



SEMI E57-1296

PROVISIONAL MECHANICAL SPECIFICATION FOR KINEMATIC COUPLINGS USED TO ALIGN AND SUPPORT 300 mm WAFER CARRIERS

1 Purpose

This standard specifies the mechanical couplings used to ergonomically align and precisely support 300 mm wafer carriers (including transport cassettes, process cassettes, quartz boats, pods, lot boxes, and shipping boxes). Such a kinematic coupling can be used at several interfaces, including:

- Between a box or cassette and a tool load-port or vehicle nest,
- Between a transport cassette and a box, and
- Between a process cassette or quartz boat and the floor of a process chamber.

2 Scope

This standard is intended to set an appropriate level of specification that places minimal limits on innovation while ensuring modularity and interchangeability at all mechanical interfaces. Only the bottom half of the kinematic coupling is specified so that suppliers can be flexible in designing wafer carriers that can mate with it.

This standard is provisional because of concerns about kinematic coupling pins causing excessive wear on carriers. Once tribology testing is done, this standard should be upgraded from provisional status.

3 Referenced Documents

3.1 SEMI Standards

SEMI E15 — Specification for Tool Load Port

SEMI E19.4 — 200 mm Standard Mechanical Interface (SMIF)

SEMI E44 — Guide for Procurement and Acceptance of Minienvironments

4 Terminology

4.1 *bilateral datum plane* — A vertical plane that bisects the wafers and that is perpendicular to both the horizontal and facial datum planes.

4.2 *box* — A protective portable container for a cassette and/or substrate(s) (as defined in SEMI E44).

4.3 *cassette* — An open structure that holds one or more substrates (as defined in SEMI E44).

4.4 *facial datum plane* — A vertical plane that bisects the wafers and that is parallel to the front side of the carrier (where wafers are removed or inserted). On tool load ports, it is also parallel to the load face plane specified in SEMI E15 on the side of the tool where the carrier is loaded and unloaded.

4.5 *horizontal datum plane* — A horizontal plane from which projects the kinematic-coupling pins on which the carrier sits. On tool load ports, it is at the load height specified in SEMI E15 and might not be physically realized as a surface.

4.6 *nominal wafer center line* — The line that is defined by the intersection of the two vertical datum planes (facial and bilateral) and that passes through the nominal centers of the seated wafers (which must be horizontal when the carrier is placed on the coupling).

4.7 *pod* — A box having a Standard Mechanical Interface (SMIF) per SEMI E19 (as defined in SEMI E44).

4.8 *wafer carrier* — Any cassette, box, pod, or boat that contains wafers (as defined in SEMI E15).



5 Requirements

5.1 *Kinematic Coupling Pin Shapes* — The physical alignment interface on the bottom of the wafer carrier consists of features (not specified in this standard) that mate with six pins underneath. As shown in Figure 1 and defined in Table 1, each pin is radially symmetric about the vertical center axis line and can be seen as the intersection of a cylinder of diameter $d1$ and a sphere of radius $r3$ (which might contact a flat plate). An additional rounding radius $r5$ provides contact with angled mating surfaces, and blend radii $r4$ and $r6$ smooth the resulting edges. A final maximum over-all surface finish of $r7$ is also required. Dimensions $r2$ and $z1$ have zero tolerance because they only give a distance to another toleranced dimension. (Dimensions in parenthesis are not part of the requirements in this standard but are intended to clarify the preparation of manufacturing instructions.)

