Economical Analysis of Optimum Insulation Thickness for HVAC Duct

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Abstract : A considerable amount of energy is usually lost due to compression of insulation in Heating, ventilation, and air conditioning (HVAC) duct. In this paper, the economic impact of compression of insulation is estimated. Relevant mathematical models were used to estimate the optimal thickness at the points of compression. Furthermore, the payback period is calculated for the optimal thickness at the critical parts of supply air duct (SAD) and return air duct (RAD) considering natural gas (NG) and liquefied petroleum gas (LPG) as fuels for chillier operation. The mathematical model is developed using preliminary data obtained for an HVAC system of a pharmaceutical company. The higher heat gain and cooling loss, due to compression of thermal insulation, is estimated using relevant heat transfer equations. The results reveal that maximum energy savings (ES) in SAD is 34.5 and 40%, while in RAD is 22.9% and 29% for NG and LPG, respectively. Moreover, the minimum payback period (PP) for SAD is 2 and 1.6years, while in RAD is 4.3 and 2.7years for NG and LPG, respectively. The optimum insulation thickness (OIT) corresponding to maximum ES and minimum PP is estimated to be 35 and 42mm for SAD, while 30 and 38mm for RAD in case of NG and LPG, respectively.

Keywords : optimum insulation thickness, life cycle cost analysis, payback period, HVAC system

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