PICA Pipeline Inspection and Condition Analysis Corp.

Inspection Report

Bracelet™ Probe Inspection

ACME County Force Main Sites

Site # Dig#45

(445 Hansmore Trail,)

PICA USA
Los Angeles, USA

Field Crew	Allen Russell, Dylin Russell and Patrick Lake
Data Analyst	Allen Russell
Inspection dates	October 25, 2017
Reviewer	David Russell
Preliminary report date	October 26, 2017
Revision	0.1

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Inspection Test Site details for 445 Hansmore Trail, Dig site #45

Bracelet Probe Inspection		
Site information		
		Comments
Date Inspected:	October 25, 2017	
Site ID:	**Digsite 45**	
Location:	445 Hansmore Trail ACME County	
GPS or Google map coordinates:	56.7645 and -85.9285	
Pipe size:	12	
Class:	350 pressure class	Provided by Client
Material type:	Ductile Iron	
Nominal wall thickness:	0.280”	Provided by Client
Lining details: internal	Yes (based on drawing)	Provided by Client
Coating details: external	Factory black paint without a Poly-ethylene wrap around the pipe	
Op. Pressure:	No information provided	
Op. Temp.:	No information provided	
Excavation depth:	~ 5 feet from pipe crown	
Scan length:	~ 9 feet	
Scan performed in flow direction?:	Yes	
Weather:	60 - 75 F Degrees, mix of sun and cloud	
Excavation wetness:	Dry	
Soil type:	Brown/red sand and clay	
Photos taken:	Yes	
External pitting noted:	No significant	
Other observations:	ARV is 15 feet upstream of trench	

Inspection Test Site Details for 445 Hansmore Dig 45 (continued)

The Zero Foot Reference (ZFR) was set on the pipe, as shown in Figure 1. ZFR was 10 foot 2 inches upstream of the bell edge. Two scans were performed from -9” to 0” and from 0” to +9”. Note: further typical setup details can be found in Appendix 2.

Bracelet Probe (BP) data for all scans are shown in Figure 2 to 3 on page 7-8. No significant external corrosion was found visually. The data showed wall thickness variations along the pipe length with some pitting.

Ultrasonic Thickness (UT) thickness readings at selected locations based on BP scan data are listed in Table 1. The lowest thickness is 0.196”, representing: 30% wall thickness variation compared to nominal wall thickness of 0.280” as provided by the client.

Inspection Summary

The pipe at this site showed wall thickness variations with some slight pitting.

The lowest UT measurement was 0.196” representing: 30% wall thickness variation.

The highest UT measurement was found to be 0.289”.

No significant external corrosion was found on the pipe visually.

