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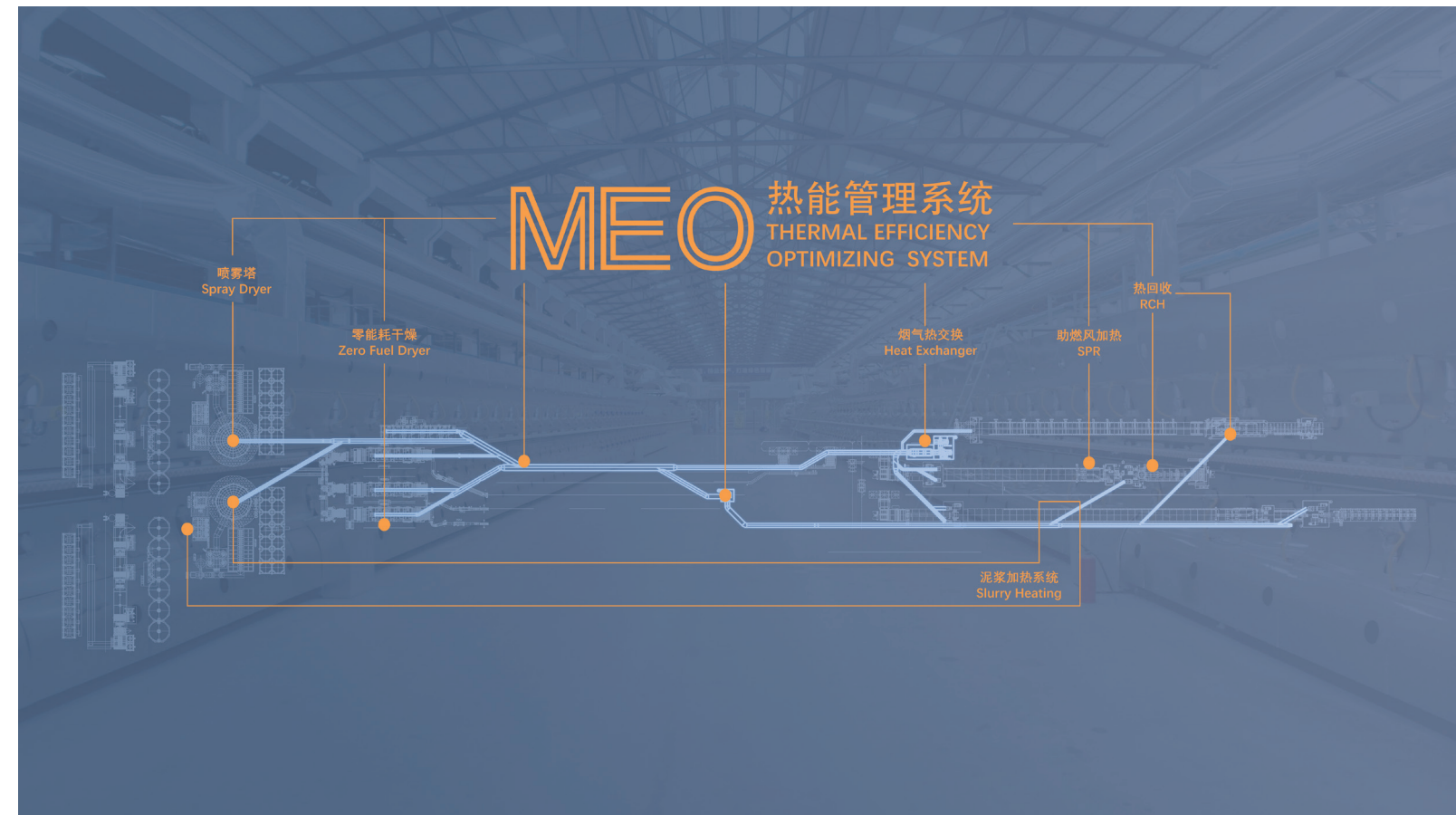
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HIGH-EFFICIENCY HEAT RECOVERY &  
SMART ENERGY MANAGEMENT

**高效热能管理系统**

国家高新技术企业

欧盟CE安全认证

中国窑炉协会理事长单位

National High-Tech Enterprise

CE Safety Certificate of European Union

Presidential Unit of China Kiln Association



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# MEO系统概述

## SYSTEM OVERVIEW



在单线产能持续提升、烧成周期不断缩短的行业背景下，窑炉烟气及尾冷系统所携带的余热总量显著增加。与此同时，高品质瓷砖装饰工艺向精细化与高端化发展，多层釉料与熔块复合应用，使釉线对热风的用量及供热点数量同步上升，对回收热风的稳定性与智能化分配提出了更高要求。

