H40光伏清洗无人机

H40 Photovoltaic Cleaning Application UAV

江苏迈步智能科技有限公司

场景应用
Scenario Application

农业播种、撒肥、喷药；军事侦查；电力巡检、清洗；物流运输；应急救援；警用安防；交通喊话；环境防治等场景。

Agricultural sowing, fertilizing, spraying; military reconnaissance; power inspection and cleaning; logistics and transportation; emergency rescue; police security; traffic warning; environmental protection and other scenarios.

清洗
Cleaning

农业
Agriculture

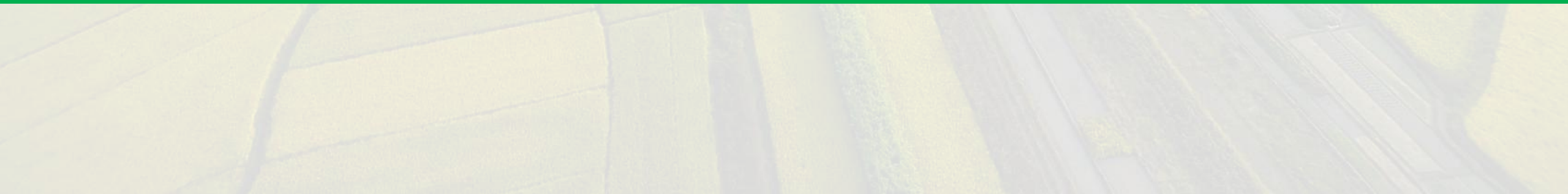物流
Transport

侦查
reconnaissance

巡检
Potrol

应急救援
Emergency rescue

光伏清洗无人机详解

Photovoltaic cleaning Application UAV detail introdution

清洗无人机的功能
Cleaning Application UAV Functions

支持的工作模式
Supported Mode

规划全自主飞行模式、AB
点半自主飞行模式、手动作
业模式
Programmable fully
autonomous flight mode, AB
point semi-autonomous flight
mode, manual operation mode

支持可视化
Visual Control

数图一体化的控制、地面站
屏幕显示，飞行航线可视化
Integrated digital and graphic
control, ground station screen
display, flight route
visualization

支持实时语音播报
Support real-time voice
broadcast

实时语音播报飞行数据，飞
行器 LED 状态显示
Real-time voice broadcast
of flight data, aircraft LED
status display

支持安全设置
Security Settings

多项可配置的安全设置，安
全自动返航
Various configurable safety
settings, safe and automatic
return to home

清洗无人机的功能
Cleaning UAV Function

飞行精度
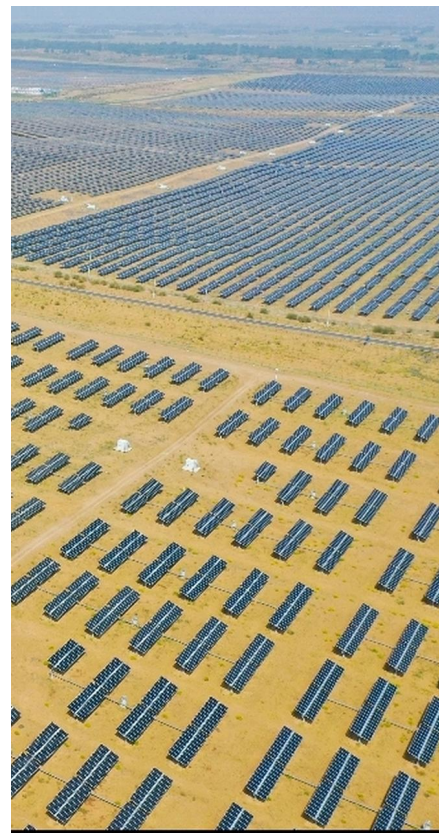### Flight accuracy

偏航距（水平）为0.18m，偏航距（高度）为0.27m，速度偏差为0.24m/s
Yaw distance (horizontal) is 0.18m, the yaw distance (height) is 0.27m, and the speed deviation is 0.24m/s

配备电子围栏系统
Electronic fence system

对通讯链路中断、电量不足等情形有报警和失效保护功能
It has alarm and failure protection functions for situations such as communication link interruption and insufficient power.

