HED

2024
Product Catalog

SHANDONG HIGH END INTELLIGENT TECHOLOGY CO.,LTD.

山东海恩德智能科技有限公司

CONTENTS

Company Profile>>>

- Position： A leading domestic power robot company
- Corporate philosophy： Integrity、Pragmatism、Innovation
- Target： Professionalization、Intelligentization
- Mission： Promote the intelligent upgrading of equipment in the power industry

Shandong HIGH END Intelligent Technology Co., Ltd. is a high-tech enterprise specializing in the field of power robots located in Jinan, Shandong Province. The company focuses on the research, development, manufacturing, and application of Insulator Inspect robot 、Transmission Line Prevent-icing Robot、Anti-icing Material、Transmission Line De-icing Robot、Overhead Transmission Line Net Sealing Robot、UAV Carrying Tower Climbing Fall-Protection Device.

While adhering to independent research and innovation and improving product quality, the company combines customers' pain points and market demands to provide complete intelligent solutions for the power industry.

Qualifications & Honors>>>

Product Introduction>>>

-Insulator Inspect Robot

-Airborne Insulator Inspect device

-Transmission Line Prevent-icing Robot

-Transmission Line De-icing Robot

-UAV Carrying Tower Climbing Fall-Protection Device

-Overhead Transmission Line Net Sealing Robot

Insulator Inspect Robot

UAV-mounted Version

UAV-mounted Insulator Inspect Robot mainly consists of the robot body, UAV mounting parts, and a control terminal. The robot is mounted onto the insulator string via the UAV, and it automatically detects the resistance value and appearance defects of the insulators. The control terminal monitors in real-time, displays live video, records inspection data,and generates reports.

UAV-mounted Insulator Inspect Robot

Robot Control Terminal

Manually-mounted Version

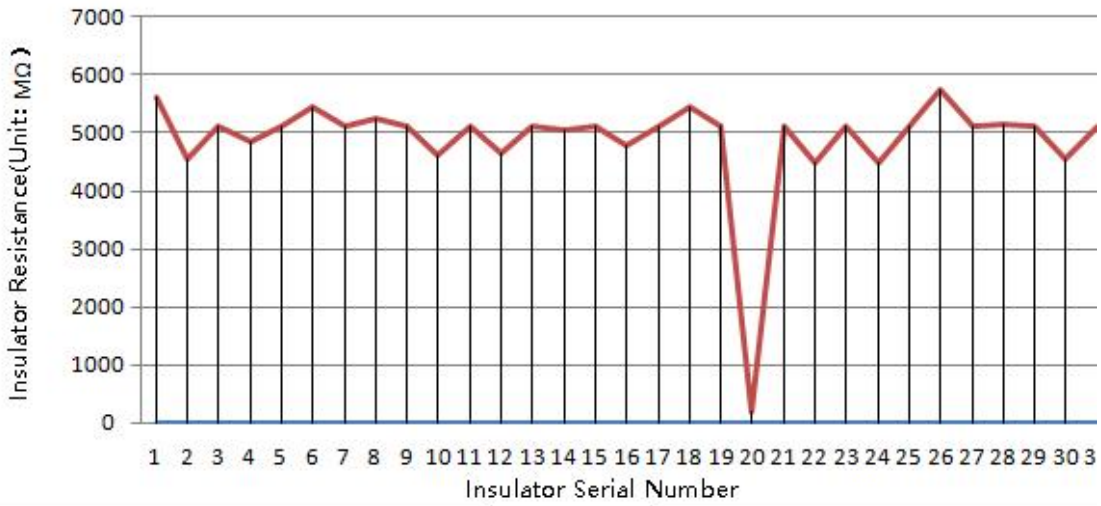
Manually-mounted Insulator Inspect Robot consists of the robot body and the robot control terminal. The robot is capable of detecting the resistance value and appearance defects of insulators. The control terminal monitors in real-time, displays live video, records inspection data, and generates reports.

