Prevention First 2002 Conference

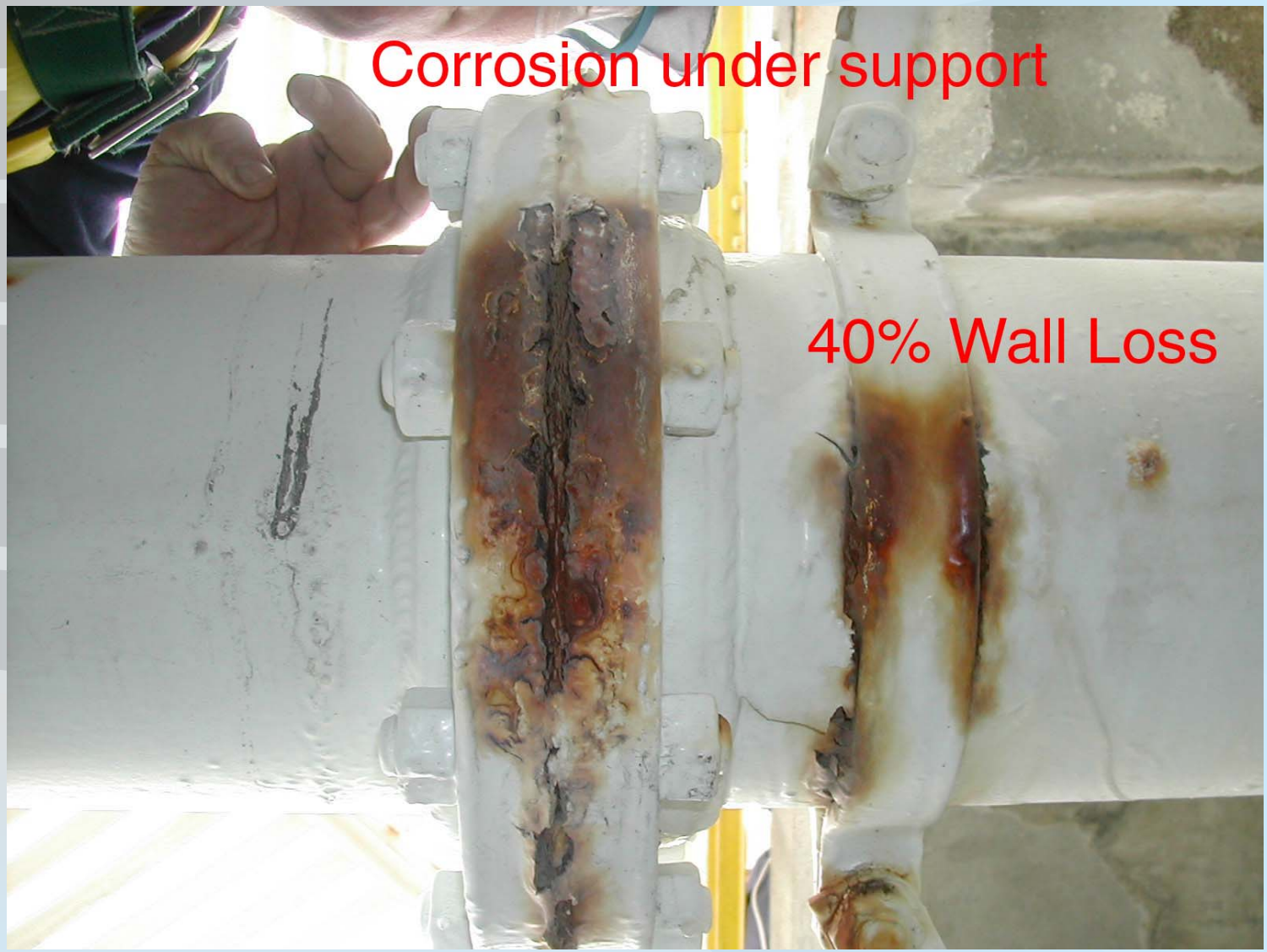
Inspection of Marine Terminal and Plant Piping Utilizing Long Range Guided Ultrasonic Inspections

Marine Terminal Piping Inspection

- Visual Inspections
- Fit for Service Hydro
- Ultrasonic Thickness Measurements

Ultrasonic Measurements


9" X 5" Corrosion Area
.200" Wall Loss 1" Dia.


Corrosion under support
40% Wall Loss

16” Line Underground

Guided Ultrasonic Ltd. (GUL)

Wavemaker Pipe Screening System

Waves are sent along the pipe

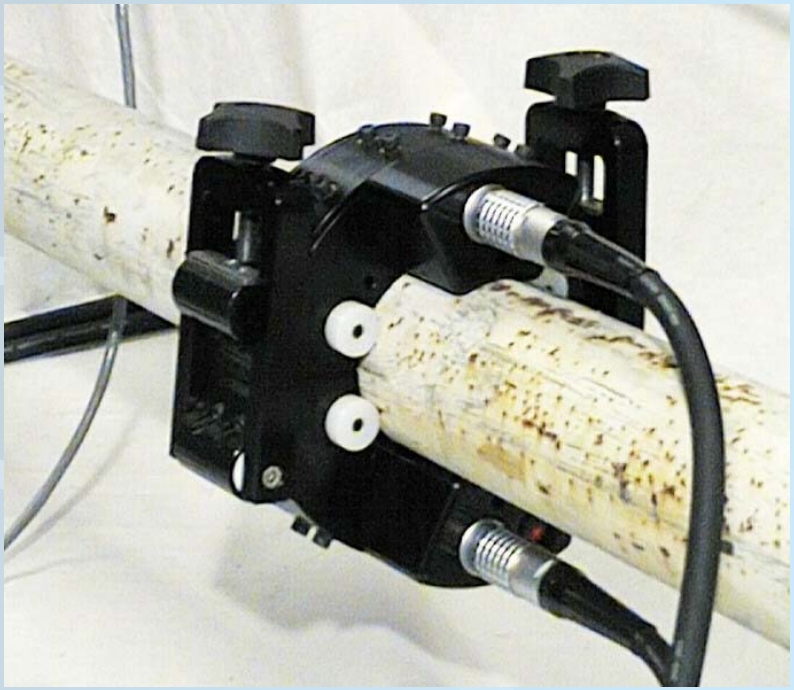
- **Several hundred feet of pipe are examined from one location depending on pipe conditions.**

