

Winner of
FLCTD Competition
for Waste Heat Recovery
by UNIDO.
Technology Vetted
by BEE, CII, GEF
& UNIDO



REGEN[®] BURNER SERIES

... Answer to the continued need for "Energy Conservation"

REGEN® SERIES

REGEN® is a series of LOW NOX Regenerative burners designed by ENCON. Regenerative Burner is a combustion heating system designed for extremely high recovery of heat from flue gases to preheat combustion air in an industrial furnace.

With REGEN® Series of Burners you can preheat the combustion air very close to the process temperature. We can achieve a preheat temperature of around 1000°C when the process temperature is around 1250°C as a result we are able to achieve additional fuels saving of 25-30% compared to conventional combustion system with metallic recuperators.

This system has been specifically adopted and popularized in high temperature furnaces, including reheating furnaces for rolling, forging furnaces, heat treatment furnaces, melting furnaces, baking furnaces, as a superb means for saving cost energy and reducing CO₂ emission.



APPLICATION FEATURES



REGEN® Burner Series have rugged construction which are able to handle the harsh working environment which are prevalent in heavy industrial applications like:

- Steel Reheating Furnaces
- Steel Heat Treatment Furnaces
- Steel Forging Furnaces
- Aluminium Melting Furnaces
- Copper Melting Furnaces

Since the products which are processed in these furnaces may be dirty or contaminated (i.e. by lubricants) or may have significant amount of dust which result in a dirty furnace environment, we have selected High Alumina Ceramic Balls as the heat recovery media for REGEN® Burner Series. We have chosen Ceramic Balls as they minimise the time required for cleaning and maintenance when compared with Honeycombs structure.

The REGEN® Burner Series comes in a range of Sizes and with gaseous fuel options. These range covers most of the conventional furnace requirements.

We also offer non-standard sizes of REGEN® Burners which are customised as per the process requirement and the Fuel and Space availability.

STANDARD DESIGN FEATURES

Type of Fuel:

- Natural Gas
- Liquefied Petroleum Gas
- Coke Oven Gas (LHV @4.000 kcal/Nm³)
- Mixed Gas (LHV > @2.500 kcal/Nm³)
- LDO (Light Diesel Oil)

Burner Operation:

Burner Control	: operated by certified BMS
Burner Ignition	: AIR-LPG or AIR-NG pilot burner
Flame detection	: UV Sensor
High Temperature mode	: bypass available in case of T > Self Ignition T

Required Feeding pressure at valve skid:

- Gaseous Fuel P > 100 mbar
- Blown Combustive Air P > 60 mbar
- Blown Suction AIR P < -60 mbar

