Australian Standard®

Pipelines—Gas and liquid petroleum

Part 1: Design and construction

This Australian Standard® was prepared by Committee ME-038, Petroleum Pipelines. It was approved on behalf of the Council of Standards Australia on 19 January 2007.
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The following are represented on Committee ME-038:

- APIA Research and Standards Committee
- Australasian Corrosion Association
- Australian Chamber of Commerce and Industry
- Australian Institute of Petroleum
- Australian Pipeline Industry Association
- Bureau of Steel Manufacturers of Australia
- Department of Consumer and Employment Protection (WA)
- Department of Energy, Utilities and Sustainability (NSW)
- Department of Mines and Energy (Qld)
- Department of Primary Industries (Victoria)
- Department of Primary Industry, Fisheries and Mines (NT)
- Energy Networks Association
- Gas Association of New Zealand
- Primary Industries and Resources SA
- Welding Technology Institute of Australia

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Pipelines—Gas and liquid petroleum

Part 1: Design and construction

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee ME-038, Petroleum Pipelines, to supersede AS 2885—1997, *Pipeline—Gas and liquid petroleum.*

This Standard incorporates Amendment No. 1 (February 2009). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this Standard as an Australian Standard rather than an Australian/New Zealand Standard.

The objective of this Standard is to provide requirements for the design and construction of steel pipelines and associated piping and components that are used to transmit single phase and multi-phase hydrocarbon fluids.

This standard provides guidelines for use of pipe manufactured from certain non steel or corrosion-resistant materials.

This Standard is part of a series, that covers high pressure petroleum pipelines, as follows:

AS		
2885	Pipelines—Gas and liquid petroleum	
A1 2885.0	Part 0:	General requirements
2885.1	Part 1:	Design and construction (this Standard)
2885.2	Part 2:	Welding
2885.3	Part 3:	Operation and maintenance
2885.4	Part 4:	Submarine pipelines
2885.5	Part 5:	Field pressure testing
A1		**Text deleted**

A1 **Text deleted'**

2007 REVISION

A1 **'Text deleted'**

The comprehensive revision of AS 2885.1 is the result of extensive work by subcommittee ME-038-1 in response to a request from the industry that it consider increasing the design factor from 0.72 to 0.80. This request prompted a detailed review of each section and each clause of the Standard, resulting in the preparation of some 70 'issue papers' that considered the underlying technical issues (in relation to an increased design factor) and recommended changes to the Standard. These issue papers were debated within the

subcommittee and published on the Industry web site to allow consideration by the Industry. The results of these deliberations form the basis of this revision. The revision also reflects the results of a significant and ongoing industry-funded research program undertaken by the Australian Pipeline Industry Association and its research contractors, and through its association with the Pipeline Research Council International and the European Pipeline Research Group.

This revision provides a basis for Industry to benefit through the application of an increased factor for pressure design (for new pipelines) and a structured basis for increasing the MAOP of a qualifying existing pipeline. These benefits are supported by robust requirements for safety, structural design, construction, testing and record keeping.

Significant changes in this Revision include the following:

(a) A restructure of the sections of the document to separate pipeline general, pipeline stations, and instrumentation and control.

(b) The incorporation of a section defining the minimum requirements for a pipeline whose maximum allowable operating pressure is proposed to be raised.

(c) Section 2 (Safety) has been rewritten, to reflect experience gained in the seven years since it was revised to provide a mandatory requirement for risk assessment. This revision provides more explicit guidance on the obligation to undertake safety assessments with the integrity required for compliance with this Standard. Material is provided in normative and informative appendices.

(d) Section 3 (Materials and components) has been revised to better address the treatment of materials used in pipelines. It includes a requirement to de-rate the specified minimum yield stress of pipe designed for operation at temperatures of 65°C and higher. The use of fibreglass and corrosion resistant alloy pipe materials for pipelines constructed to this Standard is permitted and limited in this Section. A minimum toughness requirement for pipe DN 100 and larger has been introduced.

(e) Section 4 (Pipeline general) contains most of the material in the 'Pipeline general' section of the 1997 revision. The Section has been expanded to include the following:

  (i) A mandatory requirement for the design of a pipeline for the existing and intended land use.

  (ii) A revision of the requirements for effective pipeline marking including a change to require the marker sign to comply with a 'danger sign' in accordance with AS 1319, *Safety signs for the occupational environment*.

  (iii) A plan for isolation of a pipeline.

  (iv) Special requirements for pipelines constructed in locations where the consequence of failure by rupture is not acceptable. Provisions for compliance with these requirements for pipelines constructed to this, or to an earlier revision of the Standard, in land where the location classification has changed to residential (or equal) is included.

  (v) The location classification definitions are revised and additional sub-classes are defined.

  (vi) The hydrostatic strength test pressure is redefined to address the situation where the pipe wall thickness exceeds the pressure design thickness, including corrosion allowance.

  (vii) Provisions for low-temperature excursions.

  (viii) Calculation methods for critical defect length, energy release rate and radiation contour.

(f) The requirements for fracture control have been extensively revised to clarify the requirements and to reflect experience gained since 1997. Emphasis is placed on the use of the Battelle Two Curve model given the fact that most gas pipelines in Australia transport 'rich' gas.

(g) Section 5 (Pipeline design) has been revised to incorporate those provisions specific to pipeline in the 1997 revision. Significant changes to this Section include the following:

(i) The pipe wall thickness is required to be the greater of the pressure design thickness, and the thickness required for each other identified load condition. The thickness terms used in this Standard are clarified.

(ii) An equation for calculating the thickness required for external pressure is provided.

