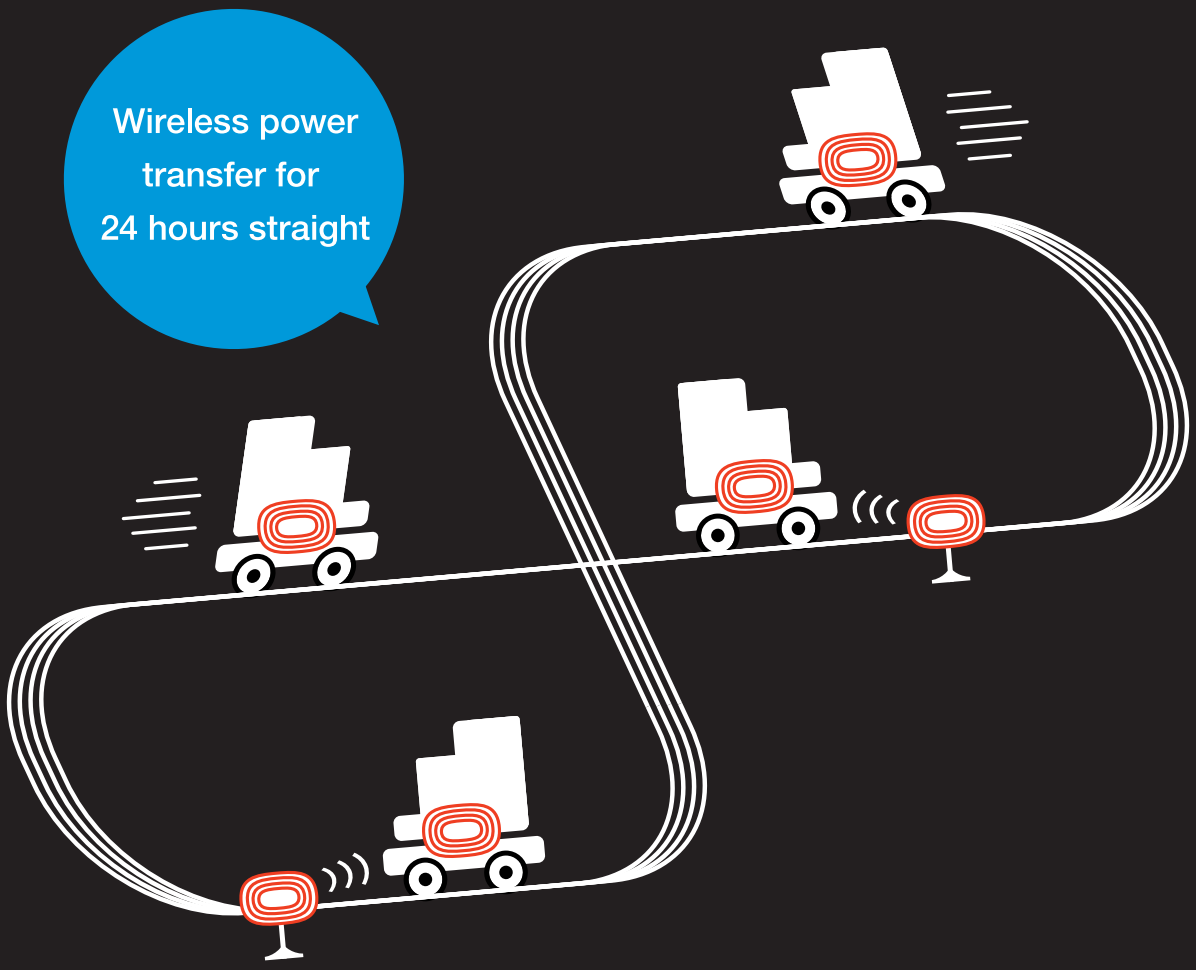
DAIHEN

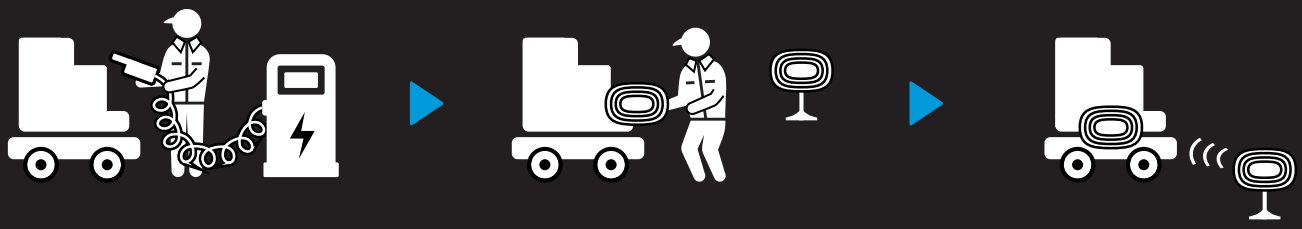
D Broad CORE

Wireless Power Transfer System for AGV

AGV Innovation

DAIHEN's wireless power transfer system for AGV offers a brand new solution to factory automation.
It is so new and revolutionary that it is worthy of being called an “AGV innovation.”





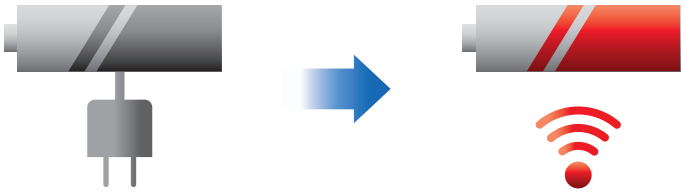
< Just replace the current charger >

< With our wireless power transfer system. >

< AGVs charge themselves! >

DAIHEN Corporation

What Is “Wireless Power Transfer”?



A new technology which can transfer electrical power wirelessly without using a power cable.

Configuration and usage of “wireless power transfer system for AGV”

Product Configuration

Connects to a three-phase 200V power supply.

Capacitor unit
- Integrates a capacitor.
- Stores energy.
- Integrates a DC/DC converter.