具备限制功能
Safty Restriction

支持限高、限速、限距功能
Support height limit, speed limit, and distance limit settings

具有避障功能
Obstacle avoidance

飞机前进后退方向能识别障碍物
Drone can identify obstacles in the forward and backward directions

清洗无人机的优势
Advantages of Cleaning UAV

无人机机身采用高强度碳纤维材料+航空铝五金件组成，机身强度高
The fuselage is made of high-strength carbon fiber material + aviation aluminum hardware, and the fuselage is high in strength

采用先进的机臂折叠结构，抗冲击，便于收纳和运输
Adopts advanced arm folding structure, impact-resistant, easy to store and transport

搭载 GNSS和 RTK 双冗余定位系统，飞行精度高，厘米级误差，可实现全自主清洗模式
Equipped with GNSS and RTK dual redundant positioning systems, which has high flight accuracy, centimeter-level error, and can achieve fully autonomous cleaning mode

配备向下FPV镜头，可实时查看光伏板上的污垢情况，可针对性定点进行清洗
Equipped with downward FPV lens, it can check the dirt on the photovoltaic panel in real time and do pinpiont cleaning

清洗无人机的优势
Advantages of Cleaning UAV

无人机具备一键作业、一键返航等功能，操作上更简单，上手快捷
One button operation and one button return functions, which makes it easier to operate and quicker to get started.
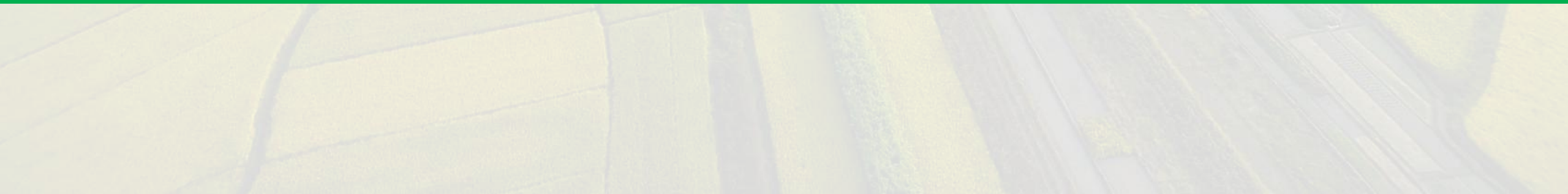
清洗水量、水压可调，清洗喷头可根据需要调整，清洗效果良好
Water volume and pressure are adjustable, and the cleaning nozzle can be adjusted according to needs, with good cleaning effect

清洗无人机机动性好，适应性广，适用于人和大型设备不方便使用的山地、湖面、水面等特殊场景
Excellent mobility and wide adaptability, and are suitable for special scenes such as mountains, lakes, and water surfaces where large equipment are inconvenient to use.

无人机功能用途多样，可以搭载清洗、运载、播撒等模块，切换多场景应用需求
Variety of functions and applications. Able to equip with cleaning, transportation, and spreading modules to meet the needs of multiple scenarios.

光伏清洗案例
Photovoltaic Cleaning Reference

光伏清洗案例—青铜峡
Reference Case – Qingtong Gorges

国家电投：青铜峡分布式光伏发电项目
State Power Investment Corporation: Qingtong Gorges
Distributed Photovoltaic Power Generation Project

试验日期Date	试验地点Location
2024年7月25日 July 25 2024	青铜峡铝厂光伏二期 Qingtongxia Aluminum Plant Photovoltaic Phase II
2024年7月26日 July 26 2024	青铜峡铝业发电有限责任公司 Qingtongxia Aluminum Power Generation Co., Ltd.

