

Accepted Manuscript

Research Paper

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PII: S1359-4311(17)32655-8

DOI: <https://doi.org/10.1016/j.applthermaleng.2017.11.140>

Reference: ATE 11510

To appear in: *Applied Thermal Engineering*

Received Date: 20 April 2017

Revised Date: 26 November 2017

Accepted Date: 27 November 2017

Please cite this article as: Z. Xinqian, Z. Meijie, Criteria for the Matching of Inlet and Outlet Distortions in Centrifugal Compressors, *Applied Thermal Engineering* (2017), doi: <https://doi.org/10.1016/j.applthermaleng.2017.11.140>

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Criteria for the Matching of Inlet and Outlet Distortions in Centrifugal Compressors

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Highlights

- Matching of inlet and outlet distortions has a great effect on the performance.
- The matching mechanism is analyzed.
- The criteria for the matching is proposed.
- An estimate formula for the best matching is proposed.

Abstract

The centrifugal compressor is a very common type of effective energy conversion device, which is used in a range of industrial processing equipment and automotive turbochargers. Due to the requirements and the limited installation space, centrifugal compressors are always connected with complex inlet and outlet pipe systems, including various kinds of bends, struts, and volutes with asymmetric geometries. These asymmetric components induce distortions at the compressor inlet and the outlet, which exert a strong influence on the compressor performance and flow field. This paper employs full-annulus unsteady simulations to study the matching of inlet and outlet distortions by adding a distortion model to compressor inlet and outlet. The results show that the matching does have a large influence on the compressor performance and flow field and there does exist the best matching. The best matching can neutralize the inlet and outlet distortions, keep the uniformity of flow parameters in the

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