



PORTLAND CEMENT MORTAR (CTI 0-106-68)

Specification for Glass Mosaic Tile Installed on Exteriors In Portland Cement Mortar.

TECHNIQUE FOR ISOLATING TILE INSTALLATION FROM MASONRY OR CONCRETE SURFACES WHEN USING CEMENT MORTAR METHOD \star

- 1. This method isolates the tile installation when installing tile over concrete or masonry subjet to cracking.
- 2. Concrete and masonry provide a surface that can not be readily nailed to. Pneumatic driven or powder actuated fire-on fasteners are therefore used to assure adequate anchoring of the metal reinforcing.
- 3. Since an isolation sheet of 15 lb. roofing felt or equivalent is used over the masonry or concrete, the pins fired into the masonry or concrete hold up the entire tile installation. This makes the selection of corrosion resistant pins most important. Monel metal or stainless steel drivepins should be used.
- 4. The method is illustrated in the following photos and captions.

1. SCOPE:

Furnish all labor, material, tools, equipment, transportation and services required to complete the installation of glass mosaic tile work indicated on drawings and as specified herein.

3 2. WORK SPECIFIED IN OTHER SECTIONS:

All surfaces to receive glass mosaic tile over wood or steel stud construction shall be left with a scratch coat applied to thickness of not less than ¼ inch nor more than ½ inch from the structural face. Scratch coat shall be mixed in the proportions of one part waterproof portland cement to three parts clean, sharp sand.

SCRATCH COAT •

Aproperly prepared scratch coat has a surface that provides a mechanical bond for the mortar bed.

The scratcher is an instrument for making the surface that provides a mechanical bond. Accompanying photographs tell the story. The scratcher, or sometimes known as a scarifier, has long tines which provide an excellent scratched surface. A good scratcher can also be made out of metal lath if it is cut correctly.

Wood or steel studs shall be covered with one the following waterproofing materials: 15 lb. asphalt saturated building felt; ASTM D 266 or polyethylene sheeting 0.004 inch thick, ASTM C 156.

Wire reinforcing shall be furred out $\frac{1}{4}$ inch from the studs and shall be 2"x 2"- 16/16 or $\frac{1}{2}$ " x 2"- 16/13, ASTM A 82 and A 185 or shall be 3.4 galvanized metal lath.

All surfaces to receive glass mosaic tile over concrete shall be heavily sandblasted to remove surface oil and slickened surface caused by forms or troweling. After concrete surfaces are sandblasted they shall receive a dash coat mixed in proportions of one part portland cement to one and one half parts graded, sharp, fine sand. Add one part of Anti-Hydro to five parts of water and mix into dry mixed sand and cement to bring to proper consistency. Roughened surfaces shall be cleaned and well saturated with water prior to application of dash coat. Maintain moisture by covering or repeated wetting until cured to maximum hardness and bond.

DASH COAT .

The dash coat, properly applied and cured, provides the surface for the mechanical bond of the mortar bed. The tenacious bond of the dash coat can be somewhat explained by the unwanted splashing of the materials containing portland cement on finished portions of a structure. If the splash marks from those unwanted materials are not cleaned off while fresh, they become a part of the finish on the structure.

A. PLEASE NOTE:

One of the most important items in a glass mosaic tile installation is to provide **control joints**. Metal extrusions in the structure can often be used to provide these. Exterior installations should have control joints not more than 16 feet (preferred) to 20 feet apart in both directions. When it is necessary to put them in the joints between tile they need not be wide and unsightly. They must, however, be continued throught the tile and mortar setting bed and kept free of mortar and grout. These shall then be filled with an approved Thiokol based caulking compound, as close as possible to the color of the grout. Control joints ¹/₄ inch wide and 16 feet on center should be ample.

B. IMPORTANT:

All steps of the conventional and thin-set methods are the same except for the final step, the bond coat.

