

**API-653**  
**Tank Inspection**  
**Sample Report**

## INTRODUCTION

This tank is an approximately 210k-gallon vertical aboveground storage tank, reportedly fabricated of carbon steel in 1970, by Tank Manufacturer, Inc. The tank is approximately 30' diameter by 40' high, and is mounted on a concrete foundation.

The ultrasonic thickness equipment used for the roof, and shell inspection was a Krautkramer Branson DMS II (this unit is capable of obtaining thickness readings through applied coatings; it has a digital CRT screen and numeric readout). A 560TC - ½", 5.0 MHz dual element transducer was used. All testing was performed as outlined in our procedure #A-401, revision 8 (Ultrasonic Thickness Examination). Refer to the attached tabular list for all thickness values.

Ultrasonic thickness readings were taken around external patch plates on the shell. Refer to drawing K0000-D-03 for thickness values, patch dimensions and locations. Corroded areas noted above patch plates that do not appear to affect the integrity at this time. Recommendations are to sand blast these areas and apply protective coating.

Please see the following narrative, attachments, figures, and drawing(s) for the details of this inspection.

## GENERAL OBSERVATIONS

The tank was in-service at the time of this inspection. The mechanical integrity of the tank *does NOT appear* to meet the requirements of API-653.

**Shell** – The shell consists of six (6) courses and *does NOT appear* to be in a serviceable condition for the following reasons:

1. Shell course weld alignment and spacing on upper shell courses on the south side, does not meet API-650, section 3.1.5.3.b. (See drawing K0000-D-01, and Fig. 5 and 6)  
Recommend radiographic weld inspection to determine weld integrity and course of action (if any).
2. Penetration on west side of tank, on 1<sup>st</sup>-to-2<sup>nd</sup> shell course weld seam, has no reinforcing plate per API-650, section 3.7.2. (See P2 on drawing K0000-D-01, and Fig. 2)  
Recommend installing reinforcing plate per API-650
3. Multiple shell inserts with non-rounded corners does not meet API-653, section 9.2 and table 9.1. (See drawing K0000-D-01 and Fig. 9 and 10)  
Recommend radiographic weld inspection to determine weld integrity and course of action (if any).

See the attached eight pages of pictures and the following line items for issues that do not appear to affect the integrity of this tank. Thickness forecasting of the shell shows a life expectancy of at least 10 years.

**Floor** – Major scale corrosion on floor protrusion, however, does not exceed minimum wall. Vacuum box inspection was performed on 100% of floor seam welds and floor-to-shell weld. No relevant indications were found at the time of inspection. Please refer to drawing K0000-D-01 for all ultrasonic thickness values and locations on the floor. Thickness forecasting of the floor shows a life expectancy of at least 10 years.

**Foundation** - appears to be in a serviceable condition.

**Welds** – Horizontal welds contain minor porosity and undercut.

**Pitting** – Shell pitting does not exceed maximum allowable pitting per API-653. Multiple pitted areas noted on the third shell course with pits up to 0.120” deep. This pit depth subtracted from the nearest thickness measurement location, calculates a thickness of approximately 0.190” vs. a minimum wall calculation of 0.151”. Multiple gouges and temporary weld attachments on shell, not filled and ground smooth with base metal.

**Secondary Containment** – There is no secondary containment or leak detection for this tank.

**Roof** – is not accessible due to major corrosion on access ladder. Inspection from manlift showed the roof to be in a serviceable condition. One bolt is missing from roof manway.

**Grounding/Cathodic Protection** – This tank *appears* to have a grounding strap attached at the time of inspection. There is no cathodic protection on this tank.

**Tank Plumbness/Out of Round/Tilt/Settlement** - *appears* to be within the specifications of API 653 (see attached deflection settlement readings).

**Exterior Coating** – Coating failure on east side of tank, and around appurtenances. Other areas have minor sags, drips and embedded products that do not appear to affect the protection of this tank, and *appear* to be in serviceable condition. Dry film thickness is 10-14 mils.

