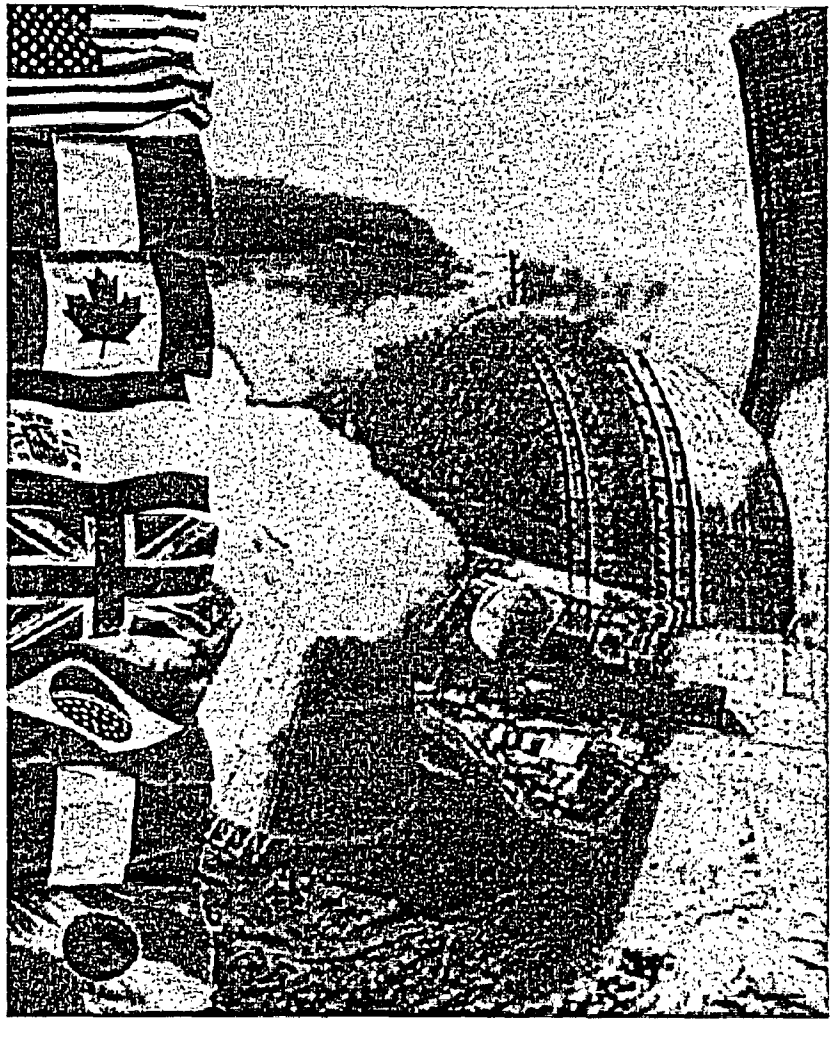


PDI-UT-10 Revision

Carl Latiolais

Project Manager Piping & Bolting

Performance Demonstration

EPRI

Outline

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

EPRI

Status Overview

- Revision of the procedure is complete
- Procedure is for detection and length only
  - Depth sizing criteria will be removed and added to new procedure PDI-UT-???
- Final Draft of detection and length procedure is ready for review Goal for issuance end of July 2005
- All comments addressed (One way or another) from initial review
- Final review will be sent to all Steering Committee Members for review and approval
- Procedure has been exercised and qualified
- After this procedure is approved work will start on depth sizing procedure and it will contain much of the same format

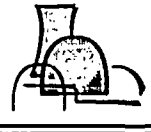
Status Overview

- Major Changes
  - Scope of procedure
  - Personnel requirements
  - Search unit selection
  - Calibration blocks
  - Tapered surfaces
  - Surface condition requirements
  - Scan pattern
  - Examination
  - Code Volume

EPRI

Scope of Procedure

- Reference to depth sizing removed
- Code year references removed
  - Program status to be stored on EPRIQ
- Clearly states all limitations
- Describes when site specific mock-ups are needed and reference PDI site specific criteria



