

# Company and Product Overview



 OPTIMAL·EV

# Biographical Information

Executive Vice President



- 30+ years of specialty vehicle manufacturing, operations, and commercial experience
- Club Car (an Ingersoll Rand Company), electric and gas golf cars and utility vehicles
- VP Operations REV Bus and Mobility Group
- Delivered results in Fortune 500, Private Equity, underperforming, turn around, and start-up businesses.
- MBA, Kelley School of Business, Indiana University
- Lean Six Sigma Black Belt



# Optimal EV | Company Overview

## Corporate HQ and R&D Center in Plymouth, MI



- Founded in 1986, pioneered CAE (computer aided engineering) and related technologies for the automotive industry
- Since 2015, Optimal has been devoting itself in full vehicle design and development involving vehicle lightweighting, electrification, and autonomous drive technologies at its R&D facility located in the Detroit, MI area
- Recently designed and developed for Bollinger Motors, Rivian, SF Motors

## Manufacturing Facility in Elkhart, IN



- 62,000 SF industrial building located in Elkhart, IN
- 6,540 SF Office
- 6.44 acres fenced yard
- 16 overhead doors
- Air rotation heat and LED lighting
- Extensive renovation in 2017 including all new metal walls, roof, offices, lighting, HVAC, asphalt, fencing, etc.

# S1 Battery-Electric Low-Floor Bus



<b>GVWR</b>	<b>14,500 lbs.</b>
<b>Weight Class</b>	<b>4</b>
<b>Curb Weight</b>	<b>10,000 lbs. Approx.</b>
<b>Wheelbase</b>	<b>212"</b>
<b>Battery Pack</b>	<b>Li-Ion (NMC)</b>
<b>Pack Size</b>	<b>113 kWh</b>
<b>Charging</b>	<b>Level 2 (J1772)</b>
<b>System Voltage</b>	<b>326V (Nominal)</b>
<b>Drive Configuration</b>	<b>RWD</b>
<b>Range</b>	<b>&gt;125 Miles**</b>
<b>Top Speed</b>	<b>70 mph</b>
<b>Gradeability</b>	<b>30%</b>
<b>Passengers</b>	<b>20 W/Driver</b>
<b>Wheelchairs</b>	<b>3 Max.</b>
<b>Step In Height</b>	<b>9.8" @ Load</b> <b>11" @ Unloaded</b>
<b>ADA Ramp</b>	<b>Optional</b>
<b>Length</b>	<b>26'-6"</b>
<b>Telematics</b>	<b>CARB Compliant</b>
<b>Buy America</b>	<b>Yes</b>
<b>Altoona Test*</b>	<b>200,000 Miles/7 Years</b>
<b>DC Fast Charge</b>	<b>Optional</b>

