STEAM ROOM CONSTRUCTION

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SYNOPSIS:

The purpose of this paper is to clarify and illustrate, in a step-by-step manner, the proper way to construct a steam room where ceramic tile is to be utilized as the finished product on all surfaces. The Tile Council of America Detail SR613-91 found in the Handbook for Ceramic Tile Installations illustrates the basic concept for steam room construction. This paper, however, will reflect more up-to-date and commonly used construction methods and will also illustrate the latest technological advancements in the uses of waterproof membrane systems and tile setting materials. We shall begin at the framing stage of construction and progress on through each step of the installations of both mud-set and thin-set tile applications.

All TCA referenced details have been taken from the Tile Council of America Handbook for Ceramic Tile Installation - 1991 edition. All ANSI referenced setting materials and installation specifications are taken from the American National Standard Specifications for The Installation of Ceramic Tile as published by the Tile Council of America.

Ref:Tile Council of America - P.O. Box 326 - Princeton, N.J., USA, 98542

STEAM ROOM CONSTRUCTION
STRUCTURAL DESIGN

WALLS:

Masonry is the preferred method for constructing the walls, but steel stud or wood frame are often used. If steel studs or wood frame are used, all walls are to be covered with cementitious backer units (cbus) according to the manufacturers instructions.

All joints and corners are to be taped/filled.

CEILINGS:

A suspended grid system of galvanized metal similar to the Tile Council of America (TCA) Detail C311 is recommended. The cbus shall be attached directly to the framing. Special attention should be given to TCA recommendations for proper slopes. According to TCA Detail SR613 a minimum of two inches per lineal foot of slope is recommended. This may sound like an excessive amount of slope, but condensation dripping on to steam room occupants can be a problem if the pitch is insufficient to achieve runoff. It is true that a pitch of only two or three degrees is all that is normally needed to get water to flow on a flat and smooth surface. But, a ceramic tile ceiling is not necessarily flat and certainly is not smooth. Cushion-edged tile, recessed and/or textured grout joints, and unglazed mosaic tiles are all factors that deter water flow and contribute to the need for more exaggerated pitches to achieve runoff. I recommend exceeding the TCA minimums of two inches per foot (ten degrees) and sloping all ceilings three inches per foot (fifteen degrees). With a fifteen degree slope to a ceiling, a typical ten foot wide room would require a ceiling height thirty inches higher on one side than the other. Or, if the high point was centered in the room at plus fifteen inches, the ceiling could be sloped in two directions towards the side walls. A very large steam room could utilize and inverted pyramid design to the ceiling and be sloped to all four walls.

FLOORS:

The floor substrate can be either concrete or wood frame as long as it is structurally sound and has a deflection not greater than 1/360 of the span as per TCA recommendations. A sloped fill must first be applied at a minimum rate of one quarter inch per lineal foot from all walls to the weep holes at the drain pipe. Use a latex modified sand/cement mortar that can meet the maximum as well as the minimum thickness performance requirements that the room size and drain type dictate.

For example, one particular drain type might require that the sloped fill be only one eighth inch thick to be just below the weep holes. At the same time, a large room with a distance of twelve feet from a particular wall to the drain would require three inches of fill at the wall and sloped to only one eighth inch at the drain. To avoid cracking or shrinking of the sloped fill, it is imperative to use only mortars or leveling coats that meet manufacturers recommendations for such variations in thickness.

If seats or benches are to be incorporated into the design and are to receive ceramic tile, the horizontal surfaces must have a sloped fill installed in the same manner as the floor so that water gets diverted to the front edges and can runoff to the weep holes in the floor drain.

WATERPROOFING:

After all the sloped fill is in place and well cured; and all cementitious backer unit work complete, the waterproof membrane may be applied. Through the year 1990 the TCA Handbook has made the statement that "steam rooms require a continuous water retarding membrane on all surfaces to prevent moisture from penetrating adjoining spaces". This statement has lead to many incorrect interpretations of exactly what type of water deterring treatment was needed, so in 1991 this was modified to read "steam rooms require a <waterproof membrane> on all surfaces to prevent moisture from penetrating adjoining spaces". This membrane, whether sheet or liquid applied, must be continuous over all vertical, horizontal, and sloped surfaces. It also must be flashed tightly around the drain pipe to allow the weep holes function without fail.

When using liquid, trowel applied membrane material a reinforcing fabric must be set in place while the membrane material is still wet and pliable. A second layer of waterproofing must then be applied to complete the process. The preferred method for waterproofing is to apply a thirty mil thick sheet of pliable membrane product that has fabric already laminated to it on both sides. This system is much more reliable, less susceptible to installer error, and is very easy to install. A latex modified thin-set mortar conforming to ANSI A-118.4 specifications is used as the bond coat for installing the sheets. A one eighth inch notched trowel is used to gauge the amount of thin-set spread. The sheets are set into the bond coat and rolled with a hand roller to flatten out the ridges of mortar and press the laminated fabric into place.

Separate sheets are easily overlapped and bonded together using a liquid applied weld material that creates a chemical fusion insuring absolute waterproofing integrity.

