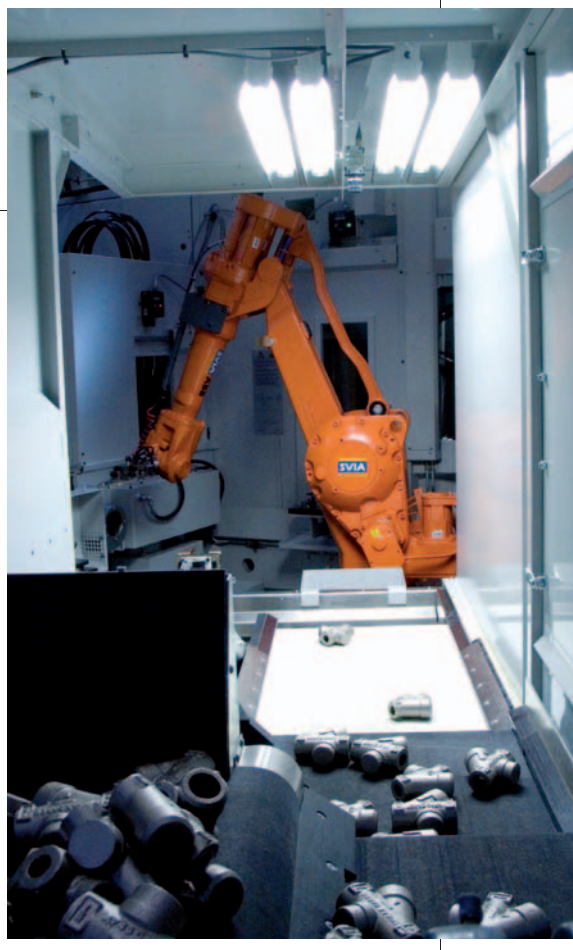
Automated success



The SVIA unit is a standard piece of equipment

An investment of £1.3 million in a single, automated production cell has secured the UK-based manufacturing of a key part for Spirax Sarco. Andrew Allcock went to Cheltenham to find out more

Spirax Sarco is a UK-headquartered and listed, globally located world leader in the design, manufacture and installation of steam plant equipment – specifically boiler and pipeline control valves. Its products are used in nuclear submarines and power stations, for example, and it had sales in 2006 of just under £400 million. Its largest market is continental Europe.

At the company's Cheltenham-based, Runnings Road main manufacturing plant, the largest single machine tool investment ever made by the company has secured the UK manufacture of a key family of parts. A fully automatic Witzig & Frank Triflex CNC rotary transfer machine with integrated SVIA Multiflex raw material feed, a separate but integrated standard grinding machine supplied by Diskus Werke Schleiftechnik, plus heat treatment equipment supplied by local company Cheltenham Induction Heating has cost Spirax Sarco £1.3 million but has boosted productivity, secured the UK manufacture of these parts for years to come and will deliver a payback of under 2.5 years into the bargain.

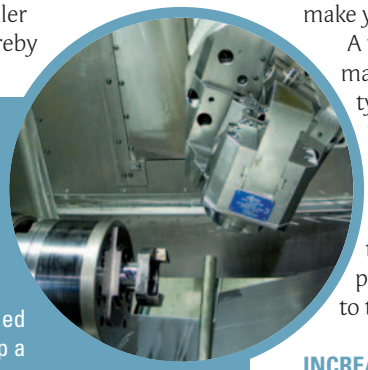
Delivered in December 2007 and commissioned in January this year, the cell (see box below) is the fruition of a project that started in September 2005, with the order placed in November 2006. And so successful has the initial start-up been that already similar technology is on the agenda for another cell at Cheltenham; while it is also being eyed up by other Spirax Sarco companies – notably in the USA.

The parts being made are so-called Thermodynamic Steam Traps; basically valves whose purpose it is to trap and return to the boiler condensate, thereby increasing the efficiency of steam plants by returning heated water to the boiler to make yet more steam.

A family of nine castings variously machined sees 128 different part types made at the rate of 123,000/year. Some 3 million have been made since 1981. Indeed, Cheltenham is their global manufacturing centre, but with the company's global footprint, this position could not be assured prior to this investment

INCREASING DOWNTIME

The previous method of manufacturing made use of machine tools up to 35 years' old, and was based on a manually tended cell of three machines: one Gnutti and one Wenzler rotary transfer machine plus a Lumsden grinder. The existing machines, which had already variously been rebuilt over the years, were seeing



The system and process in more detail

The four-station Witzig & Frank Uniflex is fed by a standard SVIA system (pictured top right) from Sweden. It takes stillages of parts as supplied and upends these onto a circulating conveyor. This system allows parts to spread out and passes them under a camera. If parts are adequately spaced out, the camera stops the conveyor. The robot is able to pick up a part no matter what its orientation.