Manually-mounted Insulator Inspect Robot

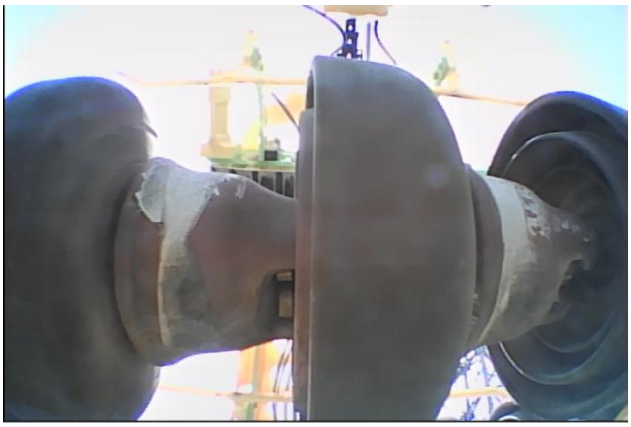
Robot Control Terminal

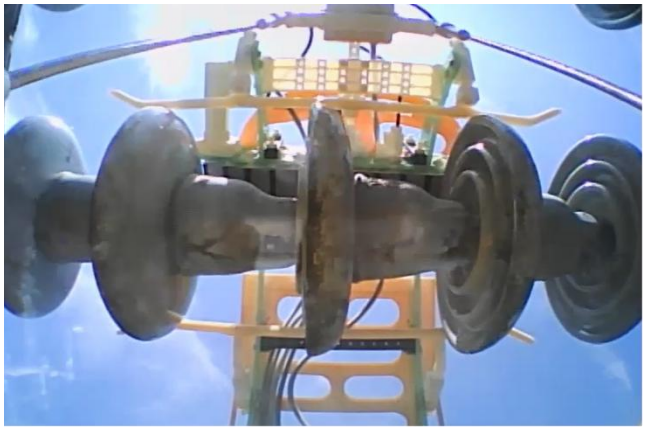
▪ Insulator Inspect Robot Inspection Items

Resistance Measurement



|Automatic Inspection of low or zero-value insulator discs|
|Sound and light alarm|Resistance curve ploting|





Appearance Inspection

|Insulator damage|Insulator crack|
|Steel foot and steel cap connection status|Contamination

▪ Insulator Inspect Robot VS Traditional Inspections

Traditional Inspection	Robot Inspection
	
・Complex operations, high labor intensity ・Insulated rods cannot reach insulator strings exceeding 5 meters	・The UAV-mounted version can complete the inspection without manual tower climbing ・Only one person is needed to climb the tower to install manually-mounted robot, which will automatically detect
・Can detect live lines up to a voltage level of 500kV	・Capable of live inspection of insulator strings on lines with voltage levels up to 1000kV (AC) and 1100kV (DC)
・Single testing item ・Live inspection can only detect distributed voltage and cannot perform resistance measurements	・Diverse inspection items ・Resistance inspection、Distributed voltage inspection、Visual inspection
・Poor inspection accuracy ・Under live conditions, judging the state of insulator discs indirectly through distributed voltage is a qualitative assessment, often leading to misjudgments and missed inspections	・High inspection accuracy ・Live inspection error is within 1%, a database of insulator resistance values is established, allowing for precise judgment of the condition of insulator, and enabling the timely discovery of critically damaged insulator.

▪ Technical Indicators

Insulator Inspect Robot Parameters	
Technical Indicators	Robot Parameters
Dimension	450*320*700mm（UAV-mounted）/ 550*320*600mm（Manually-mounted）
Weight	4kg（UAV-mounted）/ 6.5kg（Manually-mounted）
Operating Duration	Continuous Operating Duration of the Robot≥8h
Remote Control Distance	Under unobstructed conditions ≥1km
Walking Mechanism	Track-Type Walking Mechanism
Operational Capacity	Resistance Measurement,Distributed voltage detection, Insulator Appearance Defect Inspection
Operating Environment	AC 110kV-1000kV； DC ±400 kV-±1100kV
Applicable Insulators	Insulator Diameter: 260mm-420mm； Nominal Structure Height: 146-265mm Type: Glass insulators, Porcelain insulators； Insulator Shape: Bell jar insulators, Anti-pollution insulators, Straw hat insulators； Connection Form: Single link, Double link, Triple link, Quadruple link, Sextuple link, Octuple link
Moving Speed	≥130mm/s
Inspection Cycle	5s/piece
Inspection Resistance Range	0-9999MΩ
Inspection Error	≤±1%
Mode of Operation	Live Working | Power Outage Working
Working Conditions	Relative Humidity：≤85%； Temperature：-20°C-50°C Atmospheric Pressure：86KPa-106KPa
Storage Conditions	Relative Humidity：≤90%； Temperature：-40°C-65°C Atmospheric Pressure：86KPa-106KPa
Protection Device	The robot is equipped with a matching insulating protection rope
Inspection Report	China Electric Power Research Institute 1000kV Live Inspection Report
Robot Control Terminal Parameters	
Dimensions	310*200*40mm
Weight	1kg
Power Consumption	5W
Batiery	12V，5Ah
Functions	Inspection of insulator resistance value display; low value, zero value alarm
Video	Real-time insulator video display, recording, and playback
Remote Control Distance	Under unobstructed conditions 1km

Inspection Report (Excerpt)

№:BA0500208-2025

山东省产品质
Shandong Institute for
检验
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样品名称 Sample	绝缘子检测机器
委托单位 Client	山东海恩德智能科技
生产单位 Manufacturer	山东海恩德智能科技
委托单位地址 Address of Client	山东省济南市高新区凤凰路 号楼 15 层
抽样地点 Sampling Location	/
抽样基数 Sample Batch	/
样品数量 Sample Quantity	1 台
样品特性和状态 Sample Description	外观完好，无破
检验检测环境 Environmental for Test	温度：20.5℃；湿度：38%R 98.50kPa
检验检测依据 Test Standard	GB/T 17626.2-2018、GB/T
判定依据 Decision Standard	山东海恩德智能科技有限公
检验检测要求 Test Item	静电放电抗扰度试验、工频
检验检测结论 Test Conclusion	该样品符合山东海恩德智能 求》的要求。
备注 Note	1、本报告含封面及封二， 2、检验检测地址：山东省

