



# BIOMASS COMBUSTION SYSTEMS, INC.

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## Comparing the BCS Horizontal Zoned Grate to a Under Feed Stoker

### Fuel Feed:

- 1) Under Feed Stoker systems deliver fuel to the center of the boiler and the fuel burns as it tumbles down the side of a “volcano” shaped pile. This design develops ash all the way around the base of the pile where it is difficult to completely rake out. In contrast, the BCS system pushes fuel across the grate and the ash collects towards the back of the boiler. Raking out ash is therefore much easier on the Horizontal Zoned Grate system.
- 2) The Under Feed Stoker system brings fuel under the boiler where it makes a right angle turn to penetrate the floor of the boiler. Since the auger delivering the fuel can not turn a right angle, it must stop before the turn and push the fuel around the corner. This puts a lot of pressure on the auger as the fuel compresses around the corner which adds to auger wear and maintenance. In addition, the right angle turn is one more place for the fuel to hang up and jam. In comparison, the BCS system introduces fuel straight into one end of the firebox. This creates less maintenance since there is no place for the fuel to hang up and less stress on the auger.
- 3) Because Under Feed Stokers deliver fuel to the center of the firebox, burn backs down the auger are more likely, particularly in dry fuel boilers with minimum loads. With minimum load the pile will burn down and air from the surrounding grate can feed the fire down into the steel auger tube. Even if the fire does not burn down the auger, heat from the fire can, and has, caused damage to this steel tube. In contrast, the BCS system has 12” of dead grate area in front of the auger so it is extremely difficult to burn the pile back to the back wall. When the boiler is turned off and this fuel is burned off the dead grate area, BCS recesses the auger in the tube so there is always a slug of fuel at the end of the auger to protect it from the heat.

### Grate:

- 1) Under Feed Stokers provides a much smaller grate for a given horsepower than the BCS Horizontal Zoned Grate. This is important because the smaller grate require more CFM of air per square foot to produce the necessary air for gasification. Higher velocities on the grate increase the likelihood that fuel will be blown off the grate before it is gasified. Once in the air, it is more likely to be sucked out of the boiler before it is completely burned.

- 2) The Under Feed Stoker grate consists of interlocking refractory bricks which permit air to flow into the fuel pile through “cracks” between the bricks. These “cracks” are the same size at the top of the brick as the bottom. This makes them more likely to get plugged than the refractory tiles sold by BCS. Our Horizontal Zoned Grate underfire air enters the firebox through holes which are cone shaped with a larger opening in the bottom than the top. So, anything that drops into the hole will drop all the way through and not get stuck. Similarly, if slag does develop the holes are easily punched clean. In contrast, Under Feed Stoker’s “cracks” can be completely filled with slag and are more difficult to clean.
- 3) Both Under Feed Stoker and BCS zone the grate to regulate the amount of air going to the fuel according to the depth of the fuel pile. Too much air under a small pile will lift the fuel off the grate before it has gasified and lead to decreases in combustion efficiency. The Under Feed Stokers system has a few zones around the base of the volcano fuel pile. BCS has many more zones across the bottom of firebox. More zones lead to more control of air flow and more efficient combustion.
- 4) Fuel brought into the Horizontal Zoned Grate dries and burns as it is pushed across the grate by fuel coming in behind it. This method of combustion creates a “burn line” where the pile sheers and the most vigorous combustion takes place. This “burn line” moves back and forth in the boiler with demand on the boiler and changes in fuel moisture content, particle size and density. A boiler which is operating properly should keep this burn line between one third and two thirds the way back in the boiler. This “burn line” provides a quick check on the boiler’s condition which is very useful to observe changing fuel conditions and seasonal demand on the boiler change. The Under Feed Stokers design relies on operators judging the height of the pile and is much less user friendly.

**Overfire Air:**

- 1) Under Feed Stokers use one fan for all overfire air. This air is controlled as it is introduced around the boiler through dampers. But when one damper is closed the air pressure in the manifold directs the dampered air to another part of the boiler. This design offers much less control over this air than the BCS system which uses two variable speed fans to introduce air over the fire. One fan can be changed without affecting air being delivered by the second fan. Once again, our system offers more operator control which leads to greater efficiency and happier operators.
- 2) Under Feed Stokers introduce this overfire air all around the boiler at the same height. If one thinks through the effect of this air flow it creates maximum turbulence in a very small area in the center of the boiler. BCS introduces air in the front and back of the boiler at different heights. In addition, the lower, rear, overfire air manifold is angled upwards. This design creates a circular air flow above the fire to maximize the amount of turbulence and residence time.

**Controls:**

- 1) BCS has spent a lot of time thinking through the minimum amount of controls necessary to control a wood fired boiler. We do not have a lot of bells and whistles which look good during the sales process but provide no useful purpose on a daily basis. Customers often comment that they “love the control panel because it is so simple”. Although our control panel has fewer features than our competitors, it is safer, offers more control over air and fuel, and is much more user friendly.

**Customer Service:**

- 1) At BCS we believe that efficient wood combustion is not rocket science. It really comes down to two variables: air and fuel. Efficient combustion is simply keeping the proper balance between air and fuel delivery. When we start up a boiler we not only talk about how to run the boiler, we explain why we are making changes to educate the operator(s) on how to maintain that balance. Wood fuel will vary, and demand on the boiler will vary over the year. All wood boilers will need occasional air and fuel adjustments. Our system makes those occasional adjustments easy, and our education process gives the operator the necessary knowledge to make those adjustments. The operators of Under Feed Stokers boilers we have talked to do not have the same level knowledge of wood combustion as we provide our operators.
- 2) The true test of any company’s customer service is their response when something is wrong with the boiler. If you have a problem with our system and call BCS, you will talk directly to one of the Principals in the Company. We know that our Company’s reputation rests on how we respond to your needs. We have thought about, and worked with, the same combustion system for more than 20 years and are out to prove that it is the best on the market. There is no way we would ever let your Company be anything but completely satisfied with our product.