Clean Harbors Environmental Services, LLC
Lone Mountain Facility
Waynoka, Oklahoma

RCRA/HSWA Permit Renewal Application

Volume 7

October 1, 2020

VOLUME 7

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SECTION EF2

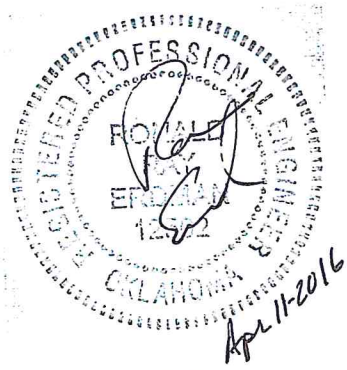
EVAPORATOR FEED TANK NO. 2 (EF2)

ASSESSMENT

LONE MOUNTAIN FACILITY

WAYNOKA, OKLAHOMA

CleanHarbors
ENVIRONMENTAL SERVICES, INC.



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6-30-2016

APRIL 2016

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1. TANK SYSTEM DESCRIPTION

Clean Harbors Environmental Services, Inc., retained ENVIROTECH ENGINEERING & CONSULTING, INC., to conduct the required 5-year assessment of Evaporator Feed Tank No. 2 (EF2), as outlined in the previous January 2011 assessment. A visual inspection of Tank EF2 was conducted by Envirotech on November 25, 2015. This report is a continuation of previous five-year assessments and references the original design data developed for this tank. Evaporator Feed Tank No. 2 (EF2) is a 60-ft.-dia. circular-steel aboveground open-top wastewater storage and treatment tank installed in July 1987. The 360,000-gal. (nominal) tank is utilized for storage and incidental treatment of pre-treated wastewater. Certain wastewater not requiring pretreatment may also be stored in the tank (i.e., contaminated rainwater, landfill leachates, etc.) After storage, the wastewater is transferred for final treatment and/or disposal. The tank (along with a similar Tank EF1 and a tank holding reagent-grade bleach) is located immediately east of the pretreatment area in a common-lined concrete secondary containment system. Tank volume calculations are included in *Appendix A*. An "As-Built" drawing depicting the tank details is included as *Figure 1*.

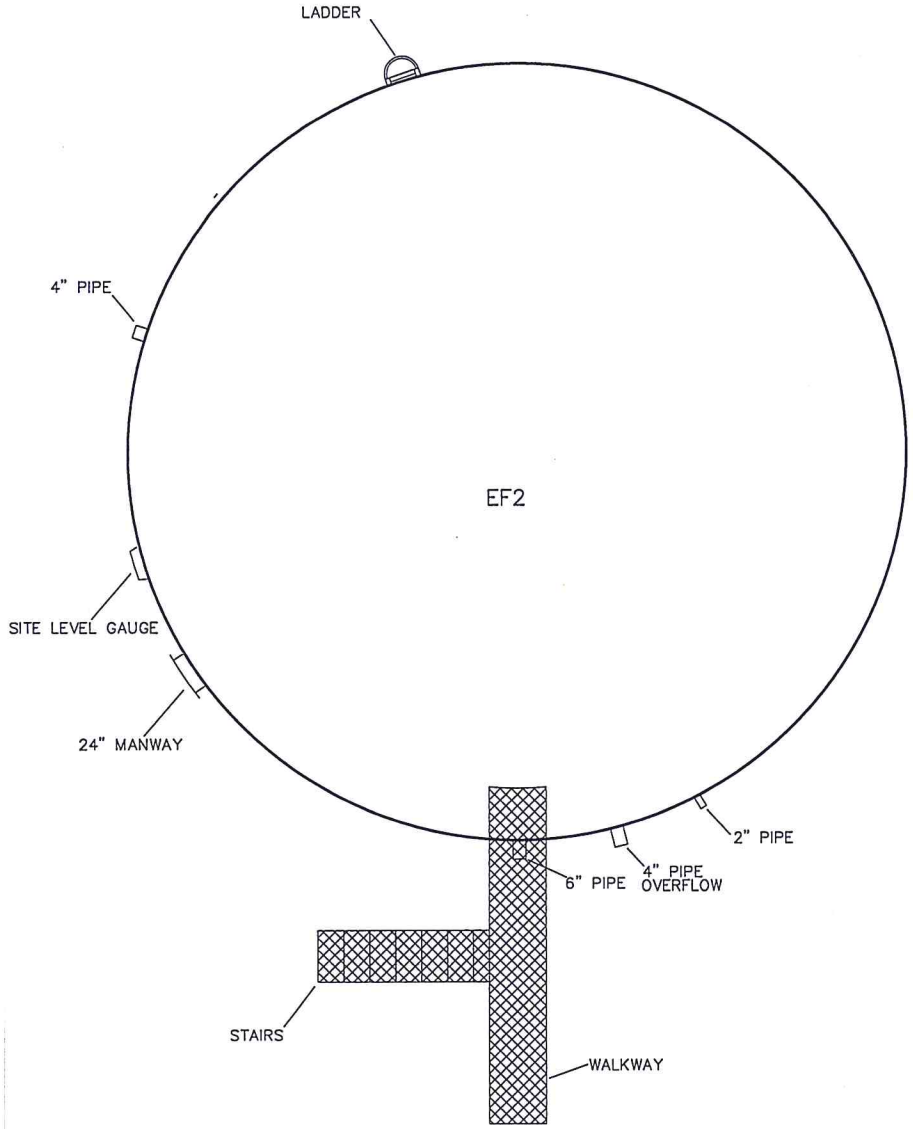
2. TANK SYSTEM ASSESSMENT

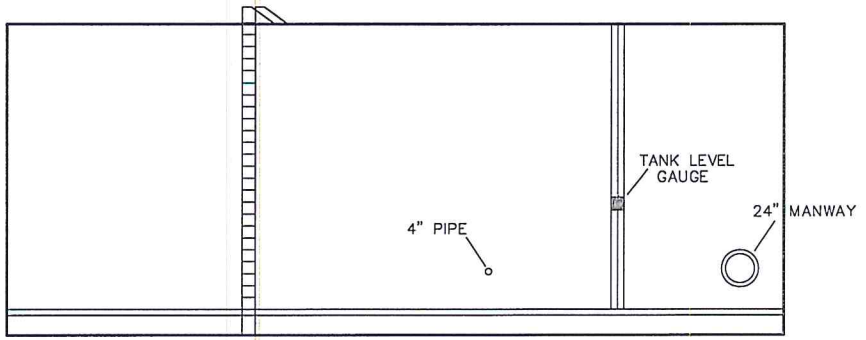
2.1 General Description of Evaporator Feed Tank No. 2 (EF2). Evaporator Feed Tank No. 2 (EF2) is a vertical circular carbon-steel tank with a nominal 60-ft.-dia. sitting on an 8-in. channel that rests upon a concrete ring wall foundation. A sand base and high-density polyethylene (HDPE) liner leak detection system is located directly under the primary tank floor with detector pipes extending through the ring wall and liner for positive leak identification.

2.2 Design Standard(s). The tank was constructed in 1987 and appears to be field-designed and constructed. Although the tank appears to be a modified design, for purposes of this assessment, structural calculations were prepared to compare the existing tank and supports to those applicable sections in the *American Petroleum Institute Standard 653 - 1995 2ND Edition (API-653)* and the *American Institute of Steel Construction (AISC) Manual of Steel Construction - 8TH Edition*. These calculations are included in *Appendices B thru D*. The actual steel specifications by which the tanks are constructed are not known, but have been assumed to be A36 (carbon steel).

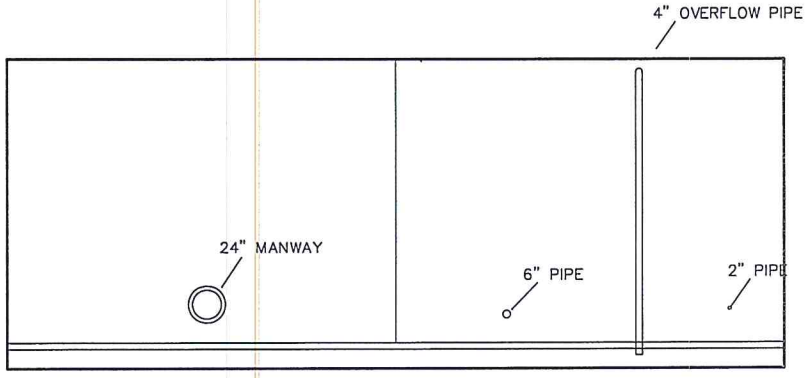
2.3 Hazardous Characteristics of Managed Waste(s). The wastes managed in this tank are both characteristic and listed waste, as summarized in *40 CFR Part 261, Subparts C and D*. This tank is a storage tank where aqueous-based waste materials that required oxidation, neutralization, filtration, or settling (among other physical/chemical treatment methods) were stored prior to evaporation or shipment off-site. Currently, the only material placed in the tank is treated wastewater. According to Clean Harbors, the waste managed in this tank has the following general characteristics:

- $4 < pH < 13$;
- $N > 1$;

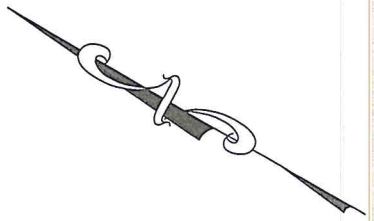




North View



West View



CleanHarbors ENVIRONMENTAL SERVICES, INC.

LONE MOUNTAIN FACILITY
WAYNOKA, OKLAHOMA

Evaporator Feed Storage Tank No. 2
Tank Details

ENVIROTECH

Date:	April 6, 2016
Scale:	n.t.s.
Designed by:	R. ERDMAN
Drawn by:	R. UNGER
Checked By:	R. ERDMAN
Project No.	015493-00

Fig. 1

- Temperature = Ambient; and
- Low-Solvent Constituents.

The tank is lined with coal tar that is resistant to most constituents-of-concern. The coal tar liner has survived well in this working environment.

With regards to the potential for corrosion, it was determined that the pH and normality levels of the waste are the primary areas-of-concern. This was to determine the applicability of a corrosion allowance for the tank material type and thickness.

2.4 **Existing Corrosion Protection.** The tank is isolated from soil and water by a ring wall, below which is a leak detection system. This system is comprised of an HDPE liner below a layer of sand on a concrete mat foundation. The HDPE liner and concrete mat foundation isolate the sand from the underlying soil. Water may be entrained in the sand when placed prior to construction of the tank bottom, but the secondary containment system is designed to drain entrained fluids to one of the leak detection drains that penetrate the ring wall. For further protection, a coal tar liner is employed on the bottom and sidewalls of the tank interior. In addition, the tank has an exterior epoxy paint layer.

2.5 **Documented Age of Tank.** Tank EF2 was erected and installed in July 1987 and is 28-years old as of this assessment conducted in November 2015.

2.6 **Results of Leak Test.** On November 25, 2015, a visual inspection of the tank system was conducted to satisfy the requirements of a leak test. No evidence of leakage from the welds, seams, flanged connections, valves and threaded connections was observed. The leak detector pipes that extend through the ring wall foundation showed no indication of tank bottom leakage.

2.7 **Existing Data Obtained.** The existing data associated with the referenced tank is summarized in *Table 2.1*.

2.8 **Calculation of Foundation Loading.** The total weight of the tank and its contents equals 1,968-ton. Detailed calculations reflecting the minimum required foundation thickness and steel reinforcement are included herein as *Appendix G*.

2.9 **Required Structural Calculation.** The calculated required wall thickness for this tank is 0.2363-in. This thickness includes 0.0625-in. added for corrosion allowance. This corrosion allowance is based on a "best-engineering" estimate, considering the materials being treated and a 20-yr. design life. Detailed calculations required for wall thickness and structural analysis of the tank support system are included herein as *Appendices B thru D*.

2.10 Comparison of Actual Structural to Theoretical Values. The comparison of actual structural to theoretical values is summarized in *Table 2.2*. Some minor variance of instrument readings can be attributed partially to the idiosyncrasies of the testing equipment such as density of "couplant" and roughness of tank surface at each test point.

TABLE 2.1
EF2 TANK DATA

Tank Diameter	60-ft.
Tank Height	16.9-ft.
Maximum Operating Level	15.9-ft.
Material	A36 (Assumed)
Wall Thickness (*See Appendix B*)	0.25-in.
Specific Gravity	1.3
Operating Temperature	Ambient
Maximum Volume	47,785-cf
Seismic Zone	1

TABLE 2.2
COMPARISON OF ACTUAL STRUCTURAL TO THEORETICAL VALUES FOR THE EF2 TANK

WALL THICKNESS COMPARISON	
Calculated Required Wall Thickness	0.2363-in.
Minimum Required Wall Thickness by API 653 (2.3.3.1)	0.1738-in.
Original Plate Thickness	0.25-in.
Measured Wall Thickness w/Coating (minimum)	0.279-in.
BOTTOM THICKNESS COMPARISON	
Minimum Required Bottom Thickness by API 653	0.10-in.
Original Plate Thickness	0.24-in.
Measured Bottom Thickness w/Coating (minimum)	0.243-in.

2.10.1 Wall Thickness Comparison. During the November 2015 assessment, a visual inspection and an ultrasonic thickness corrosion survey were conducted on the tank walls. Wall thickness measurements of the interior protective surface ranging from

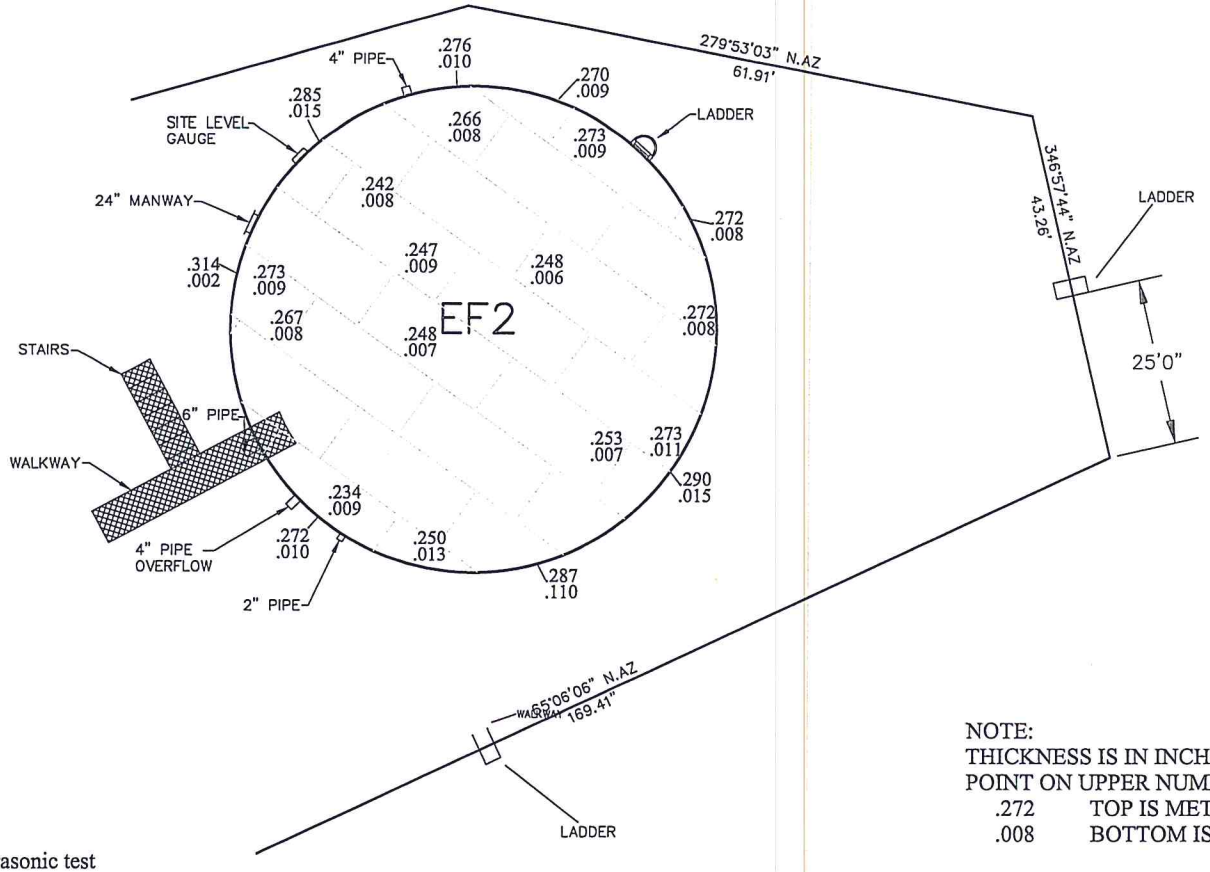
0.270-in. to 0.314-in. exceeded the minimum required wall thickness of 0.2363-in. and 0.1738-in., as graphically depicted on *Figure 1a*. The interior wall coating appeared sound and intact, with no pitting or corrosion. Separate readings indicating that the coating thickness varies are most likely the result of normal wear and tear. Furthermore, the difference in values does not indicate a reduction that would adversely impact the minimum thickness requirement.

2.10.2 Bottom Thickness Comparison. During the November 2015 assessment, a visual inspection was conducted on the tank bottom. Floor thickness measurements of the interior protective surface, ranging from 0.270- to 0.391-in., exceeded the minimum required floor thickness of 0.10-in., as graphically depicted on *Figure 1a*. The floor coating appeared sound and intact, with not pitting or corrosion. Separate readings indicating that the coating thickness varies are most likely the result of normal use. Furthermore, the difference in values does not indicate a reduction that would adversely impact the minimum thickness requirement.

2.10.3 Foundation Integrity. Evaporator Feed Tank No. 2 (EF2) is situated on a concrete ring foundation with a sand base. The sand base rests on a concrete slab that is tied to the foundation ring. Indications of insignificant minor cracks in the foundation ring have been coated with an impermeable coating. On the top of the foundation ring is a steel channel to which the tank is attached.

In September 1993, USPCI (former facility owner) retained Law Engineering to conduct an investigation that would yield site-specific subsurface data in the vicinity of Tank EF2. Law drilled four (4) geotechnical borings as part of this investigation. In general, the soil profile consisted of 1- to 2-ft. of gravel followed by 15- to 20-ft. of soft-to-hard, reddish-brown silty clay. A review of the data within the Law report, including the boring logs, indicates the soil strengths should be adequate to support the tank and associated ring foundation. The applicable portion of the Law report is included herein as *Appendix F*. In addition, a foundation design analysis is included in *Appendix G*.

To quantify foundation settlement since October 2001, Jividen Surveying shot nine (9) points around the perimeter of the tank on several occasions, as indicated in the monitoring documents included in *Appendix E*. The survey points are graphically depicted on the drawing included herein as *Figure 2*. These existing foundation elevations were compared with previous surveys of the same points. A graphic representation of the historical foundation data is included herein as *Figure 3*. The most recent survey data indicates that minor foundation movement continues to occur at a reasonably uniform rate excepting point No. 89 which demonstrated an 0.11 ft. difference in 2014 but returned to its normal level in 2015. It was determined this was due to a measurement recording error. Foundation movement appears uniform without generating a concern for structural or containment failure. Generally, the tank in its entirety has demonstrated a minor cyclical rise and fall in



NOTE:
THICKNESS IS IN INCHES AND AT DECIMAL POINT ON UPPER NUMBER

.272	TOP IS METAL THICKNESS
.008	BOTTOM IS COATING THICKNESS

Note:

1. Wall and floor thickness measured with ultrasonic test device equipment (owned by Envirotech) on Nov 25, 2015.
2. Wall thickness measured at height of 3' above floor around perimeter.
3. Thickness shown in 0.000" measured inside the tank.

Clean Harbors
ENVIRONMENTAL SERVICES, INC.

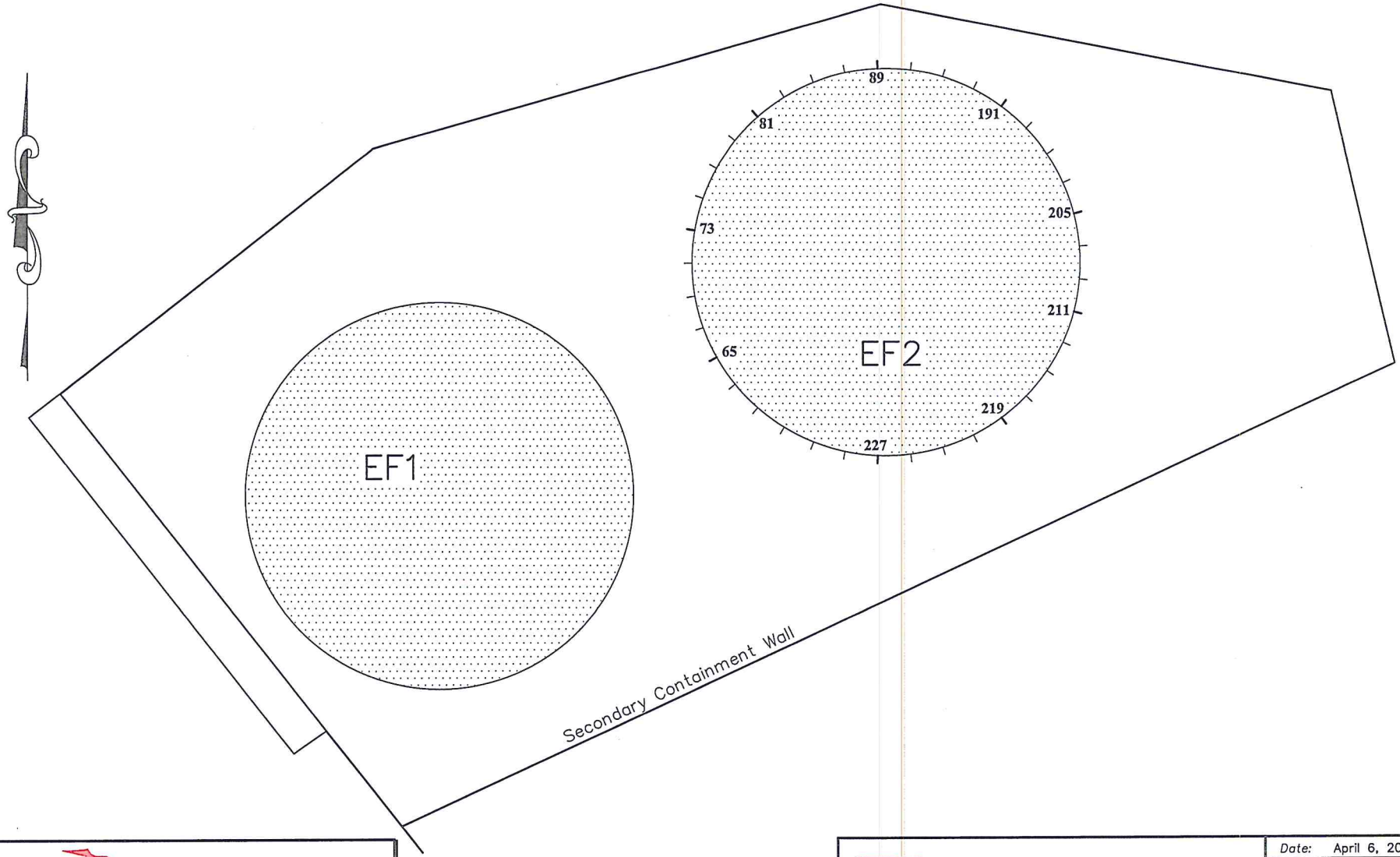
LONE MOUNTAIN FACILITY
WAYNOKA, OKLAHOMA

Evaporator Feed Storage Tank No. 2
Measured Plate Thickness

ENVIROTECH

Date:	April 6, 2016
Scale:	n.t.s.
Designed by:	R. ERDMAN
Drawn by:	R. UNGER
Checked By:	R. ERDMAN
Project No.	015493-00

Fig. 1a



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ENVIRONMENTAL SERVICES, INC.

LONE MOUNTAIN FACILITY
WAYNOKA, OKLAHOMA

Evaporator Feed Storage Tank No. 2
Survey Points Schematic

ENVIROTECH

Date:	April 6, 2016
Scale:	NTS
Designed by:	R. ERDMAN
Drawn by:	R. UNGER
Checked By:	R. ERDMAN
Project No.	015493-00

Fig. 2

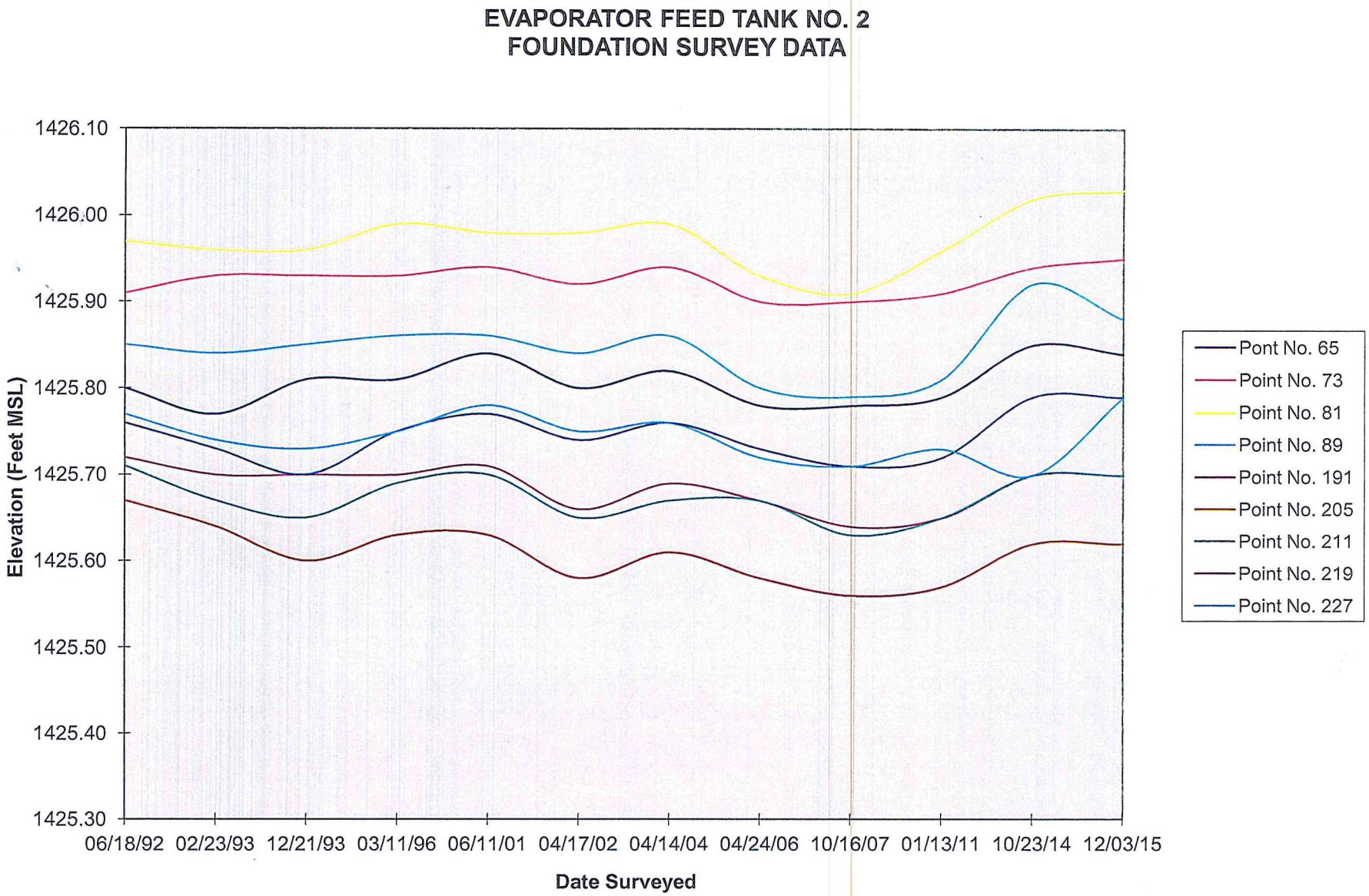

EVAPORATOR FEED TANK NO. 2
FOUNDATION SURVEY DATA
Elevation (Feet MSL)
1426.10
1426.00
1425.90
1425.80
1425.70
1425.60
1425.50
1425.40
1425.30
06/18/92
02/23/93
12/21/93
03/11/96
06/11/01
04/17/02
04/14/04
04/24/06
10/16/07
01/13/11
10/23/14
12/03/15
Date Surveyed
Pont No. 65
Point No. 73
Point No. 81
Point No. 89
Point No. 191
Point No. 205
Point No. 211
Point No. 219
Point No. 227

Figure 3.

elevation over time that is attributed to normally-occurring groundwater table fluctuations and which has not resulted in any known tank damage.

3. SECONDARY CONTAINMENT SYSTEM

3.1 **General Description of Secondary Containment.** The secondary containment system is designed and operated to prevent migration of wastes or liquids out of the system. Evaporator Feed Tank Nos. 1 and 2 are located in a reinforced-concrete-base floor area with vertical concrete sidewalls. This area is inspected on a daily basis.

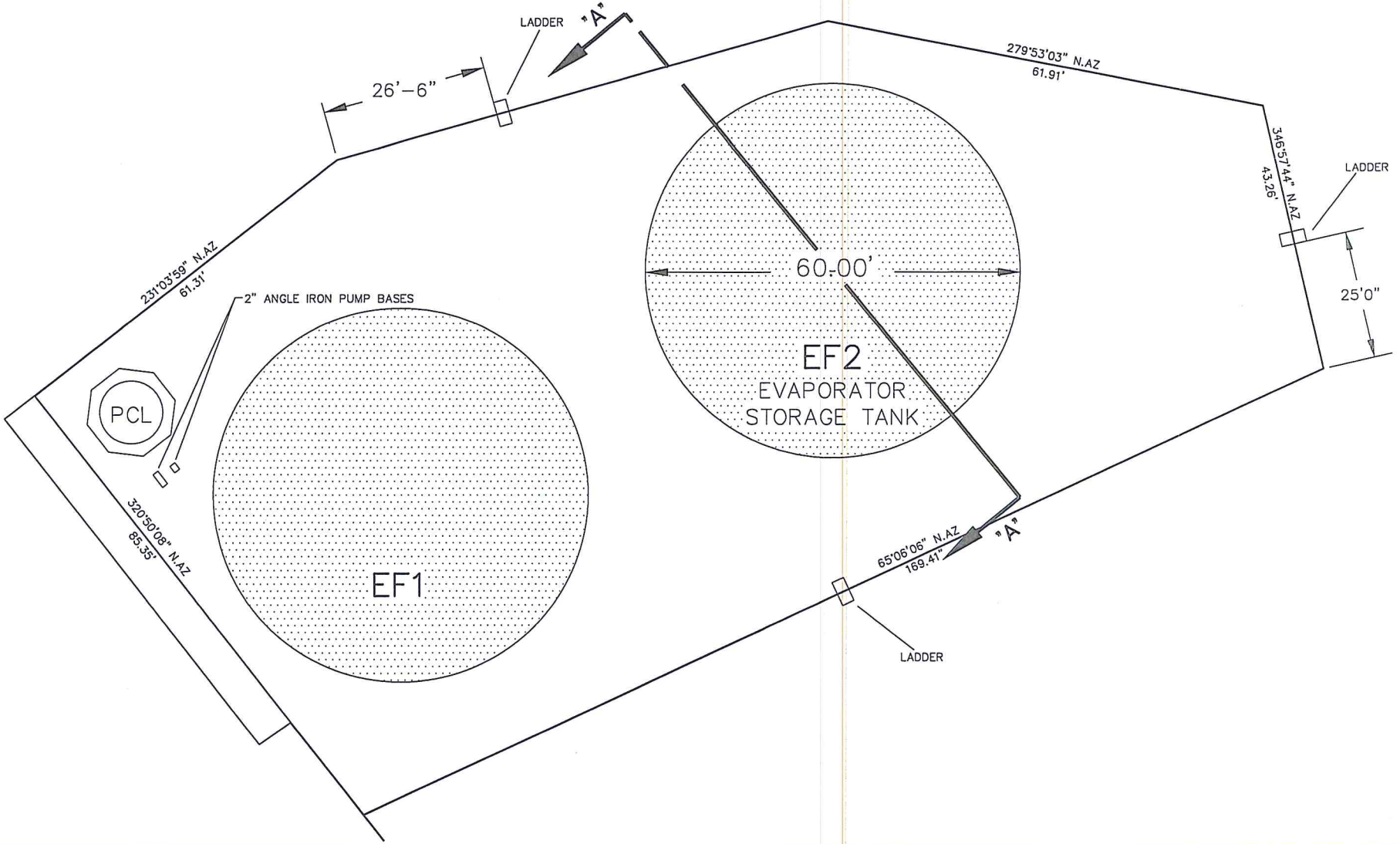
A previously-reported visual inspection prior to October 2001 showed apparent stress cracks or other conditions that would indicate an insufficiency in the foundation design. The previously-referenced geotechnical investigation has addressed these issues. It was determined that this apparent failure in the concrete was due to the lack of proper steel reinforcement and/or differential settlement (consolidation) in the subgrade. The subgrade appeared to be comprised of fill material. The possibility that the subgrade was not properly compacted before the concrete was poured was suspected. It was determined that the concrete under the primary tank was in fair condition. The ground surrounding the secondary containment system is sloped to shed rainfall runoff to aid in preventing saturated soil. The containment system is walled-off and receives no direct vehicular traffic. The foundation walls and base are mass-poured in-place.

During this assessment, the concrete secondary containment area appeared to be in satisfactory condition. The walls and floor have a uniform sealant coating and an ongoing maintenance program repairs cracks on a continual basis. The ground surrounding the secondary containment system is sloped to shed rainfall runoff to aid in preventing saturation of the foundation soil.

The containment area and tanks are visually monitored on a daily basis for leaks. The floor is sloped to collect any drainage or spills. Any released tank contents or surface runoff will drain on top of the sloped concrete to the sump area. The accumulated liquids are then withdrawn within a specified time period. The secondary containment system is graphically depicted in the drawings included herein as *Figures 4 and 5*.

3.2 **Design Standards.** "As-Built" drawings for this area were obtained and utilized as a reference. The structural capacity of the foundation and walls were compared to those applicable sections in the *API 653-95* and the *American Concrete Institute (ACI 318/89/318r-89)*. These calculations were used as a guide to verify the ability of the system to contain hazardous waste.

3.3 **Hazardous Characteristics of Wastes Stored.** The wastes managed in the primary tank are both characteristic and listed waste, as found in *40 CFR Part 261, Subparts C and D*. This tank is a storage tank where aqueous-based waste materials that required oxidation, neutralization, filtration, or settling (among other physical/chemical treatment methods) were



CleanHarbors
ENVIRONMENTAL SERIVCES, INC.

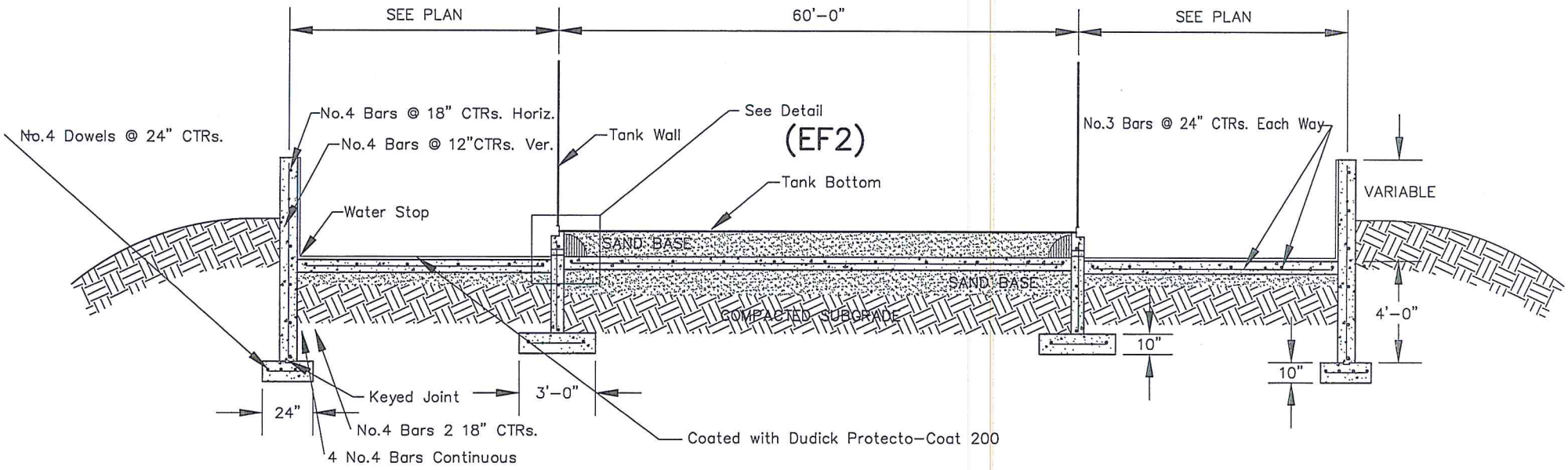
LONE MOUNTAIN FACILITY
WAYNOKA, OKLAHOMA

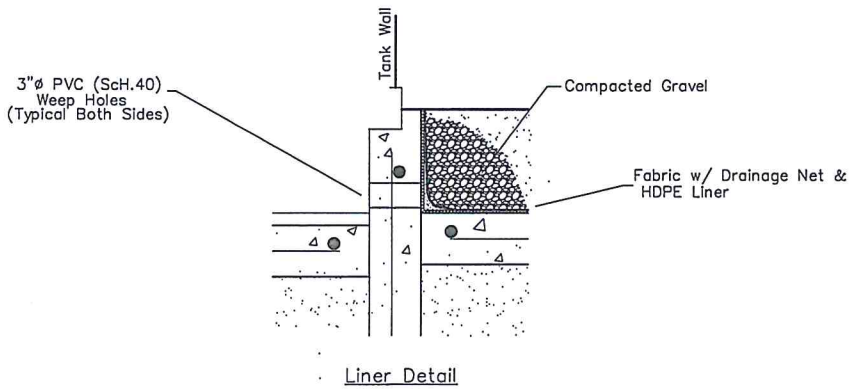
Evaporator Feed Storage Tank No. 2
Secondary Containment System

ENVIROTECH

Date:	April 6, 2016
Scale:	n.t.s.
Designed by:	R. ERDMAN
Drawn by:	R. UNGER
Checked By:	R. ERDMAN
Project No.	015493-00

Fig. 4





Liner Detail

Containment Section Details

Scale = N.T.S.

CleanHarbors ENVIRONMENTAL SERVICES, INC.

LONE MOUNTAIN FACILITY
WAYNOKA, OKLAHOMA

Evaporator Feed Storage Tank No. 2
Secondary Containment Section A-A

ENVIROTECH

Date:	April 6, 2016
Scale:	n.t.s.
Designed by:	R. ERDMAN
Drawn by:	R. UNGER
Checked By:	R. ERDMAN
Project No.	015493-00

Fig. 5

stored prior to evaporation or shipment off-site. Currently, the only material placed in the tank is treated wastewater. The waste managed in this tank has the following general characteristics:

- $4 < pH < 13$;
- $N > 1$;
- Temperature = Ambient; and
- Low-Solvent Constituents.

The hazardous characteristics of the waste treated in the primary tank were examined. It was determined that the pH and normality levels of the waste are the primary areas-of-concern.

3.4 **Existing Corrosion Protection.** The entire secondary containment area has been coated with Dudick, Inc. Protecto-Coat 200.

3.5 **Documented Age of the Containment System.** The secondary containment system was constructed and installed in 1987, thus making the system 28-years old at the time of this assessment. The system has undergone significant upgrading since it was initially installed to include the following.

- A coating was applied in June 2012. The secondary containment surface coating Chemproof Polymers-Permacoat 3000 on horizontal surfaces and Chemproof Polymers-Permacoat 3000V on vertical surfaces. Equivalent or superior coating materials are used during any necessary repairs to the coating. Information regarding Chemproof Polymere-Permacoat is included herein as *Appendix H*.

- Potential cross-connections were eliminated in 1993. The main lines from the primary treatment and storage areas exited the containment area through the floor of the secondary containment area down to the final treatment area, thereby potentially allowing material from a tank failure to migrate into the secondary containment area within the final treatment area. Elimination of this potential cross-connection acts to segregate the secondary containment area for EF1 and EF2 from any other.

3.6 **Results of Leak Test.** A visual inspection of the containment area was conducted to satisfy the requirements of a leak test. No evidence of leakage from the manways or signs of penetration of the tank or containment area was observed. Based on this inspection, this area appears to be adequate to contain any leaks or spills.

3.7 **Existing Data Obtained.** The collected data associated with the secondary containment area is summarized in *Table 3.1*.

3.8 **Calculation of Existing Capacity.** The volume containment capacity available (CCA) calculation is:

CCA = Gross Volume - Volume of Items in Containment - Volume of Rainfall

Detailed calculations of the available containment volume are included in *Appendix I*. The containment capacity available equals 59,487-cf.

TABLE 3.1 SECONDARY CONTAINMENT AREA DATA	
Area	14,589-ft.^{2}
Available Wall Height	5.5-ft.
Material	Concrete
Gross Volume	80,240-ft.^{3}

3.9 Required Volume. The containment capacity required (CCR) is calculated as follows:

CCR = Volume of Largest Tank in Secondary Containment = (EF2) = 47,785-cf

3.10 Comparison of Available Volume to Required Volume. The containment capacity comparison is calculated as follows:

Containment Capacity Required = 47,785-cf
Secondary Containment Volume Available = 59,487-cf
Excess Containment Volume = 11,702-cf
Safety Factor = 1.24

CCA > CCR. Adequate capacity (under normal operating conditions) is available.

4. CONCLUSIONS

4.1 Primary Tank Vessel. The tank vessel at the time of inspection is appropriate for use with the present waste stream at given densities, chemical, and physical characteristics, as verified by Clean Harbors. While the useful life of the steel tank was originally estimated at 5-years, interim inspections have revealed satisfactory service conditions. Therefore, it appears that the life may be extended up to an additional 5-years, provided an annual tank foundation survey is conducted at the points previously identified in *Figure 2* to ensure that the annual maximum settlement does not exceed 1-in.

In the event the tank foundation settles more than 1-in/yr., ENVIROTECH ENGINEERING & CONSULTING, INC. requests that a new tank assessment be conducted immediately.

4.2 Secondary Containment. The secondary containment area at the time of inspection is appropriate for use with the present waste stream at given densities, chemical, and physical

4.2 Secondary Containment. The secondary containment area at the time of inspection is appropriate for use with the present waste stream at given densities, chemical, and physical characteristics. While the useful life of the secondary containment was originally estimated at 5-years, interim inspections have revealed satisfactory service conditions. Therefore, it appears that the life may be extended up to an additional 5-years, provided the constraint addressed in *Section 4.1* is complied with.

5. RECOMMENDATIONS

5.1 Primary Tank. Clean Harbors should continually ensure compatibility with the waste and densities stored. Daily inspections should be continued to detect any visual corrosion or defects. Due to the known history and pattern of movement, inspection in terms of collecting and evaluating the foundation survey for settlement shall be performed between one (1) to three (3) years.

5.2 Secondary Containment. The secondary containment should be visually inspected periodically for any deterioration as well as structural integrity.

5.3 Routine Inspections. When routine and preventive measures are to be implemented, the tank should be cleaned and internally inspected to determine any interior defects or corrosion. Continued routine painting and coating of tanks on the interior and exterior, as well as routine inspections, is recommended.

6. CERTIFICATION

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to ensure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for collecting the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment, for knowing violations."

DATED this _____ day of April, 2016.

Ron Erdman, P.E.
ENVIROTECH ENGINEERING & CONSULTING, INC.

C.A. 1960 - Expiration 06/30/2016

APPENDIX A.

PRIMARY TANK VOLUME CALCULATIONS

PRIMARY TANK VOLUME CALCULATIONS

❒ DIMENSIONS

Geometry	Cylindrical
Diameter	60.00-ft.
Height	16.90-ft.
Operating Height	15.50-ft.
Bottom	Flat

❒ TANK VOLUME

Maximum Volume	47,785.26-cf = 357,458.57-gal.
Operating Volume	43,826.72-cf = 327,846.63-gal.
Total Primary Tank Volume	*47,785.26-cf = 357,458.57-gal.*

❒ WEIGHT ON FOUNDATION

Contents S.G.	1.3
Density	81.12-lb/cf

❒ SURFACE AREA CALCULATION

Tank Top	n/a
Tank Bottom	2,827.53-sf
Tank Wall	3,185.68-sf
Total Surface Area	*6,013.21-sf*

Steel Thickness - Sidewalls	0.250-in.
Steel Thickness - Bottom	0.240-in.
Volume of Steel - Sidewalls	66.37-cf
Volume of Steel - Bottom	56.55-cf
Density of Steel	490-lb/cf
Weight of Steel (Tank)	30.12-ton = 60,230.32-lb.
Weight of Tank Contents	*1,938-ton = 3,876,340-lb.*
Total Weight of Tank and Contents	*1,968-ton = 3,936,570-lb.*

APPENDIX B.

PRIMARY TANK WALL THICKNESS

PRIMARY TANK WALL THICKNESS

❒ DIMENSIONS

Geometry	Cylindrical
Diameter	60.00-ft.
Height	16.90-ft.
Specific Gravity	1.30
Normal Operating Temperature	Ambient

❒ STEEL THICKNESS CALCULATIONS

Thickness (t)	(2.6 * H * D * S.G.) / (s * E) + CA
s (Allowable Design Stress)	23,200.00-psi
E (Joint Efficiency)	85.00%
Thickness (t)	0.1738-in.
Corrosion Allowance	0.0625-in.

Calculated Minimum Wall Thickness ..... *0.2363-in.*

APPENDIX C.

SEISMIC CALCULATIONS

SEISMIC CALCULATIONS

❒ DIMENSIONS

Diameter ..... 60.00-ft.
Height ..... 16.90-ft.
Weight of Tank (Steel) ..... 75,817.00-lb.
Weight of Maximum Contents ..... 3,876,340.00-lb.
Tank Shell Thickness ..... 0.25-in.
Tank Bottom Thickness ..... 0.240-in.

❒ STRESS IN TANK SHELL FROM SEISMIC FORCES

Max. weight of tank contents that may be used to resist shell overturning moment ..... WI
WI ..... 7.9 * tb * (Fby * G * H)^ .5
Fby (Minimum Yield Strength in Bottom Plate) 36,000.00
tb (Thickness of Tank Bottom) 0.240
G (Design Specific Gravity of Liquid) 1.3
WI 1,686.18
*Note: WI Shall Not Exceed 1.25 * G * H * D ..... 1,647.75-lb/ft. of Shell Circumference*
Density of Tank Shell Material 490.00-lb/cf
WT (Weight of Tank Shell) ..... 172.52-lb/ft. of Shell Circumference
M/[D^2(WT+WI)] 0.1071
Maximum Longitudinal Compressive Force at the Bottom of Tank Shell ..... b
b ..... WT + 1.273*M/D^2
b ..... 420.63-lb/ft. of Shell
G*H*D^2/t^2 1,265,472
Fa (10^6*t/D) 4,167-psi

OR

Fa (.5*Fty) 18,000-psi
Use Minimum Value for Fa 4,167-psi
b/12*t 140.21-psi
Note: b/12t Cannot Exceed Fa for a Stable Tank

❒ OVERTURNING MOMENT

Overturning Moment (M) ..... Z*I*(C1*Ws*Xs+C1*W1*X1+C2*W2*X2)
Zone Coefficient (Z) 0.1875
Essential Facilities Factor (I) 1.000

Lateral Earthquake Force Coefficient (C1)	0.240
D/H	3.55
k Factor (@ D/H = 3.55)	0.680
Site Amplification Factor (S)	1.5
Natural Period of First Sloshing Mode (T)	5.11
Lateral Earthquake Force Coefficient (C2)	0.07755
Weight of Tank (Ws)	60,230.32
Weight of Tank Contents (Wt)	3,876,340.00
W1 / Wt (@ D/H = 3.55)	0.32
W2 / Wt (@ D/H = 3.55)	0.60
Weight of Effective Mass (W1)	1,240,428.80
Weight of Effective Mass (W2)	2,325,804.00
Height from Bottom of Shell to Center of Shell (Xs)	8.45
X1/H	0.38
Height from Bottom of Center of Lateral Seismic Force (X1)	6.422
X2/H	0.55
Height from Bottom of Center of Lateral Seismic Force (X2)	9.295
Overturning Moment (M)	*695,718-ft/lb.*
Opposing Moment (M)*	*118,097,110-ft/lb.*

APPENDIX D.

WIND LOAD CALCULATIONS

WIND LOAD CALCULATIONS

❒ DIMENSIONS

Diameter	60.00-ft.
Height	16.90-ft.
Weight of Tank (Steel)	60,230.32-lb.
Weight of Max. Contents	3,876,340.00-lb.
Tank Shell Thickness	0.25-in.
Tank Bottom Thickness	0.240-in.

❒ OVERTURNING MOMENT FROM WIND LOADS

M	Overturning Moment Due to Wind Loading
M	Pw * Ap * Hc
Pw (Wind Pressure - Assume 18-psi for 100-MPH Wind on Cylinders)	18.00-psi
Ap (Projected Frontal Area of Tank (H*D)	1,014-Ft^2
H1 (Height from Ground to Centroid of Tank)	8.45-ft.
M	154,229.40-ft-lb.
M Max	.66*(WD)/2
W (Weight of Tank)	60,230.32-lb.
M Max	1,192,560-ft-lb.

M Must Be Less Than M Max

APPENDIX E.

FOUNDATION INTEGRITY MONITORING DOCUMENTS

Annual Tank In-Service Inspection Checklist

Tank Name: EF-2 Tank Number: 2

Tank Location: WWPT Date: 10-23-2014

Inspected By: _____ Signature: _____

Date of Last Inspection: _____

I. Foundation

A. Measure foundation levelness and bottom elevations (8 points for EF-1 and 9 points for EF-2). Note: No other tanks require foundation levelness and elevation survey.

EF-1:

37 _____ 47 _____ 55 _____ 263 _____

271 _____ 278 _____ 293 _____ 303 _____

EF-2:

65 1425.85 73 1425.94 81 1426.02 89 1425.92 181 1425.70

205 1425.62 211 1425.70 219 1425.79 227 1425.70

B. Has the yearly maximum settlement exceeded 1 inch? (EF-1 and EF-2 only)

EF-1: EF-2:

Yes____ No____ Yes____ No____

C. Check 8 inch annular channel for deflection of more than 2 degrees from its correct position. (EF-1 only)

Deflection _____

Comments:

_____

_____

_____

Annual Tank In-Service Inspection Checklist

Tank Name: EF-2 Tank Number: #2

Tank Location: WWPT Date: _____

Inspected By: _____ Signature: _____

Date of Last Inspection: 12-03-2015

I. Foundation

A. Measure foundation levelness and bottom elevations (8 points for EF-1 and 9 points for EF-2). Note: No other tanks require foundation levelness and elevation survey.

EF-1:

37 _____ 47 _____ 55 _____ 263 _____

271 _____ 279 _____ 293 _____ 303 _____

EF-2:

65 1425.84 73 1425.95 81 1426.03 89 1425.88 191 1425.70

205 1425.62 211 1425.70 219 1425.79 227 1425.79

B. Has the yearly maximum settlement exceeded 1 inch? (EF-1 and EF-2 only)

EF-1: EF-2:

Yes____ No____ Yes____ No____

C. Check 8 inch annular channel for deflection of more than 2 degrees from its correct position. (EF-1 only)

Deflection _____

Comments: _____

APPENDIX F.

LAW ENGINEERING GEOTECHNICAL REPORT

LAW
ENGINEERING AND ENVIRONMENTAL SERVICES

lovember 22, 1993

Ir. Walter Sonne, P.E.
USPCI, Inc.
515 West Greens Road, Suite 500
ouston, Texas 77067

SUBJECT: REVISED REPORT OF GEOTECHNICAL EXPLORATION
Expansion of Wastewater Treatment Facilities--
Lone Mountain Facility, Major County, Oklahoma
Law Engineering Projects No. 392-01406-01

Law Engineering, Inc. has completed the geotechnical exploration at the subject site. Our ervices were provided in accordance with our Revised Proposal for Geotechnical , xploration Services No. HP-8173-93G, dated September 22, 1993; and a Request for Change Order letter dated October 12, 1993. This report briefly discusses our nderstanding of the project information, describes our exploratory procedures and ..ndings, and presents our recommendations and conclusions. The data obtained during the field exploration and from the laboratory testing program is presented in the endices.

We will be happy to discuss our recommendations with you and would welcome the pportunity to provide the additional studies or construction testing services necessary o complete this project. We look forward to serving as your geotechnical engineer on the remainder of this project and on future projects.

n you have any questions, or if you require additional information, please do not hesitate to contact us.

Sincerely,

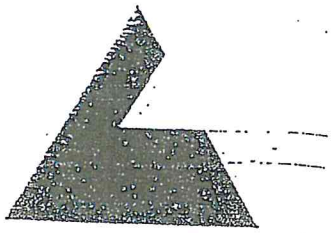
AW ENGINEERING, INC.

Fernando Pons, E.I.
Project Geotechnical Engineer

Michael W. Palmer, P.E.
Principal Geotechnical Engineer
USPCI - Client Manager

Michael H. Homan, P.E.
Principal Geotechnical Engineer
Oklahoma Registration No. 15777

Distribution Copies:
Walter Sonne (2) - USPCI
Larry Marr (1) - USPCI



LAW ENGINEERING

REVISED REPORT OF GEOTECHNICAL EXPLORATION

EXPANSION
OF WASTEWATER TREATMENT FACILITIES

LONE MOUNTAIN FACILITY
MAJOR COUNTY, OKLAHOMA

prepared for
USPCI, Inc.
HOUSTON, TEXAS

LAW ENGINEERING PROJECT NO. 392-1406-01

NOVEMBER 1993

1.0 PURPOSE OF EXPLORATION

The purpose of this exploration was to obtain specific subsurface data at the site and to provide recommendations and opinions for:

- ~~General geotechnical design and construction criteria for the Expansion of Wastewater Final Treatment Facilities (WWFT): Phase I (Expansion of the WWFT Building) and Phase II (Leachate Storage Tanks).~~
- ~~Site preparation and construction of compacted fills for the WWFT Phase I, and the WWFT Phase II.~~
- Soil stratigraphy at the Wastewater Pretreatment Facilities (WWPT): Phase III tanks.

It should be noted that it was not the purpose of this study to directly assess or to address any environmental conditions at the site, i.e., the presence of contaminants or other substances in the soil, rock, or ground water. An additional study should be undertaken if USPCI decides to specifically address environmental conditions.

2.2 LEACHATE STORAGE TANKS

We understand that USPCI plans to construct three tanks within a containment area. The proposed site of construction is south of Cell 4. The proposed tanks will include a 60-foot diameter, 16-feet tall, 300,000 gallon tank; and two 33-foot diameter, 16-feet tall, 100,000 gallon tanks.

The proposed tanks, containing leachate with a specific gravity of 1.3, will be located within a concrete containment structure with walls on the order of 7 feet in height.

We understand that the preferred foundation system at the present time is a drilled pier underground system, 18-inch diameter, straight-sided drilled piers founded at 8-feet on centers. In turn, these drilled piers will support the containment wall and a 10-inch thick concrete slab on 6 inches of sand and 24 inches of structural fill.

2.3 WASTEWATER PRETREATMENT (WWPT) BUILDING

We understand that two existing on-line 300,000 storage tanks structures within the Wastewater Pretreatment (WWPT) Building are experiencing foundation distress. We further understand that these two tanks and the containment area are supported on shallow footings.

4.1.3 Wastewater Pretreatment (WWPT) Building

Exploration borings L-5, L-6, L-6A, and L-7 were drilled in this area. The measured surface elevation of these borings were 1418.35, 1428.62, 1428.48, and 1430.23 feet MSL, ...spectively, as provided by USPCI. The subsurface conditions for this area are generalized as follows:

AREA C

WASTEWATER PRETREATMENT BUILDING

(Borings L-5, L-6, L-6A, and L-7)

STRATUM	DEPTH (ft)	DESCRIPTION	USCS CLASSIFICATION[2]
I C	0 to 2	FILL: GRAVEL	Unclassified
II C	1 to 22.5	FILL: Soft to hard, reddish brown with gray, silty CLAY, with gypsum fragments and gravel.	CL
III C	15.5 to 20.5	Very stiff to hard, reddish brown with gray, silty CLAY, with gypsum fragments and gray silt streaks.	CL
IV C	18.5 to TOB[1]	Gray silty CLAYSTONE to reddish brown silty CLAYSTONE.	Unclassified

[1] Termination of Boring
[2] Unified Soil Classification System

ith reference to the Soil Stratum Summary, the TEST BORING RECORDS, Soil Profiles and the Laboratory Test Results, our discussion of the soil conditions for Area C is as lows:

Stratum IC consists of GRAVEL to gravelly fill soils encountered in all borings from a isting surface to approximately 2 feet below existing grade.

Stratum IIC consists of fill soils of soft to hard, reddish brown with gray, silty CLAY with psum fragments and gravel. Law personnel performed continuous sampling with elby tubes, and utilized on-site extruding techniques to better identify the extent of this fill stratum. These fill soils were encountered from a depth of 1 foot from existing surface 22.5 feet below grade. Organic odor and wet seams were identified in the lower two eet of this formation in Borings L-6 and L-7. Plasticity for this stratum was medium with plasticity index values ranging from 17 to 21. Liquid limit values range from 43 to 45 rcent and plastic limit values range from 24 percent to 26 percent. Stratum IIC soils were generally moist with occasional wet seams. Natural moisture contents ranged from 24 to 30 percent, and were from 0 to 2 percent above corresponding PL values.

Pocket penetrometer tests and laboratory unconfined compression tests, on relatively ndisturbed samples, indicated shear strength values that varied erratically throughout e fill depth in Boring L-5 (easternmost boring). Shear strength values in Borings L-6 and L-7 were similar throughout the same depths of the fill stratum. There was a similar niform decrease of shear strehgth values with depth in Borings L-6 and L-7 to a depth approximately 12.5 feet. (See TEST BORING RECORDS L-6 and L-7).

ratum IIIC consists of very stiff to hard, reddish brown with gray, silty CLAY with psum fragments and gray silt streaks. These soils were encountered in all borings, except Boring L-5, from 15.5 feet from existing surface to a depth of 20.5 feet below ade. One Standard Penetration Test N-value was 40 blows per foot (bpf) at a depth 17 feet in Boring L-6A. Plasticity for this stratum was medium with a plasticity index value of 13, a LL value of 32 percent, and a PL value of 19 percent. One natural moisture ntent was 24 percent. Based on this natural moisture content and corresponding terberg Limit tests, the soil was very moist with a moisture content 5 percent above the corresponding PL value. Pocket penetrometer tests resulted in cohesion values ranging m 3,750 psf to an excess of 4,500 psf.

Stratum IVC consists of gray silty CLAYSTONE to reddish brown silty CLAYSTONE. This formation was encountered from a depth of 18.5 feet below existing surface to termination depth. Standard Penetration Test N-values resulted in refusal values ranging from 6 inches per 50 blows to 4.5 inches per 50 blows. One natural moisture content was 21 percent. All pocket penetrometer tests resulted in cohesion values in excess of 4,500 psf.

4.2 WATER LEVEL CONDITIONS

~~Water level observations were made in the boreholes during drilling operations and 24~~ hours after completion of drilling to investigate the short term ground water levels.

Ground water was identified during our subsurface exploration at depths of 7 feet and 5.5 feet in Borings L-1 and L-2A, respectively (24 hour readings). Ground water was encountered 1.5-feet to 1-foot above the top of the claystone formation in these borings.

~~Borings L-3 and L-4 were dry at the time of drilling and 24 hours thereafter.~~

Water was identified during drilling at a depth of 24 feet below existing ground surface in Boring L-5. Boring L-6 was dry to termination depth during drilling operations and 24 hours thereafter. Ground water was not identified in Borings L-6A and L-7 during and immediately following drilling operations. Law personnel could not obtain 24 hour water level readings at L-5, L-6A, or L-7, due to caving soils in L-5 at 15.8 feet, and surficial cuttings that obstructing the boreholes at L-6A and L-7.

Fluctuations in rainfall, evaporation, construction activity, surface runoff, and other site specific factors could cause ground water conditions at the time of construction to vary from that observed during our field exploration.

5.4.3 Settlement

Predicted settlements for the drilled piers will be relatively small and are expected to be limited to the elastic compression of the founding claystone formation. The maximum total settlement of any drilled shaft under the anticipated sustained loading conditions is predicted to be less than 0.25 inch.

5.5 CONSTRUCTION CONSIDERATIONS

Once a foundation excavation is completed, the setting of reinforcing steel and placement of concrete should proceed expeditiously to reduce exposure of the bearing stratum and possible disturbance of the material. Should the bottom of an excavation become disturbed due to ponding of water or desiccation, the disturbed soils should be removed before concrete is placed.

We recommend that the geotechnical engineer, or their representative, observe the footing excavations immediately prior to placing concrete. The engineer should compare the soils exposed with those encountered in the soil test borings and document the results. Any significant differences should be brought to the attention of the Owner's representatives along with appropriate recommendations. The foundation bearing area should be level or suitably benched. It should also be free of loose soil, ponded water and debris prior to the inspection.

5.6 WASTEWATER PRETREATMENT BUILDING STRATIGRAPHY

We understand that two existing on-line 300,000 storage tanks structures within the Wastewater Pretreatment (WWPT) Building are experiencing foundation distress. We further understand that these two tanks and the containment area are supported on shallow footings, which are currently bearing in fill soils consisting of soft to hard, reddish brown with gray, silty CLAY with gypsum fragments and gravel (Stratum IIC).

As discussed previously in this report, the soil stratigraphy encountered in the WWPT area generally consists of silty fill soils to a maximum depth of 22.5 feet underlain by silty clay soils which grade into claystone. Law personnel performed continuous sampling in borings L-5, L-6, and L-7 and utilized shelby tubes and on-site extruding techniques to better identify the extent of this fill stratum.

The properties of the soils, deemed significant in the evaluation of distress of the structures, are the following:

(a) the moist condition of the silty clay fill soils (Stratum IIC) at the site;

(b) the medium shrink-swell potential of the silty clay matrix within the zone of major seasonal moisture change;

(c) the erratic variation in consistency of the fill soils encountered in Boring L-5;

(d) the similar uniform decrease in shear strength in Borings L-6 and L-7 to a minimum at approximately 13 feet from existing ground level;

(e) the presence of wet seams, organics, and organic odor in the fill soils
of Boring L-6 and Boring L-5;

(f) the presence of ground water in Boring L-5 at a depth of 24.5 feet;

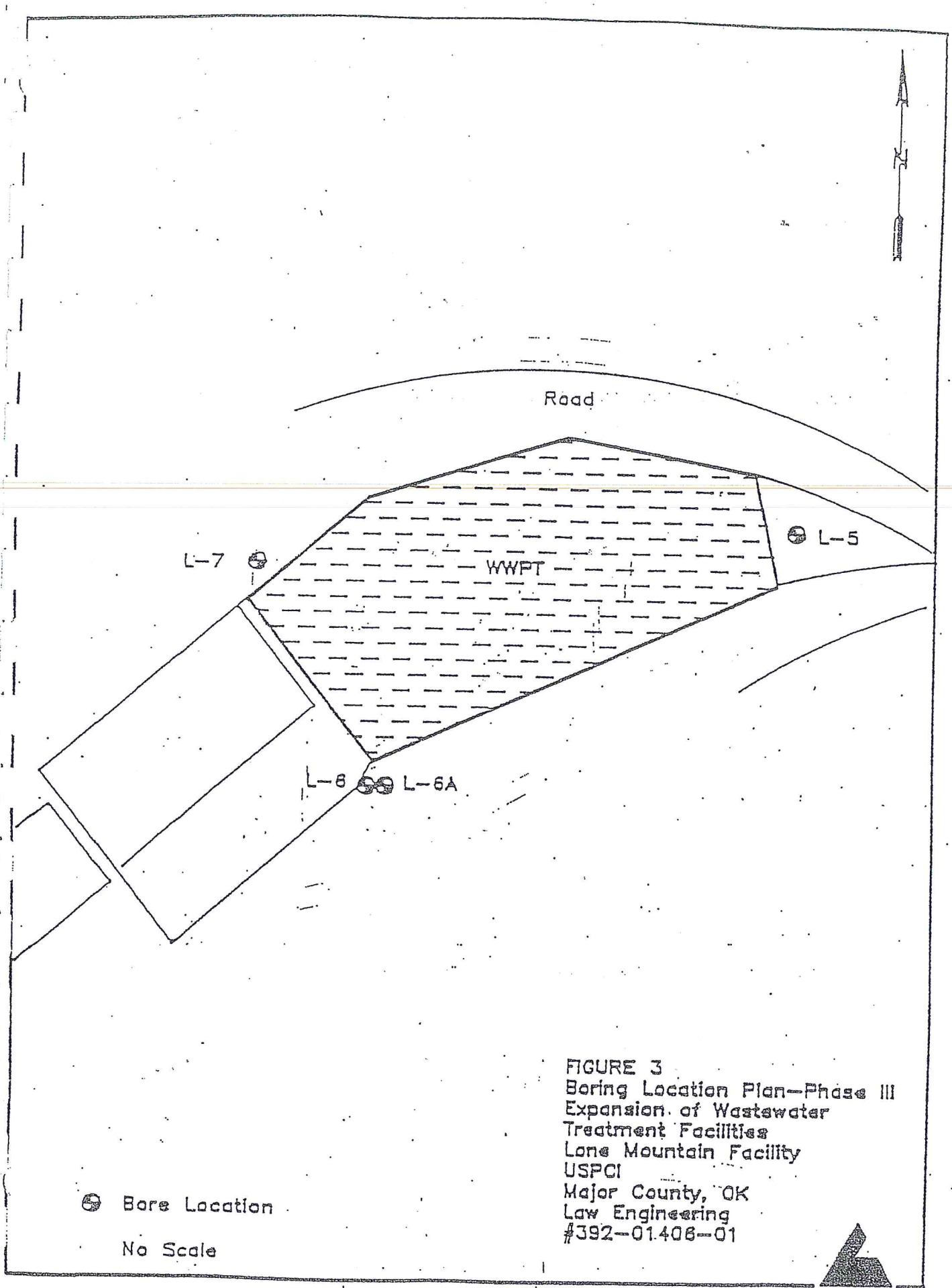


FIGURE 3
Boring Location Plan—Phase III
Expansion of Wastewater
Treatment Facilities
Lone Mountain Facility
USPCI
Major County, OK
Law Engineering
#392-01406-01

DESCRIPTION OF MATERIAL	LEGEND	DEPTH (ft)	ELEVATION	SAMPLES / TESTS: DEPTH (ft)	Sample: Type	Sample: No.	Test: Dry density (pcf)	Test: % Fines	Plastic Limit(%) NM (%) Liquid Limit(%); COHESION (100 psf); PENETRATION (bpf)
SURF. EL: 1430.23 ft. MSL									10 20 30 40 50 60 70 80 90
VEL									
to hard, reddish-brown with some LAY with gypsum fragments and				3.0		1			
		5	1425.2	5.0		2			
				7.0		3			
				9.0		4	102.9		
		10	1420.2	11.0		5			
				13.0		6			
		15	1415.2	15.0		7			
o hard, reddish-brown with gray, silty				17.0		8			
gray silty CLAY with gypsum very moist				19.0		9			
		20	1410.2						
CLAYSTONE				21.0		10			5"/50
own silty CLAYSTONE									
Boring terminated at 25 feet		25	1405.2			11			4.5"/50

KS:

ATES: N10920.34 E9182.90. Borehole advanced 5 truck-mounted drill rig using 3 1/4" I.D. hollow ...s.

...rnold Caeser

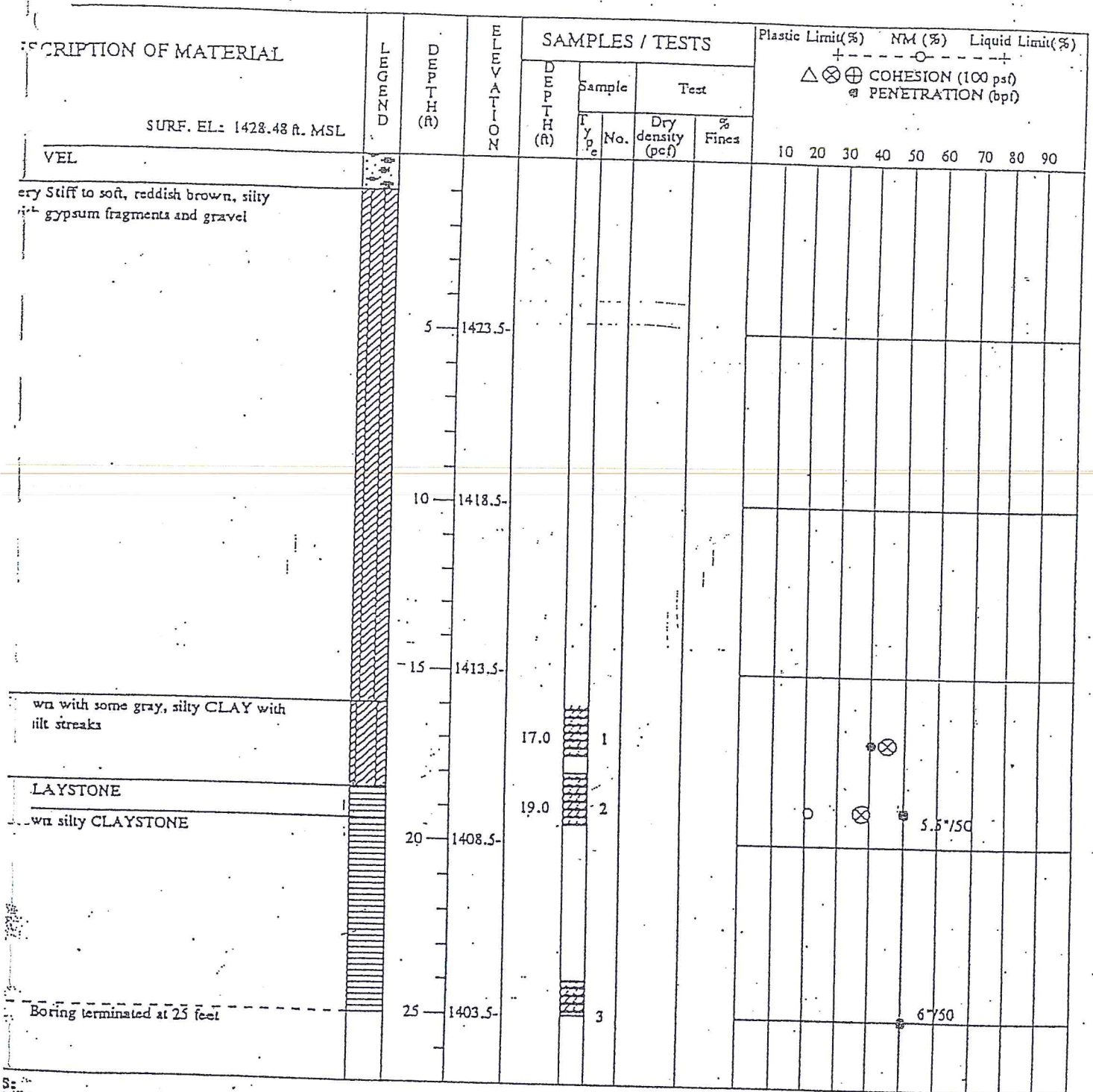
...rnando Pons

SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVATIONS USED ABOVE

TEST BORING RECORD

BORING NUMBER	L-7
DATES DRILLED	Start: October 1, 1993 Complete: October 1, 1993
PROJECT NUMBER	392-01406-01
PROJECT	Expansion of WWT Facilities
PAGE 1 OF 1	

LAW ENGINEERING
Tulsa, Oklahoma



S:

ES: N10829.08 E9253.23. Borehole advanced truck-mounted drill rig using 3 1/4" I.D. hollow Soil classification from 0 to 16 feet is based on

old Caeser

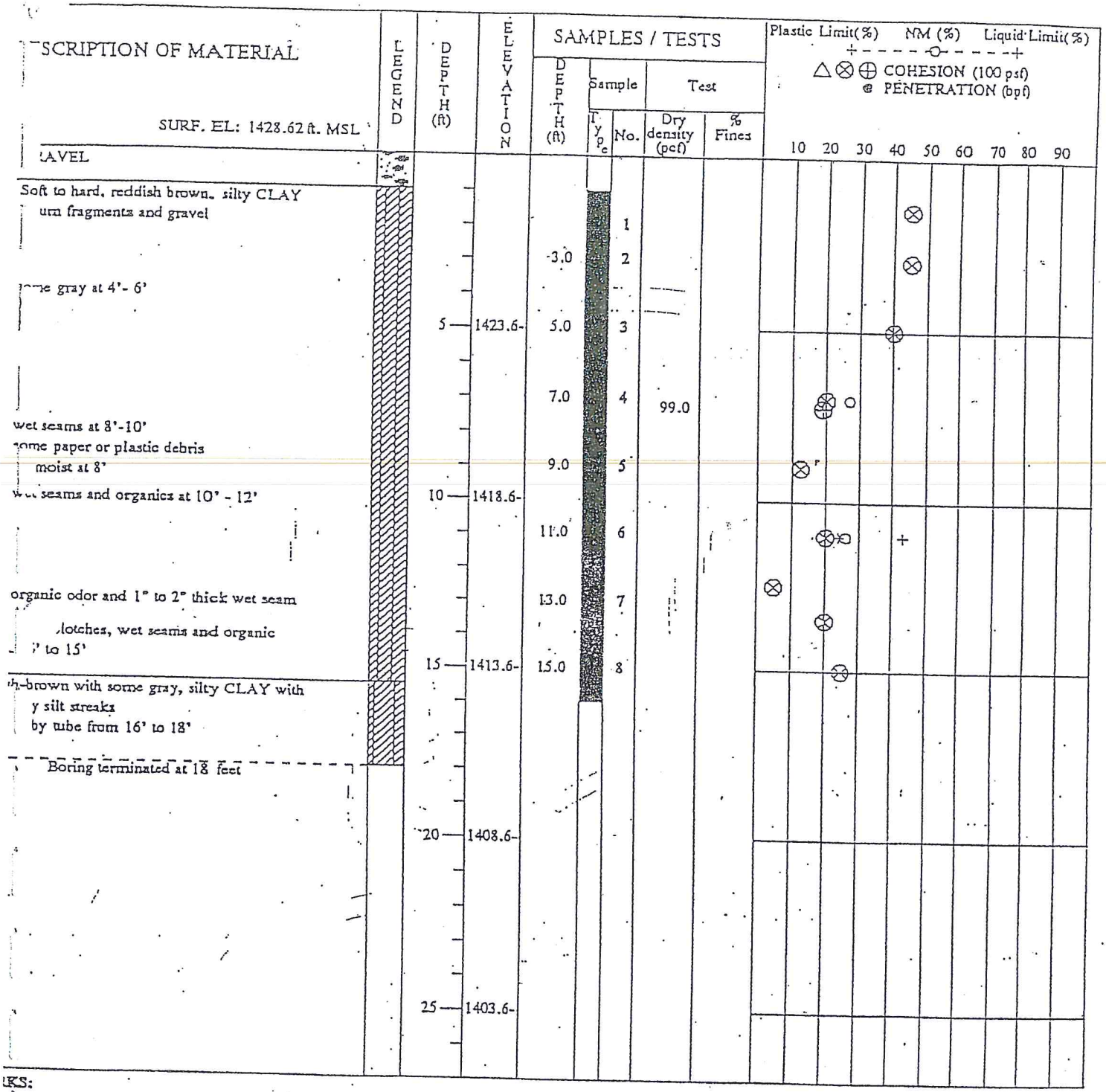
ando Pons.