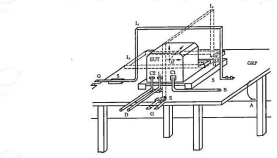
检验检测报
TEST REPORT

样品名称：绝缘子检测机器人
生产单位：山东海恩德智能科技有限公司
委托单位：山东海恩德智能科技有限公司
检验检测类别：委托

批准：潘勇 审核：
日期：2025-04-21 日期：

山东省产品质量检验研
Shandong Institute for Product Quality I

№:BA050020
山东省产品质量检验研究
Shandong Institute for Product Quality Ins
检验检测报告（续页）
Test Report (continued)



GRP—接地平面；C1—供电回路；A—安全接地；C2—信号回路；S—绝缘支座；L—通信线路；
EUT—受试设备；B—至电源；L—感应线圈；D—至信号源、模拟器；G—至试验发生器

图 5 脉冲磁场抗扰度试验接线图

图 6 脉冲磁场抗扰度试验受试设备布置图

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山东省产品质量检验研究院
Shandong Institute for Product Quality Inspection
检验检测报告（续页）
Test Report (continued)
共 8 页 第 7 页

图 7 受试设备和辅助设备（地面终端）

图 8 辅助设备（地面终端）

China Electric Power Research Institute Test Report（Excerpt）

国家电网
STATE GRID
中国电力科学研究院有限公司

绝缘子串检测机

图 1 1500kV 工频试

图 2 特高压户外

试验变压器型号参数：YDTCW-6000kV
4800kVA /10.5kV。
高压绝缘电阻表：额定电压：25
0.0-499.0MΩ，500V 档 0.0-999MΩ，1
0.0-99.9GΩ，5000V 档 0.0-1000GΩ。

2.3 试验试品与试品布置

（1）绝缘子串检测机器人系统

该绝缘子串检测机器人系统型号规格为 ZH-ACHV，由检测机器人、遥控数据接收器、视频图像接收终端 3 部分组成。试品如图 3 所示。

视频图像接收终端（中间）。机器人
图 3 ZH-ACHV 型绝缘子串检测

（2）绝缘子串及金具配置

如图 4 所示，试验选取型号为 U420BP/
联绝缘子串用于试验。

图 4 防污双伞绝缘

U420BP/205D-1 型绝缘子参数见表 2。

表 2 U420BP/205D-1 防污

型号	主要 公称爬电距离 D (mm)
U420BP/205D-1	380

双联耐张绝缘子串每串由 56 片 U420BP
测机器人的带电检测性能，选取高压侧的第
模拟弧阻值绝缘子。绝缘子与金具连接串型

10 为 635kV 电压下视频截图。

图 9 577kV 电压下机器人实时回传的视频截图

图 10 635kV 电压下机器人实时回传

（7）在试验过程中，机器人动作系统正常，
片上下两端钢帽，完成检测后，快速分离；机器
检测数据实时回传至地面显示终端；视频图像可
（8）绝缘子串检测机器人在模拟绝缘子耐
施偏等情况。

4 结论

本次试验针对绝缘子串检测机器人试品，在

№: BA0500446-2021
山东省产品质量检验研究院
检验报告
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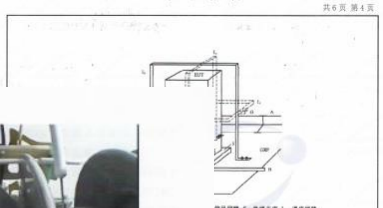


试验设备布置图

▪ Insulator Inspect Robot Operating Methods

UAV-mounted

After the hanging hook is installed under the drone, the robot is lifted from the ground and installed onto the insulator string from the top down. The drone descends to a lower altitude to automatically release the hook and then returns to the ground. The robot activates its automatic inspection process. Once the Inspection is completed, the drone retrieves the robot.


Take-off and ascend


Mounting the robot

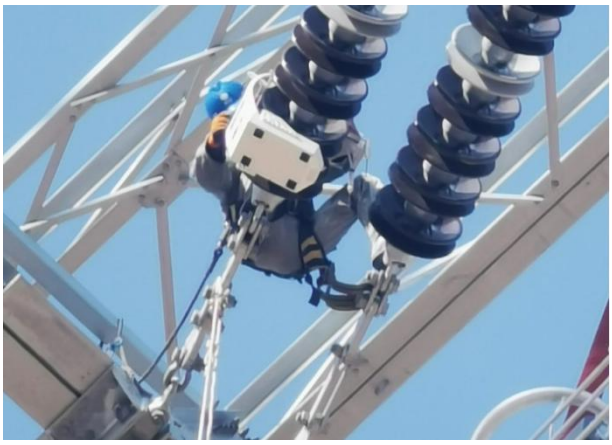

Unhooking and landing

Manually-mounted

The worker carries insulating ropes and pulleys to climb the tower. Fix the pulley to the cross arm of the tower or the low-voltage side fittings of the insulator string and pass it through the transfer rope.

