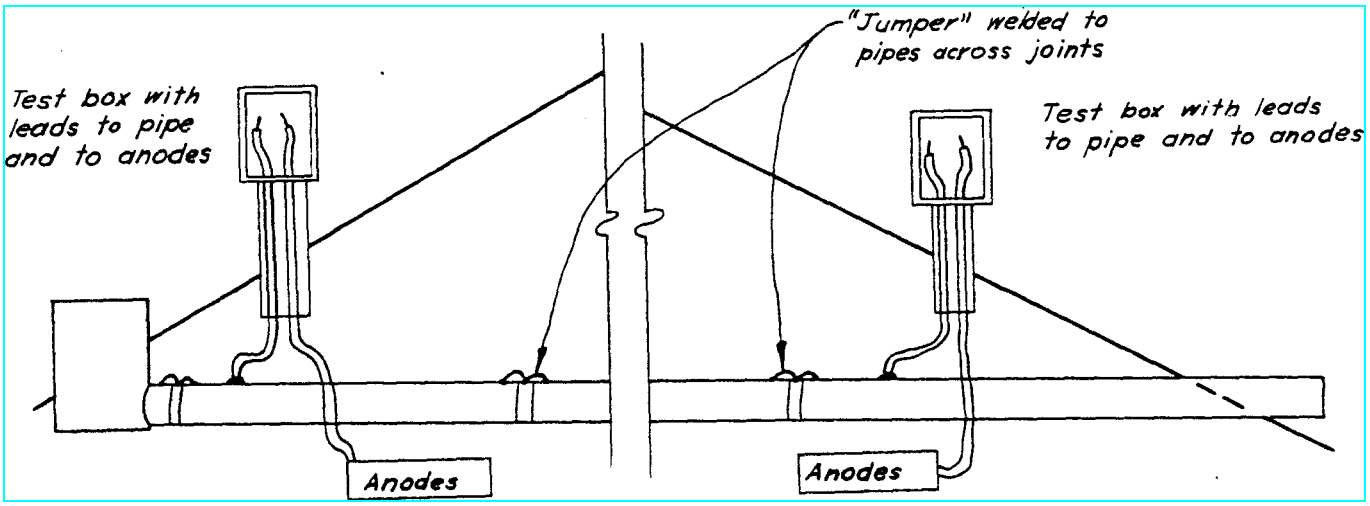
CATHODIC PROTECTION MAINTENANCE TESTING

Cathodic protection systems need to be checked at least once every two to four years to make sure they are functioning. Testing the system is relatively straightforward, but special equipment is necessary to perform the test. Each cathodic protection system has a test box(es) installed to facilitate checking the system.

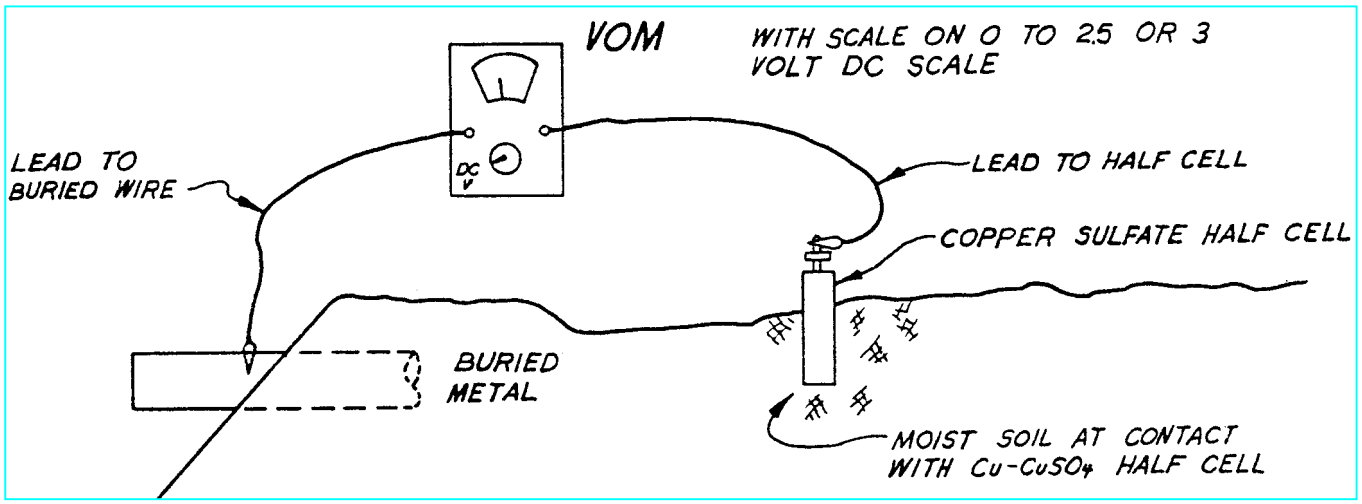
Anodes are a very low voltage-current flow system with a voltage and current flow less than that of a 2-cell flashlight. As the anode corrodes to supply the small current, it is being 'sacrificed' to keep the pipe from corroding and, eventually, is used up to the point where the anode, like a battery, ceases to function. Problems most likely to occur in a system will be a broken wire, bad wire connections, or a broken weld. A schematic of a typical system looks like this:



