Paper for APIA Convention 2016

Title: Offshore Pipeline Standards Revision

Authors
Leif Collberg – Vice President – Pipeline Technology DNVGL
Eric Jas – General Manager – Atteris Pty Ltd and ME-38/4 Subcommittee Member

Abstract
When designing a pipeline system, the complete pressure containing system should be designed in a consistent manner. In practice, there are code breaks that may violate such a consistency. One such point is at the landfall, or shore crossing.

In Australia, offshore oil and gas pipelines are designed to AS 2885.4[1]. Whilst some specifics are addressed in this document, it largely refers to the globally used standard for submarine pipeline systems, DNV-OS-F101[2].

Applying this set of standards has proven to be effective for the many Australian pipeline systems which travel from offshore to onshore and necessitate a shore crossing design and construction. However, lessons learned from several projects have prompted the need for making some changes in both these documents.

A research project was undertaken in this regard, and an engineering guideline for pipelines crossing shorelines and waterways was written based on the research findings. This guideline was used to initiate a discussion on proposed changes in AS 2885.4 and DNV-OS-F101.

The changes, which have now been incorporated in both standards, result in a unified approach to defining the interaction between the Australian Standard and the International Standard for pipeline engineering and design in the shore crossing zone.

The changes in the wording of both documents are one part in ensuring continual improvement in safety and reliability levels of our national offshore to onshore pipeline network. The second part requires both the offshore and onshore pipeline industries to further enhance their collaboration for a common cause.

Introduction
This paper presents the recent changes related to shore crossing made to both the Australian and the International standards for submarine pipeline systems. The task of making changes to both documents at the same time has been an orchestrated event. The main changes center on the area where a submarine pipeline transitions into a terrestrial pipeline. The aim has been to achieve better clarity and guidance on process and engineering considerations for this traditionally difficult part in pipeline routes. Several other parts of both standards have undergone modification; these are also addressed in this paper.

CrossWay JIP

Specific industry expertise has been used in contributing to the changes made in both standards. In addition, the output from the CrossWay JIP[3] has been a source of information. This JIP has focused on developing a guideline for pipelines which cross shorelines and waterways. The guideline provides recommendations regarding the design, construction, operation, decommissioning and abandonment of pipelines at these crossings. The aim has been to provide the pipeline engineering industry with easy to use processes and considerations for the following life-cycle phases of pipelines at shoreline and waterway crossings:

- The design of pipelines at these crossings, from early concept through to detailed design
- The operational phase of a pipeline system at these crossings, focusing on inspection, monitoring, maintenance and response (IMMR)
- The decommissioning and abandonment of a pipeline system at these crossings.

The guideline has been written primarily for the Australian hydrocarbon pipeline industry, making reference to applicable Australian Standards. However, the principles presented can also be applied in other countries using equivalent local or international standards.

The document is not intended to provide a detailed engineering manual that describes a solution to every shoreline and waterway crossing situation. Rather, recommended processes that may be followed are presented, together with key considerations to assist in the decision making processes.

The aspects covered by the guideline in relation to crossings are: design interfaces, pipeline route selection, design concept selection, onshore-offshore design and operational interface aspects, pipeline system integrity design, pipeline operational aspects, decommissioning and abandonment.

The shoreline crossing is more than an already complex change of environment for the pipeline from an engineering perspective. It is also the point where the applicable jurisdiction authority transitions between regulators. Traditionally, the shoreline also represents the boundary between two culturally different industries; onshore, which has a stronger national identity; and offshore, which has a more global identity. In addition, shoreline areas have commonly very high environmental and social value.

The work done by the CrossWay JIP will assist in future developments which encompass a shoreline crossing.

One particular area is still undergoing research, which is in relation to the interface of the two different types of cathodic protection systems used on submarine and terrestrial pipelines. This research, which is currently underway, is planned to be completed in 2017, and may trigger an addendum to the standards.

AS 2885.4

The overarching standard that applies to the pipeline industry in Australia is AS 2885, which relates to the design, construction, testing, operations and maintenance of gas and petroleum pipelines that operate at pressures in excess of 1050 kPa. The many other standards used by the pipeline industry are referred to in AS 2885 as the principal document.