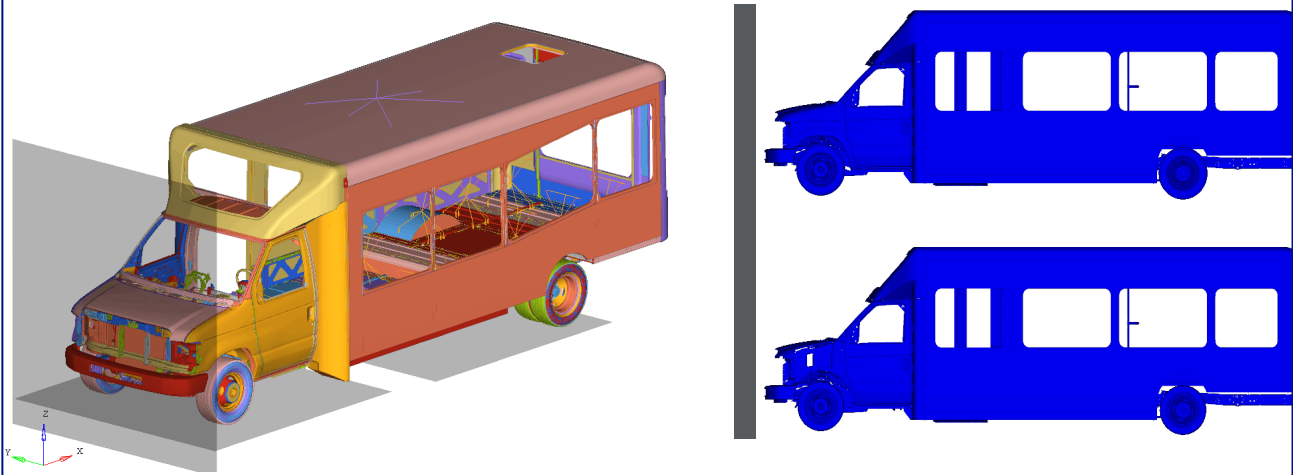
- One-step or quick ramp
- Widebody & high ceiling (interior width 99", interior height 86", superior passenger experience)
- Battery between the frame rails for maximum protection
- Focus on serviceability ("manhole" cradle design, easy in easy out major component design)
- Quick wheelchair ramp
  - Safer
  - Save loading/unloading time: e.g., saving 5:54 in a real loading operation test (3:03 vs. 8:57)
  - Save AC energy & comfort during loading/unloading e.g., inside temperature raised only 3.7o F vs. 13o F on a warm day test, saving significant AC energy
  - Save costly ADA lift or unreliable air-spring "kneeling" suspension
  - Save passenger dignity – all passengers use the same entrance
- Engineered using state-of-art automotive technology for safety, durability, and comfort

\*Passed all CAE virtual testing, physical test to be complete in 4Q2023

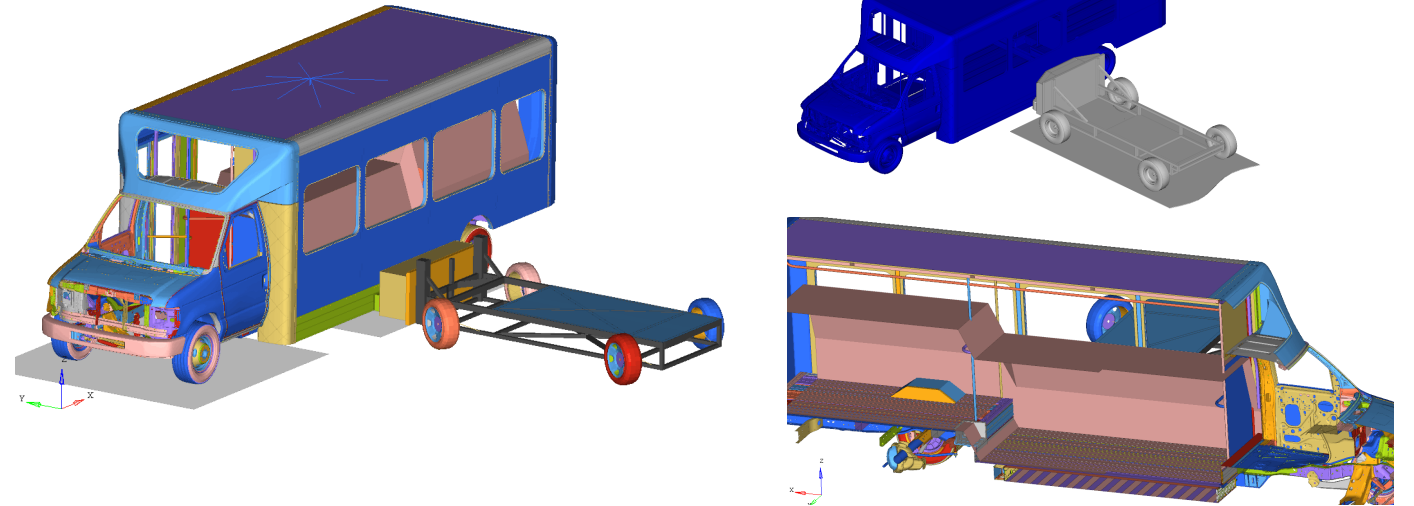
\*\*Range dependent upon ambient temperature, drive cycle, loading condition, ancillary loads, driver habits, geography/topography, etc.