- Outputs 24V or 48V to AGV constantly.

*Option

Power transmitting unit
- Integrates a highly efficient 85 kHz inverter.
- Converts commercial frequency (50/60Hz) to high frequency (85kHz).
- Supplies 85 kHz AC to the power transmitting coil.

Power transmitting coil unit
- Integrates a circular coil.
- The coil receives 85 kHz AC and generates an AC magnetic field.
- Converts electrical energy to magnetic energy.

Power transmitting side

Transfers energy wirelessly

Power receiving coil unit
- Integrates a circular coil.
- The coil receives the AC magnetic field, generates an 86 kHz AC and supplies power to the power receiving unit.
- Converts magnetic energy to electrical energy.

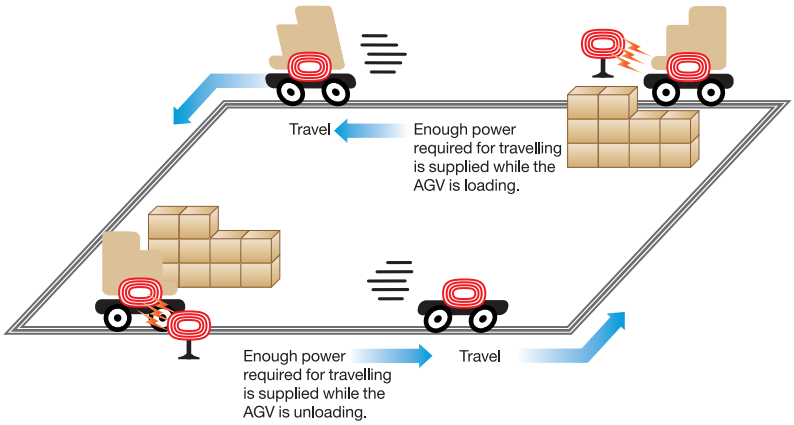
Power receiving unit
- Integrates a rectification smoothing circuit.
- Converts 85 kHz AC to DC by rectification and smoothing, and charges the battery device.

