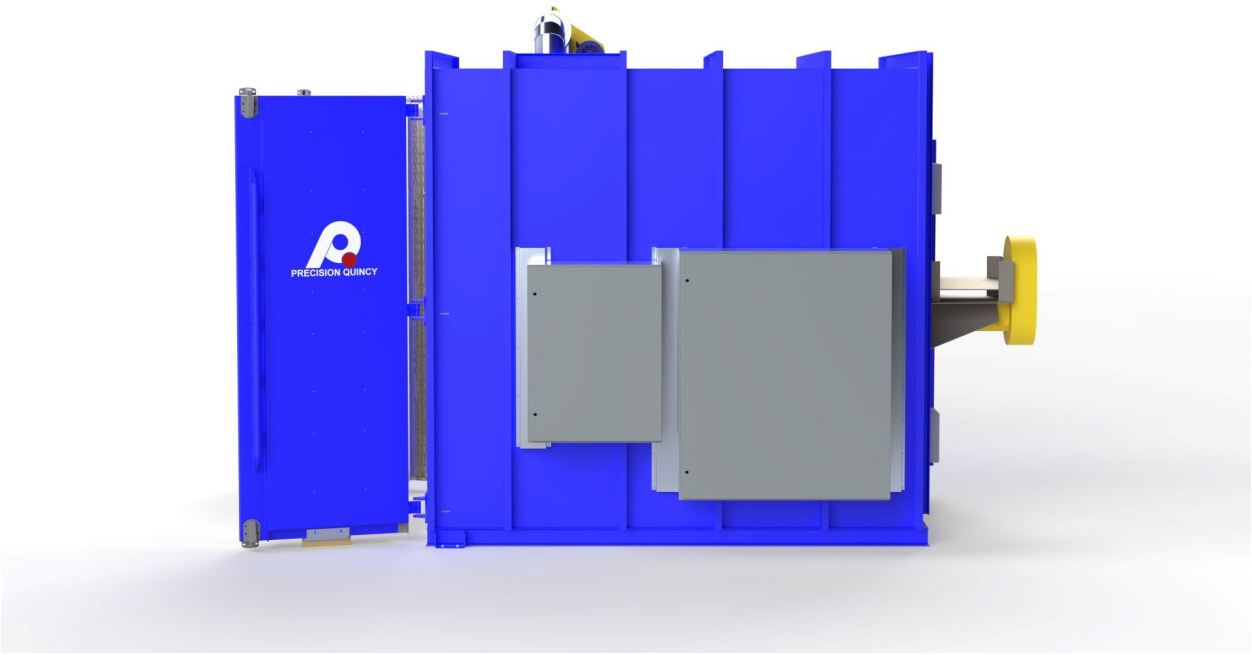


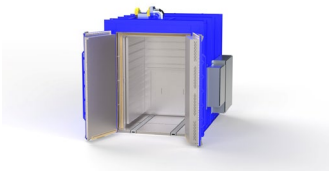
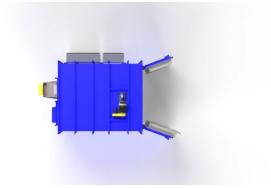
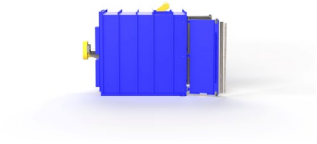
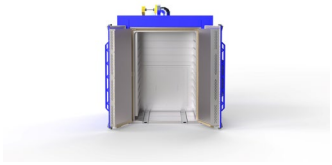
PRECISION QUINCY

CASE STUDY

High-Temperature Electric Batch Ovens

for Zinc Oxide Powder Processing

High-temperature electrically heated batch ovens engineered for the heat treatment of zinc oxide powder used in pharmaceutical and cosmetic applications—featuring a 60 in W × 60 in D × 96 in H work chamber, back-mounted heat chamber, full-horizontal airflow at 8,000 CFM, nominal 180 kW electric heating, ±10.8°F (±6°C) uniformity across a 662°F–932°F operating range, 304 stainless-steel process surfaces, NFPA 86 Class B architecture, and an export-configured control package with VFD, ramp/soak controller, PLC, and remote diagnostics.

