Accepted Manuscript

Effect of misalignments on the tribological performance of elastomeric rod lip seals: Study methodology and case study

B. Pinedo, M. Conte, J. Aguirrebeitia, A. Igartua

PII: S0301-679X(17)30310-9

DOI: 10.1016/j.triboint.2017.06.022

Reference: JTRI 4782

To appear in: *Tribology International*

Received Date: 23 January 2017

Revised Date: 26 May 2017

Accepted Date: 15 June 2017

Please cite this article as: Pinedo B, Conte M, Aguirrebeitia J, Igartua A, Effect of misalignments on the tribological performance of elastomeric rod lip seals: Study methodology and case study, *Tribology International* (2017), doi: 10.1016/j.triboint.2017.06.022.

Effect of misalignments on the tribological performance of elastomeric rod lip seals: study methodology and case study.

B. Pinedo[1*], M. Conte[2], J. Aguirrebeitia[3], A. Igartua[1]

[1]*Ik4- Tekniker, Tribology Unit, Iñaki Goenaga 5, 20600, Eibar (Gipuzkoa), Spain*
[2]*Anton Paar TriTec SA, Rue de la Gare 4, CH-2034, Peseux, Switzerland*
[3]*ETSI-BILBAO, Department of Mechanical Engineering, University of Basque Country, Alameda Urquijo, 48013, Bilbao, Spain*

*Corresponding author. Tel: +34943206744.
Email address: bihotz.pinedo@tekniker.es; bpinedoa@gmail.com (B.Pinedo).

Abstract

The main objective of this work is to determine the effects of unavoidable eccentricities on the tribological behaviour of elastomeric rod lip seals, in an attempt to contribute to the lack of studies related to this issue. To this aim, this work addresses the study of how rod radial eccentricities affect the main tribological parameters, such as contact force and contact temperature distributions on seals, the friction generated and the progress of wear, during operation. The investigation carried out combines different analytical, numerical and experimental methods. Results demonstrated that small misalignments may accelerate considerably the wear and degradation of elastomeric seals, and lead to a considerable friction force rise.

Key Words: eccentricities; misalignments; elastomeric seals; tribological modelling.

1 Introduction

In order to design individual sealing components or complete sealing systems for specific applications, it is essential to consider several and very diverse aspects. Seal geometry, surface conditions of the mating surfaces, fluid and counter-material properties, and operating conditions are some of the factors defining the performance of seals under operation.

Previous investigations addressed the study of the effect of operating velocity, fluid pressure and temperature on the main sealing parameters, as well as on their evolution during operation, through several theoretical and experimental techniques [1]. Some authors also developed lubrication models that included specific surface roughness patterns in order to understand better the pumping mechanisms that occur at the interface between the matching surfaces. Salant et al. [2] developed analytical lubrication models assuming regular asperity patterns in order to gain knowledge on the pumping mechanism of rotary lip seals. Shen et al. [3] developed an elastohydrodynamic model applied to a rotary lip seal based on fluid mechanics; they theoretically demonstrated that the pumping mechanism and sealing capability of seals depend to a great extent on the roughness of the shaft. Current advanced simulation tools enable building accurate 3D models of seals combining both micro-scale and macro-scale properties. Wenk et al. [4] modelled a complete shaft lip seal combining micro-scale roughness measurements and the macro-scale bulk seal geometry, and found that the contact pressure distribution between the shaft and the seal is