**Instructions for the use of Castables   (Heat Resistant Concretes)**

**The Product**

Refractory castables consist of suitably graded aggregates and hydraulic cements in proportions formulated to achieve certain desired properties for the particular end use. They require only the addition of clean water either by hand or mechanical mixing or during pneumatic gunning to form a heat resistant concrete piece or structure.

**Forming**

Refractory castables can either be cast between formwork, cast in-situ, gunned, trowelled or cast into moulds to make special shapes Coarse, regular or fine mixes are available to suit the method of application and end use selected. As most castables have negligible shrinkage, the moulds, formwork, etc., can be made to exact size. Mould should be watertight and structurally strong and treated with a suitable release oil or grease to facilitate stripping.

**Preparation of Surfaces**

Steelwork should be reasonably free from scale and timber should be clean and smooth. For repairs to an existing brickwork or castable structure the area should be cleaned by chipping off slagged or affected areas (See Note 1. below) and then thoroughly damped to prevent absorption of mixing water from the newly applied castable.

**Mixing**

Mixing is best done in a paddle mixer, but it is essential that all vessels and implements are clean. Contamination by lime or Portland cement will have a detrimental effect on setting time and properties. For small casts, mix with a shovel on a clean surface. For mechanical and hand mixing, water is worked into the material gradually until its texture changes from “harsh” to “workable”. The correct water addition is achieved when a handful of mix can be formed into a ball and be tossed 30 – 40 cm into the air and caught as a cohesive mass.     If too little water is present,   the “ball” will break up.     If too much,   the “ball” will slump (See Note 2. below). Where vibration is used to assist placement, slightly lower water contents will give satisfactory results. Excess water reduces strength. Thoroughly mix before placing and never mix more than can be properly handled inside 20 to 30 minutes.

Ideally temperature of mixing water will be 10ºC to 25ºC. If site ambient temperatures exceed 25ºC, chilled water should be used. Where site ambients reach 35ºC or higher, loss of workability may be encountered.

The refractory concrete can be consolidated by rodding, tamping or vibration. Finish off the surface to the correct profile with a trowel or screeding level. Do not overwork and/or slick to a wet smooth finish. For restoration of vertical surfaces in particular a fine mix of the appropriate grade of castable is recommended. (It is applied with a trowel in the same manner as cement-sand plaster rendering on walls). Alternatively it can be cast behind formwork (See Note 3. below).

**Gunning**

Pneumatic gun placement procedures vary from product to product. Details of typical variables, nozzle air pressure and predamping levels, are available on request.

**Curing and Drying**

After the initial set, cover with damp bags, polythene sheeting, fine water spray, or apply a curing membrane etc., to prevent loss of mixing water. Cure for 24 hours, then remove covering. Air dry for 48 hours. Drying can be prompted by using radiant heat.

If a piece of cold steel when placed against the drying structure for 20 – 30 seconds exhibits moisture droplets on the contact surface, pore water is still present and drying should be continued.

**Firing**

A slow fire can be applied and the temperature raised at the rate of 50ºC approx per hour per 25mm thickness of lining until working temperature is reached.

**Incorrect Curing**

Castables cast in a hot environment or against a hot structure or denied a proper curing and/or drying treatment will not generate the same properties as at ambient temperatures.

**Notes:**

1. Always try to provide a “key” for the new material to adhere to, e.g. an enlarged joint.
2. When mixing, it is best to reserve a small amount of dry mix. If excess water is added, a correction can be made by adding in the dry mix and proceeding as described above. (If all the mix is committed and excess water is added, the result will be a segregated, under strength casting).
3. Light weight insulating castables are unsuitable for the trowelling vertical repair technique.

**The Curing and Firing of Refractory Castables**

**Densecretes and Litecretes**

Installed refractory linings and castings containing calcium aluminate cement binders should be cured prior to drying. This applies to both cast and gun placed material. Curing is necessary to prevent moisture loss during the setting of the material. If the moisture loss is allowed to occur, the refractory material will be weaker due to an incomplete hydration process of the cement binders.

Curing time should be at least 24 hours and maybe undertaken by several methods:-

1. Covering the refractory concrete with wet Hessian bags which must be kept wet
2. Covering with plastic sheeting
3. Spray the surface with a curing compound
4. Spray the surface with a fine water spray

**Drying of Densecretes and Litecretes**

After curing the lining should be air dried for up to 24 hours. If the lining is greater than 250mm, curing should be 24 hours. If Q.T. fibre is present in the refractory concrete, this step may be reduced to 8 to 12 hours for linings greater that 100 mm.

**Firing of Densecretes and Litecretes**

Raise the temperature of the lining to 100ºC to 150ºC at a rate of 15 to 25ºC per hour and hold for 8 to 12 hours depending upon the lining thickness. Ensure steaming ceases before heating the lining further.

Increase the temperature to 500 to 600ºC at a rate of 25 to 50ºC per hour and hold for 1 hour per 25mm of lining thickness; and

Increase the temperature to the final working temperature plus 25ºC if possible at a rate of 50 to 100ºC per hour and hold for 1hour. Never exceed the maximum service temperature of the refractory castable.

**REMARKS:**

1. The holding time is dependent upon the lining thickness. For each 25mm thickness above 200mm an extra holding time of one hour per step is recommended.
2. Preheating should be carried out as slowly as possible and with a good control over temperature. Refractory castables usually have a dense structure which does not allow the water to escape easily. A too rapidly increased temperature may create steam formation in the structure of the castable, thus causing spaulling of the layers from the surface and/or cracks. During preheating sufficient ventilation should be provided so that the water vapour can escape.
3. Temperatures are the lining temperatures measured on the surface of the lining.
4. It is of critical importance to execute a uniform and graduated drying out procedure with professional standards and practice. This schedule is accordingly made available without warranty of any kind. The firm or person executing the drying out procedure is solely responsible for any damages resulting to the refractories or other items for which Darley Refractories Australia Pty Ltd disclaims all liability.