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**NAVY PUBLIC WORKS CENTER  
NORFOLK, VIRGINIA  
UTILITIES DEPARTMENT**

**STANDARD OPERATING PROCEDURE / JOB HAZARD ANALYSIS**

**TITLE**  
**PM UNIT SUBSTATION TRANSFORMER**

**PROCEDURE NUMBER**  
**WC 624 HVE 075**

**SIGNED:** \_\_\_\_\_ **(DATE)**

**APPROVED:** \_\_\_\_\_ **(DATE)**

**SAFETY PROFESSIONAL:** \_\_\_\_\_ **(DATE)**

**MANAGEMENT OFFICIAL:** \_\_\_\_\_ **(DATE)**

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## PM UNIT SUBSTATION TRANSFORMER

**Purpose:**

Procedure to perform preventative maintenance on a unit substation transformer.

**Potential Energy Sources:**

1. 34.5/11.5/4.16 kv primary cables feeding the unit substation
2. Generators if installed at facilities to provide temporary power during the transformer change out.

**Tools and PPE:**

Tools: Hand tools, high voltage tester. PPE: Nomex coveralls, Nomex hood, insulating rubber gloves, insulating rubber sleeves, hard hat, safety shoes, work gloves, safety glasses, and back brace if required by back injury prevention and control program. The class of rubber gloves and sleeves will depend on the exposure voltage as per the following: Class 0 - up to 1,000 volts, Class 1 - up to 7,500 volts, Class 2 - up to 17,000 volts, Class 3 - up to 26,500 volts, Class 4 - up to 36,000 volts.

**References:**

1. PWC Occupational Safety and Health Program Manual, PWCNORVAINST 5100.33E
2. Occupational Safety and Health Standards for General Industry (29 CFR PART 1910): Subpart I, Personnel Protective Equipment; Subpart R, Electrical Power Generation / Transmission / Distribution; Subpart S, Electrical
3. NFPA 70 E approach distances to exposed, energized, electrical conductors and circuit parts.
4. SOP WC 622 HVE 013, Hazardous Energy Control(Lockout, Tagout)
5. SOP WC 622 HVE 007, Switchout And Switchback Energized Circuit
6. NFPA 70B, Electrical Equipment Maintenance, 1990 Edition

**Procedures:**

1. Ops personnel will deenergize the primary circuit per SOPs
  - a) WC 622 HVE 007, Switchout and Switchback Energized Circuit
  - b) WC 622 HVE 013, Hazardous Energy Control(Lockout, Tagout)

Ops personnel will ensure that the facility's emergency generator or temporary power generator, if present, is isolated and will not back feed to the transformer.

2. Using a high voltage tester test the primary circuit's cables to verify they are deenergized. Before the conductors are checked, test the high voltage tester on same voltage circuit voltage to verify the tester is working. Test each deenergized conductor separately, taking care not to cross phase during test. If voltage is detected, stop the test and (a) notify Ops personnel that the circuit is still energized, (b) wait for Ops personnel to correct the problem, (c) perform the deenergization verification test once again after Ops personnel finish switching operations and declare the cables deenergized. If no voltage is indicated, retest the high voltage tester to re-verify it is working properly. Wear Nomex coveralls, Nomex hood, safety glasses, safety shoes, insulating rubber gloves and sleeves, and hard hat while testing.

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If the primary circuit's cables can not be accessed, then go to another transformer site on the same circuit, which has accessible conductors, and perform the deenergization verification test there.

3. The required PPE for the PM work includes work gloves, safety shoes, safety glasses. Refer to the JHA for details.
4. Remove the access covers.
5. Inspect case for rusting, corrosion, and peeling paint.
6. Inspect, and clean the transformers primary and secondary bushings.
7. Check the primary and secondary cable connections and tighten if necessary.
8. Note all gauge reading for evidence of possible problem.
9. Inspect case, valves, gauges, fittings, and bushings for oil leaks.
10. Perform megger test on primary to ground, secondary to ground and primary to secondary.
11. Check oil level and add oil if the level is low.
12. Obtain a sample of the oil and test it's dielectric strength. If the oil tests greater than 25 kv proceed with procedures. If the oil tests below 25 kv, then oil has to be filtered and retested till the 25 kv point is reached. If 25 kv can not be obtained, or the oil is visibly in poor condition(blackened, sludge present), replace the existing oil. Test the new oil prior to placing in the device. If the oil is less than 30 kv obtain another batch of oil. Test the new oil after it has been placed in the device. If the oil tests below 30 kv, then oil has to be filtered and retested till the 30 kv point is reached.
13. Settling time after replacing oil - The transformer's settling time will be 12 hours. Because there will be a 3 psig Nitrogen blanket placed, place a 5 psig vacuum on the tank during the settling time.
14. Replace access covers.
15. Ops personnel will energize the primary circuit and transformer per SOPs
  - a) WC 622 HVE 007, Switchout and Switchback Energized Circuit
  - b) WC 622 HVE 013, Hazardous Energy Control(Lockout, Tagout)

END