ATMOSPHERIC STORAGE TANK

API 653 EXTERNAL & ULTRASONIC

IN-SERVICE INSPECTION REPORT

SHELL PIPELINE COMPANY, LP

TANK NO. 5

SUGARLAND TERMINAL

SUGARLAND, LA

JUNE 16, 2017

Prepared by:

HMT Inspection
A Division of HMT LLC
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Pasadena, TX 77503
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EXECUTIVE SUMMARY

It is recommended that the owner / user reviews, evaluates and implements the recommendations set forth in Section 2.0, Inspection Summary, of this report or, the owner / user may determine that no action(s) need be taken prior to continued service and such decision(s) should be documented in the AST historical record file.

It is recommended that the owner / user adheres to the safe fill height recommendations given herein in Section 2.0 for continued service until such time as tank operating conditions change or another inspection assessment per API 653 guidelines determines that an adjustment in safe operating height for this tank should be made.

- The next formal external API 653 Visual (VT) inspection should be conducted within 5 years and no later than June 2022 (ref. API 653, Para. 6.3.2.1). Complete API 653 out-of-service inspection prior to this date would supplement the next external inspection requirement. It should be noted that a product specific gravity of 1.0 and fill height of 33.36 feet were utilized for this calculation.

- Shell Ultrasonic (UT) testing should be conducted again within 15 years and no later than June 2032 (ref. API 653, Para. 6.3.3.2.b). Complete API 653 out-of-service inspection prior to this date would supplement the next external inspection requirement. It should be noted that a product specific gravity of 1.0 and fill height of 33.36 feet were utilized for this calculation.

- Shell thickness calculations indicate the <u>safe fill height</u> of 33.36 feet can be utilized with product specific gravities up to 1.0 (ref. API 653, Para. 4.3.3.1). For products with a specific gravity over 1.0, additional calculations should be performed (ref. API 653, Para. 4.3.3.1). These calculations do not take into account operational restrictions from such items as high-level alarms or owner / operator-imposed safe fill restrictions. There are no shell-mounted overflow vents on this tank.

PERSONNEL

HMT Inspection provided the following personnel:

Brandon Benoit
API 653 Aboveground Storage Tank Inspector
Certification Number: 50711
Level II Technician

Brendan Soulier, Freeman Hancock, Logan Petersen
Technicians

TABLE OF CONTENTS

1.0 DESCRIPTION....5

2.0 INSPECTION SUMMARY....6

3.0 INSPECTION REPORT....10
- 3.1 FOUNDATION....10
  - 3.1.1 FOUNDATION SETTLEMENT EVALUATION....10
  - 3.1.2 FOUNDATION SETTLEMENT SURVEY....11
- 3.2 SHELL....12
  - 3.2.1 SHELL THICKNESS CALCULATIONS....12
  - 3.2.2 SHELL CORROSION RATE CALCULATIONS....13
  - 3.2.3 SHELL EXTERNAL INSPECTION....14
  - 3.2.4 B-SCAN ULTRASONIC (UT) THICKNESS READINGS....15

4.0 INSPECTION REPORT....33
- 4.1 FOUNDATION....33
  - 4.1.1 FOUNDATION INSPECTION CHECKLIST....33
- 4.2 BOTTOM....34
  - 4.2.1 BOTTOM INSPECTION CHECKLIST....34
- 4.3 SHELL....35
  - 4.3.1 SHELL INSPECTION CHECKLIST....35
  - 4.3.2 SHELL LAYOUT....36
- 4.4 NOZZLES AND APPURTENANCES....37
  - 4.4.1 NOZZLE AND APPURTENANCE INSPECTION CHECKLIST....37
  - 4.4.2 NOZZLE AND APPURTENANCE TABLE....38

5.0 NDT INSPECTION....41
- 5.1 NDT INSPECTION SCOPE....41
- 5.2 BOTTOM INSPECTION....41
- 5.3 SHELL INSPECTION....41
- 5.4 NOZZLE INSPECTION....41

6.0 EQUIPMENT....42
- 6.1 ULTRASONIC....42
- 6.2 LEVEL....42

7.0 WARRANTY....43

8.0 PHOTOGRAPHS....44

9.0 CERTIFICATIONS....61

1.0 DESCRIPTION

GENERAL:	TANK NUMBER / IDENTIFICATION:	5
	OWNER:	Shell Pipeline Company LP
	TANK LOCATION:	Sugarland, LA
	TYPE OF FACILITY:	Terminal
	MANUFACTURER:	Graver Tank & Mfg. Co. Inc.
	DESIGN STANDARD:	API 650, 6th Ed., w/ Apps. D and K
	PRODUCT PRIOR TO INSPECTION:	Crude Oil
	DESIGN SPECIFIC GRAVITY:	1.0
	PRODUCT SPECIFIC GRAVITY:	No Data Available
	DESIGN PRESSURE:	Atmospheric
	OPERATING TEMPERATURE:	Ambient
	CATHODIC PROTECTION & TYPE:	Yes (Impressed Current)
	NAMEPLATE PRESENT:	Yes (Located Above Cleanout A)
	DOT REGULATED:	Yes
	LATITUDE:	30° 00’ 37” N
	LONGITUDE:	90° 51’ 08” W
DIMENSIONS:	DIAMETER:	300.00 ft.
	HEIGHT:	36.92 ft. (as measured)
	CAPACITY GROSS:	464,058 bbls.
	OPERATING HEIGHT:	33.36 ft. (per Files)
	CAPACITY NOMINAL:	418,707 bbls.
GEOMETRY:	FOUNDATION:	Concrete Ringwall
	BOTTOM:	Lap Welded
	SHELL:	Butt Welded
	MATERIAL OF CONSTRUCTION:	Carbon Steel (A-36 per Files)
	COURSE 1 AVERAGE THICKNESS:	1.085 inches
	FIXED ROOF:	N/A
	FLOATING ROOF:	Lap Welded Annular Pontoon w/ Deck Pontoons
	PRIMARY SEAL:	Mechanical Shoe
	SECONDARY SEAL:	Metallic Wiper
DATES:	YEAR OF CONSTRUCTION:	1979
	SECOND BOTTOM & DATE INSTALLED:	N/A
	LAST COATED:	No Data Available
	LAST INSPECTION:	2012
ACCESS:	STAIRWAY:	Spiral (CCW Up)
	FLOATING ROOF ACCESS:	Rolling Ladder
COATINGS / LININGS:	BOTTOM & DATE APPLIED:	Thin-Film Epoxy (Date Applied Not Known)
	SHELL:	External - White Paint Internal - Thin-Film Epoxy (Lower 24 inches)
	FLOATING ROOF:	Top Side - White Paint Product Side - No Data Available

2.0 INSPECTION SUMMARY

The following is a summary of the significant findings of the inspection (item numbers correspond with the HMT API 653 Checklist).

INSPECTION INTERVALS: The next formal external API 653 Visual (VT) inspection should be conducted within 5 years and no later than June 2022 (ref. API 653, Para. 6.3.2.1). Complete API 653 out-of-service inspection prior to this date would supplement the next external inspection requirement. It should be noted that a product specific gravity of 1.0 and fill height of 33.36 feet were utilized for this calculation.

Shell Ultrasonic (UT) testing should be conducted again within 15 years and no later than June 2032 (ref. API 653, Para. 6.3.3.2.b). Complete API 653 out-of-service inspection prior to this date would supplement the next external inspection requirement. It should be noted that a product specific gravity of 1.0 and fill height of 33.36 feet were utilized for this calculation.

FOUNDATION:

ITEM F2: The survey found the tank out of level by 3.30 inches. API 653 calculation for deflection of this tank is 0.45 inch. API maximum deflection permitted for this tank is calculated at 1.83 inches (ref. API 653, Appendix B, Para. B.3). Differential settlement for this tank does not exceed the API allowable (ref. API 653, Appendix B, Para. B.3). Future settlement should be monitored during the next API 653 external inspection.

ITEM F3: Inspection found sediment build-up present in the east tank quadrant. Consideration should be given to removing this to ensure adequate inspection of the ringwall and bottom edge protection at all times.

ITEM F5: The tank is resting on earth with a concrete ringwall that has cracks and spalling present intermittently around the perimeter. These areas should be sealed to minimize further degradation of the foundation from moisture penetration corroding the reinforcement or from freeze / thaw cycling further opening these cracks.

INSPECTION SUMMARY (CONT'D.)

FOUNDATION (CONT'D.):

ITEM F9: The moisture barrier in place between the bottom edge projection and the concrete ringwall has deteriorated, allowing water to enter under the tank bottom. The moisture barrier should be removed and replaced with more suitable material around the entire tank perimeter.

BOTTOM:

Tank No. 5 was in service at the time of inspection. Only formal external API 653 inspection was performed at this time.

ITEM B1: The bottom edge projection has areas of coating failure present. Consideration should be given to properly cleaning and re-coating the affected areas.

SHELL:

ITEMS S1: Shell thickness calculations indicate the safe fill height of 33.36 feet can be utilized with product specific gravities up to 1.0 (ref. API 653, Para. 4.3.3.1). For products with a specific gravity over 1.0, additional calculations should be performed (ref. API 653, Para. 4.3.3.1). These calculations do not take into account operational restrictions from such items as high-level alarms or owner / operator-imposed safe fill restrictions. There are no shell-mounted overflow vents on this tank.

ITEM S6: The shell has areas of coating failure present. Consideration should be given to properly cleaning and re-coating the affected areas.

ITEM S11: The top side and underside of the wind girder have areas of coating failure present. Consideration should be given to properly cleaning and re-coating the affected areas.

INSPECTION SUMMARY (CONT'D.)

SHELL (CONT'D.):

ITEM S12: Inspection noted no reinforcing plates beneath the automatic gauge pipe supports, piping supports, wind girder supports, stiffener ring supports, vertical ladder supports, or platform supports to the shell. Reinforcing plates, while not required, provide additional thickness in these areas.

ITEM S15: Limited Visual (VT) inspection only was performed on the shell, welds, and supports from ground level.

NOZZLES AND APPURTENANCES:

ITEM N2: The nozzles have areas of coating failure present**.** Consideration should be given to properly cleaning and re-coating the affected areas.

ITEM N2: The neck thickness of Nozzle Z does not meet the minimum requirements of API 650, Table 5-6, Column 3. This detail has been present for an extended period of time and no immediate corrective action is required. Consideration should be given to further evaluation to determine whether or not the nozzle neck is suitable for continued service without repair or replacement, or to modifying this detail as necessary at a future opportunity when welded repairs to the tank are performed.

ITEM N2: Shell Items I, O, T, BB, EE, and II have weld spacing between their reinforcing plates and shell-to-bottom joint less than that required by API 650, Para. 5.7.3. Such practice results in areas of increased stress concentration and possible accelerated corrosion. Visual (VT) inspection of these nozzle details did not identify any such corrosion at this time. Consideration should be given to modifying these penetration details in accordance with API 650 guidelines the next time this tank has major repairs to the shell or when hydrostatic testing is required for other reasons. These details have been present for an extended period of time and no immediate corrective action is required.

ITEM N9: The automatic gauge is missing the number dial. Consideration should be given to correcting this detail.

INSPECTION SUMMARY (CONT'D.)

NOZZLES AND APPURTENANCES:

ITEM N11: The stairway has areas of coating failure present. Consideration should be given to properly cleaning and re-coating the affected areas.

