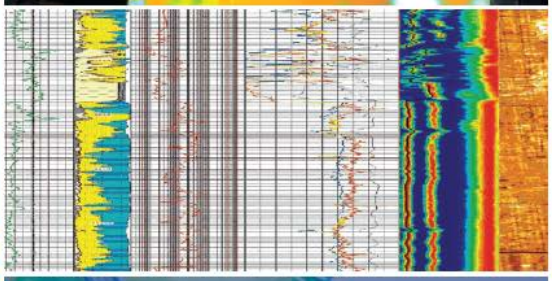
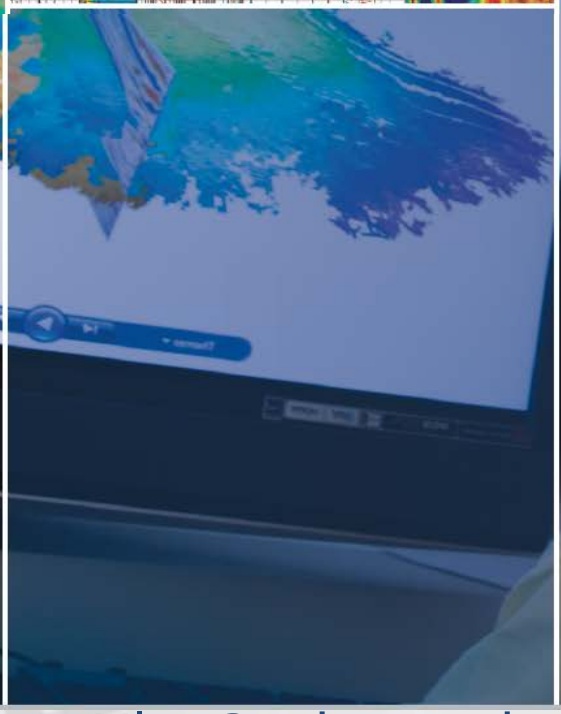
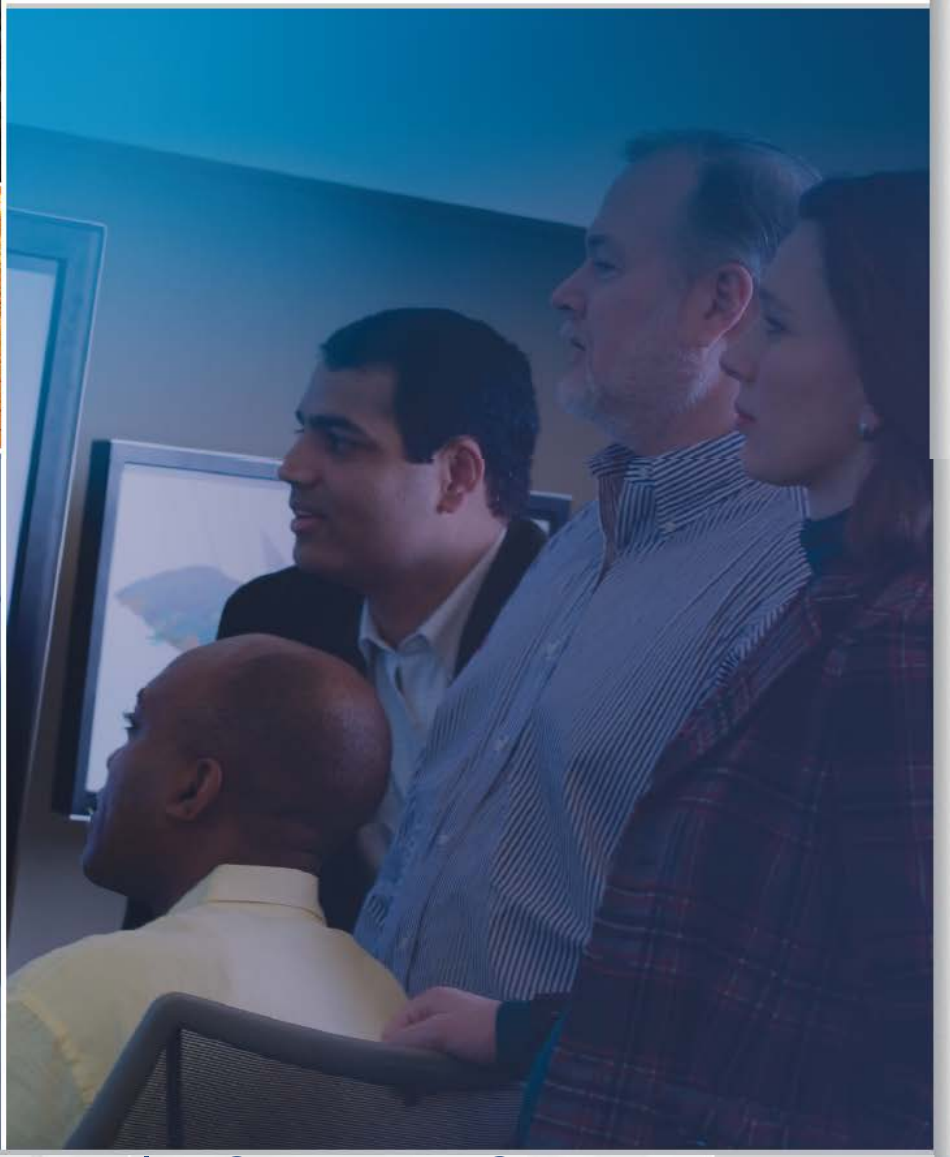
PetroTechnical Services







UltraSonic Imaging Tool – Corrosion Summary

Company	Encana Oil & Gas Inc (USA)
Field	Wattenberg
Well Name	Ranchero 1
UWI	
Log Date	06-May-2013
Analyst	Matt Beken

Schlumberger

Contents

SCHLUMBERGER LEGAL DISCLAIMER 3
Executive Summary 4
Objectives 4
Comments 4
Original Log Header 5
Tabular Listing 6
Log Snapshots 14

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Executive Summary

Objectives

A USIT corrosion log was run in the Ranchero 1 well to evaluate casing condition.

Comments

Out of 168 joints surveyed, 14 joints show penetrations above 12.5%. The joint table below gives the details of these joints with remarks. Below are screenshots of the relevant log sections.

Original Log Header

Schlumberger

Company: ENCANA OIL & GAS INC (USA)

Well: RANCHERO 1
Field: WATTENBERG
County: WELD State: COLORADO

ULTRASONIC IMAGER
CASING EVALUATION

County: WELD
Field: WATTENBERG
Location: SEC. 34, T2N, R66W
Well: RANCHERO 1
Company: ENCANA OIL & GAS INC (USA)

LOCATION

SEC. 34, T2N, R66W SHL: 1650' FSL X 990' FWL NWSW	Elev.: K.B.	5013.00 ft
	G.L.	5010.00 ft
	D.F.	5012.00 ft
Permanent Datum: GROUND LEVEL	Elev.:	5010.00 ft
Log Measured From: GROUND LEVEL	3.00 ft	above Perm. Datum
Drilling Measured From: GROUND LEVEL		

API Serial No.	Section	Township	Range
05-123-08576-0000	34	2N	66W

Logging Date	6-May-2013		
Run Number	1		
Depth Driller	7131 ft		
Schlumberger Depth	7130 ft		
Bottom Log Interval	7130 ft		
Top Log Interval	0 ft		
Casing Fluid Type	FRESH WATER		
Salinity			
Density	8.4 lbm/gal		
Fluid Level	0 ft		
BIT/CASING/TUBING STRING			
Bit Size	7.875 in		
From			
To			
Casing/Tubing Size	0.000 in		
Weight	11.6 lbm/ft		
Grade			
From			
To			
Maximum Recorded Temperatures			
Logger On Bottom Time	6-May-2013	8:30	
Unit Number Location	3030 FORT MORGAN, CO		
Recorded By	KERI LORING		
Witnessed By	ED MARTIN		

Tabular Listing

Casing Integrity Advisor

Schlumberger

Company Name: ENCANA OIL & GAS INC (USA)
Well Name: RANCHERO 1
Field: WATTENBERG

Casing Data

Casing Details	String 1
Top (ft)	108.00
Base (ft)	7086.00
Casing Size (CSIZ) (in)	4.5
Casing Weight (CWEI) (lb/f)	11.6
Casing Grade (CASG)	J-55
Yield Strength (psi)	55000
Casing Nom. ID (CSID) (in)	4.0
Casing Nom. Thk (THNO) (in)	0.25
Good/Bad Threshold (%)	*12.5*
ECCE Max(in)	*0.11*
Collapse Pressure	4958
Collapse Multilpier	*1*

Pipe Tally Sheet - USI

Reduction in Thickness	List of Joints	Total # of Joints
0% to 12.5%	2, 4, 5, 6, 7, 8, 11, 12, 13, 14, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 29, 30, 31, 32, 33, 34, 36, 37, 38, 40, 41, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 77, 78, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 164, 165, 166, 1	154
12.5% to 40%	1, 3, 9, 10, 15, 27, 28, 35, 39, 42, 76, 79, 140, 163	14
40% to 60%		0
60% to 100%		0
>100%		0
Total		**168**

