MONTHLY CP SYSTEM MAINTENANCE

This presentation is a part of the Basic Cathodic Protection Maintenance Training Course given by Thomas Tehada, P.E. CP Program Technical Expert. Used with permission of NFESC. Edited by David Jutton, NACE Cathodic Protection Specialist, LANTNAVFACENGCOM CP Program Manager.

Cathodic Protection Rectifier Monthly Maintenance

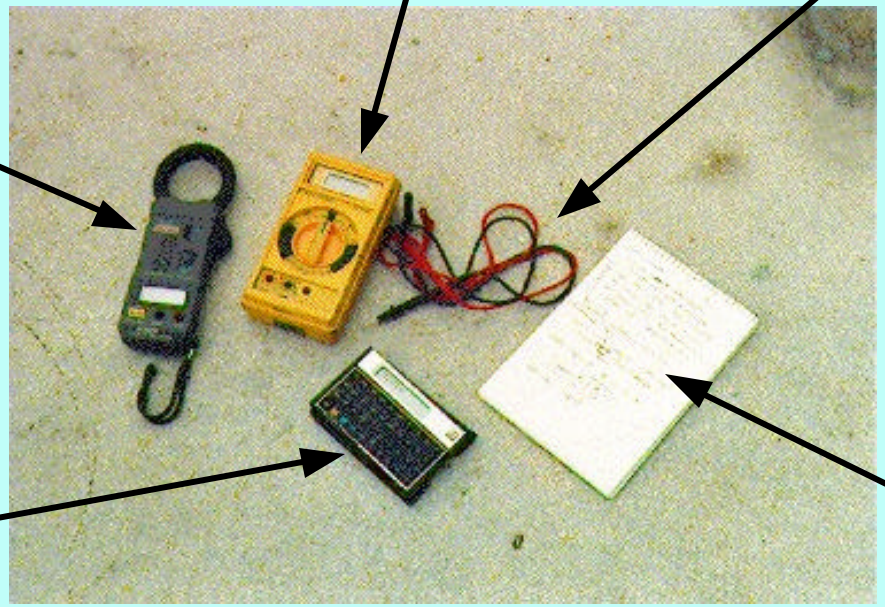
- ***IMPRESSED CURRENT SYSTEMS***
  - ***Monthly (or at least Bi-monthly) Requirements***
    - ✓ *Read and record rectifier meter readings. Confirm readings with a portable meter.*
    - ✓ *Compare with previous readings and troubleshoot as necessary.*
  - ***As Required***
    - ✓ *Inspect, clean, and tighten wire connections.*
    - ✓ *Lubricate enclosure hinges & locks. Lubricate test hole covers.*

CP MAINTENANCE REQUIREMENTS

- ***O&M MANUALS, INSTRUCTIONS AND GUIDELINES***
  - *NAVFAC MO-306 provides general Navy guidelines*
  - *MILHDBK 1136/1 pocket manual*
  - *LANTNAVFACENGCOMINST* 11014.9
  - *National Association of Corrosion Engineers (NACE) Standards provide S/E criteria for protection*
    - *RP 0169 for buried pipelines and structures*
    - *RP 0285 for underground storage tanks*
    - *RP 0388 and RP 0196 for water storage tanks*
    - *RP 0193 for bottoms of on-grade storage tanks*

