
**SESSION 15: Regenerator / Recuperator
Investigations**

Paper 15.4

Thursday ORAL Session

11:30 AM

***Heat Capacity and the Coefficient of
Performance in 4-Kelvin Regenerators***

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It is well established that to reach 4K in a regenerative cooler, the regenerator must use materials with high heat capacity to minimize enthalpy flow. This has led to the erroneous conclusion that the highest possible heat capacities are desirable. But, since acoustic power consumption also increases with higher heat capacities, the balance between acoustic power and enthalpy may be more optimal with lower heat capacities when the Coefficient of Performance is the metric for the regenerator. We demonstrate this with an analytic model for a dissipationless regenerator. The validity of this model was then confirmed with a numerical model with a low dissipation regenerator configuration. These models were first run with temperature-independent heat capacities, which showed higher COP for lower heat capacities. The analytic model was then run with actual regenerator solids, which showed more complex behavior but demonstrated that details of the temperature dependence of the heat capacity influences the COP, and higher overall heat capacities do not necessarily translate to higher COP.