WE ARE WELDING

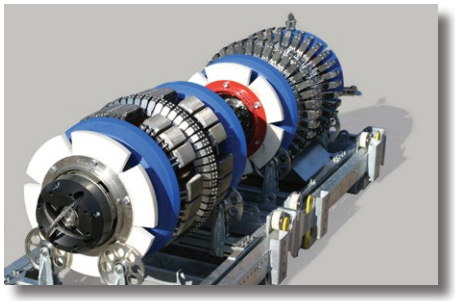
CustomerStory

terranets bw

terranets bw GmbH

Degaussing pipelines with the Degauss 600

EWM technology being used on terranets bw GmbH building sites



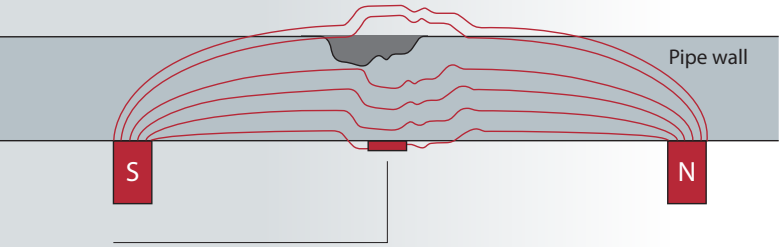
Intelligent pipeline pig for inspecting the condition of high-pressure gas lines

High-pressure gas lines must comply with the highest safety standards meaning that every weld seam has to be perfect. That's why operating companies such as terranets bw GmbH regularly inspect wall thickness in pipes using pipeline inspection gauges, also known as "pigs".

The catch is, however, that these inspection systems magnetise the pipelines. If repairs are needed, this magnetisation causes arc deflection during welding, resulting in trapped pores in the weld and lack of fusion. To combat this, EWM has developed the Degauss 600 degaussing machine, a practical, compact machine that is suitable for use on building sites.

High-pressure gas lines are inspected using "intelligent pigging" to ensure their integrity.
A pig is a cylindrical device made up of several disks, which are sealed against the pipe wall with cups. It is transported through the line using the differential pressure within the pipe. Pigs are 6 to 10 m long with feed rates between 1 and 5 m/s.
The pipe's wall thickness is measured using the magnetic flux leakage procedure. This procedure requires strong,

Magnetic flux leakage procedure schematic



A strong magnetic field is applied parallel to the pipe wall. The magnetic flux lines are deflected if:
· there is material loss within the pipe wall.
· there is magnetisable material near the pipe wall.
· the pipe material's properties change.

ring-shaped magnets attached to the pig, and the magnetic flux lines are immediately registered via sensors. These recorded signals are then compared with reference signals. Any deviations in the recorded signals can help to identify potential areas of material loss or ovality. As intelligent pigs are equipped with systems for determining the distance covered, the position of the findings can be identified. The downside to this method, though, is that the pipelines being

Inspected pipelines are permanently magnetised

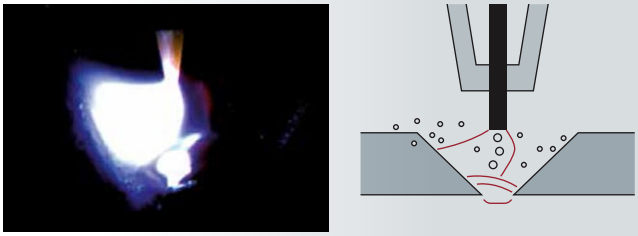
inspected are permanently magnetised. That's why prompt repair of the faulty areas upon receiving the results is crucial. For the companies involved, terranets bw GmbH as the operator and Leonard & Weiss GmbH as the executive construction company, it was clear that pigging caused a strong residual magnetism in the pipeline.
To combat the problem of magnetism when welding, leading to arc blow, weld porosity and lack of fusion, EWM AG was commissioned to eliminate the residual magnetism in the pipeline during welding with its Degauss 600 degaussing machine. The core principle is to create a magnetic field through a live conductor. To degauss a pipe, a power cable is coiled around it as closely as possible. A current flow then creates an opposing magnetic field of equal strength to eliminate the residual magnetism. The more coils are wrapped around the pipe, the greater is the maximum field strength that can be generated with a constant current.
The Degauss 600 is able to degauss in two ways:

1. Using the degauss function, the current flow is reduced in steps starting with a high current value and alternating polarity. Here, the component is degaussed alongside a hysteresis curve. This method is great for short components.