光伏清洗案例—青铜峡
Reference Case – Qingtong Gorges

国家电投：青铜峡分布式光伏发电项目
State Power Investment Corporation: Qingtong Gorges Distributed Photovoltaic Power Generation Project

- 7月25日，在青铜峡铝厂二期项目，使用现场自来水，使用无人机喷洒的方式进行光伏板清洁。在此过程中，调节了无人机飞行的速度，喷嘴距离光伏板的距离，以及整个组串清洗时无人机运行的次数（上下走两次）。同一组串，清洗多次后，接近达到手动高压水枪清洗的效果。

- 7月26日，在青铜峡铝业发电有限公司，使用现场自来水，使用无人机喷洒的方式进行光伏板清洁，在此过程中，直接使用前日测试最好的试验方案，进行清洗，能看到明显清洗的效果。

- On July 25, at the Qingtongxia Aluminum Plant Phase II project, the photovoltaic panels were cleaned by drone spraying using on-site tap water. During this process, the drone flight speed, the distance between the nozzle and the photovoltaic panel, and the number of drone operations during the cleaning of the entire string were adjusted (two up and down movements). After multiple cleanings of the same string, it was close to the effect of manual high-pressure water gun cleaning.

- On July 26, at Qingtongxia Aluminum Power Generation Co., Ltd., the photovoltaic panels were cleaned by drone spraying using on-site tap water. During this process, the best test solution tested the day before was directly used for cleaning, and the cleaning effect was obvious.

铝厂清洗前
Before Cleaning

铝厂清洗后
After Cleaning

无人机的清洗效率
UAV Cleaning Efficiency

- 31.1平方米/分钟（合13.5块光伏板（2.3平方/块））；

- 124.4平方米/架次（合54块光伏板（2.3平方/块））；

- 622平方米/小时（合270块光伏板（2.3平方/块））；

- 6210平方米/天（按照工作10个小时，每小时清洗5个架次，每个架次清洗54块光伏板，合计2700块光伏板）。

- 31.1 square meters/minute (equivalent to 13.5 photovoltaic panels (2.3 square meters/block));

- 124.4 square meters/trip (equivalent to 54 photovoltaic panels (2.3 square meters/block));

- 622 square meters/hour (equivalent to 270 photovoltaic panels (2.3 square meters/block));

- 6210 square meters/day (based on 10 working hours, 5 trips per hour, 54 photovoltaic panels per trip, a total of 2700 photovoltaic panels)

现场清洗工作
On-site Cleaning Work

现场清洗工作
On-site Cleaning Work

01

设备整理

清洗无人机、电池、充电器、发电机等设备的整理放置，确定充电模式（现场电源供电、发电机供电），充电地点，确定现场通信环境。

Equipment Arrangement
Clean and arrange the drone, batteries, chargers, generators and other equipment, determine the charging mode (on-site power supply, generator power supply), charging location, and determine the on-site communication environment.

02

辅助工作安排

做好清洗用水取水和电池充电准备。

Preparation:
Prepare for water collection for cleaning and battery charging.

03

现场前调

对清洗现场做调查评估，对清洗区域、周边环境、水电环境、污垢种类、干扰因素等的分析。

Pre-site survey
Investigate and evaluate the cleaning site, analyze the cleaning area, surrounding environment, water and electricity environment, dirt types, interference factors, etc.

04

确定清洗方案

针对现场环境，污垢特点等，构建清洗方案。

Make cleaning plan based on the on-site environment, dirt characteristics, etc..

现场清洗工作
On-site Cleaning Work

05

06

07

航线规划

按照光伏板环境及排列模式，进行航线规划，以单位清洗面积做规划设计。

Route planning

Route planning is carried out according to the photovoltaic panel environment and arrangement mode, and planning and design are carried out based on the unit cleaning area.

安全保障工作

现场工作人员必须佩戴安全帽、安全手套等用具；培训现场工作人员安全操作规程；安全操控距离20米以上，现场无关人员远离无人机起降现场；清离光伏清洗区，不得有任何人员在清洗区域活动。

