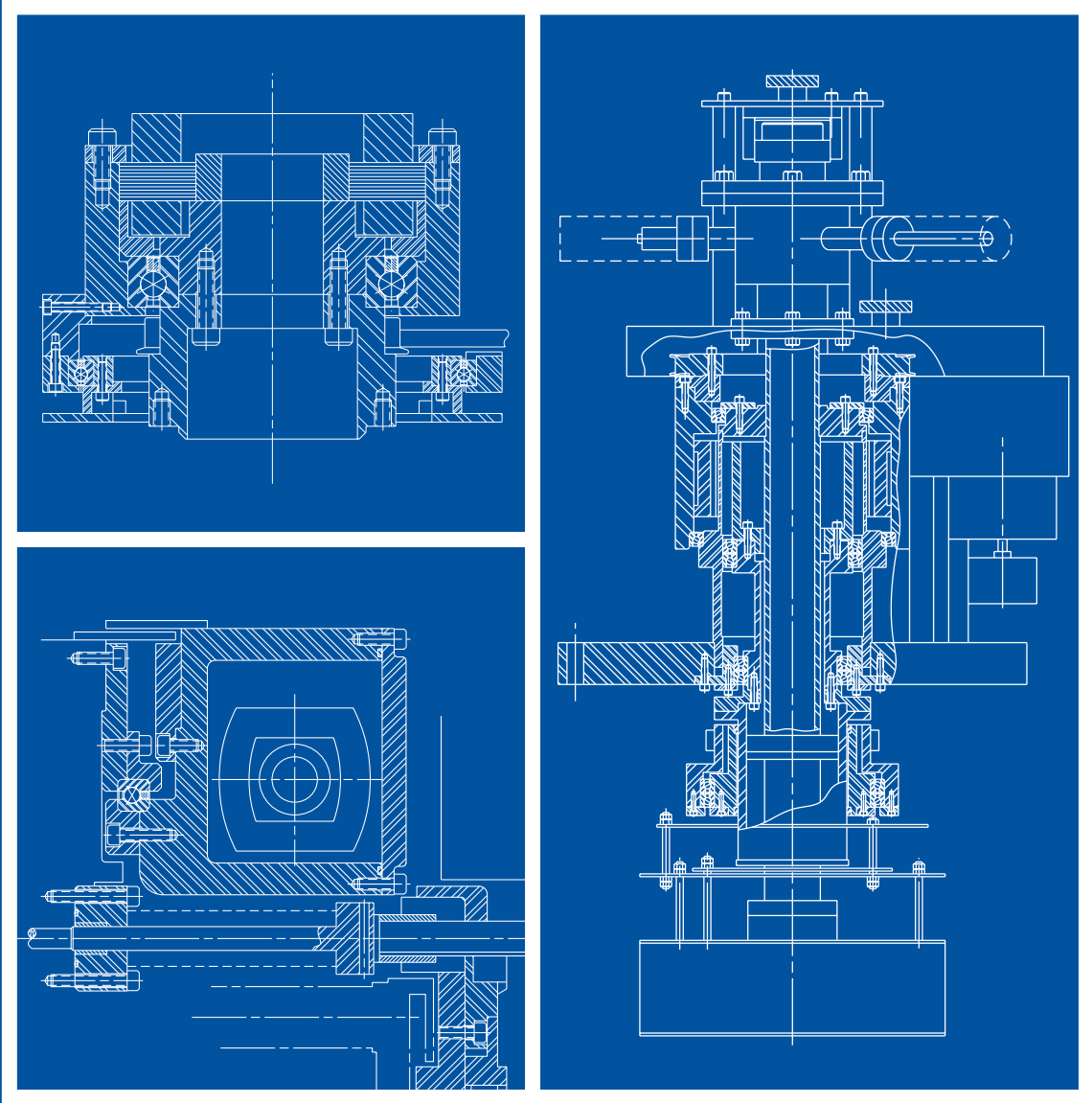


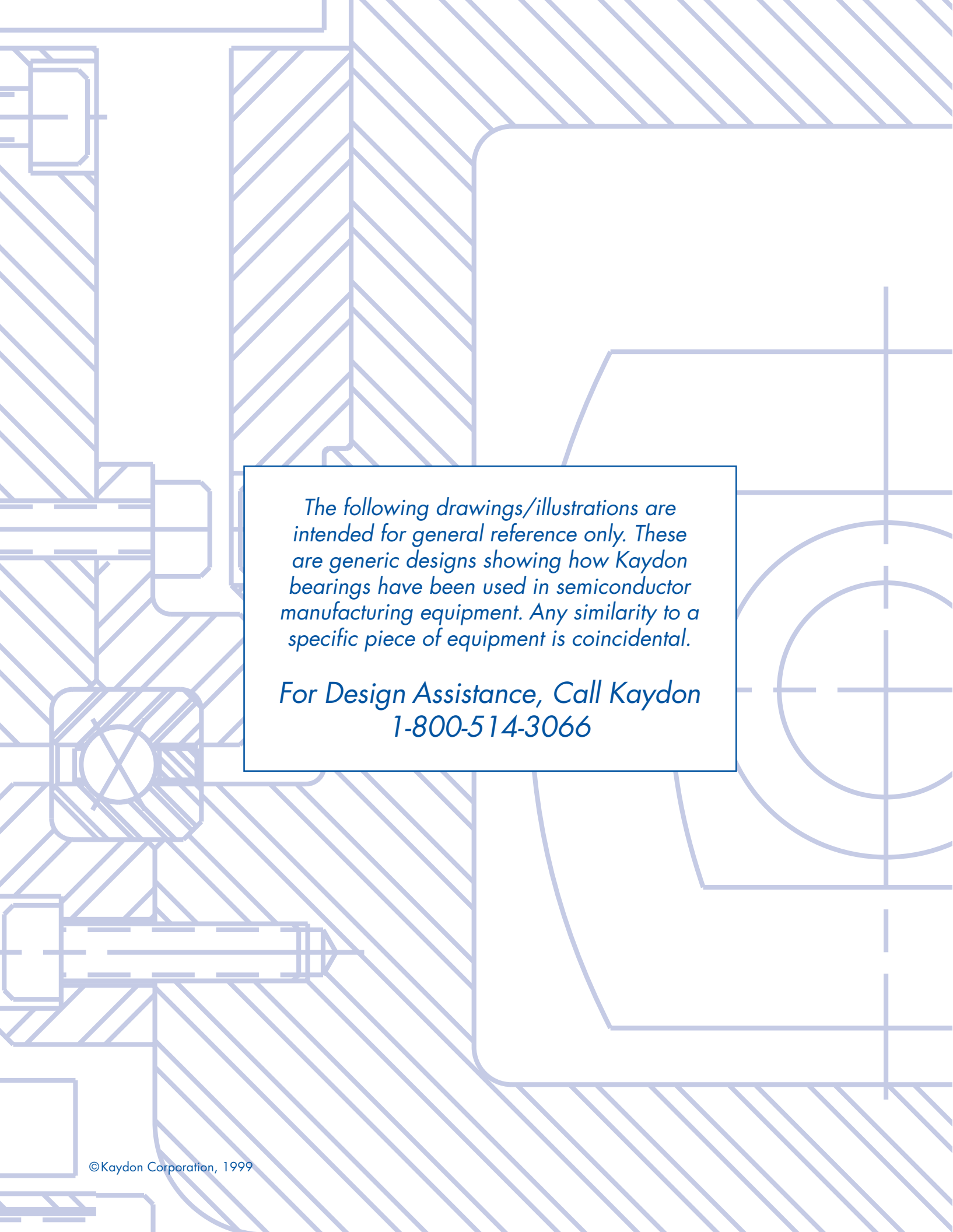
# DESIGN ENGINEERED SOLUTIONS FOR SEMICONDUCTOR APPLICATIONS

## Using Reali-Slim® Bearings from Kaydon

AN ILLUSTRATED MOUNTING GUIDE



KAYDON

The background of the page is a complex technical drawing in light blue lines. It features various mechanical components, including what appears to be a bearing assembly, a shaft, and a housing. The drawing uses standard engineering conventions, such as hatching to indicate different materials and cross-sections. The overall style is that of a professional engineering drawing.

*The following drawings/illustrations are intended for general reference only. These are generic designs showing how Kaydon bearings have been used in semiconductor manufacturing equipment. Any similarity to a specific piece of equipment is coincidental.*

*For Design Assistance, Call Kaydon  
1-800-514-3066*

# BEARING APPLICATION DATA FAX SHEET — FAX: 231-759-4102

Need application assistance on a current project? Please answer the questions on this form as completely as possible. Include a drawing (or sketch) of the application if available. Be sure to show all parts and information relevant to the application and then photocopy and fax the sheet to Kaydon for a free design review.

