



## CASE STUDY

# Electric Class A Cabinet Oven for Powder-Coating Cure of Steel Automotive Components

*Precision Quincy engineered this oven as a 40B-550 electric Class A cabinet oven for repeatable batch powder-coating cure of steel automotive components. The system combined full horizontal airflow, electric resistance heat, powered exhaust, and interlocked purge and safety controls in a compact cabinet format suited for controlled finishing operations within an automotive manufacturing environment.*



## OVERVIEW

The project was developed as a 40B-550 electric cabinet oven for the customer, part of an automotive manufacturing organization supporting vehicle-system production. The oven supported batch thermal processing of powder-coated steel components in a controlled front-loading cabinet format.

The delivered design centered on a 48 in W × 30 in D × 48 in H work chamber with an operating range of 125°C to 200°C, a maximum temperature of 550°F, and required work-zone uniformity of  $\pm 10^{\circ}\text{F}$ . To deliver that performance, Precision Quincy used a full horizontal airflow pattern, 31.5 kW of installed electric heat, a 1500 CFM recirculation system, and a 225 CFM powered exhauster within a Class A safety architecture.

The oven used 4-inch insulated wall construction, two swing doors, two 100 lb shelves, and a side-mounted NEMA 1 control enclosure. The control package included a standard temperature controller, independent excess-temperature protection, airflow proving, and timed purge logic to support safe, repeatable operation in daily production use.

This configuration delivered a compact and durable cure platform for steel part finishing while maintaining the airflow, temperature control, and safety functions required for consistent batch processing.

Overall GA view

Side view or front render



## CUSTOMER PROCESS REQUIREMENTS

The project required a compact batch oven for the controlled thermal processing of powder-coated steel components in an automotive manufacturing environment.

### Application requirement

- The oven had to support the batch curing of coated steel parts and associated fixtures.
- The process had to fit within a cabinet-oven footprint suited for production support work rather than a larger walk-in platform.

- The equipment had to provide repeatable thermal processing for steel loads associated with automotive component manufacturing.

**Work chamber and loading requirement**

- Required internal work chamber: 48 in W × 30 in D × 48 in H.
- The oven had to support shelf-loaded batch processing with flexible part and fixture arrangements.
- The standard shelf package included two 100 lb capacity shelves.
- Product and fixture placement had to preserve open airflow paths through the work chamber during use.

**Operator and access requirement**

- The oven had to allow front loading and unloading through two swing doors.
- The cabinet format had to support practical daily use in a production setting with straightforward operator access.
- The side-mounted controls package had to remain accessible for routine operation and maintenance.

**Quality requirement**

- The process required repeatable cure conditions across the specified operating range.
- The oven had to maintain  $\pm 10^{\circ}\text{F}$  work-zone uniformity for consistent thermal results.
- The system had to provide stable work-area temperature control for repeatable finishing performance.

**Safety and utility requirement**

- The customer required an electric Class A oven configuration with powered exhaust and purge protection.
- Required site power was 460V / 3PH / 60Hz.
- The process required a control system that would prove airflow and complete purge before heat could be enabled.
- Front elevation
- Door-open view
- Work chamber image

## **THERMAL / PHYSICAL PROCESS REQUIREMENTS**

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The project required a controlled batch curing process based on horizontal forced convection, electric heat input, and Class A ventilation sequencing.

**Temperature requirement**

- Operating temperature range:  $125^{\circ}\text{C}$  to  $200^{\circ}\text{C}$  ( $257^{\circ}\text{F}$  to  $392^{\circ}\text{F}$ ).
- Maximum temperature capability:  $550^{\circ}\text{F}$  ( $288^{\circ}\text{C}$ ).
- Required work-zone uniformity:  $\pm 10^{\circ}\text{F}$ .

### **Airflow and heat-transfer requirement**

- Airflow direction: full horizontal airflow.
- The process required forced convection across the work chamber to support even heating of shelf-loaded steel parts.
- Chamber air velocity was approximately 150 feet per minute, providing the heat-transfer rate needed for repeatable cure performance.

