How the world's TOUGHEST LAND ROVER ALLOY WHEELS are made

John Pearson visits northern Italy for a fascinating look at the production of Silverline 4x4's Blindo wheels

WMIK Defender 110s are shod with the same Blindo wheels you and I can buy

The Italian word blindo means strong, tough or armoured – an autoblindo is an armoured car. It's also the name of what Warwick-based Silverline 4x4 proudly declares is the world's strongest Land Rover alloy wheel.

'We didn't actually have a name for it,' admits Silverline's marketing chief Chris Dawson. 'But the Italian factory that produces the wheels – Arcasting – sent them in boxes bearing the name Blindo, so it stuck.'

Chris is justifiably pleased with the Blindo wheel, and when chatting to him at the 2009 LRO Billing Show about buying a set for my 110, he offered to arrange a tour of the Arcasting factory in northern Italy where the Blindos are produced exclusively for Silverline. And good to his word, towards the end of the year I was on board a Ryanair flight to Treviso with Chris, Silverline's sales director Anthony Barnsley and photographer Tom Critchell.

From this to this... Arcasting's Maurizio Vettorato shows the raw material and the finished product

On the way over Anthony explained why the company has its flagship wheels produced at what is a relatively expensive Italian factory. 'We could buy cheaper wheels from China, but we can't guarantee the quality that we get in Italy.'

That guarantee of quality is why the Blindos are not only used on off-road Land Rovers, but for rally-raid competition vehicles, and for military use. The WMIK (Weapons Mount Installation Kit) stripped-down Defender 110s, built by Riccardo for use as mobile weapons platforms by the British Army, also run on these high quality wheels.

On arrival at the factory, Arcasting's export manager Maurizio Vettorato gave me a run-down of the differences between quality wheels and the also-rans:

- Only prime aluminium is used – 'not recycled drinks cans'.
- The aluminium has seven per cent silicon mix instead of 12 per cent used in cheaper wheels.
- It's heat-treated for improved mechanical properties.
- The molten metal goes through a de-gassing process, where nitrogen is used to help remove hydrogen bubbles, which cause micro-porosity.
- The wheels are cast under low pressure rather than gravity, for improved metal density.
- Once the wheels are made, each one is subjected to an x-ray check for any structural defects, shrinkage or porosity, after which it is submerged in a water tank and pressurised to ensure there are no air leaks.

Wheel mould is in four sections, which are clamped together

Above: vast supplies of 10kg aluminium ingots. Below: Ingots go into giant furnace at 800º C... and quickly change from solid to liquid (bottom pic)

Both Silverline and Arcasting are proud of the Blindo's quality – and its toughness. Apparently, it's shrugged off the TUV's (international testing and assessment organisation) maximum test of 1550kg being dropped on it. And I was promised I'd see a live test later in the day.

Entering the high-ceilinged factory, we were first shown an example of the wheel moulds. If you can visualise a giant jelly mould made in four sections clamped together – two sides, top and bottom – you'll get an idea of what one is like.

'Every time a mould is used, it's cleaned and all technical parameters checked for accuracy,' explains Maurizio Vettorato. They're sandblasted, then cleaned manually with fine emery cloth. Made from high-quality tool steel, each mould is good for 10,000 wheel castings.

Arcasting's huge stack of aluminium ingots reminds me of the gold bars in the USA's Fort Knox Depository, as depicted in the 1964 James Bond film, Goldfinger. Each ingot weighs 22lb (10kg) and costs about £15. Okay, that's nowhere near as heavy or as expensive as gold (a 10kg gold

The furnace tilts on its centre axis and the immensely hot liquid aluminium pours into the container with the consistency of thin soup

It looks like a giant food mixer as the molten metal is swirled around, while nitrogen gas is pumped in


After de-gassing, the metal is skimmed to remove impurities

ingot might set you back £200,000 or thereabouts), but still a substantial investment. A Blindo wheel weighs 31.5lb (14.3kg), so just under one and a half ingots are used to produce it.

Maurizio stresses the use of prime aluminium for their wheels; the only recycled material used is the re-melting of their own scrap. 'Good alloy and good casting are the basis of a good wheel,' he says.

The aluminium ingots are melted at about 800°C in a giant, natural-gas-powered furnace, a bubbling cauldron containing 7000kg of bright orange liquid metal. The heat is incredible when the door is opened.

The next stage of the process involves a man with a forklift truck trundling towards the furnace carrying a five-foot-diameter pre-heated crucible.

The whole furnace then tilts on its centre axis and the immensely hot orange liquid aluminium pours into the container at the consistency of thin soup. A small quantity (0.03 per cent) of Strontium bar is added, again to improve the metal's mechanical properties.

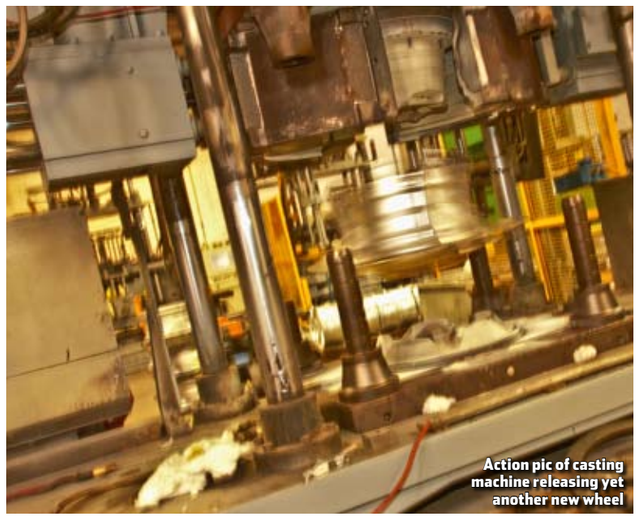
Once the container is topped up with molten metal, the furnace returns to its upright position and the fork-lift man shifts it over for the next process – de-gassing.

