For The Builders of A Better World

Installation of Ceramic Tile In Swimming Pools

TDS-1006

DESIGN CONSIDERATIONS

Primary Types of Swimming Pool Structures

Cast-in-place reinforced concrete.

Definition – concrete placed or pumped on-site over steel reinforcing; vertical walls contained by form-work on both sides.

Applications – typically large commercial pools, elevated pools, or on-grade pools in areas with poor sub-soil conditions.

Gunite or Shot-Crete Reinforced Concrete pumped through a hose.

Definition – mortar or concrete pumped through a hose and pneumatically projected at high velocity onto a reinforced surface, usually formed on one side by soil excavation.

Applications – below grade, small residential or light commercial pools with good sub-soil conditions; may also be used over form-work.

Combination Concrete Slab and core filled Concrete Masonry Unit (CMU).

Definition - concrete floor placed or pumped on site over steel reinforcement: wall consisting of reinforced core filled CMU's

Applications - below grade, small residential or light commercial pools.

Stainless Steel Pool Shells

Definition - manufactured high grade stainless steel panels cut to the desired shapes and sizes. These panels are welded to a stainless steel frame to create a tank that can be tiled.

Applications - small residential to commercial swimming pool installations.

Movement Joints

Definitions

Construction / cold joint – walls / floors typically are cast monolithically but large pools require multiple pours; concrete will crack at these weak intersections and require movement joint with integral water stops.

Control joint – prevents random cracking by controlling drying shrinkage in straight lines with saw cutting, can be eliminated by the use of additional reinforcing to control shrinkage and curing concrete correctly.

Structural Movement Joint – Joint between structures, typically long pools shells that are poured in two or more parts; requires integral water stops to be built into the shells. See detail 5.

Intermediate joints – in addition to any movement joints carried through from the underlying shell to the tile surface, additional joints must be provided every 2.5–4 m to provide for long term moisture expansion, and shrinkage as the pool is emptied. Refer to AS 3958 Movement Joint section for further information regarding the construction, design and placement of movement joints.

Perimeter Joints – in addition to any structure movement joints, perimeter joints are carried from the underlying structure to the tile surface at abutments or protrusions. See Detail 1 which depicts a perimeter and change of plane joint.

Sealing movement joints – whether a pool needs to be completely waterproof (prevents any leaks), or watertight (monolithic structure which contains water with minimal absorption and leakage), movement joints must be designed to prevent rapid loss of water. The project architect or engineer must specify movement joints and show location and other details on drawings and specifications. Sealant for movement joints – LATASIL™ with LATASIL 9118 Primer.
NOTE: Sealants need regular (approx 3 to 5 years depending on usage) inspection, maintenance or replacement to ensure junctioning joints.

A Primary protection – sealants – provide primary closure of joints, but cannot provide 100% effectiveness as a barrier to water leakage. Sealants must be suitable for water immersion and be installed with proper backer rod, primer (as required), and tooling by specialists. The sealants need to be inspected and maintained on a regular basis.

B. Secondary protection – water stops - flexible plastic or butyl rubber devices which are integrally cast in, or placed below movement joints in pools to provide a flexible yet monolithic, watertight connection across movement joints. Water stops are critical secondary protection even when a waterproofing membrane is specified. See Detail 5 which depicts a post installed water-stop incorporating and sealant filled movement joint.

Deflection

Swimming pool shells must be structurally sound, stable and rigid enough to support ceramic tile, stone and similar finishes. Substrate deflection under all expected live, dead and impact loads, including concentrated loads must not exceed L/360 for ceramic tile installations, or L/720 for stone installations where L = Span.

INSTALLATION PROCEDURES

LATICRETE Australia strongly recommends the use of installers who have demonstrated their commitment to their craft and taken the time to stay current with the latest materials and methods. Requiring references and a portfolio along with a bid or estimate is a good way to ensure the installer has successfully completed work of similar size, scope, and complexity. LATICRETE offers training free of charge, to those not familiar with our products. Training is required for some LATICRETE products as a condition of warranty.

Surface Preparation

Inspection

Pool shells surfaces, are rarely free of contamination and defects, smooth enough, or meet the required plane tolerances, for the direct bonding of waterproof membranes or surface finishes. For instance cast in place concrete walls present specific defects such as laitance, form release oils and surface defects, (e.g. honeycombing and blow holes). Concrete pool shells are also subject to surface defects such as dusting, crazing and laitance from improper finishing, as well as significant ground-in construction contamination. Prior to commencing the installation, the contractor shall examine the areas to be covered and advise the Main Builder and Architect of any existing conditions or surface contamination, which will require correction before the work commences.

Preparation

Improper preparation and cleaning are a primary cause of failure of waterproofing membranes and levelling mortars (renders and screeds) in pools. As required, concrete and CMU substrates shall be prepared/processed by whatever method deemed necessary by the contractor to expose the fine aggregates, present with a sound clean open pored surface prior to installing render/screeds, waterproofing or adhesives. Concrete Surface Profile shall be a minimum of CSP3. See www.icri.org for more information of Concrete Surface Profiles.

Note: Prior to starting works, implement all National, State, Local occupational health and site safety procedures. All works shall be in accordance with Work Safe Australia.

