

Cat® lift trucks with Logisnext Li-ion batteries

ENERGY THAT MOVES YOUR BUSINESS FORWARD

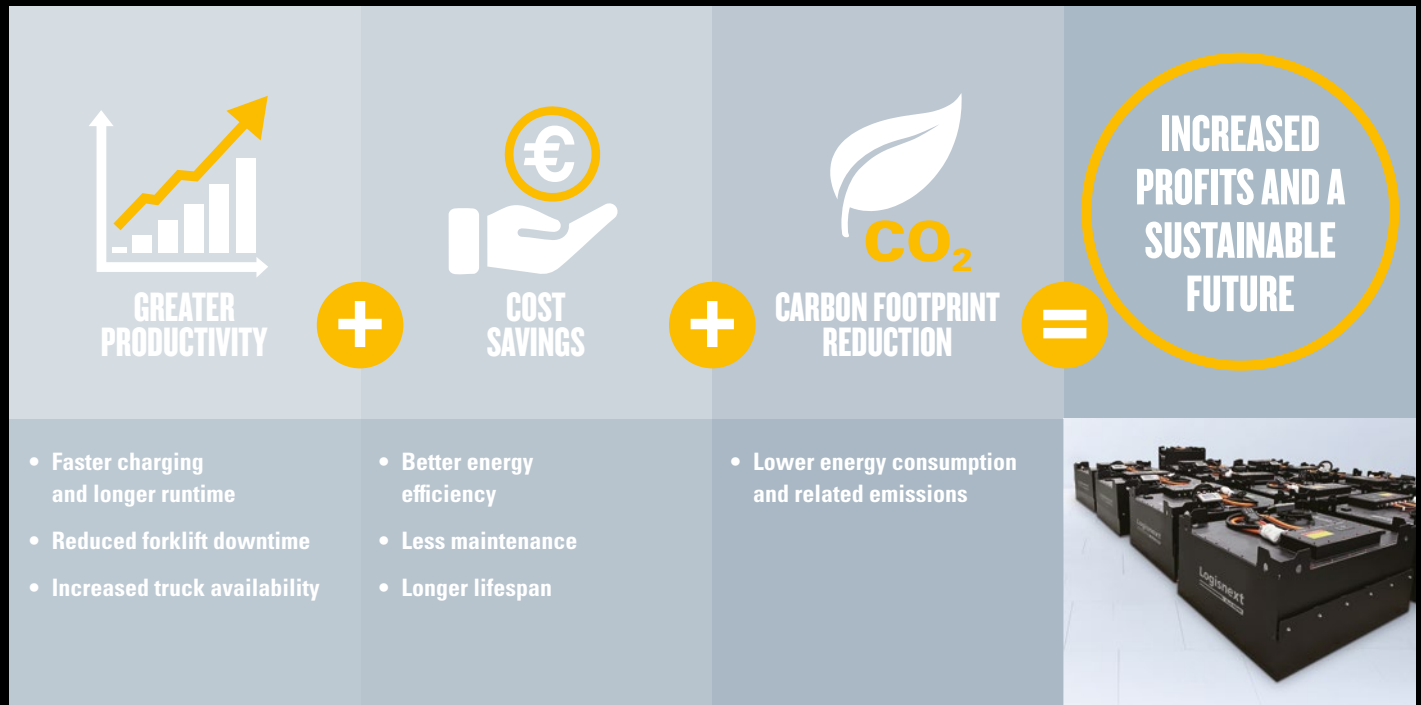


Li-ion batteries

OEM SOLUTIONS

CAT® Lift
Trucks

Choose a more profitable and sustainable future



At Cat® Lift Trucks, we're taking the advantages of lithium-ion technology to a higher level. Welcome to a new generation of superior Li-ion batteries – created by trusted partners in our global materials handling family. In combination with specially prepared Cat® trucks, they maximise every Li-ion benefit.

