APPENDIX 5A – 12-INCH DIAMETER PIPE TEST RESULTS

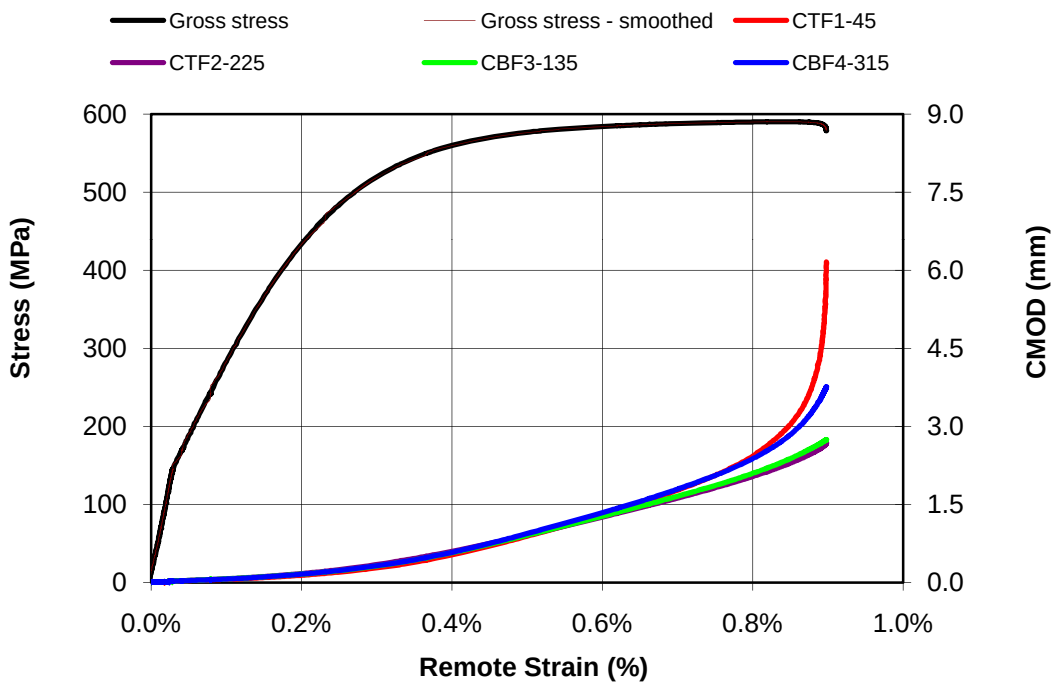
Test Summary Sheet

Spec. No. **1.1** Test type **12" NPS**

Specimen Details		
Pipe Diameter, OD	324.4	mm
Wall thickness, t	12.70	mm
Type	High Y/T	
Grade	X65	
SMYS	448	MPa
SMTS	531	MPa
F yield (hoop | axial)	509 | 547	MPa
F tensile (hoop | axial)	588 | 593	MPa
Test temperature	21	ºC
Test pressure	30.20	MPa
Specimen length, L1	2,138	mm
Target flaw size	3 x 50	mm
Number of Flaws	4 (2 per cross-section)	
Target flaw location	Pipe body	

	Load Peak	End Point	
Total Load	7,338	7,196	kN
Gross Stress	590.1	578.7	MPa
Strain LTU	0.81%	0.88%	
Strain LMU	0.81%	0.87%	
Strain LBU	0.91%	0.98%	
Strain LTMBU	0.83%	0.90%	
CMOD	2.81	6.16	mm

Strain Notation:
Strain LTU: avg. strain in uniform strain zone of top weld can (LTU series LVDTs)
Strain LMU: avg. strain in uniform strain zone of middle weld can (LMU series LVDTs)
Strain LBU: avg. strain in uniform strain zone of bottom weld can (LBU series LVDTs)
Strain LTMBU: avg. strain in uniform strain zones of all weld cans (LTU, LMU and LBU series LVDTs)

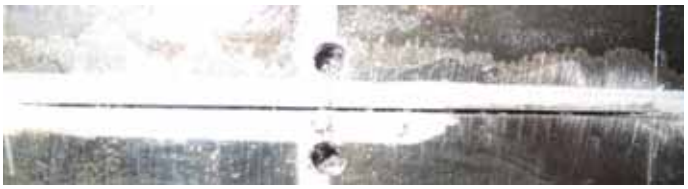


**Average strain from LVDTs in uniform strain zones of all weld cans (i.e. LTMBU strain)*

C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 25-Sep-07	PRCI/DOT
	Approval for Testing: RTP	Date: 25-Sep-07	1.1

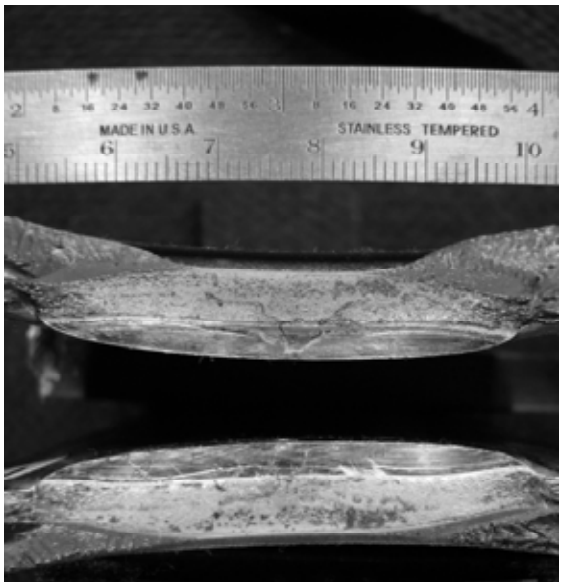
Photographs

Test Set-up



45º Flaw Prior to Testing

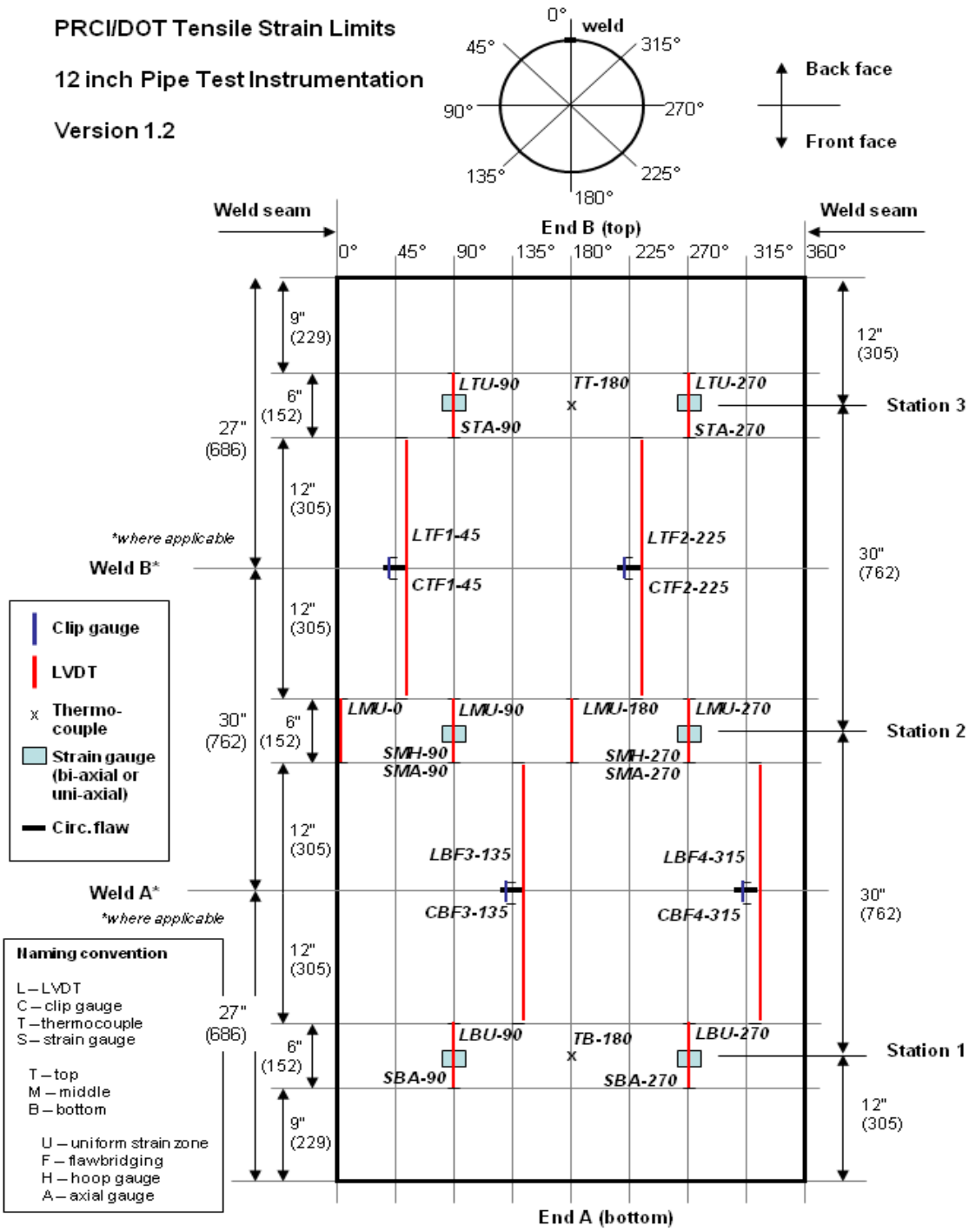
45º Flaw After Testing



45º Flaw Fracture Surface

C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 25-Sep-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 25-Sep-07	**1.1**

Instrumentation Layout



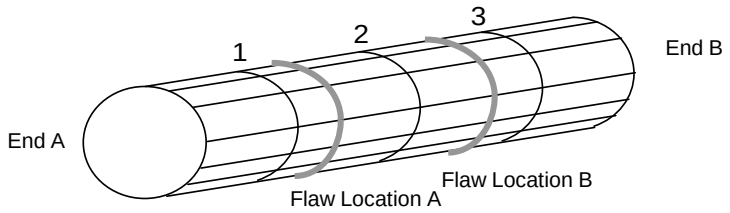
C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 25-Sep-07	PRCI/DOT
	Approval for Testing: RTP	Date: 25-Sep-07	1.1

Specimen Measurements Before Testing

Distance from Scan to Seam
N/A

Weld Number
N/A

Weld Letter Label
N/A

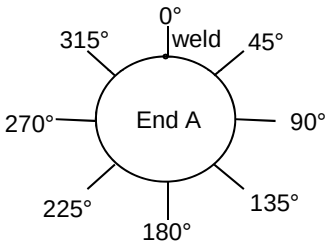


Distance Between Stations (mm)	
End A to 1	305
1 to 2	761
2 to 3	764
3 to End B	308
End A to Location A	688
Location A to Location B	768
Locatio B to End B	682

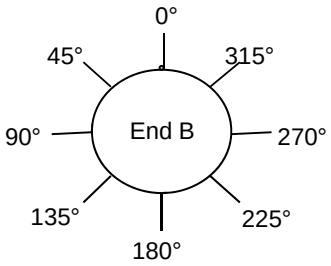
Pipe Length (mm)	
0°	2,138.0
90°	2,138.0
180°	2,138.0
270°	2,138.0
Average:	2,138.0

Circumference (mm)	
End A	1,021
End B	1,021

Diameter Measurement (mm)				
Station	Angle			
	0°-180°	45°-225°	90°-270°	135°-315°
1	324.434	324.282	324.333	324.333
2	324.637	324.256	324.231	324.536
3	324.764	324.155	324.256	324.637



Ultrasonic Probe Measurement	
Probe Calibration	
0.200" gauge block reading:	0.197
0.500" gauge block reading:	0.485



Wall Thickness Measurement (mm)			
Angle	Station 1	Station 2	Station 3
0°	13.00	13.13	13.20
45°	12.63	12.76	12.70
90°	12.66	12.65	12.66
135°	12.66	12.66	12.64
180°	12.62	12.60	12.64
225°	12.57	12.60	12.64
270°	12.60	12.60	12.66
315°	12.62	12.62	12.63
Average	12.67	12.70	12.72
Overall average		12.70	

C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 25-Sep-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 25-Sep-07	**1.1**

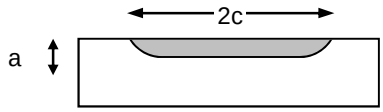
Specimen Measurements Before Testing

Gauge Length (mm)								
Location	0°	45°	90°	135°	180°	225°	270°	315°
LTU			154				150	
LTF		610				608		
LMU	153		149		153		152	
LBF				608				610
LBU			151				155	
CTF		8				8		
CBF				8				8

Average OD (mm)	324.40
Average ID (mm)	299.01
ID Area (mm^2)	70,219
Gross Area (mm^2)	12,435

C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 25-Sep-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 25-Sep-07	**1.1**

Specimen Measurements Before Testing

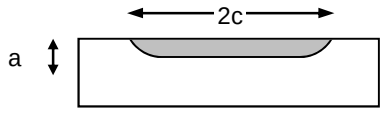


Defect Size (mm) F1-45			
Length	2c	49.85	
Depth	a_1	1.82	
	a_2	2.55	
	a_3	3.03	average depth = 3.06
	a_4	3.02	
	a_5	3.18	
	a_6	2.95	
	a_7	3.06	
	a_8	3.11	
	a_9	1.88	
	a_{10}	1.62	
Defect Area (mm^2)		126.82	
Scribe Offset	N/A		

Defect Size (mm) F2-135			
Length	2c	50.02	
Depth	a_1	1.54	
	a_2	2.71	
	a_3	2.91	average depth = 3.02
	a_4	2.98	
	a_5	2.98	
	a_6	3.13	
	a_7	3.12	
	a_8	2.98	
	a_9	1.95	
	a_{10}	1.81	
Defect Area (mm^2)		125.76	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 25-Sep-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 25-Sep-07	**1.1**

Specimen Measurements Before Testing



Defect Size (mm) F3-225			
Length	2c	50.23	
Depth	a_1	1.85	
	a_2	2.32	
	a_3	3.10	average depth = 3.09
	a_4	3.07	
	a_5	2.97	
	a_6	3.16	
	a_7	3.12	
	a_8	3.12	
	a_9	2.64	
	a_{10}	1.95	
Defect Area (mm^2)		129.19	
Scribe Offset	N/A		

Defect Size (mm) F4-315			
Length	2c	50.26	
Depth	a_1	1.89	
	a_2	2.21	
	a_3	2.95	average depth = 3.03
	a_4	3.12	
	a_5	3.16	
	a_6	2.95	
	a_7	2.94	
	a_8	3.08	
	a_9	2.85	
	a_{10}	1.76	
Defect Area (mm^2)		127.12	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 25-Sep-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 25-Sep-07	**1.1**

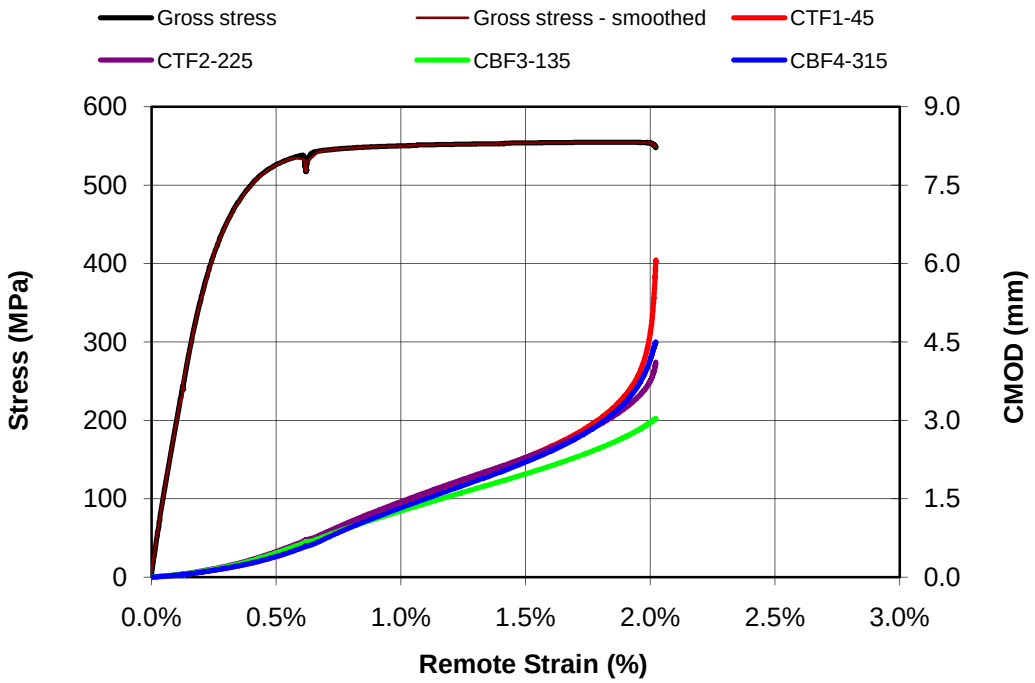
Test Summary Sheet

Spec. No. **1.2** Test type **12" NPS**

Specimen Details		
Pipe Diameter, OD	324.4	mm
Wall thickness, t	12.77	mm
Type	High Y/T	
Grade	X65	
SMYS	448	MPa
SMTS	531	MPa
F yield (hoop | axial)	509 | 547	MPa
F tensile (hoop | axial)	588 | 593	MPa
Test temperature	22	ºC
Test pressure	0.50	MPa
Specimen length, L1	2,140	mm
Target flaw size	3 x 50	mm
Number of Flaws	4 (2 per cross-section)	
Target flaw location	Pipe body	

	Load Peak	End Point	
Total Load	6,934	6,847	kN
Gross Stress	554.6	547.6	MPa
Strain LTU	2.02%	2.17%	
Strain LMU	1.77%	1.91%	
Strain LBU	1.97%	2.11%	
Strain LTMBU	1.88%	2.02%	
CMOD	3.38	6.06	mm

Strain Notation:
Strain LTU: avg. strain in uniform strain zone of top weld can (LTU series LVDTs)
Strain LMU: avg. strain in uniform strain zone of middle weld can (LMU series LVDTs)
Strain LBU: avg. strain in uniform strain zone of bottom weld can (LBU series LVDTs)
Strain LTMBU: avg. strain in uniform strain zones of all weld cans (LTU, LMU and LBU series LVDTs)



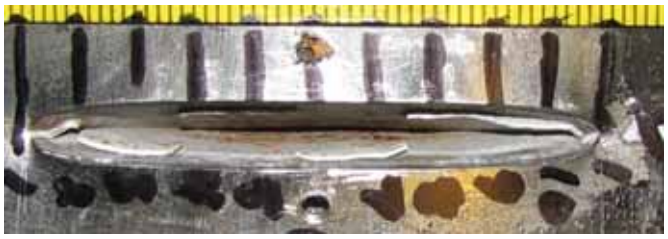
**Average strain from LVDTs in uniform strain zones of all weld cans (i.e. LTMBU strain)*

C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 20-Sep-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 20-Sep-07	**1.2**

Photographs

Test Set-up

45º Flaw Prior to Testing



45º Flaw After Testing

45º Flaw Fracture Surface

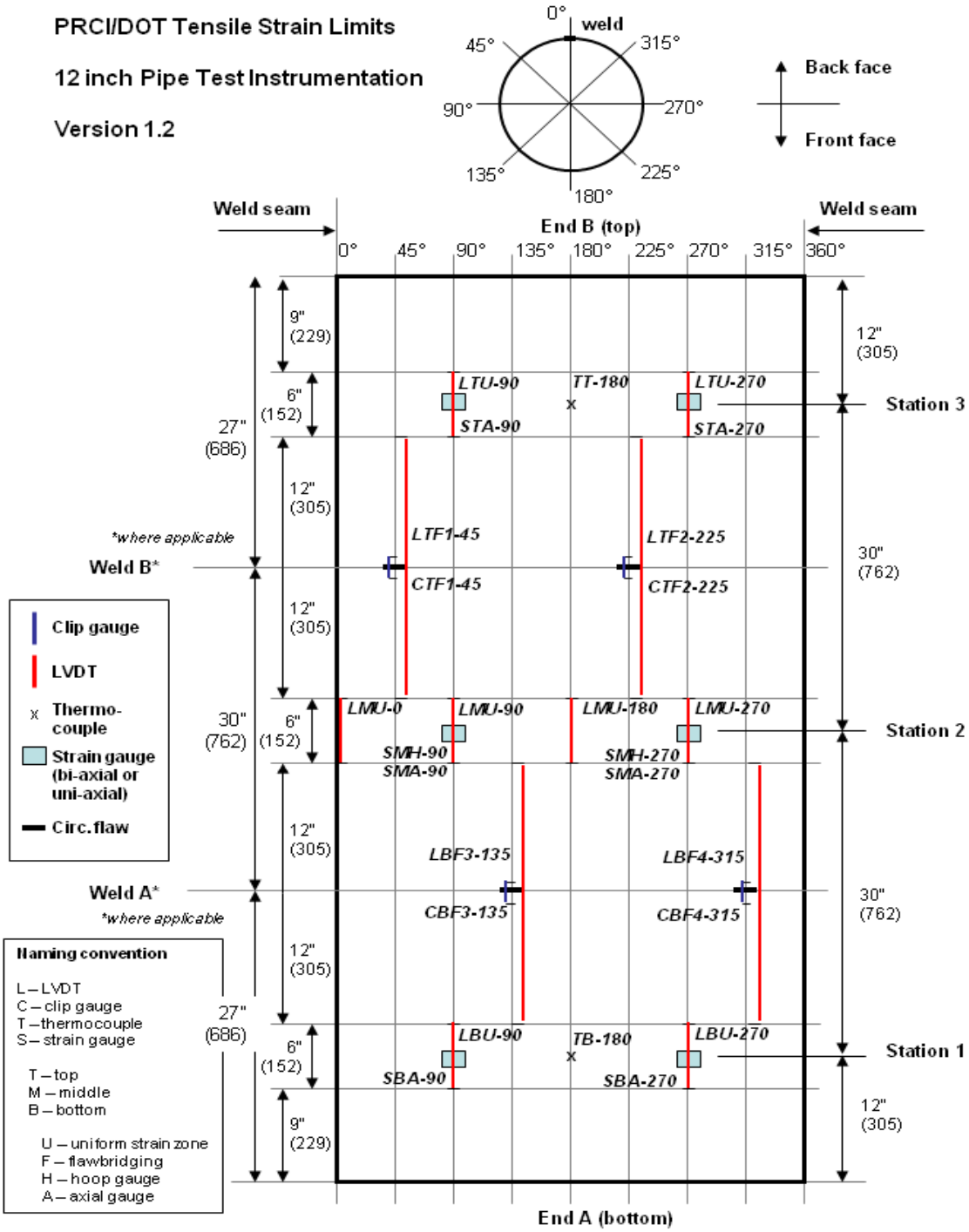
C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 20-Sep-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 20-Sep-07	**1.2**

Instrumentation Layout

PRCI/DOT Tensile Strain Limits

12 inch Pipe Test Instrumentation

Version 1.2

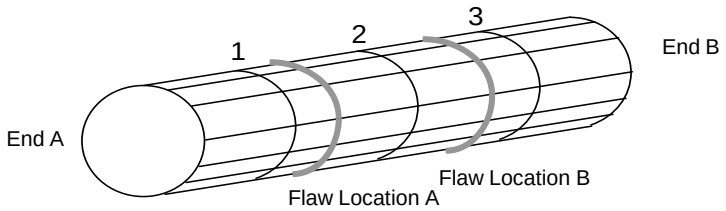


C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 20-Sep-07	PRCI/DOT
	Approval for Testing: RTP	Date: 20-Sep-07	1.2

Specimen Measurements Before Testing

Distance from Scan to Seam
N/A
Weld Number
N/A

Weld Letter Label
N/A

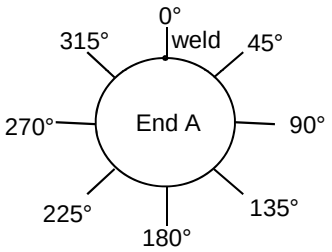


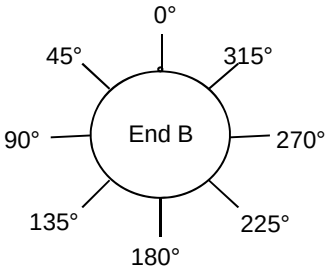
Distance Between Stations (mm)	
End A to 1	307
1 to 2	760
2 to 3	763
3 to End B	310
End A to Location A	688
Location A to Location B	762
Location B to End B	690

Pipe Length (mm)	
0°	2,140.0
90°	2,140.0
180°	2,140.0
270°	2,140.0
Average:	2,140.0

Circumference (mm)	
End A	1,021
End B	1,021

Diameter Measurement (mm)				
Station	Angle			
	0°-180°	45°-225°	90°-270°	135°-315°
1	324.612	324.282	324.282	324.460
2	324.739	324.231	324.333	324.485
3	324.561	324.231	324.333	324.510





Ultrasonic Probe Measurement	
Probe Calibration	
0.200" gauge block reading:	0.200
0.500" gauge block reading:	0.497

Wall Thickness Measurement (mm)			
Angle	Station 1	Station 2	Station 3
0°	13.04	13.04	13.05
45°	12.76	12.80	12.83
90°	12.73	12.78	12.72
135°	12.67	12.69	12.68
180°	12.70	12.78	12.69
225°	12.67	12.73	12.70
270°	12.70	12.76	12.80
315°	12.70	12.78	12.67
Average	12.75	12.80	12.77
Overall average		12.77	

C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 20-Sep-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 20-Sep-07	**1.2**

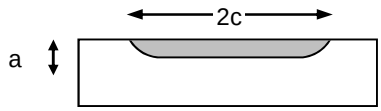
Specimen Measurements Before Testing

Gauge length (mm)								
Location	0°	45°	90°	135°	180°	225°	270°	315°
LTU			153				153	
LTF		610				608		
LMU	152		152		151		152	
LBF				608				609
LBU			152				151	
CTF		8				8		
CBF				8				8

Average OD (mm)	324.42
Average ID (mm)	298.88
ID Area (mm^2)	70,160
Gross Area (mm^2)	12,502

C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 20-Sep-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 20-Sep-07	**1.2**

Specimen Measurements Before Testing

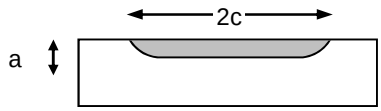


Defect Size (mm) F1-45			
Length	2c	50.51	
Depth	a_1	1.68	
	a_2	1.94	
	a_3	2.92	average depth = 3.03
	a_4	2.96	
	a_5	3.18	
	a_6	2.97	
	a_7	3.12	
	a_8	3.04	
	a_9	2.53	
	a_{10}	1.44	
Defect Area (mm^2)		127.82	
Scribe Offset	N/A		

Defect Size (mm) F2-135			
Length	2c	49.89	
Depth	a_1	1.43	
	a_2	2.88	
	a_3	3.06	average depth = 3.03
	a_4	2.91	
	a_5	3.09	
	a_6	3.04	
	a_7	3.08	
	a_8	3.00	
	a_9	2.01	
	a_{10}	1.47	
Defect Area (mm^2)		125.87	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 20-Sep-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 20-Sep-07	**1.2**

Specimen Measurements Before Testing



Defect Size (mm) F3-225			
Length	2c	49.74	
Depth	a_1	1.41	
	a_2	2.82	
	a_3	3.02	average depth = 3.00
	a_4	3.04	
	a_5	3.07	
	a_6	2.95	
	a_7	2.99	
	a_8	2.91	
	a_9	2.03	
	a_{10}	1.45	
Defect Area (mm^2)		124.16	
Scribe Offset	N/A		

Defect Size (mm) F4-315			
Length	2c	49.58	
Depth	a_1	1.40	
	a_2	1.77	
	a_3	2.99	average depth = 3.03
	a_4	3.11	
	a_5	3.08	
	a_6	3.01	
	a_7	3.04	
	a_8	2.95	
	a_9	1.98	
	a_{10}	1.52	
Defect Area (mm^2)		124.93	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 20-Sep-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 20-Sep-07	**1.2**

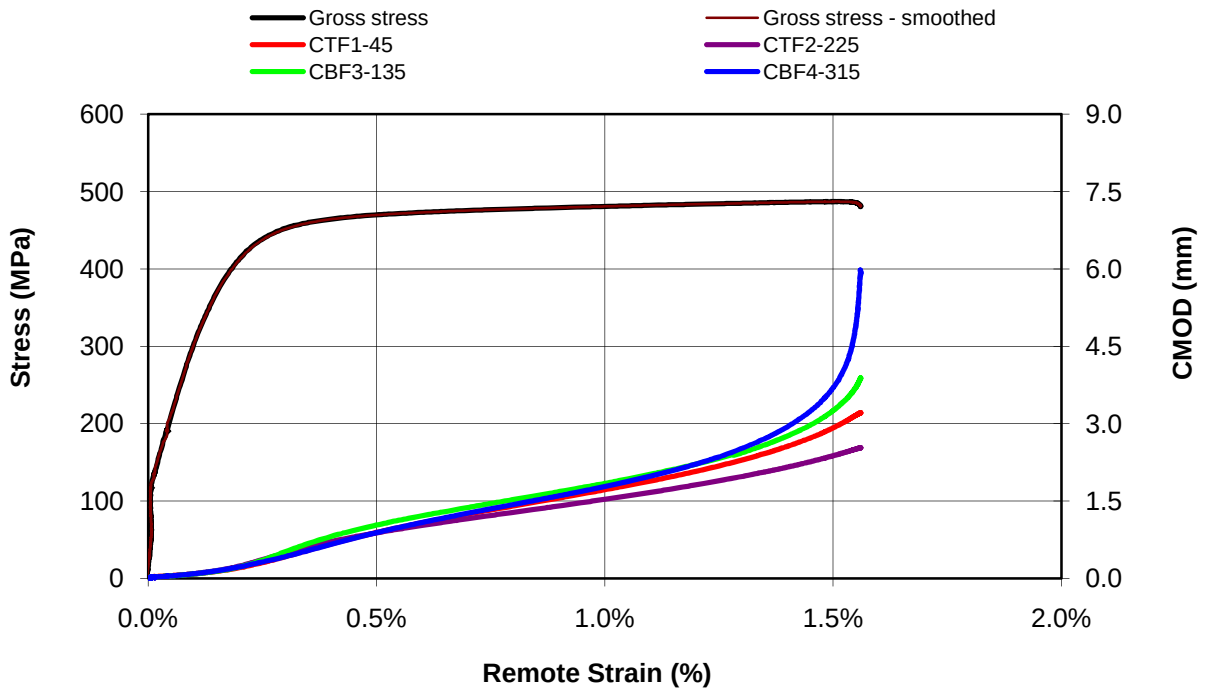
Test Summary Sheet

Spec. No. **1.3** Test type **12" NPS**

Specimen Details		
Pipe Diameter, OD	324.0	mm
Wall thickness, t	12.70	mm
Type	Low Y/T	
Grade	X65	
SMYS	448	MPa
SMTS	531	MPa
F yield (hoop | axial)	437 | 421	MPa
F tensile (hoop | axial)	491 | 479	MPa
Test temperature	22	ºC
Test pressure	24.20	MPa
Specimen length, L1	2,139	mm
Target flaw size	3 x 50	mm
Number of Flaws	4 (2 per cross-section)	
Target flaw location	Pipe body	

	Load Peak	End Point	
Total Load	6,050	5,971	kN
Gross Stress	487.0	480.6	MPa
Strain LTU	1.43%	1.47%	
Strain LMU	1.61%	1.66%	
Strain LBU	1.40%	1.44%	
Strain LTMBU	1.51%	1.56%	
CMOD	3.85	5.98	mm

Strain Notation:
Strain LTU: avg. strain in uniform strain zone of top weld can (LTU series LVDTs)
Strain LMU: avg. strain in uniform strain zone of middle weld can (LMU series LVDTs)
Strain LBU: avg. strain in uniform strain zone of bottom weld can (LBU series LVDTs)
Strain LTMBU: avg. strain in uniform strain zones of all weld cans (LTU, LMU and LBU series LVDTs)

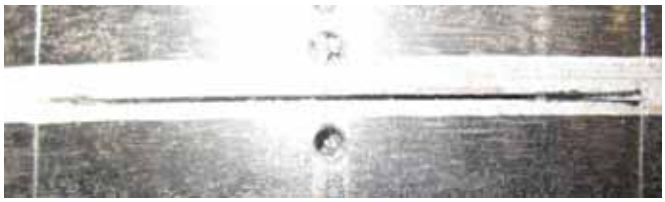


**Average strain from LVDTs in uniform strain zones of all weld cans (i.e. LTMBU strain)*

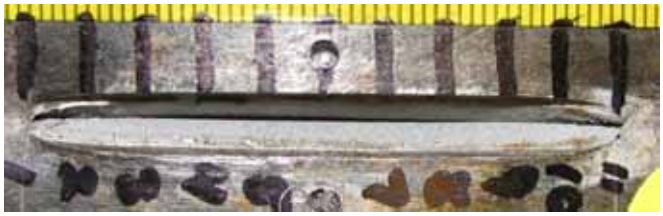
C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 26-Sep-07	PRCI/DOT
	Approval for Testing: RTP	Date: 26-Sep-07	1.3

Photographs

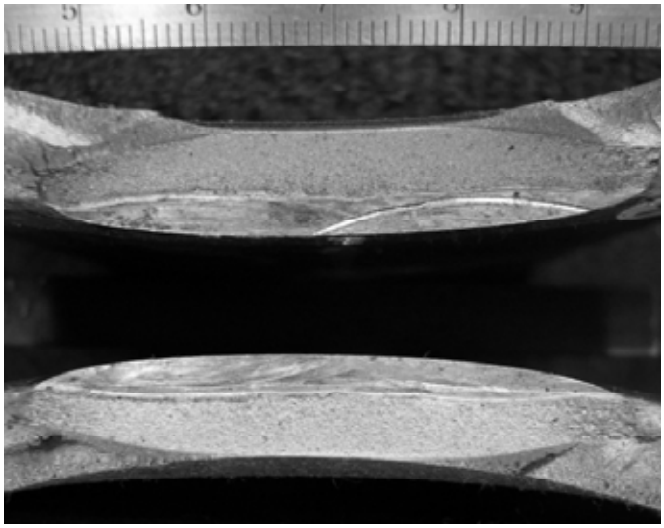
Test Set-up



315º Flaw Prior to Testing



315º Flaw After Testing



315º Flaw Fracture Surface

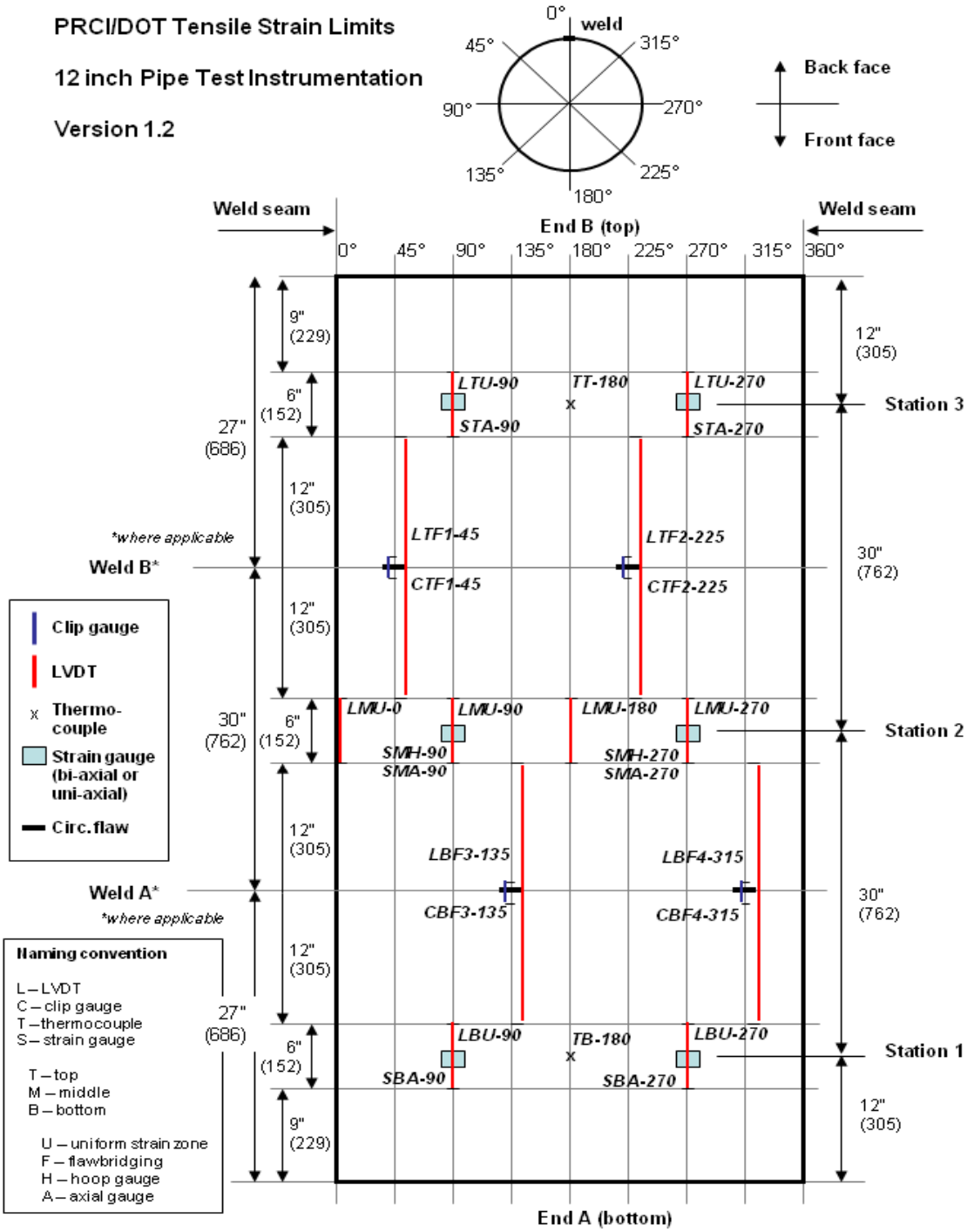
C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 26-Sep-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 26-Sep-07	**1.3**

Instrumentation Layout

PRCI/DOT Tensile Strain Limits

12 inch Pipe Test Instrumentation

Version 1.2



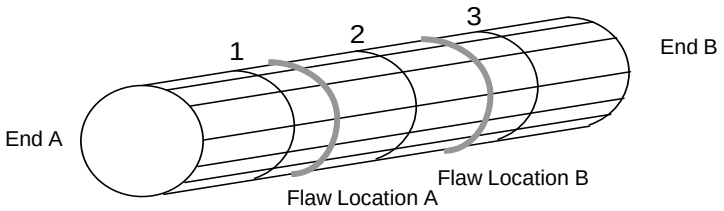
C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 26-Sep-07	PRCI/DOT
	Approval for Testing: RTP	Date: 26-Sep-07	1.3

Specimen Measurements Before Testing

Distance from Scan to Seam
N/A

Weld Number
N/A

Weld Letter Label
N/A

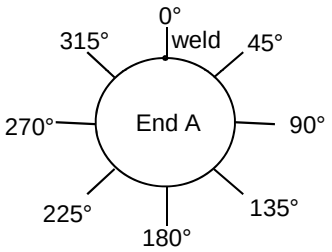


Distance Between Stations (mm)	
End A to 1	307
1 to 2	761
2 to 3	764
3 to End B	305
End A to Location A	687
Location A to Location B	762
Location B to End B	688

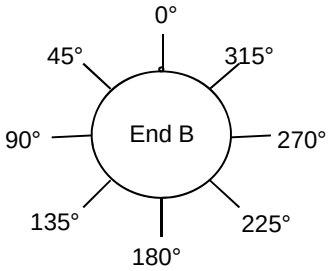
Pipe Length (mm)	
0°	2,138.0
90°	2,139.0
180°	2,140.0
270°	2,139.0
Average:	2,139.0

Circumference (mm)	
End A	1,020
End B	1,020

Diameter Measurement (mm)				
Station	Angle			
	0°-180°	45°-225°	90°-270°	135°-315°
1	324.002	324.129	323.926	323.850
2	324.206	324.053	323.952	324.053
3	324.231	323.977	323.748	323.952



Ultrasonic Probe Measurement	
Probe Calibration	
0.200" gauge block reading:	0.196
0.500" gauge block reading:	0.489



Wall Thickness Measurement (mm)			
Angle	Station 1	Station 2	Station 3
0°	12.54	12.45	12.55
45°	12.88	12.53	12.68
90°	12.59	12.66	12.75
135°	12.89	12.76	12.92
180°	12.70	12.73	12.74
225°	12.90	12.86	12.84
270°	12.63	12.71	12.91
315°	12.53	12.54	12.60
Average	12.71	12.66	12.75
Overall average		12.70	

C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 26-Sep-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 26-Sep-07	**1.3**

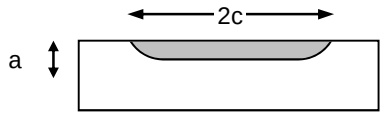
Specimen Measurements Before Testing

Gauge Length (mm)								
Location	0°	45°	90°	135°	180°	225°	270°	315°
LTU			155				153	
LTF		607				610		
LMU	156		156		155		152	
LBF				608				610
LBU			151				148	
CTF		8				8		
CBF				8				12

Average OD (mm)	324.01
Average ID (mm)	298.60
ID Area (mm^2)	70,027
Gross Area (mm^2)	12,424

C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 26-Sep-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 26-Sep-07	**1.3**

Specimen Measurements Before Testing

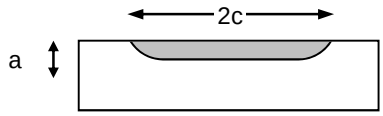


Defect Size (mm) F1-45			
Length	2c	50.32	
Depth	a_1	1.82	
	a_2	2.91	
	a_3	3.04	average depth = 3.02
	a_4	3.08	
	a_5	2.94	
	a_6	3.00	
	a_7	2.96	
	a_8	3.12	
	a_9	1.76	
	a_{10}	1.46	
Defect Area (mm^2)		126.92	
Scribe Offset	N/A		

Defect Size (mm) F2-135			
Length	2c	51.03	
Depth	a_1	1.43	
	a_2	2.79	
	a_3	2.91	average depth = 3.01
	a_4	2.98	
	a_5	3.11	
	a_6	3.04	
	a_7	3.07	
	a_8	2.96	
	a_9	2.76	
	a_{10}	2.06	
Defect Area (mm^2)		128.61	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 26-Sep-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 26-Sep-07	**1.3**

Specimen Measurements Before Testing



Defect Size (mm) F3-225			
Length	2c	49.94	
Depth	a_1	1.58	
	a_2	2.94	
	a_3	3.01	average depth = 3.00
	a_4	3.02	
	a_5	2.92	
	a_6	3.01	
	a_7	2.96	
	a_8	3.08	
	a_9	2.11	
	a_{10}	1.51	
Defect Area (mm^2)		124.89	
Scribe Offset	N/A		

Defect Size (mm) F4-315			
Length	2c	49.81	
Depth	a_1	1.85	
	a_2	2.77	
	a_3	3.11	average depth = 3.06
	a_4	3.06	
	a_5	3.01	
	a_6	3.11	
	a_7	2.97	
	a_8	3.07	
	a_9	2.78	
	a_{10}	1.68	
Defect Area (mm^2)		126.57	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 26-Sep-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 26-Sep-07	**1.3**

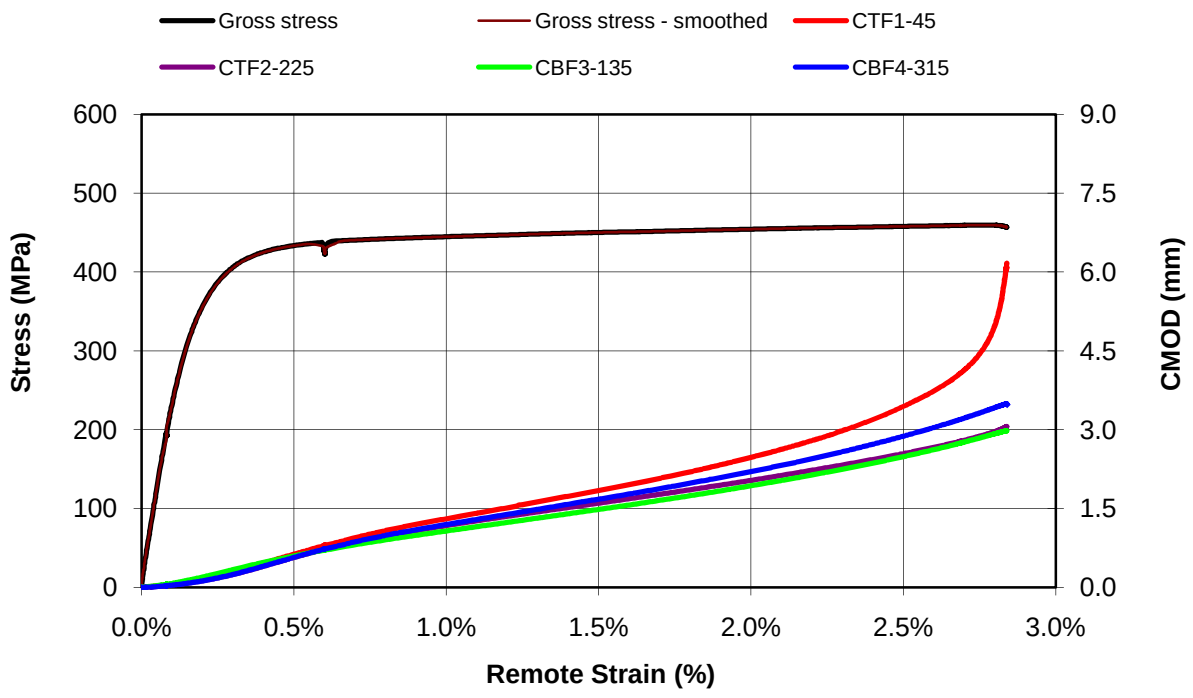
Test Summary Sheet

Spec. No. **1.4** Test type **12" NPS**

Specimen Details		
Pipe Diameter, OD	323.8	mm
Wall thickness, t	12.68	mm
Type	Low Y/T	
Grade	X65	
SMYS	448	MPa
SMTS	531	MPa
F yield (hoop | axial)	437 | 421	MPa
F tensile (hoop | axial)	491 | 479	MPa
Test temperature	22	ºC
Test pressure	0.38	MPa
Specimen length, L1	2,134	mm
Target flaw size	3 x 50	mm
Number of Flaws	4 (2 per cross-section)	
Target flaw location	Pipe body	