Casing Integrity Advisor

Schlumberger

Company Name: ENCANA OIL & GAS INC (USA)
Well Name: RANCHERO 1
Field: WATTENBERG

Joint Summary - USI

No. (Incl)	Joint Top	Length	Remark	Penetration	USI Min min Thick	USI Depth of MT	USI Max Int. rad.	USI Depth of Max Int Rad	Min Burst Strength	Collapse Pressure	Min ID	Min ID Depth
	ft	ft		%	in	ft	in	ft	psig	psig	in	ft
1	154.25	42.23	Repeats at 14.8% with no flag. Main pass had loop processing flag indicating 22.4% value probably incorrect.	22.4	0.194	181.50	2.044	173.25	4742	2911 (API3)	3.99	155.50
2	196.48	41.77	Repeats at 12.8%	11.2	0.222	206.00	2.041	199.00	5427	3934 (API3)	4.00	234.25
3	238.25	41.75	No flags. External corrosion over several feet	21.2	0.197	258.25	2.041	246.75	4816	3021 (API3)	4.00	240.25
4	280.00	41.50		6.4	0.234	297.50	2.046	282.75	5720	4373 (API3)	4.00	281.25
5	321.50	42.01		4.8	0.238	353.50	2.035	328.00	5818	4519 (API3)	3.99	339.50
6	363.51	41.49		3.6	0.241	395.75	2.037	398.75	5891	4629 (API3)	3.93	403.75
7	405.00	41.00		4.8	0.238	410.00	2.044	407.50	5818	4519 (API3)	3.99	431.50
8	446.00	41.75		5.2	0.237	463.75	2.037	448.00	5793	4483 (API3)	3.98	449.00
9	487.75	39.75	Repeat Unavailable, No flags, single sample event	21.2	0.197	516.25	2.035	500.25	4816	3021 (API3)	3.96	490.50
10	527.50	41.75	Repeat unavailable, No flags, single sample event	21.6	0.196	535.75	2.033	545.25	4791	2984 (API3)	3.97	529.25
11	569.25	41.50		4.8	0.238	591.75	2.035	597.25	5818	4519 (API3)	3.97	570.50
12	610.75	40.50		11.6	0.221	634.25	2.038	613.50	5402	3898 (API3)	3.97	612.00
13	651.25	40.25		5.2	0.237	656.00	2.034	654.00	5793	4483 (API3)	3.98	652.50
14	691.50	42.00		4.8	0.238	700.75	2.028	693.50	5818	4519 (API3)	3.97	710.75
15	733.50	41.50	Repeat unavailable, No flags, single sample event, low amplitude on map	21.6	0.196	736.75	2.032	757.50	4791	2984 (API3)	3.98	735.25
16	775.00	41.00		4.4	0.239	778.75	2.025	791.25	5842	4556 (API3)	3.97	784.75
17	816.00	42.33		6.4	0.234	847.75	2.026	851.00	5720	4373 (API3)	3.96	817.25
18	858.33	43.10		6.4	0.234	898.25	2.032	886.50	5720	4373 (API3)	3.97	860.75
19	901.43	37.82		4.4	0.239	936.00	2.041	904.50	5842	4556 (API3)	3.91	904.00
20	939.25	41.75		6.0	0.235	941.00	2.024	964.75	5744	4410 (API3)	3.98	940.50
21	981.00	41.50		7.2	0.232	1014.00	2.031	1019.50	5671	4300 (API3)	3.96	997.00
22	1022.50	42.27		7.2	0.232	1034.25	2.031	1063.50	5671	4300 (API3)	3.94	1023.75
23	1064.77	41.68		12.0	0.220	1073.75	2.031	1104.75	5378	3861 (API3)	3.97	1066.25
24	1106.45	41.80		8.4	0.229	1137.50	2.029	1110.25	5598	4190 (API3)	3.97	1108.25
25	1148.25	42.00		8.0	0.230	1164.00	2.040	1151.00	5622	4227 (API3)	3.98	1149.50
26	1190.25	41.75		7.6	0.231	1216.25	2.033	1193.00	5647	4263 (API3)	3.98	1191.50
27	1232.00	42.00	Repeat unavailable. Not flagged, 2 radial samples, 2 vertical samples.	18.8	0.203	1242.50	2.032	1253.00	4962	3240 (API3)	3.98	1258.50
28	1274.00	41.00	Repeats at 21.2%	16.4	0.209	1311.25	2.064	1311.25	5109	3459 (API3)	3.99	1276.50
29	1315.00	42.25		6.4	0.234	1331.50	2.029	1336.75	5720	4373 (API3)	3.98	1344.75
30	1357.25	41.50		5.2	0.237	1378.75	2.034	1360.25	5793	4483 (API3)	3.98	1360.00
31	1398.75	41.50		7.2	0.232	1415.50	2.028	1409.25	5671	4300 (API3)	3.95	1400.75
32	1440.25	41.25		3.2	0.242	1447.50	2.026	1452.50	5916	4665 (API3)	3.97	1442.75
33	1481.50	42.65		8.8	0.228	1501.00	2.041	1507.50	5573	4154 (API3)	3.94	1523.00
34	1524.15	41.60		4.4	0.239	1555.50	2.034	1531.75	5842	4556 (API3)	3.99	1559.75

No. (Ind)	Joint Top	Length	Remark	Penetration	USI Min min Thick	USI Depth of MT	USI Max Int. rad.	USI Depth of Max Int Rad	Min Burst Strength	Collapse Pressure	Min ID	Min ID Depth
	ft	ft		%	in	ft	in	ft	psig	psig	in	ft
35	1565.75	42.54	Spikes removed at 1571 & 1577 by increasing thickness window.	20.4	0.199	1603.50	2.034	1598.50	4864	3094 (API3)	3.97	1567.75
36	1608.29	41.46		4.0	0.240	1637.25	2.027	1626.50	5867	4592 (API3)	3.97	1610.25
37	1649.75	41.50		11.6	0.221	1661.75	2.059	1661.75	5402	3898 (API3)	3.96	1651.25
38	1691.25	41.75		3.6	0.241	1731.50	2.029	1720.50	5891	4629 (API3)	3.97	1703.50
39	1733.00	41.50	Repeat unavailable. Low amplitude marking, some signs on radius throughout joint. Looks like internal corrosion. Loop processing flags presnt, so max penetration value may be pessimistic.	21.2	0.197	1770.00	2.061	1757.00	4816	3021 (API3)	3.97	1754.75
40	1774.50	42.00		5.2	0.237	1780.50	2.026	1798.25	5793	4483 (API3)	3.97	1801.00
41	1816.50	41.50		3.6	0.241	1837.25	2.027	1819.75	5891	4629 (API3)	3.98	1853.75
42	1858.00	42.00	Repeat unavailable. Data point is flagged so may not be accurate. However, internal corrosion seen throughout joint. Similar to joint 39	20.4	0.199	1868.75	2.051	1890.25	4864	3094 (API3)	3.96	1876.50
43	1900.00	41.92		9.2	0.227	1910.00	2.042	1902.75	5549	4117 (API3)	3.95	1940.75
44	1941.92	41.99		8.4	0.229	1948.25	2.022	1944.25	5598	4190 (API3)	3.96	1951.00
45	1983.90	41.11		4.0	0.240	2023.25	2.022	2020.50	5867	4592 (API3)	3.96	1994.50
46	2025.00	41.50		3.2	0.242	2034.25	2.026	2040.25	5916	4665 (API3)	3.97	2055.50
47	2066.50	40.91		4.8	0.238	2071.25	2.031	2068.75	5818	4519 (API3)	3.98	2101.75
48	2107.41	41.98		6.0	0.235	2143.50	2.031	2115.75	5744	4410 (API3)	3.95	2109.75
49	2149.39	40.85		5.6	0.236	2165.75	2.031	2151.75	5769	4446 (API3)	3.95	2189.25
50	2190.24	41.88		5.6	0.236	2218.50	2.027	2192.50	5769	4446 (API3)	3.97	2192.00
51	2232.12	41.10		6.4	0.234	2267.00	2.024	2242.00	5720	4373 (API3)	3.96	2245.75
52	2273.22	41.28		6.8	0.233	2279.75	2.024	2276.00	5696	4336 (API3)	3.96	2310.00
53	2314.50	41.75		6.0	0.235	2326.25	2.028	2355.00	5744	4410 (API3)	3.97	2330.50
54	2356.25	42.17		5.6	0.236	2378.00	2.024	2378.00	5769	4446 (API3)	3.95	2357.50
55	2398.42	40.83		4.0	0.240	2413.25	2.023	2404.50	5867	4592 (API3)	3.97	2430.50
56	2439.25	42.53		5.6	0.236	2474.00	2.023	2474.00	5769	4446 (API3)	3.96	2480.50
57	2481.78	41.47		7.2	0.232	2505.00	2.019	2490.50	5671	4300 (API3)	3.97	2484.00
58	2523.25	42.00		7.2	0.232	2547.25	2.027	2526.00	5671	4300 (API3)	3.96	2527.50
59	2565.25	41.50		5.2	0.237	2583.00	2.016	2582.75	5793	4483 (API3)	3.96	2576.00
60	2606.75	41.13		8.0	0.230	2614.00	2.024	2620.00	5622	4227 (API3)	3.96	2625.00
61	2647.88	41.38		8.8	0.228	2664.00	2.047	2664.00	5573	4154 (API3)	3.96	2649.75
62	2689.25	41.25		6.8	0.233	2703.50	2.020	2693.25	5696	4336 (API3)	3.93	2690.50
63	2730.50	42.25		6.4	0.234	2771.00	2.021	2733.50	5720	4373 (API3)	3.95	2767.75
64	2772.75	41.75		5.2	0.237	2783.75	2.014	2807.75	5793	4483 (API3)	3.95	2798.75
65	2814.50	41.46		6.0	0.235	2822.50	2.021	2844.00	5744	4410 (API3)	3.92	2854.50
66	2855.96	41.29		3.6	0.241	2858.75	2.015	2862.50	5891	4629 (API3)	3.95	2867.00
67	2897.25	42.67		3.6	0.241	2931.75	2.014	2899.25	5891	4629 (API3)	3.95	2903.00
68	2939.92	41.33		4.0	0.240	2966.75	2.016	2949.00	5867	4592 (API3)	3.95	2941.25
69	2981.25	42.25		4.8	0.238	3011.75	2.013	3010.00	5818	4519 (API3)	3.95	2984.00
70	3023.50	40.33		5.2	0.237	3041.50	2.020	3047.50	5793	4483 (API3)	3.92	3062.75
71	3063.83	40.97		5.6	0.236	3065.50	2.017	3065.25	5769	4446 (API3)	3.95	3097.00
72	3104.80	41.59		4.8	0.238	3132.75	2.017	3110.25	5818	4519 (API3)	3.92	3107.25
73	3146.39	40.11		3.2	0.242	3160.50	2.016	3148.75	5916	4665 (API3)	3.94	3179.00