The Logisnext battery designers have worked closely with our Cat lift truck R&D teams. We've built on our organisation's accumulated experience in equipping trucks with Li-ion technology. And we've helped in refining and testing the batteries to ensure they meet your operational needs perfectly.

There's also a new range of compatible Logisnext chargers. They're engineered to gain full advantage from the integrated truck, battery and charger package.

The safe choice

You can switch from lead-acid to Logisnext Li-ion batteries without in any way compromising safety. We've chosen a stable chemistry – lithium iron phosphate (LFP) – to minimise fire risks. Then we've added further inbuilt safeguards for total confidence.

Read on to find out:

- Why you should choose Li-ion over lead-acid batteries
- Why Logisnext Li-ion batteries are better still

You can trust us for impartial advice. We produce lift trucks driven by the other main power sources too: lead-acid batteries, diesel fuel, LPG and more. Our expert sales advisers will guide you to the ideal solution for your application.

Logisnext Li-ion batteries - key advantages



Higher efficiency – maximising truck availability and productivity

Longer runtime
Gaining more work hours from each charge.



Fast charging and opportunity charging
Means less downtime, greater truck availability and higher productivity.



Consistent output
With minimal drop in power as charge level declines through a shift.



Intelligent inbuilt battery management system (BMS)
Optimises performance, runtime, reliability, lifespan and safety.



Inbuilt heater
Ensures optimal charging temperature, for long runtime even in environments as cold as minus 20°C.



Effective thermal insulation
Avoiding loss of capacity due to low temperature.

Longer life and zero maintenance – saving on battery-related costs and time

Longer lifespan
With a 4,000+ cycle life (3-4 times the life of lead-acid), you will need much fewer batteries.



Five-year warranty
For worry-free operation.



Zero maintenance needs
No need for water top-ups, daily/post-shift battery exchanges or long/overnight charging.



Lower facility needs
No need for large battery room and gas extraction facilities.

Higher quality and safety – avoiding battery-related accident, damage and injury expenses

Lithium iron phosphate (LFP) chemistry
For high thermal stability and low fire risk.



Inbuilt fire extinguisher
Giving extra assurance of safety.



IP54 sealing
Allowing reliable performance in difficult conditions.



Anti-condensation design
Absorbing moisture to keep the battery box dry inside.



Start protection system
Preventing sudden start-up or movement during charging.



Clear digital display
Linking with BMS and truck control systems to give real-time fault warnings, state of charge, state of health and other critical information.

Lower environmental impact – increasing sustainability

Smaller carbon footprint
Thanks to lower energy consumption, longer battery life (less manufacture of replacements), potential for second and third battery lives, and high recyclability.



Lower natural habitat impact
LFP chemistry has no need for quarrying of cobalt or nickel.

Raise your productivity

With Li-ion batteries, our lift trucks will work harder and more effectively for your business.



Maximise truck availability and performance – and minimise downtime

Longer runtime

Li-ion batteries have a higher energy density. Essentially, that means you can pack more energy into the space a conventional lead-acid battery would have taken.

They also transfer that energy more efficiently. For instance, less is lost as energy is transferred from being stored in the battery to powering the drive and lift motors. In other words, consumption is lower.

At the same time, Li-ion batteries capture energy from regenerative braking more efficiently.

These efficiencies greatly extend the runtime achieved per charge.

Fast opportunity charging for continuous operation

Highly efficient energy transfer in Li-ion batteries also allows faster* charging with less energy loss in the process. You save on both downtime and electricity.

In addition, charging of Li-ion batteries can be much more flexible. With lead-acid, the so-called 'memory effect' reduces a battery's capacity if it is recharged before being fully discharged. Reduction of its performance and lifespan is even greater if you repeatedly charge it for short periods, rather than fully recharging.

Li-ion batteries are free from these limitations. You can use opportunity charging to top them up during short breaks or between tasks.

This will have no ill-effect on the battery. Using a fast charger, you can keep the truck working continuously without ever having to take it out of service for charging.

