NEW POWER NOW

INNOVATIVE SOLUTIONS

LITHIUM POWERED

RELIABLE LITHIUM-ION TECHNOLOGY

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HANGCHA GROUP CO., LTD reserves the right to make any changes without notice concerning colors, equipment or specifications detailed in this brochure, or to discontinue individual models. The colors of trucks, delivered may differ slightly from those in brochures.
Innovative, reliable lithium-ion technology (Lithium Iron-Phosphate), which are developed jointly by HANGCHA and CATL. Battery cells and modules are from CATL, with reliable quality, exclusively for HANGCHA.

HANGCHA WARRANTY SERVICE

Integrated Battery Management System (BMS) continually monitors energy management and ensures reliable operation. HANGCHA provides Li-Ion battery (LiFePO4) with 5 years or 10000 hours warranty.
LITHIUM BATTERY

ADVANTAGES

Long service life
4000 full charging cycles with at least 80% residual capacity

High safety and reliability
Intelligent battery management monitoring every important function, no emission of battery gases

Maintenance free
No topping up of water or checking acid levels

Fast charging
2 hours full charge, economic use of each break

Intermediate charging
Full performance during several shifts thanks to effective interim charging

Cold area application
Li-Ion batteries maintain high performance at temperatures below freezing

Return on investment
Add flexibility to your operation, cost saving in the long term, increased efficiencies

High energy density
The high energy density of the Li-Ion battery ensures long working times and increases the high availability

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Safety Design

- Topology optimization
- Shape optimization
- Pre-design
- Size optimization
- Thermal runaway
- Design
- Modal analysis
- Mechanical shocks
- Test & Validation
- Vibration
- Electrochemical analysis

Battery Management System (BMS) monitors the Li-Ion cells at all times. As a result, our Li-Ion solution is the most reliable power option.

Battery Safety Management:
- Overcharge/over discharge protection
- Overcurrent/over-temperature/low-temperature protection
- Multi-level fault diagnosis protection
- Composite fault monitoring

SIC/ISO Detection:
- Nominal capacity estimates
- Battery health estimates
- High precision capacity integration

High Pressure Safety Management:
- High voltage interlock (HVIL)
- High voltage insulation monitoring
- High voltage switch diagnostics

Battery Parameter Detection:
- Battery voltage detection and analysis
- Battery current detection and analysis
- Battery temperature detection and analysis

Equilibrium Management:
- Equalization based on time mode
- Equalization based on interval mode
- Equalization based on battery and SOC
- Active/passive equalization

Other Features:
- Low cost, low power consumption
- High performance periods
- Feature expansion
- Flexible cascade expansion
- Fault isolation
With the biggest testing lab by area, largest number of charging & discharging equipment, most complete standards, CATL’s testing is among the best domestically.

By December 2018, CATL is able to carry out 273 kinds of tests* including safety, reliability and performance tests.

*The 273 kinds of tests included 100 performance tests, 48 safety tests and 125 reliability tests.

FEATURES & BENEFITS

Power
/ High energy density with an identical volume as a lead-acid battery, the Li-Ion battery contains twice as much energy.
/ High availability by quick opportunity charging without the need to change the battery.
/ Longer truck performance thanks to stable voltage supply throughout the discharging process.
/ Lithium batteries maintain their performance level also at temperatures below freezing making them ideal for use in cold areas.

Precision
/ The communication between truck and battery controller allows to efficiently use and deploy the Li-Ion battery.

Compactness
/ Higher energy density for compact battery dimensions.

Safety
/ Intelligent battery management monitoring every important function.
/ Higher user safety, thanks to acid-free use.
/ User friendly due to avoided battery change.
/ No emission of battery gases.

Ecologic responsibility
/ Eco-friendly thanks to twice the service life.
/ Eco-friendly due to absence of acid.
/ Substantially higher efficiency of the Li-Ion battery when charging and discharging reduces energy costs.

Ergonomics
/ Virtually no physical strain, because battery changes are not needed.
/ Maintenance free operation - no topping up of water or checking acid levels.
/ No organizational effort - pre-work checks and providing water are not needed.

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**PERFECT PERFORMANCE IN COLD AREA**

**BATTERY PACK HEATING MANAGEMENT**

HANGCHA battery pack with heating management during the discharge process, the temperature rises from -20°C to 0°C, only takes 25-30 minutes. General battery pack during the discharge process, the temperature rises from -20°C to 0°C, will take 85-90 minutes.

**LONG CYCLE LIFE**

**BATTERY PACK CYCLE LIFE TEST**

- **Attenuation rate comparison**
  - HANGCHA: First year 6.29%, Second year 4.66%, third year 3.18%
  - General: First year 10.9%, Second year 7.23%, third year 5.26%

Total attenuation 14%

HANGCHA: First year 6.29%, second year 4.66%, third year 3.18%

General: First year 10.9%, second year 7.23%, third year 5.26%

Total attenuation 23.4%

HANGCHA provides Li-ion (LiFePO4) battery with 5 years or 10000 hours warranty.

