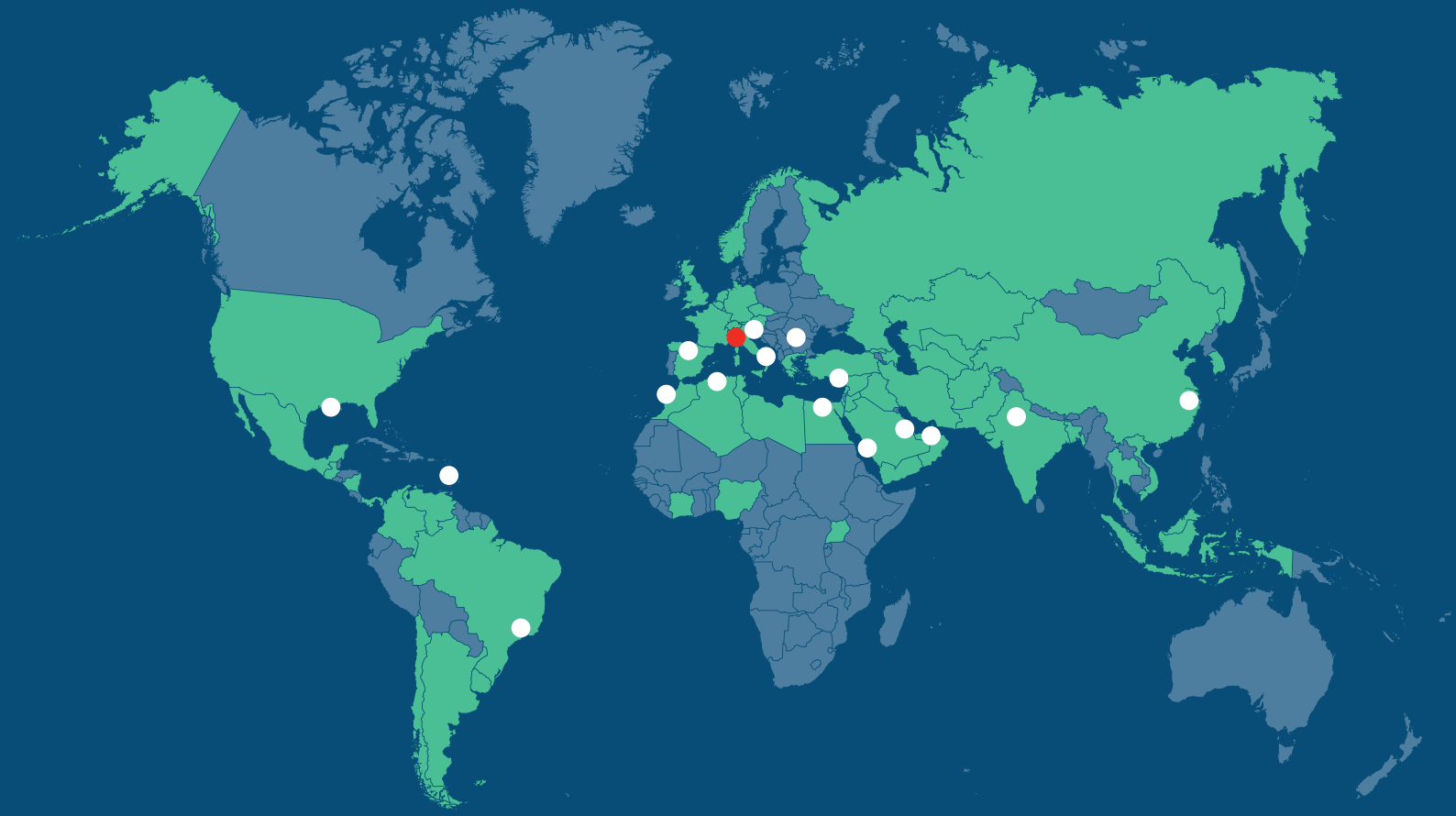
