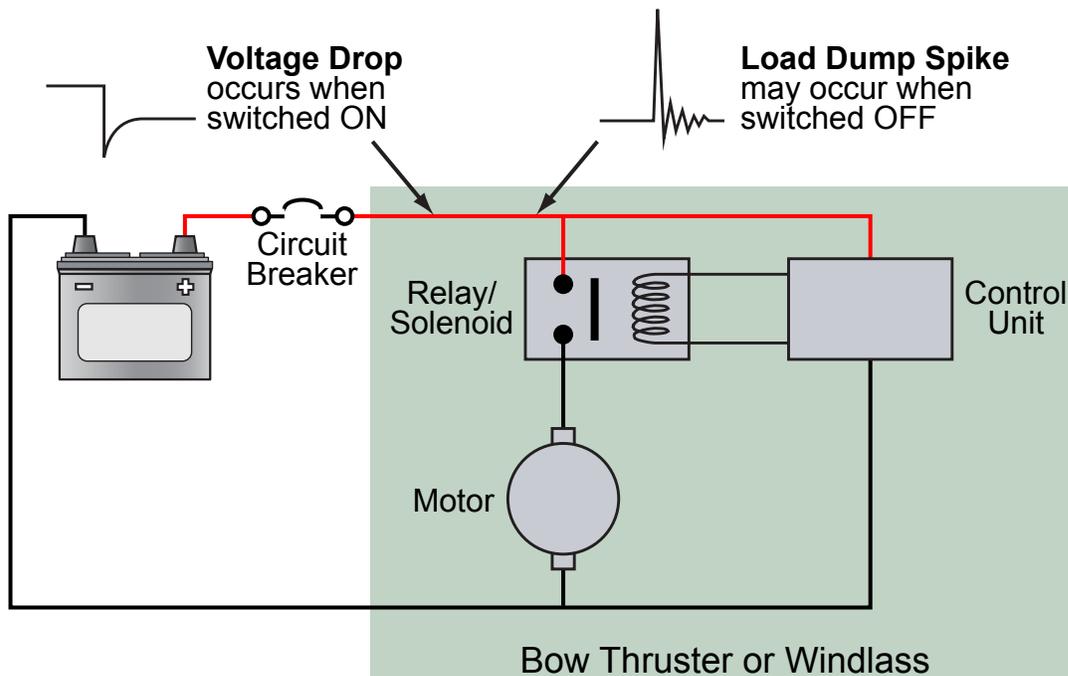


## Technical Brief - Windlass and Bow Thruster Relay Contact Chatter

**Problem** The relay contacts in windlasses and bow thrusters may chatter when they are switched ON and when they are switched OFF. This contact chatter can cause the device to not function, will result in excessive wear, and may cause the contacts to weld together in the ON position possibly leading to extensive damage.

**How they Work** To understand these problems, it is helpful to understand how these devices work. Bow thrusters and windlasses have three basic components: motor, relay, and controller. When switched ON, a signal is sent to the control unit that in turn sends a signal to the relay that closes a switch and activates the motor.



Two events can cause chatter: voltage drop when the circuit is closed, load dump spike when the circuit is opened.

### Voltage Drop

When the thruster or windlass is turned ON, the relay closes and a high inrush of current flows to the motor. This inrush of current causes a drop in the battery voltage, and a voltage drop along the wiring. (This phenomena is especially a problem if the wires to and from the battery are long.) If the relay receives its current from the same wiring as the motor, the voltage supplied to the relay is reduced. If it is reduced below its drop-out level, the relay will release. When it releases, the voltage will again rise because there is no current going to the motor. The recovered voltage will be sufficient to pull the relay contacts back in to start the cycle again. This may occur repeatedly very quickly with the contacts "chattering" open and closed. A long string of opening and closing events will heat up the contacts and may lead to them welding together.

### Load Dump Spike

Another phenomenon that can cause chatter is the voltage spike that occurs in the wiring when current is suddenly interrupted, such as when it is turned OFF. This is sometimes called "load dump spike." This is most likely to occur when the motor is turned OFF while running at high capacity. Load dump spike occurs because energy is stored in the magnetic field around any wire conducting current. This energy can show up as a high voltage spike when a contactor is opened under load. If the voltage spike is big enough, it can cause a control circuit, especially an electronic one, to re-close the contactor.

### Solution

A possible solution is to provide an independent wiring path, both positive and negative, from the control circuit to the battery. Providing power to the relay and control unit circuit from independent wiring removes the influence of the voltage drop from the control unit. Appropriately-sized thin wire and an in-line fuse are sufficient for the control unit circuit.