AS 2885 was developed by a working group from both industry and government. APGA and its members continue to actively participate in the design, review and development of the national standard for gas and liquid petroleum high-pressure pipelines by participating as members and associates on Standards Australia development committees. Standards Australia is the peak non-government body responsible for assisting in the development and maintenance of industry standards in Australia, such as AS 2885.

The ME-38 Committee is responsible for standardisation in the field of gas and liquid petroleum pipelines. Many members of the committee are also members of APGA. Standards in the ME-38 suite of standards are generally considered for revision roughly every five years, with the latest revision one completed in 2010. The recent changes of the suite of AS 2885 standards were commenced in 2015.

The ME-38/4 Subcommittee is responsible for maintaining AS 2885.4. The committee consists of a number of subject matter experts pertaining to submarine pipelines in the areas of pipeline design, materials and surveying as well as a representative from DNVGL in Norway to ensure that the committee stays abreast of the latest developments associated with the DNV OSF101 Standard upon which AS2885.4 is based.

As part of the process, approximately 20 companies including offshore oil and gas operators, construction contractors and engineering consultancies in Australia were consulted. The revision has considered the latest developments in the submarine pipeline industry in terms of the design, construction and operation of submarine pipelines.

The new official code name of the standard will become AS/NZS 2885.4:2016[4], to include application of the standard in New Zealand.

A revision was made in describing the applicability limits for AS/NZS 2885.4, to make them clearer. Industry feedback, and work done by the CrossWay JIP, concluded that because each project is unique, it is not practicable to be overly prescriptive in defining the battery limits. In the new version it is the responsibility of the licensee or operator to define the limits and seek regulatory approval where required. The standard merely provides guidance on those limits through diagrams.

Figures 1 and 2 provide guidance on the application limits between subsea a conventional platform and between subsea and a floating production facility respectively.

