

APEK GUIDANCE NOTE	ACCEPTANCE OF NON-CONFORMING WELD ROOT OVERLAP, REINFORCEMENT, SPATTER IN CS PE	APEK GN 234 Rev: 1 17/10/2017
-----------------------	--	-------------------------------------

Developed for: ACA, AICIP, AIE, AIES, AINDT, APIA, CAAA, EA, ME Aust, NATA, Standards Aust, WTIA, PE Industry & Regulators

- 1 Scope** Shows and assesses 4 significant signs or indications (Fig 1) detected during in-service inspection of PE
Gives basis for acceptance of these flaws and non-conforming weld root overlap

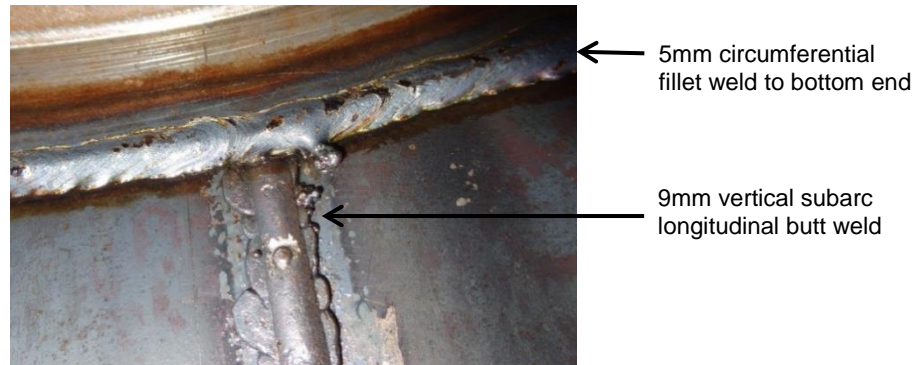


Fig 1 Internal View
(4 types of flaw)

- 2 Purpose** Feedback for all, including trainees; show that some DNCs can be accepted; & support AS/NZS 3788
- 3 PE involved** New vertical air-oil separator: Carbon steel, Class 3 pressure vessel 9mm thick, 700mm OD. Imported ASME VIII-1, $\eta=70\%$ ie no RT or UT, P = 2MPa, Hydrotest = 1.3P, T = 60C, Hazard Level = C
- 4 Signs** **Root reinforcement:** 2.5mm continuous; **root overlap:** 2mm – continuous on both sides;
(Indications) minor **spatter** from circumferential weld; and weld **oxide scale**
- 5 Sign location** Inside vessel on vertical longitudinal weld.
- 6 Detection** By IS Inspector during commissioning inspection in Australia by VT in 2014
- 7 Assessment** .1 The inspector sought competent advice on flaw identification etc, and which Standard applied.
(by inspector, .2 Check with 100% UT showed no other flaws. Various Standards were reviewed.
adviser and .3 **Overlap** did not conform (DNC) with AS 4037, but was acceptable in ASME VIII-1
owner-user) UW35a).
Overlap is equivalent to a joint joggled or with backing strip - both allowed for circumferential joints.
Overlap (and **spatter** and oxide **scale**) might not be acceptable for severe corrosion service or where hygiene is critical as with food or medical PE.
.4 For this Service conditions: Corrosion negligible with oil – very low risk of corrosion failure.
Low stress (effective safety factor = $3.5/(\eta=70\%) = 5.0$; low stress range, medium no. of cycles and "crack" parallel to stress. Hence very low risk of fatigue failure.
Spatter and thin **oxide scale** acceptable.
.5 **Weld root reinforcement** of 2.5 mm complies with AS 4037, is within 0.1mm with ASME VIII-1. It might not be acceptable for flow-accelerated corrosion or complete drainage
- 8 Occurrence** During manufacture 2013 overseas
Root overlap is rare - some inspectors did not recognise
- 9 Failure modes** Corrosion and fatigue possible – very low probability damage mechanism

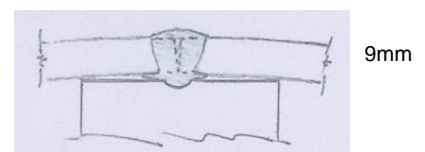


Fig 2 Joint during welding

- 10 **Probable cause(s)** Poor fitting backing bar (eg copper) for small diameter vessel
- 11 **Outcome** Put into service without removal or repair because:
a) Conformance with ASME
b) For this application – corrosion and fatigue failure are very unlikely
c) Owner-user happy as PE was urgently needed at minimum cost
- 12 **Fix** No correction was required.
- 13 **Prevention** In manufacture: better shaped backing bar, edge bending or clamping; better QA or inspection.
In service: after 10 to 15 years, spot UT of the vertical weld lower half might be desirable
- 14 **Lesson(s)** .1 If a flaw is judged DNC, consider if PE might be fit for service and if an assessment is worthwhile.
.2 Different laws, Standards or service may have different acceptance criteria eg see 8.3 & .5.
.3 Acceptance of DNCs requires proper assessment, justification, documentation and sign-off.
- 15 **References** AS/NZS 3788 PE In-service inspection
AS 4037 PE Examination and testing
ASME BPV Code Sect. VIII Pressure vessels Div 1
- SA,NY