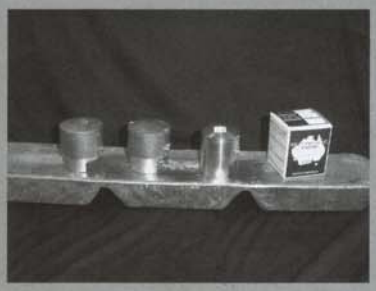
# STRIKE PISTON ARTICLE


## HOW STRIKE PISTONS ARE MADE



It has only been a few years since the introduction of the Australian made STRIKE pistons onto the karting scene, but in that time they are now well established in the Clubman and Formula Australia classes. With the STRIKE J piston now coming on to the market for 2004, we felt it worthwhile following up on their progress.

As they are manufactured in Perth, also the home of this magazine, it should be a simple exercise for us to see just how they are made. A call to Ken Seeber was made and his response was "sure, but I can't show you everything."

**BACKGROUND.** Ken worked at the Orbital Engine Company from 1975 through to 2000. "It was a really great company to be involved with, particularly the quality of the people. I had a variety of roles from senior management to engineering, but the engineering was the best by far.

"We were privy to many of the largest automotive companies, their engineering teams and emerging engineering practices and techniques. Through isolation from the main international automotive players, it was necessarily a very much vertically integrated (meaning they did almost everything itself) company and we all learnt a lot. As a result, a very modern and advanced manufacturing facility was created. Whilst this was very busy at times, there were other times when it was quiet, a seeming inevitable scenario of commercial R & D. Orbital sought to overcome the quiet times by taking on products and projects that would level out the workload. On of these was the ARC engine. I wasn't involved initially, but with a series of redundancies and overall downsizing I was offered the opportunity to oversee the ARC project, amongst others I was also responsible for.

"Some project it turned out to be. Alltype & Orbital versus the AKA! What happened, good or bad, is now history, but I was proud to be behind the project and particularly the design of the watercooled engine and the tooling as well. I still maintain a very close contact with Frank of Alltype"

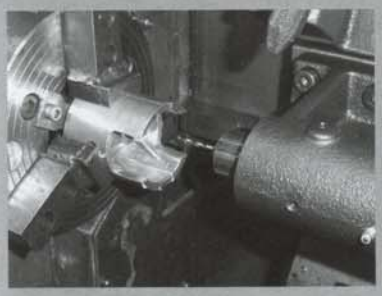
**BACK TO PISTONS.** "I was personally involved in various other piston type projects from 2.5 cc air compressors to international projects with 500 cc per cylinder blown 2 stroke DI engines. In addition we also commenced the manufacture of a piston for the ARC engine. At this time, Orbital dropped the ARC project ...a total disappointment for me, but under the circumstances entirely the right thing to do. The ARC piston was made using multiple machining operations and was never going to be commercially viable unless this was changed. I personally put in quite a bit of thought how this could be improved, but the end came too soon.

"A year or so after the offer of redundancy came up and I took it. Just prior to this, I had purchased a CNC lathe to prove out some of my ideas as to manufacture of small pistons. With some initial castings from Orbital, the concept was shown to be successful. However, due to further downsizing at Orbital, the original intent of using Orbital castings came to an end. I then (necessarily) created a small gas fired, gravity die casting foundry."

**HOW?**

The specialist aluminium alloy for the pistons comes from Melbourne in one tonne lots in ingot form, each ingot weighing 7 kg. These are melted in a gas fired furnace to a temperature of around 700 deg C. Each melt is treated to improve the final microstructure and is also degassed by bubbling nitrogen to remove impurities, but mainly hydrogen which can show up as very fine bubbles in the casting unless the material is correctly degassed

During each casting cycle time of around 2 minutes, the castings have the ingate/riser/runner removed and the serial number engraved on the interior of the piston. After engraving, the castings are then placed in a heat treatment oven for "subsequent artificial aging at around pizza temperatures" Machining is done in three stages or operations. All machining is done on CNC lathes, rather than high production, specifically dedicated machinery. "CNC



machines offer excellent flexibility and are relatively low cost in comparison to specially made production machines. The down side of this is that general purpose CNC machines are slightly compromised in output rate, but for what we are doing they are very flexible"

The first operation is to hold the heat treated casting in specially made jaws of the lathe chuck and the piston skirt is cut to length, the outside turned down "to a standard 53.5 for AKA sizes" and the interior counterbore is also turned out. Big bore pistons have the outside diameter turned to 55.5 to cater for a range of larger finished sizes. During the operation, pistons are checked for the counterbore size and depth to the underside of the crown.

