BOILER COMPARISON REPORT

A steam boiler is a major plant purchase and selection of the correct unit requires careful consideration. This report is an analysis of the available designs.

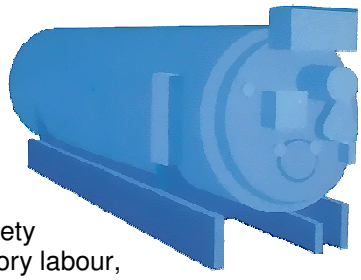
THE SIMPLE HORIZONTAL QUICK STEAM GENERATOR

The most inexpensive way of producing steam is the simple horizontal quick steam generator. In this type of boiler water is heated as it flows through a coil.

However some of these units have inherent disadvantages and require the use of well trained operators. The main criticisms of this type of steam generator are **low quality wet steam: fluctuating steam pressures: fixed flowrates: limited water failure safeguards: constantly switching burners: fixed water/fuel rates: rapid scale build up: high start-up losses: high maintenance: problematic multi-boiler plant and premature corrosion attack.**

These units can rarely be tolerated in an industrial environment.

SHELL BOILER



The second type of boiler normally considered is the traditional shell boiler which has it's origins in the industrial revolution. This type of unit has a cylindrical steel shell which is filled with water up to a level near the top. A firetube is heated by the horizontally mounted burner and steam is produced from the water surface by means of natural convection.

The result is a large size boiler with a long heating up period and critical safety monitoring requirements. This has a knock-on effect on efficiency, supervisory labour, running expenses and installation costs.

THE CLAYTON VERTICAL STEAM GENERATOR

The Clayton Steam Generator, by comparison, is an advanced forced circulation water tube boiler which has been designed to provide all the advantaged required for a steam boiler installation without any of the disadvantages of the simple quick steam generator or shell boiler. It has been designed to be flexible and suitable for all steam applications.

The Clayton Steam Generator can start and stop on demand and steam is produced under controlled conditions. The design used three main components which are the specially designed positive displacement pump, the heated coil and an extremely high efficiency steam separator.

COMPARISON TABLE

The chart overleaf is a comparison between the simple horizontal quick steam generator, the traditional shell boiler and the Clayton Steam Generator.

BOILER COMPARISON TABLE

	Quick Steam Generator	Shell Boiler	Clayton Steam Generator
Steam Quality	Wet steam. Low quality.	Moisture carryover from water surface. Increases during sudden steam demand.	Steam quality is the best available from any steam boiler. Steam is 99.5% dry saturated.
Quick Start Up	Short heat-up time due to low water content. But high start-up losses due to frequent purging.	Start up can be around 60 minutes due to large mass of water and steel.	Start-up within five minutes from cold. Low start-up heat. Semi-permanent pilot can be used for faster starts.
Rapid Response	Can respond rapidly but produces fluctuating steam pressures.	Inherent lag characteristics limit operational flexibility	Adjusts rapidly. Rapid increases in steam flow possible without loss of temperature and pressure.
Safety	No information available.	Steam explosions can result from the uncontrolled, release of energy that is present in stored water at saturated conditions – conditions that exist in shell boilers	There has never been a steam explosion of a Clayton Steam Generator. The Clayton design has eliminated the need to store large water volumes.
Scale Control	Rapid scale build-up possible.	Scale can form due to the low water velocity. Undesirable on a shell boiler because of effects on heat transfer, and water safety devices.	Scale easily detected without the need for an internal inspection. Early corrective action can be taken.
Water Level Safeguards	Limited and unreliable water failure safeguarding.	Loss of water level is one of the most common causes of catastrophic failures in shell boilers.	The Clayton Steam Generator does not have a discernable water level and no level controls are required.
Burner Operation	Frequent on/off switching of the burner can cause increased fuel consumption.	When no steam is being demanded burner must continually switch on and off. This wastes energy and can lead to high maintenance.	Fully modulating burner are available. The Clayton Steam Generator is off when no steam is demanded.
Maintenance	High wear and tear on burner and switchgear and high maintenance feed pump. Suffers from pre-mature corrosion attack.	Cost of repairing corrosion damage can be high.	The Clayton Steam Generator is designed to be low maintenance.
Steam Reserve	No steam reserve. Generator can boil out when steam demand is excessive.	Steam reserve is the amount available between maximum and minimum operating pressures – usually around 2 minutes.	Steam pressure profile reliably followed using the generator controls.
Automatic Operation	Requires well trained operators.	Boiler must be started under operator supervision and must be regularly monitored.	The Clayton Steam Generator can start-up and operate fully automatically without supervision. This eliminates human error.
Running Costs	No information available.	Higher running costs due to inefficient design.	Known for it's important design advantage of high efficiency which is due to the basic principle of operation.
Space and Weight	Low space and weight.	Typically three times the size of a Clayton Steam Generator and up to 7 times heavier.	The small space and weight means lower installation costs and more location options. A separate boiler house is not required.
Blowdown Losses	No blowdown. Contaminants remain in steam.	Low tolerance to dissolved solids and blowdown must be taken from the whole mass of water as a regular maintenance procedure.	High tolerance to dissolved solids and very low blowdown. Automatic blowdown line is only 10 mm.