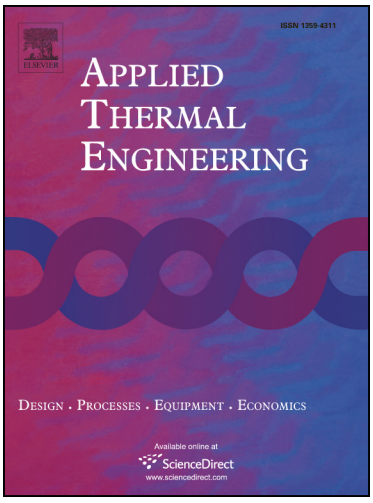

Performance analysis of a linear compressor in a cryocooler

Xiaokuan You, Limin Qiu, Xiaoqin Zhi, Chaoxiang Duan, Xijun Tao, Jianjun Wang

PII: S1359-4311(18)31805-2
DOI: https://doi.org/10.1016/j.applthermaleng.2018.06.017
Reference: ATE 12288

To appear in: *Applied Thermal Engineering*

Received Date: 22 March 2018
Revised Date: 23 May 2018
Accepted Date: 5 June 2018

Please cite this article as: X. You, L. Qiu, X. Zhi, C. Duan, X. Tao, J. Wang, Performance analysis of a linear compressor in a cryocooler, *Applied Thermal Engineering* (2018), doi: https://doi.org/10.1016/j.applthermaleng.2018.06.017

Performance analysis of a linear compressor in a cryocooler

Xiaokuan You, Limin Qiu, Xiaoqin Zhi*, Chaoxiang Duan, Xijun Tao, Jianjun Wang
Institute of Refrigeration and Cryogenics, Zhejiang University, 38# Zheda Road, Zhejiang 310027, China
*xiaoqin628@126.com

Highlights

- A method is proposed to calibrate phase angles between the stroke and the pressure.
- Acoustic power and efficiency are calculated based on the calibrated phase angle.
- Experiments are conducted to verify the calibration method.
- The energy distribution and the losses of the compressor are analyzed.

Abstract

A linear compressor is widely used to drive Stirling-type cryocoolers. The acoustic power it provides directly affects the performance of a cryocooler. However, it is hard to determine the output acoustic power of a linear compressor since it is difficult to measure the phase angle between the pressure and velocity. In the study, a method is proposed to calibrate the phase angle. The acoustic power of the compressor is estimated based on the calibration. The energy distribution and efficiency of the linear compressor are also analyzed. Theoretical analyses and experiments on a linear compressor are conducted. The results show that the accuracy of the calibrated phase angle is acceptable. The total power calculated by the calibrated phase angle when compared with the measured input power exhibits a deviation of less than 10%. In large scale linear compressors where the back volume is only several times higher than the compression volume, it is not possible to ignore the loss in the back volume since it can correspond to 19% of the total input