

CLEANING MAKES PV POWER PLANTS MORE EFFICIENT  
**SOLAR CLEANING MACHINE**

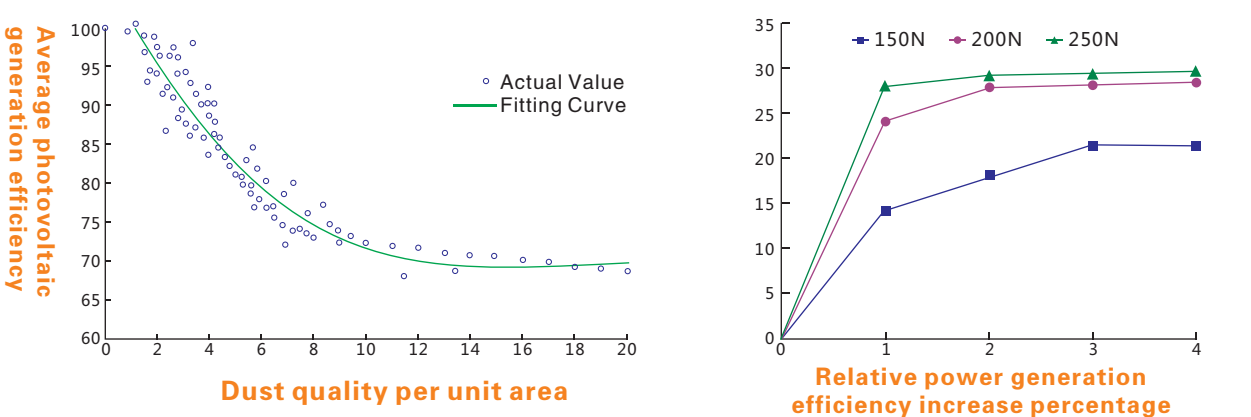
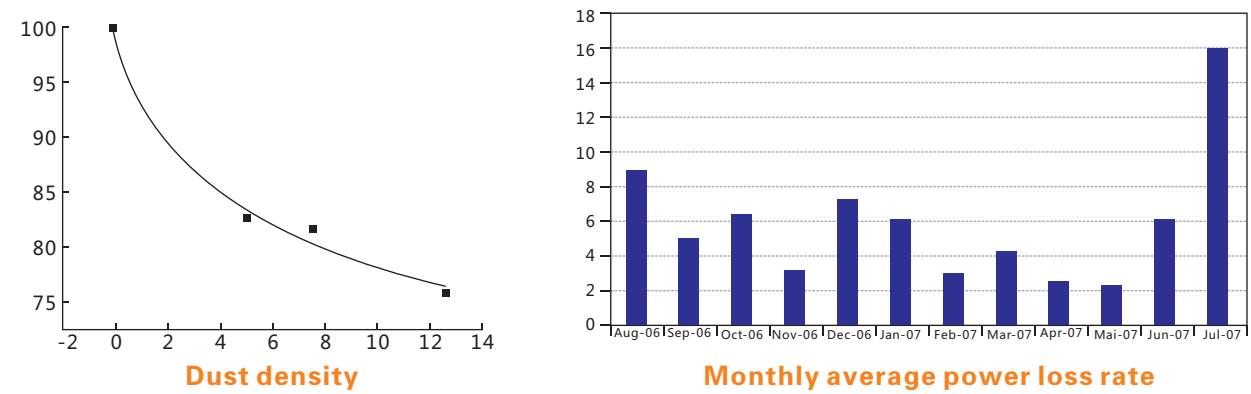


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Dust is one of the key factors affecting the efficiency of solar energy generation, Dust pollution will greatly reduce the energy generation of photovoltaic power plants, Estimated at least 5% per year. According to the estimation of global installation capacity in 2020, it is expected to reach about 500GW, The annual economic loss caused by dust reduction in power generation will be as high as \$5 billion. As the installed capacity of the power station continues to grow, this loss will become more serious. When the global installation capacity comes to 1400 GW in 2030, the economic losses caused by dust are expected to reach \$13 billion.



According to measurement, the dirt and dust on the surface of the modules caused an average annual reduction in power generation efficiency of 6%. During the period of lack of raining, the power efficiency loss can reach 15% or more due to accumulated dirt in the surface of the modules.