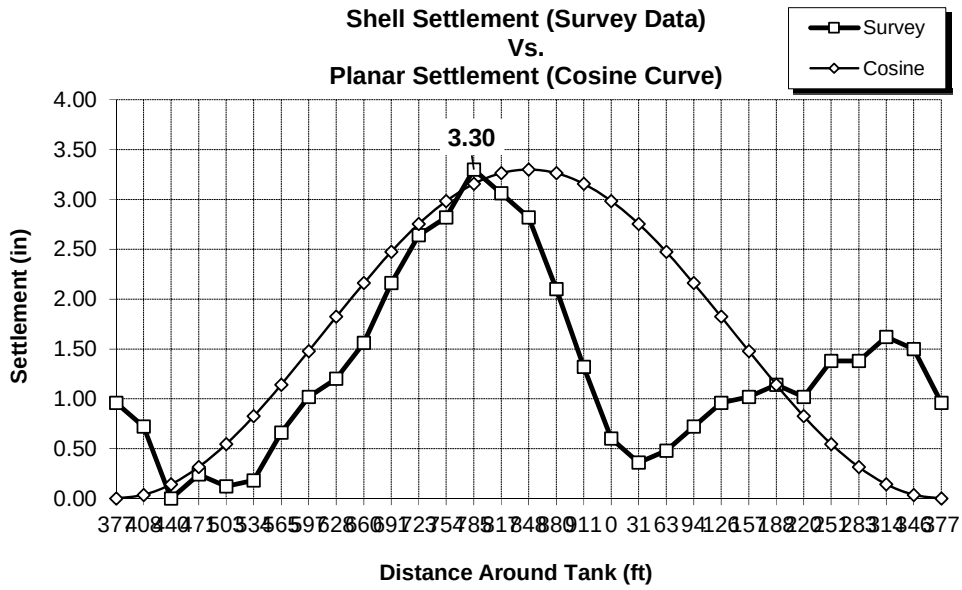
FLOATING ROOF:

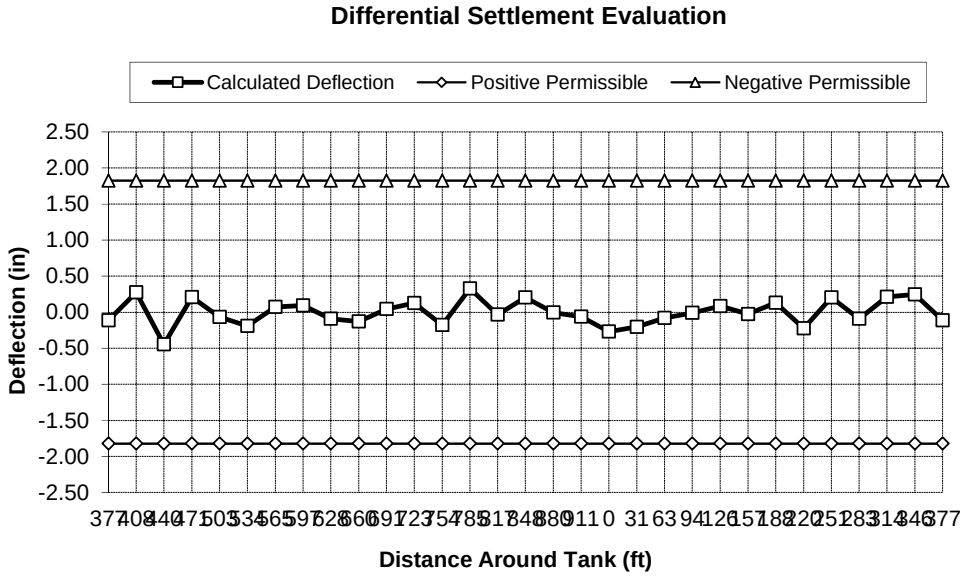
Inspection of the floating roof was not performed due to restricted access (per client safety regulations).

3.0 INSPECTION REPORT

3.1 FOUNDATION

3.1.1 FOUNDATION SETTLEMENT EVALUATION





3.1.2 FOUNDATION SETTLEMENT SURVEY

The survey was conducted externally counterclockwise from the reference Shell Manway A located at Station 0.0. The circumferential distance between the readings is 31.416 feet.

Point No.	Shell Settlement Reading (ft.)
1	2.600
2	2.580
3	2.590
4	2.610
5	2.630
6	2.635
7	2.645
8	2.635
9	2.665
10	2.665
11	2.685
12	2.675
13	2.630
14	2.610
15	2.550
16	2.570
17	2.560
18	2.565
19	2.605
20	2.635
21	2.650
22	2.680
23	2.730
24	2.770
25	2.785
26	2.825
27	2.805
28	2.785
29	2.725
30	2.660

3.2 SHELL

3.2.1 SHELL THICKNESS CALCULATIONS

The minimum acceptable shell plate thickness for tanks with a diameter greater than two hundred (200) feet are calculated utilizing the variable design point method (ref. API 653, Para. 4.3.3.4):

$$t_{\min} = \frac{2.6(H-1)DG}{SE}$$

Where:

S =	See Table	=	Allowable Stress (psi)
D =	300.00	=	Nominal Diameter of Tank (ft.)
G =	1.0	=	Highest Specific Gravity of Contents
H =	See Table	=	Product Height (ft.)
E =	See Table	=	Joint Efficiency

Course	Course Height (in.)	Product Height (ft.)	Joint Efficiency	Allowable Stress (psi)	Average Thickness (in.)	Required Thickness (in.)	Material Type / Grade
1	110	33.36	1.00	24,900	1.085	0.948	A-36
2	110	24.19	1.00	24,900	0.776	0.727	A-36
3	110	15.03	1.00	27,400	0.506	0.375	A-36
4	110	5.86	1.00	27,400	0.397	0.124	A-36
Top Angle	3						

Shell thickness calculations indicate the safe fill height of 33.36 feet can be utilized with product specific gravities up to 1.0 (ref. API 653, Para. 4.3.3.1). For products with a specific gravity over 1.0, additional calculations should be performed (ref. API 653, Para. 4.3.3.1). These calculations do not take into account operational restrictions from such items as high-level alarms or owner / operator-imposed safe fill restrictions. There are no shell-mounted overflow vents on this tank.

3.2.2 SHELL CORROSION RATE CALCULATIONS

When the corrosion rate is not known, the maximum interval shall be 5 years (API 653, Para. 6.3.3.2 a). When the corrosion rate is known, the maximum interval shall be the smaller of *RCA / 2N* years or fifteen (15) years (API 653, Para. 6.3.3.2 b):

$$RCA = t_{act} - t_{min}$$
$$N = t_{prev} - t_{act} / Y$$
$$I_{UT} = t_{act} - t_{min} / 2N$$

Where:

RCA =	See Table	=	Difference between the measured shell thickness and the minimum required thickness in inches.
N =	See Table	=	Shell corrosion rate in inches per year
Y =	Years in service		5
I_{UT} =	See Table	=	Inspection interval for the next Ultrasonic (UT) testing, in years (not exceeding 15 years)

Course No.	Previous Thickness (in.) ($t_{prev.}$)*	Current Measured Average Thickness (in.) (t_{act})	Material Loss (in.)	Minimum Acceptable Course Thickness (in.) (t_{min})	*RCA* (in.)	Corrosion Rate (in. / yr.) (*N*)	Next Ultrasonic (UT) Thickness Inspection (years) (I_{ut})
1	1.059	1.085	0.000	0.948	0.137	0.0000	**15.00**
2	0.746	0.776	0.000	0.727	0.049	0.0000	**15.00**
3	0.479	0.506	0.000	0.375	0.131	0.0000	**15.00**
4	0.395	0.397	0.000	0.124	0.273	0.0000	**15.00**

* = Previous thickness data from 2012 provided by client to facilitate corrosion rate calculations. It should be noted that without established Condition Monitoring Location (CML) points, data collection locations may vary between inspections.

3.2.3 SHELL EXTERNAL INSPECTION

The external inspection interval shall be the lesser of 5 years or RCA / 4N (API 653, Para. 6.3.2.1):

$$RCA = t_{act} - t_{min}$$
$$N = t_{prev} - t_{act} / Y$$
$$I_{VT} = t_{act} - t_{min} / 4N$$

Where:

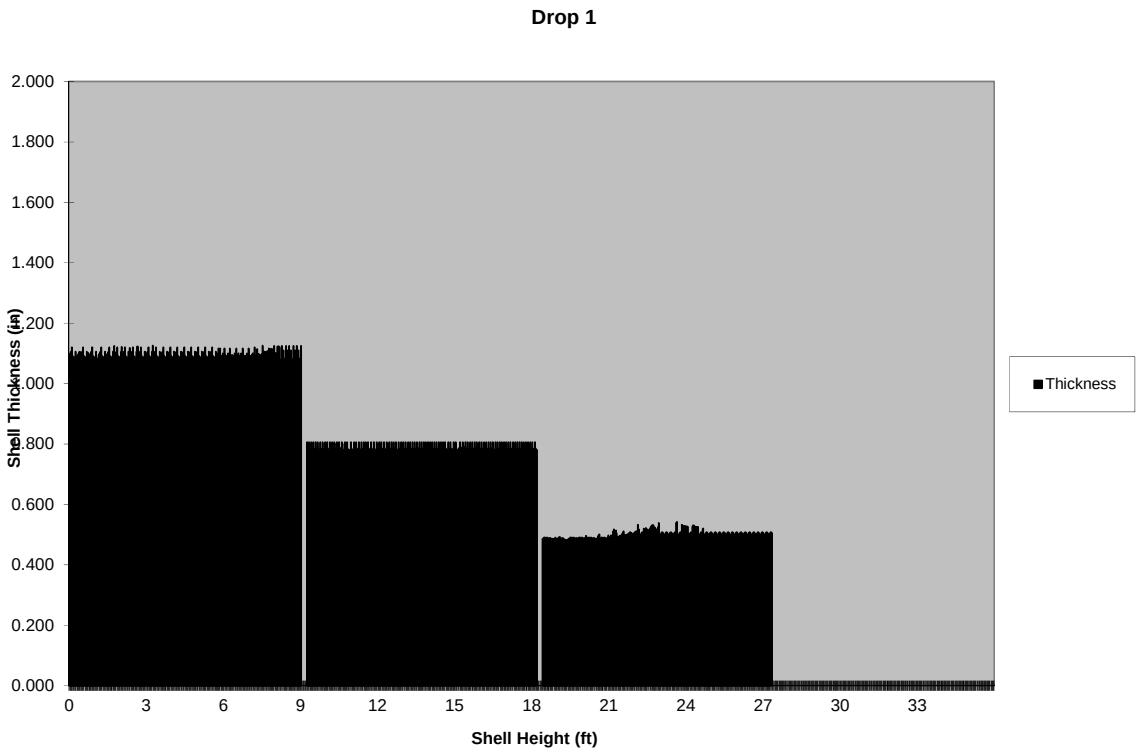
RCA =	See Table	=	Difference between the measured shell thickness and the minimum required thickness in inches.
N =	See Table	=	Shell corrosion rate in inches per year
Y =	Years in service		5
I_{vt} =	See Table	=	Inspection interval for the next External Visual Inspection, in years (not exceeding 5 years)

Course No.	Previous Thickness (in.) ($t_{prev.}$)*	Current Measured Average Thickness (in.) (t_{act})	Material Loss (in.)	Minimum Acceptable Course Thickness (in.) (t_{min})	*RCA* (in.)	Corrosion Rate (in. / yr.) (*N*)	Next External Visual Inspection (years) (I_{vt})
1	1.059	1.085	0.000	0.948	0.137	0.0000	**5.00**
2	0.746	0.776	0.000	0.727	0.049	0.0000	**5.00**
3	0.479	0.506	0.000	0.375	0.131	0.0000	**5.00**
4	0.395	0.397	0.000	0.124	0.273	0.0000	**5.00**

* = Previous thickness data from 2012 provided by client to facilitate corrosion rate calculations. It should be noted that without established Condition Monitoring Location (CML) points, data collection locations may vary between inspections.

3.2.4 B-SCAN ULTRASONIC (UT) THICKNESS READINGS

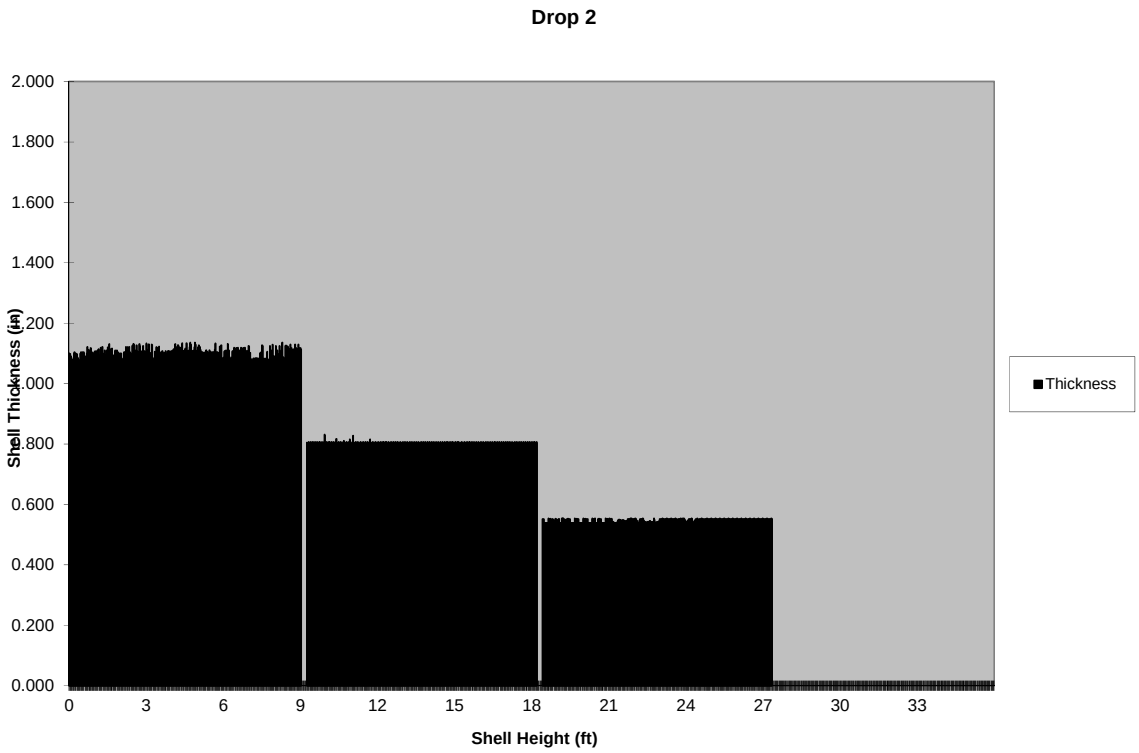
DROP 1



Drop 1	Min	Avg	Max
Course 1	1.077	1.097	1.126
Course 2	0.774	0.788	0.806
Course 3	0.482	0.502	0.542
Course 4	--	--	--

