

# ENERGY RECUPERATORS



## ■ DIRECT REDUCED IRON (DRI)

The exhaust heat line downstream of the direct iron reduction process generally consists of two parallel channels in which the heat exchangers are arranged in series in the direction of the flue gas.

The combustion air for the reformer is heated up to 650°C in radiation and convection recuperators. The flue gas inlet temperature is approx. 1150°C.

Preheaters for the feed gas are installed downstream. The feed gas (a mixture of natural and process gas) is preheated to 565°C in U-shaped tube bundles, which meet the acceptance conditions for this type of plant.



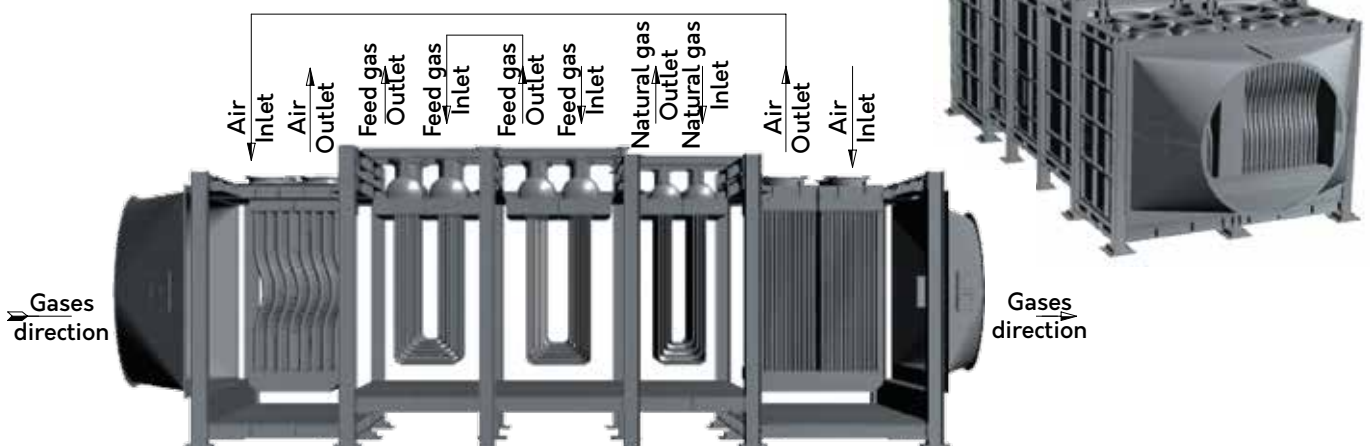
The same conditions apply to the natural gas preheater for the natural gas preheater in a downstream tube bundle.

The natural gas is preheated from 10°C up to 350°C.

## EXPERIENCE, PASSION AND RESPONSIBILITY

### KALFRISA OFFERS:

- Design and manufacture of complete heat recovery systems for new direct iron reduction plants.
- Design and manufacture of complete heat recovery systems for existing installations where an increase in production is required.
- Supply of spare parts according to original or new design drawings.
- Consultancy work for the optimisation and improvement of heat recovery systems in existing installations.





## ■ HEAT RECUPERATORS

A heat recuperator unit absorbs an important part of the heat energy of the gases generated in the combustion of a solid, liquid or gaseous fuel, in the process of: melting, heating, roasting, drying, etc., of a certain product. The heat energy absorbed is transferred to another fluid, most of the time the combustion air for the process itself, and the fuel savings are so considerable that the recuperator is amortised in a few months.

Heat recovery units can be installed in all exhaust flue gas ducts from a production process where combustion air is required, the most classic ones being the following:

### Iron and steel industry

Reheating furnaces, forge furnaces, treatment furnaces.

### Glass industry

In melting furnaces, either starting from earth, cut glass or mixed.

### Enamel industry

In frit melting furnaces.



As a result of high energy costs and the worldwide concern for energy savings, heat recovery units are becoming increasingly important.