# Examples of S1's unique advanced engineering process in the market

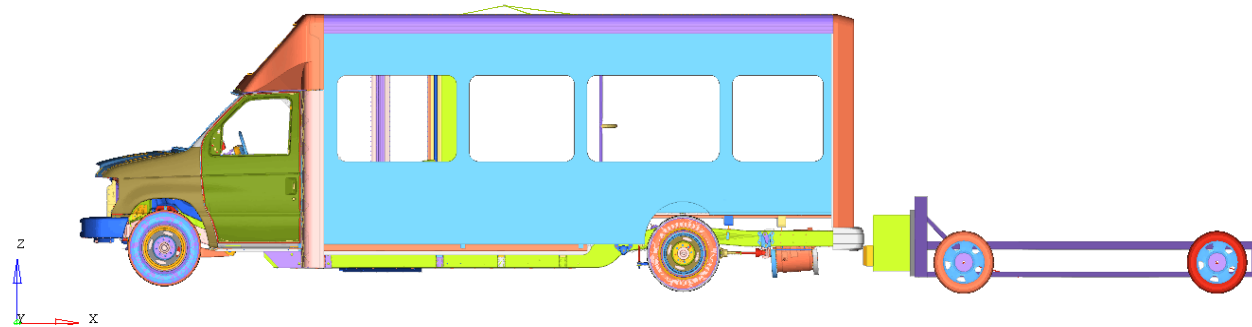
## Frontal Impact Safety



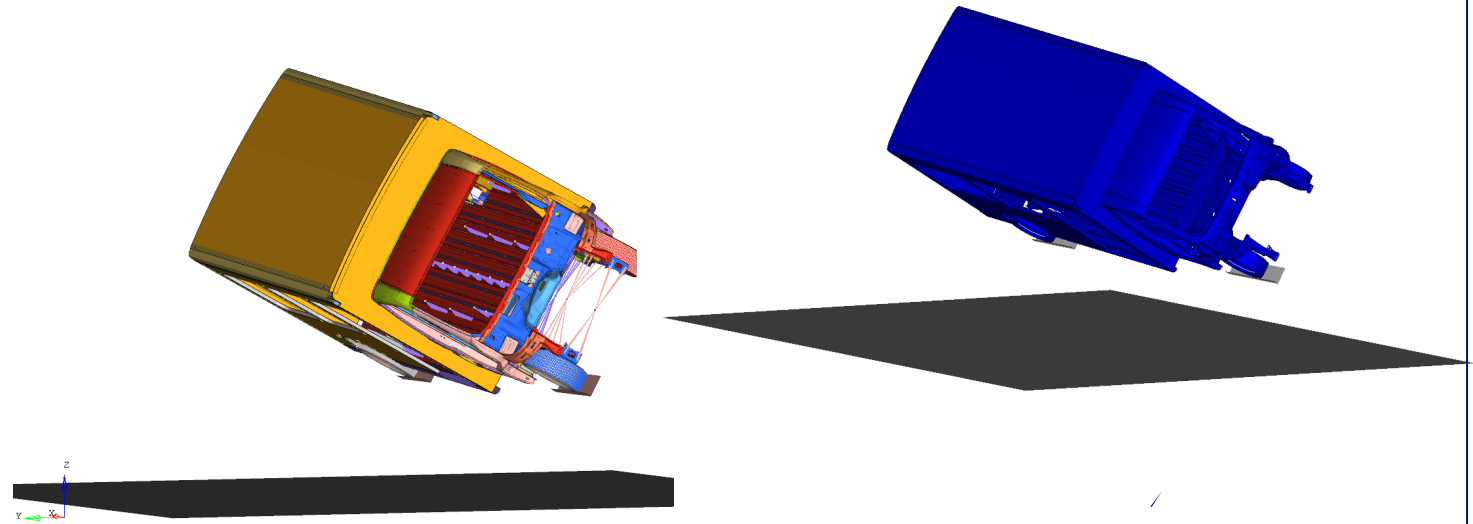
