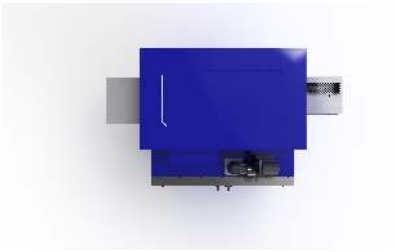
PRECISION QUINCY

CASE STUDY

# Electric Class A Truck Oven for Drying Magnesium Oxide in Tubular Resistive Heating Elements

*Precision Quincy engineered this oven as a 73-800 electric Class A truck oven for controlled, repeatable drying of magnesium oxide packed within tubular resistive heating elements. The final design combined 800°F capability, full horizontal airflow, 54 kW electric heat, powered exhaust, and truck-guided loading in a compact production format built for consistent daily use.*

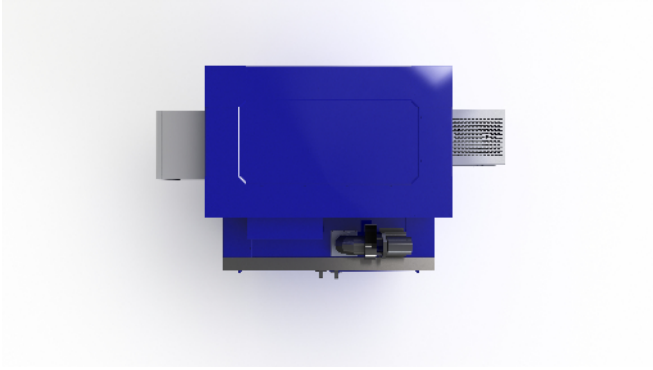


## OVERVIEW

The project was developed for the customer, a long-established manufacturer of electric heaters, electric heating systems, controls, and related thermal components. At the operation, the company supports the manufacture of electric heating products, including tubular resistive heating elements used across industrial process-heating applications. Within that manufacturing setting, Precision Quincy developed this project as a high-temperature truck oven platform for repeatable batch drying of magnesium oxide packed within tubular resistive heating elements.

The oven was built around a 36 in W x 36 in D x 60 in H work chamber and a full horizontal airflow pattern suited for truck-loaded product arranged in organized batches. The final design basis established a 700°F operating temperature, 800°F maximum capability, and +/-10°F uniformity within the work area. Heat is provided by a 54 kW electric heating system and airflow is delivered by a recirculation package rated at 1,856 CFM at 2 in. W.c.

The project was configured as an electric Class A oven with a PQ1 exhauster rated for 550 CFM at 1 in. W.c., a customer-specific the customer temperature control and high-limit package, and a NEMA 1 UL508A open industrial control panel. The final machine package combines dual swing doors, floor guide tracks, dual heater banks, powered exhaust, airflow proving, timed purge logic, and 6-inch insulated wall construction into a dedicated batch drying platform for tubular heating element production.



## CUSTOMER PROCESS REQUIREMENTS

The project required a repeatable truck-loaded batch oven for drying magnesium oxide within tubular resistive heating elements inside the customer electric-heater manufacturing environment. The customer needed a production-ready oven platform sized for batches of tubular elements that had to move through a controlled convection-drying cycle with consistent temperature performance and reliable exhaust and purge protection.

### Application requirement

- The project supported a manufacturing environment producing electric heaters, electric heating systems, and tubular resistive heating elements.

- The oven had to support batch drying of magnesium oxide packed within tubular resistive heating elements.
- The process required a machine platform appropriate for daily production use with repeatable drying performance from batch to batch.

**Work chamber / loading requirement**

- Required internal work chamber: 36 in W x 36 in D x 60 in H.
- The oven had to support truck-guided loading for organized batch handling.
- The machine required front loading and unloading through two swing doors.
- The loading arrangement had to accommodate batches of tubular elements while maintaining airflow through the chamber.

**Quality requirement**

- The process required controlled elevated-temperature drying with +/-10°F work-area uniformity.
- The system needed dependable control of temperature, airflow, exhaust, and safety interlocks so moisture could be removed consistently from batch to batch.
- The oven had to provide a stable production environment for repeatable high-temperature drying cycles.

**Safety / environmental requirement**

- The project required an NFPA 86 Class A oven architecture.
- The drying cycle required powered exhaust, airflow verification, and purge sequencing to manage chamber ventilation safely as moisture was driven from the magnesium oxide fill.
- The final design basis included a documented Class A exhaust basis of 0.29 gal/batch on an o-xylene calculation basis.

**Site / utility requirement**

- Required electrical service: 460V / 3PH / 60Hz.
- Design elevation basis: 4,300 ft.
- The customer also required the oven to use a the customer-branded control package aligned with the application.

