



## **PDI-UT-8 Revision**

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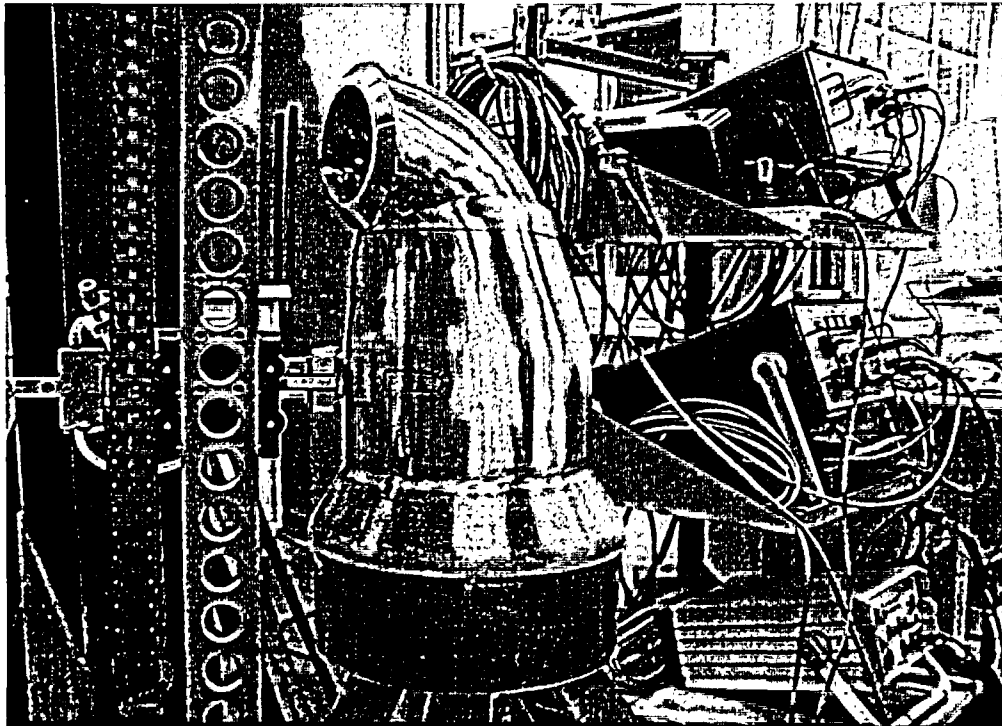
Project Manager Piping & Bolting

Performance Demonstration



# Outline

- Status of Procedure Re-write
- Changes Section by Section
- Summary



# Status Overview

- Revision of the procedure is complete
- Procedure has been expanded down to 2.0" in diameter
- Procedure now addresses tapered or non-standard overlays
- Final Draft procedure is ready for review
- Goal for issuance end of June
- Procedure has been demonstrated and qualified
- Final review will be sent to all Steering Committee Members for review and approval



# Status Overview

- Major Changes
  - Scope of procedure
  - Search unit selection
  - Calibration blocks
  - Tapered surfaces
  - Scan pattern
  - Examination
  - Depth Sizing
  - NDE requirements during application of overlay
    - Tapered Overlays
  - Code Volume



# Scope of Procedure

- Changed to address different diameters and tapered conditions
- Removed code year references
  - References program status to be stored on EPRIQ
- Addresses Code Case N-740 requirements
- Clearly states all limitations



# Search Unit Selection

- In most cases contoured search units for diameters equal to or less than 10.0" will be required.
  - Includes formula to determine if contouring is needed
  - Based on actual outside diameter not nominal
- Search unit size is determined by the depth of focusing required
  - No maximum search unit size table
- Focusing requirements will be better defined
  - PSI
  - ISI