3.2.4 B-SCAN ULTRASONIC (UT) THICKNESS READINGS (CONT'D.)

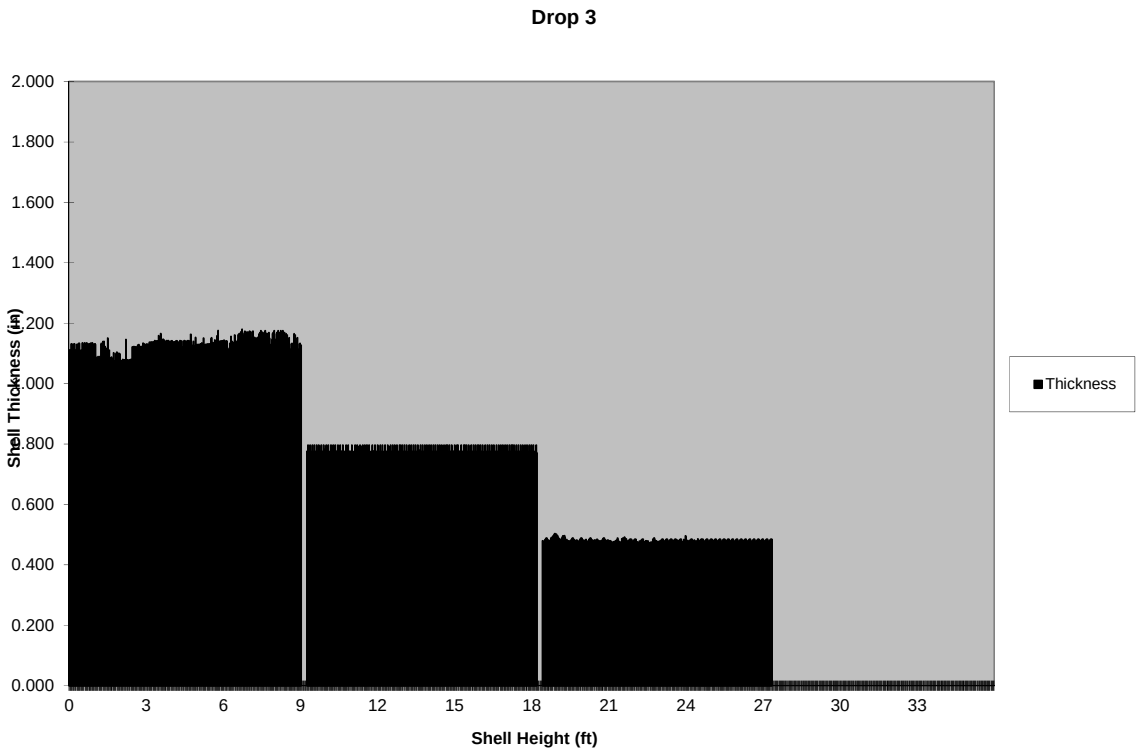
DROP 2



Drop 2	Min	Avg	Max
Course 1	1.073	1.100	1.136
Course 2	0.780	0.794	0.831
Course 3	0.539	0.548	0.555
Course 4	--	--	--

3.2.4 B-SCAN ULTRASONIC (UT) THICKNESS READINGS (CONT'D.)

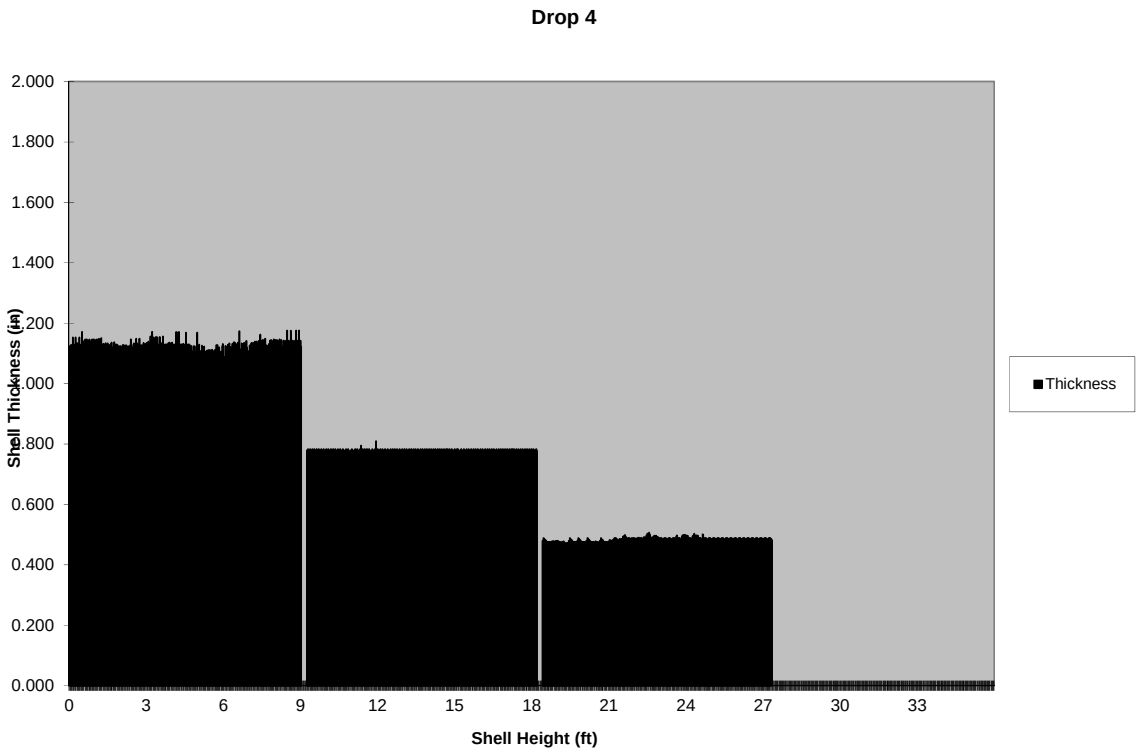
DROP3



Drop 3	Min	Avg	Max
Course 1	1.072	1.127	1.180
Course 2	0.765	0.779	0.797
Course 3	0.468	0.481	0.504
Course 4	--	--	--

3.2.4 B-SCAN ULTRASONIC (UT) THICKNESS READINGS (CONT'D.)

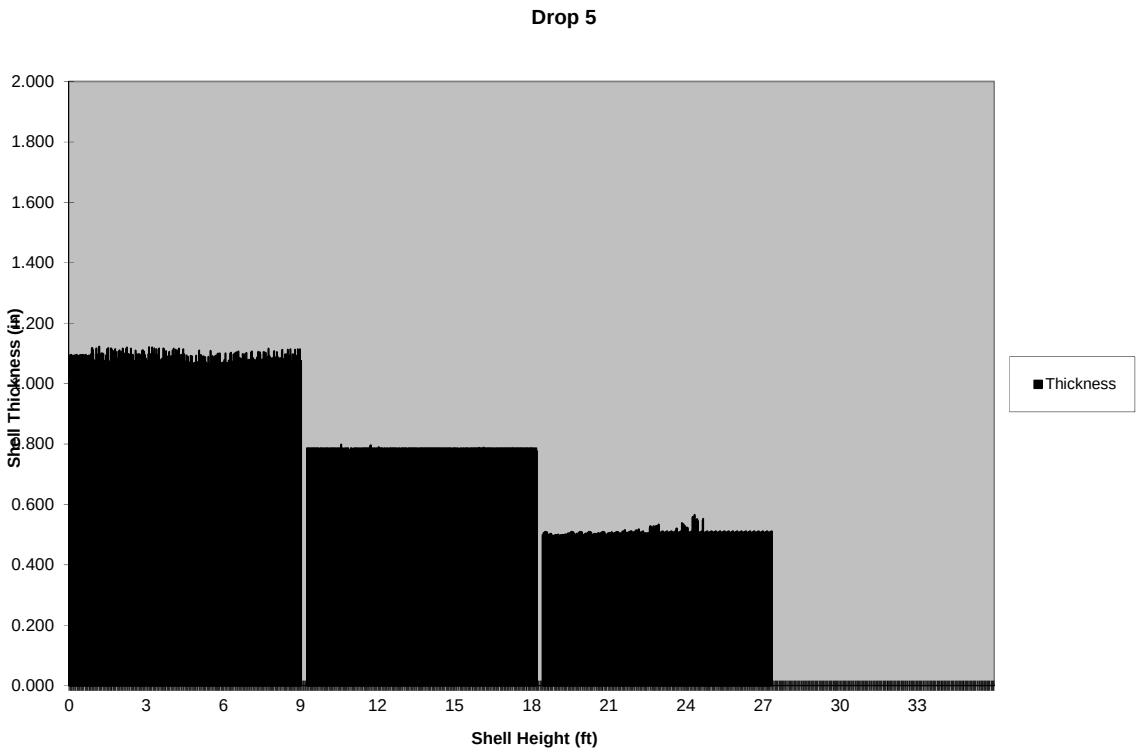
DROP 4



Drop 4	Min	Avg	Max
Course 1	1.080	1.122	1.176
Course 2	0.763	0.779	0.810
Course 3	0.468	0.485	0.507
Course 4	--	--	--

3.2.4 B-SCAN ULTRASONIC (UT) THICKNESS READINGS (CONT'D.)

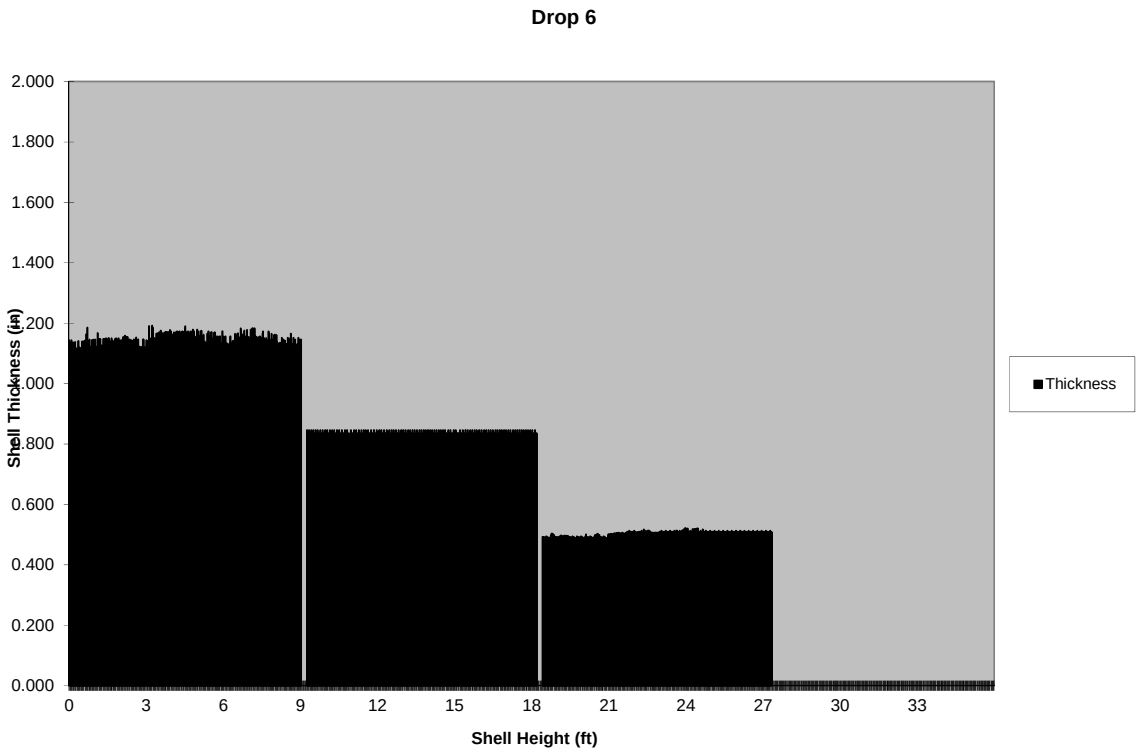
DROP 5



Drop 5	Min	Avg	Max
Course 1	1.062	1.085	1.123
Course 2	0.739	0.782	0.799
Course 3	0.495	0.510	0.566
Course 4	--	--	--

