

# Furnace relining – can metal to metal be achieved in seven days?

In this contribution from IMS and Permotech, Inc, it is suggested that the use of the company's BIG-BLOCK™ refractory manufacturing and installation expertise brings the possibility of relining a furnace, from metal to metal, in seven days, ever closer.



Typical block incorporating a burner prior to installation. The photograph shows the diversity of shape and size attainable

The concept of being able to carry out the relining of an aluminium holding or melting furnace, metal to metal, in a period as short as seven days might be thought impossible. Right now, this is probably true. However, after success in recent projects, Permotech and IMS believe they have the only solution that is able to look at 10 days as being an achievable rebuild programme, with eight days being the goal. Utilising their "BIG-BLOCK™" refractory manufacturing and installation expertise, Permotech has recently redefined the time required to refurbish a 100-tonne-capacity tilting melt furnace. Using their proprietary techniques and skilled engineering project management, Permotech has proved that it is possible to take a furnace from hot and full of metal, back to hot and full of metal *inside 10 days*.

Why is such speed really necessary? Currently, the demand for aluminium is at its highest in some time, with cast-house managers seeking longer runs, shorter maintenance and minimised downtime. What was formerly spare capacity in furnaces is now utilised in full production. The Permotech BIG BLOCK engineered system now leads the way in turning the cast-house manager's wishes into reality.

Over 25 years ago, the concept of using larger "bricks" to reline a furnace was investigat-

ed. The intent was to minimise joint issues and maximise life, with the added benefit of installation speed. Several key problems were immediately discovered, requiring years of research and investment that would enable core furnace expertise to be developed. Permotech was the pioneer of the BIG BLOCK concept, and has now taken the art to the next level, by continuing to reduce the time required from "metal-to-metal", and in turn, continuing to lead the field in furnace refractory construction technology.

What makes BIG BLOCK so good? Jed Dulberg, Technical Director of Permotech, writes: "The choice of refractory is the first critical component. For the critical hearth and lower wall sections, Permotech has developed BETA-2HPSL, a proprietary high-alumina low-cement castable designed specifically for the most abusive aluminium furnace applications. Considered by several major aluminium companies to be the best material in its class, this high-performance castable exhibits exceptional resistance to mechanical abuse and reaction by molten aluminium alloys. The next critical component is the BIG BLOCK manufacturing process technology. In addition to using our own materials for hearth and lower wall linings, Permotech uses other well-known products for the upper wall and roof sections. These are typically low-

cement 50-60% alumina castables that are selected by the customer. Regardless of the choice of material though, Permotech utilises state-of-the-art manufacturing technology and highly-controlled firing conditions to ensure that each several-tonne BIG BLOCK is processed to exact specifications that will ensure a perfect fit and optimum performance. Permotech BETA-2HPSL BIG BLOCK linings offer exceptional performance, far exceeding that of traditional cast-in-situ or brick furnace linings. We are very confident that BETA-2HPSL BIG BLOCK will offer service lifetimes in excess of seven or eight years, in those furnaces where typical lifetimes are four years or less. We honestly do not yet know the full potential lifetime, since to-date, not a single BETA-2HPSL BIG BLOCK lining has been replaced".

The final component of the BIG BLOCK system is engineering. Even with the best-made refractory furnace block, metal-to-metal in 10 days is not possible without a dedicated engineering commitment. The Permotech Engineering Services Department is an experienced problem-solving team whose goal is to provide rapid engineering, design, project management and installation services for a wide range of molten metal handling systems, including the rapid turnaround of complete turnkey BIG BLOCK furnace rebuilds.

For commercial reasons, the full details of Permotech's systems cannot be detailed, but the following outline of a recent 100 tonne furnace project may be of interest:



Typical appearance after three years arduous use – almost unchanged since installation

Permotech was invited to tender for a re-lining project of one of the workhorse furnaces used by a key client. The overall cost of the relining operation was not the driving investment parameter. However, minimising the downtime of the furnace was critical. Traditional rebuilding methods would require between 30 and 50 days, depending on the technique, but in order to ensure good continuity and minimise plant disruption, a new approach had to be used. Permotech worked through the design phase of the project, fully detailing every aspect of the installation, including materials selection and block design, full programme of manufacture, delivery scheduling and installation programme. It was not until all of these subjects were fully addressed that Permotech felt confident in committing to a target downtime of "less than

two weeks". This offered the potential for a three to five week reduction in downtime or, said another way, three to five additional weeks of production potential. If achieved, this financial benefit would easily offset any additional materials costs, and so contribute to savings in the rebuild cost overall — a major financial advantage.

The approximately 50-piece BIG BLOCK jigsaw puzzle, made to Permatech's exacting engineering and quality specifications, was shipped to the site ahead of work commencing, and when ready, the furnace was turned off. Supervised by Permatech's engineering staff who project-managed the scheme, a local Permatech-approved contractor went to work, and not only achieved the promise of a two-week rebuild time, but with the following timeline reduced it further:

- 1 One day to wreck out and remove the spent furnace refractory.
- 2 Five days to re-engineer the steelwork and install the BIG BLOCK through the front door and roof access.
- 3 One day to complete all jointing, interfacing and finishing.
- 4 Two days to complete the controlled furnace preheat. The purpose of the preheat was to minimise thermal stress and ensure the integrity of the BIG BLOCK construction. Since all of the lining and insulation refractories were dry, a typical extended bakeout was not required.
- 5 Ten days after switch off, the furnace was

filled and operational.

Looking forward, Permatech firmly believe that the customer has saved up to 40 days downtime. This can be equated to a dollar value increase in production, offset against the installation cost of the furnace, showing just how cost effective the BIG BLOCK system really is. It is not the outright initial cost that is the issue, but instead, it is the balance of cost v cost recovery through productivity benefit. Furthermore, very little ongoing maintenance cost is expected, which further contributes to real dollar savings.

Permatech believes that this project has been a significant step forward in furnace rebuilding technology, and based on experience gained, firmly believes that further BIG BLOCK system advancements are possible to reduce the time required for "metal-to-metal" to under eight days.

#### Reader Reply No.53



Typical furnace installation showing lower wall, upper wall and roof