



Clad Bends with Salzgitter Mannesmann

Explosion welding demonstrates higher performance
in clad induction bends



EXECUTIVE SUMMARY

NobelClad, in partnership with three pipe industry leaders, conducted a trial to determine whether explosion welding is a reliable and economical option for producing clad induction bends. The results not only prove that explosion welding is a better option, but also allows designers to gain insight into how mechanical and corrosion properties are influenced at every step of the production process before becoming a final product.

CHALLENGES

The upstream oil and gas industry is frequently challenged when facing the demanding requirements of producing much of the world's oil reserves. The production and transportation of sour oil and gas may require clad metal in pipeline fabrication to resist the most severe conditions. Historically, designers have been limited in choosing between two options in the production of metallurgically bonded clad induction bends: roll bond and weld overlay.

Roll bond has issues with compatibility between the clad rolling schedule and the steel rolling schedule – producing sub-optimum steel. Roll bond is also susceptible to disbond when formed aggressively. Weld overlay is vulnerable to inspection challenges and suffers from dilution of the corrosion resistant alloy.

To overcome these challenges, industry professionals looked to alternative technologies to produce clad plates that would not disbond, would maintain mechanical and corrosion properties, and would allow for easy inspection. Salzgitter Mannesmann Grobblech (SMGB), a world renowned and German based producer of steel and manufacturer of induction bends, understood the importance of demonstrating the capability of a proven alternative like explosion welding.



It is important for the industry to know about explosion welding. The explosion welding done by NobelClad has demonstrated the capability to maintain critical material properties through the processing steps of making clad line pipe and bends...”

– Marion Erdelen Pepler
Salzgitter Mannesmann Forschung



SOLUTIONS

A trial was conducted to demonstrate the validity of explosion welding as a better, viable option for clad induction bends. NobelClad and Salzgitter Mannesmann Grobblech collaborated on the trial with Eisenbau Kr  mer, a world class pipe manufacturer with extensive experience producing clad pipes for induction bending, and Salzgitter Mannesmann Forschung (SZMF), the premier testing facility for linepipe steels and materials.

The trial included inspection and testing at each step of the production process. SZMF created a testing regime that included analyzing bends with a tight radius to demonstrate explosion welding's resistance to disbonding. The test also included corrosion and mechanical evaluation to verify there was no degradation in the properties of the materials.

To ensure accuracy of the trial, the highly demanding environment for producing an induction bend was recreated in these tests.

*Top:
Disbond of roll bond clad after
forming*

QUICK FACTS

- Did you know when stainless steel and nickel alloys are explosion welded onto API X-grade pipe steels by a qualified cladder, the bond between the metals has been demonstrated to be stronger than the metals themselves?
- After all heat treatment and forming, the explosion welded induction bend passed ASTM G48 Method A.
- NobelClad has demonstrated on-time delivery and trouble-free, long-term clad reliability for over 50 years.

RESULTS

The results showed explosion welding is the most reliable, and in many cases, the most economical choice for producing clad for induction bends.

Explosion welding is most effective in cases requiring the highest resistance against disbonding, high level of inspectability, no acceptance of dilution, and - of course - when cost efficiency is a must. It was also found TMCP plates maintained their superior properties throughout the production process and explosion welding did not alter or degrade the original material properties. To get a more in-depth analysis of the results, you can read the full paper [here](#).