Electric Vehicle Load Calculation In ETAP Software For Selection of Protection System

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Abstract- *The design of an internal electrical protection system in an electric vehicle safeguards its components and wiring from overcurrent, overvoltage, and electrical faults. Key steps in designing this system using ETAP software involve identifying critical components, assigning protective devices (like fuses or circuit breakers). Testing includes simulating various fault conditions to ensure device functionality.*

Keywords- Electric Vehicle Protection, Electric Vehicle Simulation, Etap Simulation, Etap Software.

I. INTRODUCTION

Electric vehicles (EVs) are gaining popularity and being actively developed. To ensure safe operation, EVs require an effective internal electrical protection system to address issues like under voltage, overload, and overcurrent. This post provides insights into the design of an Internal Electrical Protection System (IEPS) for EVs using ETAP software. It focuses on "Electrical DC Protection" and highlights the advantages of EVs such as zero emissions, low maintenance, and cost-efficiency. The project emphasizes the design of an internal electrical protection system within ETAP software to prevent short circuits between the battery, charger, and other components. Calculations are based on direct current (DC). This study aims to determine the optimal design for adequate protection of the power source and equipment components, identify potential damages during operation, and propose preventive measures. The DC short circuit protection system includes hardware like a battery charger, power converter, and circuit protection devices. Simulation results demonstrate a well-performing design with superior voltage regulation and safety against battery pack faults during charging.

II. CALCULATION

For Battery Calculation,

$$Isc = K * (1 \text{ min Amp}) * String \ldots\ldots\ldots\ldots (1)$$

$$Voc = (0.84 + Specific\ Gravity) + (Tmax - 25) * 0.0003 \ldots\ldots\ldots (2)$$

For Motor Calculation,

$$Full\ Load\ Ampere = (kW * 1000) / (V * Eff.) \ldots.(3)$$

III. SIMULATION MODEL WITH ETAP SOFTWARE

This Model is developed in Etap Software to determine Maximum and minimum Current drawn in the system. Under Different condition we will get different types of Current output.

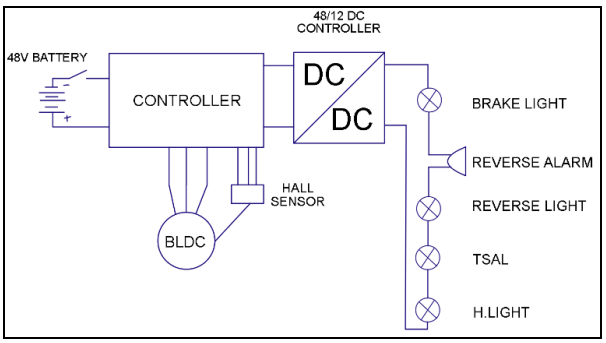

Fig. 1.Basic component used in Electric Vehicle system

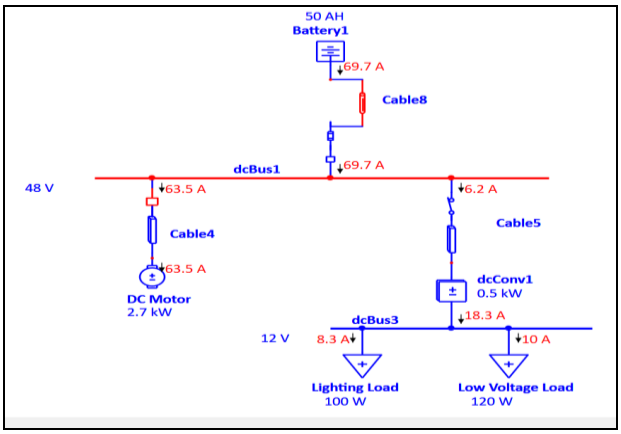

Fig. 2. DC Load Flow Analysis of EV at Continuous Load.

Fig. 1 shows the Basic structure of electric vehicle design and Fig. 2 shows the DC load flow of the system in the

model through which we can analysis the current flowing through bus and basic requirement of the current. Bus load is 69.7 A.

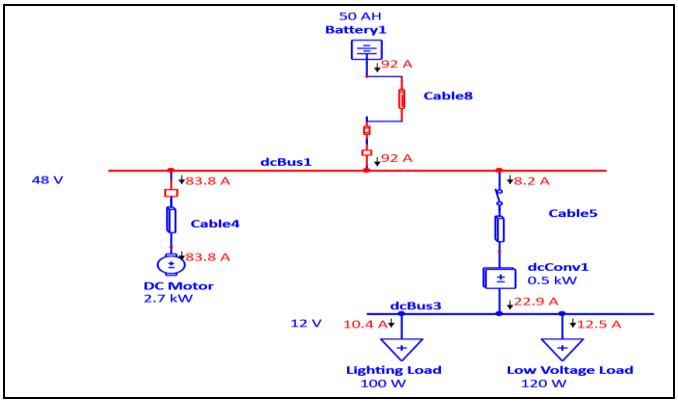

Fig.3. DC Load Flow Analysis of EV at Minimum Bus Maximum Diversity Factor.

In Fig. 3, Here we get maximum current passing through the bus bar, which will help to choose the correct bus bar and other parameters. Maximum Load at bus is 92 Ampere which is distributed with 83.8 Ampere with DC motor load and 8.2 Ampere with low voltage load.

IV. CONCLUSION

Developing a robust internal electrical protection system for electric vehicles using ETAP software is a complex but indispensable endeavor. This system provides vital safeguarding for the vehicle's electrical components and wiring against potential damage arising from overcurrent, overvoltage, and electrical faults. By identifying critical components, assigning protective devices, and configuring trip characteristics, effective protection is ensured. Thorough testing through fault simulations is imperative to validate the system's functionality.

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