E KEY SHEET FOR EXPLANATION OF MBOLS AND ABBREVATIONS USED ABOVE

TEST BORING RECORD

BORING NUMBER	L-6A
DATES DRILLED	Start: October 1, 1993 Complete: October 1, 1993
PROJECT NUMBER	392-01406-01
PROJECT	Expansion of WWT Facilities
PAGE 1 OF 1	

LAW ENGINEERING
Tustin, California



KS:

ATES: N10826.86 E9250.81. Borehole advanced
75 truck-mounted drill rig using 3 1/4" I.D. hollow
ers. Borehole dry 24 hours after drilling.

Arnold Caeser

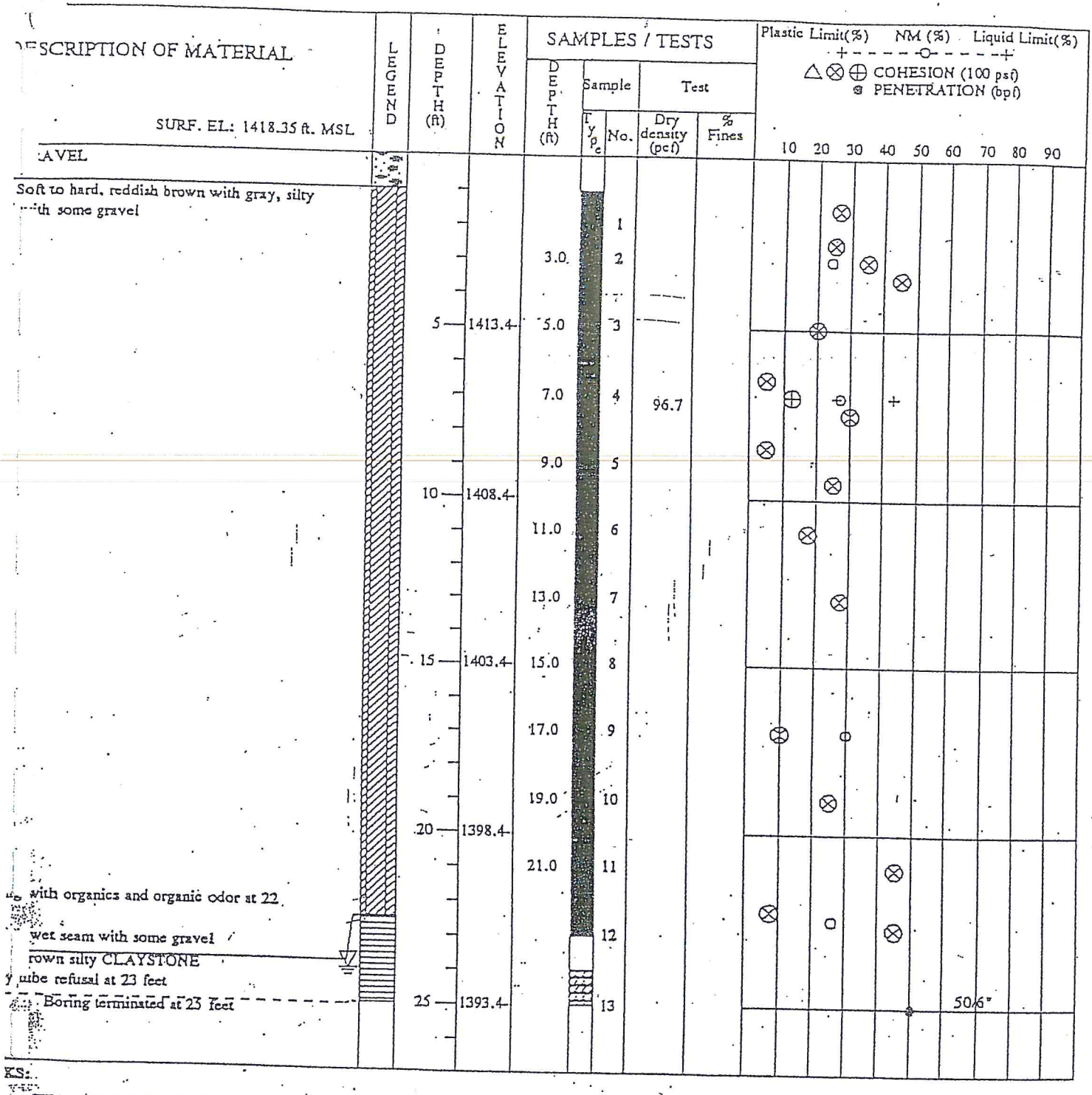
ndo Pons

SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVATIONS USED ABOVE

TEST BORING RECORD

BORING NUMBER	L-6
DATES DRILLED	Start: October 1, 1993 Complete: October 1, 1993
PROJECT NUMBER	392-01406-01
PROJECT	Expansion of WWT Facilities
PAGE 1 OF 1	

LAW ENGINEERING
Tulsa, Oklahoma



KS:

TES: N10939.63 E9409.49. Borehole advanced
5 truck-mounted drill rig using 3 1/4" I.D. HSAs.
ired immediately following drilling operations.
hole at 15.8' identified on 10/2/93.

rnold Caeser

rnando Pons

SEE KEY SHEET FOR EXPLANATION OF
SYMBOLS AND ABBREVATIONS USED ABOVE

TEST BORING RECORD

BORING NUMBER	L-5
DATES DRILLED	Start: October 1, 1993 Complete: October 1, 1993
PROJECT NUMBER	392-01406-01
PROJECT	Expansion of WWT Facilities
PAGE 1 OF 1	

LAW ENGINEERING
Tulsa, Oklahoma

APPENDIX G.

FOUNDATION DESIGN ANALYSIS

FOUNDATION DESIGN ANALYSIS

❒ DIMENSIONS

Diameter	60.00-ft.
Height	16.90-ft.
Weight of Tank (Steel)	60,230.32-lb.
Weight of Max. Contents	3,876,340.00-lb.
Tank Shell Thickness	0.25-in.
Tank Bottom Thickness	0.240-in.

❒ CONCRETE FOUNDATION DESIGN

Assumed Footing Depth	48-in.
Assumed Footing Width	12-in.
Assumed Effective Soil Pressure - (Based on Law Engineering Investigation)	1,500-psf
Max. Bottom Shell Compression - (Based on Seismic Analysis) b	420.63-lb/ft. of circ.
Footing Width	1.00-ft.
Actual Applied Loading	420.63-psf

The actual applied loading is significantly less than the assumed effective soil pressure and therefore, the foundation should be stable.

APPENDIX H.

CHEMPROOF, PERMACOAT 3000 DOCUMENTATION

Chemproof Polymer Flooring

Home
Heavy Duty
Medium Duty
- PermaCoat 2000
- PermaCoat 2000 SL
- PermaCoat 3000
- PermaCoat 4000
- PermaCoat 5000
- PermaCoat 6000
- PermaCoat 6500

Construction Details
Application Guidelines
System Specifications
About Us
Contact Us

PERMACOAT 3000
Epoxy Floor Coating

DESCRIPTION
PERMACOAT 3000 is a 100% solids floor coating. PERMACOAT 3000 can be utilized as a glaze coat for the PERMATEC high build floors, or as a two coat floor or containment system (30-80 mils). When applied as a two coat floor or containment system, a silica broadcast is used between coats.

The PERMACOAT 3000 consists of two components, resin and hardener, in both the horizontal and vertical formulations. Its application is accomplished with rubber squeegees and short nap paint rollers.

FUNCTION
PERMACOAT 3000 is designed as a medium duty (30-80 mils) floor coating and/or secondary containment system where moderate mechanical abuse and chemical exposure are anticipated, so you may use the Chemical Resistant Flooring. PERMACOAT 3000 can be installed over most sound floors, including new or old concrete, steel and wood, providing a cost effective alternative to high-build floor toppings.

TYPICAL APPLICATIONS
- Food processing plants
- Chemical processing plants
- Breweries
- Laboratories
- Pulp and paper mills

TYPICAL PROPERTIES

Solids, by Volume	100%
Hardness Shore D ASTM D2240	82-85
Taber Abrasion ASTM D4060 CS 17 Wheels	Loss/1000 cycles = 25mg
Compressive Strength ASTM C579	14,400 psi
Flexural Strength ASTM D790	16,500 psi
Tensile Strength ASTM D307	11,000 psi
Bond Strength to Concrete ASTM D4541	Exceeds tensile strength of concrete. Failure in concrete

PACKAGING & COVERAGE
PERMACOAT 3000 is packaged in one and three gallon units. Each unit consists of premeasured components, Part A (Resin) and Part B (Hardener).

Application thickness may vary from 30 to 80 mils, depending on the expected service conditions. Factors to consider are 1) length of chemical exposure; 2)mechanical abuses; and 3) substrate texture.

- Processing area in general where chemicals are used
- Any area that requires a safe, non-slip floor

FEATURES

PERMACOAT 3000 allows for fast, easy application. It also offers chemical resistance and physical performance much higher than those found in paints and other thin mil coatings.

Note: At 30-50 mils, PERMACOAT 3000 provides excellent chemical resistance for splash and spill exposures. In addition, when applied at 50-80 mils, it can often be recommended for containment service. (For specific recommendations refer to PERMATEC 3000 "Chemical Resistance Guide" and your local distributor.)

OTHER FEATURES INCLUDE:

- Rapid cure resulting in minimal "downtime"
- Odor-free
- Nonskid safety finish optional

MIXING

Prior to application, the PERMACOAT 3000 (Resin, Hardener, and Silica) and the substrate should be between 70 degrees and 95 degrees F.

Premix the Resin (Part A) for 30 seconds using a Jiffler mixer blade attached to a 500-750 RPM drill. Add the Hardener (Part B) only when the batch is ready to be applied. Mix for approx. 90-120 seconds. After mixing pour immediately onto floor.

APPLICATION

Use a rubber squeegee to spread

CURE TIME

The cure time of PERMACOAT 3000 and other resinous systems are very dependent upon the temperature of the substrate. The chart below represents the approximate times for the respective service conditions, following the last coat:

Service (hours)	70°F	80°F	90°F
Foot traffic	10	8	6
Light Chemical	14	12	10
Fork Lift	20	16	12

CLEAN-UP

All mixing and application equipment should be cleaned immediately after use. If this is done, soap and water, or biodegradable cleaners can be used. If the material has begun to set, more aggressive solvents may be necessary. Before using solvents, refer to their respective MSDS for handling considerations.

MAINTENANCE

For systems designed for splash and spill exposures, routine washdowns are recommended to reduce the length of chemical exposure. This step is not necessary where the product is recommended for containment service.

WARRANTY

For product warranty see ChemProof Polymers, Inc. "Standard Limited Warranty." If one is not included with this literature contact your local distributor or ChemProof Polymers, Inc. for a copy.

STORAGE & SHELF LIFE

PERMACOAT 3000 should be stored at 50-90°F out of direct sunlight. All containers should

the resin over the pre-measured area to be covered. Immediately back roll the PERMACOAT 3000 with a short nap (1/8 inches) wool or mohair roller. At this point several pre-specified readings should be made with a wet mil gauge to assure uniform coverage. After the coating has been back rolled and uniform thickness verified, the surface should be saturated with a silica broadcast.

After the first coat supports foot traffic, the excess silica can be removed. Within 24 hours a second coat of PERMACOAT 3000 should be applied using the same procedure, minus the silica broadcast.

Note: Additional broadcasts and roll coats can be utilized to increase floor thickness.

SAFETY

PERMACOAT 3000 contains blended Epoxies as the resin and blended Amines as the hardener. Protective clothing and gloves are recommended to prevent sensitization to these materials. In case of ingestion or eye contact, contact a physician immediately. MSDS are available for this product upon request.

remain unopened until ready for use. If stored as set out above, PERMACOAT 3000 has a minimum shelf life of one year.

WHERE PERMACOAT 3000 SHOULD NOT BE INSTALLED

PERMACOAT 3000 should not be applied over substrates:

- which are wet during the application
- subject to hydrostatic pressure
- which are unsound
- which are contaminated and cannot be cleaned
- at temperatures below 70^{o}F (consult ChemProof Polymers)

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APPENDIX I.

SECONDARY CONTAINMENT CALCULATIONS

SECONDARY CONTAINMENT CALCULATIONS

❒ DIMENSIONS

EF Tank Diameter ..... 60.00-ft.
PCL Tank Diameter ..... 12.00-ft.
Secondary Containment Height - Hsc 5.50
Secondary Containment Surface Area - Asc 14,589.00-sf
Gross Volume of Secondary Containment 80,239.50-cf

❒ DISPLACEMENT VOLUMES

EF Tank Base (PI*D^2/4*Hsc) 15,551.42-cf
PCL Tank Base (PI*D^2/4*Hsc) 622.06-cf

Note: Displacement volumes include only one of the EF tanks. It is assumed that a failed tank would not displace available secondary containment.

Displacement Volume 16,173.47-cf

❒ RAINFALL VOLUMES

Depth of Rainfall ..... 6.150-in.
Impacted Area 8,934.00-sf
Rainfall Volume 4,578.68-cf

❒ CONTAINMENT CAPACITY AVAILABLE

CCA ..... Gross Volume - Displacement Volume - Rainfall Volume

CCA 59,487-cf

Volume of Largest Tank (EF1) 47,785.26-cf

Excess Containment Volume 11,702-cf

Safety Factor 1.24

SECTION EF3

MYERS Engineering CORPORATION

ENGINEERING FOR TODAY'S CHANGING WORLD

June 14, 1993

RECEIVED
MAY 23 1994
LARRY J. ODEN

Mr. Don Dillie
Project Engineer
USPCI, Inc.
Lone Mountain Facility
Route 2, Box 180A
Waynoka, Oklahoma 73860

Re: Evaporator Feed Tank No. 3 (EF3)
Tank Installation

Dear Mr. Dillie:

At the time of our inspection of Evaporator Feed Tank No. 3 (EF3) at the Lone Mountain Facility, there were no visual apparent weld breaks, punctures, scrapes of protective coatings, cracks, corrosion or damage due to construction or installation. This is to certify that Evaporator Feed Tank No. 3 was installed in such a manner which did not produce any structurally adverse conditions in accordance with 40 CFR 264.192(b).

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment of knowing violations.

If you have any questions please feel free to call us at 405-755-5325.

Sincerely,

E.E. Myers

cc: Larry Oden
Jim Williams
Dennis Dodd

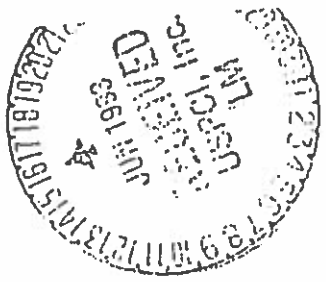
FILE INSTRUCTIONS	
Unit Final Treatment	
Project EF3 Tank Assessment	
Section Tank Certification	
Rcvd. by: L. J. ODEN	
ROUTE	COPY
File	[redacted]
	D. Dodd

TANK INSTALL

11102 NORTH STRATFORD DRIVE • SUITE D400 • OKLAHOMA CITY, OKLAHOMA • 73120 • 405/755-5325 • FAX 405/755-5

MYERS Engineering CORPORATION

ENGINEERING FOR TODAY'S CHANGING WORLD



June 14, 1993

Mr. Don Dillie
Project Engineer
USPCI, Inc.
Lone Mountain Facility
Route 2, Box 180A
Waynoka, Oklahoma 73860

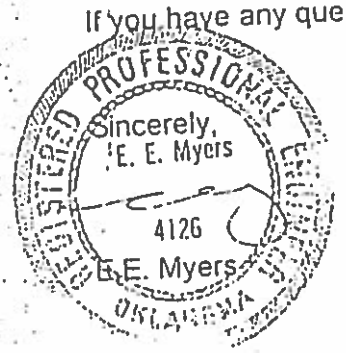
Re: Evaporator Feed Tank No. 3 (EF3)
Tank Leak Test

Dear Mr. Dillie:

Evaporator Feed Tank No. 3 (EF3) was tested for leaks by the tank manufacturer before shipping. Once the tank was installed, and before it was put into service, it was filled with water and allowed to remain in hydraulic static equilibrium for a period of several hours. The tank did not leak during this period in accordance with 40 CFR 264.192 (d).

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment of knowing violations.

If you have any questions please feel free to call us at 405-755-5325.



cc: Larry Oden
~ Jim Williams
Dennis Dodd

FILE INSTRUCTIONS	
Unit Final Treatment	
Project EF3 Tank Assessment	
Section Tank Certification	
Rcvd. by: L. J. ODEN	
ROUTE	COPY
FILE	B. Cannon
	D. Dodd

(LEAK TEST)

SECTION 301
ASSESSMENT OF EVAPORATOR FEED STORAGE TANK No. 3 (EF3)
LONE MOUNTAIN HAZARDOUS WASTE FACILITY
U.S.P.C.I.
WAYNOKA, OKLAHOMA

A. TANK SYSTEM DESCRIPTION

The Evaporator Feed Storage Tank No. 3 (EF3) is a new cylindrical carbon steel aboveground vertical tank located in the wastewater treatment building of the Lone Mountain Hazardous Waste Facility. The Evaporator Feed Storage Tank No. 3 and its ancillary equipment are located together in a concrete curbed containment area.

B. PRIMARY TANK VESSEL

1. General Description

The Evaporator Feed Storage Tank No. 3 is being assessed to determine if the unit is adequately designed with sufficient structural strength, and compatibility with the waste to be treated. The Evaporator Feed Storage Tank No. 3 will be used to store treated wastes prior to entrance into the exchanger units. The tank is vertical in position, aboveground and cylindrical in shape. The tank is supported by a skirted base. The Feed Tank has a slightly elevated temperature due to the return waste line from the Flash Tank.

2. Design Standards.

Structure calculations were performed to compare the existing tank and supports to those sections that are applicable in the American Petroleum Institute Standard 650 - 1988 edition (API-650) and the American Institute of Steel Construction (AISC) Manual of Steel Construction (8th Edition). These calculations can be found in the Appendix of this report. The tank was built to API-650 Standards and the steel specifications and mill test reports will be located in Appendix F. Appendix A and M were utilized from API-650 due to the small diameter and elevated temperature.

3. Hazardous Characteristics of Wastes Treated

The wastes which are treated in this tank have the following characteristics:

Treated wastes
pH (4-12)
N < 6
Temperature = < 245°F

The hazardous characteristics of the waste treated in this tank were examined. It was determined that the pH and normality levels of the waste are the primary areas of concern. This was to determine the applicability of a corrosion allowance for the tank material type and thickness.

4. Existing Corrosion Protection

The tank is coated on the inside with Sherwin Williams Hi-Mil Sher Tar Epoxy. The exterior is painted with Glidden Epoxy Primer No. 5466. It should be noted that when thickness calculations were compared, a 1/8" corrosion allowance was used.

5. Documented Age of Tank

The tank was manufactured by Delta Tanks of Houston Texas in March of 1993. The tank was installed in April, 1993.

6. Result of Leak Tests

A leak test was performed by the manufacturer and witnessed by an inspector prior to shipment. An inplace leak was performed and no leaks were found.

7. Existing Data Obtained

Diameter of Tank	6'-4"
Height	12'
(Normal Operating Level)	11'
Material	Carbon Steel (ASTM A-36)
Wall Thickness	0.375"
Specific Gravity	1.5
Operating Temperature	245°
Maximum Volume	1625 Gal.
Normal Operating Volume	1389 Gal.
Seismic Zone	1

8. Calculation of Foundation Loading

Total Weight of Tank and Contents = 11.42 tons

Detailed calculations reflecting the volume and weight of the tank are found in appendix A. The minimum required foundation thickness and steel reinforcement are included in appendix E of this assessment.

9. Required Structural Calculation

The calculated required wall thickness for this tank is 0.1448 inches. 0.125 inches is added for corrosion allowance. This corrosion allowance is based on a best engineering estimate taking into account the materials being treated and a 20 year design life. (See appendix B of this assessment for detailed calculations or required wall thickness and structural analysis of the tank support system.) The API-650 standard and Appendix A and M were used in determining the maximum allowable stress. The maximum allowable stress for this tank will be 17,600 psi.

10. Comparison of Actual Structure to Theoretical Values

Wall Thickness Comparison

Calculated Required Wall Thickness	0.1448"
Minimum Required Wall Thickness By API 650-88	0.1875"
Measured Wall Thickness	0.375"

C. SECONDARY CONTAINMENT SYSTEM

1. General Description of Secondary Containment

The secondary containment system is designed and operated to prevent any migration of wastes or liquids out of the system. (See appendix G for layout of secondary containment area.) The Evaporator Feed Storage Tank No. 3 is located inside the wastewater final treatment building within a concrete containment area. All associated piping is aboveground and a portion of the associated piping is contained in this area. The area is inspected on a daily basis.

Design or construction details were not available for detailed structural analysis of the concrete curb and floor. The minimum required foundation thickness and steel reinforcement were calculated and are included in the appendix E of this assessment. See appendix G for detailed drawings of the containment area. The section through the containment area is based on concrete cores taken in this area. The size and spacing of the steel reinforcement is not known, however, it would be acceptable to assume No. 3 bars spaced at 12" center to center in each direction. The concrete slab is resting on a sand base. The thickness of the slab in this area is no less than 6". The compressive strength determined from the concrete removed in the coring procedure was found to be approximately 7000 psi. For calculation purposes a compressive strength of 4000 psi was used.

The containment area and tanks are routinely visually monitored on a daily basis for leaks. A sump pump and drain are located in the containment area. The floor is sloped to the low area to collect any drainage or spills. Any released tank contents or surface runoff will drain on top of the sloped concrete to the sump area. The accumulated liquids are then removed and pumped to the wastewater pretreatment area within a maximum of 24 hours, as a permit condition.

2. Design Standards

The structural capacity of the foundation and walls were compared to those sections that are applicable in the API 650-88 and the American Concrete Institute (ACI 318-89/318r-89) and these calculations were used as a guide in verifying the ability of the system to contain hazardous waste. No design drawings or standards were found.

3. Hazardous Characteristics of Wastes Treated

The wastes which are treated in the primary tank have the following characteristics:

Treated Wastes
pH Level (4-12)
N < 6
Temperature < 245°

The hazardous characteristics of the waste treated in the primary tank were examined. It was determined that the pH and normality levels of the waste were the primary areas of concern. This was to determine the applicability of a corrosion allowance for the containment system material type and thickness.

4. Existing Corrosion Protection

The entire secondary containment area floor and walls have been coated with an impermeable coating (Overcrete Plus by Concrete Protection Systems, Inc. and Sentry Polymers, Semstone 805). The coating is compatible with the present waste stream as verified by USPCI.

5. Documented Age of the Containment Area

The secondary containment system was constructed and installed in 1987 thus making the containment system 5 years old.

6. **Result of Leak Tests**

A visual inspection of the containment area was performed and from this inspection there were no cracks or breaks in the impermeable coating, therefore it would be adequate to contain any leaks or spills. The area is inspected daily on a routine basis checking for leaks from the primary tank.

7. **Existing Data Obtained**

Area	2396 s.f.
Wall Height	0.46 ft. (Lowest point)
Material	Concrete

See Appendix G of this assessment for detailed drawings of the containment area.

8. **Calculation of Existing Capacity**

Containment Capacity Available (CCA)

CCA = Gross Volume - Volume of items in the containment - Volume of rainfall.

See Appendix D of this assessment for detailed calculations of the available containment volume. The containment capacity available = 1186.60 c.f.

9. **Required Volume**

Containment Capacity Required (CCR)

CCR = Volume of Largest Tank in the secondary containment

Volume of Largest Tank = 315.24 c.f. (FT3 Section 303)

10. **Comparison of Available Volume to Required Volume**

Containment Capacity Comparison

Containment Capacity Required =	315.24 c.f.
Secondary Containment Volume Available =	1186.60 c.f.
Excess Containment Volume =	871.36 c.f.

CCA>CCR Adequate Capacity (under normal operating conditions) is available.

D. CONCLUSIONS

1. Primary Tank System

The tank vessel at the time of inspection was fit for use with the present waste stream at given densities, chemical and physical characteristics as verified by USPCI. The useful life of the steel tank would be estimated at 20 years if the current waste stream is maintained. This useful life was determined by using a design life of 20 years less the period that the tank has been in use at the USPCI Lone Mountain Facility.

2. Secondary Containment System

The secondary containment area at the time of inspection was fit for use, if the present waste stream at given densities and chemical and physical characteristics as verified by USPCI were released from the primary tank. The useful life of the concrete containment area is estimated at 15 years. This useful life was determined by using a design life of 20 years less the period that the tank has been in use at the USPCI Lone Mountain Facility. There did not seem to be any extensive corrosion or deterioration of the secondary containment area.

E. RECOMMENDATIONS

The following repairs or modifications should be made:

1 Primary Tank

The tank should be cleaned and internally inspected periodically for corrosion. The tank should be checked periodically with ultrasonic testing procedures to establish a verified limit of corrosion. USPCI should continually insure compatibility with the waste and densities stored. Daily inspections should be continued to detect any visual corrosion or defects.

2 Secondary Containment System

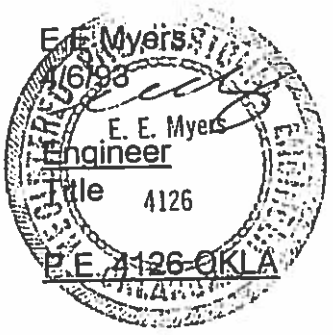
The secondary containment should be checked periodically for any deterioration and structural integrity.

3 Routine Inspections

When routine and preventative measures are to be completed, the tank should be cleaned and internally inspected to determine any interior defects or corrosion. Continued routine painting and coating of tanks on the interior and exterior, and routine inspection is recommended.

F. CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to be the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.



E.E. Myers
1/6/93
Engineer
Title
4126
P.E. 4126 OKLA

SECTION 301 - APPENDIX A

EF3, Evaporator Feed Tank No.3

PRIMARY TANK VOLUME

DIMENSIONS:				
Geometry:	CYLINDRICAL			
Diameter:	6.33	FEET		
Max Height:	6.00	FEET		
Normal Operating Height:	5.00	FEET		
Cone Height:	2.50	FEET		
Bottom Cone Diameter	0.50	FEET		
Cone Length	4.03	FEET		
Cone Volume:	28.46	C.F. or	212.88	Gal.

VOLUME CALCULATIONS

Max. Volume :	217.28	C.F. or	1625.26	Gal.
Normal Operating Volume	185.81	C.F. or	1389.86	Gal.

MAXIMUM OPERATING TANK VOLUME =		217.28	C.F.
	OR	1,625.26	GAL

WEIGHT ON FOUNDATION

CONTENTS S.G.:	1.50	
DENSITY:	93.60	LB/C.F.

SURFACE AREA CALCULATION

Tank Top =	31.47	S.F.
Tank Bottom Cone =	68.66	S.F.
Tank Wall= Cir*h	119.32	S.F.
TOTAL SURFACE AREA WALL AND TOP	219.44	S.F.

Steel Thickness=		
Sidewalls and Top	0.25	INCHES
Cone	0.31	INCHES
Volume of Steel =		
Sidewalls	2.49	C.F.
Top and bottom	2.61	C.F.
Density of Steel =	490.00	LB/C.F.
Weight of Steel =	1.25	TONS
WEIGHT OF TANK CONTENTS =	10.17	TONS

TOTAL WEIGHT OF TANK AND CONTENTS =	11.42	TONS

SECTION 301 - APPENDIX B

EF3, Evaporator Feed Tank No.3

PRIMARY TANK WALL THICKNESS

DIMENSIONS:		
Geometry:	CYLINDRICAL	
Diameter:	6.33	FEET
Height :	12.00	FEET
Specific Gravity:	1.50	
Normal Operating Temperature =	ambient	

STEEL THICKNESS CALCULATIONS @ BOTTOM RING

Thickness (t) = (2.6 * H * D * S.G.) / (s * E) + CA

s = Allowable Design Stress =	17600.00	PSI ***
E = Joint Efficiency =	85.00%	
Thickness (t) =	0.0198	INCHES
Corrosion Allowance =	0.1250	INCHES
Calculated Req'd Wall thk. =	0.1448	INCHES

*** THIS DESIGN STRESS IS OBTAINED FROM API-650-88 WITH THE USE OF APPENDIX A.

CONE WALL THICKNESS CALCULATION

Cosine Alpha = cos(67.6594)	0.3801	
P1= Internal Pressure=		
=Density*s.g.*(x+D/6*cot(alpha)	3263.83	psi
P2= H*density*s.g.=33*62.4*1.5 =	3182.40	psi
Tc= top cone radius =	6.36	inches
Fb = Allowable stress	17600	psi

The required wall thickness of the cone will be the greater of the following Formulas.

1. Ts=P1*Tc/2*cos(alpha)*fb =	0.098	+1/8"C.A.=	0.223	in.
2. Ts=P2*D/cos(alpha)*Fb =	0.125	+1/8"C.A.=	0.250	in.

SECTION 301 - APPENDIX C

EF3, Evaporator Feed Tank

STRUCTURAL SUPPORT CALCULATIONS

GIVEN:

Tank Diameter =	6.33	feet
Total Height =	12.00	feet
Weight of Tank =	2500.00	lbs
Weight of Max. Contents =	22840.00	lbs
Tank Nominal Thickness =	0.375	in

-----SEISMIC DESIGN CHECK-----

ZONE COEFFICIENT (Z):	0.1875	
ESSENTIAL FACILITIES FACTOR (I):	1.000	
LATERAL EARTHQUAKE FORCE COEFF. (C1):	0.240	
D/H:	0.528	
k factor:	0.590	
SITE AMPLIFICATION FACTOR (S):	1.500	
NATURAL PERIOD OF FIRST SLOSHING (T):	1.485	
LATERAL EARTHQUAKE FORCE COEFF. (C2):	0.311	
WEIGHT OF TANK SHELL (Ws):	2500.000	LBS
TOTAL WEIGHT OF TANK CONTENTS (Wt):	22840.000	LBS
W1/Wt:	0.950	
W2/Wt:	0.100	
WEIGHT OF EFFECTIVE MASS OF CONTENTS MOVES IN UNISON WITH THE TANK SHELL (W	21698.000	LBS
WEIGHT OF EFFECTIVE MASS IN FIRST SLOS	2284.000	LBS
HT FROM BTM OF SHELL TO CENT. OF SHELL	8.000	FEET

X1/H:	0.500	
HT FROM BTM TO CENT. OF LAT. SEISMIC FO	8.000	FEET
X2/H:	0.900	
HT FROM BTM TO CENT. OF LAT. SEISMIC FO	10.800	FEET

OVERTURNING MOMENT (M) = Z*I*(C1*Ws*Xs + C1*W1*X1 + C2*W2*X2)

OVERTURNING MOMENT (M):	10149.686	FT-LBS

Note: All of the above calculations are based on API-650-88 Seismic Design Procedure (Appendix E).

CHECK STRESS IN TANK SHELL FROM SEISMIC FORCES:

Wl = MAXIMUM WEIGHT OF TANK CONTENTS THAT MAY BE USED TO RESIST THE SHELL OVERTURNING MOMENT

Wl = 7.9*tb*(Fby*G*H)^.5

tb = THK. OF BTM. PLATE UNDER SHELL:	0.375	IN
Fby = MINIMUM YIELD STRENGTH OF BOTTOM PLATE:	9000.000	PSI
G = DESIGN SPECIFIC GRAV. OF LIQUID:	1.50	
Wl =	1192.38	LBS/FT OF SHELL CIRCUMFRENCE
DENSITY OF TANK SHELL MATERIAL:	490.00	LBS/CF
WT = WEIGHT OF TANK SHELL AND THE PORTION OF FIXED ROOF SUPPORTED BY TANK SHELL:	183.75	LBS/FT OF SHELL CIRCUMFRENCE
M/[D^2(WT+Wl)]:	0.1839	

b = MAXIMUM LONGITUDINAL COMPRESSIVE FORCE AT THE BTM. OF TANK SHELL

b = WT + 1.273*M/D^2

b:	505.90	LBS/FT OF SHELL

G*H*D^2/t^2:	5133.68	
Fa = MINIMUM OF 10^6*t/D or Fty/2:	4500.00	PSI
Fty = MINIMUM YIELD STRENGTH OF BTM. PLATE:	9000.00	PSI
MAX. LONGITUDINAL COMPRESSIVE STRESS IN THE TANK SHELL = b/12t =	112.42	PSI

CHECK OVERTURNING MOMENT FROM WIND PRESSURE

M must be Less Than or Equal To .66*(WD)/2
If M is Greater Than .66*(WD)/2 Anchor Bolts
Would Be Required

Where:

W = Shell Weight Available To Resist Uplift (lbs)

D = Tank Diameter (feet)

M = Overturning Moment

M = Pw*Projected Area*H1

H1 = Height from ground to centroid of tank shell

Pw = Wind Pressure (18 psf for 100 MPH Wind on cylinders)

.66*(WD)/2:	5224.73	FT-LBS
M:	8207.57	FT-LBS

M > .66*(WD)/2 therefore anchor bolts are required

Number of Anchors:	8.00	
Anchor Diameter:	0.75	inches
Dia. of Anchor Circle:	6.66	feet

tB = design tension load per anchor

tB:	303.41	pounds
Allowable Load/ Anchor:	8835.73	pounds

SECTION 301 - APPENDIX D

Wastewater Final Treatment

SECONDARY CONTAINMENT VOLUME CALCULATIONS

AREA 13-1

Area No.13-1-1		
Length =	50.33	feet
Width =	29.00	feet
Height =	0.46	feet
Surface Area =	1459.66	S.F.
Volume =	671.44	C.F.
Area No.13-1-2		
Length =	15.00	feet
Width =	13.25	feet
Height =	0.41	feet
Surface Area =	198.75	S.F.
Volume =	81.49	C.F.
Area No.13-1 Sump (Trench)		
Length =	49.17	feet
Width =	1.25	feet
Height =	0.83	feet
Surface Area =	61.46	S.F.
Volume =	51.22	C.F.
Area No.13-1 Sump (Trench)		
Length =	22.00	feet
Width =	1.25	feet
Height =	0.33	feet
Surface Area =	27.50	S.F.
Volume =	9.17	C.F.

Gross Area =	Summ of Area 1 and 2	1658.41	S.F
Gross Volume =	Area * Height + Sumps	813.31	C.F.

Volumes of Items of Displacement ** Area 13-1

1. DU Tank pad =	19*12*2/12 =	38.00 C.F.
2. BB1 Tank Skirt =	2*pi*r*thk.*0.46 =	0.24 C.F.
3. BB1 pump base =	4*1.333*0.46 =	2.45 C.F.
4. Filter Base =	0.15 c.f.	0.15 C.F.
5. Channel supports for LF2 =	5*.46*3.83/144 =	0.06 C.F.
6. Walkway support legs =	4*0.0875*0.46 =	0.16 C.F.
7. Building supports =	8*(19.7/144)*0.46 =	0.50 C.F.
8. DU Pumps =	8*1.333*0.5*0.25 =	1.33 C.F.
9. EV3 support legs	4*0.46*7.34/144 =	0.09 C.F.
10. EB1 Support Legs =	4*2*19.7/144 =	1.09 C.F.
11. Sump for pipes =	6*4*.46 =	11.04 C.F.
12. Small Base DU units	Pi*D*(.5/12)*.46	0.15 C.F.
13. Large Base DU units	Pi*D*(.5/12)*.46	0.10 C.F.

Total volume to deduct for items in containment area = 55.38 C.F.

Subtraction for volume of rainfall

This entire area is covered and will not receive any rain

TOTAL AVAILABLE VOLUME = Gross Volume - Subtractions =	813.31 C.F.
Items of displacement	-55.38 C.F
Volume of rainfall	0.00 C.F
TOTAL AVAILABLE VOLUME AREA 13-1	**757.93 C.F**

AREA 13-2

Area No.13-2	
Length =	41.00 feet
Width =	18.00 feet
Height =	0.46 feet
Surface Area =	738.00 S.F.
Volume =	339.48 C.F.
Area No.13-2 Sump	
Length =	2.00 feet

Width =	3.00	feet
Height =	2.54	feet
Surface Area =	6.00	S.F.
Volume =	15.25	C.F.

Area No.13-2 Sump (Cont.)

Length =	4.00	feet
Width =	4.00	feet
Height =	4.92	feet
Surface Area =	16.00	S.F.
Volume =	78.67	C.F.

Gross Area =	Area 1	738.00	S.F
Gross Volume =	Area * Height + Sumps	433.40	C.F.

Volumes of Items of Displacement **

1. Bearing Pads	12*(1.5*1*2/12) =	3.00 C.F.
2. Pump Base (5" high steel) =	5'"*1.5'*3.5' =	0.30 C.F.
3. Hydraulic unit support legs	4*0.0064*.64 =	0.02 C.F.
4. Steps and supports, ladder supports =		0.50 C.F.
5. 8" Tank support legs =	12*(17.2/144)*0.64 =	0.92 C.F.

Total volume to deduct for items in containment area = 4.73 C.F.

Subtraction for volume of rainfall

This entire area is covered and will not receive any rain

TOTAL AVAILABLE VOLUME = Gross Volume - Subtractions =	433.40 C.F.
Items of displacement	-4.73 C.F
Volume of rainfall	0.00 C.F

TOTAL AVAILABLE VOLUME AREA 13-2 428.67 C.F

TOTAL AVAILABLE VOLUME AREA 13	1186.60 C.F. OR 8875.77 GAL

SECTION 301 - APPENDIX E

EF3, Evaporator Feed Tank No.3

FOUNDATION DESIGN ANALYSIS

ASSUMPTIONS:

f'c =		4.00	KSI
fy =		60.00	KSI
Allowable Soil Press. =		2.20	KSI
Structural Steel =	A36		

GIVEN:

Tank Diameter =	6.33	feet
Sidewall Height =	12.00	feet
Weight of Tank (Shell)	2500.00	lbs
Weight of Max. Contents =	20340.00	lbs

Tank is Resting on a concrete foundation.

CHECK CONCRETE FOUNDATION DESIGN:

Assume Footing Depth =	6.00	inches
Assume Footing Width =	12.00	inches
Assumed Effective Soil Press. =	1925.00	psf
		psf

Look at what is resisiting overturning moment from seismic load:

b = 506.00 lb/ft of circ.

Where b is the maximum shell compression at the bottom of the shell.

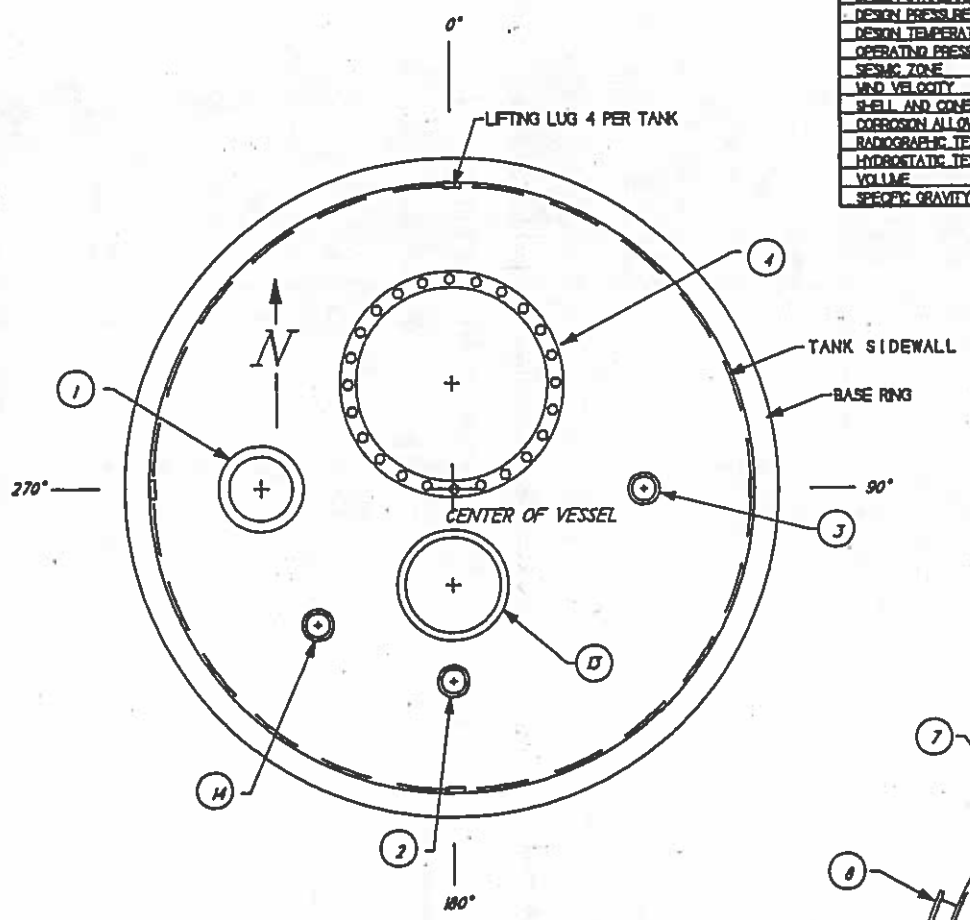
If the footing is 12.00 inches wide
then the actual applied pressure to the subgrade is 506.00 lb/sf

This is less than the effective soil pressure.

DESIGN DATA	
DESIGN STANDARD	API-650
DESIGN PRESSURE	ATMOSPHERIC
DESIGN TEMPERATURE	250 DEG F
OPERATING PRESSURE	ATMOSPHERIC
SEISMIC ZONE	1
WIND VELOCITY	100 MPH
SHELL AND CONE MIN. THK.	3/16"
CORROSION ALLOWANCE	1/8"
RADIOGRAPHIC TESTING	YES
HYDROSTATIC TESTING	YES
VOLUME	1025 GAL
SPECIFIC GRAVITY	1.5

GENERAL NOTES:

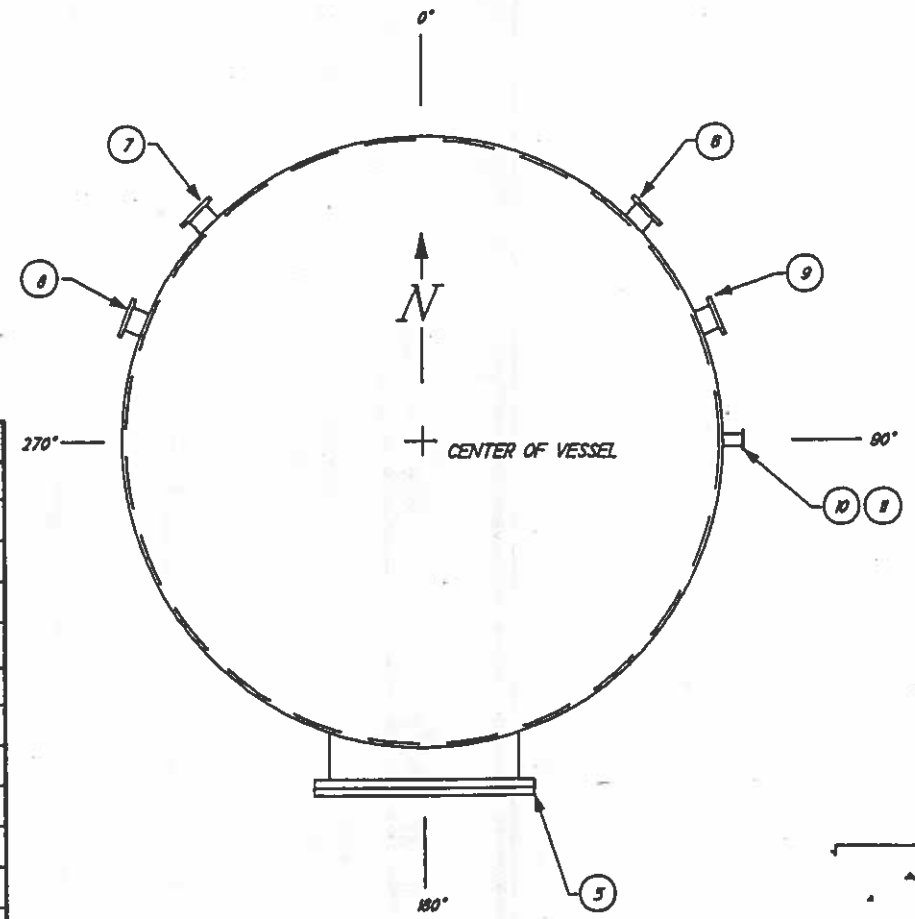
1. PROPOSED TANK SHALL BE DESIGNED, FABRICATED, AND ERECTED IN STRICT ACCORDANCE WITH AMERICAN PETROLEUM INSTITUTES STANDARD 650 1988 EDITION, (API-650). HOWEVER THE NOZZLES AND MANWAYS SHALL BE FABRICATED WITH 150# FLANGES WITH BLIND FLANGES PROVIDED.
2. THE SHELL AND CONE BOTTOM SHALL BE 3/16" MINIMUM THICKNESS. THE CONTRACTOR SHALL VERIFY THAT THIS ACCOMMODATES A 1/8" CORROSION ALLOWANCE AND MEETS THE THICKNESS REQUIREMENTS OF API-650.
3. THE FABRICATOR SHALL PROVIDE A SIDEWALL REINFORCING PAD FOR A 12" OPENING IN THE SKIRT. THIS OPENING SHALL BE FIELD LOCATED.
4. THE INTERIOR SHALL BE SAND BLASTED AND COATED (SEE NOTE NO. 8 & 10) THE TANK SHALL BE INSPECTED BY THE OWNERS REPRESENTATIVE PRIOR TO SAND BLASTING. THE VESSEL SHALL BE LEAK TESTED AT THE TIME OF THE OWNERS REPRESENTATIVES INSPECTION PRIOR TO THE COATING OF THE INTERIOR OR EXTERIOR.
5. THE FABRICATOR SHALL PROVIDE FULLY DIMENSIONED SHOP DRAWINGS FOR APPROVAL PRIOR TO COMMENCING FABRICATION.
6. ALL SHELL MANWAYS SHALL BE PROVIDED WITH DAVITS.
7. THE BASE RING SHALL BE DESIGNED TO LIMIT THE LOAD TRANSFERRED TO THE CONCRETE SLAB TO LESS THAN 2500 PSI(AVG.)
8. FLAT TOP ROOF SHALL BE USED AS A WORKING PLATFORM. ROOF MUST BE PREPARED FOR FOOT TRAFFIC SAFETY. LIVE LOAD = 100 PSI DEAD LOAD = 25 PSI
9. THE INTERIOR SHALL BE COATED WITH "SHERWIN WILLIAMS HI-HIL SHER-TAR EPOXY." THIS COATING SHALL BE APPLIED IN STRICT ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTION. WITH 2 COATS APPLIED AT THE RATE OF 8 MILS WET (3.5 MILS DRY).
10. THE EXTERIOR SHALL BE SHOP PRIMED WITH GLIDDEN EPOXY PRIMER NO. 5488 APPLIED AT 3-4 MILS DRY.



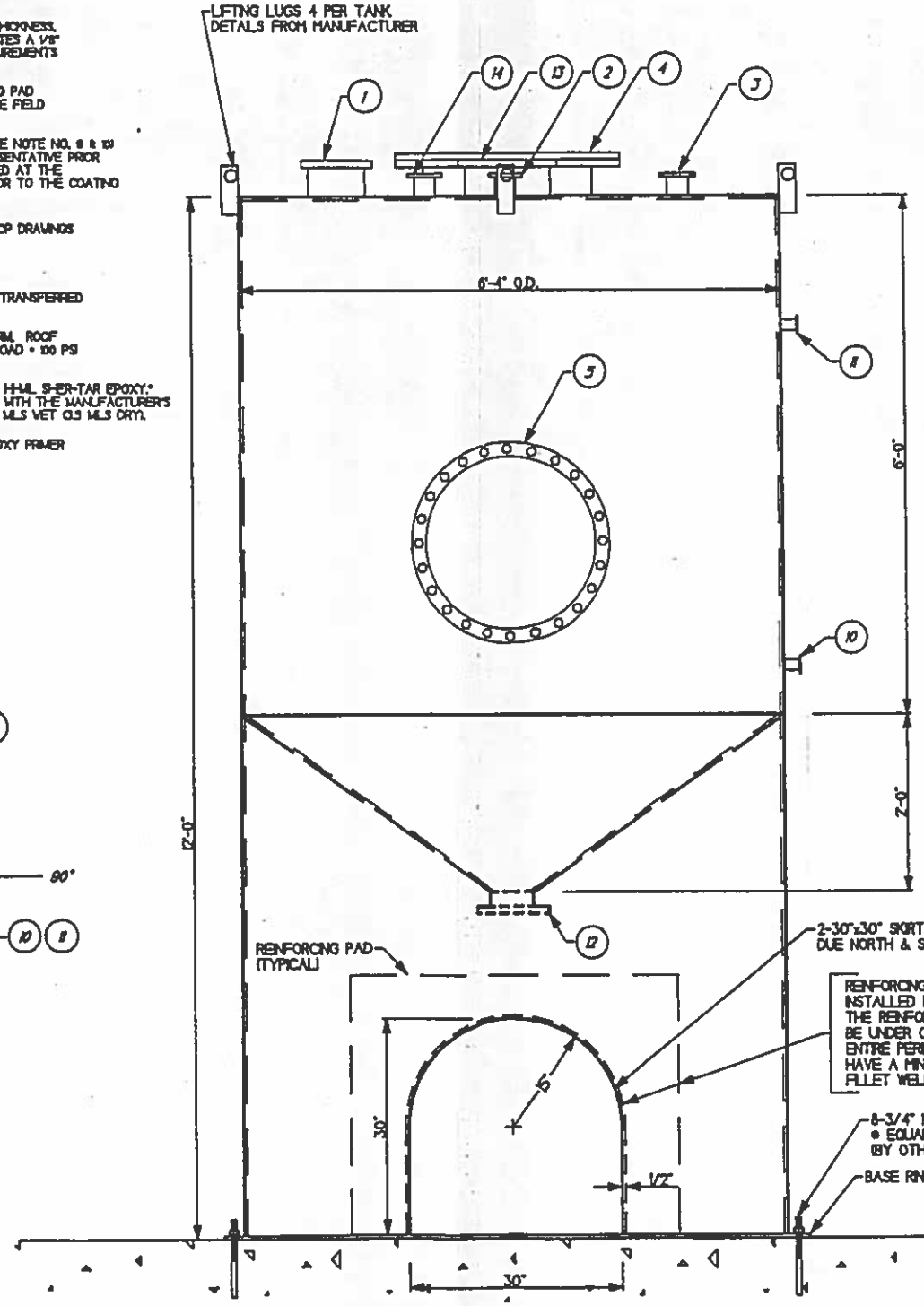
ROOF NOZZLE ORIENTATION

NOZZLE MATRIX

NOZZLE NO.	SIZE	LOCATION	[illegible]	[illegible]	DESCRIPTION
1	8"	ROOF	270°	2'-0"	FLASH TANK OVERFLOW
2	3"	ROOF	180°	2'-6"	FUTURE USE
3	3"	ROOF	90°	2'-0"	LEVEL GAUGE
4	24"	ROOF	0°	1'-1"	MANWAY
5	24"	SIDEWALL	180°	8'-0"	MANWAY
6	3"	SIDEWALL	45°	7'-8"	FILL
7	3"	SIDEWALL	315°	7'-8"	FILL
8	3"	SIDEWALL	292.5°	10'-8"	OVERFLOW
9	3"	SIDEWALL	67.5°	7'-8"	FUTURE USE
10	1"	SIDEWALL	90°	8'-8"	SIGHT GLASS
11	1"	SIDEWALL	90°	10'-8"	SIGHT GLASS
12	6"	CONE	BOTTOM	CENTER	PUMP SUCTION
13	12"	ROOF	180°	1'-6"	VENT
14	3"	ROOF	225°	2'-0"	OVERFLOW



SIDE NOZZLE ORIENTATION



ELEVATION VIEW LOOKING NORTH

RECORD DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION
1	3/26/92	REVISED CONCRETE SLAB
2	7/24/92	REVISED CONCRETE SLAB

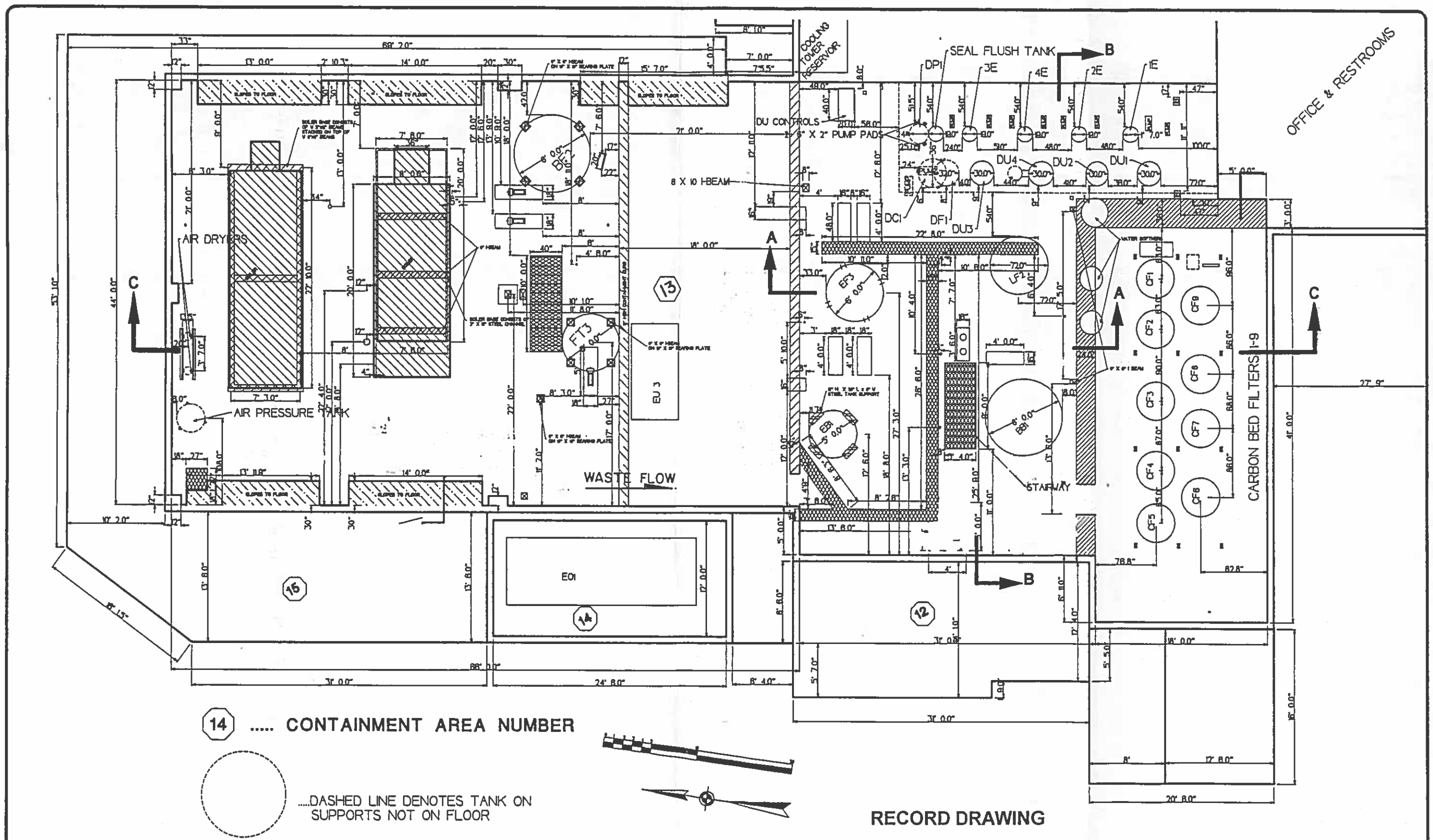
USPCI
A Subsidiary of Union Pacific Corporation

USPCI
LONE MOUNTAIN FACILITY
WAYNOKA, OKLAHOMA

Myers
ENGINEERING CORPORATION
11102 N. Stratford Dr. Suite B400
Oklahoma City, Oklahoma 73120
(405) 755-5325

EF3 CONSTRUCTION PLANS
WASTE WATER TREATMENT AREA

JOB NO. 5150
SCALE
DRAWN GRS/MWS
DATE 12/30/92
SHEET 2 OF 4



14 ..... CONTAINMENT AREA NUMBER

....DASHED LINE DENOTES TANK ON SUPPORTS NOT ON FLOOR

RECORD DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION
1	11/93	As-Built

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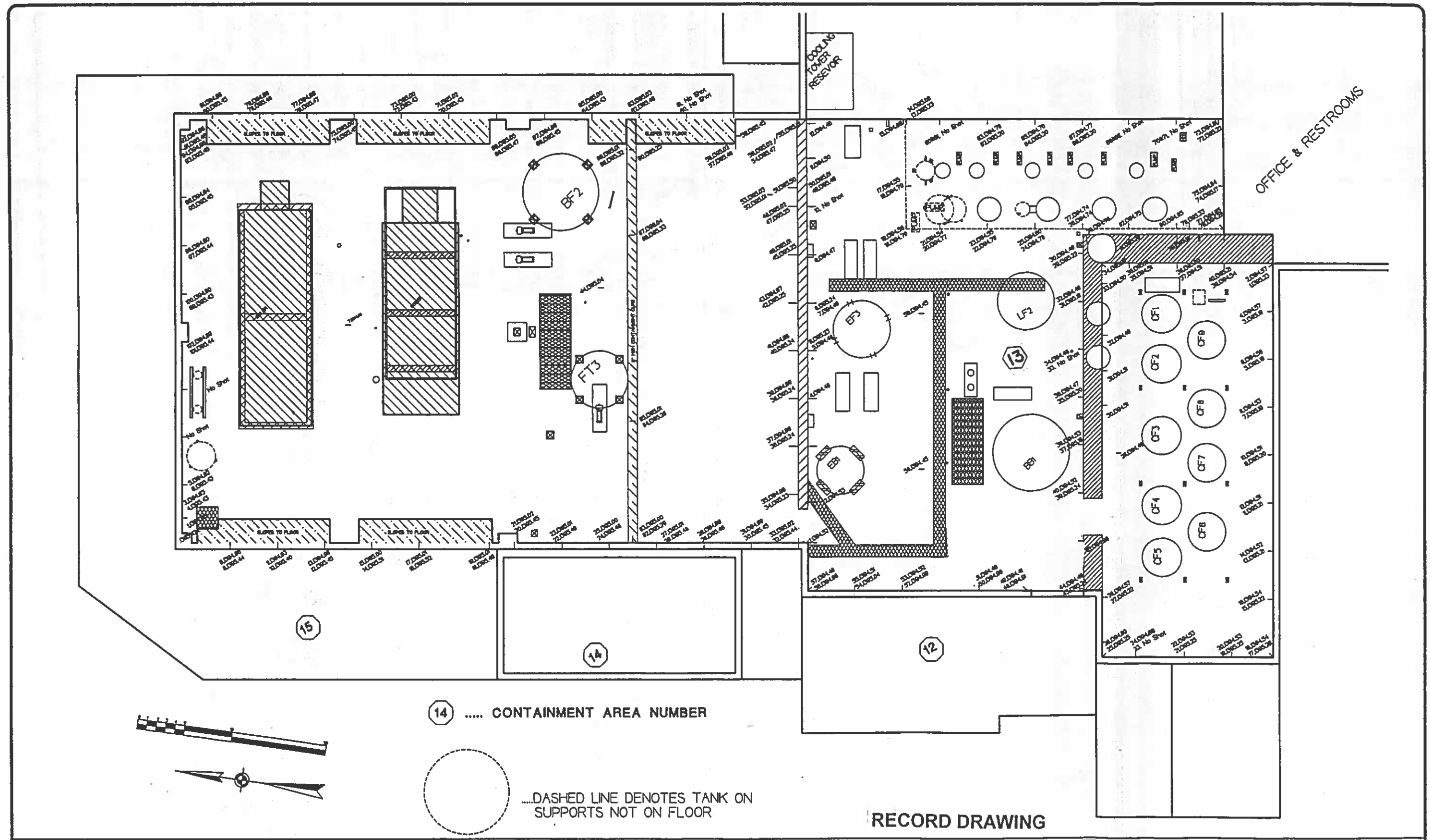
Oklahoma City, Oklahoma 73120
(405) 755-6325

WASTEWATER FINAL TREATMENT PLANT
PLAN VIEW

JOB NO.	5111
SCALE	
DRAWN	GRS
DATE	9-17-92
SHEET	OF



RECORD DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

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WAYNOKA, OKLAHOMA

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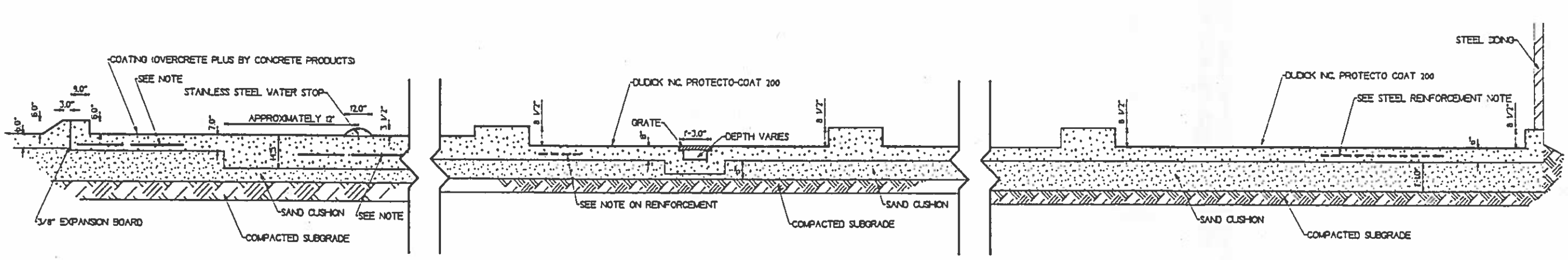
11102 N. Stratford Dr. Suite B400
Oklahoma City, Oklahoma 73120
(405) 755-5325

ELEVATIONS OF
WASTEWATER FINAL TREATMENT AREA

JOB NO.	511
SCALE	
DRAWN	mtc
DATE	9-16-92
SHEET	OF



SECTION C - C
NOT TO SCALE

NOTE: THE ACTUAL STEEL CONFIGURATION IS NOT KNOWN; HOWEVER, STEEL WAS ENCOUNTERED DURING CORING OPERATIONS.

RECORD DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

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LONE MOUNTAIN FACILITY
WAYNOKA, OKLAHOMA

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11102 N. Stratford Dr. Suite B400
Oklahoma City, Oklahoma 73120
(405) 755-5325

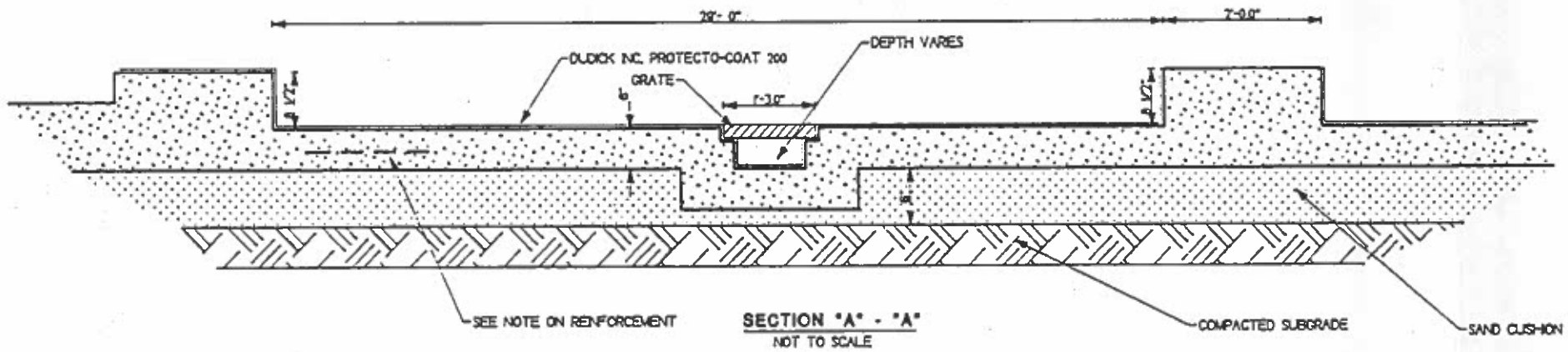
Section C-C
Containment Area Section Detail
Containment Area 13

JOB NO. 5111
SCALE NT
DRAWN VC
DATE 4/12
SHEET OF

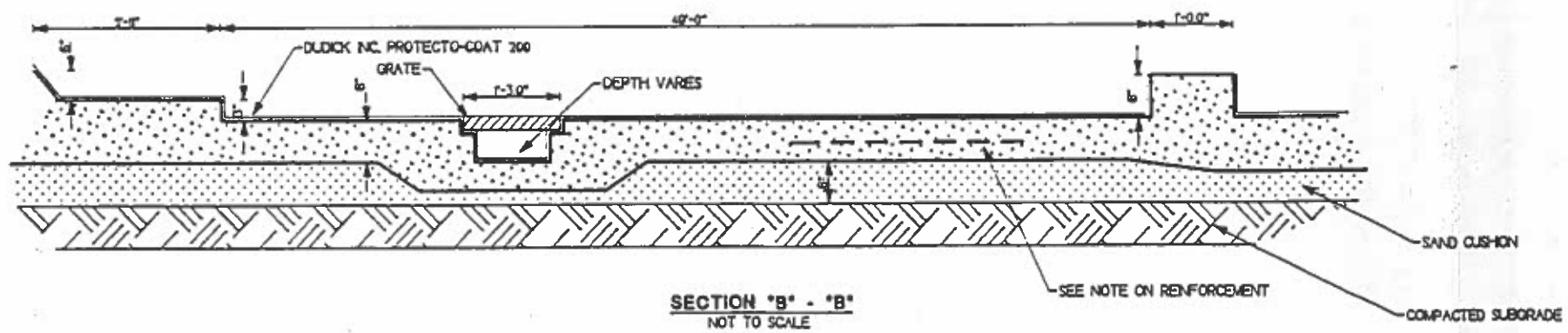
NOTE: THE ACTUAL STEEL CONFIGURATION IS NOT KNOWN, HOWEVER STEEL WAS ENCOUNTERED DURING CORING OPERATIONS.

CORING TESTS

CORE NO.	DEPTH	COMPRESSIVE STRENGTH
4	8"	7320 PSI
5	8"	7100 PSI



SECTION "A" - "A"
NOT TO SCALE



SECTION "B" - "B"
NOT TO SCALE

RECORD DRAWING

REVISIONS

NO.	DATE	DESCRIPTION

USPCI
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WAYNOKA, OKLAHOMA

Myers
ENGINEERING CORPORATION
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Oklahoma City, Oklahoma 73120
(405) 755-5325

Containment Area Section Detail
Containment Area 13B

JOB NO. 511
SCALE NTS
DRAWN CRS
DATE 9-2-92
SHEET OF

SECTION EF4

(OUT OF SERVICE)

ASSESSMENT OF EVAPORATOR FEED TANK NO. 4 (EF4)
LONE MOUNTAIN HAZARDOUS WASTE FACILITY
U.S.P.C.I./LAIDLAW
WAYNOKA, OKLAHOMA

A TANK SYSTEM DESCRIPTION

Evaporator Feed Tank No. 4 (EF4) is a new replacement welded above-ground wastewater storage and treatment tank to be installed as a part of the final wastewater treatment plant at the Lone Mountain Facility. Evaporator Feed Tank #4 (EF4) is located within the Wastewater Final Treatment building on the first mezzanine level of the support structure. The tank system consists of Evaporator Feed Tank #4 (EF4), Circulating Pump (P76), Circulating Pump (P79), Heat Exchanger #4 (EU4), and associated piping and instruments.

B PRIMARY TANK VESSEL

1. General Description

Evaporator Feed Tank No. 4 (EF4) is a circular steel tank with an outside diameter of 6'4" and a height of 12'0". The tank proper has a skirt that is anchored to the support structure, and it has a closed flat top that is vented to the atmosphere. The bottom of the tank is cone shaped. Flash Tank No. 4 is being assessed to determine if the unit is adequately designed with sufficient structural strength and compatibility with the waste to be stored.

2. Design Standards

The tank is designed and constructed to those sections that are applicable in the American Petroleum Institute Standard 650-1993 edition (API-650).

3. Hazardous Characteristics of Wastes Stored

The wastes which are stored in this tank are treated and untreated brine solutions. Representative samples of both the treated and the untreated wastes were sent for analysis. The results of those analyses are included in Appendix G of this assessment. In addition, the following characteristics of the wastes were verified:

Ignitability - Flash Point > 240° F

Corrosiveness

$7 < pH < 12$

$2 < N < 7$

Reactivity - None

Temp < 300° F

From the examination of the hazardous characteristics of the waste to be stored in this tank, it was determined that the pH and normality levels (Corrosiveness) of the waste are the primary areas of concern. This is to determine the applicability of a corrosion allowance for the tank material type and thickness.

4. Corrosion Protection

The interior of the tank is coated with two layers of Sherwin Williams Hi-Mil Sher-Tar Epoxy. Each layer is applied at a dry film thickness of not less than 7.0 mils. The exterior coating consists of one layer of Glid-Guard Corrosion Resistant HS Epoxy No. 5466 series, at a dry film thickness of not less then 3.0 mils. Appendix F contains manufacturer's information on both the interior and the exterior corrosion protection systems.

5. Documented Age of Tank

This tank was manufactured by Lide Tank Company of Mexia, Texas in November 1994 and installed in February of 1995.