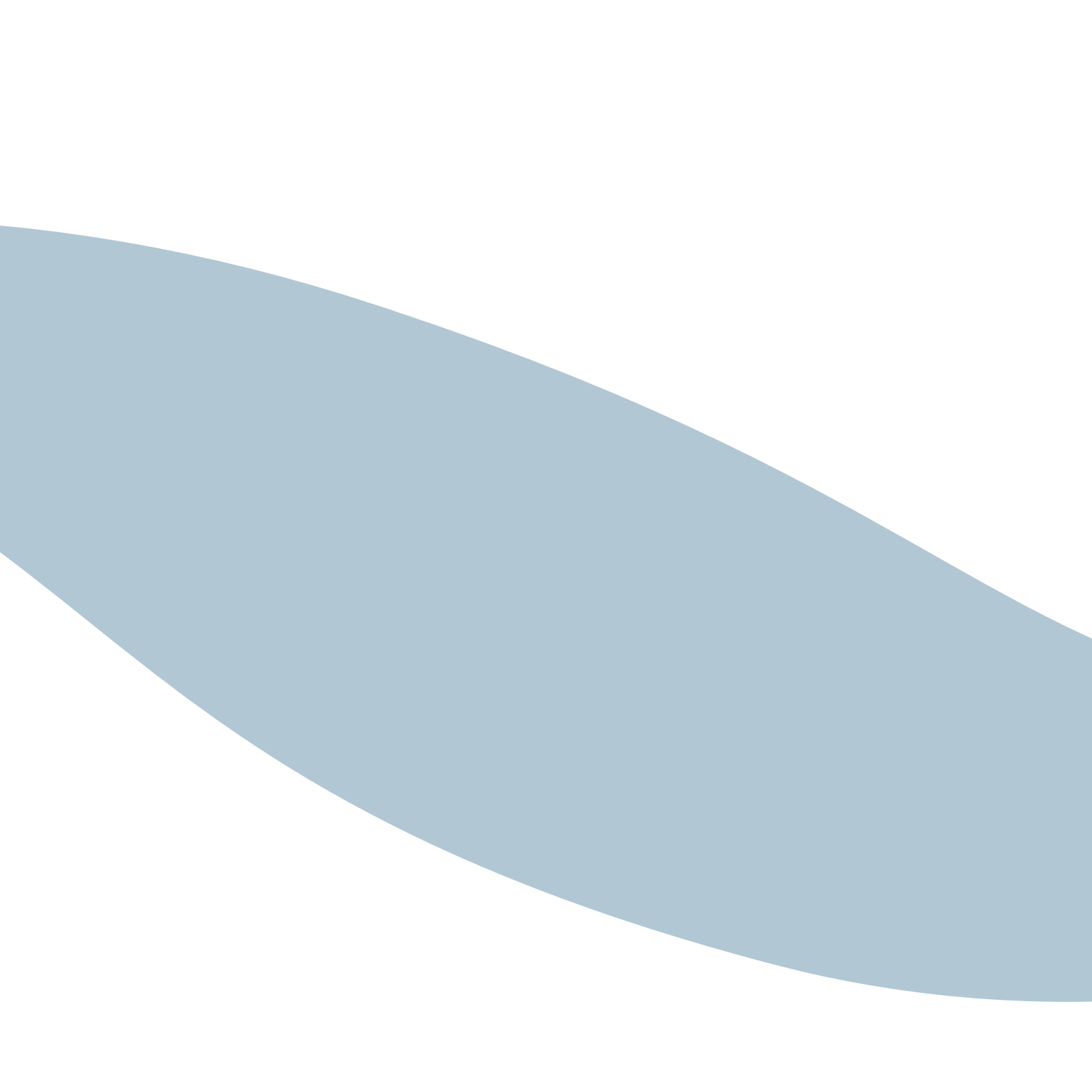


