PRECISION QUINCY

CASE STUDY

Electric Class A Cabinet Oven for EMI/RFI Shielding Product Batch Processing

Precision Quincy engineered this oven as a 40D-350 electric Class A cabinet oven for repeatable shelf-loaded batch thermal processing in an EMI/RFI shielding manufacturing environment. The documented design basis combined 350°F operation, full horizontal airflow, 24 kW electric heat, powered Class A exhaust, and programmable ramp/soak control in a compact cabinet format.

OVERVIEW

The project was developed as a 40D-350 electric cabinet oven for the customer, a manufacturer of EMI/RFI shielding products, custom shielding gaskets, and related shielding materials. The oven was built around a 55 in W × 30 in D × 60 in H work chamber with a 350°F operating / maximum temperature, ±10°F uniformity, and a full horizontal airflow pattern.

The final design package shows an electric Class A configuration with a PQ1 powered exhauster, 24 kW installed heat, and a Watlow F4T ramp/soak controller in a NEMA 1 UL508A open industrial control panel. The package also included a 12-inch stand, two swing doors, and a shelf arrangement with one 500 lb bottom shelf, one 250 lb shelf, and two 100 lb shelves.

From the documented source package and customer background, this project was a compact batch oven package for controlled shelf-loaded processing of shielding-related products or materials in a manufacturing environment that required Class A exhaust and purge logic, flexible internal loading, and factory-finished controls.

CUSTOMER PROCESS REQUIREMENTS

The project required a shelf-loaded batch oven sized for controlled thermal processing in a compact production format. Based on the source package and customer background, the oven supported an EMI/RFI shielding manufacturing environment involving shielding products, shielding gaskets, conductive shielding materials, or related fabricated shielding components.

Application requirement

- The project required a batch process oven for shielding-related production work.
- The oven had to support shelf-loaded product or fixtures in a manufacturing environment handling custom or variable product forms.
- The work area had to be large enough to handle multiple load arrangements within one cabinet chamber.

Work chamber / loading requirement

- Required work chamber: 55 in W × 30 in D × 60 in H.

- The oven needed to support multiple shelf elevations for different product heights and batch arrangements.
- The documented shelf package included one 500 lb bottom shelf, one 250 lb shelf, and two 100 lb shelves.
- Maximum shelved oven capacity had to be 750 lb evenly distributed.

Operator / access requirement

- The oven had to allow front loading and unloading through two swing doors.
- The loading arrangement had to work with a 12-inch stand for practical loading height.
- Trays, product positioning, and fixturing had to be arranged to minimize airflow restriction through the oven.

Quality / control requirement

- The customer needed repeatable thermal processing within the stated work-zone uniformity.
- The process required programmable temperature control for defined thermal cycles.
- The machine had to arrive factory wired, tested, temperature surveyed, and balanced before shipment.

Safety / environmental requirement

- The oven had to be configured as a Class A oven.
- The documented maximum volatile load basis was 0.21 gal/batch o-xylene.
- The customer process required powered exhaust and purge logic for safe handling of volatile, toxic, or otherwise undesirable fumes.

Site / utility requirement

- Required electrical service: 230V / 3PH / 60Hz.
- Shipping and receiving dock door basis: 12 ft W × 16 ft H.

THERMAL / PHYSICAL PROCESS REQUIREMENTS

The project required a controlled moderate-temperature batch heating process based on horizontal forced convection, Class A ventilation, and programmable heat control.

Temperature requirement

- Operating temperature basis: 350°F.
- Maximum temperature basis: 350°F.
- Required work-zone uniformity: ±10°F.

Airflow / heat-transfer requirement

- Airflow direction basis: full horizontal airflow.
- The process required forced-convection heating across the work chamber.

- Using the documented recirculation airflow and the chamber cross-sectional area in the airflow direction, the first-pass chamber air velocity is approximately 96 FPM.

Heat-input requirement

- Heat source: electric resistance heat.
- Installed heat basis: 24 kW total.
- Heating arrangement basis: two 12 kW heater banks.
- The process required controlled heater-bank operation through the temperature-control system.

Ventilation requirement

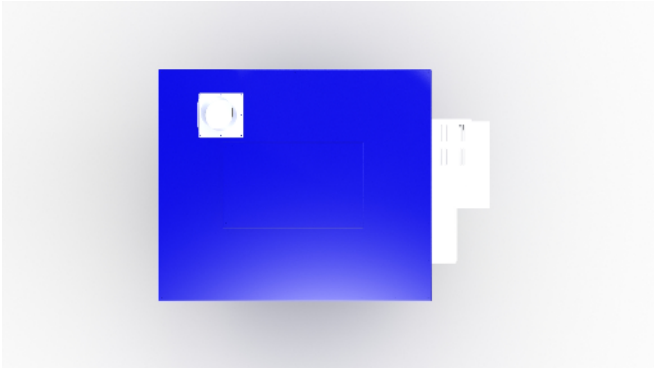
- The process required Class A exhaust and purge sequencing.
- Powered exhaust basis: 225 CFM.
- Maximum volatile load basis: 0.21 gal/batch o-xylene.
- The process required ventilation to be proven before heat could be enabled.

Control / sequencing requirement

- Primary control basis: ramp/soak temperature control.
- Minimum purge time basis: 3 minutes.
- Documented operating sequence:
- Start exhaust fan.
- Start recirculation fan.
- Complete purge.
- Turn on heater bank(s).
- Run at temperature or programmed profile.

