



**LANEMARK**  
COMBUSTION ENGINEERING

**KS BURNER**

**KS9000  
Series**

**FUEL STAGE™**

LOW NOx BURNER



# PRINCIPLES

## OF FUEL-STAGE NO<sub>x</sub> REDUCING

### Single Air Supply

KS9000 uses a single air damper. No special mechanism is necessary to separate air flows. Just like a conventional burner - no modifications are necessary to existing air - intake systems when KS9000 replaces conventional burners.

### PROVEN TECHNOLOGY

#### Two Combustion Zones

The KS9000 Fuel-Stage Low NO<sub>x</sub> Burners has two combustion zones. Fuel gas discharge is separated in two stages, primary and secondary. The standard fuel stage distribution ratio is 30% primary / 70% secondary and is automatically distributed by the gas tips. This ratio is designed subject to the burner application and fuel specifications.

**LOW NO<sub>x</sub> EXHAUST GAS**

**SECONDARY COMBUSTION AIR**  
70% Fuel with Low Oxygen Flue Gas

**PRIMARY COMBUSTION ZONE**  
30% Fuel with High Ratio Excess-air

**COMBUSTION AIR**

# and MORE





# KS9110

**FUEL STAGE™**  
LOW NO<sub>x</sub> BURNER

## Patented Single-Lance Round Flame Gas Firing

55-65% lower NO<sub>x</sub> emissions than from conventional burners without De-NO<sub>x</sub> steam.

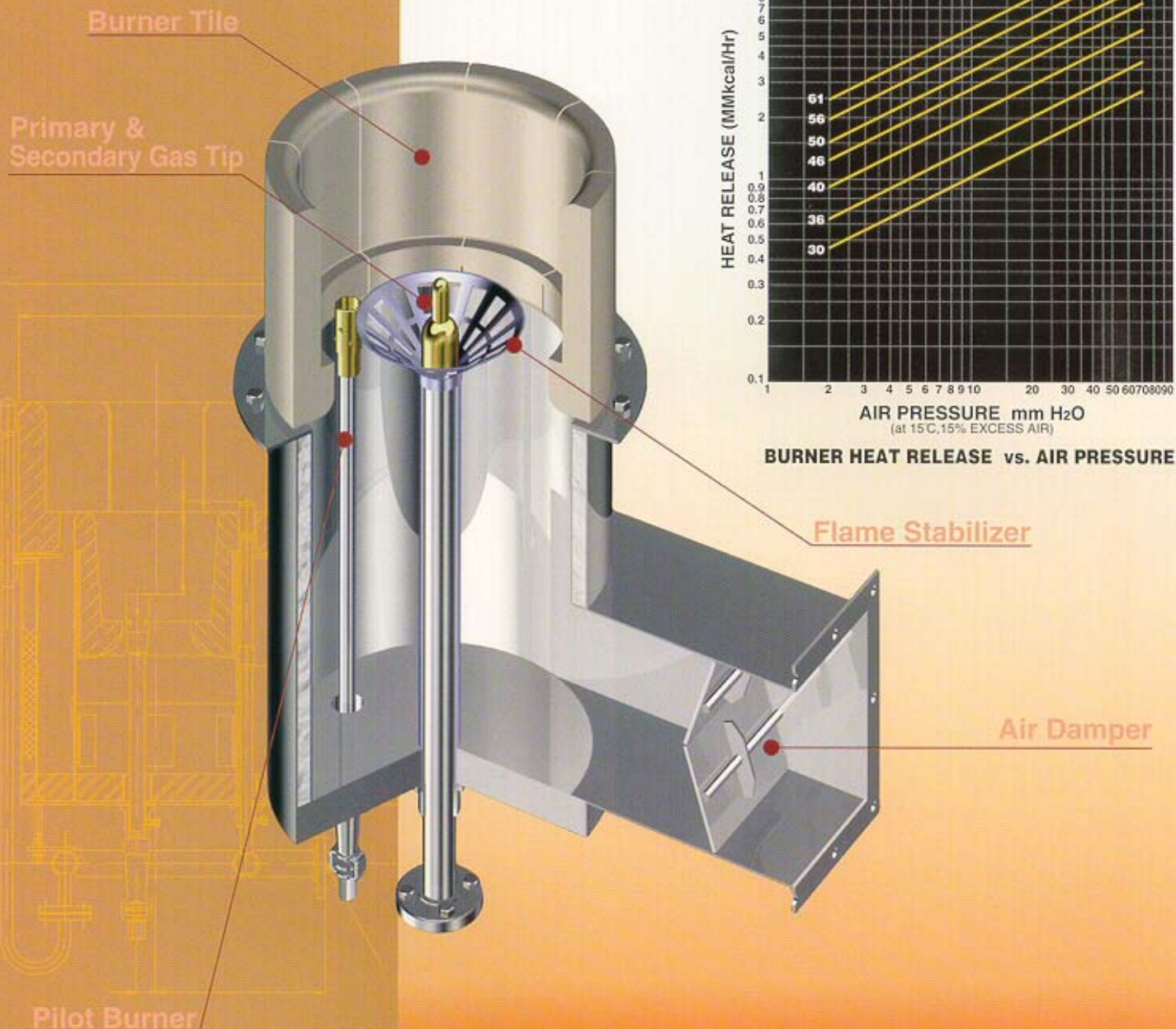
Easy maintenance and competitive price as a result of its simple configuration.

