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Detection and Mitigation of Stray Current Corrosion of Reinforced and Prestressed Concrete Structures

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Detection and Mitigation of Stray-Current Corrosion of Reinforced and Prestressed Concrete Structures

Foreword

This NACE International standard practice establishes the general principles to be adopted in order to minimize the effects of stray current corrosion caused by direct current (DC) and/or alternating current (AC) from external sources on steel reinforced concrete (RC) and prestressed concrete (PC) structures or structural elements. The standard practice is intended to offer guidance for: the design of concrete structures that may be subject to stray-current corrosion; the detection of stray current interference; the selection of appropriate protection measures; and the selection of appropriate mitigation methods.

The standard practice is intended for use by designers of RC and PC structures, professionals dealing with electrochemical techniques (e.g., cathodic protection [CP], realkalization, and electrochemical chloride extraction [ECE]), owners of structures with the risk of reinforcement corrosion caused by stray currents, owners of systems that could generate stray currents to concrete structures, engineers, and other interested parties.

The technical background for this standard is published as NACE Publication 01110, prepared by Task Group (TG) 356.[1]

In AMPP standards, the terms *shall* and *must* are used to state requirements and are considered mandatory. The term *should* is used to state something that is recommended, but is not considered mandatory. The term *may* is used to state something considered optional.

Section 1: General

1.1 Stray Currents

1.1.1 Stray currents are defined as electrical currents flowing through electrical paths other than the intended paths. Stray-current interference can result in localized corrosion of reinforcing bars where current leaves the steel, and in hydrogen embrittlement of prestressing steel where current enters the steel if the potential is negative enough to generate hydrogen gas. The mechanism of stray-current corrosion is described in detail in NACE Publication 01110.[1]

1.1.2 Stray currents find a parallel and alternative route of lower electrical resistance to flow, for example, through metallic structures buried in the soil such as pipelines, tanks, and industrial and marine structures. Stray currents can be a serious problem for the corrosion engineer, not only for the damage they can cause, but also for the difficulties encountered in the solution of the problem. Even though corrosion is the main focus of stray current effects, issues of hazards and safety to people should also be taken into account. Information on the dangers to people from AC effects on metallic structures is given in NACE SP0177[2] and EN[(1)] 50443.[3]

1.1.3 Stray currents may be DC, AC, or telluric currents, depending on the source. Sources of DC stray currents include: DC traction systems; impressed current CP systems; industrial devices (such as welding equipment); high voltage DC power transmission systems; and telecommunication systems. Sources of AC stray currents include electric power transmission and AC electrified railroad systems. Telluric currents originate from disturbances in the earth's magnetic field. Detailed information on the sources of stray currents is presented in NACE Publication 01110.[1]

1.2 Scope and Limitations

1.2.1 This standard practice describes appropriate prevention and mitigation measures that can be applied to RC and PC structures that are, or can be, exposed to stray-currents from external sources in order to minimize or eliminate stray-current corrosion. This standard practice addresses only steel corrosion related issues, and does not deal with issues of safety and hazards to people or

[(1)] European Committee for Standardization (CEN), Rue de la Science 23, B - 1040 Brussels, Belgium, www.cencenelec.eu.