Continuous operation through opportunity charging gives a huge productivity advantage. Some operations, however, require non-stop activity through a whole shift, with no opportunity for interim charging. For these, Li-ion's long runtime is still highly beneficial, while its fast charging minimises downtime between shifts.

No battery changes

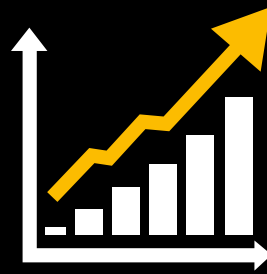
Except in the case of replacement at the end of their service life, Li-ion batteries are not usually exchanged. Typically, they remain on board the truck for charging. Exceptions to this include some warehouse trucks with small batteries which are quickly and easily swapped and recharged as necessary.

With traditional lead-acid batteries, removing and replacing heavy batteries each day, or between each shift, is laborious and time-consuming. Li-ion technology has made this a thing of the past. You no longer lose productivity while waiting for a truck's battery to be exchanged. Nor do you have to factor in an overnight or similarly long recharging period for your batteries.

No battery maintenance

Li-ion batteries have no need for water checks and top-ups. Nor do they require related procedures such as specific gravity measurement and equalisation charging. These factors all save on downtime.

*Full charge in around 2 hours with fastest charger.



- ✓ **Lower energy consumption/losses**
Typically saving 30% in charging and operation.
- ✓ **Better energy recovery**
By optimising the effect of regenerative braking.
- ✓ **Minimum self-discharge**
Maintaining high capacity during storage.

Minimal self-discharge

Loss of charge when Li-ion batteries are left unused are tiny compared to lead-acid. You can expect them to give full runtime, straight from the shelf.

Consistently high performance

Forklift performance is consistently high with a Li-ion battery, hour after hour. With lead-acid, power declines as the battery charge level falls toward the end of a shift.

Extra benefits with Logisnext

Intelligent battery management and protection

Our Li-ion batteries benefit from an advanced battery management system (BMS). This communicates effectively with our trucks' control systems and makes constant adjustments according to changing conditions and needs. It keeps everything working optimally, protects the battery and extends the battery's service life. Key information is presented to the operator via the truck's display. This includes battery state of charge and state of health.

Long runtime even in cold conditions

Low temperatures in cold stores or in winter weather can limit battery charge capacity and runtime. Our Li-ion batteries counter this with an inbuilt heater which optimises the temperature for charging. This enables highly productive use of the truck in a wider range of work environments and applications (down to -20°C). (For applications below -20°C our dealers have alternative solutions.)



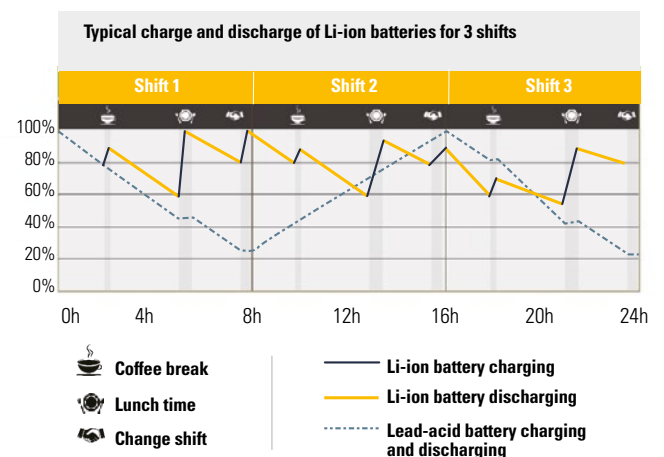
Fast charging

Rapid charging is a key Li-ion advantage – whether you're running a few trucks in single shifts or a large fleet 24/7.

Reduced downtime – increased availability

Spend less time charging. Less downtime means higher productivity. Top up the battery's charge during short rest, lunch or shift-change breaks – or any time the truck isn't in use.

- No need for a full charge every time
- No need for frequent time-consuming battery swaps
- No risk of battery-changing accidents



Lower your TCO (total cost of operation)

Our Li-ion batteries and trucks will save you money day after day – over a long battery lifetime.