6. Result of Leak Tests

The manufacturer conducted a hydrostatic leak test of the tank before shipping. A description of that test is included in Appendix D of this assessment. In addition, a visual inspection was performed of the interior and exterior of the tank after installation. This inspection was conducted specifically to detect the presence of any of the following items:

a) Weld break
b) Punctures
c) Scrapes of protective coatings
d) Cracks
e) Corrosion
f) Other structural damage or inadequacies of construction and/or installation

The tank hydrostatic test after installation is included in Appendix D of this Assessment. A description of that procedure is also included in Appendix D of this assessment. From these tests it was determined that the primary tank was not leaking.

7. Existing Data Obtained

a. Diameter of Tank		6'4"
b. Nominal Height of Tank		12'0"
c. Maximum Capacity		1625 gal.
d. Overflow Liquid level		11'6"
e. Overflow Volume		1504 gal.
f. Design Specific Gravity		1.5
g. Maximum Bottom Pressure		5.9 psi
h. Maximum Operating Temperature		250° F
i. Material of Construction		
	i) Shell, Root & Bottom	ASTM A36
	ii) Reinforcing Pads	ASTM A36
	iii) Structural Supports	ASTM A36
	iv) Steel Pipe	ASTM SA106, Grade B
	v) Bolts	ASTM SA193, B7
	vi) Flanges, Blinds, Couplings & Plugs	ASTM SA105
j. Wall Thickness		0.375"
k. Operating Pressure		Atmospheric
l. Seismic Zone		1

8. Calculation of Existing Foundation Loading

Total Weight of Tank and Contents 27,350 lbs.

Detailed calculations reflecting the volume and weight of the tank are included in Appendix A of this assessment.

9. Required Structural Calculation

Calculations for the required wall thickness for this tank are shown in Appendix B. Metallurgical information on the materials used is included in Appendix E of this assessment. The minimum required thickness in accordance with API 650, is 0.148 inches. A corrosion allowance of 0.125 is provided for. The measured wall thickness is 0.375 inches.

Design calculations for the support structure are included in Appendix C of this assessment. These calculations were done in accordance with BOCA National Building Code 1990 Edition.

Structural analysis of the foundation is included in Appendix C of this assessment.

10. Comparison of Actual to Theoretical Structural Values

Wall Thickness Comparison

Calculated Required Wall Thickness	0.1875"
Minimum Required Wall Thickness By API 650	0.148"
Measured Wall Thickness	0.375"

Bottom Thickness Comparison

Calculated Required Bottom Thickness	0.150"
Minimum required Bottom Thickness by API 650	0.250"
Measured Bottom Thickness	0.375"

Support Structure Comparison

See Appendix C of this assessment for complete comparison of the loads and support information for vertical columns, horizontal beams and diagonal bracing.

Foundation Integrity Comparison

Maximum Calculated Load (6" Slab)	17.6 Kips
Calculated Foundation Support (6" Slab)	26.7 Kips
Maximum Calculated Load (17" Slab)	62.9 Kips
Calculated Foundation Support (17" Slab)	127.7 Kips

C ANCILLARY EQUIPMENT

1. General Description

The ancillary equipment for the Evaporator Feed Tank No. 4 (EF4) system includes the following:

a) Circulating Pump (P76) - a centrifugal pump designed to pump 80 GPM at 50 feet of discharge head with a suction head of 5 feet.

b) Circulation Pump (P79) -- a centrifugal pump designed to pump 80 gpm at 50 ft. discharge head with a suction head of 5 ft.

c) Heat Exchanger (EU4) - a plate and frame unit of stainless steel construction designed to operate at a pressure of 150 PSIG and a temperature of 300°F. Manufacturer's design information is included in Appendix B of this assessment.

d) Associated piping, valves and instruments - all piping is Schedule 40 carbon steel fitted with 150 psi flanges. All piping with an inside

diameter of 2" or smaller is socket-welded using, at a minimum, 3000# connections. All piping with an inside diameter greater than 2" is butt-welded. All valves, fittings & instruments are rated for 150 psi or higher.

2. Design Standards

All piping is to be installed according to ASME/ANSI Code section B31.3. Metallurgical information on the materials used is included in Appendix E of this assessment.

3. Corrosion Protection

The exterior of all waste piping will be coated with two layers of Kem-Kromik Universal Metal Primer - B50Z Series. Each layer is applied at a dry film thickness of not less than 5 mils. Detailed information on the coating is included in Appendix F of this assessment.

4. Documented Age of Piping System

The piping and other ancillary equipment was purchased during a period of time between December 1994 and January 1995. It will be installed in April 1995.

5. Result of Leak Tests

A Hydrostatic leak test was performed in accordance with ASME/ANSI. B31.3 Chapter VI paragraph 345.5 using paragraph 345.4.2 to determine the pressure requirements of the test. A description of this testing procedure, along with the results of that test, are inserted in Appendix D of this assessment.

6. Data Obtained

Included in Appendix H of this assessment is a Piping and Flow Diagram of the treatment process. This Piping and Flow Diagram reflects data such as valves, blowoffs, vents, level controls and the overall flow pattern of the treatment process.

7. Piping Support System

A visual inspection of the pipe support system will be conducted. This inspection will include a look at such things as materials of construction, welds, and construction methods. From this inspection a determination will

be made as to the adequacy of the piping support system.

D SECONDARY CONTAINMENT SYSTEM

1. General Description of Secondary Containment

The secondary containment system was originally designed and operated to prevent any migration of wastes or liquids out of the system. Evaporator Flash Tank No. 1, Evaporator Flash Tank No. 2, Evaporator Flash Tank No. 3, Evaporator Blowdown Tank No. 2, and Evaporator Feed Tank No. 4 are located on a reinforced concrete base floor area with vertical concrete sidewalls. All associated piping is above ground and located within the secondary containment system. The area is inspected daily on a routine basis.

At the time of inspection the concrete area was withstanding daily operations, and routine climatic conditions. No cracks from compression or uplift were visually apparent.

Any released tank contents are removed and pumped to an appropriate storage area within the maximum time allowed as a permit condition.

2. Design Standards

Corings of the concrete in the existing containment area were taken and tested for comprehensive strength. A copy of the report generated from those tests is included in Appendix C of this assessment. The structural capacity of the foundation was compared to those sections that are applicable in the API-650 and the ACI-318, and these calculations were used as a guide in verifying the ability of the system to contain hazardous waste.

3. Corrosion Protection

There is an impermeable coating applied to the entire concrete floor and curbs. Appendix F of this assessment contains detailed information on the coating(s) employed.

4. Documented Age of the Containment Area

The secondary containment system was constructed and installed in 1987.

5. Result of Leak Tests

A visual inspection of the containment area was performed and from this inspection there were no cracks or breaks in the impermeable coating, therefore it appears to be adequate to contain any leaks or spills.

6. Calculation of Capacity Available (CCA)

Area	2738 s.f.
Curb Height	0.25 ft.
Material	Concrete
Gross Volume	685 c.f.

See Appendix H for detailed drawings of this containment area. Appendix A of this assessment contains detailed calculations of the available containment volume. The containment capacity available = 685 c.f.

7. Required Volume

Containment Capacity Required (CCR)

CCR=Volume of Largest Tank in the secondary containment

Volume of Largest Tank = (FT1)= 401 c.f.

8. Comparison of Available Volume to Required Volume

Containment Capacity

Containment Capacity Required =	401 c.f.
Secondary Containment Volume Available =	685 c.f
Excess Containment Volume =	284 c.f.

CCA>CCR Adequate Capacity (under normal operating conditions is available)

E CONCLUSIONS

1. The foundation, structural support beams, connections, and controls for the Evaporator Feed Tank No. 4 (EF4) System have been adequately designed.

2. The Evaporator Feed Tank No. 4 (EF4) system has sufficient structural strength, is compatible with the wastes to be stored and treated, and has adequate corrosion protection to ensure that it will not collapse, rupture or fail.

3. The Evaporator Feed Tank No. 4 (EF4) system was inspected on 3/1/95 for weld breaks, punctures scrapes of protective coating, cracks, leaks, corrosion, and other structural damage or inadequacies of construction/installation.

4. The Evaporator Feed Tank No. 4 (EF4) was tightness tested on 3/1/95, and it was found that the tank test positive for tightness.

5. The Secondary Containment for the Evaporator Feed Tank No. 4 (EF4) system is

of sufficient structural strength and of sufficient volume to meet the requirements set forth in 40 CFR 264.193.

6. All ancillary equipment associated with the Evaporator Feed Tank No. 4 (EF4) system is properly supported and protected against physical damage and excessive stress due to settlement, vibration, expansion, or contraction.

7. The Evaporator Feed Tank No. 4 (EF4) system associated ancillary equipment have been tightness tested in accordance with ASME/ANSI B31.

F CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to be the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

REGISTERED PROFESSIONAL ENGINEER
JAMES CLARK REICHENBACH
14326
OKLAHOMA

James C. Reichenbach P.E.

Date 12/9/96

Primary Tank Volume Calculations

EF4 Volume Calculations

Shell Volume $= \pi r^2 L$

$= 3.14 \times 3.17ft \times 3.17ft \times 6ft.$

$\cong 189.5\ ft^3$

Cone Volume $= \frac{1}{3}\pi r^2 L$

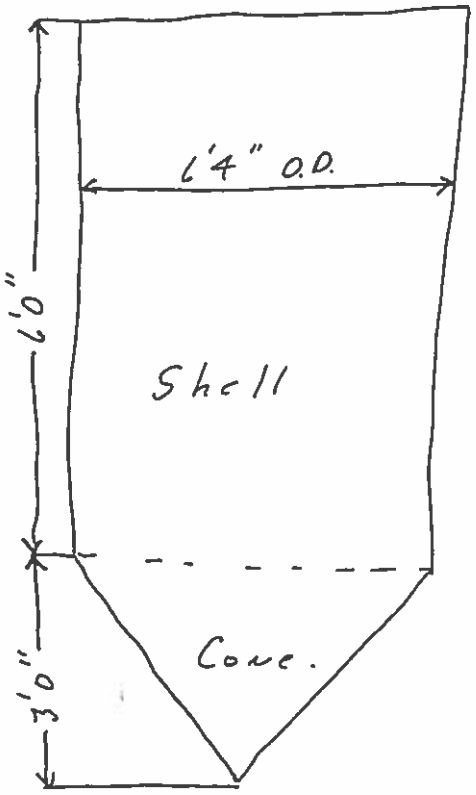
$= 0.33 \times 3.14 \times 3.17ft \times 3.17ft \times 3ft$

$\cong 31.25\ ft^3$

Total Volume = Shell Volume + Cone Volume

$= 189.5\ ft^3 + 31.25\ ft^3$

$= 220.75\ ft^3$



Secondary Containment Volume Calculations

SECONDARY CONTAINMENT VOLUME CALCULATIONS

A. DIMENSIONS

1.	Length	64′ 9"
2.	Width	44′ 0"
3.	Height	3" min

B. VOLUME (Before encroachments) 64.75′x 44′x .25′ = 712.25ft^3

C. ENCROACHMENTS

1.	Posts	16 @ 10"x 10"x 3"
2.	Posts	9 @ 12"x 10"x 3"
3.	Posts	1 @ 14"x 15"x 3"
4.	Posts	1 @ 24"x 8"x 3"
5.	Posts	2 @ 12"x 12"x 3"
6.	Posts	2 @ 32"x 12"x 3"
7.	Posts	1 @ 24"x 24"x 3"
8.	Ramps	4 @ 14′x 30"x 3"
9.	Ramps	1 @ 16′x 32"x 3"
10.	Heat Exchangers	2 @ 2′x 51"x 3"
11.	Pumps	4 @ 5′x 20"x 3"
12.	Pumps	4 @ 3′x 1′x 3"

D. ENCROACHMENT VOLUME CALCULATIONS

1.	16 x 0.83 ft x 0.83 ft x 0.25 ft =	2.75 ft^3
2.	9 x 1 ft x 0.83 ft x 0.25 ft =	1.87 ft^3
3.	1 x 1.17 ft x 1.25 ft x 0.25 ft =	0.37 ft^3
4.	1 x 2 ft x 0.67 ft x 0.25 ft =	0.34 ft^3
5.	2 x 1 ft x 1 ft x 0.25 ft =	0.5 ft^3
6.	2 x 2.67 ft x 1 ft x 0.25 ft =	1.34 ft^3
7.	1 x 2 ft x 2 ft x 0.25 ft =	1.0 ft^3
8.	4 x 1.17 ft x 2.5 ft x 0.25 ft =	2.93 ft^3
9.	1 x 1.33 ft x 2.67 ft x 0.25 ft =	0.89 ft^3
10.	2 x 2 ft x 4.25 ft x 0.25 ft =	4.25 ft^3
11.	4 x 5 ft x 1.67 ft x 0.25 ft =	8.35 ft^3
12.	4 x 3 ft x 1 ft x 0.25 ft =	3 ft^3

TOTAL ENCROACHMENT VOLUME 27.59 FT^3

AVAILABLE CONTAINMENT VOLUME 684.66 FT^3

LARGEST TANK VOLUME (FT 1) 401 FT^3

EXCESS CONTAINMENT 283.66 FT^3

Manufacturers Design Information

USPCL
item # EB2
EF4

QW-482 SUGGESTED FORMAT FOR WELDING PROCEDURE SPECIFICATION (WPS)

(See QW-200.1, Section IX, ASME Boiler and Pressure Vessel Code)

Company Name LIDE VESSELS INC. By: EVAN LEMON

Welding Procedure Specification No. BB01 Date 6-1-82 Supporting PQR No.(s) BB01

Revision No. 1 Date 5-1-90

Welding Process(es) SMAW Type(s) MANUAL

(Automatic, Manual, Machine, or Semi-Auto.)

JOINTS (QW-402) Details

Joint Design SEE PRODUCTION DRAWINGS

Backing (Yes) F4 (No) F3

Backing Material (Type) WELD METAL OR BASE METAL

(Refer to both backing and retainers.)

☐ Metal ☐ Nonfusing Metal RETAINERS NOT USED

☐ Nonmetallic ☐ Other

Sketches, Production Drawings, Weld Symbols or Written Description should show the general arrangement of the parts to be welded. Where applicable, the root spacing and the details of weld groove may be specified.

(At the option of the Mfgr., sketches may be attached to illustrate joint design, weld layers and bead sequence, e.g. for notch toughness procedures, for multiple process procedures, etc.)

BASE METALS (QW-403)

P-No. 1 Group No. 1&2 to P-No. 1 Group No. 1&2

OR

Specification type and grade --

to Specification type and grade --

OR

Chem. Analysis and Mech. Prop. --

to Chem. Analysis and Mech. Prop. --

Thickness Range:

Base Metal: Groove .1875 - 1.500 * Fillet ALL

Pipe Dia. Range: Groove ALL Fillet ALL

Other * PROCEDURE LIMITED TO 1.500 DUE TO NO PWHT

*FILLER METALS (QW-404)			
Spec. No. (SFA)	5.1	5.1	
AWS No. (Class)	E6010	E7018	
F-No.	3	4	
A-No.	1	1	
Size of Filler Metals	1/8" - 5/32"	1/8" - 5/32"	
Deposited Weld Metal	.250	.614	
Thickness Range:	--	--	
Groove	.500	1.228	
Fillet	ALL	ALL	
Electrode-Flux (Class)	--	--	
Flux Trade Name	--	--	
Consumable Insert	--	--	
Other	--	--	

*Each base metal-filler metal combination should be recorded individually.

QW-482 (Back)

WPS No. BB01 Rev. 1

POSITIONS (QW-405)
Position(s) of Groove: ALL
Welding Progression: Up F4 Down F3
Position(s) of Fillet: ALL

POSTWELD HEAT TREATMENT (QW-407)
Temperature Range: NA
Time Range: --

PREHEAT (QW-406)
Preheat Temp. Min.: 50°F ** -
Interpass Temp. Max.: 600°F
Preheat Maintenance: NA
(Continuous or special heating where applicable should be recorded)

GAS (QW-408)

	Gas(es)	Percent Composition (Mixture)	Flow Rate
Shielding	--	--	--
Trailing	--	--	--
Backing	--	--	--

ELECTRICAL CHARACTERISTICS (QW-409)
Current AC or DC: DC Polarity: REV
Amps (Range): SEE BELOW Volts (Range): SEE BELOW
(Amps and volts range should be recorded for each electrode size, position, and thickness, etc. This information may be listed in a tabular form similar to that shown below.)

Tungsten Electrode Size and Type: -- (Pure Tungsten, 2% Thoriated, etc.)

Mode of Metal Transfer for GMAW: -- (Spray arc, short circuiting arc, etc.)

Electrode Wire feed speed range: --

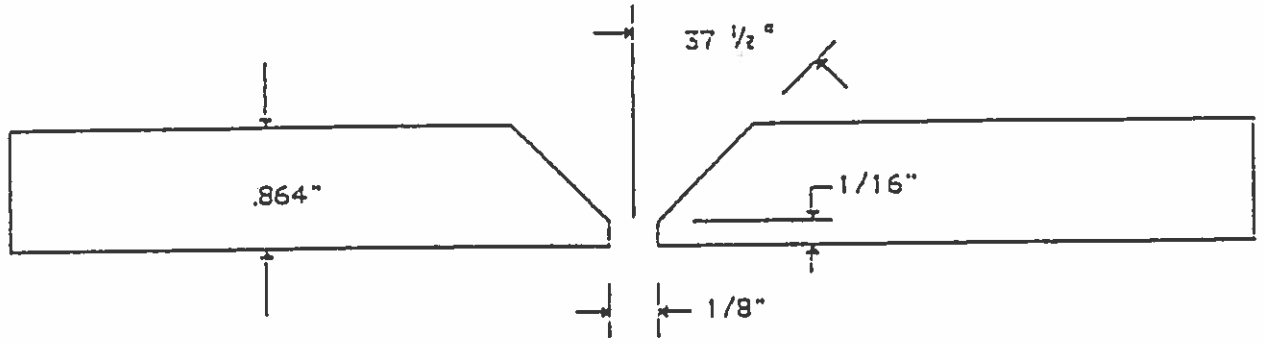
TECHNIQUE (QW-410)
String or Weave Bead: STRING
Orifice or Gas Cup Size: --
Initial and Interpass Cleaning (Brushing, Grinding, etc.): BRUSH, GRIND, OR CHIP AS NEEDED
Method of Back Gouging: AIR ARC OR GRIND AS NEEDED
Oscillation: --
Contact Tube to Work Distance: --
Multiple or Single Pass (per side): MULTIPLE
Multiple or Single Electrodes: SINGLE
Travel Speed (Range): --
Peening: NONE
Other: NO SINGLE PASS TO EXCEED 1/2" IN THICKNESS
** 200°F MINIMUM PREHEAT FOR THICKNESSES OVER 1.25" AND THROUGH 1.5"

Weld Layer(s)	Process	Filler Metal Class	Filler Metal Dia.	Current Type Polar.	Current Amp. Range	Volt Range	Travel Speed Range	Other (e.g., Remarks, Comments, Hot Wire Addition, Technique, Torch Angle, Etc.)
1&2	SMAW	E6010	1/8"	REV	75-125	18-24	NA	
"	"	"	5/32"	"	110-170	20-26	"	
REM	SMAW	E7018	1/8"	"	115-165	20-26	"	
"	"	"	5/32"	"	150-220	21-27	"	

QW-483 SUGGESTED FORMAT FOR PROCEDURE QUALIFICATION RECORD (PQR)
(See QW-200.2, Section IX, ASME Boiler and Pressure Vessel Code)
Record Actual Conditions Used to Weld Test Coupon.

Company Name LIDE VESSELS INC.
Procedure Qualification Record No. BB01 Date 5-26-82
WPS No. BB01
Welding Process(es) SMAW
Types (Manual, Automatic, Semi-Auto.) MANUAL

JOINTS (QW-402)



Groove Design of Test Coupon
(For combination qualifications, the deposited weld metal thickness shall be recorded for each filler metal or process used.)

BASE METALS (QW-403)
Material Spec. SA-106
Type or Grade B
P-No. 1 to P-No. 1
Thickness of Test Coupon .864
Diameter of Test Coupon 6-5/8" OD
Other ---

POSTWELD HEAT TREATMENT (QW-407)
Temperature NA
Time ---
Other ---

GAS (QW-408)

	Gas(es)	Percent Composition (Mixture)	Flow Rate
Shielding	---	---	---
Trailing	---	---	---
Backing	---	---	---

FILLER METALS (QW-404)		
SFA Specification	5.1	5.1
AWS Classification	E6010	E7018
Filler Metal F-No.	3	4
Weld Metal Analysis A-No.	1	1
Size of Filler Metal	1/8"	1/8"
Other	---	
Deposited Weld Metal	.250	.614

ELECTRICAL CHARACTERISTICS (QW-409)
Current DC
Polarity REV
Amps. F3-120, F4-120 Volts F3-20, F4-24
Tungsten Electrode Size NA
Other ---

POSITION (QW-405)
Position of Groove 6G
Weld Progression (Uphill, Downhill) F3-DOWN, F4-UP
Other ---

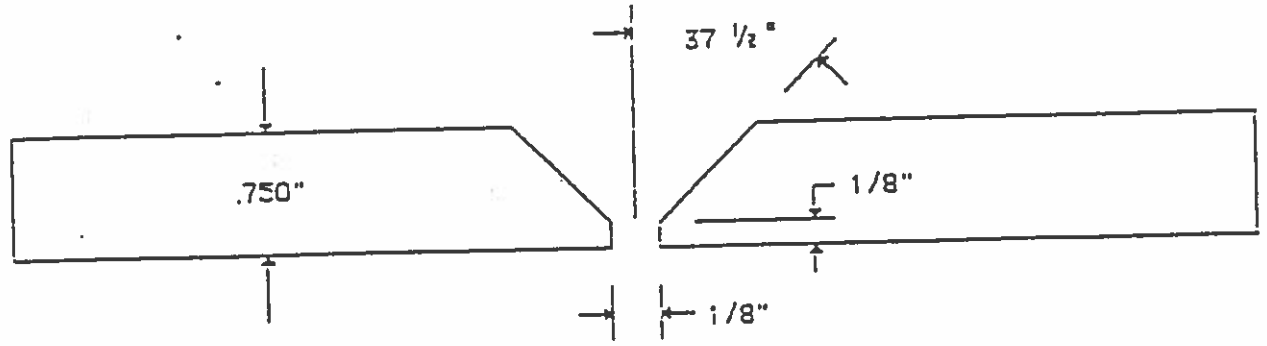
TECHNIQUE (QW-410)
Travel Speed NOT RECORDED
String or Weave Bead STRING
Oscillation NONE
Multipass or Single Pass (per side) MULTIPLE
Single or Multiple Electrodes SINGLE
Other ---

PREHEAT (QW-406)
Preheat Temp. 70°F
Interpass Temp. 500°F
Other ---

QW-483 SUGGESTED FORMAT FOR PROCEDURE QUALIFICATION RECORD (PQR)
(See QW-200.2, Section IX, ASME Boiler and Pressure Vessel Code)
Record Actual Conditions Used to Weld Test Coupon.

Company Name LIDE VESSELS INC.
Procedure Qualification Record No. BB02 Date 5-26-82
WPS No. BB02
Welding Process(es) SMAW
Types (Manual, Automatic, Semi-Auto.) MANUAL

JOINTS (QW-402)



Groove Design of Test Coupon
(For combination qualifications, the deposited weld metal thickness shall be recorded for each filler metal or process used.)

BASE METALS (QW-403)
Material Spec. SA-36
Type or Grade --
P-No. 1 to P-No. 1
Thickness of Test Coupon .750
Diameter of Test Coupon --
Other PLATE

POSTWELD HEAT TREATMENT (QW-407)
Temperature NA
Time --
Other --

GAS (QW-408)

	Gas(es)	Percent Composition (Mixture)	Flow Rate
Shielding	--	--	--
Trailing	--	--	--
Backing	--	--	--

FILLER METALS (QW-404)

SFA Specification	5.1	5.1
AWS Classification	E6010	E7024
Filler Metal F-No.	3	1
Weld Metal Analysis A-No.	1	1
Size of Filler Metal	1/8"	3/16"
Other	--	
Deposited Weld Metal	.250"	.500"

ELECTRICAL CHARACTERISTICS (QW-409)
Current DC
Polarity REV
Amps. F3-110, F1-250 Volts F3-20, F1-22
Tungsten Electrode Size --
Other --

POSITION (QW-405)
Position of Groove 1G
Weld Progression (Uphill, Downhill) FLAT
Other --

TECHNIQUE (QW-410)
Travel Speed NOT RECORDED
String or Weave Bead STRING
Oscillation --
Multipass or Single Pass (per side) MULTIPLE
Single or Multiple Electrodes SINGLE
Other --

HEAT (QW-406)
Preheat Temp. 70°F
Interpass Temp. 500°F
Other --

QW-482 SUGGESTED FORMAT FOR WELDING PROCEDURE SPECIFICATION (WPS)
(See QW-200.1, Section IX, ASME Boiler and Pressure Vessel Code)

Company Name LIDE VESSELS INC. By: EVAN LEMON

Welding Procedure Specification No. 8802 Date 5-28-82 Supporting PQR No.(s) 8802

Revision No. 1 Date 3-7-89

Welding Process(es) SMAW Type(s) MANUAL
(Automatic, Manual, Machine, or Semi-Auto.)

JOINTS (QW-402) Details

Joint Design SEE PRODUCTION DRAWINGS

Backing (Yes) (No) XX

Backing Material (Type) WELD METAL OR BASE METAL
(Refer to both backing and retainers.)

☐ Metal ☐ Nonfusing Metal NO RETAINERS USED

☐ Nonmetallic ☐ Other

Sketches, Production Drawings, Weld Symbols or Written Description should show the general arrangement of the parts to be welded. Where applicable, the root spacing and the details of weld groove may be specified.

(At the option of the Mfgr., sketches may be attached to illustrate joint design, weld layers and bead sequence, e.g. for notch toughness procedures, for multiple process procedures, etc.)

BASE METALS (QW-403)

P-No. 1 Group No. 1&2 to P-No. 1 Group No. 1&2

OR

Specification type and grade --

to Specification type and grade --

OR

Chem. Analysis and Mech. Prop. --

to Chem. Analysis and Mech. Prop. --

Thickness Range:

Base Metal: Groove .1875" - 1.5" Fillet ALL

Pipe Dia. Range: Groove ALL Fillet ALL

Other --

*FILLER METALS (QW-404)			
Spec. No. (SFA)	5.1	5.1	
AWS No. (Class)	E6010	E7024	
F-No.	3	1	
A-No.	1	1	
Size of Filler Metals	1/8", 5/32"	1/8", 5/32", 3/16"	
Deposited Weld Metal	.250	.500	
Thickness Range:	--	--	
Groove	.500	1.00	
Fillet	ALL	ALL	
Electrode-Flux (Class)	--	--	
Flux Trade Name	--	--	
Consumable Insert	--	--	
Other	--	--	

*Each base metal-filler metal combination should be recorded individually.

QW-482 (Back)

WPS No. BB02 Rev. 1

POSITIONS (QW-405)
Position(s) of Groove F3-ALL, F1-FLAT
Welding Progression: Up F3 Down ___
Position(s) of Fillet ALL

POSTWELD HEAT TREATMENT (QW-407)
Temperature Range NA
Time Range ___

PREHEAT (QW-406)
Preheat Temp. Min. 50°F *
Interpass Temp. Max. 600°F
Preheat Maintenance NONE
(Continuous or special heating where applicable should be recorded)

GAS (QW-408)

	Gas(es)	Percent Composition (Mixture)	Flow Rate
Shielding	--	--	--
Trailing	--	--	--
Backing	--	--	--

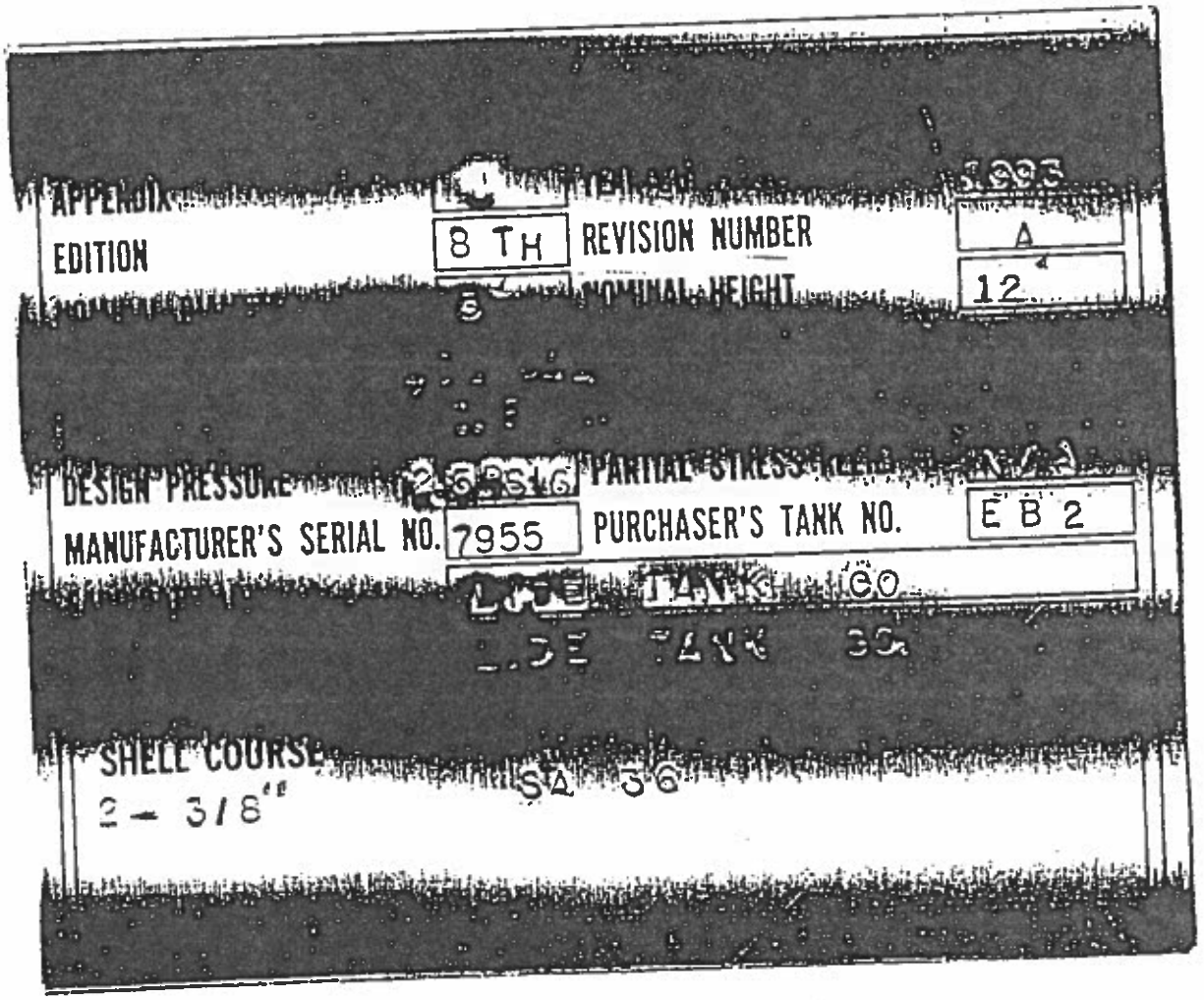
ELECTRICAL CHARACTERISTICS (QW-409)
Current AC or DC DC Polarity REV
Amps (Range) SEE BELOW Volts (Range) SEE BELOW
(Amps and volts range should be recorded for each electrode size, position, and thickness, etc. This information may be listed in a tabular form similar to that shown below.)

Tungsten Electrode Size and Type -- (Pure Tungsten, 2% Thoriated, etc.)
Mode of Metal Transfer for GMAW -- (Spray arc, short circuiting arc, etc.)
Electrode Wire feed speed range --

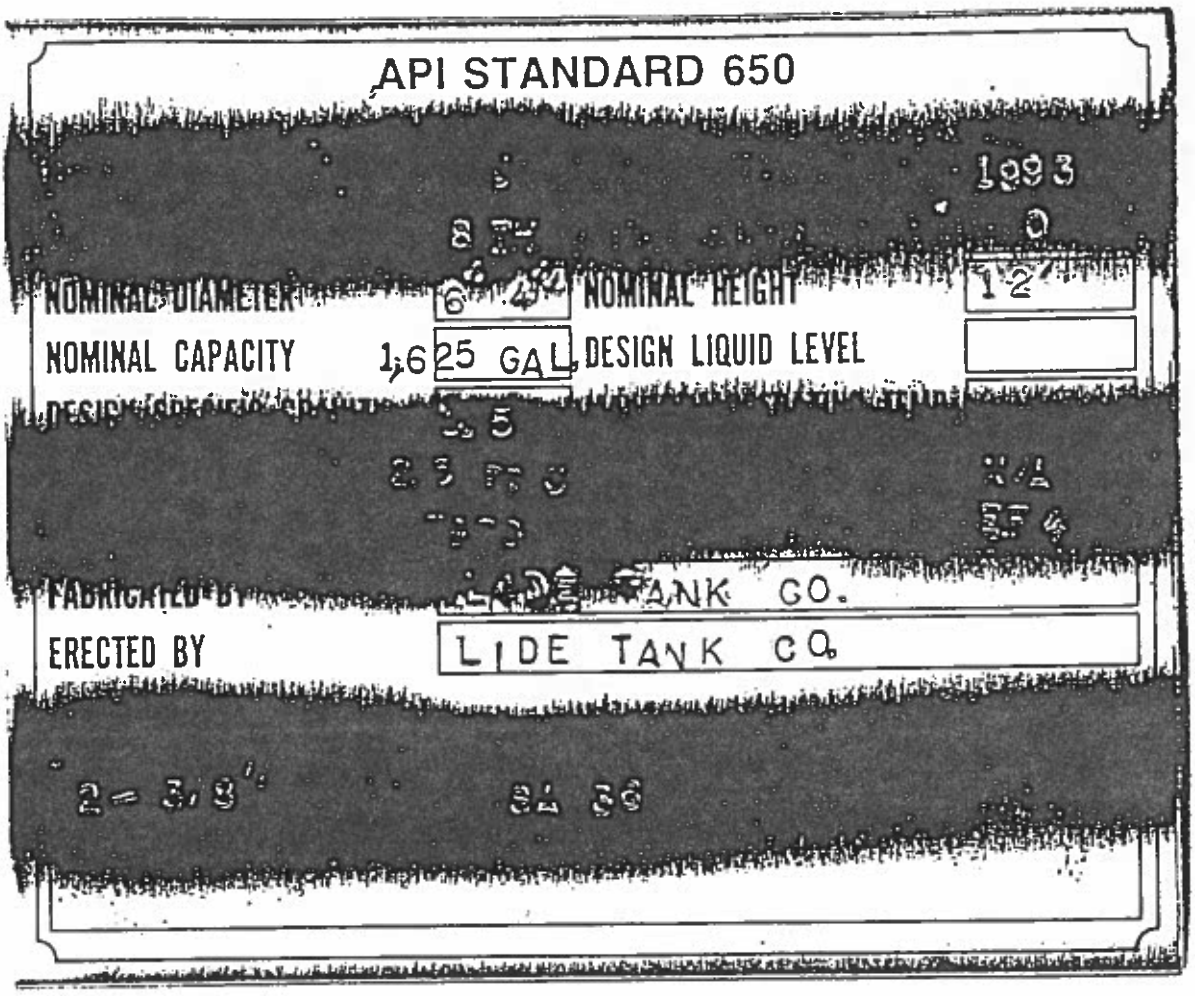
TECHNIQUE (QW-410)
String or Weave Bead STRING
Orifice or Gas Cup Size --
Initial and Interpass Cleaning (Brushing, Grinding, etc.) BRUSH, GRIND, OR CHIP AS NEEDED
Method of Back Gouging AIR ARC OR GRIND AS NEEDED
Oscillation --
Contact Tube to Work Distance --
Multiple or Single Pass (per side) MULTIPLE
Multiple or Single Electrodes SINGLE
Travel Speed (Range) --
Peening NONE
Other NO SINGLE PASS TO EXCEED 1/2" IN THICKNESS
* 200°F MINIMUM PREHEAT FOR THICKNESSES OVER 1.25" AND INCLUDING 1.5"

Weld Layer(s)	Process	Filler Metal Class	Filler Metal Dia.	Current Type Polar.	Current Amp. Range	Volt Range	Travel Speed Range	Other (e.g., Remarks, Comments, Hot Wire Addition, Technique, Torch Angle, Etc.)
1&2	SMAW	E6010	1/8"	REV	75-125	18-24	NA	
"	"	"	5/32"	"	110-170	20-26	"	
REM	"	E7024	1/8"	"	140-190	18-24	"	
"	"	"	5/32"	"	180-250	20-26	"	
"	"	"	3/16	"	230-305	21-27	"	

USPCI


APPENDIX
EDITION
8 TH
REVISION NUMBER
A
12
DESIGN PRESSURE
MANUFACTURER'S SERIAL NO.
7955
PURCHASER'S TANK NO.
E B 2
SHELL COURSE
2 - 3/8"
SA 36

USPCI



API STANDARD 650

1993

NOMINAL DIAMETER 6' 4"

NOMINAL HEIGHT 12'

NOMINAL CAPACITY 1,625 GAL

DESIGN LIQUID LEVEL

FABRICATED BY LIDE TANK CO.

ERECTED BY LIDE TANK CO.

QW-483 (Back)

PQR No. 9802

Tensile Test (QW-150)

Specimen No.	Width	Thickness	Area	Ultimate Total Load lb	Ultimate Unit Stress psi	Type of Failure & Location
1	.505	DIA.	.200	14120	70600	WLD DUCT
2	.506	DIA.	.201	13740	68400	BM DUCT

Guided-Bend Tests (QW-160)

Type and Figure No.	Result
SIDE BEND QW-462.2	ACCEPTABLE
SIDE BEND QW-462.2	ACCEPTABLE
SIDE BEND QW-462.2	ACCEPTABLE
SIDE BEND QW-462.2	ACCEPTABLE

Toughness Tests (QW-170)

Specimen No.	Notch Location	Notch Type	Test Temp.	Impact Values	Lateral Exp.		Drop Weight	
					% Shear	Mils	Break	No Break

Fillet-Weld Test (QW-180)

Result — Satisfactory: Yes -- No -- Penetration into Parent Metal: Yes -- No --

Macro—Results --

Other Tests

Type of Test --

Deposit Analysis --

Other

Welder's Name BILLY LIDE Clock No. _____ Stamp No. L

Tests conducted by: SOUTHWESTERN LABORATORIES Laboratory Test No. D9-8220-1

We certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance with the requirements of Section IX of the ASME Code.

Manufacturer LIDE VESSELS INC.

Date 9-11-90 By Brian Lemon

(Detail of record of tests are illustrative only and may be modified to conform to the type and number of tests required by the Code.)

QW-483 (Back)

PQR No. 8B01

Tensile Test (QW-150)

Specimen No.	Width	Thickness	Area	Ultimate Total Load lb	Ultimate Unit Stress psi	Type of Failure & Location
1	.506	DIA	.201	15800	78600	BM DUCT
2	.506	DIA	.201	15600	77600	BM DUCT

Guided-Bend Tests (QW-160)

Type and Figure No.	Result
SIDE BEND QW-462.2	ACCEPTABLE
SIDE BEND QW-462.2	ACCEPTABLE
SIDE BEND QW-462.2	ACCEPTABLE
SIDE BEND QW-462.2	ACCEPTABLE

Toughness Tests (QW-170)

Specimen No.	Notch Location	Notch Type	Test Temp.	Impact Values	Lateral Exp.		Drop Weight	
					% Shear	Mils	Break	No Break

Fillet-Weld Test (QW-180)

Result — Satisfactory: Yes ______ No ______ Penetration into Parent Metal: Yes ______ No ______

Macro—Results ______

Other Tests

Type of Test BNH F3 WELD-174 HAZ-179, F4 WELD-179 HAZ-182 & 185

Deposit Analysis ______

Other ______

Welder's Name JOHN MCKINNEY Clock No. 114 Stamp No. M

Tests conducted by: SOUTHWESTERN LAB Laboratory Test No. D9-8220-2

We certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance with the requirements of Section IX of the ASME Code.

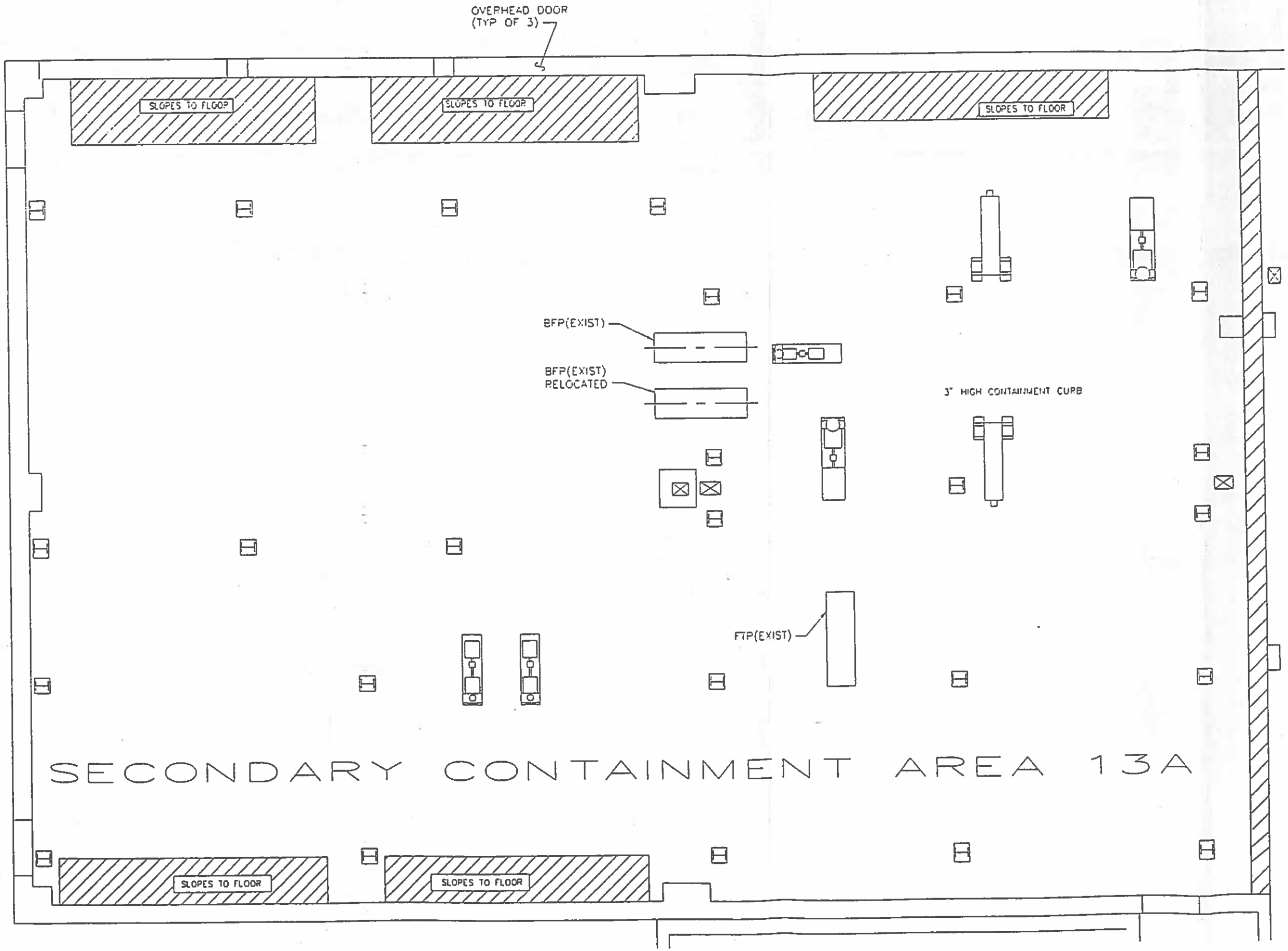
Manufacturer LIDE VESSELS INC.

Date 6-2-82 By [signature]

(Detail of record of tests are illustrative only and may be modified to conform to the type and number of tests required by the Code.)

Tank Wall Thickness

Secondary Containment Drawings


OVERHEAD DOOR
(TYP OF 3)
SLOPES TO FLOOR
SLOPES TO FLOOR
SLOPES TO FLOOR
BFP(EXIST)
BFP(EXIST)
RELOCATED
3" HIGH CONTAINMENT CURB
FTP(EXIST)
SECONDARY CONTAINMENT AREA 13A
SLOPES TO FLOOR
SLOPES TO FLOOR

KSL ENGINEERING & DESIGN INC.
306 RIDGECREST
TYLER, TEXAS 75701

CHECK SEISMIC

D/H = 5.0/12.0 = .42

TANK SHELL = 3360 lbs
TANK ROOF 400 lbs
TANK CONTENTS 14,700 lbs

Z = .1875 FOR ZONE 1
I = 1.0

FIND EFFECTIVE MASS W_1 & W_2

FROM APP. E FIG. E-2 FOR D/H = .42

$\frac{W_1}{W_T} = .1$ $\frac{W_2}{W_T} = .9$

$W_1 = 1470$ lbs $W_2 = 13,230$ lbs

FIND X_1 & X_2 FROM FIG. E-3

$X_1/H = .43$ $X_2/H = .85$

$X_1 = 5.2$ FT $X_2 = 10.2$ FT

NATURAL PERIOD $T = K\sqrt{D}$ WHERE $K = .59$ FOR FIG. E-4

$T = .59\sqrt{5} = 1.32 \Rightarrow C_1 = .24$ $C_2 = \frac{.305}{T} = \frac{.30(1.5)}{1.32}$

$C_2 = .34$ for $S = 1.5$ UNKNOWN SOIL CONDITION

$M = ZI(C_1 W_s X_s + C_1 W_r H_t + C_1 W_1 X_1 + C_2 W_2 X_2)$
(shell, roof, TANK SLOSHING)

$M = .1875(1.0)[.24(3360)9.0 + .24(400)12 + .24(1470)5.2 + .34(13,230)10.2] =$

$M = 10,524$ ft-lb

FOR ANCHORED TANK CHECK SHELL COMP. STRESS b

$b = \frac{4200\text{ lb}}{5.0(\pi)} + \frac{1.273(10,524)}{(5.0)^2} = 803$ lb/ft of circ

Stress: $\frac{803}{12(.25)} = 270$ psi OK

Allow. Compressive = $.50 F_y = .5(3$

KSL ENGINEERING & DESIGN INC.
306 RIDGECREST
TYLER, TEXAS 75701

SHELL DESIGN $t_s = \frac{2.6\,D(H-1)\,G}{E\,(21{,}000)} + CA$

$t_s = \frac{2.6\,(5)\,6\,(1.5)}{.7\,(21000)} + 1/8" \Rightarrow .008" + 1/8" = .133"$

3/8" SHELL IS OK

HEAD DESIGN BTM CONE

$t_c = t_s/\cos\alpha = .004/\cos 42.7 = .0104 + 1/8" = .136"$

3/8" CONE OK

TOP HEAD: FLAT PLATE DESIGN

LOADING IS 50psf (DEAD + 100psf LIVE LOAD

$150\,lbs/144 = 1.04\ psi$

$t_h = D\sqrt{\frac{CP}{S}} + 1/8"$ C = .25 for WELDED CONNECTED JOINT

$t_h = 60"\sqrt{\frac{.25(1.04}{21{,}000}} + 1/8" \quad .211 + 1/8" = .336"$

3/8" HEAD PLATE OK

CHECK WIND ASSUME: TANK EMPTY
EFF DIA = 6'
SHAPE FACTOR .80

WIND PRESS. $.00256\,(100)^2 = 26\,psf$

WIND FORCE $26\,psf\,(.8)\,6'\,(12') = 1500\#$

MOMENT = $1500\,lb\,(12'/2) - 4200\#\,(5.3/2) = -2130\,ft\text{-}lb$

NO UPLIFT

KSL ENGINEERING & DESIGN INC.
306 RIDGECREST
TYLER, TEXAS 75701

STRUCTURAL DESIGN

5'-0" I.D. x 12'-0" TALL

DESIGN CONDITIONS: ATMOSPHERIC TANK

DESIGN TEMP 250°F

WIND VELOCITY 100 MPH SEISMIC ZONE 1

S.G. = 1.5

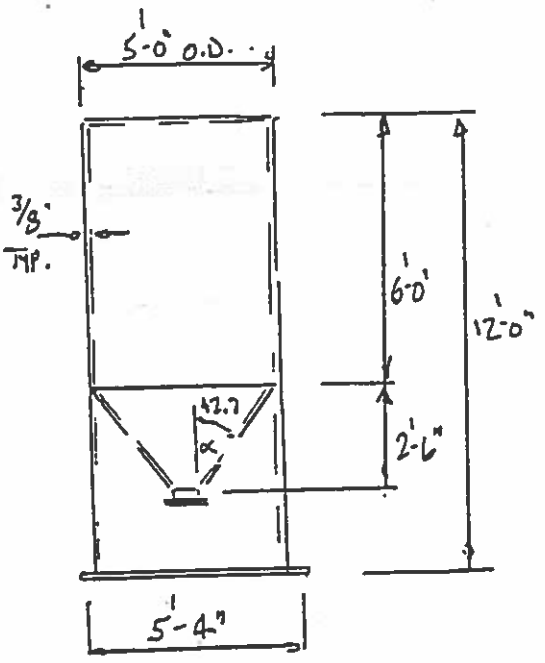
CORROSION ALLOW. = 1/8"

SHELL & HEAD 3/8" THK

CONE ANGLE α = 42.7°

TANK EMPTY 4200#

TANK FULL 17,200#



STRESS CORRECTION FOR 250°F = .90 Y_S

.90(36000) = 32,400 > 1 ALLOWABLE = 2/3 Y_S = 2/3 (32,400)

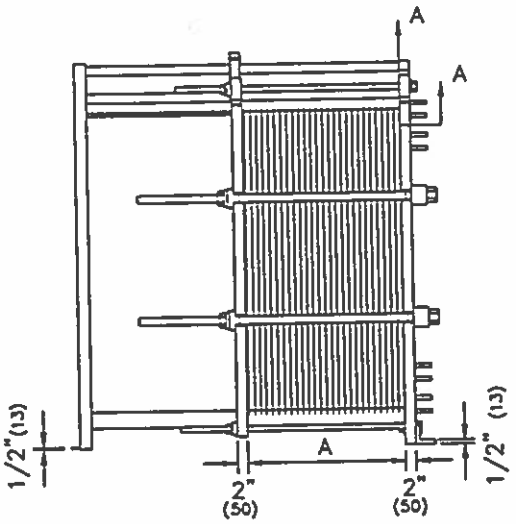
ALLOWABLE = 21,600 psi

Heat Exchanger

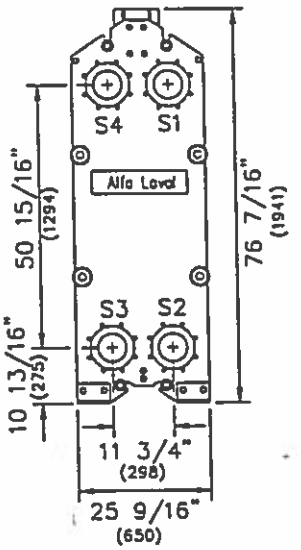
Designed, Constructed and National Board Stamped in Accordance with latest 1992 A.S.M.E. Code and Addendum.

Alfa Laval

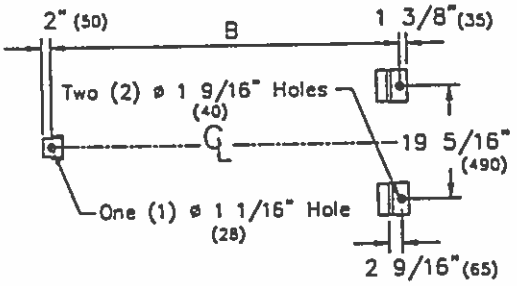
Side



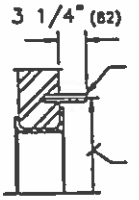
Front



Footing



Section AA



B= 42 5/16"(1075) A= See Plate Spec Documentation Dimensions in () are millimeters(mm)

Connections

LOC	Function	Fluid	Material	Size	Rating	Type
S1	Hotside Inlet	30.7 psig Steam	SS	6"	150#	STUD
S2	Hotside Outlet	30.7 psig Steam	SS	6"	150#	STUD
S3	Coldside Inlet	Solution	SS	6"	150#	STUD
S4	Coldside Outlet	Solution	SS	6"	150#	STUD

Notes: Carboline 134 1.5 mils DFT (Alfa Laval Blue)

CERTIFIED
APPROVED FOR FABRICATION
BY _____ DATE 10/23/94

Customer Name : USPCI
P.O. Number : 20572
Item : # 2 Heat Exchangers
Order Number : 942005
A/L Serial#(s) : 30101-96638 thru 96639

Design Press/Temp.: 150 PSI / 300 °F
Plate/Gasket Mat'l: AISI 316 / EPDM
Plates Actual/Max.: 39 / 64 (0.5mm)
Weight Dry/Flooded: 2350 lb / 2607 lb
Length CBar/TBolt.: 900 mm / 750 mm

M15-FFG
Plate Heat Exchanger

Alfa Laval Thermal Inc.
Manufactured in Richmond, Virginia

rev.	description	by	ck	date
A	Revised Stud Bolt, Foot Dimension & Foot Print	MG	AV	11/91

by	date	check	date	approval	date
MG	11/91	AV	11/91	TC	11/91

Rev: A 0

Alfa Laval Thermal Inc.
5400 International Trade Drive
Richmond, VA 23231

Plate Heat Exchanger
Bill of Materials

Implementation Date: 2/28/94
Revision: 1

QA03138

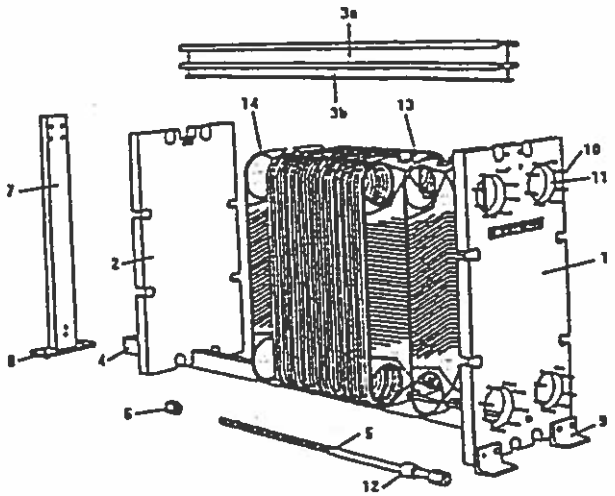
Subject: M15-FFD

BACKGROUND
Given are standard ASME/ASTM materials of construction.

No.	Item	Quantity	Material	Notes	Dimensions
1.	Frame Plate	1	SA516-70	1	
2.	Pressure Plate	1	SA516-70	1	
3a.	Carrying Bar	1	Aluminum		900 mm
3b.	T-Profile Cladding	2	SA240,304SS		
4.	Guide Bar	1	SA479,304SS		900 mm
5.	Tightening Bolt	8	SA193,B7		750 mm 2" - 4 1/2 UNC
6.	Tightening Nut	8	SA194,2H2		2" - 4 1/2 UNC
7.	Support Column	1	Aluminum		
8.	Support Foot	1	SA36	1	
9.	Frame Foot	2	SA36	1	
10.	Stud Bolt	48	SA193,B7	2	
11.	Connection Liner	4	SA240,316SS		
12.	N/A				
13.	Channel Plate Gasket	40	EPDM		
14.	Channel Plate	39	SA240,316SS		Electropolished
Not Shown					
	OSHA Shroud	1	Aluminum	3	

Notes: (1)Painted. (2)Zinc Plated. (3)Not Shown

Drawing is not an accurate depiction, see certified print.



USPCI
P.O. #: 20572
TAG: #2 HEAT EXCHANGERS
A/L ORDER #: 942005
A/L SERIAL #: 30101-96638
30101-96639

CERTIFIED
APPROVED FOR FABRICATION
BY _____ DATE 6/23/94

A L F A - L A V A L T H E R M A L

PLATE HEAT EXCHANGER
Specification Sheet

CUSTOMER: USPCI
Supplier: Alfa Laval Thermal Inc.
Agent: Charles Martin, Thermal Engineering Co

P.O.#: 20572
Order#: 942005
Tag#: # 2 Heat Exchangers

Quantity: 2
Serial#: 30101-96638 thru 96639

PHE Model Type: M15-FFG

		HOT SIDE -1-	COLD SIDE =2=
Fluids		: 30.7 psig Steam	Solution
Flow rates	lb/hr	10349	312000
Inlet temperature	F	275.0	180.0
Outlet temperature	F	272.2	230.0
Pressure drops	psi	2.0	8.9
Total Surface Area		: 260 sq ft	
Flow regimen fluids		: counterflow	
Connection locations	in :	S1	S3
	out :	S2	S4
Material in connections		: SS	SS
Total number of plates		: 39	
Plates material		: AISI 316	
thickness		: 0.5mm	
Gasket material		: EPDM Clip-on	
Design pressure		: 150 PSI	
Design temperature		: 300 F	
Liquid volumes	US gallon	13	13
Total unit dry weight		: 2300 lb	

CERTIFIED
APPROVED FOR FABRICATION
BY _____ DATE 6/29/94

Document

Date 06/22/94

CUSTOMER: USPCI

P.O.#: 20572

ALFA-LAVAL THERMAL PLATE HEAT EXCHANGER

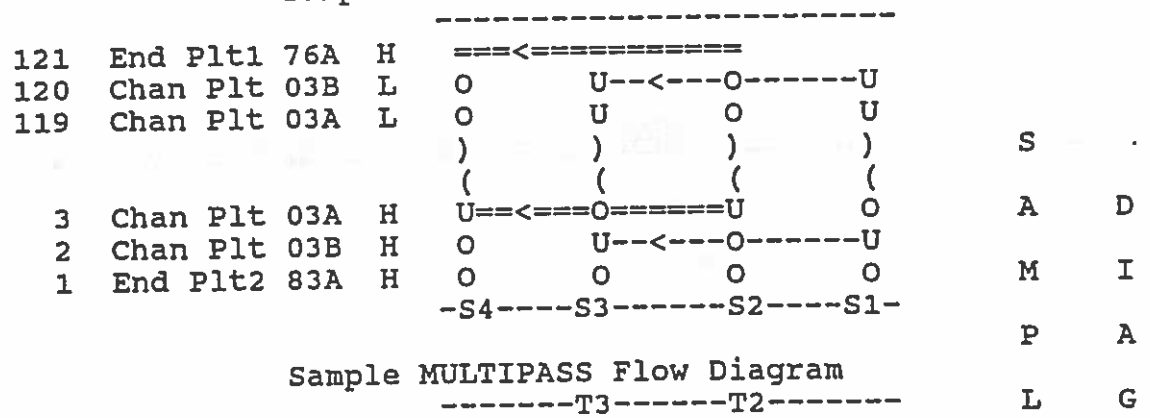
Model Type M15-FFG
Quantity 2
Serial#: 30101-96638 thru 96639
Supplier: Alfa Laval Thermal Inc. Order#: 942005
Agent: Charles Martin, Thermal Engineering Co Tag#: # 2 Heat Exchangers

Gasket sides of the plates are facing the frame plate.
Plates with parallel flow.

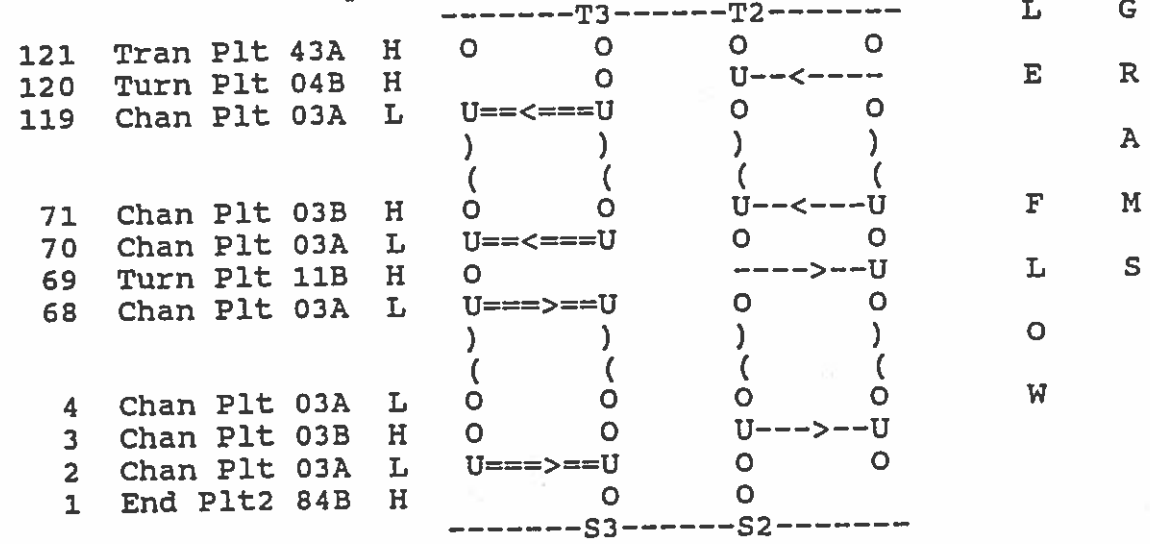
Plates material	AISI 316
thickness	0.5mm
Gasket material	EPDM Clip-on
A - Dimension (See Drawing)	174 mm
Total number of plates	39
Total unit dry weight	2300 lb
Extra/Inspection port location	Side 1: Side 2:

SAMPLE FLOW DIAGRAMS

Sample SINGLEPASS Flow Diagram



Sample MULTIPASS Flow Diagram



See following page for Flow Diagram Discriptions.
*** SEE PAGE 1 FOR YOUR FLOW DIAGRAM. ***

ument

==========FLOW DIAGRAM DESCRIPTIONS==========

Singlepass....Plate heat exchanger with connections on frame plate (stationary cover) only.
Multipass.....Plate heat exchanger with both frame plate and pressure plate (movable cover) connections.
S1,S2,S3,S4...Frame plate connection designations.
T1,T2,T3,T4...Pressure plate connection designations. (See drawing for locations of T and S ports.)

----------PLATE DESCRIPTIONS----------

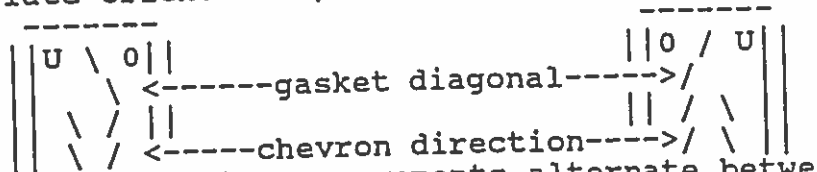
1 to 121...Plate position starting from frame plate.
Chan Plt...Channel Plate. Standard 4-port channel plate. Gasketed so that flow from two ports opens to the channel plate center.
End Plt2...End Plate 2. Channel plate adjacent to frame plate. With port holes fully gasketed so that flow does not go between this plate and the frame plate.
End Plt1...End Plate 1. Channel plate adjacent to pressure plate on single pass unit.
Turn Plt...Turning Plate. Redirects flow with port locations which are not punched (no U or O) on multipass units.
n Plt...Transition Plate. Channel plate adjacent to both pressure plate and partition plates on multipass unit.
rt Plt...Partition Plate. Thicker steel plate required on some multipass units.
Twin Plt...Twin plate. Channel plate type used on welded units only.
76,03,83...Plate hole punching description. A-L internal use only.

----------PORT PUNCHING----------

O.....Port surrounded by ring gasket. Fluid in this port
U.....Flow opening port. Fluid flows into this channel.
No O or U..If no U or O is shown then this port location is not punched and fluid does not flow through this port.

----------PLATE ORIENTATION----------

A,B.....Plate orientation, as seen from gasketed side of plates:



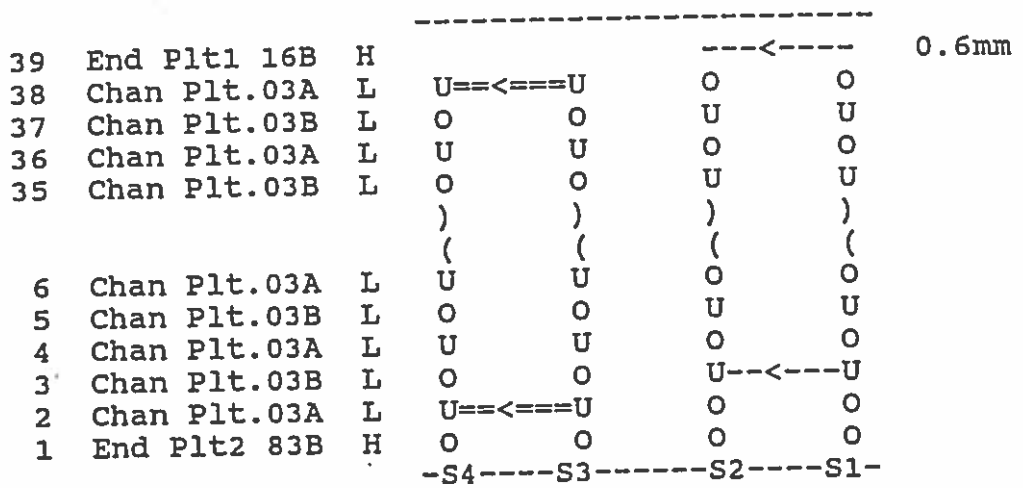
(Channel plate arrangements alternate between A and B plates)

.....High Theata channel plate. Chevrons at angle greater than 90 degrees.
.....Low Theata channel plate. Chevrons at angle less than 90 degrees.
(Channel plate arrangements can have all Highs, all Lows or a mixture of Highs and Lows.)

---------- 942005\1

2*M15-F CH__ AISI_316 0.5mm EPDM_Clip-on 06/22/94

1*19 L S1->S2 30.7 psig Steam
1*19 L S4<=S3 Solution



942005\1

Plates:		M15-F CH__ AISI_316 0.5mm EPDM_Clip-on		
74	37	Chan Plt.03 L	Channel plate	
2	1	End Plt1 16B H	End plate 1	0.6mm
2	1	End Plt2 83B H	End plate 2	
Gaskets:		EPDM Clip-on		
74	37	32330-1804-3	Channel plate gasket	
2	1	32330-1804-3	Channel plate gasket	
2	1		End plate gasket II consists of:	
4	2	32330-1804-3	2 Channel plate gaskets	

Structural Support Calculations

COLUMN LOADS

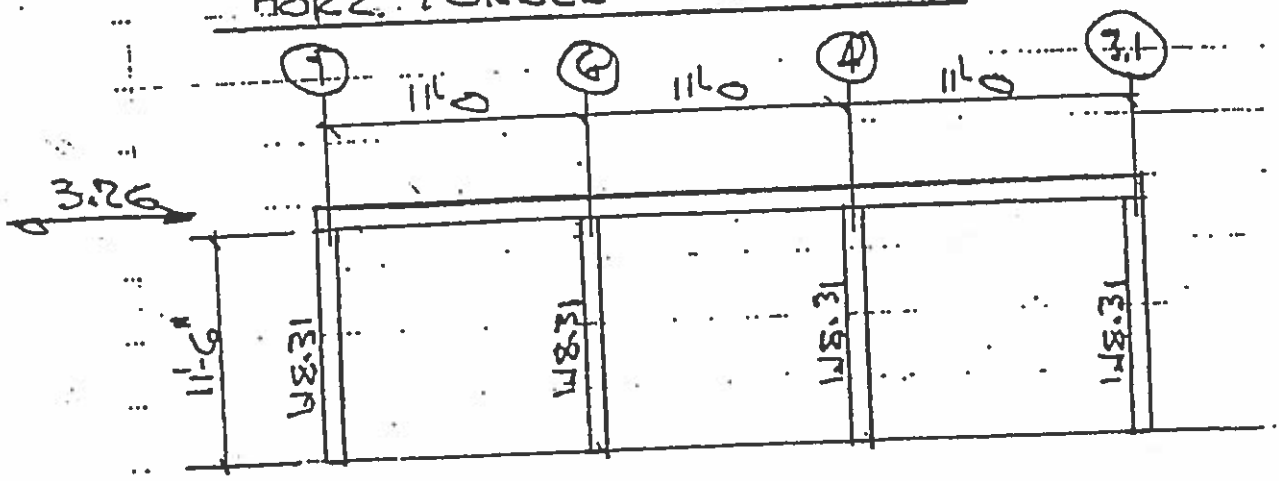
A-1	3.6 K
B-1	14.3 K
C.9-1	14.1 K
D.1-1	19.0 K
E-1	14.2 K
A-2	4.5 K
B-2	36.3 K
D-2	62.9 K
E-2	34.1 K
A-3	8.4 K
B-3	27.9 K
C.9-3	28.8 K
D.1-3	19.9 K
E-3	14.4 K
A-5	9.8 K
B-5	17.6 K
A-7	4.8 K
B-7	8.5 K
C-7	11.5 K
F-7	12.1 K
C-6	24.8 K
F-6	24.2 K
C-4	28.1 K
F-4	24.2 K
F-3.1	12.0 K

EXCEPT @ GRID F ALL COLUMNS WILL BE 14.8=24

WITH KL 130 ALLOWABLE COL LOAD IS 93.0 K.

THIS SATISFIES ALL CONDITIONS

HORZ. FORCES @ GRID "F"



$\frac{3.26}{4}$ = .8150 KIPS PER COL.

.8150 x 11.5 = 9.37 K' MOMENT

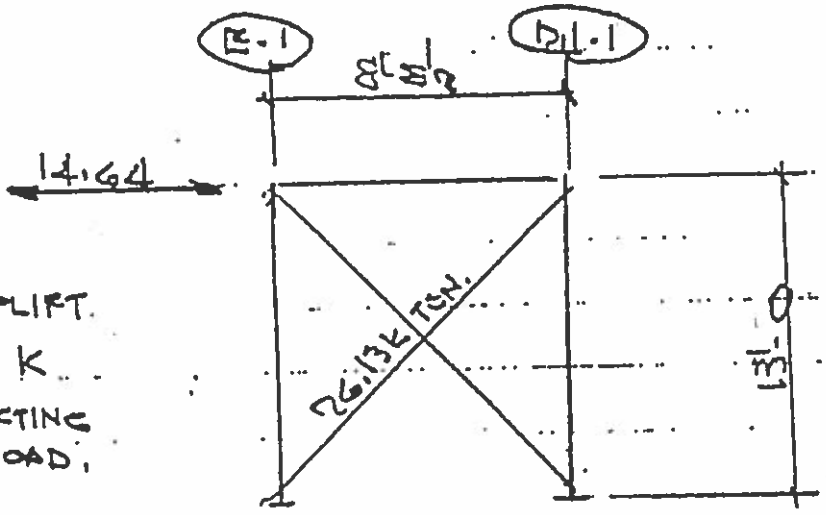
$\frac{9.37 \times 12 \times 1000}{21600}$ = 5.2 REQD S3'

W8x31 = 27.5 > 5.2 COLUMNS OK

REGISTERED PROFESSIONAL ENGINEER
OTIS ARVIN CLARK
14897
OKLAHOMA

HORZ. FORCES @ DIAG. BRACING.

7.26 KIPS @ C-1 TO F-1
12.23 @ E-2 TO E-3
6.10 @ A-1 TO A-2
14.64 @ D.1-1 TO E-1



COL. UPLIFT
21.65 K
NEGLECTING
DEAD LOAD.

DIAG BRACE $\perp$ 4 x 3 x .1875" $\frac{26.13}{1.5}$ = 17.42 ksi < 24 BRACE O.K.

COLUMN UPLIFT 21.65 W/ 4 - 3/4 @ EPOXY ANCHORS

PULLOUT TEST ON 3/4 @ EPOXY ANC. W/ 6 1/2" EMBEDMENT IS 24.2 KIPS. WITH A SAFETY FACTOR OF 4 TO 1
= 6 KIPS PER ANCHOR

6k x 4 = 24 > 21.65 O.K.

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OTIS ARVIN CLARK
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OKLAHOMA

DESIGN LOADS (1990 BOCA NATIONAL BLDG CODE)

LIVE LOAD 100 PSF. (LIGHT MANUFACTURING - PAGE 246)
DEAD LOAD 20 PSF.
TOTAL 120 PSF.

