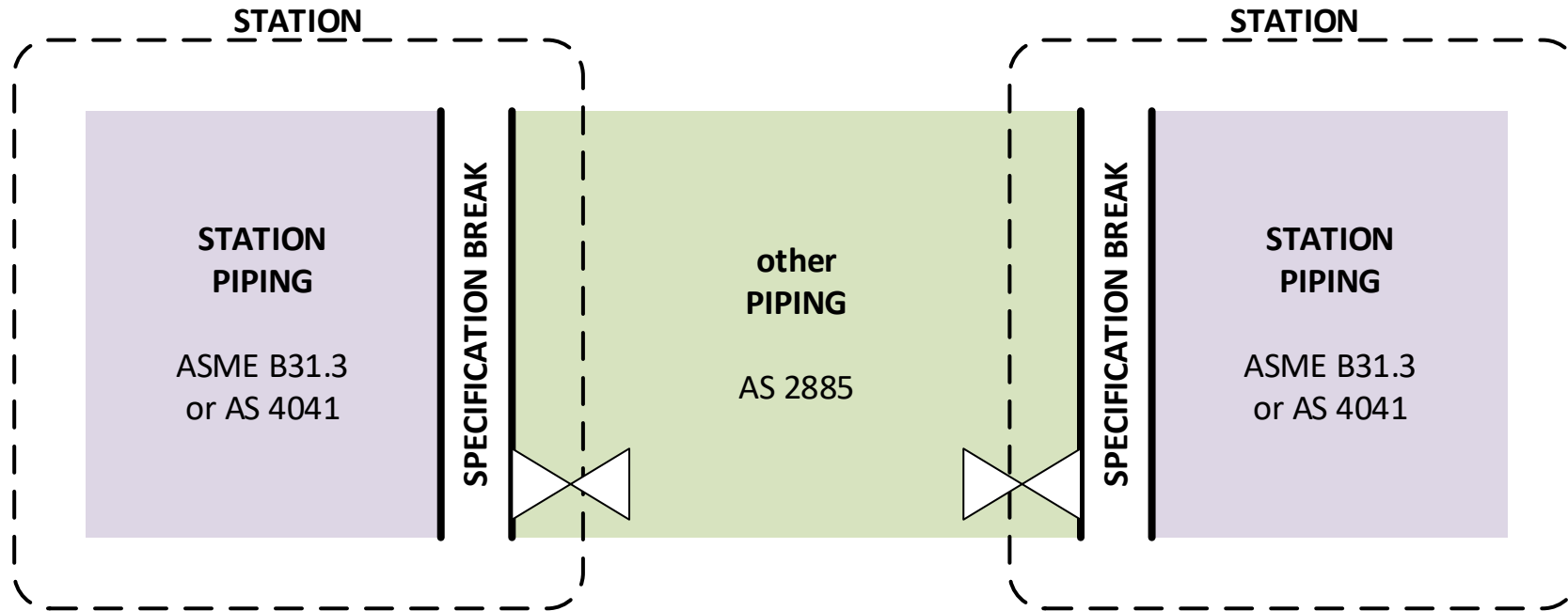


AS/NZS 2885 PIPELINE ASSEMBLIES DESIGN DECISIONS



Categories

- ▶ A pipeline system is made up of Pipeline and **Stations** (facilities),
- ▶ Separated at a specification break.