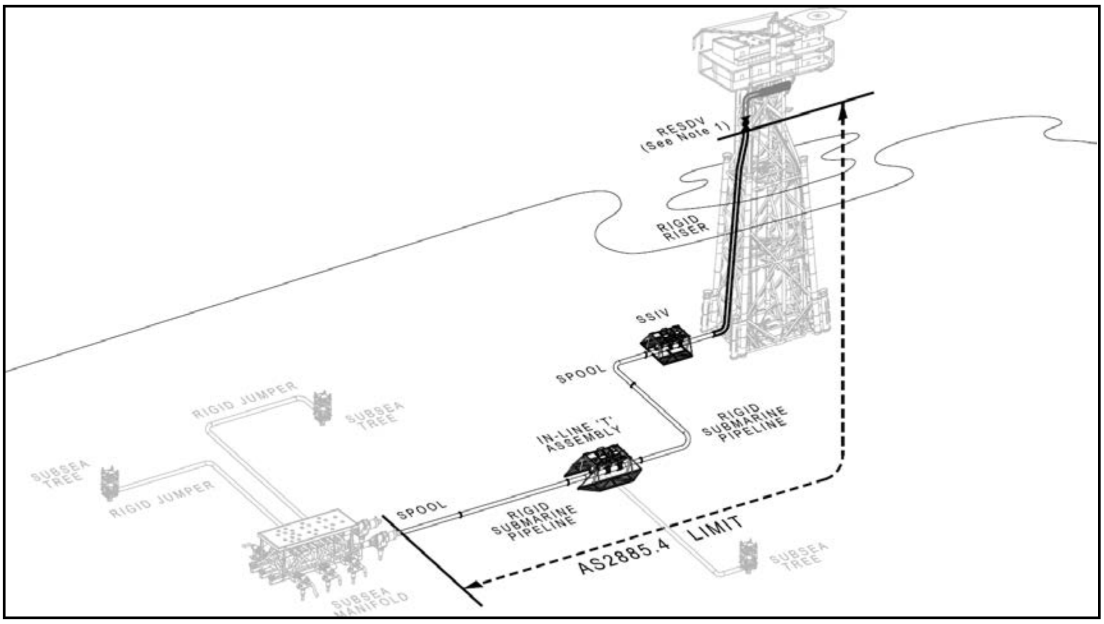

Figure 1 – Application Limits between Subsea and Fixed Facility

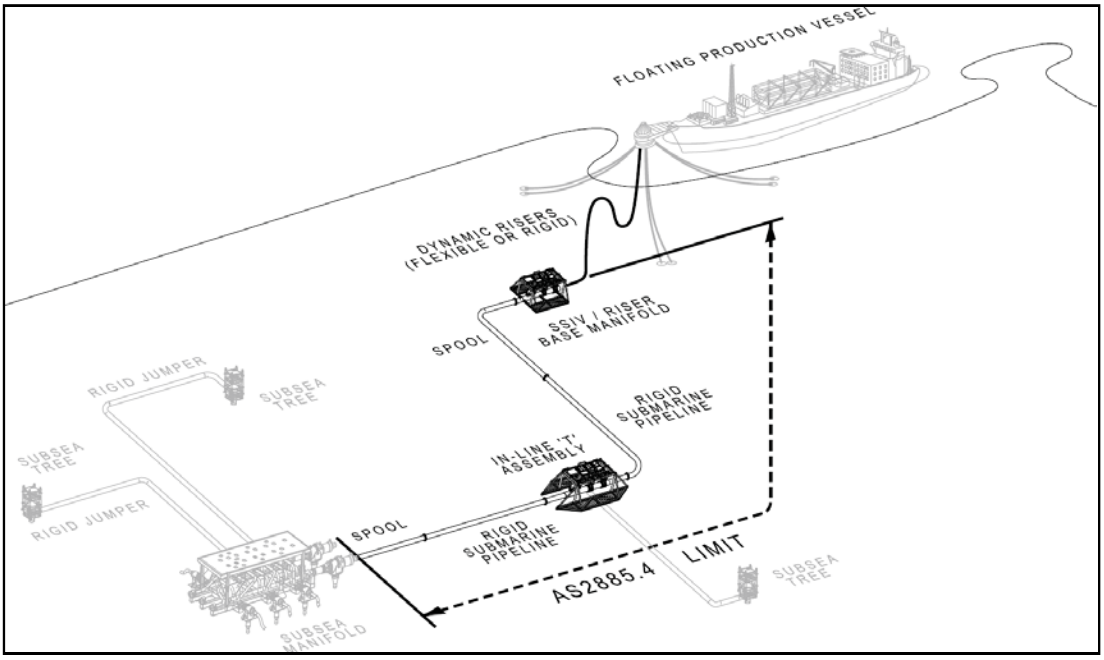

Figure 2 – Application Limits between Subsea and Floating Facility

Figure 3 provides guidance on the application limits between AS/NZS 2885.4 (submarine pipeline section) and AS/NZS 2885.1 (terrestrial pipeline section) for a range of commonly used shore crossing design options.

The code break for a jetty-based shore crossing design should be at the first weld or mechanical connector between the riser and the pipeline section on the jetty. This is a change from the previous standard, recommended by the CrossWay JIP. In the previous standard the interface point was where the pipeline would transition from the landward side of the jetty onto the dry land.