Attach the lock of the transmission rope to the lifting ring on the robot to mount or dismount the robot. During the operation, ensure that the robot maintains a certain safe insulating distance from the high-voltage power transmission lines to avoid contact with the tower, preventing damage to the robot and potential harm to personnel.
The robot's housing is made entirely of insulating materials, preventing any arcing or discharge phenomena.

After the tower worker receives the robot, they hang it on an insulator near the tower.The robot has an overall hook shape, and the worker simply needs to insert the opening of the robot into the insulator string from the upper right side of the insulator string.



▪ Insulator Inspect Robot Application Cases

Airborne Insulator Inspect Device

Work Environment	35kV-220kV
Work Methods	Live working | Power outage operation
Work Capacity	resistance measurement
Remote control distance	under unobstructed conditions ⩾1km
Size/Weight	1550*200*200mm/1.2kg

The airborne insulator inspect device mainly consists of a inspection device and a drone. When in use, the inspection device is installed under the drone, and the drone carries the inspection device into the air. The insulator resistance can be detected under power outage and live working conditions. The appearance of the inspection device is fork shaped, which can detect both suspension insulator strings and tension insulator strings. The drone camera can monitor and detect the device in real time, and can view real-time videos and record inspection data.

Inspection screen

▪ Technical Indicators

Airborne Insulator Inspect device	
Technical Indicators	Inspecting device parameters
Dimension	1550*200*200mm
Weight	1.2kg
Running time	≥8h
Remote control distance	Under unobstructed conditions ≥1km
Work Capacity	Resistance Measurement
Work Environment	35kV-220kV
Applicable Insulators	Insulator Diameter: 260mm-420mm;Nominal Structure Height: 146-265mm Type: Glass insulators, Porcelain insulators; Insulator Shape: Bell jar insulators,Anti-pollution insulators, Straw hat insulators; Connection Form: Single link, Double link, Triple link, Quadruple link, Sextuple link, Octuple link
Inspection Cycle	3s/piece
Inspection Resistance Range	0-9999MΩ
Inspection Error	≤±1%
Mode of Operation	Live Working | Power Outage Working
Working Conditions	Relative Humidity：≤90%；Temperature：-40℃-60℃； Atmospheric Pressure：86KPa-106KPa
Storage Conditions	Relative Humidity：≤90%；Temperature：-40℃-65℃； Atmospheric Pressure：86KPa-106KPa

▪ Airborne Insulator Inspect Device Application Cases

Airborne insulator inspect device

Airborne insulator inspect device take off

Inspecting tension insulator strings

Inspecting suspension insulator strings

Drone captured footage (tension string)

Drone captured footage (hanging string)

Transmission Line Prevent-icing Robot

UAV-mounted

Work Environment	≤220 kV line conductor and ground wire； ≥500kV line grounding wire
Work Methods	Live working | Power outage operation
Work Speed	5-10m/min
Spraying Thickness	0.2mm
Size	570*500*400㎜
Weight	12kg

The UAV-mounted Transmission Line Prevent-icing Robot consists of a mounting device, a walking mechanism, a spraying mechanism, and a remote control system. The mounting device can be adapted to various types of unmanned aerial vehicles, and the robot can be installed on power transmission lines through unmanned aerial vehicles.The walking mechanism is capable of carrying anti-icing materials along the power line, with a certain climbing ability, and the operating speed is adjustable. The anti-icing material supply device accurately controls the supply of anti-icing materials, delivering them through an anti-icing material conduit to the anti-icing material spraying mechanism. The anti icing material spraying mechanism is placed at the back of the robot to evenly spray the anti icing material on the power line. By replacing the inner core of the anti icing material spraying mechanism, it can adapt to different types of lines.

Manually-mounted

Work Environment	≤220 kV line conductor and ground wire； ≥500kV line grounding wire
Work Methods	Live working | Power outage operation
Work Speed	5-10m/min
Spraying Thickness	0.2mm
Size	570*500*400mm
Weight	12kg

The manually-mounted Transmission Line Prevent-icing Robot is mainly composed of a walking mechanism, an anti-icing material supply device, an anti-icing material spraying mechanism and a hoisting mechanism. The robot can be installed online via a high-altitude boom truck, or it can be manually hoisted online using a pulley block through a hoisting mechanism.

▪ Features of the Transmission Line Prevent-icing Robot

--Anti-Icing material spraying function： Capable of completing the spraying of anti icing materials for wires and ground wires, with uniform coating thickness controlled at around 0.2mm, without affecting the heat dissipation of the circuit.

--Communication control function： It can achieve remote control of anti icing material spraying robot, control of travel speed, and on/off feeding.

--Wireless Image transmission function： Realize real-time image monitoring of the anti-icing material spraying operation and inspect the spraying effect of the anti-icing material.