Spend less on energy, batteries, maintenance and facilities – and stay safe

Lower energy costs

The energy efficiency advantages of Li-ion over lead-acid, as already described, mean its consumption is lower.

Battery charging is more efficient, with less energy loss in the process. Energy transmission from the battery to the truck's functions is also more efficient. Meanwhile, regenerative braking captures and recycles energy from the truck's motion more efficiently than in lead-acid systems. In addition, self-discharge losses from stored Li-ion batteries are comparatively tiny.

These savings translate into less electricity (typically 30% less) being needed to enable the lift truck's work. In other words, you can achieve the required level of productivity while lowering your electricity bills. Looking at it another way, you can achieve higher productivity without spending more on electricity.

Lower overall battery purchase cost

An Li-ion battery does, of course, cost more to buy than a comparable lead-acid one. However, it typically lasts three times longer. You should be comparing the Li-ion price* against the total cost of three lead-acid batteries.

Consider, also, that lead-acid batteries are susceptible to shortening of their service life if strict charging procedures are not followed. For instance, recharging before the optimum discharge level is reached, or recharging to less than full capacity, will reduce their lifespan. Li-ion batteries are not affected in this way.

Lower maintenance time and labour costs

Maintenance staff have very little to do in relation to Li-ion batteries. They do have to exchange them at the end of their service life, but that comes around much less frequently than with lead-acid.

Charging of Li-ion batteries, by simply plugging into an electrical socket or external charger, is often left to the driver. By contrast, maintenance personnel spend considerable time exchanging and charging heavy lead-acid batteries. Their work may involve managing and monitoring the recharging of large numbers of batteries, each requiring several hours in the charging station.

Maintenance tasks on lead-acid batteries may include checking and topping up water levels, measuring the electrolyte's specific gravity and applying equalisation charges. None of this is needed for Li-ion batteries. Even keeping the battery clean is easier with Li-ion, as it comes in a plain, wipe-clean case. In comparison, lead-acid battery tops and terminals can be tricky to maintain.

Lower facility costs

For lead-acid batteries, you need to set aside and maintain a large, specially designated space for battery storage, charging and maintenance. This must be equipped with a gas extraction system and kept separate from potential ignition sources.

These facilities are unnecessary with Li-ion. Much fewer spare batteries are stored, and charging takes place on the trucks at conveniently distributed stopping points.



- ✓ **Flexible charging**
Short charging sessions, at any state of charge, have no ill-effect on battery capacity and lifespan.
- ✓ **Thick metal cover**
Protecting against physical damage.
- ✓ **Certification**
Our batteries are certified according to CE safety standards and have passed the UN safe transportation test.

Less risk of costs relating to injury or damage

Use of lead-acid batteries poses various safety hazards. In the event of a battery-related accident, costs to your business might include sickness absence, compensation, fines, downtime and repairs.

Frequent handling of heavy lead-acid batteries, during exchanges for charging, has obvious dangers. These include crushed feet and strained backs. Regular maintenance activities increase the chances of electric shocks and burns from contact with battery terminals. Acid spills can burn personnel and damage building structures. Gases and vapours released while charging may be toxic if breathed in and can explode if ignited.

Li-ion batteries avoid all these risks.

Extra benefits with Logisnext

Longer lifespan – guaranteed

Our Li-ion batteries typically give you the equivalent service life of three lead-acid batteries. They also outlive many competitors' Li-ion products. You can expect 4,000 charge/discharge cycles before the battery's capacity drops to 80% of its original state. For extra confidence, each of our batteries comes with a five-year warranty.

Extra safety

You will undoubtedly have seen reports of electric scooter, bike or car batteries catching fire. However, this is relatively rare and is easy to prevent.

Most importantly, you should avoid using cheap, poor-quality batteries. A high level of build and design quality increases an Li-ion battery's safety. You can be sure of this with Logisnext Li-ion batteries.