Typical Applications

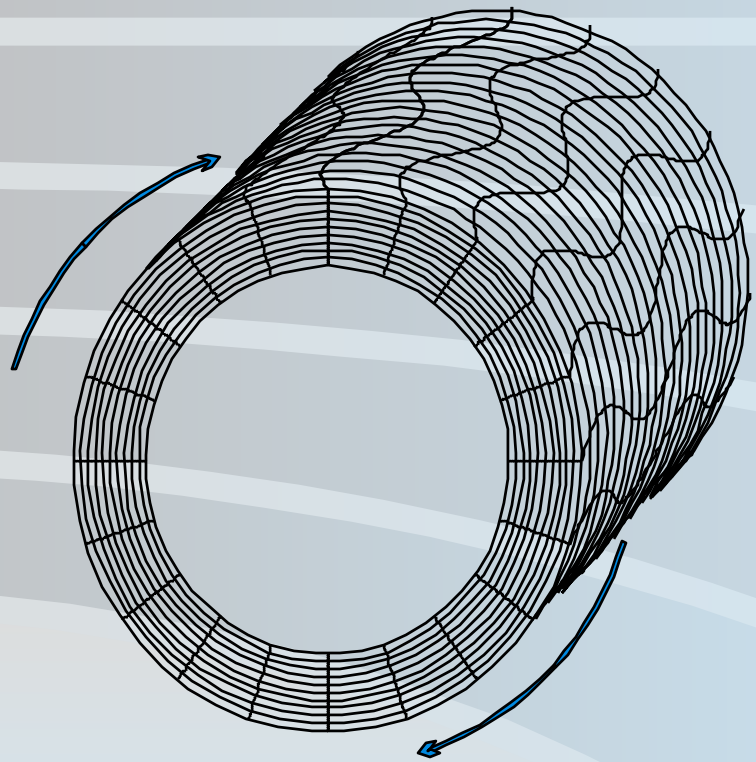
- **Rapid, full coverage screening of pipe**
- **Especially cost effective in difficult to access locations**
  - **Monitoring overhead piping on columns**
  - **Corrosion under insulation (CUI)**
  - **Roadcrossings**
  - **Wall penetrations**
  - **Pipe racks**
  - **Pipe support point of contact corrosion**
- **Can detect cracks and general metal loss (greater than 3% of the cross-sectional area)**

How it works

- A ring of transducers is placed around the pipe
- No couplant is required
- Usually no surface preparation required

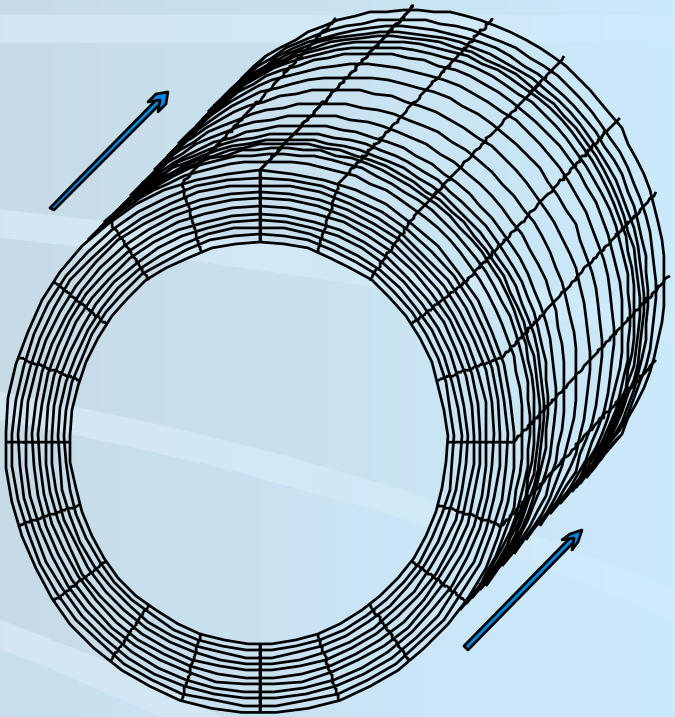


Two types of waves can be used



Torsional

(twisting of the pipe)



Longitudinal

(compression of the pipe)

WaveMaker WavePro - [example_road_crossing.ts2]

File Edit View Configure Scope Window Help

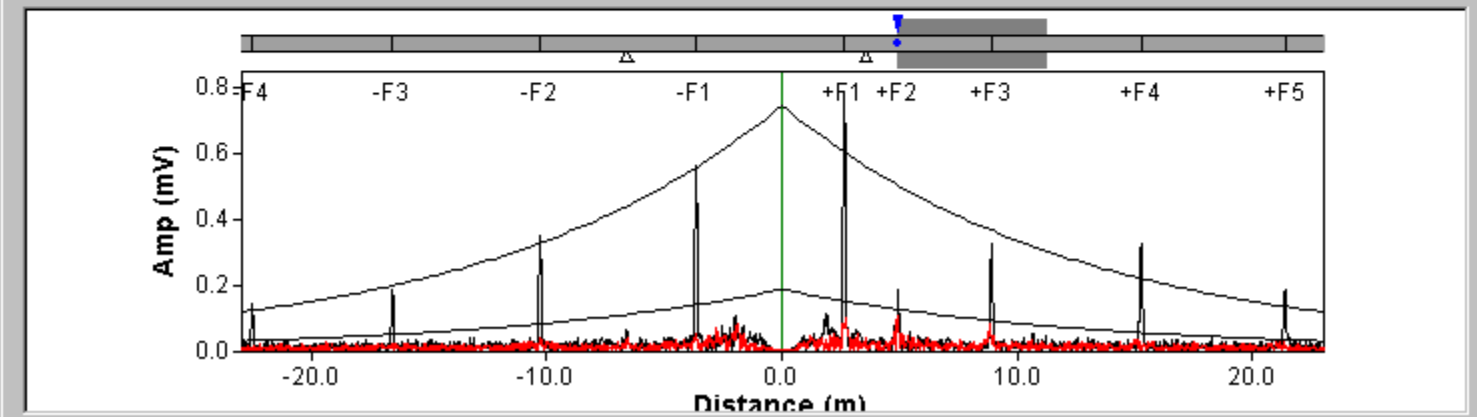
Collect | Analyze | Report | Status

Pipe: PPRPY 16
Site: Unspecified
Location: East 2 m
Size: 4 inch
Tested: 15 Sept 1999 16:12 (brian)
Ring: R4F4(5)-Circum

Coating: None
Contents: None
Supports: None
Corrosion: None

Results from a painted four inch line as it crosses under a roadway (for which it is epoxy painted on at least one side). The line is in good condition except possible for the point where it enters the west side of the road crossing.

P	A	Feature	Locati...	Size (...	ECL	Class	Phase	Notes
P		+F1	2.65	0.565	-	Weld		
		+	3.59	0.0417	1	Support		
P		+F2	4.92	0.183	8	Minor		Corrosion present at the point where the pipe enters the roadway. (M
		+	4.93	0.118	8	Entrance		
P		+F3	8.91	0.226	-	Weld		
		+	11.24	0.039	-	Exit		End of the road crossing (as measured)
P		+F4	15.27	0.223	-	Weld		Weld with larger weld cap than usual as seen from other side
P		+F5	21.38	0.128	-	Weld		
P		-F1	-3.65	0.42	-	Weld		The first of a series of very regular welds
		-	-6.59	0.0468	2	Support		
P		-F2	-10.28	0.252	-	Weld		
P		-F3	-16.55	0.126	-	Weld		



