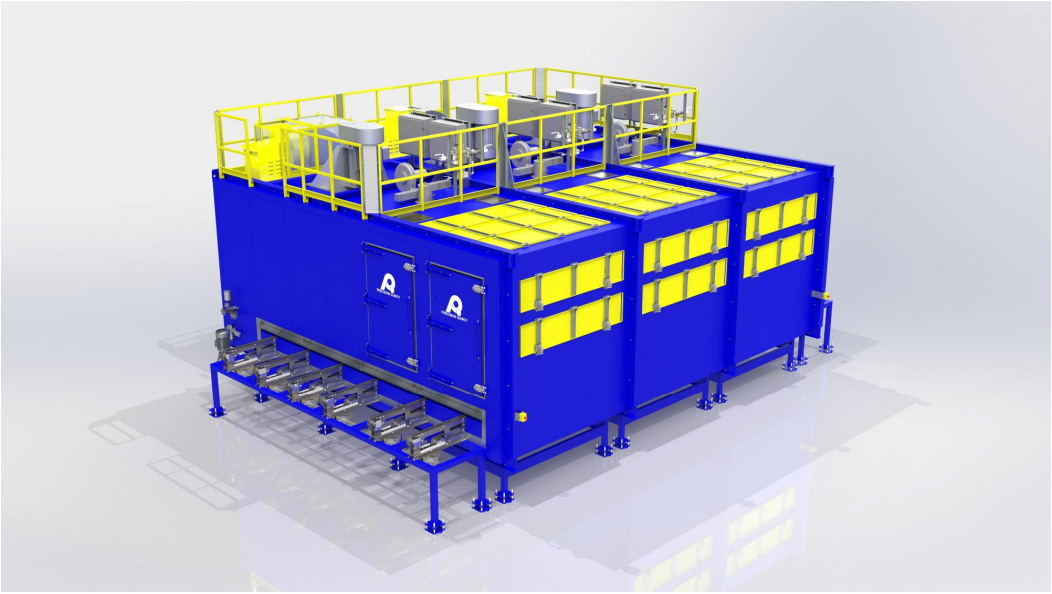
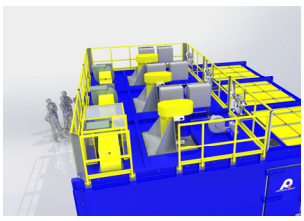


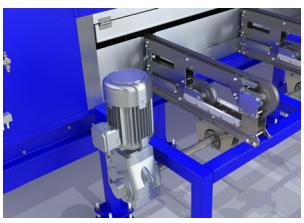
PRECISION QUINCY

CASE STUDY

Three-Zone Continuous Curing Oven for High-Volume Trim Finishing

Single-path, three-zone inline curing module engineered for edge-applied coatings on high-volume trim—delivering ~152,000 lb/hr with edge-focused vertical-down airflow (perpendicular to oven length) across a 200–300°F operating process (450°F max capability), low-NOx combustion, and service-forward access in a compact 377-inch footprint.

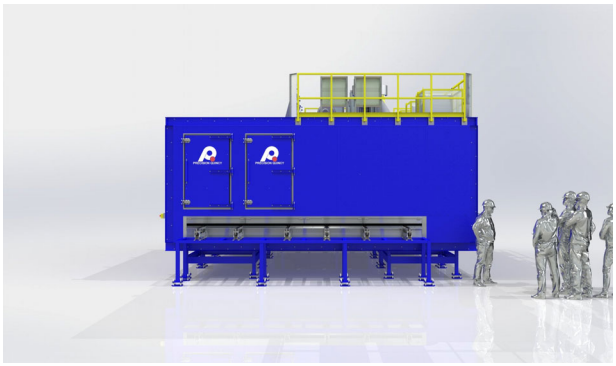




OVERVIEW

Precision Quincy engineered a high-throughput curing module for a major North American building-products manufacturer, designed to integrate inline within a larger two-machine production cell. The system cures edge-applied coatings on widthwise-oriented trim boards (wide way in)—concentrating heat transfer where it matters (the edges) without wasting energy on wrapped top/bottom surfaces—while delivering approximately 152,000 lb/hr across a wide product mix.