TO: **Kaydon Corporation, Muskegon, Michigan 49443** Date \_\_\_\_\_

FROM: Name \_\_\_\_\_ Title \_\_\_\_\_

Company \_\_\_\_\_ Telephone (\_\_\_\_\_) \_\_\_\_\_

Address \_\_\_\_\_

Application \_\_\_\_\_ Project \_\_\_\_\_

Experimental  Prototype  Production  Special Machine  Other \_\_\_\_\_

Quantity \_\_\_\_\_ Original Equipment  Manufacturer  Resale  Own Use  Replacement

LOADS: Static Radial (Max.) \_\_\_\_\_ Dynamic Radial (mean) \_\_\_\_\_

Static Thrust (Max.) \_\_\_\_\_ Dynamic Thrust (Mean) \_\_\_\_\_

Static Moment (Max.) \_\_\_\_\_ Dynamic Moment (Mean) \_\_\_\_\_

If mean dynamic loads are unknown, attach all conditions with percent of time each occurs.

Vibration or shock? \_\_\_\_\_ Describe \_\_\_\_\_

Factor of Safety of \_\_\_\_\_ (is) (is not) included in loads above.

SPEED: RPM (Max.) \_\_\_\_\_ RPM (Mean) \_\_\_\_\_ or attach conditions with percent of time.

OSCILLATION: Angle \_\_\_\_\_ ° Frequency \_\_\_\_\_

ACCURACY: Kaydon Precision Class \_\_\_\_\_ or:

Permissible Eccentricity: Inner \_\_\_\_\_ Outer \_\_\_\_\_

Permissible Face Run-out: Inner \_\_\_\_\_ Outer \_\_\_\_\_

Permissible Looseness: Radial \_\_\_\_\_ Axial \_\_\_\_\_

LIFE: Hours (Min.) \_\_\_\_\_ Hours (Avg.) \_\_\_\_\_ Other \_\_\_\_\_

TEMPERATURE: Normal Operating \_\_\_\_\_ °F Minimum \_\_\_\_\_ °F Maximum \_\_\_\_\_ °F

Differential between shaft and housing \_\_\_\_\_ °F

LUBRICATION: Proposed lubricant \_\_\_\_\_ and method \_\_\_\_\_

BEARING: Preferred Size: Bore \_\_\_\_\_ Outside Dia. \_\_\_\_\_ Width \_\_\_\_\_

Min. Bore \_\_\_\_\_ Max. Outside Dia. \_\_\_\_\_ Max. Width \_\_\_\_\_

Preferred Type: \_\_\_\_\_

Bearing Axis in (vertical) (horizontal) position with (outer) (inner) race rotation relative to load.

MATERIAL: Shaft \_\_\_\_\_ Housing \_\_\_\_\_

SPECIAL: Allowable Bearing Torque \_\_\_\_\_

REQUIREMENTS: Sealing \_\_\_\_\_ Protective Coating \_\_\_\_\_ Other \_\_\_\_\_

REMARKS: \_\_\_\_\_

\_\_\_\_\_

# Why Reali-Slim Bearings Are Selected for So Many SME Applications

- **Lightweight** — Reali-Slim thin-section bearings offer significant weight savings compared to more traditional bearings. For example, a Reali-Slim bearing with a bore size of 200mm is about 77% lighter. And as bore size increases, the percentage of weight savings increases. For example, a Reali-Slim bearing with a bore size of 600mm is about 96% lighter.

- **Compact design** — The compact, space-saving design of Reali-Slim bearings allows you to engineer rotating devices that are smaller, simpler, and lighter.

- **Precision tolerances** — Reali-Slim thin-section bearings are manufactured in a range of precision classes for optimal precision and design flexibility.

- **Hybrid and ceramic bearings** — When a standard bearing will not meet your design parameters, Kaydon will design and supply hybrid or ceramic bearings. Hybrid bearings, with stainless steel races and ceramic balls, may extend bearing life and reduce particulate generation. For extreme harsh environments, Kaydon can supply all ceramic bearings.

- **High temperature ratings** — With a wide selection of materials and lubricants available, Kaydon can provide off-the-shelf Reali-Slim bearings suitable for processing temperatures up to 250°F with full capacity, and special materials for higher temperature applications.

- **Vacuum compatibility** — For operations that take place in a vacuum environment, Kaydon can provide specifications on standard bearing materials to determine outgassing characteristics. Special materials and processing are available to meet specific vacuum requirements.

- **Chemical compatibility** — Kaydon can recommend special materials, protective surface treatments, or special processing for SME processing environments where bearings may be exposed to corrosive chemicals such as HCl, H<sub>2</sub>SO<sub>4</sub>, HF and DI water.

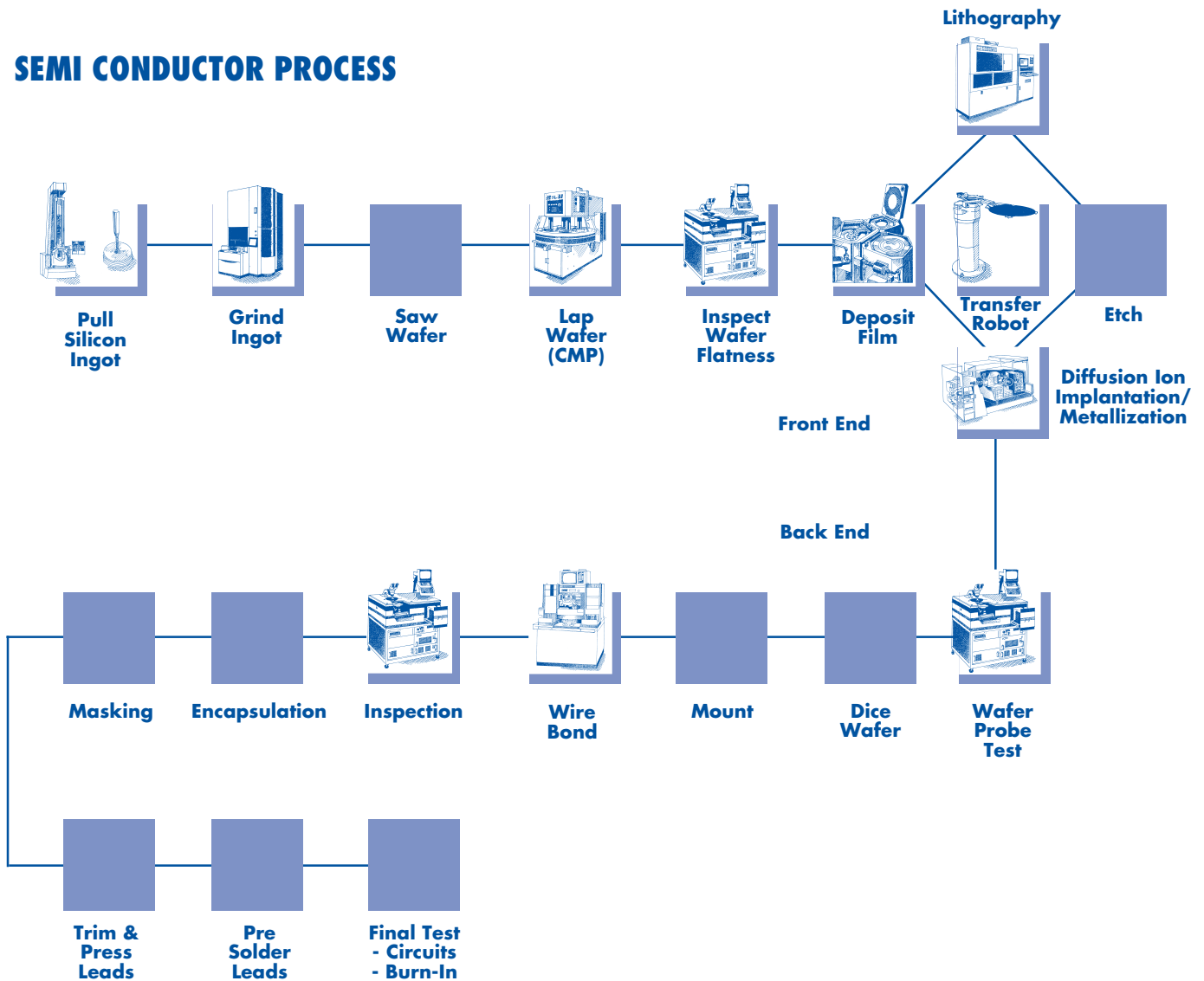
- **Special surface treatments** — We offer a variety of special surface treatments, including graphite, molybdenum disulfide, tungsten disulfide, Teflon<sup>®</sup>, silver and lead to meet a wide range of processing conditions and environments.

- **Large selection of stock bearings available for immediate delivery** — Kaydon offers over 350 catalog bearing sizes — the largest selection of stock thin-section bearings anywhere. Radial sections from 3/16" x 3/16" to 1" x 1", and up to 40" diameters. Fast delivery is available nationwide from local stocking distributors.

