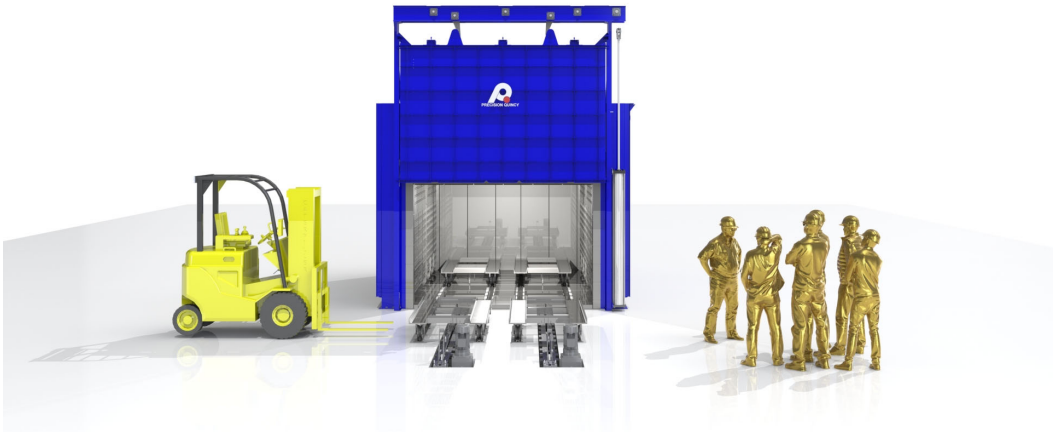


PRECISION QUINCY

CASE STUDY

Natural Gas Direct-Fired Fiberglass Heat-Cleaning Batch Oven System

for Fiberglass Binder Removal

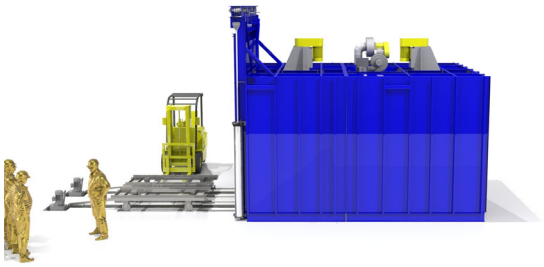
Natural gas direct-fired batch heat-cleaning system engineered for processing 18,000 lb per batch of reclaimed fiberglass roll stock at 1,000°F to remove binder for chopped-strand reuse, featuring a powered-loading, two-wide by two-deep cart configuration, 51,000 CFM recirculation with CFD-validated airflow, NFPA 86 Class A compliance, and pit-mounted pusher-extractor loading with a vertical lift door.

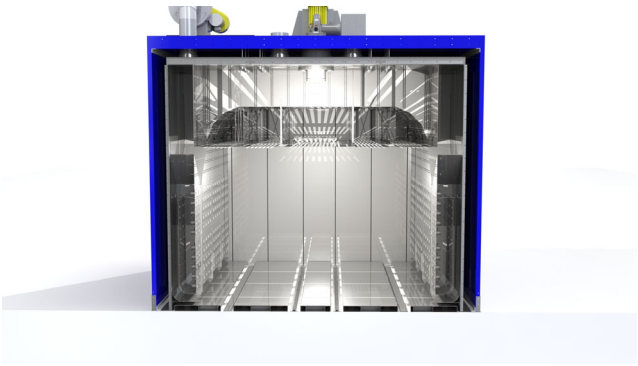
OVERVIEW

Precision Quincy engineered a natural gas direct-fired fiberglass heat-cleaning batch oven system to safely remove binder from reclaimed fiberglass roll stock so the material could be post-processed into consistent chopped strands for reuse as reinforcement in downstream products. The project replaced a legacy system not manufactured by Precision Quincy that had experienced an explosion, improving overall safety while maintaining the customer's existing cart-based material handling. The customer processes rolls of fiberglass typically used in chop guns, and any excess, expired, or waste fiberglass is recovered and heat-cleaned to break down and remove binder so the fiberglass strands can be chopped into consistent sizes and reused as reinforcement in plastics and other applications such as brake caliper pistons.

To meet the customer's production requirement of 18,000 lb per batch in an 18-hour cycle, Precision Quincy implemented a powered-loading, two-wide by two-deep batch configuration (four cart positions per batch) operating at 1,000°F with a validated ±15°F temperature uniformity requirement. The system was developed using customer-provided fiberglass rolls and in-house heat-cleaning testing to determine the required air speeds and temperatures, supported by computational fluid dynamics (CFD) to evaluate recirculation pressure drops and flow distribution. Precision Quincy worked with the customer to fit within the available installation space of 212 in wide by 258 in deep while reusing the customer's existing carts measuring 44 in W by 96 in L with a cart load surface height of 13.5 in above floor.