Personnel Requirements

- Procedure includes additional personnel qualification requirements for examinations performed in BWR's
  - Must have current IGSCC qualifications for detection and length sizing as applicable

Search Unit Selection

- In most cases contoured search units are required for diameters equal to or less than 10.0" and recommend it for some larger diameters
  - 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 are better defined
  - Lower angle search units shall be focused to within 25% of the thickness instead of should
  - Higher angle search units will be required to be focused with 60 to 110% or the thickness

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	0.42	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)**

EPRI

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)**

EPRI

Search Unit Selection

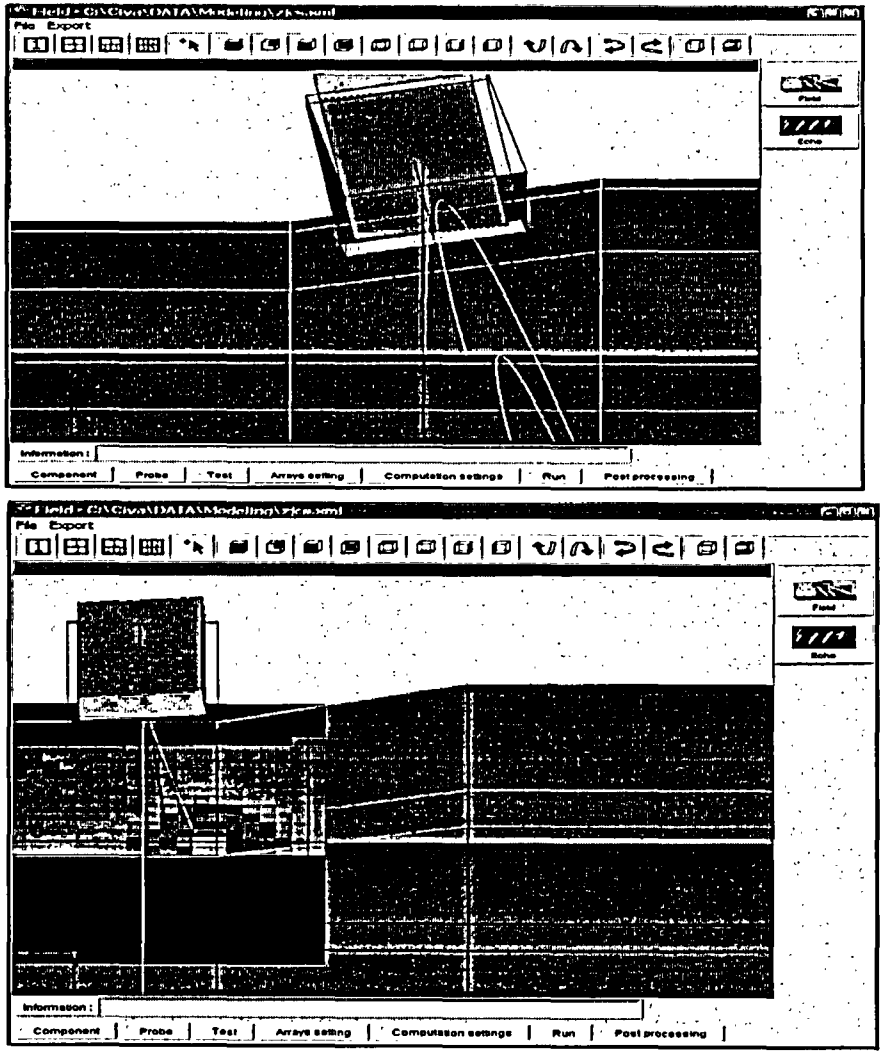
- Criteria is included on how to verify that the search unit is focused properly includes definition of focus
- Procedure has clear reference to Table 1 for PDI-UT-2 for shear wave selection
- Procedure has defined criteria for selection of the proper frequency

EPRI

Search Unit Selection

- Procedure describes the use of advanced or specialized search units designed to address specific geometric conditions such as tapers or limited scan access conditions
  - Tandem search units designed to adjust for tapers and maximize coverage
  - Tandem search units with smaller footprint that allow scanning closer to tapers
  - Search units with non standard angles that will increase coverage on specific configurations

