The True Cost of Ownership for Counterbalance Forklifts:

Understanding the Impact of Hidden Costs

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Introduction

"The forklift is down."

Words no material handling manager wants to hear. Depending on the size and margins of a material handling operation, forklift downtime can mean lost production time, unexpected service and repair costs, and a solid bite out of the bottom line.

When most people hear the word "forklift," they envision counterbalance forklifts. As the name suggests, the trucks operate on a counterbalance principle where the weight on one end of the truck off sets the load on the other end of the truck. Counterbalance trucks can feature electric motors or internal combustion (IC) engines, or a combination of both, depending on the needs of the application.

The weight on one end of the counterbalance forklift off sets the load on the other end of the truck.

Because the basic functionality of counterbalance trucks is relatively the same across all vendors, the best criterion for selecting a counterbalance truck is total cost of ownership (TCO). However, true TCO can be extremely difficult to calculate accurately and every vendor seems to have their own formula, which often seems to favor their own truck over competitor offerings. This makes many purchasers rightly skeptical of TCO calculations. Some costs are straightforward and easy to measure, such as initial cost and energy costs, while others can be less predictable.

This paper explores the "hidden costs" associated with counterbalance forklift ownership to arm purchasers with the information they need to develop their own cost of ownership calculation.

Performance and Durability

Keeping a counterbalance truck up and running depends, in part, on the durability and strength of the truck's design and components. Counterbalanced trucks often are counted on to be jacks-of-all-trades; however, not all forklifts are designed to handle every application.

The range of applications for which counterbalance forklifts are used creates a variety of potential issues that could cause premature failure to trucks that are not designed for the conditions in which they are operating. Impacts, heat, dirt, dust and corrosive environments can be found in both indoor and outdoor applications from warehousing, recycling, manufacturing and foundries.

In addition, yearly hour usage on counterbalance forklifts varies greatly, from less than 1,000 hours per year up to 5,000 hours per year. Sometimes it is not the hours of use but the environment in which the truck operates that takes a toll. The term "powertrain" is most commonly associated with IC forklifts but also applies to electric vehicles. Electric forklifts have motors that provide power through a gearbox and drive axle just as an internal combustion engine provides power through a transmission and drive axle.

The powertrain is the heart of the forklift and is typically the most expensive component to replace. In fact, 50 percent of the initial cost of the forklift can be the powertrain. A durable powertrain is key to eliminating expensive repairs and downtime.

AC motor technology has helped increase the durability of electric forklifts by eliminating the need for brush replacement that was common on older DC motors. The AC motor's brushless design provides more power and runs cooler than DC motors. This means the motor doesn't have to work as hard, and, combined with fewer internal components, extends life and reduces maintenance and downtime. However, the gearbox and axle must be designed to support a more powerful motor. Any mechanic can attest to the fact that more power means more torque. If the gearbox/transmission and axle are not designed to handle the power of the AC motor the advantages and cost savings of an AC motor will not be realized.

For IC trucks, which are typically selected for the harshest environments, potential problems that may occur include clogged or easily damaged radiators, engines that run too hot and transmissions that are undersized for the assigned tasks. Poor braking performance and component durability are issues that may be relevant to both IC and electric trucks. All may lead to possible downtime and increased maintenance costs.

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That makes a robust, industrial design for all major components a consideration that should not be taken lightly. Components and systems that have their roots in the automotive world may not withstand the rigors of counterbalance truck applications.

The biggest problem for many IC forklifts is heat management, which directly affects the engine, the transmission and other systems. It also impacts operator comfort and forklift performance.

Automotive-style engines with aluminum heads and lightweight materials are often used in IC trucks. These engines are designed primarily for highway-speed fuel economy, in which the operating speed of the vehicle helps to cool the engine along with the cooling fan. That's not how IC trucks are used. They work in off-highway environments at speeds typically less than 10 mph, so the cooling benefit is negated. As a result, normal use of an automotive engine in a typical forklift environment can result in overheating, causing aluminum cylinder heads to crack or warp and creating significant, unplanned repair costs.

A more practical engine solution involves the application of a larger cast iron block and cylinder head engine based on an industrial drive design. Such engines are built with larger bearings and internal components, and are designed with harsh environments in mind, thus reducing many of the heat-related problems that affect automotive-style engines, almost doubling their life expectancy (20,000 hours vs. 10,000 to 12,000 hours).

Industrial Engine

Automotive-based Engine

While automotive-style engines often are used on IC forklifts, industrial engines are designed with harsh environments in mind.

True industrial engines typically have a larger oil capacity and are sometimes equipped with an external oil cooler which helps maintain oil temperature and viscosity, extending engine life and potentially enabling extended oil change intervals. Service intervals also can be extended through the use of a gear-driven camshaft and valve train as opposed to the typical automotive approach of timing belts and chains that require replacement or service.

