



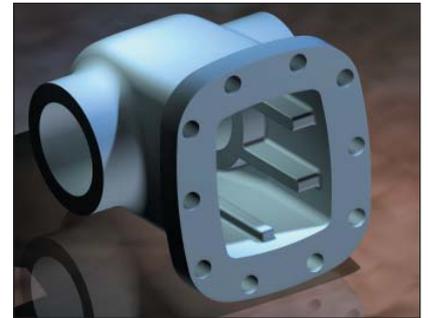
Bestobell Valves

## Bestobell Valves Convert to Castings to Secure Export Opportunities

Sheffield based Bestobell Valves Ltd has been manufacturing valves using traditional design and manufacturing techniques for over 140 years. However, following a survey of their markets, they discovered that their designs were facing greater competition from newer valve technologies. Therefore, they needed to investigate bringing their valve designs up to date, and so called on Cti to assist.

### Key project objectives

- design a valve using the relevant design codes, embracing the inherent valve manufacturing and casting experience, using 3D computer modelling
- verify initial valve designs using cast valves manufactured by rapid prototyping technologies
- optimise the casting design and select the most appropriate casting process to achieve the 'lowest total product manufacturing cost'
- quantify the quality, time and cost factors associated with the manufacture of the new valve design
- develop the casting supply chain
- apply the design and casting principles to other gate valves within the range



### Industrial impact

- Bestobell have now established 3D modelling as a design tool, with 2 seats of Solid Works available
- 50, 65 and 80mm stainless steel cryogenic gate valves are now being manufactured using the design and casting principles developed as part of the ICT Carrier Programme
- feedback from the users of this range of cryogenic valves is very positive with all of the valve actuation and performance criteria being achieved
- sales revenues of £90,000 have been generated to the end of 2003; this is projected to rise to £200,000 over the next 5 years
- export markets have been penetrated, now representing 17% of valve sales
- an additional engineering job has been created and secured based upon the success of the initiative
- the price of cast and machined components from the Far East proved to be lower than European competitors. Commercial pressures dictated that Bestobell had to extend their supply chain to the East.



## Why was this work necessary?

Bestobell produce standard and bespoke valves for industries such as tank fabricators, trailer manufacturers and producers of process plants. The company has state-of-the-art manufacturing and assembly plant dedicated to the production of bronze and stainless steel units. These are traditionally manufactured using cell production with controlled induction brazing. Components are cleaned using aqua-blasted glass beads and ultrasonic methods before entering a dedicated clean room for assembly and testing. The valves are then tested at full pressure in cryogenic conditions (-196°C).

Sales and marketing information collected by Bestobell personnel indicated that their traditional gate valve designs were old fashioned in actuation, required enhancement to meet international standards and were expensive in comparison to equivalent valves.

The initial response to these findings was to manufacture gate valves using a combination of commercial T pieces and solid bar, which were fabricated and machined to achieve the desired dimensional requirement. Although these valves met their technical requirements, they were slow and costly to produce, and prone to non-conformance due to difficulties experienced during welding.

With this unsatisfactory situation in mind, a partnership between Bestobell and Cti was created as part of the ICT Carrier E-Valve Project to investigate the use of optimally cast valves as an alternative to the forged/fabricated version. A 65mm cryogenic gate valve body was selected as the test component to establish the suitability of castings.

## Key steps on the road to success

Based on the traditional 2D drawings of the forged/fabricated valve, the design engineers from Bestobell Valves and Cti developed a design for the cast valve alternative. This design was translated from 2 to 3D using recently purchased modelling software. Cti's design engineers provided specialist valve modelling advice, strategies and training.

Casting designs were jointly developed with the 'lowest total manufacturing cost' as a key driver. The resultant design incorporated:

- as-cast bolt holes in the cover flange
- casting tolerances to ISO 8062 CT6
- cast to profile valve seating surface
- machining allowances of 2mm

Casting design was achieved using 'empirical calculations' and casting design expertise with the aim of achieving a yield commensurate with the quality standard and feeding removal techniques using abrasive cut-off techniques.

Rapid Prototype models of the valve were manufactured from the 3D model generated, and the resultant wax model was used as a pattern for the investment casting - the selected casting manufacturing process. The valves were cast in stainless steel at Cti. These passed the subsequent radiographic inspection and so were machined, assembled and tested by Bestobell Valves.

The initial sample valves highlighted a minor problem with the seating of the gate. This was rectified with a subtle change to the design. With the 3D model modified, new samples were made using the same Rapid Prototyping techniques. This set of cast valves was successful and were fully tested to meet the exacting international codes ASME B31.3 and BS EN 1626.

Test valves manufactured from the Rapid Prototypes were supplied to one of Bestobell's major US customers for evaluation. The new valve exceeded their performance criteria as it resolved the issues associated with leakage of the weld.

Having established a technically acceptable valve design, the commercial aspects of the valve became paramount. It was vital to maintain and grow market share in the highly competitive market for cryogenic trailers used to transport liquid gas. The valve designs were supplied to foundries around the world. The price of investment dies, cast products and machined components delivered to the UK from the Far East were substantially lower than those of their European competitors. Commercial pressures dictated that Bestobell had to extend their supply chain to the East in order to obtain the commercial edge required to meet valve sales.

By purchasing fully machined cast valve bodies, any issues of quality and delivery associated with a distended supply chain were minimised. Further cost benefits have been realised by commissioning the same supplier to supply the 50mm and 80mm variants of the gate valve.

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