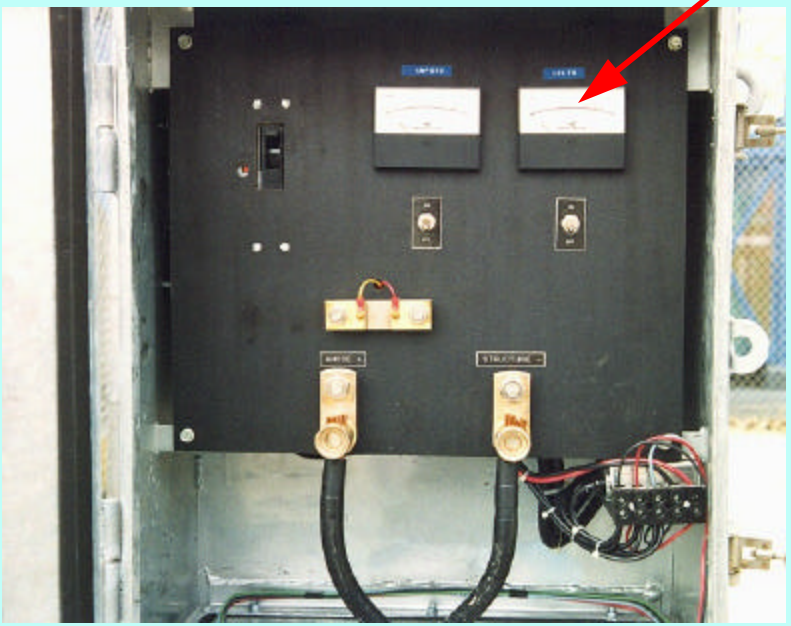
GENERAL TEST EQUIPMENT

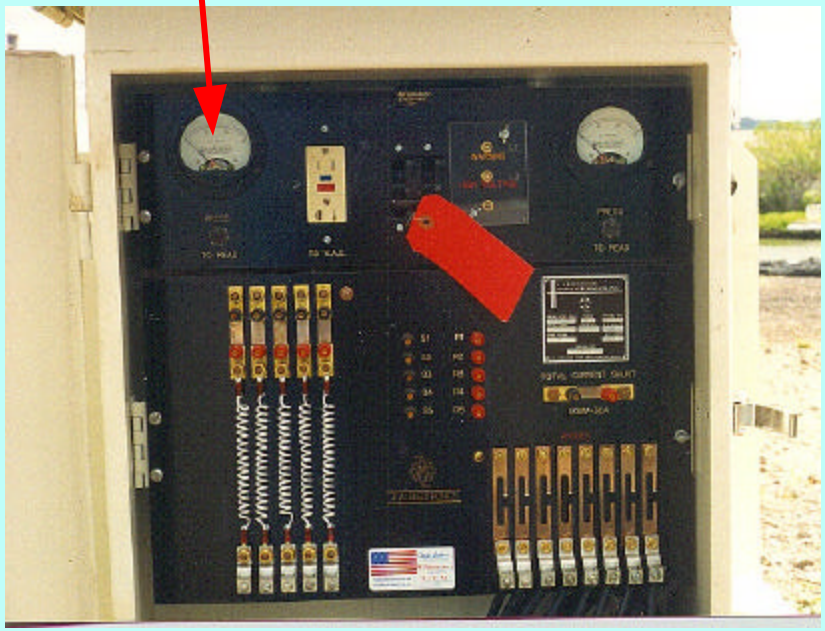
- **MONTHLY (BI-MONTHLY) RECTIFIER CHECKS**
  - **Required test equipment:**



GENERAL TEST PROCEDURES

- **RECTIFIER OUTPUT VOLTAGE**
  - **Read the built in voltmeter**





RECORD OUTPUT VOLTAGE

- **RECTIFIER OUTPUT VOLTAGE**
  - **Read the built in voltmeter**
  - **Check with a portable voltmeter or multimeter.**

***** CAUTION *****

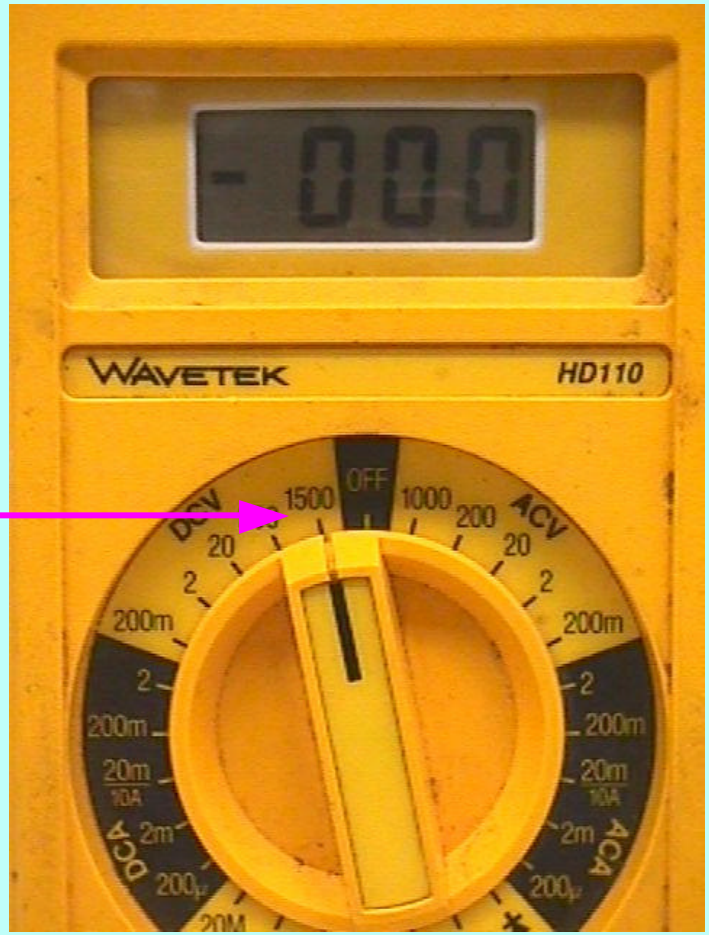
Electric Shock Hazard!!