TANKS FT1, FT2, & FT3 47300 LBS. EACH (FILLED).
TANK FT4 25,300 LBS (FILLED)

LATERIAL FORCES FOR EARTHQUAKE LOADS

$V = 2.5 A_v I K C S W$ (PAGE 278)

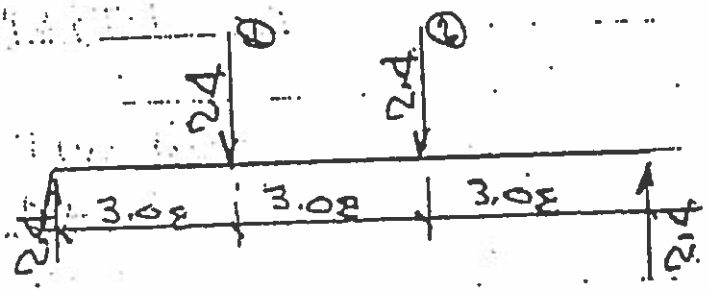
$A_v = .1$ (ZONE 1) (PAGE 273)
$I = 1.0$ (TABLE 1113.1, PAGE 275)
$K = 1.0$ (TABLE 1113.4.3., PAGE 278)
$C = .12$ (PAGE 279)
$S = 1.5$ (TABLE 1113.4.6, PAGE 281)
$W =$ WEIGHT

$V = 2.5 \times .1 \times 1.0 \times 1.0 \times .12 \times 1.5 \times W$
$V = .045 W$

REGISTERED PROFESSIONAL ENGINEER
OTIS ARVIN CLARK
14897
OKLAHOMA

BEAM @ GRID A-1 TO B-1 (LW12.14)

UNBRACED LGTH. 3.1

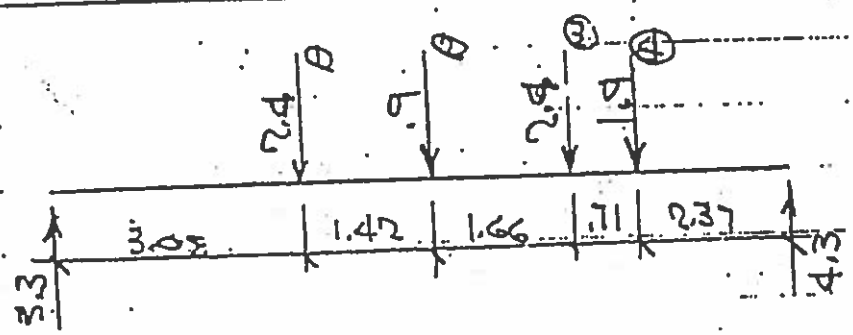


M @ ① = ② = 24 x 3.08 = 7.4

FROM ASD 2-174 ALLOWABLE M = 27.3 > 7.4

BEAM @ GRID A-2 TO B-2 (LW12.14)

UNBRACED LGTH 3.1



M @ ① 3.3 x 3.08 = 10.2

M @ ② 3.3 x 4.50 - 2.4 x 1.42 = 11.4

M @ ③ 4.3 x 3.08 - 1.9 x .71 = 11.9

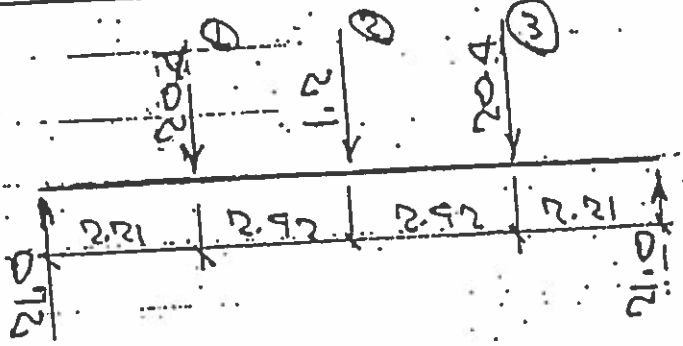
M @ ④ 4.3 x 2.37 = 10.2

FROM ASD 2-174 ALLOWABLE M = 27.3 > 11.9

BEAM @ GRID B-2 TO D-2

(W12.35)

UNBRACED LGTH 21'



M @ ① 21.0 x 2.21 = 46.4

M @ ② 21.0 x 5.13 - 20.4 x 2.92 = 48.2

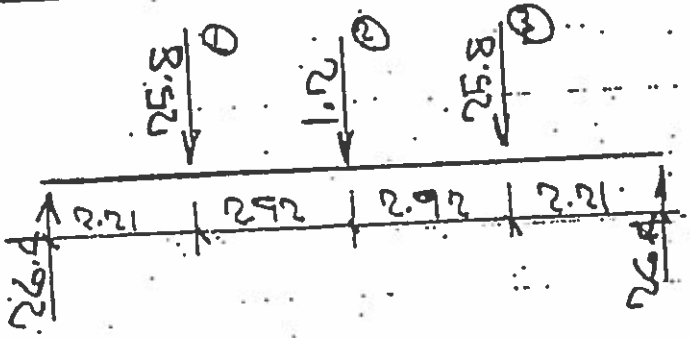
M @ ③ 21.0 x 2.21 = 46.4

FROM ASD 2-172 ALLOWABLE M = 91.2 > 48.2

BEAM @ GRID D-2 TO E-2

(W12.26)

UNBRACED LGTH 21'



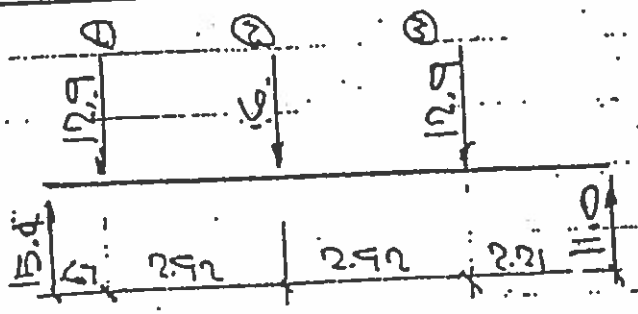
M @ ① 26.4 x 2.21 = 58.3

M @ ② 26.4 x 5.13 - 25.8 x 2.92 = 60.1

M @ ③ 26.4 x 2.21 = 58.3

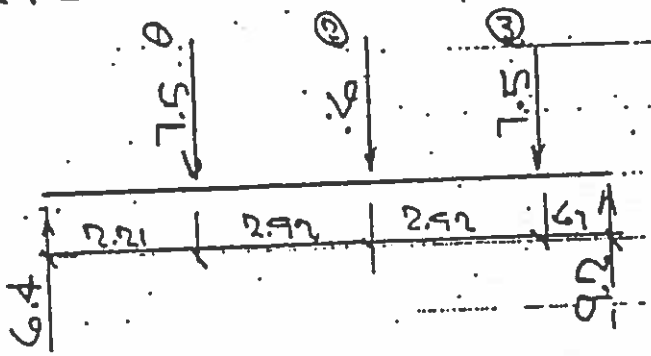
FROM ASD 2-173 ALLOWABLE M = 66.8 > 60.1

BEAM @ GRID D.1-1 TO E-1 & D.1-3 TO E-3 (W12x26)
(UNBRACED LGTH 24')



M = @ 15.4 x .67 = 10.3
M = @ 15.4 x 3.59 - 12.9 x 2.92 = 17.6
M = @ 11.0 x 2.21 = 24.3
FROM ASD 2-173 ALLOWABLE M = 66.6 > 24.3

BEAM @ GRID B-1 TO C.9-1 (W12x19)
UNBRACED LGTH 24'

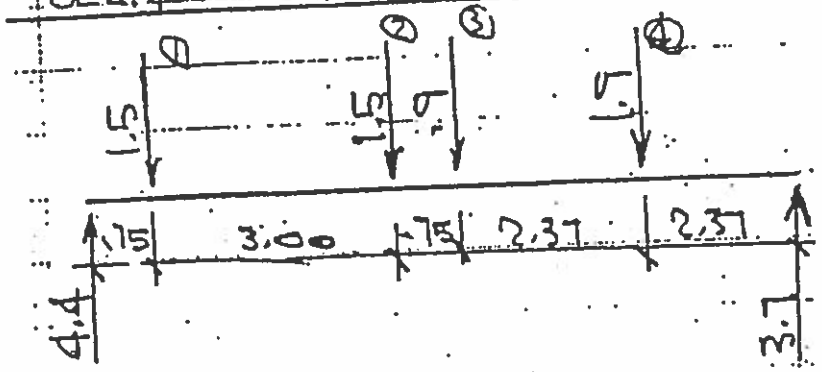


M = @ 6.4 x 2.21 = 14.1
M = @ 6.4 x 5.13 - 7.5 x 2.92 = 10.9
M = @ 9.2 x .67 = 6.2

FROM ASD 2-174 ALLOWABLE M = 42.5 > 14.1

BEAM • GRID A-3 TO B-3 (WIND)

UNBRACED LGTH 3-0



M • Ⓑ 4.4 × .75 =

M • Ⓒ 4.4 × 3.75 − 1.5 × 3.00 =

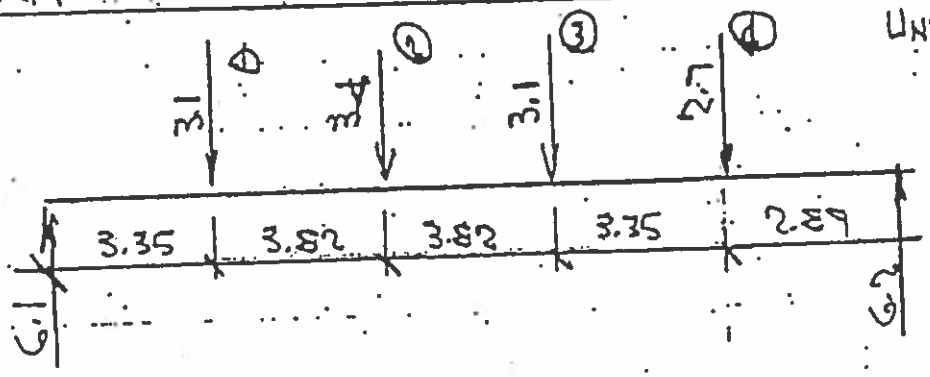
M • Ⓓ 3.7 × 5.14 − 1.9 × 2.37 =

M • Ⓔ 3.7 × 2.37

FROM ASD 2.174 ALLOWABLE M = 27.3 >

BEAM • GRID A-5 TO A-7 (WIND)

UNBRACED LGTH 3'10



M • Ⓐ 6.1 × 3.35 = 20.4

M • Ⓑ 6.1 × 7.17 − 3.1 × 3.82 = 31.9

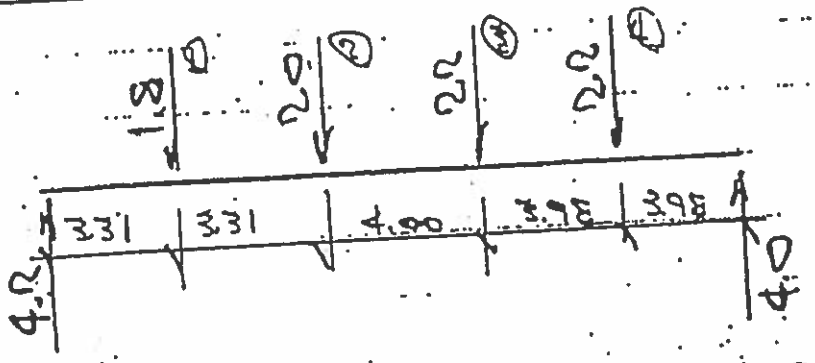
M • Ⓒ 6.2 × 6.24 − 2.7 × 3.35 = 29.6

M • Ⓓ 6.2 × 2.89 = 17.9

FROM ASD 2.172 ALLOWABLE M = 76.2 > 31.9

BEAM @ GRID A-3 TO A-5 W12.26

UNBRACED LGTH 40



M @ ① = 4.2 × 3.31 = 13.9

M @ ② = 4.2 × 6.62 - 1.8 × 3.31 = 22.0

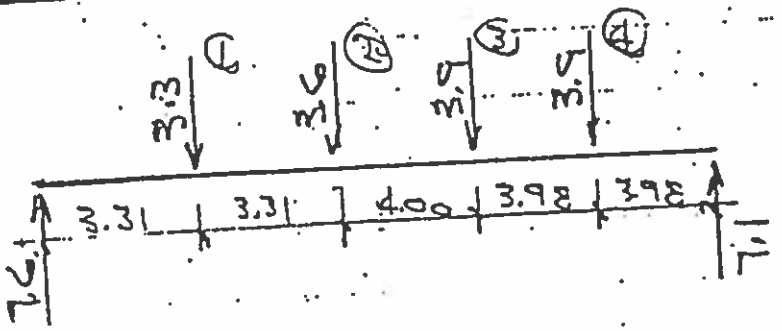
M @ ③ = 4.0 × 7.96 - 2.2 - 3.98 = 23.4

M @ ④ = 4.0 × 3.98 = 15.9

FROM ASD 2.1.7c ALLOWABLE M = 76.2 > 23.4

BEAM @ GRID B-3 TO B-5 (W12.26)

UNBRACED LGTH 40.



M @ ① = 7.6 × 3.31 = 25.1

M @ ② = 7.6 × 6.62 - 3.3 × 3.31 = 39.3

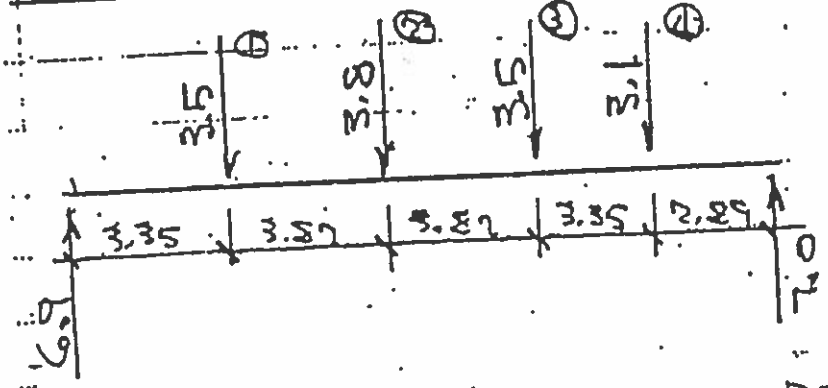
M @ ③ = 7.1 × 7.96 - 3.7 × 3.98 = 41.2

M @ ④ = 7.1 × 3.98 = 28.4

FROM ASD 2-17c ALLOWABLE M = 76.2 > 41.2

BEAM & GRID B-5 TO B-7 (1&12.26)

UNBRACED LGTH 39'-2"



M @ A = 6.9 × 3.35 = 23.1

M @ B = 6.9 × 7.17 − 3.5 × 3.57 = 36.1

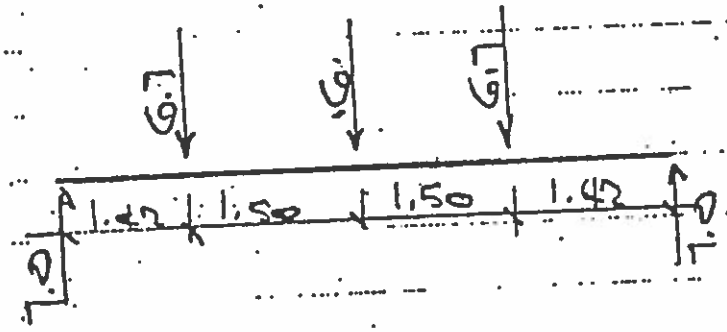
M @ C = 7.0 × 6.24 − 3.1 × 3.35 = 33.3

M @ D = 7.0 × 2.89 = 20.2

FROM ASD 2-172 ALLOWABLE M = 76.2 > 33.3

CROSS BEAM UNDER FT 1,2,3 (S.PLACED) 5½ SPAN (W12.18)

UNBRACED LGTH 16'



M @ A = 7.0 × 1.42 = 9.9

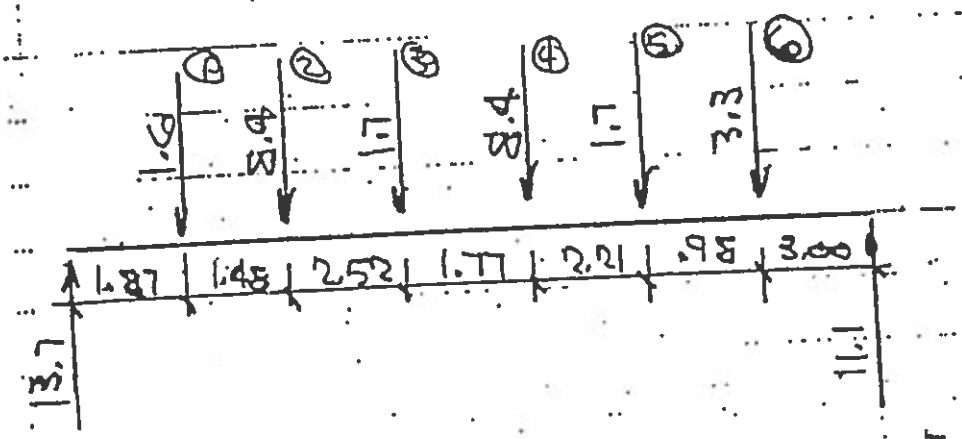
M @ B = 7.0 × 2.92 − 6.7 × 1.50 = 10.4

M @ C = 7.0 × 1.42 = 9.9

FROM ASD 2.174 ALLOWABLE M = 30.7 > 10.4

(W12.35)

BEAM & GRID C-3 TO C-4

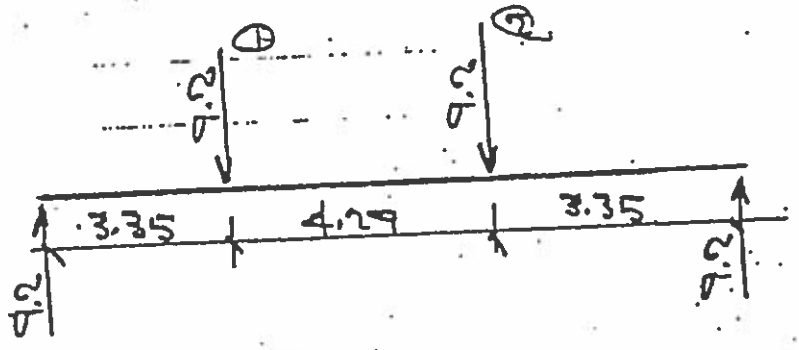


M @ (1) = 13.7 x 1.87 = 25.6
M @ (2) = 13.7 x 3.35 - 1.6 - 1.48 = 43.5
M @ (3) = 13.7 x 5.27 - 1.6 - 4.0 - 8.4 - 2.52 = 52.9
M @ (4) = 11.1 x 6.19 - 3.3 - 3.19 - 1.7 x 2.21 = 54.4
M @ (5) = 11.1 x 3.78 - 3.3 x .98 = 40.9
M @ (6) = 11.1 x 3.00 = 33.3

FROM ASD ... 2 - 172 ... ALLOWABLE M = 91.2 > 54.4

(W12.26)

BEAM & GRID F-3.1 TO F-4, F-4 TO F6
& F6 TO F-7

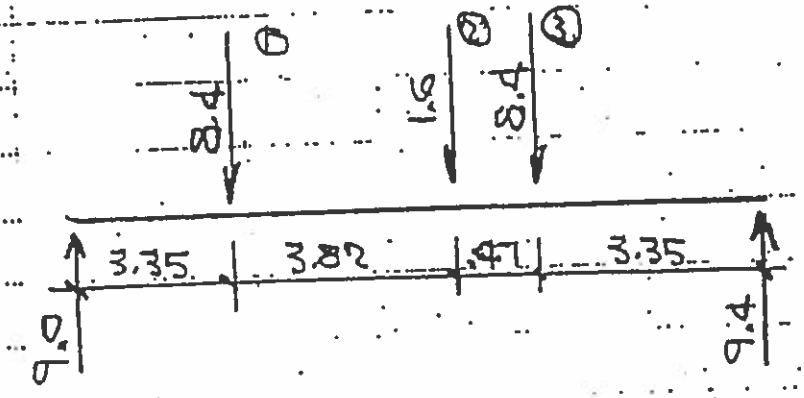


M @ (D) = 9.2 x 3.35 = 30.8
M @ (E) = 9.2 x 3.35 = 30.8

FROM ASD ... 172 ALLOWABLE M = 66.8 > 30.8

BEAM @ GRID C-6 TO C-7 (W12.26)

UNBRACED LGTH 31 4/4



M @ ① 9.0 x 3.35 = 30.2

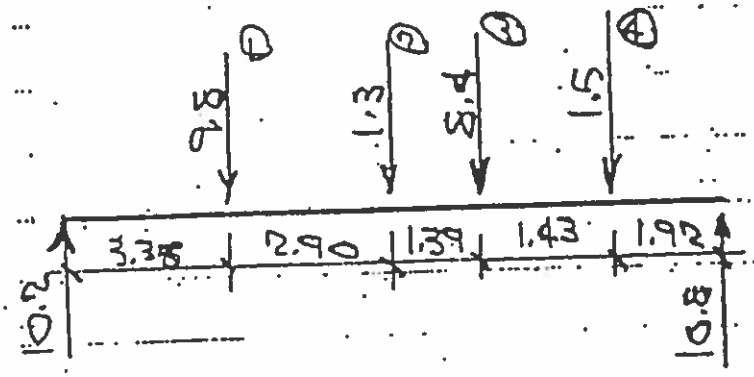
M @ ② 9.0 x 7.17 - 8.4 x 3.82 = 32.4

M @ ③ 9.4 x 3.35 = 31.5

FROM ASD 2.173 ALLOWABLE M = 66.8 > 32.4

BEAM @ GRID C-4 TO C-6 (W12.26)

UNBRACED LGTH 31 4/4



M @ ① = 10.2 x 3.35 = 34.2

M @ ② = 10.2 x 6.25 - 9.8 x 2.90 = 35.3

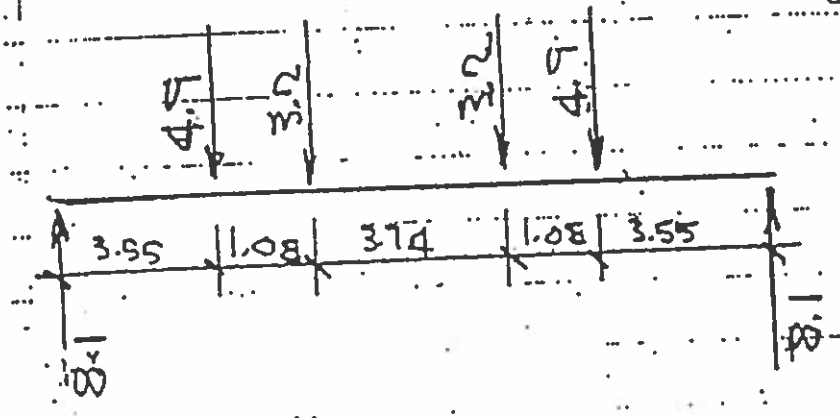
M @ ③ = 10.8 x 3.35 - 1.5 x 1.43 = 34.0

M @ ④ = 10.8 x 1.5 = 16.2

FROM ASD 2.173 ALLOWABLE M = 66.8 > 35.3

BEAM UNDER EF 4 (2 PLACES) (4/12.26)

UNBRACED LGTH 5'-10 3/4"

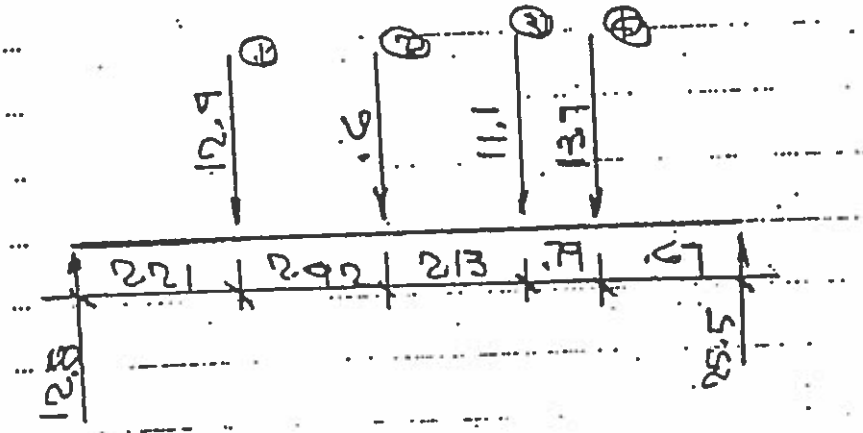


M @ ① & ⑤ = 8.1 x 3.55 = 28.8

M @ ② & ④ = 8.1 x 4.63 - 49 x 1.08 = 32.2

FROM ADS 2-173 ALLOWABLE M = 66.8 > 32.2

BEAM @ GRID B-3 TO C.9-3 (4/12.35)



M @ ① 12.8 x 2.21 = 28.3

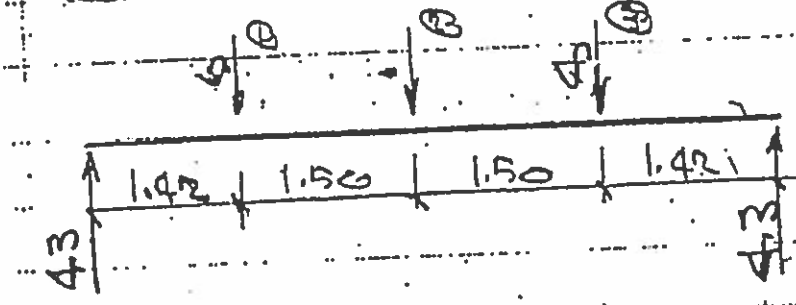
M @ ② 12.8 x 5.13 - 12.9 x 2.92 = 28.0

M @ ③ 25.5 x 1.46 - 13.7 x .79 = 26.4

M @ ④ 25.5 x .67 = 17.1

FROM ADS 2-172 ALLOWABLE M = 91.2 > 28.3

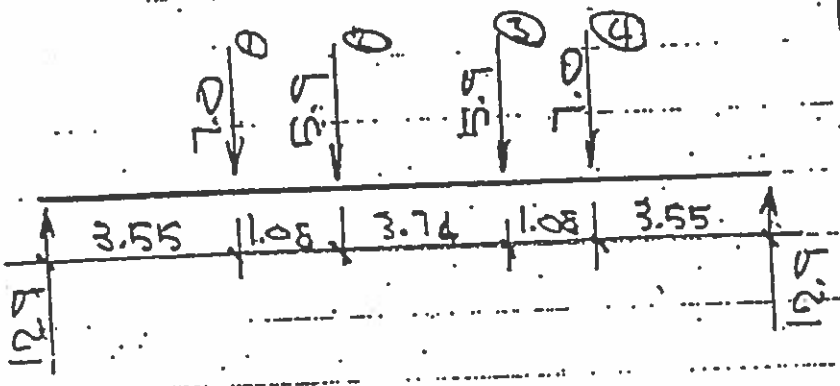
CROSS BEAM UNDER EF4 (2 PLACES) 5½ SPAN (W8x18)
UNBRACED LGTH 11'6



M @ B 4.3 × 1.42 = 6.1
M @ C 4.3 × 2.92 − 4.0 × 1.58 = 6.6
M @ D 4.3 × 1.42 = 6.1

FROM ASD 2-174 ALLOWABLE M = 30.3 > 6.6

BEAM UNDER FLASH TANKS (5 PLACES) (W12x26)
UNBRACED LGTH 5'10½"



M @ B & C = 12.9 × 3.55 = 45.8
M @ C & D = 12.9 × 4.63 − 7.0 × 1.08 = 52.2

FROM ASD 2-173 ALLOWABLE M = 66.8 > 52.2

BEAM @ GRID E-2 TO E-3 (W8.24)
UNBRACED LGTH 12.4

$M = \frac{1.8 \times 12.33}{8} = 2.8\ k'$

FROM ASD 2-174 ALLOWABLE M = 38.3 > 2.8

BEAM @ GRID B-2 TO B-3 (W8.24)
UNBRACED LGTH 12.4

$M = \frac{3.6 \times 12.33}{8} = 5.5\ k'$

FROM ASD 2-174 ALLOWABLE M = 38.3 > 5.5

BEAM @ GRID B-1 TO B-2 (W8.24)
UNBRACED LGTH 12.4

$M = \frac{4.2 \times 12.33}{8} = 6.5\ k'$

FROM ASD 2-174 ALLOWABLE M = 38.3 > 6.5

BEAM @ GRID A-1 TO A-2 (W8.24)
UNBRACED LGTH 12.4

$M = \frac{2.4 \times 12.33}{8} = 3.7\ k'$

FROM ASD 2-174 ALLOWABLE M = 38.2 > 3.7

BEAM @ GRID A-5 TO B-5 (W8.24)
UNBRACED LGTH 9'3

$M = \frac{3.4 \times 9.25}{8} = 3.9$

FROM ASD 2-174 ALLOWABLE M = 38.3 > 3.9

BEAM 7 1/2 SOUTH OF GRID B-7 TO C-7 W8x10

UNBRACED LGTH 7'-3

$M = \frac{3.2 \times 7.25}{8} = 2.9^{k'}$

FROM ASD PAGE 2-175 ALLOWABLE M = 11.5 > 2.9

BEAM 6 1/2 NORTH OF GRID B-5 TO C-5 (W8x10)

UNBRACED LGTH 7'-3

$M = \frac{3.2 \times 7.25}{8} = 2.9^{k'}$

FROM ADS 2-175 ALLOWABLE M = 11.5 > 2.9

BEAM 2 10 3/4 NORTH OF GRID B-5 TO C-5 (W8x10)

UNBRACED LGTH 7'-3

$M = \frac{2.8 \times 7.25}{8} = 2.5^{k'}$

FROM ADS 2-175 ALLOWABLE M = 11.5 > 2.5

BEAM 3 3 3/4 SOUTH OF GRID B-5 TO C-5 (W8x10)

UNBRACED LGTH 7'-3

$M = \frac{3.0 \times 7.25}{8} = 2.7^{k'}$

FROM ADS 2-175 ALLOWABLE M = 11.5 > 2.7

BEAM 6 7 1/2 SOUTH OF GRID B-5 TO C-5 (W8x10)

UNBRACED LGTH 7'-3

$M = \frac{3.2 \times 7.25}{8} = 2.9^{k'}$

FROM ADS 2-175 ALLOWABLE M = 11.5 > 2.9

BEAM 2'10¾ NORTH OF GRID A-5 TO B-5 (W8x10)
UNBRACED LGTH 9'3

$M = \frac{3.4 \times 9.25}{8} = 3.9\ K'$

FROM ADS 2-175 ALLOWABLE M = 9.0 > 3.9

BEAM 6'3 NORTH OF GRID A-5 TO B-5 (W8x10)
UNBRACED LGTH 9'3

$M = \frac{4.0 \times 9.25}{8} = 4.6\ K'$

FROM ADS 2-175 ALLOWABLE M = 9.0 > 4.6

BEAM 7'2½ SOUTH OF GRID A-7 TO B-7 (W8x10)
UNBRACED LGTH 9'3

$M = \frac{4.2 \times 9.25}{8} = 4.9\ K'$

FROM ADS 2-175 ALLOWABLE M = 9.0 > 4.9

BEAM 3'4¼ SOUTH OF GRID A-7 TO B-7 (W8x10)

$M = \frac{4.0 \times 9.25}{8} = 4.6\ K'$

FROM ADS 2-175 ALLOWABLE M = 9.0 > 4.6

BEAM 3'4¼ SOUTH OF GRID B-5 TO C-5 (W8x10)
UNBRACED LGTH 7'3

$M = \frac{3.2 \times 7.25}{8} = 2.9\ K'$

FROM ADS 2-175 ALLOWABLE M = 11.5 > 2.9

BEAM @ GRID D-2 TO D-3 (W12x14)

UNBRACED LGTH 11'-10

$M = \frac{3.2 \times 11.83}{8} = 4.7$ K'

FROM ASD 2-175 ALLOWABLE M = 20.75 > 4.7

BEAM @ GRID D-1 TO D-2 (W12x19)

UNBRACED LGTH 12'-6

$M = \frac{3.2 \times 12.5}{8} = 5.0$ K'

FROM ASD 2-175 ALLOWABLE M = 17.0 > 5.0

BEAM 3'-11¾" & 7'-11½" NORTH OF GRID A-3 TO B-3 (W8x10)

UNBRACED LGTH 9'-3"

$M = \frac{4.4 \times 9.25}{8} = 5.1$ K'

FROM ASD 2-175 ALLOWABLE M = 9.0 > 5.1

BEAM 6'-7½" SOUTH OF GRID A-5 TO B-5 (W8x10)

UNBRACED LGTH 9'-3

$M = \frac{4.0 \times 9.25}{8} = 4.6$

FROM ASD 2.175 ALLOWABLE M = 9.0 > 4.6

BEAM 3'-3¾ SOUTH OF GRID A-5 TO B-5 (W8x10)

UNBRACED LGTH 9'-3

$M = \frac{3.6 \times 9.25}{8} = 4.2$

FROM ASD 2-175 ALLOWABLE M = 9.0 > 4.2

BEAM 3'-1 ± 6½ WEST OF GRID B-1 TO B-2 (2 PLACES)
(W8x15) UNBRACED LGTH = 13'-0

$M = \frac{4.8 \times 13}{8} = 7.8$ K'

FROM ASD 2.175 ALLOWABLE M = 12.1 > 7.8

BEAM 2'-4½ WEST OF GRID B-2 TO B-3 (W8x15)
UNBRACED LGTH 13'-0

$M = \frac{3.8 \times 13}{8} = 6.2$ K'

FROM ASD PAGE 2-175 ALLOWABLE M = 12.1 > 6.2

BEAM UNDER TANKS (8 PLACES) (W8x10)
UNBRACED LGTH 2'-11

$M = \frac{1.6 \times 5.9}{8} = 1.2$ K'

FROM ASD 2-175 ALLOWABLE M = 15.6 > 1.2

BEAM @ TANKS 3'-6 5/8 SPAN (8 PLACES) (W8x10)
UNBRACED LGTH 3'-6 5/8

$M = \frac{.42 \times 3.55}{8} = .5$ K'

FROM ASD 2-175 ALLOWABLE M = 15.6 > .5

BEAM - GRID A-7 TO B-7 (W8.24)
UNBRACED LGTH 9'-3"

$M = \frac{1.8 \times 9.25}{8} = 2.1$ k'

FROM ASD 2.174 ALLOWABLE M = 38.3 > 2.1

BEAM - GRID B-7 TO C-7 (W8.24)
UNBRACED LGTH 7'-3"

$M = \frac{1.4 \times 7.25}{8} = 1.3$

FROM ASD 2.174 ALLOWABLE M = 38.3 > 1.3

BEAM - GRID B-5 TO C-5 (W8.24)
UNBRACED LGTH 7'-3"

$M = \frac{2.6 \times 7.25}{8} = 2.4$ k'

FROM ASD 2.174 ALLOWABLE M = 38.3 > 2.4

BEAM - GRID C-7 TO F-7 (W12.26)
UNBRACED LGTH 18'-0"

$M = \frac{3.6 \times 18.04}{8} = 8.1$ k'

M - CANT. END $= \frac{120 \times 5.45^2}{2} = 3.0$ k'

FROM ASD 2.174 ALLOWABLE M = 31.4 > 8.1

BEAM @ GRID C-G TO F-G & C-4 TO F-4 (W12.26)
UNBRACED LGTH 18'-0"

$N = \frac{7.2 \times 18.04}{8} = 16.2\ k'$

$N_{CONT} = \frac{.40 \times 5.45^2}{2} = 5.9\ k'$

FROM ASD 2.174 ALLOWABLE $N = 31.4 > 16.2$

BEAM @ GRID C-3.1 TO F-3.1 (W12.26)
UNBRACED LGTH 18'-0"

$N = \frac{6.6 \times 18.04}{8} = 14.9\ k'$

$N_{CANT.} = \frac{2.0 \times 5.46^2}{2} = 3.0\ k'$

FROM ASD 2.174 ALLOWABLE $N = 31.4 > 14.9$

BEAM - FILTER PRESSES GRID C TO F (6 PLACES) (W12.26)
UNBRACED LGTH 18'-0"

$N = \frac{3.6 \times 18.04}{8} = 8.1\ k'$

$N_{CANT.} = \frac{.46 \times 5.45^2}{2} = 6.8\ k'$

FROM ADS 2.174 ALLOWABLE $N = 31.4 > 8.1$

BEAM W 11½ x 34 North of GRID B-3 TO C-3 (W8.10)

UNBRACED LGTH 7.3

$M = \frac{3.4 \times 7.25}{8} = 3.1$ k'

FROM ASD 9.175 ALLOWABLE M = 11.5 > 3.1

BEAM @ GRID E-1 TO E-2 (W8.10)

UNBRACED LGTH 11.4

$M = \frac{1.8 \times 11.33}{8} = 2.5$

FROM ASD Page 2.175 ALLOWABLE M = 5.2 > 2.5

BEAM ALG EAST OF GRID A-3 TO A-2 (W8.10)

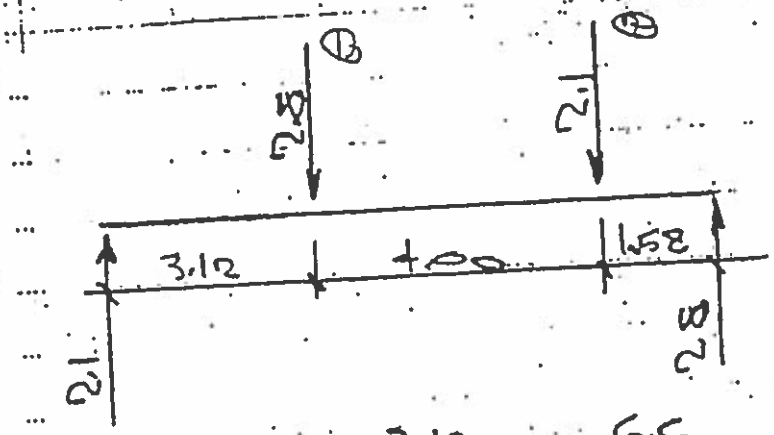
UNBRACED LGTH 13.0

$M = \frac{1.8 \times 13}{8} = 2.9$ k'

FROM ASD 2.175 ALLOWABLE M = 4.8 > 2.9

MEZZ BEAM - GRID B-1 TO C9-1 (W8.15)

UNBRACED LGTH. 4'-0



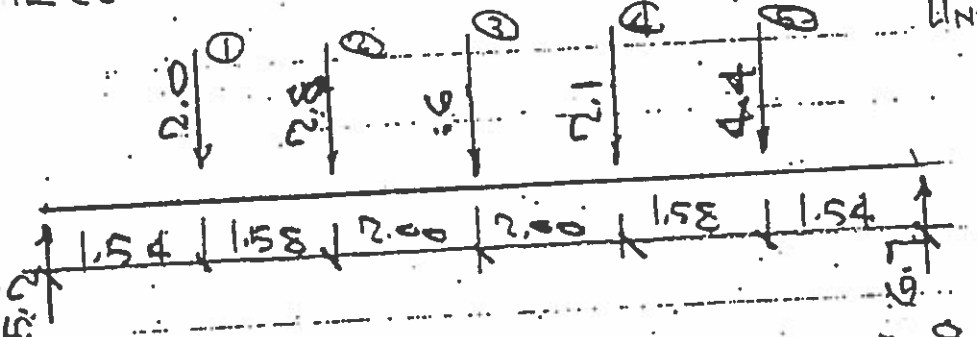
M @ ① = 2.1 x 3.12 = 6.6

M @ ② = 2.8 - 1.58 = 4.4

FROM ASD 2.175 ALLOWABLE M = 23.6 > 6.6

MEZZ BEAM - GRID B-2 TO D-2 (W 12.14)

UNBRACED LGTH 2'-0



M @ ① = 5.2 x 1.54 = 8.0

M @ ② = 5.2 x 3.12 - 2.0 x 1.58 = 13.3

M @ ③ = 5.2 x 5.12 - 2.0 x 3.58 - 2.8 x 2.00 = 14.4

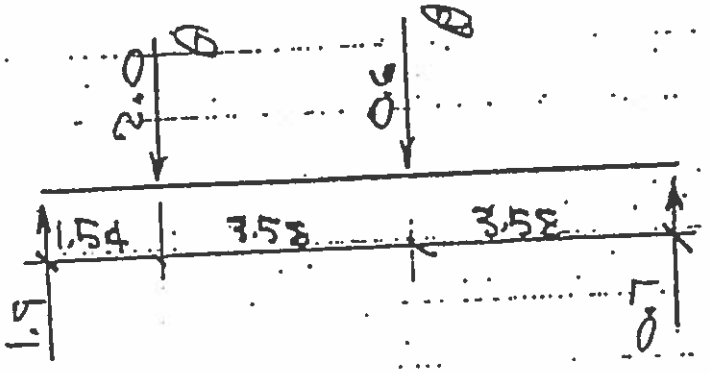
M @ ④ = 6.7 x 3.12 - 4.4 x 1.58 = 13.9

M @ ⑤ = 6.7 x 1.54 = 10.3

FROM ASD 2.174 ALLOWABLE M = 29.8 > 14.4

(3 PLACES)

MEZZ BEAM B-3 TO C.9-3 & D.1-3 TO E-3 (W8x15)
& E-1 TO D.1-1 UNBRACED LGTH 3.7

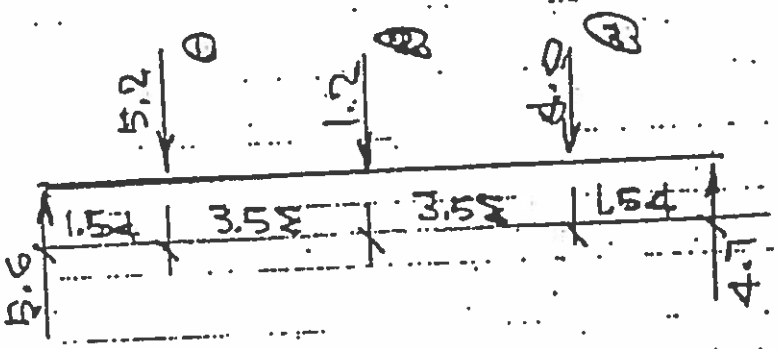


M @ B 1.9 x 1.5Σ = 2.9 k'

M @ D 0.7 x 3.5Σ = 2.5 k'

FROM ASD 3-175 ALLOWABLE M = 23.6 > 2.9

MEZZ BEAM @ GRID D-2 TO E-2 (W12x14)
UNBRACED LGTH 3.7



M @ B = 5.6 x 1.5Σ = 8.6

M @ 2 = 5.6 x 5.12 - 5.2 x 3.5Σ = 10.1

M @ 3 = 4.7 x 1.5Σ = 7.2

FROM ASD 2-114 ALLOWABLE M = 27.6 > 10.1

MEZZ BEAM C.9-1 TO C.9-2 (W8x15)
(UNBRACED LGTH = 10'-1")

$M = \frac{3.6 \times 12^2}{8} = 5.7$ k'

FROM ADS 2.175 ALLOWABLE M = 14.0 > 5.7

MEZZ BEAM D.1-1 TO D.1-2 (W8.15)
(UNBRACED LGTH = 7'-2")

$M = \frac{5.2 \times 12^2}{8} = 8.2$ k'

FROM ADS 2.175 ALLOWABLE M = 21.0 > 8.2

MEZZ BEAM 1'-7 WEST OF C.9-1 TO C.9-2 (W8.15)
(UNBRACED LGTH 41'-6")

$M = \frac{4.2 \times 13}{8} = 6.8$ k'

FROM ADS 2.175 ALLOWABLE M = 21.25 > 6.8

MEZZ BEAM 3'-1/2 EAST OF B-1 TO B-2 (W8.15)
(41'-6 UNBRACED LGTH)

$M = \frac{5.6 \times 13}{8} = 9.1$

FROM ADS 2.175 ALLOWABLE M = 21.25 > 9.1

MEZZ BEAM 1'-6" EAST OF B2 TO B3 (W8.15)
(UNBRACED LGTH 7'-2")

$M = \frac{4.0 \times 13}{8} = 6.5$

FROM ADS 2-175 ALLOWABLE M = 21.0 > 6.5

MEZZ BEAM @ GRID E-1 TO E-2, (W8.10)
B2 TO B3 & E2 TO E3

$M = \frac{1.2 \times 13}{8} = 1.95$ K' (UNBRACED LGTH 15'0)

FROM ADS 2.175 ALLOWABLE M = 4.0 > 1.95

MEZZ BEAM @ GRID B1 TO B2 (W8.10)
(UNBRACED LGTH 6'8)

$M = \frac{2G \times 13}{8} = 4.2$ K'

FROM ADS PAGE 2.175 ALLOWABLE M = 12.2 >

MEZZ BEAM @ GRID C.9-3 TO C.9-2 & D.1-3 TO D.1-2
(W8.15) (UNBRACED LGTH 7'2)

$M = \frac{52 \times 13}{8} = 8.5$ K'

FROM ADS 2.175 ALLOW. M = 21.2 > 8.5

MEZZ BEAM 1'6" WEST OF E1 TO E2 & E2 TO E3 (W8.15)
(UNBRACED LGTH 7'2)

$M = \frac{40 \times 13}{8} = 6.5$ K'

FROM ADS 2.175 ALLOWABLE M = 21.2 > 6.5

MEZZ BEAM 2'-11 SPAN, 6 PLACES, W8x10
(2'-11 UNBRACED LGTH)

$N = \frac{1.2 \times 2.92}{2} = 1.4\ K'$

FROM ADS 2-175 ALLOWABLE N = 16.0 > 1.4

MEZZ BEAM @ TANK OPENINGS (6 PLACES) (W8x10)
(UNBRACED LGTH 2'-1")

$N = \frac{.6 \times 7.16}{4} = 1.1\ K'$

FROM ADS 2-175 ALLOWABLE N = 16.0 > 1.1

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14897
OKLAHOMA

(REVISED)

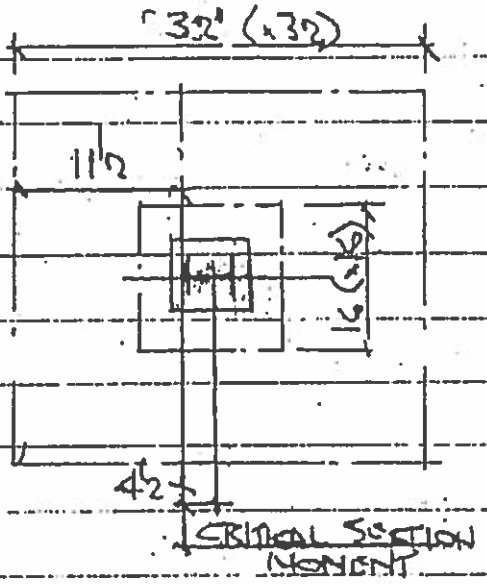
COLUMNS ON 6" SLABS

MAX COL LOAD IS AT B.5 = 17.6 KIPS

6" SLAB, 4000 PSI CONC W/ #4@12 E.W. @ TOP

ALLOWABLE M PER FT. OF SLABS

$\phi A_s f_s jd = .20 \times 24000 \times .85 \times 3 \times 12,240$" LBS.



CHECK OF 2 WAY (PUNCHING) SHEAR

$4 \times 16" \times 6" \times 1.1\sqrt{4000} = 26.7K > 17.6K$ O.K.

REQUIRED MOMENT PER FT OF SLABS

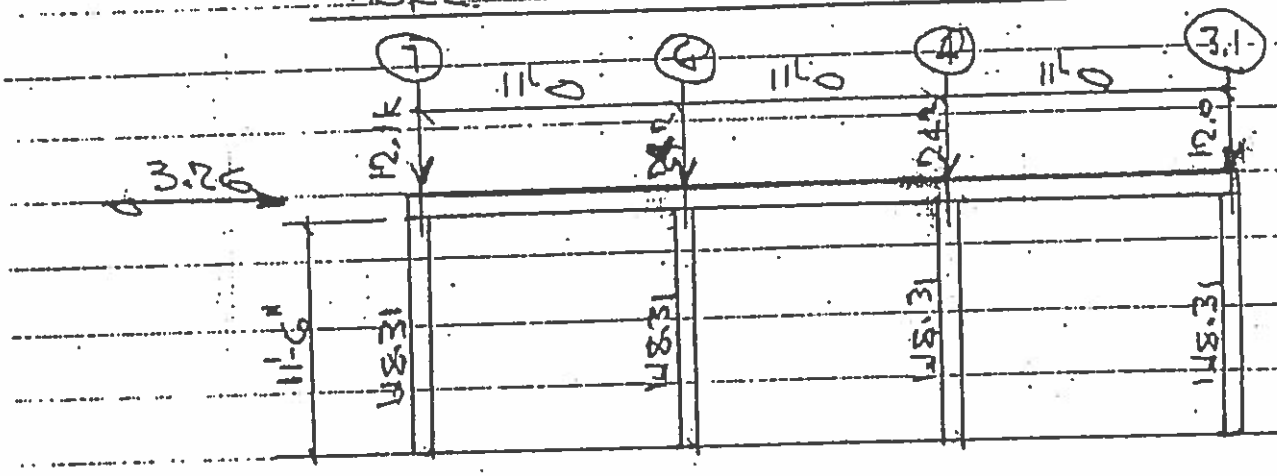
$\frac{2500 \times 11.5}{12} \times 11.5 = 9184$" LBS $< 12,240$" LBS. O.K.

FROM ASD PAGE 12-302 BEAM DIAG. #20

Otis A Clark PE. TEL NO.405 878-0338

(REVISED)

HORZ FORCES @ GRID "F"



$\frac{3.26}{4}$ = .8150 KIPS PER COL.

.8150 x 11.5 = 9.37 k' MOMENT

$\frac{9.37 \times 12 \times 1000}{21600}$ = 5.2 RIGHT SIDE

W8x31 = 27.5 > 5.2 COLUMNS OK

COMBINED LOADS.

$\frac{5.2}{27.5} + \frac{24.2}{149}$ = .3515 < 1 Cols: O.K

FROM W6x-3.31

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OTIS ARVIN CLARK
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OKLAHOMA

HORZ FORCES @ MEZZ. MAX COL LOAD @ B2 = 7.1 k
D2 = 12.3 k
E2 = 5.9 k

HORZ FORCE @ GRID 2 = (7.1 + 12.3 + 5.9) x .045 = 1.14 k

$\frac{1.14}{3}$ = .38 k HORZ FORCE PER COL.

M k' @ BASE OF COL = .38 x 12.25 = 4.66 k'

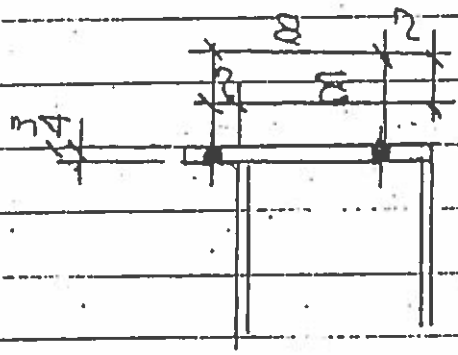
f_{cm} = $\frac{4.66 \times 12}{21.6}$ = .259 < 5.63 ok

COMBINED LOADING

$\frac{.259}{5.63} + \frac{12.3}{95}$ = .046 + .13 = .59 < 1

COLS. OK

MOMENT CONN @ COL CAP PLATES - COLS F3.1, F4, F6, & F7



CAP PLS @ COLS F3.1 & F7

FROM PAGE 5 MOMENT = 9.37 K'

FORCE = FLG. $\frac{9.37 \times 12}{(8 - .435)}$ = 14.86 K

WELD @ FLANGES .70 x 4 x 8 = 22.4 > 14.86 o.k.

MAX TEN @ BOLTS. $\frac{9.37 \times 12}{6.75}$ = 16.66 K

$\frac{16.66}{2}$ = 8.32 PER BOLT < 9.3 o.k.

Foundation Design Analysis

OTIS A. CLARK PE.

Phone
(405) 878-0338

130 Bdwy. Bldg.
Suite 202
Shawnee, OK. 74801

To: USPCI
Lone Mountain Facility
Route 2, Box 180A
Waynoka, Okla. 73806

Attn: Lawson Fenton

March 28, 1995

The following is an investigation for the foundation support for the mezzanine platforms for the Wastewater Final Treatment Facility, and the calculations for the design of the beams, columns, and bracing for the structure. The design loads are per the 1990 BOCA National Building Code and are shown on page #7 of the following submittal.

COLUMN	LOAD, KIPS	FOUNDATION CONDITION	REMARKS
A-1	3.6	17" floor slab	OK (see page #2)
A-2	4.5		
A-3	8.4		
A-5	9.8	6" floor slab	OK (see page #1)
A-7	4.8		
B-1	14.3	17" floor slab	OK (see page #2)
B-2	36.3		
B-3	27.9		
B-5	17.6	6" floor slab	OK (see page #1)
B-7	8.5		
C-4	28.1	24" x 36" cont.ftg.	Ok (see page #3)

C-6	24.8	24" x 36" cont.ftg.	Ok (see page #3)
C-7	11.5	6" floor slab	OK (see page #1)
C.9-1	14.1	17" floor slab	OK (see page #2)
C.9-3	28.8	〃	〃
D-2	62.9	〃	〃
D.1-1	19.0	〃	〃
D.1-3	19.9	〃	〃
E-1	14.2	〃	〃
E-2	34.1	〃	〃
E-3	14.4	〃	〃
F-3.1	12.0	6" floor slab	OK (see page #1)
F-4	24.2	24" x 36" cont. ftg.	OK (see page #3)
F-6	24.2	〃	〃
F-7	12.1	6" floor slab	OK (see page #1)

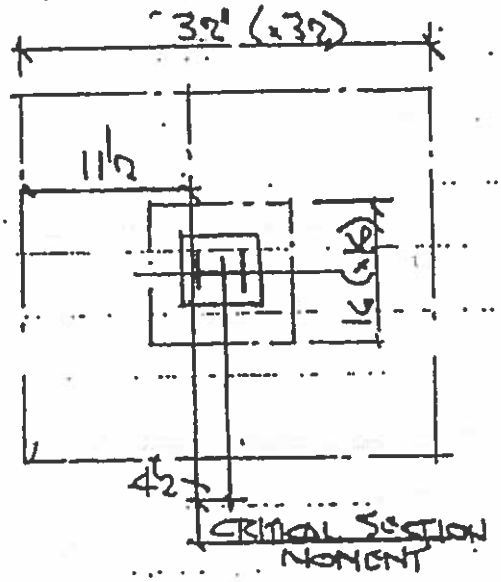
COLUMNS ON 6" SLABS

MAX CAL LOAD IS AT B.5 - 17.6 KIPS.

6" SLABS, 4,000 P.S.I CONC. W/ #4@12 E.W. @ CTR.

ALLOWABLE M PER FT. OF SLABS

$= A_s f_s jd = .20 \times 24000 \times .85 \times 3 = 17,240$ " LBS.



CHECK OF 2 WAY (PUNCHING) SHEAR

$4 \times 16" \times .6" \times 1.1\sqrt{4000} = 26.7K > 17.6K$ O.K

REQUIRED MOMENT PER FT OF SLABS

$$\frac{\frac{2500 \times 11.5}{12} \times 11.5}{4} = 6,888 \text{ "LBS} < 17,240 \text{ "LBS.} \quad \text{O.K.}$$

COLUMNS ON 17" SLAB W/ #6 @ 12" E.W. T&B

MAX. COL LOAD IS AT GRID D-2 = 62.9 KIPS

ALLOWABLE MOMENT IN SLAB

.44 × 24000 × 12 = 126,720 "LB. = 10.56 K'

ALLOWABLE SOIL BRG. = 2500 − SLAB WT 180 = 2320

$\frac{62.9}{2.32}$ = 27.11 SQ FT REQD. AREA = 5'-3" SQUARE

2 WAY (PUNCHING) SHEAR $4 \times 27 \times 17 \times 1.1 \sqrt{4000}$

= 127.7 K > 62.9 K ... O.K.

REQD MOMENT IN GRADE BEAM

$\frac{2.25 \times 2.32}{4}$ = 1.31 K' < 10.56 K' O.K.

COLUMNS ON 24" x 36" GRADE BEAM

MAX COL LOAD IS AT COL C-4 - 28.1 KIPS.

GRADE BEAM HAS 2 #6 @ TOP, CTR & BOTT
(ACCORDING TO LAWSON FENTON)

ALLOWABLE MOMENT IN GRADE BEAM (FIGURING T&B REINF)

$A_s f_s jd = .18 \times 24000 \times 30 \times .63 = 2,041.2$ LB. OR 52.8 K'

ALLOWABLE SOIL BRG 2500 - GB WEIGHT 360 = 2140

$\frac{28,100}{2140 \times 2}$ = 6'-8 LENGTH OF GRADE BEAM TO SUPPORT SOIL

READ MOMENT IN GRADE BEAM.

$\frac{21.8K \times 6.67}{2} = 18.2K < 52.8K$ O.K.

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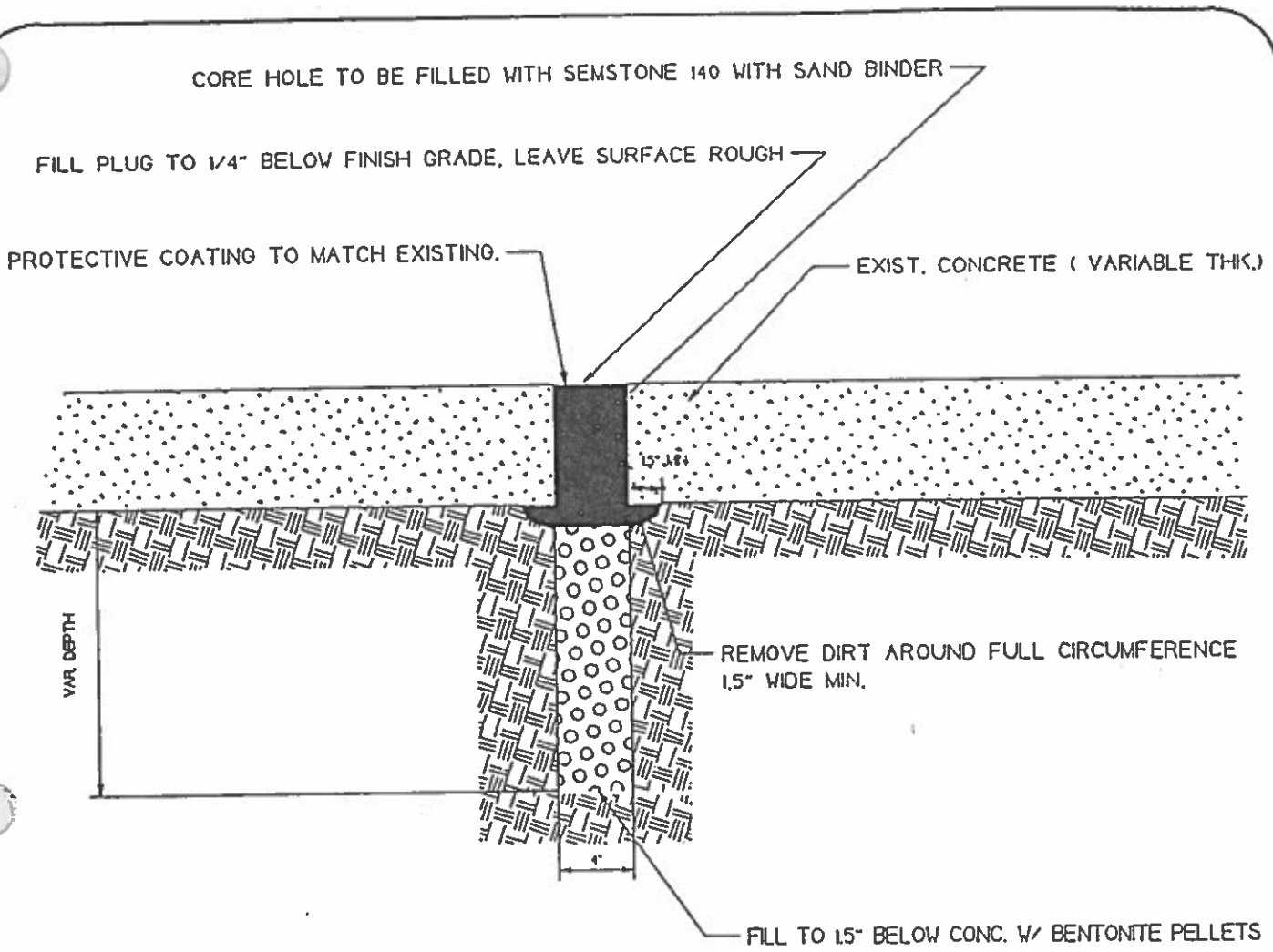


CORE PLUG DETAIL

CORE PLUG DETAIL FOR USPCI, LONE MOUNTAIN FACILITY WAYNOKA, OKLAHOMA	Myers ENGINEERING CORPORATION Oklahoma City Oklahoma	JOB NO. 511 SCALE NTS DRAWN DMC DATE 6/23/97
		SHEET 1 OF 1

CHANGE FILL N SOIL TO BENTONITE SEAL PER GENE WALKER REQUEST

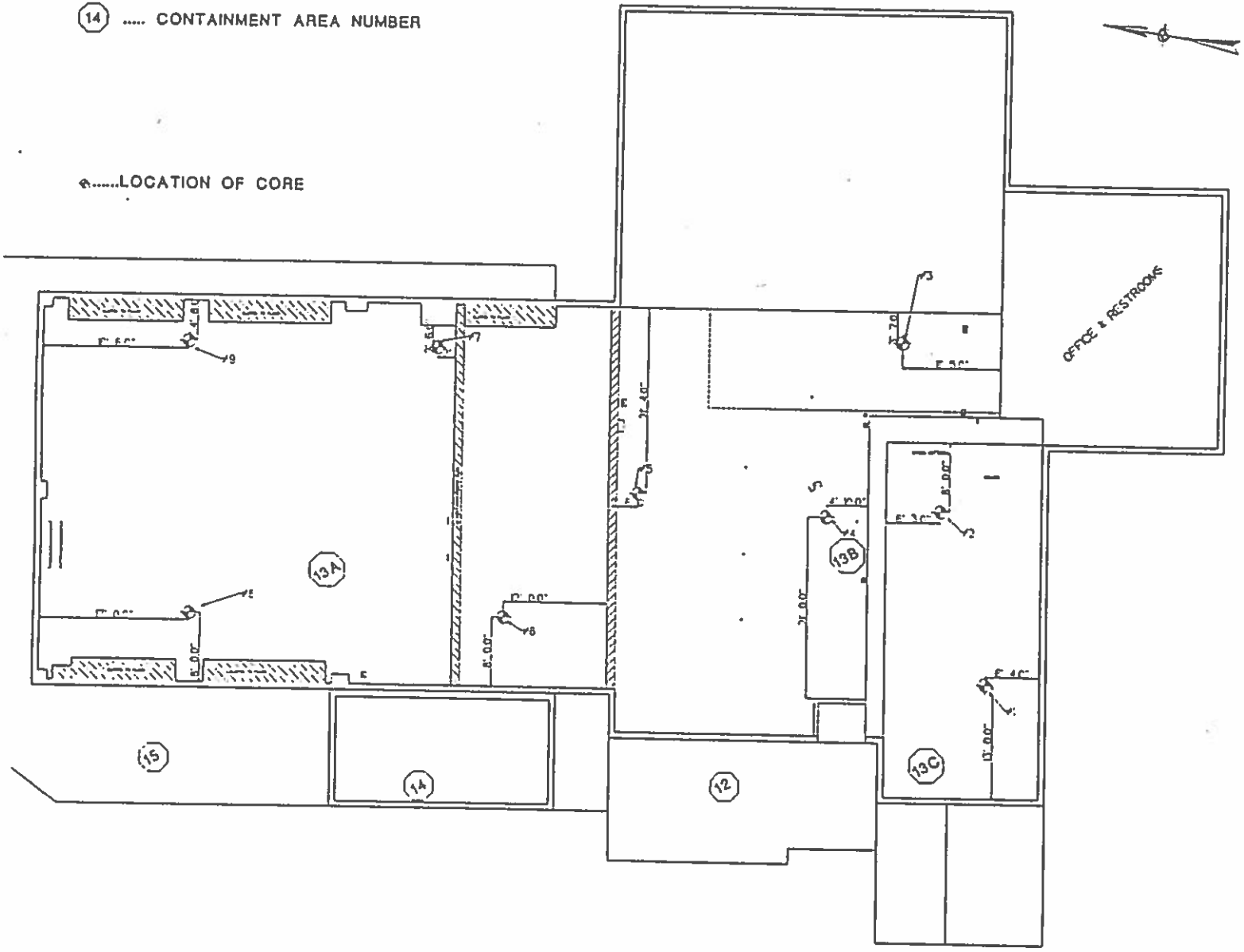
Specimen	Diameter, in.	Drilled Length, in.	Capped Length, in.	Crushing Load, lbs.	L/D Correction Factor	Compressive Strength, psi
PHT-1	3.75	5.5	5.7	32,440	0.96	2,810
PHT-2	3.75	5.5	4.9	47,200	0.93	3,980
PHT-3	3.75	6.5	4.5	41,400	0.93	3,490
PHT-4	3.75	7.5	4.6	60,700	0.93	5,110
PHT-5	3.75	7.0	7.1	43,000	0.99	3,860
PHT-6	3.75	6.5	4.1	57,100	0.88	4,550
PHT-7	3.75	7.0	5.8	43,800	0.96	3,810
PHT-8	3.75	6.0	5.8	74,800	0.96	6,480
PHT-9	3.75	5.0	5.5	33,900	0.96	2,950
PHT-10	3.75	6.0	4.7	72,500	0.93	6,100
PHT-11	3.75	6.0	5.6	55,720	0.96	4,840
PHT-12	3.75	6.0	6.6	65,600	0.98	5,800
PHT-13	3.75	5.0	5.3	68,700	0.94	5,850
PHT-14	3.75	5.0	5.3	80,200	0.95	6,900
PHT-15	3.75	6.0	5.1	60,200	0.97	5,290
FHT-1A	3.75	6.0	4.7	53,800	0.93	4,530
FHT-1B	3.75	13.0	6.0	50,800	0.97	4,460
FHT-2	3.75	22.0	7.0	30,740	0.99	2,760
*FHT-3	3.75	15.0	-	-	-	-
FHT-4	3.75	6.0	7.0	81,600	0.99	7,320
FHT-5	3.75	6.0	5.8	81,700	0.96	7,100
*FHT-6	3.75	19.0	-	-	-	-
*FHT-7	3.75	14.5	-	-	-	-
FHT-9	3.75	7.0	7.0	53,200	0.99	4,770

PHT - Pre-Water Treatment
FHT - Final Water Treatment

* Samples which we were not able to pull out of the hole.

(14) ..... CONTAINMENT AREA NUMBER

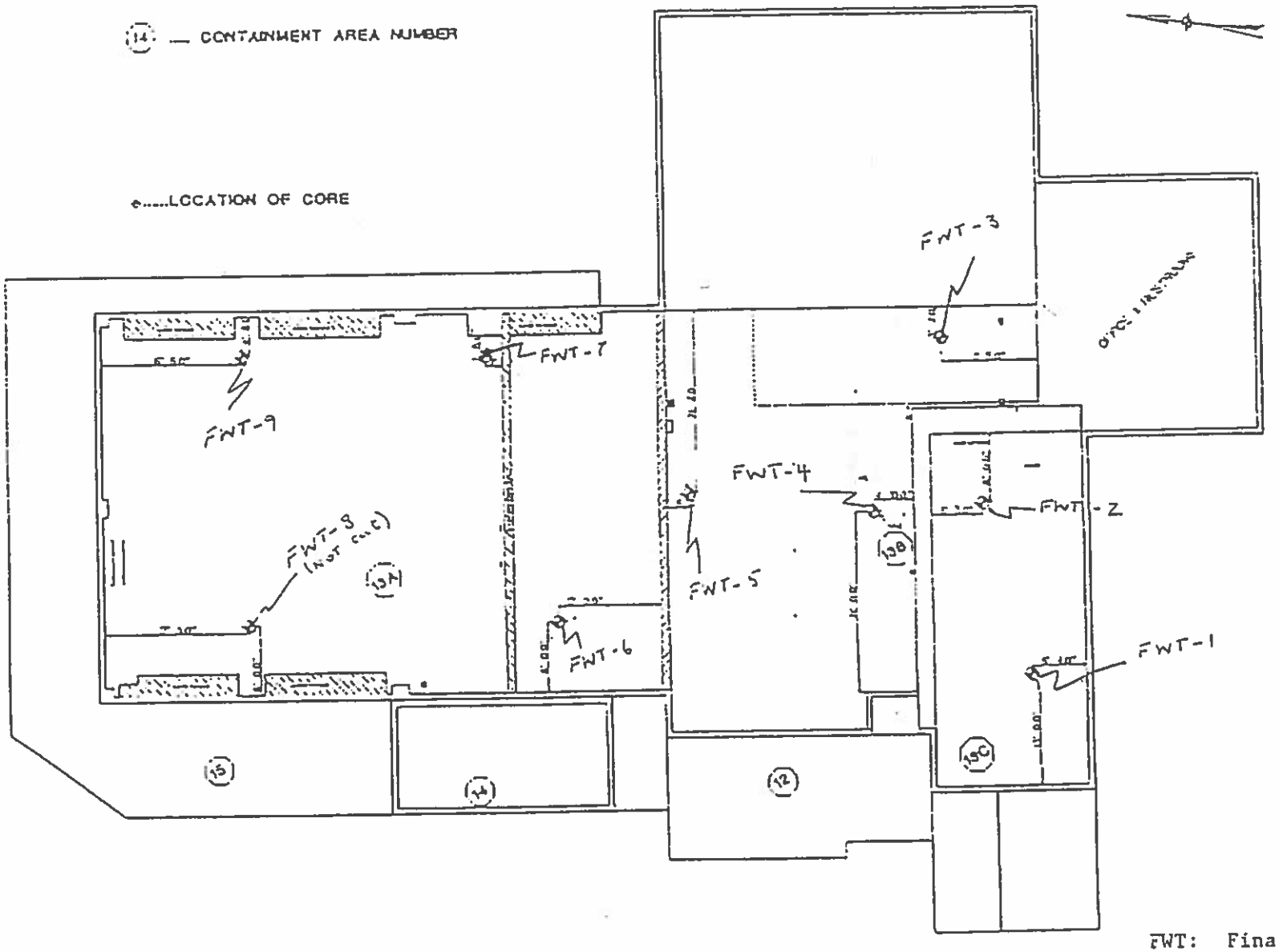
←.....LOCATION OF CORE



LAYOUT OF WASTE WATER TREATMENT BUILDING USPCI LONE MOUNTAIN HAZARDOUS WASTE FACILITY WAYNOKA, OKLAHOMA

Myers ENGINEERING CORPORATION Oklahoma City Okla.

JOB NO. 381
SCALE 1/4"=1'-0"
DRAWN
DATE 5-17-93
SHEET OF



FWT: Final Water Treatment

LAYOUT OF WASTE WATER TREATMENT BUILDING USPCI LONE MOUNTAIN HAZARDOUS WASTE FACILITY WAYNOKA, OKLAHOMA

Myers

USPCI
A Subsidiary of
Union Pacific Corporation

March 27, 1995

Mr. Jim Richenbaugh
Black & Veatch Waste Science
4717 Grand Avenue, Suite 500
Kansas City, MO 64112

Re: USPCI Lone Mountain Facility
Subject: Waste Water Treatment Floor Structural Design

The concrete floors in the area where the mezzanine has been erected were poured as part of two different building expansions. The first expansion was poured in the spring of 1987 and was designed to be eighteen inches thick with two layers of 3/4 inch reinforcement bars tied on one foot centers and separated by twelve inches between the top and bottom mats. All reinforcement bars were kept within three inches of the slab's surfaces and were supported by concrete brick on a two inch layer of sand. This slab underlies the area that supports the Flash Tanks and EF4 and extends to the south edge of the filter press mezzanine.

The second expansion attaches to the north side of the first slab and was poured in November of 1987. It was poured around four existing boiler foundations that were 2 feet wide, 3 feet deep, and 24 feet long. The floor slab was poured six inches thick and used a layer of 1/2 inch reinforcement bars tied on one foot centers, supported on a concrete brick and a 2 inch layer of sand. This slab underlies the area supporting the filter presses.

Both slabs were poured using a 4000 psi concrete strength mix as verified by the core sample tested by Meyers Engineering of which a report has been sent to you earlier this week.

I hope this will provide the information you needed for the certification work now in progress.

Sincerely,

Lawson Fenton

Lawson Fenton
Project Manager

2, Box 170
Waynoka, Oklahoma 73860-9622
Tel: 405/697-3500
Fax: 405/697-3596

EF4 Tank Loading

Tank Volume = 1625 gal.

Fluid Sp. Gr = 1.5 maximum

Fluid weight (max) = 1625 gal. × 8.35 lb/gal(water) × 1.5 Sp.Gr. = 20,350 Lb

Tank Weight ≅ 7000 lb.

Weight of tank + contents = 7000 lb + 20,350 lb = 27,350 Lb

Weight distribution to base plate.

