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Performance Investigation of a Pressure Pulsation Dampener applied in the Discharge Chamber of a Twin Screw Refrigeration Compressor

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Highlights

- Effect of a pressure pulsation dampener (PPD) was studied in a twin-screw compressor.
- A theoretical model and experimental set-up were developed for this purpose.
- Fluid sound speed and oil flow rate largely affected the pressure attenuation ratio.
- The PPD designed using the proposed model had an optimal performance.
- The PPD reduced the vibration acceleration of the compressor by 36.2 to 41.1%.

Abstract

Intermittent gas flow generates pressure oscillations in the twin-screw refrigeration compressor that cause serious problems such as structural vibration and noise. In order to reduce the amplitude of this pressure pulsation, a pressure pulsation dampener (PPD) applied in the discharge chamber of a twin screw refrigeration compressor was proposed based on the theory of Helmholtz resonator. A mathematical model was developed to design an optimal PPD by incorporating the R134-oil mixture sound speed model and the pressure pulsation simulation model. A comprehensive experimental study was then performed to validate the model and evaluate the effect of key parameters such as oil flow rate and cavity volume on attenuation performance of the PPD. Vibrational characteristics of the compressor equipped with and without the PPD were also measured and compared. Under the design frequency of 250 Hz, the vibrational acceleration of compressor under-chassis reduced by 36.2% to 41.1% when the compressor was fitted with the proposed PPD.

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