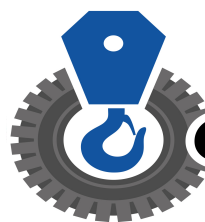




Moving Heavy Objects Efficiently: The Internal Transportation Guide for The Manufacturing Industry

Aerofilm Systems
AIRCUSHION TRANSPORT



Cranes for You
Knowledge centre

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Introduction

In the manufacturing industry, there are constant needs to transport, lift and position objects, especially since manufacturing equipment doesn't simply stay in one place like it used to. It's not just fixed machinery, semi-manufactured products or modules that are on the move. It is also about changing an assembly-line set-up, exchanging molds in the production line or moving components to machines. This means the challenges of moving heavy loads are multi-faced, but luckily so are the solutions.

In the production process, solutions for transporting large and massive loads have to comply with the overall production and company goals and should therefore be both practical and functional. The logistical processes in manufacturing companies ask for transport solutions that incorporate safety standards, efficiency norms, little to no downtime, optimum lead time in assembly-lines, cost savings, and the newest technology.

There are many factors to take into account when opting for a solution to transport and lift heavy objects, such as floor loading capacity, point load, friction, maneuverability, positioning, and overall moving space. The employee's physical well-being is also to be considered when looking for a solution to move heavy loads.

In this Internal Transportation Guide on the challenges and opportunities for moving heavy objects in the manufacturing industry, we'll provide you with an overview and comparison between the different solutions. Moreover, you'll get an in-depth introduction into moving objects with air, and the requirements and working of this solution. In the last chapter, we share three specific applications of the use of air caster transportation, so you'll learn to determine whether moving objects with air could be of value for your company.

Chapter 1. The four challenges of moving heavy objects

In the manufacturing industry, optimizing the process of moving heavy objects and machinery is a crucial requirement for efficiency and improvement of the logistical processes. Bad internal logistics can prevent adding value to production lines, whereas excellent internal logistics can contribute to the best process performance necessary in production. In short, good transportation leads to quality improvement, less downtime, more efficient production times, and better overall business performance. In this chapter, you'll learn about the four challenges of moving heavy objects.

- **Weight of the object**

The obvious challenge for moving heavy objects in the manufacturing industry is the weight of the object. Human power is not sufficient for moving objects that are much heavier than a person's body weight. In the manufacturing industry, most of the machinery, sub-assemblies, and other tools and loads have to be moved or carried with the support of technical solutions. This makes internal logistics and finding the right transportation solution for your business an expertise on its own.



- **Floor loading capacity**

The weight of heavy objects has a calculated impact on the floor loading capacity. This capacity represents the maximum load that a floor may be expected to carry safely. For example, in case of relocation of machinery, the weight of the transportation equipment needs to be taken into account as well. The weight of the transportation equipment adds up to the weight of the machine. Because of this additional weight on the surface, the total weight might exceed the floor loading capacity.

Multi-level buildings

Not all heavy objects that need to be moved are located on the same level. Especially in multi-level buildings it's important to realize that the floor loading capacity isn't always the same for every floor. When looking for a solution to move heavy loads, a calculation of the maximum permissible load per square meter and an extensive risk assessment should always be on the agenda.

- **Space limitation**

Production halls are stacked with fixed machinery, high warehouse racks and production parts, but also with moving vehicles, such as forklifts and pallet trucks and — of course — the employees themselves. When moving heavy or awkward objects, the external factors in the surroundings can limit the space that is available for transportation. Space limitation is not only determined by the size of the object and its surroundings, but also by the construction height of the object. On top of that, when heavy objects need to be moved within a production hall or through a gateway, the space between the floor and the ceiling or door frames has implications for the space that is needed to move the objects.

- **Well-being of employees**

Besides the practical and functional limitations of moving heavy objects, the physical restriction of human resources is an important focus area. There are more and more automated systems, but employees are still needed. For the well-being of employees, the ergonomic work standards are recorded in health and safety legislation. Since companies are held accountable for the right working conditions, manufacturers benefit from low friction when moving heavy objects. Reducing friction with the floor ensures that moving heavy loads requires little force compared to situations with friction.

