Hovair Systems

The Load Moving Specialists

Air Bearing Systems - Everything You Need To Know

Air Bearing Systems function using what is known as Air Film Technology. This technology uses exactly the same principle as that used in the operation of hovercraft. As the hovercraft has been around since 1955, this technology is not entirely new to the material handling industry. However, the majority of industrial companies just don't know about it. Large industrials like Boeing, NASA, Pilkington, Lockheed Martin and other large corporations use it all the time and have done so for many years - these companies are all good customers of ours, by the way. Once people realize that you can actually place a load or heavy machine onto a set of air bearing modules, plug in an air line, then push the load effortlessly to its destination, they are amazed at the concept and usually buy into it quite quickly. You can physically see that while trying to move an odd-shaped 10-ton load with a forklift is a nightmare, it is a piece of cake with an air bearing system. And so much safer for the workplace personnel, too!

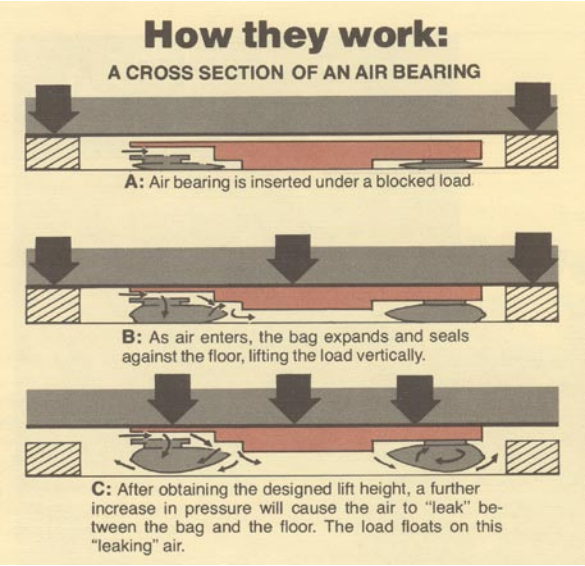
What Is Air Film Technology?

Air Film Technology is an action that causes the presence of an invisible film of air between an air bearing diaphragm and the surface it is standing on. In our case, this would be the air bearings sitting underneath a load, and the floor. There are a lot of physics and variables that can be applied to this technology, but for the purpose of this document, we are able to keep it simple, as all our air bearing products operate in the same way every time they are used.

Air Film is achieved when compressed air exhausting from a set of air bearings in contact with the floor's surface is of sufficient pressure to repel against the floor and cause the load to lift away from the floor. The resistance of the solid, non-porous floor causes the compressed air to repel back against the bearing thus forming a thin film of air between the floor surface and the air bearings that are supporting a heavy load or machine. The forming of an air film will be dependent on the weight of the load bearing down on the floor and the amount of air pressure being applied to the floor by the air bearings.

The heavier the load, the more air pressure you are going to require to cause enough down-force to form the air film and subsequently lift the load away from the floor surface. If there is not enough air pressure, the air film cannot be formed and the load stays where it is. As we will outline later in this document, there are different air bearings available for varying load weights.

Once a film of air has been achieved, the load will start to rise off the floor. Until adjustments have been made to the system, it will almost certainly be lop-sided, uneven in its operation, and won't be totally clear of the floor surface. This is quite normal and no cause for concern. To reach a stage of perfect flotation, we need to apply enough pressure to the floor surface from each individual air bearing module to cause the load to lift sufficiently away from the floor surface to kill the friction between floor and air bearing diaphragm surface. Once this has been achieved the load is ready for action.

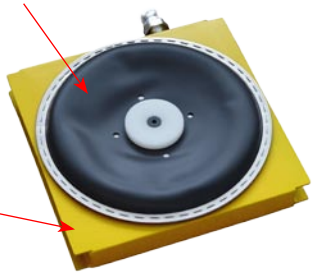


The diagram on the right shows a load sitting on blocks with the air bearing system deflated and in the off position (top). In the center you can see the air bearings starting to inflate to form a seal with the floor - no load movement as yet. Once the air bearing has fully inflated, air film is achieved and the load is floated off the blocks and ready to be moved away.

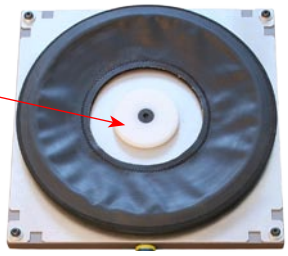
It really is that simple!