**Overfill Protection System** - *appears* to be functioning correctly.

**Appurtenances** – have corrosion, but *appear* to be in serviceable condition.

## **RECOMMENDATIONS**

**General** – Tank should be repaired to recommendations below:

**Shell** - Consideration should be given to:

1. Sandblast and apply protective coating
2. Remove shell patches and repair shell in accordance with API-653
3. Seal tank floor protrusion to concrete foundation interface after repairs, to prevent moisture from migrating under the tank
4. Perform radiographic weld inspections of non-rounded shell inserts and non-conforming weld seams, as indicated above
5. Install reinforcing plate around 8” penetration on lower west side of tank

**Roof** – Consideration should be given to:

1. Install missing bolt in roof manway
2. Sandblast and apply protective coating

**Nova Data Testing Services, Inc. makes no implied or expressed warranty that these recommendations would return any tank to serviceability.**

**Please contact Nova Data Testing Services at the numbers below for information on detailed repair specifications or quality assurance for this, or any other project.**



Fig. 1 – Major scale corrosion of floor protrusion



Fig. 2 – Penetration with no reinforcing plate

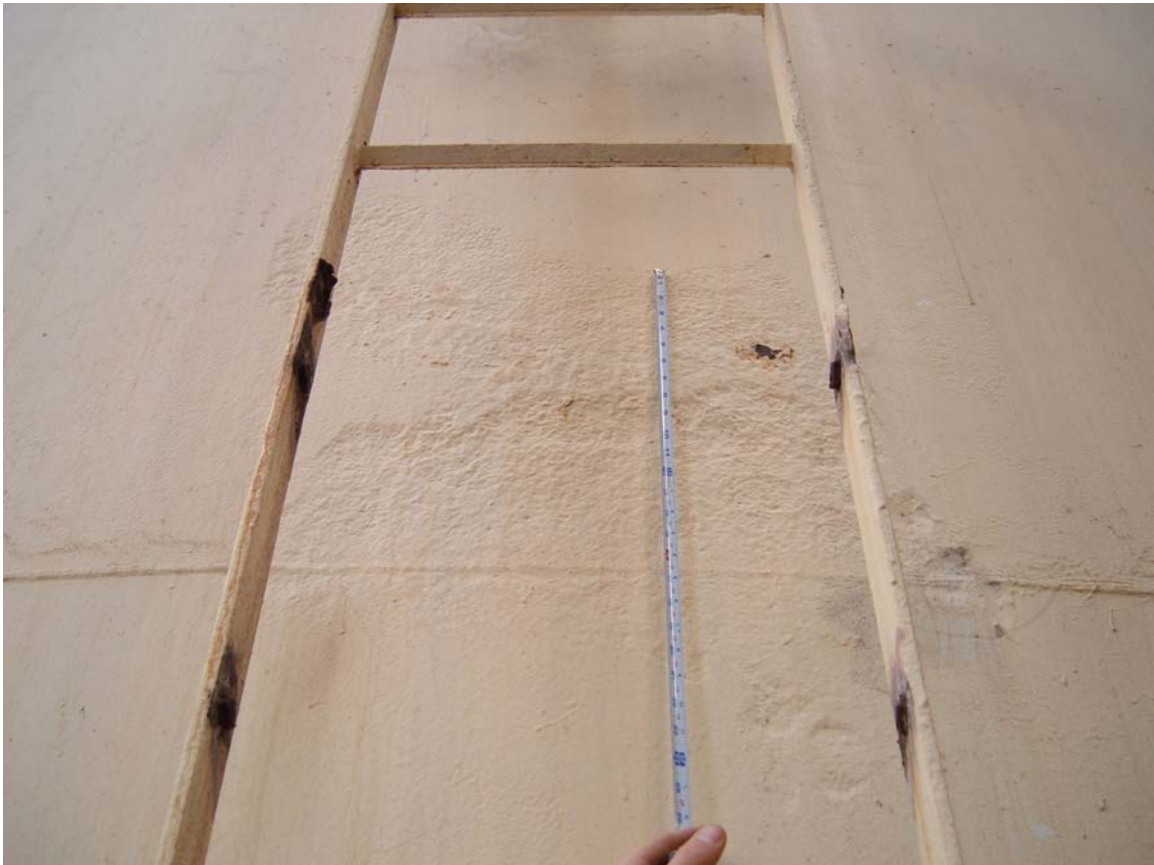


Fig. 3 – Major pitting on the third shell course, south side of tank



Fig. 4 – Poor and excessive weld on penetration reinforcing plate (East side)