No. (Ind)	Joint Top	Length	Remark	Penetration	USI Min min Thick	USI Depth of MT	USI Max Int. rad.	USI Depth of Max Int Rad	Min Burst Strength	Collapse Pressure	Min ID	Min ID Depth
	ft	ft		%	in	ft	in	ft	psig	psig	in	ft
74	3186.50	42.32		7.6	0.231	3198.50	2.033	3189.50	5647	4263 (API3)	3.95	3215.00
75	3228.82	40.93		7.6	0.231	3233.25	2.022	3240.25	5647	4263 (API3)	3.96	3231.50
76	3269.75	41.00	Repeat unavailable. Data point is flagged so may not be accurate. However, internal corrosion seen throug	28.4	0.179	3290.75	2.058	3285.75	4376	2374 (API5)	3.95	3302.25
77	3310.75	42.07		7.2	0.232	3316.75	2.014	3325.75	5671	4300 (API3)	3.95	3331.25
78	3352.82	40.93		5.6	0.236	3370.75	2.018	3384.75	5769	4446 (API3)	3.95	3354.00
79	3393.75	42.25	Repeat unavailable. No flags. THMN and IRMX coincide.	20.0	0.200	3413.25	2.014	3413.25	4889	3130 (API3)	3.94	3420.00
80	3436.00	41.34		2.4	0.244	3438.50	2.015	3439.00	5964	4738 (API3)	3.95	3456.75
81	3477.34	41.66		4.4	0.239	3500.75	2.014	3500.50	5842	4556 (API3)	3.92	3478.50
82	3519.00	41.08		2.0	0.245	3522.00	2.015	3526.50	5989	4775 (API3)	3.94	3522.00
83	3560.08	41.17		3.6	0.241	3599.25	2.017	3572.75	5891	4629 (API3)	3.94	3563.00
84	3601.25	41.25		4.4	0.239	3625.00	2.017	3610.50	5842	4556 (API3)	3.93	3602.75
85	3642.50	41.75		2.4	0.244	3652.75	2.020	3645.25	5964	4738 (API3)	3.95	3674.25
86	3684.25	42.00		4.8	0.238	3724.75	2.018	3718.25	5818	4519 (API3)	3.94	3686.00
87	3726.25	39.00		2.8	0.243	3729.00	2.010	3728.75	5940	4702 (API3)	3.94	3764.25
88	3765.25	41.75		2.8	0.243	3778.75	2.018	3768.00	5940	4702 (API3)	3.95	3766.75
89	3807.00	41.25		2.8	0.243	3809.00	2.013	3813.00	5940	4702 (API3)	3.95	3815.25
90	3848.25	41.75		3.2	0.242	3857.25	2.015	3856.50	5916	4665 (API3)	3.95	3866.00
91	3890.00	41.00		2.8	0.243	3914.75	2.014	3924.00	5940	4702 (API3)	3.96	3892.25
92	3931.00	41.75		1.2	0.247	3935.00	2.010	3934.00	6038	4848 (API3)	3.92	3933.75
93	3972.75	40.75		1.2	0.247	3975.25	2.009	4011.00	6038	4848 (API3)	3.94	3976.00
94	4013.50	41.96		2.0	0.245	4016.00	2.012	4020.25	5989	4775 (API3)	3.90	4054.50
95	4055.46	42.06		2.0	0.245	4093.75	2.009	4089.25	5989	4775 (API3)	3.92	4057.00
96	4097.51	41.24		3.6	0.241	4127.25	2.009	4108.50	5891	4629 (API3)	3.91	4099.00
97	4138.75	42.00		3.2	0.242	4177.50	2.009	4168.75	5916	4665 (API3)	3.94	4156.50
98	4180.75	40.75		4.4	0.239	4211.00	2.013	4183.25	5842	4556 (API3)	3.93	4216.50
99	4221.50	41.75		2.8	0.243	4238.00	2.008	4250.25	5940	4702 (API3)	3.94	4254.50
100	4263.25	42.00		2.8	0.243	4265.75	2.011	4266.25	5940	4702 (API3)	3.94	4270.00
101	4305.25	41.00		1.2	0.247	4344.75	2.008	4326.25	6038	4848 (API3)	3.95	4308.25
102	4346.25	42.00		4.8	0.238	4348.75	2.009	4349.50	5818	4519 (API3)	3.94	4384.50
103	4388.25	41.00		1.6	0.246	4411.00	2.012	4397.50	6013	4812 (API3)	3.93	4420.75
104	4429.25	40.00		2.4	0.244	4460.50	2.007	4459.50	5964	4738 (API3)	3.94	4451.75
105	4469.25	41.25		3.2	0.242	4475.00	2.009	4488.25	5916	4665 (API3)	3.94	4478.75
106	4510.50	41.50		1.2	0.247	4542.75	2.006	4520.00	6038	4848 (API3)	3.94	4513.50
107	4552.00	42.00		0.8	0.248	4572.25	2.003	4555.25	6062	4885 (API3)	3.93	4553.50
108	4594.00	41.50		4.8	0.238	4598.75	2.007	4599.25	5818	4519 (API3)	3.93	4596.00
109	4635.50	40.73		1.2	0.247	4646.25	2.002	4659.00	6038	4848 (API3)	3.90	4674.50
110	4676.23	40.02		6.8	0.233	4714.75	2.012	4678.75	5696	4336 (API3)	3.94	4677.75
111	4716.25	41.75		8.4	0.229	4726.75	2.004	4728.75	5598	4190 (API3)	3.93	4742.00
112	4758.00	41.50		5.6	0.236	4785.25	2.007	4786.50	5769	4446 (API3)	3.93	4790.25
113	4799.50	40.72	Sub stops rotating at tool passes through the collar. Data is invalid where sub is not rotating however this is seen at 5 different collars and repeated. This suggests that there may be something in the collar causing the sub to stop rotat	3.6	0.241	4816.00	2.162	4803.25	5891	4629 (API3)	3.55	4800.75

No. (Ind)	Joint Top	Length	Remark	Penetration	USI Min min Thick	USI Depth of MT	USI Max Int. rad.	USI Depth of Max Int Rad	Min Burst Strength	Collapse Pressure	Min ID	Min ID Depth
	ft	ft		%	in	ft	in	ft	psig	psig	in	ft
114	4840.22	41.53		8.8	0.228	4867.00	2.005	4847.50	5573	4154 (API3)	3.92	4856.00
115	4881.75	41.00		3.2	0.242	4898.50	2.002	4907.00	5916	4665 (API3)	3.93	4885.25
116	4922.75	41.00		2.0	0.245	4956.25	2.004	4940.75	5989	4775 (API3)	3.93	4927.50
117	4963.75	41.75		8.0	0.230	4993.25	2.006	4993.25	5622	4227 (API3)	3.92	4995.00
118	5005.50	41.25		10.4	0.224	5035.25	2.009	5017.25	5476	4007 (API3)	3.93	5030.75
119	5046.75	41.75		6.8	0.233	5066.75	2.025	5053.75	5696	4336 (API3)	3.93	5085.50
120	5088.50	41.02		6.4	0.234	5119.25	2.009	5119.50	5720	4373 (API3)	3.92	5128.50
121	5129.52	42.24		3.6	0.241	5161.75	2.007	5132.25	5891	4629 (API3)	3.92	5164.50
122	5171.76	41.49		3.2	0.242	5203.25	2.000	5184.25	5916	4665 (API3)	3.91	5173.50
123	5213.25	40.25		2.8	0.243	5245.50	2.000	5226.25	5940	4702 (API3)	3.92	5221.25
124	5253.50	35.25		8.0	0.230	5287.50	2.007	5256.50	5622	4227 (API3)	3.93	5275.00
125	5288.75	41.33		8.4	0.229	5319.25	2.006	5319.25	5598	4190 (API3)	3.87	5329.00
126	5330.08	41.42		6.4	0.234	5350.50	2.002	5366.25	5720	4373 (API3)	3.92	5342.50
127	5371.50	41.87		5.6	0.236	5411.75	1.998	5375.50	5769	4446 (API3)	3.89	5373.00
128	5413.37	40.43		2.4	0.244	5452.00	2.004	5441.00	5964	4738 (API3)	3.92	5415.75
129	5453.79	40.93		2.4	0.244	5482.50	2.005	5463.50	5964	4738 (API3)	3.88	5493.75
130	5494.72	40.28		4.8	0.238	5508.25	2.018	5499.50	5818	4519 (API3)	3.91	5511.50
131	5535.00	41.75		6.8	0.233	5539.50	1.992	5548.75	5696	4336 (API3)	3.91	5565.50
132	5576.75	41.30	Sub stops rotating at tool passes through the collar. Data is invalid where sub is not rotating however this is seen at 5 different collars and repeated. This suggests that there may be something in the collar causing the sub to stop rotat	4.0	0.240	5602.75	2.176	5578.25	5867	4592 (API3)	3.87	5578.00
133	5618.05	41.20		6.4	0.234	5627.75	2.001	5627.50	5720	4373 (API3)	3.91	5619.75
134	5659.25	42.00		6.0	0.235	5696.25	2.022	5665.50	5744	4410 (API3)	3.92	5661.75
135	5701.25	42.00		4.4	0.239	5729.50	2.002	5737.75	5842	4556 (API3)	3.92	5703.25
136	5743.25	39.50		2.8	0.243	5781.50	2.009	5745.00	5940	4702 (API3)	3.93	5772.00
137	5782.75	40.50		2.8	0.243	5790.25	2.005	5785.75	5940	4702 (API3)	3.92	5813.75
138	5823.25	42.25	Sub stops rotating at tool passes through the collar. Data is invalid where sub is not rotating however this is seen at 5 different collars and repeated. This suggests that there may be something in the collar causing the sub to stop rotat	3.2	0.242	5853.50	2.113	5826.00	5916	4665 (API3)	3.71	5824.50
139	5865.50	41.00		4.8	0.238	5887.25	2.012	5889.75	5818	4519 (API3)	3.92	5875.00
140	5906.50	41.50	Repeat unavailable. No flags. Low amplitudes indicate rugosity in the joint.	22.0	0.195	5937.75	2.007	5943.50	4767	2947 (API3)	3.91	5937.75
141	5948.00	42.00		3.6	0.241	5979.75	1.999	5957.50	5891	4629 (API3)	3.92	5950.00
142	5990.00	40.69		2.4	0.244	5992.50	2.004	6000.50	5964	4738 (API3)	3.92	5993.50
143	6030.69	40.56		2.4	0.244	6041.75	2.008	6037.75	5964	4738 (API3)	3.93	6070.25
144	6071.25	41.50		4.0	0.240	6106.75	2.008	6083.50	5867	4592 (API3)	3.93	6101.25
145	6112.75	41.55		2.4	0.244	6115.00	2.005	6116.50	5964	4738 (API3)	3.88	6152.75
146	6154.30	41.72		2.4	0.244	6177.25	2.011	6158.50	5964	4738 (API3)	3.93	6156.25
147	6196.01	41.24		3.6	0.241	6202.25	2.020	6199.00	5891	4629 (API3)	3.92	6211.75
148	6237.25	41.75		4.4	0.239	6265.50	2.000	6263.75	5842	4556 (API3)	3.91	6240.50
149	6279.00	41.25		2.8	0.243	6311.75	2.008	6282.00	5940	4702 (API3)	3.93	6307.50
150	6320.25	41.50		4.4	0.239	6329.00	2.000	6329.00	5842	4556 (API3)	3.91	6321.50