## Side Impact Safety



## Rear Impact Safety

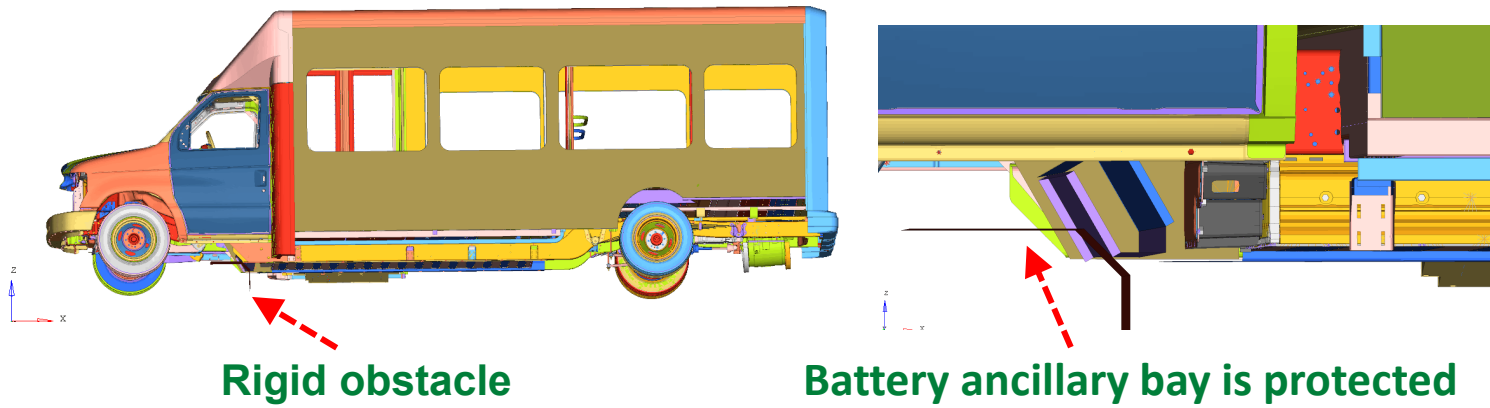


## Rollover Safety

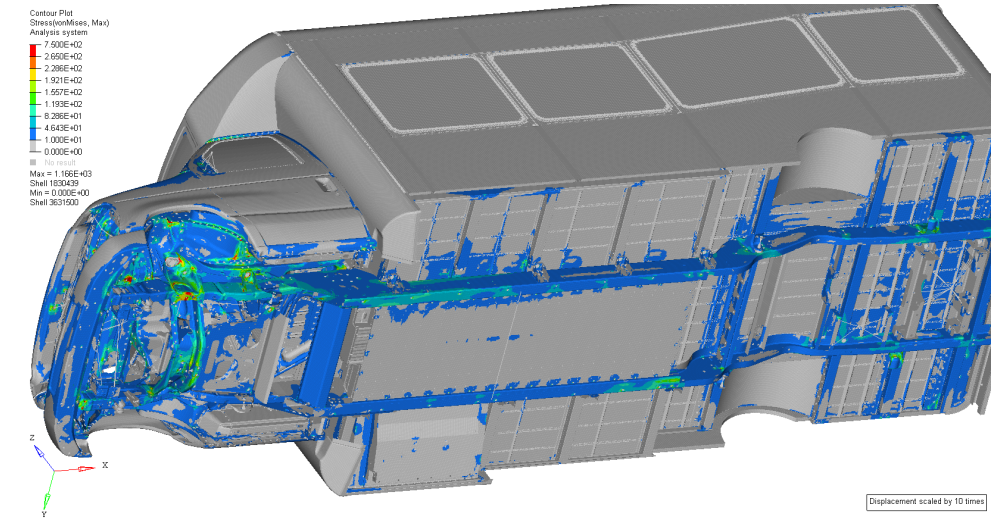


# Examples of S1's unique advanced engineering