(iii) Recognizing the result of a comprehensive investigation, of its purpose and the impact of change, the design factor has been changed from 0.72 to 0.80, and the design factor for pipeline assemblies and pipelines on bridges has been changed from 0.60 to 0.67.

A1 (iv) **'Text deleted'**

(v) Requirements for stress and strain have been completely redrafted to clarify the requirements. The limits for each stress condition are tabulated and normative and informative appendices are provided incorporating the relevant equations. Reliability and limit state design methods are permitted for pipeline design and integrity analysis, using approved methods.

(vi) The requirements for a 'prequalified' design are included in a new clause. This is permitted for short pipelines DN 200 and smaller with a MAOP of 10.2 MPa or less.

(vii) The provisions for reduced cover for a pipeline constructed through 'rock' have been revised.

A1 (viii) The method for calculating reinforcement of branch connections in AS 2885.1—1987 has been reinstated in full.

(h) Section 6 (Station design) incorporates the provisions of Clause 4.4 of the 1997 revision in relation to stations. The Section has been expanded to require the Design Basis for stations to be documented. Additional guidance is provided on treatment of lightning, together with some clarifying revisions to the text.

(i) Section 7 (Instrumentation and control design) incorporates the requirements of Clause 4.2 of the 1997 revision. The requirements for pipeline operation under transient conditions and a tolerance specification for pressure controls on pipelines intended to be operated at MAOP are addressed.

(j) Section 8 (Corrosion mitigation) incorporates the requirements of Section 5 of the 1997 revision. The Section incorporates clarifying revisions.

(k) Section 9 (Upgrade of MAOP) is a new Section that sets down the minimum process, including activities required, to demonstrate the fitness of a pipeline designed and operated at one pressure as suitable for approval for operation at a higher pressure. The Section establishes a structured methodology for demonstrating the pipeline fitness and, once approved, for commissioning the pipeline at the new pressure. The maximum pressure is limited to the hydrostatic strength test pressure divided by the equivalent test pressure factor.

(l) Section 10 (Construction) incorporates Section 6 of the 1997 Standard. The requirements for construction survey are clarified, and a minimum accuracy for as-constructed survey is incorporated. Since padding and backfilling are two activities that impact on the pipeline integrity, this revision incorporates additional requirements for these activities reflecting outcomes from APIA research on backfilling.

(m) Section 11 (Inspection and testing) has been revised to align it with the requirements of AS 2885.5. It specifies strength test endpoint requirements for pipelines with a pressure design factor of 0.80, and references APIA research and associated software designed to enable the analysis of the pipe in a proposed (and constructed) test section to be analysed to determine the presence and location of pipe that may be exposed to excessive strain at the intended strength test pressure.

(n) Section 12 (Documentation). Obligations on the developer of a new pipeline to document the design and construction, and to transfer this information to the pipeline operator, are clarified and expanded.

(o) Each appendix in the 1997 revision of the Standard has been critically reviewed and revised, as appropriate. New appendices are provided reflecting the findings of APIA research, clarification of concepts in the Standard, and providing detailed calculation methods.

A1 (p) Resistance to penetration calculation methods and design requirements provided.

In addition to the items identified above, there are a great many changes of lesser significance incorporated in the document to the extent that users should consider it as a familiar but new Standard.

A1 **2008 Amendment No. 1**

Amendment No. 1 to AS 2885.1—2007 was prepared to correct errors in the 2007 revision and to clarify items identified as being potentially confusing. The amendment includes guidance on specifying fracture toughness when purchasing line pipe and includes a simplified calculation for energy release from leaks.

The requirements for the control of fracture initiation in components other than line pipe have been clarified.

An informative Appendix which provides guidance on the design, construction and testing of fibreglass pipelines is included.

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.

Statements expressed in mandatory terms in notes to tables and figures are deemed to be requirements of the Standard.

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SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies requirements for design and construction of carbon and carbon-manganese steel pipelines and associated piping and components that are used to transmit single-phase and multi-phase hydrocarbon fluids, such as natural and manufactured gas, liquefied petroleum gas, natural gasoline, crude oil, natural gas liquids and liquid petroleum products.

The principles are expressed in practical rules and guidelines for use by competent persons.

The fundamental principles and the practical rules and guidelines set out in AS 2885.1, AS 2885.2, AS 2885.3 and AS 2885.5 are the basis on which an engineering assessment is to be made where these Standards do not provide detailed requirements appropriate to a specific item.

NOTE: AS 2885.4 for offshore submarine pipeline systems is a standalone document.

1.2 GENERAL

Where approved, this Standard may also be used for design and construction of pipelines made with corrosion-resistant alloy steels, fibreglass and other composite materials. Where this Standard is used for pipelines fabricated from these materials, appropriate requirements shall be established to replace the provisions of this Standard in relation to nominated standards for materials (Section 3), fracture control (Clause 4.8), stress and strain (Clause 5.7) and corrosion (Section 8) and the provisions of AS 2885.2 in relation to welding and non-destructive examination. For composite material, appropriate requirements shall be established to replace the hydrostatic strength test endpoint provisions of AS 2885.5.

Where this Standard imposes requirements, which add to or override the requirements of a permitted Standard or code, the additional requirements are explicitly stated in this Standard and shall be met.

1.3 RETROSPECTIVE APPLICATION

A1 Retrospectivity is governed by AS 2885.0.

AS 2885.1—2007 introduces changes that reflect matters of public safety in high consequence areas and which are intended to apply retrospectively.

Each existing pipeline shall be assessed against the requirements of Clauses 4.7.2 and 4.7.3. Where the existing pipeline does not comply with either Clause, mitigation shall be applied in accordance with Clause 4.7.4 regardless of whether or not there has been a land use change.