--Practical and compact structure： Practical design easy for robots to go online and offline.

▪ Advantage comparison of the Transmission Line Prevent-icing Robot

HED

- √ Simple operation：low power consumption, available for construction at any time,preventing problems before they occur.
- √ Long effective time：Spraying once does not require repeated spraying within three years.
- √ Wide range：Rapid construction in heavy icing areas, covering large areas.
- √ Safety：Effectively prevent people from climbing the tower to remove ice in ice disaster weather.

Vs

Laser Cannon De-Icing：
High power consumption, small range

Flame Ice Removal：
Small range, poor effect

Robotic Mechanical De-Icing：
It is difficult and highly dangerous to install robots on iron towers after they have iced up.

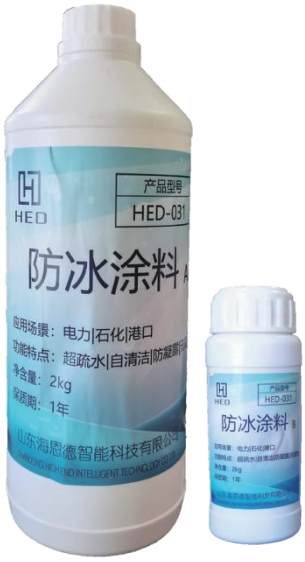
Direct Current De-Icing：
Operation is complex and energy consumption is high.

▪ Robot Technical Indicators

Technical Indicators	Technical Parameters
Robot Weight (without material)	12kg
Robot Weight (with full material load)	20kg
Dimensions	570*500*400mm
Speed	5-10m/min
Climbing Angle	30°
Spray Thickness	0.2mm
Continuous Operation Duration	8h
Robot's voltage withstand	1000kV
Remote Control Distance	3km
Spraying Distance/Material Consumption	40m/kg
Operating Environment	Live working | Power outage operation

Anti-icing Material

Anti-icing Material have characteristics such as superhydrophobicity, self-cleaning, and anti condensation. Can be used for anti icing of power equipment such as transmission lines, insulators, towers, and wind turbines. It does not affect the heat dissipation of power equipment, has no corrosion to lines and power equipment, isolates air and pollution, reduces power transmission energy consumption, and extends the service life of lines.



- Unique and durable anti-icing coating.
- Excellent resistance to UV rays, moisture, wear, and corrosion.
- Single-layer spraying, no primer needed (except for metal and polyethylene, where primer is recommended).
- 100% volume solid content, VOC-free.
- Operates without the need for heating or external force factors.
- Can be applied by brushing or rolling.
- Drying and curing time of 24 hours or less.

➢ Performance data：

•Product Color	Yellow transparent and colorless transparent
•Finished Surface	Luster
•Components	3 part（A/B/C)
•Curing Mechanism	Chemical Reaction RT (Room Temperature）
•Volume solid content	100%
•Dry film thickness	125-250 μm (0.125-0.25mm)
•Theoretical coverage rate	4.4-6.6 m^2 /L

➢ Curing time (at 21°C or room temperature)

•Touch dry	2 hours
•Fully dry	10 hours
•Fully cured	1 day

➢ Storage temperature (Between 0°C and 20°C)

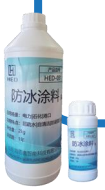
•Part A and Part B	Within 1 year atier leaving the factory

➢ Wear (ASTM D4060)

•1 kg load/1000 cycles	Weight loss
•CS-17 wheel (a type of wheel used for measuring abrasion)	72mg
•Adhesion Reduction Factor (ARF)	25 or above

➢ Ultraviolet (UV) accelerated weathering

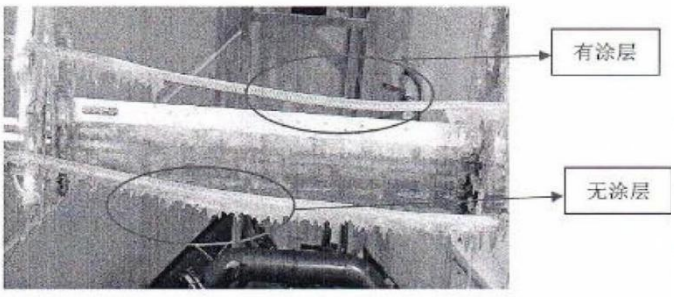
• ISO 16474-3	1 month
•QUV-A（Ultraviolet lamp）60℃	336 hours
•50℃ water condensation	336 hours