process in the market

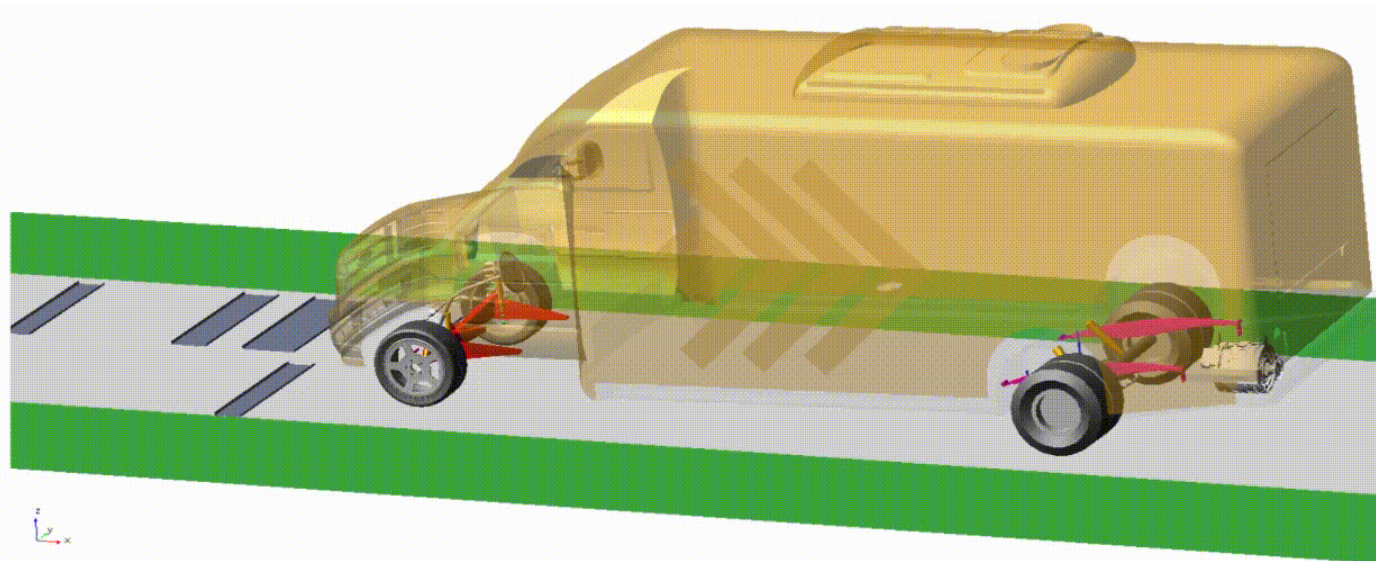
## Battery Scraping - Safety



## Durability Design CAE & Validation



## Ride & Handling + Durability CAE





