# Indoor pool challenge

There have been some spectacular failures from indoor heated swimming pools with condensation in the walls and roof, mould growth, saturated decaying timber and severe corrosion of steel. Quite different construction is needed to avoid this.

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**INDOOR HEATED SWIMMING POOLS** provide unique challenges. Usually, the main challenge of the building enclosure is to keep the water out. However, with indoor heated swimming pools, it's necessary to keep both exterior water out and interior water in.

Incorrect design can result in severe damage. Water vapour inside the building may migrate through the wall assembly until it finds a cold surface. These problems can be addressed by building wall and roof assemblies with methods that are unfamiliar to many in New Zealand.

### *Vapour barrier and insulation needed*

The key to success is having an appropriate vapour barrier and sufficient insulation located in the correct position within both the roof and wall assembly.

Interior air temperature needs to be controlled and maintained at a higher temperature to the pool water to conserve energy, avoid condensation on internal surfaces and excessive humidity, which will be uncomfortable for non-swimming building occupants.

Opening windows are undesirable - random opening of windows will prevent accurate temperature control - so a mechanical ventilation system is required. This also provides a net positive pressure on the inside, preventing the migration of cold external air into the building.

However, the consequence of a net positive internal air pressure is that very humid warm air will migrate into the wall and roof assembly if there is not an effective and continuous vapour barrier present. If the warm, humid air does escape into the wall and roof assembly, it will find a cold surface where condensation will occur, and this can cause saturation of all materials in the wall or roof.

### *The right balance is crucial*

When designing an indoor heated swimming pool, identify the interior conditions and user experience required. This includes the desired water and air temperatures and the on-going budget for maintaining those temperatures. This must be compared with the outside air temperatures throughout an entire year.

Getting the balance wrong can have unintended consequences, such as high water loss from the pool due to excessive evaporation. This will increase water consumption and heating costs.

Temperature ranges for pools vary according to the use, but air temperatures should always be slightly higher. For leisure pools, 27°C is a common pool temperature, with interior air in the 28-30°C range.

### *Wall and roof details*

Appropriate wall and roof assemblies are shown in Figures 1 and 2. In a hot and humid environment with forced mechanical ventilation, the vapour barrier must be continuous across the entire enclosure and should not be penetrated by services. Unavoidable penetrations should be planned and thoroughly sealed to prevent air escaping.

The continuity of the vapour barrier between the roof and the wall is particularly important. This is a challenging location where designers and builders are most likely to fail.

The most reliable location for a continuous vapour barrier is usually on the outside of a rigid air barrier located on the outside of the framing. This location receives the least number of penetrations for building services and allows the easiest continuity at the wall to roof intersection.

The vapour barrier must be located on the warm side of the wall assembly, meaning that the insulation needs to be on the outside of the framing, not between the framing as is traditional. If the insulation is outside of the vapour barrier, there will be no rapid transition from outside cold to inside warm to attract condensation, and the inside of the vapour barrier will not be cold enough to cause condensation of internal vapour.

This method requires a wide rainscreen carrier to provide space for insulation and a drainage gap behind the cladding. Fixing points for the carrier system need to be minimised to reduce the number of thermal bridges that penetrate the insulating layer. It is also helpful for fixings to be on an insulated pad to minimise thermal bridging.

The roof detail in Figure 1 has purlins supported on specially made brackets. If purlins are fixed directly to the rafter below, they will provide a large thermal bridge for heat loss. There is also a high risk of creating unsealed holes in the barrier from skew nailing purlins though the vapour barrier. The bracket allows better continuity of insulation, a smaller area of thermal bridge and specific, disciplined fixing placement.

### *Consider the windows*

Windows also need careful consideration. Single glazing is unsuitable as it would allow extensive energy loss and a high level of condensation, resulting in mould or algae growth on the inside.

The vapour barrier must be sealed to every window so there is no air escape at the wall to window connection (see Figure 2).

Using thermally broken aluminium window frames reduces the risk of condensation forming on the window frame within the wall assembly where it will remain undetected and, if the window frame is not wrapped thoroughly, the adjacent framing will become wet.

