

# Forklifts: Operational and Environmental Impacts

## *Things to Consider When Buying Electric or Internal Combustion Forklifts<sub>1</sub>*

**For use indoors vs. outdoors** - If the lift will be used indoors, you will probably want an electric forklift. Electric lifts produce no harmful emissions and are quieter. Outdoors, you will generally want an internal combustion (IC) forklift. Whether gas or diesel, these machines are less expensive than electric lifts with a similar capacity. They're also waterproof, unlike electric models. For use on uneven ground, rough terrain forklifts use large pneumatic tires and an extendable lifting arm.

If you're going back and forth, or using the lift in a semi-enclosed area like a loading dock, a liquid propane (LPG) forklift might be the best choice. They produce less exhaust than other types of IC lifts, so they can be used indoors, but can also operate safely outdoors.

**If for indoor warehouse use** - There are many specialized types of forklifts designed for the crowded conditions inside warehouses. These machines are all electric powered.

- \* **Walkies** and **riders** are simply motorized pallet jacks. They are great for moving palletized loads around a warehouse, but do not provide much in the way of safety or lifting heights. These are the least expensive type of lifts.
- \* **Narrow aisle forklifts** let you save space in your warehouse by setting up aisles only 8' to 10' apart, instead of the 11' width required by most lifts. Very narrow aisle forklifts can operate in aisles only 6' wide. Both types of narrow aisle forklifts are more expensive than standard lifts.
- \* **Order pickers** and **turret trucks** are also designed to be used in narrow aisles. These trucks lift the operator as well as the forks, providing access to higher shelves. Reach trucks are similar but can extend their forks deeper into the shelves.

**Height and weight requirements** - Estimate your weight capacity needs. Forklift capacities go as high as 15,000 lbs or more, but the most common range is between 3,000 and 8,000 lbs. It should be noted that unusually shaped loads change the center of gravity, and can reduce the capacity of the lift. If you often move odd-sized loads, be sure to ask the dealer how they will affect your needs. Height requirements are also important, so make sure you know the maximum height you will need to place or pick loads. If you will be doing a lot of work at 15' or 20' high, a double- or triple-stage mast adds stability. Make sure you can accommodate changing requirements in the future. What if the next version of your product is 10% heavier, or you switch to a new supplier who ships heavier pallets? Is there a chance you will reorganize your warehouse? Planning ahead can help you avoid an expensive mistake.

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- \* Electric forklift models generally have a maximum capacity of 10,000 to 15,000 lbs. Internal combustion forklifts, which include gasoline, propane or diesel fork lifts, are required for any loads over 15,000 lbs.<sup>2</sup>
- \* Electric forklifts are cleaner and more efficient to operate, producing no emissions at the facility. Utilizing electric forklifts reduces a company's environmental impact and improves ambient air quality in and around freight docking areas.<sup>3</sup>
- \* Forklifts operate primarily indoors, where the Occupational Safety and Health Administration (OSHA) regulates worker exposure to pollution.

### Comparison of Forklift Environmental Impacts <sub>2</sub>

Type of Forklift	Contaminants	Emissions and Acoustics
Diesel/ Gasoline	Higher maintenance - contaminates lubricating oil and engine parts	Spillage will contaminate ground Contains carcinogens in fuel and exhaust
Electric	Battery disposal hazard	Discharging batteries may emit harmful and combustible gases

### Costs<sub>1</sub>

- \* With electric forklifts initial costs may include multiple battery packs per truck, a battery recharger per truck, battery swapping equipment, battery charging station space and battery swapping personnel.
- \* Forklift pricing ranges from as little as \$3,000 for a manually operated "walkie" to \$100,000+ for high-capacity forklifts.

**Do not worry about the extremes** - unless you have some unusual height or capacity requirements, chances are you can get a new forklift that will meet all your needs for between \$15,000 and \$30,000. Here are some general rules around forklift pricing:

- \* **The higher the operating capacity (weight) and lift height, the more expensive the forklift will be.** Operating capacity is how much weight a forklift can safely handle. The bulk of the market is 3,000, 5,000, and 8,000 pound models, and these often fall in the \$15,000 to \$30,000 price range we've mentioned. As you get into higher capacities, you will find prices going up very quickly. Similarly, if you need your forklift to reach over 20' high, you'll move into a more expensive price bracket.
- \* **Top-tier brands are more expensive than lesser-known brands, but their technology advantages enable greater productivity and reliability.** There is no denying it: top-tier brands like Toyota, Hyster, and CAT are more costly than lesser-known forklift brands. But that extra cost gives you a forklift that is more productive, reliable, boasts a lower cost of ownership, and gives you access to a more established dealer network for service, parts, and accessories. If the forklift is going to be part of your everyday business, it is probably worth the cost to get a brand name machine.

- \* **Electric forklifts are generally more expensive than internal combustion forklifts with identical specifications.** While electric trucks are more expensive to purchase than their internal combustion (IC) counterparts, they do offer significant advantages for some situations. For one thing, they can be used indoors, which IC trucks cannot. (Exception: propane-powered forklifts can be used indoors with sufficient ventilation.) In addition, they are environmentally friendly, quieter, and offer a lower cost of ownership. On the other hand, forklifts for rough terrain use or for highest capacities are usually IC-powered.
- \* **Pneumatic tires are generally more expensive than cushion tires.** Forklifts with pneumatic tires provide better traction and a smoother ride on rough surfaces. Cushion tires are less expensive and better for use indoors or on smooth surfaces.