\*①参考文献《不起眼的灰尘对光伏组件的伤害竟有这么大》  
 \*表一参考文献灰尘覆盖对光伏组件性能影响的原位实验研究  
 \*表二、表四参考文献《荒漠光伏太阳能电池板表面灰尘作用机理及其清洁方法研究》  
 \*表三、②参考文献《COMPARATIVE ANALYSIS OF THE DUST LOSSES IN PHOTOVOLTAIC MODULES WITH DIFFERENT COVER GLASSES》



Daily cleaning 800KW, about 2500 solar panels, power generation efficiency increased by 10%



**Dry cleaning:** No water needed, solve the problem of cleaning for desert power station. The roller brush is automatically covered upwards to make the cleaning staff work easier and greatly improve work efficiency.

**Washing:** The water cleaning brush has the characteristics of low water consumption, strong atomization and high conversion rate, which can greatly save water, save cost and improve cleaning efficiency.

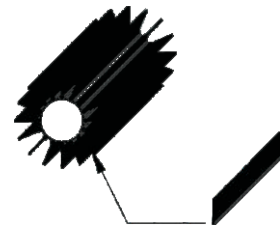
**Snow Cleaning:** It can increase the power generation of photovoltaic power plants in winter, increase the power generation income of power stations in winter, and reduce the load caused by snow on the ground racking system.

**Cleaning bird droppings:** The brush head is light, the point of attachment is accurate, the disturbance power is large, and the cleaning power is strong.



D21 Solar panel cleaning system, which is designed and made for the special environment of photovoltaic power station. It is suitable for barren mountain power station, distributed power station and farming photovoltaic power station within 10 meters where the big solar panel cleaning system can't get into.

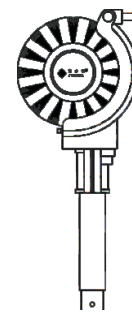
### Cleaning Brush Head



#### Features

- ◆ Soft brush and no damage to the modules
- ◆ light and smart, 500–600rpm
- ◆ 100–150MW service life
- ◆ Removable and replaceable

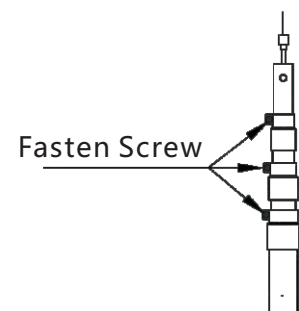
### Brushless Motor



#### Features

- ◆ Low energy consumption
- ◆ 24V DC high efficiency motor
- ◆ lightweight body
- ◆ low noise

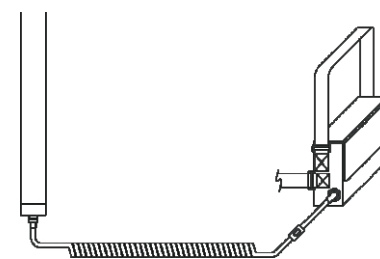
### Telescopic Rod



#### Features

- ◆ Each 1.8m, freely expandable
- ◆ Telescopic length 2–7.2m
- ◆ Toughness
- ◆ Used nearby, faraway, bevel, flat

### Rechargeable Battery



#### Features

- ◆ Easy Carrying
- ◆ Huge power capacity, Long life
- ◆ No wires
- ◆ No cleaning places restrictions

	Item	D21-3600	D21-5400	D21-7200
<b>Product Parameters</b>	Type	with water feeder	with water feeder	with water feeder
	minimum size	575*2330mm	575*2330mm	575*2330mm
	maximum size	575*3630mm	575*5430mm	575*7230mm
	Net weight	12KG	13KG	14KG
	Gross weight	13KG	14KG	15KG
	Carton size	2030*170*420MM	2030*170*420MM	2030*170*420MM
<b>Technical Parameters</b>	Working mode	motor	motor	motor
	Operating voltage	24V	24V	24V
	Charging voltage	220V/110V	220V/110V	220V/110V
	Motor power	200W	200W	200W
	Battery capacity	20Ah	20Ah	20Ah
	Idler electric current	7–8A	7–8A	7–8A
	Idler revolutions	500–600rpm	500–600rpm	500–600rpm
	Battery life	3–4h Affected by working environment and season	3–4h Affected by working environment and season	3–4h Affected by working environment and season
	Length of brush roller	φ 150*570*400mm	φ 150*570*400mm	φ 150*570*400mm
	Length of telescopic rod	3600mm	5400mm	7200mm
Day work efficiency	0.5–0.8MW	0.5–0.8MW	0.5–0.8MW	
Work temperature range	30–60℃	30–60℃	30–60℃	
<b>Accessories</b>		backpack	backpack	backpack
		Tool bag	Tool bag	Tool bag
<b>HS Code</b>		8424899900	8424899900	8424899900

※Note:our company reserves the right to change or stop the technical parameters. Specification is subject to change,please refer to this system for actual data.