To meet the customer's footprint constraint (377 in total length) and low-NOx corporate standard, the process was developed through a combination of Precision Quincy testing, customer experience, and prior application knowledge. The result is a flexible 200–300°F operating process with 450°F maximum capability, delivered through a three-zone, single-path architecture (three 96 in heated zones). The final design combines edge-focused vertical-down airflow (5,800 FPM ±870 through 3/8″ slots, with airflow direction perpendicular to the oven length), roof-mounted recirculation/heating using (3) Maxon OvenPak LE15 burners (4.8 MMBtu/hr total) with SmartLink MRV emissions control, and a wide-control exhaust system (3,945–15,750 CFM total) using VFDs + modulating dampers to stabilize low-temperature operation under low-NOx turndown constraints. A service-forward layout includes 10 access doors, roof/sidewall explosion relief, and a full-length roof walkway for maintenance access.



CUSTOMER PROCESS REQUIREMENTS

A major North American building-products manufacturer required a continuous curing module to be integrated inline as part of a larger, two-machine production cell (the curing system mechanically and controls-wise interfaces with upstream/downstream equipment).

Material flow & layout

- Product travels widthwise (boards oriented with length perpendicular to direction of travel; "wide way in").
- Single product path runs through the curing system.
- The customer required a fixed overall equipment length to match their production layout.

Throughput requirement (primary)

- The key requirement was mass throughput (≈152,000 lb/hr target). Line speed is secondary and is simply whatever speed is required to achieve lb/hr given product mix.

Product + upstream context

- Trim boards are wood/composite.
- Upstream, the trim is wrapped on the top and bottom surfaces.

- After trim is cut, the exposed edges must be painted; this system's job is to dry/cure the edge paint.

Energy focus / edge-only heating challenge

- The customer's process requires concentrating heat transfer on the edges without wasting energy heating surfaces that do not need it.
- The system must accommodate a wide product width range (~1.5 in to 12 in) while still directing airflow/heat where needed (edge-focused) without disturbing product.

Conveyor / value requirement

- The customer required a conveyor approach that supports boards reliably while minimizing the number of chain strands to maximize value.

Low-NOx burner corporate standard

- The customer requires low-NOx burners.
- This creates a control/turndown challenge, especially at low heat-load conditions (e.g., empty/lightly loaded operation) where it is difficult to maintain low temperatures while preserving needed high-temperature capability.

Access / maintainability requirement

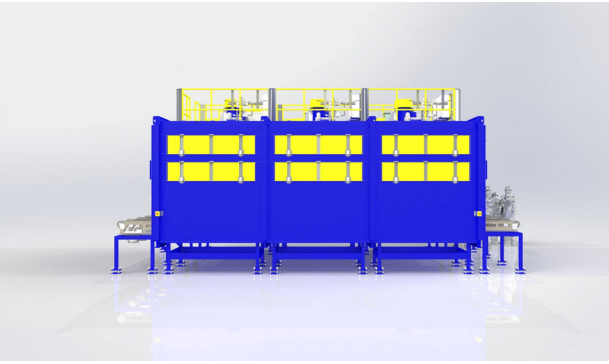
- The customer required side access so operators can quickly remove broken boards inside the oven (open side access rather than full disassembly).

