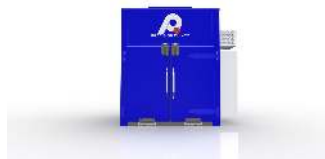
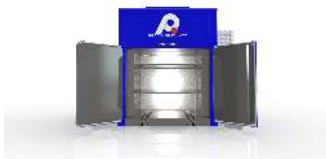




## CASE STUDY

# Electric Class A Cabinet Oven for Blade Component Curing

*Precision Quincy engineered this oven as a 43C-550 electric Class A cabinet oven for repeatable batch curing of blade components. The documented design basis combined 550°F maximum temperature capability, full horizontal airflow, 36 kW electric heat, powered Class A exhaust, and ramp/soak temperature control in a compact front-loading cabinet format.*



## OVERVIEW

The project was developed for the customer. The customer background indicated a business centered on aeroderivative turbine and package manufacturing, fast-start power generation, and lifecycle care / depot repair. The project documents identified the process as curing and the product as blades, so the oven likely supported blade-related component processing within that broader turbine-service environment.

The final design package was built around a 48 in W × 48 in D × 38 in H work chamber with a 150°F to 550°F operating range, a 550°F maximum temperature,  $\pm 10^\circ\text{F}$  uniformity, and a full horizontal airflow pattern. The final machine package used an electric Class A configuration with 36 kW installed heat, 1,500 CFM recirculation airflow, 225 CFM powered exhaust, and a Watlow F4T ramp/soak controller inside a NEMA 1 UL 508A open industrial control panel.

The oven used two front swing doors, an insulated floor with guide tracks, and a side-mounted control enclosure. The overall package supported controlled batch blade curing with programmable profiles, airflow proving, purge logic, and a straightforward cabinet layout for plant use.



## CUSTOMER PROCESS REQUIREMENTS

The project required a batch curing oven sized for blade-component processing in a power-generation equipment environment. Based on the documented product listing of blades and the broader customer context, the project likely supported blade-related part processing associated with aeroderivative turbine manufacturing, repair, or lifecycle-care work.

### Application requirement

- The process had to support batch curing of blade components.
- The oven had to accommodate blade parts and fixtures in a way that allowed repeatable heating without excessive airflow restriction.
- The customer needed a controlled batch process suitable for regular production use rather than informal heat-up work.

**Work chamber / loading requirement**

- Required work chamber: 48 in W × 48 in D × 38 in H.
- The oven had to allow front loading and unloading through two swing doors.
- Product and fixture positioning had to be arranged to minimize restrictions in airflow passage through the unit during use.

**Operator / maintenance requirement**

- Production, maintenance, and applications personnel needed a system that could be programmed, loaded, and maintained without an extended learning curve.
- Startup expectations included training on controls programming, proper loading, and maintenance requirements.

**Quality requirement**

- The process had to operate within the required temperature specification and support consistent curing results.
- The control package had to support programmable thermal cycles and repeatable operation during production integration.

**Safety / environmental requirement**

- The oven had to be configured as a Class A oven.
- The documented maximum volatile load basis was 0.17 gal/batch o-xylene.
- The project required a powered exhaust system, purge logic, and installation provisions compatible with NFPA 86 / NFPA 68 exhaust handling requirements.

**Site / utility requirement**

- Required electrical service: 460V / 3PH / 60Hz.
- The floor at point of use had to be non-combustible, rated for oven temperature, and flat to +/- 0.25 in.
- Utility hookups, permits, and local code compliance remained part of the site requirement.

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**THERMAL / PHYSICAL PROCESS REQUIREMENTS**

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The project required a moderate-to-high-temperature forced-convection curing process with programmable profile capability and Class A ventilation.

**Temperature requirement**

- Operating temperature basis: 150°F to 550°F.
- Maximum temperature basis: 550°F.
- Required work-zone uniformity: ±10°F.

**Airflow / heat-transfer requirement**

- Airflow direction basis: full horizontal airflow.

- The process required repeatable forced convection across the work chamber.
- Estimated chamber air velocity basis: approximately 118 FPM.

**Heat-input requirement**

- Heat source: electric resistance heat.
- Installed heat basis: 36 kW total.
- Heating arrangement basis: 24 elements at 1.5 kW each.

**Ventilation requirement**

- The process required Class A exhaust and purge sequencing.
- Powered exhaust basis: 225 CFM.
- Maximum volatile load basis: 0.17 gal/batch o-xylene.
- Minimum purge time basis: 4 minutes before heat enable.

