

How Self-Propelled Carts Support LEAN MANUFACTURING



Introduction

Getting behind the wheels

A growing number of manufacturers are supporting lean principles by selecting self-propelled carts over overhead cranes, conveyors and rails.

On shop floors across North America and around the world, self-propelled wheeled carts are proving to be more versatile, less expensive to install and safer to operate than traditional material handling systems.

A matter of Principle Three

Lean manufacturing, of course, is focused on shortening lead times, minimizing waste and maximizing throughput. Lean manufacturing consists of five principles:

1

Define Value

Discover the needs of your customer, understanding that value is what the customer is willing to pay for.

2

Map the Value Stream

Use the customer's value as a reference point to identify all the activities that contribute to these values.

3

Create Flow

Remove waste from the value stream, then ensure the remaining steps run smoothly without interruptions or delays.

4

Establish Pull

Limit inventory and work-in-process items using just-in-time delivery so that products are created at the time they are needed and in just the quantities needed.

5

Pursue Perfection

Make Lean thinking and continuous process improvement a part of the organizational culture.

Principle Three is where manufacturers are focusing their efforts these days. A well-organized factory floor, after all, must have an efficient product flow from production to shipping, one that maximizes efficiency and minimizes waste.

Principle Three of the five principles of lean manufacturing involves analyzing each step in the process, finding ways to maximize efficiencies, and looking for ways to reduce waste.

Manufacturers are using self-propelled carts to put Principle Three into action. This white paper describes what self-propelled carts are, how they differ from traditional material handling systems, and how they support lean manufacturing.

Self-Propelled Carts

Self-Propelled Carts are material handling vehicles that operate on shop floor level to transport large or heavy parts and machinery. They are also known as Self-Propelled Modular Transporters, wheeled transfer carts, transfer carts, transporters and manually guided vehicles.

Self-Propelled Carts are unique in the manufacturing space. They have a number of features that distinguish them from all other methods for moving material and equipment around shop floors.

Self-propelled

Self-Propelled Carts, as their name suggests, are unlike traditional carts in that they don't need a worker to push or pull them. They also do not need to be connected to a chain or other system that pulls them along the floor. Self-Propelled Carts feature a self-contained drive and power system that allows them to operate without any outside source of power.

360° of travel

Unlike overhead cranes, drag chains, rails and conveyors, Self-Propelled Carts feature a grid of computer-controlled axles that allow the devices to travel in any direction and rotate 360° in place.

Manually guided

Self-Propelled Carts are not to be confused with autonomous guided vehicles, which navigate by following a magnetic tape on a factory floor. Self-Propelled Carts are guided around a factory floor by a worker using a wireless remote. Larger loads may require both an operator and a spotter.

Wheeled

Self-Propelled Carts ride directly on shop floors using a set of urethane wheels (as opposed other systems that operate with steel wheels on rails embedded in the floor).

Heavy lifting capacity

Self-Propelled Carts can lift and move loads of up to 100 tons.

Self-loading

Self-Propelled Carts typically do not need another device, such as a crane or forklift, for loading. Instead, the cart drives underneath the item that is to be moved (which is resting on a steel skid), lifts it off the ground, moves it to the desired location and sets it back down.

Modular

Self-Propelled Carts can be combined with other units of the same kind and operated with a single control. This modular design allows manufacturers to move oversize or especially heavy loads by placing one unit under each corner of the load. The units synchronize their movements based on input from one operator using one remote control.



Would you like Principle Five with that?

Self-Propelled Carts deliver an added benefit that goes beyond the day-to-activities of the shop floor. They help manufacturers free up employees and resources for innovation, and quality control.

Self-Propelled Carts Versus Other Material Handling Systems

Overhead Cranes

Overhead cranes come in a variety of models and styles and move loads of almost any weight. Lightweight cranes move relatively light loads that you might not want to move by hand, or that you need to pick up and set on a table. Giant gantry cranes move enormous and ungainly loads. Overhead cranes typically lift and move loads of up to 400 tons.

Rail Cars

Rail cars are vehicles that run along rails at floor level in an industrial facility. The rails are fixed, allowing for movement only along a set path. They are typically operated by remote control. Rail cars typically move loads of up to 200 tons.

Forklift Trucks

Forklift trucks are powered industrial trucks with a pronged device in front (a “fork”) for lifting and carrying heavy loads short distances. They are powered by either liquified petroleum gas, batteries or hydrogen fuel cells. Average forklifts move loads of up to 10 tons. Heavy-duty forklifts move loads of up to 50 tons.

Drag Chains

Drag chains are material handling systems that use chains or cables housed in a track in the floor to pull wheeled carts. They typically move loads of up to 100 tons.

Conveyor Systems

Conveyors are mechanical handling systems that move materials between specific points over a fixed path, typically very quickly. They usually move loads of up to 100 tons.

How do Self-Propelled Carts compare with other material-handling solutions?

| | Self-Propelled Carts | Overhead Cranes | Rail Cars | Forklifts | Drag Chains | Conveyors |
|----------------------|--|-------------------|-----------|---|-------------|-----------|
| Lifting Capacity | 100 tons | 400 tons | 200 tons | 50 tons | 100 tons | 100 tons |
| Travel Path | ☑ 360° | Static | Static | 360° | Static | Static |
| Equipment Cost | ☑ Moderate | High | Moderate | Moderate | High | Moderate |
| Rotate Load in Place | ☑ Yes | Yes | Limited | No | Limited | Limited |
| Turning Radius | ☑ Rotate 360° within their own footprint | Long reach radius | None | Extra space required because of cantilevered load | None | Wide |
| Self-Loading | ☑ Yes | Yes | No | Yes | No | No |
| Flexibility | ☑ High | Low | Low | High | Low | Low |
| Installation Time | ☑ Days | Weeks | Weeks | Days | Weeks | Weeks |
| Training | ☑ Low | High | Low | Moderate | Low | Low |
| Safety Risks | ☑ Low | High | Moderate | High | Moderate | High |

Self-Propelled Carts are the perfect choice when you must move loads of up to 100 tons, need to implement quickly, and when move path flexibility is a requirement. Only requiring one person to move the loads and minimizing safety risks are additional key benefits.