Cooldown requirement

- The process required continued fan operation during cooldown.
- The source package states that fans are not to be shut down while oven temperature is above 250°F.



EQUIPMENT CONCEPT & ARCHITECTURE

To satisfy those requirements, Precision Quincy configured the project as a 40D-350 electric Class A cabinet oven with horizontal airflow, powered exhaust, flexible shelving, and interlocked controls.

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 batch loading.

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 elements.
- Heater power controlled through solid-state relays with backup contactors.

Airflow architecture

- Airflow pattern: full horizontal airflow.
- Recirculation system based on an RB fan assembly delivering 1200 CFM at 2 in. W.c..
- Final drawing package identifies adjustable louver openings for airflow setup.

Exhaust / ventilation architecture

- Class A exhaust based on a PQ1 exhauster delivering 225 CFM.
- Fresh-air damper integrated into the oven body.
- Purge timer and airflow switches interlocked with the heat system.

Chamber / shell architecture

- Internal work chamber: 55 in W × 30 in D × 60 in H.
- 2-inch insulated wall construction.
- Insulation: 2 in of 6 lb mineral wool.
- Interior: unpainted aluminized steel.
- Exterior finish: PQ Blue.
- Control enclosure finish: ANSI 61 gray.
- Approximate oven weight: 1450 lb.

Door / loading architecture

- Two swing doors.

- 12-inch oven stand.
- Shelf package includes one 500 lb bottom shelf, one 250 lb shelf, and two 100 lb shelves.
- Shelf adjustment based on 3-inch centers.

Controls architecture

- Watlow F4T ramp/soak controller for primary temperature control.
- Gefran 650L for excess-temperature protection.
- NEMA 1 UL508A open industrial control panel.
- Separate operator controls for exhaust fan, recirculation fan, and each heater bank.
- Panel includes purge complete, fan on, and heater-bank on indication.
- Enclosure layout includes cooling fan and panel-mount USB port.

Safety architecture

- Applicable standards basis: NFPA 79, NFPA 86, UL508A.
- Safety logic includes:
- Exhaust airflow proving
- Recirculation airflow proving
- Timed purge before heat enable
- Excess-temperature shutdown
- Heat shutdown if required safe operating conditions are not met

Shipping / installation architecture

- Proposal package states the oven is shipped assembled on 4x4 lumber or larger as required and shipped on a flatbed truck.
- Shipping basis is FOB Origin / PPA.

TECHNICAL SPECIFICATIONS

Oven Configuration	
Model	40D-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
Stand	12 in oven stand

Electrical System	
Power Supply	230V / 3PH / 60Hz
Full Load Amps	71.0 A
Control Enclosure	NEMA 1
Enclosure Listing Basis	UL508A Open Industrial Control Panel
Enclosure Size	42 in × 36 in × 12 in
SCCR	5,000 amps

Heating System	
Operating Temperature	350°F
Maximum Temperature	350°F
Uniformity	±10°F
Heat Source	Electric
Installed Heat	24 kW
Heater Banks	2 × 12 kW
Element Basis	24 total elements, 1000 W each

Heater Control	SSRs with backup contactors

Recirculation / Airflow System

Airflow Pattern	Full horizontal airflow
Recirculation Fan Performance	1200 CFM at 2 in. W.c.
Recirculation Fan Motor	1.5 HP
Estimated Chamber Air Velocity Basis	~96 FPM

Exhaust / Ventilation System

Exhaust Fan	PQ1 exhauster
Exhaust Airflow	225 CFM
Exhaust Fan Motor	0.75 HP
Minimum Purge Time	3 minutes
Maximum VOC Load	0.21 gal/batch o-xylene
Oven Classification	Class A

Construction

Wall Thickness	2 in
Insulation	2 in of 6 lb mineral wool
Interior Material	Unpainted aluminized steel
Exterior Finish	PQ Blue
Control Enclosure Finish	ANSI 61 gray
Approximate Weight	1450 lb
Design Elevation	<1000 ft

Shelving / Loading

Bottom Shelf	500 lb capacity

Intermediate Shelf	250 lb capacity
Upper Shelves	2 × 100 lb capacity
Shelf Slotting	3 in centers
Maximum Shelved Capacity	750 lb evenly distributed
Height from Floor to Top of 500 lb Shelf	22.23 in

Controls & Safety

Main Temperature Controller	Watlow F4T ramp/soak
Excess Temperature Controller	Gefran 650L
Airflow Proving	Exhaust and recirculation airflow switches
Indicators	Purge complete, fan on, heater bank on
Fan Shutdown Protection	Do not shut down fans above 250°F
Applicable Standards Basis	NFPA 79, NFPA 86, UL508A

Equipment Dimensions

Overall Width	82.45 in
Overall Depth	44.80 in
Overall Height	105.13 in
Oven Body Width	65.00 in
Oven Body Depth	32.00 in
Oven Body Height	80.76 in
Height to Top of Control Enclosure	69.00 in
Work Area Bottom Above Floor	14.09 in

Shipping / Receiving Basis

Shipping Dock Door Size	12 ft W × 16 ft H
Receiving Dock Door Size	12 ft W × 16 ft H

Shipment Basis	Oven shipped assembled on flatbed truck
Freight Terms	FOB Origin / PPA

PRECISION QUINCY

MAKE BADASS PRODUCTS

pqovens.com