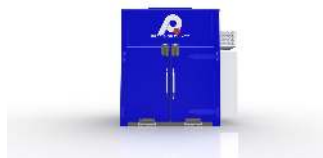




CASE STUDY

Electric Class B Cabinet Oven for Soils and Aggregate Sample Thermal Processing

Precision Quincy engineered this oven as a 40D-350 electric Class B cabinet oven for controlled batch thermal processing of soils and aggregate samples in pans and bowls. The delivered design combined 140°F to 230°F operating capability, full horizontal airflow, 12 kW electric heat, and a compact floor-standing cabinet format for repeatable work in a transportation materials testing environment.



OVERVIEW

The project was developed for the the customer in. The project fit within the customer broader materials-testing work, including standardized procedures and soils-and-aggregates evaluation that supported the transportation system. Within that context, this oven was built to support controlled batch heating of sample materials used in lab testing work.

The oven was built around a 55 in W × 30 in D × 60 in H work chamber with an operating range of 140°F to 230°F, a 350°F maximum temperature, and $\pm 10^\circ\text{F}$ uniformity. The final configuration used full horizontal airflow, 12 kW electric resistance heat, non-powered exhaust, and a 12.19 × 4 RB recirculation fan assembly delivering 1,200 CFM at 2 in. W.c. With a 1.5 HP motor.

Controls were packaged in a side-mounted NEMA 1 UL 508A open industrial control panel using an SSI 804 temperature controller, Gefran 650L excess-temperature controller, and Type J thermocouples. The oven also included two 100 lb shelves, a 12-inch stand, and a Traffic Gray / ANSI 61 finish package suited to a compact laboratory installation.

The final load basis remained Class B, with no VOCs allowed. The design emphasized repeatable convection heating, straightforward local operation, and practical service access for routine batch use.



CUSTOMER PROCESS REQUIREMENTS

The project required a compact batch oven for controlled thermal processing of soils and aggregate samples in pans and bowls as part of transportation materials testing activity.

Application requirement

- The project required controlled batch heating of soils and aggregate samples.
- The oven had to support a laboratory environment handling sample pans and bowls rather than large production fixtures.
- The batch format had to accommodate varying sample quantities and loading arrangements within one chamber.

Work chamber / loading requirement

- Required work chamber: 55 in W × 30 in D × 60 in H.
- The loading arrangement had to support shelf-loaded samples across multiple elevations.
- Two 100 lb capacity shelves were included for flexible pan and bowl placement.

Operator / access requirement

- The oven had to allow front loading and unloading through two swing doors.
- The 12 in stand had to position the chamber at a practical working height for routine lab handling.
- Loading practices had to preserve airflow passages through the chamber.

Quality / control requirement

- The customer required repeatable sample processing within the stated operating range and work-zone uniformity.
- The process needed straightforward local control and visible operating status for day-to-day laboratory use.
- The oven had to support consistent handling of batch sample loads without forcing a single fixed load arrangement.

Safety / process basis

- The application used a Class B load basis.
- The process basis did not allow VOC-bearing loads.

Site / utility requirement

- Required electrical service: 208V / 3PH / 60Hz.
- Design elevation basis: less than 1,000 ft.

THERMAL / PHYSICAL PROCESS REQUIREMENTS

The project required controlled low-to-moderate-temperature forced-convection heating suited to batch sample processing in pans and bowls.

Temperature requirement

- Operating temperature basis: 140°F to 230°F.
- Maximum temperature basis: 350°F.
- Required work-zone uniformity: ±10°F.

Airflow / heat-transfer requirement

- Airflow direction basis: full horizontal airflow.
- Estimated chamber air velocity through the work zone was approximately 96 FPM.
- The airflow had to provide even convective heat transfer across shelf-loaded samples.

Heat-input requirement

- Heat source: electric resistance heat.
- Installed heat basis: 12 kW total.
- Heating arrangement basis: one heater bank built from twelve 1000 W elements.

Ventilation requirement

- Exhaust basis: non-powered exhaust with a dedicated fresh-air opening.
- Process classification basis: Class B.
- Volatile load basis: no VOCs allowed.

Control / sequencing requirement

- The thermal process used a dedicated work-area temperature controller and separate excess-temperature protection.
- Documented operating sequence:
 - Start recirculation fan.
 - Turn on heater bank.
 - Run at desired set point.
- The heating circuit shut off whenever required safe operating conditions were not met.

Cooldown requirement

- The recirculation fan remained in operation during cooldown.
- Fan shutdown was delayed until oven temperature fell below 250°F.



EQUIPMENT CONCEPT & ARCHITECTURE

To satisfy those requirements, Precision Quincy configured the project as a 40D-350 electric Class B cabinet oven with full horizontal airflow, a side-mounted control enclosure, and a floor-standing cabinet arrangement with a 12-inch stand.

Pages 6–8 — Technical Specifications

Overall concept

- One electric Class B cabinet oven.
- Compact front-loading batch configuration.
- Shelf-loaded work chamber sized for sample pans and bowls.

Heating architecture

- Heat source: electric resistance heat.
- Total installed heat: 12 kW.
- Heating was provided by one heat bank built from twelve 1000 W elements at 208V.
- Heater power was controlled through a solid state relay with a backup contactor.