### Contrast before and after cleaning





**Item Number: A21**

Parameter	Model	A21-2030	A21-3340	A21-4060	Remarks
Working Mode		Manual Monitoring			
Operating Voltage		24V			
Power Supply Mode		Lithium Battery+ External Power Source+ Generator			Lithium Battery On Back
Driving Mode		Motor Output Drive			
Walking Mode		Walking Motor Drive Walking Tracks			
Cleaning Bush		Dry Cleaning PVC Double Bush Roller ( No Water )			
Control System		Switch/ Remote Control			
Working Temperature		-40~70° C			
Noise		<35db			
Working Speed		7~8m/min			
Motor		159W	270W		
Length of Brush Roller		2030mm	3340mm	4060mm	Size Can Be Custom Made
Working Efficiency Per Day		1~1.2MWp	1.5~2MWp	1.5~2MWp	
Weight		22kg	31kg	36kg	Battery Not Included
Size		2400*540*130mm	3700*540*130mm	4400*540*120mm	Size Can Be Custom Made

※Note: Our company reserves the right to change or stop the technical parameters. Specification is subject to change, please refer to this system for actual data.

Professional, smart A21 series photovoltaic cleaning system, which is designed, researched and developed, made for Chinese special barren mountain photovoltaic power station. It is suitable for farming photovoltaic power station, barren mountain power station and floating photovoltaic power station where the big solar panel cleaning system can't get into.

A21 system is simple operation and maintenance; easy carrying and low cost of usage. 2 persons can clean 1.5~2MWp photovoltaic panels per day.

A21 system is light, small and easy carrying, can clean the dust with high efficiency in farming photovoltaic power station and barren mountain power station, which with large slope, multi-angles, distributed mounting, different heights/ arrays. Safe, stable, reliable and efficiently solve the difficult technical problem with low efficiency, high cost in farming photovoltaic/ barren mountain power station.

**Features:**

- 1.A21 photovoltaic power station cleaning system, walking with frame panel rail, running multiple times under the control of switch and remote controller, aim at fully cleaning for photovoltaic panel surface.
2. A21 system is lithium battery, external power source or generator powered; easy, simple and flexible usage.
3. In farming photovoltaic power station, barren mountain/ floating photovoltaic power station, different heights array can't be connected as one lot for operating, manual lifting to another array. Manual monitoring the control equipment, 2 persons can finish the cleaning of 1.5~2MWp photovoltaic power station per day.



Professional A31 series photovoltaic cleaning system, which is designed, researched and developed, made for the cleaning of farming photovoltaic power station, agriculture greenhouse power station.

A31 system is simple maintenance; easy carrying and low cost of usage. 2 persons can clean 1.5~2MWp photovoltaic panels per day.

A31 system is light, small and easy moving, can clean the dust with high efficiency in farming photovoltaic power station and agriculture greenhouse power station, which with high ground clearance panel mountings, different panel mounted ways. Safe, stable, reliable and efficiently solve the difficult technical problem with low efficiency, high cost in farming photovoltaic/ agriculture greenhouse power station.

**Features:**

1.A31 photovoltaic power station cleaning system, walking with frame panel rail, running multiple times under manual pull, aim at fully cleaning for photovoltaic panel surface.

2.A31 system is back type lithium battery power supply, easy, convenient and low cost usage.

3.In farming photovoltaic/ agriculture greenhouse power station, high ground clearance panel mountings, different panel mounted ways, equipment can't walk automatically. B31 uses manual pull as the simplest way to realize the automatic walking of cleaning. 2 persons can finish the cleaning of 1.5~2MWp photovoltaic power station per day.



**Item Number: A31**

Parameter	Model	A31-3340	A31-5000	A31-6600	Remarks
Working Mode		Semi-Automatic			
Operating Voltage		24V			
Power Supply Mode		Lithium Battery Power Supply			24V
Driving Mode		Motor Output Drive			
Walking Mode		Manual Pull Walking			
Cleaning Bush		Dry Cleaning PVC Single Bush Roller ( No Water )			
Control System		Switch Control			
Working Temperature		-40~70° C			
Noise		<35db			
Working Speed		Manual Control			Affected by Working Environment
Motor		120W	180W	240W	
Length of Brush Roller		3340mm	5000mm	6600mm	Size Can Be Custom Made
Working Efficiency Per Day		1.0~1.5MWp	1.5~2.0MWp	1.5~2.0MWp	
Weight		25kg	30kg	35kg	Battery Not Included
Size		3600*400*130mm	5300*400*130mm	6900*400*120mm	Size Can Be Custom Made

※Note: Our company reserves the right to change or stop the technical parameters. Specification is subject to change, please refer to this system for actual data.





