Steinmüller Africa: South Africa's strategic welding innovator

At Mondi's Richards Bay paper mill, Steinmüller Africa is leading an 18-month boiler construction project, Vuselela, that showcases a powerful blend of engineering excellence and cutting-edge technologies, marking a major milestone for the paper and pulp sector and Africa's broader industrial progress.

Steinmuller's senior welding engineer, Friedrich Schwim.

Contracted to erect a new boiler to meet the future needs of a Mondi paper mill in Richards Bay, Steinmüller Africa is currently engaged in Project Vuselela, a welded-assembly project for an imported process steam boiler for Mondi's Paper Mill in Richards Bay.

"We have a team of approximately 130-200 skilled professionals onsite, including 28 welders. We are responsible for the full mechanical installation, including the welded assembly and installation of all the steel structures, pressure parts, fans, flue gas ducts, tanks and critical systems such as the air preheater and flue gas damper," says Steinmuller's senior welding engineer, Friedrich Schwim.

The process steam boiler is being built as an eventual replacement for four very old boilers on the site that are currently delivering process steam to the mill. Thousands of metres of continuous welding are required. "The new Mondi boiler is known as a circulating fluidised bed (CFB) boiler, a more modern design that is cleaner, more cost-effective and fuel-flexible," Schwim tells *AF*, adding that while some components are being manufactured locally, most are being imported as pre-fabricated and prepped sub-assemblies and sections for assembly onsite.

"We started with the first components in October 2024, and we expect to be pressure testing by February 2027, in time for the handover in about June," he says.

Welding process choices and innovations

Steinmüller uses various welding processes for its construction projects, including conventional stick and tungsten inert gas (TIG) welding, as well as advanced metal-cored welding processes that have recently been qualified.

"On this project, most of the boiler tubing is small bore – 45 and 51 OD – with a relatively thin wall thickness, typically 4.0 mm, so these are all completed using the TIG welding process for both root and capping runs. We wanted to use some orbital welding for these, but all the tubes are precut to length with a V-preparation. Orbital welding requires a squarer prep, which would not have been possible without changing the length of each pipe section," he explains, adding that for the capping runs on tubes with larger wall sizes, stick electrodes are used following the TIG root runs.

A lot of the welding, however, involves long, continuous plate-work welds that do not have to hold pressure. "Here, we have developed and qualified some advanced, deposition-efficient procedures based on using a metal-cored welding consumable," says Schwim.

The process was initially qualified using a Miller welding machine, where the RMD mode – a modified short-arc process with superior puddle control – could effectively control the fusion of the weld root. In contrast, a pulse mode was qualified for the fill and capping runs. "We are still using the two original Miller machines we bought for this work, but we have now found other brands with similar short-arc and pulse modes that offer equivalent weld quality," he says.

On the gas side, the metal-cored wire enables higher CO_2 levels in the gas mix, delivering better penetration. "For these long structural welds, we are using a universal gas mix with between 20 and 25% CO_2. This gives us a good combination of weld stability and penetration," says Schwim.

The use of advanced, modified short-arc and pulse modes on Mondi's Vuselela boiler project has increased productivity by 2-3 times while maintaining weld integrity. This is projected to cut welding time by at least 50%. "By strategically reengineering proven technologies, we are achieving a perfect balance between speed and quality," says Schwim. "This level of efficiency is crucial for fast-paced, large-scale projects like this," he adds.

Steinmüller Africa is leading an 18-month boiler construction project for the pulp and paper industry. Shown here is the pre-fabricated steam drum, the heart of the boiler, being lifted into place.

Safety first solutions

Mondi is very strict on safety requirements, continues Schwim, especially with respect to lifting gas bottles into a boiler under construction. "Gas cylinders have to be lifted into and out of the boiler one bottle at a time, so for 24 welders, there will have to be 24 separate lifts to get them all safely supplied at height. And when the cylinders are empty, a separate lift must be arranged to remove and replace each one. So it was important for us to incorporate Afrox's Multi-User Pressure Panel (MUPP) into this project," Schwim explains.