Fig. 5 – Weld spacing does not meet API-650 or good engineering practices



Fig. 6 – Weld spacing does not meet API-650 or good engineering practices



Fig. 7 – Shell plate misalignment near roof on the south side



Fig. 8 – Roof manway is corroded and missing one bolt



Fig. 9 – Corrosion on west side and multiple shell insert plates with non-rounded corners



Fig. 10 – Typical shell insert plate with non-rounded corners



Fig. 11 – Major scale corrosion on ladder. Lower rungs have been removed to prevent access



Fig. 12 – Multiple attachments with non-rounded corners, poor weld quality, and major corrosion (south-east side)



Fig. 13 – Minor shell deflection on upper second shell course (south-east side of tank)



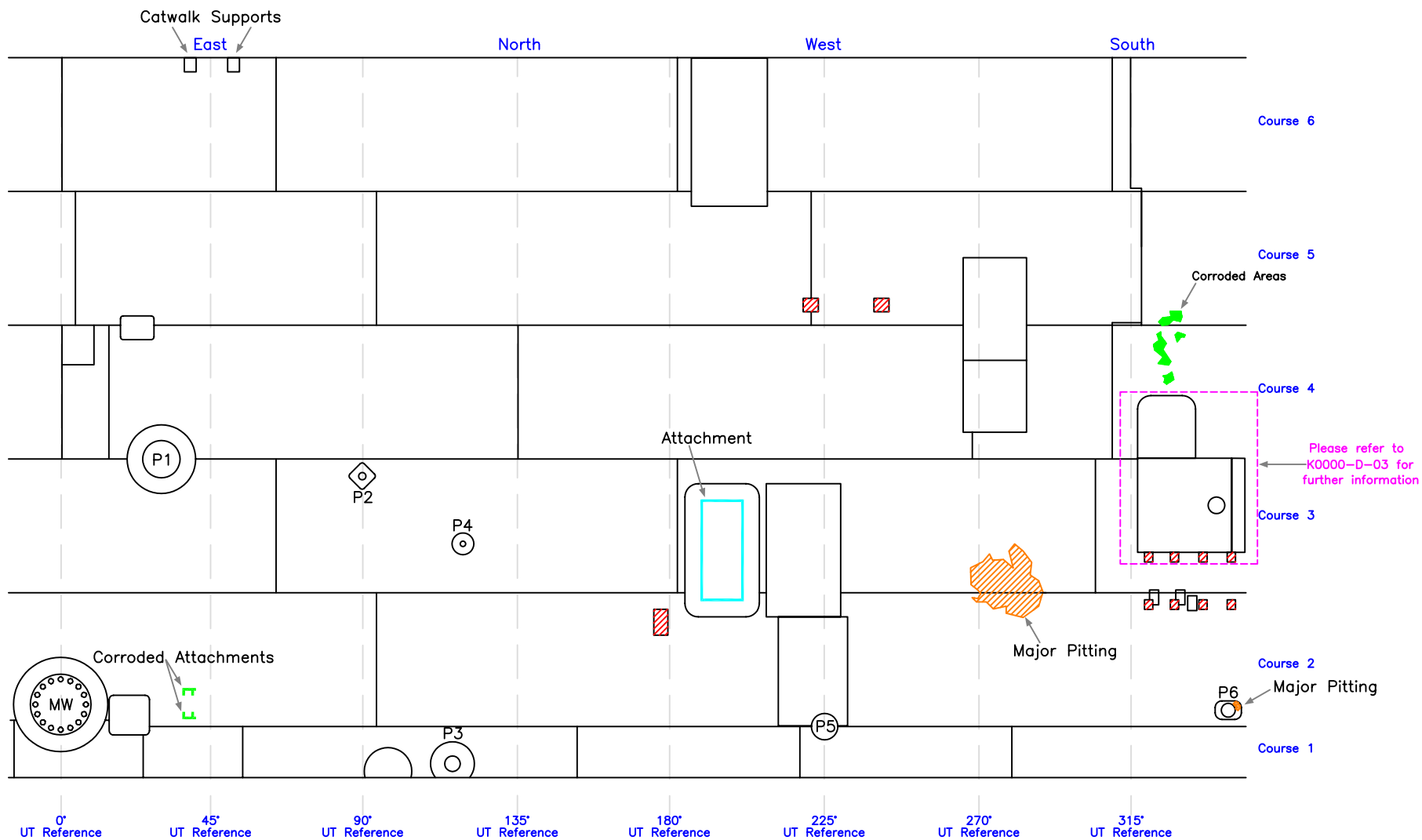
Fig. 14 – Attachments on lower second shell course on the east side of tank