# Search Unit Selection

<b>*Focus Min. and Max achievable (estimated) for RL Transducers</b>													
Element Size		2(7x10)		2(8x14)		2(10x18)		2(15x25)		2(20x34)		2(24x42)	
Housing Size		20x20mm		25x25mm		30x30mm		40x40mm		50x50mm		60x60mm	
Frequency (MHz)	Angle	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
0.5	45	n/a	n/a	n/a	n/a	n/a	n/a	0.42	0.84	0.70	1.67	0.97	2.23
	60	n/a	n/a	n/a	n/a	n/a	n/a	0.30	0.49	0.39	0.79	0.59	1.38
	70	n/a	n/a	n/a	n/a	n/a	n/a	0.20	0.27	0.27	0.47	0.34	0.81
1.0	45	n/a	n/a	0.28	0.70	0.42	0.84	0.56	1.53	0.84	2.23	1.11	3.34
	60	n/a	n/a	0.20	0.39	0.30	0.59	0.39	0.89	0.49	1.48	0.69	2.17
	70	n/a	n/a	0.13	0.27	0.20	0.40	0.20	0.61	0.34	1.01	0.40	1.35
2.0	45	0.28	0.70	0.42	0.84	0.56	1.25	0.70	2.37	1.11	3.62	1.25	4.45
	60	0.20	0.49	0.20	0.59	0.30	0.79	0.39	1.48	0.59	2.36	0.79	2.76
	70	0.13	0.27	0.13	0.34	0.20	0.47	0.27	0.94	0.40	1.48	0.47	1.68
4.0	45	0.28	0.97	0.56	1.67	0.70	2.51	0.84	2.78	n/a	n/a	n/a	n/a
	60	0.20	0.69	0.30	1.08	0.39	1.38	0.49	1.77	n/a	n/a	n/a	n/a
	70	0.13	0.40	0.13	0.67	0.20	0.88	0.27	1.14	n/a	n/a	n/a	n/a

Choose Display Unit:

FD (inch) ▼

\* Focus displayed in: **FD (inch)**



# Search Unit Selection

*Focus Min. and Max achievable (estimated) for RL Transducers													
Element Size		2(7x10)		2(8x14)		2(10x18)		2(15x25)		2(20x34)		2(24x42)	
Housing Size		20x20mm		25x25mm		30x30mm		40x40mm		50x50mm		60x60mm	
Frequency (MHz)	Angle	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
0.5	45	n/a	n/a	n/a	n/a	n/a	n/a	0.59	1.18	0.98	2.36	1.38	3.15
	60	n/a	n/a	n/a	n/a	n/a	n/a	0.59	0.98	0.79	1.57	1.18	2.76
	70	n/a	n/a	n/a	n/a	n/a	n/a	0.59	0.79	0.79	1.38	0.98	2.36
1.0	45	n/a	n/a	0.39	0.98	0.59	1.18	0.79	2.17	1.18	3.15	1.57	4.72
	60	n/a	n/a	0.39	0.79	0.59	1.18	0.79	1.77	0.98	2.95	1.38	4.33
	70	n/a	n/a	0.39	0.79	0.59	1.18	0.59	1.77	0.98	2.95	1.18	3.94
2.0	45	0.39	0.98	0.59	1.18	0.79	1.77	0.98	3.35	1.57	5.12	1.77	6.30
	60	0.39	0.98	0.39	1.18	0.59	1.57	0.79	2.95	1.18	4.72	1.57	5.51
	70	0.39	0.79	0.39	0.98	0.59	1.38	0.79	2.76	1.18	4.33	1.38	4.92
4.0	45	0.39	1.38	0.79	2.36	0.98	3.54	1.18	3.94	n/a	n/a	n/a	n/a
	60	0.39	1.38	0.59	2.17	0.79	2.76	0.98	3.54	n/a	n/a	n/a	n/a
	70	0.39	1.18	0.39	1.97	0.59	2.56	0.79	3.35	n/a	n/a	n/a	n/a

Choose Display Unit:

FS (inch) ▼

\* Focus displayed in: FS (inch)