A flue gas stack is being prefabricated at the construction site.

Although still working on the ground, SteinMüller is already utilising this solution. "It is just easier to have one single manifold pack of gas stored somewhere permanently, so that a welder never has to fetch and carry full and empty gas cylinders around the site," he notes.

The idea underpinning the MUPP solution is to leave gas cylinders on the ground in a safe, secure and convenient fenced-off area. A single braided steel hose connects the gas to a pressure-regulated MUPP with eight connection points, allowing eight welders to be serviced simultaneously. Initially developed for at-height welding on boilers, the solution enables an MUPP to be installed where welders work, eliminating the need to lift gas cylinders into the boiler.

"We think it works well. We plug it in, check for leaks and then we can supply eight welders at the same time," says Friedrich Schwim. "We plan to have three teams of welders working at three different levels, so we have invested in three of these multi-user panels for the Vuselela Project," he adds.

This is not the first time Steinmüller has adopted this solution, having used it on the Camden Power Station site. "We also find it useful in our workshops. In the Pretoria workshop, for example, we used a MUPP when we built the Eskom HP heaters, because it results in less gas having to be moved to the point of welding," he adds.

Mitigating against challenging conditions

Richards Bay's high humidity poses significant corrosion challenges. To mitigate this, Steinmüller Africa has deployed laser cleaning technology to remove surface contaminants without compromising weld integrity. "Laser cleaning is ideal, because these components are already prepped, and while it does come with a protective weld primer applied, some components had already started rusting on arrival. Laser cleaning quickly removes this rust without changing the tube length or the prep accuracy.

After laser cleaning, a weld pre-primer is applied: "I'm quite surprised at how good modern weld pre-primers are. It's the first time I have worked with them, and once the joint is laser cleaned and the primer is sprayed on, it's still not rusted two weeks later. So the prep can be lightly brushed and it's ready to weld."

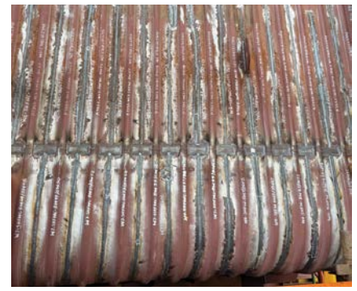
The primer has been extensively tested and proven successful in maintaining weld integrity in high-moisture conditions without affecting the welding performance or the properties of the finished weld.

Other Steinmuller Innovations

Beyond the Mondi boiler project, Steinmüller Africa is pioneering new lifecycle extension technologies for Eskom's high-pressure heaters, which preheat water before it enters boilers. These heaters often develop tube leaks that were previously repaired by manual plugging, with limitations on the size of the plug that can be inserted.

Now, through a two-year research and development (R&D) process, Steinmüller Africa has developed and qualified a non-standard explosive plugging process for sealing larger tube diameters, which was previously unfeasible. "We have been doing explosive weld plugging for the past 12 years, but we could only repair 17 to 18.5 mm OD tube holes. We've now developed an approved procedure for bigger plugs, based on Eskom's current needs," Schwim explains.

A pre-fabricated conical section being installed in the Mondi boiler.



A boiler membrane wall panel. For long structural welds, Steinmüller uses a qualified metal-cored wire procedure. Laser cleaning is used before welding, and a weld prep primer is added after.

"When an HP Heater tube started to leak, these were repaired by cutting off the tube, pressing in a cap and welding a seal around the outside edge. Weld fusion was limited to the surface area around the cap and this could corrode through relatively quickly. The fusion zone of the explosive plug is longer, across the full thickness of the heater shell, so there is much more material to resist corrosion. In addition, we can use a plug with a little nickel in it to resist corrosion," he explains.

"Our ability to reengineer technology, adapt to environmental realities and deliver under pressure defines who we are," says Schwim. "We are building more than infrastructure, we are laying foundations for Africa's industrial resilience," he concludes.

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