



CASE STUDY

Electric Cabinet Oven for Controlled Batch Curing of Serpentine Product

Precision Quincy engineered this oven as a 40D-550 electric cabinet oven for controlled batch curing of serpentine product at the customer's operation. The delivered equipment combined 400°F operating temperature, 550°F maximum temperature capability, full horizontal airflow, 24 kW electric heat, and multi-shelf batch loading in a compact cabinet format.



OVERVIEW

The project was developed for the customer (the customer), which served government and technical programs through engineering, integration, and mission-support work. At the site, the oven supported controlled batch curing of serpentine product in a technical operations environment requiring repeatable temperature control and flexible shelf loading.

The final equipment package was configured as a 40D-550 electric Class B cabinet oven with a 55 in W × 30 in D × 60 in H work chamber, 400°F operating temperature, 550°F maximum temperature, and $\pm 10^\circ\text{F}$ work-zone uniformity. The oven used full horizontal airflow, 24 kW of installed electric heat, and a 1.5 HP recirculation system delivering 1,500 CFM at 2 in. W.c.

The final design package also used a non-powered exhaust arrangement, 4-inch insulated wall construction, and a NEMA 1 UL508A open industrial control panel with SSI-804 temperature control, Gefran 650L excess-temperature protection, and separate operator control of the recirculation fan and heater banks. The result was a compact batch oven platform for repeatable curing work with flexible shelf loading and straightforward front access.



CUSTOMER PROCESS REQUIREMENTS

The project required a shelf-loaded batch oven for controlled curing of serpentine product in a technical operations environment. The customer needed a repeatable batch process that fit within a compact cabinet format while still allowing flexible product placement and multiple shelf elevations.

Application requirement

- The project required controlled batch curing of serpentine product.
- The oven supported a technical operating environment handling government- and engineering-related program work.
- The process required repeatable thermal performance for batch-loaded product rather than continuous conveyORIZED flow.

Work chamber / loading requirement

- Required internal work chamber: 55 in W × 30 in D × 60 in H.
- The customer required a chamber large enough for multi-shelf batch loading.
- The loading package included two 100 lb shelves and three 250 lb shelves.
- Total oven load basis was 750 lb maximum capacity.
- Product and fixture placement had to support open airflow passage through the work chamber.

Operator / access requirement

- The oven had to allow front loading and unloading through two swing doors.
- The loading arrangement had to support flexible shelf placement with 3-inch minimum shelf spacing, center to center.
- The installed layout had to allow clearance for door swing and control enclosure access.

Quality requirement

- The process required repeatable batch-to-batch curing performance.
- The customer required controlled temperature operation within the stated work-zone uniformity.
- The curing process needed a batch timer and temperature-control system suited for repeatable cycle execution.

Site / utility requirement

- Required electrical service: 230V / 3PH / 60Hz.
- Design elevation basis: less than 1,000 ft.
- Shipping and receiving access basis: 12 ft W × 16 ft H dock doors.

THERMAL / PHYSICAL PROCESS REQUIREMENTS

The project required a moderate-temperature batch curing process based on electric heat, full horizontal forced convection, and controlled cooldown protection.

Temperature requirement

- Operating temperature basis: 400°F.
- Maximum temperature capability: 550°F.
- Required work-zone uniformity: ±10°F.

Airflow / heat-transfer requirement

- Airflow direction basis: full horizontal airflow.
- The curing process required consistent horizontal forced-convection airflow across the shelf-loaded work chamber.
- The airflow pattern had to support even heat delivery across multiple shelf elevations within the chamber.

Heat-input requirement

- Heat source: electric resistance heat.
- Installed heat basis: 24 kW total.
- Heating was divided into two 12 kW heater banks.
- The heat system had to provide controlled temperature rise and stable setpoint holding for the curing cycle.

Ventilation / chamber requirement

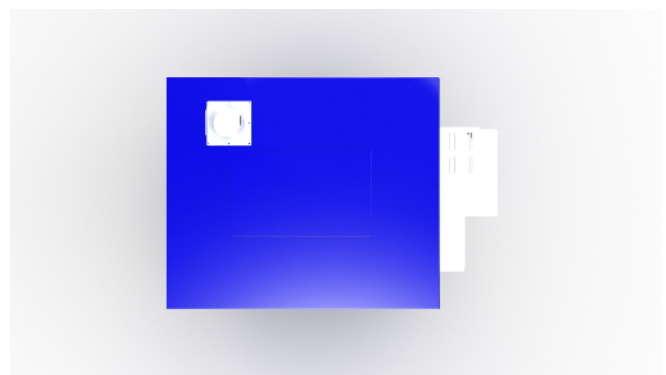
- The process used a non-powered exhaust arrangement with a fresh-air inlet integrated into the oven body.
- The curing application was defined on a Class B, no-VOC load basis.

Control / cycle requirement

- The process required a work-area temperature controller, excess-temperature protection, and a heat cycle timer.
- The batch cycle had to turn heat off at the end of the timed cycle while preserving controlled cooldown behavior.

Cooldown requirement

- The recirculation fan had to remain in operation during cooldown until oven temperature fell below 250°F.
- The control system included fan-shutdown logic tied to the oven temperature falling below that threshold.



EQUIPMENT CONCEPT & ARCHITECTURE

To satisfy those requirements, Precision Quincy configured the project as a 40D-550 electric Class B cabinet oven with horizontal airflow, multi-shelf loading, side-mounted controls, and interlocked electric heat.