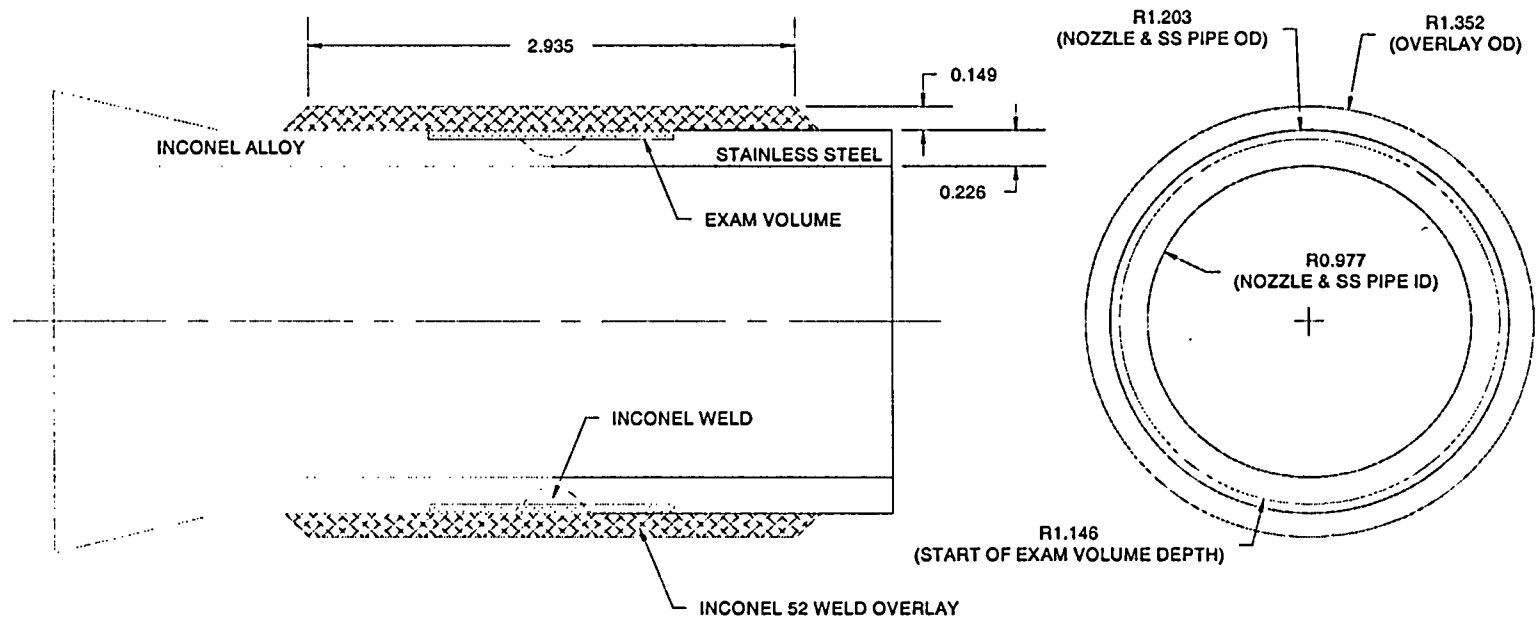
# Search Unit Selection

- Addresses examination of very thin overlay < 0.2”
  - Shallow focused probes
  - Has good resolution of small ligaments ~ .05”
- Addresses the examination of thick overlays on small diameter components



