



MUNRO



**2022 TESLA
MODEL S PLAID
COST ASSESSMENT**



TESLA PLAID COST ASSESSMENT REPORTS

These reports provide a comprehensive vehicle cost analysis that are highly advantageous for OEMs or Tier Suppliers looking to effectively compete the EV marketplace.

Each report is a consolidation of Munro's technical findings related to cost, features, performance, and technology implementation including Executive Summaries, Eye-Catching Features, and Quick Cost Estimates.

Munro offers several 2022 Tesla Model S Plaid standard reports.

ZONE REPORTS

- Zone 1 Body and Chassis
- Zone 2 Controlling Electronics
- Zone 3 Interiors and Safety
- Zone 4 Powertrain and Battery Pack

FOCUSED REPORTS

- Electrical and Electronics (E/E) Assessment
 - o All E/E from Zones 1-4, plus power distribution, network communication architecture, and ECU details
- Electrical Topologies - Low and High Voltage
- Electric Drive Module (Motors, Gearbox and Inverters)
- Thermal Systems (Cooling & Heating)

Contact for pricing

NOTE

- Additional report bundling options are available at a discounted price
- Custom reports are available upon request
- Please direct purchase inquiries to reports@leandesign.com



TESLA MODEL S PLAID DESCRIPTION

- The Tesla Model S Plaid vehicle which Munro analyzed sports a 1,020-horsepower powertrain using three 250kW motors; a single front motor with a differential and dual rear motors with torque vectoring, driven by a 100kWh battery pack with a 396-mile range at 119/112 MPGe city/highway
- The Tesla Model S Plaid The front and rear gearboxes have a gear reduction ratio of 7.54:1 from the motor to the driveshaft, decreasing from the 9.00:1 gear ratio seen in the Model Y
- This new motor assembly is capable of 20,000 rpm and provides up to 1,050 lb-ft of torque
- The front motor and both rear motors use identical rotors and stators
- Prior to Munro's purchase, the car was never driven.

2022 Tesla Model S Plaid	
Long Range Performance 4dr Sedan	
Drivetrain	AWD
Power (HP)	340
Torque (lb-ft)	350
Motor Type	PMSM



ZONE REPORTS

Zones 1 – 4 provide a system by system break down of the Tesla Model S Plaid. Each report contains detailed cost information down to the component level and supporting technical information as outlined below.

EXECUTIVE SUMMARY & SIDE-BY-SIDE COMPARISON

- The Executive Summary highlights the purpose and key points of each report including Munro’s observations and cost summaries.
- Side by Side comparisons highlight prominent EVs and their associated specifications, features, integration strategies and other relevant data.

EDM Side-by-Side Comparison

Battery Electric Vehicles (BEV)- Permanent Magnet (PM) Motors

Parameters	MOTOR SPECIFICATIONS						
	Tesla Model 3 Rear	BMW i3	Chevrolet Bolt	Jaguar I-PACE	Nissan Leaf	Tesla Model Y Rear	Tesla Model S Plaid
Motor Type	PM	PM	PM	PM	PM	PM	PM
Total Motor Weight (kg)	41.46	35.47	33.76	38.83	34.75	40.69	45.1

EDM Integration Strategies

Integration Level: 5 (Tesla Model S Plaid), Integration Level: 4 (Ford Mustang Mach-E), Integration Level: 3 (Nissan Leaf)

Executive Summary

This project report provides a detailed analysis for costing parts and labor associated with the manufacturing and production practices of the Tesla Model S Plaid electric drive motors (EDMs). The purpose of this report is to analyze the design and processes that are required to manufacture the parts and components that make up the EDMs as well as the strategies in place to control and monitor them.

The cost model baseline is established by disassembling the EDMs. The parts are then documented in detail, capturing the assembly operations and weight of components.

A baseline process map is modeled in the Design Profit® software and is used to determine the cost associated with materials and manufacturing processes.

Design strategies, exploded views, fluid circuit diagrams, and dimensional data (mm) of the EDMs are captured and documented.



EYE-CATCHING FEATURES

- Munro identifies specific observations of interest called "Eye-Catching Features." These observations can represent advantages or disadvantages in cost, weight, feature content, or performance as related to design, material choice, assembly, or manufacturing process selection.