MUD-SET TILE APPLICATION
DETAIL: MODIFIED SR613-1

A. METAL LATH INSTALLATION:

Screw attaching the metal lath without damaging the integrity of the waterproofing material takes special care. This can be accomplished by dipping each screw into A liquid caulking material prior to drilling or by making flexible washers out of the sheet membrane material and inserting them between the lath and the membrane. If large-headed screws are not available it is important to use galvanized metal washers to ensure against the lath becoming loose. The galvanized lath shall be flat-expanded type and weigh not less than three pounds per square yard. Individual sheets shall be overlapped a minimum of two inches and screw attached every six to eight inches on all studs with minimum one and one quarter inch long galvanized screw.

B. SCRATCH AND FLOAT COATS:

Each plane of surface must be scratched and floated out separately, enabling an open slip joint to be formed at each surface juncture. These slip joints should be constructed according to TCA Detail EJ-171. It is highly recommended that liquid mortar additives that add strength and reduce water absorption rates be used in all mortar mixes. Scratch and float coat mortar mixes shall be comprised of one part portland cement, one half part lime, and four parts damp sand (or three parts dry sand) by volume. The scratch coat must be allowed to dry for one to two days or at least until the moisture content reaches a level of five percent or less before the float coat is attached. The float coat is to be applied at a minimum thickness of one half inch (the total thickness of the lath and all mortar coats must be a minimum of three quarters of an inch). as with the scratch coat, the float coat must also be allowed to dry out to a water content level of five percent or less before ceramic tile can be installed.

C. CERAMIC TILE INSTALLATION:

Polymer modified dry set mortars meeting ANSI A-118.4 minimums are a must for the bond coats. The "second generation" classification of these types of latexes are preferred. There are presently no industry or ANSI standards that recognize second generation latexes as such, but these products generally contain the newer polymers which produce thin-set mortars that are more flexible and possess superior bonding capabilities. Mortar flexibility is a very desirable trait for steam room applications where ambient temperatures fluctuate to great extremes at frequent intervals.

The use of second generation latexes is also most desirable when installing porcelain or glass bodied tile because of the exceptional bonding capabilities they possess.

Every effort should be made to obtain 100% coverage on the back of the tile to the bond coat. Use the appropriate sized notched trowel to match the size of tile being used. A one quarter inch by three sixteenth inch sawtooth trowel is recommended for mosaics and small ceramic tiles whereas a one quarter inch by one quarter inch square notched trowel is recommended for wall tiles and flat-backed floor tiles. Large or irregular tills will also require back-buttering and possibly the use of a three eighth inch deep trowel to obtain adequate coverage. All larger tiles should be set with a twisting motion as beating-in of tile is only successful by itself with small tiles such as ceramic mosaics.

The mud-bed for the floor shall be reinforced with two inch by two inch sixteen gauge welded wire mesh or equivalent. the minimum thickness of the mud bed shall be one and one quarter inch. The mix shall be comprised of one part portland cement and four parts damp sand by volume. Liquid mortar additives are recommended. The floor drain is to be treated according to TCA Detail B-414 making sure that the weep holes do not become plugged with mortar. TCA Method F121-91 is to be followed using a second generation latex modified portland cement mortar as the bond coat over a cured mortar bed rather than setting the tile fresh and using a portland cement paste on a plastic mortar bed.

D. GROUTING:

Before grouting can commence, the bond coat must be allowed to adequately dry. Depending on temperature and humidity, this may take forty eight to seventy two hours; or even more if large tiles are used. The grout mixture should be commercially prepared and polymer modified. The newer state-of-the-art polymer enhanced grouts create easier to spread and clean-up products that result in denser grout joints with water absorption rates of three percent or less. It is important to firmly press the grout into the joints until maximum compaction is obtained. Cheesecloth, plastic scrub pads, or sponges with small pore structure should be used to clean the tile surface. It is very important to use a minimum amount of water during this process. Final clean-up can be obtained with a damp sponge. There should never be a need to acid wash a properly grouted glazed tile surface. If, however, a slight cement residue should appear upon curing, a mild, thirty to one mixture of water and white vinegar should remove it. If residue persists on unglazed tiles, wait a minimum of ten days and then use a mild solution of sulfamic acid in accordance with ANSI A108.

THIN-SET TILE APPLICATION
DETAIL: MODIFIED SR613-2

The technological advancements made recently in sheet waterproof membrane materials, and the fact that they can now be installed by tilesetters using tile setter methods, enables steam room walls and ceiling to have ceramic tile installed via thin-set methods. The chlorinated polyethylene sheet membrane material described in the waterproofing section has a polyester fabric laminated on both sides so that it not only can be installed with latex modified thin-set, but can also have ceramic tile installed directly over it with the same setting material. The floors, however, must remain as mud set applications in order to get adequate waterproofing flashed around the weep holes in the drain pipe and to enable proper slopes on the floor to be formed.

Second generation latexes are recommended for the thin-set mortar additive for installing the waterproofing material as well as when installing the tile over it. The sticky nature of this type of latex additive is also very helpful when installing membrane and ceramic tile on the ceilings. Use the tile laying and grouting techniques described in parts C and D of the "Mud-set Application".