3.2.4 B-SCAN ULTRASONIC (UT) THICKNESS READINGS (CONT'D.)

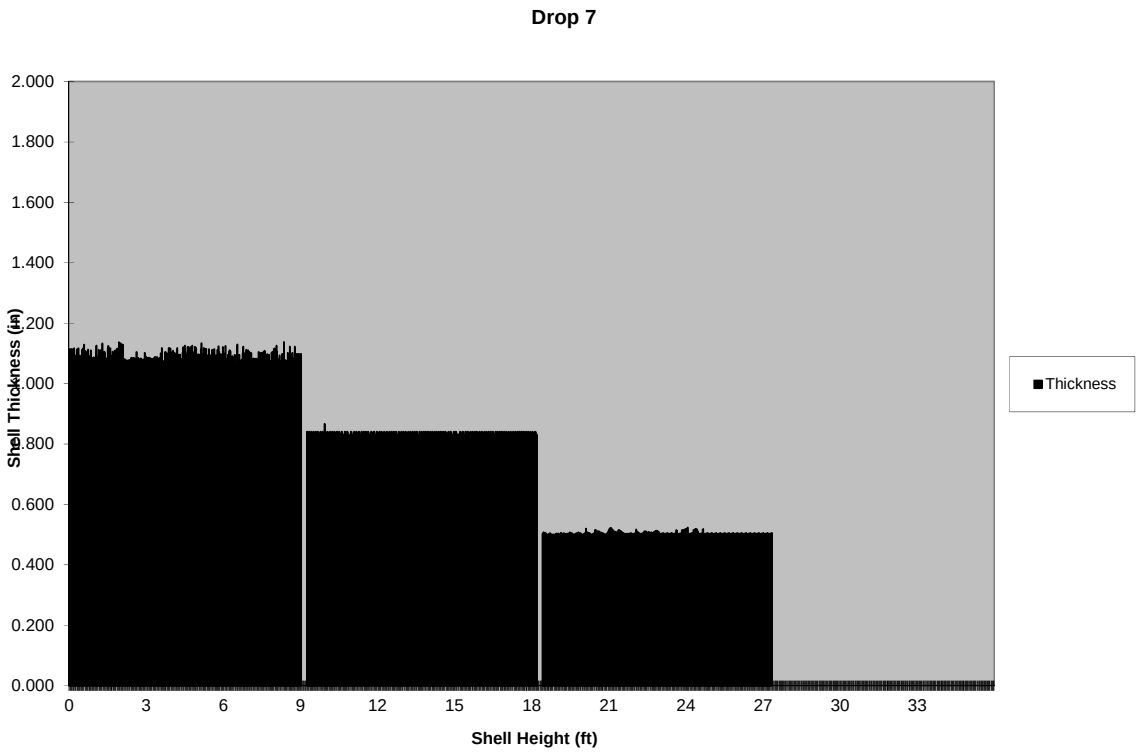
DROP 6



Drop 6	Min	Avg	Max
Course 1	1.112	1.144	1.192
Course 2	0.784	0.835	0.846
Course 3	0.489	0.505	0.522
Course 4	--	--	--

3.2.4 B-SCAN ULTRASONIC (UT) THICKNESS READINGS (CONT'D.)

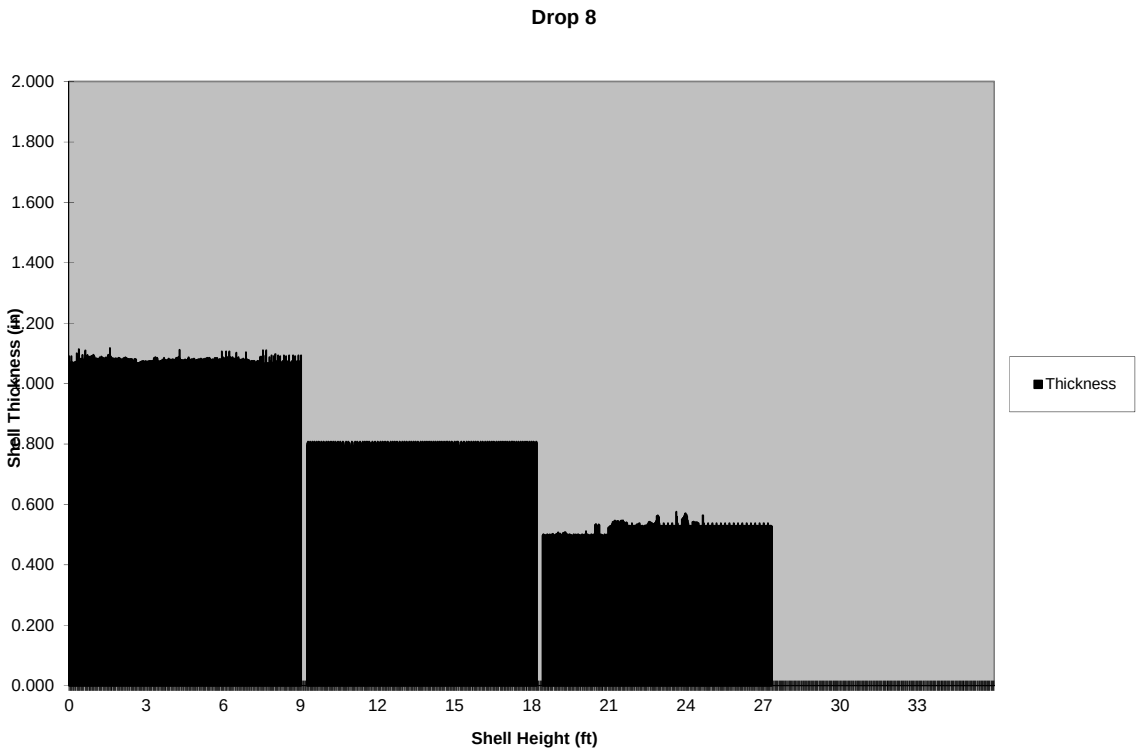
DROP 7



Drop 7	Min	Avg	Max
Course 1	1.066	1.091	1.138
Course 2	0.782	0.833	0.867
Course 3	0.499	0.505	0.524
Course 4	--	--	--

3.2.4 B-SCAN ULTRASONIC (UT) THICKNESS READINGS (CONT'D.)

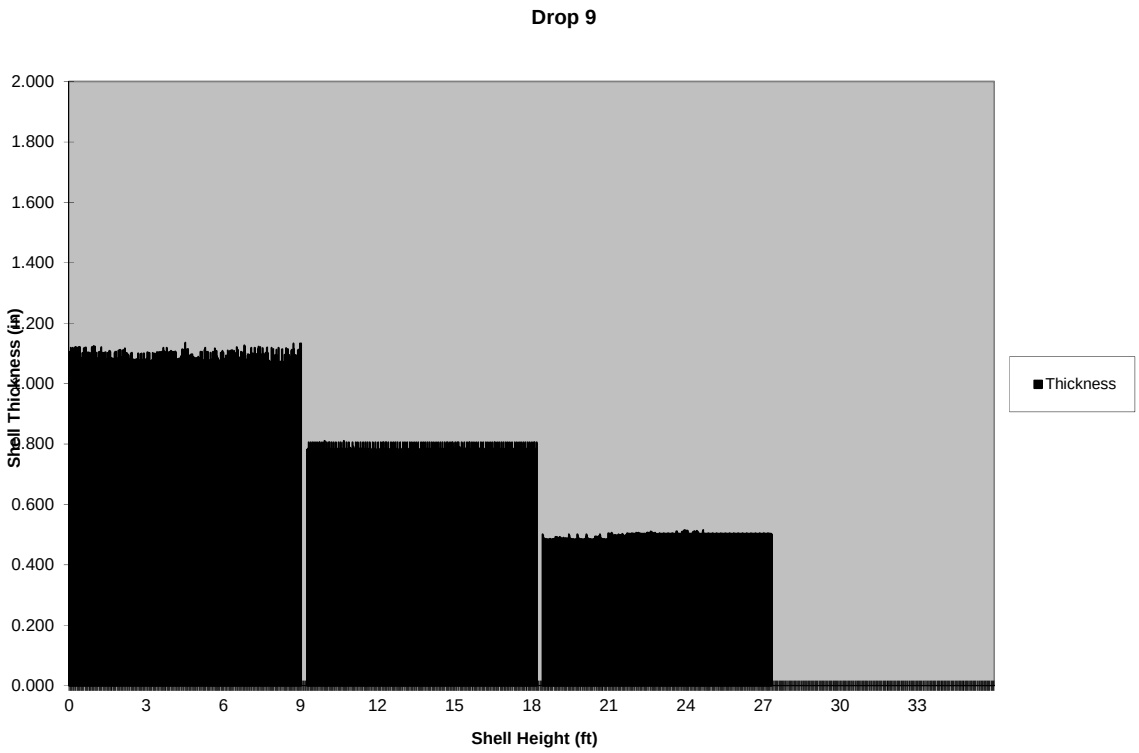
DROP 8



Drop 8	Min	Avg	Max
Course 1	1.062	1.080	1.118
Course 2	0.778	0.803	0.808
Course 3	0.445	0.524	0.576
Course 4	--	--	--

3.2.4 B-SCAN ULTRASONIC (UT) THICKNESS READINGS (CONT'D.)

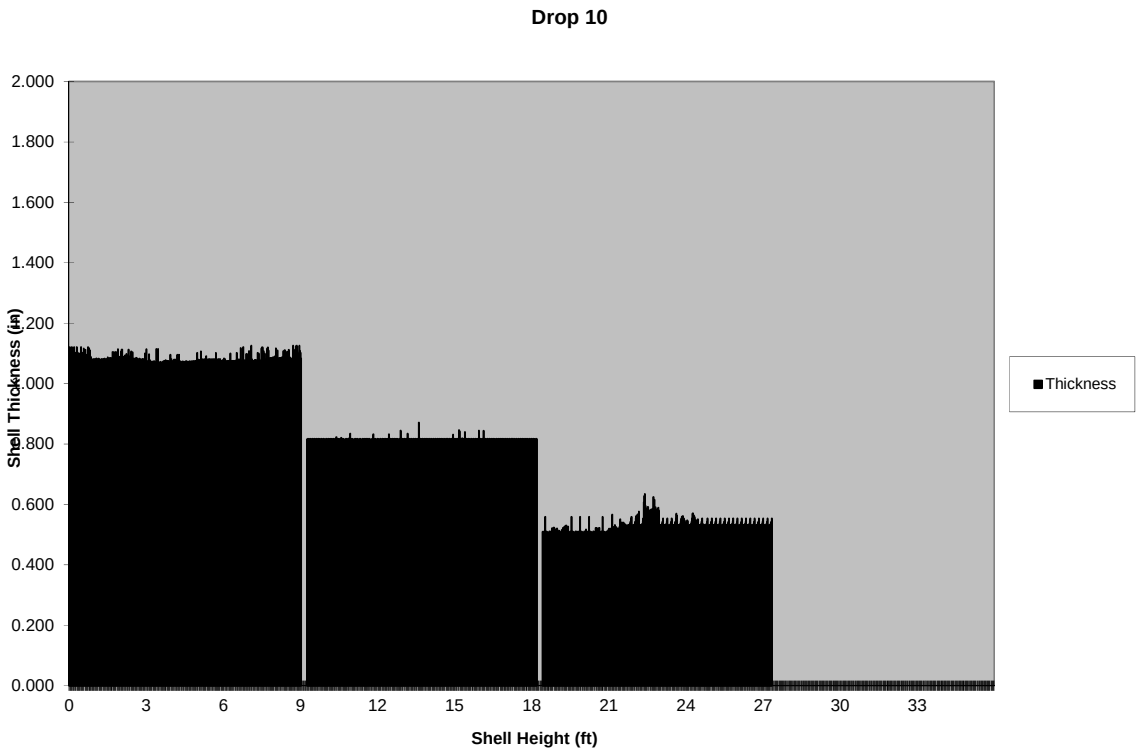
DROP 9



Drop 9	Min	Avg	Max
Course 1	1.069	1.094	1.136
Course 2	0.776	0.789	0.811
Course 3	0.482	0.499	0.516
Course 4	--	--	--

