**Medium High-Expansion HYDROCAL Cements**

Specialized expansion plasters for fabricating expanded patterns, models and molds meet the specific needs of aircraft, automotive, foundry, plastics and other industries. Materials such as Medium High-Expansion HYDROCAL Gypsum Cement have facilitated industrial tooling and pattern making to such a degree that many pattern shops have adopted these materials in standard shop procedures.

**Applications**

Expansion plaster can be used wherever patterns, matchplates and models with shrink allowance are fabricated. For example, expansion plasters are used for core-dryer patterns by making a cast or impression from the pattern. After the cast expands to the desired oversize dimensions, subsequent gypsum pattern making operations are used to complete the pattern. A matchplate firm makes use of expansion plasters to add the extra shrink necessary in a wood matchplate to be reproduced in aluminum by pressure casting.

**Removal of Casts from Patterns**

For easier plaster removal, seal rigid patterns with one or two coats of a good-grade lacquer followed by a coating of plaster-parting compound such as stearic acid and kerosene. This will not alter detail or soften the face of the plaster cast. When plaster is removed from the pattern, place cast on a flat, smooth surface that has been lubricated to permit free growth of the expanding medium. The surface plate or table top on which the cast is placed should not have a chilling effect on the warm plaster during expansion. A cold surface will retard the growth of the cast. Cold water (below room temperature) also will retard expansion; consequently, the pattern will not grow to the desired shrink allowance. Water temperature should be approximately 70° to 75°F for optimum results. Properly support intricately shaped patterns when they are placed on the surface plate or table to prevent possible warpage during and after the expansion period. Lacquer the expanded pattern and coat with parting compound. For possible future use, take a splash cast off the oversize pattern from which the plaster foundry-pattern is made.

**Expansion Characteristics**

The desired expansion is usually obtained within 2 or 3 hours after initial set. When large casts or patterns (in excess of 150 lb.) are poured, a slightly higher consistency should be used to prevent possible over-expansion. Patterns made from Medium High-Expansion HYDROCAL Gypsum Cement are dimensionally stable for 3 to 4 days after the desired expansion is achieved.

In the manufacture of HYDROCAL Gypsum Cements, every effort is made to maintain uniformity. The performance of Medium High-Expansion HYDROCAL Cement is affected to a considerable extent by transit time and seasonal temperature variations beyond our control, making it impossible to guarantee the degree of expansion obtained with Medium High-Expansion HYDROCAL Cement at any given plaster-water ratio.

Periodic test bars, approximately 6x6x12-in., should be cast under shop conditions and the expansion determined. Such test bars are recommended especially in the case of unusually large and bulky casts.

Medium High-Expansion HYDROCAL Cement is a specially formulated gypsum cement having unique characteristics. This material expands uniformly in all directions and has the highest setting expansion of any known gypsum cement. Expansion values can be controlled by the quantity of water used in the mix. Through proper water-to-plaster ratio, expansion values from 1⁄8 to 3⁄16 in. per ft. are achieved.

The following shop variables, often inadequately controlled, affect the expansion obtained:

1. Age of Medium High-Expansion HYDROCAL Gypsum Cement
2. Water-plaster ratio
3. Water and plaster temperature
4. Mixing time, speed and method
5. Time interval between mixing and pouring
6. Size and shape of cast
7. Air temperature and humidity
8. Speed of set (from contamination, water, etc.)
9. Degree of confinement of cast
10. Temperature of work table
Recommended Proportions for Medium High-Expansion Cement

<table>
<thead>
<tr>
<th>Parts</th>
<th>Maximum Expansion (in. per ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium High-Expansion Gypsum Cement (by weight-lb.)</td>
<td>Water (by weight-lb.)</td>
</tr>
<tr>
<td>100</td>
<td>48-50</td>
</tr>
<tr>
<td>100</td>
<td>44-45</td>
</tr>
</tbody>
</table>

Casts must be a min. of 4 to 5-in. in depth to obtain these values. Expansion values can be increased 10 to 15 percent by using hot water (120° to 130°F for a slurry temperature of 100° to 110°F).

Mixing

Weigh expansion plaster and water as recommended and strew plaster into water as evenly as possible. Allow plaster to soak for a few minutes; with heavier mixes, however, there will not be enough water to completely soak the plaster.

With hand mixing, force plaster into water and mix vigorously until a smooth mass is obtained. For mixes from 10 to 15 lbs., a ¼-in. drill motor with a 4-in. disc has been found to be far superior to hand mixing.

Where larger machine mixing is used, a planetary-action batch mixer equipped with a bar-type agitator is recommended.

<table>
<thead>
<tr>
<th>Lower</th>
<th>Expansion</th>
<th>Greater</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approx. Lower Limits and Effects</td>
<td>Controllable Variables</td>
<td>Approx. Upper Limits and Effects</td>
</tr>
<tr>
<td>About 60 cc Over this amount material too watery and slow set</td>
<td>Consistency (Parts of water to 100 lb. HYDROCAL by weight)</td>
<td>About 40 cc Below this amount material too pasty to handle</td>
</tr>
<tr>
<td>About 1 Min. Unmixed lumps giving variable expansion and sets</td>
<td>Mixing Time (Mechanical mixer of appropriate size operating at approximately 1,760 rpm)</td>
<td>About 5 Min. Extremely fast set. Danger of mixing through set and disrupting structure so no set or strength will result</td>
</tr>
<tr>
<td>About 32°F.</td>
<td>Slurry Temperature (Temperature of HYDROCAL and water combined)</td>
<td>About 110°F. Above this temperature set is retarded. Up to this temperature set is accelerated and may become too fast for use.</td>
</tr>
</tbody>
</table>