The robot then loads a new part into the first, overturning station (above) after removing the machined part. The machined part is then placed it in the induction heat treatment unit to harden the sealing surface before moving to the separate grinding machine to grind the sealing surface.

While the part itself is quite simple and, bar the three 2 mm diameter holes, not overly challenging, this heating process is a key area, with Spirax Sarco's knowledge critical for successful, extended operation of the valve, Mr Fern underlines.

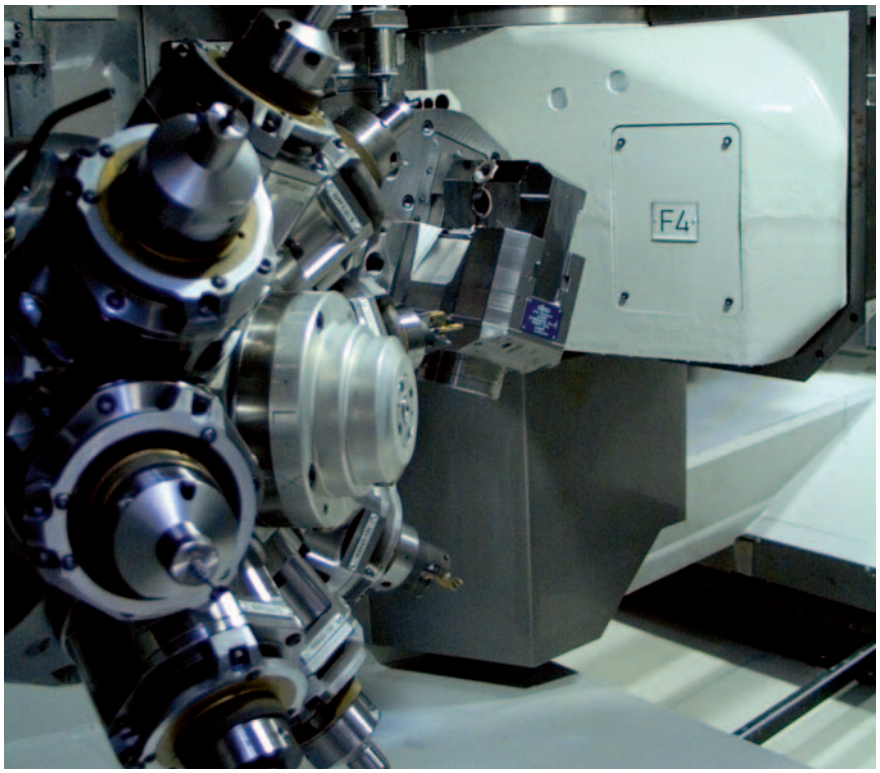
increasing amounts of downtime, both for setting (eight hour shift/changeover) and due to breakdown: collectively, 60 per cent. A production backlog and negative impact on customer service were the result. The key to globally competitive manufacture for any replacement technology was to drastically reduce the manual labour content, explains Roger Fern, production engineer, who has been responsible for this project and its justification.

As with any plc, justification for any investment had to be thorough and cover all alternative scenarios. Those scenarios took in: do nothing; install like-for-like replacement; refurbish the Wenzler and Gnutti machines (again); install four robot-loaded turning and milling machines (turning/milling technology is employed at the company's French factory but for slightly different, lower volume parts); install the Witzig & Frank automated cell; transfer production to another group factory; plus the requisite make-or-buy analysis.

Between the five UK investment choices, the Witzig & Frank machine came out as clear winner in the reduction of manual labour, output and payback stakes. The continuation of the existing plant, its rebuild or its like-for-like replacement offered nothing on this score, of course, they required the same 123 man-hours per week for a production output of 19.5/hours. What's more the rebuild investment was just over £1 million, while the replacement cost would have approached £1.2 million, so no huge savings were on offer.

The turning and milling option – which at £1.36 million was the most expensive – cut the labour content to 27 man-hours/week for an output of 28 pieces/hour, but the Witzig & Frank cell – at a slightly more reasonable £1.3 million – won hands-down with 25 man-hours required per week for an output of 40 per hour.

Setting time between jobs on the Witzig & Frank is just 1.5-2 hours against the previous system's one shift (eight hours), while the downtime due to breakdown is minimal for the new technology, of course, although maintenance requirement downtime was included in the justification – a 95 per cent uptime figure has been guaranteed for three years, with Spirax Sarco having to adhere to a preventative maintenance schedule on their side. Modem linkage allows remote diagnosis from Germany.



One of the four machining stations, three of which have turret-held tooling set to work on fixture-held components, seen in the background. The fourth, overturning station can be seen on page 67

The outcome is that there is 20 per cent spare capacity available with the new installation, thus allowing it to support increased growth and eliminate the former almost permanent backlog.