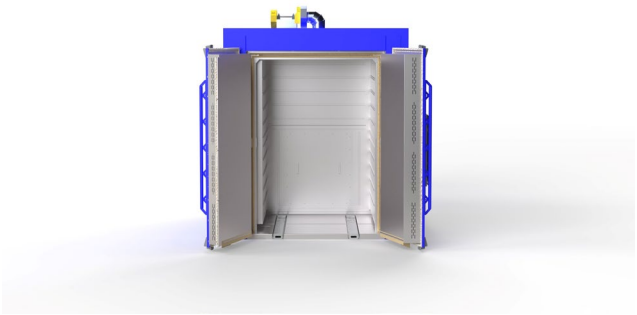





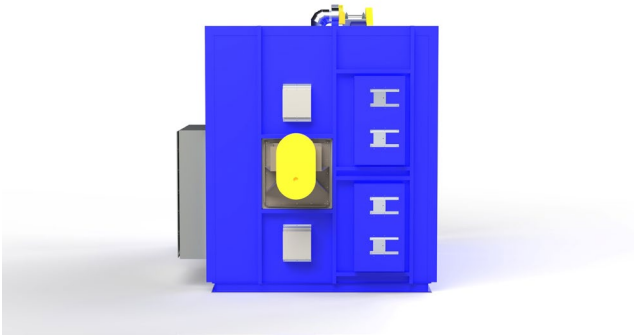
OVERVIEW

A repeat-order program of high-temperature electrically heated batch ovens was engineered to process zinc oxide powder for pharmaceutical and cosmetic material production. The customer relationship was established when the end user evaluated Precision Quincy based on the company's reputation; this project continued that relationship with the most recent batch of ovens supplied into the program. In total, six units have been delivered into the program, with this order representing the latest group.

The equipment was designed around a 60 in W × 60 in D × 96 in H work chamber and a cart-loaded batch process handling up to approximately 3,615 lb per batch. The oven platform supports high-temperature processing from 662°F to 932°F (350°C to 500°C) with a required work-area uniformity of ±10.8°F (±6°C). To achieve that performance, a back-mounted heat chamber was used with a full-horizontal airflow pattern, a New York Blower 208 PLR plug fan delivering 8,000 CFM at 2.5 in. w.c., and an electric heater system built around 3 kW elements providing a nominal installed capacity of 180 kW.

The system was configured as an NFPA 86 Class B oven with a documented no-VOC-allowable process basis. The shell combines an 18-gauge 304 stainless-steel interior, 3/16-inch mild-steel exterior construction, and an 8-inch insulated wall system using 2 inches of 8 lb Superwool backed by 6 inches of 6 lb mineral wool. The controls architecture combines a WATLOW F4T ramp/soak controller, Allen-Bradley Micro820 PLC, PowerFlex 525 VFD, work-area excess-temperature protection, airflow proving, current monitoring, pressure monitoring, and TOSIBOX remote diagnostics in a dual-enclosure NEMA 1 control package configured for 415V / 3PH / 50Hz export service.





CUSTOMER PROCESS REQUIREMENTS

The equipment was developed for a zinc oxide powder processing application associated with pharmaceutical and cosmetic material production. The oven platform had to provide a repeatable, high-temperature batch capability that could be duplicated across multiple installed units while supporting export deployment and customer operating practices.

Application requirement

- The equipment had to process zinc oxide powder in a controlled batch format.
- The oven platform supports material processing associated with pharmaceutical and cosmetic production.
- The customer required a repeatable platform suitable for ongoing multi-unit deployment rather than a one-off experimental system.
- This order continued an established repeat program, with this batch representing the most recent supply group delivered.