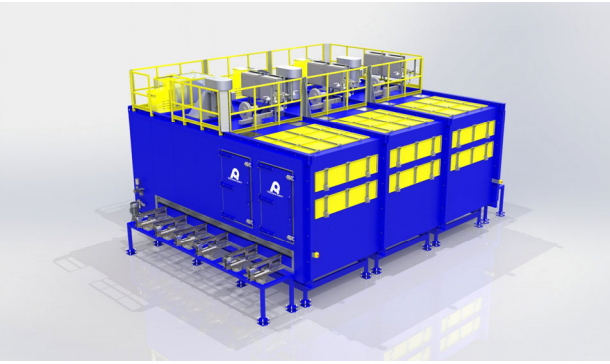
Product stability requirement

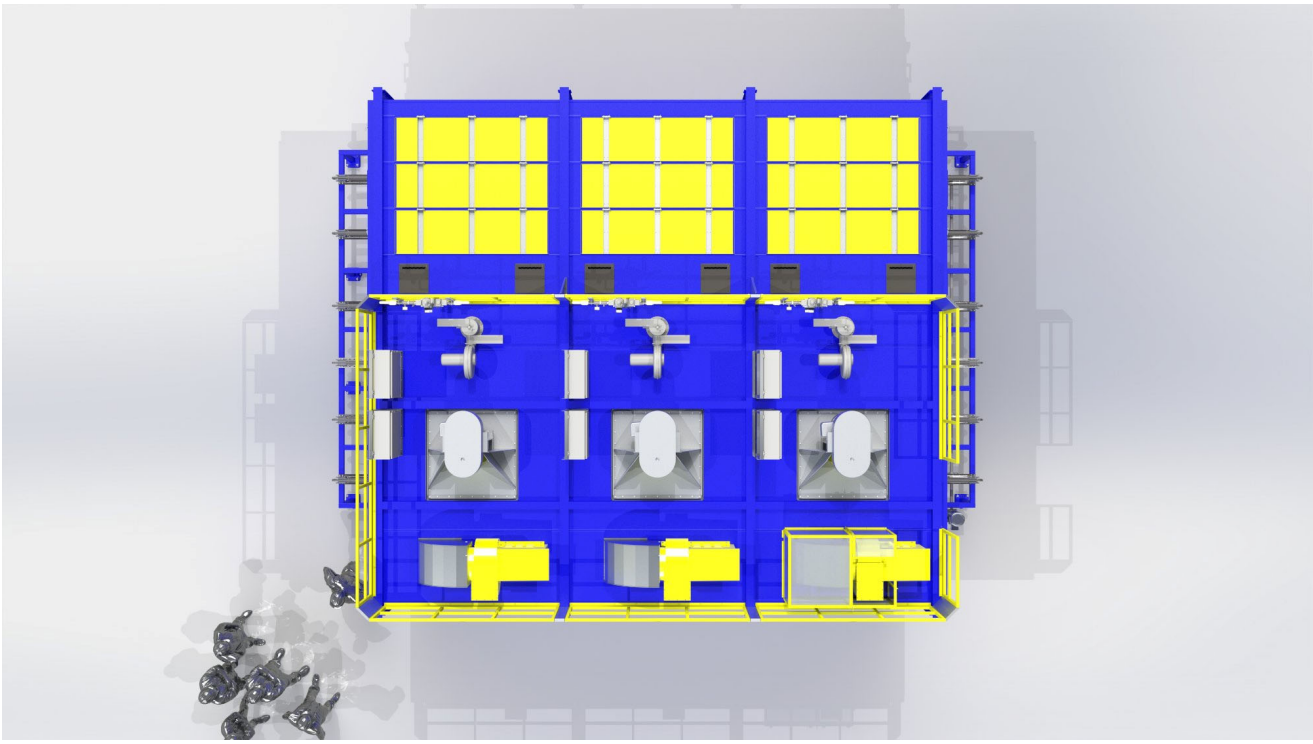
- Boards must remain stable and properly guided—no lateral drift, hopping, or airflow-induced movement—while still achieving the required edge paint cure.

Footprint constraint

- The customer provided a very limited installation envelope; the full solution had to fit within 377 inches total length.







THERMAL PROCESS REQUIREMENTS

These thermal process requirements were jointly developed to meet the customer's process needs, based on a combination of Precision Quincy testing, customer experience, and Precision Quincy's prior experience with similar product lines.

Temperature requirements

- Normal operating temperature range: 200–300°F.
- Maximum capability: 450°F.

Conveyor exposure / time-in-heat

- Conveyor speed must be adjustable to achieve different time-in-heat values based on product size.
- Speed range includes up to 60 ft/min.

Edge-focused airflow delivery

- Airflow must be delivered vertically downward at the board edges.
- Airflow direction is perpendicular to the length of the oven.
- Target nozzle discharge velocity: 5,800 FPM, with allowable variation ±870 FPM.
- Nozzle geometry: 3/8-inch-wide slots.

Exhaust requirements (temperature control + process removal)

- Minimum exhaust: 3,945 CFM total.
- Maximum exhaust capability: 15,750 CFM to support stable low-temperature operation given low-NOx turndown limitations.