基于上述工况需求，摩德娜推出 **MEO 系统（Modena Efficiency Optimization System）**。该系统通过程序化集中控制，对生产线回收的各类余热进行统一管理，并按实际工艺需求精准分配至不同用热点，实现余热资源的最大化利用，全面提升整线热能使用效率。

Against the backdrop of continuously increasing single-line production capacity and shortened firing cycles, the amount of waste heat contained in kiln exhaust gas and cooling air has risen significantly. At the same time, the decoration processes for high-quality ceramic tiles are becoming increasingly refined and high-end. The combined use of multiple glaze layers and frits has led to higher hot-air demand and a greater number of heat supply points along the glazing line, placing higher requirements on the intelligent distribution and stable control of recovered hot air.

In response to these challenges, Modena has developed the **MEO System (Modena Efficiency Optimization System)**. Through centralized, program-based control, the system manages all recovered waste heat from the production line and distributes it precisely to each consumption point according to real process demand. This enables deeper and more efficient utilization of waste heat, significantly improving overall thermal energy efficiency.

# 工作原理与结构概述

## WORKING PRINCIPLE & STRUCTURE OVERVIEW

**工作原理：**窑炉烟气余热综合利用是实现窑炉系统节能降耗与绿色生产的核心技术之一。通过烟气换热器回收窑炉排放的高温烟气显热，将其转化为热空气并输送至干燥窑使用，可显著降低干燥系统的天然气消耗与二氧化碳排放，同时减轻干燥窑内部腐蚀，延长设备整体使用寿命。

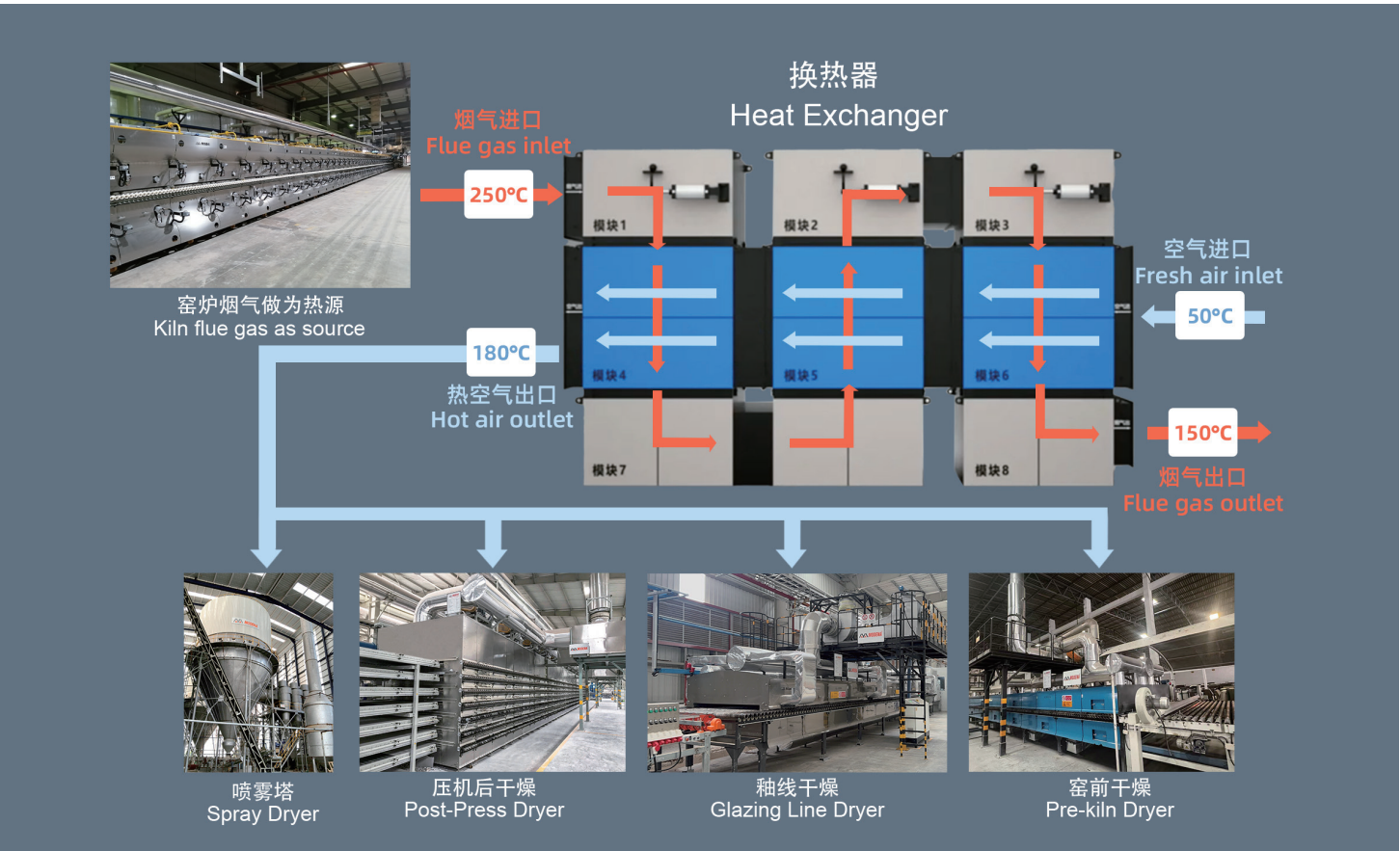
**结构原理：**全自动自清洁烟气换热器以成型金属板片作为核心传热元件，多层板片按优化间距叠装，并采用全焊接密封结构，在确保强度与密封性的同时，实现冷热介质的有效分隔。烟气与空气分别在板片两侧流道内流动，通过板片完成高效热交换。针对生产烟气特性专门设计的板片结构，相比传统波纹板片通道更为顺畅，在提升换热效率的同时有效降低系统阻力。