Our Li-ion batteries are based on lithium iron phosphate (LFP), which has a higher thermal stability than other Li-ion chemistries. Thermal runaway is much less likely and is much less severe if it happens*. For further confidence, each of our Li-ion batteries has an inbuilt fire extinguisher. This is designed to bring down the temperature and contain any lithium fire.

In addition, our Li-ion batteries are protected by a thick metal cover, which provides physical strength and prevents water and dust ingress to IP54 standard. These defences guard against external factors which can damage batteries and make them vulnerable to thermal runaway. The batteries have been crash and drop tested to prove their resilience (according to UN38.3 and IEC 62281).

Our advanced battery management system (BMS) also provides important safeguards. It monitors the Li-ion battery and protects against hazardous conditions including overload, short circuit, deep discharge and overcharge.

Another safety feature is our start protection system. This prevents the truck from operating while its battery is connected to a charger and power supply.

Our batteries are certified according to CE safety standards. They have also passed the relevant UN safe transportation test (UN38.3).

*In the unlikely event of an LFP thermal runaway, the operator will receive a clear warning via the display. LFP thermal runaways take much longer to develop, so there will be more time to act. The heat emitted and the maximum temperature reached in LFP thermal runaways are lower than in other Li-ion batteries. Also, the ejections in an LFP fire are less dangerous.

Shrink your carbon footprint

Our sustainable Li-ion batteries and lift trucks are good for your business and the planet. They will futureproof your operation against increasingly stringent environmental legislation. Switching to Li-ion also gives customers a clear sign of your social responsibility.

Reduce, re-use and recycle – and futureproof your business

Reduce your consumption and emissions

With Li-ion batteries you will consume less energy, which ultimately means less carbon will be emitted. Even if all your electricity comes from renewable sources, consuming it efficiently will leave more of that green energy for use by others. It all contributes to reducing society's reliance on fossil fuels.

Re-use and conserve your resources

The longer life (typically three times longer) of Li-ion batteries means that fewer replacements are needed. This, in turn, means less manufacturing, less consumption of energy and materials by manufacturers, and lower industrial emissions. The energy consumption and emissions associated with Li-ion battery manufacture are outweighed by energy savings through their efficient operation and long life.

Extended value from your investment, and from resources contained in the batteries, is gained through second and third battery lives. At the end of their first life, they can be refurbished and used in second-hand forklifts. After this, they can become part of an energy storage system for household or industrial electricity supply.

Recycle materials economically

Up to 95% of the component material in an Li-ion battery can now be recovered and recycled. We are committed to recycling at least 80% of the material initially. Improvements will follow. Making batteries from recycled materials requires much less energy than extracting fresh materials from the earth and processing them. It also produces much lower emissions, consumes much less water and reduces depletion of the earth's mineral resources.

For you as the battery user, access to a battery collection and recycling scheme saves on the effort and cost of disposal. We handle all the recycling and take-back logistics for our Li-ion batteries.