Industrial design extends to power transmission as well. Rugged cast iron transmissions and axle housings provide thermal and impact protection. Larger axles and bearing diameters provide strength and durability. Some cooling system radiators intended to minimize heat-related problems may not be sufficient to keep the powertrain cool in a heavy use application; often they are compromised even more by dirt and debris.

Some users have developed methods to compensate for these issues, such as cleaning facilities more often to reduce airborne dirt, or developing a routine schedule to clean radiators with brushes, high pressure water and air to remove debris. Continued cleaning may only lead to more damage if the radiator is an automotive-style component constructed of thin-gauge aluminum.

In heavy use applications, some cooling system radiators are compromised by dirt, debris or blowing dust.

Thin aluminum and plastic automotive-style radiators that combine engine and transmission cooling into one package cannot offer the protection needed for some applications. In some cases, the duty cycle of the application may exceed the cooling system's capacity, even with a clean radiator.

IC trucks typically pull air for cooling from below – along with dirt and debris – like a vacuum cleaner. Debris sticks to the radiator and, if not cleaned, the truck will run hotter and performance could deteriorate. Inexperienced operators may continue to run a truck until failure.

Some cooling systems use a dual radiator approach; one radiator for the engine coolant and one for the transmission. This is common in large off-highway equipment or commercial vehicles that do a lot of towing. These industrial style radiators use heavier gauge aluminum with larger openings to reduce the amount of debris that can lodge on the radiator fins where cooling of fluids occurs. They typically last the lifetime of the forklift because of their heavy-gage aluminum industrial design.

Cooling fans on forklifts are typically mounted to the engine, which means fan speeds are dependent on engine speed. More recent cooling system designs control the cooling fan independently. Automatic radiator clearing is performed every time the truck is started via a hydraulic motor and cooling fan located on the backside of the radiator. This enables the system to cool more precisely and reduces radiator clogging, resulting in consistent performance and longer engine and transmission life.

Most electric and IC forklifts have built-in protection software that manages truck performance to help protect components from thermal damage. This type of software protection is an adequate safeguard for occasional events, but should not be relied upon day-to-day. Taking a component to its thermal limit day after day can still cause damage. Good thermal management and cooling systems keep you from reaching a reduced performance mode.

Rugged design also is a factor in minimizing service on braking systems on both IC and electric counterbalance trucks. Brake designs available today include drum brakes, wet disc brakes and heavy-duty, full-circle contact brakes. The full-circle contact brakes provide up to 90 percent more friction area to execute stops with significantly less operator effort; which can be a great benefit when a truck is moving down a ramp carrying a 5,000 lb. load. The full-circle contact brake design is virtually sealed, which helps eliminate foreign material and debris from entering the brake. This results in extended life that increases time between service intervals, and reduces maintenance costs.

Durability and performance are also directly impacted by the frame, axles and masts. Operator confidence, as well as overall productivity and safety, are affected by a truck's ability to perform under heavy loads or adverse conditions. Axles and frames must be designed to take the abuse of driving over potholes or transitioning from concrete driving to dirt and stone operation.

Mast design that accounts for stiffness and stability at height – where it matters most – can mean the difference between a truck that offers full value throughout its range of operation and a truck that cannot perform at the level for which it was originally specified.

The Economics of Ergonomics
Outside of personal breaks and maintenance stops, counterbalance truck operators spend their entire day in the truck. Making sure that time is comfortable can increase productivity levels; a tired, uncomfortable operator is often an underperforming operator. While that can be difficult to quantify, it's just good common sense. Making operators' workdays more comfortable contributes to overall safety, may enhance their confidence and may increase their feeling of control. A residual benefit is that an operator who drives a more comfortable truck is more likely to take better care of the truck in appreciation of a better overall work experience.

It begins with operator access– making it easy to go to work and leave work at the end of the day. For instance, the location of the steering column and seat deck can determine how much head, foot, knee and leg room is available. A comfortable seat, designed to reduce pressure and discomfort, can decrease stress throughout the workday.

Thinking through the location of components for both operation and visibility enhances the driving experience. Keeping controls within easy reach of operators enhances their productivity. Pedal location and easy activation improves overall operation and lessens safety concerns.

Improved visibility – both to the front and to the rear – also improves safety. Moving the operator position forward brings the operator closer to the work. In industries that have razor-thin margins, reductions in product and equipment damage can have a significant impact on the bottom line. Side shift indicators and fork tip markings allow operators to be more precise and efficient. Minimizing obstructions from chains and cables helps to maximize forward visibility. Rear visibility can be enhanced through seat positioning, location of bottle brackets (on trucks powered by

Making operators more comfortable contributes to overall safety and may help increase productivity.

liquid propane) and by reducing the height of the counterweight. This allows operators to function confidently at higher reverse speeds safely; better rearward visibility reduces the chance of backing into objects behind the truck or on the floor.

