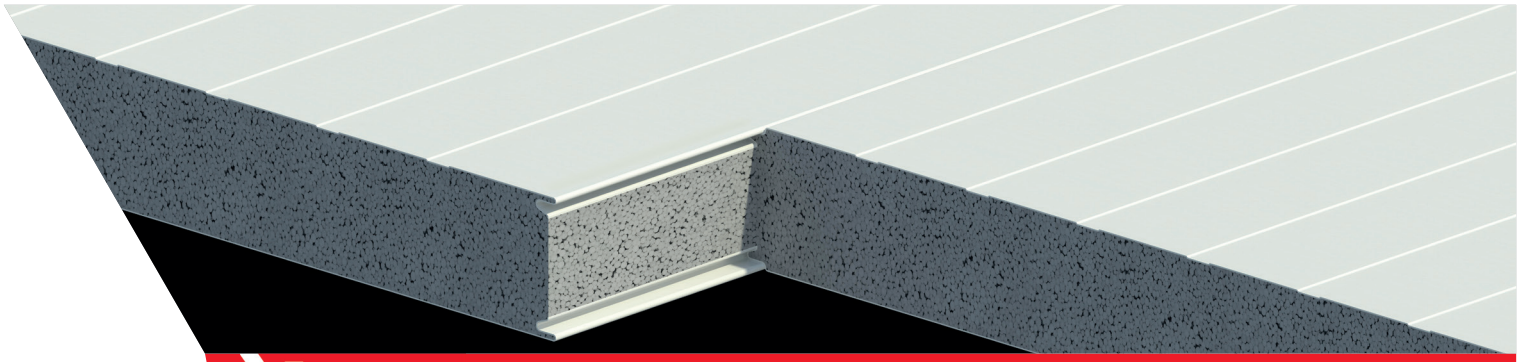


TECHNICAL BULLETIN NO. 15

PRODUCT: XFLAM® INSULATION **JUNE 2014**

SITUATION: TEMPERATURE DIFFERENTIALS

APPLICATION: COLD STORAGE

ISSUE: DESIGN AND DETAILING FOR INSULATED PANEL STRUCTURES IN COLD STORAGE CONSTRUCTION.

BACKGROUND:

Most materials expand when heated, and conversely contract when cooled. This movement needs to be accommodated in the design of structures, and particularly where there are temperature differentials between interior and exterior surfaces.

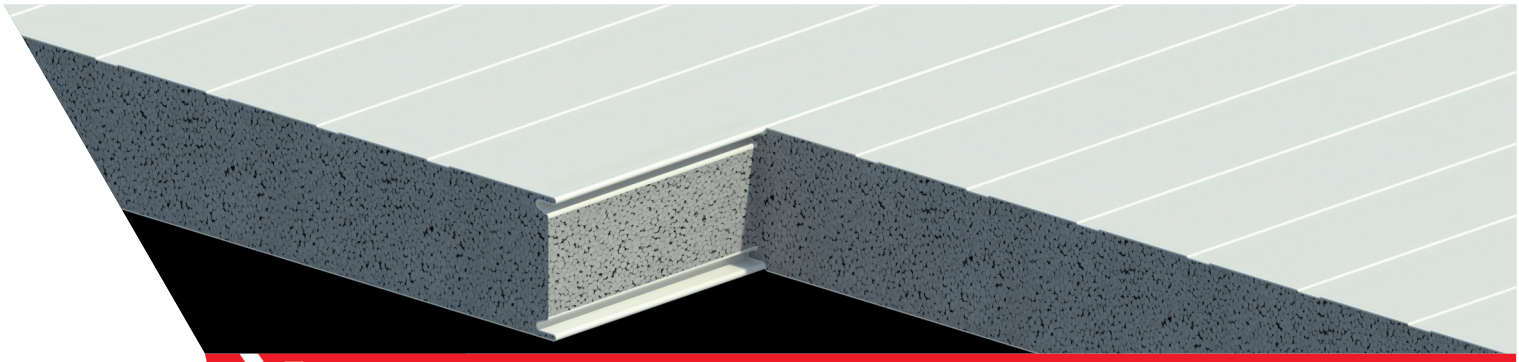
Insulated panel is no different in this regard, being insulation bonded held rigidly between two skins of steel. Material needs to be flexible enough to accommodate this movement without breaking, which could occur with brittle materials with different thermal properties to the steel. In building applications there will invariably be a temperature differential between interior and exterior leading to differential movement between the steel skins. This gets translated into bending as the warmer skin becomes longer than the cool skin. This effect is more pronounced on thinner panel and can lead to the warmer skin rippling and ultimately delaminating from the core if the strain is not released. This strain can be reduced by making a cut into the cooler skin thus allowing movement to be taken up over the gap. Typically these cuts will be placed in positions hidden by structural steelwork.