Eye-Catching Features

Carbon Fiber Rotor Wrap

Eye-Catching Features

Inverter Phase Lead Squeeb

Eye-Catching Features

Capacitor Bank Potting

Eye-Catching Features

Rear Motor Housing Bearing Surface Finish

Description:

- Carbon fiber rotor wrap
- This design is

Description:

- All three inverters are located between the inverter and the motor housing

Description:

- Capacitor Bank (TIM) in Model Y

Description:

- Bearing surface on motor housing casting has been machined to achieve a high surface finish

Advantages:

- Improved surface finish of bearing mating surface helps to optimize bearing performance, extending lifespan

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48



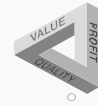
QUICK COST ESTIMATES

- The Tesla Plaid is broken down into systems and components for Quick Cost Estimating (QCE). QCE is Munro's proprietary methodology developed in response to the need for speed-driven results and is quickly gaining popularity. Quick Cost Estimates provide approximate costs in a timely fashion. While less accurate than detailed costing (also available from Munro), QCE allows OEMs and suppliers the ability to make sound comparisons and directional decisions expeditiously.

Douglas Richman - EPA Peer Reviewer from Kaiser Aluminum

"Munro is recognized as being technically competent, highly experienced, knowledgeable and creative in benchmarking and lean engineering of automotive and non-automotive systems. Costing models are thorough covering all elements of total production cost."





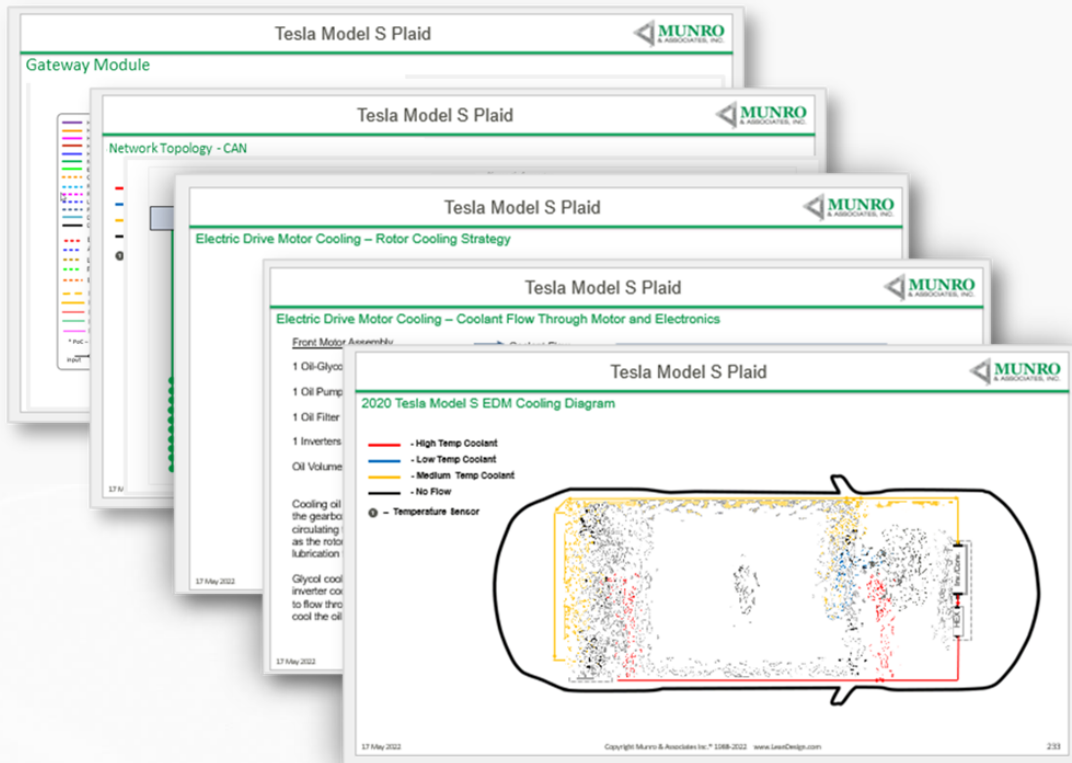
COSTED BILL OF MATERIAL

- The Summary Costed Bill of Material (CBOM) is a consolidated view of the information presented in the complete vehicle report or an individually purchased Zone report.
- The CBOM is in an indented format and includes:
 - Part name
 - Material
 - Supplier (as available)
 - Total Cost
 - Weight
 - Quantity
 - Total Weight



ELECTRICAL AND COOLING TOPOLOGIES

- Diagrams include electrical and electronic component locations, HV and LV wire harness layouts, connection points, touchscreen user interface screenshots, and hydraulic brake system topology.
- Cooling diagrams illustrate all cooling lines and connections for coolant and refrigeration fluids. Both heating and cooling circuits are included.
- Selected topologies are presented in *Zone 2-Controlling Electronics*, *Zone 4-Powertrain & Battery Pack*, and duplicated in the Focused Reports as appropriate.

