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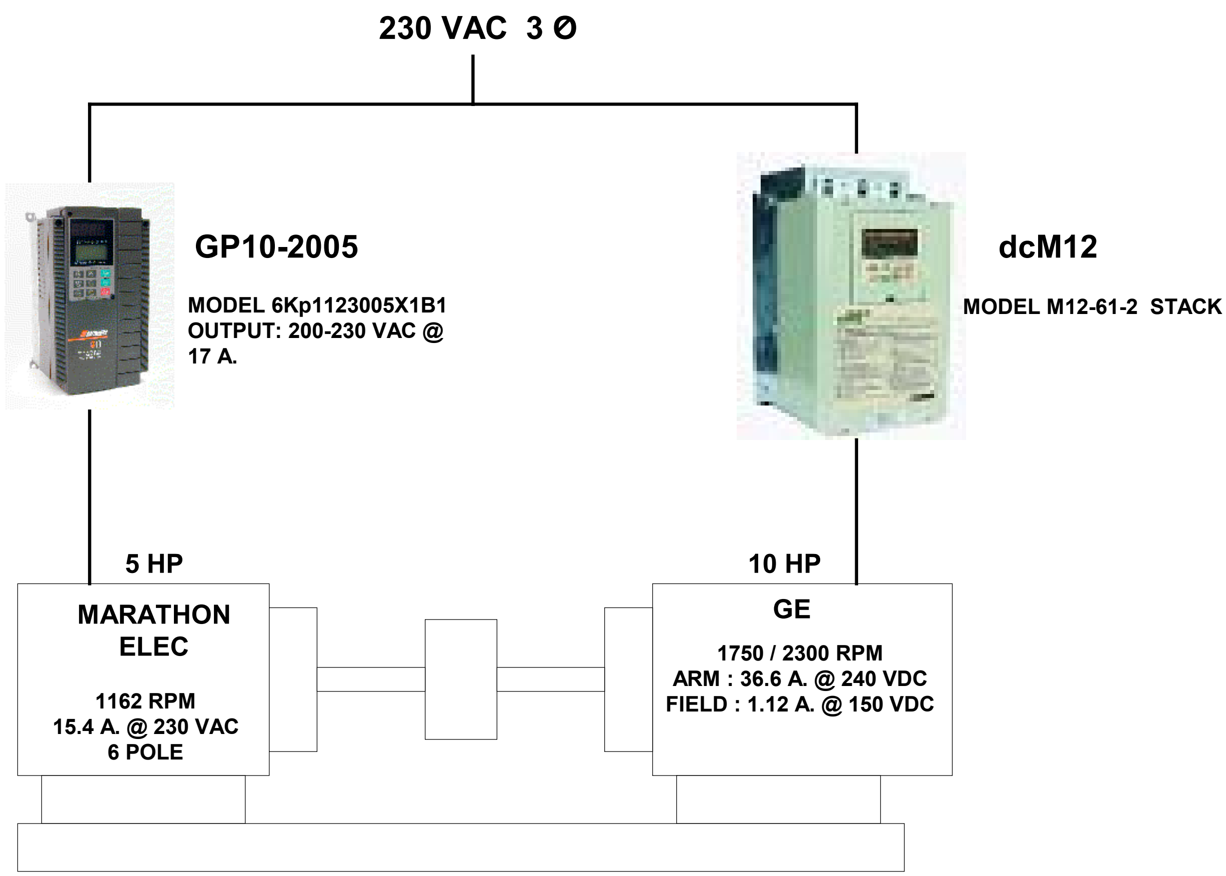
GP10 SPEED REGULATION



TEST SET-UP

OVERVIEW

A request was made of Saftronics to show the speed regulation was really .2% with a dynamically changing load. The above test set up was utilized, first we need to understand what speed regulation is. Speed regulation is the motor speed change between minimum load and full-load torque from a set speed, expressed as a percentage of the full-load motor speed. This change is measured after all transient disturbances, due to load change have terminated. The time required to recover and maintain speed within the specified regulation tolerance after a specified change in load is called the Transient Response Time. This performance is dependent on load inertia, motor inertia, load friction, etc. Two tests were conducted, one with a load added to the motor and the other with an overhauling load to the motor.