Anti-icing Material Parameter Indicators

Project	Basis	Indicators
Appearance	GB/T 19250-2013	The product is a uniform viscous body, free of gel and caking.
Nonvolatile Content	GB/T 1725-2007	≥45%
Drying Time (Surface Drying)	GB/T 1728-2020	≤2h
Drying Time (Practical)	GB/T 1728-2020	≤24h
Pencil Hardness (Abrasion)	GB/T 6739-2022	≤F
Impact Resistance	GB/T 1732-2020	50cm
Adhesion (Pull off Method)	GB/T 5210-2006	≥5MPa
Resistance to liquid media	GB/T 9274-1988	168h without any abnormalities
Alkali	GB/T 9265-2009	168h without any abnormalities
Adhesion	GB/T 9286-2021	≥130mm/s
Water Resistance	GB/T 1733-1993	≤ level 1
Abrasion Performance	GB/T 1768-2006	0-9999MΩ
Contact Angle	GB/T 30447-2013	≥1000r
Self-cleaning Property	GB/T 30191-2013	≥ level 1
Temperature Resistance	GB/T 17748	-60°—120°

Anti-icing Material Inspection Report




检测报告

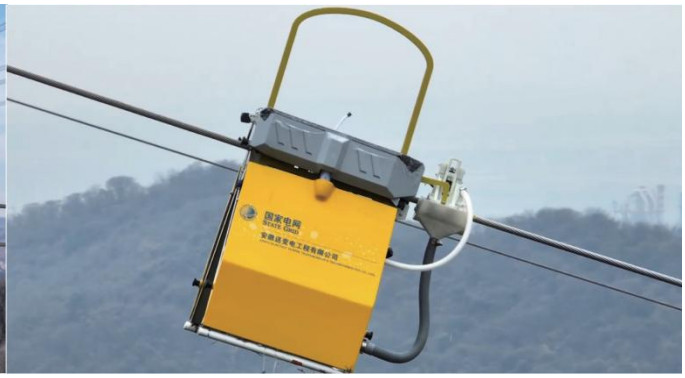

中科检测技术服务（广州）股份有限公司

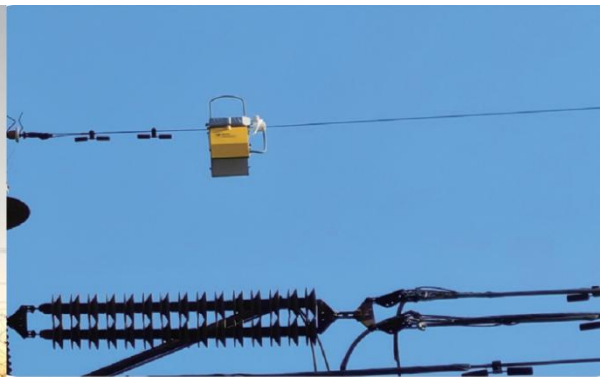
▪ Transmission Line Prevent-icing Robot Application Cases













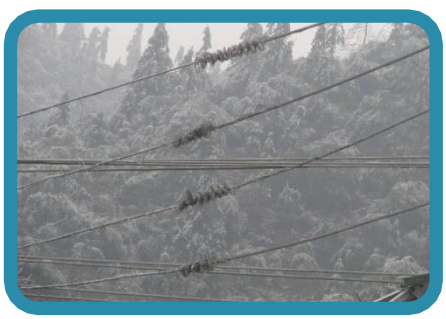



Transmission Line De-icing Robot

Work Environment	10kV-1000kV live transmission line conductors and ground wires
De-icing Capacity	Ice coating diameter 0-14cm
Moving Speed	0-50cm/s
Remote Control Distance	6km
Operating Temperature	-40℃-10℃
Climbing Angle	0-45°
Work Methods	Live working | Power outage operation

The Transmission Line De-icing Robot is mainly composed of the robot body and the robot remote controller. The robot is equipped with a wheeled mobile mechanism, mounted with de-icing blades, and performs mechanical impact de-icing, capable of removing ice columns atiached to power transmission lines while they are energized.

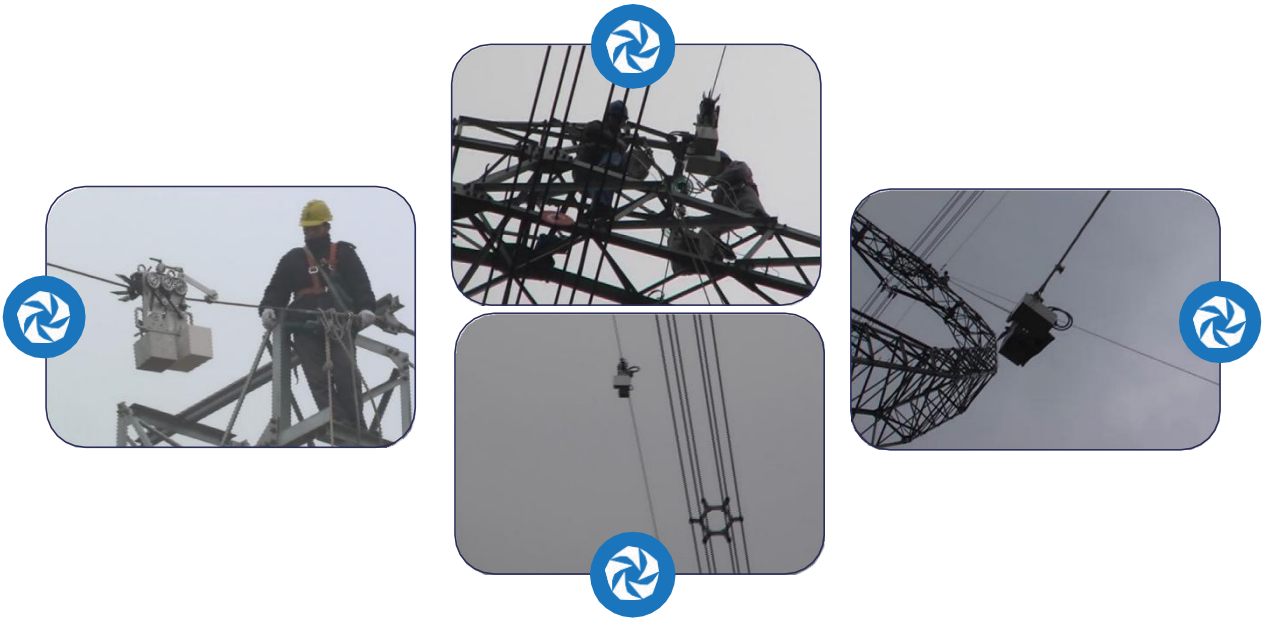
The current situation of ice formation on transmission lines