While performing rectifier measurements be careful not to touch electrical terminals and/or insulating oil with hands or other parts of the body as they can cause electric shock.

GENERAL TEST PROCEDURES

- **RECTIFIER OUTPUT VOLTAGE**
  - **Check with a portable voltmeter or multimeter.**

Step 1. *Set the portable meter range at the maximum DC Volt scale to avoid accidental damage to the meter. (Not necessary for auto ranging meter)*



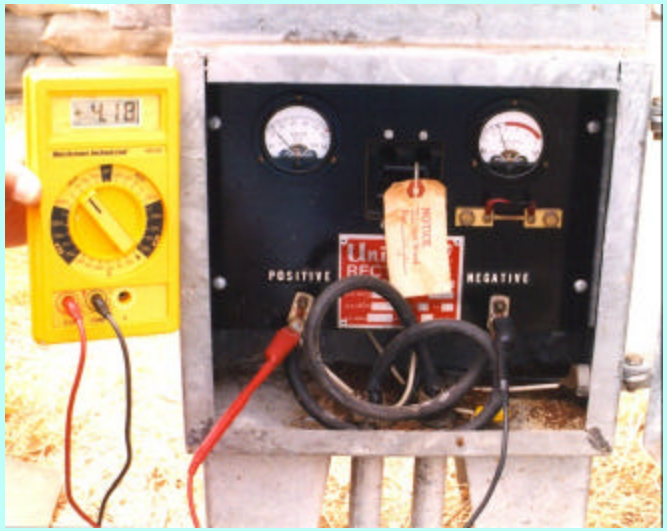
GENERAL TEST PROCEDURES (cont.)

- **RECTIFIER OUTPUT VOLTAGE**
  - **Check with a portable voltmeter/multimeter (cont.)**

Step 2. *Connect the positive portable meter lead to the rectifier positive DC output terminal, and the negative portable meter lead to the rectifier negative DC terminal.*

COMMON WAY

BETTER



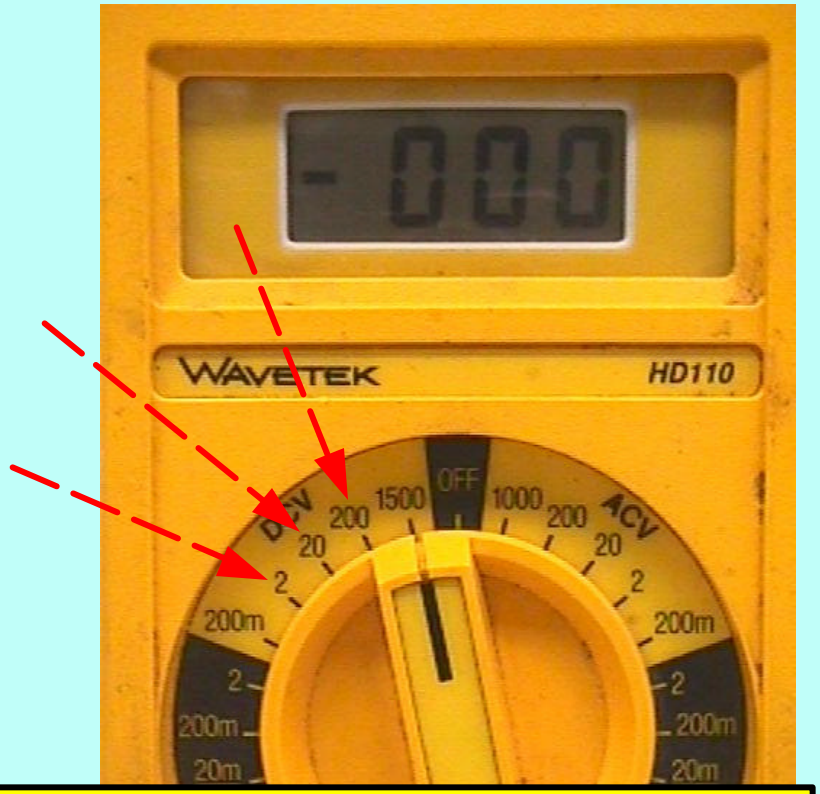
BEST

RECORD OUTPUT VOLTAGE

- **RECTIFIER OUTPUT VOLTAGE**

Step 3. *Adjust the portable meter range switch until there is one digit after the decimal point, then read the meter. This reading should be close to the built in meter reading.*