TEST PROCEDURE 1

Using the test set-up, the inverter operates the AC motor at 60 Hz. The DC motor has a 50V/1000RPM DC tach attached to it as a feedback device. An oscilloscope was connected to the analog output of the inverter, terminal FMA for current(bottom trace) and DC volt meter was across the DC tach output(top trace). The oscilloscope signal shows when the load was added to the motor and the reaction of the AC motor through the attached DC tach(common shaft).

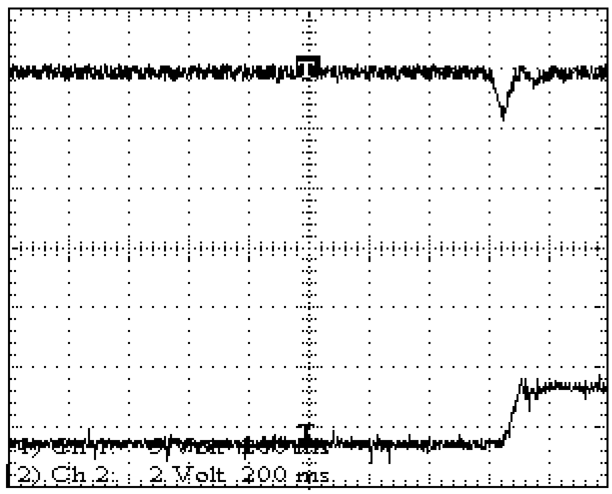


Fig 1

RESULTS 1

As shown in the above waveforms the Transient Response time is approximately 80-100ms from no-load to full-load speed. The voltmeter measured the DC tach(50V/1000RPM) voltages which went from 60.8 to 60.7 no load to full load. In RPM this speed transition was from 1216RPM to 1214RPM. To calculate the speed regulation the following formula should be used.

$$\%\ \text{Speed} = \frac{(\text{No-Load Speed}) - (\text{Full-load Speed})}{(\text{Motor Rated Speed})} \times 100$$

In the above tests the formula would work like this.

$$.167\% = \frac{1216\text{RPM} - 1214\text{RPM}}{1200} \times 100$$

TEST PROCEDURE 2

In this test a drive was connected per the test set up, except this time we used the DC drive to overhaul the AC motor and a DB resistor was added to the inverter. The DC drive was set to run the motor at 1284RPM and the AC motor at 1214RPM. The oscilloscope and meter were connected to the same places as in test one. Below shows the waveforms with the top waveform being speed and the bottom being current.

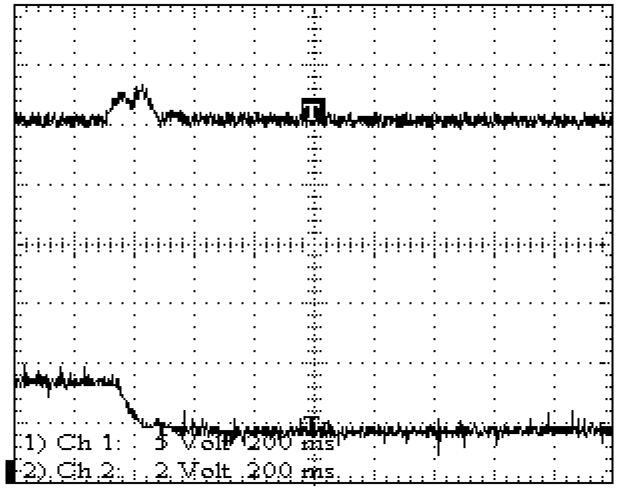


Fig 2

RESULTS 2

As shown in the top waveform(speed) the DC motor tried to take over the AC motor but in approximately 176ms the GP10 drive pulled the AC motor back into set speed. You can also see by the bottom waveform, the current went down now that the DC drive was trying to do all the work and the AC drive was regenerating at this time. The DB resistor was on during this time, with the DC bus voltage staying at about 384V continuous. With the DC voltmeter on the tach signal the DC voltage went from 60.7 Volts to 60.6 volts or 1214RPM to 1212RPM.

Using the formula from above we come to the following conclusion.

$$.167\% = \frac{1214RPM - 1212RPM}{1200} \times 100$$

CONCLUISION

As was shown in both tests the motor stayed well within the .2% speed regulation that is published for the GP10 series inverters. The test simply goes to prove the exception speed regulation of the GP10 with out the use of a feedback device. In the past the only way to achieve tight speed regulation was the addition of a feedback device, which includes addition cost and wiring. With the advancement of dynamic torque vector control the inverter is capable of one of the tightest speed regulation in the industry.