

Tandem *PowerPack*

Modular Battery for Hybrid Electrification





Efficiency

\$2.56/hr savings
on fuel when in electric mode

Up to 80% lower
maintenance costs and engine hours

1176 pounds lighter
than a genset and fuel

Over 85% quieter
than diesel-only systems

**Up to 100%
reduction**
in greenhouse gas emissions

Performance data is dependent on operational settings, environmental conditions, and market rates. Tandem test results and models assume \$4/gal diesel and \$0.07/kWh electricity costs.

Maintenance and fuel savings



Electric standby has long been available to reduce fuel and maintenance costs while stationary.

The Tandem PowerPack allows your fleet to take the same great benefits out on the road with you.

By utilizing the electric motor, the efficiency of your cooling system is drastically increased by leaving the diesel generator off for most or all of your day.

At the same time, the PowerPack significantly reduces the strain on the diesel components and increases the lifespan of your unit.





Always Cold

Reliability for your cold chain.

Utilizing electric power reduces the strain on the diesel engine and components.

This significantly reduces maintenance costs and increases the life of the unit.

Operating your cold chain equipment in the field shouldn't be reliant on just one system.

With the Tandem PowerPack, you're always carrying two capable systems on the road.

When battery power runs out, the system automatically switches over to diesel.





Sustainable

Tomorrow's sustainability goals met **today**

Whatever your sustainability goals may be, getting there shouldn't just be about buying new vehicles and trailers.

The Tandem PowerPack allows you to operate your cold chain at zero emissions, utilizing existing trailers.

Our products introduce sustainable practices into your existing operations, without negatively impacting them and saving you money.



Attachable EVs for Heavy Duty Vehicles

drive**TANDEM**.com



Easy

**Ready to save?
Visit us online.**



The Tandem PowerPack makes going green a breeze. Our mobile team installs without disrupting your operations.

Our products are pre-assembled, require no modifications, and are installed in 1-hour.

Zero

new infrastructure required

1-hour

installed in one hour or less

For Your Trailer

installed on existing tractors

Anywhere

delivery + install in all lower 48 states



Attachable EVs for Heavy Duty Vehicles

drive**TANDEM**.com

Placement Options

Flexibility for All Operations

Depending on the needs of your operation, the PowerPack can be placed...

On the Tractor



Under the Trailer



Under the Chassis



Zero Emissions Refrigerated Drayage

The Tandem PowerPack NextGen brings all of the benefits of our refrigerated trailer electrification solution to drayage.

The PowerPack can now stay with your refrigerated container when disconnected from the tractor.

The NextGen form factor brings zero emission refrigeration to your existing operations, and can be clipped on or off in just minutes with no new training.



PowerPack NextGen





PowerPack for Box Trucks

Zero Emissions Refrigerated Straight Trucks

The Tandem PowerPack platform easily attaches to existing refrigerated box trucks.

By utilizing the existing electric standby plugs, your Class 3-7 fleet can see all of the benefits of the Tandem PowerPack.

Charge off of the same plugs that your fleet is already using for electric standby and electric pulldown operations.

PowerPack automatically switches back to diesel power if the battery runs out.



Zero Emissions Refrigerated Trailers

The Tandem PowerPack is not required to be mounted on the rear of the tractor.

The PowerPack can now stay with your refrigerated trailer when disconnected from the tractor.

This form factor is important for operators that do not own their own tractors or cannot ask their carrier to operate the traditional PowerPack form factor.



Trailer Dedicated PowerPack



Charging Options

Tandem PowerPack

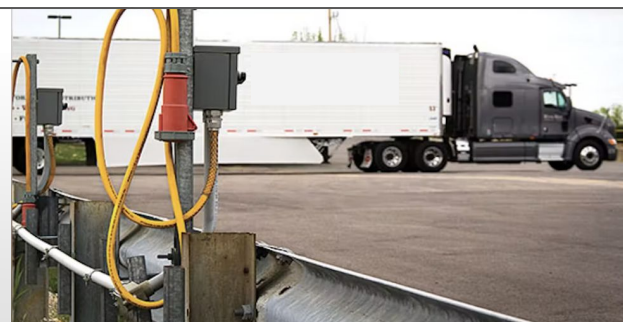


Shore Power at Docks

The Tandem PowerPack has an **onboard charger** and is compatible with shore power plugs at docks. These plugs offer medium charging times and low to zero upfront costs.