Typical Substrate Preparation Methods

High-pressure water blasting – 5,000 – 8,000 psi (34–54MPa) to remove severe contamination by removing top 3 mm to 6 mm of concrete and to expose aggregate for improved mechanical bond of standard Portland cement levelling mortars (screeds and renders).

Shot blasting – effective for floors and walls (with hand held equipment); removes and collects debris in one step from top layer 1.5 mm to 6 mm with fine to coarse steel pellets. Use to remove existing paint coatings or concrete surface defects such a laitance

Grinding - variety of mechanical scarifying methods available, must ensure final cleaning of residue with high pressure water or air cleaning.

Grit blasting – includes traditional slag blasting, which is effective but intrusive and hazardous; or, new methods incorporating water soluble, mechanically refined sodium carbonate grit media.

Acid cleaning – this method is not recommended if other methods are available because improper dilution and/or improper application methods (failure to saturate surfaces with water), and improper neutralizing/rinsing of residue can deteriorate concrete surfaces. Improper methods and dilutions can also cause post installation efflorescence from residual soluble chlorides. Residual chloride can also inhibit bond, accelerate set of cement based mortars and adhesives, or cause chloride ion deterioration of steel reinforcing.

Cleaning

As required the substrate shall be cleaned after surface preparation and processing by high pressure water cleaning to clean surface dirt and contamination or weakened surface layers. Any approved cleaning agents must be completely removed, neutralized and rinsed. For steel substrates, contact the manufacturer for cleaning instructions.

Dimensional Surface Correction

Is necessary where the substrate is not finished accurately to meet levelness or flatness tolerances for direct application of ceramic tile or stone using thin-set method. For thick bed (wet bed mortar installations) ceramic and stone tile installation, maximum allowable variation in the substrate shall be 10 mm in 3 m. For thin bed ceramic tile installations when a cementitious bonding material will be used, including medium bed mortar: maximum allowable variation in the tile substrate – for tiles with edges shorter than 375 mm, maximum allowable variation is 6 mm in 3 m from the required plane, with no more than 1.5 mm variation in 300 mm when measured from the high points in the surface. For tiles with at least one edge 375 mm in length or larger, maximum allowable variation is 3 mm in 3 m from the required plane, with no more than 1.5 mm variation in 600 mm when measured from the high points in the surface. For modular substrate units, such as adjacent concrete masonry units, adjacent edges cannot exceed 1 mm difference in height. Should the architect/designer require a more stringent finish tolerance (e.g. 3 mm in 3 m), the subsurface specification must reflect that tolerance, or the tile specification must include a specific and separate requirement to bring the subsurface tolerance into compliance with the desired tolerance.

Latex Portland Cement Levelling Render

3701 Fortified Mortar Bed; or, 226 Thick Bed Mortar mixed with 3701 Mortar Admix is recommended for superior adhesion, flexibility, resistance to differential movement and immersion; should be mixed to a plastic consistency and applied no greater than 12 mm thick per application (lift). Carry any underlying movement joints to the surface. Slurry Bond Coats are not required for wet wall renders

Latex Portland Cement Mortar Beds

3701 Fortified Mortar Bed; or, 226 Thick Bed Mortar mixed with 3701 Mortar Admix, applied from 50 mm to feather edge, is mixed to a semi-dry consistency and placed over a latex/cement slurry bond coat consisting of 254 Adhesive, or 211 gauged with 4237 Latex Additive or 3701 Mortar Admix, levelled between screed boards and thoroughly compacted. For beds over 50 mm thick, install in layers. Scratch and allow to dry before the application of the slurry bond coat and new layer.

Skim Coats

A **Latex Portland Cement Skim Coats**
Skimming may also be required to render the substrate perfectly smooth with the use of 254 Adhesive or 211 gauged with 4237 Latex Additive. Mix to the desired consistency and apply at a nominal thickness of 2 - 3mm with the flat edge of the trowel. Scratch and allow to dry before making subsequent coats.

B **Epoxy Skim Coats**
Skim coat steel substrates with LATAPOXY® 300 Adhesive. Apply at a nominal thickness of 2 - 3mm with the flat edge of the trowel.

Waterproofing

Where required, the installation of the LATICRETE® HYDRO BAN® Waterproof Membrane System in immersed applications must be installed in a manner which creates a continuous "waterproof pan effect" without voids/interruptions. Applying waterproofing membranes in limited areas (e.g. solely at the water line) in immersed applications is not recommended.

Methods of Waterproofing Swimming Pools

External or "Sandwich" Slab Waterproofing Membranes

Sheet or fluid applied waterproofing membrane installed between two layers of concrete or between grade and concrete shell; this method is costly and is typically used when external or negative hydrostatic pressure is present to protect ceramic tile from delamination when pool is emptied, or with waterproofing membranes that do not allow direct adhesion of ceramic tile.

Direct Bond Waterproofing Membranes

Protects underlying levelling mortars and concrete shell from saturation and prevents problems caused by moisture penetration such as moisture expansion, chemical attack (chloride ion deterioration of reinforcing steel), and efflorescence. LATICRETE HYDRO BAN Waterproof Membrane System can be used. All installation of HYDRO BAN in immersed installations shall be over LATAPOXY Moisture Shield.