## THERMAL / PHYSICAL PROCESS REQUIREMENTS

The project required a high-temperature forced-convection drying process that could drive moisture from magnesium oxide packed within tubular resistive heating elements while maintaining even heat exposure across truck-loaded batches.

**Temperature requirement**

- Operating temperature basis: 700°F.
- Maximum temperature capability: 800°F.
- Required work-area uniformity: +/-10°F.

### Airflow / heat-transfer requirement

- Required airflow pattern: full horizontal airflow.
- The process required forced convection across the full chamber width to move heated air through and around the loaded element batches and support moisture removal.
- Using the final recirculation airflow and chamber cross-sectional area in the airflow direction, the first-pass average chamber air velocity is approximately 124 FPM.

### Heat-input requirement

- Heat source: electric resistance heat.
- Installed heat basis: 54 kW total.
- Heating arrangement basis: two 27 kW heater banks.
- The oven required staged electric heat delivery with controlled temperature response at elevated operating temperatures.

### Ventilation requirement

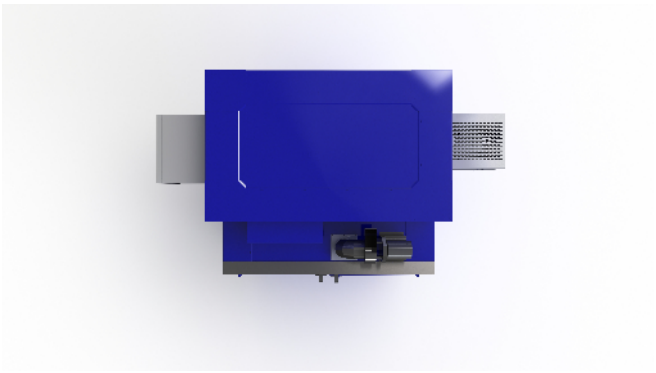
- The process required exhaust and purge sequencing to remove moisture-laden air generated during drying.
- Powered exhaust basis: 550 CFM.
- The documented Class A exhaust design basis was 0.29 gal/batch on an o-xylene calculation basis.
- The exhaust and safety basis had to remain valid at 4,300 ft design elevation.

### Control / sequencing requirement

- The process required verified safe-start sequencing before heat could be energized.
- Exhaust airflow and recirculation airflow had to be proven before the oven could complete purge and enable the heater banks.
- The thermal cycle required dedicated temperature control and separate excess-temperature protection.

### Cooldown requirement

- The process required continued fan operation during cooldown.
- The final control sequence states that the fans are not to be shut down while oven temperature is above 250°F.



## EQUIPMENT CONCEPT & ARCHITECTURE

To satisfy those requirements, Precision Quincy configured the project as a 73-800 electric Class A truck oven dedicated to drying magnesium oxide in tubular resistive heating elements, using horizontal airflow, dual-bank electric heat, powered exhaust, and interlocked controls.

Pages 6–8 — Technical Specifications

### Overall concept

- One electric Class A truck oven platform for truck-loaded batches of tubular resistive heating elements.
- Front-loading batch configuration for organized product handling.
- Compact insulated oven body with integrated recirculation, exhaust, and controls.

### Heating architecture

- Heat source: electric resistance heat.
- Total installed heat: 54 kW.
- Heating split into two 27 kW heater banks.
- Final wiring basis shows 18 total heating elements at 3000 W each, arranged as 9 elements per bank.
- Heater power is controlled through solid-state relays with backup contactors.

### Airflow architecture

- Airflow pattern: full horizontal airflow.
- Recirculation system based on a 13.5 in x 5 in forward-curved fan wheel delivering 1,856 CFM at 2 in. W.c.
- Recirculation fan motor: 1.5 HP.
- The chamber arrangement supports horizontal air movement across truck-loaded product to provide repeatable convective drying.

### Exhaust / ventilation architecture

- Class A exhaust based on a PQ1 exhauster delivering 550 CFM at 1 in. W.c.
- Exhaust fan motor: 0.75 HP.

- The oven includes a fresh-air inlet / damper arrangement integrated into the body.
- Purge timing and airflow-switch logic are interlocked with the heat system to support safe chamber ventilation and moisture removal during drying.

**Chamber / shell architecture**

- Internal work chamber: 36 in W x 36 in D x 60 in H.
- Wall construction: 6 in insulated oven walls.
- Standard wall insulation: 5 in of 6 lb mineral wool.
- Heat-chamber wall insulation: 1 in of 8 lb Super Wool plus 5 in of 6 lb mineral wool.
- Interior material: unpainted aluminized steel.
- Exterior finish: PQ Blue.
- The floor includes integrated truck guide tracks for repeatable loading alignment.

