Kelvion: SA's integrated Heat Exchanger Specialist

The SAIW member profile for this issue comes from Kelvion Services, an OEM that fabricates and services a comprehensive range of heat exchangers and coolers. *AF* talks to ISO 3834 welding coordinator and IWE, Pule Maleme; Kelvion's South African MD, Alex Dreyer; and Engineering Manager, Mike Coats.

Kelvion Services' patented tube-to-tube orbital welding process has been used extensively to weld U-bend tubes efficiently during the manufacturing or refurbishing of air finned coolers.

The South African facility of Kelvion has recently been recertified to ISO-3834-2 for the 3rd time under the Kelvion name. But under the GEA banner, the company's South African operation was first certified by the SAIW soon after the launch of the scheme in 2008, so its South African fabrication operation is one of the longest continuously certified ISO 3834 facilities in South Africa.

Kelvion participated extensively with the new-build work for Medupi Power Station, most notably for the air-cooled condenser system. "Today, Eskom is still a major client, but mostly on the maintenance and upgrading side, but we also do substantial amounts of work for the petrochemical sector, both here in South Africa and across the continent," begins Alex Dreyer, the company's MD.

"We look after processing equipment such as shell and tube heat exchangers, air cooled heat exchangers, plate heat exchangers, cooling towers, steam and air heaters and condensers. And we remain very strong in condenser refurbishing work," he adds.

A power station typically consists of four essential parts, he explains, "A boiler that turns the condensate into steam; the steam then expands to drive a turbine; a water cooled or air-cooled condenser; the fourth component is the pump that takes the condensate from the condenser back to the boiler. Often a small turbine of between 5.0 and 10 MW is used to drive the pump with two or more electric motors driving smaller pumps as backup. But it's much cheaper to use a steam turbine," he says.

"Over long periods of time, due high steam velocities at the inlet cutting through tubes or corrosion from dirty water, some tubes begin to leak, which then have to be plugged. Once 5% or so of the tubes have been plugged, the performance of the whole condenser drops off enough to justify fully retubing it. We have developed a cost-effective way of replacing these tubes," he continues.

"Many of the main condensers and boiler feed pump turbine condensers are getting to the end of their lives, and we've been retubing the condensers on these systems to bring them back online," he explains. "The condensers are basically a shell with tubes inside. Cold water is typically pumped through the tubes, while the outlet steam from the turbine is passed into the outer shell, condensing on the outside surface of the colder tubes".

He cites, in particular, Kelvion's boiler feed turbine condenser retubing work: "Boiler feed pumps are very high-pressure pumps used to pump condensed feedwater back into the boiler – at main steam boiler pressures. These pumps tend to be powered by small steam turbines. The steam used to power these turbines, however, also needs to be condensed before being recirculated, and we have developed the expertise to retube these condensers.

Due to the large size of these condensers, the retubing has to be done in-situ at the power station, so access is always an issue, he says. "We move into the power station, take the water box covers off the condenser, and then we systematically remove and replace every tube," he says.

Mike Coats goes on to present a similar repair application for a main steam condenser solution for a utility boiler, below the floor in the turbine hall, with the boiler somewhere above. "The hot steam from the turbine exhausts downwards into the condensers tube bundle, which is very large, and the tubes are very close together. The tubes used to be brass, but increasingly we are now using titanium, where a machine is used to expand each tube end into a groove on the end plates to make the seal" he notes.

Pule Maleme: IWE and ISO 3834-2 Welding co-ordinator

After graduating from the University of Pretoria with a degree in metallurgical engineering, Pule Maleme did an Honours degree in Welding Engineering at the University of Pretoria under Prof Pieter Pistorius.

After completing modules on welding processes, fabrication, design of welded structures and welding metallurgy, he sat for the SAIW/IIW exams for his International Welding Engineer (IWE) certificate, which he passed in 2022.

Pule Maleme joined Kelvion Services in 2019 as an engineering intern and is now the company's welding engineer and the welding coordinator of the ISO 3834-2 Certification scheme.

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Heat exchangers, waste heat boilers and orbital welding

Most of the heat exchanger and waste heat boiler work done at Kelvion's facility in Roodekop requires high integrity fusion welds between the tubes and the tubesheet, continues Pule Maleme.

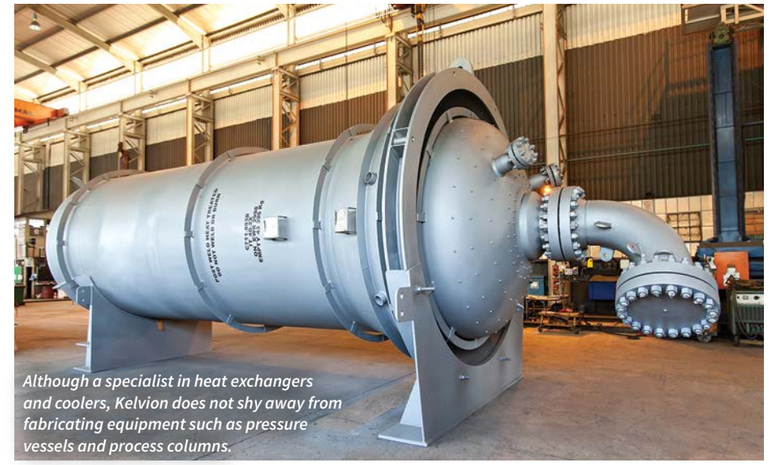
He cites some recently fabricated waste heat boilers for a petrochemical application that were constructed using Kelvion's orbital welding expertise, which has the benefit of decades of experience. "When using an orbital welding system, a custom designed GTAW welding head is used for in-bore welding of the tube to tubesheet. The torch is rotated inside the tube, fusing it to the edge of the tubesheet," he explains.

