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

STANDARD OPERATING PROCEDURE / JOB HAZARD ANALYSIS

**TITLE
REFUSE 11.5 KV CAPACITOR BANK**

**PROCEDURE NUMBER
WC 622 HVE 028**

**SIGNED: _____
(DATE)**

**APPROVED: _____
(DATE)**

**SAFETY PROFESSIONAL: _____
(DATE)**

**MANAGEMENT OFFICIAL: _____
(DATE)**

REVISION

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REFUSE 11.5 KV CAPACITOR BANK

Purpose:

Procedure to deenergize an 11.5 kv capacitor bank, replace blown capacitor fuses, and reenergize the capacitor bank.

Potential Energy Sources:

1. 11.5 equipment and cables.
2. Charged, or partially charged, capacitors.

Tools and PPE:

Tools: High voltage tester, shotgun stick, fiberglass ladder, and hand tools. PPE: Nomex coveralls, Nomex hood, insulating rubber gloves, insulating rubber sleeves, hard hat, safety shoes, safety glasses, and back brace if required to 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. ANSI C2-1987, National Electrical Safety Code
5. PWC SOP# 600 HVE 6, PWC Switching or Breaker Operation
6. PWC SOP WC 622 HVE 013, Hazardous Energy Control(Lockout, Tagout)

Procedures:

1. Prior to switching out the capacitor bank, raise the substation transformer's secondary voltage to approximately 12 kv. To do this place the transformer's tap changer in manual mode and operate till the desired voltage is reached. Wear Nomex coveralls, safety glasses, hard hat, and safety shoes while performing the task.
2. Open, roll out, lock, and tag the capacitor circuit breaker.
Follow SOPs
PWC SOP# 600 HVE 6, PWC Switching or Breaker Operation
PWC SOP WC 622 HVE 013, Hazardous Energy Control(Lockout, Tagout)
Wear Nomex coveralls, Nomex hood, safety glasses, safety shoes, hard hat, insulating rubber gloves, and insulating rubber sleeves.
3. Using a high voltage tester test the capacitor bank's high voltage cable terminations to verify the capacitor circuit is

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deenergized. Before the terminators are checked, test the high voltage tester on a known energized circuit to verify the tester is working. Test each deenergized terminator separately, taking care not to cross phase during test. If voltage is detected, stop the test, determine why voltage is still present, correct the problem and, perform the deenergization verification test once again. 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.

4. Wait approximately 5 minutes to allow the capacitors to internally discharge.

5. Attach grounds onto the capacitor terminators. Each terminator will be grounded. To attach grounds, first connect one ground cable end to station ground, or a grounded structure, then attach the other end to a fiberglass shotgun stick. Using the shotgun stick bleed off any static build up on the terminator. Once the static has been bled off, attach the ground cable to the terminator using the shotgun stick. Repeat for each phase. Follow SOP WC 622 HVE 013, Hazardous Energy Control(Lockout, Tagout) concerning ground tags. Wear Nomex coveralls, Nomex hood, safety glasses, safety shoes, insulating rubber gloves and sleeves, and hard hat.

6. Secure fiberglass ladder to the capacitor structure. This may have to be done several times depending upon how many fuses have to be replaced.

7. For each fuse to be replaced - Remove fuse leader from capacitor bushing and remove fuse from bus bar. Obtain a new fuse and install, following the removal steps in reverse order. Wear Nomex coveralls, safety shoes, work gloves, and hard hat.

8. Remove the grounds attached to the terminators. Test that the circuit is still deenergized using a high voltage tester. Before the terminators are checked, test the high voltage tester on a known energized circuit to verify the tester is working. Test each deenergized terminator separately, taking care not to cross phase during test. If voltage is detected, stop the test, determine why voltage is still present, correct the problem and, perform the deenergization verification test once again. If no voltage is indicated, retest the high voltage tester to re-verify it is working properly. After the circuit has been verified dead, remove the grounds using a fiberglass shotgun stick. Remove the ground cable end attached to the terminator first, then remove the end attached to station ground, or a grounded structure. Wear Nomex coveralls, Nomex hood, safety glasses, safety shoes, insulating rubber gloves and sleeves, and hard hat.

9. Remove the lock and tag on the capacitor breaker and roll the breaker back in per SOP WC 622 HVE 013. Wear Nomex coveralls,

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Nomex hood, safety glasses, safety shoes, insulating rubber gloves and sleeves, and hard hat.

10. Prior to closing the capacitor bank's breaker, lower the substation transformer's secondary voltage to approximately 11 kv. To do this place the transformer's tap changer in manual mode and operate till the desired voltage is reached. Wear Nomex coveralls, safety glasses, hard hat, and safety shoes while performing the task.

11. Close the capacitor bank breaker per SOP 600 HVE 6, PWC Switching or Breaker Operation, and adjust transformer secondary voltage to 11.5 kv. Wear Nomex coveralls, Nomex hood, safety glasses, safety shoes, insulating rubber gloves and sleeves, and hard hat.

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