



Improving Lift Truck Safety... One Component at a Time



ENGINEERING YOUR SUCCESS.

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Introduction

Forklift engineering and design teams are confronting a number of challenges that are rapidly transforming major industrial markets worldwide:

- First and foremost, operational safety continues to be a principal focus, driving changes in ergonomics and machine design.
- The need to control operational costs while addressing safety concerns has resulted in the rapid adoption of autonomous vehicles.
- Burgeoning global trade is expanding the need to move freight as cost-efficiently as possible.
- Emerging IoT applications are creating the expectation of user-friendly telematics and big data analytics to improve productivity.
- The rapid growth of e-commerce businesses and an increase in governmental infrastructure investments are significant contributors to market growth.¹
- Environmental mandates are encouraging manufacturers of larger fork lifts to adopt electric machines to limit potentially hazardous emissions.
- In markets such as port machinery, heightened environmental concerns are also driving a move towards alternative fuel technologies.

As reported by “Global Market Insights”², the global forklift market is expected to grow 10.5 percent CAGR between 2020 and 2026, with industry shipments projected to exceed 3 million units by 2026. Clearly, the need for lifting and transporting material goods is increasing.

Partnering with the right forklift component supplier can help lift truck engineering and design teams take advantage of these trends by providing innovative design concepts that can be customized to meet the characteristic profiles associated with each OEM’s brand.

Component Innovations

Hose Design

An OEM's initial investment in high-performance hosing is likely to significantly improve dealer, and ultimately customer, satisfaction. Here are some evaluation factors worth considering.

In a recent survey of lift truck maintenance work orders³, the most common source of forklift repairs was leaks, and the average cost of each leak-related repair was just over \$700. Nearly 38 percent of those forklift leaks were caused by a blown hose or damaged tubing.



Most of today's multiple stage fork lift masts use hose sheaves, which add a couple of new concerns to the selection criteria of hoses. For example, hose sheave mast applications demand higher abrasion resistance and flexibility over a wider range of temperatures, with operating temperatures as low as -70°F, and with the expectation of more than 250,000 cycles. Given the tight bend radius created by the sheave, a Parker hose using the highest quality of materials and manufactured to withstand the toughest of applications can best fulfill such exacting performance requirements.

In addition to mast hook-up applications, high-performance hoses are required for side-shifter, power tilt, power steering, pump supply and other lift truck functions. Such applications will benefit from the high levels of temperature flexibility and industry-leading abrasion resistance Parker hoses provide.



Display Modules

As competition for qualified lift truck operators increases, there is great demand across market segments for lift truck components that can improve both the ease and safety of material handling operations. Rugged outdoor applications require robust programmable electronic displays capable of withstanding the extremes of temperature, vibration and EMC/EMI conditions. Durable mechanical designs should seal out dust and water ingress while providing all the user-friendly features today's computer-savvy operators demand.

Today's compact, easy-to-read, full-color touch screen displays, with graphical programming capabilities, support multiple languages and enable rapid application and customized menu screen development. Typically, electronic displays will be compatible with both CAN and USB

communication protocols. Advanced systems can even feature NTSC/PAL video support to help keep your customers' fleets moving when problems occur.



According to the International Ergonomics Association⁴, the ultimate objective of humanizing design factors is to improve occupational health and safety, as well as industrial productivity. Expertly designed, field-proven interfaces can increase up time by reducing operator error, providing the added benefits of a safer, more productive work environment.

Filters

Improving fluid system cleanliness helps to ensure predictable performance while enabling planned maintenance intervals - both of which translate into improvements in uptime.

One of the most practical and simple methods for reducing maintenance downtime is to use spin-on filters that make change-outs fast and easy. Today's spin-on filter technology provides reliable performance in a lightweight, compact package that is a cost-effective addition to lift truck designs.

When looking for spin-on filter solutions, you will want a supplier capable of providing a variety of mounting and port options, as well as interchangeable canister heads. Easy-to-read gauges that allow operators to quickly identify operating conditions can also provide your product line with meaningful differentiation. Containers should be easy to dispose of with no oil leakage. Some spin-on filter designs also enable double-length filters that can extend intervals between filter changes.