Take special note of the cove base portion of Detail: Modified SR613-2. The expansion joint between the cove base and the floor is an important one and can easily be formed by installing the walls first over a mud screed. After the mud has set up sufficiently it can be cut off vertically at the edge of the cove base to neatly form one side of the expansion joint. A temporary filler made of plastic, wood, or metal can then be inserted before the floor mortar is placed to form the width of the joint. After the mortar is cured, the filler is removed to allow the proper expansion joint material to be installed. Refer to TCA Detail EJ-171 on page nineteen of the Handbook for Ceramic Tile Installations for proper expansion joint specifications.

NOTES:

1. The reasons for the extended curing times listed between the scratch coats, float coats, dond coats, and grouting procedures are two-fold. First, it is important to let all moisture escape from the installation to prevent the possibility of efflorescence occurring. Efflorescence, the crystalline deposits that can appear on the surface of grout joints as a whitish powder, can only occur through capillary action through the setting system. Excessive water in the setting system can provide the avenue for this wicking action to take place. Secondly, latex leaching has a chance of occurring if the steam room is put into service while there is still a large amount of moisture in the setting system. This substantial addition of moisture may cause the latex to leach out of the mortar and bond coats. This liquid can be clear in color or it can become stained with grout color pigments as it seeps through the grout joints and runs down the face of the tile. If latex leaching ever does occur it can be very difficult to remove if not noticed immediately. but, if all latex fortified mud beds and mortar coats are allowed to cure completely during the installation, the chances of latex leaching occurring are all but eliminated.

2. Penetrating sealers for the grout and tile can be applied if so desired. Though not essential to the installation, the use of such sealers may help reduce the possibility of efflorescence occurring. For further information on sealers refer to Materials & Methods Standards Association Bulletin Number twelve.

3. Only "compressible" urethane or silicone caulks should be used in the expansion joints. The tiled surfaces will expand first as heat is introduced into the room before they contract during the subsequent cooling cycles.

4. The layer of two inch thick insulation material shown on TCA Detail SR613 is there to protect the waterproof membrane from the heat. This has been eliminated because the newer waterproof membrane products described in this paper can withstand heats sustained in steam room environments.

5. Because of the complexity of the total system, and the reliability of each function of the installation upon the others, it is best to have one singular qualified ceramic tile contractor perform all work beyond the framing stage if local work rules allow.

REFERENCES

- WATERPROOF MEMBRANE INSTALLATION INSTRUCTIONS - THE NOBLE CO
Form 191 NSTS

- SECOND GENERATION LATEX INFORMATION - NTCA Technical Bulletin
10-90 E-16

- GROUT SEALERS - Materials & Methods Standards Association
315 S. Hicks Rd., Palatine, 11., USA 60067