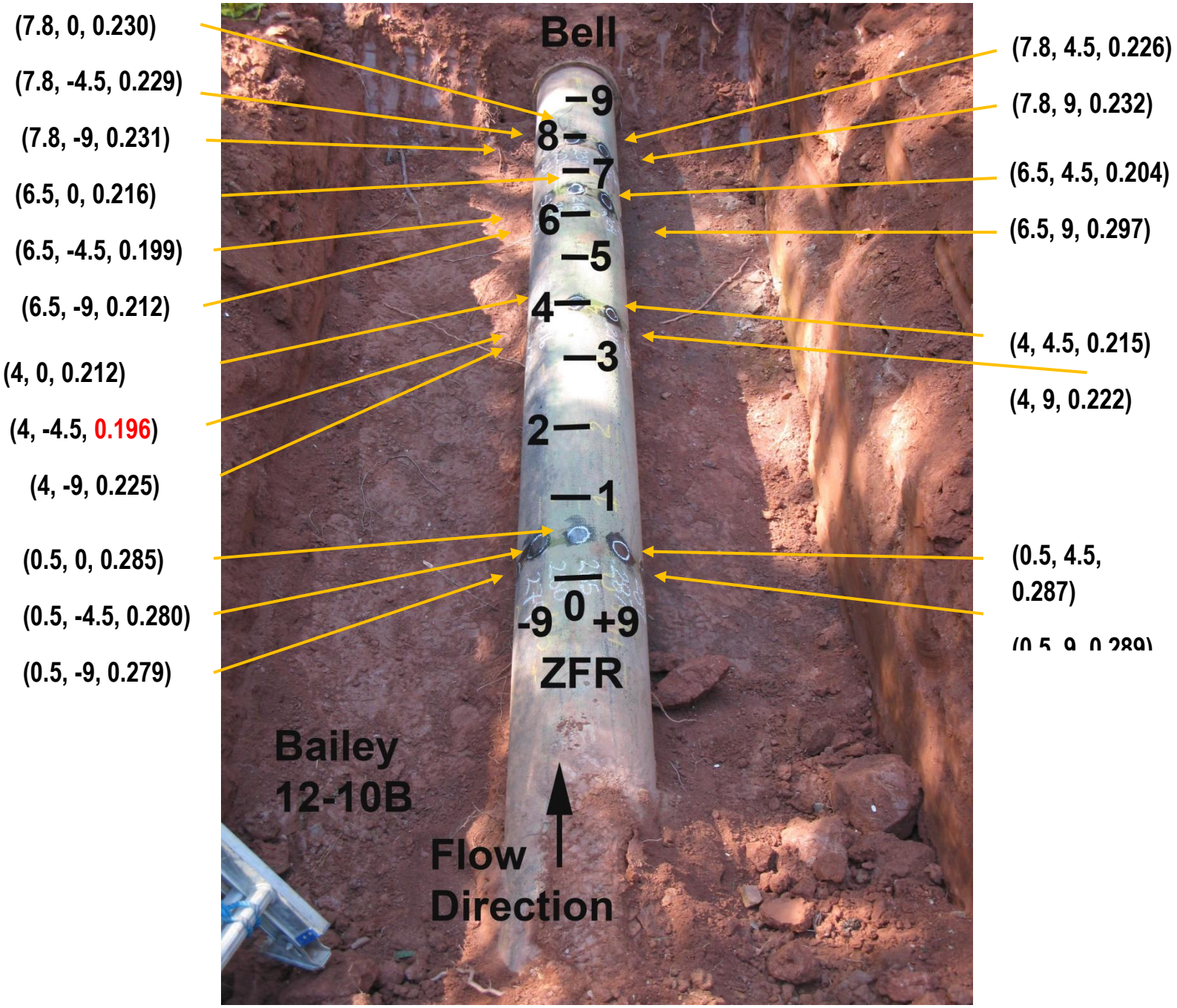
Locations for UT measurement were chosen at 0.5’, 4’, 6.5’ and 8’.

Table 1. UT Thickness Measurements at selected spots at Site 45

Axial distance from ZFR (feet)	Circumferential distance from 12 o'clock (in)*	UT thickness reading (in)
0.5	-9	0.279
0.5	-4.5	0.280
0.5	0	0.285
0.5	4.5	0.287
0.5	9	0289
4	-9	0.225
4	-4.5	**0.196**
4	0	0.212
4	4.5	0.215
4	9	0.222
6.5	-9	0.212
6.5	-4.5	0.199
6.5	0	0.216
6.5	4.5	0.204
6.5	9	0.197
7.8	-9	0.231
7.8	-4.5	0.229
7.8	0	0.230
7.8	4.5	0.226
7.8	9	0.232

*Negative and positive values were measured CCW and CW from 12 o'clock position, respectively.

Note: The lowest UT measurement has been highlighted red at **0.196"**



(Distance, Circumference, Thickness)

Figure 1. Showing **Site 12-10B** with ZFR, Flow Direction and UT Locations. The 3 numbers in parentheses are coordinates (axial distance from ZFR in foot, circumference distance from 12 o'clock in inches and pipe wall thickness in inches), respectively.