Transmission Line De-icing Robot Technical Indicators

Transmission Line De-icing Robot		Remote Controller	
Technical Indicators	Technical Parameters	Technical Indicators	Technical Parameters
Dimension	550*260*400mm	Dimension	310*200*40mm
Weight	16.5kg	Weight	1kg
Running Time	≥3h	Power Consumption	5w
Work Environment	10kV-1000kV live transmission line conductors and ground wires	Batiery	12V，5Ah
De-icing Capacity	Ice coating diameter 0-14cm	Function	De-icing robot control
Walking Mechanism	Wheeled walking mechanism	Video	Real-time video display, recording, and playback of de-icing operations.
Moving Speed	0-50cm/s	Remote Control Distance	1km(No occlusion)
Remote Control Distance	6km		
Operating Temperature	-40℃-10℃		
Climbing Angle	0-45°		
Work Methods	Live working | Power outage operation		
Protection Device	Equipped with a fall prevention mechanism		

Transmission Line De-icing Robot Application Cases



UAV Carrying Tower Climbing Fall-Protection Device

Intelligent Version

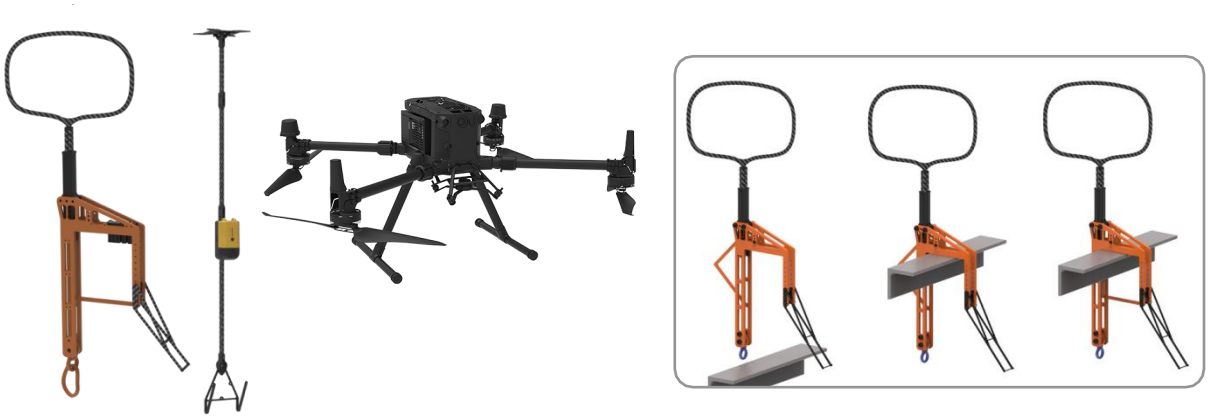
The intelligent version of the Power Tower Climbing Fall-Protection Device consists of anti fall hooks, safety ropes, anti fall self-locking devices, mounting devices, and ground monitoring systems. When in use, install the mount under the drone, carrying an anti fall hook, and mount it on the tower crossbar. The installation process is fully visualized, effectively reducing the difficulty of operation. During the process of climbing the tower, the self-locking device always slid along the safety rope, achieving the purpose of anti fall protection.

