



CMS expands with Replicast®

CMS has recently expanded its Replicast® production facilities. The high quality, near-net shape castings with a smooth surface finish provide the company with a competitive edge, helping them to win new customers wanting valves and other finished castings ready for assembly.

CMS Srl located in Urbisaglia, Italy, obtained a licence from Cti for the Replicast® process in 1987. The success of the operation over the next ten years led to the decision to expand the plant further in 1997, with considerable investment in automation and new technology.

Mr Serdi, Managing Director of CMS explains that Replicast® has become a crucial means of developing relationships with new customers. "The process delivers products of a superior quality and surface finish compared with sand castings, giving CMS a distinct advantage in a highly competitive marketplace."

CMS has both sand casting and Replicast® processes in operation at the same plant but according to Mr Serdi, "It is better for CMS to offer Replicast® because of the quality of the product and the cost savings. The material costs are the same but there are savings in fettling and machining

time and for us it is a more automated process, with less manual labour."

CMS traditionally manufactured valve bodies for the chemical and petrochemical industries, but they have found new markets in the cement, pulp/paper industries and general engineering. Replicast® has given them the ability to move into new markets such as diffusers, impellers and heat treatment furniture. The trend is for customers to expect finished castings ready for assembly and so CMS increasingly carry out all the machining on site. Demand is now so great that the company is looking at setting up a separate machining facility in the near future.

At present CMS exports more than 20% of its castings. The plan is to increase this figure significantly and the company now has agents in major European countries.



Expansion in melting

Having used Replicast® since 1987, CMS believe they have perfected the process in terms of quality. They have now turned their attention to increasing productivity and reducing the fettling operation further.

The investment in 1997 doubled the melting capacity from the original 1.3 tonnes. This large increase was prompted by confidence in the potential growth in the market for high quality castings, coupled with a need to produce double the quantity in the same shift due to newly enforced power restrictions.

The CMS plant in Urbisaglia still employs less than 50 staff, the same as 4 years ago. The alternative to the large capacity furnace would have been to run a third shift, with the associated increase in labour costs. Instead, CMS installed a two tonne capacity coreless induction melting furnace and a three tonne capacity coreless holding furnace, linked to an induction heated pouring ladle. This plant can supply the majority of the company's steel requirements in the short periods of the day when off peak energy tariffs are available.

Automation of Replicast®

Mr Serdi explained how the Replicast® plant developed over the first ten years. "When we first obtained the licence from Cti we could only install a small pilot shelling plant because of space restrictions. Despite this, we could still see that the system worked well and that the castings were much better than the conventional sand castings. Once we had finished constructing our new building we were able to install the first full-scale plant, using a robot for shelling and a powered ceramic shell dryer. This enabled us to demonstrate the potential of the process."

As part of the investment in 1997, the plant was extended to 6,500m² and CMS introduced new equipment to further optimise the pattern and ceramic shelling processes. "We added a fully automatic pattern press to the two semi-automatic presses and the polystyrene bead expander". A new temperature controlled drying room was also installed to accelerate the stabilisation of the polystyrene patterns before shelling.

CMS built two automated shelling lines, each with 48 stations. Both lines incorporate a Comau industrial robot which handles and manipulates shells up to 350mm in diameter. When larger trees are required for the casting line, CMS manufactures the feeders separately and then attaches them after shelling. The largest valve currently in production at CMS is around 150kg finished weight.

Small price to pay for materials

The shelling process for Replicast® has several advantages over the lost wax process. Fewer coats are needed making the process quicker and more cost effective. The finished shells are also lighter and easier to handle.

Replicast® uses less than 50% of the same high quality ceramics as investment casting. Once shelled, the moulds are transported to the firing furnace where the polystyrene is burnt out before pouring. CMS has a firing furnace with a substantial afterburner making Replicast® a very clean process with no emissions. Up to 15kg of polystyrene patterns can be fired in each batch. Given that each kg of polystyrene is replaced by 160-200kg of metal, a full furnace of moulds is equivalent to 2.4-3.0 tonnes of poured steel.