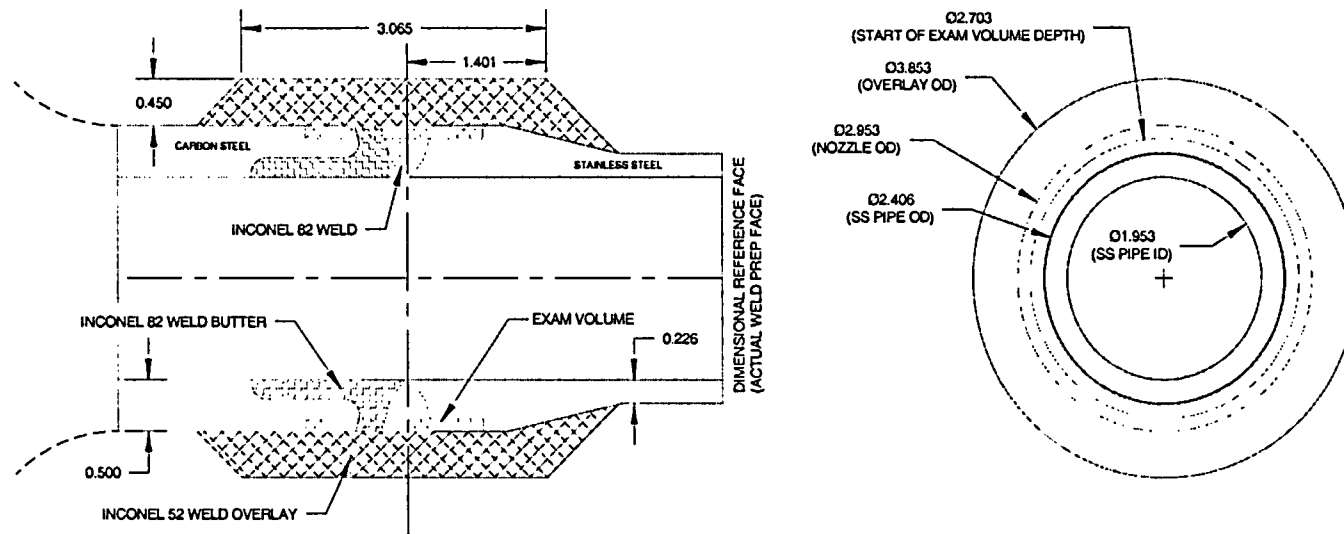
# Search Unit Selection

## LIMERICK DESIGN BASE 2" SAMPLE



# Search Unit Selection

DUANE ARNOLD DESIGN BASE 2" SAMPLE



# Search Unit Selection

- Criteria included on how to verify that the search unit is focused properly and defines focusing
- Procedure has more defined criteria for selection of the proper frequency



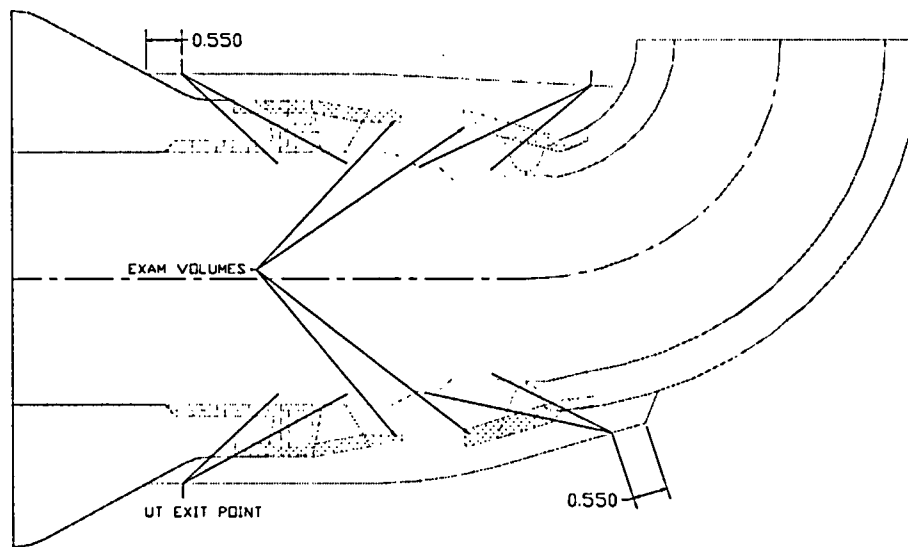
# Search Unit Selection

- Better describes search unit selection for circumferential scanning
  - Reduced angles to accommodate for curvature
  - Small contoured probes for scanning on small diameter overlay
  - Small footprint probes for scanning on intrados of elbows