3.2.4 B-SCAN ULTRASONIC (UT) THICKNESS READINGS (CONT'D.)

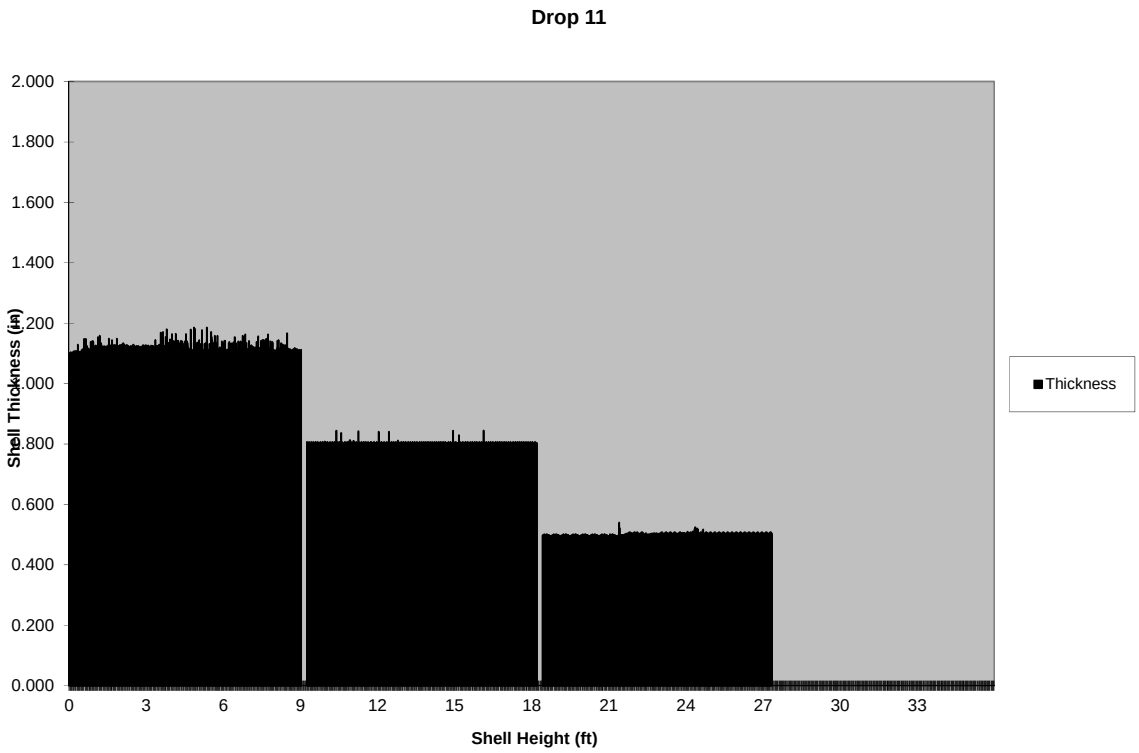
DROP 10



Drop 10	Min	Avg	Max
Course 1	1.065	1.085	1.126
Course 2	0.805	0.817	0.871
Course 3	0.459	0.532	0.635
Course 4	--	--	--

3.2.4 B-SCAN ULTRASONIC (UT) THICKNESS READINGS (CONT'D.)

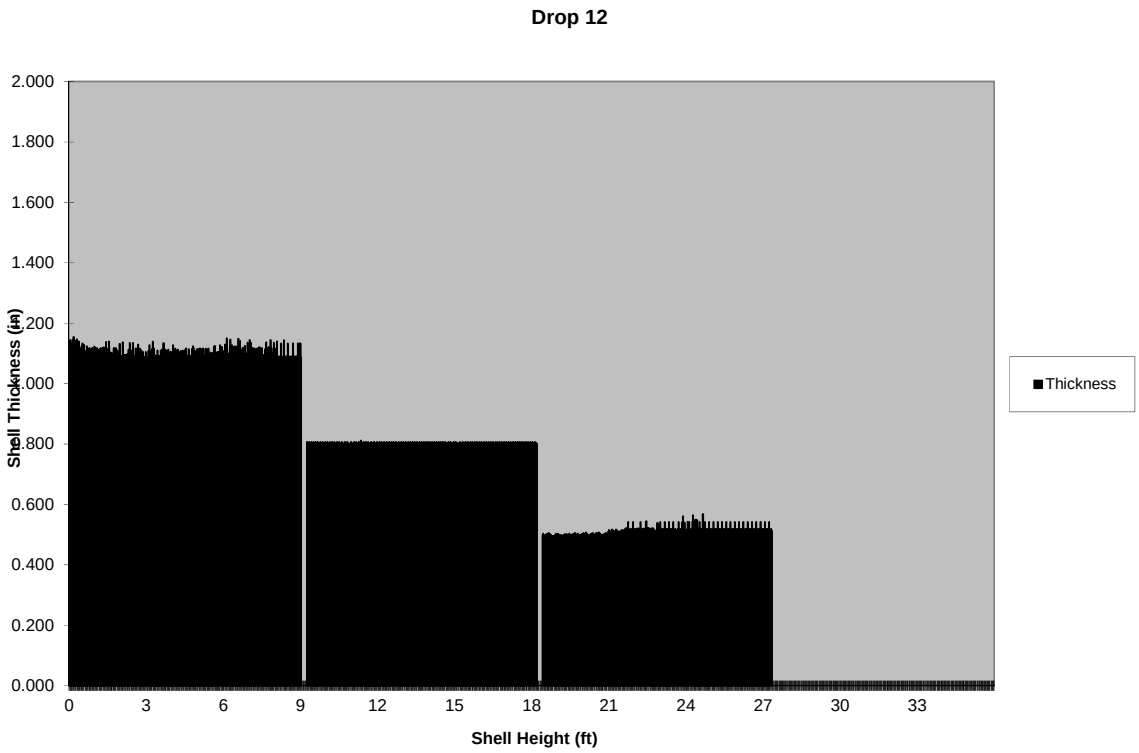
DROP 11



Drop 11	Min	Avg	Max
Course 1	1.088	1.124	1.186
Course 2	0.797	0.806	0.845
Course 3	0.494	0.503	0.540
Course 4	--	--	--

3.2.4 B-SCAN ULTRASONIC (UT) THICKNESS READINGS (CONT'D.)

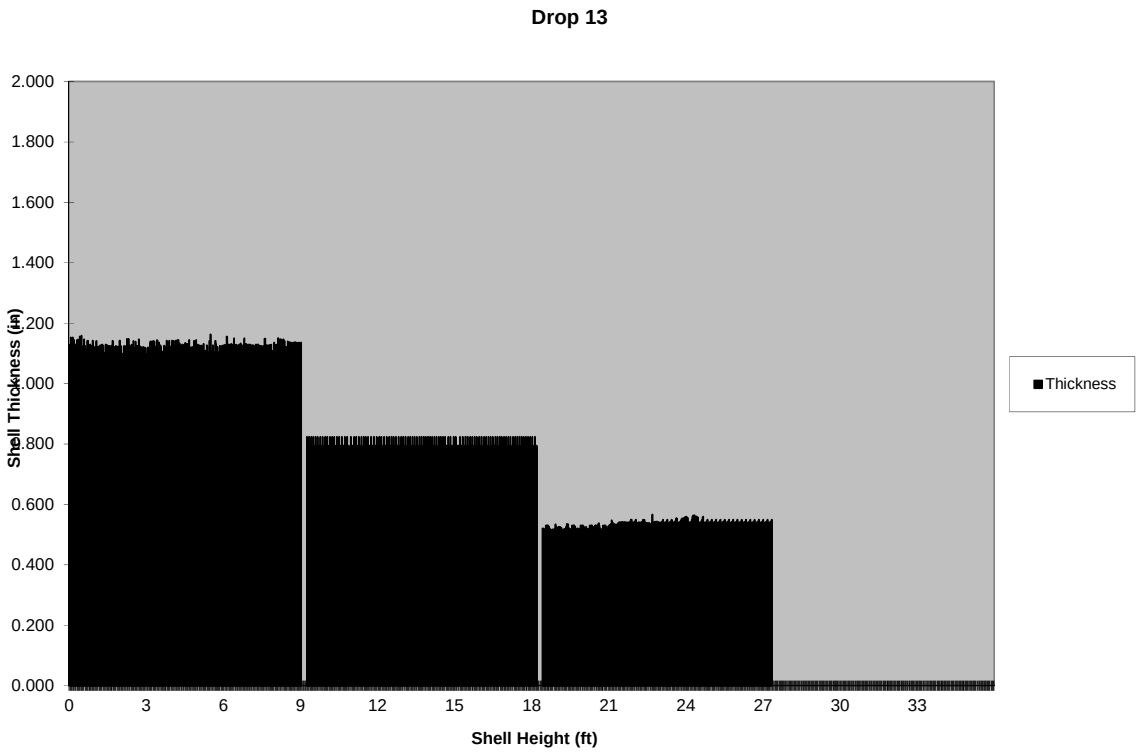
DROP 12



Drop 12	Min	Avg	Max
Course 1	1.082	1.105	1.155
Course 2	0.763	0.802	0.812
Course 3	0.494	0.515	0.568
Course 4	--	--	--

3.2.4 B-SCAN ULTRASONIC (UT) THICKNESS READINGS (CONT'D.)

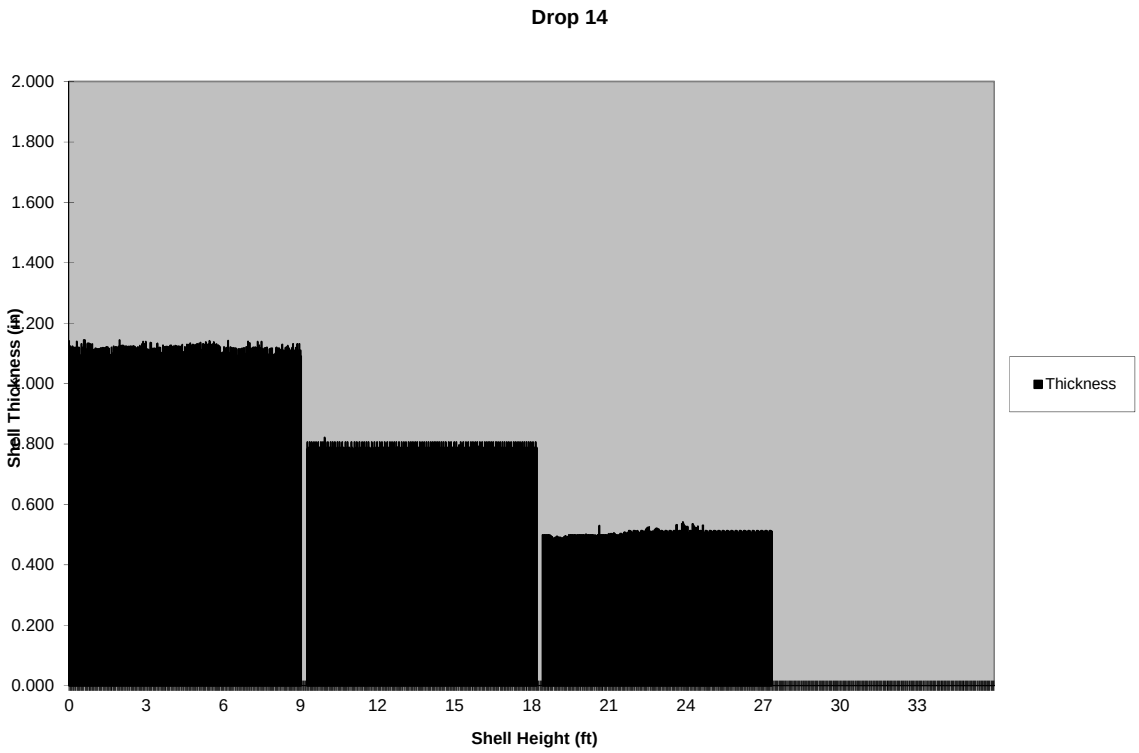
DROP 13



Drop 13	Min	Avg	Max
Course 1	1.092	1.121	1.163
Course 2	0.766	0.791	0.824
Course 3	0.512	0.537	0.567
Course 4	--	--	--

