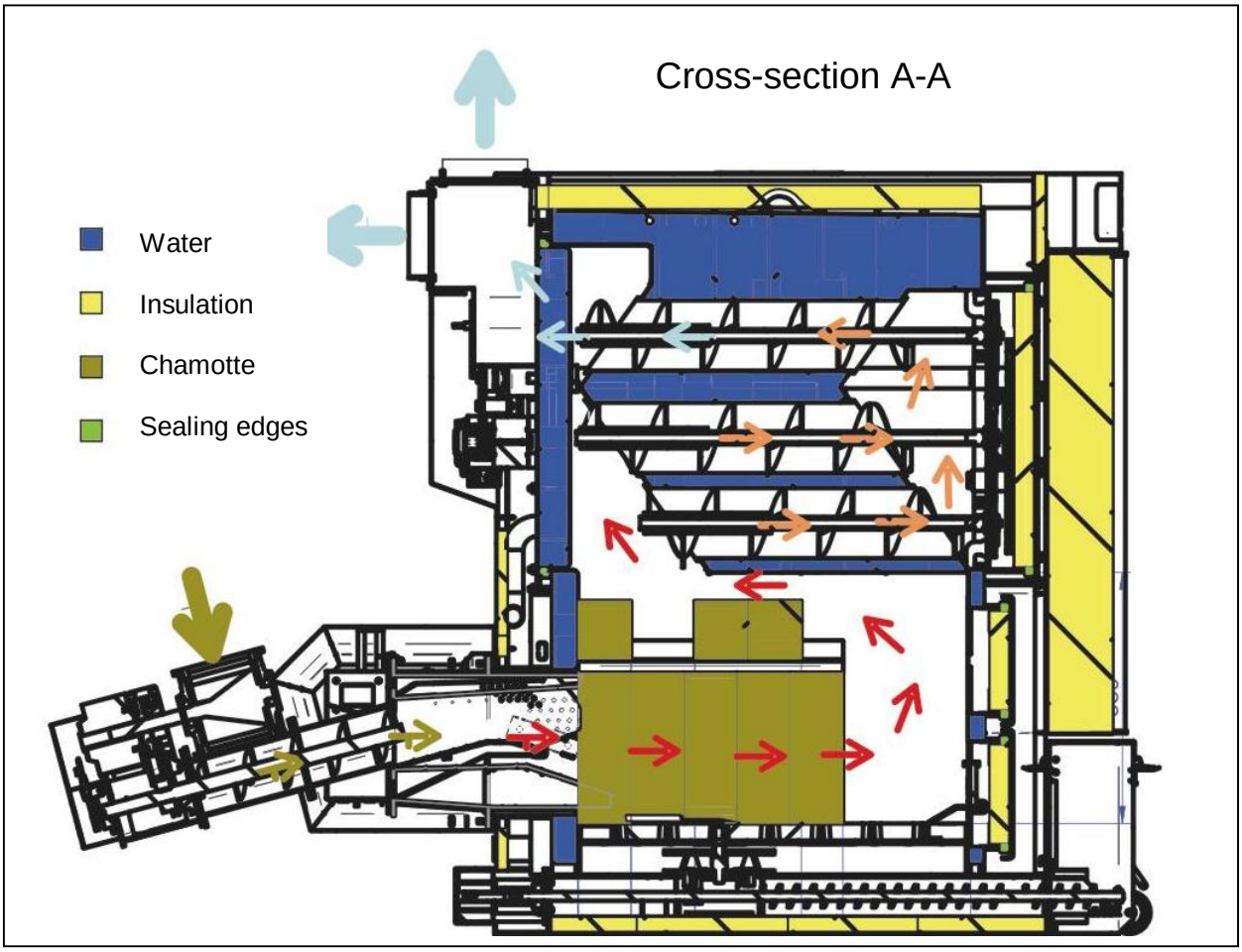
TECHNOLOGY



TECHNOLOGY

1. Facility description

General description

The automatic wood heating system HPK-RA is constructed for the purposes of an economical and environment friendly combustion of fuels specified in chapter 3. The heat produced by combustion is used for thermic purposes. Since the exigency on the heat performance differs depending on the various kinds of heated buildings, rooms or areas, a number of various types of heating systems were developed ï their nominal outputs range from 15 to 150.