Countries with Sofinter Installed Units
Sofinter Headquarters
Sofinter Companies and Branches

www.macchiboiler.it

MACCHI
STEAM & POWER GENERATION
a division of Sofinter

BURNERS TECHNOLOGY




MACCHI
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Ultra Low NOx Burners

Proprietary Proven Technology & Design

MACCHI has developed reliable, safe and performing burners for 60 years, ranging from combustion of simple hydrocarbons to multiple gaseous and liquid fuel combination streams coming from Industrial Processes as a Waste, thus increasing the overall efficiency of the plant.

FUEL EXPERTISE

Gaseous Fuels

- Natural gas
- LPG
- Hydrogen
- Ethylene
- Gassified Pentane
- Flare Gas
- Tail Gas
- Spent Air

Liquid Fuels

- Standard Fuel Oil, From Light to Heavy Fuel Oil
- Pyrolysis Gasoline
- Methanol
- Liquid Pentane
- Crude Oil
- Waste Lube Oil

Note: other fuels may be checked upon request

MACCHI last generation MARS II burner was designed to minimize OPEX and satisfy the most severe emissions limits.

References
MACCHI supplied more than 1200 Boilers all over the world, with hundreds of different fuels.

MACCHI burners reference list available upon request.

Energy Evolution towards Zero Flaring

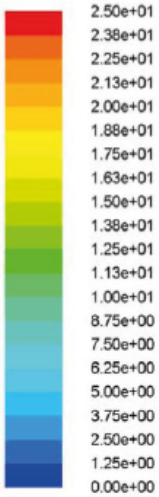
Thanks to proprietary combustion & burner technology, MACCHI burners are able to handle multiple fuels/operating conditions:

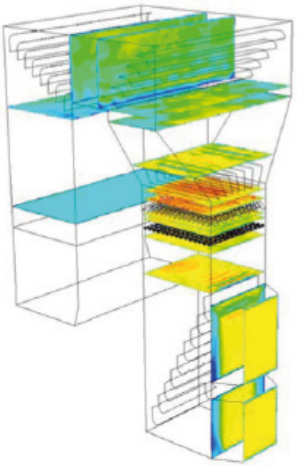
- Plant start up with natural gas or diesel
- Normal operation burning waste process streams rich of Hydrogen, Olefin Tails, Ethylene, Aromatics, C4, C5, Liquid By-product instead of flaring
- Rejected streams during upset process plant condition instead of flaring
- Middle and long term variation of HHV due to feedstock composition change

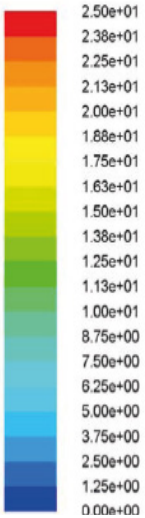
Emission Control

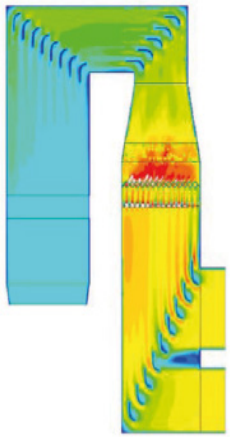
Single source, Cost Effective, Fully Modularized Solution

- SCR & CO catalyst system design fully integrated with Boilers for NOx/CO control.
- Reagent selection to achieve the Best Break-Even of CAPEX vs OPEX.
- Reagent injection grid designed through CFD for optimum distribution.
- Catalyst selection and position to optimize emission abatement efficiency vs geometry
- Complete skid mounted ancillaries, such as reagent tank, pumps, vaporization unit and relevant interconnecting piping and access structures.
- Fully automated control system designed to cope with any load variation.
- Achieving single digit NOx/CO guaranteed result.
- SCR & CO catalyst, ammonia flow control unit, distribution and injection system fully shop assembled on the main boiler Plug&Play module