Heat input requirement

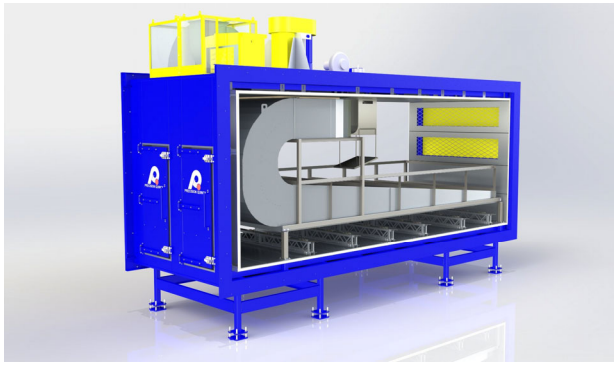
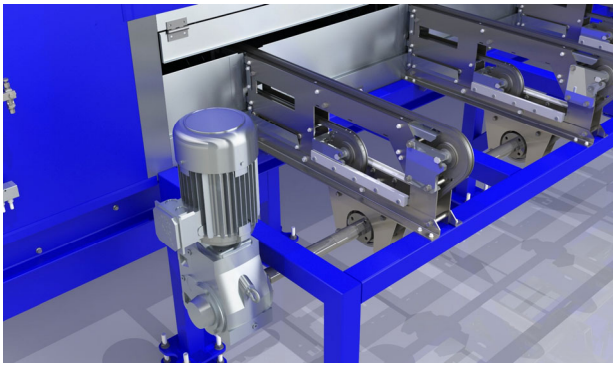
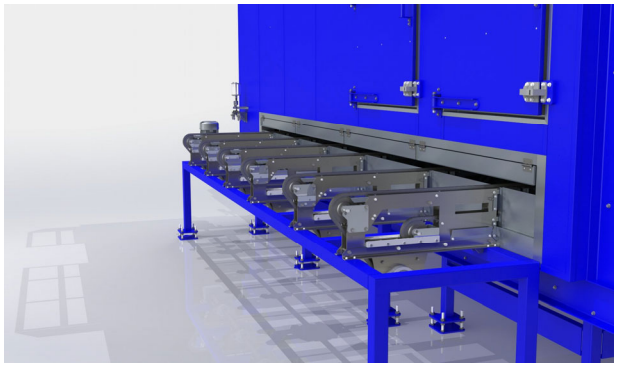
- Required heat input: 4,800,000 BTU/hr.

Moisture load

- Maximum water load capacity: 8 gallons/hr.

Temperature uniformity

- ±10°F from setpoint at the nozzle discharge (sufficient to meet even-heating requirement).

EQUIPMENT CONCEPT & ARCHITECTURE

To deliver the thermal process requirements (which deliver the customer process requirements), Precision Quincy settled on the following equipment concept and architecture.

Overall concept

- Three-zone, single-path conveyor oven.
- Roof-mounted recirculation fans, burners, and exhaust.
- Conditioned air is directed down from nozzles above the conveyor (edge-focused, vertical-down discharge), then returns down the sides back to the heat source/fan loop.

Airflow/ducting architecture (“Nautilus” duct)

- Each zone uses a Nautilus duct arrangement: recirculation fan shaft transitions from horizontal into a curved down-turn with turning vanes, then back to horizontal distribution.
- Discharge air exits overhead nozzles straight down to the product.
- Return air travels down the sides of each duct path, then flows back up through the burner/heat section, and is re-delivered for heating.

Zone architecture (one fan + one burner + one exhaust per zone)

- Each zone includes: (1) recirculation fan, (1) burner, (1) exhaust connection.
- Recirculation fan concept: 40-inch fan, 40,000 CFM @ 3 in. w.c. (per fan; 120,000 CFM total), 40 HP motor (per fan; 120 HP total).
- Heating concept: Low-NOx requirement fulfilled using (3) Maxon OvenPak LE15 burners total (one per zone), each 1.6 MMBtu/hr. Emissions control uses a servo-driven system (SmartLink MRV, Maxon/Honeywell) mapped to hold NOx < 30 ppm.

Exhaust concept

- Each zone exhaust includes modulating dampers to adjust exhaust rate for cooldown and low-temperature stability given low-NOx turndown limitations.

Serviceability / access

- Access is provided via distributed service doors (total of 10 access doors).
- Explosion relief is incorporated in the roof and sidewalls, and also via access door relief as applicable.

Shell / structural architecture

- Shell is built around a structural steel frame.
- Interior construction uses free-floating sheet-metal pans designed to accommodate thermal expansion/contraction while minimizing through-metal.
- Construction: 16-gauge interior pans (aluminized), insulation outside the interior pans, 16-gauge exterior cladding (mild steel), exterior finished with a two-part epoxy paint, light gray specified by the customer.

Shipping architecture

- The oven is designed to ship as three main pieces (three zones), bolted together on site.
- Support feet are integral (not removable for shipment).