Airflow architecture

- Airflow pattern: full horizontal airflow.
- Recirculation system used a 12.19 × 4 RB fan assembly delivering 1,200 CFM at 2 in. W.c.
- Recirculation fan motor: 1.5 HP.
- The chamber included a fresh-air opening and 6 in × 6 in exhaust outlet.

Chamber / shell architecture

- Internal work chamber: 55 in W × 30 in D × 60 in H.
- Wall system: 2 in thick insulated construction with 2 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: 1,450 lb.

Door / loading architecture

- Two swing doors at the loading face.
- Two 100 lb shelves.
- 3 in typical shelf spacing.
- 12 in oven stand integrated into the floor-standing arrangement.

Controls architecture

- SSI 804 work-area temperature controller.
- Gefran 650L excess-temperature controller.
- Type J thermocouples for work-area sensing.
- 42 in × 30 in × 12 in NEMA 1 control enclosure.
- Local operator controls for recirculation fan and heater bank, plus operating status indication.
- 60A non-fused disconnect and enclosure cooling fan were included in the control package.

Safety architecture

- Applicable standards basis: NFPA 79, NFPA 86, UL 508A.
- Safety logic included recirculation airflow proving, excess-temperature shutdown, and heater shutdown when safe operating conditions were not met.
- The control package maintained fan operation until the oven cooled below 250°F.

Service / installation architecture

- 36 in door swing at the oven face.
- 36 in control enclosure door swing clearance.
- 6 in fan removal clearance.
- 15 in heater plug removal clearance.

TECHNICAL SPECIFICATIONS

Oven Configuration

Model	40D-350
Type	Electric Class B cabinet oven
Quantity	1 oven
Application	Soils and aggregate samples in pans and bowls
Process	Testing / batch thermal processing
Airflow Pattern	Full horizontal airflow
Work Chamber	55 in W × 30 in D × 60 in H
Doors	2 swing doors
Stand	12 in oven stand

Electrical System

Power Supply	208V / 3PH / 60Hz
Full Load Amps	41.6 A
Control Enclosure	NEMA 1
Enclosure Listing Basis	UL 508A Open Industrial Control Panel
Enclosure Size	42 in × 30 in × 12 in
SCCR	5,000 amps
Main Disconnect	60A non-fused disconnect switch
Transformer	350VA / 120V

Heating System

Operating Temperature	140°F to 230°F
Maximum Temperature	350°F
Uniformity	±10°F

Heat Source	Electric resistance
Installed Heat	12 kW
Heater Banks	1
Element Basis	12 elements × 1000W @ 208V
Heater Control	Solid state relay with backup contactor

Recirculation / Airflow System

Airflow Pattern	Full horizontal airflow
Recirculation Fan	12.19 × 4 RB fan assembly
Recirculation Performance	1,200 CFM at 2 in. W.c.
Recirculation Fan Motor	1.5 HP
Recirculation Motor FLA	6.6 A
Estimated Chamber Air Velocity	~96 FPM

Ventilation / Classification

Classification	Class B
Exhaust Configuration	Non-powered exhaust
Exhaust Outlet	6 in × 6 in
Fresh Air Opening	Included
VOC Basis	No VOCs allowed

Construction

Wall Thickness	2 in
Insulation	2 in of 6 lb mineral wool
Interior Material	Unpainted aluminized steel
Exterior Finish	Traffic Gray (RAL 7042)
Control Enclosure Finish	Gray (ANSI 61)

Approximate Weight	1,450 lb
Design Elevation	<1,000 ft

Shelving / Loading

Shelf Quantity	2
Shelf Capacity	100 lb each
Shelf Spacing	3 in typical
Shelf Thickness	1 in
Height to Bottom Shelf	17.84 in
Height to Work Area Bottom	14.09 in

Controls & Safety

Main Temperature Controller	SSI 804
Excess Temperature Controller	Gefran 650L
Thermocouples	Type J
Airflow Proving	Recirculation airflow switch
Indicators	Recirculation fan on / heat bank on
Fan Shutdown Protection	Fans remain on until below 250°F
Applicable Standards Basis	NFPA 79, NFPA 86, UL 508A

Equipment Dimensions

Overall Width	83.28 in
Overall Depth	43.01 in
Overall Height	96.30 in
Oven Body Width	66.63 in
Oven Body Depth	35.10 in
Oven Body Height	91.26 in

Height to Top of Control Enclosure	68.01 in
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Service / Installation Clearances

Oven Door Swing	36 in
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Control Enclosure Door Swing Clearance	36 in
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Fan Removal Clearance	6 in
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Heater Plug Removal Clearance	15 in
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Shipping Dock Door Size	12 ft W × 16 ft H
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Receiving Dock Door Size	12 ft W × 16 ft H
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Process Summary

Market / Application	Transportation materials testing
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Product	Soils and aggregate samples in pans and bowls
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Process Type	Controlled batch thermal processing for testing support
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Key Thermal Basis	140°F to 230°F forced-convection operation with ±10°F uniformity
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Key Verification Concept	Repeatable temperature control, airflow delivery, and protected cooldown sequencing
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