### **Heat-input requirement**

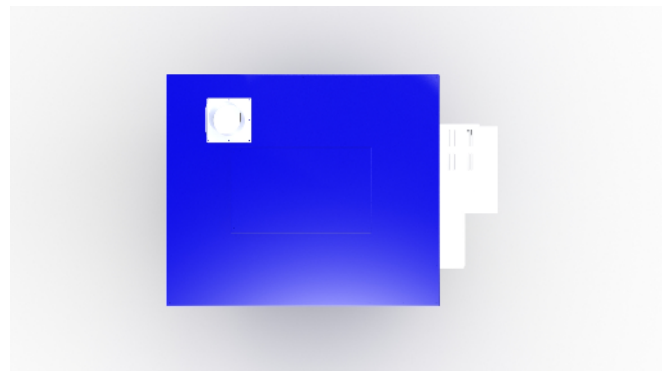
- Heat source: electric resistance heat.
- Installed heat: 31.5 kW.
- The thermal process required enough installed heat to bring loaded steel parts to cure temperature and hold the required operating range with controlled stability.

### **Ventilation and purge requirement**

- The oven required Class A exhaust and purge protection.
- Powered exhaust basis: 225 CFM.
- Minimum purge time: 3 minutes.
- Exhaust airflow and recirculation airflow both had to be proven before heat could be enabled.

### **Thermal safety requirement**

- The process required independent excess-temperature protection in addition to the main temperature controller.
- Heat had to shut off automatically if required safe operating conditions were not maintained.
- The oven required continued fan operation during cooldown, and the circulating air system remained in operation until the oven temperature dropped below 250°F.
- GA airflow view
- Wiring-diagram sequence area



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## EQUIPMENT CONCEPT & ARCHITECTURE

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To satisfy those requirements, Precision Quincy configured the project as a 40B-550 electric Class A cabinet oven with horizontal airflow, powered exhaust, flexible shelf loading, and an interlocked single-enclosure controls package.

Pages 6–8 — Technical Specifications

### Overall concept

- One electric Class A cabinet oven.
- Compact front-loading batch configuration.
- Shelf-loaded work chamber sized for flexible cure batches.

### Heating architecture

- Heat source: electric resistance heat.
- Installed heat: 31.5 kW.
- Heating system built around twenty-one 1.5 kW heating elements.
- Heater power was switched through solid-state relay control with a backup contactor arrangement.

### Airflow architecture

- Airflow pattern: full horizontal airflow.
- Recirculation system designed to deliver 1500 CFM at 2 in. W.c.
- Final motor selection used a 1.5 HP recirculation fan motor.
- Airflow proving protected the heat system by verifying recirculation performance before heat enable.

### Exhaust and ventilation architecture

- Class A exhaust system based on a PQ1 exhauster delivering 225 CFM at 1 in. W.c.
- Exhaust system used a 0.75 HP motor.
- Fresh-air intake and powered exhaust operated with purge timing and airflow switches as part of the oven safety sequence.

### Chamber and shell architecture

- Internal work chamber: 48 in W × 30 in D × 48 in H.
- Wall system: 4 in thick insulated construction.
- Insulation: 4 in of 6 lb mineral wool.
- Interior material: aluminized steel.
- Exterior finish: PQ Blue.
- Control enclosure finish: ANSI 61 gray.
- Approximate oven weight: 1,250 lb.

### **Door and loading architecture**

- Two swing doors for front access.
- Two 100 lb shelves for flexible batch loading.
- Insulated floor construction supported thermal stability and work-chamber durability.

### **Controls architecture**

- Main temperature controller: SSI-804.
- Excess-temperature controller: Gefran 650L.
- Control enclosure: NEMA 1 UL508A open industrial control panel.
- Control enclosure size: 42 in × 30 in × 12 in.
- Operator controls included separate fan and heat functions with visual status indication for purge complete, fan operation, and heater operation.