How Self-Propelled Carts are Enabling Lean Manufacturing

1

Flexibility

Because Self-Propelled Carts are self-contained units that operate in 360 degrees of travel, they give manufacturers increased flexibility in how they lay out their shop floors. Self-Propelled Carts make it easy to accommodate changes to floorplans and processes and eliminate first in first out requirements.

Manufacturers who deploy Self-Propelled Carts enjoy the added benefit of getting up and running almost immediately. Installation time for Self-Propelled Carts is much shorter than that for drag chains, rails, conveyors and cranes.



3

Higher return on capital

Unlike overhead cranes, conveyors and rails, Self-Propelled Carts don't require permanent installation. They can be used in multiple parts of the plant, helping manufacturers leverage asset investments. This makes them more cost-effective than installing a conveyor or crane. Plus, a single unit serves multiple loads via self-loading skids.



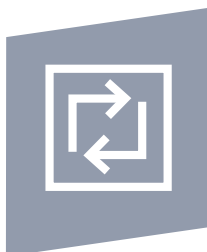
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2

Floorspace utilization

Self-Propelled Carts do not extend beyond the load and can rotate within their footprint. Thus, they typically need less floorspace than forklifts and other conventional ride-on vehicles to move a load from one place on the factory floor to another.

All four corners of a Self-Propelled Cart can be steered independently for precise steering. This enables efficient use of manufacturing floor space. Self-Propelled Carts also need less floorspace to maneuver a load into place, and eliminate the need for fixed in-floor fixtures.



How Self-Propelled Carts are Enabling Lean Manufacturing - *continued*

4

Increased safety

A critical consideration in lean manufacturing and a key part of the fifth lean principle is continuous improvement in operations and safety performance. And that includes safety.

Self-Propelled Carts are inherently safe because they are operated from a safe standoff operation using radio remote control.

One operator can safely move loads of up to 100 tons. Radio remote operation allows 100% walkaround visibility because the operator walks beside the unit as it travels, giving the operator a clear line of sight at all times. Ground level movement also protects workers and payloads, since low-profile operation eliminates dangerous overhead moves.



5

Increased efficiency

With Self-Propelled Carts, their rapid self-loading capability and ease of operation lower Takt times. Self-loading skids allow units to slide under and lift loads, eliminating the need for a secondary loading device, such as a crane or forklift.

Unlike a number of other material handling options, Self-Propelled Carts don't need specialized operators which may not always be accessible and thus cause operational delays.



6

Scalability

Unlike forklifts, their closest competitor on the shop floor, multiple Self-Propelled Carts can be combined as needed to increase capacity with a single control.

Manufacturers simply gang up as many units as they need, move the load, then deploy the units back to their stations.



The technology behind the advanced capabilities of Self-Propelled Carts

The Self-Propelled Carts that are being used in increasing numbers in today's lean manufacturing plants were not possible until recently. A number of innovations have made their wide-spread adoption only possible recently.

Better batteries

Recent advancements in battery and motor technology have made Self-Propelled Carts a cost-effective replacement for overhead cranes, forklifts and other costly material handling systems.

The electric motors and drives in Self-Propelled Carts are more efficient than ever before. And their electric batteries are more efficient, more powerful and hold a charge longer, thanks in large part to the hybridization and electrification of the automotive industry.

Better wheels

Wheel technology in transport vehicles has also come a long way in the last 10 years. Until recently, self-propelled vehicles that could move 100 tons or more were tremendously expensive or simply impractical. But prices for advanced wheel and axle systems have dropped markedly in recent years, while Self-Propelled Carts themselves have also become better.

Lower pressures

Today's Self-Propelled Carts measure roughly 5 feet wide by 20 feet long, helping them spread their loads over a large area. They operate at such low pressures that they can lift and move 100 tons across standard industrial floors without damaging the surface and without requiring special sub-floor footings.

A full process automation system

Self-Propelled Carts are being adopted in multiple industries, from aerospace to shipbuilding, from engineered products to modular structures. One of the attractive things about these transfer carts is that they offer many more options than manufacturers find with forklifts and similar vehicles.

Self-Propelled Carts, for example, can be transformed into full factory automation solutions by adding a number of options. These include:

- Precision alignment systems
- Mating fixtures
- Wood tops for die transfer
- Cleanroom compatibility
- Explosion-proof compatibility
- Load support skids
- Lifting systems

Conclusion

Ever since Toyota pioneered the principles of lean manufacturing in the 1980s on their automobile assembly lines, manufacturers have looked for cost-effective ways to put the five principles of lean manufacturing into practice.

One of these ways is with Self-Propelled Carts, which improve efficiency, increase productivity and reduce waste. Which sort of brings

us full circle. Toyota pioneered Lean principles to revolutionize the manufacture of wheeled vehicles (cars). Now manufacturers in multiple industries are using wheeled vehicles (Self-Propelled Carts), to revolutionize the application of Lean principles.



About AeroGo

AeroGo is a proven world leader in the engineering, design, manufacturing and support of material transport systems. Our **Self-Propelled Carts** help manufacturers to shorten lead times, minimize waste, increase productivity and maximize value for their customers.



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