North American TwinBed® II Overview

Bulletin 4343

TwinBed II Regenerative Burners recover waste heat from furnace exhaust gases and preheat combustion air, to significantly increase efficiency over conventional burners or burners with recuperators. NOx emissions are extremely low, even when compared with cold air burners. TwinBed II regenerators are heat and corrosion resistant and tolerate hostile environments that can destroy recuperators.

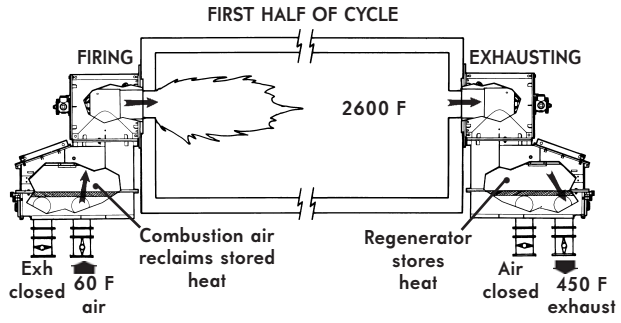
TwinBed II burners save significant amounts of fuel when applied to a variety of high temperature furnaces. The higher the process temperature, the higher the potential fuel saving when compared with conventional burners.

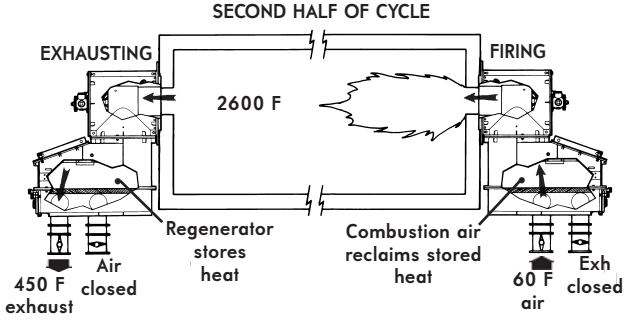
ACTUAL PERFORMANCE DATA

Furnace temp. F	Air preheat temp. F (average)	Waste Gas Temp. F at 90% bed extraction	TwinBed II combustion efficiency % (average)	Combustion efficiency % (cold air)	Fuel savings over cold air operation %
1470	1220	270	82	57	30
1830	1560	330	79	47	42
2190	1900	370	77	37	52
2640	2280	460	74	23	69

TYPICAL APPLICATIONS

aluminum melter
steel forge furnace
heat treat furnace
glass melter
steel reheat furnace
retort furnace



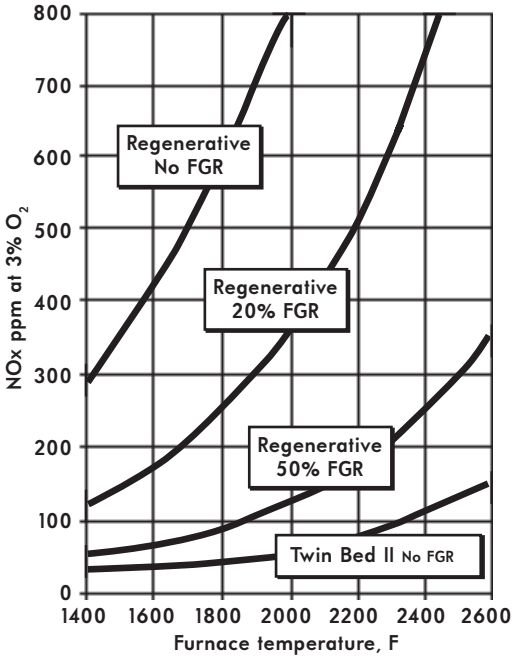


REGENERATIVE FIRING

Each TwinBed II has a compact heat storage regenerator containing ceramic balls. Operating in pairs, one burner fires while the other burner exhausts. Combustion air is preheated in the regenerator of the firing burner and furnace gas gives up heat to the regenerator in the exhausting burner. Burner operations are switched within an application specific time period. The burner that was firing, now exhausts; and the burner that was exhausting, now fires. Burner operation continues cycling between firing and exhausting.

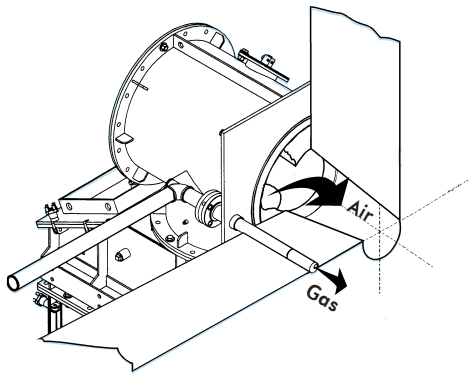
LOW NOx EMISSIONS

TwinBed II uses low NOx technology developed by Tokyo Gas Co. Ltd. of Japan. North American is the exclusive worldwide licensee for use of this technology with regenerative burners. To minimize NOx formation, two different air-fuel mixing techniques are used depending on furnace temperature.



Conventional regenerative burner NOx levels *vs.* TwinBed II

TwinBed II is operated as a conventional regenerative high velocity burner when furnace temperature is below 1450°F (788°C). Above 1450°F fuel is switched to strategically placed nozzles adjacent to the burner tunnel port. Low NOx Injection of fuel (LNI) into the furnace chamber allows inspiration of combustion products into the air and fuel streams reducing the rate and temperature of the combustion reaction, thus significantly suppressing the formation of NOx. This "in-furnace" direct NOx control method maintains highest potential efficiency. There is no efficiency loss as with flue gas recirculation (FGR) that is frequently used to reduce NOx emission from regenerative burners.