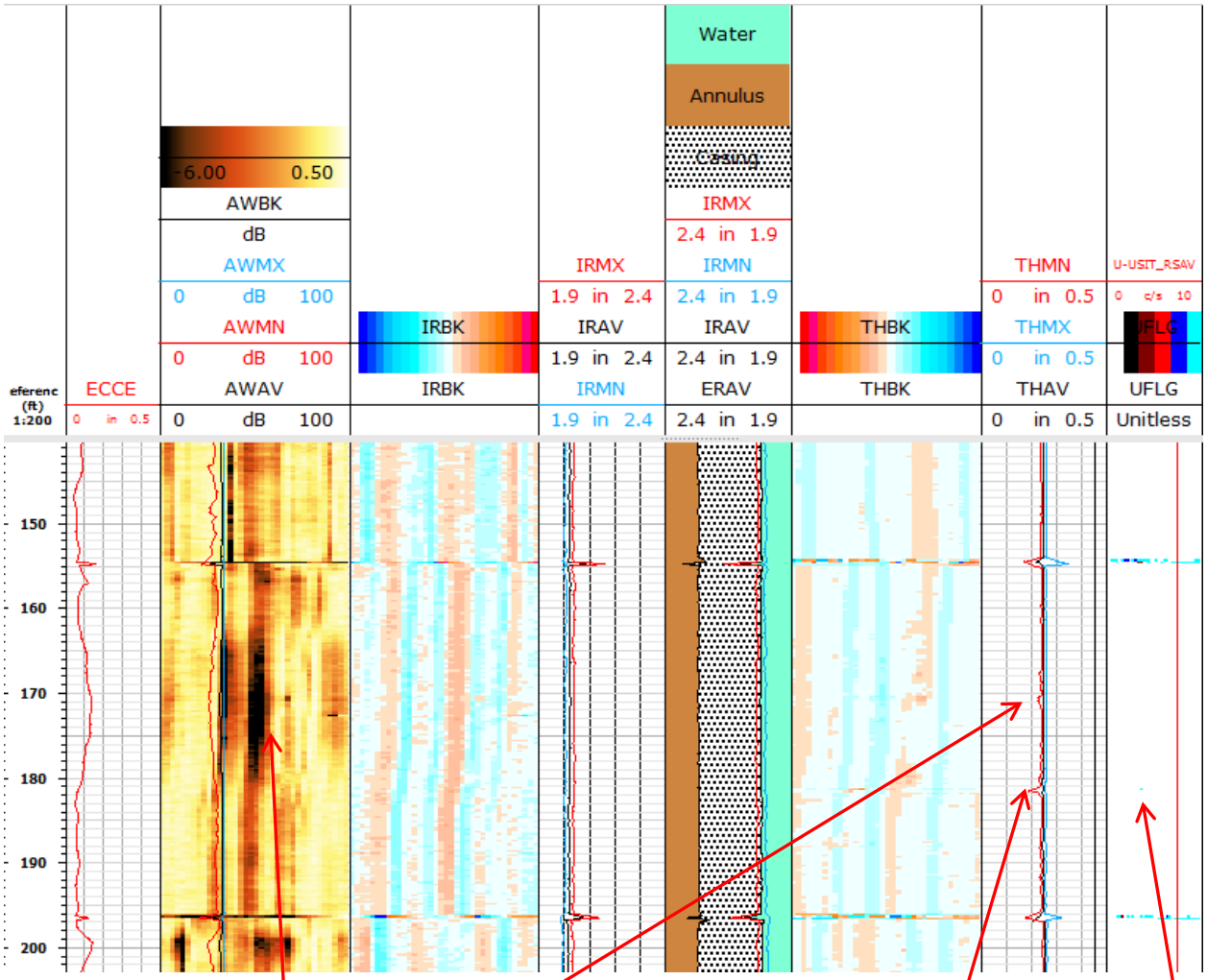
No. (Ind)	Joint Top	Length	Remark	Penetration	USI Min min Thick	USI Depth of MT	USI Max Int. rad.	USI Depth of Max Int Rad	Min Burst Strength	Collapse Pressure	Min ID	Min ID Depth
	ft	ft		%	in	ft	in	ft	psig	psig	in	ft
151	6361.75	40.73	Sub stops rotating at tool passes through the collar. Data is invalid where sub is not rotating however this is seen at 5 different collars and repeated. This suggests that there may be something in the collar causing the sub to stop rotat	4.0	0.240	6370.00	2.120	6364.50	5867	4592 (API3)	3.72	6364.50
152	6402.48	41.52		3.2	0.242	6422.75	1.997	6433.75	5916	4665 (API3)	3.90	6404.00
153	6444.00	38.88		4.4	0.239	6471.00	2.000	6467.50	5842	4556 (API3)	3.88	6481.75
154	6482.88	41.37		2.8	0.243	6517.00	2.005	6485.75	5940	4702 (API3)	3.91	6484.25
155	6524.25	41.75		2.8	0.243	6543.00	2.004	6541.75	5940	4702 (API3)	3.91	6558.25
156	6566.00	41.50		4.4	0.239	6588.00	1.993	6572.25	5842	4556 (API3)	3.90	6602.00
157	6607.50	42.00		4.8	0.238	6631.50	1.991	6645.00	5818	4519 (API3)	3.89	6609.25
158	6649.50	42.00	No resonance flag	3.2	0.242	6690.00	2.005	6660.50	5916	4665 (API3)	3.92	6658.75
159	6691.50	42.00		2.8	0.243	6705.75	2.056	6695.25	5940	4702 (API3)	3.90	6693.75
160	6733.50	42.21		3.2	0.242	6743.25	1.997	6745.50	5916	4665 (API3)	3.91	6735.00
161	6775.71	41.55		2.0	0.245	6782.00	2.002	6799.75	5989	4775 (API3)	3.90	6777.00
162	6817.25	42.00		4.0	0.240	6839.75	2.000	6837.75	5867	4592 (API3)	3.91	6819.00
163	6859.25	41.25	Repeat unavailable. No flags. Low amplitudes indicate rugosity in the joint.	27.2	0.182	6894.00	2.014	6863.75	4449	2472 (API3)	3.92	6884.75
164	6900.50	41.75		3.2	0.242	6928.50	2.007	6908.00	5916	4665 (API3)	3.92	6904.50
165	6942.25	41.75		4.4	0.239	6944.75	2.003	6945.00	5842	4556 (API3)	3.92	6977.75
166	6984.00	41.75		1.6	0.246	7017.00	2.022	6992.75	6013	4812 (API3)	3.92	7012.75
167	7025.75	41.75		4.4	0.239	7034.00	1.998	7043.75	5842	4556 (API3)	3.91	7043.50
168	7067.50	18.50		2.4	0.244	7077.50	1.990	7079.50	5964	4738 (API3)	3.90	7069.00

Joint Summary Reference Table

Column	Unit	Explanation
No. (Incl)		Joint Number
Joint Top	ft	Top of joint. Measured to center of collar above.
Joint Length	ft	Length of joint. Difference of Base and Top.
Remark		General interpreters remarks.
Penetration	%	Penetration. % of total wall thickness lost. Method dependant on the source of min. thickness measurement. -Minimum thickness: Used where direct thickness measurement is available. The single azimuthal point with the minimum thickness in the joint. %ppen = (1 - (minTHK /CTHK)) * 100. -minTHK = Measured thickness. -CTHK = Casing Nominal thickness
USI Min min Thick	in	Minimum minimum thickness. Single azimuthal measurement with the minimum thickness in the joint. Minimum of all level by level minimums. Same as minimum value of THMN channel within the joint.
USI Depth of MT	ft	Depth of Min Min Thickness.
USI Max Int. rad.	in	Maximum Internal Radius. Maximum of all maximum radii at each level within the joint. Same as maximum value of IRMX channel within the joint.
USI Depth of Max Int Rad	ft	Depth of Maximum Internal Radius. Depth of event IRMX_C_U
Min Burst Strength	psig	Minimum Burst strength. Burst is computed using the computed minimum thickness in the joint. The source for the thickness measurement is: USI thickness: THK=Min thickness from USI. Burst = burstSafetyFactor * YS * 2 * THK / COD -burst safety factor = 1 -YS = Yield Strength for casing (current joint) -THK = computed remaining thickness from above method -COD = Casing Nominal Diameter.

Column	Unit	Explanation
Collapse Pressure	psig	Collapse pressure. API computation for collapse pressure given by API 1, API 3 API5 Or API 7. All are based on ratio of Diameter to thickness and Yield Strength, where thickness is measured by one of the above methods. The user can select to have to the program select the best method depending on range of D/thickness or can select one of the API equations.
Min ID	in	Minimum Internal Diameter. Computed from pair of 180 degree apart calipers radius readings that produce the smallest sum or diameter.
Min ID Depth	ft	Depth of the Minimum Internal Diameter value.

