

Resolution to Walls Surfaces Condensation & Mould Growth Issue in an 24-hours Air Conditioned Room

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ABSTRACT

The aim of the project is to resolve the condensation and mould growth issues in a 24-hours air conditioned room. With the boundary conditions provided, a solution to optimize the design of insulation panel and installation method to prevent condensation and mould growth is proposed.

The project started by conducting case studies to identify the root of condensation and mould growth problems as well as the critical areas where the condensation most likely to occur. The fundamental knowledge of heat transfer, thermodynamics and relevant topics are applied to interpret the heat transfer operation inside and outside of the air conditioned room. A comprehensive study on the available insulation materials in the market is conducted. By comparing each material's specification, Polyurethane is the selected due to its excellent strength-to-weight ratio, insulation properties, durability and flexibility which provide effective solution for this project.

Moreover, heat transfer formulas are employed to determine the wall surface temperatures, dew point temperature and optimum insulation thickness. At the same time, the room condition is simulated using Solidworks FloEFD and Ansys Fluent software. Based on calculations, there will be condensation problem due to the outer wall temperature is lower than the dew point temperature and this is further validated with the simulated results. After analyzing the calculated results, it shows that required insulation thickness must be more than 55.52 millimeter to eliminate condensation. These parameters are then input into simulation and the simulated results show that the condensations stop which matched the calculated results. According to the insulation guideline, a safety factor of 1.5 is considered to ensure that the insulation panel is safe and will not fail when degrade over time. Hence, the actual thickness of the Polyurethane panel proposed is 83.28 millimeter.

The proposed installation method is a combination of foam spraying and foam injection method. For wall insulation, foam injection method is used to ensure seamless insulation; for roof and floor insulation, foam spraying method is selected due to these areas are hard to reach.