Our production in this field covers:

- Radiation recuperators:
  - Tube cage recuperators.
  - Double shell recuperators.
- Convection recuperators, of tubes.
- Combination of these two types.

Five parameters determine the design of a recuperator:

- a) The composition of the fumes and their dust content.
- b) Flue gas temperature at the recuperator inlet and the temperature at which the air is to be heated.
- c) Fume and air flow rates to be passed through the recuperator.
- d) Working pressure of the installation.
- e) Location where the recuperator is to be installed.



## ■ CONVECTION RECUPERATORS

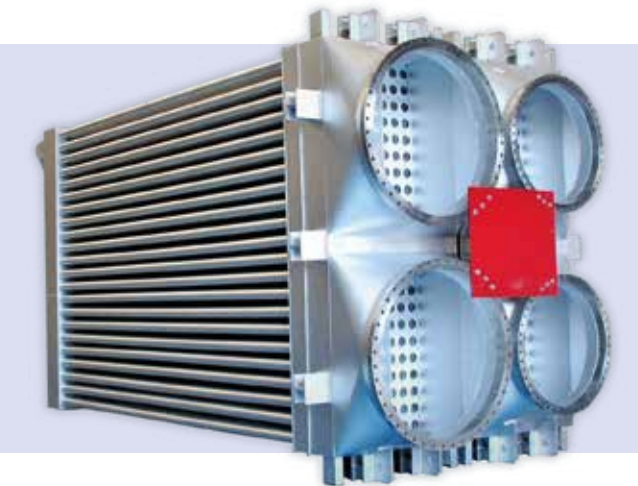


Through smooth steel tube bundles, the heat transfer between the primary and secondary fluid in these recuperators is done by convection.

The tube recuperators can be supplied loose, to be inserted into a horizontal (underground or overhead) or vertical (chimney) flue or, alternatively, with the shell lined on the inside.

These devices have several applications to new technological developments and are preferably used when the flue gas energy in a combustion process can be recovered and recycled in the process itself as useful energy, e.g. in the iron and steel industry, in direct reduction processes, heating furnaces, forging furnaces, treatment and annealing furnaces.

We are able to create a specific design for each process according to its needs makes it possible to achieve energy recovery with, in many cases, very significant savings, either in new installations or in recovery systems already installed by optimising them with new exchange surfaces or replacing them with more efficient ones.



## ■ HEAT EXCHANGERS

The heat exchangers transfer heat through convection. They have a much more compact design, which allows a quick and easy assembly.



### SUITABLE EQUIPMENT FOR THE FOLLOWING CASES:

Not excessive high flue gas temperature, in the order of 700-750°C, when there is no channel available to introduce the tube bundle.

### APPLICATIONS:

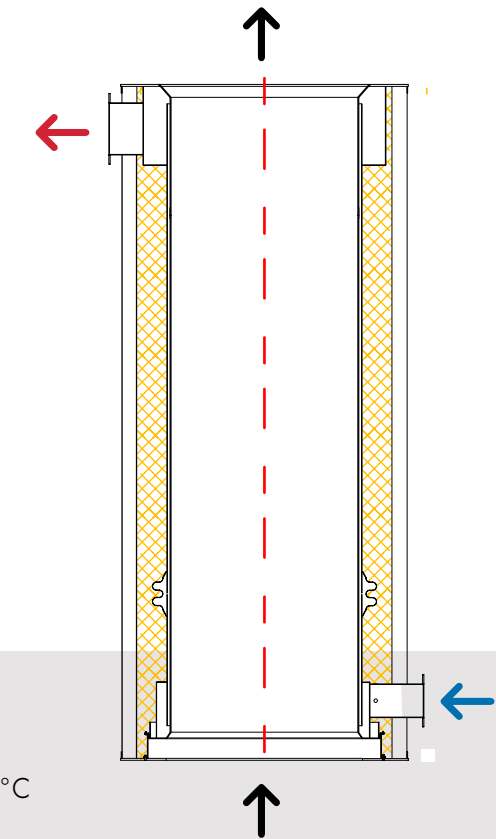
Solvent incineration plants in the automotive industry, cogeneration plants, metal and plastic surface treatment plants...