Pre-Treat Junctions

As required, a 12mm – 15mm fillet of HYDRO BAN Fillet and Sealant shall be installed to all wall/floor, wall/wall and hob/wall junctions prior to the application of LATICRETE HYDRO BAN Waterproof Membrane. When the sealant has skinned/ dried, apply a liberal coat^ of HYDRO BAN Membrane at all treated wall/floor, wall/wall and hob/wall junctions. See Detail 1.

Pre-Treat Penetrations

In immersed installations it is recommended to V out around the penetration and make the surface good with HYDRO BAN Fillet & Sealant to seal and create better transition for the membrane at the base of the V. When the sealant has cured, apply a liberal coat^ of HYDRO BAN Membrane onto and around penetration. When the first coat has completely dried to the dark olive green colour, cover with a second liberal coat^ of liquid and allow to dry. After the membrane has cured, the V can be filled with LATICRETE latex Mortar to the desired surface level/finish and allowed to cure. This surface can then be further covered with the HYDRO BAN Waterproof membrane to the correct coverage and thickness. See Detail 2.

Glazed Portals

The responsibility of waterproofing glazed portals is the responsibility of the glazier. HYDRO BAN shall not be used as the primary membrane, and requires termination. See Detail 3 for termination details.

See TDS 1003 for more detailed information.

Do not expose unprotected membrane to sun or weather for more than 30 days.

^Dry coat thickness is 0.6 mm – 0.9 mm; consumption per coat is approximately 0.4 litre/m2; coverage per coat is approximately 2.4 m2/litre.

Water / Flood Testing

Where required, flood testing may be undertaken to test for water tightness once membrane has been allowed to fully cure. Please refer to LATICRETE PDS for cure time of HYDRO BAN prior to flood testing. Fill at the rate of 610 mm per 24 hours. Please refer to TDS 1169 "Flood Testing Procedures" for more information on conducting flood tests.

Selection and Installation of Ceramic Tile

Considerations for Selection of Ceramic Tile

Pre-mounted mosaics – use of paper face mounted ceramic, stone and glass mosaics is recommended; use caution when considering back mounted sheets using PVC dot mounting or adhesive mounted mesh mosaic tile; the types and quality of mounting methods vary and resulting bond strengths may be very low after saturation and chemical attack of pool water. Check with the manufacturer of the selected tile to verify compatibility in immersed installations. For further information on the installation of glass mosaics, please refer to TDS 1145 "installation of Glass Mosaic Tiles" Consult LATICRETE on the installation of any mesh mounted mosaics.

Moisture expansion – use only impervious (<0.5% absorption rate) or vitreous (<3.0% absorption rate) tiles to reduce the effects of moisture expansion, or, in the case of exterior pools in cold climates, to eliminate freeze/thaw problems. Tiles with an absorption rate over 3% may permanently expand from moisture exposure.

Selection of Tile Adhesive

(Contact LATICRETE for a custom project specification)

Latex fortified mortars and adhesives (wet bed or thin bed) – use mortars and adhesives suitable for continuous water immersion. Latex mortars and adhesives improve adhesion, reduce chemical attack by coating Portland cement, and impart flexibility to withstand moisture expansion and shrinkage. For wet bed fixing mortars use 3701 Fortified Mortar Bed; or, 226 Thick Bed Mortar gauged with 3701 Mortar Admix. For thin bed applications use 254 Adhesive, 257 TITANIUM™ Adhesive, 335 Adhesive 335 LITE Adhesive or 211 Adhesive gauged with 4237 Latex Additive.

Epoxy adhesives – (e.g. LATAPOXY® 300 Adhesive or LATAPOXY SP-100 Coloured Adhesive) are recommended to eliminate deterioration from chemical attack. Many epoxies suitable for interior and exterior use have flexibility and exceptional adhesive qualities to withstand differential movement from thermal and moisture expansion and drying shrinkage.

Installation of Tile by the Thin bed Method:

NOTE: Minimum final bed thickness shall be 1.5mm for mosaic tile and 3mm for ceramic tile.

The LATICRETE Adhesive shall be applied with a notched trowel using a scraping motion to work the material into good contact with the surface to be covered. A trowel having notches of sufficient size to optimize bedding is recommended. On site test should be carried out to determine the appropriate trowel size to target no voids in the adhesive bed, full bedding of the tile and complete adhesive distribution once the tiles are installed. Excess adhesive shall be cleaned from the tile face and joints shall be free from adhesive prior to grouting.

Grouting of Ceramic Tile

Considerations for Selection of Tile Grout

In immersed applications, the performance of the grout is critical to the long term durability of the installation system. Therefore, the selection and use of the appropriate grout is a key design element. Grout in immersed applications can be exposed to chemicals, pH imbalance, varying water mineral and metal content levels, moisture expansion and other factors that could affect the integrity of traditional cement based grouts. In addition, for grout exposed above the water line, consideration for UV resistance must also be made. Therefore, it is important to manage the expectation of colour consistency due to UV and different states of dryness. In many commercial and public water features, pH pool water imbalance can lead to degradation of cement and epoxy grouts. In addition, calcium extraction of the Portland cement component of traditional cement based grouts can occur when prolonged mineral imbalance occurs. Epoxy grouting products are more resistant to these issues. Epoxy grouts are also more resistant to harsh cleaners and chemicals that may be used to clean and maintain institutional and therapeutic pools which are emptied, cleaned on a frequent basis and then filled again.