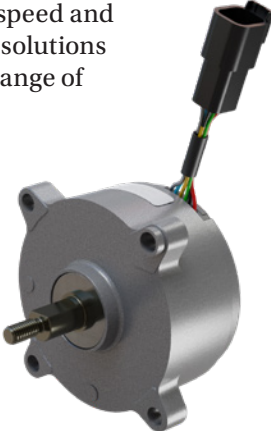
Next Generation Technologies

When you are looking to establish core differentiators in a competitive market, there are several next-generation technologies worth considering.

Tactile Feedback Drives (TFD)

TFD steering units are key components of fully electric and electric-hydraulic Steer-by-Wire (SbW) systems. This leading-edge technology enables OEMs to characterize the operating profile of their vehicles with an integrated solution that combines bearing support, steering position sensing, communication and continuously variable resistive steering torque. Customized resistive steering delivers high-fidelity tactile feedback to lift truck operators for optimized control and safety. TFD units are fully programmable, allowing OEMs to meet the operating conditions of specific industrial environments.

Parker's TFD will integrate seamlessly with other lift truck systems. Since torque feedback is typically independent of speed and temperature, these electric solutions are effective across a wide range of target markets.



Parker's TFD will integrate seamlessly with other lift truck systems

Permanent Magnet Electric Motor and Inverter

Optimizing power density is a critical design factor. Permanent magnet motors and inverters for drive train applications on electric or hybrid-electric vehicles provide maximum torque in a smaller lighter package. Where size and weight are

significant design considerations, the torque density and speed capabilities of these motor/inverter combinations can achieve breakthrough levels of performance.

Emerging Power Source Technologies

Motive power preferences have never been more varied than they are today. Lithium-ion batteries are rapidly replacing traditional lead-acid batteries, thanks to increasing warehouse demands for more predictable up time, reduced maintenance, longer run times and faster charging⁵.

The newest arrival on the lift truck scene is hydrogen fuel cell technology. For applications with zero tolerance for downtime, the speedy refueling time

required by lift trucks powered by fuel cells can't be beaten. Since they offer the added benefits of zero emissions and smooth consistent power delivery, many OEMs are transitioning to this space- and time- saving power source.

When evaluating hydraulic system components for your lift truck designs, compatibility with emerging power source technologies is another critical consideration.



The scalability of individual components is critical to cost-effective production.

Ancillary Performance-Enhancing Components

Other system components now considered to be “table stakes,” collectively represent a performance advantage that should not be minimized. These include:

- Reliable, leak-free seals that have been optimized for high-pressure, -vibration and impulse environments
- Non-spill couplings that connect and disconnect hydraulic fuel lines quickly with minimal spillage and limited air inclusion
- Zero-leak mobile directional control valves that deliver quick response, minimize heat generation and are flexible enough for a full range of tough mobile applications
- Silent fixed-displacement gear pumps for applications demanding noise levels less than 65cb, where high power density is required
- Robustly designed analog lever sensors for boom and mast positioning in outdoor applications

Scalability / Adaptability

The ability to adapt a design platform to meet the specific needs of individual vehicle classifications, industries, geographies, applications and regulatory requirements is essential in today’s highly competitive global market. In addition, OEM engineers typically design a multitude of specification differentiators into their vehicles—from the positioning of valves, to interface characteristics, to the tactile sensations associated with operator controls.

The scalability of individual components is critical to cost-effective production. Precise replication of every OEM specification, whether an individual part is being made for the Middle Eastern or North American market, is equally important. Other factors to consider in choosing a component supplier include:

- Regional manufacturing locations to reduce freight costs and facilitate speedy delivery
- Deep knowledge and experience with regulatory standards worldwide
- Component identification tagging to ensure accurate and prompt component replacements
- An engineering team well-acquainted with the trends driving the forklift industry and capable partnering with in-house design teams to provide truly customized solutions



Conclusion

The lift truck industry is growing not only in volume, but in sophistication. Societal expectations for friendly interfaces, predictable performance, increased productivity, IoT connectivity and environmental safety are raising the bar on lift truck design. Parker would welcome an opportunity to become your engineering and technology partner—optimizing and scaling individual components to meet your specification requirements and ensuring predictable and consistent component performance worldwide.

References

- 1 <https://www.alliedmarketresearch.com/forklift-truck-market>
- 2 <https://www.gminsights.com/industry-analysis/forklift-market>
- 3 <https://www.conger.com/common-forklift-repairs/#update>
- 4 <https://iea.cc>
- 5 https://www.mmh.com/article/making_the_case_for_next_generation_forklift_power_sources

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