IV. PLIBRICO WOOD WASTE FUEL ENERGY RECOVERY FURNACES

A. Wood Waste

In the light of today's new awareness of our rapid depletion of limited natural energy resources, those fuels which are renewable, such as wood wastes, municipal, industrial, and commercial refuse are awakening new interest. Research and development of systems to efficiently utilize these materials to produce heat, steam and power is proceeding worldwide.

One of these energy producing wastes is wood fuel derived from lumber mills, the paper and pulp industry, furniture factories, plywood and hardboard plants. Wood waste has long been utilized as fuel to obtain heat, steam and power, and to assist in various manufacturing processes. This type of waste fuel is undoubtedly the most widely used in power boilers from HRT's to large water wall steam and power generators.

Wood, when freshly cut, may contain 30 to 60% moisture. After air drying for approximately one year this moisture content would be on the order of 18 to 25%. Kiln dried wood contains 8 to 15% moisture.

The heat value of average wood waste is about 8,500 BTU/lb. on a moisture free basis. Approximately 0.5 to 2% of wood is non-combustible but in actual operation the resulting ash will, in poorly designed furnaces, often amount to much more than 2% due to incomplete combustion.

The quantity of wood waste burned at various installations is often quite high. When large capacities are to be burned it is necessary that multiple cells be provided in which air ducts and nozzles can be located and protected to assure the necessary mixing of air and fuel. If the cells are too wide, the air pressure required would cause excessive entrainment of solid particles in the exit gas stream.

When the wood waste contains a high moisture content, the location of furnace auxiliary burners should be such as to immediately fire into the newly charged wood and to provide as long as possible, a flame pattern over the length of the furnace and hearth. In some cases, this may require that the furnace be shaped by means of the arch and hearth configuration so as to provide as small a passage for the burner flame and the products of combustion for the wood waste as practical. This is to prevent the too rapid dissipation of heat into excessively large volumes of furnace space, thus resulting in too low of a heat release per cu. ft. of furnace volume. The actual heat release within a furnace should be on the order of 25,000 to 35,000 BTU per cubic ft. Unfortunately, the wettest waste requires the smallest volume furnace, happens to also require the largest area hearth to assure sufficient spreading to dry. The two opposing requirements require strict attention in determining furnace configuration.

It would appear that when wet wood is to be burned, a dutch oven is far more efficient because of heat retention than an open top furnace installed directly under a boiler. On the other hand, dry waste, particularly if it contains quantities of fines, would perform better from a combustion and heat recovery point-of-view when fired directly into the boiler furnace. When fine material is charged from some elevated opening directly into a boiler furnace 60% to 70% of the combustion can take place in suspension. When sufficiently high temperatures are obtained in this type of operation, quantities of wet wood waste can be introduced and will flash dry and burn in suspension.

Feed systems are of great importance as they are a source of air infiltration which might not be desireable, be difficult to measure, and equally difficult to control. Too, the quantity of wood waste delivered at any one time by various systems can also have great affect on the operation of the furnace/boiler combination. The type of waste being charged will also determine the method by which it will be introduced to the furnace.

Obviously, the simplest method of charging is for the operator to throw a shovel full of wood waste through an open door into the furnace. If the wood waste contains light materials such as sawdust, the operator will be living a precarious life indeed. Although primitive, this method is still being used.

More up-to-date charging methods are by conveyor fed hopper systems having a charge point at some elevated position in the furnace, such as the arch. Gravity is depended upon to drop the material from hopper to furnace. A conveyor system running across the furnace or multiple furnaces can discharge directly into charging openings. Where the waste is of such a nature that screw conveyors can be employed, this system can be used. And, of course, pneumatic conveyance and feeding can be quite successful. In some instances, kicker devices and spreaders may be employed at the end of the feed duct to throw the waste into the furnace where it can be burned on a hearth, grate or stoker.

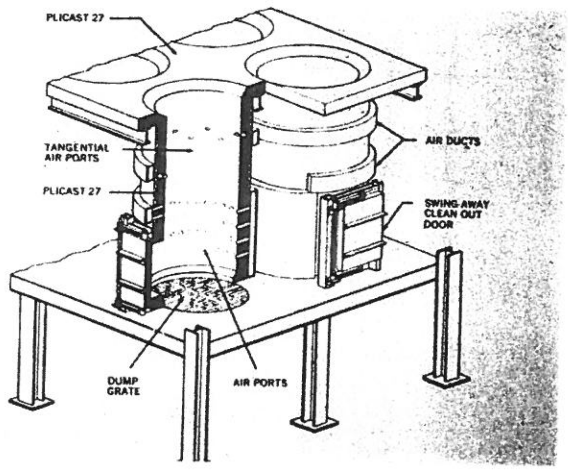
Regardless of how the furnace is loaded, air will be admitted and, in some cases, a danger of back burning exists.