(a) The four tests normally used for checking the system are:

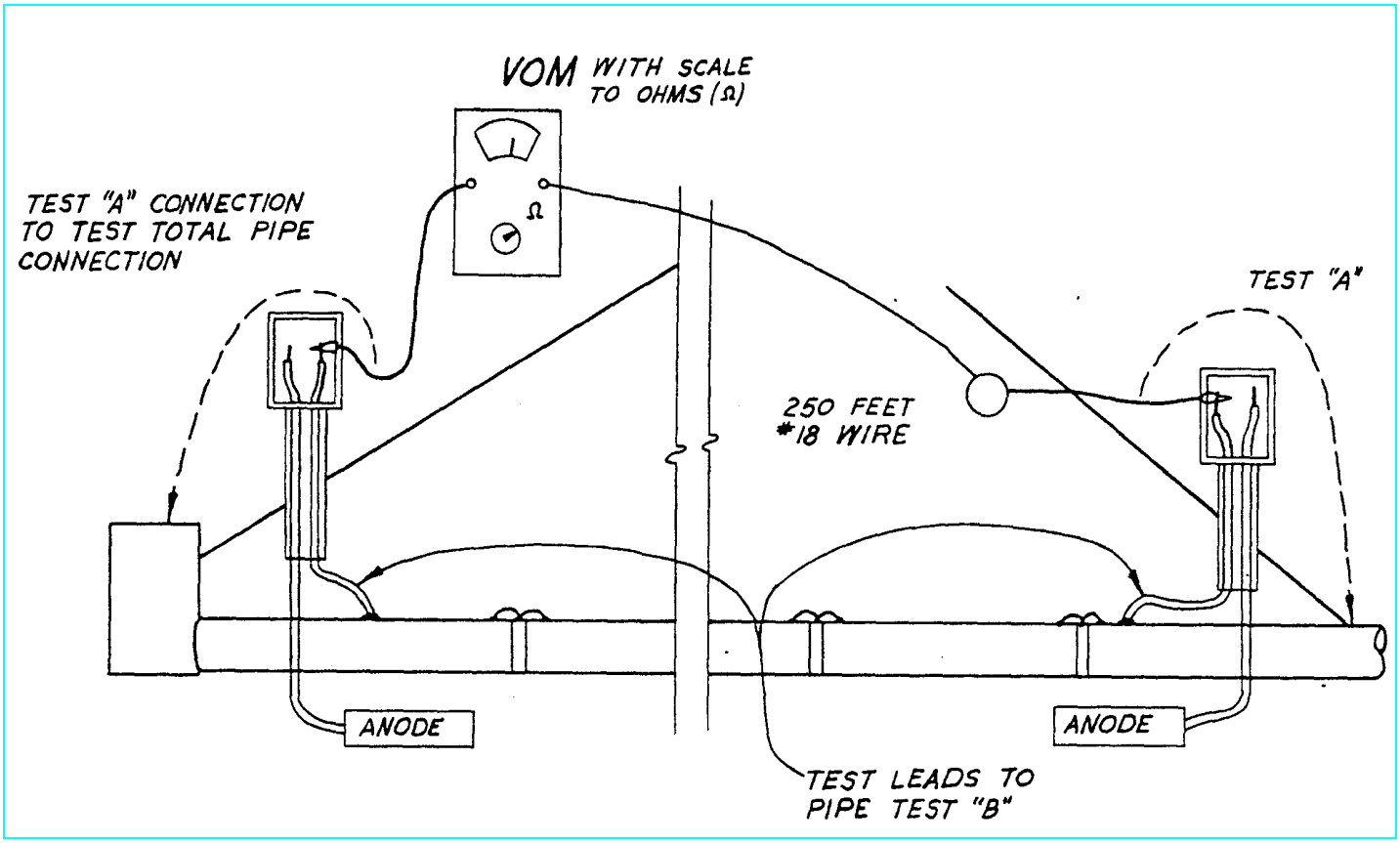
(1) Test the pipe-to-soil voltage potential by comparing to a copper sulfate half-cell.