Step 4*. Record Results*

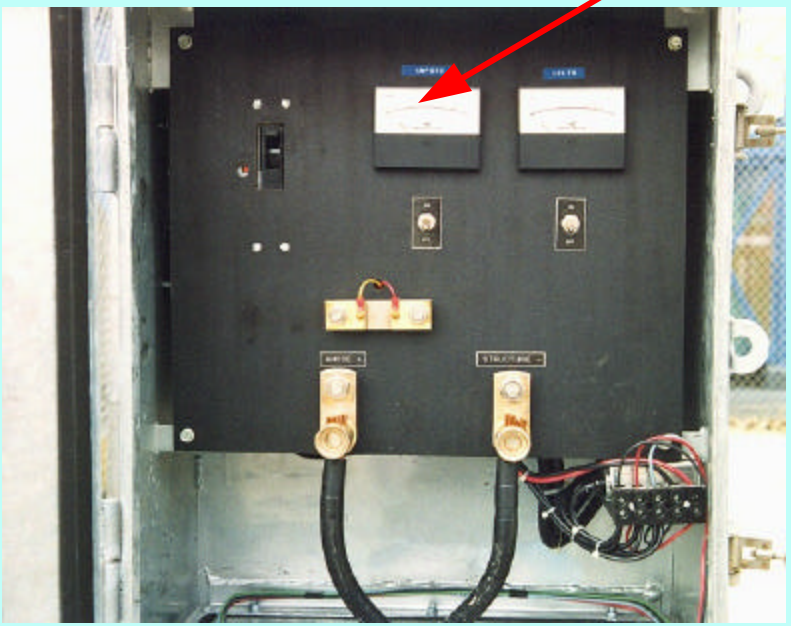


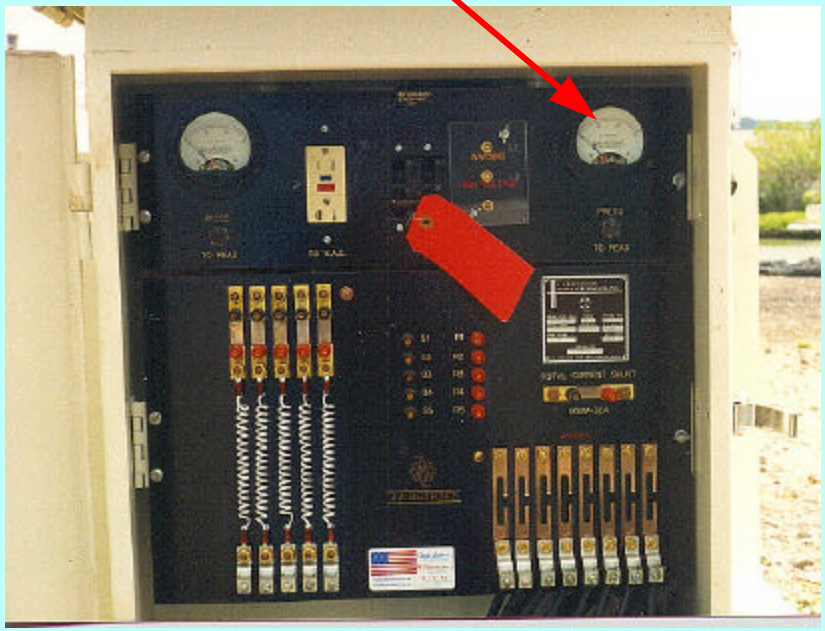
***** IMPORTANT *****

Rectifier output should not exceed its rated maximum.