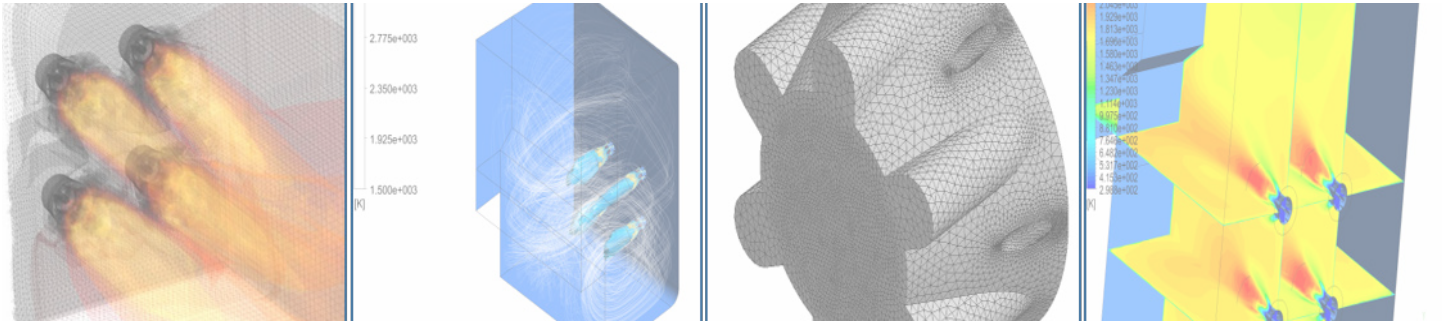


Customization details

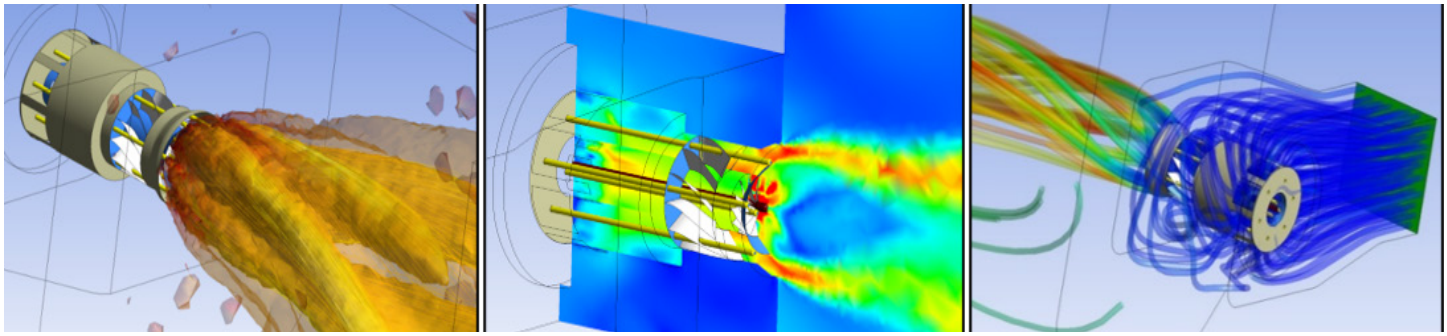
- Burners are suitable to fit existing furnaces
- Bottom, frontal installation
- Suitable to use different Flame scanner brands
- Fuel gas removable guns
- Secondary or tertiary fuel gas circuits
- Internal or external fuel gas manifold
- Cold or hot combustion air
- Customized number of fuel gas guns to adapt to any existing furnace size
- Single or double automatic air register
- Igniter of NFPA 85 class I, II, III (fixed or retractable)
- High energy spark igniter (fixed or retractable)
- Fuel oil steam/air fed atomizer with double circuits
- External Flue gas recirculation of induced type
- Steam injection features
- Special furnace design
- Common or separate wind-box
  Negligible quantity of refractory
- Components certified FM/UL for US market

CFD Capabilities and Experience

The design of Burners and Boilers is developed on fully integrated basis, first simulated by CFD, then in-house construction, finally performances are validated in MACCHI owned full scale test rig facility where any fuel can be prepared according to field actual compositions.



CFD ensures proper distribution of combustion air through complex geometry air duct and wind box.



Own Test Rig Full Scale in Actual Conditions

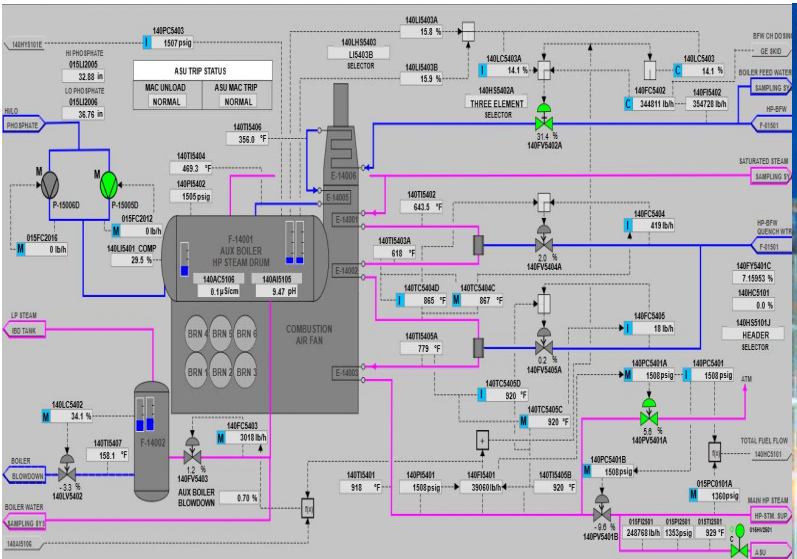
CCA test facility, owned by Macchi, is one of the best and largest full-scale burner testing facilitie in the world.