Ready | Device not connected | Ring not connected

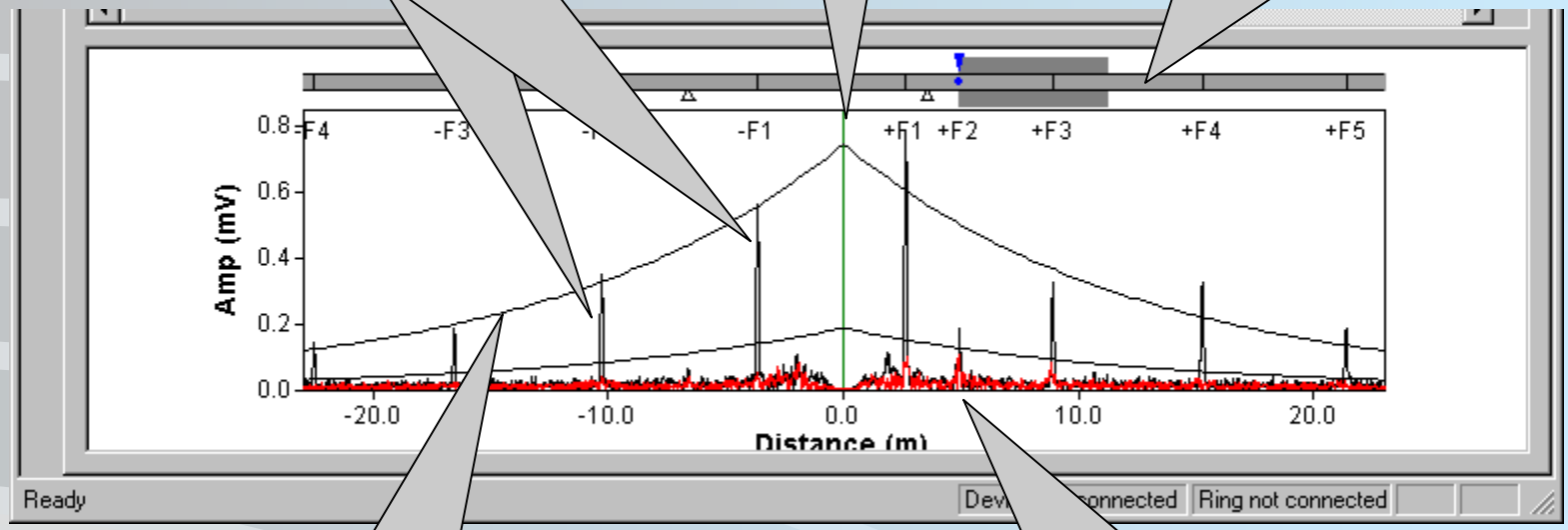
Backward

Position of Ring

Forward

Series of Welds

Iconic representation of identified features



Decay Curves

Corrosion is indicated by large red component

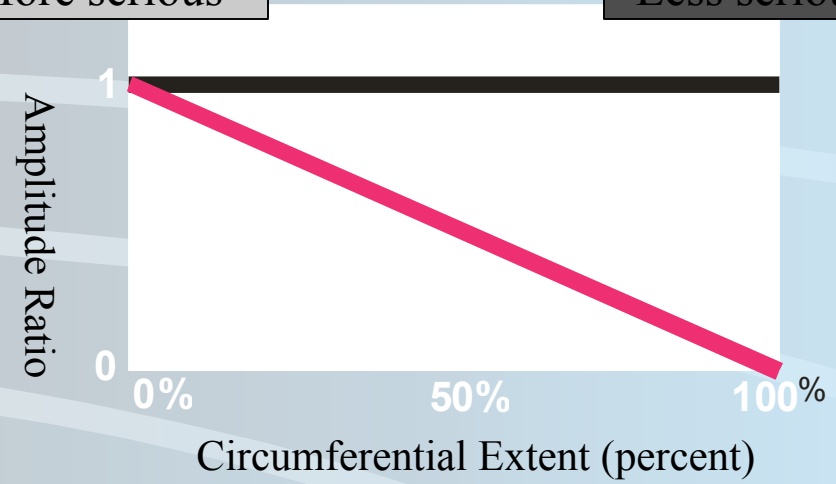
The symmetric nature of a reflection can help classify it

More serious

Less serious

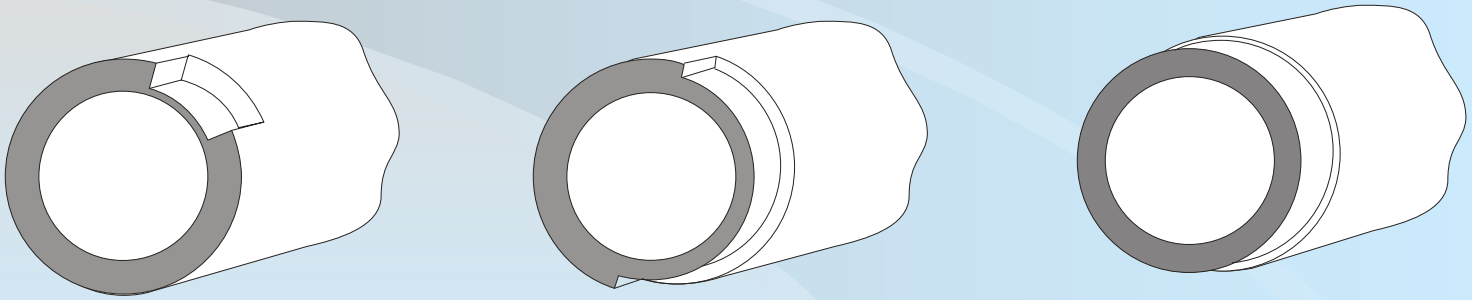
When the feature does not extend very far around the circumference,

RED = BLACK



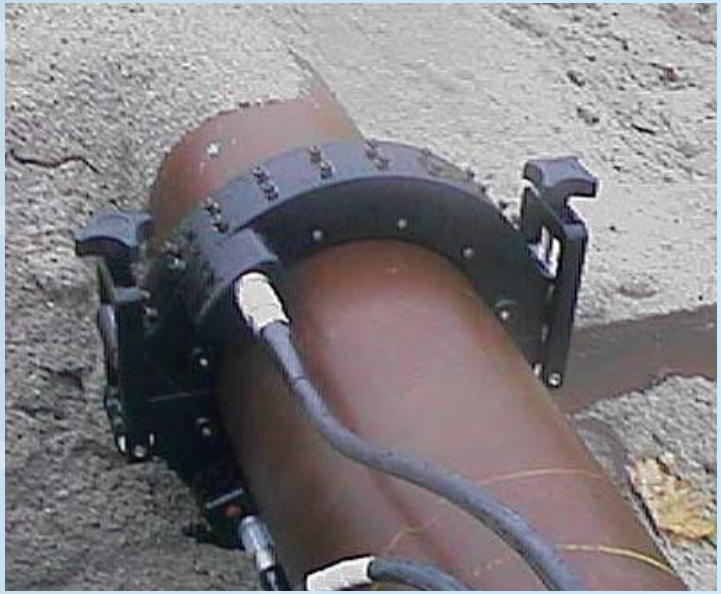
When the feature extends significantly around the circumference,

RED << BLACK



Small Diameter Pipes

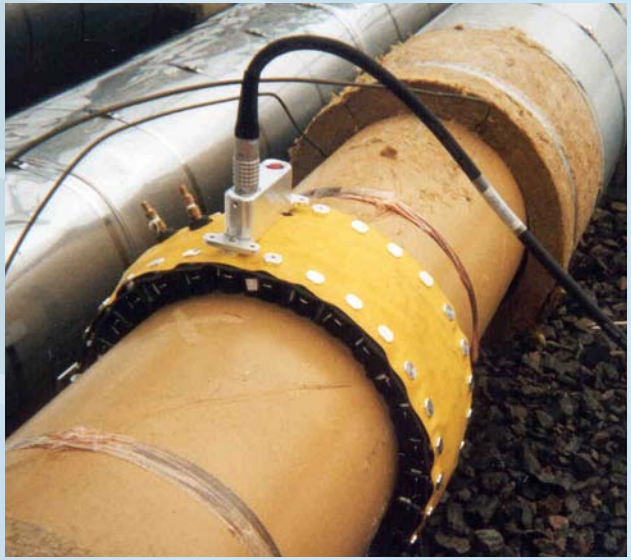
- Tested using solid rings
- For pipes 1 - 8 inches diameter
- Can be mounted in less than a minute
- 3 inches clearance needed around pipe
- Temperature limit of 300°F