	Load Peak	**End Point**	
Total Load	5,694	5,658	kN
Gross Stress	459.5	456.6	MPa
Strain LTU	2.67%	2.74%	
Strain LMU	2.78%	2.85%	
Strain LBU	2.84%	2.91%	
Strain LTMBU	2.77%	2.84%	
CMOD	4.61	6.17	mm

Strain Notation:
Strain LTU: avg. strain in uniform strain zone of top weld can (LTU series LVDTs)
Strain LMU: avg. strain in uniform strain zone of middle weld can (LMU series LVDTs)
Strain LBU: avg. strain in uniform strain zone of bottom weld can (LBU series LVDTs)
Strain LTMBU: avg. strain in uniform strain zones of all weld cans (LTU, LMU and LBU series LVDTs)



**Average strain from LVDTs in uniform strain zones of all weld cans (i.e. LTMBU strain)*

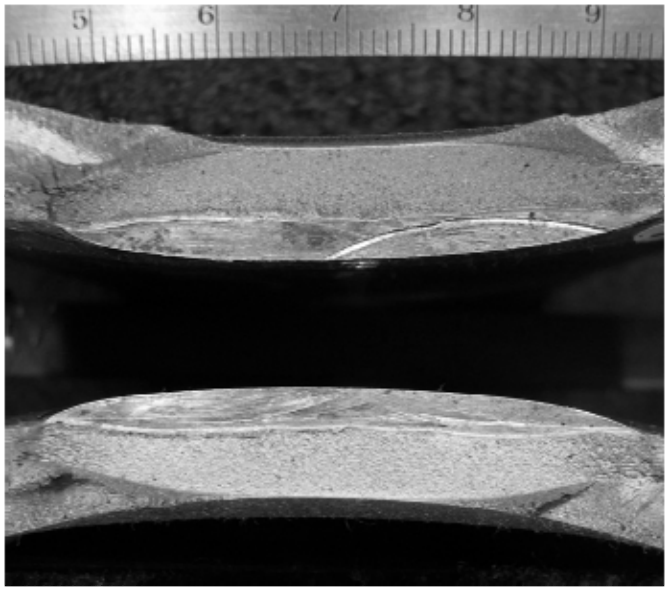
C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 21-Sep-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 21-Sep-07	**1.4**

Photographs

Test Set-up

45º Flaw Prior to Testing

45º Flaw After Testing



45º Flaw Fracture Surface

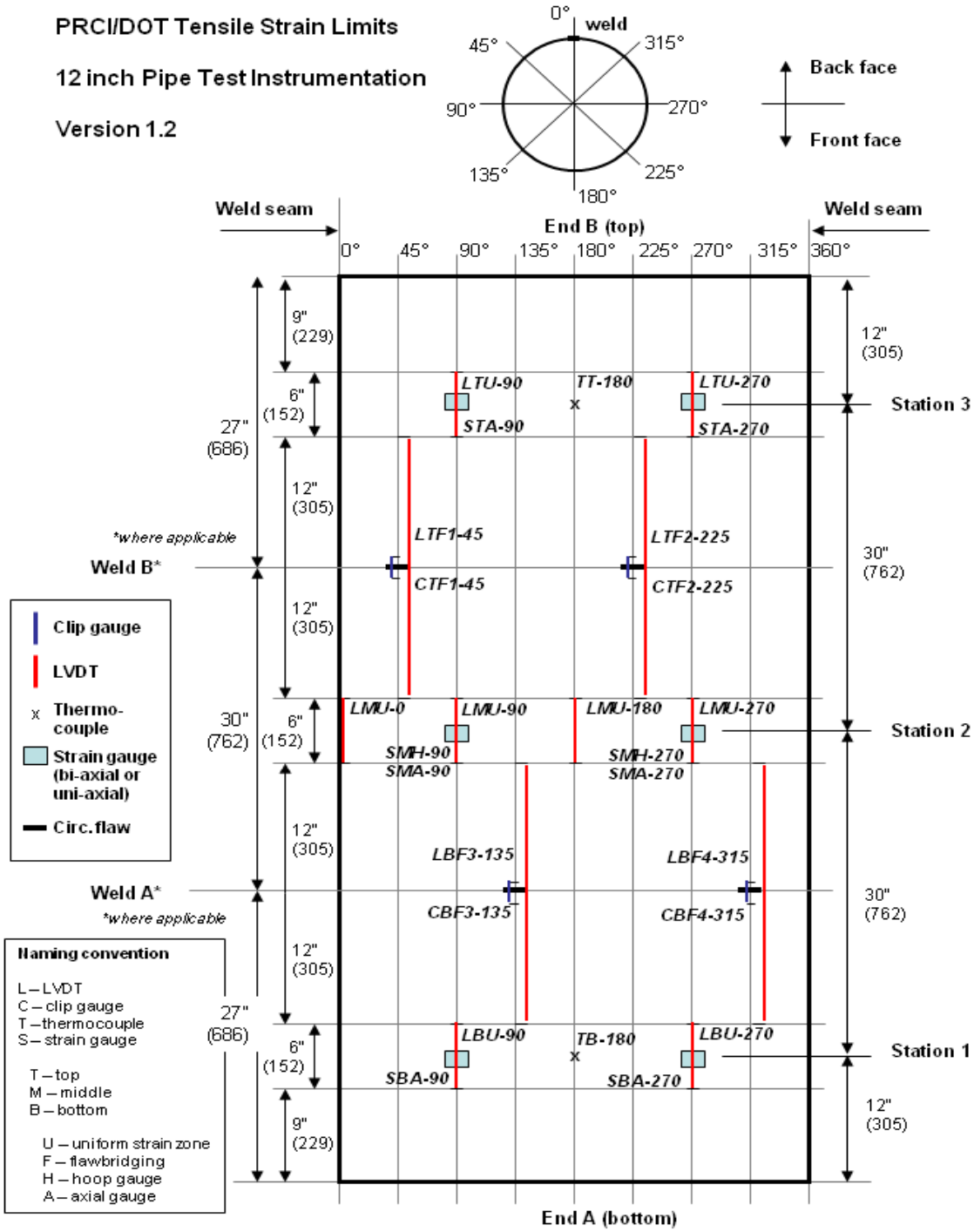
C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 21-Sep-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 21-Sep-07	**1.4**

Instrumentation Layout

PRCI/DOT Tensile Strain Limits

12 inch Pipe Test Instrumentation

Version 1.2

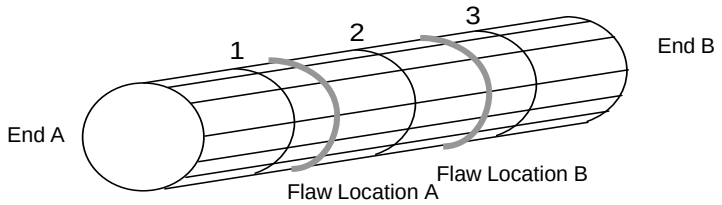


C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 21-Sep-07	PRCI/DOT
	Approval for Testing: RTP	Date: 21-Sep-07	1.4

Specimen Measurements Before Testing

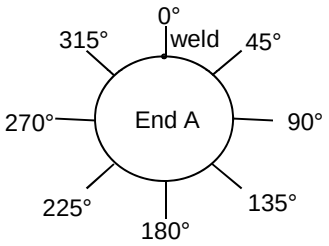
Distance from Scan to Seam
N/A
Weld Number
N/A

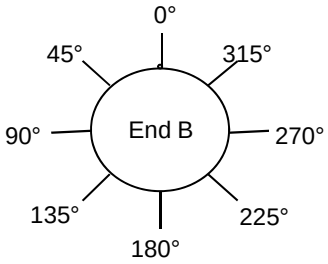
Weld Letter Label
N/A



Distance Between Stations (mm)	
End A to 1	303
1 to 2	762
2 to 3	760
3 to End B	310
End A to Location A	685
Location A to Location B	761
Locartion B to End B	689

Circumferences (mm)	
End A	1,020
End B	1,020





Pipe Length (mm)	
0°	2,135.0
90°	2,134.0
180°	2,134.0
270°	2,134.0
Average:	2,134.3

Diameter Measurement (mm)

Station	Angle			
	0°-180°	45°-225°	90°-270°	135°-315°
1	324.028	324.002	323.088	323.494
2	324.002	324.028	323.774	323.698
3	323.901	323.723	323.850	323.875

Ultrasonic Probe Measurement	
Probe Calibration	
0.200" gauge block reading:	0.197
0.500" gauge block reading:	0.494

Wall Thickness Measurement (mm)

Angle	Station 1	Station 2	Station 3
0°	12.74	12.55	12.49
45°	12.74	12.58	12.54
90°	12.74	12.58	12.70
135°	12.85	12.85	12.66
180°	12.65	12.65	12.63
225°	12.81	12.86	12.83
270°	12.76	12.66	12.61
315°	12.64	12.58	12.55
Average	12.74	12.66	12.63
Overall average		12.68	

C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 21-Sep-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 21-Sep-07	**1.4**

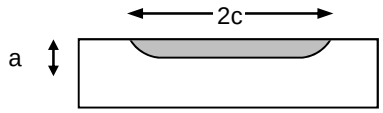
Specimen Measurements Before Testing

Gauge Length (mm)								
Location	0°	45°	90°	135°	180°	225°	270°	315°
LTU			153				152	
LTF		609				612		
LMU	152		153		152		154	
LBF				609				610
LBU			154				152	
CTF		8				8		
CBF				8				8

Average OD (mm)	323.79
Average ID (mm)	298.43
ID Area (mm^2)	69,950
Gross Area (mm^2)	12,390

C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 21-Sep-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 21-Sep-07	**1.4**

Specimen Measurements Before Testing

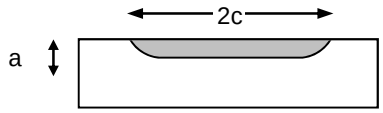


Defect Size (mm) **F1-45**			
Length	2c	51.46	
Depth	a_1	1.68	
	a_2	1.86	
	a_3	3.10	average depth = 3.08
	a_4	3.14	
	a_5	3.11	
	a_6	3.13	
	a_7	2.99	
	a_8	2.99	
	a_9	1.88	
	a_{10}	1.85	
Defect Area (mm^2)		132.47	
Scribe Offset	N/A		

Defect Size (mm) F2-135			
Length	2c	49.62	
Depth	a_1	1.79	
	a_2	2.82	
	a_3	3.16	average depth = 3.05
	a_4	3.10	
	a_5	3.03	
	a_6	2.96	
	a_7	3.03	
	a_8	2.99	
	a_9	2.82	
	a_{10}	1.51	
Defect Area (mm^2)		125.62	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 21-Sep-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 21-Sep-07	**1.4**

Specimen Measurements Before Testing



Defect Size (mm) F3-225			
Length	2c	50.60	
Depth	a_1	1.80	
	a_2	2.82	
	a_3	3.00	average depth = 3.03
	a_4	3.09	
	a_5	3.03	
	a_6	3.13	
	a_7	3.01	
	a_8	2.92	
	a_9	2.18	
	a_{10}	1.52	
Defect Area (mm^2)		128.03	
Scribe Offset	N/A		

Defect Size (mm) F4-315			
Length	2c	49.91	
Depth	a_1	1.48	
	a_2	2.67	
	a_3	3.11	average depth = 3.08
	a_4	3.15	
	a_5	2.95	
	a_6	3.13	
	a_7	3.14	
	a_8	2.97	
	a_9	2.43	
	a_{10}	1.91	
Defect Area (mm^2)		127.64	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 21-Sep-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 21-Sep-07	**1.4**

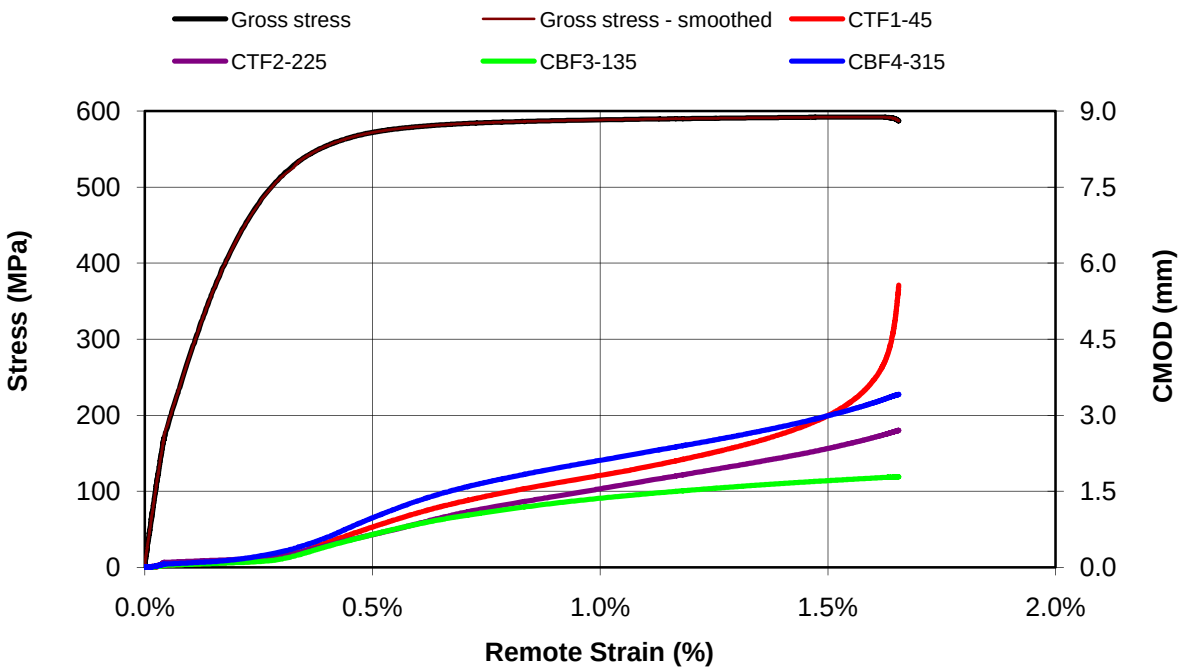
Test Summary Sheet

Spec. No. **1.5** Test type **12" NPS**

Specimen Details		
Pipe Diameter, OD	324.4	mm
Wall thickness, t	12.81	mm
Type	High Y/T	
Grade	X65	
SMYS	448	MPa
SMTS	531	MPa
F yield (hoop | axial)	509 | 547	MPa
F tensile (hoop | axial)	588 | 593	MPa
Test temperature	21	ºC
Test pressure	30.25	MPa
Specimen length, L1	2,184	mm
Target flaw size	3 x 35	mm
Number of Flaws	4 (2 per cross-section)	
Target flaw location	Weld Centreline	

	Load Peak	End Point	
Total Load	7,422	7,355	kN
Gross Stress	592.1	586.7	MPa
Strain LTU	1.70%	1.78%	
Strain LMU	1.47%	1.54%	
Strain LBU	1.69%	1.77%	
Strain LTMBU	1.58%	1.66%	
CMOD	3.49	5.57	mm

Strain Notation:
Strain LTU: avg. strain in uniform strain zone of top weld can (LTU series LVDTs)
Strain LMU: avg. strain in uniform strain zone of middle weld can (LMU series LVDTs)
Strain LBU: avg. strain in uniform strain zone of bottom weld can (LBU series LVDTs)
Strain LTMBU: avg. strain in uniform strain zones of all weld cans (LTU, LMU and LBU series LVDTs)



**Average strain from LVDTs in uniform strain zones of all weld cans (i.e. LTMBU strain)*

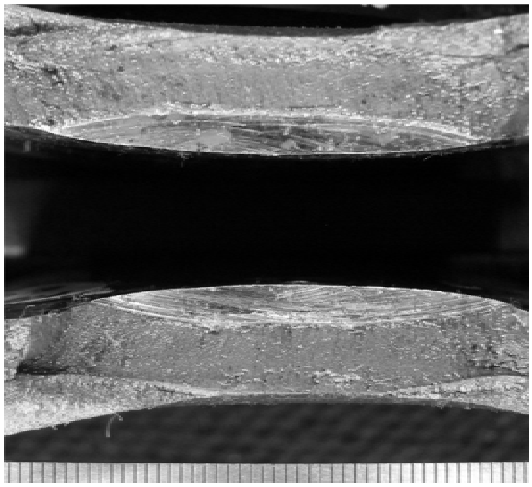
C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 23-Nov-07	PRCI/DOT
	Approval for Testing: RTP	Date: 23-Nov-07	1.5

Photographs

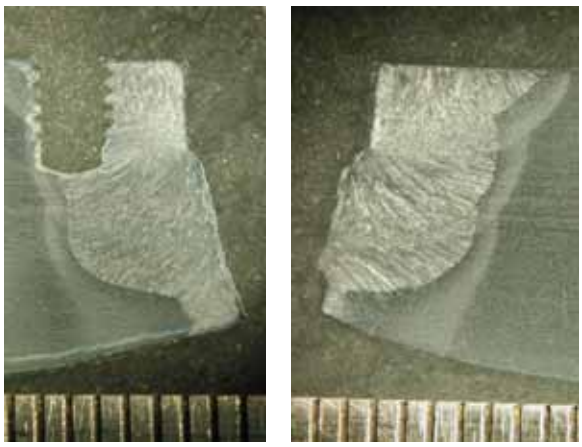
Test Set-up

45º Flaw Clip Gauge

45º Flaw After Testing



45º Flaw Fracture Surface



45º Flaw Macro Images

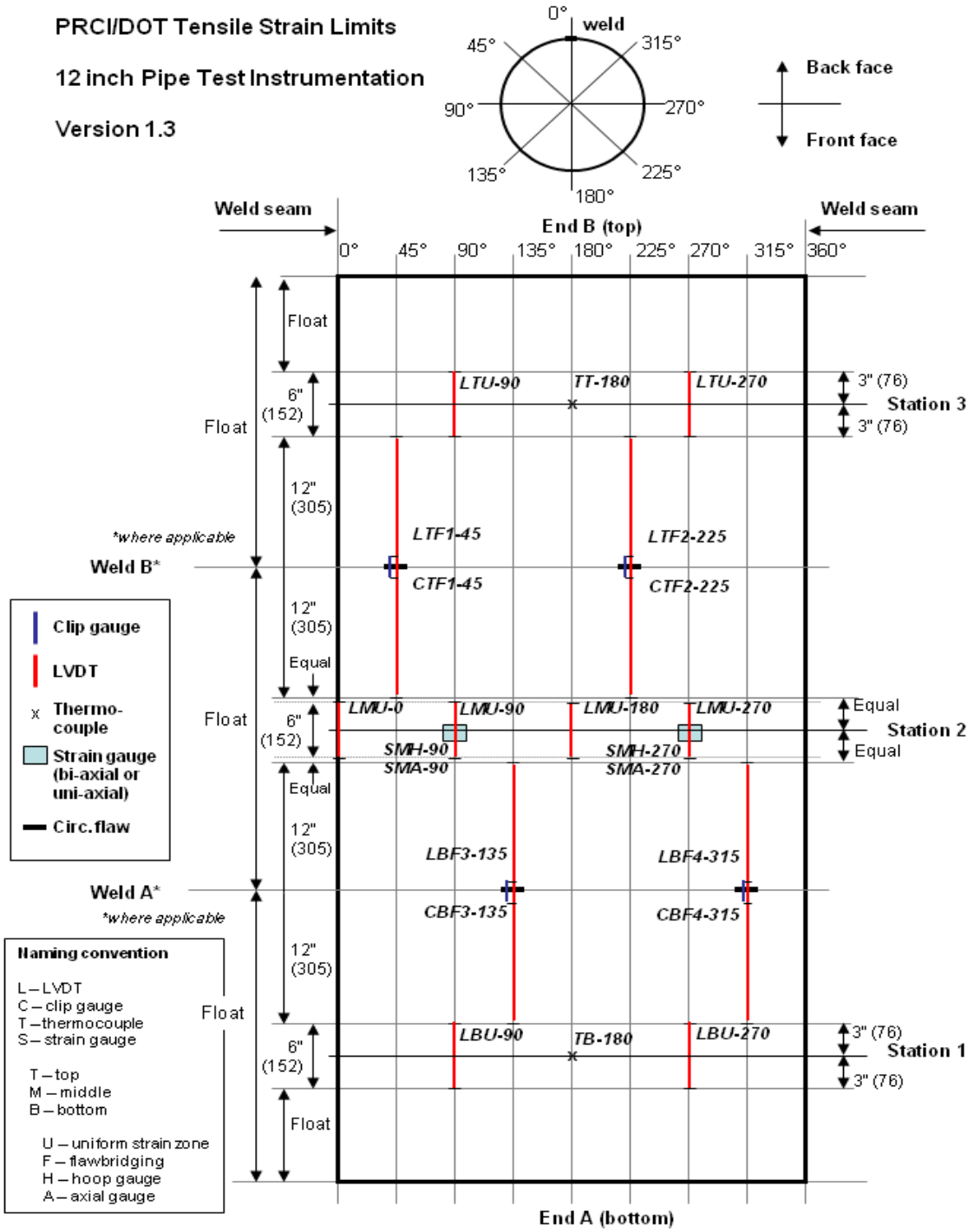
C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 23-Nov-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 23-Nov-07	**1.5**

Instrumentation Layout

PRCI/DOT Tensile Strain Limits

12 inch Pipe Test Instrumentation

Version 1.3



C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 23-Nov-07	PRCI/DOT
	Approval for Testing: RTP	Date: 23-Nov-07	1.5

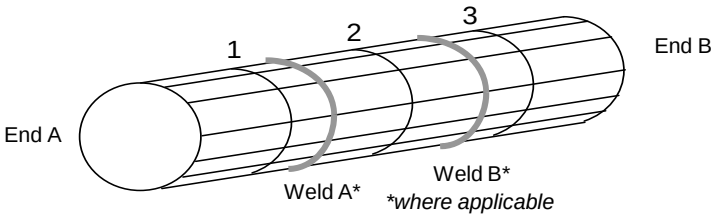
Specimen Measurements Before Testing

Distance from Scan to Seam
-129 mm (towards 315°)
Weld Number

Weld A	776-L
Weld B	776-M

Weld Letter Label

Weld A	B
Weld B	C

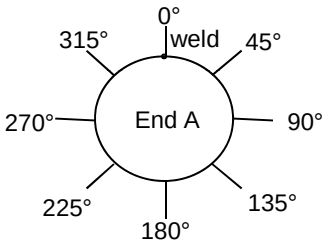


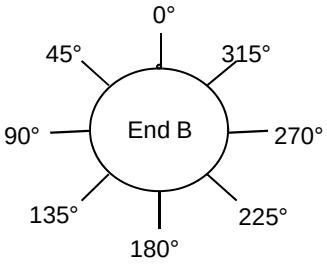
Distance Between Stations (mm)	
End A to 1	309
1 to 2	781
2 to 3	782
3 to End B	311
End A to Weld A	689
Weld A to Weld B	804
Weld B to End B	691

Pipe Length (mm)	
0°	2,184.0
90°	2,184.0
180°	2,184.0
270°	2,184.0
Average:	2,184.0

Circumference (mm)	
End A	1,025
End B	1,025

Diameter Measurement (mm)				
Station	Angle			
	0°-180°	45°-225°	90°-270°	135°-315°
1	324.536	324.206	324.307	324.485
2	324.663	324.256	324.206	324.485
3	324.434	324.409	324.333	324.358





Ultrasonic Probe Measurement	
Probe Calibration	
0.200" gauge block reading:	0.199
0.500" gauge block reading:	0.499

Wall Thickness Measurement (mm)			
Angle	Station 1	Station 2	Station 3
0°	13.081	13.183	13.157
45°	12.802	12.751	12.776
90°	12.751	12.776	12.751
135°	12.725	12.776	12.751
180°	12.751	12.751	12.751
225°	12.725	12.751	12.725
270°	12.776	12.751	12.751
315°	12.802	12.776	12.751
Average	12.80	12.81	12.80
Overall average		12.81	

C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 23-Nov-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 23-Nov-07	**1.5**

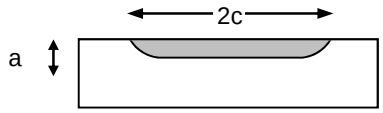
Specimen Measurements Before Testing

Gauge Length (mm)								
Location	0°	45°	90°	135°	180°	225°	270°	315°
LTU			152				153	
LTF		612				610		
LMU	148		153		151		154	
LBF				607				609
LBU			153				153	
CTF		8				8		
CBF				8				8
CBW		28				28		

Average OD (mm)	324.39
Average ID (mm)	298.78
ID Area (mm^2)	70,111
Gross Area (mm^2)	12,535

C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 23-Nov-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 23-Nov-07	**1.5**

Specimen Measurements Before Testing

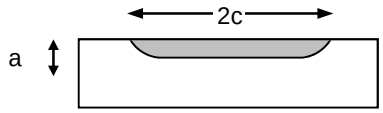


Defect Size (mm) F1-45			
Length	2c	35.16	
Depth	a_1	1.47	
	a_2	1.86	
	a_3	2.97	average depth = 2.98
	a_4	2.94	
	a_5	3.04	
	a_6	1.81	
	a_7	1.16	
	a_8		
	a_9		
	a_{10}		
Defect Area (mm^2)		80.16	
Scribe Offset	N/A		

Defect Size (mm) F2-135			
Length	2c	34.57	
Depth	a_1	1.44	
	a_2	1.79	
	a_3	3.02	average depth = 3.07
	a_4	3.15	
	a_5	3.05	
	a_6	1.81	
	a_7	1.34	
	a_8		
	a_9		
	a_{10}		
Defect Area (mm^2)		80.42	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 23-Nov-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 23-Nov-07	**1.5**

Specimen Measurements Before Testing



Defect Size (mm) F3-225			
Length	2c	35.25	
Depth	a_1	1.39	
	a_2	1.78	
	a_3	2.99	average depth = 3.00
	a_4	2.97	
	a_5	3.04	
	a_6	1.96	
	a_7	1.41	
	a_8		
	a_9		
	a_{10}		
Defect Area (mm^2)		80.82	
Scribe Offset	N/A		

Defect Size (mm) F4-315			
Length	2c	34.84	
Depth	a_1	1.32	
	a_2	1.83	
	a_3	3.14	average depth = 3.10
	a_4	3.13	
	a_5	3.03	
	a_6	2.07	
	a_7	1.56	
	a_8		
	a_9		
	a_{10}		
Defect Area (mm^2)		81.86	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: JWP	Date: 23-Nov-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 23-Nov-07	**1.5**

Test Summary Sheet

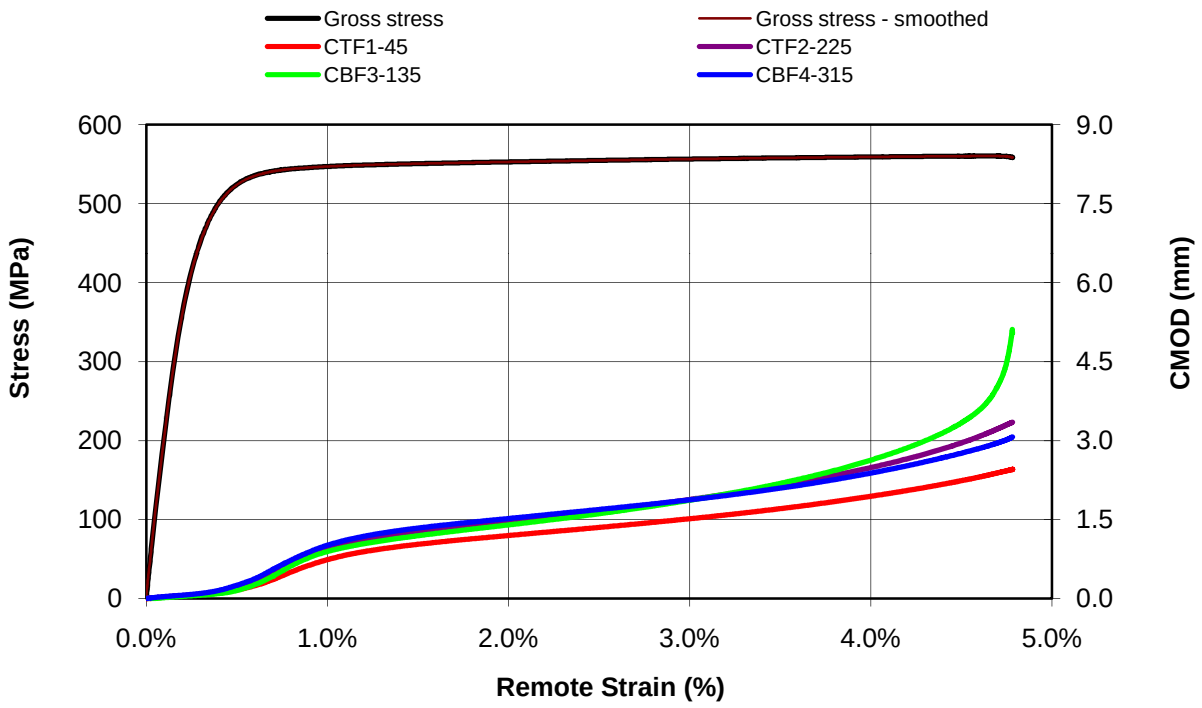
Spec. No. **1.6** Test type **12" NPS**

Specimen Details		
Pipe Diameter, OD	324.5	mm
Wall thickness, t	12.82	mm
Type	High Y/T	
Grade	X65	
SMYS	448	MPa
SMTS	531	MPa
F yield (hoop | axial)	509 | 547	MPa
F tensile (hoop | axial)	588 | 593	MPa
Test temperature	22	ºC
Test pressure	0.33	MPa
Specimen length, L1	2,176	mm
Target flaw size	3 x 35	mm
Number of Flaws	4 (2 per cross section)	
Target flaw location	Weld Centreline	

	Load Peak	End Point	
Total Load	7,032	7,008	kN
Gross Stress	560.3	558.3	MPa
Strain LTU	4.63%	4.76%	
Strain LMU	4.70%	4.84%	
Strain LBU	4.54%	4.68%	
Strain LTMBU	4.64%	4.78%	
CMOD	3.73	> 5.11*	mm

* clip gauge unseated

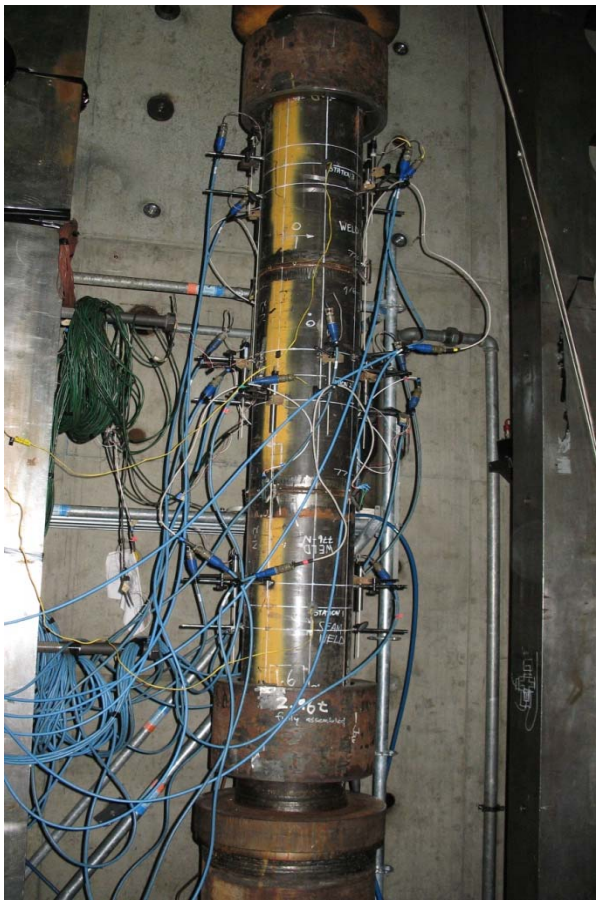
Strain Notation:
Strain LTU: avg. strain in uniform strain zone of top weld can (LTU series LVDTs)
Strain LMU: avg. strain in uniform strain zone of middle weld can (LMU series LVDTs)
Strain LBU: avg. strain in uniform strain zone of bottom weld can (LBU series LVDTs)
Strain LTMBU: avg. strain in uniform strain zones of all weld cans (LTU, LMU and LBU series LVDTs)



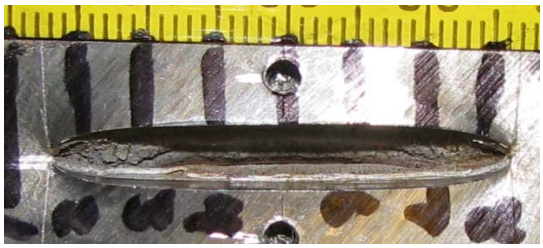
**Average strain from LVDTs in uniform strain zones of all weld cans (i.e. LTMBU strain)*

C-FER Technologies	Pre-test Measurements Taken By: MDM	Date: 21-Nov-07	PRCI/DOT
	Approval for Testing: RTP	Date: 21-Nov-07	1.6

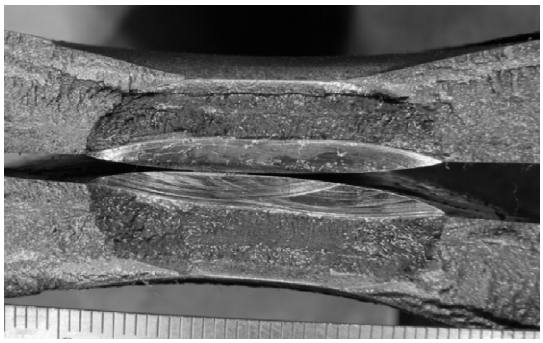
Photographs



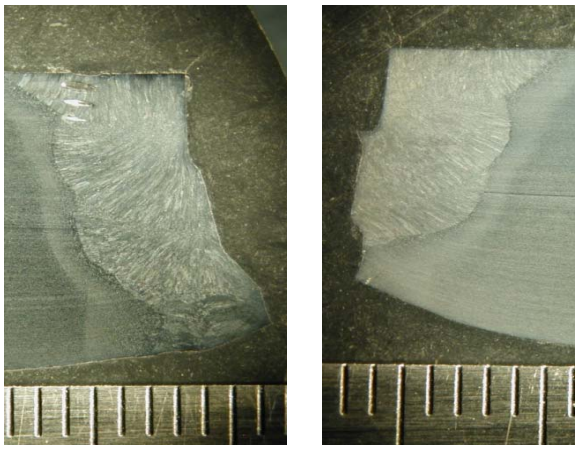
Test Set-up



135º Flaw After Testing



135º Flaw Fracture Surface



135º Flaw Macros

135º Flaw Clip Gauge

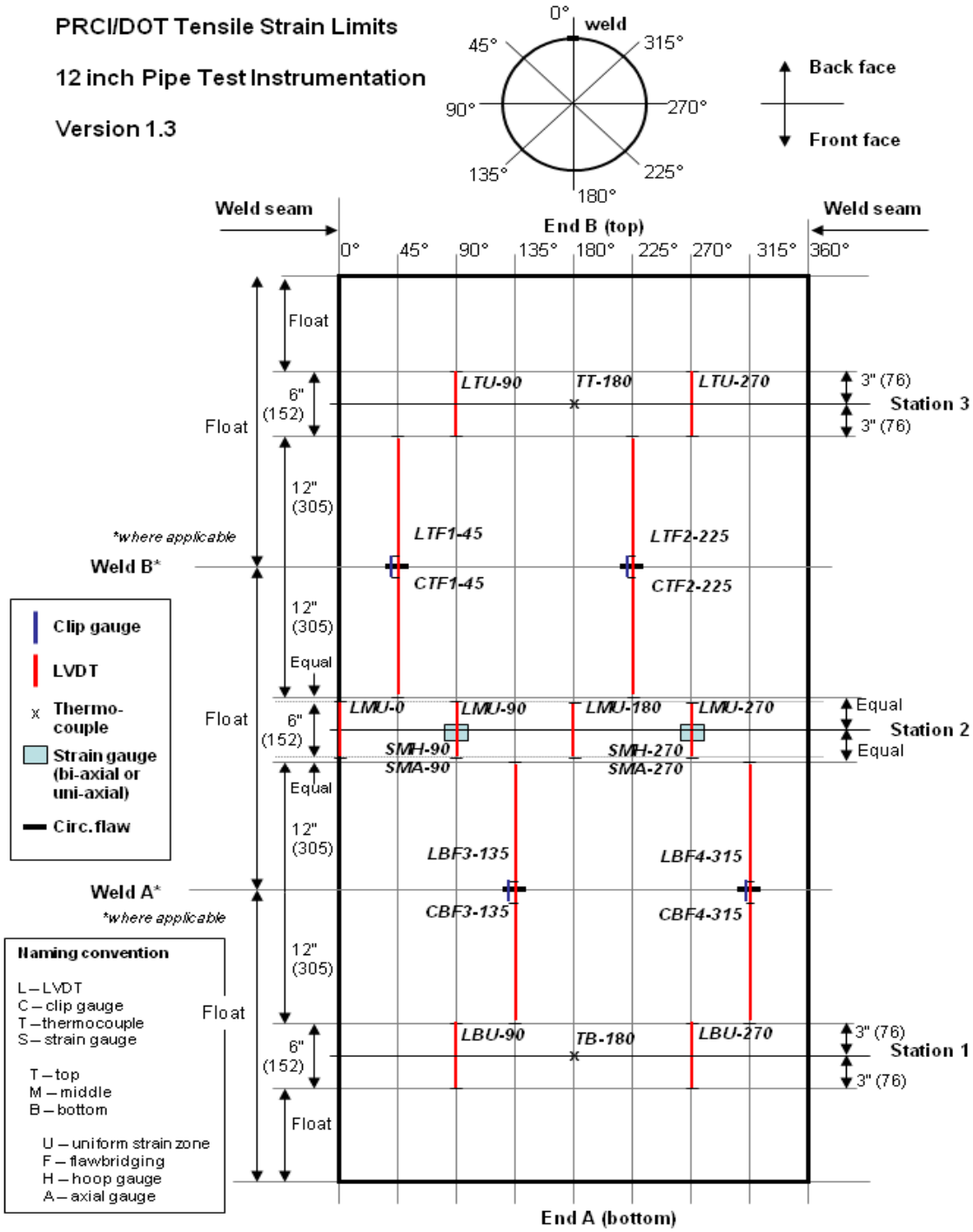
C-FER Technologies	Pre-test Measurements Taken By: MDM	Date: 21-Nov-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 21-Nov-07	**1.6**

Instrumentation Layout

PRCI/DOT Tensile Strain Limits

12 inch Pipe Test Instrumentation

Version 1.3



C-FER Technologies	Pre-test Measurements Taken By: MDM	Date: 21-Nov-07	PRCI/DOT
	Approval for Testing: RTP	Date: 21-Nov-07	1.6

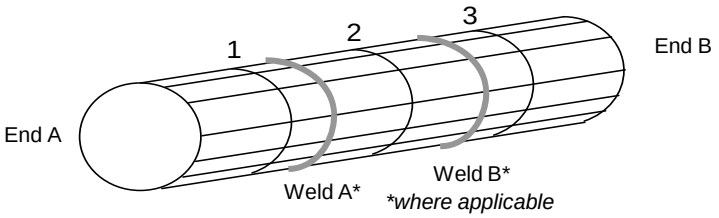
Specimen Measurements Before Testing

Distance from Scan to Seam
132 mm
Weld Number

Weld A	776-N
Weld B	776-O

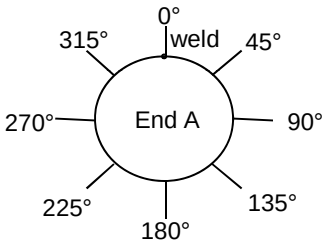
Weld Letter Label

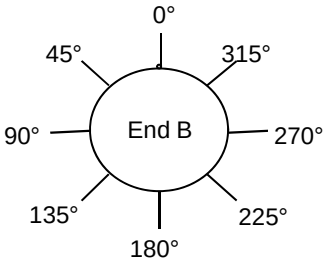
Weld A	E
Weld B	F



Distance Between Stations (mm)	
End A to 1	308
1 to 2	778
2 to 3	778
3 to End B	312
End A to Weld A	691
Weld A to Weld B	790
Weld B to End B	695

Circumference (mm)	
End A	1,024
End B	1,025





Pipe Length (mm)	
0°	2,176.0
90°	2,176.0
180°	2,176.0
270°	2,176.0
Average:	2,176.0

Diameter Measurement (mm)

Station	Angle			
	0°-180°	45°-225°	90°-270°	135°-315°
1	324.485	324.587	324.663	324.612
2	324.358	324.256	324.206	324.536
3	324.561	324.688	324.612	324.714

Ultrasonic Probe Measurement	
Probe Calibration	
0.200" gauge block reading:	0.199
0.500" gauge block reading:	0.499

Wall Thickness Measurement (mm)

Angle	Station 1	Station 2	Station 3
0°	13.208	13.310	13.259
45°	12.776	12.700	12.751
90°	12.802	12.776	12.802
135°	12.776	12.776	12.675
180°	12.725	12.751	12.700
225°	12.751	12.776	12.776
270°	12.827	12.751	12.776
315°	12.700	12.776	12.700
Average	12.82	12.83	12.80
Overall average		12.82	

C-FER Technologies	Pre-test Measurements Taken By: MDM	Date: 21-Nov-07	PRCI/DOT
	Approval for Testing: RTP	Date: 21-Nov-07	1.6

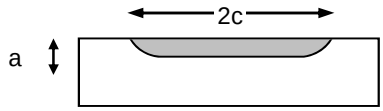
Specimen Measurements Before Testing

Gauge Length (mm)								
Location	0°	45°	90°	135°	180°	225°	270°	315°
LTU			153				152	
LTF		610				609		
LMU	148		151		150		152	
LBF				608				624
LBU			150				152	
CTF		8				8		
CBF				8				8
CBW		28				28		

Average OD (mm)	324.52
Average ID (mm)	298.89
ID Area (mm^2)	70,163
Gross Area (mm^2)	12,552

C-FER Technologies	Pre-test Measurements Taken By: MDM	Date: 21-Nov-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 21-Nov-07	**1.6**

Specimen Measurements Before Testing

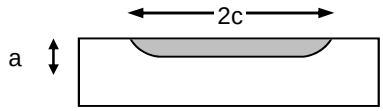


Defect Size (mm) F1-45			
Length	2c	34.88	
Depth	a_1	1.55	
	a_2	1.95	
	a_3	2.91	average depth = 2.98
	a_4	3.02	
	a_5	3.02	
	a_6	1.79	
	a_7	1.52	
	a_8		
	a_9		
	a_{10}		
Defect Area (mm^2)		79.33	
Scribe Offset	N/A		

Defect Size (mm) F2-135			
Length	2c	35.13	
Depth	a_1	1.42	
	a_2	2.07	
	a_3	3.02	average depth = 3.00
	a_4	2.91	
	a_5	3.06	
	a_6	1.88	
	a_7	1.52	
	a_8		
	a_9		
	a_{10}		
Defect Area (mm^2)		80.38	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: MDM	Date: 21-Nov-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 21-Nov-07	**1.6**

Specimen Measurements Before Testing



Defect Size (mm) F3-225			
Length	2c	35.29	
Depth	a_1	1.34	
	a_2	1.75	
	a_3	3.06	average depth = 3.03
	a_4	3.11	
	a_5	2.93	
	a_6	2.08	
	a_7	1.50	
	a_8		
	a_9		
	a_{10}		
Defect Area (mm^2)		81.71	
Scribe Offset	N/A		

Defect Size (mm) F4-315			
Length	2c	35.06	
Depth	a_1	1.45	
	a_2	2.03	
	a_3	3.08	average depth = 3.05
	a_4	3.12	
	a_5	2.96	
	a_6	1.82	
	a_7	1.58	
	a_8		
	a_9		
	a_{10}		
Defect Area (mm^2)		81.47	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: MDM	Date: 21-Nov-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 21-Nov-07	**1.6**

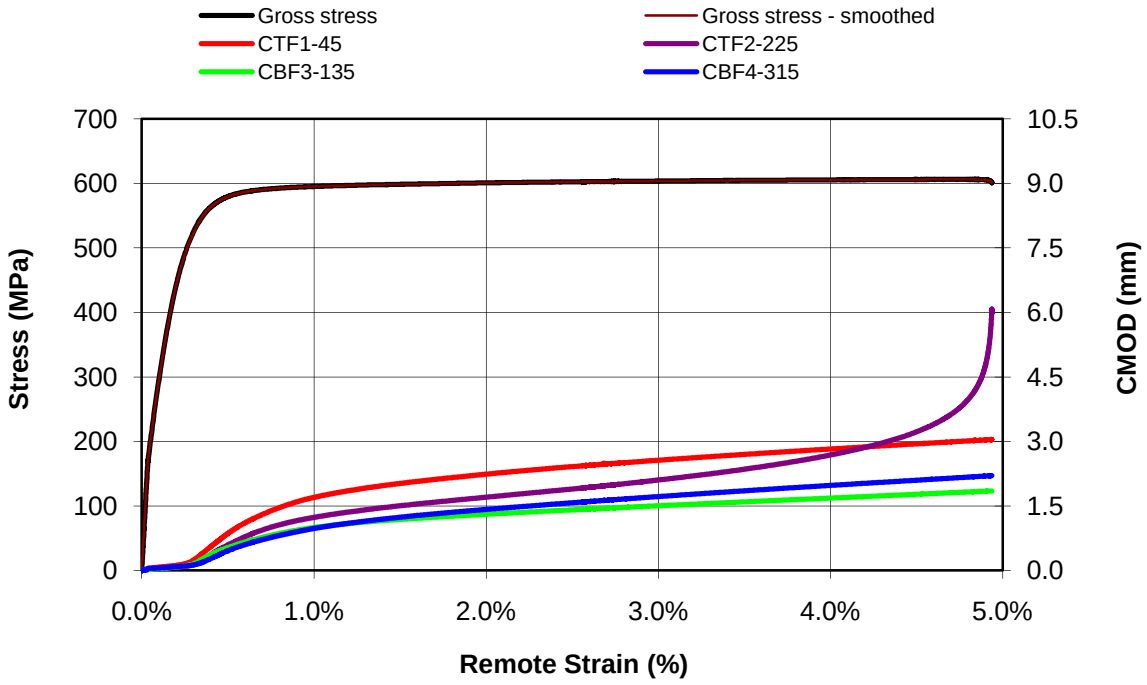
Test Summary Sheet

Spec. No. **1.7** Test type **12" NPS**

Specimen Details		
Pipe Diameter, OD	324.4	mm
Wall thickness, t	12.74	mm
Type	High Y/T	
Grade	X65	
SMYS	448	MPa
SMTS	531	MPa
F yield (hoop | axial)	509 | 547	MPa
F tensile (hoop | axial)	588 | 593	MPa
Test temperature	22	ºC
Test pressure	30.20	MPa
Specimen length, L1	2,176	mm
Target flaw size	3 x 35	mm
Number of Flaws	4 (2 per cross-section)	
Target flaw location	HAZ	