A 40 MWth industrial boiler devoted to test individual burners in full scale and actual operating conditions, capable of firing coal, oil, gas and other pulverized fuels.

The full analysis of the combustion performance and the complete characterization of the combustion system can get benefit by special diagnostic. In-flame temperature and gas analysis can be measured in an extensive pattern by means of water cooled probes.

The facility has a special design in order to comply with the main requirements of boiler combustion test.

The water wall combustion chamber is partially refractory lined in order to balance the heat released from the flame and generate the suitable flame thermal boundary conditions and the proper flame temperature.



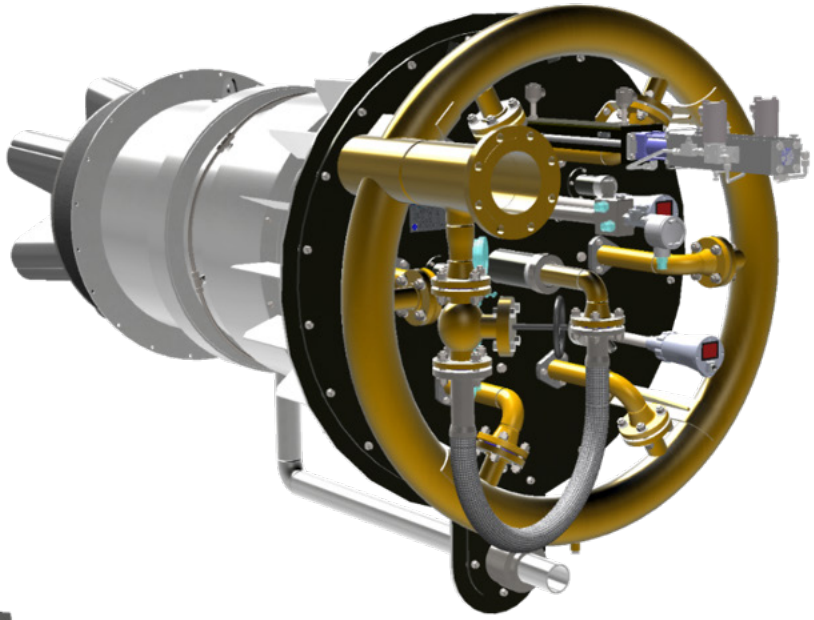
MACCHI Burners selection

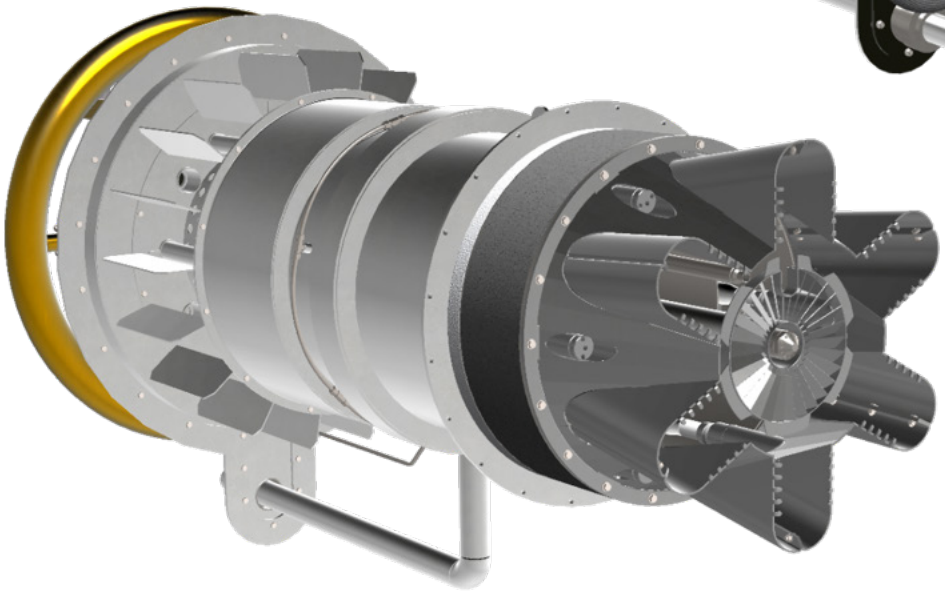
Burners Model MARS II E3

- Multiple Fuels Burner
- Low air excess 5÷10%
- Duty from 15 up to 80 MWth each
- Up to 2 different gas distribution systems
- Central gun for Liquid Fuel (steam/air atomized)
- Low draft loss (6÷8 in WG)
- Suitable for hot or cold combustion air
- NOx emissions (fuel gas firing)(*)
  - stand-alone 30÷60 ppm(**)
  - GR operation 20÷40 ppm(**)
  - GR+Steam inj. Operation 9÷25 ppm(**)
- CO emissions
  - Oil firing ≤ 35 ppm (**)
  - Gas firing ≤ 25 ppm (**)
- Very compact flame shape
- Customizable to meet Client's specific requirement

(*)NOx emission for Standard Product; (**) 3% O_2 Dry Vol.

Emission range are typical. Macchi will be pleased to evaluate emissions upon request.





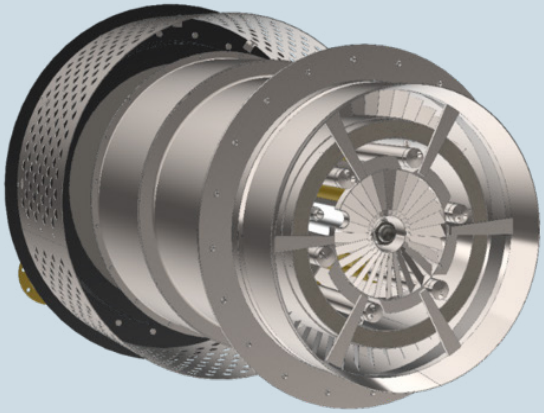