Power receiving side

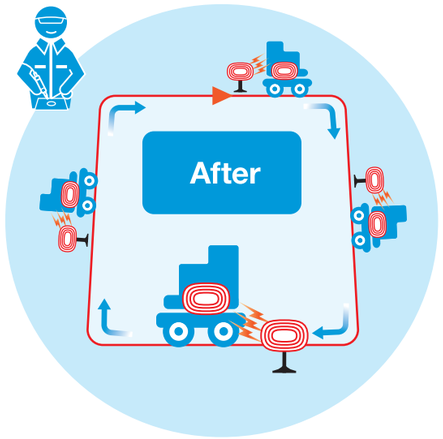
Attachment example

Application image

You can use the wireless power transfer system simply by attaching “a power receiving coil unit and a power receiving unit” to the AGV and installing “a power transmitting coil unit and a power transmitting unit” in the AGV stop positions (work area) on the production line.

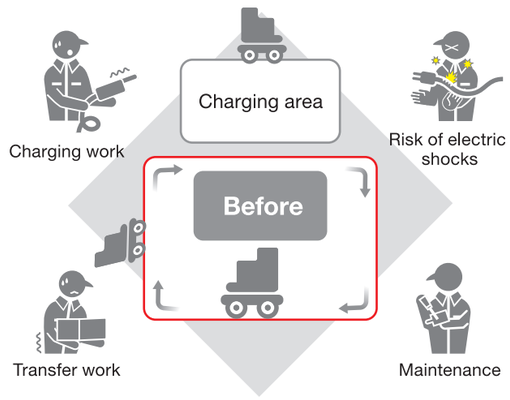


Advantages of incorporating the wireless power transfer system into AGVs



Advantages of wireless power transfer system

1. **Full automation of transfer lines (Improvement of productivity, reduction of labor cost)**
   Because power is transferred on the production line, troublesome procedures to “charge” and “change lead batteries” are eliminated.
2. **Improved safety**
   Non-contact power transfer eliminates accidents due to electric shocks or sparks.
3. **Creation of maintenance-free environments**
   Eliminating charging cables prevents failures caused by worn parts or intruding dust.
4. **Space-saving**
   Because charging areas are unnecessary, the factory space can be fully used.



Disadvantages of wired charging system

1. Manual battery charging and transfer are required.
2. Risk of electric shock exists in operation.
3. Failures due to worn parts (charging cables and connectors) or intruding dust may occur, and corresponding troubleshooting is required.
4. Areas to store battery chargers or other related parts are required.

Features of D-Broad CORE

1 Made quick charging of large current/highly efficient power transfer into reality even when the coil-to-coil distance is 40 mm.

Applicable to various types of power storage devices

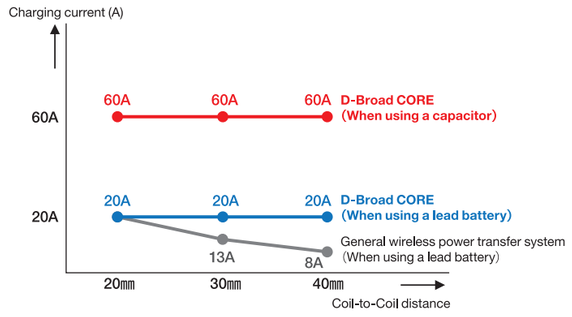
D-Broad CORE is applicable to various types of power storage devices such as lead batteries, lithium-ion batteries and electric double layer capacitors.

〈Types and features of power storage devices〉

lead battery	◯Low price △Large size and heavy weight △Charging/Discharging loss is relatively large. △Service-life is short.
Lithium-ion battery	◯Energy density is high. ◯Charging/Discharging loss is small. △Expensive
Electric double layer capacitor	◎Quick charging of large current is possible. ◎Service-life is long (Feasible charging/discharging cycles are approx. 1000 times that of lead batteries.) ◎Charging/Discharging loss is very small. ◯Small in size and lightweight △Energy density is low.