# Search Unit Selection

45° & 60° UT COVERAGE WITH OVERLAY

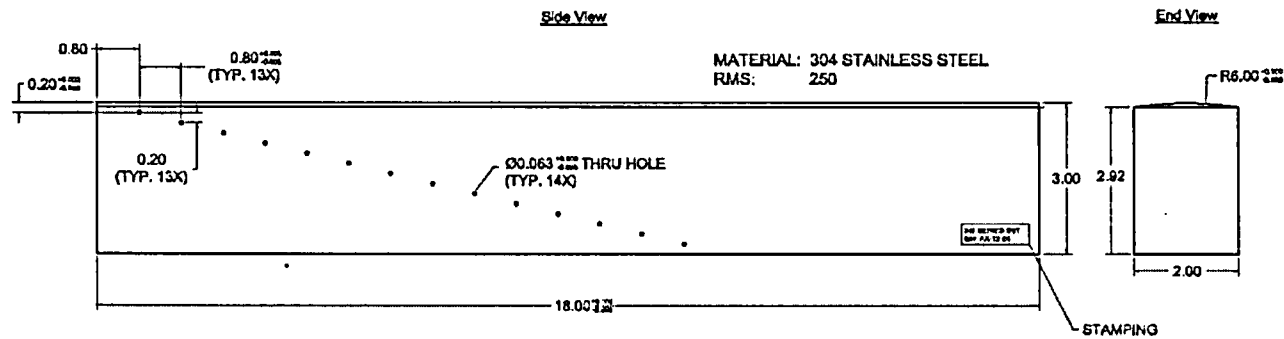


# Calibration Blocks

- Procedure addresses contoured or curved calibration standards
  - Blocks already designed and available
- Alternative calibration block design has been changed
  - Must have block with holes for RL search units
  - Must be able to address contoured search units



# Calibration Blocks



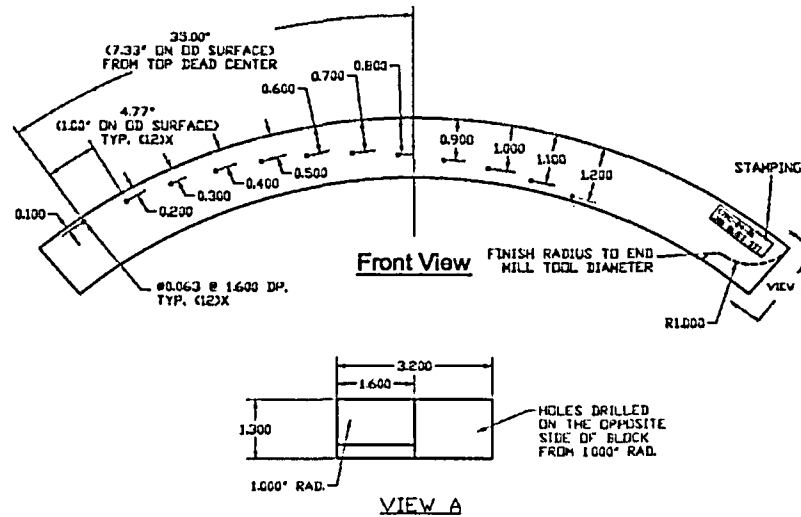
EPRI Contoured Probe Calibration Block





# Calibration Blocks

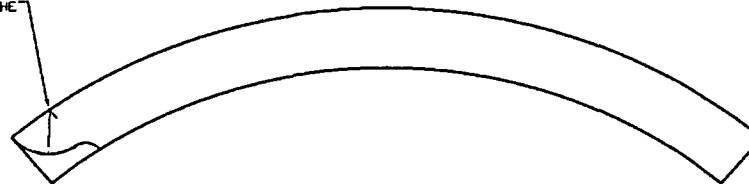
## 24" STAINLESS STEEL PIPE SEGMENT BLOCK