	Load Peak	**End Point**	
Total Load	7,563	7,499	kN
Gross Stress	606.2	601.0	MPa
Strain LTU	5.20%	5.44%	
Strain LMU	4.60%	4.79%	
Strain LBU	4.56%	4.73%	
Strain LTMBU	4.74%	4.94%	
CMOD	3.75	6.06	mm

Strain Notation:
Strain LTU: avg. strain in uniform strain zone of top weld can (LTU series LVDTs)
Strain LMU: avg. strain in uniform strain zone of middle weld can (LMU series LVDTs)
Strain LBU: avg. strain in uniform strain zone of bottom weld can (LBU series LVDTs)
Strain LTMBU: avg. strain in uniform strain zones of all weld cans (LTU, LMU and LBU series LVDTs)

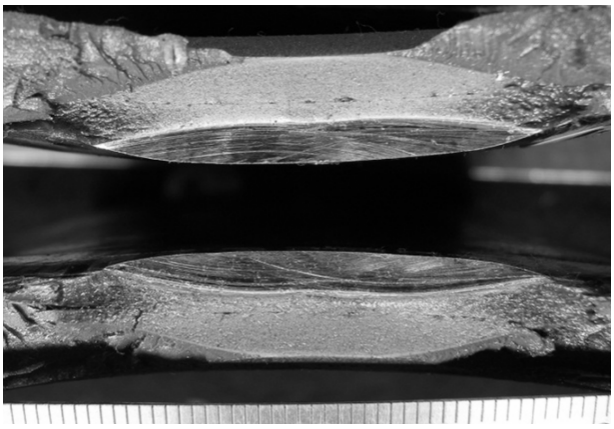


**Average strain from LVDTs in uniform strain zones of all weld cans (i.e. LTMBU strain)*

C-FER Technologies	Pre-test Measurements Taken By: MDM	Date: 26-Nov-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 26-Nov-07	**1.7**

Photographs

Test Set-up



225º Flaw Fracture Surface

225º Flaw After Testing

225º Flaw Macro Images

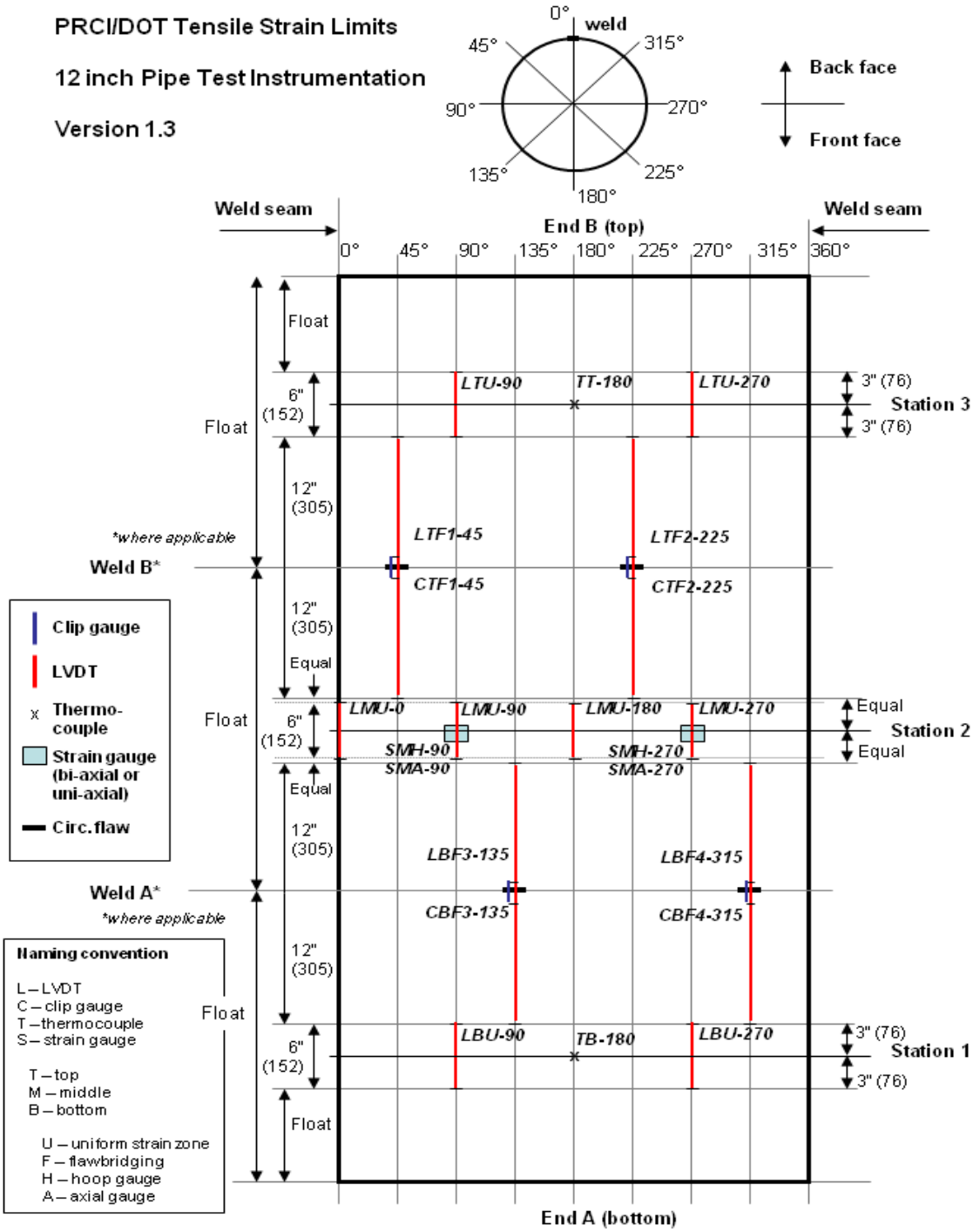
C-FER Technologies	Pre-test Measurements Taken By: MDM	Date: 26-Nov-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 26-Nov-07	**1.7**

Instrumentation Layout

PRCI/DOT Tensile Strain Limits

12 inch Pipe Test Instrumentation

Version 1.3



C-FER Technologies	Pre-test Measurements Taken By: MDM	Date: 26-Nov-07	PRCI/DOT
	Approval for Testing: RTP	Date: 26-Nov-07	1.7

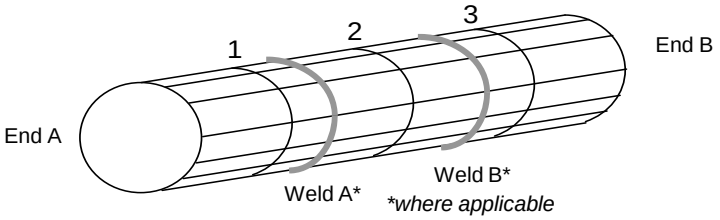
Specimen Measurements Before Testing

Distance from Scan to Seam
156 mm
Weld Number

Weld A	776-V
Weld B	776-W

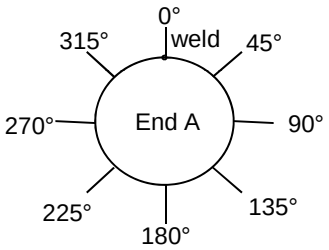
Weld Letter Label

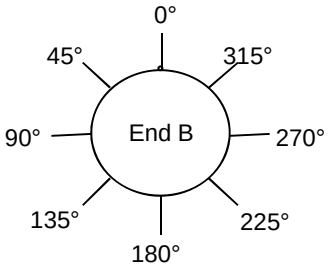
Weld A	B
Weld B	C



Distance Between Stations (mm)	
End A to 1	305
1 to 2	781
2 to 3	781
3 to End B	308
End A to Weld A	686
Weld A to Weld B	801
Weld B to End B	689

Circumference (mm)	
End A	1,024
End B	1,023





Pipe Length (mm)	
0°	2,176.0
90°	2,176.0
180°	2,176.0
270°	2,176.0
Average:	2,176.0

Diameter Measurement (mm)

Station	Angle			
	0°-180°	45°-225°	90°-270°	135°-315°
1	324.256	324.383	324.307	324.612
2	324.333	324.434	324.536	324.485
3	324.358	324.561	324.383	324.409

Ultrasonic Probe Measurement	
Probe Calibration	
0.200" gauge block reading:	0.199
0.500" gauge block reading:	0.499

Wall Thickness Measurement (mm)

Angle	Station 1	Station 2	Station 3
0°	12.929	12.979	12.979
45°	12.700	12.751	12.725
90°	12.725	12.725	12.776
135°	12.725	12.700	12.700
180°	12.725	12.700	12.675
225°	12.675	12.675	12.725
270°	12.675	12.700	12.700
315°	12.675	12.675	12.776
Average	12.73	12.74	12.76
Overall average		12.74	

C-FER Technologies	Pre-test Measurements Taken By: MDM	Date: 26-Nov-07	PRCI/DOT
	Approval for Testing: RTP	Date: 26-Nov-07	1.7

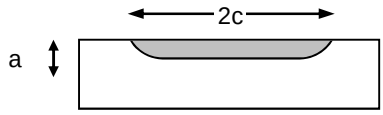
Specimen Measurements Before Testing

Gauge Length (mm)								
Location	0°	45°	90°	135°	180°	225°	270°	315°
LTU			152				152	
LTF		610				610		
LMU	153		153		152		153	
LBF				608				610
LBU			154				157	
CTF		8				8		
CBF				8				8

Average OD (mm)	324.42
Average ID (mm)	298.94
ID Area (mm^2)	70,187
Gross Area (mm^2)	12,476

C-FER Technologies	Pre-test Measurements Taken By: MDM	Date: 26-Nov-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 26-Nov-07	**1.7**

Specimen Measurements Before Testing

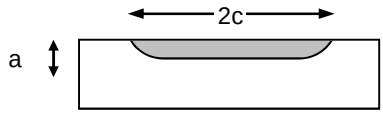


Defect Size (mm) F1-45			
Length	2c	35.82	
Depth	a_1	1.32	
	a_2	1.95	
	a_3	3.11	average depth = 3.12
	a_4	3.11	
	a_5	3.13	
	a_6	1.82	
	a_7	1.55	
	a_8		
	a_9		
	a_{10}		
Defect Area (mm^2)		85.29	
Scribe Offset	N/A		

Defect Size (mm) F2-135			
Length	2c	35.04	
Depth	a_1	1.42	
	a_2	2.07	
	a_3	3.02	average depth = 3.00
	a_4	2.91	
	a_5	3.06	
	a_6	1.88	
	a_7	1.52	
	a_8		
	a_9		
	a_{10}		
Defect Area (mm^2)		80.11	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: MDM	Date: 26-Nov-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 26-Nov-07	**1.7**

Specimen Measurements Before Testing



Defect Size (mm) F3-225			
Length	2c	34.80	
Depth	a_1	1.34	
	a_2	1.75	
	a_3	3.06	average depth = 3.03
	a_4	3.11	
	a_5	2.93	
	a_6	2.08	
	a_7	1.50	
	a_8		
	a_9		
	a_{10}		
Defect Area (mm^2)		80.22	
Scribe Offset	N/A		

Defect Size (mm) F4-315			
Length	2c	35.71	
Depth	a_1	1.45	
	a_2	2.03	
	a_3	3.08	average depth = 3.05
	a_4	3.12	
	a_5	2.96	
	a_6	1.82	
	a_7	1.58	
	a_8		
	a_9		
	a_{10}		
Defect Area (mm^2)		83.46	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: MDM	Date: 26-Nov-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 26-Nov-07	**1.7**

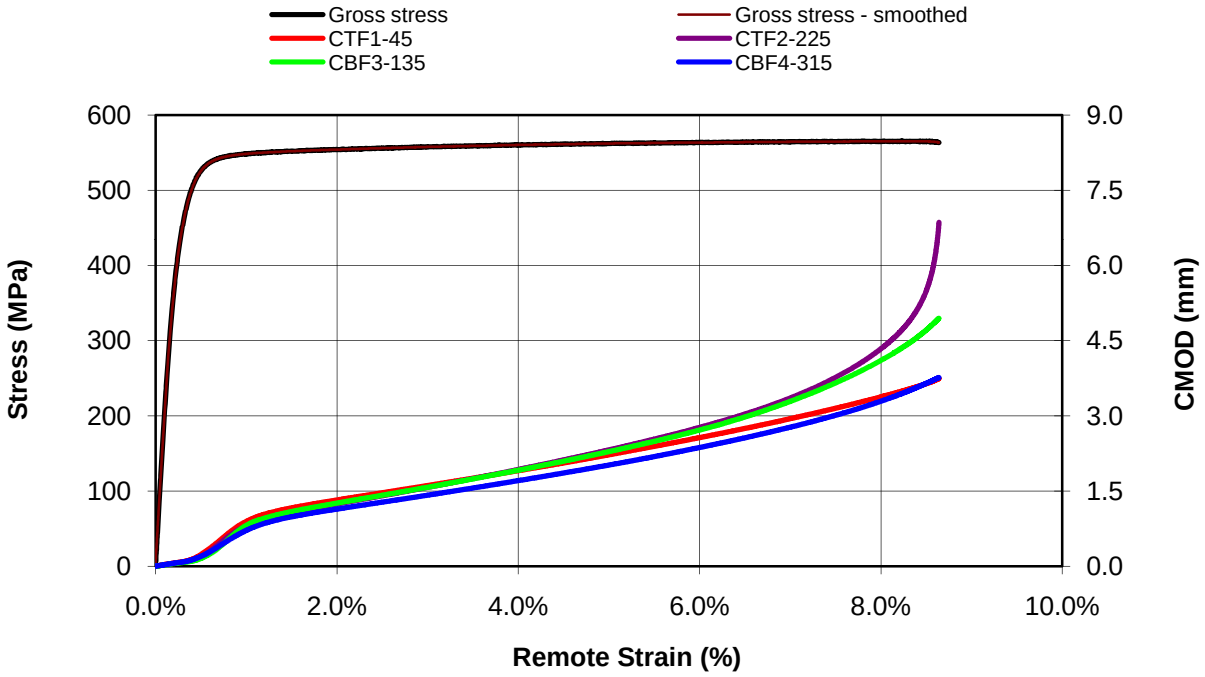
Test Summary Sheet

Spec. No. **1.8** Test type **12" NPS**

Specimen Details		
Pipe Diameter, OD	324.4	mm
Wall thickness, t	12.81	mm
Type	High Y/T	
Grade	X65	
SMYS	448	MPa
SMTS	531	MPa
F yield (hoop | axial)	509 | 547	MPa
F tensile (hoop | axial)	588 | 593	MPa
Test temperature	25	ºC
Test pressure	0.34	MPa
Specimen length, L1	2,173	mm
Target flaw size	3 x 35	mm
Number of Flaws	4 (2 per cross-section)	
Target flaw location	HAZ	

	Load Peak	End Point	
Total Load	7,083	7,063	kN
Gross Stress	564.9	563.3	MPa
Strain LTU	7.71%	8.21%	
Strain LMU	8.69%	9.37%	
Strain LBU	7.21%	7.62%	
Strain LTMBU	8.07%	8.64%	
CMOD	4.44	6.86	mm

Strain Notation:
Strain LTU: avg. strain in uniform strain zone of top weld can (LTU series LVDTs)
Strain LMU: avg. strain in uniform strain zone of middle weld can (LMU series LVDTs)
Strain LBU: avg. strain in uniform strain zone of bottom weld can (LBU series LVDTs)
Strain LTMBU: avg. strain in uniform strain zones of all weld cans (LTU, LMU and LBU series LVDTs)

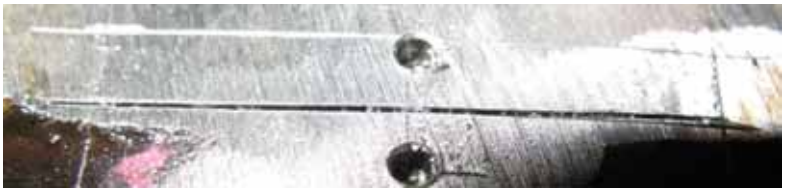


**Average strain from LVDTs in uniform strain zones of all weld cans (i.e. LTMBU strain)*

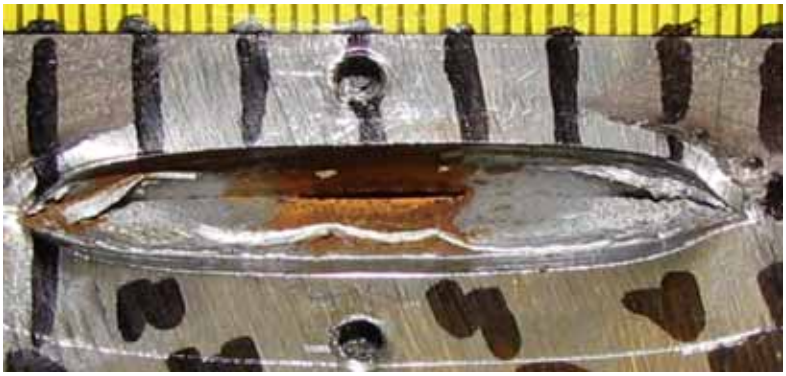
C-FER Technologies	Pre-test Measurements Taken By: MDM	Date: 28-Nov-07	PRCI/DOT
	Approval for Testing: RTP	Date: 28-Nov-07	1.8

Photographs

Test Set-up

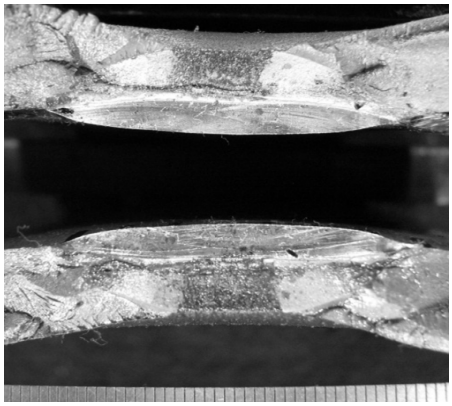


225º Flaw Before Testing



225º Flaw After Testing

225º Flaw Macro Images



225º Flaw Fracture Surface

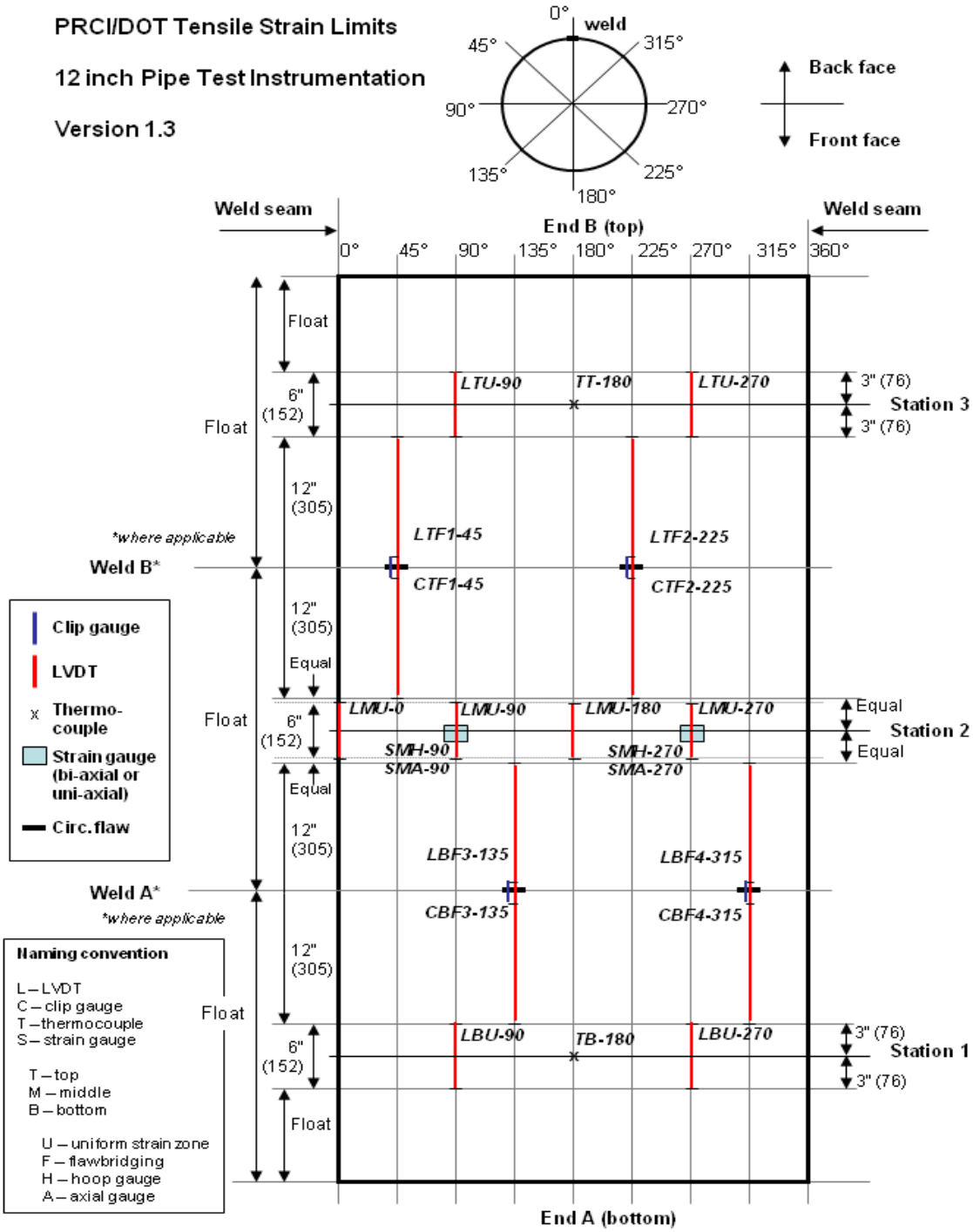
C-FER Technologies	Pre-test Measurements Taken By: MDM	Date: 28-Nov-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 28-Nov-07	**1.8**

Instrumentation Layout

PRCI/DOT Tensile Strain Limits

12 inch Pipe Test Instrumentation

Version 1.3



C-FER Technologies	Pre-test Measurements Taken By: MDM	Date: 28-Nov-07	PRCI/DOT
	Approval for Testing: RTP	Date: 28-Nov-07	1.8

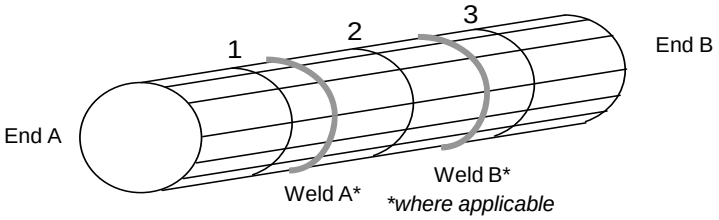
Specimen Measurements Before Testing

Distance from Scan to Seam
140 mm
Weld Number

Weld A	776-X
Weld B	776-Y

Weld Letter Label

Weld A	E
Weld B	F



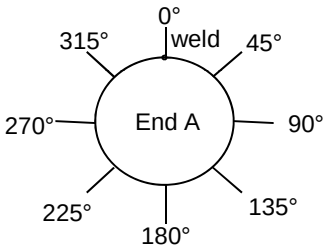
Distance Between Stations (mm)	
End A to 1	294
1 to 2	792
2 to 3	792
3 to End B	295
End A to Weld A	674
Weld A to Weld B	825
Weld B to End B	674

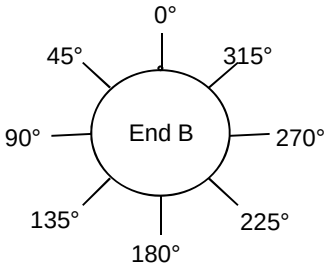
Pipe Length (mm)	
0°	2,173.0
90°	2,173.0
180°	2,173.0
270°	2,173.0
Average:	2,173.0

Circumference (mm)	
End A	1,023
End B	1,022

Diameter Measurement (mm)

Station	Angle			
	0°-180°	45°-225°	90°-270°	135°-315°
1	324.231	324.358	324.561	324.333
2	324.510	324.333	324.460	324.561
3	324.536	324.358	324.231	324.358





Ultrasonic Probe Measurement

Probe Calibration	
0.200" gauge block reading:	0.199
0.500" gauge block reading:	0.499

Wall Thickness Measurement (mm)

Angle	Station 1	Station 2	Station 3
0°	13.386	13.310	13.310
45°	12.776	12.725	12.751
90°	12.802	12.725	12.725
135°	12.751	12.675	12.675
180°	12.675	12.776	12.751
225°	12.751	12.751	12.725
270°	12.725	12.700	12.725
315°	12.802	12.700	12.725
Average	12.83	12.80	12.80
Overall average		12.81	

C-FER Technologies	Pre-test Measurements Taken By: MDM	Date: 28-Nov-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 28-Nov-07	**1.8**

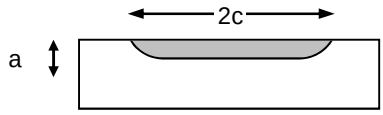
Specimen Measurements Before Testing

Gauge Length (mm)								
Location	0°	45°	90°	135°	180°	225°	270°	315°
LTU			148				150	
LTF		605				606		
LMU	153		150		151		149	
LBF				606				604
LBU			148				148	
CTF		8				8		
CBF				8				8

Average OD (mm)	324.40
Average ID (mm)	298.78
ID Area (mm^2)	70,114
Gross Area (mm^2)	12,539

C-FER Technologies	Pre-test Measurements Taken By: MDM	Date: 28-Nov-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 28-Nov-07	**1.8**

Specimen Measurements Before Testing

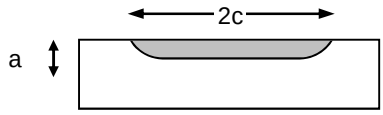


Defect Size (mm) F1-45			
Length	2c	35.74	
Depth	a_1	1.53	
	a_2	2.05	average depth = 3.04
	a_3	2.95	
	a_4	3.13	
	a_5	3.05	
	a_6	1.79	
	a_7	1.46	
	a_8		
	a_9		
	a_{10}		
Defect Area (mm^2)		83.31	
Scribe Offset	N/A		

Defect Size (mm) F2-135			
Length	2c	35.49	
Depth	a_1	1.44	
	a_2	2.08	average depth = 3.00
	a_3	2.93	
	a_4	3.11	
	a_5	2.95	
	a_6	2.06	
	a_7	1.32	
	a_8		
	a_9		
	a_{10}		
Defect area (mm^2)		81.46	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: MDM	Date: 28-Nov-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 28-Nov-07	**1.8**

Specimen Measurements Before Testing



Defect Size (mm) F3-225			
Length	2c	37.12	
Depth	a_1	1.50	
	a_2	1.96	average depth = 3.04
	a_3	3.01	
	a_4	3.05	
	a_5	3.06	
	a_6	2.02	
	a_7	1.42	
	a_8		
	a_9		
	a_{10}		
Defect Area (mm^2)		87.43	
Scribe Offset	N/A		

Defect Size (mm) F4-315			
Length	2c	34.67	
Depth	a_1	1.55	
	a_2	2.07	average depth = 3.05
	a_3	3.05	
	a_4	3.13	
	a_5	2.97	
	a_6	1.88	
	a_7	1.57	
	a_8		
	a_9		
	a_{10}		
Defect Area (mm^2)		80.21	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: MDM	Date: 28-Nov-07	**PRCI/DOT**
	Approval for Testing: RTP	Date: 28-Nov-07	**1.8**

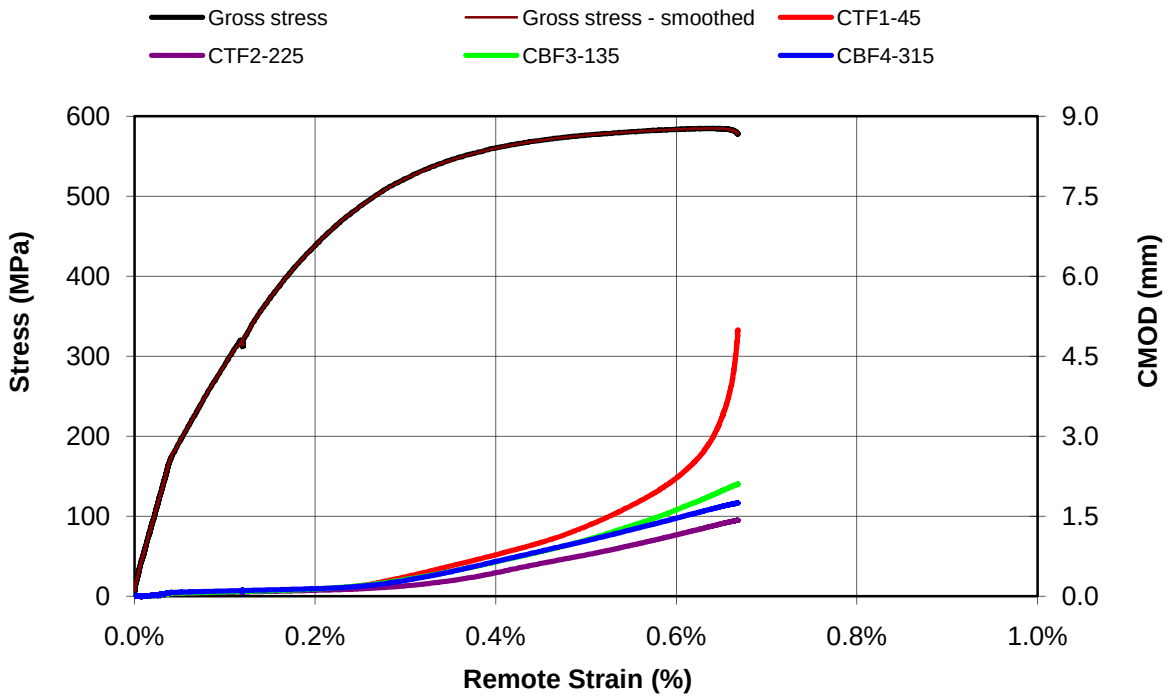
Test Summary Sheet

Spec. No. **1.9** Test type **12" NPS**

Specimen Details		
Pipe Diameter, OD	324.4	mm
Wall thickness, t	12.65	mm
Type	High Y/T	
Grade	X65	
SMYS	448	MPa
SMTS	531	MPa
F yield (hoop | axial)	509 | 547	MPa
F tensile (hoop | axial)	588 | 593	MPa
Test temperature	20	ºC
Test pressure	30.28	MPa
Specimen length, L1	2,179	mm
Target flaw size	3 x 50	mm
Number of Flaws	4 (2 per cross-section)	
Target flaw location	WCL	

	Load Peak	End Point	
Total Load	7,244	7,156	kN
Gross Stress	584.6	577.5	MPa
Strain LTU	0.67%	0.71%	
Strain LMU	0.62%	0.65%	
Strain LBU	0.64%	0.67%	
Strain LTMBU	0.64%	0.67%	
CMOD	2.93	4.99	mm

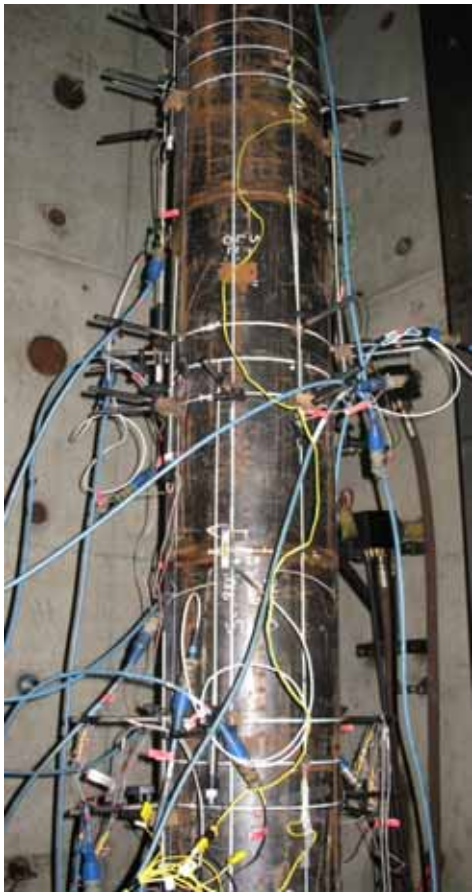
Strain Notation:
Strain LTU: avg. strain in uniform strain zone of top weld can (LTU series LVDTs)
Strain LMU: avg. strain in uniform strain zone of middle weld can (LMU series LVDTs)
Strain LBU: avg. strain in uniform strain zone of bottom weld can (LBU series LVDTs)
Strain LTMBU: avg. strain in uniform strain zones of all weld cans (LTU, LMU and LBU series LVDTs)



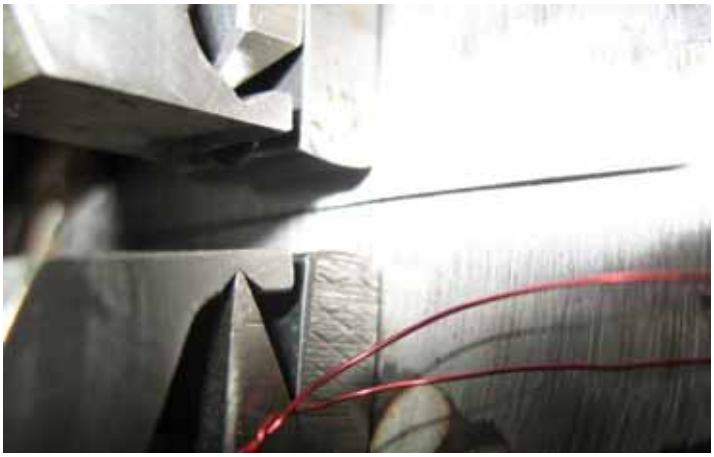
**Average strain from LVDTs in uniform strain zones of all weld cans (i.e. LTMBU strain)*

C-FER Technologies	Pre-test Measurements Taken By: LS/KTS	Date: 13-Nov-08	PRCI/DOT
	Approval for Testing: RTP	Date: 13-Nov-08	1.9

Photographs

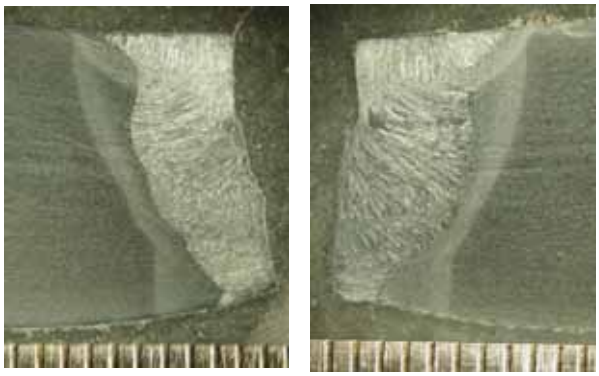


Test Set-up

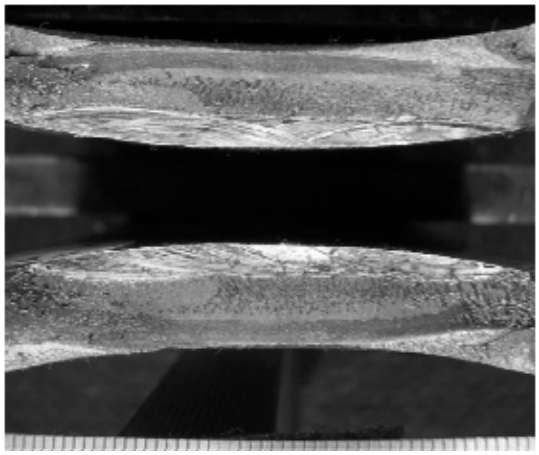


45º Flaw Clip Gauge

45º Flaw After Testing



45º Flaw Macro Images



45º Flaw Fracture Surface

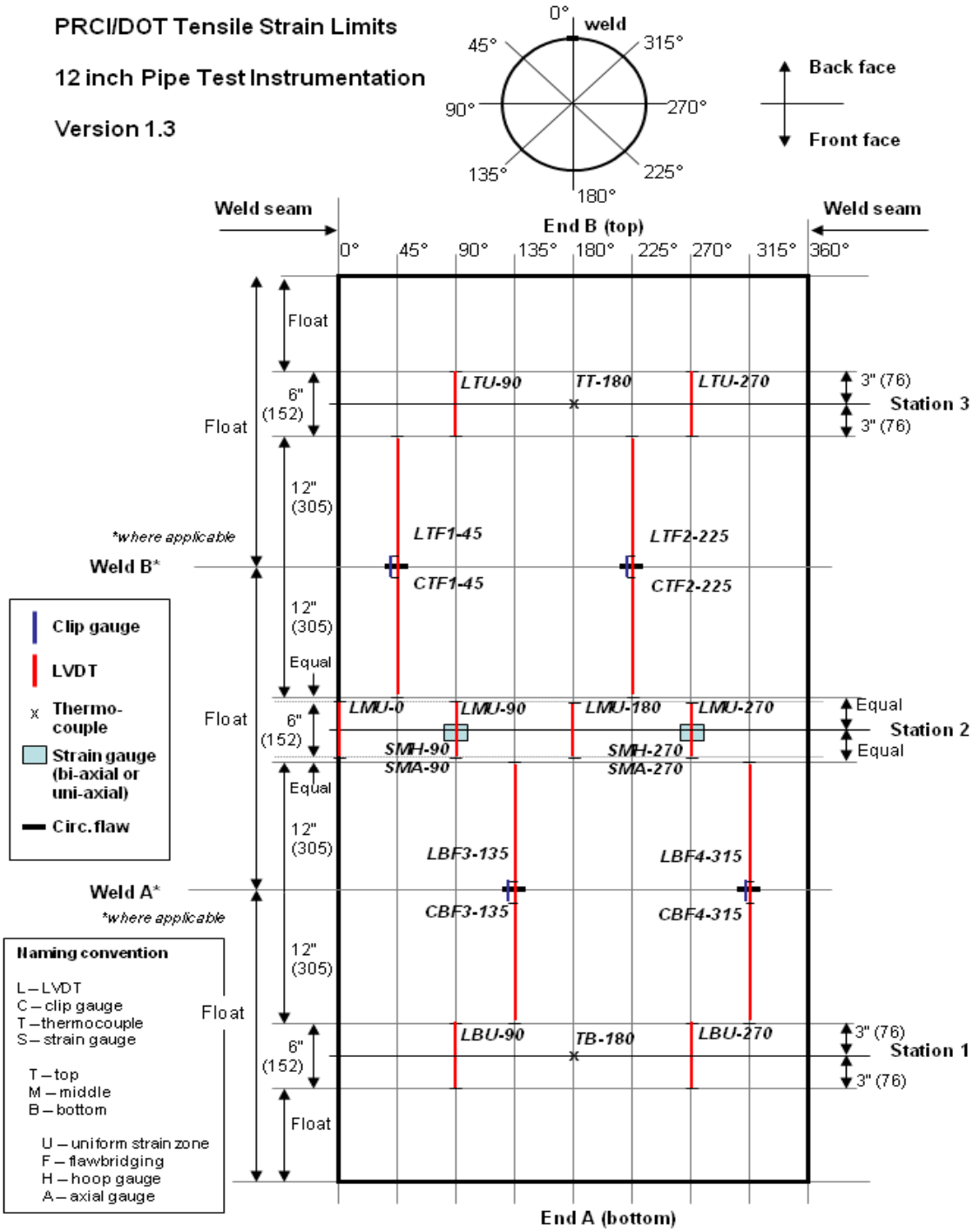
C-FER Technologies	Pre-test Measurements Taken By: LS/KTS	Date: 13-Nov-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 13-Nov-08	**1.9**

Instrumentation Layout

PRCI/DOT Tensile Strain Limits

12 inch Pipe Test Instrumentation

Version 1.3



C-FER Technologies	Pre-test Measurements Taken By: LS/KTS	Date: 13-Nov-08	PRCI/DOT
	Approval for Testing: RTP	Date: 13-Nov-08	1.9

Specimen Measurements Before Testing

Distance from Scan to Seam

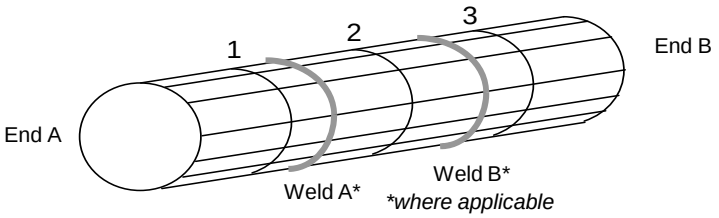
Weld Number

Weld A	776-CU
Weld B	776-CV

Weld Letter Label

Weld A

Weld B

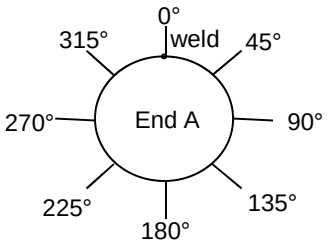


Distance Between Stations (mm)	
End A to 1	330
1 to 2	759
2 to 3	761.5
3 to End B	330.5
End A to Weld A	709
Weld A to Weld B	760
Weld B to End B	712

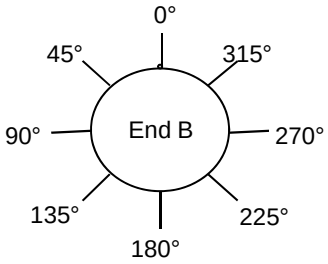
Pipe Length (mm)	
0°	2,178.0
90°	2,178.0
180°	2,179.0
270°	2,180.0
Average:	2,178.8

Circumference (mm)	
End A	1,023
End B	1,022

Diameter Measurement (mm)				
Station	Angle			
	0°-180°	45°-225°	90°-270°	135°-315°
1	324.358	324.383	324.587	324.434
2	324.244	324.155	324.485	324.663
3	324.460	324.393	324.460	324.637



Ultrasonic Probe Measurement	
Probe Calibration	
0.200" gauge block reading:	
0.500" gauge block reading:	



Wall Thickness Measurement (mm)			
Angle	Station 1	Station 2	Station 3
0°	12.830	12.530	12.860
45°	12.650	12.720	12.560
90°	12.790	12.740	12.650
135°	12.580	12.620	12.650
180°	12.660	12.710	12.580
225°	12.620	12.600	12.580
270°	12.670	12.590	12.640
315°	12.560	12.620	12.620
Average	12.67	12.64	12.64
Overall average		12.65	

C-FER Technologies	Pre-test Measurements Taken By: LS/KTS	Date: 13-Nov-08	PRCI/DOT
	Approval for Testing: RTP	Date: 13-Nov-08	1.9

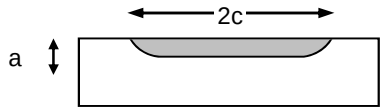
Specimen Measurements Before Testing

Gauge Length (mm)								
Location	0°	45°	90°	135°	180°	225°	270°	315°
LTU			154				153	
LTF		609				610		
LMU	149		147		148		149	
LBF				611				610
LBU			153				152	
CTF		8				8		
CBF				8				8

Average OD (mm)	324.44
Average ID (mm)	299.14
ID Area (mm^2)	70,279
Gross Area (mm^2)	12,392

C-FER Technologies	Pre-test Measurements Taken By: LS/KTS	Date: 13-Nov-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 13-Nov-08	**1.9**

Specimen Measurements Before Testing

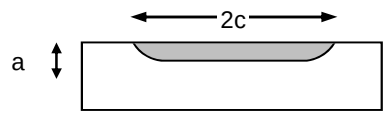


Defect Size (mm) F1-45			
Length	2c	50.12	
Depth	a_1	1.41	
	a_2	1.83	
	a_3	3.13	average depth = 3.06
	a_4	2.99	
	a_5	3.05	
	a_6	3.04	
	a_7	3.15	
	a_8	2.98	
	a_9	1.83	
	a_{10}	1.49	
Defect Area (mm^2)		127.59	
Scribe Offset	N/A		

Defect Size (mm) F2-135			
Length	2c	50.38	
Depth	a_1	1.39	
	a_2	1.89	
	a_3	3.15	average depth = 3.04
	a_4	3.01	
	a_5	2.91	
	a_6	2.93	
	a_7	3.15	
	a_8	3.11	
	a_9	2.02	
	a_{10}	1.55	
Defect Area (mm^2)		127.87	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: LS/KTS	Date: 13-Nov-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 13-Nov-08	**1.9**

Specimen Measurements Before Testing



Defect Size (mm) F3-225			
Length	2c	49.98	
Depth	a_1	1.39	
	a_2	2.08	
	a_3	3.14	average depth = 3.07
	a_4	3.02	
	a_5	2.97	
	a_6	3.14	
	a_7	3.03	
	a_8	3.09	
	a_9	2.05	
	a_{10}	1.53	
Defect Area (mm^2)		127.47	
Scribe Offset	N/A		

Defect Size (mm) F4-315			
Length	2c	50.81	
Depth	a_1	1.41	
	a_2	1.95	
	a_3	3.02	average depth = 3.00
	a_4	2.99	
	a_5	2.92	
	a_6	2.98	
	a_7	3.05	
	a_8	3.06	
	a_9	1.78	
	a_{10}	1.55	
Defect Area (mm^2)		127.63	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: LS/KTS	Date: 13-Nov-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 13-Nov-08	**1.9**

