

DISCLAIMER: These Standard Operating Procedures (SOP's) are for the exclusive use of Navy Public Works Center (PWC) Norfolk. They are promulgated as guidance for their NAVFAC Commands. If intended to be used by other activities, they must be tailored to each activity's particular requirements and must be reviewed/approved by the activity's safety professionals prior to use.

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SOP Title: Meggar Testing of Motors

SOP Number: 75 Elect 08

Written by: Ted Gibson & David Lane Date: 01/ 13/ 96.

Reviewed by: \_\_\_\_\_ Date:    /   /   .

Approved by: \_\_\_\_\_ Date:    /   /   .

**Potential Energy Sources:**

1. Electrical supply (120 Vac, 480 Vac, up to 2500 Vdc).

**Tools Required:** Hard hat, safety shoes, safety glasses, work gloves, flame retardant clothing, insulated tools, multimeter, ammeter, meggar, grounding straps, thermometer (ambient reading), thermometer (surface reading), calculator.

**References:**

1. OSHA 1910.147, The Control of Hazardous Energy (lockout/tagout).
2. PWC 5100.33E Chapter 24, Energy Control Sources.
3. OSHA 1910 Subpart I, Personal Protective Equipment (PPE).
4. PWC 5100.33E Chapter 20, Personal Protective Equipment (PPE).

**Procedures:**

1. Ensure proper PPE is worn [references (3) and (4)].
2. Verify tools are in good working condition.
3. Record the motor rating, manufacturer, and serial number.
4. Record the ambient temperature and the winding temperature.
- 4a. If the motor has RTD's installed in the windings and is currently connected to the RTD display, record the temperature indicated.  
If not and;
  - 4a1. The motor has idle for more than eight hours, assume the winding temperature is the same as the ambient temperature.
  - 4a2. The motor has been run in the previous eight hours, assume the winding temperature is the same as the temperature of the frame plus 20 degrees F.
5. Ground all windings. Verify they are discharged by measuring the discharge current to ground. It should be insignificant (less than 10 milliamperes).
6. Connect the meggar between one winding and ground. Connect the windings not being tested to ground. Apply the test voltage for 10 minutes recording the one minute and 10 minute readings.
  - 6a. The test voltage shall be as follows:
    - 6a1. 115 Vac motors... 1230 Vdc (minimum), not to exceed 2500 Vdc.
    - 6a2. 460 Vac motors... 1920 Vdc (minimum), not to exceed 2500 Vdc.
  - 6b. Repeat Step 6 for the remainder of the windings.
    - 6b1. USE CAUTION when applying grounding straps to windings which have been tested as they are charged and act as capacitors.
    - 6b2. Verify windings are discharged before testing (refer to Step 5).
7. Verify windings are discharged before continuing the test (refer to Step 5).
8. Connect the meggar between two of the windings. Connect the winding not being tested to ground. Apply the test voltage for 10 minutes recording the one minute and 10 minute readings.
  - 8a. Repeat Step 6 for the remainder of the windings.
    - 8a1. USE CAUTION when applying grounding straps to windings which have been tested as they are charged and act as capacitors.

- 8a2. Verify windings are discharged before testing (refer to Step 5).  
 9. Convert the ambient temperature to degrees C by using the following equation.  $\text{Deg C} = 5/9(\text{Deg F} - 32)$ .  
 10. Convert the winding temperature to degrees C using the same equation.  
 11. Convert the measured values of insulation resistance, from Steps 6 and 8, to values normalized to a 40 deg C value by using the following equation.  $40 \text{ deg C Value} = Kt(\text{measured value})$ .

Winding Temp (deg C)	Kt	Winding Temp (deg C)	Kt	Winding Temp (deg C)	Kt
0	0.060				
5	0.085	30	0.490	55	2.80
10	0.110	35	0.670	60	3.80
15	0.115	40	1.00	65	5.50
20	0.120	45	1.10	70	7.60
25	0.350	50	1.90	75	10.20

12. Calculate the polarization index (PI) of the insulation by using the following equation.  $\text{PI} = 10 \text{ min value} / 1 \text{ min value}$ .  
 12a. The following table should be used to evaluate the condition of the motor windings.

PI	Condition	Suggested Action
Less than 1.0	Dangerous	Repair or replace immediately.
1.0 to 2.0	Questionable	Repair or replace as soon as possible.
2.01 to 4.0	Good	
4.01 to 4.8	Excellent	
Above 4.8	Questionable	Repair or replace as soon as possible. Insulation too dry/brittle.