

BOILERS FOR HONEY PROCESSING PLANTS

The seven things you need to know before buying a boiler

Boilers for Beekeepers in Honey Processing Plants

1. What is a boiler?

A boiler is a vessel where steam is generated. Water is heated at a pressure above that of the atmosphere by the application of heat.

Boiler thermodynamics

The thermodynamic process relevant to boilers is:

1. The burner flame radiates heat to the heat exchange tubes in direct contact with the flame.
2. Heat passes through the steel tubes by conduction to the water.
3. The heat is transferred through the water by convection.
4. Steam is created by the heat energy of water evaporation.
5. Steam then is moved throughout the system to do work.

The use of Steam in the processing of honey includes the following steps:

1. Uncapping of honeycomb frames
2. Extraction of honeycomb frames at higher than room temperature.
3. Honey filtration for removing wax, foreign particles after heating honey to 45 degree C.
4. Separation, handling and rendering of beeswax.

2. Why do I need a boiler for honey processing?

A steam boiler has many uses appropriate to honey processing operations; particularly in beeswax handling. The application of steam can facilitate uncapping, rendering pure beeswax, injection to water-jackets to heat honey lines, which will speed up the extracting process. Steam can also be used to sterilize plant equipment.

At what stage is a boiler necessary in a beekeeping operation?

There are a lot of variables to this question but to put it simply if you are running a reducer, you would need a boiler. A steam boiler will produce the most efficient and effective form of heat to run a reducer. Beeswax has a melting point of 65 degrees. Hot water running through the water jacket will lose its heat too quickly due to the large surface area of the reducer. At 5psi steam will provide heat of around 108 degrees C. allowing your reducer to do the job it was designed to do. Because steam is produced under pressure it has extra heat to do more work. As the pressure rises so does the heat.

3 What type of boiler is best?

This can depend on a number of variables, size of operation, mobile or permanent extraction plant and available energy source. Energy source could be: gas, diesel, oil or electricity.

There are two basic boiler designs

1. Fire tube boilers
2. Water tube Boilers

Fire tube boiler

In a fire tube boiler, heat is directed through metal tubes that pass through the water in the vessel before escaping through the chimney or flue. The hot gases transfer the heat to the water by convection. The fire tube system has the maximum amount of water storage space. For a beekeeping operation these are the simplest and easiest boilers to run and maintain. Once up to pressure they only need a small amount of heat to provide steam for the extracting operation.

Water tube boiler

In a water tube boiler, the heat is directed around metal tubes, which contain the water. Water tube boilers have the ability to generate more units of steam per hour but also provide less water storage than fire tube configurations. They are requiring more maintenance and monitoring. It is more critical to treat the water used in the boiler to prevent scale build up on the inside of tubes. This will reduce heat transfer to water and can create hotspots in tubes causing boiler failure.

There are three different classes of boilers, which relate to the construction and operational requirement.

For bee keeping a class 3 boiler or low pressure is all that is need

Low-pressure boilers are designed for pressure below 35 psi or 250Kpa
The working pressure of an extracting plant would be between 5 psi to 20psi.

4 What do I need to know about Boiler Safety?

Operating Water level

What happens if there is low water in a boiler? Boiler is no longer kept cool by water and steel heats up above its critical temp changing structural integrity of steel. There is potential for boiler failure.

The most important task in boiler operation is maintaining the Normal Operating Water Level (NOWL). A low water condition is the most common cause of boiler failure. The first thing an operator should do when approaching the boiler is check the NOWL.

In an emergency, shut-off the burner first before adding water to the boiler. At the very least, an overheated boiler is ruined, and should not be reused without inspection. Boilers MUST HAVE WATER IN THEM!

The Safety valve

Safety relief equipment is provided in any pressurized system, and boilers are no exception. Boilers have safety valves and can relieve the entire generating capacity of the boiler if the pressure goes above the working pressure limit. Depending upon the design pressure of boiler, the various safety valves in the boiler are set to open at a particular pressure called the "*set pressure*." Until the system pressure reaches the set pressure, the valve will not open or leak. Once the valve pops or opens, the pressure in the system may still rise. Because of this, the safety valves are designed to go full open.

