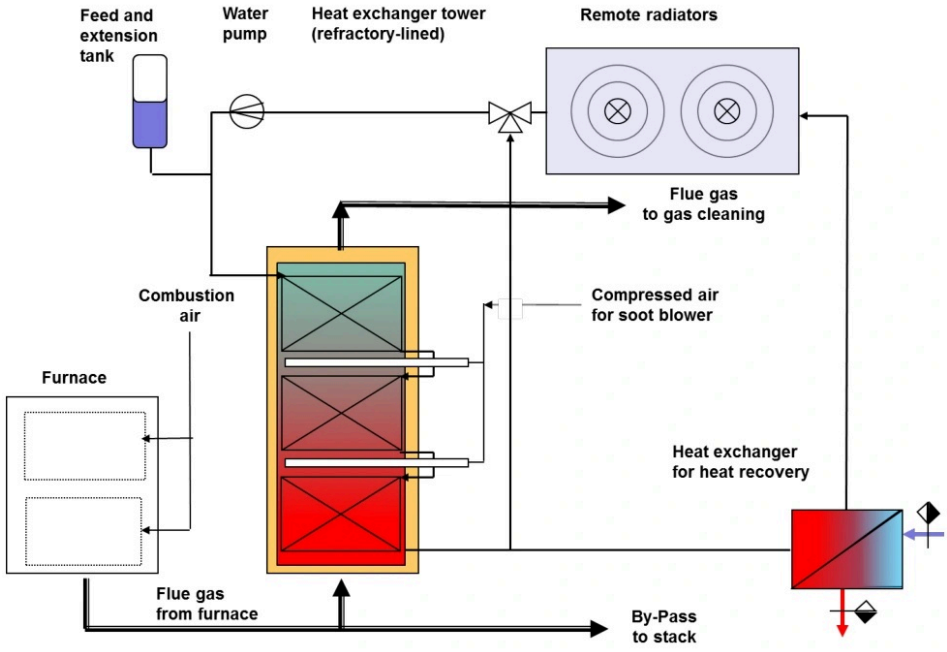
Flue-gas Cooling & Cleaning Package

Integrated gas cooling, dry sorbent injection, reaction, pulse-cleaned fabric filtration, induced-draft fan and stack interfaces for thermal-treatment systems.



Cooling reference: From max. 1200 °C to approx. 140 °C

Process: Cooling -> reagent injection -> reactor -> fabric filter -> ID fan -> stack

Filter cleaning: Compressed-air pulse cleaning

Design input: Gas volume, inlet temperature, contaminants and emission limits

Flue-gas cooling and heat-transfer concept

Flue gas Treatment

ue gas cooling

Bevor leaving the furnace the flue will be cooled by an internal flue gas cooler. The integrated flue gas cooler is positioned inside the furnace casing.

As shown in Fig. 5 the cooler is equipped with economizer bundles passed through by a Water-Glykol mixture.

The flue gas is cooled down from max. 1,200 °C to about 140°C to allow a safe operation of the fabric filter and the dry sorption process.

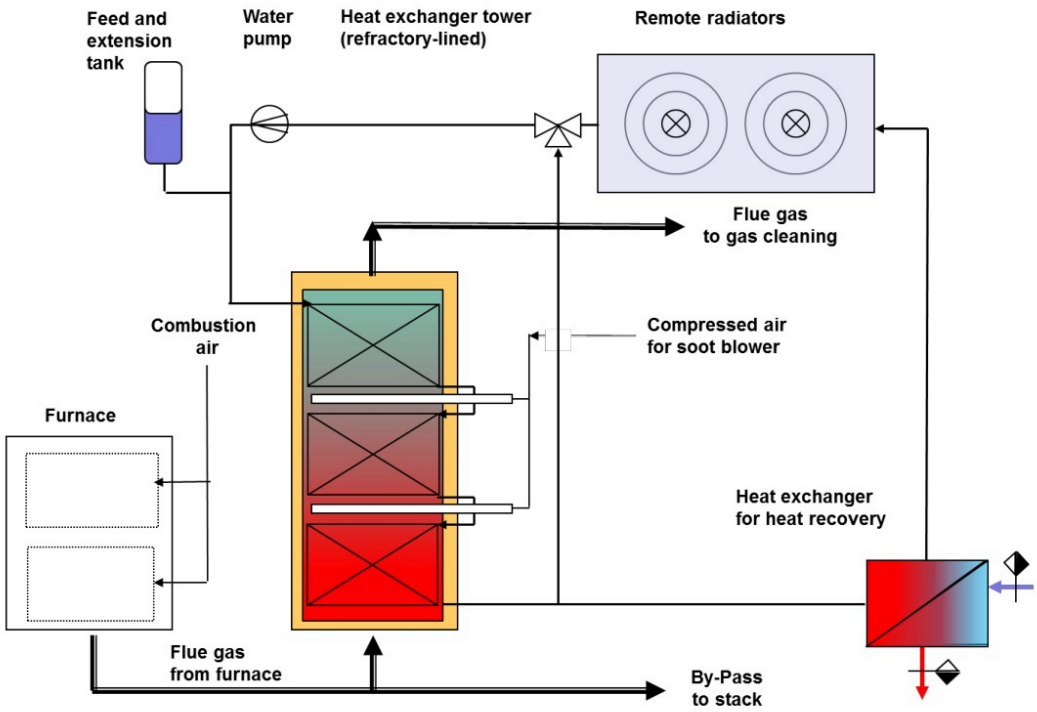


Fig. 5 *Schematic view of a furnace with flue gas cooling system*

The economizer bundles are integrated in a closed water circle equipped with a heat exchanger tc emit the warmth to atmosphere. In parallel the warmth can be used for heating devices. The priori of the control system is at keeping the correct flue gas temperature at the outlet of the furnace to protect the downstream flue gas treatment plant. The use of the warmth is on a lower level of prio ty.