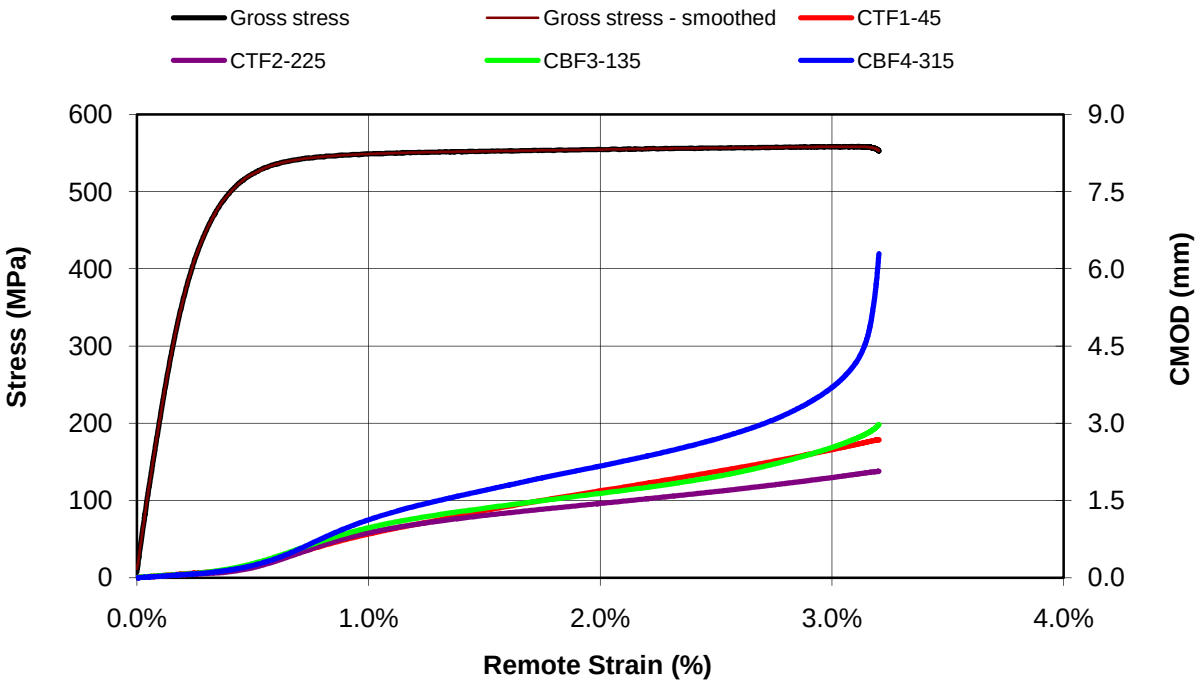
Test Summary Sheet

Spec. No. **1.10** Test type **12" NPS**

Specimen Details		
Pipe Diameter, OD	324.5	mm
Wall thickness, t	12.71	mm
Type	High Y/T	
Grade	X65	
SMYS	448	MPa
SMTS	531	MPa
F yield (hoop | axial)	509 | 547	MPa
F tensile (hoop | axial)	588 | 593	MPa
Test temperature	20	ºC
Test pressure	0.34	MPa
Specimen length, L1	2,199	mm
Target flaw size	3 x 50	mm
Number of Flaws	4 (2 per cross-section)	
Target flaw location	WCL	

	Load Peak	End Point	
Total Load	6,946	6,876	kN
Gross Stress	558.2	552.5	MPa
Strain LTU	2.84%	2.92%	
Strain LMU	3.25%	3.36%	
Strain LBU	3.07%	3.17%	
Strain LTMBU	3.10%	3.20%	
CMOD	4.18	6.29	mm

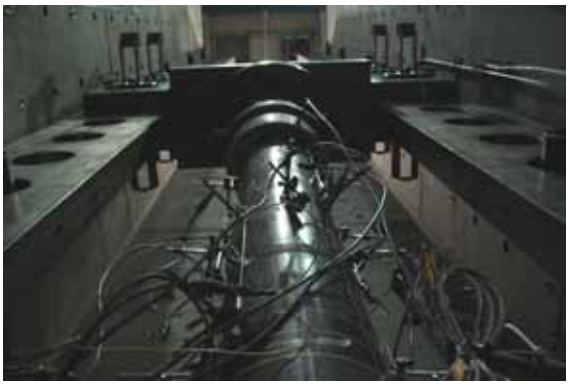
Strain Notation:
Strain LTU: avg. strain in uniform strain zone of top weld can (LTU series LVDTs)
Strain LMU: avg. strain in uniform strain zone of middle weld can (LMU series LVDTs)
Strain LBU: avg. strain in uniform strain zone of bottom weld can (LBU series LVDTs)
Strain LTMBU: avg. strain in uniform strain zones of all weld cans (LTU, LMU and LBU series LVDTs)



**Average strain from LVDTs in uniform strain zones of all weld cans (i.e. LTMBU strain)*

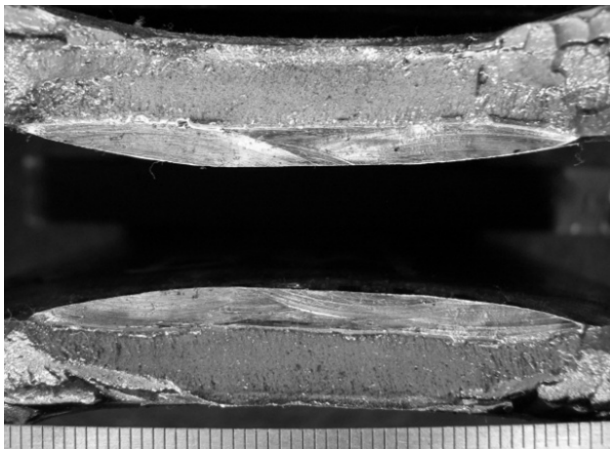
C-FER Technologies	Pre-test Measurements Taken By: LS/KTS	Date: 6-Nov-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 6-Nov-08	**1.10**

Photographs



Test Set-up

315º Flaw After Testing



315º Flaw Fracture Surface

315º Flaw Macro Images

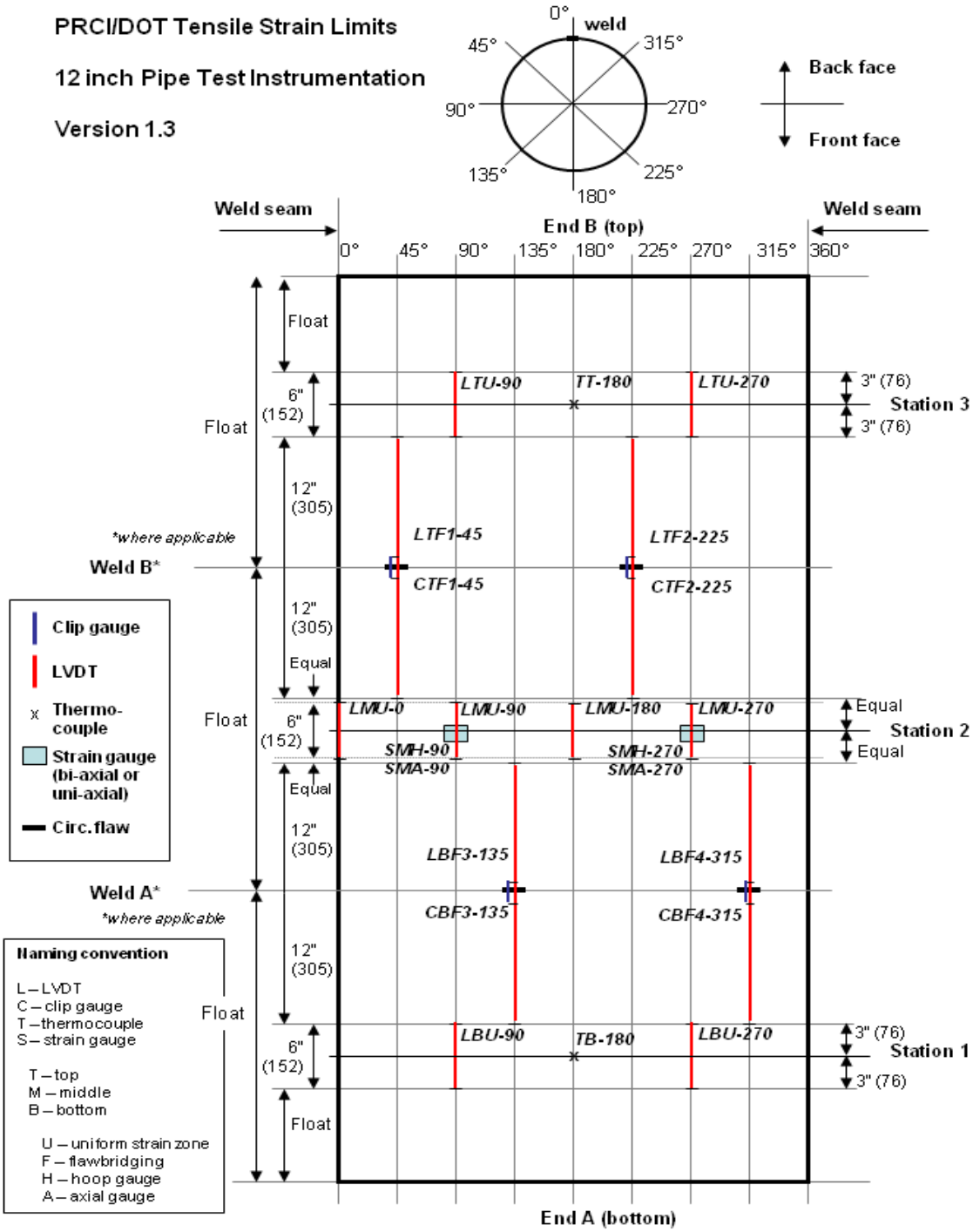
C-FER Technologies	Pre-test Measurements Taken By: LS/KTS	Date: 6-Nov-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 6-Nov-08	**1.10**

Instrumentation Layout

PRCI/DOT Tensile Strain Limits

12 inch Pipe Test Instrumentation

Version 1.3



C-FER Technologies	Pre-test Measurements Taken By: LS/KTS	Date: 6-Nov-08	PRCI/DOT
	Approval for Testing: RTP	Date: 6-Nov-08	1.10

Specimen Measurements Before Testing

Distance from Scan to Seam

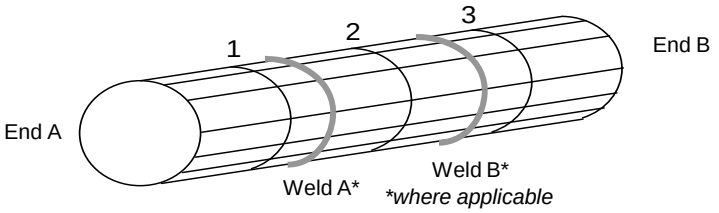
Weld Number

Weld A	776-CE
Weld B	776-BW

Weld Letter Label

Weld A

Weld B

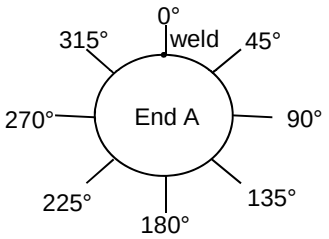


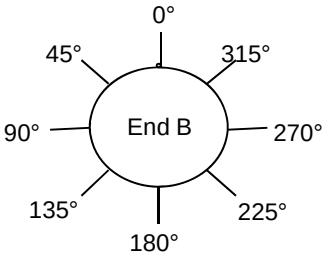
Distance Between Stations (mm)	
End A to 1	320
1 to 2	779
2 to 3	778
3 to End B	321
End A to Weld A	701
Weld A to Weld B	797
Weld B to End B	703

Pipe Length (mm)	
0°	2,200.0
90°	2,197.0
180°	2,197.0
270°	2,200.0
Average:	2,198.5

Circumference (mm)	
End A	1,021
End B	1,021

Diameter Measurement (mm)				
Station	Angle			
	0°-180°	45°-225°	90°-270°	135°-315°
1	324.458	324.434	324.434	324.485
2	324.460	324.460	324.434	324.434
3	324.485	324.612	324.409	324.333





Ultrasonic Probe Measurement	
Probe Calibration	
0.200" gauge block reading:	
0.500" gauge block reading:	

Wall Thickness Measurement (mm)			
Angle	Station 1	Station 2	Station 3
0°	12.760	12.810	12.760
45°	12.730	12.710	12.730
90°	12.740	12.730	12.690
135°	12.670	12.680	12.680
180°	12.640	12.630	12.660
225°	12.740	12.660	12.780
270°	12.700	12.720	12.710
315°	12.690	12.660	12.680
Average	12.71	12.70	12.71
Overall average		12.71	

C-FER Technologies	Pre-test Measurements Taken By: LS/KTS	Date: 6-Nov-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 6-Nov-08	**1.10**

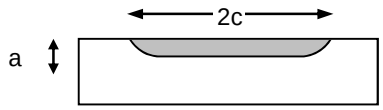
Specimen Measurements Before Testing

Gauge Length (mm)								
Location	0°	45°	90°	135°	180°	225°	270°	315°
LTU			154				154	
LTF		611				609		
LMU	151		153		153		150	
LBF				612				612
LBU			152				152	
CTF		8				8		
CBF				8				8

Average OD (mm)	324.45
Average ID (mm)	299.04
ID Area (mm^2)	70,234
Gross Area (mm^2)	12,445

C-FER Technologies	Pre-test Measurements Taken By: LS/KTS	Date: 6-Nov-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 6-Nov-08	**1.10**

Specimen Measurements Before Testing

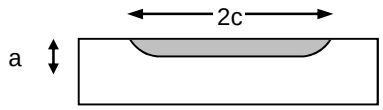


Defect Size (mm) F1-45			
Length	2c	50.52	
Depth	a_1	1.44	
	a_2	2.06	
	a_3	2.97	average depth = 3.02
	a_4	2.92	
	a_5	3.11	
	a_6	3.09	
	a_7	3.00	
	a_8	3.05	
	a_9	2.02	
	a_{10}	1.44	
Defect Area (mm^2)		127.53	
Scribe Offset	N/A		

Defect Size (mm) F2-135			
Length	2c	50.17	
Depth	a_1	1.47	
	a_2	2.00	
	a_3	3.06	average depth = 3.03
	a_4	3.01	
	a_5	2.92	
	a_6	3.11	
	a_7	2.93	
	a_8	3.15	
	a_9	1.98	
	a_{10}	1.41	
Defect Area (mm^2)		126.73	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: LS/KTS	Date: 6-Nov-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 6-Nov-08	**1.10**

Specimen Measurements Before Testing



Defect Size (mm) F3-225			
Length	2c	49.82	
Depth	a_1	1.49	
	a_2	1.94	
	a_3	3.04	average depth = 3.07
	a_4	3.11	
	a_5	2.98	
	a_6	3.05	
	a_7	3.11	
	a_8	3.11	
	a_9	1.78	
	a_{10}	1.49	
Defect Area (mm^2)		127.05	
Scribe Offset	N/A		

Defect Size (mm) F4-315			
Length	2c	49.47	
Depth	a_1	1.35	
	a_2	1.84	
	a_3	3.05	average depth = 3.07
	a_4	3.07	
	a_5	3.09	
	a_6	3.11	
	a_7	3.03	
	a_8	3.06	
	a_9	2.04	
	a_{10}	1.44	
Defect Area (mm^2)		126.04	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: LS/KTS	Date: 6-Nov-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 6-Nov-08	**1.10**

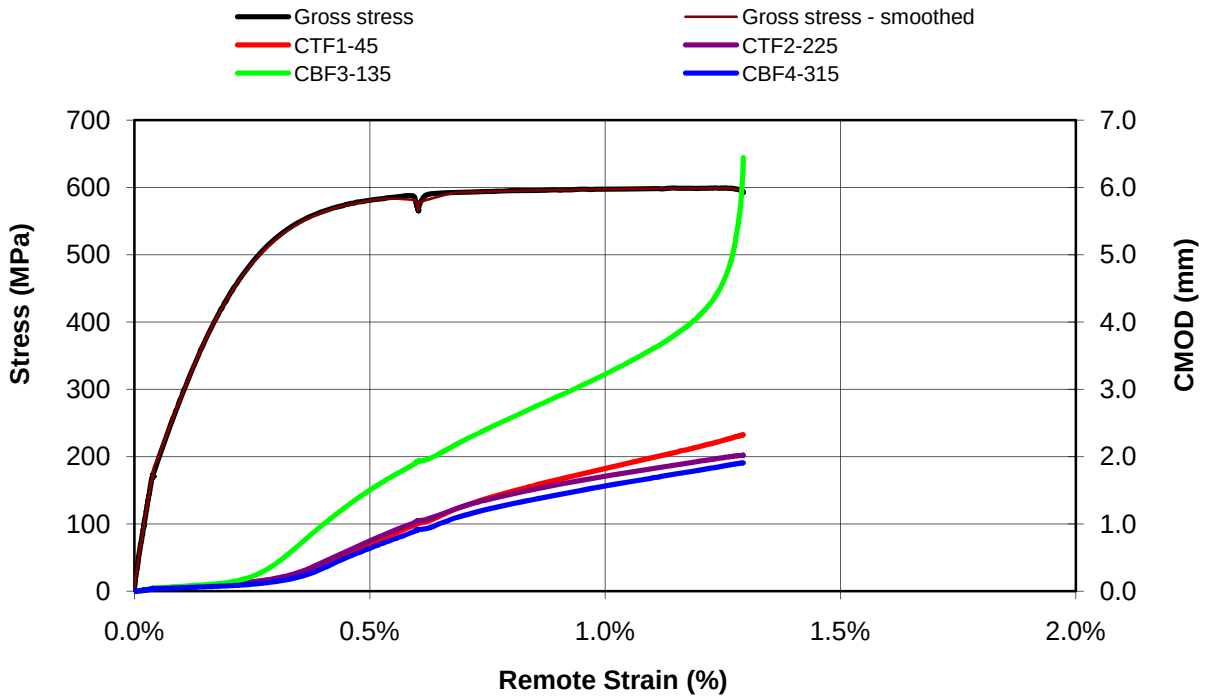
Test Summary Sheet

Spec. No. **1.11** Test type **12" NPS**

Specimen Details		
Pipe Diameter, OD	324.6	mm
Wall thickness, t	12.68	mm
Type	High Y/T	
Grade	X65	
SMYS	448	MPa
SMTS	531	MPa
F yield (hoop | axial)	509 | 547	MPa
F tensile (hoop | axial)	588 | 593	MPa
Test temperature	21	ºC
Test pressure	30.20	MPa
Specimen length, L1	2,207	mm
Target flaw size	3 x 50	mm
Number of Flaws	4 (2 per cross-section)	
Target flaw location	HAZ	

	Load Peak	End Point	
Total Load	7,445	7,362	kN
Gross Stress	599.0	592.4	MPa
Strain LTU	1.22%	1.25%	
Strain LMU	1.26%	1.31%	
Strain LBU	1.25%	1.31%	
Strain LTMBU	1.24%	1.29%	
CMOD	4.50	6.44	mm

Strain Notation:
Strain LTU: avg. strain in uniform strain zone of top weld can (LTU series LVDTs)
Strain LMU: avg. strain in uniform strain zone of middle weld can (LMU series LVDTs)
Strain LBU: avg. strain in uniform strain zone of bottom weld can (LBU series LVDTs)
Strain LTMBU: avg. strain in uniform strain zones of all weld cans (LTU, LMU and LBU series LVDTs)



**Average strain from LVDTs in uniform strain zones of all weld cans (i.e. LTMBU strain)*

C-FER Technologies	Pre-test Measurements Taken By: WM/LS	Date: 24-Mar-08	PRCI/DOT
	Approval for Testing: RTP	Date: 24-Mar-08	1.11

Photographs

Test Set-up

Clip Gauge Set-up

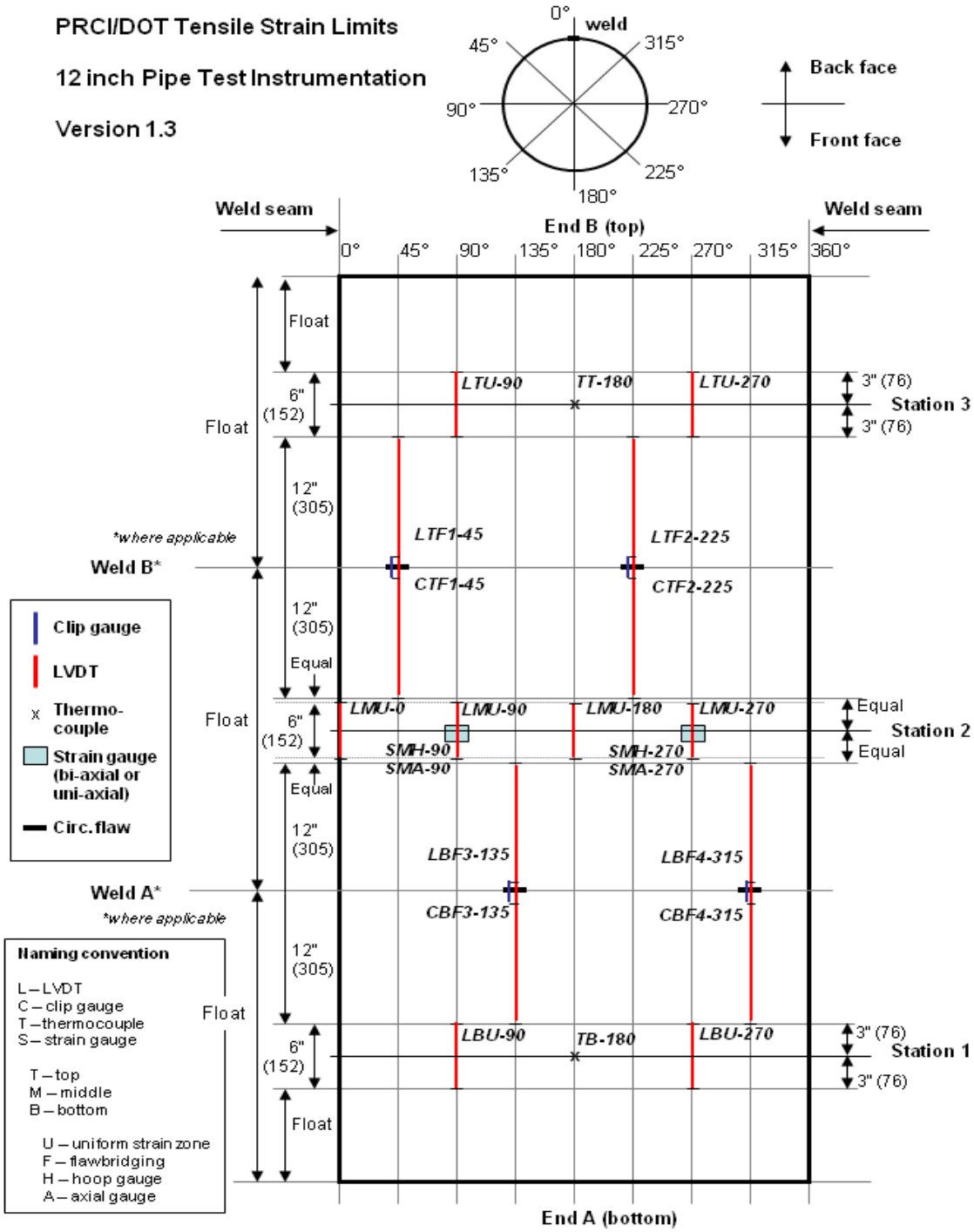
C-FER Technologies	Pre-test Measurements Taken By: WM/LS	Date: 24-Mar-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 24-Mar-08	**1.11**

Instrumentation Layout

PRCI/DOT Tensile Strain Limits

12 inch Pipe Test Instrumentation

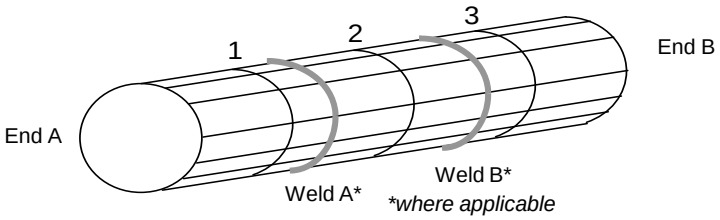
Version 1.3



C-FER Technologies	Pre-test Measurements Taken By: WM/LS	Date: 24-Mar-08	PRCI/DOT
	Approval for Testing: RTP	Date: 24-Mar-08	1.11

Specimen Measurements Before Testing

Distance from Scan to Seam
382 mm
Weld Number
Weld A 776-CA
Weld B 776-CB
Weld Letter Label
Weld A
Weld B

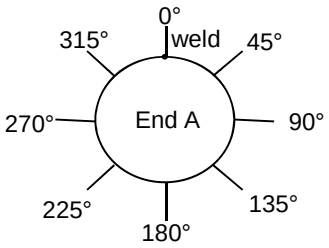


Distance Between Stations (mm)	
End A to 1	324
1 to 2	780
2 to 3	781
3 to End B	321
End A to Weld A	708
Weld A to Weld B	796
Weld B to End B	702

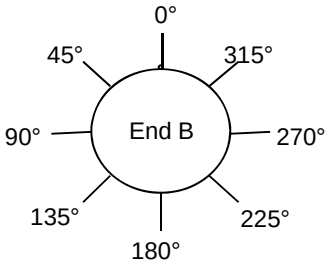
Pipe Length (mm)	
0°	2,208.0
90°	2,205.0
180°	2,206.0
270°	2,207.0
Average:	2,206.5

Circumferences (mm)	
End A	1,021
End B	1,021

Diameter Measurement (mm)				
Station	Angle			
	0°-180°	45°-225°	90°-270°	135°-315°
1	324.739	324.637	324.485	324.587
2	324.510	324.739	324.358	324.561
3	324.485	324.739	324.282	324.587



Ultrasonic Probe Measurement	
Probe Calibration	
0.200" gauge block reading:	
0.500" gauge block reading:	



Wall Thickness Measurement (mm)			
Angle	Station 1	Station 2	Station 3
0°	13.157	13.233	13.208
45°	12.649	12.649	12.649
90°	12.649	12.649	12.649
135°	12.522	12.548	12.573
180°	12.624	12.624	12.548
225°	12.624	12.573	12.624
270°	12.649	12.675	12.649
315°	12.548	12.598	12.548
Average	12.68	12.69	12.68
Overall average		12.68	

C-FER Technologies	Pre-test Measurements Taken By: WM/LS	Date: 24-Mar-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 24-Mar-08	**1.11**

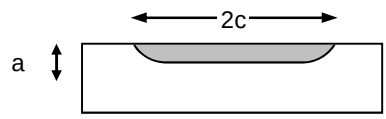
Specimen Measurements Before Testing

Gauge Length (mm)								
Location	0°	45°	90°	135°	180°	225°	270°	315°
LTU			154				154	
LTF		611				607		
LMU	158		154		153		152	
LBF				611				614
LBU			152				156	
CTF		8				8		
CBF				8				8

Average OD (mm)	324.56
Average ID (mm)	299.19
ID Area (mm^2)	70,305
Gross Area (mm^2)	12,428

C-FER Technologies	Pre-test Measurements Taken By: WM/LS	Date: 24-Mar-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 24-Mar-08	**1.11**

Specimen Measurements Before Testing

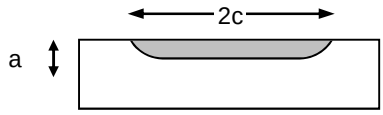


Defect Size (mm) F1-45			
Length	2c	50.21	
Depth	a_1	1.35	
	a_2	1.92	
	a_3	3.14	average depth = 3.04
	a_4	3.14	
	a_5	2.91	
	a_6	3.11	
	a_7	3.02	
	a_8	2.91	
	a_9	1.92	
	a_{10}	1.50	
Defect Area (mm^2)		127.16	
Scribe Offset	N/A		

Defect Size (mm) F2-135			
Length	2c	51.02	
Depth	a_1	1.58	
	a_2	1.93	
	a_3	3.04	average depth = 3.07
	a_4	3.08	
	a_5	3.09	
	a_6	3.11	
	a_7	3.02	
	a_8	3.05	
	a_9	2.04	
	a_{10}	1.57	
Defect Area (mm^2)		130.66	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: WM/LS	Date: 24-Mar-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 24-Mar-08	**1.11**

Specimen Measurements Before Testing



Defect Size (mm) F3-225			
Length	2c	49.89	
Depth	a_1	1.33	
	a_2	1.93	
	a_3	3.04	average depth = 3.03
	a_4	3.02	
	a_5	2.92	
	a_6	3.06	
	a_7	3.05	
	a_8	3.08	
	a_9	1.78	
	a_{10}	1.34	
Defect Area (mm^2)		125.81	
Scribe Offset	N/A		

Defect Size (mm) F4-315			
Length	2c	48.66	
Depth	a_1	1.54	
	a_2	2.08	
	a_3	3.03	average depth = 3.05
	a_4	3.08	
	a_5	3.05	
	a_6	3.08	
	a_7	2.97	
	a_8	2.96	
	a_9	1.91	
	a_{10}	1.49	
Defect Area (mm^2)		123.00	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: WM/LS	Date: 24-Mar-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 24-Mar-08	**1.11**

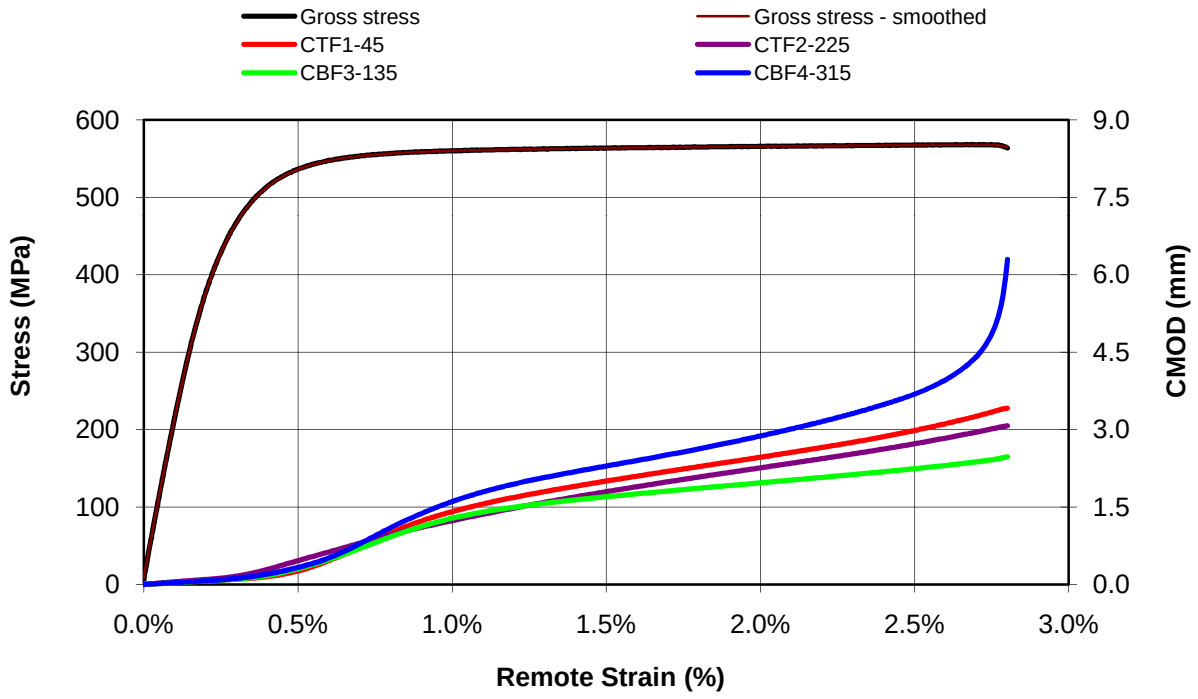
Test Summary Sheet

Spec. No. **1.12** Test type **12" NPS**

Specimen Details		
Pipe Diameter, OD	324.4	mm
Wall thickness, t	12.64	mm
Type	High Y/T	
Grade	X65	
SMYS	448	MPa
SMTS	531	MPa
F yield (hoop | axial)	509 | 547	MPa
F tensile (hoop | axial)	588 | 593	MPa
Test temperature	22	ºC
Test pressure	0.34	MPa
Specimen length, L1	2,208	mm
Target flaw size	3 x 50	mm
Number of Flaws	4 (2 per cross-section)	
Target flaw location	HAZ	

	Load Peak	End Point	
Total Load	7,031	6,975	kN
Gross Stress	567.9	563.4	MPa
Strain LTU	2.69%	2.79%	
Strain LMU	2.67%	2.79%	
Strain LBU	2.72%	2.84%	
Strain LTMBU	2.69%	2.80%	
CMOD	4.33	6.30	mm

Strain Notation:
Strain LTU: avg. strain in uniform strain zone of top weld can (LTU series LVDTs)
Strain LMU: avg. strain in uniform strain zone of middle weld can (LMU series LVDTs)
Strain LBU: avg. strain in uniform strain zone of bottom weld can (LBU series LVDTs)
Strain LTMBU: avg. strain in uniform strain zones of all weld cans (LTU, LMU and LBU series LVDTs)



**Average strain from LVDTs in uniform strain zones of all weld cans (i.e. LTMBU strain)*

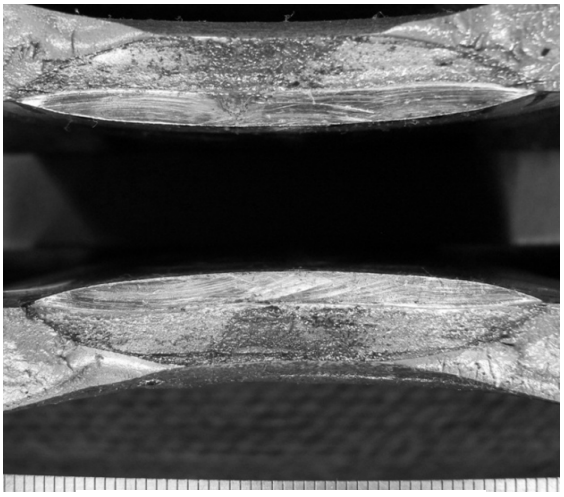
C-FER Technologies	Pre-test Measurements Taken By: WM/LS	Date: 28-Mar-08	PRCI/DOT
	Approval for Testing: RTP	Date: 28-Mar-08	1.12

Photographs

Test Set-up

315º Flaw Before Testing

315º Flaw After Testing



315º Flaw Fracture Surface

315º Flaw Macro Images

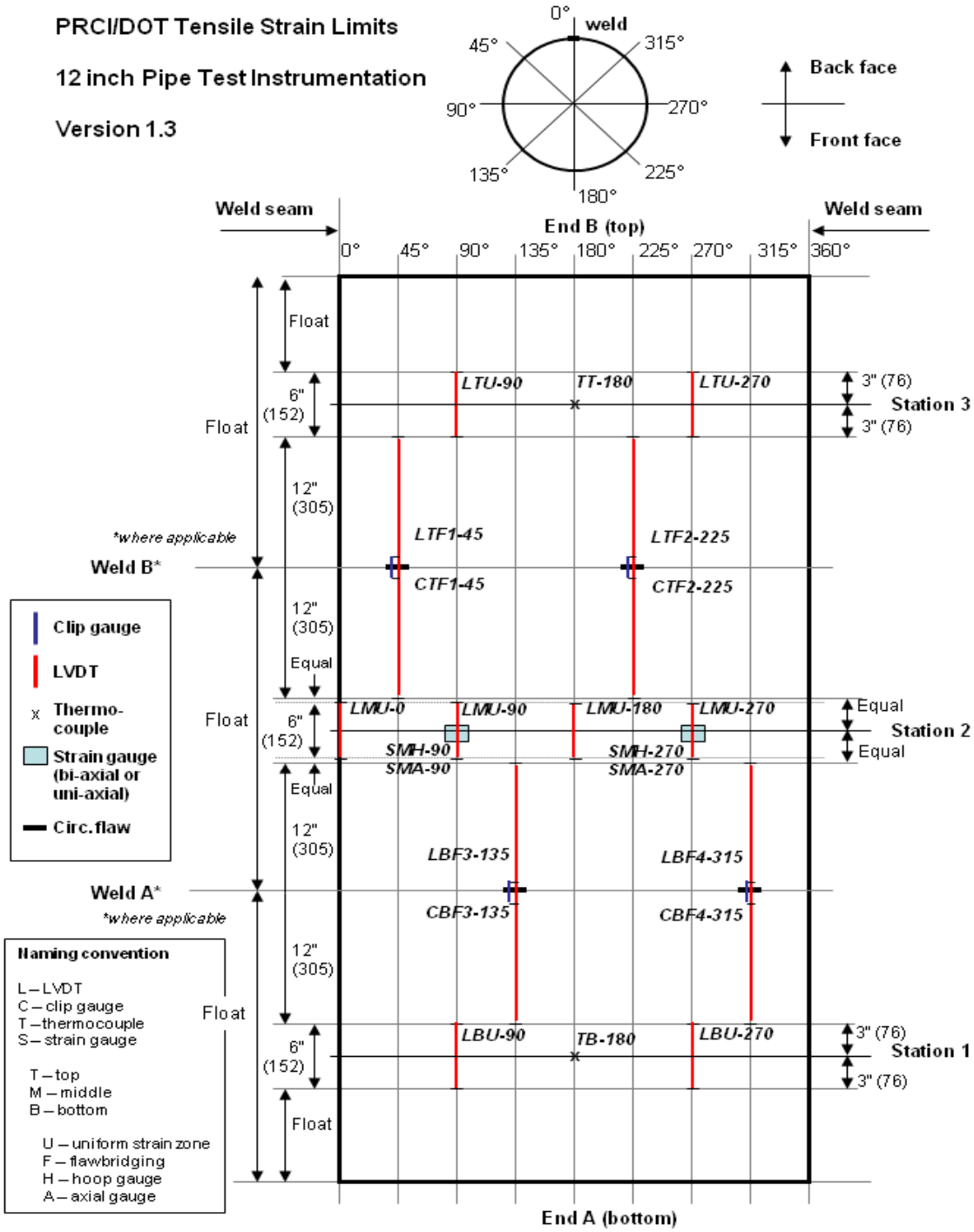
C-FER Technologies	Pre-test Measurements Taken By: WM/LS	Date: 28-Mar-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 28-Mar-08	**1.12**

Instrumentation Layout

PRCI/DOT Tensile Strain Limits

12 inch Pipe Test Instrumentation

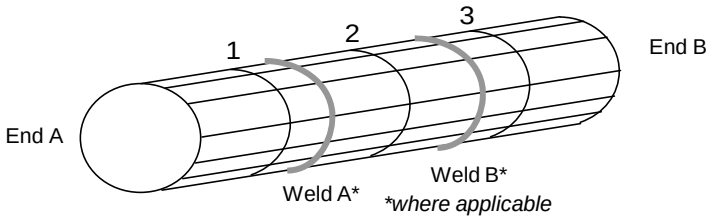
Version 1.3



C-FER Technologies	Pre-test Measurements Taken By: WM/LS	Date: 28-Mar-08	PRCI/DOT
	Approval for Testing: RTP	Date: 28-Mar-08	1.12

Specimen Measurements Before Testing

Distance from Scan to Seam
383 mm
Weld Number
Weld A 776-AN
Weld B 776-AM
Weld Letter Label
Weld A
Weld B

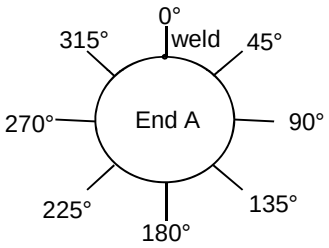


Distance Between Stations (mm)	
End A to 1	326
1 to 2	774
2 to 3	784
3 to End B	321
End A to Weld A	707
Weld A to Weld B	799
Weld B to End B	702

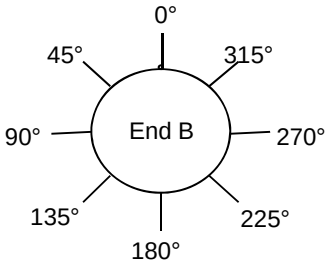
Pipe Length (mm)	
0°	2,209.0
90°	2,210.0
180°	2,208.0
270°	2,205.0
Average:	2,208.0

Circumference (mm)	
End A	1,021
End B	1,021

Diameter Measurement (mm)				
Station	Angle			
	0°-180°	45°-225°	90°-270°	135°-315°
1	324.383	324.180	324.206	324.231
2	324.612	324.612	324.612	324.714
3	324.434	324.358	324.206	324.409



Ultrasonic Probe Measurement	
Probe Calibration	
0.200" gauge block reading:	
0.500" gauge block reading:	



Wall Thickness Measurement (mm)			
Angle	Station 1	Station 2	Station 3
0°	12.954	12.649	12.802
45°	12.675	12.573	12.573
90°	12.649	12.649	12.573
135°	12.649	12.675	12.573
180°	12.624	12.598	12.573
225°	12.624	12.598	12.598
270°	12.624	12.624	12.624
315°	12.624	12.649	12.598
Average	12.68	12.63	12.61
Overall average		12.64	

C-FER Technologies	Pre-test Measurements Taken By: WM/LS	Date: 28-Mar-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 28-Mar-08	**1.12**

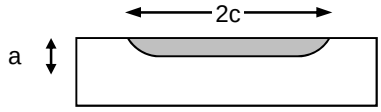
Specimen Measurements Before Testing

Gauge Length (mm)								
Location	0°	45°	90°	135°	180°	225°	270°	315°
LTU			156				156	
LTF		612				609		
LMU	155		153		156		158	
LBF				610				609
LBU			153				157	
CTF		8				8		
CBF				8				8

Average OD (mm)	324.41
Average ID (mm)	299.13
ID Area (mm^2)	70,278
Gross Area (mm^2)	12,380

C-FER Technologies	Pre-test Measurements Taken By: WM/LS	Date: 28-Mar-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 28-Mar-08	**1.12**

Specimen Measurements Before Testing

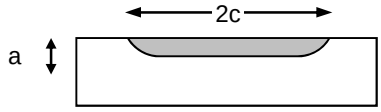


Defect Size (mm) F1-45			
Length	2c	49.67	
Depth	a_1	1.34	
	a_2	2.00	
	a_3	3.14	average depth = 3.10
	a_4	3.10	
	a_5	3.09	
	a_6	3.13	
	a_7	3.01	
	a_8	3.15	
	a_9	1.81	
	a_{10}	1.41	
Defect Area (mm^2)		127.96	
Scribe Offset	N/A		

Defect Size (mm) F2-135			
Length	2c	51.20	
Depth	a_1	1.42	
	a_2	2.04	
	a_3	3.01	average depth = 3.06
	a_4	3.02	
	a_5	3.14	
	a_6	3.13	
	a_7	2.99	
	a_8	3.04	
	a_9	1.95	
	a_{10}	1.45	
Defect Area (mm^2)		130.82	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: WM/LS	Date: 28-Mar-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 28-Mar-08	**1.12**

Specimen Measurements Before Testing



Defect Size (mm) F3-225			
Length	2c	50.42	
Depth	a_1	1.32	
	a_2	1.88	
	a_3	2.97	average depth = 2.98
	a_4	2.92	
	a_5	2.94	
	a_6	3.08	
	a_7	2.94	
	a_8	3.01	
	a_9	1.90	
	a_{10}	1.58	
Defect Area (mm^2)		125.43	
Scribe Offset	N/A		

Defect Size (mm) F4-315			
Length	2c	50.12	
Depth	a_1	1.37	
	a_2	2.03	
	a_3	3.06	average depth = 3.08
	a_4	3.06	
	a_5	3.12	
	a_6	3.07	
	a_7	3.14	
	a_8	3.02	
	a_9	1.80	
	a_{10}	1.56	
Defect Area (mm^2)		128.41	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: WM/LS	Date: 28-Mar-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 28-Mar-08	**1.12**

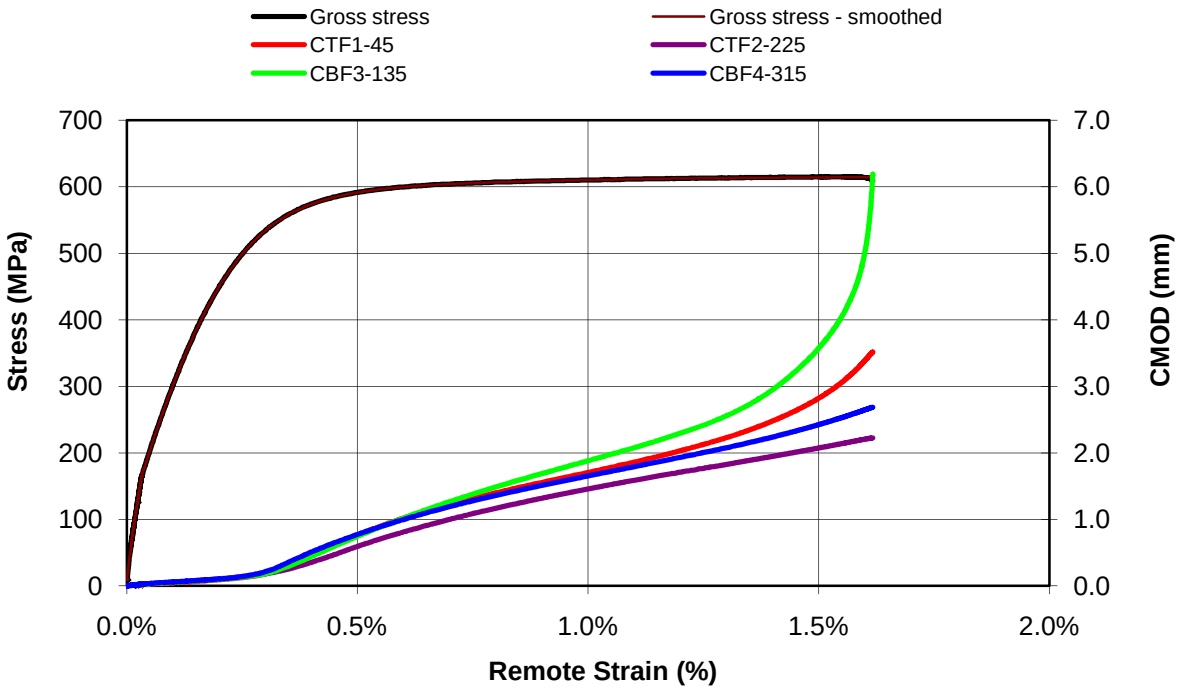
Test Summary Sheet

Spec. No. **1.13** Test type **12" NPS**

Specimen Details		
Pipe Diameter, OD	324.5	mm
Wall thickness, t	12.69	mm
Type	High Y/T	
Grade	X65	
SMYS	448	MPa
SMTS	531	MPa
F yield (hoop | axial)	509 | 547	MPa
F tensile (hoop | axial)	588 | 593	MPa
Test temperature	-20	ºC
Test pressure	30.20	MPa
Specimen length, L1	2,725	mm
Target flaw size	3 x 50	mm
Number of Flaws	4 (2 per cross-section)	
Target flaw location	HAZ	

