A Better Way To Blast Freeze

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QFR Zone®

HOW IT WORKS

High static pressure plenum fans create a vacuum capable of pulling air through spacers or boxes with air holes.

Radial air discharge releases warmed air for return to evaporator coils. Warm air not discharged in one location, but distributed for room evaporators to remove heat.

Chilled air is pulled through cases and spacers. Design provides air wipe along the top, bottom and sides of all cases. Air flow provides superior heat transfer allowing for reduced product freeze times.

Adjustable top seal for changing pallet heights

Pallet with spacers

Pallet seals

Pallet guides locate product/pallet into sealed position

Standard heavy duty select racking utilized for long life, easy access to loading and unloading, and usable storage when no quick freezing is required.

QFR Zone fits within a standard rack configuration. No blast cell rooms required.

Easy access for cleaning and ice removal
Traditional Blast Cell

Ineffective Air Flow

- In a traditional blast cell, air follows the path of least resistance, so the cold air doesn’t hit all cases evenly.
- This translates into longer freezing times, and forces the user to run the blast cell at a much lower temperature in order to reach the desired freezing results.

High Labor

- Takes Approximately 7+ hours to turn an 80-pallet blast cell
- Can only be done in batch process
QFR Zone®

**Significantly Improved Airflow**

- **QFR Zone®:** Measured airflow at 200 feet per minute between spacers.

- **Compared to:**
  Traditional blast cell measured at 15 feet per minute because air deflects off and around pallet load

- Better airflow means more efficient freezing

**Lower Labor Time & Cost**

- Takes approximately 2+ hours to turn an 80-pallet QFR Zone cell

- Not a batch freezer, can pull one pallet out when it’s frozen and replace it with a hot pallet, without affecting any other pallets
QFR Zone® - Air Flow Comparison

QFR vs. Blast Cell

Normalized Heat Transfer Rate vs. Air Flow Through Cases (FPM)

- Blast Cell Range
- QFR Range
QFR Zone® Recent Installations

Hatfield Quality Meats – Hatfield, PA
8 QFR Zones®
320 Total Pallet Positions

Sara Lee – Rochelle, IL
10 QFR Zones®
480 Total Pallet Positions

Quantum Foods – Bolingbrook, IL
8 QFR Zones®
240 Total Pallet Positions

Universal Cold Storage – Lincoln, NE
4 QFR Zones®
160 Total Pallet Positions

Innovative Cold Storage – San Diego, CA
2 QFR Zones®
64 Total Pallet Positions

Interstate Warehousing – Newport News, VA
16 QFR Zones®
480 Total Pallet Positions

Interstate Warehousing – Murfreesboro, TN
4 QFR Zones®
144 Total Pallet Positions

Columbia Colstor – Woodland, WA
2 QFR Zones®
64 Total Pallet Positions
May Installation Scheduled

New Orleans Cold Storage – New Orleans, LA
1,224 (+/-) Total Pallet Positions
(Enough To Handle 30 Loads Per Day)
October Installation Scheduled
QFR Zone® - Located In Freezer
QFR Zone® - Pallet Seals
QFR Zone® - Product In Place
QFR Zone® - Single Sided Option
QFR Zone® - Retro-fit into building