Shore Power in Lots

The Tandem PowerPack has an **onboard charger** and is compatible with shore power plugs in parking lots. These plugs offer medium charging times and low to zero upfront costs.



Solar on Trailers

The Tandem PowerPack is solar-ready. This means that any trailer with solar on top can easily charge the PowerPack while over the road or stationary.

Truck Support

The PowerPack can draw portions of power from the alternator of the host truck or by adding a PTO. This increases runtimes while fuel emissions go through the truck's emissions control systems.



EV Chargers

Tandem products can be optioned to be compatible with all EV chargers. This is the fastest charging method on the market today.

Mobile Charging Trailer

To support pilot programs or until charging plugs can be installed, mobile charging trailers will make your electrified fleet ready to go.



PowerPack

TANDEM

Total Cost of Ownership Comparison



Fuel vs. Electricity

\$3.40/hr

\$0.84/hr

Maintenance

\$1.50/hr

\$1.00/hr

Infrastructure Cost (Chargers)

\$0

\$800



Up to 100%
Emissions Reduction



Over \$12,600+
OpEx saved /yr



Over 83,000
lb/Co2 avoided /yr



Increase Resale
significantly reduced
engine hours

1-Year OpEx:

\$21,462

\$8,859

5-Year OpEx:

\$107,310

\$41,096

16-Year OpEx:

(Expected Lifespan)

\$343,392

\$129,747



**Performance data is dependent on operational settings, environmental conditions, and market rates. Tandem test results and models assume \$4/gal diesel, \$0.07/kWh electricity costs, and a 12-hour per day usage cycle including all runtimes including pulldown times.*

PowerPack



Specifications

Model	PP-50	PP-100	PP-200	PP-300
Weight	850lbs	1215 lbs	2178 lbs	3141 lbs
Dimensions (l x d x h) in inches	76.43" (W) x 12.65" (D) x 36.00" (H)	76.43" (W) x 12.65" (D) x 63.25" (H)	84" (W) x 15" (D) x 72" (H)	84" (W) x 15" (D) x 72" (H)
Charge (3 Phase, 480V, slow)	5 hours	10 hours	20 hours	30 hours
Charge (3 Phase, 480V, rapid)	1.5 hours	3 hours	6 hours	9 hours
Charge (DCFC, EV fast charge)	0.5 hours	1 hour	2 hours	3 hours
Output (Cooling, Standard)	460V/3ph/60Hz			
Output (Cooling, Optional)	230V/3ph/60Hz			
Dual Output (Optional)	Dual output package available. Additional weight of 170 lbs.			
Output (APU/Auxiliary)	12V, 48V			
Available Continuous Output	50kW	100kW	200kW	300kW
Available Peak Output (30s)	100kW	200kW	400kW	600kW
Self-discharge rate	<3%/month			
Cycle Life	6000 cycles			
EOL Capacity	EOL capacity >= 70% nominal capacity			
Storage Temperature	-20 °C to 45 °C			
IP Rating (Enclosure)	Designed to meet IP66 and NEMA 1, 2, 4, 4X, & 12 specifications			
Certification (Enclosure)	CE / ROHS Approved			
Feature (Enclosure)	Lockable, Waterproof, Fire-Resistant			

Safety Performance and Testing

Over-Discharge	No fire, No explosion
Over-Charging	No fire, No explosion
Short Circuit	No fire, No explosion
Drop	No fire, No explosion

Heating	No fire, No explosion
Extrusion	No fire, No explosion
Low Pressure	No fire, No explosion
Thermal Runaway	No fire, No explosion

PowerPack



Continuous Runtime Tests (for TRUs)

						Runtime in Hours
Use Case	Ambient Temp	Set Temp	Standard Mode	Truck Support Enabled	Solar Enabled	Truck Support + Solar Enabled
48' Refrig. Trailer PP-100	100 °F	60 °F	20.0 hrs	2 days 2.3 hrs	<i>inf</i>	<i>inf</i>
	100 °F	33 °F	9.1 hrs	12.5 hrs	16.7 hrs	1 day 9.6 hrs
	100 °F	0 °F	12.5 hrs	20.0 hrs	1 day 9.4 hrs	<i>inf</i>
48' Refrig. Trailer PP-200	100 °F	60 °F	1 day 16 hrs	4 days 4.5 hrs	<i>inf</i>	<i>inf</i>
	100 °F	33 °F	18.2 hrs	1 day 1.0 hrs	1 day 9.4 hrs	2 days 19.1 hrs
	100 °F	0 °F	1 day 1 hrs	1 day 16.1 hrs	2 days 18.9 hrs	<i>inf</i>
48' Refrig. Trailer PP-300	100 °F	60 °F	2 days 12 hrs	6 days 6.8 hrs	<i>inf</i>	<i>inf</i>
	100 °F	33 °F	1 day 3.3 hrs	1 day 13.5 hrs	2 days 2.1 hrs	4 days 4.7 hrs
	100 °F	0 °F	1 day 13.5 hrs	2 days 12.1 hrs	4 days 4.3 hrs	<i>inf</i>