RECORD OUTPUT CURRENT

- **RECTIFIER OUTPUT CURRENT**
  - **Read the built in ammeter**
  - **Record Current**

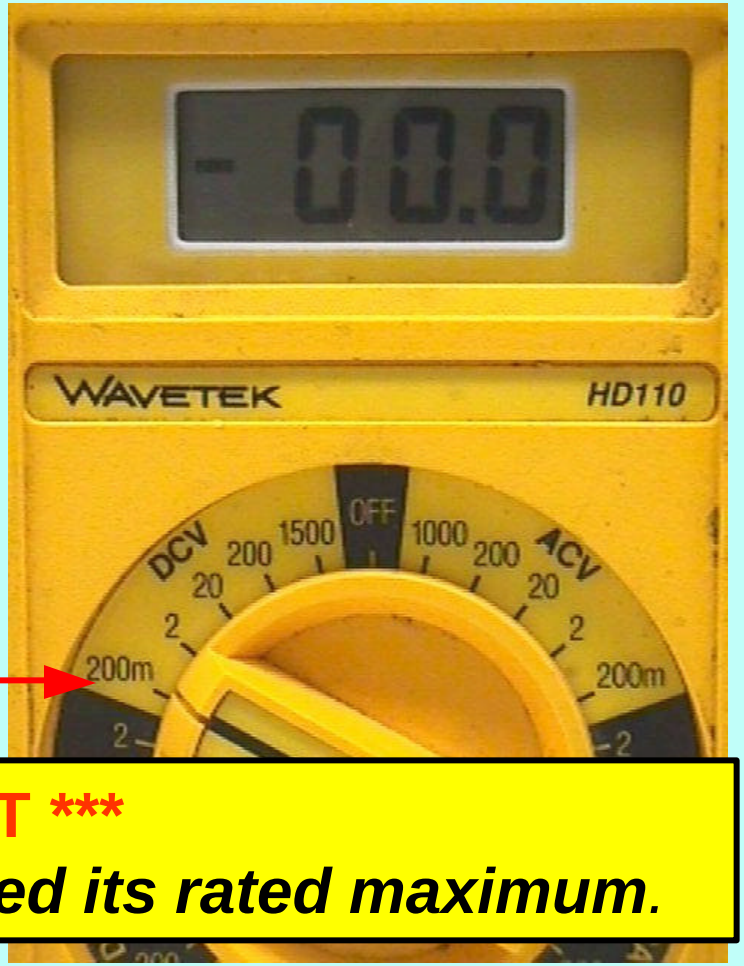




GENERAL TEST PROCEDURES

- **RECTIFIER OUTPUT CURRENT**
  - **Check with a portable voltmeter or multimeter.**

Step 1. *Set the portable meter range to the DC millivolt scale. (Not necessary for auto ranging meter)*



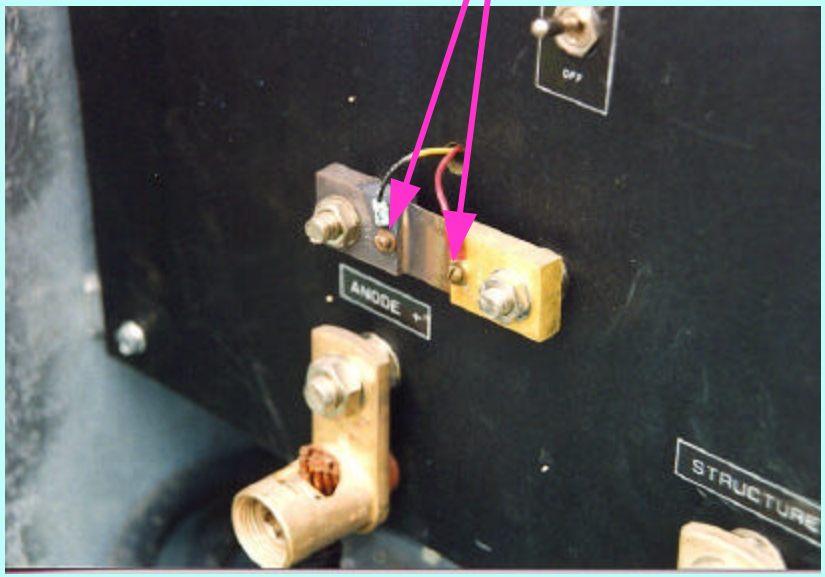
***** IMPORTANT *****

Rectifier output should not exceed its rated maximum.