It looks like nothing more than a giant food mixer as the molten metal is swirled around, while nitrogen gas is pumped in to help reduce the amount of hydrogen, which causes small bubbles to appear in the metal. 'Micro-porosity is our biggest problem, our biggest enemy,' says Maurizio.

After seven minutes, a worker uses a skimming tool to whisk any impurities from the surface, after which the crucible of molten metal takes another fork-lift truck ride over to a row of three casting machines that are producing a steady flow of new alloy wheels.

The fork-lift tips 600kg of liquid alloy into one of the casting machines, where it is kept heated. It's then forced into the mould at 0.5 bar (7.25psi), which ensures that the metal gets into every one of its nooks and crannies. 'A gravity process is cheaper,' says Maurizio, referring to systems where the metal just runs into the mould, 'but the molecular structure is not as good as this.'

Below: 600kg of hot molten metal being tipped into wheel casting machine


Action pic of casting machine releasing yet another new wheel


X-ray machines show any possible internal defects

Above: new wheel is released from mould then quenched in tank of de-ionised water

Once the mould is full, the pressure is increased to 1.5 bar (21.75psi), which helps to reduce porosity, before being cooled by air. This cooling process is carefully controlled, explains Maurizio: 'Some parts are kept warmer and some cooler for optimum cooling, which achieves smaller grains of aluminium for higher mechanical properties.'

The now solid wheel is released from the mould, but it s still at 400°C. It s then quenched in a tank of de-ionised water for the process of normalising, which eliminates stress from the metal and improves its mechanical properties.

Each wheel is checked visually for quality before going over to Arcasting's two x-ray machines. These are used to check for possible casting defects, shrinkage or porosity.


Editor-in-Chief John Pearson found the wheel production process fascinating


Wheel machining is computer-controlled

'You can't see everything without the x-ray,' says Maurizio. 'This process isn't visible to the customer in the tyre shop who asks why Italian wheels are expensive. *This* is why – because of all of the work involved.'

The company's passion for its products really shines through. Maurizio Vettorato is pleased to be showing off the production and testing facilties, and the workforce is going about the business of producing quality wheels in a purposeful and efficient manner.

After the x-ray checks, the wheel has its centre drilled out and the wire mesh filter that stops impurities getting into the mould is knocked out. Then it goes ont o a CNC (computer numerical control) turning machine to be machined into the perfect finished product. Then the wheel centre and stud holes are drilled for its relevant vehicle application.


Any sign of bubbles in tank will mean wheel is rejected

The checks aren't finished yet, because our wheel now goes into a special testing chamber, where it's sealed top and bottom, immersed in water and then pressured. Any air bubbles apparent now will mean immediate rejection and the wheel will end up on the Arcasting recycling pile.

The only job not tackled in-house at Arcasting is the painting process, which is outsourced to a specialist paintworks in Brescia – a quality company approved by Fiat, one of the many companies that Arcasting also make wheels for.

After painting, the wheel gets steel inserts pressed into its stud holes, to protect the aluminium under use. Then it's packaged in a box ready for despatch to Silverline's Warwick HQ.

Well, that's what happens to most of them, anyway. But today one wheel painted in military beige is pulled out to demonstrate the TUV test. It's fitted with a tyre and then strapped at an angle on the test rig. The cage doors are locked shut and a platform loaded with 1550kg of weights slams down on the wheel rim with such violence you can feel the thump through the ground. But the Blindo wheel lives up to its name and reputation; it doesn't flinch.

It's removed from the rig for examination, and is totally undamaged.

That's why it's used by the British Army for front-line duties in conflicts including Afghanistan, where component failure could mean the difference between life and death. A good recommendation, we reckon. LRO

Steel inserts are a press fit in Blindo stud holes


Above: 1550kg weight has just slamed down on this wheel, but you'd never know it!

If the Blindo is tough enough for the Army...

...then it's certainly good enough for my more humble Defender. So, after the Arcasting visit I drove over to Silverline's Warwick HQ to have a set of Anthracite Blindo wheels fitted with the newly arrived 235/85 R16 Mickey Thompson Baja ATZ Plus tyres. LRO's off-roading guru Vince Cobley has had a set of the larger 265/75 R16 Bajas on his LRO Adventure Club expedition Defender for over a year, and has highly rated their performance in the variety of conditions he drives it in.

So, now that the 235s are available, I thought I'd give them a try. My initial reaction is that they're quieter and give less rolling resistance than the Goodyear MTRs I've had on the vehicle, so hopefully there will be an mpg bonus. And they look exceptionally cool.

Prices vary, depending upon size applications and tyre choice. So it's best to check Silverline's ad pages in LRO, or phone for a quote.

● silverlinewheels-tyres.com, 01926 496668


The wheel men: Silverline 4x4's Chris Dawson (left) and Anthony Barnsley (right) with Maurizio Vettorato from Arcasting