Australian/New Zealand Standard™

Electrical hazards on metallic pipelines

Standards Australia

STANDARDS NEW ZEALAND

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee EL/1, Wiring Rules. It was approved on behalf of the Council of Standards Australia on 3 November 2000 and on behalf of the Council of Standards New Zealand on 27 October 2000. It was published on 1 December 2000.

The following interests are represented on Committee EL/1:

The Association of Consulting Engineers Australia
Australian Building Codes Board
Australian Electrical and Electronic Manufacturers Association
Communications, Electrical Plumbing Union
Electrical Contractors Association of New Zealand
Electrical Contractors Association Qld
Electrical Safety Organisation (New Zealand)
Electricity Supply Association of Australia
Institute of Electrical Inspectors
Institution of Engineers Australia
Insurance Council of Australia Limited
Ministry of Commerce New Zealand
National Electrical and Communications Association
New Zealand Council of Elders
New Zealand Electrical Institute
Regulatory authorities (electrical)
Telstra Corporation Limited

Additional interests participating in the preparation of this Standard:

Cathodic Protection Consultants/Installers
Electrical Protection Engineers
Gas Suppliers
Pipe Manufacturers
Pipeline Installers
Pipeline Operators
Railways
Water Authorities

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We also welcome suggestions for improvement in our Standards, and especially encourage readers to notify us immediately of any apparent inaccuracies or ambiguities. Please address your comments to the Chief Executive of either Standards Australia International or Standards New Zealand at the address shown on the back cover.

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Australian/New Zealand Standard™

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL-001, Wiring Rules.

The objective of this Standard is to provide guidelines on how to limit the electrical hazards which may appear on metallic pipelines, to identify some additional safeguards which may be necessary, and to specify acceptable electrical limits on pipelines.

This Standard also provides a range of informative appendices (which is not intended to be exhaustive) on the following subjects, which have a bearing on the application of the Standard:

(a) Sample methods of calculation of induced and other voltages from high voltage power lines and a.c. electric rail on pipelines.

(b) Methods of controlling or reducing the induced or coupled voltages on pipelines, to achieve the prescribed values.

(c) Precautions available to mitigate hazards due to fault conditions on the high voltage system.

(d) The interaction of cathodic protection systems with protective earthing systems and some suggested means of resolving the resultant problems.

(e) Check lists of data that may be required for calculation of low frequency induction (LFI) from the electricity transmission organization and from the pipeline owner or authority.

(f) Pipeline lightning protection.

(g) A brief bibliography on the technical matters addressed in this Standard.

During preparation of this Standard, reference was made to documentation provided by Brisbane Water and acknowledgment is made of their assistance.

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of the appendix to which they apply. A ‘normative’ appendix is an integral part of a Standard, whereas an ‘informative’ appendix is only for information and guidance.

Symbols used in equations in this Standard are defined in relation to the particular equations in which they occur.

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FOREWORD

To utilize land effectively, it is common to use easements for both high voltage power lines and pipelines. This close proximity of high voltage power lines and pipelines can result in voltages being induced onto the pipeline from a number of external influences.

Although overland transmission lines and metallic pipelines have been laid and constructed in the same easements for many years, the continuous growth of energy consumption, with increases in voltages, load currents and fault capacities, has resulted in an increase in the electrical and physical problems. The adoption of modern pipeline insulating coatings has exacerbated these problems.

There is a growing concern about the following aspects:

(a) Safety of people making contact with the pipeline.

(b) Risk of damage to the pipeline coating and metal.

(c) Risk of damage to equipment such as the pipeline cathodic protection (CP) system and telemetry systems.

This Standard considers a number of circumstances which give rise to electrical conditions on pipelines.

(i) Low frequency induction (LFI) due to parallel or near parallel positioning of the pipelines and high voltage power lines or high voltage a.c. traction systems.

(ii) Earth potential rise (EPR) due to pipeline proximity with high voltage power line towers, substation earth mats, and other earthing current discharge points.

(iii) EPR due to lightning current following flash attachment to objects or structures adjacent to the pipelines.

(iv) Capacitive coupling due to the placing, temporarily or permanently, of pipelines sufficiently adjacent to high voltage power lines to intercept a significant proportion of their electric field.

(v) The effects of lightning current introduced to the pipeline, directly or indirectly, and the effects due to the electrical properties of the pipeline and its coating.

(vi) The fortuitous contact of pipelines with other electrical systems such as electricity distribution or traction systems.

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1 SCOPE

This Standard specifies voltage limits and corresponding time constraints acceptable on both underground and above-ground pipelines that may be subject to power system influences. Guidance on the mitigation of lightning flash attachments is also provided.

NOTE: The acceptable voltage and time limits are based on the conditions outlined in AS 3859.

This Standard describes the mechanisms which create hazardous electrical conditions on such pipelines and provides guidance on how to calculate and mitigate these hazards.

This Standard does not cover electrical hazards on electricity power plant associated with the construction of pipelines and their coatings. Such hazards are covered by AS/NZS 3000 and its associated Standards.

2 APPLICATION

This Standard is applicable to those pipelines with electrically conducting walls, usually steel, and with an aqueous slurry or hydrocarbon-based product content such as water, oil or gas.

The responsibility for the application of this Standard rests with the owner or operating authority of the pipeline and therefore they should seek competent advice with regards to its content.

It is not intended that this Standard be applied retrospectively to installations existing at the date of publication of this Standard in so far as design, construction, operation, maintenance and testing are concerned. However, this Standard may be used during redesign or upgrading of existing pipelines to achieve conformance.

3 REFERENCED DOCUMENTS

The documents referred to in this Standard are listed in Appendix A.

4 DEFINITIONS

For the purpose of this Standard the definitions listed in Appendix B apply.

5 ACCEPTABLE VOLTAGE LIMITS

5.1 General

This Clause 5 sets out requirements for two categories of acceptable voltage limits for pipelines. Requirements for Category A touch voltage limits are provided in Clause 5.3. Requirements for Category B touch voltage limits are provided in Clause 5.4.

NOTES:

1 The voltage limits are touch voltage limits as defined in this Standard.

2 Pipelines which have touch voltages above those given in Clause 5.4 are outside the scope of this Standard. Some indication of the nature of such voltages is provided in Clause 5.5.

3 Reference in other documents to the acceptable voltage limits given in this Standard may be achieved by the wording ‘Category A (or Category B) touch voltage limits in accordance with AS/NZS 4853 (this Standard)’ as appropriate.

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