- **Quick delivery on modified bearings** — When your application requires a special bearing, you can count on Kaydon for a fast engineering recommendation and delivery. As a domestic manufacturer, our turn-around on bearings with special lubricants and coatings, and special race, ball and cage materials is considerably faster than overseas suppliers.

- **Design verification** — To help you optimize the performance of Reali-Slim bearings in applications requiring special bearing characteristics, Kaydon can provide bearing recommendations and a specification control drawing for your reference.

# SEMI CONDUCTOR PROCESS



## INDEX TO KAYDON BEARING APPLICATIONS

### Material Preparation and Design

#### Wafer manufacture

1. Pulling silicon ingot — page 5
2. Grinding of glass liner tubes for semiconductor furnaces — page 6
3. Grinding ingot
4. Wafer slicing
5. Lap wafer (chemical mechanical polishing) — page 7
6. Inspect wafer wire flatness — page 8

#### Wafer processing

#### Thin film layering

7. Film deposition — page 9
8. Process robots — page 10

#### Patterning

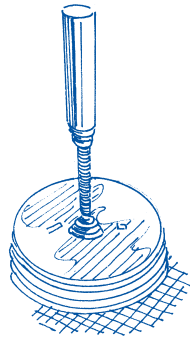
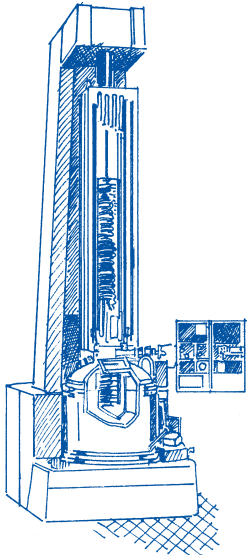
9. Lithography — page 11
10. Etching

#### Doping

11. Diffusion ion implantation/metallization — page 12

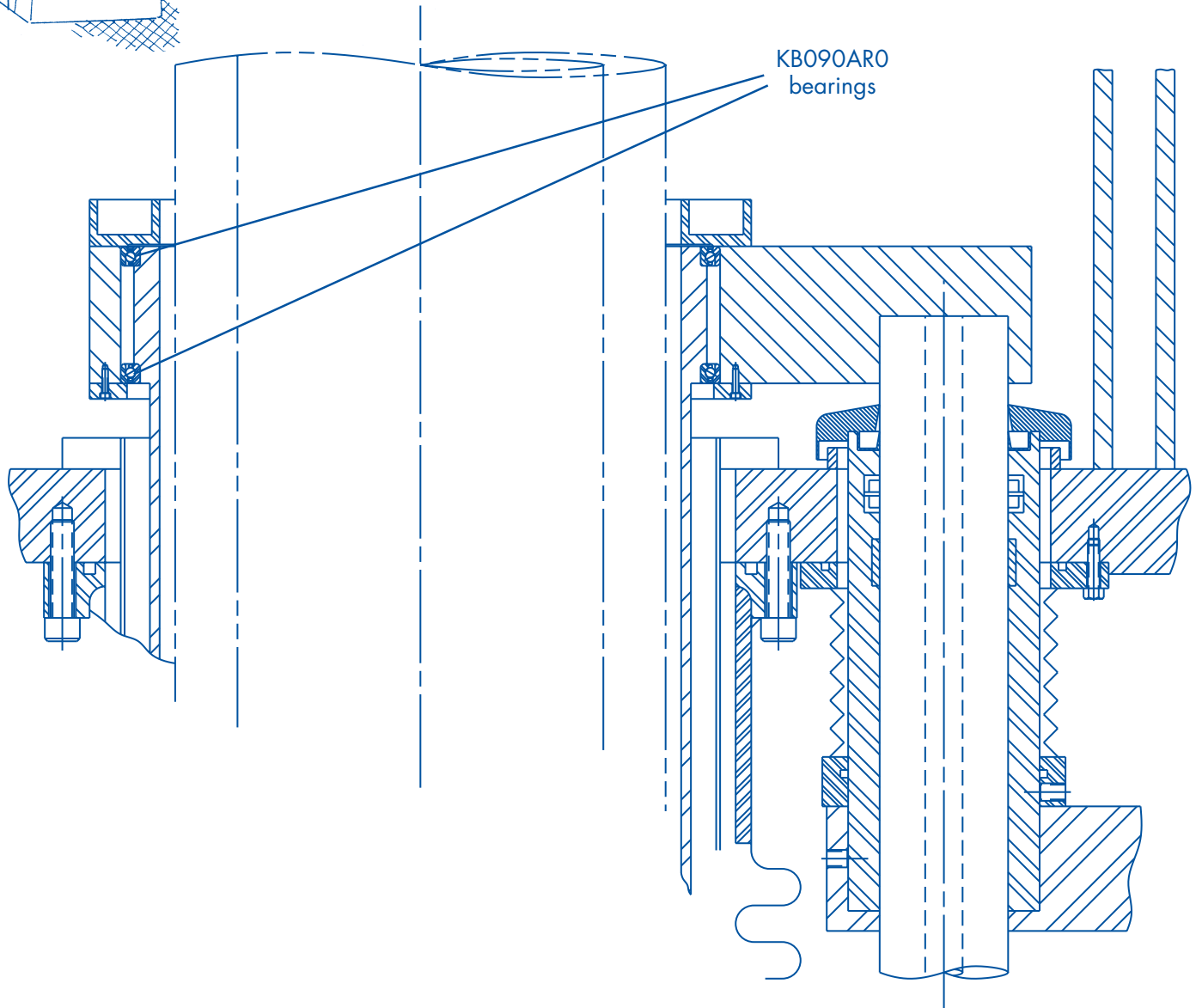
#### Assembly, packaging and test

12. Wafer probe test — page 13
13. Wafer dicing
14. Die attach
15. Wire bond — page 14
16. Inspection — page 8
17. Marking
18. Trim & press leads
19. Pre-solder leads
20. Final test

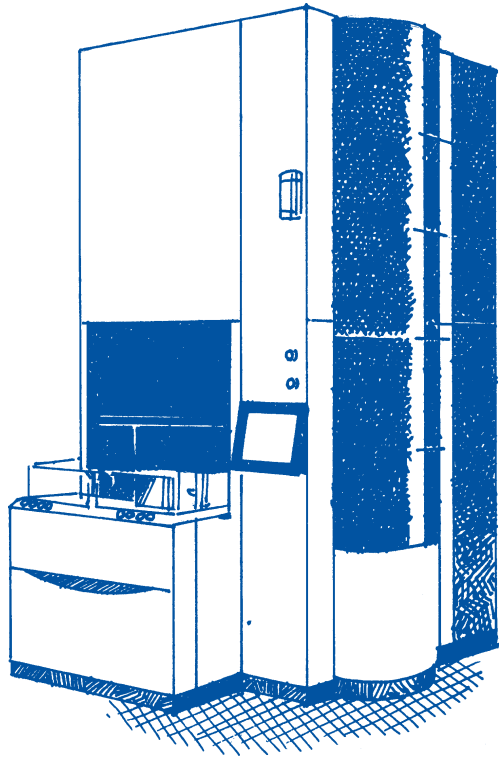


**Wafer manufacture** — *pulling the silicon ingot*

Atoms of high-purity molten silicon attach to a small seed crystal, forming a single crystal ingot. The apparatus uses a pair of .312" angular contact single steel bearings with 9" bore.

