

## **Horizontal Directional Drilling in External Pipeline Coating Integrity**

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### **Abstract**

External coating testing for pipeline directional drilling installations or informally “Bore Test”. It is a very much requested test in Alberta, Canada. The conditions of the installation are severe for the integrity of the external coating. So, a procedure has been developed after the involvement in several projects. This presents the synergies between field data and cathodic protection theories. Two different field tests are presented by using DC and AC power sources furthermore a theoretical calculation but with given field data. Also, it is introduced a specific theory how to get the resistance of the soil. As the results, pipe-to-earth resistance was similar for both field tests and consistent with the theoretical calculation given field resistivity data. Any Horizontal Directional Drilling external pipeline coating integrity evaluation has its own limitations. Such as, site conditions, backfill settle, aboveground survey techniques access, as well as suitable equipment. Bore tests are run in different conditions therefore it is important to understand the engineering theories for these field tests.

Key words: Bore test, Horizontal Directional Drilling, Coating Damage, Coating Integrity, Cathodic Protection.

## Introduction

The purpose of the “Bore Test” is to know the external quality of the coating after the installation of the pipe section, as picture 1. NACE<sup>1</sup> standard “TM-102-2002-SG”<sup>1a</sup> defines four kinds of coating quality such as: excellent, good, fair and poor. To know the final quality of coating with this procedure. It was used two different electrical tests. DC current test using minimum voltage drop method<sup>2a</sup> and, the 3 pole test which is called by the same manufacture of the Multifunction Ground Resistance tester. 3 pole test is done with AC current and the device itself gives the resistance to remote earth. The main goal of this procedure is to share with the cathodic protection industry that with two different electrical tests and get similar results. Besides, it is added a theoretical calculation but with field data as a third result which it could be compared with the electrical tests. Coating fusion bond epoxy is the first option for pipelines though so far, to know the quality of the coating the generic conditions of the application are not required. However, start collecting field data of the coating features of these pipe sections it may be helpful for future decisions. This bore test case was done in the northeast side of Edmonton, Alberta in summer. Nevertheless, these tests are run in winter as well even with temperatures as low as -20 °C (-4 °F). Therefore, it is important the analysis of the field data collected in the same site job. The procedure was adapted from NACE standard “TM-102-2002-SG” NACE CP 3 Cathodic Protection Technologist Course Manual, CP Interference Course Manual, CP 2 Cathodic Protection Technician Course Manual and the ground resistance tester AEMC model 6471 manual. The case is for a pipe section of 445 m (1460 ft) length, 0.305 m (12 inch) diameter.

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<sup>1</sup> NACE International 15835 Park Ten Place Houston, Texas 77084, USA

## Methods

### DC Current Test (Minimum Voltage Drop Method)

This test uses a DC power source, an interrupter and electronic ammeter. The temporary groundbed (a pin) is installed perpendicular to one end of the pipe section, and at around 100 m (328 ft) This is in order to get the best current distribution. In the picture 1, the negative cable connection to the south end. In the picture 2, the half-cell (copper-cooper sulfate electrode) is connected and located to remote earth in the north end of the pipe section. The minimum voltage drop procedure is used in order to avoid polarization. The interrupter was set to operate at 4 seconds current ON and 1 second current OFF. Also, both ends are lifted as Picture 1 and 2.



Picture 1 South End



Picture 2 North End

### 3 Pole Test

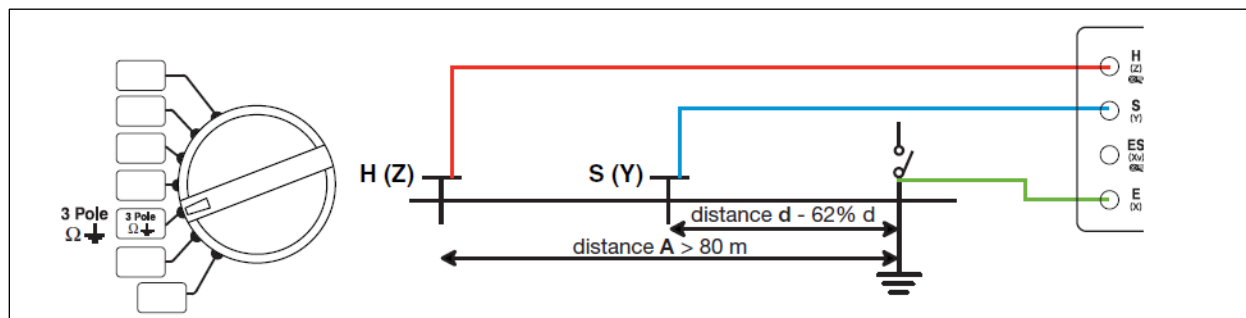


Figure 1

3 Pole Test (62% Method);  
figure from AEMC Manual model 6471,  
by Courtesy of Chauvin Arnoux, Inc. d. b. a. AEMC Instruments<sup>3</sup>

The ground resistance tester AEMC model 6471 is AC power source which by default is 128 Hz. The 3 Pole Test is run according 62% method<sup>4</sup>. The ground symbol is one end of the pipe section. H (Z) and S (Y) are the poles (pins).