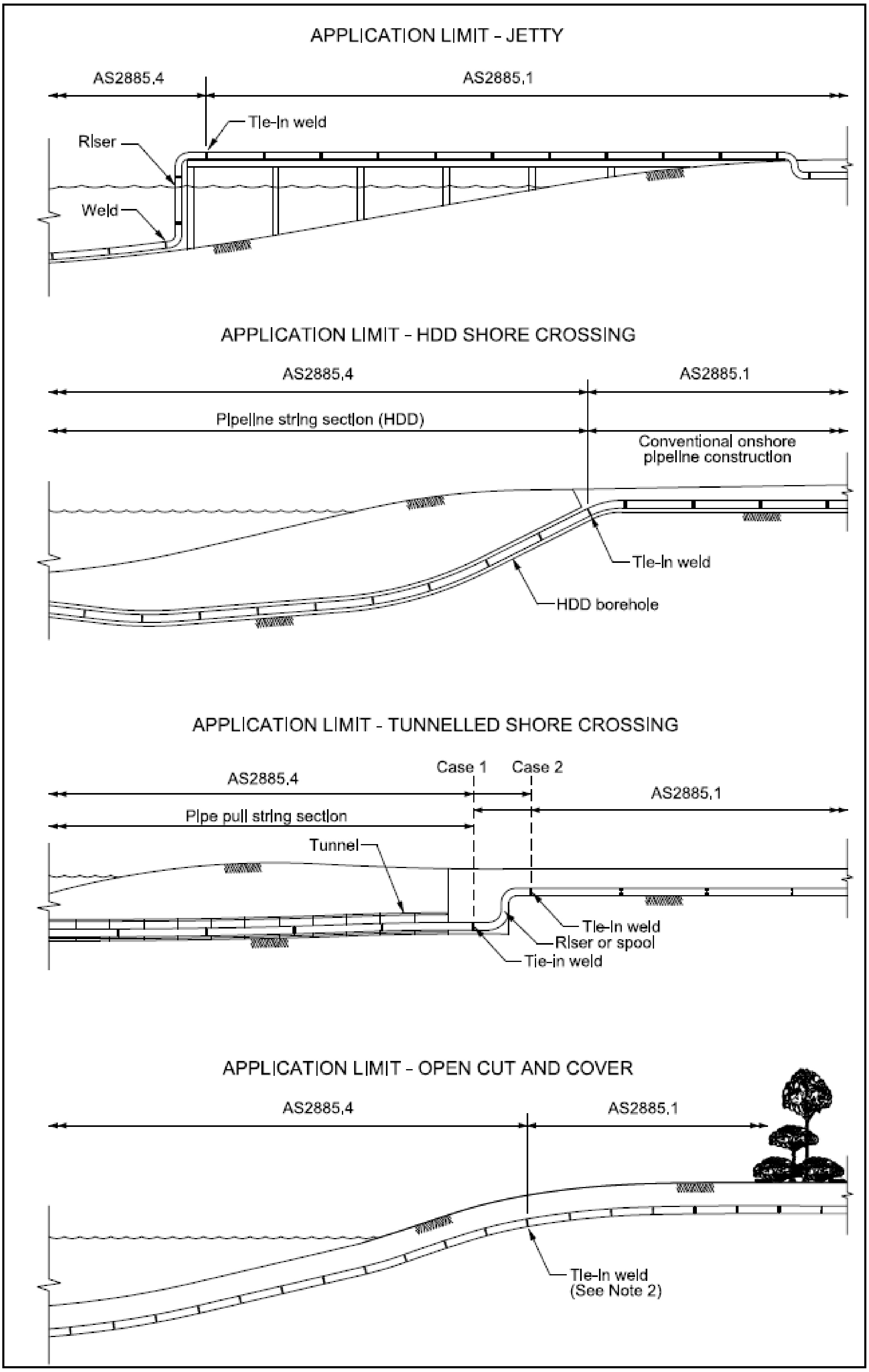

Figure 3 – New Code Break Locations between AS/NZS 2885.1 and AS/NZS 2885.4

The code break for a HDD shore crossing design should be at the onshore tie-in weld, assuming that a fabricated bend is introduced between the inclined pipeline section (installed by the HDD method) and the onshore pipeline section. There is more clarity in the revised standard for the interface point.

A tunnelled shore crossing design has been added to the standard, based on recent developments in the industry where tunnels have been used. The design may or may not include a tie-in riser or metrology spool on the onshore side of the crossing. The location of the Code Break may differ, and could either be at the base (Case 1) or at the top (Case 2) of the riser/tie-in spool (Figure 3). If there is no tie-in riser or metrology spool, then the code break should be at the onshore tie-in weld to the pipeline section installed through the tunnel.

The code break for an open cut and cover shore crossing design should be defined on a case by case basis, once a sufficient level of engineering definition has been achieved.

The revised wording in the standard provides a process which should be followed to define the boundary limits either end of the shoreline crossing.

The new wording of the standard makes a distinction between a “Licensee” and an “Operator”. However no distinction is made between the two in terms of their obligations for ensuring safe operation and approvals of key parameters they must provide

Industry feedback noted there is an ambiguity between the wording in DNV-OS-F101 and AS/NZS 2885.1 regarding the allowable duration of pressure transients above MAOP. AS/NZS 2885.1 specifically mentions that the pressure transients above MAOP are of limited time duration. DNV-OS-F101 does not provide guidance on allowable durations for pressure transients above MAOP up to Incidental Pressure. DNV-OS-F101 only provides guidance on probability of exceeding Incidental Pressure. This comment was passed on to DNVGL for consideration in the 2016 revision of DNVGL-ST-F101.

