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What production operation isn't full of mechanical seals? This industry expert shows you why it's so critical for them to be specified correctly.

To improve the performance of any piece of equipment requires a complete understanding of its operation and the effect on its component parts. The definition of mechanical reliability is the probability that a component, device or system will perform its prescribed service without failure for a given time when operated correctly in a specified environment.

A component part is the smallest part that would normally be replaced. A device, such as a pump, compressor, agitator, mixer, etc., is made up of many component parts. A system, such as a process plant, refinery, power plant, ship, etc. is made up of many devices. Thus, when a critical component fails, it can have a tremendous economic impact, not only on the device in which it is installed, but on an entire system. A mechanical seal is just such a component. The major causes for seal failure on a pump are a result of the following conditions:

1. Operating seals near the boiling point of the liquids being sealed
2. Operating seals in poor mechanical environments

Identifying the cause for failure will lead to significant savings for the user.

As the shaft of a pump begins to rotate, a small fluid film develops between the seal faces along with unwanted frictional heat from the seal surfaces in sliding contact. If the amount of frictional heat developed at the seal faces cannot be removed, then the liquid being sealed will flash to a gas or begin to carbonize. Developed frictional heat at the seal faces must be removed.

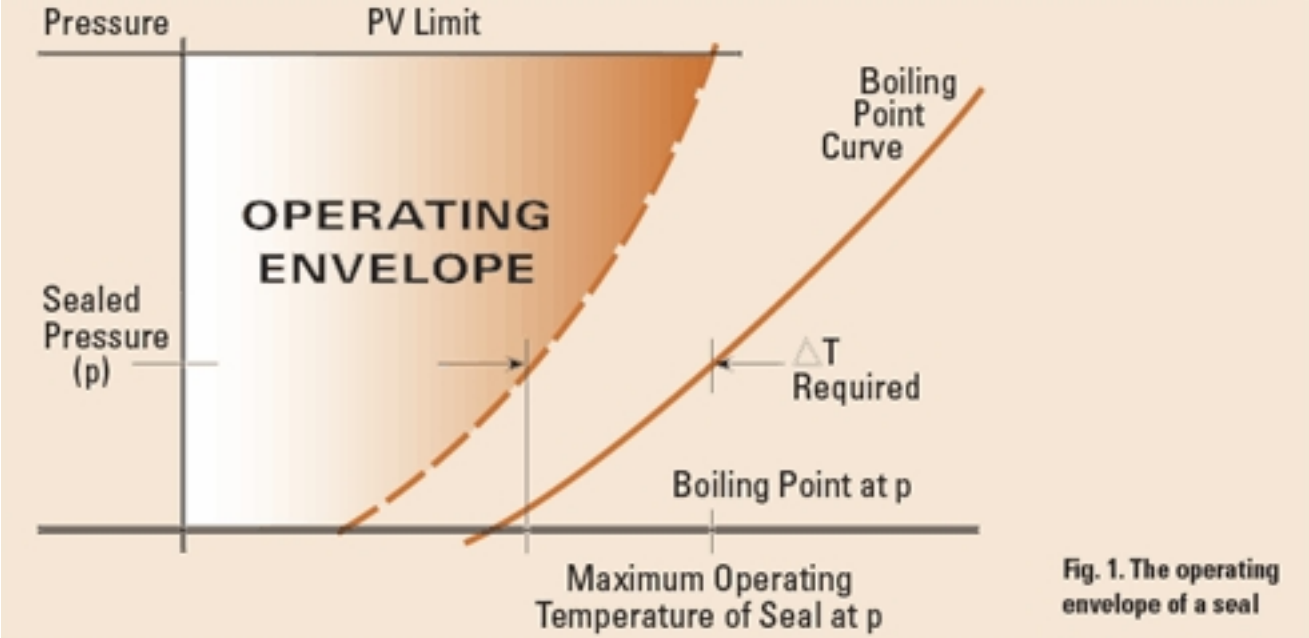

Fig. 1. The operating envelope of a seal

Table I. Analysis of Seal Life & Repair Costs for the Example Cryogenic Fluid Delivery Fleet Operation

CRYOGENIC FLUID SEALED	TANKERS IN SERVICE	AVERAGE SEAL LIFE IN WEEKS	FAILURES PER YEAR	COST PER YEAR	ACHIEVED SAVINGS WITH MINIMUM SEAL LIFE OF 6 YEARS
ARGON	5	6	45	$67,500	$405,000
NITROGEN	10	14	35	$52,500	$315,000
OXYGEN	10	25	20	$30,000	$180,000
Cost of Maintenance Per Year				$150,000	0
Total Savings Over 6 Years					$900,000

Table II. Properties of Cryogenic Fluids to Be Sealed in the Example Delivery Fleet Operation

Cryogenic Fluid	Boiling Point @ Atmos. Pressure	Freezing Point @ Atmos. Pressure
Argon	-302.50 F -185.60 C	-308.50 F -189.20 C
Nitrogen	-320.46 F -195.81 C	-345.80 F -209.90 C
Oxygen	-297.40 F -183.00 C	-361.90 F -218.83 C

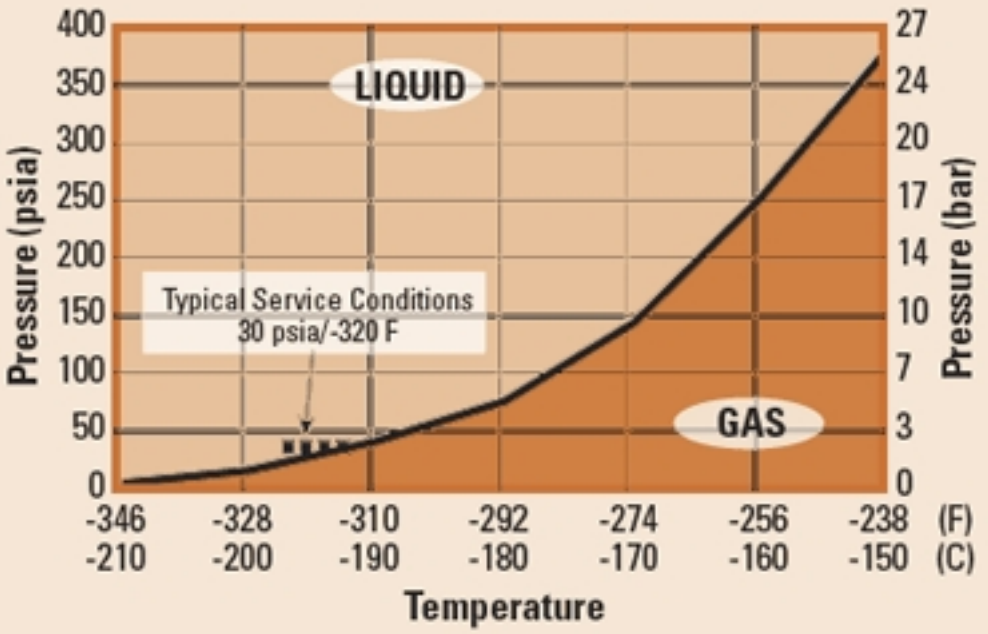

Fig. 2. Vapor pressure curve for nitrogen, as required in the example cryogenic delivery fleet operation

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