



## CYLINDRICAL BUSHING AIR BEARINGS HANDLING AND INSTALLATION INSTRUCTIONS

Air bearings require special handling and installation. Complete familiarization of these instructions will help ensure proper operation.

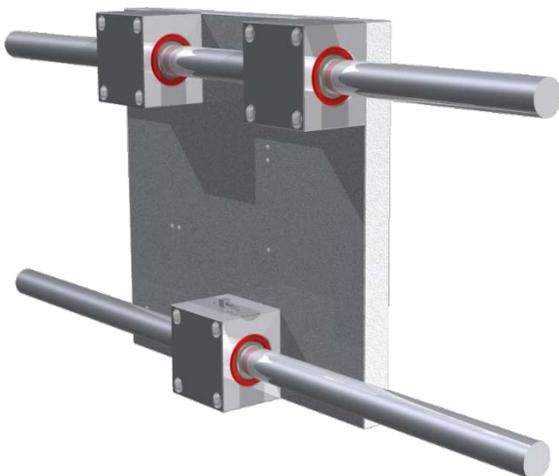
**CAUTION:** Prior to unpacking, allow the bearing to reach room temperature. This will help prevent water from condensing on the surfaces. During this time, please become familiar with the bearing by reading through these instructions.

SOME AIR BEARINGS REQUIRE HIGH PRESSURE GAS TO OPERATE. ALWAYS USE ADEQUATE PROTECTION WHEN HANDLING HIGH PRESSURE SOURCES.

### **DESCRIPTION :**

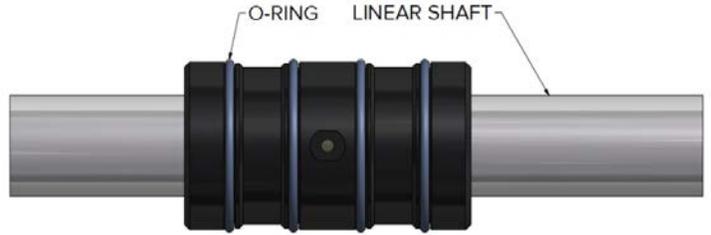
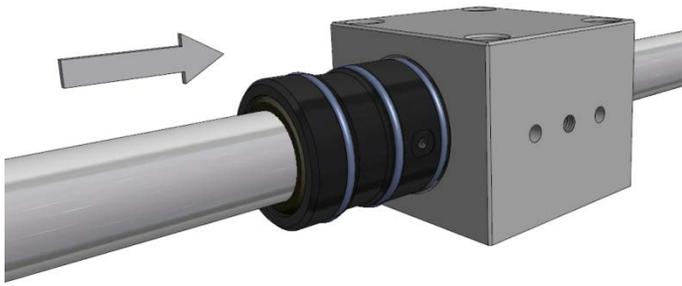
Cylindrical bushing air bearings of the LCAX series are designed for aerostatic, frictionless rotary motion in one axis and linear motion about the same axis while supporting radial loads using either a porous carbon surface or an orifice fed surface.

Anodized aluminum provides scratch resistance of the housing. A threaded hole located centrally on the outside diameter of the assembly provides an inlet for externally pressurized air to reach the gap through either porous carbon or discrete orifices. If equipped, gap sensing air bearings have a second hole to allow measurement of the air gap pressure and lift. Load is imparted in the radial direction.

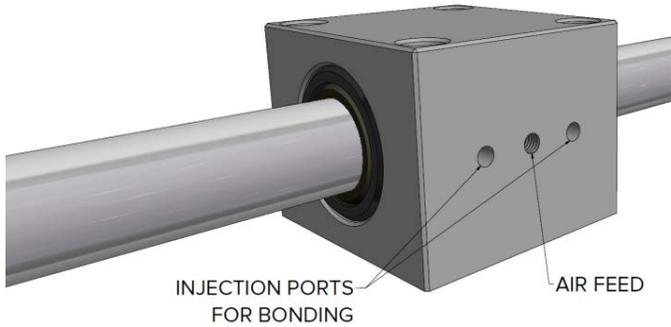


Typically used as a bushing on common size linear shafts, they are an economical means to provide frictionless linear motion due to the small number of components required. They are often paired with other air bearings to constrain motion to one degree of freedom.