Fig. 15 – Isolated major corrosion on east side of lower second shell course




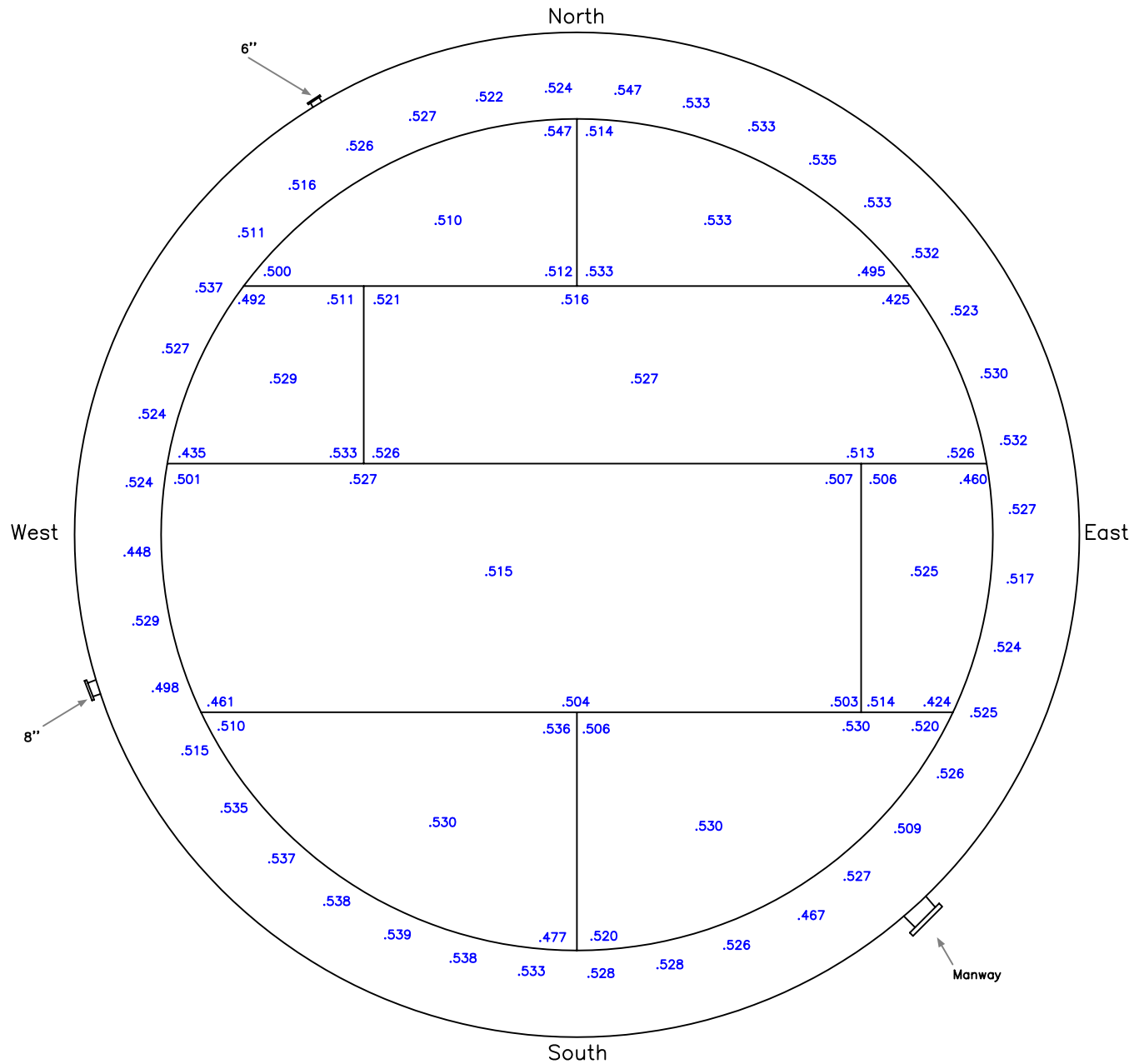
Fig. 16 – Minor shell deflection between 1<sup>st</sup> and 2<sup>nd</sup> shell course on east side of tank



