Hayes Continuous Vacuum Carburizing

The Hayes Series VBQ Vacuum / Air Heat Treating Furnace is a modular design system that permits the user to thermally process parts in a variety of controlled atmospheres including vacuum and air. Continuous operation is provided with a heating / loading chamber and an in-line integral oil quench module or optional gas pressure quench module.

The Hayes Series VBQ is designed for carburizing applications that require tighter case depth, microhardness profile control and reproducibility than is possible with conventional atmosphere carburizing furnaces. The furnace also has applications with difficult to carburize geometries such as blind holes, roots of fine pitched gears or where the presence of intergranular oxidation is detrimental as in highly loaded gears and bearings.

Routine maintenance is simplified and reduced during air processing as the furnace performs a self-cleaning operation.

- **PULSE / PUMP CARBURIZING SYSTEM**
  The carburizing chamber is equipped with a Pulse / Pump Carburizing System. This system ensures maximum carburizing uniformity with minimum gas consumption. The system also permits blending of process gases for optimum composition for special requirements such as carbonitriding of ferritic nitrocarburizing.

- **LOAD / EVACUATION CHAMBER**
  The chamber is mounted on a structural steel frame, which is on wheels to provide easy access to the furnace internals for maintenance. On multi-chamber designs, this chamber, in addition to preheating capabilities, can be equipped with partial pressure/vacuum de-oiling to eliminate prewashing.

- **MODULAR COMPONENT DESIGN**
  Precise present and future customer requirements are met by our modular design to suit the soak time, carburizing cycle, quench and throughput requirements for carburizing applications.

- **HEATING CHAMBER**
  The heating chamber consists of up to three (3) zones of heating. High purity ceramic fiberboard forms the heating chamber. The number of heating chambers can be varied to suit the soak time, carburizing cycle and throughput requirements for each application. Each chamber is mounted on a structural steel frame which is on wheels to provide easy access to the furnace internals.

- **HEATING ELEMENTS**
  The furnace is heated with silicon carbide tubular type heating elements. The elements are designed for efficient and uniform heat transfer which is critical to obtaining tight case depth and microhardness profile control and reproducibility.

- **PUMPING SYSTEM**
  The modular design and ability to isolate and vary the partial pressure in each chamber ensures the number of vacuum pumps is kept to a minimum.

- **WORK TRANSPORT SYSTEM**
  Work is transported through the chambers on high strength rollers and rails. The robust pusher and puller mechanisms automatically transfer work through the furnace.

- **QUENCH MODULE**
  The furnace can be equipped with atmosphere oil quench, vacuum oil quench or high pressure gas quench modules to suit the hardenability and cleanliness requirements of virtually any steel.

- **GRAPHICAL COMPUTER INTERFACE (GCI)**
  Mechanical and electrical components are integrated with computer software to provide control and diagnostics of equipment, monitoring process variables, displaying real time trending and storing and retrieving historical data.
## Specifications

### Typical VBQ 8 HR. Day

<table>
<thead>
<tr>
<th>Heat Chamber Work Size (H x W x L)</th>
<th>VBQ-091824</th>
<th>VBQ-202436</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat Chamber Work Size (H x W x L)</td>
<td>9&quot; x 18&quot; x 24&quot;</td>
<td>20&quot; x 24&quot; x 36&quot;</td>
</tr>
<tr>
<td>Heating Elements</td>
<td>18 Silicon Carbide Tubes</td>
<td>30 Silicon Carbide Tubes</td>
</tr>
<tr>
<td>Maximum Operating Temperature</td>
<td>2000°F</td>
<td>2000°F</td>
</tr>
<tr>
<td>Temperature Uniformity Total Spread @ Carburizing Temperature</td>
<td>25°F</td>
<td>25°F</td>
</tr>
<tr>
<td>Backfill Gas Requirement:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heat Chamber</td>
<td>68 cu. ft./cycle</td>
<td>350 cu. ft./cycle</td>
</tr>
<tr>
<td>Oil Quench Module</td>
<td>90 cu. ft./cycle</td>
<td>300 cu. ft./cycle</td>
</tr>
<tr>
<td>Pressure Quench Module (@ 1 Atmosphere)</td>
<td>90 cu. ft./cycle</td>
<td>200 cu. ft./cycle</td>
</tr>
<tr>
<td>Carburizing and Carbonitriding Gas</td>
<td>Dependent on Cycle</td>
<td>Dependent on Cycle</td>
</tr>
<tr>
<td>Hearth Loading (Gross)</td>
<td>300 Lbs.</td>
<td>670 Lbs.</td>
</tr>
<tr>
<td>Quench Transfer Time</td>
<td>Less Than 10 Seconds</td>
<td>Less Than 10 Seconds</td>
</tr>
<tr>
<td>Quench Oil Volume</td>
<td>600 Gallons</td>
<td>1700 Gallons</td>
</tr>
<tr>
<td>Hearth Level</td>
<td>54&quot;</td>
<td>54&quot;</td>
</tr>
<tr>
<td>Heating Power</td>
<td>60 kVA</td>
<td>150 kVA</td>
</tr>
<tr>
<td>Total Power</td>
<td>76.5 kVA</td>
<td>210 kVA</td>
</tr>
<tr>
<td>Cooling Water (with a rise of 20°F)</td>
<td>20 GPM</td>
<td>50 GPM</td>
</tr>
<tr>
<td>Example of Production Rate:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.040 Case at 1900°F (Cycle Time)</td>
<td>106 pounds/hour</td>
<td>237 pounds/hour</td>
</tr>
<tr>
<td></td>
<td>2.83 hours</td>
<td>2.83 hours</td>
</tr>
</tbody>
</table>

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