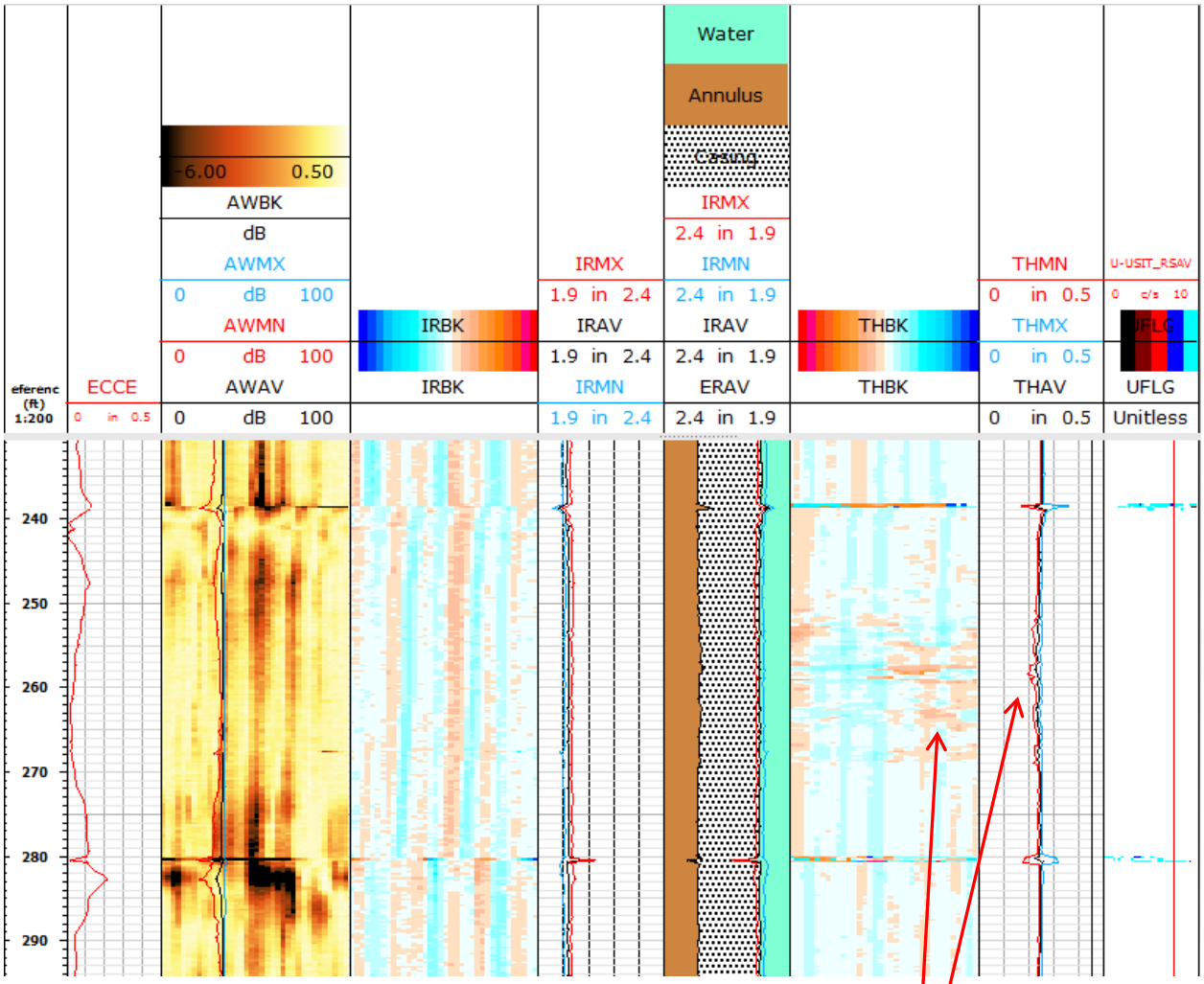
Log Snapshots

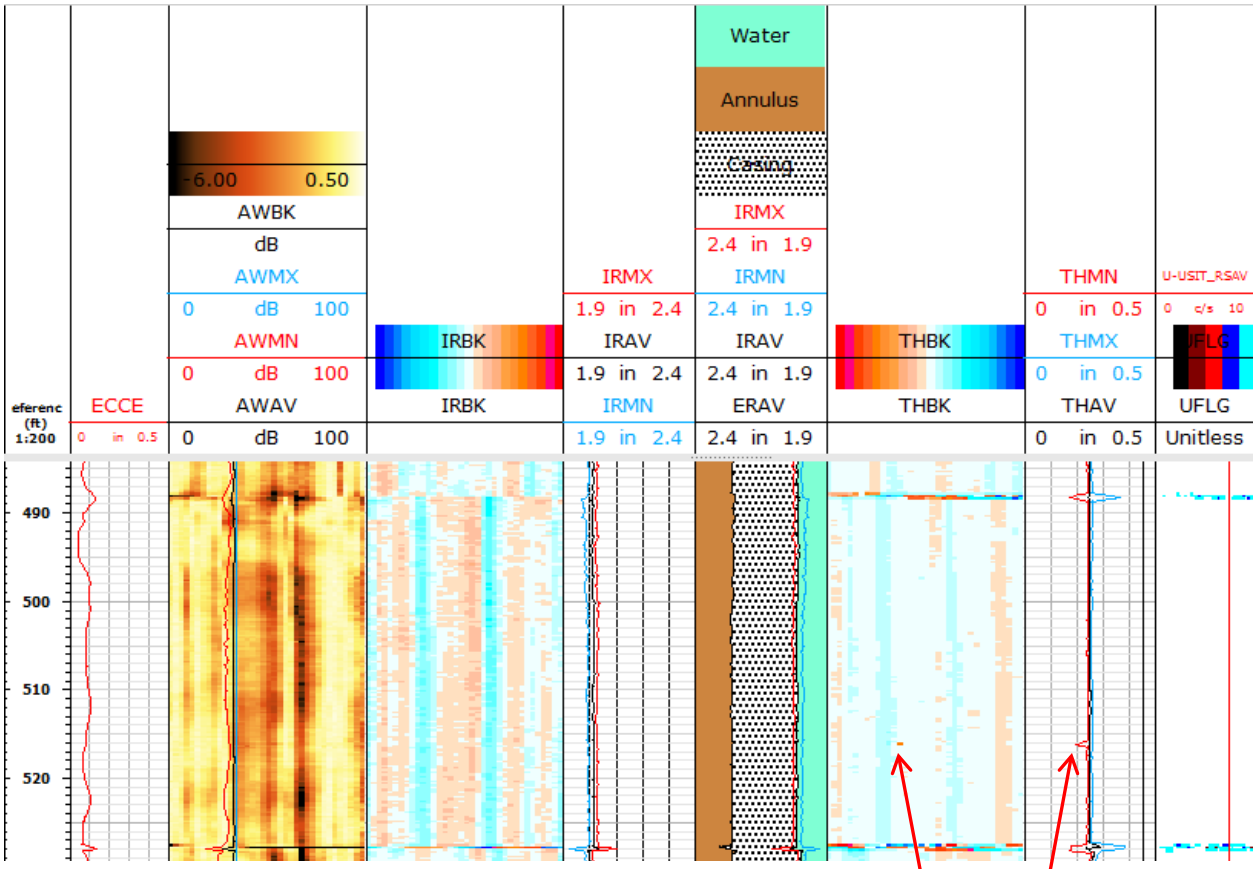


Low amplitude indicating internal rugosity and thickness reduction

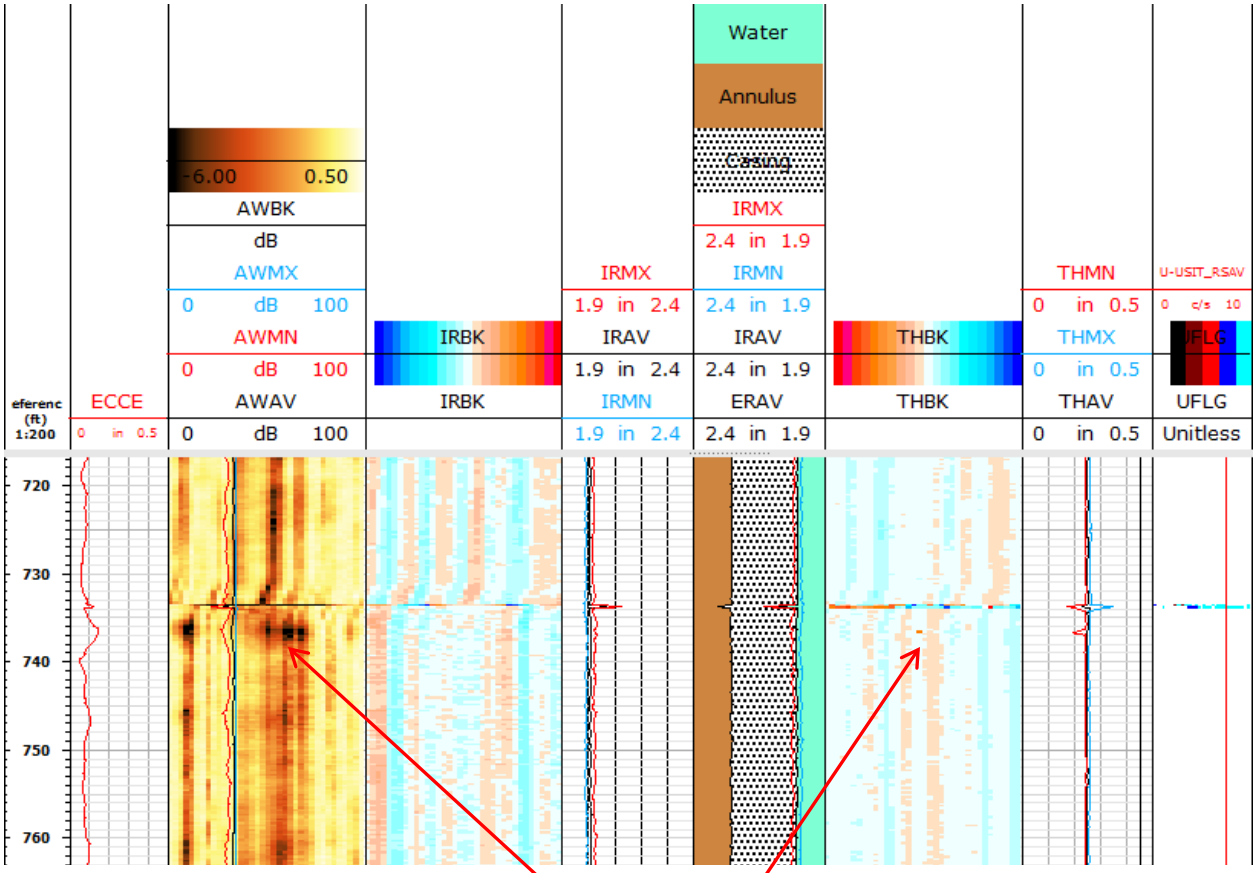
Min ID. Also present on repeat with no processing flag, at 14.8% penetration

Processing flag – non-convergence with model

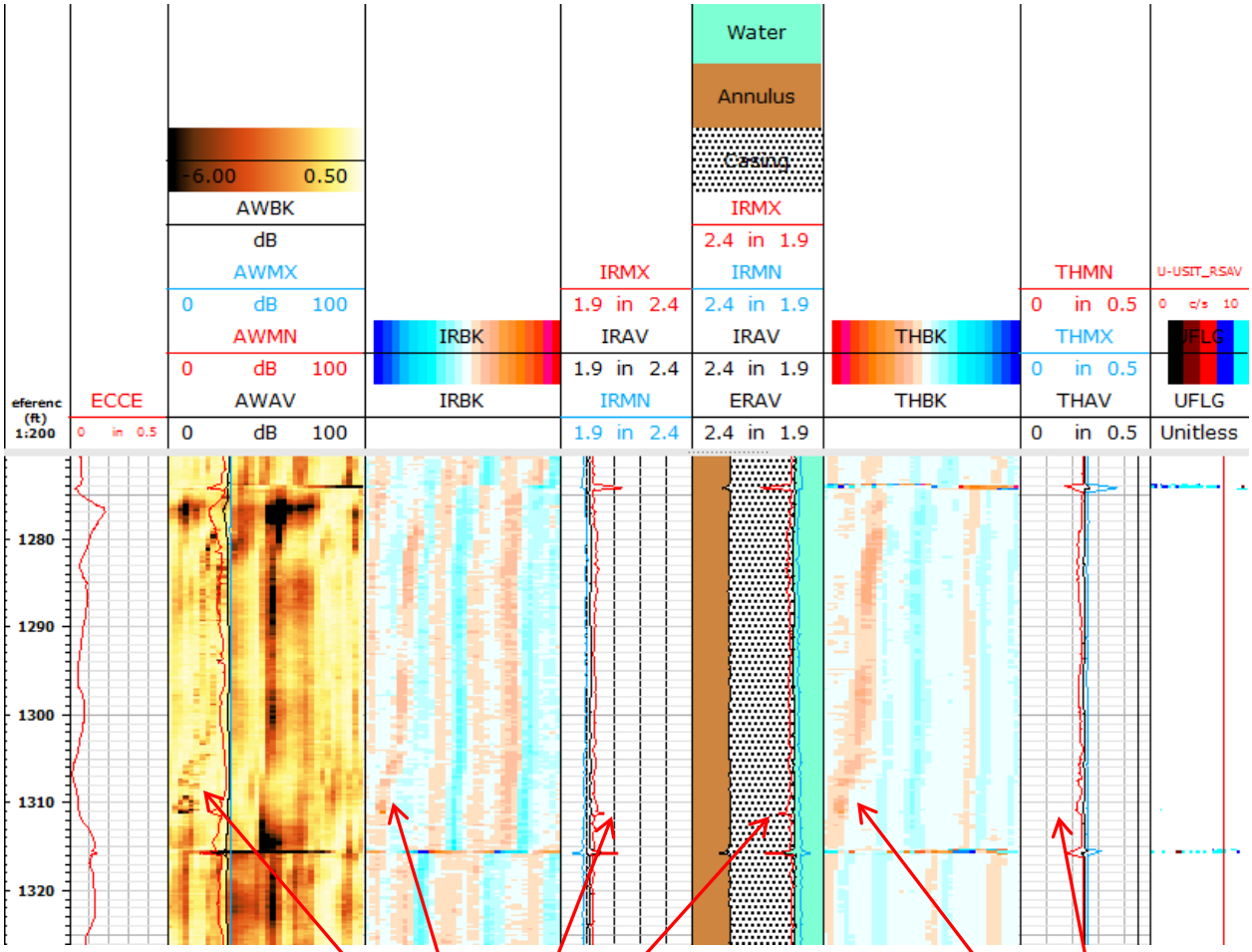

Water
Annulus
Casing
-6.00
0.50
AWBK
dB
AWMX
0 dB 100
AWMN
0 dB 100
AWAV
0 dB 100
ECCE
0 in 0.5
IRBK
IRBK
IRMX
1.9 in 2.4
IRAV
1.9 in 2.4
IRMN
1.9 in 2.4
IRMX
2.4 in 1.9
IRMN
2.4 in 1.9
IRAV
2.4 in 1.9
ERAV
2.4 in 1.9
THBK
THBK
THMN
0 in 0.5
THMX
0 in 0.5
THAV
0 in 0.5
U-USIT_RSAV
0 c/s 10
UFLG
UFLG
Unitless
eferenc
(ft)
1:200
240
250
260
270
280
290
External corrosion



Single sample.