The oven is an NFPA 86 Class A design featuring a top-mounted recirculation system with two NYB 33 in PLR plug fans (backward-inclined) delivering 51,000 CFM total with Allen-Bradley PowerFlex 525 VFD control, and a Maxon OvenPak LE burner package providing 3,150,000 BTU/hr direct-fired heat input selected for high turndown ratio. Exhaust was sized at 2,100 ACFM based on product combustion and VOC capacity. A vertical lift door and pit-mounted pusher-extractor system (two pusher-extractors, one per lane) allow carts to be side-loaded by forklift and automatically loaded and unloaded for improved safety and throughput, while meeting local fuel train safety requirements. Nozzle discharge velocity of 4,000 FPM is delivered at 1,000°F perpendicular to the axis of the roll to achieve the required heating performance, with process validation including thermocouples placed inside the product to verify heating performance.





CUSTOMER PROCESS REQUIREMENTS

The customer processes rolls of fiberglass typically used in chop guns, where any excess, expired-age, or waste fiberglass is recovered and heat-cleaned to break down and remove binder, then chopped into consistent sizes so the material can be reused as reinforcement in plastics and other applications such as brake caliper pistons, requiring Precision Quincy to replace a legacy non-PQ system that experienced an explosion with safer, more automated equipment while reusing existing carts and fitting within available installation space.

Process Objective

- Heat clean reclaimed fiberglass roll stock to remove binder so the fiberglass can be post-processed into chopped strand reinforcement material.

Capacity and Throughput Requirement

- Batch capacity of 18,000 lb per batch.
- Batch cycle time of 18 hours to process one batch.
- Load configuration goal to heat clean four loads per batch using a two-wide, two-deep cart lane arrangement.

Temperature and Uniformity Requirement

- Operating temperature setpoint of 1,000°F.
- Temperature uniformity requirement of ±15°F.

Material Flow and Layout

- Customer's existing carts with dimensions of 44 in W by 96 in L and cart load surface height of 13.5 in above floor.
- Carts must be side-loaded with a forklift.
- Oven loading concept with two lanes into the oven with carts positioned side-by-side.
- Pusher-extractor system installed in pits beneath the oven interface with two pusher-extractors (one per lane) to automate cart loading and unloading where forklift side-loads carts into position, pusher-extractor pushes carts into the oven, and after processing the pusher-extractor extracts completed carts and retracts to allow loading of the next set.

Site and Installation Constraints

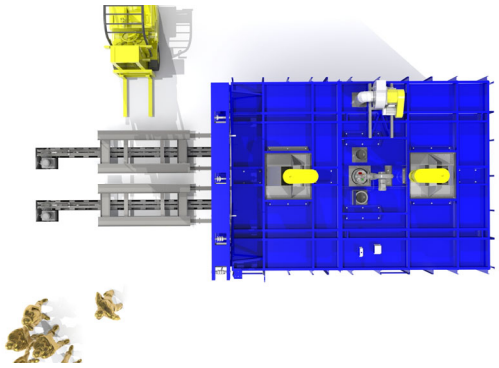
- Must fit within the customer's available space of 212 in wide by 258 in deep.
- Must work around the customer's existing carts and handling method.

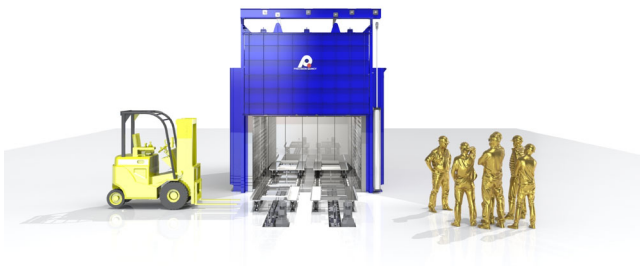
Safety and Compliance Requirements

- Improve safety and reduce risk relative to the customer's prior system which experienced an explosion.
- Comply with local fuel train safety requirements.

Validation and Acceptance

- Acceptance based on evaluating the forces required to break down the fiberglass rolls and confirming the material could be properly processed downstream.





THERMAL PROCESS REQUIREMENTS

Precision Quincy developed the thermal process requirements based on customer-provided fiberglass rolls and heat-cleaner testing to determine required air speeds and temperatures, then used computational fluid dynamics (CFD) to understand recirculation-system pressure drops and flow distribution to support fan and duct sizing for the 1,000°F operating temperature with 3,150,000 BTU/hr direct-fired heat input and 4,000 FPM nozzle discharge velocity perpendicular to roll axis.

Temperature Requirements

- Normal operating temperature (heat-cleaning setpoint) of 1,000°F.
- Maximum operating temperature of 1,000°F.
- Temperature uniformity requirement of ±15°F.

Heat Input Requirement

- Required heat power to heat fiberglass to process temperature of 3,150,000 BTU/hr.
- Heat source of natural gas, direct-fired.