8” Ring R2F8

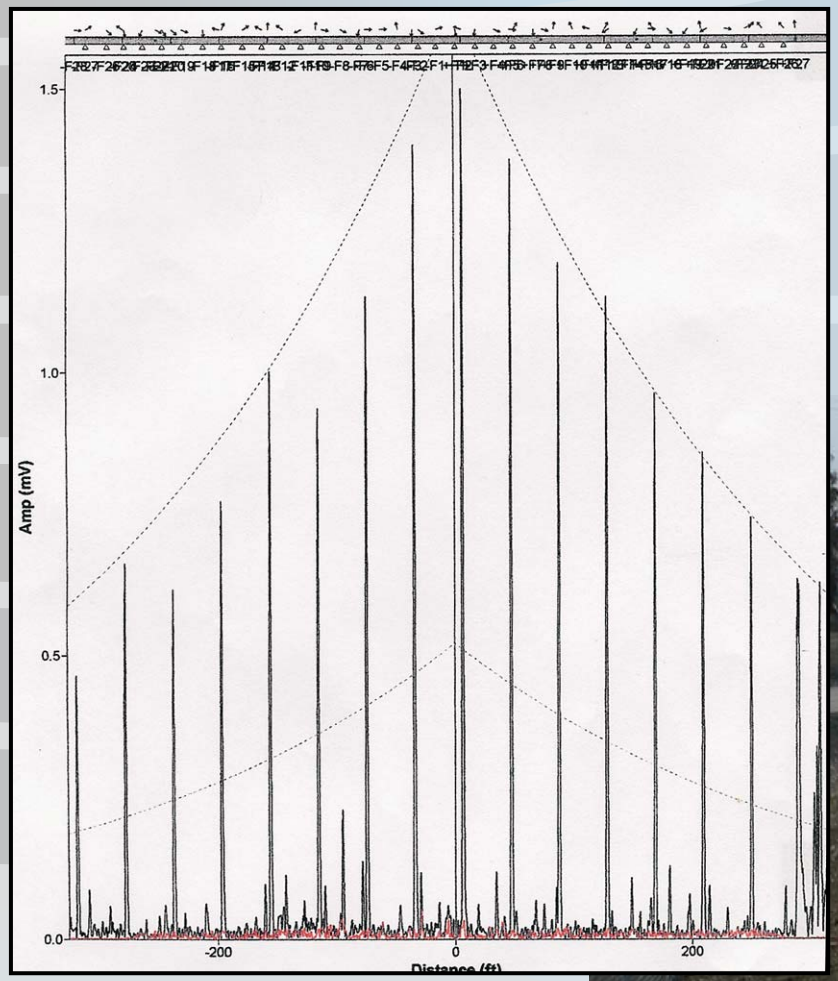
Large Diameter Pipes

- Tested using inflatable ring
- For pipes 10 – 46 inches diameter
- Employ conventional foot pump to inflate
- 2 inches clearance needed around most of pipe
- Temperature Limit of 300°F