### **Safety architecture**

- Applicable design basis included NFPA 79, NFPA 86, and UL508A.
- Safety logic included:
  - Powered exhaust proving
  - Recirculation airflow proving
  - Timed purge before heat enable
- Independent excess-temperature shutdown
- Automatic heat shutdown if safe operating conditions were not met
- Enclosure layout
  - Side/front GA view
  - Work chamber view

## TECHNICAL SPECIFICATIONS

### Oven Configuration

|                 |                               |
|-----------------|-------------------------------|
| Model           | 40B-550                       |
| Type            | Electric Class A cabinet oven |
| Quantity        | 1 oven                        |
| Airflow Pattern | Full horizontal               |
| Work Chamber    | 48 in W × 30 in D × 48 in H   |
| Doors           | 2 swing doors                 |
| Shelves         | 2 × 100 lb capacity shelves   |

### Thermal and Heating System

|                               |                                   |
|-------------------------------|-----------------------------------|
| Operating Temperature Range   | 125°C to 200°C (257°F to 392°F)   |
| Maximum Temperature           | 550°F (288°C)                     |
| Uniformity                    | ±10°F                             |
| Heat Source                   | Electric resistance heat          |
| Installed Heat                | 31.5 kW                           |
| Element Basis                 | 21 × 1.5 kW elements              |
| Heater Control                | SSR with backup contactor         |
| Excess Temperature Protection | Independent high-limit controller |

### Recirculation and Airflow System

|                               |                         |
|-------------------------------|-------------------------|
| Airflow Pattern               | Full horizontal airflow |
| Recirculation Airflow         | 1500 CFM                |
| Recirculation Static Pressure | 2 in. W.c.              |
| Recirculation Motor           | 1.5 HP                  |
| Chamber Air Velocity          | Approximately 150 FPM   |

## Exhaust and Ventilation System

|                         |                                 |
|-------------------------|---------------------------------|
| Exhaust Fan             | PQ1 exhauster                   |
| Exhaust Airflow         | 225 CFM                         |
| Exhaust Static Pressure | 1 in. W.c.                      |
| Exhaust Motor           | 0.75 HP                         |
| Oven Classification     | Class A                         |
| Maximum VOC Basis       | 0.17 gal/batch (o-xylene basis) |
| Minimum Purge Time      | 3 minutes                       |
| Design Elevation        | Less than 1000 ft               |

## Construction and Materials

|                          |                           |
|--------------------------|---------------------------|
| Wall Thickness           | 4 in                      |
| Insulation               | 4 in of 6 lb mineral wool |
| Interior Material        | Aluminized steel          |
| Exterior Finish          | PQ Blue                   |
| Control Enclosure Finish | ANSI 61 gray              |
| Approximate Weight       | 1,250 lb                  |
| Floor Construction       | Insulated floor           |

## Controls and Electrical

|                               |                                      |
|-------------------------------|--------------------------------------|
| Main Temperature Controller   | SSI-804                              |
| Excess Temperature Controller | Gefran 650L                          |
| Control Enclosure             | NEMA 1                               |
| Enclosure Listing Basis       | UL508A Open Industrial Control Panel |
| Enclosure Size                | 42 in × 30 in × 12 in                |
| Power Supply                  | 460V / 3PH / 60Hz                    |
| Full Load Amps                | 44.9 A                               |



|                          |                                            |
|--------------------------|--------------------------------------------|
| <b>SCCR</b>              | 5,000 amps                                 |
| <b>Airflow Proving</b>   | Exhaust and recirculation airflow switches |
| <b>Purge Timer</b>       | Eagle BRE8A6                               |
| <b>Enclosure Cooling</b> | Panel cooling fan                          |

### Equipment Dimensions and Access

|                                           |          |
|-------------------------------------------|----------|
| <b>Overall Width</b>                      | 83.17 in |
| <b>Overall Depth</b>                      | 42.21 in |
| <b>Overall Height</b>                     | 86.73 in |
| <b>Oven Body Width</b>                    | 69.00 in |
| <b>Oven Body Depth</b>                    | 38.00 in |
| <b>Oven Body Height</b>                   | 73.10 in |
| <b>Work Area Width</b>                    | 48.00 in |
| <b>Work Area Depth</b>                    | 30.00 in |
| <b>Work Area Height</b>                   | 48.00 in |
| <b>Height to Top of Control Enclosure</b> | 52.00 in |
| <b>Door Swing Clearance</b>               | 35.00 in |
| <b>Control Enclosure Door Clearance</b>   | 36.00 in |
| <b>Heater Plug Service Clearance</b>      | 16.00 in |



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