Gas injectors reduce NOx emissions.

FGR involves adding furnace exhaust gas to the combustion air where the inert constituents reduce the rate and temperature of the combustion reaction. If added after the combustion air flows through the regenerator, FGR can reduce system thermal efficiency up to 15%. If added prior to the regenerator system, efficiency can be maintained, but larger regenerators are required to accept the additional volume. Other regenerative burners use up to 50% FGR.

A very practical advantage of TB-II low NOx technology is the simplicity of construction of the burner and tile. Burners that use air staging to reduce NOx require internal refractory baffles that the TB-II design eliminates.

CONTROLS

TwinBed II operates with the same controls (air/fuel ratio, furnace pressure, and flame detection) used with conventional burners.

Air/fuel ratio is typically controlled with differential pressures from an orifice plate in the combustion air line and a flow-based fuel rate control system--either regulator or electronic.

Typically, about 80% of the furnace gases are exhausted through the regenerators. The remaining 20% passes through a pressure controlled furnace flue.

Exhaust flow through the regenerators is controlled by the temperature of the exhaust gases leaving the regenerator. If temperature is too low, the exhaust flow through the regenerator is increased. Furnace pressure is controlled with the flue damper. Logic links from the furnace pressure control to the burner exhaust system prevent excessive pull through the burners which would result in negative furnace pressure.

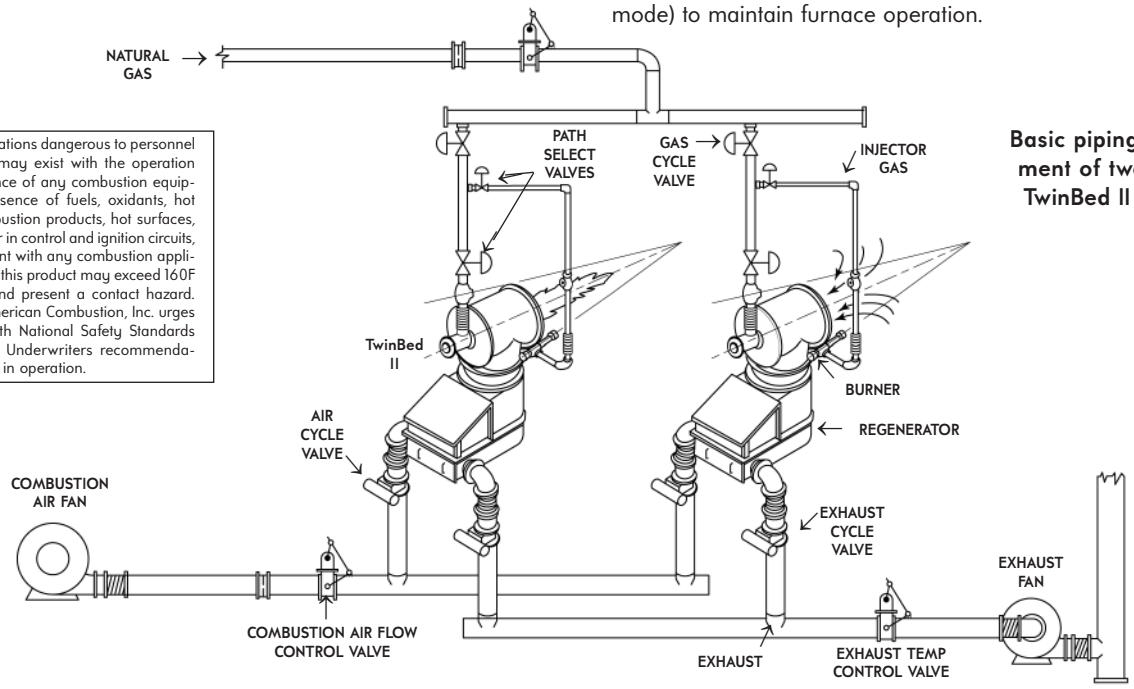
Each burner's flame supervision uses ultraviolet flame detectors on both the pilot and main flames connected to a single flame relay. By switching detector signals when burners alternate firing, the flame relays monitor the main flame of the firing burner and the pilot flame of the exhausting burner.

CONSTRUCTION FEATURES

TwinBed II has enhanced rugged construction. Burner and regenerator are separate modules. Angled transitions are available to change burner firing angles relative to regenerator. Burner and regenerator can be rotated for ease of installation. Other improvements include nozzle-mix pilot with flanged mounting.

TwinBed II is insensitive to furnace operating environments that can quickly destroy recuperators. There are no boundaries between air and waste gas streams to be maintained against leakage. Materials of construction have been chosen to withstand the corrosive effects of exhaust gas borne volatiles.

Regenerators can be easily cleaned of dirt or condensed fouling by dropping the bed support plate and removing bed material through the rear hatch. Clean heat transfer material can be replaced through the top hatch. A regenerator can be cleaned while the other burner in the pair fires direct (a non-reversing mode) to maintain furnace operation.



Basic piping arrangement of two burner TwinBed II system.

WARNING: Situations dangerous to personnel and property may exist with the operation and maintenance of any combustion equipment. The presence of fuels, oxidants, hot and cold combustion products, hot surfaces, electrical power in control and ignition circuits, etc., are inherent with any combustion application. Parts of this product may exceed 160F in operation and present a contact hazard. Fives North American Combustion, Inc. urges compliance with National Safety Standards and insurance Underwriters recommendations, and care in operation.

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