The copper sulfate half-cell is a specialized half of a battery cell which, when placed in contact with the ground and connected through a volt meter to a metal in contact with the ground, will produce a comparative voltage for the metal to soil. The comparative voltage for a corrugated metal (iron) pipe that is protected should be 0.85 volt or higher. Less than 0.80 means the pipe probably is corroding.



(2) Testing continuity of the pipe.

The pipe should act like one large wire from riser to the last fully buried joint so that current added from the anodes will follow through and protect the total length of the pipe. Since a weld under a fill on a small pipe is almost impossible to correct, the pipe is thoroughly checked before backfill is completed. This is done with an ohmmeter with a small internal battery to supply the low voltage. The same procedure can be used to check for breaks in a pipe circuit as the pipe ages. See schematic on following page.



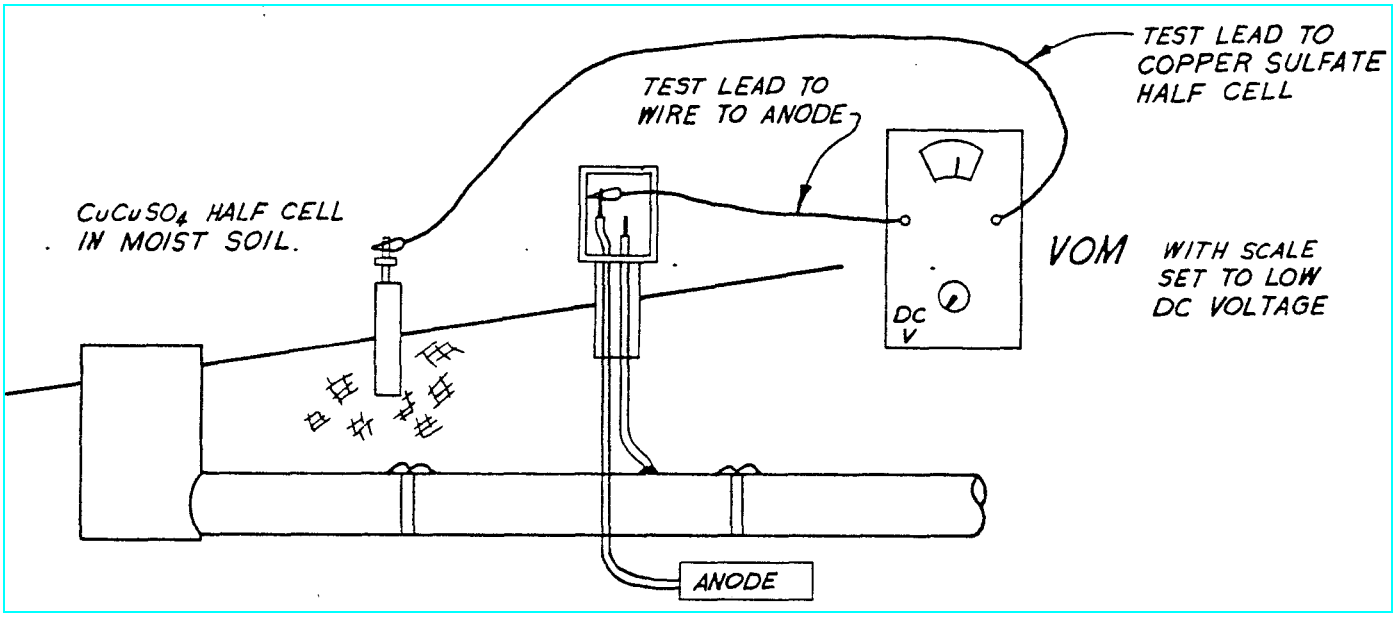
Test "A" will show if the pipe is making a continuous circuit.