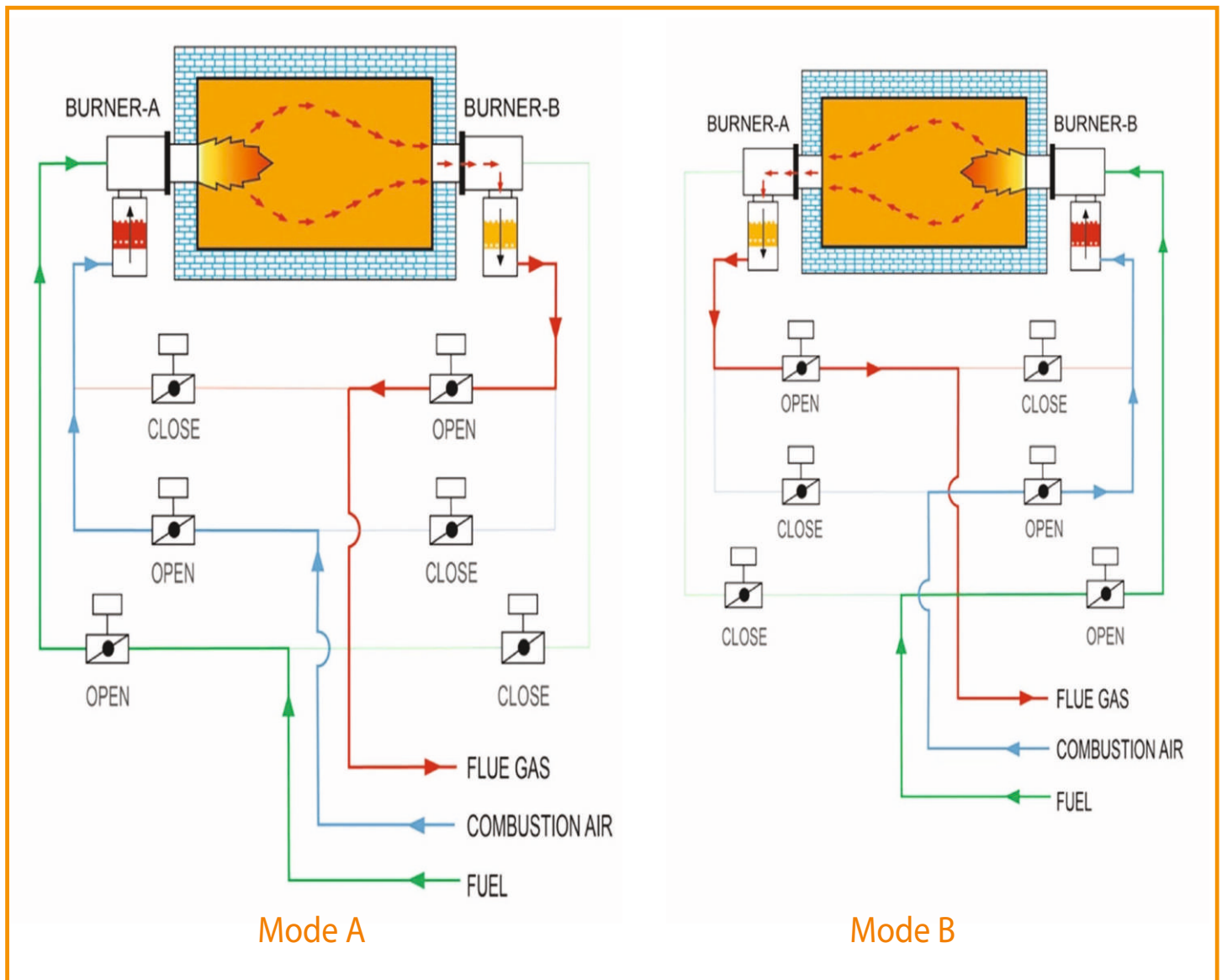
Maximum Furnace Temperature	: 1.300°C
Standard Firing Rate	: From 500kW up to 6.000kW
Standard Range (turn down)	: 4 to 1

Designed for Low CO and NO_x generation (diluted flame combustion). Flameless Kit for Ultra Low NO_x application available

WORKING OF REGENERATIVE BURNER

Regenerative burners work in pairs. In Mode A, Burner A fires and Burner B act as a regenerator or heat sink, the flue gas is sucked by Burner B, the flue gas travels through the media box of Burner B to the chimney, The Media box is filled with Ceramic balls which absorbs the heat of the flue gasses.

In Mode B, the process is reversed and Burner A act as the regenerator and Burner B fires. In this case combustion air passes through the hot media and we are able to achieve a Combustion air temperature which is approximately 200 to 300°C below the process temperature depending on the process parameters, for example if the process temperature is 1200 °C we will be able to achieve a temperature of 900 to 1000 °C for the combustion air.



LOW NO_x FLAMELESS COMBUSTION (OPTIONAL)

In order to minimize the formation of NO_x, a staged combustion solution has been applied, so that a flameless condition can be obtained once the furnace has achieved a certain temperature.

All burners of the REGEN® series have been equipped with a system of separate gaseous fuel injection, through dedicated high speed lances, that promote the internal re-circulation of the furnace atmosphere, diluting the combustion area and reducing the peak flame temperature. The injection of fuel through lances at high speed I also improve the homogeneity of the chamber temperature.

The flameless condition of burning should be activated only when the chamber temperature is minimum 200°C above the self ignition temperature of fuel.

PARTS REGEN® BURNER



The REGEN® burner series has been designed to cover the most common size required in industrial application, but other firing rate or fuel combinations may be available on demand.

Regenerator box

The regenerator boxes of REGEN® Burners have been designed in order to

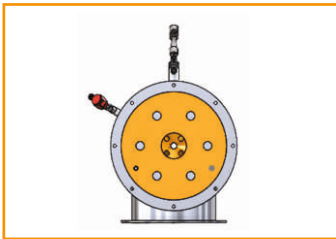
- quickly allow the replacement of alumina balls during maintenance activities, through one charging door on its top and one discharging door on its bottom
- standardize the installation with a central AIR/FLUE connection for INLET/OUTLET, so that all burners can be considered identical and the piping for the Combustion air and Flue Gases can be installed on the sides of the burner

it may happen that the installation area available for burners on the side of the furnace, doesn't allow to fit also the regenerator boxes; in this case the boxes can be customized and reconfigured for a "remote" installation, i.e. over the top of the furnace, extending the connecting pipes between the burner's head and the box.