A lower center of gravity and more weight on the rear tires makes the truck feel more "planted." Such stability enhances operator confidence and increases overall productivity.

Service Intervals and Unplanned Maintenance

Correctly managing service intervals can spell the difference between operating a truck or a fleet of trucks at a profit or loss. Regular service intervals should be set and strictly followed. The goal is to keep a truck in production while minimizing unplanned maintenance issues. It's not much different than maintaining any vehicle, with the caveat that a truck is operated continuously, typically by one or more individuals. Scheduling maintenance shouldn't be based on an operator's intuition. Regularly scheduled maintenance supports reliable performance and extends truck life.

Forklift manufacturers have a variety of maintenance programs, ranging from regularly scheduled maintenance/emergency repair combinations to on-demand repair. It's not a one-size-fits-all program; different users have different needs and levels of in-house expertise.

Selecting a more rugged and durable truck can help reduce maintenance costs and increase performance levels. Simply stated, the more "industrial" the truck, the more service intervals can be extended.

One method of ensuring that a truck is properly operated and maintained is through a fleet management system in which an operator logs on and truck data is collected and correlated to that operator. This can help ensure that only authorized (and licensed) personnel are operating the trucks and can automate the checklist inspection process. Truck event codes can be relayed to service technicians that allow service calls to be proactively scheduled.

Establishing a good maintenance and inspection program through either in-house personnel, a dealership/distributor, manufacturer or any combination thereof reduces unplanned downtime and maintenance costs in the long run.

The best way to help reduce maintenance and costs and increase performance levels is by opting for a more rugged and durable truck in the first place.

Unplanned downtime results in lost production time, defined as the combination of lost performance while paying for an operator who is sitting idle. Service calls, depending on the urgency, can be costly and will typically include labor charges and travel charges outside of a contract (if such exists), as well as potential rush charges.

Ensuring that spare parts are readily available is just as important as a good maintenance/repair program. The time to think about establishing an on-site consignment or vendor-managed parts program agreement with a distributor/dealer and/or manufacturer is at the time of purchase or lease – well before it is actually needed. Parts usage analysis and management reports help a user understand the parts used most often and allow for pre-planning in terms of availability and cost expectation. Some users opt to maintain their own parts inventory, using skilled technicians and inventory management personnel.

A word of warning, however, in regard to the origin of the parts used to maintain the forklift – use only genuine manufacturers' approved parts. Pirated, copy-cat or knock-off spare parts should never be part of a spare parts program. A part that looks like an original equipment manufacturer's (OEM) part seems like it will work, and it may for a limited amount of time. Chances are that they were not built to the OEM's tolerances, or are made of a different material, and will not perform to OEM standards.

Often, knock-off parts are even sold as OEM parts, so it is important that inventory management personnel understand how the OEM marks or labels these parts. They may be identified with the OEM's logo, distinctive lettering, part numbers or serial numbers stamped or etched on the parts themselves. Packaging alone may be deceptive; pirated parts can be repacked in an OEM's packaging.

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Conclusion

As in many instances in both life and business, what may seem like an apples to apples comparison when comparing counterbalance forklifts is not necessarily so.

Truck selection – and determination of the true costs behind that selection – should be based on the truck's ability to meet the conditions in which it will operate, as well as other factors:

- Matching the durability of design and the ability to perform to the application – a more rugged design means increased uptime and reduced maintenance costs.
- Ensuring safety and reliability – providing maximum visibility and truck stability increases operator confidence and enhances safety.
- Maximizing operator productivity – increased comfort and enhanced ergonomic design improve the operator's experience throughout the work shift to reduce fatigue.
- Developing and adhering to a service and maintenance program – leads to significant savings over the life of the truck and reduces the potential for unexpected downtime.

The forklift with the lowest acquisition cost may not always be the best deal. If the truck is not durable enough for the application, or has a negative impact on the safety or productivity of the operator, it may end up costing a lot more during the life of the truck. Organizations that understand this and take a more comprehensive approach that considers the hidden costs and attempts to identify the true total cost of ownership, will ensure they have the right trucks for their operation and their bottom line.

Crown's award-winning line of forklifts maintains a reputation for advanced product design, engineering and technology, and integrated manufacturing processes. Offering a broad range of forklifts, as well as automation and fleet management technologies, Crown seeks to provide customers with forward thinking and innovative products designed to improve performance and lower operating costs. Headquartered in New Bremen, Ohio, with regional headquarters in Australia, China, Germany and Singapore, Crown operates a global service and distribution network.

Contact Information:

Crown Equipment Corporation
44 South Washington St.
New Bremen, OH 45869 USA
Tel 419 629 2311
crown.com

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