Inspection

A boiler should be inspected annually by a certified Boiler inspector internally and externally for any defects, which may develop during its life. Additional inspections should include:

1. *Hydro test*. The hydraulic test is carried out to inspect the tightness of joints, fittings and the leakages from the repaired parts. To carry out this test, the boiler is completely filled with pressurized water.
2. *Steam test*. The steam test checks the setting of the safety valves at the working pressure.

5 What are the dangers of Second-Hand Boilers?

- Some boilers have been *overheated* or "*cooked*" likely due to low water malfunction. It may be still running, but not for too long since its life may have been severely compromised.
- Stains, rust trails and debris between boiler sections are indicative of existing leaks; this is a sign of corrosion.
- The boiler should have an ID Plate. With the following information: Boiler Serial no, Boiler Class, Manufacture Date, Tested By, Date Tested, Worksafe registration number, Design Pressure. The boiler should have a design certificate a Manufactures Data Sheet, certificate for steel used and certificate from a boiler inspector.
- When buying a new boiler, ensure that the manufacturer uses a high-grade steel and design integrity and has been built to the specifications set by the Australian Standards AS 1228 code.
- A second hand boiler needs to be inspected to make sure it is safe to use. They will provide a condition report, which will look at internal metal condition, weld joints and boiler fittings.

6 Boiler Fittings, what are they and what do they do?

It is useful to realize that boilers are controlled on two separate sides; the “waterside” and the “fireside”.

- *Fireside Controls* regulate burner intensity, fuel temperature and fuel pressure
- *Waterside Controls* regulate the pressure, temperature, and the level of water and steam.

Sight glass	A sight glass (or gauge glass) is a tube that indicates the level of water in the boiler. The tube extends vertically from the bottom of the water to the top of the steam area, and thus shows the actual water level in the boiler.
Safety valve	A safety valve (sometimes referred to as a relief valve, pop-off valve, or safety valve) protects the pressure vessel from over-pressuring and explosion. The safety valve is spring-loaded and can be regularly tested by simply lifting the test lever on the side of the valve.
gate valve	A gate valve is an isolation valve used to stop water or steam flow, for example the blow-down valve. These valves are either in an OPEN or Closed setting only.
globe valve	A globe valve disrupts the flow of fluid even in the fully OPEN setting.
check valve	A check valve permits only a one-way flow. These are often used between the pump and boiler.
LWCO	A Low Water Fuel Cut-Out or LWCO protects the boiler from a low-water condition. This control stops the burner if it detects a low-water level. This mechanical float should be blown-down regularly to prevent sediment from accumulating in the float chamber. Not on All Boilers

7 How should Boilers be stored?

At some point in time boilers may need to be off line and stored for an extended period of time. This is actually a delicate operation. Boilers that sit idle will corrode leaving a disaster when placed back in service.

Two ways to store a boiler:

The first is *wet storage*, which is generally better for shorter periods of time. e.g. between extractions.

For *wet storage* following steps are necessary:

1. Inspect the boiler and clean it if needed
2. Fill the boiler with water and add an oxygen scavenger like Tannin.

The *dry storage* method is preferred for boilers that will be out of service for an extended period of time.

1. Inspect and clean the boiler
2. Drain all the water and make sure that the boiler is completely dried. Remember, any moisture left on boiler surfaces will eventually corrode
3. Make sure that moisture cannot enter the boiler. Close off any steam lines, feed lines.
4. Place moisture absorbent material, such as lime or silica gel inside the boiler. This should be placed inside the boiler.

Summary

I hope this report has informed you on boilers for beekeeping. If you have any other questions please email me at info@easystem.com.au or phone 042 996 3180

Brett Murley
Easy Steam Boilers