GENERAL TEST PROCEDURES *(cont.)*

- **RECTIFIER OUTPUT CURRENT (*cont.*)**
  - **Check with a portable voltmeter/multimeter (cont.)**

Step 2. *Connect the portable meter leads across the measurement terminals of the shunt.*



GENERAL TEST PROCEDURES *(cont.)*

- **RECTIFIER OUTPUT CURRENT (*cont.*)**
  - **Check with a portable voltmeter or multimeter (cont.)**

Step 2. *Connect the portable meter leads across the measurement terminals of the shunt.*

Step 3. *Measure the voltage across the shunt.* ***Be careful not to touch any other terminals around the shunt as they can cause electric shock.***

GENERAL TEST PROCEDURES *(cont.)*

- **RECTIFIER OUTPUT CURRENT (*cont.*)**
  - **Check with a portable voltmeter or multimeter (cont.)**

Step 4. *Calculate the current using the following equation:*

$$\text{Output Current} = \text{Shunt Current Rating} \times \frac{\text{Measured voltage}}{\text{Shunt Voltage Rating}}$$

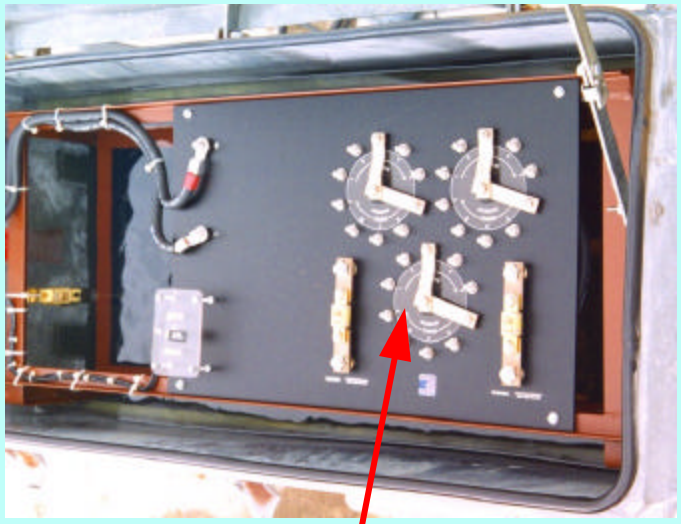
The calculated current should be close to the built in ammeter reading.

***** IMPORTANT *****

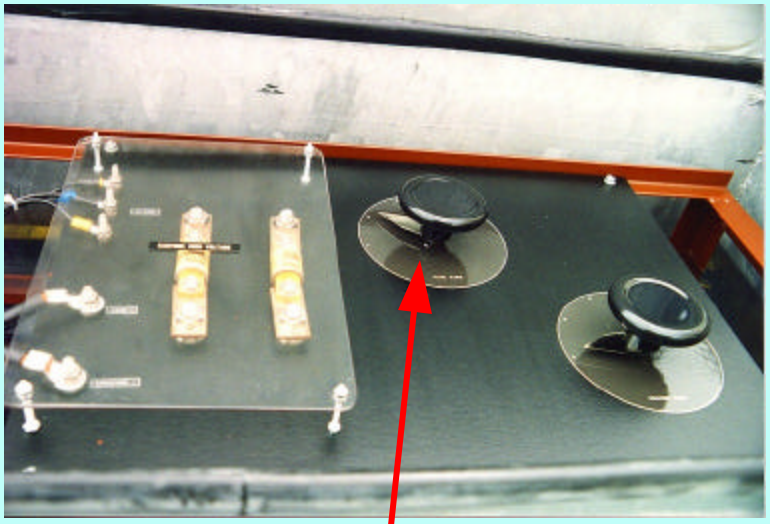
Rectifier output current should not exceed rated maximum current for rectifier or anode bed.