Air Bearings

Air Bearings are the heart and soul of an air bearing system. We need the air bearings to cause the load to float off the floor, and we need the modules to house the air bearings as well as support the weight of the load. The air bearing is basically a flexible diaphragm made of either rubber or a tough urethane fabric depending on the type of bearing it is. The diaphragm is molded to the correct shape and fixed to a backing plate usually with industrial staples, rivets or glue. The backing plate is then fixed to the module to form one unit of a load moving system. The picture at top right shows a tough urethane fabric A-type air bearing stapled to a (concealed) round aluminum backing plate which is secured to the module via a center load pad. The air bearing is the black and silver part and the module is the yellow part. The lower picture shows a urethane fabric B-type air bearing which has been vulcanized to a square backing plate and secured to its module via four corner bolts.



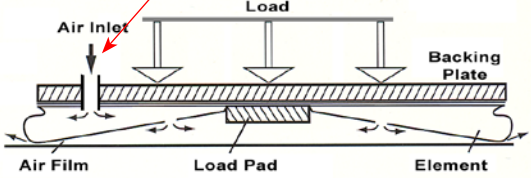
As you have already learned, it is the air bearing diaphragm that does all the work for you when moving your heavy loads around. It is the diaphragm that has most contact with the floor surface. Most air bearings have what is known as a load pad which comes in contact with the floor and helps the module to support the load when the air bearings are deflated and out of use. The load pads ensure that the air bearing diaphragms are not strained or susceptible to damage while they are still under the load but not in action.



Why would they still be under the load when not in action? Good question, and our favorite! One of the most important benefits of converting to air bearing systems is the ability to bolt the modules directly to your heavy loads and machinery and leave them there permanently. So every time that load needs to be moved, simply plug in your air line and GO! Again, it really is that simple. Just imagine having to lug a 20-ton machine from A to B every day of the week. Sure, it can be done, but what could be simpler than bolting an air bearing kit to it, plugging in an air line and have a couple of guys send it back up the line in just a minute or two?

Air Bearing Modules

An Air Bearing Module is essentially a metal housing that incorporates a formed air bearing unit, and has the strength to withstand and support the weight of heavy loads being placed upon it. It is also a channel for the routing of compressed air from its source to the air bearing for load-moving use. At Hovair Systems, our modules are mainly of the Round Steel and Square Aluminum types, with a light-weight stainless steel module being available for lighter and more delicate loads. Pictured right is a typical square aluminum module - top and bottom views. The top view shows the part that will support the load. You will also notice a round fitting in the side of the module. Depending on the type of system chosen, this fitting will be either an air inlet port or an air flow control valve. If it is an air inlet port, then it will simply be a component that allows air to enter the module from the compressed air source via a series of air line hoses. The air flow will be controlled centrally from a remote control unit, so the pressure will already be correctly set and therefore should run unimpeded directly into the module. If the system is not using a remote control unit, then the fitting will be an air flow control valve. Air will be directed unregulated to the module through a series of air supply hoses. When it reaches the module, control of that air will then be passed to the air flow control valve which will then allow it into the system at the pressure the operator will deem appropriate for the air bearing and load properties. From the air flow control valve, the compressed air will flow through a series of chambers until they fill with air. Air then passes from an air outlet port in the module base through to the air inlet port of the fitted air bearing. The air bearing then inflates and causes the load to float.



The diagram (left) highlights the inflation process with an A-type bearing fitted to a square module. Note the air travel and how it inflates the bearing to form a seal with the floor and subsequently escapes from the bearing to cause air film and lift to take place.

How Do Air Bearings Work?

Once an air bearing is fitted to a module, it is ready to go to work. Compressed air is introduced to the module via an air flow control valve / air inlet port fitted directly to the module. When the air is turned on, the air bearing diaphragm inflates rapidly to quickly lift the load off the floor. When the diaphragm is in its deflated state, it is lifeless and does nothing much at all. However, as air enters the system, the diaphragm starts to inflate. As it expands it first makes initial contact with the floor surface and eventually forms a seal between itself and the floor. When a seal has been formed, the diaphragm continues to inflate until the compressed air starts to be forced out of the air exhaust holes in the diaphragm. At this point the compressed air is forced against the floor surface and has nowhere to go - the floor surfaces repels the air and sends it back again. This build up of pressure and repelling action eventually causes a thin film of air to form and the air bearing gently lifts away from the floor. When it has lifted sufficiently, it is ready to be moved to its destination.