Work chamber / load requirement

- Required internal work chamber: 60 in W × 60 in D × 96 in H.
- The oven had to support a cart-loaded batch process. Maximum product load basis: approximately 3,615 lb per batch.
- The loading concept was based around a steel product cart configured for multiple tray levels.
- The cart basis accommodates tray positions sized around a 48 in × 48 in × 2.5 in tray envelope.

Material handling / operator requirement

- The oven had to load and unload from one end through bi-parting swing doors.
- After the cycle is complete, the operator opens the doors and removes the cart from the oven.
- The process required an insulated floor and guided loading path suited to repeated cart movement.

Process requirement

- The system had to support repeatable high-temperature batch heat treatment of powder-based product loads.
- The customer required a robust, production-oriented oven platform rather than a light-duty lab unit.
- The process basis required clean, durable internal materials suited to repeated powder-processing service.

Safety / compliance requirement

- The oven was required to be designed on an NFPA 86 Class B basis.
- The documented process basis was no VOCs allowable.
- The equipment required appropriate excess-temperature protection, airflow proving, and controlled heater shutdown logic for safe operation.

Utility / site requirement

- Required electrical service: 415V / 3PH / 50Hz.
- Full-load current basis: approximately 261.1 A FLA.
- The export installation required controls and wiring architecture adapted for the destination site requirements.

Service / support requirement

- Because the equipment was being installed at a remote location, the project incorporated a controls architecture that supported remote diagnostics and off-site troubleshooting visibility.
- The system needed to support practical remote review of operating conditions without requiring immediate on-site factory presence for every issue.

Program / delivery requirement

- This project formed part of a repeat-unit supply relationship, with six total ovens ultimately delivered.
- The ovens were factory assembled, pre-wired, tested, and prepared for export shipment.

THERMAL PROCESS REQUIREMENTS

These thermal process requirements were established from the need to process zinc oxide powder in a repeatable, high-temperature electric batch oven platform.

Temperature capability

- Operating range: 662°F to 932°F (350°C to 500°C).
- Maximum operating temperature: 932°F (500°C).
- Required work-area temperature uniformity: ±10.8°F (±6°C).

Process basis

- The thermal process basis is high-temperature batch heat treatment of zinc oxide powder.
- The ovens support production-oriented material processing associated with pharmaceutical and cosmetic applications.
- The thermal platform had to be repeatable across multiple installed ovens serving the same customer program.

Heat input requirement

- Heat source: electric resistance heating. Heater basis: 3 kW elements.
- Installed heat basis: nominal 180 kW total.
- Documented wiring basis: six heater banks at 29.4 kW per bank, for 176.4 kW total operating basis.

Airflow delivery requirements

- Required airflow style: full horizontal airflow.
- Recirculation airflow basis: 8,000 CFM. Recirculation static pressure basis: 2.5 in. w.c.
- Air movement had to support even heat transfer across a tray-loaded cart arrangement.

Exhaust / ventilation basis

- Exhaust airflow basis: 255 CFM.
- Exhaust fan basis: PQ65 exhauster delivering 255 CFM at 1 in. w.c.
- Documented process basis: no VOCs allowable. Oven classification basis: NFPA 86 Class B.

Thermal instrumentation / control basis

- Primary temperature controller: WATLOW F4T ramp/soak controller. Thermocouple type: Type J.
- Work-area excess-temperature protection: independent high-limit controller.
- Work-area-to-atmosphere pressure monitoring included for process and operating visibility.
- Heater-bank current monitoring included across all heater circuits.

Safety / operating basis

- The oven was designed so heat is removed if required safe-operating conditions are not met.
- The thermal system includes airflow proving for both recirculation and exhaust functions.
- The operating sequence includes controlled shutdown logic to protect the oven during cool-down.

EQUIPMENT CONCEPT & ARCHITECTURE

To deliver the customer and thermal process requirements, the following equipment concept and architecture was developed for this zinc oxide powder processing application.