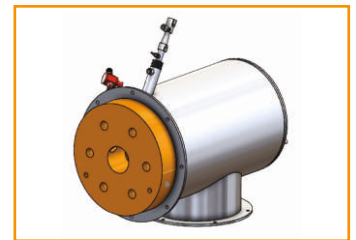


Burner's Head

The head of the burner has been internally lined with high alumina refractory in order to minimize the heat losses.



The burner block is which stabilizes and shape the flame has been designed as a separate part from the burner's head, in order to allow easier replacement in case of maintenance requirement



Fuel lances

The injection of fuel are done through lances , These lances have an air jacket around them and are cooled with cold air to ensure that they are not damaged during operation.

All fuel lances are flanged to the burner's head, in order to allow a fast replacement in case of maintenance requirements.



Pilot burner

The AIR-NG or AIR-LPG pilot burner of REGEN® burner has been designed to warrant a reliable and steady flame formation, as well as to resist to the high temperature reached by the refractory where it is inserted.

UV Sensor

The UV sensor is a critical item to allow a steady operation of the burner and therefore it has to be protected by

- overheating from fumes entering inside the burner's body while in regeneration mode
- dust deposition over the UV lenses (still coming from the flue gases that pressurize the burner during the regeneration mode)

For this purpose the UV sensor has been provided with a dedicated purge air injection

MAINTENANCE OPERATION

REGEN® burners are made by several parts that are considered consumable and therefore are required to be monitored and inspected regularly (i.e. UV sensors or Pilot burners).

In order to maintain a high level of heat recovery the Alumina balls inside the regenerators have to be inspected and cleaned regularly, the heat accumulation capacity of these balls is directly related to the efficiency of the system. In furnaces with dusty or atmosphere which is rich with volatile material, the dust and volatile particulates tend to stick on these balls limiting the heat absorption and transferring capabilities and can also create additional pressure drops affecting the overall performance of the Burner.

Therefore it is recommended to execute a program of inspection of the alumina balls conditions and eventually an operation of replacement/cleaning of the balls itself; the frequency of such activities may vary according the process, for instance