3.2.4 B-SCAN ULTRASONIC (UT) THICKNESS READINGS (CONT'D.)

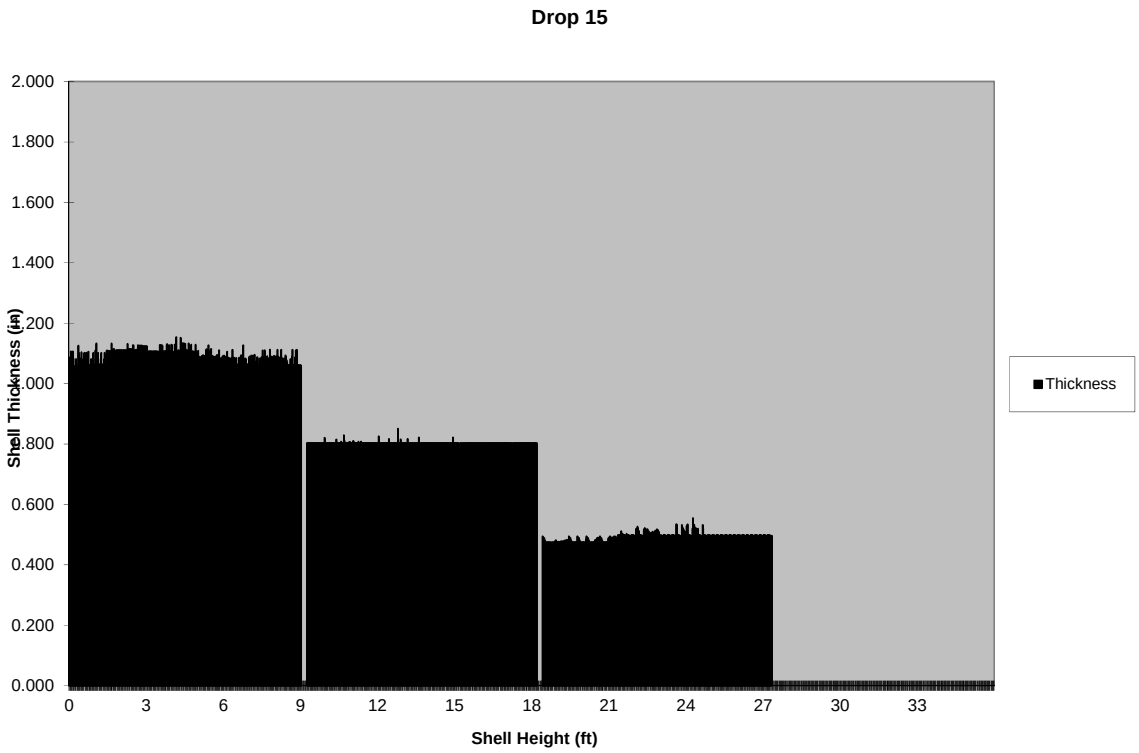
DROP 14



Drop 14	Min	Avg	Max
Course 1	1.089	1.113	1.145
Course 2	0.776	0.791	0.822
Course 3	0.486	0.507	0.542
Course 4	--	--	--

3.2.4 B-SCAN ULTRASONIC (UT) THICKNESS READINGS (CONT'D.)

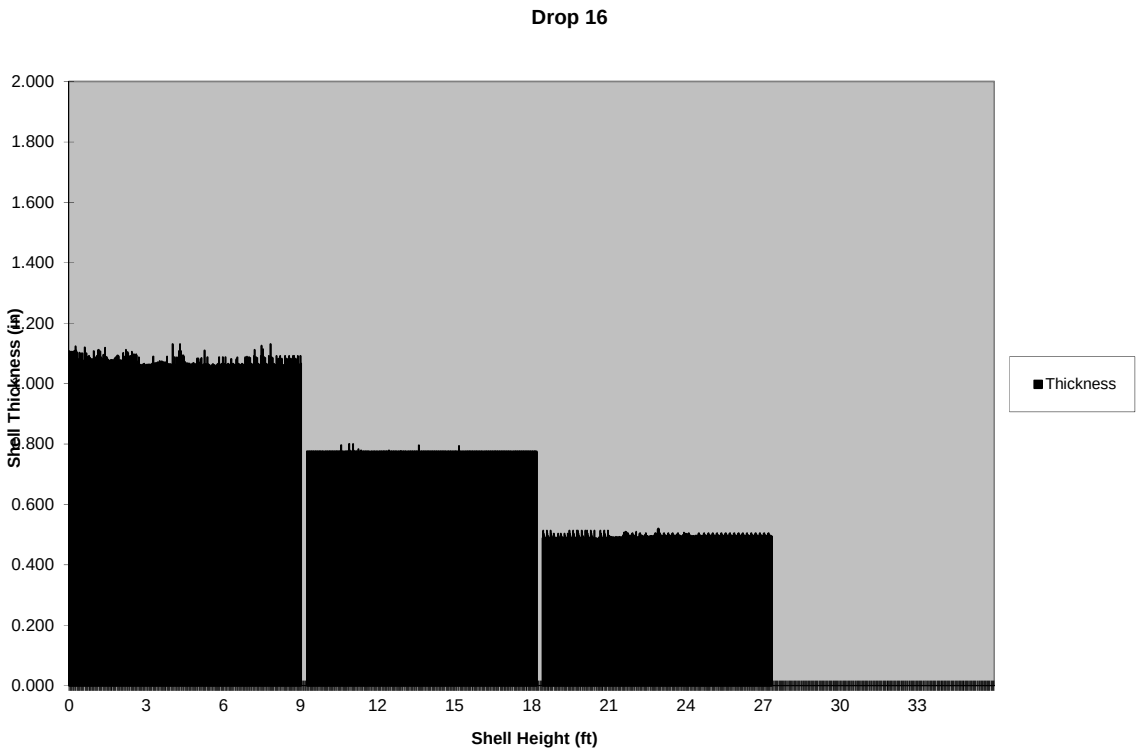
DROP 15



Drop 15	Min	Avg	Max
Course 1	1.056	1.093	1.154
Course 2	0.786	0.803	0.851
Course 3	0.472	0.495	0.555
Course 4	--	--	--

3.2.4 B-SCAN ULTRASONIC (UT) THICKNESS READINGS (CONT'D.)

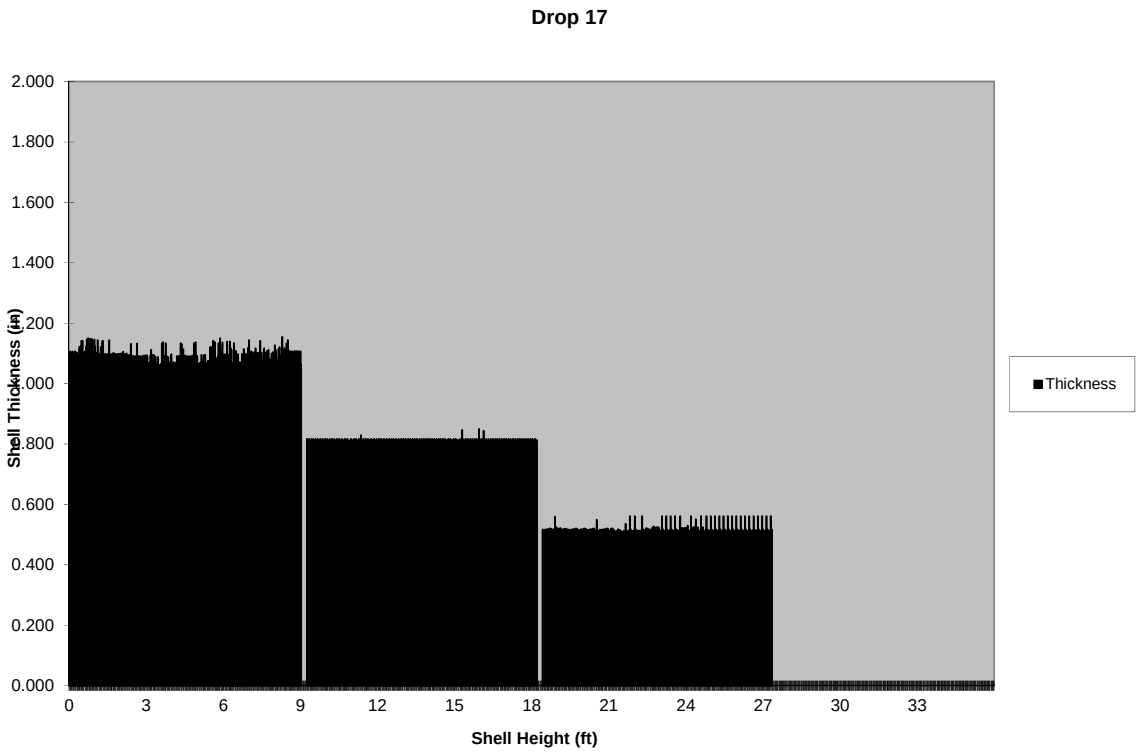
DROP 16



Drop 16	Min	Avg	Max
Course 1	1.038	1.075	1.131
Course 2	0.737	0.775	0.801
Course 3	0.460	0.497	0.521
Course 4	--	--	--

3.2.4 B-SCAN ULTRASONIC (UT) THICKNESS READINGS (CONT'D.)

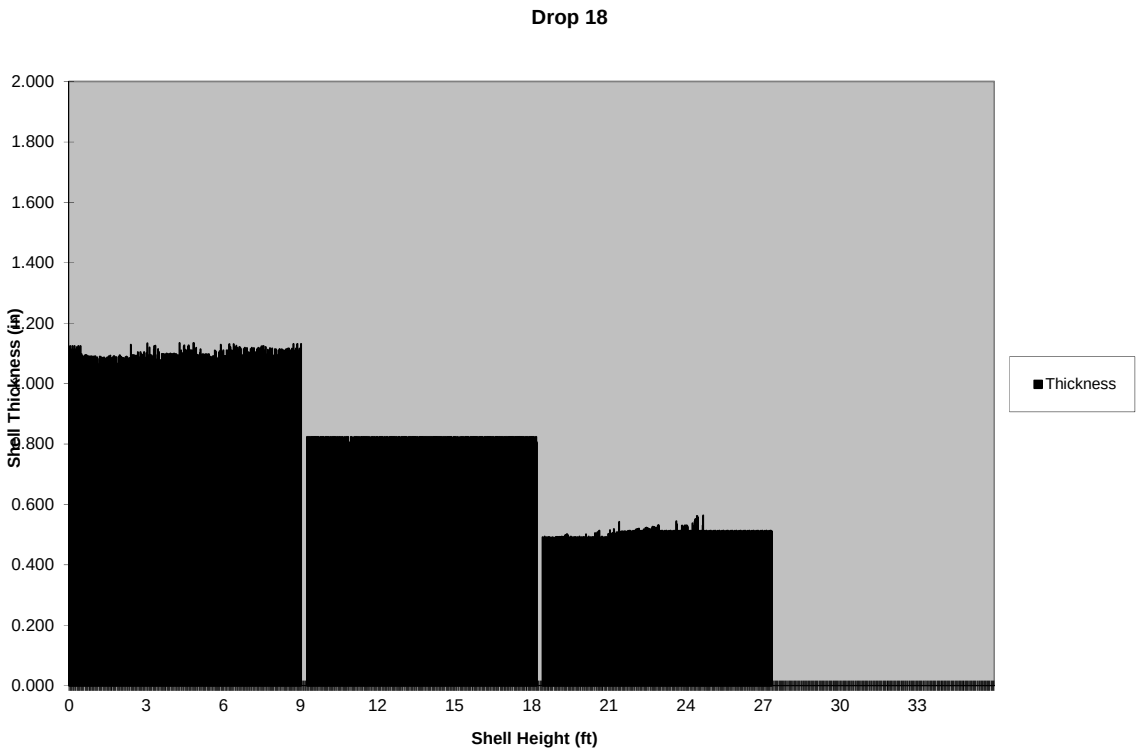
DROP 17



Drop 17	Min	Avg	Max
Course 1	1.060	1.092	1.155
Course 2	0.782	0.808	0.850
Course 3	0.508	0.519	0.561
Course 4	--	--	--

3.2.4 B-SCAN ULTRASONIC (UT) THICKNESS READINGS (CONT'D.)

DROP 18



Drop 18	Min	Avg	Max
Course 1	1.062	1.094	1.135
Course 2	0.767	0.813	0.824
Course 3	0.488	0.508	0.564
Course 4	--	--	--

4.0 INSPECTION REPORT

4.1 FOUNDATION

4.1.1 FOUNDATION INSPECTION CHECKLIST

ITEM NO.	FOUNDATION	INSPECTION COMMENTS
F1	Condition of foundation support (ref. API 653, Para. 4.5.1).	Acceptable
F2	Perform bottom settlement survey (ref. API 653, Para. B.2.1).	Reference Sections 2.0 and 3.1.2
F3	Concrete ringwall free of debris (ref. API 653, Para. 6.3.1).	Reference Section 2.0
F4	Concrete ringwall beveled away from tank.	Acceptable
F5	Concrete ringwall free of cracks, breaks, spalling, exposed rebar, etc. (ref. API 653, Para. 4.5.1).	Reference Section 2.0
F6	Earth eroded due to water running off the tank (ref. API 653, Paras. 6.3.1, 4.4.2).	Acceptable
F7	Check for proper drainage and water runoff away from the tank (ref. API 653, Para. C.1.1.5).	Acceptable
F8	Check around the tank and within the dike for build-up of trash and vegetation (ref. API 653, Para. C.1.1.6).	Acceptable
F9	Moisture barrier condition at bottom edge projection to concrete ringwall (ref. API 653, Para. 6.3.1).	Reference Section 2.0
F10	Indications of bottom leakage (ref. API 653, Para. 6.3.1).	Acceptable
F11	Cavities or holes around / under tank perimeter (ref. API 653, Paras. 6.3.1 & C.1.1.1).	Acceptable
F12	Check for anchorage. Record sizes, spacing between anchors and condition (ref. API 653, Paras. 4.5.3 & 8.8).	N/A
F13	List any limitations to the foundation inspection.	Acceptable