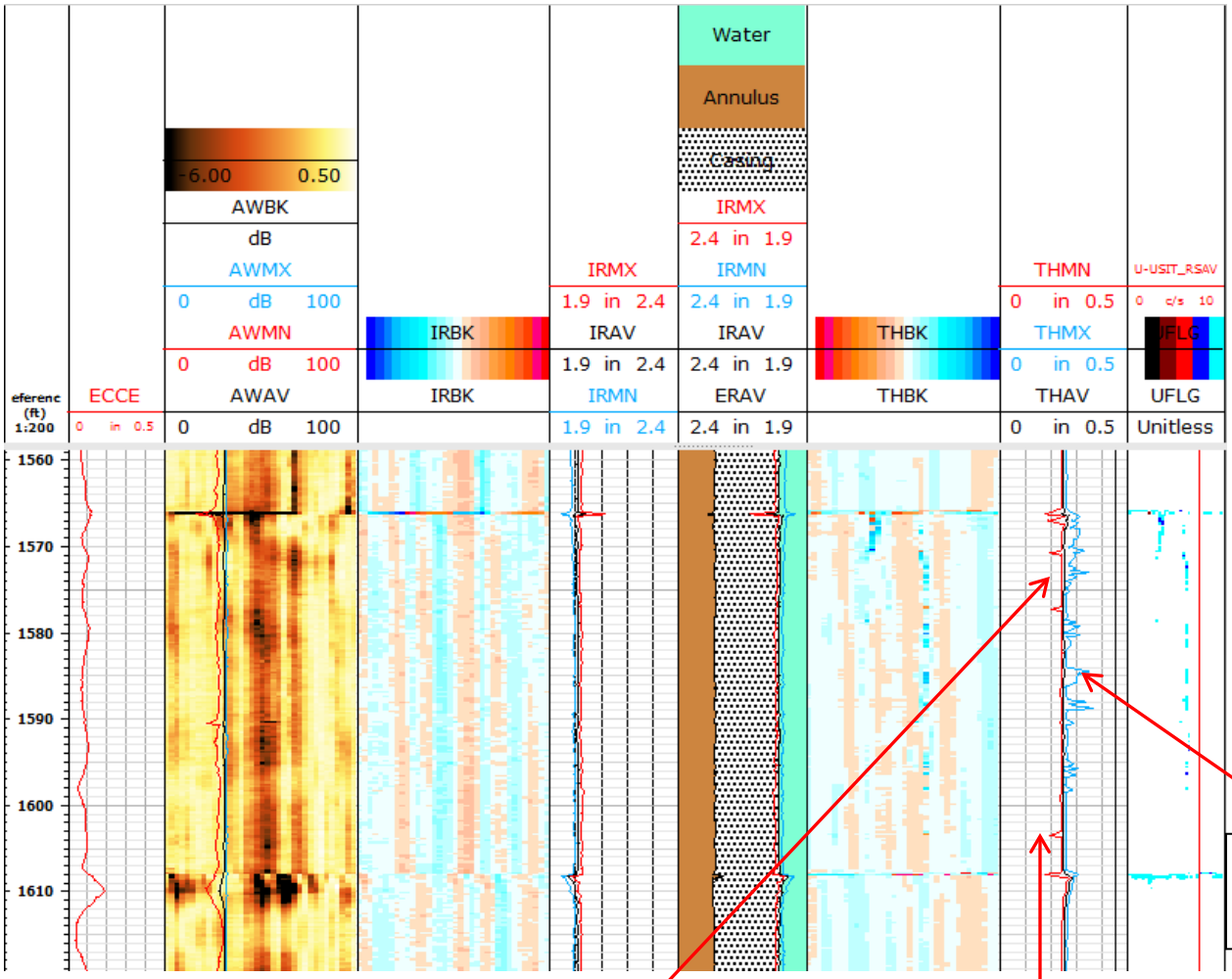


Single sample, low amplitude showing internal rugosity



Feature also seen on radius and amplitude, indicating internal feature that extends through the whole joint

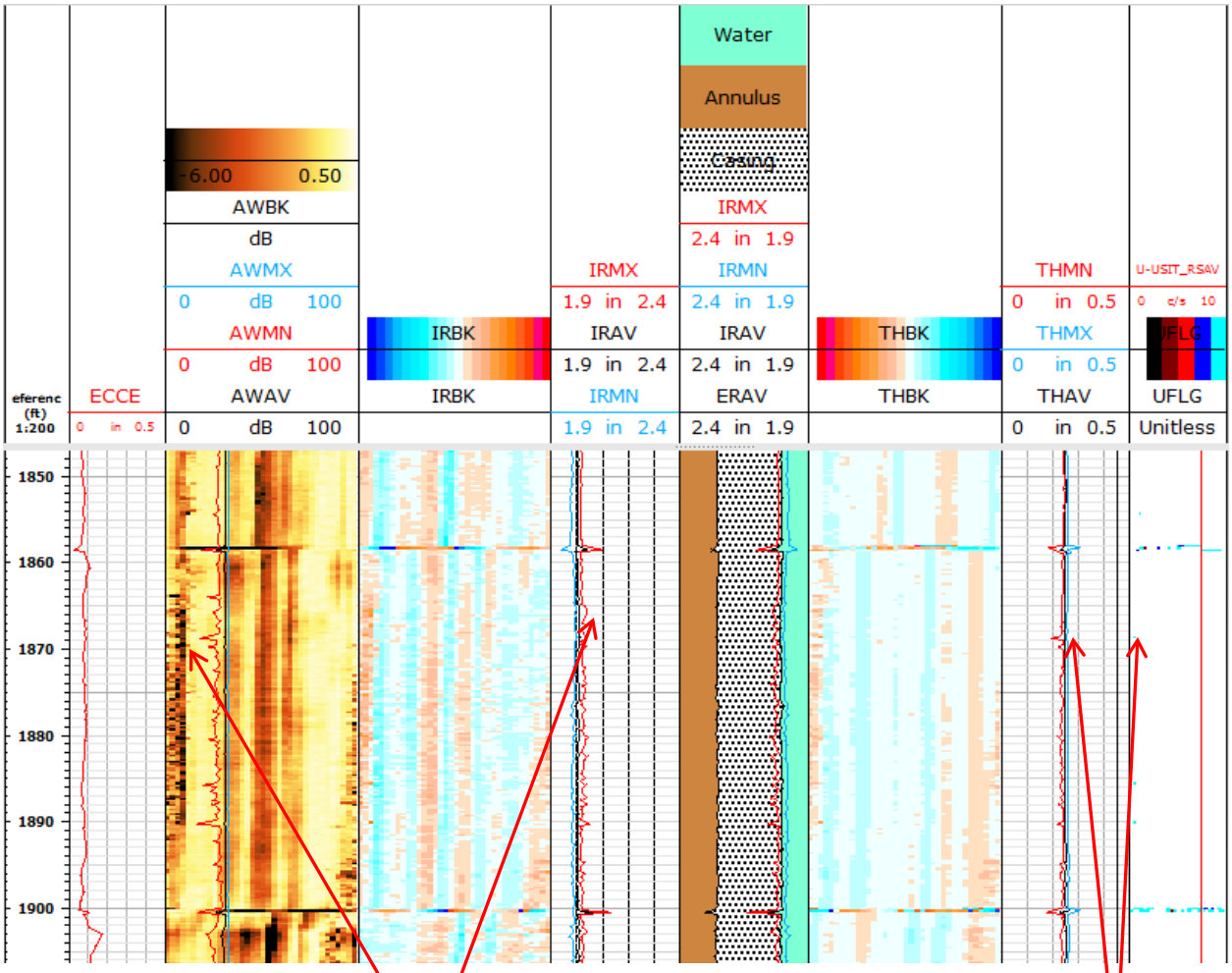
Metal loss seen on thickness



Max thickness spikes due to loop processing errors

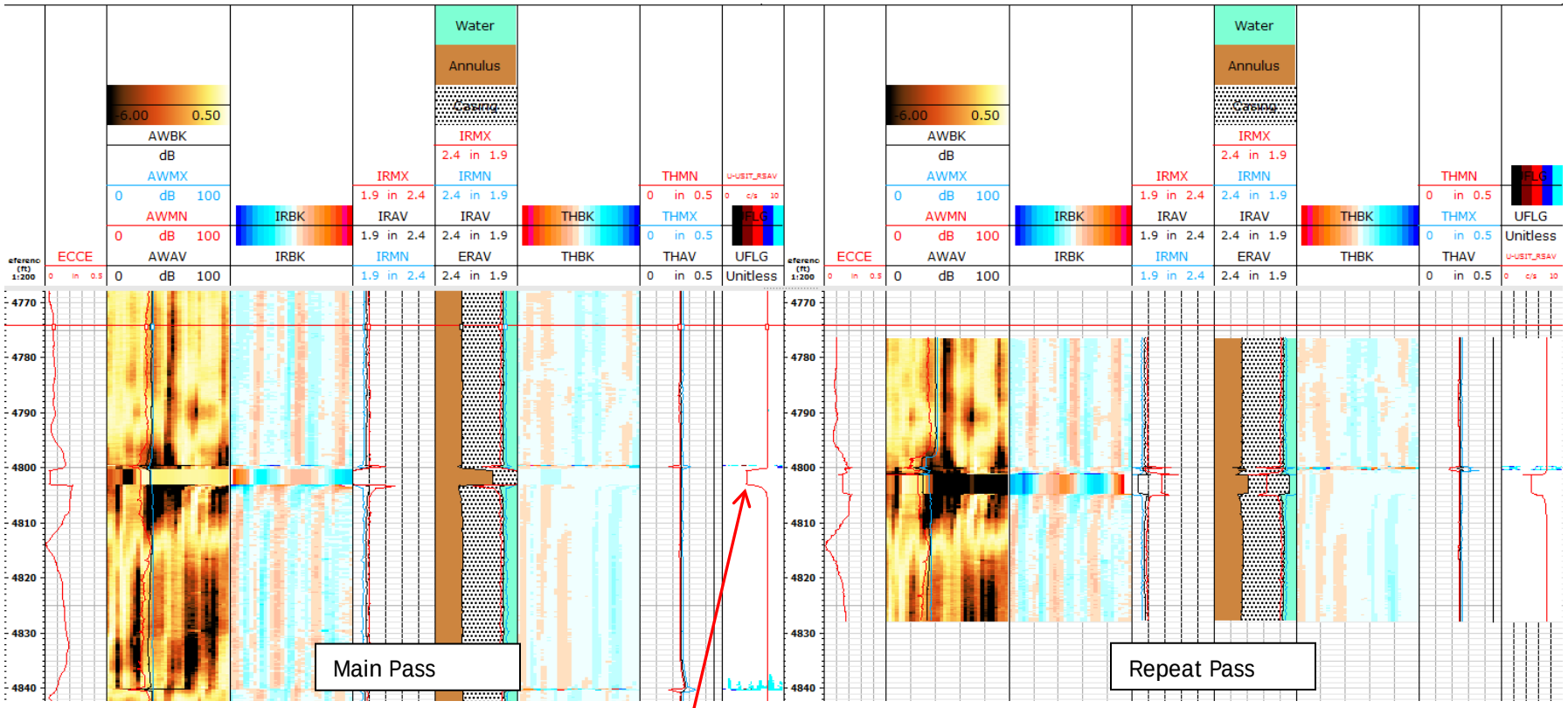
These points are invalid data

Point of max penetration



Rugosity seen on amplitude and radius curves.

Data point is flagged so absolute value may not be accurate



Sub stops rotating as lower centralizer goes through the collar on both passes

Comparison to 2011 Log results.