The second operation is to machine in the piston bore and circlip grooves. This operation requires careful setting up, as the squareness of the piston is completely dependent on this operation. After the pin bore is machined out, the hole is finally sized using a roller burnish tool. This gives excellent control of the bore size, but as well it also gives the surface a hard and smooth finish. The third and final machining operation is, as Ken says "the heart of the process". Here the piston is mounted on a mandrel on the lathe spindle. "The CNC lathe used for this operation is a gang plate machine, rather than a turret type, allowing all the tools to be mounted on a preset tooling plate. With a dedicated product, such as the STRIKE piston, all the tools can be laid out to follow the machining sequence, making for an efficient and accurate operation.

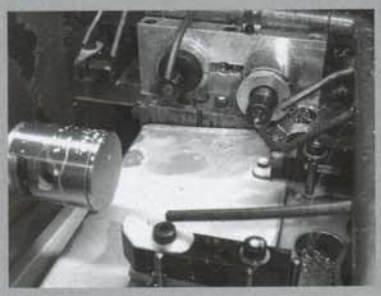
"There are seven tools; roughing the crown and skirt, finishing the crown, pilot drilling the anti rotation pin hole, peck drilling the hole, chamfering the ring groove and crown, cutting the ring groove and finally the skirt profile machining. The beauty of doing all these ion one set-up or operation is that all these are related to one another and concentricity and squareness are inherent in the operation"

I had to ask how do you get such a smooth finish on the side of the piston. "Nothing trick there, just using diamond tipped tools and a fine feed rate".

It is absolutely fascinating to watch this operation, almost scary as the tools approach the piston at suicidal speed. In particular to watch the piston to be removed after machining, glistening under the white coolant as it is air blasted off.

During the automatic machining operation, the previously machined piston is graded for size, deburred, piston ring anti-rotation pin installed, cleaned, packed in its box after labelling and put on the shelves. There are a series of checks made on the piston during this operation, including squareness, ring groove depth and width and profile. A record of each piston against its serial number is also kept, both as to its size, other manufacturing details and ultimately its customer.

What then? "I just wait for the phone, fax or email, put them into a bag and call the courier. That's the theory anyway".



## WAS IT DIFFICULT?

"Yep. I've had my share of disappointments, but that's the way it goes. The learning curve has been steep. But with the many recent successes it has all been worth it for us.

"For us to distribute the product has been a great success. It was a case of either "make more for less" or "make less for more". We chose the latter. Obviously the distribution takes time, but with that comes both the distribution margin plus the very strong and direct contact with the customers and the dealers.

I have had lots of useful and constructive feedback and help from various dealers, something I may not have got if we were one step removed. However, the best part is the friendships that we have established as a result. Even those who were opposed to the ARC introduction in those dim dark days. I also can't deny that manufacturing is a passion for me"

## THE FUTURE?

"We are commencing on the design of a 3rd piston (I was sworn to secrecy as to what engine it will be for), but the advantage of this one is that we will be able to supply the worldwide market, not just Australia. Other than that to just keep expanding as we have done, coupled with some stronger marketing".

"While we have taken two steps forwards and one step backwards at times, we are always striving to improve the product. While we can't do anything major (to the design of the piston for AKA compliance reasons) there have been some very subtle design changes, processing changes and the introduction of certain measurement techniques. Some of these are the direct result of feedback from the dealers, and I am indebted to them for this input. This feedback is another useful by-product of being the manufacturer and the distributor.

"Also, being a relatively fledgling operation, we are able to provide a customised service, particularly with our big bore pistons that are used for speedway and dirt track racing. This is working out to be a bit of a niche for us, another example being the big bore J, above 52.5 mm using Clubman rings, for an industrial engine application where there are no longer oversize pistons available."

Well there it is, from raw ingot of aluminium to one of the most critical components of your race engine, all made with a recipe combining large amounts of mechanical and scientific wizardry. For me it was also remarkable not just to see all the pistons being made, but also the little gadgets for checking and doing little functions as part of the overall operation. Very impressive indeed.

## WHY STRIKE???

Again we learn more about Ken Seeber. "When I worked at Orbital, I had made 2 road racing 125 cc motor bikes for myself, but in later years I had a desire to make a road licensed vehicle. It was going to have a body and use a car engine and be different. Various concepts were looked at, but a trike looked to be the go. Initial plans were to use a Subaru engine with the engine forward of the rear wheels. At the same time, Orbital had bought one hundred Ford Festivas and had removed the engine and gearboxes to be replaced with an Orbital 3 cylinder, 2 stroke, direct injected engine plus a gearbox with different ratios. A brand new engine and gearbox as the basis for anything looked good, so that was that decision made. Once competed we called it the STRIKE".

It took a couple of years to build "the bodywork being the real hard bit", but it was completed, police road worthy passed and is still occasionally used "if it's a fine Sunday morning, I'll spark it up and my wife and I will go to a country pub for a counter lunch"

## STILL WHY STRIKE?

"Well as it's a TRIKE, put an S in front from my surname and you get STRIKE...nothing to do