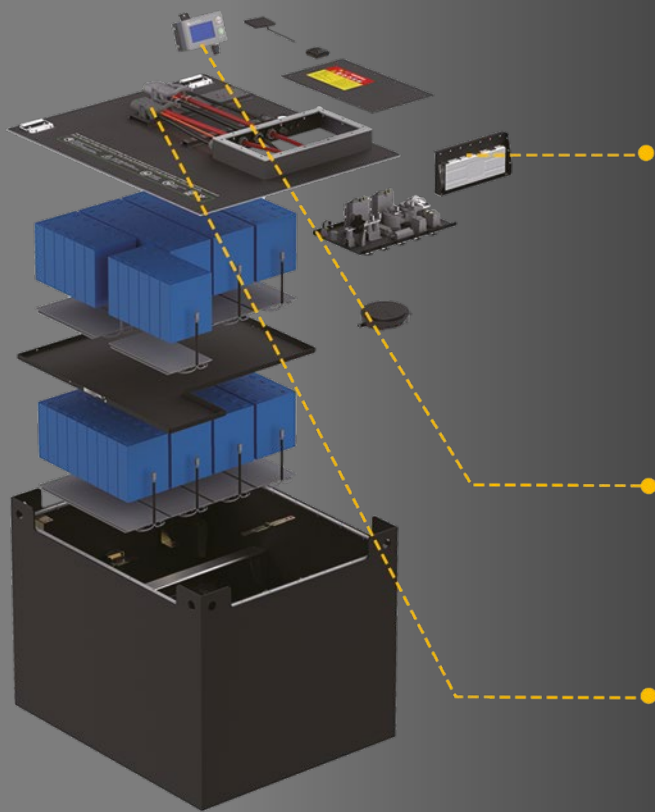
Extra benefits with Logisnext

The eco-friendly choice

LFP batteries, like ours, are considered to be the most ecologically friendly Li-ion option. They have no need for cobalt and nickel, whose quarrying can be damaging to the environment. They are also easier to recycle, again due to the absence of cobalt and nickel.

The long lifespan of Logisnext batteries is another key to reducing material and energy consumption. And when they have reached the end of their useful life with you, we will collect 100% of those batteries.

Inbuilt intelligence



Inbuilt BMS
(battery management system)

Inbuilt control panel

Shows all critical indications of battery performance and condition – including voltage, current, remaining charge and fault warnings.

Inbuilt REMA-branded plug

High-current charging plug featuring integrated start protection system – preventing unintended start-ups.

Battery management system (BMS)

Equipped with automotive-grade components, our inbuilt BMS assures the highest levels of safety, quality and energy efficiency. Everything is optimised to meet the most demanding of industrial application requirements.

Our BMS software maintains peak battery performance, extends runtime between charges and maximises total lifespan. It ensures effective communication between the battery, charger and users.

Its key functions include:

Constant cell balancing and battery management

Intelligent balancing of charge between cells helps to keep performance consistent. As well as optimising efficiency, it extends the battery's service life.

Real-time monitoring and communication

Via CANbus connection, the BMS monitors cell voltage, electric current, battery temperature and other key factors. If any deviation from the normal range is detected, it disconnects the cell or entire battery.

Fault warnings and safety provision

Alarm signals include an audible warning if the battery's charge level goes below 10%. This gives the operator time to reach the nearest charging station rather than having to stop without notice. There are also warnings if voltage, current or temperature are too high or too low. These and other fault alarms warn the user to seek help to make the battery safe.