The engineering staff of the Plibrico Company, through many years of experience, can design the most suitable, practical and efficient wood burning furnace for any new or old boiler you may have purchased or re-design any existing furnace you now have that you wish to modernize and obtain maximum capacity by increased efficiency. The exterior wall construction would be designed for minimum BTU loss with the proper insulation.

B. CIRCULAR CELLS

Boiler efficiency is increased with the type of design illustrated in the cutaway drawing below. More effective combustion is achieved by controlled circulation and distribution of air. Primarily used for bagasse fuel, this same type of cell can also be utilized in a wood burning application for wood refuse with a 25% or greater moisture content, due to the similar characteristics of the waste material.

Importantly too, downtime fades because of the operational flexibility and the freedom from maintenance built into this compact, modern setting.



Several major design features contribute to the remarkable combustion efficiency attained. First, there's the cell shape, encircling the wood fuel pile, more effectively concentrating radiant heat upon it. Second, there's the controlled circulation and distribution of air. Straight through ports in the lower wall deliver primary air which penetrates the fuel bed and, with the radiant heat, achieves a high rate of burning. Tangential ports in the upper wall inject secondary air in a turbulent swirling pattern, intimately mixing with the gases for complete combustion. And this upper cell turbulence has yet a third feature, for it induces suspension burning of entering wood fines, keeping them from blanketing and retarding combustion of the fuel bed below.

This setting offers you great flexibility. It's adaptable to most types of boilers and can be used for new installations or to modernize existing ones. The design provides ample combustion chamber volume to accomodate auxiliary burners when desired. Air distribution to each cell is independently controlled, permitting shut down of individual cells for cleanout without affective continuous boiler operation. Cells may be equipped with dump grates as shown or constructed with solid hearths.

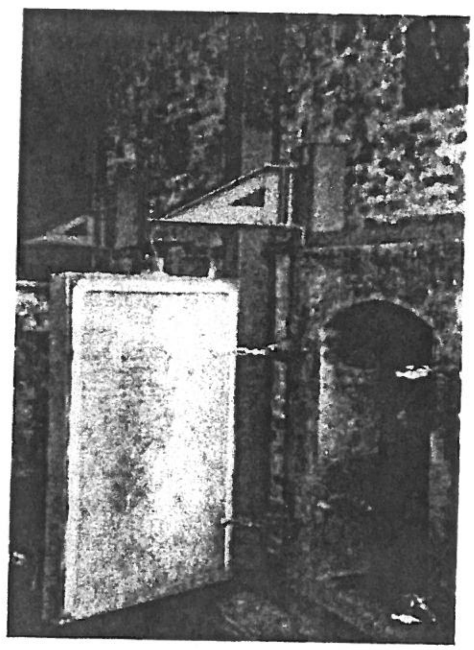
To promote uninterrupted service, the circular cells feature monolithic Plibrico designed linings that require a minimum of maintenance. The lining for each cell employs Plicast castable refractories to form a single, continuous tightly knit structure, a durable monolith free of trouble producing joints. Even the air ports are cast as an integral part of this rugged one-piece lining. And a system of positive anchorage is built into the lining to further extend service life.

C. HORSESHOE CELLS

Our Plibrico horseshoe furnaces are also engineered for maximum efficiency and in some boiler applications lend themselves better than the circular fuel cell. Typical installations are fully illustrated and described in our Sugar Mill Catalog.

D. "SWINGAWAY" CLEANOUT DOOR

Plibrico's "swingaway" cleanout door operates smoothly, virtually effortlessly, due to its double-pivot design. Illustrated here in the open position it swings clear and stays clear, allowing unobstructed cleanout. Closure is tight and positive, for the door is equipped with asbestos gasket seals and quick cam action locking clamps which will prevent flame stingers around the door periphery that eventually warp doors and structural supports.



They are designed for openings measuring 3'-6" high and 2'-2" wide. The "swingaway" door is fully insulated and lined with Plicast Tuff-Mix.

This door will end problems of hard to open and close doors that bind and jamb.

E. BAFFLES

Plicast Beco Turner Baffle Mix will provide for you an absolutely gas-tight baffle and eliminate leaky joints found in tile baffles.

We cannot only provide you with the material, but also engineer for you the most efficient baffle design for your boiler.

The installation of Beco Turner baffles results in more uniform gas velocity, better heat distribution throughout the boiler passes, lower flue gas temperatures, and increased boiler efficiency - all of which mean reduced fuel consumption and greater economy.

On the attached typical Plibrico wood fired installations are various types of baffle designs for different types of boilers.