- ▶ *General practice: Isolation valve (on the pipeline side), separating station piping from full pipeline inventory.*
- ▶ *Specification break is cleanest at a flange interface.*

Categories

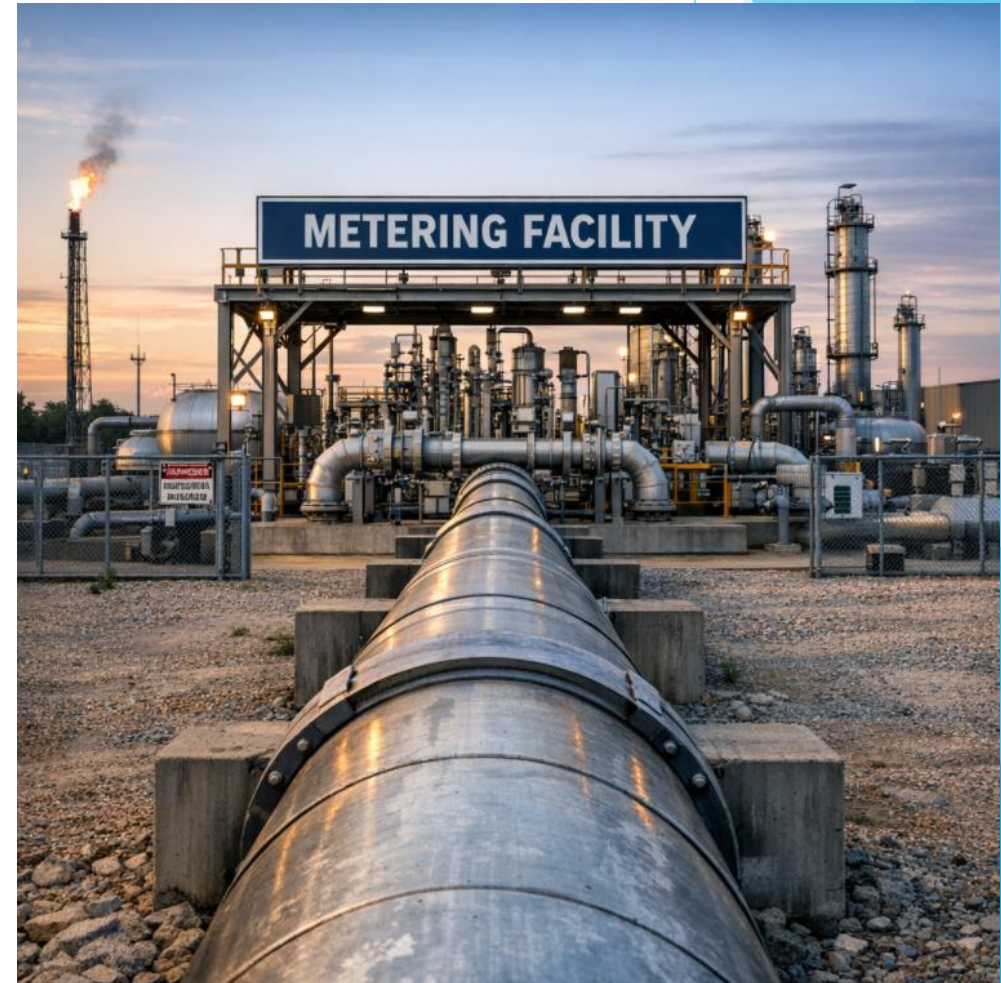
- ▶ Different philosophies on each side:

- ▶ *Station:*

- ▶ *Flexible piping*
- ▶ *Small leak volumes*
- ▶ *Mechanical joints*
- ▶ *Many components*