Note: For each class of burner, several customized solution may be implemented

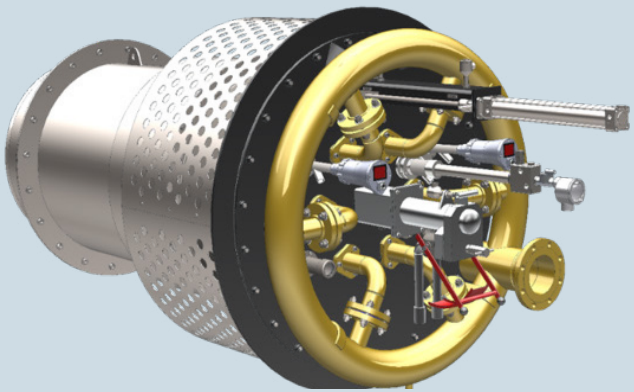
Burners Model MHM

- Multiple Fuels Burner
- Low air excess 5÷10%
- Duty from 15 up to 100 MWth each
- Up to 2 different gas distribution systems
- Central gun for Liquid Fuel (steam/air atomized)
- Low draft loss (6÷8 in WG)
- Suitable for hot or cold combustion air
- NOx emissions (fuel gas firing) (*)
  - stand-alone 60÷ 95 ppm (**)
  - GR operation 40÷60 ppm (**)
- CO emissions
  - Oil firing ≤ 32 ppm (**)
  - Gas firing ≤ 20 ppm (**)
- Compact flame shape
- Customizable to meet Client's specific requirements

(*) NOx emission for Standard Product; (**) 3% O_2 Dry Vol.

Emission range are typical. Macchi will be pleased to evaluate emissions upon request.





Other operational advantages

- Fully automatic operation
- Safety logics developed by Macchi and implemented in the BMS in full compliance to NFPA 85.
- Easy maintenance from outside. No need to enter furnaces.
- High rangeability. It is possible to operate boiler with all burners in service from minimum to maximum.
- All burners models have been successfully tested at our test rig.
- Easy availability of spare parts.

MACCHI ABS
ADVANCED BOILER SYSTEMS

Macchi burner may be fully integrated with **our new technology for burner and boiler control**: MACCHI ABS.

ABS stands for Advanced Boiler System which consists of several algorithms to optimize boiler and burner operation and perform predictive maintenance on long term operation.

Contact us for futher information

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