



MORTARS FOR CAST STONE INSTALLATION

Selecting the appropriate type of mortar for setting cast stone is perhaps the most important factor in the performance of a masonry wall. The mortar must have sufficient strength, be durable, resist rain penetration as much as possible and yet be flexible enough to accommodate slight movement within the wall assembly.

As noted in TMS 604-16, Standard Specification for Installation of Architectural Cast Stone, mortars used in the setting of cast stone should meet the requirements of ASTM C270, Type N mortars. These mortars generally consist of one part cementitious material (Portland cement and lime, or masonry or mortar cement) to three parts of clean, washed masonry sand (ASTM C144). The mortar may also contain iron oxide coloring pigments (ASTM C979) and admixtures (ASTM C1384).

The selection of a Type N mortar provides good bond strength with desired weather resistance and sufficient compressive strength relative to the cast stone when cured. Plasticizing agents, such as lime or ground limestone, enhance the workability of the mortar while reducing shrinkage. The practice of wetting the head and bed joints of the stone and tooling the mortar when thumbprint hard will further protect against joint shrinkage. Although Type N mortar is the standard used with cast stone (as well as many natural cut stone), the proportions may be varied to suit specific applications.

Proper mixing is essential to good consistency. All materials, except pigments, should be measured by volume. Sands should be placed in the spiral-blade or paddle type mixer first, followed by pigments (if required), pre-water, lime and cement, final water and 5-7 minutes of mixing time. Due to the various admixtures available for mortar, consult with the manufacturer for recommended addition rates and mix sequencing. Mortars unused after 2 ½ hours should be discarded (this time may be shorter depending on the ambient conditions).

Head joints in most hand-set cast stone may be set with the usual wet consistency mortar used in setting brick and block. Stiffer mortar must be used when setting larger stones and shims are recommended for all pieces over 300 lbs. When setting, fill all dowel holes, anchor slots and similar building stone anchor pockets completely with mortar. Non-shrink grout or anchoring cement may be specified for dowel connections. Caution should be used when the bed joint is on horizontal flashing as it will act as a bond breaker. Special anchorage may be necessary to accommodate this condition as well as in the vertical joints of the first course below a relief angle. Mechanical anchors are recommended to be installed within the first course above and below each relief angle.

Mortar systems have the ability to carry loads but cannot absorb much joint movement. For this reason, thoughtful designers often require that joints at parapets, copings and other particularly sensitive areas be left un-mortared for later filling with sealants. A mortar lock feature may be incorporated in the sides of the cast stone in order to add positive engagement of the mortar element into the cast stone unit. This helps to restrain the cast stone if the shear bond is lost between the cast stone and mortar.

When using a post-setting pointing system, all stone-to-stone joints should be raked to a depth of ¾ in. for later pointing. It should be noted that in many cases, but in particular when setting small veneer pieces, it is not practical to rake out and point all joints. In these instances, full bed setting and finishing in one operation can be used. Particular attention must be paid to the waterproofing systems incorporated into the veneer. Stone-to-brick joints are usually struck and tooled to a concave shape (See [Technical Bulletin #44](#) on Pointing). Sponge all mortar smears from the face of the cast stone with water as hardened, mortar smears are difficult to remove from the surface of cast stone. Clean with water and a stiff fiber brush or with a commercial masonry cleaner approved for use with cast stone. Metal bristle brushes should not be used. Consult the cast stone manufacturer before performing any cleaning procedure. Direct high pressure power washers should never be used to clean cast stone. See [Technical Bulletin #39](#) on Cleaning.

If lug sills, which extend beyond the masonry opening, are fully set in mortar, the mortar at the ends under the lugs (where the load is) may, in certain situations, compress or shrink more than the rest of the mortar (due to overburden forces), causing shear or bending stress in the sill and possibly leading to failure. One of two techniques can be used when setting lug sills. The first technique is to set only the ends of lug sills in a full bed of mortar and point the portion of the sill inside the masonry opening after the initial mortar bed has cured. The second technique is to shim under the lugs to bear any compressive loads. The designer should examine the lug sill configuration and how it interfaces with the adjacent and under-supporting masonry units to ensure that point bearing will not occur at the mid-span of the sill. Slip sills, which do not extend past the masonry opening, do not carry any load other than itself and are set in a full bed of mortar.

