



WASTING ENERGY THROUGH STEAM LOSS

By Tim Gardner, Managing Director of Gardner Energy Management

In the past, energy management was not a core function for many processing and manufacturing companies. However the continuing and unwavering increase in energy prices together with ongoing legislation regarding carbon emissions has put energy management on the boardroom agenda. The Carbon Trust has recently ascertained that UK companies waste £1bn a year on energy largely due to energy plant optimisation issues, energy wastage and inefficient energy usage across the manufacturing site.

In a recent announcement the Carbon Trust stated that this summer alone, businesses were emitting over 8 million tonnes of carbon dioxide, the equivalent to Birmingham's annual carbon emissions and enough to fill the new Wembley stadium a thousand times. Across manufacturing, including the food, drink and chemical sectors, the amount of energy spent is £1.8 billion, of which 12 per cent (£226 million) is wasted.

Steam has been a popular mode of conveying energy since the industrial revolution. It is used extensively in industry for generating power and is also utilised within process industries such as sugar, paper, oil refineries, petrochemicals, chemicals, food, synthetic fibre and textiles. As a heat transfer medium, steam has an advantage over fluids such as hot water and oil as it is able to store very large quantities of heat, which can be given up at constant temperature as the steam condenses. Unfortunately, more energy is lost in industry through steam wastage than through any other medium. Research studies by industry experts in early 2000 suggested that losses from steam systems make up approximately 35% of all identified potential energy savings.

The purpose of installing steam traps is to obtain fast heating of the product and equipment by keeping the steam lines and equipment free from condensate, air and non-condensable gases. A steam trap is a device that discharges condensate and air from the line or piece of equipment without discharging the steam. The three important functions of a steam trap are:

- To discharge condensate as soon as it is formed
- Not to allow steam to escape

- To be capable of discharging air and other condensable gases

However around 10% of mechanical steam traps will fail each year. Traps that fail 'open' result in a loss of steam and its energy. Where condensate is not returned, the water is lost as well. The result is significant economic loss, directly via increased boiler plant costs, and potentially indirectly via decreased steam heat capacity. Steam leakage is a visible indicator of waste and accounts for up to 11% of steam consumption in a small or medium scale industry rising up to an astonishing 55% in high usage processing industries.

Steam traps need to be working at optimum efficiency with a minimum impact on the environment. For example, for each litre of heavy fuel oil burned unnecessarily to compensate for a steam leak, approximately 3kg of CO₂ are emitted to the atmosphere. Steam traps can have different sized orifices to suit different conditions. If a trap leaks steam, the amount wasted will depend on the size of the trap and the steam pressure. The cost of waste will also depend on the number of traps and the operating time. For example a process plant with 200 traps based on an average trap size of DN20 and a steam pressure of 14-bar g with 10% failing annually will have steam wastage of 8,900 tonnes. If the overall cost of steam for this plant were £10 per tonne, the direct cost of ignoring these leaking steam traps would be £178,000 each year, which is equivalent to well over a million litres of fuel oil. The cost to the environment would be 3,000 tonnes of CO₂ dumped into the atmosphere.

UK manufacturers are looking for ways of reducing overheads and many are cutting maintenance budgets and staff. The consequence is a spiral of ever-increasing steam loss and escalating fuel bills as mechanical steam traps fail open. This has lead management with two options; either minimal maintenance and watch the steam plume from the condensate receiver rise along with the fuel, water and chemical treatment costs or regularly test, repair and replace faulty mechanical traps at considerable ongoing cost.

What to look for in a Steam Trap

To be efficient and economical, a steam trap has to:

- Minimize the loss of steam
- Provide long lasting and dependable service by minimizing trap testing, repair, cleaning, downtime and other associated losses
- Be corrosion resistance to prevent the damaging effects of acidic or oxygen-laden condensate
- Ventilate air for efficient heat transfer and to prevent system binding
- Remove CO₂ to prevent the formation of carbonic acid. This means that the steam trap must function at or near steam temperature since CO₂ dissolves in condensate that has cooled below steam temperature
- Operate against the actual backpressure build-up in the return lines
- Be free of the dirt collected by the condensate as it travels through the distribution piping and on to the boiler. Even particles passing through

strainer screens are erosive and, therefore, the steam trap must be able to function in the presence of dirt

There are numerous steam traps available and selecting the correct type of steam trap is an important element of any steam system. Whilst Thermostatic, Thermodynamic and Mechanical are extensively used, the Fixed Orifice Condense Discharge Trap is now becoming the steam trap of choice. Instead of utilising a valve mechanism to close off steam for maximum energy and water conservation, the venturi orifice design effectively drains condensate from the steam system. As these steam traps have no moving parts to wedge open or fail, they provide the ultimate in reliability necessitating only minimal maintenance and requiring no spares, testing or monitoring equipment. They are available in a range of options for specific applications, manufactured from corrosion resistant stainless steel and are performance guaranteed for 10 years, obviating the need for repair or replacement.

Unfortunately, when it comes to steam traps, people often ignore them. This complacency is costing steam users much more than they realise. The hard reality of a plant maintaining its boiler and forgetting about the rest of the steam system can be a horribly wasteful proposition. Losses can include not only wasted energy but also replacement of damaged equipment and misuse of man-hours. Fortunately, installing low maintenance orifice venturi steam traps can avert much of these potential losses.

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Please note photographs are available on request.