When you face the challenge of moving heavy objects, in the manufacturing industry or elsewhere, it makes sense to look into the specific challenges of your situation first before opting for a transportation solution. Your challenges could vary from the weight of your load and power you need to move the object, to the floor loading capacity and the space which is available. Eventually, these challenges determine your best fitting transportation solution.



Chapter 2. Comparing the solutions to moving heavy objects

There are many logistical challenges when it comes down to choosing the right solution for moving heavy objects. Choosing a transport solution depends on the logistical process, limitations and the object itself. There are as many transportation solutions as there are objects, surroundings, and external factors. In this chapter, different transport solutions are reviewed.

Forklift

When choosing a forklift for your internal transportation issue, you need to consider the in-house requirements of the production facilities. For example, the emission regulations for forklifts are becoming stricter.

Pros of forklifts:

- ✓ Lifts objects up and down to higher locations
- ✓ Transports materials over reasonably long distances
- ✓ Requires floor conditions that are less critical

Cons of forklifts:

- ✗ Can cause damage to the floor
- ✗ Has a higher impact on the floor loading capacity
- ✗ Needs space because of counterweight on the back
- ✗ Is difficult to expand maximum weight capacity
- ✗ Requires the driver to obtain certifications

Moving skates

Moving skates are also known as machine skates or moving rollers. The skates essentially provide the movement of heavy loads through rollers. Besides manual machine skates, there are also machine skates powered by batteries.

Pros of moving skates:

- ✓ Is a known concept, so feels less like a risk
- ✓ Requires no extra space than the size of the heavy object
- ✓ Is relatively easy to expand weight capacity
- ✓ Battery-powered dollies: only one employee is needed to steer the moving skates and position the heavy object due to the automation

Cons of moving skates:

- ✗ Needs extra height because of the construction height of the wheels and its casing
- ✗ Requires a lifting solution to place the heavy object on top of the skates
- ✗ Can cause damage to the floor due to the point load
- ✗ Causes relatively high friction
- ✗ Requires floor conditions that are more critical
- ✗ Causes less flexibility with positioning
- ✗ Manual moving skates: is bad for ergonomics because it needs a lot of force and thus physical power to move the heavy object

Crane

In internal logistics, there are two types of commonly used cranes:

- An **overhead crane**, also known as a bridge crane, consists of parallel runways with a traveling bridge spanning the gap. The lifting component of the crane, the hoist, travels along the bridge. That allows it to lift and move heavy materials from one location to another.
- A **gantry crane**, also known as a goliath crane, is when the bridge is rigidly supported on two or more legs running on a fixed rail at ground level.

Pros of crane:

- ✓ Has no set-up time, because it is always ready to use
- ✓ Can reach higher locations

Cons of crane:

- ✗ Is fixated to one location
- ✗ Needs space to transport heavy objects
- ✗ Is difficult to expand maximum weight capacity
- ✗ Needs extra reinforcement in the building
- ✗ Is dangerous due to the possibility of falling objects
- ✗ Overhead crane: needs to be tailored inside a building

Rails

In production facilities, the rails carry trolleys to move lightweight or heavy objects on top of the trolleys. This kind of transportation solution is commonly used in assembly-line production where products have to undergo a treatment at every step of the production process.

Pros of rails:

- ✓ Has no set-up time, because it is always ready to use
- ✓ Creates hardly any friction

Cons of rails:

- ✗ Has no flexibility, because it is bound to the pre-set track
- ✗ When placed on the floor (instead of in the floor): could be a hurdle for logistics
- ✗ When placed in the floor (instead of on the floor): are labor-intensive to (keep) clean
- ✗ All of the attached trolleys or other equipment usually move at the same time



AGV: Automated Guided Vehicle

This portable robot moves according to pre-set routes without human interference along marked lines or wires on the floor, but can also navigate with radio waves, vision cameras, magnets or lasers. Traffic control can be carried out locally or by software running on a fixed computer elsewhere in the building.