**Control / sequencing requirement**

- Primary process-control basis: ramp/soak temperature control.
- Documented operating sequence required:
  - Start exhaust fan
  - Start recirculation fan
  - Complete timed purge
  - Enable heat
  - Run at setpoint or programmed profile
  - Safe operating conditions had to be proven before heat could remain energized.

**Cooldown requirement**

- The system supported a programmed shutdown profile for fan control.
- Fans had to remain on until the oven cooled to below 250°F.

**Thermal instrumentation basis**

- Work-area temperature sensing used Type J thermocouple instrumentation.
- Independent excess-temperature protection monitored the work area in parallel with the primary controller.



## EQUIPMENT CONCEPT & ARCHITECTURE

To satisfy those requirements, Precision Quincy configured the project as a 43C-550 electric Class A cabinet oven with one electric heat bank, horizontal recirculation airflow, powered exhaust, and a side-mounted control enclosure.

Pages 6–8 — Technical Specifications

### Overall concept

- One electric Class A cabinet oven.
- Front-loading batch configuration.
- 43 Series cabinet platform.

### Heating architecture

- Heat source: electric resistance heat.
- Total installed heat: 36 kW.
- Heating arrangement: one heat bank.
- Element basis: 24 × 1,500 W elements.
- Heat output was controlled through solid-state relays with a backup contactor.

### Airflow architecture

- Airflow pattern: full horizontal airflow.
- Recirculation system basis:
  - 9.94 in × 6 in FC fan wheel
  - 1,500 CFM at 2 in. W.c.
  - 1.5 HP motor
- The oven floor used guide tracks integrated into the insulated floor assembly.

### Exhaust / ventilation architecture

- Exhaust system basis:

- PQ1 exhauster
- 225 CFM at 1 in. W.c.
- 0.75 HP motor
- The oven used a fresh-air damper and Class A purge logic.
- Airflow switches monitored both exhaust and recirculation airflow before heat remained enabled.

**Chamber / shell architecture**

- Internal work chamber: 48 in W × 48 in D × 38 in H.
- Wall system: 4 in thick construction with 4 in of 6 lb mineral wool.
- Interior material: unpainted aluminized steel.
- Exterior finish: Traffic Gray (RAL 7042).
- Control enclosure finish: Gray (ANSI 61).
- Approximate oven weight: 1,400 lb.

**Door / access architecture**

- Two swing doors provided front access to the work chamber.
- Required clearance for door swing: 35 in.
- Required clearance at control enclosure: 36 in.

**Controls architecture**

- Primary temperature control: Watlow F4T ramp/soak controller.
- Excess-temperature protection: Gefran 650L.
- Control enclosure: NEMA 1 UL 508A open industrial control panel.
- Enclosure size: 36 in × 30 in × 12 in.
- Panel hardware included:
  - Non-fused disconnect
  - 350 VA control transformer
  - Solid-state relay package
  - Enclosure cooling fan
  - Purge complete indication
  - Exhaust fan and recirculation fan controls
  - Heater-bank on indication
  - Panel-mount USB port

**Safety architecture**

- Applicable standards basis: NFPA 79, NFPA 86, UL 508A.
- Safety logic included:
  - Exhaust airflow proving
  - Recirculation airflow proving

- Timed purge before heat enable
- Excess-temperature shutdown
- Heat shutdown if required safe operating conditions were not met
- Cooldown protection above 250°F

## TECHNICAL SPECIFICATIONS

### Oven Configuration

|                 |                               |
|-----------------|-------------------------------|
| Model           | 43C-550                       |
| Type            | Electric Class A cabinet oven |
| Airflow Pattern | Full horizontal               |
| Work Chamber    | 48 in W × 48 in D × 38 in H   |
| Doors           | 2 swing doors                 |
| Product Basis   | Blade components              |
| Process Basis   | Curing                        |

### Electrical System

|                         |                                       |
|-------------------------|---------------------------------------|
| Power Supply            | 460V / 3PH / 60Hz                     |
| Full Load Current       | 50.5 A                                |
| Main Disconnect         | 100 A non-fused disconnect            |
| Control Transformer     | 350 VA / 120V                         |
| SCCR                    | 5,000 amps                            |
| Control Enclosure       | NEMA 1                                |
| Enclosure Listing Basis | UL 508A Open Industrial Control Panel |
| Enclosure Size          | 36 in × 30 in × 12 in                 |