Applicable in virtually all firing directions.

Flame length equivalent to conventional burners because of high performance stable flame.

High turndown ratio (exceeding 10 to 1).

Nozzle mix burner tip eliminates flashback.



KS9110 Burner provides maximum flexibility for new installations or retrofit of existing burners, with easy operation and maintenance.

KS9110 Burner can be incorporated with natural or forced draft, preheated combustion air and/or noise attenuation.

KS9110 Burner burns any combustible gaseous fuel. The Single-Lance (one gas tip) configuration provides for a low initial investment and ongoing maintenance costs.



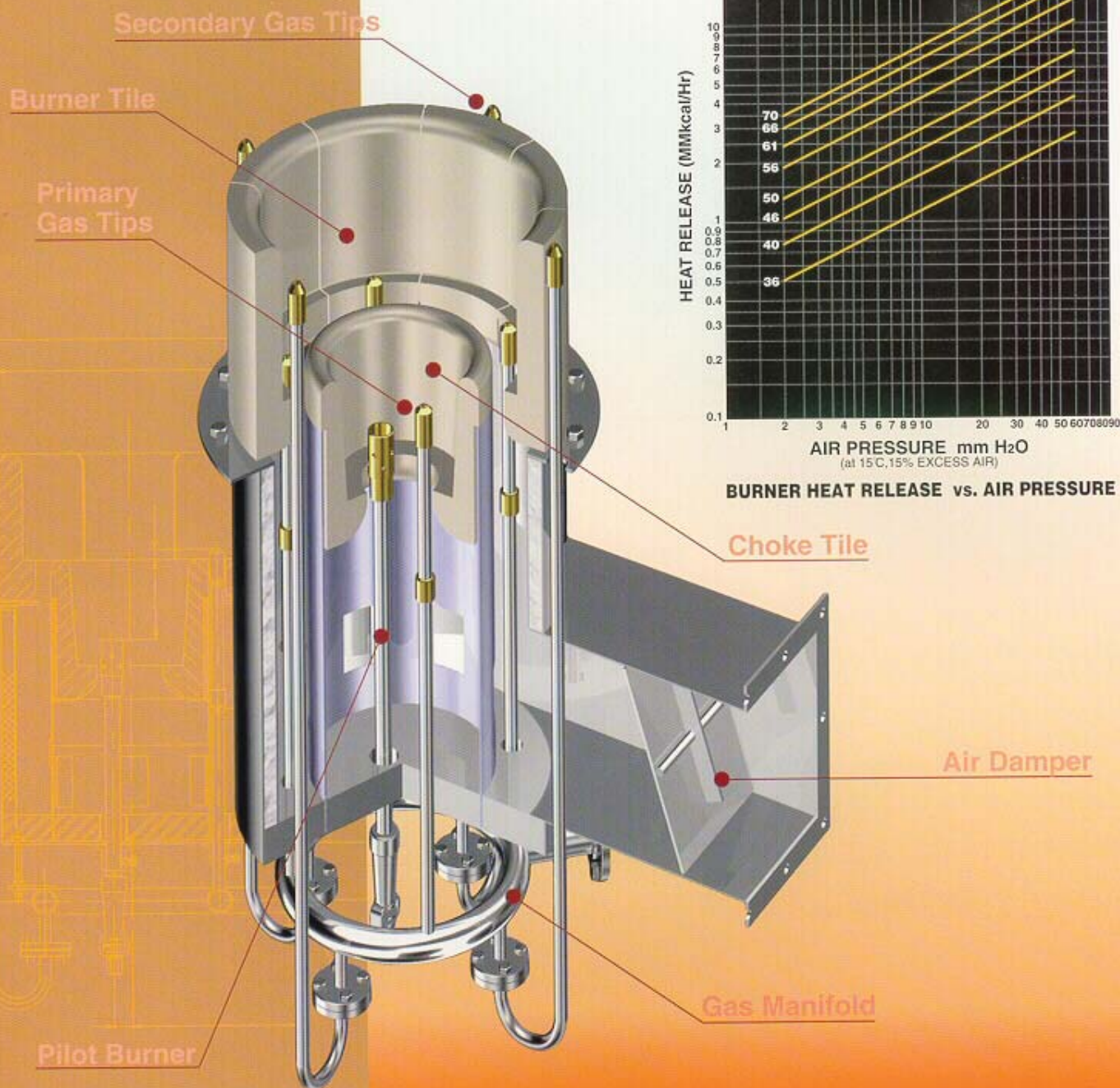
**KS9210****FUEL STAGE™**  
LOW NO<sub>x</sub> BURNER**Multi-Lance Round Flame Gas Firing - the Best Selling Model**30-40% lower NO<sub>x</sub> emissions than from conventional burners without De-NO<sub>x</sub> steam.