## ■ RADIATION RECUPERATORS

In these recuperators, the transfer of heat energy between the primary and secondary fluids is done mainly by radiation. Double-shell radiation recuperators offer a reduction in fuel consumption of even more than 40% by preheating the combustion air and a compact design that facilitates their installation in the flue gas outlet chimney.

They are made by two concentric cylinders in which the secondary fluid circulates through the circular crown, either parallel to the recuperator axis or helically, in countercurrent or in parallel currents. Suitable for working pressures up to 2000 mm. A.C.

For higher working pressures, the tube basket type recuperators offer better performance, greater resistance and more homogeneous air distribution. They are designed by replacing the inner shell with a basket of annularly arranged tubes, through which the air circulates, so that the heat transfer is still carried out by radiation.



### APPLICATIONS:

- Forging furnaces.
- Frit melting.
- Glass manufacture.
- Aluminium smelting.

### CRITERIA FOR USE:

- Temperature of hot gas > 1000°C
- Gases containing aggressive components or with a large amount of particles.



### NEW RECUPERATOR HIGH EFFICIENCY DOUBLE JACKET



### RELIABILITY

MIXED COUNTERCURRENT  
+ PARALLEL CURRENTS DESIGN:  
Maximum metal temperature up to 150°C lower  
vs  
Traditional Countercurrent Recuperator.

### EFFICIENCY

Ta MAX PREHEATING  
OF AIR OF 800°C:  
Continuous operation, remotely supervised.  
Tested by leading companies in the sector.



# KALFRISA

## 360°

### EXPERIENCE, KNOWLEDGE AND INVOLVEMENT



The knowledge and experience gained over more than 50 years working with energy and environment techniques at industrial plants has enabled us to offer reliable and cost-effective solutions to our customers.

Our equipment is approved, certified and authorised by the EC. In addition, KALFRISA has been recognised as an INNOVATIVE SME by the Ministry of Science and Innovation of the Spanish Government in order to comply with its commitment to innovation in its equipment.

Competing for European leadership is only possible through a 360° service. KALFRISA has its own technologies, designing, developing, manufacturing, commissioning and providing technical support once the equipment has been sold.

Kalfrisa guarantees the optimum adaptation of its facilities to the client's requirements, adapting its design to the different technical specifications of each project. Obtaining the ISO 9001:2015 quality certificate signifies Kalfrisa's commitment to excellence, implementing a work philosophy regulated by both external and internal quality standards.

#### GUARANTEE FOR A BETTER UNDERSTANDING OF YOUR INSTALLATION

##### ■ SUPPORT AND REPAIR

With the maximum experience and under certified procedures, the professionals who have designed and manufactured your equipment will be your support, guaranteeing the training and qualification of our technicians.

Guarantee of using only original spare parts.

Remote service will be attended to as quickly as possible.

Breakdown notifications with diagnosis and 365 days on-call service.

##### ■ PREVENTIVE CONTRACT

Protocols of scheduled visits on route throughout the territory for periodic inspections, which allow functional continuity covering the established check-up visits and priority attention to breakdown notifications, which allows for the rapid diagnosis of the same.

##### ■ WE ARE CONNECTED

This allows us to know how your equipment is working in real time, which is key to prevention or immediate intervention through expert advice.

#### INDUSTRIAL ASSEMBLY AND INSTALLATIONS

Our engineering department studies the needs of each project in order to design an appropriate and exclusive solution for each client.

We take charge of the installation, assembly and works necessary to leave the machinery in optimum operation.

Our team can be in charge of the preventive maintenance of the installation, as well as the periodic revision of the same to obtain the maximum performance.



## KALFRISA

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