RECORD TAP SETTINGS

- CHECK RECTIFIER OUTPUT TAP SETTING

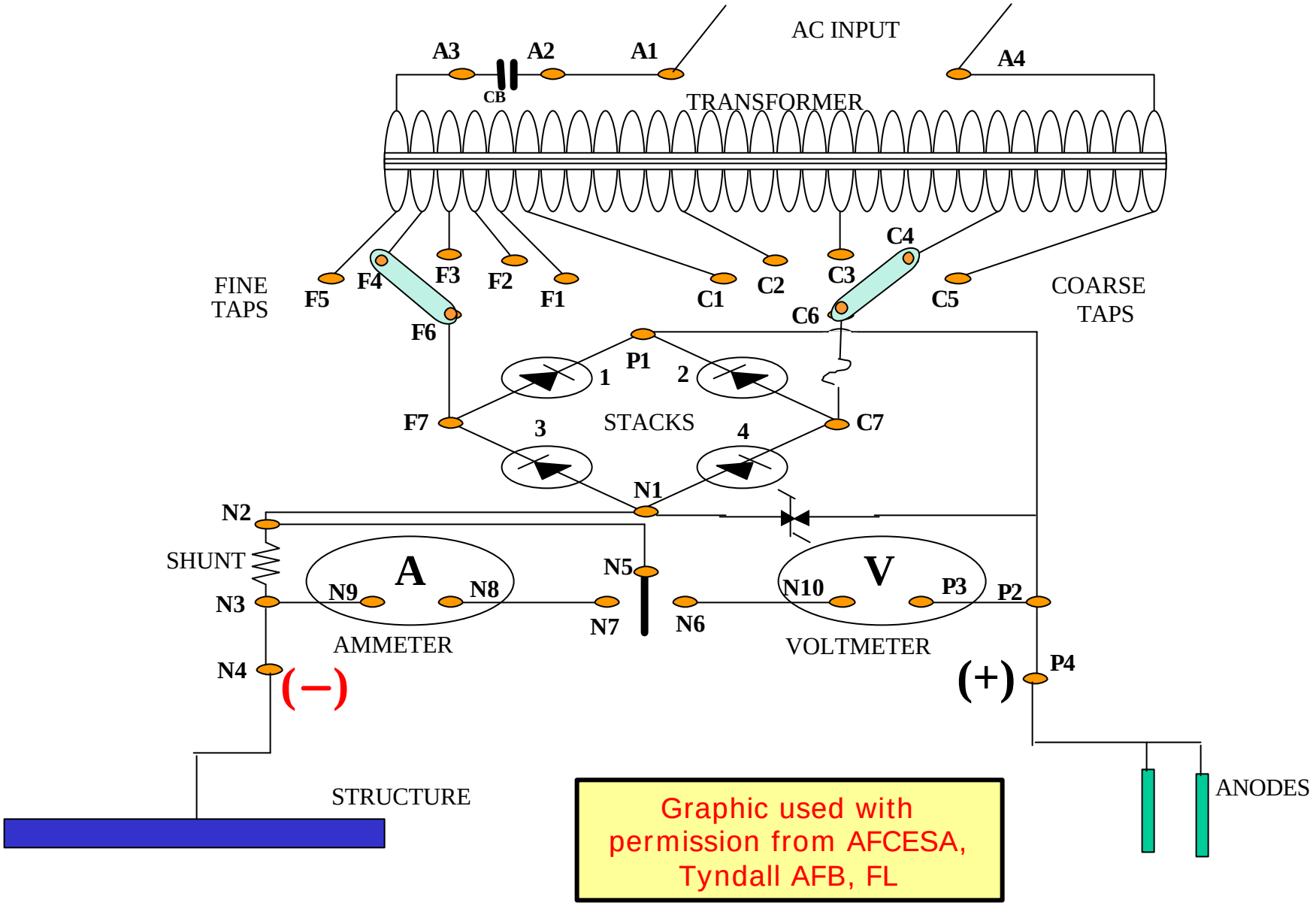


TAP SET (3 PHASE) UTILIZING TAP BARS FOR ADJUSTMENT



TAP SET (1 PHASE) UTILIZING KNOBS FOR ADJUSTMENT

RECTIFIER SCHEMATIC



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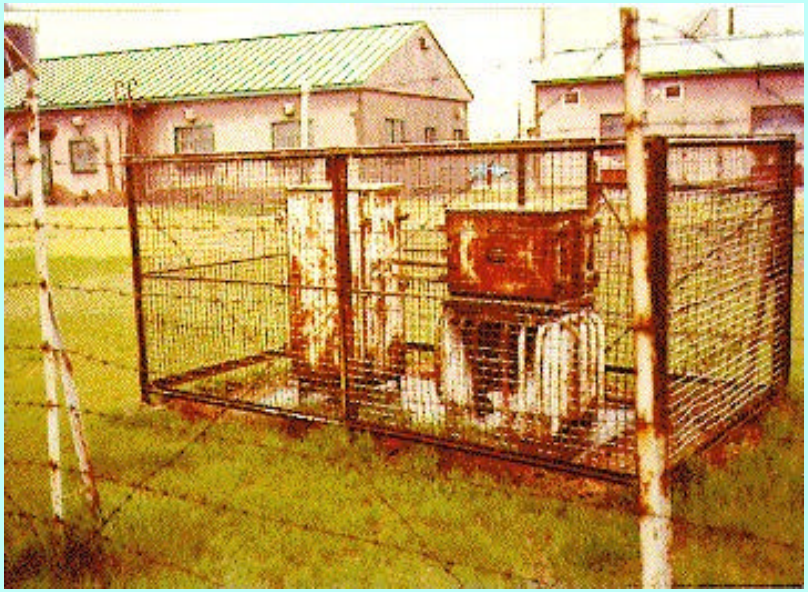
GENERAL TEST PROCEDURES *(cont.)*