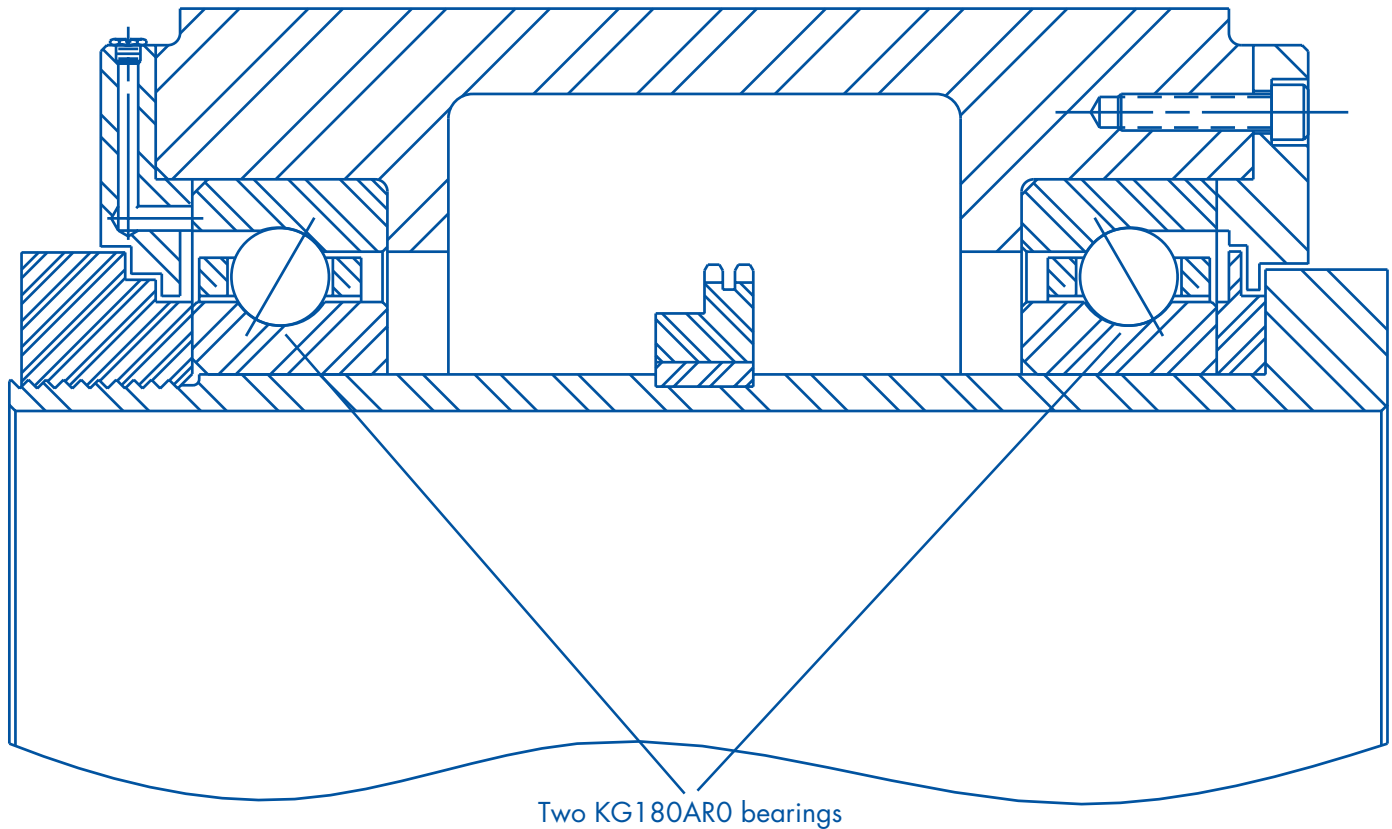


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|--|-----------------------|
| KAYDON CORPORATION                         |                       |
| <b>APPARATUS FOR PULLING SILICON INGOT</b> |                       |
| BEARINGS<br>USED:                          | Two KB090AR0 bearings |
| Design #1                                  |                       |

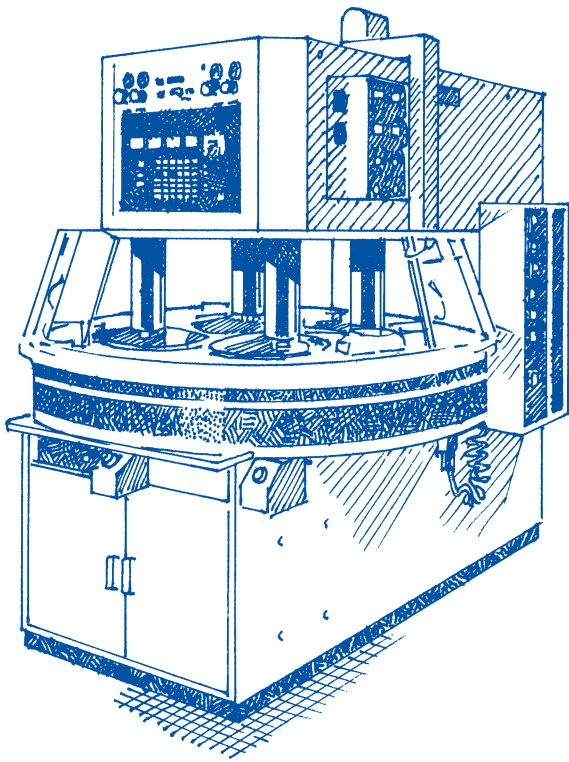


**Wafer manufacture** — grinding of glass liner tubes for semiconductor furnaces

Grinding machine incorporates two 1" cross-section angular contact single steel bearings with 18" bore.



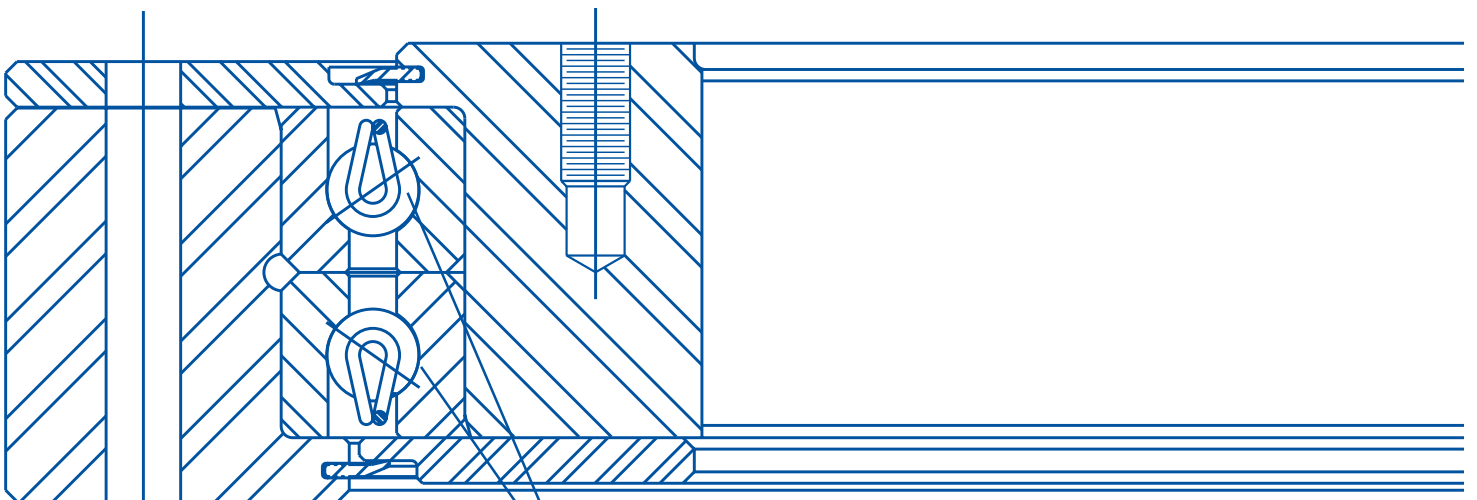
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| KAYDON CORPORATION                  |                       |
| <b>GLASS LINER GRINDING MACHINE</b> |                       |
| BEARINGS<br>USED:                   | Two KG180AR0 bearings |
| Design #2                           |                       |



**Wafer manufacture** — *lap wafer (CMP)*

Chemical mechanical polishing (CMP) machine laps and polishes wafer to a mirror-like finish.

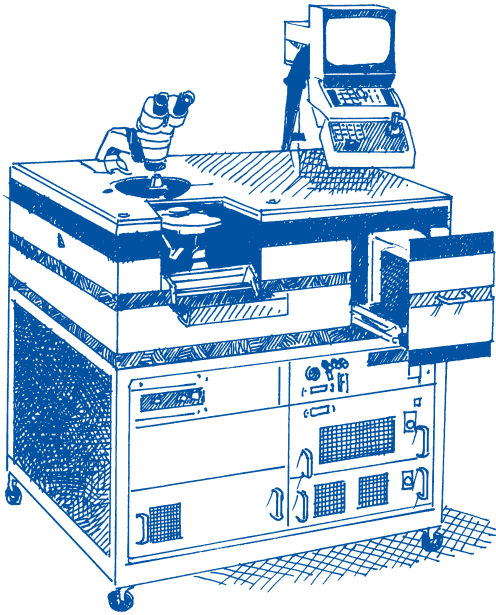
A duplexed pair of 1" cross-section bearings utilizes formed wire separators to increase the ball complement. Back-to-back mounting, and precision class 4 tolerances are utilized to maintain exact wafer linearization.