Applicable in virtually all firing directions.

Flame length equivalent to conventional burners because of high performance stable flame.

High turndown ratio (exceeding 10 to 1).

Nozzle mix burner tip eliminates flashback.



KS9210 Burner provides maximum flexibility for new installations or retrofit of existing burners, with easy operation and maintenance.

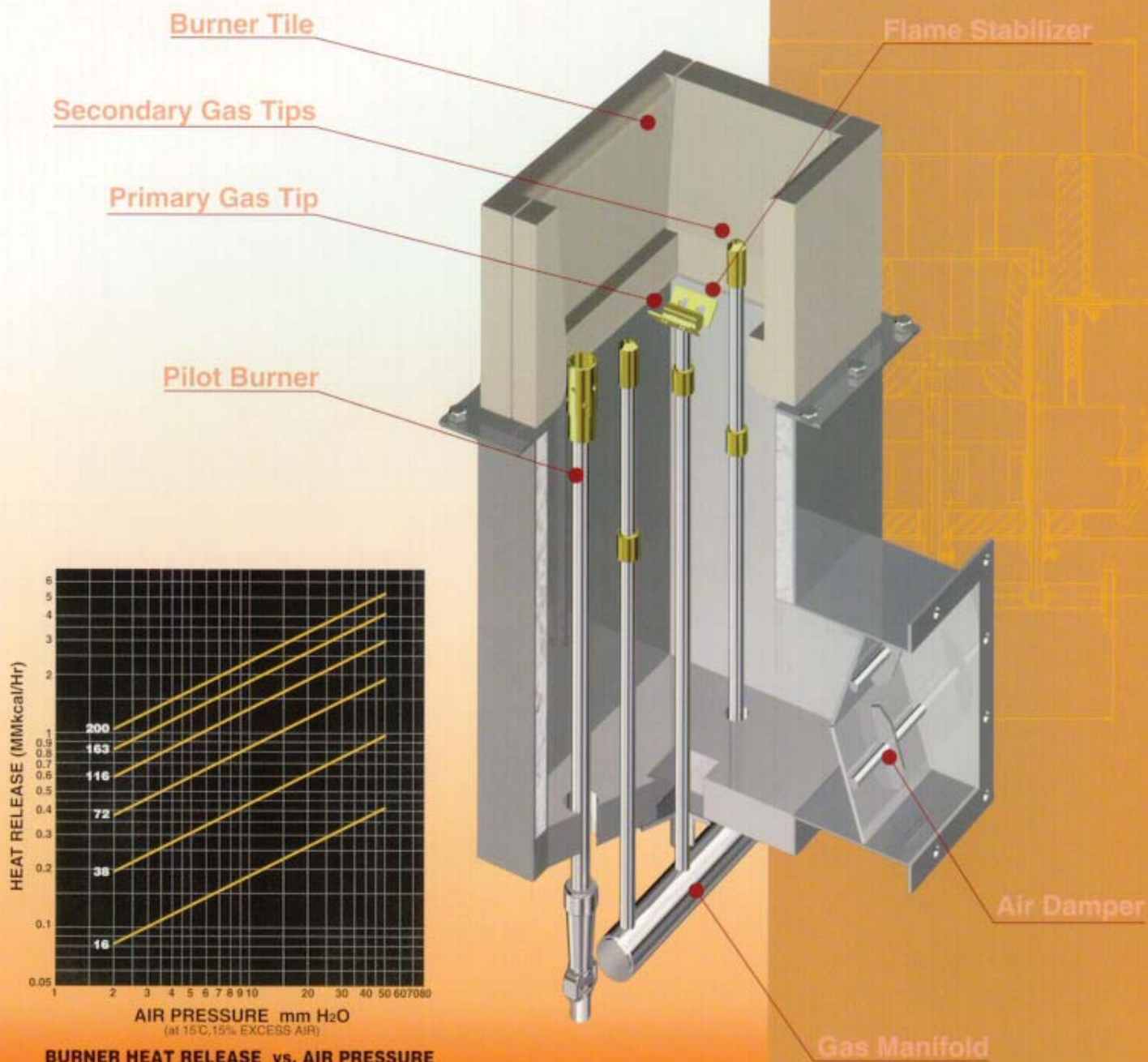
KS9210 Burner design can be incorporated with natural or forced draft, preheated combustion air and/or noise attenuation.

