THEORETICAL ANALYSES AND EXPERIMENTAL STUDIES OF RELIABILITY AND STABILITY OF THE GLAND PACKING

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ABSTRACT

In this paper, the leaking possibilities and their influence parameters of the gland packing in mounted condition are discussed, the relations between the lateral pressures and the circumferential pressure of the packings are determined and also the dimensionless factors of the sealing reliability for the packing element are given, and the theoretical criteria for identifying the sealing reliability in static condition are derived.

On the basis of looking into the influences of the basic characteristics of the packings on the sealing performances of the gland packing, the asbestoid packings, the graphitic packings and the carbon-fibre packings are taken as tested pieces, the basic characteristics such as the reductions of the axial pressures and that of the lateral pressures, the coefficients of the lateral pressures and the compression-resilience properties of the packings are experimentally investigated for a packing ring or a number of packing rings in mounted condition; The experimental relations of the parameters signifying the basic characteristics of the packings to the influence parameters are set up; For the three kinds of packings, the effects of the basic characteristics of them on the reliability and stability of the gland packing are analysed preliminarily.

NOTATION LIST

\[ A = 2 \left( \mu_1 K_1 r_1 + \mu_0 K_0 r_0 \right) / \left( r_0^2 - r_1^2 \right) \] parameter
\[ A_b = \frac{P_{bf}}{P_{bl}} \] coefficient of pressure reduction at bottom side
\[ A_f = \frac{P_f}{\hat{P}_f} \] dimensionless factor
\( a_j \)  \( (j = 1,2,\ldots,8) \)  formula constant

\( A_g = \frac{P_{gf}}{P_{g1}} \)  coefficient of pressure reduction at top side

\( A_{ii} = \frac{K_{if}}{K_{ii}} \)  ratio of \( K_{if} \) to \( K_{ii} \)

\( A_{oo} = \frac{K_{of}}{K_{oi}} \)  ratio of \( K_{of} \) to \( K_{oi} \)

\( A_{ri} = \frac{P_{ri}/P_f}{P_{z1}} \)  dimensionless factor

\( A_{ro} = \frac{P_{ro}/P_f}{P_{z1}} \)  dimensionless factor

\( A_g = \frac{P_{g1}}{P_{g1}} \)  dimensionless factor

\( b_j \)  \( (j = 1,2,\ldots,8) \)  formula constant

\( c_j \)  \( (j = 4,5,8) \)  formula constant

\( H = h n \)  length of \( n \) pieces of packings mounted before compression

\( h \)  length of a packing before compression

\( K_i = \frac{P_{ri}}{P_z} \)  coefficient of lateral pressure between packing and shaft

\( K_{if} = \frac{P_{rif}}{P_{zf}} \)  coefficient of lateral reduced pressure between packing and shaft

\( K_{ii} = \frac{P_{rii}}{P_{zi}} \)  coefficient of lateral initial pressure between packing and shaft

\( K_o = \frac{P_{ro}}{P_z} \)  coefficient of lateral pressure between packing and stuffing-box

\( K_{of} = \frac{P_{rof}}{P_{zf}} \)  coefficient of lateral reduced pressure between packing and stuffing-box

\( K_{oi} = \frac{P_{roi}}{P_{zi}} \)  coefficient of lateral initial pressure between packing and stuffing-box

\( n \)  number of packing rings mounted in stuffing-box

\( P_b \)  pressure at bottom of a packing or packings

\( P_{bf} \)  reduced pressure at bottom of a packing or packings

\( P_{bi} \)  initial pressure at bottom of a packing or packings

\( P_f \)  pressure of leaking fluid

\( P_{f1} \)  pressure of fluid sealed

\( P_g \)  gland pressure

\( P_{gf} \)  reduced gland pressure

\( P_{g1} \)  initial gland pressure

\( P_{re} \)  pre-formed pressure of a packing

\( P_{ri} \)  lateral pressure between packing and shaft

\( P_{rif} \)  lateral reduced pressure between packing and shaft