

## **"BYPASS/1A Circuits"**

Hopefully everyone reading this month's article will know generally what is meant by the term "bypass". Most lift trucks incorporate a circuit to achieve the bypass function. We have all heard different names for the same function; ie: 1A, bypass, M speed and shorting contactor ...where did the OEM's come up with some of these names? This month I will try to eliminate some of the mysteries surrounding the "bypass" circuit.

Bypass typically involves a contactor, microswitch (FS2) and some form of adjustable timer circuit. The bypass contactor, when energized, does exactly what it's name implies. Once the bypass contactor energizes it bypasses the entire SCR system and applies full battery voltage across the motor. This provides top vehicle speed, torque and efficiency, only the addition of field weakening will give you a faster speed. Since the SCR system is bypassed this also gives the panel a short relief time to cool down.

In a typical early style General Electric system the bypass contactor coil, positive side, is connected to positive battery voltage. The negative side is connected to a timer circuit, either within the main control card or an auxiliary timer card used specifically for bypass operation.

Before bypass is called for, by the bypass microswitch, the timer circuit is shut off so the bypass contactor will not energize during the shut off period. If we were to measure the coil voltage, with reference to battery negative, we would measure battery positive on both sides of the coil. Whenever you measure the same voltage on both sides of any contactor coil, this means that there is no current through the coil. Without current flowing through the coil, it will not energize. To energize the bypass contactor we must accelerate to top speed and close the bypass microswitch (FS2-Foot Switch #2).

Before the bypass microswitch is closed the timer circuit is held in limbo, waiting for the command to start. The bypass microswitch, when closed, gives life and battery negative to the timer circuit. The length of time between microswitch closure and actual bypass contactor closure is determined by the timer circuit potentiometer, usually adjustable from 1 second to 5 seconds or more, depending on the system. When the timer circuit

reaches the end of its setting the bypass contactor coil negative side is pulled to battery negative. This allows current to flow through the contactor coil, which builds a magnetic field and energizes the bypass contactor. Any coil is like an electro-magnet; when enough current flows through the coil the magnetic field builds and pulls in the contactor arm. Now, when you measure the voltage at the coil, with reference to battery negative, you should read 0 volts on the negative side and full battery voltage on the positive side. This tells us that we have full battery voltage dropped across the coil and maximum current flowing through it to energize the contactor.

There are many different features associated with the bypass circuit, depending on the system. Demand pickup, thermal hold-off, plugging hold-off, bypass drop-out and current hold-off hold-off are all features that may be seen with the bypass circuit. I seem to get the most questions regarding the demand pick-up. This feature is used on the General Electric EV1 system. The demand pick-up automatically energizes the bypass contactor without the bypass microswitch closed. Once the vehicle attains 80 to 85 percent speed the bypass contactor will energize without any delay. This feature can be confusing when running a vehicle off the ground. Unloaded the vehicle will increase speed rapidly and automatically energize the bypass contactor with the demand feature. It appears as though the bypass timer has no adjustment when actually the timer is not being used because the demand pick-up will override the timed pick-up mode. On certain EV1 control cards this feature may be eliminated either permanently or for the timed adjustment. All General Electric "H" series control cards have the feature to eliminate demand bypass by connecting a jumper from R9 to R4 (or battery negative). All Flight Systems EV1 control cards either "H" or "E" series will eliminate the demand bypass by connecting a jumper from L8 to R4 (or battery negative).