The heat exchanger is completely integrated in the steel casing of the furnace which internally is completely covered by bricks and insulation material. The economizer bundles are placed by oper ings in the flue gas stream. The bundles are screwed to the side walls of the furnace and can be released easily for maintenance and cleaning or repair.

Dry sorption and fabric filtration

Delivery of Ethylenglykol
Flushing, filling of the cooling system with a mixture of Water-Glykol, hydraulic pressure test.
The flue gas of the furnace will be cleaned in a flue gas cleaning plant. Due to our practical experi ence in those reference plants, we can provide essential knowledge about the secure constructior of flue gas cleaning. This includes especially filter temperature, filter surface load and power of the ID fan.

After being cooled the flue gas enters the flue gas cleaning plant. This so-called dry sorbent reac- tion process for flue gas cleaning is designed on the following chemo-physical fundamentals:

- **Chemisorption** of acidic harmful gas components HCl and SO_2/SO_3 using calcium hydrox- ide as sorbent material,
- **Adsorption** of gaseous content of heavy metals as well as dioxins and furans by injection c activated carbon.

The adsorption of heavy metals and dioxins/furans using activated carbon is based on physical ac sorption on the outer and inner surfaces of the adsorption material. The main governing parame- ters are the surface activity of the used activated car-bon (reagent), the kind and dimensions of th micro-pores and the specific inner and outer surface area. The designed flue gas cleaning system leads to optimised conditions to achieve the European emission Guidelines for all acidic harmful sub-stances, heavy metals as well as dioxins and furans.
The technical components are described in detail, as follows:

- Internal reagent storage and dosing device
- Flow rate reactor (horizontal cyclones) as a mixer
- Fabric filter
- ID fan

2.3.1 Internal reagent storage and supply

The flue gas cleaning is done by dry adsorption. In this project a big bag station, filled with sorben material, including screw conveyor is taken into account. By a pneumatic transport system the rea gent material is conveyed to the dosing device from which the reagents are added to the flue gas duct at the entrance to the flow rate reactor. The dosing quantity is automatically controlled, ac- cording to operation requirements. The system consists of:

- Discharge device for big bags filled with Sorbalit
- Rated dosing device, screw conveyor with gear motor frequency controlled
- Pneumatic injection device with flexible hose connection to reaction channel in front of the flow rate reactor

The transport of the additive is done by compressed air (6 bar) provide by client.

2.3.2 Flow rate reactor

After the injection point the flue gas is flowing through the cyclones of the flow rate reactor. By the clones the reagent and the flue gas is mixed intensely. This intensive mixing lead to a good reac- tion between the reagent and the components to be discharged from the flue gas.

2.3.3 Fabric filter

The separation of dust and reagents, loaded with gaseous harmful substances, from the flue gas i achieved on the surface of the filter bags during the flue gas passed the bags. Thus, the separate particles forms a so mentioned ‘filter cake’, which is a porous system with many inner capillaries, flowed by gas and finest particles. Caused on its structure the formed cake is a very efficient filter material and very effective sorption reactor, too. That is why the process inside of the fabric filter is split in two essential parts, dust separation and gas sorption, followed by chemical reactions. Au- tomatic cleaning of these filter bags is accomplished by passing compressed air through a row of filter bags in opposite to the filtration flow. The removal of dust and particles, deposited on and en

Fabric filter, fan and ductwork

bedded in the filter material, is enhanced by a rapid sequence of acceleration and deceleration of the material. The separated dust and harmful particles are collected in the hopper of the filter casing

The fabric filter consists of:
Casing made from mild steel 1.0038, designed for underpressure, with inspection door, hood for raw gas entrance and clean gas discharge, hopper to collect the particulates, barrel for dust collection with flange connection.

Cleaning system for the filter bags, cleaning by compressed air,

Filtration area approx. 25/50 m”,

Filter material: needle felt from special fibres on PTFE.

The compressed air station for cleaning the baghouse is not included in this quotation and can be provided by the Employer directly. The quality of the air must be technical free from oil and water, pressure at minimum 6 bar.

2.3.4 ID Fan

Via an ID fan the cleaned gas is transferred to the chimney. This ID fan, is equipped with a three-phase-motor and controlled by a frequency converter, whereas the under pressure of the complet system is generated.

The technical data are:

Volume flow	RE 50	max. 1,100 m³/h
	RE 150	max. 3,150 m³/h
Material if the ID-fan:	mild steel	
Total pressure	ca. 800 daPa, 1.2 kg/m³	
Motor power	8/15 kW	

Provided by the customer:
The complete noise insulation according to our specification

2.3.5 Flue gas ducts

The flue gas duct, designed as underfloor ducts, will connect the cooler of the furnace outlet.

The flue gas ducts behind the flue gas cooling will connect the cleaning system to the stack.

This includes in detail:
flue gas duct from heat exchanger to flow rate reactor
(the flow rate reactor is directly connected to the fabric filter)
flue gas duct from the fabric filter to ID-fan
flue gas duct from the ID-fan to the stack

Duct for the gas take-off system.
Based on our preliminary plant layout sketch we have calculated as follows:

Flue gas duct

- Length (assumption): 3/6 m
- Gas flow rate (design): max. 1,100/3,150 m3/h, actual
- Gas temperature (design): up to 150 °C
- Material: mild steel
- Minimum wall thickness: 3 mm