Safety Assurance

On-site workers must wear safety helmets, safety gloves and other equipment; train on-site workers on safe operating procedures; the safe operating distance is more than 20 meters, and irrelevant personnel on site are away from the drone take-off and landing site; clear the photovoltaic cleaning area, and no personnel are allowed to move in the cleaning area.
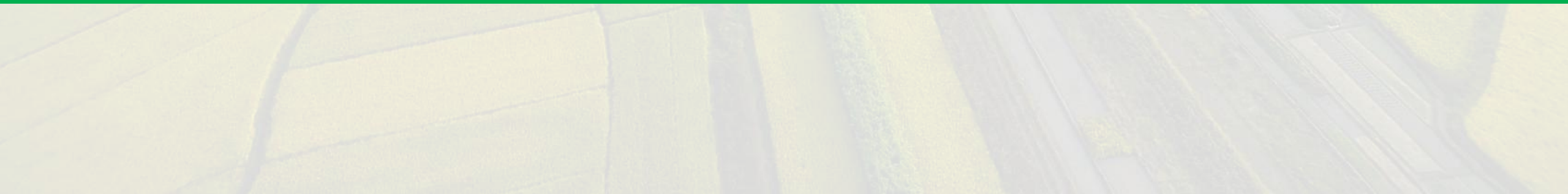
清洗作业

针对浮尘和表面污垢做宽喷幅摆臂清洗，针对鸟粪等顽固污垢做高压大流量定点清洗。

Cleaning operation

Wide-spray arm cleaning is used for floating dust and surface dirt, and high-pressure, high-flow fixed-point cleaning is used for stubborn dirt such as bird droppings.

光伏清洗无人机参数

Photovoltaic Cleaning UAV Parameters

整机参数
Basic Parameters

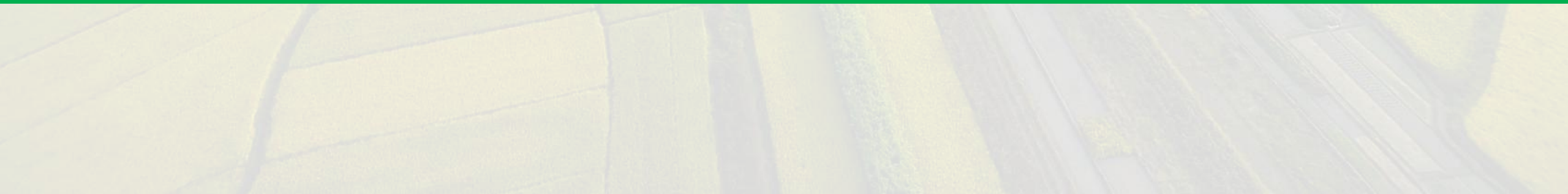|	
飞机尺寸 Drone Size	展开尺寸Unfold：1875mm*2035mm*890mm 折叠尺寸Fold：1290mm*760mm*890mm
旋翼数量 Number of Prepeller	6旋翼，三叶桨结构 6 rotors, three-blade propeller
空机重量 Drone Weight (with no load)	44.2kg
满载起飞重量 Take off weight (fully loaded)	84.2kg
电池 Battery	18s 24000mAh（标配2块Standard Two Batteries）
充电器 Charger	7200w 输入电压 Input Voltage 90-264ac
飞行速度 Speed	0.2-10m/s
续航时间 Flight Duration	7-21min

清洗参数
Cleaning Parameters

无人机载水量 Water Tank Capacity	40L
清洗流量 Flow	6-8L/min
清洗喷头 Cleaning Nozzle	扇形清洗喷头4个，喷嘴出水角度15° 4 fan-shaped cleaning nozzles, nozzle water outlet angle 15°
清洗模式 Cleaning Method	摆臂交叉清洗 Swing arm cross cleaning
清洗幅宽 Cleaning Width	水平面幅宽3米 Horizontal 3 meters wide
喷头压力 Nozzle Pressure	0.7Mpa

