



University
of Victoria

Graduate Studies

Notice of the Final Oral Examination
for the Degree of Master of Applied Science

of

ABHISHEK SHARMA

BTech (Punjab Technical University, 2012)

“Moisture Management in VIP Retrofitted Walls”

Department of Mechanical Engineering

Tuesday, March 14, 2017

10:00 A.M.

Engineering and Computer Science Building
Room 467

Supervisory Committee:

Dr. Phalguni Mukhopadhyaya, Department of Civil Engineering, University of Victoria (Co-Supervisor)
Dr. Catherina Valeo, Department of Mechanical Engineering, UVic (Co-Supervisor)

External Examiner:

Dr. Ajith Rao, Corporate Innovation Centre, USG Corporation

Chair of Oral Examination:

Dr. Kin Fun Li, Department of Electrical and Computer Engineering, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

Thermal resistance per unit thickness for Vacuum Insulation Panel (VIP) is 5 to 10 times higher than conventional insulation materials. This makes VIP an attractive option for retrofitting exterior building envelopes. Insulation can be added in an exterior wall either on the interior side, exterior side or in the available stud cavity. VIP has high vapor diffusion resistance factor and could lead to moisture management risk in the wall layers because of the steep temperature gradient in the wall generated due to very high thermal resistance of VIP. VIP is a relatively new insulation material for building envelope construction, thus the hygrothermal or moisture management performance of VIP-insulated exterior building envelopes need to be distinctively analyzed before its application. This study aims to evaluate the moisture management risk associated with wood-frame stucco-cladded exterior walls retrofitted with VIP using a 2-D hygrothermal simulation tool WUFI-2D. Eight North American locations were considered, based on Moisture Index (MI) which varied between 0.13 and 1.17, and two different indoor hygrothermal loading conditions as prescribed by the ASHRAE 160P and EN 13788, respectively. The outputs from hygrothermal simulations (water content, relative humidity and temperature) were critically analysed and expressed further using freeze-thaw and RHT indices. The results show that the appropriately designed VIP retrofitted walls can have superior moisture management performance as compared to conventional stucco-cladded wall.