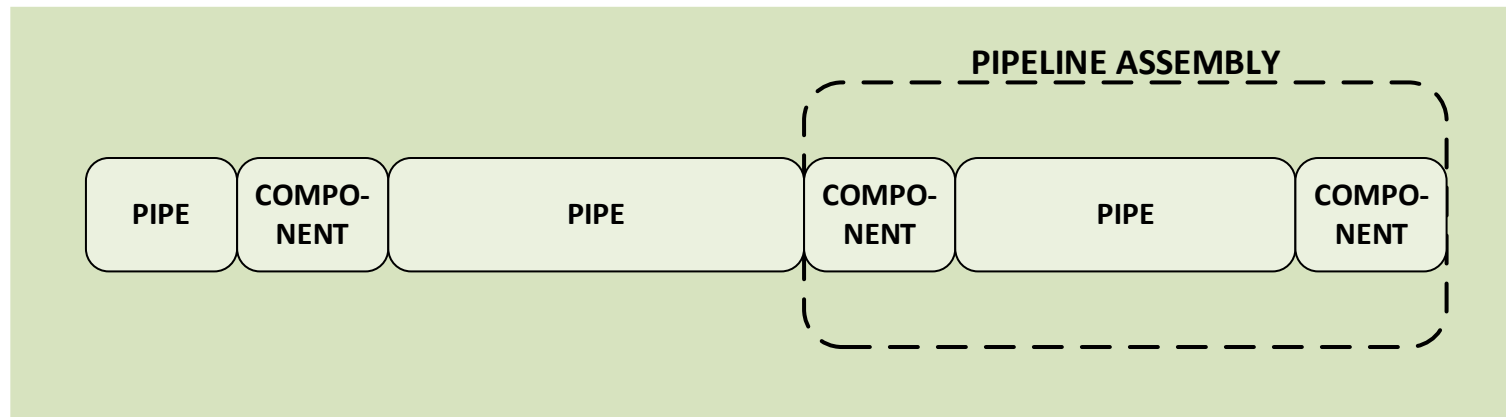
- ▶ *Pipeline:*

- ▶ *Restrained piping*
- ▶ *Very large inventory*
- ▶ *Welds (avoid mechanical joints)*
- ▶ *Few components*



Categories

- ▶ On the pipeline side, our piping includes...
 - ▶ (mainline) “pipe”,
 - ▶ “components”,
 - ▶ “assemblies” - which consist of both pipe and components.



Categories

- ▶ What these words all mean is defined in [AS 2885.0 §1.5](#).
- ▶ But also, these are also **common English words** and we aren't giving them a strange meaning here...
- ▶ ALL CAPS gives you the “defined term” usage within the standard.

1.5.52 piping

assembly of pipes and COMPONENTS

1.5.51 pipeline system

set of assets used for safe transmission of fluid, comprising MAINLINE PIPE, PIPELINE ASSEMBLIES, and COMPONENTS together with any necessary STATIONS and other facilities

1.5.48 pipeline assembly

assembly of pipe and COMPONENTS that allows for a single simple function such as pipeline isolation, diversion of flow, separation of phases or launching or receiving pigs

Note 1 to entry: See also STATION (1.5.65). PIPELINE ASSEMBLIES include but are not limited to scraper assemblies, mainline valve assemblies and branch connection assemblies.

1.5.47 pig trap scraper trap launcher-receiver

PIPELINE ASSEMBLY to enable a pig to be inserted into or removed from a pipeline

1.5.65 station

facility that controls and/or measures pipeline fluids, including compressor and pump stations, pressure regulation and metering facilities. Other facilities that involve frequent operational activity may also be designated STATIONS for the purpose of this Standard. A STATION includes infrastructure such as control facilities, power supply, and security fencing

Note 1 to entry: A STATION may include PIPELINE ASSEMBLIES as well as STATION PIPING and other equipment and infrastructure.

