DC Motor Testing & In-rush Current

Nowadays, DC motors can be utilized in a wide variety of ways in today's vehicles. How they are applied is based on what they were designed to do. Some are turned on and left on for long periods of time as seen with cooling fans, heater blowers, air pumps, etc. Others are turned on but not left running like with power windows, power door locks, and starter motors. Even with the advent of AC motors, it is clear that DC motor systems are here to stay for the foreseeable future. DC motors tend to have a number of advantages including a higher starting torque, quick starting and stopping, variable speeds with voltage input, and the fact that they are easier and cheaper to control than AC motors.

Demand is quickly growing for motors that support solar, marine, and portable equipment, which DC technology readily supports. Motor companies continue to invest into R&D and state-of-the-art testing systems with the goal of simultaneously reducing maintenance costs and extending motor life.

Challenge

A problem often encountered when testing DC motors are the consequences of extremely high in-rush currents being generated when turned on. Even seemingly small DC motors can generate suprisingly high inrush current relative to their rated power. Small DC motors can have an initial in-rush current of up to 300% of their rated operating current. Medium DC motors can have an initial in-rush current of 400% of their rated operating current. Large DC motors can even have an initial in-rush current from 500 to 700% of their rated current! This initial in-rush current can have a negative impact on the current path connections and can interfere with various DC motor tests, potentially damaging the DUT over time and eventually destroying it. In addition to the extremely high cost of replacing damaged DUT's, the extremely high in-rush currents in DC motor tests can also have the added effect of triggering OCP (over current protection) in the power supplies used for testing, which can be extremely inconvenient and waste countless hours of precious time. High in-rush current values can arc across and pit connections in any current path containing a motor which will, over time, develop excessive resistance. This added resistance will result in increased heat, which will end up generating even more resistance. The end result is an overall drop in voltage required to overcome the resistance encountered in the current path. These changes in values caused by excess in-rush current can skew results in DC motor testing and result in a much shorter life span for the DUT.

Solution

Programmable DC power supplies like the PWR-01 can be a cost-effective, convenient solution to the in-rush current dilemma often seen in DC motor testing. The PWR-01 has a "soft-start" feature that allows the operator to limit the amount of in-rush current generated when turning on the device, resulting in a smooth rise in current that is much gentler on the DUT and useful for preventing OCP from being activated on your power supply. The soft-start circuit limits the amount of current being generated for a specified amount of time (0.05 - 10 seconds) until it reaches the current cap where current flow will no longer be restricted and will be output at a normal rate. This function has been praised by major automotive companies as it makes motor testing much easier and more convenient while allowing them to conduct tests for a much longer period without replacing the DUT.

Summary

The soft-start function included on the PWR-01 programmable DC power supply is a cost-effective solution for various DC motor tests that generate massive amounts of in-rush current. A single PWR-01 unit can increase the lifespan of a DUT by a very large margin and greatly reduce the possibility of skewing test results due to increased resistance and voltage drop.

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