



## CASE STUDY

# Electric Class A Cabinet Oven for Drying Water Slurries of Glass and Inorganic Powders

*Precision Quincy engineered this oven operation, as a 43D-350 electric Class A cabinet oven for controlled batch drying of water slurries of glass and inorganic powders. The delivered package combined 302°F operating conditions, full horizontal airflow, powered exhaust, programmable safety sequencing, and a rolling shelf-cart load system in a compact cabinet format suited for repeatable production drying.*



## OVERVIEW

The project was developed as a 43 Series horizontal-airflow cabinet oven for the customer operation. The customer is a specialty materials company with long-standing glass, ceramic, pigment, and inorganic materials capabilities, and this project supported a plant process centered on drying water slurries of glass and inorganic powders.

The oven was built around a 55 in W × 30 in D × 60 in H work chamber and a documented 302°F operating temperature with a 350°F maximum temperature and  $\pm 10^\circ\text{F}$  uniformity. The final design package shows an electric Class A configuration with 24 kW installed heat, a full horizontal airflow pattern, a powered exhaust system, and a side-mounted NEMA 1 control enclosure.

The loading concept used a 1000 lb capacity shelf cart with mixed-capacity shelves so the customer could handle variable batch heights and product arrangements inside a compact cabinet footprint. The thermal and safety package combined forced convection drying, Class A exhaust and purge sequencing, airflow proving, and excess-temperature protection to support repeatable batch processing.

This project resulted in a compact, front-loading cabinet oven configured for controlled drying of slurry-based material loads while maintaining the airflow, exhaust, and safety architecture required for dependable production use.

GA front / side view

Control enclosure view



## CUSTOMER PROCESS REQUIREMENTS

The project required a batch drying oven sized for controlled thermal processing of water slurries of glass and inorganic powders within a specialty materials manufacturing environment. The customer needed a compact cabinet platform that could support repeatable drying while accommodating variable product arrangements and maintaining safe operation.

**Application requirement**

- The system had to support batch drying of water-based slurry materials associated with glass and inorganic powder processing.
- The process required a controlled heated environment suitable for removing moisture from production loads without sacrificing repeatability.
- The customer required a cabinet-style batch oven rather than a larger walk-in format.

**Work chamber / loading requirement**

- Required work chamber: 55 in W × 30 in D × 60 in H.
- The oven had to support cart-based loading for flexible batch handling.
- The delivered cart had to support mixed shelf capacities for different product weights and loading arrangements.
- The final cart package provided 1000 lb total cart capacity with two 100 lb shelves and two 250 lb shelves.

**Operator / access requirement**

- The oven had to allow front loading and unloading through two swing doors.
- The floor and guide-track arrangement had to support repeatable cart positioning through the chamber.
- Product and fixture placement had to be arranged to minimize restriction of airflow through the load.

**Quality / control requirement**

- The customer required repeatable thermal drying performance at the defined process temperature.
- The oven had to maintain the stated work-zone temperature uniformity.
- The process required operator control over fan operation, purge completion, and heat enable.

**Safety / facility requirement**

- The delivered equipment had to use Class A exhaust and purge safety architecture.
- The oven had to include airflow proving and excess-temperature protection before heat could operate.
- The project required compatibility with 230V / 3PH / 60Hz plant power.
- GA front elevation
- Cart arrangement drawing

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**THERMAL / PHYSICAL PROCESS REQUIREMENTS**

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The project required a controlled forced-convection drying process based on horizontal airflow, electric heat input, moisture removal, and interlocked exhaust sequencing.

**Temperature requirement**

- Operating temperature basis: 302°F.
- Maximum temperature basis: 350°F.

- Required work-zone uniformity:  $\pm 10^{\circ}\text{F}$ .

### **Drying requirement**

- The process required removal of moisture from water slurry loads containing glass and inorganic powders.
- The thermal process depended on repeatable circulation of heated air across the load to support consistent drying from batch to batch.

### **Airflow / heat-transfer requirement**

- Airflow direction basis: full horizontal airflow.
- The process required forced-convection heat transfer across the chamber.
- Based on the documented recirculation airflow and the chamber cross-sectional area in the airflow direction, chamber air velocity was approximately 96 feet per minute.

