



**SEMICONDUCTOR INDUSTRY**

**CUSTOM WAFER AUTOMATION OVERVIEW**

As the semiconductor industry drives to ever decreasing line widths and increasing automation, wafer handling solutions must continually be reinvented. Critical requirements include decreasing front side and backside particles, reducing metals contamination, increasing throughputs, and improving integration to factory automation systems.

Owens Design has developed innovative and reliable designs to address these challenges. Working closely with your development team, Owens Design will customize solutions for your application and provide these as a turnkey sub-system.



*Wafer heat and cool module*

Owens Designs customized solutions include:

**Wafer heat and cool module:**

For applications where the wafer must be heated or cooled during processing, the wafer heat module provides uniform heating to 400 C in



*Custom Wafer Transfer  
Three axis edge grip*

15 seconds. Particle and metal contamination are minimized through an innovative chuck design. The unit can be configured as a BOLTS compliant module or standalone and comes standard with wafer pin lifters.

**Custom wafer transfer mechanisms:** When standard wafer handling robots are too costly or do not fit the application, Owens Design will develop custom wafer

transfer mechanisms to your precise requirements. We provide a fully tested, turnkey sub-system that is easily integrated into your tool. Our designs encompass solutions for all wafer sizes, for challenging environments (wet, high temperature, and vacuum), for low contamination platens, and custom end effectors.

**BOLTS Modules:** The SEMI BOLTS plane has become a popular means to integrate customer specials and options. While taking advantage of the BOLTS interface offers tool enhancements and product configurability, careful design attention must be paid to airflow, vibration, footprint, and serviceability. Owens Design has developed unique solutions to ensure successful BOLTS implementations.



*BOLTS Metrology  
Module*



## CUSTOM WAFER AUTOMATION OVERVIEW (CONT'D)

### Typical Specifications

- Wafer Sizes: 50 - 200mm, 300mm
- Substrate Types: Si, GaAs, Quartz
- Environments: Atmospheric, low and high vacuum, and corrosive (gas and liquid phases)
- Vertical, horizontal, and front-to-back flipping orientations

### Cleanliness

- Front side: < 0.2 particles @ 0.1  $\mu\text{m}$ , PWP
- Backside: < 1,400 particles @ 0.2  $\mu\text{m}$ , PWP
- Metals (TXRF/VPD) measurements :
- Heavy (Fe, Cr, Ni, Cu, Zn) < 1E10 atoms/cm<sup>2</sup> per element
- Alkali (Na, Mg, Ca, K) < 1E10 - 5E10 atoms/cm<sup>2</sup> per element
- Light (Al) < 1E10 - 4E10 atoms/cm<sup>2</sup>
- Airborne: No degradation to ISO Class 2 environment

### Reliability

- MTBF > 5000hrs
- MTBS > 6-months
- MTBI > 1000hrs
- MTTR < 4hrs

### Wafer Handling End Effectors

- Orientation: Fixed vertical, fixed horizontal, Variable: wafer flipping
- Contact type: Vacuum end-effector, Edge Grip end-effector
- High temperature: Handle wafer temperatures up to - 450°C

### Regulatory Compliance

- SEMI  
Equipment Automation Hardware Standards  
Equipment Automation Software Standards  
Facility Standards and Safety Guidelines
- CE  
Essential Health and Safety  
Harmonized Standard
- Local Jurisdictional  
NFPA, UL, FMRC

### Design Analysis

We achieve state of the art solutions through careful analysis of reliability, airflow, throughput, and vibration requirements. CFD modeling and attention to design details allow us to meet stringent cleanliness targets. Reliability goals are proven through highly accelerated life testing (HALT) to identify problems before reaching the field. Owens Design's solutions reflect a long history of developing mature designs.



**200mm Vacuum Robot**



**Owens Design's Wafer Transfer Mechanism Makes SEMI Cover**