The automatic wood heating systems HPK-RA are characterised by:

- fully automatic heat exchanger cleaning,
- automatic ash removal from the furnace bed,
- fully automatic discharge of ash,
- continuous output control results in mutual dependence of boiler, flue gases temperature and O_2 value,
- possibility to heat using larger wood pieces within the emergency mode without any necessary heating system modifications,
- automatic ignition by hot air,
- security against back-burning ï burn-back safe star feeder,
- TÜV, CE and IBS examination
  see the chapter 1 ï **General ï testing and marking,**
- the energy efficiency of all our systems (boiler or heating system efficiency) is over 90 %.

The combination of two or more types of boilers, or of other heat producing equipment is possible and recommended, since the well thought out arrangement of heating facilities influences both the heating efficiency and the level of environment pollution substantially.

1.2 Composition

The function of the heating system consists always of the following performance steps:

- fuel deposition,
- fuel discharge and transportation,
- combustion,
- heat exchange,
- ash removal.

The factors influencing the utilisation of a specified type of facility:

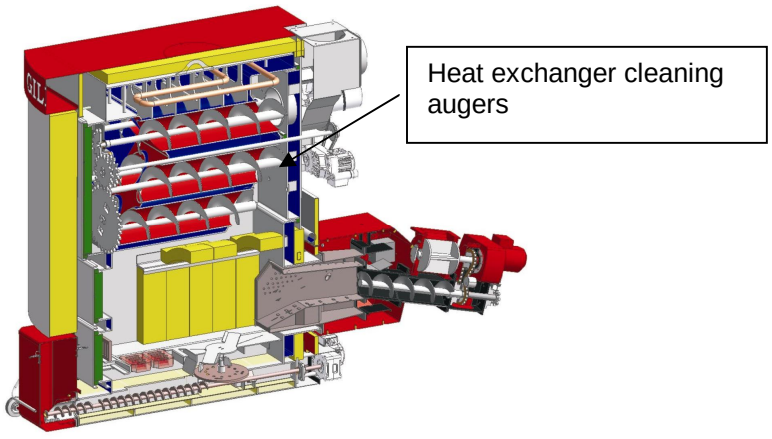
- fuel shape a humidity
- requirement on output
- construction terms and conditions

1.3. Heating boiler description

1.3.1. Heating boiler

The well-tried wood chips boiler HPK-RA is welded, steel construction of 70 mm thick heat insulation and coated with an industrial powdered steel sheets. There are 3 doors on the front side for the cleaning facilities (screwed for cleaning the ash and burner room (see abs. **8.2 ï maintenance**).

On the boiler back side, there are the hydraulic connections, flue gas pipe and engines for automatic cleaning, or ash removal. the automatic ash removal facility is placed on the welded boiler base. Two separate gear motors drive the automatic ash removal and heat exchanger cleaning systems. The ash container is connected to the boilerôs front side by an ash channel.

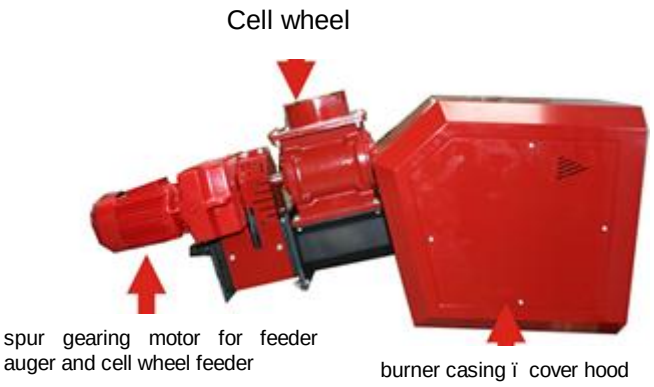


The stocking of the GILLES HPK-RA boiler is possible either from the left or the right sides, as well as on the backside

The **heat exchanger** consists in general, of four (HPK-RA 15-49), or nine (HPK-RA 60 ï 160) horizontally placed pipes, assuring an optimum heat transfer. In addition, the side and back walls and the heating chamber cover serve also as heat exchanging surfaces.

