

Design of Oil-Free, Resonating Linear Compressors for Five-Stage Cascade System with New Refrigerants

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Due to its reliability & high efficiency compared to other systems, VCR systems are most famous systems being used for refrigeration purpose nowadays. To make this system more efficient, ecofriendly, durable and compact, linear compressor seems to be advantageous over the conventional compressor. The linear motor has been proved to be electrically more efficient than that of rotary induction motor. Along with this, absences of slider crank mechanism make linear compressor drive mechanically more efficient and durable. Oil-free operation is also possible which leads to compact design of heat exchangers. Cascade refrigeration system is one of the ways to reach low temperatures. It consists of number of VCR cycles cascaded together & each cycle run by its own individual compressor. The evaporative temperature for liquefaction of air (78.8 K) can be achieved by cascading 5 VCR systems each run by individual linear compressor. In this work, cascade system with cooling capacity 5 W at the evaporative temperature of 78.8 K and condenser temperature of 40 °C has been taken into consideration and oil-free, resonating linear compressors for each stage have to be designed for this purpose. Due to restrictions on HCFCs, design is being carried out considering ecofriendly refrigerant R1270 as a working substance in first loop. For the subsequent loops, propane (R270), ethylene (R1150), methane (R50) & air (R729) will be used in order. As assumed evaporative & condenser temperatures for first loop falls in the range similar to that required for air conditioning applications, this compressor design may serve dual purpose. It would form one of the loops in cascade system & this individual loop can directly be used in the air conditioning applications. The new linear compressors are expected to be efficient, compact & more durable compared to the conventional compressors run by rotary induction motor.