- NOTCHED TROWEL ILLUSTRATIONS - CUSTOM BUILDING PRODUCTS

- EFFLORESCENCE - MMSA BULLETIN NUMBER SIX

- CEMENTITIOUS BACKER UNITS - ANSI 118.9 and ANSI 108.11

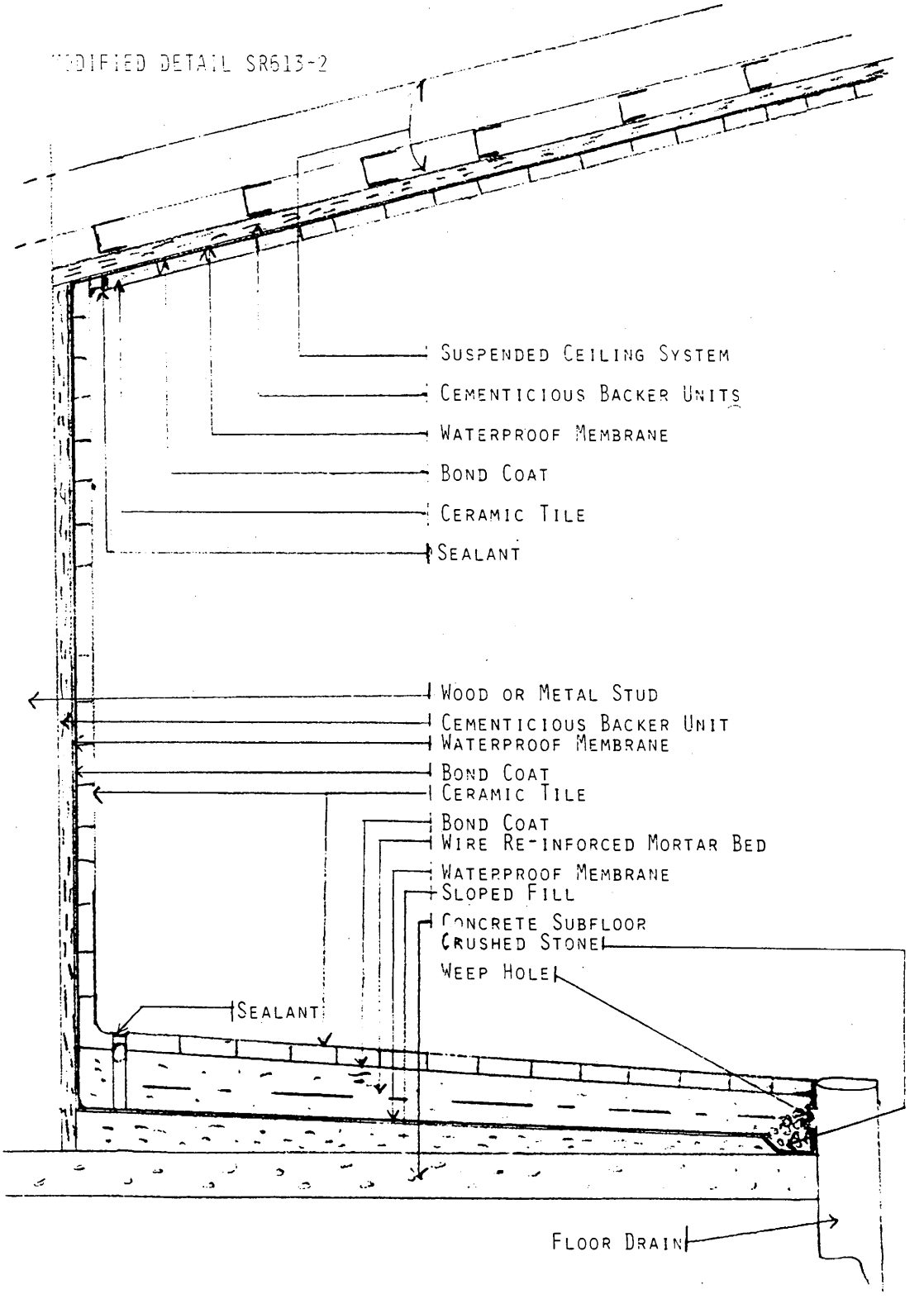
- CDU ATTACHMENT AND ACCESSORIES INFORMATION - GLASCRETE, INC.

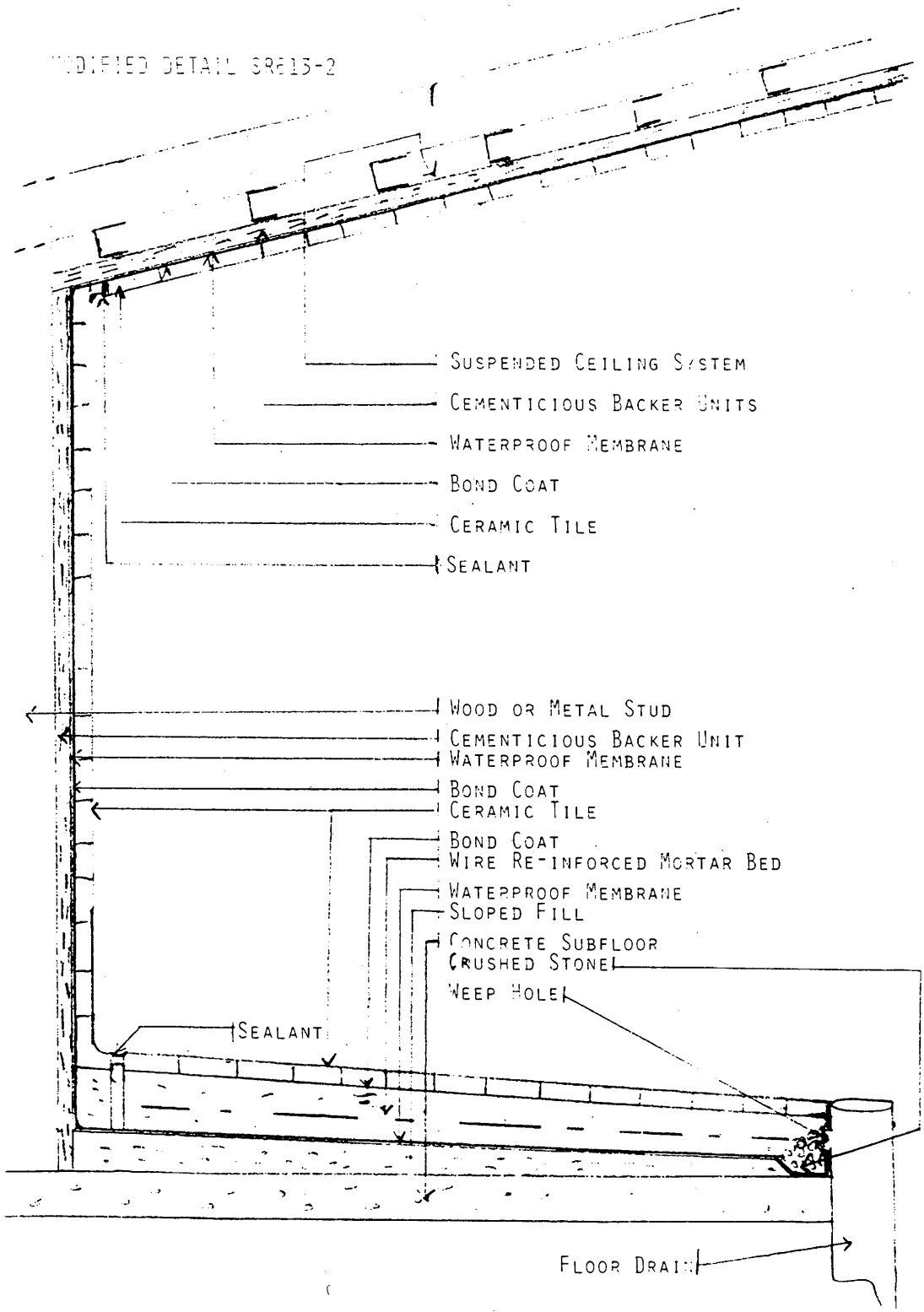
- LATEX MODIFIED THIN-SET MORTARS - ANSI 118.4 and ANSI 108.5