配套件

Accessories

电池
Battery

67.5v，18s，24000mAh

大容量锂聚合物电池

采用全新电芯配方

升级控温系统

65度亦可快速充电

装箱尺寸：365mm*395mm*345mm

装箱重量：24.5kg

67.5v,18s,24000mAh,

Large capacity lithium polymer battery

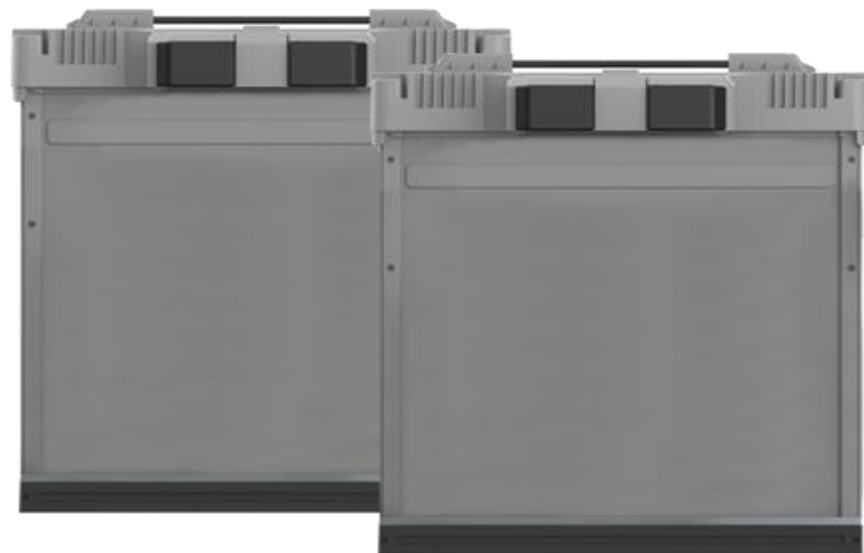Adopt a new battery core composite

Upgrade the temperature control system,

Fast charging is also possible even at 65 ℃.

Packing Size：365mm*395mm*345mm

Packing Weight：24.5kg

智能充电器

Intelligent charger

在家3600W慢充，在外7200W快充

过温保护，强制风冷散

12分钟即可充满

装箱尺寸：370mm*430mm*360mm

装箱重量：15.5kg

3600W slow charging at home,

7200W fast charging outside,

Over temperature protection,

Heat dissipation through forced air cooling,

Full charge in 12 minutes.

Packing Size：370mm*430mm*360mm

Packing Weight：15.5kg

半导体式电"冰箱"

Semiconductor type "refrigerator"

行业首创半导体式电"冰箱"，自动启动；3秒钟开始制冷，可快速将电芯内部热量传导至散热片；1分钟电池降温可达15℃，实现高温下的连续快充；提高循环效率，提高电池使用寿命。

装箱尺寸：480mm*450mm*350mm

装箱重量：15kg

Industry-first semiconductor "refrigerator", with automatic start;

Start cooling in 3 seconds, quickly transferring the heat inside the core to the heat sink;The battery can cool down 15 ℃ in one minute, realizing continuous and fast charging at high temperature;Improve circulation efficiency; Improve battery life.

Packing Size：480mm*450mm*350mm

Packing Weight：15kg
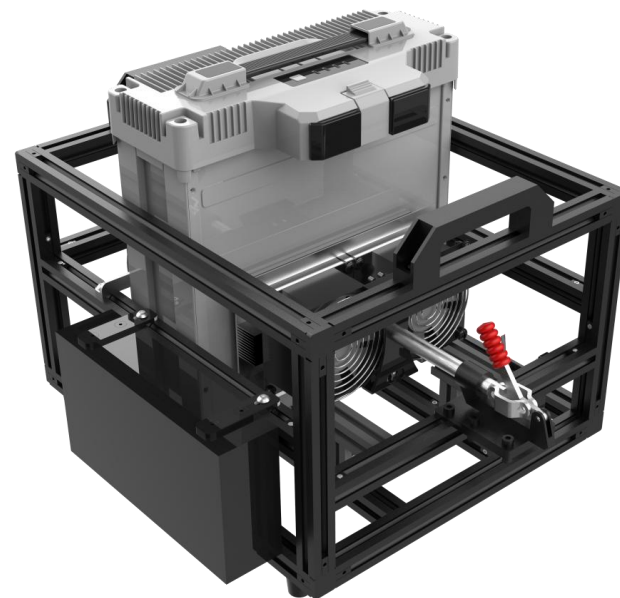
发电机
Generator

9000W大功率发电机，额定电压230V；单缸、四冲程、强制风冷；
晶体管点火；轮式运输，高效快捷。
装箱尺寸：715mm*565mm*645mm
装箱重量：100kg

9000W high-power generator,rated voltage 230V;
Single cylinder, four stroke, forced air cooling;
Transistor ignition;Wheeled transportation,efficient and fast.
Packing Size：715mm*565mm*645mm
Packing Weight：100kg

谢 谢

THANK YOU

江苏迈步智能科技有限公司