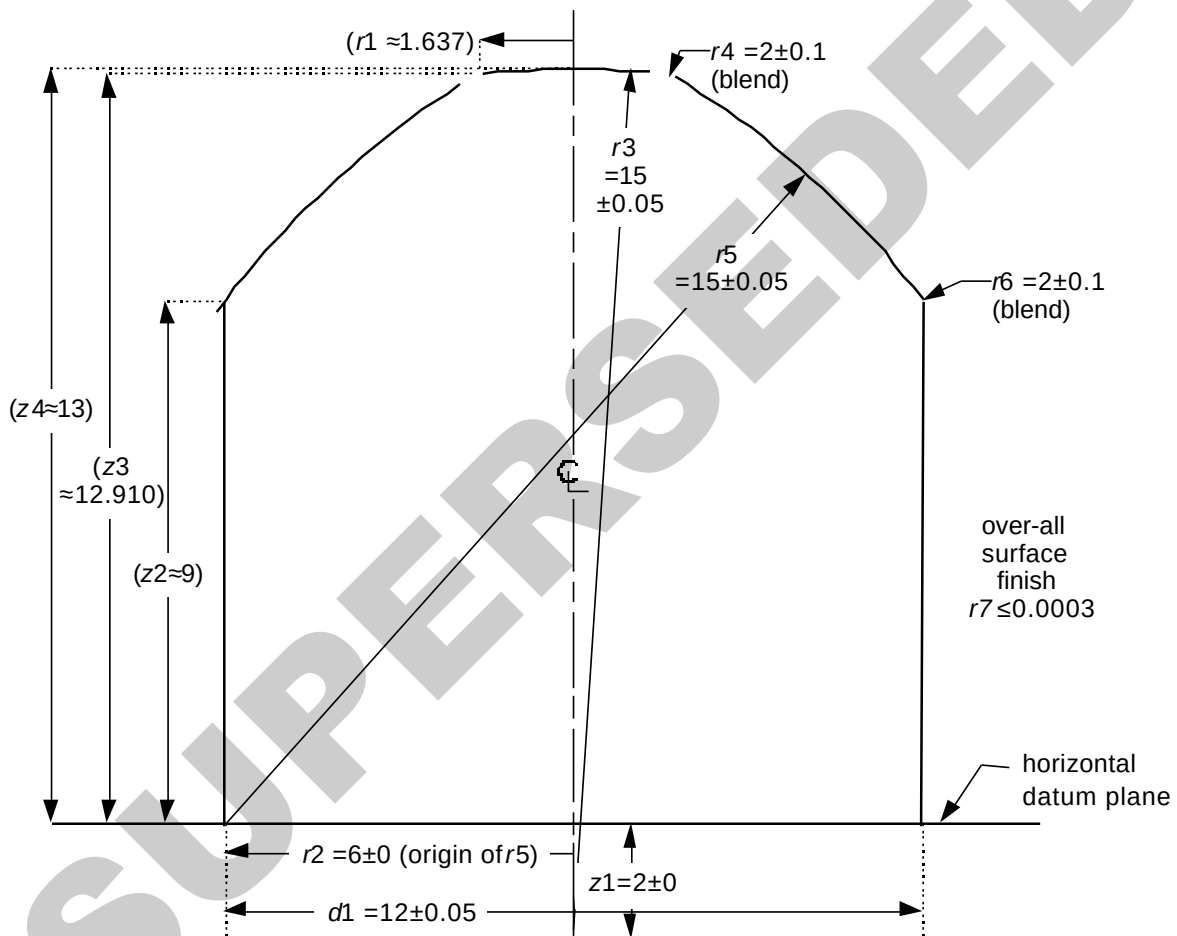


Figure 1
Kinematic Coupling Pin Shape



Table 1. Kinematic Coupling Pin Dimensions

<i>Symbol Used</i>	<i>Distance Specified</i>	<i>Dimension Description</i>
<i>d1</i>	12 ± 0.05 mm (0.4724 ± 0.002 in.)	Diameter of pin centered on the center axis line
<i>r2</i>	6 mm (0.2362 in.)	Radial distance from the center axis line to the origin of the shoulder radius <i>r5</i>
<i>r3</i>	15 ± 0.05 mm (0.5906 ± 0.002 in.)	Radial distance from the intersection of the center axis line and <i>z1</i> to the top of the pin
<i>r4</i>	2 ± 0.1 mm (0.0787 ± 0.004 in.)	Blend radius for the intersection of <i>r3</i> and <i>r5</i>
<i>r5</i>	15 ± 0.05 mm (0.5906 ± 0.002 in.)	Radial distance from the intersection of the horizontal datum plane and <i>r2</i> to the far shoulder of the pin
<i>r6</i>	2 ± 0.1 mm (0.0787 ± 0.004 in.)	Blend radius for the intersection of <i>r5</i> and <i>d1</i>
<i>r7</i>	0.0003 mm (0.000012 in.)	Maximum over-all surface finish
<i>z1</i>	2 mm (0.08 in.)	Vertical distance from the horizontal datum plane to the origin of top radius <i>r3</i>