# CONSTRUCTIVE FEATURES ENERGY SUPPLY SYSTEM NISSAN LEAF

## A. Dzyubenko, assistant professor, cand. eng. sc., I. Zelenchuk, student, KhHNADU

*Annotation.* The paper deals with the basic elements of an electric Nissan Leaf high-voltage battery. *The principle of the Li-ion controller and sensors used has been analyzed.* 

**Keywords**: electric car, Nissan Leaf, Li-ion battery, ccurrent sensors, high voltage battery, power supply system.

# КОНСТРУКТИВНА ОСОБЛИВІСТЬ СИСТЕМИ ЖИВЛЕННЯ NISSAN LEAF

## О.А. Дзюбенко доцент, к.т.н., І.Д. Зеленчук, студент, ХНАДУ

**Анотація.** Розглянуто основні елементи високовольтної батареї електромобіля Nissan Leaf. Проаналізовано принцип роботи Li-ion контролера та датчиків периферійної обв'язки.

**Ключові слова:** електромобіль, Nissan Leaf, Li-ion акумулятор, датчик струму, високовольтна батарея, система електропостачання.

# КОНСТРУКТИВНАЯ ОСОБЕННОСТЬ СИСТЕМЫ ПИТАНИЯ NISSAN LEAF

### А.А. Дзюбенко доцент, к.т.н., И.Д. Зеленчук, студент, ХНАДУ

Аннотация. Рассмотрено основные элементы высоковольтной батареи электромобиля Nissan Leaf. Проанализировано принцип работы Li-ion контролера и датчиков периферийной обвязки.

**Ключевые слова:** электромобиль, Nissan Leaf, Li-ion аккумулятор, датчик тока, высоковольтная батарея, система электропитания.

#### Introduction

The Nissan Leaf electric car is very popular and accessible today. About 200 000 of such modern vehicles one can see in city streets and country roads in Europe, Japan and North America. In recent years, Nissan can be purchased in Ukraine. The engineers who produced the Leaf sought to make a full electric vehicle not inferior to a gasoline-engined conventional car. Nissan has opened the door to a new mobile era with zero emissions.

## The objective of the article

The objective of the article aim is to analyze the

structural feature of the high-voltage battery and to consider the principle of Li-ion controller and sensors used for monitoring battery state.

### Presenting the main material

Li-ion batteries have a high energy density, which means that the battery can store more energy than the nickel-metal hydride (NiMh), nickel-cadmium (NiCd), Lead Acid batteries of the same volume. It follows that the battery with the same amount of electricity can be made smaller, so the battery Li-ion ideally suits to be the battery in the electric vehicle as it is compact and light weighted [2]. The Nissan Leaf uses Li-ion rechargeable battery of nominal capacity of 24-30 kWh [1]. The battery is located under the car floor (Fig 1). The battery itself is composed of Li-ion battery (2,3), safety current sensor (4), temperature sensor and controller (1) (Fig. 2).

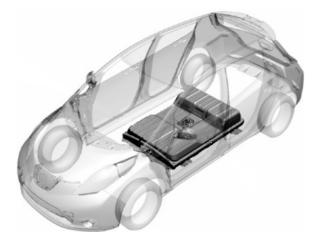


Fig. 1. Layout of high-voltage battery

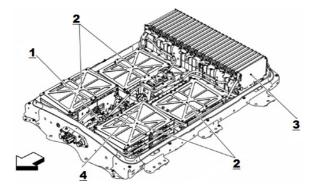


Fig. 2. Unit pack layout

Li-ion battery consists of 48 modules placed in the middle of the battery casing (Fig. 2). The module itself is assembled from four li-ion elements combined in one module (Fig. 3).

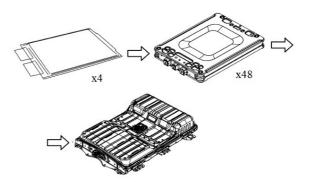


Fig. 2. Combining battery sections

A module consists of two parallel-connected cells placed in series. The Li-ion battery has 48 modules placed in series in total. Ninety-six parallel-connected cell pairs are connected in series providing total battery voltage 317 V and the voltage of a single cell is 3.200-3.400 mV (Fig. 4,5).

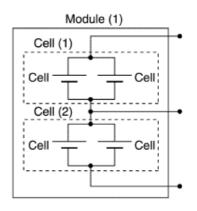


Fig. 3.Connecting Li-ion items

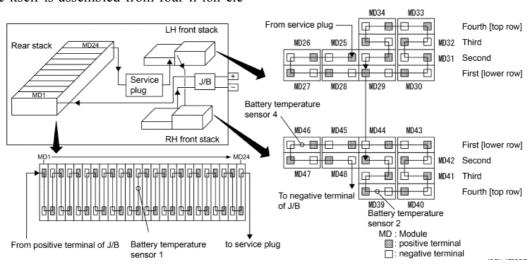


Fig. 4.The exterior module

In order to control the temperature condition of the battery it has two sensors. Two sensors were located in front of the battery and one at the rear, which allows monitoring the temperature. As a sensor a thermistor is used, with the resistance varying according to temperature changes. The thermistor electrical resistance decreases with increasing temperature, and by this dependence the controller determines the overall temperature of the battery (Fig. 6).

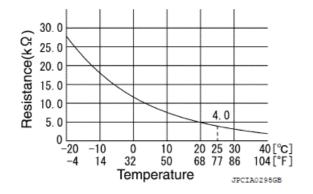


Fig. 6.Battery temperature sensor characteristics

The sensor a measure the current charge / discharge that occurs in lithium-ion battery and transmits a signal to the controller power li-ion battery. Li-ion battery controller (LBC) measures remaining battery level according to charge/discharge current and sends the data to VCM. (Fig.7).

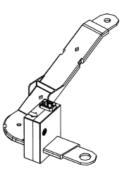


Fig. 7.Current sensors

Li-ion battery controller is the core pack of control. LBC monitors the battery at any time and sends the information to the control module vehicle (VCM) by means of communication system.

The controller monitors the battery state and transmits the information signal about charge / discharge to VCM, to prevent strain on the discharge or excessive temperature rise in the battery, or over loading. When an error occurs, immediate signal is sent to the VCM, which turns off system main relay to interrupt the discharge / charge. It maintains optimum battery charge function with constant power control module to prevent the reduction of capacity on an item caused by fluctuations in the power module. It detects the state of insulation resistance of detection of insulation resistance between the high and low voltage, and transmits the result to VCM. (Fig. 8) [3].

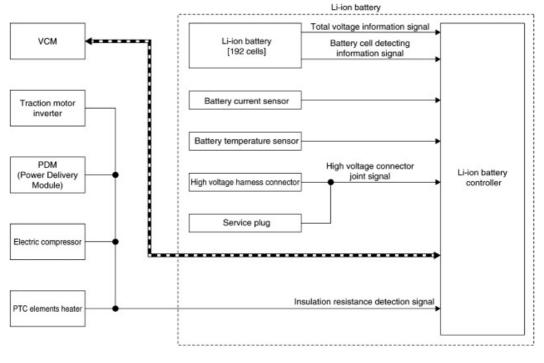


Fig.8. Communication controller

## Conclusion

Electric vehicle battery systems require high characteristics; they must have satisfactory capacity to absorb and release energy over a wide dynamic mode, drive mode and recovery. The concepts of modern electric vehicles are directed at reducing CO2 and harmful emissions. High voltage power supply system of electric Nissan Leaf fully satisfies the performance, safety and durability of the modules that are critical to the performance of the vehicle.

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Reviewer: O.V. Bazhynov, professor, Ph.D., KhNAHU

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