A Novel Defrosting Method in Gasoline Vapor Recovery Application

Condensation method is comprehensively applied for gasoline vapor recovery (GVR), of which frosts in the heat exchanger is the greatest challenge, especially for the continuous long running cases. A novel dual channel GVR cascade refrigeration system with shell-tube heat exchanger was presented and tested in this paper. With one-work-one-standby evaporator settings, combined with refrigerant evacuation and delay switching strategies, the defrosting of low temperature shell-tube heat exchanger was analyzed and solved. Also multi-stage cycle was introduced to supply three cooling stage, which cooled the gasoline vapor from ordinary temperature to about -70°C. By the means of industrial application validation and process calculation, the ability of the non-stop cooling during defrosting was verified. The refrigerant evacuation was proposed to prevent high pressure drop caused by frost accumulation, which also improved the cooling capacity by 28.2% and approached the defrost efficiency of 55.4%. In addition, it was found that delay switching can effectively reduce the capacity fluctuation. Based on sensitivity studies, 20 minutes delay was identified as the best switching timing for this device. The capacity of this system performed lower reduction, higher duty ratio and defrost efficiency.