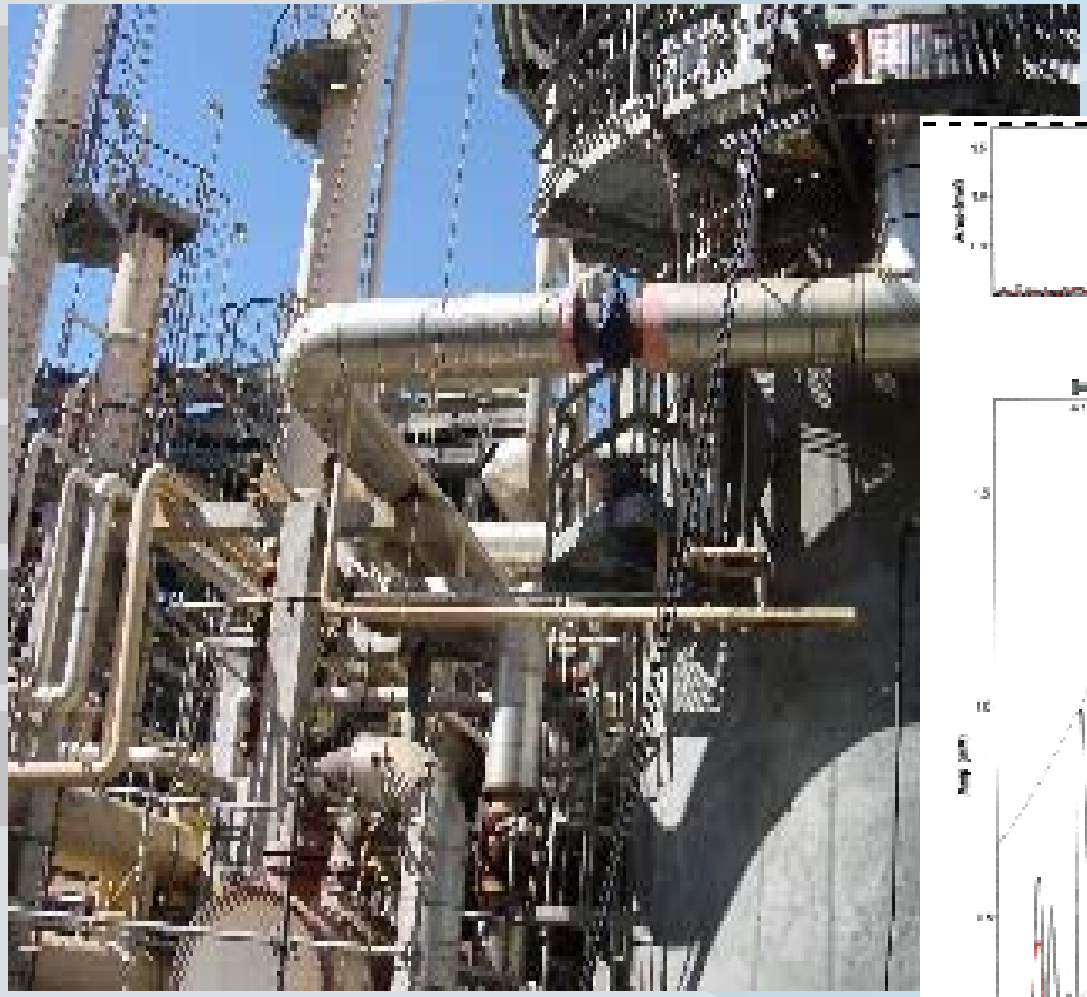


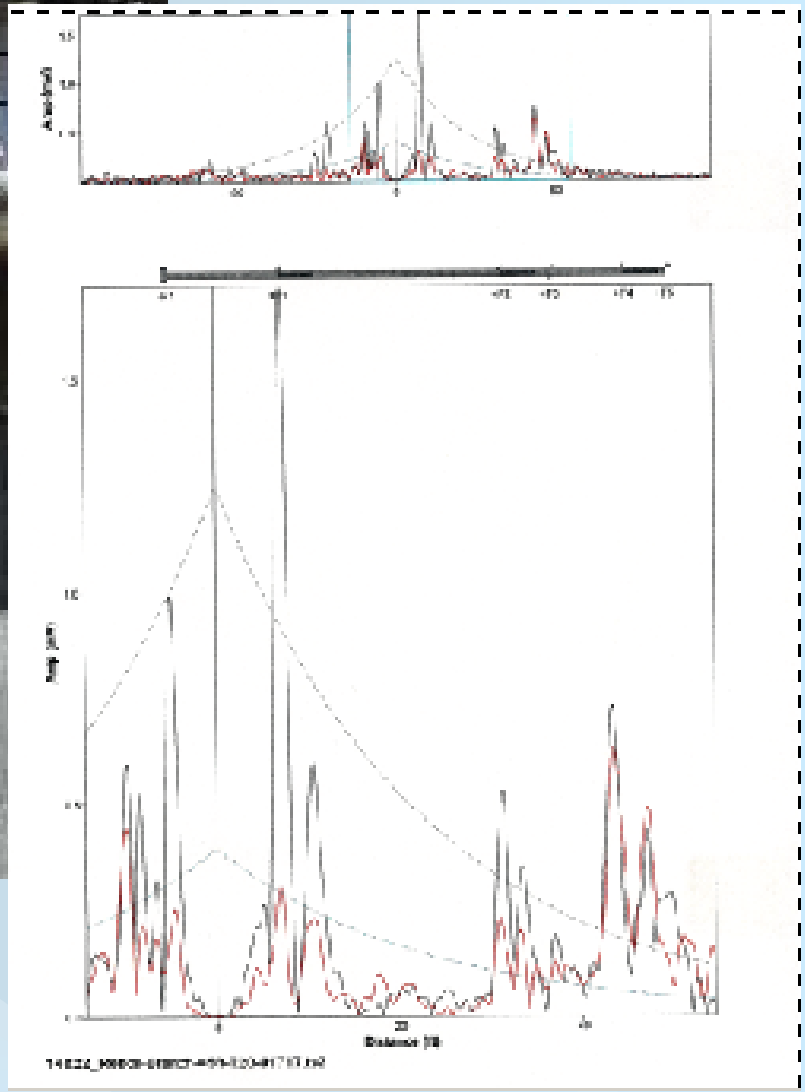
12” Ring R2B12

650’ of Pipe Screened From a Single Location



Long Range Guided Wave Ultrasonics Performing CUI Inspection



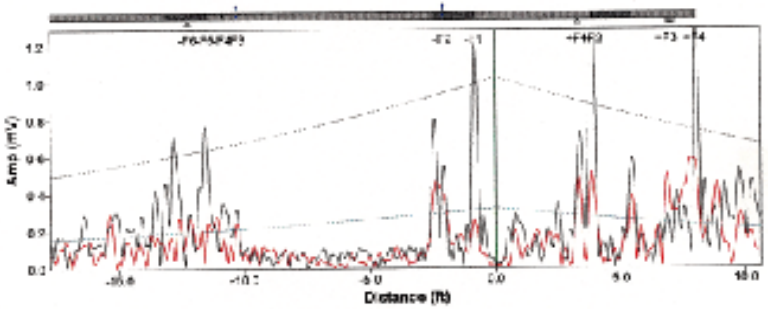


F:\SHOT.psd @ 16.7% (RGB)

Test ID: 1707
Pipe: 8" Coil 7
Size: 8 inch
Tested: Apr 12 2002 11:17
Tested by: Larry Walcel
Ring: R2F06: 72-Circum
Calibration: Automatic (1: 055 mV)
Client: Phillips 66
Procedure: GJ 1.1

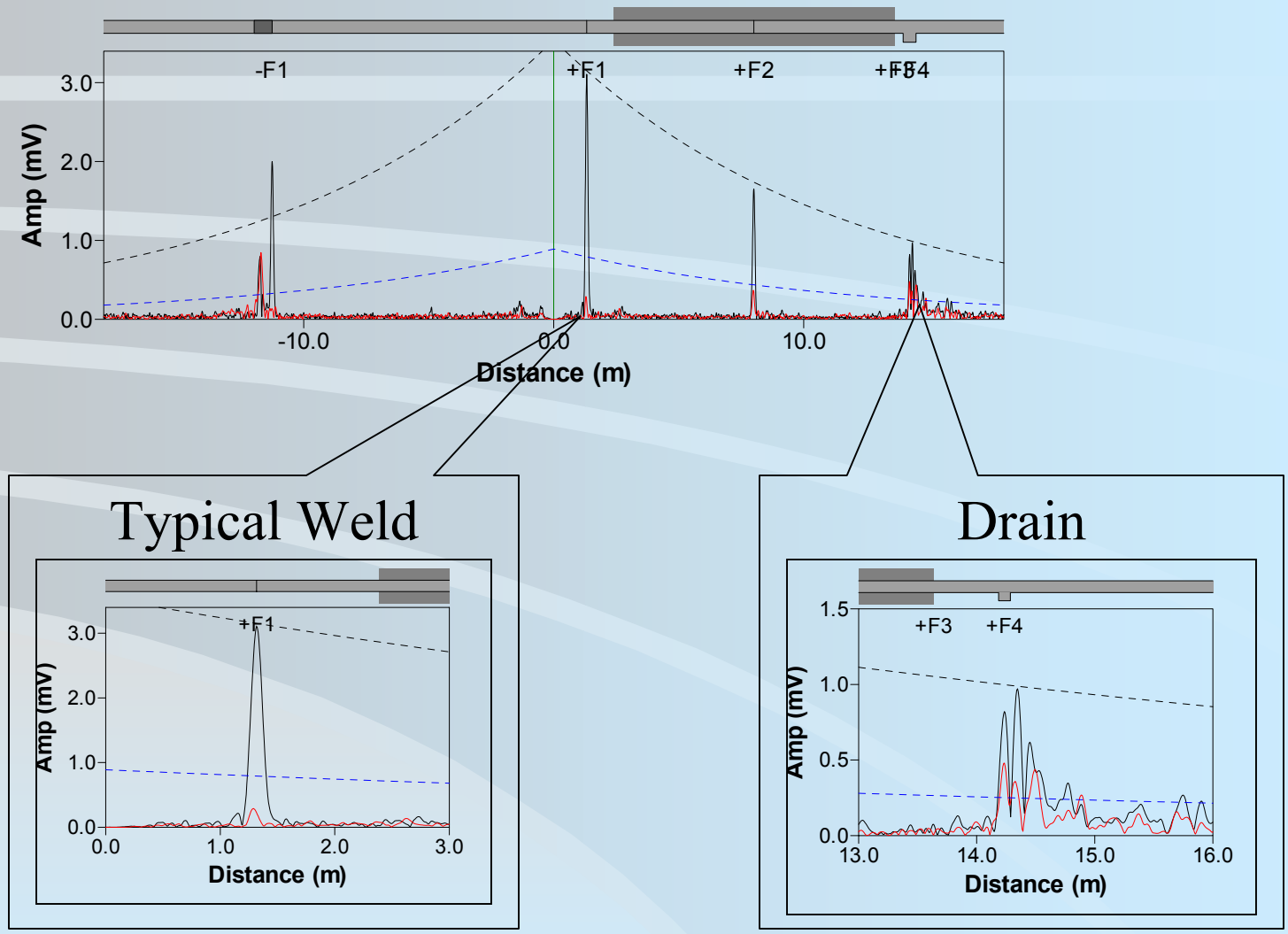
General Notes: B-301 Heater Bottom

Feature	Location	Size (mV)	BCL	Class	Notes
HF1	3'2"	0.736	-	Support	
HF2	4'1"	1.62	-	ID Band	
HF3	7'1"	0.288		Y	
HF4	[illegible]	1.33	-	Flange	
-F1	-11'1"	1.22	-	Band	
-F2	-21'	0.632	17	Medium	
-F3	-10'3"	0.326	14	Medium	
-F4	-11'1"	0.348	16	Wire	
-F5	-11'6"	0.721	-	Band	
-F6	-12'5"	0.297	-	Support	