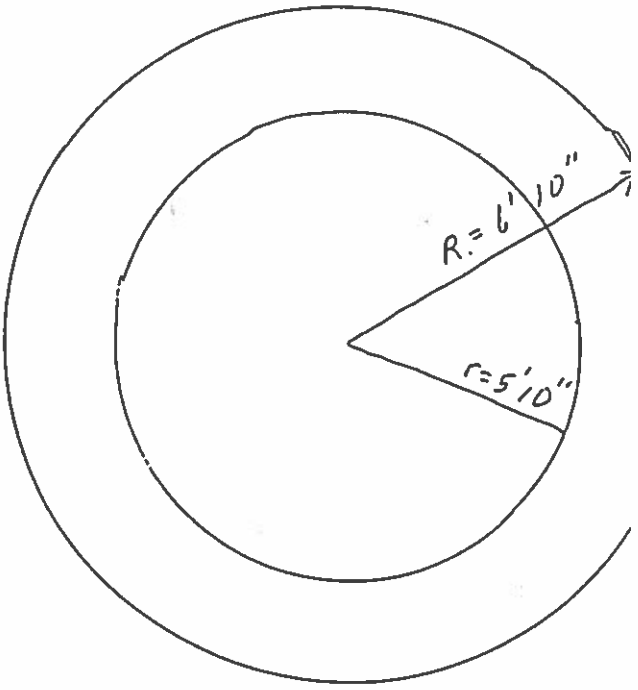
Base plate Area = $\pi R^2 - \pi r^2 = \pi(R^2 - r^2)$

$= 3.14\left[(3'5'')^2 - (2'11'')^2\right]$

$= 10\ ft^2$

$$\text{Loading} = \frac{\text{wt. (tank + contents)}}{A}$$

$$L = \frac{27350\ lb}{10\ ft^2} = 2735\ lb/ft^2$$



Tank Base Plate

Tank Leak Tests

Hydrostatic Test Record

Customer: USPCI - Lone Mt. Facility

Project: Evaporation Feed Tank No. 4

Location: Waynoke, OK

Test Start Date 3/1/95 Test Start Time 7:45 a.m.

Test Finish Date 3/1/95 Test Finish Time 11:45 a.m.

Test Procedure:

Fill evaporator feed tank to the top mtd. nozzle with water.

Results:

All tank nozzles were flanged off below the test water level. There was no change in water level inside the feed tank. Visual inspection of tank and tank nozzles indicated no water leaks.

Witness Gary Price Date: 3/1/95

WISco, INC.

11811 North Fwy., Suite 670
Houston, Texas 77060
(713) 820-8066

Page 1 of 1
Report Date 11/19/93
Report No. 001

Customer USPCI Attn: Bruce Patterson
Order No. 12418-30-46 Dated ____ Rev. ____ Dated ____
Mat'l Destination Lone Mt. Facility, Waynoka, OK Req. Date ____
Shipment Date is now 11/24/93 As of 11/19/93 Changed from ____
Inspector estimated shipment date 11/24/93 Order is 85 percent completed
Vendor Lide Tank Co. Order No. ____ Dated ____
Manufacturer Lide Tank Co. Phone 817-562-5526
Shop Location Mexia, TX Shop Order TKEB2 & TKEF4
Inspector's Contact Mr. Billy Lide Position Customer Contact
Report is: X Interim ___ Final Regarding: X Inspection ___ Expediting ___ Status
MATERIAL DESCRIPTION:

Two (2) tanks - one 6' 4" OD x 12' 0" high; one 5' 0" OD X 12' 0" high
To specifications of USPCI and API 650

STATUS OF ORDER: Engineering, Materials, Fabrication, Inspection, Completion

The following was performed on each item:

Dimensional checks covering elevation, orientation, projection of all nozzles and manways. All of which were noted to be acceptable and as noted on shop approved drawings.

Fit-up of material: seams, junctions and welding of same was found to be very good. Visual inspection on nozzle fit-up and welding was noted as very good.

Review of two (2) spot x-rays (one on each item) was found to be satisfactory.

Leak test on each item was performed and noted as acceptable. Vessels were filled for over twelve (12) hours. Visual inspection disclosed no leaks or seeps.

Inspection of blasting and painting is scheduled for Wednesday, 11/24/93.

Rec 12-4-93 Dub

INSPECTOR: Dub Greer
INSPECTION ORDER: 12418-30-46

Piping Leak Tests

Piping Pressure Test

Customer: USPCI - Lone Mt. Facility

Project: Discharge piping from Evaporation Feed Pumps P76 and P79 to
(1) the block valve located just before suction side of Pump P75.
(2) the block valves located on either side of Preheat Exchanger EU-4.
(3) the check valves located between the normally closed (NC) valves and the TEEs connecting to the suction side of Filter Press Pumps P77, P80, and P83 (including by-pass lines).
(4) the flange located on suction side of Pump P-5.

Location: Waynoka, OK

Test Start Date: 8/5/96 Test Start Time: 3:55 p.m.

Test Finish Date: 8/5/96 Test Finish Time: 5:55 p.m.

Test Procedure:

Fill piping section between Pumps P76 and P79 discharge to valves described above. Apply water pressure to system up to 105 psig by hydro pump and hold this pressure for minimum 2 hours.

Results:

Piping section was isolated from Pumps P76, P79, and P-5 by flange and Pump P75, EU-4, and Pump P83 by valve. System was pressured up to 105 psig and held this pressure for 2 hours. No change in pressure gauge reading was observed.

Signature Geoffrey E. Brueggemann

Geoffrey E. Brueggemann, P.E.
Envirotech Services, Inc.

Date: Aug. 20, 1996

Tank Metallurgy

ACCEPTANCE STANDARD API 650 ITEM DESCRIPTION TK. EF4

RADIOGRAPHIC REQUIREMENTS RT-3

SOURCE:
TYPE Ir 192
SIZE .1
STRENGTH 41 ci.

EXPOSURE:
S. TO F. DISTANCE 16"
MAT'L THICKNESS .375
TIME 1 min 45 sec

VIEWING:
SINGLE ✓
COMPOSITE
SINGLE WALL
DOUBLE WALL

FILM:
MFG Kodak
TYPE T
SIZE 4½ x 10"

PENETRAMETER:
SIZE 17
SHIM THICKNESS .093
SOURCE SIDE yes
FILM SIDE

SCREENS:
FRONT .005
BACK .010

VIEW NUMBER	ACCEPT	REJECT	SLAG	POROSITY	INC. FUSION	BURN THRU	CRACK	UNDERCUT	INC. PENET	CONCAVE ROOT	CONVEX ROOT	UNDERFILL	OTHER
1-1													
1-2	✓												

RADIOGRAPHER D. Stanley LEVEL II Q.C. MGR. Evan Lemon DATE 11-18-93

AUTHORIZED INSPECTOR Reviewed Dale Lowe DATE

COMMENTS: 11-19-93 Wisco Inc.

PTANCE STANDARD API 650 ITEM DESCRIPTION TK. EB 2

DIOGRAPHIC REQUIREMENTS RT-3

URCE:
TYPE Ir 192
SIZE .1
STRENGTH 41 ci.

EXPOSURE:
S. TO F. DISTANCE 16"
MAT'L THICKNESS .375
TIME 1 min 45 sec

VIEWING:
SINGLE ✓
COMPOSITE
SINGLE WALL
DOUBLE WALL

M:
MFG Kodak
TYPE T
SIZE 4½ x 10"

PENETRAMETER:
SIZE 17
SHIM THICKNESS .093
SOURCE SIDE yes
FILM SIDE

SCREENS:
FRONT .005
BACK .010

VIEW NUMBER	ACCEPT	REJECT	SLAG	POROSITY	INC. FUSION	BURN THRU	CRACK	UNDERCUT	INC. PENET	CONCAVE ROOT	CONVEX ROOT	UNDERFILL	OTHER
L-1		✓											
1-2	✓												

ADIOGRAPHER D. Staly LEVEL II Q.C. MGR. Evan Lemon DATE 11-18-93

UTHORIZED INSPECTOR Reviewed 11-19-93 Duke Crum Wisco Inc. DATE

OMMENTS:

GENEVA ST

Test Report

JOB, CONTRACT .

P.O. DATE	PURCHASE O. NO.
06/09/93	60-0641/X-53625

SHIPPERS NO.	MILL ORDER NO.	TALLY NO.
GC625400 09-23-93	EA66015	GC625400

VEHICLE IDENTITY SP 595603

GENEVA STEEL
P.O. BOX 2500
PROVO. UTAH 84603

MANNESMANN PIPE&STEEL CORP
1990 POST OAK BLVD
HOUSTON TX 77056-3811

ONEAL STEEL INC
10848 LUNA ROAD
DALLAS TEXAS

SHIP TO

THIS IS TO CERTI[illegible] THAT THE PRODUCT DESCRIBED HEREIN WA MANUFACTURED. SAMPLED. TES[illegible] ED AND/OR INSPECTED IN ACCORDANCE WITH THE SPECIF[illegible] CATION AND FULFILLS REQUIRE MENTS IN SUCH RESPECTS.

Edward T. Brodle

CORPORATE DIRECTOR. QUALIT[illegible]

DATE 09-23-93

H.R. SHEET C.25 MAX P.040 MAX S.050 MAX HR36S058 Y/P 36 KSI MIN
T/S 58 KSI MIN DRY NO OIL (FOR CONVERSION TO ASTM A-36)

01 MILL RA/SN CERTIFIED T/R

ITEM NO.	MATERIAL DESCRIPTION: THICKNESS OR SECTION	WIDTH, DIA. OR FT. WT.	LENGTH	QUANTITY	WEIGHT	HEAT NO.	TEST OR PIECE IDENTITY	YIELD PT. PSI	TENSILE STR. PSI	ELONGATION % IN 8"	ELONGATION % IN 2"	% RED. OF AREA	B
3	.3650"	72.0000"	COIL 655782	1	48630#	103294	.3610"	43000	62500	27.0			
							.3680"	46700	64900	24.0			
							***END OF	DATA***					

HEAT NO.	TYPE	C	MN	P	S	SI	CU	NI	CR	MO	SN	AL	N	V	B	TI	CB	CO
103294	HEAT	24	79	011	019	06												
'GENEVA STEEL COMPANY CERTIFIES ALL SMELTING, MELTING AND MANUFACTURING PROCESSES OCCURRED IN THE USA.'																		
END OF DATA																		

008064 [illegible]

GENEVA STEEL

Test Report

JOB, CONTRACT NO.

P.O. DATE	PURCHASE ORDER NO.
10/16/92	60-8349/23-3878-92

SHIPPERS NO.	MILL ORDER NO.	INVOICE NO.
GC508408 12-08-92	EA54100	GC508408

VEHICLE IDENTITY RG 310945

GENEVA STEEL
P.O. BOX 2500
PROVO, UTAH 84603

MANNESMANN PIPE&STEEL CORP
1990 POST OAK BLVD
HOUSTON TX 77056-3811

SHIP TO
FERRO UNION
7400 MESA ROAD
SP SPIN#243093
HOUSTON,TEXAS

THIS IS TO CERTIFY THAT THE PRODUCT DESCRIBED HEREIN HAS MANUFACTURED, SAMPLED, TESTED AND/OR INSPECTED IN ACCORDANCE WITH THE SPECIFICATION AND FULFILLS REQUIREMENTS IN SUCH RESPECTS.

Larry D. Clinger
MANAGER - QUALITY ASSURANCE
DATE 12-08-92

H.R. SHEET C.25MAX P.040MAX S.050MAX HR36S058 Y/P 36 KSI MIN T/S 58 KSI MIN DRY NO OIL

01 MILL RA/SN CERTIFIED T/R ANALYSIS REPORT TEST RESULTS PER PROD SPECN CAPTION

ITEM NO.	MATERIAL DESCRIPTION: THICKNESS OR SECTION	WIDTH, DIA. OR FT. WT.	LENGTH	QUANTITY	WEIGHT	HEAT NO.	TEST OR PIECE IDENTITY	YIELD PT. PSI	TENSILE STR. PSI	ELONGATION % IN 8"	ELONGATION % IN 2"	% RED. OF AREA	BEN
	.3600"	72.0000"	COIL 566534	1	43230#	1C3269	.3600"	46600	70600	20.0			
	3/8						.3600"	51100	72000	23.0			
							END OF DATA						

HEAT NO.	TYPE	C	MN	P	S	SI	CU	NI	CR	MO	SN	AL	N	V	B	TI	CB	CO
C3269	HEAT	23	86	011	022	03												

GENEVA STEEL COMPANY CERTIFIES ALL SMELTING, MELTING AND MANUFACTURING PROCESSES OCCURRED IN THE USA.

END OF DATA

008064 REMARKS CONTINUED ON BACK

Piping Metallurgy

BELLVILLE TUBE CORP

P.O.Box 220
Bellville, Texas 77418

MILL CERTIFICATION

S.O.#	CUSTOMER ORDER #:	DATE:	SOLD
001363	74454	5-13-93	20142

SOLD TO:	SHIP TO:
Texas Pipe & Supply 2330 Holmes Rd. Houston, Texas 77051	Texas Pipe & Supply 2330 Holmes RD. Houston, Texas

SIZE:	WALL	GRADE:	TYPE	LENGTH	QUANTITY
3.500"	.216"	5L Gr B/X42 A53 Gr B	ERW	SEE BELOW	1,303 Pcs.

SPECIAL INSTRUCTIONS: 25°
BEVELED FOR WELDING

LOT	HEAT	C	Mn	P	S	Si	ULT.	YIELD	%El.
DE009	25963	.20	.99	.010	.006	.22	72,710	51,254	45.7
DE010	25965	.21	.98	.010	.004	.21	72,510	50,313	45.7
DE011	25965	.21	.98	.010	.004	.21	72,903	51,479	44.7
DE012	25965	.21	.98	.010	.004	.21	72,054	48,330	45.3
DE013	25962	.20	1.00	.011	.005	.20	71,971	49,872	45.4
DE014	25962	.20	1.00	.011	.005	.20	75,206	53,979	43.8
DE015	25962	.20	1.00	.011	.005	.20	74,687	54,291	42.1
DE016	25965	.21	.98	.010	.004	.21	71,451	48,730	45.1

All material has passed API flatting tests,
and Hydrostatic tests.

Notwithstanding any other provision in this contract, B.T.C. gives no warranty as to the suitability or fitness of this product for upgrading by Quench and Temper or any other process, unless B.T.C. shall be consulted in advance and give its approval in writing.

We hereby certify that the above information is true and correct as contained in the records of this division.

HACKNEY, INC.

A DIVISION OF TRINITY INDUSTRIES

P.O. Box 568887 • 2525 Stemmons Freeway
Dallas, Texas 75356-8887 • (214) 634-2850

YOUR ORDER NUMBER	REFERENCE	CUSTOMER NO.	INVOICE NO.	INVOICE DATE	DATE SHIPPE
DARRELL ANDERSO		454634			

SOLD TO: K & K SUPPLY CO
PO BOX 548
DUNCAN OK 75533

SHIP TO:

TSI 414 (R 6/91)

CERTIFIED TEST REPORT

ITEM	QUANTITY	DESCRIPTION/SPECIFICATION	HEAT CODE
		6 STD LR 90 A234-92A/SA234 WPB A106B 09 / U60907 STRESS RELIEVED AT 1200 F	C66W

CHEMICAL ANALYSIS

CODE	C	Mn	P	S	Si	Cr	Mo	Cu	Ni	V	Nb		C.E. -
6W	.17	.77	.011	.007	.23	.02	.00	.01	.01	.00	.00		.30

MECHANICAL PROPERTIES

HEAT CODE	TENSILE * KSI	YIELD KSI	% Elong. IN 2"	Hardness HB	Size MM x 10 mm	Temp. °F	FOOT POUNDS	LATERAL EXPANSION	% SHEAR
C66W	65.9 L	41.9	33.0	126					

* = LONGITUDINAL, T = TRANSVERSE

C66W CONFORMS TO THE REQUIREMENTS OF NACE MR0175-92

The above items were heat treated in accordance with the requirements of the specification to which they were manufactured.

We hereby certify that the products covered by this report comply with the applicable requirements of ASTM and/or ASME specifications, as noted for each item.

We hereby certify that the above figures are correct, as contained in the records of the Company.

Glinda Lastfluss

HACKNEY, INC.

A DIVISION OF TRINITY INDUSTRIES

P.O. Box 568887 • 2525 Stemmons Freeway
Dallas, Texas 75356-8887 • (214) 634-2850

YOUR ORDER NUMBER	REFERENCE	CUSTOMER NO.	INVOICE NO.	INVOICE DATE	DATE SHIPPED
0099-001186	C121252	454634	982719	01/20/94	01/20/94

Woodward

SOLD TO: M & M SUPPLY CO
PO BOX 548
DUNCAN OK 75533

SHIP TO: M&M SUPPLY CO
2512 NO. 4TH STREET
ENID, OK 73701

CERTIFIED TEST REPORT

RI 414 (R 8/91)

ITEM	QUANTITY	DESCRIPTION/SPECIFICATION		HEAT CODE
1	8	6 150 RF WN STD	A105-92 /SA105	1293LB
		A105 01 / DJB	AS FORGED	
10	8	8 STD LR 90	A234-92A/SA234 WPB	C67R
		A106B 09 / X63386	STRESS RELIEVED AT 1200 F	

CHEMICAL ANALYSIS

CODE	C	Mn	P	S	Si	Cr	Mo	Cu	Ni	V	Nb		C.E.=
1293LB	.19	1.02	.012	.022	.25	.07	.01	.17	.06	.02	.00		.40
C67R	.18	.84	.008	.005	.25	.02	.01	.01	.02	.00	.00		.33

PHYSICAL PROPERTIES / CHARPY RESULTS

HEAT CODE	TENSILE * KSI	YIELD KSI	% Elong. IN 2"	Hardness HB	Size MM x 10 mm	Temp. °F	FOOT POUNDS	LATERAL EXPANSION	% SHEAR
1293LB	88.8	58.4	30.6	187					
	% R.A.	=63.4		MAX					
C67R	71.1 L	46.6	37.0	153					

*L = LONGITUDINAL, T = TRANSVERSE

1293LBC67R CONFORM TO THE REQUIREMENTS OF NACE MR0175-92

The above items were heat treated in accordance with the requirements of the specification to which they were manufactured.

We certify that the products covered by this report comply with the applicable requirements of ASTM and/or ASME specifications, as noted for each item.

We hereby certify that the above figures are correct, as contained in the records of the Company.

By: Brinda Matthews

MILL TEST REPORTS FURNISHED BY
TEXAS PIPE & SUPPLY CO., INC.

CUSTOMER ____________

CUSTOMER P.O. # ____________

NORTH STAR STEEL
Seamless Tubular Products

CERTIFIED TEST REPORT

HEAT NO.: SLN 8Y0167		NSSO MILL ORDER NO.: 0-0017155-0
PRODUCT DESCRIPTION : 6.625 OD 0.280 WALL 18.97 LBS/FT PE DRL	CUSTOMER ORDER NO.: 7273	NSSH W/O NO.:
GRADE :API 5L X42/B	CUSTOMER SPEC.:	NSSH LOT NO.:

MECHANICAL PROPERTIES: LONGITUDINAL

SPECIMEN CROSS SECTION			ACTUAL LOAD (KIPS)		STRENGTH (KSI)		ELONGATION	
WIDTH (IN)	THICK (IN)	AREA (SQIN)	YIELD	TENSILE	YIELD	TENSILE	GAGE LENGTH	% ELONG
1.479	0.273	0.4038	20.4	31.0	50.5	76.8	2.0	36.8
1.472	0.287	0.4225	22.1	32.9	52.3	77.9	2.0	38.8

COMMENTS

This material is also manufactured to
ASTM A519 Rev. 96
ASTM A106 Rev. 91
ASME SA53-B Rev. 96
ASME SA106-B Rev. 91

CHEMICAL ANALYSIS: (N861)

	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Sn	Cb	V	Al	Ca	B	Ti	N	CE
HEAT	0.21	0.74	0.007	0.007	0.25	0.25	0.11	0.07	0.03	0.017		0.001	0.026	0.0028			0.0104	0.38
PRODUCT #1	0.21	0.71	0.008	0.007	0.24	0.24	0.11	0.07	0.03	0.016		0.002	0.025	0.0017			0.0112	0.38
PRODUCT #2	0.21	0.78	0.008	0.007	0.23	0.23	0.11	0.07	0.03	0.016		0.002	0.026	0.0017				0.38
PRODUCT #3	0.21	0.77	0.007	0.008	0.25	0.25	0.11	0.07	0.03	0.015		0.002	0.024	0.0019				0.38
PRODUCT #4	0.21	0.77	0.007	0.003	0.23	0.25	0.11	0.07	0.03	0.015		0.002	0.025					0.38

HYDROSTATIC TEST (psi): 2660

SUPPLEMENTAL REQUIREMENTS	YES	NO	REMARKS
HARDNESS	X		RB AVG 85
CHARPY IMPCT TST			
FLATTENING TEST	X		PASSED
NACE TEST			
JOMINY HARDEN			
GRAIN SIZE			
OTHER			Satisfies NACE MR-01-75

Signed: [signature]

Date: 2-2-94

Signature: ____________

SWORN AND SUBSCRIBED TO BEFORE ME

THE ______ DAY ______

Notary Public

MY COMMISSION EXPIRES ______

THIS CERTIFICATE IS NOTORIZED ONLY WHEN REQUESTED

WELDED PIPE SECTION

REPORT OF CHEMICAL ANALYSIS AND PHYSICAL TESTS

Newport Steel

Oil Country Tubular Goods
Line Pipe • Piling

NINTH & LOWELL STREETS • NEWPORT, KY. 41072
606-292-6000

DATE 12/18/92 | CUSTOMER'S PURCHASE ORDER 79584

CERTIFICATION NUMBER C18871 | TUBULAR MILL ORDER T5694

SHIP DATE 12/16/92 | BILL OF LADING NUMBER B25404

VEHICLE I.D. | RANGE NUMBER C&O 356426

MADE AND MANUFACTURED IN U.S.A.

CERTIFICATION STATEMENT

This is to certify that the product described as in accordance with the described specification and all information is correct as contained in the records of this co... Prepared by the office of D. K. Haggard-Manager Mat... & Inspection.

12/18/9

SOLD TO
TEXAS PIPE & SUPPLY, INC.
2330 HOLMES ROAD
HOUSTON TX
77051

COMMENTS

SHIP TO
TEXAS PIPE & SUPPLY INC.
SP DELIVERY PIERCE JCT. TRACK
SPIN 774190
HOUSTON, TEXAS.

DESCRIPTIONS AND SPECIFICATIONS: API-5L X42 GRADE

GAUGE AND SIZE: .237 4-1/2"

CHEMICAL ANALYSIS

HEAT	C0643		C0607		A6017		B4882		A6021			
LOT	121592D		121592D		121592D		121592D		121592D			
	LADLE	CHECK	LADLE	CHECK	LADLE	CHECK	LADLE	CHECK	LADLE	CHECK	LADLE	CHECK
C.	.1800	.1800	.1700	.1700	.1700	.1700	.1800	.1900	.1900	.1900		
Mn.	.5200	.5300	.5100	.5400	.5800	.5600	.5000	.4900	.5000	.4900		
P.	.0060	.0060	.0070	.0070	.0070	.0070	.0050	.0040	.0070	.0080		
S.	.0040	.0060	.0100	.0120	.0070	.0090	.0040	.0070	.0070	.0080		
Si.	.1600	.1500	.1500	.1600	.1700	.1800	.1500	.1600	.1700	.1600		
Cu.	.2000	.2000	.1000	.1000	.1700	.1600	.0900	.0900	.3100	.3000		
Ni	.0600	.0700	.0400	.0400	.0600	.0600	.0300	.0300	.0600	.0700		
Cr	.1000	.1000	.0500	.0500	.0700	.0700	.0400	.0400	.0900	.0900		
Mo	.0200	.0200	.0100	.0100	.0200	.0200	.0100	.0100	.0300	.0300		
Al	.0290	.0310	.0370	.0360	.0340	.0350	.0340	.0310	.0330	.0350		
V	.0010	.0010	.0010	.0010	.0010	.0010	.0010	.0010	.0010	.0010		
Cb.												
Ca	.0040	.0040	.0020	.0010	.0034	.0040	.0054	.0043	.0042	.0027		

PHYSICAL TESTS

TENSILE	64200	64900	65500	65900	80500	
WELD TEST						
YIELD	53300	53200	56800	55000	65900	
ELG	39	37	37	38	32	
TEST PRESS	2650	2650	2650	2650	2650	
FLAT	OK	OK	OK	OK	OK	

KOPPEL DIVISION
AMBRIDGE DIVISION
PHONE: 412-843-7100
FAX: 412-847-4071

KOPPEL STEEL
A Subsidiary of Ipsi Group Inc.

TUBULAR TEST REPORT

ORDER NO: T3334

SOLD TO:
TEXAS PIPE & SUPPLY CO., INC.
ATTN: PURCHASING DEPARTMENT
2330 HOLMES ROAD
HOUSTON, TX 77051

SHIP TO:
TEXAS PIPE & SUPPLY CO., INC.
HOUSTON, TX SPIN 774190
S. PIERCE JUNCTION TEAM
TRACK

CUST P.O.
79335 H

SPECIFICATION(S): ASTM ASME SA/A53-93a SA/A106-93/API 5L GR B/X42

O.D.	WALL	WT/FT	GRADE	QUALITY
3.5000	.216	7.58	1023M	SEAMLESS HOT FINISH

CONDITION (SPECIAL):

HEAT #		C	Mn	S	P	Si	Cr	Ni	Mo	Cu	Al	SN	CB	V	CA
414640	L	.19	.51	.013	.010	.24	.12	.10	.02	.19	.022			.003	
	P	.19	.51	.014	.010	.24	.12	.10	.02	.19	.024			.003	
	P	.19	.51	.013	.009	.24	.12	.10	.02	.19	.022			.002	
	P	.19	.51	.012	.010	.24	.12	.10	.02	.19	.022			.002	
	P	.19	.51	.012	.009	.24	.12	.10	.02	.19	.022			.002	

LOT #	SPECIMEN	YIELD KSI	TENSILE KSI	ELONG 2"	R\A	BHN	ROCK WELL	GRAIN SIZE	MACROLYSIS F	S
	.750 " STR	48.8 49.6	71.2 72.3	36 36				7		

MATERIAL MELTED AND MANUFACTURED IN USA

OTHER

HYDRO - 3000 PSI. 5 SEC HOLD
FLATS - OK
CERTIFIED NACE MR0175

MILL TEST REPORTS FURNISHED BY
TEXAS PIPE & SUPPLY, CO. INC.
CUSTOMER _____
CUSTOMER PO# _____

7-26-94 Laurie Burnette
DATE QUALITY ASSURANCE

MATERIAL WAS NOT EXPOSED TO MERCURY DURING PROCESSING.

NO WELDING OR WELD REPAIR PERFORMED ON THIS MATERIAL.

T E S T R E P O R T

Koppel Steel Corporation
Ambridge Tube Operations
P.O. Box 410
Ambridge, PA 15003
Koppel Steel Operations/General Offices
P.O. Box 750
Beaver Falls, PA 15010
Phone 412-843-7100, Fax 412-847-6258

MILL TEST REPORTS FURNISHED BY
TEXAS PIPE & SUPPLY CO., INC.

CUSTOMER_____

CUSTOMER PO #_____

KOPPEL DIVISION
AMBRIDGE DIVISION
PHONE: 412-843-7100
FAX: 412-947-4071

KOPPEL STEEL
A Subsidiary of KS Group Inc.

TUBULAR TEST REPORT

ORDER NO: T3561

SOLD TO:
TEXAS PIPE & SUPPLY CO., INC.
ATTN: PURCHASING DEPARTMENT
2330 HOLMES ROAD
HOUSTON, TX 77051

SHIP TO:
TEXAS PIPE & SUPPLY CO., INC.
RAIL SPUR NO. 774190

HOUSTON, TX

CUST P.O. 80477H

SPECIFICATION(S): ASTM ASME SA/A53-93a SA/A106-93/API 5L GR B/X42
CERTIFIED NACE MR0175

O.D.	WALL	WT/FT	GRADE	QUALITY
3.5000	.216	7.58	1023M	SEAMLESS HOT FINISH

CONDITION (SPECIAL):

HEAT #		C	Mn	S	P	Si	Cr	Ni	Mo	Cu	Al	SN	CB	V	CA
416412	L	.20	.51	.011	.006	.26	.07	.07	.01	.15	.021			.001	
	P	.19	.49	.009	.006	.25	.08	.07	.01	.15	.020			.001	
	P	.18	.49	.010	.006	.25	.08	.07	.01	.15	.020			.001	
	P	.19	.50	.009	.006	.26	.07	.08	.01	.15	.020			.001	
	P	.18	.49	.010	.006	.25	.07	.07	.01	.14	.019			.001	

LOT #	SPECIMEN	YIELD KSI	TENSILE KSI	ELONG 2"	R\A	BHN	ROCK WELL	GRAIN SIZE	MAGNAFLUX F	MAGNAFLUX D
	.750 " STR	51.8 52.7	72.8 73.5	36 35				7		

MATERIAL MELTED AND MANUFACTURED IN USA

OTHER

HYDRO - 3000 PSI 5 SEC HOLD
FLATS - OK

lb

10-11-94 Lauri Ruisette
DATE QUALITY ASSURANCE

MATERIAL WAS NOT EXPOSED TO MERCURY DURING PROCESSING.

NO WELDING OR WELD REPAIR PERFORMED ON THIS MATERIAL.

TEST REPORT

Koppel Steel Corporation

Ambridge Tube Operations
P.O. Box 410
Ambridge, PA 15003

Koppel Steel Operations/General Offices
P.O. Box 750
Beaver Falls, PA 15010
Phone 412-843-7100, Fax 412-847-4355

of USA Corporation

METALLURGICAL TEST REPORT

10M 10:41:34

CONTRACT NO.

P.O. DATE | PURCHASER DO. 1349287

USS TUBULAR PRODUCTS

SHIPPERS NO. R13023 | MILL ORDER NO. D589600 01 | INVOICE NO. 1

VEHICLE IDENTIFY LT2240 / /

MAIL TO

THIS IS TO CERTIFY THAT THE PRODUCT DESCRIBED HEREIN WAS MFG., SAMPLED, TESTED, AND/OR INSPD. IN ACCORDANCE WITH THE SPECIFICATION AND FULFILLS REQUIREMENTS IN SUCH RESPECTS.
APPROVED BY OFFICE OF:
D.S. DABKOWSKI MGR. MET. & Q.A. USS TUBULAR PRODUCTS

DATE 02/23/93

MILL TEST REPORTS FURNISHED BY
TEXAS PIPE & SUPPLY CO., INC.
CUSTOMER MTM
CUSTOMER PO # DTL 100273

MATERIAL DESCRIPTION			MATL	HEAT/LOT NO.	MIN. HYDRO PSI	YIELD STR. PSI	TENSILE STR. PSI	ELONG. % IN 2"	GAGE WIDTH IN.	FLAT	BEND
SIZE	WALL	SPECIFICATION & GRADE									
2 3/8	.154	ASTM A53-90BGR.B ASME SA53 GR.B 89ED.91 ADD ASTM A106 91 GR.B ASME SA106 GR.B 89 ED.91 ADD. API 5L GR.B/X42 10TH ED.11/92	BML	N66003	3000	74100	74400	35.0	3/4		OK
2 3/8	.154	ASTM A53-90BGR.B ASME SA53 GR.B 89ED.91 ADD ASTM A106 91 GR.B ASME SA106 GR.B 89 ED.91 ADD. API 5L GR.B/X42 10TH ED.11/92	BML	N66011	3000	72400	75700	32.0	3/4		OK

HEAT NO.	TYPE	C	MN	P	S	SI	CU	NI	CR	MO	BN	AL	N	V	B	TI	CB	CO	
N66003	HEAT	16	106	012	005	28	02	01	04	01				001					CE=.36
N66003	PROD	19	107	008	007	25	01	01	08	01				001					HRB=76.0
N66011	HEAT	17	103	011	011	26	02	01	05	01				001					CE=.35
N66011	PROD	17	106	007	012	25	02	01	06	01				001					HRB=73.0

END OF DATA THIS SHEET ***

ALL MELTING AND MANUFACTURING TOOK PLACE IN THE USA.

PREV. (to 25) DECIMAL POSITIONS FOR ELEMENTS ARE INDICATED BY THE LEFT MARGIN, VERTICAL DOTTED LINE OR DECIMAL POINT.

MILL TEST REPORTS FURNISHED BY
TEXAS PIPE & SUPPLY CO., INC.

CUSTOMER_____

CUSTOMER PO #_____

KOPPEL DIVISION
AMBRIDGE DIVISION
PHONE: 412-343-7100
FAX: 412-847-4071

KOPPEL
A Subsidiary of IRI Group Inc.

TUBULAR TEST REPORT

ORDER NO: T3554

SOLD TO:	SHIP TO:	CUST P.O.
TEXAS PIPE & SUPPLY CO., INC. ATTN: PURCHASING DEPARTMENT 2330 HOLMES ROAD HOUSTON, TX 77051	TEXAS PIPE & SUPPLY CO., INC. RAIL SPUR 774190 HOUSTON, TX	8C477H

SPECIFICATION(S): ASTM A5MX SA/A53-93a/SA/A106-93/API 5L GR B/X42

O.D.	WALL	WT/FT	GRADE	QUALITY
2.3750	.154	3.65	1023M	SEAMLESS HOT FINISH

CONDITION (SPECIAL):

HEAT #		C	Mn	S	P	Si	Cr	Ni	Mo	Cu	Al	SN	CB	V	CA
418527	L	.19	.52	.009	.006	.29	.09	.09	.02	.18	.018				
	D	.19	.53	.010	.006	.28	.10	.09	.02	.18	.020				
	P	.19	.53	.010	.006	.27	.09	.09	.02	.19	.019				
	P	.18	.53	.010	.006	.27	.09	.09	.03	.18	.018				
	P	.19	.52	.010	.005	.28	.09	.09	.02	.18	.020				

LOT #	SPECIMEN	YIELD KSI	TENSILE KSI	ELONG 2"	R\A	BHN	ROCK WELL	GRAIN SIZE	MAGNAFLUX F S
	.750 " STR	54.9 54.4	73.8 73.1	33 38				7	

MATERIAL MELTED AND MANUFACTURED IN USA

OTHER

-HYDRO - 3000 PSI 5 SEC HOLD
BENDS - OK
CERTIFIED NACE MR0175

MILL TEST REPORTS FURNISHED BY
TEXAS PIPE & SUPPLY, CO. INC.
CUSTOMER_____
CUSTOMER PO#_____

9-21-94 Laurie Burnette
DATE QUALITY ASSURANCE

MATERIAL WAS NOT EXPOSED TO MERCURY DURING PROCESSING.

NO WELDING OR WELD REPAIR PERFORMED ON THIS MATERIAL.

T E S T R E P O R T

HACKNEY, INC.

A DIVISION OF TRINITY INDUSTRIES

P.O. Box 568887 • 2525 Stemmons Freeway
Dallas, Texas 75356-8887 • (214) 634-2850

YOUR ORDER NUMBER	REFERENCE	CUSTOMER NO.	INVOICE NO.	INVOICE DATE	DATE SHIPPED
0099-002979	C139654	454634	819873	12/02/94	12/02/9

SOLD TO: M & M SUPPLY CO
PO BOX 548
DUNCAN OK 75533

SHIP TO: M & M SUPPLY
3923 OKLAHOMA AVE
WOODWARD, OK 73801

CERTIFIED TEST REPORT

TRI 414 (R 12/93)

ITEM	QUANTITY	DESCRIPTION/SPECIFICATION	HEAT CODE
30		3X1 STD CONC. A234-92A/SA234 WPB A106B 09 / N69975	XGJ
31	12	3X2 STD CONC A234-92A/SA234 WPB A106B 09 / L82128 STRESS RELIEVED AT 1200 F	LYH1
32	6	4X2 STD CONC A234-92A/SA234 WPB A106B 09 / C86737 STRESS RELIEVED AT 1200 F	MAL1
33	12	4X3 STD CONC A234-92A/SA234 WPB A106B 09 / C86737 STRESS RELIEVED AT 1200 F	MAL1

CHEMICAL ANALYSIS

T CODE	C	Mn	P	S	Si	Cr	Mo	Cu	Ni	V	Nb		CE =
XGJ	.18	.82	.010	.009	.26	.06	.01	.01	.02	.00	.00		.33
LYH1	.18	.83	.011	.004	.26	.06	.02	.03	.02	.00	.00		.34
MAL1	.18	.78	.010	.010	.24	.03	.01	.01	.00	.00	.00		.32
MAL1	.18	.78	.010	.010	.24	.03	.01	.01	.00	.00	.00		.32

	PHYSICAL PROPERTIES				CHARPY RESULTS				
HEAT CODE	TENSILE * KSI	YIELD KSI	% Elong. IN 2"	Hardness HB	Size MM x 10 mm	Temp. °F	FOOT POUNDS	LATERAL EXPANSION	% SHEAR
XGJ	70.0 L	45.3	37.0	197 MAX					
LYH1	62.1 L	42.5	26.0	125					
MAL1	67.80L	47.7	31.0	121					
MAL1	67.80L	47.7	31.0	121					

*L = LONGITUDINAL, T = TRANSVERSE, R = ROUND, S = STRIP

HACKNEY is a domestic manufacturer, and these items conform to the following specifications as they apply:
FITTINGS: ASTM A234 WPB, ASME SA234 WPB, ANSI B16.9, B16.28, AND NACE MR01-75.
FLANGES: ASTM A105 AND A516-70, ASME SA105, ANSI B16.5, and NACE MR01-75.
were heat treated as required by the applicable specification. They also conform to the requirements of Parts 192 and 195, Title 49, Code of Federal ons. All welded fittings are welded by certified welders to ASME Section X, and 100% radiographically examined per Article 2, ASME Section V. All are ce with the requirements of Paragraph UG-11, Section VII, Division 1 of the ASME code. Hackney weld caps meet ASME Division 1, Section VIII Pressure Vessel Code Requirements, Paragraph UCS-79d. We certify these flanges and fittings capable of passing a hydrostatic test compatible with their rating, and the above figures are correct as contained in the records of the Company. Hardness testing and stamping are per NACE MR01-75.

HACKNEY, INC.

A DIVISION OF TRINITY INDUSTRIES

P.O. Box 568887 • 2525 Stemmons Freeway
Dallas, Texas 75356-8887 • (214) 634-2850

YOUR ORDER NUMBER	REFERENCE	CUSTOMER NO.	INVOICE NO.	INVOICE DATE	DATE SHIPPED
0099-002979	C139654	454634	819873	12/02/94	12/02/94

SOLD TO: H & M SUPPLY CO
PO BOX 548
DUNCAN OK 75533

SHIP TO: M & M SUPPLY
3923 OKLAHOMA AVE
WOODWARD, OK 73801

CERTIFIED TEST REPORT

TRI 414 (R 12/93)

ITEM	QUANTITY	DESCRIPTION/SPECIFICATION		HEAT CODE
28	7	8 STD WC A516-70 TUSCL 5B92016	A234-92A/SA234 WPB	AZKD
29	3	10 STD WC A516-70 TUSCL 5B92016	A234-92A/SA234 WPB	AZJW
30	8	3X1 STD CONC. A106B 09 / N76276	A234-92A/SA234 WPB	XCV
30		3X1 STD CONC A106B 15 / 76406	A234-92A/SA234 WPB	XCC

CHEMICAL ANALYSIS

CODE	C	Mn	P	S	Si	Cr	Mo	Cu	Ni	V	Nb		C.E. *
AZKD	.24	1.07	.020	.009	.22	.03	.00	.03	.02	.00	.00		.43
AZJW	.24	1.07	.020	.009	.22	.03	.00	.03	.02	.00	.00		.43
XCV	.17	1.03	.004	.003	.22	.04	.01	.02	.02	.00	.00		.36
XCC	.19	1.00	.026	.009	.29	.01	.01	.01	.00	.00	.00		.36

PHYSICAL PROPERTIES / CHARPY RESULTS

HEAT CODE	TENSILE * KSI	YIELD KSI	% Elong. IN 2"	Hardness HB	Size MM x 10 mm	Temp. °F	FOOT POUNDS	LATERAL EXPANSION	% SHEAR
AZKD	80.1 T	55.7	33.0	197 MAX					
AZJW	85.0 T	58.6	32.0	197 MAX					
XCV	74.4 L	48.1	35.0	197 MAX					
XCC	75.4 L	51.5	31.0	197 MAX					

*L = LONGITUDINAL, T = TRANSVERSE, R = ROUND, S = STRIP

HACKNEY is a domestic manufacturer, and these items conform to the following specifications as they apply:
FITTINGS: ASTM A234 WPB, ASME SA234 WPB, ANSI B16.9, B16.28, AND NACE MR01-75.
FLANGES: ASTM A105 AND A516-70, ASME SA105, ANSI B16.5, and NACE MR01-75.
were heat treated as required by the applicable specification. They also conform to the requirements of Parts 192 and 195, Title 49, Code of Federal ns. All welded fittings are welded by certified welders to ASME Section X, and 100% radiographically examined per Article 2, ASME Section V. All are in e with the requirements of Paragraph UG-11, Section VII, Division 1 of the ASME code. Hackney weld caps meet ASME Division 1, Section VIII Pressu Vessel Code Requirements, Paragraph UCS-79d. We certify these flanges and fittings capable of passing a hydrostatic test compatible with their rating, and that above figures are correct as contained in the records of the Company. Hardness testing and stamping are per NACE MR01-75.

HACKNEY, INC.

A DIVISION OF TRINITY INDUSTRIES

P.O. Box 568887 • 2525 Stemmons Freeway
Dallas, Texas 75356-8887 • (214) 634-2850

YOUR ORDER NUMBER	REFERENCE	CUSTOMER NO.	INVOICE NO.	INVOICE DATE	DATE SHIPPED
0099-002979	C139654	454634	819873	12/02/94	12/02/94

SOLD TO: M & M SUPPLY CO
PO BOX 548
DUNCAN OK 75533

SHIP TO: M & M SUPPLY
3923 OKLAHOMA AVE
WOODWARD, OK 73801

TRI 414 (R 12/93)

CERTIFIED TEST REPORT

ITEM	QUANTITY	DESCRIPTION/SPECIFICATION	HEAT CODE
24	6	3 600 RF BLIND A105-93B/SA105 A105-04 / H0787 NORMALIZED AT 1650 F	0894CE
25	6	2 STD WC A234-92A/SA234 WPB A516-70 40 / J3543	AZFD
26	5	3 STD WC A234-92A/SA234 WPB A516-70 40 / K0848	AZHP
27	5	6 STD W/C A234-92A/SA234 WPB A516-70 TUSCL 88551000	AZJM

CHEMICAL ANALYSIS

CODE	C	Mn	P	S	Si	Cr	Mo	Cu	Ni	V	Nb		CE
0894CE	.25	1.04	.015	.027	.26	.08	.03	.28	.08	.00	.00		.47
AZFD	.17	1.01	.027	.010	.27	.09	.00	.03	.11	.02	.00		.37
AZHP	.15	1.08	.010	.009	.31	.06	.01	.03	.09	.01	.00		.35
AZJH	.26	1.19	.013	.014	.22	.01	.01	.02	.02	.00	.00		.46

PHYSICAL PROPERTIES / CHARPY RESULTS

HEAT CODE	TENSILE * KSI	YIELD KSI	% Elong. IN 2"	Hardness HB	Size MM x 10 mm	Temp °F	FOOT POUNDS	LATERAL EXPANSION	% SHEAR
0894CE	93.5 T % R.A.	55.6 =54.0	27.0	159					
AZFD	73.7 T	54.0	29.0	197 MAX					
AZHP	73.9 T	54.3	29.0	197 MAX					
AZJH	79.1 T	52.1	33.0	197 MAX					

L = LONGITUDINAL T = TRANSVERSE R = ROUND S = STRIP

HACKNEY is a domestic manufacturer, and these items conform to the following specifications as they apply:
FITTINGS: ASTM A234 WPB, ASME SA234 WPB, ANSI B16.9, B16.28, AND NACE MR01-75.
FLANGES: ASTM A105 AND A516-70, ASME SA105, ANSI B16.5, and NACE MR01-75.
were heat treated as required by the applicable specification. They also conform to the requirements of Parts 192 and 195, Title 49, Code of Federal
s. All welded fittings are welded by certified welders to ASME Section X, and 100% radiographically examined per Article 2, ASME Section V. All are in
with the requirements of Paragraph UG-11, Section VIII, Division 1 of the ASME code. Hackney weld caps meet ASME Division 1, Section VIII Pressure
essel Code Requirements, Paragraph UCS-79d. We certify these flanges and fittings capable of passing a hydrostatic test compatible with their rating, and that the
bove figures are correct as contained in the records of the Company. Hardness testing and stamping are per NACE MR01-75.

HACKNEY, INC.

A DIVISION OF TRINITY INDUSTRIES

P.O. Box 568887 • 2525 Stemmons Freeway
Dallas, Texas 75356-8887 • (214) 634-2850

YOUR ORDER NUMBER	REFERENCE	CUSTOMER NO.	INVOICE NO.	INVOICE DATE	DATE SHIPPE
0099-002979	C139654	454634	821782	12/16/94	12/16/9

SOLD TO: M & M SUPPLY CO
PO BOX 548
DUNCAN OK 75533

SHIP TO: M & M SUPPLY
3923 OKLAHOMA AVE
WOODWARD, OK 73801

CERTIFIED TEST REPORT

RI 414 (R 12/93)

ITEM	QUANTITY	DESCRIPTION/SPECIFICATION	HEAT CODE
42	100	3 STD LR 90 A234-92A/SA234 WPB A106B 09 / L82412 STRESS RELIEVED AT 1200 F	LZA1
51	3	8 STD TEE A234-92A/SA234 WPB A106B 07 / H60403 STRESS RELIEVED AT 1200 F	LZE1
53	6	4 XH LR 90 A234-92A/SA234 WPB A106B 09 / U82173 STRESS RELIEVED AT 1200 F	MCY1

CHEMICAL ANALYSIS

CODE	C	Mn	P	S	Si	Cr	Mo	Cu	Ni	V	Nb		C E =
LZA1	.19	.80	.011	.009	.26	.04	.01	.02	.02	.00	.00		.34
LZE1	.14	.70	.006	.007	.17	.09	.02	.18	.09	.00	.00		.30
MCY1	.17	.78	.012	.010	.23	.03	.01	.01	.01	.00	.00		.31

PHYSICAL PROPERTIES & CHARPY RESULTS

HEAT CODE	TENSILE * KSI	YIELD KSI	% Elong. IN 2"	Hardness HB	Size MM x 10 mm	Temp °F	FOOT POUNDS	LATERAL EXPANSION	% SHEAR
LZA1	67.5 L	45.1	26.0	127					
LZE1	67.4 L	46.9	36.0	114					
MCY1	70.2 L	51.9	32.0	137					

L = LONGITUDINAL, T = TRANSVERSE, R = ROUND, S = STRIP

HACKNEY is a domestic manufacturer, and these items conform to the following specifications as they apply:
FITTINGS: ASTM A234 WPB, ASME SA234 WPB, ANSI B16.9, B16.28, AND NACE MR01-75.
FLANGES: ASTM A105 AND A516-70, ASME SA105, ANSI B16.5, and NACE MR01-75.
were heat treated as required by the applicable specification. They also conform to the requirements of Parts 192 and 195, Title 49, Code of Federal
ns. All welded fittings are welded by certified welders to ASME Section X, and 100% radiographically examined per Article 2, ASME Section V. All are
e with the requirements of Paragraph UG-11, Section VII, Division 1 of the ASME code, Hackney weld caps meet ASME Division 1, Section VIII Press
essel Code Requirements, Paragraph UCS-79d. We certify these flanges and fittings capable of passing a hydrostatic test compatible with their rating, and tha
bove figures are correct as contained in the records of the Company. Hardness testing and stamping are per NACE MR01-75.

HACKNEY, INC.

A DIVISION OF TRINITY INDUSTRIES

P.O. Box 568887 • 2525 Stemmons Freeway
Dallas, Texas 75356-8887 • (214) 634-2850

YOUR ORDER NUMBER	REFERENCE	CUSTOMER NO.	INVOICE NO.	INVOICE DATE	DATE SHIPPED
0099-002979	C139654	454634	824237	01/12/95	01/12/95

ILD TO: M & M SUPPLY CO
PO BOX 548
DUNCAN OK 75533

SHIP TO: M & M SUPPLY
3923 OKLAHOMA AVE
WOODHARD, OK 73801

CERTIFIED TEST REPORT

1414 (R 12/93)

ITEM #	QUANTITY	DESCRIPTION/SPECIFICATION	HEAT CODE
35	12	6X4 STD CONC A234-92A/SA234 WPB A106B 07 / H90368 STRESS RELIEVED AT 1200 F	MCA1
41	80	2 STD LR 90 A234-92A/SA234 WPB A106B 09 / L82414 STRESS RELIEVED AT 1200 F	MCW1
45	18	3 STD TEE A234-92A/SA234 WPB A106B 09 / L82412 STRESS RELIEVED AT 1200 F	LZA1
46	18	4 STD TEE A234-92A/SA234 WPB A106B 09 / X85246 STRESS RELIEVED AT 1200 F	MCO1

CHEMICAL ANALYSIS %

CODE	C	Mn	P	S	Si	Cr	Mo	Cu	Ni	V	Nb		C.E. *
MCA1	.14	.64	.007	.006	.21	.08	.02	.14	.09	.00	.00		.25
MCW1	.17	.60	.010	.008	.24	.05	.01	.02	.03	.00	.00		.32
LZA1	.19	.80	.011	.009	.26	.04	.01	.02	.02	.00	.00		.34
MCO1	.16	.78	.014	.007	.22	.03	.01	.01	.01	.00	.00		.32

PHYSICAL PROPERTIES & CHARPY RESULTS

HEAT CODE	TENSILE * KSI	YIELD KSI	% Elong. IN 2"	Hardness HB	Size MM x 10 mm	Temp °F	FOOT POUNDS	LATERAL EXPANSION	% SHEAR
MCA1	62.6 L	43.7	38.0	107					
MCW1	70.2 L	45.9	35.5	197 MAX					
LZA1	67.5 L	45.1	26.0	127					
MCO1	68.1 L	46.7	47.6	197 MAX					

L = LONGITUDINAL, T = TRANSVERSE, R = ROUND, S = STRIP

ACKNEY is a domestic manufacturer, and these items conform to the following specifications as they apply:
FITTINGS: ASTM A234 WPB, ASME SA234 WPB, ANSI B16.9, B16.28, AND NACE MR01-75.
FLANGES: ASTM A105 AND A516-70, ASME SA105, ANSI B16.5, and NACE MR01-75.
ll were heat treated as required by the applicable specification. They also conform to the requirements of Parts 192 and 195, Title 49, Code of Federal e s. All welded fittings are welded by certified welders to ASME Section X and 100% radiographically examined per Article 2, ASME Section V. All are in x with the requirements of Paragraph UG-11, Section VII, Division 1 of the ASME code. Hackney weld caps meet ASME Division 1, Section VIII Pressure essel Code Requirements, Paragraph UCS-79d. We certify these flanges and fittings capable of passing a hydrostatic test compatible with their rating, and that the bove figures are correct as contained in the records of the Company. Hardness testing and stamping are per NACE MR01-75.

HACKNEY, INC.

A DIVISION OF TRINITY INDUSTRIES

P.O. Box 568887 • 2525 Stemmons Freeway
Dallas, Texas 75356-8887 • (214) 634-2850

YOUR ORDER NUMBER	REFERENCE	CUSTOMER NO.	INVOICE NO.	INVOICE DATE	DATE SHIPPED
0099-002979	C139654	454634	826204	01/25/95	01/25/95

SOLD TO: M&E M SUPPLY CO
P.O. BOX 548
DUNCAN, OK 75533

SHIP TO: M & M SUPPLY
3923 OKLAHOMA AVE
WOODWARD, OK 73801

CERTIFIED TEST REPORT

(RI 414 (R 12/93))

ITEM	QUANTITY	DESCRIPTION/SPECIFICATION	HEAT CODE
10	6	2 150 RF SO A105 26 / 494-3223	A105-93B/SA105 AS FORGED	1194CR
34	12	6X3 STD CONC A1068 07 / H90368	A234-92A/SA234 WPB STRESS RELIEVED AT 1200 F	MCA1

CHEMICAL ANALYSIS

HEAT CODE	C	Mn	P	S	Si	Cr	Mo	Cu	Ni	V	Nb		C.E.
1194CR	.19	.83	.019	.029	.21	.05	.02	.22	.10	.00	.00		.36
MCA1	.14	.64	.007	.006	.21	.08	.02	.14	.09	.00	.00		.33

PHYSICAL PROPERTIES

HEAT CODE	TENSILE * KSI	YIELD KSI	% Elong, IN 2"	Hardness HB	Size MM x 10 mm	Temp F	CHARPY RESULTS FOOT POUNDS	LATERAL EXPANSION	% SHEAR
1194CR	80.4	46.5	31.0	135					
	% R.A.	=65.0							
MCA1	62.6 L	43.7	38.0	107					

L = LONGITUDINAL, T = TRANSVERSE, R = ROUND, S = STRIP

HACKNEY is a domestic manufacturer, and these items conform to the following specifications as they apply:
FITTINGS: ASTM A234 WPB, ASME SA234 WPB, ANSI B16.9, B16.28, AND NACE MR01-75.
FLANGES: ASTM A105 AND A516-70, ASME SA105, ANSI B16.5, and NACE MR01-75.
were heat treated as required by the applicable specification. They also conform to the requirements of Parts 192 and 195, Title 49, Code of Federal
ns. All welded fittings are welded by certified welders to ASME Section X, and 100% radiographically examined per Article 2, ASME Section V. All are in
ce with the requirements of Paragraph UG-11, Section VII, Division 1, of the ASME code. Hackney weld caps meet ASME Division 1, Section VIII Pressur
/essel Code Requirements, Paragraph UCS-79d. We certify these flanges and fittings capable of passing a hydrostatic test compatible with their rating, and that th
above figures are correct as contained in the records of the Company. Hardness testing and stamping are per NACE MR01-75.

HACKNEY, INC.

A DIVISION OF TRINITY INDUSTRIES

P.O. Box 568887 • 2525 Stemmons Freeway

Dallas, Texas 75356-8887 • (214) 631-2850

YOUR ORDER NUMBER	REFERENCE	CUSTOMER NO.	INVOICE NO.	INVOICE DATE	DATE SHIPPED
0026945	C116345	297190	974358	11/16/93	11/16/93

SOLD TO: GRINNELL CORP.
4118 SOUTH 70TH AVE.
TULSA OK 74145

SHIP TO: GRINNELL CORP
4118 SOUTH 70TH EAST AVE.
TULSA, OK 74145

CERTIFIED TEST REPORT

ITEM	QUANTITY	DESCRIPTION/SPECIFICATION		HEAT CODE
7	20	6 15C RF WN STD A105 26 / 493-1631	A105-92 /SA105 AS FORGED	0593CA
7		6 15C RF WN STD A105 26 / 493-1247	A105-92 /SA105 AS FORGED	0593AX

CHEMICAL ANALYSIS

HEAT CODE	C	Mn	P	S	Si	Cr	Mo	Cu	Ni	V	Nb	CE *
0593CA	.22	.94	.020	.023	.23	.07	.02	.27	.09	.00	.00	.40
0593AX	.25	.83	.034	.029	.24	.12	.02	.34	.09	.00	.00	.45

PHYSICAL PROPERTIES / CHARPY RESULTS

HEAT CODE	TENSILE * KSI	YIELD KSI	% Elong. IN 2"	Hardness HB	Size MM x 10 mm	Temp. °F	FOOT POUNDS	LATERAL EXPANSION	% SHEAR
0593CA	74.4	56.0	30.0	150					
	% R.A.	=58.0							
0593AX	84.3	48.9	28.0	156					
	% R.A.	=52.0							

* LONGITUDINAL, T = TRANSVERSE

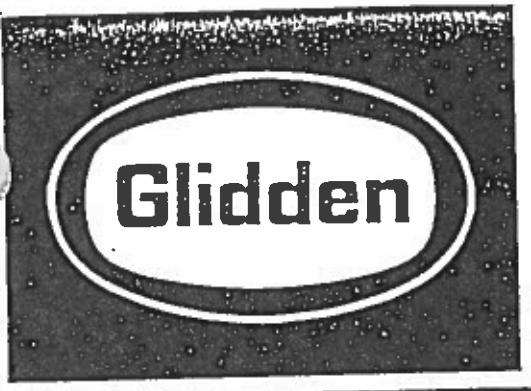
0593CA 0593AX CONFORM TO THE REQUIREMENTS OF NACE MR0175-92

[illegible] items were heat treated in accordance with the requirements of the specification to which they were manufactured.

I certify that the products covered by this report comply with the applicable requirements of ASTM and or ASME specifications, as noted for each item.

I hereby certify that the above figures are correct, as contained in the records of the Company.

Tank Corrosion Protection



PROTECTIVE MAINTENANCE COATINGS DATA

For Industrial Use and Professional Application Only
Rust Inhibitive Polyamide Epoxy Coating

GLID-GUARD® Corrosion Resistant HS Epoxy No. 5465 Series

For Interior-Exterior Metal

Read Label and Material Safety Data Sheet Prior to Use.
See other cautions on last page. DSF1-0690

PRODUCT DESCRIPTION

GLID-GUARD Corrosion Resistant HS Epoxy is a low VOC, high solids, two package polyamide epoxy coating intended for direct application to interior and exterior metal. It is rust inhibitive and resistant to moisture and many chemicals. The product's excellent penetrating properties result in superior adhesion.

This product is an excellent choice for application to metal when surface preparation is limited to Hand Tool or Power Tool Cleaning. It is also suitable for use as a high build intermediate coat in heavy-duty industrial systems and may be used as a topcoat when the color and sheen are acceptable.

Like most epoxy coatings, GLID-GUARD Corrosion Resistant HS Epoxy will chalk and lose gloss on exposure to direct sunlight but will maintain excellent film integrity and continue to provide excellent protection to the substrate.

PRODUCTS AVAILABLE

GLID-GUARD Corrosion Resistant HS Epoxy Red No. 5465 (Component A)
GLID-GUARD Corrosion Resistant HS Epoxy Gray No. 5466 (Component A)
GLID-GUARD Corrosion Resistant HS Epoxy White No. 5467 (Component A)
GLID-GUARD Corrosion Resistant HS Epoxy Aluminum Mastic No. 5468 (Component A)
GLID-GUARD Corrosion Resistant HS Epoxy Curing Agent No. 5469 (Component B)

NOTE: Refer to Protective Maintenance Coatings Data sheet Section 8 No. 29 for detailed information on Aluminum Mastic No. 5468.

TYPICAL USES

Ideal for use as a primer and intermediate build coat on storage tanks, structural steel, machinery and equipment in the food processing industries, chemical industries, petroleum refineries, paper mills, marine structures, mining industries, waste water treatment facilities, and general industrial buildings.

PRODUCT ADVANTAGES

- Low VOC
- Rust inhibitive
- Tolerates surface moisture during application
- Long term flexibility—does not become brittle with age
- Hard, tough film
- Free of toxic amine curing agents
- Excellent alkali and solvent resistance
- High film build
- Protection in fresh or salt water immersion
- Lead and chromate free
- Simple 1 to 1 mixing ratio

SERVICE CONDITIONS

Do not use for potable water or direct food contact service. Do not use on unprimed wood or unprimed gypsum wallboard. Do not use on surfaces that may be subjected to severe abrasion.

Will withstand 250°F. continuous and 300°F. intermittent dry heat. The color may change as these limits are approached, but the film will remain intact.

REGULATORY RESTRICTIONS

The application VOC of this product may be restricted by law in some locations. Application VOC is increased by thinning with solvent. If the application VOC is restricted to 420 gm/liter (3.5 lbs/gal.), thinning must not exceed 7% by volume (9 fl.oz./gal.) with GLID-GUARD Epoxy Solvent No. 5568. If the application VOC is restricted to 450 gm/liter (3.75 lbs./gal.) or higher or is not restricted, thinning with up to 10% (12 fl.oz./gal.) is permissible.

TECHNICAL DATA

All data shown is for a mixed (converted) gallon unless otherwise noted

*Product No.—5467/5469
Generic Type—Polyamide epoxy
Color—White
Gloss—Approximately 30 @ 60°
Percent Solids by Weight—71% ± 1%
Percent Solids by Volume—54% ± 1%
Theoretical Coverage per 1.0 dry mil (1.9 mils wet)—866 sq.ft./gallon
**Recommended Film Build/Coverage (theoretical, unreduced)
Minimum—3.0 mils dry (5.5 mils wet) 289 sq.ft./gallon
Typical—5.0 mils dry (9.5 mils wet) 173 sq.ft./gallon
Maximum—8.0 mils dry (15.0 mils wet) 108 sq.ft./gallon
(wet mil figures rounded to the nearest 0.5 mil)
When computing working coverage, allow for application losses, surface irregularities, any solvent addition, etc.
Percent Vehicle (Solids) by Weight—28% ± 1%
Percent Pigment by Weight—43% ± 1%
Percent Solvent by Weight—29% ± 1%
Viscosity—95-100 KU
Weight per Gallon—11.1 lbs.
Flash Point (Closed Cup)—Base No. 5467—46°F. Curing Agent No. 5469—43°F.
VOC—3.24 lbs/gallon (388 gm/liter) unreduced
3.48 lbs/gallon (417 gm/liter) reduced 7% by volume with No. 5568
3.56 lbs/gallon (427 gm/liter) reduced 10% by volume with No. 5568
Drying Time (70°F., 50/Relative Humidity)
Touch—1-2 hours
Handle—7 hours
Recoat—7 hours
Full Cure—7 days
Reduction Solvent—GLID-GUARD Epoxy Solvent No. 5568 (10% maximum)
Clean-Up Solvent—GLID-GUARD Epoxy Solvent No. 5568 or MEK
Type of Cure—Converted
Mixing Ratio (Base/Curing Agent) by Volume—1 to 1
Induction Before Use—30 minutes @ material temperatures >70°F.
60 minutes @ material temperatures 60°-70°F.
Pot Life—4 hours @ 70°F.
Tinting—DO NOT TINT

*Compositional data for other products in this series may differ slightly.
**As measured over the peaks of any surface projections or blast profile.

GLID-GUARD Corrosion Resistant HS Epoxy (Continued)

MATERIAL PREPARATION

Do not add unspecified curing agents or solvents or mix with other paints. Do not tint.

Thoroughly mix the selected GLID-GUARD Corrosion Resistant HS Epoxy (Component A) and Corrosion Resistant HS Epoxy Curing Agent No. 5469 (Component B) separately, then combine the two components in equal parts by volume using power agitation. If agitation equipment is not explosion proof, provide good ventilation to prevent build up of vapors. Allow the combined material to stand 30 minutes before use. Extend this induction (standing) time to 60 minutes if the surface or material temperature is 60°—70°F. After the induction period has elapsed, add up to 10% by volume GLID-GUARD Epoxy Solvent No. 5568 (12 fluid ounces per gallon of combined material) if necessary for application and mix thoroughly (see "Regulatory Restrictions" above). Pot life is 4 hours at 70°F., less at higher temperatures.

SURFACE PREPARATION

All surfaces should be clean, dry and free of all contaminants.

Metal Surfaces

Ferrous Metal

Surface preparation is dependent upon service conditions as follows:

TYPE A—AGGRESSIVELY CORROSIVE
This exposure is an area characterized by aggressive chemical fumes, mists or dusts or other chemical contaminants that combine with high humidity and condensed moisture to corrode zinc at rates greater than one mil per year. The need to limit air pollution and protect personnel generally confines chemical concentrations of such an aggressive nature to within a radius of about 50 yards from the source of contamination. For Type A environments and all immersion exposures, White Metal Blast Cleaning (SSPC-SP5-82 and SSPC-SP-COM) is recommended. For splash and spillage, Near-White Blast Cleaning (SSPC—SP10-82 and SSPC-SP-COM) is satisfactory.

TYPE C—CORROSIVE
This exposure is less destructive than Type A exposure and is characterized by moderately aggressive chemical fumes, mists, or dusts that combine with moisture and high humidity to corrode zinc at rates less than one mil per year. Type A exposure may, in many instances, become Type C exposure outside of a radius of about 50 yards from the source of contamination for a limited further distance. For Type C environments, Near-White Blast Cleaning (SSPC-SP10-82 and SSPC-SP-COM) is recommended.

TYPE M—MODERATE
This exposure is generally outdoors and is characterized by normal atmospheric weathering and/or light or moderate concentrations of chemical fumes that combine with humidity and condensed moisture to corrode carbon steel at rates less than three mils per year. Zinc in this exposure is virtually free of corrosion. Light to moderate chemical fume concentrations in indoor areas without excessive humidity may produce similar conditions. For Type M environments, Commercial Blast Cleaning (SSPC-SP6-82 and SSPC-SP-COM) is recommended. Where exposure is normal weathering only, Brush-Off Blast Cleaning (SSPC-SP7-82 and SSPC-SP-COM), Power Tool Cleaning (SSPC-SP3-82 and SSPC-SP-COM), or Hand Tool Cleaning (SSPC-SP2-82 and SSPC-SP-COM) will provide excellent service.

TYPE P—PROTECTED (ARCHITECTURAL)
In this category, surfaces are generally indoors and are not subjected to high humidity or chemical contaminants that will attack paint or steel. For Type P environments, Brush-Off Blast Cleaning (SSPC-SP7-82 and SSPC-SP-COM), Power Tool Cleaning (SSPC-SP3-82 and SSPC-SP-COM), or Hand Tool Cleaning (SSPC-SP2-82 and SSPC-SP-COM) will provide the sound substrate needed for proper adhesion.

Galvanized and Aluminum

Sandblasting is unnecessary. Remove oil, grease, dirt, dust and chemical contaminants using the prescribed cleaning methods.

Poured Concrete

Verify that all surface projections have been leveled. Remove all oils, grease, dust, dirt and chemical contaminants with the prescribed cleaning methods. Remove weak or powdery surfaces by acid etching or brush abrasive blasting. Dull very smooth concrete by similar means. Prime with this product thinned 10% by volume with GLID-GUARD Epoxy Solvent No. 5568 (see "Regulatory Restrictions" above).

Previously Painted Surfaces

The performance of this coating over previously painted surfaces is directly influenced by the type, age and condition of the old finish. For best results in immersion situations, completely remove any old coating and prepare as for new surfaces. For non-immersion service, remove all blistered, loose or peeling old coating. Hard or glossy finishes should be dulled by sanding or other abrasive means. Apply to a test area; if wrinkling or lifting occurs after overnight drying, remove the old coating.

APPLICATION

Do not apply when air or substrate temperature is below 60°F.

For best appearance, primary application should be by airless or conventional spray. Use brush or roller application for small areas only—flow and leveling will be limited. Spray application is required to obtain 5.0 mils dry in a single coat. Application by brush or roller will limit the film thickness to 3.0-4.0 mils dry per coat.

SPRAY APPLICATION

Airless Spray

Glidden equipment is specified.
Gun: ASM 400 Fluid Tip: 315-619
Pump: GLIDDEN 500™, GLIDDEN 750™, GLIDDEN 750GE™, GLIDDEN FORMULA ONE™
Pressure: 2000-2500 psi
NOTE: All pumps must be kept well away from areas where vapors from this product may collect.

Conventional Spray

Gun: Binks Model 18, Binks 2001, or equivalent
Needle: Binks Model 63A or equivalent
Fluid Nozzle: Binks Modes 63PB or equivalent
Air Cap: Binks Model 63B or equivalent

COVERAGE

Typical coverage (calculated, unreduced) is 173 sq.ft./gallon at 5.0 mils dry (9.5 mils wet). Minimum film thickness is 3.0 mils dry (5.5 mils wet) 289 sq.ft./gallon, maximum is 8.0 mils dry (15.0 mils wet) 108 sq.ft./gallon. All wet mil figures are rounded to the nearest 0.5 mil. When computing working coverage, allow for application losses, surface irregularities, any solvent addition, etc.

DRYING

Dries to touch in 1-2 hours, to handle in 7 hours, to recoat in 7 hours, to full cure in 7 days at 70°F., 50% relative humidity. Allow longer drying times under cooler or more humid conditions.

CLEAN-UP

Clean all equipment immediately after use with GLID-GUARD Epoxy Solvent No. 5568 or methyl ethyl ketone.

TOPCOATS

SOLVENT EPOXY FINISHES
GLID-GUARD Corrosion Resistant HS Epoxy No. 5465/5469 series
GLID-GUARD Chemical Resistant Epoxy No. 5240/5242 series
GLID-GUARD High Solids Epoxy No. 5430/5434 series
GLID-GUARD® DURAMASTER™ High Solids Epoxy No. 5295/5299 series
GLID-GUARD® METALLITE™ High Build Epoxy No. 5475/5476
GLID-GUARD Cold Cure Epoxy No. 5281/5265
GLID-GUARD Coal Tar Epoxy No. 5270/5271
GLID-GUARD Hi-Build Coal Tar Epoxy No. 5273/5274
GLID-GUARD® GLID-TILE™ Epoxide No. 5550/5552 series
NU-PON® COTE Color Coat No. 7240/7200 series

WATER-BORNE EPOXY FINISHES
GLID-GUARD Acrylic Epoxy No. 5277/5278
GLID-GUARD Amine-Adduct Epoxy No. 5585/5586 series

POLYURETHANE FINISHES
GLID-THANE™ ONE Moisture Cured Polyurethane No. 6100 series
GLID-THANE II Acrylic Polyurethane No. 6200/6252 series
GLID-GUARD High Solids Acrylic/Polyester Urethane No. 5410/5414 series

SOLVENT VINYL FINISHES
GLID-GUARD Double Build Vinyl No. 5514
GLID-GUARD® VINYL-COTE™ High Build No. 5522

WATER-BORNE ACRYLIC FINISHES
LIFEMASTER™ PRO Hi Performance Acrylic No. 6900 series
LIFEMASTER PRO HB Acrylic No. 5440 series

The Sherwin-Williams Company
Cleveland, OH 44115

Hi-Mil Sher-Tar™ Epoxy—B69B40/B60V40

Description

Hi-Mil Sher-Tar Epoxy is a high build, polyamide cured epoxy coal tar coating. Can be applied at high film thicknesses in one coat.

Characteristics

Color:		Black
Coverage:		
Recommended:		45-68 sq. ft./gal. 24-35 mils wet; 16-24 mils dry
Theoretical, no loss:		1090 sq. ft./ gal. @ 1.0 mil dry
Curing Mechanism:		Crosslink Polymerization
Drying Schedule: (temperature & humidity dependent)		
@ 77°F & 50% RH @ 29 mils wet:		
To Touch:		8-10 hours
Tack Free:		48 hours
To Recoat:	Minimum	Maximum
@50-60°F	24 hours	72 hours
@60-80°F	16 hours	48 hours
@80-100°F	8 hours	16 hours
@100-120°F	1 hour	6 hours
Finish:		Semi-Gloss
Flash Point:		110°F (Pensky-Martens Closed Cup)
Number of Components (Ratio):		2 (3:1)
Pot Life:		4 hours @ 77°F
Sweat-In time:		30 minutes @ 77°F
Solvent/Reducer:		Reducer #54
Vehicle Type:		Polyamide Epoxy
VOC:		306 grams/liter; 2.55 lbs /gal
Volume Solids:		68 ± 2%
Weight Solids:		77 ± 2%
Weight per Gallon:		10.3 ± .3 lbs

Application

Application Conditions

Temperature (air, surface, material): ..... 50-100°F
(surface temp. at least 5°F above dew point)
Relative humidity: ..... 90% max.
Brush: No reduction required.Use a natural bristle brush.
Roller: No reduction required. Use a 3/4" woven nap with phenolic core.
Small areas may be brushed or rolled, but film build will be lower.

Airless spray:

Pump	30:1
Pressure	2500 - 3000 psi
Tip	.031"
Hose	3/8" - 1/2" I.D.
Filter	none

Reduction ... up to 1 quart per gallon of catalyzed material

Conventional spray:

Gun	Binks 18 gun
Air Pressure	60 psi
Fluid Pressure	40 psi
Fluid/Air Nozzle	66/63 PB
Hose	1/2" I.D.