Test "B" will show if either of the wires between the test box and the pipe is broken or has a bad connection to the pipe.

Ohm readings of less than 3 ohms indicate continuity.

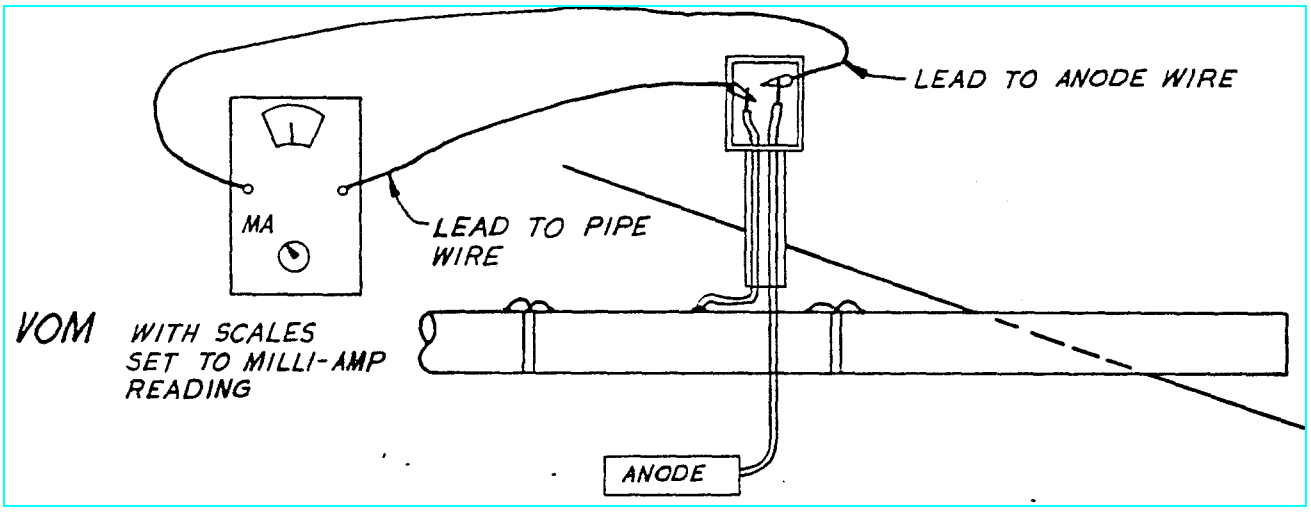
(3) The voltage output of the anode.

This test is a comparative test using the copper sulfate half-cell as in Test 1. The normal anode potential voltage will be in the range of 1.4 to 1.6 volts. A 0 to 0.3 voltage reading means the wire or a connection is broken between the test box and the anode. Sometimes this can be corrected by digging to the base of the post, back toward the anode, and checking the wire for breaks, since the break often is at the base of the post due to the post having been knocked over. A schematic of the test is:



(4) The measuring of the current flow from the anode(s) to the pipe.

This could vary from 5 ma (0.005 amp) to 300+ ma (0.3 amp), depending on pipe area, soils resistivity, and soil moisture. A current flow larger than the design current usually means the pipe is protected to a higher level than needed and a waste of the anode, which will result in a reduced anode life. If the current is more than 1.3 times the design needs, a resistance should be added to the circuit to extend the life of the anodes. This is done with a length of special high-resistance wire between the connections in the test box. Schematic follows:



The following basic equipment is needed for maintenance testing:

- 250 ft to 300 ft of rubber-coated #18 wire on a reel
- 1 volt ohm-milliamp (VOM) meter

  with
  - DC volt ranges of 0 to 2.5 or 3 volts
  - milliamp ranges of 0 to 500 with 2 lower maximum deflection ranges
  - ohm ranges with expanded scale in the 1 to $5^{+/-}$ ohm range
- 1 copper-copper sulfate half-cell with porous plug

  The half-cells are available from any supplier of corrosion engineering testing equipment.
- 2 or 3 extra 4- to 8-ft leads of #18 wire with small alligator clips