What Does An Air Bearing System Consist Of?

A single air bearing and module unit cannot work on its own. It needs to be connected to a series of similar modules to form a load moving system - see diagram below. Air bearing systems for use in regular industrial facilities usually consist of four or six modules. A standard system of 4 square aluminum or round steel modules will consist of 4 bearings incorporated into modules, air flow control valves or inlet ports, depending on the system's specifications, a series of inter-connecting air supply hoses to link the modules to the air supply, and any other valves and tee-pieces necessary to complete the system.

Assembling An Air Bearing System

With Remote Control

Assembling an air bearing system is very easy and virtually anyone can do it - it is not rocket science! Your first task is to determine the rough outline size of your load's footprint and arrange your module units in a similar formation. Connect one end of an air supply hose to each module's inlet port (see diagram below) using the pre-fitted quick-disconnect fittings - just slide them on the valve and pull back the locking cams and you're done! Fit the other ends of the hoses onto the remote control air outlet ports. Connect the remote control unit to the main air supply at shop source, turn on the air and you are ready to go. It really is that easy!

Without Remote Control

Similar to the remote control assembly, you determine the load's footprint and arrange your modules accordingly. Systems supplied without remote control will have air flow control valves included (see diagram below) with quick-disconnect fittings. Connect the end of each air supply hose to the appropriate module and lock the cams down. The other ends of the air supply hoses will connect to tee-pieces and subsequently an On/Off ball valve which will control the air supply to the system.

See diagrams below and on following pages.