1.3.2. Feeder ï burner

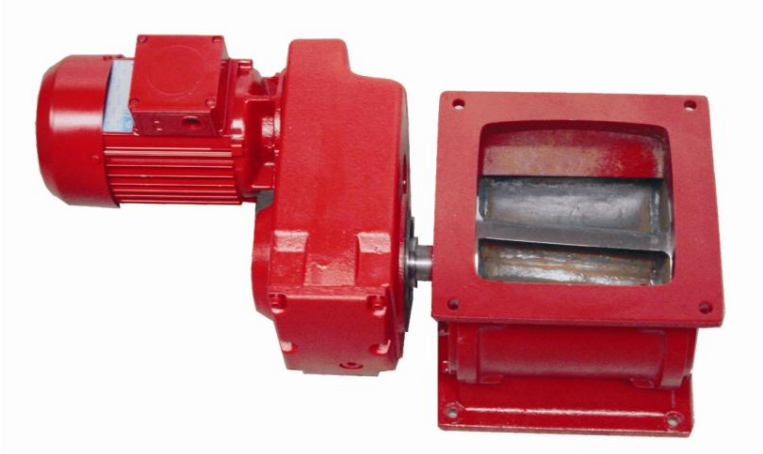
The **GILLES-burner** is a welded construction on which the burn-back cell wheel and the auger are attached, being driven by a roller chain of the installed gear motor. The ignition facility and the burning air blower are installed on the burner as well.



The primary and secondary airs, necessary for burning, are conducted through the burner head. The burner head is made of a high temperatures resistive steel sheet. It is installed between the boiler and auger. The burning system is welded and completely protected by a cover hood.