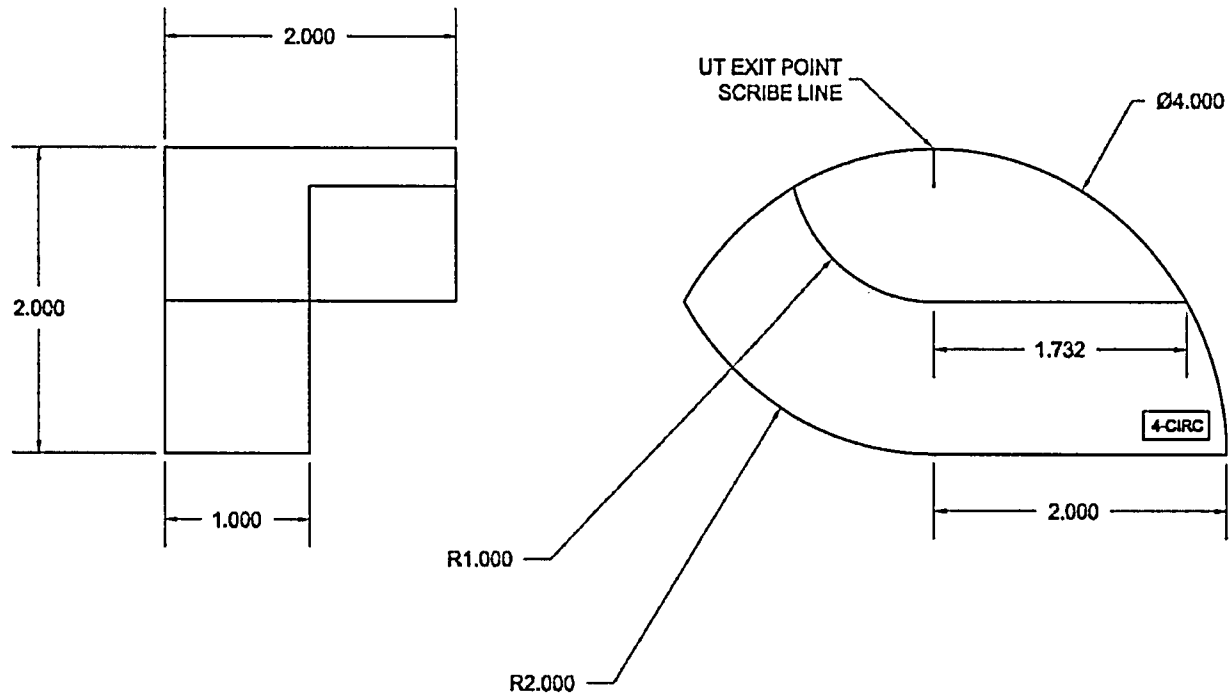
### NOTES:

1. STAMP RADIAL SDH DEPTH (I.E. 0.20, 0.30, ETC.) NEXT TO EACH RESPECTIVE SIDE DRILLED HOLE
2. THE DEPTH AXIS OF THE SIDE DRILLED HOLES SHALL BE PARALLEL TO THE OD INSPECTION SURFACE
3. TOLERANCE FOR SDH Ø  $\pm 0.000/0.005$
4. TOLERANCE FOR SDH RADIAL DEPTH  $\pm 0.005$
5. TOLERANCE FOR SDH DEPTH  $\pm 0.050$