No. (Incl)	Joint Top	Base	Ave Metal Loss	Ave Metal Loss	Change in Ave Metal Loss	Penetration(Min Thk)	Penetration(Min Thk)	Min Burst Strength	Min Burst Strength	Change in Burst
	ft	ft	%	%		%	%	psig	psig	
			30-Mar-11	6-May-13	Change in percentage points	30-Mar-11	6-May-13	30-Mar-11	6-May-13	Change in psi
0	111.89	154.76	0		0	3.6		5891		
1	154.76	196.25	0.8	8	7.2	5.2	22.4	5793	4742	-1051
2	196.25	238.5	0	6.1	6.1	10	11.2	5500	5427	-73
3	238.5	280.25	3.5	7.5	4	18.4	21.2	4987	4816	-171
4	280.25	321.5	2.5	7	4.5	6.4	6.4	5720	5720	0
5	321.5	363.95	1.1	4.5	3.4	25.2	4.8	4571	5818	1247
6	363.95	405.06	0	3.8	3.8	4.8	3.6	5818	5891	73
7	405.06	446.63	0.4	5.1	4.7	4.4	4.8	5842	5818	-24
8	446.63	488	1.5	4.3	2.8	5.6	5.2	5769	5793	24
9	488	527.75	1.2	4.9	3.7	4.8	21.2	5818	4816	-1002
10	527.75	569.25	1	4.3	3.3	6.8	21.6	5696	4791	-905
11	569.25	610.75	0.7	5.9	5.2	4.4	4.8	5842	5818	-24
12	610.75	651.25	0.7	3.7	3	6	11.6	5744	5402	-342
13	651.25	691.5	0.7	3.8	3.1	4.4	5.2	5842	5793	-49
14	691.5	733.25	0.6	2.5	1.9	5.6	4.8	5769	5818	49
15	733.25	774.75	0.7	2.8	2.1	4.8	21.6	5818	4791	-1027
16	774.75	816	0.4	1.7	1.3	4	4.4	5867	5842	-25
17	816	858.11	1.8	1.2	-0.6	10	6.4	5500	5720	220
18	858.11	901.72	2.1	2.5	0.4	7.6	6.4	5647	5720	73
19	901.72	939.65	0	0.7	0.7	4	4.4	5867	5842	-25
20	939.65	981.25	0.1	1.3	1.2	5.6	6	5769	5744	-25
21	981.25	1022.84	0.9	2.4	1.5	6.4	7.2	5720	5671	-49
22	1022.84	1065.17	0.4	2.8	2.4	6.4	7.2	5720	5671	-49
23	1065.17	1107.13	1.1	5	3.9	9.2	12	5549	5378	-171
24	1107.13	1148.54	0.5	2.8	2.3	6.8	8.4	5696	5598	-98
25	1148.54	1190.25	0.3	2.4	2.1	5.6	8	5769	5622	-147
26	1190.25	1232	0	3.3	3.3	5.2	7.6	5793	5647	-146
27	1232	1273.75	0.5	3.3	2.8	5.2	18.8	5793	4962	-831
28	1273.75	1315.65	1.6	4.6	3	12.4	16.4	5353	5109	-244
29	1315.65	1357.25	0.8	2.8	2	5.6	6.4	5769	5720	-49
30	1357.25	1398.75	1	2.5	1.5	4.4	5.2	5842	5793	-49
31	1398.75	1439.5	1.3	3.4	2.1	6.4	7.2	5720	5671	-49
32	1439.5	1481.25	0	2	2	3.2	3.2	5916	5916	0
33	1481.25	1523.62	0	2.4	2.4	8.4	8.8	5598	5573	-25
34	1523.62	1565.5	0.2	3.2	3	3.6	4.4	5891	5842	-49
35	1565.5	1607.5	0.6	3.2	2.6	5.6	20.4	5769	4864	-905
36	1607.5	1649.5	0	3	3	3.2	4	5916	5867	-49

No. (Incl)	Joint Top	Base	Ave Metal Loss	Ave Metal Loss	Change in Ave Metal Loss	Penetration(Min Thk)	Penetration(Min Thk)	Min Burst Strength	Min Burst Strength	Change in Burst
	ft	ft	%	%		%	%	psig	psig	
			30-Mar-11	6-May-13	Change in percentage points	30-Mar-11	6-May-13	30-Mar-11	6-May-13	Change in psi
37	1649.5	1691	0	3	3	5.6	11.6	5769	5402	-367
38	1691	1732.75	0	1.5	1.5	3.2	3.6	5916	5891	-25
39	1732.75	1774.25	1	2.7	1.7	9.6	21.2	5524	4816	-708
40	1774.25	1816.5	0.5	1.8	1.3	3.6	5.2	5891	5793	-98
41	1816.5	1858	0	1.5	1.5	3.2	3.6	5916	5891	-25
42	1858	1900	0.6	1.7	1.1	8	20.4	5622	4864	-758
43	1900	1939.5	0	1.1	1.1	7.6	9.2	5647	5549	-98
44	1939.5	1983.5	0	1.2	1.2	6.4	4	5720	5867	147
45	1983.5	2024.75	0	1.2	1.2	4	4	5867	5867	0
46	2024.75	2066.25	0	2.2	2.2	3.2	3.2	5916	5916	0
47	2066.25	2106.5	0.4	3.2	2.8	4	4.8	5867	5818	-49
48	2106.5	2148.99	0.2	1.4	1.2	5.2	6	5793	5744	-49
49	2148.99	2189.49	0	1.6	1.6	5.2	5.6	5793	5769	-24
50	2189.49	2231.63	0	1.1	1.1	5.2	5.6	5793	5769	-24
51	2231.63	2272.68	0	0.2	0.2	4.4	6.4	5842	5720	-122
52	2272.68	2314	0.2	0.8	0.6	5.6	6.8	5769	5696	-73
53	2314	2356	1.7	0.5	-1.2	10.4	6	5476	5744	268
54	2356	2398.19	0.6	0.2	-0.4	6.8	5.6	5696	5769	73
55	2398.19	2439.42	0	0	0	4.4	4	5842	5867	25
56	2439.42	2481.38	0	0	0	4.4	5.6	5842	5769	-73
57	2481.38	2523	0.4	0	-0.4	6.8	7.2	5696	5671	-25
58	2523	2564.75	0.2	0	-0.2	5.6	7.2	5769	5671	-98
59	2564.75	2606.25	0	0	0	4.8	5.2	5818	5793	-25
60	2606.25	2647.5	0.6	0.1	-0.5	7.6	8	5647	5622	-25
61	2647.5	2688.75	0.4	0	-0.4	6.4	8.8	5720	5573	-147
62	2688.75	2730.25	0	0	0	5.6	6.8	5769	5696	-73
63	2730.25	2772.5	0	0	0	5.2	6.4	5793	5720	-73
64	2772.5	2814	0	0	0	4.4	5.2	5842	5793	-49
65	2814	2855	0	0	0	5.6	6	5769	5744	-25
66	2855	2897	0	0	0	2.8	3.6	5940	5891	-49
67	2897	2939	0	0	0	2.8	3.6	5940	5891	-49
68	2939	2981	0	0	0	3.6	4	5891	5867	-24
69	2981	3023.25	0	0	0	4.4	4.8	5842	5818	-24
70	3023.25	3062.97	0	0	0	4.4	5.2	5842	5793	-49
71	3062.97	3104.25	0	0	0	4	5.6	5867	5769	-98
72	3104.25	3146	0	0	0	4.4	4.8	5842	5818	-24
73	3146	3186	0	0	0	2.4	3.2	5964	5916	-48

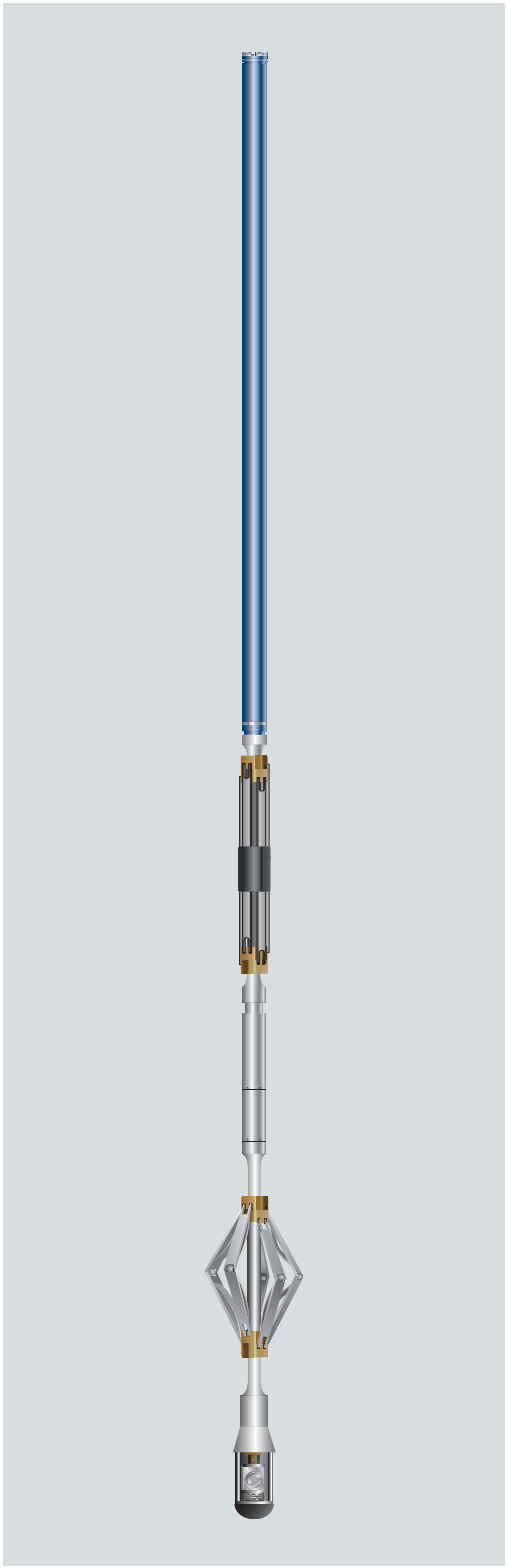
No. (Incl)	Joint Top	Base	Ave Metal Loss	Ave Metal Loss	Change in Ave Metal Loss	Penetration(Min Thk)	Penetration(Min Thk)	Min Burst Strength	Min Burst Strength	Change in Burst
	ft	ft	%	%		%	%	psig	psig	
			30-Mar-11	6-May-13	Change in percentage points	30-Mar-11	6-May-13	30-Mar-11	6-May-13	Change in psi
74	3186	3228.43	0	0	0	5.2	7.6	5793	5647	-146
75	3228.43	3269	1.5	0	-1.5	6.8	7.6	5696	5647	-49
76	3269	3310.25	0	0	0	4	28.4	5867	4376	-1491
77	3310.25	3352	0	0	0	6.8	7.2	5696	5671	-25
78	3352	3393.88	0	0	0	5.2	5.6	5793	5769	-24
79	3393.88	3435.85	0	0	0	5.6	20	5769	4889	-880
80	3435.85	3476.75	0	0	0	1.6	2.4	6013	5964	-49
81	3476.75	3519	0	0	0	4	4.4	5867	5842	-25
82	3519	3559.75	0	0	0	1.6	2	6013	5989	-24
83	3559.75	3601.25	0	0	0	2.8	3.6	5940	5891	-49
84	3601.25	3642.25	0	0	0	4.4	4.4	5842	5842	0
85	3642.25	3684.25	0	0	0	2	2.4	5989	5964	-25
86	3684.25	3725.75	0	0	0	4.4	4.8	5842	5818	-24
87	3725.75	3764.75	0	0	0	2.4	2.8	5964	5940	-24
88	3764.75	3806.5	0	0	0	2	2.8	5989	5940	-49
89	3806.5	3848.31	0	0	0	2.4	2.8	5964	5940	-24
90	3848.31	3889.75	0	0	0	3.2	3.2	5916	5916	0
91	3889.75	3930.5	0	0	0	2.4	2.8	5964	5940	-24
92	3930.5	3972.75	0	0	0	0.8	1.2	6062	6038	-24
93	3972.75	4013.4	0	0	0	1.6	1.2	6013	6038	25
94	4013.4	4054.99	0	0	0	1.2	2	6038	5989	-49
95	4054.99	4097	0	0	0	2	2	5989	5989	0
96	4097	4138.75	0	0	0	3.2	3.6	5916	5891	-25
97	4138.75	4180.69	0	0	0	3.2	3.2	5916	5916	0
98	4180.69	4221.74	0	0	0	3.2	4.4	5916	5842	-74
99	4221.74	4263.15	0	0	0	2.8	2.8	5940	5940	0
100	4263.15	4305	0	0	0	2	2.8	5989	5940	-49
101	4305	4346.25	0	0	0	0.8	1.2	6062	6038	-24
102	4346.25	4388	0	0	0	2	4.8	5989	5818	-171
103	4388	4429.5	0	0	0	1.6	1.6	6013	6013	0
104	4429.5	4469.25	0	0	0	2.4	2.4	5964	5964	0
105	4469.25	4509.75	0	0	0	1.2	3.2	6038	5916	-122
106	4509.75	4552	0	0	0	0.8	1.2	6062	6038	-24
107	4552	4594.07	0	0	0	0.4	0.8	6087	6062	-25
108	4594.07	4635.48	0	0	0	3.6	4.8	5891	5818	-73
109	4635.48	4675.97	0	0	0	0.8	1.2	6062	6038	-24
110	4675.97	4716.28	0	0	0	6.8	6.8	5696	5696	0