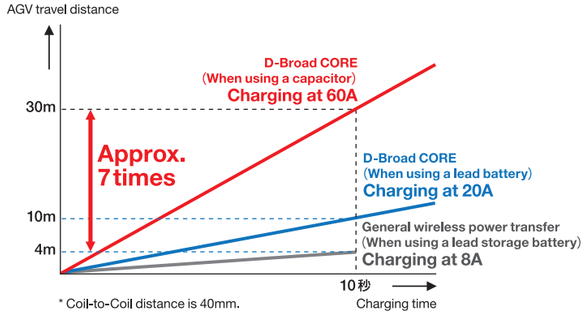
Stable power transfer is possible even when the coil-to-coil distance changes.

Stable power transfer of large current and high efficiency is possible even when the coil-to-coil distance changes.Prevents momentary stopping. (Eliminates insufficient charging.)



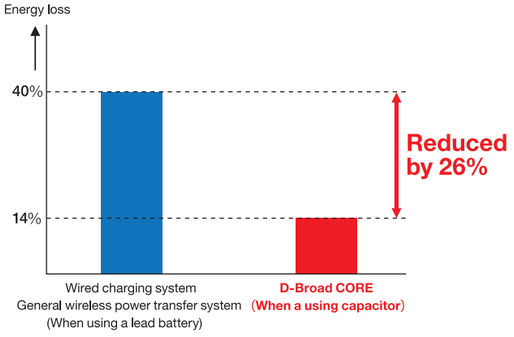
Quick charging at 60A maximum (*When using a capacitor)

D-Broad CORE can charge power storage devices using currents as high as 60A. Charging at high current dramatically reduces charging time.



Approx. 26% power-savings

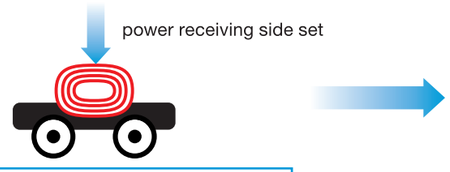
Saves approx. 26% power (in terms of electricity usage and CO2 reduction).



2 Easy attachment to your existing AGV

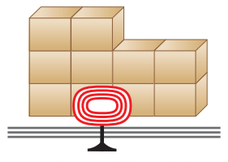
You can introduce the wireless power transfer system by simply attaching our system to your existing AGV.

1 Attach a power receiving side set to your AGV.



Replace your existing power storage device with our capacitor unit.

2 Install a power transmitting side set.



Wireless power transfer on the production line

Comparisonofpowertransfersystems

Owing to our accumulated “high frequency circuit technologies” and “high power generation and control technologies” that are the basis of wireless power transfer system, DAIHEN’s solution shows overwhelming advantages compared to other power transfer systems.

Comparison of DAIHEN’ s wireless power transfer system with others

	Rated input power	Charging current	Battery device	Charging efficiency*1	Frequency
D-Broad CORE (When used in conjunction with a capacitor)	4kW	Coil-to-Coil distance 40mm, 60A	Applicable with capacitor and lead battery	86％	85kHz
General wireless power transfer system	1kW	Coil-to-Coil distance 20mm, 20A	Mainly applicable with lead battery	≤ 60%*2	25kHz
Wired charging system	1kW	20A	Mainly applicable with lead battery	≤ 60%*2	Unknown

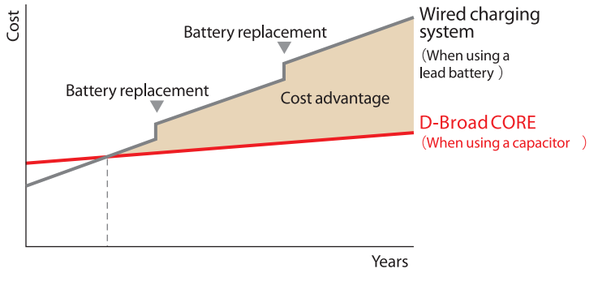
*1 Between AC input and power storage device
*2 Estimated value

ComparisonofcostofAGVchargingsystems

The capacitor-based wireless power transfer method, which DAIHEN’s wireless power transfer system for AGV employs, provides many advantages.

