Zero Emission Electric Railcar Movers

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Prepared for: South Coast AQMD – PR 2306

Wabtec CORPORATION

Railcar Movers

South Coast AQMD PR 2306 Work Group

SHUTTLEWAGON
MOBILE RAILCAR MOVERS

Zero-Emission Electric Railcar Movers

Electric Railcar Movers are designed for transit/freight rail switching operations. Whether moving people or freight, companies must process railcars. Railcar movers can provide alternatives for switching operations. These machines are designed for years of use in light, medium, and heavy-duty railcar switching applications.

The useful life of an electric machine is substantial.

- Most batteries are expected to last 10 years based upon 2,000 hrs per year operation.
- Actual life expectancy is dependent on the number of charge cycles batteries experience over time.
- Charge cycles vary based upon battery type and utilization.

Shuttlewagon, Inc, a Wabtec Company, is one two North American suppliers offering not only diesel, but zero-emission electric railcar movers. Shuttlewagon does provide the widest range of railcar mover models in North America.

Portfolio

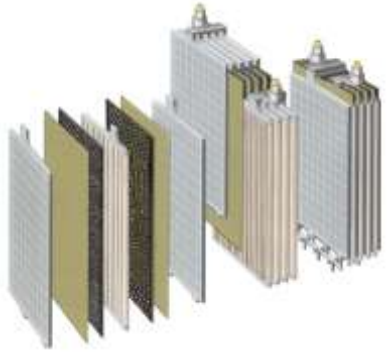
- 7 Clean Diesel
- 1 Hybrid Mobile Railcar Mover (locomotive)
- 10 Zero Emission, Electric
  - Both Lead Acid and Li-Ion Technology

Electric Railcar Movers Eliminate NOx, PM and other Emissions

Tier Rating	Tons NOx Per Year	Total Tons NOx Lifetime*
Unregulated*	4.18	62.7
Tier 0	0.35	5.3
Tier 1	0.26	3.9
Tier 2	0.18	2.6
Tier 3	0.11	1.6
Tier 4	0.01	0.2

Based upon hourly usage of just 1,000hrs per year, a zero emission Mobile Railcar Mover eliminates considerable NOx pollutant. “Unregulated” locomotives often run many more hours annually.

Battery Power Technology – Types/Railcar Movers



Sample Fiamm Motive Power

Lead Acid (flooded) Traction Batteries – Industry standard, railcar movers

- Tubular vented technology (PzS), shown here
- Requires distilled water, generally weekly but depends on use, electrolytes must be at proper level
- Conduct an equalize charge once a week following normal charging cycle; maintains efficiency following deep dischargers or incomplete charge cycles
- Must fully discharge to 20% before re-charging to full
- Charge time; 20% SoC is ~8hrs
- Total run time is dependent upon load; most applications see multiple shift use as duty cycle is not continuous.

Pure Lead Batteries – Optional on some makes/models

- Thin pure plate lead (TPPL)
- Sealed; no watering, battery cleaning, battery changing or long equalize charges
- 3X more plates and 10% more energy dense vs. flooded batteries
- Opportunity charging compatible
- Quicker charge time by 20%, return to duty more quickly
- 1,500 cycles

Lithium-Ion Batteries – Available only to Shuttlewagon's NVX-E

- NMC-Nickel Manganese Cobalt
- BMS; protects and manages individual packs and the storage system
- Charge at any SoC
- Fast charge; from a depleted SoC to full charge is 2.5 hours, with optional Rapid Charger
- 2,500 charge cycles

Zero-Emission, Electric Railcar Movers

Smalls

Lead Acid

100-500 Ton Tow Capacity
TE: 1,125lbs – 5,250lbs
S/P Range: ~$125k- $210k USD

Charger:
On-board 480V/30amp

Batteries:
Traditional Lead Acid-wet/gel

*Optional Pure Lead, some models

SHUTTLEWAGON POWERED BY COLMAR

Mids

Lead Acid

700 to 1,000 Ton Tow Capacity
TE: 7,400lbs – 10,000lbs
S/P Range: ~$195k- $285k USD

Charger: On-board
On-board 480V/60amp

Batteries:
Traditional Lead Acid-wet/gel

*Optional Pure Lead, some models

SHUTTLEWAGON POWERED BY COLMAR

Bigs

Lead Acid

2,000 to 3,200 Ton Tow Capacity
TE: 20,000lbs – 32,000lbs
S/P Range: ~$400k- 650k USD

