



## LAMTEC innovation

# PAVE equipment system - innovative burner technology with LAMTEC control serving the environment.

Efficiency of up to 107 %,  
reduced NO<sub>x</sub> and CO<sub>2</sub> emissions and  
low exhaust gas temperatures make  
the PAVE burner system the  
gas burner of the future.

Sensors and systems for combustion engineering



LAMTEC partners



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The PAVE burner system marks a milestone in the history of gas burner technology, because it works according to an entirely new procedure. In this procedure, combustion in the boiler is supported by thermodynamic processes and the burner flame is cooled by pre-heated moist air. The key innovation is the integrated water vapour pump cycle. LAMTEC systems are used to control and regulate the burner.

The advantages of this approach have been known in theory for many years. Now, for the first time, the PAVE burner system is making it possible to develop a fully functional burner system with water vapour pump cycle for series production. This joint development project between LAMTEC and the French company CIEC has brought together international expertise to create an innovative combustion procedure which significantly increases efficiency. In parallel with increased efficiency of up to 107%, emission values for NO<sub>x</sub> and CO<sub>2</sub> in the exhaust gas are falling dramatically.

### Structure

A standard condensing boiler of rust-free design provides the technical basis for the PAVE burner system. A conventional condenser is installed at the end of the combustion process. The condenser uses the thermal energy contained in the exhaust gas for the first time, cooling the exhaust gas from a temperature of 220 °C when it exits the boiler to approximately 80 °C.

The system also has two air towers. The first air tower wets and heats up the combustion air. The second tower, which is positioned at the end of the cycle, recovers the residual energy contained in the exhaust gas heat and cools the exhaust gas from 80 °C to 40 °C.

Two circulation pumps keep the water vapour pump cycle running; there is a transfer pump for each of the cold and hot water components of the circuit. The LAMTEC ETAMATIC OEM burner control with LT2/LS2 O<sub>2</sub> trim ensures reliable combustion of the gas/air mixture enriched with water vapour according to burner power.

### Advantages:

- Innovative and highly efficient combustion
- Efficiency of up to 107 %
- Saving on running costs of approx. 15 %
- European know-how
- Environmentally-friendly thanks to reduction in NO<sub>x</sub> and CO<sub>2</sub>

### Principle of operation

The process starts with the flange-mounted fan feeding air into the first air tower. The air blown into the boiler chamber usually has a temperature of approx. 20 °C and approx. 50 % air humidity. At the same time, gas flows into the burner, where it inflames together with the suction air and heats the boiler. During this process, the temperature of the exhaust gases exiting the boiler is 220 °C.

When the PAVE system is switched in and the transfer pumps are activated as a result, the following happens: the fresh air conveyed by the fan continues to flow through the first air tower, into which hot water from the condenser and the second tower is now being sprayed. This heats the incoming combustion air up to approx. 60 °C; at the same time, the air humidity rises to 100 %. The cooled water falls to the floor of the first air tower in droplets and is pumped from here to the second air tower.

