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Page Changes to MRP-169 Rev. 1 to Address the Presence of Alloy 600 Safe Ends

Page 4-3, next to last paragraph:

Code Cases N-504-2 and N-740-2 [3, 4] also provide guidance for weld overlay length sizing, and these are the same for both FSWOLs and OWOLs. The underlying requirement is that sufficient weld overlay length be provided on either side of the observed crack to allow for adequate transfer of axial loads between the pipe and the weld overlay. For axisymmetric loading of a cylinder local loading effects can be shown to attenuate to a small fraction of their peak value at an axial distance of $0.75\sqrt{Rt}$ from the point of loading [10] (where R is the outer radius and t is the nominal wall thickness of the cylinder). Thus, if the weld overlay length is set equal to $0.75\sqrt{Rt}$ on either side of the crack, resulting in a total weld overlay length of $1.5\sqrt{Rt}$, the overlay will extend beyond any locally elevated stresses due to the crack. In application of weld overlays preemptively, however, no crack will have been detected, so the above criterion is conservatively applied such that the minimum weld overlay length must be $0.75\sqrt{Rt}$ beyond either side of the susceptible material (Alloy 82 or 182 weld metal and buttering plus Alloy 600 base metal, if present). This will result in a total weld overlay length equal to $1.5\sqrt{Rt}$ plus the length of susceptible material on the OD surface of the original DMW. It is noted that the $0.75\sqrt{Rt}$ recommendation is only a rule of thumb, and that shorter lengths may be used if justified by stress analysis of the specific PWOL configuration, to demonstrate that adequate load transfer and stress attenuation are achieved.

Paragraph starting at bottom of page 4-4:

Finally, the initial residual stress condition of the DMW joint has a significant bearing on its susceptibility to PWSCC, especially as influenced by in-process repairs performed during plant construction. In fact, in essentially all cases in which PWSCC has been discovered in PWR butt welds, evidence of significant in-process repairs during construction has been found. Thus to adequately demonstrate the favorable residual stress effects of a weld overlay one must start with a highly unfavorable, pre-overlay residual stress condition such as that which would result from an ID surface weld repair during construction. If the nozzle-specific weld overlay design is shown to produce favorable residual stresses in this severe case, one can be assured that it will effectively mitigate against future PWSCC in the DMW. Acceptable residual stresses for purposes of satisfying this requirement are those which after application of the weld overlay, are compressive on the inside surface of the nozzle, over the entire length of PWSCC susceptible material on the inside surface (Alloy 82 or 182 weld metal and buttering plus Alloy 600 base metal if present), at operating temperature, but prior to applying operating pressure and loads.

After application of operating pressure and loads, the resulting inside surface stresses must be less than 10 ksi tensile. As documented in References [52-54] laboratory data and field observations have shown that high stresses, on the order of the material yield strength, are necessary to initiate PWSCC. Thus limiting ID surface stresses under sustained steady state conditions to less than 10 ksi ensures a very low probability of initiating new PWSCC cracks after application of the weld overlay.

Page 7-5 (Figure 7-1 b)

b) Preservice and Subsequent Inservice Inspections

Surface: Liquid penetrant examination of overlay material surface

Volumetric: Overlay directly over original PWSCC susceptible weldment (including nozzle buttering, DMW and PWSCC susceptible safe-end if present) plus ½ inch to either side, to a depth of the outer 25% (FSWOL) or 50% (OWOL) of underlying material . (A-B-C-D)

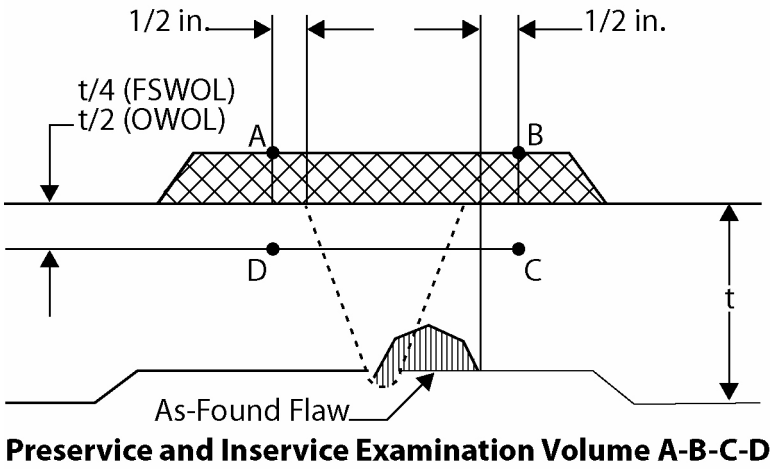

Figure 7-1
Inspection Requirements for Weld Overlays

Note: Figure included clarifying that no modifications are necessary, since it already includes reference to PWSCC susceptible safe-end if present. However a typo was identified – the comma after nozzle should be deleted.