4.2 BOTTOM

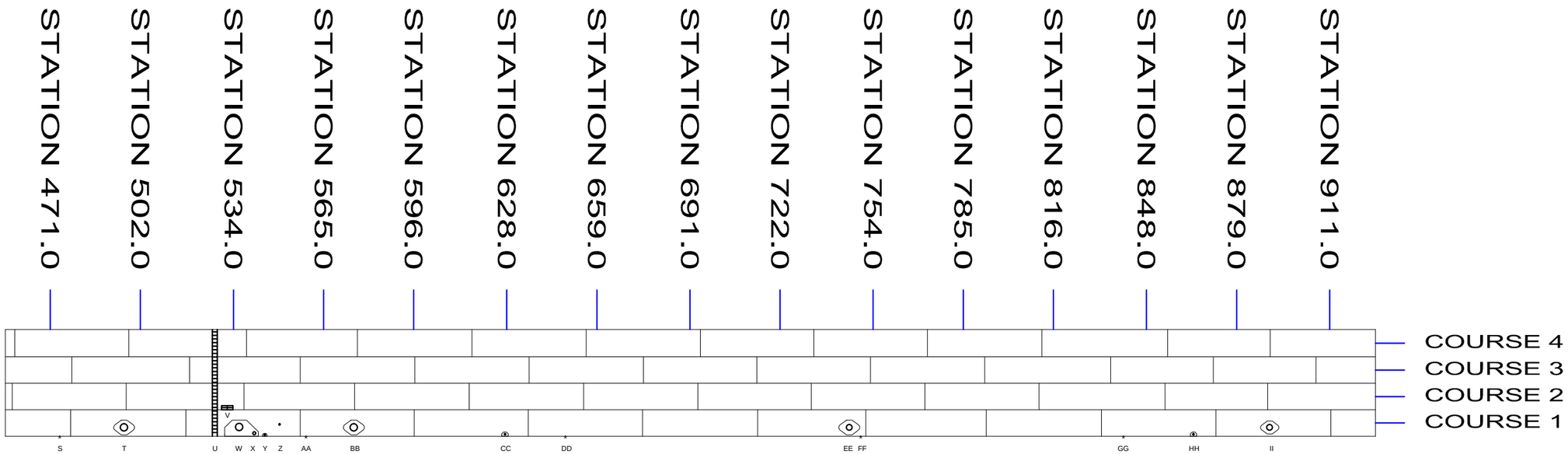
4.2.1 BOTTOM INSPECTION CHECKLIST

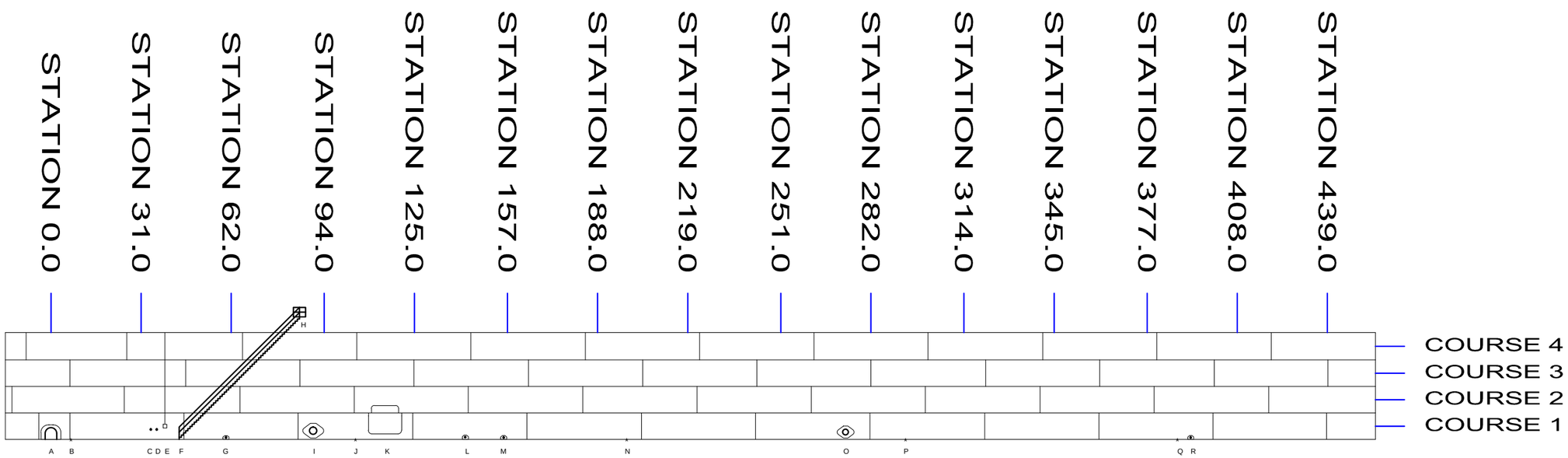
ITEM NO.	BOTTOM	INSPECTION COMMENTS
B1	Bottom edge projection condition (corroded or pitted, thinning, deformed, obstructed) (ref. API 653, Paras. 4.4.5.7 & 6.3.1.3).	Reference Section 2.0
B2	Visual inspection of accessible external bottom plate surface condition (ref. API 653, Para. 4.4.1).	Acceptable
B3	List any limitations to bottom inspection.	Acceptable

4.3 SHELL

4.3.1 SHELL INSPECTION CHECKLIST

ITEM NO.	EXTERNAL SHELL	INSPECTION COMMENTS
S1	Shell weld / seam condition. Perform shell thickness calculations (ref. API 653, Paras. 4.3.3.1, 4.3.4, 4.3.8 & 4.3.10).	Reference Section 2.0 Butt Welded
S2	Record number and pattern of rivets or bolts (ref. API 653, Table 4.3).	N/A
S3	Check exterior shell-to-bottom weld condition (ref. API 653, Para. 6.3).	Acceptable
S4	Identify all signs of product leakage (exterior) (ref. API 653, Para. 6.3).	Acceptable
S5	Perform Magnetic Particle testing of exterior shell-to-bottom weld (ref. API 653, Para. 4.3.6).	N/A
S6	Coating condition (Coating failure such as blistering, thinning, cracks, or discolored) (ref. API 653, Para. 6.3).	Reference Section 2.0
S7	Shell condition (deformations, corrosion, pitting) (ref. API 653, Para. 4.3).	Acceptable
S8	Rivet condition (worn, corroded, loose rivet sealer, leaking).	N/A
S9	Perform UT thickness readings on shell per job scope.	Reference Section 5.0
S10	Inspect support welds to shell for corrosion or defects.	Acceptable
S11	Wind girder / shell stiffeners condition (corrosion, weld failure). (ref. API 653, Para. 4.3.7)	Reference Section 2.0
S12	Note whether supports have reinforcing pads welded to shell.	Reference Section 2.0
S13	Shell-mounted vents / overflow slots present. Check for debris covering & condition of screens (ref. API 650, App. H, Para. H.5.3.3).	N/A
S14	Conduct Visual inspection of shell insulation. Inspect for damage (ref. API 653, Para. 6.3.2.2)	N/A
S15	List any limitations to shell inspection.	Reference Section 2.0





DRAWING NOT TO SCALE

GENERAL

1. DESIGN STANDARD : API 650, 6th ED., w/ APPS. D AND K
2. MANUFACTURER : GRAVER TANK & MFG. CO. INC.
3. PRODUCT : CRUDE OIL
4. NAMEPLATE : YES
5. DIAMETER : 300.00'
6. HEIGHT : 36.92'
7. JOINT EFFICIENCY:

COURSE	
1	1.00
2	1.00
3	1.00
4	1.00

8. BUTT WELDED
9. COURSES : 4
10. CONSTRUCTED : 1979
11. STAIRWAY : SPIRAL (CCW UP)
12. COATING : EXTERNAL WHITE PAINT

NDA = NO DATA AVAILABLE

COURSE	AVERAGE THICKNESS (INCH)	HEIGHT (INCH)
1	1.085	110
2	0.776	110
3	0.506	110
4	0.397	110

LEGEND

REFERENCE NOZZLE AND APPURTENANCE TABLE FOR ITEM IDENTIFICATION

Protecting your world, one tank at a time ©

HMT INSPECTION
611 E. SAM HOUSTON PKWY S, SUITE 800
PASADENA, TX 77503

TITLE: SHELL LAYOUT

OWNER: SHELL PIPELINE COMPANY, LP

TANK NO:	JOB NO:
5	224-42381
DRAWN BY: J.VAZQUEZ	DATE: 16 JUN 2017

4.4 NOZZLES AND APPURTENANCES

4.4.1 NOZZLE AND APPURTENANCE INSPECTION CHECKLIST

ITEM NO.	EXTERNAL NOZZLES AND APPURTENANCES	INSPECTION COMMENTS
N1	Document nozzle / manway information on the Nozzle and Appurtenance Table (ref. API 653, Para. 4.3.9).	Reference Table 4.4.2
N2	Evaluate nozzle(s) / manway(s) acceptability to current API 650 / 653 guidelines. Weld spacing, centerline, reinforcement size, nozzle neck thickness (inspect shell nozzles for thinning, pitting and coating failure) and telltale holes, etc. (ref. API 650, Paras. 5.7, 5.7.5.1 and 5.7.2.10 & API 650, Table 5.6B & Fig. 5.8)	Reference Section 2.0 and Table 4.4.2
N3	Visual inspection of all external welds (ref. API 653, Para. 4.3.9.1).	Acceptable
N4	Indications of leakage around manways, nozzles, flanges and appurtenances (including reinforcement, bolting, gaskets and seals).	Acceptable
N5	Check piping and valves for leaks, thermal relief, or signs of damage (ref. API 653, Para. C.1.3.2).	Acceptable
N6	Inspect mixer for support, leakage and defects (ref. API 653, Para. C.1.3.6).	Acceptable
N7	Roof drain leakage.	Acceptable
N8	Temperature indicators / probes (corrosion, mechanical damage).	Acceptable
N9	Automatic gauge condition (corrosion, mechanical damage) (ref. API 653, Para. C.1.3.3) & (ref. API 653, Para. 6.9.3b).	Reference Section 2.0 Type: Tape & Float Mfg.: Varec Model: 2500B
N10	Check welds on shell-mounted davit clips above large valves or equipment (ref. API 650, Para. 5.8.3.5) & (ref. API 653, Para. C.1.3.2h).	Acceptable
N11	Welds on stairways / ladders, gauge platform / ladder, landing platform stringers (corrosion, broken, coating failure) (ref. API 650, Para. 5.8.1.2.a & API 653, Para. C.2.12.4).	Reference Section 2.0
N12	Verify requirements for Platforms, Walkways & Stairways (ref. API 650, Table 5.17 & Table 5.18). **Note: retrofit of existing tanks is not required.**	Acceptable
N13	List any limitations to nozzle & appurtenance inspection.	Acceptable

4.4.2 NOZZLE AND APPURTENANCE TABLE

Item	Description	Pipe Size (in.)	Station (ft.)	CL Elev. (in.)	Width (in.)	Height (in.)	Thick (in.)	Shape	1 or 2 Piece	Neck Thick (in.)	Flange Thick (in.)	Cover Thick (in.)	Tell-tale	Weld Space (in.)	Comments
A	Cleanout	48x48	0.00	24	125	71	0.998	D	1	1.243	0.999	0.995	Y-1	Flush	
B	Grounding Clip	--	6.90	--	--	--	--	--	--	--	--	--	--	--	--
C	Nozzle	2	34.40	40.50	--	--	--	--	--	--	--	--	--	38.50	
D	Nozzle	1.50	36.40	40.50	--	--	--	--	--	--	--	--	--	39	
E	Automatic Gauge	--	39.20	--	--	--	--	--	--	--	--	--	--	--	
F	Stairway Bottom	--	44.10	--	--	--	--	--	--	--	--	--	--	--	
G	Nozzle	4	60.20	61.90	15	11.50	1.077	K	1	0.423	0.921	--	Y-1	Flush	
H	Stairway Top	--	86.60	--	--	--	--	--	--	--	--	--	--	--	
I	Manway	30	90.20	36	76	66	1.105	A	1	1.100	0.852	1.151	Y-1	4.50	w/ Mixer, IWS
J	Grounding Clip	--	104.80	--	--	--	--	--	--	--	--	--	--	--	
K	Insert	--	114.90	--	120	97	1.162	L	1	--	--	--	--	11	
L	Nozzle	6	142.50	8.50	19	16.50	1.102	K	1	0.420	1.146	--	Y-1	Flush	
M	Nozzle	6	155.70	7.50	19	16.50	1.064	K	1	0.413	1.221	1.085	Y-1	Flush	
N	Grounding Clip	--	198.10	--	--	--	--	--	--	--	--	--	--	--	
O	Manway	24	273.30	30	60	48	1.086	A	1	0.549	0.449	0.554	Y-1	9.75	IWS
P	Grounding Clip	--	294.00	--	--	--	--	--	--	--	--	--	--	--	
Q	Grounding Clip	--	387.40	--	--	--	--	--	--	--	--	--	--	--	
R	Nozzle	6	392.00	7.50	19	16.50	1.021	K	1	0.461	1.028	1.025	Y-1	Flush	
S	Grounding Clip	--	474.20	--	--	--	--	--	--	--	--	--	--	--	
T	Manway	30	496.40	36	76	66	1.082	A	1	1.149	1.124	1.309	Y-1	4.50	w/ Mixer, IWS
U	Vertical Ladder	--	527.60	--	--	--	--	--	--	--	--	--	--	--	
V	Platform	--	531.60	--	--	--	--	--	--	--	--	--	--	--	
W	Nozzle	30	536.00	38	125	72	1.190	H	1	0.696	2.250	--	Y-1	Flush	Shared Reinforcing Plate
X	Nozzle	12	541.20	12						0.535	1.264	--	Y-1	Flush	
Y	Nozzle	4	544.80	5.50	15	11	1.057	K	1	0.414	0.941	--	Y-1	Flush	
Z	Nozzle	2	549.90	48	--	--	--	--	--	0.142	0.810	0.814	--	46.50	INT