Charger: On-board
On-board 480V/60amp

Batteries:
Traditional Lead Acid-wet/gel

*Optional Pure Lead, some models

SHUTTLEWAGON POWERED BY COLMAR

Performance +

Li-Ion

4,500 Ton+ Tow Capacity
TE. 45,000lbs rate; like
S/P Range: ~$1.050k - $1.175M

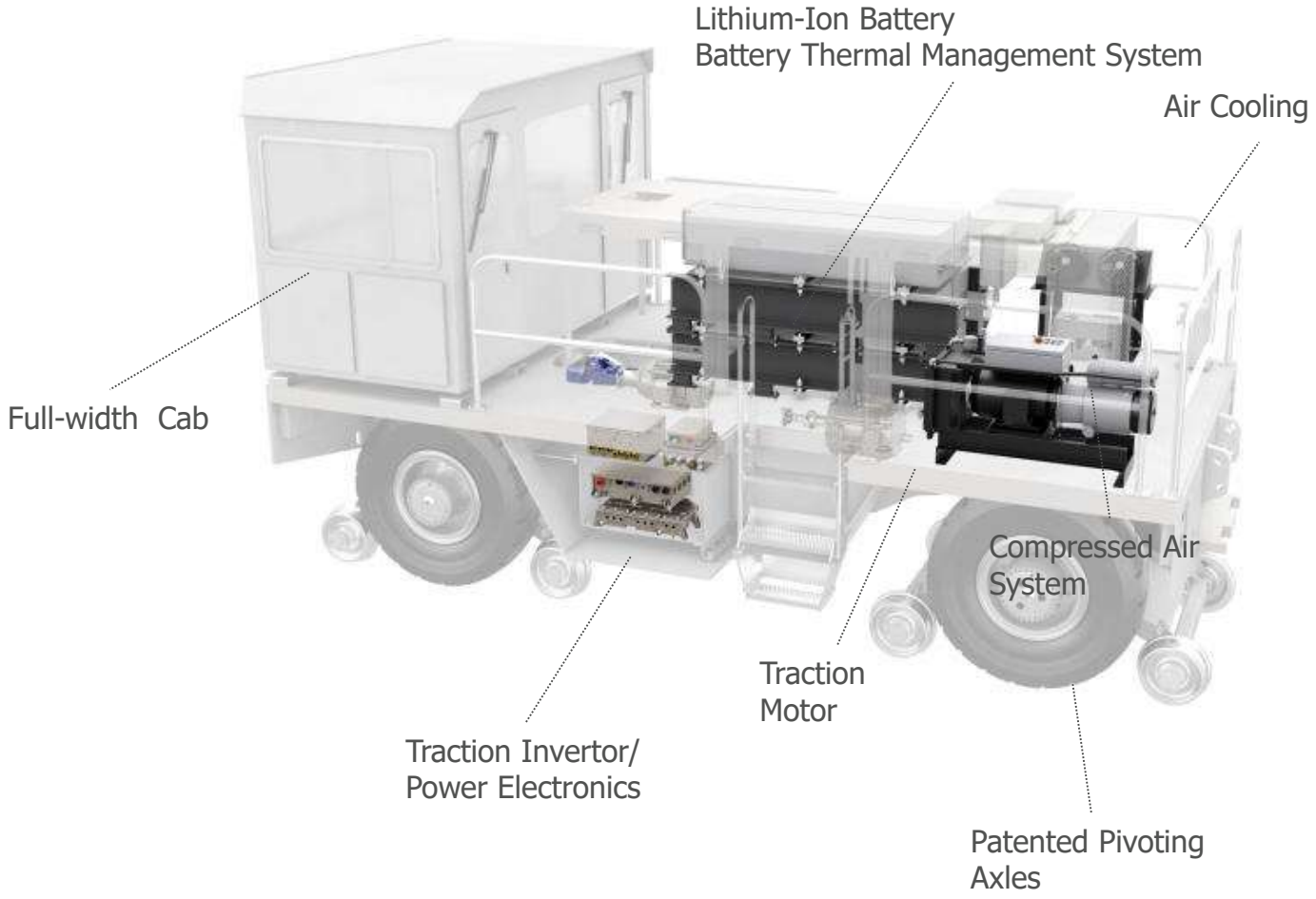
Chargers: required purchase
- level 2: $6,500 each USD
- level 3: $85,000 each USD

Batteries:
Li-Ion

ELECTRIC NAVIGATOR BY SHUTTLEWAGON

ZERO Emission, Li-Ion Powered Railcar Mover

- ✓ Full diesel railcar mover/switcher locomotive replacement
- ✓ The only Li-ion (Lithium Ion) mobile railcar mover in the world
- ✓ Leve 2 and Level 3 Charging
- ✓ Battery Management System
- ✓ 45,000+ lbs. Tractive effort
- ✓ Up to 235 kWh li-ion battery pack
  - ✓ Increased charge cycles
  - ✓ Longer battery life
  - ✓ 150 kWh fast charge capability
  - ✓ Fully charged in 2.5 hours with a Level 3 charger
- ✓ Rubber-tire drive system
- ✓ Lower operating costs
- ✓ Low maintenance costs
- ✓ Higher performance – Precision Drive Technology
- ✓ Reduced noise
- ✓ Zero-emission
- ✓ Qualifies for state and local grant funding



ZERO Emission, Li-Ion Powered Railcar Mover

Level 2; 240V/80amp

Level 3; 150kWh

ELECTRIC NAVIGATOR
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