

A Survey Method Using Magnetic Sensors to Detect the Contact Locations of Other Metal Structures on Pipelines

1. Introduction

To prevent corrosion of buried pipelines, pipelines have been provided with protective coating or/and cathodic protection. However, if a pipeline is electrically linked to any other metallic structure, pipelines cannot be completely protected from the inevitable corrosion or other forms of deterioration.

Nippon Steel Corporation owns a contact detection method employing magnetic sensors that permits detection of any contact between a pipeline and other metallic structures from the earth's surface without having to disturb the ground thereabove.

2. Principle

When an AC signal is applied to a pipeline, a magnetic field is induced around the pipeline. By measuring the voltage electromagnetically induced in the magnetic sensors by the magnetic field, it is possible to determine the amount of signal current flowing through the pipeline. This method of contact detection is called a magnetic

field method.

By analyzing the amount of signal current, it is possible to determine any overburden on the pipeline, the positions of branch pipes and points of contact between a pipeline and any other underground structure (embedded objects, valve chests, etc.).

3. Device Configuration

This contact detection device which uses magnetic sensors is similar to the "Super CODINS[®]" - a device owned by NSC to inspect coating defects on pipelines. The primary difference between this method and that device is that wheel electrodes on the Super CODINS have been replaced with a sensing car equipped with magnetic sensors. The sensing car is equipped with a plurality of magnetic sensors to detect three-dimensional components of the generated magnetic field. The induced voltage of each of the magnetic sensors is input to a recorder after being processed by the Super CODINS' signal processor.

4. Characteristics

(1) Signal processing method

In the contact detection device, signal processing using a phase sensitive demodulation method is performed. This detects minute signals buried in peripheral noise. By applying this phase sensitive demodulation method, it is possible to measure signals with a very high signal-to-noise ratio. In addition, from the phase information, it is possible to judge the direction of the signal current.

(2) Uses

The magnetic field method has the following functions.

- Detecting pipeline position
- Measuring pipeline depth
- Detecting branch pipe positions
- Detecting points of contact between pipelines and adjoining pipes, and structure

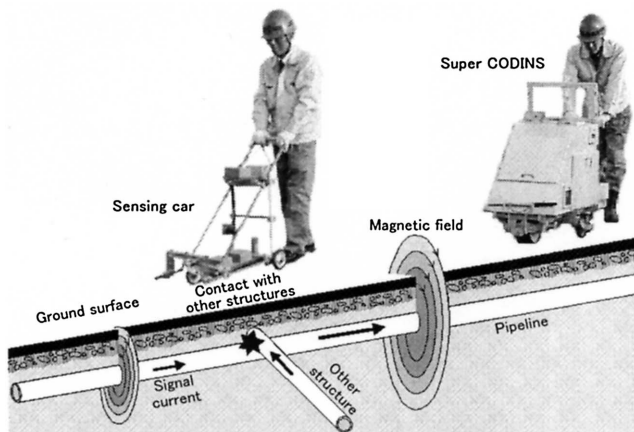


Fig. 1 The survey of pipelines using magnetic sensors

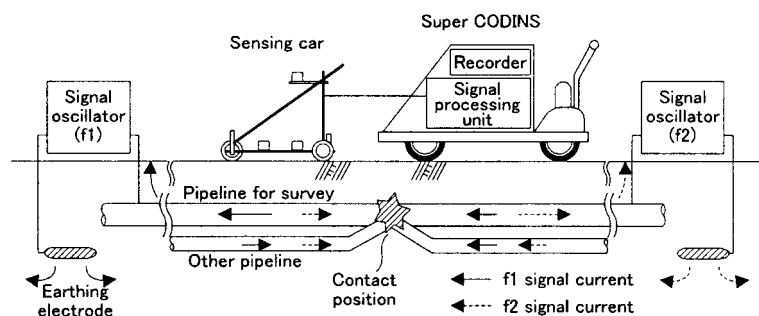


Fig. 2 The survey method using two-frequency signals to detect the contact locations of other parallel pipelines

(3) Method of detecting contact between parallel pipelines

In the past, it was difficult to determine points of contact when a pipeline being inspected was in contact with another parallel pipeline when using the magnetic field method. Nippon Steel has many years of experience in this particular field, so in 2003, NSC used the Super CODINS technology to develop a new technique for detecting points of contact between two parallel pipelines. This new technique uses a simultaneous, two-frequency signals transmission method.

5. Application

Many pipelines are provided with protective cathodic protection. In recent years, there are more utility companies, mainly city gas providers, that apply the magnetic field method to study the causes of defects in the protective cathodic protection. Defects are often detected during periodic inspections.

By employing the magnetic field method for contact detection in combination with Super CODINS system for inspection of damage to painted films, it is possible to implement effective maintenance and management of existing buried pipelines.

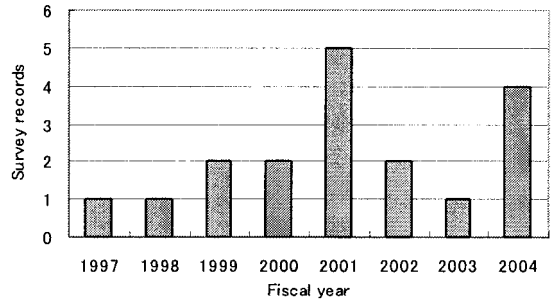


Fig. 3 Survey records

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