	Load Peak	End Point	
Total Load	7,637	7,570	kN
Gross Stress	614.3	608.9	MPa
Strain LTU	1.60%	1.62%	
Strain LMU	1.61%	1.64%	
Strain LBU	1.55%	1.58%	
Strain LTMBU	1.59%	1.62%	
CMOD	4.77	6.17	mm

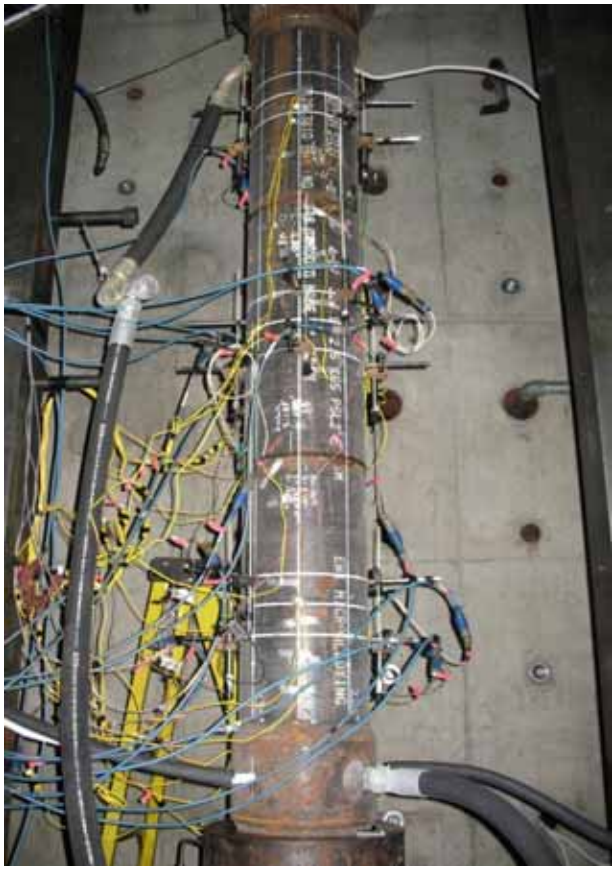
Strain Notation:
Strain LTU: avg. strain in uniform strain zone of top weld can (LTU series LVDTs)
Strain LMU: avg. strain in uniform strain zone of middle weld can (LMU series LVDTs)
Strain LBU: avg. strain in uniform strain zone of bottom weld can (LBU series LVDTs)
Strain LTMBU: avg. strain in uniform strain zones of all weld cans (LTU, LMU and LBU series LVDTs)



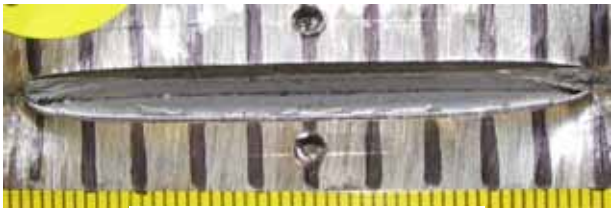
**Average strain from LVDTs in uniform strain zones of all weld cans (i.e. LTMBU strain)*

C-FER Technologies	Pre-test Measurements Taken By: LS	Date: 4-Dec-08	PRCI/DOT
	Approval for Testing: RTP	Date: 4-Dec-08	1.13

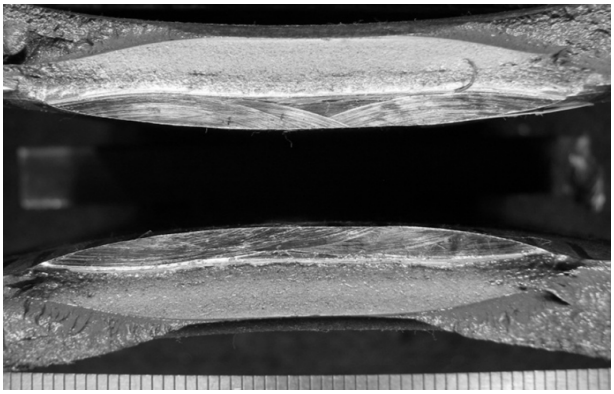
Photographs



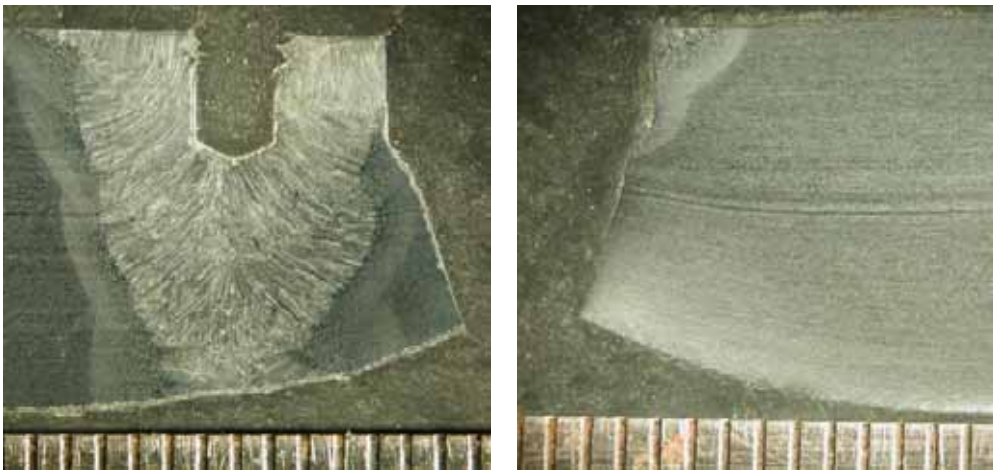
Test Set-up



135º Flaw After Testing



135º Flaw Fracture Surface



135º Flaw Macro Images

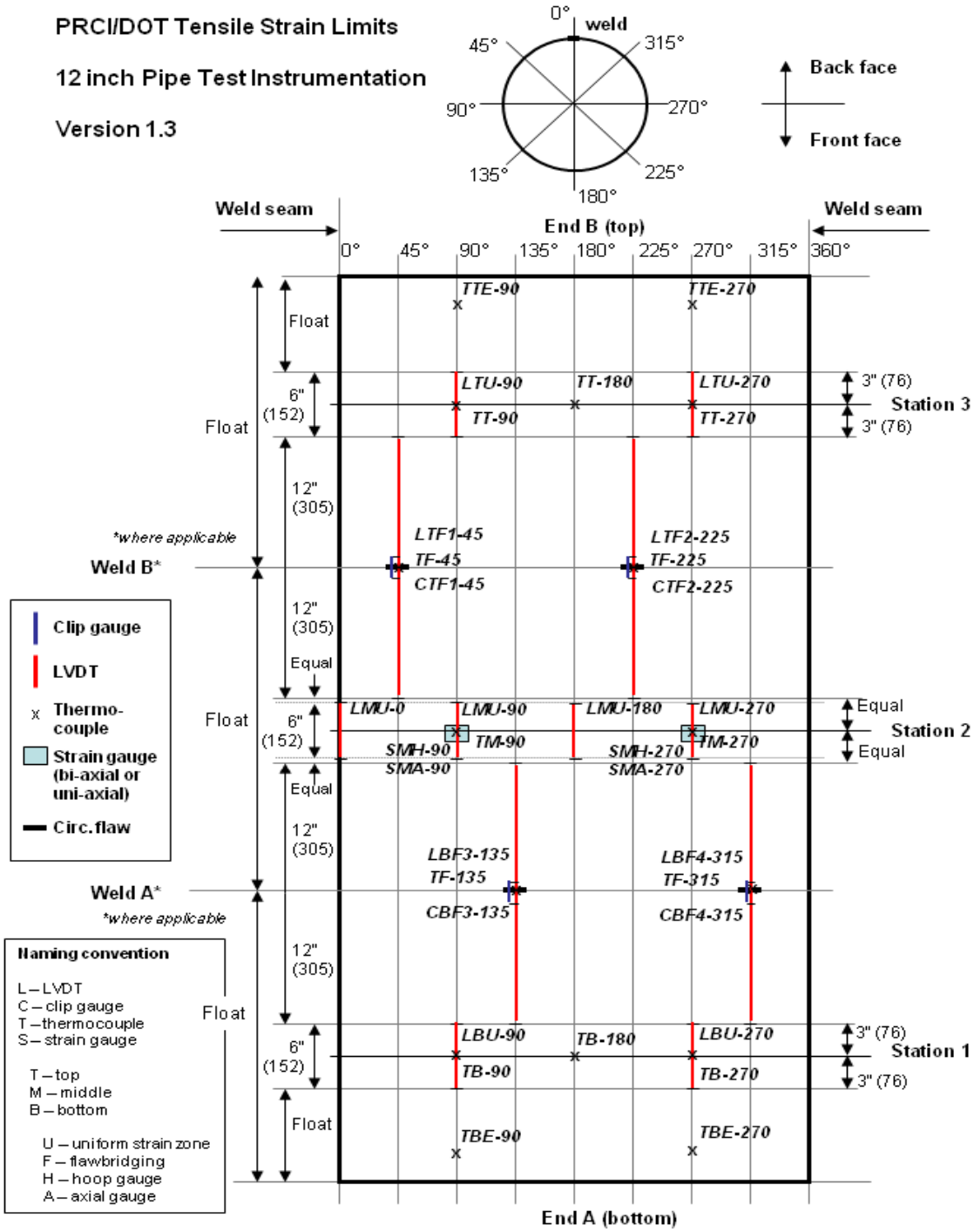
C-FER Technologies	Pre-test Measurements Taken By: LS	Date: 4-Dec-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 4-Dec-08	**1.13**

Instrumentation Layout

PRCI/DOT Tensile Strain Limits

12 inch Pipe Test Instrumentation

Version 1.3



C-FER Technologies	Pre-test Measurements Taken By: LS	Date: 4-Dec-08	PRCI/DOT
	Approval for Testing: RTP	Date: 4-Dec-08	1.13

Specimen Measurements Before Testing

Distance from Scan to Seam

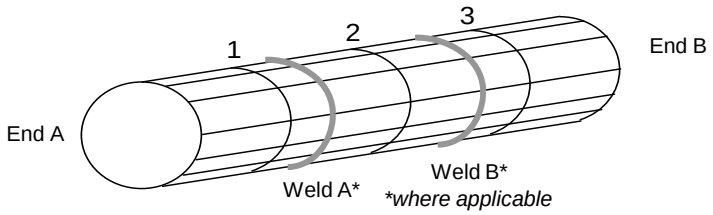
Weld Number

Weld A	776-CI
Weld B	776-CJ

Weld Letter Label

Weld A

Weld B

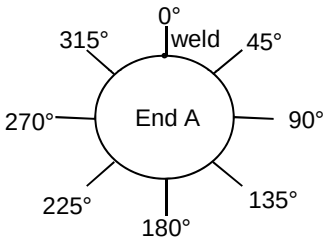


Distance Between Stations (mm)	
End A to 1	605
1 to 2	773
2 to 3	773
3 to End B	573
End A to Weld A	984
Weld A to Weld B	785
Weld B to End B	954

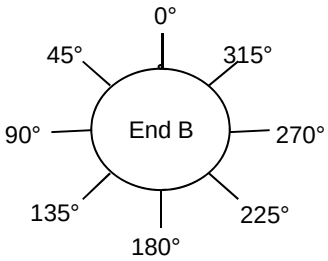
Pipe Length (mm)	
0°	2,723.0
90°	2,726.0
180°	2,725.0
270°	2,724.0
Average:	2,724.5

Circumference (mm)	
End A	1,019
End B	1,020

Diameter Measurement (mm)				
Station	Angle			
	0°-180°	45°-225°	90°-270°	135°-315°
1	324.587	324.663	324.383	324.561
2	324.688	324.485	324.587	324.587
3	324.688	324.434	324.333	324.104



Ultrasonic Probe Measurement	
Probe Calibration	
0.200" gauge block reading:	
0.500" gauge block reading:	



Wall Thickness Measurement (mm)			
Angle	Station 1	Station 2	Station 3
0°	12.830	12.760	12.950
45°	12.760	12.710	12.650
90°	12.780	12.740	12.680
135°	12.660	12.750	12.710
180°	12.720	12.650	12.600
225°	12.550	12.550	12.610
270°	12.680	12.640	12.660
315°	12.620	12.650	12.660
Average	12.70	12.68	12.69
Overall average		12.69	

C-FER Technologies	Pre-test Measurements Taken By: LS	Date: 4-Dec-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 4-Dec-08	**1.13**

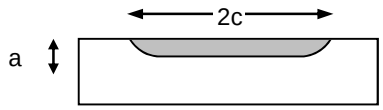
Specimen Measurements Before Testing

Gauge Length (mm)								
Location	0°	45°	90°	135°	180°	225°	270°	315°
LTU			152				152	
LTF		611				611		
LMU	147		152		176		151	
LBF				609				605
LBU			152				154	
CTF		8				8		
CBF				8				8

Average OD (mm)	324.51
Average ID (mm)	299.13
ID Area (mm^2)	70,275
Gross Area (mm^2)	12,432

C-FER Technologies	Pre-test Measurements Taken By: LS	Date: 4-Dec-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 4-Dec-08	**1.13**

Specimen Measurements Before Testing

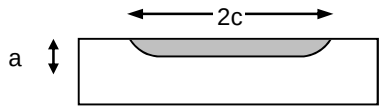


Defect Size (mm) F1-45			
Length	2c	50.81	
Depth	a_1	1.40	
	a_2	1.82	
	a_3	3.07	average depth = 3.02
	a_4	2.95	
	a_5	3.13	
	a_6	3.11	
	a_7	2.91	
	a_8	2.94	
	a_9	1.92	
	a_{10}	1.38	
Defect Area (mm^2)		128.21	
Scribe Offset	N/A		

Defect Size (mm) F2-135			
Length	2c	50.92	
Depth	a_1	1.32	
	a_2	1.88	
	a_3	2.93	average depth = 3.03
	a_4	3.00	
	a_5	3.03	
	a_6	3.04	
	a_7	3.08	
	a_8	3.11	
	a_9	1.79	
	a_{10}	1.44	
Defect Area (mm^2)		129.06	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: LS	Date: 4-Dec-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 4-Dec-08	**1.13**

Specimen Measurements Before Testing



Defect Size (mm) F3-225			
Length	2c	49.91	
Depth	a_1	1.50	
	a_2	1.94	
	a_3	3.04	average depth = 2.99
	a_4	2.91	
	a_5	2.97	
	a_6	3.01	
	a_7	3.07	
	a_8	2.91	
	a_9	1.95	
	a_{10}	1.56	
Defect Area (mm^2)		124.23	
Scribe Offset	N/A		

Defect Size (mm) F4-315			
Length	2c	50.33	
Depth	a_1	1.32	
	a_2	1.86	
	a_3	3.00	average depth = 3.07
	a_4	3.12	
	a_5	3.15	
	a_6	2.96	
	a_7	3.11	
	a_8	3.06	
	a_9	1.87	
	a_{10}	1.52	
Defect Area (mm^2)		128.61	
Scribe offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: LS	Date: 4-Dec-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 4-Dec-08	**1.13**

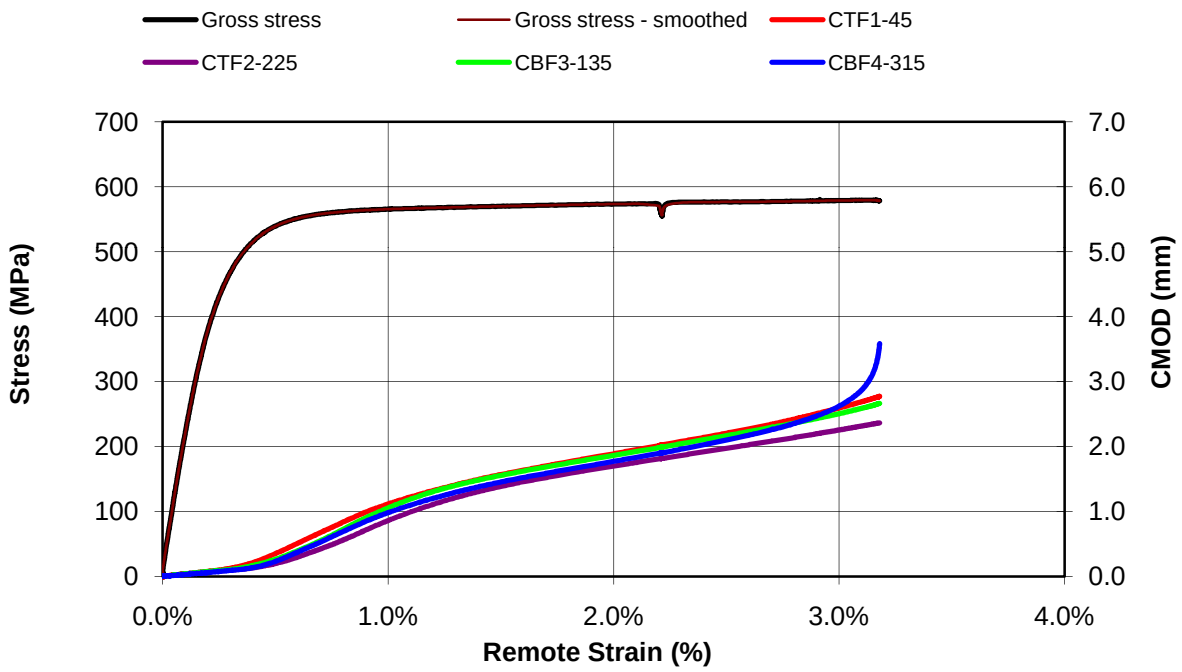
Test Summary Sheet

Spec. No. **1.14** Test type **12" NPS**

Specimen Details		
Pipe Diameter, OD	324.5	mm
Wall thickness, t	12.73	mm
Type	High Y/T	
Grade	X65	
SMYS	448	MPa
SMTS	531	MPa
F yield (hoop | axial)	509 | 547	MPa
F tensile (hoop | axial)	588 | 593	MPa
Test temperature	-20	ºC
Test pressure	0.30	MPa
Specimen length, L1	2,761	mm
Target flaw size	3 x 50	mm
Number of Flaws	4 (2 per cross-section)	
Target flaw location	HAZ	

	Load Peak	End Point	
Total Load	7,220	7,208	kN
Gross Stress	579.3	578.3	MPa
Strain LTU	3.09%	3.14%	
Strain LMU	3.11%	3.17%	
Strain LBU	3.19%	3.24%	
Strain LTMBU	3.12%	3.18%	
CMOD	2.97	3.59	mm

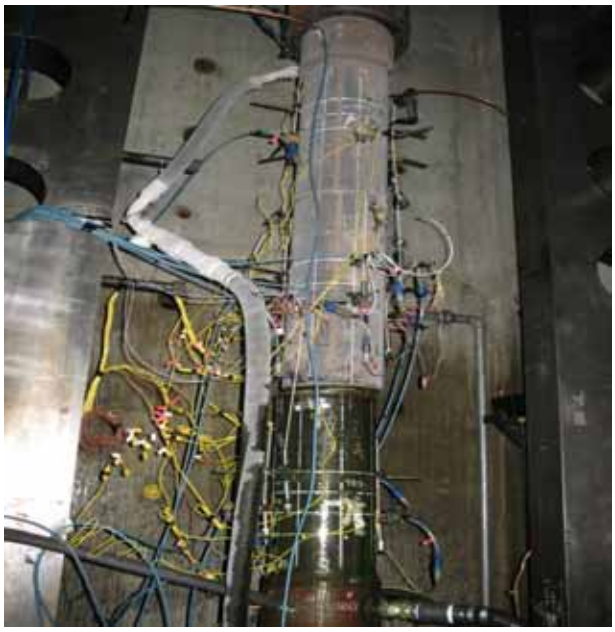
Strain Notation:
Strain LTU: avg. strain in uniform strain zone of top weld can (LTU series LVDTs)
Strain LMU: avg. strain in uniform strain zone of middle weld can (LMU series LVDTs)
Strain LBU: avg. strain in uniform strain zone of bottom weld can (LBU series LVDTs)
Strain LTMBU: avg. strain in uniform strain zones of all weld cans (LTU, LMU and LBU series LVDTs)



**Average strain from LVDTs in uniform strain zones of all weld cans (i.e. LTMBU strain)*

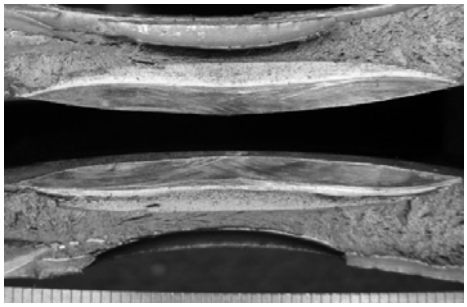
C-FER Technologies	Pre-test Measurements Taken By: LS	Date: 27-Nov-08	PRCI/DOT
	Approval for Testing: RTP	Date: 27-Nov-08	1.14

Photographs



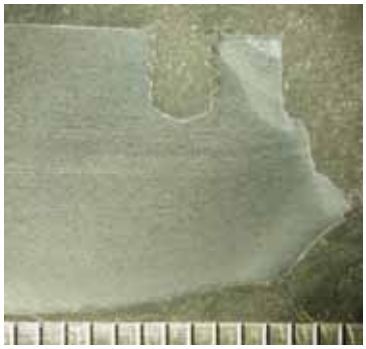
Specimen Failure

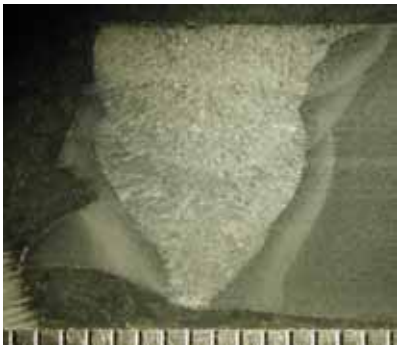
315º Flaw After Testing



315º Flaw Fracture Surface

315º Flaw Fracture Surface - Expanded View





315º Flaw Macro Images

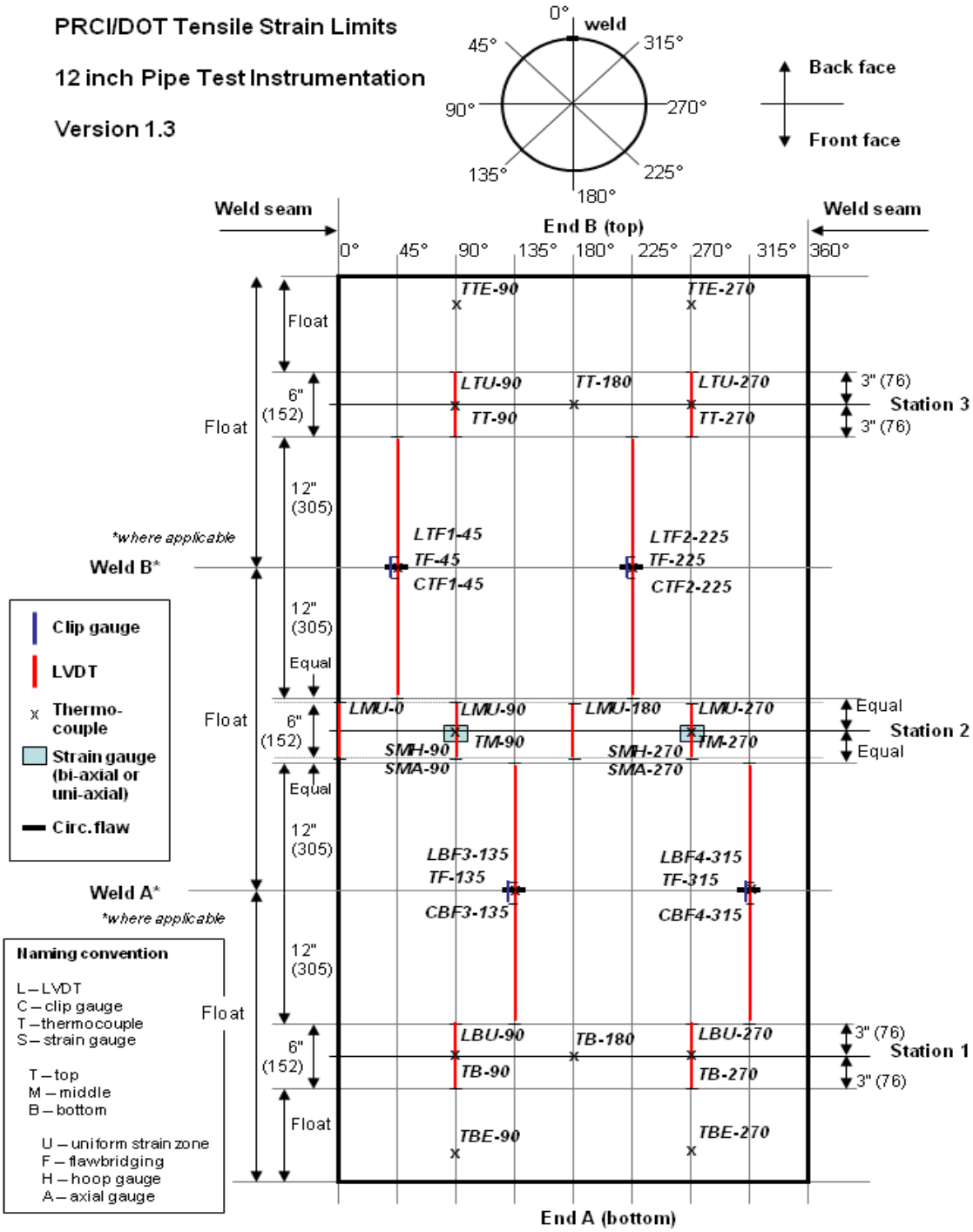
C-FER Technologies	Pre-test Measurements Taken By: LS	Date: 27-Nov-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 27-Nov-08	**1.14**

Instrumentation Layout

PRCI/DOT Tensile Strain Limits

12 inch Pipe Test Instrumentation

Version 1.3



C-FER Technologies	Pre-test Measurements Taken By: LS	Date: 27-Nov-08	PRCI/DOT
	Approval for Testing: RTP	Date: 27-Nov-08	1.14

Specimen Measurements Before Testing

Distance from Scan to Seam

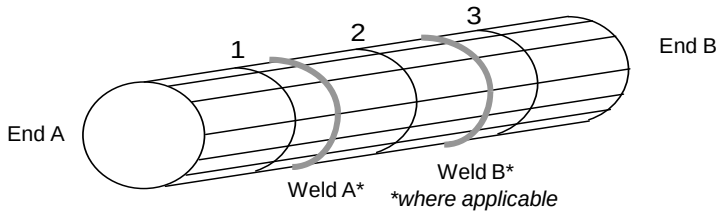
Weld Number

Weld A	776-CR
Weld B	776-CQ

Weld Letter Label

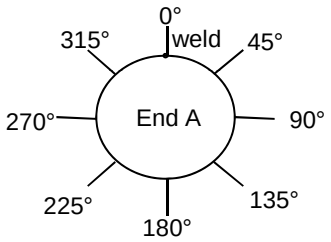
Weld A

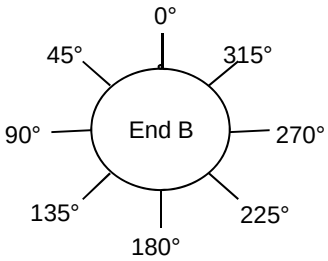
Weld B



Distance Between Stations (mm)	
End A to 1	599
1 to 2	784
2 to 3	783
3 to End B	595
End A to Weld A	981
Weld A to Weld B	804
Weld B to End B	975

Circumference (mm)	
End A	1,022
End B	1,022





Pipe Length (mm)	
0°	2,760.0
90°	2,760.0
180°	2,761.0
270°	2,762.0
Average:	2,760.8

Diameter Measurement (mm)

Station	Angle			
	0°-180°	45°-225°	90°-270°	135°-315°
1	324.612	324.587	324.383	324.231
2	324.510	324.612	324.587	324.180
3	324.561	324.612	324.358	324.307

Ultrasonic Probe Measurement	
Probe Calibration	
0.200" gauge block reading:	
0.500" gauge block reading:	

Wall Thickness Measurement (mm)

Angle	Station 1	Station 2	Station 3
0°	13.010	13.050	12.960
45°	12.640	12.610	12.650
90°	12.780	12.720	12.780
135°	12.660	12.710	12.680
180°	12.620	12.670	12.720
225°	12.690	12.720	12.660
270°	12.730	12.700	12.730
315°	12.680	12.640	12.620
Average	12.73	12.73	12.73
Overall average		12.73	

C-FER Technologies	Pre-test Measurements Taken By: LS	Date: 27-Nov-08	PRCI/DOT
	Approval for Testing: RTP	Date: 27-Nov-08	1.14

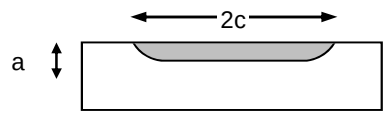
Specimen Measurements Before Testing

Gauge Length (mm)								
Location	0°	45°	90°	135°	180°	225°	270°	315°
LTU			152				150	
LTF		607				610		
LMU	152		153		153		154	
LBF				609				610
LBU			152				154	
CTF		8				8		
CBF				8				8

Average OD (mm)	324.46
Average ID (mm)	299.01
ID Area (mm^2)	70,220
Gross Area (mm^2)	12,463

C-FER Technologies	Pre-test Measurements Taken By: LS	Date: 27-Nov-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 27-Nov-08	**1.14**

Specimen Measurements Before Testing

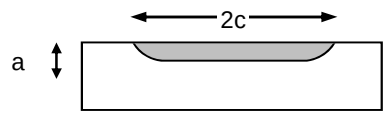


Defect Size (mm) F1-45			
Length	2c	50.17	
Depth	a_1	1.58	
	a_2	1.88	
	a_3	3.08	average depth = 3.05
	a_4	3.03	
	a_5	3.05	
	a_6	3.07	
	a_7	3.07	
	a_8	3.01	
	a_9	1.83	
	a_{10}	1.50	
Defect Area (mm^2)		127.55	
Scribe Offset	N/A		

Defect Size (mm) F2-135			
Length	2c	50.10	
Depth	a_1	1.57	
	a_2	2.01	
	a_3	3.13	average depth = 3.03
	a_4	2.96	
	a_5	2.99	
	a_6	2.93	
	a_7	3.08	
	a_8	3.10	
	a_9	1.83	
	a_{10}	1.36	
Defect Area (mm^2)		126.57	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: LS	Date: 27-Nov-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 27-Nov-08	**1.14**

Specimen Measurements Before Testing



Defect Size (mm) F3-225		
Length	2c	49.88
Depth	a_1	1.48
	a_2	1.96
	a_3	3.11
	a_4	2.95
	a_5	2.93
	a_6	2.93
	a_7	3.00
	a_8	3.06
	a_9	2.05
	a_{10}	1.47
Defect Area (mm^2)		124.58
Scribe Offset	N/A	

average depth = 3.00

Defect Size (mm) F4-315		
Length	2c	50.49
Depth	a_1	1.55
	a_2	1.98
	a_3	3.05
	a_4	3.05
	a_5	2.97
	a_6	3.07
	a_7	3.12
	a_8	2.92
	a_9	1.76
	a_{10}	1.47
Defect Area (mm^2)		127.69
Scribe Offset	N/A	

average depth = 3.03

C-FER Technologies	Pre-test Measurements Taken By: LS	Date: 27-Nov-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 27-Nov-08	**1.14**

Test Summary Sheet

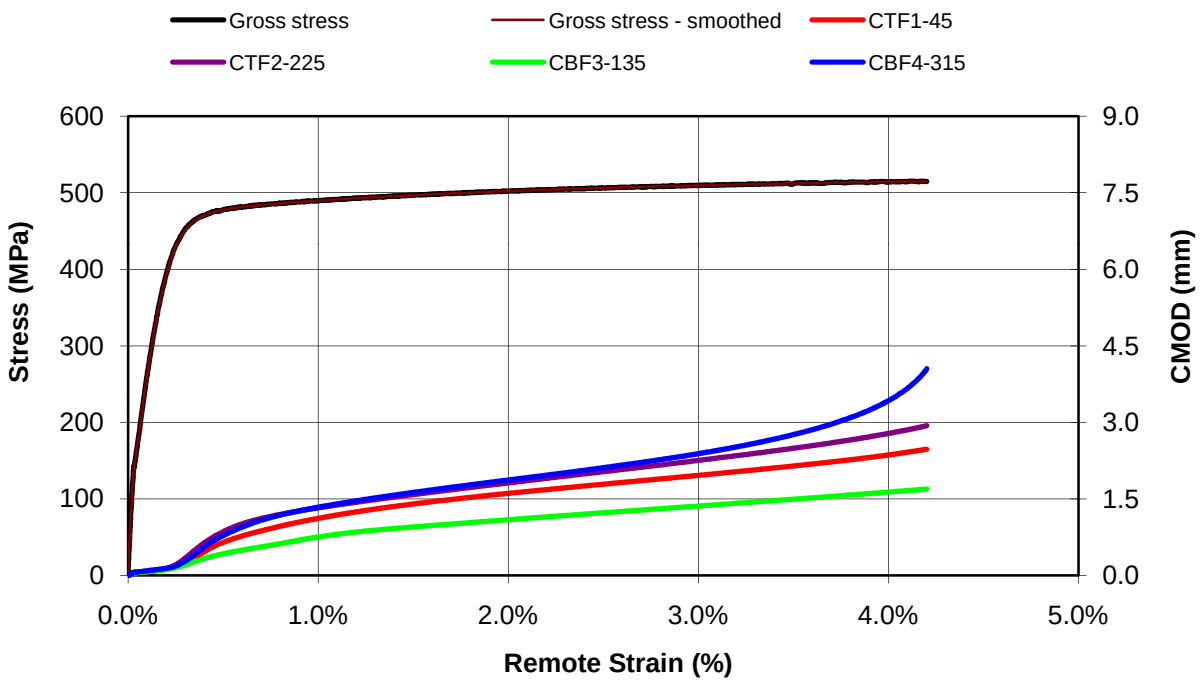
Spec. No. **1.15** Test type **12" NPS**

Test terminated prematurely due to end cap weld failure.

Specimen Details		
Pipe Diameter, OD	323.8	mm
Wall thickness, t	12.49	mm
Type	Low Y/T	
Grade	X65	
SMYS	448	MPa
SMTS	531	MPa
F yield (hoop | axial)	437 | 421	MPa
F tensile (hoop | axial)	491 | 479	MPa
Test temperature	19	ºC
Test pressure	24.20	MPa
Specimen length, L1	2,236	mm
Target flaw size	3 x 50	mm
Number of Flaws	4 (2 per cross-section)	
Target flaw location	HAZ	

	Load Peak	End Point	
Total Load		6,286	kN
Gross Stress		514.7	MPa
Strain LTU		4.51%	
Strain LMU		4.15%	
Strain LBU		4.00%	
Strain LTMBU		4.20%	
CMOD		4.05	mm

Strain Notation:
Strain LTU: avg. strain in uniform strain zone of top weld can (LTU series LVDTs)
Strain LMU: avg. strain in uniform strain zone of middle weld can (LMU series LVDTs)
Strain LBU: avg. strain in uniform strain zone of bottom weld can (LBU series LVDTs)
Strain LTMBU: avg. strain in uniform strain zones of all weld cans (LTU, LMU and LBU series LVDTs)



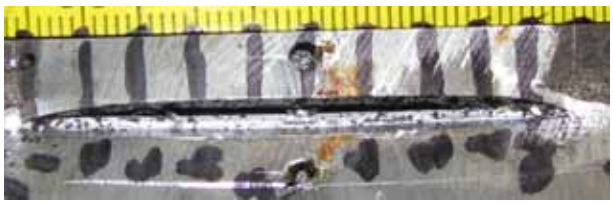
**Average strain from LVDTs in uniform strain zones of all weld cans (i.e. LTMBU strain)*

C-FER Technologies	Pre-test Measurements Taken By: LS/WM	Date: 1-Apr-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 1-Apr-08	**1.15**

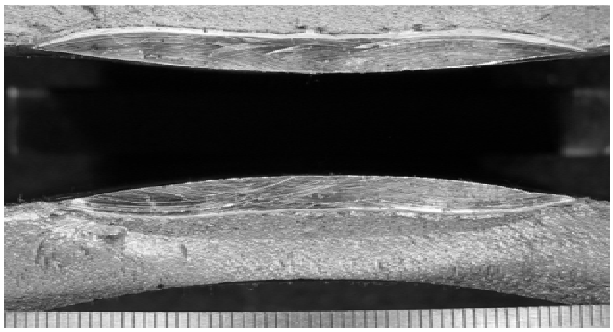
Photographs

Test Set-up

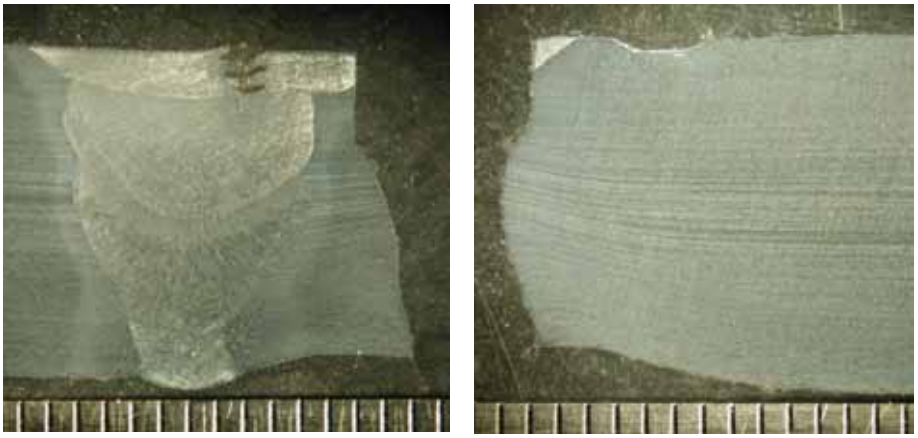
315º Flaw Before Testing



315º Flaw After Testing



315º Flaw Fracture Surface



315º Flaw Macro Images

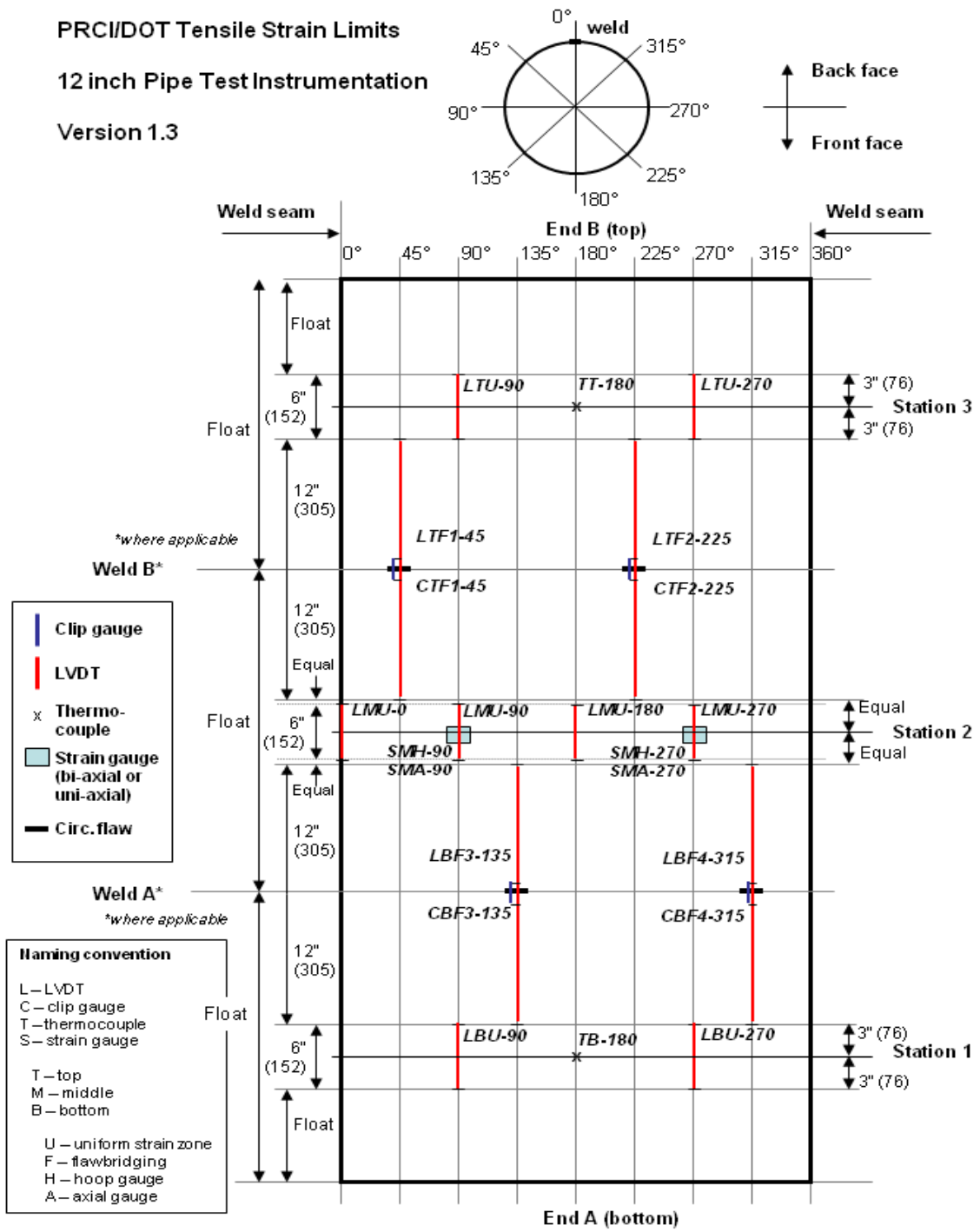
C-FER Technologies	Pre-test Measurements Taken By: LS/WM	Date: 1-Apr-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 1-Apr-08	**1.15**

Instrumentation Layout

PRCI/DOT Tensile Strain Limits

12 inch Pipe Test Instrumentation

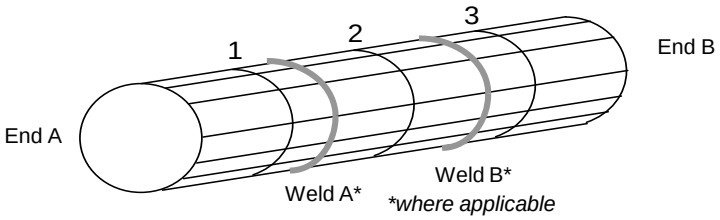
Version 1.3



C-FER Technologies	Pre-test Measurements Taken By: LS/WM	Date: 1-Apr-08	PRCI/DOT
	Approval for Testing: RTP	Date: 1-Apr-08	1.15

Specimen Measurements Before Testing

Distance from Scan to Seam
140 mm
Weld Number
Weld A 776-BG
Weld B 776-AW
Weld Letter Label
Weld A
Weld B

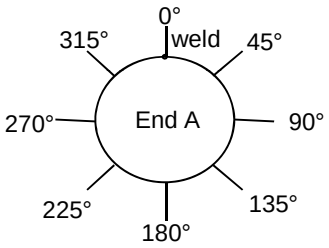


Distance Between Stations (mm)	
End A to 1	323
1 to 2	795
2 to 3	792
3 to End B	328
End A to Weld A	702
Weld A to Weld B	824
Weld B to End B	708

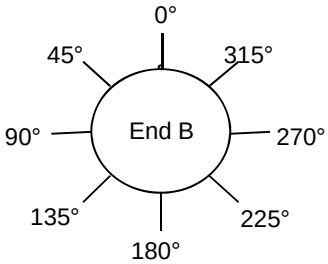
Pipe Length (mm)	
0°	2,234.5
90°	2,236.5
180°	2,238.5
270°	2,232.5
Average:	2,235.5

Circumference (mm)	
End A	1,020
End B	1,020

Diameter Measurement (mm)				
Station	Angle			
	0°-180°	45°-225°	90°-270°	135°-315°
1	323.875	323.647	323.672	323.901
2	323.723	323.799	323.672	323.926
3	323.952	323.952	323.672	324.002



Ultrasonic Probe Measurement	
Probe Calibration	
0.200" gauge block reading:	
0.500" gauge block reading:	



Wall Thickness Measurement (mm)			
Angle	Station 1	Station 2	Station 3
0°	12.624	12.497	12.548
45°	12.395	12.370	12.395
90°	12.471	12.471	12.446
135°	12.548	12.471	12.573
180°	12.522	12.522	12.446
225°	12.624	12.548	12.573
270°	12.471	12.446	12.446
315°	12.421	12.446	12.395
Average	12.51	12.47	12.48
Overall average		12.49	

C-FER Technologies	Pre-test Measurements Taken By: LS/WM	Date: 1-Apr-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 1-Apr-08	**1.15**

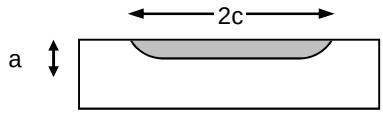
Specimen Measurements Before Testing

Gauge Length (mm)								
Location	0°	45°	90°	135°	180°	225°	270°	315°
LTU			153				154	
LTF		611				610		
LMU	156		153		153		154	
LBF				609				610
LBU			154				153	
CTF		8				8		
CBF				8				8

Average OD (mm)	323.82
Average ID (mm)	298.84
ID Area (mm^2)	70,142
Gross Area (mm^2)	12,212

C-FER Technologies	Pre-test Measurements Taken By: LS/WM	Date: 1-Apr-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 1-Apr-08	**1.15**