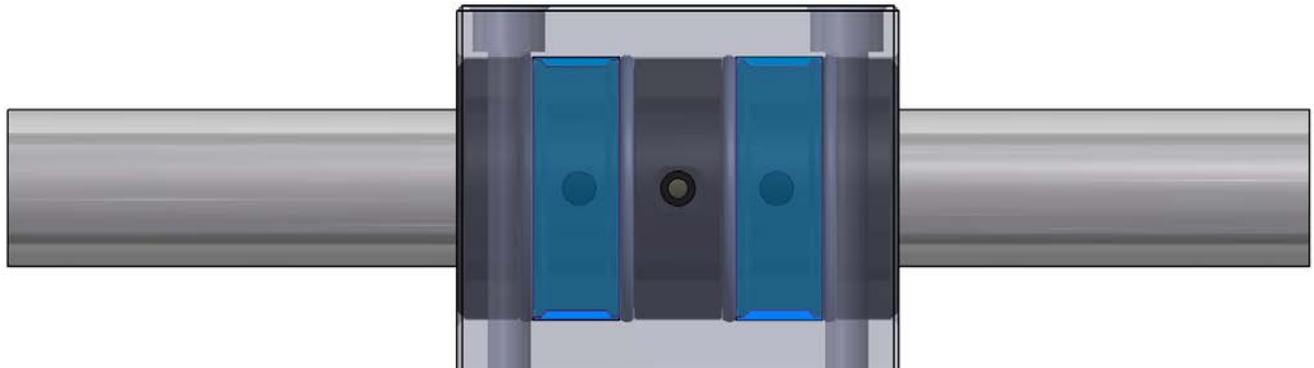
**MATING COMPONENTS:**



Four o-ring grooves on the outside diameter allow the bearing to be inserted within a block or similar structure for even load distribution and compliance.



These o-rings also help to create two cavities (blue regions below) which can be injected with epoxy or other compounds. This somewhat permanent method of assembly produces a stiff union between the air bearing, block and the upper level stage assembly.



The air bearing bushing may also be clamped; although this must be performed carefully to avoid deformation of the housing and inside diameter.

**HANDLING:**

Functionality is made possible by manufacturing the air bearing surface to precise sub-micron tolerances. Small injuries to the mating surfaces, including those invisible to the naked eye, can cause deformations that impede performance. Never leave the bearing exposed where they might be damaged and inform persons nearby of the delicate handling requirements. Store air bearings separately in a clean and dry environment between 50-110 °F.

**SUPPLY AIR QUALITY REQUIREMENTS:**

Air supplied to the bearing requires special filtration. Due to the small clearance gaps and small pores in the carbon or orifice, particles present in unfiltered air can accumulate and restrict the flow of air. Although a single particle large enough can clog an orifice type air bearing, multiple small particles over time can slowly clog a porous carbon air bearing.



NOTE: Contaminated air is one of the leading causes of air bearing failure.

Air quality standard 8573.1 has been developed by ISO. It describes the following specifications for compressed air:

| Quality Class | SOLIDS –<br>Maximum particle size (µm) | MOISTURE –<br>Dew Point |     | OIL –<br>Liquid and Gas |                    |
|---------------|--|-------------------------|-----|-------------------------|--------------------|
|               |  | °C                      | °F  | mg/m <sup>3</sup>       | ppm <sub>w/w</sub> |
| 2             | 1                                      | -40                     | -40 | 0.1                     | 0.08               |
| 3             | 5                                      | -20                     | -4  | 1                       | 0.8                |

We recommend class 3 or better however, in any case, the maximum particle size should be 1 µm. Air filtration systems are sold as an optional accessory.

**TUBING:**

Tubing which transmits the supply air to the bearing should have an adequate diameter to account for pressure loss over its length. The tubing should be flexible enough not to induce additional loads that might cause tilt or rotation of the bearing. A variety of materials are available and polyurethane with a durometer of about 85-95 works well in most applications using barbed fittings.

**MATING SURFACE REQUIREMENTS:**

Impervious materials like steel, ceramic, glass, silicon carbide and anodized aluminum work well as a companion surface. The mating shaft should have a roundness of 2-3 µm or less and a diametral clearance of 8-10 microns. A surface finish of 16 µinch Ra or better is recommended. Although large variations in form and finish will allow the bearing to ride without friction, to assure optimal performance, the straightness of the shaft should be less than 1/3<sup>rd</sup> of the expected minimum air gap within the region local to the air bearing face and the finish should be less than 16 µinch Ra.