Pros of AGVs:

- ✓ Is an automated transport solution, so there is no need of a driver
- ✓ Is adequate for supply of production lines

Cons of AGVs:

- ✗ Even though there is no driver needed, an operator for AGV traffic control is still required
- ✗ Needs infrastructure adjustments for the pre-set routes to be established
- ✗ Has sophisticated software and connectivity and requires a reasonably significant set-up from an IT person
- ✗ Has a high risk rate because if Wi-Fi goes down or other software issues arise, the on-site skills to repair the issues may not exist, leading to significant delays

Air casters

As the name suggests, transport on air casters, also known as air bearings or air skates, makes use of its core element: compressed air. With compressed air in the air cushions, the heavy object is lifted. Subsequently, a thin air film is created between the floor and the air caster which enables users to move the heavy object without hardly any friction (1/1000 of the load).




Pros of air caster transport:

- ✓ Requires no extra space than the size of the heavy object
- ✓ Has a very low building height
- ✓ Needs little force to move heavy objects
- ✓ Can be used for fast and accurate positioning
- ✓ Has no vibration during transport
- ✓ Creates no damage to the floor
- ✓ Has no point load to the floor
- ✓ Is easy to expand weight capacity
- ✓ Is almost maintenance-free
- ✓ Has a virtually friction-free movement, which makes omnidirectional movement possible

Cons of air caster transport:

- ✗ Requires floor conditions that are more critical
- ✗ Needs compressed air

Overview of transport solutions

	Forklift	Moving skates	Crane	Rails	AGV	Air caster
Load capacity versus size						
Impact on floor						
Reach low and high locations						
No need of extra surrounding space						
Costs / investment						
Ease of positioning / maneuverability						
No need of constructional adjustments						
Level of maintenance						
Vibration						

For every transportation challenge, a transportation solution exists. The logistical challenge determines which solution is most applicable to your situation. In the next chapter, we'll elaborate on why air caster systems are the most efficient transport solution according to the comparison.

Chapter 3. Moving heavy objects with air: the most safe, ergonomic, and cost-effective solution

A relatively unknown solution for industrial manufacturers is the possibility to move machinery, sensitive objects and other heavy products with air. The transport of heavy objects with air overcomes and eliminates negative impacts due to its core element: compressed air.

In this chapter, you'll learn whether this relatively unknown solution could be of value for your company. You'll read more in-depth about the reasons and specific requirements for opting for an air caster system. Lastly, we'll briefly explain how air skates work.

Pros

- **Economical design & lightweight**

Due to its compact design, air casters need little space for use and storage. The low building height of air casters makes them appropriate for direct installation in the small space between the floor and the heavy object. The flexibility and compact design makes it easy for air casters to be transported to different floors or levels within the same building.

- **Little physical workload**

The size and weight of the heavy object make it impossible for people alone to move it. With air casters only one kilo of force is required to move a weight of 1,000 kilo. This makes it simple for the operator to change course and move around without effort. Due to its effortless movement, air casters adhere to the health and safety legislation that include high ergonomic standards for the well-being of employees.

- **Friction-free movement with less risk of damaging floors**

Air skates isolate vibration so they don't transfer bumps in the floor to heavy and sensitive loads. Due to the thin film of air, there is almost no floor contact and very little friction as a result. The loads are distributed over a wide surface area instead of a point or line contact which results in low floor loading and less risk of damaging floors. Since air casters are flexible in movement, they offer easy and accurate positioning.

- **Low maintenance**

Air skates are robust systems that are easy to maintain. They have no mechanical moving parts, require no lubrication and have no maintenance schedule. The rubber membranes can become dirty but are easy to clean with water and soap.

- **Custom-made solution**

Depending on the object that has to be moved, air caster systems can be adjusted to the specific object and its surroundings while taking into account external factors, such as the space limitation, the maximum floor loading capacity and strict ergonomic standards for employees.