### Heating System

|                       |                          |
|-----------------------|--------------------------|
| Operating Temperature | 150°F to 550°F           |
| Maximum Temperature   | 550°F                    |
| Uniformity            | ±10°F                    |
| Heat Source           | Electric resistance heat |
| Installed Heat        | 36 kW                    |



|                       |                                         |
|-----------------------|-----------------------------------------|
| Heat Bank Arrangement | 1 heat bank                             |
| Element Basis         | 24 × 1,500 W @ 460V                     |
| Heater Control        | Solid-state relay with backup contactor |
| Work Thermocouple     | Type J                                  |

### Recirculation / Airflow System

|                                |                             |
|--------------------------------|-----------------------------|
| Airflow Pattern                | Full horizontal airflow     |
| Recirculation Fan Wheel        | 9.94 in × 6 in FC fan wheel |
| Recirculation Airflow          | 1,500 CFM                   |
| Recirculation Static Pressure  | 2 in. W.c.                  |
| Recirculation Fan Motor        | 1.5 HP                      |
| Estimated Chamber Air Velocity | ~118 FPM                    |

### Exhaust / Ventilation System

|                         |                         |
|-------------------------|-------------------------|
| Exhaust Fan             | PQ1 exhauster           |
| Exhaust Airflow         | 225 CFM                 |
| Exhaust Static Pressure | 1 in. W.c.              |
| Exhaust Fan Motor       | 0.75 HP                 |
| Fresh Air Device        | Fresh-air damper        |
| Maximum VOC Load        | 0.17 gal/batch o-xylene |
| Minimum Purge Time      | 4 minutes               |
| Oven Classification     | Class A                 |

### Construction

|                   |                            |
|-------------------|----------------------------|
| Wall Thickness    | 4 in                       |
| Insulation        | 4 in of 6 lb mineral wool  |
| Interior Material | Unpainted aluminized steel |

|                                 |                         |
|---------------------------------|-------------------------|
| <b>Exterior Finish</b>          | Traffic Gray (RAL 7042) |
| <b>Control Enclosure Finish</b> | Gray (ANSI 61)          |
| <b>Approximate Weight</b>       | 1,400 lb                |
| <b>Design Elevation</b>         | <1,000 ft               |

### Floor / Loading Geometry

|                                    |                                   |
|------------------------------------|-----------------------------------|
| <b>Floor Style</b>                 | Insulated floor with guide tracks |
| <b>Cart Track Center to Center</b> | 30.00 in                          |
| <b>Track Width</b>                 | 4.00 in                           |
| <b>Guide Width</b>                 | 2.00 in                           |
| <b>Guide Height</b>                | 1.00 in                           |
| <b>Insulated Floor Height</b>      | 2.89 in                           |
| <b>Floor Thickness</b>             | 0.18 in                           |

### Controls & Safety

|                                      |                                                                    |
|--------------------------------------|--------------------------------------------------------------------|
| <b>Main Temperature Controller</b>   | Watlow F4T ramp/soak                                               |
| <b>Excess Temperature Controller</b> | Gefran 650L                                                        |
| <b>Airflow Proving</b>               | Exhaust and recirculation airflow switches                         |
| <b>Purge Timer</b>                   | Eagle BRE8A6                                                       |
| <b>Indicators</b>                    | Purge complete, exhaust fan on, recirculation fan on, heat bank on |
| <b>Additional Panel Features</b>     | Enclosure cooling fan, panel USB port                              |
| <b>Applicable Standards Basis</b>    | NFPA 79, NFPA 86, UL 508A                                          |
| <b>Cooldown Protection</b>           | Fans remained on until oven temperature fell below 250°F           |

### Equipment Dimensions / Clearances

|                      |          |
|----------------------|----------|
| <b>Overall Width</b> | 82.68 in |
| <b>Overall Depth</b> | 60.46 in |

|                                           |                   |
|-------------------------------------------|-------------------|
| <b>Overall Height</b>                     | 76.91 in          |
| <b>Oven Body Width</b>                    | 67.18 in          |
| <b>Oven Body Depth</b>                    | 56.50 in          |
| <b>Oven Body Height</b>                   | 68.17 in          |
| <b>Height to Top of Control Enclosure</b> | 43.00 in          |
| <b>Door Swing Clearance</b>               | 35.00 in          |
| <b>Control Enclosure Clearance</b>        | 36.00 in          |
| <b>Exhaust Outlet Size</b>                | 3.375 in × 7.5 in |
| <b>Exhaust Outlet CL to Side of Oven</b>  | 19.85 in          |
| <b>Exhaust Outlet CL to Face of Oven</b>  | 50.23 in          |
| <b>Floor Anchors</b>                      | 4                 |



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