Types of Grout

PERMACOLOR® Grout – high performance, polymer fortified grout that provides a durable, dense and hard grout that is ideal for immersed installations; mixes with water only.

SPECTRALOCK® PRO Premium Grout – contains no Portland cement, excellent colour uniformity, durability, stain resistance. Epoxies may discolour when exposed to ultraviolet rays in exterior applications which does not affect the grouts' performance.

LATAPOXY® SP-100 Epoxy Grout – high performance epoxy grout, which contains no Portland cement, offers stain resistance, chemical resistance, pigment free epoxy grout and durability Epoxies may discolour when exposed to ultraviolet rays in exterior applications which does not affect the grouts' performance.

MAINTENANCE

Opening, Seasonal Closing and Pool Idling for Maintenance and Repairs

A. Curing – observe an average minimum cure time of 14 days at 21°C for latex fortified Portland cement grout installations to prevent latex migration, and 10 days at 21°C for epoxy grouts to reach maximum chemical resistance prior to filling pool. Cure time can be significantly increased or decreased due to temperature and humidity effects on curing.

B. Filling – fill pool with water at a rate of 610 mm per 24 hours to allow gradual exposure to water pressure, thermal and moisture differentials. Initial alkalinity of pool water is usually very high from exposure to Portland cement based finishes, mortars and grouts, so careful and frequent balancing is required (see Water balance below). Do not fill if potential thermal gradients exist (e.g. very cold source water into an exterior pool which has been exposed to several days of solar radiation).

C. Draining - drain pool water at a rate of 610 mm per 24 hours to allow gradual relief of water pressure and thermal and moisture differentials.

Effects of Water Treatment in Tiled Swimming Pools

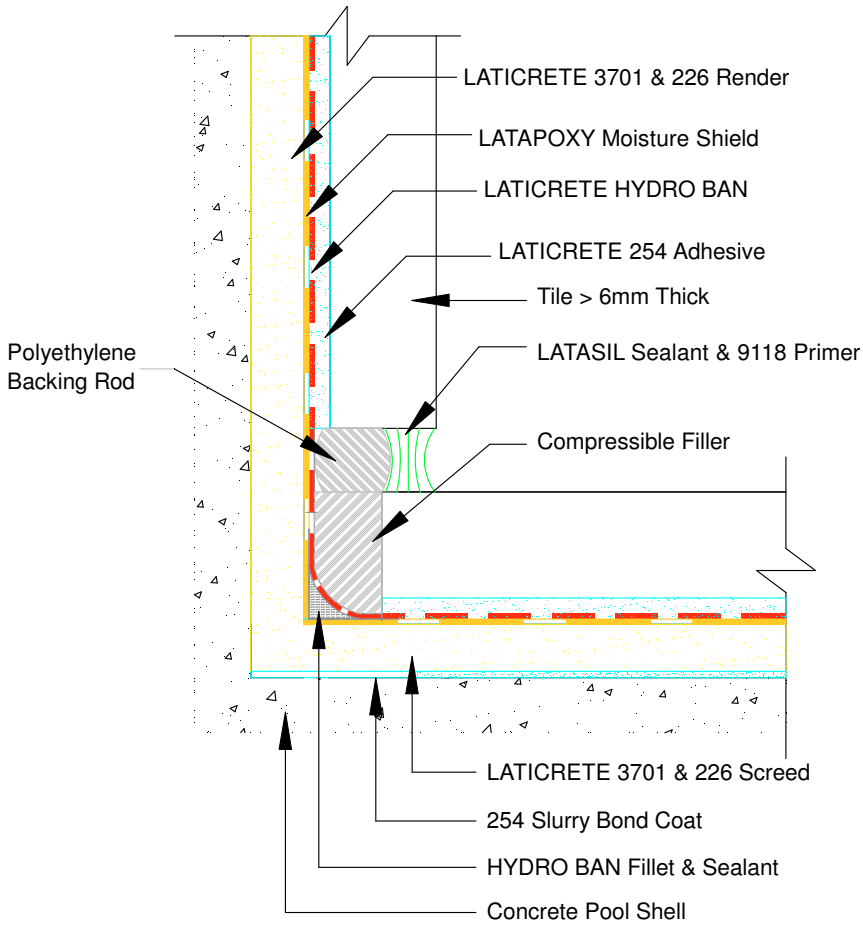
Swimming pool chemistry is very complex but crucial for the proper and healthy functioning of any pool. Certain water chemistry or sanitation systems can affect Portland cement materials. Epoxy adhesives and grouts offer enhanced chemical resistance, and it may be advisable to incorporate these materials into the tiling system if necessary.