Specifications

Substrate — Surface Preparation (See pages 2 through 5)

Primer (see primer page for additional details) ..... Page #

Aluminum, atmospheric only ..... SSPC SP7/SW-18
No primer needed

Concrete ..... SW-6, A
No primer needed

Galvanized Metal, atmospheric only ... SSPC SP7/SW-18
No primer needed

Steel, atmospheric only ..... SSPC SP6/SW-17
Zinc Clad Primer 115-120
Tile-Clad II Epoxy Primer 109

Steel, immersion SSPC-SP5/SW-16
No primer needed

Performance Specifications

Physical Properties:

Abrasion Resistance (ASTM D4060, 1000 cycles)	101 mg
Direct Impact (ASTM G14)	>80 inch lbs.
Dry Heat Resistance (ASTM D2485)	250° F
Elcometer Adhesion (ASTM D4541)	600 psi
Flexibility (ASTM D522, 180° bend)	1" mandrel
Moisture Condensation Resistance (ASTM D4585)	1000 hours
Pencil Hardness (ASTM D3363)	4H
Salt Fog Resistance (ASTM B117)	1000 hours
Thermal Shock (ASTM D2246)	250 cycles
Wet Heat Resistance (not immersion)	120° F

Resistance Guide:
(Resistance to fumes, splash and spillage - not immersion-ASTM D3912)

Acid Salt Solutions	Severe
Aliphatic Hydrocarbons	Severe
Alkalies	Severe
Alkali Salt Solutions	Severe
Aromatic Hydrocarbon Solvents	Moderate
Chlorinated Solvents	Moderate
Fresh Water	Immersion
Salt Water	Immersion
Glycol ethers, alcohols, formaldehyde	Severe
Inorganic Acids	Severe
Oils (cutting, vegetable, lubricating)	Severe
Organic Acids	Severe
Oxygenated Solvents	Moderate

WISco, INC.

11811 North Fwy., Suite 670
Houston, Texas 77060
(713) 820-8066

Page 1 of 1
Report Date 11/25/93
Report No. 002

Customer USPCI Attn: Bruce Patterson
Order No. 12418-30-46 Dated _____ Rev. _____ Dated _____
Mat'l Destination Lone Mt. Facility, Waynoka, OK Req. Date _____
Shipment Date is now unknown As of 11/25/93 Changed from _____
Inspector estimated shipment date _____ Order is 90 percent completed
Vendor Delta Tank Co. Order No. _____ Dated _____
Manufacturer Lide Tank Co. Phone 817-562-5526
Shop Location Mexia, TX Shop Order TKEB2 & TKEF4
Inspector's Contact Mr. Billy Lide Position Customer Contact
Report is: x Interim ___ Final Regarding: x Inspection ___ Expediting ___ Status
MATERIAL DESCRIPTION:

Two (2) tanks - one 6' 4" OD x 12' 0" high; one 5' 0" OD X 12' 0" high
To specifications of USPCI and API 650

STATUS OF ORDER: Engineering, Materials, Fabrication, Inspection, Completion

Writer's visit to vendor on Wednesday, 11/24/93, was to witness sandblast, initial paint coating and first coat of Sher-Tar epoxy.

Sandblast was verified to be as required SSPC-SP6, but due to immediate change in weather conditions, writer informed vendor's Mr. Billy Lide, that painting and/or epoxy coating at this time was not recommended. He also agreed. Items are to be reblasted and inspection of first coatings is to be on Monday, 11/29/93 or Tuesday, 11/30/93, weather permitting.

A spark or holiday test is to be performed on Sher-Tar epoxy along with micro-test of same and external coating of Glidden epoxy #5466-3 to 4 mils. A requirement of 7 mils on Sher-Tar epoxy will also be verified.

INSPECTOR: Dub Greer
INSPECTION ORDER: 12418-30-46

Post-it™ brand fax transmittal memo 7671 | # of pages ▸ 8

To Bruce Patterson	From Luana
Co.	Co.
Dept.	Phone #
x #	Fax #

, INC.

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Page 1 of 1
Report Date 12/3/93
Report No. 003

Customer USPCI Attn: Bruce Patterson
Order No. 12418-30-46 Dated _____ Rev. _____ Dated _____
Mat'l Destination Lone Mt. Facility, Waynoka, OK Req. Date _____
Shipment Date is now ready now As of 12/3/93 Changed from _____
Inspector estimated shipment date ready now Order is 100 percent completed
Vendor Delta Tank Co. Order No. _____ Dated _____
Manufacturer Lide Tank Co. Phone 817-562-5526
Shop Location Mexia, TX Shop Order TKE-B2 & TKE-F4
Inspector's Contact Mr. Billy Lide Position Vice President
Report is: ___ Interim x Final Regarding: x Inspection ___ Expediting ___ Status
MATERIAL DESCRIPTION:

Two (2) tanks - one 6' 4" OD x 12' 0" high; one 5' 0" OD X 12' 0" high
To specifications of USPCI and API 650

STATUS OF ORDER: Engineering, Materials, Fabrication, Inspection, Completion

Writer's visits to vendor on Tuesday, 11/30/93, and Friday, 12/3/93, inspection functions were performed as follows:

11/30/93

First coat of Sher-Tar epoxy (internally) was micro-tested. Results were noted to be acceptable with an average of 3.5 mils.

Sandblast was verified to be SSPC-SP-6 with anchor pattern of 3.5 to 4.0. A Keane-Tator surface comparator was used to verify anchor pattern on each vessel.

12/3/93

Writer verified Sher-Tar epoxy to have mil thickness ranging from 7.2 to 14.8 on each vessel.

External gray primer paint range from 3.5 to 6.5 on each vessel.

A holiday test was performed internally on each vessel and found to be satisfactory. Items were released for shipment.

INSPECTOR: Dub Greer
INSPECTION ORDER: 12418-30-46

Piping Corrosion Protection

The Sherwin-Williams Company
Cleveland, OH 44115

Kem Kromik Universal Metal Primer—B50Z Series

Description

Kem Kromik Universal Metal Primer is a low VOC, modified alkyd resin primer designed for use over iron and steel substrates. Can be used as a "universal" primer under high performance topcoats and is also suitable as a "barrier" coat over conventional coatings which would normally be attacked by strong solvents in high performance coatings.

Characteristics

Color: Brown, Off White, and Buff

Coverage:

Recommended: 204-273 sq. ft./gal.
6-8 mils wet; 3-4 mils dry

Theoretical, no loss: 818 sq. ft./ gal. @ 1.0 mil dry

Curing Mechanism: Oxidation

Drying Schedule: (temperature & humidity dependent)
@ 6 mils wet, 50% R. H. and:

	@ 40°F	@77°F	@110° F
To Touch:	2 hours	30 minutes	15 minutes
Tack Free:	2½ hours	1 hour	20 minutes
To Recoat with:			
alkyds	2½ hours	1 hour	45 minutes
epoxy	36 hours	16 hours	16 hours
urethane	36 hours	16 hours	16 hours

Finish: 0-10 units @ 85°

Flash Point: 80°F (Pensky-Martens Closed Cup)

Solvent: Xylene

Vehicle Type: Phenolic Alkyd

VOC: 415 grams/liter; 3.45 lbs./gal.

Volume Solids: 51 + 2%

Weight Solids: 72 ± 2%

Weight per Gallon: 12.5 ± .35 lbs

Meets the performance requirements, not necessarily composition, of Federal Specification: TT-P-664D

Application

Application Conditions

Temperature (air, surface, material): ..... 40-120°F
(surface temp. at least 5°F above dew point)

Relative humidity: ..... 85% maximum.

Brush: No reduction required. Use a natural bristle brush.

Roller: No reduction required. Use a 3/8" woven nap with phenolic core.

Airless spray:

Pressure ..... 1800-3000 psi

Tip ..... .015" - .019"

Hose ..... 1/4" I.D.

Filter ..... 60 mesh

Reduction ..... normally no reduction required

Specifications

Substrate	Surface Preparation (See pages 2 through 5)
Steel	SSPC SP2/ SW-14

2 topcoats are recommended over all primers/substrates.

Suggested topcoats	Page
A-100 Exterior Latex Finishes	24-26
Corothane II Satin Polyurethane	32
DTM Acrylic Coatings	34
Heavy Duty Epoxy	49
Hi-Bild Aliphatic Polyurethane	50
Hi-Solids Polyurethane	53
Industrial Enamel	54
Industrial Enamel HS	55
Metalatex Semi-Gloss Coating	64
ProMar Interior & Exterior Alkyd & Latex Topcoats	73-95
Sher-Tile Epoxy	100
Silver-Brite Aluminum	102
Tile-Clad High Solids Epoxy	108
Water Based Catalyzed Epoxy	111

Performance Specifications

Physical Properties:

Abrasion Resistance (ASTM D4060, 1000 cycles)	250 mg
Direct Impact (ASTM G14)	70 inch lbs.
Dry Heat Resistance (ASTM D2485)	200° F
Elcometer Adhesion (ASTM D4541)	260 psi
Exterior Durability (with chalk)	Good
Flexibility (ASTM D522, 180° bend)	1/4" mandrel
Moisture Condensation Resistance (ASTM D4585)	500 hrs.
Pencil Hardness (ASTM D3363)	H
Salt Fog Resistance (ASTM B117)	500 hours
Thermal Shock (ASTM D2246)	5 cycles

Resistance Guide:
(Resistance to fumes, splash and spillage - not immersion-ASTM D3912).

Acid Salt Solutions	Moderate
Aliphatic Hydrocarbons	Moderate
Alkalies	Not recommended
Aromatic Hydrocarbon Solvents	Light
Chlorinated Solvents	Not recommended
Fresh Water	Moderate
Salt Water	Moderate
Glycol ethers, alcohols, formaldehyde	Moderate
Oils (cutting, vegetable, lubricating)	Severe
Organic Acids	Ligh
Oxygenated Solvents	Not recommended

Secondary Containment Corrosion Protection

Dudick Inc.

1818 Miller Parkway
Streetsboro, Ohio 44241

(216) 562-1970
(216) 562-7638 FAX

Primer 67/67C

100 % SOLIDS, MOISTURE-TOLERANT EPOXY PRIMER FOR STEEL AND CONCRETE 3-4 MILS (0.1 mm)

RECOMMENDED APPLICATIONS

Concrete Substrates
Steel Substrates
Primer for Epoxy and Urethane
Floor Toppings, Linings, Coatings and Grout

PHYSICAL PROPERTIES

Tensile Strength ASTM C-307	2,000 - 2,500 PSI
Tensile Elongation ASTM C-307	12-25 %
Adhesion to Concrete ASTM D-4541	Cohesive Failure of concrete
Adhesion to Steel ASTM D-4541	2,200-2,500 PSI
Electrical Properties NFPA #99, ASTM F-150	< 25,000 ohms

SPECIFICATIONS

Primer shall be 3-4 mils thick, 100% solids bisphenol A epoxy cured with an amine adduct as manufactured by Dudick Inc. Primer 67 shall be brush, roller or spray applied in accordance with the manufacturer's recommended practices. Primer 67C must be spray or roller applied.

PRIMER 67

Primer 67 is designed to prevent abrasive-blasted steel from developing rust bloom prior to the application of a Dudick coating or lining system. For maximum performance all steel surfaces should be primed, but primer may not be needed for mild, non-immersion service. Concrete, however, must always be primed to aid in the "wetting out" required for good adhesion.

PRIMER 67C - CONDUCTIVE PRIMER

Primer 67C is a 100% solids, two component epoxy primer designed to be used over concrete whenever the coating or lining system must be spark tested.

ESTIMATING QUANTITIES AND ORDER BILL OF MATERIAL

SQUARE FEET PER GALLON		
	CONCRETE	STEEL
Primer 67	150-200	250-300
Primer 67C	100-150	———

Quantities shown are for estimating purposes only. Actual field usage may vary. Primer 67/67C are available in 1 and 2 gallon units.

APPLICATION INSTRUCTIONS

SURFACE PREPARATION

Metal: Surfaces must be abrasive blasted to an appropriate finish.

Immersion and heavy spillage service: White Metal SSPC SP-5 or NACE #1, 3.0 mil minimum profile.

Heavy, non-immersion service (i.e. fumes and spillage): Near white SSPC SP-10 or NACE #2, 2.0 mil minimum profile.

Atmospheric service: Commercial SSPC SP-6 or NACE #3, 2.0 mil minimum profile.

Concrete: Concrete must be abrasive blasted or etched with muriatic acid (Solution of 1 part 20° Be HCl and 1 part water) to remove surface laitance and other contaminants. Concrete must be free of curing compounds and form release agents. Surface texture should be similar to 40-60 grit sandpaper. The prepared surface should have a minimum tensile strength of 250 PSI per ASTM D-4541.

All concrete substrates must be checked for moisture prior to product application using the Plastic Sheet Test, ASTM D-4263.

Additional surface preparation will be required if a 40-60 grit texture is not achieved and the surface laitance not completely removed after a single application of acid or with the first mechanical preparation procedure.

Abrasive blasting removes laitance, exposing honeycombs or voids beneath the surface which must be filled with Scratch Coat 100. (Refer to separate product bulletin)

APPLICATION SPECIFICATIONS

Substrate temperature for both concrete and metal must be between 50°F and 110°F.

Relative humidity must not exceed 90%.

Substrate temperature must be 5°F above the Dew Point.

PRIMER 67/67C MIX RATIOS:

<u>Primer 67</u>	
Component A	1 gal.
Component B	1 gal.
<u>Primer 67C</u>	
Component A	1 gal.
Component B	95 fl. oz.

*Pre-mix primer 67C Component A for 1-2 minutes to disperse the conductive fillers prior to adding the correct amount of Component B.

Primer 67C must be spray or roller applied. Use brush application for small touch-up or repair work only.

The pot life of the mixed Primer 67/67C will depend on the temperature. To prevent material waste and avoid damage to equipment, do not open and mix more material than can be used according to the following table:

PRIMER 67/ 67C POT LIFE

TEMPERATURE	POT LIFE
50°F	90 min.
75°F	60 min.
90°F	30 min.

At 75° F the pot life and thin film cure of Primer 67 can be decreased by the addition of Accelerator #1 as follows:

Ozs./Accelerator #1 per mixed gal. Primer 67	Pot Life	Thin Film Cure
3-4	36 min.	4 hrs.
6-7	15 min.	2 hrs.

Using 7 ounces of accelerator #1 per mixed gallon of Primer 67, the thin film cure @ 40° F is reduced to 8 hours.

PRIMING

Metal: Mix the pre-measured units of Component A with Component B. Prime all metal surfaces to be coated with Primer 67 at 3-4 mils WFT.

Concrete: Mix the pre-measured units of Component A with Component B. Prime all concrete surfaces to be coated with either Primer 67 or 67C at 3-4 mils WFT. The basecoat may be applied over primer that is "tacky". Do not allow the primer to puddle.

Important - With all epoxies after priming and before each additional coat, examine the surface for amine blush (oily film). If present, remove by washing with warm water and detergent.

Cure Cycle for Primer 67/67C:

Temperature	Minimum Recoat Time	Maximum Recoat Time
50°F	12 hrs.	8 Days
75°F	6-8 hrs.	5 Days
90°F	4-5 hrs.	3 Days

To optimize intercoat adhesion, we recommend application of the basecoat while the primer is tacky. If this is not possible, the above recoat times must be observed. Exposure of the primer to direct sunlight will considerably shorten the recoat times. If recommended recoat times are exceeded, consult a Dudick Representative; sanding or abrasive blasting may be required before the coating, lining or floor topping can be applied.

CLEANING

Use S-10 Cleaning Solvent to clean tools and equipment. **DO NOT USE ACETONE.**

SHIPPING

Primer 67/67C Component A's are non-regulated plastic liquids. Primer 67/67C Component B's are flammable corrosives with a flash point of 106°F (Setaflash) and carry both a red warning label and a black and white warning label. S-10 Cleaning Solvent is a flammable liquid with a flash point of 52°F (PMCC) and carries a red warning label.

STORAGE

*Warning:*All Dudick products classified by DOT labels as either white, yellow or red labels, must not be mixed or stored together as an explosive reaction can occur. All products should be stored in a cool, dry area away from open flames, sparks or other hazards.

When properly stored in their original, unopened containers, Primer 67/67C components have a one year shelf life.

SAFETY

M.S.D.S - Sheets must always be read before using products. Primer 67/67C are intended for application by experienced, professional personnel. Dudick Inc. can supply supervision to help determine that the surface has been properly prepared, the ingredients correctly mixed, and the materials properly and safely applied.

If materials are to be applied by your own personnel or by a third party contractor, please be sure that they are aware of the following safety precautions:

- Exposure to resins and hardeners through direct skin contact and/or inhalation may cause severe dermatitis reactions in some people. Cleanliness of the skin and clothing is critical and must be of paramount concern.

- Fumes are flammable and heavier than air. Proper ventilation should be maintained to minimize breathing of concentrated fumes.

- Suitable respirators should be used during application.

- Safety glasses, gloves, and suitable protective clothing must be worn at all times during application.

- If contact with hardeners occurs, remove any clothing involved and flush the skin with flowing water. Discard the clothing. Do not attempt to wash and reuse it. Primer liquids can be removed with S-10 Cleaning Solvent, MEK, or lacquer thinner. **DO NOT USE ACETONE.**

- Keep open flames and sparks away from the area where materials are being mixed and applied.

- If a rash occurs, remove the individual from the work area and seek a physician's care for dermatitis.

- In case of eye contact, flush with water for at least 15 minutes and consult a physician.

- If swallowed, do not induce vomiting; call a physician immediately.

Note:
Dudick Inc. ("Dudick") warrants all goods of its manufacture to be as represented in its catalogs and that the application of its products by its employees or sub-contractors shall be performed in a workmanlike manner. Dudick's obligation under this warranty shall be the repair to and replacement of any applications which its examination shall disclose to be defective. Dudick makes no warranty concerning the suitability of its product for application to any surface, it being understood that the goods have been selected and the application ordered by the purchaser. DUDICK INC. MAKES NO WARRANTY, EXPRESS OR IMPLIED, THAT THE GOODS SHALL BE MERCHANTABLE OR THAT THE GOODS ARE FIT FOR ANY PARTICULAR PURPOSE. THE WARRANTY OF REPAIR OR REPLACEMENT SET FORTH HEREIN IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES ARISING BY LAW OR OTHERWISE; AND DUDICK INC. SHALL NOT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOST PROFITS, DOWN TIME, DAMAGES TO PROPERTY OF THE PURCHASER OR OTHER PERSONS, OR DAMAGES FOR WHICH THE PURCHASER MAY BE LIABLE TO OTHER PERSONS, WHETHER OR NOT OCCASIONED BY DUDICK'S NEGLIGENCE. This warranty shall not be extended, altered or varied except by written instrument signed by Dudick and Purchaser.

Dudick Incorporated
1818 Miller Parkway
Streetsboro, Ohio 44241

Dudick Inc.

Dudick Incorporated
Corrosion-Proof Products
1816 South Wason Drive
Streetsboro, Ohio 44241
216-562-1970
FAX No. 216-562-7638

Protecto-Coat 200

ELASTOMERIC, SPRAY APPLIED, ENVIRONMENTALLY SAFE, URETHANE COATING. 40-60 MILS (1-1 1/2 mm)

Protecto-Coat 200 is a high solids aromatic polyurethane coating with superior elongation. It is especially suited to bridge cracks in concrete.

RECOMMENDED APPLICATIONS

- Secondary Containment Areas
- Process Floors
- Railroad Tank Cars
- Underground Pipes & Tanks - Exterior
- Thickener Tanks & Mechanisms
- Spent Liquor Storage Tanks
- Food Processing
- Pharmaceutical
- Breweries
- Structural Steel

CHEMICAL RESISTANCE

Protecto-Coat 200 provides a tough, durable surface and will withstand splash and spills of many inorganic and organic acids as well as alkalies. Also resistant to aliphatic solvents.

PHYSICAL PROPERTIES

Protecto-Coat 200	40 Mil Basecoat	20 Mil Topcoat
Tensile Strength (PSI) ASTM C307	2,400-2,600	2,200-2,500
Elongation*	225% to 250%	50 to 60%
Shore D Hardness	40-45	65-70
Abrasion Resistance CS 17 wheels/1000 cycles x 1000 gm load	10 mg weight loss	32 mg weight loss
Solids by Volume	80%	100%

*At 60% elongation the chemical resistant topcoat begins to surface crack while the basecoat will continue to elongate to 250% extension.

SPECIFICATIONS

Coating shall be 40-60 mils thick, 80-100% solids aromatic urethane resin, consisting of 2 basecoats and a topcoat of 20 mils each, manufactured by Dudick, Inc. Materials shall be brush-, roller- or spray- applied in accordance with manufacturer's recommended practices.

THE PROTECTO-COAT 200 SYSTEM

The Protecto-Coat 200 system uses a moisture tolerant primer and two or three coats of elastomeric thermosetting urethane resins to protect concrete and steel.

Primer 67 is designed to prevent abrasive-blasted steel from developing rust bloom prior to the application of a Protecto-Coat System. For maximum performance, all steel surfaces should be primed, but primer may not be needed for mild, non-immersion service. Concrete, however, must always be primed to aid in the "wetting out" required for good bonding.

Protecto-Coat 200 is applied in three coats by brush, roller or spray. The elastomeric basecoat is applied in two 25 mil applications to achieve a nominal 40 mils DFT. The chemical resistant topcoat is applied in a single 20 mil application. Total thickness shall be a nominal 60 mils.

Post-it™ brand fax transmittal memo 7671 | # of pages ▸

To Dominic Quiens	From Rob
Co.	Co.
Dept.	Phone # Mid-America
Fax # 697-3592	Fax #

ESTIMATING QUANTITIES AND ORDER BILL OF MATERIAL

SQUARE FEET PER GALLON		
	CONCRETE	STEEL
Primer 67	150-200	250-300
Protecto-Coat 200		
2 Base Coats - Actual 35-40 mil DFT	25	25
Top Coat Actual 15-20 mil DFT	60	60
S-10 Solvent	500	500

Quantities shown are for estimating purposes only. Actual field usage may vary.

APPLICATION INSTRUCTIONS

SURFACE PREPARATION

Metal: For immersion service, abrasive blast to a white metal finish and a 2-4 mils minimum profile according to SSPC 5 or NACE No. 1. For fume or splash service, abrasive blast to a near-white metal finish according to SSPC 10 or NACE No. 2. Atmospheric service: Commercial SSPC 6 or NACE No. 3.

Concrete: Concrete must be abrasive-blasted or etched with muriatic acid (solution of 1 part 20° Be HCl and 1 part water) to remove surface laitance and other contaminants. Concrete must be free of curing compounds and form release agents. Surface texture should be similar to 40-60 grit sandpaper. The prepared surface should have a tensile strength of between 250 and 300 PSI per ASTM D4541.

Additional surface preparation will be required if a 40-60 grit texture is not achieved and the surface laitance not completely removed after a single application of acid or with the first mechanical preparation procedure.

If, after abrasive blasting, honeycombs/voids appear on the concrete, these have to be filled with a suitable material. Contact a Dudick representative for this information.

Recommended application temperatures should be between 40°F and 90°F substrate temperature. **Do not apply Protecto-Coat 200 over concrete exposed to direct sunlight during the warming trend of the concrete as measured by surface temperature.** To do so may lead to blistering, pinholes, or wrinkling in the coating due to outgassing of air in the concrete and high substrate temperatures. Wait for a definite downturn or cooling trend within the concrete as again measured by surface temperature. If this is not possible consult a Dudick representative for alternatives such as double priming.

PRIMING

Metal: For maximum performance, prime all steel surfaces with Primer 67, mixed with appropriate amount of hardener to 3-4 mils. For mild non-immersion service, priming of steel may be omitted.

Concrete: Concrete must be primed to aid in the "wetting out" required for good bonding. Mix Component A with Component B in the premeasured units for 2-3 minutes and apply by brush, roller, or spray. We recommend the basecoat be applied over slightly tacky or tack-free primer. Do not allow the primer to puddle.

Protecto-Coat 200 Mix Ratio:

Protecto-Coat 200 Basecoat	
Component A*	1 Gallon
Component B*	54 fl. ozs.

*Premeasured units by weight

Protecto-Coat 200 Topcoat	
Protecto-Coat 200 Top Coat Comp. A*	1 Gal.
Component B*	54 fl. oz.

*Premeasured quantities by weight

BASECOAT

Add appropriate amount of hardener for each gallon of Protecto-Coat Liquid and mix thoroughly until uniform color is achieved. Apply a 25 mil wet (20 mil DFT) basecoat using spray, brush or roller. Allow basecoat application to cure to at least a "firm" or slightly "tacky" feel before applying the second 25 mil wet (20 mil DFT) basecoat. Brush or roller may require several coats to achieve desired thickness.

Horizontal surfaces may be basecoated in one application by applying 50 mils wet (40 mil DFT) in a single coat.

TOPCOAT

Add appropriate amount of hardener for each gallon of Protecto-Coat Liquid and mix thoroughly until a uniform color is achieved. Apply a 20-mil-thick topcoat using spray, brush or roller.

Cure Cycle for Protecto-Coat 200

TEMPERATURE	RECOAT TIME	CURE TIME
50°	48 Hrs.	96 Hrs.
70°	24 Hrs.	48 Hrs.
90°	16 Hrs.	36 Hrs.

If these recoat times are exceeded, consult a Dudick representative: sanding or abrasive blasting may be required before the next coat. Recoat times are dramatically reduced when the coating is exposed to direct sunlight.

Single Component Airless Spray Equipment — Graco King 45-to-1 spray pump or equivalent. Use Graco Golden Mastic Gun or Graco No. 207945 Gun with airless adapter equipped with a Reverse-A-Clean tip and a tip size between .035-.041. Spray hose should be 1/2" or 3/8" ID. Available inlet pressure must be a minimum of 100 psi.

Brush or roller application may require additional coats to meet specified dry film thickness.

Pot life of the opened and mixed Protecto-Coat 200 will depend on the temperature at the work site. To prevent material waste and avoid damage to equipment, do not open and mix more material than can be used according to the following table:

TEMPERATURE	POT LIFE
50°F	120 Min.
75°F	60 Min.
90°F	45 Min.

Do not attempt to store mixed material. Residual material should be properly disposed of at the end of each work period.

Where immersion service is required, spark test the coating with a 5,000 to 7,000 volt AC spark tester. Mark and repair all pinholes. Use Protecto-Coat liquid mixed with the appropriate amount of hardener. Retest only the repairs.

CLEANING

Use S-10 Solvent to clean tools and equipment.

SHIPPING

Protecto-Coat 200 Topcoat A and B and Protecto-Coat 200 Basecoat A are classified as plastic liquids and are non-regulated.

Protecto-Coat 200 Basecoat B is combustible. Primer 67 Component B is corrosive and carries a black and white warning label. Primer 67 Component A is classified as a plastic liquid and is nonregulated, while S-10 Cleaning Solvent is red label liquid with a flash point of 52°F (PMCC).

STORAGE

Warning: All Dudick products classified by DOT labels as either white, yellow or red labels must not be mixed or stored together as an explosive reaction may occur.

When stored in a cool and dry location, Protecto-Coat 200 ingredients have a one-year shelf life. Exposure to excessive heat may cause premature gelling and reduce working time.

SAFETY

M.S.D.S. - Sheets must always be read before using products. Protecto-Coat Systems are intended for application by experienced, professional personnel. Dudick Inc. can supply Protecto-Coat systems supervision to help determine that the surface has been properly prepared, the ingredients correctly mixed, and the materials properly and safely applied.

If Protecto-Coat materials are to be applied by your own personnel or by a third-party contractor, please be sure that they are aware of the following safety precautions:

- Exposure to resins and hardeners may cause severe dermatitis reactions in some people. Cleanliness of the skin and clothing is critical and must be of paramount concern.
- Safety glasses, gloves and suitable protective clothing must be worn at all times during application.
- Suitable respirators should be used.
- If contact with hardeners occurs, remove any clothing involved and wash the skin with large amounts of water. Discard the clothing. Do not attempt to wash and reuse it. Protecto-Coat liquid may be washed off with S-10 Cleaning Solvent, MEK liquid, or laquer thinner.
- Fumes are flammable and heavier than air. Proper ventilation should be maintained to minimize breathing of concentrated fumes.
- If a rash or dermatitis occurs, remove the individual from the work area and seek a physician's care for dermatitis.
- Keep open flames and sparks away from the area where toppings are being mixed and applied.
- In case of eye contact, wash with water for at least 15 minutes and consult a physician. If swallowed, do not induce vomiting: call a physician immediately.

Note:

Dudick Inc. ("Dudick") warrants all goods of its manufacture to be as represented in its catalogs and that the application of its products by its employees or sub-contractors shall be performed in a workmanlike manner. Dudick's obligation under this warranty shall be the repair to and replacement of any applications which its examination shall disclose to be defective. Dudick makes no warranty concerning the suitability of its product for application to any surface, it being the understood that the goods have been selected and the application ordered by the purchaser. DUDICK INC. MAKES NO WARRANTY, EXPRESS OR IMPLIED, THAT THE GOODS SHALL BE MERCHANTABLE OR THAT THE GOODS ARE FIT FOR ANY PARTICULAR PURPOSE. THE WARRANTY OF REPAIR OR REPLACEMENT SET FORTH HEREIN IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES ARISING BY LAW OR OTHERWISE; AND DUDICK INC. SHALL NOT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOST PROFITS, DOWN TIME, DAMAGES TO PROPERTY OF THE PURCHASER OR OTHER PERSONS, OR DAMAGES FOR WHICH THE PURCHASER MAY BE LIABLE TO OTHER PERSONS, WHETHER OR NOT OCCASIONED BY DUDICK'S NEGLIGENCE. This warranty shall not be extended, altered or varied except by written instrument signed by Dudick and Purchaser.

Dudick Incorporated
Corrosion-Proof Products
1818 South Wason Drive
Streetsboro, Ohio 44241
(12-91)

Waste Analysis

Treated Blowdown

ANACHEM INC.

8 Prestige Circle, Suite 104 • Allen, Texas 75002
214/727-9003 • FAX # 214/727-9686 • 1-800-966-1186

Customer Name: USPCI
Date Received: August 17, 1994 at 11:10:45
Date Reported: August 26, 1994
Submission #: 9408000203
Project: HEAT EXCHANGERS

SAMPLES The submission consisted of 1 sample with sample I.D. shown in the attached data table.

TESTS The sample listed in the attached result pages was analyzed for:

* ALKALINITY, TOTAL (EPA 310.1)
* ANION/CATION RATIO (CALCULATION)
* CALCIUM/Ca (EPA 215.1)
* CHLORIDE (EPA 300.6)
* CYANIDE, TOTAL (EPA 335.2)
* HARDNESS, TOTAL (BASED ON AAS/ICP)
* ICP SCAN (EPA 200.7)
* IRON/Fe (EPA 236.1)
* MAGNESIUM/Mg (EPA 242.1)
* MICROWAVE DIGESTION (EPA 3015)
* pH (EPA 150.1)
* POTASSIUM/K (EPA 200.7)
* SILICA (EPA 370.1)l
* SODIUM/Na (EPA 273.1)
* SPECIFIC CONDUCTANCE (EPA 120.1)
* SULFATE (EPA 375.4)
* TDS-TOTAL DISSOLVED SOLIDS (EPA 160.1)
* TSS-TOTAL SUSPENDED SOLIDS (EPA 160.2)

Distribution Of Reports
2-Bruce Patterson of USPCI
Ph. (405) 697-3500 Fax (405) 697-3592

Respectfully Submitted,
Anachem,Inc.

C E Newton

C.E. Newton, Ph.D.
Chemist

Submission #: 9408000203 lims

Client Name: USPCI
Submission #: 9408000203
Project Name: HEAT EXCHANGERS
Report Date: 08/26/94

Client Sample #: TREATED EXHAUST BLOWOFF
Laboratory ID #: *35372* *Matrix:* *Liquid*
Sample Container: *3xGallon Plastic*
Sampling Location: *Not listed on the chain of custody.*
Sampling Date : *Not listed on the chain of custody.*
Temperature (Celcius):21

ALKALINITY, TOTAL (EPA 310.1)

Analyte	Results(mg/l)	Det.Limit
Total Alkalinity	7800	1

ANION / CATION RATIO (CALCULATION)

Analyte	Results(%)	Det.Limit
Anion/Cation Ratio	1.00	0

CALCIUM / Ca (EPA 215.1)

Analyte	Results(mg/l)	Det.Limit
Calcium	30.2	0.01

CHLORIDE (EPA 300.6)

Analyte	Results(mg/l)	Det.Limit
Chloride	145000	0.1

CYANIDE, TOTAL (EPA 335.2)

Analyte	Results(mg/l)	Det.Limit
Total Cyanide	23.9	0.20

NESS, TOTAL (BASED ON AAS / ICP)

Analyte	Results(mg/l)	Det.Limit
Hardness, Calculated	1500	

ICP SCAN (EPA 200.7)

Analyte	Results(mg/l)	Det.Limit
Silver	<0.0120	0.0120
Cadmium	0.072	0.0014
Chromium	0.112	0.0146
Copper	0.286	0.0046
Cobalt	1.38	0.0028
Lead	0.362	0.042
Manganese	0.034	0.0004
Nickel	0.925	0.0049
Antimony	<0.0246	0.0246
Thallium	0.286	0.056
Zinc	0.031	0.0031
Arsenic	32.6	0.044
Selenium	2.61	0.026
Aluminum	2.96	0.107
Barium	0.152	0.045
Beryllium	<0.0011	0.0011
Molybdenum	31.2	0.0069
Tin	<0.023	0.023
Titanium	<0.017	0.017
Vandium	0.139	0.0037
Silicon	4.09	0.015
Strontium	1.33	0.0013
Lithium	12	0.001

Mc (EPA 236.1)

Analyte	Results(mg/l)	Det.Limit
L	5.09	0.03

MAGNESIUM / Mg (EPA 242.1)

Analyte	Results(mg/l)	Det.Limit
Magnesium	31.7	0.01

Client Name: USPCI
Submission #: 9408000203
Project Name: HEAT EXCHANGERS
Report Date: 06/26/94

	Results(----)	Det.Limit
pH (EPA 150.1)		
Analyte		
pH For Liquid	7.5	0
POTASSIUM/K (EPA 200.7)		
Analyte	Results(mg/l)	Det.Limit
Potassium	12300	0.010
SILICA (EPA 370.1)l		
Analyte	Results(mg/l)	Det.Limit
Silicon Dioxide/Silica	100	2
SODIUM/Na (EPA 273.1)		
Analyte	Results(mg/l)	Det.Limit
Sodium	105000	0.01
SPECIFIC CONDUCTANCE (EPA 120.1)		
Analyte	Results(umhos/cm	Det.Limit
Specific Conductance	78900	1
SULFATE (EPA 375.4)		
Analyte	Results(mg/l)	Det.Limit
Sulfate	30200	1
TDS-TOTAL DISSOLVED SOLIDS (EPA 160.1)		
Analyte	Results(mg/l)	Det.Limit
Total Dissolved Solids	299000	1
TOTAL SUSPENDED SOLIDS (EPA 160.2)		
Analyte	Results(mg/l)	Det.Limit
Total Suspended Solids	1440	1

Report to: USPCI
Lab Number: 9408000203
Page 4 of 4

Project: Heat Exchangers

QUALITY CONTROL DATA

ANALYTE	DATE ANALYZED	SPIKE VOL	STAND. DEV.	COEFF. OF VAR %	REC1/%	REC2/%
Hardness, Calc.	8/19/94	----	0	0	96	----
Total Alkalinity	8/19/94	----	5.7	0.7	100	----
Silica	8/25/94	----	0	0	100	----
Sulfate	8/19/94	----	0.31	1.2	100	----
Chloride	8/25.04	----	178	8	100	----
T.S.S.	8/18/94	----	181	10	99	98
Total Cyanide	8/25/94	----	0	0	109	----

Standard Deviation = (x1-x2)/1.414
Coefficient of Variability % = (S.D./Avg.) X 100
Recovery % = [(spiked-unspiked)/expected] X 100

ICP SCAN INFORMATION

Note: ***ICP scans are very general in nature and do not include precise calibration or quality control. The process is intended as a screening procedure to identify very high metal concentrations.***

Evaporator Blowdown

uc: USPCI
i# : 9407000227
ame: HEAT EXCHANGERS
Date: 08/04/94

t Sample #: EV #1
atory ID #: 33964 Matrix: Liquid
le Container: 2 Liter Plastic Bottle
ling Location: Not listed on the chain of custody.
ling Date : Not listed on the chain of custody.

CAN (EPA 6010)	Results(mg/l)	Det.Limit
dc		
r	333	
um	2.4	
ium	0.166	
mium	0.514	
er	1.76	
lt	97.6	
	12600	
ssium	0.242	
	41.7	
nesium	0.264	
ganese	136000	
m	36.4	
el	0.336	
mony	0.198	
llium	0.264	
	52.2	
nic	4.5	
nium		
	67.2	
um		
ium	3.1	
dium		
con	1	
ntium	22.4	
ium		

RCURY DIGESTION (EPA 7470)
e of Mercury Digestion:07/20/94

RCURY / Hg BY COLD VAPOR (EPA 245.1)	Results(mg/l)	Det.Limit
alyte		
rcury	0.002	

ient Sample #: EV #2
boratory ID #: 33965 Matrix: Liquid
mple Container: 2x2Liter Plastic Bottle
mpling Location: Not listed on the chain of custody.
mpling Date : Not listed on the chain of custody.

KALINITY, TOTAL (EPA 310.1)	Results(mg/l)	Det.Limit
alyte		
tal Alkalinity	18900	1

VION / CATION RATIO (CALCULATION)	Results()	Det.Limit
alyte		
ion/Cation Ratio	1.08	0

NATE ALKALINITY (EPA 310.1)	Results(mg/l)	Det.Limit
ate Alkalinity	23100	1

ALCIUM / Ca (EPA 200.7)	Results(mg/l)	Det.Limit
alyte		
alcium	735	0.001

Name: USPCI
Sample #: 9407000227
Type: HEAT EXCHANGERS
Date: 08/04/94

	Results(mg/l)	Det.Limit
NATE ALKALINITY (EPA 310.1)		
te Alkalinity	<1	1
IDE (EPA 300.6)	Results(mg/l)	Det.Limit
	176000	0.1
DE, TOTAL (EPA 335.2)	Results(mg/l)	Det.Limit
anide	<0.02	0.02
Fe (EPA 200.7)	Results(mg/l)	Det.Limit
	112	0.013
ESIUM/Mg (EPA 200.7)	Results(mg/l)	Det.Limit
ium	222	0.030
A 150.1)	Results(----)	Det.Limit
Liquid	13	0
SIUM/K (EPA 200.7)	Results(mg/l)	Det.Limit
	17400	0.010
A 370.1)l	Results(mg/l)	Det.Limit
Dioxide/Silica	400	2
M/Na (EPA 200.7)	Results(mg/l)	Det.Limit
	150000	0.001
FIC CONDUCTANCE (EPA 120.1)	Results(umhos/cm	Det.Limit
c Conductance	840000	1

IS A CALCULATED VALUE; THE MATRIX OF THE
LE PRECLUDED THE USE OF A CONDUCTIVITY
E DUE TO OILY COATING; THE CALCULATED VALUE
MES INFINITE DILUTION OF THE SAMPLE.)

	Results()	Det.Limit
FIC GRAVITY (USP 841)		
c Gravity	1.31	1
ATE (EPA 375.4)	Results(mg/l)	Det.Limit
	55300	1
OTAL DISSOLVED SOLIDS (EPA 160.1)	Results(mg/l)	Det.Limit
Dissolved Solids	417000	1
OTAL SUSPENDED SOLIDS (EPA 160.2)	Results(mg/l)	Det.Limit
ided Solids	6780	1

...t to: USPCI
...o Number: 9407000227
Page 4 of 4

Project: Heat Exchangers

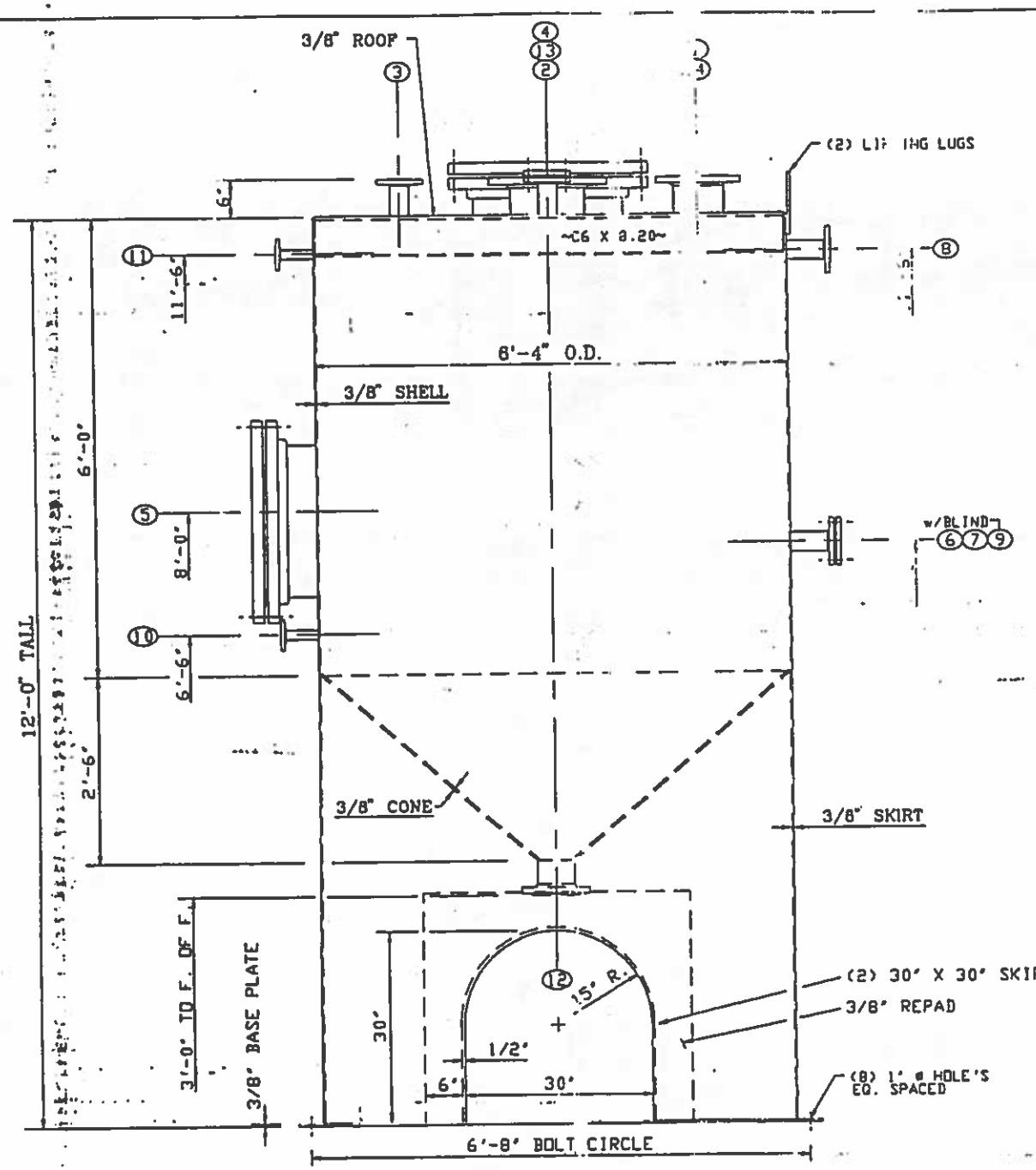
QUALITY CONTROL DATA

ANALYTE	DATE ANALYZED	SPIKE VOL	STAND. DEV.	COEFF. OF VAR %	REC1/%	REC2/%
Mercury	7/20/94	---	0.141	2.0	102	99
Total Alkalinity	7/26/94	---	0	0	100	---
T.D.S.	7/28/94	995	304	0.1	96	96
Silicon Dioxide/ Silica	8/1/94	---	0	0	100	---
Sulfate	8/1/94	---	5	2.4	99	---
Chloride	7/26/94	500	2.1	1.1	100	99
Hardness, Calcium	8/1/94	---	±4.2	1.1	110	100
T.S.S.	7/21/94	298	0.7	0	98	95

Standard Deviation = (x1-x2)/1.414
...ent of Variability % = (S.D./Avg.) X 100
...ry % = [(spiked-unspiked)/expected] X 100

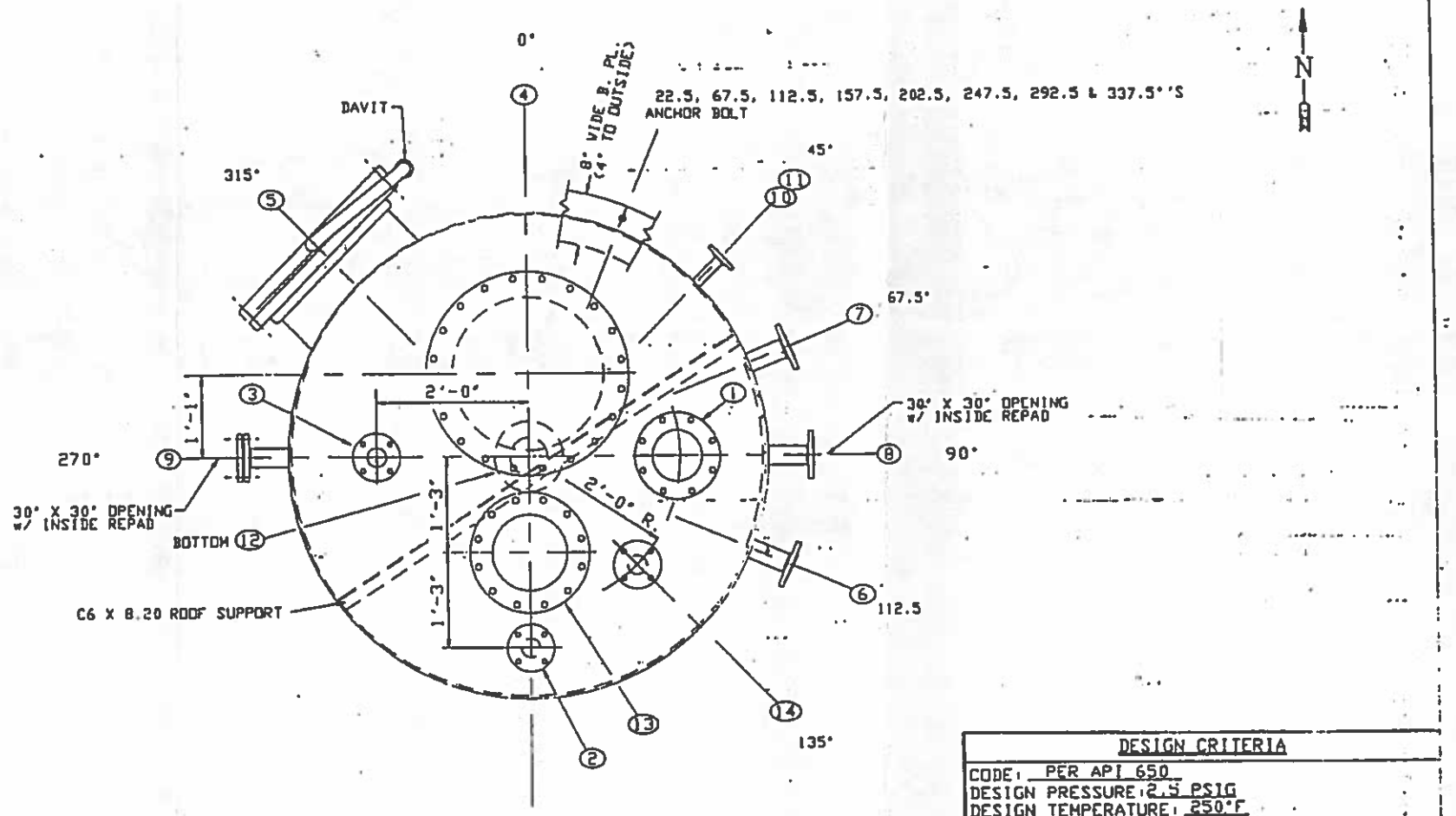
ICP SCAN INFORMATION

Note: ***ICP scans are very general in nature and do not include precise calibration or quality control. The process is intended as a screening procedure to identify very high metal concentrations.***



ELEVATION

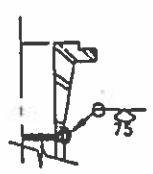
SEE PLAN VIEW FOR TRUE ORIENTATION.



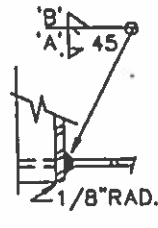
PLAN VIEW

MARK	NO. REQ'D.	SIZE	RATING	FACING	NECK	O.S. PROJ.	I.S. PROJ.	TYPE	'A'	'B'	REINFORCEMENT PAD	'C'	BLIND	NO STUDS	STUD SIZE	SERVICE	MARK
14	1	3"	150#	RFSO	SCH 80	7"	3/8"	I,V	3/8"	3/8"	N/A		YES	4	5/8"	FUTURE USE	14
13	1	12"	150#	RFSO	SCH 80	SEE DWG	3/8"	I,V	3/8"	3/8"	N/A					VENT	13
12	1	6"	150#	RFSO	SCH 80	SEE DWG	3/8"	I,V	3/8"	3/8"	N/A					PUMP SUCTION	12
11	1	1½"	150#	RFSO	SCH 80	6"	3/8"	I,V	3/8"	3/8"	N/A					SIGHT GLASS	11
10	1	1½"	150#	RFSO	SCH 80	6"	3/8"	I,V	3/8"	3/8"	N/A					SIGHT GLASS	10
9	1	3"	150#	RFSO	SCH 80	7"	3/8"	I,V	3/8"	3/8"	N/A		YES	4	5/8"	FUTURE USE	9
8	1	3"	150#	RFSO	SCH 80	7"	3/8"	I,V	3/8"	3/8"	N/A					OVERFLOW	8
7	1	3"	150#	RFSO	SCH 80	7"	3/8"	I,V	3/8"	3/8"	N/A					FILL	7
6	1	3"	150#	RFSO	SCH 80	7"	3/8"	I,V	3/8"	3/8"	N/A					FILL	6
5	1	24"	150#	RFSO	SCH 80	8"	3/8"	I,V	3/8"	3/8"	N/A		YES	20	1 1/4"	MANWAY	5
4	1	24"	150#	RFSO	SCH 80	SEE DWG	3/8"	I,V	3/8"	3/8"	N/A		YES	20	1 1/4"	MANWAY	4
3	1	3"	150#	RFSO	SCH 80	SEE DWG	3/8"	I,V	3/8"	3/8"	N/A					LEVEL GAUGE	3
2	1	3"	150#	RFSO	SCH 80	SEE DWG	3/8"	I,V	3/8"	3/8"	N/A		YES	4	5/8"	FUTURE USE	2
1	1	8"	150#	RFSO	SCH 80	SEE DWG	3/8"	I,V	3/8"	3/8"	N/A					FT4 OVERFLOW	1

SCHEDULE OF OPENINGS



TYPE II



TYPE V

DESIGN CRITERIA

CODE: PER API 650
DESIGN PRESSURE: 2.5 PSIG
DESIGN TEMPERATURE: 250°F
OPERATING PRESSURE: ATM.
OPERATING TEMPERATURE:
SPECIFIC GRAVITY: 1.5
JOINT EFFICIENCY: 85%
RADIOGRAPHY: SPOT
CORROSION ALLOWANCE: 1/8"

MATERIAL

ROOF, SHELL & BOTTOM: A-36
REINFORCEMENT PADS: A-36
STRUCTURAL SUPPORTS: A-36
PIPE: SA-106 GR. B
FLANGES, BLINDS, COUPLINGS & PLUGS: SA-105
BOLTING: SA-193 B7
SERVICE GASKETS: 1/8" GASKET
ESTIMATED WEIGHT EMPTY: 7,000 LBS
CAPACITY: 1,625 GAL.
SURFACE PREPARATION: INSIDE SSPC-SP 6
OUTSIDE SSPC-SP 6

PAINT:
INSIDE -(2)-Coats of S.W. Hi-Mil Sher-Tar Epoxy (7 mils DFT)
OUTSIDE - Prime w/ Glidden Epoxy No. 5466 (3 - 4 mils DFT)

A	10-19-93	REVISED PER CUSTOMER COMMENTS
0	8-27-93	ISSUED FOR APPROVAL

REVISIONS

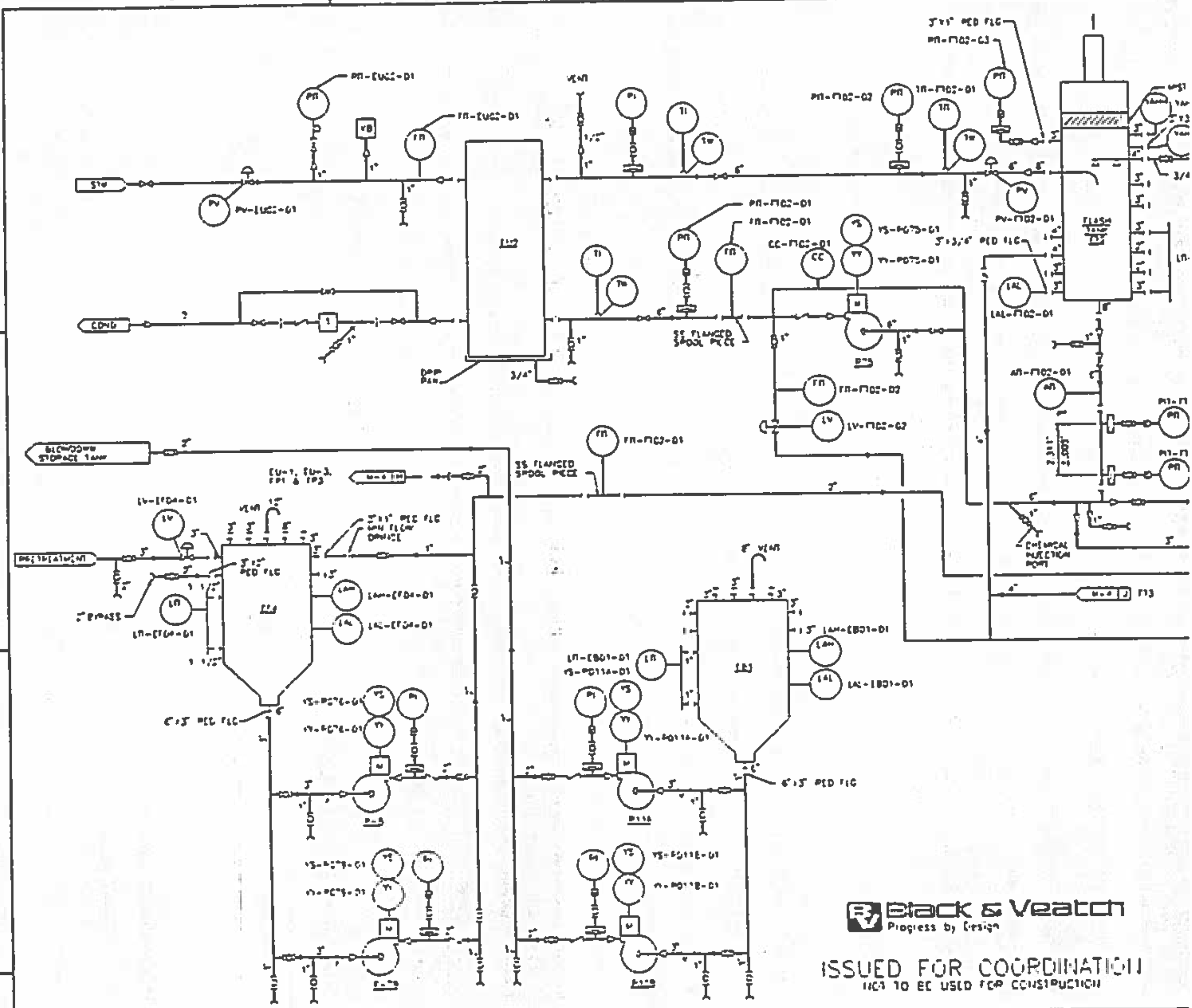
DRAWN BY: BDL
CHECKED BY: BLJ
SHOP ORDER NO.:
DATE: 8-27-93
PURCHASE ORDER NO.
DRAWING NAME: USPCI1

USPCI
DELTA TANK CO.
LONE MOUNTAIN FACILITY WAYNOKA, OKLAHOMA
ITEM# EF4 6'-4" O.D. X 8'-6" TALL EVAPORATOR FEED TANK

LIDE TANK COMPANY
RT. 2 BOX 158 D
MEXIA, TEXAS 76667

SHEET 1 OF 1

Ancillary Equipment Drawings



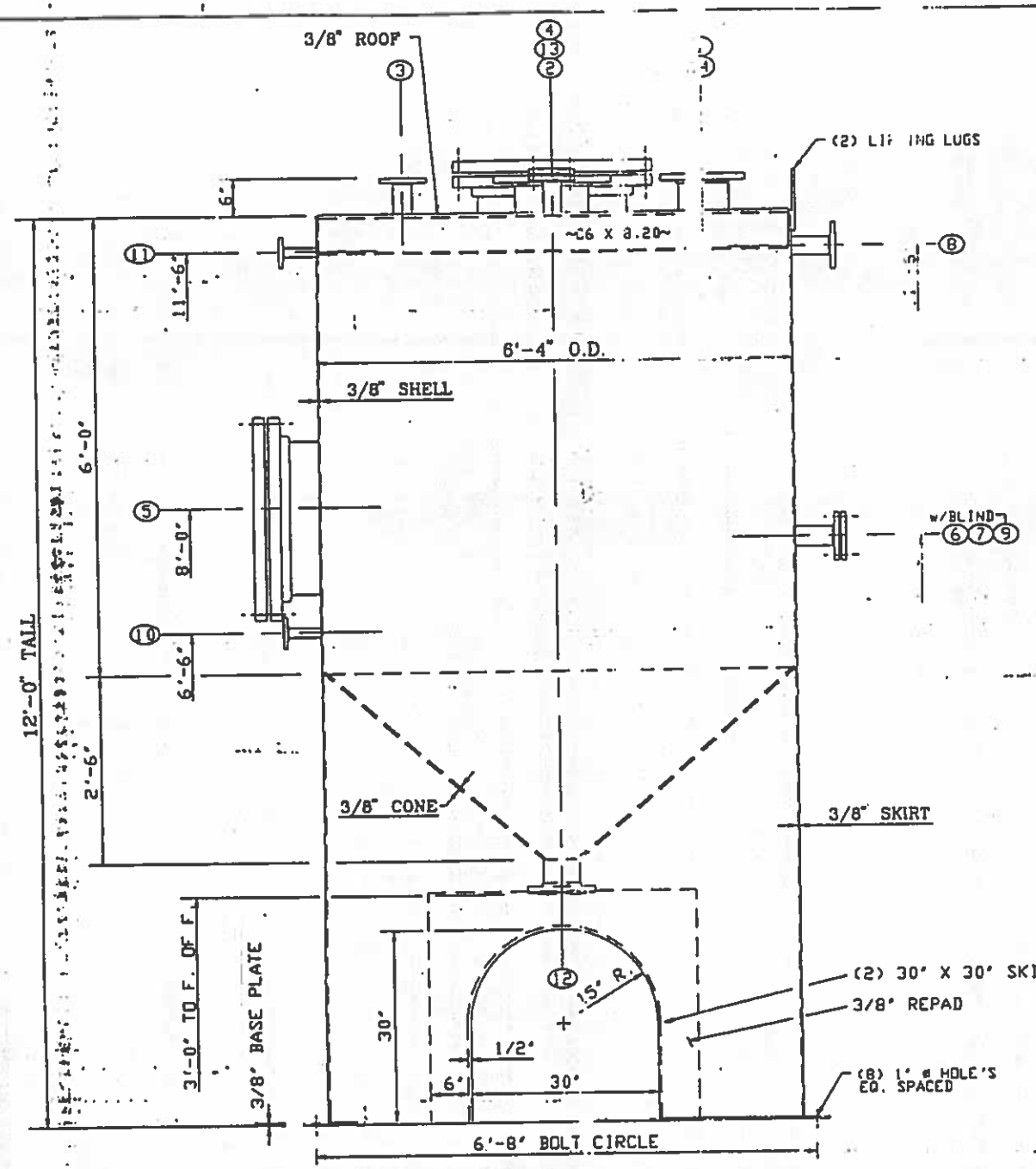
Black & Veatch
Progress by Design

ISSUED FOR COORDINATION
NOT TO BE USED FOR CONSTRUCTION

PRETREATMENT PRETREATMENT STORAGE RAW LEACHATE FLOW RATE: VARIABLE	EVAPORATION FEED TANK	RAW LEACHATE FEED PUMP		EVAPORATION ... PUMP	EVAPORATION HEAT EXCHANGER	FLASH TANK

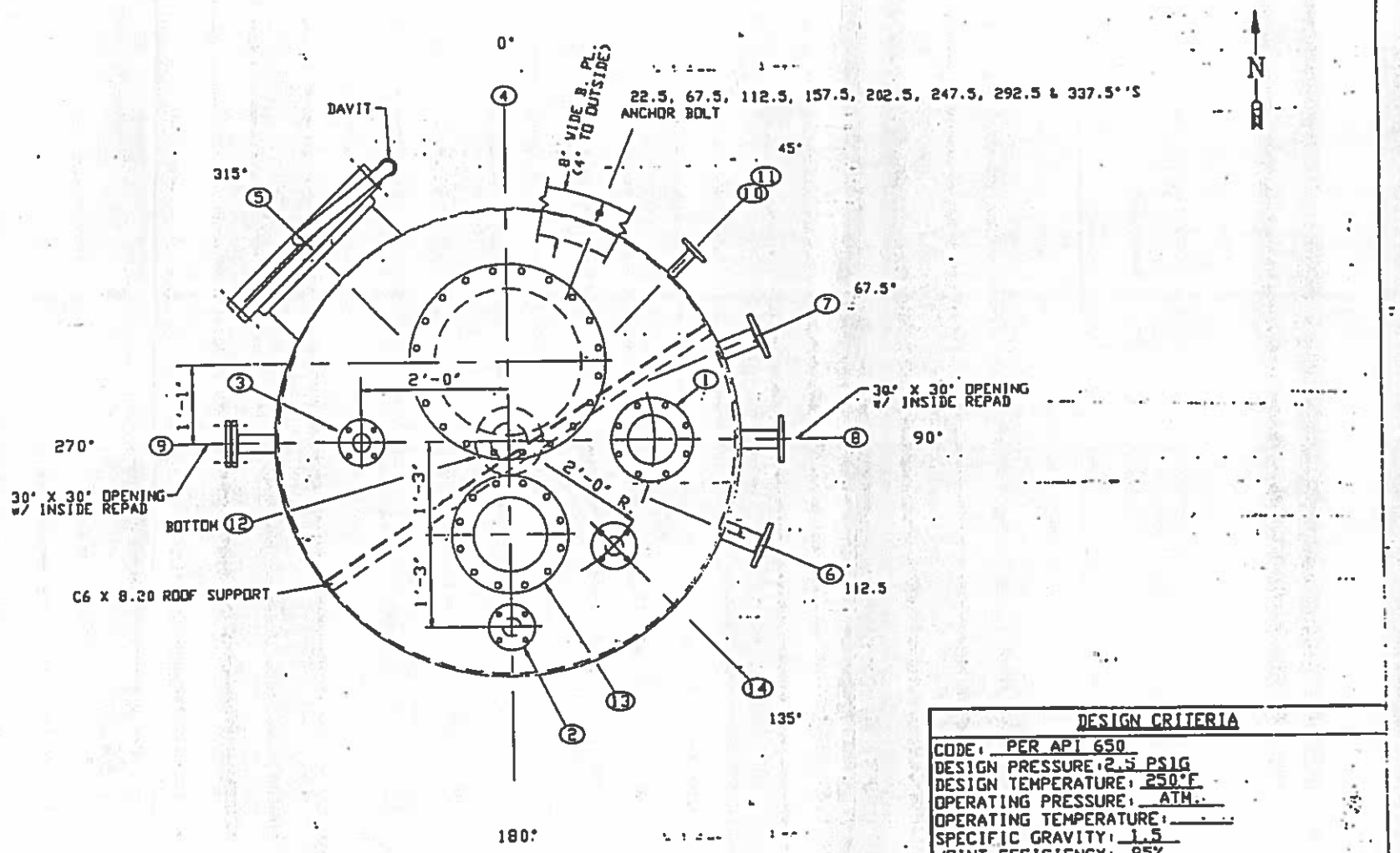
REVISIONS						REVISIONS						REFERENCE DRAWINGS		PRINT RECORD			
NO	DESCRIPTION	DATE	BY	CHK	APP	NO	DESCRIPTION	DATE	BY	CHK	APP	DRAWING NO.	TITLE	DATE	NO	SET	TO

Tank Drawings



ELEVATION

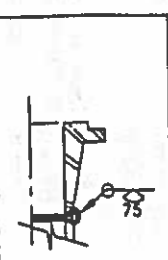
SEE PLAN VIEW FOR TRUE ORIENTATION.



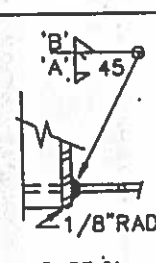
PLAN VIEW

MARK	NO. REQ'D.	SIZE	RATING	FACING	NECK	O.S. PROJ.	I.S. PROJ.	TYPE	'A'	'B'	REINFORCEMENT PAD	'C'	BLIND	NO STUDS	STUD SIZE	SERVICE	MARK
14	1	3"	150#	RFSO	SCH 80	7"	3/8"	I,V	3/8"	3/8"	N/A		YES	4	5/8"	FUTURE USE	14
13	1	12"	150#	RFSO	SCH 80	SEE DWG	3/8"	I,V	3/8"	3/8"	N/A					VENT	13
12	1	6"	150#	RFSO	SCH 80	SEE DWG	3/8"	I,V	3/8"	3/8"	N/A					PUMP SUCTION	12
11	1	1 1/2"	150#	RFSO	SCH 80	6"	3/8"	I,V	3/8"	3/8"	N/A					SIGHT GLASS	11
10	1	1 1/2"	150#	RFSO	SCH 80	6"	3/8"	I,V	3/8"	3/8"	N/A					SIGHT GLASS	10
9	1	3"	150#	RFSO	SCH 80	7"	3/8"	I,V	3/8"	3/8"	N/A		YES	4	5/8"	FUTURE USE	9
8	1	3"	150#	RFSO	SCH 80	7"	3/8"	I,V	3/8"	3/8"	N/A					OVERFLOW	8
7	1	3"	150#	RFSO	SCH 80	7"	3/8"	I,V	3/8"	3/8"	N/A					FILL	7
6	1	3"	150#	RFSO	SCH 80	7"	3/8"	I,V	3/8"	3/8"	N/A					FILL	6
5	1	24"	150#	RFSO	SCH 80	8"	3/8"	I,V	3/8"	3/8"	N/A		YES	20	1 1/4"	MANWAY	5
4	1	24"	150#	RFSO	SCH 80	SEE DWG	3/8"	I,V	3/8"	3/8"	N/A		YES	20	1 1/4"	MANWAY	4
3	1	3"	150#	RFSO	SCH 80	SEE DWG	3/8"	I,V	3/8"	3/8"	N/A					LEVEL GAUGE	3
2	1	3"	150#	RFSO	SCH 80	SEE DWG	3/8"	I,V	3/8"	3/8"	N/A		YES	4	5/8"	FUTURE USE	2
1	1	8"	150#	RFSO	SCH 80	SEE DWG	3/8"	I,V	3/8"	3/8"	N/A					FT4 OVERFLOW	1

SCHEDULE OF OPENINGS



TYPE II



TYPE V

DESIGN CRITERIA

CODE: PER API 650
DESIGN PRESSURE: 2.5 PSIG
DESIGN TEMPERATURE: 250°F
OPERATING PRESSURE: ATM.
OPERATING TEMPERATURE:
SPECIFIC GRAVITY: 1.5
JOINT EFFICIENCY: 85%
RADIOGRAPHY: SPOT
CORROSION ALLOWANCE: 1/8"

MATERIAL

ROOF, SHELL & BOTTOM: A-36
REINFORCEMENT PADS: A-36
STRUCTURAL SUPPORTS: A-36
PIPE: SA-106 GR. B
FLANGES, BLINDS, COUPLINGS & PLUGS: SA-105
BOLTING: SA-193 B7
SERVICE GASKETS: 1/8" GASKET
ESTIMATED WEIGHT EMPTY: 7,000 LBS
CAPACITY: 1,625 GAL
SURFACE PREPARATION: INSIDE SSPC-SP 6
OUTSIDE SSPC-SP 6
PAINT:
INSIDE -(2)-Coats of S.W. Hi-Mil Sher-Tar Epoxy (7 mils DFT)
OUTSIDE - Prime w/ Glidden Epoxy No. 5466 (3 - 4 mils DFT)

A	10-19-93	REVISED PER CUSTOMER COMMENTS
0	8-27-93	ISSUED FOR APPROVAL

REVISIONS

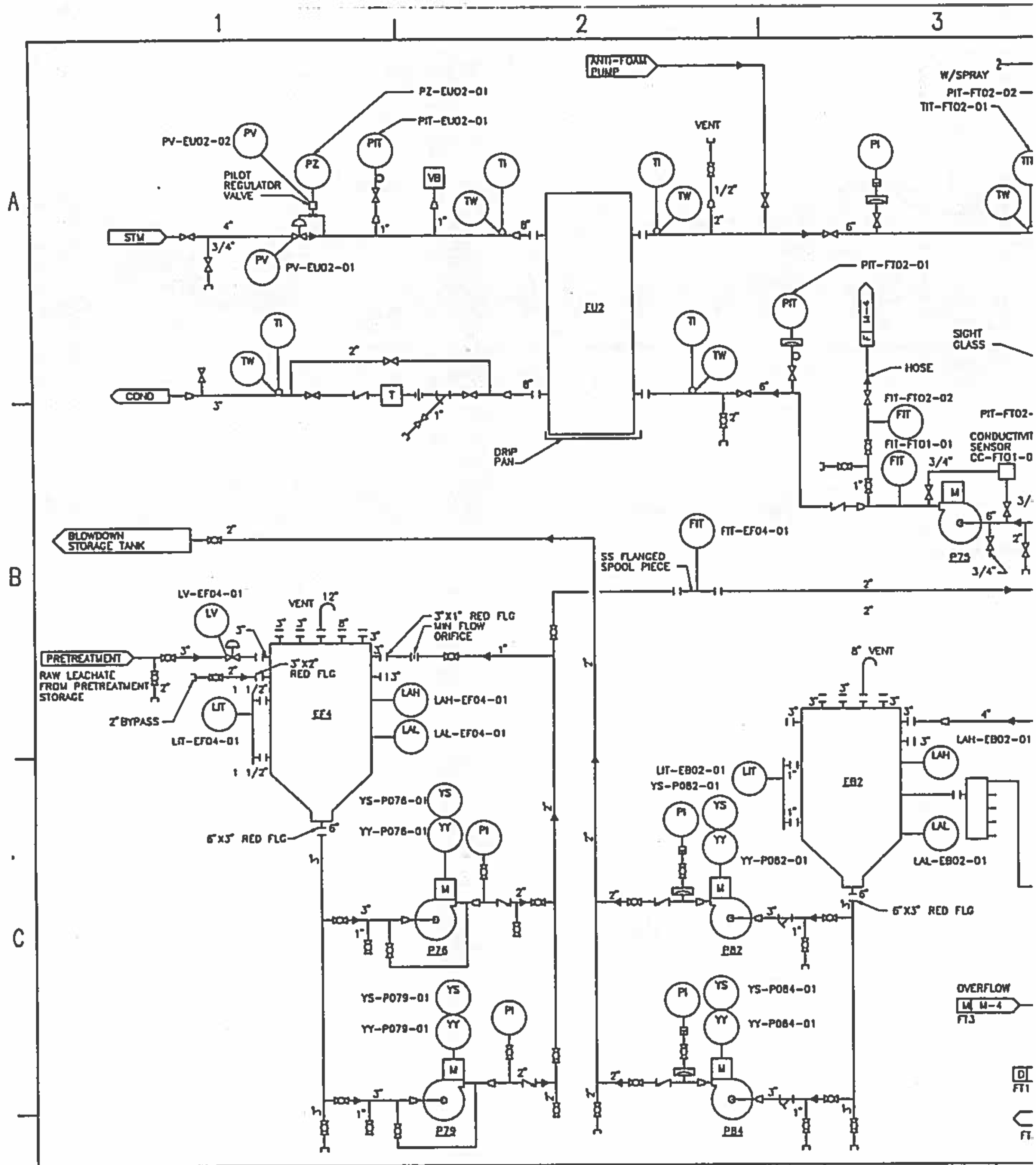
DRAWN BY: BDL
CHECKED BY: BLL
SHOP ORDER NO.:
DATE: 8-27-93
PURCHASE ORDER NO.
DRAWING NAME: USPC11

USPCI
DELTA TANK CO.
LONE MOUNTAIN FACILITY WAYNOKA, OKLAHOMA
ITEM# EF4 6'-4" O.D. X 8'-6" TALL EVAPORATOR FEED TANK

LIDE TANK COMPANY
RT. 2 BOX 158 D
MEXIA, TEXAS 76667

SHEET OF

Ancillary Equipment Drawings



PRETREATMENT

PRETREATMENT STORAGE
RAW LEACHATE
FLOW RATE: VARIABLE
SPECIFIC GRAVITY: 1.03
TOTAL SOLIDS: 2-4%

EF4

EVAPORATION FEED TANK
ATMS DESIGN TANK
SIZE: 8'-4" DIA. X 10' HIGH
MATERIAL: CARBON STEEL
VOLUME: 1825 GAL±
MAKE UP: LEVEL CONTROLLED
INSULATION: NONE

P76 & P79

RAW LEACHATE FEED PUMP
DESIGN: END SUCTION
GPM: 80
HEAD: 50 FT(PRELIMINARY)
HP: 2
SPECIFIC GRAVITY: 1.03
LB/HR: 20412±(PER FT)
TEMP: 40 TO 80 F

P75

EVAPORATION FT PUMP
DESIGN: END SUCTION
GPM: 800
HEAD: 231 FEET
HP: 60
SPECIFIC GRAVITY: 1.2
LB/HR: 451,800
TEMP: 200 TO 210 F

EU2

EVA
DES
MAT
HEA

D

REVISIONS

NO	DESCRIPTION	DATE	BY	CHK	APP

REVISIONS

NO	DESCRIPTION	DATE	BY	CHK	APP

REFERENCE DRAWIN

DRAWING NO.	TITLE

SECTION EO1

SECTION 305
ASSESSMENT OF EVAPORATOR OVERFLOW TANK (EO1)
LONE MOUNTAIN HAZARDOUS WASTE FACILITY
U.S.P.C.I.
WAYNOKA, OKLAHOMA

A. TANK SYSTEM DESCRIPTION

Evaporator Overflow Tank (EO1) is an aboveground evaporator overflow storage tank. The wastewater stored in this tank is treated or neutralized wastewater according to USPCI. The tank is horizontal in position and cylindric in shape. This tank and a portion of the ancillary piping is located together inside a concrete containment area.