SCRIBE A LINE 0.250" DOWN THE FACE ADJACENT TO THE 1.000" RADIUS



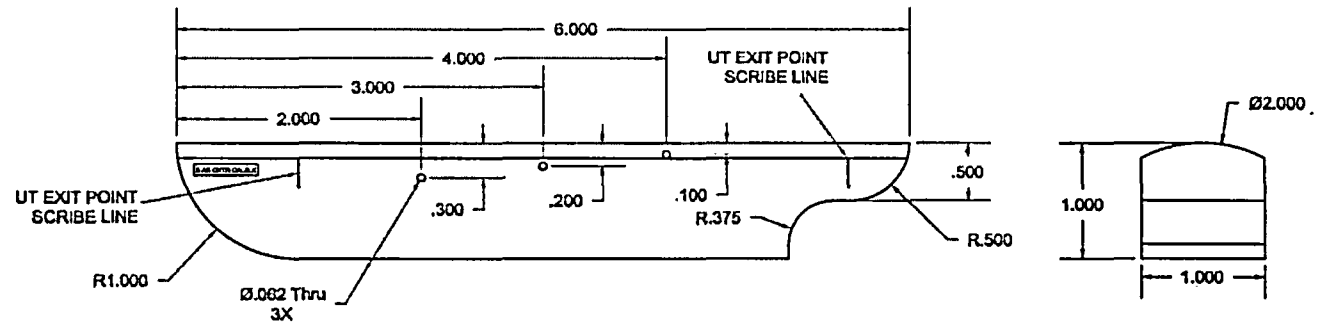
# Calibration Blocks



4" CIRC FOR ANGLES  $\leq 50^\circ$



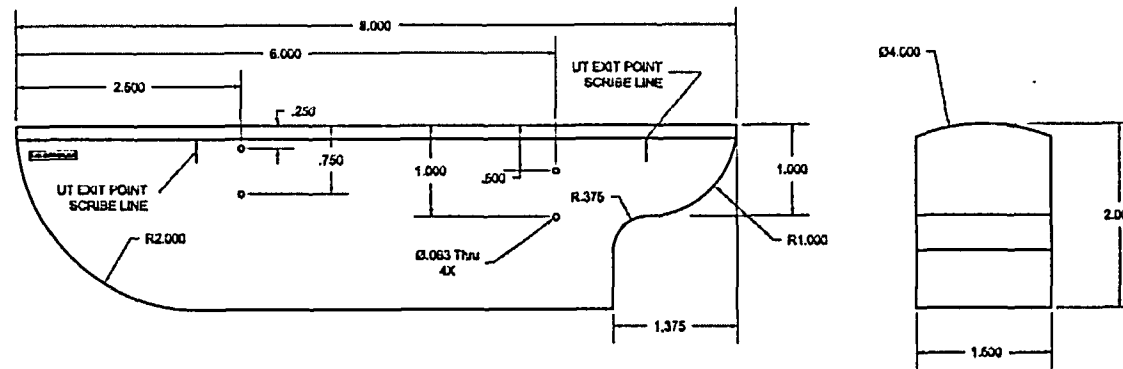
# Calibration Blocks



2" CONTOUR CAL BLOCK FOR AXIAL SCANS



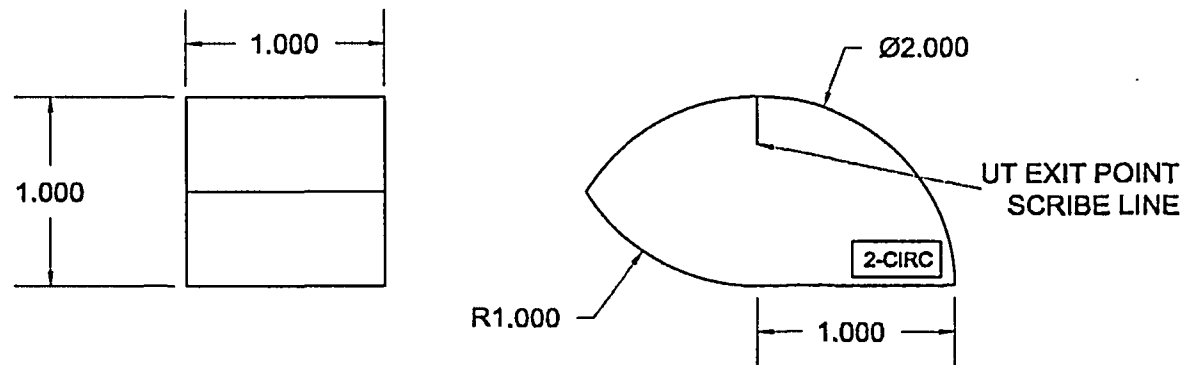
# Calibration Blocks



4" CONTOUR CAL BLOCK FOR AXIAL SCANS



# Calibration Blocks



2" CIRC FOR ANGLES  $\leq 50^\circ$



# Tapered Surfaces

- Includes additional requirements to address tapered surfaces
  - Search unit selection
  - Scan pattern
  - Focusing
  - Documentation of Limitations



