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Weld Overlay of Cast Material

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Objectives

- Issue
- Identify cast locations associated with dissimilar metal butt welds
- Describe limitations
- Describe actions being taken
- Summarize

Issue

- Several dissimilar metal weld butt welds are joined to cast components
- If these welds are overlaid the design will require that the overlay cover cast base material
  - There has been one application of this type of overlay already
  - Review of configuration drawings from several plants indicate this type of overlay may be required for several configurations that present in the fleet
- Presently, there are no PDI qualified procedures available to examine the cast base material covered by these weld overlays
- Appendix VIII, Supplement 11 does not address overlay over cast materials

Locations

- Westinghouse Plants
  - Reactor Coolant System
    - All butt welds connecting the cold legs to both the steam generator and RPV
    - Some butt welds connecting the cold legs to both steam generator and RPV
  - Large diameter 29.00” to 31.00”
  - Quite thick 2.5” to 3.0”

Locations

- Combustion Engineering (CE) Plants
  - Majority of welds greater than 6.0” in diameter in most CE units have cast CF8M safe-ends
    - Safety Relief (2 Units)
      - Waterford
      - San Onofre
    - Surge Lines at the Hot Leg and Pressurizer
      - All units with the exception of Palo Verde and Palisades
    - Shut Down Cooling
      - All units with the exception of Palo Verde and Palisades
    - Safety Injection
      - All units with the exception of Palo Verde and Palisades
    - Reactor Coolant Pump (RCP) Suction and Discharge
      - All units with the exception of Palo Verde and Palisades

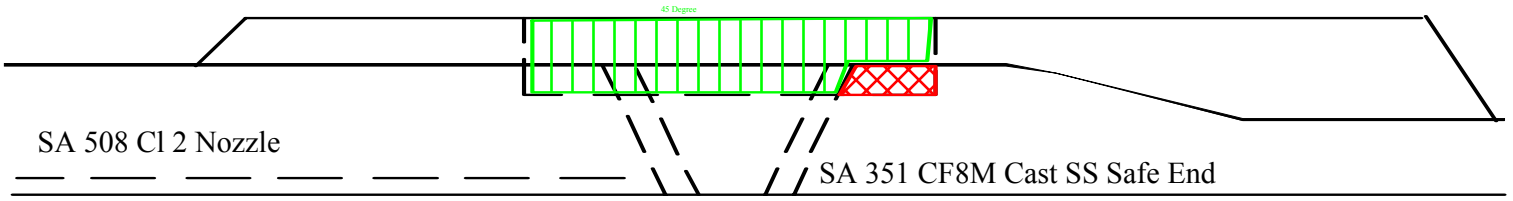
Locations

- Babcock & Wilcocks (B&W)
  - Reactor Coolant Pump (RCP) Suction and Discharge
    - Only one unit in the fleet has been identified to date

Limitations

- The only area that is not examined with qualified techniques is the cast base material adjacent to the original butt weld under the overlay
  - Volume is dependant on the thickness of the base material
    - Upper 25%
- Presently the qualified techniques are capable of;
  - Examining 100% of the weld overlay material
  - Examining 100% of the weld overlay to base material and weld to assure bonding
  - Examining 100% of the susceptible inconel material contained in the examination volume
  - Determining if any flaws had propagated into the overlay from the cast base material

Limitations



= Area of no coverage due to Cast SS material limitation

= Area of coverage in Circumferential scan direction

Inputs used for coverage calculations:
Weld length - 28.11" OD
Overlay thickness - .5"
Original weld thickness - 1.40"
Original weld width - 1.60"

Volume required for complete examination = 248.48 cubic inches

Volume obtained in Circumferential scan direction= 56.78 cubic inches

Total volume obtained: 56.78 cubic inches or 91.40%

Work Underway

- A limited amount of funding has been provided to evaluate the capabilities of examining the cast material on the thinner wall thicknesses
  - Safety Relief
  - Pressurizer Surge
  - Hot Leg Surge
  - Safety Injection
  - Shut Down Cooling
- Additional proposals have been presented that will expand the project if acceptable results are obtained to the larger component with increased wall thickness
  - RCP inlet and outlet welds

Work Underway

- Micrograph information has been requested
  - Calibration blocks with cast safe-ends made of same material as what is installed in the plants
  - Scrap material of the same vintage
- This information will be used to;
  - Order similar material for mock-ups
  - Evaluate the effects on the ultrasound
- Detection capability before weld overlay will also be evaluated

Long Term Plan

- If we are successful on thinner material work will be expanded to thicker components such as the RCP
- Code work will start to address qualification
  - Complexity of code changes will be based on the changes in techniques required to do successful examination
  - If current qualified techniques are capable of achieving acceptable results very few changes are needed
- If techniques are not successful a technical basis can be made that shows examination of this area is not critical to the design and function of the overlay
  - No flaw mechanism
  - In most cases greater than 90% of the volume can be examined without taking credit for this area
  - No structural credit taken in the design of the overlay for the area not examined

Summary

- No qualified procedures are available for the examination of weld overlays over cast components
- Work is underway to evaluate current techniques to determine if the examination is possible
- If successful a code case will be drafted to address examination and qualification