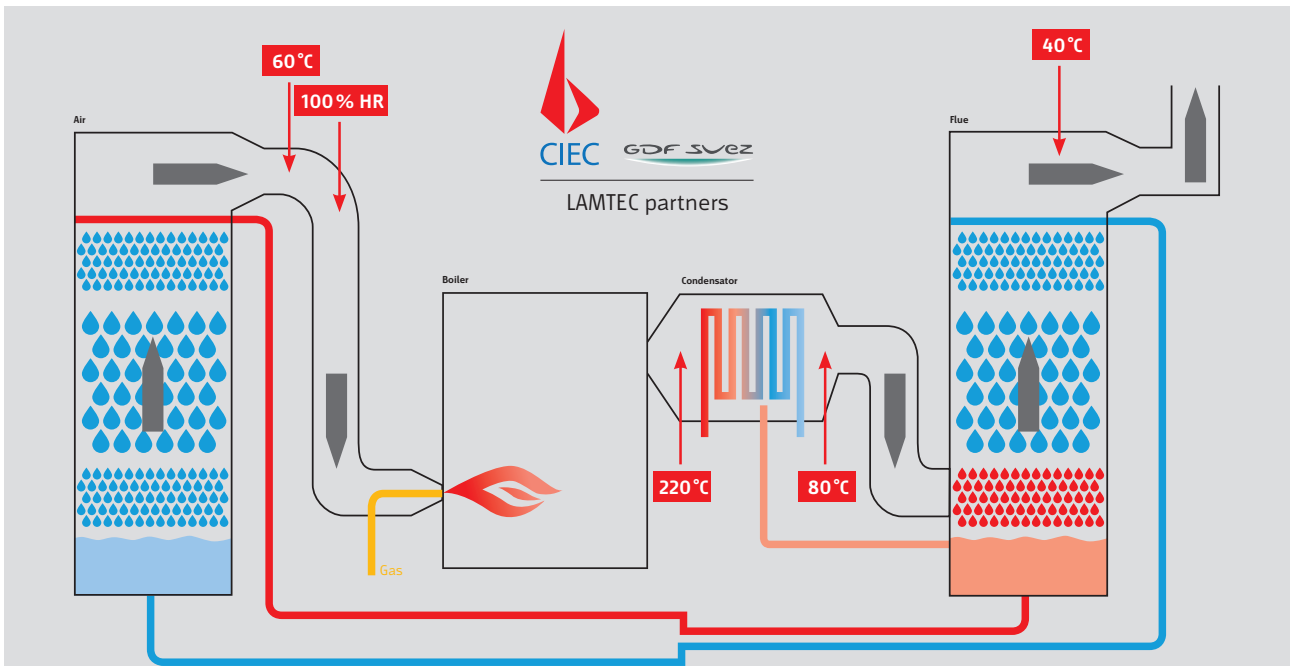
The air enriched with water is burned in the boiler together with the gas. The high water content in the suction air, which can reach up to 150 g of water per kg of dry air, causes a change in the colour of the burner flame. When the system is switched on, a change in the colour of the flame to a more orange shade is recognisable via the LAMTEC burner control. In addition to the main flame, a pilot burner works in continuous operation to support the main flame.



Flame without cooling of flame.



Flame with cooling of flame.



### Technical information

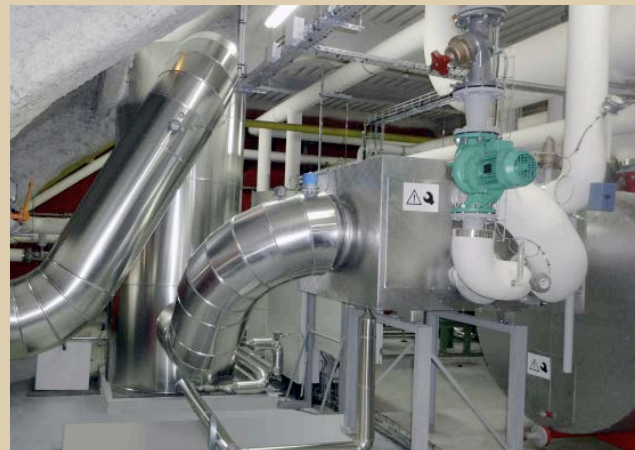
The PAVE gas burner system can be operated with the following components by LAMTEC:

- Burner with 0.5 to 1.5 MW
  - BT300 burner control
  - FFS07 or FFS08 flame monitoring
- Burner with 1.5 to 3 MW
  - ETAMATIC OEM burner control system
  - LT2 Lambda Transmitter and LS2 probe for measuring O<sub>2</sub>
  - FFS07 or FFS08 flame monitoring

### Overview of functions.

Although the temperature of the exhaust gas remains unchanged at 220°C when the PAVE system is switched on, the emission values for NO<sub>x</sub> and CO<sub>2</sub> are significantly reduced due to the cooling of the burner flame. After flowing through the condenser, the temperature of the exhaust gas also remains unchanged at 80°C. The flue gas temperatures downstream of the boiler outlet and after flowing through the condenser therefore remain unchanged compared with a standard combustion process.

Once the exhaust gas has flowed through the condenser, cooling its temperature down to 80°C, it flows through the second air tower, into which the cold water from the first tower is being sprayed. This process cools the exhaust gas down from 80°C to its final temperature of 40°C. The droplets of heated water collect on the floor of the second air tower, from where they are pumped back to the first tower to enrich and heat up the suction air. The water circuit is thus complete.



## Advantages

The advantages of the PAVE burner system with its integrated water vapour pump cycle are obvious: due to the significant increase in efficiency from the typical 95% to up to 107%, the system works highly effectively. The bottom line is that with the PAVE burner system, running costs can be reduced by up to 15% compared with conventional gas burners. At the same time, environmental pollution is reduced due to the fall in NOx and CO<sub>2</sub> emissions.

In practical applications, the burner system impresses with its unrestricted suitability for everyday use and its low maintenance requirements. The water vapour pump cycle is entirely maintenance-free, as the water or water vapour circulates in a closed circuit. What's more: the water does not have to be changed, because it does not contain any exhaust gases.

