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GUIDE TO THE CATHODIC PROTECTION OF METALS

Part 1—PIPES, CABLES AND DUCTS

For referenced documents see Preface

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This Australian standard was prepared by Committee MT/14, Corrosion of Metals. It was approved on behalf of the Council of the Standards Association of Australia on 16 September 1985 and published on 2 December 1985.

The following interests are represented on Committee MT/14:

Aluminium Development Council

Australasian Corrosion Association

Australasian Institute of Metal Finishing

Australian Gas Association

Australian Institute of Steel Construction Ltd

Australian Zinc Development Association

Bureau of Steel Manufacturers of Australia

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AUSTRALIAN STANDARD

GUIDE TO THE CATHODIC PROTECTION OF METALS

Part 1
PIPES, CABLES AND DUCTS

AS 2832.1—1985

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PREFACE

This standard was prepared under the direction of the Association's Commitee on the Corrosion of Metals by its subcommittee on cathodic protection. It was prepared at the request of industry to provide a standard for the guidance of owners of underground structures which are to be cathodically protected, and is not intended to be a complete cathodic protection design manual. Those requiring further information should refer to the other standards mentioned, to text books on the subject or to appropriate corrosion prevention specialists.

During preparation of this standard, cognizance was taken of the following publications:

BS CP1021	Code of Practice for Cathodic Protection
IS 8062	Code of Practice for Cathodic Protection of Steel Structures Part 1. General Principles Part 2. Underground Pipelines
NEN 1091	Cathodic Protection (CP) of Buried Steel Pipelines
NACE Standard RP-01-69	Control of External Corrosion on Underground or Submerged Metallic Piping Systems

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Queensland Electricity Act 1976—Electricity Regulations—Part VII Cathodic Protection Systems.

Victorian State Electricity Commission Act 1958—State Electricity Commission Cathodic Protection Regulations 1970.

New South Wales Regulations No. 306, 1973, Electricity Development Act, 1945.

In addition, account was taken of the regulations of the various State Authorities which differ in their approach to cathodic protection.

The standard forms one of a proposed series of standards on cathodic protection of metals; AS 2832.2 will deal with cathodic protection of external surfaces of compact buried structures, such as tank farms, service stations, tower footings, steel pilings (in soil), well casings, pumping stations, and associated buried pipework; AS 2832.3 will deal with compact immersed structures, such as steel pilings in sea water, spillway and lock gates and travelling water screens, while AS 2832.4 will deal with the internal protection of such items as water storage tanks.

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Australian Standard

GUIDE TO THE CATHODIC PROTECTION OF METALS

PART 1—PIPES, CABLES AND DUCTS

FOREWORD

Introduction

Corrosion of a metal is an electrochemical reaction between the metal and its environment. Thus corrosion is a combination of chemical effects along with an associated flow of electrical energy (corrosion current).

In most practical situations, it is impossible to change the nature of the environment in order to prevent corrosion. Cathodic protection is employed instead. This is achieved by applying an appropriate direct current flowing in opposition to the original corrosion current, thus stopping the natural tendency of the metal to react with its environment.

A circuit is established by metallically connecting a suitable source of external direct current to the structure to be protected. To complete the circuit the other current source end (the anode) is immersed or buried in the conducting medium, which is the corrosive environment, surrounding the structure. A complete circuit is thus established, partially metallic and partially electrolytic.

Fig. A shows a typical system using a galvanic anode as the current source, while Fig. B shows a similar system using a mains operated current source with a relatively permanent anode. Correct polarity must be observed to achieve protection. With proper design and operation, both systems are capable of completely preventing the corrosion of any metallic surface in contact with a bulk of soil or water, for as long as sufficient current flow is maintained.

All metal surfaces in contact with soil or water are subject to corrosion. Factors which affect the rate of corrosion of a given metal include:

(a) *The environment surrounding the structure.*
   (i) Resistivity.
   (ii) pH value.
   (iii) Composition of dissolved salts.
   (iv) Moisture content.
   (v) Presence of sulphate-reducing bacteria and their state of activity.
   (vi) Degree of aeration.

(b) *Abnormal environment factors.*
   (i) Presence of mineral ores in the route of the buried structure which are cathodic to steel.
   (ii) Presence of ash, cinders or other corrosion-inducing substances.
   (iii) Presence of any sewage effluents.
   (iv) Presence of some entomological species.

(c) *Alternating and direct currents.*
   (i) Presence of stray direct current from traction systems and/or other man-made sources.
   (ii) Occurrence of telluric current.
   (iii) Alternating current arising from conductive or inductive sources.

(d) *Climatic and tidal factors.*
   (i) Rainfall.
   (ii) Temperature.
   (iii) Velocity of water.
   (iv) Effect of lightning strikes.
   (v) Water table and its fluctuation.

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