Search Unit Selection



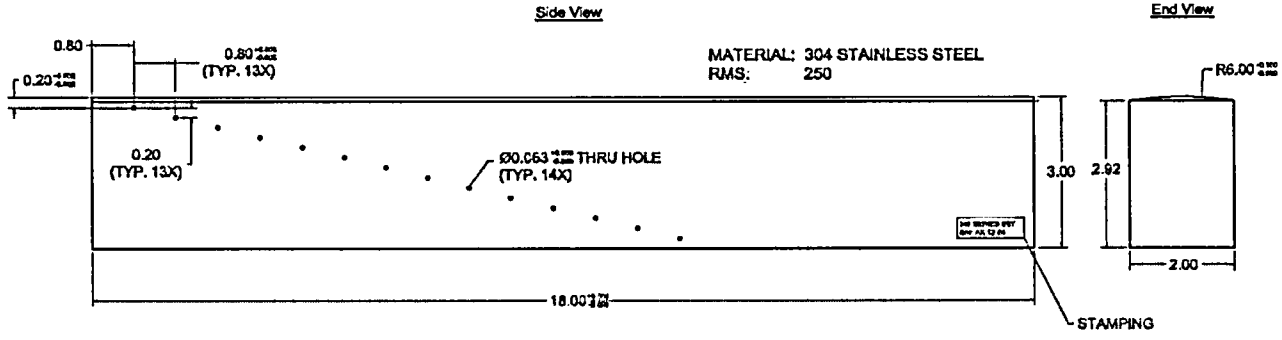
Search Unit Selection

- Better describes search unit selection for circumferential scanning
  - Reduced angles to accommodate for curvature
  - Better describes the use of shear waves
    - Limited to base material on either side of weld
    - Skewed into weld to maximize coverage
    - Reduces scanning on weld itself
  - Procedure now requires use of RL search units on thicknesses less than 0.50”
    - New samples purchased shows need for Longitudinal search units
    - Review of many of the configurations show that welds are extremely wide and would require scanning on welds and penetration through butter material

Calibration Blocks

- Procedure addresses contoured or curved calibration standards
  - Blocks already designed and available
- Alternative calibration block design was changed
  - Must have block with holes for RL search units
  - Must be able to address contoured search units
  - Use of ASME Blocks may be best alternative