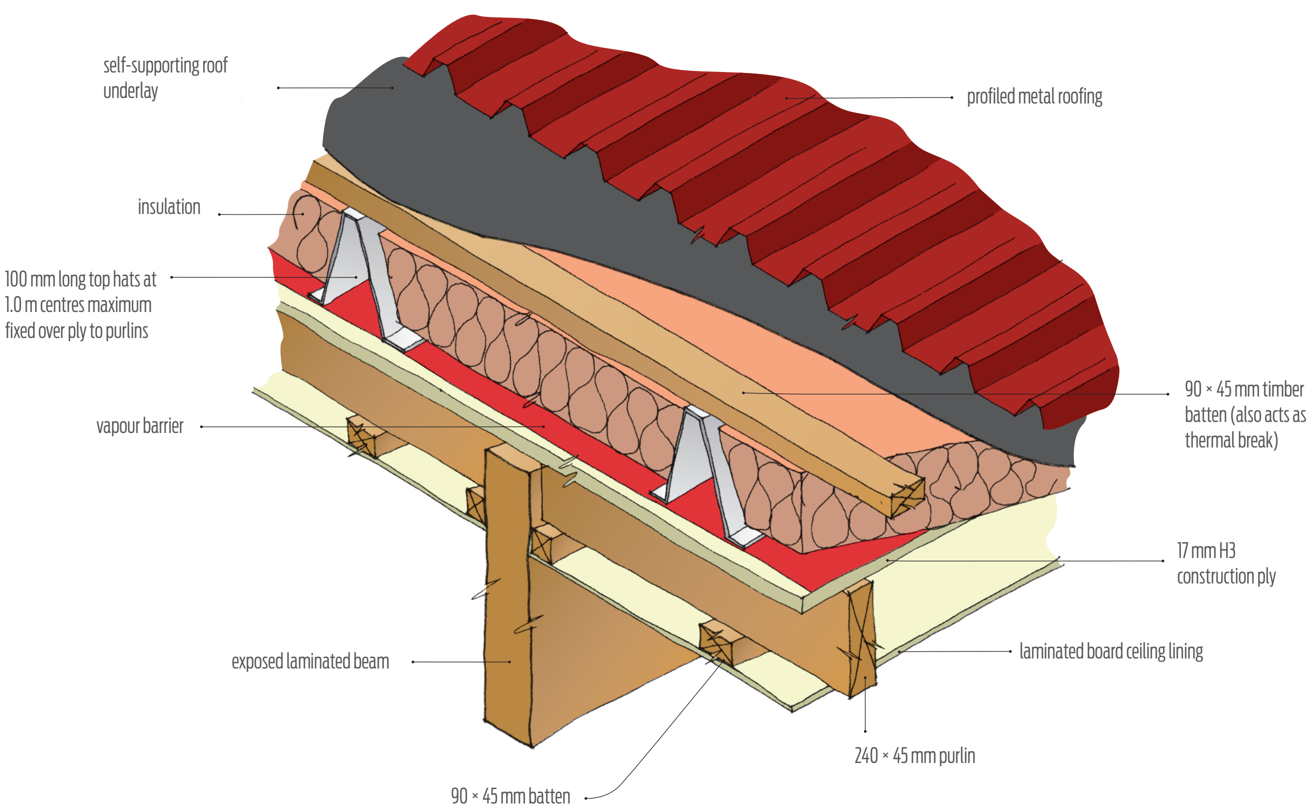


Figure 1: Roof detail.

### Interior walls

The temperature and humidity in the pool room and facilities opening into it may be higher than the adjacent habitable spaces. Specific calculations will need to be carried out to determine the temperature and vapour pressure differences and whether a vapour barrier is needed.

However, when designing interior walls, note that the demands on them equate to exterior conditions - water splash creates wet conditions, and cleaning is often performed with a hose and broom.

### Common overseas in colder climates

While this type of wall assembly is not common in New Zealand, it is common all around the world in colder climates. By placing a hot pool inside a building in the colder areas of New Zealand, we are effectively inducing the conditions that exist in climates much colder than New Zealand.

### Existing pools can be checked

The performance of existing pool structures can be assessed by installing dataloggers in the wall and roof assemblies and measuring weather conditions outside to provide actual data about the difference between internal and external conditions in all seasons.