# Examination

- Procedure includes criteria that will describe approach to examination of small diameter overlays and non-standard overlays that may include tapers



# Positioning of Flaws

- Procedure contains additional criteria describing how to position flaws on tapered surfaces where the search unit is on a different diameter than the flaw
- Plotting is required
- Additional steps must be considered during the application of an overlay on a tapered surface
  - Profiling and thickness measurements must be done in order to determine
    - Thickness of overlay in different locations along surface
    - Location of the interface
    - Measurements taken on non-parallel surfaces



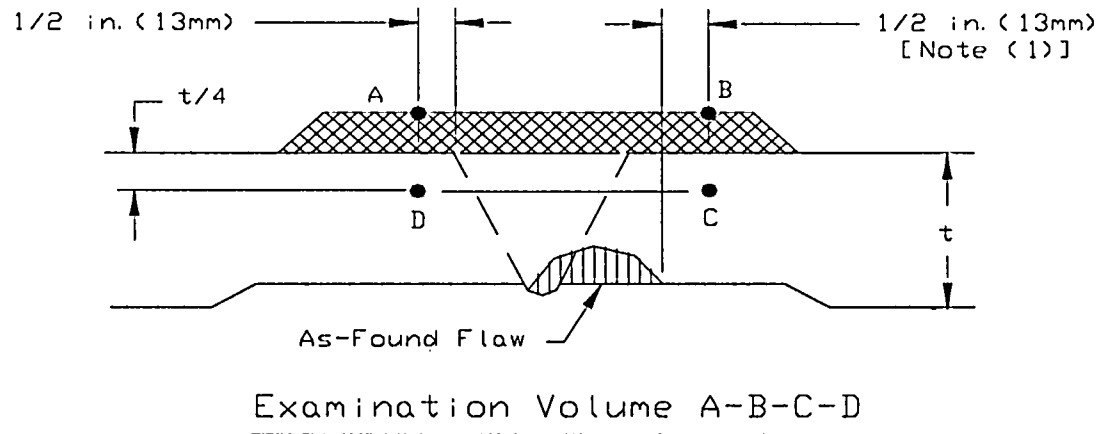


# Depth Sizing

- Criteria added to address depth sizing of flaws from tapered surfaces
  - Plotting
  - Correction factors



# Examination Volume Code Case N-740



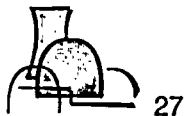
## NOTE:

- (1) For axial or circumferential flaws, the axial extent of the examination volume shall extend at least 1/2 in. (13mm) beyond the as-found flaw and at least 1/2 in. (13mm) beyond the toes of the original piping weldment, including weld end butter, where applied.



# Qualification Requirements

- Personnel qualifications will be required for individuals that wish to examine overlays less than 4.0" in diameter
  - Basis
    - Outside the present diameter and thickness ranges of the procedure and the qualification
- No additional personnel qualifications for non-standard tapered overlays
  - Basis
    - Already within the diameter and thickness ranges of the procedure
  - Procedures has been revised to address examination of these non-standard overlays
    - Vendor procedures will also have to be addressed
  - Open sample is available for vendors to work with, but the results must be documented and the data reviewed by the PDA



# Summary

- PDI-UT-8 has gone through a major revision that incorporated
  - Lessons learned
  - Inclusion of advanced techniques
  - Some changes to essential parameters
- The goal was to increase the reliability of the procedure
- Increase pass rates
- Eliminate known limitations in the field
- Reduce confusion for the user
- Include updated code references
- Expand ranges of procedure to 2.0” diameters
- Address tapered non-standard overlays