The Degauss 600 is able to degauss in two ways

2. Using the activgauss method, the current flows continuously through the coils to create a permanent magnetic field. This method is used for long components such as, in this case, pipelines.
Before inserting the new pipe section with a diameter of 600 mm and a wall thickness of 10 mm, the residual magnetism was measured at the welding joint using a field strength meter. The values were between 2 and 5 mT along the pipe circumference. From experience, EWM AG assessed that these values were below the range in which one can weld with an electrode. So it was determined that it was highly likely that no degaussing would be required for

Arc with residual magnetism



Arc with Degauss 600

this side of the pipe. The old, removed pipe section gave field strength readings of 18 to 35 mT.
Thanks to extensive preliminary testing at EWM, engineers were able to deter-

mine the number of coils and the estimated current required. In this case, the specialists from EWM opted to apply nine coils to the pipe.
After inserting the new pipe section, the remaining old pipe section was inspected. Field strengths of 15 to 30 mT were measured along the circumference. The coils needed for the old pipe section can be seen in the picture.
Once the welding joint was preheated to approx. 100 °C, the field strength was measured again as heating the pipe can affect the magnetic field. Using a remote control, the suitable current value (175 A) was set to compensate the magnetic field. Just one minute later, the magnetic field at the welding position was compensated and welding could begin.

Just one minute later, the magnetic field at the welding position was compensated

As mentioned, the field strength at the pipe circumference is not constant. A coil system cannot physically compensate these fluctuations. It was not surprising, then, that the degaussing current had to be changed after almost one quarter of the circumferential weld had been completed. The field strength decreases as the weld goes on (as both pipe sections are connected) and so the current value must be reduced accordingly. This was repeated four times until the root welding process was completed. The welders were instructed to stop welding when the magnetic field started to negatively affect the weld. The readings showed that the threshold for this for MMA welding was 4 to 5 mT. This was in line with EWM's experience with MMA welding. If the root pass has been successfully welded, the magnetic fields balance out. So the interpass and cover pass could be welded without any compensation.
The second butt joint saw a higher field strength reading between 26 and 43 mT. This required 13 coils and a degaussing current of 140 A. The gap between the coiled cables and the welding joint was 16 cm. Thanks to the groundwork that had been carried out in the lab, the welded joints could be completed on the building site without delay. After four and a half hours, the work was complete and both weld seams were successfully in place. The final X-ray and ultrasound inspections showed no abnormalities. The independent inspecting engineer from TÜV Süd was impressed by the Degauss 600's easy operation and building site practicality (light weight and small size), as were the company representatives from terranets bw GmbH and Leonhard & Weiss GmbH.

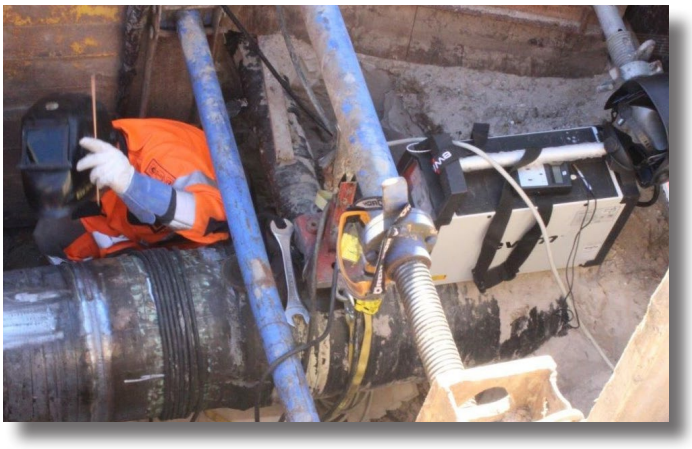
Measuring the field strength right before welding. The new pipe section was not degaussed.

On the second building site, a difficult task awaited

Here, the old gate valve of a high-pressure gas line should be replaced. As the welding joint was situated near the gate valve, MMA welding was not feasible; the ball valve's sealing surfaces would have been damaged by unavoidable spatter on the inside of the pipe. Instead, engineers opted for the TIG welding procedure. TIG welding, however, is much more sensitive to magnetisation than MMA welding and the magnetic fields have to be completely eliminated.

The measured field strengths were 10 to 12 mT, significantly lower than the values for the pigged pipe section at the first building site. That is why only six coils were required at 70 A to completely eliminate the magnetic field (measured values below 0.5 mT = 8 A/cm). Welding behaviour started to be negatively affected from a field strength of approx. 1.3 mT. Here, welding was interrupted three times to adjust the induced magnetic fields as the current was reduced in steps to approx. 40 A.

While degaussing was only needed for the pipe side when welding the first butt joint, both the valve side (-4 mT) and the pipe section (-12 to -18 mT) needed to be compensated at the second weld joint, likely due to the drifting of the magnetic field upon completing the first weld. This time, six coils were used on the pipe side. The different polarities of the magnetic fields allowed the power cable to be extended from the pipe side to the valve side with three coils in the same winding direction. The residual magnetism was completely compensated with a current of approx. 80 A. The welding process was stopped four times until completion of root welding to adjust the current value. The end current was approx. 25 A.



Successful TIG welding on a flange between a pipe section and a ball valve

> The residual magnetism was completely compensated with a current of approx. 80 A

These examples of the Degauss 600 in practice showed that it can effectively solve the problem of magnetism during repair welding in pipe construction even when faced with strong magnetic fields. The components required are easy to handle, compact and suitable for use on building sites. The Degauss 600 is easy to use and, thanks to the remote control, the power source can even be placed outside the excavation.

The dream team: EWM power source PICO 260 CEL PWS and the Degauss 600 (in the background)

In collaboration with

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