KS9210 Burner burns any combustible gaseous fuel from Hydrogen rich light gases to heavy hydrocarbons such as Butane etc. Many process systems produce low calorie mixtures containing a high ratio of inert gas - these are also burned successfully through KS9210.



### Multi-Lance Flat Flame Gas Firing

- 40-50% lower NOx emissions than from conventional burners without De-NOx steam.
- Applicable in virtually all firing directions.
- Flame length equivalent to conventional burners because of high performance stable flame.
- High turndown ratio (exceeding 10 to 1).
- Nozzle mix burner tip eliminates flashback.



KS9220 Burner provides maximum flexibility for new installations or retrofit of existing burners, with easy operation and maintenance.

KS9220 Burner design can be incorporated with natural or forced draft, preheated combustion air and/or noise attenuation.

KS9220 Burner burns any combustible gaseous fuel and can be applied to various specialized process heaters such as Ethylene Crackers, Platformer, Steam Super Heater, etc.



## Patented Single-Lance Round Flame Oil Firing

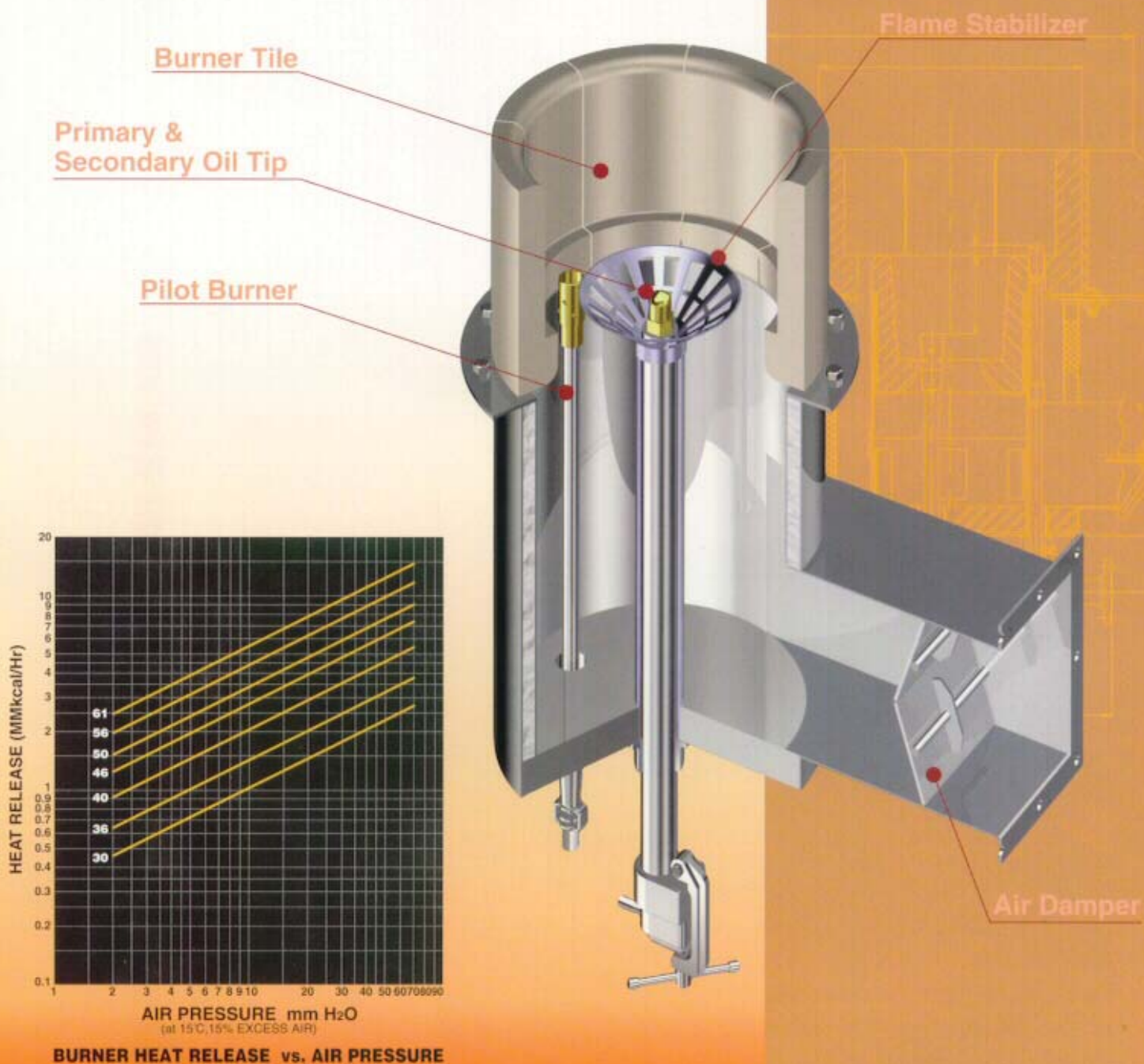
40-50% lower NOx emissions than from conventional burners.

No comparable burners exist.

The patented single oil tip Fuel Stage is the state of the art.

Flame length equivalent to conventional burners because of high performance stable flame.

Same turndown ratio to conventional burners.

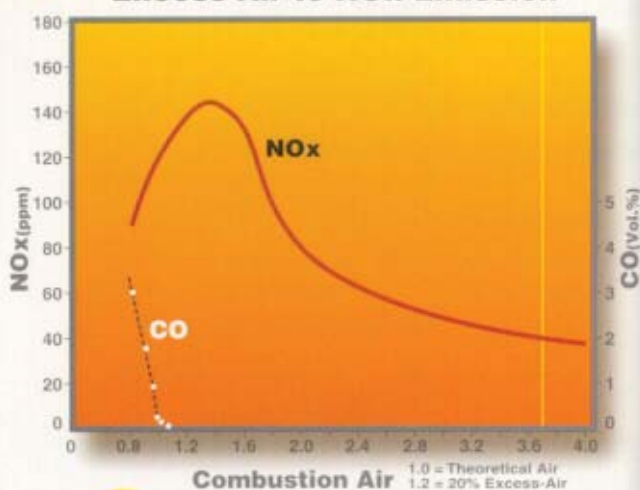


KS9310 Burner provides maximum flexibility for new installations or retrofit of existing burners, with easy operation and maintenance.