Designers should specify where to use mortar/pointed joints and where to use sealant joints. Typically, conventional masonry cast stone units may be set with mortar joints. Where panels are larger than conventional masonry units (1 ft. 6 in. tall by 2 ft. 6 in. in length for vertical applications), “soft” sealant joints are generally recommended. In such unique cases, a professional designer or engineer should be consulted for proper joint design and function. After setting, prime the ends of the stones (if necessary), insert a properly sized backup rod followed by application of a sealant using a caulking tool.

Selection of Joint Type for Cast Stone

Control or Expansion Joint Location	Mortar/pointed joints	Sealant joints
Most bed joints	Recommended	As needed
Head joints at coping, joints at column covers, cornices, platforms, soffits, stone with projecting profiles, exposed top joints, rigid suspension connections	Not recommended	Recommended
Units larger than 1 ft. 6 in. x 2 ft. 6 in.*	Not recommended for vertical applications	Recommended

*Proper joint design and function should be based on recommendations from an engineer or other design professional. For recommendations on sealants, please see [Technical Bulletin #43](#).

This Technical Bulletin addresses generally accepted practices, methods and general details for the use of Architectural Cast Stone. This document is designed **only as a guide** and is **not** intended for any specific application or project. It is the responsibility of design and construction professionals to determine the applicability and appropriate application of any detail to a specific project based on professional judgment, specific project conditions, manufacturer’s recommendations and solid understanding of product characteristics. The Cast Stone Institute makes no express or implied warranty or guarantee of the techniques or construction methods identified herein. Technical references shall be made to the edition of the International Building Codes for the location of the structure, the latest edition of the TMS 402/406 Masonry Standards document and TMS 404, 504, 604 Standards for Design, Fabrication and Installation of Architectural Cast Stone.

The Cast Stone Institute (CSI) is a not-for-profit organization created to advance the design, manufacture and use of Architectural Cast Stone. To further this goal, the CSI continually disseminates information to targeted construction industry audiences through presentations, programs and technical publications.

POINTING OF JOINTS

Tooled mortar joints are required for cast stone units larger than conventional masonry units because mortar shrinks modestly as it cures. Since mortar beds harden from the outside in, stresses can be applied to the edge of the stone which can cause spalling. Shrinkage also can create cracks at the joints; a condition which may lead to moisture penetration. Tooled mortar joints are best suited for masonry-bound trim items such as belt courses, lintels, window surrounds, date stones, inscription blocks, quoins, keystones and similar applications.

It should be noted that in many cases (and specifically when setting small veneer pieces) it is not practical to rake out and point all joints. In these instances, full bed setting and finishing in one operation can be used. Particular attention must be paid to the waterproofing systems behind and incorporated into the veneer.

Regardless of whether the mortar or sealant is selected as the face joint material, the mortar must be raked out of the joint to a minimum depth of 3/4 inch. If sealant is to be used at the head joints, then mortar is normally not used there at all.

Pointing is usually done in 1 or 2 stages to allow maximum sealing of shrinkage cracking in the mortar. It should not be done in areas exposed to hot sunshine and it is suggested that pointing be accomplished after touch and repair of cast stone and before final wash-down.

Apply pointing mortar using proper tools to compress the material against the edges of the cast stone. A concave joint is recommended for the best protection against leakage although other joint types are often available in the stone setting trade.

Pointing mortar should be softer than the stone so that thermal stress will not cause spalling at the edges of the joints. It is usually slightly drier than normal setting mortar consistency to prevent shrinkage and is usually composed of the following:

- 1 part Portland cement, ASTM C150
- 1 part hydrated lime, ASTM C207
- 6 parts masonry sand, ASTM C144

Coloring may be added to achieve almost any hue, however pointing mortar which sharply contrasts with the color of the cast stone may cause staining. Excess pointing material must be sponged away from the face of the stone immediately. Taping the cast stone adjacent to the joints prior to pointing can help protect the cast stone from staining as well. Colors added must be natural or synthetic mineral oxides which meet the requirements of ASTM C979 (sun-fast, lime-proof, alkali-resistant) and the dosage must not exceed 10% of the weight of the cement used. Carbon black or ultramarine blue pigments should not be used. In general, pigmentation types and amounts used in the manufacture of Cast Stone can also be used as a starting point when custom blending the pointing mortar to match or complement the color of the Cast Stone.

Always specify a mockup wall when approving final colors and be sure that it has been properly cleaned because cleaning will usually affect the color of pigmented masonry materials.

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