



GETTING UP A STEAM – YOU HAVE A CHOICE!

**CHRIS HORSLEY, MANAGING DIRECTOR OF BABCOCK
WANSON UK, LOOKS AT THE MOVE AWAY FROM
TRADITIONAL FIRE TUBE BOILERS TO COIL TYPE STEAM
GENERATORS AS THE MOST EFFICIENT MEANS OF
INDUSTRIAL STEAM RAISING.**

Anyone used to working in a steam boiler house in the 60s or 70s would be hard pushed to recognise their modern day counterparts. Gone are the oily, dirty, noise filled rooms that were home to goliath industrial boilers – akin to a scene from Dante’s Hell for some; for others, a reassuring sight where a tool kit and a tin of Brasso were more common than a computer. Modern plant rooms are clean, bright, high tech, computer controlled environments where barely a person in overalls can be found.

The key driving forces in this dramatic change haven’t been health and safety and they most certainly haven’t been interior design driven! They have been economic –

no surprise there. With ever increasing fuel costs, the single most important factor in changing the face of the plant room has been the need to reduce energy consumption. This dates back as far as the 1970s with the onset of the energy crises, up to today with ever increasing fuel costs, issues of fuel security, sustainability and the growing concern about the overall environmental impact from all sectors of industry.

Boiler combustion efficiency was the initial focus, with distribution losses across the plant the next item on the energy saving agenda. The former was very much a manufacturer based problem, whilst the latter issue required a joint approach between the boiler maker and the plant owner to ensure the maximum amount of energy being produced actually made its way into the process. Part of the solution was to decentralise the steam raising plant, providing steam at the point of use, largely made possible through the widespread availability of natural gas which eradicated the need to store fuel at a central point.

However, conventional fire tube boilers are not ideal for this type of modern

layout, not only because of their bulk, but because of their safety aspects, operational needs and the maintenance requirements they come with.

Enter centre stage the coil type steam generator!

Behind the Scenes

Both fire tube boilers and steam generators have the same goal: to produce ‘dry’ saturated steam to maximise the delivery of heat to the user. Both types of boiler operate along the same basic principles in that water



is confined in a restricted space and is heated by burning a fuel source. The energy of combustion is transferred from the flame to the water by radiation and conduction, heating the water and ultimately raising steam. However, the means of heating the water to the point of ‘dry’ steam are markedly different and have resulted in one being the modern day champion.

In a traditional fire tube boiler hot flue gases from the combustion process pass through one or more tubes running through a large sealed tank of pressurised water. The large volume of pressurised stored water is used to resolve the standard potential variables that affect all boiler type systems, including variations in the feed water, fuel and combustion quality and temperatures and importantly steam load variation.

With modern coil tube steam generators a precisely controlled burner creates an accurately defined heat input to a multi coil of steel tube through which a precise quantity of feed water is pumped. Only a small amount of excess water is fed into the coil to ensure control of steam quality. A separator is normally incorporated at the coil outlet to ensure best conditions for steam output and to return excess water back to the hotwell.

Ironically in their early days coil type steam generators were a victim of their own success to some extent. As they require very little in the way of day-to-day maintenance or even operational attendance, they were prone to being ignored entirely. Whilst they carried on working and remained safe, the complete lack of attention did lead to some operational issues and a reduced efficiency. Thankfully nowadays plant operators are better versed in the technology and its requirements and manufacturers have improved the designs for even greater reliability.

Both types of steam generation systems are in widespread use today, but it’s the coil tube steam generator that continues to grow in popularity. Why?



Coil Steam Generators Keep Making it to the Top

The immediately obvious benefit of a coil steam generator over a fire tube boiler is size. Steam generators are around half the footprint of comparable fire tube boilers as they have no large drums of pressurised water; instead, the tube is coiled concentrically within a compact unit. When space is at a premium, especially in decentralised plant, you cannot beat a coil steam generator.

Of course, the coiled nature of the tube also maximises the surface area to be heated thereby ensuring minimal loss of efficiency from the boiler surface.