Cons

- **Not suitable for all floor conditions**

Compressed air creates a thin air film. The air pressure in the air caster slightly lifts the heavy load and make it float. Air skates rely on this thin air film to move heavy objects from one place to the other. The air film can only exist when the floor is airtight, smooth and flat. This means that particular floors, such as outside terrain and uneven levels, are not suitable for the use of air casters.

... But there are ways to make floors suitable. With metal or plastic sheets, floors can temporarily be evened out to create an airtight, smooth and flat surface for air skates to move the heavy objects.

- **No reach of higher locations**

Whereas other transport solutions can lift heavy objects, air caster systems are meant for movement and positioning. This is why air casters on its own only reach same level locations.

... However, there are possibilities to reach higher places. When air skates are combined with lifting devices, such as lifting tables or lifting cushions, heavy objects can be lifted and moved to reach higher locations.



Requirements

In order to implement the air skate solution, you'll need to bear in mind its two requirements:

- **Compressed air**

The transportation of heavy loads with air skates relies on its core element: compressed air. Air caster systems create a thin air film between the air caster and the floor. To achieve this, you need to have sufficient air pressure and flow at all times. Insufficient air supply leads to higher friction, more wear, and even failure to function.

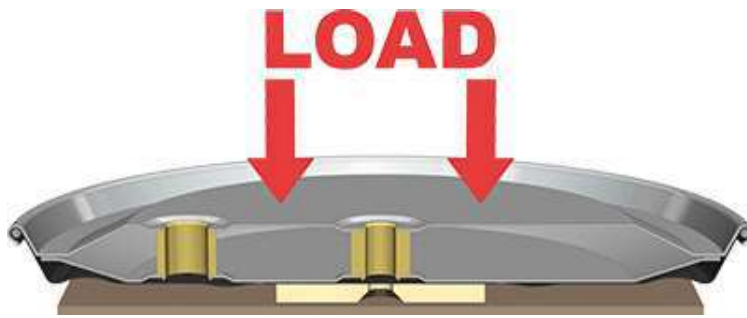
- **Suitable floor**

The right kind of floor for air skate movement is airtight, smooth, and flat. Less suitable floors cause higher air use, friction, and wear. With metal or plastic sheets an unsuitable floor can (temporarily) be improved to enable the air casters to create a thin air film and make the heavy object move. Any joints can be filled using a suitable silicone product.

How it works

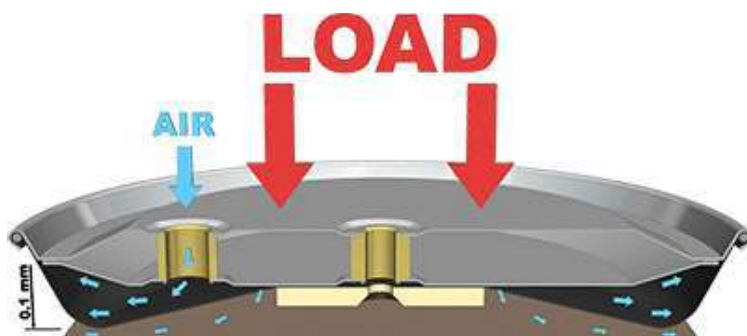
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The air caster is a flexible rubber membrane that is inflated with compressed air.



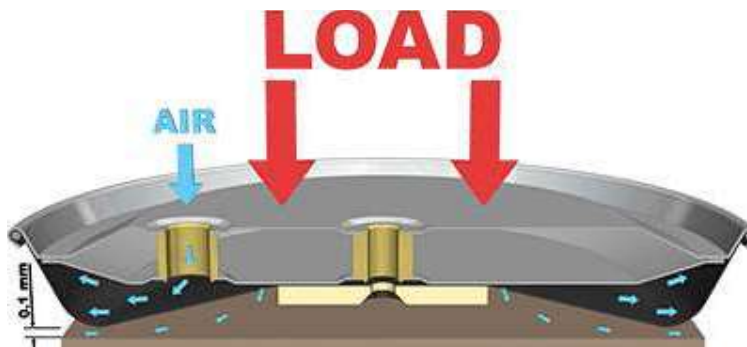
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A controlled 'leakage' of the compressed air creates a thin air film between the floor and the air caster.