### **Total Cost of Ownership<sub>3</sub>**

The real cost of a forklift is far more than just the initial purchase price. In addition to the actual cost of the forklift, total cost of ownership includes maintenance costs, fuel or electricity consumption, supplies such as batteries and oil, repairs, and operator training. These operating costs are calculated on a per-hour basis. You can expect hourly operating costs to range from as low as \$1/hour for small, efficient electric forklifts to \$20/hour or more for large IC forklifts.

These costs are one reason you should make sure you have an efficient maintenance program in place for all of your machines. If you cannot do it, pay the dealer for a service contract - but not taking care of required maintenance on the recommended schedule is an easy way to drive your operating costs through the roof as you suffer more breakdowns and costly downtime.

There are many other costs to consider, too. How far away is the dealer you are thinking of buying from? You could pay less initially from a dealer who is further away, but when it comes time to repair your forklift, you may waste valuable time and money transporting it back and forth. Battery replacement is another - ask your dealer about the expected battery life of the forklift and how much it costs to replace.

You should also think about productivity. How fast can each forklift accelerate and move? Moving more pallets per hour will save you money and may be reason to buy a more expensive lift truck. Also, consider the ergonomics of the forklift you are buying. Buying a machine with a better ergonomic design will allow your employees to work more productively and to stay healthy.

### **Perks of Electric vs. Internal Combustion Forklifts<sub>4</sub>**

Typical AC systems recover battery energy using three forms of "regenerative" braking: when the accelerator lever is released (coasting), when the brake is applied, and when the directional lever is operated (switch back or plugging). Essentially, the inertia energy that is created by these actions is converted to electrical energy and returned to the battery, extending overall operating times and operating cycles.

Industrial truck manufacturers are constantly searching for ways to meet the pending EPA clean-air regulations. Technical advancements for IC engine trucks, such as three-way catalytic converters have been designed to meet the standards. However, electric trucks with their zero-emission capabilities provide the buyer with the ultimate solution to environmental concerns.

Apart from emissions, the elimination of "fuel" costs can add to acceptance of electric trucks. For example, an electric forklift may cost \$4 in electricity, whereas an IC forklift may need \$10 in fuel to accomplish the same amount of work. The initial costs of an electric truck with battery and charger may be higher, but the overall true operating costs over time will provide significant savings.

Electric vehicles have digital displays providing operators with instant information regarding the status of their vehicle condition. Speedometer readings, battery discharge gauges, warning messages and multiple-hour meter readings are common on most trucks. Using built-in analyzers and self-diagnostic capabilities, electrical forklifts with digital displays make troubleshooting quick and easy.

### **List of the leading forklift manufacturers:**

Toyota Material Handling: <http://www.toyotaforklift.com>

Hyster Company: <http://www.hysterusa.com>

Yale Materials Handling: <http://www.yale.com>

Mitsubishi Forklift Trucks: <http://www.mit-lift.com>

CAT Lift Trucks: <http://www.cat-lift.com>

Nissan Forklift Corporation: <http://www.nissanforklift.com>

Linde Material Handling: <http://www.lmh-na.com>

Crown Equipment Corporation: <http://www.crown.com>

Komatsu Forklifts: <http://www.komatsuforkliftusa.com>

Jungheinrich Lift Truck Corporation: <http://www.jungheinrich-us.com>

### **Information on Hydrogen Fuel Cell Forklifts<sub>5</sub>**

In a development/deployment project lead by Hydrogenics, two Hyster Class 1 5,500 lbs. capacity battery-powered forklifts were converted to hydrogen technology through the integration of a hybrid fuel cell power pack developed by Hydrogenics.

The hybrid power pack incorporates a HyPM 10 fuel cell power module for base load requirements and energy-storing ultracapacitors to handle load peaks, long duration transients, and to capture braking energy. To complete the system, additional power pack components include a hydrogen storage tank, thermal management and power electronics and controls.

- \* Minimize the modifications done to the forklift truck, transferable for other new or used electric trucks.
- \* Fuel cell power pack is seamlessly integrated into the existing battery compartment, fitting within the cubic boundaries where the lead acid battery is normally placed.
- \* Fuel cell power solution is lighter than the original battery, and in a lift truck designed specifically for battery power, the lead acid battery provides a portion of the counterbalance. As a result, additional weight is needed to provide sufficient counterbalance.
- \* There are a number of hydrogen refueling options available to companies including delivered gas from a local supplier, or on-site generation through either electrolysis or natural gas reformation.
- \* The process of hydrogen generation and dispensing occur inside the manufacturing building and operators are able to fill their vehicles without going outside.

- \* Fuel cell forklift are faster and quieter and there is a longer distance before refueling versus battery replacement.
- \* Productivity is increased through fast refueling (a full tank takes approximately two minutes to fill), extended run time, and consistent and abundant power.
- \* In contrast, battery electric forklifts need more frequent battery changes that require more time. While a battery change can be as fast as five minutes, battery changes can take upwards of 30 minutes.

## **Safety & Training<sub>6</sub>**

According to OSHA, tens of thousands of injuries related to powered industrial trucks (PIT), or forklifts, occur in US workplaces each year. Most employee injuries and property damage can be attributed to lack of safe operating procedures, lack of safety-rule enforcement, and insufficient or inadequate training. OSHA regulations 1910.178 require training in basic lift truck principles, lift truck components and controls, safe driving and load handling principles, and vehicle inspection for lift truck operators. For more information on acquiring licenses or training courses contact your employer or local technical college.

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