Background

- Thermal glass tempering is currently achieved by heating glass sheets in a furnace to above the softening point of the glass (~640 deg C) then quenching the glass in a quench chamber.

- The quench air pressure required to successfully temper glass varies with glass thickness. The rate of cooling, and the required air pressure, increase as the thickness of the glass decreases.

- The thinnest glass that is currently economical to temper is 3mm. Great economic advantage to be able to temper 2mm glass.

- New Way and Glaston developing new surface cooling process utilizing viscous shear by a high velocity air film.

- Glass is introduced into a narrow slot, supported by air bearings, and with a thin clearance gap (25 um) above and below the glass.

- High pressure air introduced into the gaps above and below the glass sheet to provide rapid cooling of the glass surface by effectively removing the insulation provided by the convection boundary layer.
Super-E System

ZERO FRICTION, EASY TO USE, SILENT, AND INEXPENSIVE HIGH PERFORMANCE LUBRICANT.

www.newwayairbearings.com
Paint The Glass with Convective Heat

ZERO FRICTION EASY TO USE
SILENT AND EAS
S M O O T H INEXPENSIVE HIGH PERFORMANCE

2.8 mm Thick Clear

The entire piece has very uniform temperatures. This gives the customer ability to minimize iridescence due to thermal irregularities in the glass.

www.newwayairbearings.com
Super-E Thermal Scan

ZERO FRICTION, EASY TO USE AND INEXPENSIVE HIGH PERFORMANCE AND SILENT SMOOTH TO LUBRICANT

Thermal Stripes

www.newwayairbearings.com
ACC: Thermal Scans

- Zero Friction
- Silent
- Easy to use
- Inexpensive high performance
- Zero wear
- Robust and lubricant free
- Uniformity

www.newwayairbearings.com
Cooling Curves

THE HEATING AND COOLING OF VARYING GLASS THICKNESSES IN THE TEMPERING PROCESS

- ZERO FRICITION
- SILENT
- EAS TO USE
- HIGH PERFORMANCE
- INEXPENSIVE
- EAS TO LUBE
3.2mm

ZERO FRICTION

EASY TO USE AND SILENT

EASILY INEXPENSIVE HIGH PERFORMANCE

SMOOTH AND

EASILY TO USE INEXPENSIVE AND HIGH PERFORMANCE

ROBUST TO LUBRICANT

www.newwayairbearings.com
NEW WAY

ZERO FRICTION

INEXPENSIVE HIGH PERFORMANCE

SILENT AND SMOOTH

EASY TO USE

HIGH PERFORMANCE

LOW WEAR

ROBUST

NO LUBRICANT

www.newwayairbearings.com

NEW WAY

air bearings
NEW WAY

ZERO FRICTION
EASILY REMOVAL
SILENT AND EASILY TO USE
INEXPENSIVE HIGH PERFORMANCE 
SMOOTH AND NO OIL OR LUBRICANT

NEWWAY®
air bearings

www.newwayairbearings.com
Air Cooling

ZERO FRICTION
SILENT
EASY TO USE AND INEXPENSIVE
HIGH PERFORMANCE
SMOOTH
OLUBRICANT

The drying warm air flows counter to the forward motion of the glass.

www.newwayairbearings.com
## Typical Air Bar Specs

### SPECIFICATIONS: 500mm Transition Zone Air Bar  #S22100C500

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value (Unit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fly Height Example (microns)</td>
<td>80 (0.0032)</td>
</tr>
<tr>
<td>Input Pressure (kPa (psi))</td>
<td>145 (21.0)</td>
</tr>
<tr>
<td>Input Pressure Flow (SLPM (SCFM))</td>
<td>12.20 (0.43)</td>
</tr>
<tr>
<td>Input Vacuum (mm H₂O (in H₂O))</td>
<td>50.8 (2.0)</td>
</tr>
<tr>
<td>Input Vacuum Flow (SLPM (SCFM))</td>
<td>8.2 (0.29)</td>
</tr>
<tr>
<td>Substrate Fly Height Range (microns)</td>
<td>20 - 120 (0.0008 - 0.0047)</td>
</tr>
<tr>
<td>Fly Height Control (μ in)</td>
<td>±5 (197)</td>
</tr>
<tr>
<td>Air Film Stiffness (N/micron (lbs/μ in))</td>
<td>0.04 (0.21)</td>
</tr>
<tr>
<td>Stability (nanometers (μ in))</td>
<td>±5 (0.2)</td>
</tr>
<tr>
<td>Transition Zone Air Bar Size - Length (mm)</td>
<td>505 (19.88)</td>
</tr>
<tr>
<td>Transition Zone Air Bar Size - Width (mm)</td>
<td>100 (3.94)</td>
</tr>
<tr>
<td>Transition Zone Air Bar Size - Height (mm)</td>
<td>42.85 (1.69)</td>
</tr>
<tr>
<td>Transition Zone Air Bar Weight (kg (lbs))</td>
<td>2.15 (4.70)</td>
</tr>
<tr>
<td>Housing Material/Finish</td>
<td>aluminum/anodized</td>
</tr>
<tr>
<td>Porous Media Material</td>
<td>carbon</td>
</tr>
<tr>
<td>Bearing Face Surface Size - Carbon (mm)</td>
<td>100 x 500 (3.94 x 19.69)</td>
</tr>
<tr>
<td>Bearing Face Surface Flatness (mm)</td>
<td>0.025 (0.001)</td>
</tr>
<tr>
<td>Air Supply</td>
<td>bottom mounted manifold</td>
</tr>
<tr>
<td>Vacuum Supply</td>
<td>bottom mounted</td>
</tr>
<tr>
<td>Viable Pressure Range (kPa (psi))</td>
<td>3.48 - 275.79 (0.5 - 40.0)</td>
</tr>
<tr>
<td>Maximum Allowable Pressure Supply (kPa (psi))</td>
<td>275.79 (40.0)</td>
</tr>
<tr>
<td>Substrate Size</td>
<td>up through Gen 10 and beyond</td>
</tr>
<tr>
<td>Substrate Thickness (mm (in))</td>
<td>0.3 and up (0.0118 and up)</td>
</tr>
<tr>
<td>Maximum Substrate Speed (m/sec (ft/sec))</td>
<td>2.5 (8.2)</td>
</tr>
</tbody>
</table>
Basic Geometry

ZERO FRICTION
SILENT
SMOOTH
EASY TO USE
INEXPENSIVE
HIGH PERFORMANCE
AND
STURDY
LUBRICANT

1-4 bar

25um gap

2mm thick

2.5mm gap

86mm

www.newwayairbearings.com
Questions

• What is the Cooling Thermal Convective Coefficient for various glass thicknesses in the Existing Quench Design?

• What is the predicted Cooling Thermal Convective Coefficient to temper 2 mm glass?

• What air pressure would we need to reach this value with the current design?

• What is the predicted coefficient at various pressures in the Air Bearing design?

• What is the input pressure and the air flow conditions (velocity, pressure) in the gap for optimal forced convection cooling to achieve tempering of 3 mm glass?

• What would be needed for 2 mm glass?