3

The air caster now floats with an air film, so there is practically no friction and it is possible to easily move heavy objects with little force.



Chapter 4. Three applications of moving heavy objects with air casters

Air skates have clear advantages over other transport solutions and are easy to use and maintain. Therefore, they are commonly used as transport solution in the logistics and manufacturing industry. Air caster systems transport heavy objects, big or small, but they have different application fields for the industry. In this chapter, you'll learn more about these application fields.

- **Machine transport**

Manufacturing companies need heavy machinery to establish the production. The machine needs to be accurately positioned at the start of the fabrication process. In some occasions, the machine needs to be relocated within the production facility, for example, in case of placing and positioning new machinery. Whereas other transport solutions ask for disassembling the working elements of your heavy machine, air caster systems move the entire machine at once.

- **Assembly-lines within production**

In the manufacturing industry, assembly-lines are part of a production line. Separate parts and products are continuously added to the sequence until the final assembly is finished. Therefore, the assembly, big or small, needs to be transported from one workstation to the next. With custom-made solutions, air caster systems can easily transport any type of part or product.

- **Embedded solution**

When manufacturers are required to clean their machine's parts regularly and to check the quality of all the working devices, they need to be able to retract these different parts from the machine. This process has to occur frequently, so it needs to be easily repeatable. Air caster systems help this process by smoothly retracting these different parts and working devices from the machines for service and maintenance. This embedded solution makes air casters fully integrated within the machines for direct access and frequent use.

Besides these application fields, air casters have more examples shown in practice, such as moving entire seating stands in entertainment areas, rotating and turning trucks, trains, and cars. Moreover, air skates are commonly used in clean rooms and explosion proof rooms. Therefore, air caster systems are multi-dimensional and can be used for many industrial purposes.



Chapter 5. Takeaways

- In the manufacturing industry, internal transport solutions should consist of safety standards, efficiency norms, little to no downtime, cost savings, and the newest technology.
- When opting for a transport solution and lift heavy objects, you should take into account: floor loading capacity, point load, friction, maneuverability, positioning and overall moving space. You should also evaluate the employee's physical well-being when using the transport device.
- The transport solution comparison shows that air skates have clear advantages over other transport solutions. Air caster systems offer economical design and lightweight, little physical workload, friction-free movement with less risk of damaging floors, low maintenance, and custom-made solutions.
- The only two requirements for air casters are a suitable floor and compressed air. The right kind of floor for air skate movement is airtight, smooth, and flat. But there are ways to make floors (temporarily) suitable. Air skates rely on its core element: air. In order to make the heavy object float, air casters require sufficient air pressure and flow at all times.
- The different application fields of air skates are machine transport, assembly-line production, and embedded solution within own machines.

Do you have to move heavy machinery and do you wonder what's the most efficient way of doing so?

Let an internal transport specialist provide you with a fitting advice to tackle your internal transport challenge

TALK WITH A SPECIALIST



About Aerofilm Systems

Aerofilm Systems designs, develops and manufactures air casters and air caster transport systems. This form of transportation is the ideal solution for moving light to very heavy objects in a safe, ergonomic and cost-effective way. It is also ideal for sensitive and therefore often expensive objects because air casters create no vibration during moving.

Aerofilm Systems' activity in the air caster transportation field began in 1981. Because air caster transportation is the company's sole business we have become experts in this field. We are working with a very competent team of designers, engineers and production specialists. The air caster systems are designed in-house and also produced entirely in our 1,500 m² production facility in Eindhoven.

Aerofilm Systems is the only company that produces both the Neoprene and Polyurethane air casters so we can provide you with the best advice for your transportation application.