

Linear Guides for the Next Generation of Medical Machines

Medical Application Requirements

- Small footprint, low profile
- Reliability Smoothness
- Low maintenance

IKO Medical Motion Components

- LWL miniature linear guide
- ML maintenance free linear guide
- LSAG ball spline
- Precision positioning table



Not too long ago, the motion systems used in medical and lab automation equipment had technical requirements that were easy to satisfy. These lightly loaded applications generally required simple point-to-point moves with low to moderate positioning accuracy requirements.

With the exception of surgical robots and some diagnostic systems, many medical machines still have modest positioning accuracy requirements, at

least compared to applications such as semiconductor and electronics assembly. Yet the motion axes in medical machines do have to run smoothly and quietly, sometimes at high speeds.

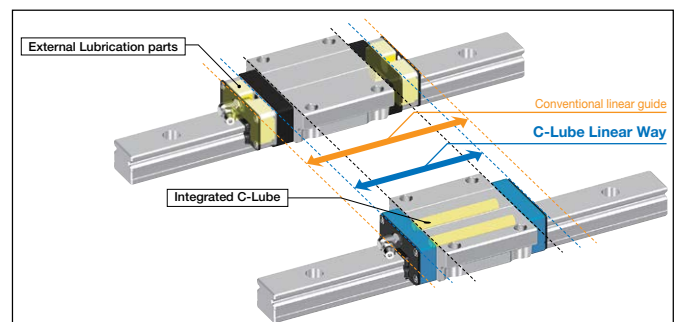
Medical motion systems have had to become more sophisticated in other respects to keep pace with two unfolding trends in the medical machine marketplace.

One of these trends is miniaturization. Diagnostic equipment, DNA sequencers and other types of automation systems occupy less space than in years past, and these machines increasingly require streamlined mechanical designs. This ongoing shift creates a strong need for miniaturized motion components, especially linear guides.

The other trend is an increasing demand for reliability and low cost of ownership. Here too, choosing the right linear guide can make a big difference in how well the machine runs—and how much it will cost to keep running.

The next generation of medical machines, then, will need linear guides that are compact relative to the loads they carry. They will also need to run smoothly with adequate precision. And finally, they will also need design features that ensure that the machine has a long, trouble-free life.

Compact - Like many types of consumer and industrial products, medical machines of all kinds are shrinking. To take one example, lab automation systems have been scaled down to meet the needs of smaller laboratories that have less floor space—and budget—to spare.



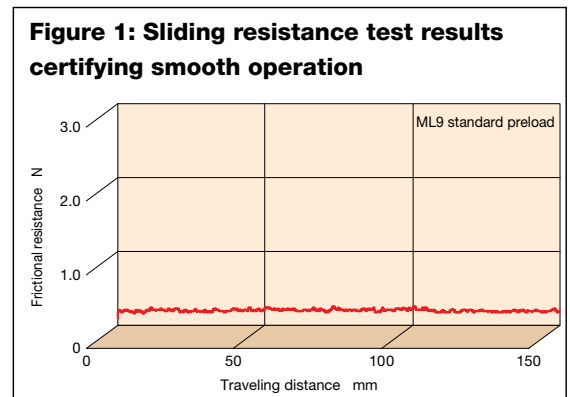
At **IKO**, we offer an extensive line of miniature linear motion products that can meet the requirements of size-constrained medical applications. Among them are the world's smallest recirculating ball linear guide, which has a track rail width of just 1-mm and a cross sectional height of 2.-mm. We also offer a tiny ball-spline guide which has a shaft diameter of 2-mm and a cylinder diameter of 6-mm. More miniature motion options can be found at <http://www.ikont.co.jp/eg/product/tech/tech03.html>.

Smooth - In medical applications, one of these functional requirements is smoothness. Many guides can move from point to point quickly, but not all can do so smoothly.

Medical robots and lab automation systems in particular can be especially sensitive to jerky motion. In many medical applications, smoothness counts for more than maximum speed.

Smoothness also translates to less noise, and quiet motion components are strongly preferred in any medical machine or diagnostic system used in proximity to patients.

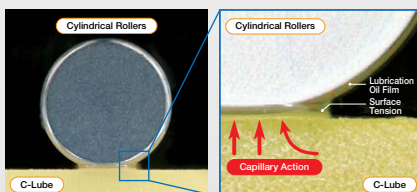
When selecting smooth guides for medical machines, look for products that have a low, uniform sliding resistance over their travel distance (See Figure 1).



Even when preloaded, IKO linear guides run smoothly, as shown by the uniform frictional resistance data.