After pouring, the ceramic material is removed on CMS's recently enhanced shotblast line. All the stainless steel castings produced by the company are put through an automated pickling plant designed in-house.

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To find out how your company could benefit, contact:

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Future plans

With machining facilities on site, CMS is able to manufacture its own Replicast® tooling. The need for an aluminium tool can be one of the barriers to winning new business and yet, last year alone, the company produced 55 new tools for customers, proving that there is a high demand for new Replicast® products and confidence in CMS's ability to service future needs.

Mr Serdi is continually investigating ways to increase productivity and efficiency. For example, CMS is designing new ways to assemble the casting trees, which will allow a simple abrasive disc cut-off without the need for additional fettling.

No taper is needed in the Replicast® process. On valves, this means that there is no need to spot machine the back face of the flange. Machining is needed on the raised face of the flange only. Feeders can be positioned on flat surfaces making cut-off simpler and, because the feeders can be positioned more effectively, less feed metal is needed.

To get the best out of the process, all valves should be cast as near net shape as possible. Minimum wall thickness can be used, as core shift is eliminated, and the metal reduced to the minimum machining allowances, with features such as holes in the flanges cast-in. This results in a Replicast® valve being up to 25% lighter than its sand cast counterpart.

Research and development work is always ongoing to convert new products to the process. Mr Serdi is investigating ways to cast impellers without machining and at improving the surface finish of diffusers for multi-stage pumps.

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Cti support for new licensees

CMS operates Replicast® under licence from Cti. The process was first developed in the early 1980's and since then over US\$15 million of Replicast® castings have been produced at Cti's own full scale demonstration facility. Products are made in many materials from carbon steels to nickel base alloys, in product and market development activities. However, it has taken the commitment of companies such as CMS to demonstrate the commercial success of the process.

Now, the interest in Replicast® around the globe is remarkable and the number of licensees is increasing significantly. As part of the licence fee, companies setting up a Replicast® facility benefit from Cti's many years of expertise. Will Jeffs, Cti's 'Mr Replicast®', leads a team of Cti process specialists who provide support and training for licensees during start-up, and ongoing support and troubleshooting even when production has become established.

Cti also provides help with plant selection and can even offer use of its own facilities until a licensee's new plant is fully operational.

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Summary

From the experience at Cti and of licensees, the main benefits of the process have been found to be as follows:

Benefits compared with sand casting

- high and consistent dimensional accuracy
- exceptional surface finish
- reduced casting weight
- consistent casting quality
- waste streams minimised
- VOC's eliminated during casting as no gas is evolved from the inert ceramic
- hot-tear defects and sand inclusions eliminated
- reduced finishing costs
- reduced machining costs
- optimisation of casting design by eliminating parting lines, cores and draft angles, and reducing feed metal
- more castings per melt
- twice the sales value from the same floorspace

Savings compared with lost wax

- Increased productivity due to fewer shell coats and accelerated drying
- lower material costs per kg of finished casting
- lower pattern costs
- efficient manufacture of larger castings – 550kg castings produced at Cti



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The Replicast® process



1

A high density expanded polystyrene pattern or 'replica' of the finished casting is produced in an aluminium die.



2

A coating, typically 4-5 layers, is built up on the replica to produce a ceramic shell approximately 5 mm thick.



3

The coating is fired at 1000°C to remove all traces of polystyrene (and carbon) and to maximise the strength of the ceramic shell.



4

No gas is evolved from the inert ceramic during pouring, the thermally stable ceramic does not erode and no sand inclusions are produced.



5

The ceramic is easily removed to reveal a casting with an exceptional surface finish. Casting quality is consistently high with quite exceptional dimensional accuracy.

Replicast® is a Registered Trade Mark of Castings Technology International.
The Process is patented and may only be used in accordance with the terms and conditions of a licence agreement.

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