### Why things go wrong

The design of these buildings requires a multi-disciplinary approach with cooperation between numerous parties and a willingness of clients and territorial authorities to embrace methods of construction that are not common in New Zealand.

Failures can arise from:

- insufficient understanding of the requirements for vapour barriers
- inadequacy of insulation
- conflict of priorities in a multi-disciplinary team.

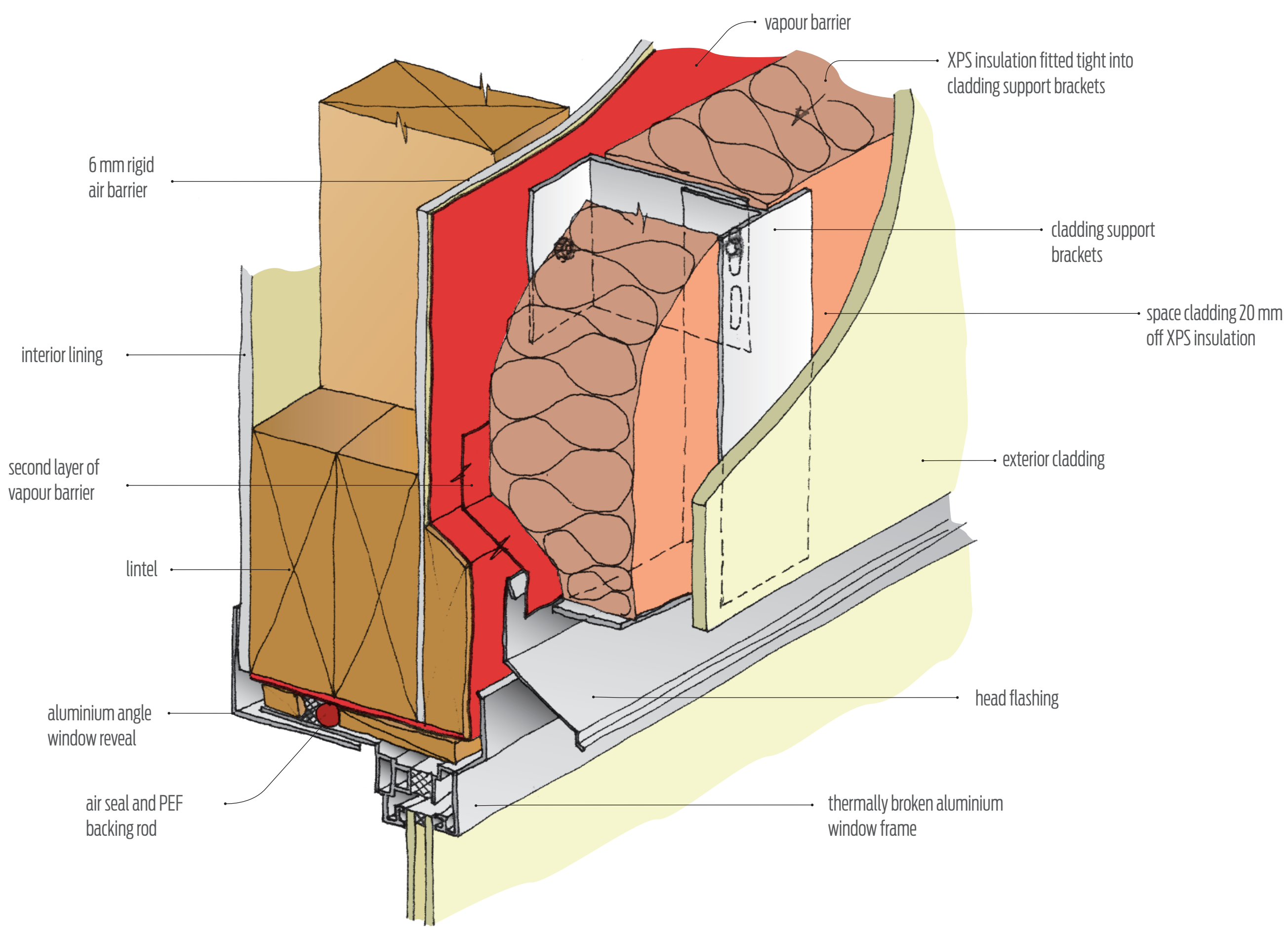


Figure 2: Window head detail.