Bearing KG180BM4K

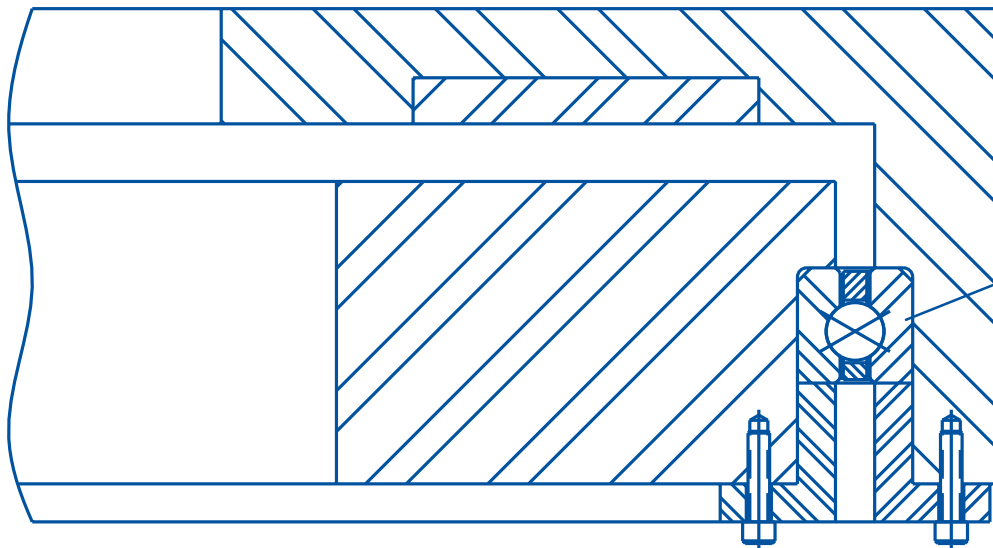
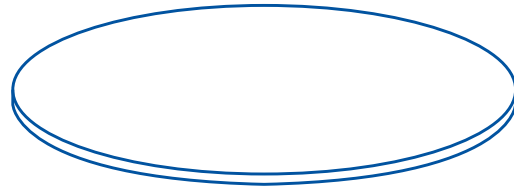
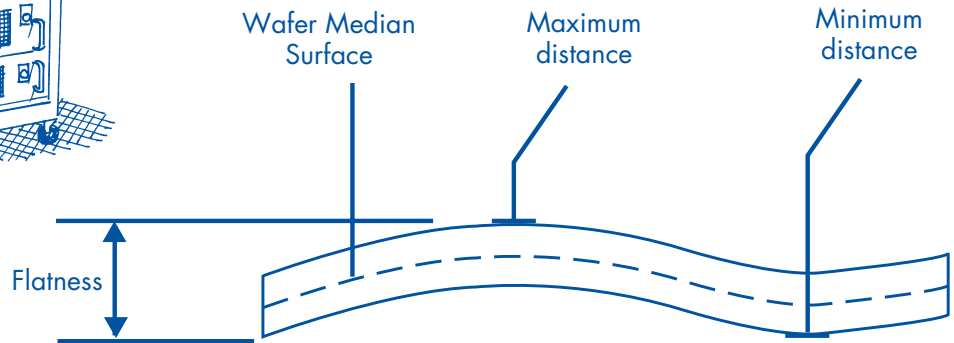
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| KAYDON CORPORATION |  |
| <b>CMP MACHINE</b> |  |
| BEARING<br>USED:   | One duplexed pair of<br>KG180BM4K bearings |
| Design #3          |  |





**Wafer manufacture** — *inspect wafer flatness*

Machine checks wafer flatness and, if necessary, makes corrections to prevent adverse effects on lithography. Machine uses a .500" cross-section four-point contact bearing with 18" bore.

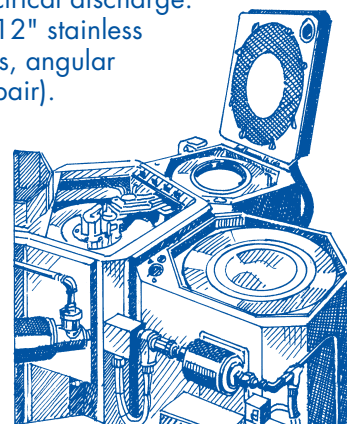
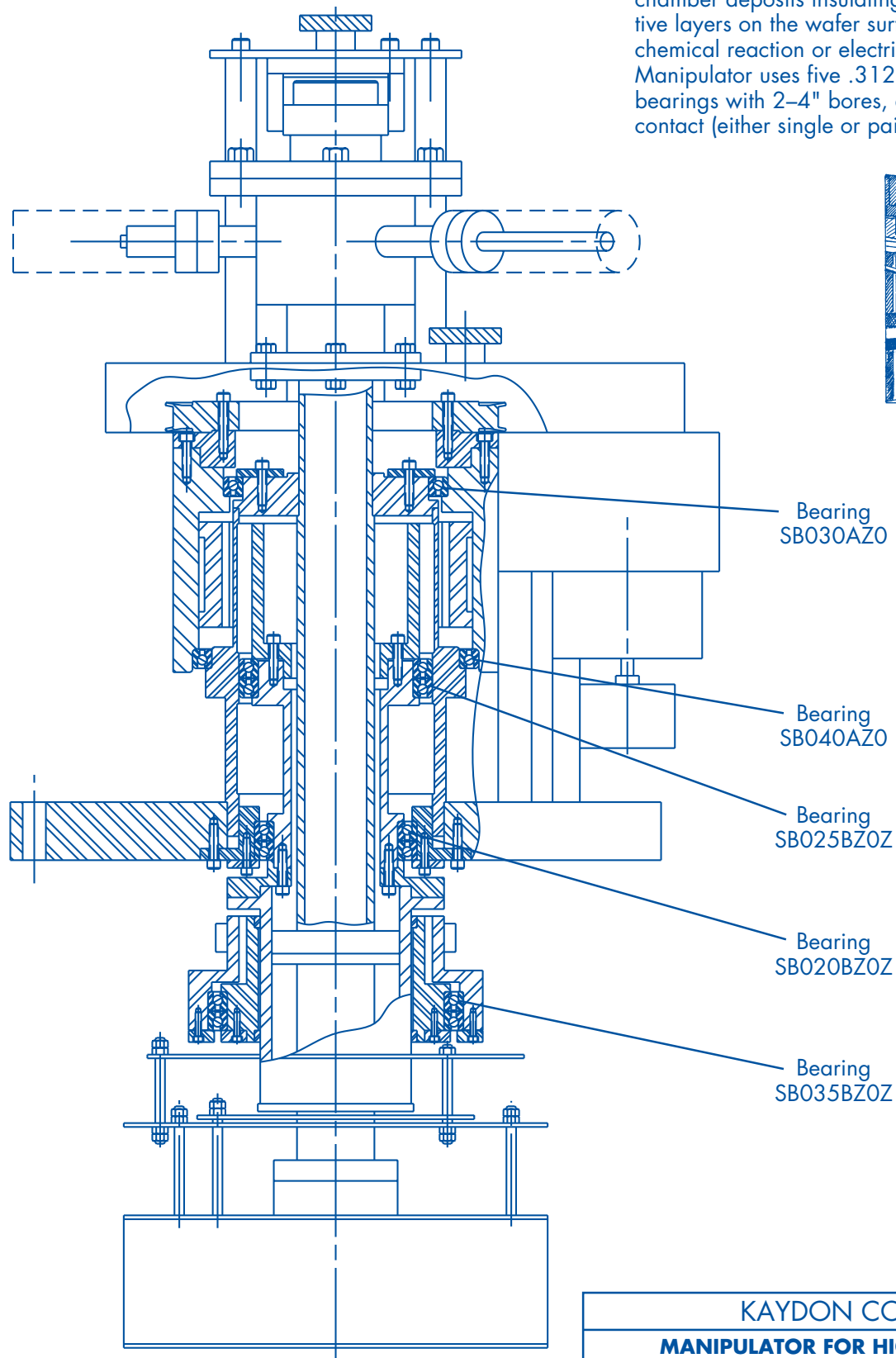


Bearing  
KD180XPOK

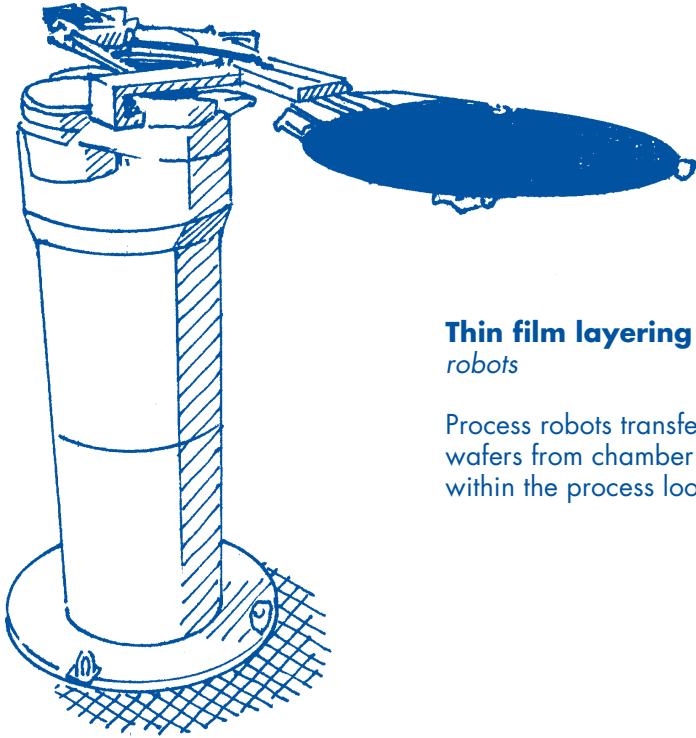
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| KAYDON CORPORATION                              |           |
| <b>MACHINE FOR CHECKING WIRE WAFER FLATNESS</b> |           |
| BEARING<br>SHOWN:                               | KD180XPOK |
| Design #4                                       |           |

**Thin film layering** — *film deposition*

Manipulator for ultra-high vacuum chamber deposits insulating or conductive layers on the wafer surface via chemical reaction or electrical discharge. Manipulator uses five .312" stainless bearings with 2–4" bores, angular contact (either single or pair).