Conveyor / mechanical concept highlights

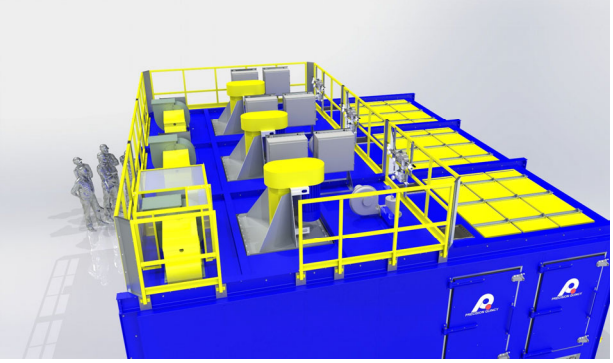
- Conveyor is an engineered RS60 steel roller chain system with flat sidebar chain.
- Six strands running on replaceable AR500 wear guides.
- Common drive shaft through all six strands to a gearbox; each strand is individually tensioned.
- Take-up/tensioning uses pneumatic tensioners (no rack-and-pinion synchronized take-up).
- Drive concept: 5 HP gearbox-driven conveyor drive, VFD-controlled.

Controls architecture

- Controls are remotely located.
- The system uses an Allen-Bradley CompactLogix PLC integrated with the paired equipment.
- VFDs are Yaskawa (customer-specified).
- Burner safety hardware uses a Karl Dungs-based safety system with Maxon/Honeywell burner control components.

Other noted attributes

- Roof areas not occupied by explosion relief are outfitted with guard rails for service access.
- Equipment was fully tested and accepted via FAT at Precision Quincy; the customer attended FAT.



TECHNICAL SPECIFICATIONS

Oven Configuration	
Type	Continuous conveyor, three-zone, single-path, vertical-down edge-focused airflow
Heated Zone Length (per zone)	96 in (total: 288 in)
Conveyor Width	204 in
Chain Strand Locations	15, 47, 89, 122, 155, 190 in from one edge (across 204 in work width)
Equipment Overall Dimensions	274 in W x 377 in L x 181 in H
Inlet/Outlet Vestibules	6 in each end
Overall Length / Shipping	Shipped as (3) zone sections bolted together
Roof Access	Full-length roof walkway
Service Access	10 access doors total
Explosion Relief	Relief in roof and sidewalls, and via access doors as applicable

Thermal Heat Power System	
Operating Temperature	200-300°F
Maximum Temperature	450°F
Temperature Uniformity	±10°F from setpoint at nozzle discharge
Heating Zones	3
Heat Source	(3) Maxon OvenPak LE15, 1.6 MMBtu/hr each (one per zone)
Heat Power	4,800,000 BTU/hr
Emissions Control	Servo-driven SmartLink MRV (Maxon/Honeywell), mapped to maintain NOx < 30 ppm

Recirculation / Airflow System	
Airflow Pattern	Vertical-down, edge-focused discharge from overhead nozzles; side returns to heat source/fan

Nozzle Geometry	3/8 in wide slots
Nozzle Discharge Velocity	5,800 FPM ±870 FPM
Fans (Per Zone)	40 in fan; 40,000 CFM @ 3 in. w.c. (per fan; 120,000 CFM total)
Fan Motor (Per Zone)	40 HP (per fan; 120 HP total)
Burner Location	Upstream of fan, firing into a diffuser for mixing prior to fan pressurization

Exhaust System	
Location	Roof-mounted (three exhaust connections; one per zone)
Minimum Exhaust	3,945 CFM total
Maximum Exhaust Capability	15,750 CFM total
Control	VFDs + modulating dampers
Basis	Supports low-temperature stability with low-NOx turndown limits; removes water from drying + products of combustion

Conveyor / Handling System	
Configuration	Six-strand engineered chain conveyor (single path)
Chain Type	RS60 steel roller chain with flat sidebar
Take-Up / Tensioning	Pneumatic tensioners, individually per strand
Drive	Common shaft through all six strands to 5 HP gearbox (single-pitch chain sprockets)
Speed Range	Adjustable up to 60 ft/min
Return	Hot return (return path runs through oven below the top chain plane)
Conveyor Capacity	2,200 lb evenly distributed across the conveyor
VFDs	Yaskawa (customer specified)

Construction Materials / Finish	
Primary Structure	Structural steel frame integrating conveyor supports
Interior	16-gauge aluminized free-floating pans (expansion/contraction tolerant)
Exterior	16-gauge mild steel cladding
Paint	Customer-specified light gray, two-part epoxy coating
Thermal Isolation	Insulation outside interior pans; minimized through-metal architecture

Safety & Compliance (Burner / System)	
NFPA 86 Classification	Class A
Burner Safety Hardware	Karl Dungs-based safety system
Burner Controls	Maxon/Honeywell components

Controls & Electrical	
PLC	Allen-Bradley CompactLogix (controls this module + adjacent paired equipment)
Control Cabinet Location	Remotely located

Process Notes	
Coating	Non-VOC
Testing	Equipment completed FAT at Precision Quincy; customer accepted

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