tr>
<tr>
<td>Plugging up to 16 bar</td>
<td>100 to 300</td>
<td>up to 16</td>
</tr>
<tr>
<td>Plugging small diameter pipes</td>
<td>25 to 80</td>
<td>up to 70</td>
</tr>
<tr>
<td>Temporary bypass lines</td>
<td>up to 150</td>
<td>up to 100</td>
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</tbody>
</table>

Hot tapping
Installing branch lines and connections on pipelines in service avoids interrupting supply and prevents methane emissions. This means that pig signalers, pressure gauges, depressurising devices etc. can be retrofitted to a pipeline during operation.

Plugging
When the plugging heads have been inserted and moved to their final position inside the pipeline the gas flows via the bypass and the plugging heads seal off the pipeline.

Repairs to pipelines
By installing split sleeves, for example, pipeline abnormalities can be made safe permanently on in-service systems. This method is used, for example, to repair areas of corrosion, cracks, dents and weld seam defects etc. Generally, there is no interruption to gas flow and methane emissions are completely avoided.

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Tailored to your requirements

Component fabrication

Our range of services for performing complex work on pipelines is not limited to hot tapping and plugging as such but also covers all peripheral project steps. The custom fabrication of special components is a mainstay of our successful project execution.

Component fabrication

The necessary pipeline and plant components such as branch connections, flanges, weld-on nozzles, sockets and sleeves etc. are custom-made in our main workshop. Thanks to efficient machines and an experienced team all our workshops are well equipped to handle all processes required (e.g. forming, cutting, joining and modifying material properties). We use hot and cold forming processes, welding and machining, to produce a wide range of components that work safely and reliably under tough conditions in the field. All components are of course supplied complete with the acceptance test certificates necessary for the respective application.

The range of components from our main workshop is also available to you independently of any hot tapping and plugging services.

<table>
<thead>
<tr>
<th>Our range of services</th>
<th>Pipe diameter (DN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipeline and plant components</td>
<td></td>
</tr>
<tr>
<td>Weld-on sockets</td>
<td>100 to 800</td>
</tr>
<tr>
<td>Sleeves (split or non-split)</td>
<td>100 to 1,200</td>
</tr>
<tr>
<td>Branch connections</td>
<td>100 to 800</td>
</tr>
<tr>
<td>Special plugging flanges</td>
<td>100 to 1,200</td>
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<tr>
<td>Pig guide bars</td>
<td>100 to 1,200</td>
</tr>
<tr>
<td>Tapping tees</td>
<td>100 to 600</td>
</tr>
<tr>
<td>Installation tees</td>
<td>100 to 600</td>
</tr>
<tr>
<td>Reducers</td>
<td>100 to 800</td>
</tr>
<tr>
<td>Wall thickness transition pieces</td>
<td>100 to 1,200</td>
</tr>
<tr>
<td>Ventilation fittings</td>
<td>25 to 100</td>
</tr>
</tbody>
</table>

Custom devices for work on pipeline, plant and machinery
Repair and assembly service for pipeline and plant components
Mechanical/technological service within the manufacturing processes of forming, cutting, joining and changing material properties

Your contact
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Certified quality

Welding

The requirements for welding work on gas pipelines - e.g. welding on split tees - are particularly stringent. Open Grid Europe has developed suitable welding methods that guarantee maximum quality and safety.

Welding is a key technology for pipeline and plant construction. Well-trained welding supervisors ensure the quality of the welded structure by selecting the most appropriate materials, welding methods and welding equipment. The use of cost-effective welding technologies improves production efficiency.

**Our services**
- Independent advice on welding methods and material selection
- Review and assessment of welding documentation
- Use of qualified welding supervisors in accordance with EN ISO 14731 (e.g. as per DVGW code of practice GW 350)
- Quality assurance of welding and fabrication in accordance with the applicable German and international codes and standards
- Targeted training of personnel in welding techniques for plant and pipeline construction
- Provision of independent experts

Non-destructive materials testing

Non-destructive materials testing enables timely identification of quality defects and helps prevent weak points and damage. It is an effective tool for manufacturers or operators of plant and systems to quickly obtain an overview of the condition of their facilities and therefore prevents shutdowns due to component failure. Experienced and certified specialists (to EN ISO 9712) with the necessary expertise and the latest equipment ensure that the tests are conducted properly.

