

Trapped steam

Steam traps may be simple enough devices, but they are single-handedly responsible for substantial energy losses, says Tim Gardner – particularly on paper mills

Pulp and paper mills are among our most energy- and emissions-intensive plants. Large quantities of steam are essential for many of its processes and the sad fact is that, because boilers, steam distribution systems, heat exchangers, dryers, evaporators etc, are prone to leaks, there is often considerable waste. Mechanical steam trap failure alone leads to waste resulting in an estimated 20% overspend on fuel, with commensurate excess emissions.

Steam traps are tasked with nothing more than removing condensed steam and non-condensable gases, without losing live steam, but some are more reliable than others. For example, surveys show that among the most common – mechanical steam traps – around 20% are malfunctioning at any time. In fact, steam leakage through traps can account for up to 55% of total losses. Hence the excessive energy usage: where condensate is not returned, water is lost, resulting in increased boiler running costs and potential production problems, due to reduced steam heat capacity.

Seriously expensive waste

Looking at the detail, if a steam trap leaks, the amount of steam wasted depends on the size of the trap and the steam pressure. The cost of waste also depends on the number of traps and the operating period. For example, a paper mill with 200 traps wastes, on average, 8,900 tonnes of steam annually, based on a DN20 trap size, steam pressure of 14 bar g and 10% failing. At, say, £20 per tonne, the direct cost of ignoring these leaks is £356,000 each year, equivalent to well over a million litres of fuel oil and 3,000 tonnes of CO₂.


And it's getting worse. As paper mills look for ways to reduce overheads, some are cutting maintenance budgets, resulting in a spiral of increasing steam losses and escalating fuel bills as failed steam traps remain open, blowing live steam.

But there is another way. There are numerous steam traps and selecting the correct type can make a big difference, particularly where maintenance is a problem. While thermostatic, thermodynamic and mechanical are extensively used, the fixed orifice condensate discharge trap is now receiving more recognition. Instead of a valve mechanism to close off steam, for energy and water

conservation, its Venturi orifice design effectively drains condensate. And, since it has no moving parts to wedge open or fail, it provides the ultimate in reliability, necessitating only minimal maintenance and requiring no spares or testing equipment.

Research carried out by Queen's University, Belfast, proved the point, showing that, over varying condensate loads and steam pressures, a Venturi trap is the most efficient available. Queen's tested buckets, floats, thermostatic and thermodynamic valve types at a constant 54 psig (3.7bar) pressure, with flows varying from no flow to 20 kg/hr. Free floating float trap and the more conventional float trap were the least efficient, with losses averaging more than 1.5 kg/hr.

What about paper mills' observations? One major paper company in Kent installed 25 Venturi orifice steam traps on a series of coater batteries and achieved savings of £125,000 in just over two months – from an investment of only £25,000. Another mill replaced preheater and end corrugator roll traps with 12 Venturi orifice steam traps and saw a drop of 11% in fuel usage. Similarly, replacing mechanical traps with Venturi orifice types at yet another plant resulted in steam savings of 30%. Other users in the industry have claimed increases in condensate return from just 28% to a staggering 70%.

Overall, a paper mill can achieve steam savings of 1.1 tonnes/hour by converting to Venturi orifice steam traps – which equates to an increase in sales of £1 million. And similar savings are perfectly possible across many more industries and plant types that are substantial steam users. 



Pointers

- 20% of mechanical traps are probably malfunctioning
- Free floating float traps and conventional float traps are the least efficient
- A paper mill with 200 traps wastes £356,000 of fuel per year due to trap problems
- Reducing maintenance budgets is exacerbating an already expensive problem
- Fixed orifice plate Venturi steam traps can slash maintenance issues
- A Kent paper mill saved £125,000 in two months, using 25 Venturi orifice traps



Tim Gardner is managing director of GEM, a division of Thermal Energy International, Canada