Overall concept

- Three identical high-temperature electric batch ovens supplied as a repeat-order group.
- Designed for zinc oxide powder processing associated with pharmaceutical and cosmetic material production.
- Developed as part of a broader multi-unit platform already proven with the customer.
- The design uses a back-mounted heat chamber and one-end cart loading.

Heating architecture

- Heat source: electric resistance elements. Installed heater basis: 3 kW elements providing nominal 180 kW total.
- Heater control arranged in six independently wired heater banks.
- Backup contactors and solid-state relay control are used across the heater-bank architecture.

Airflow / recirculation architecture

- Airflow pattern: full horizontal airflow.
- Recirculation fan: New York Blower 208 PLR plug fan — 8,000 CFM at 2.5 in. w.c.; 7.5 HP motor; VFD-controlled speed.
- Exhaust fan: PQ65 exhauster — 255 CFM at 1 in. w.c.; 1 HP motor.
- Supply ductwork: four-sided, straight duct construction with adjustable discharge louvers for balancing and uniformity tuning.
- Return ductwork fabricated to complement the supply pattern and provide additional control of work-area airflow behavior.

Chamber / construction architecture

- Internal work chamber: 60 in W × 60 in D × 96 in H. Interior volume: 200 ft³ (5.66 m³).
- Wall system thickness: 8 inches. Insulation: 2 in of 8 lb Superwool (hot-face) backed by 6 in of 6 lb mineral wool.
- Interior wall material: 18 gauge 304 stainless steel. Exterior wall material: 3/16 in mild steel. Exterior finish: PQ Blue.
- The oven includes a 3-inch insulated floor designed to be bolted to the concrete foundation.

Door / access architecture

- Door style: 8-inch-thick bi-parting swing doors on one end.
- Door construction: triple-wall reinforced doors with structural reinforcement for hinges and hardware.
- Interior door surface: 304 stainless steel. Exterior door surface: mild steel.

Load-handling architecture

- Product handling concept: steel product cart with 17 shelf positions at 5-inch vertical centers.
- Tray envelope basis: 48 in × 48 in × 2.5 in.
- The cart design incorporates a two-piece reinforced concept with support-angle orientation intended to improve airflow around the load.

Controls architecture

- Operator temperature control: WATLOW F4T ramp/soak controller.
- Work-area overtemperature protection: Chromalox 6050 excess-temperature controller.
- PLC platform: Allen-Bradley Micro820. Recirculation fan drive: Allen-Bradley PowerFlex 525 VFD.
- Remote diagnostics: TOSIBOX Lock 150, supported by an unmanaged 5-port Ethernet switch connecting PLC, VFD, controller, and remote access device.
- The remote-diagnostics package provided practical operating visibility and troubleshooting support from a distance, with access to heater-bank current draw, temperature data, fan status, pressure-related signals, and safety-chain status.
- Additional instrumentation: Type J thermocouples; exhaust and recirculation airflow switches; work-area pressure transmitter; current transducers on all six heater banks; exhaust fan motor current transducer; 3-tier stack light and audible alarm.
- Control enclosures: Enclosure 1 — NEMA 1, 40 in × 30 in × 12 in (front of oven). Enclosure 2 — NEMA 1, 47 in × 56 in × 12 in (rear of oven).

Shipping / installation architecture

- The ovens were pre-assembled, pre-wired, and pre-tested prior to shipment.
- Each unit underwent fit-and-finish review and multi-point uniformity testing before release.
- The platform was developed for export deployment as part of an established repeat-order program.