Another fundamentally important aspect is that of safety. The chance of a pressurised water explosion is virtually eliminated with a coil type steam generator as the steam generation process takes place inside the tube with its relatively small volume of water under pressure. There is no large pressure vessel or volume of water under pressure as in the case of fire tube boilers.

Precision control of energy usage and all aspects of operation can also be better achieved with a coil steam generator. From a cold start a full head of steam is available in as little as three minutes in most cases – not something you could ever consider with a fire tube boiler. Furthermore, the very low overall thermal inertia also means very rapid response to changing load conditions. When combined with modern control equipment, fuel and water flow control can be precisely matched to changing conditions. This, along with the very low surface heat losses, can provide an immediate substantial fuel saving over the alternatives.

A coil steam generator is also more flexible in many respects than its counterpart. For example, it can accommodate a wide quality of feed water, including supplies with naturally high levels of total dissolved solids (TDS), which would lead to excessive blowdown and greater risk of carry-over from a fire tube

boiler. A well designed coil steam generator can accommodate feed water with TDS of around 2000PPM, a level not so far from the blowdown water of a fire tube boiler.

With all these benefits to be had, you might expect a coil steam generator to be a complex piece of engineering with a price tag to match. It's true that they must be well engineered but that doesn't mean they are complex to use. There is no discernible water level in a coil boiler so therefore there is no need for level gauges or controls with their incumbent checking regime. The key moving parts are found in the combustion equipment and feed water pump. Blow down is continuous or fully automatic primarily depending on the water quality. In fact, a coil steam generator is really very simple to operate. What's more, all steam generator functions can be remotely monitored and simple, safe sequence control of multi unit



installations is also possible, removing one further operative action.

As for the price, they are comparable to a traditional fire tube boiler and generally have a low whole life cost especially when considering the very simple annual inspection needs, all of which make them an attractive proposition.

And lastly, as we mentioned at the start of the article, they are quiet, clean and cool in operation, making the boiler house a far nicer environment in which to work - perhaps not the key factors, but certainly a bonus for anyone working there.

The move away from fire tube boilers to steam generators has been ongoing for the past two decades, with the public sector often leading the way. One of the most recent converts has been Bedford Hospital NHS Trust which replaced its four heavy oil fired fire tube Boilers with three Babcock Wanson 2500kg/h ESM coil type Steam Generators fitted with high efficiency exhaust gas economisers.

These new units use modern steam generator technology to give operating combustion efficiencies of around 94% and low emissions. The driving factor for the Trust in their decision was to reduce its carbon footprint, which it expects to do by around 15% with this new boiler plant using natural gas as its main fuel source. However, the reduction in the fuel cost, along with removing the necessity of continual deliveries to site by road, as well as the costs of keeping the fuel oil on the premises at a set temperature (and ongoing maintenance of the fuel storage facilities) have all been very welcome.

But the rise of the coil steam generator is not restricted to the public sector, with many commercial organisations now coming to understand the benefits. The UK's largest plastic recycling company, J&A Young (Leicester) Ltd.

has opted for a Babcock Wanson ESM4000 Steam Generator at its new recycling facility in Corby. A food-grade PET (Polyethylene terephthalate) recycling plant, with the ability to handle up to 30,000 tonnes of PET plastic bottles per annum needs a considerable amount of steam as part of the recycling process. The ESM4000 has proven to be an efficient alternative to fire tube boilers and its flexibility meant that it could be used with both an exhaust

gas recuperator for the feed water system plus an additional secondary heat exchanger between the hot well and the feed pumps to further improve overall efficiency.

Fire tube boilers aren't about to disappear from our radar any time soon and they often remain an important solution for very large steam outputs. Furthermore, many engineers who've spent their working lives operating them simply won't consider using steam generators as an alternative. But for the bulk of users with more general steam requirements, whether in the public sector or in industry, coil type steam generators are so efficient, safe, compact and adaptable that they will continue to be the number one choice.

Babcock Wanson offers a complete range of products and services for boiler houses and other process heating needs, from steam boilers, thermal fluid heaters, rapid steam generators and hot water boilers to VOC and odour treatment by thermal oxidation, water treatment or process air heating solutions. For more information, please contact Babcock Wanson on 0208 9537111 or info@babcock-wanson.co.uk