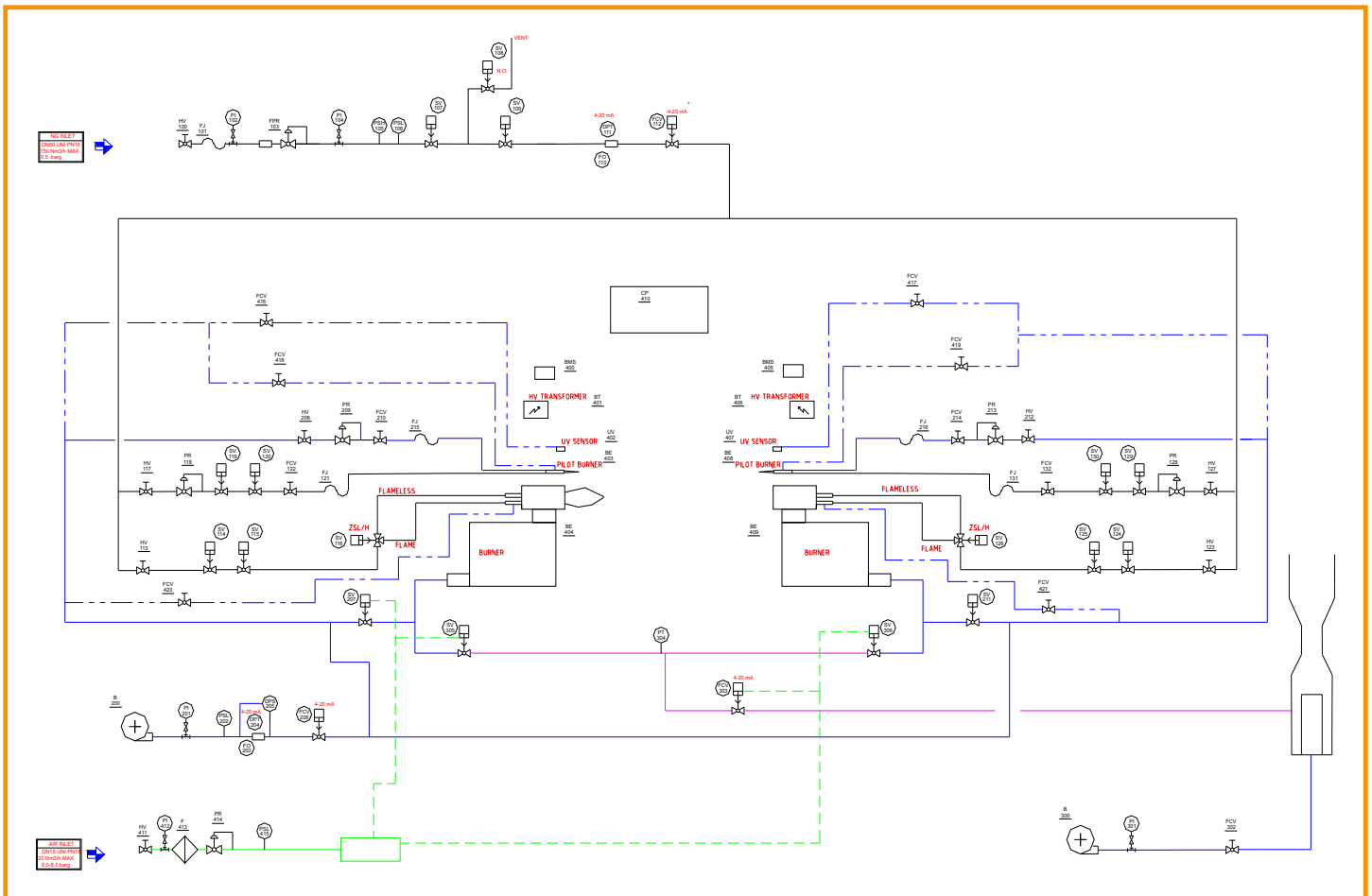
- it could be done once per month for an aluminium melting furnace where highly contaminated scraps are processed
- it could be done once per year in continuous steel reheating furnaces

SAFETY DESIGN CODES

The burners can be supplied with a fully integrated valve control system, designed to comply with the most strict International Safety Standards for combustion applications, as

- EN746-2:2010,
- NFPA86
- SANS329.

REGEN® burners are intended to be used only by properly trained personnel, expert in dealing with combustion applications and equipped with all required safety DPI.



OPERATING MODE

REGEN® burners can operate in several mode according the process requirements like :-

- Modulating firing rate
- OFF-MIN-MAX
- OFF-MAX

The selection of the proper control logic has to be performed in compliance with the type of application, the furnace geometry, the number of temperature control zones, but generally, whatever is the firing rate control solution adopted, the burner's inversion logic should be always the same.

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PROCESS PARAMETER

TEMP MODE

CYCLE START CYCLE STOP

FLAMELESS

BURNER PARAMETER

TEMP-TOP	TEMP-BOTTOM	B-1 TIMER SP	B-2 TIMER SP	FLAMELESS TEMP SP
850.0 (°C)	300.0 (°C)	300 Sec	300 Sec	850.0 (°C)

FURNACE PARAMETER

FURNACE TEMPERATURE SP	AIR FLOW SP	FURNACE PRESSURE SP
900.0 (°C)	600.0 m3/h	2.000 InH2O
GAS PR. HI SP	GAS PR. LOW SP	GAS: AIR
200.00m bar	50.00m bar	30

BACK OVERVIEW PID SETTING PROCESS PARAMETER SUMMARY ALARM MANUAL SETTING

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BURNER-1

ON OFF

MAIN FLAME FLAMELESS

CYCLE TIME 300 Sec

38.0 (°C)

43.0 (°C)

FURNACE TEMPERATURE

92.0 (°C)

FURNACE PRESSURE

0.040 InH2O

FLUE GAS TEMP

41.0 (°C)

BURNER-2

ON OFF

MAIN FLAME FLAMELESS

CYCLE TIME 300 Sec

64.0 (°C)

135.0 (°C)

BACK OVERVIEW PID SETTING PROCESS PARAMETER SUMMARY ALARM NEXT

The most common way adopted to maximize the heat recovery efficiency of REGEN® burners is based on a temperature control of the fumes leaving the burner in "Regeneration" mode: once the fumes temperature rises till a defined value (i.e. 300°C), the burner's operation is switched, so that the energy recovery can be maximized.