Alternate Thin-Set-Method: For this method delete- paragraph 4.(c)- and replace as follows: The exposed back of the sheets shall be given a buttercoat of the grouting material. The sheets shall then be placed in position on tested thin-set portland cement mortar or rubber latex portland cement mortar freshly combed onto the mortar setting bed with a notched trowel. All combing must be done in horizontal direction. Care shall be taken to cover the mortar with the backbuttered sheets before it has become glazed over from exposure to sun or wind. Sheets shall then be tamped firmly into place, true and even with the finished surface line or plane.



The metal lath into the concrete



Close up of drivepin anchoring the reinforcing wire after being driven through metal slug and into the concrete.



Gun in action to secure metal lath



Metal Lath Scratcher



Metal Lath Scratcher in Use.





Specification for Glass Mosaic Tile (cont.)

The requirements for the dash coat are as follows:

- The concrete shall be given a sandblast followed by a good washing.
- The concrete must be dampened just prior to applying the dash coat, without free water on the concrete surface.
- The dash coat is a mixture of half portland cement and half washed plasterer's sand.
- The mixture will be on the soupy side, as it must be picked up by the brush and dashed onto the damp surface.
- The dash coat is not applied in a thick coat. It should be no more than about 1/2-inch thick at the thickest places.
- Curing is important and starts when the dash coat is firm enough not be washed away by the moisture applied
- for curing. For spraying, or wetting several times a day for 72 hours after applied, are usual ways to cure.

Examination of Surfaces to Receive Glass Mosaic. Representatives of the general contractor, plastering contractor and tile contractor firms shall test hardness of scratch coat and dash coat with hammer and chisel and agree to suitability before installation is started.

3. MATERIALS

a. Glass Mosaic Tile shall be of highest quality tiles of sizes and colors hereinafter specified and mounted on paper sheets, with a reasonably uniform joint, of size and patterns indicated on drawings. Glass shall be (state brand to be used) or approved equal. Tile shall be as perfect as it is possible to manufacture. The colors and shades shall be reasonably uniform. The exposed face of the tile shall be a smooth, even surface, uniform in texture without chips. *

Size: All tessarae shall be cast approximately 3/16 inch uniform thickness, and shall be (give size) in size.

- Colors: Shall be (state colors). All colors used in the work shall match approved samples.
- b. Portland Cement shall conform to ASTM C 150, Type 1. +
- c. Hydrated Lime shall be for masonry purposes and conform to ASTM C 207, Type S, plus the added requirement limiting the unhydrated exides to eight per cent maximum.
- d. Sand shall comply with "Method for Test for Organic Impurities in Sand for Concrete," ASTM, Designation C 40 and "Specifications for Aggregate for Masonry Mortar", ASTM Designation C 144.
- e. Water free from any impurity that is injurious to the construction and shall be fit for human consumption.
- f. Grout and Buttering Mix shall be a waterproof grout mix with up to one part of sand added to each two parts of portland cement. Sand to comply with CTI-70-6 Standard for Graded Extra Fine Sand Aggregate. Colors shall be (state color or natural cement).
- g. Pure Coat shall be pure portland cement mixed with water into a trowelable wet slurry.
- h. Mortar Setting Bed shall be mixed in the proportions of one part portland cement, one part hydrated lime, six parts of clean sharp sand.

4. WORKMANSHIP

Glass Mosaic Tile shall be set by journeymen tile setters experienced in setting tile of this type under similar conditions. Experience in setting clay ceramic tiles only may not be deemed qualifications for setting glass mosaics tiles.