TECHNICAL SPECIFICATIONS

Oven Configuration	
Type	High-temperature electrically heated batch oven
Quantity	3 identical ovens
Application	Zinc oxide powder processing for pharmaceutical and cosmetic applications
Program Context	Repeat-order platform; latest batch within a six-unit supply program
Internal Work Chamber	60 in W × 60 in D × 96 in H
Interior Volume	200 ft³ (5.66 m³)
Approx. Exterior Size	114 in W × 151 in L × 126 in H
Loading Style	One-end cart loading through bi-parting swing doors
Product Load Basis	Approx. 3,615 lb per batch
Heat Chamber Arrangement	Back-mounted heat chamber

Thermal Heat Power System	
Operating Temperature Range	662°F to 932°F (350°C to 500°C)
Maximum Operating Temperature	932°F (500°C)
Temperature Uniformity	±10.8°F (±6°C)
Heat Source	Electric resistance heating
Heater Element Basis	3 kW elements
Installed Heat Basis	Nominal 180 kW total

Documented Heater Bank Basis	6 banks × 29.4 kW per bank = 176.4 kW operating
Oven Classification	NFPA 86 Class B
VOC Basis	No VOCs allowable

Recirculation / Airflow System	
Airflow Pattern	Full horizontal airflow
Recirculation Fan	New York Blower 208 PLR plug fan
Recirculation Airflow	8,000 CFM
Recirculation Static Pressure	2.5 in. w.c.
Recirculation Fan Motor	7.5 HP
Fan Speed Control	Variable frequency drive
Supply Duct Construction	Straight four-sided ducting with adjustable balancing louvers

Exhaust System	
Exhaust Fan	PQ65 exhauster
Exhaust Airflow	255 CFM
Exhaust Static Pressure	1 in. w.c.
Exhaust Fan Motor	1 HP

Construction Materials / Shell System	
Wall Thickness	8 in
Insulation Layer 1	2 in of 8 lb Superwool (hot-face)
Insulation Layer 2	6 in of 6 lb mineral wool
Interior Wall Material	18 ga 304 stainless steel
Exterior Wall Material	3/16 in mild steel
Exterior Finish	PQ Blue
Interior Finish	Unpainted 304 stainless steel
Floor Construction	3 in thick insulated floor
Door Style	8 in thick bi-parting swing doors
Door Construction	Triple-wall reinforced door construction
Interior Door Surface	304 stainless steel
Exterior Door Surface	Mild steel

Load Handling	
Product Cart	Steel cart included in process basis
Shelf Positions	17
Shelf Vertical Centers	5 in
Tray Envelope Basis	48 in × 48 in × 2.5 in

Cart Configuration	Two-piece reinforced cart with airflow-oriented support geometry

Controls & Electrical

Temperature Controller	WATLOW F4T ramp/soak controller
Work-Area High-Limit	Chromalox 6050 excess-temperature controller
Thermocouple Type	Type J
PLC	Allen-Bradley Micro820
Recirculation VFD	Allen-Bradley PowerFlex 525
Remote Diagnostics	TOSIBOX Lock 150 remote diagnostics package
Airflow Proving	Exhaust and recirculation airflow switches
Pressure Monitoring	Work area vs. atmosphere pressure transmitter
Heater Monitoring	Current transducers on heater banks 1–6
Motor Monitoring	Exhaust fan motor current transducer
Remote Operating Visibility	Remote monitoring of heater-bank current draw, temperature, fan status, pressure-related signals, and critical oven functions
Status Indication	3-tier stack light and audible alarm
Control Enclosure 1	NEMA 1, 40 in × 30 in × 12 in (front of oven)
Control Enclosure 2	NEMA 1, 47 in × 56 in × 12 in (rear of oven)
Primary Power	415V / 3PH / 50Hz
Full Load Amperage	261.1 A

Process Summary

Product	Zinc oxide powder
Market / Application	Pharmaceutical and cosmetic materials processing
Process Type	High-temperature cart-loaded batch heat treatment
Export Basis	Export-configured electrical and control architecture for international installation
Repeat-Unit Context	Six total units supplied; this order representing the latest batch
Key Verification Concept	Repeatable control of temperature, airflow, heater output, and safe operating limits

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