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Innovations from the new API 682 standard for mechanical seals and supply systems

Nearly six years of work went into the update of the API 682 mechanical seal standard, due to come into force shortly. Since its introduction in 1994, API 682 has become *the* standard, setting the global tone for the procurement and operation of seal and supply systems for centrifugal pumps in the oil and gas sector, as well as in (petro)chemistry. The objective of API 682 is a continuous operation of the seal system for at least three years (25,000 operating hr, subject to the legally stipulated emission values, or for maximum "Screening Value" of 1,000 ppm volume, EPA method 21), increased operational reliability and simplified maintenance.

A quality of the API 682 standard is that it is permanently updated by practical people. In addition to proven and tested standard solutions (defaults), the regulations also deliberately list alternatives (options), and even allow customized solutions (engineered solutions).

The Fourth Edition includes the revised product coding system. The proven classification parameters "Category," "Arrangement" and "Type" will be continued, and are now listed first. Details regarding the supply system, specified as "Plan," are also included. The addition of precise information to material selection and shaft diameter is new to this edition, giving more meaning to the code and guaranteeing a clear specification of the mechanical seal and its operation.

The selection process of an API seal system is a complicated affair. Several flow charts and tables on more than 10 pages are dedicated to this topic in the new edition. In order to determine the seal arrangement more precisely, a scheme pursuant to the "Risk & Hazard Code" has been introduced in the Fourth Edition for the first time. The starting point here is the pumped medium, whose real hazard potential is accurately recorded and described by "Risk & Hazard Codes" in the "Material Safety Data Sheets." The selection scheme enables the quick and secure recognition of whether a single or double seal with barrier pressure system is required.

The "lived" standard of API 682 is also demonstrated in the new edition, which allows for the two silicon carbide (SiC) variants "Reaction Bonded Silicon Carbide" and "Self-Sintered Silicon Carbide" to be used equally as "default" materials for sliding surfaces. Until now, sintered SiC was set for chemical applications, due to its superior chemical stability, whereas the reaction bonded variant established itself in the refinery sector. This allocation was canceled, due to practical application examples that were brought to the attention of the API Task Force, and which called for a course correction.

Chapters 8 and 9, which deal with the hardware for the supply systems and instrumentation, were subjected to intense revision. They were completely reorganized, whereby the topic is now handled in three systematic stages. The first block introduces the supply systems in total, after which piping and the components are addressed.

Plan 53, with a pressurized barrier fluid, belongs to the more complicated supply systems. In detail, three types are possible: Plan 53A is the solution with the least amount of effort, constructively. The pressure on the barrier medium here is generated directly by the gas pressurization in the tank. However, the application has limits, because higher barrier pressures could cause dissolution of the barrier medium. The consequence would be the risk of inadequate lubrication in the sealing gap. Higher barrier pressures are, therefore, the pursuit of Plans 53B and 53C.

Whereas Plan 53C works with a piston accumulator, putting it among the more sophisticated seal supply systems, Plan 53B uses an especially clever solution. In this plan, pressurization occurs via an elastomer bladder in the reservoir that separates the nitrogen from the barrier fluid. Pressure monitoring, with consideration of the temperature in the bladder accumulator, records the values and transfers them to the control room. The fill level, with consideration of any temperature impacts, is calculated there, and the correct time for refilling the barrier fluid is determined.

A new prescribed refilling interval of at least 28 days has also been included. Consequently, the fluid reservoir must be large enough to reliably supply the seal with barrier fluid during this entire period. To obtain as compact a reservoir as possible, seal manufacturers are required to find optimized system solutions with minimal leakage values. The Fourth Edition heralds a change to modern transmitters for the supply systems. They may be more cost-intensive than switches, but they transmit continuous measured values in return. The control room knows the actual system status at any time, and can immediately sound the alarm in case of irregularities.

The essential improvements, in addition to all the technical supplements and updates, are the clear structures of the latest API regulation. The body of text was tightened and restructured, while technical details and background information were placed in the annexes.

A special detail of the Fourth Edition is the new red plugs that are inserted into the supply connections of the seal gland, when the unit is delivered. These plastic closures prevent the ingress of dirt in the seal. During operation, the connections are either assigned to pipelines, or the plastic plugs are replaced with enclosed metal plugs. A nice side effect: Fourth Edition API seals are quickly identified by the red plugs. WO

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