In order to perform such temperature control, each REGEN® burner must be provided by a dedicated thermocouple installed at the outlet of the fumes from the regenerator.

Due to the temperature ranges that are potentially to be monitored, it is recommended to instal K type thermocouples.

Usually, 80% of Flue gases generated through the burners flow through the regenerator box. A dedicated blower (ID Fan) is needed to suck the flue gases through the heat recovery system.

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BURNER-1 STATUS

ON OFF

BURNER-2 STATUS

ON OFF

SUMMARY

FURNACE TEMPERATURE	953.0 (°C)
FURNACE PRESSURE	2.270 InH2O
REGEN BURNER-1	
TOP TEMP	1200.0 (°C)
BOTTOM TEMP	292.0 (°C)
REGEN BURNER-2	
TOP TEMP	250.0 (°C)
BOTTOM TEMP	113.0 (°C)
MAIN GAS TRAIN	
GAS PRESSURE	99.0m bar
GAS FLOW	18.1 Nm3/h
MAIN AIR TRAIN	
AIR PRESSURE	63.0m bar
AIR FLOW	526.0 m3/h

B-1 THREE WAY VALVE

MAIN FLAME ON

FLAMELESS OFF

B-2 THREE WAY VALVE

MAIN FLAME ON

FLAMELESS OFF

REGEN BURNER-1

AIR VALVE-A ON

FLUE VALVE-C ON

REGEN BURNER-2

AIR VALVE-B ON

FLUE VALVE-D ON

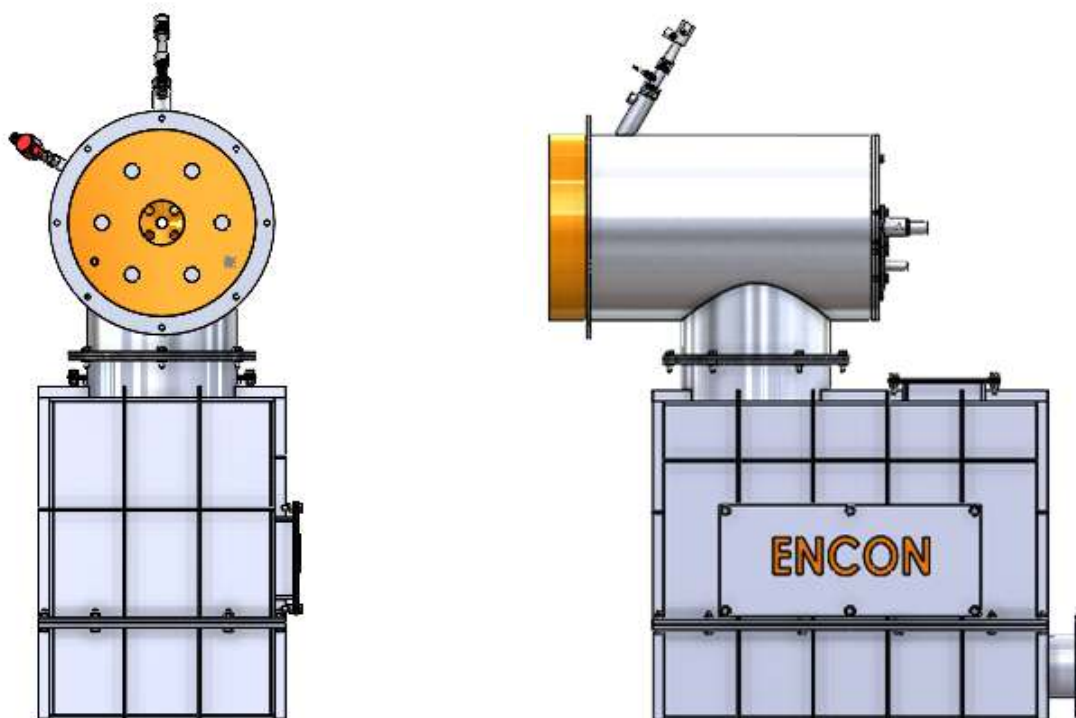
MAIN FLUE GAS LINE

TEMPERATURE 159.0 (°C)