Air supply hose with factory-fitted Quick-Disconnect fittings

Typical round steel module with air flow control valve fitted

Typical square aluminum module with air inlet port fitted

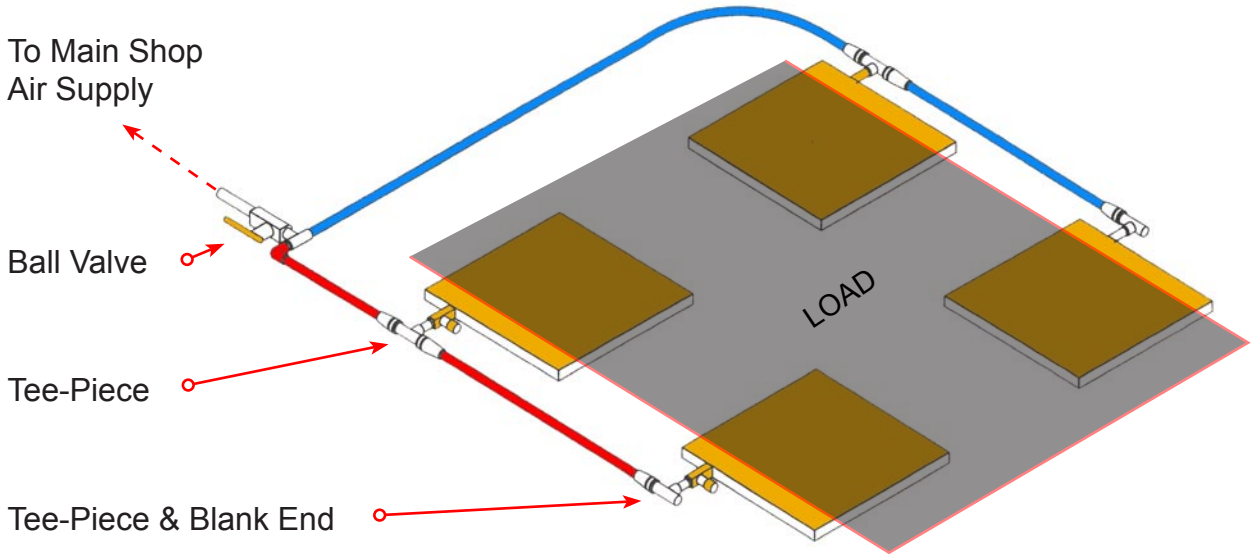
Typical Air Bearing System Footprints

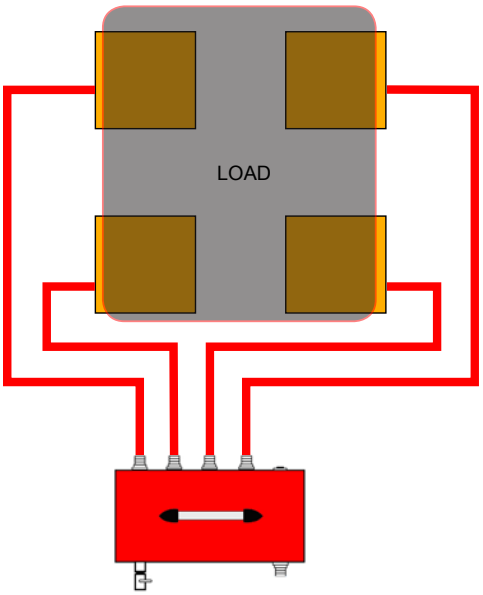
Below are diagrams of typical air bearing system footprints.

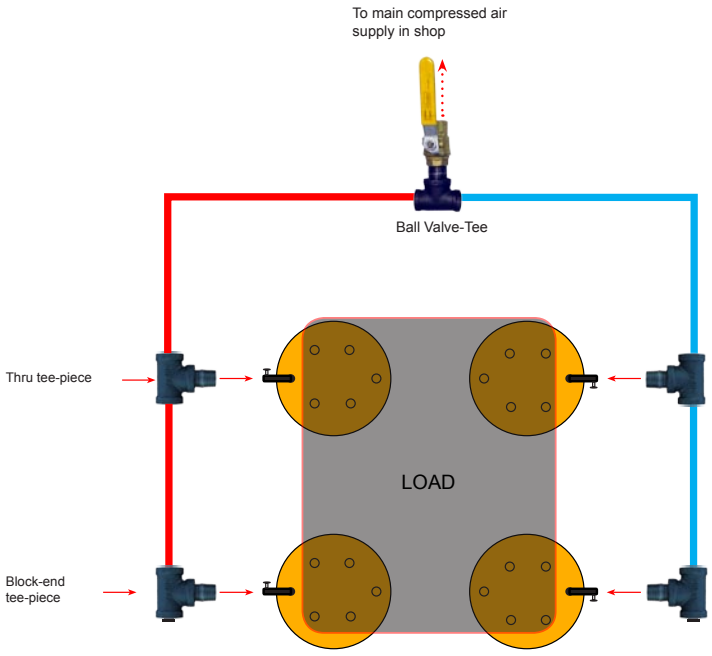
Top: A square aluminum system with manual non-remote control - air flow control valves on modules

Bottom Left: A square aluminum system with remote control

Bottom Right: A stainless steel VL-type air bearing system







Air Bearing Lifting Capacities

Air bearings have tremendous lifting capabilities, and when combined together to form a load moving system, they can easily lift and move loads of up to 150 tons and more. In fact, air bearings thrive on weight. The more you load onto them the more efficiently they work. However, they are not really suitable for loads of under 500 pounds.

While air bearings have much greater lifting capacities than their traditional forklift and overhead crane counterparts, they are also much safer. A 50-ton load sounds like a big safety hazard when being moved, doesn't it? But when you consider that the load is floated very close to the ground, it becomes much less of a safety concern. For instance, it cannot fall from a crane, it cannot be toppled from a forklift. It simply floats across the floor, staying very close to the ground - making it virtually impossible to fall from anywhere or to be damaged by the actions of the moving tools. It only requires a constant supply of compressed air to make the move.

However, you do need to be aware of gravitational drift, and have personnel available to keep the load on course in case gravity causes the load to float away from its travel path.

Here is a chart outlining the lifting capacities of some of our most popular air bearings. Remember, this is only a small selection of the wide and varied air bearings that are available.

All capacities are in pounds.

Air Bearing Size	Individual Lift Capacity	Combined Lift Capacity	
A-type Bearing		4-Station Systems	6-Station Systems
12-inch	1,000	4,000	6,000
16-inch	2,000	8,000	12,000
22-inch	4,000	16,000	24,000
B-type Bearing			
12-inch	2,200	8,800	13,200
15-inch	3,300	13,200	19,800
21-inch	7,150	28,600	42,900
Heavy duty versions of these air bearings are available which will effectively double the above capacities without increasing their physical size.			