Pages 6–8 — Technical Specifications

Overall concept

- One electric cabinet batch oven.

- Class B curing configuration.
- Front-loading, shelf-loaded chamber sized for flexible batch placement.

Heating architecture

- Heat source: electric resistance heat.
- Total installed heat: 24 kW.
- Heating split into two 12 kW heater banks.
- Each heater bank used twelve 1000 W elements at 230V.
- Heater power was controlled through solid-state relays with backup contactors.

Airflow architecture

- Airflow pattern: full horizontal airflow.
- Recirculation system used a Jan-Air 9.94 × 6 FC fan assembly.
- Recirculation performance was 1,500 CFM at 2 in. W.c. With a 1.5 HP motor.
- The oven used a roof-mounted fresh-air inlet and a 6 in × 6 in exhaust opening with non-powered exhaust.

Chamber / shell architecture

- Internal work chamber: 55 in W × 30 in D × 60 in H.
- Wall system: 4-inch-thick insulated construction.
- Insulation: 4 in of 6 lb mineral wool.
- Interior material: unpainted aluminized steel.
- Exterior finish: PQ Blue (RAL 5005).
- Control panel finish: gray (ANSI 61).
- The oven body included four floor anchors.

Door / loading architecture

- Two swing doors at the front of the oven.
- Shelf package included two 100 lb shelves and three 250 lb shelves.
- Shelf arrangement used 3-inch minimum spacing, center to center.
- Maximum oven load basis was 750 lb.

Controls architecture

- Primary temperature controller: Super Systems SSI-804.
- Excess-temperature controller: Gefran 650L.
- Thermocouples: Type J work-area thermocouples.
- Control enclosure: NEMA 1 UL508A open industrial control panel.
- Enclosure size: 42 in × 36 in × 12 in.
- Operator controls included recirculation fan start/stop and independent heater-bank switches with status indication.

- The enclosure also included an enclosure cooling fan and internal power distribution, disconnect, motor protection, and relay hardware.

Safety architecture

- Applicable standards basis: NFPA 79, NFPA 86, UL508A.
- Safety logic included:
- Recirculation airflow proving
- Excess-temperature shutdown
- Heat shutdown if safe operating conditions were not met
- Controlled fan shutdown below 250°F

Installation / access architecture

- Controls were mounted on the side enclosure face.
- Required access included 36-inch door swing clearance and 36-inch control enclosure clearance.
- Shipping and receiving basis used 12 ft W × 16 ft H dock doors.

TECHNICAL SPECIFICATIONS

Oven Configuration

Model	40D-550
Type	Electric Class B cabinet oven
Quantity	1 oven
Application	Controlled batch curing of serpentine product
Work Chamber	55 in W × 30 in D × 60 in H
Airflow Pattern	Full horizontal
Door Style	Two swing doors

Thermal / Electrical System

Operating Temperature	400°F
Maximum Temperature	550°F
Uniformity	±10°F
Heat Source	Electric resistance heat
Installed Heat	24 kW total
Heater Banks	2 × 12 kW
Element Basis	24 total elements, 1000 W each @ 230V
Power Supply	230V / 3PH / 60Hz
Full Load Amps	67.8 A
SCCR	5,000 amps
Design Elevation	<1,000 ft

Recirculation / Ventilation System

Recirculation Fan Assembly	Jan-Air 9.94 × 6 FC
Recirculation Airflow	1,500 CFM @ 2 in. W.c.

Recirculation Fan Motor	1.5 HP
Exhaust Arrangement	Non-powered exhaust
Exhaust Opening	6 in × 6 in
Fresh Air Inlet	Roof-mounted
Load Basis	Class B / no-VOC load basis

Construction / Loading

Wall Construction	4 in thick walls
Insulation	4 in of 6 lb mineral wool
Interior Material	Unpainted aluminized steel
Exterior Finish	PQ Blue (RAL 5005)
Control Panel Finish	Gray (ANSI 61)
Approximate Weight	1,600 lb
Shelves Included	2 × 100 lb shelves; 3 × 250 lb shelves
Maximum Oven Capacity	750 lb
Minimum Shelf Spacing	3 in center to center

Controls / Safety

Temperature Controller	Super Systems SSI-804
Excess Temperature Controller	Gefran 650L
Thermocouples	Type J
Control Enclosure	NEMA 1
Enclosure Listing Basis	UL508A Open Industrial Control Panel
Enclosure Size	42 in × 36 in × 12 in
Heater Control	SSRs with backup contactors
Airflow Proving	Recirculation airflow switch
Cooldown Protection	Fan shutdown below 250°F

Applicable Standards	NFPA 79, NFPA 86, UL508A
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Equipment Dimensions / Site Basis

Overall Width	90.83 in
Overall Depth	42.30 in
Overall Height	90.54 in
Oven Body Width	77.17 in
Oven Body Depth	38.08 in
Oven Body Height	85.14 in
Control Enclosure Height	60.00 in
Door Swing Clearance	36.00 in radius
Control Enclosure Clearance	36.00 in radius
Floor Anchors	4 locations
Shipping Dock Door Size	12 ft W × 16 ft H
Receiving Dock Door Size	12 ft W × 16 ft H

Process Summary

Product	Serpentine product
Process Type	Batch curing
Load Style	Shelf-loaded batch process
Primary Process Controls	Temperature control, timer-based batch cycle, controlled cooldown



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