PRESSURE 2.270 InH2O

BACK OVERVIEW PID SETTING PROCESS PARAMETER SUMMARY ALARM NEXT

BURNER SIZING FOR NATURAL GAS APPLICATION*



BURNERS SIZES

	BLOCK DIA. mm	FURNACE OPENING DIA. mm	BURNER HEAD LENGHT	REGENERATOR BOX HEIGHT mm	REGENERATOR BOX WIDTH mm	REGENERATOR BOX LENGHT mm
REGEN500	500	510	890	672	900	1070
REGEN1000	550	560	940	839	950	1120
REGEN1500	600	610	990	973	1000	1170
REGEN2000	650	660	1040	1105	1050	1220
REGEN2500	700	710	1090	1188	1100	1270
REGEN3000	750	760	1140	1245	1150	1320
REGEN4500	800	810	1190	1421	1200	1370
REGEN6000	850	860	1240	1595	1250	1420

	FIRING RATE kW	NG Nm ³ /h	AIR Nm ³ /h	80% FUMES @ 300°C	NG inlet DN	AIR inlet DN	AIR DUCT DN	FUME DUCT DN	APPROX FLAME LENGHT mm
REGEN500	500	50	550	1007	25	150	150	200	1500
REGEN1000	1000	100	1100	2015	40	200	200	250	2000
REGEN1500	1500	150	1650	3022	40	250	250	300	2600
REGEN2000	2000	200	2200	4030	50	250	250	300	3400
REGEN2500	2500	250	2750	5037	65	350	350	400	4000
REGEN3000	3000	300	3300	6045	65	350	350	400	4300
REGEN4500	4500	450	4950	9067	80	450	450	500	5200
REGEN6000	6000	600	6600	12090	100	450	450	500	6000

PLEASE CONTACT US FOR LIVE DEMONSTRATION OF THE TECHNOLOGY AT OUR PLANT



The Technology was awarded with FLCTD – for Year 2019, by UNIDO and has been vetted by BEE, UNIDO, GEF & CII

 UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Regional Office in India

 FLCTD
Promoting Investment and Deployment of
Low Carbon Technologies

24 November 2020

To Whom It May Concern

This serves to confirm that the United Nations Industrial Development Organization (UNIDO) technically and financially supported the development and validation of the Regenerative Burner System of M/s ENCON Thermal Engineers Pvt Ltd (Faridabad) under its Facility for Low Carbon Technology Development (FLCTD), following independent screening by subject area expert panel.


The United Nations Industrial Development Organization (UNIDO) is implementing a project with the Bureau of Energy Efficiency (BEE), Ministry of Power titled 'Facility for Low Carbon Technology Deployment' (www.low-carbon-innovation.org). The project is funded by the Global Environment Facility (GEF) and has been formally endorsed for implementation in India by the Ministry of Environment Forest and Climate Change (MoEFCC).

The main objective of this FLCTD Project is to facilitate the deployment and scaling up of innovative energy efficient and low-carbon technologies in India. The project conducts annual innovation challenges to solicit applications of innovative technologies under different technology verticals, including waste heat recovery. Expert panels review the applications to select those applications that are innovative, promise significant energy savings, have good techno-economic prospects and appear scalable and replicable. The top-ranked applicants are supported by FLCTD to deploy their technology in a suitable industrial or other appropriate user setting in India, through industry liaison, oversight and validation of efficacy and market potential, along with partial grant funding for such deployment up to maximum of USD50,000.

M/s ENCON Thermal Engineers Pvt. Ltd was selected to receive aforementioned deployment support for its innovative "Regenerative Burner System" following the expert panel review in the 2019 annual innovation challenge in the waste heat recovery category. UNIDO provided M/s ENCON Thermal Engineers Pvt Ltd INR 3,600,000 (three million and six hundred thousand Indian Rupees) to deploy and validate its regenerative burner system at its unit located at 53 KM Stone, Delhi - Mathura Road, District Palwal, Haryana. UNIDO contracted the Confederation of Indian Industries - Godrej Green Business Centre (CII-GGBC) for the independent validation of the deployed technology.

The ENCON regenerative burner system recovered more than eighty (80) percent of the waste heat and achieved more than eighteen (18) percent fuel saving, depending on the flue gas temperature. The replication potential of the technology has been rated very high specially in commercial furnaces for steel reheating, forging and heat treatment. The technology validation report prepared by CII-GGBC contains full details of the validation.

This statement is issued to encourage further consideration and assessment of the ENCON regenerative burner system, however, does not constitute an endorsement in whatsoever form by the United Nations Industrial Development Organization.



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