Specimen Measurements Before Testing

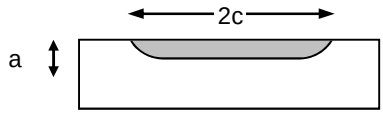


Defect Size (mm) F1-45			
Length	2c	49.98	
Depth	a_1	1.53	
	a_2	2.04	
	a_3	3.05	average depth = 3.02
	a_4	3.11	
	a_5	2.93	
	a_6	2.93	
	a_7	3.05	
	a_8	3.07	
	a_9	1.99	
	a_{10}	1.35	
Defect Area (mm^2)		125.89	
Scribe Offset	N/A		

Defect Size (mm) F2-135			
Length	2c	50.87	
Depth	a_1	1.33	
	a_2	1.94	
	a_3	3.15	average depth = 3.04
	a_4	3.02	
	a_5	3.11	
	a_6	2.97	
	a_7	2.91	
	a_8	3.05	
	a_9	2.03	
	a_{10}	1.55	
Defect Area (mm^2)		129.04	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: LS/WM	Date: 1-Apr-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 1-Apr-08	**1.15**

Specimen Measurements Before Testing



Defect Size (mm) F3-225			
Length	2c	50.64	
Depth	a_1	1.53	
	a_2	2.06	
	a_3	3.09	average depth = 3.03
	a_4	2.98	
	a_5	3.13	
	a_6	2.92	
	a_7	3.12	
	a_8	2.92	
	a_9	2.07	
	a_{10}	1.33	
Defect Area (mm^2)		128.02	
Scribe Offset	N/A		

Defect Size (mm) F4-315			
Length	2c	49.12	
Depth	a_1	1.43	
	a_2	1.86	
	a_3	3.13	average depth = 3.05
	a_4	3.07	
	a_5	2.97	
	a_6	2.95	
	a_7	3.13	
	a_8	3.06	
	a_9	2.05	
	a_{10}	1.51	
Defect Area (mm^2)		124.35	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: LS/WM	Date: 1-Apr-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 1-Apr-08	**1.15**

Test Summary Sheet

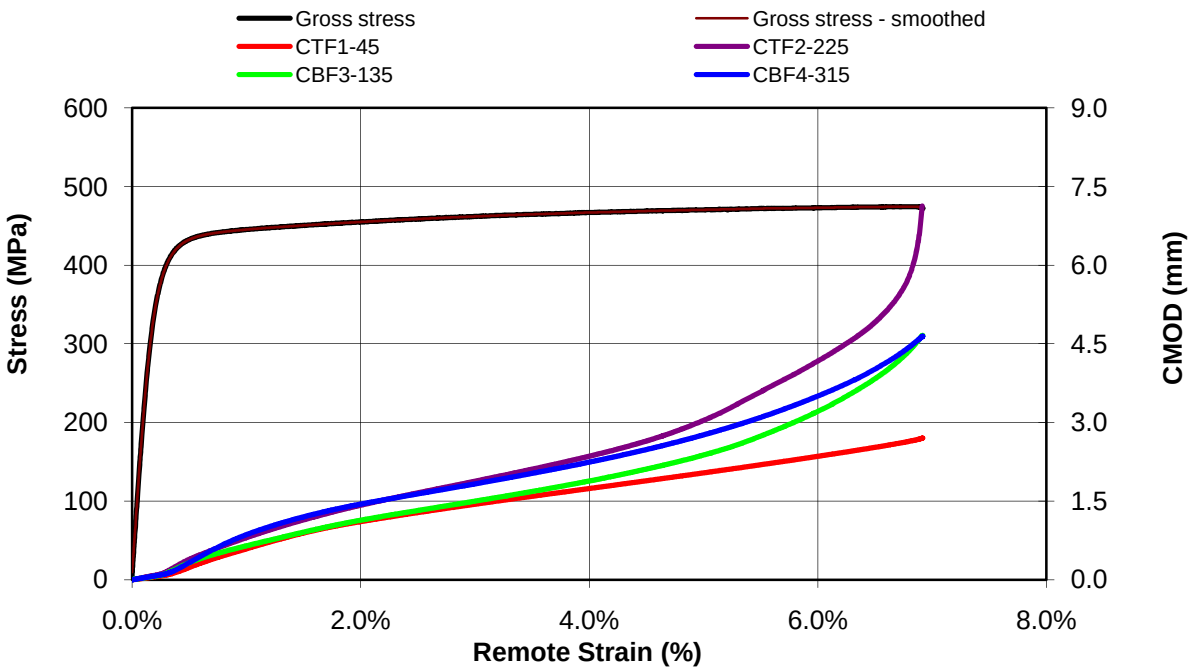
Spec. No. **1.16** Test type **12" NPS**

Specimen Details		
Pipe Diameter, OD	323.7	mm
Wall thickness, t	12.55	mm
Type	Low Y/T	
Grade	X65	
SMYS	448	MPa
SMTS	531	MPa
F yield (hoop | axial)	437 | 421	MPa
F tensile (hoop | axial)	491 | 479	MPa
Test temperature	25	ºC
Test pressure	0.34	MPa
Specimen length, L1	2,227	mm
Target flaw size	3 x 50	mm
Number of Flaws	4 (2 per cross-section)	
Target flaw location	HAZ	

	Load Peak	End Point	
Total Load	5,819	5,795	kN
Gross Stress	474.4	472.5	MPa
Strain LTU	6.11%	6.21%	
Strain LMU	7.25%	7.37%	
Strain LBU	6.63%	6.72%	
Strain LTMBU	6.81%	6.92%	
CMOD	5.85	> 7.13*	mm

* clip gauge unseated

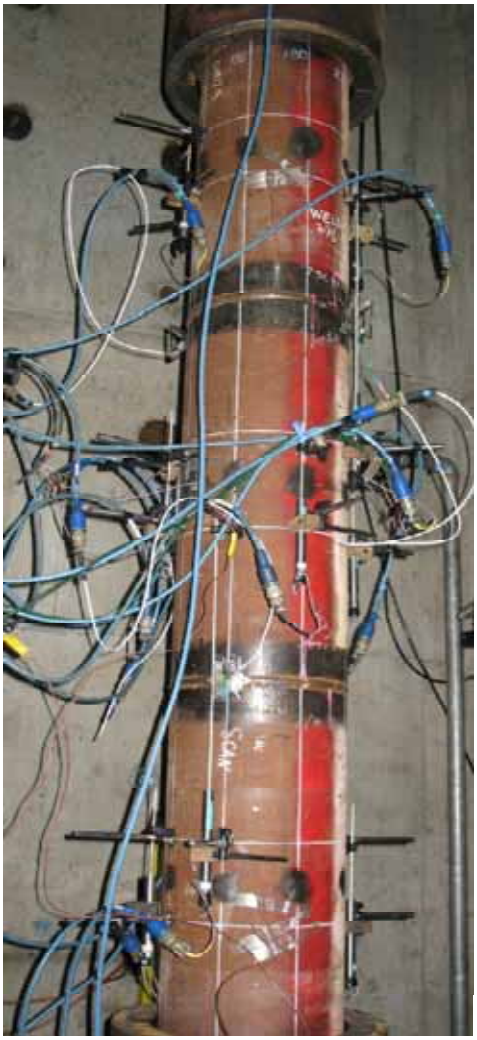
Strain Notation:
Strain LTU: avg. strain in uniform strain zone of top weld can (LTU series LVDTs)
Strain LMU: avg. strain in uniform strain zone of middle weld can (LMU series LVDTs)
Strain LBU: avg. strain in uniform strain zone of bottom weld can (LBU series LVDTs)
Strain LTMBU: avg. strain in uniform strain zones of all weld cans (LTU, LMU and LBU series LVDTs)



**Average strain from LVDTs in uniform strain zones of all weld cans (i.e. LTMBU strain)*

C-FER Technologies	Pre-test Measurements Taken By: LS/WM	Date: 31-Mar-08	PRCI/DOT
	Approval for Testing: RTP	Date: 31-Mar-08	1.16

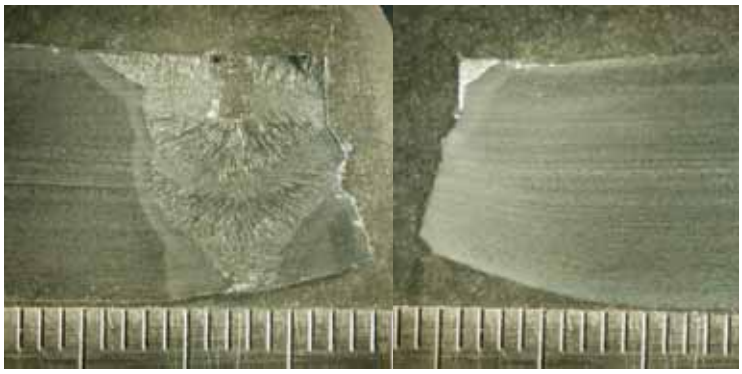
Photographs



Test Set-up

225° Flaw After Testing

225° Flaw Fracture Surface



225° Flaw Macro Images

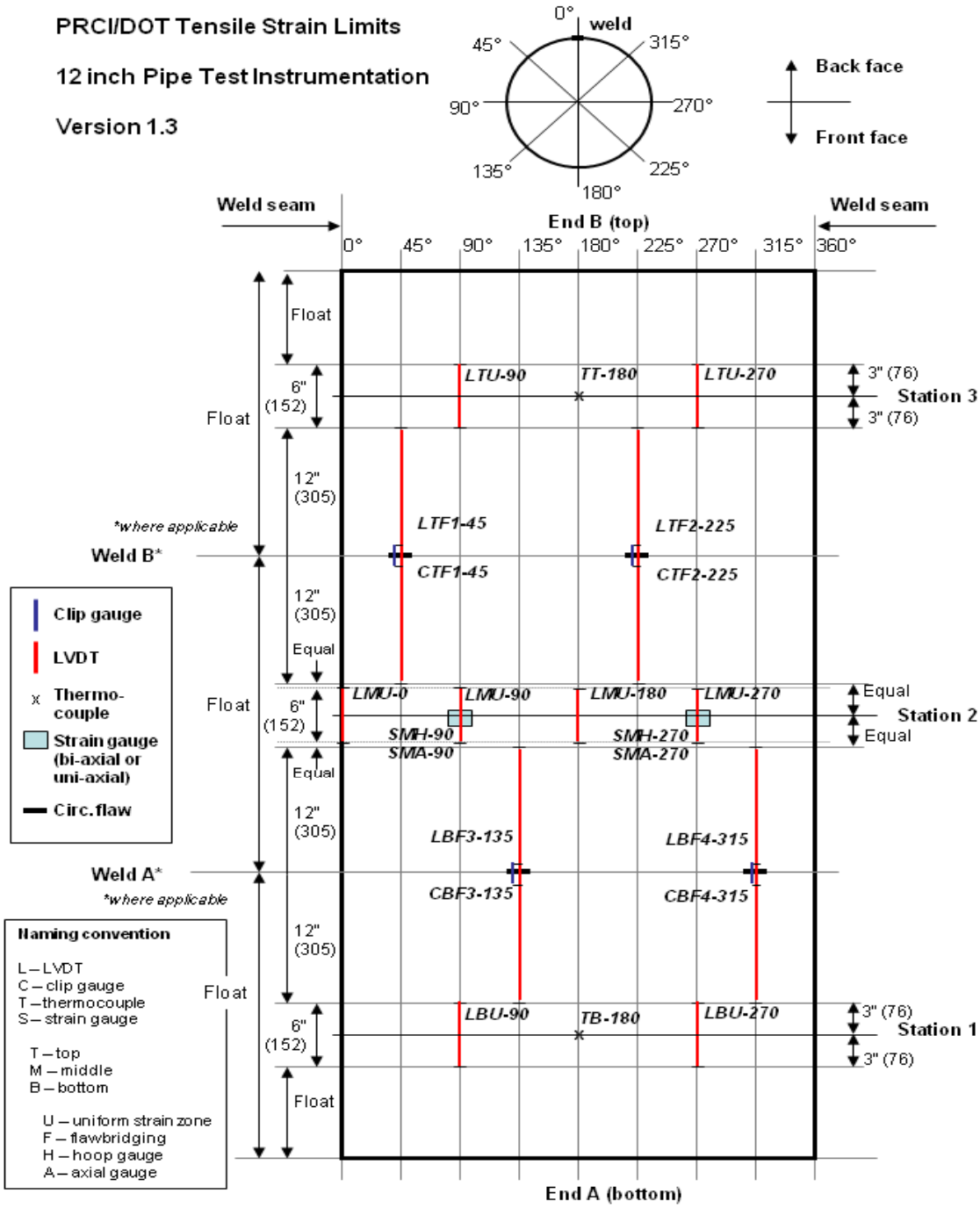
C-FER Technologies	Pre-test Measurements Taken By: LS/WM	Date: 31-Mar-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 31-Mar-08	**1.16**

Instrumentation Layout

PRCI/DOT Tensile Strain Limits

12 inch Pipe Test Instrumentation

Version 1.3



C-FER Technologies	Pre-test Measurements Taken By: LS/WM	Date: 31-Mar-08	PRCI/DOT
	Approval for Testing: RTP	Date: 31-Mar-08	1.16

Specimen Measurements Before Testing

Distance from Scan to Seam

765 mm

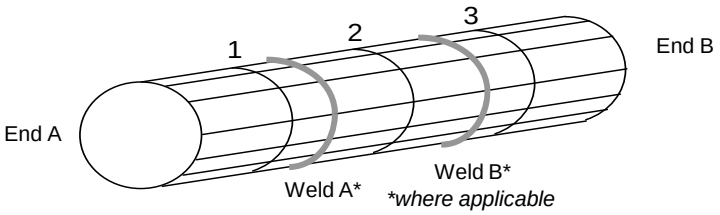
Weld Number

Weld A	776-BI
Weld B	776-BJ

Weld Letter Label

Weld A

Weld B



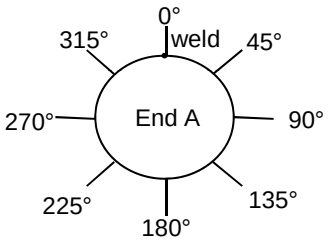
Distance Between Stations (mm)	
End A to 1	323
1 to 2	790
2 to 3	770
3 to End B	326
End A to Weld A	706
Weld A to Weld B	812
Weld B to End B	709

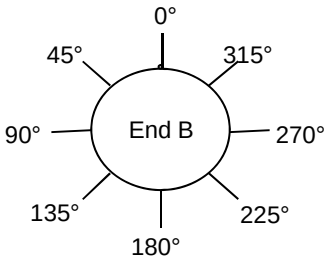
Pipe Length (mm)	
0°	2,227.0
90°	2,229.0
180°	2,227.0
270°	2,226.0
Average:	2,227.3

Circumference (mm)	
End A	1,020
End B	1,020

Diameter Measurement (mm)

Station	Angle			
	0°-180°	45°-225°	90°-270°	135°-315°
1	323.825	323.748	323.825	323.774
2	323.875	323.875	323.596	323.647
3	323.774	323.520	323.672	323.825





Ultrasonic Probe Measurement

Probe Calibration	
0.200" gauge block reading:	
0.500" gauge block reading:	

Wall Thickness Measurement (mm)

Angle	Station 1	Station 2	Station 3
0°	12.573	12.573	12.649
45°	12.522	12.522	12.497
90°	12.497	12.497	12.573
135°	12.598	12.573	12.624
180°	12.522	12.548	12.446
225°	12.598	12.598	12.573
270°	12.471	12.598	12.522
315°	12.497	12.497	12.522
Average	12.53	12.55	12.55
Overall average		12.55	

C-FER Technologies	Pre-test Measurements Taken By: LS/WM	Date: 31-Mar-08	PRCI/DOT
	Approval for Testing: RTP	Date: 31-Mar-08	1.16

Specimen Measurements Before Testing

Gauge Length (mm)								
Location	0°	45°	90°	135°	180°	225°	270°	315°
LTU			152				152	
LTF		609				613		
LMU	157		156		156		155	
LBF				613				610
LBU			154				153	
CTF		8				8		
CBF				8				8

Average OD (mm)	323.75
Average ID (mm)	298.66
ID Area (mm^2)	70,054
Gross Area (mm^2)	12,265

C-FER Technologies	Pre-test Measurements Taken By: LS/WM	Date: 31-Mar-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 31-Mar-08	**1.16**

Specimen Measurements Before Testing

Defect Size (mm) F1-45		
Length	2c	49.81
Depth	a_1	1.35
	a_2	1.84
	a_3	3.04
	a_4	3.03
	a_5	3.04
	a_6	2.93
	a_7	2.93
	a_8	3.06
	a_9	1.80
	a_{10}	1.51
Defect Area (mm^2)		124.69
Scribe Offset	N/A	

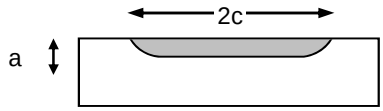
average depth = 3.01

Defect Size (mm) F2-135		
Length	2c	51.03
Depth	a_1	1.44
	a_2	1.97
	a_3	3.14
	a_4	3.15
	a_5	2.92
	a_6	3.01
	a_7	2.96
	a_8	2.95
	a_9	1.82
	a_{10}	1.51
Defect Area (mm^2)		129.00
Scribe Offset	N/A	

average depth = 3.02

C-FER Technologies	Pre-test Measurements Taken By: LS/WM	Date: 31-Mar-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 31-Mar-08	**1.16**

Specimen Measurements Before Testing



Defect Size (mm) F3-225			
Length	2c	50.64	
Depth	a_1	1.42	
	a_2	2.06	
	a_3	2.91	average depth = 3.00
	a_4	2.95	
	a_5	3.01	
	a_6	2.93	
	a_7	3.13	
	a_8	3.06	
	a_9	1.86	
	a_{10}	1.55	
Defect Area (mm^2)		126.93	
Scribe Offset	N/A		

Defect Size (mm) F4-315			
Length	2c	50.82	
Depth	a_1	1.49	
	a_2	1.85	
	a_3	2.91	average depth = 3.04
	a_4	3.10	
	a_5	2.93	
	a_6	3.14	
	a_7	3.14	
	a_8	2.99	
	a_9	2.07	
	a_{10}	1.37	
Defect Area (mm^2)		128.89	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: LS/WM	Date: 31-Mar-08	**PRCI/DOT**
	Approval for Testing: RTP	Date: 31-Mar-08	**1.16**

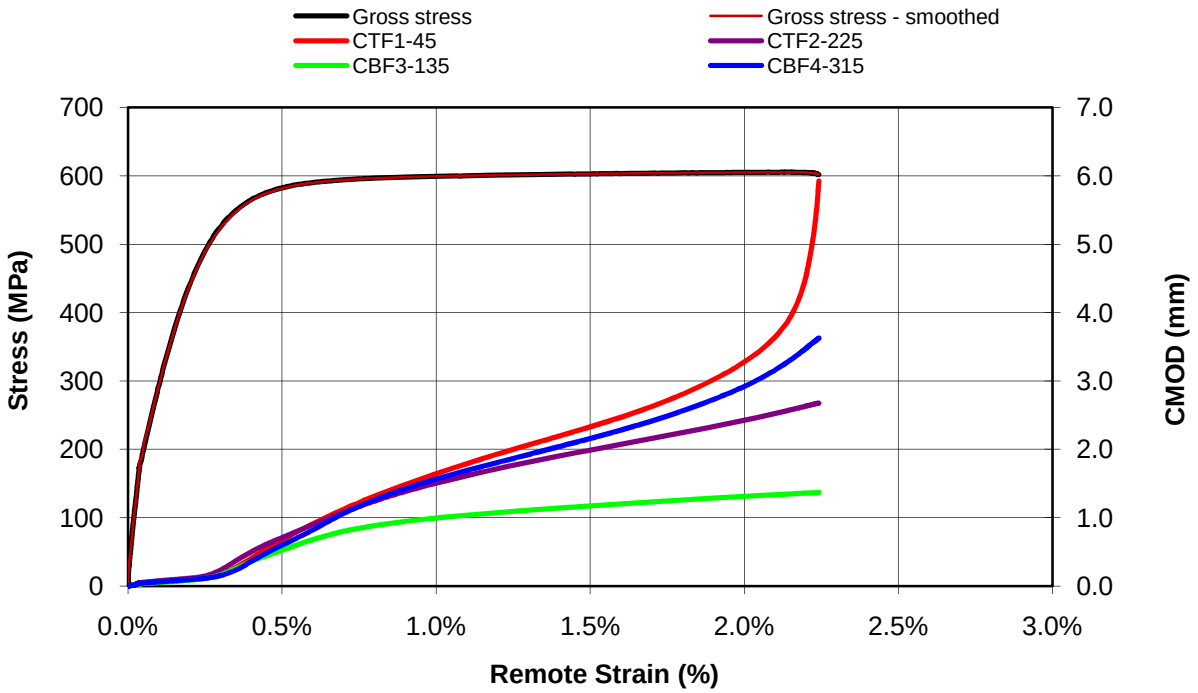
Test Summary Sheet

Spec. No. **1.17** Test type **12" NPS**

Specimen Details		
Pipe Diameter, OD	324.3	mm
Wall thickness, t	12.62	mm
Type	High Y/T	
Grade	X65	
SMYS	448	MPa
SMTS	531	MPa
F yield (hoop | axial)	509 | 547	MPa
F tensile (hoop | axial)	588 | 593	MPa
Test temperature	22	ºC
Test pressure	30.20	MPa
Specimen length, L1	2,247	mm
Target flaw size	3 x 50	mm
Number of Flaws	4 (2 per cross-section)	
Target flaw location	Weld Metal	

	Load Peak	End Point	
Total Load	7,479	7,434	kN
Gross Stress	605.4	601.7	MPa
Strain LTU	2.10%	2.22%	
Strain LMU	2.14%	2.25%	
Strain LBU	2.14%	2.24%	
Strain LTMBU	2.13%	2.24%	
CMOD	3.80	5.93	mm

Strain Notation:
Strain LTU: avg. strain in uniform strain zone of top weld can (LTU series LVDTs)
Strain LMU: avg. strain in uniform strain zone of middle weld can (LMU series LVDTs)
Strain LBU: avg. strain in uniform strain zone of bottom weld can (LBU series LVDTs)
Strain LTMBU: avg. strain in uniform strain zones of all weld cans (LTU, LMU and LBU series LVDTs)

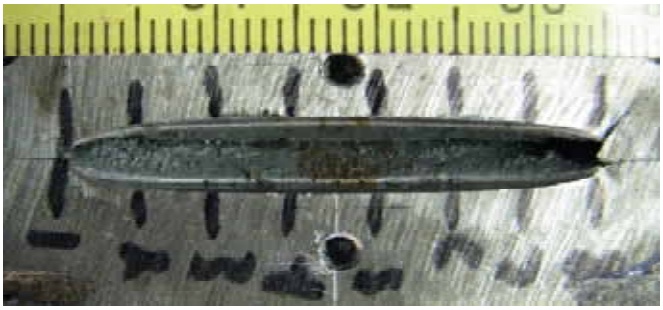


**Average strain from LVDTs in uniform strain zones of all weld cans (i.e. LTMBU strain)*

C-FER Technologies	Pre-test Measurements Taken By: JZW/JAL	Date: 27-Jan-10	PRCI/DOT
	Approval for Testing: RTP	Date: 16-Feb-10	1.17

Photographs

Test Set-up



45° Degree Flaw After Testing

45° Flaw Fracture Surface

45° Flaw Macro Images

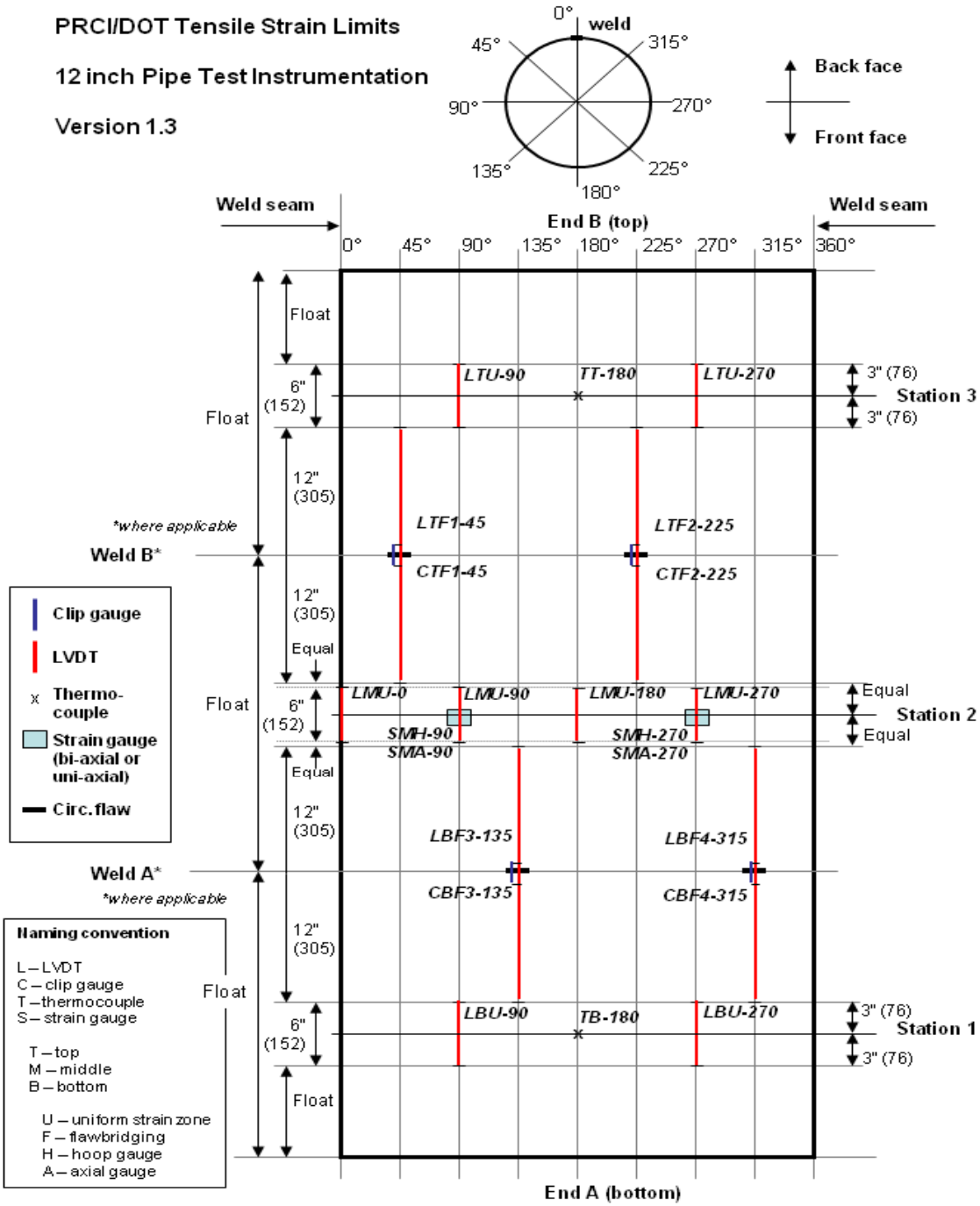
C-FER Technologies	Pre-test Measurements Taken By: JZW/JAL	Date: 27-Jan-10	**PRCI/DOT**
	Approval for Testing: RTP	Date: 16-Feb-10	**1.17**

Instrumentation Layout

PRCI/DOT Tensile Strain Limits

12 inch Pipe Test Instrumentation

Version 1.3



C-FER Technologies	Pre-test Measurements Taken By: JZW/JAL	Date: 27-Jan-10	PRCI/DOT
	Approval for Testing: RTP	Date: 16-Feb-10	1.17

Specimen Measurements Before Testing

Distance from Scan to Seam

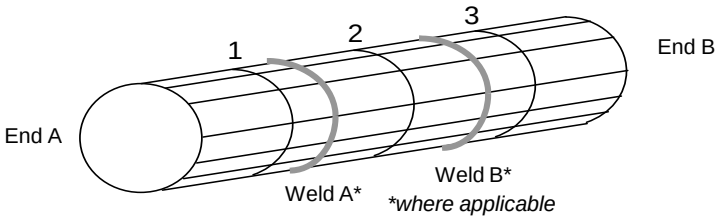
Weld Number

Weld A	776-AI
Weld B	776-AH

Weld Letter Label

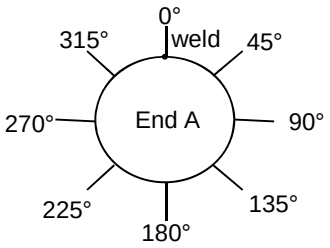
Weld A

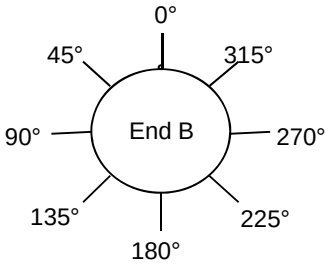
Weld B



Distance Between Stations (mm)	
End A to 1	336
1 to 2	789
2 to 3	786
3 to End B	336
End A to Weld A	719
Weld A to Weld B	815
Weld B to End B	713

Circumference (mm)	
End A	1,022
End B	1,022





Pipe Length (mm)	
0°	2,246.0
90°	2,246.0
180°	2,248.0
270°	2,249.0
Average:	2,247.3

Diameter Measurement (mm)

Station	Angle			
	0°-180°	45°-225°	90°-270°	135°-315°
1	324.231	324.460	324.409	324.180
2	324.587	324.485	324.561	324.002
3	324.282	324.358	324.129	324.079

Ultrasonic Probe Measurement

Probe Calibration	
0.200" gauge block reading:	0.196
0.500" gauge block reading:	0.495

Wall Thickness Measurement (mm)

Angle	Station 1	Station 2	Station 3
0°	12.45	12.52	12.67
45°	12.57	12.55	12.57
90°	12.62	12.65	12.70
135°	12.60	12.65	12.65
180°	12.62	12.65	12.65
225°	12.62	12.67	12.55
270°	12.65	12.62	12.65
315°	12.65	12.57	12.65
Average	12.60	12.61	12.64
Overall average		12.62	

C-FER Technologies	Pre-test Measurements Taken By: JZW/JAL	Date: 27-Jan-10	PRCI/DOT
	Approval for Testing: RTP	Date: 16-Feb-10	1.17

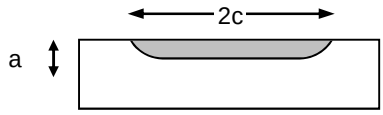
Specimen Measurements Before Testing

Gauge Length (mm)								
Location	0°	45°	90°	135°	180°	225°	270°	315°
LTU			152				150	
LTF		607				610		
LMU	152		152		153		151	
LBF				606				608
LBU			153				151	
CTF		8				8		
CBF				8				8

Average OD (mm)	324.31
Average ID (mm)	299.08
ID Area (mm^2)	70,254
Gross Area (mm^2)	12,353

C-FER Technologies	Pre-test Measurements Taken By: JZW/JAL	Date: 27-Jan-10	**PRCI/DOT**
	Approval for Testing: RTP	Date: 16-Feb-10	**1.17**

Specimen Measurements Before Testing

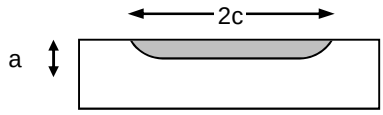


Defect Size (mm) F1-45			
Length	2c	35.46	
Depth	a_1	1.40	
	a_2	1.82	
	a_3	3.06	average depth = 3.01
	a_4	2.97	
	a_5	2.99	
	a_6		
	a_7		
	a_8		
	a_9	2.05	
	a_{10}	1.32	
Defect Area (mm^2)		81.61	
Scribe Offset	N/A		

Defect Size (mm) F2-135			
Length	2c	35.21	
Depth	a_1	1.57	
	a_2	1.87	
	a_3	2.92	average depth = 2.99
	a_4	3.05	
	a_5	2.99	
	a_6		
	a_7		
	a_8		
	a_9	2.08	
	a_{10}	1.32	
Defect Area (mm^2)		80.39	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: JZW/JAL	Date: 27-Jan-10	**PRCI/DOT**
	Approval for Testing: RTP	Date: 16-Feb-10	**1.17**

Specimen Measurements Before Testing



Defect Size (mm) F3-225			
Length	2c	35.08	
Depth	a_1	1.47	
	a_2	2.08	
	a_3	3.15	average depth = 3.08
	a_4	3.02	
	a_5	3.08	
	a_6		
	a_7		
	a_8		
	a_9	1.82	
	a_{10}	1.50	
Defect Area (mm^2)		82.22	
Scribe Offset	N/A		

Defect Size (mm) F4-315			
Length	2c	35.17	
Depth	a_1	1.54	
	a_2	1.97	
	a_3	2.99	average depth = 2.98
	a_4	2.98	
	a_5	2.98	
	a_6		
	a_7		
	a_8		
	a_9	1.90	
	a_{10}	1.55	
Defect Area (mm^2)		80.19	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: JZW/JAL	Date: 27-Jan-10	**PRCI/DOT**
	Approval for Testing: RTP	Date: 16-Feb-10	**1.17**

Test Summary Sheet

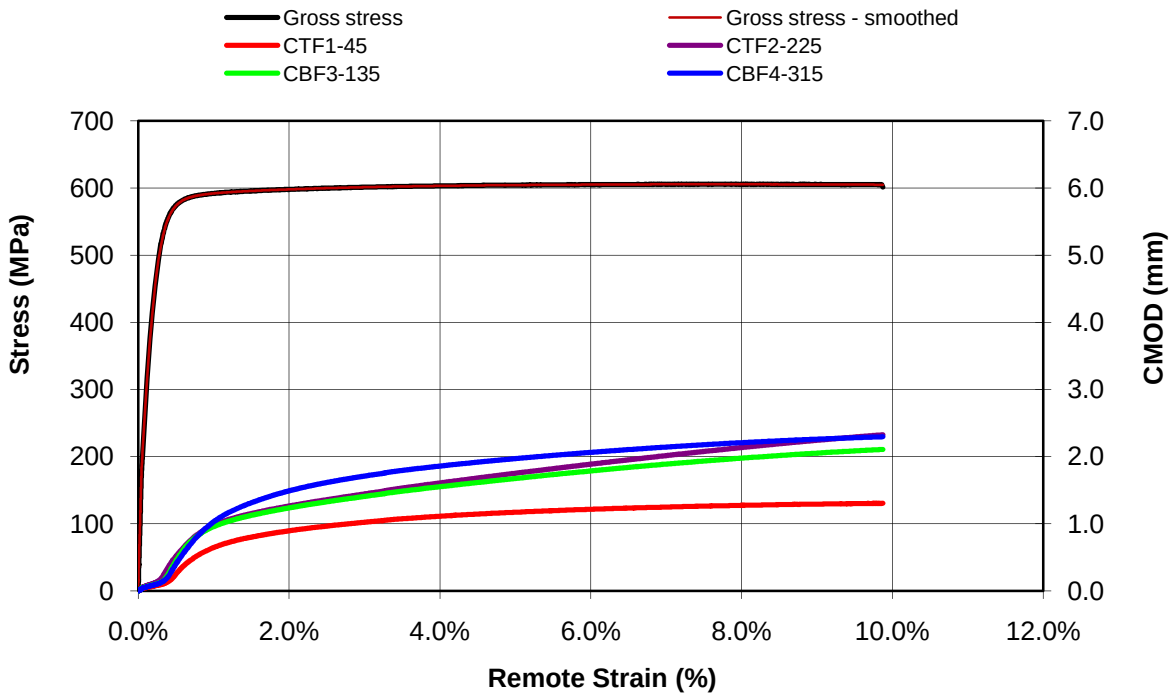
Test terminated prematurely due to pipe body necking.

Spec. No. **1.18** Test type **12" NPS**

Specimen Details		
Pipe Diameter, OD	324.3	mm
Wall thickness, t	12.64	mm
Type	High Y/T	
Grade	X65	
SMYS	448	MPa
SMTS	531	MPa
F yield (hoop | axial)	509 | 547	MPa
F tensile (hoop | axial)	588 | 593	MPa
Test temperature	22	ºC
Test pressure	30.20	MPa
Specimen length, L1	2,209	mm
Target flaw size	3 x 50	mm
Number of Flaws	4 (2 per cross-section)	
Target flaw location	HAZ	

	Load Peak	End Point	
Total Load	7,497	7,443	kN
Gross Stress	605.6	601.3	MPa
Strain LTU	7.21%	8.89%	
Strain LMU	7.85%	10.05%	
Strain LBU	7.99%	10.50%	
Strain LTMBU	7.73%	9.87%	
CMOD	2.10	2.32	mm

Strain Notation:
Strain LTU: avg. strain in uniform strain zone of top weld can (LTU series LVDTs)
Strain LMU: avg. strain in uniform strain zone of middle weld can (LMU series LVDTs)
Strain LBU: avg. strain in uniform strain zone of bottom weld can (LBU series LVDTs)
Strain LTMBU: avg. strain in uniform strain zones of all weld cans (LTU, LMU and LBU series LVDTs)

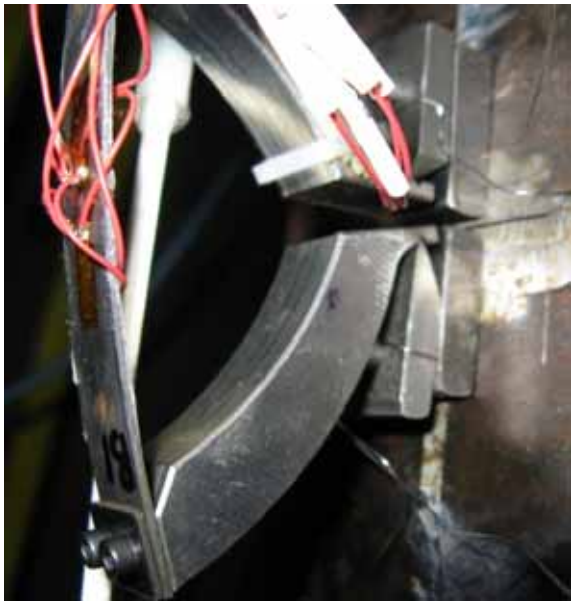


**Average strain from LVDTs in uniform strain zones of all weld cans (i.e. LTMBU strain)*

C-FER Technologies	Pre-test Measurements Taken By: JZW	Date: 28-Jan-10	PRCI/DOT
	Approval for Testing: RTP	Date: 18-Feb-10	1.18

Photographs

Test Set-up



Flaw Pre-test and Clip Gauge Set-up

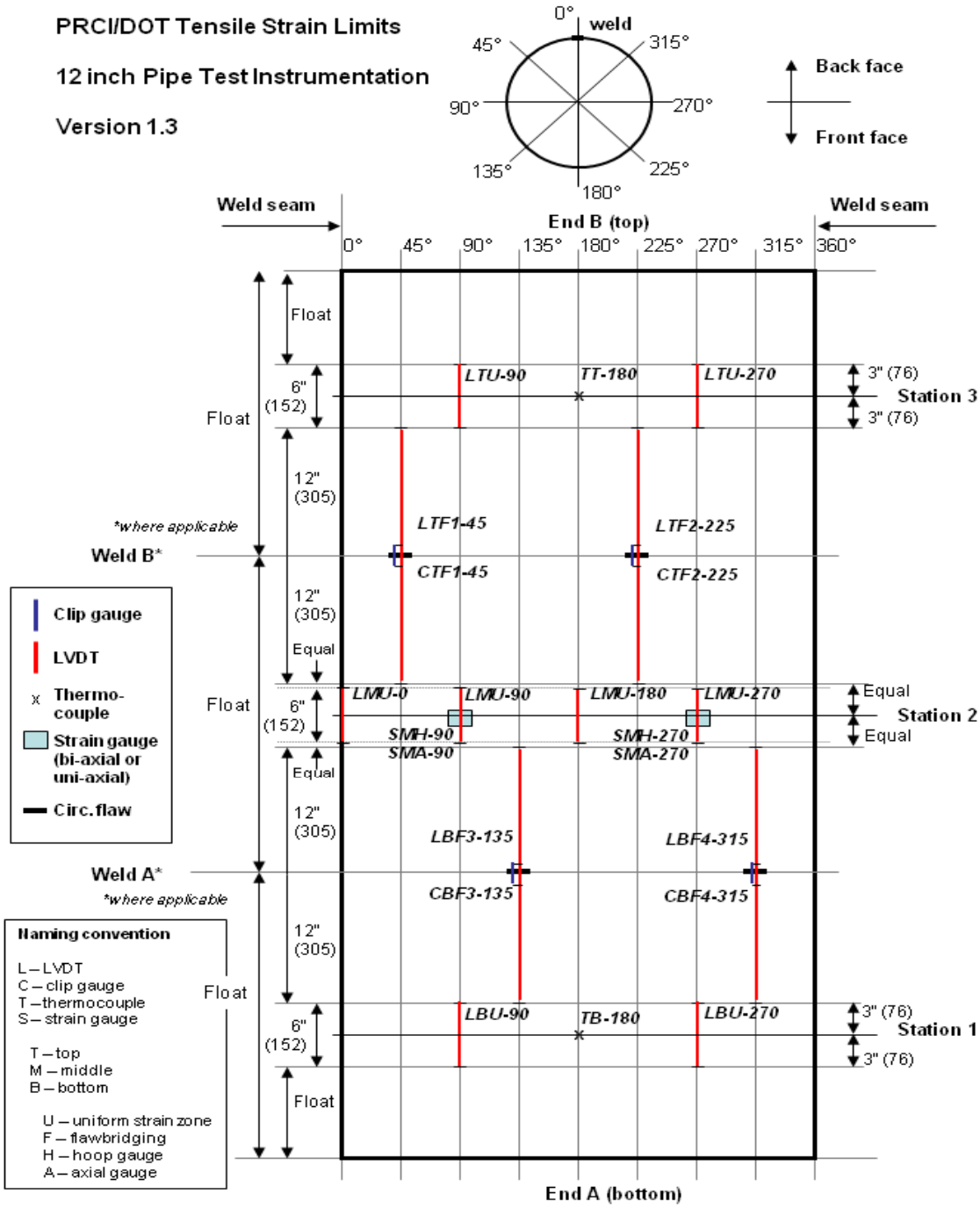
C-FER Technologies	Pre-test Measurements Taken By: JZW	Date: 28-Jan-10	**PRCI/DOT**
	Approval for Testing: RTP	Date: 18-Feb-10	**1.18**

Specimen Measurements Before Testing

PRCI/DOT Tensile Strain Limits

12 inch Pipe Test Instrumentation

Version 1.3



C-FER Technologies	Pre-test Measurements Taken By: JZW	Date: 28-Jan-10	PRCI/DOT
	Approval for Testing: RTP	Date: 18-Feb-10	1.18

Specimen Measurements Before Testing

Distance from Scan to Seam

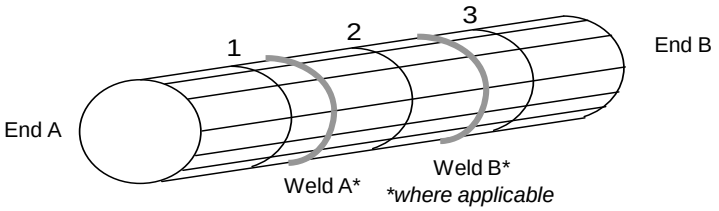
Weld Number

Weld A	776-CO
Weld B	776-CQ

Weld Letter Label

Weld A

Weld B

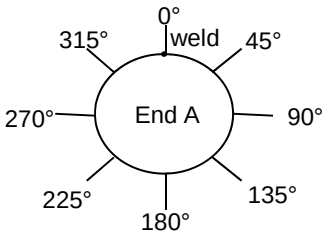


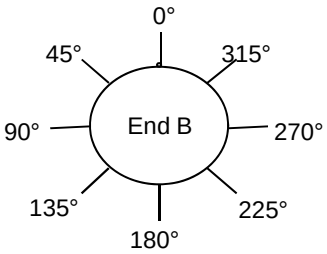
Distance Between Stations (mm)	
End A to 1	333
1 to 2	772
2 to 3	773
3 to End B	328
End A to Weld A	713
Weld A to Weld B	782
Weld B to End B	713

Pipe Length (mm)	
0°	2,211.0
90°	2,208.0
180°	2,207.0
270°	2,208.0
Average:	2,208.5

Circumference (mm)	
End A	1,022
End B	1,020

Diameter Measurement (mm)				
Station	Angle			
	0°-180°	45°-225°	90°-270°	135°-315°
1	324.358	324.333	324.358	324.206
2	324.561	324.510	324.155	324.155
3	324.460	324.460	324.206	324.307





Ultrasonic Probe Measurement	
Probe Calibration	
0.200" gauge block reading:	
0.500" gauge block reading:	

Wall Thickness Measurement (mm)			
Angle	Station 1	Station 2	Station 3
0°	13.03	12.93	12.83
45°	12.62	12.52	12.55
90°	12.62	12.62	12.57
135°	12.62	12.65	12.60
180°	12.60	12.60	12.57
225°	12.57	12.55	12.65
270°	12.60	12.65	12.62
315°	12.65	12.60	12.57
Average	12.67	12.64	12.62
Overall average		12.64	

C-FER Technologies	Pre-test Measurements Taken By: JZW	Date: 28-Jan-10	PRCI/DOT
	Approval for Testing: RTP	Date: 18-Feb-10	1.18

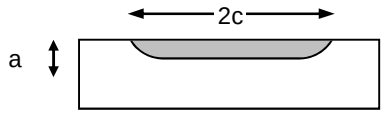
Specimen Measurements Before Testing

Gauge Length (mm)								
Location	0°	45°	90°	135°	180°	225°	270°	315°
LTU			153				155	
LTF		611				607		
LMU	152		151		152		152	
LBF				611				610
LBU			154				153	
CTF		8				8		
CBF				8				8

Average OD (mm)	324.34
Average ID (mm)	299.06
ID Area (mm^2)	70,241
Gross Area (mm^2)	12,379

C-FER Technologies	Pre-test Measurements Taken By: JZW	Date: 28-Jan-10	**PRCI/DOT**
	Approval for Testing: RTP	Date: 18-Feb-10	**1.18**