### **Heat-input requirement**

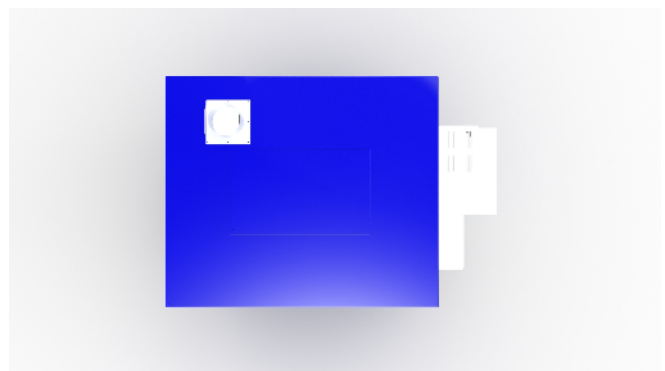
- Heat source: electric resistance heat.
- Installed heating capacity: 24 kW total.
- The heat system was divided into two independently switched 12 kW heater banks.

### **Ventilation / safety requirement**

- The thermal process required a powered exhaust system operating ahead of heat enable.
- The delivered exhaust basis was 225 CFM.
- The oven used Class A purge and airflow-proving logic before the heater banks could operate.
- The maximum documented volatile-load basis was 0.21 gal per batch.

### **Cooldown requirement**

- The process required continued fan operation during cooldown.
- The operating basis required that fans remain on until oven temperature dropped below  $250^{\circ}\text{F}$ .
- GA airflow view
- Wiring diagram sequence / safety logic area



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## EQUIPMENT CONCEPT & ARCHITECTURE

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To satisfy those requirements, Precision Quincy configured the project as a 43D-350 electric Class A cabinet oven with horizontal airflow, electric heater banks, powered exhaust, cart loading, and interlocked controls.

Pages 6–8 — Technical Specifications

### Overall concept

- One electric Class A cabinet oven.
- Compact front-loading batch configuration.
- Cart-loaded work chamber sized for variable batch drying.

### Heating architecture

- Heat source: electric resistance heat.
- Total installed heat: 24 kW.
- Heating split into two 12 kW heater banks.
- Each heater bank built from twelve 1000 W heating elements.
- Heater power controlled through solid-state relays with backup contactors.

### Airflow architecture

- Airflow pattern: full horizontal airflow.
- Recirculation system based on a Jan-Air radial blade assembly delivering 1200 CFM at 2 in. W.c.
- Recirculation fan motor: 1.5 HP.

### Exhaust / ventilation architecture

- Exhaust system based on a PQ1 exhauster delivering 225 CFM at 1 in. W.c.
- Exhaust fan motor: 0.75 HP.
- The oven included a fresh-air damper, purge timer, and airflow switches interlocked with the heating system.

### Chamber / shell architecture

- Internal work chamber: 55 in W × 30 in D × 60 in H.
- 2-inch-thick wall construction with 2 inches of 6 lb mineral wool insulation.
- Interior material: aluminized steel.
- Exterior finish: PQ blue.
- Control enclosure finish: ANSI 61 gray.
- The oven floor included cart guide tracks for repeatable cart positioning.

### Loading architecture

- Two swing doors for front access.

- Shelf cart with 1000 lb total capacity.
- Cart construction in unpainted mild steel with aluminized shelves.
- Shelf package included two 100 lb shelves and two 250 lb shelves.

**Controls architecture**

- Primary temperature controller: SSI 804.
- Work-area excess-temperature controller: Gefran 650L.
- Control enclosure: 42 in × 36 in × 12 in NEMA 1 enclosure.
- Operator interface included separate controls for exhaust fan, recirculation fan, and heater banks 1 and 2.
- The control package included purge complete, fan on, and heater-bank on indication.
- The enclosure also included an enclosure cooling fan.

**Safety architecture**

- Applicable design basis: NFPA 79, NFPA 86, and UL 508A open industrial control panel construction.
- Safety logic included exhaust airflow proving, recirculation airflow proving, timed purge before heat enable, and excess-temperature shutdown.
- Enclosure layout drawing
- GA overall view
- Cart arrangement drawing

## TECHNICAL SPECIFICATIONS

### Oven Configuration

|                       |                               |
|-----------------------|-------------------------------|
| Model                 | 43D-350                       |
| Type                  | Electric Class A cabinet oven |
| Quantity              | 1 oven                        |
| Airflow Pattern       | Full horizontal               |
| Work Chamber          | 55 in W × 30 in D × 60 in H   |
| Doors                 | 2 swing doors                 |
| Operating Temperature | 302°F                         |
| Maximum Temperature   | 350°F                         |
| Uniformity            | ±10°F                         |