Screen Captures of Bracelet Probe Scan Data

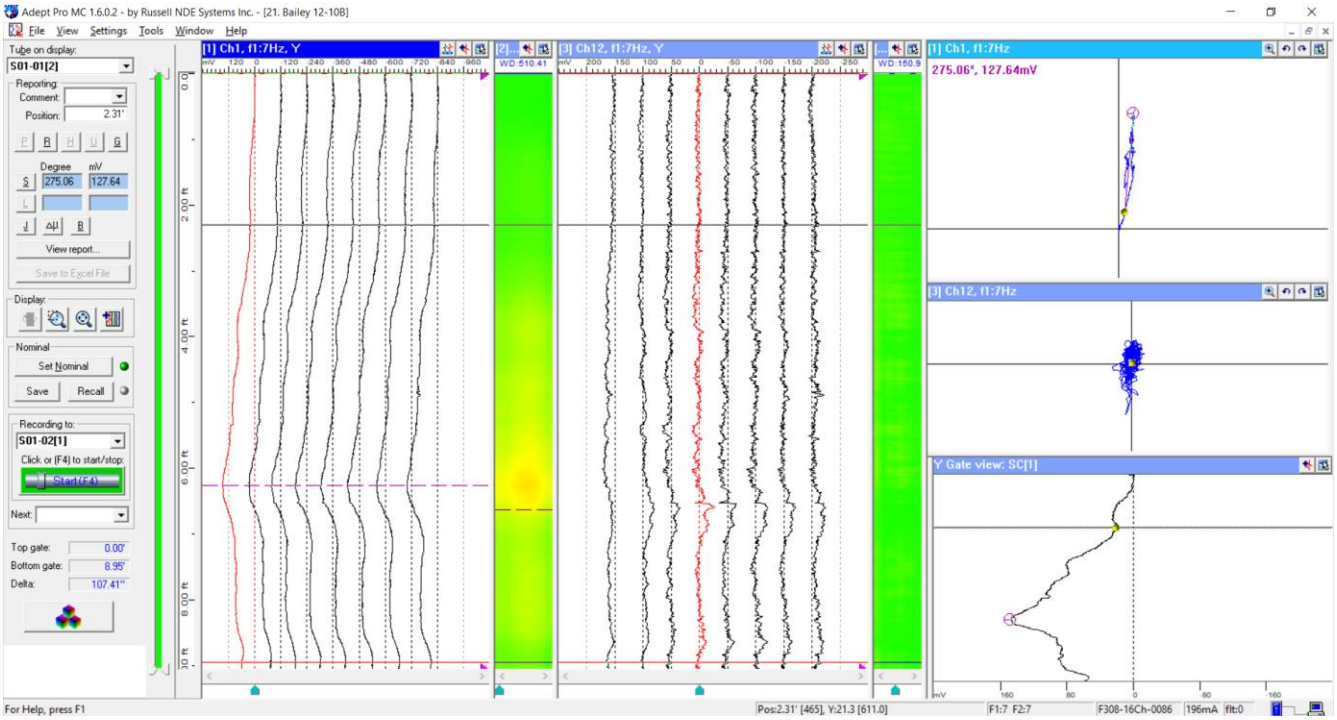


Figure 2 (Scan S01-01) BP data for a scan covering -9” to 0” circumference (Probe centered at -4.5” position)

Screen Captures of Bracelet Probe Scan Data

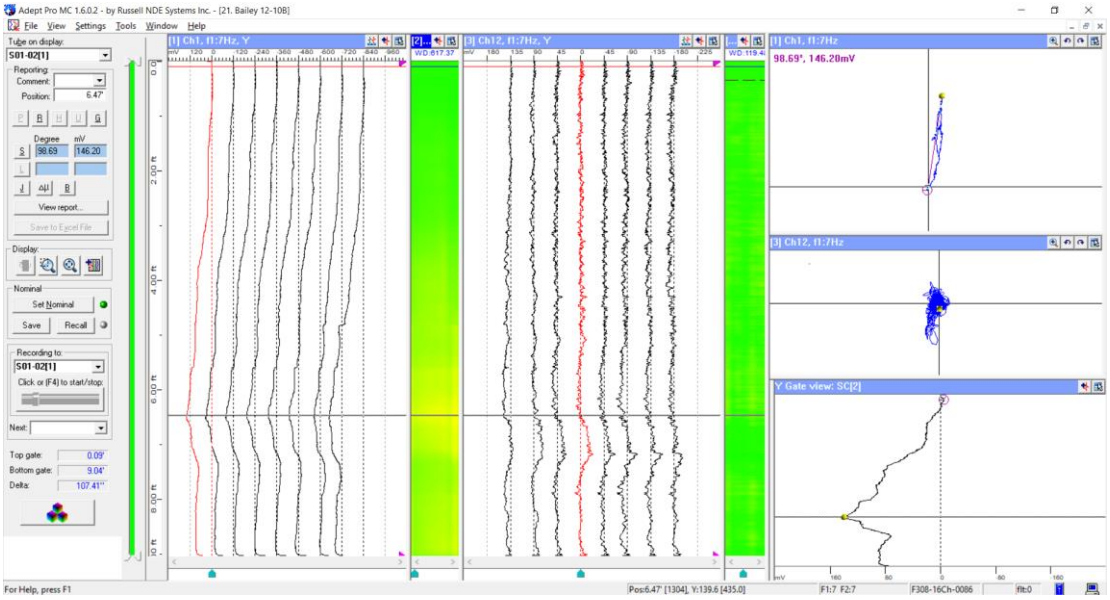


Figure 3 (Scan S01-02) BP data for a scan covering 0” to +9” circumference (Probe centered at 4.5” position)

Appendix 1: Technology Background

The Bracelet™ and Blanket™ probe system is Russell NDE Systems' latest external pipe inspection tool. The probes are flexible and one Probe can fit on pipe sizes 6" and larger.