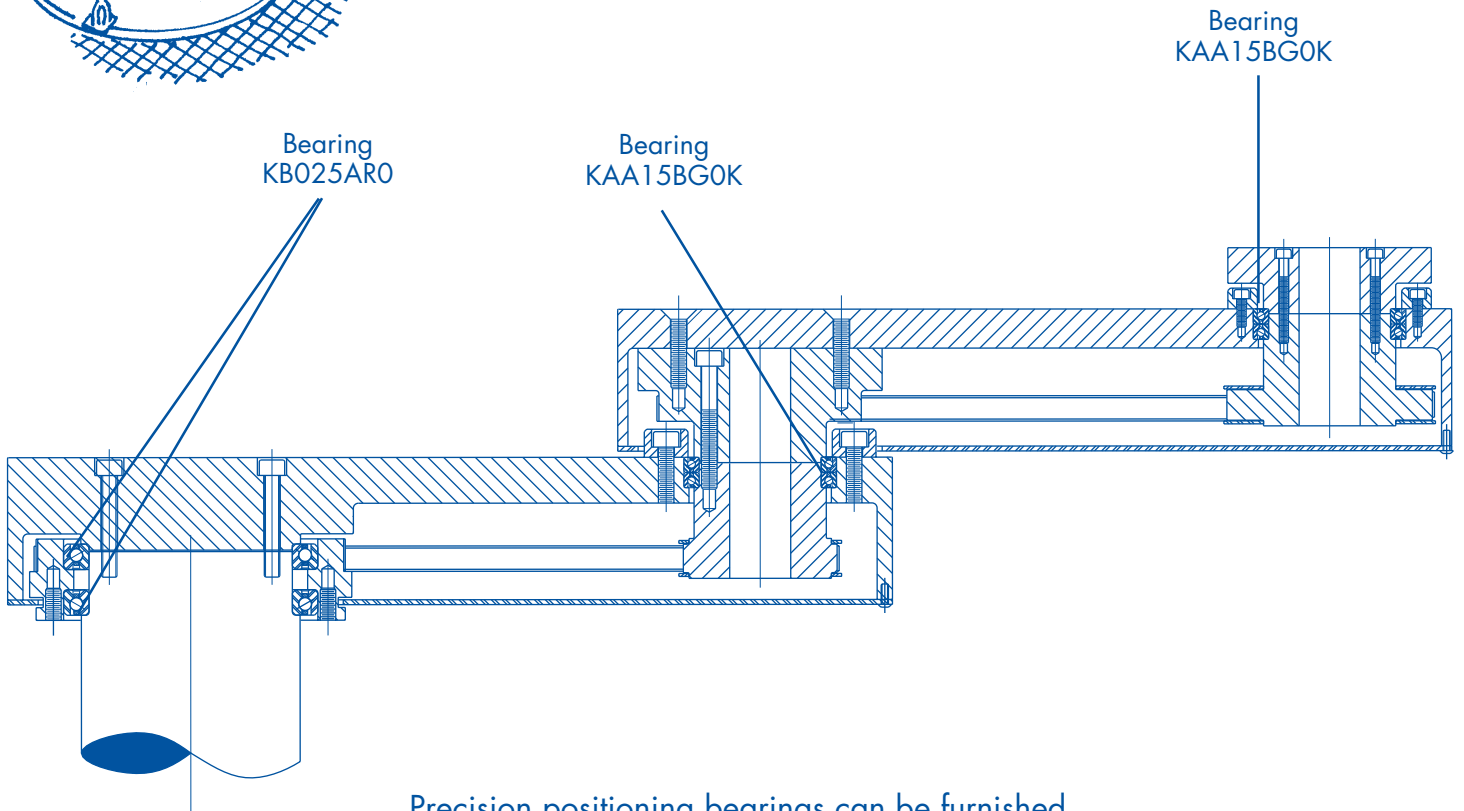


|  |   |
|--|---|
| KAYDON CORPORATION                         |   |
| <b>MANIPULATOR FOR HIGH-VACUUM CHAMBER</b> |   |
| BEARINGS<br>USED:                          | SB035BZ0Z, SB020BZ0Z, SB025BZ0Z<br>SB040AZO, SB030AZO |
| Design #5                                  |   |



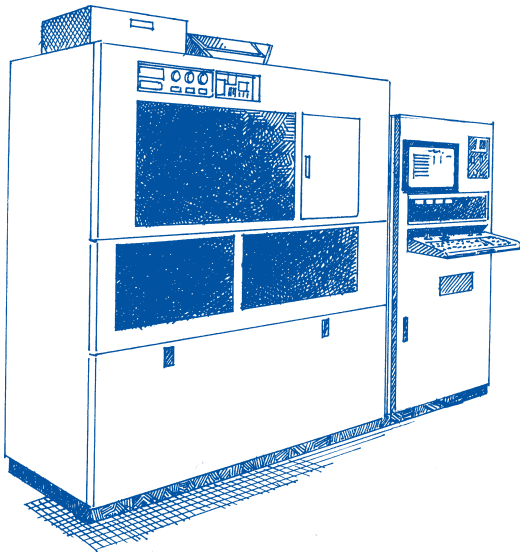
**Thin film layering** — process robots

Process robots transfer/turn/rotate wafers from chamber to chamber within the process loop.



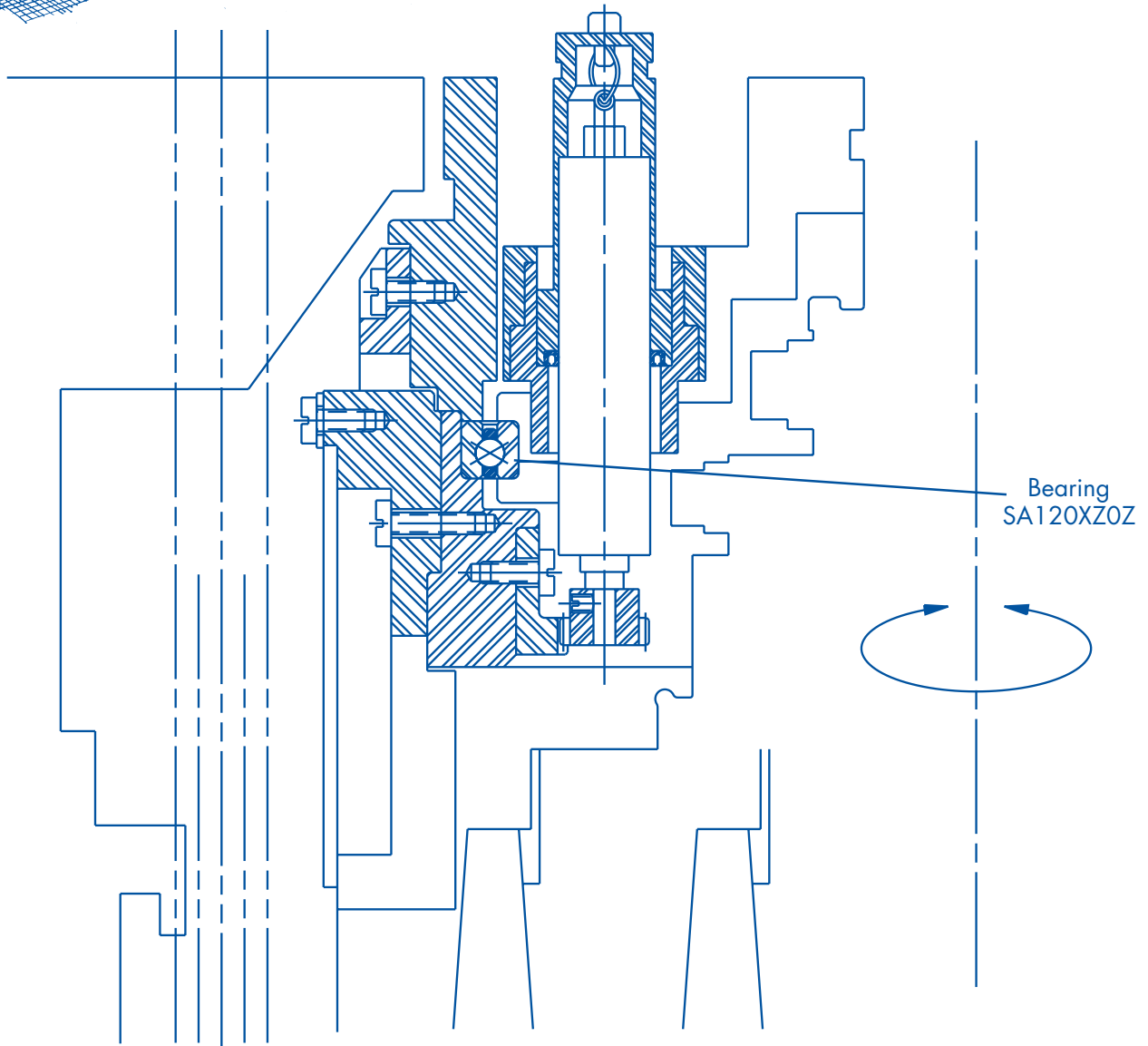
Precision positioning bearings can be furnished for operation in both vacuum or atmospheric environments.