### Heating System

|                |                                           |
|----------------|-------------------------------------------|
| Heat Source    | Electric resistance heat                  |
| Installed Heat | 24 kW total                               |
| Heater Banks   | 2 × 12 kW                                 |
| Element Basis  | 24 total elements, 1000 W each            |
| Heater Control | Solid-state relays with backup contactors |

### Recirculation / Airflow System

|                                |                                                |
|--------------------------------|------------------------------------------------|
| Airflow Pattern                | Full horizontal airflow                        |
| Recirculation Fan Assembly     | Jan-Air 12.188 in × 4 in radial blade assembly |
| Recirculation Airflow          | 1200 CFM                                       |
| Recirculation Static Pressure  | 2 in. W.c.                                     |
| Recirculation Fan Motor        | 1.5 HP                                         |
| Estimated Chamber Air Velocity | 96 FPM                                         |

## Exhaust / Safety Ventilation System

|                           |                                                             |
|---------------------------|-------------------------------------------------------------|
| Exhaust Fan               | PQ1 exhauster                                               |
| Exhaust Airflow           | 225 CFM                                                     |
| Exhaust Static Pressure   | 1 in. W.c.                                                  |
| Exhaust Fan Motor         | 0.75 HP                                                     |
| Oven Classification       | Class A                                                     |
| Documented VOC Load Basis | 0.21 gal/batch                                              |
| Safety Sequence           | Exhaust fan, recirculation fan, purge complete, heat enable |
| Cooldown Protection       | Fans remain on until below 250°F                            |

## Electrical / Controls

|                               |                                            |
|-------------------------------|--------------------------------------------|
| Electrical Service            | 230V / 3PH / 60Hz                          |
| Full Load Amperage            | Approximately 71 A                         |
| Control Enclosure             | NEMA 1                                     |
| Control Enclosure Size        | 42 in × 36 in × 12 in                      |
| Control Listing Basis         | UL 508A open industrial control panel      |
| Main Temperature Controller   | SSI 804                                    |
| Excess Temperature Controller | Gefran 650L                                |
| Airflow Proving               | Exhaust and recirculation airflow switches |
| Indicators                    | Purge complete, fan on, heater bank on     |
| Applicable Standards          | NFPA 79, NFPA 86, UL 508A                  |

## Construction / Materials

|                   |                           |
|-------------------|---------------------------|
| Wall Thickness    | 2 in                      |
| Insulation        | 2 in of 6 lb mineral wool |
| Interior Material | Aluminized steel          |
| Exterior Finish   | PQ blue                   |



|                                 |                   |
|---------------------------------|-------------------|
| <b>Control Enclosure Finish</b> | ANSI 61 gray      |
| <b>Approximate Oven Weight</b>  | 1450 lb           |
| <b>Design Elevation</b>         | Less than 1000 ft |

### Equipment Dimensions

|                                    |                   |
|------------------------------------|-------------------|
| <b>Overall Width</b>               | 84.67 in          |
| <b>Overall Depth</b>               | 38.02 in          |
| <b>Overall Height</b>              | 92.89 in          |
| <b>Oven Body Width</b>             | 70.00 in          |
| <b>Oven Body Depth</b>             | 32.00 in          |
| <b>Oven Body Height</b>            | 79.26 in          |
| <b>Floor to Top of Enclosure</b>   | 60.00 in          |
| <b>Exhaust Opening</b>             | 7.5 in × 3.375 in |
| <b>Door Swing Clearance</b>        | 35.64 in          |
| <b>Control Enclosure Clearance</b> | 36.00 in          |

### Cart / Loading System

|                             |                                              |
|-----------------------------|----------------------------------------------|
| <b>Cart Type</b>            | Shelf cart                                   |
| <b>Total Cart Capacity</b>  | 1000 lb                                      |
| <b>Shelf Package</b>        | Two 100 lb shelves and two 250 lb shelves    |
| <b>Cart Construction</b>    | Unpainted mild steel with aluminized shelves |
| <b>Overall Cart Width</b>   | 48.00 in                                     |
| <b>Overall Cart Depth</b>   | 26.00 in                                     |
| <b>Overall Cart Height</b>  | 58.00 in                                     |
| <b>Shelf Width</b>          | 44.43 in                                     |
| <b>Shelf Spacing</b>        | 9.84 in between shelves                      |
| <b>Floor to First Shelf</b> | 11.88 in                                     |

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**Caster Diameter**

6.00 in

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