

## **AC/DC MOTOR TEST LAB**

### **OBJECTIVE:**

*The objective of this experiment is to conduct performance tests on AC and DC motors. This is accomplished by determining the efficiencies of an AC motor and a DC motor when operating under the assigned conditions.*

### **EXPERIMENT:**

#### **Apparatus - AC Motor:**

*An AC power supply is connected to an AC motor which drives a DC generator. Power from the DC generator is dissipated in a series combination of a variable resistance and a constant resistance (located under the lab bench). The variable resistance is used to vary the load on the motor (see Figures 1 and 2).*

*The AC motor is mounted on a torque table instrumented with single strain gages located on each of the four support beams that support the motor. These four strain gages are connected to a strain indicator in full-bridge arrangement. The OUTPUT motor torque is determined by measuring the full bridge strain and reading the corresponding torque from a torque/strain calibration curve.*

*AC motor rpm is determined by using a strobe tachometer.*

*A wattmeter and ammeter are mounted on the bench surface to measure INPUT power and current to the motor. A voltmeter is connected across the wattmeter to measure input rms voltage to the motor.*

#### **Apparatus - DC Motor:**

*A power supply is connected to a SCR (silicon-controlled rectifier) which controls the input voltage to the DC motor. The DC motor drives a DC generator. Power from the DC generator is dissipated in a series combination of a variable resistance and parallel network of constant resistances (located under the lab bench). The variable resistance is used to vary the load on the motor (see Figures 1 and 2).*

*The DC motor (like the AC motor) is mounted on a torque table used to measure the OUTPUT motor torque. Motor rpm is determined using a strobe tachometer.*

*A voltmeter and ammeter are mounted on the bench surface to measure INPUT voltage and current to the motor.*

*See Figure 1 for a complete description of apparatus and Figure 2 for the wiring diagrams of the AC and DC motor test setups.*

### **Procedure - AC Motor:**

*The procedure for the AC motor performance test is as follows:*

- The group is to perform one constant speed, variable load test.*
- First calibrate the torque table by both the direct or indirect method as prescribed by the lab instructor(s). Direct calibration method consists of attaching a lever arm to the torque table and suspending several known weights at a prescribed distance to achieve a specific calibration torques. Indirect calibration involves shunting a precision calibration resistor across a designated arm of the full-bridge strain gage arrangement to result in a strain reading equivalent to a factory calibrated torque as specified in the operating manual.*
- Before starting the AC motor make sure switch A is closed and the variable resistance position slider is positioned at 100. Start the motor by closing the AC motor control switch. This initial condition is a minimum load condition on the AC motor.*
- Measure and record the AC motor speed (rpm), strain reading from the torque table (may fluctuate), and the motor input voltage, current and power.*
- Increase the motor load by moving the variable resistance position slider from the 100 position to the zero position. Measure and record data at increments of 5 units on the slider as the load is increased.*

### **Procedure - DC Motor:**

*The procedure for the DC motor performance test is as follows:*

- The group is to perform one constant speed, variable load test.*
- Calibrate the DC motor torque table using both of the methods prescribed by the lab instructor(s). Direct calibration method consists of attaching a lever arm to the torque table and suspending several known weights at a prescribed distance to achieve a specific calibration torques. Indirect calibration involves shunting a precision calibration resistor across a designated arm of the full-bridge strain gage arrangement to result in a strain reading equivalent to a factory calibrated torque as specified in the operating manual.*
- Before starting the DC motor make sure Switch B is closed, Switches 1 and 2 are open and the variable resistance position slider is at 100. Start the motor by closing the DC motor switch located on the SCR speed controller. Adjust the speed control knob until the voltage is 180 volts DC.*

- *Record the DC motor speed, strain reading from torque table, and motor current.*
- *Increase motor load by moving the variable resistance position slider from the 100 position (minimum motor load) towards the zero position. Measure and record data at increments of 10-20 (on the slider) until the maximum load is attained. Maximum load occurs when the variable resistance slider is located at the zero position for a given setting of switch 1 and 2. Repeat the incrementing of the variable load for each combination of the positions of switches 1 and 2. Check the electrical schematic to understand what the positions of switches 1 and 2 accomplish if you are unclear about this.*

## **RESULTS:**

*For the AC motor test:*

- *Calculate the motor output horsepower and motor efficiency.*
- *Graph output motor torque, output horsepower, motor current, and motor efficiency as functions of motor speed.*

*For the DC motor test:*

- *Calculate the motor output horsepower, input motor horsepower, and motor efficiency.*
- *Graph output horsepower, motor current, motor speed, and efficiency as functions of motor torque.*

## **DISCUSSION:**

*Briefly discuss the performance characteristics of the AC and DC motors tested at the conditions specified.*