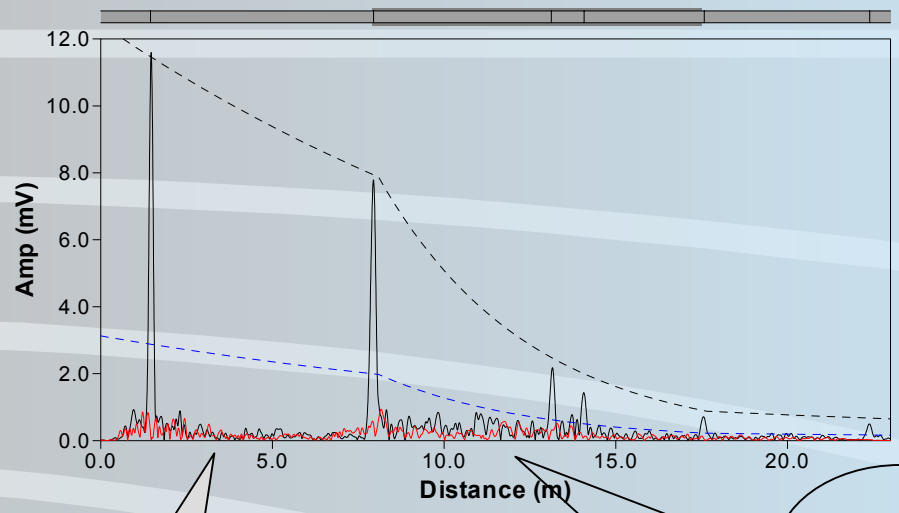


0822_Coil_7-Weld-HR-125-#1707.B2

Example of Insulated Pipe



General Condition of Pipe



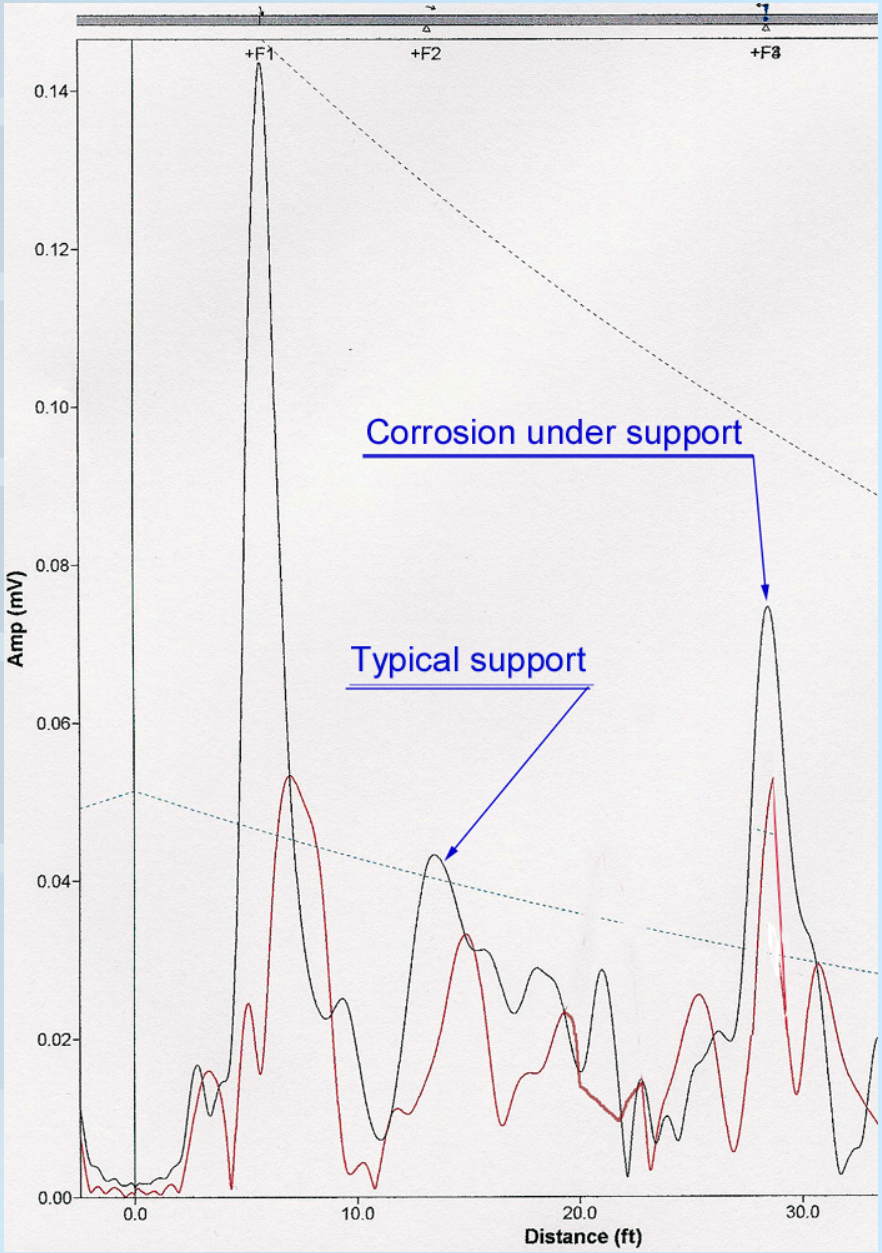
Clean Pipe

Generally Corroded Pipe

Typical Road Crossing

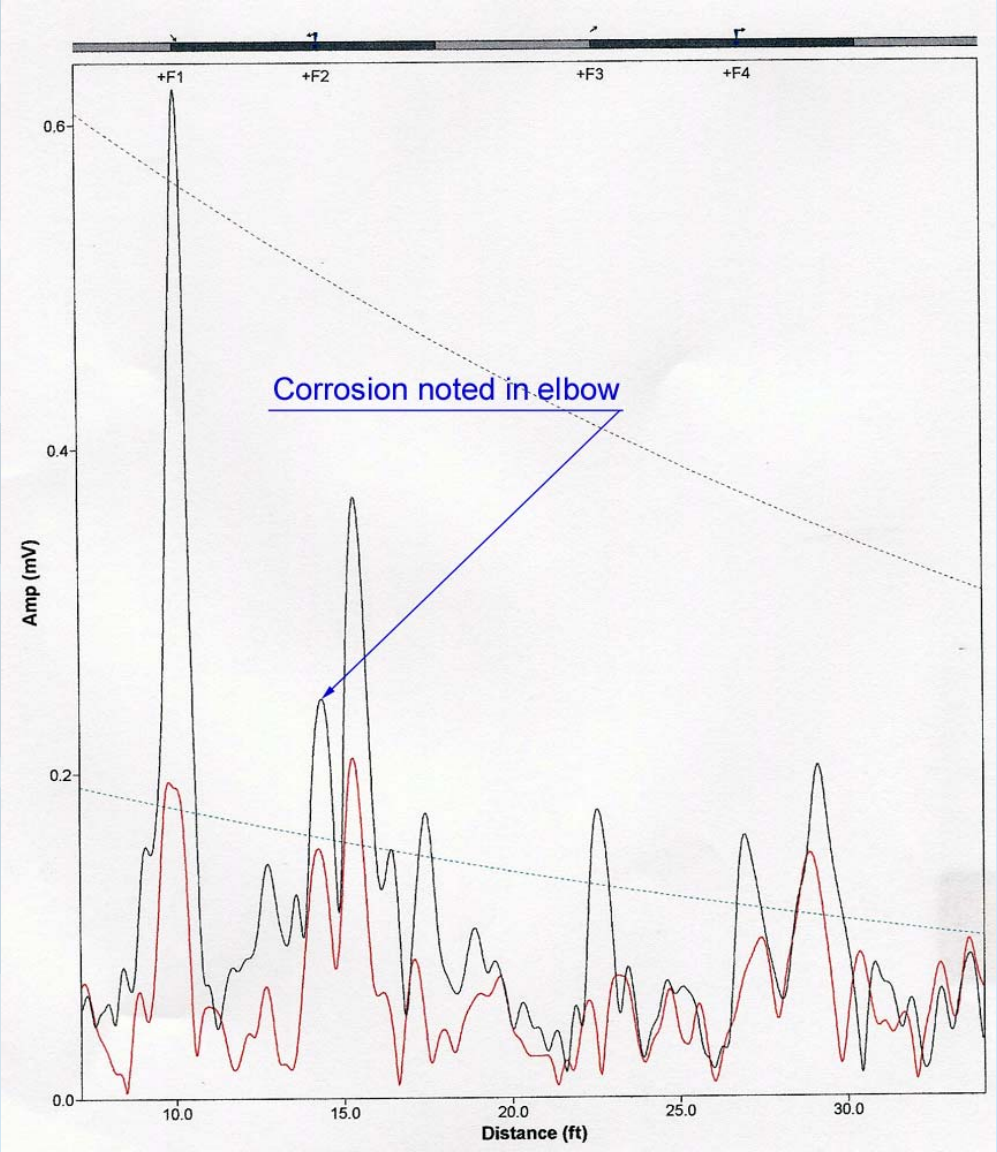
Example of Point of Contact Corrosion Under Supports

