

## MODELLING VALVE DYNAMICS AND FLOW IN RECIPROCATING COMPRESSORS

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UDC:629.3.018.2

### Summary

*Thermodynamic performance (delivery rate and power intake) and reliability of reciprocating compressors are dependent upon the valves. Since the valves open and close automatically, there is a high degree of coupling between the gas flow through the valve and the sealing element dynamics; a mismatch between the two leads inevitably to degradation of the compressor performance and/or short valve life. The latter is due to impact forces between the sealing element and other parts of the valve assembly. Therefore, matching the valves to the compressor application at hand is a complex task that calls for the use of the corresponding simulation models.*

*Surveyed in the paper are mathematical models for the prediction of the valve performance, consisting of the sub models describing compressible gas flow through the valves, sealing element dynamics, and the interaction of the latter with the flow. Flow models based on the discharge coefficient are intrinsically not able to predict the critical flow regime with sufficient accuracy, requiring thus experimental data that are not always available. It is also suggested that other loss calculation approaches, such as the stagnation pressure loss model, should be investigated as possible alternatives to the discharge coefficient concept.*

**Key words:** Valve dynamics, Valve flow, Discharge coefficient, Reciprocating compressor.

## MODELIRANJE DINAMIKE VENTILA I PROTOKA U KLIPNIM KOMPRESORIMA

UDC:

### Rezime

*Termodinamičke performanse (isporuka i usisna snaga), i pouzdanost klipnih kompresora zavise od funkcionalnosti ventila. Obzirom da se ventili otvaraju i zatvaraju automatski, njihov protok zavisi od dinamike ventila; njihove neusaglašenosti dovode do pogoršanja performansi kompresora i/ili kraćeg veka ventila. Tome doprinose udarne sile između zaptivnog elementa i delova ventila. Prema tome, izbor kompresorskog ventila je veoma složeno pitanje i zahteva primenu odgovarajućih simulacionih modela.*

*U radu je dat pregled matematičkih modela za proračun performansi ventila, u okviru kojih su integrisani submodeli za opisivanje protoka stišljivog gasa kroz ventil, dinamiku zaptivnog elementa i njegovu interakciju sa protokom. Modeli protoka bazirani na određivanju koeficijenta isticanja su neodgovarajući za preciznije određivanje kritičnih režima protoka, gde se zahtevaju eksperimentalni podaci koji nisu raspoloživi. Predloženo je da se proračun ostalih gubitaka određuje modelom gubitaka usled pada pritiska, kao moguća alternativa koncepciji određivanja koeficijenta isticanja.*

**Ključne reči:** Dinamika ventila, protok ventila, koeficijent isticanja klipni kompresor.

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