

INSTALLATION INSTRUCTIONS for CALDERYS AUSTRALIA P/L

Installation method - CASTING.

- **CONVENTIONAL CASTABLES**

- **Water Addition**

Water is required not only for the hydraulic reaction with the cement but also to impart the required degree of workability to enable ease of placement. The wetter the castable the better it will flow, however, strength can be markedly reduced by too high a water content causing segregation of aggregate and cement and/or increasing porosity on drying and firing.

Too dry a consistency can also result in reduced strength due to insufficient lubrication or inadequate contact between the water and cement. For general casting, the 'ball in hand' consistency is a good guide to water addition, since some variation from the recommended quantities does occur from batch to batch due to composition and sizing variations.

- **Formers**

Untreated wood forms and/or porous back-up walls will absorb water from the castable that it needs to develop its hydraulic bond. Coat the form or back-up material with form oil or grease.

- **Pre-mix Entire Sack**

Premix entire bag of material then portion off when using only part of a bag since some segregation of the fine and coarse particles may have taken place during shipping and handling.

- **Avoid Contamination**

The mixing and handling equipment must be clean. If castable has been left in the mixer for a long period of time >60 minutes, it should be cleaned out as old material may cause the next batch to set more rapidly.

- **Mix Properly**

Never mix a castable on a floor or in a leaky mortar box where some of the binder may be washed away with the water that escapes. A paddle type mixer is recommended which mixes rapidly and homogeneously, so developing good workability with the minimum amount of water. Experience has shown that the drum type mixer has a slower and less thorough mixing action. Some of the more sticky castables adhere to the sides of the drum, preventing proper mixing action.

- **Mixing Time**

The mixing time is equally as important as the use of the right equipment. Mixing time for dense castables is 2-4 minutes. Ensure that castable has wetted right through and that correct amount of water has been used (See Data Sheet). Ball in hand test may also be used to determine the right water content.

- **Install the Castable within the Recommended Time**

Most castables gel considerably faster than ordinary structural concrete. Once the castable has started to gel do not add water to bring it back to workable consistency. Throw that batch away and mix new materials.

- **Consolidation by Internal Vibration**

Consolidation is aimed at minimising material segregation, eliminating voids and expelling air bubbles from the lining. The action of vibration reduces the friction between particles, enabling the castable to flow with a lower water content than for general casting and so achieving higher bulk density and strength. Thus, a consistency slightly dryer than the 'ball in hand' consistency is generally used. The exact quantity of water required is best determined on the job. The water content is correct when a fine film or sheen of water is observed on top of the castable during the vibration process. If this film is excessive then the water content should be reduced.

- **Vibration Technique**

The quality of the results obtained in vibration casting is considerably dependent on the skill of the operator. If the correct technique is not employed, strengths can be as much as 50% low in dense castables.

The rod should at all times be held vertically to the exposed face of the castable. Speed of movement through the castable should be 25-50 mm per second and speed of withdrawal about half this figure in order to minimise the formation of voids. Duration of vibration should generally be 1-1/2 to 3 minutes depending on bulk density and water content, but should not be continued longer than necessary.

When vibrating around obstructions such as nozzles, tubes and anchors add all fresh material from one side and vibrate the mixed material under and around the obstacle to avoid air pockets.

- **LOW CEMENT AND SELF LEVELLING CASTABLES**

All low cement refractory castables are considerably lower in cement content than conventional castables, which renders them somewhat different to handle and place. If however, correct procedures are adhered to, difficulties will not be encountered and superior properties to those of conventional castables will be achieved.

- **Water Addition**

The most important factor to appreciate is that the recommended water additions for low cement castables must be adhered to; if the correct consistency is not then achieved, mixing time should be increased, resisting the temptation to add extra water which will significantly reduce properties. The majority, say 80%, of the recommended quantity of water should be added to the mixer with the castable, the remainder being added during mixing. As with conventional castables water quality should be first class and should be measured.

Water temperature should ideally be from 10°C to 20°C. Temperatures higher than 30°C will reduce setting times. Temperatures below 10°C result in the production of certain calcium aluminate hydrates which render the castable more susceptible to steam spalling as well as increasing setting times. The former effect may be detrimental in cases where due to installation constraints there is a delay between mixing and placement of the castable. The tendency for steam spalling may be reduced by the addition of organic fibres, which are contained in all castables.

Should environmental conditions be such that the available water temperature is outside the required range then auxiliary heating or cooling should be employed.

- **Mixing**

Barrel type cement mixers are not suitable for low cement castables. This is because the amount of energy necessary to distribute the relatively small volume of water throughout the castable cannot be achieved with this type of machine. A refractory paddle mixer is therefore essential to ensure the correct consistency is achieved without the undesirable addition of extra water. With separate cement packaged material the bulk material should be emptied into the mixer. The separately packaged cement should be distributed evenly over the bulk material. Once the total batch is emptied into the mixer, the material should be dry mixed for at least 30 seconds. Mixing times to achieve consistency is usually 3-4 minutes, but this will depend on the mixer efficiency. Should a more workable mix than normal be required, this can be achieved by extending the mixing times (e.g. 6-7 minutes); if the effort is taken to do this then quite workable mixes can be achieved without sacrificing physical properties. However, longer mixing times can result in a reduction in workability due to the castable heat and cause rapid set times.

Once the mixing action is stopped, low cement castables begin to stiffen. Therefore, the mixer should be positioned as close as possible to the job site and the low cement castable placed within 20 minutes of adding the water. Should a barrow or hopper be required to transport from the mixer to the site an immersion vibrator can be used to prevent stiffening of the mix prior to placement.

Important Notes For Both Conventional and Low Cement Castables

- **Storage**

Castable products should be stored in dry, undercover areas and preferably away from sources of excessive heat. All castables, however, become partially hydrated over time by the ambient humidity so limiting practical shelf life to about 12 months for conventional castables and 6 months for low cement.

- **Setting Times**

Our Quality Control procedure is to have a set time ex factory of 2-4 hours. Some customers may require a shorter or longer setting time owing to operational parameters. We can control and achieve setting times outside this range and will produce same upon request.

- **Do Not Trowel to a Slick Finish**

Trowelling causes fines to come to the surface and sealing it off so resulting in slower drying after the curing period has been completed. Simply screed off level or use a wooden float.

- **Avoid Temperature Extremes**

Avoid temperature extremes during installation and while castable is developing its hydraulic bond. Atmospheric temperatures in the range of 15-32 °C are most desirable. Higher temperatures increase the rate at which the castable sets or becomes hard. This means that there is less time for mixing and placing the material. If the castable is too warm, as it mixes, it may be necessary to use chilled water to reduce the temperature of the mix so that there is sufficient time to install before setting starts. For this reason, it is best NOT to store castables beside a furnace or in the hot sunshine.

- **Curing and Commissioning**

Please refer to Standard Heat Up Schedules for Curing and Commissioning of castable refractories.

- **Health and Safety**

Health and safety regulations apply to all Calderys materials. These are outlined in the appropriate Material Safety Data Sheet, which is available on request.

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