- CERAMIC TILE GROUT - ANSI 118.6 and ANSI 108.10

- METAL LATH - ANSI AN3.3.2 - 3.3.3

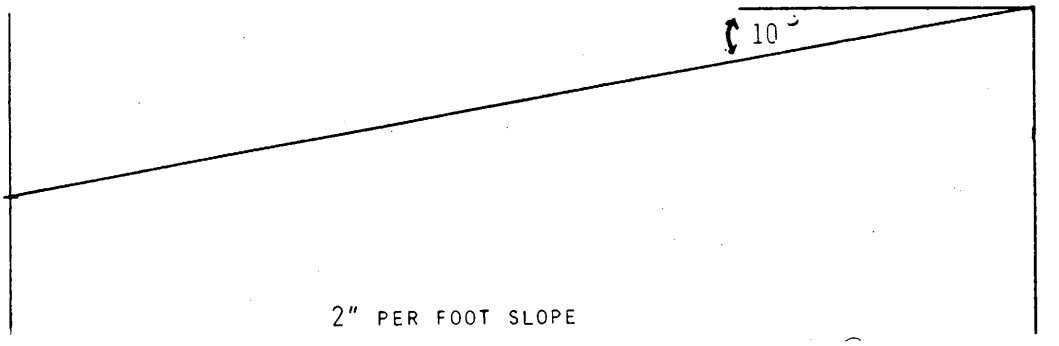
- PORTLAND CEMENT MORTAR - ANSI 108.1


MODIFIED DETAIL SR613-2
SUSPENDED CEILING SYSTEM
CEMENTICIOUS BACKER UNITS
WATERPROOF MEMBRANE
BOND COAT
CERAMIC TILE
SEALANT
WOOD OR METAL STUD
CEMENTICIOUS BACKER UNIT
WATERPROOF MEMBRANE
BOND COAT
CERAMIC TILE
BOND COAT
WIRE RE-INFORCED MORTAR BED
WATERPROOF MEMBRANE
SLOPED FILL
CONCRETE SUBFLOOR
CRUSHED STONE
WEEP HOLE
SEALANT
FLOOR DRAIN

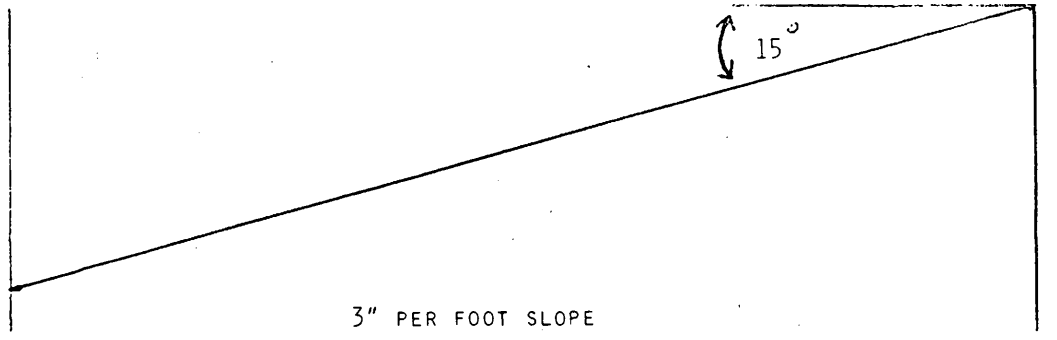

MODIFIED DETAIL SR615-2
SUSPENDED CEILING SYSTEM
CEMENTICIOUS BACKER UNITS
WATERPROOF MEMBRANE
BOND COAT
CERAMIC TILE
SEALANT
WOOD OR METAL STUD
CEMENTICIOUS BACKER UNIT
WATERPROOF MEMBRANE
BOND COAT
CERAMIC TILE
BOND COAT
WIRE RE-INFORCED MORTAR BED
WATERPROOF MEMBRANE
SLOPED FILL
CONCRETE SUBFLOOR
CRUSHED STONE
WEEP HOLE
SEALANT
FLOOR DRAIN

