Mechanical Seal Design Enhancements for NGL Pumps

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Abstract

Objectives/Scope: Reboiler Pumps at NGL Unit were suffering repetitive mechanical seal issues leading to excessive leakage from seal faces which affected equipment availability and reliability. This issue was common in around 16 pumps showing similar symptoms. Therefore, this abstract will discuss findings and issue diagnosis and suggested enhancement to overcome this issue.

Methods, Procedures, Process: In search of a solid statistical approach, different pumps from each train were analyzed. Since all of the subjected pumps are using API plan 11, suction and discharge pressure were trended and compared with the drain line transmitter pressure readings where this was done using SEEQ software. This study covered the operating parameters in the past three years to identify pumps operating conditions effect on seal issue. On the other hand, different mechanical seal was sent to manufacturer facility for full dismantling and internal inspection. The findings from the two methods where combined together to link findings from mechanical seal inspection with pump operating conditions.

Results, Observations, Conclusions: In terms of operating condition, selected pumps suction and discharge pressure trends did not experience any major fluctuation in past three years. However, seals drain pressure were noticed with sudden and major increment exceeding 40 Psi in most cases. On the other hand, mechanical seal faces were found in a condition doesn't explain the excessive seal noticed from the seal. This led to conclude that mechanical seal is experiencing two phase phenomena due to the low margin between seal chamber pressure and NGL vapor pressure. In fact, in this scenario liquid is changing to vapor phase between the seal faces leading to increase the thin liquid gap between seal faces and causing excessive leakage regardless of seal faces condition. Referring to the three-phase diagram of NGL, we can achieve sufficient margin against vapor pressure by either decreasing generated temperature, increasing pressure or trying to do both. The suggested design enhancement is aiming to tackle this issue by doing both decreasing temperature and increasing chamber pressure. To elaborate, changing the seal face profile and apply diamond coating is expected to reduce generated heat from 650 to 200 KW. Additionally, orifice diameter increment by 2 mm will increase chamber pressure leading to overall safe operating point.

Novel/Additive Information: This paper includes investigation and lesson leaned on equipment exist in every NGL unit in each Gas Plant. Furthermore, it shows how to validate mechanical seal design integrity by following the mentioned method of linking operating condition with equipment material condition.