**LOAD APPLICATION:**

Cylindrical bushing air bearings should have the load centered evenly distributed to minimize tilt. Any mounting or bonding to the housing should be performed carefully in order to maintain co-axiality of the shaft and bore of the bushing.

**INSTALLATION:**

The surrounding environment of the bearing should be clean and free of flying debris. Adequate shielding should be provided if the bearing is not installed in a clean and debris-free area. The temperature and humidity of the surroundings should be regulated to such an extent that condensation does not occur on the bearing surfaces. Due to the high accuracy of the air bearing surfaces, any installation requirement that would deform the bearing surfaces beyond a few microns, will adversely affect the performance of the bearing.

Prepare a clean and well-lit work surface near the point of installation for assembly of the mating parts.

NOTE: Avoid contact of liquids or oils with the air film surface of a porous carbon bearing due to the highly absorbent nature of the material.

If possible, handle parts with clean gloves. We recommend latex or nitrile gloves, without talc powder; they provide cleanliness as well as a good grip. To minimize risk of injury to the critical bearing surfaces, reduce the amount of time handling the parts and once assembled, do not repeatedly take apart the mating components unnecessarily; the bearing is best protected when assembled with its mating surface.



**AVOID ATTEMPTING TO MOVE THE BUSHING WITHOUT AN ADEQUATE AIR SUPPLY. DAMAGE MAY OCCUR. LIMITED SLIDING OF POROUS CARBON BEARINGS IS PERMITTED. Mechanical and pressure interlocks are recommended as a preventative measure**

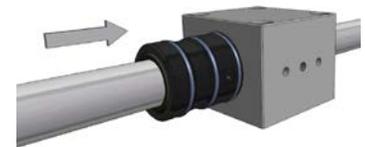


Inspect the air film surface inside the bore of the air bearing. Make sure the bearing surface is clean and free of debris or dirt. NOTE: Particles, dust and/or debris must be removed from the air bearing surface of the bore as well as the shaft.

Connect the supply air hose to the fitting on the bearing and initiate air flow at 20 psig.

Clean the surface using a lint free cloth dampened with isopropyl alcohol (or other MILD solvent). Carefully wipe the intended area of both mating surfaces and allow the surfaces to dry prior to assembly.

If applicable, install the air bearing bushing into a block or similar structure.



Carefully fit the shaft into the air bushing. The bearing should slide smoothly without friction. If it does not, remove and inspect the surfaces.

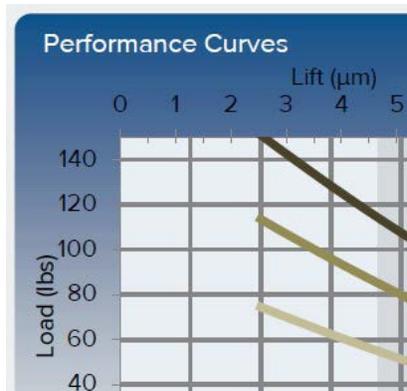
The air bearing(s) assembly should slide very freely and smoothly. If it does not, make sure that the proper pressure and load is applied. Check the mating surface for oil or debris; re-clean if necessary. Remove/adjust any hardware within the machine tool assembly that might cause drag.

### GAP SENSE BEARINGS:

Some air bearings include gap sensing<sup>1</sup>. This allows for quick and reliable installation of the air bearing; no displacement sensor is required to know the air gap. In the case of the cylindrical bushing air bearing, this feature is commonly used for real time flying height monitoring during operation; this can help increase reliability of the machine tool. An additional port located next to the pressure inlet allows for correlation of the film pressure to the air gap.



The gap sense pressure to air gap is correlated on a graph per the specification of the air bearing. Additionally, customized gap sense curves can be supplied with each bearing upon request:



### CARE AND MAINTENANCE:

Never clean the bearing without the airflow initiated. The bearing is best protected when the air is flowing. The inherent positive pressure forces particles and contaminants out of the bearing.

Never use pressurized air to remove dust or debris from the outer surfaces of an air bearing. The high-pressure air may force dirt and debris into the small gap between the mating surfaces.

To clean the housing, **initiate airflow** and wipe the surfaces using a lint free cloth lightly dampened with a mild solvent such as isopropyl alcohol. The bearing should always run very smoothly without any friction. Periodically disconnect the actuation system, if applicable, and test for frictionless motion.

Also, check the air filtration/conditioning system in accordance with the manufacturer specifications and replace filters and/or desiccant whenever required.

With proper handling, installation and operation, air bearings have an unlimited lifetime.