Point of Contact Corrosion Under Supports

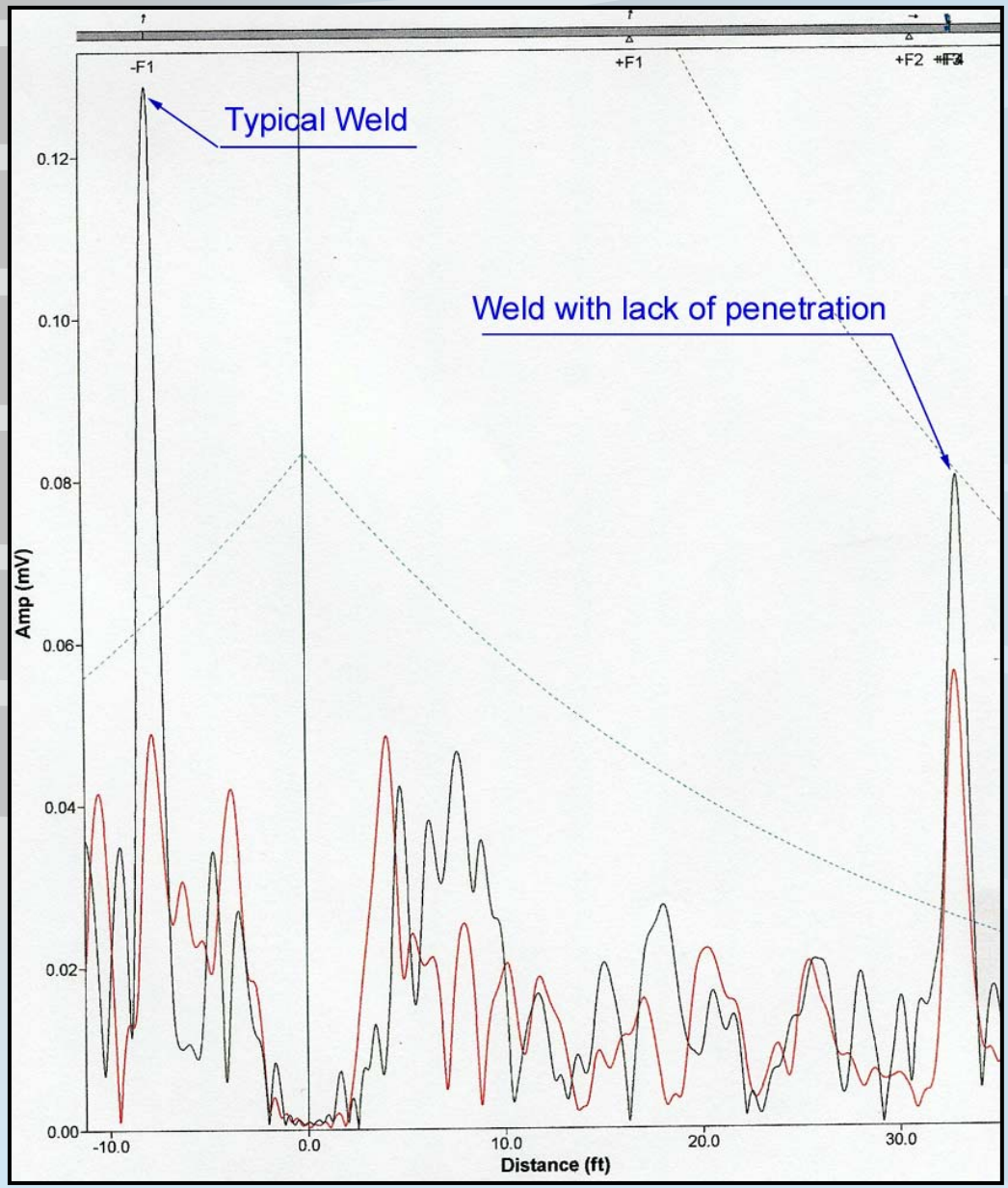


Corrosion Noted in Elbow

Example of Corrosion Noted in Elbow



Example of Weld Examination



Weld Examination

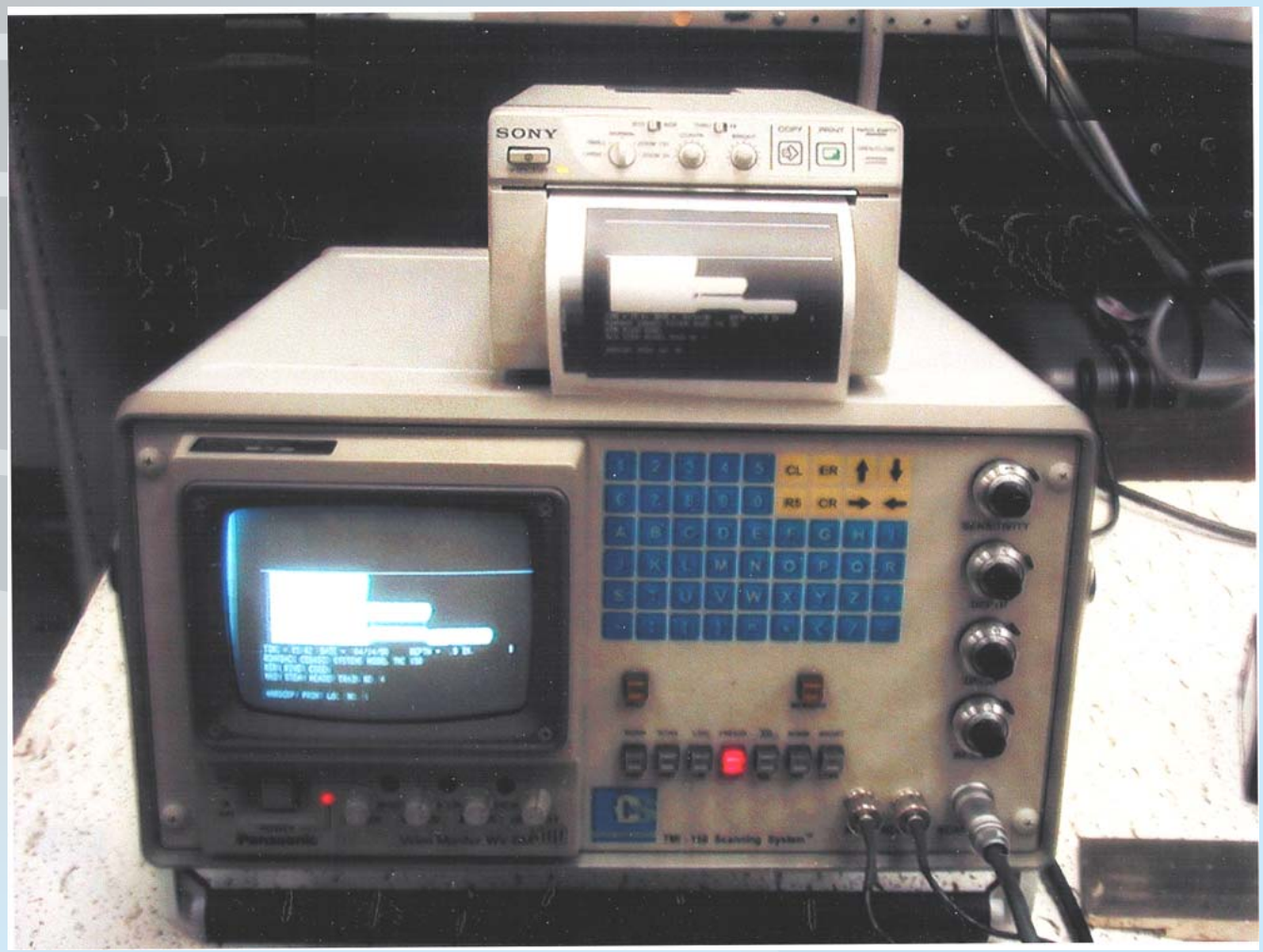
Offshore Piping Inspection

Platform Riser Inspection

Long Range Guided Wave Limitations:

- Inspector qualifications and experience
- Temperature limitations 300°F ?
- Wave mode – Torsional or longitudinal ?
- Insulation type
- Design of supports
- Pipe survey vs. Quantitative results
- Pipe geometry
  1. Flanges & valves
  2. Two to three elbows
  3. Branch connections

Quantifying G.U.L. Inspection Results With B-Scan

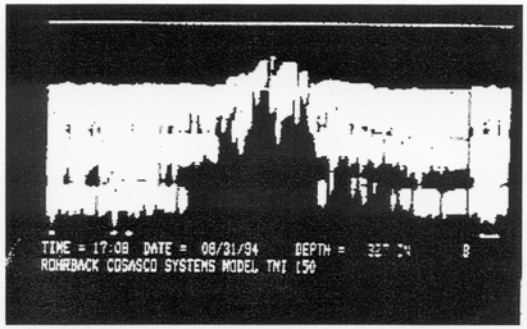


TMI-150

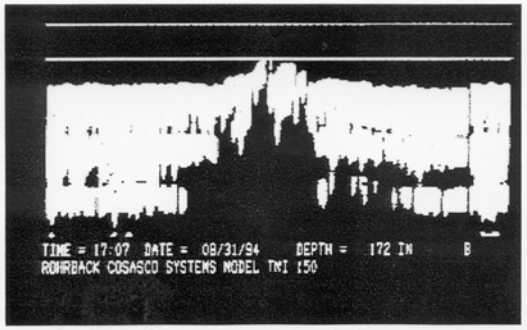
Hard Copy Prints

- **UNITEK Energy Service technicians take hard copy prints of corrosion pits to verify the pit profiles and provide a detailed report.**

TANK WALL SHOWING LARGE CORROSION PIT



TOP CURSER IS THE OUTSIDE OF THE TANK WALL.
LOWER CURSER INDICATES THE GENERAL WALL THICKNESS .327 IN.



THE LOWER CURSER (DOTTED LINE) INDICATES THE REMAINING WALL THICKNESS AT THE DEEPEST PART OF THE PIT. .172 IN.

Factory/ Company Certifications

Guided Ultrasonics

Wavemaker™ pipe screening system Training and Qualification Scheme
Appendix 1
Page 1 of 2

Appendix 1 Table of qualification levels for applications. For Training aapplications the required qualification levels are mandatory for all other applications they are recommended.

Application description	Type of application	Qualification level
Training		
Level 1 training course (Lead trainer)	Advanced	GUL Only
Level 1 training course (second trainer)	Advanced	Level 2
Level 2 training	Advanced	Only GUL (D. Alleyne and B Pavlakovic