- a. At no time shall the mortar setting bed be over ½" thick. Apply a plumb scratch coat where necessary to establish this. Plumb scratch shall be mixed in the proportions of one part waterproof portland cement to four parts clean, sharp sand.
- **b.** Apply rod and float the mortar setting bed to uniform plumb and level surface, allowing room for glass mosaic, to bring finished surface to required plane. Thickness of mortar shall be from 1/4 to 1/2 inch as required, cut through the setting bed horizontally and vertically every 24 inches.
- c. The exposed back of the glass mosaic tile shall be given a butter coat of the buttering mix. The sheets shall then be placed in position on the pure coat freshly combed onto the mortar setting bed with a notched trowel. All combing must be done in a horizontal direction. Care shall be taken to cover the mortar with the back buttered sheets before it has become glazed over from exposure to sun or wind. Sheets shall then be tamped firmly into place, true and even with the finished surface line or plane.
- d. Where they occur and at least every 20 feet in both directions in the structure, expansion joints or control joints must be continued through the mortar bed and glass mosaic and kept free of mortar and grout. These shall be filled with an approved Thiokol based compound, as close as possible to the color of the grout.
- e. Interiors corners shall be butt. External corners shall have the glass mosaic fitted together with a close quirk miter. Where external corners are subject to pedestrian traffic, they shall be carefully gone over with a fine carborundum stone to remove sharp edges.
- f. Grout all joints, after removal of the paper, leaving them completely and uniformly filled. At no time shall sand or any abrasive be used that will damage the natural sheen of the natural sheen of the glass mosaic tile.

5. CLEANING *

All excess grout, glue and scum shall be removed from the face of the tile leaving the finished surface clean. If acid is used, care shall be taken so that it will not damage color of grout, painted or metal finished.





Portland Cement, Hydrated Lime asnd Sand









GLASS MOSAIC MURAL INSTALLATION |

FIELD REPORT #CTI 82-1-4 (R85).

A. INTRODUCTION

- 1. The purpose of this report is to offer some insight into the challenges and peculiarities of installing glass mosaics, especially murals.
- 2. This report will outline procedures for installing glass mosaic murals. Elsewhere in this manual there appears a suggested Specification for Glass Mosaic Tile Installated on Exteriors in Portland Cement Mortar, CTI-0-106-68.
- 3. The types of murals that will be discussed are those made of both Smalti, Byzantine glass and Venetian glass.
- 4. Murals made of glass mosaic, especially the Smalti type glass, are very costly and can easily be ruined unless they are properly handled and installed. For this reason, many specifications require the mural be installed by: "Journeyman tile setters experienced in setting tile of this type under similar conditions". This field report therefore is a much a not- to-do warning for those inexperienced in mural installations, as it is a review of procedure for those who are experienced.

B. DISCUSSION

- **1.** Both types of glass are installed basically the same way.
- 2. As stated in a prior issued CTI Field Report, No.66-2-9 (appearing elsewhere in this section), "Backbuttering Glass Mosaics", a succesful glass mosaic installation cannot be obtained by combing thinset material over a hardened surface, such as a prefloat mortar bed, and placing the glass mosaic sheets directly on the thinset mortar. This procedure most surely will result in a failure. The major factors contributing to the failure are:
- a) Insufficient contact of the thinset bonding mortar to the glass, resulting in little or no bond.
- b) An inability to beat the Byzantine glass in on a hard wall because all tesserae are not of equal thickness.
- c) Both kinds of glass must be back grouted, they cannot be face grouted.
- d) Not locking each individual tessera of glass into place by back-buttering the bondable side of the sheet of glass.

C. MATERIAL AND MIXING RATIOS

- 1. Glass mosaics are best set in the mortar method of tile installation.
- 2. The mortar method referred to is in the ANSI A108.1 specification.
- **3.** The materials are as follows:
- a) Portland Cement: Conforming to ASTM C150, Type I.
- b) **Hydrated Lime**: For masonry purposes and to conform to ASTM C-207 types, plus the added requirement limiting the unhydrated oxides to eight percent maximum.
- c) Sand: ASTM designation C-144 washed plaster sand and specification for aggregate for masonry mortar ASTM C-144.
- d) Water: Free from impurity that is injurious to the construction and shall be fit for human consumption.
- e) Grout and Buttering Mix: Shall be a grout mix with up to one part sand to two parts portland cement. Sand to comply with CTI 70-6 Standard for Graded Extra Fine Sand Aggregate. White sand complying with CTI 70-6 is available from Crystal Silica Sand Company in Oceanside, California. It is called *Tile 70 Sand*. The only way to get grey graded sand is to screen washed plaster sand, using a 16 mesh screen (window screen).
- f) Mortar Setting-Bed: Shall be mixed in the proportions of one part portland cement, one part hydrated lime, six part washed plaster sand.