针对陶瓷窑炉烟气中灰尘多、易堵塞、易腐蚀等典型工况，设备配置在线自动清灰系统与低温防腐控制，可长期保持换热通道畅通，稳定换热性能，避免露点腐蚀。模块化结构设计并预留充足检修空间，使安装、维护与检修更加便捷可靠，全面提升系统运行安全性与使用寿命。

**Working Principle:** Kiln flue gas waste heat recovery is a key technology for energy saving and green production in modern kiln systems. By recovering the sensible heat of high-temperature exhaust gas through a heat exchanger and using it to preheat air for dryers, natural gas consumption and CO<sub>2</sub> emissions are significantly reduced, while corrosion inside the dryer is minimized and overall equipment service life is extended.

**Structure Overview:** The fully automatic self-cleaning flue gas heat exchanger uses formed metal plates as the core heat transfer elements. Multiple plates are stacked at optimized spacing and sealed by a fully welded structure, ensuring high strength, tightness, and effective separation of hot and cold media. Flue gas and air flow through channels on opposite sides of the plates, enabling efficient heat transfer. Plate geometry specifically designed for kiln flue gas offers smoother flow paths than conventional corrugated plates, improving heat transfer efficiency while reducing pressure drop.

To address typical ceramic kiln challenges such as dust fouling, efficiency degradation, and corrosion, the exchanger is equipped with an online automatic cleaning system and low-temperature anti-corrosion control. These features ensure long-term stable performance and prevent dew-point corrosion. The modular design with sufficient inspection space allows easy installation, maintenance, and reliable operation.





# MEO 系统配套换热器 — 自清洁板式烟气换热器

## MEO SYSTEM HEAT EXCHANGER — SELF-CLEANING PLATE-TYPE FLUE GAS HEAT EXCHANGER

专为陶瓷行业高温、高尘、高腐蚀烟气工况设计，采用全焊接密封结构，结合在线自动刮灰与低温防腐控制，确保长期稳定换热，防堵塞、防露点腐蚀。

Specifically designed for high-temperature, high-dust, and corrosive flue gas in the ceramic industry. Fully welded and sealed, combined with online automatic dust removal and low-temperature anti-corrosion control, ensuring long-term stable heat transfer while preventing blockage and dew-point corrosion.



### 主要优势：

- 智能在线自清洁 — 自动刮灰系统持续清理烟气灰尘，防止堵塞，保证长期稳定换热。
- 全自动运行与监控 — 数字化人机界面实时显示运行状态，无人值守管理温度与风量。
- 低温防腐保护 — 内置低温智能保护系统，有效防止露点腐蚀，延长使用寿命。
- 模块化设计 — 模块化制造，螺栓连接，安装、拆运及维护便捷。
- 自动化激光焊接 — 板片一次成型，机械手激光焊接，兼顾结构强度与外观质量。

### Key Advantages:

- **Intelligent Online Self-Cleaning** — Automatic scraper continuously removes flue dust, prevents blockage, and maintains long-term stable heat transfer.
- **Fully Automated Operation & Monitoring** — Digital HMI provides real-time status monitoring, allowing unattended control of temperature and airflow.
- **Low-Temperature Anti-Corrosion Protection** — Built-in system prevents dew-point corrosion, extending equipment service life.
- **Modular Design** — Modular manufacturing with bolted connections for easy installation, transport, and maintenance.
- **Automated Laser Welding** — Plates are formed in one piece and assembled via robotic laser welding, ensuring both structural strength and refined appearance.