**Our services**
- Non-destructive materials testing (x-ray, ultrasonic, magnetic particle and dye penetration tests) for pipeline, plant and process vessel construction.
- Evaluation and expert appraisal of non-destructive testing methods
- Feasibility studies for novel testing procedures, taking various test methods into account
- Informed choice of the most suitable process
- Advice on the use of special test methods (Phased Array, TOFD, EMUS etc.)
- Test supervision
- Targeted training of personnel
- Independent advice
- Quality assurance of all connections

Your contact
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Flexible technology to prevent gas losses during pipeline depressurisation

Mobile compressors

During maintenance of gas pipelines the relevant sections often have to be shut off with isolation valves and then depressurised.

This normally involves venting large quantities of gas to atmosphere, but this can be avoided thanks to mobile compressors from Open Grid Europe. The compressors can be used singly or in highly efficient parallel operation and enable gas to be pumped from the isolated pipeline section into another pipeline system. The pressure can be reduced down to 3 bar. If required, the residual gas can then be flared off in an environmentally compatible process using mobile flares located downstream.

Transmission pipeline with block valve assembly: An 18 km DN 1000 (40") isolated pipeline section operated at 70 bar contains around 1 million Nm³ of natural gas.

Our services
- Two mobile compressors each with an output of 749 kW
- Pumping of gas to another section or another pipeline system
- Pressure reduction down to 3 bar
- Two-stage double-acting reciprocating compressor
- Suction pressure: 70-3 bar
- Maximum discharge pressure: 72 bar
- Volumetric flow: 2,000 to 66,000 m³/h
- Complete service customised to your requirements
- Connecting piping and adapters for all diameters and pressure stages
- Retrofitting of a transfer nozzle using tapping method
- Documentation of all work performed

Environmen tally compatible and cost-effective
The use of mobile compressors minimises the environmental impact and represents a significant cost saving. As well as preventing depressurisation losses and evacuating the pipeline down to minimal residual pressures, methane emissions are reduced by up to 95%. In addition, responsible use of natural gas as a primary energy source is ensured, because the gas not wasted and remains available for use.

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Mobile compressors in operation
Supplying natural gas in tankers and cylinders

Mobile natural gas supply

Basically, natural gas is a grid-based energy source. However, sometimes it is not possible to supply gas via pipelines, e.g. if they are undergoing repairs or maintenance or a natural gas connection has not yet been established. For over 40 years we have been offering a special service to accommodate these circumstances: our mobile gas supply.

Complete service customised to your needs
We supply natural gas in the required volume and quality e.g. to ensure continuity of supply during commissioning etc. Our range of services for mobile gas supply includes the complete handling of the project, from receipt of your enquiry through preparation on-site, procurement and delivery of the gas to the actual feed-in operation. We advise you on the optimum workflow, the technical prerequisites and the necessary preparations on your part. In all phases of the project, our experienced team is on hand to professionally manage and supervise the mobile gas delivery, ensuring maximum safety and efficiency.

Our service - other quantities available on request:

<table>
<thead>
<tr>
<th>Trailer</th>
<th>CNG</th>
<th>LNG</th>
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<tbody>
<tr>
<td></td>
<td>10,000 Nm³</td>
<td>24,000 Nm³</td>
</tr>
</tbody>
</table>

Your contact
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Our customers

National energy suppliers

International energy suppliers
Creos, Luxembourg | ENERGINET.DK, Denmark | Exxon Mobil, Germany | Fluxys, Belgium | GAS CONNECT AUSTRIA GmbH, Austria | Gasunie, Netherlands | GRT gaz, France | Nord Stream AG, Switzerland | Philips Petrol, Germany | Soteg, Luxembourg | Statoil, Norway | Swissgas, Switzerland | Tgas, Austria | Transgas, Portugal | Transgas AG, Switzerland

German and international chemical companies

Open Grid Europe | The Gas Wheel
Open Grid Europe is one of the leading transmission system operators in Europe. We provide secure gas transmission in line with our customers’ needs and are a partner you can rely on for all grid-related services – 24 hours a day, 7 days a week.

The facts
Our customers: more than 450 national and European network operators, municipal utilities, industrial customers and gas traders | Our employees: around 1,450 throughout Germany | Our transmission system: about 12,000 km of pipelines, 30 compressor stations, 100 compressor units, 17 border crossing points. Around 1,100 exit points, 632,000 million kWh of exit quantities in 2017. Around 142 million kW of peak load in 2017.

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Plugging/stopping, mobile compressors, mobile natural gas supply
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