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## 5.15 HALF-CELL TESTING

### 5.15.1 Introduction

Steel reinforcement is typically protected from corrosion by the alkaline nature of concrete, which creates a protective passivation layer around the steel. If the alkalinity of the concrete is compromised, corrosion on the steel will commence provided that moisture and oxygen are present. The corrosion reaction will promote anodic and cathodic activity along the reinforcing steel. The corrosion of the reinforcement produces a corrosion cell caused by these differences in electrical potential.

The Half-Cell testing method uses this process to detect whether the reinforcing steel is under active corrosion. This method utilizes a multimeter to measure the potential difference between the steel and a half-cell apparatus. The analysis of the potential difference can indicate if active corrosion is taking place on the reinforcing steel. Refer to Figure 5.15.1-1 for a schematic of a basic half-cell test.

This test is described in American Society for Testing and Materials (ASTM) C876-91, "Standard Test Method for 'Half-Cell' Potentials of Reinforcing Steel in Concrete."

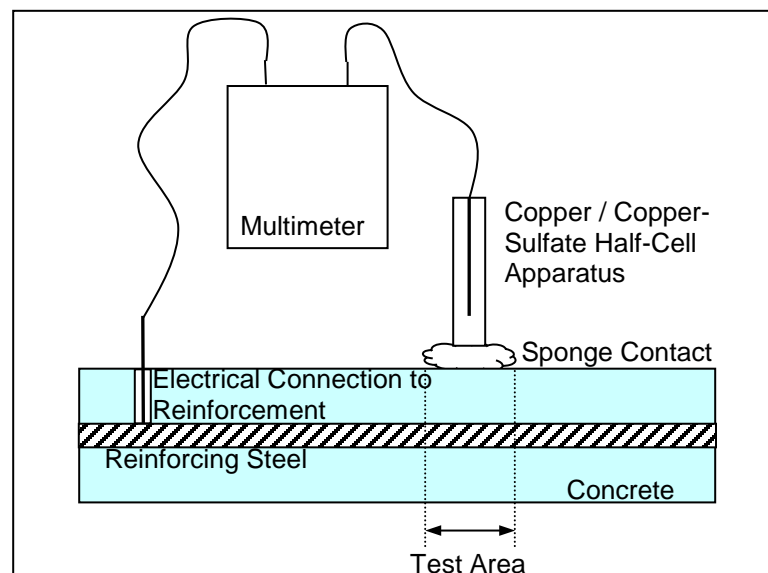


Figure 5.15.1-1: Basic Half-Cell Test Configuration.

### 5.15.2 Applications

Although commonly used on bridge decks, the half-cell test can be performed on any reinforced concrete component, provided a direct electrical connection can be made to the reinforcing steel. Since the test can only detect corrosion directly under the device, a systematic grid of test points should be created to map the potential readings throughout the concrete component. This map can then be analyzed to determine the probable areas of active corrosion.

It is generally agreed that the potential measurements can be interpreted as follows:



1. 0.00 to –0.20 volts indicates greater than 90% probability of no corrosion.
2. -0.20 to –0.35 volts indicates that corrosion is uncertain.
3. < -0.35 volts indicates greater than 90% probability that corrosion is occurring.
4. A positive number indicates that the moisture content of the concrete is insufficient and therefore, the test is not valid.

### 5.15.3 Limitations

Half-Cell testing requires specialized equipment, typically a copper/copper-sulfate half-cell apparatus and a multimeter. A connection with the reinforcing steel is required and therefore, holes may need to be drilled in the concrete to locate and connect to the steel. This test method only indicates the probability of corrosion present at the time of testing, and does not indicate the extent or rate of corrosion.



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