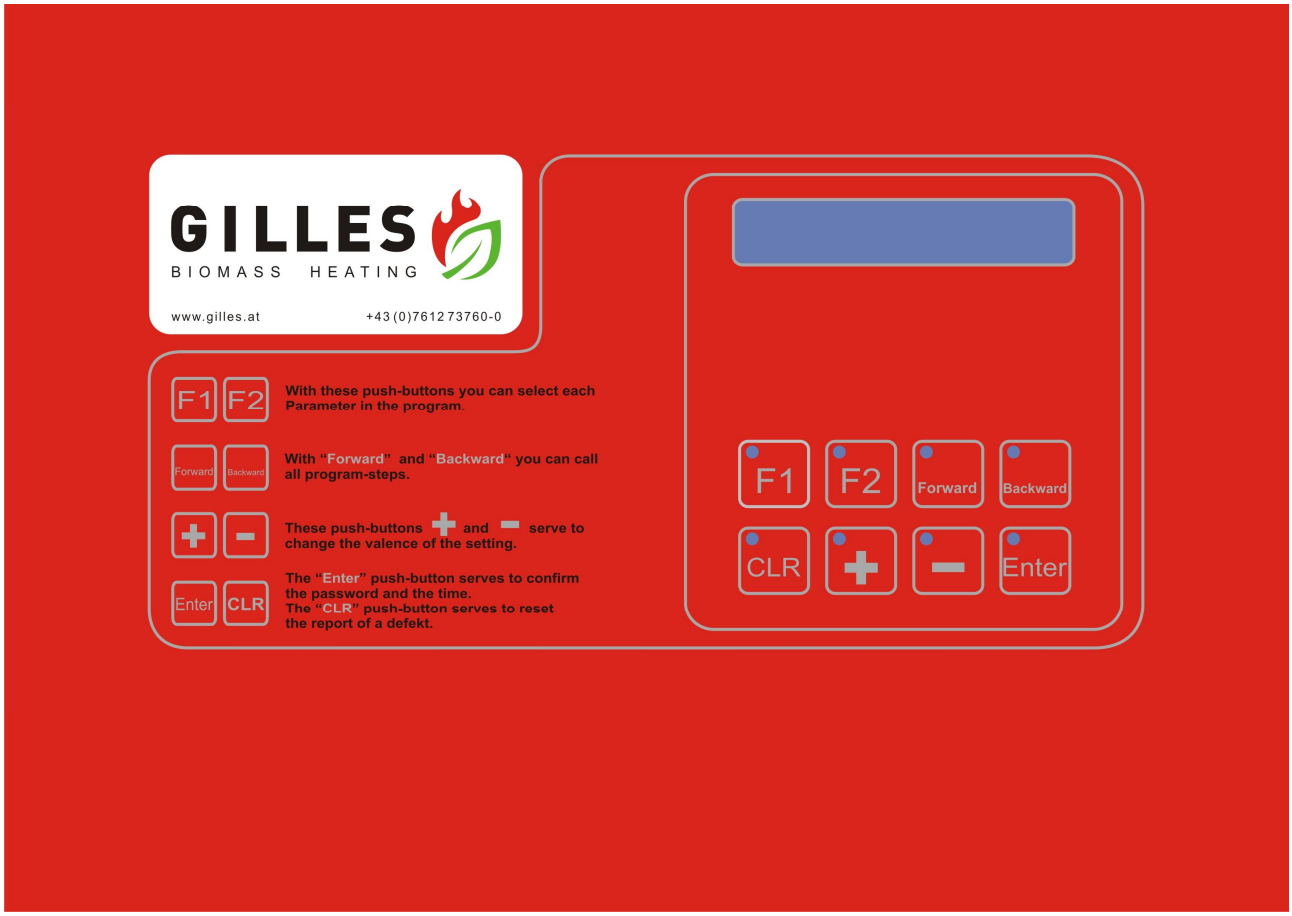
1.3.3. Cell wheel

The well-tried **full metal cell wheel** may be relied on to interrupt the link between combustion chamber and fuel store. The rotating wheel is equipped with blades angled offset to rotation axis in order to increase the cutting effect. In addition, the blades are slightly concave, reducing thus the pressure forces and lowering the noise substantially. The well stable and noise absorbing cast iron housing contains a counter blade cutter to cut up longer material pieces.



1.3.4. PLC- Control unit

PLC ï control unit (see chapter 7 **-** Connections**)** assures a fully automatic operation of the facility. Upon switching on the equipment, the fuel is fed to the burning head and ignited by a hot air blower (automatic ignition). The system enables to control the burning by means of the boiler temperature sensor PT 1000 (regulating the output energy according to the requirements), the flue gases temperatures by means of a thermocouple Fe-CuNi, type L, and the residual oxygen in the flue gas (lambda probe). At the same time, the fuel and air quantities may be controlled by setting up the auger impulses length and by the regulating the blower revolution, in order to achieve the required output. The output may be modulated from 30 % up to 100 %. Any functions of the system are monitored electronically.



Lambda- control:

The burning is specified as the chemical reaction of the burnable fuel part with the oxygen present in ambient air. The reaction is defined as exothermic reaction performed at high temperatures, by which the heat is released. During this process, also gaseous and solid materials are generated, depending on the fuel. The air oxygen that has not entered into the reaction process returns together with flue gas again in the atmosphere. The quantity of this residual oxygen increases directly with increasing quantity of the combustion air. The air number as a dimensionless quantity gives a relation of the actual air quantity delivered to burning process and of the tacheometrically necessary air quantity. These values are usually marked by the Greek letter lambda. The air number = 1 means that the air quantity delivered to the flame is the quantity precisely necessary for a complete burning, so the flue gas contains 0 % of the residual oxygen. In order to prevent the incomplete burning, the burning boilers of the present generation are working mostly in the range of = 1,5 to 4. %. The use of burn value requires as low air number as possible, while the air surplus number is considered as the lower limit for complete burning including safety assurance. The influence of the constant factors, e.g. air distribution, combustion chamber size and its shape is known and specified during construction. Nevertheless, the burning process and its quality level are influences also by variable circumstances factors, such as air pressure, burning air temperature, fuel quality (water content) and fuel quantity fed into the burner. Any change of these factors affects immediately the residual oxygen content in flue gas. When a deviation of the planned air number occurs, it must be switched off in order to continue the optimum run of burning. The residual oxygen in the flue gas is measured by the lambda-probe. The measured signal is evaluated electronically. Upon the difference between the actual measured value and planned value the lambda control changes the control voltage and thus also the number of the secondary air ventilator revolutions. The revolutions are changing until both the values representing the residual oxygen content do not correspond again. Simultaneously also the fuel stocking is regulated.

The main feature of the Lambda control process consists in the elimination of a crucial state of burning. It means the interconnection of the influences disturbing the burning process and of the Lambda probe and

a possibility to bring them back to the required level. The control by means of Lambda probe significantly helps to achieve and to maintain the constantly good burning parameters within the total energy range.

