



VENTURI ORIFICE STEAM TRAPS BECOME GENERAL CHOICE FOR INEOS COLOGNE FOLLOWING STUDENT DISSERTATION

INEOS is now specifying Venturi Orifice steam traps on ‘drip leg’ and ‘trace heating’ applications at its plant in Cologne. The decision to generally allow Venturi Orifice steam traps follows a trial carried out by Ines Zießau, a student of Energy Systems Technology, for her dissertation entitled “Evaluation and Performance of Steam Traps in the Chemical Industry” on her degree at the University of Applied Science “Technische Hochschule Mittelhessen” in Gießen, Germany.

The eight month trial was overseen by Prof. Reinhold Altensen of the University and Dr. Stefan Krämer, Energy Manager at INEOS’s Cologne site. The trial proved it was economically viable to replace conventional mechanical traps with Venturi Orifice steam traps supplied by EBE Engineering.

What makes Venturi Orifice traps different to mechanical steam traps is its construction. The orifice venturi design works well over varying loads by using the residual enthalpy in the condensate that produces ‘flash’ steam as it passes from a high pressure to a low pressure state. This extends the operating range from that of a plate orifice (with a point of operation) to a significantly larger operating range. Indeed it was shown through computational fluid dynamics modelling that a turndown

ratio of about 80% from the maximum operation point can be achieved, based upon the orifice's maximum capacity. It also showed that condensate volumes without flash steam production were five times greater than when flash steam was present.

Because the Venturi Orifice design has no moving parts to breakdown or wear out it not only provides a lifespan that is considerable longer than mechanical traps but also offers the ultimate in reliability, requiring no spares, testing or monitoring equipment. Being smaller than mechanical traps, Venturi Orifice traps require less space and are also an ideal solution when there are weight restrictions as they are lighter than high capacity process mechanical traps.

When undertaking a comparison of mechanical traps with Venturi Orifice steam traps it was decided to evaluate the traps using theoretical "worst case scenario" of a 20% mechanical trap annual failure rate. Based on this premise, and using a 20 year life cycle, different maintenance plans were evaluated:

- Once installed, the mechanical traps were not tested or replaced. Steam losses based on a 20 year cycle were estimated.
- Failed mechanical traps were replaced during plant shutdown which occurred every five years.
- Mechanical traps were inspected on an annual basis. Failed mechanical traps were then replaced as they were discovered.
- Mechanical traps were continually monitored by an online conditioning monitoring system. Failed traps were replaced within a week of discovery.
- All mechanical steam traps were replaced with Venturi Orifice traps.

- Mechanical traps were inspected on an annual basis and failed mechanical traps were replaced with Venturi Orifice traps as they were discovered.

Following these evaluations it was recommended that INEOS implement the final maintenance plan for low capacity “drip leg” and “trace heating” applications, based upon total life costs.

The Venturi Orifice steam traps work by using the difference in density between steam and condensate. Steam is 1000 times less dense than condensate, so at the entrance of the trap’s orifice, the low-density steam is literally squeezed out of the condensate. The high density, slow moving condensate is then preferentially discharged through the orifice, trapping the low-density steam behind it.

“EBE has sold Venturi Orifice traps to other INEOS plants in Germany during the past eight years” says Nigel Egginton, CEO of EBE Engineering “The venturi traps have been operating on trace heating lines where condensate loads have been very small (<10 kg/hr) and thermosyphon reboilers with process loads in excess of 2.5 Tonnes of condensate per hour.”

The reliability and reduction in maintenance have been a main driver for replacement of conventional mechanical steam traps on the INEOS sites according to the site production Engineers.

The university thesis has backed up EBE's practical experience and shown that the venturi technology is adaptable and reliable in applications where up to now the mechanical traps have been the natural choice.

The Cologne petrochemicals site was originally founded in 1957. It was acquired by INEOS from BP in 2005. Today it remains an important raw material supplier for the chemical industry, converting naphtha and butane into essential raw materials for the production of plastics, rubber and fibre. Products made at the site are also used in solvents, detergents, coatings, fertiliser, pesticides and in cosmetics and pharmaceuticals. Employing 2,200 people in six business areas, the INEOS Cologne site is the largest chemical company in Cologne.

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