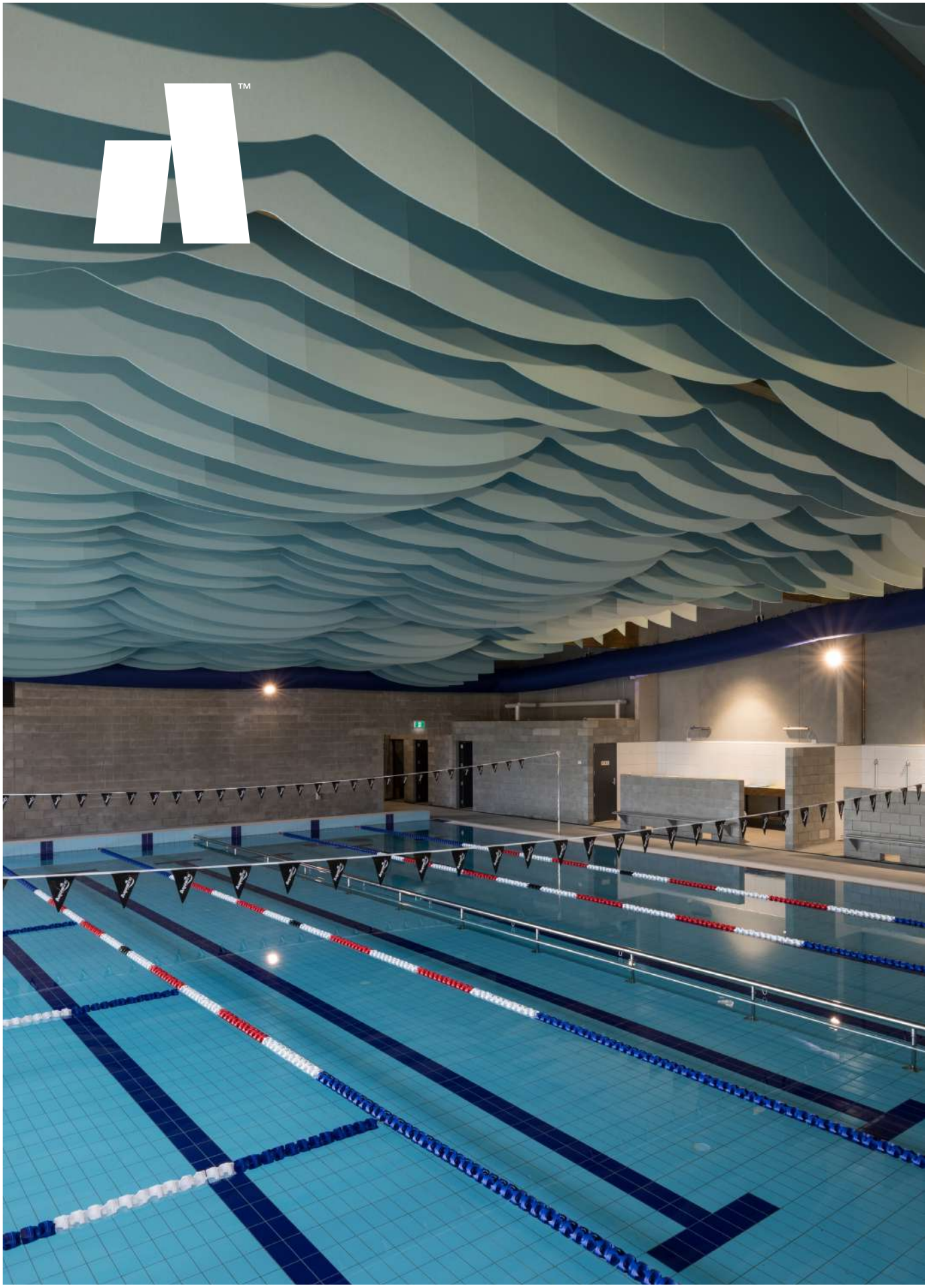

Design considerations in highly humid environments

- Custom Cube™ in Savoye
- Hilton Brown Hobsonville, New Zealand

Autex Acoustics®

Design considerations in highly humid environments

High humidity in indoor spaces pose unique challenges to any acoustic wall or ceiling systems. Interior acoustics features must be designed so that condensation risks are mitigated, moulds do not grow on the surface, and any metal components do not corrode and fail over time. An acoustic feature covered in mould and mildew is both unhealthy and unsightly. Likewise, any acoustic ceiling with corroded fixings may result in the collapse of the ceiling which is a safety risk for occupants of the space. This highlights the importance of correct design of acoustic wall and ceiling systems in humid environments.

High humidity

An environment is considered to have high humidity when the relative humidity is above 65%. High humidity environments are common in locations closer to the equator or to a body of water. For example, many coastal cities in southern states that border the Gulf of Mexico are considered the most humid cities in the US. Similarly, coastal areas of New Zealand and the UK have high annual average relative humidity levels ranging from 70 to 90%. Major centres along the Australian coastline, including Darwin, Brisbane, Melbourne, and Sydney, may experience high relative humidity levels of up to 80%.

Condensation

As relative humidity levels go closer to 100%, there is a higher probability of condensation occurring. Condensation occurs in indoor spaces when the indoor air is so saturated with moisture that it can no longer hold more moisture. Condensation can also occur when warm humid air comes into contact with cold surfaces.