*Performance data is dependent on operational settings, environmental conditions, and market rates.

***inf* is short for infinity and means that the input power from the auxiliary sources will allow the system to run without ever needing a charge. However, it is possible that charging the unit when possible will reduce operating costs.



PowerPack GenSet

Continuous Runtime Tests (for Containers)



				Runtime in Hours
Use Case	Ambient Temp	Set Temp	Standard Mode	Truck Support Enabled
20' Refrig. Container PP-50	100 °F	60 °F	2 days 2.0 hrs	<i>inf</i>
	100 °F	33 °F	16.7 hrs	<i>inf</i>
	100 °F	0 °F	1 day 1.0 hrs	<i>inf</i>
20' Refrig. Container PP-100	100 °F	60 °F	4 days 4.0 hrs	<i>inf</i>
	100 °F	33 °F	1 day 9.3 hrs	<i>inf</i>
	100 °F	0 °F	2 days 2.0 hrs	<i>inf</i>
40' Refrig. Container PP-50	100 °F	60 °F	16.7 hrs	<i>inf</i>
	100 °F	33 °F	10.0 hrs	1 day 1.1 hrs
	100 °F	0 °F	12.5 hrs	2 days 2.5 hrs
40' Refrig. Container PP-100	100 °F	60 °F	1 day 9.3 hrs	<i>inf</i>
	100 °F	33 °F	20.0 hrs	2 days 2.3 hrs
	100 °F	0 °F	1 day 1.0 hrs	4 days 5.0 hrs



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PowerPack



Continuous Runtime Tests (for Box Trucks)

						Runtime in Hours
Use Case	Ambient Temp	Set Temp	Standard Mode	Truck Support Enabled	Solar Enabled	Truck Support Enabled + Solar
16' Box. Truck PP-50	100 °F	60 °F	2 days 2.0 hrs	<i>inf</i>	<i>inf</i>	<i>inf</i>
	100 °F	33 °F	16.7 hrs	2 days 2.5 hrs	2 days 2.5 hrs	<i>inf</i>
	100 °F	0 °F	1 day 1.0 hrs	<i>inf</i>	<i>inf</i>	<i>inf</i>
16' Box. Truck PP-100	100 °F	60 °F	4 days 4.0 hrs	<i>inf</i>	<i>inf</i>	<i>inf</i>
	100 °F	33 °F	1 day 9.3 hrs	4 days 5.0 hrs	4 days 5.0 hrs	<i>inf</i>
	100 °F	0 °F	2 days 2.0 hrs	<i>inf</i>	<i>inf</i>	<i>inf</i>
26' Box. Truck PP-50	100 °F	60 °F	1 day 1.0 hrs	<i>inf</i>	<i>inf</i>	<i>inf</i>
	100 °F	33 °F	12.5 hrs	1 day 1.1 hrs	1 day 1.1 hrs	<i>inf</i>
	100 °F	0 °F	16.7 hrs	2 days 2.5 hrs	2 days 2.5 hrs	<i>inf</i>
26' Box. Truck PP-100	100 °F	60 °F	2 days 2.0 hrs	<i>inf</i>	<i>inf</i>	<i>inf</i>
	100 °F	33 °F	1 day 1.0 hrs	2 days 2.3 hrs	2 days 2.3 hrs	<i>inf</i>
	100 °F	0 °F	1 day 9.3 hrs	4 days 5.0 hrs	4 days 5.0 hrs	<i>inf</i>



*Performance data is dependent on operational settings, environmental conditions, and market rates.

***inf* is short for infinity and means that the input power from the auxiliary sources will allow the system to run without ever needing a charge. However, it is possible that charging the unit when possible will reduce operating costs.