Diameters of Penetrations  
 MW-32"  
 P1-24"  
 P2-6"  
 P3-8"  
 P4-4"  
 P5-8"  
 P6-8"

Red hatch indicates shell patch plates with non-rounded corners

 <b>NOVA DATA TESTING SERVICES, INC.</b> (912) 729-3895	ICN K0000	LOCATION Lotsa Power, Inc. Somewhere, USA	EQUIPMENT Big Tank #2 Tank - Shell	DATE(S) OF INSPECTION 01/01/2005
	REPORT DATE 01/01/2005			DRAWING NUMBER K0000-D-01



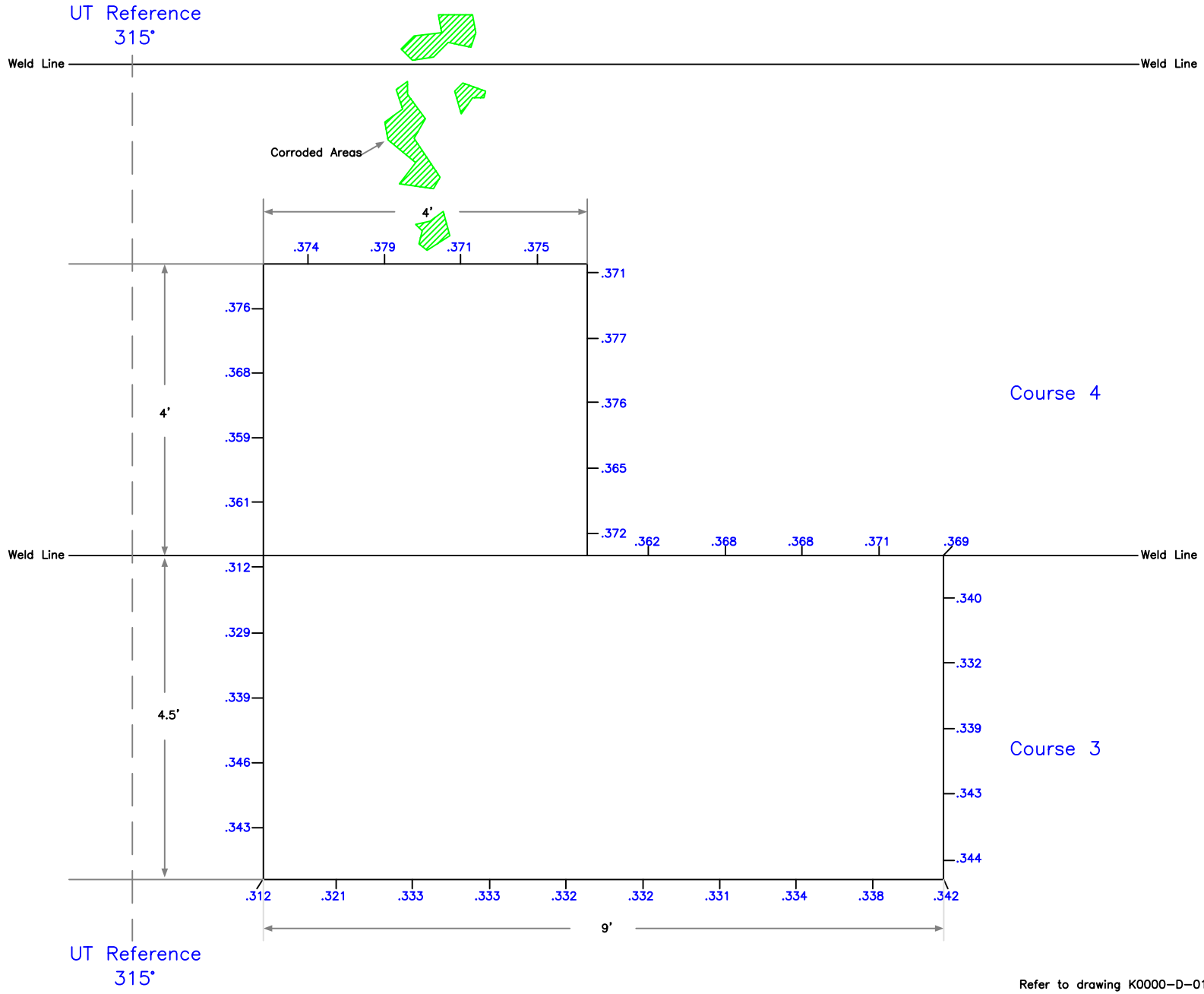
**NOVA DATA TESTING  
SERVICES, INC.**  
(912) 729-3895