**CHARGING**

Rapid charging and opportunity charging ensure continuous availability of vehicles.

Li-ion powered forklifts are always available. They allow for fast full charging or boost charging (100% charge in 2-hours). They are maintenance free and do not require a battery change when used for multi-shift operations.

**EFFICIENCY**

The high performance Li-ion technology is especially suitable in cases where lead acid batteries are in use and have to be changed in two to three-shift operation. Lithium-ion batteries do not need to be replaced. By quick interim charging any downtime, such as a lunch break, can be efficiently used and the battery is recharged in a very short period of time. Interim charging does not affect the battery service life.

Lithium-ion technology supplies constant voltage throughout the entire application time. Accordingly, you can work under full power through several shifts without having to change a battery or do any kind of maintenance at all.

**COMPARING BATTERY CHARGING TIMES**

- **Li-ion battery**
- **Lead acid battery**

<table>
<thead>
<tr>
<th>Charging time [h]</th>
<th>Li-ion battery</th>
<th>Lead acid battery</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
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<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Battery pack with LiFePO4 features heating management.
After taking a look at the complete total cost of ownership (TCO), currently high procurement costs are more than compensated for by HANGCHA’s longer service times and significantly lower operating expenses.

### HANGCHA Li-ION FAMILY

#### Warehouse Equipment

- **Mini Pallet Truck**
  - 1.2t
  - 24V/20Ah

- **Pallet Truck**
  - 1.2t
  - 24V/20Ah
  - 1.5/2.0t
  - 24V/40Ah, 48V/20Ah

- **Pallet Truck**
  - 2.0/3.0t
  - 24V/120(202)Ah, LiFePO4

- **Rider Pallet**
  - 2.0/3.0t
  - 24V/120(202)Ah, LiFePO4

- **A Series 3-W Electric Forklift**
  - 1.6~2.0t
  - 48V/480Ah, LiFePO4

- **A Series 4-W Electric Forklift**
  - 1.0~3.5t
  - 80V/202Ah, LiFePO4
  - 4.0~5.0t
  - 80V/542Ah, LiFePO4

- **Pallet Stacker**
  - 1.2~2.0t
  - 24V/120(202)Ah, LiFePO4

- **Reach Truck**
  - 1.6~2.0t
  - 80V/271Ah, LiFePO4

- **Tow Tractor**
  - 4.0/6.0t
  - 48V/200Ah, LiFePO4

- **XC Series 4-W Electric Forklift**
  - 2.0~3.5t
  - 80V/271Ah, 404Ah, 542Ah, LiFePO4

#### Counterbalanced Truck

- **A Series 3-M Electric Forklift**
  - 1.0~1.5t
  - 48V/100Ah, LiFePO4

- **A Series 4-M Electric Forklift**
  - 1.0~1.5t
  - 48V/100Ah, LiFePO4

#### Lithium-Ion Battery Recycling Solution

In the future, battery components will not be sourced solely from mining; they will have to come from recycling and from applications utilizing industrial side streams. HANGCHA has been committed to working with CATL to improve the secondary use technology. In doing so, we help to protect our environment.

#### 24/7 Service by Hangcha and CATL

Service Purpose: Loading the way with attentive service.
Service Concept: Results orientation and quick service.

#### TCO

The above data refer to the case for actual use from lithium forklift.

<table>
<thead>
<tr>
<th>Item unit</th>
<th>Lithium battery</th>
<th>Lead acid battery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>V</td>
<td>48</td>
</tr>
<tr>
<td>Capacity</td>
<td>Ah</td>
<td>403</td>
</tr>
<tr>
<td>Battery energy</td>
<td>kWh</td>
<td>19.2</td>
</tr>
<tr>
<td>Charge efficiency</td>
<td>%</td>
<td>95%</td>
</tr>
<tr>
<td>Annual charge times</td>
<td>h</td>
<td>300</td>
</tr>
<tr>
<td>Electricity price</td>
<td>USD/kWh</td>
<td>0.14</td>
</tr>
<tr>
<td>Annual electric charge</td>
<td>USD</td>
<td>866</td>
</tr>
<tr>
<td>Annual maintenance cost</td>
<td>USD</td>
<td>162</td>
</tr>
<tr>
<td>Maintenance cost of ten years</td>
<td>USD</td>
<td>8881</td>
</tr>
<tr>
<td>Maintenance cost of ten years</td>
<td>USD</td>
<td>(162 kWh/1400 USD)</td>
</tr>
<tr>
<td>Total cost per forklift</td>
<td>USD 24376</td>
<td>54326</td>
</tr>
</tbody>
</table>

Lithium battery’s cost reduction is about 55%.

HANGCHA has started to work with Li-ion batteries early on and being able to develop a large number of trucks with this technology. Today we are ready to offer you a complete fleet of Li-ion trucks. Low lift or high lift pallet trucks, counterbalanced trucks - our portfolio is constantly growing.

Let’s find out more about the innovative Li-ion family from HANGCHA.