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The rectifer is the heart of an impressed current cathodic protection system. As it is subject to many adverse conditions including power surges, lightning strikes, vandalism, physical damage, and deterioration from atmospheric exposure, frequent inspections of rectifiers are vital to keeping an impressed current system operating so that it can provide nearly continuous protection of the underground, or submerged structures that are being protected.

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Techdata Sheet

2002-SHR

February 1994

NAVAL FACILITIES ENGINEERING SERVICE CENTER, PORT HUENEME, CA 93043-4328

CATHODIC PROTECTION SYSTEM INSPECTION V

The rectifier is the heart of an impressed current cathodic protection system. As it is subject to many adverse conditions including power surges, lightning strikes, vandalism, physical damage, and deterioration from atmospheric exposure, frequent inspections of rectifiers are vital to keeping an impressed current system operating so that it can provide nearly continuous protection of the underground, or submerged structures that are being protected.

The rectifier is also a point where adjustments can be easily made to control the current flow in the system. However, rectifier adjustments should only be made when necessary, and when it has been determined that rectifier adjustment is the proper corrective action.

ROUTINE RECTIFIER INSPECTIONS

NAVFAC MO-306 recommends that rectifiers be inspected monthly and NAVFAC Form 11014-74B completed to record the results of these inspections. Copies of the completed forms should be forwarded to the local EFD annually for review. From these records, the EFD Corrosion Control Engineer can identify problems within the system.

The historical record of monthly rectifier inspections can be very useful in troubleshooting problems in the system as trends in rectifier outputs are often diagnostic for specific system problems. For example, the output current drops slowly over a period of years while the output voltage remains relatively constant, anode consumption or gas blockage is the most likely cause. If, however, the output current falls to a very low value between monthly inspections while the output voltage remains relatively constant, a fault in the anode lead wire is the most likely problem.

A monthly rectifier inspection consists of:

- Recording the rectifier identification, date, and inspectors initials on Form 11014-74B.

- Making a physical inspection to detect external damage or deterioration. Note any problems as comments on Form 11014-74B.

- Reading the output voltage and current indicated on the rectifier panel meters. Record the readings on Form 11014-74B.

- Recording the fine and coarse voltage tap settings on Form 11014-74B.

SAFETY ITEM

TURN THE AC POWER TO THE RECTIFIER OFF BEFORE DOING THE FOLLOWING INSPECTIONS.

1. Touch the rectifier stacks to see if they are warmer than the surrounding material. When operating properly, each stack section should be equally warm.

2. Touch input and output power connections. They should not be warmer than the surrounding material. Hot connections indicate a high resistance in the system.

3. Touch filter chokes and capacitors to see if they are hotter than the surrounding material. These can be warm, but should not be hot.

4. Visually inspect the circuit boards and insulation for any signs of arcing.

5. Remove dirt, dust, insects, birds nest, or other debris from inside of rectifier housing.

6. Record problems with the system in the comments column on Form 11014-74B.

TURN THE AC POWER TO THE RECTIFIER BACK ON AFTER DOING THESE INSPECTIONS.

7. Check the rectifier panel meter readings to ensure that they have returned to the values indicated before the AC power was turned off.

RECTIFIER ADJUSTMENTS

Adjustments to the output of the rectifier can be required to offset changes in other portions of the cathodic protection system. In some cases, the problem can be best accommodated by adjusting the rectifier, in other cases, other system changes may be required.

Do not adjust the rectifier unless or until the reason for the change in rectifier output or system performance has been determined. The structure to electrolyte potential is the best guide to rectifier adjustment. As long as the structure to electrolyte potentials are within the protection criteria for the system, rectifier adjustments are usually not necessary. If the structure to electrolyte potential has fallen below the protection criteria for the system, rectifier adjustment may or may not be appropriate.

Review of the monthly rectifier inspection reports are frequently useful in determining whether rectifier adjustments are the appropriate means of correcting inadequate structure to electrolyte potentials.