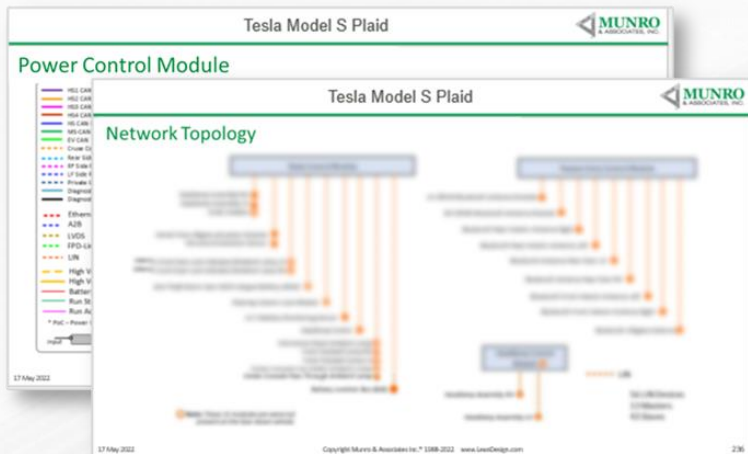




FOCUSED COST REPORTS

For those interested in specific aspects of the Tesla Model S Plaid, focused cost reports are sold separately:

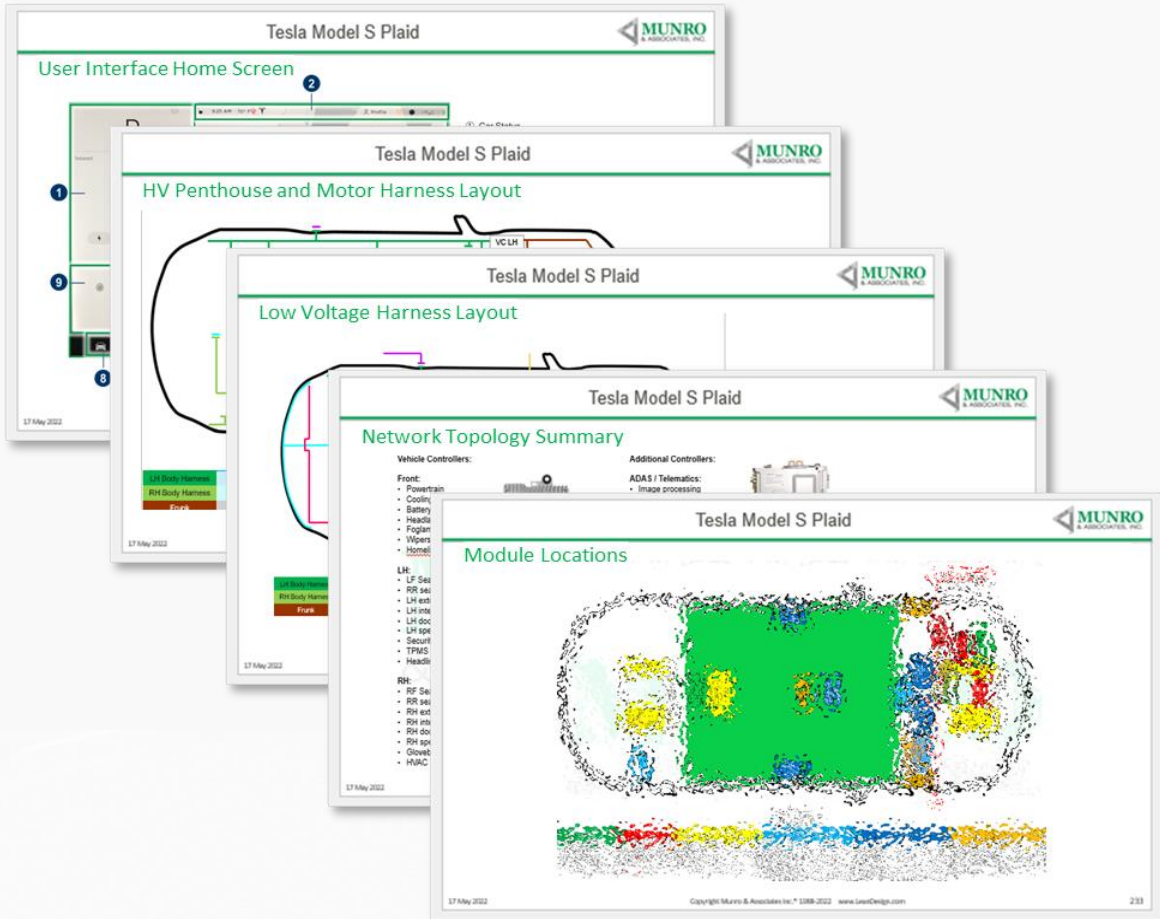
- **Electrical and Electronics (E/E) Assessment**
 - Includes selections from Zones 1-4, including Electrical Topology, Communication Architecture and ECU details.
 - The report outlines the vehicle’s entire electrical system, including part names, materials, suppliers (as available,) weights, photographs, Eye-Catching Features and estimated costs for all high- and low-voltage components. The report contains the following sections:
 - **Communication Systems:** Networking, Antenna Locations, Over-the-Air (OTA) Updates
 - **ECUs**
 - **Integrated Circuit Summary:** Microcontroller, Memory, and Communication ICs identified by ECU
 - **Components by Function:** Antennas, Sensors, Switches, Actuators, Motors, Lighting
 - **Power Distribution & Wiring:** Fusing, Harness Diagrams, Connector Summary





