

Refractories for sheddies

A guide to firebricks and other things

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PHOTOGRAPHS: CERTEC, GERALD SHACKLOCK

A standard firebrick, a 40 split and 25 split.

It has been said that the beginnings of civilised society can be traced back to the ability to control fire. Societies able to do this became the dominant civilisations of the time and led the world out of the Stone Age into the Iron Age and later Bronze Age, along with developing pottery and ceramics. In fact, civilised society as we know it stemmed from this control and has led, ultimately, to the sheddie being able to produce his own outdoor fireplace, pizza oven and even the home foundry. It has even been claimed that the profession of refractory engineer is the second oldest in the world – men have always got their priorities right. Articles on pizza ovens, outdoor fireplaces, home foundries and the like appear to have created interest and inquiries for “hot bricks” and “that casting crap” and “fireproof wool” so it’s opportune to present a very brief summary of refractories for sheddies.

Collins *English Dictionary* defines refractory as: 1 (adj) stubborn or rebellious (well, that covers most sheddies); 2. (of a material) able to withstand high temperatures without fusion or decomposition.

Refractories include products from the familiar firebrick through to the tiles found on the Nasa space shuttles – “flying brick-yards” as they are known by their drivers. These are possibly beyond the scope of even the most ambitious sheddie, so we will stick to the home product range.

This is the alumina-silicate family and as the name implies is manufactured from alumina-based clays and aggregates. Products in this range can be broadly divided into

* firebricks;

* refractory concretes – “castables”;

* mouldables (also called plastics);

* mortars; and

* ceramic fibre.

FIREBRICKS

Firebricks range in alumina content from 25 percent through to 90 percent. Typically, the 35 percent alumina high-duty (HD) and the 45 percent alumina super-duty (SD) brick will suit most sheddie applications with the HD being more than adequate for pizza ovens, outdoor fireplaces, fire pits etc. The 45 percent SD is used for foundry applications. A full range of high alumina brick is available from Huntly if you are thinking of starting up your own steelworks. Nomenclature for bricks is generally based on the alumina content e.g. shiral 35, shiral 45, shiral 50 etc.

The standard size for firebricks in New Zealand is 230 x 115 x 75mm. They are also available as splits with thicknesses of 25mm, 40mm and 65 mm.

The standard shape is called a square. They also come as a side arch with the 115mm dimension tapered from 75mm to 69mm, 63mm and 51mm, enabling the construction of an arch or a circle with a lining thickness of 115mm, or as a wedge with the taper over the length of the brick giving a lining thickness of 230mm. The arch is frequently used and the wedge rarely used.

REFRACTORY CONCRETES

Refractory concretes are castables, “that casting crap.” These are a blend of graded refractory aggregates and calcium aluminate cements and generally come in a 25kg bag. Just add water. To achieve best results use potable water - if it’s good

enough for whisky, it’s good enough for refractory castable. Keep the water added to what the manufacturer specifies. It is preferable to mix by hand in a mixing trough rather than in a conventional drum-concrete mixer. With the correct amount of water added, concrete mixers tend to produce “ball bearings” rather than a homogeneously mixed product. Paddle mixers are the recommended weapon of choice. The ideal to aim for is a “ball in hand” mix consistency. To test, take a handful of the mixed product, form it into a ball and chuck it up and down 150mm a couple of times. If it slumps and oozes through your fingers it is too wet. If it breaks up, it is too dry and if it just slumps a bit it is about right.

Ideally, castables should be vibrated into place but rodding and tamping will get you there on small jobs. A quick sweep with a wooden float gives the best finish. If you overwork with a metal float, it brings the fines to the top and tends to seal the surface, thereby making it more prone to explosive spalling on initial heat up. Castables require slow and controlled initial firing and can explode if fired up too quickly (“explosive spalling” occurs when moisture trapped in concrete under heat becomes converted into uncontrollable steam pressure which eventually explodes super-heated concrete out of the structure). Ask your supplier for a heat-up schedule.

Nomenclature for castables is generally based on the maximum continuous service temperature of the product. e.g. shiral 145 is a 1450 grade castable (maximum service temperature of 1450° C) and is more than adequate for most sheddie applications.

Dense castables are available up to an 1800° C rating. If you have something that hot in the shed, drink the whisky and call the fire brigade. True sheddies might like to spend hours smashing up old firebricks with a hammer and making their own brew by adding fondu cement but the result is unlikely to be as good as the factory-made product.

Castables are also available in insulating lightweight grades for use as back-up linings as well as hot-face applications. Castables generally require anchoring to the furnace side-wall and roof. Anchors should be in a “V” configuration made

from 304 / 310 stainless steel, with the end no closer than 25mm from the hot-face and a spacing of about 11 per square metre depending on the lining thickness. Overhead will require up to 22 anchors per square metre.

MOULDABLES

Mouldables are a mix of refractory aggregate and clay which normally comes as a slab or slabs in a 25 kg carton. These are used for patching or as a stand-alone hot-face lining for pit furnaces, ladles etc. The material is hammered into place. The higher alumina products may be available as a phosphate-bonded product which has the advantage of setting hard at 400° C. Clay-bonded products should be fired up to 1200° C minimum before use in order to achieve a ceramic bond, even if the furnace operating temperature will be lower. Once the heat-up schedule has commenced, under no circumstances should it be stopped as a mud-slip plane can form and the hot-face can sheet off. Immediately after installation, the lining should be "rodded" to allow steam venting to 2/3 lining thickness at 200mm centres. A pointed welding rod does the trick.



High-duty brick for pizza ovens.

REFRACTORY MORTAR

Refractory mortar is either "heat-set" or "air-set". Heat-set mortars have no binder and are a blend of clays and ball-milled aggregates relying on a ceramic bond at high temperature. This bond is comparatively weak.

Air-set mortars are ball-milled aggregates bonded with sodium silicate. They come ready-mixed in pails or can be available as a dry mix in bags. While having a much stronger green strength than heat-set mortars, the air-set mortar only reaches full strength after being fired to a few hundred degrees.

Fireclay is a naturally occurring clay that is ball-milled and can be used as a

heat-set mortar. Refractory mortar joints should only be 1-2mm thick.

CERAMIC FIBRE

Ceramic fibre is available in blanket form in rolls, as vacuum-formed board, paper and rope. The base material is made from alumina-silicate aggregates melted and either spun or blown to form a blanket or loose fibre from which the derivative products are made. The products are normally available in 1260 grade or 1400 grade.

These are about the most cost-effective high-temperature insulation products available.

Safety precautions are important for handling ceramic fibre. It is recommended that full-cover paper overalls be worn when installing and handling the blanket and exposed skin be given a coating of barrier cream. You should wear a p2 respirator.

Special care should be taken when handling used material and a p2 respirator is the minimum. In overhead or enclosed conditions, a full-face p3 respirator is recommended. Installation instructions will be available from the supplier.

Your suppliers are there to help as well as take your money, so ask the questions. ▲



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