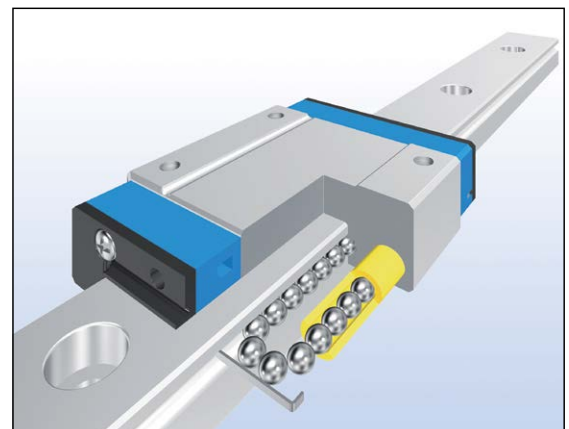
Maintenance-Free - The cost of maintenance, particularly lubrication needs, drives up the cost of ownership for many types of moving machines. Medical and lab automation machines are no exception.

The **IKO** solution to this maintenance problem is a proprietary technology called "C-Lube". It allows our linear guides to operate for more than 20,000 kilometers without the need to replenish the lubricant. C-Lube consists of a porous polymer "reservoir" that we impregnate with lubricant during our manufacturing process.



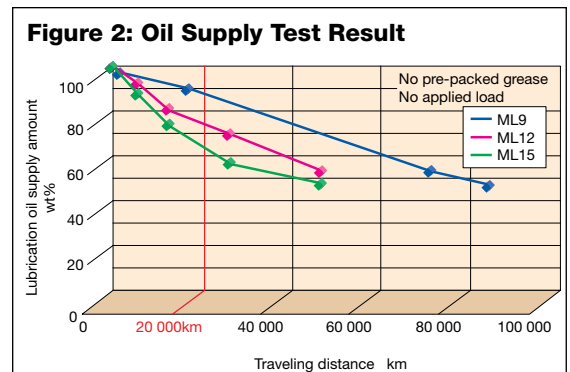
Lubrication oil is continuously supplied to the rolling elements by surface tension in the C-Lube resin material.

The polymer reservoir is positioned within the guide's slider so that it comes in contact with the recirculating balls or rollers. Surface tension in the porous polymer continually brings lubricant to the surface of the C-Lube reservoir, allowing lubricant to transfer to the balls or rollers as they pass by. This method has proven itself much more cost-effective and far cleaner than other maintenance-free methods that apply lubricant directly to the guide rails via a lubricating plate.

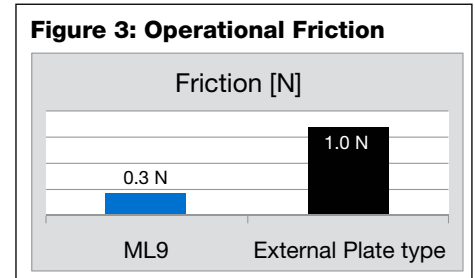


C-Lube technology keeps our linear guides running without the need to add lubricant. While we conservatively cite 20,000 km as the maintenance interval, our tests show that C-Lube can in fact go for much longer.

These lubricating plates, which remain in contact with the rails, have another downside. The plate can increase the drag forces on the slider, driving up the guide's overall resistance. With no external lubricating plate, C-Lube does not suffer from this problem (see figures 2 and 3).



While we do include grease fittings on products that have C-Lube, many users will not need them. In practice, many of the linear guides and positioning tables that use C-Lube technology in medical applications are “lubed-for-life” since their maintenance intervals will exceed the life cycle of the machine itself.



Aside from the obvious cost advantage to lubed-for-life components, they also reduce the potential for grease contamination of sensitive medical equipment. Because **IKO**'s C-Lube cuts down on grease applications while medical machines are in service, it is a natural fit for clean rooms, laboratories, operating rooms and other contamination-sensitive environments.

Reliable, long life - There are many reasons why a linear guide can fail to live up to its projected life cycle. Unabated contamination for example, can shorten the life of a linear guide. So can excess temperatures. So can mechanical design or installation errors that cause misalignment between the sliders and rails. All these failure modes are possible in medical applications, but the most common and easily avoidable premature failures result from under- or over-lubrication of linear motion components.

C-Lube can again help on this score by ensuring that linear motion components always run with the proper amount of lubrication—a task maintenance workers rarely do well.

IKO Clean Lubrication



Wide Rails Can Save Space

There are ways to achieve a compact motion system other than simply picking the smallest products available. Consider, for example, our wide rail linear guides. While not our smallest guide in terms of footprint, the extra moment load capacity of these low-profile guides has often let them take the place of two standard rail guides, resulting in an overall reduction in the size of the linear motion system. Picking a single robust guide to take the place of two smaller guides is a design strategy engineers should keep in mind when trying to reduce the size of medical machines.



For more information on IKO's full range of bearings and linear motion products please visit www.ikont.eu or call +31 10 462 68 68