The stations are measured circumferentially counterclockwise from Cleanout A

NOTE: IWS= Inadequate Weld Spacing / INT= Inadequate Neck Thickness / Y-1 (Telltale)= Yes, One

Shape

4.4.2 NOZZLE AND APPURTENANCE TABLE (CONT'D.)

Item	Description	Pipe Size (in.)	Station (ft.)	CL Elev. (in.)	Width (in.)	Height (in.)	Thick (in.)	Shape	1 or 2 Piece	Neck Thick (in.)	Flange Thick (in.)	Cover Thick (in.)	Tell-tale	Weld Space (in.)	Comments
AA	Grounding Clip	--	558.90	--	--	--	--	--	--	--	--	--	--	--	
BB	Manway	30	575.40	36	74	60	1.097	A	1	1.017	0.690	1.120	Y-1	4.50	w/ Mixer, IWS
CC	Nozzle	6	627.40	8	19	15	1.072	K	1	0.472	1.082	1.097	Y-1	Flush	
DD	Grounding Clip	--	648.20	--	--	--	--	--	--	--	--	--	--	--	
EE	Manway	24	745.80	36	60	48	1.096	A	1	0.571	0.430	0.549	Y-1	9.50	IWS
FF	Grounding Clip	--	749.70	--	--	--	--	--	--	--	--	--	--	--	
GG	Grounding Clip	--	840.10	--	--	--	--	--	--	--	--	--	--	--	
HH	Nozzle	6	864.20	7.50	19	16	1.049	K	1	0.448	1.97	1.61	Y-1	Flush	
II	Manway	24	890.40	36	60	48	1.060	A	1	0.592	0.491	0.577	Y-1	9.50	IWS
	Total Strapped Circumference	--	944.40	--	--	--	--	--	--	--	--	--	--	--	

The stations are measured circumferentially counterclockwise from Cleanout A

NOTE: IWS= Inadequate Weld Spacing / INT= Inadequate Neck Thickness / Y-1 (Telltale)= Yes, One

Shape

COURSE 1 VERTICAL WELD LOCATIONS:

1) 6.50	2) 45.70	3) 85.00	4) 124.40	5) 163.70	6) 203.10	7) 242.30	8) 281.65	9) 321.15
10) 36.04	11) 399.60	12) 438.70	13) 478.00	14) 517.65	15) 557.00	16) 596.20	17) 635.40	18) 674.70
19) 714.30	20) 751.50	21) 792.90	22) 832.50	23) 871.90	24) 911.40	25) 938.30		

COURSE 2 VERTICAL WELD LOCATIONS:

1) 25.20	2) 65.00	3) 104.30	4) 143.50	5) 182.90	6) 222.20	7) 261.50	8) 300.70	9) 340.20
10) 379.40	11) 418.80	12) 457.90	13) 497.10	14) 537.60	15) 575.70	16) 615.10	17) 654.40	18) 693.70
19) 732.70	20) 771.80	21) 811.10	22) 854.40	23) 889.70	24) 929.10			

VERTICAL WELD OFFSET FOR COURSES 3, 4, 5, etc.:

3) 6.50	4) 26.10							

4.4.2 NOZZLE AND APPURTENANCE TABLE (CONT'D.)

SUPPLEMENTAL NOZZLE UT

Nozzle ID	Clock Position				
Item	12	3	6	9	Average
A	1.246	1.249	1.243	1.251	1.247
G	0.426	0.423	0.428	0.424	0.425
I	1.103	1.106	1.103	1.100	1.103
L	0.420	0.426	0.429	0.423	0.425
M	0.416	0.413	0.419	0.421	0.417
O	0.556	0.549	0.551	0.560	0.554
R	0.461	0.468	0.463	0.467	0.465
T	1.153	1.150	1.149	1.159	1.153
W	0.698	0.696	0.699	0.696	0.697
X	0.538	0.536	0.535	0.541	0.538
Y	0.419	0.423	0.421	0.419	0.421
Z	0.153	0.152	0.142	0.149	0.149
BB	1.017	1.019	1.026	1.020	1.020
CC	0.478	0.472	0.476	0.474	0.475
EE	0.571	0.573	0.580	0.582	0.577
HH	0.452	0.451	0.448	0.458	0.452
II	0.598	0.592	0.596	0.600	0.597

5.0 NDT INSPECTION

5.1 NDT INSPECTION SCOPE

The following Nondestructive Testing (NDT) was conducted to evaluate the physical characteristics of the tank:

A) Visual (VT) inspection of areas for the detection of anomalies or significant product side metal loss which may affect the integrity. Performed in accordance with HMT Inspection VT Procedure No. 1611.9, Revision No. 4.

B) Random Ultrasonic (UT) testing. Performed in accordance with HMT Inspection UT Procedure No. 1611.1, Revision No. 7.

5.2 BOTTOM INSPECTION

Bottom edge projection was inspected utilizing VT inspection method.

External shell-to-bottom weld was inspected utilizing VT inspection method.

5.3 SHELL INSPECTION

External shell welds were inspected utilizing VT inspection method.

Shell plate UT data was collected utilizing random readings. Readings were taken along eighteen (18) vertical B-Scan drops, evenly spaced, around the shell (counterclockwise from Manway A) (ref. Section 3.2.4).

5.4 NOZZLE INSPECTION

External shell nozzle welds were inspected utilizing VT inspection method.

Shell nozzle UT data was collected utilizing random readings. One (1) reading per reinforcing pad, flange face, and cover (when applicable) was taken. Four (4) readings per nozzle neck at 0°, 90°, 180°, and 270° were taken (ref. Section 4.4.2).

6.0 EQUIPMENT

6.1 ULTRASONIC

UT equipment utilized for the inspection was a GE USM Go Plus Flaw Detector (Serial No. 13100061).

Transducer equipment utilized was a BRITEK 7.5 MHz, 0.312 inch dual element.

Calibration block equipment utilized was a 5 step, carbon steel test block (0.100 inch to 0.500 inch) and a Tipsy Step Block, 1018 carbon steel (1-inch to 4.5-inches in 0.500 inch increments).

Echogel 20 and water were used as couplant.

B-Scan: ScanTech C-1 Spider with GE, 7.5 MHz, 5 inch bubbler transducer.

6.2 LEVEL

Level equipment utilized was a Spectra Precision LL300 self-leveling rotating laser.

7.0 WARRANTY

WARRANTY

HMT Inspection, a division of HMT LLC ("HMT"), has evaluated the condition of this tank based on the observations and measurements made by the HMT Tank Inspector and within API 653 guidelines. While our evaluation accurately describes the condition of the tank at the time of inspection, the tank owner / operator must independently assess the inspection information / report provided by HMT and any conclusions reached by the tank owner / operator and any action taken or omitted to be taken are the sole responsibility of the owner / operator. With respect to inspection and testing, HMT warrants only that the services have been performed in accordance with accepted industry practice. If any such services fail to meet the foregoing warranty, HMT shall re-perform the service to the same extent and on the same conditions as the original service.

The preceding paragraph sets forth the exclusive remedy for claims based on failure or of defect in materials or services, whether such claim is made in contract or tort (including negligence) and however instituted, and, upon expiration of the warranty period, all such liability shall terminate. The foregoing warranty is exclusive and in lieu of all other warranties, whether written, oral, implied or statutory. NO IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE SHALL APPLY, nor shall HMT be liable for any loss or damage whatsoever by reason of its failure to discover, report, repair or modify latent defects or defects inherent in the design of any tank inspected. In no event, whether a result of breach of contract, warranty or tort (including negligence) shall HMT be liable for any consequential or incidental damages including, but not limited to, loss of profit or revenues, loss of use of equipment tested or services by HMT or any associated damage to facilities, down-time costs or claims of other damages.

8.0 PHOTOGRAPHS

Tank 5 Shell Stand-off

Shell Stand-off

Shell Stand-off

Shell Stand-off

Foundation Stand-off

Foundation Stand-off

Foundation Stand-off

Foundation Stand-off

8.0 PHOTOGRAPHS

Deteriorated Moisture Barrier

Deteriorated Moisture Barrier

Deteriorated Moisture Barrier

Cracking in Foundation

8.0 PHOTOGRAPHS

Cracking in Foundation

Spalling in Foundation

Spalling in Foundation

Bottom Edge Projection Coating Failure

Bottom Edge Projection Coating Failure

8.0 PHOTOGRAPHS

Cleanout A

Grounding Clip B

Nozzle C

Nozzle D

Automatic Gauge E

Automatic Gauge E Number Dial Missing

Stairway Bottom F

Nozzle G

Stairway Top H

Manway I

Grounding Clip J

Insert K

Nozzle L

Nozzle M

Grounding Clip N

Manway O

Grounding Clip P

Grounding Clip Q

Nozzle R

Grounding Clip S

Manway T

Vertical Ladder U

Platform V

Nozzle W

Nozzle X

Nozzle Y

Nozzle Z

Grounding Clip AA

Manway BB

Nozzle CC

Grounding Clip DD

Manway EE

Grounding Clip FF

Grounding Clip GG

Nozzle HH

Manway II

Stairway Coating Failure

8.0 PHOTOGRAPHS

Floating Roof Stand-off

Floating Roof Stand-off

Floating Roof Stand-off

Floating Roof Stand-off

Secondary Seal

AMERICAN PETROLEUM INSTITUTE
Individual Certification Programs: ICP™

API Individual Certification Programs

certifies that

Brandon Casey Benoit

has met the requirements to be a certified

API-653 Aboveground Storage Tank Inspector

Certification Number *50711*

Original Certification Date *November 30, 2013*

Current Certification Date *November 30, 2016*

Expiration Date *November 30, 2019*

Tina Briskin
Manager, Individual Certification Programs

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ICP

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2015-027 | PDF

Certificate of Qualification

HMT

INSPECTION

This is to Certify

Brandon Benoit

is qualified in accordance with the HMT Procedure for Qualification and Certification of Nondestructive Examination Personnel which is in compliance with the requirements of the American Society for Nondestructive Testing Recommended Practice SNT-TC-1A-2011 ed.

Method	Level	Expiration Date
API 653	No. 50711	11/30/2019
UT(t)	II	04/16/2019
MFL	II	04/17/2022
STI	No. AC 44094	03/13/2020

Hugh K. Howerton

Hugh K. Howerton
ASNT Level III

April 18, 2017
Date

Certificate of Qualification

HMT

INSPECTION

This is to Certify

Brendan Soulieer

is qualified in accordance with the HMT Procedure for Qualification and Certification of Nondestructive Examination Personnel which is in compliance with the requirements of the American Society for Nondestructive Testing Recommended Practice SNT-TC-1A-2011 ed.

Method	Level	Expiration Date
MFL	II	10/19/2021
LT/BT	II	10/16/2021
MT(y)	II	10/21/2021
UT(t)	II	04/28/2022

Hugh K. Howerton

Hugh K. Howerton
ASNT Level III

April 30, 2017
Date

Certificate of Qualification

HMT

INSPECTION

This is to Certify

Freeman Hancock

is qualified in accordance with the HMT Procedure for Qualification and Certification of Nondestructive Examination Personnel which is in compliance with the requirements of the American Society for Nondestructive Testing Recommended Practice SNT-TC-1A-2011 ed.

Method	Level	Expiration Date
STI	No. 990371	10/03/2019
UT(t)	II	10/27/2021
MFL	II	10/27/2021
LT/BT	II	10/27/2021
MT(y)	II	10/27/2021
PT	II	10/27/2021
VT	II	10/27/2021

Hugh K. Howerton

Hugh K. Howerton
ASNT Level III

October 27, 2016
Date