"This process is one of our specialties and very few companies in South Africa use it as much as we do," he says, adding that achieving full penetration welds is critical. "The edges of the tubes are machined accurately so that they fit precisely into the pre-machined tubesheet recess. During welding the two parts are fused together, ensuring perfect, full penetration welds." he explains.

"To guarantee an ideal choice of welding parameters and repeatability, we weld qualification mock ups, followed by laboratory testing and analysis. Production welding is then performed by following precisely the qualified welding parameters and procedures. This ensures complex heat exchangers such as waste heat boilers are manufactured to the highest international standards" Pule Maleme tells *AF*.

Describing the operation of the waste-heat boiler, Mike Coats says that hot waste gas enters the heat exchanger at about 1 000 °C, and a sound weld is required to withstand the extreme temperature and pressure. Around the opening of each tube there is a trumpet-shaped ceramic ferule to prevent the gas stream from coming into direct contact with the tube end. The gas then flows though the bundle of tubes, heating the water on the shell side, which creates reusable heat for preheating and other process applications," he explains.

Kelvion Services has developed a patented tube-to-tube orbital welding process, as well. This has been used extensively to weld U-bend tubes efficiently during the manufacturing or refurbishing of air finned coolers. Tubes in carbon steel, stainless steel and Incoloy have been successfully welded using this proprietary process.



Although a specialist in heat exchangers and coolers, Kelvion does not shy away from fabricating equipment such as pressure vessels and process columns.

Welding and ISO 3834

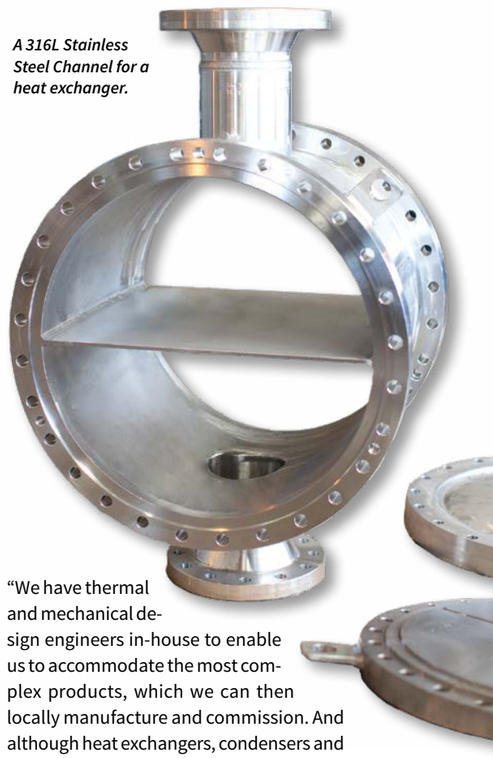
Maleme says that, apart from the ongoing orbital welding work he coordinates, Kelvion focuses on four key welding processes. "We use TIG welding extensively for high integrity work, along with MMA welding. To achieve better productivity, we also use MIG/MAG welding and submerged-arc welding. When required by the contract, we perform corrosion resistance weld overlays, using FCAW or sub-arc welding processes. We also perform Stellite hardfacing weld overlays when it is specified in the contract" he informs *AF*.

"Kelvion successfully welds carbon steel, low alloyed steel, stainless steel materials including duplex and super duplex grades, and exotic materials such as Monel, Inconel, Hastelloy and Incoloy" he adds.

He cites the manufacture of filter vessels for Temane, Mozambique: "These vessels were thick-walled carbon steel requiring mandatory PWHT. They also required welded-in stainless steel internals. A buttering layer of Inconel was applied to the carbon steel followed by PWHT. And after the PWHT, the stainless-steel internals were welded to the Inconel buttering layer without the need for further PWHT, thus eliminating risk to the stainless-steel corrosion resistant properties and the shape of the components. We used the sub-arc welding process to deposit the Inconel buttering layer." Pule notes.

Kelvion's competitive advantage?

"As well as our welding expertise and experience, we pride ourselves on our in-house design expertise," responds Mike Coats.



A 316L Stainless Steel Channel for a heat exchanger.

"We have thermal and mechanical design engineers in-house to enable us to accommodate the most complex products, which we can then locally manufacture and commission. And although heat exchangers, condensers and coolers differentiate us in the fabrication market, we don't shy away from fabricating equipment such as pressure vessels and process columns," he says.

Pule Maleme adds: "On our latest ISO 3834-2 certificate we have broadened our scope statement to be more inclusive of our wide product range. It now reads that Kelvion specialises in the: manufacture and refurbishment of shell and tube heat exchangers, air cooled condensers, pressure piping, waste-heat boilers, air-finned coolers, process columns, storage tanks and structural steel," he concludes.

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