Work Efficiency  
**5 MW /day**

The photovoltaic power stations are usually built on high terrain and abundant sunshine place, where usually have sandstorm and shortage of water resource. Therefore the dust and dirt can easily accumulate on solar panels.

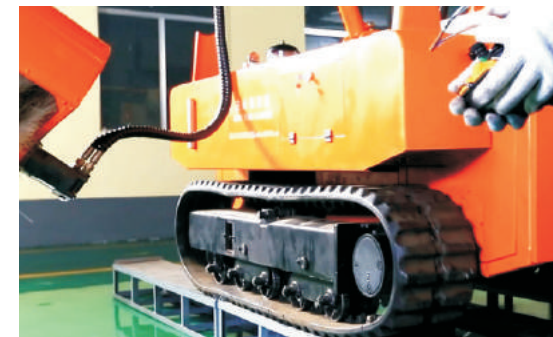
On account of this practical situation of the photovoltaic power station and years of field investigation by our R&D department, we designed the new product, photovoltaic power station cleaning machine T22.

Item	Unit	Technical Parameters
Motor power	KW	40
Maximum torque	N.m	≥ 152
Transmission		Hydraulic
Hydraulic work temperature	°C	50~70
Working pressure	MPa	13~15
Operating voltage	V	12
Battery capacity	Ah	105
Optimum speed of diesel engine	rpm	1300~1600
Diesel engine capacity	L	100
Oil consumption	L/h	4.2
Walking speed	Km/h	2.5~3.5
Working speed	Km/h	1.5~2.5
Climbing Capacity	°	>45
Day work efficiency	MWp	3~5
Maximum cleaning height	mm	4800
Minimum cleaning height	mm	200
Cleaning angle	°	0~80
Cleaning-arm extension size	mm	80~1300
Cleaning-arm rotation angle	°	180
Rotational speed of brush roller	rpm/min	400~500
Diameter of brush roller	mm	700
Length of brush roller	mm	3600~4200
Effective remote-controlled distance	m	300
Total weight	Kg	2500
Product size	mm	2550*1500*2200

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Remote Operation, No Water Cleaning,  
Improving Power Generation Efficiency **10%**



**Caterpillar walking system**

It is suitable for different landform and topography because of using small rubber caterpillar and floating load-bearing wheel structure, which made the cleaning platform stable and keep the balance of equipment to the maximum extent.



**Cleaning-brush roller system**

Using high strength aluminum alloy frame structure, hydraulic power drive and PVC nylon brush,which can effectively attached to solar panel to clean the solar panel safely.



**Remote-controlled system**

Using advanced remote-controlled products make one person can operate remotely this cleaning system ( simple operation) in long distance.

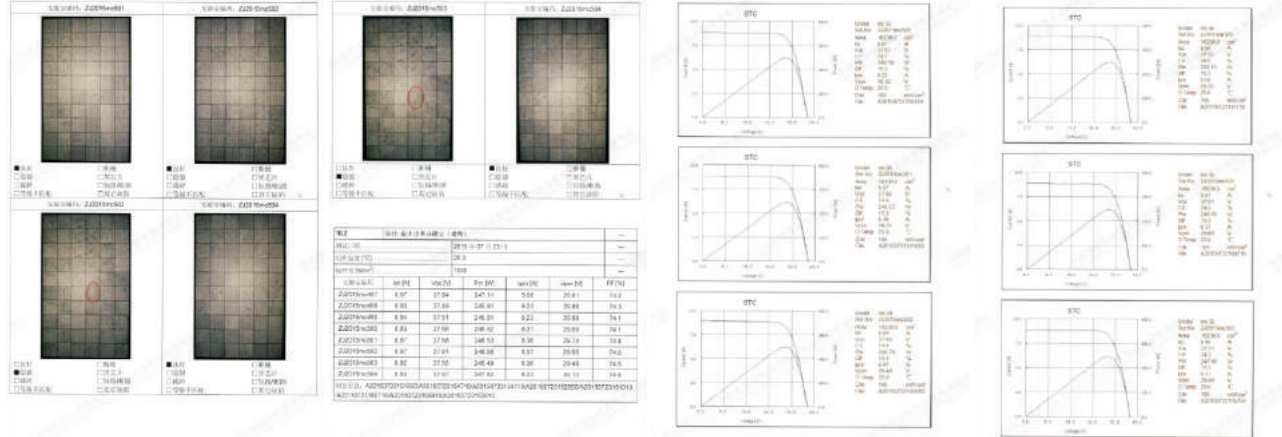


**Power system**

We adopt diesel engine power to provide enough power to this walking system and cleaning-brush roller system for working.