Looking at the chart, you can quickly figure out that a load of some 10,000 pounds (5 tons) can easily be moved by, say, a 6-station 16-inch system or a 4-station 22-inch system - both with room to spare. However, it is worth remembering that one of the great benefits of these amazing systems is their flexibility and modular formation. This means that a 6-station system can easily be reduced to a 4-station by removing two of the modules, thus lowering the combined capacity to 8,000 pounds. This will give you the added advantage of having two "extra" modules you can use to support and bolster loads of uneven weight distribution or odd-shape in size. You would simply connect the two "extra" modules and place them exactly where they are required to support the load. The modular possibilities are quite expansive, so please be sure to ask your Hovair sales contact for assistance when considering what system will suit your needs best.

As well as lifting capacity, there are other factors that need to be considered when selecting an air bearing system. You need to determine exactly how you need your load to move. A large machine, for instance, only needs to be lifted clear of the floor and moved laterally to its destination. Other loads need to be "lifted clear" of their base before being floated away. Some loads have a very low height clearance from the floor and will need a low profile system.

There are many variables to consider. We will do this in the next section: The Right Air Bearing For The Job.

The Right Air Bearing For The Job

As we have previously mentioned, it is important that you choose the right air bearing for the particular job it is intended for. At the same time, it is worth considering what other types of load you might be needing to move, so you can select a system that will easily handle most loads in your facility.

Hovair Systems offers three types of air bearing that can be incorporated into any of their load moving systems:

A-type Bearing, B-type Bearing and VL-type Bearing

These air bearings have different characteristics and properties, any of which can almost certainly offer a solution to your load moving needs.

A-type Air Bearings

A-type air bearings generally offer the best solution for simple float and move applications that just need to go from A to B in a safe and cost-effective manner. Repetitive moving of large loads or machines are best handled with an A-type system where modules can be fitted permanently to the load. Once the modules and air flow have been adjusted at the first time of use, you simply plug an air line into the control valve and off you go. It really is that simple!

A-type air bearings do not offer high lift - they only need enough air pressure to lift off the floor sufficiently to kill the friction between the load and the floor. Once flotation has been attained, they can be steered to their destination with very little effort. A-type air bearings are housed in standard steel or aluminum modules that have a profile height of less than 3 inches. Modules can be placed underneath loads with sufficient clearance height, or bolted directly to the load, or have the load placed directly onto the modules' footprint.

Available in Square Aluminum (lightweight) or Round Steel modules (for extra durability in load support), A-type air bearings require little maintenance and are easy to replace whenever necessary. They are the most cost-effective of our bearings when it comes to air consumption and durability. For regular movements of large machines or similar loads, their low-lift operation makes them more stable. They are the prefect choice.

B-type Air Bearings

B-type air bearings offer the same properties of the A-type bearing, but with Vertical Lift capability. As stated, their A-type counterparts lift the load only enough to kill the friction between the air bearing and the floor, before floating the load away. The B-type air bearing has a much greater vertical lift capacity which allows it to lift a load as much as 2½ inches vertically away from its base before floating it away. Air bearing systems fitted with B-type air bearings immediately offer another dimension to load moving facilities that require a load to both be lifted and dropped during the process. Such loads could be those that are dropped on blocks, or that are stored on customized pallets or similar platforms.

B-type air bearings are available mounted on standard square aluminum modules giving a profile height of just under 3 inches, or on our low profile aluminum modules with profile height of around 1½ inches.

We have a free video CD on our web site that highlights a small air pallet lifting a load vertically before floating it away. If your load or machine needs to be lifted vertically for any reason, consider B-type as your air bearing choice. Our experienced staff can help you determine air bearing choice.

VL-type Air Bearings

VL-type air bearings are specialized bearings which are incorporated into a low profile, stainless steel module. Used for moving lighter loads, VL-type bearings operate identically to the A-types in that they only need to clear the friction and off they go. However, they do have a bolt-through access allowing them to be bolted directly to small machines. They are often the bearing of choice for moving smaller delicate machines, perhaps in the medical field, and for applications in a "clean room" environment.

What About Floor Surfaces?

First of all, it is important to know that none of Hovair Systems products will damage your floor surface, providing they have been set up correctly and in good working order. They are completely safe in that regard.