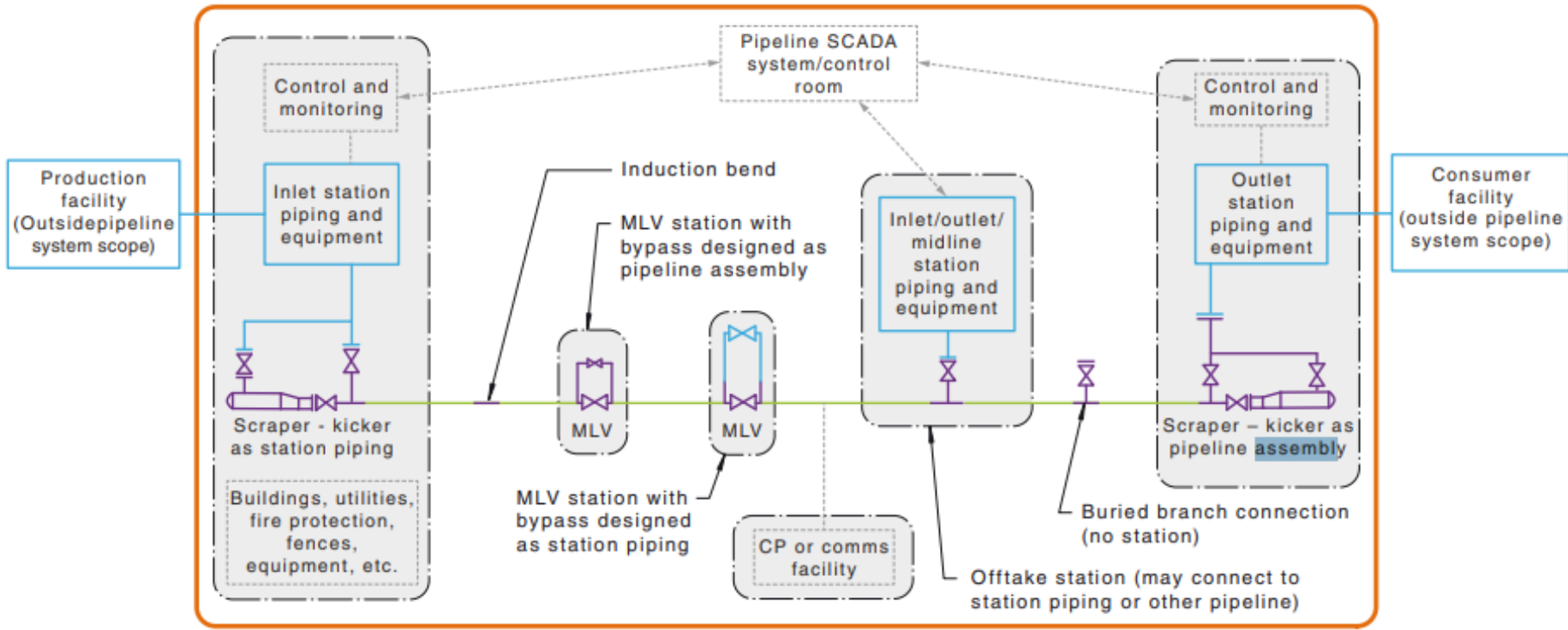
1.5.66 station piping

assembly of pipes and COMPONENTS associated with a STATION and designed, fabricated and tested in accordance with a STATION PIPING code

Definitions?

▶ The whole point of this image in AS/NZS 2885.1 is to show **designer discretion** in designation of station boundaries.

▶ AS 2885.0 has a similar diagram, but the two have different features and intent.



LEGEND:

- Pipeline system (AS 2885 scope)
- Station
- Other pipeline system infrastructure (not pressure-containing)
- Mainline pipe, includes cold field bends (AS 2885.1 with full fracture control requirements)
- Pipeline assembly or induction bends (typically AS 2885.1 piping, fracture initiation control only)
- Station piping (AS 4041 or ASME B31.3), station equipment eg compressors, pumps, meters, vents, etc.

NOTES:

- 1 This diagram is an informative aid to assist in interpretation of defined terms and their scope, but the requirements of the text take precedence over this diagram.
- 2 The demarcation between AS 2885 piping and station piping at MLV and scraper assemblies may be varied as required. This diagram shows two variations of each and other variations are possible.

FIGURE 4.1 PIPELINE SYSTEM SCHEMATIC

All about choice

- ▶ The central notion of assemblies is really:

The **OPTION** of designing the assembly to an approved station piping code:

ASME B31.3 or **AS 4041**.

The **OPTION** of designing to **AS/NZS 2885.1** *with a design factor of 0.67*

Hence, there are two types of assemblies: those that are designed to AS2885 and those that are designed to Station Piping codes.