Cold storage is a special case where the internal temperatures are held to zero or below while external temperatures may be sustained as high as 45°C. Therefore potential temperature differences may be up to 80°C. The other impact of the temperature differential across the panel, is that the ability of air to hold water vapour increases with temperature.

Warm humid air meeting a cold surface deposits condensation on the cold surface as the ability of the air to carry water vapour is decreased and the vapour condenses to water. If warm damp air is allowed to migrate through the outer skin into the insulation material there is no way to prevent condensation occurring in the insulation. As the pressure inside the cold storage facility is very low there will be a pressure differential between the inside and outside skins working to draw moisture through the wall.

Ultimately a failure of the insulation will occur with the change of water vapour to liquid then ice. Formation of ice is accompanied by an increase in volume and frequently this may be seen with ice extruding from joints and openings.

Two factors impact on cold storage construction; firstly the expansion differential, which can be dealt with using stress cuts. Secondly, control of water vapour requires the use of a vapour barrier and needs a material which is impervious to water vapour.



TECHNICAL BULLETIN NO. 15

JUNE 2014

BACKGROUND CONTINUED:

Thermal insulation materials are commonly cellular foams which gain their low thermal conductivity from trapping small pockets of low conductivity gas to reduce heat transfer. Thin cell walls and low densities mean that they are not impermeable and an aggressive gas like water vapour will migrate through the cell walls at a significant rate.

An advantage of closed cell foams is their property of being impermeable to liquid water. In this respect closed cell foams are useful for applications requiring buoyancy in water as found in boats. Closed cell foams however are permeable to water vapour. Standard open celled foams on the other hand contain air which is isolated from convection by the cell walls yet will not exert forces on the foam leading to dimensional stability where a significant thermal gradient exists between the two panel skins. All foams can be manufactured to include hydrophobic chemicals which act to reduce water vapour transmission, but in no way are these properties able to compensate for the lack of a true water vapour barrier with either closed or open celled foams.

Steel clad panel offers a highly efficient vapour barrier by virtue of the steel skin. By careful sealing of the joints in the external steel skin no significant vapour migration occurs preventing possible water logging in a cellular foam. Joint sealing can be facilitated in a well designed interlocking joint with steel surfaces designed to prevent lateral movement of the panels with a thin layer of flexible vapour resistant sealant. Panel systems with loose joints will be difficult to seal as thermally induced strain will translate into excessive working and pumping of the sealant.

IN SUMMARY:

The critical factors for longevity of a cold storage building are controlling thermally induced movement using stress cuts, thicker panel and installing a competent vapour barrier.

A well designed panel connecting joint which requires minimal sealant, using an insulation core with flexibility, strength and excellent bonding to both steel skins, will ensure integrity of the vapour barrier over the building envelope.

Askin Performance Panels have over 40yrs experience successfully supplying product, expertise and installation of cladding for cold storage throughout Australasia. For reliable, knowledgeable, personally dedicated and accessible service contact us at 13 000 ASKIN.

Approval

Technical Manager
XFLAM Pty Ltd