2. Means of operation and functioning

2.1. Fuel feeding

The fuel is transported from the storage room to the burner by the discharge systems. Depending on the heat demand, the fuel quantity is changed and dosed by a regular on/off operation. The burner delivers the dosed fuel quantity into the burner casing.

2.2. GILLES burning technology

The GILLES HPK-RA burning boiler assures high burning temperatures in all the energy ranges, and thus the optimum utilisation of your fuel. The sophisticated primary and secondary air supplies are inevitable presuppositions for the best possible quality of burning.

HPK-RA with chamotte

In order to achieve an optimum burning level, the fuel fed to the burner passes through these necessary phases:

- drying
- gassing
- burning

For the control of this comprehensive process, there are created two different zones for air delivery.

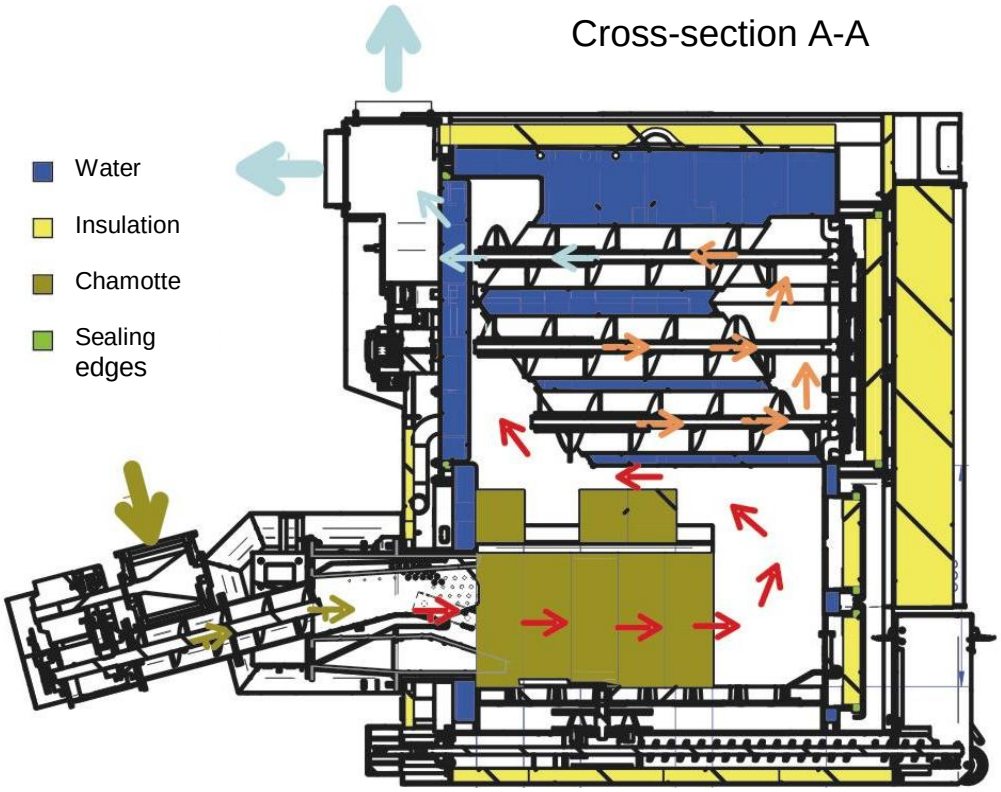
- The primary air supply under the burner casing serves for fuel drying and gassing.
- The secondary air supply into the burner casing assures the burning itself.

The burning process quality, decisive factor in relation to the exhaust gases is controlled by:

- flue gases temperature sensor
- Lambda-probe

2.3. Hot water boiler

The heat energy generated in the furnace is indirectly transported into the water in the above placed heat exchanger. The boiler is double walled; the space between the walls is filled with water. The colder heating system back run is lead in the beneath part. On the boilerŝ highest point the flow is installed, through which the heat generated in the boiler system passes to the heating system.