B. PRIMARY TANK VESSEL

1. General Description

Evaporator Overflow Tank (EO1) consists of a circular steel tank placed in the horizontal position supported by a steel plate support system. The actual steel specifications to which the tank is constructed of is not known. The tank was inspected prior to the placement of interior coatings. Influent piping is located from the wastewater treatment building. This tank receives water from roof drains. Water from rains or an overflow of the flash tank will be collected in the gutter system and deposited into this tank.

2. Design Standards.

Structure calculations were performed to compare the existing tank and supports to those sections that are applicable in the American Petroleum Institute Standard 650 - 1988 edition (API-650) and the American Institute of Steel Construction (AISC) Manual of Steel Construction (8th Edition). These calculations can be found in Appendix B and C of this report. The actual steel specifications to which the tank is constructed are not known. Appendix A of API-650 was utilized in the analysis of this vessel due to the small diameter of the vessel.

3. Hazardous Characteristics of Wastes Stored

The wastes which are treated in this tank have the following characteristics:

Neutralized wastewater with a pH level between 4-10
$N < 6$
Temperature = Ambient

The hazardous characteristics of the waste treated in this tank were examined. It was determined that the pH and normality levels of the waste are the primary areas of concern. This is to determine the applicability of a corrosion allowance for the tank material type and thickness

4. Existing Corrosion Protection

The interior of the tank is coated with a coal tar epoxy coating. This coating was applied in May of 1992 and is in excellent condition. The exterior of the tank is painted with an epoxy paint as corrosion protection.

5. Documented Age of Tank

This tank was purchased as a used tank and the actual documented age is unknown. This tank was installed in July of 1987. The estimated age of the tank is 5 years old. This age was determined by using a 20 year design life less the estimated useful life of 15 years. A 20 year design life is assumed from the time of installation at USPCI.

6. Result of Leak Tests

No leak tests have been performed, however, the vessel is in service and a visual leak inspection was performed. In the visual leak test items such as welds, seams, flange connections, valves and threaded connections were examined to verify that no leaks were present. From this visual analysis it was determined that the primary tank is not leaking.

7. Existing Data Obtained

	Diameter of Tank	6.87'
	Height	20'-6"
	Material	Carbon Steel.
*	Thickness	0.70"
	Specific Gravity	1.5
	Operating Temperature	< 230°
	Maximum Volume	5514 Gal.
	Seismic Zone	1

* A complete and exhaustive ultrasonic thickness corrosion survey has been completed, the results of which can be found in Appendix F of this assessment.

8. Calculation of Foundation Loading

Total Weight of Tank and Contents = 37.07 tons

Detailed calculations reflecting the volume and weight of the tank along with the minimum required foundation thickness and steel reinforcement are included in Appendix A and E of this assessment.

9. Required Structural Calculation

The calculated required wall thickness for this tank is 0.066 inches. 0.0625 inches is added for corrosion allowance. This corrosion allowance is based on a best engineering estimate taking into account the materials being treated and a 20 year design life. (See Appendix B of this assessment for detailed calculations or required wall thickness and structural analysis of the tank support system).

10. Comparison of Actual Structure to Theoretical Values

Wall Thickness Comparison

Calculated Required Thickness	0.066"
Minimum Required Wall Thickness By API 650-88	0.1875"
Measured Wall Thickness	0.70"

C. SECONDARY CONTAINMENT SYSTEM

1. General Description of Secondary Containment

The secondary containment system is designed and operated to prevent any migration of wastes or liquids out of the system. (See Appendix G of this assessment for layout of secondary containment area.) The Evaporator Overflow Tank (EO1) #1 is located in a 12' x 24.5' x 3' high concrete containment area.

The containment area and tanks are routinely visually monitored on a daily basis for leaks. A sump pump and drain are located in the containment area. The floor is sloped to the sump to collect any drainage or spills. Any released tank contents or surface runoff will drain on top of the sloped concrete to the sump area. The accumulated liquids are then removed and pumped to the wastewater pretreatment area within a maximum of 24 hours, as a permit condition.

2. Design Standards

The structural capacity of the foundation and walls were compared to those sections that are applicable in the API 650-88 and the American Concrete Institute (ACI 318-89/318r-89) and these calculations were used as a guide in verifying the ability of the system to contain hazardous waste.

3. Hazardous Characteristics of Wastes Treated

The wastes which are treated in the primary tank have the following characteristics:

Treated Wastes
pH Level (4-10)
N < 6
Temperature = Ambient

The hazardous characteristics of the waste treated in the primary tank were examined. It was determined that the pH and normality levels of the waste are the primary areas of concern. This is to determine the applicability of a corrosion allowance for the containment system material type and thickness.

4. **Existing Corrosion Protection**

The entire secondary containment area floor and walls are coated with an impermeable coating by (Overcrete Plus by Concrete Protection Systems, Inc.) installed by Mid-America Painters of Woodward, Oklahoma. See Appendix H of this report for detailed information on this coating.

5. **Documented Age of the Containment Area**

The secondary containment system was constructed and installed in 1992 thus making the containment system less than 1 year old.

6. **Result of Leak Tests**

A visual inspection of the containment area was performed and from this inspection there were no cracks or breaks in the impermeable coating, therefore it appears to be adequate to contain any leaks or spills.

7. **Existing Data Obtained**

Area	295.23 s.f.
Wall Height	3.05 ft.
Material	Concrete
Gross Volume	906.44 c.f.

8. **Calculation of Existing Capacity**

Containment Capacity Available (CCA)

CCA = Gross Volume - Volume of items in the containment - Volume of rainfall.

See the appendix of this report for detailed calculations of the available containment volume. The containment capacity available = 749.13 c.f.

9. **Required Volume**

Containment Capacity Required (CCR)

CCR = Volume of Largest Tank in the secondary containment

Volume of Largest Tank = 737.29 c.f.

10. **Comparison of Available Volume to Required Volume**

Containment Capacity Comparison

Containment Capacity Required =	737.29 c.f.
Secondary Containment Volume Available =	749.13 c.f.
Excess Containment Volume =	11.84 c.f.

CCA>CCR Adequate Capacity (under normal operating conditions) is available.

D. CONCLUSIONS

1. Primary Tank Vessel

The tank vessel at the time of inspection was fit for use with the present waste stream at given densities, chemical and physical characteristics as verified by USPCI.

2. Secondary Containment System

The secondary containment area at the time of inspection was fit for use, if the present waste stream at given densities and chemical and physical characteristics as verified by USPCI were released from the primary tank. The useful life of the concrete containment area is estimated at 15 years. This useful life was determined by using a design life of 20 years less the period that the tank has been in use at the USPCI Lone Mountain Facility. There did not seem to be any extensive corrosion or deterioration of the secondary containment area.

E. RECOMMENDATIONS

The following repairs or modifications should be made:

1) Primary Tank

The tank should be checked periodically with ultrasonic testing procedures to establish a verified limit of corrosion. USPCI should continually insure compatibility with the waste and densities stored. Daily inspections should be continued to detect any visual corrosion or defects.

2) Secondary Containment System

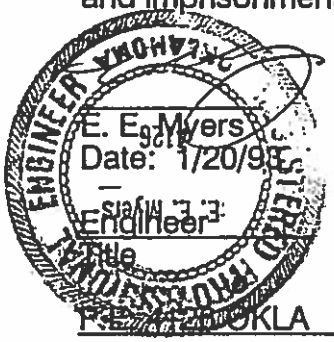
The secondary containment should be checked periodically for any deterioration and structural integrity.

3) Routine Inspections

When routine and preventative measures are to be completed, the tank should be cleaned and internally inspected to determine any interior defects or corrosion. Continued routine painting and coating of tanks on the interior and exterior, and routine inspection is recommended.

F. CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted, is to be the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment from knowing violations.



E. E. Myers
Date: 1/20/98

Engineer
Title

OKLA

APPENDIX A

Primary Tank Volume Calculations

SECTION 305 - APPENDIX A

EO1, Evaporator Overflow Tank

PRIMARY TANK VOLUME CALCULATIONS

DIMENSIONS:

Geometry:	CYLINDRICAL		
Diameter:		6.87	FEET
Height =		17.60	FEET
Top = Std. Umbrella =			
Bottom = Std. Umbrella =			

TANK VOLUME:

Top = approx. Std. Umbrella volume = 0.05539*D^3		42.44	C.F.
Bottom = Std. approx. Umbrella volume = 0.05539*D^3		42.44	C.F.
Tank Cylinder =		652.40	C.F.
TOTAL PRIMARY TANK VOLUME =		737.29	C.F.
	OR	5,514.93	GAL

WEIGHT ON FOUNDATION

CONTENTS S.G.:	1.50	
DENSITY:	93.60	LB/C.F.

SURFACE AREA CALCULATION

Tank Top = 0.8418*D^2 =	39.73	S.F.
Tank Bottom = 0.8418*D^2 =	39.73	S.F.
Tank Wall= Cir*h	379.86	S.F.
TOTAL SURFACE AREA =	459.32	S.F.
Steel Thickness=		
Sidewalls	0.26	INCHES
Top and bottom Dish	0.34	INCHES
Volume of Steel =		
Sidewalls	8.23	C.F.
Top and bottom dish	2.22	C.F.
Density of Steel =	490.00	LB/C.F.
Weight of Steel =	2.56	TONS
WEIGHT OF TANK CONTENTS =	34.51	TONS
TOTAL WEIGHT OF TANK AND CONTENTS =	37.07	TONS

APPENDIX B

Primary Tank Wall Thickness Calculations

SECTION 305 - APPENDIX B

EO1, Evaporator Overflow Tank

PRIMARY TANK WALL THICKNESS

DIMENSIONS:			
GEOMETRY:	CYLINDRICAL		
DIAMETER:		6.87	
LENGTH:		17.60	
TANK VOLUME:		737.29	C.F.
CONTENTS S.G.:		1.30	
DENSITY:		81.12	LB/C.F.
TOTAL WEIGHT OF TANK AND CONTENTS =		37.14	TONS
STEEL THICKNESS =		0.740	INCHES

THIS TANK IS LYING ON ITS SIDE THEREFORE TREAT TANK AS A CONTINOUS BEAM		
Allowable Stress API-650-88	23200.00	psi
I =	162819.18	in4
S (provided) =	3950.00	in3
w =	4.22	K/LF
Length Between Supports=	8.80	feet
M = wl ^ 2/8	40.85	K-FT
	490.25	K-IN
S required =	21.13	in3
Thickness Required =	0.004	in
Corrosion Allowance =	0.0625	in
Thickness Required =	0.066	in

APPENDIX C

Structural Support Calculations

SECTION 305 - APPENDIX C

EO1, Evaporator Overflow Tank

STRUCTURAL SUPPORT CALCULATIONS

GIVEN:		
Tank Diameter =	6.87	feet
Total Height =	17.60	feet
Weight of Tank (Steel) =	5120.00	lbs
Weight of Max. Contents =	69020.00	lbs
Tank Nominal Thickness =	0.25	in

—SEISMIC DESIGN CHECK—

ZONE COEFFICIENT (Z):	0.1875	
ESSENTIAL FACILITIES FACTOR (I):	1.000	
LATERAL EARTHQUAKE FORCE COEFF. (C1):	0.240	
D/H:	0.390	
k factor:	0.550	
SITE AMPLIFICATION FACTOR (S):	1.500	
NATURAL PEERIOD OF FIRST SLOSHING (T):	1.442	
LATERAL EARTHQUAKE FORCE COEFF. (C2):	0.312	
WEIGHT OF TANK SHELL (Ws):	5120.000	LBS
TOTAL WEIGHT OF TANK CONTENTS (Wt):	69020.000	LBS
W1/Wt:	0.900	
W2/Wt:	0.100	
WEIGHT OF EFFECTIVE MASS OF CONTENTS THAT MOVES IN UNISON WITH THE TANK SHELL (W1):	62118.000	LBS
WEIGHT OF EFFECTIVE MASS IN FIRST SLOSHING (W2):	6902.000	LBS
HT FROM BTM OF SHELL TO CENT. OF SHELL (Xs):	8.800	FEET
X1/H:	0.480	
HT FROM BTM TO CENT. OF LAT. SEISMIC FORCE (X1):	8.448	FEET
X2/H:	0.800	
HT FROM BTM TO CENT. OF LAT. SEISMIC FORCE (X2):	14.080	FEET

OVERTURNING MOMENT (M) = Z*I*(C1*Ws*Xs + C1*W1*X1 + C2*W2*X2)

OVERTURNING MOMENT (M): 31330.178 FT-LBS

Note: All of the above calculations are based on API-650-88 Seismic Design Procedure (Appendix E).

CHECK STRESS IN TANK SHELL FROM SEISMIC FORCES:

Wl = MAXIMUM WEIGHT OF TANK CONTENTS THAT MAY BE USED TO RESIST THE SHELL OVERTURNING MOMENT		
Wl = 7.9*tb*(Fby*G*H) ^ .5		
Wl must be less than 1.25*G*H*D:	226.71	
tb = THK. OF BTM. PLATE UNDER SHELL:	0.250	IN
Fby = MINIMUM YIELD STRENGTH OF BOTTOM PLATE:	36000.000	PSI
G = DESIGN SPECIFIC GRAV. OF LIQUID:	1.50	
Wl =	1925.40	LBS/FT OF SHELL CIRCUMFRENCE
DENSITY OF TANK SHELL MATERIAL:	490.00	LBS/CF
WT = WEIGHT OF TANK SHELL AND THE PORTION OF FIXED ROOF SUPPORTED BY TANK SHELL:	179.67	LBS/FT OF SHELL CIRCUMFRENCE
M/[D ^ 2(WT+Wl)]:	0.3153	
b = MAXIMUM LONGITUDINAL COMPRESSIVE FORCE AT THE BTM. OF TANK SHELL		
b = WT + 1.273*M/D ^ 2		
b:	1024.71	LBS/FT OF SHELL
G*H*D ^ 2/t ^ 2:	19935.97	
Fa = MINIMUM OF 10 ^ 6*t/2.5*D + 600*(G*H) ^ .5 or .5*Fty	18000.00	PSI
Fty = MINIMUM YIELD STRENGTH OF BTM. SHELL COURSE:	36000.00	PSI
MAX. LONGITUDINAL COMPRESSIVE STRESS IN THE TANK SHELL = b/12t =	341.57	PSI

CHECK OVERTURNING MOMENT FROM WIND PRESSURE

Mmax must be Less Than or Equal To .66*(WD)/2

Where:

W = Shell Weight Available To Resist Uplift (lbs)

D = Tank Diameter (feet)

M = Overturning Moment

M = Pw*Projected Area*H1

H1 = Height from ground to centroid of tank shell

Pw = Wind Pressure (18 psf for 100 MPH Wind on cylinders)

Mmax:	11607.55	FT-LBS
M:	19152.46	FT-LBS

APPENDIX D

Containment Area Volume Calculations

SECTION 305 APPENDIX D

EO1, Evaporation Overflow Tank

SECONDARY CONTAINMENT CALCULATIONS

Area No.1		
Length =	24.50	feet
Width =	12.05	feet
Height =	3.05	feet
Surface Area =	295.23	S.F.
Volume =	900.44	C.F.

Gross Area =	Area 1	295.23 S.F
Gross Volume =	Vol. 1	900.44 C.F.

Volumes of Items of Displacement **

There are no items in secondary containment except tank EO1

Total volume to deduct for items in containment area = 0.00 C.F.

Subtraction for volume of rainfall

Volume of rain = Area x depth of rainfall

Depth of rainfall =	6.15 In.
Area =	295.23 S.F.
Volume =	151.30 C.F.

TOTAL AVAILABLE VOLUME = Gross Volume - Subtractions =	900.44 C.F.
Items of diplacement	0.00 C.F
Volume of rainfall	-151.30 C.F

TOTAL AVAILABLE VOLUME =		749.13 C.F.
	OR	5603.52 Gal.

APPENDIX E

Foundation Design Analysis

SECTION 305 - APPENDIX E

EO1, Evaporator Overflow Tank

FOUNDATION DESIGN ANALYSIS

ASSUMPTIONS:

f'c =		3.50	KSI
fy =		60.00	KSI
Allowable Soil Press. =		2.00	KSI
Structural Steel =	A36		

GIVEN:

Tank Diameter =	6.87	feet
Sidewall Height =	17.60	feet
Weight of Tank (Shell)	5120.00	lbs
Weight of Max. Contents =	69020.00	lbs

Tank is Resting on a concrete foundation.

CHECK CONCRETE FOUNDATION DESIGN:

Assume Footing Depth =	6.00	inches	
Assume Footing Width =	12.00	inches	
Assumed Effective Soil Press. =	1925.00	psf	
			psf

Look at what is resisiting overturning moment from seismic load:

b =	1024.71	lb/ft of circ.

Where b is the maximum shell compression at the bottom of the shell.

If the footing is	12.00	inches wide
then the actual applied pressure to the subgrade is	1024.71	lb/sf

This is less than the effective soil pressure.

APPENDIX F

Ultrasonic Thickness Testing Results

REPORT OF UT THICKNESS INSPECTION

TESTED FOR: VSPCI
LONE MOUNTAIN

PROJECT: CORROSION SURVEY

DATE: 8-3-92

OUR REPORT NO.: 53

Client Order Number:	Lab Number: UT #1	Location: EO-1
Test Method Standard: QC UT 5	Acceptance Standard: QC UT 5	Scanning Method: RANDOM / 2'

UT UNIT
_____ A-Scan
✓ Direct Readout
_____ A-Scan and Direct Readout

Manufacturer: KBA
Model: DME
Serial No.: 103162

CALIBRATION BLOCK
ID Number: 01
Material Type: STEEL
Size: .100" - .500" STEP

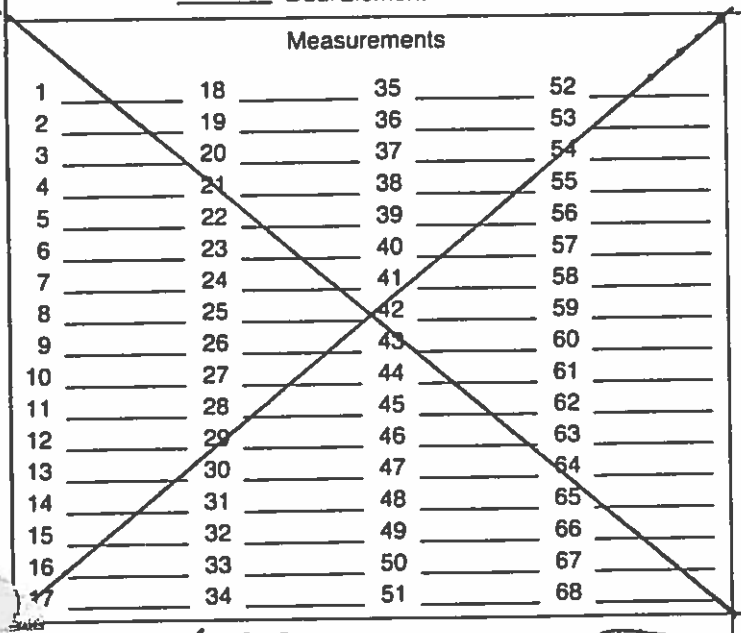
SEARCH UNIT
_____ Single Element
✓ Dual Element

Size: .625"
Frequency: 5 MHZ
Serial No.: E08931

Measurements

1	18	35	52
2	19	36	53
3	20	37	54
4	21	38	55
5	22	39	56
6	23	40	57
7	24	41	58
8	25	42	59
9	26	43	60
10	27	44	61
11	28	45	62
12	29	46	63
13	30	47	64
14	31	48	65
15	32	49	66
16	33	50	67
17	34	51	68

Diagram



*NOTE: SEE DRWG. #EO-1 AND ATTACHMENTS FOR READINGS AND LOCATIONS.

*NOTE: BLANK AREAS ON DRAWING DENOTE AREAS UNINSPECTABLE DUE TO INACCESSABILITY.

Technician: J. BROOKS Level: II

Technician: [signature] Level: II

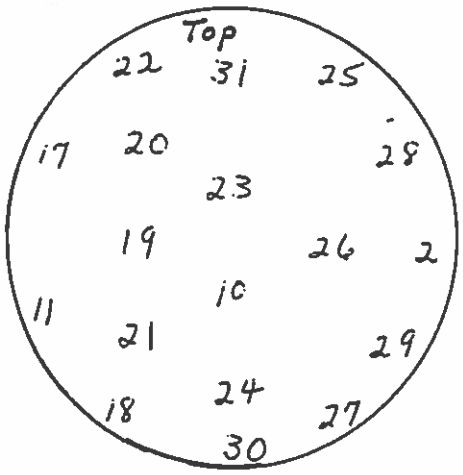
REMARKS: READINGS TAKEN AT 2 FOOT GRIDS

P.S.I. Tank Number EO-1 Date 8-3-92

0.724	29	0.951	57	0.708	85	0.696	113	0.755	141	0.	168	0.
0.953	30	0.985	58	0.719	86	0.734	114	0.701	142	0.	169	0.
0.707	31	0.985	59	0.714	87	0.765	115	0.708	143	0.	170	0.
0.695	32	0.693	60	0.720	88	0.757	116	0.754	144	0.	171	0.
0.728	33	0.705	61	0.711	89	0.756	117	0.695	145	0.	172	0.
0.702	34	0.719	62	0.711	90	0.778	118	0.702	146	0.	173	0.
0.720	35	0.705	63	0.728	91	0.760	119	0.738	147	0.	174	0.
0.920	36	0.706	64	0.701	92	0.757	120	0.706	148	0.	175	0.
0.893	37	0.709	65	0.728	93	0.741	121	0.720	149	0.	176	0.
0.918	38	0.717	66	0.971	94	0.743	122	0.745	150	0.	177	0.
0.970	39	0.696	67	0.937	95	0.765	123	0.725	151	0.	178	0.
0.931	40	0.708	68	0.953	96	0.752	124	0.702	152	0.	179	0.
0.96	41	0.726	69	0.910	97	0.719	125	0.706	153	0.	180	0.
0.700	42	0.766	70	0.905	98	0.699	126	0.694	154	0.	181	0.
0.699	43	0.730	71	0.499	99	0.715	127	0.705	155	0.	182	0.
0.686	44	0.741	72	0.895	100	0.710	128	0.	156	0.	183	0.
0.952	45	0.755	73	0.943	101	0.740	129	0.	157	0.	184	0.
0.955	46	0.747	74	0.910	102	0.700	130	0.	157	0.	185	0.
0.923	47	0.740	75	0.934	103	0.688	131	0.	158	0.	186	0.
0.911	48	0.730	76	0.912	104	0.687	132	0.	159	0.	187	0.
0.949	49	0.765	77	0.970	105	0.693	133	0.	160	0.	188	0.
0.993	50	0.720	78	0.931	106	0.685	134	0.	161	0.	189	0.
0.923	51	0.743	79	0.715	107	0.680	135	0.	162	0.	190	0.
0.928	52	0.746	80	0.739	108	0.705	136	0.	163	0.	192	0.
0.915	53	0.714	81	0.742	109	0.709	137	0.	164	0.	193	0.
0.29	54	0.730	82	0.743	110	0.750	138	0.	165	0.	194	0.
0.908	55	0.711	83	0.725	111	0.718	139	0.	166	0.	195	0.
0.950	56	0.711	84	0.683	112	0.722	140	0.	167	0.	196	0.

P.S.L. Tank Number EU-1 Date 5-3-42.

North End



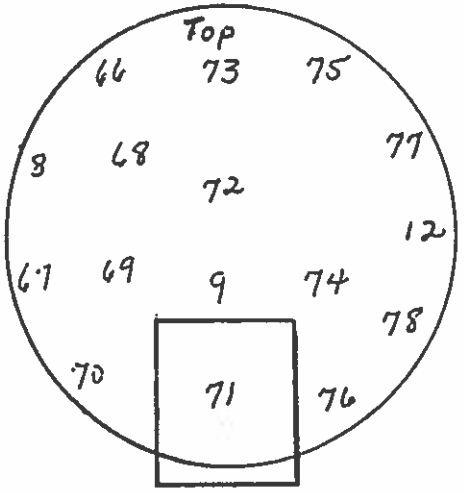
North End

	16	14	15	34	33	1	32	18	101
West Side	103	105		38	37	35	36	83	104
			Bottom						
	106			41	40	3	39	85	107

82 Top Manway 84 — East Side

109	108	44	43	4	42	87	88	110
112	111	48	47	45	46	89	90	113
		Bottom						
115	114	51	50	5	49	91	92	116

South End



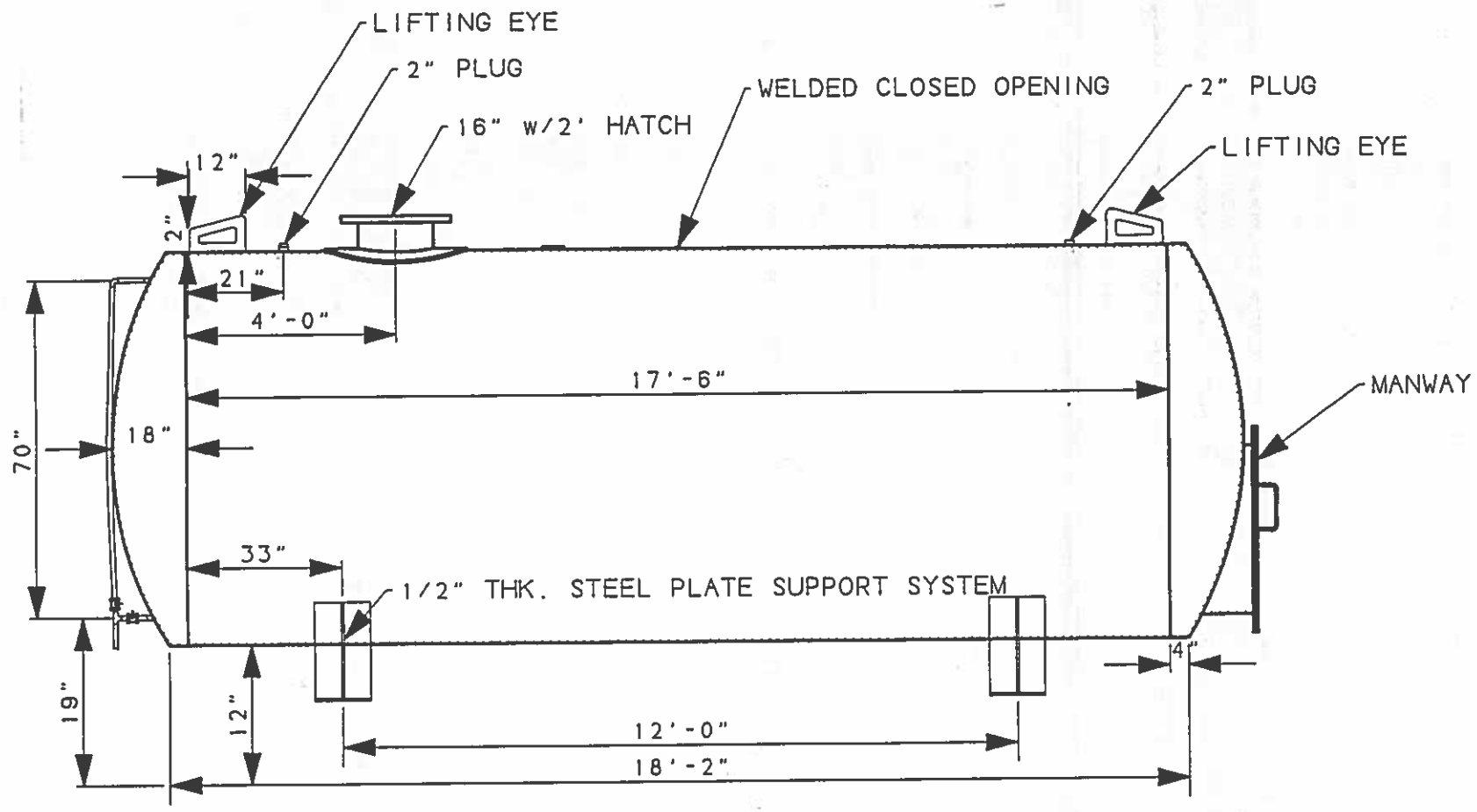
	118	117		54	53	6	52	93	94	119
West Side	121	120		58	57	55	56	95	96	122
	124	123	Bottom	62	61	59	60	97	98	125
	126	13		65	64	7	63	99	100	127
	79									

East Side

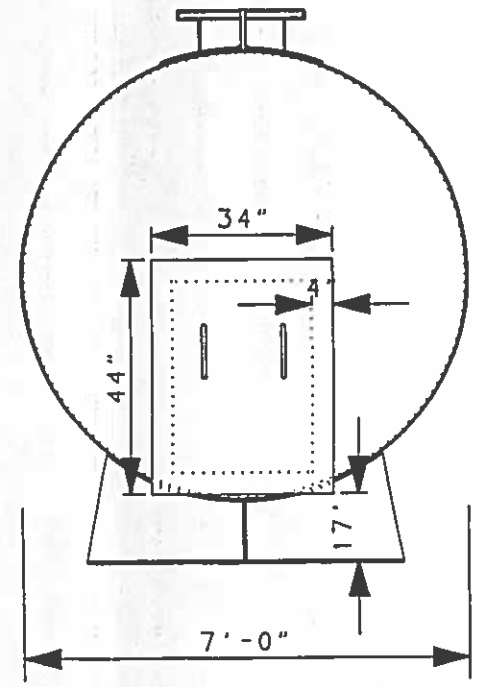
South End

APPENDIX G

Drawings



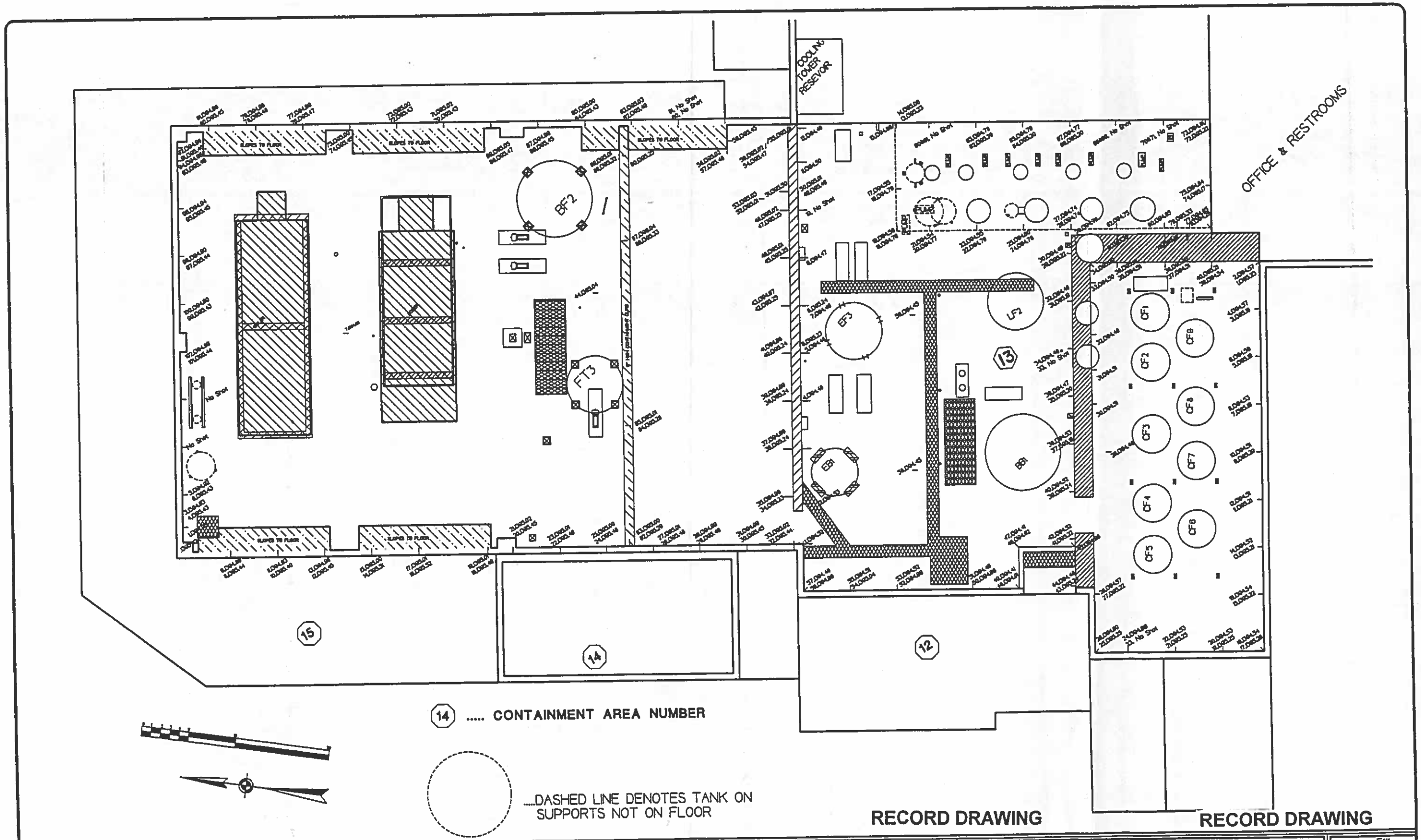
SIDE VIEW



END VIEW

RECORD DRAWING

(EO) EVAPORATION OVERFLOW TANK DETAIL USPCI, LONE MOUNTAIN FACILITY Waynoka, Oklahoma	Myers ENGINEERING CORPORATION Oklahoma City Oklahoma	JOB NO. 9111 SCALE DRAWN RF DATE 8-5-93
EO-DET.DGD		SHEET OF



REVISIONS

NO.	DATE	DESCRIPTION

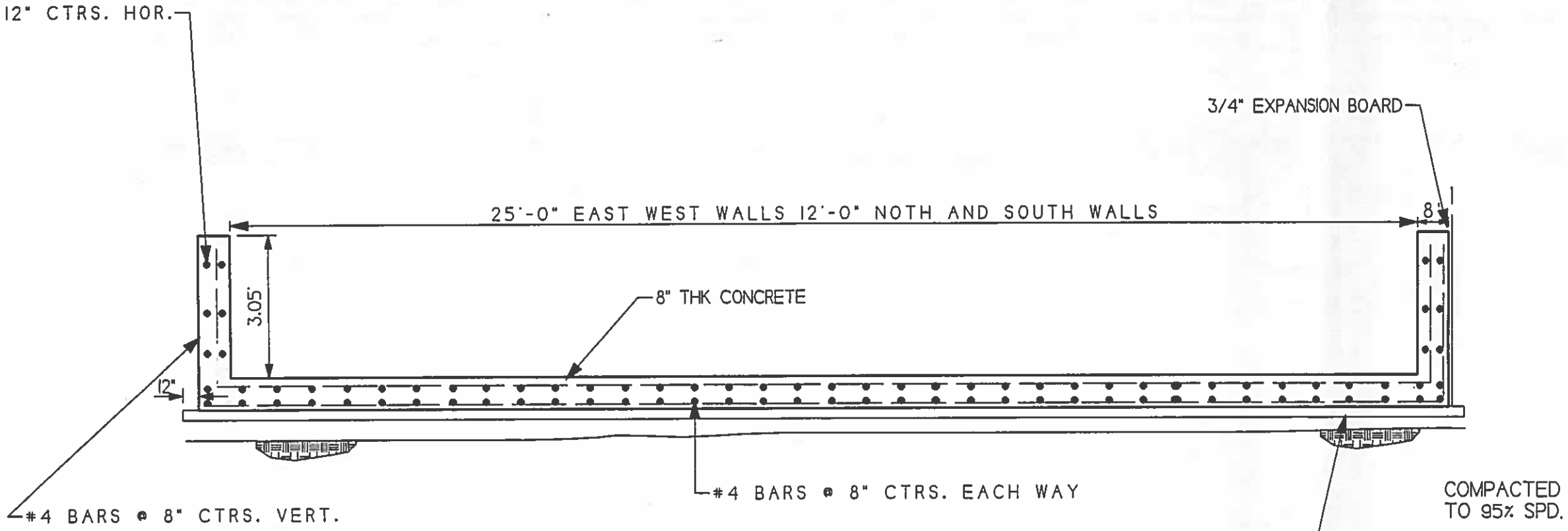
USPCI
A Subsidiary of Union Pacific Corporation

USPCI
LONE MOUNTAIN FACILITY
WAYNOKA, OKLAHOMA

Myers
ENGINEERING CORPORATION
11102 N. Stratford Dr. Suite B400
Oklahoma City, Oklahoma 73120
(405) 755-5325

ELEVATIONS OF
WASTEWATER FINAL TREATMENT AREA

JOB NO. 511
SCALE
DRAWN ntc
DATE 9-16-92
SHEET OF



SECTION "A" - "A" SECONDARY CONTAINMENT

RECORD DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

USPCI
A Subsidiary of Union Pacific Corporation

USPCI
LONE MOUNTAIN FACILITY
WAYNOKA, OKLAHOMA

Myers
ENGINEERING CORPORATION
11102 N. Stratford Dr. Suite B400
Oklahoma City, Oklahoma 73120
(405) 755-5325

(E01) EVAPORATION OVERFLOW
TANK DETAIL

JOB NO. 5111
SCALE
DRAWN RF
DATE 9-16-92
SHEET OF

SECTION FT1

ASSESSMENT
Of
EVAPORATOR FLASH TANK NO. 1
(FT 1)
Located At The
LONE MOUNTAIN HAZARDOUS WASTE FACILITY
WAYNOKA, OKLAHOMA

PREPARED FOR

July 2002

ENVIROTECH
ENGINEERING & CONSULTING, INC.
C. A. 1960--Expiration Date 06/30/03

2500 North Eleventh Street ■ Post Office Box 6029 ■ Enid, Oklahoma 73702 ■ (580) 234-8780 ■ Fax (580) 237-4302

02-084

ASSESSMENT
Of
EVAPORATOR FLASH TANK NO. 1 (FT 1)
Located At The
LONE MOUNTAIN HAZARDOUS WASTE FACILITY
WAYNOKA, OKLAHOMA
Prepared For
SAFETY-KLEEN, INC.

TABLE OF CONTENTS

LIST OF APPENDICES:

ASSESSMENT
Of
EVAPORATOR FLASH TANK NO. 1 (FT 1)
Located At The
LONE MOUNTAIN HAZARDOUS WASTE FACILITY
WAYNOKA, OKLAHOMA
Prepared For
SAFETY-KLEEN, INC.

1. TANK SYSTEM DESCRIPTION

Evaporator Flash Tank No. 1 (FT 1) is a welded, above-ground wastewater treatment and storage tank to be installed as a part of the final wastewater treatment plant at the Lone Mountain Facility in Waynoka, Oklahoma. This tank is a replacement for an existing tank which is constructed of carbon steel. The new tank, which is constructed of stainless steel, is exactly the same size as the original tank. The top of the tank is completely open to the atmosphere for evaporation purposes. Evaporator Flash Tank No. 1 (FT 1) is located within the Wastewater Final Treatment building on the first mezzanine level of the support structure. The complete tank system consists of Evaporator Flash Tank No. 1 (FT 1), Circulating Pump (P 78), Heat Exchanger (EU 1), Pump (P 80), Filter Press (FP 1), and associated piping and instruments.

2. PRIMARY TANK VESSEL

2.1 **General Description.** Evaporator Flash Tank No. 1 (FT 1) is a circular steel tank with an outside diameter of 6-ft. 4-in. and a height of 31-ft. The tank proper's skirt is anchored to the support structure, and the bottom of the tank is dished and welded to the shell. A self-supporting flue is attached to the top of the tank. Evaporator Flash Tank No. 1 (FT 1) is being assessed to determine if the unit is adequately designed with sufficient structural strength and compatibility with the waste to be stored.

2.2 **Design Standards.** The tank is designed and constructed to those sections that are applicable in the American Petroleum Institute Standard 650, 10TH Edition (API-650). The manufacturer's certification is included in *Appendix A*.

2.3 **Hazardous Characteristics of Waste Stored.** The waste stored in this tank is treated and untreated brine solutions. The following parameters are characteristics of the waste treated:

Ignitability: Flash Point > 240° F

Corrosiveness: 6 < pH < 13
0 < N < 7

Reactivity: None

Temperature: < 240° F

Based on the results of the examination of the hazardous characteristics of the waste to be stored in this tank, it was determined that the pH, normality levels, and salinity (corrosiveness) of the waste are the primary areas of concern. These levels are used to determine the applicability of a corrosion allowance for the tank material type and thickness.

2.4 Welding Specifications and Inspection. The welding procedures utilized in the tank construction and the Radiographic Examination Report are included in *Appendix B*.

2.5 Corrosion Protection. The tank shell is constructed of 316L stainless steel for corrosion protection.

2.6 Documented Age of Tank. This tank was manufactured by Lide Industries of Mexia, Texas, in January 2002, and installed in July 2002.

2.7 Results of Leak Tests. The manufacturer conducted a hydrostatic leak test of the tank prior to shipping. A description of this test is included in *Appendix C* of this assessment. In addition, a visual inspection was performed of the tank's interior and exterior subsequent to installation. This inspection was conducted specifically to detect the presence, if any, of the following defects:

(a) Weld break
(b) Punctures
(c) Cracks
(d) Corrosion
(e) Other structural damage or inadequacies of construction and/or installation

The tank was again hydrostatically tested subsequent to installation. A description of this procedure is summarized in *Appendix C* of this assessment. Based on the results of these tests, it was determined that the primary tank was not leaking.

2.8 Existing Data Obtained.

Tank Diameter	6-ft. 4-in.
Nominal Height of Tank	31-ft.
Maximum Capacity	3,785-gal.*
Overflow Liquid Level	9-ft. 1-in.
Overflow Volume	1,137-gal.
Design Specific Gravity	1.5
Maximum Bottom Pressure	10.8-psi
Maximum Operating Temperature	300° F
Construction Material:	
Flue	ASTM A36
Shell	ASTM 316L
Bottom	ASTM 316L
Skirt	ASTM A36
Flanges, Blinds, Coupler and Plugs	ASTM 316L
Bolts	SA 193-B7/SA 194-2H
Wall Thickness (Shell and Bottom)	0.250-in.
Operating Pressure	Atmospheric
Seismic Zone	1

* The maximum capacity of the assessed tank is the same as the original tank, however the original tank assessment indicates otherwise. There appears to have been an error in the original assessment's volume calculations.

2.9 Calculation of Existing Foundation Loading.

Total Weight of Tank and Contents (maximum volume)	59,406-lb.

Detailed calculations reflecting the volume and weight of the tank are included in *Appendix D* of this assessment.

2.10 Required Structural Calculation. Calculations for the required wall thickness for this tank are presented in *Appendix D* of this assessment. Metallurgical information on the materials used is included in *Appendix E* of this assessment. The minimum required thickness in accordance with API 650 is 0.1875-in. A corrosion allowance of 0.125 is provided for. The measured wall thickness is 0.25-in.

Design calculations for the support structure are included in *Appendix F* of this assessment. These calculations were completed in accordance with the BOCA National Building Code 1990 Edition and were part of a previous tank assessment prepared by Black and Veach. The structural support was inspected and no changes have been made since the date of the Black and Veach assessment.

Structural analysis of the foundation is included in *Appendix G* of this assessment.

2.11 Comparison of Actual to Theoretical Structural Values.

(a) *Wall Thickness Comparison:*

Calculated Required Wall Thickness (includes corrosion allowance) ..... 0.156-in.
Minimum Required Wall Thickness by API 650 ..... 0.1875-in.
Measured Wall Thickness ..... 0.250-in.

(b) *Bottom Thickness Comparison:*

Calculated Required Bottom Thickness ..... 0.151-in.
Minimum Required Bottom Thickness by API 650 ..... 0.250-in.
Measured Bottom Thickness ..... 0.250-in.

(c) *Foundation Integrity Comparison:*

Maximum Calculated Load (6-in. Slab) ..... 17.6 Kips
Calculated Foundation Support (6-in. Slab) ..... 26.7 Kips

Maximum Calculated Load (17-in. Slab) ..... 62.9 Kips
Calculated Foundation Support (17-in. Slab) ..... 127.7 Kips

2.12 Ancillary Equipment. The ancillary equipment for the Evaporator Flash Tank No. 1 (FT 1) system includes the following:

(a) *Circulating Pump (P 78).* A centrifugal pump designed to pump 800-GPM at 150-ft. of discharge head with a suction head of 11-ft.

(b) *Heat Exchanger (EU 1).* A plate and frame unit of stainless steel construction designed to operate at a pressure of 150-PSIG and a temperature of 300° F.

(c) *Pump (P 80).* A pneumatically-operated, double-diaphragm pump designed to pump from 100- to 0-GPM at head pressures varying from 0- to 100-PSIG, pumping fluid at a temperature up to 212° F.

(d) *Filter Press (FP 1).* A gasketed unit employing glass-filled polypropylene plates designed to operate at a temperature/pressure limit of 100-psi at 212° F.

(e) *Associated Piping, Valves, and Instruments.* All piping is Schedule 40 carbon steel fitted with 150-psi flanges. All piping with an inside diameter of 2-in. or smaller is socket-welded using, at minimum, 3,000-lb. connections. All piping with an inside diameter greater than 2-in. is butt-welded. All valves, fittings, and instruments are rated for 150-psi or higher.

Note: Items (a) - (c) are part of the tank system. However, no changes were made to them during the installation of the new FT 1 tank.

3. SECONDARY CONTAINMENT SYSTEM

3.1 General Description of Secondary Containment. The secondary containment system is designed and operated to prevent migration of wastes or liquids out of the system. Evaporator Flash Tank Nos. 1, 2 and 3, Evaporator Blowdown Tank No. 2, and Evaporator Feed Tank No. 4 are located on a reinforced concrete base floor area with vertical concrete sidewalls. This area is inspected daily on a routine basis.

At the time of inspection, the concrete area was withstanding daily operations and routine climatic conditions. No cracks from compression or uplift were visually apparent.

Any released tank contents are removed and pumped to an appropriate storage area within the maximum time allowed as a permit condition.

3.2 Corrosion Protection. There is an impermeable coating applied to the entire concrete floor and curbs. Detailed information on the coatings employed is included in *Appendix H* of this assessment.

3.3 Documented Age of the Containment Area. The concrete secondary containment system was constructed and installed in 1987.

3.4 Results of Leak Tests. A visual inspection of the containment area was conducted and no cracks or breaks in the impermeable coating were observed. Therefore, it appears to be adequate to contain any leaks or spills.

3.5 Calculation of Capacity Available (CCA).

Area	2,739-sf
Curb Height	0.25-ft.
Material	Concrete
Gross Volume	685-cf

Note: See *Appendix I* for secondary containment.

3.6 Required Volume.

(a) *Containment Capacity Required (CCR):*

CCR = Volume of Largest Tank (Overflow Volume) in the Secondary Containment

Volume of Largest Tank = (FT1) 506.cf

3.7 Comparison of Available Volume to Required Volume.

(a) *Containment Capacity Available (CCA):*

Containment Capacity Required (CCR)	506-cf
Secondary Containment Volume Available	685-cf
Excess Containment Volume	179-cf

CCA > CCR Adequate Capacity (under normal operating conditions is available.)

Note: See *Appendix I* for secondary containment calculations.

4. CONCLUSIONS

The foundation and structural support for the Evaporator Flash Tank No. 1 (FT1) system have been previously analyzed, reviewed, and deemed to be adequately designed.

The Evaporator Flash Tank No. 1 (FT 1) system has sufficient structural strength, is compatible with the waste to be stored and treated, and has adequate corrosion protection to ensure that it will not collapse, rupture, or fail.

The Evaporator Flash Tank No. 1 (FT 1) system was inspected on July 18, 2002, for weld breaks, punctures, scrapes of protective coating, cracks, leaks, corrosion, and other structural damage or inadequacies of construction/ installation.

The Evaporator Flash Tank No. 1 (FT 1) equipment was hydrostatically tested on July 18, 2002, and it was determined that the tank does not leak.

The Secondary Containment for the Evaporator Flash Tank No. 1 (FT 1) system is of sufficient structural strength and volume to meet the requirements set forth in 40 CFR 264.193.

5. RECOMMENDATIONS

Due to a previous history with interior deterioration of the Evaporator Flash Tank No. 1 (FT 1), the following recommendations are suggested:

- ☐ Visual inspections of the tank interior subsequent to the initial 6-mo. of operation.
- ☐ Annual visual inspections of the tank interior subsequent to the initial 6-mo. inspection.
- ☐ Perform an ultrasonic survey of the tank shell subsequent to 5-yr. of operation to determine the average shell thickness.

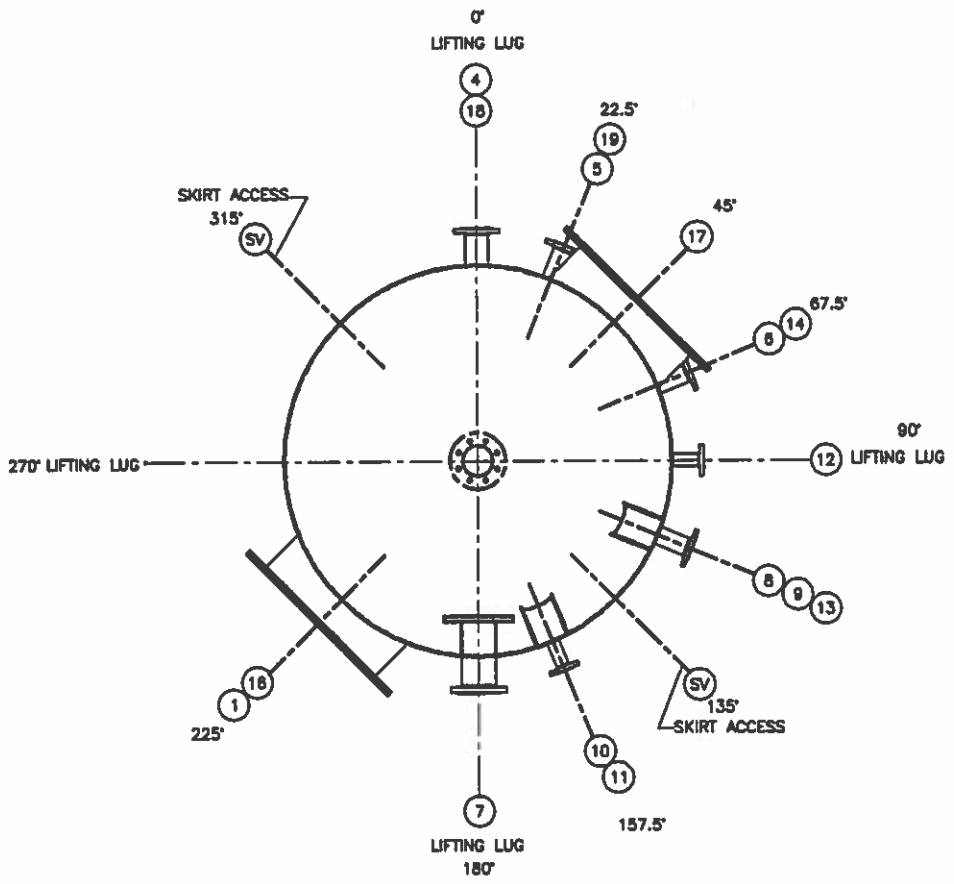
6. CERTIFICATION

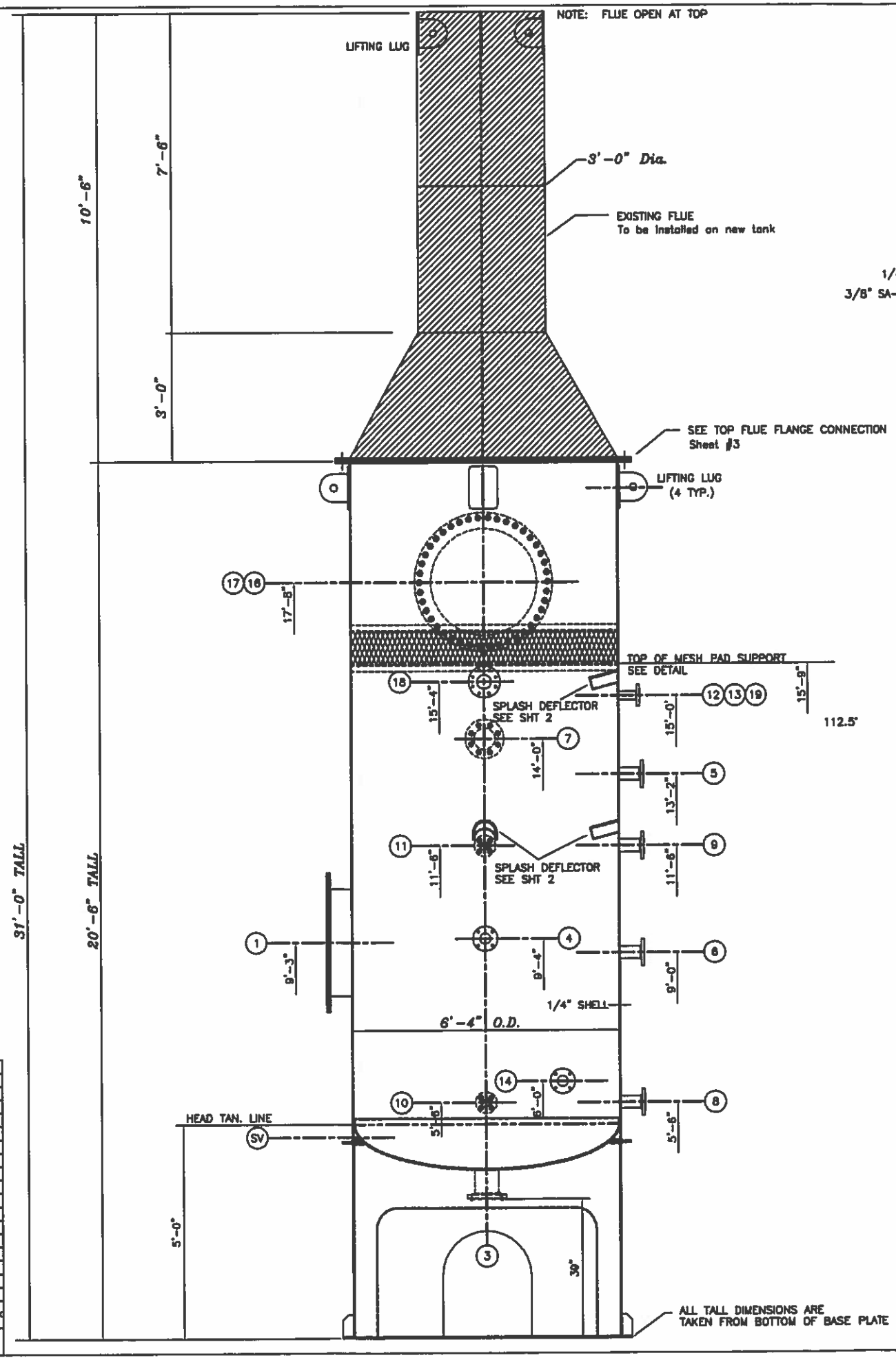
"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision, in accordance with a system designed to ensure that qualified personnel properly collect and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for collecting the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

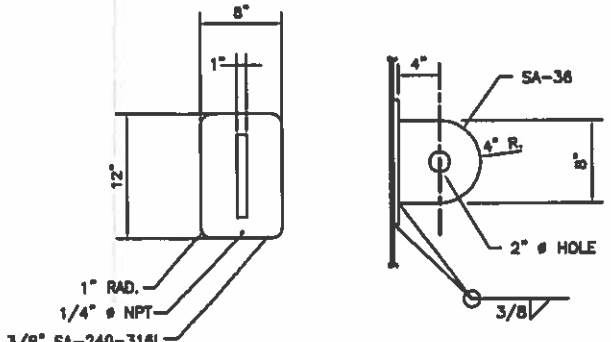
8/5/02

Rob L. Stallings, P.E.
Envirotech Engineering & Consulting, Inc.

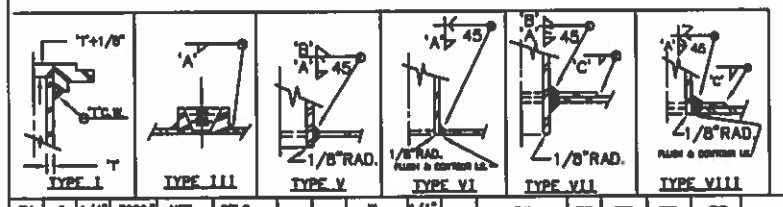
C.A. 1960 - Expiration Date 06/30/03







LIFTING LUG DETAIL
(4 TYP.)



SV	2	1/4"	3000#	NPT	CPLG	—	—	III	1/4"	—	—	—	—	—	SIGHT VENTS	SV
19	1	3"	150#	RFSO	SCH STD	7"	1/4"	I, V	1/4"	1/4"	—	—	—	—	FUTURE	19
18	1	4"	150#	RFSO	SCH STD	7"	1/4"	I, V	1/4"	1/4"	—	—	—	—	OVERFLOW	18
17	1	30"	API	FF	1/4" PLT.	6"	1/4"	I, VIII	1/4"	0"	1/4" x 83"	1/4"	YES	42	7/8"	MANWAY	17
16	1	30"	API	FF	1/4" PLT.	6"	1/4"	I, VIII	1/4"	0"	1/4" x 83"	1/4"	YES	42	7/8"	MANWAY	16
14	1	3"	150#	RFSO	SCH STD	7"	1/4"	I, V	1/4"	1/4"	—	—	—	—	—	LOW LEVEL ALARM	14
13	1	3"	150#	RFSO	SCH STD	7"	1/4"	I, V	1/4"	1/4"	—	—	—	—	—	PRESSURE GAUGE	13
12	1	3"	150#	RFSO	SCH STD	6"	1/4"	I, V	1/4"	1/4"	—	—	—	—	—	FUTURE	12
11	1	3"	150#	RFSO	SCH STD	6"	1/4"	I, V	1/4"	1/4"	—	—	—	—	—	SIGHT GLASS	11
10	1	3"	150#	RFSO	SCH STD	6"	1/4"	I, V	1/4"	1/4"	—	—	—	—	—	SIGHT GLASS	10
9	1	3"	150#	RFSO	SCH STD	7"	1/4"	I, V	1/4"	1/4"	—	—	—	—	—	LEVEL GAUGE	9
8	1	3"	150#	RFSO	SCH STD	7"	1/4"	I, V	1/4"	1/4"	—	—	—	—	—	LEVEL GAUGE	8
7	1	6"	150#	RFSO	SCH STD	6"	1/4"	I, VIII	1/4"	0"	1/4" x 19"	1/4"	YES	8	7/8"	INFLUENT	7
6	1	3"	150#	RFSO	SCH STD	7"	1/4"	I, V	1/4"	1/4"	—	—	—	—	—	HIGH LEVEL ALARM	6
5	1	3"	150#	RFSO	SCH STD	7"	1/4"	I, V	1/4"	1/4"	—	—	—	—	—	LEVEL GAUGE (FOAM DETECTOR)	5
4	1	4"	150#	RFSO	SCH STD	7"	1/4"	I, V	1/4"	1/4"	—	—	—	—	—	OVERFLOW	4
3	1	6"	150#	RFSO	SCH STD	6"	FLUSH	I, V1	1/4"	0"	—	—	—	—	—	EFFLUENT	3
1	1	30"	API	FF	1/4" PLT.	6"	1/4"	I, VIII	1/4"	0"	1/4" x 83"	1/4"	YES	42	7/8"	MANWAY	1
MARK	NO. REQ'D.	SIZE	RATING	FACING	NECK	G.S. PROJ.	LS. PROJ.	TYPE	'A'	'B'	REINFORCEMENT PAD	'C'	BLIND	NO STUDS	STUD SIZE	SERVICE	MARK

SCHEDULE OF OPENINGS

GENERAL NOTES

1) ALL BOLT HOLES TO STRADDLE NORMAL TANK CENTERLINES UNLESS SHOWN OTHERWISE.
2) ALL BLINDS TO BE FURNISHED BY CUSTOMER.
3) BEFORE DRILLING HOLES FOR 30" FLANGES CUSTOMER MUST HAVE SUPPLIED EXISTING BLINDS OR TEMPLATES.
4) DAVIT ARMS SUPPLIED BY CUSTOMER. LIDE TO FURNISH DAVIT CLIPS.
5) MANWAY FLANGE RINGS, & TOP FLANGE CONNECTION TO BE SA-36 MATERIAL

DESIGN CRITERIA

CODE: API - 650
DESIGN PRESSURE: ATM.
DESIGN VACUUM: N/A
DESIGN TEMPERATURE: 300°F
OPERATING PRESSURE: ATM.
OPERATING VACUUM: N/A
OPERATING TEMPERATURE: 300°F
SPECIFIC GRAVITY: 1.0
JOINT EFFICIENCY: 85%
RADIOGRAPHY: SPOT
CORROSION ALLOWANCE: 0"
TEST: FILL w/ WATER & HOLD FOR 24 HOURS.

MATERIAL

ROOF, SHELL & BOTTOM: SA-240-316L
REINFORCEMENT PADS: SA-240-316L
STRUCTURAL SUPPORTS: SA-36
PIPE: 316L
FLANGES, BLINDS, COUPLINGS & PLUGS: 316L
BOLTING: SA-193-B7 / SA-194-2H
SERVICE GASKETS: 1/8" BUNA NITRILE RUBBER
ESTIMATED WEIGHT EMPTY: 7,300 lbs
SKIRT & CARBON BLINDS: SSPC-SP6
PAINT: Sherwin Williams #B58W401 Macro HS PU White.

2	5/21/02	CERTIFIED - AS BUILT
1	1/23/02	REVISED PER CUSTOMER COMMENTS
0	1/04/02	ISSUED FOR APPROVAL

REVISIONS

DRAWN BY: MD
CHECKED BY: BDL
JOB NO.: 203
DATE: 1/04/02

PURCHASE ORDER NO. 103634 PROG.No. CAPITAL DRAWING NAME: SK-001

SAFETY - KLEEN

CAPITAL PROJECT / LONE MOUNTAIN FACILITY
TWO 6'-4" O.D. X 20'-6" TALL STAINLESS STEEL FLASH TANK

LIDE INDUSTRIES

6 MILES E. HWY 84
MEDIA, TEXAS 76667

ENVIROTECH ENGINEERING & CONSULTING, INC.
7510 North 10th Street - Enid, Oklahoma 73703
Phone (580) 234-5780 Fax (580) 237-4202
C.A. #1588 Expiration Date 6-30-2003
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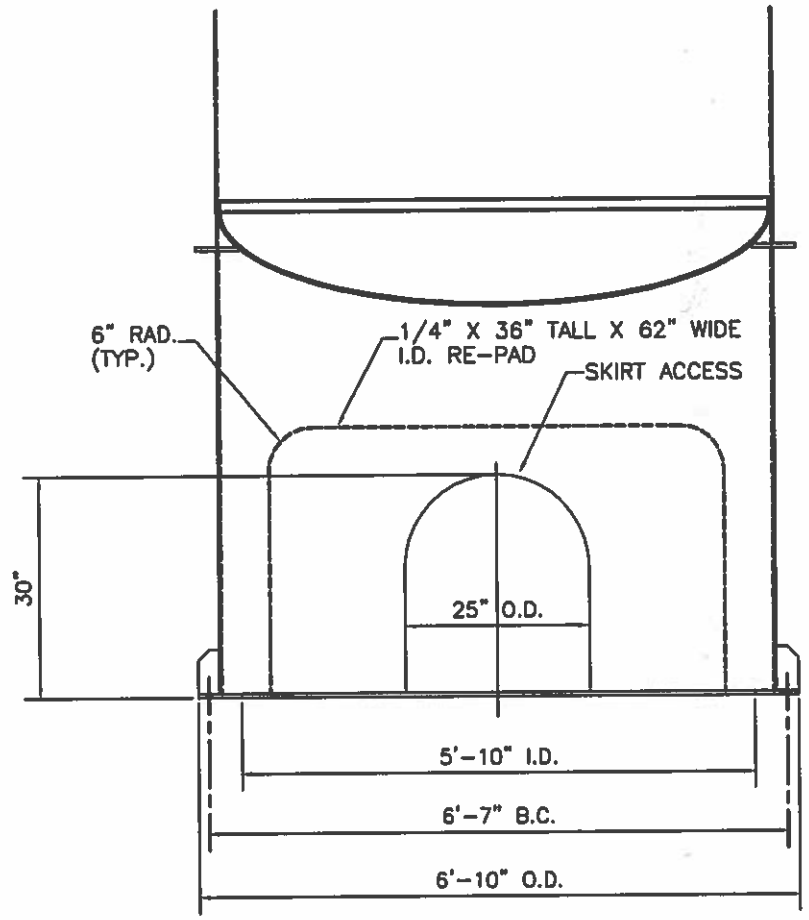
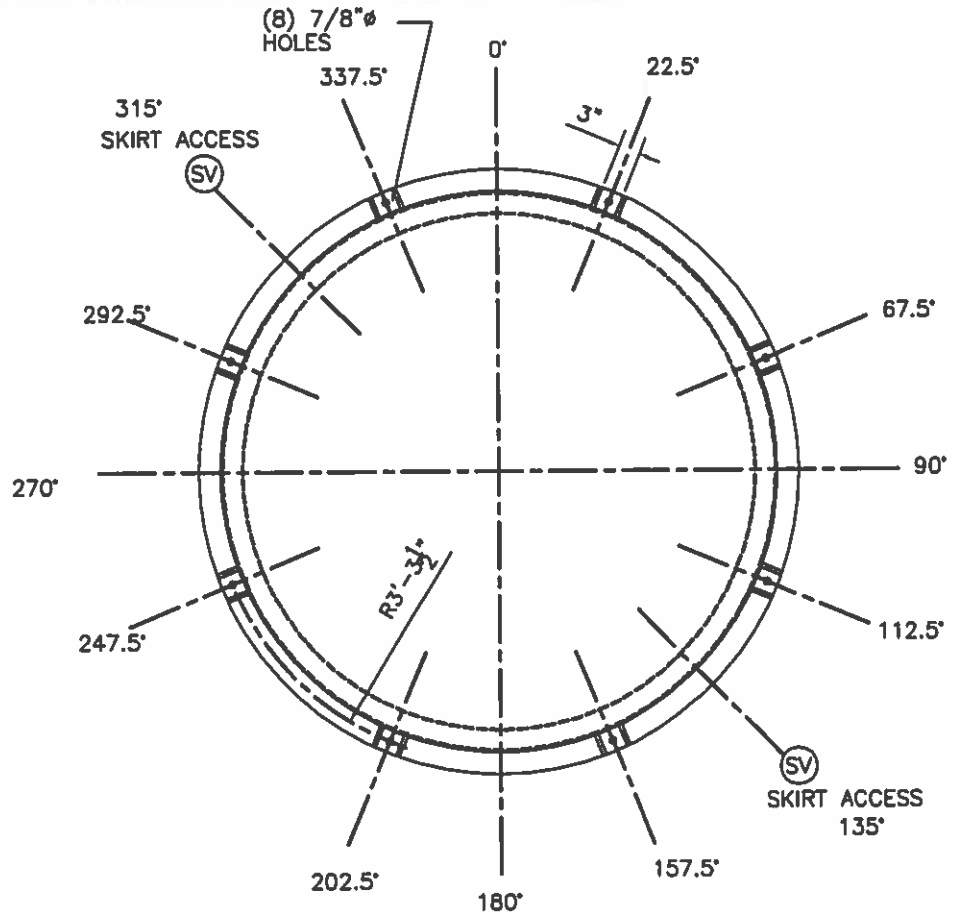
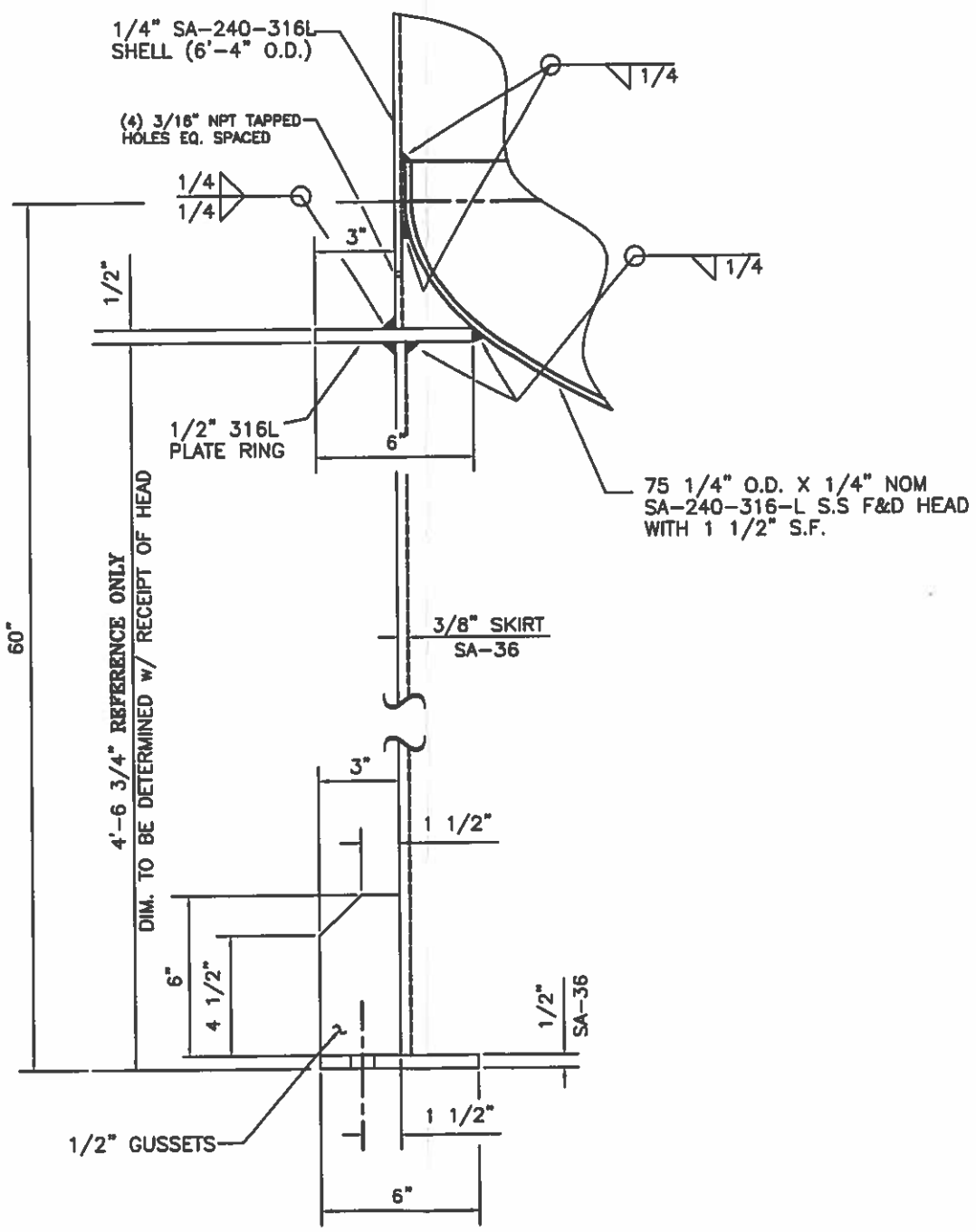
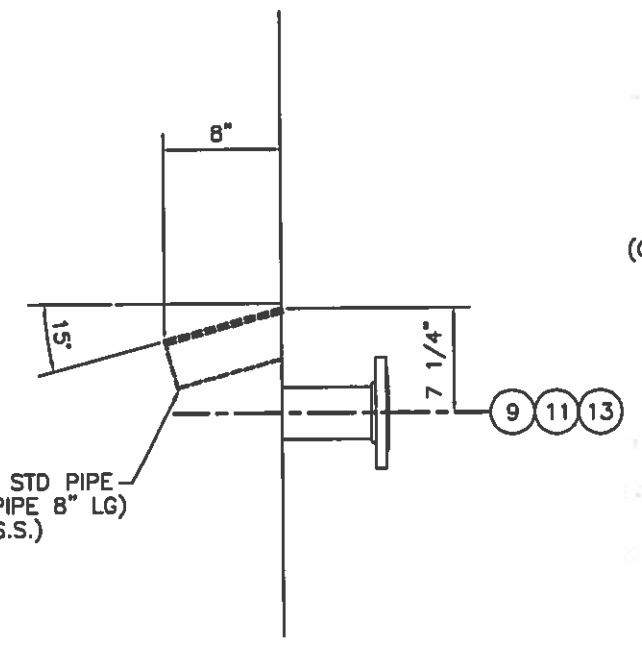






SKIRT & BASE PLATE DETAIL



SPLASH DEFLECTOR
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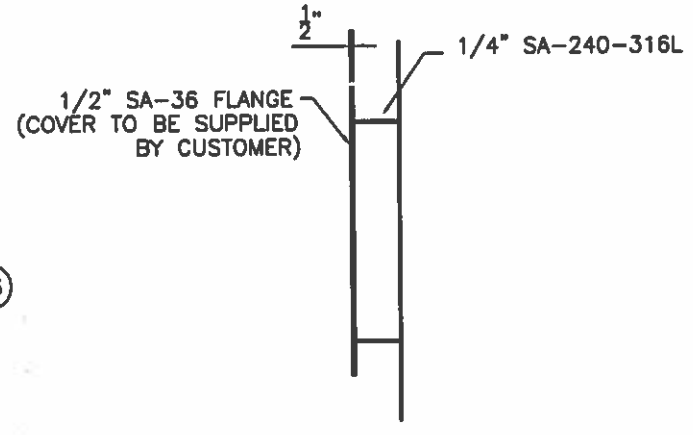

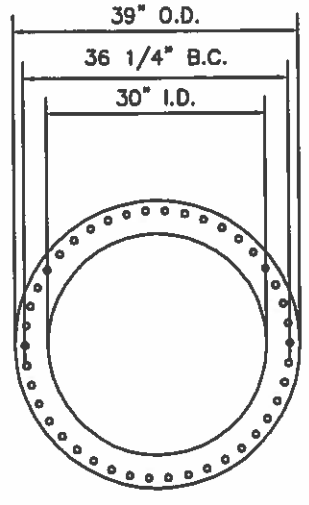

DO NOT FABRICATE FLANGE RING UNTIL RECEIPT OF CUSTOMER FURNISHED BLINDS OR TEMPLATE.