Effects of high humidity

High humidity in an indoor space can have detrimental effects to the materials in that space as well as the occupants. Firstly, high humidity allows for the growth of moulds and mildew which can cause health problems such as asthma and allergies. Secondly, condensation resulting from high humidity might enhance the corrosion of some metal components which can weaken their structural integrity. Some surfaces, particularly painted and timber surfaces, might also experience discolouration when exposed to high humidity.

Growth of moulds and mildew

Moulds and mildew are microscopic fungi that exist everywhere. These microbes can grow and multiply under a combination of four conditions:

1. **Indoor temperature** – Temperatures must be between 15 - 35°C for moulds to thrive. The ideal indoor temperature for people to feel thermal comfort is also within this range.
2. **Water** – Moulds thrive in damp, humid conditions, typically between 70 - 95% relative humidity.
3. **Nutrients** – Moulds need a food source to grow. Moulds feed on any organic matter, including wood, paper, and dust that contains organic matter.
4. **Oxygen** – Moulds need oxygen to survive, which is present in all habitable indoor environments.

Moulds and mildew can grow on any material surface, including glass, metal, and plasterboard or drywall, if all the above conditions are met.

Performance of Autex Acoustics® products in humid spaces

Autex Acoustics® products have low moisture absorption and perform well in high humidity environments. Our products have been independently tested and results show that when left in a 49°C and 95% relative humidity environment for four days, the product only absorbed 0.4% water. This is extremely good performance and is unique to the material used to make our product.

Autex Acoustics products have also been tested for mould resistance and no mould growth was observed on the tested product when exposed to mould spores at 30°C and 90% relative humidity for 28 days.

Although Autex Acoustics products do not inherently promote the growth of moulds and mildew, moulds and mildew might grow on the surface when the previously mentioned four listed conditions are present. Moulds can grow particularly when nutrients are introduced to the product surface, such as when organic matter is blown from an air conditioning vent on to the surface, or when organic matter is carried with condensation from a source to the product. Water needed for mould growth may come from condensation somewhere which then travels to the product. An example of this would be when condensation occurs on the underside of a roof and the resulting water droplets fall on top of a suspended ceiling.

Preventing condensation

By preventing condensation, the risk of mould growth is reduced significantly. Adequate ventilation combined with best practice wall and ceiling design is critical to preventing condensation.

To avoid condensation while keeping occupants comfortable, The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) recommends:

- Indoor temperatures to be between 19 - 28°C, and
- Relative humidity to be below 65%.

The Chartered Institution of Building Services Engineers (CIBSE), another reputed international authority in building services and ventilation, recommends a similar target for relative humidity of 40 - 70%.

Indoor swimming pools pose higher risks of condensation due to the presence of significant amounts of water, and as such has more stringent requirements. According to ASHRAE, indoor air temperature must be maintained 1 - 2°C above the pool temperature but not more than 30°C, and relative humidity must be maintained between 50% - 60%.

To achieve these ideal conditions, adequately designed heating, ventilation, and air conditioning (HVAC) systems and controls must be employed. There must be good HVAC operational management in place before interior acoustics products are installed in a space. Air distribution must also be sufficient to effectively direct humid air from wall and ceiling surfaces and prevent condensation.

Design and installation of Autex Acoustics

Although Autex Acoustic products offer superior performance in highly humid environments, they must be designed and installed in a manner that does not enhance condensation on the surface. This same advice also applies to other materials in the same environment.

Autex Acoustics products installed on ceilings must not create an airtight cavity in the roof to prevent a significant temperature difference across the cavity. This would reduce the risk of condensation caused by warmer air encountering a cold surface. There should also be efficient air distribution in the roof area to direct humid air away from the roof, further reducing the risk of condensation.

When installing acoustic panels on ceilings, it is important that any cavity between the roof and the acoustic panel is kept well-ventilated to avoid condensation.

a. Bespoke louvre panel design allowing air flow in the roof cavity

b. Quietspace® Panels with gaps to keep the roof cavity well-ventilated

Design and installation of Autex Acoustics cont.

Vertical acoustic baffle products such as Frontier™ are recommended as they pose a lower risk of condensation by allowing efficient air movement through the ceiling and not causing any significant temperature difference in the roof that may result to condensation.

Clients are advised to consult with their Autex Acoustics account manager during the design phase of a project involving humid spaces. Autex Acoustics have been involved with installations in high humidity environments for many years and in that time have gathered specific knowledge in addressing issues of condensation and mould growth. Our design team can create bespoke products that are unique to the conditions and requirements of each project.

c. Frontier Talus in a humid space

Fixings for Autex Acoustics ceiling systems

Fixings used for Autex Acoustics ceiling systems in high humidity environments must be carefully selected so that the risk of corrosion is minimised. The Australasian standard AS/NZS 2785 for suspended ceilings recommends avoiding the use of type 304 and type 316 stainless steels in safety-critical and load-bearing applications as these are prone to stress corrosion cracking.

Type 254 stainless steel or any stainless steel with 6% molybdenum, is deemed as a more suitable fixing material in high humidity environments such as indoor pools.

Pairing zinc fixings with aluminium components should also be avoided to prevent corrosion on zinc fixings.

For more information on designing for highly humid spaces, please contact your Autex Acoustics account manager.

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