Li-ion technology for all



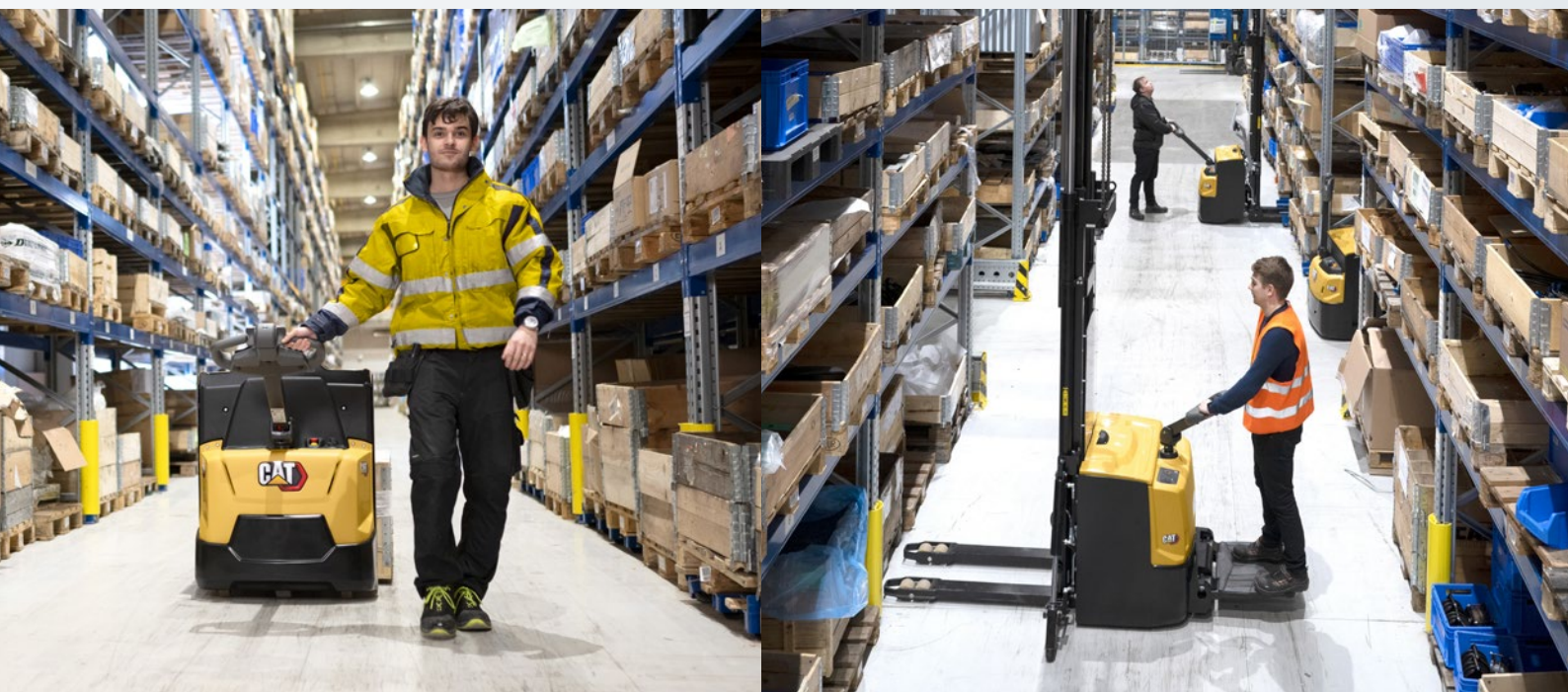
Whether you need...

- A truck for just three hours a day
- A fleet for an intensive multi-shift operation
- Equipment for use in refrigerated storage
- A clean solution for an impurity-free environment

... we have the perfect combination of trucks and Li-ion batteries for you. We can apply their productivity advantages, convenience and cost-effectiveness to these applications and many more.

Your local Cat lift truck dealer will supply the Li-ion battery that best suits your truck and application. For instance, if you want to keep the truck running continuously, using opportunity charging, a relatively small battery capacity might be best. If the truck is to work continuously through its shift, without even a small break, a larger-capacity battery will be better.

If you're buying, leasing or hiring new forklifts from our dealers, we can factory-fit them with our Li-ion battery system. Our dealers can also retrofit the system to used forklifts, to individual trucks already on your premises, or to your whole fleet. In any case, we fully integrate the Li-ion battery with each truck's systems for optimum advantage. That includes full CANbus communication, pre-installed in the batteries.





Logisnext chargers

Logisnext chargers have been specifically developed for forklift battery charging. They use advanced algorithms and high-frequency technology to minimise energy loss and extend battery life. Their benefits include versatility, allowing both high-voltage and lower-voltage batteries to be charged by the same unit. This saves on equipment costs and adds convenience. Cat lift truck dealers can guide you to the ideal chargers for your operation and, if you wish, install your charging infrastructure.



LED panel clearly indicates state of charge



Acid and oil resistant coating



Efficiency rating >90%



Sealing rated IP21 (indoor use)



Low standby power consumption (<5W)



Automatic stop when charger disconnected



CE/UL certifications



Cat[®] lift trucks and Logisnext Li-ion technology



Move your business forward

Logisnext batteries, combined with Cat lift trucks, are pushing the advantages of Li-ion further. Would you like to raise your productivity and profits, lower your environmental impacts and have greater confidence in the future? If so, ask what we can do for you.



Please contact your nearest Cat lift truck dealer for further information and a demonstration.



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