D. LOFTING

- 1. Lofting is a procedure whereby the mural is laid out on a clean, dry surface, paper side down.
- 2. The sheets are placed so that they fit tightly together.
- 3. Measurements are then taken to make certain that the mural fits properly into the space it is designed for.
- 4. Special care should be taken when lofting to protect the sheets from moisture such as a damp concrete slab. Also, the sheets must be protected from the direct heat of the sun. Moisture will begin to release the tile from its paper face. Excessive heat will cause the paper to curl and the glue to become brittle. Either condition could cause the tile to come loose from the paper face.















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SPECIFICATION FOR GLASS MOSAIC TILE

Specification for Glass Mosaic Tile (cont.)

E. INSTALLATION- FOR VENETIAN AND BYZANTINE GLASS

- 1. Mortar bed should not exceed ½ " in thickness. A plumb scratch can be applied to obtain desired thickness, or compensate for irregularities in the wall or floor.
- 2. Setting the mosaic in fresh mortar provides the most favorable installation.
- **3.** An area not to exceed a day's installation should be floated. An experienced journeyman can expect to set 50 square feet per day. This estimate, is for course, depend upon job and weather conditions.
- 4. The mortar bed must be firm before setting sheets. A wet or heavy bed could precipitate slipping, air pockets, and difficulty in working the sheets together. Mosaic sheets are one-of- a- kind units. If they fall apart or are ruined by placement on too wet a bed, an expensive work of art may be irreparably damaged.
- 5. Mosaicists draw a center line and also draw squiggle lines all over the back of the cartoon paper prior to cutting it into sections and mounting the tessarae. These lines are used to plumb and level and keep details such as hands and faces straight and true.
- 6. Constant care must be taken to make sure the mural is level and plumb. If it begins to drift out of level, it is difficult or impossible to correct the mistake.
- 7. The backbuttering of the mosaic is of great importance for several reasons:

One, it locks the individual pieces into place so that they do not move independently after the sheet is set. **Two**, it provides a 100 percent bond between tile and mortar bed.

Three, it removes any foreign substance such dirt or dust from the back of the tile that could act as a bond breaker.

Four, backbuttering also back-grouts the tile.Beveled Venetian glass cannot effectively be face- grouted.

8. Extreme care should be taken not to butter the glass too far in advance of setting the sheet. Dependent upon the weather, consistency of the backbutter and the experience of the setter, the glass tile sheet has between 30 and 60 seconds before the water in the backbutter affects the glue on the paper holding the glass together. If the water is allowed to dissolve the glue, the sheet could tear, fall apart, or become almost impossible to handle.

FIELD REPORT #CTI 66-2-9 (R85). C. BACKBUTTERING

- 1. Authorities on installing glass mosaic tile agree that the backbuttering of the sheets is a very necessary step.
- 2. The buttering mix specified in the Ceramic Tile Institute Specification CTI-0-106-68 is one part of fine graded sand added to each two parts of portland cement. This is also used for the grouting.
- 3. The specification calls for the exposed back of the glass mosaic tile to be backbuttered with the buttering mix. The mosaic sheets are then positioned on the portland cement pure coat, freshly combed onto the mortar setting-bed with a notched trowel. The combing is done in a horizontal direction. Care is taken to cover the pure with the backbuttered sheets before it has become glazed over from exposure to sun or wind. Sheets are then tapped firmly into place, paper removed, cleaned and grouted.

D. CONCLUSION

- 1. Backbuttering is a very necessary step in the installation of glass mosaic.
- 2. The backbuttering locks each individual piece of glass mosaic in its own setting much the same as a jeweler sets a stone in a mounting.
- 3. Shortcuts of using materials that are supposed to have a superior bond to glass, combing them only on the surface, and setting the glass mosaic sheets against such bonding materials are sure to fail.
- 9. The placing of the sheets is critical. Care should be taken to fit the sheets together as tightly and smoothly as possible. A few extra minutes fitting the sheets initially will save hours of tedious work after the paper has been pulled from the face of the glass. This careful fitting of the sheets is to prevent sheet marks from showing where two sheets come together.

