DJI Ecological Intelligent Control Edition

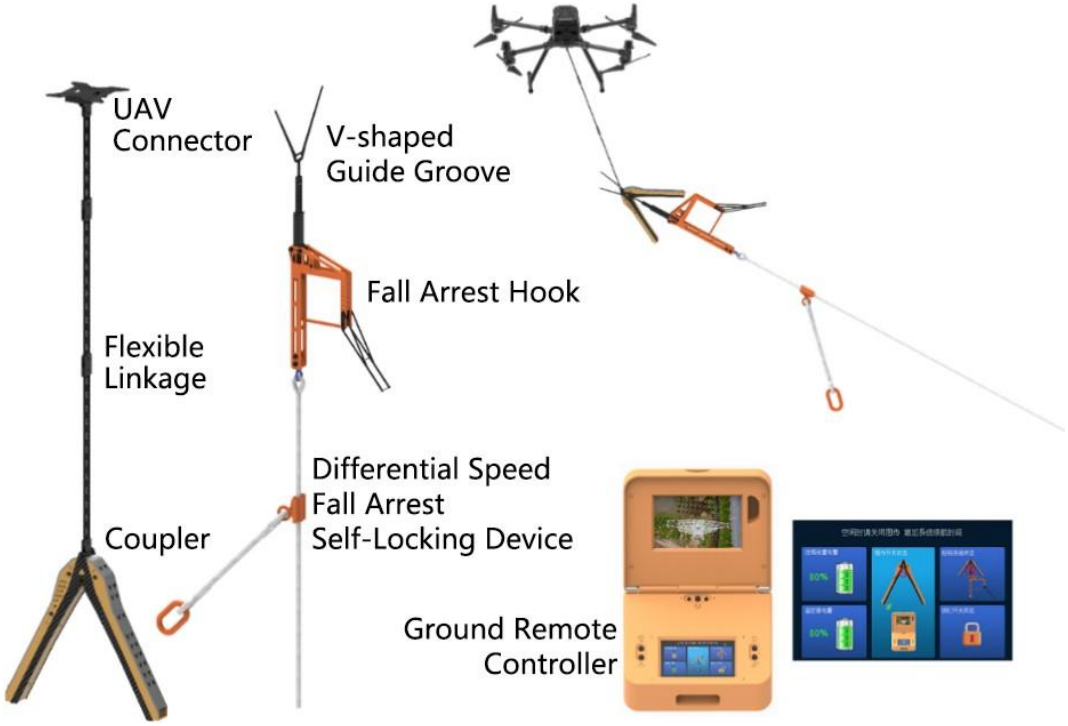
The DJI Ecological Intelligent Control Edition Tower Climbing Fall-Protection Device consists of a binocular camera, a mounting device, and an anti fall hook. The binocular camera can be connected to the DJI drone transmission link to accurately identify the tower and achieve fully automatic hanging and dismantling without manual intervention.

Simple Version

The simple version of the Power Tower Climbing Fall-Protection Device consists of an elliptical ring fall-arrest hook and a quick attachment and detachment device. The entire set of equipment can be operated with just one drone and a drone operator.The drone operator can achieve docking with the elliptical ring fall-arrest hook by simply controlling the attitude of the quick attachment and detachment device, thus completing the hanging and removal work of the fall protection device.



Product Advantages



（1） The shape like “ /\ ” and the V-shaped guide groove above the hook reduce the difficulty of dismantling the device.

（2） Double hook redundant design, double safety protection. The buckle claw is self-locking by gravity to prevent the hook from falling out. Guide frame design, easy to mount.

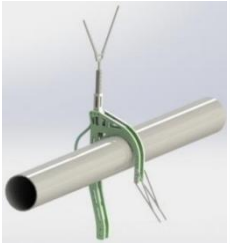
（3） **The intelligent version** is equipped with dual cameras, allowing for real-time monitoring of each link in the hanging and detachment operations, with the hanging status feedback in real time.

（4） **The DJI ecological intelligent control edition** binocular camera can be connected to the DJI drone transmission link to accurately identify the tower and achieve fully automatic hanging and dismantling without manual intervention.

（5） **The simple version** is lightweight and cost-effective.

（6） Suitable for all tower types: “干”-shaped, V-shaped,cup-shaped,cat head shaped, sheep horn shaped, door shaped, T-shaped, umbrella-shaped.

Suitable for various tower materials:
75-185mm angle steel, Φ35-Φ200mm steel pipes

Type	CLI-DJI-DLX/CLI-PRO-DLX/CLI-STD-DLX	CLI-PRO-DG
Pattern		
Applicable crossbar size	65-150mm angle steel	Suitable for steel pipes

- UAV Carrying Tower Climbing Fall-Protection Device Application Cases

Overhead Transmission Line Net Sealing Robot

Maximum Traction Force	900N
Remote Control Distance	6km
Applicable Wire Diameter	9mm-35mm
Walking Speed	0-12m/min
Climbing Angle	0-60°
Weight	20kg

The Overhead Transmission Line Net Sealing Robot is mainly composed of a robot body and the robot remote control. The robot adopts a wheeled mobile mechanism and can work collaboratively with multiple machines. A group of 4 robots travel along 2 lines to pull and erect a power construction protection net. After the robot reaches the designated location, the safety net will be deployed. The robot is fixed and locked at a precise position. Complete the erection of protective net.

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Wechat Public Platiorm

15th Floor, Building 2, Hisense Chuangzhi Valley, Century Avenue,
Lixia District, Jinan City, Shandong Province

13260988616

htip://www.highend-ai.com/