ICN K0000  
REPORT DATE 01/01/2005

LOCATION Lotsa Power, Inc.  
Somewhere, USA

EQUIPMENT Big Tank #2  
Tank - Floor

DATE(S) OF INSPECTION 01/01/2005  
DRAWING NUMBER K0000-D-02



Refer to drawing K0000-D-01 for location information



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ICN K0000  
REPORT DATE 01/01/2005

LOCATION Lotsa Power, Inc.  
Somewhere, USA

EQUIPMENT Big Tank #2  
Tank - Shell

DATE(S) OF INSPECTION 01/01/2005  
DRAWING NUMBER K0000-D-03

**Lotsa Power, Inc.**  
**TANK INSPECTION PROGRAM**  
**UT DATA REPORT**

REPORT DATE: 1/1/2005  
 INSP LAB: NOVA DATA TESTING  
 TECHNICIANS: Barksdale/Czaplicki  
 INSP START: 1/1/2005

TANK ID: #2  
 DESCRIPTION: Big Tank

**READINGS**

COURSE NO:	Elevation:	0 / 360	45	90	135	180	225	270	315	MIN. WALL	FLAG	NOMINAL
Roof	1' from edge			.380	.405	.390	.385	.380	.410	.100	.100	
6	40	N/A				.305				.100	.100	
6	39.5				.280				.385	.100	.100	
6	39			.320				.290		.100	.100	
6	38.5		N/A				.315			.100	.100	
6	38	N/A				.280				.100	.100	
6	37.5				.330				.390	.100	.100	
6	37			.325				.310		.100	.100	
6	36.5		N/A				.320			.100	.100	
6	36	N/A				.300				.100	.100	
6	35.5				.330				.390	.100	.100	
6	35			.330				.320		.100	.100	
6	34.5		N/A				.320			.100	.100	
6	34	N/A				.320				.100	.100	
6	33.5				.330				.385	.100	.100	
6	33			.315				.315		.100	.100	
6	32.5		N/A				.315			.100	.100	
6	32	N/A				.320				.100	.100	
5	31.5				N/A				.395	.100	.100	
5	31			.320				.290		.100	.100	
5	30.5		N/A				.315			.100	.100	
5	30	N/A				.325				.100	.100	
5	29.5				.335				.400	.100	.100	
5	29			.325				.320		.100	.100	
5	28.5		N/A				.320			.100	.100	
5	28	N/A				.300				.100	.100	
5	27.5				.330				.405	.100	.100	
5	27			.325				.320		.100	.100	
5	26.5		N/A				.320			.100	.100	
5	26	N/A				.330				.100	.100	
5	25.5				.330				.400	.100	.100	
5	25			.325				.385		.100	.100	
5	24.5		N/A				.305			.100	.100	
5	24	N/A				.320				.100	.100	
4	23.5				.330				.370	.100	.100	
4	23			.325				.380		.100	.100	
4	22.5		N/A				.330			.100	.100	
4	22	N/A				.330				.100	.100	
4	21.5				.325				.375	.100	.100	
4	21			.325				.370		.100	.100	
4	20.5		N/A				.335			.100	.100	
4	20	N/A				.340				.100	.100	
4	19.5				.315				.370	.100	.100	
4	19			.325				.385		.100	.100	
4	18.5		N/A				.340			.100	.100	
4	18	N/A				.340				.100	.100	
4	17.5				.330				.380	.100	.100	
4	17			.320				.380		.100	.100	
4	16.5		N/A				.340			.100	.100	
4	16	N/A				.330				.100	.100	
3	15.5				.330				.325	.100	.100	
3	15			.330				.330		.100	.100	
3	14.5		N/A				.330			.100	.100	
3	14	N/A				.330				.100	.100	
3	13.5				.340				.335	.100	.100	
3	13			.335				.330		.100	.100	
3	12.5		N/A				.375			.100	.100	
3	12	N/A				.335				.100	.100	
3	11.5				.330				.340	.100	.100	
3	11			.335				.330		.100	.100	
3	10.5		N/A				.375			.100	.100	
3	10	N/A				.330				.100	.100	
3	9.5				.330				.335	.100	.100	
3	9			.330				.310		.100	.100	
3	8.5		N/A				.375			.100	.100	
3	8	N/A				.310				.100	.100	
2	7.5				.300				.345	.151	.151	
2	7			.315				.350		.151	.151	
2	6.5		.310				.370			.151	.151	
2	6	.310				.310				.151	.151	
2	5.5				.305				.355	.151	.151	
2	5			.320				.355		.151	.151	
2	4.5		.315				.375			.151	.151	
2	4	N/A				.315				.151	.151	
2	3.5				.305				.360	.151	.151	
2	3			.315				.355		.151	.151	
2	2.5		.310				.335			.151	.151	
2	2	N/A				.315				.151	.151	
2	1.5				.305				.360	.151	.151	
1	1			.380				.380		.155	.155	
1	0.5		.380				.340			.155	.155	
1	0	.370				.385				.155	.155	