This is another case of **designer discretion**.

An assembly could include both, but requires clear defined specification break between (§5.9.1).

All about choice

- ▶ Common pipeline assemblies:

Scraper traps	Mainline valves	Branch connections	MIJs	Vent and bypass
Major barrel [P] Minor barrel [P] Reducer [C] Closure [C] Nozzles [C] Pig Signaller [C] Flange [C]	Valve [C] Transition spool [P] Cavity connections [P/C]	Tee [C] Transition spools [P] Tee Bars [N]	MIJ [C] Transition spools [P] Electrical connection tabs [N]	Vent pipe [P] Bypass pipe [P] Tees [C] Elbows [C] Throttling valve [C] Isolating valve [C] Rain solution [C/N]

[C] = component, [P] = pipe, [N] = not pressure-containing

- ▶ But really... any subset of the pipeline system could be allocated as an assembly.

All about choice

The designation sets up a design pathway that affect everything from that point onwards...

- ▶ Design code
- ▶ Design factor
- ▶ Material selection
- ▶ Component design and type
- ▶ Weld qualifications
- ▶ Fracture control
- ▶ Supplementary material requirements (e.g. Y/T ratio)

...and the main complexities arise from the following:

Station piping codes	AS 2885
<ul style="list-style-type: none">• The interface between the assembly and the rest of the pipeline.	<ul style="list-style-type: none">• Component design and approval• Qualification of welds within the assembly.

SPOILERS



All about choice

Common selection considerations...

- ▶ **Wall thickness** - typically steps up for station piping (and pressure vessel codes), hence AS 2885 is used where needed to support pigability.
- ▶ **Severe(ish) service conditions:** high vibration risk, low temperatures, thermal cycling - typically design using station codes. AS 2885 isn't generally intended for these conditions. In gas, this may apply to pressurisation bypass lines.
- ▶ **Cost** - station piping (e.g. ASTM A106) is typically more readily available in small quantities, and many companies have pre-approved ASME B31.3 or AS 4041 pipe specifications.
- ▶ **Pipe arrangement flexibility** - station pipe codes are more streamlined for above-ground, flexible piping. They are well codified in available software for simple stress analysis.

Assemblies to station codes



Where AS 2885 permits the use of another standard, it intends it to be applied in full ([AS2885.0 §1.6.3](#)) unless explicitly overridden.

Example:

- ▶ ASME B31.3 permits ASTM A106 pipe without toughness testing;
- ▶ AS 2885.2 defect acceptance assume that weld toughness requirements have been met per AS 2885.1.
- ▶ Material to B31.3 but welding to AS 2885.2 creates a problem: *the defect tolerance presupposes a toughness that we don't have.*

That said... despite different philosophies, there are many commonalities between the three standards, so it is not so difficult to **simultaneously comply with two codes** in many situations.

Assemblies to station codes

This raises an issue:

Joints now exist **at the boundary of two standards**. *Typically welded joints because we avoid mechanical joints when they cannot be isolated from full pipeline inventory.* This transition is explicitly addressed in the standard:

AS 2885 Part 1

- ▶ Components that are **welded directly to the mainline pipe** must meet the toughness criteria of AS 2885.1 *even if designed to an alternate standard.* (§5.3.3.2)
- ▶ A toughness correction formula is provided, so that common low temperature carbon steel material specifications (such as ASTM A333) may be used. (§5.3.3.2)
- ▶ Use of ASTM A106 is strongly not recommended, though it remains a recognised standard... (§3.2.2)

Assemblies to station codes

AS 2885 Part 2

- ▶ Up to strength X65/L450, the ASME and AS 4041 weld qualifications may be used *within* and *at the boundary of* the assembly (§6.4.3), but
- ▶ Pipeline assembly weld qualifications to ASME or AS 4041 *must still achieve toughness requirements* (§7.4.7.1)