440 pallet positions lost
QFR Zone® - Retro-fit into building

200 Pallet QFR Zone in place
Each QFR Zone® is designed to your freezing application with the flexibility to freeze virtually any palletized products.
<table>
<thead>
<tr>
<th></th>
<th>Conventional Blast (Single Stage)</th>
<th>Ultra-Low Blast (2-Stage)</th>
<th>QFR (Single Stage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evap Temp (°F)</td>
<td>-30</td>
<td>-55</td>
<td>-20</td>
</tr>
<tr>
<td>Freeze Time (hrs)</td>
<td>72</td>
<td>36</td>
<td>24</td>
</tr>
<tr>
<td>Fan HP</td>
<td>15</td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>Daily Product Load (TR)</td>
<td>12.2</td>
<td>24.4</td>
<td>36.6</td>
</tr>
<tr>
<td>Daily Fan Load (TR)</td>
<td>3.8</td>
<td>3.8</td>
<td>5</td>
</tr>
<tr>
<td>Total Daily Load (TR)</td>
<td>16.0</td>
<td>28.2</td>
<td>41.6</td>
</tr>
<tr>
<td>Compressor HP/TR</td>
<td>2.9</td>
<td>3.4</td>
<td>2.4</td>
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<tr>
<td>Total HP-hr</td>
<td>3330</td>
<td>3446</td>
<td>2346</td>
</tr>
<tr>
<td>Total KWh</td>
<td>2615</td>
<td>2706</td>
<td>1842</td>
</tr>
<tr>
<td>Cost @ $0.10/KWh</td>
<td>$261.52</td>
<td>$270.57</td>
<td>$184.24</td>
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<tr>
<td>Cost per Pallet</td>
<td>$6.54</td>
<td>$6.76</td>
<td>$4.61</td>
</tr>
</tbody>
</table>
Product:  Frying Chicken Leg Quarters
Equipment:  Tippmann QFR Zone®
Freezer Temperature:  approximately -8° F

Pallets of product for testing. Two cases were selected to receive a temperature probe, one case from the top layer (outside case) and the second case from the middle (inside case) of the pallet stack. Once the probes were inserted into the product, the cases were returned to the stack.

At 4:26pm, the pallets were loaded into the QFR Zone®. One pallet was placed in a floor position and the other on a beam position. The starting temperature of the product varied between 33.8 and 37.7 degrees F.

Pallets were removed from the QFR Zone® 45 hours from the start of the test at approximately 1:26pm. The product temperatures are listed below:

<table>
<thead>
<tr>
<th></th>
<th>Inside Case</th>
<th>Outside Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time to Zero Degrees F:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inside Case</td>
<td>-11.1° F</td>
<td>-11.4° F</td>
</tr>
<tr>
<td>Outside Case</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inside Case</td>
<td>29 hrs</td>
<td></td>
</tr>
<tr>
<td>Outside Case</td>
<td>24 hrs</td>
<td></td>
</tr>
</tbody>
</table>
**Beginning Temperature**

- Inside Case: 37.7 degrees
- Outside Case: 33.8 degrees

**Time to Zero Degrees**

- Inside Case: 29 Hours
- Outside Case: 24 Hours
QFR Zone® - Product Test - Beef

Product: Beef – TBone & Sirloin Steaks
Equipment: Tippmann QFR Zone®
Freezer Temperature: approximately -7° F

Pallets of product for testing. Two cases were selected to receive a temperature probe, one case from the top layer (outside case) and the second case from the middle (inside case) of the pallet stack. Once the probes were inserted into the product, the cases were returned to the stack.

At approximately 2:30pm, the pallets were loaded into the QFR Zone®. The starting temperature of the product varied between 29.8 to 30.2 degrees F (T-Bone) and 44.5 to 45.2 degrees F (Sirloin).

The pallets were removed from the QFR Zone® 48 hours from the start of the test at approximately 2:30 pm. The product temperatures are listed below:

<table>
<thead>
<tr>
<th></th>
<th>Time to Zero Degrees F:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inside Case</td>
<td>-7.3° F</td>
</tr>
<tr>
<td>Outside Case</td>
<td>-6.7° F</td>
</tr>
<tr>
<td>Inside Case</td>
<td>25.5 hrs</td>
</tr>
<tr>
<td>Outside Case</td>
<td>29 hrs</td>
</tr>
</tbody>
</table>
**Beginning Temperature**

- Inside Case: 29.8 degrees
- Outside Case: 30 degrees

**Time to Zero Degrees**

- 25.5 hours to Zero degrees
- 29 hours to Zero degrees
QFR Zone® - Real-World Testing
QFR Zone® - Real-World Testing