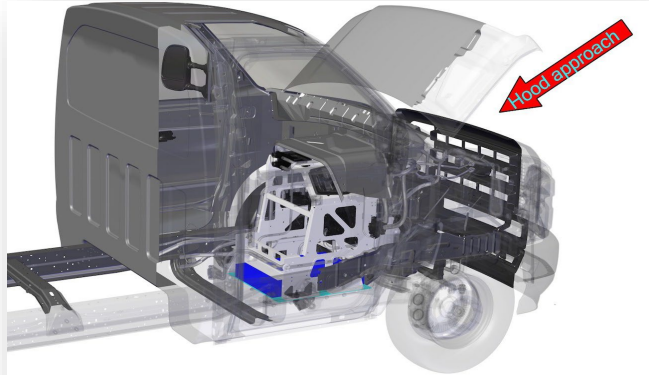
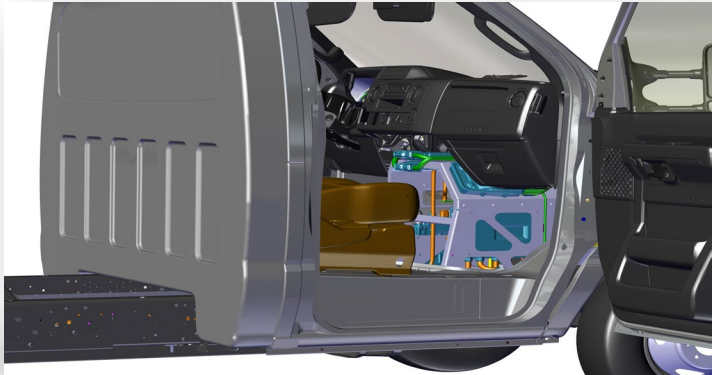
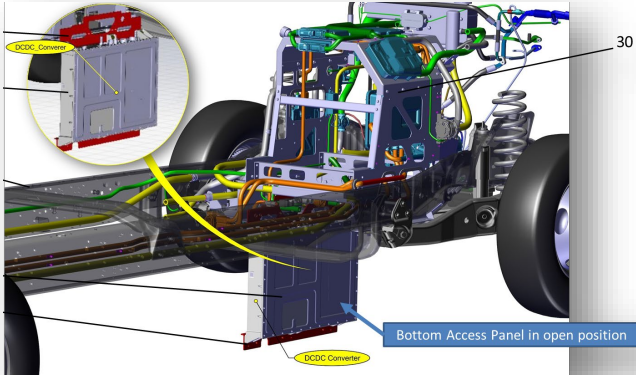
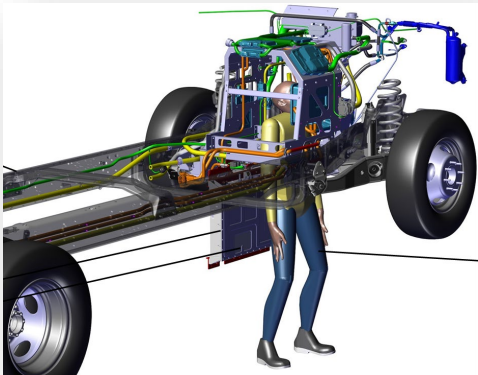
# Battery-Electric Cutaway Chassis