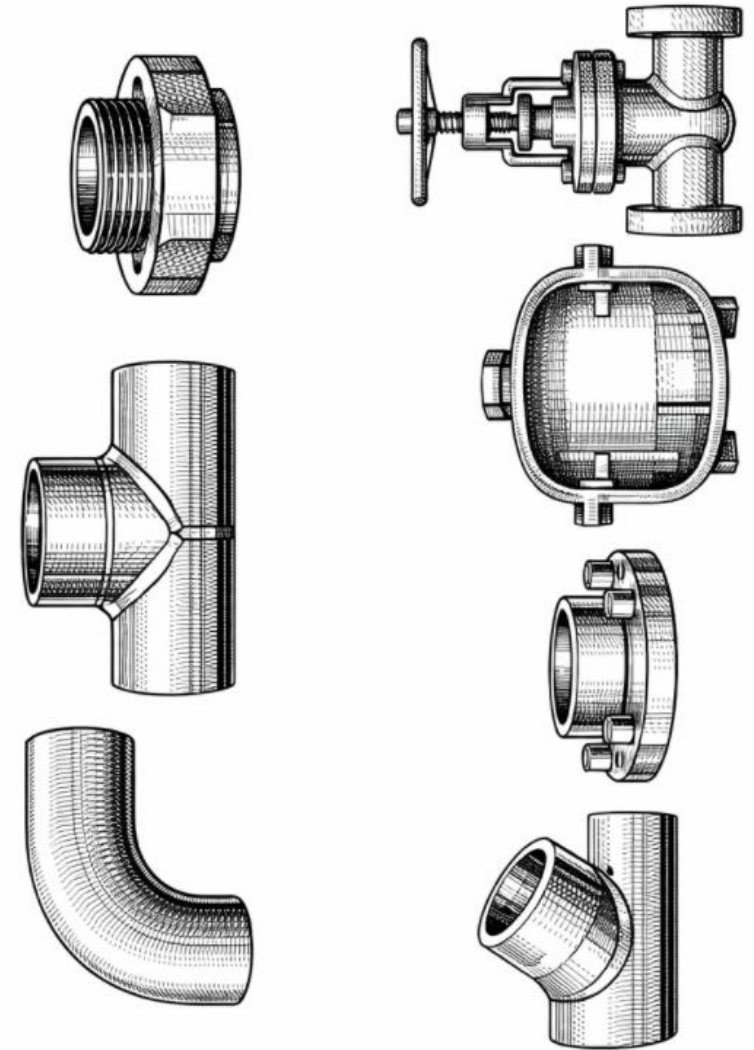
Components

Components are a significant complexity when designing to AS 2885.1

AS 2885 Part 1 Chapter 3 lays out the philosophy:

1. Pipe/Components to **nominated standards** (§3.2.2)
2. Pipe/Components to *other* standards (§3.2.3)
3. Pipe/Components with *no standard* (§3.2.4)

All of these may **be used**. But the pathway for their approval varies.



Components to nominated standards

Linepipe - [API 5L](#), 5LC, 5LD, 15LR, 15HR, [ISO 3183](#), 14692-1, 14692-2, DNVGL ST-F101

Pipe - ASTM [A106](#), [A333](#), ~~A671~~,

Forgings - ASTM [A105](#), [A350](#), A694

Wrought - ASTM [A234](#), [A420](#), A860

High-strength steels, needed for compatibility with line-pipe (pigability, strength/thickness-ratio, etc.)

Low temperature carbon steel. Toughness tested!
Most common under [AS 2885](#)

“Grade B” high-temperature carbon steel. *No toughness testing.*
Most common under [ASME B31.3](#)

Components to nominated standards

Induction bends - ASME B16.49, ISO 15590-1

- ▶ Heat treatment requires re-establishment of final pipe properties (§3.6.2).
- ▶ Specify minimum thickness using *bend* wall thickness formula (§5.2.5).