The Bracelet™ probe works on the principle of through-transmission (TT) Electromagnetics. Typical magnetic field pattern generated by the Bracelet™ is shown in Figure A1-1. The probe can detect internal and external wall loss in bare or coated ferromagnetic pipes (i.e., steel, cast and ductile-iron pipes). The threshold of detection (TOD) for local and general internal defects is respective 15-20% and 10-15% wall loss depending on corrosion morphology.

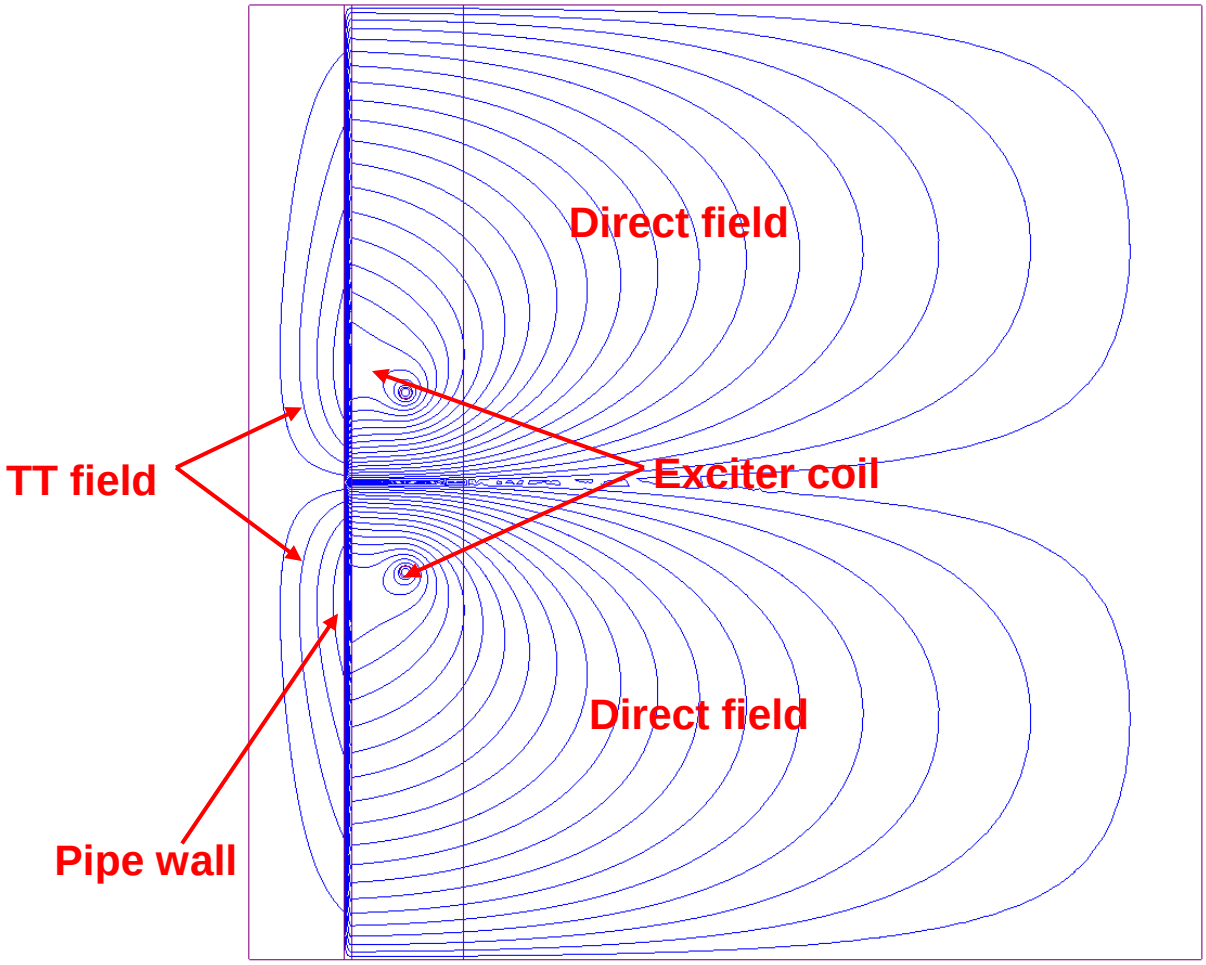


Figure A1-1. Typical magnetic field pattern of a Bracelet™ Probe.

Appendix 2. The Bracelet Probe Technique: Typical Setup

Scan Numbering and Clock Position

Clock position was defined by looking in product flow direction, as shown in Figure A2-1. The pipe crown area along the pipe length was examined. A total of 2 to 3 scans centered at 12 o'clock were performed to cover the crown area. Circumferential distance was measured clockwise (CW) as a positive number or counter-clockwise (CCW) as a negative number from the 12 o'clock position.