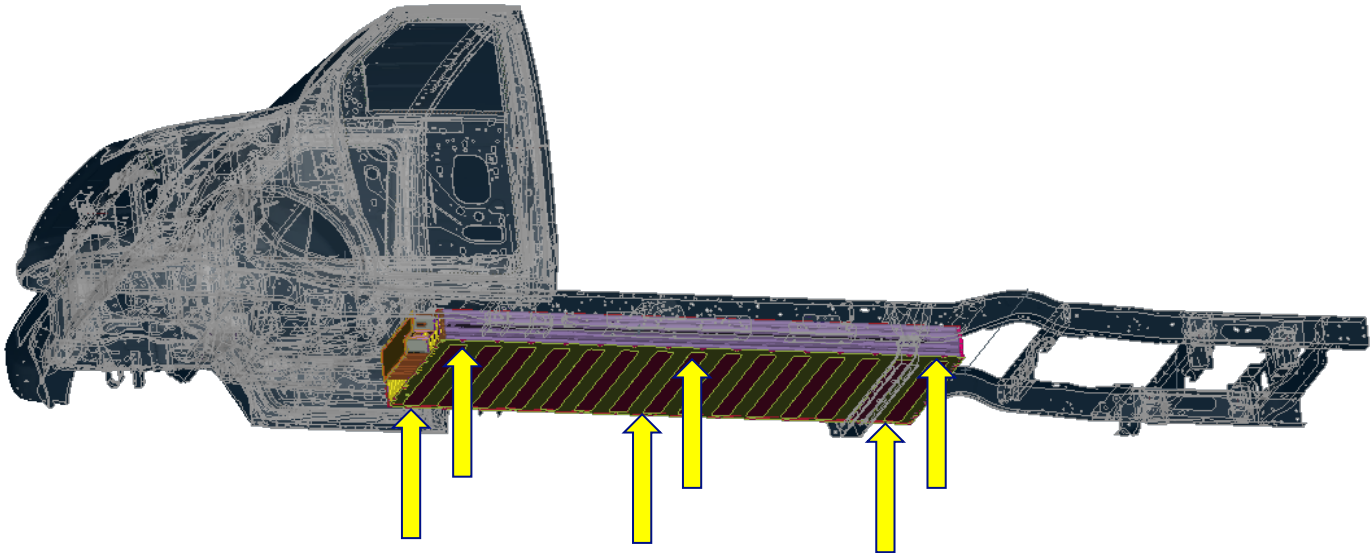
<b>Platform</b>	<b>Ford E450</b>
<b>GVWR</b>	<b>14,500 lbs.</b>
<b>Weight Class</b>	<b>4</b>
<b>Wheelbase</b>	<b>158", 176"</b>
<b>Battery Pack</b>	<b>Li-Ion (NMC)</b>
<b>Pack Size</b>	<b>113 kWh</b>
<b>Charging</b>	<b>Level 2 (J1772)</b>
<b>System Voltage</b>	<b>326V (Nominal)</b>
<b>Drive Configuration</b>	<b>RWD</b>
<b>Range</b>	<b>&gt;125 Miles**</b>
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<b>DC Fast Charge</b>	<b>Optional</b>
<b>Telematics</b>	<b>CARB Compliant</b>

# Maintenance and Serviceability

Smart design of a cradle for a Commercial EV Chassis : Easy access from the bottom, center console, and hood for major components



Simplistic single battery design for easy service



Other Service Features

- Direct drive (no transmission)
- Rear mounted motor
- Single closed loop cooling system

# Warranty

The Optimal EV warranty covers 5 years or 75,000 miles (whichever occurs first) for the high voltage drive system\*. Certain component parts have specific warranties provided by the part manufacturer. See list below:

- i. Bumper to Bumper Warranty – 3 yrs. 36,000 miles
- ii. Traction Motor Warranty – 5 yrs. 150,000 miles
- iii. Proterra Battery Warranty<sup>+</sup> – 6 yrs. or 175,000 kWh of gross discharge throughput per battery pack (whichever comes first). Coverage includes all materials, components and workmanship of the Battery Pack to be free of defects. Retained Energy of at least 80% of Nameplate Energy for the earlier of 6 years or 175,000 kWh GDT per Battery Pack.

## S1 Warranty (all above plus)

- iv. Body Structure – 5yrs. / 100,000 miles whichever comes first
- v. A/C components whose defect or performance failure risks leakage of refrigerant (including but not exclusive to lines, fittings, compressor, evaporator, condenser, accumulator, chiller) – 5 yrs. 50,000

\*Individual components which will be covered by the high voltage drive system warranty are as follows: Rear axle, Inverter, HVPDU, all electrical lines and cables, cooling system including pump, radiator and lines, charge port connector and cabling. 240 VAC charger/DC to DC converter, DC fast charge module and all cables.

<sup>+</sup>This Warranty applies to the following Battery Pack components: Battery Modules, Battery Management System (BMS), Internal Battery Pack Cooling System, Battery Pack Enclosure, Electrical, mechanical, and thermal interfaces, Manual Service Disconnect (MSD)

# Thank You



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[www.optimal-ev.com](http://www.optimal-ev.com)