**Door / loading architecture**

- Two swing doors.
- Truck-guided loading through the front of the chamber.
- The chamber and door arrangement support organized loading of tubular element batches with repeatable placement inside the work area.

**Controls architecture**

- Customer-specific the customer temperature controller.
- Customer-specific the customer high-limit controller.
- NEMA 1 control enclosure built as a UL508A open industrial control panel.
- Separate operator controls for exhaust fan, recirculation fan, and each heater bank.
- Panel arrangement includes purge complete, fan on, and heater bank on indication.

**Safety architecture**

- Applicable standards basis: NFPA 79, NFPA 86, UL508A.
- Safety logic includes:
- Exhaust airflow proving
- Recirculation airflow proving
- Timed purge before heat enable
- Excess-temperature shutdown
- Automatic heat shutdown if safe operating conditions are not met

## TECHNICAL SPECIFICATIONS

| Oven Configuration | |
|---|---|
| **Model** | 73-800 |
| **Type** | Electric Class A truck oven |
| **Application** | Drying magnesium oxide in tubular resistive heating elements |
| **Airflow Pattern** | Full horizontal |
| **Work Chamber** | 36 in W x 36 in D x 60 in H |
| **Chamber Capacity** | 45 cu ft |
| **Door Style** | 2 swing doors |
| **Loading Basis** | Truck-guided floor tracks |

| Thermal Process Basis | |
|---|---|
| **Primary Process** | Drying magnesium oxide within tubular resistive heating elements |
| **Operating Temperature** | 700°F |
| **Maximum Temperature** | 800°F |
| **Uniformity** | +/-10°F |
| **Documented Class A Design Basis** | 0.29 gal/batch on an o-xylene calculation basis |
| **Design Elevation** | 4,300 ft |
| **Estimated Average Chamber Air Velocity** | ~124 FPM |

| Electrical / Heating System | |
|---|---|
| **Power Supply** | 460V / 3PH / 60Hz |
| **Full Load Amps** | 73.1 A |
| **Heat Source** | Electric resistance heat |
| **Installed Heat** | 54 kW total |

| | |
|---|---|
| **Heater Banks** | 2 x 27 kW |
| **Element Basis** | 18 total elements, 3000 W each |
| **Heater Power Control** | SSRs with backup contactors |
| **SCCR** | 5,000 amps |

## Airflow / Ventilation System

| | |
|---|---|
| **Recirculation Fan Basis** | 13.5 in x 5 in forward-curved fan wheel |
| **Recirculation Airflow** | 1,856 CFM |
| **Recirculation Static Pressure** | 2 in. W.c. |
| **Recirculation Fan Motor** | 1.5 HP |
| **Exhaust Fan** | PQ1 exhauster |
| **Exhaust Airflow** | 550 CFM |
| **Exhaust Static Pressure** | 1 in. W.c. |
| **Exhaust Fan Motor** | 0.75 HP |
| **Exhaust Opening** | 3.63 in x 7.5 in |

## Construction

| | |
|---|---|
| **Wall Thickness** | 6 in |
| **Standard Wall Insulation** | 5 in of 6 lb mineral wool |
| **Heat Chamber Wall Insulation** | 1 in of 8 lb Super Wool + 5 in of 6 lb mineral wool |
| **Interior Material** | Unpainted aluminized steel |
| **Exterior Finish** | PQ Blue |
| **Control Enclosure Finish** | PQ White |
| **Floor Feature** | Integrated truck guide tracks |

## Controls & Safety

| | |
|---|---|
| **Temperature Control** | The customer 2104-T0100 |

| | |
|---|---|
| **Excess Temperature Protection** | The customer 3101-11000 |
| **Control Enclosure** | NEMA 1 |
| **Enclosure Listing Basis** | UL508A open industrial control panel |
| **Enclosure Size** | 42 in x 36 in x 12 in |
| **Airflow Proving** | Exhaust and recirculation airflow switches |
| **Purge Logic** | Timed purge with purge-complete indication |
| **Fan Shutdown Protection** | Fans remain on until oven temperature is below 250°F |
| **Applicable Standards Basis** | NFPA 79, NFPA 86, UL508A |

## Equipment Dimensions

| | |
|---|---|
| **Overall Width** | 80.19 in |
| **Overall Depth** | 59.34 in |
| **Overall Height** | 95.97 in |
| **Oven Body Width** | 60.27 in |
| **Oven Body Depth** | 51.64 in |
| **Height to Exhauster Outlet Centerline** | 84.35 in |
| **Guide Track Centers** | 18.00 in |

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