Coverage

The Bracelet Probe (BP) typically covers a 9" axial swath for each scan on a pipe; therefore several scans are required for full 360 degree inspection coverage.

Measurements

A "Zero Foot Reference" (ZFR, or datum line) was marked on each pipe and indicates the start of each BP scan. The scanning direction is from upstream (US) to downstream (DS), as shown in Figure A2-2. Axial distance increases downstream (DS) from the ZFR.

Scanning Speed

The probe was scanned at a speed of 1-2 feet per minute on the pipe, as shown in a photo in Figure A2-3. The BP data and distance information were gathered and stored in the laptop computer while the data was displayed real-time on the computer screen. The data was analyzed on site and any defects were noted and marked on the pipe with UT (Ultrasonic Testing) performed if needed for confirmation of BP results. Typical setup for Ferroscope and laptop computer is shown in Figure A2-4. The laptop was connected to the Ferroscope for data gathering and real-time data display.

Mill Tolerance

For general wall variation that is less than 20%, we report it as mill tolerance variations. Unless there are clear pit indications, we do not differentiate between mill variations and internal wall loss due to pitting.

It is common to have mill variations of up to +/-20% in brand new DI pipe, due to the spin-cast technique. Wall loss due to pitting becomes easier to call if there are definite pitting signals and wall variation exceeding 20%. Pitting shows in our third strip chart from the left and general wall variation shows in the first strip chart from the left.

Bracelet Probe Calibration

Probe calibration was performed using the defects found in the pipe. The two detector arrays in the BP detect general wall variations (GWV) and local wall loss (LWL), which can be calibrated by using the GWV and LWL defects detected in the pipes at excavation sites. The wall thickness in the GWV and LWL areas was measured by the UT instrument and was used to calibrate the BP.

Ultrasonic System Calibration

The UT system was calibrated against a set of machined step wedges made of ductile iron. The step thicknesses are 0.100”, 0.200”, 0.300”, 0.400” and 0.500”

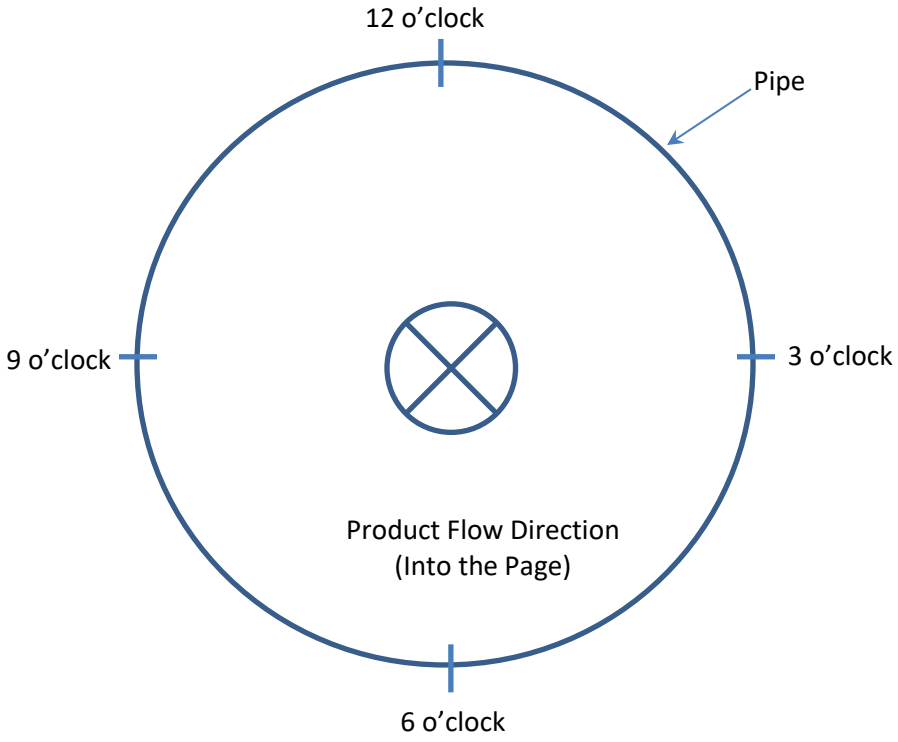


Figure A2-1. Pipe Cross Section Clock Definition vs. Product Flow Direction.

Zero Foot Refrence (ZFR) ‘0’ Location

Figure A2-2: Typical initial location of the Bracelet™ Probe placed at the start location.

Figure A2-3 Typical BP scanning a pipe.

Figure A2-4 Typical setup for Ferroscope and laptop computer at job site.