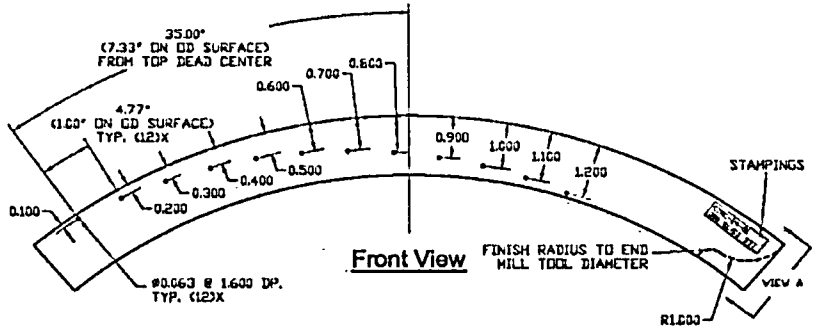
Calibration Blocks

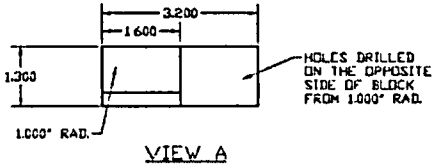


EPRI Contoured Probe Calibration Block

Calibration Blocks

24" STAINLESS STEEL PIPE SEGMENT BLOCK



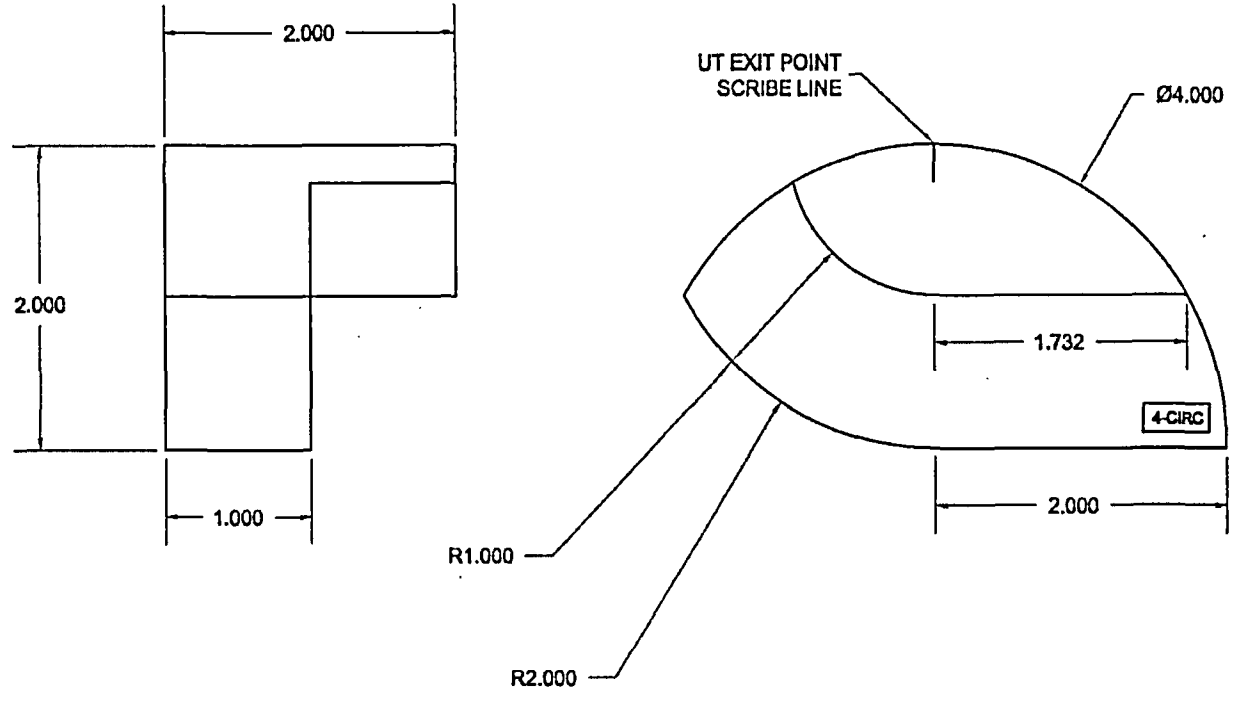


VIEW A

NOTES:

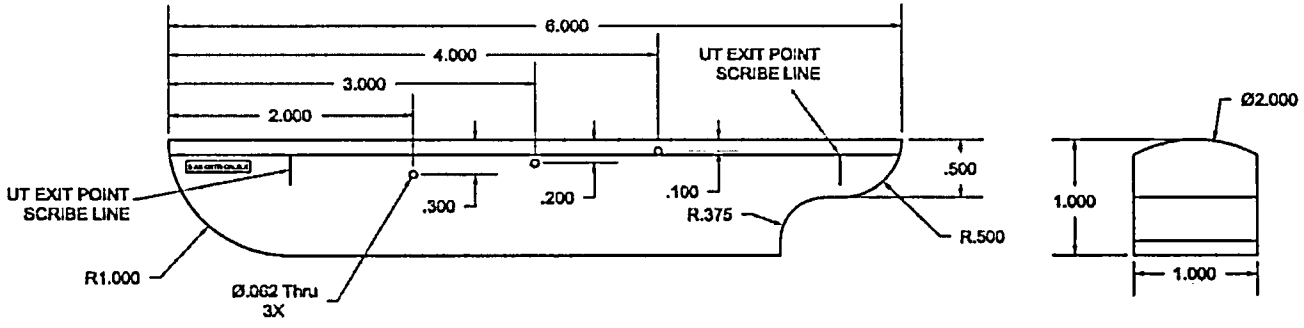
1. STAMP RADIAL SDH DEPTH (I.E. 0.20, 0.30, ETC.) NEXT TO EACH RESPECTIVE SIDE DRILLED HOLE
2. THE DEPTH AXIS OF THE SIDE DRILLED HOLES SHALL BE PARALLEL TO THE OD INSPECTION SURFACE
3. TOLERANCE FOR SDH Ø +0.000/-0.005
4. TOLERANCE FOR SDH RADIAL DEPTH ±0.005
5. TOLERANCE FOR SDH DEPTH ±0.050