	Running cost: Labor cost	Running cost: Power storage device replacement cost	Running cost: Power storage disposal cost	Initial cost: Workload (Number of AGV units)	Initial cost: Power storage device	Initial cost: Charging facility
D-Broad CORE (When used in conjunction with a capacitor)	◎ Automatically chargeable on the production line	◎ The capacitor has long service-life and does not need replacing.	◎ The capacitor has long service-life and does not need to be disposed.	◎ 24-hour continuous operation is possible.	△ The capacitor is more expensive than a lead battery.	△ The wireless power transfer system is more expensive than a wired charging system.
Wireless power transfer system (When using a lead battery)	○ The lead battery requires charging and replacement less frequently than in a wired charging system	△ The lead battery needs replacing even though less frequently.	△ The lead battery needs to be disposed even though less frequently.	△ Power transfer takes time, so additional AGVs are required.	○ Conventional lead batteries can be used.	△ The wireless power transfer system is more expensive than a wired charging system.
Wired charging system (When using a lead battery)	× Charging and replacement of lead battery is troublesome.	× Annual replacement is required.	× Annual disposal is required.	△ Operation is interrupted while changing the lead batteries.	○ Conventional lead batteries can be used.	○ Its cost is less expensive than a wired charging system.

Image of cost comparison



The reason why the running cost dramatically reduced

- Man-hours in charging are reduced.
- Cost reduction because of few replacement of the battery devices.
- Power consumption is reduced owing to efficient power transfer.

Specifications

Configuration

- Power transmitting unit 1 unit
- Power transmitting coil unit (Including 1 m cable to be connected to the power transmitting unit) 1 unit
- Power receiving coil unit (Including 1 m cable to be connected to the power receiving unit) 1 unit
- Power receiving unit 1 unit
- [Option] Capacitor unit 1 unit

Power transmitting unit

Number of phases	3
Rated input frequency	50/60 Hz
Rated input voltage	200V ± 10%
Rated input power	4 kW
Required power supply capacity	4.6 kVA
Rated power factor	0.9 or more
Weight	6 kg
External dimensions (W×D×H)	343×421×130 mm (Excluding protrusions)

Power transmitting coil unit

External dimensions (W×D×H)	290×31×396 mm (Excluding protrusions)
Weight	3 kg

Common to units

Distance between the power transmitting and power receiving coil units	• 30 mm ± 10 mm • Charging current remains the same even if the distance changes.
AGV stop position misalignment allowable range (In the travelling direction)	Charging current remains the same even if the stop position is misaligned by ±10 mm.
Operating temperature range	-10 to 40°C
Operating humidity range	20 to 80% (No condensation)
Storage temperature range	-20 to 55°C
Storage humidity range	20 to 80% (No condensation)
Maintenance Cycle	7 years (Fan, electrical devices, etc.)

Power receiving unit

Output voltage range	0 to 52.5 V
Maximum output current	60 A
Weight	4 kg
External dimensions (W×D×H)	261×354×80 mm (Excluding protrusions)

Power receiving coil unit

External dimensions (W×D×H)	290×31×396 mm (Excluding protrusions)
Weight	3 kg

Options

Capacitor unit (24V output)

Output voltage range	24V ± 10%
Maximum output current	67.2 A
Weight	43 kg
External dimensions (W×D×H)	398×500×359 mm (Excluding protrusions)

Capacitor unit (48V output)

Output voltage range	48V ± 10%
Maximum output current	33.6 A
Weight	43 kg
External dimensions (W×D×H)	398×500×359 mm (Excluding protrusions)

Frequently asked questions

Q: What size AGV is this system applicable to?
A: It is applicable with AGV units of 1-t loading capacity.

Q: Does this system adversely affect people or other equipment?
A: It is as safe as household IH cookers (lower than the reference value of the Radio Radiation Protection Guidelines) .

Q: Is this system applicable to any equipment other than AGVs?
A: Parallel connections of the wireless power transfer systems can cover equipment that requires large current, such as unmanned and manned electric forklifts.

Precautions for Use

- Use this system in places where not contacted by water.
- Use this system in places where not exposed to direct sunlight.
- Do not place metallic objects between the power transmitting and receiving coils.
- Use the system as a complete set. (This product cannot be combined with wireless power transfer systems of other manufacture.)
- Keep 50-cm away from the power transmitting coil unit in all directions during wireless power transfer.
- Permission is required for installation because this equipment uses high frequency.

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