

# ***Design of Resonating, Linear Compressors for Five-Stage Cascade System with New Refrigerants***

*V.A. Santosh, B.T. Kuzhiveli, Centre of Adv. Studies in Cryogenics, Nat'l Inst. of Tech., Calicut, India*

Due to its reliability and high efficiency compared to other systems, VCR systems are most famous systems being used for refrigeration purposes. To make this system more efficient, eco-friendly, 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, absence of motion conversion mechanism makes linear compressor drive mechanically more efficient and durable. Also, oil-less operation is possible in this case which have its own benefits. Cascade refrigeration system is one of the ways to reach low temperatures. It consists of number of VCR stages cascaded together and each run by its own individual compressor. In this study, cascade system with total cooling capacity of 20 W at the temperature of 78.8 K had been taken into consideration. This cascade system consisted five stages with refrigerant R1270, R290, R1150, R50 and R729 in series. The first loop of cascade system (with R1270) was designed such that it could be used as dual purpose, either one of the loop in cascade system or individually for air conditioning purpose. The aim of this study was design of linear compressors for each stage for resonating and oil-free operation. The variation of gas spring stiffness had been observed and with some allowance on natural frequency, design had been done for resonating operation. For oil-free operation, enthalpy leakage rate due to transfer of refrigerant past the radial clearance between piston and cylinder had been found out and its effect on overall system performance was also studied. By putting maximum limit on drop in COP of the system due to this transfer of refrigerant, maximum radial clearance that could be provided for oil-free operation had been found for these five stages