Calibration Blocks



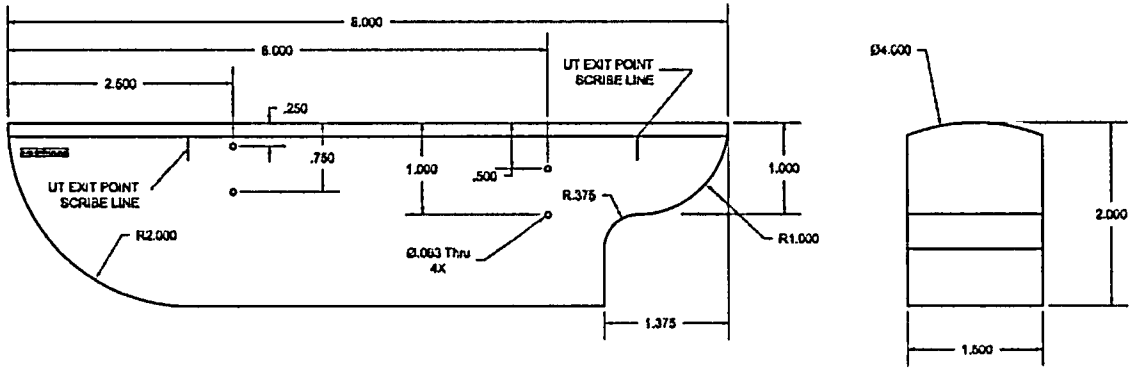
4" CIRC FOR ANGLES ≤ 50°

Calibration Blocks



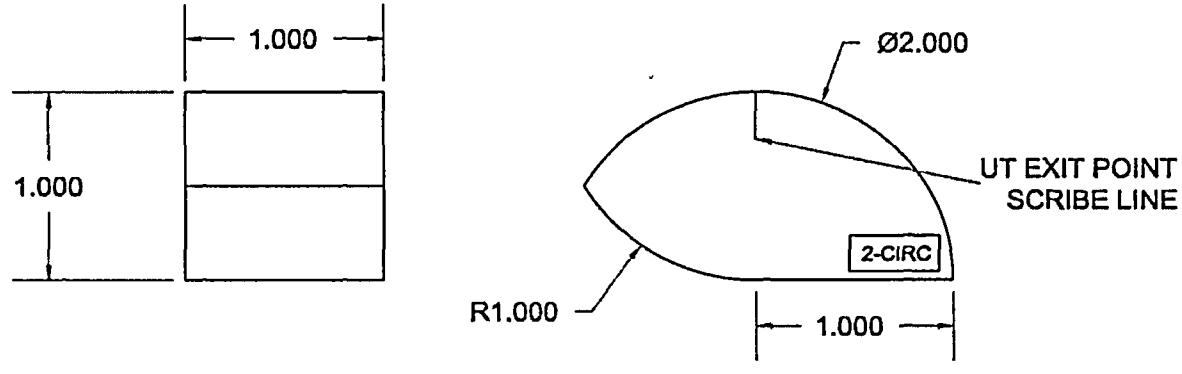
2" CONTOUR CAL BLOCK FOR AXIAL SCANS

Calibration Blocks



4" CONTOUR CAL BLOCK FOR AXIAL SCANS

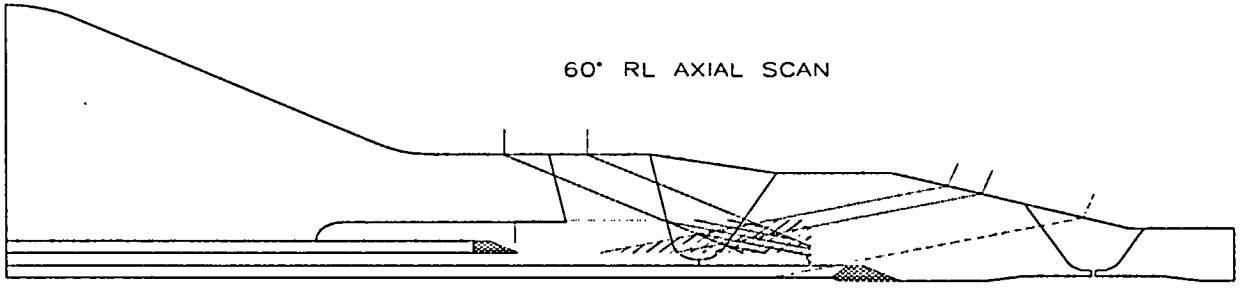
Calibration Blocks



2" CIRC FOR ANGLES ≤ 50°

Tapered Surfaces

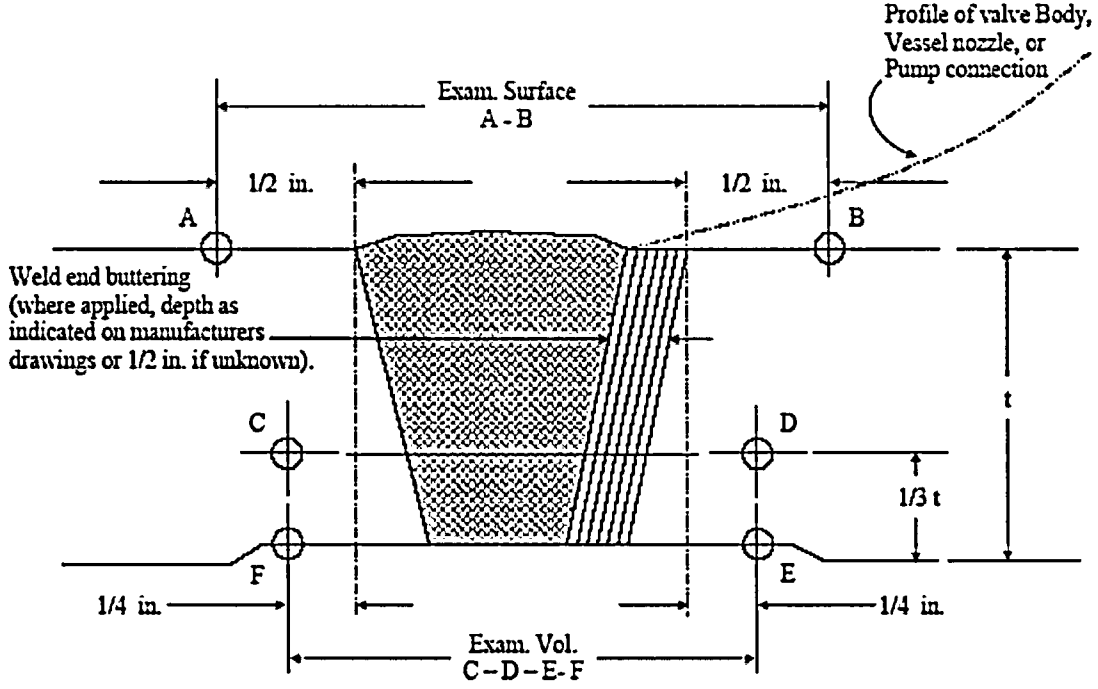
- Additional requirements to address tapered surfaces added
  - Search unit selection
  - Scan pattern
  - Focusing
  - Documentation of Limitations



Surface Condition Requirements

- Procedure clearly describes weld crown and surface condition requirements
  - Flush Weld Crowns
    - 1/32" over length of search unit
  - Documentation of limitations

Code Volume



Summary

- PDI-UT-10 has gone through a major revision that incorporated
  - Lessons learned
  - Inclusion of advanced techniques
  - Numerous 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