Note:

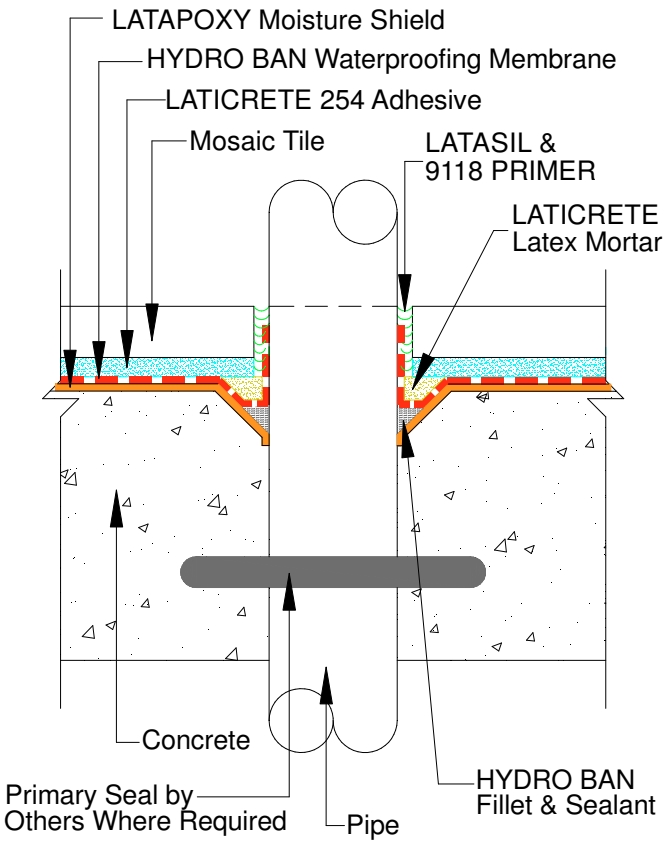
- Source water – may have high sulfate content that can damage Portland cement masonry and installation materials. Epoxy Products should be used.
- Disinfection – Liquid chlorine dosing or sodium chloride chlorinators are the most popular disinfection agents for swimming pool water. Bromine, ozone, salt and peroxide disinfection systems to name some, are also available. Check with LATICRETE for the compatibility of these and other types of water treatment systems with your proposed system.

For more information on the effects of water treatment in tiled swimming pools, See TDS 1023 "Pool Maintenance Guide"