MANWAY DETAIL
(3 TYP.)

3	5/21/02	CERTIFIED - AS BUILT
2	2/26/02	REVISED PER CUSTOMER COMMENTS
1	1/23/02	REVISED PER CUSTOMER COMMENTS
0	1/04/02	ISSUED FOR APPROVAL

REVISIONS

DRAWN BY: JED
CHECKED BY: BDL
JOB NO.: 203
DATE: 1/04/02

PURCHASE ORDER NO. 103034 PROG.No. CAPITAL DRAWING NAME: SK-001

ENVIROTECH ENGINEERING & CONSULTING, INC.
2500 North 8th Street - Enid, Oklahoma 73701
Phone (580) 234 8780, Fax (580) 237 4302
C.A. #1960 - Expiration Date: 6-30-2003
www.envirotech-consulting.com

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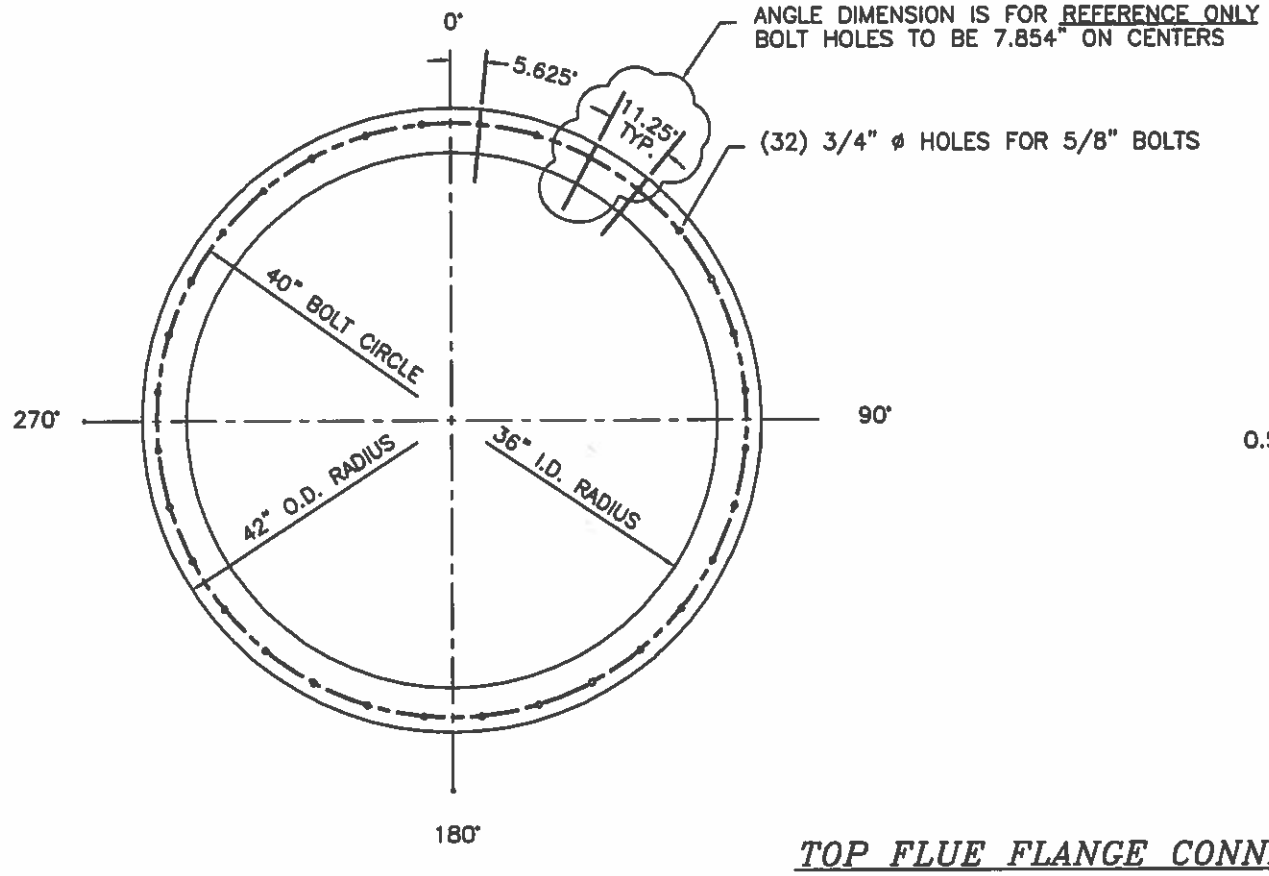
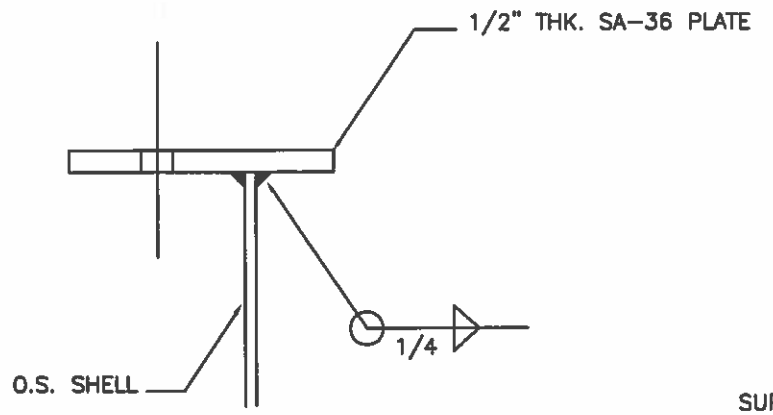
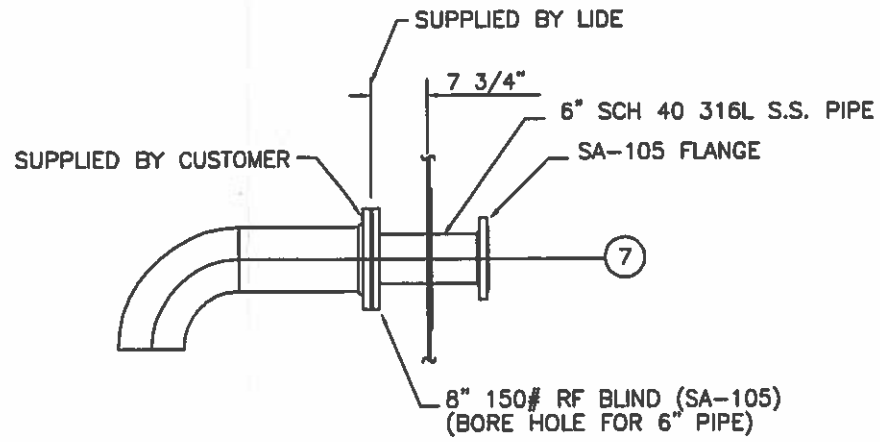
CAPITAL PROJECT / LONE MOUNTAIN FACILITY
TWO 6'-4" O.D. X 20'-6" TALL STAINLESS STEEL FLASH TANK

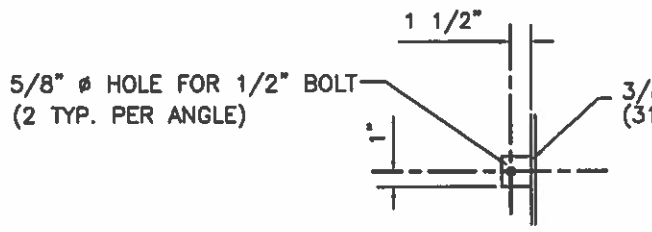
LIDE INDUSTRIES
8 MILES E. HWY 84
MEXIA, TEXAS 76667



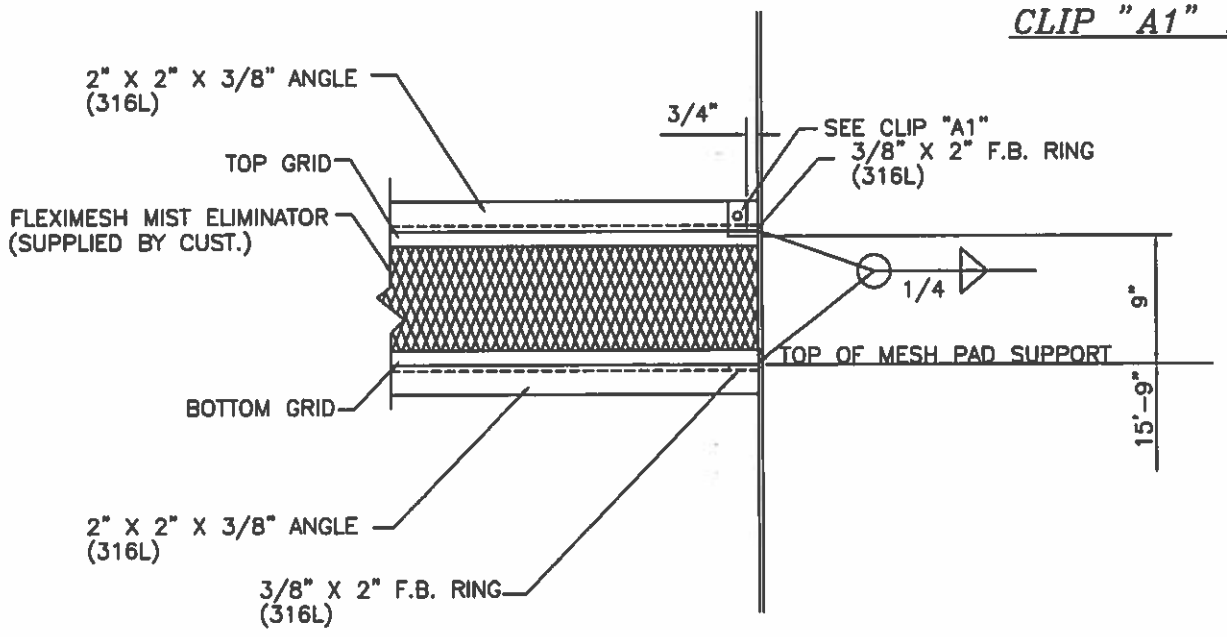
TOP FLUE FLANGE CONNECTION





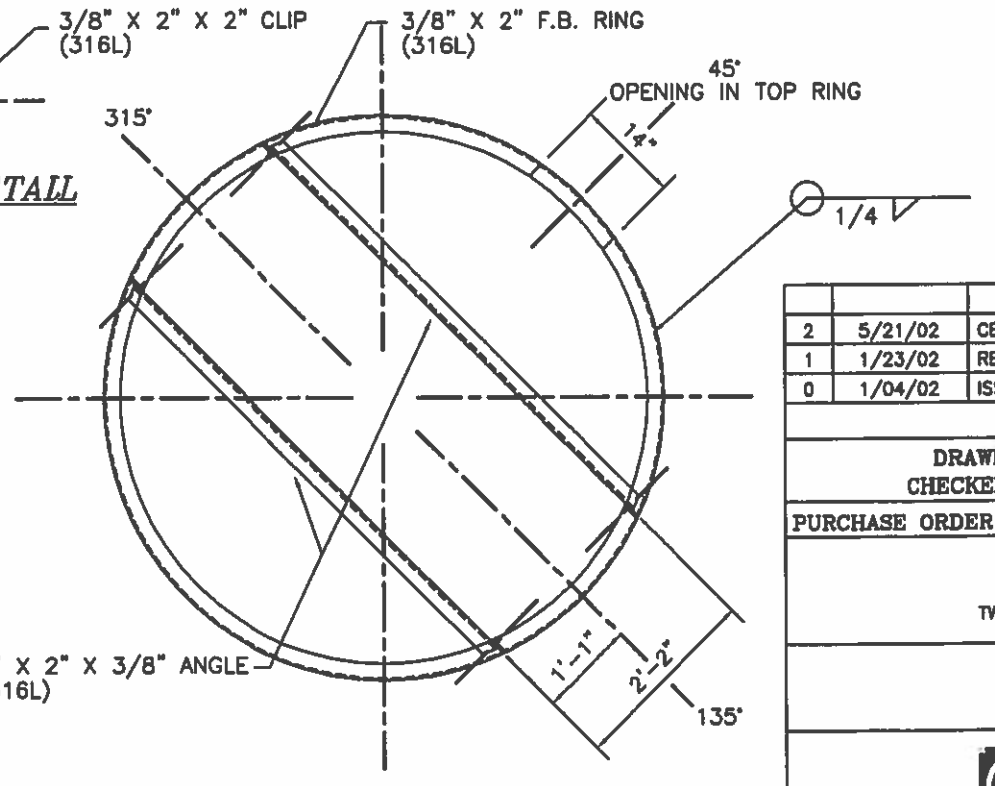


CLIP "A1" DETAIL



MIST PAD DETAIL

INFLUENT CONNECTION (NOZZLE "7") DETAIL



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1	1/23/02	REVISED PER CUSTOMER COMMENTS
0	1/04/02	ISSUED FOR APPROVAL

REVISIONS

DRAWN BY: JED
CHECKED BY: BDL
JOB NO.: 203
DATE: 1/04/02

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SAFETY – KLEEN

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Phone (580) 234-8780, Fax (580) 237-4302
C.A. #1560 - Expiration Date: 6-30-2003
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APPENDIX A.

PRIMARY TANK VOLUME CALCULATIONS

APPENDIX A.

PRIMARY TANK VOLUME CALCULATIONS
For
EVAPORATOR FEED TANK NO. 2 (EF2)

☐ **DIMENSIONS:**

Geometry:	Cylindrical
Diameter:	60.00-ft.
Height:	16.90-ft.
Operating Height:	15.50-ft.
Bottom:	Flat

☐ **TANK VOLUME:**

Maximum Volume	=	47,785.26-cf	=	357,458.57-gal.
Operating Volume	=	43,826.72-cf	=	327,846.63-gal.
Total Primary Tank Volume	=	*47,785.26-cf*	=	*357,458.57-gal.*

☐ **WEIGHT ON FOUNDATION:**

Contents S.G.	1.3
Density	81.12-lb/cf

☐ **SURFACE AREA CALCULATION:**

Tank Top	=	n/a
Tank Bottom	=	2,827.53-sf
Tank Wall	=	3,185.68-sf
Total Surface Area	=	*6,013.21-sf*

Steel Thickness:	Sidewalls	=	0.250-in.		
	Bottom	=	0.240-in.		
Volume of Steel:	Sidewalls	=	66.37-cf		
	Bottom	=	56.55-cf		
Density of Steel		=	490-lb/cf		
Weight of Steel (Tank):		=	30.12-ton	=	60,230.32-lb.
Weight of Tank Contents		=	*1,938-ton*	=	*3,876,340-lb.*
Total Weight of Tank and Contents		=	*1,968-ton*	=	*3,936,570-lb.*

APPENDIX B.

PRIMARY TANK WALL THICKNESS

APPENDIX B.

PRIMARY TANK WALL THICKNESS
For
EVAPORATOR FEED TANK NO. 2 (EF2)

☐ **DIMENSIONS:**

Geometry:	Cylindrical
Diameter:	60.00-ft.
Height:	16.90-ft.
Specific Gravity:	1.30
Normal Operating Temperature:	Ambient

☐ **STEEL THICKNESS CALCULATIONS:**

Thickness (t) = (2.6 * H * D * S.G.) / (s * E) + CA

s	=	Allowable Design Stress	=	23,200.00-psi
E	=	Joint Efficiency	=	85.00%
Thickness (t)			=	0.1738-in.
Corrosion Allowance			−	0.0625-in.
Calculated Minimum Wall Thickness			=	*0.2363-in.*

APPENDIX C.

SEISMIC CALCULATIONS

APPENDIX C.

SEISMIC CALCULATIONS
For
EVAPORATOR FEED TANK NO. 2 (EF2)

☐ **DIMENSIONS:**

Diameter:	60.00-ft.
Height:	16.90-ft.
Weight of Tank (Steel):	60,230.32-lb.
Weight of Maximum Contents:	3,876,340.00-lb.
Tank Shell Thickness:	0.25-in.
Tank Bottom Thickness:	0.240-in.

☐ **STRESS IN TANK SHELL FROM SEISMIC FORCES:**

Maximum weight of tank contents that may be used to resist shell overturning moment: Wl

Wl	=	7.9 * tb * (Fby * G * H)^ .5	
Fby	=	Minimum Yield Strength in Bottom Plate	36,000.00
tb	=	Thickness of Tank Bottom	0.240
G	=	Design Specific Gravity of Liquid	1.3
Wl	=		1686.18
Note:		*Wl Shall Not Exceed 1.25 * G * H * D*	*1,647.75-lb/ft. of Shell Circumference*
Density of Tank Shell Material			490.00-lb/cf
WT	=	Weight of Tank Shell	172.52-lb/ft. of Shell Circumference
M/[D^2(WT+Wl)]			0.1071

b = Maximum Longitudinal Compressive Force at the Bottom of Tank Shell

b = WT + 1.273*M/D^2

b = 420.63-lb/ft. of Shell

G*H*D^2/t^2 = 1,265,472

Fa = 10^6*t/D = 4,167-psi

OR

Fa = .5*Fty = 18,000-psi

Use Minimum Value for Fa Fa = 4,167-psi

b/12*t = 140.21-psi

Note: b/12t Cannot Exceed Fa for a Stable Tank

❒ OVERTURNING MOMENT:

Overturning Moment (M)	=		Z*I*(C1*Ws*Xs+C1*W1*X1+C2*W2*X2)
Zone Coefficient (Z)	=		0.1875
Essential Facilities Factor (I)	=		1.000
Lateral Earthquake Force Coefficient (C1)	=		0.240
D/H	=		3.55
k Factor (@ D/H = 3.55)	=		0.680
Site Amplification Factor (S)	=		1.5
Natural Period of First Sloshing Mode (T)	=		5.11
Lateral Earthquake Force Coefficient (C2)	=		0.07755
Weight of Tank (Ws)	=		60,230.32
Weight of Tank Contents (Wt)	=		3,876,340.00
W1 / Wt (@ D/H = 3.55)	=		0.32
W2 / Wt (@ D/H = 3.55)	=		0.60
Weight of Effective Mass (W1)	=		1,240,428.80
Weight of Effective Mass (W2)	=		2,325,804.00
Ht from Btm of Shell to Cent. of Shell (Xs)	=		8.45
X1/H	=		0.38
Ht from Btm of Cent. of Lat Seismic Force (X1)		=	6.422
X2/H		=	0.55
Ht from Btm of Cent. of Lat. Seismic Force (X2)		=	9.295
Overturning Moment	*M*	=	*695,718-ft/lb.*
Opposing Moment	*M**	=	*118,097,110-ft/lb.*

APPENDIX D.

WIND LOAD CALCULATIONS

ENVIROTECH
ENGINEERING & CONSULTING, INC.

APPENDIX D.

WIND LOAD CALCULATIONS
For
EVAPORATOR FEED TANK NO. 2 (EF2)

❒ **DIMENSIONS:**

Diameter:	60.00-ft.
Height:	16.90-ft.
Weight of Tank (Steel):	60,230.32-lb.
Weight of Max. Contents:	3,876,340.00-lb.
Tank Shell Thickness:	0.25-in.
Tank Bottom Thickness:	0.240-in.

❒ **OVERTURNING MOMENT FROM WIND LOADS:**

M	=	Overturning Moment Due to Wind Loading		
M	=	Pw * Ap * Hc		
Pw	=	Wind Pressure (Assume 18-psi for 100-MPH Wind on Cylinders)	=	18.00-psi
Ap	=	Projected Frontal Area of Tank (H*D)	=	1,014-Ft^2
H1	=	Height from Ground to Centroid of Tank	=	8.45-ft.
M	=	Overturning Moment		154,229.40-ft-lb.
M Max	=	Returning Moment		.66*(WD)/2
W	=	Wt of Tank	=	60,230.32-lb.
M Max	=			1,192,560-ft-lb.

M Must Be Less Than M Max

APPENDIX E.

FOUNDATION INTEGRITY MONITORING DOCUMENTS

Annual Tank In-Service Inspection Checklist

Tank Name: EF-2 Tank Number: #2

Tank Location: WWPT Date: 06-11-01

Inspected By: Terry L. Phillips Signature: Terry L. Phillips

Date of Last Inspection: 03-07-01

I. Foundation

A. Measure foundation levelness and bottom elevations (8 points for EF-1 and 9 points for EF-2). Note: No other tanks require foundation levelness and elevation survey.

EF-1:

37 _____ 47 _____ 55 _____ 263 _____

271 _____ 279 _____ 293 _____ 303 _____

EF-2:

65 1425.84 73 1425.94 81 1425.98 89 1425.86 191 1425.71

205 1425.63 211 1425.70 219 1425.77 227 1425.78

B. Has the yearly maximum settlement exceeded 1 inch? (EF-1 and EF-2 only)

EF-1: Yes____ No____ EF-2: Yes____ No____

C. Check 8 inch annular channel for deflection of more than 2 degrees from its correct position. (EF-1 only)

Deflection _____

Comments: _____

Annual Tank In-Service Inspection Checklist

Tank Name: EF-2 Tank Number: #2

Tank Location: WWPT Date: 4-17-02

Inspected By: _____ Signature: _____

Date of Last Inspection: _____

I. Foundation

A. Measure foundation levelness and bottom elevations (8 points for EF-1 and 9 points for EF-2). Note: No other tanks require foundation levelness and elevation survey

EF-1:

37 _____ 47 _____ 55 _____ 263 _____

271 _____ 279 _____ 293 _____ 303 _____

EF-2:

65 1425.80 73 1425.92 81 1425.98 89 1425.84 191 1425.66

205 1425.58 211 1425.65 219 1425.74 227 1425.75

B. Has the yearly maximum settlement exceeded 1 inch? (EF-1 and EF-2 only)

EF-1: Yes_____ No_____

EF-2: Yes_____ No X

C. Check 8 inch annular channel for deflection of more than 2 degrees from its correct position. (EF-1 only)

Deflection _____

Comments: _____

Annual Tank In-Service Inspection Checklist

Tank Name: EF-2 Tank Number: #2

Tank Location: WWPT Date: 4-14-04

Inspected By: _____ Signature: _____

Date of Last Inspection: _____

I. Foundation

A. Measure foundation levelness and bottom elevations (8 points for EF-1 and 9 points for EF-2). Note: No other tanks require foundation levelness and elevation survey.

EF-1:

37 _____ 47 _____ 55 _____ 263 _____

271 _____ 279 _____ 293 _____ 303 _____

EF-2:

65 1425.82 73 1425.94 81 1425.99 89 1425.86 191 1425.69

205 1425.61 211 1425.67 219 1425.76 227 1425.76

B. Has the yearly maximum settlement exceeded 1 inch? (EF-1 and EF-2 only)

EF-1: Yes____ No____ EF-2: Yes____ No X

C. Check 8 inch annular channel for deflection of more than 2 degrees from its correct position. (EF-1 only)

Deflection _____

Comments: _____

Annual Tank In-Service Inspection Checklist

Tank Name: EF-2 Tank Number: #2

Tank Location: WWPT Date: 4/24/06

Inspected By: _____ Signature: _____

Date of Last Inspection: ~~4-24-05~~ 4/14/04

I. Foundation

A. Measure foundation levelness and bottom elevations (8 points for EF-1 and 9 points for EF-2)
Note: No other tanks require foundation levelness and elevation survey.

EF-1:

37 _____ 47 _____ 55 _____ 263 _____

271 _____ 279 _____ 293 _____ 303 _____

EF-2:

65 1425.78 73 1425.90 81 1425.93 89 1425.80 191 1425.67

205 1425.58 211 1425.67 219 1425.73 227 1425.72

B Has the yearly maximum settlement exceeded 1 inch? (EF-1 and EF-2 only)

EF-1: EF-2:

Yes____ No____ Yes____ No____

C. Check 8 inch annular channel for deflection of more than 2 degrees from its correct position. (EF-1 only)

Deflection _____

Comments: _____

APPENDIX F.

LAW ENGINEERING GEOTECHNICAL REPORT

November 22, 1993

LAW
ENGINEERING AND ENVIRONMENTAL SERVICES

Mr. Walter Sonne, P.E.
USPCI, Inc.
515 West Greens Road, Suite 500
Houston, Texas 77067

SUBJECT: REVISED REPORT OF GEOTECHNICAL EXPLORATION
Expansion of Wastewater Treatment Facilities--
Lone Mountain Facility, Major County, Oklahoma
Law Engineering Projects No. 392-01406-01

Law Engineering, Inc. has completed the geotechnical exploration at the subject site. Our services were provided in accordance with our Revised Proposal for Geotechnical Exploration Services No. HP-8173-93G, dated September 22, 1993; and a Request for Change Order letter dated October 12, 1993. This report briefly discusses our understanding of the project information, describes our exploratory procedures and findings, and presents our recommendations and conclusions. The data obtained during the field exploration and from the laboratory testing program is presented in the appendices.

We will be happy to discuss our recommendations with you and would welcome the opportunity to provide the additional studies or construction testing services necessary to complete this project. We look forward to serving as your geotechnical engineer on the remainder of this project and on future projects.

If you have any questions, or if you require additional information, please do not hesitate to contact us.

Sincerely,

LAW ENGINEERING, INC.

Fernando Pons, E.I.
Project Geotechnical Engineer

Michael W. Palmer, P.E.
Principal Geotechnical Engineer
USPCI - Client Manager

Michael H. Homan, P.E.
Principal Geotechnical Engineer
Oklahoma Registration No. 15777

Distribution Copies:
Walter Sonne (2) - USPCI
Larry Marr (1) - USPCI

LAW ENGINEERING

REVISED REPORT OF GEOTECHNICAL EXPLORATION

EXPANSION
OF WASTEWATER TREATMENT FACILITIES

LONE MOUNTAIN FACILITY
MAJOR COUNTY, OKLAHOMA

prepared for
USPCI, Inc.
HOUSTON, TEXAS

LAW ENGINEERING PROJECT NO. 392-1406-01

NOVEMBER 1993

1.0 PURPOSE OF EXPLORATION

The purpose of this exploration was to obtain specific subsurface data at the site and to provide recommendations and opinions for:

- ~~General geotechnical design and construction criteria for the Expansion of Wastewater Final Treatment Facilities (WWFT): Phase I (Expansion of the WWFT Building) and Phase II (Leachate Storage Tanks).~~
- ~~Site preparation and construction of compacted fills for the WWFT Phase I, and the WWFT Phase II.~~
- Soil stratigraphy at the Wastewater Pretreatment Facilities (WWPT): Phase III tanks.

It should be noted that it was not the purpose of this study to directly assess or to address any environmental conditions at the site, i.e., the presence of contaminants or hazardous substances in the soil, rock, or ground water. An additional study should be undertaken if USPCI decides to specifically address environmental conditions.

2.2 LEACHATE STORAGE TANKS

We understand that USPCI plans to construct three tanks within a containment area. The proposed site of construction is south of Cell 4. The proposed tanks will include a 60-foot diameter, 16-feet tall, 300,000 gallon tank; and two 33-foot diameter, 16-feet tall, 100,000 gallon tanks.

The proposed tanks, containing leachate with a specific gravity of 1.3, will be located within a concrete containment structure with walls on the order of 7 feet in height.

We understand that the preferred foundation system at the present time is a drilled pier underground system, 18-inch diameter, straight-sided drilled piers founded at 8-feet on centers. In turn, these drilled piers will support the containment wall and a 10-inch thick concrete slab on 6 inches of sand and 24 inches of structural fill.

2.3 WASTEWATER PRETREATMENT (WWPT) BUILDING

We understand that two existing on-line 300,000 storage tanks structures within the Wastewater Pretreatment (WWPT) Building are experiencing foundation distress. We further understand that these two tanks and the containment area are supported on shallow footings.

4.1.3 Wastewater Pretreatment (WWPT) Building

Exploration borings L-5, L-6, L-6A, and L-7 were drilled in this area. The measured surface elevation of these borings were 1418.35, 1428.62, 1428.48, and 1430.23 feet MSL, respectively, as provided by USPCI. The subsurface conditions for this area are generalized as follows:

AREA C

WASTEWATER PRETREATMENT BUILDING

(Borings L-5, L-6, L-6A, and L-7)

STRATUM	DEPTH (ft)	DESCRIPTION	USCS CLASSIFICATION[2]
I C	0 to 2	FILL: GRAVEL	Unclassified
II C	1 to 22.5	FILL: Soft to hard, reddish brown with gray, silty CLAY, with gypsum fragments and gravel.	CL
III C	15.5 to 20.5	Very stiff to hard, reddish brown with gray, silty CLAY, with gypsum fragments and gray silt streaks.	CL
IV C	18.5 to TOB[1]	Gray silty CLAYSTONE to reddish brown silty CLAYSTONE	Unclassified

[1] Termination of Boring
[2] Unified Soil Classification System

Expansion of Wastewater Facilities
CI, Inc.
Law Eng. Proj. No: 392-01406-01

With reference to the Soil Stratum Summary, the TEST BORING RECORDS, Soil Profiles and the Laboratory Test Results, our discussion of the soil conditions for Area C is as follows:

Stratum IC consists of GRAVEL to gravelly fill soils encountered in all borings from a existing surface to approximately 2 feet below existing grade.

Stratum IIC consists of fill soils of soft to hard, reddish brown with gray, silty CLAY with gypsum fragments and gravel. Law personnel performed continuous sampling with Shelby tubes, and utilized on-site extruding techniques to better identify the extent of this fill stratum. These fill soils were encountered from a depth of 1 foot from existing surface to 22.5 feet below grade. Organic odor and wet seams were identified in the lower two feet of this formation in Borings L-6 and L-7. Plasticity for this stratum was medium with plasticity index values ranging from 17 to 21. Liquid limit values range from 43 to 45 percent and plastic limit values range from 24 percent to 26 percent. Stratum IIC soils were generally moist with occasional wet seams. Natural moisture contents ranged from 24 to 30 percent, and were from 0 to 2 percent above corresponding PL values.

Pocket penetrometer tests and laboratory unconfined compression tests, on relatively undisturbed samples, indicated shear strength values that varied erratically throughout the fill depth in Boring L-5 (easternmost boring). Shear strength values in Borings L-6 and L-7 were similar throughout the same depths of the fill stratum. There was a similar uniform decrease of shear strength values with depth in Borings L-6 and L-7 to a depth of approximately 12.5 feet. (See TEST BORING RECORDS L-6 and L-7).

Stratum IIIC consists of very stiff to hard, reddish brown with gray, silty CLAY with gypsum fragments and gray silt streaks. These soils were encountered in all borings, except Boring L-5, from 15.5 feet from existing surface to a depth of 20.5 feet below grade. One Standard Penetration Test N-value was 40 blows per foot (bpf) at a depth of 17 feet in Boring L-6A. Plasticity for this stratum was medium with a plasticity index value of 13, a LL value of 32 percent, and a PL value of 19 percent. One natural moisture content was 24 percent. Based on this natural moisture content and corresponding Atterberg Limit tests, the soil was very moist with a moisture content 5 percent above the corresponding PL value. Pocket penetrometer tests resulted in cohesion values ranging from 3,750 psf to an excess of 4,500 psf.

Stratum IVC consists of gray silty CLAYSTONE to reddish brown silty CLAYSTONE. This formation was encountered from a depth of 18.5 feet below existing surface to termination depth. Standard Penetration Test N-values resulted in refusal values ranging from 6 inches per 50 blows to 4.5 inches per 50 blows. One natural moisture content was 21 percent. All pocket penetrometer tests resulted in cohesion values in excess of 4,500 psf.

4.2 WATER LEVEL CONDITIONS

~~Water level observations were made in the boreholes during drilling operations and 24~~ hours after completion of drilling to investigate the short term ground water levels.

Ground water was identified during our subsurface exploration at depths of 7 feet and 5.5 feet in Borings L-1 and L-2A, respectively (24 hour readings). Ground water was encountered 1.5-feet to 1-foot above the top of the claystone formation in these borings.

~~Borings L-3 and L-4 were dry at the time of drilling and 24 hours thereafter~~.

Water was identified during drilling at a depth of 24 feet below existing ground surface in Boring L-5. Boring L-6 was dry to termination depth during drilling operations and 24 hours thereafter. Ground water was not identified in Borings L-6A and L-7 during and immediately following drilling operations. Law personnel could not obtain 24 hour water level readings at L-5, L-6A, or L-7, due to caving soils in L-5 at 15.8 feet, and surficial cuttings that obstructing the boreholes at L-6A and L-7.

Fluctuations in rainfall, evaporation, construction activity, surface runoff, and other site specific factors could cause ground water conditions at the time of construction to vary from that observed during our field exploration.

5.4.3 Settlement

Predicted settlements for the drilled piers will be relatively small and are expected to be limited to the elastic compression of the founding claystone formation. The maximum total settlement of any drilled shaft under the anticipated sustained loading conditions is predicted to be less than 0.25 inch.

5.5 CONSTRUCTION CONSIDERATIONS

Once a foundation excavation is completed, the setting of reinforcing steel and placement of concrete should proceed expeditiously to reduce exposure of the bearing stratum and possible disturbance of the material. Should the bottom of an excavation become disturbed due to ponding of water or desiccation, the disturbed soils should be removed before concrete is placed.

We recommend that the geotechnical engineer, or their representative, observe the drilling excavations immediately prior to placing concrete. The engineer should compare the soils exposed with those encountered in the soil test borings and document the results. Any significant differences should be brought to the attention of the Owner's representatives along with appropriate recommendations. The foundation bearing area should be level or suitably benched. It should also be free of loose soil, ponded water and debris prior to the inspection.

5.6 WASTEWATER PRETREATMENT BUILDING STRATIGRAPHY

We understand that two existing on-line 300,000 storage tanks structures within the Wastewater Pretreatment (WWPT) Building are experiencing foundation distress. We further understand that these two tanks and the containment area are supported on shallow footings, which are currently bearing in fill soils consisting of soft to hard, reddish brown with gray, silty CLAY with gypsum fragments and gravel (Stratum IIC).

As discussed previously in this report, the soil stratigraphy encountered in the WWPT area generally consists of silty fill soils to a maximum depth of 22.5 feet underlain by silty clay soils which grade into claystone. Law personnel performed continuous sampling in Borings L-5, L-6, and L-7 and utilized shelby tubes and on-site extruding techniques to better identify the extent of this fill stratum.

The properties of the soils, deemed significant in the evaluation of distress of the structures, are the following:

(a) the moist condition of the silty clay fill soils (Stratum IIC) at the site;

(b) the medium shrink-swell potential of the silty clay matrix within the zone of major seasonal moisture change;

(c) the erratic variation in consistency of the fill soils encountered in Boring L-5;

(d) the similar uniform decrease in shear strength in Borings L-6 and L-7 to a minimum at approximately 13 feet from existing ground level;

(e) the presence of wet seams, organics, and organic odor in the fill soils
of Boring L-6 and Boring L-5;

(f) the presence of ground water in Boring L-5 at a depth of 24.5 feet;

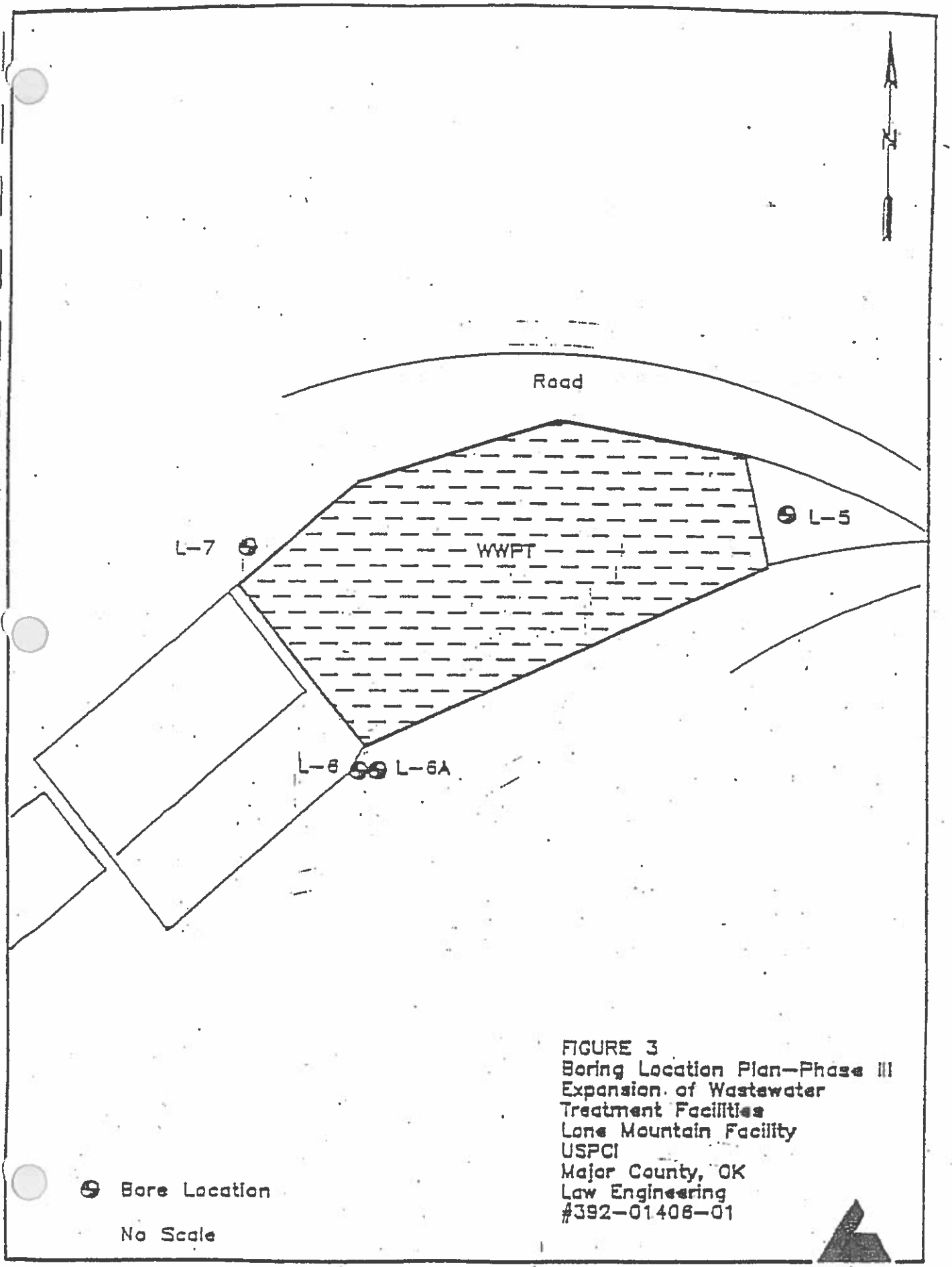
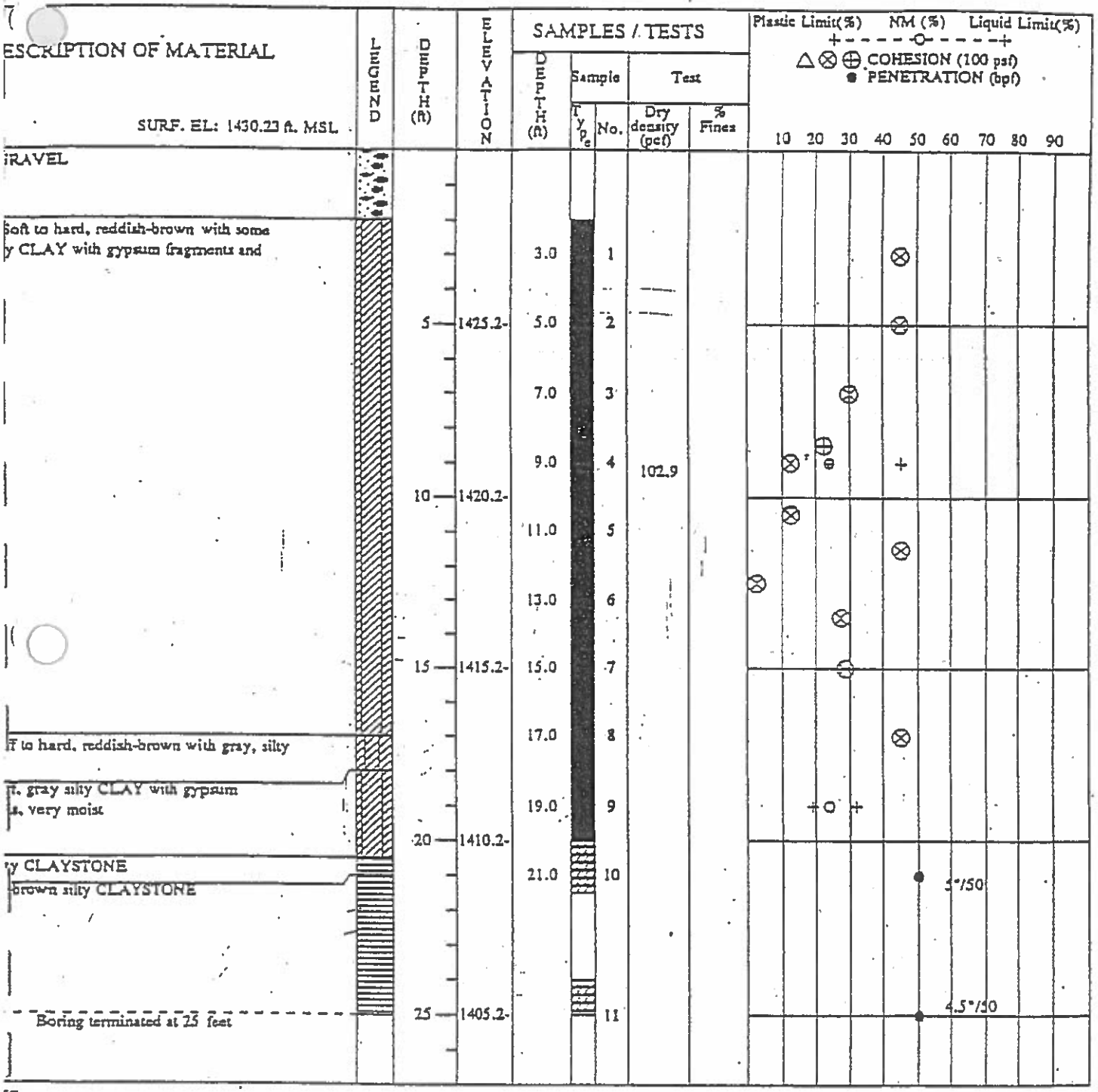


FIGURE 3
Boring Location Plan—Phase III
Expansion of Wastewater
Treatment Facilities
Lone Mountain Facility
USPCI
Major County, OK
Law Engineering
#392-01406-01



ES:

ATES: N10920.34 E9182.90. Borehole advanced
-75 truck-mounted drill rig using 3 1/4" I.D. hollow
s.

Arnold Caeser

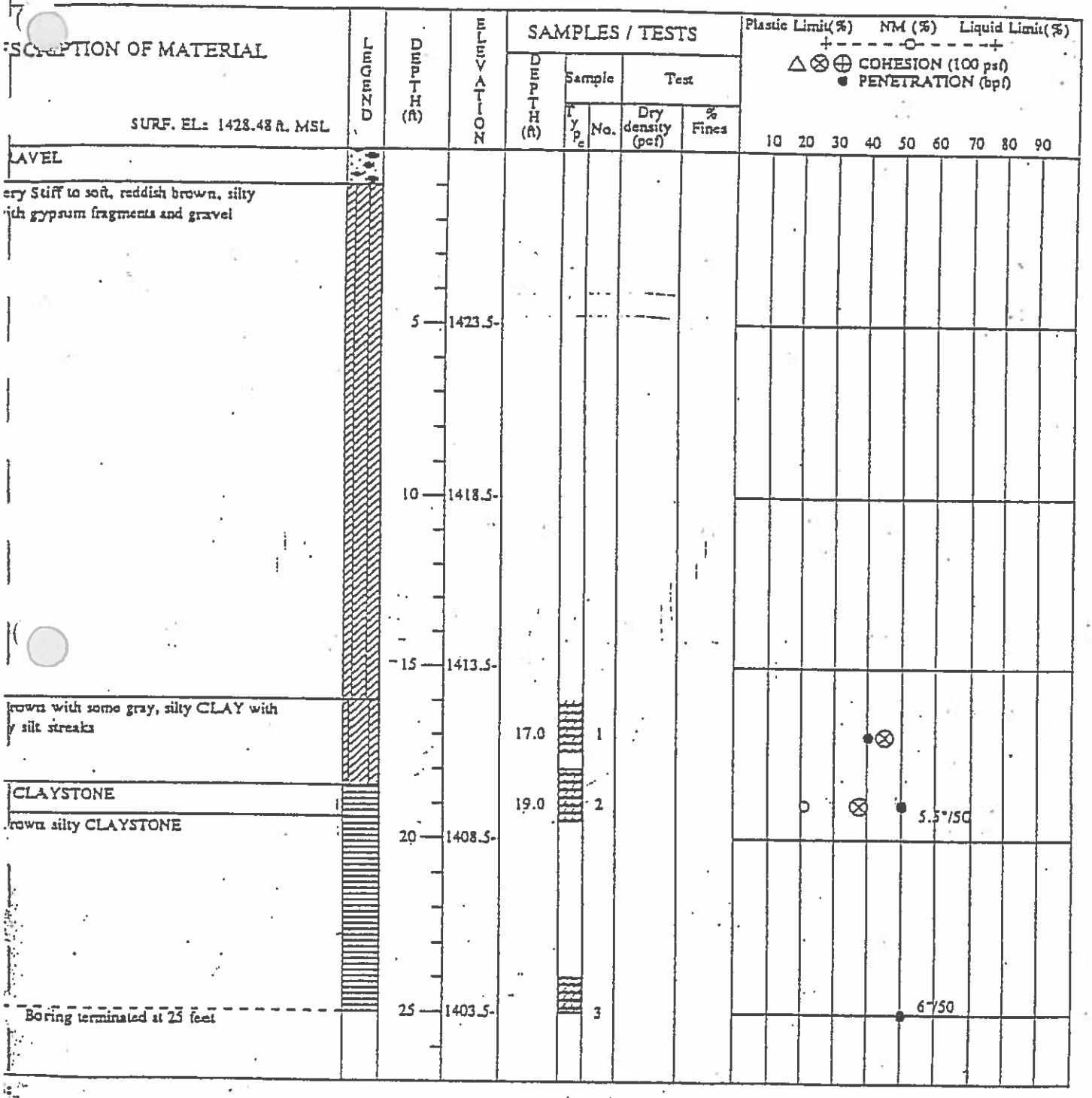
Fe--ndo Pons

SEE KEY SHEET FOR EXPLANATION OF
YMBOLS AND ABBREVATIONS USED ABOVE

TEST BORING RECORD

BORING NUMBER	L-7
DATES DRILLED	Start: October 1, 1993 Complete: October 1, 1993
PROJECT NUMBER	392-01406-01
PROJECT	Expansion of WWT Facilities
PAGE 1 OF 1	

LAW ENGINEERING
Tulsa, Oklahoma



NOTES: N10829.08 E9253.23. Borehole advanced
5 truck-mounted drill rig using 3 1/4" I.D. hollow
Soil classification from 0 to 16 feet is based on

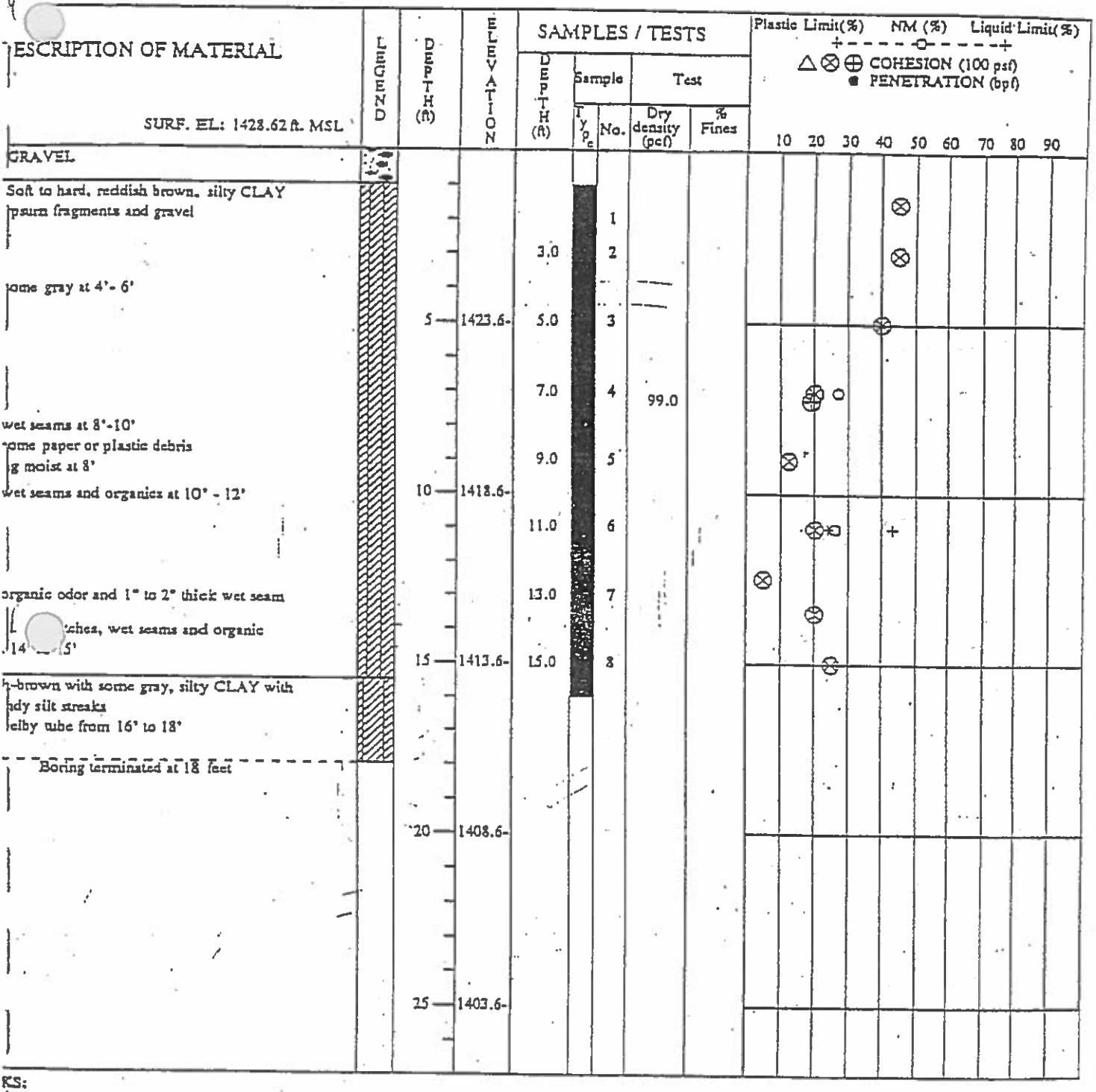
Arnold Caeser
Fernando Pons

SEE KEY SHEET FOR EXPLANATION OF
SYMBOLS AND ABBREVATIONS USED ABOVE

TEST BORING RECORD

BORING NUMBER	L-6A
DATES DRILLED	Start: October 1, 1993 Complete: October 1, 1993
PROJECT NUMBER	392-01406-01
PROJECT	Expansion of WWT Facilities
PAGE 1 OF 1	

LAW ENGINEERING
Tulsa, Oklahoma



KS:

NATES: N10826.86 E9250.81. Borehole advanced
-75 truck-mounted drill rig using 3 1/4" I.D. hollow
ers. Borehole dry 24 hours after drilling.

Arnold Caeser

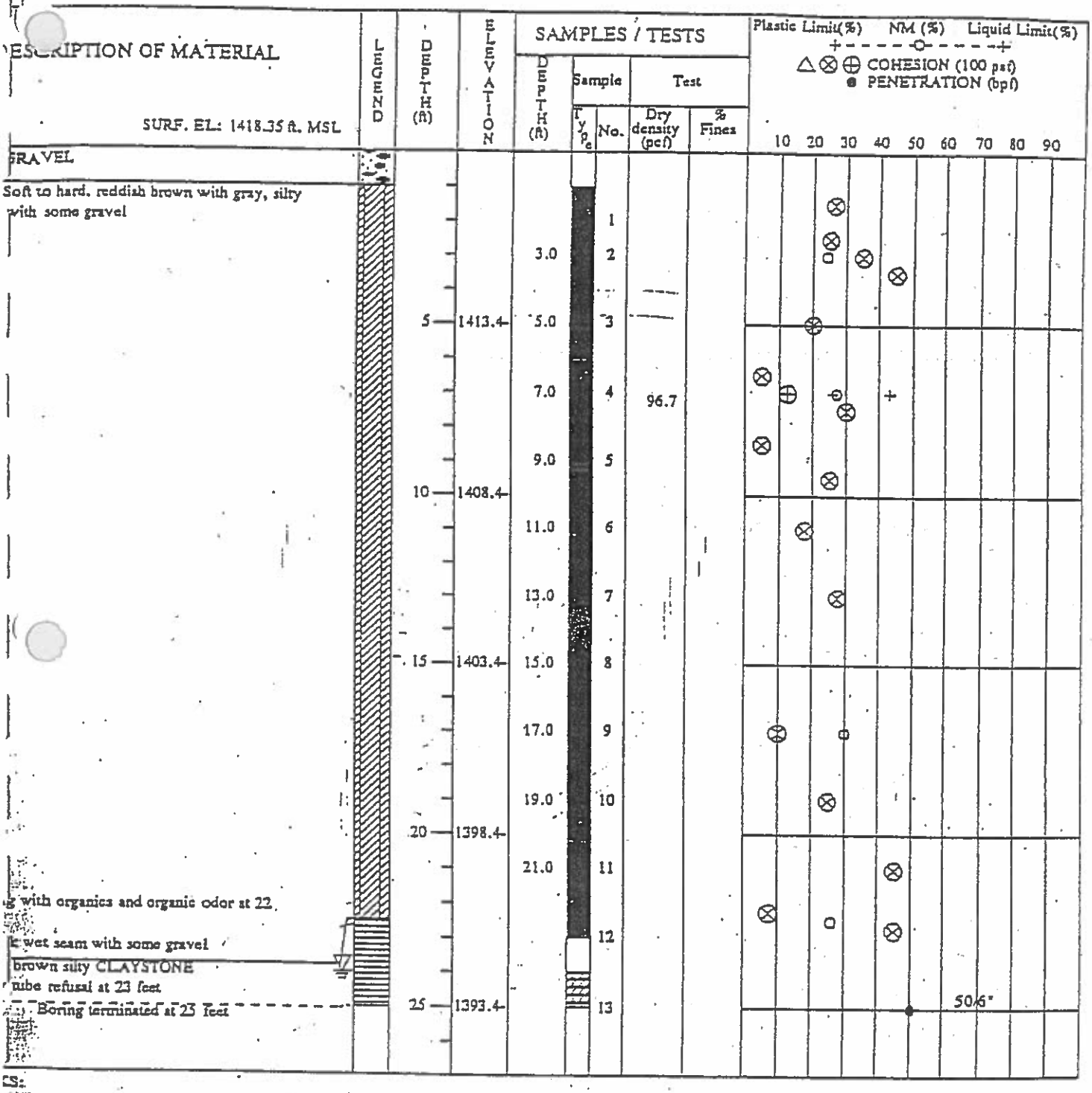
odo Ponz

SEE KEY SHEET FOR EXPLANATION OF
YMBOLS AND ABBREVATIONS USED ABOVE

TEST BORING RECORD

BORING NUMBER	L-6
DATES DRILLED	Start: October 1, 1993 Complete: October 1, 1993
PROJECT NUMBER	392-01406-01
PROJECT	Expansion of WWT Facilities
PAGE 1 OF 1	

LAW ENGINEERING
Tulsa, Oklahoma



NOTES: N10939.63 E9409.49. Borehole advanced with CME-75 truck-mounted drill rig using 3 1/4" I.D. HSAs. Groundwater measured immediately following drilling operations. Caved hole at 15.8' identified on 10/2/93.

Logged by: Arnold Caeser

Reviewed by: Fernando Pons

SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVATIONS USED ABOVE

TEST BORING RECORD

BORING NUMBER	L-5
DATES DRILLED	Start: October 1, 1993 Complete: October 1, 1993
PROJECT NUMBER	392-01406-01
PROJECT	Expansion of WWT Facilities
PAGE 1 OF 1	

LAW ENGINEERING
Tulsa, Oklahoma

APPENDIX G.

FOUNDATION DESIGN ANALYSIS

APPENDIX G.

FOUNDATION DESIGN ANALYSIS
For
EVAPORATOR FEED TANK NO. 2 (EF2)

❒ **DIMENSIONS:**

Diameter:	60.00-ft.
Height:	16.90-ft.
Weight of Tank (Steel):	60,230.32-lb.
Weight of Max. Contents:	3,876,340.00-lb.
Tank Shell Thickness:	0.25-in.
Tank Bottom Thickness:	0.240-in.

❒ **CONCRETE FOUNDATION DESIGN:**

Assumed Footing Depth	=	48-in.
Assumed Footing Width	=	12-in.
Assumed Effective Soil Pressure (Based on Law Engineering Investigation)	=	1,500-psf
Maximum Shell Compression at Bottom of Shell (Based on Seismic Analysis) b	=	420.63-lb/ft. of circ.
Footing Width	=	1.00-ft.
Actual Applied Loading	=	420.63-psf

The actual applied loading is significantly less than the assumed effective soil pressure and therefore, the foundation should be stable.

APPENDIX H.

DUDICK, INC.
PROTECTO-COAT 200
DATA

Dudick Inc.

Dudick Incorporated
Corrosion-Proof Products
1818 South Wason Drive
Streetsboro, Ohio 44241
216-562-1970
FAX No. 216-562-7638

Protecto-Coat 200

ELASTOMERIC, SPRAY APPLIED, ENVIRONMENTALLY SAFE, URETHANE COATING. 40-60 MILS (1-1 1/2 mm)

Protecto-Coat 200 is a high solids aromatic polyurethane coating with superior elongation. It is especially suited to bridge cracks in concrete.

RECOMMENDED APPLICATIONS

- Secondary Containment Areas
- Process Floors
- Railroad Tank Cars
- Underground Pipes & Tanks - Exterior
- Thickener Tanks & Mechanisms
- Spent Liquor Storage Tanks
- Food Processing
- Pharmaceutical
- Breweries
- Structural Steel

CHEMICAL RESISTANCE

Protecto-Coat 200 provides a tough, durable surface and will withstand splash and spills of many inorganic and organic acids as well as alkalies. Also resistant to aliphatic solvents.

PHYSICAL PROPERTIES

Protecto-Coat 200	40 Mil Basecoat	20 Mil Topcoat
Tensile Strength (PSI) ASTM C307	2,400-2,600	2,200-2,500
Elongation*	225% to 250%	50 to 60%
Shore D Hardness	40-45	65-70
Abrasion Resistance CS 17 wheels/1000 cycles x 1000 gm load	10 mg weight loss	32 mg weight loss
Solids by Volume	80%	100%

*At 60% elongation the chemical resistant topcoat begins to surface crack while the basecoat will continue to elongate to 250% extension.

SPECIFICATIONS

Coating shall be 40-60 mils thick, 80-100% solids aromatic urethane resin, consisting of 2 basecoats and a topcoat of 20 mils each, manufactured by Dudick, Inc. Materials shall be brush-, roller- or spray- applied in accordance with manufacturer's recommended practices.

THE PROTECTO-COAT 200 SYSTEM

The Protecto-Coat 200 system uses a moisture tolerant primer and two or three coats of elastomeric thermosetting urethane resins to protect concrete and steel.

Primer 67 is designed to prevent abrasive-blasted steel from developing rust bloom prior to the application of a Protecto-Coat System. For maximum performance, all steel surfaces should be primed, but primer may not be needed for mild, non-immersion service. Concrete, however, must always be primed to aid in the "wetting out" required for good bonding.

Protecto-Coat 200 is applied in three coats by brush, roller or spray. The elastomeric basecoat is applied in two 25 mil applications to achieve a nominal 40 mils DFT. The chemical resistant topcoat is applied in a single 20 mil application. Total thickness shall be a nominal 60 mils.

ESTIMATING QUANTITIES AND ORDER BILL OF MATERIAL

SQUARE FEET PER GALLON		
	CONCRETE	STEEL
Primer 67	150-200	250-300
Protecto-Coat 200		
2 Base Coats Actual 35-40 mil DFT	25	25
Top Coat Actual 15-20 mil DFT	60	60
S-10 Solvent	500	500

Quantities shown are for estimating purposes only. Actual field usage may vary.

APPLICATION INSTRUCTIONS

SURFACE PREPARATION

Metal: For immersion service, abrasive blast to a white metal finish and a 2-4 mils minimum profile according to SSPC 5 or NACE No. 1. For fume or splash service, abrasive blast to a near-white metal finish according to SSPC 10 or NACE No. 2. Atmospheric service: Commercial SSPC 6 or NACE No. 3.

Concrete: Concrete must be abrasive-blasted or etched with muriatic acid (solution of 1 part 20° Be HCl and 1 part water) to remove surface laitance and other contaminants. Concrete must be free of curing compounds and form release agents. Surface texture should be similar to 40-60 grit sandpaper. The prepared surface should have a tensile strength of between 250 and 300 PSI per ASTM D4541.

Additional surface preparation will be required if a 40-60 grit texture is not achieved and the surface laitance not completely removed after a single application of acid or with the first mechanical preparation procedure.

If, after abrasive blasting, honeycombs/voids appear on the concrete, these have to be filled with a suitable material. Contact a Dudick representative for this information.

Recommended application temperatures should be between 40°F and 90°F substrate temperature. **Do not apply Protecto-Coat 200 over concrete exposed to direct sunlight during the warming trend of the concrete as measured by surface temperature.** To do so may lead to blistering, pinholes, or wrinkling in the coating due to outgassing of air in the concrete and high substrate temperatures. Wait for a definite downturn or cooling trend within the concrete as again measured by surface temperature. If this is not possible consult a Dudick representative for alternatives such as double priming.

PRIMING

Metal: For maximum performance, prime all steel surfaces with Primer 67, mixed with appropriate amount of hardener to 3-4 mils. For mild non-immersion service, priming of steel may be omitted.

Concrete: Concrete must be primed to aid in the "wetting out" required for good bonding. Mix Component A with Component B in the premeasured units for 2-3 minutes and apply by brush, roller, or spray. We recommend the basecoat be applied over slightly tacky or tack-free primer. Do not allow the primer to puddle.

Protecto-Coat 200 Mix Ratio:

Protecto-Coat 200 Basecoat

Protecto-Coat 200 Basecoat Comp. A*	1 Gal.
Component B*	4 Gal.

*Premeasured quantities by weight

Protecto-Coat 200 Topcoat

Protecto-Coat 200 Top Coat Comp. A*	1 Gal.
Component B*	54 fl. oz.

*Premeasured quantities by weight

BASECOAT

Add appropriate amount of hardener for each gallon of Protecto-Coat Liquid and mix thoroughly until uniform color is achieved. Apply a 25 mil wet (20 mil DFT) basecoat using spray, brush or roller. Allow basecoat application to cure to at least a "firm" or slightly "tacky" feel before applying the second 25 mil wet (20 mil DFT) basecoat. Brush or roller may require several coats to achieve desired thickness.

Horizontal surfaces may be basecoated in one application by applying 50 mils wet (40 mil DFT) in a single coat.

TOPCOAT

Add appropriate amount of hardener for each gallon of Protecto-Coat Liquid and mix thoroughly until a uniform color is achieved. Apply a 20-mil-thick topcoat using spray, brush or roller.

Cure Cycle for Protecto-Coat 200

TEMPERATURE	RECOAT TIME	CURE TIME
50°	48 Hrs.	96 Hrs.
70°	24 Hrs.	48 Hrs.
90°	16 Hrs.	36 Hrs.

If these recoat times are exceeded, consult a Dudick representative; sanding or abrasive blasting may be required before the next coat. Recoat times are dramatically reduced when the coating is exposed to direct sunlight.

Single Component Airless Spray Equipment -- Graco King 45-to-1 spray pump or equivalent. Use Graco Golden Mastic Gun or Graco No. 207945 Gun with airless adapter equipped with a Reverse-A-Clean tip and a tip size between .035-.041. Spray hose should be 1/2" or 3/8" ID. Available inlet pressure must be a minimum of 100 psi.

Brush or roller application may require additional coats to meet specified dry film thickness.

Pot life of the opened and mixed Protecto-Coat 200 will depend on the temperature at the work site. To prevent material waste and avoid damage to equipment, do not open and mix more material than can be used according to the following table:

TEMPERATURE	POT LIFE
50°F	120 Min.
75°F	60 Min.
90°F	45 Min.

Do not attempt to store mixed material. Residual material should be properly disposed of at the end of each work period.

Where immersion service is required, spark test the coating with a 5,000 to 7,000 volt AC spark tester. Mark and repair all pinholes. Use Protecto-Coat liquid mixed with the appropriate amount of hardener. Retest only the repairs.

CLEANING

Use S-10 Solvent to clean tools and equipment.

SHIPPING

Protecto-Coat 200 Topcoat A and B and Protecto-Coat 200 Basecoat A are classified as plastic liquids and are non-regulated.

Protecto-Coat 200 Basecoat B is combustible. Primer 67 Component B is corrosive and carries a black and white warning label. Primer 67 Component A is classified as a plastic liquid and is nonregulated, while S-10 Cleaning Solvent is red label liquid with a flash point of 52°F (PMCC).

STORAGE

Warning: All Dudick products classified by DOT labels as either white, yellow or red labels must not be mixed or stored together as an explosive reaction may occur.

When stored in a cool and dry location, Protecto-Coat 200 ingredients have a one-year shelf life. Exposure to excessive heat may cause premature gelling and reduce working time.

SAFETY

M.S.D.S. - Sheets must always be read before using products. Protecto-Coat Systems are intended for application by experienced, professional personnel. Dudick Inc. can supply Protecto-Coat systems supervision to help determine that the surface has been properly prepared, the ingredients correctly mixed, and the materials properly and safely applied.

If Protecto-Coat materials are to be applied by your own personnel or by a third-party contractor, please be sure that they are aware of the following safety precautions:

• Exposure to resins and hardeners may cause severe dermatitis reactions in some people. Cleanliness of the skin and clothing is critical and must be of paramount concern.

• Safety glasses, gloves and suitable protective clothing must be worn at all times during application.

• Suitable respirators should be used.

• If contact with hardeners occurs, remove any clothing involved and wash the skin with large amounts of water. Discard the clothing. Do not attempt to wash and reuse it. Protecto-Coat liquid may be washed off with S-10 Cleaning Solvent, MEK liquid, or laquer thinner.

• Fumes are flammable and heavier than air. Proper ventilation should be maintained to minimize breathing of concentrated fumes.

• If a rash or dermatitis occurs, remove the individual from the work area and seek a physician's care for dermatitis.

• Keep open flames and sparks away from the area where toppings are being mixed and applied.

• In case of eye contact, wash with water for at least 15 minutes and consult a physician. If swallowed, do not induce vomiting; call a physician immediately.

Note:

Dudick Inc. ("Dudick") warrants all goods of its manufacture to be as represented in its catalogs and that the application of its products by its employees or sub-contractors shall be performed in a workmanlike manner. Dudick's obligation under this warranty shall be the repair to and replacement of any applications which its examination shall disclose to be defective. Dudick makes no warranty concerning the suitability of its product for application to any surface, it being the understood that the goods have been selected and the application ordered by the purchaser. DUDICK INC. MAKES NO WARRANTY, EXPRESS OR IMPLIED, THAT THE GOODS SHALL BE MERCHANTABLE OR THAT THE GOODS ARE FIT FOR ANY PARTICULAR PURPOSE. THE WARRANTY OF REPAIR OR REPLACEMENT SET FORTH HEREIN IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES ARISING BY LAW OR OTHERWISE; AND DUDICK INC. SHALL NOT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOST PROFITS, DOWN TIME, DAMAGES TO PROPERTY OF THE PURCHASER OR OTHER PERSONS, OR DAMAGES FOR WHICH THE PURCHASER MAY BE LIABLE TO OTHER PERSONS, WHETHER OR NOT OCCASIONED BY DUDICK'S NEGLIGENCE. This warranty shall not be extended, altered or varied except by written instrument signed by Dudick and Purchaser.

Dudick Incorporated
Corrosion-Proof Products
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Streetsboro, Ohio 44241
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APPENDIX I.

SECONDARY CONTAINMENT CALCULATIONS

APPENDIX I.

SECONDARY CONTAINMENT CALCULATIONS
For
EVAPORATOR FEED TANK NO. 2 (EF2)

❒ **DIMENSIONS:**

EF Tank Diameter:	60.00-ft.
PCL Tank Diameter:	12.00-ft.
Secondary Containment Height - Hsc	5.50
Secondary Containment Surface Area - Asc	14,589.00-sf
Gross Volume of Secondary Containment	80,239.50-cf

❒ **DISPLACEMENT VOLUMES:**

EF Tank Base	PI*D^2/4*Hsc	15,551.42-cf
PCL Tank Base	PI*D^2/4*Hsc	622.06-cf

Note: Displacement volumes include only one of the EF tanks. It is assumed that a failed tank would not displace available secondary containment.

Displacement Volume *16,173.47-cf*

❒ **RAINFALL VOLUMES:**

Depth of Rainfall	6.150-in.
Impacted Area	8,934.00-sf
Rainfall Volume	4,578.68-cf

❒ **CONTAINMENT CAPACITY AVAILABLE:**

CCA = Gross Volume - Displacement Volume - Rainfall Volume

CCA	=	*59,487-cf*
Volume of Largest Tank (EF1)	=	*47,785.26-cf*
Excess Containment Volume	=	*11,702-cf*
Safety Factor	=	*1.24*