|                                 |  |
|---------------------------------|--|
| <b>KAYDON CORPORATION</b>       |  |
| <b>WAFER TRANSFER ROBOT ARM</b> |  |
| BEARINGS SHOWN:                 | Two KB025AR0 bearings<br>Two duplexed pairs KAA15BG0K bearings |
| Design #6                       |  |

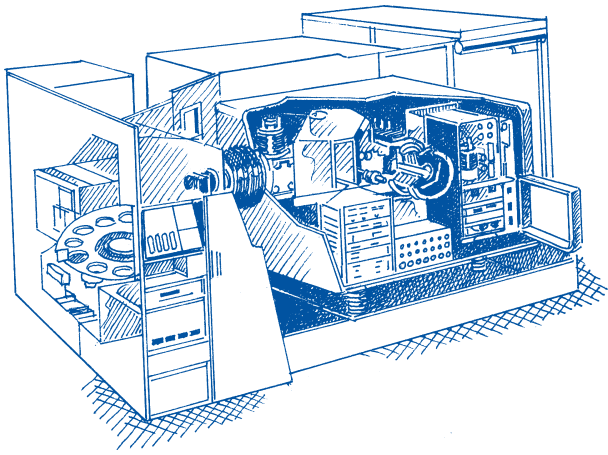


**Patterning** — *Lithography*

Lithography equipment spreads photo-sensitive material (photoresist) evenly over the wafer surface. It will be used for transfer of layer patterns to the wafer. Equipment uses a .250" cross-section four-point contact stainless bearing with a 12" bore to support a high-speed lens shutter arrangement.

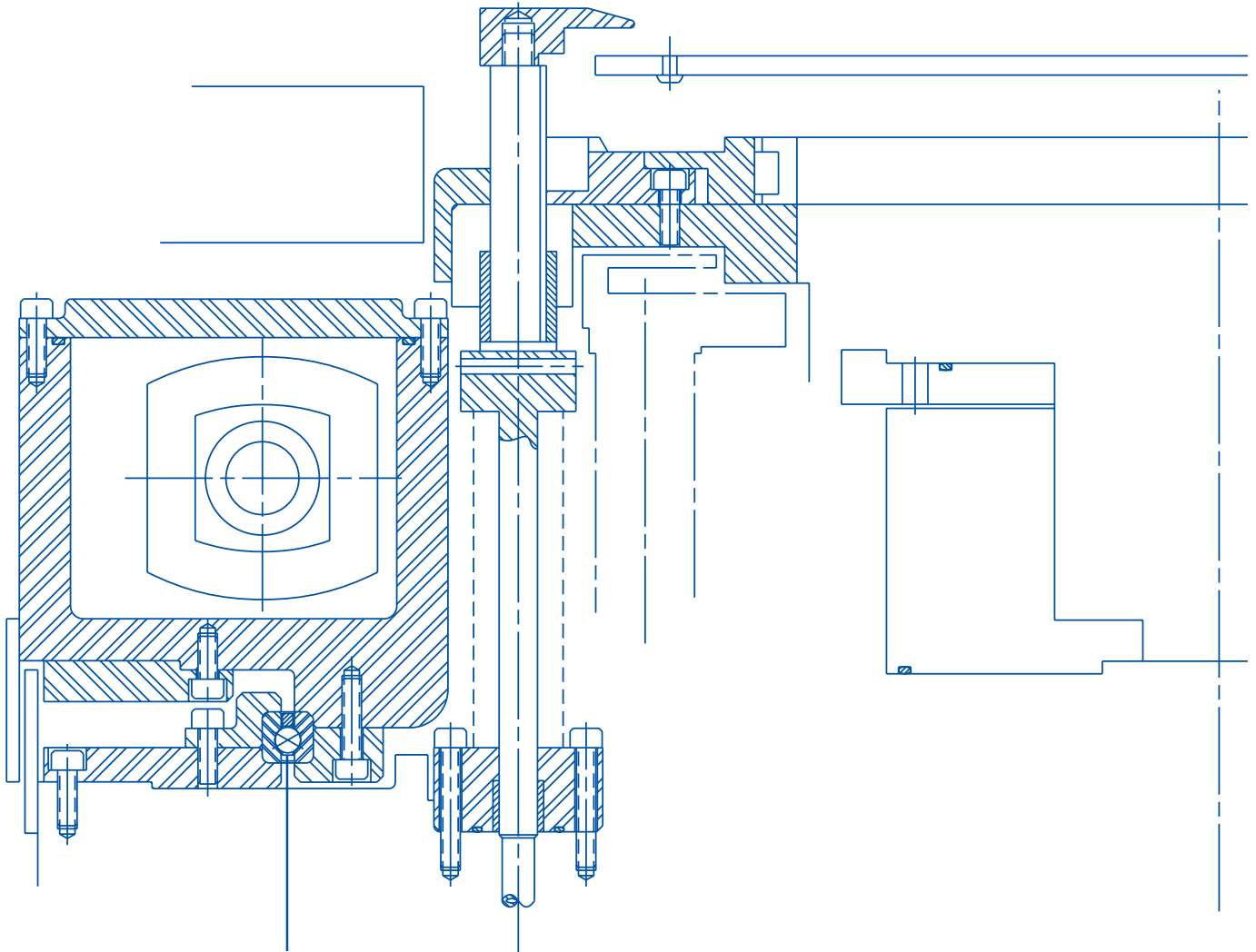


|                              |           |
|------------------------------|-----------|
| KAYDON CORPORATION           |           |
| <b>LITHOGRAPHY EQUIPMENT</b> |           |
| BEARING SHOWN:               | SA120XZ0Z |
| Design #7                    |           |



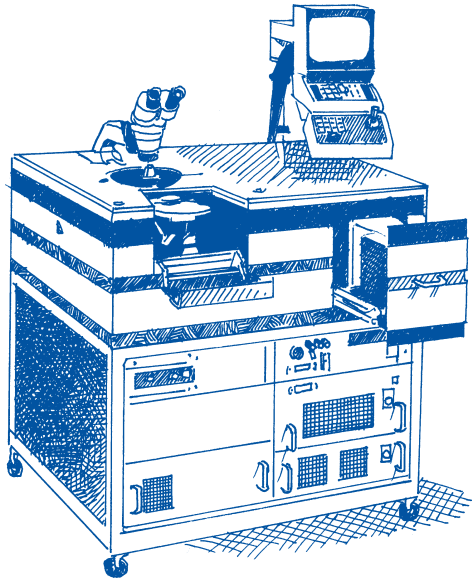
**Doping** — *diffusion ion implantation/  
metallization*

Diffusion ion implantation/metallization equipment drives high-energy ions of boron, phosphorus or arsenic into the exposed areas of the patterned wafer to create electrically conductive regions that read/write computer hard disks. Equipment uses an angular contact steel bearing with a .5" cross-section and a 14" bore to support the rotation of an axis that carries a mechanism which orientates the magnetic fields of the wafers.