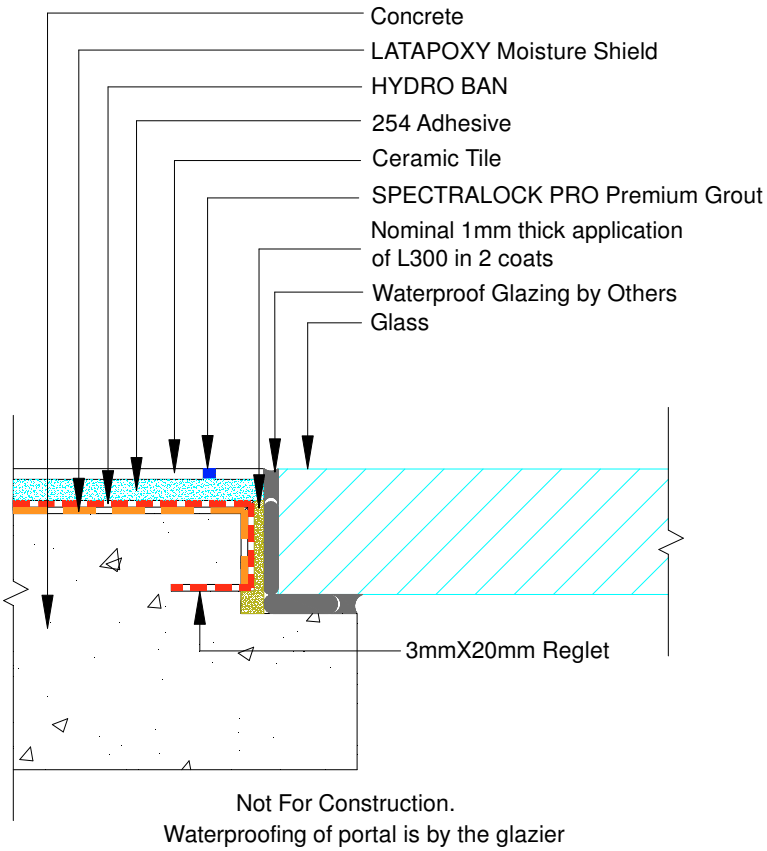
INFORMATIVE DETAILS



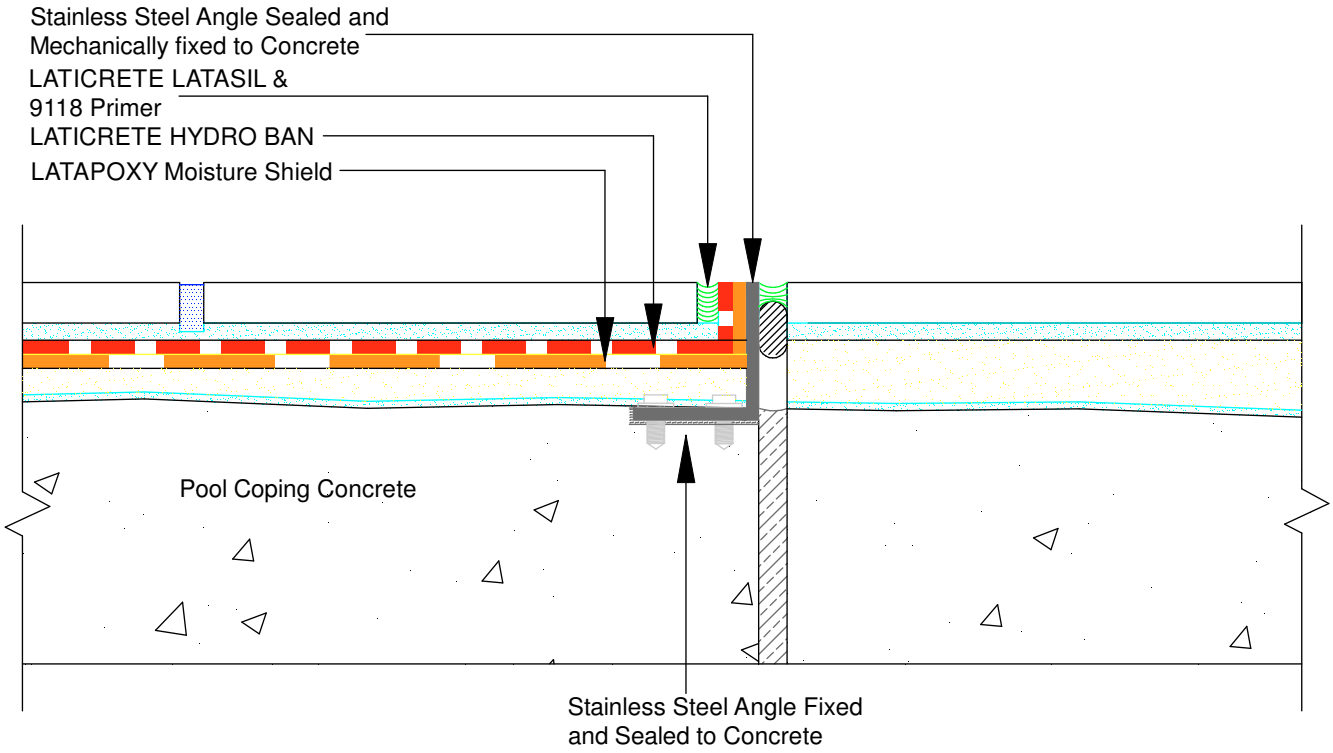
DETAIL 1 Transition Fillet and Movement Joint