Welded fittings - ASME B16.9, MSS SP-75, (& BS 1965)

- ▶ *Strength-matched to the nominated pipe schedule, but not the same thickness!*

Socket / threaded fittings - ASME B16.11 (& BS 3799)

- ▶ Strength-matched to nominated pipe schedule on a class designation equivalency.
- ▶ CL2000 ≡ Sch. 80, CL3000 ≡ Sch. 160, CL6000 ≡ Sch. XXS

O'lets - MSS SP-97

- ▶ “Integrally reinforced”.
- ▶ In AS 2885 cannot be welded to pipe thinner than 6.4mm (§5.9.6).
- ▶ No ASME code.

Flanges - ASME B16.5, B16.21, B16.47, MSS SP 6, SP 44, BS 3381

- ▶ Pressure-temperature classes are a function of material group.
- ▶ Derating under 120°C is overridden by AS 2885.1 (§3.5.3)

Pressure components general - ASME BPVC VIII, BS 5500, (AS/NZS 1200)

Valves - ASME B16.34, API 6D, 600, 602, 603, ISO 17292, MSS SP-25, SP-67

- ▶ Welds made under a nominated standard are accepted without further qualification (§3.4)

Components to *other* standards

Components to other standards (*that are not explicitly prohibited*) (§3.2.3)

1. An approved standard that does not vary materially from a nominated standard.
2. Tests and investigations:
 - a) Proof in service under comparable service conditions
 - b) Proof tests as described in AS 1210, or equivalent international standard,
 - c) Experimental stress analysis
 - d) Theoretical calculations

Examples of something qualified by this clause: spectacle blinds and spades may be designed according to the suitable section of ASME B31.8. That could meet item 2(a) or 2(d) above.

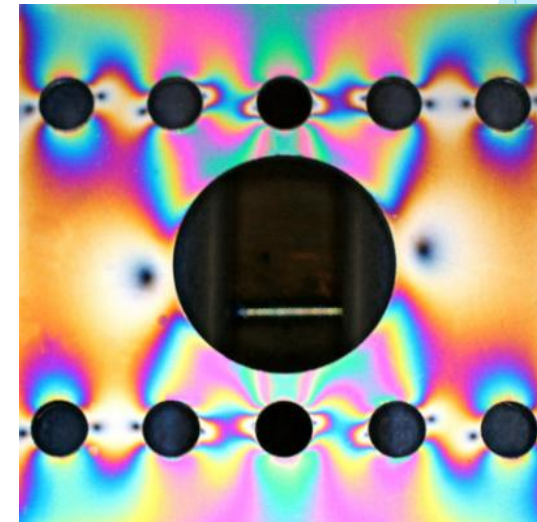
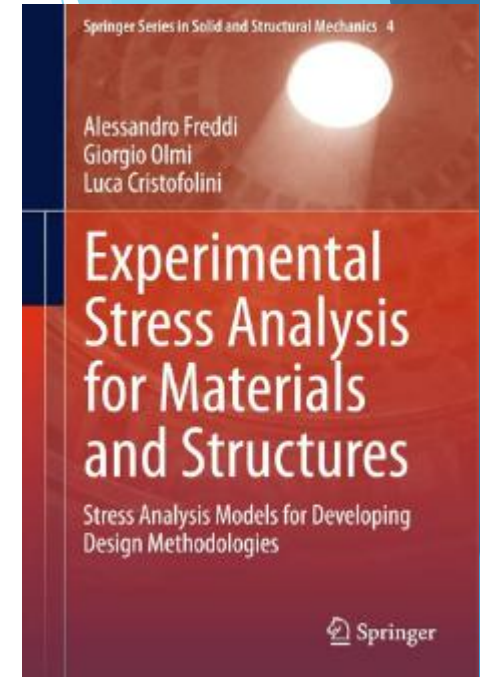


Components with no standard

Components for which no standard exists (§3.2.4)

1. Tests and investigations:
 - a) Proof in service under comparable service conditions
 - b) Proof tests as described in AS 1210, or equivalent international standard,
 - c) Experimental stress analysis
 - d) Theoretical calculations

Examples of something qualified by this clause: **pig signallers** and **quick-opening closures** are bespoke designs, though they may be designed to ASME BPVC VIII, they might also meet item 2(a) above.