**Cleaning-arm system**  
Cleaning-arm has many functions, such as rotation, folding, second adjustment angle, controlling brush roller distance and lifting function and so on.

**Hydraulic system**  
We use advanced oil pump, valve body and valve block to transmit diesel engine power ,what make the walking system and cleaning-brush roller system in working order .



>Gully



>Grassland



>Gobi Desert



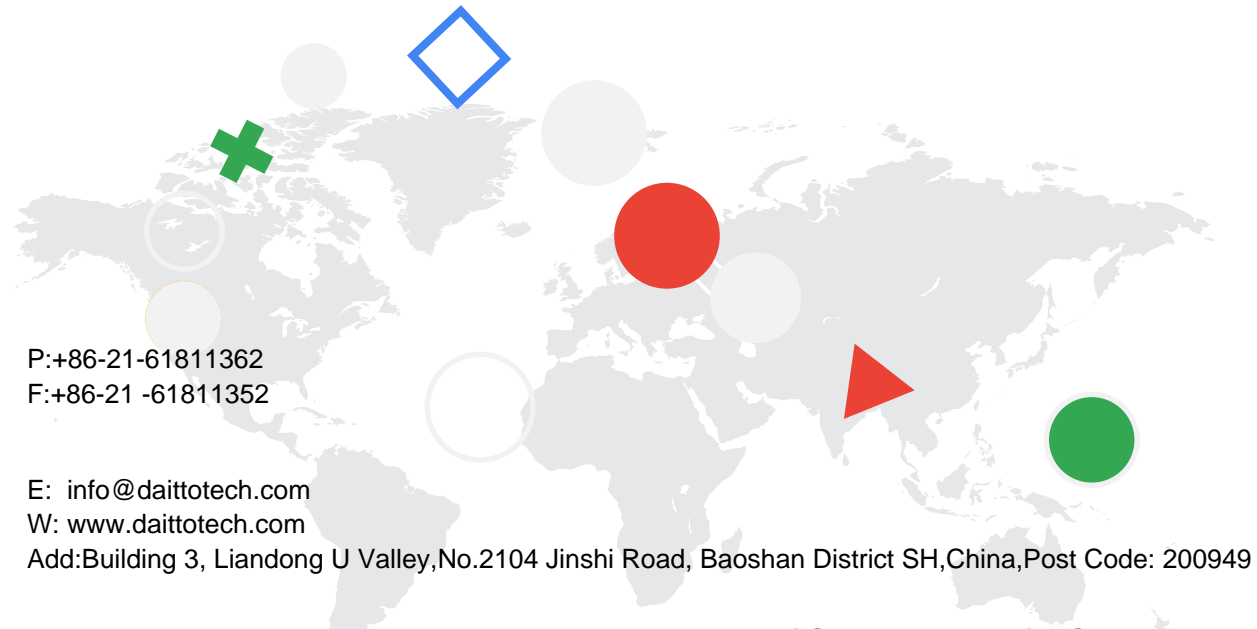
>Saline-alkali land

The purpose of this experiment is to verify whether locomotive cleaning will affect the performance of crystalline silicon PV modules. The laboratory has conducted four experimental comparison projects. From the test data of each test item before and after the cleaning,

Conclusion as following:

- 1.The visual inspection results show that the locomotive cleaning has no effect on the appearance of the modules;
- 2.Electroluminescence (EL) test results show that locomotive cleaning has almost no effect on module's power output;
- 3.The maximum power output test results show that the locomotive cleaning has almost no effect on module's power output;
- 4.Leakage current test results show that the locomotive cleaning has no effect on the wet insulation performance of modules;

Note: 10 times a year, 200 times in 20 years; 20 times a year, 500 times in 25 years.



P:+86-21-61811362  
F:+86-21-61811352

E: info@daittotech.com  
W: www.daittotech.com  
Add: Building 3, Liandong U Valley, No.2104 Jinshi Road, Baoshan District SH, China, Post Code: 200949

### Daitto Technology Development(Shanghai) Co.,Ltd

**Thank you!**

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and we look forward to your joining!**