CEILING SLOPE ILLUSTRATIONS

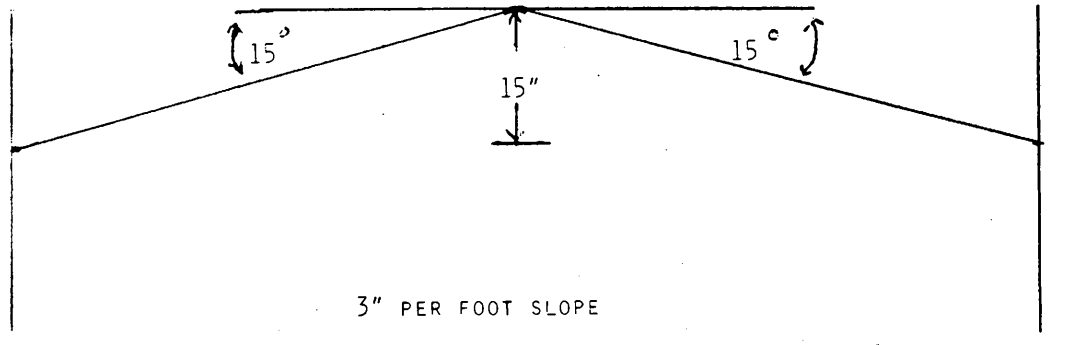
SCALE 3/4" = 1 FOOT



2" PER FOOT SLOPE



3" PER FOOT SLOPE



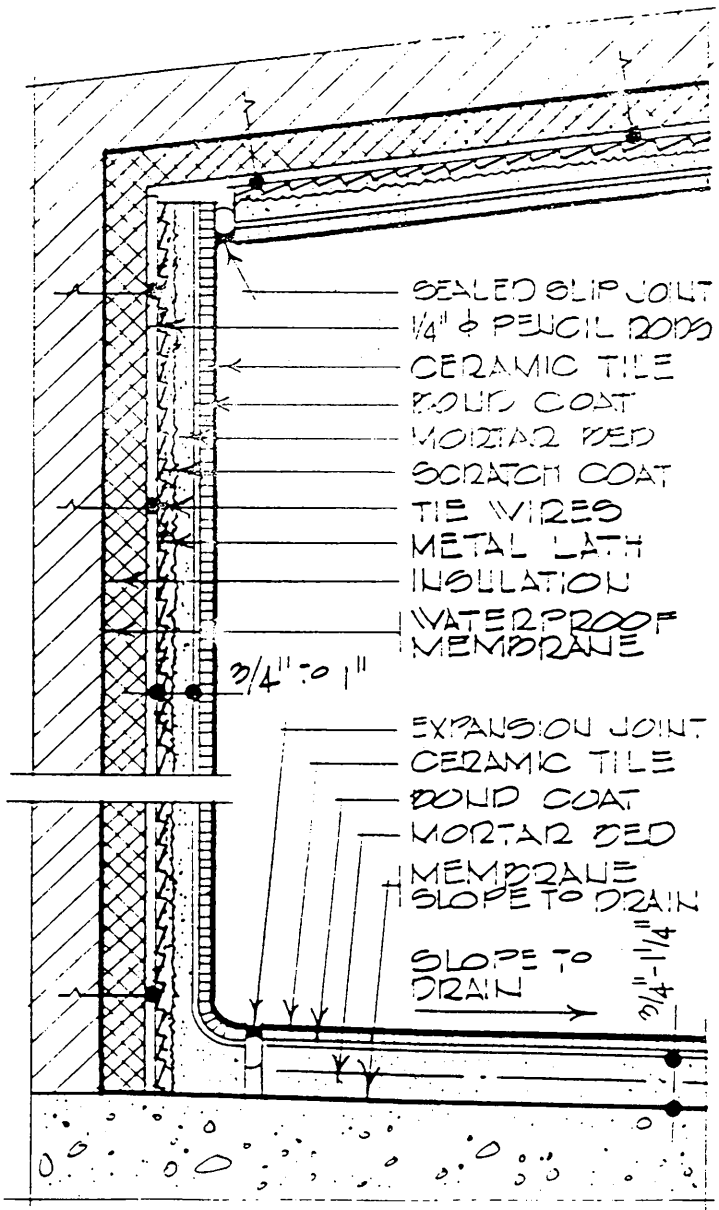
3" PER FOOT SLOPE

STEAM ROOMS

TILE COUNCIL OF AMERICA

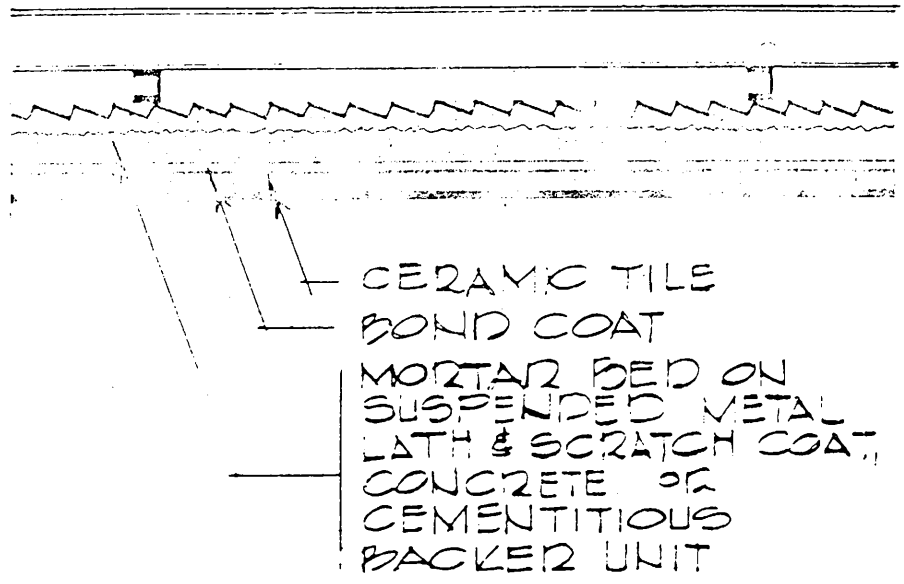
Membrane

Cement Mortar SR613-91



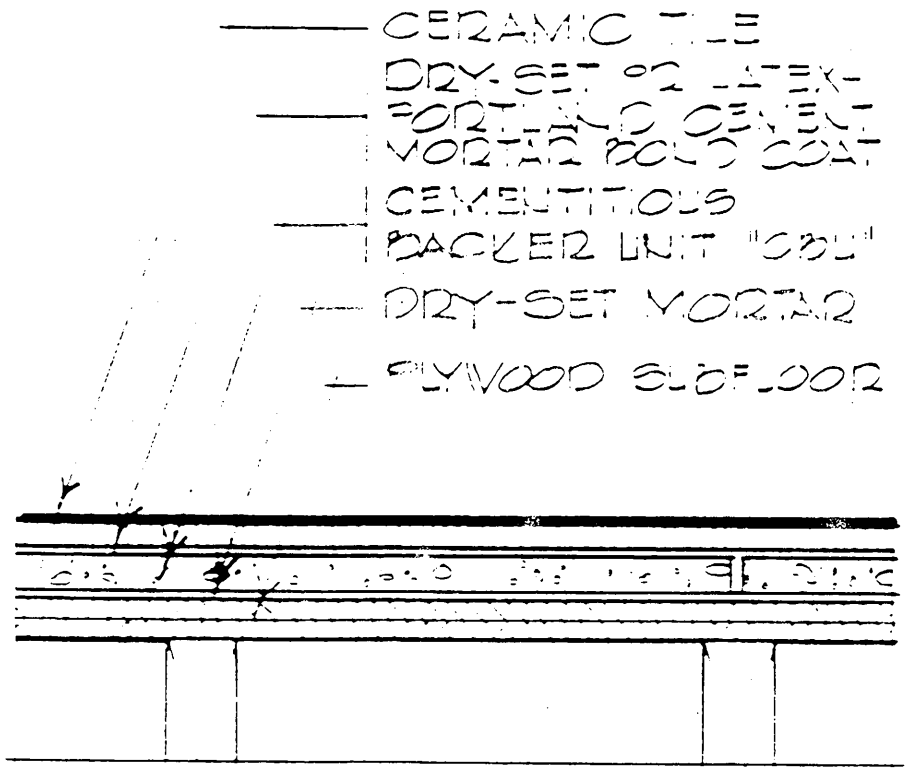
CEILINGS, SOFFITS

General C311-91



Cementitious Backer Units

Dry-Set Mortar or Latex-Portland Cement F144-91



Waterproof Membranes:

In addition to built-up membranes. single-ply membranes, non-metallic and lead or copper waterproofing, there are also waterproof membranes available for use with both vertical and horizontal thin-bed and thick-bed installations of ceramic tile which may be installed by tile trades. However, no industry or ANSI/ ASTM standards are presently recognized for these materials.

