Steve Fleetwood, the MIG unit manager of Afrox's welding consumable factory in Brits.

Afrox masters

MIG wire manufacturing

Afrox's welding consumable factory – originally built in 1971 to manufacture welding electrodes – has installed a new R85-million facility to produce MIG wire to best international standards. *African Fusion* talks to Steve Fleetwood, the MIG unit manager in Brits.

"I think it is time we started to boast about our new MIG plant and put it on the map," begins Fleetwood proudly. "It is a state-of-the-art new factory, a total replacement for the old plant that some of our customers are familiar with. It doubles our previous capacity to 600 tons and consistently produces the quality required for our premium MIG 6000 brand," he claims. "In benchmarking tests, wire from the new plant proved to have excellent weldability with less spatter, vibration, hesitation and nibbling."

Afrox management, in setting up this new factory, went for the best equipment available, the best people and best operating practices to ensure that it was able to produce the highest quality of product available anywhere in the world. The machines chosen came from the Italians, renowned for their MIG wire quality – from Gimax and the GCR-group. Top drawer engineers, operators and technicians were chosen to man the site.

"During the early stages and commissioning phase of the plant, we experienced some challenges in terms of meeting the highest quality standards that we set for ourselves, however, after extensive testing and implementing more stringent measures in terms of quality and process control, we have managed to overcome all challenges," says Fleetwood. "The process parameters have now clicked smoothly into place."

The making of MIG wire can be divided into three key stages: rod-breakdown; drawing and coppering; and spooling. "It starts with the delivery of two-ton coils of 5,5 mm OD rod from ArcelorMittal," he explains. The metallurgy of the rod needs to comply very accurately with the requirements of the wire, not only of the core constituents – carbon, silicon and manganese – but also of the deoxidisers in its chemistry – titanium, nickel and zirconium. "We test every batch in a cast, as it comes in," says Fleetwood, "and when we get the results, we compare them to those specified by the steelmaker, to make sure the steel we use will produce a quality wire."

Fleetwood shows us the rod breakdown line: "We start manufacturing on this line, where the rod is cleaned and then drawn down into one of two sizes, either 2,22 mm, used for making 0,8 mm, 0,9 mm and 1,0 mm wires, or 2,86 mm, which ends up as 1,2 mm or 1,6 mm wire."

The rod is first descaled by passing it through a set of rollers, which bends the wire and breaks off the surface scale. Steam is then used to wash the descaled wire. Then it goes through a pickling acid unit to get down to the clean metal and remove surface impurities. Cold and hot water is then used to rinse the wire before it enters the lubricant carrier unit, where the clean rod is coated with lubricant. The rod passes through an induction heater where it is flash-dried from the core to the outside.

The lubricated dried rod is now ready for the drawing process and it will be drawn down to either 2,22 mm or 2,86 mm through five or six sets of dies, and wound onto two-ton bobbins.

Critical to the smooth operation of the drawing process, is the wire temperature. "Temperature effects the yield strength, so if the wire is drawn too cold, it will snap, and too hot, it will thin," says Fleetwood. The speed at which the machine is operating, the reduction ratio between the blocks as well as the soap pick-up also play a vital role when trying to maintain the yield strength in a required range. "Unless the wire is kept at the right temperature throughout the process, you are going to have problems with the yield strength." The factory, while running a single eight-hour shift, is producing around three two-ton bobbins every day on the rod break down line, "Running at 6,0 m/s, we can process a two-ton bobbin in two to three hours," Fleetwood tells *African Fusion*.

After being spooled onto two-ton bobbins at the end of the rod breakdown line, the wire is tested for cast and helix for the first time. These bobbins are then moved to one of the four draw and coppering lines.

"The objective of these lines is to take the 2,22 or the 2,86 wire and to draw it down, through seven or eight dies to 0,8 mm, 0,9 mm, 1,0 mm, 1,2 mm or 1,6 mm," explains Fleetwood. Once drawn, the wire passes through a caustic soda bath to remove the soap, and another hot rinse process which washes off the caustic soda. Finally it is passed into a copper bath where a very thin, high-quality copper layer is electroplated onto the wire surface. "This is a quality differentiator for us," claims Fleetwood. "We have a thinner copper layer on our wire because we can run the line at between 15 and 20 m/s. This gives a better quality copper layer and very few other manufacturers can run wire though a copper bath this fast."

At the end of the draw and copper lines, the wire is wound onto one-ton bobbins ready for the spooling process. "At the start of the spooling stage, samples of wire from every one-ton bobbin are tested for cast and helix; appearance and loose spooled wire,"

Fleetwood informs us. He cuts a length of wire from a spool and throws it onto the ground to show us the cast and helix test. "We cut about a metre and a half of wire off the block and throw it on the ground. The cast is the diameter of the coil that forms on the ground and the helix is the distance that the wire end lifts off the ground." Cast and helix is set using carefully orientated rollers on the draw and coppering lines. "The roller settings on the preparation line are the most important though," he informs us. "If these are not set correctly, you are never going to get the cast and helix right after drawing." He measures the cast (1 000 mm) and the helix (10 mm). "The cast on this wire needs to be between 800 mm and 1 500 mm to meet the premium requirements (MIG 6000) and the helix needs to be less than 10 mm, so this one complies," he says. "On 1,2 mm and 1,6 mm wire, the helix is usually flat but on 0,8 wire it is very sensitive," he adds.

The factory has four spooling machines for 18 kg spools of MIG-wire and a fifth, which is used to spool the 230 kg Megapacs. "Megapacs are used in automatic welding, so only MIG 6000 is acceptable." The factory is also able to produce continuous feed wire on the Megapacs, which enables increased productivity and limited downtime during automatic applications.

The second last stage of the manufacturing process, just before packing, involves a physical weld test. "Although the wire is coppered perfectly, has a shiny appearance with no waves or streaks, it is critical that a physical weld test is done in order to make sure that the wire performs and meets all our requirements in terms of weldability," he says.

Afrox weld-tests wire from every bobbin. A one-ton bobbin produces 18 kg spools, which are packed in four layers of around nine spools, depending on the wire diameter of the spooled wire. "We will use one spool from each of the four layers to test weldability, thus ensuring that wire sampled for testing is from the beginning, the middle and the end of each bobbin," says Fleetwood.

"The wire needs to meet all the requirements of the AWS Standards and show exceptional welding characteristics, in all of our welding performance indicators, to be classified as MIG 6000. Wire which is deemed not to meet this standard in any respect is rejected. Our wire is also SABS approved and meets international approval standards such as the Lloyds register, ABS and TUV," he tells *African Fusion*.

"In principle, the factory is set up to produce premium MIG wire (MIG 6000) and currently 95% of product meets these standards. "Most fabricators will require a wire that meets the highest standards of quality and performance. Our MIG 6000 wire is well positioned to achieve this. It is as good, if not better, than any premium wire you can purchase anywhere in the world," Fleetwood concludes.

95% of the product coming off the production lines now meets the standard for Afrox's MIG 6000 premium brand welding wire.

Afrox's new state-of-the-art MIG welding wire factory in Brits.