- **INSPECT RECTIFIER WIRING AND CONDITION**
  - **Check condition of rectifier enclosure for damage, corrosion, etc. Lubricate hinges and hasps.**

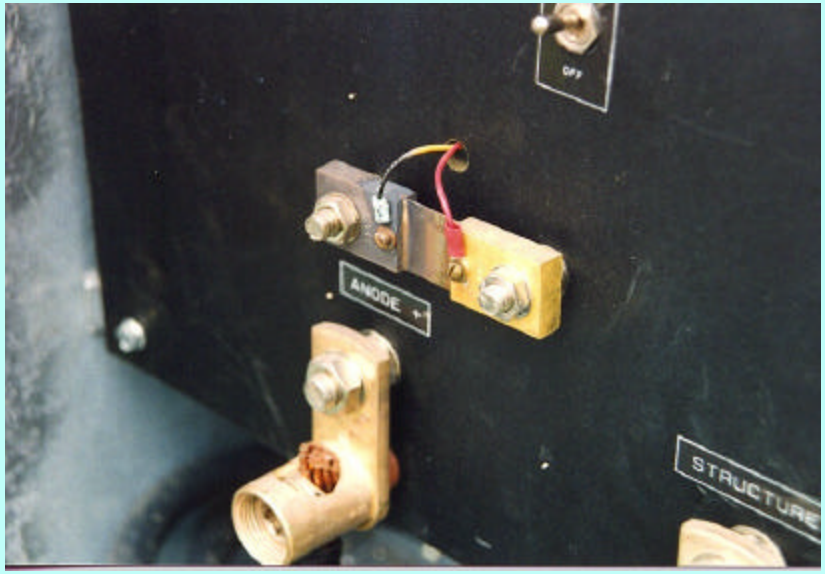


CORROSION

OVERGROWTH

GENERAL TEST PROCEDURES *(cont.)*

- **INSPECT RECTIFIER WIRING AND CONDITION**
  - **Check Interior Wiring and Terminals. Clean and tighten wiring terminals. Clean out insect and bird nests.**



DISCOLORED SHUNT

MISSING CABLES

GENERAL TEST PROCEDURES *(cont.)*

✸ **UPDATE MAINTENANCE TAG**

- **SHOULD START USING TAGS OR OTHER MAINTENANCE RECORD IF NOT CURRENTLY PART OF THE MAINTENANCE PROGRAM.**

COMPARE TEST DATA

- ***Comparison with Historical Data***
  - Compare all test data with previous CP Survey data and Monthly CP Reports. Significant differences indicate possible problems requiring additional testing.
  - Write down any discrepancies and the actions taken to correct the deficiencies on monthly report . Contact the EFD CP Program Manager for assistance.

REPORTING REQUIREMENTS

- ***REPORT SUBMISSION***
  - *Test data reports should be submitted to the EFD CP Program Manager. The CP Program Manager analyzes the test data to verify CP system operation and adequacy, and compile the data into a historical data file.*

Test data need not be typed but should be legible. FAX or EMAIL Report to the EFD CP Program Manager

Naval Activities Located in Mid Atlantic & Northeast United States, Puerto Rico, & Europe Submit Rectifier Reports to:

David Jutton, EIT
Cathodic Protection Specialist/CP Program Manager
LANTNAVFACENGCOM
1510 Gilbert Street, Code BE14DJ
Norfolk, VA 23511

DSN: 262-4650 COMM'L: (757) 322-4650
FAX: (757) 322-4614
EMAIL: juttondf@efdlant.navfac.navy.mil

For information on CP training courses in your area or to arrange for training, contact the EFD CP Program Manager or the Naval Facilities Engineering Service Center CP Technical Expert.