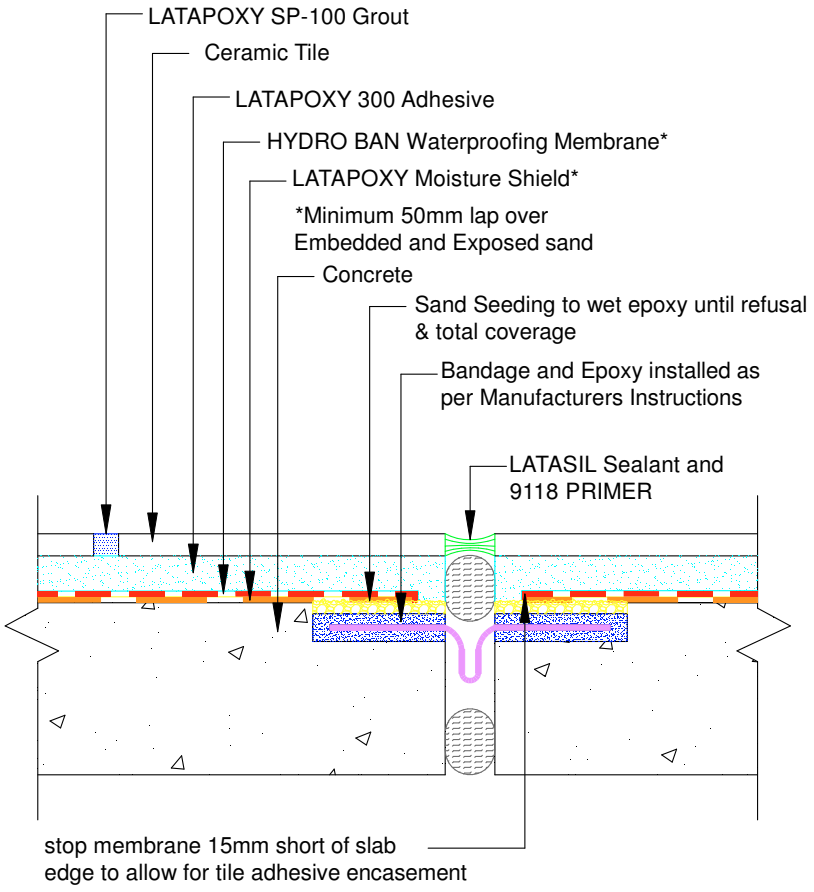
DETAIL 2 Immersed Pipe Penetration



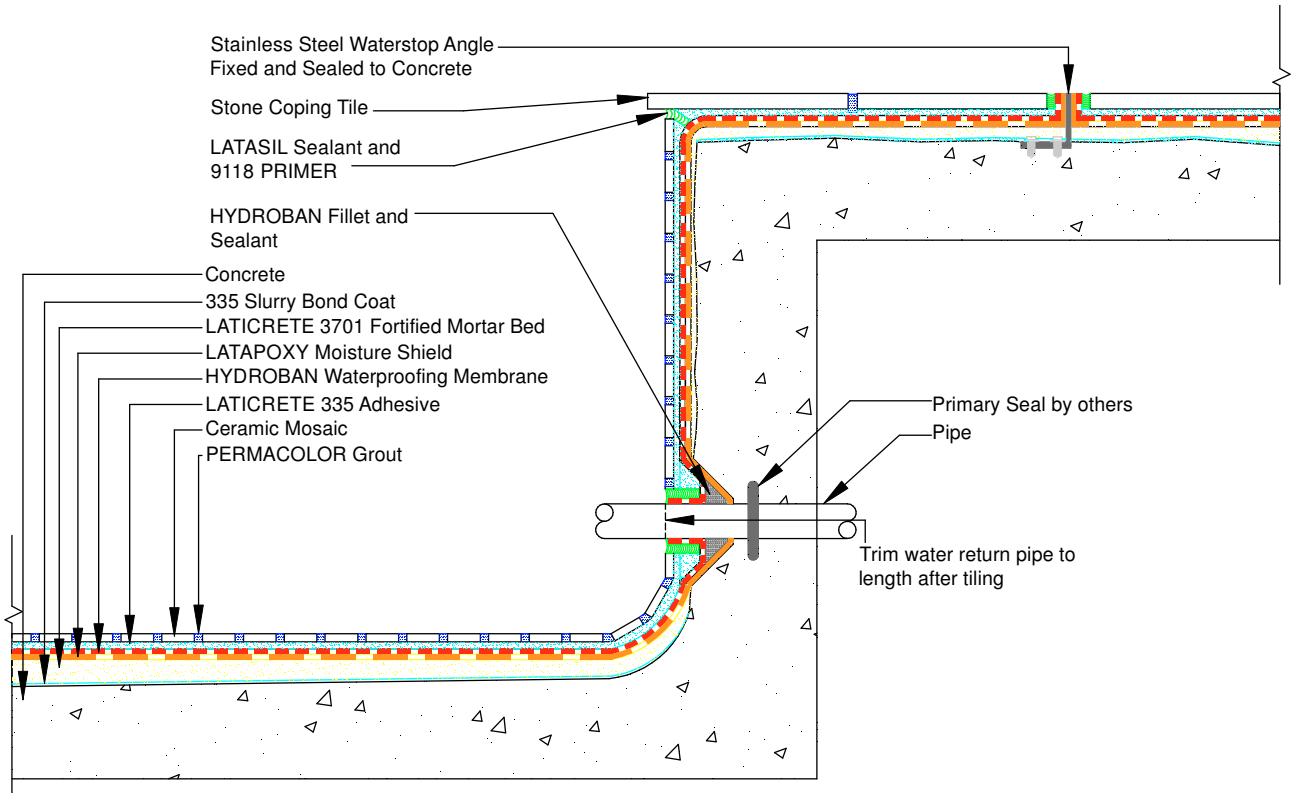
DETAIL 3 Termination of HYDRO BAN Membrane at Glazed Portal



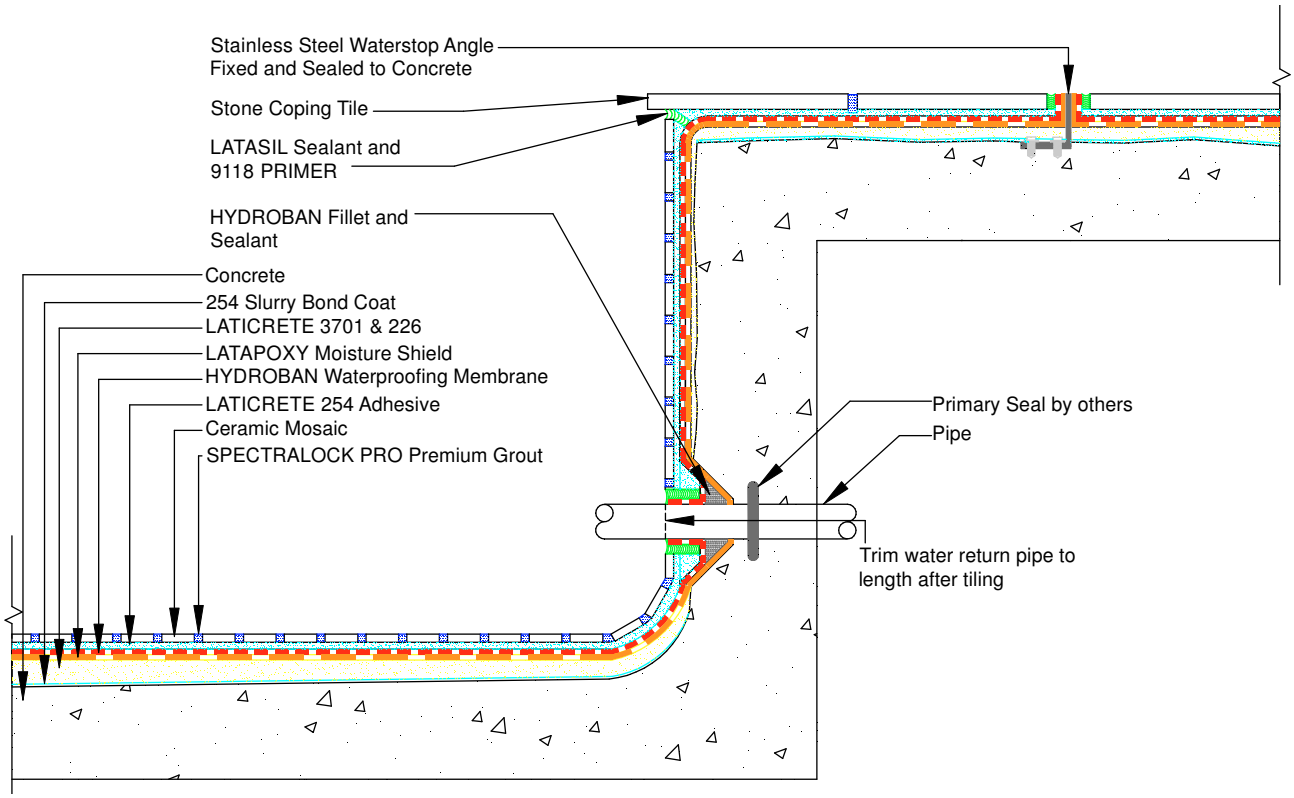
DETAIL 4 HYDRO BAN Termination – Stainless Steel Angle