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SPECIFICATION FOR GLASS MOSAIC TILE

Specification for Glass Mosaic Tile (cont.)

- 10. Sheets should be tapped into place and joint lines smoothed before pulling the paper.
- 11. Wetting the sheets is a variable. In hotter weather, fewer sheets would be set before wetting. The opposite, of course, is true in colder weather. Generally, between 20 and 30 square feet could be set before wetting the sheets and pulling the paper.

F. WORKING THE GLASS

- The glass must be rubbed into place, using a block of wood or comparable implement. The face of the glass must be rubbed flat and smooth.
- 2. When a mural is so large that it takes more than one day to install, the mortar extending past the edges of the sheets in place must be cut clean, back to the scratch coat. This procedure is done so that the next day's work can be fit nicely into place.
- G. DISCUSSION OF ALTERNATIVE METHOD OF SETTING SMALTI BYZANTINE GLASS
- 1. This method has been related by workers who have used it successfully in the field.
- The materials are the same as those specified in C.3 (a)-(d). The mixing ratio for the backbutter is different. The backbutter mix is three parts sand, one part portland cement and one part hydrated lime.
- 3. This procedure is for setting Smalti Byzantine over a prefloated setting-bed.

H. PROCEDURE

- 1. Mural is lofted and actual dimensions are taken.
- 2. The area is prefloated, using the mortar mix detailed in C.3(f). The prefloating is done to accommodate the thickness of the glass plus 1/2".
- 3. The mortar bed is then cover-cured until dimensionally stable, with recommendation for 7-day curing.
- 4. A box screed is then made so that each sheet will have exactly ½" of backbutter in addition to the glass.
- 5. A skim coat of thinset is the applied on a small section of the wall. Care should be taken that the thinset does not skim over before sheets are applied to mortar bed.
- 6. Make certain that there is a good bond between the prefloated mortar bed and the backbutter. The shear strength of one coat of mortar applied to another coat of mortar without an effective bonding ingredient, such as a cement slurry or thinset, is very low.
- 7. All other procedures are the same as those outlined in the previous sections.

I. GROUTING

- 1. Refer to backbutter mix section C.3 (e). This same material is used to grout the glass.
- 2. All cement and glue scum must be cleaned from the face of the tile prior to grouting.

FIELD REPORTS #CTI 73-7-2 R85

1. Acid should not be used on colored grouts. Even the acid in vinegar will be detrimental on dark or black grout. The acid can make a whitish haze over the grout joints. It does little good to have a colored grout when the color is hidden by a whitish film. Acid will often cause irregular shades of light and dark in colored grout.

2. Irregular colors of light and dark can also be caused by not making all of the joints the same depth. If part of the grout joints are ½ inch deep and part of the grout joints are only ¼ inch deep they cannot be expected to be the same shade. It has been observed that rubber spacers, left in an installation, and even the spacer lugs on tile, can cause light and dark shades in the grout.

3. Tile joints that are uniform in size and depth, and damp cured, will be the most uniform in color. This may require wetting and cover curing with waterproof paper or polyethylene sheeting.

J. CONCLUSION

- Glass mosaics are fragile work of art. Each step of the procedure must be taken with care by those experienced in doing this work.
- Lofting for dimension, backbuttering for maximum bond and careful placement and working in of the sheets are important aspects of a good installation.
- 3. The installation of glass mosaic murals is perhaps the most difficult procedure in tile setting. It is for that reason that we recommended only journeymen with experience in dealing with this material under many circunstances be called upon for an installation of this kind. There can be no short cuts when installing glass mosaics. The glass dictates its own speed. Therefore, control of all of the materials is absolutely critical. Glass is most unforgiving. One simple mistake coul ruin an expensive work of art and be very costly to the installer.

























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I TOOLS OF THE TRADE |

Following is a description of the principal tools used by tile layers.