For example, when inadequate protection potentials are found and the rectifier output current has not dropped, the most likely cause is an increase in current demand for the structure. This can be caused by coating deterioration, additions to the structure, or shorting of the structure to adjacent systems. If the additional current is within the capacity of the rectifier and anode bed, then adjusting the rectifier to accommodate the changes to the protected structure are appropriate.

However, when inadequate protection potentials are found and the output current has dropped slowly over time, the problem is most likely in the anode bed. Anode resistance could have increased due to many factors, such as the soil drying out, consumption of the anodes, or a gas blockage that forces soil moisture away from the anodes. In this case, the problem with the anode bed should be corrected instead of adjusting the rectifier for more output. Correction of the problem with the anode bed will restore the system to proper operations, as determined by the structure to electrolyte potential, without the need for rectifier adjustment.

When adjusting the rectifier output, it is important to make small incremental changes in the tap settings and observe the reaction of the system to these changes. For example, if the structure to electrolyte potential is low due

to additions to the system, the rectifier should be set to the next highest setting and the structure to electrolyte potential on the system should then be taken on the following day. If the structure to electrolyte potential is still not satisfactory, then the output should be increased again to the next highest setting and the process repeated until an adequate structure to electrolyte potential is achieved. If the rectifier is adjusted to immediately give the desired structure to electrolyte potential, it is almost certain that subsequent structure to electrolyte potential readings taken after a short period will be too high and the rectifier output will need to be reduced.

Rectifiers are usually adjusted by setting "taps" on the rectifier panel. These adjustments determine the voltage output of the rectifier. The current output depends on the external circuit resistance, primarily the resistance of the anode bed. The taps are connections within the AC transformer that change the AC output of the transformer, which is the input to the rectifier stacks. These taps can be adjusted by turning knobs or by moving shorting bars that are held in place by nuts or wing nuts depending on the design of the rectifier. There is usually a coarse and fine adjustment. The fine taps allow adjustments between the coarse adjustment increments. For example, on a rectifier with three coarse and three fine adjustments, the settings from lowest to highest are:

Tap Settings

	Coarse	Fine
Lowest Output	1	1
	1	2
	1	3
	2	1
	2	2
	2	3
	3	1
	3	2
Highest Output	3	3

For assistance in the inspection of cathodic protection rectifiers or in interpretation of rectifier readings or advice regarding rectifier adjustments, contact the corrosion control coordinator at your geographical Engineering Field Division or Activity, the Cathodic Protection System Center of Expertise, or the Naval Facilities Engineering Service Center.

REMEMBER **- The rectifier is the heart of any impressed current cathodic protection system. It must be checked regularly, cared for properly, and adjusted only when necessary.**

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NEW SOURCE FOR FACILITIES ENGINEERING SERVICES

As of 1 October 1993, technical support to Naval activities for corrosion control, as well as many other support functions will be provided by a new organization, the Naval Facilities Engineering Service Center. This new organization is the result of a realignment of the functions and capabilities of several former Naval Facilities Engineering Command (NAVFAC) organizations and groups: the Naval Civil Engineering Laboratory, Naval Energy and Environment Support Activity, the Chief Engineers Office (Code 04B) at NAVFAC Headquarters, and Fleet Project Offices 1 and 2.

As is the case for all major restructuring efforts, the impact of the formation of this new Engineering Service Center on support for Naval Shore Activities has not been fully determined, but the intent is to provide more comprehensive support from a single, more efficient source. Although there are future plans for physical consolidation of personnel and functions, there are no immediate relocations involved in the realignment.

Current plans are for the new Naval Facilities Engineering Service Center to continue to issue this series of Techdata Sheets on Corrosion Control and to provide direct support services in corrosion control, only the names have been changed.

New Addresses for Former Naval Civil Engineering Laboratory Corrosion Control Points of Contact

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