

# 90-TPH WALKING-BEAM FURNACE COMMISSIONED

## at Posco SS Vina, Vietnam

As part of the 1.0-Mtpy Danieli minimill, Danieli Centro Combustion supplied two walking-beam furnaces, one for the rebar mill and one for the heavy-section mill, both designed with state-of-the-art regenerative burner combustion.

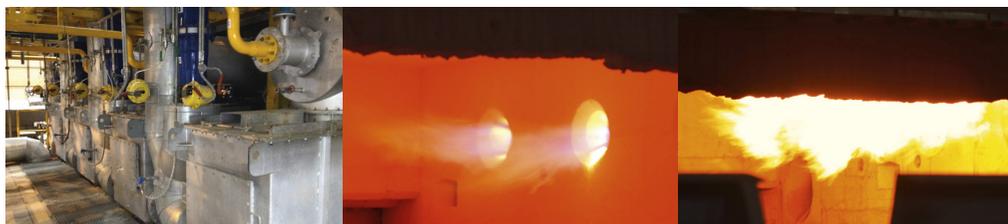
Regenerative burners function in the cyclic mode, alternating from burner mode to aspiration mode, in which fumes from combustion are drawn toward the regenerator case. Flue gas heat is stored in special spheres of ceramic material and released in the following cycle during combustion air flow. Combustion air can easily reach temperatures approximately 100 °C lower than those of the furnace fumes when the aspiration mode is used. The flow of cold combustion air and waste gas is alternated inside the regenerator case during each cycle. Burners are associated in pairs for each combustion zone. This association ideally couples burners in front of each other in the furnace so that waste gas produced by the first burner is sucked by the burner installed directly opposite. During the switch phase, both burners can work in the flame mode in order to minimize unfavorable combustion by-products. The switch operation is performed at predetermined intervals and modulated according to necessity (typically every 45 seconds). The traditional division between upper and lower combustion zones is not necessary; however, each zone covers the entire height of a furnace sector. Correct furnace conduction involves the same number of burners in flame mode on the lateral walls of the furnace, in order to guarantee uniform thermal exchange between waste gas and the feedstock. During the furnace start-up phase, regenerative burners also can function in the conventional mode using cold air and without using the regenerator cases.

### Furnace length optimization

Although a furnace equipped with regenerative burners is shorter than a traditional furnace, it is designed to achieve the same performance. Moreover, the quantity of waste gas following the traditional path is minimal compared to waste gas passing through the regenerators, therefore there is no convection heat transfer between the feedstock and flue gas and a recuperative area on the charging side is unnecessary. A recuperator heat exchanger is not installed either. This offers considerable savings in steel structures and refractories. Compared to a traditional furnace, the regenerative combustion system offers a reduction of approximately 25% of furnace length.

### Heat recovery increase

Waste gas, which preheats the air passing through the regenerator, leaves the area at approximately 200 °C and is sent to the stack through forced draught. Waste gas exiting the recuperator has an average temperature of 380 °C in a furnace equipped with a traditional combustion system. Differences in temperature demonstrate greater furnace heat recovery with a



	Rebar mill	Section mill
Useful length (mm)	12,000	19,200
Production rate (tph)	90	160
Charge size (mm)	Billets 150-160x12,000	Billets 160x12,000; Blooms 300x200x 12,000; Beam blanks 480x380, 380x290, 285x200x12,000
Discharging temp. (°C)	1,150	1,200
Installed power (Gcal/h)	41	44.4
Regenerative/traditional combustion zone (quantity)	3 regenerative	2 regenerative (preheating and heating); 2 traditional (soaking)

regenerative system compared with the traditional system. Installing the regenerative system makes it possible to recover up to 70% of heat from the waste gas compared to an average of 55 % with a traditional combustion system. Regenerative burners also increase the overall efficiency of the furnace, from an average value of 69%, a global efficiency of 75% can be achieved due to the higher total contribution of hot air. The regenerative system also can be advantageous when using low calorific value fuels (i.e. mixed gas, BFG, COG), employing the heat coming from waste gas to reheat fuel and increase its enthalpy. In this case, combustion air is heated using a heat exchanger installed in the waste gas duct. Although installing a regenerative combustion system leads to a greater CapEx (compared to a traditional system, the cost of a regenerator media, an additional circuit with relevant control valves for exhaust waste-gas management, and an exhaust fan need to be taken into account) the regenerative system offers higher efficiency and greater reliability, significantly lowering the OpEx. Performance tests for the rebar mill were completed in January 2015, and performance tests for the section mill are in progress now ■

Furnace overview.  
Regenerative burner – detail.  
Regenerative burners flames.