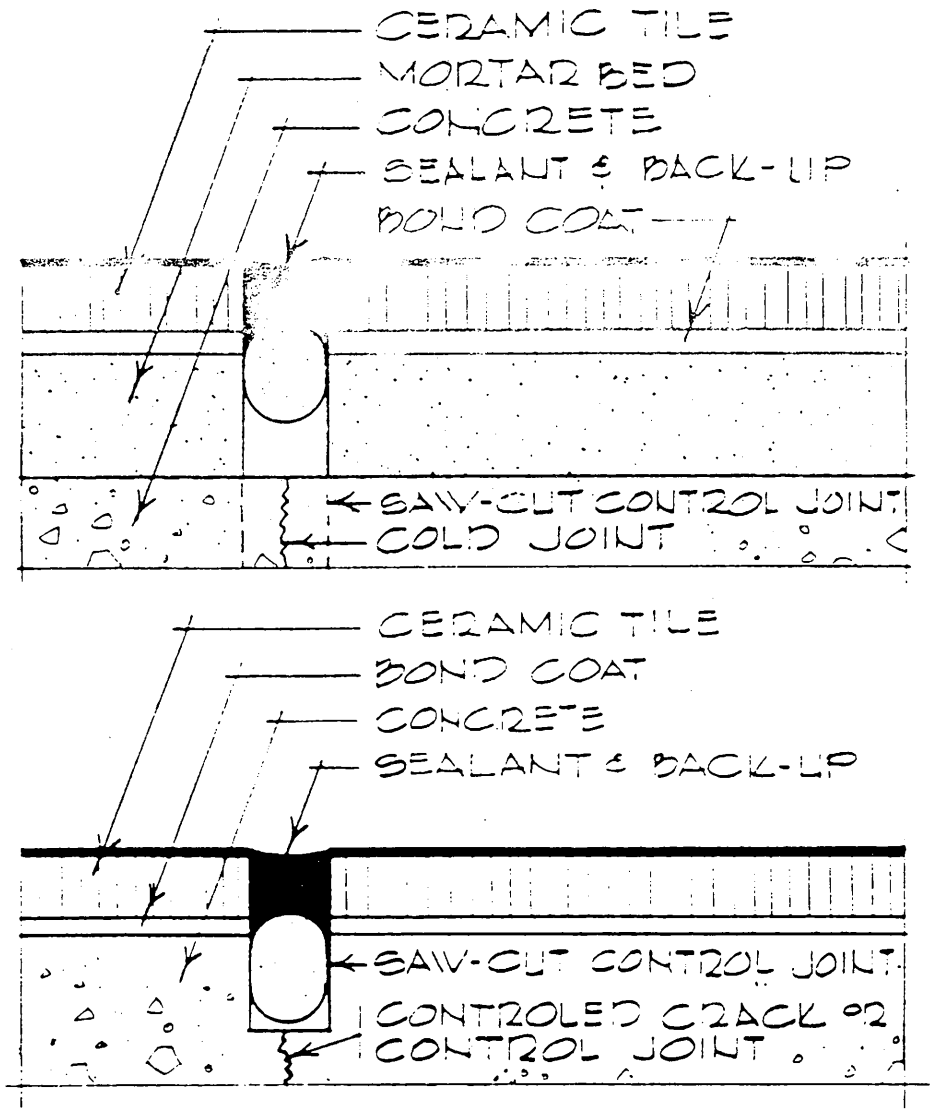
Among these are: single- or multi-component membranes applied in liquid/ paste form which cure into continuous membranes: and membranes applied in flexible sheet form. Some of these membranes have integral reinforcing fabrics for tensile strength and minor crack bridging properties. Others are designed to be used as a combination waterproofing and setting material for ceramic tile.

Depending upon the type of waterproofing membrane, manufacturers may require that tile products be installed on a reinforced portland cement mortar bed applied over the membrane: directly on the membrane with a thin-set application of dry-set or latex-portland cement mortar, or thin-set to the membrane using a troweled application of the waterproofing membrane product.

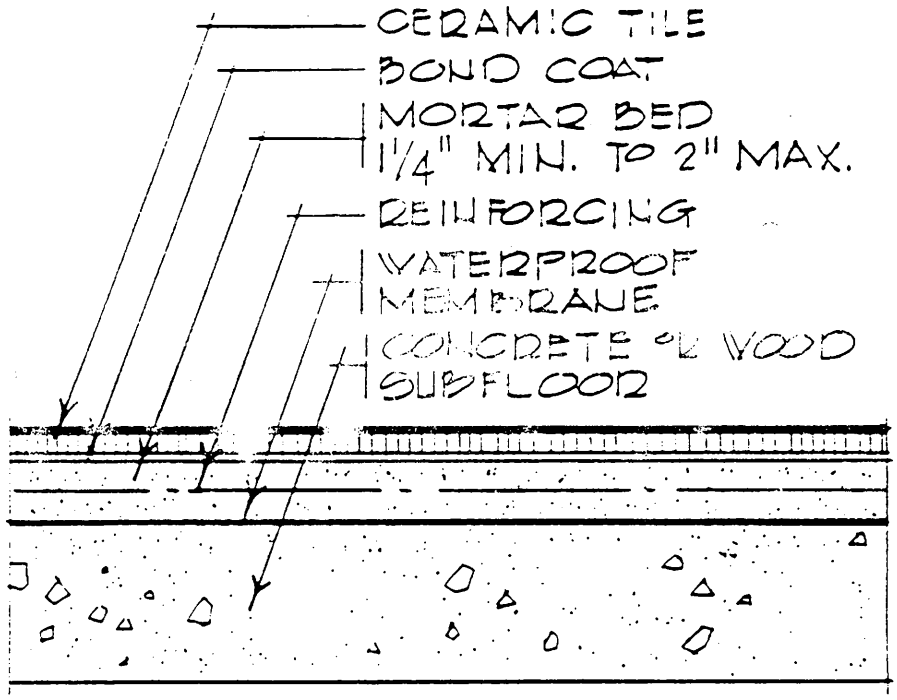
EXPANSION JOINTS

Vertical & Horizontal
Joint Design Essentials EJ171-91

Cold Joints



Cement Mortar Bed F121-91



Cement Mortar B414-91