Level 3 training	Advanced	GUL Only
Procedure development	Advanced	Level 3
Written practice for applications	Advanced	Level 2
Auditing reports	Advanced	Level 2
Auditing field activities	Advanced	Level 2 or 3
Simply supported long runs of pipe		
Long lengths of simply supported pipe in pipe rack	Basic	Level 1
Monitoring		
Simple sample monitoring (in place of random thickness checks)	Basic	Level 1
Monitoring after period using "repeat shot" and "overlay" features	Advanced	Level 2
Buried pipe applications		
Road crossings in sleeves painted (no special coatings)	Basic	Level 1
Road crossings in sleeves painted (no special coatings) with centring lugs	Advanced	Level 2
Buried pipe in sand/earth painted (no special coatings)	Advanced	Level 2
Buried pipe with attenuative coatings	Advanced	Level 2
Short transitions through bund walls etc	Advanced	Level 2
Different materials		
Stainless steel	Basic	Level 1
Plastic to check welds	Advanced	(GUL only) Level 3
Testing pipes with different contents		
Gas-low velocity	Basic	Level 1
Gas-high velocity	Basic	Level 1
Light viscosity liquid	Basic	Level 1
Heavy viscosity liquid	Basic	Level 1
Very high viscosity liquids	Advanced	Level 2
Liquids that leave attenuating internal deposits	Advanced	Level 2

March 2002 issue

GUL Applications

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- **Especially cost effective in difficult to access locations**
  - **Monitoring overhead piping on columns**
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  - **Roadcrossings**
  - **Wall penetrations**
  - **Pipe racks**
  - **Pipe support point of contact corrosion**
- **Can detect cracks and general metal loss (greater than 3% of the cross-sectional area)**