

# SOLUTIONS TECH BRIEF

Technical solutions on circuit protection from Littelfuse, Inc.

## Circuit Protection of the 42V Automotive Electrical System

To solve many of the challenges facing vehicle electrical systems, and to prepare for increased power demands and ever-greater fuel economy quests, the automotive industry is currently developing a high voltage 42V electrical system. Littelfuse has been working directly with the automotive industry in developing its high voltage fuse products to meet the needs of the 42V vehicle electrical system.

The traditional voltage of vehicle electrical systems has remained at 14 volts, but this starts to change in 2002 when the auto industry will move toward the adoption of a 42-volt system. North American and European automakers have generally agreed upon the 14V/42V standard for vehicle electrical systems.

Littelfuse, as the leader in the circuit protection industry, is working closely with major automakers and wire harness suppliers to develop and establish new standards of circuit protection for upcoming high voltage 42V system requirements. Littelfuse has developed a new blade fuse series to ensure safe opening characteristics and predictable time/current characteristics for the high voltage requirement. Also Littelfuse is developing high current circuit protection products with various terminal designs for the high voltage system.

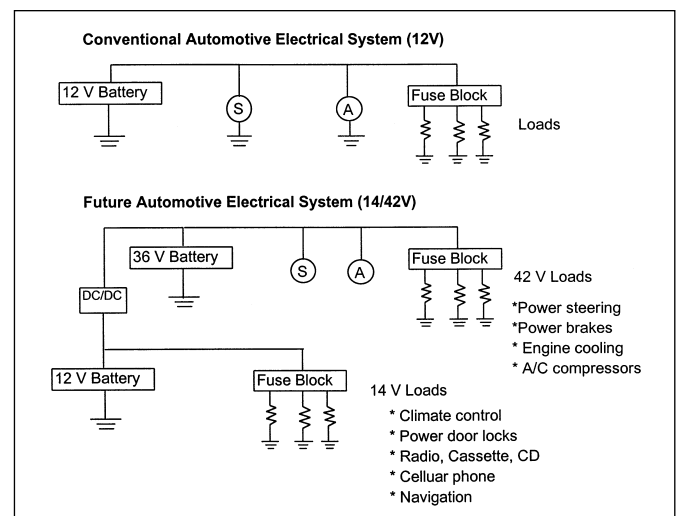
There are severe dangers involved with using a fuse designed for a 12V system in a 42V system. These dangers include severe arcing, housing rupture, expelling of molten material, and low insulation resistance – all of which can result in severe damage to the vehicle wiring and the fuse block, or even a thermal incident – FIRE!

The power demands in vehicles continue to grow, and the need for more electrical power and fuel economy are the driving forces behind the move to the high voltage system. The increased demand is due to the conversion of mechanical applications into electromechanical alternatives such as steering systems, braking systems and suspension systems for improved performance, as well as adding of new safety and communication features.

The continuous electrical power which will be needed in the year 2005 is estimated to be in the range of 3000W to 7000W; and the traditional 14V electrical system in today's car is rated at approximately 800W to 1500W continuous load. The current 12V DC system cannot be adequately upgraded to handle these increasing electrical loads, and present day automotive electrical systems have reached the limit of their efficiency; it would cost too much, weigh too much, and be too inefficient.

### The Transition System: Dual Voltage

For the transition to the new 14/42 volt system, vehicles will have dual voltage batteries for 12 volts and 36 volts. The transition period is expected to be three to five years while cost-effective battery technologies are optimized for the new system. The split voltage electrical system provides 42 volts for high power applications such as power steering and power brakes, and a 14-volt system for applications with low power loads such as electronic accessories.



## Advantages of the High Voltage System

The high voltage electrical system has many advantages. It enables better management of the increasing power requirements of auto electrical systems while providing greater efficiency in energy management.

Advantages include:

- Reduced current
- Improved fuel efficiency
- Downsized wiring
- Reduced mass and volume
- Lower electrical system cost
- Lower vehicle noise, vibration and harshness
- Improved system stability
- Incorporation of advanced technologies

## Requirements for High Voltage Fuses

There are several requirements unique to the high voltage system. Littelfuse is addressing these requirements with the development of its new line of high voltage fuses.

Suggested interrupting capacity:

- 1500A @ 55VDC for main circuit protection
- 800A @ 55VDC for all branch circuit protection

## High Voltage Fuse Safety Features

Littelfuse's new MINI-HV and JCASE high voltage fuses will offer rejection features to provide increased safety. Traditional automotive fuses are rated at 32 volts, and use in 42 volts systems could cause problems ranging from severe damage to the vehicle wiring and components to extreme hazards such as thermal incidents.

To limit these dangers, a rejection feature is required to prevent a fuse of a lower voltage rating (32V) from being inserted in a circuit designed to handle a higher voltage (55V). The Littelfuse new high voltage blade fuse and JCASE cartridge fuse will include unique rejection features, so devices designed for the 42V system will not be replaced with devices designed for the 12V system.

## Setting Industry Standards

The specifications of the high voltage and dual voltage electrical systems are set by the Consortium on Advanced Automotive Electrical and Electronic Components and Systems. The Consortium is an industry group working with the MIT Laboratory for Electromagnetic and Electronic Systems to research advanced automotive electrical and electronic systems and exchange ideas and information on the future of these systems. Started by Mercedes-Benz and Ford, the MIT Consortium has participants throughout the automotive industry including AMP, BMW, Bosch, Delphi-Packard, Dow Chemical, Eaton, GM, Honda, Motorola, Renault, Siemens, UTA, Volvo and Yazaki. Many of these companies are Littelfuse customers, and Littelfuse has been working directly with them to provide the first series of fuses that meet the special needs of the high voltage system.

## MINI-HV High Voltage Blade Fuse

The first high voltage fuse to be introduced by Littelfuse will be the new MINI®-HV blade fuse series. The MINI-HV will be a modified version of the Littelfuse MINIR Fuse, the circuit protection standard for automotive original equipment manufacturers worldwide. Available ratings are 3A, 4A, 5A, 7.5A, 10A, 15A and 20A. These fuses meet the new 55VDC/800A short-circuit requirement, as well as all overload requirements.

## NEW JCASE High Voltage Cartridge Fuse

The new JCASE cartridge fuse will be introduced by Littelfuse for protection of medium current circuits. It will be a modified version of the current Littelfuse JCASE cartridge fuse, a high current, time delay fuse with female termination. This new JCASE will be available in ratings from 20A to 60A.

## MIDI-HV High Voltage Bolt-Down Fuse

For high-current applications in the high voltage system, the MIDI-HV will be available in ratings from 60A-150A. The MIDI-HV is a bolt-on fuse for wiring harness protection in applications such as headlights, alternators, heater controls and anti-lock brakes. It is a modified version of the Littelfuse MIDI Fuse which provides a solid bolt-down connection for high-current applications.

## Littelfuse CablePro® and MEGA® Fuses

Littelfuse Cable Protectors and MEGA fuses will satisfy the requirements of the high voltage system at 55 VDC and 1500 A.



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