Components

even though a number of components are **not covered by nominated standards** (such as anything that is ‘qualified’ to ASME B31.8!), that **DOES NOT** mean that it can’t be used!

Design conformity



Station design:

- ▶ Requires conformity assessment to AS 3920.
- ▶ A function of the *Hazard Level* of the pipe/vessel (AS4343).
- ▶ Pressure vessels also incur either/both *design* and *vessel manufacture* registration requirements under WHS legislation (state-based).

Pipeline design:

- ▶ Some states may impose verification / conformity assessment requirements.
- ▶ But covered under license conditions, *not* required in AS/NZS 2885.

AS 2885 Philosophy

But... What should be designated an assembly, or station, or component?

What design factor, code, weld qualification method, etc. will be suitable?

Unfortunately...

- ▶ The standard is a Human document - it has flaws and can't necessarily foresee everything.
- ▶ It also carries some 'legacy' standard philosophies and content, which result in sub-optimal organisation.
- ▶ The standard requires that work is undertaken by **COMPETENT PERSONS**.



AS 2885 Philosophy

- ▶ The standard is intended to be *performance-based*. ~~Conformance is a pathway to performance.~~ Performance is conformance.
- ▶ The standard does not intend to prohibit good design that doesn't conform ([AS2885.0 §1.6.2](#)).

1.6.2 Departures from AS(/NZS) 2885 series Standards

AS(/NZS) 2885 series Standards are not intended to prohibit the use of any materials, designs, methods of assembly, procedures or practices (items) that do not conform with specific requirements of the AS(/NZS) 2885 series, or are not mentioned in it, but do give equivalent or better results to those specified.

The LICENSEE shall ensure the suitability of the item is determined against the fundamental principles of the AS(/NZS) 2885 series, and any additional requirements (including technical, quality, procedural, safety, maintenance) needed to satisfy the fundamental principles shall be developed. Prior to the item being used, it shall be APPROVED.

NOTE DNVGL-RP-A203 and API 17N provide guidance on the structured evaluation and demonstration of new technology for general use.

AS 2885 Philosophy

- ▶ The objectives of the whole standard are defined in AS2885.0 §1.3

The fundamental principles set out above, including the practical rules and guidelines set out throughout the AS(/NZS) 2885 series, are the basis on which an engineering assessment is made where the AS(/NZS) 2885 series do not provide detailed requirements appropriate to a specific item.

The AS(/NZS) 2885 series is not an instruction manual for untrained persons, nor is it a detailed specification. Although certain sections of the AS(/NZS) 2885 series contain specific requirements, these requirements need to be applied with appropriate experience and engineering judgement.

- ▶ Additionally... Read the “Basis of Section” sections in AS 2885, so you know what each section is meant to achieve.

AS 2885 Philosophy

- ▶ AS 2885.1 and 2 are not about existing pipelines and assemblies. If dealing with in existing pipeline... *always begin with Part 3*. If something is not compliant, being already in-service, this may be addressed using FFS methods and standards like API 579, rather than design standards.



Summary

- ▶ Assemblies = flexible category bridging mainline pipe and station piping.
- ▶ Designers may choose AS 2885 or station codes – but must stick with one fully.
- ▶ Designers need to be aware of the flow-on effect of their decisions (and hence the remainder of this workshop)
- ▶ The main supplementary requirement that AS 2885 imposes over all assemblies (even designed to station codes) relates to weld toughness, (and hence the recommendation to avoid ASTM A106).
- ▶ Components may come from nominated standards, other standards, or be justified individually.
- ▶ Design intent matters – Part 0 philosophy underpins everything.

