



The Battery Pack Selection Checklist for Agricultural Off-Highway Machinery

What really counts in battery pack selection?



Use this checklist to methodically evaluate and compare battery packs, focusing on long-term benefits and strategic partnership potential.

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Evaluate Basic Specifications

Form

Confirm the physical compatibility (including dimensions and weight), and investigate the changes needed on the vehicle to accommodate the battery. Also, assess the amount of extra space needed for cable and hose routing and any additional components like converters, onboard chargers, and junction boxes.

There is typically very limited amount of space in tractors and weight can affect performance and efficiency. A balance between a compact size and available energy is important.

Fit

Check if the battery's energy (kWh) aligns with operational energy demands, and ensure it meets the operational and charging power demands.

Agricultural machinery may require long periods of operation with moderate power demands (Discharge Current). Therefore, capacity is more crucial than available power.

Function

Ensure functional compatibility within the application. Pay attention to specifications such as communication protocol and input/output variables.

Important to take into account

When determining the necessary battery capacity for your equipment, it's crucial to think beyond simply having enough energy to last an entire day. Consider the broader context of charging availability and operational patterns.

Agricultural operations typically have easier access to the energy grid, as farms are often located near grid-connected buildings or infrastructure. This allows for more frequent and convenient charging opportunities. For instance, during a midday pause in fieldwork, when machinery is idle, batteries can be recharged directly from the farm's power supply or via mobile charging units that are easily powered by the grid. This accessibility could allow for a smaller battery size while still meeting the operational demands, reducing overall equipment costs and minimizing downtime.

By integrating these considerations into your planning, you can move beyond the conservative approach of simply sizing batteries for all-day use, and instead, develop a more efficient and versatile power management strategy.



02 Advanced Application Considerations

Operational Durability

Test for resilience against vibrations and shocks specific to off-highway environments and applications.

Agricultural machinery usually operates on rough and uneven terrain. However, vibrations encountered are generally of lower frequency and intensity compared to other off-highway equipment. Ensure the battery can deal with momentary inclinations that are expected in the field. Also consider how likely it is that the machine will turn-over during operation or in idle-state.

Certified Safety

Validate compliance with the latest safety standards suitable for off-highway use and appropriate for the application. This includes advanced Battery Management Systems (BMS) features and physical safety tests. Additionally, assess any safety requirements needed for the specific application separate from certifications. Align and agree on this with the battery manufacturer.

Consider how will the battery cope with chemicals like fertilizers and pesticides? Ask the battery supplier about the battery's chemical resistance. Also, typical agricultural machinery, like tractors, directly or indirectly interact with food production. While RoHS and REACH are not specific for agriculture, they play a critical role in ensuring that agricultural machinery is safe for both the environment and food production. Compliance with these regulations helps prevent crop and soil contamination. Verify if the batteries are RoHS and REACH compliant.

Integration Compatibility

Make sure that the other powertrain components in the vehicle are compatible with the battery.



03

Operational Requirements

Thermal Management Needs

Assess the thermal properties of the battery pack and compare them with its use (both charge and discharge). Consider both operational requirements and the intensity of use.

Most agricultural machines have longer periods of operation with moderate power demand. Because of this, the battery cell temperature is more likely to stay consistent. Determine (together with the battery supplier if needed) if passive liquid thermal management (condenser & pump) or no liquid thermal management is sufficient to keep the battery cells within a healthy temperature range.

Ingress Protection

Confirm how well the battery pack needs to be protected against water and dust. Typically expressed in IP rating.

04

Data-Driven Selection

Real-World Performance Data

Assess if and how you want to use telemetry to monitor real-world performance and usage data.

Serviceability

Understand how you'll be able to service and diagnose problems around the world, and see where you can leverage your suppliers network.

Usage and Efficiency Analysis

Study usage patterns and efficiency under typical and extreme conditions for future developments.



05

Longevity and Sustainability

Maintenance Requirements

Investigate requirements on periodic maintenance, and ensure operators and dealers are equipped with the right tools.

Sustainability Measures

Evaluate the battery's end-of-life recyclability and manufacturer's sustainability practices.

Aging

Consider how your specific use-case could impact cyclic aging of your battery pack.

06

Regulation

Compliance

Ensure the battery packs meet all necessary regulatory requirements relevant to the geographic areas where the vehicles will operate. This could include local environmental regulations and import/export restrictions.



07

Scalability and Flexibility

Modularity

Check if the battery pack design supports modular adjustments or adaptations for various vehicle types.

Production Scalability

Ensure the battery pack integration method is optimized and scalable for mass production, and can be scaled up efficiently to meet production demands without significant performance compromises.

08

Pricing and Timeline

Total Cost of Ownership

Evaluate Total Cost of Ownership instead of just battery pack pricing. First evaluate the cost on a system level, taking into account the capacity, thermal management, charging, power distribution box, battery management system and other features.





Partnership and Support

Integration Support

Look for partners with comprehensive integration support and a strong track record in the off-highway sector

Aftersales

Confirm the availability of long-term technical support to minimize downtime and enhance lifecycle value. Look for vendors who can provide products and value-added services such as custom engineering support, training for your teams, and joint development opportunities. Also, consider the geographic location.

Long-Term Support

Consider how the supplier intends to remain competitive in the long-term, considering the quick introduction of new technologies into the market.

Vendor Stability and Reputation

Consider the financial health of the battery supplier, which can impact long-term supply chain stability and reliability.

Battery Lifecycle

Discuss how the supplier plans to provide the same or replacement battery for many years to come, evaluate your suppliers future product roadmap and their commitments to supplying a state of the art battery in the years to come.





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