- NOTE:
1. COURSE 1 IS AT BOTTOM. SEE REFERENCE LAYOUT DRAWING.
  2. DISTANCE IS MEASURED FROM REFERENCE ELEVATION, GENERALLY BOTTOM OF TANK.
  3. LOCATION IS MEASURED IN DEGREES FROM REFERENCE, COUNTERCLOCKWISE GENERALLY FROM CENTERLINE OF MANWAY.
  4. WORK THIS DATA WITH THE REFERENCE LAYOUT DRAWING.

Reviewed by Lotsa Power representative

Date

API TANK INSPECTION PROGRAM - ATMOSPHERIC  
MINIMUM WALL CALCULATION

REPORT DATE: **1/1/2005**

Tank ID: **#2**  
DESCRIPTION: **Big Tank**

MATERIAL **A283-C** MAX STRESS **55000**

DIAMETER: **30**

	COURSE 1	COURSE 2	COURSE 3	COURSE 4	COURSE 5
HEIGHT:	<b>40</b>	<b>39</b>	<b>24</b>	<b>16</b>	<b>8</b>

SP GRAVITY: **1.2**

	COURSE 1 - 2	COURSE 3 - UP
STRESS (PSI):	<b>23600</b>	<b>26000</b>

	COURSE 1	COURSE 2	COURSE 3	COURSE 4	COURSE 5
MW	<b>.155</b>	<b>.151</b>	<b>.083</b>	<b>.059</b>	<b>.025</b>

NOMINAL:

JOINT EFF. **1**

	SIDES	TOP	BOTTOM
CORR. ALLOWANCE			

FORMULA: 
$$T_{min} = \frac{2.6 D (H-1) G}{SE}$$

WHERE:

- $T_{min}$  = MINIMUM ACCEPTABLE THICKNESS.
- $D$  = NOMINAL DIAMETER OF TANK IN FEET.
- $H$  = NOMINAL HEIGHT FROM THE BOTTOM OF EACH TANK COURSE TO THE MAXIMUM DESIGN LIQUID LEVEL IN FEET.
- $G$  = HIGHEST SPECIFIC GRAVITY OF CONTENTS.
- $S$  = MAXIMUM ALLOWABLE STRESS IN POUNDS PER SQUARE INCH.  
USE  $(0.426)T$  FOR BOTTOM AND SECOND COURSE AND  $(0.472)T$  FOR ALL OTHER COURSES.
- $E$  = ORIGINAL JOINT EFFICIENCY FOR THE TANK, CALCULATED USING  $(0.7)$ .

NOTE:

1. COURSE 1 IS AT BOTTOM OF TANK WITH HIGHEST NUMBER AT TOP COURSE.
2. IF CALCULATED  $T_{min}$  IS LESS THAN  $.100"$ , THEN  $T_{min}$  SHALL BE  $.100"$ .

Big Tank #2 - deflection settlement readings