A great variety of specialized tools are utilized by the modern tile setter in performing his work. These tools have been developed down throught the ages as the craft has envolved and become more perfected. Many of the tools are the same as those used by other members of the trowel trades. Certain major manufacturers, such as the *Goldblatt Tool Company of Kansas City, Missouri*, who provided most of the illustrations used in this section, specialize in providing a complete line of tools for the tile layers. It goes without saying that an adequate variety of modern tools, kept in good repair, are a necessary prerequisite to a good tile installation. Following is a description of the principal tools used by tile layers.



Spirit Level: The spirit level is used by the tilesetter for small or close work and wall and floor work. When it is used with straightedge, it can serve to level or plumb certain surfaces or work, such as the floating stips on walls and floors and the screed strips on horizontal surfaces. The 12", 24" and 48" spirit levels are generally the most useful for the tilesetter.



Rubber Trowel: The rubber trowel used for grouting is a nonporous synthetic-rubber-faced float that is mounted on an aluminum back with a wood handle. This trowel is used to force material deep into tile joints and to remove excess material for a perfect finish.



Floating Strip: The floating strip is a wood strip approximately ¼" x ½", cut to any desired lenght. It is a useful tool for the tilesetter when the plane of the setting bed is being established.



Measuring Tape: The tilesetter will find that the measuring tape is also an invaluable help in squaring and paralleling. The steel tape is preferred.



Rubber Mallet: The rubber mallet is useful in setting large tiles that require considerable weight exerted on them. It does not splinter or wear out the straightedges or beating blocks when used on them.



Plumb Bob: The plumb bob is an accurate tool for indicating a vertical direction. A chalk line is tied to the hole in the center of the cap on the bob and then fastened at the ceiling height so that the plumb bob extends to the floor level but does not touch it. A reading is then made with a rule parallel to the string.



Flat Trowel: The flat trowel is used in conjunction with the hawk for the transferring of mortar from the mortarboard to the wall or to other vertical surfaces. It is frequently used for spreading pure cement on the finished float coat. The flat trowel also is used for spreading mortar on floor surfaces before tiles are set.

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SPECIFICATION FOR GLASS MOSAIC TILE

I TOOLS OF THE TRADE |



Brick Trowel: The brick trowel is larger than the buttering trowel. The most popular size used by tilesetters in 5" wide and 11" long. It is used when any preparatory brick work hast to be done. Some tilesetters use it for quarry and terra cotta tilework. Its greater surface and weight are adventageous in the buttering and tapping in of the larger tiles.



Pointing Trowel: The pointing trowel or pointer is probably the most essential tool in the trade. It comes in sizes ranging from 4" to 7" in length, but the 6" trowel is the most popular. The tilesetter uses this trowel in every phase of the work, especially for straightening tiles on walls and floors, marking floated surfaces, filling small depressions on floats coats, buttering tiles and trim work, and placing mortar in areas that are too small for the flat trowel. The butt of the handle is used for tapping tiles that are not on a true plane with the rest of the tilework. The trowel's flat working surface must be protected. The tilesetter should not use it to pry or chop hardened materials such as concrete or plaster.



Nippers: Two sizes of nippers or biters are preferred by the tilesetter. The 8" nippers are used for inside curves, and the 10" nippers are used for straight cuts that cannot be made with the tile cutter. These tools usually are tipped with tungsten carbide. Ceramic mosaic cutters are a specialized form of nippers with a smaller bite and greater leverage. They are effective when used on hard tile.



Mortar Mixer: Most mortar mixers are driven by gasoline combustion engines of ½ horsepower or greater, depending on the type of sack mix. Electrically driven mixers are used when small batches of mortar are needed. The quality of machine-mixed mortar far exceeds that of hand-mixed mortar.



Beating Block: The beating or smoothing block is approximately 4" x 14" in size. It should be made of hardwood, such as maple, which does not warp readily. The block is used by the tilesetter to beat in the tiles so that they will be set permanently and will be flush with each other.



Scrub Brush: A scrub brush is used to remove excess mortar from the joints and the face of the tile. The preferred size is approximately 2³/₄" x 8".



Water Brush: The water brush, which is usually of the dutch brush type, is used to wet mortar and to dampen walls and floors.