



An ISO 9001:2000 Registered Company

Technical Service Bulletin

TSB # T2008-02 09/04/08

Product: All products manufactured by InterMotive Vehicle Controls.

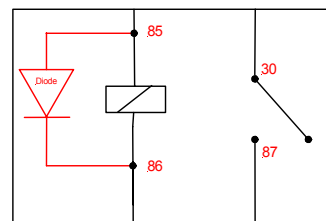
Vehicle: All vehicles.

Issue: The use of a relay without diode clamped Transient Voltage Suppression (TVS) can cause very large voltage spikes when the relay coil is deactivated. These voltage spikes may damage or cause intermittent behavior of on-board vehicle electronics. It is recommended that only relays with diode clamped coils be used. Resistors and other methods of clamping are not as effective at eliminating voltage spikes and are not recommended.

Action: Install only relays with diode clamped Transient Voltage Suppression on vehicles to improve the vehicle's electronic system reliability. Care must be taken to observe proper polarity when connecting relay coils which are diode clamped. The diode "arrow" or "cathode line" should be towards the connected positive voltage.

Additional information: The coil of a relay is an inductor which can create large voltage spikes when it's current is shut off (think of an spark plug ignition coil). The collapsing magnetic field will send a large voltage spike back into **all** connected circuits which can propagate throughout the vehicle's electronics, causing damage and/or intermittent behavior. Relays are readily available with a clamping diode, which will prevent high transient voltages from damaging solid state semiconductor devices which are increasingly used in modern vehicles. Relays with **resistor** Transient Voltage Suppression are not as effective in clamping high voltages, and are therefore not recommended. Instead, use **diode** clamped relays. Most relays have a printed diagram on the case, which indicates if the relay has diode Transient Voltage Suppression.

A relay with diode Transient Voltage Suppression (shown in red)



SAE recommendation:

www.sae-a.com.au/fsae/downloads/newsletters/fsae_09_2005.pdf

“If you are using relays in the circuit to switch fans etc by grounding the relay trigger circuit through the ECU, ***make sure you use a protected relay*** (Inbuilt resistor, diode or capacitor as appropriate) in order to protect the switching circuit in the ECU.” (*Emphasis added*)

Ford recommendation:

<https://www.fleet.ford.com/TRUCKBBAS/non-html/Q130.pdf>

“Purpose: This bulletin is an attempt to provide a source of general ***best practices*** for modifications and/or interfacing with any Ford Truck electrical system....

All electrical devices that have inductive loads (i.e. electrical motors, ***relay coils***, PTO clutch pump clutches, etc.) ***must*** be provided with isolation discharge paths for the reverse voltage generated when power is disconnected from the device. The disconnection could be an intentional disconnection (i.e. a switch, relay, timer, etc.) or an unintentional disconnection (i.e. a blown fuse, damage to a device in series, disconnection of a wiring harness connector, etc.). Either case will cause ***a large reverse voltage pulse*** of very short duration to be sent through any connected electrical conductor. The short duration precludes the use of fuses as protective devices. Additionally, any connection between a device with an inductive load and the OEM electrical system should be isolated with a relay. Contact the manufacturer of the electrical device for proper instructions to add a discharge path to their device.” (*Emphasis added*)

Relay manufacturer recommendation:

http://relays.tycoelectronics.com/appnotes/app_pdfs/13c3311.pdf

“The Need for Transient Suppression

When an electromechanical relay is de-energized rapidly by a mechanical switch or semiconductor, the collapsing magnetic field produces a substantial voltage transient in its effort to disperse the stored energy and oppose the sudden change of current flow. ***A 12VDC relay, for example, may generate a voltage of 1,000 to 1,500 volts during turn-off.*** With the advent of modern electronic systems, this relatively large voltage transient has created EMI, semiconductor breakdown, and switch wear problems for the design engineer. It has thus become common practice to suppress relay coils with other components which limit the peak voltage to a much smaller level.” (*Emphasis added*)

Additional Reading:

<http://www.intermotive.net/Tech%20Tip/Tech%20Tip%20-%20April%2008.pdf>

Technical inquiries – InterMotive Technical Support (530) 346-1801