Specimen Measurements Before Testing

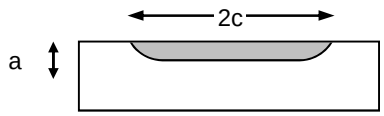


Defect Size (mm) F1-45			
Length	2c	34.89	
Depth	a_1	1.38	
	a_2	1.92	
	a_3	3.11	average depth = 3.04
	a_4	3.03	
	a_5	2.97	
	a_6		
	a_7		
	a_8		
	a_9	1.83	
	a_{10}	1.55	
Defect Area (mm^2)		80.58	
Scribe Offset	N/A		

Defect Size (mm) F2-135			
Length	2c	35.22	
Depth	a_1	1.52	
	a_2	2.05	
	a_3	2.94	average depth = 3.05
	a_4	3.07	
	a_5	3.14	
	a_6		
	a_7		
	a_8		
	a_9	1.78	
	a_{10}	1.54	
Defect Area (mm^2)		81.89	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: JZW	Date: 28-Jan-10	**PRCI/DOT**
	Approval for Testing: RTP	Date: 18-Feb-10	**1.18**

Specimen Measurements Before Testing



Defect Size (mm) F3-225			
Length	2c	35.46	
Depth	a_1	1.46	
	a_2	1.85	
	a_3	3.02	average depth = 3.02
	a_4	3.06	
	a_5	2.97	
	a_6		
	a_7		
	a_8		
	a_9	1.96	
	a_{10}	1.34	
Defect Area (mm^2)		81.84	
Scribe Offset	N/A		

Defect Size (mm) F4-315			
Length	2c	34.92	
Depth	a_1	1.50	
	a_2	1.77	
	a_3	2.95	average depth = 3.03
	a_4	3.15	
	a_5	3.00	
	a_6		
	a_7		
	a_8		
	a_9	1.81	
	a_{10}	1.45	
Defect Area (mm^2)		80.59	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: JZW	Date: 28-Jan-10	**PRCI/DOT**
	Approval for Testing: RTP	Date: 18-Feb-10	**1.18**

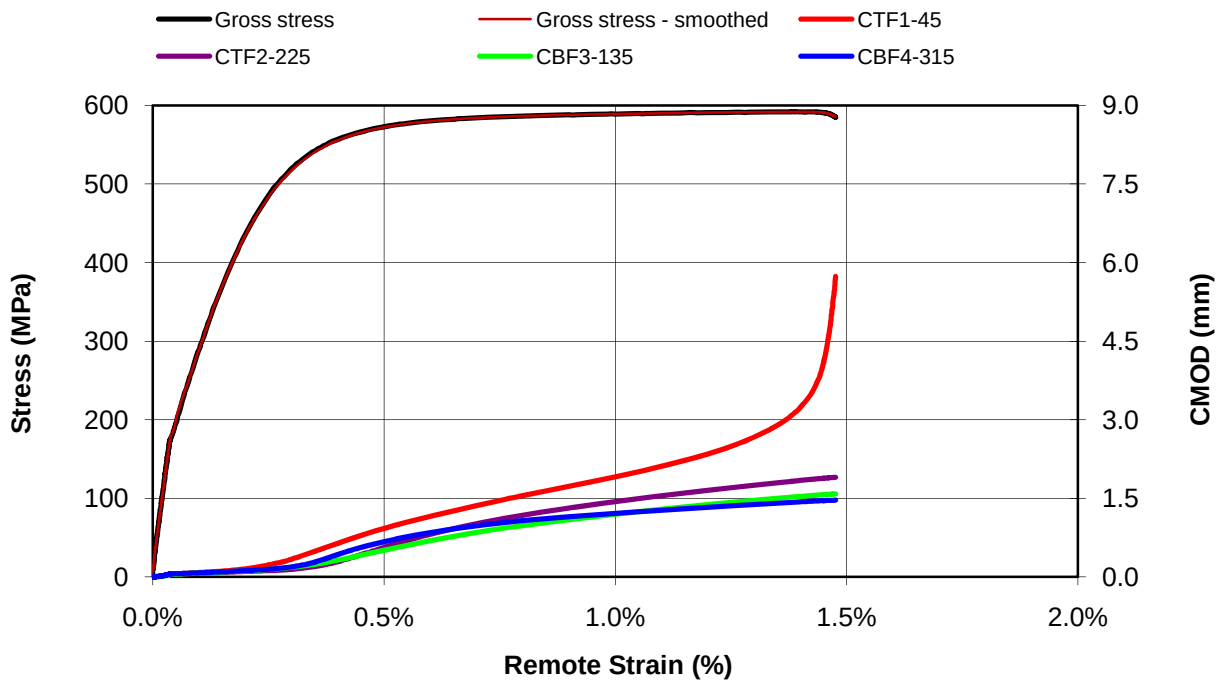
Test Summary Sheet

Spec. No. **1.19** Test type **12" NPS**

Specimen Details		
Pipe Diameter, OD	324.3	mm
Wall thickness, t	12.64	mm
Type	High Y/T	
Grade	X65	
SMYS	448	MPa
SMTS	531	MPa
F yield (hoop | axial)	509 | 547	MPa
F tensile (hoop | axial)	588 | 593	MPa
Test temperature	22	ºC
Test pressure	30.20	MPa
Specimen length, L1	2,205	mm
Target flaw size	3 x 50	mm
Number of Flaws	4 (2 per cross-section)	
Target flaw location	Weld Metal	

	Load Peak	End Point	
Total Load	7,323	7,236	kN
Gross Stress	591.8	584.8	MPa
Strain LTU	1.92%	2.06%	
Strain LMU	1.22%	1.29%	
Strain LBU	1.19%	1.25%	
Strain LTMBU	1.39%	1.48%	
CMOD	3.13	5.74	mm

Strain Notation:
Strain LTU: avg. strain in uniform strain zone of top weld can (LTU series LVDTs)
Strain LMU: avg. strain in uniform strain zone of middle weld can (LMU series LVDTs)
Strain LBU: avg. strain in uniform strain zone of bottom weld can (LBU series LVDTs)
Strain LTMBU: avg. strain in uniform strain zones of all weld cans (LTU, LMU and LBU series LVDTs)

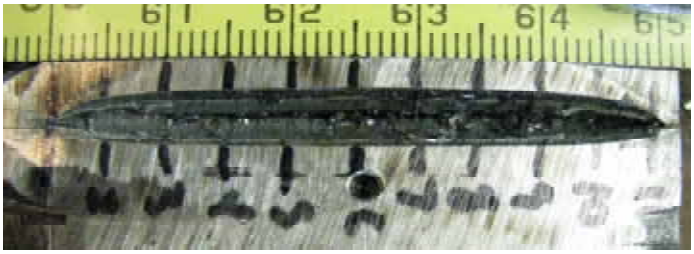


**Average strain from LVDTs in uniform strain zones of all weld cans (i.e. LTMBU strain)*

C-FER Technologies	Pre-test Measurements Taken By: JZW/JAL	Date: 27-Jan-10	**PRCI/DOT**
	Approval for Testing: RTP	Date: 23-Feb-10	**1.19**

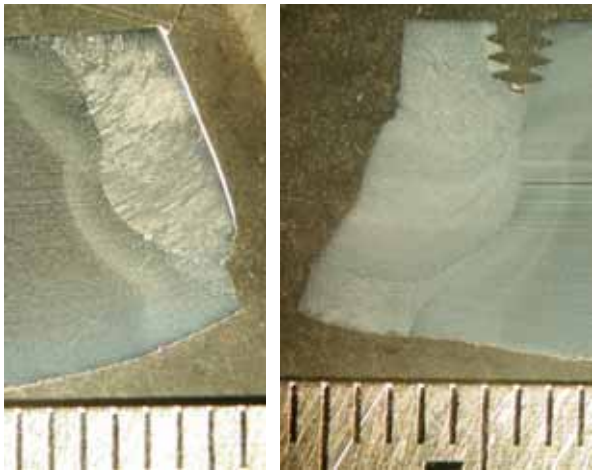
Photographs

Test Set-up



45° Flaw After Testing

45° Flaw Fracture Surface



45° Flaw Macro Images

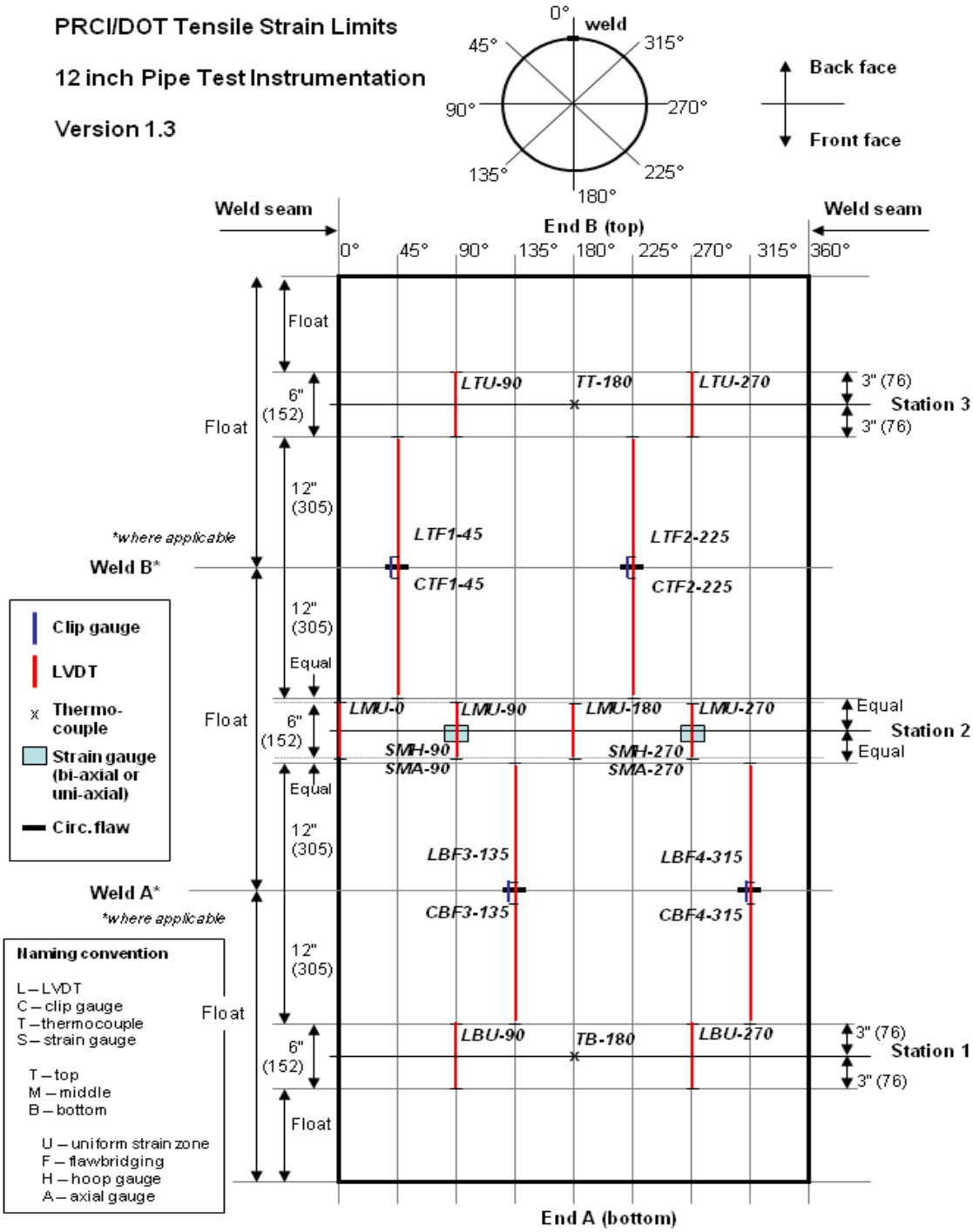
C-FER Technologies	Pre-test Measurements Taken By: JZW/JAL	Date: 27-Jan-10	**PRCI/DOT**
	Approval for Testing: RTP	Date: 23-Feb-10	**1.19**

Instrumentation Layout

PRCI/DOT Tensile Strain Limits

12 inch Pipe Test Instrumentation

Version 1.3



C-FER Technologies	Pre-test Measurements Taken By: JZW/JAL	Date: 27-Jan-10	PRCI/DOT
	Approval for Testing: RTP	Date: 23-Feb-10	1.19

Specimen Measurements Before Testing

Distance from Scan to Seam

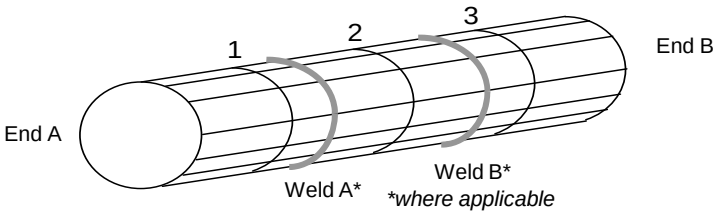
Weld Number

Weld A	776-CG
Weld B	776-CH

Weld Letter Label

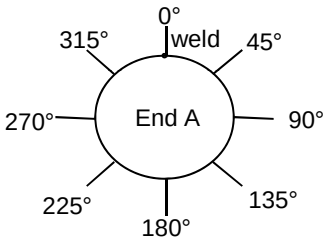
Weld A

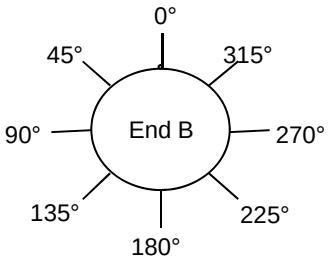
Weld B



Distance Between Stations (mm)	
End A to 1	320
1 to 2	783
2 to 3	780
3 to End B	322
End A to weld A	687
Weld A to weld B	823
Weld B to end B	692

Circumference (mm)	
End A	1,022
End B	1,020





Pipe Length (mm)	
0°	2,204.5
90°	2,204.0
180°	2,206.0
270°	2,206.0
Average:	2,205.1

Diameter Measurement (mm)

Station	Angle			
	0°-180°	45°-225°	90°-270°	135°-315°
1	324.231	324.460	324.460	324.358
2	324.256	324.155	324.333	324.256
3	324.485	324.358	324.079	324.460

Ultrasonic Probe Measurement	
Probe Calibration	
0.200" gauge block reading:	0.196
0.500" gauge block reading:	0.495

Wall Thickness Measurement (mm)

Angle	Station 1	Station 2	Station 3
0°	12.75	12.75	12.78
45°	12.60	12.62	12.67
90°	12.57	12.62	12.62
135°	12.62	12.57	12.60
180°	12.62	12.60	12.62
225°	12.60	12.62	12.62
270°	12.65	12.62	12.62
315°	12.65	12.65	12.60
Average	12.63	12.63	12.64
Overall average		12.64	

C-FER Technologies	Pre-test Measurements Taken By: JZW/JAL	Date: 27-Jan-10	**PRCI/DOT**
	Approval for Testing: RTP	Date: 23-Feb-10	**1.19**

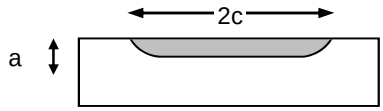
Specimen Measurements Before Testing

Gauge Length (mm)								
Location	0°	45°	90°	135°	180°	225°	270°	315°
LTU			154				152	
LTF		609				608		
LMU	153		153		153		154	
LBF				610				609
LBU			153				150	
CTF		8				8		
CBF				8				8

Average OD (mm)	324.32
Average ID (mm)	299.05
ID Area (mm^2)	70,239
Gross Area (mm^2)	12,374

C-FER Technologies	Pre-test Measurements Taken By: JZW/JAL	Date: 27-Jan-10	**PRCI/DOT**
	Approval for Testing: RTP	Date: 23-Feb-10	**1.19**

Specimen Measurements Before Testing

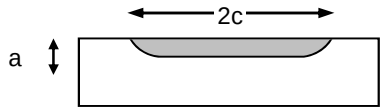


Defect Size (mm) F1-45			
Length	2c	50.41	
Depth	a_1	1.32	
	a_2	1.86	
	a_3	2.93	average depth = 3.03
	a_4	3.10	
	a_5	2.95	
	a_6	3.03	
	a_7	3.06	
	a_8	3.09	
	a_9	1.77	
	a_{10}	1.54	
Defect Area (mm^2)		127.32	
Scribe Offset	N/A		

Defect Size (mm) F2-135			
Length	2c	50.60	
Depth	a_1	1.36	
	a_2	1.77	
	a_3	3.07	average depth = 3.09
	a_4	3.11	
	a_5	2.99	
	a_6	3.15	
	a_7	3.07	
	a_8	3.13	
	a_9	2.00	
	a_{10}	1.49	
Defect Area (mm^2)		130.20	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: JZW/JAL	Date: 27-Jan-10	**PRCI/DOT**
	Approval for Testing: RTP	Date: 23-Feb-10	**1.19**

Specimen Measurements Before Testing



Defect Size (mm) F3-225			
Length	2c	50.33	
Depth	a_1	1.55	
	a_2	1.88	
	a_3	2.91	average depth = 3.01
	a_4	3.10	
	a_5	3.06	
	a_6	3.06	
	a_7	2.93	
	a_8	2.97	
	a_9	1.91	
	a_{10}	1.37	
Defect Area (mm^2)		126.25	
Scribe Offset	N/A		

Defect Size (mm) F4-315			
Length	2c	50.24	
Depth	a_1	1.51	
	a_2	2.07	
	a_3	3.05	average depth = 3.02
	a_4	2.93	
	a_5	3.11	
	a_6	2.97	
	a_7	3.08	
	a_8	2.95	
	a_9	1.86	
	a_{10}	1.45	
Defect Area (mm^2)		126.36	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: JZW/JAL	Date: 27-Jan-10	**PRCI/DOT**
	Approval for Testing: RTP	Date: 23-Feb-10	**1.19**

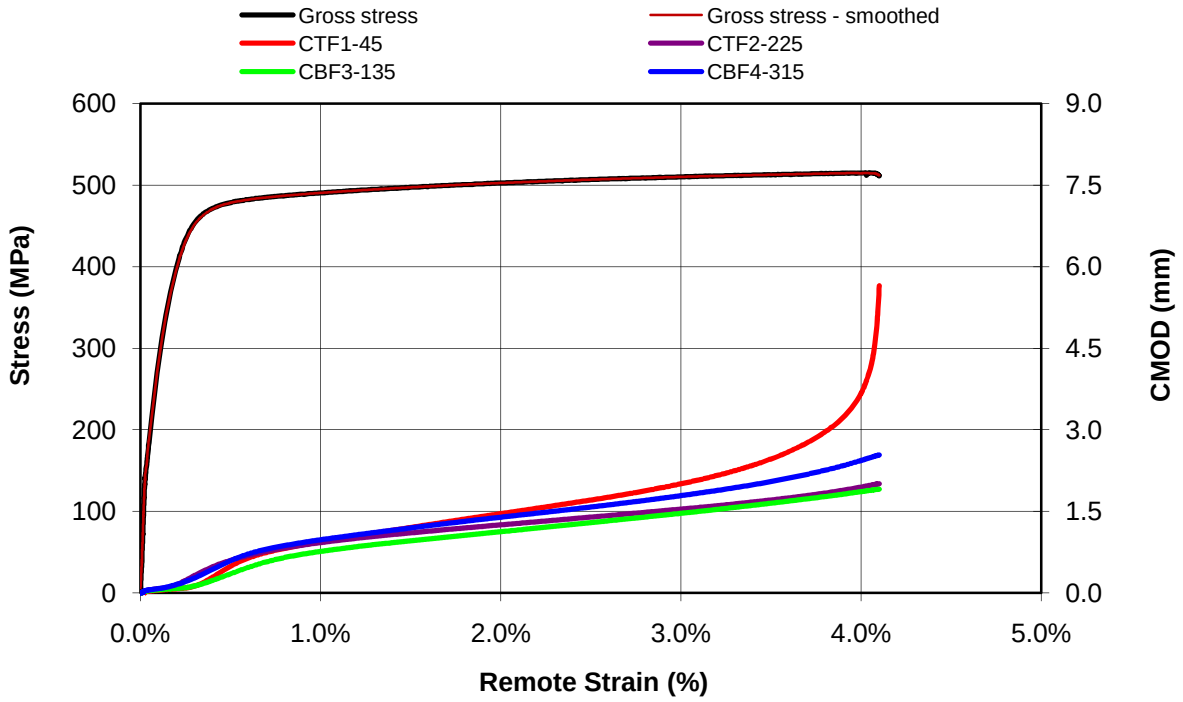
Test Summary Sheet

Spec. No. **1.20** Test type **12" NPS**

Specimen Details		
Pipe Diameter, OD	323.7	mm
Wall thickness, t	12.51	mm
Type	Low Y/T	
Grade	X65	
SMYS	448	MPa
SMTS	531	MPa
F yield (hoop | axial)	437 | 421	MPa
F tensile (hoop | axial)	491 | 479	MPa
Test temperature	22	ºC
Test pressure	24.20	MPa
Specimen length, L1	2,207	mm
Target flaw size	3 x 50	mm
Number of Flaws	4 (2 per cross-section)	
Target flaw location	Weld Metal	

	Load Peak	End Point	
Total Load	6,294	6,249	kN
Gross Stress	514.7	511.1	MPa
Strain LTU	3.86%	3.98%	
Strain LMU	4.12%	4.26%	
Strain LBU	3.79%	3.90%	
Strain LTMBU	3.97%	4.10%	
CMOD	3.52	5.65	mm

Strain Notation:
Strain LTU: avg. strain in uniform strain zone of top weld can (LTU series LVDTs)
Strain LMU: avg. strain in uniform strain zone of middle weld can (LMU series LVDTs)
Strain LBU: avg. strain in uniform strain zone of bottom weld can (LBU series LVDTs)
Strain LTMBU: avg. strain in uniform strain zones of all weld cans (LTU, LMU and LBU series LVDTs)

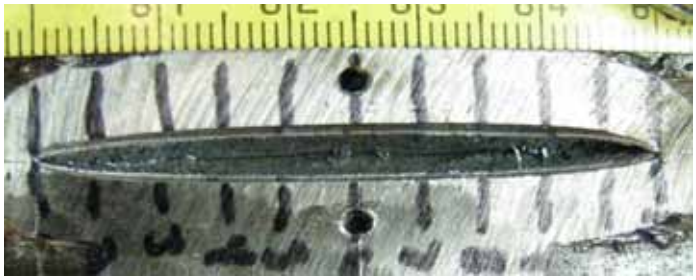


**Average strain from LVDTs in uniform strain zones of all weld cans (i.e. LTMBU strain)*

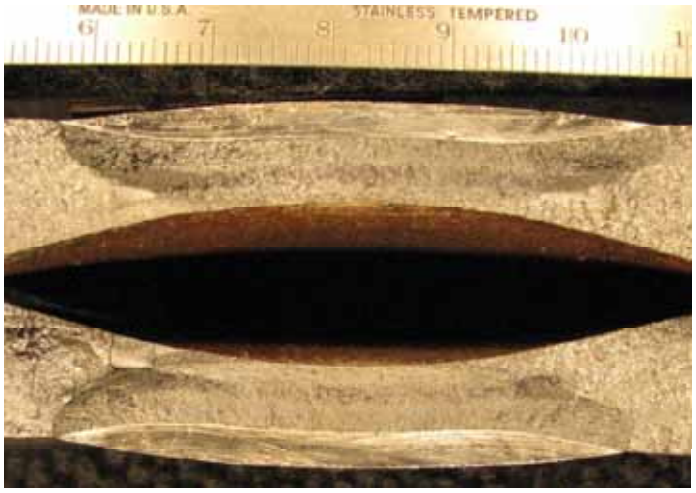
C-FER Technologies	Pre-test Measurements Taken By: JZW	Date: 28-Jan-10	PRCI/DOT
	Approval for Testing: RTP	Date: 26-Feb-10	1.20

Photographs

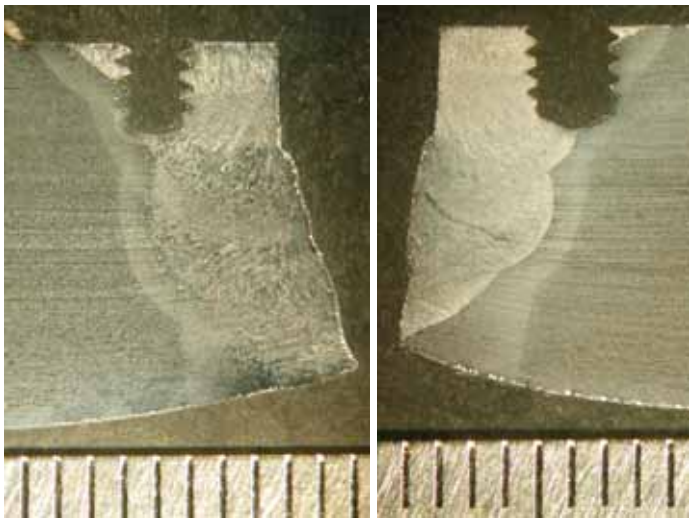
Test Set-up



45° Flaw After Testing



45° Flaw Fracture Surface



45° Flaw Macro Images

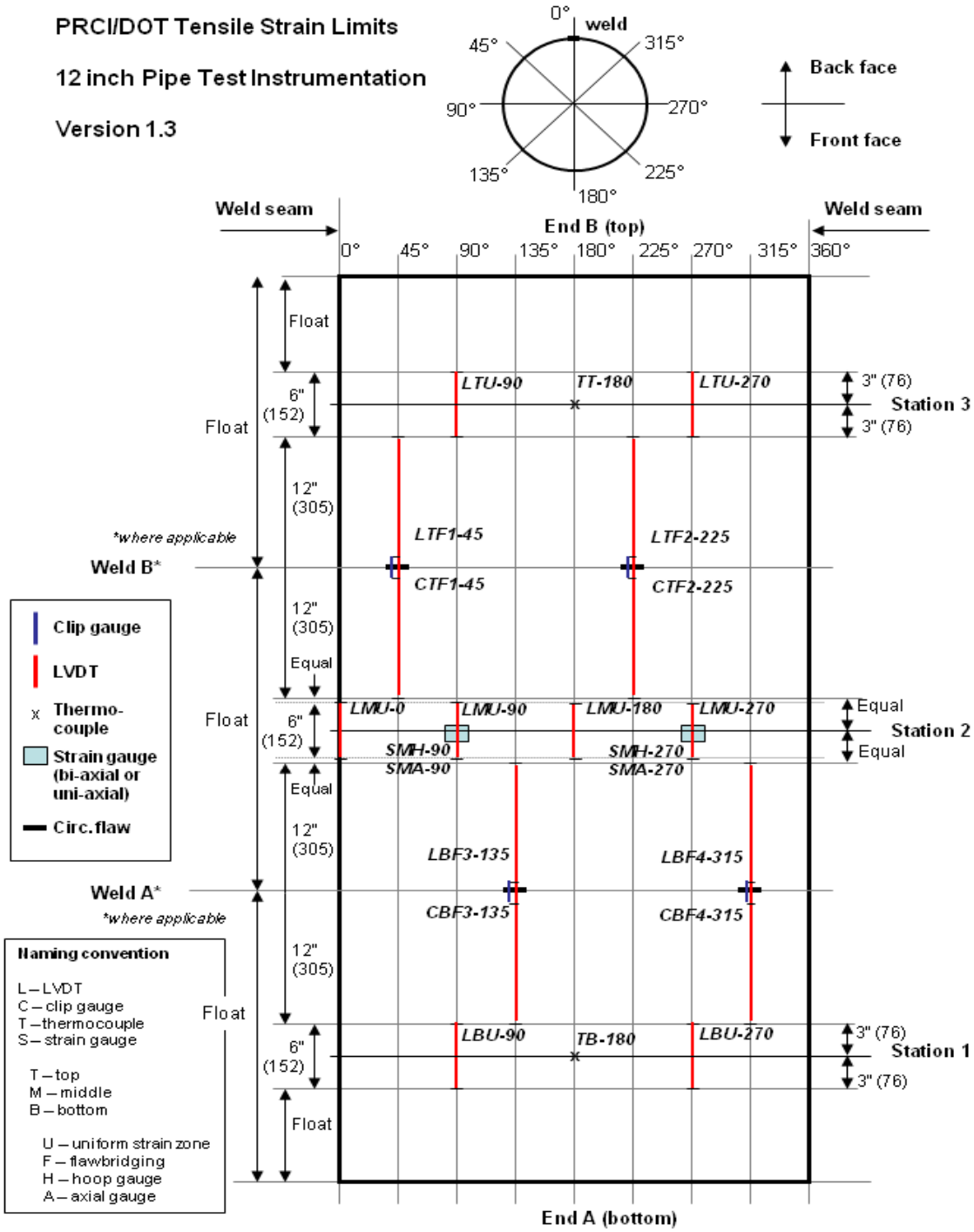
C-FER Technologies	Pre-test Measurements Taken By: JZW	Date: 28-Jan-10	**PRCI/DOT**
	Approval for Testing: RTP	Date: 26-Feb-10	**1.20**

Instrumentation Layout

PRCI/DOT Tensile Strain Limits

12 inch Pipe Test Instrumentation

Version 1.3



C-FER Technologies	Pre-test Measurements Taken By: JZW	Date: 28-Jan-10	PRCI/DOT
	Approval for Testing: RTP	Date: 26-Feb-10	1.20

Specimen Measurements Before Testing

Distance from Scan to Seam

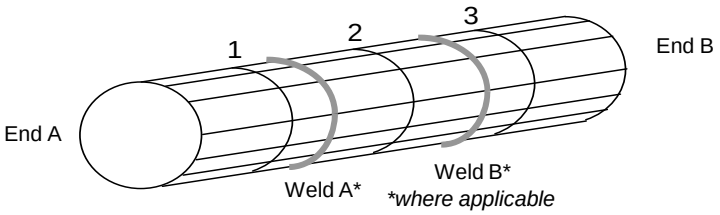
Weld Number

Weld A	776-CF
Weld B	776-BU

Weld Letter Label

Weld A

Weld B

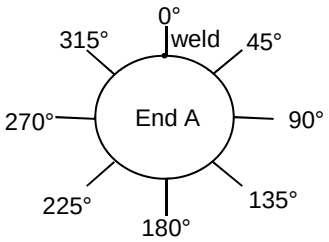


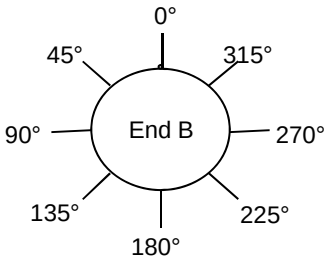
Distance Between Stations (mm)	
End A to 1	319
1 to 2	782
2 to 3	783
3 to End B	322
End A to weld A	703
Weld A to weld B	800
Weld B to end B	703

Pipe Length (mm)	
0°	2,207.0
90°	2,208.0
180°	2,207.0
270°	2,206.0
Average:	2,207.0

Circumference (mm)	
End A	1,022
End B	1,020

Diameter Measurement (mm)				
Station	Angle			
	0°-180°	45°-225°	90°-270°	135°-315°
1	323.825	323.545	323.469	323.774
2	323.825	323.748	323.596	323.875
3	324.002	323.647	323.444	323.672





Ultrasonic Probe Measurement	
Probe Calibration	
0.200" gauge block reading:	0.194
0.500" gauge block reading:	0.487

Wall Thickness Measurement (mm)			
Angle	Station 1	Station 2	Station 3
0°	12.40	12.60	12.62
45°	12.42	12.50	12.45
90°	12.50	12.47	12.47
135°	12.60	12.60	12.60
180°	12.52	12.52	12.50
225°	12.57	12.60	12.67
270°	12.45	12.45	12.42
315°	12.40	12.40	12.45
Average	12.48	12.52	12.52
Overall average		12.51	

C-FER Technologies	Pre-test Measurements Taken By: JZW	Date: 28-Jan-10	PRCI/DOT
	Approval for Testing: RTP	Date: 26-Feb-10	1.20

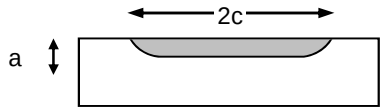
Specimen Measurements Before Testing

Gauge Length (mm)								
Location	0°	45°	90°	135°	180°	225°	270°	315°
LTU			153				150	
LTF		609				610		
LMU	153		154		153		153	
LBF				611				611
LBU			153				150	
CTF		8				8		
CBF				8				8

Average OD (mm)	323.70
Average ID (mm)	298.69
ID Area (mm^2)	70,069
Gross Area (mm^2)	12,227

C-FER Technologies	Pre-test Measurements Taken By: JZW	Date: 28-Jan-10	**PRCI/DOT**
	Approval for Testing: RTP	Date: 26-Feb-10	**1.20**

Specimen Measurements Before Testing

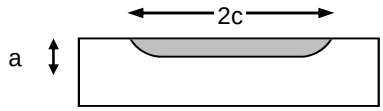


Defect Size (mm) F1-45			
Length	2c	50.28	
Depth	a_1	1.35	
	a_2	2.07	
	a_3	3.05	average depth = 3.04
	a_4	3.10	
	a_5	3.15	
	a_6	3.03	
	a_7	2.93	
	a_8	2.98	
	a_9	2.00	
	a_{10}	1.46	
Defect Area (mm^2)		127.44	
Scribe Offset	N/A		

Defect Size (mm) F2-135			
Length	2c	50.46	
Depth	a_1	1.40	
	a_2	1.91	
	a_3	3.15	average depth = 3.00
	a_4	2.92	
	a_5	3.11	
	a_6	2.94	
	a_7	2.99	
	a_8	2.91	
	a_9	1.91	
	a_{10}	1.46	
Defect Area (mm^2)		126.58	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: JZW	Date: 28-Jan-10	**PRCI/DOT**
	Approval for Testing: RTP	Date: 26-Feb-10	**1.20**

Specimen Measurements Before Testing



Defect Size (mm) F3-225			
Length	2c	50.98	
Depth	a_1	1.58	
	a_2	1.76	
	a_3	2.93	average depth = 3.00
	a_4	3.04	
	a_5	3.00	
	a_6	3.01	
	a_7	3.05	
	a_8	2.98	
	a_9	1.87	
	a_{10}	1.48	
Defect Area (mm^2)		128.07	
Scribe Offset	N/A		

Defect Size (mm) F4-315			
Length	2c	50.60	
Depth	a_1	1.48	
	a_2	1.94	
	a_3	2.94	average depth = 3.09
	a_4	3.13	
	a_5	3.14	
	a_6	3.11	
	a_7	3.05	
	a_8	3.14	
	a_9	1.90	
	a_{10}	1.55	
Defect Area (mm^2)		130.14	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: JZW	Date: 28-Jan-10	**PRCI/DOT**
	Approval for Testing: RTP	Date: 26-Feb-10	**1.20**

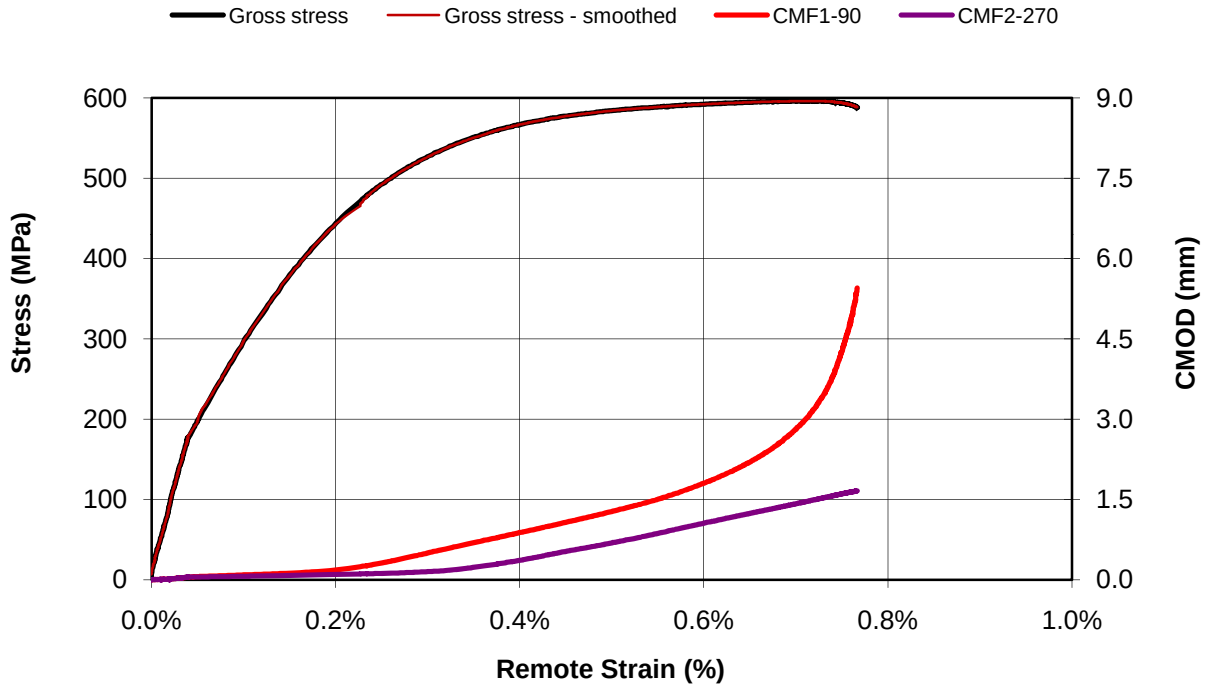
Test Summary Sheet

Spec. No. **1.21** Test type **12" NPS**

Specimen Details		
Pipe Diameter, OD	324.3	mm
Wall thickness, t	12.50	mm
Type	High Y/T	
Grade	X65	
SMYS	448	MPa
SMTS	531	MPa
F yield (hoop | axial)	509 | 547	MPa
F tensile (hoop | axial)	588 | 593	MPa
Test temperature	29	ºC
Test pressure	30.20	MPa
Specimen length, L1	1,392	mm
Target flaw size	3 x 50	mm
Number of Flaws	2 (2 per cross-section)	
Target flaw location	Weld Metal	

	Load Peak	End Point	
Total Load	7,295	7,199	kN
Gross Stress	595.9	588.0	MPa
Strain LTU	0.75%	0.80%	
Strain LBU	0.68%	0.74%	
Strain LTBU	0.72%	0.77%	
CMOD	3.14	5.45	mm

Strain Notation:
Strain LTU: average strain in uniform strain zone of top weld can (LTU series LVDTs)
Strain LBU: average strain in uniform strain zone of bottom weld can (LBU series LVDTs)
Strain LTBU: average strain in uniform strain zones of both weld cans (LTU and LBU series LVDTs)

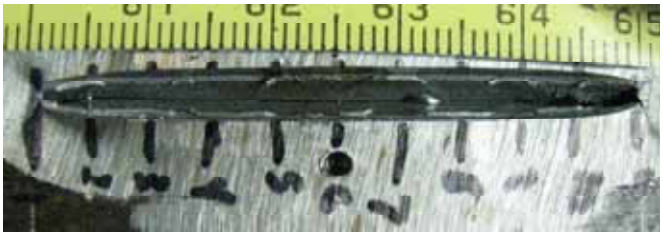


**Average strain from LVDTs in uniform strain zones of both weld cans (i.e. LTBU strain)*

C-FER Technologies	Pre-test Measurements Taken By: JAL	Date: 29-Jan-10	PRCI/DOT
	Approval for Testing: RTP	Date: 3-Mar-10	1.21

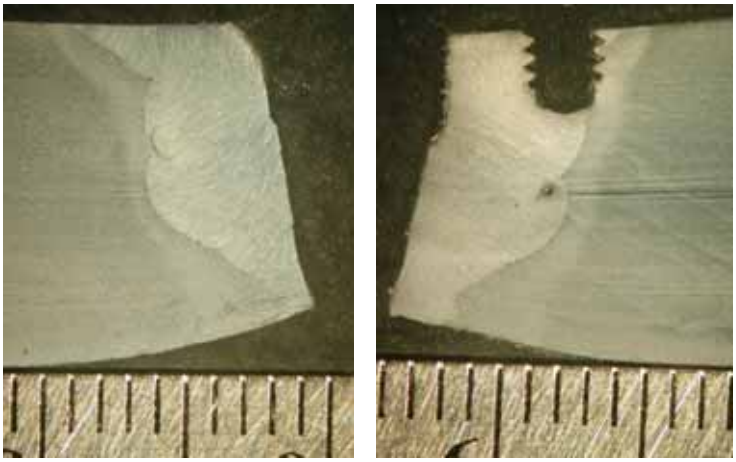
Photographs

Test Set-up



90° Flaw After Testing

90° Flaw Fracture Surface



90° Flaw Macro Images

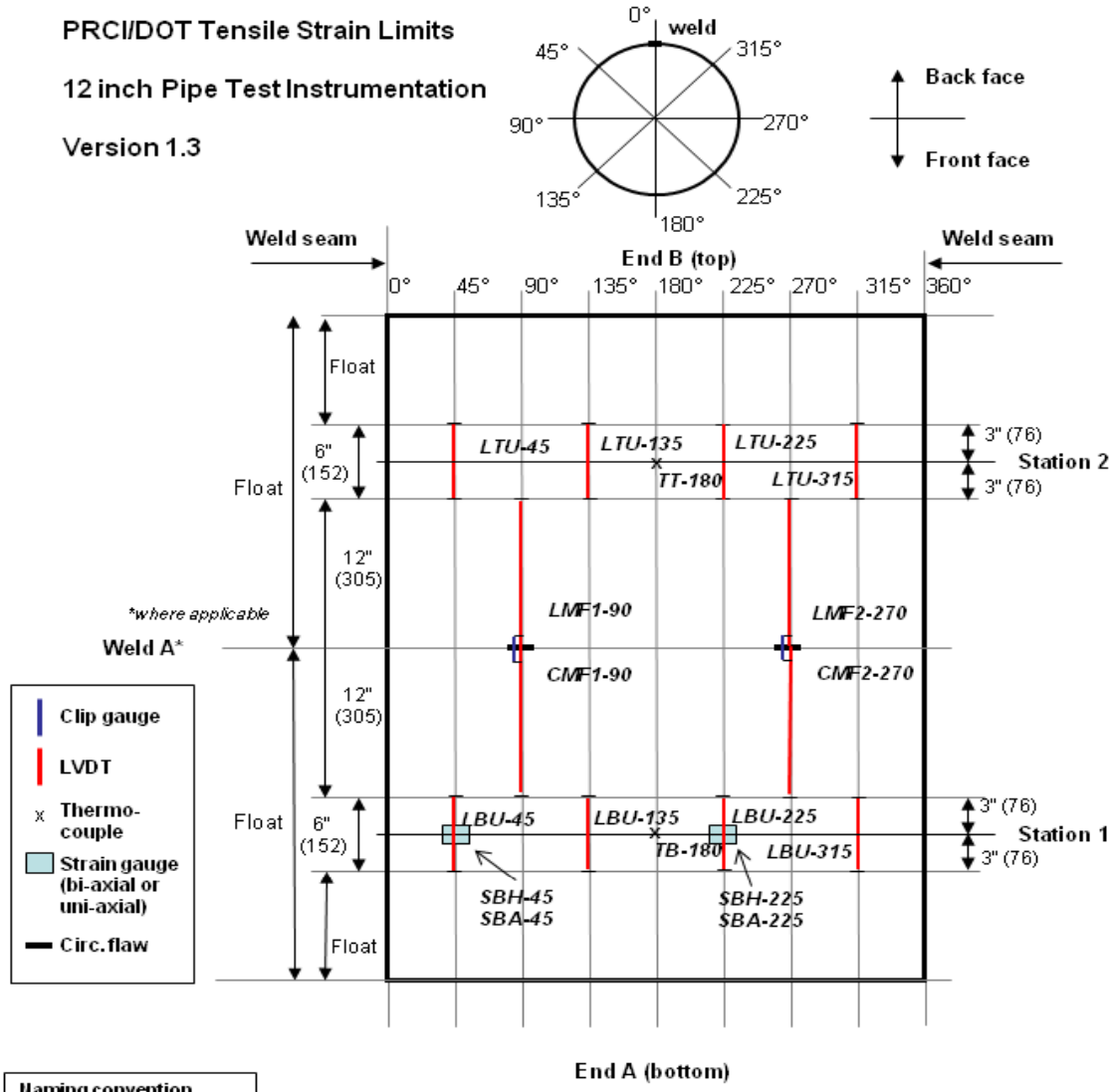
C-FER Technologies	Pre-test Measurements Taken By: JAL	Date: 29-Jan-10	**PRCI/DOT**
	Approval for Testing: RTP	Date: 3-Mar-10	**1.21**

Instrumentation Layout

PRCI/DOT Tensile Strain Limits

12 inch Pipe Test Instrumentation

Version 1.3



Naming convention

L – LVDT
C – clip gauge
T – thermocouple
S – strain gauge

T – top
M – middle
B – bottom

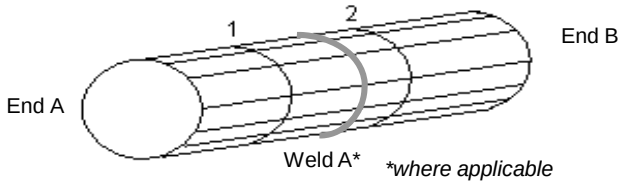
U – uniform strain zone
F – flawbridging
H – hoop gauge
A – axial gauge

C-FER Technologies	Pre-test Measurements Taken By: JAL	Date: 29-Jan-10	PRCI/DOT
	Approval for Testing: RTP	Date: 3-Mar-10	1.21

Specimen Measurements Before Testing

Distance from Scan to Seam

Weld Number
Weld A 776-CL
Weld Letter Label
Weld A

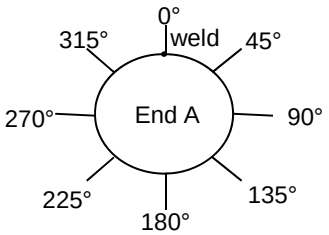


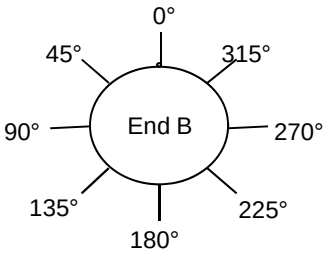
Distance Between Stations (mm)	
End A to 1	315
1 to 2	765
2 to End B	313
End A to weld A	700
Weld A to End B	693

Pipe Length (mm)	
0°	1,392.0
90°	1,391.0
180°	1,393.0
270°	1,393.0
Average:	1,392.3