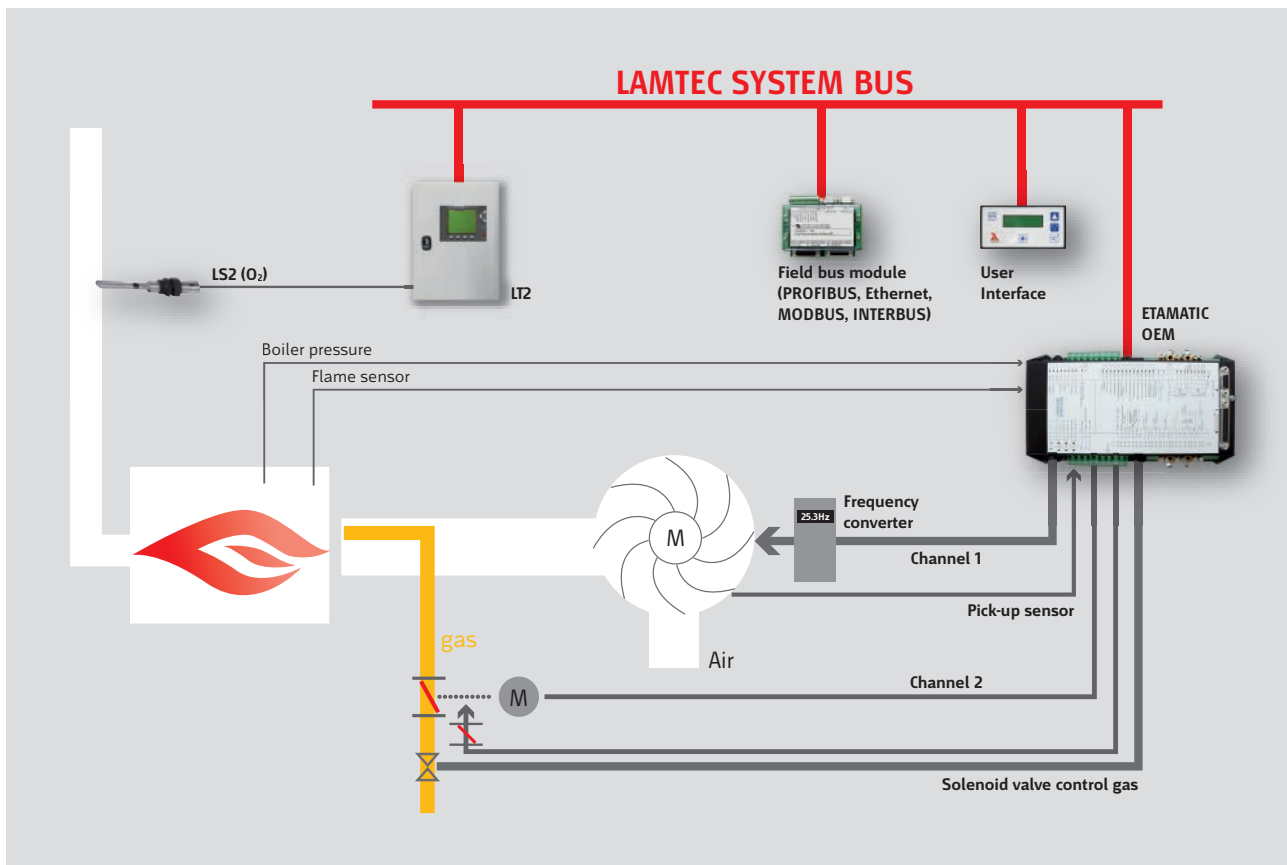
## The future

A number of large European companies collaborated in the development of the PAVE burner system. The French

company CIEC provided the burner technology; LAMTEC added the ETAMATIC OEM burner control and software expertise; Bosch contributed the condensing boiler. Accordingly, the PAVE burner system is an outstanding example of the type of international collaborative partnership, LAMTEC has wanted to be involved in for many years and will continue to promote.

To achieve widespread market penetration in the future, we are working closely with both our development partners and our customers. Through constant dialogue and exchange between our engineers and our customers all over the world, we are ensuring that their specific needs are taken into account in the series production of the PAVE burner system.

The development of the innovative PAVE (Pompes à Vapeau d'Eau) burner system has not gone unnoticed by circles of experts. Our French partner company CIEC has recently been awarded an innovation prize for its contribution to the PAVE pilot burner system.



Functions in the LAMTEC ETAMATIC OEM burner control with O<sub>2</sub> trim (LT2/LS2).

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