No. (Incl)	Joint Top	Base	Ave Metal Loss	Ave Metal Loss	Change in Ave Metal Loss	Penetration(Min Thk)	Penetration(Min Thk)	Min Burst Strength	Min Burst Strength	Change in Burst
	ft	ft	%	%		%	%	psig	psig	
			30-Mar-11	6-May-13	Change in percentage points	30-Mar-11	6-May-13	30-Mar-11	6-May-13	Change in psi
111	4716.28	4757.88	0	0	0	6	8.4	5744	5598	-146
112	4757.88	4799.47	0	0	0	4.4	5.6	5842	5769	-73
113	4799.47	4839.04	0	0	0	4.8	3.6	5818	5891	73
114	4839.04	4881.62	0	0	0	1.2	3.2	6038	5916	-122
115	4881.62	4923	0	0	0	2.4	3.2	5964	5916	-48
116	4923	4963.98	0	0	0	1.2	2	6038	5989	-49
117	4963.98	5005.68	0	0	0	3.2	8	5916	5622	-294
118	5005.68	5046.75	0	0	0	6	10.4	5744	5476	-268
119	5046.75	5088.5	0	0	0	3.6	6.8	5891	5696	-195
120	5088.5	5129.53	0	0	0	5.2	6.4	5793	5720	-73
121	5129.53	5171.41	0	0	0	1.2	3.6	6038	5891	-147
122	5171.41	5213.5	0	0	0	2.4	3.2	5964	5916	-48
123	5213.5	5253	0	0	0	1.2	2.8	6038	5940	-98
124	5253	5287.86	0	0	0	3.2	8	5916	5622	-294
125	5287.86	5329.96	0	0	0	1.2	8.4	6038	5598	-440
126	5329.96	5371.63	0	0	0	3.2	6.4	5916	5720	-196
127	5371.63	5413.34	0	0	0	5.2	5.6	5793	5769	-24
128	5413.34	5452.75	0	0	0	3.2	2.4	5916	5964	48
129	5452.75	5494.51	0	0	0	2	4.8	5989	5818	-171
130	5494.51	5534.87	0	0	0	1.2	4.8	6038	5818	-220
131	5534.87	5576.69	0	0	0	0.8	6.8	6062	5696	-366
132	5576.69	5617.96	0	0	0	0.4	4	6087	5867	-220
133	5617.96	5659.24	0	0	0	4.4	6.4	5842	5720	-122
134	5659.24	5701	0	0	0	2.8	6	5940	5744	-196
135	5701	5742.25	0	0	0	2.8	4.4	5940	5842	-98
136	5742.25	5782	0	0	0	2	2.8	5989	5940	-49
137	5782	5822	0	0	0	1.2	2.8	6038	5940	-98
138	5822	5864.51	0	0	0	3.2	4.8	5916	5818	-98
139	5864.51	5906	0	0	0	4	4.8	5867	5818	-49
140	5906	5946.75	0	0	0	1.6	22	6013	4767	-1246
141	5946.75	5989.25	0	0	0	2	2.4	5989	5964	-25
142	5989.25	6029.5	0	0	0	1.6	2.4	6013	5964	-49
143	6029.5	6070.5	0	0	0	2.4	4	5964	5867	-97
144	6070.5	6111.75	0	0	0	3.6	4	5891	5867	-24
145	6111.75	6153.06	0	0	0	1.6	2.4	6013	5964	-49
146	6153.06	6194.51	0	0	0	2.4	3.6	5964	5891	-73
147	6194.51	6236.44	0	0	0	2.8	4.4	5940	5842	-98

No. (Incl)	Joint Top	Base	Ave Metal Loss	Ave Metal Loss	Change in Ave Metal Loss	Penetration(Min Thk)	Penetration(Min Thk)	Min Burst Strength	Min Burst Strength	Change in Burst
	ft	ft	%	%		%	%	psig	psig	
			30-Mar-11	6-May-13	Change in percentage points	30-Mar-11	6-May-13	30-Mar-11	6-May-13	Change in psi
148	6236.44	6278.62	0	0	0	28.4	4.4	4376	5842	1466
149	6278.62	6318.47	0	0	0	25.2	2.8	4571	5940	1369
150	6318.47	6359.56	0	0	0	2	4	5989	5867	-122
151	6359.56	6401.2	0	0	0	3.6	3.2	5891	5916	25
152	6401.2	6443.25	0	0	0	2	4.4	5989	5842	-147
153	6443.25	6481.51	0	0	0	3.6	4.4	5891	5842	-49
154	6481.51	6523.74	0	0	0	2.4	2.8	5964	5940	-24
155	6523.74	6564.5	0	0	0	1.6	2.8	6013	5940	-73
156	6564.5	6607	0	0	0	2.8	4.8	5940	5818	-122
157	6607	6648.63	0	0	0	2.4	4.8	5964	5818	-146
158	6648.63	6690.5	0	0	0	2	3.2	5989	5916	-73
159	6690.5	6732.75	0	0	0	2	2.8	5989	5940	-49
160	6732.75	6774.6	0	0	0	1.2	3.2	6038	5916	-122
161	6774.6	6816.75	0	0	0	1.6	4	6013	5867	-146
162	6816.75	6859.23	0	0	0	2.8	4	5940	5867	-73
163	6859.23	6900	0	0	0	4	27.2	5867	4449	-1418
164	6900	6941	0	0	0	2	3.2	5989	5916	-73
165	6941	6982.86	0	0	0	3.2	1.6	5916	6013	97
166	6982.86	7026.17	0	0	0	0.8	4.4	6062	5842	-220
167	7026.17	7067.5	0	0	0	2.8	4.4	5940	5842	-98
168	7067.5	7107.25	0	0	0	0.8	2.4	6062	5964	-98
169	7107.25	7149.79	0		0	3.2		5916		-5916
170	7149.79	7191.84	0		0	2.4		5964		-5964
171	7191.84	7233.25	0		0	1.2		6038		-6038
172	7233.25	7270.71	0		0	1.6		6013		-6013
173	7270.71	7314.02	0		0	1.6		6013		-6013
174	7314.02	0	0		0	1.6		6013		-6013

USI UltraSonic Imager Tool

Schlumberger



The USI* UltraSonic Imager tool (USIT) uses a single transducer mounted on an Ultrasonic Rotating Sub (USRS) on the bottom of the tool. The transmitter emits ultrasonic pulses between 200 and 700 kHz and measures the received ultrasonic waveforms reflected from the internal and external casing interfaces. The rate of decay of the waveforms received indicates the quality of the cement bond at the cement/casing interface, and the resonant frequency of the casing provides the casing wall thickness required for pipe inspection. Because the transducer is mounted on the rotating sub, the entire circumference of the casing is scanned. This 360° data coverage enables the evaluation of the quality of the cement bond as well as the determination of the internal and external casing condition. The very high angular and vertical resolutions can detect channels as narrow as 1.2 in. [3.05 cm]. Cement bond, thickness, internal and external radii, and self-explanatory maps are generated in real time at the wellsite.

Applications

- Cement evaluation
- Casing inspection
  - Corrosion detection and monitoring
  - Detection of internal and external damage or deformation
  - Casing thickness analysis for collapse and burst pressure calculations

Measurement Specifications

	USIT
Output	Acoustic impedance, cement bonding to casing, internal radius, casing thickness
Logging speed	1,800 ft/hr [549 m/h]
Range of measurement	Acoustic impedance: 0 to 10 MRayl [0 to 10 MPa.s/m]
Vertical resolution	Standard: 6 in. [15.24 cm]
Accuracy	Less than 3.3 MRayl: ±0.5 MRayl
Depth of investigation	Casing-to-cement interface
Mud type or weight limitations†	Water-base mud: Up to 15.9 lbm/gal Oil-base mud: Up to 11.2 lbm/gal
Combinability	Bottom-only tool, combinable with most tools
Special applications	Identification and orientation of narrow channels

† Exact value depends on the type of mud system and casing size.

Mechanical Specifications

	USIT
Temperature rating	350°F [177°C]
Pressure rating	20,000 psi [138 MPa]
Casing size—min.	4½ in. [11.43 cm]
Casing size—max.	13⅜ in. [33.97 cm]
Outer diameter†	3.375 in. [8.57 cm]
Length†	19.75 ft [6.02 m]
Weight†	333 lbm [151 kg]
Tension	40,000 lbf [177,930 N]
Compression	4,000 lbf [17,790 N]

† Excluding the rotating sub

USIT Rotating Sub Mechanical Specifications

	USRS-AB	USRS-A	USRS-B	USRS-C	USRS-D
Outer diameter	3.41 in. [8.66 cm]	3.58 in. [9.09 cm]	4.625 in. [11.75 cm]	6.625 in. [16.83 cm]	8.625 in. [21.91 cm]
Length	9.8 in. [24.89 cm]	9.92 in. [25.20 cm]	9.8 in. [24.89 cm]	8.3 in. [21.08 cm]	8.3 in. [21.08 cm]
Weight	7.7 lbm [3.5 kg]	7.7 lbm [3.5 kg]	10.6 lbm [4.8 Kg]	15.0 lbm [6.8 kg]	18.3 lbm [8.3 kg]

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CE_04_005_0

August 2004

Produced by Marketing Communications, Houston.

Schlumberger