Circumference (mm)	
End A	1,021
End B	1,022

Diameter Measurement (mm)				
Station	Angle			
	0°-180°	45°-225°	90°-270°	135°-315°
1	324.409	324.155	324.307	324.333
2	324.409	324.231	324.206	324.409





Ultrasonic Probe Measurement	
Probe Calibration	
0.200" gauge block reading:	
0.500" gauge block reading:	

Wall Thickness Measurement (mm)		
Angle	Station 1	Station 2
0°	12.40	12.60
45°	12.42	12.50
90°	12.50	12.47
135°	12.60	12.60
180°	12.52	12.52
225°	12.57	12.60
270°	12.45	12.45
315°	12.40	12.40
Average	12.48	12.52
Overall average	12.50	

C-FER Technologies	Pre-test Measurements Taken By: JAL	Date: 29-Jan-10	**PRCI/DOT**
	Approval for Testing: RTP	Date: 3-Mar-10	**1.21**

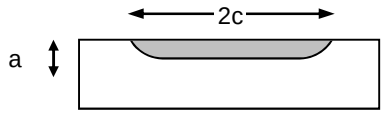
Specimen Measurements Before Testing

Gauge Length (mm)								
Location	0°	45°	90°	135°	180°	225°	270°	315°
LTU		153		152		154		153
LMF			610				609	
LBU		153		153		154		153
CMF			8				8	

Average OD (mm)	324.31
Average ID (mm)	299.31
ID Area (mm^2)	70,361
Gross Area (mm^2)	12,243

C-FER Technologies	Pre-test Measurements Taken By: JAL	Date: 29-Jan-10	**PRCI/DOT**
	Approval for Testing: RTP	Date: 3-Mar-10	**1.21**

Specimen Measurements Before Testing



Defect Size (mm) F1-90			
Length	2c	50.72	
Depth	a_1	1.50	
	a_2	1.90	
	a_3	3.04	average depth = 3.02
	a_4	3.01	
	a_5	2.96	
	a_6	3.02	
	a_7	3.00	
	a_8	3.11	
	a_9	1.88	
	a_{10}	1.36	
Defect Area (mm^2)		128.13	
Scribe Offset	N/A		

Defect size (mm) F2-270			
Length	2c	50.34	
Depth	a_1	1.35	
	a_2	1.77	
	a_3	2.95	average depth = 3.06
	a_4	3.11	
	a_5	2.98	
	a_6	3.10	
	a_7	3.10	
	a_8	3.11	
	a_9	1.90	
	a_{10}	1.39	
Defect Area (mm^2)		128.32	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: JAL	Date: 29-Jan-10	**PRCI/DOT**
	Approval for Testing: RTP	Date: 3-Mar-10	**1.21**

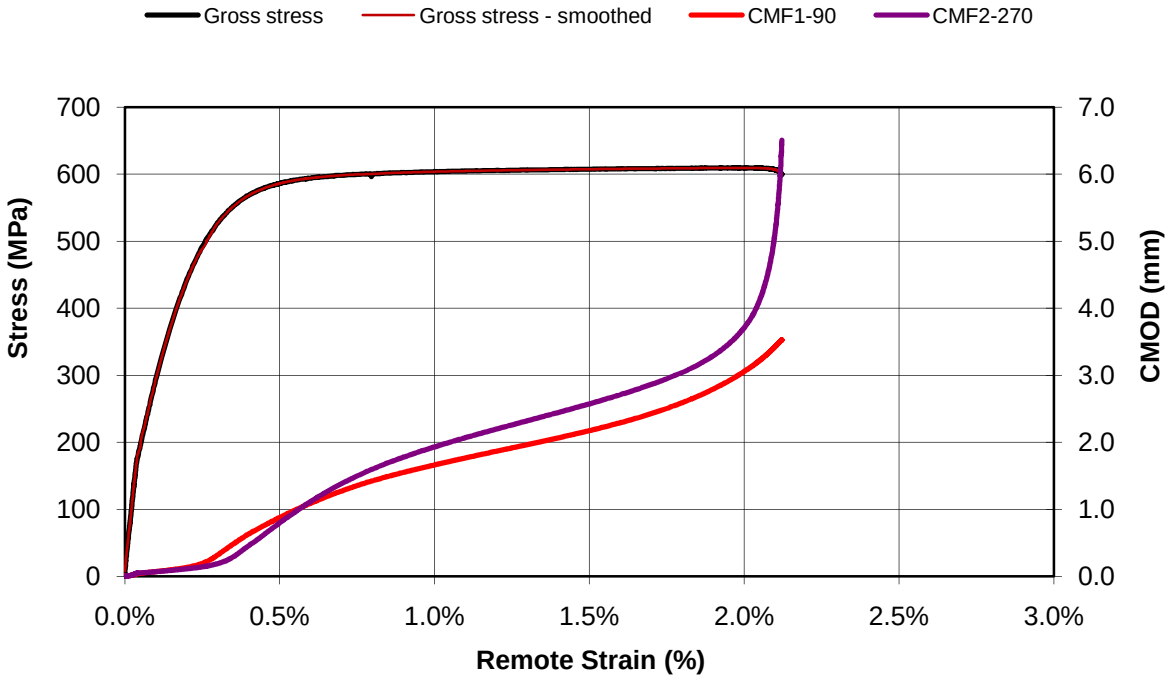
Test Summary Sheet

Spec. No. **1.22** Test type **12" NPS**

Specimen Details		
Pipe Diameter, OD	324.4	mm
Wall thickness, t	12.59	mm
Type	High Y/T	
Grade	X65	
SMYS	448	MPa
SMTS	531	MPa
F yield (hoop | axial)	509 | 547	MPa
F tensile (hoop | axial)	588 | 593	MPa
Test temperature	21	ºC
Test pressure	30.20	MPa
Specimen length, L1	1,402	mm
Target flaw size	3 x 50	mm
Number of Flaws	2 (2 per cross-section)	
Target flaw location	HAZ	

	Load Peak	End Point	
Total Load	7,514	7,397	kN
Gross Stress	609.3	599.8	MPa
Strain LTU	2.00%	2.11%	
Strain LBU	2.02%	2.13%	
Strain LTBU	2.01%	2.12%	
CMOD	3.75	6.51	mm

Strain Notation:
Strain LTU: average strain in uniform strain zone of top weld can (LTU series LVDTs)
Strain LBU: average strain in uniform strain zone of bottom weld can (LBU series LVDTs)
Strain LTBU: average strain in uniform strain zones of both weld cans (LTU and LBU series LVDTs)

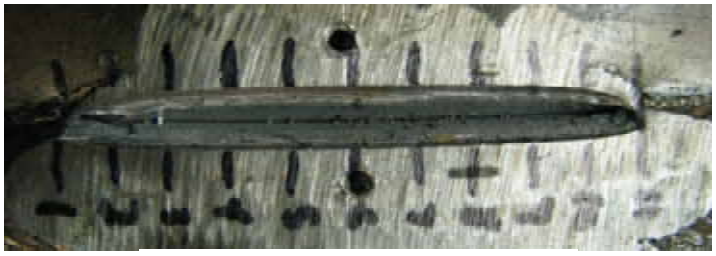


**Average strain from LVDTs in uniform strain zones of both weld cans (i.e. LTBU strain)*

C-FER Technologies	Pre-test Measurements Taken By: JAL	Date: 29-Jan-10	PRCI/DOT
	Approval for Testing: RTP	Date: 5-Mar-10	1.22

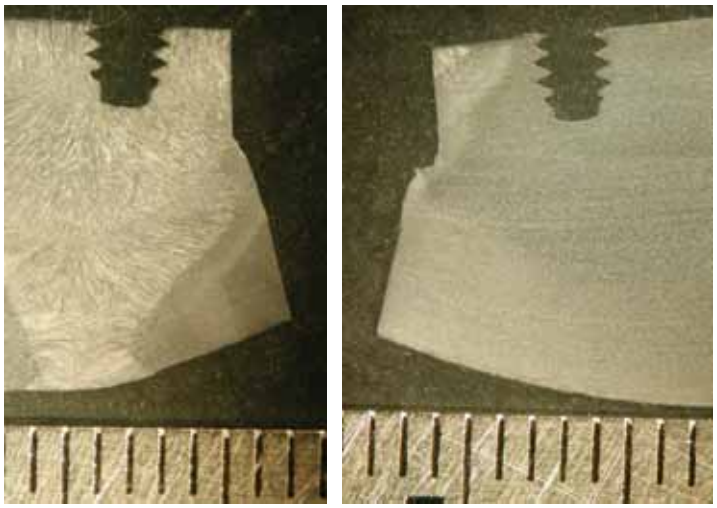
Photographs

Test Set-up



270° Flaw After Testing

270° Flaw Fracture Surface



270° Flaw Macro Images

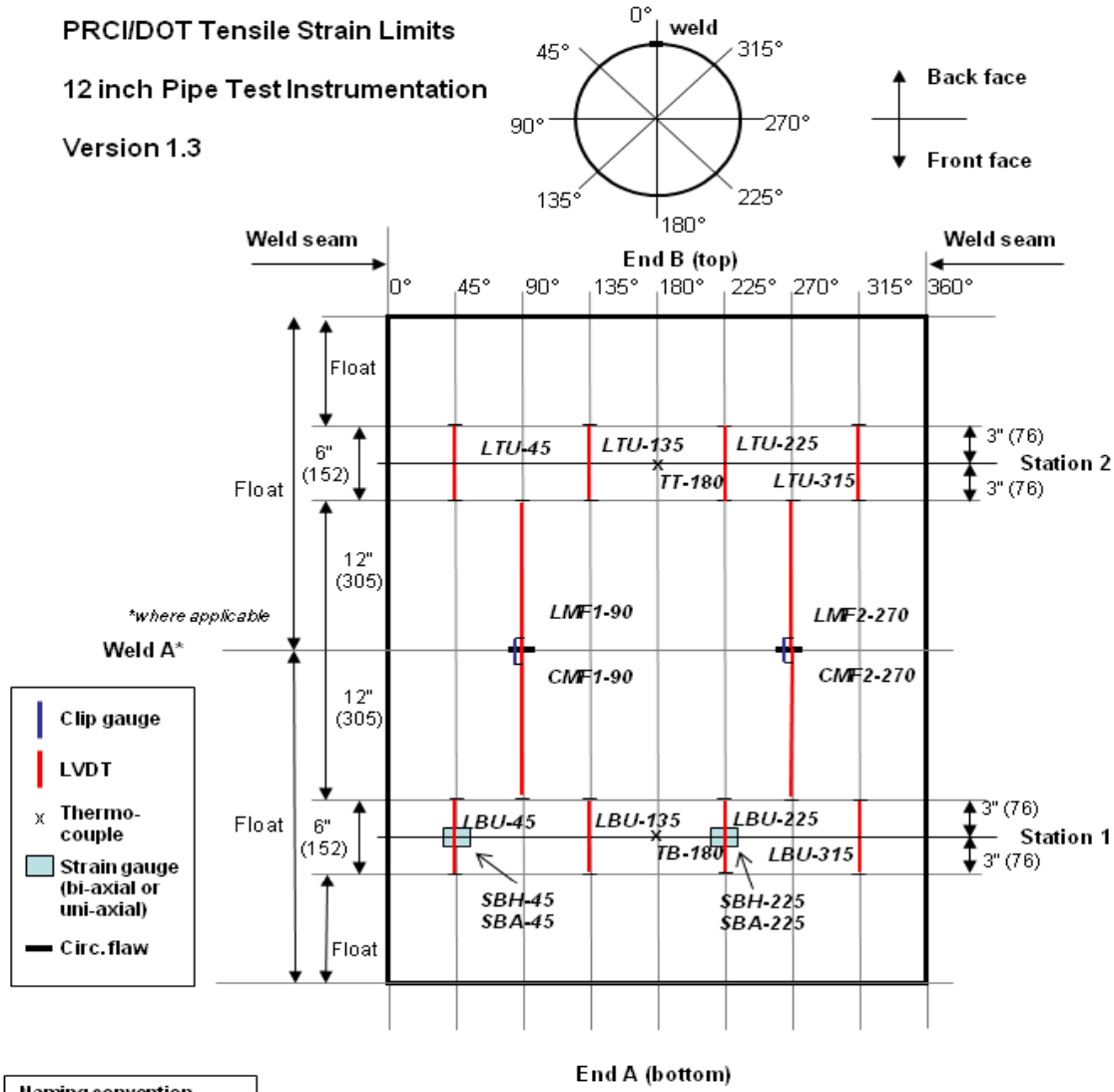
C-FER Technologies	Pre-test Measurements Taken By: JAL	Date: 29-Jan-10	**PRCI/DOT**
	Approval for Testing: RTP	Date: 5-Mar-10	**1.22**

Instrumentation Layout

PRCI/DOT Tensile Strain Limits

12 inch Pipe Test Instrumentation

Version 1.3



Naming convention

L – LVDT
C – clip gauge
T – thermocouple
S – strain gauge

T – top
M – middle
B – bottom

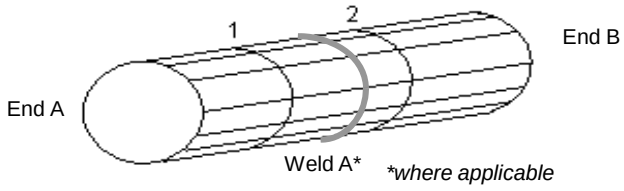
U – uniform strain zone
F – flawbridging
H – hoop gauge
A – axial gauge

C-FER Technologies	Pre-test Measurements Taken By: JAL	Date: 29-Jan-10	PRCI/DOT
	Approval for Testing: RTP	Date: 5-Mar-10	1.22

Specimen Measurements Before Testing

Distance from Scan to Seam

Weld Number
Weld A 776-CR
Weld Letter Label
Weld A

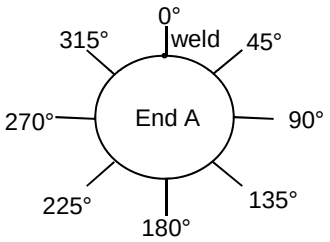


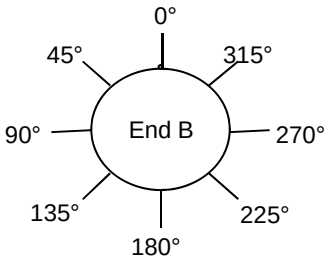
Distance Between Stations (mm)	
End A to 1	318
1 to 2	764
2 to End B	320
End A to Weld A	700
Weld A to End B	702

Pipe Length (mm)	
0°	1,402.0
90°	1,402.0
180°	1,402.0
270°	1,402.0
Average:	1,402.0

Circumference (mm)	
End A	1,022
End B	1,020

Diameter Measurement (mm)				
Station	Angle			
	0°-180°	45°-225°	90°-270°	135°-315°
1	324.764	324.333	324.333	324.409
2	324.536	324.383	324.256	324.180





Ultrasonic Probe Measurement	
Probe Calibration	
0.200" gauge block reading:	
0.500" gauge block reading:	

Wall Thickness Measurement (mm)		
Angle	Station 1	Station 2
0°	12.83	12.88
45°	12.55	12.55
90°	12.57	12.55
135°	12.55	12.55
180°	12.55	12.52
225°	12.55	12.57
270°	12.55	12.57
315°	12.55	12.55
Average	12.59	12.59
Overall average	12.59	

C-FER Technologies	Pre-test Measurements Taken By: JAL	Date: 29-Jan-10	**PRCI/DOT**
	Approval for Testing: RTP	Date: 5-Mar-10	**1.22**

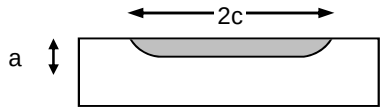
Specimen Measurements Before Testing

Gauge Length (mm)								
Location	0°	45°	90°	135°	180°	225°	270°	315°
LTU		151		153		152		150
LMF			611				612	
LBU		153		153		153		152
CMF			8				8	

Average OD (mm)	324.40
Average ID (mm)	299.22
ID Area (mm^2)	70,319
Gross Area (mm^2)	12,332

C-FER Technologies	Pre-test Measurements Taken By: JAL	Date: 29-Jan-10	**PRCI/DOT**
	Approval for Testing: RTP	Date: 5-Mar-10	**1.22**

Specimen Measurements Before Testing



Defect Size (mm) F1-90			
Length	2c	50.44	
Depth	a_1	1.52	
	a_2	1.79	
	a_3	3.05	average depth = 3.04
	a_4	3.10	
	a_5	2.93	
	a_6	3.07	
	a_7	2.99	
	a_8	3.07	
	a_9	1.99	
	a_{10}	1.58	
Defect Area (mm^2)		127.73	
Scribe Offset	N/A		

Defect Size (mm) F2-270			
Length	2c	49.99	
Depth	a_1	1.32	
	a_2	2.05	
	a_3	3.09	average depth = 3.02
	a_4	3.02	
	a_5	2.98	
	a_6	3.03	
	a_7	2.98	
	a_8	3.04	
	a_9	1.85	
	a_{10}	1.45	
Defect Area (mm^2)		125.92	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: JAL	Date: 29-Jan-10	**PRCI/DOT**
	Approval for Testing: RTP	Date: 5-Mar-10	**1.22**

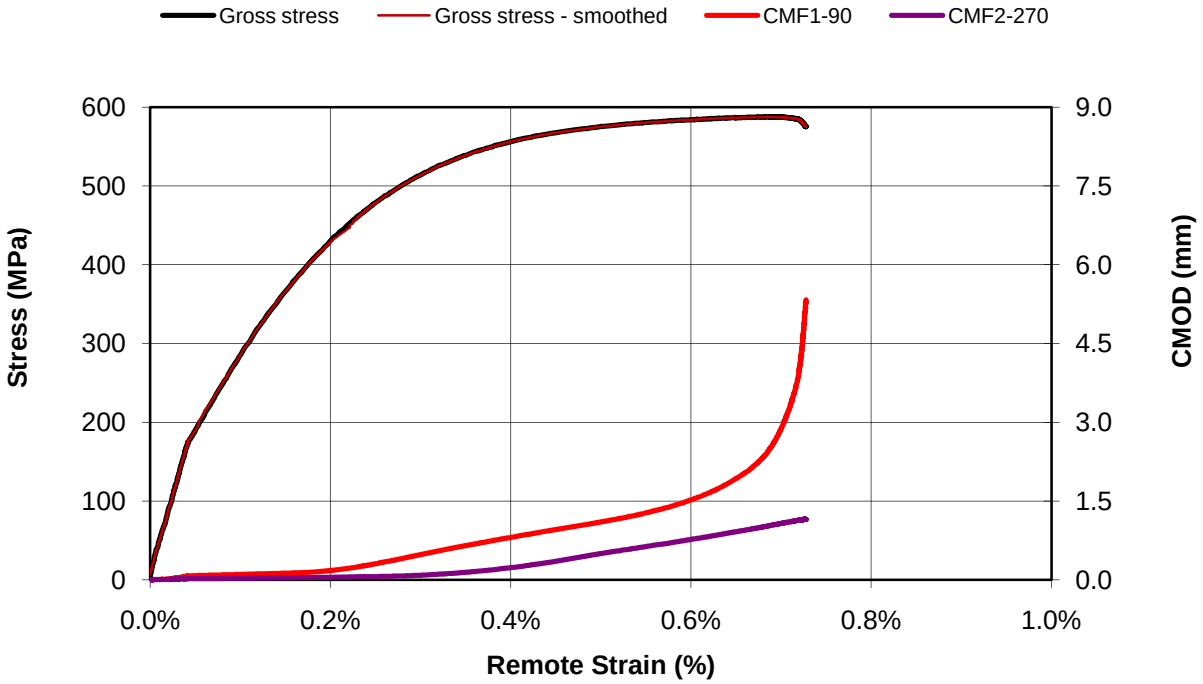
Test Summary Sheet

Spec. No. **1.23** Test type **12" NPS**

Specimen Details		
Pipe Diameter, OD	324.3	mm
Wall thickness, t	12.63	mm
Type	High Y/T	
Grade	X65	
SMYS	448	MPa
SMTS	531	MPa
F yield (hoop | axial)	509 | 547	MPa
F tensile (hoop | axial)	588 | 593	MPa
Test temperature	21	ºC
Test pressure	30.20	MPa
Specimen length, L1	1,400	mm
Target flaw size	2 x 70	mm
Number of Flaws	2 (2 per cross-section)	
Target flaw location	Weld Metal	

	Load Peak	**End Point**	
Total Load	7,271	7,117	kN
Gross Stress	587.7	575.2	MPa
Strain LTU	0.71%	0.74%	
Strain LBU	0.67%	0.72%	
Strain LTBU	0.69%	0.73%	
CMOD	2.50	5.33	mm

Strain Notation:
Strain LTU: average strain in uniform strain zone of top weld can (LTU series LVDTs)
Strain LBU: average strain in uniform strain zone of bottom weld can (LBU series LVDTs)
Strain LTBU: average strain in uniform strain zones of both weld cans (LTU and LBU series LVDTs)

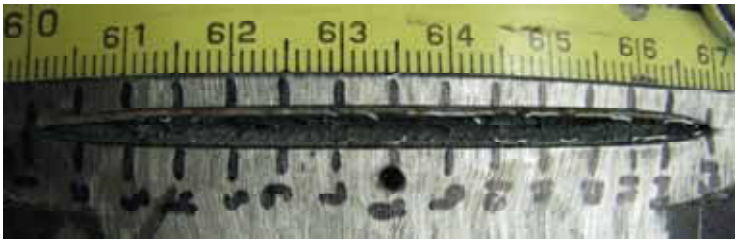


**Average strain from LVDTs in uniform strain zones of both weld cans (i.e. LTBU strain)*

C-FER Technologies	Pre-test Measurements Taken By: JAL	Date: 4-Mar-10	**PRCI/DOT**
	Approval for Testing: RTP	Date: 10-Mar-10	**1.23**

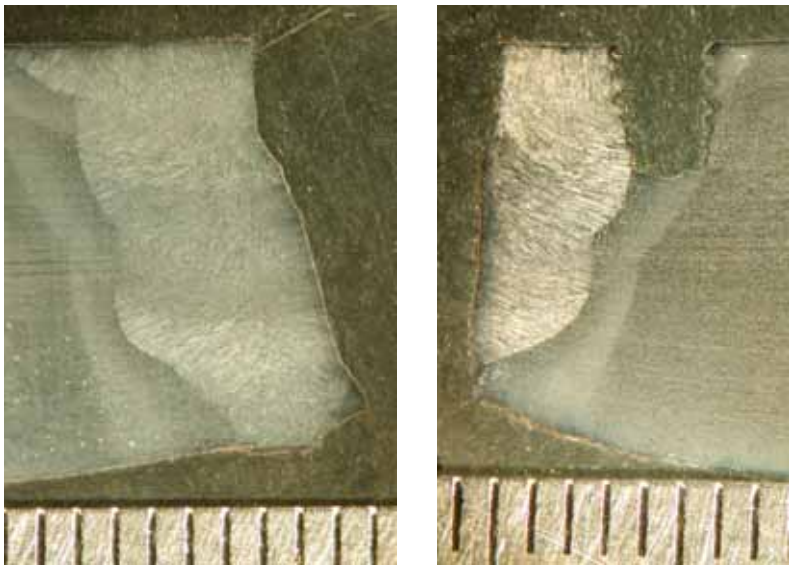
Photographs

Test Set-up



90° Flaw After Testing

90° Flaw Fracture Surface



90° Flaw Macro Images

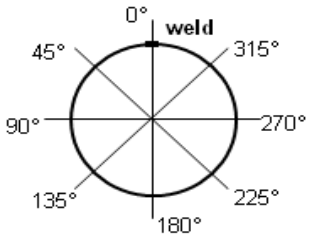
C-FER Technologies	Pre-test Measurements Taken By: JAL	Date: 4-Mar-10	**PRCI/DOT**
	Approval for Testing: RTP	Date: 10-Mar-10	**1.23**

Instrumentation Layout

PRCI/DOT Tensile Strain Limits

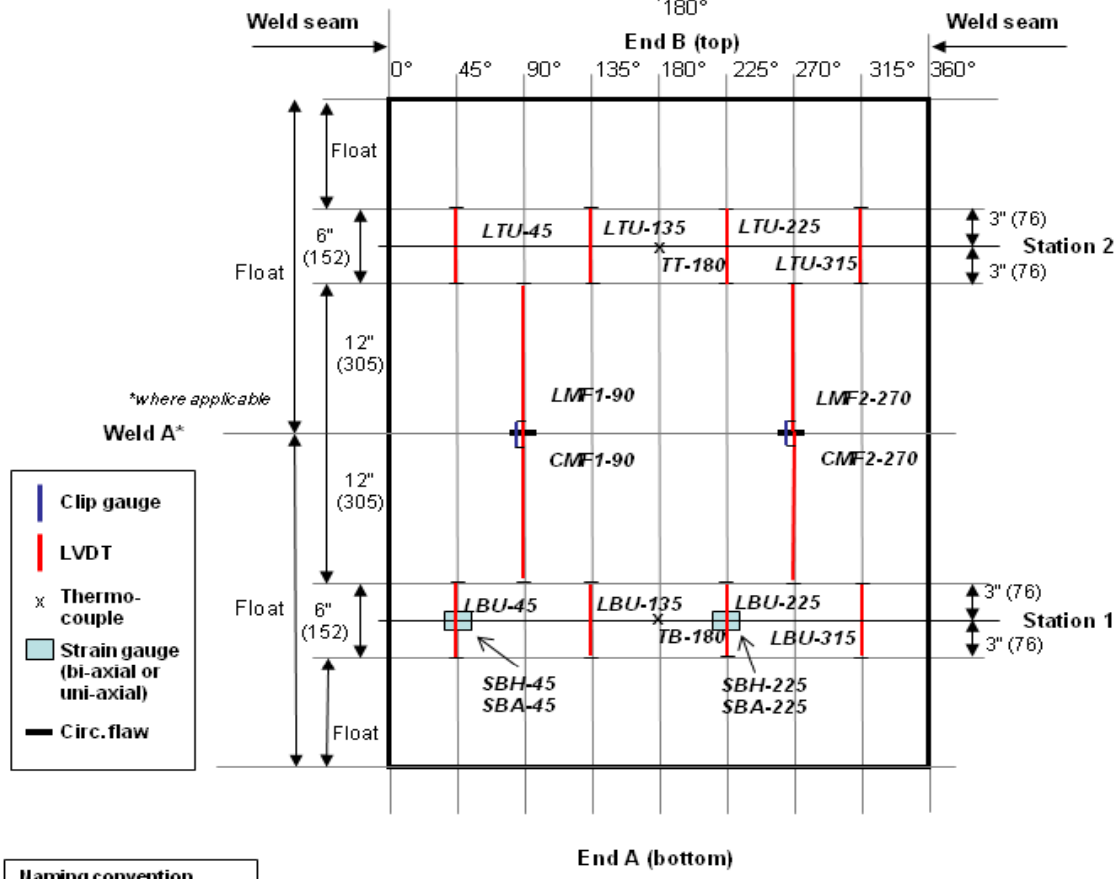
12 inch Pipe Test Instrumentation

Version 1.3



Back face

Front face



Naming convention

L – LVDT
C – clip gauge
T – thermocouple
S – strain gauge

T – top
M – middle
B – bottom

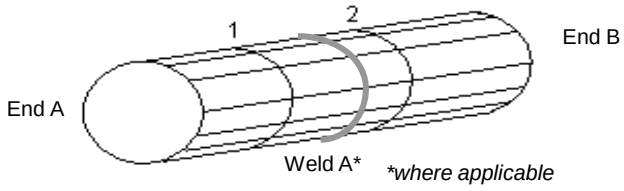
U – uniform strain zone
F – flawbridging
H – hoop gauge
A – axial gauge

C-FER Technologies	Pre-test Measurements Taken By: JAL	Date: 4-Mar-10	PRCI/DOT
	Approval for Testing: RTP	Date: 10-Mar-10	1.23

Specimen Measurements Before Testing

Distance from Scan to Seam

Weld Number
Weld A 776-CN
Weld Letter Label
Weld A

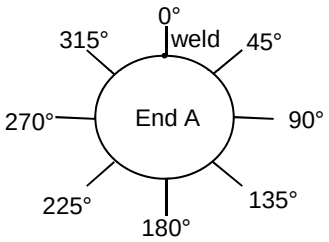


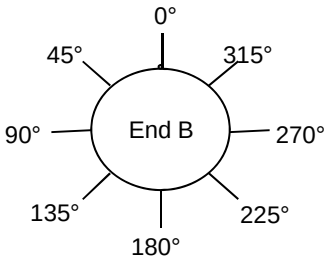
Distance Between Stations (mm)	
End A to 1	319
1 to 2	760
2 to End B	323
End A to Weld A	699
Weld A to End B	703

Pipe Length (mm)	
0°	1,402.0
90°	1,398.0
180°	1,397.0
270°	1,401.0
Average:	1,399.5

Circumference (mm)	
End A	1,021
End B	1,021

Diameter Measurement (mm)				
Station	Angle			
	0°-180°	45°-225°	90°-270°	135°-315°
1	324.485	324.460	324.256	324.612
2	324.282	324.002	324.231	324.358





Ultrasonic Probe Measurement	
Probe Calibration	
0.200" gauge block reading:	
0.500" gauge block reading:	

Wall Thickness Measurement (mm)		
Angle	Station 1	Station 2
0°	12.67	12.73
45°	12.62	12.65
90°	12.62	12.67
135°	12.55	12.65
180°	12.60	12.65
225°	12.65	12.55
270°	12.65	12.67
315°	12.55	12.67
Average	12.61	12.66
Overall average	12.63	

C-FER Technologies	Pre-test Measurements Taken By: JAL	Date: 4-Mar-10	**PRCI/DOT**
	Approval for Testing: RTP	Date: 10-Mar-10	**1.23**

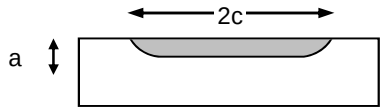
Specimen Measurements Before Testing

Gauge Length (mm)								
Location	0°	45°	90°	135°	180°	225°	270°	315°
LTU		154		156		155		153
LMF			609				610	
LBU		154		151		156		153
CMF			8				8	

Average OD (mm)	324.34
Average ID (mm)	299.07
ID Area (mm^2)	70,246
Gross Area (mm^2)	12,373

C-FER Technologies	Pre-test Measurements Taken By: JAL	Date: 4-Mar-10	**PRCI/DOT**
	Approval for Testing: RTP	Date: 10-Mar-10	**1.23**

Specimen Measurements Before Testing



Defect Size (mm) F1-90			
Length	2c	70.84	
Depth	a_1	1.43	
	a_2	2.05	
	a_3	2.01	average depth = 2.04
	a_4	1.95	
	a_5	2.11	
	a_6	1.97	
	a_7	2.11	
	a_9	2.05	
	a_{10}	2.02	
	a_{11}	2.10	
	a_{12}	2.01	
	a_{13}	1.95	
	a_{14}	2.11	
	a_{15}	2.01	
	a_{16}	1.58	
Defect Area (mm^2)		130.03	
Scribe Offset	N/A		

Defect Size (mm) F2-270			
Length	2c	70.47	
Depth	a_1	1.48	
	a_2	2.02	
	a_3	1.99	average depth = 2.02
	a_4	1.95	
	a_5	1.95	
	a_6	1.98	
	a_7	2.08	
	a_8	1.96	
	a_{10}	2.12	
	a_{11}	2.08	
	a_{12}	2.04	
	a_{13}	2.06	
	a_{14}	2.05	
	a_{15}	2.09	
	a_{16}	1.34	
Defect Area (mm^2)		128.56	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: JAL	Date: 4-Mar-10	**PRCI/DOT**
	Approval for Testing: RTP	Date: 10-Mar-10	**1.23**

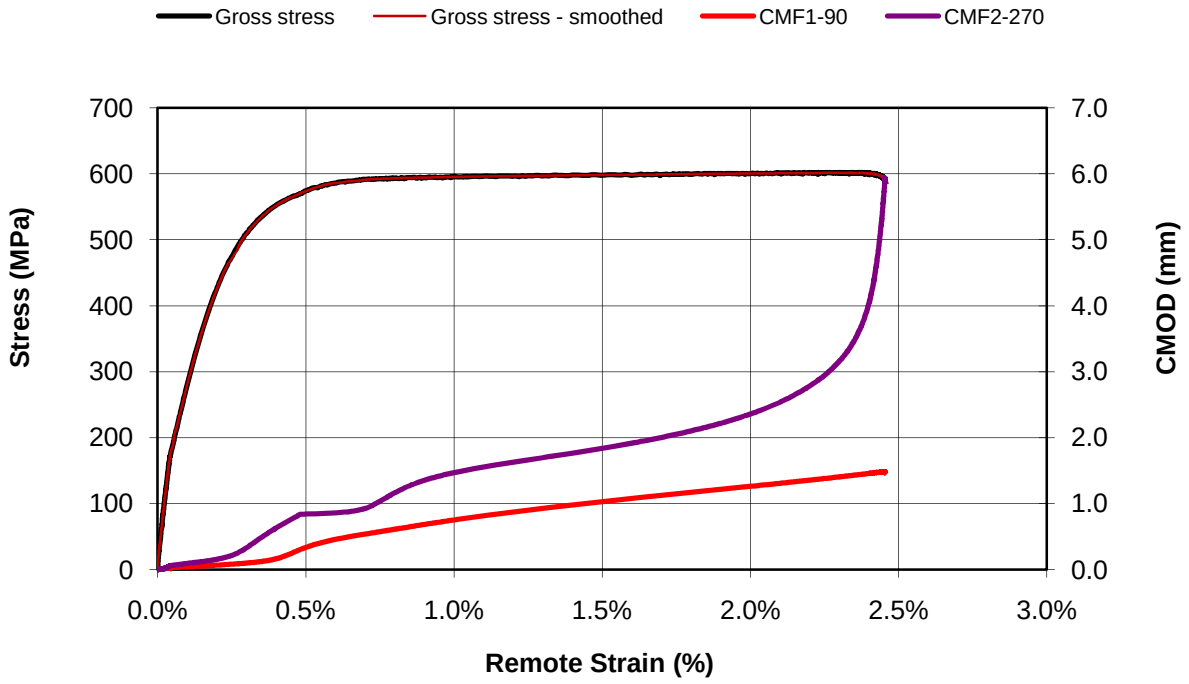
Test Summary Sheet

Spec. No. **1.24** Test type **12" NPS**

Specimen Details		
Pipe Diameter, OD	324.4	mm
Wall thickness, t	12.78	mm
Type	High Y/T	
Grade	X65	
SMYS	448	MPa
SMTS	531	MPa
F yield (hoop | axial)	509 | 547	MPa
F tensile (hoop | axial)	588 | 593	MPa
Test temperature	17	ºC
Test pressure	30.20	MPa
Specimen length, L1	1,324	mm
Target flaw size	3 x 50	mm
Number of Flaws	2 (2 per cross-section)	
Target flaw location	HAZ	

	Load Peak	End Point	
Total Load	7,530	7,418	kN
Gross Stress	601.7	593	MPa
Strain LTU	2.23%	2.40%	
Strain LBU	2.33%	2.51%	
Strain LTBU	2.28%	2.45%	
CMOD	3.05	5.94	mm

Strain Notation:
Strain LTU: average strain in uniform strain zone of top weld can (LTU series LVDTs)
Strain LBU: average strain in uniform strain zone of bottom weld can (LBU series LVDTs)
Strain LTBU: average strain in uniform strain zones of both weld cans (LTU and LBU series LVDTs)

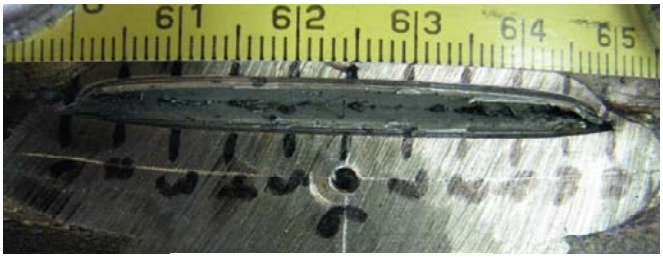


**Average strain from LVDTs in uniform strain zones of both weld cans (i.e. LTBU strain)*

C-FER Technologies	Pre-test Measurements Taken By: JZW	Date: 10-Mar-10	PRCI/DOT
	Approval for Testing: RTP	Date: 11-Mar-10	1.24

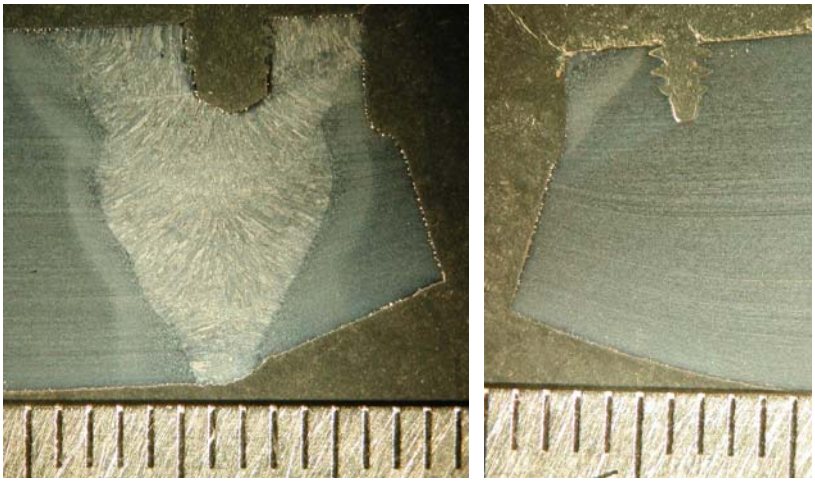
Photographs

Test Set-up



45° Flaw After Testing

270° Flaw Fracture Surface



270° Flaw Macro Images

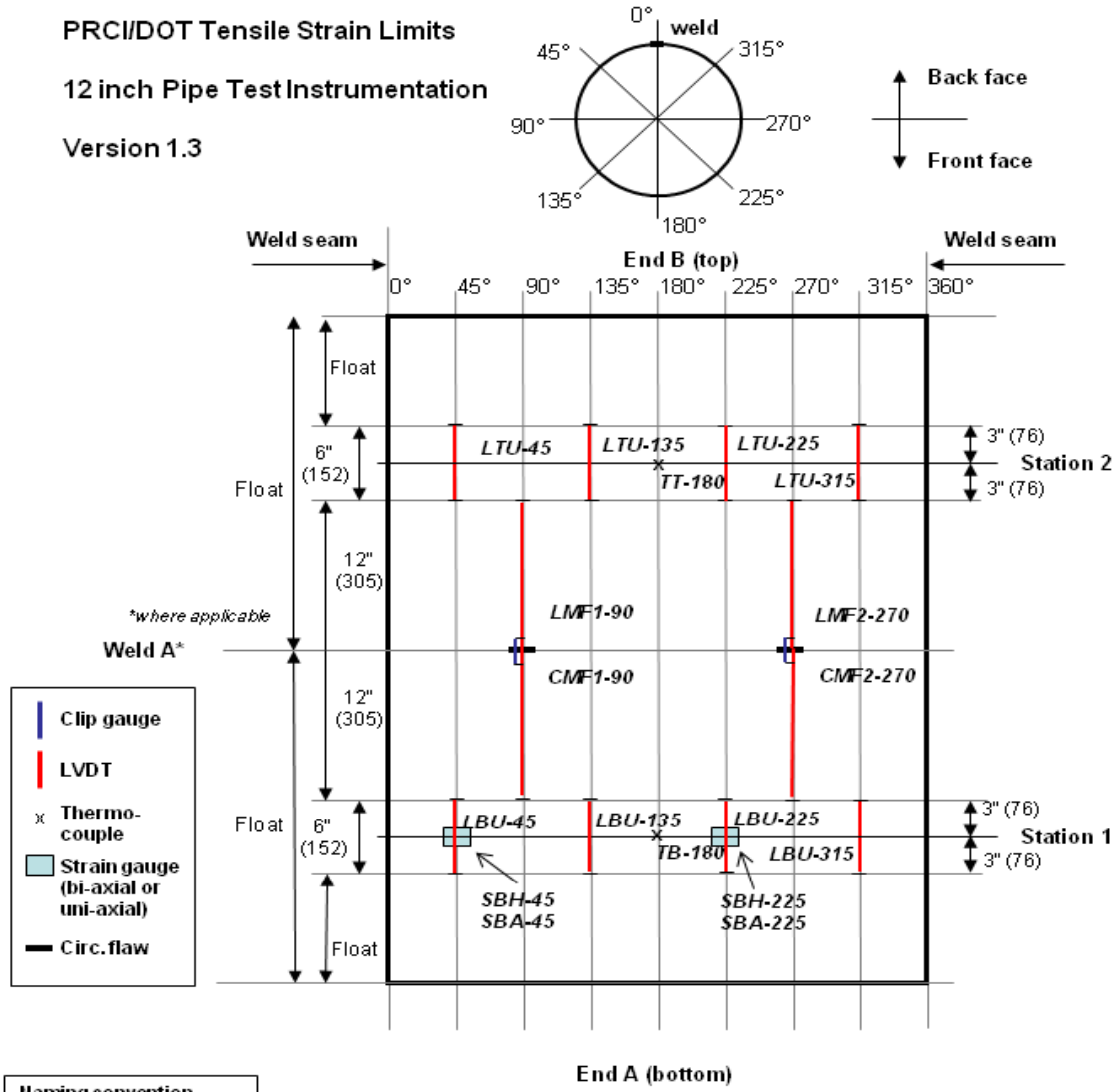
C-FER Technologies	Pre-test Measurements Taken By: JZW	Date: 10-Mar-10	**PRCI/DOT**
	Approval for Testing: RTP	Date: 11-Mar-10	**1.24**

Instrumentation Layout

PRCI/DOT Tensile Strain Limits

12 inch Pipe Test Instrumentation

Version 1.3



Naming convention

L – LVDT
C – clip gauge
T – thermocouple
S – strain gauge

T – top
M – middle
B – bottom

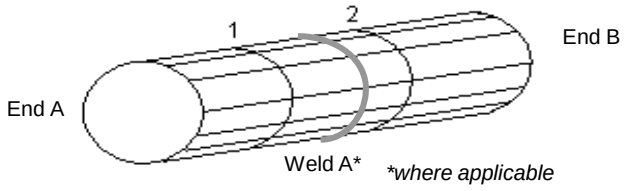
U – uniform strain zone
F – flawbridging
H – hoop gauge
A – axial gauge

C-FER Technologies	Pre-test Measurements Taken By: JZW	Date: 10-Mar-10	PRCI/DOT
	Approval for Testing: RTP	Date: 11-Mar-10	1.24

Specimen Measurements Before Testing

Distance from Scan to Seam

Weld Number
Weld A 776-CO
Weld Letter Label
Weld A

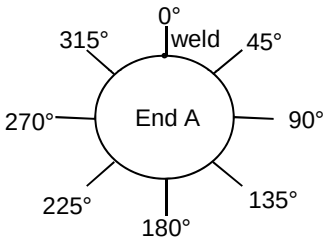


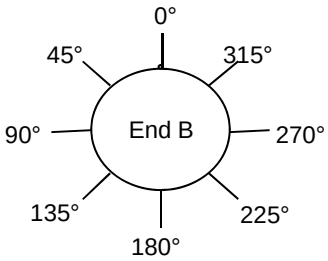
Distance Between Stations (mm)	
End A to 1	319
1 to 2	762
2 to End B	241
End A to Weld A	696
Weld A to End B	624

Pipe Length (mm)	
0°	1,324.0
90°	1,325.0
180°	1,324.0
270°	1,323.0
Average:	1,324.0

Circumference (mm)	
End A	1,020
End B	1,022

Diameter Measurement (mm)				
Station	Angle			
	0°-180°	45°-225°	90°-270°	135°-315°
1	324.485	324.561	324.307	324.561
2	324.383	324.460	324.231	324.307





Ultrasonic Probe Measurement	
Probe Calibration	
0.200" gauge block reading:	
0.500" gauge block reading:	

Wall Thickness Measurement (mm)		
Angle	Station 1	Station 2
0°	12.70	12.73
45°	12.78	12.75
90°	12.78	12.85
135°	12.75	12.80
180°	12.80	12.80
225°	12.80	12.78
270°	12.83	12.78
315°	12.75	12.85
Average	12.77	12.79
Overall average	12.78	

C-FER Technologies	Pre-test Measurements Taken By: JZW	Date: 10-Mar-10	PRCI/DOT
	Approval for Testing: RTP	Date: 11-Mar-10	1.24

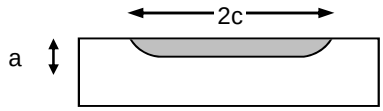
Specimen Measurements Before Testing

Gauge Length (mm)								
Location	0°	45°	90°	135°	180°	225°	270°	315°
LTU		153		153.0		152		153
LMF			609				611	
LBU		153		153		154		153
CMF			8				8	

Average OD (mm)	324.41
Average ID (mm)	298.85
ID Area (mm^2)	70,143
Gross Area (mm^2)	12,514

C-FER Technologies	Pre-test Measurements Taken By: JZW	Date: 10-Mar-10	**PRCI/DOT**
	Approval for Testing: RTP	Date: 11-Mar-10	**1.24**

Specimen Measurements Before Testing



Defect Size (mm) F1-90			
Length	2c	50.31	
Depth	a_1	1.39	
	a_2	1.93	
	a_3	3.14	average depth = 3.00
	a_4	2.96	
	a_5	2.96	
	a_6	3.12	
	a_7	2.92	
	a_8	2.91	
	a_9	1.82	
	a_{10}	1.35	
Defect Area (mm^2)		126.06	
Scribe Offset	N/A		

Defect Size (mm) F2-270			
Length	2c	50.39	
Depth	a_1	1.45	
	a_2	1.86	
	a_3	3.15	average depth = 3.00
	a_4	2.97	
	a_5	2.92	
	a_6	2.95	
	a_7	2.92	
	a_8	3.11	
	a_9	1.84	
	a_{10}	1.33	
Defect Area (mm^2)		126.37	
Scribe Offset	N/A		

C-FER Technologies	Pre-test Measurements Taken By: JZW	Date: 10-Mar-10	**PRCI/DOT**
	Approval for Testing: RTP	Date: 11-Mar-10	**1.24**