### 余热回收 — 高效节能

窑炉烟气余热综合利用是实现窑炉系统节能降耗与绿色生产的核心技术之一。通过烟气换热器回收窑炉排放的高温烟气显热，将其转化为热空气并输送至干燥窑使用，可显著降低干燥系统的天然气消耗与二氧化碳排放，同时减轻干燥窑内部腐蚀，延长设备整体使用寿命。

### 核心技术 — 板片设计

一次性模具成型板片，实现极高传热效率，是高效换热解决方案。

### Waste Heat Recovery — High Efficiency & Energy Saving

Efficiently converts kiln flue gas sensible heat into usable thermal energy for dryer air preheating, raw material heating, and plant heating, reducing natural gas consumption and CO<sub>2</sub> emissions while extending the service life of dryers and heat exchangers.

### Core Technology — Plate Design

One-time molded plates achieve extremely high heat transfer efficiency, recognized as a highly effective heat recovery solution.





# 性能指标与优势

## KEY PERFORMANCE & ADVANTAGES



100% 绿色余热  
GREEN WASTE HEAT

仅利用窑头烟气通过无接触充分换热间接加热洁净空气，换出的热空气无任何腐蚀性气体。

Only use the flue gas from the kiln to indirectly heat up the clean air through non-contact sufficient heat exchange, the hot air exchanged is free of any corrosive gases.



≤20% 废气体积减  
REDUCED EXHAUST VOLUME

降温后烟气体积减少，高效节约尾气处理成本。

Reduced exhaust volume after cooling, saving on tail gas treatment costs.



≥60% 高效换热  
EFFICIENT HEAT EXCHANGCE

烟气显热高效回收，余热温度与风量可按生产动态调节。

High-efficiency flue gas heat recovery, adjustable temperature and airflow.



干燥零燃气消耗  
ZERO FUEL CONSUMPTION

窑炉全工况运行下，干燥系统无需额外燃烧。

Under full operating conditions of the kiln, the drying system does not require additional combustion.

每生产 10,000 m<sup>2</sup> 瓷砖 节省天然气 ≈ 2,180 m<sup>3</sup> 减排 CO<sub>2</sub>: ≈4.3 t  
Tiles=10,000 m<sup>2</sup> Save ≈ 2,180 m<sup>3</sup> NATURAL GAS Reduce ≈ 4.3t CO<sub>2</sub>

# MEO 型号范围

## MODEL RANGE

按换热面积分类：  
270 / 400 / 450 / 600 / 800 / 1008 / 1180 / 1400 （m<sup>2</sup>）

- 每种型号对应的换热面积
- 推荐窑炉生产能力与适配产线场景
- 设备尺寸示例

270 / 400 / 450 / 600 / 800 / 1008 / 1180 / 1400 (m<sup>2</sup>)

- Heat-exchange area of each model
- Recommended production capacity matching
- Example dimensions per model



窑炉产量 Kiln output m²/D	烟气进出口温度 Flue gas inlet and outlet temperature /°C		空气进出口温度 Air inlet and outlet temperature /°C		烟气阻力 flue gas resistance /pa	空气阻力 air resistance /pa	换热量 heat exchange capacity /kcal	换热面积 heat transfer area /m²	引风机功率 Induced draft fan power	鼓风机功率 blower power	烟气流量 flue gas flow rate /m³	空气流量 air flow /m³
5000-8000	250	140	50	180	800	500	≤400,000	270	22KW	30KW	≤22000	≤12000
8500-12000	250	140	50	180	800	500	≤600,000	400	30KW	37KW	≤32000	≤18000
12500-15000	250	140	50	180	800	500	≤800,000	450	37KW	37KW	≤40000	≤22000
15500-18000	250	140	50	180	800	500	≤1,000,000	600	45KW	55KW	≤48000	≤26000
18500-22000	250	140	50	180	800	500	≤1,250,000	680	75KW	55KW	≤58000	≤32000
22500-25000	250	140	50	180	800	500	≤1,500,000	800	75KW	55KW	≤66000	≤36000
25500-30000	300	150	50	180	800	500	≤2,000,000	1008	75KW	90KW	≤87000	≤63000
30500-35000	300	150	50	180	800	500	≤2,500,000	1180	110KW	110KW	≤100000	≤73000
35500-40000	300	150	50	180	800	500	≤3,000,000	1400	132KW	132KW	≤116000	≤83000