Heating Airflow Delivery Requirements

- Nozzle discharge velocity of 4,000 FPM, delivered at 1,000°F perpendicular to the axis of the roll.

Recirculation System and Pressure-Drop Basis

- Recirculation-system pressure drops and flow distribution evaluated using computational fluid dynamics (CFD) to support fan and duct sizing.
- Recirculation fan speed control using VFD (Allen-Bradley PowerFlex 525).
- Total recirculation airflow of 51,000 CFM total (25,500 CFM each times two fans).

Exhaust and VOC Basis

- Exhaust airflow sized based on product combustion and VOC capacities.
- Exhaust rate of 2,100 ACFM.

Safety and Compliance Basis

- NFPA 86 classification Class A.

Validation and Acceptance Basis

- Process validation included placing thermocouples inside the product to verify heating performance.
- Downstream processing performance and roll breakdown force checks.

EQUIPMENT CONCEPT & ARCHITECTURE

Precision Quincy settled on a natural gas direct-fired recirculating powered-loading batch oven for heat cleaning fiberglass rolls with a two-row wide, two-deep load arrangement (four cart positions per batch) featuring a vertical lift door, top-mounted recirculation system with one control zone and two NYB 33 in PLR plug fans delivering 51,000 CFM total with Allen-Bradley PowerFlex 525 VFD control, NFPA 86 Class A classification, and Maxon OvenPak LE burner package providing 3,150,000 BTU/hr direct-fired heat input.

Overall Concept

- Natural gas, direct-fired, recirculating, powered-loading batch oven for heat cleaning fiberglass rolls.
- Load arrangement of two-row wide, two-deep (four cart positions per batch) with a vertical lift door.
- Recirculation system top-mounted, one control zone, two recirculation fans.
- NFPA 86 classification Class A.

Recirculation System

- Two NYB 33 in PLR plug fans (backward-inclined).
- Total recirculation airflow of 51,000 CFM (25,500 CFM each fan).
- VFD control using Allen-Bradley PowerFlex 525.
- Nozzle discharge velocity of 4,000 FPM delivered at 1,000°F perpendicular to the axis of the roll.
- CFD analysis used to evaluate recirculation-system pressure drops and flow distribution.

Heating System

- Maxon OvenPak LE burner package.
- Heat input of 3,150,000 BTU/hr direct-fired.
- Selected for high turndown ratio, not operated as low-NOx.
- Natural gas fuel.

Exhaust System

- Exhaust rate of 2,100 ACFM.
- Sized based on product combustion and VOC capacity.

Material Handling and Loading

- Powered-loading system with pit-mounted pusher-extractor.
- Two pusher-extractors (one per lane).
- Carts side-loaded by forklift into position.
- Pusher-extractor pushes carts into the oven and extracts completed carts after processing.
- Customer's existing carts with dimensions of 44 in W by 96 in L.
- Cart load surface height of 13.5 in above floor.

Enclosure and Door

- Vertical lift door.
- System fits within 212 in wide by 258 in deep available installation space.

Controls and Safety

- Allen-Bradley PowerFlex 525 VFD for fan speed control.
- Meets local fuel train safety requirements.
- NFPA 86 Class A design.

Validation

- Thermocouples placed inside the product to verify heating performance.
- Acceptance based on forces required to break down fiberglass rolls and downstream processing performance.

TECHNICAL SPECIFICATIONS

Technical Specifications	
Oven Type	Natural gas direct-fired fiberglass heat-cleaning batch oven
Application	Fiberglass roll reclamation and binder removal
NFPA 86 Classification	Class A
Batch Capacity	18,000 lb per batch
Batch Cycle Time	18 hours
Load Configuration	Two-wide by two-deep (four cart positions per batch)
Operating Temperature	1,000°F
Maximum Operating Temperature	1,000°F
Temperature Uniformity	±15°F
Heat Input	3,150,000 BTU/hr
Fuel Type	Natural gas, direct-fired
Burner Package	Maxon OvenPak LE
Total Recirculation Airflow	51,000 CFM
Recirculation Fans	Two NYB 33 in PLR plug fans (backward-inclined)
Airflow Per Fan	25,500 CFM
Fan Control	Allen-Bradley PowerFlex 525 VFD
Nozzle Discharge Velocity	4,000 FPM perpendicular to roll axis
Exhaust Rate	2,100 ACFM
Control Zones	One control zone
Recirculation System Location	Top-mounted
Door Type	Vertical lift door
Material Handling	Pit-mounted pusher-extractor system
Number of Pusher-Extractors	Two (one per lane)
Cart Dimensions	44 in W by 96 in L
Cart Load Surface Height	13.5 in above floor
Cart Loading Method	Forklift side-loading
Installation Space	212 in wide by 258 in deep
Validation Method	Thermocouples placed inside product

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