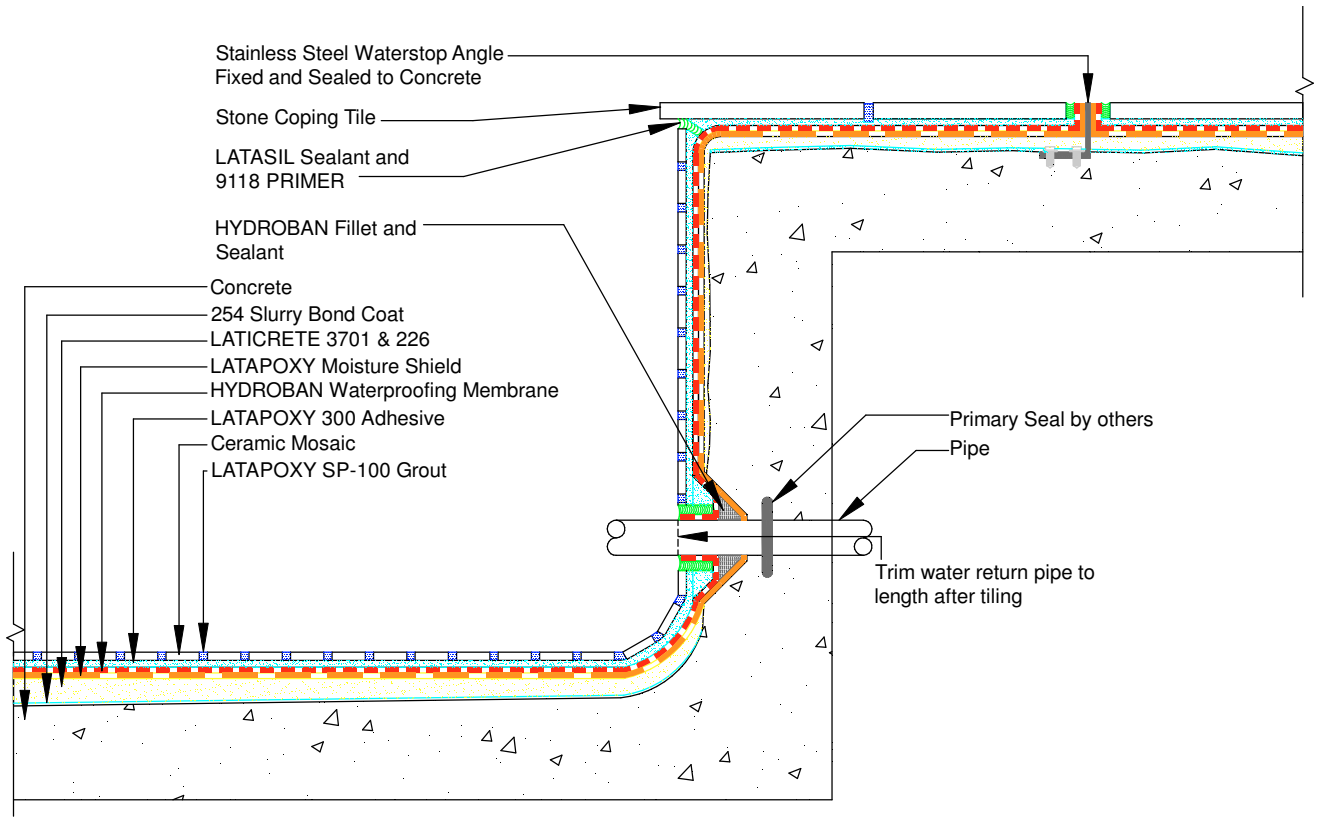
Detail 5 Termination of HYDRO BAN membrane at water stop.



DETAIL 6 LATICRETE 10 Year System Warranty



DETAIL 7 LATICRETE 15 Year System Warranty



DETAIL 8 LATICRETE 25 Year System Warranty

Please refer to Tiled Swimming Pool, Fountain and Spa Technical Design Manual available at www.laticrete.com.au for more in-depth information.

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