

Public Comment Draft - Briefing Note to ME38 and Industry

AS / NZS 2885.5 Pipelines – Gas and liquid petroleum Part 5: Field pressure testing

This briefing note was prepared by subcommittee ME38-5 to provide a background for members of Committee ME38, and for people interested in reviewing and commenting on the public comment draft of AS 2885.5 – 2010.

AS / NZS 2885.5 was last revised in 2002 following an exhaustive gestation. The Standard was originally published in 1977, and revised in 1987. The original revision was largely based on experience gained in testing the DN 850 Moomba to Sydney pipeline, where the test sections were typically between valves (roughly 20,000 m³). This and the 1987 revisions were largely procedural documents, with the acceptance criteria incorporated in the primary Standard (see AS 2885 1987). Subsequently AS 2885 was broken into Parts. AS 2558.1 1997 started a transition from its technical responsibility for the testing from Part 1 to the planned Part 5.

Important to the 2010 revision is the fact that between 1976 and 2002, most pipelines were small diameter (<DN 500). Leak acceptance criteria which in AS 2885-1987 were “Suggested unaccountable test fluid loss per test section” in various location classes), became mandatory criteria which when applied to other parameters of the test limit the maximum volume of a test section so that the measurement uncertainty is sufficient for the test to discriminate between a pressure change resulting from fluid loss and a pressure change resulting from a change (usually) in the temperature of the test fluid. It is thought that the small diameter pipe experience at that time resulted in the responsible committee concentrating on these when developing the 2002 revision, and not really considering the effect of the leak test acceptance criteria on larger volume test sections.

Currently there are several DN 1050 pipelines proposed for construction in Australia, and the prospective increase in demand for gas as preferred fuel to limit CO₂ emissions is expected to result in future construction of pipelines with diameters larger than DN 500. (The application of the leak test acceptance criteria to a DN 1050 pipeline would restrict the length of a test section to approximately 5 km for a 24 hour test). Clearly this will increase the construction cost, and is an unreasonable requirement (unless it is necessary).

Moreover a change in AS 2885.1 2007 to permit a maximum design factor of 0.8 (requiring a minimum strength test pressure equal to 100% of SMYS), the almost default use of Grade X70 steel, and the almost default use of factory applied FBE or 3 Layer coatings has resulted in a significant increase in the installed yield to tensile strength, significantly increasing the risk that in a typical test with an offset volume limit to a strength test, some pipes would experience excessive strain which could not be detected by the offset volume limit method (The RSC conducted research on hydrostatic testing including a full scale burst test on modern FBE coated pipe – this test showed that the strain to failure was 2%, against an expectation for “typical” pipe of 6-7%).

AS 2885.1 2007 recognised this problem and changed the offset volume limit, and it also recommended the use of a product or the RSC’s research program (PIPESTRAIN) should be used with as-built pipe and pipe property data to simulate each test section to identify pipes with the potential to be subjected to excessive strain and allow an engineering decision to be made to prevent potential damage to some pipes by the strength test.

It is against this background that the 2010 revision has been prepared.

The AS 2885.5 draft is a full revision intended to:

- Recognise the technical risk associated with testing pipe to a pressure which exceeds the nameplate yield strength of the line pipe and to require the pipeline design engineer to nominate the test acceptance criteria, analyse each test section and verify that it is fit for test. The supervising test engineer’s responsibility is restricted to the test design, the conduct of the test and the interpretation of the results.
- Introduce specific pressurisation limits to a strength test, and for pipe with increasing yield-tensile strength ratio (based on the coated pipe yield strength (after “ageing”)).
- Revise the leak test acceptance criteria as they apply to test sections of increasing volume, recognising that discrimination between a leak and a measurement uncertainty for small volume

test sections can be achieved with relatively simple measurement (pressure only) while large volume sections require increasing levels of sophistication.

- Recognising that the typical leak in an ERW pipe is a small seam weld flaw that was not detected in the manufacturing process, and which under leak strength pressures, leaks at a rate of 50-150 L/24 hours, while a large diameter SAW pipe (because of the joining process is a multi-pass, double sided automatic welding process that does not produce these flaws). Consequently the draft revision has proposed different leak test acceptance criteria for pipe manufactured by these processes, where large volume test sections are required (and in R1 location class). The nominated criteria for SAW pipe is approximately the same as the estimated sensitivity obtained from hydrostatic tests on the Moomba-Sydney pipeline.
- An alternative test criteria is proposed for large volume test sections which could achieve a 100 L/24 hours using an extended test period and less stringent temperature measurement criteria.
- Restructure the Standard in the format of other Parts of AS 2885.
- Recognise that because a hydrostatic test is a strength proof test, it is inherently unsafe. Consequently the draft revision incorporates a new section *Safety*, together with a new Appendix which provides extensive information on hydrostatic test safety.
- There are a great number of other changes of lesser importance than those outlined above.

The Design section of the draft Revision must be transferred to AS 2885.1. In the light of recent experience where excessive strain appears to have occurred in some pipelines, it is hoped that this can be done relatively quickly following resolution of public comment.

People reviewing the public comment should be aware that because of the need to bring this revision to publication as quickly as possible, the responsible subcommittee has not finalised its review of the informative appendices. These appendices are currently being reviewed in parallel with the public comment. The only appendix that is expected to contain significant change when published is Appendix D (Calculations for hypothetical test sections). These are currently under revision to reflect the requirements of the draft revision.

As a separate project the APIA's Research and Standards Committee is planning to prepare a revision to PIPESTRAIN to reflect the requirement of the draft revision for pipelines tested to pressures that will create hoop stress close to or higher than the nameplate yield strength of the pipe material. It is also continuing a research project through the Energy Pipelines CRC to extend an initial research project "Understanding Hydrostatic Test Measurement Uncertainty". This project is expected to permit a future revision to the Standard to provide improved guidance on temperature measurement, which in turn is expected to improve measurement uncertainty in leak tests of large volume test sections.