STANDARD

INSPECTION OF GUY ANCHORS IN DIRECT CONTACT WITH SOIL

Rev: 4/06

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Commentary *- Guy anchors in direct contact with soil have proven to be susceptible to galvanic corrosion. As telecommunications towers are coming of age the issue has been brought to the forefront due to tower failures caused by guy anchor corrosion. This standard outlines minimum requirements for inspection of deadman guy anchors on existing towers as well as presenting minimum corrosion control measures to protect anchors in direct contact with soil.*

1.0 Introduction

The standard will discuss two types of anchor inspections. The first is referred to as *surface inspection* where only a portion of the anchor is inspected below grade. The second type is referred to as *subsurface inspection* where the entire anchor shaft in direct contact with soil is exposed allowing complete inspection.

The standard outlines what is included in both types of inspection. The information gathered during an inspection is intended to help owners and inspectors determine corrosive conditions at the tower site, the structural condition of the anchor and mitigating measures to prevent corrosion.

2.0 Surface Inspection

Commentary: A surface inspection is intended to be the most economical and give the inspector / owner a basis for determining if further action may be necessary.

2.1 Measure and record the dimensions of the anchor shaft above grade.

2.2 Excavate each anchor to expose a minimum of two feet of the buried portion of the anchor shaft.

2.3 Collect a forty-eight ounce sample or six cups of soil from the bottom of the excavation and store in a water tight container. *Soil from one anchor is adequate to perform necessary tests.*

2.3.1 Laboratory test the sample in both as-found and saturated state to determine resistivity in ohm-centimeters.

2.4 Clean the anchor of soil and/or corrosion scale to bare metal in the location where corrosion appears to be the most severe.

2.5 Measure and record the cross sectional dimensions of the anchor shaft in its most corroded location.

2.6 Rate the anchor shaft based on the *Corrosion Severity Factor*, i.e. CSF1, CSF 2 or CSF 3 (See Annex A)

2.7 Backfill and compact the excavation. *Painting or cold galvanizing the anchor is not required.*

3.0 Subsurface Inspection

Commentary: A subsurface inspection is intended to provide a complete condition assessment of the portion of the steel guy anchor in direct contact with the soil.

3.1 Measure and record the dimensions of the anchor shaft above grade.

3.2 Excavate the anchor to expose the entire length of the buried portion of the anchor shaft to where it meets the concrete anchorage. **NOTE:** Subsurface inspection should not be conducted on helical anchors.

3.2.1 Care should be taken to not over expose the concrete anchorage during the excavation process.

3.2.2 Temporary anchorage may be advisable to protect the tower against failure if anchors are suspected to have structural damage.

3.3 Clean the anchor of soil and/or corrosion scale to bare metal in the location where corrosion appears to be the most severe.

3.4 Measure and record the cross sectional dimensions of the anchor shaft in its most corroded location.

3.5 Rate the anchor shaft based on the *Corrosion Severity Factor*, i.e. CSF1, CSF 2 or CSF 3 (See Annex A)

3.6 Backfill and compact the excavation. *Painting or cold galvanizing the anchor is not required.*

4.0 Corrosion Control

Commentary – There are several methods that can be utilized to mitigate corrosion of steel in direct contact with soil. This section discusses the most effective methods for tower guy anchors. It is up to the user to determine the best

method for their particular application. For further information refer to *ANSI/TIA 222-G, Annex H, Additional Corrosion Control* or contact AnchorGuard, LLC.

4.1 Galvanic Anode Cathodic Protection: The size, type and placement of galvanic anodes are to be determined by a competent corrosion control specialist or firm.

Galvanic anode cathodic protection shall be used for anchors in direct contact with soil when soil resistivity is lower than 5000 ohm-centimeters, pH is above 8.5 or below 4. This method may also be advisable when soil resistivity is lower than 10,000 ohm-centimeters. Refer to *Table 4.1.1*

Table 4.1.1: Soil Resistivity Classification [A.W.Peabody]

Resistivity in ohm/cm	Category
0 – 5,000	Very Corrosive
5,000 – 10,000	Moderately Corrosive
10,000 – 25,000	Progressively Less Corrosive

4.2 Concrete Encasement at Time of Initial Installation: Sulfate resisting concrete designs should be used for all concrete below grade. When a concrete deadman is used with an anchor, the reinforcing in the concrete encasement shall be properly engineered into the concrete deadman to prevent excess cracking. The concrete encasement shall extend a minimum of 6 inches (150 mm) above grade.

Concrete encasement other than at the time of initial installation is not advised since the area near the cold joint of the encasement and the initial deadman could be subject to accelerated corrosion.

References:

Corrosion Basics, An Introduction, 2nd Edition, Roberge, P. National Association of Corrosion Engineers, 2006.

Evaluating Soil Corrosivity Then and Now. Fitzgerald III, J.H., Corrosion 93, The NACE Annual Conference and Corrosion Show, 1993, Paper No. 4.

Peabody's Control of Pipeline Corrosion, 2nd Edition, edited by Bianchetti, R.L., NACE International, August 2001.

Structural Standards For Steel Antenna Towers and Antenna Supporting Structures. ANSI/TIA 222-G, Annex H: Additional Corrosion Control, January 2006.

Annex A Corrosion Severity Factor (CSF)

Anchor shafts shall be given a rating at time of inspection relative to the severity of the corrosion found. The rating is based on a scale referred to hereafter as the *corrosion severity factor* or CSF. Corrosion Severity Factor shall be compared against the most corroded area of the shaft.

1. **Corrosion Severity Factor 1** (CSF 1) includes the following: Galvanizing in tact, no signs of rust, no cross sectional material loss. Anchors rated CSF 1 should be monitored in the future during regular tower inspections.

2. **Corrosion Severity Factor 2** (CSF 2) includes any of the following: Galvanizing slightly to mostly gone, rust spots prevalent, minor pitting or flaking, no cross sectional material loss. Additional corrosion control is highly recommended.

3. **Corrosion Severity Factor 3** (CSF 3) includes ANY of the following: Galvanizing mostly to completely gone, heavily corroded, deep pitting, large areas of flaking, measurable cross sectional material loss. Anchors rated CSF 3 require additional corrosion control methods and may require repair or replacement.