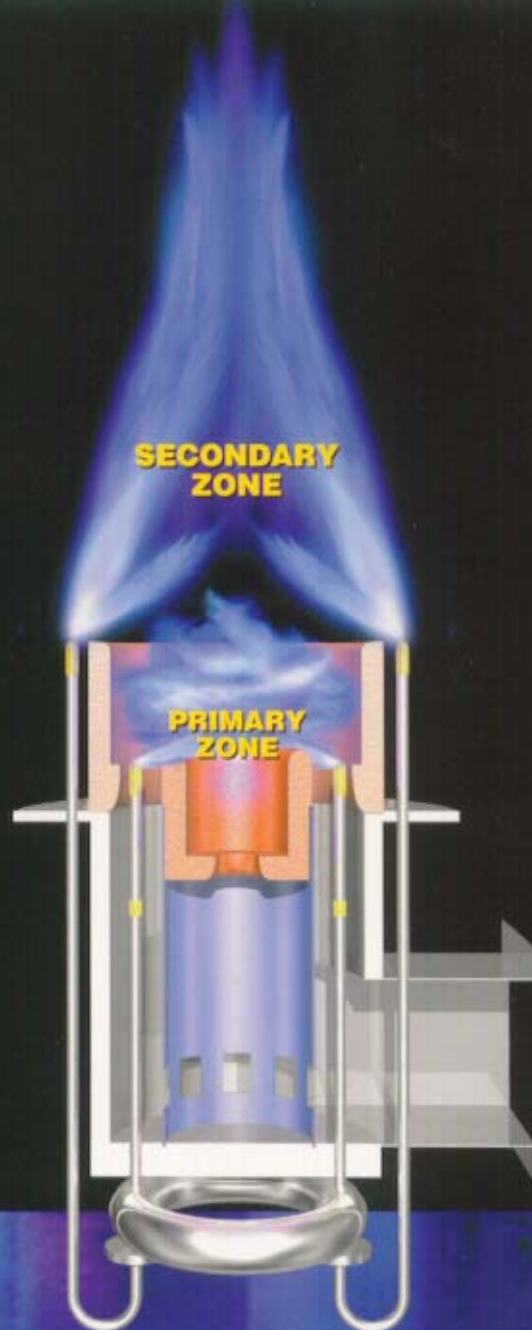
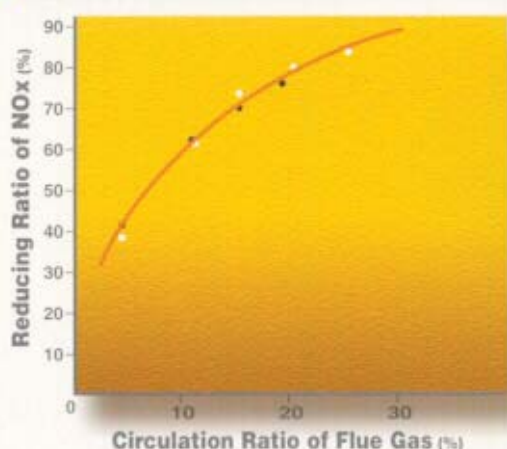
KS9310 Burner design can be incorporated with natural or forced draft, preheated combustion air and/or noise attenuation.

KS9310 Burner burns light oil fuel such as liquid butane, naphtha etc.

**Fig.1** Relationship  
Excess Air to NO<sub>x</sub> Emission



**Fig.2** Relationship  
Flue Gas Recirculation to NO<sub>x</sub> Emission



## P Primary Combustion Zone

The zone where the primary fuel is burned together with high excess-air is called the primary combustion zone.

Please refer to **Fig 1**, this shows how changes in the air ratio will affect the NO<sub>x</sub> exhaust density, NO<sub>x</sub> generation will reduce as the excess-air ratio increases.

Since high flame temperature (more than approx. 1500°C) generates NO<sub>x</sub>, increasing the excess-air results in a cooler flame which in turn reduces NO<sub>x</sub>.

## S Secondary Combustion Zone

Fuel Gas discharged through the secondary gas tip burns in the secondary combustion zone. In the secondary combustion zone, the fuel gas burns in the low oxygen atmosphere (low partial pressure of oxygen) created by the primary combustion zone. Consequently, NO<sub>x</sub> generation in the secondary combustion zone will be suppressed. This is known as the effectiveness of exhaust gas re-circulation, as indicated in **Fig 2**.

# LOW NO<sub>x</sub>





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