It is important to note, however, that air bearings do need a non-porous and smooth floor surface to operate at optimum performance. It is essential that the down-forced air cannot penetrate the floor's surface which will cause the formation of the air film and lifting process to falter. Smooth concrete provides one of the best operating surfaces, but shiny, smooth, hardwood floors will also work for you. Therefore the floor surface should be hard, smooth and non-porous.

What about cracks, cavities, holes and gaps?

Generally an air bearing system will move over minor cracks with no apparent problems. However, to run at optimum performance, it is better that all cracks, cavities and suchlike are filled in - especially if you are going to be using this floor surface regularly to move your loads across. It will make economic sense. If the surface will only be used occasionally, you could try using heavy adhesive tape to cover the floor's deformities. This may work, but only as a temporary measure.

What about moving from building to building over a rough surface?

This is a common occurrence and can be solved in various ways. Sometimes we find a client needs to move a heavy machine from building A to building B - both of which have suitable floor surfaces - but the floor surface between the buildings is not so good. Sometimes it might be worthwhile considering applying a concrete skim over the rough surface to bring it into line with the other two. The cost of this could easily be offset by improved efficiency, time spent on the load's move, and the decrease in personnel requirements, plus added safety. Other clients simply improvise and lay thin metal or hardwood sheeting in the load's pathway. Other solutions may be available and our customer support staff are always on hand to advise you.

Does the floor surface have to be flat and even?

In an ideal world, yes! But this is not always possible, of course. The main thing to remember is that these air bearing systems do not have brakes and will therefore run, like water, via gravity. If you know your floor surface is not flat and has some gradient to it, station key personnel around the load and use load chocks to control the movement. Your loads can still be moved in safety - using a little forethought and a little safety savvy.

How Do I Purchase An Air Bearing System?

At Hovair Systems we know just how confusing it can be when choosing a system to tackle your load moving needs. The days of compiling confusing orders with two of these and one of those and two of these are over. We now supply your air bearing system in a complete kit that includes everything you are going to need to ensure you are up and running within minutes.

Depending on the type of kit you are purchasing, and the type of load movement operations, we will put together everything you are going to need: air bearings, modules, air flow control valves (or air inlet ports), air supply hoses, quick-disconnect fittings - factory fitted to appropriate hardware, tee-pieces, block ends, ball valve, and anything else you are going to need. All the guesswork and stress will be taken care of for you and your system will arrive with everything included. You will even get a comprehensive, easy-to-understand operator's manual with full assembly instructions, component ID, setup and configuration info, as well as troubleshooting and customer support contact information. Could you possibly need anything else? Tell us, and we'll probably do that too!

Even though some people find it a daunting task to start with, setting up and operating a system really is a piece of that proverbial cake. And once you see just how easy these systems are to use, you will not want to go back to your old system. Musclemen are no longer required to move big heavy loads. Teams of gals as well as guys are using our air bearing systems all over the USA. Did you know that one pound of human force will easily move 1000 pounds of weight on an air bearing system?

Here are some of the major benefits of using air bearing systems for your load moving needs:

- ► Very safe to operate: loads cannot fall or tip over - only stop, personnel safety is increased
- ► They only require compressed air to operate, no other power source is necessary
- ► Shipped as a complete kit with all components and fittings necessary for your system
- ► Assembly and configuration is easy - everything just plugs into each other
- ► Fully modular and flexible - add or subtract modules as the need dictates
- ► Can be used for multiple loads - move system from load to load as necessary
- ► Take your loads to places forklifts and cranes cannot reach
- ► No problem on wet surfaces
- ► Great for repetitive machinery moving - bolt permanently to machine, plug in air line and go
- ► Three types of air bearing to suit virtually all load moving requirements
- ► Four types of load module, including very low profile, to suit all types of load
- ► Optional remote control units for central air flow control operation
- ► Low maintenance, easy to fit replacement parts, low operating cost
- ► And lots more...

And here are some things that air bearing systems will not do:

- ► Will not operate on grass, rough, porous and badly damaged floor surfaces
- ► Will not operate unless you have a constant supply of compressed air
- ► Lift vertically like a forklift - maximum lift height is around 2½ inches
- ► Not designed to move loads of under 500 pounds

Contact Hovair Systems Today For Further Details

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