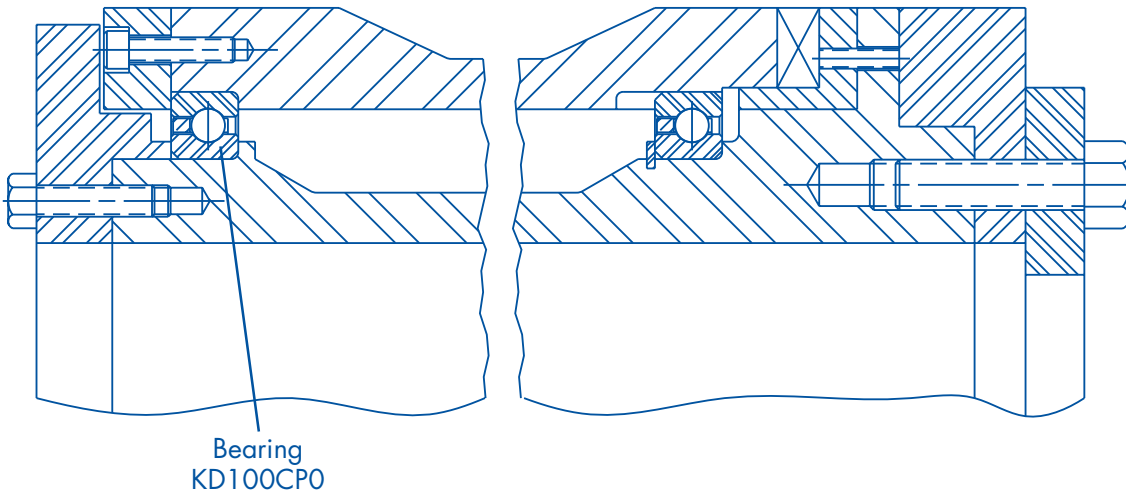
Bearing  
KD140XP0

|   |          |
|---|----------|
| KAYDON CORPORATION                              |          |
| <b>DIFFUSION ION IMPLANTATION/METALLIZATION</b> |          |
| BEARING<br>SHOWN:                               | KD140XP0 |
| Design #8                                       |          |



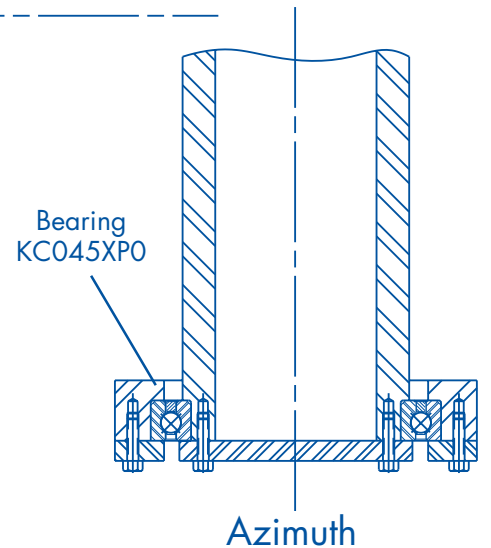
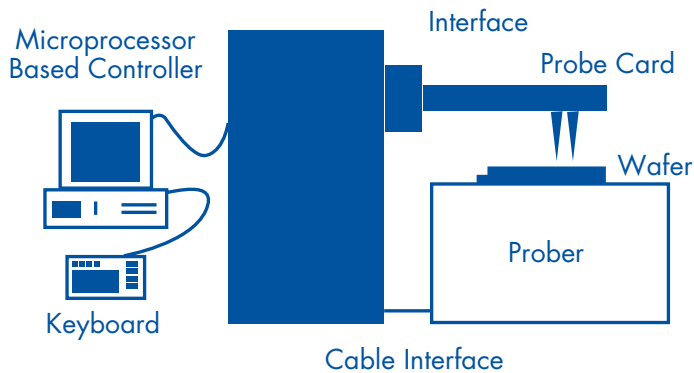
### Wafer probe test

Manipulator electrically tests and characterizes each integrated circuit (IC) on the wafer. The manipulator incorporates a .375" cross-section four-point contact bearing with a 4.5" bore in the azimuth (ascension) and two .500" cross-section radial contact bearings with a 10" bore in declination.

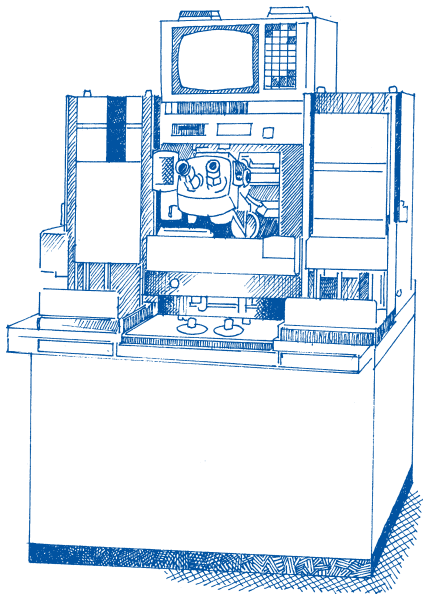


Elevation

### Water Probe Test

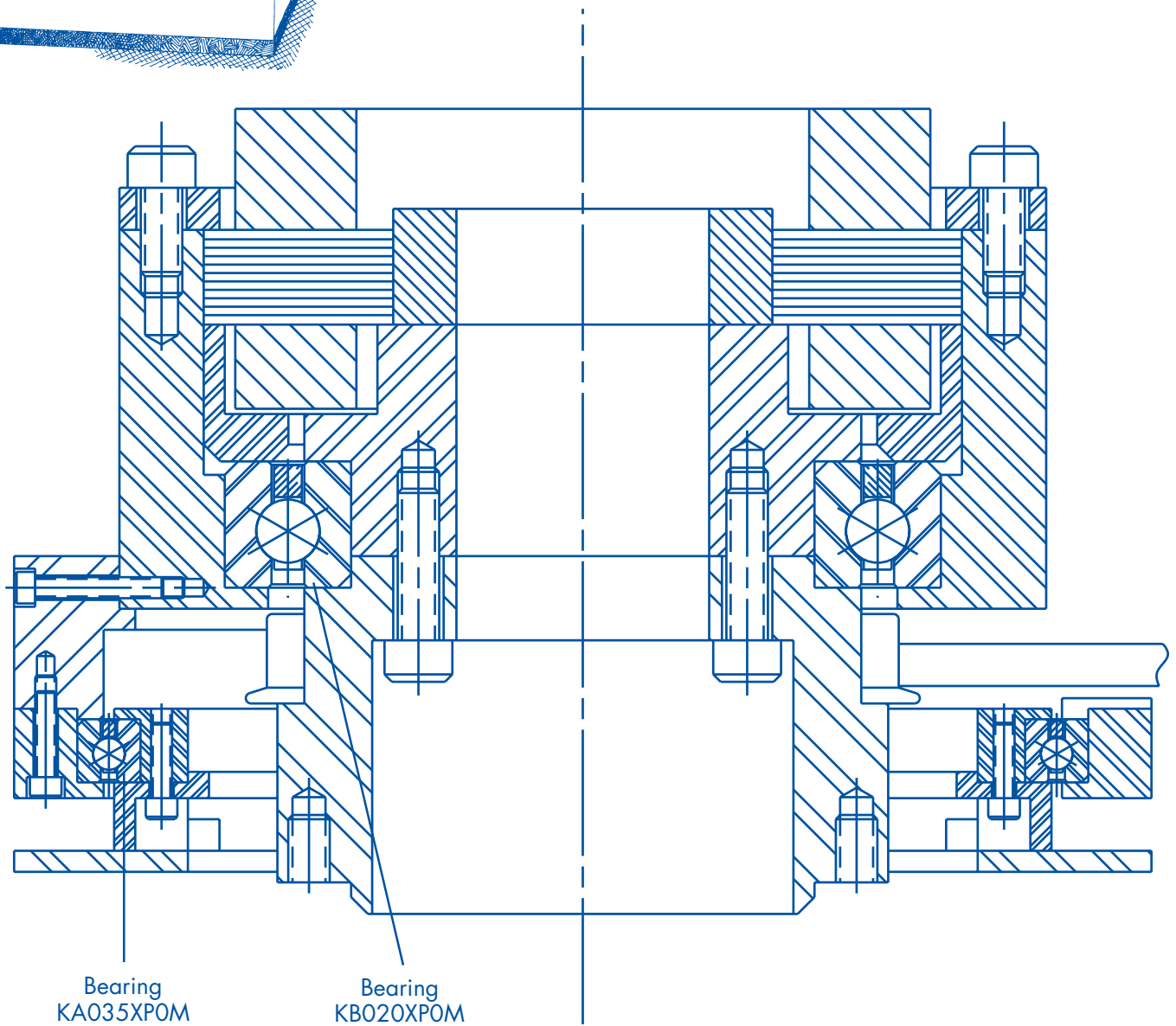


|                    |                    |
|--------------------|--------------------|
| KAYDON CORPORATION |                    |
| <b>MANIPULATOR</b> |                    |
| BEARINGS SHOWN:    | KC045XP0, KD100CP0 |
| Design #9          |                    |



## Wire bond

After a wafer is diced into chips and chips are mounted in a suitable package, fine wires connect each chip's bonding pads with leads in the package.



Bearing  
KA035XPOM

Bearing  
KB020XPOM

|                                     |                      |
|-------------------------------------|----------------------|
| KAYDON CORPORATION                  |                      |
| <b>HEAD SPIRALS IN WIRE BONDERS</b> |                      |
| BEARINGS<br>SHOWN:                  | KA035XPOM, KB020XPOM |
| SCALE: FULL                         | Design #10           |

WARRANTY: Kaydon Corporation guarantees its products to be free from defects in materials and workmanship for a period of one year from date of shipment from our plant. Any product proving defective within this one year period will be replaced free of charge provided the defective product is returned, charges prepaid to Muskegon, Michigan, and is found to have been properly mounted, lubricated, loaded and used. No responsibility will be assumed by Kaydon for contingent charges.

## KAYDON CORPORATION

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<http://www.kaydoncorp.com>



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