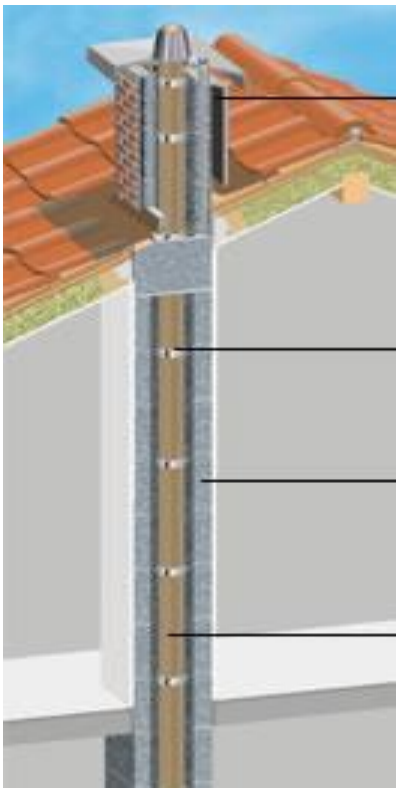
2.4. Heat exchanger

There are flue gas ducts inside the boiler into that the flue gases flow. In this manner, the indirect heat exchange is carried out. The pipes contain tabulators (augers) functioning like a brake, so the flue gas cannot escape so quickly. These tabulators intensify the heat exchange substantially and reduce the flue gases temperatures by ca. 50 °C, increasing thus the energy efficiency by ca. 5 %. And in addition to it, the augers moving enables better cleaning of flue gases ducts, the cleaning is simpler, reliable and quite (the exchanger cleaning). Once a day the augers pull the ash down towards the ash removing auger automatically.

2.5. Exhaust blower

The exhaust blower is insufflating the burn gases through the boiler, when they pass their heat to exchanger, up to the chimney. This equipment assures a permanent under pressure during the burning process. The under pressure is blocking the possible slight explosion.

2.6. Remarks to chimney



In order to achieve the boilerís highest possible efficiency, it is necessary to keep the flue gases temperature low (<200 °C over the room). Thatís why the chimney should be constructed so that it is not inclined to moisture. Besides, the chimney condition may be demonstrated very differently. We recommend you to consult the evaluation of your specific situation with your chimneysweeper!

You can see a chimney construction from Schiedel.

2.7. Heating pumps

The heating pumps assure the flow of hot water from boiler to heating tubes. For a standard control, there is a possibility to connect two heating pumps.

In the operation modes ĂTime operationñ and ĂAutomatic operationñ, the heating pump is stated in the moment, when the boiler temperature exceeds 60 °C and if permitted by the heat circuit control.

The heating pumps are in operation only when the external permissions are activated!

heating pump 1 -> external permission 1
heating pump 2 -> external permission 2

In the operation mode ĂBoiler operationñthe heating pump is started 1 minute every day in order to prevent its seizing up.

33. Safety equipment according to prTRVB H 118 2003

The following table presents the necessary safety equipment depending on the facility construction, heat output, fuel and stored fuel quantities of

- fine, medium size and thick wood chips (in accordance with standards ÖNORM M 7132 and M 7133) and
- slices (small pieces of wood together with bark or without it):

Type of facility	Energy output	Fuel stored quantity	Safety equipment required
Compact facility (storage tank in heating room)	Ò150 kW	Ò1,5 m³ in heating room	RHE
Compact facility (storage tank in heating room) with the connection to the fuel store	Ò150 kW	Ò1,5 m³ in heating room	RSE TÜB (in storage containers)
Automatic discharge from the fuel store	Ò400 kW	Ò50 m³ in fuel store	RSE TÜB
	Ò400 kW	> 50 m³ Ò200 m³ in fuel store	RSE TÜB HLE
Automatic discharge from the fuel storage room in the outbuildings, while the fire area section must not exceed 500 m^2; the dwelling part must be protected by a fire wall	Ò150 kW	Ò200 m³ in fuel store	RSE RZS SLE TÜB HLE

Key:

RHE: Burn-back safety equipment ⇨ the diagonal position of the feeding auger
RSE: Burn-back safety equipment ⇨ cell wheel
RZS: Burn-back security confirmed by ⇨ IBS (*Fire Security Institute)*
SLE: Automatic extinguishing equipment ⇨ sprinkling facility on channel
TÜB: Temperature control in the fuel store or silo ⇨ alarm sensor
HLE: Manual extinguishing equipment ⇨ sprinkling facility on the fuel store shield