In these 'green' times, a point worthy of note is that the power consumption of the Witzig & Frank cell was also the lowest – annual costs running at just under £10,500 against the existing cell's almost £19,000 and the nearest contender's £13,000, the turning and milling option.

There were alternatives to making in-house in the UK, though. The company has manufacturing operations in China, for example. However, this was dismissed because the low labour content of the new installation (¾ of a man) plus import duties into the EU negated the effects of a low-wage economy. In addition, the level of technical and manufacturing competence was not considered high enough.

On the make-or-buy front, the company already sources raw castings from India, so a logical question was 'why not outsource fully machined from India?', says Mr Fern. However, set against the £1.3 million investment's capability and compared on a marginal machining cost basis, calculations showed the India price to be 68 per cent higher. This clearly underlines the competitive advantage that minimal manning and automated manufacture have delivered.

But the strongest argument against outsourcing was that the parts are core products, and moving them out of group

would have been contrary to 'Group Strategic Objective'.

A strength of the Witzig & Frank system is that it fits the company's lean, LIFE (Little Improvements From Everyone) initiative, and also complements what is soon to become a demand-driven production environment (demand flow technology), following the switching over to a new computerised production management system – "But we wouldn't really want to do a run of under 200," Mr Fern offers. Another recognised strength is that the fully CNC machine could be retooled for other components should the business change in coming years.

The new installation has also allowed the company to move away from a hardenable stainless steel with low sulphur content (CA40F) to one with zero sulphur content (CA40). Sulphur was incorporated to aid machineabilty, but this negatively impacted castability. While the old system allowed for the manual inspection by operators for blow holes or inclusions, for example, this fully automated system will not distinguish between good and bad, and a tool breakage on this high productivity machine would clearly be unhelpful, while similarly, wasting time by processing parts only to discover a void in a seating face is also not desirable, explains Mr Fern.

This switch, not an initial requirement, was an extra challenge thrown into the mix: but the proven capability of Witzig & Frank machines to tackle difficult-to-machine materials was a factor that saw it win in the initial selection process against other rotary transfer makers, in fact, and it has had no difficulty with the new material.

As at *Machinery*'s early March visit, the cell was running on an initial family of three parts which had been delivered as a turnkey complete with programs and fixturing. The company was running the cell up and analysing dimensional and surface finish quality levels – superior to previous practice, of course.

Trials of a batch of 200 at Witzig & Frank had already demonstrated capability and also that the benchmark cycle time of 76 secs/part could be achieved, with this expected to be bettered. Tooling costs per part are being progressively reduced, while tool life is being balanced to eliminate multiple stops to change single tools. Production shifting is currently one day and one night shift with the potential for automated running between the two: "But it is early days yet," Mr Fern explains.

It is left now for Spirax production engineers to program the remaining 125 components and to draw and manufacture the fixturing, both to be undertaken in house. Programming will take the form of a modification to the initial three programs, and in-house design and manufacture of the fixturing will similarly be based upon the delivered technology, although it is proving to be a more lengthy undertaking than initially envisaged, admits Mr Fern. The original cell is still running to clear the backlog of work but will be gone by the end of the year at the latest, he concludes.□

The [potential] cost of buying cheaper

Supporting the new cell and adjacent to it is a fully automated tool store/management system supplied, managed and supported by Kennametal – supplier of all tooling used in the cell. A major reason for this is the company's strength in the drilling of small holes in difficult-to-machine materials, says Mr Fern.

While Spirax Sarco already has tool dispensing technology elsewhere, this dedicated facility will allow much deeper analysis of tool cost per part and any deviation from normal tool life, he offers. This capability will, for the first time, allow any deterioration in casting quality to be linked precisely to impact on tool costs. "Buyers are often rewarded or congratulated for driving costs down at the purchasing end while potential negative impacts at the production level, such as increased tool costs due to lower quality or more variable raw material, see production efficiency drop with consequent management focus on this in isolation of the root cause.

"With this tool management system, Kennametal will flag up immediately if tool usage moves away from the norm, while also being able to put a definite cost/part price on it." Currently Kennametal emails a report to the tool storeman each Monday with cost, usage and parts produced information. The information can be highly detailed, if required.

Raw casting quality is now a highly critical issue. As already highlighted, the company has moved away from the sulphur content because of its impact, but dimensional control must now be stricter because any deviation could see the component fail to locate properly in the fixturing with consequent damage to tooling and downtime in the system. In a manual system, the person loading could compensate for poor quality by not using the part, of course, but in this automated system that element of flexibility has gone. " I don't want my machine to find the rejects," underlines Mr Fern.

A second machining area is visible in this shot