DNV GL’s view on this is that the assumption that all pipeline systems can be described by a maximum pressure distribution curve representing all pipeline systems is much more ambiguous than how long a pressure can be maintained at a certain level. The hydraulic behaviour of pipeline systems varies with content, size and length, not to mention the more and more common pipeline network with different design pressures.

As a response to the Australian and other feedback, a small project has started on the issue of pressure (or pipeline) protection systems in general. The objective of this study is to develop bridging documents between different codes (that may currently be inconsistent) as well as between disciplines. This document will provide guidance on transient simulations (as e.g. a basis for the ratio between design and incidental pressures), requirements to barriers, definitions of different type of barriers, and provide guidance on set points for different control systems, including so-called HIPPS. The above comment from the Australian industry will be included in this work.

DNV-OS-F101

DNV-OS-F101 is currently subject to revision. This revision will include the following major changes:

- Due to the merger between Det Norske Veritas (DNV) and Germanischer Lloyd (GL), all DNV and GL codes has been renamed, DNV-OS-F101 to DNVGL-ST-F101[5] (the last four characters of current abbreviations will remain the same for all documents affected).
- Improvements and more guidance on the shore crossing based on the CrossWay JIP, has been included in section 3 and Appendix F.
  Changes reflect those made to AS 2885.4 with regard to the shore crossing application limits, battery limits and design considerations. The same figures and words have been used to provide guidance to defining the interface point between submarine and terrestrial pipelines.
- Guidance on fracture assessment has been removed from Appendix A to a new revision of DNVGL-RP-F108. Only premises for fracture assessment remain in the standard with a reference to the new revision of the RP. This will open up for alternative fracture assessment methods as long as these fulfil the premises stated.
- Fixed risers have been removed and are covered in DNVGL-ST-F201 instead.
- Requirements to load effect analyses are now clarified and compiled into one subsection in section 4.
- Dimensional tolerances and measurements of linepipes have been re-visited by an industry workshop.
- The linepipe requirements to smaller pipes, in particular coiled pipes, have been revisited and requirements have been added to make it a more complete specification for such pipes.
- Supplementary requirements P has been re-visited.
- The use of DNV GL-RP-0034 for forged components has been acknowledged.
- Requirements to hydrostatic testing of components and pipeline assemblies are clarified.
- Other minor corrections have been made.

The revision is almost completed and the new revision will be sent for hearing at the end of 2016.

Conclusion

The changes to AS 2885.4 and DNV-OSF-101 (now renamed to AS/NZS 2885.4 and DNVGL-ST-F101 respectively) have resulted in a much more unified approach to defining the interaction between the Australian and the international standards for submarine pipelines.

The changes in the wording of both documents are one part in ensuring continual improvement in safety and reliability levels of our national offshore to onshore pipeline network. The second part requires both the offshore and onshore pipeline industries to further enhance their collaboration for a common cause. This can be achieved through:

- Improved collaboration between onshore and offshore industry groups and on projects
- Development and implementation of effective contracting strategies by projects for engineering design and construction in relation to the onshore-offshore interface.

The work performed by the CrossWay JIP is a brilliant example on how the industry should participate in improvement of codes.

Acknowledgements

The authors acknowledge the contributions made by the ME-38 committee and in particular Mr Andrew Pearce from Woodside Energy Limited, who has chaired the ME-38/4 subcommittee for more than 11 years.

References

1. AS 2885.4:2010 Pipelines – Gas and Liquid Petroleum, Submarine Pipeline Systems.
2. DNV-OS-F101 Submarine Pipeline Systems, Det Norske Veritas 2013.
3. CrossWay JIP, an Engineering Guideline for Pipeline Shoreline and Waterway Crossings (Energy Pipelines Co-operative Research Centre, Woodside Energy Limited, Chevron Australia and Atteris Pty Ltd).
4. AS/NZS 2885.4:2016 Pipelines – Gas and Liquid Petroleum, Submarine Pipeline Systems.
5. DNVGL-ST-F101 Submarine Pipeline Systems, DNV GL 2017 (planned).