FOCUSED COST REPORTS

- **Electrical Topologies - Low and High Voltage**
 - This report includes electrical and electronic component location, major HV and LV wire harness layouts, connection points and touchscreen user interface screenshots.





FOCUSED COST REPORTS

- **Electric Drive Module (EDM)**
 - The Electric Drive Module (EDM) cost assessment includes the Front Motor, Rear Motor, Inverter, Front Gear Box, Rear Gear Box, and several technical details of the motor design.

Tesla Model S Plaid

Electric Drive Motor Cooling – Rotor Cooling Strategy

Tesla Model S Plaid

Electric Drive Motor Cooling – Coolant Flow Through Motor and Electronics

Front Motor Assembly

- 1 Oil-Glycol Heat Exchanger
- 1 Oil Pump
- 1 Oil Filter
- 1 Inverters

Oil Volume: 1.107 L

Coolant Flow
Oil Flow
Oil Pump

Cooling oil circuit is contained within the gearbox and motor housing, circulating through an oil jacket as well as the rotor and stator while providing lubrication for the gearbox

Glycol coolant removes heat from the inverter cooling fin array then proceeds to flow through the heat exchanger to cool the oil circulating inside the EDM

17 May 2022

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234



FOCUSED COST REPORTS

- Thermal Systems (Cooling & Heating)

- Cost and description of associated thermal system components. Heat exchangers, coolant and AC tubing, cold plates, heat pump, AC compressor, etc..
- Includes coolant tube diagram(s), flow diagram, AC diagram and flow paths for all control valves.
- Electrical diagrams showcase the following components: heat pump (solenoids / sensors / pumps), cabin sensors, component temperature sensors (ADAS, motors, batteries etc.), and network communications

Tesla Model S Plaid
Electric Drive Motor Cooling – Rotor Cooling Strategy

Tesla Model S Plaid
Electric Drive Motor Cooling – Coolant Flow Through Motor and Electronics

Tesla Model S Plaid
2020 Tesla Model S EDM Cooling Diagram

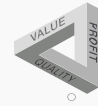


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REPORT DELIVERY

- All reports and accompanying deliverables are made available for easy access through a secure File Transfer Protocol (FTP) site.
- A user-friendly PDF format ensures ease of viewing, sharing, and printing.
- The large reports feature a linked table of contents, allowing users to easily navigate the report contents and quickly locate specific data.



FREQUENTLY ASKED QUESTIONS

- **Were any OEMs involved in the study?**

No. Neither Tesla nor any supplier's quoted costs were used in this study.

- **Is there any Tesla proprietary information in this report?**

No. All data was developed through Munro's proven methodologies, obtained by analyzing Munro's purchased production-version Model S Plaid.

- **Are the components costed using country specific costing centers?**

Yes. Munro uses country-specific labor rates and working patterns, factory floor costs, utility rates, and loan interest rates.

- **Is this a Costing or Pricing report?**

This is a Costing Report. Pricing has too many variables.

- **How can I receive more details on the contents of the reports?**

Questions regarding report contents should be sent to reports@leandesign.com Munro will respond with clarification, and if necessary, meet virtually to discuss and review. Complex and/or detailed requests may require additional consulting fees.

- **Are Sample reports available?**

Sample reports are available. Please contact reports@leandesign.com

Note: Some data may be redacted.